1. Features of the LM Guide®

Functions Required for Linear Guide Surface

- Smooth motion with no clearance
- Running accuracy can be obtained easily
- High positioning repeatability
- Highly rigid in all directions
- Large permissible load
- High accuracy can be maintained over a long period
- Superbly high speed

Features of the LM Guide

- Ideal four-row, circular-arc groove, two-point contact structure
- Superb error-absorbing capability with the DF structure
- Accuracy averaging effect that absorbs mounting surface error
- Large permissible load and high rigidity
- Low friction coefficient

As a result, the following features are achieved.

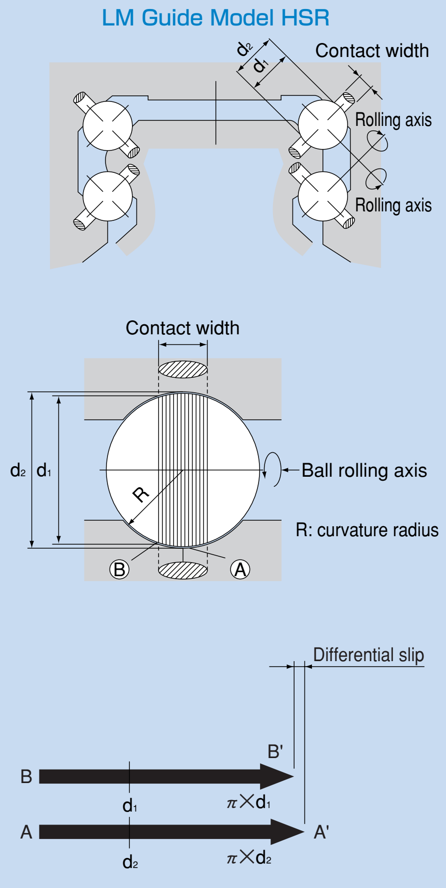
- **●Low total cost**
- **●Higher accuracy of the machine**
- **●Increased productivity of the equipment**
- **●Substantial energy savings**
- **●Higher efficiency in machine design**
- **●Easy maintenance**

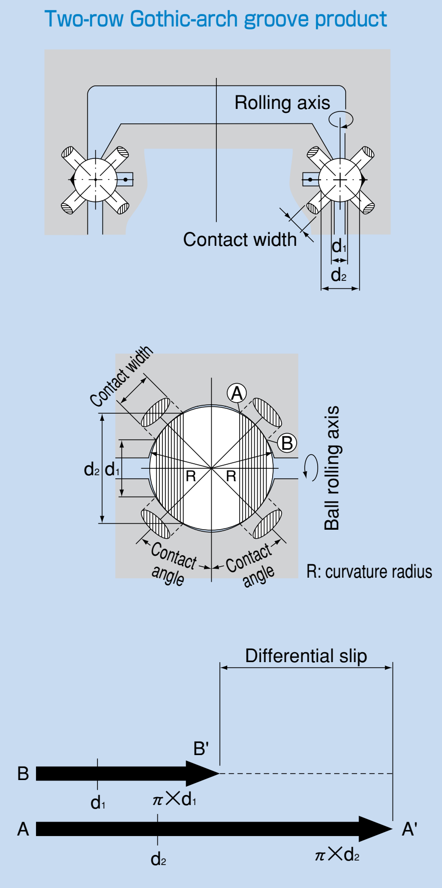
1.1. Ideal Four-Row, Circular-Arc Groove, Two-Point Contact Structure

The LM Guide has a self-adjusting capability that competitors' products do not have.
This feature is achieved with an ideal four-row, circular-arc groove, two-point contact structure.

Comparison of Characteristics between the LM Guide and Similar Products

LM Guide: four-row, circular-arc groove, two-point contact structure	Other product: two-row, Gothic-arch groove four-point contact structure





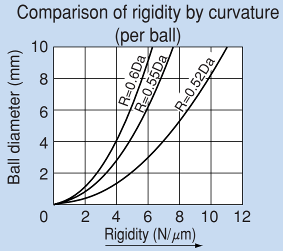
As indicated in the figure(s) above, when the ball rotates one revolution, the ball slips by the difference between the circumference of the inner contact diameter (πd_1) and that of the outer contact diameter (πd_2). This slip is called differential slip. If the difference is large, the ball rotates while slipping, the friction coefficient increases more than 10 times and the friction resistance steeply increases.

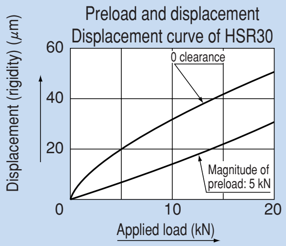
	Four-Row, Circular-Arc Groove, Two-Point Contact Structure	Two-Row, Gothic-Arch Groove, Four-Point Contact Structure
Smooth motion	Since the ball contacts the groove at two points in the load direction as shown in the figure on page A-5 even under a preload or a normal load, the difference between d_1 and d_2 is small and the differential slip is minimized to allow smooth rolling motion.	The difference between d_1 and d_2 in the contact area is large as shown in the figure on page A-5. Therefore, if any of the following occurs, the ball will generate differential slip, causing friction almost as large as sliding resistance and shortening the service as a result of abnormal friction. ① A preload is applied, ② A lateral load is applied, or ③ The mounting parallelism between the two axes is poor
Accuracy and rigidity of the mounting surface	In the ideal two-point contact structure, four rows of circular arc grooves are given appropriate contact angles. With this structure, a light distortion of the mounting surface would be absorbed within the LM block due to elastic deformation of the balls and moving of the contact points to allow unforced, smooth motion. This eliminates the need for a robust mounting base with high rigidity and accuracy for machinery such as a conveyance system.	With the Gothic-arch groove product, each ball contacts the groove at four points, preventing itself from being elastically deformed and the contact points from moving (i.e., no self-adjusting capability). Therefore, even a slight distortion of the mounting surface or an accuracy error of the rail bed cannot be absorbed and smooth motion cannot be achieved. Accordingly, it is necessary to machine a highly rigid mounting base with high precision and mount a high precision rail.
Rigidity	With the two-point contact, even if a relatively large preload is applied, the rolling resistance does not abnormally increase and high rigidity is obtained.	Since differential slip occurs due to the four-point contact, a sufficient preload cannot be applied and high rigidity cannot be obtained.
Rated load	Since the curvature radius of the ball raceway is 51 to 52% of the ball diameter, a large rated load can be obtained.	Since the curvature radius of the gothic arch groove has to be 55 to 60% of the ball diameter, the rated load is reduced to approx. 50% of that of the circular arc groove.

Difference in rigidity

As shown in the figure below, the rigidity widely varies according to the difference in curvature radius or difference in preload.

Curvature radius and rigidity





Difference in service life

Since the rated load of the gothic arch groove is reduced to approx. 50% of that of the circular arc groove, the service life also decreases to 87.5%.

Accuracy Error of the Mounting Surface and Test Data on Rolling Resistance

The difference between the contact structures translates into a rolling resistance.

In the gothic arch groove contact structure, each ball contacts at four points and differential slip or spinning occurs if a preload is applied to increase rigidity or an error in the mounting accuracy is large. This sharply increases the rolling resistance and causes abnormal wear in an early stage.

The following are test data obtained by comparing an LM Guide having the four-row, circular-arc groove two-point contact structure and a product having the two-row, Gothic-arch, four-point contact structure.

Sample

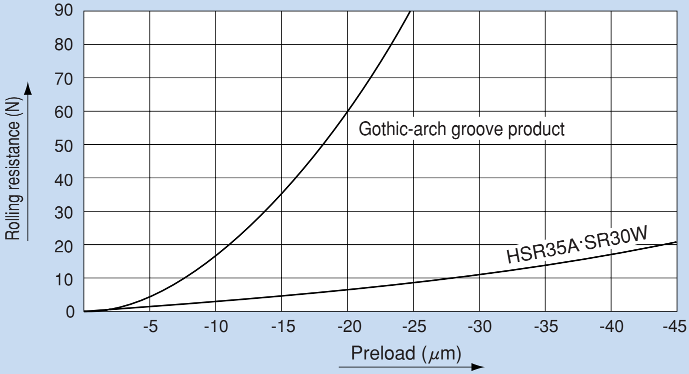
① LM Guide	
SR30W (self-adjusting type):	2 sets
HSR35A (four-way equal-load type):	2 sets
② Two-row Gothic-arch groove product	
Type with dimensions similar to HSR30:	2 sets

Conditions

Radial clearance: ±0μm
Without seal
Without lubrication
Load: table mass of 30 kg

Data 1: Preload and rolling resistance

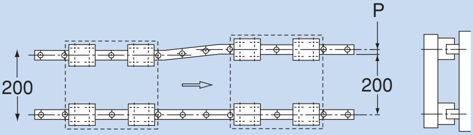
When a preload is applied, the rolling resistance of the Gothic-arch groove product steeply increases and differential slip occurs. Even under a preload, the rolling resistance of the LM Guide does not increase.

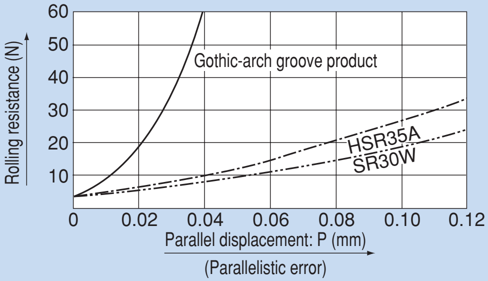


Data 2: Error in parallelism of two axes and rolling resistance

As shown in the figure below, part of the rails mounted in parallel is parallelly displaced and the rolling resistance at that point is measured.

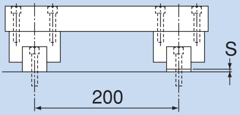
With the Gothic-arch groove product, the rolling resistance is 34 N when the parallelistic error is 0.03 mm and 62 N when the error is 0.04 mm. These resistances are equivalent to the slip friction coefficients, indicating that the balls are in sliding contact with the groove.

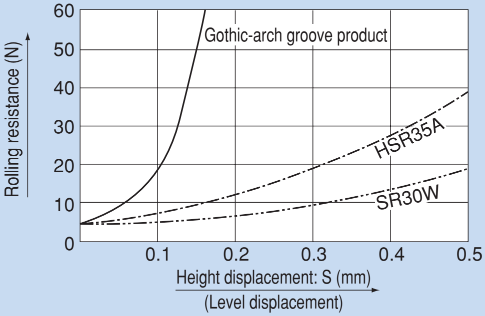




Data 3: Difference between the levels of the right and left rails and rolling resistance

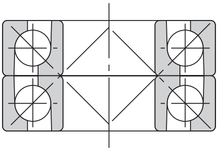
The bottom of either rail is displaced by distance S so that there is a level difference between the two axes, and then rolling resistance is measured. If there is a level difference between the right and left rails, a moment acts on the LM block, and in the case of the Gothic-arch groove, spinning occurs. Even if the level difference between the two rails is as great as 0.3/200 mm, the LM Guide absorbs the error. This indicates that the LM Guide can operate normally even when such errors are present.



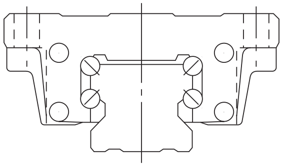


1.2. Superb Error-Absorbing Capability with the DF Structure

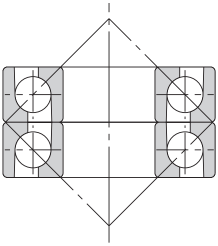
Since the LM Guide has a contact structure similar to the front-to-front mount of angular ball bearings, it has superb self-adjusting capability.



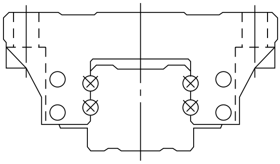
Angular ball bearings mounted front-to-front (DF type)



DF type four-row angular contact
(LM Guide)



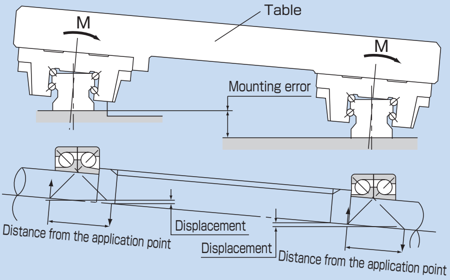
Angular ball bearings mounted back-to-back (DB type)



Four-row Gothic-arch contact

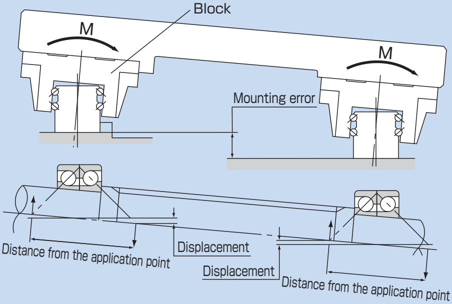
An LM ball guide mounted on a plane receives a moment (M) due to an error in flatness or in level or a deflection of the table. Therefore, it is essential for the guide to have self-adjusting capability.

LM Guide model HSR



Since the distance from the application point of the bearing is small, the internal load generated from a mounting error is small and the self-adjusting capability is large.

Similar product of a competitor



Since the distance from the application point of the bearing is large, the internal load generated from a mounting error is large and the self-adjusting capability is small.

With an LM ball guide having angular ball bearings mounted back-to-back, if there is an error in flatness or a deflection in the table, the internal load applied to the block is approx. 6 times greater than that of the front-to-front mount structure and the service life is much shorter. In addition, the fluctuation in sliding resistance is greater.

1.3. Accuracy Averaging Effect by Absorbing Mounting Surface Error

The LM Guide contains highly spherical balls and has a constrained structure with no clearance. In addition, it uses LM rails in parallel on multiple axes to form a guide structure with multiple-axis configuration. Thus, the LM Guide is capable of absorbing misalignment in straightness, flatness or parallelism that would occur in the machining of the base to which the LM Guide is to be mounted or in the installation of the LM Guide by averaging these errors. The magnitude of the averaging effect varies according to the length or size of the misalignment, the preload applied on the LM Guide and the number of axes in the multiple-axis configuration. When misalignment is given to one of the LM rails of the table as shown in Fig. 1, the magnitude of misalignment and the actual dynamic accuracy of the table (straightness in the horizontal direction) are as shown in Fig. 2.

By applying such characteristics obtained with the averaging effect, you can easily establish a guide structure with high dynamic accuracy.

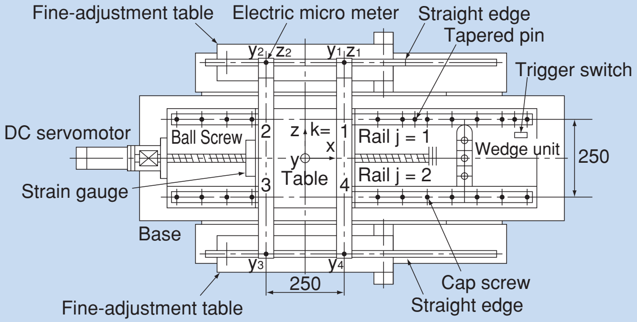
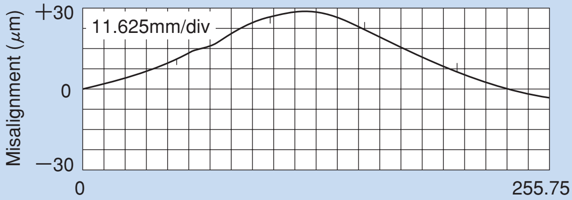
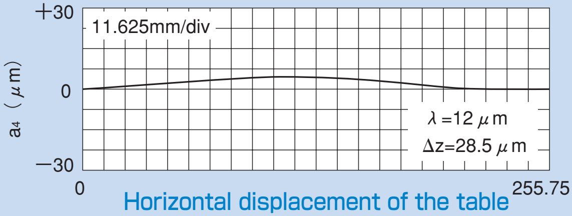


Fig. 1



Misalignment curve



Horizontal displacement of the table

Fig. 2

Dr. Shigeo Shimizu: Study on the accuracy averaging effect of an LM ball guide system, from a collection of papers (1990) at an academic lecture of the Spring Conference of the Precision Manufacturers Association 1990

Even on a roughly milled mounting surface, the LM Guide drastically increases running accuracy of the top face of the table.

■Example of installation

When comparing the mounting surface accuracy (a) and the table running accuracy (b), the results are:

Vertical	92.5 μm	→	15 μm	=	1/6
Horizontal	28 μm	→	4 μm	=	1/7

Table 1 Actual Measurement of Mounting Surface Accuracy

Unit: μm

Direction	Mounting surface		Straightness	Average (a)
Vertical	Horizontal	A	80	92.5
		B	105	
Bottom surface	Side surface	C	40	28
		D	16	

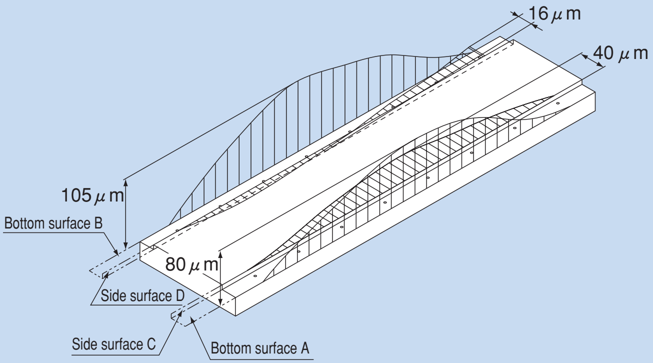


Fig.3 Surface Accuracy of the LM Guide Mounting Base (Milled Surface Only)

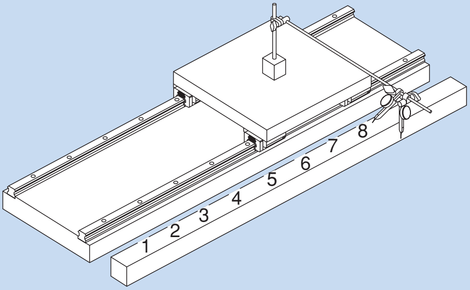


Fig. 4 Running Accuracy After the LM Guide Is Mounted

Table 2 Actual Measurement of Running Accuracy on the Table (Based on Measurement in the Figure Above)

Unit: μm

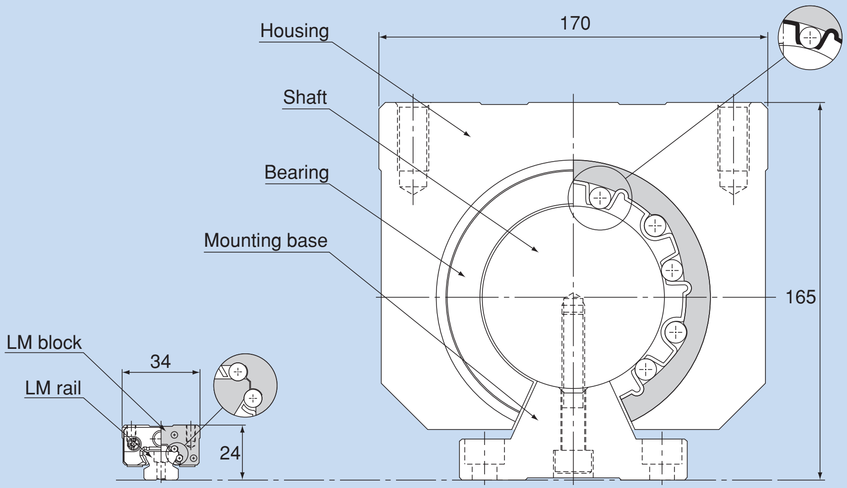
Measurement point / Direction	1	2	3	4	5	6	7	8	Straightness (b)
Vertical	0	+2	+8	+13	+15	+9	+5	0	15
Horizontal	0	+1	+2	+3	+2	+2	−1	0	4

1.4. Large Permissible Load and High Rigidity

●Large Permissible Load

The LM Guide has raceway grooves with a radius almost equal to the ball radius, which is significantly different from the linear bush. As shown in Fig. 5, which compares size between the LM Guide and the linear bush with similar basic dynamic load ratings, the LM Guide is much smaller than the linear bush, indicating that the LM Guide allows a significantly compact design.

The reason for this space saving is the greater difference in permissible load between the R-groove contact structure and the surface contact structure. The R-groove contact structure (radius: 52% of the ball radius) can bear a load per ball 13 times greater than the surface contact structure. Since service life is proportional to the cube of the permissible load, this increased ball-bearing load translates into a service life that is approximately 2,200 longer than the linear bush.



LM Guide model SR15W
Basic dynamic load rating: 9.51 kN

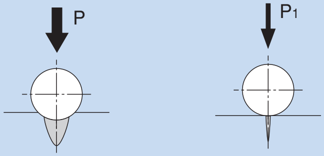
Linear Bush model LM80 OP
Basic dynamic load rating: 7.35 kN

Fig. 5 Comparison between the LM Guide and the Linear Bush

Table 3 Load Capacity per Ball (P and P_1)

Permissible contact surface pressure: 4,200 MPa

	R-groove (P)	Flat surface (P_1)	P/P_1
ϕ 3.175(1/ 8")	0.9 kN	0.07 kN	13
ϕ 4.763(3/16")	2.03 kN	0.16 kN	13
ϕ 6.350(1/ 4")	3.61 kN	0.28 kN	13
ϕ 7.938(5/16")	5.64 kN	0.44 kN	13
ϕ11.906(15/32")	12.68 kN	0.98 kN	13



R-groove

Flat surface

Fig. 6 Load Capacity per Ball

●High rigidity

The LM Guide is capable of bearing vertical and horizontal loads. Additionally, due to the circular-arc groove design, it is capable of carrying a preload as necessary to increase its rigidity. When compared with a feed screw shaft system and a spindle in rigidity, the guide surface using an LM Guide has higher rigidity.

Example of comparing static rigidity between the LM Guide, a feed screw shaft system and a spindle

(vertical machining center with the main shaft motor of 7.5 kW)

Components

LM Guide: HSR45LB···C0
(C0 clearance: preload = 6.43 kN)
Ball Screw: BNFN4010-5···G0
(C0 clearance: preload = 2.64 kN)
Spindle: general-purpose cutting spindle

Table 4 Comparison of Static Rigidity

Unit: N/μm

Components	X-axis direction	Y-axis direction	Z-axis direction
LM Guide	—	2800	6,600 (radial) 4,300 (reverse radial)
Ball Screw	330	—	—
Spindle	250	250	280

Note: The rigidity of the feed screw shaft system includes rigidity of the shaft end support bearing.

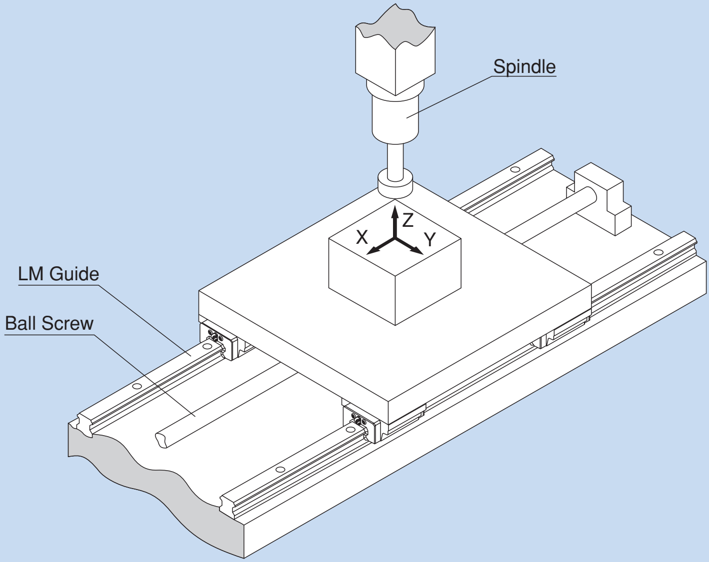


Fig. 7

1.5. Low Friction Coefficient

Since an LM system makes rolling motion via its rolling elements such as balls and rollers between the raceways, its frictional resistance is 1/20 to 1/40 smaller than a sliding guide. Its static friction is especially small and almost the same as dynamic friction, preventing the system from making a stick slip. Therefore, the system is capable of being fed by the submicron distance.

The frictional resistance of an LM system varies according to the type of the LM system, preload, viscosity resistance of the lubricant and the load applied on the LM system.

In particular, when a moment is given or a preload is applied to increase rigidity, the frictional resistance increases.

Normal frictional resistances by LM systems are indicated in Table 5.

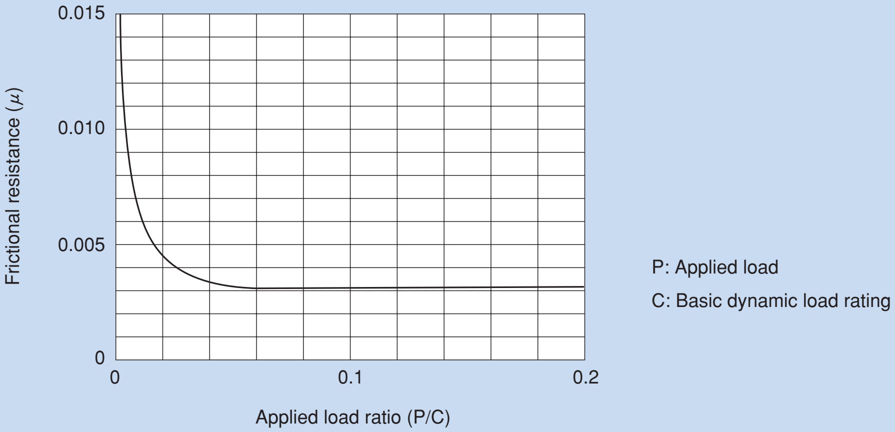


Fig. 8 Relationship between Applied Load Ratio and Frictional Resistance

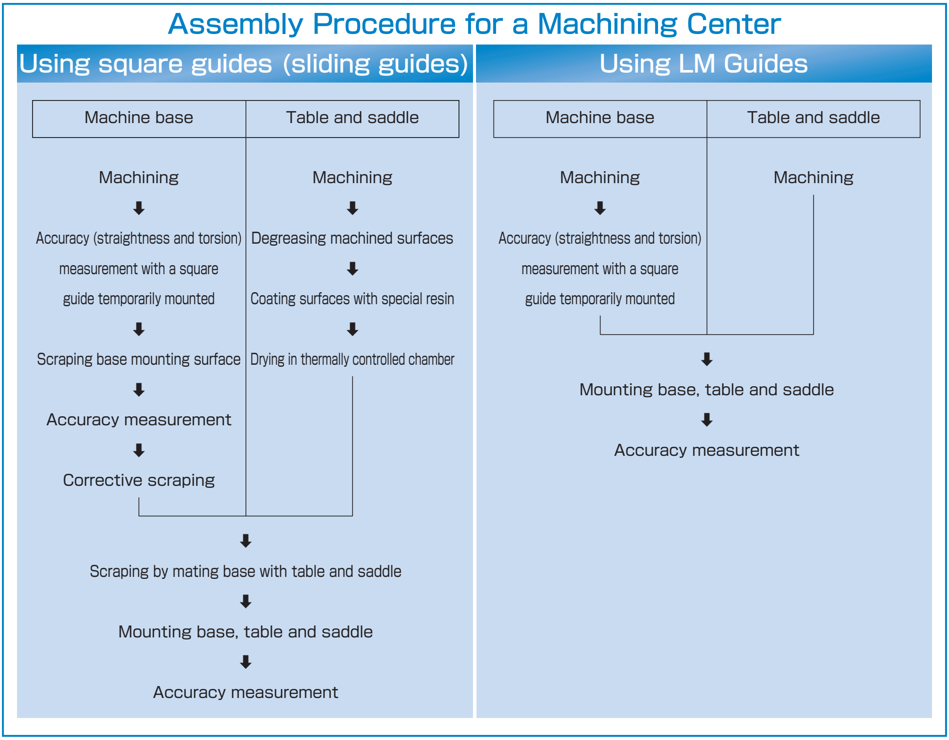
Table 5 Frictional Resistances (μ) of LM Systems

Types of LM systems	Representative types	Frictional resistance (μ)
LM Guide	SSR, SHS, SNR/SNS, SRS, RSR, HSR, NR/NRS	0.002 to 0.003
	SRG, SRN	0.001 to 0.002
Ball Spline	LBS, LBF, LT, LF	0.002 to 0.003
Linear Bush	LM, LMK, LMF, SC	0.001 to 0.003
LM Stroke	MST, ST	0.0006 to 0.0012
LM Roller	LR, LRA	0.005 to 0.01
Flat Roller	FT, FTW	0.001 to 0.0025
Cross-roller Guide/Cross-roller Table	VR, VRU, VRT	0.001 to 0.0025
Linear Ball Slide	LS	0.0006 to 0.0012
Cam Follower/Roller Follower	CF, NAST	0.0015 to 0.0025

1.6. Low Total Cost

Compared with a sliding guide, the LM Guide is easier to assemble and does not require highly skilled technicians to perform the adjustment work. Thus, the assembly man-hour for the LM Guide are reduced, and machines and systems incorporating the LM Guide can be produced at lower cost. The figure below shows an example of difference in the procedure of assembling a machining center between using siding guides and using LM Guides.

Normally, with a sliding guide, the surface on which the guide is installed must be given a very smooth finish by grinding. However, the LM Guide can offer high precision even if the surface is milled or planed. Using the LM Guide thus cuts down on machining man-hours and lowers machining costs as a whole.



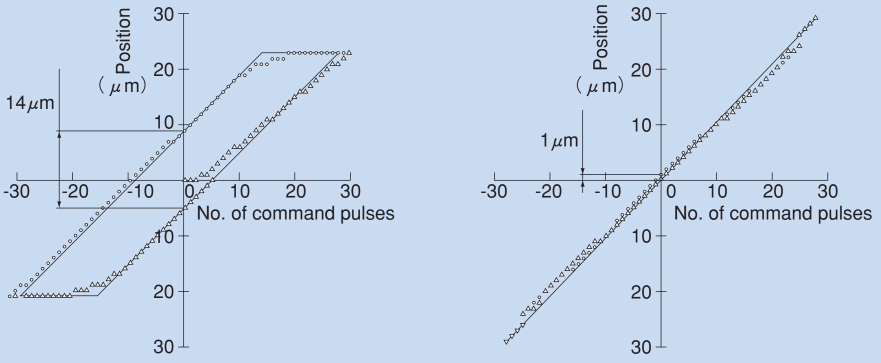
Assembly Procedure for a Machining Center

When extremely high precision is not required (e.g., running precision), the LM Guide can be attached to the steel plate even if the black scale on it is not removed.

1.7. High Dynamic Accuracy

●Small motion loss

The LM Guide is provided with an ideal rolling mechanism. Therefore, the difference between dynamic and static friction is minimal and motion loss hardly occurs.



Square slide + Turcite

LM Guide

(Measurements are taken with the single-axis table loaded with a 500-kg weight)

Fig. 9 Comparison of Motion Loss between the LM Guide and a Slide Guide

Table 6 Motion Loss Comparison

Unit: μm

Test method Type	Clearance	As per JIS B 6330			Based on minimum unit feeding
		10mm/min	500mm/min	4000mm/min	
Square slide + Turcite	0.02 mm	10.7	15	14.1	14
	0.005 mm	8.7	13.1	12.1	13
LM Guide (HSR45)	C1 clearance$^{\text{Note}}$	2.3	5.3	3.9	0
	C0 clearance$^{\text{Note}}$	3.6	4.4	3.1	1

Note: Radial clearance of the LM Guide

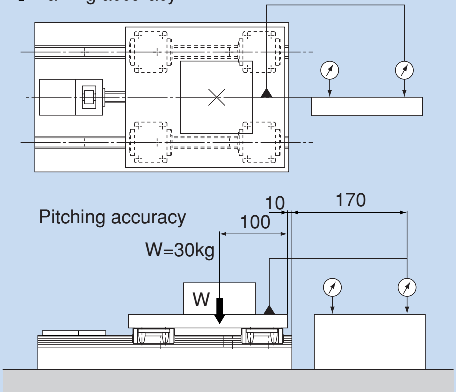
Unit: μm

Symbol	C1	C0
Radial clearance	-25 to -10	-40 to -25

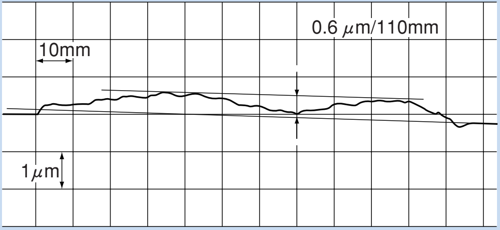
●High running accuracy

Use of the LM Guide allows you to achieve high running accuracy.

[Measurement method]



Pitching accuracy



Yawing accuracy

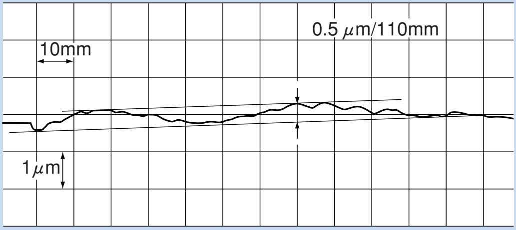


Fig. 10 Dynamic Accuracy of a Single-axis Table

●High accuracy maintained over a long period

As the LM Guide employs an ideal rolling mechanism, wear is negligible and high precision is maintained for long periods of time. As shown in Fig. 12, when the LM Guide operates under both a preload and a normal load, more than 90% of the preload remains even after running 2,000 km.

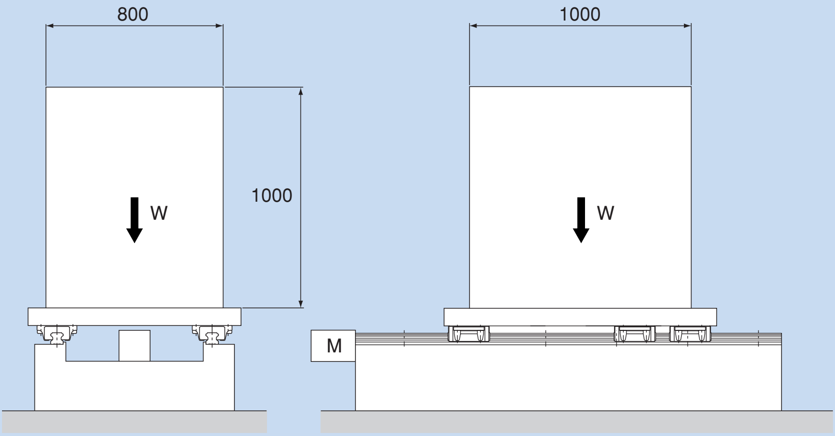


Fig. 11 Service Conditions

[Service conditions]

Model No. : HSR65LA3SSC0 + 2565LP-Ⅱ
Radial clearance : C0 (preload: 15.7 kN)
Stroke : 1,050 mm
Speed : 15 m/min (stops 5 sec at both ends)
Acceleration time : 300 ms
(acceleration: $\alpha = 0.833$ m/s^2)
Mass : 6,000 kg
Drive : Ball Screw
Lubrication : Lithium soap-based grease No. 2
(greased every 100 km)

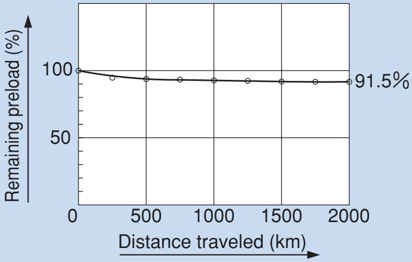


Fig. 12 Distance Traveled and Remaining Preload

1.8. Improved Productivity of the Machine

Since the LM Guide is superb in high speed, productivity of the machine is improved.

Table 7 Examples of Using the LM Guide in High-speed Applications

Machine using the LM Guide	Place where the LM Guide is used	Speed (m/s)	Model No.
Durability test machine	X axis	5.0	SSR25W
Pick-up robot	X axis	2.0	SSR25W
	Z axis	3.0	SSR15W
Injection molding machine	Automatic unloading unit	2.2	HSR30LR
Glass cutting machine	Cutter sliding unit	3.7	HSR25B
Inspection machine	Workpiece transfer unit	5.0	HRW27CA
Conveyance robot	Workpiece transport unit	4.2	HSR25R
XY table	X-Y axis	2.3	RSR15WV

1.9. Substantial Energy Savings

As shown in Table 8, the LM Guide has a substantial energy-saving effect.

Table 8 Comparative Data on Sliding and Rolling Characteristics

Machine Specifications			
Type of machine	Single-axis surface grinding machine (sliding guide)	Three-axis surface grinding machine (rolling guide)	
Overall length x overall width	13m×3.2m	12.6m×2.6m	
Total mass	17,000 kg	16,000 kg	
Table mass	5,000 kg	5,000 kg	
Grinding area	0.7m×5m	0.7m×5m	
Table guide	Rolling through V-V guide	Rolling through LM Guide installation	
No. of grinding stone axes	Single axis (5.5 kW)	Three axes (5.5 kW + 3.7 kW x 2) Grinding capacity: 3 times greater	
Table Drive Specifications			**Ratio**
Motor used	38.05kW	3.7kW	10.3
Drive hydraulic pressure	Bore diameter φ160×1.2MPa	Bore diameter φ65×0.7MPa	—
Thrust	23,600N	2,270N	10.4
Power consumption	38kWH	3.7kWH	10.3
Drive hydraulic pressure oil consumption	400 ℓ /year	250 ℓ /year	1.6
Lubricant consumption	60 ℓ /year (oil)	3.6 ℓ /year (grease)	16.7

1.10. Easy Maintenance

Unlike with sliding guides, the LM Guide does not incur noticeable wear. As a result, sliding surfaces do not need to be reconditioned, and precision needs not be altered. Regarding lubrication, sliding guides require forced circulation of a large amount of lubricant so as to maintain an oil film on the sliding surfaces, whereas the LM Guide only needs periodical replenishing of a small amount of grease or lubricant. Maintenance is that simple. This also helps keep the work environment clean.

2. Caged Ball/Roller Technology

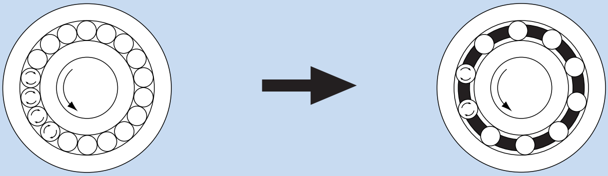
The early forms of ball bearings were full-ball types without ball cages. Friction between balls caused loud noise, made high-speed rotation impossible and shortened the service life.

Twenty years later, a Cage Ball design was developed for ball bearings. The new design reduced the number of balls used while enabling high-speed rotation at a low noise level and extending the service life. It marked a major development in the history ball bearings.

Similarly, the quality of needle bearings was significantly improved by the Caged Ball structure.

With cage-less types of ball bearings, balls make metallic contact one another and produce loud noise. In addition, they rotate in opposite directions, and the sliding contact between two adjacent balls occurs at a speed twice the ball-spinning rate. It causes sever wear and shortens the service life. Normally, an oil film breaks under a bearing stress of 3 kg/mm². Without a cage, balls make point contact, increasing bearing stress and facilitating breakage of the oil film. In contrast, each caged ball contact the cage over a wide area. Therefore, the oil film does not break, the noise level is low and balls can rotate at a high speed, resulting in a long service life.

●Rotary ball bearing



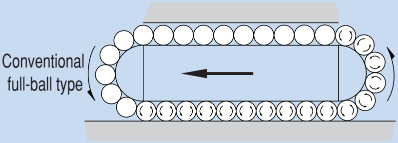
Early bearing (full-ball type)

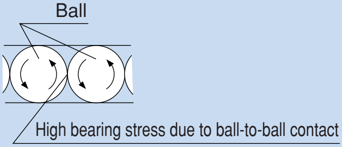
- ●Adjacent balls contact each other at a point. As a result, contact stress is high and the oil film breaks due to friction.
- ●The service life becomes shorter.

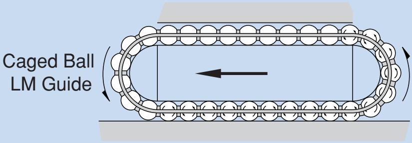
Current bearing (Caged Ball type)

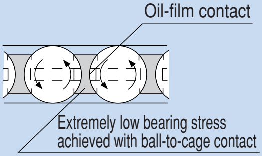
- ●The service life is prolonged due to the elimination of wear caused by friction between balls.
- ●The absence of friction between balls results in reduced heat generation during high-speed rotation.
- ●The absence of friction between balls eliminates collision noise of the balls.
- ●Even spacing of the balls enables them to move smoothly.
- ●Retention of lubricant in the ball cage ensures a long service life.

●LM Guide









2.1. Structure and Features of the Caged Ball® LM Guide®

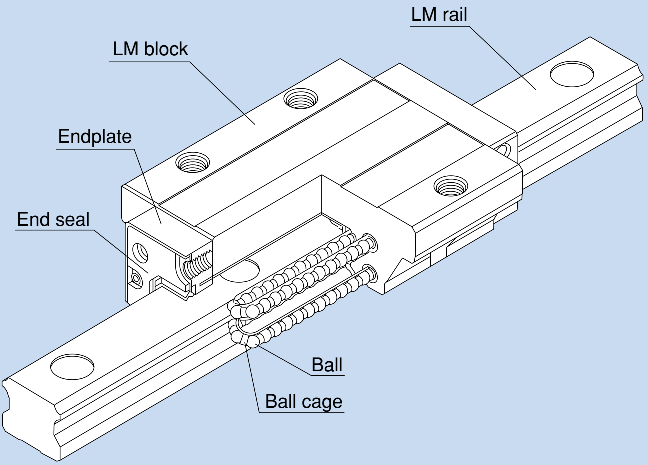


Fig. 1 Structural Drawing of the Caged Ball LM Guide Model SHS

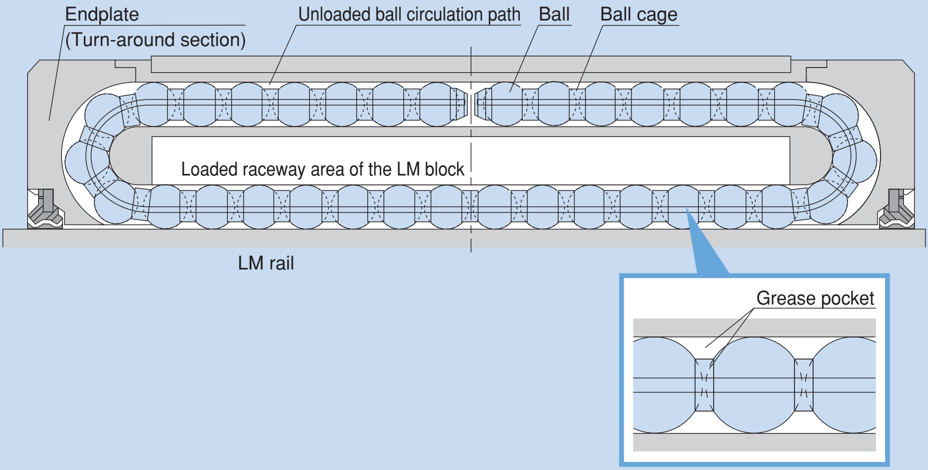


Fig. 2 Circulation Structure inside the LM Block of the Caged Ball LM Guide

With the Caged Ball LM Guide, the use of a ball cage allows lines of evenly spaced balls to circulate, thus to eliminate friction between the balls.

In addition, grease held in a space between the ball circulation path and the ball cage (grease pocket) is applied on the contact surface between each ball and the ball cage as the ball rotates, forming an oil film on the ball surface. This minimizes the risk of oil-film break.

2.1.1. Advantages of the Ball Cage® Technology

① The absence of friction between balls, together with increased grease retention, achieves long service life and long-term maintenance-free (lubrication-free) operation.

② The absence of ball-to-ball collision achieves low noise and acceptable running sound.

③ The absence of friction between balls achieves low heat generation and high-speed operation.

④ The circulation of lines of evenly spaced balls ensures smooth ball rotation.

⑤ The absence of friction between balls allows high grease retention and low dust generation.

Long Service Life and Long-term Maintenance-free Operation

Rated life equation for the LM Guide

$$L = \left(\frac{C}{P}\right)^3 \times 50$$

L : Rated life (km)
C : Basic dynamic load rating (N)
P : Applied load (N)

As indicated in the equation, the greater the basic dynamic load rating, the longer the rated life of the LM Guide.

[Example of calculation]

Comparison of rated life between the Caged Ball LM Guide model SHS25LR and the conventional full-ball type model HSR25LR

Calculation assuming P = 13.6 kN

Basic dynamic rated load (C) of SHS25LR = 36.8 kN
Basic dynamic rated load (C) of HSR25LR = 27.2 kN

Model SHS25LR $L = \left(\frac{C}{P}\right)^3 \times 50 = \left(\frac{36.8}{13.6}\right)^3 \times 50 = 990\ \text{km}$

Model HSR25LR $L = \left(\frac{C}{P}\right)^3 \times 50 = \left(\frac{27.2}{13.6}\right)^3 \times 50 = 400\ \text{km}$

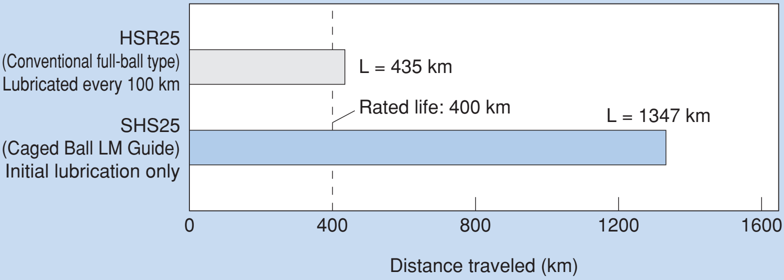
The rated life of the Caged Ball LM Guide model SHS25LR is **2.4 times*** longer than the conventional full-ball type model HSR25LR.

* Note: When selecting a model number, it is necessary to perform a service life calculation according to the service conditions.

■Data on Long Service Life and Long-term Maintenance-free Operation

Use of a ball cage eliminates friction between balls and increases grease retention, thus to achieve long service life and long-term maintenance-free operation.

Model No. : SHS25/HSR25
Speed : 60m/min
Stroke : 350mm
Acceleration : $9.8 m/s^2$
Orientation : horizontal
Load : Caged Ball LM Guide model SHS : 11.1 kN
Conventional full-ball type model HSR : 9.8 kN

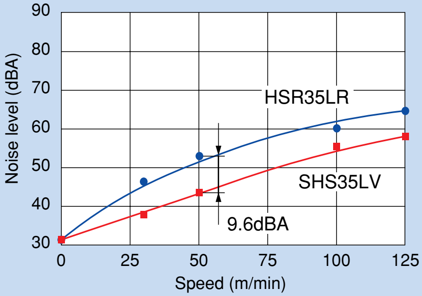


●Low Noise, Acceptable Running Sound

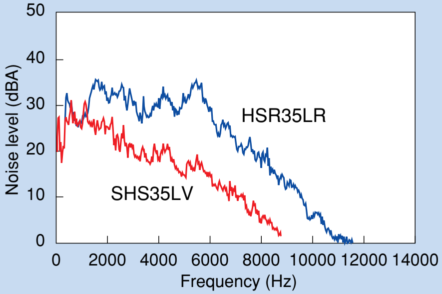
■Noise Level Data

Since the ball circulation path inside the LM block is made of resin, metallic noise between balls and the LM block is eliminated. In addition, use of a ball cage eliminates metallic noise of ball-to-ball collision, allowing a low noise level to be maintained even at high speed.

Model SHS35LV: Caged Ball LM Guide
Model HSR35LR: conventional full-ball type



Noise level comparison between SHS35LV and HSR35LR



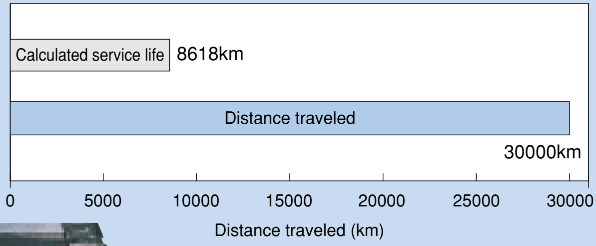
Noise level comparison between SHS35LV and HSR35LR
(at speed of 50 m/min)

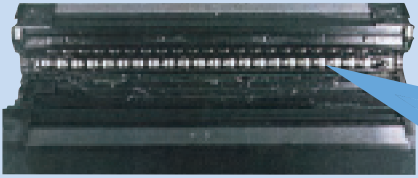
●High Speed

■High-speed Durability Test Data

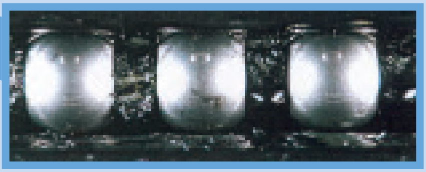
Since use of a ball cage eliminates friction between balls, only a low level of heat is generated and superbly high speed is achieved.

Sample : Caged Ball LM Guide model SHS65LVSS
Speed : 200m/min
Stroke : 2500mm
Lubrication : initial lubrication only
Applied load : 34.5kN
Acceleration : 1.5G





Grease remains, and no anomaly is observed in the balls and grease.



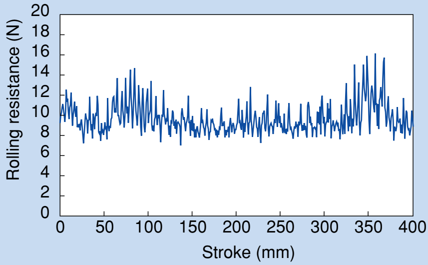
Detail view of the ball cage

●Smooth Motion

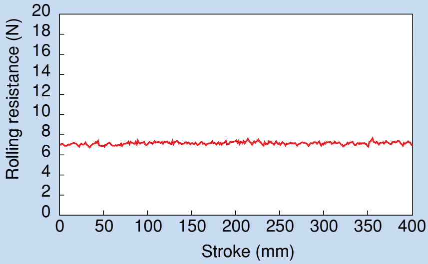
■Rolling Resistance Data

Use of a ball cage allows the balls to be uniformly aligned and prevents a line of balls to meander as they enter the LM block. This enables smooth and stable motion to be achieved, minimizes fluctuations in rolling resistance, and ensures high accuracy, in any mounting orientation.

Model SHS25LV: Caged Ball LM Guide
Model HSR25LR: conventional full-ball type



Rolling resistance fluctuation data with HSR25LR
(Feeding speed: 10 mm/sec)

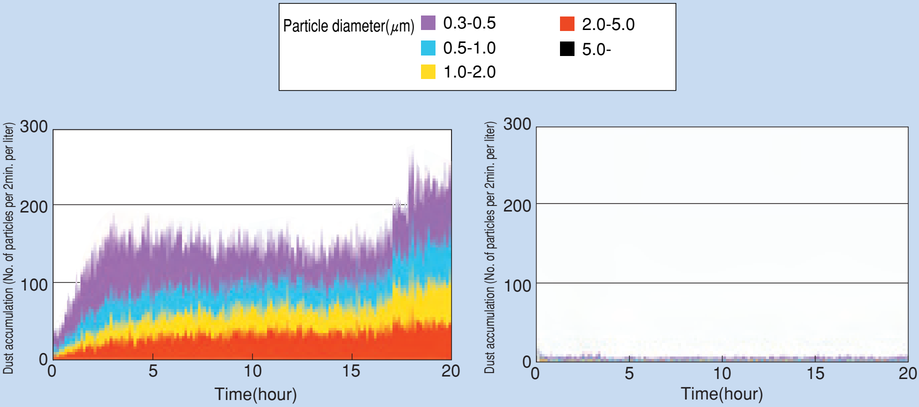


Rolling resistance fluctuation data with SHS25LV
(Feeding speed: 10 mm/sec)

●Low dust generation

■Low Dust Generation Data

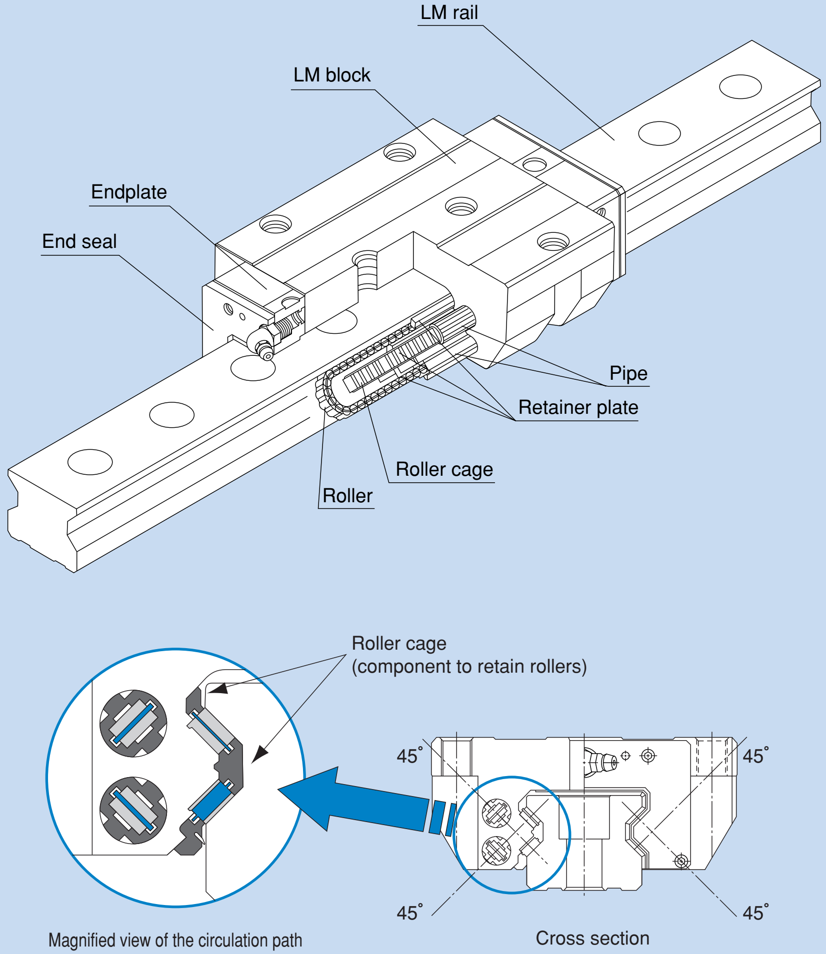
In addition to friction between balls, metallic contact has also been eliminated by using resin for the through holes. Furthermore, the Caged Ball LM Guide has a high level of grease retention and minimizes fly loss of grease, thus to achieve superbly low dust generation.



Conventional full-ball type

Caged Ball LM Guide model SSR20

2.2. Structure and Feature of the Caged Roller LM Guide



Magnified view of the circulation path

Cross section

Fig. 3 Structural Drawing of Model SRG

Using a roller cage, the Caged Roller LM Guide achieves low-friction and smooth motion and long-term maintenance-free operation. In addition, to ensure super-ultra-high rigidity, rollers with low elastic deformation are used as the rolling elements and the roller diameter and the roller length are optimized.

Furthermore, the lines of rollers are placed at a contact angle of 45° so that the same rated load is applied in the four (radial, reverse and lateral) directions.

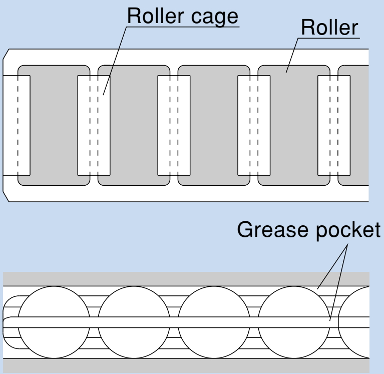
2.2.1. Advantages of the Roller Cage Technology

① Evenly spaced and aligned rollers circulate, preventing the rollers from skewing, minimizing rolling resistance fluctuations and achieving smooth and stable motion.

② The absence of friction between rollers allows grease to be retained in grease pockets and achieves long-term maintenance-free operation.

③ The absence of friction between rollers achieves low heat generation and superbly high speed.

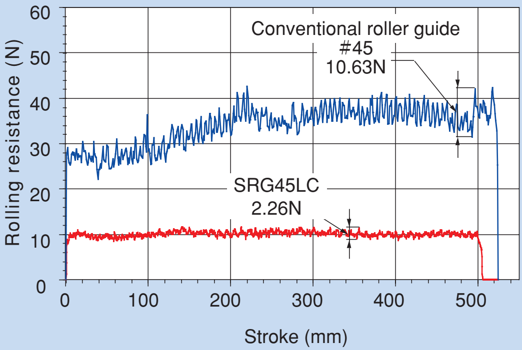
④ The absence of roller-to-roller collision ensures low noise and acceptable running sound.



●Smooth Motion

■Rolling resistance data

Evenly spaced and aligned rollers circulate, minimizing rolling resistance fluctuations and achieving smooth and stable motion.



Result of measuring rolling resistance fluctuations

[Conditions]Feeding speed: 10 mm/s;
applied load : none (one block)

●Long-term Maintenance-free Operation

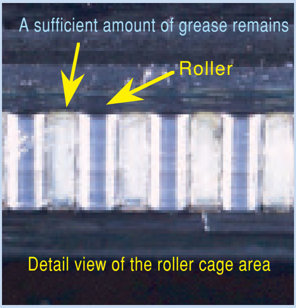
■High-speed durability test data

Use of a roller cage eliminates friction between rollers and increases grease retention, thus to achieve long-term maintenance-free operation.

[Tested model] SRG45LCC0

[Conditions]
Preload : C0 clearance
Stroke : 2,300 mm
Acceleration : 1.5G
Speed : 180m/min
Lubrication : initial lubrication only
(THK AFB grease)

[Test result]
No anomaly observed after running 15,000 km



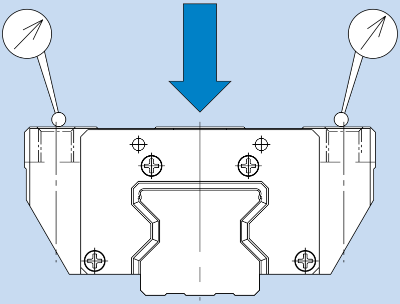
Detail view of the roller cage area

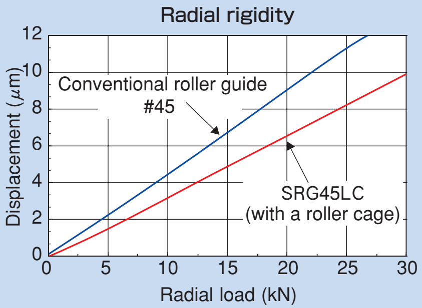
●Super-ultra-high Rigidity

■High rigidity evaluation data

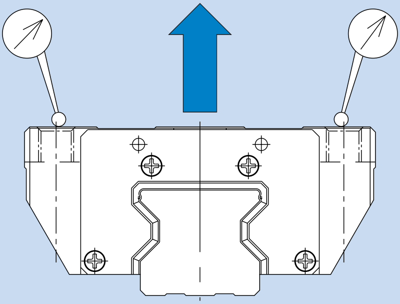
[Preload] SRG : radial clearance C0
Conventional type: radial clearance equivalent to C0

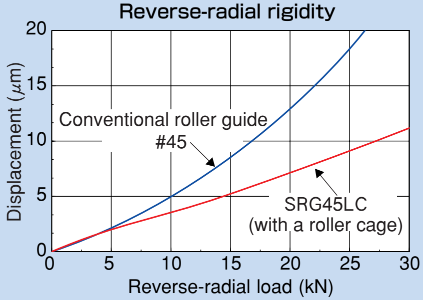
Radial rigidity



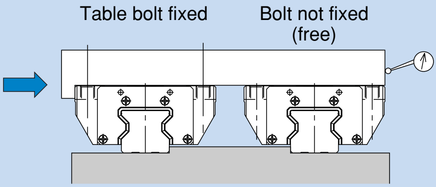


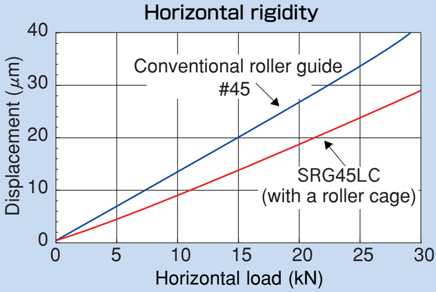
Reverse-radial rigidity





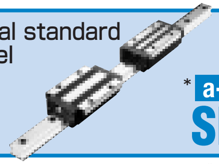
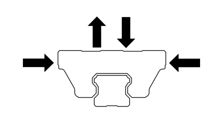
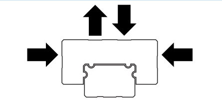
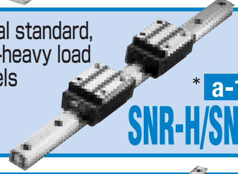
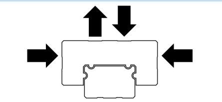
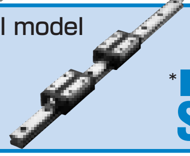
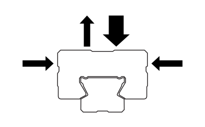
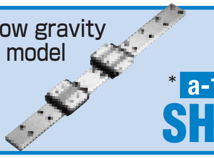
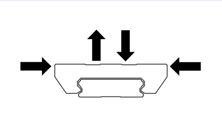
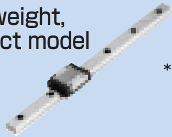
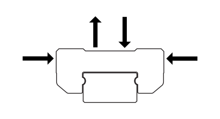
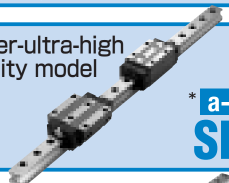
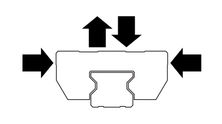
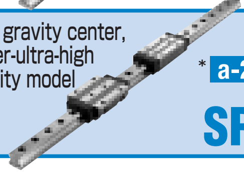
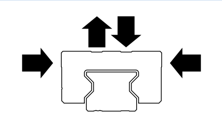
Horizontal rigidity





Rigidity is measured with the two axes placed in parallel and one of the axes not fixed with a bolt in order not to apply a moment.

2.3. Caged Ball/Roller LM Guides®

			Features	Load capacity diagram	Major application
Caged Ball/Roller LM Guides	Caged Ball LM Guides	Global standard model  * a-134 **SHS**	●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model. ●4-way equal-load design allows SHS to be used in all orientations.		Machining center NC lathe Drilling machine Electric discharge machine Conveyance system
		Low gravity center, ultra-heavy load models  * a-104 **SNR/SNS**	●Ultra-heavy load, high rigidity. ●Improved damping characteristics. ●Selectable from the radial-type SNR and the 4-way equal load type SNS.	 SNS	Machining center NC lathe Grinding machine Penta-plano milling machine
		Global standard, ultra-heavy load models  * a-104 **SNR-H/SNS-H**	●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model. ●Ultra-heavy load, high rigidity. ●Improve damping characteristics. ●Selectable from the radial-type SNR-H and the 4-way equal load type SNS-H.	 SNS-H	Machining center NC lathe Grinding machine Penta-plano milling machine
		Radial model  * a-86 **SSR**	●Low mounting height, compact design. ●Optimal for horizontal guide due to large radial load capacity.		Grinding machine Semiconductor manufacturing machine Printed circuit board drilling machine 3D measuring instrument Chip mounter Medical equipment
		Wide, low gravity center model  * a-154 **SHW**	●Capable of receiving a large moment due to a 4-way equal-load, wide, low gravity center structure. ●The geometrical moment of inertia of the LM rail is large and the lateral rigidity is high.		Printed circuit board drilling machine Semiconductor manufacturing machine Electric discharge machine Insertion machine Optical stage
		Light-weight, compact model  * a-170 **SRS**	●The most compact type in the Caged Ball LM Guide series. ●Light-weight, low-inertia structure.		Semiconductor manufacturing machine Optical stage Medical equipment IC bonder
	Caged Roller LM Guides	Super-ultra-high rigidity model  * a-186 **SRG**	●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model. ●Super-ultra-high rigidity structure using rollers as rolling elements. ●Smooth motion through prevention of rollers from skewing.		Penta-plano milling machine Ultra-precision machining center Heavy cutting machine Ultra-precision lathe Jig boring machine
		Low gravity center, super-ultra-high rigidity model  * a-204 **SRN**	●Super-ultra-high rigidity structure using rollers as rolling elements. ●Smooth motion through prevention of rollers from skewing. ●Compact design based on model SRG, with a lower total height.		Penta-plano milling machine Ultra-precision machining center Heavy cutting machine Ultra-precision lathe Jig boring machine

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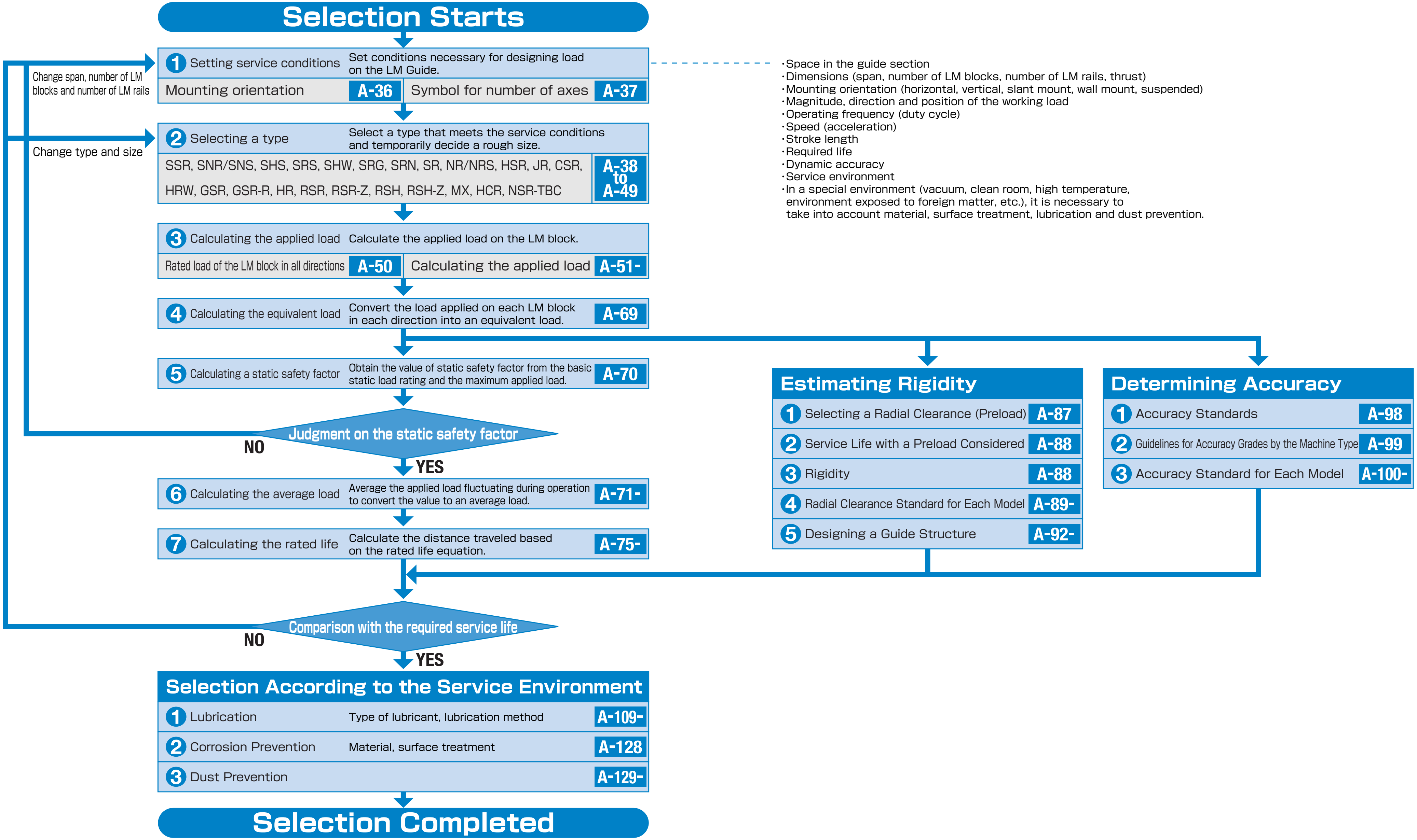
* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

3. Flow Chart for Selecting an LM Guide®

Steps for Selecting an LM Guide

The following is a flow chart as a measuring stick for selecting an LM Guide.



Selection Starts

① Setting service conditions — Set conditions necessary for designing load on the LM Guide.
- Mounting orientation A-36
- Symbol for number of axes A-37

- ·Space in the guide section
- ·Dimensions (span, number of LM blocks, number of LM rails, thrust)
- ·Mounting orientation (horizontal, vertical, slant mount, wall mount, suspended)
- ·Magnitude, direction and position of the working load
- ·Operating frequency (duty cycle)
- ·Speed (acceleration)
- ·Stroke length
- ·Required life
- ·Dynamic accuracy
- ·Service environment
- ·In a special environment (vacuum, clean room, high temperature, environment exposed to foreign matter, etc.), it is necessary to take into account material, surface treatment, lubrication and dust prevention.

② Selecting a type — Select a type that meets the service conditions and temporarily decide a rough size.
- SSR, SNR/SNS, SHS, SRS, SHW, SRG, SRN, SR, NR/NRS, HSR, JR, CSR, HRW, GSR, GSR-R, HR, RSR, RSR-Z, RSH, RSH-Z, MX, HCR, NSR-TBC A-38 to A-49

③ Calculating the applied load — Calculate the applied load on the LM block.
- Rated load of the LM block in all directions A-50
- Calculating the applied load A-51-

④ Calculating the equivalent load — Convert the load applied on each LM block in each direction into an equivalent load. A-69

⑤ Calculating a static safety factor — Obtain the value of static safety factor from the basic static load rating and the maximum applied load. A-70

Judgment on the static safety factor

NO — Change type and size / Change span, number of LM blocks and number of LM rails

YES

⑥ Calculating the average load — Average the applied load fluctuating during operation to convert the value to an average load. A-71-

⑦ Calculating the rated life — Calculate the distance traveled based on the rated life equation. A-75-

Estimating Rigidity

① Selecting a Radial Clearance (Preload)	A-87
② Service Life with a Preload Considered	A-88
③ Rigidity	A-88
④ Radial Clearance Standard for Each Model	A-89-
⑤ Designing a Guide Structure	A-92-

Determining Accuracy

① Accuracy Standards	A-98
② Guidelines for Accuracy Grades by the Machine Type	A-99
③ Accuracy Standard for Each Model	A-100-

Comparison with the required service life

NO

YES

Selection According to the Service Environment

① Lubrication	Type of lubricant, lubrication method	A-109-
② Corrosion Prevention	Material, surface treatment	A-128
③ Dust Prevention		A-129-

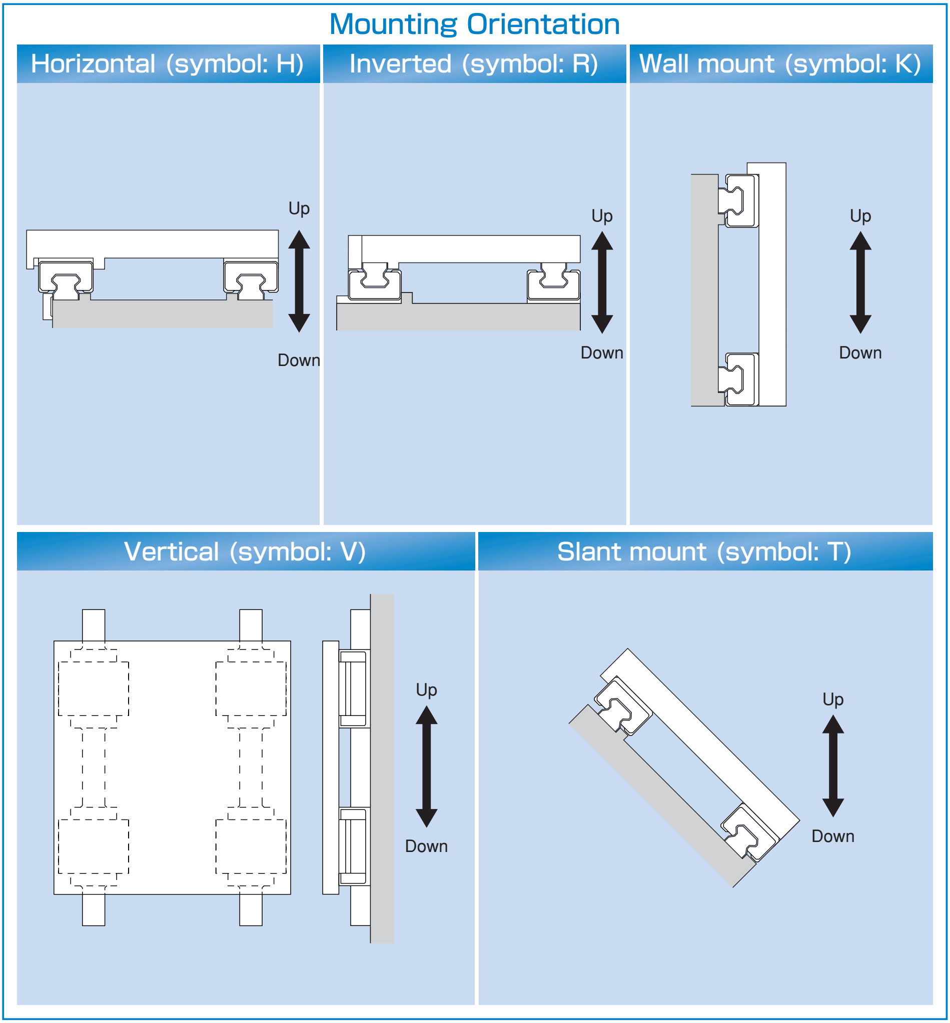
Selection Completed

3.1. Setting Service Conditions

3.1.1. Service Conditions of the LM Guide®

Mounting Orientation

The LM Guide can be mounted in the following five orientations. If oil is to be used as a lubricant, it is necessary to change the lubrication routing and the related settings. When ordering an LM Guide, please specify the mounting orientation.



Symbol for Number of Axes

With the LM Guide, the normal- and high-accuracy grades are interchangeable when two or more units of the LM Guide are used in combination on the same plane. However, when using two or more units of a model of precision or higher grade, or with a radial clearance of C1 or C0, specify the number of LM rails (symbol for number of axes) in advance.

(For accuracy standards and radial clearance standards, see pages A-100 and A-89, respectively.)

SHS25C2SSC0+1000LP−Ⅱ

1 2

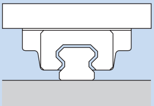
1 Model number (details are given on the corresponding page of the model)

2 Symbol for number of axes ("Ⅱ" indicates 2 axes. No symbol for a single axis)

Symbol for Number of Axes

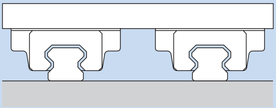
Symbol for number of axes: none

Required number of axes: 1



Symbol for number of axes: Ⅱ

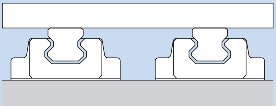
Required number of axes: 2



Note:
When placing an order, specify the number in multiple of 2 axes.

Symbol for number of axes: Ⅱ

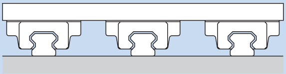
Required number of axes: 2



Note:
When placing an order, specify the number in multiple of 2 axes.

Symbol for number of axes: Ⅲ

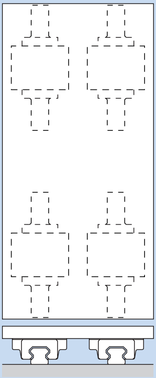
Required number of axes: 3



Note:
When placing an order, specify the number in multiple of 3 axes.

Symbol for number of axes: Ⅳ

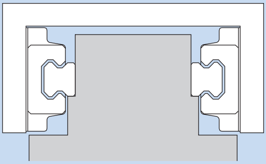
Required number of axes: 4



Note:
When placing an order, specify the number in multiple of 4 axes.

Other

Required number of axes: 2



Using 2 axes opposed to each other

3.2. Selecting a Type

Types of LM Guides

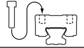
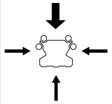
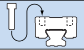
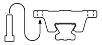
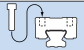
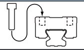
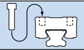
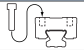
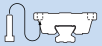
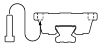
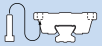
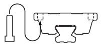
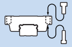
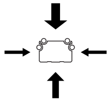
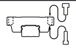
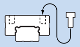
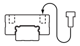
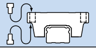
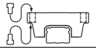
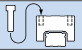
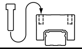
THK offers a wide array of types and dimensions with LM Guides as standard so that you can select the optimal product for any application. With the unit structure of each model, you can easily obtain high running accuracy with no clearance simply by mounting the product on a plane surface with bolts. We have a proven track record and know-how in extensive applications with LM Guides.

①

- Surface grinder table
- Tool grinder table
- Electric discharge machine
- Printed circuit board drilling machine
- Chip mounter
- High-speed conveyance system
- Traveling unit of robots
- Machining center
- NC lathe
- Penta-plano milling machine
- Conveyance system
- Mold guide of pressing machines
- Inspection machine
- Testing machine
- Food-related machine
- Medical equipment
- 3D measuring instrument
- Packaging machine
- Injection molding machine
- Woodworking machine
- Ultra precision table
- Semiconductor manufacturing machine

②

- Machining center
- NC lathe
- Grinding machine
- Penta-plano milling machine
- Jig boring machine
- Drilling machine
- NC milling machine
- Plano miller
- Mold processing machine
- Graphite processing machine
- Electric discharge machine
- Wire-cutting electric discharge machine

Category		Type		Major application	Load capacity diagram	Basic load rating (kN)		External dimensions (mm)		Reference page*	Features
						Basic dynamic load rating	Basic static load rating	Height	Width		
Radial types	Caged Ball LM Guides	SSR-XW		①		14.7 to 64.6	16.5 to 71.6	24 to 48	34 to 70	a-94	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Thin, compact design, large radial load capacity ●Superb in planar running accuracy ●Superb capability of absorbing mounting error ●Stainless steel type also offered as standard
		SSR-XV				9.0 to 21.7	9.7 to 22.5	24 to 33	34 to 48	a-96	
		SSR-XTB				14.7 to 31.5	16.5 to 36.4	24 to 33	52 to 73	a-98	
	Full-ball LM Guides	SR-W, T				9.51 to 411	19.3 to 537	24 to 135	34 to 250	a-232	●Thin, compact design, large radial load capacity ●Superb in planar running accuracy ●Superb capability of absorbing mounting error ●Stainless steel type also offered as standard ●Type M1, achieving max service temperature of 150℃, also available
		SR-M1W				9.51 to 41.7	19.3 to 77.2	24 to 48	34 to 70	a-244	
		SR-V				5.39 to 23.8	11.1 to 44.1	24 to 48	34 to 70	a-232	
		SR-M1V				5.39 to 23.8	11.1 to 44.1	24 to 48	34 to 70	a-244	
		SR-TB				9.51 to 98.1	19.3 to 157	24 to 68	52 to 140	a-234	
		SR-M1TB				9.51 to 41.7	19.3 to 77.2	24 to 48	52 to 100	a-246	
		SR-SB				5.39 to 23.8	11.1 to 44.1	24 to 48	52 to 100	a-234	
		SR-M1SB				5.39 to 23.8	11.1 to 44.1	24 to 48	52 to 100	a-246	
	Caged Ball LM Guides - ultra-heavy-load, high-rigidity types	SNR-C		②		48 to 260	79 to 409	31 to 75	72 to 170	a-118	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Ultra-heavy load capacity optimal for machine tools ●Thin, compact design, large radial load capacity ●High vibration resistance and impact resistance due to improved damping characteristics ●Superb in planar running accuracy
		SNR-LC				57 to 340	101 to 572	31 to 75	72 to 170	a-118	
		SNR-R				48 to 260	79 to 409	31 to 75	50 to 126	a-114	
		SNR-LR				57 to 340	101 to 572	31 to 75	50 to 126	a-114	
		SNR-CH				90 to 177	144 to 292	48 to 70	100 to 140	a-126	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Ultra-heavy load capacity optimal for machine tools ●Large radial load capacity ●High vibration resistance and impact resistance due to improved damping characteristics ●Superb in planar running accuracy ●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model
		SNR-LCH				108 to 214	188 to 383	48 to 70	100 to 140	a-126	
		SNR-RH				90 to 177	144 to 292	55 to 80	70 to 100	a-122	
		SNR-LRH				108 to 214	188 to 383	55 to 80	70 to 100	a-122	

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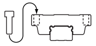
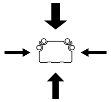
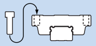
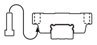
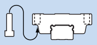
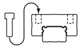
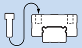
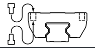
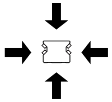
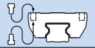
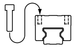
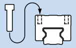
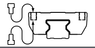
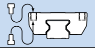
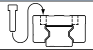
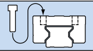
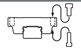
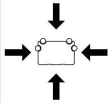
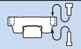
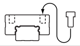
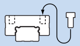
* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

②

- Machining center
- NC lathe
- Grinding machine
- Penta-plano milling machine
- Jig boring machine
- Drilling machine
- NC milling machine
- Plano miller
- Mold processing machine
- Graphite processing machine
- Electric discharge machine
- Wire-cutting electric discharge machine

Category		Type		Major application	Load capacity diagram	Basic load rating (kN)		External dimensions (mm)		Reference page*	Features
						Basic dynamic load rating	Basic static load rating	Height	Width		
Radial types	Full-ball LM Guides - ultra-heavy-load, high-rigidity types	NR-A		②		33 to 479	84.6 to 1040	31 to 105	72 to 260	a-266	Ultra-heavy load capacity optimal for machine tools High vibration resistance and impact resistance due to improved damping characteristics Thin, compact design, large radial load capacity Superb in planar running accuracy
		NR-LA				44 to 599	113 to 1300	31 to 105	72 to 260	a-266	
		NR-B				33 to 479	84.6 to 1040	31 to 105	72 to 260	a-270	
		NR-LB				44 to 599	113 to 1300	31 to 105	72 to 260	a-270	
		NR-R				33 to 479	84.6 to 1040	31 to 105	50 to 200	a-262	
		NR-LR				44 to 599	113 to 1300	31 to 105	50 to 200	a-262	
4-way equal-load types	Caged Roller LM Guides - super-ultra-heavy load, high-rigidity types	SRG-C				27.9 to 131	57.5 to 266	36 to 70	70 to 140	a-196	Long service life, long-term maintenance-free operation Low noise, acceptable running sound Superbly high speed Smooth motion due to prevention of rollers from skewing Ultra-heavy load capacity optimal for machine tools
		SRG-LC				34.2 to 278	75 to 599	36 to 90	70 to 170	a-196	
		SRG-R				27.9 to 131	57.5 to 266	40 to 80	48 to 100	a-198	
		SRG-LR, LV				34.2 to 278	75 to 599	40 to 90	48 to 126	a-198	
		SRN-C				59.1 to 131	119 to 266	44 to 63	100 to 140	a-214	Long service life, long-term maintenance-free operation Low noise, acceptable running sound Superbly high speed Smooth motion due to prevention of rollers from skewing Ultra-heavy load capacity optimal for machine tools Low gravity center, super-ultra-high rigidity
		SRN-LC				76 to 278	165 to 599	44 to 75	100 to 170	a-214	
		SRN-R				59.1 to 131	119 to 266	44 to 63	70 to 100	a-216	
		SRN-LR				76 to 278	165 to 599	44 to 75	70 to 126	a-216	
	Caged Ball LM Guides - ultra-heavy-load, high-rigidity types	SNS-C				37 to 199	61 to 315	31 to 75	72 to 170	a-120	Long service life, long-term maintenance-free operation Low dust generation, low noise, acceptable running sound Superbly high speed Smooth motion in all mounting orientations Ultra-heavy load capacity optimal for machine tools Thin, compact design, 4-way equal-load High vibration resistance and impact resistance due to improved damping characteristics
		SNS-LC				44 to 261	78 to 441	31 to 75	72 to 170	a-120	
		SNS-R				37 to 199	61 to 315	31 to 75	50 to 126	a-116	
		SNS-LR				44 to 261	78 to 441	31 to 75	50 to 126	a-116	

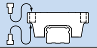
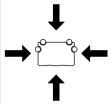
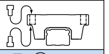
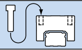
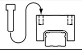
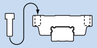
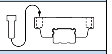
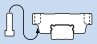
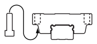
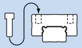
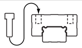
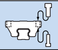
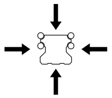
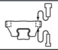
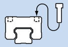
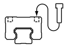
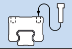
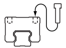
* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

②

- ●Machining center
- ●NC lathe
- ●Grinding machine
- ●Penta-plano milling machine
- ●Jig boring machine
- ●Drilling machine
- ●NC milling machine
- ●Plano miller
- ●Mold processing machine
- ●Graphite processing machine
- ●Electric discharge machine
- ●Wire-cutting electric discharge machine

③

- ●Machining center
- ●NC lathe
- ●XYZ axes of heavy cutting machine tools
- ●Grinding head feeding axis of grinding machines
- ●Components requiring a heavy moment and high accuracy
- ●NC milling machine
- ●Plano miller
- ●Gantry penta-plano milling machine
- ●Z axis of electric discharge machines
- ●Wire-cutting electric discharge machine
- ●Multistory garage
- ●Food-related machine
- ●Testing machine
- ●Vehicle doors
- ●Printed circuit board drilling machine
- ●ATC
- ●Building equipment/machine
- ●Shield tunneling machine
- ●Semiconductor manufacturing machine

Category		Type	Major application	Load capacity diagram	Basic load rating (kN)		External dimensions (mm)		Reference page*	Features
					Basic dynamic load rating	Basic static load rating	Height	Width		
4-way equal-load types	Caged Ball LM Guides - ultra-heavy-load, high-rigidity types	SNS-CH 	②		69 to 136	110 to 225	48 to 70	100 to 140	a-128	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Ultra-heavy load capacity optimal for machine tools ●4-way equal-load ●High vibration resistance and impact resistance due to improved damping characteristics ●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model
		SNS-LCH 			83 to 164	144 to 295	48 to 70	100 to 140	a-128	
		SNS-RH 			69 to 136	110 to 225	55 to 80	70 to 100	a-124	
		SNS-LRH 			83 to 164	144 to 295	55 to 80	70 to 100	a-124	
	Full-ball LM Guides - ultra-heavy-load, high-rigidity types	NRS-A 			25.9 to 376	59.8 to 737	31 to 105	72 to 260	a-268	●Ultra-heavy load capacity optimal for machine tools ●High vibration resistance and impact resistance due to improved damping characteristics ●Thin, compact design, 4-way equal-load
		NRS-LA 			34.5 to 470	79.7 to 920	31 to 105	72 to 260	a-268	
		NRS-B 			25.9 to 376	59.8 to 737	31 to 105	72 to 260	a-272	
		NRS-LB 			34.5 to 470	79.7 to 920	31 to 105	72 to 260	a-272	
		NRS-R 			25.9 to 376	59.8 to 737	31 to 105	50 to 200	a-264	
		NRS-LR 			34.5 to 470	79.7 to 920	31 to 105	50 to 200	a-264	
	Caged Ball LM Guides - heavy-load, high-rigidity types	SHS-C 	③		14.2 to 205	24.2 to 320	24 to 90	47 to 170	a-144	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Heavy load, high rigidity ●Has dimensions almost the same as that of the full-ball type LM Guide model HSR, which is practically a global standard model ●Superb capability of absorbing mounting error
		SHS-LC 			17.2 to 253	31.9 to 408	24 to 90	47 to 170	a-144	
		SHS-V 			14.2 to 205	24.2 to 320	24 to 90	34 to 126	a-146	
		SHS-LV 			17.2 to 253	31.9 to 408	24 to 90	34 to 126	a-146	
		SHS-R 			14.2 to 128	24.2 to 197	28 to 80	34 to 100	a-148	
		SHS-LR 			36.8 to 161	64.7 to 259	28 to 80	34 to 100	a-148	

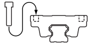
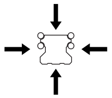
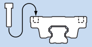
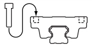
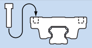
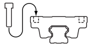
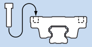
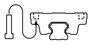
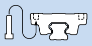
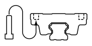
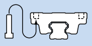
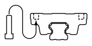
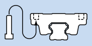
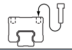
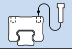
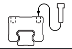
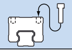
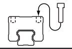
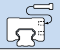
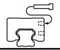
* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

③

- Machining center
- NC lathe
- XYZ axes of heavy cutting machine tools
- Grinding head feeding axis of grinding machines
- Components requiring a heavy moment and high accuracy
- NC milling machine
- Plano miller
- Gantry penta-plano milling machine
- Z axis of electric discharge machines
- Wire-cutting electric discharge machine
- Multistory garage
- Food-related machine
- Testing machine
- Vehicle doors
- Printed circuit board drilling machine
- ATC
- Building equipment/machine
- Shield tunneling machine
- Semiconductor manufacturing machine

④

- Cross rails of gantry machine tools
- Z axis of woodworking machines
- Z axis of measuring instruments
- Components opposed to each other

Category		Type	Major application	Load capacity diagram	Basic load rating (kN) Basic dynamic load rating	 Basic static load rating	External dimensions (mm) Height	 Width	Reference page*	Features
4-way equal-load types	Full-ball LM Guides - heavy-load, high-rigidity types	HSR-A 	③		8.33 to 210	13.5 to 310	24 to 110	47 to 215	a-290	●Heavy load, high rigidity ●Practically a global standard model ●Superb capability of absorbing mounting error ●Stainless steel type also offered as standard ●Type M1, achieving max service temperature of 150°C, also available ●Type M2, with high corrosion resistance, also available (Basic dynamic load rating: 2.33 to 5.57 kN Basic static load rating: 2.03 to 5.16 kN)
		HSR-M1A 			8.33 to 37.3	13.5 to 61.1	24 to 48	47 to 100	a-318	
		HSR-LA 			21.3 to 282	31.8 to 412	30 to 110	63 to 215	a-290	
		HSR-M1LA 			21.3 to 50.2	31.8 to 81.5	30 to 48	63 to 100	a-318	
		HSR-CA 			13.8 to 210	23.8 to 310	30 to 110	63 to 215	a-300	
		HSR-HA 			21.3 to 518	31.8 to 728	30 to 145	63 to 350	a-300,304	
		HSR-B 			8.33 to 210	13.5 to 310	24 to 110	47 to 215	a-292	
		HSR-M1B 			8.33 to 37.3	13.5 to 61.1	24 to 48	47 to 100	a-320	
		HSR-LB 			21.3 to 282	31.8 to 412	30 to 110	63 to 215	a-292	
		HSR-M1LB 			21.3 to 50.2	31.8 to 81.5	30 to 48	63 to 100	a-320	
		HSR-CB 			13.8 to 210	23.8 to 310	30 to 110	63 to 215	a-302	
		HSR-HB 			21.3 to 518	31.8 to 728	30 to 145	63 to 350	a-302,304	
		HSR-R 			1.08 to 210	2.16 to 310	11 to 110	16 to 156	a-294,296	
		HSR-M1R 			8.33 to 37.3	13.5 to 61.1	28 to 55	34 to 70	a-322	
		HSR-LR 			21.3 to 282	31.8 to 412	30 to 110	44 to 156	a-296	
		HSR-M1LR 			21.3 to 50.2	31.8 to 81.5	30 to 55	44 to 70	a-322	
		HSR-HR 			351 to 518	506 to 728	120 to 145	250 to 266	a-304	
	Full-ball LM Guides - side mount types	HSR-YR 	④		8.33 to 141	13.5 to 215	28 to 90	33.5 to 124.5	a-298	●Easy mounting and reduced mounting height when using 2 units opposed to each other since the side faces of the LM block have mounting holes ●Heavy load, high rigidity ●Superb capability of absorbing mounting error ●Stainless steel type also offered as standard ●Type M1, achieving max service temperature of 150° C, also available
		HSR-M1YR 			8.33 to 37.3	13.5 to 61.1	28 to 55	33.5 to 69.5	a-324	

* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

⑤

- Automated warehouse
- Garage
- Gantry robot
- FMS traveling rail
- Elevator
- Conveyance system
- Welding machine
- Lifter
- Crane
- Forklift
- Coating machine
- Shield tunneling machine
- Stage setting

⑥

- Low gravity center, precision XY table
- NC lathe
- Optical measuring instrument
- Automatic lathe
- Inspection machine
- Cartesian coordinate robot
- Bonding machine
- Wire-cutting electric discharge machine
- Hollow table
- Printed circuit board assembler
- Machine tool table
- Electric discharge machine
- XY axes of horizontal machining centers

⑦

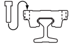
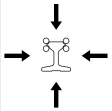
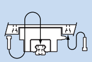
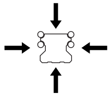
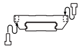
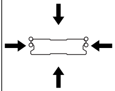
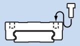
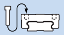
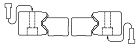
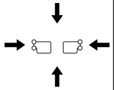
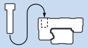
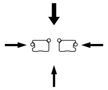
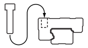
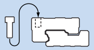
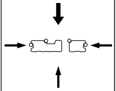
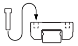
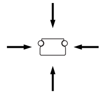
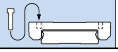
- Z axis of IC printed circuit board drilling machine
- Z axis of small electric discharge machine
- Loader
- Machining center
- NC lathe
- Robot
- Wire-cutting electric discharge machine
- APC
- Semiconductor manufacturing machine
- Measuring instrument
- Wafer transfer equipment
- Building equipment
- Railroad vehicle

⑧

- XYS axes of electric discharge machine
- Precision table
- XZ axes of NC lathe
- Assembly robot
- Conveyance system
- Machining center
- Wire-cutting electric discharge machine
- Tool changer
- Woodworking machine

⑨

- Industrial robot
- Various conveyance systems
- Automated warehouse
- Palette changer
- ATC
- Door closing device
- Guide using an aluminum mold base
- Welding machine
- Coating machine
- Car washing machine

Category		Type	Major application	Load capacity diagram	Basic load rating (kN)		External dimensions (mm)		Reference page*	Features
					Basic dynamic load rating	Basic static load rating	Height	Width		
4-way equal-load types	Full-ball LM Guides - special LM rail types	JR-A 	⑤		19.9 to 88.5	34.4 to 137	61 to 114	70 to 140	a-342	●Since the central part of the LM rail is thinly structured, the LM Guide is capable of absorbing an error and achieving smooth motion if the parallelism between the 2 axes is poor ●Since the LM rail has a highly rigid sectional shape, it can be used as a structural member
		JR-B 			19.9 to 88.5	34.4 to 137	61 to 114	70 to 140	a-342	
		JR-R 			19.9 to 88.5	34.4 to 137	65 to 124	48 to 100	a-342	
	Full-ball LM Guides - orthogonal type	CSR 	⑥		8.33 to 80.4	13.5 to 127.5	47 to 118	38.8 to 129.8	a-352	●A compact XY structure is allowed due to an XY orthogonal, single-piece LM block ●Since a saddle-less structure is allowed, the machine can be light-weighted and compactly designed
	Caged Ball LM Guides - wide, low gravity center types	SHW-CA 	⑦		4.31 to 70.2	5.66 to 91.4	12 to 50	40 to 162	a-162	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Wide, low gravity center design, space saving structure ●Stainless steel type also available as standard
		SHW-CR, HR 			4.31 to 70.2	5.66 to 91.4	12 to 50	30 to 130	a-164	
	Full-ball LM Guides - wide, low gravity center types	HRW-CA 			4.31 to 63.8	81.4 to 102	17 to 60	60 to 200	a-364	●4-way equal-load, thin and highly rigid ●Wide, low gravity center design, space saving structure ●Stainless steel type also available as standard
		HRW-CR, LR 			4.31 to 50.2	7.16 to 81.5	12 to 50	30 to 130	a-366	
	Full-ball LM Guides - separate types	HR, HR-T 	⑧		1.57 to 141	3.04 to 206	8.5 to 60	18 to 125	a-402	●Thin, high rigidity, space saving structure ●Interchangeable with Cross-Roller Guide ●Preload can be adjusted ●Stainless steel type also available as standard
Interchangeable types		GSR-T 	⑨		5.69 to 25.1	8.43 to 33.8	20 to 38	32 to 68	a-376	●LM block and LM rail are both interchangeable ●Preload can be adjusted ●Capable of absorbing vertical level error and horizontal parallelism error
		GSR-V 			4.31 to 10.29	5.59 to 12.65	20 to 30	32 to 50	a-376	
	Full-ball LM Guides - LM rail-rack integrated type	GSR-R 			10.29 to 25.1	12.65 to 33.8	30 to 38	59.91 to 80.18	a-388	●LM rail-rack integrated design eliminates assembly and adjustment work ●LM rail-rack integrated design enables a space-saving structure to be achieved ●Capable of supporting long strokes
Miniature types	Caged Ball LM Guides	SRS 	⑩		2.69 to 16.5	2.31 to 20.2	10 to 25	20 to 48	a-178	●Long service life, long-term maintenance-free operation ●Low dust generation, low noise, acceptable running sound ●Superbly high speed ●Smooth motion in all mounting orientations ●Stainless steel type also available as standard ●Lightweight, compact
		SRS-W 			3.29 to 9.12	3.34 to 8.55	12 to 16	30 to 60	a-180	

* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

⑩

- IC/LSI manufacturing machine
- Hard disc drive
- Slide unit of OA equipment
- Wafer transfer equipment
- Printed circuit board assembly table
- Medical equipment
- Electronic components of electron microscope
- Optical stage
- Stepper
- Plotting machine
- Feed mechanism of IC bonding machine
- Inspection machine

⑪

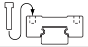
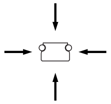
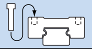
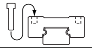
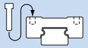
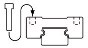
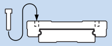
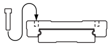
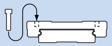
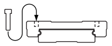
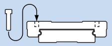
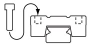
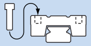
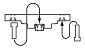
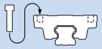
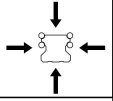
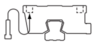
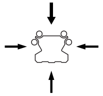
- IC/LSI manufacturing machine
- Inspection machine
- Slide unit of OA equipment
- Wafer transfer equipment
- Feed mechanism of IC bonding machine
- Printed circuit board assembly table
- Medical equipment
- Electronic components of electron microscope
- Optical stage

⑫

- Large swivel base
- Pendulum vehicle for railroad
- Pantagraph
- Control unit
- Optical measuring machine
- Tool grinding machine
- X-ray machine
- CT scanner
- Medical equipment
- Stage setting
- Multistory garage
- Amusement machine
- Turntable
- Tool changer

⑬

- XY axes of ordinary industrial machinery
- Various conveyance systems
- Automated warehouse
- Palette changer
- Automatic coating machine
- Various welding machines

Category		Type	Major application	Load capacity diagram	Basic load rating (kN)		External dimensions (mm)		Reference page*	Features
					Basic dynamic load rating	Basic static load rating	Height	Width		
Miniature types	Full-ball LM Guides	RSR, RSR-K, RSR-V 	⑩		0.18 to 8.82	0.27 to 12.7	4 to 25	8 to 46	a-416, 418	Stainless steel type offered as standard Long type with increased load capacity also offered as standard Type M1, achieving max service temperature of 150°C, also available
		RSR-M1V 			1.47 to 8.82	2.25 to 12.7	10 to 25	20 to 46	a-444	
		RSR-N 			0.3 to 14.2	0.44 to 20.6	4 to 25	8 to 46	a-416, 418	
		RSR-M1N 			2.6 to 14.2	3.96 to 20.6	10 to 25	20 to 46	a-444	
		RSR-Z 			0.88 to 4.41	1.37 to 6.57	8 to 16	17 to 32	a-432	
	Full-ball LM Guides - wide types	RSR-W, WV 			0.25 to 6.66	0.47 to 9.8	4.5 to 16	12 to 60	a-420	Stainless steel type offered as standard Long type with increased load capacity also offered as standard Type M1, achieving max service temperature of 150°C, also available
		RSR-M1WV 			2.45 to 6.66	3.92 to 9.8	12 to 16	30 to 60	a-446	
		RSR-WN 			0.39 to 9.91	0.75 to 14.9	4.5 to 16	12 to 60	a-420	
		RSR-M1WN 			3.52 to 9.91	5.37 to 14.9	12 to 16	30 to 60	a-446	
		RSR-WZ 			1.37 to 6.66	2.16 to 9.8	9 to 16	25 to 60	a-434	
	Full-ball LM Guides - ball-retaining plate types	RSH, RSH-K, RSH-V 			0.88 to 2.65	1.37 to 4.02	8 to 13	17 to 27	a-456	Equipped with a ball-retaining plate Stainless steel type offered as standard
		RSH-Z 			0.88 to 4.41	1.37 to 6.57	8 to 16	17 to 32	a-466	
	Full-ball LM Guide - orthogonal type	MX 	⑪		0.59 to 2.04	1.1 to 3.21	10 to 14.5	15.2 to 30.2	a-478	A compact XY structure is allowed due to an XY orthogonal, single-piece LM block Stainless steel type offered as standard
Circular arc types	Full-ball LM Guide	HCR 	⑫		4.7 to 141	8.53 to 215	18 to 19	39 to 170	a-486	Circular-arc motion guide in a 4-way equal load design Highly accurate circular-arc motion without play Allows an efficient design with the LM block placed in the loading point Large circular-arc motion easily achieved
Self-aligning types	Full-ball LM Guide	NSR-TBC 	⑬		9.41 to 90.8	18.6 -152	40 to 105	70 to 175	a-498	Can be used in rough mount due to self-aligning on the fit surface of the case Preload can be adjusted Can be mounted on a black steel sheet

* Note: These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

3.3. Calculating the Applied Load

The LM Guide is capable of receiving loads and moments in all directions that are generated due to the mounting orientation, alignment, gravity center position of a traveling object, thrust position and cutting resistance.

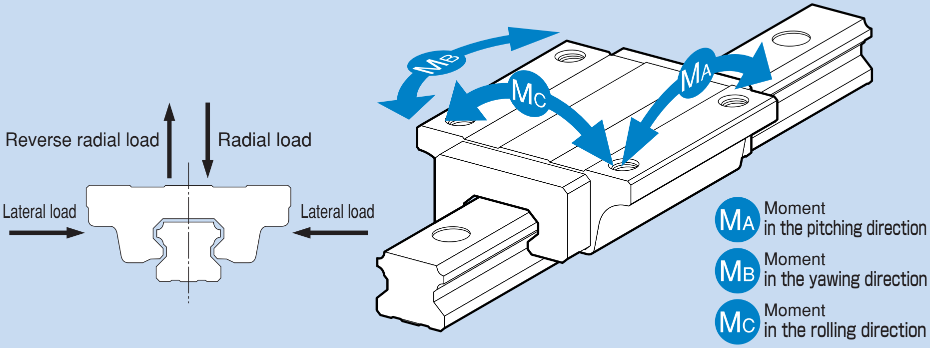
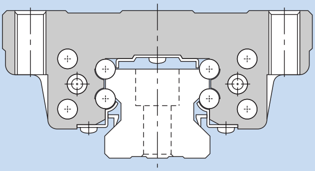
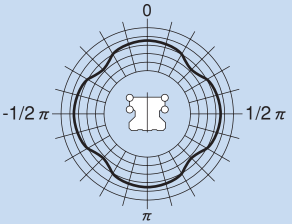
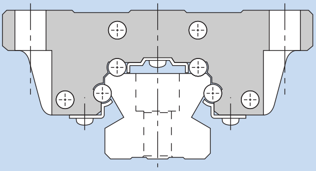
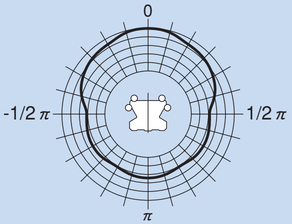


Fig. 1 Directions of Applied Loads on the LM Guide

3.3.1. Rated Load of an LM Guide® in Each Direction

The LM Guide is categorized into roughly two types: the 4-way equal-load type, which has the same rated load in the radial, reverse-radial and lateral directions, and the radial type, which has a large rated load in the radial direction. With the radial type LM Guide, the rated load in the radial direction is different from that in the reverse-radial and lateral directions. When such loads are applied, multiply the basic load rating in the "THK General Catalog - Product Specifications," provided separately, by the corresponding factor. Those factors are specified in the respective sections.

Rated Load in Each Direction

Type	Load distribution curve
4-way equal-load type 	
Radial type 	

3.3.2. Calculating an Applied Load

Single-Axis Use

●Moment Equivalence

When the installation space for the LM Guide is limited, you may have to use only one LM block, or two LM blocks closely contacting with each other. In such a setting, the load distribution is not uniform and, as a result, an excessive load is applied in localized areas (i.e., rail ends) as shown in Fig. 2. Continued use under such conditions may result in flaking in those areas, consequently shortening the service life. In such a case, calculate the actual load by multiplying the moment value by any one of the equivalent-moment factors specified in Tables 1 to 8.

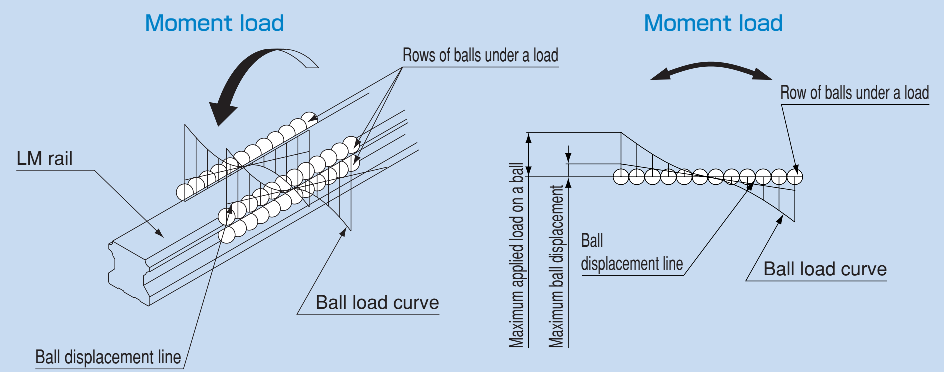


Fig. 2 Ball Load when a Moment is Applied

An equivalent-load equation applicable when a moment acts on an LM Guide is shown below.

$$P=K\cdot M$$

P	: Equivalent load per LM Guide	(N)
K	: Equivalent moment factor	
M	: Load moment	(N・mm)

●Equivalent Factor

Since the rated load is equivalent to the permissible moment, the equivalent factor to be multiplied when equalizing the M_A, M_B and M_C moments to the applied load per block is obtained by dividing the rated loads in the corresponding directions.

With those models other than 4-way equal-load types, however, the rated loads in the 4 directions differ from each other. Therefore, the equivalent factor values for the M_A and M_C moments also differ depending on whether the direction is radial or reverse-radial.

Equivalent factors for the M_A moment

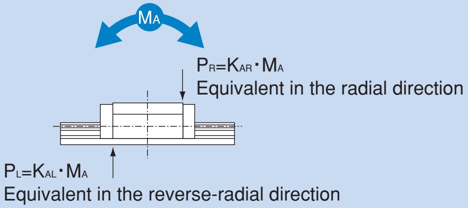


Fig. 3 Equivalent Factors for the M_A Moment

Equivalent factors for the M_A moment

Equivalent factor in the radial direction $K_{AR}=\dfrac{C_0}{M_A}$

Equivalent factor in the reverse-radial direction $K_{AL}=\dfrac{C_{0L}}{M_A}$

$$\frac{C_0}{K_{AR}\cdot M_A}=\frac{C_{0L}}{K_{AL}\cdot M_A}=1$$

Equivalent factors for the M_B moment

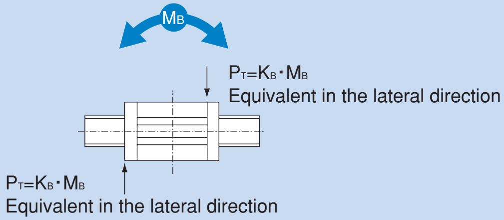


Fig. 4 Equivalent Factors for the M_B Moment

Equivalent factors for the M_B moment

Equivalent factor in the lateral directions $K_B=\dfrac{C_{0T}}{M_B}$

$$\frac{C_{0T}}{K_B\cdot M_B}=1$$

Equivalent factors for the M_C moment

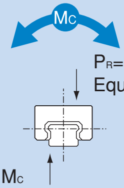


Fig. 5 Equivalent Factors for the M_C Moment

Equivalent factors for the M_C moment

- Equivalent factor in the radial direction $K_{CR} = \frac{C_0}{M_C}$
- Equivalent factor in the reverse-radial direction $K_{CL} = \frac{C_{0L}}{M_C}$

$$\frac{C_0}{K_{CR} \cdot M_C} = \frac{C_{0L}}{K_{CL} \cdot M_C} = 1$$

C_0 : Basic load rating (radial direction) (N)
C_{0L} : Basic load rating (reverse-radial direction) (N)
C_{0T} : Basic load rating (lateral directions) (N)
P_R : Calculated load (radial direction) (N)
P_L : Calculated load (reverse-radial direction) (N)
P_T : Calculated load (lateral directions) (N)

Table 1 Equivalent Factors (Models SSR, SNR and SNS)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
SSR 15XW(TB)	2.08×10^{-1}	1.04×10^{-1}	3.75×10^{-2}	1.87×10^{-2}	1.46×10^{-1}	2.59×10^{-2}	1.71×10^{-1}	8.57×10^{-2}
SSR 15XV	3.19×10^{-1}	1.60×10^{-1}	5.03×10^{-2}	2.51×10^{-2}	2.20×10^{-1}	3.41×10^{-2}	1.71×10^{-1}	8.57×10^{-2}
SSR 20XW(TB)	1.69×10^{-1}	8.46×10^{-2}	3.23×10^{-2}	1.62×10^{-2}	1.19×10^{-1}	2.25×10^{-2}	1.29×10^{-1}	6.44×10^{-2}
SSR 20XV	2.75×10^{-1}	1.37×10^{-1}	4.28×10^{-2}	2.14×10^{-2}	1.89×10^{-1}	2.89×10^{-2}	1.29×10^{-1}	6.44×10^{-2}
SSR 25XW(TB)	1.41×10^{-1}	7.05×10^{-2}	2.56×10^{-2}	1.28×10^{-2}	9.86×10^{-2}	1.77×10^{-2}	1.10×10^{-1}	5.51×10^{-2}
SSR 25XV	2.15×10^{-1}	1.08×10^{-1}	3.40×10^{-2}	1.70×10^{-2}	1.48×10^{-1}	2.31×10^{-2}	1.10×10^{-1}	5.51×10^{-2}
SSR 30XW	1.18×10^{-1}	5.91×10^{-2}	2.19×10^{-2}	1.10×10^{-2}	8.26×10^{-2}	1.52×10^{-2}	9.22×10^{-2}	4.61×10^{-2}
SSR 35XW	1.01×10^{-1}	5.03×10^{-2}	1.92×10^{-2}	9.60×10^{-3}	7.04×10^{-2}	1.33×10^{-2}	7.64×10^{-2}	3.82×10^{-2}
SNR 25	1.16×10^{-1}	7.41×10^{-2}	2.18×10^{-2}	1.40×10^{-2}	7.02×10^{-2}	1.33×10^{-2}	9.09×10^{-2}	5.82×10^{-2}
SNR 25L	8.79×10^{-2}	5.62×10^{-2}	1.82×10^{-2}	1.16×10^{-2}	5.41×10^{-2}	1.13×10^{-2}	9.09×10^{-2}	5.82×10^{-2}
SNR 30	1.02×10^{-1}	6.51×10^{-2}	1.86×10^{-2}	1.19×10^{-2}	6.16×10^{-2}	1.13×10^{-2}	8.11×10^{-2}	5.19×10^{-2}
SNR 30L	7.60×10^{-2}	4.87×10^{-2}	1.55×10^{-2}	9.93×10^{-3}	4.68×10^{-2}	9.58×10^{-3}	8.11×10^{-2}	5.19×10^{-2}
SNR 35	8.92×10^{-2}	5.71×10^{-2}	1.67×10^{-2}	1.07×10^{-2}	5.40×10^{-2}	1.01×10^{-2}	6.73×10^{-2}	4.31×10^{-2}
SNR 35L	7.01×10^{-2}	4.48×10^{-2}	1.37×10^{-2}	8.79×10^{-3}	4.27×10^{-2}	8.41×10^{-3}	6.73×10^{-2}	4.31×10^{-2}
SNR 45	6.55×10^{-2}	4.19×10^{-2}	1.35×10^{-2}	8.62×10^{-3}	4.03×10^{-2}	8.32×10^{-3}	5.10×10^{-2}	3.27×10^{-2}
SNR 45L	5.32×10^{-2}	3.41×10^{-2}	1.10×10^{-2}	7.01×10^{-3}	3.26×10^{-2}	6.73×10^{-3}	5.10×10^{-2}	3.27×10^{-2}
SNR 55	5.85×10^{-2}	3.74×10^{-2}	1.13×10^{-2}	7.24×10^{-3}	3.56×10^{-2}	6.92×10^{-3}	4.36×10^{-2}	2.79×10^{-2}
SNR 55L	4.55×10^{-2}	2.91×10^{-2}	9.36×10^{-3}	5.99×10^{-3}	2.79×10^{-2}	5.75×10^{-3}	4.36×10^{-2}	2.79×10^{-2}
SNR 65	5.07×10^{-2}	3.25×10^{-2}	9.92×10^{-3}	6.35×10^{-3}	3.09×10^{-2}	6.06×10^{-3}	3.70×10^{-2}	2.37×10^{-2}
SNR 65L	3.58×10^{-2}	2.29×10^{-2}	7.67×10^{-3}	4.91×10^{-3}	2.21×10^{-2}	4.75×10^{-3}	3.70×10^{-2}	2.37×10^{-2}
SNS 25	1.12×10^{-1}	9.42×10^{-2}	2.11×10^{-2}	1.78×10^{-2}	1.02×10^{-1}	1.91×10^{-2}	9.41×10^{-2}	7.90×10^{-2}
SNS 25L	8.52×10^{-2}	7.16×10^{-2}	1.77×10^{-2}	1.48×10^{-2}	7.73×10^{-2}	1.60×10^{-2}	9.41×10^{-2}	7.90×10^{-2}
SNS 30	9.86×10^{-2}	8.28×10^{-2}	1.80×10^{-2}	1.51×10^{-2}	8.93×10^{-2}	1.63×10^{-2}	8.42×10^{-2}	7.07×10^{-2}
SNS 30L	7.37×10^{-2}	6.19×10^{-2}	1.50×10^{-2}	1.26×10^{-2}	6.68×10^{-2}	1.36×10^{-2}	8.42×10^{-2}	7.07×10^{-2}
SNS 35	8.64×10^{-2}	7.26×10^{-2}	1.61×10^{-2}	1.36×10^{-2}	7.83×10^{-2}	1.46×10^{-2}	7.01×10^{-2}	5.89×10^{-2}
SNS 35L	6.80×10^{-2}	5.71×10^{-2}	1.33×10^{-2}	1.12×10^{-2}	6.17×10^{-2}	1.21×10^{-2}	7.01×10^{-2}	5.89×10^{-2}
SNS 45	6.34×10^{-2}	5.33×10^{-2}	1.30×10^{-2}	1.10×10^{-2}	5.75×10^{-2}	1.18×10^{-2}	5.27×10^{-2}	4.43×10^{-2}
SNS 45L	5.17×10^{-2}	4.34×10^{-2}	1.06×10^{-2}	8.94×10^{-3}	4.69×10^{-2}	9.64×10^{-3}	5.27×10^{-2}	4.43×10^{-2}
SNS 55	5.67×10^{-2}	4.76×10^{-2}	1.10×10^{-2}	9.22×10^{-3}	5.14×10^{-2}	9.94×10^{-3}	4.52×10^{-2}	3.80×10^{-2}
SNS 55L	4.42×10^{-2}	3.72×10^{-2}	9.09×10^{-3}	7.64×10^{-3}	4.01×10^{-2}	8.24×10^{-3}	4.52×10^{-2}	3.80×10^{-2}
SNS 65	4.92×10^{-2}	4.13×10^{-2}	9.62×10^{-3}	8.08×10^{-3}	4.46×10^{-2}	8.71×10^{-3}	3.82×10^{-2}	3.21×10^{-2}
SNS 65L	3.47×10^{-2}	2.92×10^{-2}	7.45×10^{-3}	6.26×10^{-3}	3.15×10^{-2}	6.75×10^{-3}	3.82×10^{-2}	3.21×10^{-2}

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 2 Equivalent Factors (Models SHS, SHW and SRS)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
SHS 15	1.38×10^{-1}		2.69×10^{-2}		1.38×10^{-1}	2.69×10^{-2}	1.50×10^{-1}	
SHS 15L	1.07×10^{-1}		2.22×10^{-2}		1.07×10^{-1}	2.22×10^{-2}	1.50×10^{-1}	
SHS 20	1.15×10^{-1}		2.18×10^{-2}		1.15×10^{-1}	2.18×10^{-2}	1.06×10^{-1}	
SHS 20L	8.85×10^{-2}		1.79×10^{-2}		8.85×10^{-2}	1.79×10^{-2}	1.06×10^{-1}	
SHS 25	9.25×10^{-2}		1.90×10^{-2}		9.25×10^{-2}	1.90×10^{-2}	9.29×10^{-2}	
SHS 25L	7.62×10^{-2}		1.62×10^{-2}		7.62×10^{-2}	1.62×10^{-2}	9.29×10^{-2}	
SHS 30	8.47×10^{-2}		1.63×10^{-2}		8.47×10^{-2}	1.63×10^{-2}	7.69×10^{-2}	
SHS 30L	6.52×10^{-2}		1.34×10^{-2}		6.52×10^{-2}	1.34×10^{-2}	7.69×10^{-2}	
SHS 35	6.95×10^{-2}		1.43×10^{-2}		6.95×10^{-2}	1.43×10^{-2}	6.29×10^{-2}	
SHS 35L	5.43×10^{-2}		1.16×10^{-2}		5.43×10^{-2}	1.16×10^{-2}	6.29×10^{-2}	
SHS 45	6.13×10^{-2}		1.24×10^{-2}		6.13×10^{-2}	1.24×10^{-2}	4.69×10^{-2}	
SHS 45L	4.79×10^{-2}		1.02×10^{-2}		4.79×10^{-2}	1.02×10^{-2}	4.69×10^{-2}	
SHS 55	4.97×10^{-2}		1.02×10^{-2}		4.97×10^{-2}	1.02×10^{-2}	4.02×10^{-2}	
SHS 55L	3.88×10^{-2}		8.30×10^{-3}		3.88×10^{-2}	8.30×10^{-3}	4.02×10^{-2}	
SHS 65	3.87×10^{-2}		7.91×10^{-3}		3.87×10^{-2}	7.91×10^{-3}	3.40×10^{-2}	
SHS 65L	3.06×10^{-2}		6.51×10^{-3}		3.06×10^{-2}	6.51×10^{-3}	3.40×10^{-2}	
SHW 12	2.48×10^{-1}		4.69×10^{-2}		2.48×10^{-1}	4.69×10^{-2}	1.40×10^{-1}	
SHW 12L	1.70×10^{-1}		3.52×10^{-2}		1.70×10^{-1}	3.52×10^{-2}	1.40×10^{-1}	
SHW 14	1.92×10^{-1}		3.80×10^{-2}		1.92×10^{-1}	3.80×10^{-2}	9.93×10^{-2}	
SHW 17	1.72×10^{-1}		3.41×10^{-2}		1.72×10^{-1}	3.41×10^{-2}	6.21×10^{-2}	
SHW 21	1.59×10^{-1}		2.95×10^{-2}		1.59×10^{-1}	2.95×10^{-2}	5.57×10^{-2}	
SHW 27	1.21×10^{-1}		2.39×10^{-2}		1.21×10^{-1}	2.39×10^{-2}	4.99×10^{-2}	
SHW 35	8.15×10^{-2}		1.64×10^{-2}		8.15×10^{-2}	1.64×10^{-2}	3.02×10^{-2}	
SHW 50	6.22×10^{-2}		1.24×10^{-2}		6.22×10^{-2}	1.24×10^{-2}	2.30×10^{-2}	
SRS 9	2.95×10^{-1}		5.26×10^{-2}		3.04×10^{-1}	5.40×10^{-2}	2.17×10^{-1}	
SRS 9W	2.37×10^{-1}		4.25×10^{-2}		2.44×10^{-1}	4.37×10^{-2}	1.06×10^{-1}	
SRS 12	2.94×10^{-1}		4.50×10^{-2}		2.94×10^{-1}	4.50×10^{-2}	1.53×10^{-1}	
SRS 12W	2.00×10^{-1}		3.69×10^{-2}		2.00×10^{-1}	3.69×10^{-2}	7.97×10^{-2}	
SRS 15	2.17×10^{-1}		3.69×10^{-2}		2.17×10^{-1}	3.69×10^{-2}	1.41×10^{-1}	
SRS 15W	1.67×10^{-1}		2.94×10^{-2}		1.67×10^{-1}	2.94×10^{-2}	4.83×10^{-2}	
SRS 20	1.80×10^{-1}		3.30×10^{-2}		1.86×10^{-1}	3.41×10^{-2}	9.34×10^{-2}	
SRS 25	1.14×10^{-1}		2.17×10^{-2}		1.14×10^{-1}	2.17×10^{-2}	8.13×10^{-2}	

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used
K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used
K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other
K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other
K_{B1} : M_B Equivalent factor when one LM block is used
K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other
K_{CR} : Equivalent factor in the M_C radial direction
K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 3 Equivalent Factors (Models SRG, SRN and SR)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
SRG 25	8.96×10^{-2}		1.55×10^{-2}		8.96×10^{-2}	1.55×10^{-2}	7.23×10^{-2}	
SRG 25L	6.99×10^{-2}		1.31×10^{-2}		6.99×10^{-2}	1.31×10^{-2}	7.23×10^{-2}	
SRG 30	8.06×10^{-2}		1.33×10^{-2}		8.06×10^{-2}	1.33×10^{-2}	5.61×10^{-2}	
SRG 30L	6.12×10^{-2}		1.11×10^{-2}		6.12×10^{-2}	1.11×10^{-2}	5.61×10^{-2}	
SRG 35	7.14×10^{-2}		1.18×10^{-2}		7.14×10^{-2}	1.18×10^{-2}	4.98×10^{-2}	
SRG 35L	5.26×10^{-2}		9.67×10^{-3}		5.26×10^{-2}	9.67×10^{-3}	4.98×10^{-2}	
SRG 45	5.49×10^{-2}		9.58×10^{-3}		5.49×10^{-2}	9.58×10^{-3}	3.85×10^{-2}	
SRG 45L	4.18×10^{-2}		7.93×10^{-3}		4.18×10^{-2}	7.93×10^{-3}	3.85×10^{-2}	
SRG 55	4.56×10^{-2}		8.04×10^{-3}		4.56×10^{-2}	8.04×10^{-3}	3.25×10^{-2}	
SRG 55L	3.37×10^{-2}		6.42×10^{-3}		3.37×10^{-2}	6.42×10^{-3}	3.25×10^{-2}	
SRG 65L	2.63×10^{-2}		4.97×10^{-3}		2.63×10^{-2}	4.97×10^{-3}	2.70×10^{-2}	
SRN 35	7.14×10^{-2}		1.18×10^{-2}		7.14×10^{-2}	1.18×10^{-2}	4.98×10^{-2}	
SRN 35L	5.26×10^{-2}		9.67×10^{-3}		5.26×10^{-2}	9.67×10^{-3}	4.98×10^{-2}	
SRN 45	5.49×10^{-2}		9.58×10^{-3}		5.49×10^{-2}	9.58×10^{-3}	3.85×10^{-2}	
SRN 45L	4.18×10^{-2}		7.93×10^{-3}		4.18×10^{-2}	7.93×10^{-3}	3.85×10^{-2}	
SRN 55	4.56×10^{-2}		8.04×10^{-3}		4.56×10^{-2}	8.04×10^{-3}	3.25×10^{-2}	
SRN 55L	3.37×10^{-2}		6.42×10^{-3}		3.37×10^{-2}	6.42×10^{-3}	3.25×10^{-2}	
SRN 65L	2.63×10^{-2}		4.97×10^{-3}		2.63×10^{-2}	4.97×10^{-3}	2.70×10^{-2}	
SR 15W(TB)	2.09×10^{-1}	1.04×10^{-1}	3.74×10^{-2}	1.87×10^{-2}	1.46×10^{-1}	2.58×10^{-2}	1.70×10^{-1}	8.48×10^{-2}
SR 15V(SB)	3.40×10^{-1}	1.70×10^{-1}	4.94×10^{-2}	2.47×10^{-2}	2.35×10^{-1}	3.32×10^{-2}	1.70×10^{-1}	8.48×10^{-2}
SR 20W(TB)	1.72×10^{-1}	8.61×10^{-2}	3.24×10^{-2}	1.62×10^{-2}	1.21×10^{-1}	2.25×10^{-2}	1.30×10^{-1}	6.49×10^{-2}
SR 20V(SB)	2.72×10^{-1}	1.36×10^{-1}	4.33×10^{-2}	2.16×10^{-2}	1.88×10^{-1}	2.94×10^{-2}	1.30×10^{-1}	6.49×10^{-2}
SR 25W(TB)	1.38×10^{-1}	6.89×10^{-2}	2.59×10^{-2}	1.30×10^{-2}	9.67×10^{-2}	1.80×10^{-2}	1.11×10^{-1}	5.55×10^{-2}
SR 25V(SB)	2.17×10^{-1}	1.09×10^{-1}	3.46×10^{-2}	1.73×10^{-2}	1.51×10^{-1}	2.35×10^{-2}	1.11×10^{-1}	5.55×10^{-2}
SR 30W(TB)	1.15×10^{-1}	5.74×10^{-2}	2.22×10^{-2}	1.11×10^{-2}	8.06×10^{-2}	1.55×10^{-2}	9.22×10^{-2}	4.61×10^{-2}
SR 30V(SB)	1.99×10^{-1}	9.93×10^{-2}	2.99×10^{-2}	1.49×10^{-2}	1.37×10^{-1}	2.02×10^{-2}	9.22×10^{-2}	4.61×10^{-2}
SR 35W(TB)	1.04×10^{-1}	5.21×10^{-2}	1.92×10^{-2}	9.61×10^{-3}	7.31×10^{-2}	1.33×10^{-2}	7.64×10^{-2}	3.82×10^{-2}
SR 35V(SB)	1.70×10^{-1}	8.51×10^{-2}	2.61×10^{-2}	1.31×10^{-2}	1.17×10^{-1}	1.77×10^{-2}	7.64×10^{-2}	3.82×10^{-2}
SR 45W(TB)	9.12×10^{-2}	4.56×10^{-2}	1.69×10^{-2}	8.47×10^{-3}	6.39×10^{-2}	1.17×10^{-2}	5.71×10^{-2}	2.85×10^{-2}
SR 55W(TB)	6.89×10^{-2}	3.44×10^{-2}	1.39×10^{-2}	6.93×10^{-3}	4.84×10^{-2}	9.66×10^{-3}	5.46×10^{-2}	2.73×10^{-2}

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 4 Equivalent Factors (Models NR and NRS)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
NR 25X	1.10×10^{-1}	7.78×10^{-2}	2.19×10^{-2}	1.55×10^{-2}	8.11×10^{-2}	1.63×10^{-2}	9.26×10^{-2}	6.58×10^{-2}
NR 25XL	8.91×10^{-2}	6.33×10^{-2}	1.79×10^{-2}	1.27×10^{-2}	6.55×10^{-2}	1.33×10^{-2}	9.26×10^{-2}	6.58×10^{-2}
NR 30	9.66×10^{-2}	6.86×10^{-2}	1.84×10^{-2}	1.31×10^{-2}	7.05×10^{-2}	1.35×10^{-2}	8.28×10^{-2}	5.88×10^{-2}
NR 30L	7.43×10^{-2}	5.27×10^{-2}	1.52×10^{-2}	1.08×10^{-2}	5.47×10^{-2}	1.13×10^{-2}	8.28×10^{-2}	5.88×10^{-2}
NR 35	8.82×10^{-2}	6.26×10^{-2}	1.64×10^{-2}	1.16×10^{-2}	6.42×10^{-2}	1.20×10^{-2}	6.92×10^{-2}	4.91×10^{-2}
NR 35L	6.67×10^{-2}	4.74×10^{-2}	1.35×10^{-2}	9.61×10^{-3}	4.90×10^{-2}	1.00×10^{-2}	6.92×10^{-2}	4.91×10^{-2}
NR 45	6.84×10^{-2}	4.86×10^{-2}	1.30×10^{-2}	9.23×10^{-3}	5.00×10^{-2}	9.58×10^{-3}	5.19×10^{-2}	3.68×10^{-2}
NR 45L	5.11×10^{-2}	3.62×10^{-2}	1.08×10^{-2}	7.66×10^{-3}	3.79×10^{-2}	8.07×10^{-3}	5.19×10^{-2}	3.68×10^{-2}
NR 55	5.75×10^{-2}	4.08×10^{-2}	1.11×10^{-2}	7.90×10^{-3}	4.21×10^{-2}	8.21×10^{-3}	4.44×10^{-2}	3.15×10^{-2}
NR 55L	4.53×10^{-2}	3.22×10^{-2}	9.16×10^{-3}	6.51×10^{-3}	3.34×10^{-2}	6.79×10^{-3}	4.44×10^{-2}	3.15×10^{-2}
NR 65	4.97×10^{-2}	3.53×10^{-2}	9.74×10^{-3}	6.91×10^{-3}	3.64×10^{-2}	7.18×10^{-3}	3.75×10^{-2}	2.66×10^{-2}
NR 65L	3.56×10^{-2}	2.53×10^{-2}	7.51×10^{-3}	5.33×10^{-3}	2.65×10^{-2}	5.61×10^{-3}	3.75×10^{-2}	2.66×10^{-2}
NR 75	4.21×10^{-2}	2.99×10^{-2}	8.31×10^{-3}	5.90×10^{-3}	3.08×10^{-2}	6.13×10^{-3}	3.16×10^{-2}	2.24×10^{-2}
NR 75L	3.14×10^{-2}	2.23×10^{-2}	6.74×10^{-3}	4.78×10^{-3}	2.33×10^{-2}	5.04×10^{-3}	3.16×10^{-2}	2.24×10^{-2}
NR 85	3.70×10^{-2}	2.62×10^{-2}	7.31×10^{-3}	5.19×10^{-3}	2.71×10^{-2}	5.40×10^{-3}	2.80×10^{-2}	1.99×10^{-2}
NR 85L	2.80×10^{-2}	1.99×10^{-2}	6.07×10^{-3}	4.31×10^{-3}	2.08×10^{-2}	4.55×10^{-3}	2.80×10^{-2}	1.99×10^{-2}
NR 100	3.05×10^{-2}	2.17×10^{-2}	6.20×10^{-3}	4.41×10^{-3}	2.26×10^{-2}	4.63×10^{-3}	2.38×10^{-2}	1.69×10^{-2}
NR 100L	2.74×10^{-2}	1.95×10^{-2}	5.46×10^{-3}	3.87×10^{-3}	2.00×10^{-2}	4.00×10^{-3}	2.38×10^{-2}	1.69×10^{-2}
NRS 25X	1.05×10^{-1}		2.11×10^{-2}		1.05×10^{-1}	2.11×10^{-2}	9.41×10^{-2}	
NRS 25XL	8.60×10^{-2}		1.73×10^{-2}		8.60×10^{-2}	1.73×10^{-2}	9.41×10^{-2}	
NRS 30	9.30×10^{-2}		1.77×10^{-2}		9.30×10^{-2}	1.77×10^{-2}	8.44×10^{-2}	
NRS 30L	7.17×10^{-2}		1.47×10^{-2}		7.17×10^{-2}	1.47×10^{-2}	8.44×10^{-2}	
NRS 35	8.47×10^{-2}		1.57×10^{-2}		8.47×10^{-2}	1.57×10^{-2}	7.08×10^{-2}	
NRS 35L	6.44×10^{-2}		1.31×10^{-2}		6.44×10^{-2}	1.31×10^{-2}	7.08×10^{-2}	
NRS 45	6.58×10^{-2}		1.25×10^{-2}		6.58×10^{-2}	1.25×10^{-2}	5.26×10^{-2}	
NRS 45L	4.92×10^{-2}		1.04×10^{-2}		4.92×10^{-2}	1.04×10^{-2}	5.26×10^{-2}	
NRS 55	5.54×10^{-2}		1.07×10^{-2}		5.54×10^{-2}	1.07×10^{-2}	4.52×10^{-2}	
NRS 55L	4.38×10^{-2}		8.85×10^{-3}		4.38×10^{-2}	8.85×10^{-3}	4.52×10^{-2}	
NRS 65	4.79×10^{-2}		9.38×10^{-3}		4.79×10^{-2}	9.38×10^{-3}	3.81×10^{-2}	
NRS 65L	3.43×10^{-2}		7.25×10^{-3}		3.43×10^{-2}	7.25×10^{-3}	3.81×10^{-2}	
NRS 75	4.05×10^{-2}		8.01×10^{-3}		4.05×10^{-2}	8.01×10^{-3}	3.20×10^{-2}	
NRS 75L	3.03×10^{-2}		6.50×10^{-3}		3.03×10^{-2}	6.50×10^{-3}	3.20×10^{-2}	
NRS 85	3.56×10^{-2}		7.05×10^{-3}		3.56×10^{-2}	7.05×10^{-3}	2.83×10^{-2}	
NRS 85L	2.70×10^{-2}		5.87×10^{-3}		2.70×10^{-2}	5.87×10^{-3}	2.83×10^{-2}	
NRS 100	2.93×10^{-2}		5.97×10^{-3}		2.93×10^{-2}	5.97×10^{-3}	2.41×10^{-2}	
NRS 100L	2.65×10^{-2}		5.27×10^{-3}		2.65×10^{-2}	5.27×10^{-3}	2.41×10^{-2}	

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 5 Equivalent Factors (Models HSR, JR and CSR)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
HSR 8	4.39×10^{-1}		6.75×10^{-2}		4.39×10^{-1}	6.75×10^{-2}	2.97×10^{-1}	
HSR 10	3.09×10^{-1}		5.33×10^{-2}		3.09×10^{-1}	5.33×10^{-2}	2.35×10^{-1}	
HSR 12	2.08×10^{-1}		3.74×10^{-2}		2.08×10^{-1}	3.74×10^{-2}	1.91×10^{-1}	
HSR 15	1.68×10^{-1}		2.95×10^{-2}		1.68×10^{-1}	2.95×10^{-2}	1.60×10^{-1}	
HSR 20	1.25×10^{-1}		2.28×10^{-2}		1.25×10^{-1}	2.28×10^{-2}	1.18×10^{-1}	
HSR 20L	9.83×10^{-2}		1.91×10^{-2}		9.83×10^{-2}	1.91×10^{-2}	1.18×10^{-1}	
HSR 25	1.12×10^{-1}		2.01×10^{-2}		1.12×10^{-1}	2.01×10^{-2}	1.00×10^{-1}	
HSR 25L	8.66×10^{-2}		1.68×10^{-2}		8.66×10^{-2}	1.68×10^{-2}	1.00×10^{-1}	
HSR 30	8.93×10^{-2}		1.73×10^{-2}		8.93×10^{-2}	1.73×10^{-2}	8.31×10^{-2}	
HSR 30L	7.02×10^{-2}		1.43×10^{-2}		7.02×10^{-2}	1.43×10^{-2}	8.31×10^{-2}	
HSR 35	7.81×10^{-2}		1.55×10^{-2}		7.81×10^{-2}	1.55×10^{-2}	6.74×10^{-2}	
HSR 35L	6.15×10^{-2}		1.28×10^{-2}		6.15×10^{-2}	1.28×10^{-2}	6.74×10^{-2}	
HSR 45	6.71×10^{-2}		1.21×10^{-2}		6.71×10^{-2}	1.21×10^{-2}	5.22×10^{-2}	
HSR 45L	5.20×10^{-2}		1.00×10^{-2}		5.20×10^{-2}	1.00×10^{-2}	5.22×10^{-2}	
HSR 55	5.59×10^{-2}		1.03×10^{-2}		5.59×10^{-2}	1.03×10^{-2}	4.27×10^{-2}	
HSR 55L	4.33×10^{-2}		8.56×10^{-3}		4.33×10^{-2}	8.56×10^{-3}	4.27×10^{-2}	
HSR 65	4.47×10^{-2}		9.13×10^{-3}		4.47×10^{-2}	9.13×10^{-3}	3.69×10^{-2}	
HSR 65L	3.28×10^{-2}		7.06×10^{-3}		3.28×10^{-2}	7.06×10^{-3}	3.69×10^{-2}	
HSR 85	3.73×10^{-2}		6.80×10^{-3}		3.73×10^{-2}	6.80×10^{-3}	2.79×10^{-2}	
HSR 85L	2.89×10^{-2}		5.68×10^{-3}		2.89×10^{-2}	5.68×10^{-3}	2.79×10^{-2}	
HSR 100	2.60×10^{-2}		5.15×10^{-3}		2.60×10^{-2}	5.15×10^{-3}	2.25×10^{-2}	
HSR 120	2.36×10^{-2}		4.72×10^{-3}		2.36×10^{-2}	4.72×10^{-3}	1.97×10^{-2}	
HSR 150	2.17×10^{-2}		4.35×10^{-3}		2.17×10^{-2}	4.35×10^{-3}	1.61×10^{-2}	
HSR 15M2A	1.65×10^{-1}		2.89×10^{-2}		1.65×10^{-1}	2.89×10^{-2}	1.86×10^{-1}	
HSR 20M2A	1.23×10^{-1}		2.23×10^{-2}		1.23×10^{-1}	2.23×10^{-2}	1.34×10^{-1}	
HSR 25M2A	1.10×10^{-1}		1.98×10^{-2}		1.10×10^{-1}	1.98×10^{-2}	1.14×10^{-1}	
JR 25	1.12×10^{-1}		2.01×10^{-2}		1.12×10^{-1}	2.01×10^{-2}	1.00×10^{-1}	
JR 35	7.81×10^{-2}		1.55×10^{-2}		7.81×10^{-2}	1.55×10^{-2}	6.74×10^{-2}	
JR 45	6.71×10^{-2}		1.21×10^{-2}		6.71×10^{-2}	1.21×10^{-2}	5.22×10^{-2}	
JR 55	5.59×10^{-2}		1.03×10^{-2}		5.59×10^{-2}	1.03×10^{-2}	4.27×10^{-2}	
CSR 15	1.68×10^{-1}		2.95×10^{-2}		1.68×10^{-1}	2.95×10^{-2}	1.60×10^{-1}	
CSR 20S	1.25×10^{-1}		2.28×10^{-2}		1.25×10^{-1}	2.28×10^{-2}	1.18×10^{-1}	
CSR 20	9.83×10^{-2}		1.91×10^{-2}		9.83×10^{-2}	1.91×10^{-2}	1.18×10^{-1}	
CSR 25S	1.12×10^{-1}		2.01×10^{-2}		1.12×10^{-1}	2.01×10^{-2}	1.00×10^{-1}	
CSR 25	8.66×10^{-2}		1.68×10^{-2}		8.66×10^{-2}	1.68×10^{-2}	1.00×10^{-1}	
CSR 30S	8.93×10^{-2}		1.73×10^{-2}		8.93×10^{-2}	1.73×10^{-2}	8.31×10^{-2}	
CSR 30	7.02×10^{-2}		1.43×10^{-2}		7.02×10^{-2}	1.43×10^{-2}	8.31×10^{-2}	
CSR 35	6.15×10^{-2}		1.28×10^{-2}		6.15×10^{-2}	1.28×10^{-2}	6.74×10^{-2}	
CSR 45	5.20×10^{-2}		1.00×10^{-2}		5.20×10^{-2}	1.00×10^{-2}	5.22×10^{-2}	

Table 6 Equivalent Factors (Models HRW, GSR and HR)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
HRW 12	2.72×10^{-1}		5.16×10^{-2}		5.47×10^{-1}	1.04×10^{-1}	1.40×10^{-1}	
HRW 14	2.28×10^{-1}		4.16×10^{-2}		4.54×10^{-1}	8.28×10^{-2}	1.01×10^{-1}	
HRW 17	1.95×10^{-1}		3.33×10^{-2}		1.95×10^{-1}	3.33×10^{-2}	6.32×10^{-2}	
HRW 21	1.64×10^{-1}		2.89×10^{-2}		1.64×10^{-1}	2.89×10^{-2}	5.92×10^{-2}	
HRW 27	1.30×10^{-1}		2.33×10^{-2}		1.30×10^{-1}	2.33×10^{-2}	5.12×10^{-2}	
HRW 35	8.66×10^{-2}		1.59×10^{-2}		8.66×10^{-2}	1.59×10^{-2}	3.06×10^{-2}	
HRW 50	6.50×10^{-2}		1.21×10^{-2}		6.50×10^{-2}	1.21×10^{-2}	2.35×10^{-2}	
HRW 60	5.77×10^{-2}		8.24×10^{-3}		5.77×10^{-2}	8.24×10^{-3}	1.77×10^{-2}	
GSR 15T	1.61×10^{-1}	1.44×10^{-1}	2.88×10^{-2}	2.59×10^{-2}	1.68×10^{-1}	3.01×10^{-2}	—	—
GSR 15V	2.21×10^{-1}	1.99×10^{-1}	3.54×10^{-2}	3.18×10^{-2}	2.30×10^{-1}	3.68×10^{-2}	—	—
GSR 20T	1.28×10^{-1}	1.16×10^{-1}	2.34×10^{-2}	2.10×10^{-2}	1.34×10^{-1}	2.44×10^{-2}	—	—
GSR 20V	1.77×10^{-1}	1.59×10^{-1}	2.87×10^{-2}	2.58×10^{-2}	1.84×10^{-1}	2.99×10^{-2}	—	—
GSR 25T	1.07×10^{-1}	9.63×10^{-2}	1.97×10^{-2}	1.77×10^{-2}	1.12×10^{-1}	2.06×10^{-2}	—	—
GSR 25V	1.47×10^{-1}	1.33×10^{-1}	2.42×10^{-2}	2.18×10^{-2}	1.53×10^{-1}	2.52×10^{-2}	—	—
GSR 30T	9.17×10^{-2}	8.26×10^{-2}	1.68×10^{-2}	1.51×10^{-2}	9.59×10^{-2}	1.76×10^{-2}	—	—
GSR 35T	8.03×10^{-2}	7.22×10^{-2}	1.48×10^{-2}	1.33×10^{-2}	8.39×10^{-2}	1.55×10^{-2}	—	—
HR 918	2.65×10^{-1}	2.65×10^{-1}	—	—	2.65×10^{-1}	—	—	—
HR 1123	2.08×10^{-1}	2.08×10^{-1}	—	—	2.08×10^{-1}	—	—	—
HR 1530	1.56×10^{-1}	1.56×10^{-1}	—	—	1.56×10^{-1}	—	—	—
HR 2042	1.11×10^{-1}	1.11×10^{-1}	—	—	1.11×10^{-1}	—	—	—
HR 2042T	8.64×10^{-2}	8.64×10^{-2}	—	—	8.64×10^{-2}	—	—	—
HR 2555	7.79×10^{-2}	7.79×10^{-2}	—	—	7.79×10^{-2}	—	—	—
HR 2555T	6.13×10^{-2}	6.13×10^{-2}	—	—	6.13×10^{-2}	—	—	—
HR 3065	6.92×10^{-2}	6.92×10^{-2}	—	—	6.92×10^{-2}	—	—	—
HR 3065T	5.45×10^{-2}	5.45×10^{-2}	—	—	5.45×10^{-2}	—	—	—
HR 3575	6.23×10^{-2}	6.23×10^{-2}	—	—	6.23×10^{-2}	—	—	—
HR 3575T	4.90×10^{-2}	4.90×10^{-2}	—	—	4.90×10^{-2}	—	—	—
HR 4085	5.19×10^{-2}	5.19×10^{-2}	—	—	5.19×10^{-2}	—	—	—
HR 4085T	4.09×10^{-2}	4.09×10^{-2}	—	—	4.09×10^{-2}	—	—	—
HR 50105	4.15×10^{-2}	4.15×10^{-2}	—	—	4.15×10^{-2}	—	—	—
HR 50105T	3.27×10^{-2}	3.27×10^{-2}	—	—	3.27×10^{-2}	—	—	—
HR 60125	2.88×10^{-2}	2.88×10^{-2}	—	—	2.88×10^{-2}	—	—	—

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 7 Equivalent Factors (Model RSR)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
RSR 3M	9.20×10^{-1}		1.27×10^{-1}		9.20×10^{-1}	1.27×10^{-1}	6.06×10^{-1}	
RSR 3N	6.06×10^{-1}		1.01×10^{-1}		6.06×10^{-1}	1.01×10^{-1}	6.06×10^{-1}	
RSR 3W	7.03×10^{-1}		1.06×10^{-1}		7.03×10^{-1}	1.06×10^{-1}	3.17×10^{-1}	
RSR 3WN	4.76×10^{-1}		8.27×10^{-2}		4.76×10^{-1}	8.27×10^{-2}	3.17×10^{-1}	
RSR 5M	6.67×10^{-1}		9.06×10^{-2}		6.67×10^{-1}	9.06×10^{-2}	3.85×10^{-1}	
RSR 5N	5.21×10^{-1}		8.00×10^{-2}		5.21×10^{-1}	8.00×10^{-2}	3.85×10^{-1}	
RSR 5W	4.85×10^{-1}		7.28×10^{-2}		4.85×10^{-1}	7.28×10^{-2}	1.96×10^{-1}	
RSR 5WN	3.44×10^{-1}		5.93×10^{-2}		3.44×10^{-1}	5.93×10^{-2}	1.96×10^{-1}	
RSR 7M	4.66×10^{-1}		6.57×10^{-2}		4.66×10^{-1}	6.57×10^{-2}	2.74×10^{-1}	
RSR 7Z	4.66×10^{-1}		6.60×10^{-2}		4.66×10^{-1}	6.60×10^{-2}	2.74×10^{-1}	
RSR 7N	2.88×10^{-1}		5.01×10^{-2}		2.88×10^{-1}	5.01×10^{-2}	2.74×10^{-1}	
RSR 7W	3.07×10^{-1}		5.30×10^{-2}		3.07×10^{-1}	5.30×10^{-2}	1.40×10^{-1}	
RSR 7WZ	3.30×10^{-1}		5.12×10^{-2}		3.30×10^{-1}	5.12×10^{-2}	1.40×10^{-1}	
RSR 7WN	2.18×10^{-1}		4.13×10^{-2}		2.18×10^{-1}	4.13×10^{-2}	1.40×10^{-1}	
RSR 9K	3.06×10^{-1}		5.19×10^{-2}		3.06×10^{-1}	5.19×10^{-2}	2.15×10^{-1}	
RSR 9Z	3.06×10^{-1}		5.23×10^{-2}		3.06×10^{-1}	5.23×10^{-2}	2.15×10^{-1}	
RSR 9N	2.15×10^{-1}		4.08×10^{-2}		2.15×10^{-1}	4.08×10^{-2}	2.15×10^{-1}	
RSR 9WV	2.44×10^{-1}		4.22×10^{-2}		2.44×10^{-1}	4.22×10^{-2}	1.09×10^{-1}	
RSR 9WZ	2.44×10^{-1}		4.22×10^{-2}		2.44×10^{-1}	4.22×10^{-2}	1.09×10^{-1}	
RSR 9WN	1.73×10^{-1}		3.32×10^{-2}		1.73×10^{-1}	4.22×10^{-2}	1.09×10^{-1}	
RSR 12V	3.52×10^{-1}	2.46×10^{-1}	5.37×10^{-2}	3.76×10^{-2}	2.81×10^{-1}	4.21×10^{-2}	2.09×10^{-1}	1.46×10^{-1}
RSR 12Z	3.52×10^{-1}	2.46×10^{-1}	5.37×10^{-2}	3.76×10^{-2}	2.81×10^{-1}	4.21×10^{-2}	2.09×10^{-1}	1.46×10^{-1}
RSR 12N	2.30×10^{-1}	1.61×10^{-1}	4.08×10^{-2}	2.85×10^{-2}	1.85×10^{-1}	3.25×10^{-2}	2.09×10^{-1}	1.46×10^{-1}
RSR 12WV	2.47×10^{-1}	1.73×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	1.99×10^{-1}	3.49×10^{-2}	1.02×10^{-1}	7.15×10^{-2}
RSR 12WZ	2.47×10^{-1}	1.73×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	1.99×10^{-1}	3.49×10^{-2}	1.02×10^{-1}	7.15×10^{-2}
RSR 12WN	1.71×10^{-1}	1.20×10^{-1}	3.36×10^{-2}	2.35×10^{-2}	1.38×10^{-1}	2.70×10^{-2}	1.02×10^{-1}	7.15×10^{-2}
RSR 15V	2.77×10^{-1}	1.94×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	2.21×10^{-1}	3.45×10^{-2}	1.69×10^{-1}	1.18×10^{-1}
RSR 15Z	2.77×10^{-1}	1.94×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	2.21×10^{-1}	3.45×10^{-2}	1.69×10^{-1}	1.18×10^{-1}
RSR 15N	1.70×10^{-1}	1.19×10^{-1}	3.24×10^{-2}	2.27×10^{-2}	1.37×10^{-1}	2.59×10^{-2}	1.69×10^{-1}	1.18×10^{-1}
RSR 15WV	1.95×10^{-1}	1.36×10^{-1}	3.52×10^{-2}	2.46×10^{-2}	1.56×10^{-1}	2.80×10^{-2}	5.83×10^{-2}	4.08×10^{-2}
RSR 15WZ	1.95×10^{-1}	1.36×10^{-1}	3.52×10^{-2}	2.46×10^{-2}	1.56×10^{-1}	2.80×10^{-2}	5.83×10^{-2}	4.08×10^{-2}
RSR 15WN	1.34×10^{-1}	9.41×10^{-2}	2.68×10^{-2}	1.88×10^{-2}	1.09×10^{-1}	2.16×10^{-2}	5.82×10^{-2}	4.08×10^{-2}
RSR 20V	1.68×10^{-1}	1.18×10^{-1}	2.92×10^{-2}	2.04×10^{-2}	1.35×10^{-1}	2.32×10^{-2}	1.30×10^{-1}	9.13×10^{-2}
RSR 20N	1.20×10^{-1}	8.39×10^{-2}	2.30×10^{-2}	1.61×10^{-2}	9.68×10^{-2}	1.84×10^{-2}	1.30×10^{-1}	9.13×10^{-2}

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

Table 8 Equivalent Factors (Model RSH, MX and NSR)

Model No.	Equivalent factor							
	K_{AR1}	K_{AL1}	K_{AR2}	K_{AL2}	K_{B1}	K_{B2}	K_{CR}	K_{CL}
RSH 7Z	4.66×10^{-1}		6.60×10^{-2}		4.66×10^{-1}	6.60×10^{-2}	2.74×10^{-1}	
RSH 7WZ	3.30×10^{-1}		5.12×10^{-2}		3.30×10^{-1}	5.12×10^{-2}	1.40×10^{-1}	
RSH 9Z	3.06×10^{-1}		5.23×10^{-2}		3.06×10^{-1}	5.23×10^{-2}	2.15×10^{-1}	
RSH 9WZ	2.44×10^{-1}		4.22×10^{-2}		2.44×10^{-1}	4.22×10^{-2}	1.09×10^{-1}	
RSH 12Z	3.52×10^{-1}	2.46×10^{-1}	5.37×10^{-2}	3.76×10^{-2}	2.81×10^{-1}	4.21×10^{-2}	2.09×10^{-1}	1.46×10^{-1}
RSH 12WZ	2.47×10^{-1}	1.73×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	1.99×10^{-1}	3.49×10^{-2}	1.02×10^{-1}	7.15×10^{-2}
RSH 15Z	2.77×10^{-1}	1.94×10^{-1}	4.38×10^{-2}	3.07×10^{-2}	2.21×10^{-1}	3.45×10^{-2}	1.69×10^{-1}	1.18×10^{-1}
RSH 15WZ	1.95×10^{-1}	1.36×10^{-1}	3.52×10^{-2}	2.46×10^{-2}	1.56×10^{-1}	2.80×10^{-2}	5.83×10^{-2}	4.08×10^{-2}
MX 5	4.27×10^{-1}		7.01×10^{-2}		4.27×10^{-1}	7.01×10^{-2}	3.85×10^{-2}	
MX 7W	2.18×10^{-1}		4.13×10^{-1}		2.18×10^{-1}	4.13×10^{-1}	1.40×10^{-1}	
NSR 20TBC	2.29×10^{-1}		2.68×10^{-2}		2.29×10^{-1}	2.68×10^{-2}	–	–
NSR 25TBC	2.01×10^{-1}		2.27×10^{-2}		2.01×10^{-1}	2.27×10^{-2}	–	–
NSR 30TBC	1.85×10^{-1}		1.93×10^{-2}		1.85×10^{-1}	1.93×10^{-2}	–	–
NSR 40TBC	1.39×10^{-1}		1.60×10^{-2}		1.39×10^{-1}	1.60×10^{-2}	–	–
NSR 50TBC	1.24×10^{-1}		1.42×10^{-2}		1.24×10^{-1}	1.42×10^{-2}	–	–
NSR 70TBC	9.99×10^{-2}		1.15×10^{-2}		9.99×10^{-2}	1.15×10^{-2}	–	–

K_{AR1} : Equivalent factor in the M_A radial direction when one LM block is used

K_{AL1} : Equivalent factor in the M_A reverse-radial direction when one LM block is used

K_{AR2} : Equivalent factor in the M_A radial direction when two LM blocks are used in close contact with each other

K_{AL2} : Equivalent factor in the M_A reverse-radial direction when two LM blocks are used in close contact with each other

K_{B1} : M_B Equivalent factor when one LM block is used

K_{B2} : M_B Equivalent factor when two LM blocks are used in close contact with each other

K_{CR} : Equivalent factor in the M_C radial direction

K_{CL} : Equivalent factor in the M_C reverse-radial direction

[Example of calculation]

When one LM block is used

Model No.: SSR20XV1

Gravitational acceleration $g=9.8$ (m/s^2)
Mass $m=10$ (kg)
$\ell_1=200$ (mm)
$\ell_2=100$ (mm)

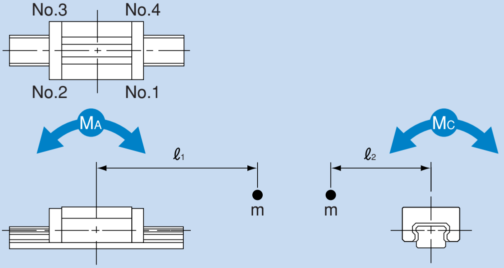


Fig. 6 One LM Block is Used

No.1 $P_1=mg+K_{AR1}\cdot mg\cdot \ell_1+K_{CR}\cdot mg\cdot \ell_2=98+0.275\times98\times200+0.129\times98\times100=6752$ (N)

No.2 $P_2=mg-K_{AL1}\cdot mg\cdot \ell_1+K_{CR}\cdot mg\cdot \ell_2=98-0.137\times98\times200+0.129\times98\times100=-1323$ (N)

No.3 $P_3=mg-K_{AL1}\cdot mg\cdot \ell_1-K_{CL}\cdot mg\cdot \ell_2=98-0.137\times98\times200-0.0644\times98\times100=-3218$ (N)

No.4 $P_4=mg+K_{AR1}\cdot mg\cdot \ell_1-K_{CL}\cdot mg\cdot \ell_2=98+0.275\times98\times200-0.0644\times98\times100=4857$ (N)

When two LM blocks are used in close contact with each other

Model No.: SNS30R2

Gravitational acceleration $g=9.8$ (m/s^2)
Mass $m=5$ (kg)
$\ell_1=200$ (mm)
$\ell_2=150$ (mm)

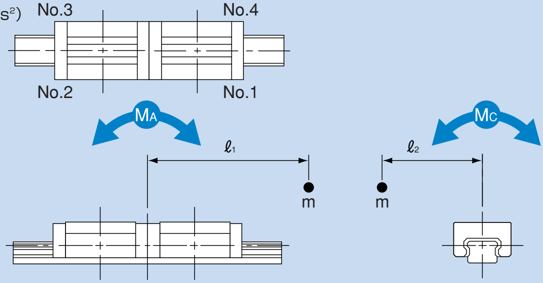


Fig. 7 Two LM Blocks are Used in Close Contact with Each Other

No.1 $P_1=\frac{mg}{2}+K_{AR2}\cdot mg\cdot \ell_1+K_{CR}\cdot \frac{mg\cdot \ell_2}{2}=\frac{49}{2}+0.018\times49\times200+0.0842\times\frac{49\times150}{2}=510.3$ (N)

No.2 $P_2=\frac{mg}{2}-K_{AL2}\cdot mg\cdot \ell_1+K_{CR}\cdot \frac{mg\cdot \ell_2}{2}=\frac{49}{2}-0.0151\times49\times200+0.0842\times\frac{49\times150}{2}=186$ (N)

No.3 $P_3=\frac{mg}{2}-K_{AL2}\cdot mg\cdot \ell_1-K_{CL}\cdot \frac{mg\cdot \ell_2}{2}=\frac{49}{2}-0.0151\times49\times200-0.0707\times\frac{49\times150}{2}=-383.3$ (N)

No.4 $P_4=\frac{mg}{2}+K_{AR2}\cdot mg\cdot \ell_1-K_{CL}\cdot \frac{mg\cdot \ell_2}{2}=\frac{49}{2}+0.018\times49\times200-0.0707\times\frac{49\times150}{2}=-58.9$ (N)

Note 1: Since an LM Guide used in vertical installation received only a moment load is applied, there is no need to apply a load force (mg).
Note 2: In some models, rated loads differ depending on the direction of the applied load. With such a model, calculate an equivalent load in the direction of the smallest rated load.

Double-axis Use

●Setting the Service Conditions

Set the service conditions needed to calculate the LM system's applied load and service life in hours.
The service conditions consist of the following items.

① Mass :m (kg)
② Direction of the working load
③ Position of the working point (e.g., center of gravity) :ℓ_2, ℓ_3, h_1 (mm)
④ Thrust position :ℓ_4, h_2 (mm)
⑤ LM system arrangement :ℓ_0, ℓ_1 (mm)
  (No. of units and axes)
⑥ Speed diagram
  Speed :V (mm/s)
  Time constant :t_n (s)
  Acceleration :α_n (mm/s^2)

$$\left(\alpha_n = \frac{V}{t_n}\right)$$

⑦ Duty cycle
  No. of reciprocations per minute :N_1 (min^{-1})
⑧ Stroke length :ℓ_s (mm)
⑨ Average Speed :V_m (m/s)
⑩ Required service life in hours :L_h (h)

Gravitational acceleration $g=9.8$ (m/s^2)

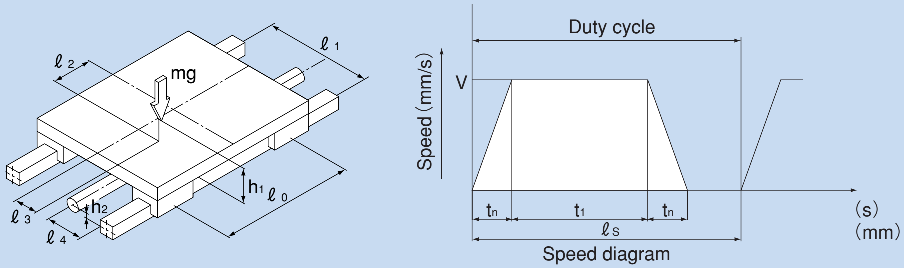


Fig. 8 Service Conditions

●Applied Load Equation

The load applied to the LM Guide varies with the external force, such as the position of the gravity center of an object, thrust position, inertia generated from acceleration/deceleration during start or stop, and cutting force.

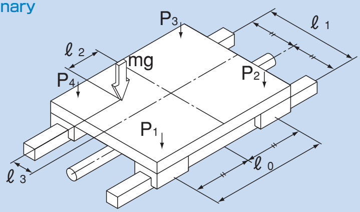
In selecting an LM Guide, it is necessary to obtain the value of the applied load while taking into account these conditions.

Calculate the load applied to the LM Guide in each of the examples 1 to 10 shown below.

m : Mass (kg)
ℓ_n : Distance (mm)
F_n : External force (N)
P_n : Applied load (radial/reverse-radial direction) (N)
P_{nT} : Applied load (lateral directions) (N)
g : Gravitational acceleration (m/s²)
($g=9.8\text{m/s}^2$)
V : Speed (m/s)
t_n : Time constant (s)
α_n : Acceleration (m/s²)

$$\left(\alpha_n = \frac{V}{t_n}\right)$$

<table>
<tr><th>Example</th><th>Service conditions</th><th>Applied load equation</th></tr>
<tr><td>1</td><td>Horizontal mount (with the block traveling)
Uniform motion or stationary


</td><td>

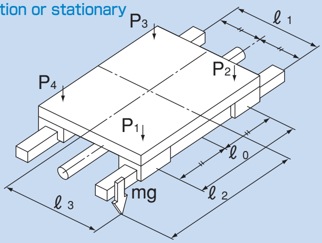
$P_1 = \frac{mg}{4} + \frac{mg\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

$P_2 = \frac{mg}{4} - \frac{mg\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\ell_3}{2\cdot\ell}$

$P_3 = \frac{mg}{4} - \frac{mg\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

$P_4 = \frac{mg}{4} + \frac{mg\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

</td></tr>
<tr><td>2</td><td>Horizontal mount, overhung (with the block traveling)
Uniform motion or stationary


</td><td>

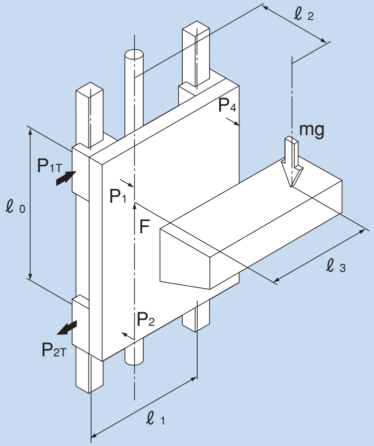
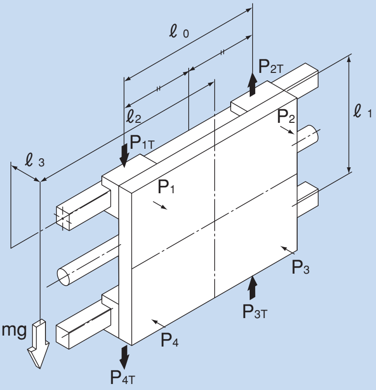
$P_1 = \frac{mg}{4} + \frac{mg\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

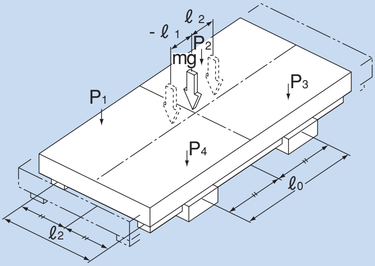
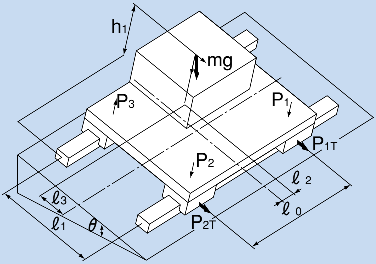
$P_2 = \frac{mg}{4} - \frac{mg\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

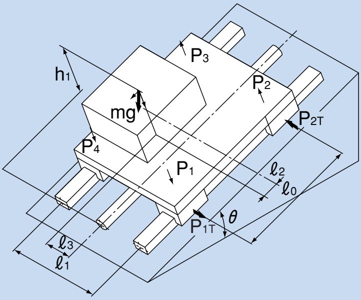
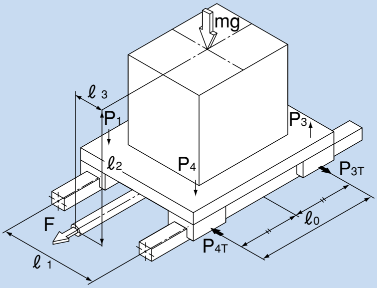
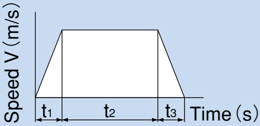
$P_3 = \frac{mg}{4} - \frac{mg\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

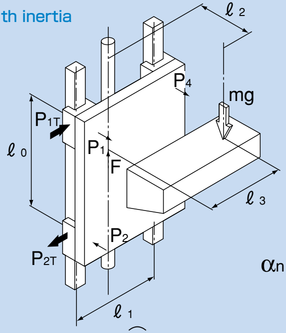
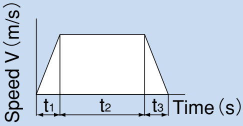
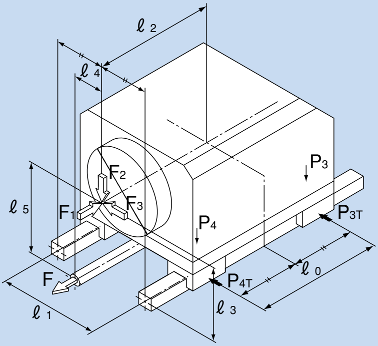
$P_4 = \frac{mg}{4} + \frac{mg\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\ell_3}{2\cdot\ell_1}$

</td></tr>
</table>

Example	Service conditions	Applied load equation
3	Vertical mount Uniform motion or stationary  E.g.: Vertical axis of industrial robot, automatic coating machine, lifter	$P_1 \sim P_4 = \frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T} \sim P_{4T} = \frac{mg\cdot\ell_3}{2\cdot\ell_0}$
4	Wall mount Uniform motion or stationary  E.g.: Travel axis of cross-rail loader	$P_1 \sim P_4 = \frac{mg\cdot\ell_3}{2\cdot\ell_1}$ $P_{1T} = P_{4T} = \frac{mg}{4} + \frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = \frac{mg}{4} - \frac{mg\cdot\ell_2}{2\cdot\ell_0}$

Example	Service conditions	Applied load equation
5	With the LM rails movable Horizontal mount  E.g.: XY table, sliding fork	$P_1 \sim P_4\ (\text{max}) = \dfrac{mg}{4} + \dfrac{mg\cdot\ell_1}{2\cdot\ell_0}$ $P_1 \sim P_4\ (\text{min}) = \dfrac{mg}{4} - \dfrac{mg\cdot\ell_1}{2\cdot\ell_0}$
6	Laterally tilt mount  E.g.: NC lathe Carriage	$P_1 = +\dfrac{mg\cdot\cos\theta}{4} + \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} - \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_1}$ $P_{1T} = \dfrac{mg\cdot\sin\theta}{4} + \dfrac{mg\cdot\sin\theta\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = +\dfrac{mg\cdot\cos\theta}{4} - \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} - \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_1}$ $P_{2T} = \dfrac{mg\cdot\sin\theta}{4} - \dfrac{mg\cdot\sin\theta\cdot\ell_2}{2\cdot\ell_0}$ $P_3 = +\dfrac{mg\cdot\cos\theta}{4} - \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_1}$ $P_{3T} = \dfrac{mg\cdot\sin\theta}{4} - \dfrac{mg\cdot\sin\theta\cdot\ell_2}{2\cdot\ell_0}$ $P_4 = +\dfrac{mg\cdot\cos\theta}{4} + \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_1}$ $P_{4T} = \dfrac{mg\cdot\sin\theta}{4} + \dfrac{mg\cdot\sin\theta\cdot\ell_2}{2\cdot\ell_0}$

Example	Service conditions	Applied load equation
7	Longitudinally tilt mount  E.g.: NC lathe Tool rest	$P_1 = +\dfrac{mg\cdot\cos\theta}{4} + \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} - \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{1T} = +\dfrac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_2 = +\dfrac{mg\cdot\cos\theta}{4} - \dfrac{mg\cdot\cos\theta\,\ell_2}{2\cdot\ell_0} - \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{2T} = -\dfrac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_3 = +\dfrac{mg\cdot\cos\theta}{4} - \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{3T} = -\dfrac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_4 = +\dfrac{mg\cdot\cos\theta}{4} + \dfrac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \dfrac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \dfrac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{4T} = +\dfrac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$
8	Horizontal mount with inertia  $\alpha_n = \dfrac{V}{t_n}$  Speed diagram E.g.: Conveyance truck	During acceleration $P_1 = P_4 = \dfrac{mg}{4} - \dfrac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \dfrac{mg}{4} + \dfrac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T}\sim P_{4T} = \dfrac{m\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0}$ During uniform motion $P_1 \sim P_4 = \dfrac{mg}{4}$ During deceleration $P_1 = P_4 = \dfrac{mg}{4} + \dfrac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \dfrac{mg}{4} - \dfrac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T}\sim P_{4T} = \dfrac{m\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0}$

Example	Service conditions	Applied load equation
9	Vertical mount with inertia  $\alpha_n = \frac{V}{t_n}$  Speed diagram E.g.: Conveyance elevator	During acceleration $P_1 \sim P_4 = \frac{m \cdot (g + \alpha_1) \cdot \ell_2}{2 \cdot \ell_0}$ $P_{1T} \sim P_{4T} = \frac{m \cdot (g + \alpha_1) \cdot \ell_3}{2 \cdot \ell_0}$ During uniform motion $P_1 \sim P_4 = \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_{1T} \sim P_{4T} = \frac{mg \cdot \ell_3}{2 \cdot \ell_0}$ During deceleration $P_1 \sim P_4 = \frac{m \cdot (g - \alpha_3) \cdot \ell_2}{2 \cdot \ell_0}$ $P_{1T} \sim P_{4T} = \frac{m \cdot (g - \alpha_3) \cdot \ell_3}{2 \cdot \ell_0}$
10	Horizontal mount with external force  E.g.: Drill unit Milling machine Lathe Machining center and other cutting machine	Under force F₁ $P_1 \sim P_4 = \frac{F_1 \cdot \ell_5}{2 \cdot \ell_0}$ $P_{1T} \sim P_{4T} = \frac{F_1 \cdot \ell_4}{2 \cdot \ell_0}$ Under force F₂ $P_1 = P_4 = \frac{F_2}{4} + \frac{F_2 \cdot \ell_2}{2 \cdot \ell_0}$ $P_2 = P_3 = \frac{F_2}{4} - \frac{F_2 \cdot \ell_2}{2 \cdot \ell_0}$ Under force F₃ $P_1 \sim P_4 = \frac{F_3 \cdot \ell_3}{2 \cdot \ell_1}$ $P_{1T} = P_{4T} = \frac{F_3}{4} + \frac{F_3 \cdot \ell_2}{2 \cdot \ell_0}$ $P_{2T} = P_{3T} = \frac{F_3}{4} - \frac{F_3 \cdot \ell_2}{2 \cdot \ell_0}$

3.4. Calculating the Equivalent Load

The LM Guide can bear loads and moments in all directions, including a radial load (P_R), reverse-radial load (P_L) and lateral loads (P_T), simultaneously.
Applied loads include the following:

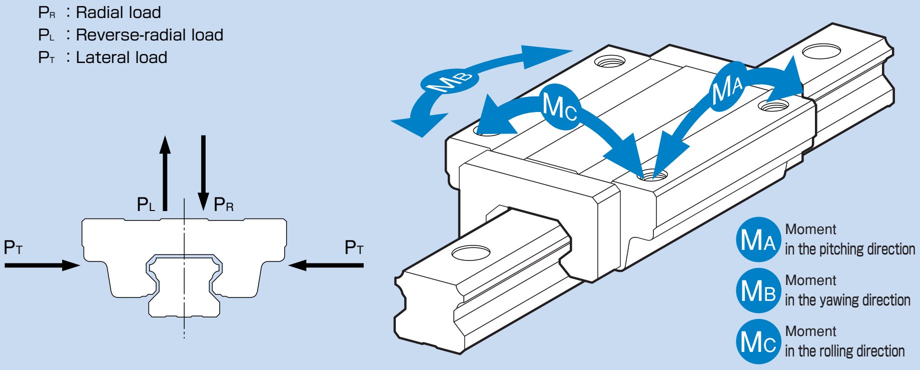


Fig. 9 Directions of the Loads Applied on the LM Guide

●Equivalent Load P_E

When two or more loads (e.g., radial load and lateral load) are simultaneously applied to the LM Guide, the service life and the static safety factor are calculated using equivalent load values obtained by converting all the loads into radial, lateral and other loads.

●Equivalent Load Equation

The equivalent load equation for the LM Guide differs by model. For details, see the section corresponding to the subject model in the "THK General Catalog - Product Specifications," provided separately.

Example of equation for LM Guide model HSR

The equivalent load when a radial load (P_R) and a lateral load (P_T) are applied simultaneously is obtained using the following equation.

$$P_E \text{ (equivalent load)} = P_R + P_T$$

P_R :Radial load
P_T :Lateral load

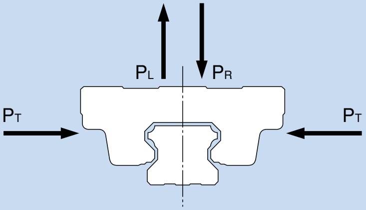


Fig. 10 Equivalent of Load of the LM Guide

3.5. Calculating the Static Safety Factor

To calculate a load applied to the LM Guide, the average load required for calculating the service life and the maximum load needed for calculating the static safety factor must be obtained first. In a system subject to frequent starts and stops, placed under cutting loads or under a large moment caused by an overhang load, an excessively large load may apply to the LM Guide. When selecting a model number, make sure that the desired model is capable of receiving the required maximum load (whether stationary or in motion). Table 9 shows standard values for the static safety factor.

Table 9 Standard Values for the Static Safety Factor (f_S)

Machine using the LM Guide	Loading conditions	Lower limit of f_S
General industrial machinery	Without vibration/impact	1 to 1.3
	With vibration/impact applied	2 to 3
Machine tool	Without vibration/impact	1 to 1.5
	With vibration/impact applied	2.5 to 7

When the radial load is large	$\frac{f_H \cdot f_T \cdot f_C \cdot C_0}{P_R} \geqq f_S$
When the reverse-radial load is large	$\frac{f_H \cdot f_T \cdot f_C \cdot C_{0L}}{P_L} \geqq f_S$
When the lateral loads are large	$\frac{f_H \cdot f_T \cdot f_C \cdot C_{0T}}{P_T} \geqq f_S$

f_S : Static safety factor

C_0 : Basic static load rating (radial direction) (N)

C_{0L} : Basic static load rating (reverse-radial direction) (N)

C_{0T} : Basic static load rating (lateral direction) (N)

P_R : Calculated load (radial direction) (N)

P_L : Calculated load (reverse-radial direction) (N)

P_T : Calculated load (lateral direction) (N)

f_H : Hardness factor (see Fig. 11 on page A-76)

f_T : Temperature factor (see Fig. 12 on page A-76)

f_C : Contact factor (see Table 10 on page A-76)

3.6. Calculating the Average Load

In cases where the load applied to each LM block fluctuates under different conditions, such as an industrial robot holding a workpiece with its arm as it advances and receding with its arm empty, and a machine tool handling various workpieces, it is necessary to calculate the service life of the LM Block while taking into account such fluctuating loading conditions.

The average load (P_m) is the load under which the service life of the LM Guide is equivalent to that under varying loads applied to the LM blocks.

The basic equation for calculating the average load is indicated below.

where

$$P_m = \sqrt[3]{\frac{1}{L} \cdot \sum_{n=1}^{n} (P_n^3 \cdot L_n)}$$

P_m : Average load (N)
P_n : Varying load (N)
L : Total distance traveled (mm)
L_n : Distance traveled under load P_n (mm)

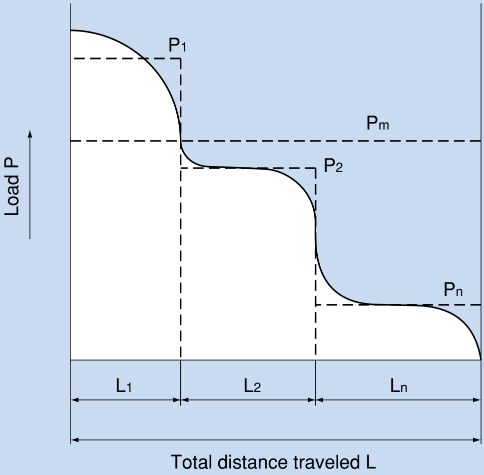
Note: The above equation or the equation (1) below applies when the rolling elements are balls.

① When the load varies in steps

where

$$P_m = \sqrt[3]{\frac{1}{L} (P_1^3 \cdot L_1 + P_2^3 \cdot L_2 \cdots\cdots + P_n^3 \cdot L_n)} \quad \cdots\cdots\cdots\cdots(1)$$

P_m : Average load (N)
P_n : Varying load (N)
L : Total distance traveled (mm)
L_n : Distance traveled under load P_n (mm)



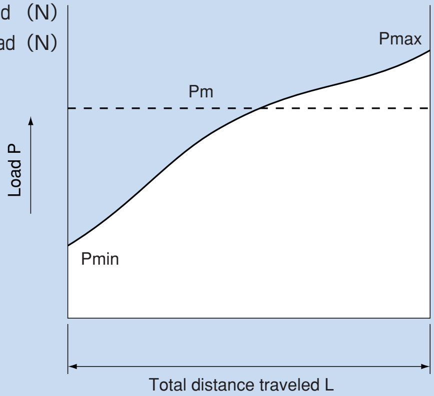
② When the load varies monotonously

where

$$P_m \fallingdotseq \frac{1}{3}\left(P_{min} + 2 \cdot P_{max}\right) \quad \cdots\cdots\cdots\cdots(2)$$

P_{min} : Minimum load (N)

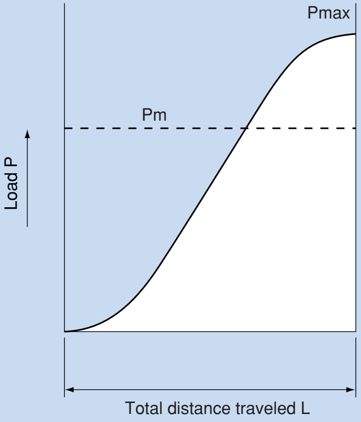
P_{max} : Maximum load (N)

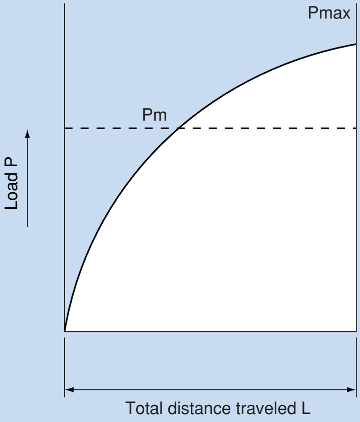


③ When the load varies sinusoidally

ⓐ $P_m \fallingdotseq 0.65P_{max}$ …………(3)

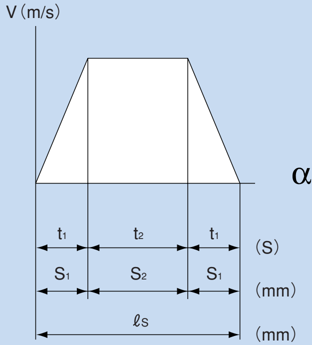
ⓑ $P_m \fallingdotseq 0.75P_{max}$ …………(4)



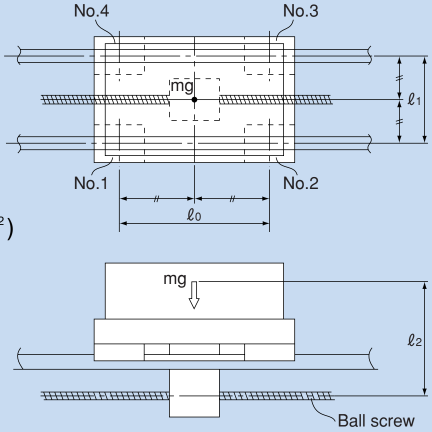


3.6.1. Example of Calculating the Average Load (1) - with Horizontal Mount and Acceleration/Deceleration Considered

[Service conditions]



$$\alpha_1 = \frac{v}{t_1} \ (\text{m/s}^2)$$



Load applied to the LM block

●During uniform motion

$$P_1 = +\frac{mg}{4}$$

$$P_2 = +\frac{mg}{4}$$

$$P_3 = +\frac{mg}{4}$$

$$P_4 = +\frac{mg}{4}$$

●During acceleration

$$Pa_1 = P_1 + \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pa_2 = P_2 - \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pa_3 = P_3 - \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pa_4 = P_4 + \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

●During deceleration

$$Pd_1 = P_1 - \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pd_2 = P_2 + \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pd_3 = P_3 + \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

$$Pd_4 = P_4 - \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$$

Average load

$$P_{m1} = \sqrt[3]{\frac{1}{\ell_S}(Pa_1^{\,3}\cdot s_1 + P_1^{\,3}\cdot s_2 + Pd_1^{\,3}\cdot s_3)}$$

$$P_{m2} = \sqrt[3]{\frac{1}{\ell_S}(Pa_2^{\,3}\cdot s_1 + P_2^{\,3}\cdot s_2 + Pd_2^{\,3}\cdot s_3)}$$

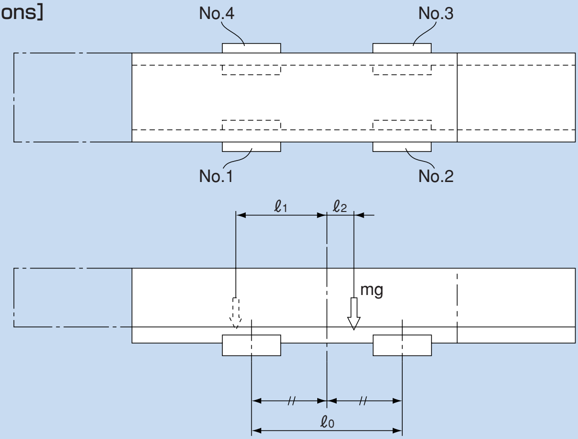
$$P_{m3} = \sqrt[3]{\frac{1}{\ell_S}(Pa_3^{\,3}\cdot s_1 + P_3^{\,3}\cdot s_2 + Pd_3^{\,3}\cdot s_3)}$$

$$P_{m4} = \sqrt[3]{\frac{1}{\ell_S}(Pa_4^{\,3}\cdot s_1 + P_4^{\,3}\cdot s_2 + Pd_4^{\,3}\cdot s_3)}$$

Note: Pa_n and Pd_n represent loads applied to each LM block. The suffix "n" indicates the block number in the diagram above.

3.6.2. Example of Calculating the Average Load (2) - When the Rails are Movable

[Service conditions]



Load applied to the LM block

●At the left of the arm

$$P_{\ell 1} = +\frac{mg}{4} + \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$$

$$P_{\ell 2} = +\frac{mg}{4} - \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$$

$$P_{\ell 3} = +\frac{mg}{4} - \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$$

$$P_{\ell 4} = +\frac{mg}{4} + \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$$

●At the right of the arm

$$P_{r1} = +\frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$$

$$P_{r2} = +\frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$$

$$P_{r3} = +\frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$$

$$P_{r4} = +\frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$$

Average load

$$P_{m1} = \frac{1}{3}(2 \cdot |P_{\ell 1}| + |P_{r1}|)$$

$$P_{m2} = \frac{1}{3}(2 \cdot |P_{\ell 2}| + |P_{r2}|)$$

$$P_{m3} = \frac{1}{3}(2 \cdot |P_{\ell 3}| + |P_{r3}|)$$

$$P_{m4} = \frac{1}{3}(2 \cdot |P_{\ell 4}| + |P_{r4}|)$$

Note: $P_{\ell n}$ and P_{rn} represent loads applied to each LM block. The suffix "n" indicates the block number in the diagram above.

3.7. Calculating the Rated Life

The service life of an LM Guide is subject to variations even under the same operational conditions. Therefore, it is necessary to use the rated life defined below as a reference value for obtaining the service life of the LM Guide. The rated life means the total travel distance that 90% of a group of units of the same LM Guide model can achieve without flaking (scale-like exfoliation on the metal surface) after individually running under the same conditions.

3.7.1. Rated Life Equation for an LM Guide® Using Balls

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C}\right)^3 \times 50$$

L : Rated life (km)
C : Basic dynamic load rating (N)
P_C : Calculated load (N)
f_H : Hardness factor (see Fig. 11 on page A-76)
f_T : Temperature factor (see Fig. 12 on page A-76)
f_C : Contact factor (see Table 10 on page A-76)
f_W : Load factor (see Table 11 on page A-77)

3.7.2. Rated Life Equation for an LM Guide® Using Rollers

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C}\right)^{\frac{10}{3}} \times 100$$

L : Rated life (km)
C : Basic dynamic load rating (N)
P_C : Calculated load (N)
f_H : Hardness factor (see Fig. 11 on page A-76)
f_T : Temperature factor (see Fig. 12 on page A-76)
f_C : Contact factor (see Table 10 on page A-76)
f_W : Load factor (see Table 11 on page A-77)

Once the rated life (L) has been obtained, the service life time can be obtained using the following equation if the stroke length and the number reciprocations are constant.

$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : No. of reciprocations per min (min^{-1})

f_H : Hardness factor

To ensure the achievement of the optimum load capacity of the LM Guide, the raceway hardness must be between 58 and 64 HRC.

At hardness below this range, the basic dynamic and static load ratings decrease. Therefore, the rating values must be multiplied by the respective hardness factors (f_H).

Since the LM Guide has sufficient hardness, the f_H value for the LM Guide is normally 1.0 unless otherwise specified.

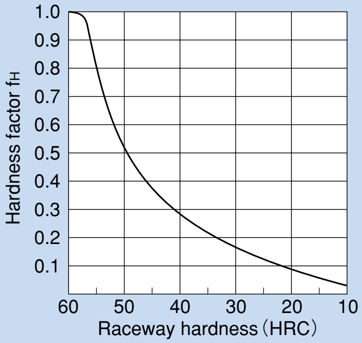


Fig. 11 Hardness Factor (f_H)

f_T : Temperature factor

For LM Guides used at ambient temperature over 100°C, a temperature factor corresponding to the ambient temperature, selected from Fig. 12, must be taken into account.

In addition, the selected LM Guide must also be of a high-temperature type.

Note: The LM Guide is designed to normally be used at ambient temperature of 80°C or less.

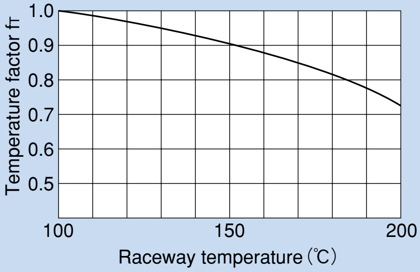


Fig. 12 Temperature factor (f_T)

f_C : Contact factor

When multiple LM blocks are used in close contact with each other, it is difficult to achieve uniform load distribution due to moment loads and mounting-surface accuracy. When using multiple blocks in close contact with each other, multiply the basic load rating (C or C_0) by the corresponding contact factor indicated in Table 10.

Note: When uneven load distribution is expected in a large machine, consider using a contact factor from Table 10.

Table 10 Contact Factor (f_C)

Number of blocks used in close contact	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
6 or more	0.6
Normal use	1

■f_w : Load factor

In general, reciprocating machines tend to produce vibrations or impact during operation. And, it is especially difficult to accurately determine all vibrations generated during high-speed operation and impacts produced each time the machine starts and stops. Therefore, where the effects of speed and vibration are estimated to be significant, divide the basic dynamic load rating (C) by a load factor selected from Table 11, which contains empirically obtained data.

Table 11 Load Factor (f_w)

Vibration/impact	Speed (V)	f_w
Faint	Hyper-slow $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Moderate	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	Fast $V > 2$m/s	2 to 3.5

3.7.3. Example of Calculating the Rated Life (1) - with Horizontal Mount and High-speed Acceleration

[Service conditions]

Model No.: HSR35LA2SS+2500LP-Ⅱ
(basic dynamic load rating: $C = 50.2$ kN)
(basic static load rating: $C_0 = 81.4$ kN)

Mass $m_1 = 800$ kg
$m_2 = 500$ kg
Speed $V = 0.5$ m/s
Time $t_1 = 0.05$ s
$t_2 = 2.8$ s
$t_3 = 0.15$ s
Acceleration $\alpha_1 = 10$ m/s²
$\alpha_3 = 3.333$ m/s²
Stroke $\ell_S = 1450$ mm

Distance $\ell_0 = 600$ mm
$\ell_1 = 400$ mm
$\ell_2 = 120$ mm
$\ell_3 = 50$ mm
$\ell_4 = 200$ mm
$\ell_5 = 350$ mm

Gravitational acceleration $g = 9.8$ (m/s²)

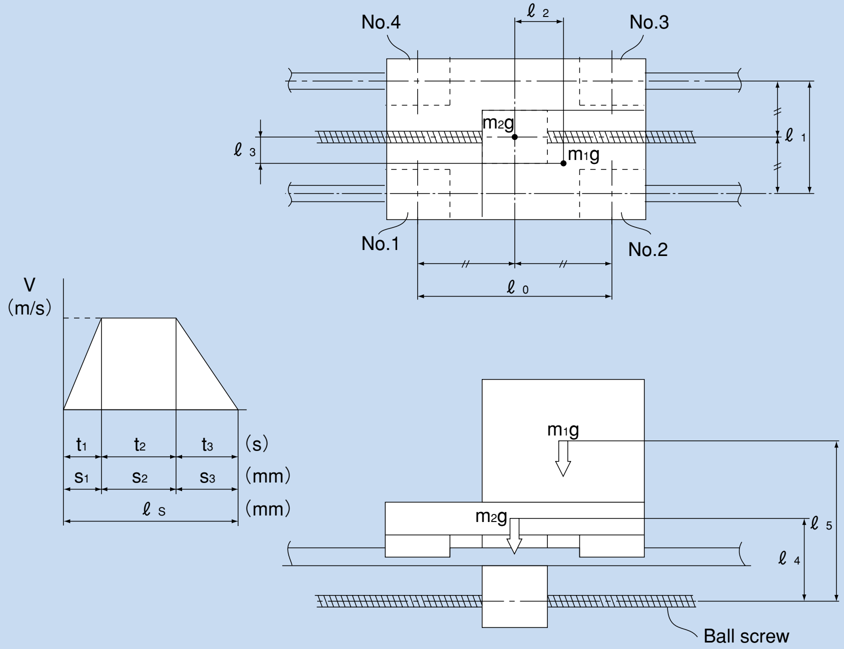


Fig. 13 Service Conditions

Load Applied to the LM Block

Calculate the load applied to each LM block.

●During uniform motion

■Applied load in the radial direction P_n

$$P_1 = +\frac{m_1 g}{4} - \frac{m_1 g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_1 g\cdot\ell_3}{2\cdot\ell_1} + \frac{m_2 g}{4} = +2891\ \text{N}$$

$$P_2 = +\frac{m_1 g}{4} + \frac{m_1 g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_1 g\cdot\ell_3}{2\cdot\ell_1} + \frac{m_2 g}{4} = +4459\ \text{N}$$

$$P_3 = +\frac{m_1 g}{4} + \frac{m_1 g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_1 g\cdot\ell_3}{2\cdot\ell_1} + \frac{m_2 g}{4} = +3479\ \text{N}$$

$$P_4 = +\frac{m_1 g}{4} - \frac{m_1 g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_1 g\cdot\ell_3}{2\cdot\ell_1} + \frac{m_2 g}{4} = +1911\ \text{N}$$

●During leftward acceleration

■Applied load in the radial direction $P\ell a_n$

$$P\ell a_1 = P_1 - \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = -\ 275.6\ \text{N}$$

$$P\ell a_2 = P_2 + \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +\ 7625.6\ \text{N}$$

$$P\ell a_3 = P_3 + \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +\ 6645.6\ \text{N}$$

$$P\ell a_4 = P_4 - \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = -\ 1255.6\ \text{N}$$

■Applied load in the lateral direction $Pt\ell a_n$

$$Pt\ell a_1 = -\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = -\ 333.3\ \text{N}$$

$$Pt\ell a_2 = +\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = +\ 333.3\ \text{N}$$

$$Pt\ell a_3 = +\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = +\ 333.3\ \text{N}$$

$$Pt\ell a_4 = -\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = -\ 333.3\ \text{N}$$

●During leftward deceleration

■Applied load in the radial direction $P\ell d_n$

$$P\ell d_1 = P_1 + \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +\ 3946.6\ \text{N}$$

$$P\ell d_2 = P_2 - \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +\ 3403.4\ \text{N}$$

$$P\ell d_3 = P_3 - \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +\ 2423.4\ \text{N}$$

$$P\ell d_4 = P_4 + \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +\ 2966.6\ \text{N}$$

Applied load in the lateral direction $Pt\ell d_n$

$$Pt\ell d_1 = +\frac{m_1\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0} = +111.1\ \mathrm{N}$$

$$Pt\ell d_2 = -\frac{m_1\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0} = -111.1\ \mathrm{N}$$

$$Pt\ell d_3 = -\frac{m_1\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0} = -111.1\ \mathrm{N}$$

$$Pt\ell d_4 = +\frac{m_1\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0} = +111.1\ \mathrm{N}$$

During rightward acceleration

Applied load in the radial direction Pra_n

$$Pra_1 = P_1 + \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +6057.6\ \mathrm{N}$$

$$Pra_2 = P_2 - \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +1292.4\ \mathrm{N}$$

$$Pra_3 = P_3 - \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +312.4\ \mathrm{N}$$

$$Pra_4 = P_4 + \frac{m_1\cdot\alpha_1\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_1\cdot\ell_4}{2\cdot\ell_0} = +5077.6\ \mathrm{N}$$

Applied load in the lateral direction $Ptra_n$

$$Ptra_1 = +\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = +333.3\ \mathrm{N}$$

$$Ptra_2 = -\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = -333.3\ \mathrm{N}$$

$$Ptra_3 = -\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = -333.3\ \mathrm{N}$$

$$Ptra_4 = +\frac{m_1\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0} = +333.3\ \mathrm{N}$$

During rightward deceleration

Applied load in the radial direction Prd_n

$$Prd_1 = P_1 - \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +1835.4\ \mathrm{N}$$

$$Prd_2 = P_2 + \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +5514.6\ \mathrm{N}$$

$$Prd_3 = P_3 + \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} + \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +4534.6\ \mathrm{N}$$

$$Prd_4 = P_4 - \frac{m_1\cdot\alpha_3\cdot\ell_5}{2\cdot\ell_0} - \frac{m_2\cdot\alpha_3\cdot\ell_4}{2\cdot\ell_0} = +855.4\ \mathrm{N}$$

■Applied load in the lateral direction $Ptrd_n$

$$Ptrd_1 = -\frac{m_1 \cdot \alpha_3 \cdot \ell_3}{2 \cdot \ell_0} = -111.1\ \text{N}$$

$$Ptrd_2 = +\frac{m_1 \cdot \alpha_3 \cdot \ell_3}{2 \cdot \ell_0} = +111.1\ \text{N}$$

$$Ptrd_3 = +\frac{m_1 \cdot \alpha_3 \cdot \ell_3}{2 \cdot \ell_0} = +111.1\ \text{N}$$

$$Ptrd_4 = +\frac{m_1 \cdot \alpha_3 \cdot \ell_3}{2 \cdot \ell_0} = -111.1\ \text{N}$$

Resultant Load

●During uniform motion

$P_{E1} = P_1 = 2891\ \text{N}$

$P_{E2} = P_2 = 4459\ \text{N}$

$P_{E3} = P_3 = 3479\ \text{N}$

$P_{E4} = P_4 = 1911\ \text{N}$

●During rightward acceleration

$P_{Era_1} = |Pra_1| + |Ptra_1| = 6390.9\ \text{N}$

$P_{Era_2} = |Pra_2| + |Ptra_2| = 1625.7\ \text{N}$

$P_{Era_3} = |Pra_3| + |Ptra_3| = 645.7\ \text{N}$

$P_{Era_4} = |Pra_4| + |Ptra_4| = 5410.9\ \text{N}$

●During leftward acceleration

$P_E \ell a_1 = |P \ell a_1| + |Pt \ell a_1| = 608.9\ \text{N}$

$P_E \ell a_2 = |P \ell a_2| + |Pt \ell a_2| = 7958.9\ \text{N}$

$P_E \ell a_3 = |P \ell a_3| + |Pt \ell a_3| = 6978.9\ \text{N}$

$P_E \ell a_4 = |P \ell a_4| + |Pt \ell a_4| = 1588.9\ \text{N}$

●During rightward deceleration

$P_{Erd_1} = |Prd_1| + |Ptrd_1| = 1946.5\ \text{N}$

$P_{Erd_2} = |Prd_2| + |Ptrd_2| = 5625.7\ \text{N}$

$P_{Erd_3} = |Prd_3| + |Ptrd_3| = 4645.7\ \text{N}$

$P_{Erd_4} = |Prd_4| + |Ptrd_4| = 966.5\ \text{N}$

●During leftward deceleration

$P_E \ell d_1 = |P \ell d_1| + |Pt \ell d_1| = 4057.7\ \text{N}$

$P_E \ell d_2 = |P \ell d_2| + |Pt \ell d_2| = 3514.5\ \text{N}$

$P_E \ell d_3 = |P \ell d_3| + |Pt \ell d_3| = 2534.5\ \text{N}$

$P_E \ell d_4 = |P \ell d_4| + |Pt \ell d_4| = 3077.7\ \text{N}$

Static Safety Factor

As indicated above, the maximum load is applied to the LM Guide during the leftward acceleration of the second LM block. Therefore, the static safety factor (f_S) is obtained in the following equation.

$$f_S = \frac{C_0}{P_E \ell a_2} = \frac{81.4 \times 10^3}{7958.9} = 10.2$$

Average Load P_{mn}

Obtain the average load applied to each LM block.

$$P_{m1} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_E\ell a_1^{3}\cdot S_1 + P_{E1}^{3}\cdot S_2 + P_E\ell d_1^{3}\cdot S_3 + P_Era_1^{3}\cdot S_1 + P_{E1}^{3}\cdot S_2 + P_Erd_1^{3}\cdot S_3\right)}$$

$$= \sqrt[3]{\frac{1}{2\times1450}\left(608.9^{3}\times12.5 + 2891^{3}\times1400 + 4057.7^{3}\times37.5 + 6390.9^{3}\times12.5 + 2891^{3}\times1400 + 1946.5^{3}\times37.5\right)}$$

$$= 2940.1\ \text{N}$$

$$P_{m2} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_E\ell a_2^{3}\cdot S_1 + P_{E2}^{3}\cdot S_2 + P_E\ell d_2^{3}\cdot S_3 + P_Era_2^{3}\cdot S_1 + P_{E2}^{3}\cdot S_2 + P_Erd_2^{3}\cdot S_3\right)}$$

$$= \sqrt[3]{\frac{1}{2\times1450}\left(7958.9^{3}\times12.5 + 4459^{3}\times1400 + 3514.5^{3}\times37.5 + 1625.7^{3}\times12.5 + 4459^{3}\times1400 + 5625.7^{3}\times37.5\right)}$$

$$= 4492.2\ \text{N}$$

$$P_{m3} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_E\ell a_3^{3}\cdot S_1 + P_{E3}^{3}\cdot S_2 + P_E\ell d_3^{3}\cdot S_3 + P_Era_3^{3}\cdot S_1 + P_{E3}^{3}\cdot S_2 + P_Erd_3^{3}\cdot S_3\right)}$$

$$= \sqrt[3]{\frac{1}{2\times1450}\left(6978.9^{3}\times12.5 + 3479^{3}\times1400 + 2534.5^{3}\times37.5 + 645.7^{3}\times12.5 + 3479^{3}\times1400 + 4645.7^{3}\times37.5\right)}$$

$$= 3520.4\ \text{N}$$

$$P_{m4} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_E\ell a_4^{3}\cdot S_1 + P_{E4}^{3}\cdot S_2 + P_E\ell d_4^{3}\cdot S_3 + P_Era_4^{3}\cdot S_1 + P_{E4}^{3}\cdot S_2 + P_Erd_4^{3}\cdot S_3\right)}$$

$$= \sqrt[3]{\frac{1}{2\times1450}\left(1588.9^{3}\times12.5 + 1911^{3}\times1400 + 3077.7^{3}\times37.5 + 5410.9^{3}\times12.5 + 1911^{3}\times1400 + 966.5^{3}\times37.5\right)}$$

$$= 1985.5\ \text{N}$$

Rated Life L_n

The rated lives of the four LM blocks are obtained from the corresponding rated life equations shown below.

$$L_1 = \left(\frac{C}{f_W\cdot P_{m1}}\right)^{3}\times50 = 73700\ \text{km}$$

$$L_2 = \left(\frac{C}{f_W\cdot P_{m2}}\right)^{3}\times50 = 20600\ \text{km}$$

$$L_3 = \left(\frac{C}{f_W\cdot P_{m3}}\right)^{3}\times50 = 43000\ \text{km}$$

$$L_4 = \left(\frac{C}{f_W\cdot P_{m4}}\right)^{3}\times50 = 239000\ \text{km}$$

(where $f_W = 1.5$)

Therefore, the service life of the LM Guide used in a machine or equipment under the service conditions stated above is equivalent to the rated life of the second LM block, which is 20,600 km.

3.7.4. Example of Calculating the Rated Life (2) - with Vertical Mount

[Service conditions]

Model No.: HSR25CA2SS+1500L-Ⅱ
(basic dynamic load rating: $C = 19.9$ kN)
(basic static load rating: $C_0 = 34.4$ kN)

Mass $m_0 = 100$ kg
$m_1 = 200$ kg
$m_2 = 100$ kg

Distance $\ell_0 =$ 300 mm
$\ell_1 =$ 80 mm
$\ell_2 =$ 50 mm
$\ell_3 =$ 280 mm
$\ell_4 =$ 150 mm
$\ell_5 =$ 250 mm

Stroke $\ell_S =$ 1000 mm

The mass (m_0) is loaded only during ascent; it is removed during descent.

Gravitational acceleration $g = 9.8$ (m/s²)

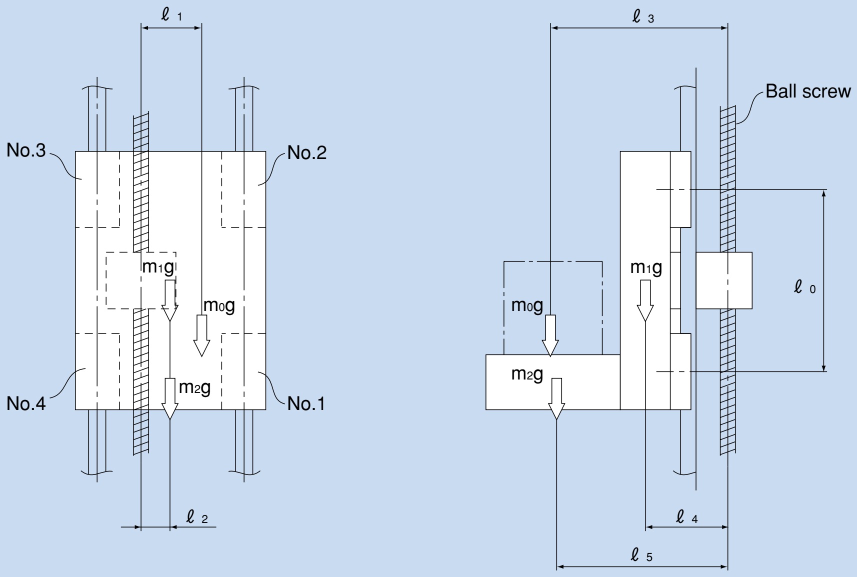


Fig. 14 Service Conditions

Load Applied to the LM Block

●During Ascent

■Load applied to each LM block in the radial direction Pu_n during ascent

$$Pu_1 = +\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} + \frac{m_0g\cdot\ell_3}{2\cdot\ell_0} = +1355.6\text{ N}$$

$$Pu_2 = -\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} - \frac{m_0g\cdot\ell_3}{2\cdot\ell_0} = -1355.6\text{ N}$$

$$Pu_3 = -\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} - \frac{m_0g\cdot\ell_3}{2\cdot\ell_0} = -1355.6\text{ N}$$

$$Pu_4 = +\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} + \frac{m_0g\cdot\ell_3}{2\cdot\ell_0} = +1355.6\text{ N}$$

■Load applied to each LM block in the lateral direction Ptu_n during ascent

$$Ptu_1 = +\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_0g\cdot\ell_1}{2\cdot\ell_0} = +375.7\text{ N}$$

$$Ptu_2 = -\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_0g\cdot\ell_1}{2\cdot\ell_0} = -375.7\text{ N}$$

$$Ptu_3 = -\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_0g\cdot\ell_1}{2\cdot\ell_0} = -375.7\text{ N}$$

$$Ptu_4 = +\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_0g\cdot\ell_1}{2\cdot\ell_0} = +375.7\text{ N}$$

●During Descent

■Load applied to each LM block in the radial direction Pd_n during descent

$$Pd_1 = +\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} = +898.3\text{ N}$$

$$Pd_2 = -\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} = -898.3\text{ N}$$

$$Pd_3 = -\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} = -898.3\text{ N}$$

$$Pd_4 = +\frac{m_1g\cdot\ell_4}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_5}{2\cdot\ell_0} = +898.3\text{ N}$$

■Load applied to each LM block in the lateral direction Ptd_n during descent

$$Ptd_1 = +\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} = +245\text{ N}$$

$$Ptd_2 = -\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} = -245\text{ N}$$

$$Ptd_3 = -\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} - \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} = -245\text{ N}$$

$$Ptd_4 = +\frac{m_1g\cdot\ell_2}{2\cdot\ell_0} + \frac{m_2g\cdot\ell_2}{2\cdot\ell_0} = +245\text{ N}$$

Resultant Load

●During ascent

$P_{Eu1} = |P_{u1}| + |Pt_{u1}| = 1731.3\ \mathrm{N}$

$P_{Eu2} = |P_{u2}| + |Pt_{u2}| = 1731.3\ \mathrm{N}$

$P_{Eu3} = |P_{u3}| + |Pt_{u3}| = 1731.3\ \mathrm{N}$

$P_{Eu4} = |P_{u4}| + |Pt_{u4}| = 1731.3\ \mathrm{N}$

●During descent

$P_{Ed1} = |Pd_{1}| + |Ptd_{1}| = 1143.3\ \mathrm{N}$

$P_{Ed2} = |Pd_{2}| + |Ptd_{2}| = 1143.3\ \mathrm{N}$

$P_{Ed3} = |Pd_{3}| + |Ptd_{3}| = 1143.3\ \mathrm{N}$

$P_{Ed4} = |Pd_{4}| + |Ptd_{4}| = 1143.3\ \mathrm{N}$

Static Safety Factor

The static safety factor (f_s) of the KM Guide used in a machine or equipment under the service conditions stated above is obtained as follows.

$$f_S = \frac{C_0}{P_{EU2}} = \frac{34.4\times10^3}{1731.3} = 19.9$$

Average Load P_{mn}

Obtain the average load applied to each LM block.

$$P_{m1} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_{EU1}{}^3\cdot\ell_S + P_{Ed1}{}^3\cdot\ell_S\right)} = 1495.1\ \mathrm{N}$$

$$P_{m2} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_{EU2}{}^3\cdot\ell_S + P_{Ed2}{}^3\cdot\ell_S\right)} = 1495.1\ \mathrm{N}$$

$$P_{m3} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_{EU3}{}^3\cdot\ell_S + P_{Ed3}{}^3\cdot\ell_S\right)} = 1495.1\ \mathrm{N}$$

$$P_{m4} = \sqrt[3]{\frac{1}{2\cdot\ell_S}\left(P_{EU4}{}^3\cdot\ell_S + P_{Ed4}{}^3\cdot\ell_S\right)} = 1495.1\ \mathrm{N}$$

Rated Life L_n

The rated lives of the four LM blocks are obtained from the corresponding rated life equations shown below.

$$L_1 = \left(\frac{C}{f_W \cdot P_{m1}}\right)^3 \times 50 = 68200 \text{ km}$$

$$L_2 = \left(\frac{C}{f_W \cdot P_{m2}}\right)^3 \times 50 = 68200 \text{ km}$$

$$L_3 = \left(\frac{C}{f_W \cdot P_{m3}}\right)^3 \times 50 = 68200 \text{ km}$$

$$L_4 = \left(\frac{C}{f_W \cdot P_{m4}}\right)^3 \times 50 = 68200 \text{ km}$$

(where $f_W = 1.2$)

Therefore, the service life of the LM Guide used in a machine or equipment under the service conditions stated above is 68,200 km.

4. Estimating the Rigidity

4.1. Selecting a Radial Clearance (Preload)

Since the radial clearance of an LM Guide greatly affects the running accuracy, load carrying capacity and rigidity of the LM Guide, it is important to select an appropriate clearance according to the application. In general, selecting a negative clearance (i.e., a preload* is applied) while taking into account possible vibrations and impact generated from reciprocating motion favorably affects the service life and the accuracy.

For specific radial clearances, contact THK We will help you select the optimal clearance according to the service conditions.

The clearances of all LM Guide models (except model HR, GSR and GSR-R, which are separate types) are adjusted as specified before shipment, and therefore they do not need further preload adjustment.

Table 1 Types of Radial Clearance

	Radial Clearance		
	Normal clearance	Clearance C1 (light preload)	Clearance C0 (moderate preload)
Service conditions	●The loading direction is fixed, impact and vibrations are minimal and 2 rails are installed in parallel. ●Very high precision is not required, and the sliding resistance must be as low as possible.	●An overhang load or moment load is applied. ●LM Guide is used in a single-rail configuration. ●Light weight and high accuracy are required.	●High rigidity is required and vibrations and impact are applied. ●Heavy-cutting machine tool
Sample applications	Beam-welding machine, book-binding machine, automatic packaging machine, XY axes of general industrial machinery, automatic sash-manufacturing machine, welding machine, flame cutting machine, tool changer, material feeder	Grinding machine table feed axis, automatic coating machine, industrial robot, high-speed material feeder, NC drilling machine, vertical axis of general industrial machinery, printed circuit board drilling machine, electric discharge machine, measuring instrument, precision XY table	Machining center, NC lathe, grinding stone feed axis of grinding machine, milling machine, vertical/horizontal boring machine, tool rest guide, vertical axis of machine tool

* Preload is an internal load applied to the rolling elements (balls, rollers, etc.) of an LM block in advance in order to increase its rigidity.

4.2. Service Life with a Preload Considered

When using an LM Guide under a moderate preload (clearance C0), it is necessary to calculate the service life while taking into account the magnitude of the preload.
To identify the appropriate preload for any selected LM Guide model, contact THK .

4.3. Rigidity

When the LM Guide receives a load, its rolling element, LM blocks and LM rails are elastically deformed within a permissible load range. The ratio between the displacement and the load is called rigidity value (rigidity values are obtained using the equation shown below). The LM Guide's rigidity increases according to the magnitude of the preload. Fig. 1 shows rigidity difference between normal, C1 and C0 clearances.
The effect of a preload for a 4-way equal-load type is translated into the calculated load approx. 2.8 times greater than the magnitude of the preload.

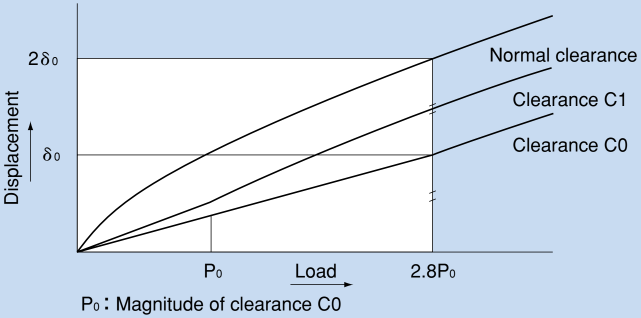
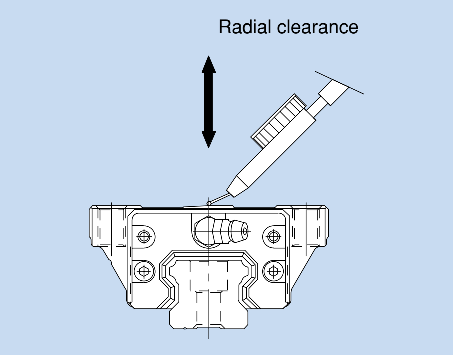


Fig. 1 Rigidity Data

$$K=\frac{P}{\delta} \qquad (N/\mu m)$$

K :Rigidity
δ :Displacement (μm)
P :Calculated load (N)

4.4. Radial Clearance Standard for Each Model



Radial clearance for model SSR

Unit : µm

Indication symbol / Model No.	Normal	Light load
	No symbol	C1
15	–4 to +2	–10 to –4
20	–5 to +2	–12 to –5
25	–6 to +3	–15 to –6
30	–7 to +4	–18 to –7
35	–8 to +4	–20 to –8

Radial clearance for model SR

Unit : µm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
15	–4 to +2	–10 to –4	——
20	–5 to +2	–12 to –5	–17 to –12
25	–6 to +3	–15 to –6	–21 to –15
30	–7 to +4	–18 to –7	–26 to –18
35	–8 to +4	–20 to –8	–31 to –20
45	–10 to +5	–24 to –10	–36 to –24
55	–12 to +5	–28 to –12	–45 to –28
70	–14 to +7	–32 to –14	–50 to –32
85	–20 to +9	–46 to –20	–70 to –46
100	–22 to +10	–52 to –22	–78 to –52
120	–25 to +12	–57 to –25	–87 to –57
150	–29 to +14	–69 to –29	–104 to –69

Radial clearance for model SHS

Unit : µm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
15	–5 to 0	–12 to –5	——
20	–6 to 0	–12 to –6	–18 to –12
25	–8 to 0	–14 to –8	–20 to –14
30	–9 to 0	–17 to –9	–27 to –17
35	–11 to 0	–19 to –11	–29 to –19
45	–12 to 0	–22 to –12	–32 to –22
55	–15 to 0	–28 to –16	–38 to –28
65	–18 to 0	–34 to –22	–45 to –34

Radial clearance for models HSR and CSR

Unit : µm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
8	–1 to +1	–4 to –1	——
10	–2 to +2	–5 to –1	——
12	–3 to +3	–6 to –2	——
15	–4 to +2	–12 to –4	——
20	–5 to +2	–14 to –5	–23 to –14
25	–6 to +3	–16 to –6	–26 to –16
30	–7 to +4	–19 to –7	–31 to –19
35	–8 to +4	–22 to –8	–35 to –22
45	–10 to +5	–25 to –10	–40 to –25
55	–12 to +5	–29 to –12	–46 to –29
65	–14 to +7	–32 to –14	–50 to –32
85	–16 to +8	–36 to –16	–56 to –36
100	–19 to +9	–42 to –19	–65 to –42
120	–21 to +10	–47 to –21	–73 to –47
150	–23 to +11	–51 to –23	–79 to –51

Radial clearance for model HSR-M2

Unit : μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
15	–4 to +2	–12 to –4
20	–5 to +2	–14 to –5
25	–6 to +3	–16 to –6

Radial clearance for model HCR

Unit : μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
12	–3 to +3	–6 to –2
15	–4 to +2	–12 to –4
25	–6 to +3	–16 to –6
35	–8 to +4	–22 to –8
45	–10 to +5	–25 to –10
65	–14 to +7	–32 to –14

Radial clearance for model JR

Unit : μm

Indication symbol	Normal
Model No.	No symbol
25	–6 to +3
35	–8 to +4
45	–10 to +5
55	–12 to +5

Radial clearance for models NR/NRS and SNR/SNS

Unit : μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
25	–3 to +2	–6 to –3	–9 to –6
30	–4 to +2	–8 to –4	–12 to –8
35	–4 to +2	–8 to –4	–12 to –8
45	–5 to +3	–10 to –5	–15 to –10
55	–6 to +3	–11 to –6	–16 to –11
65	–8 to +3	–14 to –8	–20 to –14
75	–10 to +4	–17 to –10	–24 to –17
85	–13 to +4	–20 to –13	–27 to –20
100	–14 to +4	–24 to –14	–34 to –24

Radial clearance for model SHW

Unit : μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
12	–1.5 to 0	–4 to –1	——
14	–2 to 0	–5 to –1	——
17	–3 to 0	–7 to –3	——
21	–4 to +2	–8 to –4	——
27	–5 to +2	–11 to –5	——
35	–8 to +4	–18 to –8	–28 to –18
50	–10 to +5	–24 to –10	–38 to –24

Radial clearance for model HRW

Unit : μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
12	–1.5 to +1.5	–4 to –1	——
14	–2 to +2	–5 to –1	——
17	–3 to +2	–7 to –3	——
21	–4 to +2	–8 to –4	——
27	–5 to +2	–11 to –5	——
35	–8 to +4	–18 to –8	–28 to –18
50	–10 to +5	–24 to –10	–38 to –24
60	–12 to +5	–27 to –12	–42 to –27

Radial clearance for model SRS

Unit : μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
9	–2 to +2	– 4 to 0
12	–3 to +3	– 6 to 0
15	–5 to +5	–10 to 0
20	–5 to +5	–10 to 0
25	–7 to +7	–14 to 0

Radial clearance for model MX

Unit : μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
5	0 to +1.5	–1 to 0
7	–2 to +2	–3 to 0

Radial clearance for models RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z

Unit : μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
3	0 to +1	– 0.5 to 0
5	0 to +1.5	– 1 to 0
7	–2 to +2	– 3 to 0
9	–2 to +2	– 4 to 0
12	–3 to +3	– 6 to 0
15	–5 to +5	–10 to 0
20	–7 to +7	–14 to 0

Radial clearance for models SRG and SRN

Unit : μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
25	–2 to –1	–3 to –2	–4 to –3
30	–2 to –1	–3 to –2	–4 to –3
35	–2 to –1	–3 to –2	–5 to –3
45	–2 to –1	–3 to –2	–5 to –3
55	–2 to –1	–4 to –2	–6 to –4
65	–3 to –1	–5 to –3	–8 to –5

Radial clearance for model NSR-TBC

Unit : μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
20	– 5 to + 5	–15 to – 5	–25 to –15
25	– 5 to + 5	–15 to – 5	–25 to –15
30	– 5 to + 5	–15 to – 5	–25 to –15
40	– 8 to + 8	–22 to – 8	–36 to –22
50	– 8 to + 8	–22 to – 8	–36 to –22
70	–10 to +10	–26 to –10	–42 to –26

4.5. Designing a Guide Structure

THK offers various types of LM Guides in order to meet diversified service conditions. Supporting ordinary horizontal mount, vertical mount, inverted mount, slant mount wall mount and single-axis mount, the wide array of LM Guide types makes it easy to achieve a linear guide system with a long service life and high rigidity while minimizing the required space for installation.

4.5.1. Examples of the Guide Structure

The following are representative guide structures and arrangements when installing the LM Guide.

Examples of Arrangements of the Guide Structure

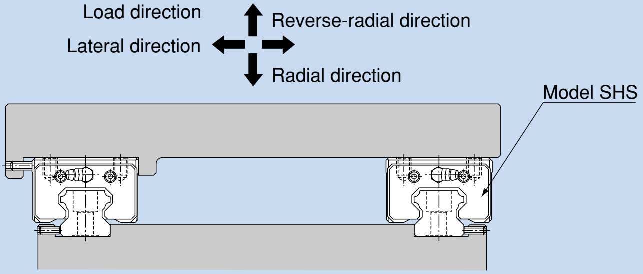


Fig. 2 Double-rail Configuration When High Rigidity is Required in All Directions

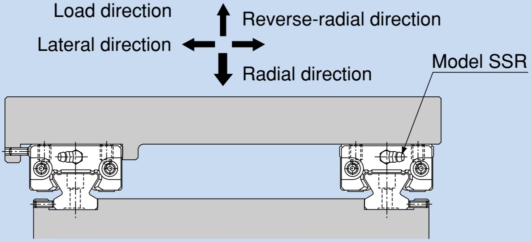


Fig. 3 Double-rail Configuration When High Rigidity is Required in the Radial Direction

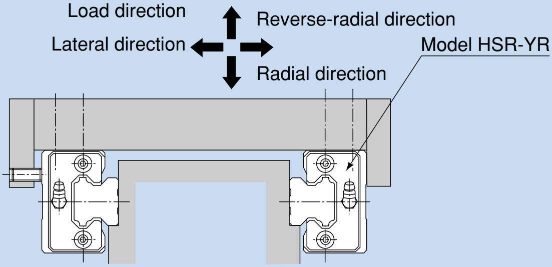


Fig. 4 When High Rigidity is Required in All Directions and the Installation Space is Limited in Height

Examples of Representative Arrangements of the Guide Structure

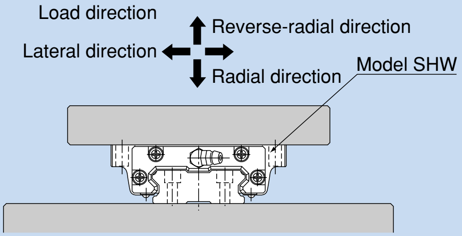


Fig. 5 Single-rail Configuration

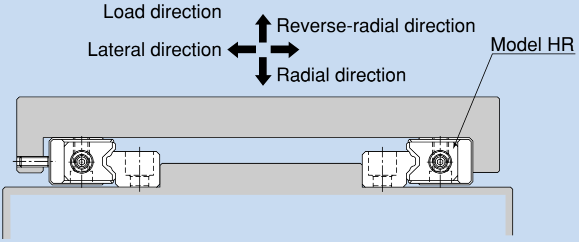


Fig. 6 When the Minimum Possible Height of the Equipment is Allowed

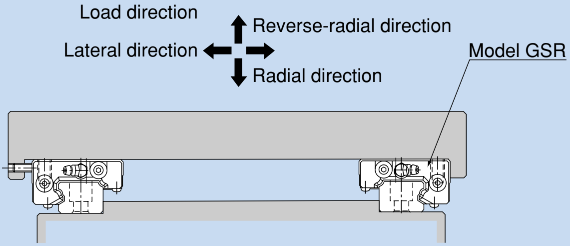


Fig. 7 When a Moderate Load is Applied and the Mounting Surface is Rough

Examples of Arrangements of the Guide Structure

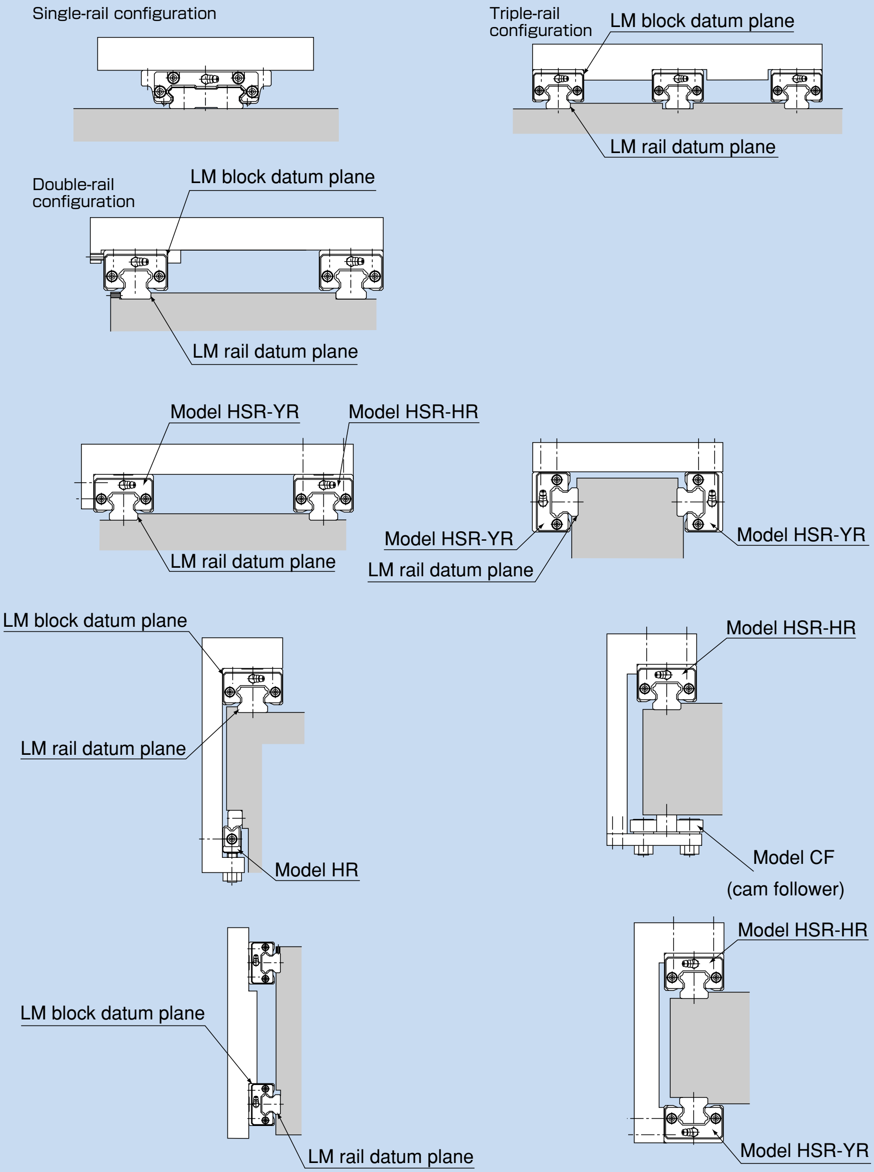


Fig. 8

Examples of Arrangements of the Guide Structure

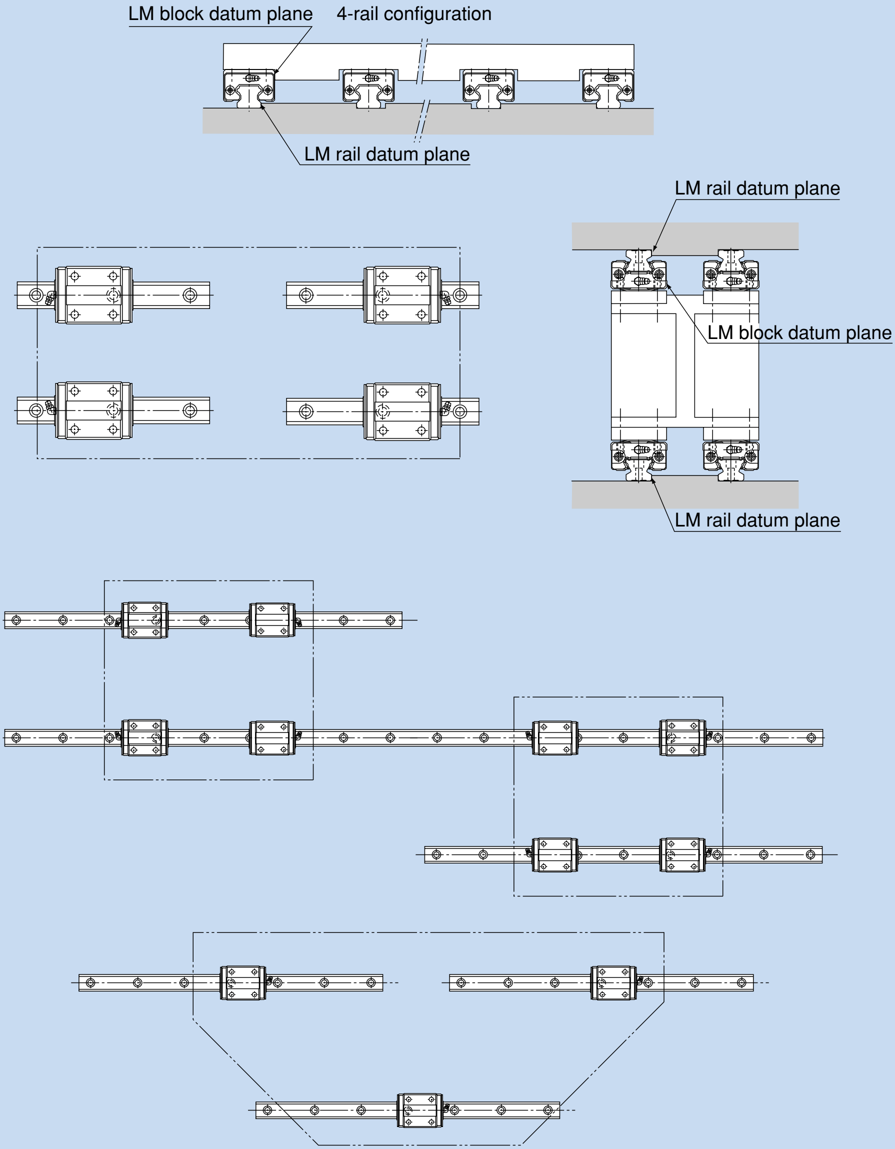


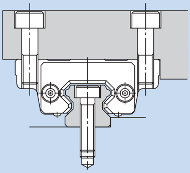
Fig. 9

4.5.2. Method for Securing an LM Guide® to Meet the Service Conditions

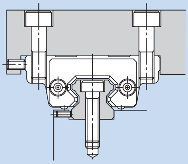
LM Guides are categorized into groups of types by mounting space and structure: a group of types to be mounted with bolts from the top, and another of types to be mounted from the bottom. LM rails are also divided into types secured with bolts and those secured with clamps (model JR). This wide array of types allows you to make a choice according to the application.
There are several ways of mounting the LM Guide as shown in Fig. 10. When the machine is subject to vibrations that may cause the LM rail(s) or LM blocks to loosen, we recommend the securing method indicated by Fig. 12 (if 2 or more rails are used in parallel, only the LM block on the master rail should be secured in the crosswise direction). If this method is not applicable for a structural reason, hammer in knock pins to secure the LM block(s) as shown in Fig. 11. When using knock pins, machine the top/bottom surfaces of the LM rail by 2 to 3 mm using a carbide end mill before drilling the holes since the surfaces are hardened.

Fig. 10 Major Securing Methods on the Master-rail Side

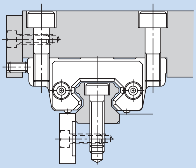
ⓐ Secured only with side datum planes



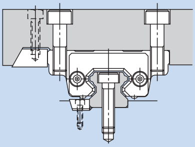
ⓑ Secured with setscrews



ⓒ Secured with a presser plate



ⓓ Secured with tapered gibs



ⓔ Secured with pins

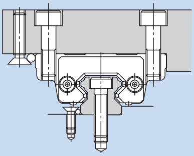
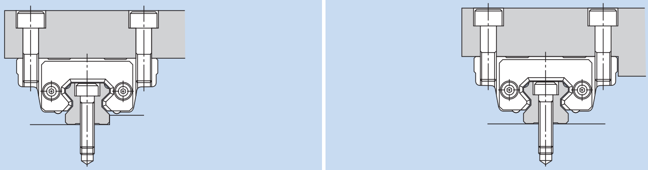


Fig. 11 Major Securing Methods on the Subsidiary-rail Side

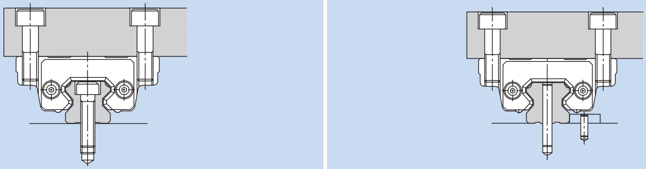
ⓐ Secured only with the side datum plane of the rail

ⓑ Secured only with the side datum plane of the block



ⓒ Secured without a side datum plane

ⓓ Secured with knock pins



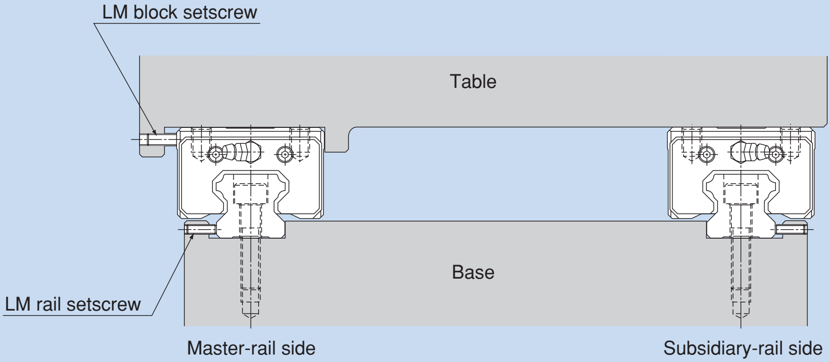


Fig. 12 When the Machine Receives Vibrations or Impact

5. Determining the Accuracy

5.1. Accuracy Standards

Accuracy of the LM Guide is specified in terms of running parallelism, dimensional tolerance for height and width, and height and width difference between a pair when 2 or more LM blocks are used on one rail or when 2 or more rails are mounted on the same plane.
For details, see pages A-100 to A-108.

●Running parallelism

It refers to a parallelism error between the LM block and the LM rail datum plane when the LM block travels the whole length of the LM rail with the LM rail secured on the reference datum plane using bolts.

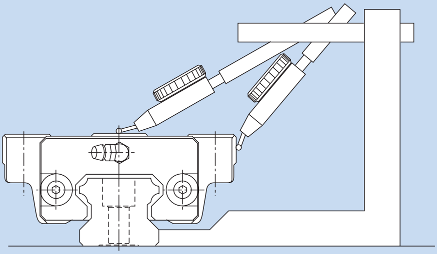


Fig. 1 Running Parallelism

●Difference in Height M

Indicates a difference between the minimum and maximum values of height (M) of each of the LM blocks used on the same plane in combination.

●Difference in Width W_2

Indicates a difference between the minimum and maximum values of the width (W_2) between each of the LM blocks, mounted on one LM rail in combination, and the LM rail.

Note 1: When 2 or more rails are used on the same plane in parallel, only the width (W_2) tolerance and the difference on the master rail apply. The master LM rail is imprinted with "KB" (except for normal grade products) following the serial number.

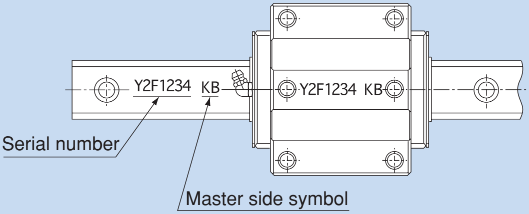


Fig 2. Master LM Rail

Note 2: Accuracy measurements each represent the average value of the central point or the central area of the LM block.

Note 3: The LM rail is smoothly curved so that the required accuracy is easily achieved by pressing the rail to the datum plane of the machine.
If it is mounted on a less rigid base such as an aluminum base, the curve of the rail will affect the accuracy of the machine. Therefore, it is necessary to define straightness of the rail in advance.

5.2. Guidelines for Accuracy Grades by Machine Type

Table 1 shows guidelines for selecting an accuracy grade of the LM Guide according to the machine type.

Table 1 Guideline for Accuracy Grades by Machine Type

Type of machine		Machine tools															
		Machining center	Lathe	Milling machine	Boring machine	Jig borer	Drilling machine	Electric discharge machine	Punching press	Laser beam machine	Woodworking machine	NC drilling machine	Tapping center	Pallet changer	ATC	Wire cutting machine	Dressing machine
Accuracy grade	UP					●	●	●									●
	SP	●	●	●	●	●	●	●		●						●	●
	P	●	●	●	●			●	●	●	●	●	●			●	
	H								●	●	●	●	●				
	Normal										●			●	●		

Type of machine		Industrial robots		Semiconductor manufacturing machines				Other equipment									
		Cartesian coordinate	Cylindrical coordinate	Wire bonding machine	Prober	Electronic component inserter	Printed circuit board drilling machine	Injection molding machine	3D measuring instrument	Office equipment	Conveyance system	XY table	Coating machine	Welding machine	Medical equipment	Digitizer	Inspection machine
Accuracy grade	UP				●				●								●
	SP			●	●		●		●			●				●	●
	P	●		●		●	●					●				●	●
	H	●	●			●	●	●		●	●	●	●	●	●	●	
	Normal	●	●					●		●	●		●	●	●		

UP: Ultra-precision grade
SP: Super-precision grade
P : Precision grade
H : High-accuracy grade
N : Normal grade

5.3. Accuracy Standard for Each Model

- Accuracies of models SR, SSR, HSR, SHS, NR/NRS, SNR/SNS, HRW, SHW, SRG, SRN and NSR-TBC are categorized into Normal grade (no symbol), High-accuracy grade (H), Precision grade (P), Super-precision grade (SP) and Ultra-super-precision grade (UP) by model numbers, as indicated in Table 2.

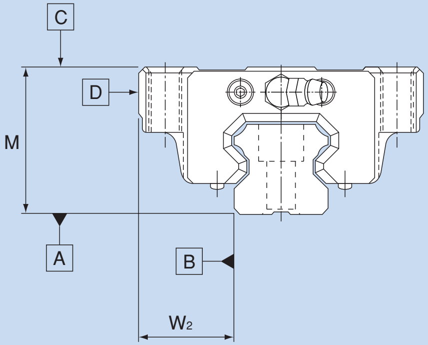


Fig. 3

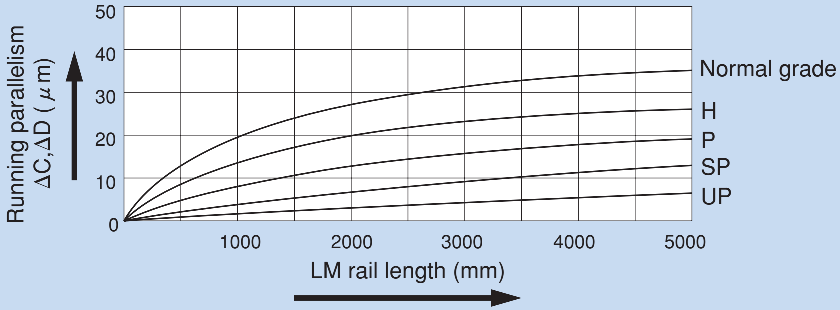


Fig. 4 LM Rail Length and Running Parallelism

Table 2 Accuracy Standards for Models SR, SSR, HSR, SHS, NR/NRS, SNR/SNS, HRW, SHW, SRG, SRN and NSR-TBC

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade	Super-precision grade	Ultra-super precision grade
	Item	No symbol	H	P	SP	UP
8 10 12 14	Dimensional tolerance for height M	± 0.08	± 0.04	± 0.02	± 0.01	———
	Difference in height M	0.015	0.007	0.005	0.003	———
	Dimensional tolerance for width W_2	± 0.05	± 0.025	± 0.015	± 0.01	———
	Difference in width W_2	0.02	0.01	0.007	0.005	———
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
15 17 20 21	Dimensional tolerance for height M	± 0.1	± 0.03	$^{0}_{-0.03}$	$^{0}_{-0.015}$	$^{0}_{-0.008}$
	Difference in height M	0.02	0.01	0.006	0.004	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.03	$^{0}_{-0.03}$	$^{0}_{-0.015}$	$^{0}_{-0.008}$
	Difference in width W_2	0.02	0.01	0.006	0.004	0.003
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
25 27 30 35	Dimensional tolerance for height M	± 0.1	± 0.04	$^{0}_{-0.04}$	$^{0}_{-0.02}$	$^{0}_{-0.01}$
	Difference in height M	0.02	0.015	0.007	0.005	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.04	$^{0}_{-0.04}$	$^{0}_{-0.02}$	$^{0}_{-0.01}$
	Difference in width W_2	0.03	0.015	0.007	0.005	0.003
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
40 45 50 55 60	Dimensional tolerance for height M	± 0.1	± 0.05	$^{0}_{-0.05}$	$^{0}_{-0.03}$	$^{0}_{-0.02}$
	Difference in height M	0.03	0.015	0.007	0.005	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.05	$^{0}_{-0.05}$	$^{0}_{-0.03}$	$^{0}_{-0.02}$
	Difference in width W_2	0.03	0.02	0.01	0.007	0.005
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
65 70 75 85 100 120 150	Dimensional tolerance for height M	± 0.1	± 0.07	$^{0}_{-0.07}$	$^{0}_{-0.05}$	$^{0}_{-0.03}$
	Difference in height M	0.03	0.02	0.01	0.007	0.005
	Dimensional tolerance for width W_2	± 0.1	± 0.07	$^{0}_{-0.07}$	$^{0}_{-0.05}$	$^{0}_{-0.03}$
	Difference in width W_2	0.03	0.025	0.015	0.01	0.007
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				

Note: For models SRG and SRN, only precision or higher grades apply (normal or high-accuracy grades are not available).

●Accuracies of model HCR are categorized into normal and high-accuracy grades by model number as indicated in Table 3.

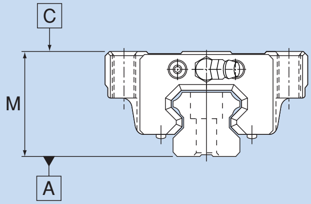


Fig. 5

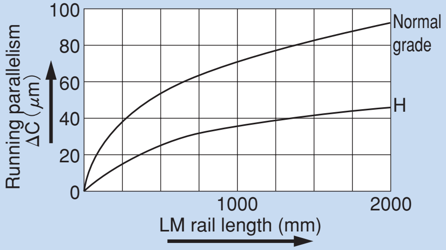


Fig. 6 LM Rail Length and Running Parallelism

Table 3 Accuracy Standard for Model HCR

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade
	Item	No symbol	H
12 15 25 35	Dimensional tolerance for height M	±0.2	±0.2
	Difference in height M	0.05	0.03
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 6)	
45 65	Dimensional tolerance for height M	±0.2	±0.2
	Difference in height M	0.06	0.04
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 6)	

●Accuracies of model JR are defined by model number as indicated in Table 4.

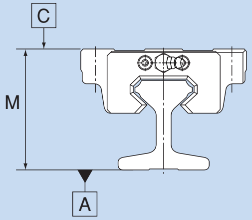


Fig. 7

Table 4 Accuracy Standard for Model JR

Unit: mm

Model No.	Accuracy standard	Normal grade
	Item	No symbol
25 35	Dimensional tolerance for height M	0.05
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 8)
45 55	Dimensional tolerance for height M	0.06
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 8)

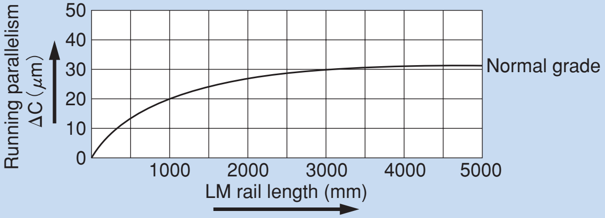


Fig. 8 LM Rail Length and Running Parallelism

- Accuracies of model CSR are categorized into precision, super-precision and ultra-precision grades by model number as indicated in Table 5.

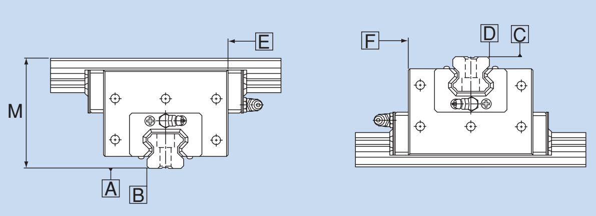


Fig. 9

Table 5 Accuracy Standard for Model CSR

Unit: mm

Model No.	Accuracy standard	Precision grade	Super-precision grade	Ultra-super precision grade
	Item	P	SP	UP
15 20	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.005	0.004	0.003
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
25	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.008	0.006	0.004
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
30 35	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.01	0.007	0.005
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
45	Difference in height M	0.012	0.008	0.006
	Perpendicularity of surface D against surface B	0.012	0.008	0.006
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		

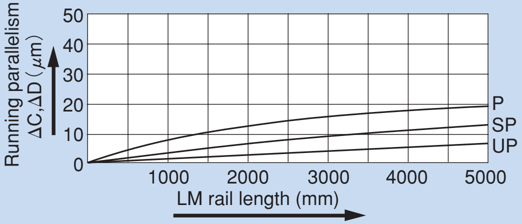


Fig. 10 LM Rail Length and Running Parallelism

●Accuracies of model HR are categorized into normal, high-accuracy, precision, super-precision and ultra-precision grades as indicated in Table 6.

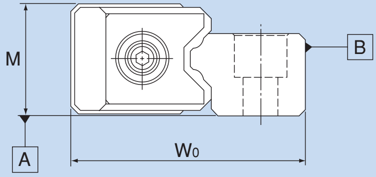


Fig. 11

Table 6 Accuracy Standard for Model HR

Unit: mm

Accuracy standard	Normal grade	High-accuracy grade	Precision grade	Super-precision grade	Ultra-super precision grade
Item	No symbol	H	P	SP	UP
Dimensional tolerance for height M	±0.1	±0.05	±0.025	±0.015	±0.01
Difference in height M[*1)]	0.03	0.02	0.01	0.005	0.003
Dimensional tolerance for total width W₀	±0.1		±0.05		
Difference in total width W₀[*2)]	0.03	0.015	0.01	0.005	0.003
Running parallelism of surface B against surface A	ΔC (as shown in Fig. 12)				

Note 1: Difference in height M applies to a set of LM Guides used on the same plane.
Note 2: Difference in total width W₀ applies to LM blocks used in combination on one LM rail.
Note 3: Dimensional tolerance and difference in total width W₀ for precision and higher grades apply only to the master-rail side among a set of LM Guides. The master rail is imprinted with "KB" following a serial number.

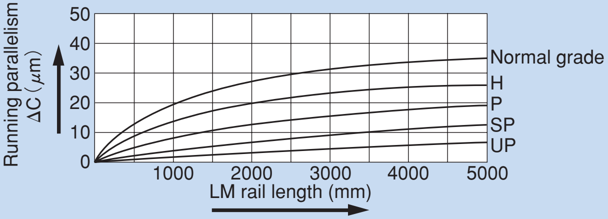


Fig. 12 LM Rail Length and Running Parallelism

●Accuracies of model GSR are categorized into normal, high-accuracy and precision grades by model number as indicated in Table 7.

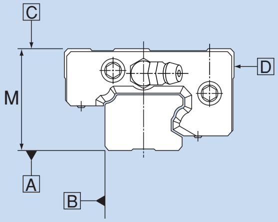


Fig. 13

Table 7 Accuracy Standard for Model GSR

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade
	Item	No symbol	H	P
15 20	Dimensional tolerance for height M	± 0.02		
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 14)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 14)		
25 30 35	Dimensional tolerance for height M	± 0.03		
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 14)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 14)		

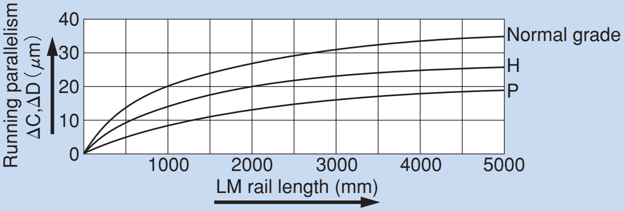


Fig. 14 LM Rail Length and Running Parallelism

●Accuracies of model GSR-R are categorized into normal and high-accuracy grades by model number as indicated in Table 8.

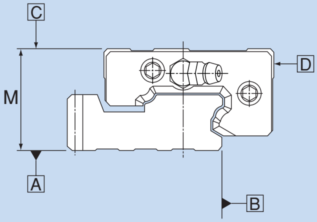


Fig. 15

Table 8 Accuracy Standard for GSR-R

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade
	Item	No symbol	H
25 30 35	Dimensional tolerance for height M	± 0.03	
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 16)	
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 16)	

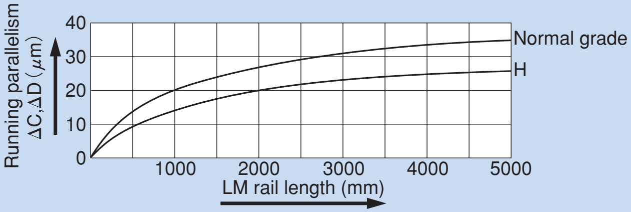


Fig. 16 LM Rail Length and Running Parallelism

●Accuracies of models SRS, RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z are categorized into normal, high-accuracy and precision grades by model number as indicated in Table 9.

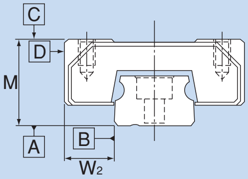


Fig. 17

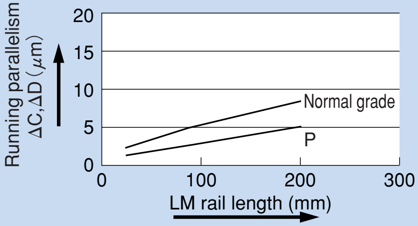


Fig. 18 LM Rail Length and Running Parallelism for Models RSR3 and 5

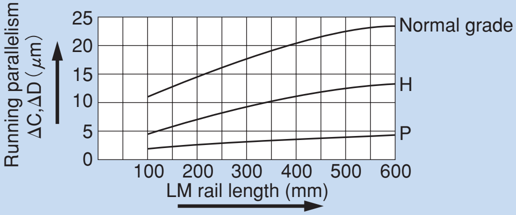


Fig. 19 LM Rail Length and Running Parallelism for Models RSR7 to 25

Table 9 Accuracy Standards for Models SRS, RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade
	Item	No symbol	H	P
3 5	Dimensional tolerance for height M	±0.03	—	±0.015
	Difference in height M	0.015	—	0.005
	Dimensional tolerance for width W_2	±0.03	—	±0.015
	Difference in width W_2	0.015	—	0.005
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 18)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 18)		
7 9 12 15 20 25	Dimensional tolerance for height M	±0.04	±0.02	±0.01
	Difference in height M	0.03	0.015	0.007
	Dimensional tolerance for width W_2	±0.04	±0.025	±0.015
	Difference in width W_2	0.03	0.02	0.01
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 19)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 19)		

●Accuracies of model MX are categorized into normal and precision grades by model number as indicated in Table 10.

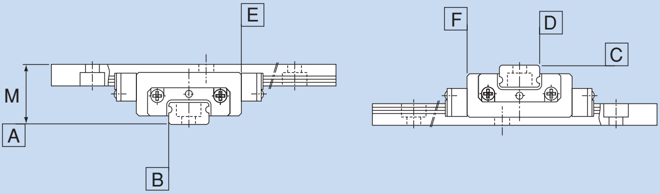


Fig. 20

Table 10 Accuracy Standard for Model MX

Unit: mm

Model No.	Accuracy standard	Normal grade	Precision grade
	Item	No symbol	P
5	Difference in height M	0.015	0.005
	Perpendicularity of surface D against surface B	0.003	0.002
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 21)	
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 21)	
7	Difference in height M	0.03	0.007
	Perpendicularity of surface D against surface B	0.01	0.005
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 22)	
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 22)	

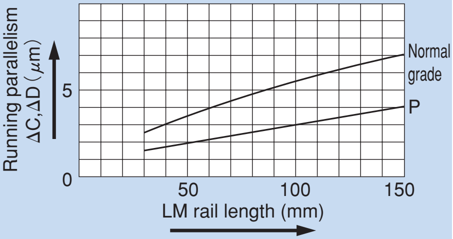


Fig. 21 LM Rail Length and Running Parallelism for Model MX5

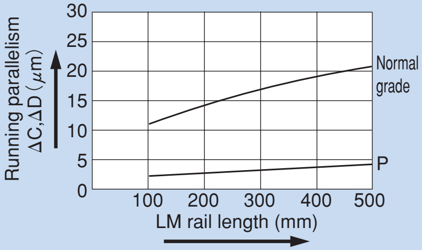


Fig. 22 LM Rail Length and Running Parallelism for Model MX7W

6. Selection According to the Service Environment

6.1. Lubrication

When using an LM system, it is necessary to adequate effective lubrication. Without lubrication, the rolling elements or the raceway may be worn faster and the service life may be shortened.

A lubricant has effects such as the following.

① Minimizes friction in moving elements to prevent seizure and reduce wear.

② Forms an oil film on the raceway to decrease stress acting on the surface and extend rolling fatigue life.

③ Covers the metal surface to prevent rust formation.

To fully bring out an LM system's functions, it is necessary to provide lubrication according to the service conditions.

Even with an LM system with seals, the internal lubricant gradually spills out during operation. Therefore, the system needs to be lubricated at an appropriate interval according to the service conditions.

6.1.1. Types of Lubricants

LM systems mainly use grease or sliding surface oil for their lubricants.

The requirements that lubricants need to satisfy generally consist of the following.

① High oil film strength

② Small friction

③ High wear resistance

④ High thermal stability

⑤ Non corrosive

⑥ Highly rust preventive

⑦ Minimum dust/water content

⑧ Consistency of grease must not be altered to a significant extent even after it is repeatedly stirred.

Lubricants that meet these requirements include the following products.

Grease Lubrication

Greasing intervals vary depending on the service conditions and service environments. For normal use, we recommend greasing the system approximately every 100 km of travel distance.

Normally, replenish grease of the same group from the grease nipple or greasing hole provided on the LM system. Mixing different types of grease may deteriorate the system's performance, such as increased consistency.

Oil Lubrication

LM systems that require oil lubrication are shipped with only anticorrosive oil applied. When placing an order, specify the required lubricant oil. If the LM system is to be mounted other than in horizontal orientation, part of the raceway may poorly be lubricated. Therefore, be sure to inform us of the mounting orientation of the LM system (for details on mounting orientations, see page A-36).

●The amount of oil to be supplied varies with stroke length. For a long stroke, increase the lubrication frequency or the amount of oil so that an oil film reaches the stroke end of the raceway.

●In environments where a liquid coolant is spattered, the lubricant will be mixed with the coolant, and this can result in the lubricant being emulsified or washed away, causing significantly degraded lubrication performance. In such settings, apply a lubricant with high viscosity (kinematic viscosity: approx. 68 cst) and high emulsification resistance, and adjust the lubrication frequency or the amount of the feed lubricant.

For machine tools and similar devices that are subject to heavy loads and require high rigidity and operate at high speed, it is advisable to apply oil lubrication.

●Make sure that lubrication oil normally discharges from the ends of your lubrication piping, i.e., the oiling ports that connect to your LM system.

Table 1 Lubricants for General Use

Lubricant	Type	Brand name
Grease	Lithium-based grease (JIS No. 2) Urea-based grease (JIS No. 2)	*) AFB-LF Grease (THK) Albania Grease No. 2 (Showa-Shell) Daphne Exponex Grease No. 2 (Idemitsu) or equivalent
Oil	Sliding surface oil or turbine oil ISOVG32～68	Super Multi 32 to 68 (Idemitsu) Vactra No. 25 (ExxonMobil) DT Oil (ExxonMobil) Tonna Oil (Showa-Shell) or equivalent

For products marked with "*", see page A-117.

6.1.2. Lubrication under Special Environments

For use under special conditions, such as continual vibrations, clean room, vacuum, low temperature and high temperature, normal grease may not be used in some cases. For lubricants that meet such conditions, contact THK .

Table 2 Lubricants Used under Special Environments

Service environment	Lubricant characteristics	Brand name
High-speed moving parts	Grease with low torque and low heat generation	*) AFG Grease (THK) *) AFA Grease (THK) NBU 15 (NOK-KLUBER) Multemp (Kyodo Yushi) or equivalent
Vacuum	Fluorine-based vacuum grease or oil (vapor pressure varies by brand) Note 1	Fomblin Grease (Solvay Solexis) Fomblin Oil (Solvay Solexis) Barrierta IEL/V (NOK-KLUBER) Isoflex (NOK-KLUBER) Krytox (Dupont)
Clean rooms	Grease with very low dust generation	*) AFE Grease (THK) *) AFF Grease (THK) (The above vacuum grease products also applicable.)
Environments subject to microvibrations or microstrokes, which may cause fretting corrosion	Grease that easily forms an oil film and has high fretting resistance	*) AFC Grease (THK)
Environments subject to a spattering coolant such as machine tools	Highly anticorrosive, refined mineral oil or synthetic oil that forms a strong oil film and is not easily emulsified or washed away by coolant Water-resistant grease Note 2	Super Multi 68 (Idemitsu) Vactra No 2S (ExxonMobil) or equivalent
Mist lubrication	Oil that can easily be atomized and offers superb lubricity.	

For items marked with "*", see pages A-117 and A-125.

Note 1: When using a vacuum grease, be sure that some brands have starting resistances several times greater than ordinary lithium-based greases.

Note 2: In an environment subject to a spattering water-soluble coolant, some brands of intermediate viscosity significantly decrease their lubricity or do not properly form an oil film. Check the compatibility between the lubricant and the coolant.

Note 3: Do not mix greases with different physical properties.

6.1.3. Lubrication Methods

There are roughly three methods of lubricating LM systems: manual lubrication using a grease gun or manual pump; forced lubrication using an automated pump; and oil-bath lubrication.

Manual Lubrication

Generally, grease is replenished periodically, fed through a grease nipple provided on the LM system, using a grease gun (Fig. 1).

For systems that have many locations to be lubricated, establish a centralized piping system and periodically provide grease from a single point using a manual pump (Fig. 2).

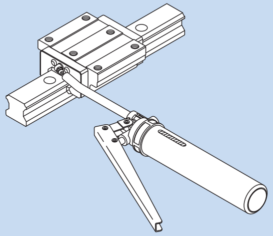


Fig. 1 Lubrication using a Grease Gun

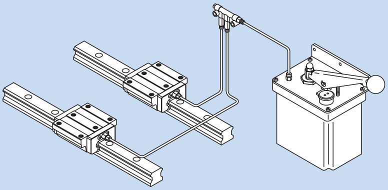


Fig. 2 Lubrication through a Centralized Piping System

Note 1: When a centralized piping system is used, lubricant may not reach the pipe end due to the viscous resistance inside the pipe. Select the right type of grease while taking into account the consistency of the grease and the pipe diameter.

Forced Lubrication

In this method, a given amount of lubricant is forcibly fed at a given interval. Normally, the lubricant is not collected after use (Fig. 3).

Although a special lubrication system using a piping or the like needs to be designed, this method reduces the likelihood of forgetting to replenish lubricant.

This method is used mainly for oil lubrication. If using grease, it is necessary to examine the appropriate piping diameter and the required grease consistency.

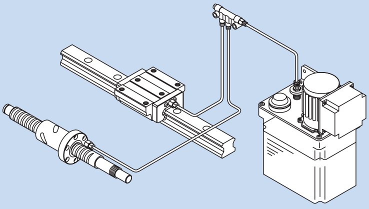


Fig. 3 Forced Lubrication Method

THK Mist Lubrication

Unlike conventional mist lubrication, THK Mist Lubrication feeds micron-size lubricant mist in a constant and accurate rate through electronic control. Therefore, the interior of LM blocks and Ball Screws is uniformly lubricated. Such electronic control minimizes the adverse effects of oil temperature, ambient temperature and viscosity that are common in conventional mist lubrication. Leakage to the atmosphere is minimal as well. Also the mist and air cool the subject system and thus inhibits heat generation resulting from high-speed motion. Since coolant and other contaminants are unlikely to invade the lubrication unit, THK Mist Lubrication is highly suitable in harsh environments (Fig. 4).

Note 2: Some types of lubricant are difficult to atomize. Contact THK for details.

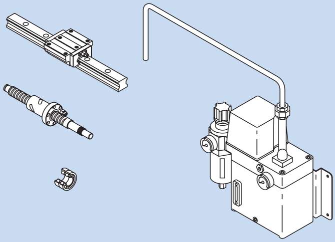


Fig. 4 Mist Lubrication

THK Grease Gun Unit MG70

Grease Gun Unit MG70 is capable of lubricating small to large types of LM Guides by replacing dedicated nozzles. For small LM Guides, MG70 is provided with dedicated attachments. The user can select from these attachment according to the model number and the installation space.

MG70 has a slit window, allowing the user to check the remaining amount of grease.

It is equipped with a bellows-type cartridge that can hold 70 g of grease and is replaceable without smirching your hand. It supports a wide range of grease products, including AFA Grease, AFB-LF Grease, AFC Grease and AFE Grease, to meet varied service conditions. This enables you to make a selection according to the area requiring grease (see pages A-117 to 125).

Table 3 Specifications of the Grease Gun

Discharge pressure	19.6 MPa max
Discharge rate	0.6 cc/stroke
Grease	70 g bellows cartridge
Overall length	235 mm (excluding the nozzle)
Weight	480 g (including the nozzle; excluding grease)

Table 4 Supported Model Numbers

Type N	LM Guides···Models SSR15, SHS15, SR15, HSR12, HSR15, CSR15, HRW17, GSR15, RSR15, RSH15, HCR12 and HCR15 Cam Followers···Models CF, CFN and CFH Rod Ends···Models PHS5 to 22, RBH and POS8 to 22
Type P	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type L	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type H	LM Guides (models with grease nipple M6F or PT1/8) Ball Screws Rod Ends···Models PHS25, PHS30, POS25 and POS30

Note: Types P and L are also capable of greasing less accessible areas other than the model numbers above (by dropping grease on the raceway).

Grease Gun Unit MG70

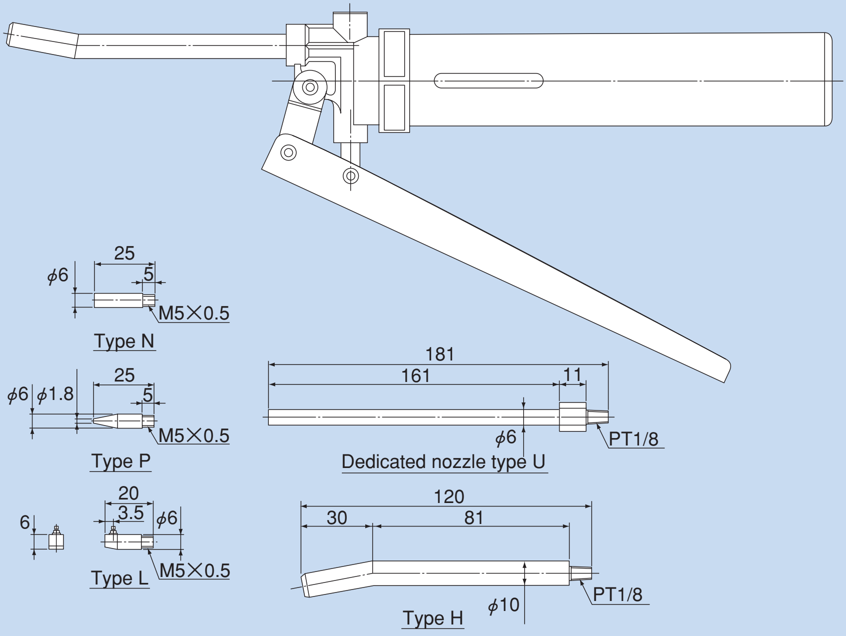


Fig. 5 Grease Gun Unit MG70

6.1.4. Accessories for Lubrication

Special Plumbing Fixtures

For centralized greasing and oil lubrication, special plumbing fixtures are available from THK. When ordering an LM system, specify the model number, mounting orientation and piping direction. We will ship the LM system attached with the corresponding fixture.

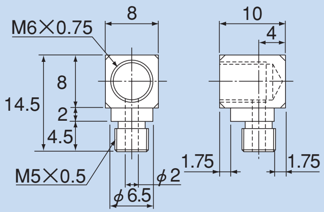
LF-A (PT1/8) L=20, L_1=12, F=2, C=12, D=12
LF-B (M8 x 1) L=18.5, L_1=10, F=2.5, C=9.5, D=18
(LF-E (PT1/8): the same size with LF-A; mounting screw: M6 x 1)

LF-C (PT1/8) L=20, L_1=12, C=12, D=12
LF-D (M8 x 1) L=18, L_1=10, C=10, D=18

SF-A (PT1/8)	t=2, C=12, D=13.8
SF-B (M8 x 1)	t=2, C=10, D=11.5

(SF-E (PT1/8): the same size with SF-A; mounting screw: M6 x 1)

SF-C (PT1/8)	C=12, D=13.8
SF-D (M8x1)	C=10, D=11.5

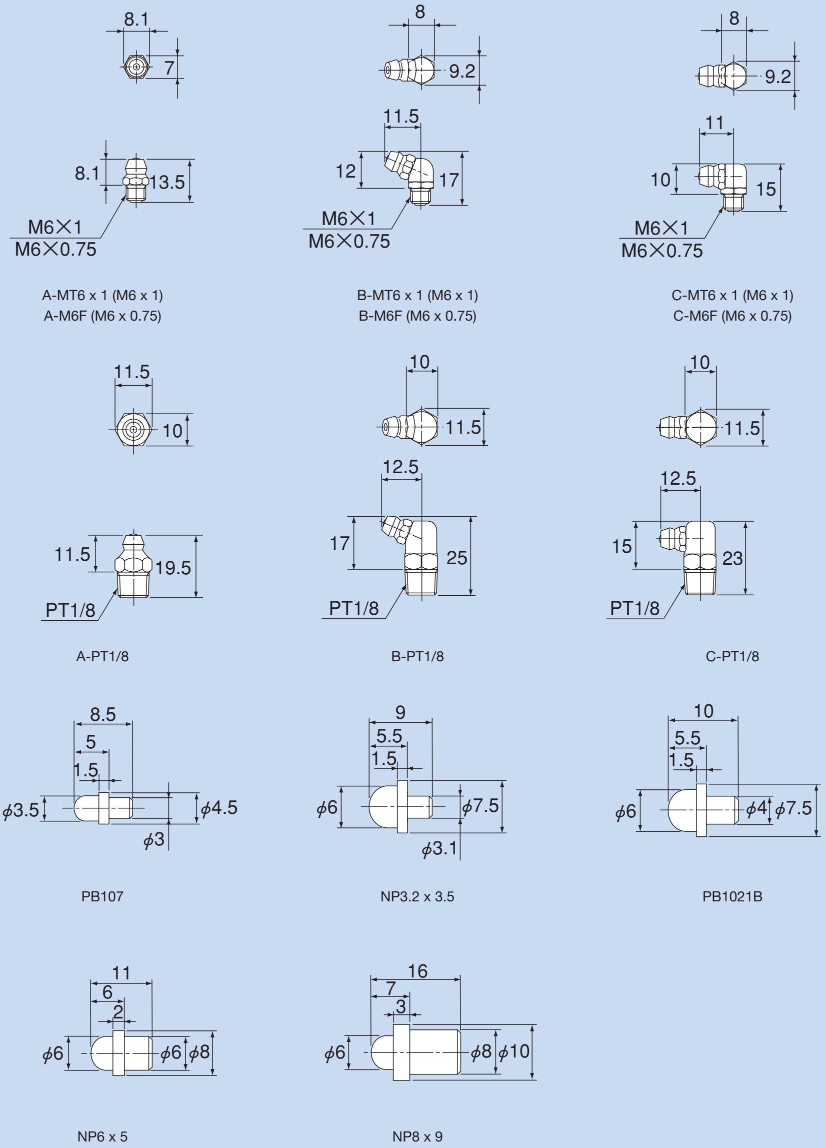


LD (M6 x 0.75)

Fig. 6 Special Plumbing Fixtures

Grease Nipples

THK provides various types of grease nipples needed for the lubrication of LM systems.



A-MT6 x 1 (M6 x 1)
A-M6F (M6 x 0.75)

B-MT6 x 1 (M6 x 1)
B-M6F (M6 x 0.75)

C-MT6 x 1 (M6 x 1)
C-M6F (M6 x 0.75)

A-PT1/8

B-PT1/8

C-PT1/8

PB107

NP3.2 x 3.5

PB1021B

NP6 x 5

NP8 x 9

Fig. 7 Grease Nipples

6.1.5. THK Original Grease

AFA Grease

AFA Grease is a high-grade, long-life grease developed with a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

●Features

① Long service life

Unlike ordinary metal soap-based greases, AFA Grease excels in anti-oxidation stability and therefore can be used for a long period of time.

② Wide temperature range

The lubricating performance remains high over a wide range of temperatures from -45℃ to +160℃.

Even at low temperatures, AFA Grease requires only a low starting torque.

③ High water resistance

AFA Grease is less vulnerable to moisture penetration than other types of grease.

④ High mechanical stability

AFA Grease is not easily softened even when used for a long period of time.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		285	JIS K 2220 5.3
Dropping point : ℃		261	JIS K 2220 5.4
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 5.5
Evaporation : mass% (99℃, 22h)		0.2	JIS K 2220 5.6
Oil separation rate : mass% (100℃, 30h)		0.5	JIS K 2220 5.7
Stability of oxidation : MPa (99℃, 100h)		0.08	JIS K 2220 5.8
Mixing stability (100,000W)		329	JIS K 2220 5.11
Resistance to removal of grease during the water rinse : mass% (38℃, 1h)		0.6	JIS K 2220 5.12
Low-temperature torque : N·m (−20℃)	Start	0.17	JIS K 2220 5.14
	Rotation	0.07	
Anticorrosive test : (52℃, 48h)		Accepted	ASTM D1743
Service temperature range (℃)		−45 to 160	—

AFB-LF Grease

AFB-LF Grease is a general-purpose grease developed with a lithium-based consistency enhancer using refined mineral oil as the base oil. It excels in extreme pressure resistance and mechanical stability.

●Features

① High extreme pressure resistance

Compared with lithium-based greases available on the market, AFB-LF Grease has higher wear resistance and outstanding resistance to extreme pressure.

② High mechanical stability

AFB-LF Grease is not easily softened and demonstrates excellent mechanical stability even when used for a long period of time.

③ High water resistance

AFB-LF Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

●Representative Physical Properties

Test item	Representative value	Test method
Worked penetration (25℃, 60W)	275	JIS K 2220 5.3
Dropping point : ℃	193	JIS K 2220 5.4
Copper plate corrosion (100℃, 24h)	Accepted	JIS K 2220 5.5
Evaporation : mass% (99℃, 22h)	0.36	JIS K 2220 5.6
Oil separation rate : mass% (100℃, 24h)	0.6	JIS K 2220 5.7
Stability of oxidation : MPa (99℃, 100h)	0.015	JIS K 2220 5.8
Mixing stability (100,000W)	335	JIS K 2220 5.11
Timken load capacity : N	45	JIS K 2220 5.16
Resistance to removal of grease during the water rinse : mass% (38℃, 1h)	1.8	JIS K 2220 5.12
Anticorrosive test : (52℃, 48h)	Accepted	ASTM D1743
Service temperature range (℃)	−15 to 100	—

AFC Grease

AFC Grease has high fretting-corrosion resistance due to a special additive and a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

●Features

① High fretting-corrosion resistance

AFC Grease is designed to be highly effective in preventing fretting corrosion.

② Long service life

Unlike ordinary metal soap-based greases, AFC Grease excels in anti-oxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

③ Wide temperature range

Since a high-grade synthetic oil is used as the base oil, the lubricating performance remains high over a wide range of temperatures from -54℃ to +177℃.

●Representative Physical Properties

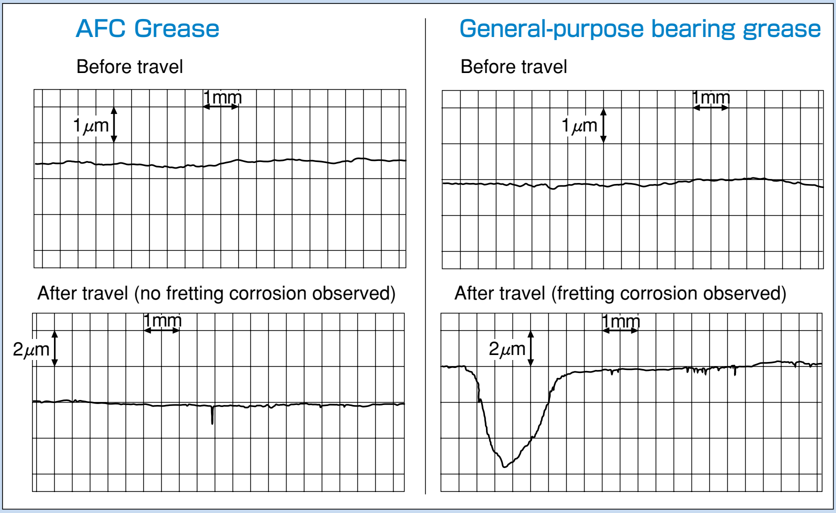
Test item		Representative value	Test method
Worked penetration（25℃, 60W）		288	JIS K 2220 5.3
Dropping point : ℃		269	JIS K 2220 5.4
Copper plate corrosion（100℃, 24h）		Accepted	JIS K 2220 5.5
Evaporation : mass%（177℃, 22h）		7.9	JIS K 2220 5.6
Oil separation rate : mass%（177℃, 30h）		2	JIS K 2220 5.7
Stability of oxidation : MPa（99℃, 100h）		0.065	JIS K 2220 5.8
No. of contaminants, pieces/cm^3	25 to 75μm	370	JIS K 2220 5.9
	75μm or more	0	
Mixing stability (100,000 W)		341	JIS K 2220 5.11
Resistance to removal of grease during the water rinse : mass%（38℃, 1h）		0.6	JIS K 2220 5.12
Low-temperature torque : N·m（−54℃）	Start	0.63	JIS K 2220 5.14
	Rotation	0.068	
Anticorrosive test :（52℃, 48h）		Accepted	ASTM D1743
Vibration test（200h）		Accepted	—
Service temperature range（℃）		−54 to 177	—

●Test Data on Fretting-corrosion Resistance

Due to its superior ingredients (urea-based consistency enhancer), high-grade synthetic oil and a special adhesive, AFC Grease provides high fretting-corrosion resistance.
The test data in Fig. 8 shows the result of comparing AFG Grease with an ordinary bearing grease.

Test conditions	
Item	Description
Stroke	3mm
No. of strokes per min	200min^{-1}
Total No. of strokes	2.88×10^5 (24 hours)
Surface pressure	1118MPa
Amount of fed grease	12 g/LM block (replenished every 8 hours)

●Comparison of Raceway Conditions



AFC Grease

Before travel

After travel (no fretting corrosion observed)

General-purpose bearing grease

Before travel

After travel (fretting corrosion observed)

Fig. 8 Test Data on AFC Grease

AFE Grease

AFE Grease uses urea as a consistency enhancer and a high-grade synthetic oil as the base oil. It has low dust-generative characteristics and is therefore a suitable grease for clean room environments.

●Features

① Low dust generation

Compared with vacuum greases in conventional use, AFE Grease generates less dust and therefore is ideal for use in clean rooms.

② Long service life

Unlike ordinary metal soap-based greases, AFE Grease excels in anti-oxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

●Representative physical properties

Test item	Representative value	Test method
Appearance	Light brown, viscous	—
Consistency enhancer	Urea	—
Base oil	Synthetic oil	—
Worked penetration (25℃, 60W)	280	JIS K 2220 5.3
Dropping point : ℃	260<	JIS K 2220 5.4
Oil separation rate : mass% (150℃, 24h)	1.8	JIS K 2220 5.7
Stability of oxidation : MPa (99℃, 100h)	10(0.1)	JIS K 2220 5.8
Bearing rust prevention : (52℃, 48h)	#1	ASTM D1743
Base oil kinematic viscosity (100℃)	12.8(12.8)	—
Service temperature range (℃)	−40 to 200	—

③ Wide temperature range

The lubricating performance remains high over a wide range of temperatures from -40℃ to +200℃.

④ High chemical stability

AFE Grease has high resistance to chemicals, NO_x and radiation.

●Test Data on Low Dust Generation

Due to its high chemical stability and superior ingredients (urea-based consistency enhancer and high-grade synthetic oil), AFE Grease generates little dust.

The test data in Fig. 9 shows the result of comparing dust accumulation between AFG Grease with another grease.

Test conditions	
Item	**Description**
Sample model No.	THK KR4610
Screw Ball rotational speed	1000min^{-1}
Strokes	210mm
Amount of fed grease	2cc in both the Ball Screw and the LM Guide
Flow rate during measurement	1 ℓ/min
Measuring instrument	Dust counter
Dust particle diameter	0.5μm

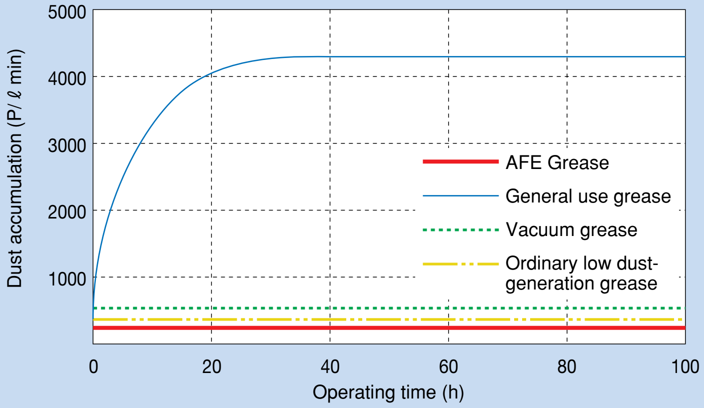


Fig. 9 Test Data on Dust Generation with AFE Grease

AFF Grease

THK AFF Grease uses a high-grade synthetic oil, lithium-based consistency enhancer and a special additive. It achieves stable rolling resistance, low dust generation and high fretting-corrosion resistance, at a level that conventional vacuum greases or low dust-generation greases have not reached.

●Features

① Stable rolling resistance

Since the viscous resistance is low, the rolling resistance fluctuation is also low. Thus, superb conformity is achieved at low speed.

② Low dust generation

AFF Grease generates little dust, making itself and ideal grease for use in clean rooms.

③ Fretting-corrosion resistance

Since AFF Grease is highly resistant to wear from microvibrations, it allows the lubrication interval to be extended.

●Representative physical properties

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		315	JIS K 2220 5.3
Dropping point : ℃		216	JIS K 2220 5.4
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 5.5
Evaporation : mass% (99℃, 22h)		0.43	JIS K 2220 5.6
Oil separation rate : mass% (100℃, 24h)		0.57	JIS K 2220 5.7
Stability of oxidation : MPa (99℃, 100h)		39	JIS K 2220 5.8
No. of contaminants, pieces/cm^3	25 µm or more	0	JIS K 2220 5.9
	75 µm or more	0	
	125 µm or more	0	
Mixing stability (100,000 W)		329	JIS K 2220 5.11
Low temperature torque : N·m (−20℃)	Start	0.22	JIS K 2220 5.14
	Rotation	0.04	
Apparent viscosity : Pa·s (−10℃, 10S^{-1})		3400	JIS K 2220 5.15
Timken load capacity : N		88.2	JIS K 2220 5.16
4-ball testing (burn-in load) : N		3089	ASTM D2596
Fretting-corrosion resistance : mg		3.8	ASTM D4170 compliant
Bearing rust prevention : (52℃, 48h)		#1	ASTM D1743
Service temperature range (℃)		-40 to 120	—

●Rolling Resistance Characteristics at Low Speed

The data in Fig. 10 represent the test results of comparing rolling resistances at low speed between AFF Grease and other greases.

Test conditions	
Item	**Description**
Model No.	HSR35RC0+440LP
Grease quantity	4 cm^3/LM block (initial lubrication only)
Feed speed	1mm/s
Stroke	3mm

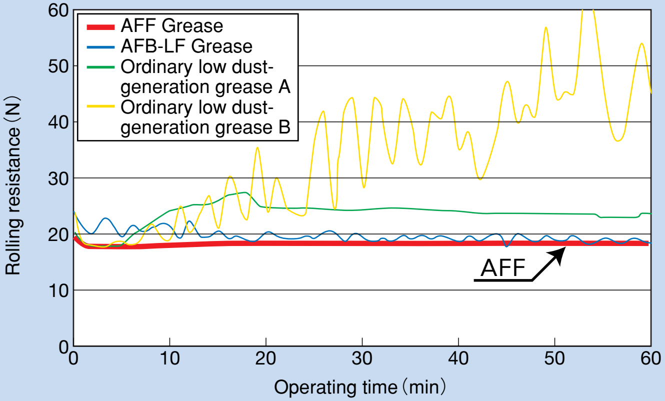


Fig. 10 Rolling Resistance at Low Speed

AFG Grease

THK AFG Grease is a high-grade grease for Ball Screws that uses a high-grade synthetic oil as the base oil and a urea-based consistency enhancer. It excels in low heat generation and supports a wide temperature range from low to high temperature.

●Features

① Low heat generation

Since the viscous resistance is low, the grease generates only a minimal level of heat even during high-speed operation.

② Low viscosity

Since the viscosity is low, a stable rotation torque is achieved.

③ Wide temperature range

Maintains a high level of lubricity in a wide temperature range of -45℃ to +160℃.

④ Long service life

AFG Grease is not easily softened and excels in stability in oxidation even after a long-term operation.

⑤ Water resistance

AFG Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration (25℃, 60W)		285	JIS K 2220 5.3
Dropping point : ℃		261	JIS K 2220 5.4
Copper plate corrosion (100℃, 24h)		Accepted	JIS K 2220 5.5
Evaporation : mass% (99℃, 22h)		0.2	JIS K 2220 5.6
Oil separation rate : mass% (100℃, 24h)		0.5	JIS K 2220 5.7
Stability of oxidation : MPa (99℃, 100h)		0.029	JIS K 2220 5.8
Mixing stability (100,000 W)		329	JIS K 2220 5.11
Resistance to removal of grease during the water rinse : mass% (38℃, 1h)		0.6	JIS K 2220 5.12
Low-temperature torque : N·m (−20℃)	Start	0.439	JIS K 2220 5.14
	Rotation	0.049	
Anticorrosive test : (52℃, 48h)		1,1,1	ASTM D1743
Service temperature range (℃)		−45 to 160	—

Test data on heat generation

Item	Description
Shaft diameter	32/10mm
Feed speed	67 to 500 mm/s
Shaft rotation speed	400 to 3000 min^{-1}
Stroke	400mm
Grease quantity	12cm^3
Temperature measurement point	Nut circumference

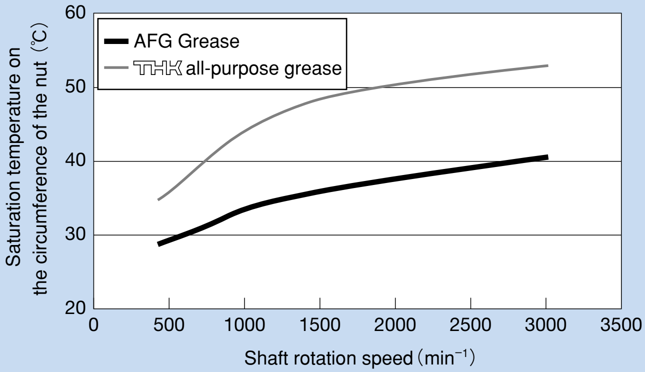


Fig. 11 Test Data on Heat Generation with AFG Grease

Model number coding

AFA Grease, AFB-LF Grease, AFC Grease,
AFE Grease, AFF Grease and AFG Grease

AFC+400
1 2

1 Type of grease 2 Cartridge capacity (400 g / 70 g)

- Type of packing: bellows cartridge
- Cartridge grease content

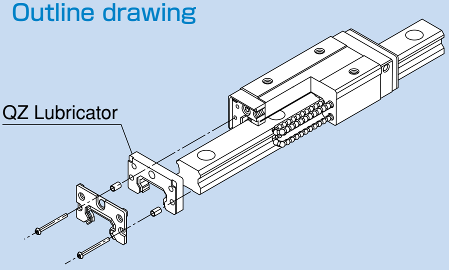
Grease capacity	AFA Grease	AFB-LF Grease	AFC Grease	AFE Grease	AFF Grease	AFG Grease
400g	○	○	○	○	○	○
70g	○	○	○	○	○	○

6.1.6. QZ Lubricator™ for the LM Guide®

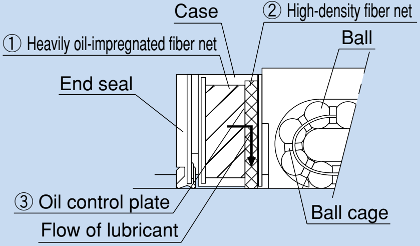
QZ Lubricator feeds the right amount of lubricant to the ball raceway on the LM rail. This allows an oil film to continuously be formed between the balls and the raceway, and drastically extends the lubrication and maintenance intervals.

The structure of QZ Lubricator consists of three major components: ① a heavy oil-impregnated fiber net (function to store lubricant), ② a high-density fiber net (function to apply lubricant to the raceway) and ③ an oil-control plate (function to adjust oil flow). The lubricant contained in QZ Lubricator is fed by the capillary phenomenon, which is used also in felt pens and many other products, as the fundamental principle.

Outline drawing



Structural drawing



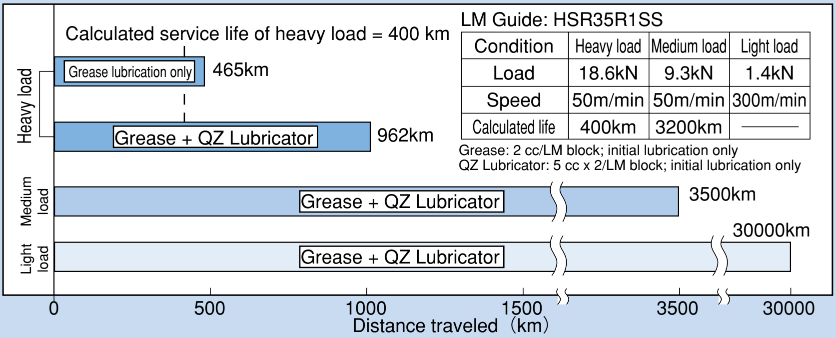
Features

- ●Supplements lost oil to drastically extend the lubrication/maintenance interval
- ●Eco-friendly lubrication system that does not contaminate the surrounding area since it feeds the right amount of lubricant to the ball raceway.
- ●The user can select a type of lubricant that meets the intended use.

Note: For models that support QZ Lubricator, see the sections corresponding to the model numbers in the "THK General Catalog - Product Specifications," provided separately.

■Significant Extension of the Maintenance Interval

Attaching QZ Lubricator helps extend the maintenance interval throughout the whole load range from the light-load area to the heavy-load area.



LM Guide: HSR35R1SS

Condition	Heavy load	Medium load	Light load
Load	18.6kN	9.3kN	1.4kN
Speed	50m/min	50m/min	300m/min
Calculated life	400km	3200km	―――

Grease: 2 cc/LM block; initial lubrication only
QZ Lubricator: 5 cc x 2/LM block; initial lubrication only

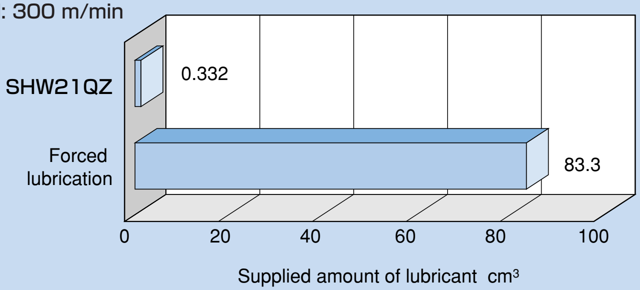
LM Guide Running Test without Replenishment of Lubricant

Effective Use of Lubricant

Since the lubricator feeds the right amount of lubricant to the ball raceway, lubricant can be used efficiently.

[Test conditions] speed: 300 m/min

Comparison of lubricant consumption after traveling 5,000 km



Amount of oil contained in QZ Lubricator 0.166 cm^3 x 2 units (attached to both ends of the LM block) = 0.332 cm^3

Compared

Forced lubrication
$0.03cm^3/6min \times 16667min$
$= 83.3cm^3$

Lubricant consumption is 1/250 less than forced lubrication.

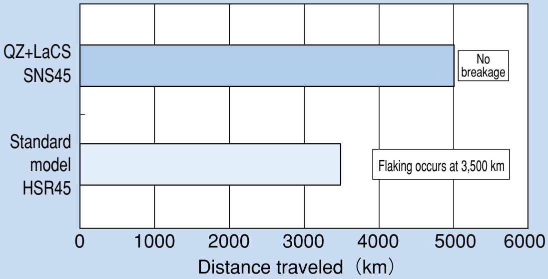
Effective in Helping Lubrication under Harsh Environments

A 5,000 km durability test was conducted under harsh environments (containing coolant and foreign matter).

[Test conditions]

Model No.	SNS45	HSR45
Load	8kN	6kN
Speed	60m/min	
Coolant	Immersed 48 hrs, dried 96 hrs	
Foreign matter	Foundry dust (125 μm or less)	
Lubrication	AFA Grease + QZ	Super Multi 68 Oiling cycle: 0.1cc/shot Periodically lubricated every 16 min

[Test result]



* When using the LM system under harsh environment, use QZ Lubricator and Laminated Contact Scraper LaCS (see page A-134) in combination.

6.2. Corrosion Prevention

6.2.1. Determining a Material

Any LM system requires a material that meets the service conditions. For use in environments where corrosion resistance is required, some LM system models can use martensitic stainless steel.

(Martensitic stainless steel can be used for LM Guide models SSR, SHW, SRS, HSR, SR, HR, HRW, RSR, RSR-Z, RSH and RSH-Z.)

The HSR series includes HSR-M2, a highly corrosion resistant LM Guide using austenitic stainless steel, which has high anti-corrosive effect. For details, see page a-328 of the "THK General Catalog - Product Specifications," provided separately.

6.2.2. Surface Treatment

The surfaces of the rails and shafts of LM systems can be treated for anti-corrosive or esthetic purposes.
THK offers THK -AP treatment, which is the optimum surface treatment for LM systems.
The THK -AP treatment consists of the following 3 types.

AP-CF

A compound surface treatment that combines black chrome film coating and special fluorine resin coating and is suitable for applications requiring high corrosion resistance.

AP-C

A type of industrial-use black chrome film coating designed to increase corrosion resistance. It achieves lower cost and higher corrosion resistance than martensitic stainless steel.

AP-HC

Equivalent to industrial-use hard chrome plating, AP-HC achieves almost the same level of corrosion resistance as martensitic stainless steel.
In addition, it is highly wear resistant since the film hardness is extremely high, 850 HV or higher.

In addition to the above treatments, other surface treatments are sometimes performed on areas other than the raceways, such as alkali coloring treatment (black anodization) and color alumite treatment. However, some of them are not suitable for LM systems. For details, contact THK .
If using an LM system whose raceways are surface-treated, set a higher safety factor.

Model number coding

SR15 V 2 F + 640L F
1 2 3 4 5 6

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With surface treatment on the LM block* 5 LM rail length (in mm) 6 With surface treatment on the LM rail*

* Specify the type of the surface treatment when placing an order.

6.3. Dust Prevention

When foreign matter enters an LM system, it will cause abnormal wear or shorten the service life, and it is necessary to prevent foreign matter from entering the system. Therefore, when possible entrance of foreign matter is predicted, it is important to select an effective sealing device or dust-prevention device that meets the atmospheric conditions.

THK offers dust prevention accessories for LM Guides by model number, such as end seals made of special synthetic rubber with high wear resistance, and side seals and inner seals for further increasing dust-prevention effect.

In addition, for locations with adverse atmosphere, Laminated Contact Scraper LaCS and dedicated bellows are available by model number. Also, THK offers dedicated caps for LM rail mounting holes, designed to prevent cutting chips from entering the LM rail mounting holes.

When it is required to provide dust prevention for a Ball Screw in an atmosphere exposed to cutting chips and moisture, we recommend using a telescopic cover that protects the whole system or a large bellows.

6.3.1. Dust Prevention Accessories

THK offers various dust prevention accessories.

Dedicated Caps for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap.

Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable. Different sizes of the dedicated cap C are in stock as standard for hexagon socket bolts of M3 to M22.

To attach the dedicated cap to the mounting hole, place a flat metal piece like one shown in Fig. 12 on the cap and gradually hammer in the cap until it is on the same level as the top face of the LM rail.

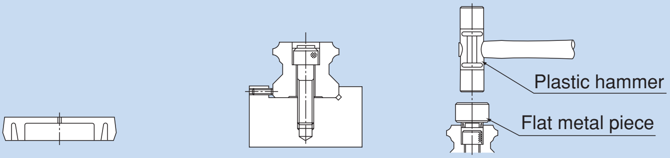


Fig. 12 Cap C

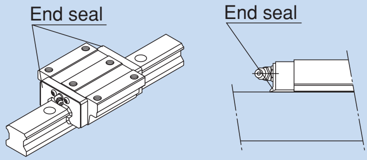
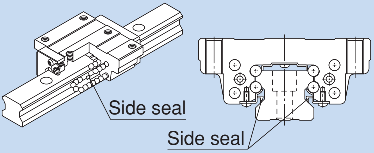
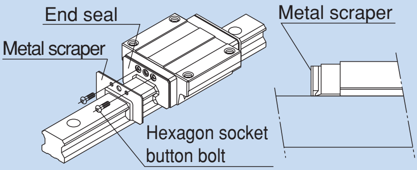
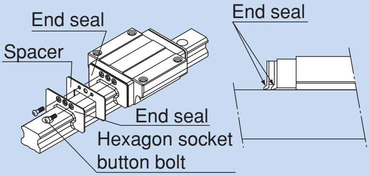
Note: When attaching the dedicated cap C for LM rail mounting holes, do not remove any of the LM blocks from the LM rail.

Table 5 List of Model Numbers Supported for the Dedicated Cap C for LM Rail Mounting Holes

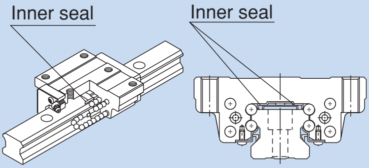
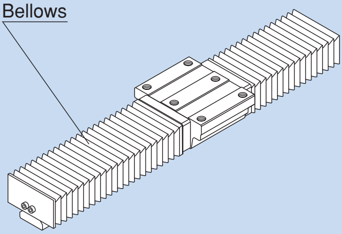
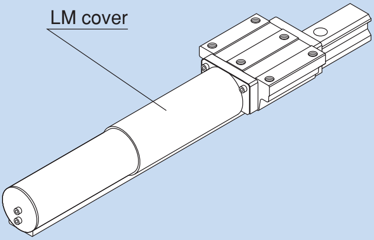
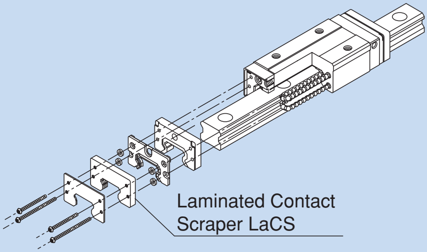
Model No.	Supported model No.											
	SSR	SR	SNR SNS	NR NRS	SHS, HSR CSR, HCR	SHW HRW	SRG SRN	GSR	HR	SRS RSR RSH	SRS-W RSR-W RSH-W	NSR-TBC
C3	—	15	—	—	12	—	—	—	1123 1530	12 15	9	—
C4	15Y	—	—	—	15	12, 14, 17, 21, 27,	—	15	2042	—	—	—
C5	20	20	25	25X	20	—	—	20	—	20	—	20
C6	25Y 30	25Y 30	30	30	25	35	25	25	—	25	—	25 30
C8	35	35	35	35	30 35	50	30 35	30	2555 3065	—	—	40
C10	—	45	—	—	—	60	—	35	3575	—	—	50
C12	—	55	45	45	45	—	45	—	4085	—	—	70
C14	—	—	55	55	55	—	55	—	—	—	—	—
C16	—	70 85	65	65	65	—	65	—	50105	—	—	—
C22	—	—	—	85	85	—	—	—	—	—	—	—

Seals, Scrapers and Bellows

The following dust prevention accessories are also available.

Item name	Schematic diagram / mounting location	Purpose/location of use
End seal		Used in locations exposed to dust
Side seal		Used in locations where dust may enter the LM block from the side or bottom surface, such as vertical, horizontal and inverted mounts
Metal scraper		Used in locations where welding spatter may adhere to the LM rail
Double seals		Used in locations exposed to much dust or many cutting chips

Note: Some of the dust prevention accessories cannot be used depending on the LM Guide model. For details, see the sections on the subject model in the "THK General Catalog - Product Specifications," provided separately.

Item name	Schematic diagram / mounting location	Purpose/location of use
Inner seal		Used in locations severely exposed to dust or cutting chips
Dedicated bellows		Used in locations exposed to dust or cutting chips
Dedicated LM cover		Used in locations exposed to dust or cutting chips Used in locations where high-temperature foreign matter such as spatter flies
Laminated Contact Scraper LaCS		Used in harsh environments exposed to foreign matter such as fine dust and liquids

Note: For details of dust prevention accessories, see the sections on the corresponding model numbers in the "THK General Catalog - Product Specifications," provided separately.

Plate Cover SV and Steel Tape SP

To increase the dust preventive capability of an LM Guide, it is necessary to increase sealability of the end seals and prevent foreign matter, such as cutting chips and dust, and a coolant from penetrating through the LM rail mounting holes. THK 's plate cover and steel tape outperform conventional bolt hole plugs in the following properties.

① Drastically increased workability (long-size)

② Drastically increased sealability

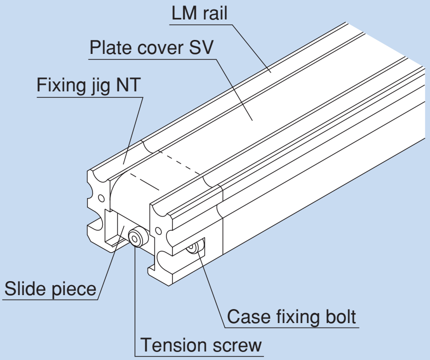
●The plate cover, made of a thin steel sheet, is secured with a tension given using a fixing jig.

●The steel tape, consisting of a thin steel sheet with an adhesive tape, is affixed using the adhesive tape and secured with end pieces on both ends.

The plate cover is available only for models SNR/SNS (35 to 65) and NR/NRS (35 to 100). The steel tape is available for small models SNR/SNS, SHS and NR/NRS as well as models HSR and SR.

●Plate Cover SV

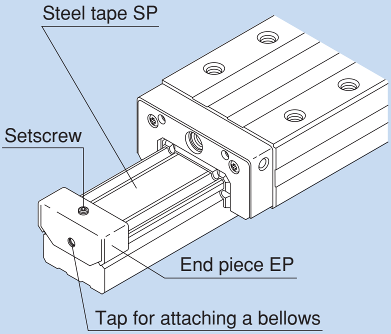
●Secured with fixing jig NT
(for SNR/SNS35 to 65)
(for NR/NRS35 to 100)



●Plate cover: SV
●Fixing jig: NT

●Steel Tape SP

●Secured with adhesive tape + end piece
(for SNR/SNS25 to 65)
(for NR/NRS25 to 100)
(for HSR15 to 100)
(for SR15 to 70)
(for SHS15 to 65)

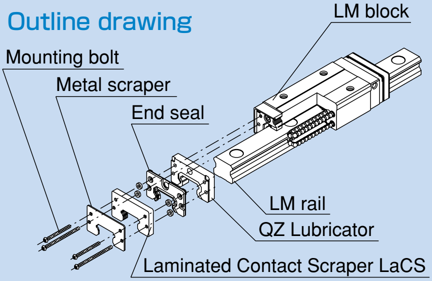


●Steel tape: SP
●End piece: EP

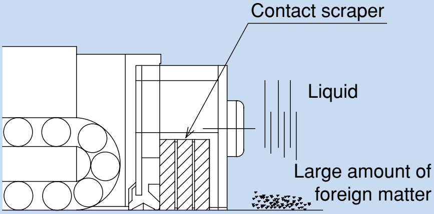
6.3.2. Laminated Contact Scraper LaCS® for the LM Guide®

LaCS removes minute foreign matter adhering to the LM rail in multiple stages and prevents it from entering the LM block with laminated contact structure (3-layer scraper).

Outline drawing



Structural drawing



Features

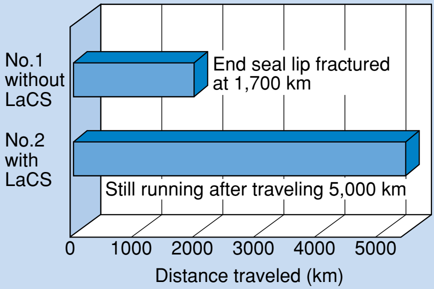
- ●Since the 3 layers of scrapers fully contact the LM rail, LaCS is highly capable of removing minute foreign matter.
- ●Since it uses oil-impregnated, foam synthetic rubber with a self-lubricating function, low friction resistance is achieved.

■Test under an Environment with a Water-soluble Coolant

[Test conditions] Test environment: water-soluble coolant

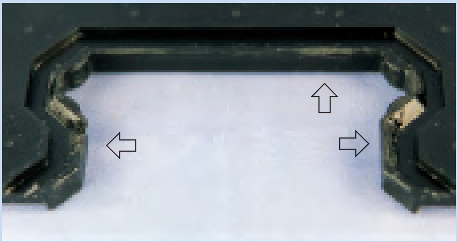
Item		Description
Tested model	No.1	SHS45R1SS+3000L (end seal only)
	No.2	SHS45R1SSHH+3000L (end seal and LaCS)
Max speed		200m/min
Environmental conditions		Coolant sprayed: 5 times per day

[Test result]



Magnified view of the end seal lip

No. 1: without LaCS; lip fractured at 1,700 km



⇦Areas marked with arrow are fractured

No. 2: with LaCS; no anomaly observed after traveling 5,000 km

Lip has not been fractured

Test under an Environment with Minute Foreign Matter

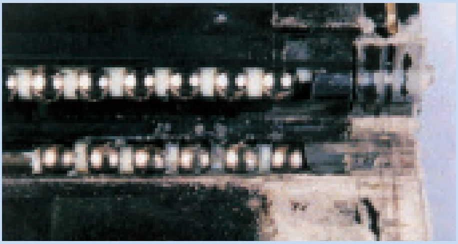
[Test conditions] Test environment: minute foreign matter

Item		Description
Tested model	No.1	SNR45R1DD+600L (double seals only)
	No.2	SNR45R1HH+600L (LaCS only)
Max speed/ acceleration		60m/min, 1G
External load		9.6kN
Foreign matter conditions		Type:(particle diameter: 125 μm or less)
		Sprayed amount: 1g / 1hour (total sprayed amount: 120 g)

[Test result] Amount of foreign matter entering the raceway

Seal configuration		Amount of foreign matter entering the raceway g
Double-seal configuration (2 end seals superposed with each other)	Tested model 1	0.3
	Tested model 2	0.3
	Tested model 3	0.3
LaCS	Tested model 1	0
	Tested model 2	0
	Tested model 3	0

No. 1 Traveled 100 km (double-seal configuration)



Large amount of foreign matter has entered the ball raceway

No. 2 Traveled 100 km (LaCS only)

No foreign matter entering the ball raceway observed

7. Special Environment Types of LM Systems

THK LM systems can be used in special environments by changing the material or grease, using optional parts or receiving surface treatments. This section describes general measures to adapt to special environments and supported products.

Clean Rooms

In a clean environment like clean rooms, generation of dust from the LM system has to be reduced and anti-corrosive oil cannot be used. Therefore, it is necessary to increase the corrosion resistance of the LM system. In addition, depending on the level of cleanliness, a dust collector is required.

Dust Generation from the LM System

■Measure to prevent dust generation resulting from flying grease

THK AFE Grease/AFF Grease

Use environmentally clean grease that produces little dust.

■Measure to prevent dust generation resulting from metallic abrasion dust

Caged Ball LM Guide

Use of the Caged Ball LM Guide, which has no friction between balls and generates little metallic abrasion dust, to allow generation of dust to be minimized.

Corrosion Prevention

■Material-based Measure

Stainless Steel LM Guide

This LM Guide uses martensitic stainless steel, which has an anti-corrosion effect.

Highly Corrosion Resistant LM Guide

It uses austenitic stainless steel, which has a high anti-corrosion effect, in its LM rail.

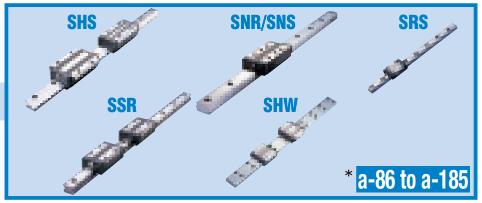
■Measure through Surface Treatment

THK AP-C Treatment, AP-CF Treatment and AP-HC Treatment

The LM system is surface-treated to increase corrosion resistance.

Caged Ball LM Guides

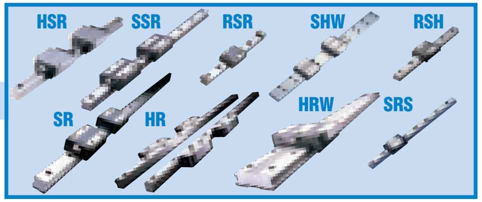
Supported models SHS SNR/SNS SSR SHW SRS



* a-86 to a-185

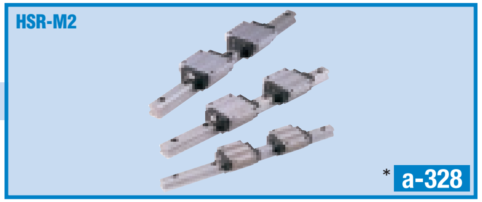
Stainless Steel LM Guides

Supported models HSR SR SSR HR RSR SHW HRW RSH SRS



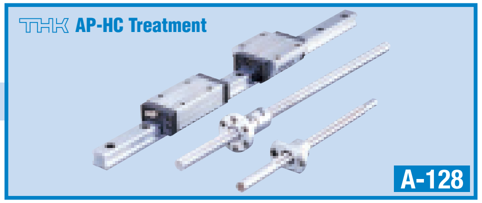
Highly Corrosion Resistant LM Guide

Supported model HSR-M2



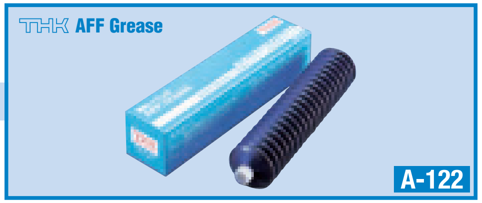
* a-328

Surface Treatment



A-128

Grease



A-122

A-120

* These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

Vacuum

In a vacuum environment, measures to prevent gas from being emitted from a resin and grease from flying are required and anti-corrosive oil cannot be used. Therefore, it is necessary to select a product with high corrosion resistance.

■Measure to Prevent Emission of Gas from Resin

Stainless steel LM Guide

It uses stainless steel in the endplate (ball circulation unit made of resin) of the LM block to reduce emission of gas.

■Measure to Prevent Grease from Evaporating

Vacuum grease

If a general-purpose grease is used in a vacuum environment, oil contained in the grease evaporates and the grease looses less lubricity. Therefore, use a vacuum grease that uses fluorine-based oil, whose vapor pressure is low, as the base oil.

■Measures to Prevent Corrosion

Stainless Steel LM Guide

In a vacuum environment, use a stainless steel LM Guide, which is highly corrosion resistant.

High-temperature LM Guide

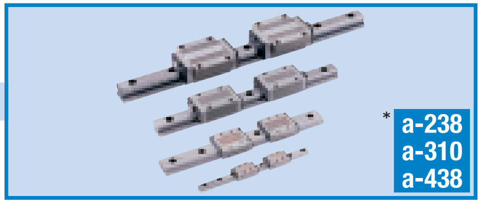
If the temperature becomes high due to baking, use a high-temperature LM Guide, which is highly resistant to heat and corrosion.

■Highly Corrosion Resistant LM Guide

This LM Guide uses austenitic stainless steel, which has a high anti-corrosion effect, in the LM rail.

High-temperature LM Guides

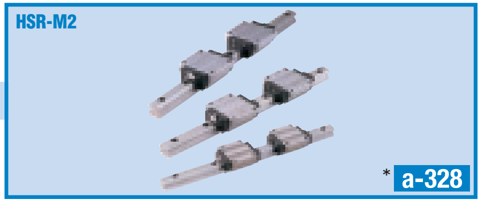
Supported models **HSR-M1 RSR-M1 SR-M1**



* a-238
a-310
a-438

Highly Corrosion Resistant LM Guide

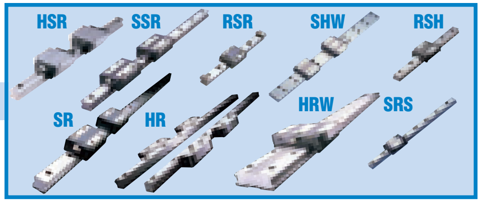
Supported model **HSR-M2**



* a-328

Stainless Steel LM Guides

Supported models **HSR SR SSR HR RSR SHW HRW RSH SRS**



Vacuum Grease

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* These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

Corrosion Prevention

As with clean room applications, it is necessary to increase corrosion resistance through material selection and surface treatment.

■Material-based Measure

Stainless Steel LM Guide

This LM Guide uses martensitic stainless steel, which has an anti-corrosion effect.

Highly Corrosion Resistant LM Guide

It uses austenitic stainless steel, which has a high anti-corrosion effect, in its LM rail.

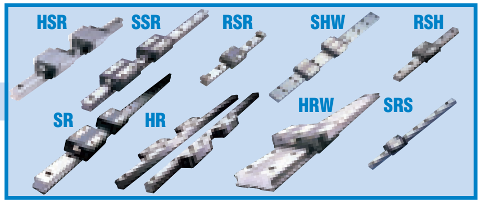
■Measure through Surface Treatment

THK AP-C Treatment, AP-CF Treatment and AP-HC Treatment

The LM system is surface-treated to increase corrosion resistance.

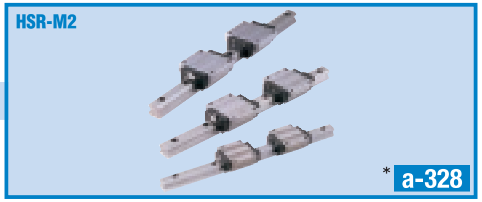
Stainless Steel LM Guides

Supported models **HSR SR SSR HR RSR SHW HRW RSH SRS**

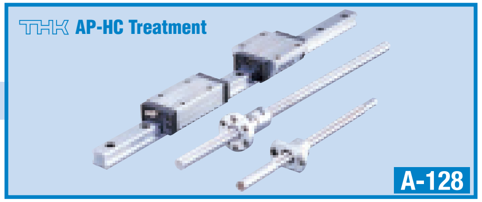


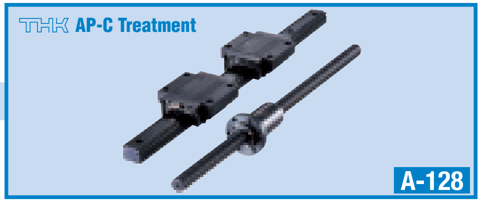
Highly Corrosion Resistant LM Guide

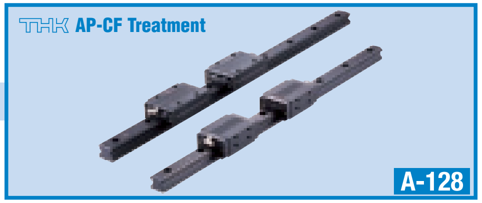
Supported model **HSR-M2**



Surface Treatment







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* These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

High Speed

In a high-speed environment, it is necessary to apply an optimum lubrication method that reduces heat generation during high-speed operation and increases grease retention.

■Measures to Reduce Heat Generation

Caged Ball LM Guide

Use of a ball cage eliminates friction between balls to reduce heat generation. In addition, grease retention is increased, thus to achieve long service life and high speed operation.

High Speed Ball Screw with Ball Cage

Use of a ball cage and an ideal ball circulation structure enables high-speed feeding, which conventional products have not achieved.

THK AFG Grease

It reduces heat generation in high-speed operation and has superb lubricity.

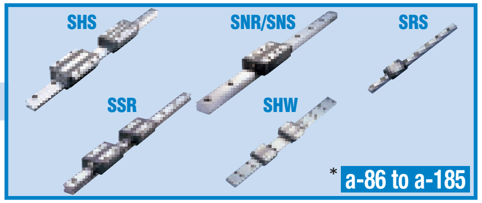
■Measure to Improve Lubrication

QZ Lubricator

Since it supplements oil loss, the lubrication and maintenance interval can significantly be extended. It also applies the right amount of oil to the raceway, making itself an eco-friendly lubrication system that does not contaminate the surrounding area.

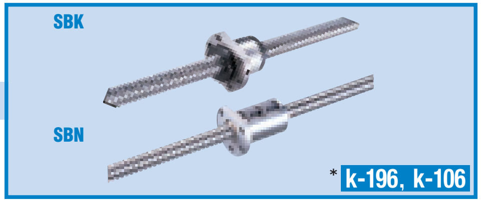
Caged Ball LM Guides

Supported models **SHS SNR/SNS SSR SHW SRS**

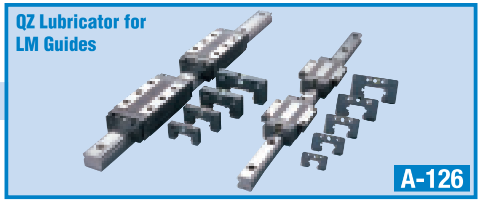


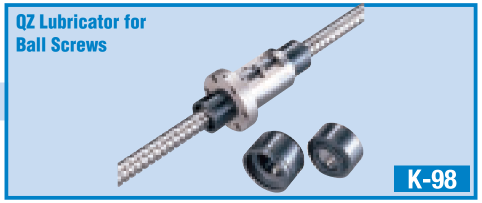
High Speed Ball Screw with Ball Cage

Supported model **SBK SBN**

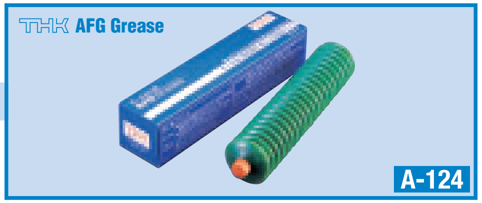


QZ Lubricator





Grease



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* These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

High Temperature

In a high-temperature environment, dimensional alteration caused by heat is problematic. Use a High Temperature LM Guide, which is heat resistant and whose dimensions little change after being heated, and a high-temperature grease.

Heat Resistance

High temperature LM Guide

It is an LM Guide that is highly resistant to heat and whose dimensions little change after being heated and cooled.

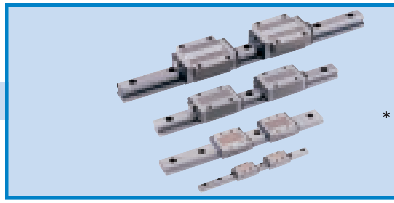
Grease

High temperature grease

Use a high-temperature grease with which the rolling resistance of the LM system little fluctuates even temperature changes from a normal to high range.

High Temperature LM Guides

Supported models **HSR-M1 RSR-M1 SR-M1**



* a-238
a-310
a-438

High Temperature Grease

Low Temperature

Use an LM system whose resin component are little affected low temperature, a measure to increase corrosion resistance in transition from normal to low temperature and a grease with a low rolling-resistance fluctuation even at low temperature.

Impact of Low Temperature on Resin Components

Stainless Steel LM Guide

The endplate (ball circulation path normally made of resin) of the LM block is made of stainless steel.

Corrosion Prevention

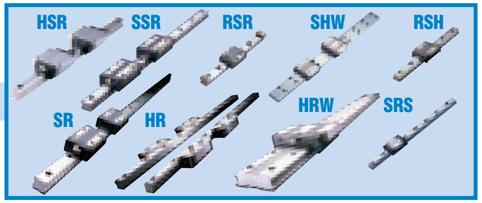
Provide surface treatment to the LM system to increase its corrosion resistance.

Grease

Use THK AFC Grease, with which the rolling resistance of the system little fluctuates even at low temperature.

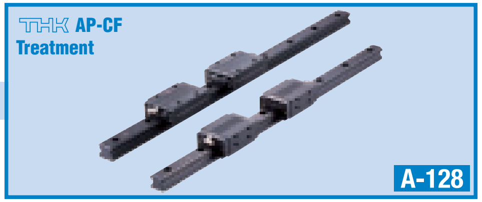
Stainless Steel LM Guide

Supported models **HSR SR SSR HR RSR SHW HRW RSH SRS**



Surface Treatment

THK AP-CF Treatment



A-128

Grease

THK AFC Grease

A-118

Micro Motion

Micro strokes cause oil film break and poor lubrication, resulting in early wear. In such cases, select a grease with which the oil film strength is high and an oil film can easily be formed.

Grease

THK AFC Grease

AFC Grease is a urea-based grease that excels in oil film strength and wear resistance.

Grease

THK AFC Grease

A-118

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* These indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

Foreign Matter

If foreign matter enters the LM system, it will cause abnormal wear and shorten the service life. Therefore, it is necessary to prevent such entrance of foreign matter. Especially in an environment containing minute foreign matter or a water-soluble coolant that a telescopic cover or a bellows cannot remove, it is necessary to attach a dust-prevention accessory capable of efficiently removing foreign matter.

■Metal Scraper

It is used to remove relatively large foreign objects such as cutting chips, spatter and sand dust or hard foreign matter that adhere to the LM rail.

■Laminated Contact Scraper LaCS

Unlike a metal scraper, it removes foreign matter while it is in contact with the LM rail. Therefore, it demonstrates a high dust preventive effect against minute foreign matter, which has been difficult to remove with conventional metal scrapers.

■QZ Lubricator

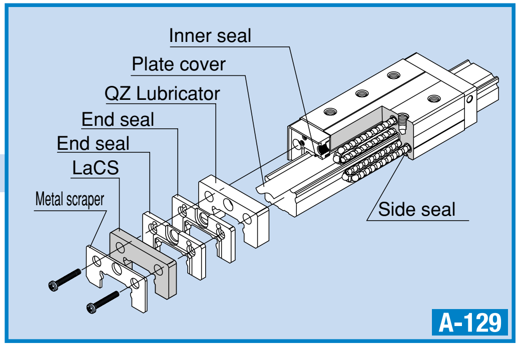
QZ Lubricator is a lubrication system that feeds the right amount of lubricant by closely contacting its highly oil-impregnated fiber net to the ball raceway.

■Wiper Ring W

With the wiper ring, a special resin that is highly wear resistant elastically contacts the circumference of the shaft and the screw groove, and removes foreign matter with 8 slits, thus preventing foreign matter from entering the nut.

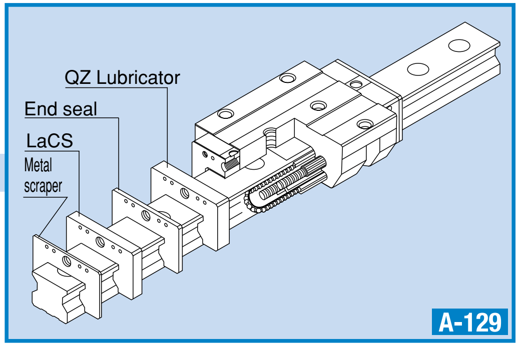
LM Guide
+ Metal Scraper
+ Laminated Contact Scraper LaCS
+ QZ Lubricator

Supported models **Caged Ball LM Guides:**
SSR SHS SNR/SNS SRS SHW
Full ball LM Guides:
HSR NR/NRS



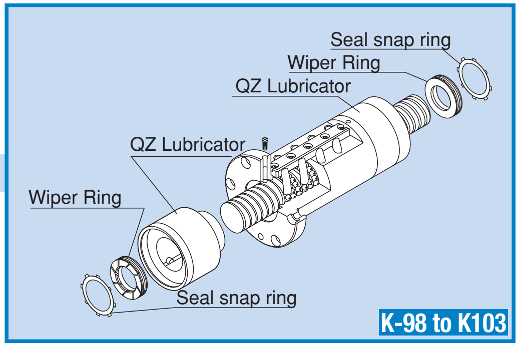
Caged Roller LM Guide
+ Metal Scraper
+ Laminated Contact Scraper LaCS
+ QZ Lubricator

Supported model **SRG**



Ball Screw
+ QZ Lubricator
+ Wiper Ring W

Supported models **SBN BNFN BIF DK**
BNF DIK BTK



8. Precautions on Using the LM Guide®

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting an LM block or LM rail may cause them to fall by their self weights.
(3) Dropping or hitting the LM Guide may damage it. Giving an impact to the LM Guide could also cause damage to its function even if the guide looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, the lubricant may not be distributed throughout the LM system depending on the mounting orientation of the system. Contact THK for details.
(6) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball (roller) circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) When planning to use the LM system in an environment where the coolant penetrates the LM block, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(3) Do not use the LM system at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) If foreign matter adheres to the LM system, replenish the lubricant after cleaning the product. For available types of detergent, contact THK .
(5) When using the LM Guide with inverted mount, breakage of the endplate due to an accident or the like may cause balls (rollers) to fall and the LM block to come off from the LM rail and fall. In these cases, take preventive measures such as adding a safety mechanism for preventing such falls.
(6) When using the LM system in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(7) When removing the LM block from the LM rail and then replacing the block, an LM block mounting/removing jig that facilitates such installation is available. Contact THK for details.

Storage

When storing the LM Guide, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

1. Features of the Ball Spline

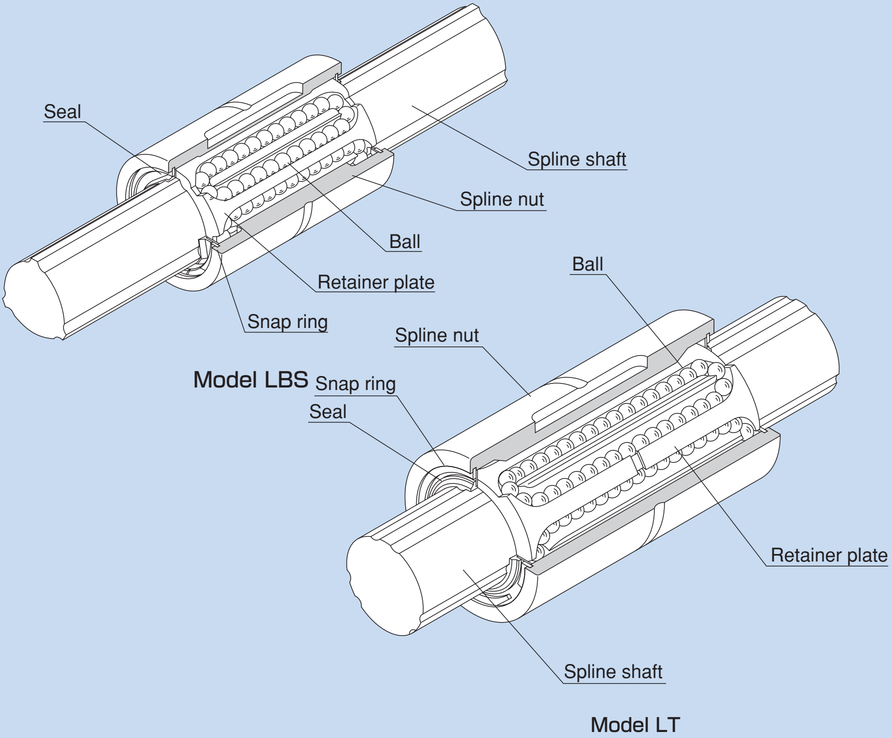


Fig. 1 Structure of Ball Spline Models LBS and LT

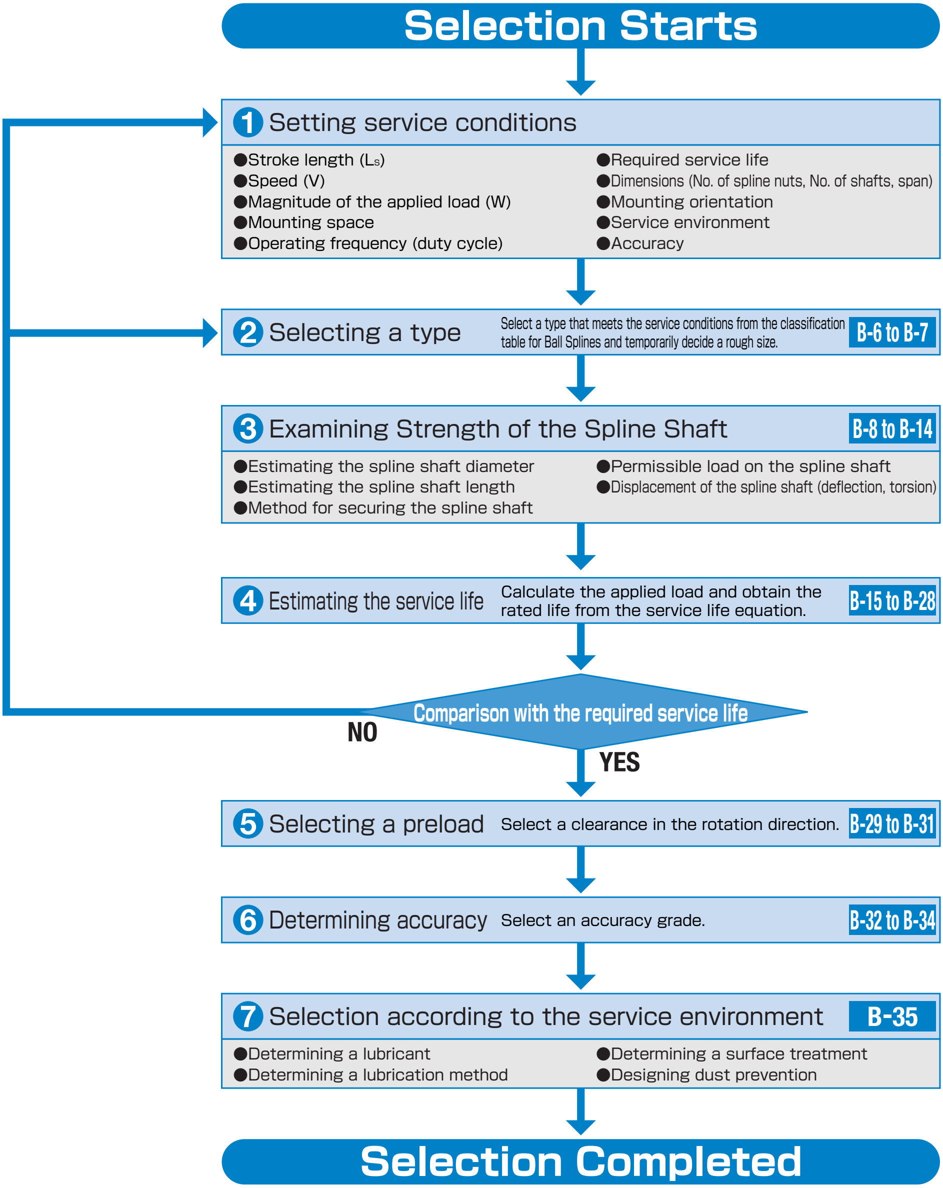
The Ball Spline is an innovative linear motion system in which balls accommodated in the spline nut transmit torque while linearly moving on precision-ground raceways on the spline shaft. Unlike the conventional structure, a single spline nut can provide a preload with THK 's Ball Spline. As a result, the Ball Spline demonstrates high performance in service environments subject to vibrations and impact loads, locations where a high level of positioning accuracy is required or areas where high-speed kinetic performance is required.

In addition, even when used as an alternative to a linear bush, the Ball Spline achieves a rated load more than 10 times greater than the linear bush with the same shaft diameter, allowing it to compactly be designed and used in locations where an overhung load or a moment load is applied. Thus, the Ball Spline provides a high degree of safety and long service life.

2. Flow Chart for Selecting a Ball Spline

Steps for Selecting a Ball Spline

The following is a flow chart as a measuring stick for selecting a Ball Spline.



Selection Starts

① Setting service conditions
- ●Stroke length (L_S)
- ●Speed (V)
- ●Magnitude of the applied load (W)
- ●Mounting space
- ●Operating frequency (duty cycle)
- ●Required service life
- ●Dimensions (No. of spline nuts, No. of shafts, span)
- ●Mounting orientation
- ●Service environment
- ●Accuracy

② Selecting a type Select a type that meets the service conditions from the classification table for Ball Splines and temporarily decide a rough size. **B-6 to B-7**

③ Examining Strength of the Spline Shaft **B-8 to B-14**
- ●Estimating the spline shaft diameter
- ●Estimating the spline shaft length
- ●Method for securing the spline shaft
- ●Permissible load on the spline shaft
- ●Displacement of the spline shaft (deflection, torsion)

④ Estimating the service life Calculate the applied load and obtain the rated life from the service life equation. **B-15 to B-28**

Comparison with the required service life

NO

YES

⑤ Selecting a preload Select a clearance in the rotation direction. **B-29 to B-31**

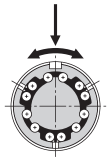
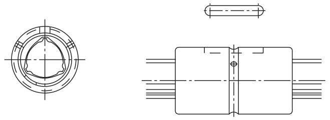
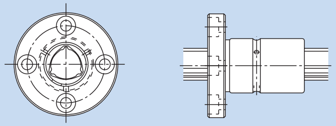
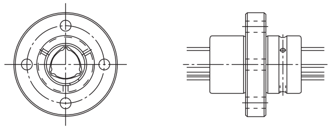
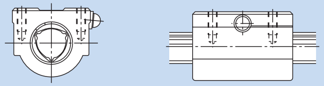
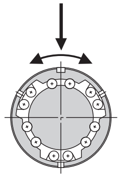
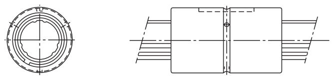
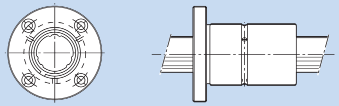
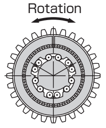
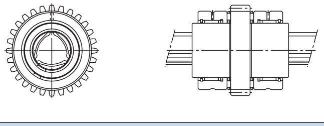
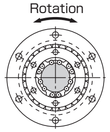
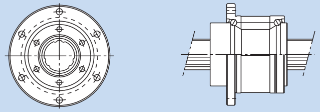
⑥ Determining accuracy Select an accuracy grade. **B-32 to B-34**

⑦ Selection according to the service environment **B-35**
- ●Determining a lubricant
- ●Determining a lubrication method
- ●Determining a surface treatment
- ●Designing dust prevention

Selection Completed

3. Classification of Ball Splines

There are three types of the Ball Spline: high-torque type, medium-torque type and rotary type. You can choose a type according to the intended use. In addition, wide arrays of spline nut shapes are available for each type, enabling the user to choose a desired shape according to the mounting or service requirements.

Classification		Type	Shape	Shaft diameter	Description page*	Structure and features	Major application
High-torque type		Type LBS Type LBST		Nominal shaft diameter: 6 to 150 mm	b-30	●The spline shaft has three crests equidistantly formed at angles of 120°. On both sides of each crest, two rows (six rows in total) of balls are arranged to hold the crest from both sides. The angular-contact design of the ball contact areas allows an appropriate preload to be evenly applied. ●Since the balls circulate inside the spline nut, the outer dimensions of the spline nut are compactly designed. ●Even under a large preload, smooth linear motion is achieved. ●Since the contact angle is large (45°) and the displacement is minimal, high rigidity is achieved. ●No angular backlash occurs. ●Capable of transmitting a large torque.	●Column and arm of industrial robot ●Automatic loader ●Transfer machine ●Automatic conveyance system ●Tire molding machine ●Spindle of spot-welding machine ●Guide shaft of high-speed automatic coating machine ●Riveting machine ●Wire winder ●Work head of electric discharge machine ●Spindle drive shaft of grinding machine ●Speed gears ●Precision indexing machine
		Type LBF		Nominal shaft diameter: 15 to 100 mm	b-36		
		Type LBR		Nominal shaft diameter: 15 to 100 mm	b-38		
		Type LBH		Nominal shaft diameter: 15 to 50 mm	b-40		
Medium-torque type		Type LT		Nominal shaft diameter: 4 to 100 mm	b-52	●The spline shaft has two to three crests. On both sides of each crest, two rows (four to six rows in total) of balls are arranged to hold the crest from both sides. This design allows an appropriate preload to be evenly applied. ●The contact angle of 20° and an appropriate preload level eliminate angular backlash, providing high-torque moment rigidity.	●Die-set shaft and similar applications requiring linear motion under a heavy load ●Loading system and similar applications requiring rotation to a given angle at a fixed position ●Automatic gas-welding machine spindle and similar applications requiring a whirl-stop on one shaft ●Column and arm of industrial robot ●Spot-welding machine ●Riveting machine ●Book-binding machine ●Automatic filler ●XY recorders ●Automatic spinner ●Optical measuring instrument
		Type LF		Nominal shaft diameter: 6 to 50 mm	b-54		
Rotary type		Type LBG Type LBGT		Nominal shaft diameter: 20 to 85 mm	b-62	●A unit type that has the same contract structure as model LBS. The flange circumference on the spline nut is machined to have gear teeth, and radial and thrust needle bearings are compactly combined on the circumference of the spline nut.	●Speed gears for high-torque transmission
		Type LTR-A Type LTR		Nominal shaft diameter: 8 to 60 mm	b-72	●A lightweight, compact type based on model LT, but has a spline nut circumference machined to have angular-contact type ball raceways to accommodate support bearings.	●Z axis of scalar robot ●Wire winder

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* These symbols indicate the corresponding reference page numbers of the "THK General Catalog - Product Specifications," provided separately.

4. Designing Spline Shaft Strength

The spline shaft of the Ball Spline is a compound shaft capable of receiving a radial load and torque. When the load and torque are large, the spline shaft strength must be taken into account.

4.1. Spline Shaft Receiving a Bending Load

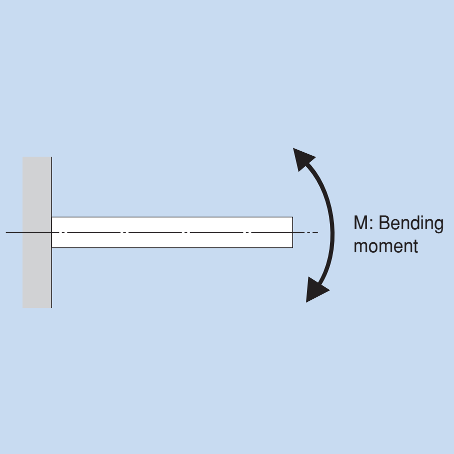
When a bending load is applied to the spline shaft of a Ball Spine, obtain the spline shaft diameter using the equation (1) below.

$$M = \sigma \cdot Z \text{ and } Z = \frac{M}{\sigma} \quad \cdots\cdots\cdots\cdots(1)$$

M : Maximum bending moment acting on the spline shaft (N•mm)

σ : Permissible bending stress of the spline shaft ($98N/mm^2$)

Z : Cross-section factor of the spline shaft (mm^3)
(See table 3 on page B-13 and table 4 on page B-14)



4.2. Spline Shaft Receiving a Torsion Load

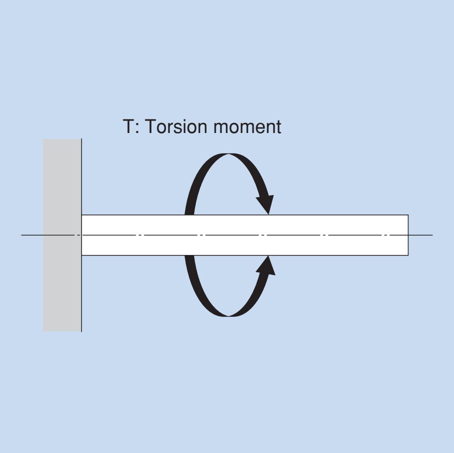
When a torsion load is applied on the spline shaft of a Ball Spline, obtain the spline shaft diameter using the equation (2) below.

$$T = \tau_a \cdot Z_P \text{ and } Z_P = \frac{T}{\tau_a} \quad \cdots\cdots\cdots\cdots(2)$$

T :Maximum torsion moment (N·mm)

τ_a :Permissible torsion stress of the spline shaft (49N/mm^2)

Z_p :Polar modulus of section of the spline nut (mm^3) (See table 3 on page B-13 and table 4 on page B-14)



4.3. When the Spline Shaft Simultaneously Receives a Bending Load and a Torsion Load

When the spline shaft of a Ball Spline receives a bending load and a torsion load simultaneously, calculate two separate spline shaft diameters: one for the equivalent bending moment (M_e) and the other for the equivalent torsion moment (T_e). Then, use the greater value as the spline shaft diameter.

Equivalent bending moment

$$M_e = \frac{M + \sqrt{M^2 + T^2}}{2} = \frac{M}{2}\left\{1 + \sqrt{1 + \left(\frac{T}{M}\right)^2}\right\} \quad \cdots\cdots\cdots\cdots(3)$$

$M_e = \sigma \cdot Z$

Equivalent torsion moment

$$T_e = \sqrt{M^2 + T^2} = M \cdot \sqrt{1 + \left(\frac{T}{M}\right)^2} \quad \cdots\cdots\cdots\cdots(4)$$

$T_e = \tau_a \cdot Z_p$

4.4. Rigidity of the Spline Shaft

The rigidity of the spline shaft is expressed as a torsion angle per meter of shaft length. Its value should be limited within 1°/4.

$$\theta = 57.3 \times \frac{T \cdot L}{G \cdot I_P} \quad \cdots\cdots\cdots\cdots(5)$$

$$\text{Rigidity of the shaft} = \frac{\text{torsion angle}}{\text{unit length}} = \frac{\theta}{\ell} < \frac{1^\circ}{4}$$

θ : Torsion angle (°)

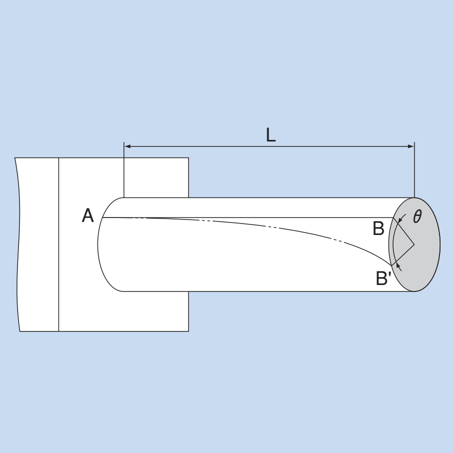
L : Spline shaft length (mm)

G : Transverse elastic modulus (7.9×10^4N/mm^2)

ℓ : Unit length (1000mm)

I_p : Polar moment of inertia (mm^4)

(See table 3 on page B-13 and table 4 on page B-14)



4.5. Deflection and Deflection Angle of the Spline Shaft

The deflection and deflection angle of the Ball Spline shaft need to be calculated using equations that meet the relevant conditions. Tables 1 and 2 (pages B-10 and 11) represent these conditions and the corresponding equations.
Tables 3 and 4 (pages B-13 and 14) show the section moduli (Z) and the geometrical moments of inertia (I) of the spline shaft. Using Z and I values in the tables, the strength and displacement (deflection) of a typical Ball Spline model can be obtained.

Table 1 Deflection and Deflection Angle Equations

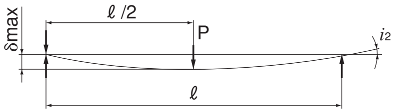
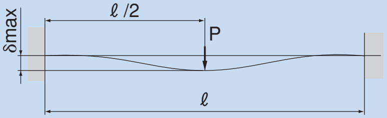
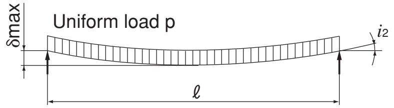
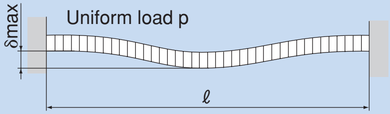
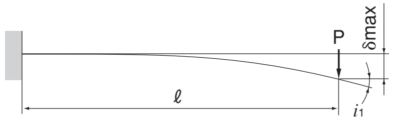
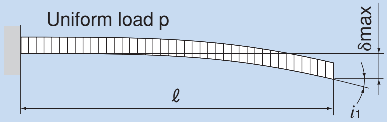
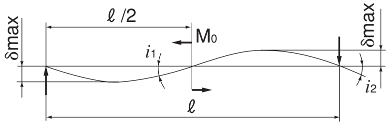
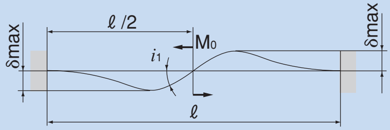
Support method	Service conditions	Deflection equation	Deflection angle equation
Both ends free		$\delta_{max} = \dfrac{P\ell^3}{48EI}$	$i_1 = 0$ $i_2 = \dfrac{P\ell^2}{16EI}$
Both ends fastened		$\delta_{max} = \dfrac{P\ell^3}{192EI}$	$i_1 = 0$ $i_2 = 0$
Both ends free		$\delta_{max} = \dfrac{5p\ell^4}{384EI}$	$i_2 = \dfrac{p\ell^3}{24EI}$
Both ends fastened		$\delta_{max} = \dfrac{p\ell^4}{384EI}$	$i_2 = 0$

Table 2 Deflection and Deflection Angle Equations

Support method	Service conditions	Deflection equation	Deflection angle equation
One end free		$\delta_{max}=\frac{P\ell^3}{3EI}$	$i_1=\frac{P\ell^2}{2EI}$ $i_2=0$
One end fastened		$\delta_{max}=\frac{P\ell^4}{8EI}$	$i_1=\frac{P\ell^3}{6EI}$ $i_2=0$
Both ends free		$\delta_{max}=\frac{\sqrt{3}M_0\ell^2}{216EI}$	$i_1=\frac{M_0\ell}{12EI}$ $i_2=\frac{M_0\ell}{24EI}$
Both ends fastened		$\delta_{max}=\frac{M_0\ell^2}{216EI}$	$i_1=\frac{M_0\ell}{16EI}$ $i_2=0$

δ_{max} : Maximum deflection (mm)
i_1 : Deflection angle at loading point
i_2 : Deflection angle at supporting point
M_0 : Moment (N·mm)
P : Concentrated load (N)
p : Uniform load (N/mm)
ℓ : Span (mm)
I : Geometrical moment of inertia (mm⁴)
E : Modulus of longitudinal elasticity 2.06×10^5 (N/mm²)

4.6. Critical Speed of the Spline Shaft

When a Ball Spline shaft is used to transmit power while rotating, as the rotation speed of the shaft increases, the rotation cycle nears the natural frequency of the spline shaft. It may cause resonance and eventually result in inability to move. Therefore, the maximum shaft speed must be limited to a level that does not cause resonance. If the shaft's rotation cycle exceeds or nears the resonance point during operation, it is necessary to reconsider the spline shaft diameter. The critical roration speed of the spline shaft is obtained using the equation (6) below, in which the value is multiplied by a safety factor of 0.8.

●Critical Rotation Speed

$$N_c = \frac{60\lambda^2}{2\pi \cdot \ell_b^{\,2}} \cdot \sqrt{\frac{E \times 10^3 \cdot I}{\gamma \cdot A}} \times 0.8 \qquad \cdots(6)$$

N_c : Critical speed (min^{-1})
ℓ_b : Center distance (mm)
E : Young's modulus (2.06×10^5N/mm^2)
I : Minimum geometrical moment of inertia of the shaft (mm^4)

$$I = \frac{\pi}{64} d^4 \qquad d : \text{Minor diameter (mm)}$$

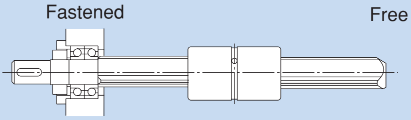
(See tables 3 and 4 on page B-18)

γ : Density (specific gravity) (7.85×10^{-6}kg/mm^3)

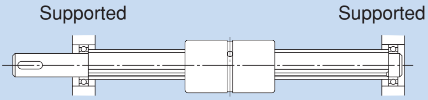
$$A = \frac{\pi}{4} d^2 \qquad d : \text{Minor diameter (mm)}$$

(See tables 3 and 4 on page B-18)

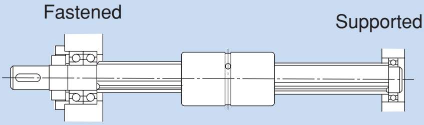
A : Spline shaft sectional area (mm^2)
λ : Factor according to the mounting method
① Fastened—free $\lambda=1.875$
② Supported—supported $\lambda=3.142$
③ Fastened—supported $\lambda=3.927$
④ Fastened—fastened $\lambda=4.73$



Fastened—free



Supported—supported



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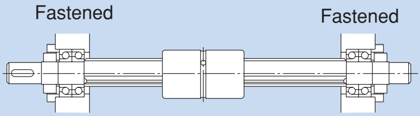


Fastened—fastened

4.7. Cross-sectional Characteristics of the Spline Shaft

4.7.1 Cross-sectional Characteristics of the Spline Shaft for Ball Spline Models LBS, LBST, LBF, LBR, LBH, LBG and LBGT

Table 3 Cross-sectional Characteristics of the Spline Shaft for Models LBS, LBST, LBF, LBR, LBH, LBG and LBGT

Nominal shaft diameter		I : Geometrical moment of inertia mm^4	Z : Section modulus mm^3	I_P : Polar geometrical moment of inertia mm^4	Z_P : Polar section modulus mm^3
6	Solid shaft	50.6	17.8	1.03×10^{2}	36.2
8	Solid shaft	1.64×10^{2}	42.9	3.35×10^{2}	87.8
10	Solid shaft	3.32×10^{2}	73.0	6.80×10^{2}	1.50×10^{2}
15	Solid shaft	1.27×10^{3}	2.00×10^{2}	2.55×10^{3}	4.03×10^{2}
20	Solid shaft	3.82×10^{3}	4.58×10^{2}	7.72×10^{3}	9.26×10^{2}
	Hollow shaft	3.79×10^{3}	4.56×10^{2}	7.59×10^{3}	9.11×10^{2}
25	Solid shaft	9.62×10^{3}	9.14×10^{2}	1.94×10^{4}	1.85×10^{3}
	Hollow shaft	9.50×10^{3}	9.05×10^{2}	1.90×10^{4}	1.81×10^{3}
30	Solid shaft	1.87×10^{4}	1.50×10^{3}	3.77×10^{4}	3.04×10^{3}
	Hollow shaft	1.78×10^{4}	1.44×10^{3}	3.57×10^{4}	2.88×10^{3}
40	Solid shaft	6.17×10^{4}	3.69×10^{3}	1.25×10^{5}	7.46×10^{3}
	Hollow shaft	5.71×10^{4}	3.42×10^{3}	1.14×10^{5}	6.84×10^{3}
50	Solid shaft	1.49×10^{5}	7.15×10^{3}	3.01×10^{5}	1.45×10^{4}
	Hollow shaft	1.34×10^{5}	6.46×10^{3}	2.69×10^{5}	1.29×10^{4}
60	Solid shaft	3.17×10^{5}	1.26×10^{4}	6.33×10^{5}	2.53×10^{4}
	Hollow shaft	2.77×10^{5}	1.11×10^{4}	5.54×10^{5}	2.21×10^{4}
70	Solid shaft	5.77×10^{5}	1.97×10^{4}	1.16×10^{6}	3.99×10^{4}
	Hollow shaft	5.07×10^{5}	1.74×10^{4}	1.01×10^{6}	3.49×10^{4}
85	Solid shaft	1.33×10^{6}	3.69×10^{4}	2.62×10^{6}	7.32×10^{4}
	Hollow shaft	1.11×10^{6}	3.10×10^{4}	2.22×10^{6}	6.20×10^{4}
100	Solid shaft	2.69×10^{6}	6.25×10^{4}	5.33×10^{6}	1.25×10^{5}
	Hollow shaft	2.18×10^{6}	5.10×10^{4}	4.37×10^{6}	1.02×10^{5}
120	Solid shaft	5.95×10^{6}	1.13×10^{5}	1.18×10^{7}	2.26×10^{5}
	Hollow shaft	5.28×10^{6}	1.01×10^{5}	1.06×10^{7}	2.02×10^{5}
150	Solid shaft	1.61×10^{7}	2.40×10^{5}	3.20×10^{7}	4.76×10^{5}
	Hollow shaft	1.40×10^{7}	2.08×10^{5}	2.79×10^{7}	4.16×10^{5}

Note: For the hole-shape of the hollow spline shaft, see pages b-23 and b-60 of the "THK General Catalog - Product Specifications."

4.7.2. Cross-sectional Characteristics of the Spline Shaft for Ball Spline Models LT, LF, LTR and LTR-A

Table 4 Cross-sectional Characteristics of the Spline Shaft for Models LT, LF, LTR and LTR-A

Nominal shaft diameter			I:Geometrical moment of inertia mm^4	Z : Section modulus mm^3	I_P :Polar geometrical moment of inertia mm^4	Z_P : Polar section modulus mm^3
4	Solid shaft		11.39	5.84	22.78	11.68
5	Solid shaft		27.88	11.43	55.76	22.85
6	Solid shaft		57.80	19.7	1.19×10^{2}	40.50
	Hollow shaft	Type K	55.87	18.9	1.16×10^{2}	39.20
8	Solid shaft		1.86×10^{2}	47.4	3.81×10^{2}	96.60
	Hollow shaft	Type K	1.81×10^{2}	46.0	3.74×10^{2}	94.60
10	Solid shaft		4.54×10^{2}	92.6	9.32×10^{2}	1.89×10^{2}
	Hollow shaft	Type K	4.41×10^{2}	89.5	9.09×10^{2}	1.84×10^{2}
13	Solid shaft		1.32×10^{3}	2.09×10^{2}	2.70×10^{3}	4.19×10^{2}
	Hollow shaft	Type K	1.29×10^{3}	2.00×10^{2}	2.63×10^{3}	4.09×10^{2}
16	Solid shaft		3.09×10^{3}	3.90×10^{2}	6.18×10^{3}	7.80×10^{2}
	Hollow shaft	Type K	2.97×10^{3}	3.75×10^{2}	5.95×10^{3}	7.51×10^{2}
		Type N	2.37×10^{3}	2.99×10^{2}	4.74×10^{3}	5.99×10^{2}
20	Solid shaft		7.61×10^{3}	7.67×10^{2}	1.52×10^{4}	1.53×10^{3}
	Hollow shaft	Type K	7.12×10^{3}	7.18×10^{2}	1.42×10^{4}	1.43×10^{3}
		Type N	5.72×10^{3}	5.77×10^{2}	1.14×10^{4}	1.15×10^{3}
25	Solid shaft		1.86×10^{4}	1.50×10^{3}	3.71×10^{4}	2.99×10^{3}
	Hollow shaft	Type K	1.75×10^{4}	1.41×10^{3}	3.51×10^{4}	2.83×10^{3}
		Type N	1.34×10^{4}	1.08×10^{3}	2.68×10^{4}	2.16×10^{3}
30	Solid shaft		3.86×10^{4}	2.59×10^{3}	7.71×10^{4}	5.18×10^{3}
	Hollow shaft	Type K	3.53×10^{4}	2.37×10^{3}	7.07×10^{4}	4.74×10^{3}
		Type N	2.90×10^{4}	1.95×10^{3}	5.80×10^{4}	3.89×10^{3}
32	Solid shaft		5.01×10^{4}	3.15×10^{3}	9.90×10^{4}	6.27×10^{3}
	Hollow shaft	Type K	4.50×10^{4}	2.83×10^{3}	8.87×10^{4}	5.61×10^{3}
		Type N	3.64×10^{4}	2.29×10^{3}	7.15×10^{4}	4.53×10^{3}
40	Solid shaft		1.22×10^{5}	6.14×10^{3}	2.40×10^{5}	1.21×10^{4}
	Hollow shaft	Type K	1.10×10^{5}	5.55×10^{3}	2.17×10^{5}	1.10×10^{4}
		Type N	8.70×10^{4}	4.39×10^{3}	1.71×10^{5}	8.64×10^{3}
50	Solid shaft		2.97×10^{5}	1.20×10^{4}	5.94×10^{5}	2.40×10^{4}
	Hollow shaft	Type K	2.78×10^{5}	1.12×10^{4}	5.56×10^{5}	2.24×10^{4}
		Type N	2.14×10^{5}	8.63×10^{3}	4.29×10^{5}	1.73×10^{4}
60	Solid shaft		6.16×10^{5}	2.07×10^{4}	1.23×10^{6}	4.14×10^{4}
	Hollow shaft	Type K	5.56×10^{5}	1.90×10^{4}	1.13×10^{6}	3.79×10^{4}
80	Solid shaft		1.95×10^{6}	4.91×10^{4}	3.90×10^{6}	9.82×10^{4}
	Hollow shaft	Type K	1.58×10^{6}	3.97×10^{4}	3.15×10^{6}	7.95×10^{4}
100	Solid shaft		4.78×10^{6}	9.62×10^{4}	9.56×10^{6}	1.92×10^{5}
	Hollow shaft	Type K	3.76×10^{6}	7.57×10^{4}	7.52×10^{6}	1.51×10^{5}

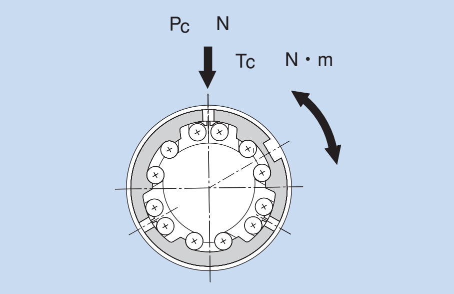
Note: For the hole-shape of the hollow spline shaft,
For type K: see pages b-47 and b-69 of the "THK General Catalog - Product Specifications."
For type N: see pages b-47 and b-69 of the "THK General Catalog - Product Specifications."

5. Estimating the Service Life

5.1. Rated Life

The service life of a Ball Spline varies from unit to unit even if they are manufactured through the same process and used in the same operating conditions. Therefore, the rated life defined below is normally used as a guidepost for obtaining the service life of a Ball Spline.

Rated life is the total travel distance that 90% of a group of identical ball splines independently operating under the same conditions can achieve without showing flaking (scale-like exfoliation on a metal surface).



5.2. Calculating the Rated Life

The rated life of a Ball Spline varies with types of loads applied during operation: torque load, radial load and moment load. The corresponding rated life values are obtained using the equations (7) to (10) below. (The basic load ratings in these loading directions are indicated in the dimensional table for the corresponding model number in the "THK General Catalog - Product Specifications," provided separately.)

5.2.1. When a Torque Load is Applied

$$L = \left(\frac{f_T \cdot f_C}{f_W} \cdot \frac{C_T}{T_C} \right)^3 \times 50 \quad \cdots\cdots\cdots(7)$$

5.2.2. When a Radial Load is Applied

$$L = \left(\frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C} \right)^3 \times 50 \quad \cdots\cdots\cdots(8)$$

L : Rated life (km)
C_T : Basic dynamic torque rating (N·m)
T_C : Calculated torque applied (N·m)
C : Basic dynamic load rating (N)
P_C : Calculated radial load (N)
f_T : Temperature factor (see Fig. 1 on page B-17)
f_C : Contact factor (see table 1 on page B-17)
f_W : Load factor (see table 2 on page B-17)

5.2.3. When a Torque Load and a Radial Load are Simultaneously Applied

When a torque load and a radial load are simultaneously applied, calculate the rated life by obtaining the equivalent radial load using the equation (9) below.

$$P_E = P_C + \frac{4 \cdot T_C \times 10^3}{i \cdot dp \cdot \cos\alpha} \quad \cdots\cdots\cdots(9)$$

P_E :Equivalent radial load (N)
$\cos\alpha$:Contact angle i=Number of rows of balls under a load

Type LBS $\alpha=45°$ $i=2$ (LBS10 or smaller)
$i=3$ (LBS15 or greater)
Type LT $\alpha=70°$ $i=2$ (LT13 or smaller))
$i=3$ (LT16 or greater)

dp :Ball center diameter (mm)
(See tables 3 and 4 on page B-18)

5.2.4. When a Moment Load is Applied with One Spline Nut or Two Spline Nuts in Close Contact with Each Other

Obtain the equivalent radial load using the equation (10) below.

$$\mathbf{P_u = K \cdot M} \qquad \cdots\cdots\cdots(10)$$

P_u : Equivalent radial load (N)
(with a moment applied)
K : Equivalent factor (table 5 on page B-21, table 6 on page B-22)
M : Applied moment (N•mm)
However, M should be within the range of the static permissible moment.

5.2.5. When a Moment Load and a Radial Load are Simultaneously Applied

Calculated the rated life from the sum of the radial load and the equivalent radial load.

5.2.6. Calculating the Service Life Time

When the rated life (L) has been obtained in the equation above, if the stroke length and the number of reciprocations are constant, the service life time is obtained using the equation (11) below.

$$\mathbf{L_h = \frac{L \times 10^3}{2 \times \ell_s \times n_1 \times 60}} \qquad \cdots\cdots\cdots(11)$$

L_h : Service life time (h)
ℓ_s : Stroke length (m)
n_1 : Number of reciprocations per minute (opm)

■f_T : Temperature factor

When the Ball Spline is used at an ambient temperature exceeding 100°C, the heat may adversely affect the performance of the Ball Spline. In such a case, the rated life must be multiplied by the corresponding temperature factor indicated on the right.
In addition, the Ball Spline must be of a high-temperature type.

Note: If the ambient temperature exceeds 80°C, high-temperature types of seal and retainer are required. Contact THK for details.

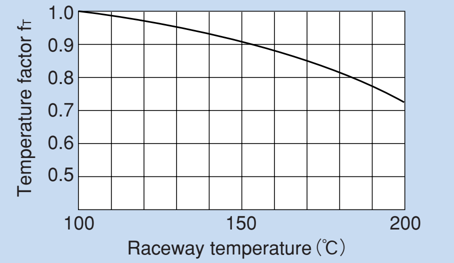


Fig. 1 Temperature Factor (f_T)

■f_C : Contact factor

When multiple spline nuts are used in close contact with each other, their linear motion is affected by moments and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in the table on the right.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in the table on the right.

Table 1 Contact Factor (f_C)

Number of spline nuts in close contact with each other	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is extremely difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when loads applied on a Ball Spline cannot be measured, or when speed and impact have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in the table of empirically obtained data on the right.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

Table 3 Sectional Shape of the Spline Shaft for Models LBS, LBST, LBF, LBR, LBH, LBG and LBGT

Unit: mm

Nominal shaft diameter	15	20	25	30	40	50	60	70	85	100	120	150
Minor diameter ϕd	11.7	15.3	19.5	22.5	31	39	46.5	54.5	67	81	101	130
Outer diameter ϕD_0	14.5	19.7	24.5	29.6	39.8	49.5	60	70	84	99	117	147
Ball center diameter ϕdp	15	20	25	30	40	50	60	70	85	100	120	150

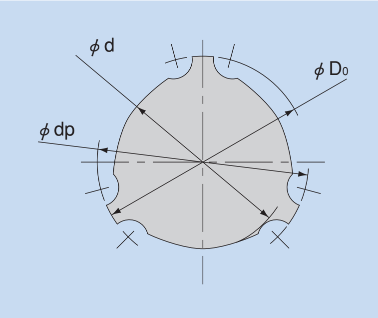
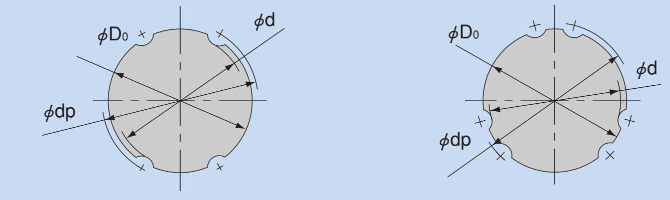


Table 4 Sectional Shape of the Spline Shaft for Models LT, LF, LTR and LTR-A

Unit: mm

Nominal shaft diameter	4	5	6	8	10	13	16	20	25	30	32	40	50	60	80	100
Minor diameter ϕd	3.5	4.5	5	7	8.5	11.5	14.5	18.5	23	28	30	37.5	46.5	56.5	75.5	95
Outer diameter ϕD_0	4	5	6	8	10	13	16	20	25	30	32	40	50	60	80	100
Ball center diameter ϕdp	4.6	5.7	7	9.3	11.5	14.8	17.8	22.1	27.6	33.2	35.2	44.2	55.2	66.3	87.9	109.5
Outer-diameter tolerance	0 −0.012			0 −0.015		0 −0.018		0 −0.021				0 −0.025		0 −0.03		0 −0.035



Nominal shaft diameter: 13 mm or less

Nominal shaft diameter: 16 mm or more

5.3. Calculating the Average Load

When the load applied on the spline shaft fluctuates according to varying conditions, such as an industrial robot arm traveling forward while holding a workpiece and traveling backward with empty weight, and a machine tool handling various workpieces, this varying load condition must be taken into account in service life calculation.

The average load (P_m) is a constant load under which the service life of an operating Ball Spline with its spline nut receiving a fluctuation load in varying conditions is equivalent to the service life under this varying load condition.

The following is the basic equation.

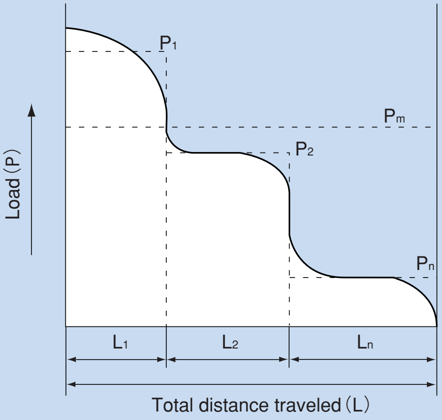
$$P_m = \sqrt[3]{\frac{1}{L}\cdot\sum_{n=1}^{n}\left(P_n^{3}\cdot L_n\right)}$$

P_m : Average load (N)
P_n : Varying load (N)
L : Total distance traveled (mm)
L_n : Distance traveled under P_n (mm)

① When the load fluctuates stepwise

$$P_m = \sqrt[3]{\frac{1}{L}\left(P_1^{3}\cdot L_1 + P_2^{3}\cdot L_2 \cdots\cdots + P_n^{3}\cdot L_n\right)} \quad \cdots\cdots\cdots\cdots(1)$$

P_m : Average load (N)
P_n : Varying load (N)
L : Total distance traveled (m)
L_n : Distance traveled under P_n (m)

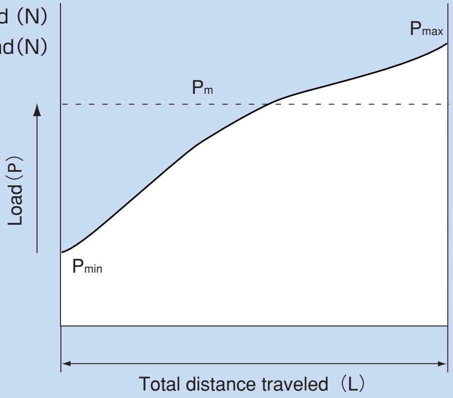


② When the load fluctuates monotonically

$$P_m \fallingdotseq \frac{1}{3}\left(P_{min} + 2 \cdot P_{max}\right) \quad \cdots\cdots\cdots\cdots(2)$$

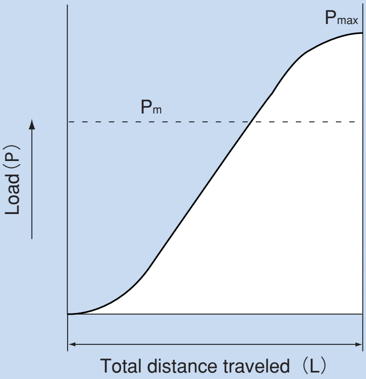
P_{min} : Minimum load (N)

P_{max} : Maximum load (N)

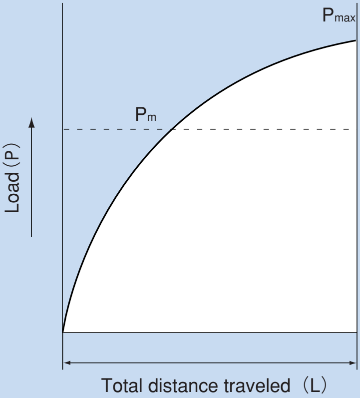


③ When the load fluctuates sinusoidally

a) $P_m \fallingdotseq 0.65P_{max}$ ············(3)



b) $P_m \fallingdotseq 0.75P_{max}$ ············(4)



5.4. Equivalent Factor

Table 5 below and table 6 on page B-22 show equivalent radial load factors calculated under a moment load.

5.4.1. Table of Equivalent Factors for Ball Spline Model LBS

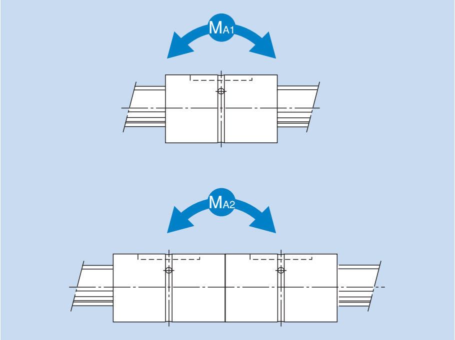


Table 5

Model No.	Equivalent factor: K	
	Single spline nut	Two spline nuts in close contact with each other
LBS 6	0.61	0.074
LBS 8	0.46	0.060
LBS 10	0.54	0.049
LBS 15	0.22	0.022
LBS 20	0.24	0.03
LBST 20	0.17	0.027
LBS 25	0.19	0.026
LBST 25	0.14	0.023
LBS 30	0.16	0.022
LBST 30	0.12	0.02
LBS 40	0.12	0.017
LBST 40	0.1	0.016
LBS 50	0.11	0.015
LBST 50	0.09	0.014
LBST 60	0.08	0.013
LBS 70	0.1	0.013
LBST 70	0.08	0.012
LBS 85	0.08	0.011
LBST 85	0.07	0.01
LBS 100	0.08	0.009
LBST 100	0.06	0.009
LBST 120	0.05	0.008
LBST 150	0.045	0.006

Note 1: Values of equivalent factor K for model LBF are the same as that for model LBS.

Note 2: Values of equivalent factor K for models LBR, LBG, LBGT and LBH are the same as that for model LBST. However, the values for model LBF60 are the same as that for model LBST60, and the values for model LBH15 are the same as that for model LBS15.

5.4.2 Table of Equivalent Factors for Ball Spline Model LT

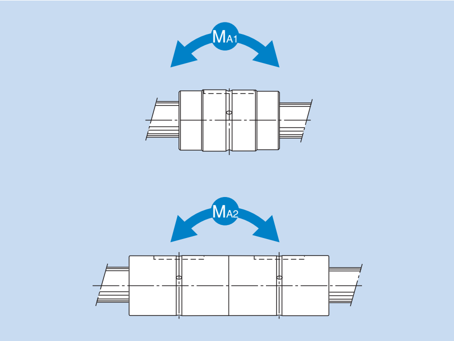


Table 6

Model No.	Equivalent factor: K	
	Single spline nut	Two spline nuts in close contact with each other
LT 4	0.65	0.096
LT 5	0.55	0.076
LT 6	0.47	0.06
LT 8	0.47	0.058
LT 10	0.31	0.045
LT 13	0.3	0.042
LT 16	0.19	0.032
LT 20	0.16	0.026
LT 25	0.13	0.023
LT 30	0.12	0.02
LT 40	0.088	0.016
LT 50	0.071	0.013
LT 60	0.07	0.011
LT 80	0.062	0.009
LT 100	0.057	0.008

Note: Values of equivalent factor K for model LF are the same as that for model LT.

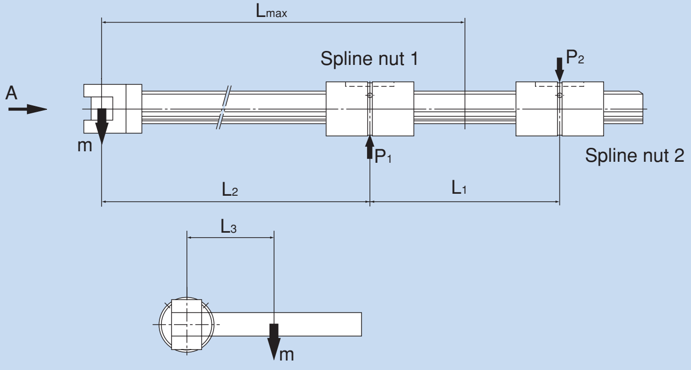
5.5. Example of Calculating the Service Life

5.5.1. Example of Calculation - 1

An industrial robot arm (horizontal)

[Service conditions]

Mass applied to the arm end	m	=50kg	Arm length at maximum stroke	L_{max}	=400mm
Stroke	ℓ_s	=200mm		L_2	=325mm
Spline nut mounting span (estimate)	L_1	=150mm		L_3	=50mm



Arrow view A (The Ball Spline type is LBS in this example.)

Fig. 2

Shaft Strength Calculation

Calculate the bending moment (M) and the torsion moment (T) applied on the shaft.

$M = m \times 9.8 \times L_{max} = 196000\text{N·mm}$

$T = m \times 9.8 \times L_3 = 24500\text{N·mm}$

Since the bending and torsion moments are applied simultaneously, obtain the corresponding bending moment (M_e) and torsion moment (T_e), and then determine the shaft diameter based on the greater value. From equations (3) and (4) on page B-9,

$$M_e = \frac{M + \sqrt{M^2 + T^2}}{2} \fallingdotseq 196762.7\text{N} \cdot \text{mm}$$

$$T_e = \sqrt{M^2 + T^2} \fallingdotseq 197525.3\text{N} \cdot \text{mm}$$

$$M_e < T_e$$

$$\text{From } \therefore T_e = \tau_a \times Z_P$$

$$Z_P = \frac{T_e}{\tau_a} \fallingdotseq 4031\text{mm}^3$$

Thus, judging from table 3 on page B-13, the nominal shaft diameter that meets Z_p is at least 40 mm.

Average Load P_m

Obtain an applied load value when the arm is extended to the maximum length (P_{max}), and another when the arm is contracted (P_{min}). Based on the values obtained, calculate the average load on the spline shaft nut.

$$P_{1max} = \frac{m \times 9.8\,(L_1+L_2)}{L_1} \fallingdotseq 1551.7\text{N}$$

$$P_{2max} = \frac{m \times 9.8 \times L_2}{L_1} \fallingdotseq 1061.7\text{N}$$

When the arm is contracted

$$P_{1min} = \frac{m \times 9.8 \times [(L_2 - \ell_s) + L_1]}{L_1} \fallingdotseq 898.3\text{N}$$

$$P_{2min} = \frac{m \times 9.8 \times (L_2 - \ell_s)}{L_1} \fallingdotseq 408.3\text{N}$$

As this load is monotonically varying as shown in the diagram on page B-20, calculate the average load using the equation (2) on page B-20.

The average load (P_{1m}) on spline nut 1:

$$P_{1m} \fallingdotseq \frac{1}{3}(P_{1min} + 2P_{1max}) = 1333.9\text{N}$$

The average load (P_{2m}) on spline nut 1:

$$P_{2m} \fallingdotseq \frac{1}{3}(P_{2min} + 2P_{2max}) = 843.9\text{N}$$

Obtain the torque applied on one spline nut.

$$T = \frac{m \times 9.8 \times L_3}{2} = 12250\text{N}\cdot\text{mm}$$

Since the radial load and the torque are simultaneously applied, calculate the equivalent radial load using equation (9) on page B-16.

$$P_{1E} = P_{1m} + \frac{4 \times T}{3 \times dp \times \cos\alpha} = 1911.4\text{N}$$

$$P_{2E} = P_{2m} + \frac{4 \times T}{3 \times dp \times \cos\alpha} = 1421.4\text{N}$$

Rated Life L_n

Based on the rated life equation (8) on page B-15, each rated life is obtained as follows.

Rated life of the spline nut 1: $L_1 = \left(\frac{f_T \times f_C}{f_W} \times \frac{C}{P_{1E}}\right)^3 \times 50 = 36598.9\text{km}$

Rated life of the spline nut 2: $L_2 = \left(\frac{f_T \times f_C}{f_W} \times \frac{C}{P_{2E}}\right)^3 \times 50 = 88996.8\text{km}$

f_T : Temperature factor = 1 (from Fig. 1 on page B-17)
f_C : Contact factor = 0.81 (from table 1 on page B-17)
f_W : Load factor = 1.5 (from table 2 on page B-17)
C : Basic dynamic load rating = 31.9 kN (model LBS40)

Given the rated life obtained for each spline nut above, the rated life of the Ball Spline unit is equal to that of spline nut 1, which is 36,598.9 km.

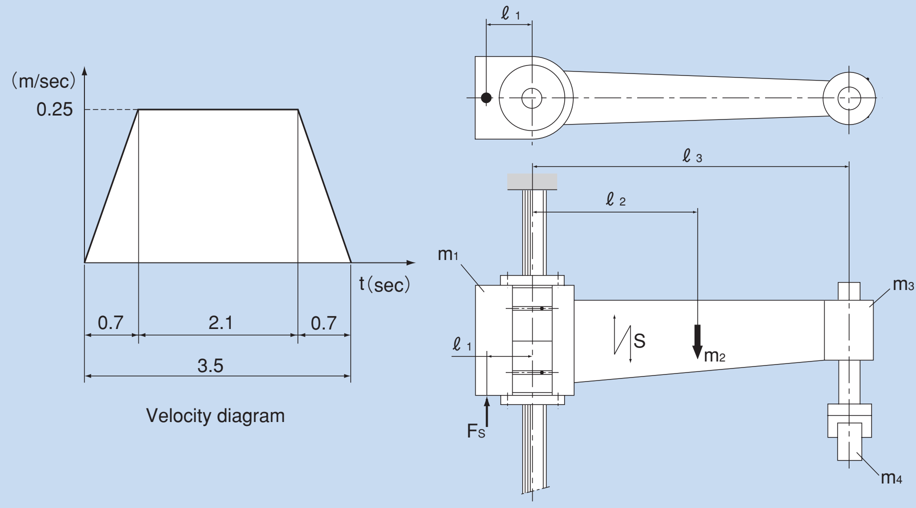
5.5.2. Example of Calculation - 2

[Service conditions]

Thrust position : F_S
Stroke speed : V_{max}=0.25m/sec
Acceleration : a=0.36m/sec^2
(from the respective velocity diagram)
Stroke : S=700mm
Housing mass : m_1=30kg
Arm mass : m_2=20kg
Head mass : m_3=15kg
Workpiece mass : m_4=12kg

Distance from the thrust position to each mass
ℓ_1= 200mm ℓ_2=500mm
ℓ_3=1276mm

Cycle (1 cycle: 30 sec)
1.Descent (3.5sec) 2. Stationary (1sec): with a workpiece
3.Ascend (3.5sec) 4. Stationary (7sec)
5.Descent (3.5sec) 6. Stationary (1sec): without a workpiece
7.Ascend (3.5sec) 8. Stationary (7sec)



Velocity diagram

(The Ball Spline type is LBF in this example.)

Fig. 3

Shaft Strength Calculation

Calculate the shaft strength while assuming the shaft diameter to be 60 mm (with two spline nuts in contact with each other).

Calculating the Moment (M_n) Applying on the Spline Nut during Acceleration, Uniform Motion and Deceleration with Different Masses (m_n)

Applied moment during acceleration : M_1

$$\mathbf{M_1 = m_n \times 9.8 \left(1 \pm \frac{a}{g}\right) \times \ell_n} \quad \cdots\cdots\cdots\text{(a)}$$

Applied moment during uniform motion : M_2

$$\mathbf{M_2 = m_n \times 9.8 \times \ell_n} \quad \cdots\cdots\cdots\text{(b)}$$

Applied moment during deceleration : M_3

$$\mathbf{M_3 = m_n \times 9.8 \left(1 \pm \frac{a}{g}\right) \times \ell_n} \quad \cdots\cdots\cdots\text{(c)}$$

m_n : Mass (kg)
a : Acceleration (m/sec^2)
g : Gravitational acceleration (m/sec^2)
ℓ_n : Offset from each loading point to the trust center (mm)

Assume:

$$A = \left(1 + \frac{a}{g}\right), \quad B = \left(1 - \frac{a}{g}\right)$$

●During descent

From equation (c),

$$M_{m1} = m_1 \times 9.8 \times B \times \ell_1 + m_2 \times 9.8 \times B \times (\ell_1 + \ell_2) + m_3 \times 9.8 \times B \times (\ell_1 + \ell_3)$$
$$= 398105.01\text{N} \cdot \text{mm}$$

From equation (b),

$$M_{m2} = m_1 \times 9.8 \times \ell_1 + m_2 \times 9.8 \times (\ell_1 + \ell_2) + m_3 \times 9.8 \times (\ell_1 + \ell_3)$$
$$= 412972\text{N} \cdot \text{mm}$$

From equation (a),

$$M_{m3} = m_1 \times 9.8 \times A \times \ell_1 + m_2 \times 9.8 \times A \times (\ell_1 + \ell_2) + m_3 \times 9.8 \times A \times (\ell_1 + \ell_3)$$
$$= 427838.99\text{N} \cdot \text{mm}$$

●During ascent

From equation (a),

$M_{m1}' = m_1 \times 9.8 \times A \times \ell_1 + m_2 \times 9.8 \times A \times (\ell_1 + \ell_2) + m_3 \times 9.8 \times A \times (\ell_1 + \ell_3)$

$= 427838.99\text{N} \cdot \text{mm}$

From equation (b),

$M_{m2}' = m_1 \times 9.8 \times \ell_1 + m_2 \times 9.8 \times (\ell_1 + \ell_2) + m_3 \times (\ell_1 + \ell_3)$

$= 412972\text{N} \cdot \text{mm}$

From equation (c),

$M_{m3}' = m_1 \times 9.8 \times B \times \ell_1 + m_2 \times 9.8 \times B \times (\ell_1 + \ell_2) + m_3 \times 9.8 \times B \times (\ell_1 + \ell_3)$

$= 398105.01\text{N} \cdot \text{mm}$

●During descent (with a workpiece loaded)

From equation (c),

$M_{m1}'' = M_{m1} + m_4 \times 9.8 \times B \times (\ell_1 + \ell_3)$

$= 565433.83\text{N} \cdot \text{mm}$

From equation (b),

$M_{m2}'' = M_{m2} + m_4 \times 9.8 \times (\ell_1 + \ell_3)$

$= 586549.6\text{N} \cdot \text{mm}$

From equation (a),

$M_{m3}'' = M_{m3} + m_4 \times 9.8 \times A \times (\ell_1 + \ell_3)$

$= 607665.37\text{N} \cdot \text{mm}$

●During ascent (with a workpiece loaded)

From equation (a),

$M_{m1}''' = M_{m1}' + m_4 \times 9.8 \times A \times (\ell_1 + \ell_3)$

$= 607665.37\text{N} \cdot \text{mm}$

From equation (b),

$M_{m2}''' = M_{m2}' + m_4 \times 9.8 \times (\ell_1 + \ell_3)$

$= 586549.6\text{N} \cdot \text{mm}$

From equation (c),

$M_{m3}''' = M_{m3}' + m_4 \times 9.8 \times B \times (\ell_1 + \ell_3)$

$= 565433.83\text{N} \cdot \text{mm}$

$\therefore M_1 = M_{m1} = M_{m3}' = 398105.01 \quad \text{N} \cdot \text{mm}$

$M_2 = M_{m2} = M_{m2}' = 412972 \quad \text{N} \cdot \text{mm}$

$M_3 = M_{m3} = M_{m1}' = 427838.99 \quad \text{N} \cdot \text{mm}$

$M_1' = M_{m1}'' = M_{m3}''' = 565433.83 \quad \text{N} \cdot \text{mm}$

$M_2' = M_{m2}'' = M_{m2}''' = 586549.6 \quad \text{N} \cdot \text{mm}$

$M_3' = M_{m3}'' = M_{m1}''' = 607665.37 \quad \text{N} \cdot \text{mm}$

Calculating the Equivalent Radial Load Considered to be Applied to the Spline Nut with Different Moments

Relational expression between moment M_n and P_n

$$\mathbf{P_n = M_n \times K} \quad \cdots\cdots\cdots(d)$$

P_n : Equivalent radial load (N)

M_n : Applied moment (N·mm)

K : Equivalent factor (from table 5 on page B-21) (If two spline nuts of LBF60 contact with each other, K = 0.013)

Calculate the equivalent radial load with different applied moments using equation (d).

$P_{m1} = P_{m3}{}' = M_1 \times 0.013 \doteqdot 5175.4N$

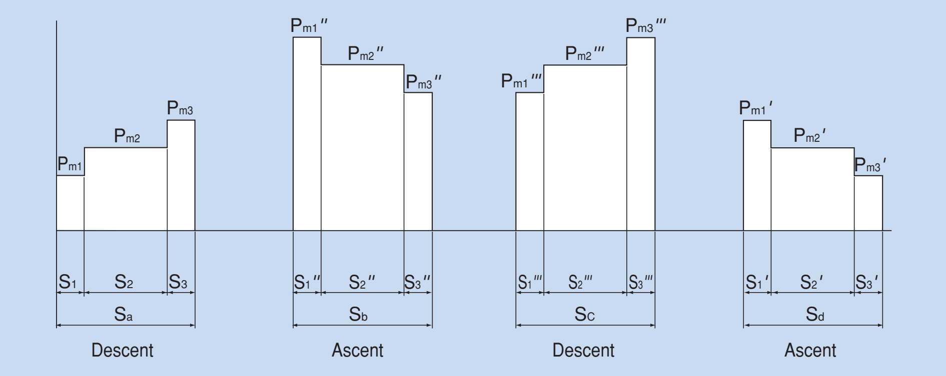
$P_{m2} = P_{m2}{}' = M_2 \times 0.013 \doteqdot 5368.6N$

$P_{m3} = P_{m1}{}' = M_3 \times 0.013 \doteqdot 5561.9N$

$P_{m1}{}'' = P_{m3}{}''' = M_1{}' \times 0.013 \doteqdot 7350.7N$

$P_{m2}{}'' = P_{m2}{}''' = M_2{}' \times 0.013 \doteqdot 7625.2N$

$P_{m3}{}'' = P_{m1}{}''' = M_3{}' \times 0.013 \doteqdot 7899.7N$



$P_1 = P_{m1} = P_{m3}{}' \doteqdot 5175.4N$

$P_2 = P_{m2} = P_{m2}{}' \doteqdot 5368.6N$

$P_3 = P_{m3} = P_{m1}{}' \doteqdot 5561.9N$

$P_4 = P_{m1}{}'' = P_{m3}{}''' \doteqdot 7350.7N$

$P_5 = P_{m2}{}'' = P_{m2}{}''' \doteqdot 7625.2N$

$P_6 = P_{m3}{}'' = P_{m1}{}''' \doteqdot 7899.7N$

$S = S_a = S_b = S_c = S_d = 700mm$

$S_1 = S_1 = S_1{}' = S_1{}'' = S_1{}''' = 87.5mm$

$S_2 = S_2 = S_2{}' = S_2{}'' = S_2{}''' = 525mm$

$S_3 = S_3 = S_3{}' = S_3{}'' = S_3{}''' = 87.5mm$

Calculating the Average Load P_m

Using equation (1) on page B-19,

$$P_m = \sqrt[3]{\frac{1}{4 \times S}\left[2\{(P_1^3 \times S_1) + (P_2^3 \times S_2) + (P_3^3 \times S_3)\} + 2\{(P_4^3 \times S_3) + (P_5^3 \times S_2) + (P_6^3 \times S_1)\}\right]}$$

$$\doteqdot 6689.5N$$

Calculating the Rated Life L from the Average Load

Using equation (8) on page B-15,

$$L = \left(\frac{f_T \cdot f_C}{f_W} \cdot \frac{C}{P_m}\right)^3 \times 50$$

$$= 7630km$$

f_T : Temperature factor = 1 (from Fig. 1 on page B-17)

f_C : Contact factor = 0.81 (from table 1 on page B-17)

f_W : Load factor = 1.5 (from table 2 on page B-17)

C : Basic dynamic load rating = 66.2 kN (model LBF60)

Given the result above, the rated life of model LBF60 with two spline nuts used in close contact with each other is 7,630 km.

6. Selecting a Preload

A preload on the Ball Spline significantly affects its accuracy, load resistance and rigidity. Therefore, it is necessary to select the most appropriate clearance according to the intended use.

Specific clearance values are standardized for each model, allowing you to select a clearance that meets the service conditions.

6.1. Clearance in the Rotation Direction

With the Ball Spline, the sum of clearances in the circumferential direction is standardized as the clearance in the rotational direction. For models LBS and LT, which are especially suitable for transmission of rotational torque, clearances in the rotational directions are defined.

Clearance in the rotational direction (BCD)

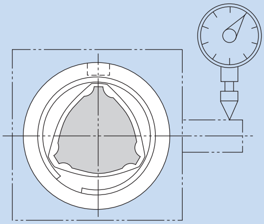


Fig. 1 Measurement of Clearance in the Rotational Direction

6.2. Preload and Rigidity

Preload is defined as the load preliminarily applied to the ball in order to eliminate angular backlash (clearance in the rotational direction) and increase rigidity.

When given a preload, the Ball Spline is capable of increasing its rigidity by eliminating the angular backlash according to the magnitude of the preload. Fig. 2 shows the displacement in the rotational direction when a rotational torque is applied.

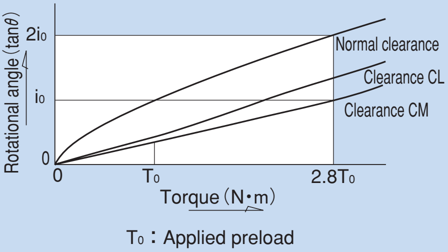


Fig. 2

Thus, the effect of a preload can be obtained up to 2.8 times that of the applied preload. When given the same rotational torque, the displacement when a preload is applied is 0.5 or less of that without a preload. The rigidity with a preload is at least twice greater than that without a preload.

6.3. Service Conditions and Selection of a Preload

Table 1 provides guidelines for selecting a clearance in the rotational direction with given service conditions of the Ball Spline.
The rotational clearance of the Ball Spline significantly affects the accuracy and rigidity of the spline nut.
Therefore, it is essential to select a correct clearance according to the intended use. Generally, the Ball Spline is preloaded during operation. When it is used in repeated circular motion or reciprocating linear motion, the Ball Spline is subject to a large vibration impact, and therefore, its service life and accuracy are significantly increased with a preload.

Table 1 Guidelines for Selecting a Clearance in the Rotational Direction for the Ball Spline

		Service conditions	Example of application
Clearance in rotational direction	CM	●High rigidity is required and vibration impact is present. ●Receives a moment load with a single spline nut.	Steering shaft of construction vehicle; shaft of spot-welding machine; indexing shaft of automatic lathe tool rest
	CL	●An overhang load or moment is present. ●High positioning accuracy is required. ●Alternating load is applied.	Industrial robot arm; automatic loaders; guide shaft of automatic coating machine; main shaft of electric discharge machine; guide shaft for press die setting; main shaft of drilling machine
	Normal	●Smooth motion with a small force is desired. ●A torque is always applied in the same direction.	Measuring instruments; automatic drafting machine; geometrical measuring equipment; dynamometer; wire winder; automatic welding machine; main shaft of horning machine; automatic packing machine

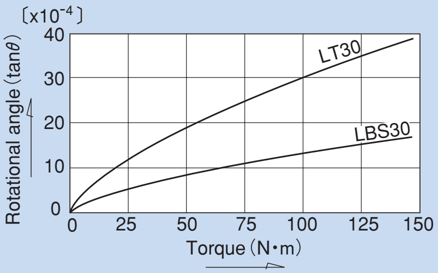


Fig. 3 Comparison between LBS and LT for Zero Clearance

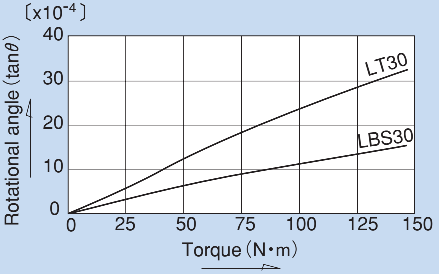


Fig. 4 Comparison between LBS and LT for Clearance CL

Table 2 Clearance in the Rotational Direction for Models LBS, LBF, LBST, LBR and LBH

Unit: μm

Symbol	Normal	Light preload	Medium preload
Nominal shaft diameter	No symbol	CL	CM
6 8	– 2 to +1	– 6 to – 2	
10 15	– 3 to +2	– 9 to – 3	–15 to – 9
20 25 30	– 4 to +2	–12 to – 4	–20 to –12
40 50 60	– 6 to +3	–18 to – 6	–30 to –18
70 85	– 8 to +4	–24 to – 8	–40 to –24
100 120	–10 to +5	–30 to –10	–50 to –30
150	–15 to +7	–40 to –15	–70 to –40

Table 3 Clearance in the Rotational Direction for Models LT and LF

Unit: μm

Symbol	Normal	Light preload	Medium preload
Nominal shaft diameter	No symbol	CL	CM
4 5 6 8 10 13	– 2 to +1	– 6 to – 2	
16 20	– 2 to +1	– 6 to – 2	– 9 to – 5
25 30	– 3 to +2	–10 to – 4	–14 to – 8
40 50	– 4 to +2	–16 to – 8	–22 to –14
60 80	– 5 to +2	–22 to –12	–30 to –20
100	– 6 to +3	–26 to –14	–36 to –24

Table 4 Clearance in the Rotational Direction for Models LBG and LBGT

Unit: μm

Symbol	Normal	Light preload	Medium preload
Nominal shaft diameter	No symbol	CL	CM
20 25 30	– 4 to +2	–12 to – 4	–20 to –12
40 50 60	– 6 to +3	–18 to – 6	–30 to –18
70 85	– 8 to +4	–24 to – 8	–40 to –24

Table 5 Clearance in the Rotational Direction for Model LTR

Unit: μm

Symbol	Normal	Light preload	Medium preload
Nominal shaft diameter	No symbol	CL	CM
8 10	– 2 to +1	– 6 to – 2	
16 20	– 2 to +1	– 6 to – 2	– 9 to – 5
25 32	– 3 to +2	–10 to – 4	–14 to – 8
40 50	– 4 to +2	–16 to – 8	–22 to –14
60	– 5 to +2	–22 to –12	–30 to –20

7. Determining the Accuracy

7.1. Accuracy Grades

The accuracy of the Ball Spline is classified into three grades: normal grade (no symbol), high grade (H) and precision grade (P), according to the run-out of spline nut circumference in relation to the support of the spline shaft. Fig. 1 shows measurement items.

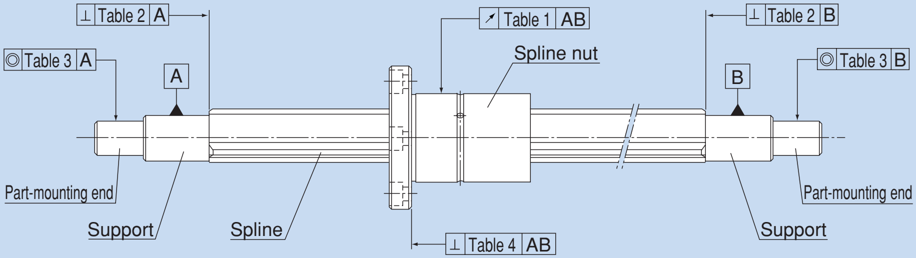


Fig. 1 Accuracy Measurement Items of the Ball Spline

7.2. Accuracy Standards

Tables 1 to 4 show measurement items of the Ball Spline.

Table 1 Run-out of the Spline Nut Circumference in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter / Overall spline shaft length (mm)		Run-out (max)																							
		4 to 8 (note)			10			13 to 20			25 to 32			40, 50			60 to 80			85 to 120			150		
Above	Or less	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision
–	200	72	46	26	59	36	20	56	34	18	53	32	18	53	32	16	51	30	16	51	30	16	–	–	–
200	315	133	(89)	–	83	54	32	71	45	25	58	39	21	58	36	19	55	34	17	53	32	17	–	–	–
315	400	–	–	–	103	68	–	83	53	31	70	44	25	63	39	21	58	36	19	55	34	17	–	–	–
400	500	–	–	–	123	–	–	95	62	38	78	50	29	68	43	24	61	38	21	57	35	19	46	36	19
500	630	–	–	–	–	–	–	112	–	–	88	57	34	74	47	27	65	41	23	60	37	20	49	39	21
630	800	–	–	–	–	–	–	–	–	–	103	68	42	84	54	32	71	45	26	64	40	22	53	43	24
800	1000	–	–	–	–	–	–	–	–	–	124	83	–	97	63	38	79	51	30	69	43	24	58	48	27
1000	1250	–	–	–	–	–	–	–	–	–	–	–	–	114	76	47	90	59	35	76	48	28	63	55	32
1250	1600	–	–	–	–	–	–	–	–	–	–	–	–	139	93	–	106	70	43	86	55	33	80	65	40
1600	2000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	128	86	54	99	65	40	100	80	50
2000	2500	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	156	–	–	117	78	49	125	100	68
2500	3000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	143	96	61	150	129	84

Note: Dimensions in parentheses do not apply to nominal shaft diameter of 4.
Note: Applicable to models LBS, LBST, LBF, LBR, LT and LF.

Table 2 Perpendicularity of the Spline Shaft End Face in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Perpendicularity (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4 5 6 8 10	22	9	6
13 15 16 20	27	11	8
25 30 32	33	13	9
40 50	39	16	11
60 70 80	46	19	13
85 100 120	54	22	15
150	63	25	18

Table 3 Concentricity of the Part-mounting in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Concentricity (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4 5 6 8	33	14	8
10	41	17	10
13 15 16 20	46	19	12
25 30 32	53	22	13
40 50	62	25	15
60 70 80	73	29	17
85 100 120	86	34	20
150	100	40	23

Table 4 Straightness of the Flange-mounting Surface of the Spline Nut in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Straightness (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
6 8	27	11	8
10 13	33	13	9
15 16 20 25 30	39	16	11
40 50	46	19	13
60 70 80 85	54	22	15
100	63	25	18

Note: This table does not apply to models LBG, LBGT, LTR and LTR-A.

7.3. Maximum Manufacturing Length by Accuracy

Tables 5 and 6 show the maximum manufacturing lengths of ball spline shafts by accuracy.

Table 5 Maximum Manufacturing Length of Models LBS, LBST, LBF, LBR, LBH, LBG and LBGT by Accuracy

Unit: mm

Nominal shaft diameter	Accuracy		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
6	200	150	100
8	300	200	150
10	500	400	300
15	1800	600	600
20	2500	700	700
25	3000	1400	1400
30	4200	1400	1400
40	4200	1400	1400
50	4200	1400	1400
60	3000	2500	2000
70	3000	2500	2000
85	3000	3000	3000
100	3000	3000	3000
120	3000	3000	3000
150	3000	3000	3000

Table 6 Maximum Manufacturing Length of Models LT, LF, LTR and LTR-A by Accuracy

Unit: mm

Nominal shaft diameter	Accuracy		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4	200	150	100
5	250	200	100
6	600	600	600
8	1000	1000	1000
10	1000	1000	1000
13	1000	1000	1000
16	1500	1500	1500
20	2000	2000	2000
25	3000	3000	3000
30	3000	3000	3000
40	3000	3000	3000
50	3000	3000	3000
60	3000	3000	2500
80	3000	3000	2500
100	3000	3000	3000

8. Selection According to the Service Environment

8.1. Lubrication

To prevent foreign matter from entering the spline nut and the lubricant from leaking, special synthetic resin seals with high wear resistance are available for the Ball Spline.
Spline nuts with seals (seal for both ends type UU, and seal for one end) contain high-quality lithium-soap group grease No. 2. However, if using them at high speed or with a long stroke, replenish grease of the same type through the greasing hole on the spline nut after running in.
Afterward, replenish grease of the same type as necessary according to the status of use.
The greasing interval differs depending on the service conditions. Normally, replenish the lubricant (or replace the product) roughly every 100 km of travel distance (six months to one year) as a rule of thumb.
For a Ball Spline model type without a seal, apply grease to the interior of the spline nut or to the raceways of the spline shaft.

8.2. Dust Prevention

Entrance of dust or other foreign matter into the spline nut will cause abnormal wear or shorten the service life. Therefore, it is necessary to prevent detrimental foreign matter from entering the Ball Spline. When entrance of dust or other foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions.

For the Ball Spline, a special synthetic rubber seal that is highly resistant to wear is available as a dust prevention accessory. If desiring a higher dust prevention effect, a felt seal is also available for some types.

In addition, THK produces round bellows. Contact us for details.

8.3. Material and Surface Treatment

Depending on the service environment, the Ball Spline requires anticorrosive treatment or a different material. For details of anticorrosive treatment and material change, contact THK .

9. Precautions on Using the Ball Spline

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting a spline nut or spline shaft may cause them to fall by their self-weights.
(3) Dropping or hitting the Ball Spline may damage it. Giving an impact to the Ball Spline could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, the lubricant may not be distributed throughout the product depending on the mounting orientation of the system. Contact THK for details.
(6) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(3) When planning to use the product in an environment where the coolant penetrates the spline nut, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.
(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Ball Spline, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

1. Features of the Linear Bush

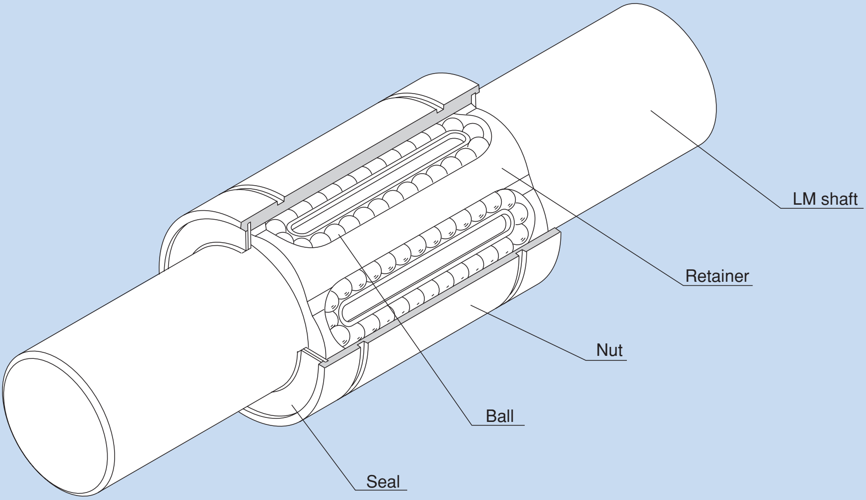


Fig. 1 Structure of Linear Bush Model LM···UU

1.1. Structure and Features of the Linear Bush

Linear Bush model LM is a linear motion system used in combination with a cylindrical LM shaft to perform infinite linear motion. The balls under a load are in point contact with the LM shaft. This allows linear motion with minimal friction resistance and achieves highly accurate and smooth motion despite, the small permissible load.
The nut uses high-carbon chromium bearing steel and its outer and inner surfaces are ground after being heat-treated.
The Linear Bush is used in a broad array of applications, such as slide units of precision equipment including OA equipment and peripherals, measuring instruments, automatic recorders and digital 3D measuring instruments, and industrial machines including multi-spindle drilling machine, punching press, tool grinder; automatic gas cutting apparatus; printing machine; card selector and food packing machine.

●Interchangeability

Since the dimensional tolerances of the Linear Bush's components are standardized, they are interchangeable. The LM shaft is machined through cylindrical grinding, which can easily be performed, and it allows highly accurate fitting clearance to be achieved.

●Highly accurate retainer plate

Since the retainer, which guides three to eight rows of balls, is integrally molded, it is capable of accurately guiding the balls in the traveling direction and achieving stable running accuracy.
Small-diameter types use integrally molded retainers made of synthetic resin. It reduces noise generated during operation and allows superb lubrication.

●Wide array of types

A wide array of types are available, such as standard type, clearance-adjustable type, open type, long type and flanged LM case unit, allowing the user to select a type that meets the intended use.

1.2. Types and Features of the Linear Bush

●Standard Type

With the Linear Bush nut having the most accurate cylindrical shape, this type is widely used.

There are two series of the Linear Bush in dimensional group.

Type LM	···········Millimeter-dimension series used most widely in Japan
Type LM-MG	······Stainless steel version of type LM
Type ME	···········Millimeter-dimension series commonly used in Europe

Standard type

●Open Type

The nut is partially cut open by one row of balls (50° to 80°). This enables the Linear Bush to be used even in locations where the LM shaft is supported by a column or fulcrum. In addition, a clearance can easily be adjusted.

Models LM-OP/LME-OP
Model LM-MG-OP

Open type

●Seal Type

This type has the same dimensions as the standard type, but a special synthetic rubber seal is incorporated into both ends or either end of the linear bush, thus to prevent foreign matter from entering the linear bush and minimize leaking of the grease.

Models LM···UU/LME···UU/LM···MGUU

(The symbol for type with its one side having a seal: "U")

A seal is also available for some of the clearance-adjustable types and the open types.

Seal type

●Clearance-adjustable Type

This type has the same dimensions as the standard type, but the nut has a slit in the direction of the LM shaft. This allows the linear bush to be installed in a housing whose inner diameter is adjustable, and enables the clearance between the LM shaft and the housing to easily be adjusted.

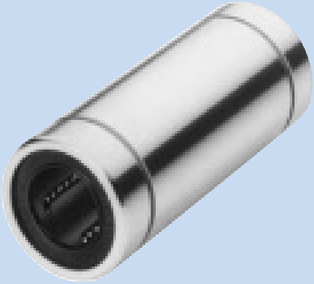
Models LM-AJ/LME-AJ
Model LM-MG-AJ

Clearance-adjustable Type

●Long Type

Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present and reduces man-hours in installation.

Model LM-L·········standard type



Long type model LM-L

●Flanged Type (Circular)

The nut of the standard type Linear Bush is integrated with a flange. This enables the Linear Bush to be directly mounted onto the housing with bolts, thus achieving easy installation.

Model LMF ·········standard type
Model LMF-M······made of stainless steel

Flanged type (circular)

●Flanged Type (Square)

Like model LMF, this type also has a flange, but the flange is cut to a square shape. Since the height is lower than the circular flange type, compact design is allowed.

Model LMK ·········standard type
Model LMK-M ···made of stainless steel

Flanged type (square)

●Flanged Type (Circular) - Long

The nut of the long type Linear Bush is integrated with a flange. This enables the Linear Bush to be directly mounted onto the housing with bolts, thus achieving easy installation. Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present.

Model LMF-L ······standard type
Model LMF-ML ···made of stainless steel

Flanged type (circular) - long

●Flanged Type (Square) - Long

Like model LMF-L, this type also has a flange, but the flange is cut to a square shape. Since the height is lower than the circular flange type, compact design is allowed.

Model LMK-L ······standard type
Model LMK-ML ···made of stainless steel

Flanged type (square) - long

●Flanged Type (Small)

The nut is integrated with a small flange. Since the height is lower than model LMK, compact design is allowed. Since the rows of balls in the Linear Bush are arranged so that two rows receive the load from the flat side, a long service life can be achieved.

Model LMH ·········standard type

Flanged type (small)

●Flanged Type (Small) - Long

The flange is smaller and lower than model LMK-L, allowing compact design. Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present. Since the rows of balls in the Linear Bush are arranged so that two rows receive the load from the flat side, a long service life can be achieved.

Model LMH-L ······standard type

Flanged type (small) - long

●LM Case Unit Type Model SC

It is a case unit where the standard type of Linear Bush is incorporated into a small, lightweight aluminum casing. This model can easily be mounted simply by securing it to the table with bolts.

LM case unit type model SC

●LM Case Unit Type (Long) Model SL

A long version of model SC, this model contains two units of the standard type Linear Bush in an aluminum casing.

LM case unit type (long) model SL

●LM Case Unit Type Model SH

It is a case unit where the standard type of Linear Bush is incorporated into a smaller and lighter aluminum casing than model SC. This model allows even more compact design than model SC. It also has flexibility in mounting orientation. Additionally, it is structured so that two rows of balls receive the load from the top of the casing, allowing a long service life to be achieved.

Flexibly mountable type

LM case unit type model SH

●LM Case Unit Type (Long) Model SH-L

A long version of model SH, this model is a case unit that contains two units of the standard type Linear Bush in an aluminum casing.

Flexibly mountable type

LM case unit type (long) model SH-L

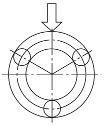
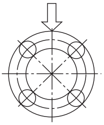
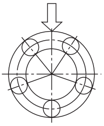
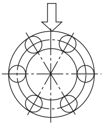
1.3. Rated Load and Rated Life

Rated Load

The rated load of the Linear Bush varies according to the position of balls in relation to the load direction. The basic load ratings indicated in the dimensional tables of the" THK General Catalog - Product Specifications," provided separately, each indicate the value when one row of balls receiving a load are directly under the load.

If the Linear Bush is mounted so that two rows of balls evenly receive the load in the load direction, the rated load changes as shown in table 1.

Table 1

Number of rows of balls	Ball position	Rated load
3 rows		1×C
4 rows		1.41×C
5 rows		1.46×C
6 rows		1.28×C

Note: For specific values for "C" above, see the respective dimensional table in the " THK General Catalog - Product Specifications," provided separately.

Calculating the Rated Life

The rated life of the Linear Bush is obtained using the following equation.

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C} \right)^3 \times 50$$

L : Rated life (km)

C : Basic dynamic load rating (N)

P_C : Calculated load (N)

f_T : Temperature factor (see Fig. 3)

f_C : Contact factor (see table 2 on page C-12)

f_W : Load factor (see table 3 on page C-12)

f_H : Hardness factor (see Fig. 2)

●When a Moment Load is Applied to a Single Nut or Two Nuts in Close Contact with Each Other

When a moment load is applied to a single nut or two nuts in close contact with each other, calculate the equivalent radial load at the time the moment is applied.

$$P_u = K \cdot M$$

P_u : Equivalent radial load (as moment applied) (N)

K : Equivalent factor (see tables 4 to 6 on page C-13)

M : Applied moment (N•mm)

However, "P_u" is assumed to be within the basic static load rating (C_0).

●When a Moment and a Radial Load are Applied Simultaneously

When a moment and a radial load are applied simultaneously, calculated the service life based on the sum of the radial load and the equivalent radial load.

■f_H : Hardness factor

To maximize the load capacity of the Linear Bush, the hardness of the raceways needs to be between 58 to 64 HRC.

If the hardness is lower than this range, the basic dynamic load rating and the basic static load rating decrease. Therefore, it is necessary to multiply each rating by the respective hardness factor (f_H).

Normally, f_H=1.0 since the Linear Bush has sufficient hardness.

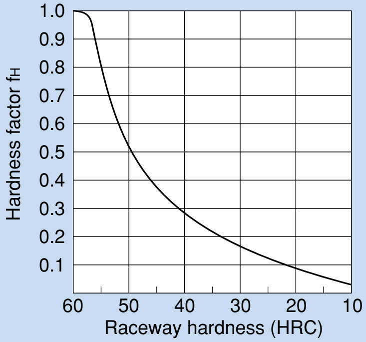


Fig. 2 Hardness factor (f_H)

■f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating Linear Bush exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in the figure on the right.

Also note that the Linear Bush itself must be of high-temperature type.

Note: If the ambient temperature exceeds 80℃, use a Linear Bush type equipped with metal retainer plates.

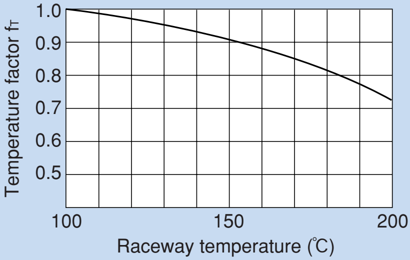


Fig. 3 Temperature factor (f_T)

■f_C : Contact factor

When multiple nuts are used in close contact with each other, their linear motion is affected by moments and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in the table on the right.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in the table on the right.

Table 2 Contact Factor (f_C)

Number of nuts in close contact with each other	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is extremely difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when loads applied on a Linear Bush cannot be measured, or when speed and impact have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in the table of empirically obtained data on the right.

Table 3 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations are constant, the service life time is obtained using the equation below.

$$L_h = \frac{L \times 10^3}{2 \times \ell_s \times n_1 \times 60}$$

L_h : Service life time (h)

ℓ_s : Stroke length (m)

n_1 : Number of reciprocations per minute (min^{-1})

1.4. Table of Equivalent Factors

Table 4 Equivalent Factors of Model LM

Model No.	Equivalent factor: K	
	Single nut	Two nuts in close contact with each other
LM 3	1.566	0.26
LM 4	1.566	0.21
LM 5	1.253	0.178
LM 6	0.553	0.162
LM 8S	0.708	0.166
LM 8	0.442	0.128
LM 10	0.389	0.101
LM 12	0.389	0.097
LM 13	0.343	0.093
LM 16	0.279	0.084
LM 20	0.257	0.071
LM 25	0.163	0.054
LM 30	0.153	0.049
LM 35	0.143	0.045
LM 38	0.127	0.042
LM 40	0.117	0.04
LM 50	0.096	0.032
LM 60	0.093	0.028
LM 80	0.077	0.022
LM 100	0.065	0.017
LM 120	0.051	0.015

Note: Equivalent factors for models LMF, LMK, LMH and SC are the same as that for model LM.

Table 5 Equivalent Factors of Model LM-L

Model No.	Equivalent factor: K
	Single nut
LM 3L	0.654
LM 4L	0.578
LM 5L	0.446
LM 6L	0.402
LM 8L	0.302
LM 10L	0.236
LM 12L	0.226
LM 13L	0.214
LM 16L	0.192
LM 20L	0.164
LM 25L	0.12
LM 30L	0.106
LM 35L	0.1
LM 40L	0.086
LM 50L	0.068
LM 60L	0.062

Note: Equivalent factors for models LMF-L, LMK-L and LMH-L are the same as that for model LM-L.

Table 6 Equivalent Factors of Model LME

Model No.	Equivalent factor: K	
	Single nut	Two nuts in close contact with each other
LME 5	0.669	0.123
LME 8	0.514	0.116
LME 12	0.389	0.09
LME 16	0.343	0.081
LME 20	0.291	0.063
LME 25	0.209	0.052
LME 30	0.167	0.045
LME 40	0.127	0.039
LME 50	0.105	0.031
LME 60	0.093	0.024
LME 80	0.077	0.018

1.5. Accuracy Standards

The accuracy of the Linear Bush in inscribed circle diameter, outer diameter, width and eccentricity is indicated in the respective dimensional table in the "THK General Catalog - Product Specifications," provided separately. The accuracy of mode LM in inscribed circle diameter and eccentricity is classified into high grade (no symbol) and precision grade (P). (Accuracy symbol is expressed at the end of the model number.)
The accuracy of clearance-adjustable types (-AJ) and open types (-OP) in inscribed circle diameter and outer diameter indicates the value before division.

1.6. Internal Dimensions of the Housing

Table 7 shows recommended housing inner-diameter tolerance for the Linear Bush. The fit between the Linear Bush and the housing is normally clearance fit. If desiring to minimize the clearance, use transition fit.

Table 7 Housing Inner-diameter Tolerance

Type		Housing	
Model No.	Accuracy	Clearance fit	Transition fit
LM	High grade (no symbol)	H7	J7
	Precision grade (P)	H6	J6
LME	—	H7	K6,J6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	High grade (no symbol)	H7	J7

1.7. Clearance between the Nut and the LM Shaft

When using the Linear Bush in combination with an LM shaft, use clearance fit in normal use and close clearance if the clearance is to be minimized.

Note 1: If setting the clearance after mounting the Linear Bush, it is preferable not to exceed the radial clearance tolerance in the dimensional table in "THK General Catalog - Product Specifications," provided separately.

Note 2: The shaft tolerance for case unit models SC, SL SH and SH-L falls under high grade (no symbol).

Table 8 Shaft Outer-diameter Tolerance

Type		LM Shaft	
Model No.	Accuracy	Normal clearance	Close clearance
LM	High grade (no symbol)	f6, g6	h6
	Precision grade (P)	f5, g5	h5
LME	—	h7	k6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	High grade (no symbol)	f6, g6	h6

1.8. Lubrication

The Linear Bush requires grease or oil as a lubricant for its operation.

Grease Lubrication

For types equipped with seals on both sides (…UU), apply grease on the balls trains of the Linear Bush before attaching it onto the LM shaft.
For standard types (without seal), do the same as above or apply grease on the LM shaft.
Afterward, replenish grease of the same type as necessary according to the status of use.
We recommend using high-quality lithium-soap group grease No. 2.

Oil Lubrication

In general, turbine oil, machine oil or spindle oil is used as a lubricant.
When replenishing the lubricant, drop it onto the LM shaft or feed it from the greasing hole on the housing as shown in Fig. 4.

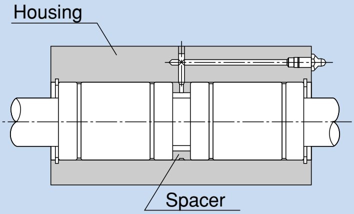


Fig. 4

1.9. Dust Prevention

Entrance of dust or other foreign matter into the Linear Bush will cause abnormal wear or shorten the service life. When entrance of dust or other foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions.

For the Linear Bush, a special synthetic rubber seal that is highly resistant to wear and a felt seal (with high dust prevention effect and low seal resistance) are available as dust prevention accessories.

In addition, THK produces round bellows. Contact us for details.

1.10. Material and Surface Treatment

Some types of the Linear Bush and the LM shaft are made of stainless steel, which is highly resistant to corrosion.

Although the LM shaft can be surface-treated, some types may not be suitable for the treatment. Contact THK for details.

2. Precautions on Using the Linear Bush

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the Linear Bush may damage it. Giving an impact to the Linear Bush could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(2) Do not mix lubricants of different physical properties.

(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(2) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(3) When planning to use the product in an environment where the coolant penetrates the Linear Bush, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.

(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.

(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Linear Bush, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the LM Stroke

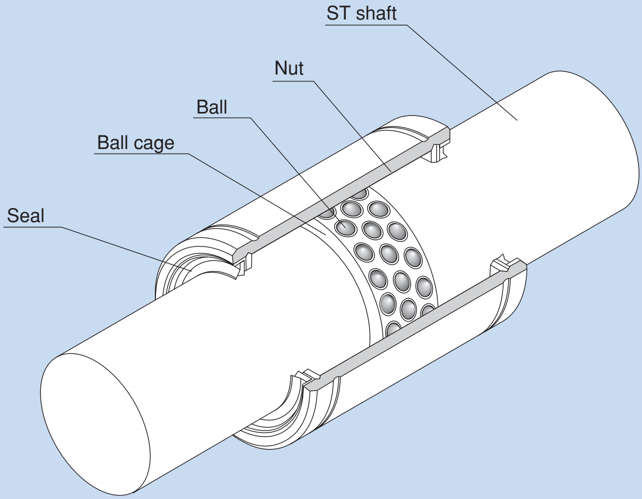


Fig. 1 Structure of LM Stroke Model ST

1.1. Structure and Features of the LM Stroke

LM Stroke model ST has a ball cage and balls both incorporated into a precision-ground cylindrical nut as shown in Fig. 1. The balls are arranged in zigzags so as to evenly receive a load. The ball cage is a drilled cage made of a light alloy with high rigidity, and capable of following high-speed motion. A thrust ring and a snap ring are installed on both sides of the inner surface of the nut to prevent the ball cage from overrunning.

This structure allows rotational motion, reciprocal motion and complex motion with a small friction coefficient. Model ST has a stroke length up to twice the range within which the ball cage can travel.

Since high accuracy can be obtained at a low price, this model is used in a broad array of applications such as press die setting, ink roll unit of printing machine, workpiece chuck unit of punching press, press feeder, work head of electric discharge machine, wound roll corrector, spinning and weaving machine, distortion measuring equipment, spindle of optical measuring instrument, and photocopiers.

●Minimal Friction Coefficient

The balls and the ball raceway are in point contact, which causes the smallest rolling loss, and the balls are individually retained in the ball cage. This allows the LM stroke to perform rolling motion at a minimal friction coefficient (μ=0.0006 to 0.0012).

●Compact Design

Since it consists only of a thin nut and balls, the outer diameter of the bearing is minimized and a light, space-saving, compact design is achieved.

●High Accuracy at a Low Price

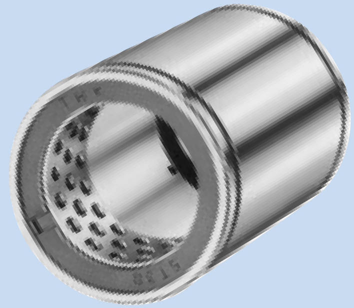
A highly accurate slide unit can be produced at a low price.

1.2. Types and Features of the LM Stroke

●Light Load Type Model ST

Model ST is a light load type that allows a long stroke.

Shaft diameter: φ6 to φ100



Model ST

●Medium Load Type Model ST-B

It has the same dimensions as model ST, but has a shorter stroke and achieves a rated load twice that of ST.

Shaft diameter: φ8 to φ100

Model ST-B

●Inner Ring Type Model STI

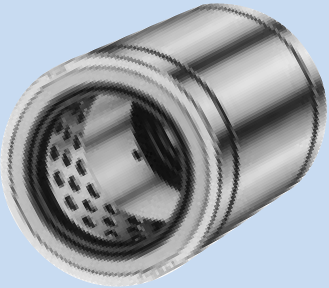
If the LM shaft cannot be hard quenched, STI allows an inner ring to be incorporated. The inner ring is available build-to-order.

Model STI

●Seal Type Models ST…UU/ST…UUB

A special synthetic rubber seal, attached to both ends of the nut, prevents foreign matter from entering the interior of the LM Stroke and grease from leaking.

When desiring lower seal resistance, a felt seal is available for some types (models ST…DD/ST…DDB).



Models ST…UU/ST…UUB

1.3. Rated Load and Rated Life

Rated Load

The basic load ratings for LM Stroke model ST are indicated in the respective dimensional tables of the "THK General Catalog - Product Specifications," provided separately.

Rated Life

The rated life of LM Stroke model ST is obtained using the following equation.

$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C}\right)^3$$

L :Rated life (rotating 10^6 times)
(The total number of revolutions that 90% of a group of identical LM strokes independently operating under the same conditions can achieve without showing flaking)
C :Basic dynamic load rating (kN)
P_C :Calculated radial load (kN)
f_H :Hardness factor (see Fig. 2 on page D-7)
f_T :Temperature factor (see Fig. 3 on page D-7)
f_C :Contact factor (see table 1 on page D-8)
f_W :Load factor (see table 2 on page D-8)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the number of revolutions per minute and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

●For Rotating Motion or Complex Motion

$$L_h = \frac{10^6 \times L}{60\sqrt{(dm \cdot n)^2 + (10 \times \alpha \cdot \ell_s \cdot n_1)^2}/dm}$$

●For Reciprocating Motion

$$L_h = \frac{10^6 \times L}{60 \times 10 \times \alpha \cdot \ell_s \cdot n_1 / \pi \cdot dm}$$

L_h :Service life time (h)
n :Number of revolutions per minute (min^{-1})
n_1 :Number of reciprocations per minute (min^{-1})
ℓ_s :Stroke length (mm)

dm :Pitch circle diameter (mm)
($dm \fallingdotseq 1.15 \times dr$)
dr :Ball inscribed circle diameter (mm)
α :Factor for cage material
(α=0.7)

Tolerance Value in Rotation and Reciprocating Speed

The permissible speed limit of LM Stroke model ST is obtained using the following equation.

$$DN \geqq dm \cdot n + 10 \times \ell_s \cdot n_1$$

For the DN value above, the following value applies as a standard value.

For oil lubrication: DN=600000

For grease lubrication: DN=300000

However, the following points must be taken into account.

$n_1 \leqq 5000$

$\ell_s \cdot n_1 \leqq 50000$

■f_H : Hardness factor

To maximize the load capacity of LM Stroke model ST, the hardness of the raceways needs to be between 58 to 64 HRC.

If the hardness is lower than this range, the basic dynamic load rating and the basic static load rating decrease. Therefore, it is necessary to multiply each rating by the respective hardness factor (f_H).

Normally, f_H=1.0 since LM Stroke model ST has sufficient hardness.

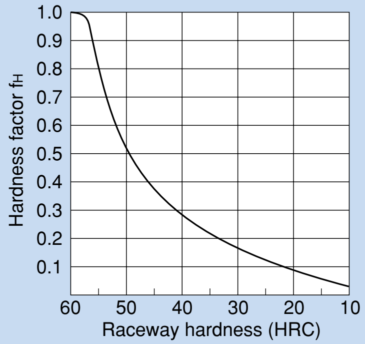


Fig. 2 Hardness factor (f_H)

■f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating LM Stroke model ST exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 3.

Note: If the ambient temperature exceeds 80℃, contact THK.

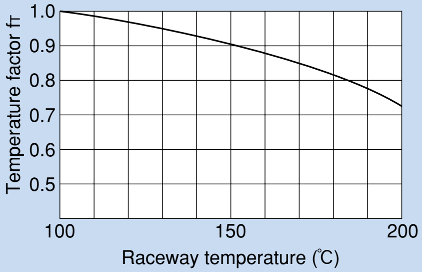


Fig. 3 Temperature Factor (f_T)

■f_C : Contact factor

When multiple nuts of LM Stroke model ST are used in close contact with each other, their linear motion is affected by moments and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in the table on the right.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in table 1.

Table 1 Contact Factor (f_C)

Number of nuts in close contact with each other	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when speed and vibrations have a significant influence, divide the basic dynamic load rating (C or C_0), by the corresponding load factor in table 2 of empirically obtained data.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

1.4. Accuracy Standards

The tolerance value in inscribed circle diameter (dr), nut outer diameter (D) and nut length (L) is indicated in the corresponding dimensional table.

The end of the nut may be deformed due to tension of the snap ring. Therefore, when measuring the nut outer diameter, it is necessary to calculate the measurement range using the following equation, and obtain the average diameter value within the range.

The tolerance value in the nut outer diameter is equal to the calculated average value of the maximum diameter and the minimum diameter obtained through two-point measurement of the outer diameter.

$$W = 4 + \frac{L}{8}$$

W : Length out of the measurement range (mm)
L : Nut length (mm)

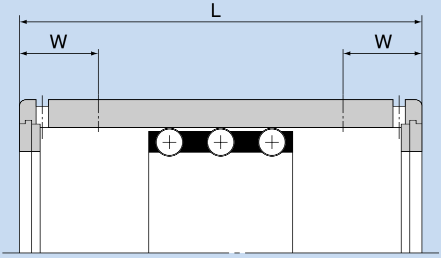


Fig. 4 Measurement Range of the Nut

1.5. Fitting

In theory, the ball cage of LM Stroke model ST moves in the same direction as the ST shaft by 1/2 of the shaft (or nut). However, to minimize the travel distance error caused by uneven load distribution or vibrations, it is necessary to reduce the clearance. If high accuracy is required or if the LM Stroke is used on a vertical shaft, we recommend setting the radial clearance between 0 and 10 μm.

Normal service conditions		Vertical shaft or high accuracy	
ST shaft	Housing	ST shaft	Housing
k5, m5	H6, H7	n5, p5	J6, J7

1.6. ST Shaft

With the ST shaft, used in LM Stroke model ST, balls roll directly on the shaft surface. Therefore, it is necessary to pay much attention to the hardness, surface roughness and dimensional accuracy when manufacturing it.

Since the hardness of the ST shaft has especially large impact on the service life, use much care in selecting a material and heat treatment method.

THK also manufactures high-quality ST shafts. Contact us for details.

●Material

The following materials are generally used as suitable for surface hardening through induction quenching.

SUJ2	(JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6	(JIS G 4401: carbon-tool steel)
S55C	(JIS G 4051: carbon steel for machine structural use)

●Hardness

We recommend surface hardness of 58 HRC (≒653 HV) or higher. The depth of the hardened layer is determined by the shaft diameter; we recommend approximately 2 mm for general use. The ST shaft can have a hardened inner ring attached on the shaft raceway.

●Roughness of the surface

To achieve smooth motion, the surface is normally finished to 0.40a or less. If higher wear resistance is required, finish the surface to 0.20a or less.

1.7. Installation of the ST Shaft

To install the ST shaft, drive it in to the designated depth. If the clearance is negative, a large driving force is required. However, do not forcibly hammer the shaft. Instead, apply a lubricant on the ST shaft first, and then gradually drive it in with a slight back action.

2. Features of the Miniature Stroke

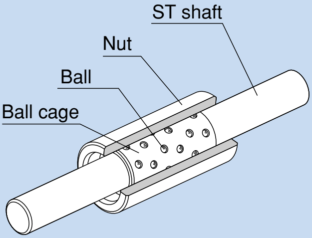


Fig. 1 Structure of Miniature Stroke Model MST

2.1. Structure and Features of the Miniature Stroke

Miniature Stroke model MST consists of an ST shaft, ball cage and nut. These components can freely be combined according to the application.

The sectional shape is small, the clearance is minimal and the motion is extremely light and smooth. Accordingly, model MST can be used in a variety of small, precision measuring equipment such as optic measuring instruments' spindle, pen plotter, OA equipment, computer terminals, automatic scale, digital length measuring machine and solenoid valve.

●Highly accurate bearing

Precision steel balls (sphericity in mutual difference: 0.0003 mm) compliant with JIS B 1501 are incorporated in a copper alloy ball cage to ensure high accuracy.

The ball cage serves to prevent the balls from falling off with a unique ball-retaining design.

●Highly durable bearing

The nut of the ST shaft uses a selected material, and is heat-treated and ground. In addition, the raceways are finished with ultra precision. The rows of balls are densely arranged in the ball cage, and the balls are placed so that the ball raceways do not overlap with each other. It enables this model to be used over a long period without wear and to demonstrate high durability.

●Compact bearing

Use of a combination of balls with a 1-mm diameter and a thin nut allows a small sectional shape and space-saving design.

●Bearing with extremely low frictional resistance

Since the balls are in point-contact with the raceways, rolling loss is minimal and rolling motion with low-friction is achieved.

2.2. Fitting

The inner surface of the housing must be finished to H6 to H7, and secured with an adhesive after the nut is inserted.
When press fitting is required, mounting the nut to the hole will reduce the inner diameter. Therefore, be sure to check the inner diameter after press fitting the nut and adjust the shaft diameter so that a correct preload is achieved. Also make sure that the preload must not exceed -2μm.

2.3. Travel Distance of the Ball Cage

The ball cage can travel by rolling up to 1/2 of the stroke length of the nut or the ST shaft in the same direction.

3. Features of the Die-setting Ball Cage

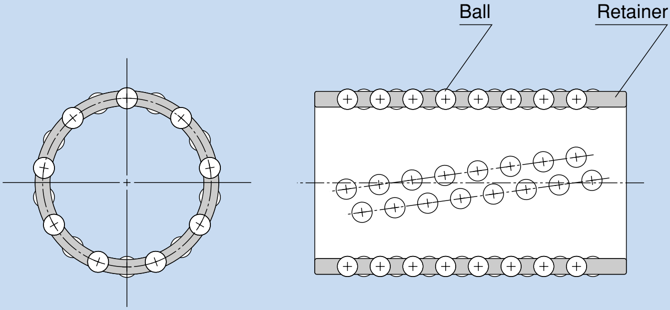


Fig.1 Structure of Die-setting Ball Cage Model KS

3.1. Structure and Features of the Die-setting Ball Cage

With Die-setting Ball Cage models KS and BS, a large number of precision steel balls (sphericity in mutual difference: 0.0005 mm) compliant with JIS B 1501 are incorporated in a lightweight, highly rigid ball cage. The balls are arranged along the circumference of the ball cage in spirals so that the ball raceways do not overlap with each other. It enables these models to be used over a long period without wear and to demonstrate high durability.

In addition, the ball pockets, which hold the balls, are finished with precision and continuously caulked with a unique process, enabling them to prevent the balls from falling. It allows the system to travel smoothly even if the ball cage is longer than the housing. These ball cages are used in precision press die set, spinning and weaving machine, precision measuring instrument, automatic recorder, medical equipment and various machine tools.

3.2. Rated Load and Service Life

The rated loads of Die-setting Ball Cage models KS and BS are indicated in the respective dimensional tables in the "THK General Catalog - Product Specifications," provided separately. Their service lives are obtained using the service life equation for LM Stroke model ST on page D-6.

3.3. Fitting

When using the Die-setting Ball Cage in the guide unit of the guide post of a precision press die set, normally select a negative clearance in order to increase the accuracy and the ball cage rigidity. Table 1 shows typical fitting between the hole and the shaft. Select a combination of a hole and a shaft so that the clearance does not exceed the tolerance value of the radial clearance indicated in the dimensional table the "THK General Catalog - Product Specifications," provided separately.

Table 1 Fitting between Holes and Shaft

Tolerance in hole dimensions: D	K 5
Tolerance in shaft dimensions: d	h 5

3.4. Installation of the Ball Cage

Fig. 2 shows examples of mounting the Die-setting Ball Cage.

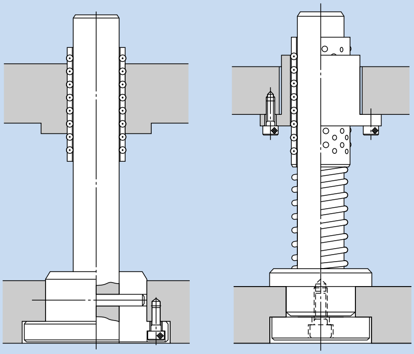


Fig. 2 Examples of Installation

4. Precautions on Using the LM Stroke

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the LM Stroke may damage it. Giving an impact to the LM Stroke could also cause damage to its function even if the product looks intact.

Lubrication

(1) LM Stroke model ST can use either oil or grease as a lubricant. Select either lubricant according to the DN value. When using grease, we recommend high-quality lithium-soap group grease No. 2.

(2) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(3) Do not mix lubricants of different physical properties.

(4) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(5) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter into LM Stroke model ST may cause abnormal wear or shorten the service life. When entrance of foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions. For LM Stroke model ST, a special synthetic rubber seal (ST···UU) that is highly resistant to wear and a felt seal with high dust prevention effect and low seal resistance (ST···DD) are available for some types as dust prevention accessories.

(2) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.

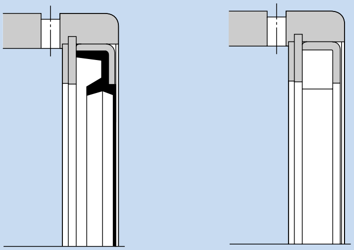

Rubber seal (standard)
Felt seal (designated)

Fig. 1 Types of the Seal for the LM Stroke

(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(4) When planning to use the product in an environment where the coolant penetrates the LM Stroke, contact THK in advance.

(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the LM Stroke, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Precision Linear Pack

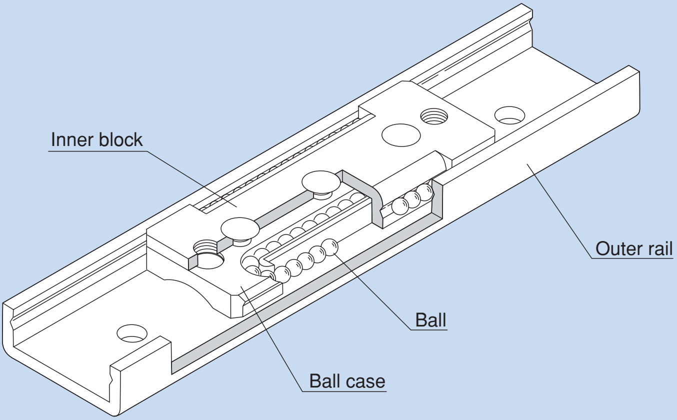


Fig. 1 Structure of Precision Linear Pack Model ER

1.1. Structure and Features of the Precision Linear Pack

Precision Linear Pack model ER is a slide unit using a stainless steel plate that is precision formed, heat-treated and then ground. It has a structure where balls rolls between the V-shaped grooves machined on the outer rail and the inner block to allow the system to slide. It is an ultra-thin, lightweight unit in which the balls circulate in a ball case incorporated in the inner block to perform infinite linear motion.

This model is used in extensive applications such as magnetic disc device, electronic equipment, semiconductor manufacturing machine, medical equipment, measuring equipment, plotting machine and photocopier.

●Reduced design and assembly costs

It provides a highly accurate linear guide system with lower design cost and fewer man-hours than the conventional miniature ball bearings used in precision machines and other equipment.

●Maintains long-term stability

It is a ball-circulating type slide unit with an extremely small friction coefficient. This slide unit maintains stable performance over a long period of time.

●Light weight, compact design and high-speed response

The outer rail and the inner block are composed of very thin stainless steel plates.

Since the linear pack is light, it has a small inertial moment and demonstrates superbly high-speed response.

1.2. Rated Load and Rated Life

Rated Loads in All Directions

The basic load rating in the dimensional table in the "THK General Catalog - Product Specifications," provided separately, indicates the rated load in the radial direction as shown in Fig. 2. The rated loads in the reverse-radial and lateral directions are obtained from table 1 below.

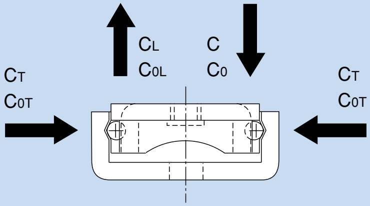


Fig. 2 Directions of the Rated Loads

Table 1 Rated Loads in All Directions

	Basic dynamic load rating	Basic static load rating
Radial direction	C (indicated in dimensional table in "THK General Catalog - Product Specifications,"	C_0(indicated in dimensional table in "THK General Catalog - Product Specifications," provided separately)
Reverse-radial direction	$C_L=C$	$C_{0L}=C_0$
Lateral direction	$C_T=1.47C$	$C_{0T}=1.73C_0$

Static Safety Factor f_S

Model ER may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

$$f_S = \frac{f_C \cdot C_0}{P_C}$$

where

f_S : Static safety factor (table 2)
f_C : Contact factor (see table 3 on page E-7)
C_0 : Basic static load rating (N)
P_C : Calculated load (N)

Reference value of static safety factor

The static safety factors indicated in table 2 are the lower limits of reference values in the respective service conditions.

Table 2 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 7

Rated Life

The rated life of Precision Linear Pack model ER is obtained using the following equation.

$$L = \left(\frac{f_C}{f_W} \cdot \frac{C}{P_C}\right)^3 \times 50$$

where

L	:Rated life (The total number of revolutions that 90% of a group of identical ER units independently operating under the same conditions can achieve without showing flaking)	(km)
C	:Basic dynamic load rating	(N)
P_C	:Calculated load	(N)
f_C	:Contact factor	(see table 3 on page E-7)
f_W	:Load factor	(see table 4 on page E-7)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \times \ell_S \times n_1 \times 60}$$

where

L_h	:Service life time	(h)
ℓ_S	:Stroke length	(mm)
n_1	:Number of reciprocations per minute	(min^{-1})

■f_C : Contact factor

When multiple inner blocks are used in close contact with each other, their linear motion is affected by a moment load and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in table 3.

Table 3 Contact Factor (f_C)

Number of inner blocks in close contact with each other	Contact factor f_C
2	0.81
3	0.72
Normal use 1	1

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied on model ER cannot be obtained, or when speed and vibrations have a significant influence, divide the basic dynamic load rating (C), by the corresponding load factor in table 4 of empirically obtained data.

Table 4 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$ m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$ m/s	1.2 to 1.5

1.3. Accuracy Standards

The running straightness of Linear Pack model ER is indicated in table 5 (see Fig. 3).

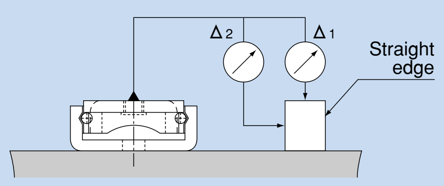


Fig. 3 Method for Measuring Running Straightness

Table 5 Running Straightness

Unit: mm

Stroke length		Running straightness of inner block in vertical directions Δ1	Running straightness of inner block in horizontal directions Δ2
Above	Or less		
–	20	0.002	0.004
20	40	0.003	0.006
40	60	0.004	0.008
60	80	0.005	0.010
80	100	0.006	0.012
100	120	0.008	0.016

1.4. Radial Clearance

The radial clearance of model ER means the value for the motion of the central part of the inner block when the inner block is slightly moved with a vertically constant force in the middle of the outer rail in the longitudinal direction. The negative values in table 6 indicate that the respective models are provided with a preload when assembled and have no clearance between their inner blocks and the outer rails.

Table 6 Radial Clearance

Unit: μm

Model No.	Radial clearance	
	Normal	C1
ER 513	±2	-2 to 0
ER 616	±2	-3 to 0
ER 920	±2	-4 to 0
ER 1025	±3	-6 to 0

2. Precautions on Using the Precision Linear Pack

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Precision Linear Pack may damage it. Giving an impact to the Precision Linear Pack could also cause damage to its function even if the product looks intact.
(3) Removing the inner block of the Precision Linear Pack from the outer rail or letting it overrun will cause balls to fall off.

Lubrication

(1) Thoroughly remove anti-corrosion oil with a cleaning detergent and apply lubricant before using the product. As the most suitable grease, we recommend THK AFC Grease, which maintains lubricity over a long period of time. For lubrication in a clean room, low dust generation THK AFE Grease and THK AFF Grease are recommended.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Installation

The mounting surface of Precision Linear Pack model ER must be finished to the maximum accuracy.
For securing the outer rail of models ER513 and ER613, also purchase and use No. 0 screws for precision equipment (see table 1) (if using ordinary screws, the inner block may hit the screw head).

Table 1 Outer Rail Securing Screws for Models ER513 and ER616

Model No.	Type	Nominal name of screw x pitch
ER513	No. 0 pan-head screw (class 1)	M2×0.4
ER616		M2.6×0.45

Japan Camera Industry Association Standard JCIS 10-70
Cross-recessed screw for precision equipment (No. 0 screw)

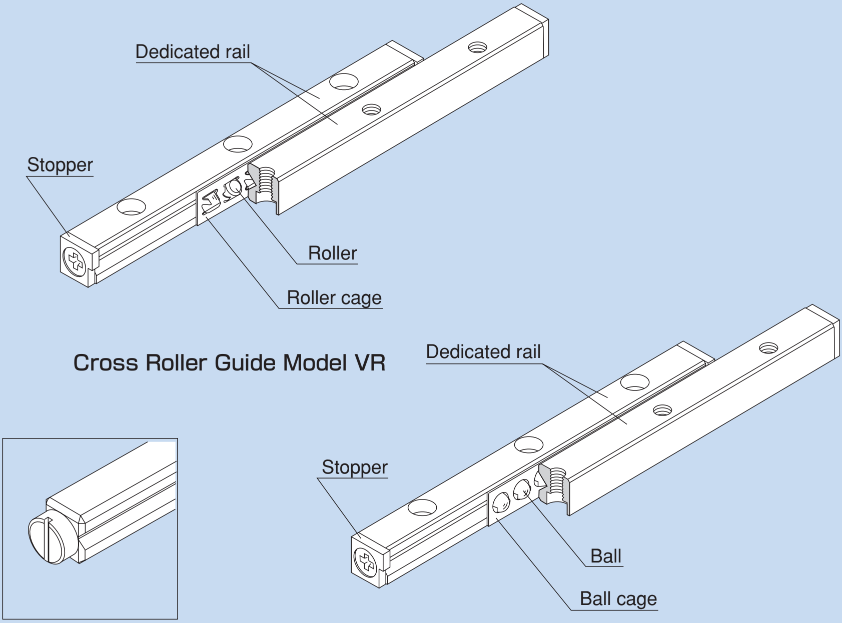
Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Precision Linear Pack, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Cross Roller Guide/Ball Guide



Cross Roller Guide Model VR

Stoppers of models V1 to V4 have round shapes.

Ball Guide Model VB

Fig. 1 Structure of Cross Roller Guide Model VR and Ball Guide Model VB

1.1. Structure and Features of the Cross Roller Guide/Ball Guide

In Cross Roller Guide model VR, precision rollers are orthogonally aligned one after another in a roller cage that is combined with a dedicated rail having a raceway cut into a V-shape groove. When two units of the Cross Roller Guide are mounted in parallel, the guide system is capable of receiving loads in all directions. In addition, since the Cross Roller Guide can be given a preload, a clearance-free, highly rigid and smooth slide mechanism is achieved.

The Cross Roller Guide is used in the slide unit of various devices such as OA equipment and its peripherals, measuring instruments, precision equipment including a printed-board drilling machine, optic measuring machine, optic stage, handling mechanism and X-ray machine.

Ball Guide model VB is a low-friction, high-accuracy, finite LM system consisting of precision steel balls, arranged in short pitches in a ball cage model B, and a dedicated rail model V.

●Long service life, high rigidity

With a unique roller retaining mechanism, the effective contact length of the rollers is 1.7 greater than the conventional type. Furthermore, the roller pitch interval is short and a sufficient number of rollers are installed, thus increasing the rigidity by twice and the service life by six times greater than the conventional type. As a result, a safety-oriented design against vibrations and impact, which commonly occur in ordinary linear motion mechanisms, can be achieved.

●Smooth motion

With Cross Roller Guide model VR, the rollers are individually held in a cage and roller pockets formed on the cage are in surface contact with the rollers to increase grease retention. Thus, smooth motion with little wear and friction is achieved.

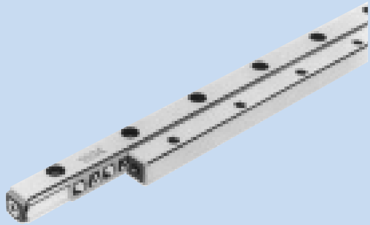
●High corrosion resistance

The Cross Roller Guide model VR series and the Ball Guide model VB series both include types made of stainless steel, which is highly resistant to corrosion.

1.2. Types and Features of the Cross Roller Guide/Ball Guide

●Cross Roller Guide Model VR

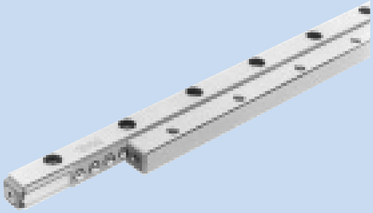
A compact, highly rigid LM system whose roller cage holding precision rollers orthogonally aligned one after another travels by half the stroke on a V-shaped groove formed on a rail.



Model VR

●Ball Guide Model VB

A low-friction, highly accurate LM system whose ball cage holding precision balls in short pitches travels by half the stroke on a V-shaped groove formed on a rail.



Model VB

1.3. Rated Load and Rated Life

Rated Loads in All Directions

The basic load ratings (C_Z and C_{0Z}) in the dimensional table in the "THK General Catalog - Product Specifications," provided separately, indicate the values per rolling element in the directions shown in Fig. 2. When obtaining the rated life, calculate the basic load ratings (C and C_0) of the actually used rolling elements from the equation below.

●For Cross Roller Guide Model VR

$$C = C_L = \left(\frac{Z}{2}\right)^{\frac{3}{4}} \times C_Z, \quad C_T = 2C$$

$$C_0 = C_{0L} = \frac{Z}{2} \times C_{0Z}, \quad C_{0T} = 2C_0$$

(For $\frac{Z}{2}$, truncate the decimals.)

●For Ball Guide Model VB

$$C = C_L = Z^{\frac{2}{3}} \times C_Z, \quad C_T = 2C$$

$$C_0 = C_{0L} = Z \times C_{0Z}, \quad C_{0T} = 2C_0$$

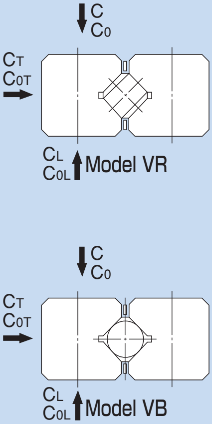


Fig. 2

C : Basic dynamic load rating (kN)
C_0 : Basic static load rating (kN)
C_Z : Basic dynamic load rating in the dimensional table in the "THK General Catalog - Product Specifications," provided separately (kN)
C_{0Z} : Basic static load rating in the dimensional table in the "THK General Catalog - Product Specifications," provided separately (kN)
Z : Number of rolling elements used (Number of rolling elements within the effective load range)

Static Safety Factor f_S

Models VR and VB may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

$$f_S = \frac{C_0}{P_C}$$

f_S : Static safety factor (table 1)
C_0 : Basic static load rating (kN)
P_C : Calculated load (kN)

Table 1 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3

Rated Life

When the basic dynamic load ratings have been obtained, the rated lives of Cross Roller Guide model VR and Ball Guide model VB are obtained using the following equations.

●For Model VR

$$L = \left(\frac{f_T}{f_W} \cdot \frac{C}{P_C} \right)^{\frac{10}{3}} \times 100$$

●For Model VB

$$L = \left(\frac{f_T}{f_W} \cdot \frac{C}{P_C} \right)^{3} \times 50$$

L : Rated life (km)
(The total number of revolutions that 90% of a group of identical VR (VB) units independently operating under the same conditions can achieve without showing flaking)
C : Basic dynamic load rating (kN)
P_C : Calculated load (kN)
f_T : Temperature factor (see Fig 3 on page F-8)
f_W : Load factor (see table 2 on page F-8)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \times \ell_S \times n_1 \times 60}$$

L_h : Service life time (h)
ℓ_S : Stroke length (mm)
n_1 : Number of reciprocations per minute (min⁻¹)

f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating model VR or VB exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 3.

Note: If the ambient temperature exceeds 100℃, contact THK.

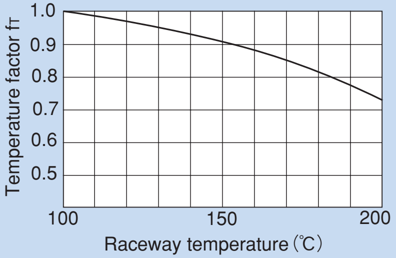


Fig. 3 Temperature Factor (f_T)

f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied on model VR or VB cannot be obtained, or when speed and vibrations have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 2 of empirically obtained data.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5

1.4. Accuracy Standards

The accuracy of the dedicated rail for the Cross Roller Guide is classified into high grade (H) and precision grade (P) as shown in table 3.

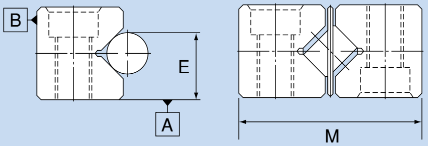


Fig. 4

Table 3 Accuracy Standards for Dedicated Rail Model V

Unite: mm

Accuracy symbol	High grade	Precision grade
Item / Symbol	H	P
Parallelism of the raceway against surfaces A and B	As per Fig. 5	
Dimensional tolerance in height E	±0.02	±0.01
Difference in height E (note)	0.01	0.005
Dimensional tolerance in width M	0 −0.2	0 −0.1

Note: The difference in height E applies to four rails used on the same plane.

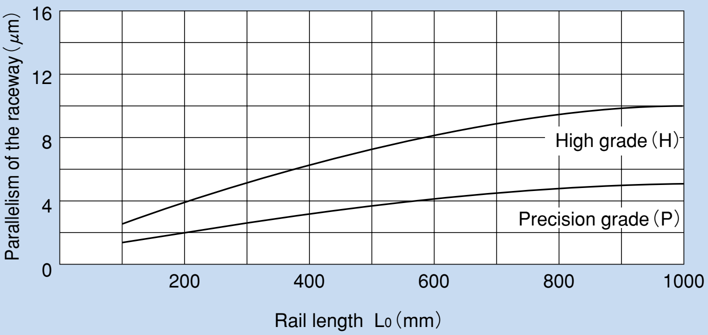


Fig. 5 Rail Length and Parallelism of the Raceway

2. Precautions on Using the Cross Roller Guide/Ball Guide

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the Cross Roller Guide/Ball Guide may damage it. Giving an impact to the Cross Roller Guide/Ball Guide could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(2) Do not mix lubricants of different physical properties.

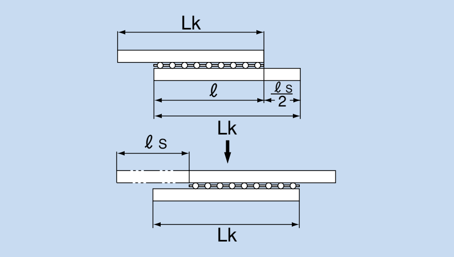
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

Rail Length

The roller cage and the ball cage move half the travel distance of the table in the same direction. To prevent the cage from overhanging from the raceway base when the cage length is "ℓ" and the stroke length is "ℓ_s," the rail length (Lk) must be at least the following.

$$Lk \geqq \ell + \frac{\ell_s}{2}$$



Offset of the Cage

The cage, which retains rollers (or balls), demonstrates extremely accurate motion. However, it may be offset as affected by driving vibrations, inertia or impact.

If using the Cross Roller Guide or Ball Guide in the following conditions, contact THK .

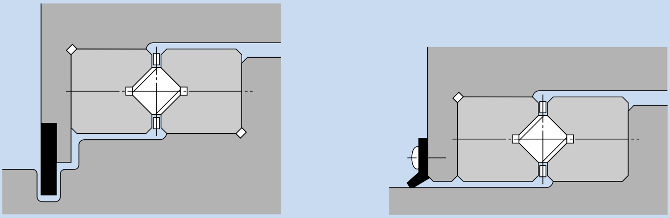
- Vertical use
- Pneumatic cylinder drive
- Cam drive
- High-speed crank drive
- Under a large moment load
- Butting the guide's external stopper with the table

Stopper

Stoppers are attached to the rail ends in order to prevent the cage from falling off. Note, however, that frequently colliding the cage with the stopper may cause wear of the stopper and loosening of the stopper fastening screws, and may cause the cage to fall off.

Dust Prevention

As a means to prevent foreign matter from entering the Cross Roller Guide or the Ball Guide, dust prevention accessories for the side faces as shown in Fig. 1 are available. For dust prevention in the front and rear directions, consider using a bellows or a telescopic cover.



Labyrinth cover   Wiper seal

Fig. 1 Dust Prevention Methods

Precautions on Use

(1) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(2) When desiring to use the system at temperature of 100℃ or higher, contact THK in advance.
(3) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Cross Roller Guide/Ball Guide, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Cross Roller Table

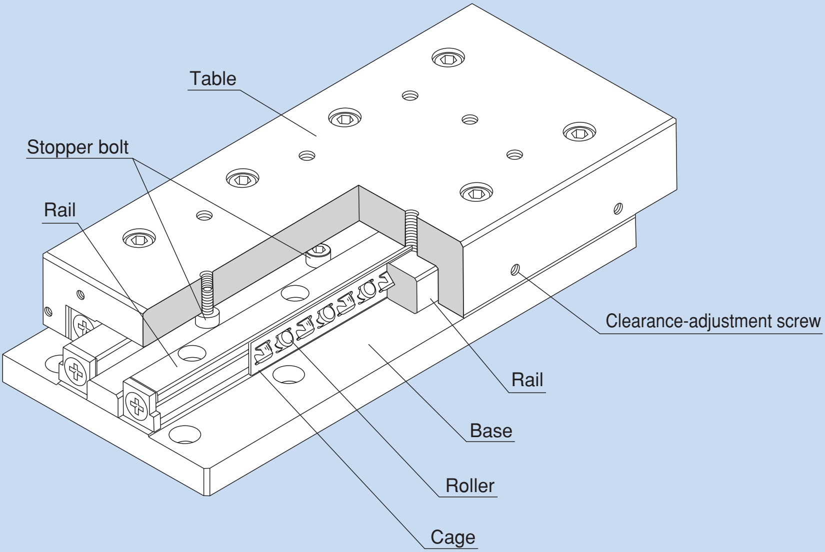


Fig. 1 Structure of the Cross Roller Table

1.1. Structure and Features of the Cross Roller Table

The Cross Roller Table is a compact, highly rigid finite linear guide unit that has the Cross Roller Guide(s) between the precision-machined table and base.

There are two types of the Cross Roller Table: model VRU, and a miniature type model VRT. The Cross Roller Table is used in extensive applications such as OA equipment and peripherals, measuring instruments and printed board drilling machine.

●Easy Installation

Since the Cross Roller Guide(s) is installed between the precision-machined table and base, a highly accurate linear guide mechanism is achieved simply by mounting the product with bolts.

●Large Permissible Load

Sine rollers with large rated loads are installed in short pitches, the cross roller guide is capable of bearing a heavy load, achieving a highly rigid linear guide mechanism and gaining a long service life.

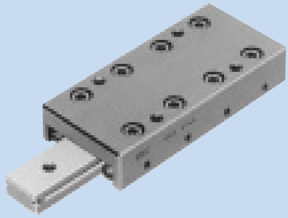
●Diversified Usage

Since the rollers are orthogonally arranged one after another, the guide system is capable of evenly receiving loads in all directions applied on the table (Fig. 2).

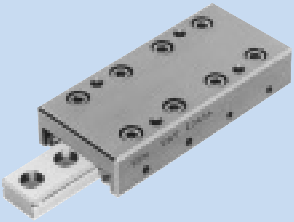
●High Corrosion Resistance

The base and the table of models VRT-M and VRT-AM use stainless steel. Their rails, rollers, roller cages and screws are also made of stainless steel. As a result, these guide systems have significantly high corrosion resistance.

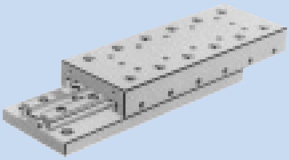
The base and the table of model VRU-M are made of aluminum.



Model VRT



Model VRT-A



Model VRU

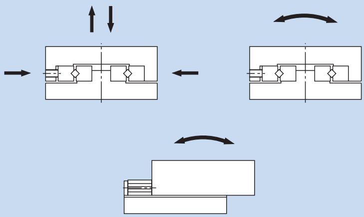


Fig. 2 Load Directions

1.2. Rated Load and Rated Life

Rated Loads in All Directions

The rated loads of models VRT, VRT-A and VRU are equal in four directions (radial, reverse-radial and lateral directions), and their values are expressed as C and C_0 in the corresponding dimensional tables in the "THK General Catalog - Product Specifications," provided separately.

Static Safety Factor f_S

The Cross Roller Table may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

$$f_S = \frac{C_0}{P_C} \text{ or } f_S = \frac{M_0}{M}$$

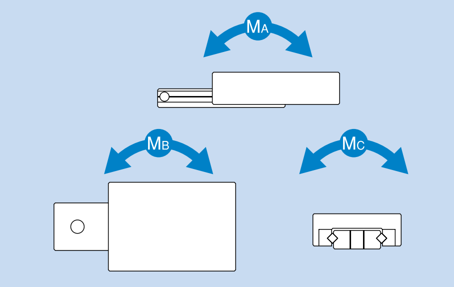
f_S : Static safety factor

C_0 : Basic static load rating (kN)

M_0 : Permissible static moment (M_A, M_B and M_C)

P_C : Calculated load (kN)

M : Calculated moment (kN)



■Reference value of static safety factor

The static safety factors indicated in table 1 are the lower limits of reference values in the respective service conditions.

Table 1 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3

Rated Life

The rated life of the Cross Roller Table is obtained using the following equation.

$$L = \left(\frac{f_T}{f_W} \cdot \frac{C}{P_C} \right)^{\frac{10}{3}} \times 100$$

L : Rated life (km)

(The total number of revolutions that 90% of a group of identical VRT, VRT-A or VRU units independently operating under the same conditions can achieve without showing flaking)

C : Basic dynamic load rating (kN)

P_C : Calculated load (kN)

f_T : Contact factor (see Fig. 3 on page G-7)

f_W : Load factor (see table 2 on page G-7)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

L_h : Service life time (h)

ℓ_s : Stroke length (mm)

n_1 : Number of reciprocations per minute (min^{-1})

f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating model VRT, VRT-A or VRU exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 3.

Note: If the ambient temperature exceeds 100℃, contact THK.

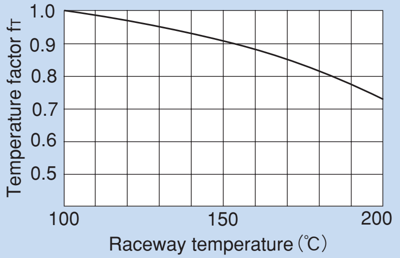


Fig. 3 Temperature Factor (f_T)

f_W : Load factor

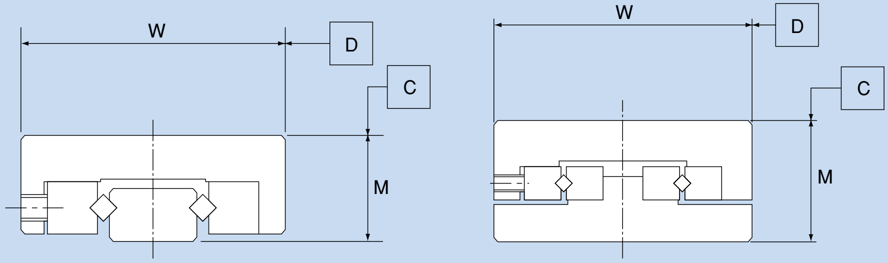
In general, reciprocating machines tend to involve vibrations or impact during operation. It is extremely difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied on model VRT, VRT-A or VRU cannot be obtained, or when speed and vibrations have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 2 of empirically obtained data.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5

1.3. Accuracy Standards

The dimensional tolerances of Cross Roller Table models VRT, VRT-A and VRU in height (M) and width (W), and the running accuracy of the base against the mounting surfaces $\boxed{C}$ and $\boxed{D}$ are indicated in the corresponding dimensional tables in the "THK General Catalog - Product Specifications," provided separately.



Models VRT and VRT-A

Model VRU

Fig. 4 Accuracy Standards

2. Precautions on Using the Cross Roller Table

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the Cross Roller Table may damage it. Giving an impact to the Cross Roller Table could also cause damage to its function even if the product looks intact.

Lubrication

(1) For lubrication of the Cross Roller Table, use lithium-soap group grease or oil according to the application, as with ordinary bearings.

(2) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(3) Do not mix lubricants of different physical properties.

(4) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(5) When planning to use a special lubricant, contact THK before using it.

Additional Machining of the Table and the Base

When additionally machining the table and the base of the Cross Roller Table according to the service conditions such as drilling mounting holes, adhere to the following precautions.

(1) Do not let cutting chips enter the Cross Roller Guide unit.

(2) Machine the mounting holes as blind holes, not though holes.

THK can perform additional machining such as mounting holes as requested.

The clearance of the Cross Roller Table is adjusted to the appropriate preload. Do not touch the clearance adjustment screw.

Offset of the Cage

The cage, which retains rollers (or balls), demonstrates extremely accurate motion. However, it may be offset as affected by driving vibrations, inertia or impact.

If using the Cross Roller Guide or Ball Guide in the following conditions, contact THK .

●Vertical use
●Pneumatic cylinder drive
●Cam drive
●High-speed crank drive
●Under a large moment load
●Butting the guide's external stopper with the table

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(2) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.

(3) When desiring to use the system at temperature of 100℃ or higher, contact THK in advance.

(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Cross Roller Table, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Linear Ball Slide

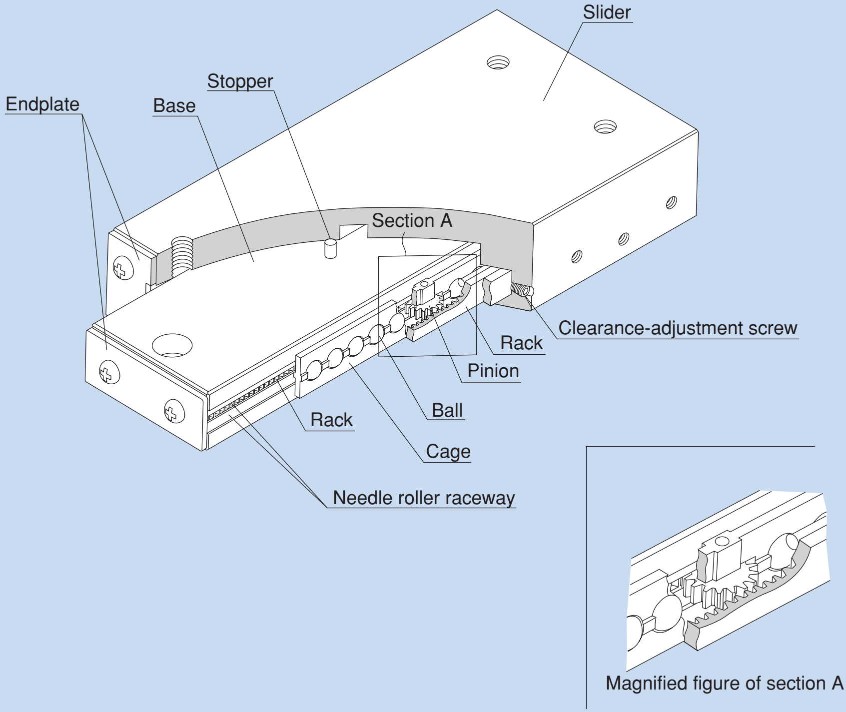


Fig. 1 Structure of Linear Ball Slide Model LSP

1.1. Structure and Features of the Linear Ball Slide

The Linear Ball Slide is a highly corrosion resistant slide unit that has an extremely low friction coefficient because stainless steel balls roll on four stainless steel needle roller raceways that are hardened and ground.
In addition, model LSP has a pinion gear in the center and a rack on the base to prevent the cage from slipping.
A ball slide equipped with a cylinder model LSC has a cylinder for drive in the base to downsize the system and reduce the space and the weight.
It components are all made of stainless steel, which is highly resistant to corrosion. Furthermore, since its inertia is small, the slide system is highly responsive to high speed.
By simply securing the Linear Ball Slide on the mounting surface, the user can easily achieve a linear guide mechanism. Thus, this slide system is optimal for locations requiring high accuracy, such as optic measuring machines, automatic recorder, small electronic-parts assembling machine, OA equipment and its peripherals.

●A Unit Type That Allows Easy Installation

The clearance and motion of the slider is adjusted to the best state. Therefore, a highly accurate slide mechanism can be gained by simply mounting the unit on the flat-finished mounting surface.

●Lightweight and Compact

A light aluminum alloy is used in the base and the slider to reduce the weight.

●Smooth Motion

The balls and the raceway (needle roller raceway) are in point contact, which causes the smallest rolling loss, and the balls are evenly retained in the ball cage. This allows the slide system to perform rolling motion at a minimal coefficient of friction (μ = 0.0006 to 0.0012).

●Highly Corrosion Resistant

The base and the slider are made of an aluminum alloy and their surfaces are anodized.
The balls, needle roller raceways and screws are made of stainless steel, making the system highly resistant to corrosion.

1.2. Types and Features of the Linear Ball Slide

●Linear Ball Slide with a Rack Model LSP

With Linear Ball Slide model LSP, the cage has a rack & pinion mechanism, thus to prevent the cage from slipping.

Also, since the cage does not slip even in vertical mount, this model is used in an even broader range of applications.

Note: Do not use the stopper as a mechanical stopper.

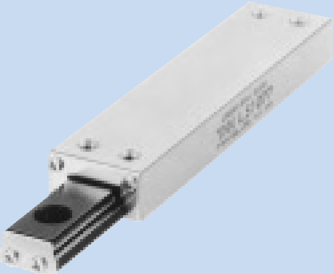
Model LSP

●Linear Ball Slide Model LS

Linear Ball Slide model LS is a unit-type linear system for finite motion that has a structure where balls are arranged between the base and the slider via a needle roller raceway.

It is incorporated with a stopper mechanism, thus to prevent damage deformation caused by collision between the cage and the end-plate.

Note: Do not use the stopper as a mechanical stopper.



Model LS

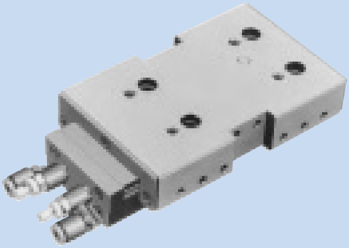
●Linear Ball Slide with a Cylinder Model LSC

Linear Ball Slide with a cylinder model LSC contains an air cylinder for drive inside the base. Feeding air from the two ports on the side face of the base allows the slide to perform reciprocating motion. Since the cylinder is of double-acting type, horizontal traveling speed can be adjusted using the speed controller. The cylinder and the piston are made of a corrosion resistant aluminum alloy, and their surfaces are specially treated to increase wear resistance and durability. Additionally, the cage has a rack & pinion mechanism, thus enabling the cage to operate without slipping.

Air-feeding ports for piping are provided on one side face, ensuring a certain degree of operability and easy assembly even if the installation site has a limited space and is complex.

The table on the right shows the specifications of the air cylinder incorporated in model LSC.

Note: Do not use the stopper as a mechanical stopper.



Model LSC

Cylinder specifications

Type of action:	double-acting
Fluid used:	air (un-lubricated)
Working pressure:	100 kPa to 700 kPa (1kgf/cm² to 7kgf/cm²)
Stroke speed:	50 to 300 mm/s

■Speed Controller

Fig. 2 shows the shape of the speed controller.

Note: The speed controller is optional.
(control method: meter-out)

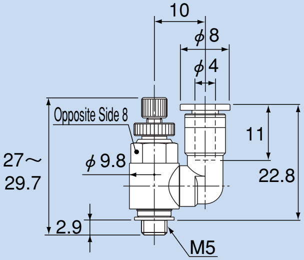


Fig. 2 Shape of the Speed Controller (common to all model numbers)

■Dedicated Unit Base Model B

With Linear Ball Slide model LSC, a limit switch for detecting the stroke end can be mounted using a dedicated unit base (Fig. 3). When fine positioning is required, a dedicated stopper can be mounted on the unit base to adjust the position (model LSC1015 is attached with the unit base as standard).

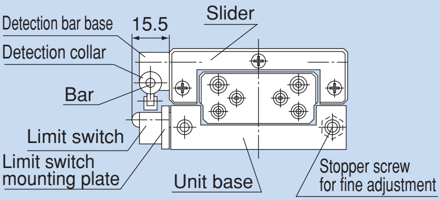


Fig. 3 Unit Base and Limit Switch Installation

1.3. Rated Load and Rated Life

Rated Loads in All Directions

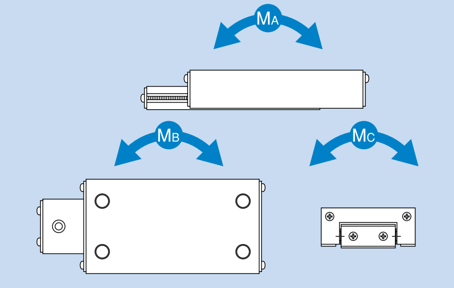
The rated loads of Linear Ball Slide models LS, LSP and LSC are identical in the vertical and horizontal directions.

Static Safety Factor f_S

Linear Ball Slide models LS, LSP or LSC may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

$$f_S = \frac{C_0}{P_C} \text{ or } f_S = \frac{M_0}{M}$$

f_S : Static safety factor
C_0 : Basic static load rating (N)
M_0 : Permissible static moment (M_A, M_B and M_C) (N·m)
P_C : Calculated load (N)
M : Calculated moment (N·m)



Reference value of static safety factor

The static safety factors indicated in table 1 are the lower limits of reference values in the respective service conditions.

Table 1 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 7

Rated Life

The service life of the Linear Ball Slide is obtained using the following equation.

$$L = \left(\frac{1}{f_W} \cdot \frac{C}{P_C}\right)^3 \times 50$$

L : Rated life (km)

(The total number of revolutions that 90% of a group of identical Linear Ball Slide units independently operating under the same conditions can achieve without showing flaking)

C : Basic dynamic load rating (N)

P_C : Calculated load (N)

f_W : Load factor (see table 2)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \times \ell_S \times n_1 \times 60}$$

L_h : Service life time (h)

ℓ_S : Stroke length (mm)

n_1 : Number of reciprocations per minute (min^{-1})

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied on model VR or VB cannot be obtained, or when speed and vibrations have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 2 of empirically obtained data.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5

1.4. Accuracy Standards

The accuracies of Linear Ball Slide models LS, LSP and LSC are defined as follows.

Running parallelism of the top face of the slide
:0.010mm MAX/10mm

Positioning repeatability of the top face of the slide
:0.0015mm MAX

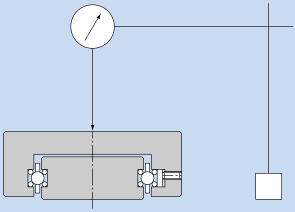


Fig. 4 Accuracy Standards

2. Precautions on Using the Linear Ball Slide

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Linear Ball Slide may damage it. Giving an impact to the Linear Ball Slide could also cause damage to its function even if the product looks intact.

Lubrication

(1) Apply lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) If foreign matter adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(5) The Linear Ball Slide is incorporated with a stopper mechanism that prevents the slider from coming off. If impact is given, the stopper may be damaged. Do not use this stopper as a mechanical stopper.

Storage

When storing the Linear Ball Slide, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the LM Roller

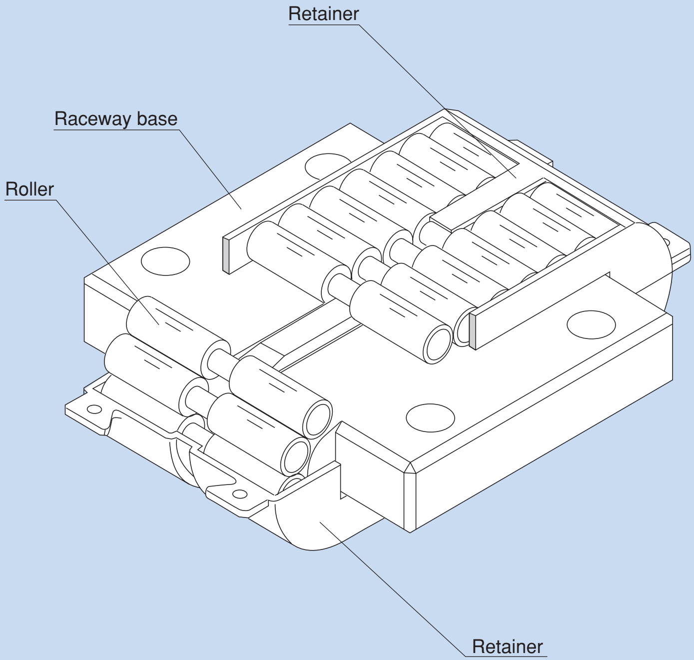


Fig. 1 Structure of LM Roller Model LR

1.1. Structure and Features of the LM Roller

In the LM Roller, dual rollers assembled on the circumference of the precision-ground, rigid raceway base travel in infinite circulation while being held by a retainer. A center guide integrated with the raceway base is formed in the central part of the loaded area of the raceway base to constantly correct skewing of the rollers. This unique structure ensures smooth rolling motion. The LM Roller is used in applications such as the XYZ guide of NC machine tools, precision press ram guides, press dies changers and heavy-load conveyance systems.

●Supports an Ultra Heavy Load and Ensures Smooth Motion

The LM Roller is compact and capable of carrying a heavy load, and one unit of model LR50130 (length: 130 mm; width: 82 mm; height: 42 mm) is capable of receiving a 255-kN load. Moreover, because of rolling motion, this model has a low friction coefficient (μ= 0.005 to 0.01) and is free from stick slip, thus to achieve highly accurate linear motion.

●High Combined Accuracy

In general, when supporting a single plane with LM rollers, multiple units of LM rollers are combined on the same plane, and therefore, the height difference between the rollers significantly affects the machine accuracy's and service life. With THK LM Roller, the user can select a combination of models with a height difference of up to 2 μm.

●Rational Skewing-preventing Structure

With an LM system using rollers, once the rollers skew, it increases friction resistance or decreases running accuracy.

To prevent skewing, THK LM Roller has roller guides on the center of the retainer full circle, and in the center of the loaded area on the raceway base. This structure enables the LM Roller to automatically correct skewing caused by a mounting accuracy error and the rollers to travel in an orderly manner. It also allows the LM Roller to be installed with slant mount or wall mount while demonstrating high performance.

1.2. Types and Features of the LM Roller

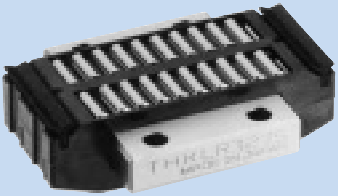
●Model LR

This model is designed to be fit into a groove machined on the mounting surface. By screwing bolts into four holes on the raceway base, it is secured on the mounting surface (fixtures SM and SE are also available).

Model LR

●Model LR-Z

A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LR. Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.



Model LR-Z

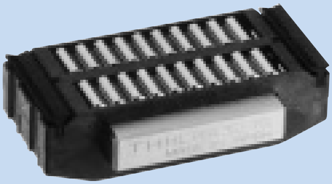
●Model LRA

Just like model LR, this model is also designed to be fit into a groove. It is a compact type that can be mounted using fixture SM or SE and bolts.

Model LRA

●Model LRA-Z

A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LRA. Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.



Model LRA-Z

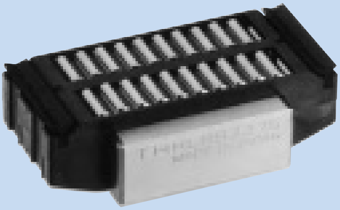
●Model LRB

Since this model does not require a groove on the mounting surface, man-hours for machining can be reduced. It can be mounted using fixture SMB or SE and bolts.

Model LRB

●Model LRB-Z

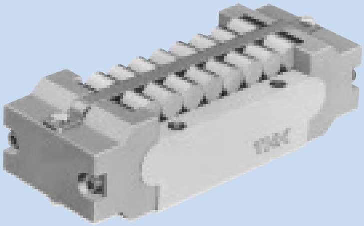
A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LRB. Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.



Model LRB-Z

●Model LRU

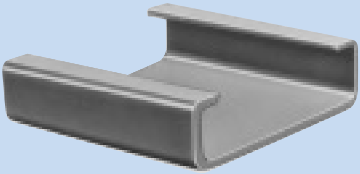
Since this model does not require a groove on the mounting surface, man-hours for machining can be reduced. By screwing bolts into four holes on the raceway base, it is secured on the mounting surface.



Model LRU

●Spring Pad Model PA

By attaching this spring pad to the back of the LM Roller as shown in Fig. 5-ⓐ on page i-10 in the "THK General Catalog - Product Specifications," provided separately, and turning the adjustment bolt, adjustment of a clearance and a preload can easily be done.

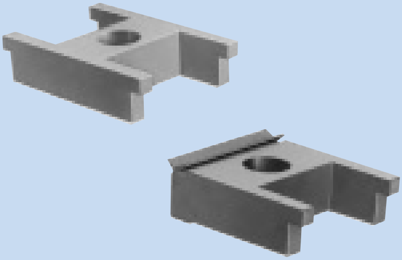


Spring Pad Model PA

●Fixture Models SM/SMB and SE/SEB

Use of fixture model SM or SE eliminates the need to machine thin tapped holes for mounting the LM Roller, and allows the roller to firmly be secured.

Models SE and SEB each have a special rubber wiper with double lips to achieve a high dust prevention effect.



Fixture Models SM/SMB and SE/SEB

●Hardened Raceway Base

THK manufactures a heat-treated, ground raceway base that allows the LM Roller to demonstrate maximum performance upon request.

1.3. Rated Load

Static Safety Factor f_S

The LM Roller may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

where

$$f_S = \frac{f_C \cdot C_0}{P_C}$$

f_S : Static safety factor

f_C : Contact factor (see table 2 on page I-10)

C_0 : Basic static load rating (kN)

P_C : Calculated load (kN)

■Reference value of static safety factor

The static safety factors indicated in table 1 are the lower limits of reference values in the respective service conditions.

Table 1 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3
Machine tools	Without vibrations or impact	1 to 1.5
	With vibrations or impact	2.5 to 7

Rated Life

The rated life of the LM Roller is obtained using the basic dynamic load rating (C) indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications,"provided separately, and the following equation.

where

$$L = \left(\frac{f_H \cdot f_C \cdot f_T}{f_W} \cdot \frac{C}{P_C} \right)^{\frac{10}{3}} \times 100$$

L : Rated life (km)
(The total number of revolutions that 90% of a group of identical LM Roller units independently operating under the same conditions can achieve without showing flaking)
C : Basic dynamic load rating (kN)
P_C : Calculated radial load (kN)
f_H : Hardness factor (see Fig. 2)
f_T : Temperature factor (see Fig. 3 on page I-10)
f_C : Contact factor (see table 2 on page I-10)
f_W : Load factor (see table 3 on page I-10)

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

where

$$L_h = \frac{L \times 10^6}{2 \times \ell_S \times n_1 \times 60}$$

L_h : Service life time (h)
ℓ_S : Stroke length (mm)
n_1 : Number of reciprocations per minute (min⁻¹)

■f_H : Hardness factor

To maximize the load capacity of the LM system, the hardness of the raceways needs to be between 58 to 64 HRC.

If the hardness is lower than this range, the basic dynamic load rating and the basic static load rating decrease. Therefore, it is necessary to multiply each rating by the respective hardness factor (f_H).

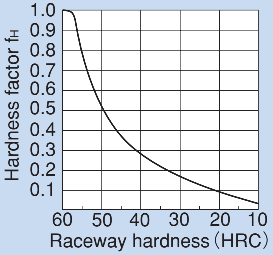


Fig. 2 Hardness factor (f_H)

f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating LM Roller exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 3.

Note: The normal service temperature of the LM Roller is 80℃ at a maximum. If the ambient temperature exceeds 80℃, contact THK.

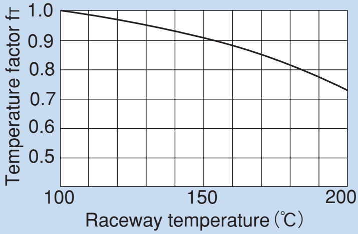


Fig. 3 Temperature factor (f_T)

f_C : Contact factor

When multiple LM Roller units are used in near close contact with each other, their linear motion is affected by moments and mounting accuracy, making it difficult to achieve uniform load distribution. In such applications, multiply the basic load rating (C) and (C_0) by the corresponding contact factor in table 2.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in table 2.

Table 2 Contact Factor (f_C)

Number of LM Roller units in close contact with each other	Contact factor f_C
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied to the LM Roller cannot be obtained, or when speed and impact have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 3 of empirically obtained data.

Table 3 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

1.4. Accuracy Standards

When multiple LM Roller units are arranged on the same plane, the mounting heights of the LM Roller units must be identical in order to achieve uniform load distribution. The dimensional tolerance of the LM Roller in height (A) is defined as indicated in table 4. When ordering LM Roller units to be used on the same plane, specify their tolerances with the same classification symbol. Each classification symbol is marked on the package box and on the side face of the LM Roller's raceway base as indicated in Fig. 5 (except for normal class).

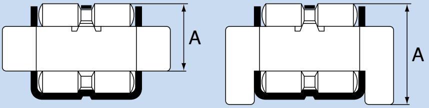


Fig. 4 Mounting Height (A) of the LM Roller

Classification symbol for height tolerance

Fig. 5

Table 4 Classification of Dimensional Tolerances in Height (A)

Unit: μm

Accuracy class	Dimensional tolerance for A	Classification symbol
Normal grade	0 to –10	No Symbol
High grade	0 to – 5	H 5
	–5 to –10	H 10
Precision grade	0 to – 3	P 3
	–3 to – 6	P 6
	–6 to – 9	P 9
	–9 to –12	P 12
Ultra-precision grade	0 to – 2	SP 2
	–2 to – 4	SP 4
	–4 to – 6	SP 6
	–6 to – 8	SP 8
	–8 to –10	SP 10

1.5. Raceway

To maximize the performance of the LM Roller, it is necessary to take into account the hardness, roughness and accuracy of the raceway, on which the rollers directly roll, when manufacturing the product. In particular, the hardness significantly affects the service life. Therefore, it is important to take much care in selecting a material and heat treatment method.

●Hardness

We recommend surface hardness of 58 HRC (≒ 653 HV) or higher. The depth of the hardened layer is determined by the size of the LM Roller; we recommend approximately 2 mm for general use. If the hardness of the raceway is lower or the raceway cannot be hardened, multiply the load rating by the corresponding hardness factor indicated in Fig. 2 on page I-9.

●Material

The following materials are generally used as suitable for surface hardening through induction quenching and flame quenching.

SUJ2 (JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6 (JIS G 4401: carbon-tool steel)
S55C (JIS G 4051: carbon steel for machine structural use)

If the machine body is a mold, depending on the service conditions, a hardened steel plate may not be used and instead, the surface of mold itself may be hardened.

●Roughness of the surface

To achieve smooth motion, the surface should preferably be finished to 0.4a or less. If slight wear is allowed in the initial stage, the surface may be finished to approximately 0.8a.

●Accuracy

When high accuracy is required, securing a hardened steel plate to the machine body may cause undulation on the raceway. To avoid this, secure the LM Roller with bolts before grinding the hardened steel plate as with when mounting the product, or tightening it to the machine body before grinding and finishing the raceway, to produce a good result.

2. Precautions on Using the LM Roller

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the LM Roller may damage it. Giving an impact to the LM Roller could also cause damage to its function even if the product looks intact.

Dust Prevention and Lubrication

With the LM Roller, once foreign matter enters the raceway due to poor dust prevention, it cannot be removed easily and tends to severely damage the raceway or the LM rollers. Therefore, use much care in dust prevention.

Fixture for the LM Roller models SE and SEB each have a special rubber wiper with double lips to achieve a high dust prevention effect. Feeding grease between the double lips when attaching the fixture, as shown in Fig. 1, will further increase the effect.

For locations subject to cutting chips or welding spatter, it is necessary to use a dust prevention cover such as a bellows and a telescopic cover, or a wiper reinforced with a metal plate as indicated in Fig. 2.

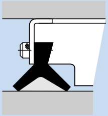


Fig. 1 Wiper of Fixture Models SE and SEB

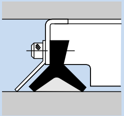


Fig. 2 Reinforced Wiper

For dust prevention of the side faces, items as shown in Fig. 3 are available.

The required quantity of lubricant is much smaller than sliding guides, making the lubrication control easy.

As for the lubricant, the same type of grease or lubricant as that of ordinary bearings will be adequately effective. To achieve a high level of grease retention, it is preferable to use lithium-soap group grease No. 1 or 2, or slightly viscous sliding surface oil or turbine oil.

To replenish the lubricant to the LM Roller, drop the lubricant from the greasing hole provided on the back of the retainer as necessary, or directly drop it to the raceway. If the LM Roller is not used frequently, it is also possible to apply grease to the rollers of the product.

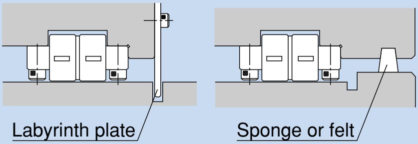


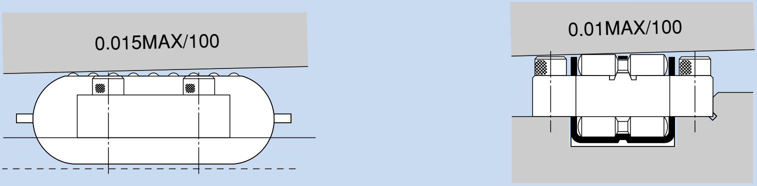
Fig. 3

Mounting Reference Surface

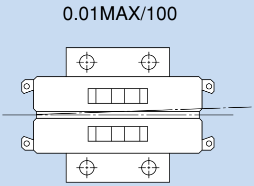
To help correctly mount the LM Roller in the traveling direction, it has a mounting reference surface on the side face of the raceway base. The reference surface is on the opposite side of the THK logo.

Mounting Accuracy

To maximize the performance of the LM Roller, it is necessary to distribute the load as evenly as possible when mounting the product. For the parallelism between the roller and the raceway indicated in Fig. 4, we recommend 0.015 mm or less against 100 mm. For the allowable tilt of the roller in the longitudinal direction, 0.01 mm or less against 100 mm is recommended.



ⓐ Parallelism between the LM Roller and the raceway ⓑ Allowable tilt of the roller in the longitudinal direction



ⓒ Parallelism between the LM Roller and the raceway in the horizontal direction

Fig. 4 LM Roller and Mounting Accuracy

Precautions on Use

⑴ If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.

⑵ Do not use the resin retainer for LM Roller model LR (A, B)-Z and seals (including SE and SEB) in an atmosphere at temperature of 80℃ or higher.

⑶ When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the LM Roller, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Flat Roller

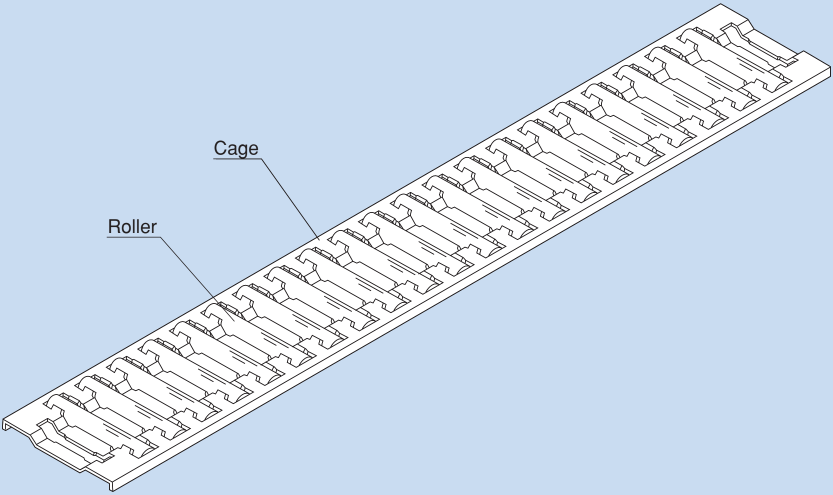


Fig. 1 Structure of LM Flat Roller Model FT

1.1. Structure and Features of the Flat Roller

With the Flat Roller, precision rollers compliant with JIS B 1506 are installed in pockets of a cage made of a thin steel plate pressed into M shape (in cross section) to increase its rigidity. Thanks to its structural design, the rollers do not fall off because they are held in cage pockets. Since the cage, which is incorporated with rollers having a diameter of 5 mm or larger, is of roller-lifter type, smooth motion is achieved without damaging the raceway even if the hardness of the raceway is low. The Flat Roller is sandwiched between the two raceways. As the table moves, the Flat Roller travels by half the distance of the table in the same direction. For example, if the table moves 500 mm, the Flat Roller travels 250 mm in the same direction.

The Flat Roller is optimal for large machine tools such as planer, plano-miller and roll-grinding machine, and for locations requiring high accuracy such as surface grinding machine, cylindrical grinder and optic measuring machine.

●Large Load Capacity

Sine rollers are installed in short pitches, the Flat Roller has a large load capacity, and depending on the conditions, it can be used on the raceway of a mold that is little hardened. In addition, the deflection rigidity of the table is almost the same as that of a sliding surface.

●Combined Accuracy of 90° V Surface and Flat Surface Supported as Standard

The Flat Roller is designed so that it can be mounted on the 90° V-flat sliding surface, which is the most common configuration among narrow guide types of tables and saddles of machinery. It allows the product to be used without major design change.

●Lowest Friction among Roller Type LM Systems

Since the rollers are evenly held in a light, rigid cage, friction between rollers is eliminated and skewing of the rollers is minimized. As a result, a small friction coefficient (μ = 0.001 to 0.0025) is achieved, and stick slip, which is problematic with sliding surfaces, does not occur.

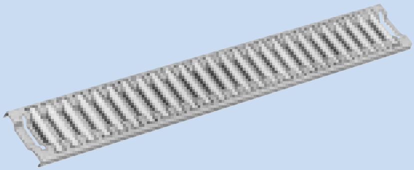
●Instant Connection of the Cage

When installing the Flat Roller in a large machine, it can easily be connected on the bed. This allows the Flat Roller to be installed even with the longest type.

1.2. Types and Features of the Flat Roller

●Models FT and FT-V

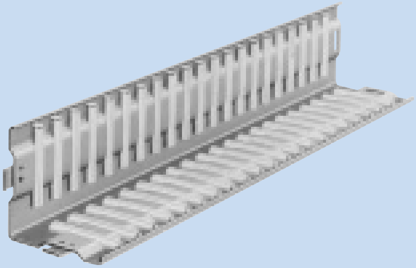
These models have a single row of rollers and are mainly used on the flat surface.



Model FT or FT-V

●Models FTW and FTW-V

These models have two or more rows of rollers, and their cages are shaped to bend at 90°. It uses rollers with a diameter 0.7071 times greater than that of the rollers on the flat surface so that model FT or FT-V can be mounted on the 90° V surface at the same height if model FT or FT-V is used on the flat surface.



Model FTW or FTW-V

1.3. Rated Load and Rated Life

Static Safety Factor f_S

The Flat Roller may receive an unexpected external force while it is stationary or operative due to the generation of an inertia caused by vibrations and impact or start-up and stop. It is necessary to consider a static safety factor against such a working load.

$$f_S = \frac{f_C \cdot C_0}{P_C}$$

where

f_S : Static safety factor

f_C : Contact factor (see "Rated Load" and "Rated Life" on page J-7)

C_0 : Basic static load rating (kN)

P_C : Calculated radial load (kN)

■Reference value of static safety factor

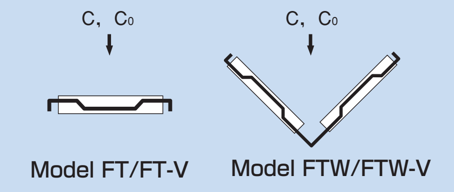
The static safety factors indicated in table 1 are the lower limits of reference values in the respective service conditions.

Table 1 Reference Values of Static Safety Factors (f_S)

Machine using the LM system	Service conditions	Lower limit of f_S
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3
Machine tools	Without vibrations or impact	1 to 1.5
	With vibrations or impact	2.5 to 7

Rated Load

The rated loads shown in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately, represent the rated loads with a unit length (ℓ) in the directions indicated in the figure below.



If the length of the Flat Roller in the effective load range differs from the unit length (ℓ), approximate rated loads (C_ℓ and $C_{0\ell}$) can be obtained using the following equation.

$$C_\ell = \left(\frac{\ell_0}{\ell}\right)^{\frac{3}{4}} \times C$$

$$C_{0\ell} = \frac{\ell_0}{\ell} \cdot C_0$$

where

C_ℓ : Basic dynamic load rating in the effective load range (kN)
ℓ_0 : Length in effective load range (mm)
ℓ : Unit length (length indicated in dimensional table in the "THK General Catalog - Product Specifications," provided separately) (mm)
$C_{0\ell}$: Basic static load rating in the effective load range (kN)
C : Basic dynamic load rating (kN)
C_0 : Basic static load rating (kN)

Note that if the hardness of the raceway is lower than 58 HRC, the rated loads will be decreased (see Fig. 3 on page J-8).

Rated Life

When the basic dynamic load rating (C_ℓ) of the Flat Roller in the effective load range has been obtained from the equation above, the rated life is obtained using the following equation.

$$L = \left(\frac{f_H \cdot f_C \cdot f_T}{f_W} \cdot \frac{C_\ell}{P_C}\right)^{\frac{10}{3}} \times 100$$

where

L : Rated life (km)
(The total number of revolutions that 90% of a group of identical Flat Roller units independently operating under the same conditions can achieve without showing flaking)
C_ℓ : Basic dynamic load rating (kN)
P_C : Calculated radial load (kN)
f_H : Hardness factor (see Fig. 3 on page J-8)
f_T : Temperature factor (see Fig. 2 on page J-8)
f_W : Load factor (see table 2 on page J-8)
f_C : Contact factor *

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* Note: Contact factor is determined according to the contact state of the two planes between which the rollers travel. If the contact ratio between the two planes is 50%, set the contact factor as f_C = 0.5 for safety's sake.

Calculating the Service Life Time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

where

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})

■f_T : Temperature factor

If the temperature of the atmosphere surrounding the operating Linear Bush exceeds 100℃, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 2.

Note: If the ambient temperature exceeds 100℃, contact THK.

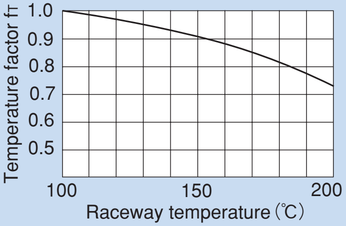


Fig. 2 Temperature factor (f_T)

■f_H : Hardness factor

To maximize the load capacity of the LM system, the hardness of the raceways needs to be between 58 to 64 HRC. If the hardness is lower than this range, the basic dynamic load rating and the basic static load rating decrease. Therefore, it is necessary to multiply each rating by the respective hardness factor (f_H).

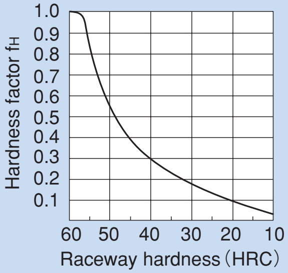


Fig. 3 Hardness factor (f_H)

■f_W : Load factor

In general, reciprocating machines tend to involve vibrations or impact during operation. It is difficult to accurately determine vibrations generated during high-speed operation and impact during frequent start-up and stop. Therefore, when the actual load applied cannot be obtained, or when speed and impact have a significant influence, divide the basic load rating (C or C_0), by the corresponding load factor in table 2 of empirically obtained data.

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Slow $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Medium $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

1.4. Accuracy Standards

The accuracy of the Flat Roller is classified into normal grade, high grade and precision grade according to the difference in diameter between the rollers incorporated in a single cage. When it is necessary to specify the dimensional tolerance in the roller diameter for reasons related to the required accuracy or combination, select the desired accuracy from table 3 and specify the corresponding accuracy symbol.

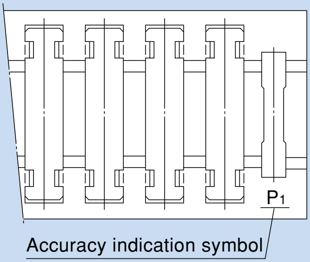


Fig. 4

Table 3 Classification of Roller Diameters for Selection

Unit: μm

Accuracy class	Diameter difference	Dimensional tolerance in diameter	Accuracy indication symbol
Normal grade	3	0 to –3	No Symbol
High grade	2	0 to –2	H2
		–2 to –4	H4
		–4 to –6	H6
Precision grade	1	0 to –1	P1

Note: The accuracy indication symbol is marked on the end of the cage as shown in Fig. 4.

1.5. Raceway

To maximize the performance of the Flat Roller, it is necessary to take into account the hardness, surface roughness and accuracy of the raceway, on which the rollers directly roll, when manufacturing the product. In particular, the hardness significantly affects the service life. Therefore, it is important to take much care in selecting a material and heat treatment method.

●Hardness

We recommend surface hardness of 58 HRC (≒653 HV) or higher. The depth of the hardened layer is determined by the size of the Flat Roller; we recommend approximately 2 mm for general use. If the hardness of the raceway is lower or the raceway cannot be hardened, multiply the load rating by the corresponding hardness factor indicated in Fig. 3 on page J-8.

●Material

The following materials are generally used as suitable for surface hardening through induction quenching and flame quenching.

SUJ2 (JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6 (JIS G 4401: carbon-tool steel)
S55C (JIS G 4051: carbon steel for machine structural use)

If the machine body is a mold, depending on the service conditions, a hardened steel plate may not be used and instead, the surface of mold itself may be hardened.

●Roughness of the surface

To achieve smooth motion, the surface should preferably be finished to 0.4a or less. If slight wear is allowed in the initial stage, the surface may be finished to approximately 0.8a.

●Accuracy

When high accuracy is required, securing a hardened steel plate to the machine body may cause undulation on the raceway. To avoid this, secure the Flat Roller with bolts before grinding the hardened steel plate as with when mounting the product, or tightening it to the machine body before grinding and finishing the raceway, to produce a good result.

2. Precautions on Using the Flat Roller

Handling

⑴ Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

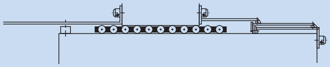
⑵ Dropping or hitting the Flat Roller may damage it. Giving an impact to the Flat Roller could also cause damage to its function even if the product looks intact.

Dust Prevention and Lubrication

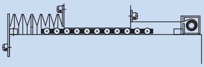
With the Flat Roller, once foreign matter enters the raceway due to poor dust prevention, it cannot be removed easily and tends to severely damage the raceway or the Flat rollers. Therefore, use much care in dust prevention. Normally, for dust prevention of the Flat Roller, a bellows or a telescopic cover that covers the whole sliding surface, as shown in Fig. 1, is effective.

The required quantity of lubricant is much smaller than sliding metals, making the lubrication control easy.

Since the Flat Roller has high lubricant retention, it is suitable for grease lubrication. It is preferable to use lithium-soap group grease No. 1 or 2, or slightly viscous sliding surface oil or turbine oil.



ⓐ Copper cover or telescopic cover



ⓑ Bellows or roller blind

Fig. 1 Dust Prevention Method

Attaching a Stopper

Although the Flat Roller performs extremely accurate motion, it may cause a traveling error due to uneven load distribution or un-uniform stop. Therefore, we recommend attaching a stopper on the end of the base or the table.

Chamfering the End Face of the Table

If the Flat Roller is longer than the overall table length, finely chamfer the end face of the table so that the rollers are easily fed to the table.

Mounting Accuracy

To maximize the performance of the Flat Roller, it is necessary to distribute the load as evenly as possible when mounting the product. For the allowable tilt as shown in Fig. 2, we recommend 0.1 mm or less against 1,000 mm.

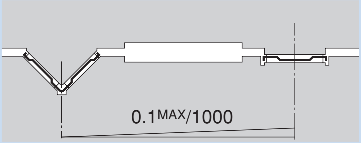


Fig. 2 Mounting Accuracy

Precautions on Use

(1) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(2) If desiring to use the product at temperature of 100℃ or higher, contact THK in advance.
(3) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(4) The Flat Roller cannot be used as a roller conveyor.
(5) A moment, vertical mount, uneven contact and machine vibrations may cause the cage to slip. If the slippage of the cage is inevitable, we recommend using an LM Guide system designed for infinite motion.

Storage

When storing the Flat Roller, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Features of the Ball Screw

1.1. Driving Torque One Third of the Sliding Screw

With the Ball Screw, balls roll between the screw shaft and the nut to achieve high efficiency. Its required driving torque is only one third of the conventional sliding screw (Fig. 1 and 2). As a result, it is capable of not only converting rotational motion to linear motion, but also easily converting linear motion to rotational motion.

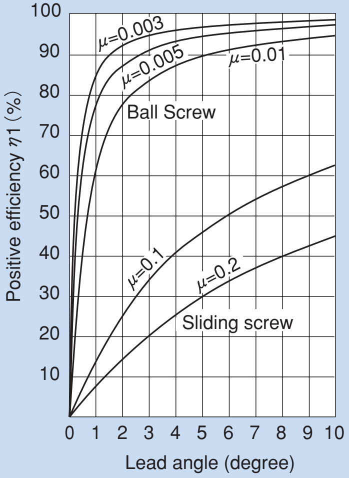


Fig. 1 Positive Efficiency (Rotational to Linear)

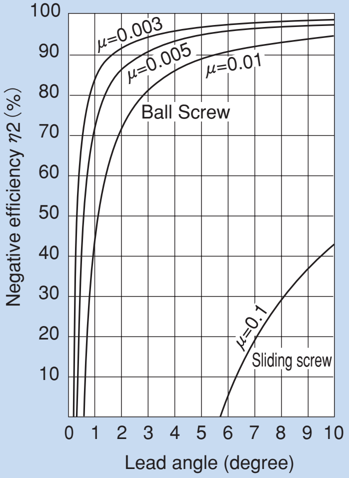


Fig. 2 Negative Efficiency (Linear to Rotational)

1.1.1. Calculating the Lead Angle

$$\tan\beta = \frac{\ell}{\pi \cdot d_P} \quad \cdots\cdots\cdots(1)$$

where

β :Lead angle (degree)

d_P :Ball center diameter (mm)

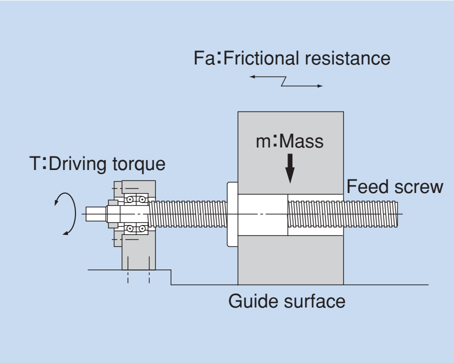
ℓ :Feed screw lead (mm)

1.1.2. Relationship between Thrust and Torque

The torque or thrust generated when thrust or torque is applied is obtained from equations (2) to (4).

Driving Torque Required to Gain Thrust

$$T = \frac{Fa \cdot \ell}{2\pi \cdot \eta 1} \quad \cdots\cdots\cdots (2)$$



where

T :Driving torque (N·mm)

Fa :Frictional resistance on the guide surface (N)

$Fa = \mu \times mg$

- μ :Friction coefficient of the guide surface
- g :Gravitational acceleration ($9.8 m/s^2$)
- m :Mass of the transferred object (kg)

ℓ :Lead of the feed screw (mm)

$\eta 1$:Positive efficiency of feed screw

(Fig. 1 on page K-5)

Thrust Generated When Torque is Applied

$$Fa = \frac{2\pi \cdot \eta 1 \cdot T}{\ell} \quad \cdots\cdots\cdots (3)$$

where

Fa :Thrust generated (N)

T :Driving torque (N·mm)

ℓ :Lead of the feed screw (mm)

$\eta 1$:Positive efficiency of feed screw

(Fig. 1 on page K-5)

Torque Generated When Thrust is Applied

$$T = \frac{\ell \cdot \eta 2 \cdot Fa}{2\pi} \quad \cdots\cdots\cdots (4)$$

where

T :Torque generated (N·mm)

Fa :Thrust input (N)

ℓ :Lead of the feed screw (mm)

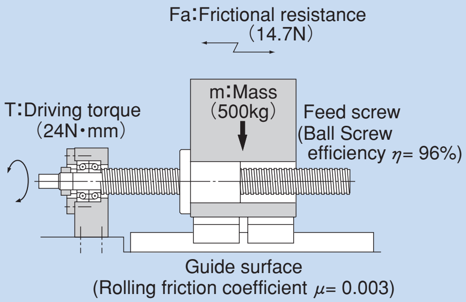
$\eta 2$:Negative efficiency of feed screw

(Fig. 2 on page K-5)

■Examples of Calculating Driving Torque

When moving an object with a mass of 500 kg using a screw with an effective diameter of 33 mm and a lead length of 10 mm (lead angle: 5°30'), the required torque is obtained as follows.

Rolling guide (μ= 0.003)
Ball Screw (from μ= 0.003, η= 0.96)



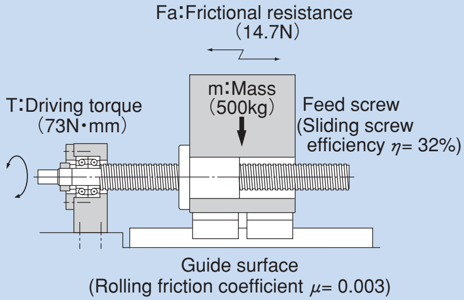
Frictional resistance of the guide surface

$$Fa = 0.003 \times 500 \times 9.8 = 14.7\ N$$

Driving torque

$$T = \frac{14.7 \times 10}{2\pi \times 0.96} = 24\ N \cdot mm$$

Rolling guide (μ= 0.003)
Ball Screw (from μ= 0.2, η= 0.32)



Frictional resistance of the guide surface

$$Fa = 0.003 \times 500 \times 9.8 = 14.7\ N$$

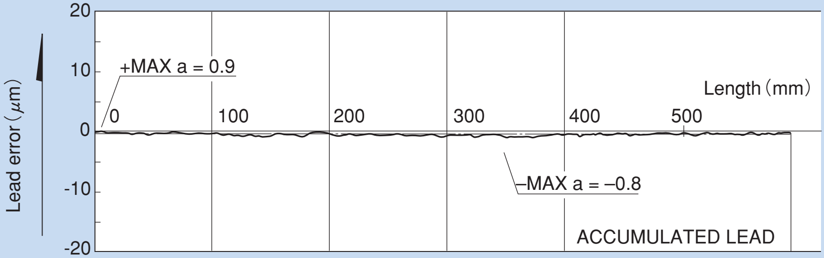
Driving torque

$$T = \frac{14.7 \times 10}{2\pi \times 0.32} = 73\ N \cdot mm$$

1.2. Ensuring High Accuracy

The Ball Screw is ground with highest-level facilities and equipment at a strictly temperature-controlled factory, and its accuracy is assured under a thorough quality control system that covers assembly to inspection.

Automatic lead measuring machine using laser



Unit: mm

Model No. TYPE	BIF3205－10RRG0＋903LC2

		Standard value STANDARD	Actual measurement DATA
Directional target value	DIRECTIONAL TARGET POINT	0	
Representative travel distance error	OVERALL LEAD DEVIATION	±0.011	–0.0012
Fluctuation	RELATIVE LEAD VARIATION	0.008	0.0017

Fig. 3 Lead Accuracy Measurement Data

1.3. Capable of Fine Feed

The Ball Screw requires a minimal starting torque thanks to its rolling motion, and does not cause a slip, which is inevitable with sliding motion. Therefore, it is capable of accurate fine feeding.
Fig. 4 shows a travel distance of the Ball Screw in one-pulse, 0.1-μm feeding (LM Guide is used for the guide surface).

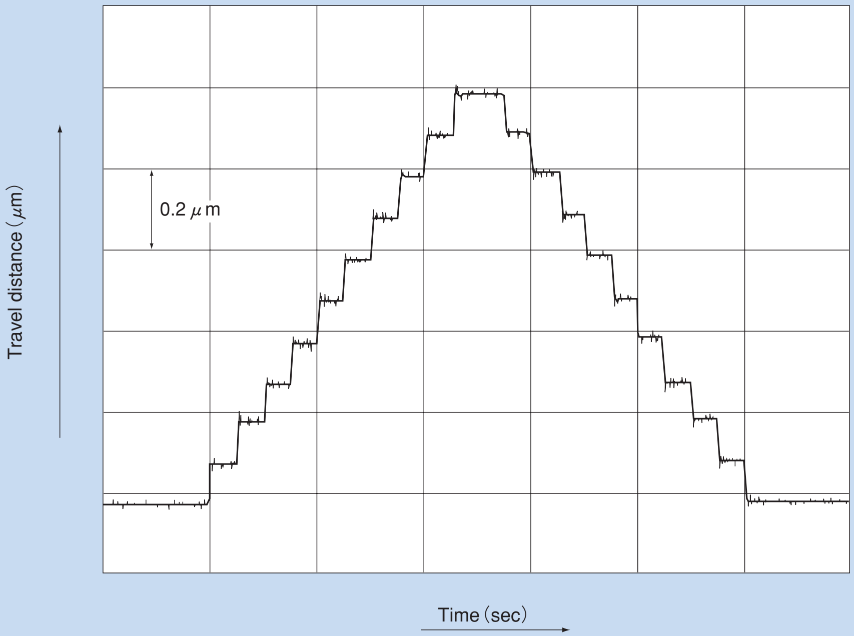


Fig. 4 Data on Travel in 0.1-μm Feeding

1.4. High Rigidity without Backlash

Since the Ball Screw is capable of receiving a preload, the axial clearance can be reduced to below zero and high rigidity is achieved because of the preload. In Fig. 5, when an axial load is applied in the positive (+) direction, the table is displaced in the same (+) direction. When an axial load is provided in the reverse (-) direction, the table is displaced in the same (-) direction. Fig. 6 shows the relationship between the axial load and the axial displacement. As indicated in Fig. 6, as the direction of the axial load changes, axial clearance occurs as a displacement. In addition, when the Ball Screw is provided with a preload, it gains higher rigidity and smaller axial displacement than zero clearance in the axial direction.

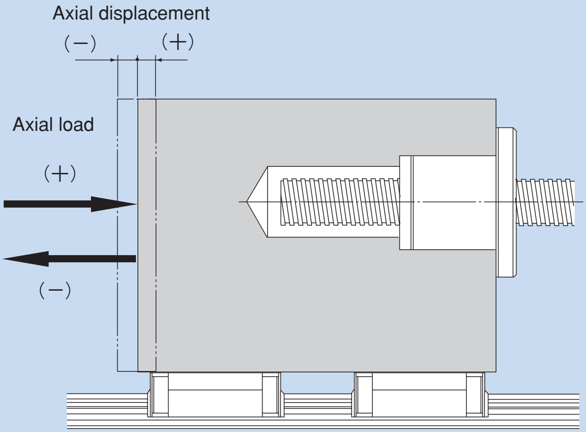


Fig. 5

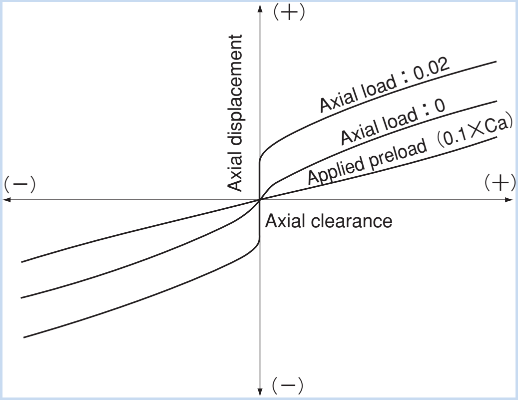


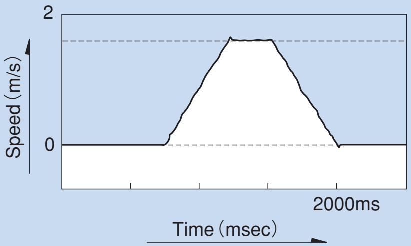
Fig. 6 Axial Displacement in Relation to Axial Load

1.5. Capable of Fast Feed

Since the Ball Screw is highly efficient and generates little heat, it is capable of fast feed.

■Example of High Speed

Fig. 7 shows a speed diagram for a large-lead rolled Ball Screw operating at 2 m/s.



Maximum speed 2m/s
(Ball Screw rotation speed: 2,000 min^{-1})

Ball Screw
Large-lead rolled Ball Screw
WTF3060 (shaft diameter: 30 mm; lead: 60 mm)

Guide surface
LM Guide: model SR25W

Fig. 7 Speed Diagram

■Example of Heat Generation

Fig. 9 shows data on heat generation from the screw shaft when a Ball Screw is used in an operating pattern indicated in Fig. 8.

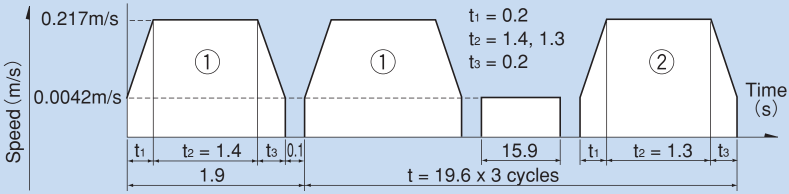


Fig. 8 Operating Pattern

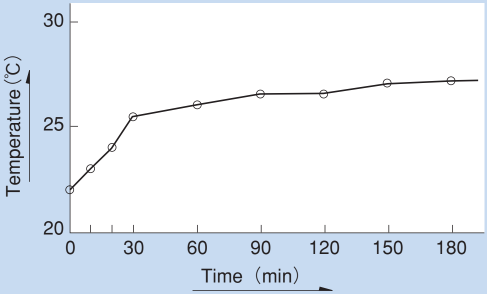


Fig. 9 Ball Screw Heat Generation Data

Ball Screw
Double-nut precision Ball Screw
Model BNFN4010-5
(Shaft diameter: 40 mm; lead: 10 mm; applied preload: 2,700 N)

Maximum speed: 0.217m/s (13m/min)
(Ball Screw rotation speed: 1,300 min^{-1})

Low speed 0.0042m/s (0.25m/min)
(Ball Screw rotation speed: 25 min^{-1})

Guide surface
LM Guide model HSR35CA

Lubricant
Lithium-based grease (No. 2)

2. Structure and Features of the Ball Screw with Ball Cage®

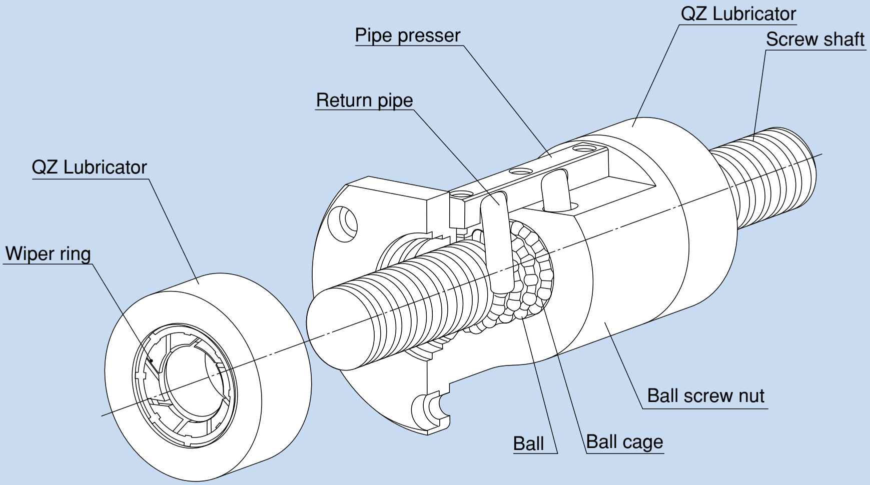


Fig. 1 Structure of High-Speed Ball Screw with Ball Cage Model SBN

Use of a ball cage in the Ball Screw with Ball Cage eliminates collision and friction between balls and increases grease retention. This makes it possible to achieve low noise, low torque fluctuation and long-term maintenance-free operation.
In addition, this Ball Screw is superbly capable of responding to high speed because of an ideal ball circulation structure, a strengthened circulation path and adoption of the ball cage.

2.1. Caged Ball® Technology

2.1.1. Caged Ball Technology

●Low noise, acceptable running sound

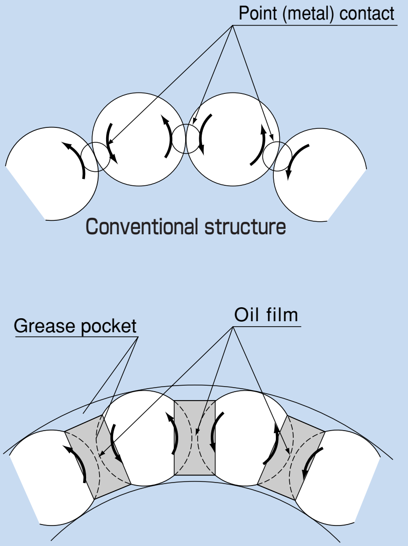
Use of the ball cage has eliminated collision noise between balls. Additionally, as balls are picked up in the tangential direction, collision noise from ball circulation has also been eliminated.

●Long-term maintenance-free operation

Friction between balls has been eliminated, and grease retention has been improved through the provision of grease pockets. As a result, long-term maintenance-free operation (i.e., lubrication is unnecessary over a long period) is achieved.

●Smooth motion

Use of the ball cage eliminates friction between balls and reduces torque fluctuation, thus to achieve smooth motion.



Structure of the Ball Screw with Ball Cage

●Low Noise

■Low noise level data

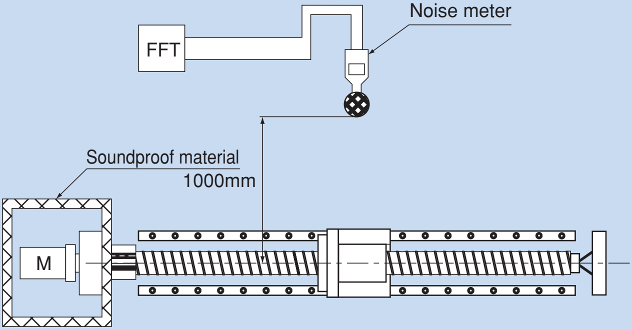
Since the balls in the Ball Screw with Ball Cage do not collide with each other, they do not produce a metallic sound and a low noise level is achieved.

[Noise measurement]

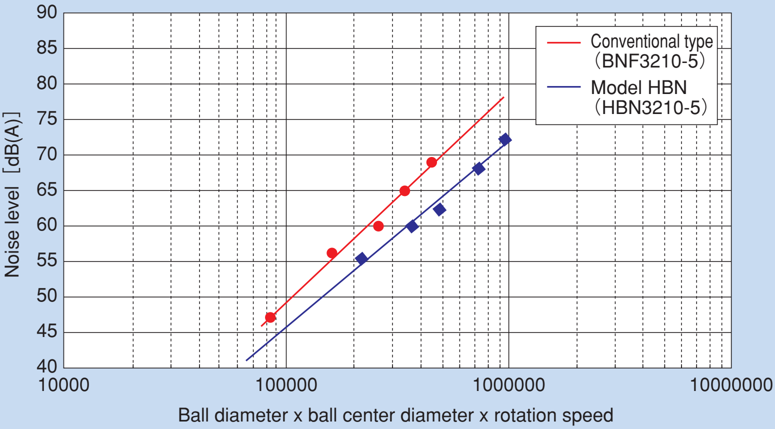
Tested products: Ball Screw with Ball Cage model HBN3210-5
Conventional type: model BNF3210-5

[Conditions]

Stroke	600mm
Lubrication	Grease lubrication (lithium-based grease containing extreme pressure agent)



Noise Measuring Equipment



Ball Screw Noise Level

●Long-term Maintenance-free Operation

■High speed, load-bearing capacity

Thanks to the ball circulating mechanism supporting high speed and the caged ball technology, the Ball Screw with Ball Cage excels in high speed and load-bearing capacity.

High Speed Durability Test

[Test conditions]

Item	Description
Tested article	High-Speed Ball Screw with Ball Cage model SBN3210-7
Speed	3900 (min^{-1}) (DN value*: 130,000)
Stroke	400mm
Lubricant	THK AFG Grease
Quantity	12cm^3 (lubricated every 1,000 km)
Applied load	1.73kN
Acceleration	1G

【Test result】
Shows no anomaly after running 10,000 km.

* DN value: Ball center diameter x rotation speed per minute

Load Bearing Test

[Test conditions]

Item	Description
Tested article	High-Speed Ball Screw with Ball Cage model SBN3210-7
Speed	1500 (min^{-1}) (DN value*: 50,000)
Stroke	300mm
Lubricant	THK AFG Grease
Quantity	12cm^3
Applied load	17.3kN (0.5Ca)
Acceleration	0.5G

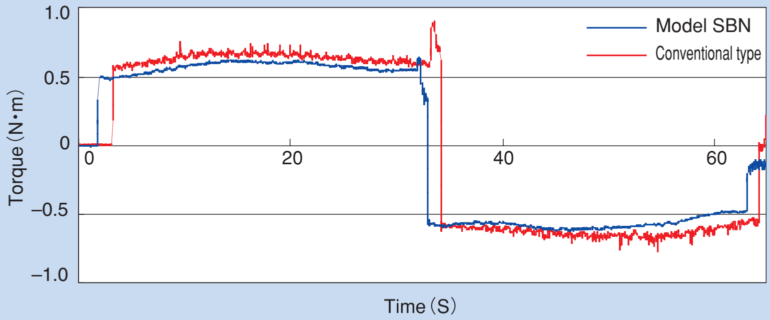
【Test result】
Shows no anomaly after running a distance 2.5 times the calculated service life.

●Smooth Motion

■Low torque fluctuation

The caged ball technology allows smoother motion than the conventional type to be achieved, thus to reduce torque fluctuation.

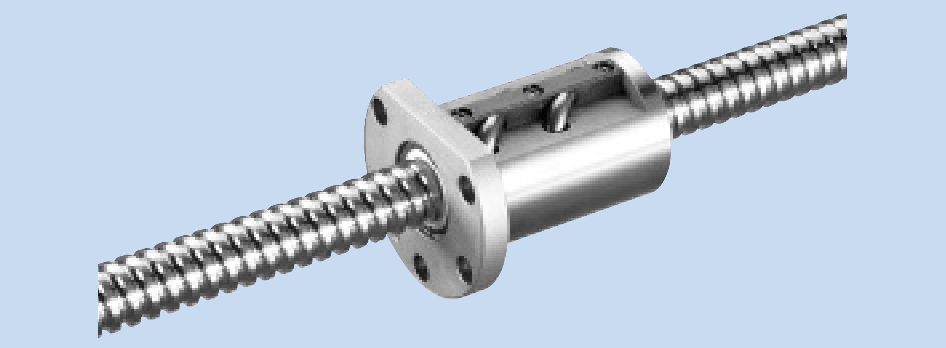
Item	Description
Shaft diameter/lead	32/10mm
Shaft rotation speed	60min^{-1}



Torque Fluctuation Data

2.2. Types of Ball Screws with Ball Cage®

High-Speed Ball Screw with Ball Cage Model SBN



●Structure and Features

High-Speed Ball Screw with Ball Cage model SBN has a circulation structure where balls are picked up at the tangential direction (Fig. 2), has a strengthened circulation path and uses a ball cage, thus to achieve a DN value* of 130,000 (* DN value = ball center diameter x rotation speed per minute).

As a result of adopting the offset preloading method (Fig. 4), which shifts the lead in the central area of the ball screw nut, its overall ball screw nut length is shorter and its body is more compact than the double-nut type, which uses the spacer-based preloading method.

Optionally, QZ Lubricator for Ball Screws (see page K-98), which has been developed for long-term maintenance-free operation, and a wiper ring (see page K-102), which prevents foreign matter from entering the ball screw nut, are available.

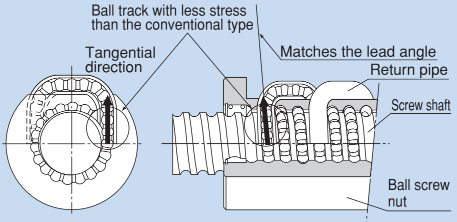


Fig. 2 Circulation Structure of Model SBN

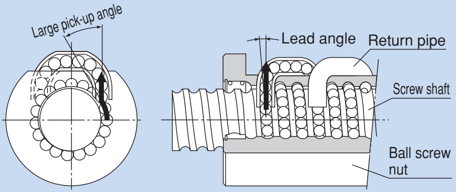


Fig. 3 Circulation Structure of Conventional Type

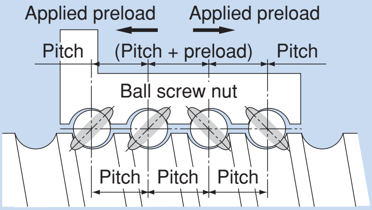
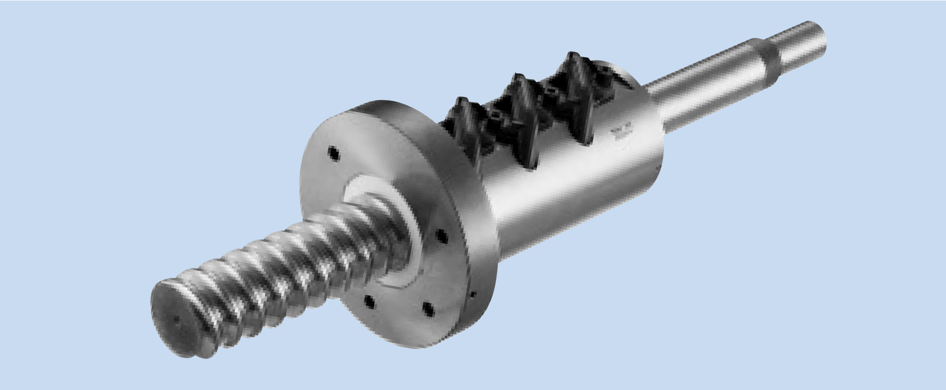


Fig. 4 Offset Preloading Method

High-Load Ball Screw with Ball Cage Model HBN



●Structure and Features

High-Load Ball Screw with Ball Cage model HBN has a rated load more than twice greater that the conventional type because of the optimal design (in ball cage, ball diameter, groove curvature radius, contact angle between ball and groove, and number of turns) for high loads.

In addition, it has a circulation structure where balls are picked up at the near-tangential direction (Fig. 5), has a strengthened circulation path and uses a ball cage, thus to achieve a DN value of 130,000.

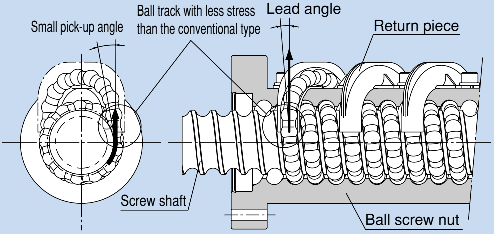


Fig. 5 Circulation Structure of Model HBN

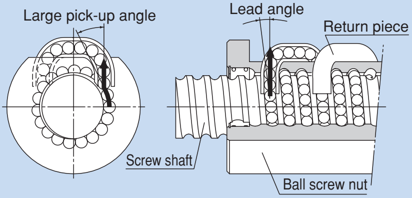


Fig. 6 Circulation Structure of the Conventional Type

High-Speed Ball Screw with Ball Cage Model SBK

●Structure and Features

Model SBK has a circulation structure where balls are picked up at the tangential direction (Fig. 7), has a strengthened circulation path and uses a ball cage, thus to achieve a DN value of 160,000.

As a result of adopting the offset preloading method (Fig. 4 on page K-16), which shifts the lead in the central area of the ball screw nut, its overall ball screw nut length is shorter and its body is more compact than the double-nut type, which uses the spacer-based preloading method.

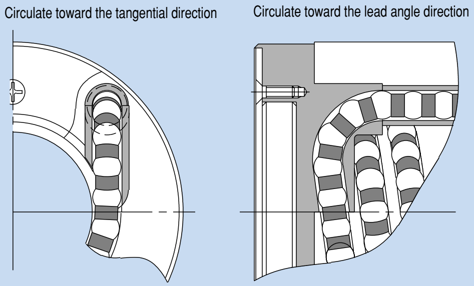
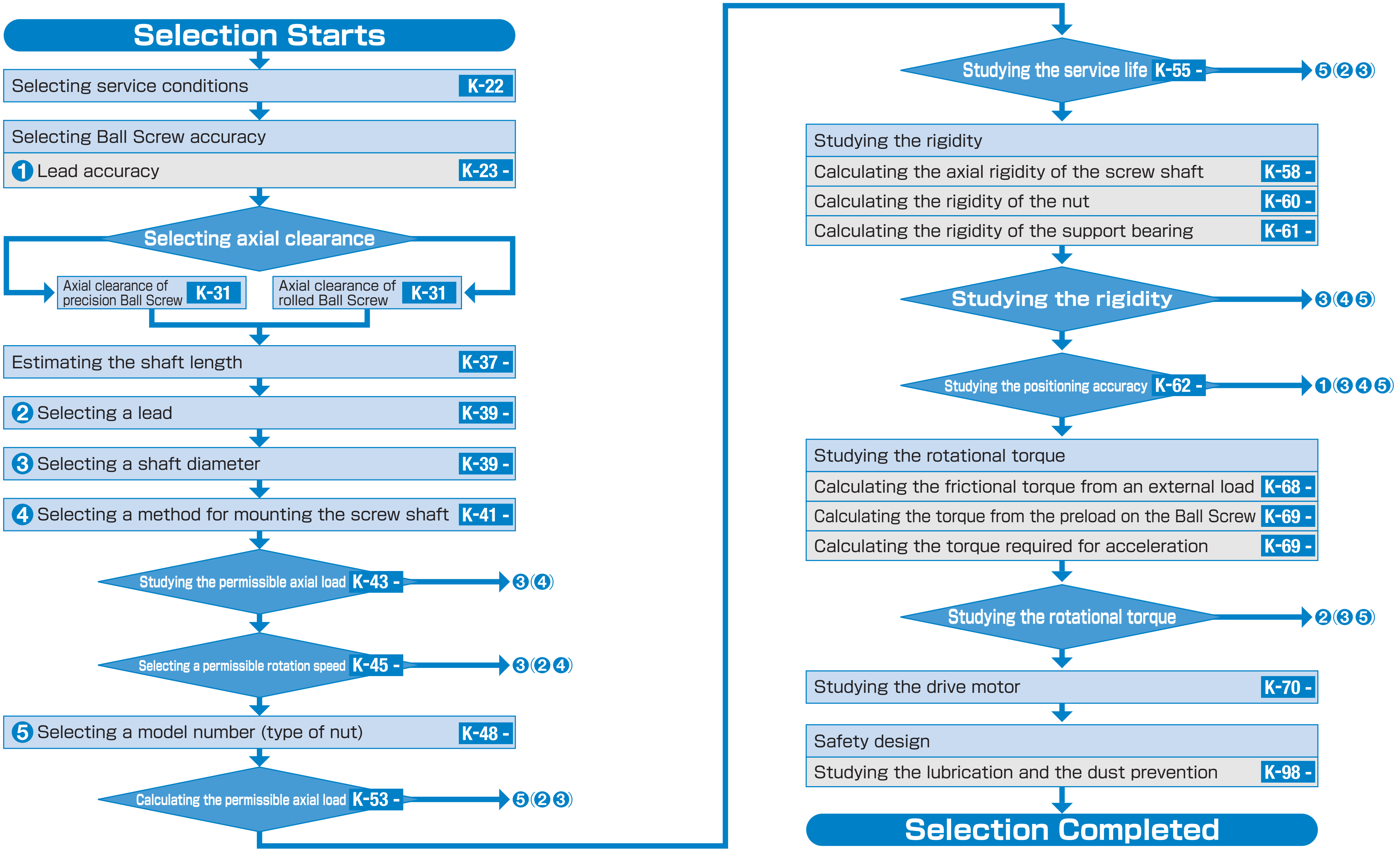


Fig. 7 Circulation Structure of Model SBK

3. Flow Chart for Selecting a Ball Screw

Steps for Selecting a Ball Screw

When selecting a Ball Screw, it is necessary to make a selection from various angles. The following is a flow chart as a measuring stick for selecting a Ball Screw.

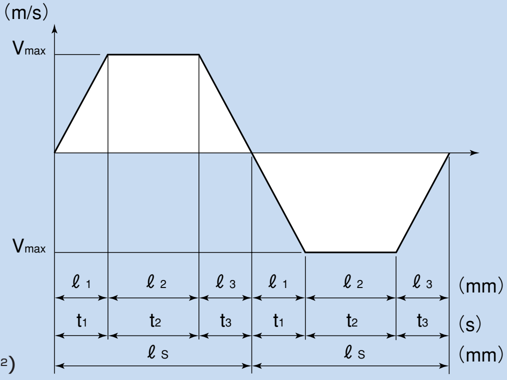


[Service Conditions of the Ball Screw]

The following conditions are required when selecting a Ball Screw.

Transfer orientation	(horizontal, vertical, etc.)
Transferred mass	m (kg)
Table guide method	(sliding, rolling)
Friction coefficient of the guide surface	μ (−)
Resistance of the guide surface	f (N)
External load in the axial direction	F (N)
Desired service life time	L_h (h)

Stroke length	ℓ_s (mm)
Operating speed	V_{max} (m/s)
Acceleration time	t_1 (s)
Even speed time	t_2 (s)
Deceleration time	t_3 (s)
Acceleration	$\alpha = \frac{V_{max}}{t_1}$ (m/s²)
Acceleration distance	$\ell_1 = V_{max} \times t_1 \times 1000/2$ (mm)
Even speed distance	$\ell_2 = V_{max} \times t_2 \times 1000$ (mm)
Deceleration distance	$\ell_3 = V_{max} \times t_3 \times 1000/2$ (mm)
Reciprocations per minute	n (min^{-1})



Speed Diagram

Positioning accuracy	(mm)
Positioning repeatability	(mm)
Backlash	(mm)
Minimum feed distance	s (mm/pulse)

Drive motor	(AC servomotor, stepping motor, etc.)
Motor rated rotation speed	N_{MO} (min^{-1})
Motor inertial moment	J_M (kg·m²)
Motor resolution	(pulse/rev.)
Reduction ratio	A (−)

4. Accuracy of the Ball Screw

4.1. Lead Accuracy

The accuracy of the Ball Screw in lead is controlled in accordance with JIS standards (JIS B 1192 - 1997). Accuracy grades C0 to C5 are defined in linearity and directional property, and C7 to C10 in travel distance error in relation to 300 mm.

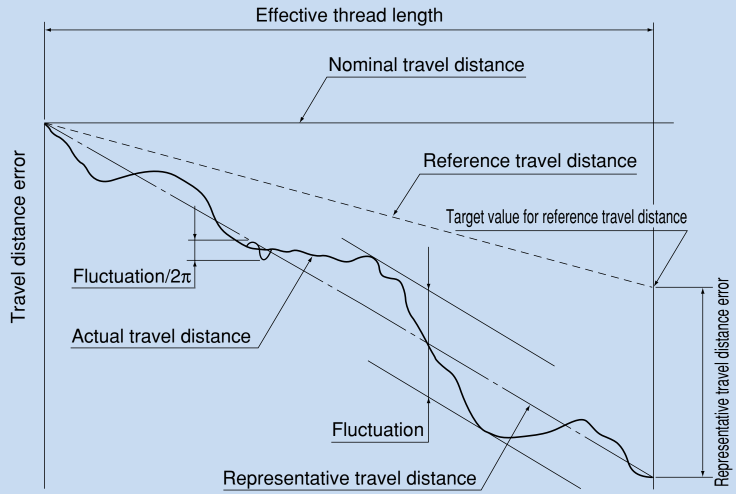


Fig. 1 Terms on Lead Accuracy

●Actual travel distance

An error in travel distance measured with an actual Ball Screw.

●Reference travel distance

Generally, it is the same as nominal travel distance, but can be an intentionally corrected value of nominal travel distance according to the intended use.

●Target value for reference travel distance

You may provide tension in order to prevent the screw shaft from running out, or set the reference travel distance in "negative" or "positive" value in advance given possible expansion/contraction from external load or temperature. In such cases, indicate a target value for the reference travel distance.

●Representative travel distance

It is a straight line representing the tendency in actual travel distance, and obtained with the least squares method from the curb that indicates the actual travel distance.

●Representative travel distance error (in ±)

Difference between the representative travel distance and the reference travel distance.

●Fluctuation

It is the maximum width of the actual travel distance between two straight lines drawn in parallel with the representative travel distance.

●Fluctuation/300

It indicates a fluctuation against a given thread length of 300 mm.

●Fluctuation/2π

It is a fluctuation in one revolution of the screw shaft.

Table 1 Lead Accuracy (permissible value)

Unit: mm

		Precision Ball Screw												
												Rolled Ball Screw		
Accuracy grade		C0		C1		C2		C3		C5		C7	C8	C10
Effective thread length		Represent active travel distance error	Fluctu-ation	Represent active travel distance error	Fluctu-ation	Represent active travel distance error	Fluctu-ation	Represent active travel distance error	Fluctu-ation	Represent active travel distance error	Fluctu-ation	Travel distance error	Travel distance error	Travel distance error
Above	Or less													
—	100	3	3	3.5	5	5	7	8	8	18	18	±50/300mm	±100/300mm	±210/300mm
100	200	3.5	3	4.5	5	7	7	10	8	20	18			
200	315	4	3.5	6	5	8	7	12	8	23	18			
315	400	5	3.5	7	5	9	7	13	10	25	20			
400	500	6	4	8	5	10	7	15	10	27	20			
500	630	6	4	9	6	11	8	16	12	30	23			
630	800	7	5	10	7	13	9	18	13	35	25			
800	1000	8	6	11	8	15	10	21	15	40	27			
1000	1250	9	6	13	9	18	11	24	16	46	30			
1250	1600	11	7	15	10	21	13	29	18	54	35			
1600	2000	—	—	18	11	25	15	35	21	65	40			
2000	2500	—	—	22	13	30	18	41	24	77	46			
2500	3150	—	—	26	15	36	21	50	29	93	54			
3150	4000	—	—	30	18	44	25	60	35	115	65			
4000	5000	—	—	—	—	52	30	72	41	140	77			
5000	6300	—	—	—	—	65	36	90	50	170	93			
6300	8000	—	—	—	—	—	—	110	60	210	115			
8000	10000	—	—	—	—	—	—	—	—	260	140			

Note: Unit of effective thread length: mm

Table 2 Fluctuation in Thread Length of 300 mm and in One Revolution (permissible value)

Unit: mm

Accuracy grade	C0	C1	C2	C3	C5	C7	C8	C10
Fluctuation/300 mm	3.5	5	7	8	18	—	—	—
Fluctuation/2π	3	4	5	6	8	—	—	—

Example: When the lead of a Ball Screw manufactured is measured with a target value for reference travel distance being -9 μm/500 mm, the following data are obtained.

Table 3 Measurement Data on Travel Distance Error

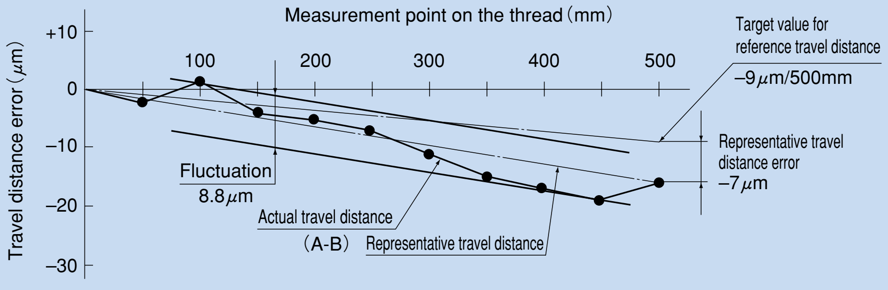
Unit: mm

Command position (A)	0	50	100	150	200	250	300	350	400	450	500
Travel distance (B)	0	49.998	100.001	149.996	199.995	249.993	299.989	349.885	399.983	449.981	499.984
Travel distance error (A-B)	0	–0.002	+0.001	–0.004	–0.005	–0.007	–0.011	–0.015	–0.017	–0.019	–0.016

The measurement data are expressed in a graph as shown in Fig. 2.

The positioning error (A-B) is indicated as the actual travel distance while the straight line representing the tendency of the (A-B) graph refers to the representative travel distance.

The difference between the reference travel distance and the representative travel distance appears as the representative travel distance error.



Measurement result - representative travel distance :−7μm

Fluctuation :8.8μm

Fig. 2 Measurement Data on Travel Distance Error

4.2. Accuracy of the Mounting Section

The accuracy of the Ball Screw mounting section complies with JIS standard (JIS B 1192).

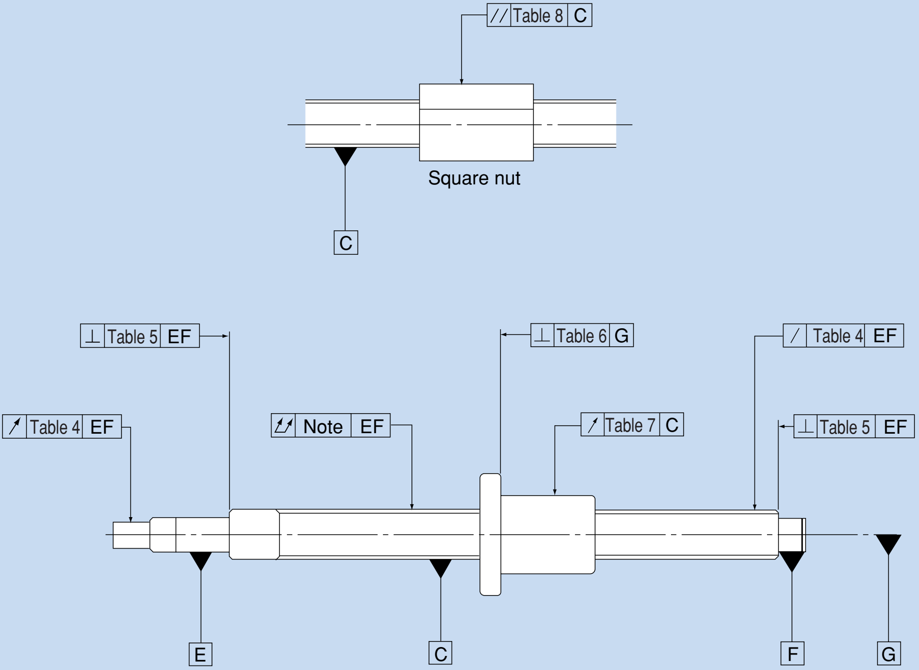


Fig. 3 Accuracy of the Mounting Section of the Ball Screw

Note: For the overall run-out of the screw shaft axis in the radial direction, refer to JIS B 1192.

4.2.1. Accuracy Standards for the Mounting Section

Tables 4 to 8 show accuracy standards for the mounting sections of the precision Ball Screw.

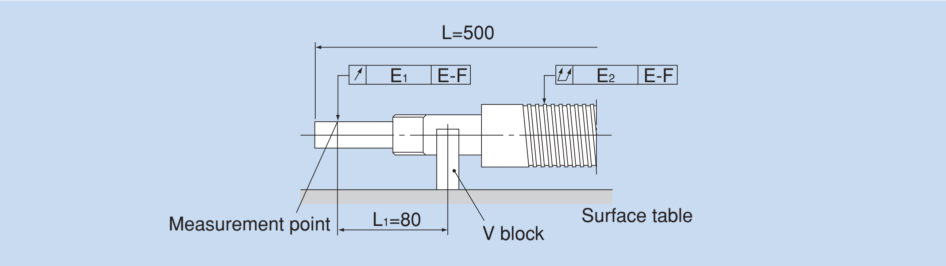
Table 4 Radial Run-out of the Circumference of the Thread Root in Relation to the Support Portion Axis of the Screw Shaft

Unit: μm

Screw shaft outer diameter (mm)		Run-out (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	8	3	5	7	8	10	14
8	12	4	5	7	8	11	14
12	20	4	6	8	9	12	14
20	32	5	7	9	10	13	20
32	50	6	8	10	12	15	20
50	80	7	9	11	13	17	20
80	100	—	10	12	15	20	30

Note: The measurements on these items include the effect of the run-out of the screw shaft diameter. Therefore, it is necessary to obtain the correction value from the overall run-out of the screw shaft axis, using the ratio of the distance between the fulcrum and measurement point to the overall screw shaft length, and add the obtained value to the table above.

Example: model No. DIK2005-6RRGO+500LC5



$\mathbf{E_1 = e + \Delta e}$

where e : Standard value in table 4 (0.012)

Δe : Correction value

$$\Delta e = \frac{L_1}{L} \times E_2$$

where E_2 : Overall radial run-out of the screw shaft axis (0.06)

$$= \frac{80}{500} \times 0.06$$

$$= 0.01$$

$$E_1 = 0.012 + 0.01$$

$$= 0.022$$

Table 5 Perpendicularity of the Supporting Portion End of the Screw Shaft to the Supporting Portion Axis

Unit: μm

Screw shaft outer diameter (mm)		Perpendicularity (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	8	2	3	3	4	5	7
8	12	2	3	3	4	5	7
12	20	2	3	3	4	5	7
20	32	2	3	3	4	5	7
32	50	2	3	3	4	5	8
50	80	3	4	4	5	7	10
80	100	—	4	5	6	8	11

Table 6 Perpendicularity of the Flange Mounting Surface of the Screw Shaft to the Screw Shaft Axis

Unit: μm

Nut outer diameter (mm)		Perpendicularity (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	20	5	6	7	8	10	14
20	32	5	6	7	8	10	14
32	50	6	7	8	8	11	18
50	80	7	8	9	10	13	18
80	125	7	9	10	12	15	20
125	160	8	10	11	13	17	20
160	200	—	11	12	14	18	25

Table 7 Radial Run-out of the Nut Circumference in Relation to the Screw Shaft Axis

Unit: μm

Nut outer diameter (mm)		Run-out (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	20	5	6	7	9	12	20
20	32	6	7	8	10	12	20
32	50	7	8	10	12	15	30
50	80	8	10	12	15	19	30
80	125	9	12	16	20	27	40
125	160	10	13	17	22	30	40
160	200	—	16	20	25	34	50

Table 8 Parallelism of the Nut Circumference (Flat Mounting Surface) to the Screw Shaft Axis

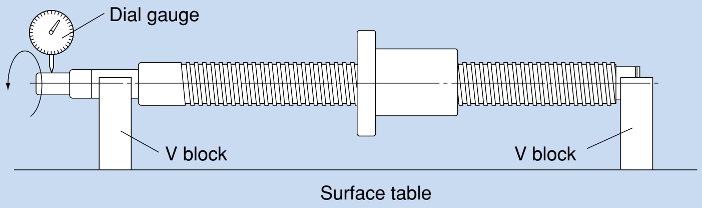
Unit: μm

Mounting reference length (mm)		Parallelism (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	50	5	6	7	8	10	17
50	100	7	8	9	10	13	17
100	200	—	10	11	13	17	30

4.2.2. Method for Measuring Accuracy of the Mounting Section

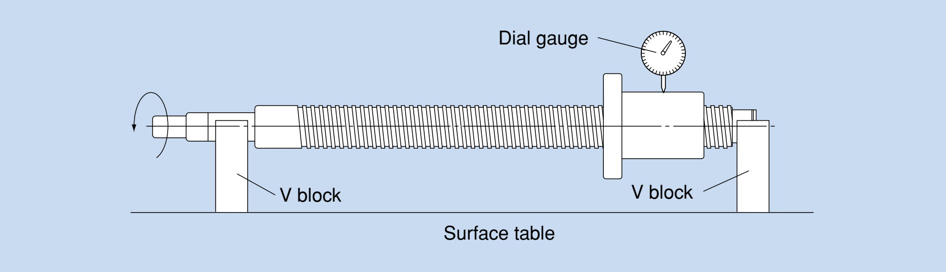
●Radial Run-out of the Circumference of the Part Mounting Section in Relation to the Supporting Portion Axis of the Screw Shaft (Table 4)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the part mounting section, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution.



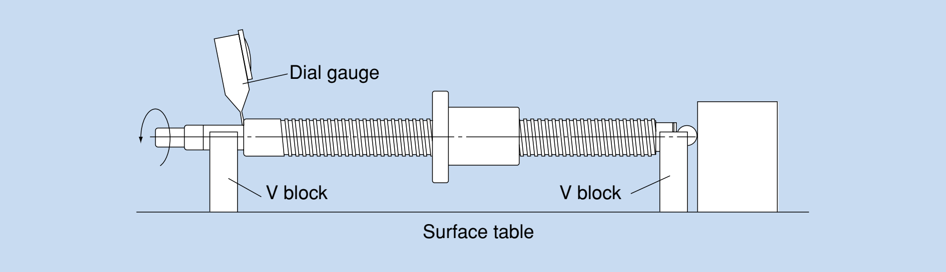
●Radial Run-out of the Circumference of the Thread Root in Relation to the Support Portion Axis of the Screw Shaft (Table 4)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the nut, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution without turning the nut.



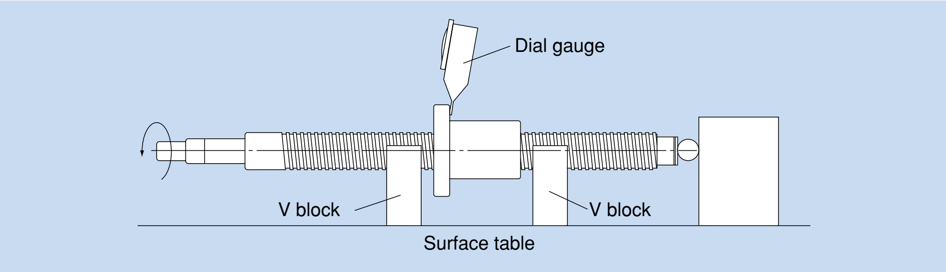
●Perpendicularity of the Supporting Portion End of the Screw Shaft to the Supporting Portion Axis (Table 5)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the screw shaft's supporting portion end, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution.



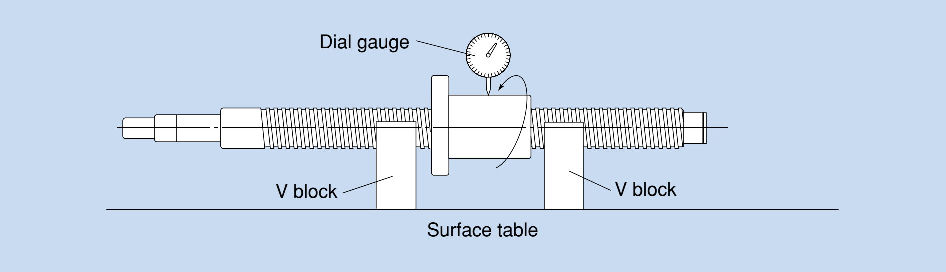
●Perpendicularity of the Flange Mounting Surface of the Screw Shaft to the Screw Shaft Axis (Table 6)

Support the nut of the screw shaft with V blocks. Place a probe on the flange end, and read the largest difference on the dial gauge as a measurement when simultaneously turning the screw shaft and the nut by one revolution.



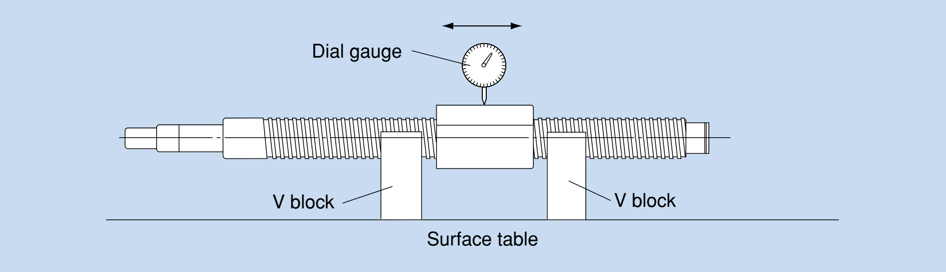
●Radial Run-out of the Nut Circumference in Relation to the Screw Shaft Axis (Table 7)

Support the thread of the screw shaft with V blocks near the nut. Place a probe on the circumference of the nut, and read the largest difference on the dial gauge as a measurement when turning the nut by one revolution without turning the screw shaft.



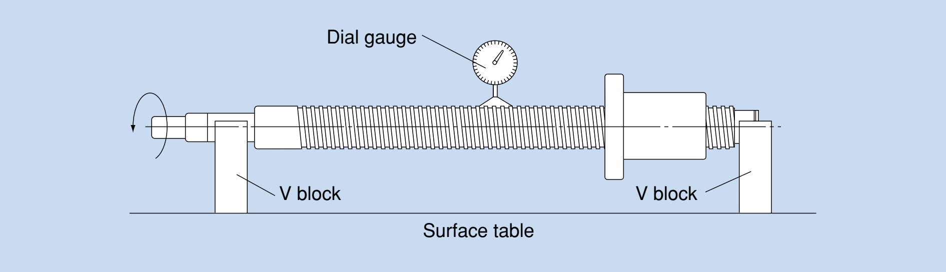
●Parallelism of the Nut Circumference (Flat Mounting Surface) to the Screw Shaft Axis (Table 8)

Support the thread of the screw shaft with V blocks near the nut. Place a probe on the circumference of the nut (flat mounting surface), and read the largest difference on the dial gauge as a measurement when moving the dial gauge in parallel with the screw shaft.



●Overall Radial Run-out of the Screw Shaft Axis

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the screw shaft, and read the largest difference on the dial gauge at several points in the axial directions as a measurement when turning the screw shaft by one revolution.



Note: For the overall radial run-out of the screw shaft axis, refer to JIS B 1192.

4.3. Axial Clearance

4.3.1. Axial Clearance of the Precision Ball Screw

Table 9 shows axial clearance of the precision Screw Ball. If the manufacturing length exceeds the value in table 10, the resultant clearance may partially be negative (preload applied).

Table 9 Axial Clearance of the Precision Ball Screw

Unit: mm

Clearance symbol	G0	GT	G1	G2	G3
Axial clearance	0 or less	0 to 0.005	0 to 0.01	0 to 0.02	0 to 0.05

Table 10 Manufacturing-limit Length of the Precision Ball Screw in Axial Clearance

Unit: mm

Screw shaft outer diameter	Overall thread length						
	Clearance GT		Clearance G1		Clearance G2		
	C0 to C3	C5	C0 to C3	C5	C0 to C3	C5	C7
4 to 6	80	100	80	100	80	100	120
8 to 10	250	200	250	250	250	300	300
12 to 16	500	400	500	500	700	600	500
18 to 25	800	700	800	700	1000	1000	1000
28 to 32	900	800	1100	900	1400	1200	1200
36 to 45	1000	800	1300	1000	2000	1500	1500
50 to 70	1200	1000	1600	1300	2500	2000	2000
80 to 100	—	—	1800	1500	4000	3000	3000

* When manufacturing the Ball Screw of precision-grade accuracy C7 with clearance GT or G1, the resultant clearance is partially negative.

4.3.2. Axial Clearance of the Rolled Ball Screw

Table 11 shows axial clearance of the rolled Ball Screw.

Table 11 Axial Clearance of the Rolled Ball Screw

Unit: mm

Screw shaft outer diameter	Axial clearance (maximum)
6 to 12	0.05
14 to 28	0.1
30 to 32	0.14
36 to 45	0.17
50	0.2

4.4. Preload

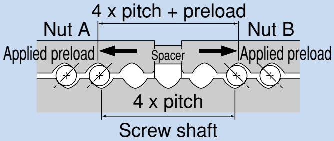
A preload is provided in order to eliminate axial clearance and minimize the displacement under an axial load.
When performing highly accurate positioning, a preload is generally provided.

4.4.1. Method for Providing a Preload

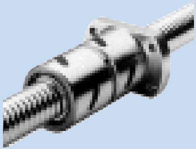
Fixed-point Preloading

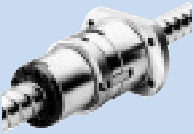
●Double-nut method (models BNFN, DKN and BLW)

This method provides a preload by inserting a spacer between two nuts.



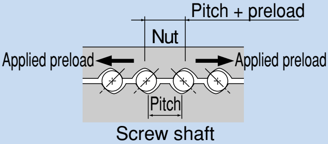

Model BNFN

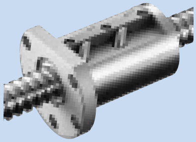

Model DKN

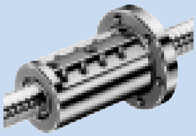

Model BLW

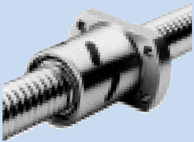
●Offset preloading (models SBN, BIF, DIK, SBK and DIR)

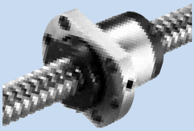
More compact than the double-nut method, the offset preloading provides a preload by changing the groove pitch in the middle of the nut without using a spacer.

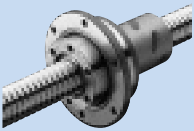



Model SBN


Model BIF

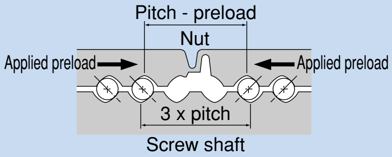

Model DIK

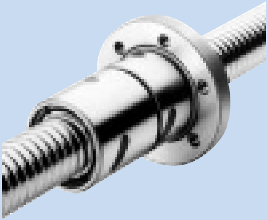

Model SBK


Model DIR

Constant-pressure Preloading Model JPF

A spring structure is established almost in the middle of the nut, and the groove pitch is changed in the middle of the nut to provide a preload.





Model JPF

4.4.2. Rigidity of the Ball Screw under a Preload

When a preload is provided to the Ball Screw, the rigidity of the nut is increased.
Fig. 4 shows elastic displacement curbs of the Ball Screw under a preload and without a preload.

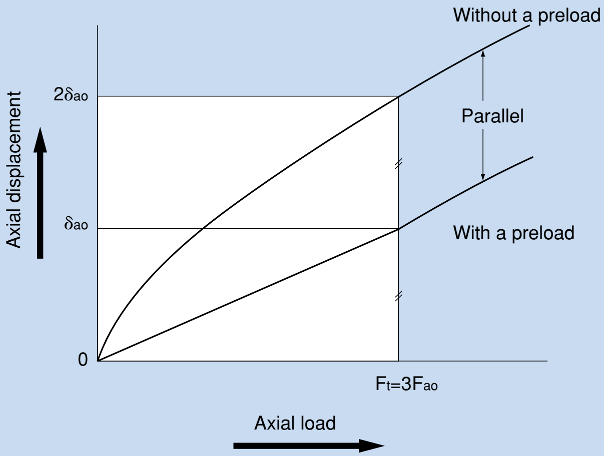


Fig. 4 Elastic Displacement of the Ball Screw

Fig. 5 shows a double-nut type of Ball Screw.

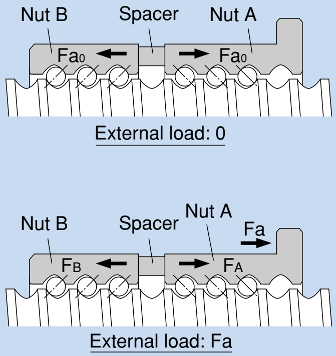


Fig. 5

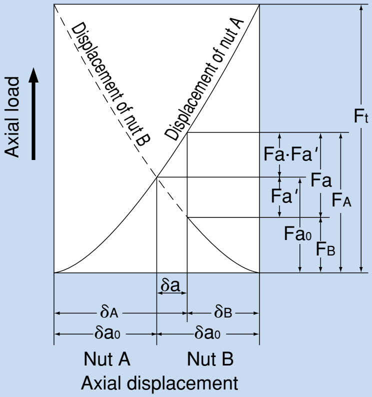


Fig. 6

Nuts A and B are provided with preload Fa_0 from the spacer. Because of the preload, nuts A and B are elastically displaced by δa_0 each. If an axial load (Fa) is applied from outside in this state, the displacement of nuts A and B is calculated as follows:

$$\delta_A = \delta a_0 + \delta a \qquad \delta_B = \delta a_0 - \delta a$$

In other words, the loads on nut A and B are expressed as follows:

$$F_A = Fa_0 + (Fa - Fa') \qquad F_B = Fa_0 - Fa'$$

Therefore, under a preload, the load that nut A receives equals to Fa - Fa'. This means that since load Fa', which is applied when nut A receives no preload, is deducted from Fa, the displacement of nut A is smaller.

This effect extends to the point where the displacement (δa_0) caused by the preload applied on nut B reaches zero.

To what extent is elastic displacement reduced? The relationship between the axial load on the Ball Screw under no preload and the elastic displacement can be expressed by $\delta a \propto Fa^{2/3}$. From Fig. 6, the following equations are established.

$$\delta a_0 = KFa_0^{2/3} \qquad \text{(K: constant)}$$

$$2\delta a_0 = KF_t^{2/3}$$

$$\left(\frac{F_t}{Fa_0}\right)^{\frac{2}{3}} = 2 \qquad F_t = 2^{3/2} \times Fa_0 = 2.8Fa_0 \fallingdotseq 3Fa_0$$

Thus, the Ball Screw under a preload is displaced by δa_0 when an axial load (F_t) approximately three times greater than the preload is provided from outside. As a result, the displacement of the Ball Screw under a preload is half the displacement ($2\delta a_0$) of the Ball Screw without a preload.

As stated above, since the preloading is effective up to approximately three times the applied preload, the optimum preload is one third of the maximum axial load.

Note, however, that an excessive preload adversely affects the service life and heat generation. As a guideline, the maximum preload should be set at 10% of the basic dynamic load rating (Ca) at a maximum.

4.4.3. Preload Torque

The preload torque of the Ball Screw in lead is controlled in accordance with JIS standard (JIS B 1192).

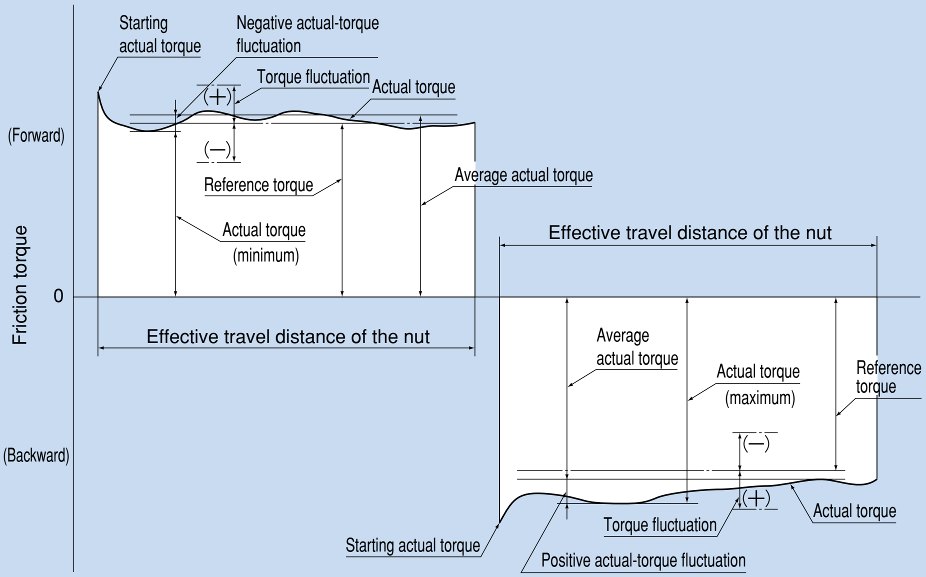


Fig. 7 Terms on Preload Torque

●Dynamic preload torque

A torque required to continuously rotate the screw shaft of a Ball Screw under a given preload without an external load applied.

●Actual torque

A dynamic preload torque measured with an actual Ball Screw.

●Torque fluctuation

Variation in a dynamic preload torque set at a target value. It can be positive or negative in relation to the reference torque.

●Coefficient of torque fluctuation

Ratio of torque fluctuation to the reference torque.

●Reference torque

A dynamic preload torque set as a target.

●Calculating the reference torque

The reference torque of a Ball Screw provided with a preload is obtained in the following equation (5).

$$T_p = 0.05\,(\tan\beta)^{-0.5}\,\frac{Fa_0 \cdot \ell}{2\pi} \quad \cdots\cdots\cdots(5)$$

where

T_p : Reference torque (N·mm)

β : Lead angle

Fa_0 : Applied preload (N)

ℓ : Lead (mm)

Table 12 Tolerance Range in Torque Fluctuation

Reference torque N·mm		Effective thread length									
		4,000 mm or less								Above 4,000 mm and 10,000 mm or less	
		$\frac{\text{Thread length}}{\text{screw shaft outer diameter}} \leqq 40$				$40 < \frac{\text{Thread length}}{\text{screw shaft outer diameter}} < 60$				—	
		Accuracy grade				Accuracy grade				Accuracy grade	
Above	Or less	C0	C1	C2, C3	C5	C0	C1	C2, C3	C5	C2, C3	C5
200	400	±35%	±40%	±45%	±55%	±45%	±45%	±55%	±65%	—	—
400	600	±25%	±30%	±35%	±45%	±38%	±38%	±45%	±50%	—	—
600	1000	±20%	±25%	±30%	±35%	±30%	±30%	±35%	±40%	±40%	±45%
1000	2500	±15%	±20%	±25%	±30%	±25%	±25%	±30%	±35%	±35%	±40%
2500	6300	±10%	±15%	±20%	±25%	±20%	±20%	±25%	±30%	±30%	±35%
6300	10000	—	—	±15%	±20%	—	—	±20%	±25%	±25%	±30%

Example: When a preload of 3,000 N is provided to Ball Screw model BNFN4010-5G0 + 1500LC3 with a thread length of 1,300 mm (shaft diameter: 40 mm; ball center diameter: 41.75 mm; lead: 10 mm), the preload torque of the Ball Screw is calculated in the steps below.

Calculating the Reference Torque

β : Lead angle

$$\tan\beta = \frac{\text{lead}}{\pi \times \text{ball center diameter}} = \frac{10}{\pi \times 41.75} = 0.0762$$

Fa_0 : Applied preload =3000N

ℓ : Lead =10mm

$$T_p = 0.05\,(\tan\beta)^{-0.5}\,\frac{Fa_0 \cdot \ell}{2\pi} = 0.05\,(0.0762)^{-0.5}\,\frac{3000 \times 10}{2\pi} = 865\text{N} \cdot \text{mm}$$

Calculating the Torque Fluctuation

$$\frac{\text{thread length}}{\text{screw shaft outer diameter}} = \frac{1300}{40} = 32.5 \leqq 40$$

Thus, with the reference torque in table 12 being between 600 and 1,000 N-mm, effective thread length 4,000 mm or less and accuracy grade C3, the coefficient of torque fluctuation is obtained as ±30%.

As a result, the torque fluctuation is calculated as follows,

$865 \times (1 \pm 0.3) = 606\ \text{N} \cdot \text{mm to } 1125\ \text{N} \cdot \text{mm}$

Result

Reference torque: 865 N-mn

Torque fluctuation: 606 N-mm to 1,125 N-mm

5. Selecting a Screw Shaft

5.1. Maximum Manufacturing Length of the Screw Shaft

The manufacturing limit length of the precision Ball Screw by accuracy grade is shown in table 1, and that of the rolled Ball Screw in table 2 on page K-38.
If the shaft dimensions exceed the manufacturing limit in table 1 or 2, contact THK .

Table 1 Manufacturing Limit Length of the Precision Ball Screw by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length					
	C0	C1	C2	C3	C5	C7
4	90	110	120	120	120	120
6	150	170	210	210	210	210
8	230	270	340	340	340	340
10	350	400	500	500	500	500
12	440	500	630	680	680	680
13	440	500	630	680	680	680
14	530	620	770	870	890	890
15	570	670	830	950	980	1100
16	620	730	900	1050	1100	1400
18	720	840	1050	1220	1350	1600
20	820	950	1200	1400	1600	1800
25	1100	1400	1600	1800	2000	2400
28	1300	1600	1900	2100	2350	2700
30	1450	1700	2050	2300	2570	2950
32	1600	1800	2200	2500	2800	3200
36	2000	2100	2550	2950	3250	3650
40		2400	2900	3400	3700	4300
45		2750	3350	3950	4350	5050
50		3100	3800	4500	5000	5800
55		3450	4150	5300	6050	6500
63		4000	5200	5800	6700	7700
70			6300	6450	7650	9000
80				7900	9000	10000
100				10000	10000	

Table 2 Manufacturing Limit Length of the Rolled Ball Screw by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length		
	C7	C8	C10
6 to 8	320	320	—
10 to 12	500	1000	—
14 to 15	1500	1500	1500
16 to 18	1500	1800	1800
20	2000	2200	2200
25	2000	3000	3000
28	3000	3000	3000
30	3000	3000	4000
32 to 36	3000	4000	4000
40	3000	5000	5000
45	3000	5500	5500
50	3000	6000	6000

5.2. Standard Combinations of Shaft Diameter and Lead for the Precision Ball Screw

Table 3 shows standard combinations of shaft diameter and lead for the precision Ball Screw. If desiring a Ball Screw not covered by the table, contact THK .

Table 3 Standard Combinations of Screw Shaft and Lead (Precision Ball Screw)

Screw shaft outer diameter	Lead																					
	1	2	4	5	6	8	10	12	15	16	20	24	25	30	32	36	40	50	60	80	90	100
4	●																					
5	●																					
6	●																					
8	●	●					●	○														
10		●	●				●		○													
12		●		●		●																
13											○											
14		●	●	●		●																
15							●				●			○			○					
16			○	●	○		○			●												
18							●															
20			○	●	○	○	●	○			●						○		○			
25			○	●	○	○	●	○		○	●		○					○				
28				○	●	○	○															
30																			○		○	
32			○	●	●	○	●	○			○				○							
36					○	○	●	○		○	○	○				○						
40				○	○	○	●	●		○	○			○			○			○		
45					○	○	○	○		○	○											
50				○		○	●	○		○	○			○		○		○				○
55							○	○		○	○			○		○						
63							○	○		○	○											
70							○	○			○											
80							○	○			○											
100											○											

For combinations marked with "●," off-the-shelf products (standard-stock products equipped with standardized screw shafts - shaft ends unfinished and finished) are available.

5.3. Standard Combinations of Shaft Diameter and Lead for the Rolled Ball Screw

Table 4 shows standard combinations of shaft diameter and lead for the rolled Ball Screw.

Table 4 Standard Combinations of Screw Shaft and Lead (Rolled Ball Screw)

Screw shaft outer diameter	Lead																			
	1	2	4	5	6	8	10	12	16	20	24	25	30	32	36	40	50	60	80	100
6	●																			
8		●																		
10		●			○															
12		●				○														
14			●	●																
15							●			●			●							
16				●					●											
18						●														
20				●			●			●						●				
25				●			●					●					●			
28					●															
30																		●		
32							●							●						
36							●			●	●				●					
40							●									●			●	
45								●												
50									●								●			●

For combinations marked with "●," off-the-shelf products are available.

5.4. Method for Mounting the Screw Shaft

Figures 1 to 4 show representative mounting methods for the screw shaft.
Permissible axial load and permissible rotation speed vary with mounting methods for the screw shaft. Therefore, it is necessary to select an appropriate mounting method according to the service conditions.

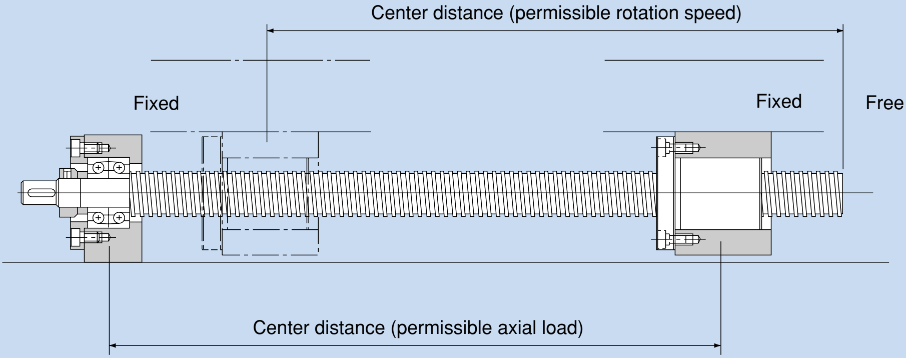


Fig. 1 Screw Shaft Mounting Method: Fixed - Free

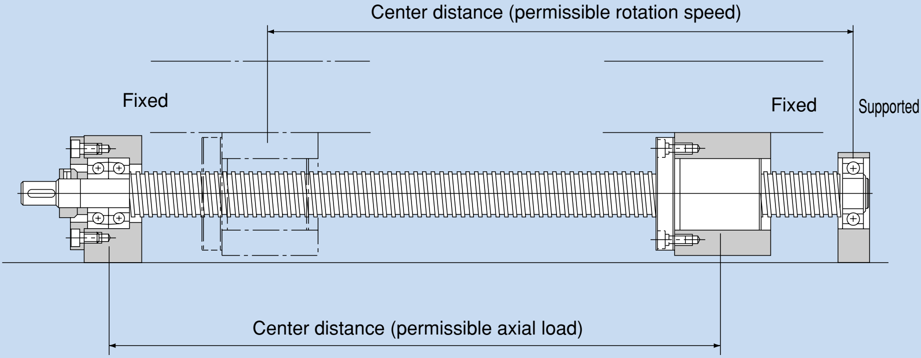


Fig. 2 Screw Shaft Mounting Method: Fixed - Supported

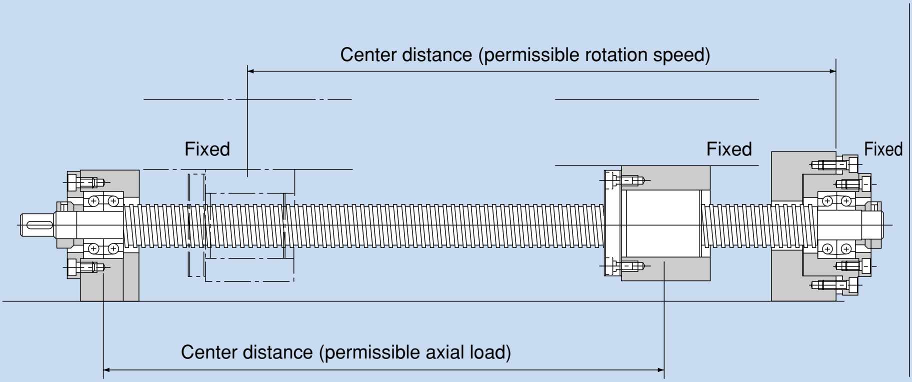


Fig. 3 Screw Shaft Mounting Method: Fixed - Fixed

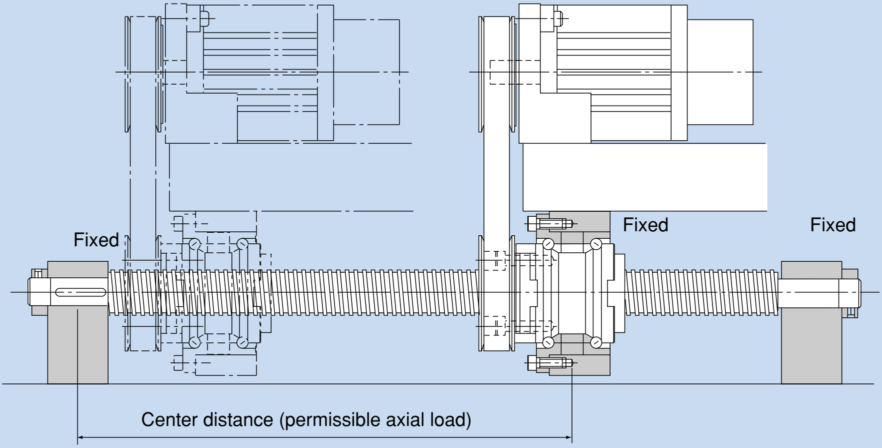


Fig. 4 Screw Shaft Mounting Method for Rotary Nut Ball Screw: Fixed - Fixed

5.5. Permissible Axial Load

5.5.1. Buckling Load on the Screw Shaft

With the Ball Screw, it is necessary to select a screw shaft so that it will not buckle when the maximum compressive load is applied in the axial direction.

Fig. 5 on page K-44 shows the relationship between the screw shaft diameter and a buckling load. If determining a buckling load by calculation, it can be obtained from the equation (6) below. Note that in this equation, a safety factor of 0.5 is multiplied to the result.

$$P_1 = \frac{\eta_1 \cdot \pi^2 \cdot E \cdot I}{\ell a^2} 0.5 = \eta_2 \frac{d_1^4}{\ell a^2} 10^4 \quad \cdots\cdots\cdots(6)$$

where

P_1 : Buckling load (N)

ℓ_a : Center distance (mm)

E : Young's modulus (2.06×10^5 N/mm²)

I : Minimum geometrical moment of inertia of the screw shaft (mm⁴)

$$I = \frac{\pi}{64} d_1^4$$

d_1 : Screw-shaft thread minor diameter (mm)

η_1, η_2 = Factor for mounting method

Fixed - free	$\eta_1=0.25$	$\eta_2=1.3$
Fixed - supported	$\eta_1=2$	$\eta_2=10$
Fixed - fixed	$\eta_1=4$	$\eta_2=20$

5.5.2. Permissible Tensile and Compressive Load on the Screw Shaft

If an axial load is applied to the Ball Screw, it is necessary to take into account not only the buckling load but also the permissible tensile and compressive load in relation to the yielding stress on the screw shaft.

The permissible tensile-compressive load is obtained from the equation (7).

$$P_2 = \sigma \frac{\pi}{4} d_1^2 = 116 d_1^2 \quad \cdots\cdots\cdots(7)$$

where

P_2 : Permissible tensile and compressive load (N)

σ : Permissible tensile-compressive stress (147 N/mm²)

d_1 : Screw-shaft thread minor diameter (mm)

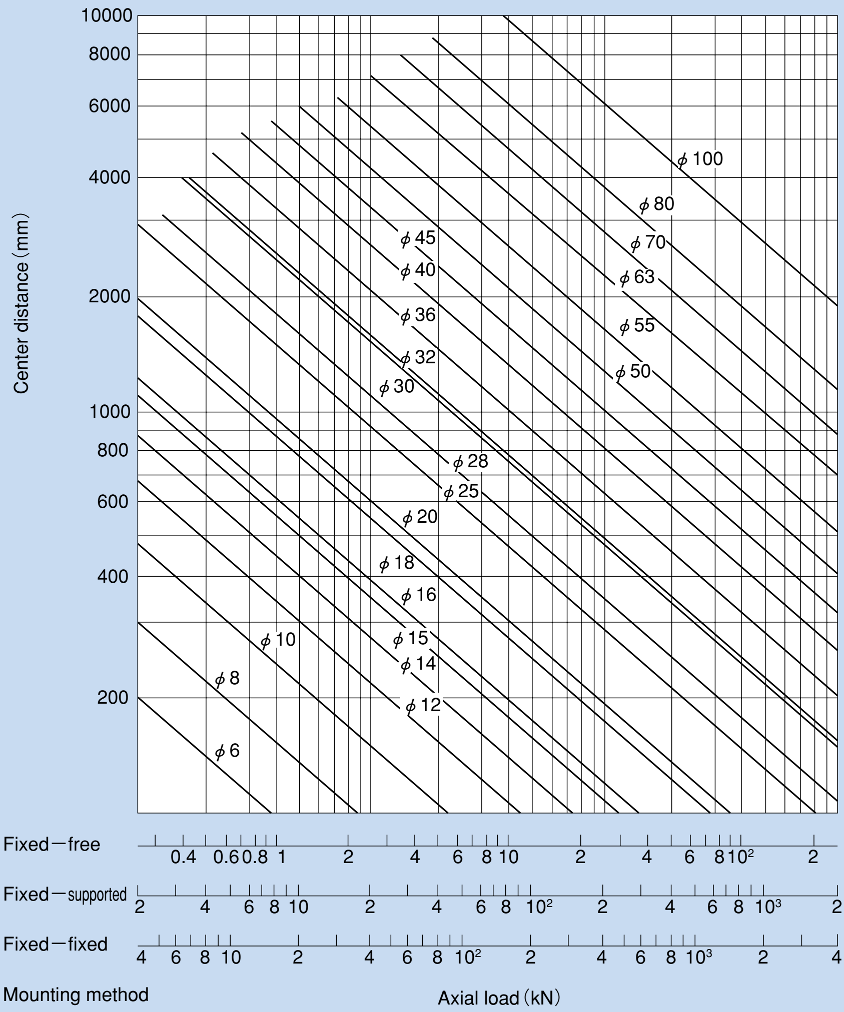


Fig. 5 Permissible Tensile and Compressive Load Diagram

5.6. Permissible Rotation Speed

5.6.1. Critical Speed of the Screw Shaft

When the rotation speed reaches a high level, the Ball Screw may resonate and eventually become unable to operate due to the screw shaft's natural frequency. Therefore, it is necessary to select a model so that it is used below the resonance point (critical speed).

Fig. 6 on page K-47 shows the relationship between the screw shaft diameter and a critical speed.

If determining a critical speed by calculation, it can be obtained from the equation (8) below. Note that in this equation, a safety factor of 0.8 is multiplied to the result.

$$N_1 = \frac{60 \cdot \lambda_1^2}{2\pi \cdot \ell_b^2} \times \sqrt{\frac{E \times 10^3 \cdot I}{\gamma \cdot A}} \times 0.8 = \lambda_2 \cdot \frac{d_1}{\ell_b^2} \cdot 10^7 \quad \cdots\cdots\cdots (8)$$

where

N_1 : Permissible rotation speed determined by critical speed (min^{-1})

ℓ_b : Center distance (mm)

E : Young's modulus (2.06×10^5 N/mm^2)

I : Minimum geometrical moment of inertia of the screw shaft (mm^4)

$$I = \frac{\pi}{64} d_1^4$$

d_1 : Screw-shaft thread minor diameter (mm)

γ : Density (specific gravity) (7.85×10^{-6} kg/mm^3)

A : Screw shaft sectional area (mm^2)

$$A = \frac{\pi}{4} d_1^2$$

λ_1, λ_2 : Factor for mounting method

Fixed - free	$\lambda_1=1.875$	$\lambda_2=3.4$
Supported - supported	$\lambda_1=3.142$	$\lambda_2=9.7$
Fixed - supported	$\lambda_1=3.927$	$\lambda_2=15.1$
Fixed - fixed	$\lambda_1=4.73$	$\lambda_2=21.9$

5.6.2. DN Value

The permissible rotation speed of the Ball Screw must be obtained from the critical speed of the screw shaft and the DN value.

The permissible rotation speed determined by the DN value is obtained using the equations (9) to (13) below.

Ball Screw with Ball Cage

●Models SBN and HBN

$$N_2 = \frac{130000}{D} \quad \cdots\cdots\cdots (9)$$

where

N_2 : Permissible rotation speed determined by DN value (min^{-1} (rpm))

D : Ball center diameter

(Described in the dimensional table for the respective model number in the "THK General Catalog - Product Specifications," provided separately.)

●Model SBK

$$N_2 = \frac{160000}{D} \quad \cdots\cdots\cdots (10)$$

Precision Ball Screw

$$N_2 = \frac{70000}{D} \quad \cdots\cdots\cdots (11)$$

Rolled Ball Screw

(excluding large-lead type)

$$N_2 = \frac{50000}{D} \quad \cdots\cdots\cdots (12)$$

Large-Lead Rolled Ball Screw

$$N_2 = \frac{70000}{D} \quad \cdots\cdots\cdots (13)$$

Of the permissible rotation speed determined by critical speed (N_1) and the permissible rotation speed determined by DN value (N_2), the lower rotation speed is regarded as the permissible rotation speed.

If the working rotation speed exceeds N_2, a high-speed type Ball Screw is available. Contact THK for details.

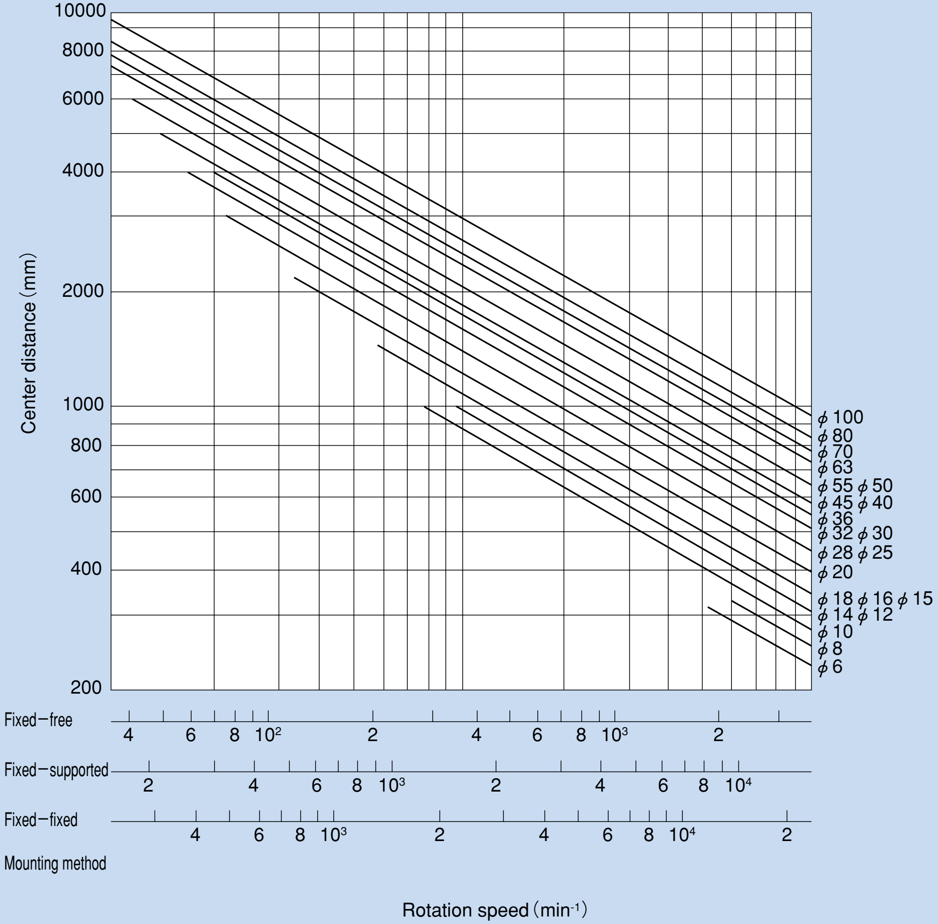


Fig. 6 Permissible Rotation Speed Diagram

6. Types of Ball Screws

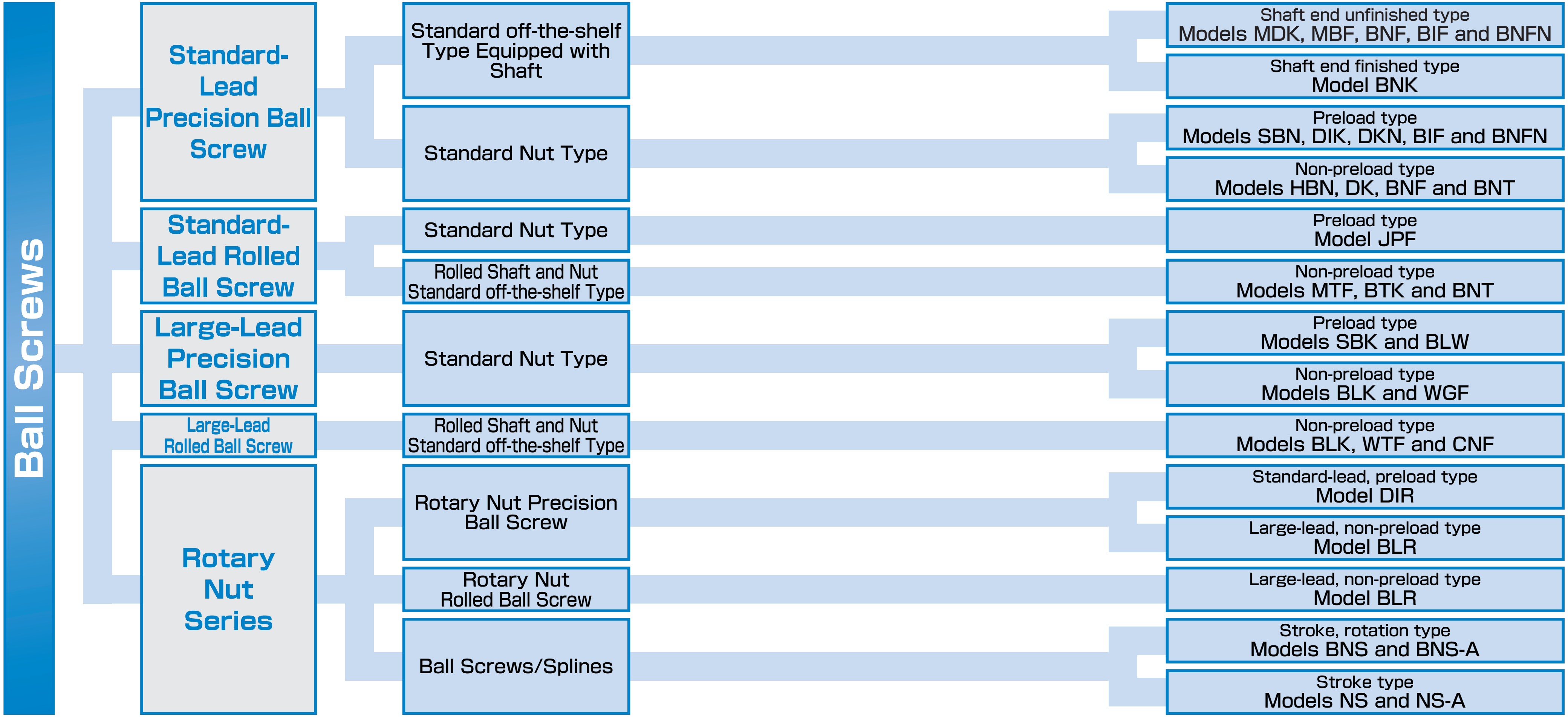
Classification of Ball Screws

For THK Ball Screws, a broad array of types are offered as standard so that the optimal product can be selected to meet diversified applications. By ball circulation method, the Ball Screws are divided into return-pipe type, deflector type and end-cap type. And by preloading method, fixed-point preloading (double-nut method, offset preloading) and constant-pressure preloading are selectable.

By screw shaft, they are divided into precision Ball Screws, which are ground with precision (six accuracy grades from C7 to C0), and rolled Ball Screws, which are formed through rolling with high accuracy (three accuracy grades from C10 to C7).

Also, a series of nut-rotating Ball Screws, which are optimal for usage based on nut rotation, are also offered in addition to those types designed for conventional use based on axial rotation.

In addition, THK also offers support units, which are incorporated with nut bracket, rock nut and support bearing, as peripherals for Ball Screws as standard.



7. Selecting a Nut

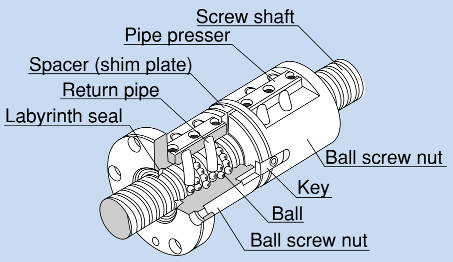
7.1. Types of Nuts

Nuts of Ball Screws are categorized by ball circulation method into return-pipe type, deflector type and end cap type. These three nut types are described as follows.
In addition to circulation methods, Ball Screws are categorized also by preloading method.

7.1.1. Types by Ball Circulation Method

Return-pipe Type
(Models SBN, BNF, BNT, BNFN, BIF and BTK)
Return-piece Type (Model HBN)

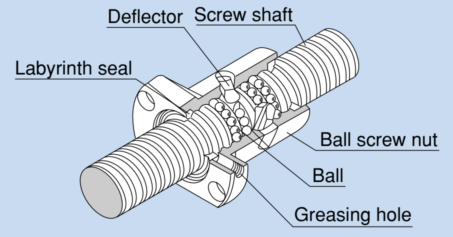
These are most common types of nuts that use a return pipe for ball circulation. The return pipe allows balls to be picked up, pass through the pipe, and return to their original positions to complete infinite motion.



Example of Structure of Return-pipe Nut

Deflector Type: Simple Nut
(Models DK, DKN, DIK, JPF and DIR)

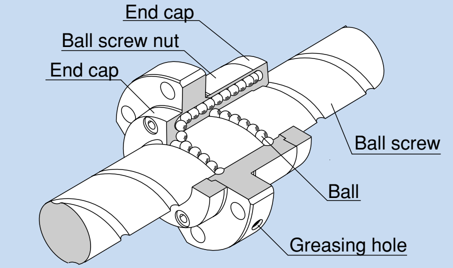
These are the most compact type of nut. Balls change their traveling direction with a deflector, pass over the circumference of the screw shaft, and return to their original positions to complete infinite motion.



Example of Structure of Simple Nut

End-cap Type: Large-lead Nut
(Models SBK, BLK, WGF, BLW, WTF, CNF and BLR)

These nuts are most suitable for fast feed. Balls are picked up with an end cap, pass through the through hole of the nut, and return to their original positions to complete infinite motion.



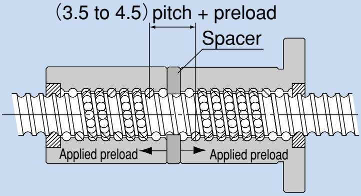
Example of Structure of Large-lead Nut

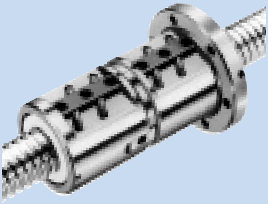
7.1.2. Types by Preloading Method

Fixed-point Preloading

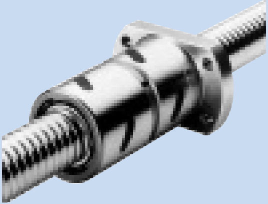
●Double-nut Method (Models BNFN, DKN and BLW)

A spacer is inserted between two nuts to provide a preload.

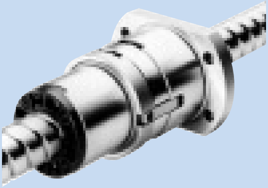




Model BNFN



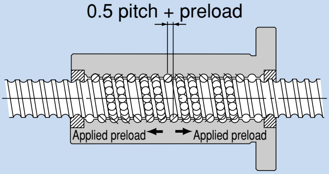
Model DKN

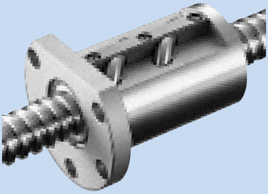


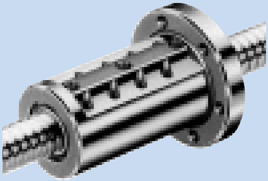
Model BLW

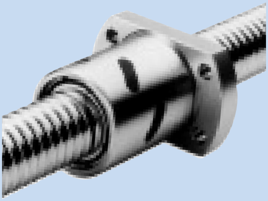
●Offset Preloading (Models SBN, BIF, DIK, SBK and DIR)

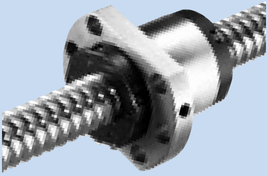
It allows more compact design than the double-nut method. This method provides a preload by changing the groove pitch in the middle of the nut without using a spacer.

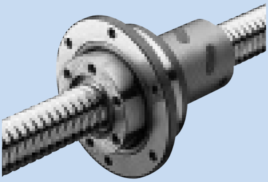



Model SBN


Model BIF

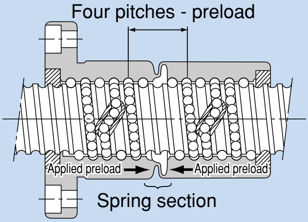

Model DIK

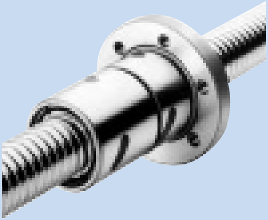

Model SBK


Model DIR

Constant-pressure Preloading (Model JPF)

With this method, a spring structure is installed almost in the middle of the nut, and it provides a preload by changing the groove pitch in the middle of the nut.




Model JPF

7.2. Calculating the Axial Load

7.2.1. In Horizontal Mount

With ordinary conveyance systems, the axial load (Fa_n) applied when horizontally reciprocating the workpiece is obtained in the equation below.

$$Fa_1 = \mu \cdot mg + f + m\alpha \cdots\cdots (14)$$

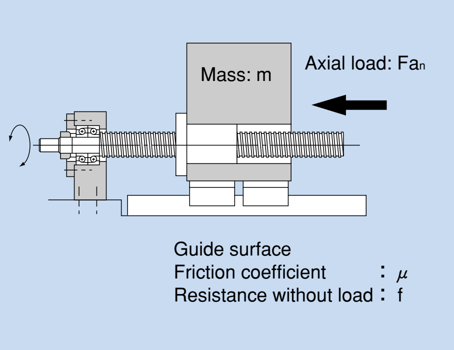
$$Fa_2 = \mu \cdot mg + f \cdots\cdots (15)$$

$$Fa_3 = \mu \cdot mg + f - m\alpha \cdots\cdots (16)$$

$$Fa_4 = -\mu \cdot mg - f - m\alpha \cdots\cdots (17)$$

$$Fa_5 = -\mu \cdot mg - f \cdots\cdots (18)$$

$$Fa_6 = -\mu \cdot mg - f + m\alpha \cdots\cdots (19)$$



Maximum speed	V_{max} (m/s)
Acceleration time	t_1 (m/s)
Acceleration	$\alpha = \frac{V_{max}}{t_1}$ (m/s²)

Axial load during forward acceleration	Fa_1 (N)
Axial load during forward uniform motion	Fa_2 (N)
Axial load during forward deceleration	Fa_3 (N)
Axial load during backward acceleration	Fa_4 (N)
Axial load during uniform backward motion	Fa_5 (N)
Axial load during backward deceleration	Fa_6 (N)
Transferred mass	m (kg)
Friction coefficient of the guide surface	μ (—)
Resistance of the guide surface (without load)	f (N)

7.2.2. In Vertical Mount

With ordinary conveyance systems, the axial load (Fa_n) applied when vertically reciprocating the workpiece is obtained in the equation below.

$$Fa_1 = mg + f + m\alpha \cdots\cdots (20)$$

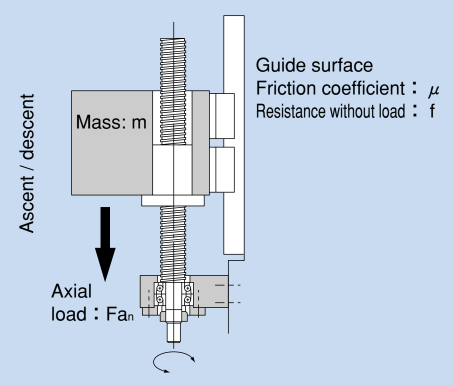
$$Fa_2 = mg + f \cdots\cdots (21)$$

$$Fa_3 = mg + f - m\alpha \cdots\cdots (22)$$

$$Fa_4 = mg - f - m\alpha \cdots\cdots (23)$$

$$Fa_5 = mg - f \cdots\cdots (24)$$

$$Fa_6 = mg - f + m\alpha \cdots\cdots (25)$$



Maximum speed	V_{max} (m/s)
Acceleration time	t_1 (m/s)
Acceleration	$\alpha = \frac{V_{max}}{t_1}$ (m/s²)

Axial load during upward acceleration	Fa_1 (N)
Axial load during uniform upward motion	Fa_2 (N)
Axial load during upward deceleration	Fa_3 (N)
Axial load during downward acceleration	Fa_4 (N)
Axial load during uniform downward motion	Fa_5 (N)
Axial load during downward deceleration	Fa_6 (N)
Transferred mass	m (kg)
Resistance of the guide surface (without load)	f (N)

7.3. Static Safety Factor

The basic static load rating (C_0a) generally equals to the permissible axial load of a Ball Screw. Depending on the service conditions, it is necessary to take into account the following static safety factor against the calculated load. When the Ball Screw is stationary or operative, unexpected external force may be applied through inertia caused by impact or start/stop.

$$Fa_{max} = \frac{C_0a}{f_S} \quad \cdots\cdots\cdots(26)$$

where

Fa_{max} : Permissible axial load (kN)

C_0a : Basic static load rating* (kN)

f_S : Static safety factor (see table 1)

Table 1 Static Safety Factor (f_s)

Machine using the LM system	Load conditions	Lower limit of f_s
General industrial machinery	Without vibrations or impact	1 to 1.3
	With vibrations or impact	2 to 3
Machine tools	Without vibrations or impact	1 to 1.5
	With vibrations or impact	2.5 to 7

* The basic static load rating (C_0a) is a static load with a constant direction and magnitude whereby the sum of the permanent deformation of the rolling element and that of the raceway on the contact area under the maximum stress is 0.0001 times the rolling element diameter. With the Ball Screw, it is defined as the axial load.
Specific values of each Ball Screw model are indicated in the dimensional table for the corresponding model number in the "THK General Catalog - Product Specifications," provided separately.

7.4. Studying the Service Life

7.4.1. Service Life of the Ball Screw

The Ball Screw in motion under an external load receives repeated stress on its raceways and balls. When the stress reaches the limit, the raceways break from fatigue and their surfaces partially exfoliate in flakes. This phenomenon is called flaking. The service life of the Ball Screw is the total number of revolutions until the first flaking occurs on any of the raceways or the balls as a result of rolling fatigue of the material.

The service life of the Ball Screw varies from unit to unit even if they are manufactured in the same process and used in the same operating conditions. For this reason, when determining the service life of a Ball Screw unit, the rated life as defined below is used as a guideline.

The rated life is the total number of revolutions that 90% of identical Ball Screw units in a group achieve without developing flaking (scale-like exfoliation of a metallic surface) after they independently operate in the same conditions.

7.4.2. Calculating the Rated Life

The service life of the Ball Screw is calculated from the equation (27) below using the basic dynamic load rating (Ca) and the applied axial load.

Rated Life (Total Number of Revolutions)

$$L = \left(\frac{C_a}{f_W \cdot F_a} \right)^3 \times 10^6 \quad \cdots\cdots\cdots(27)$$

where

L : Rated life (total number of revolutions) (rev)
Ca : Basic dynamic load rating* (N)
Fa : Applied axial load (N)
f_W : Load factor (see table 2)

Table 2 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low $V \leqq 0.25$m/s	1 to 1.2
Weak	Low $0.25 < V \leqq 1$m/s	1.2 to 1.5
Medium	Moderate $1 < V \leqq 2$m/s	1.5 to 2
Strong	High $V > 2$m/s	2 to 3.5

* The basic dynamic load rating (Ca) is used in calculating the service life when a Ball Screw operates under a load.

The basic dynamic load rating is a load with constant direction and magnitude under which the rated life (L) equals to 10^6rev. when a group of the same Ball Screw units independently operate. (Specific basic dynamic load ratings (Ca) are indicated in the dimensional tables of the corresponding model numbers in the "THK General Catalog - Product Specifications," provided separately.)

Service Life Time

If the rotation speed per minute is determined, the service life time can be calculated from the equation (28) below using the rated life (L).

$$L_h = \frac{L}{60 \times N} = \frac{L \times \ell}{2 \times 60 \times n \times \ell_S} \quad \cdots\cdots\cdots(28)$$

where

L_h : Service life time (h)

N : Rotation speed per minute (min^{-1})

n : Reciprocations per minute (min^{-1})

ℓ : Lead of the Ball Screw (mm)

ℓ_S : Stroke length (mm)

Service Life in Travel Distance

The service life in travel distance can be calculated from the equation (29) below using the rated life (L) and the Ball Screw lead.

$$L_S = \frac{L \times \ell}{10^6} \quad \cdots\cdots\cdots(29)$$

where

L_S : Service life in travel distance (km)

ℓ : Ball Screw lead (mm)

Applied Load and Service Life with a Preload Taken into Account

If the Ball Screw is used under a preload (medium load), it is necessary to consider the applied preload in calculating the service life since the ball screw nut already receives an internal load. For details on applied preload for a specific model number, contact THK.

Average Axial Load

If an axial load acting on the Ball Screw is present, it is necessary to calculate the service life by determining the average axial load.

The average axial load (F_m) is a constant load that equals to the service life in fluctuating load conditions.

If the load changes in steps, the average axial load can be obtained from the equation below.

$$F_m = \sqrt[3]{\frac{1}{L}\left(Fa_1^{3}\ell_1 + Fa_2^{3}\ell_2 + \cdots\cdots + Fa_n^{3}\ell_n\right)} \quad \cdots\cdots\cdots(30)$$

where

F_m : Average axial load (N)

Fa_n : Fluctuating load (N)

ℓ_n : Distance traveled under a load (F_n)

ℓ : Total travel distance

To determine the average axial load using a rotation speed and time, instead of a distance, calculate the average axial load by determining the distance in the equation below.

where

$\ell = \ell_1 + \ell_2 + \cdots \ell_n$

$\ell_1 = N_1 \cdot t_1$

$\ell_2 = N_2 \cdot t_2$

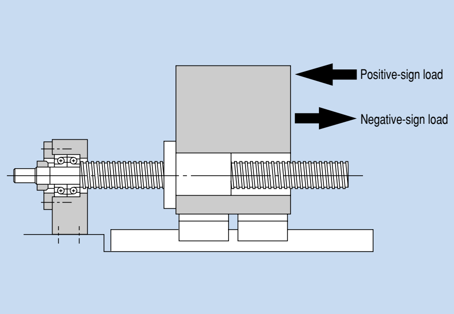
$\ell_n = N_n \cdot t_n$

N : Rotation speed

t : Time

When the Applied Load Sign Changes

When all signs for fluctuating loads are the same, the equation (30) applies without problem. However, if the sign for the fluctuating load changes according to the operation, it is necessary to calculate both the average axial load of the positive-sign load and that of the negative-sign load while taking in to account the load direction (when calculating the average axial load of the positive-sign load, assume the negative-sign load to be zero). Of the two average axial loads, the greater value is regarded as the average axial load for calculating the service life.



Example:

Calculate the average axial load with the following load conditions.

Operation No.	Fluctuating load Fa_n(N)	Travel distance ℓ_n(mm)
No.1	10	10
No.2	50	50
No.3	–40	10
No.4	–10	70

* The subscripts of the fluctuating load symbol and the travel distance symbol indicate operation numbers.

Average axial load of positive-sign load

* To calculate the average axial load of the positive-sign load, assume Fa_3 and Fa_4 to be zero.

$$F_{m1} = \sqrt[3]{\frac{Fa_1^{\,3} \times \ell_1 + Fa_2^{\,3} \times \ell_2}{\ell_1 + \ell_2 + \ell_3 + \ell_4}} = 35.5\text{N}$$

Average axial load of negative-sign load

* To calculate the average axial load of the negative-sign load, assume Fa_1 and Fa_2 to be zero.

$$F_{m2} = \sqrt[3]{\frac{|Fa_3|^3 \times \ell_3 + |Fa_4|^3 \times \ell_4}{\ell_1 + \ell_2 + \ell_3 + \ell_4}} = 17.2\text{N}$$

Accordingly, the average axial load of the positive-sign load (F_{m1}) is adopted as the average axial load (F_m) for calculating the service life.

8. Studying the Rigidity

To increase the positioning accuracy of feed screws in NC machine tools or precision machines, or to reduce the displacement cause by the cutting force, it is necessary to design the rigidity of the components in a well-balanced manner.

8.1. Axial Rigidity of the Feed Screw System

When the axial rigidity of a feed screw system is K, the elastic displacement in the axial direction can be obtained using the equation (31) below.

$$\delta = \frac{Fa}{K} \quad \cdots\cdots\cdots(31)$$

where

δ : Elastic displacement of a feed screw system in the axial direction (μm)

Fa : Applied axial load (N)

The axial rigidity (K) of the feed screw system is obtained using the equation (32) below.

$$\frac{1}{K} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \quad \cdots\cdots\cdots(32)$$

where

K : Axial rigidity of the feed screw system (N/μm)

K_S : Axial rigidity of the screw shaft (N/μm)

K_N : Axial rigidity of the nut (N/μm)

K_B : Axial rigidity of the support bearing (N/μm)

K_H : Rigidity of the nut bracket and the support bearing bracket (N/μm)

8.1.1. Axial Rigidity of the Screw Shaft

The axial rigidity of a screw shaft varies depending on the method for mounting the shaft.

For Fixed-Supported (or -Free) Configuration

$$K_S = \frac{A \cdot E}{1000 \cdot L} \quad \cdots\cdots\cdots(33)$$

where

A : Sectional area of the screw shaft (mm²)

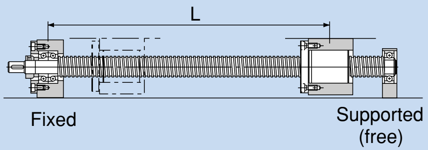
$$A = \frac{\pi}{4} d_1^2$$

d_1 : Screw-shaft thread minor diameter (mm)

E : Young's modulus (2.06×10^5 N/mm²)

L : Center distance (mm)

Fig. 1 shows an axial rigidity diagram for the screw shaft.



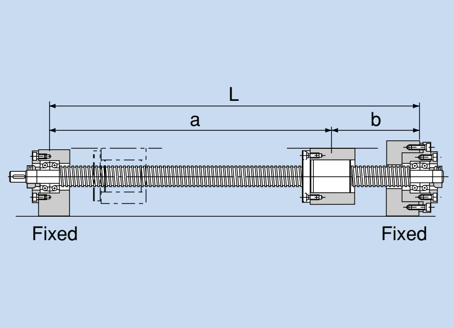
For Fixed-Fixed Configuration

$$K_s = \frac{A \cdot E \cdot L}{1000 \cdot a \cdot b} \quad \cdots\cdots\cdots(34)$$

K_s becomes the lowest and the elastic displacement in the axial direction is the greatest at the position of $a = b = \frac{L}{2}$.

$$K_s = \frac{4A \cdot E}{1000L}$$

Fig. 2 on page K-60 shows an axial rigidity diagram of the screw shaft in this configuration.



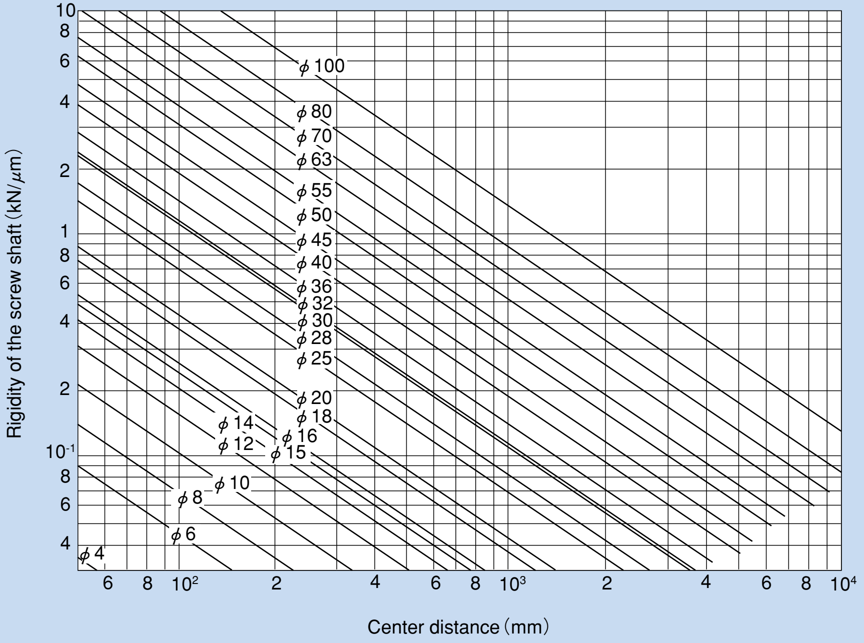


Fig. 1 Axial Rigidity of the Screw Shaft (Fixed-Free, Fixed-Supported)

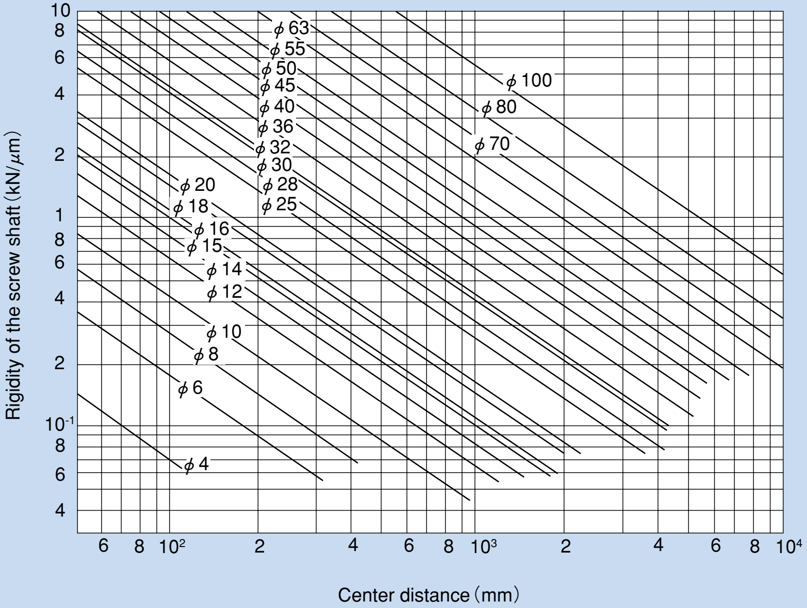


Fig. 2 Axial Rigidity of the Screw Shaft (Fixed-Fixed)

8.1.2. Axial Rigidity of the Nut

The axial rigidity of the nut varies widely with preloads.

Non-preload Type

The logical rigidity in the axial direction when an axial load accounting for 30% of the basic dynamic load rating (Ca) is applied is indicated in the dimensional table of the corresponding model number in the "THK General Catalog - Product Specifications," provided separately. This value does not include the rigidity of the components related to the nut-mounting bracket. Therefore, generally set the rigidity at roughly 80% of the value in the table.

The rigidity when the applied axial load is not 30% of the basic dynamic load rating (Ca) is calculated using the equation (35) below.

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}} \times 0.8 \qquad \cdots\cdots\cdots(35)$$

where

K_N : Axial rigidity of the nut (N/μm)

K : Rigidity value in the dimensional table in the "THK General Catalog - Product Specifications," provided separately (N/μm)

Fa : Applied axial load (N)

Ca : Basic dynamic load rating (N)

Preload Type

The logical rigidity in the axial direction when an axial load accounting for 10% of the basic dynamic load rating (Ca) is applied is indicated in the dimensional table of the corresponding model number in the "THK General Catalog - Product Specifications," provided separately. This value doe not include the rigidity of the components related to the nut-mounting bracket. Therefore, generally set the rigidity at roughly 80% of the value in the table.

The rigidity when the applied preload is not 10% of the basic dynamic load rating (Ca) is calculated using the equation (36) below.

$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}} \times 0.8 \quad \cdots\cdots\cdots(36)$$

where

K_N : Axial rigidity of the nut (N/μm)

K : Rigidity value in the dimensional table in the "THK General Catalog - Product Specifications," provided separately (N/μm)

Fa_0 : Applied preload (N)

Ca : Basic dynamic load rating (N)

8.1.3. Axial Rigidity of the Support Bearing

The rigidity of the Ball Screw support bearing varies depending on the support bearing used. The calculation of the rigidity with a representative angular ball bearing is shown in the equation (37) below.

$$K_B \doteqdot \frac{3Fa_0}{\delta a_0} \quad \cdots\cdots\cdots(37)$$

K_B : Axial rigidity of the support bearing (N/μm)

Fa_0 : Applied preload of the support bearing (N)

δa_0 : Axial displacement (μm)

$$\delta a_0 = \frac{0.45}{\sin\alpha}\left(\frac{Q^2}{Da}\right)^{\frac{1}{3}}$$

$$Q = \frac{Fa_0}{Z\sin\alpha}$$

Q : Axial load (N)

Da : Ball diameter of the support bearing (mm)

α : Initial contact angle of the support bearing (degree)

Z : Number of balls

For details of a specific support bearing, contact its manufacturer.

8.1.4. Axial Rigidity of the Nut Bracket and the Support Bearing Bracket

Take this factor into consideration when designing your machine. Set the rigidity as high as possible.

9. Studying the Positioning Accuracy

9.1. Causes of Error in Positioning Accuracy

Causes of error in the positioning accuracy include lead accuracy, axial clearance and axial rigidity of the feed screw system. Other important factors include thermal displacement from heat and orientation change of the guide system during traveling.

9.2. Studying the Lead Accuracy

It is necessary to select the correct accuracy grade of the Ball Screw that satisfies the required positioning accuracy from Ball Screw accuracies (table 1 on page K-24). Table 1 shows examples of selecting accuracy grades by application.

9.3. Studying the Axial Clearance

The axial clearance is not a factor of positioning accuracy in single-directional feed. However, it will cause backlash when the feed direction is inversed or the axial load is inversed. Select an axial clearance that meets the required backlash from tables 9 and 11 on page K-31.

Table 1 Examples of Selecting Accuracy Grades by Application

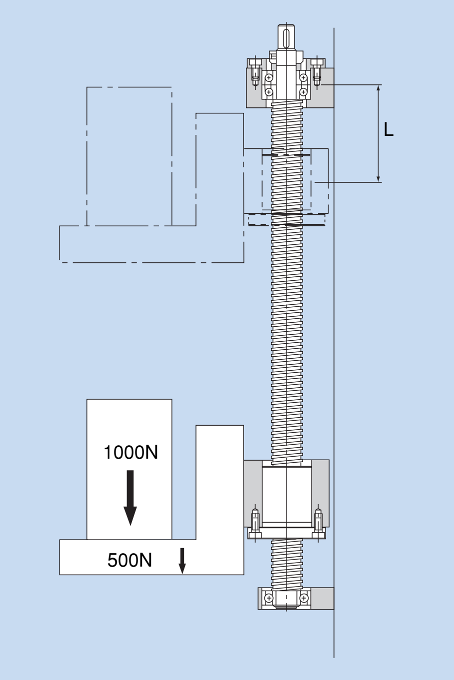
Application		NC machine tools																		
		Lathe		Machining center		Drilling machine		Jig borer		Surface grinder			Cylinder grinder		Electric discharge machine		Electric discharge machine Wire cutting			Punching press
Axis		X	Z	XY	Z	XY	Z	XY	Z	X	Y	Z	X	Z	XY	Z	XY	Z	UV	XY
Accuracy grade	C0							○	○				○		○		○	○		
	C1	○						○	○		○	○	○	○	○	○	○	○	○	
	C2	○		○	○						○	○	○	○	○	○	○	○	○	
	C3	○	○	○	○	○				○	○	○		○		○		○	○	○
	C5	○	○	○	○	○	○			○	○	○				○				○
	C7						○													○
	C8																			
	C10																			

Application		NC machine tools			General-purpose machine; dedicated machine	Industrial robots					Semiconductor related machines						3D measuring instrument	Image processing machine	Injection molding machine	Office equipment
		Laser processing machine		Wood working machine		Cartesian coordinate		Vertical articulated type		Cylindrical coordinate	Photolithography machine	Chemical treatment machine	Wire bonder	Prober	Printed board drilling machine	Electronic component inserter				
Axis		X	Z			Assembly	Other	Assembly	Other											
Accuracy grade	C0										○			○			○	○		
	C1										○		○	○	○		○	○		
	C2											○	○	○	○	○	○	○		
	C3	○	○		○	○				○		○		○	○	○				
	C5	○	○	○	○	○	○	○		○		○			○	○				○
	C7	○	○	○	○	○	○	○	○	○		○			○	○			○	○
	C8			○	○	○	○	○	○			○							○	○
	C10			○	○		○					○							○	○

9.4. Studying the Axial Rigidity of the Feed Screw System

Of the axial rigidities of the feed screw system, the axial rigidity of the screw shaft fluctuates according to the stroke position. When the axial rigidity is large, such change in the axial rigidity of the screw shaft will affect the positioning accuracy. Therefore, it is necessary to take into account the rigidity of the feed screw system (pages K-58 to K-61).

Example: Positioning error due to the axial rigidity of the feed screw system during vertical transfer



[Service conditions]
Transferred weight: 1,000 N; table weight: 500 N
Ball Screw used: model BNF2512 - 2.5 (screw-shaft thread minor diameter d_1 = 21.9 mm)
Stroke length: 600 mm (L=100 mm to 700 mm)
Screw shaft mounting type: fixed-supported

■Consideration

The difference in axial rigidity between L = 100 mm and L = 700 mm applied only to the axial rigidity of the screw shaft. Therefore, positioning error due to the axial rigidity of the feed screw system equals to the difference in the axial displacement of the screw shaft between L = 100 mm and L = 700 mm.

■Axial Rigidity of the Screw Shaft (see pages K-58 and K-59)

$$K_S = \frac{A \cdot E}{1000L} = \frac{376.5 \times 2.06 \times 10^5}{1000 \times L} = \frac{77.6 \times 10^3}{L}$$

$$A = \frac{\pi}{4} d_1^{\,2} = \frac{\pi}{4} \times 21.9^2 = 376.5\text{mm}^2$$

$$E = 2.06 \times 10^5 \text{ N/mm}^2$$

① When L = 100 mm

$$K_{S1} = \frac{77.6 \times 10^3}{100} = 776 \text{ N}/\mu\text{m}$$

② When L = 700 mm

$$K_{S2} = \frac{77.6 \times 10^3}{700} = 111 \text{ N}/\mu\text{m}$$

■Axial Displacement due to Axial Rigidity of the Screw Shaft

① When L = 100 mm

$$\delta_1 = \frac{Fa}{K_{S1}} = \frac{1000+500}{776} = 1.9\ \mu\text{m}$$

② When L = 700 mm

$$\delta_2 = \frac{Fa}{K_{S2}} = \frac{1000+500}{111} = 13.5\ \mu\text{m}$$

■Positioning Error due to Axial Rigidity of the Feed Screw System

Positioning accuracy $=\delta_1-\delta_2=1.9-13.5$

$=-11.6\mu\text{m}$

Therefore, the positioning error due to the axial rigidity of the feed screw system is 11.6 μm.

9.5. Studying the Thermal Displacement through Heat Generation

If the temperature of the screw shaft increases during operation, the screw shaft is elongated due to heat thereby to lower the positioning accuracy. The expansion and contraction of the screw shaft is calculated using the equation (38) below.

$$\Delta \ell = \rho \times \Delta t \times \ell \quad \cdots\cdots\cdots (38)$$

where

$\Delta \ell$: Axial expansion/contraction of the screw shaft (mm)
ρ : Thermal expansion coefficient (12×10^{-6}/℃)
Δt : Temperature change in the screw shaft (℃)
ℓ : Effective thread length (mm)

Thus, if the temperature of the screw shaft increases by 1℃, the screw shaft is elongated by 12 μm per meter. Therefore, the faster the Ball Screw travels, the more heat is generated. And, the higher the temperature, the lower the positioning accuracy become. Accordingly, if high accuracy is required, it is necessary to take a measure to cope with temperature increase.

9.5.1. Measures to Cope with Temperature Rise

Minimize Heat Generation

- **Minimize preloads on the Ball Screw and the support bearing.**
- **Increase Ball Screw lead and reduce rotation speed.**
- **Select a correct lubricant (see page A-109).**
- **Cool the circumference of the screw shaft with a lubricant or air.**

Avoid Effect of Temperature Rise through Heat Generation

- **Set a negative target value for the reference travel distance of the Ball Screw.**

  Generally, set a negative target value for the reference travel distance assuming a temperature increase of 2℃ to 5℃ by heat.
  (-0.02 mm to -0.06 mm/m)

- **Pretension the screw shaft (see Fig. 3 of the structure on page K-42).**

9.6. Studying Orientation Change during Traveling

The lead accuracy of the Ball Screw equals to the positioning accuracy of the shaft center of the Ball Screw. Normally, the point where the highest positioning accuracy is required changes according to the ball screw center and the vertical or horizontal direction. Therefore, orientation change during traveling affects the positioning accuracy.

The largest factor of orientation change affecting the positioning accuracy is pitching if the change occurs in the ball screw center and the vertical direction, and yawing if the change occurs in the horizontal direction.

Accordingly, it is necessary to study the orientation change (accuracy in pitching, yawing, etc.) during traveling on the basis of the distance from the ball screw center to the location where positioning accuracy is required.

Positioning error due to pitching and yawing is obtained using the equation (39) below.

$$A = \ell \times \sin\theta \cdots\cdots\cdots (39)$$

where

A :Positioning accuracy due to pitching (or yawing) (mm)
ℓ :Vertical (or horizontal) distance from the ball screw center (mm) (see Fig. 1)
θ :Pitching (or yawing) (℃)

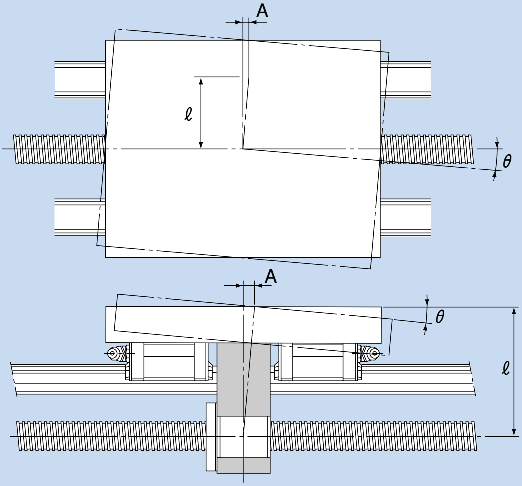


Fig. 1

10. Studying the Rotation Torque

The rotation torque required to convert rotational motion of the Ball Screw into linear motion is obtained using the equation (40) below.

●During uniform motion

$$T_t = T_1 + T_2 + T_4 \quad \cdots\cdots\cdots(40)$$

where

T_t : Rotation torque required during uniform motion (N-mm)
T_1 : Friction torque due to external load (N-mm)
T_2 : Preload torque of the Ball Screw (N-mm)
T_4 : Other torque (N-mm)
(friction torque of the support bearing and oil seal)

●During acceleration

$$T_K = T_t + T_3 \quad \cdots\cdots\cdots(41)$$

where

T_K : Rotation torque required during acceleration (N-mm)
T_3 : Torque required for acceleration (N-mm)

●During deceleration

$$T_g = T_t - T_3 \quad \cdots\cdots\cdots(42)$$

where

T_g : Rotation torque required for deceleration (N-mm)

10.1. Friction Torque Due to an External Load

Of the turning forces required for the Ball Screw, the rotation torque needed for an external load (guide surface resistance or external force) is obtained using the equation (43) below

$$T_1 = \frac{Fa \cdot \ell}{2\pi \cdot \eta} \cdot A \quad \cdots\cdots\cdots(43)$$

where

T_1	: Friction torque due to an external load	(N-mm)
Fa	: Axial load	(N)
ℓ	: Ball Screw lead	(mm)
η	: Ball Screw efficiency (0.9 to 0.95)	
A	: Reduction ratio	

10.2. Torque Due to a Preload on the Ball Screw

For a preload on the Ball Screw, see "Preload Torque" on page K-35.

$$T_2 = T_d \cdot A \quad \cdots\cdots\cdots(44)$$

where

T_2 : Torque due to a preload on the Ball Screw (N-mm)
T_d : Preload torque of the Ball Screw (N-mm)
A : Reduction ratio

10.3. Torque Required for Acceleration

$$T_3 = J \times \omega' \times 10^3 \quad \cdots\cdots\cdots (45)$$

where

T_3 : Torque required for acceleration (N-mm)

J : Inertial moment (kg-m²)

ω' : Angular acceleration (rad/sec²)

$$J = m\left(\frac{\ell}{2\pi}\right)^2 \cdot A^2 \cdot 10^{-6} + J_S \cdot A^2 + J_A \cdot A^2 + J_B$$

m : Transferred mass (kg)

ℓ : Ball screw lead (mm)

J_S : Inertial moment of the screw shaft (kg-m²)

(indicated in the dimensional table of the respective model number in the "THK General Catalog - Product Specifications," provided separately)

A : Reduction ratio

J_A : Inertial moment of gears, etc. attached to the screw shaft side (kg-m²)

J_B : Inertial moment of gears, etc. attached to the motor side (kg-m²)

$$\omega' = \frac{2\pi \cdot Nm}{60t}$$

Nm : Motor rotation speed per minute (min⁻¹)

t : Acceleration time (sec)

[Ref.] Inertial moment of a round object

$$J = \frac{m \cdot D^2}{8 \cdot 10^6}$$

J : inertial moment (kg-m²)

m : Mass of a round object (kg)

D : Screw shaft outer diameter (mm)

11. Studying the Driving Motor

When selecting a driving motor required to rotate the Ball Screw, normally take into account the rotation speed, rotation torque and minimum feed distance.

11.1. When Using a Servomotor

11.1.1. Rotation Speed

The rotation speed required for the motor is obtained using the equation (46) based on the feed speed, Ball Screw lead and reduction ratio.

$$N_M = \frac{V \times 1000 \times 60}{\ell} \times \frac{1}{A} \quad \cdots\cdots\cdots(46)$$

where

N_M	:Required rotation speed of the motor	(min^{-1})
V	:Feed speed	(m/s)
ℓ	:Ball Screw lead	(mm)
A	:Reduction ratio	

The rated rotation speed of the motor must be equal to or above the calculated value (N_M) above.

$N_M \leqq N_R$

Where

N_R :The rated rotation speed of the motor (min^{-1})

11.1.2. Required Resolution

Resolutions required for the encoder and the driver are obtained using the equation (47) based on the minimum feed distance, Ball Screw lead and reduction ratio.

$$B = \frac{\ell \cdot A}{S} \quad \cdots\cdots\cdots(47)$$

where

B	:Resolution required for the encoder and the driver	(p/rev)
ℓ	:Ball Screw lead	(mm)
A	:Reduction ratio	
S	:Minimum feed distance	(mm)

11.1.3. Motor Torque

The torque required or the motor differs between uniform motion, acceleration and deceleration. To calculate the rotation torque, see "Studying the Rotation Torque" on page K-68.

ⓐ Maximum torque

The maximum torque required for the motor must be equal to or below the maximum instantaneous torque of the motor.

$T_{max} \leqq Tp_{max}$

where

T_{max} :Maximum torque acting on the motor

Tp_{max} :Maximum instantaneous torque of the motor

ⓑ Effective value of the torque

The effective value of the torque required for the motor must be calculated. The effective value of the torque is obtained using the equation (48) below.

$$T_{rms} = \sqrt{\frac{T_1^2 \times t_1 + T_2^2 \times t_2 + T_3^2 \times t_3}{t}} \quad \cdots\cdots\cdots(48)$$

where

T_{rms}	: Effective value of the torque	(N-mm)
T_n	: Fluctuating torque	(N-mm)
t_n	: Time during which the torque T_n is applied	(s)
t	: Cycle time $(t=t_1+t_2+t_3)$	(s)

The calculated effective value of the torque must be equal to or below the rated torque of the motor.

$T_{rms} \leqq T_R$

where

T_R :Rated torque of the motor (N-mm)

11.1.4. Inertial Moment

The inertial moment required for the motor is obtained using the equation (49) below.

$$J_M = \frac{J}{C} \quad \cdots\cdots\cdots(49)$$

where

J_M :Inertial moment required for the motor (kg-m²)

C :Factor determined by the motor and the driver

(It is normally between 3 to 10. However, it varies depending on the motor and the driver. Check the specific value in the catalog by the motor manufacturer.)

The inertial moment of the motor must be equal to or above the calculated J_M value.

11.2. When Using a Stepping Motor (Pulse Motor)

11.2.1. Minimal Feed (Feed per Step)

The step angle required for the motor and the driver is obtained using the equation (50) below based on the minimum feed distance, Ball Screw lead and reduction ratio.

$$E = \frac{360S}{\ell \cdot A} \quad \cdots\cdots\cdots \text{(50)}$$

where

E	:Step angle required for the motor and the driver	(degree)
S	:Minimum feed distance (feed per step)	(mm)
ℓ	:Ball Screw lead	(mm)
A	:Reduction ratio	

11.2.2. Pulse Speed and Motor Torque

ⓐ Pulse speed

The pulse speed is obtained using the equation (51) below based on the feed speed and the minimum feed distance.

$$f = \frac{V \times 1000}{S} \quad \cdots\cdots\cdots \text{(51)}$$

where

f	:Pulse speed	(Hz)
V	:Feed speed	(m/s)
S	:Minimum feed distance	(mm)

ⓑ Torque required for the motor

The torque required for the motor differs between uniform motion, acceleration and deceleration. To calculate the rotation torque, see "Studying the Rotation Torque" on page K-68.

Thus, the pulse speed required for the motor and the required torque can be calculated in the manner described above.

Although the torque varies depending on the motor used, normally the calculated torque should be doubled to ensure safety. Check if the torque can be used in the motor speed-torque curve.

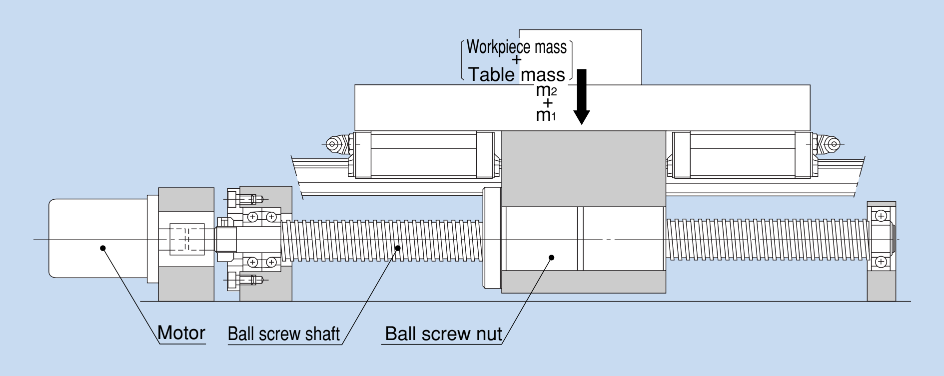
12. Examples of Selecting a Ball Screw

12.1. High Speed Conveyance System (Horizontal Use)

12.1.1. Selection Conditions

Table mass	m_1	$=60$kg
Workpiece mass	m_2	$=20$kg
Stroke length	ℓ_s	$=1000$mm
Maximum speed	V_{max}	$=1$m/s
Acceleration time	t_1	$=0.15$s
Deceleration time	t_3	$=0.15$s
Reciprocations per minute	n	$=8\text{min}^{-1}$
Backlash		0.15mm
Positioning accuracy		±0.3 mm/1000 mm (Perform positioning from the negative direction)

Positioning repeatability		±0.1 mm
Minimum feed distance	s	$=0.02$mm/pulse
Desired service life time		30000h
Driving motor		AC servomotor Rated rotation speed: $3{,}000\ \text{min}^{-1}$
Motor inertial moment	J_m	$=1\times10^{-3}\ \text{kg}\cdot\text{m}^2$
Deceleration mechanism		None (direct coupling) A=1
Friction coefficient of the guide surface	μ	$=0.003$ (rolling)
Resistance of the guide surface	f	$=15$ N (without load)



12.1.2. Selection Items

Screw shaft diameter
Lead
Nut model No.
Accuracy
Axial clearance
Screw shaft support method
Driving motor

12.1.3. Selecting Lead Accuracy and Axial Clearance

●Selecting lead accuracy

To achieve positioning accuracy of ±0.3 mm/1,000 mm:

$$\frac{\pm 0.3}{1000} = \frac{\pm 0.09}{300}$$

The lead accuracy must be ±0.09 mm/300 mm or higher.

Therefore, the accuracy grade of the Ball Screw (see table 1 on page K-24) needs to be:

C7 (travel distance error: ±0.05 mm/300 mm)

Accuracy grade C7 is available for both Rolled and Precision Ball Screws. Assume that a Rolled Ball Screw is selected here because it is less costly.

●Selecting axial clearance

To satisfy the backlash of 0.15 mm, it is necessary to select a Ball Screw with an axial clearance of 0.15 mm or less.

Therefore, a Rolled Ball Screw model with a screw shaft diameter of 32 mm or less that meets the axial clearance of 0.15 mm or less (see table 11 on page K-31) meets the requirements.

Thus, a Rolled Ball Screw model with a screw shaft diameter of 32 mm or less and accuracy grade of C7 is selected.

12.1.4. Selecting a Screw Shaft

●Assuming the screw shaft length

Assume the overall nut length to be 100 mm and the screw shaft end length to be 100 mm.

Therefore, the overall length is determined as follows based on the stroke length of 1,000 mm.

$$1000 + 200 = 1200 \text{ mm}$$

Thus, the screw shaft length is assumed to be 1,200 mm.

●Selecting lead

With the driving motor's rated rotation speed being 3,000 min^{-1} and the maximum speed 1 m/s, the Ball Screw lead is obtained as follows:

$$\frac{1 \times 1000 \times 60}{3000} = 20 \text{ mm}$$

Therefore, it is necessary to select a type with a lead of 20 mm or longer.

In addition, the Ball Screw and the motor can be mounted in direct coupling without using a reduction gear. The minimum resolution per revolution of an AC servomotor is obtained based on the resolution of the encoder (1,000 p/rev; 1,500 p/rev) provided as a standard accessory for the AC servomotor, as indicated below.

1000 p/rev (without multiplication)
1500 p/rev (without multiplication)
2000 p/rev (doubled)
3000 p/rev (doubled)
4000 p/rev (quadrupled)
6000 p/rev (quadrupled)

To meet the minimum feed distance of 0.02 mm/pulse, which is the selection requirement, the following should apply.

Lead20mm —— 1000 p/rev
30mm —— 1500 p/rev
40mm —— 2000 p/rev
60mm —— 3000 p/rev
80mm —— 4000 p/rev

●Selecting a screw shaft diameter

Those Ball Screw models that meet the requirements defined in Section 12.1.3.: screw shaft diameter of 32 mm or less and being a rolled Ball Screw; and the requirement defined in Section 12.1.4.: lead being 20, 30, 40, 60 or 80 mm (see table 4 on page K-40) are as follows.

Shaft diameter　Lead
15mm —— 20mm
15mm —— 30mm
20mm —— 20mm
20mm —— 40mm
30mm —— 60mm

Since the screw shaft length has to be 1,200 mm as indicated in Section 12.1.4., the shaft diameter of 15 mm is insufficient. Therefore, the Ball Screw should have a screw shaft diameter of 20 mm or greater.

Accordingly, there are three combinations of screw shaft diameters and leads that meet the requirements: screw shaft diameter of 20 mm/lead of 20 mm; 20 mm/40 mm; and 30 mm/60 mm.

●Selecting a screw shaft support method

Since the assumed type has a long stroke length of 1,000 mm and operates at high speed of 1 m/s, select either the fixed-supported or fixed-fixed configuration for the screw shaft support.

However, the fixed-fixed configuration requires a complicated structure, needs high accuracy in the installation and is costly.

Accordingly, the fixed-supported configuration is selected as the screw shaft support method.

●Studying the permissible axial load

■Calculating the maximum axial load

Guide surface resistance	f	$=15$ N(without load)
Table mass	m_1	$=60$ kg
Workpiece mass	m_2	$=20$ kg
Friction coefficient of the guide surface	μ	$=0.003$
Maximum speed	V_{max}	$=1$ m/s
Gravitational acceleration	g	$=9.807$ m/s^2
Acceleration time	t_1	$=0.15$ s

Hence,

Acceleration:

$$\alpha = \frac{V_{max}}{t_1} = 6.67 \text{ m/s}^2$$

During forward acceleration:

$$Fa_1 = \mu \cdot (m_1 + m_2)\, g + f + (m_1 + m_2) \cdot \alpha = 550 \text{ N}$$

During forward uniform motion:

$$Fa_2 = \mu \cdot (m_1 + m_2)\, g + f = 17 \text{ N}$$

During forward deceleration:

$$Fa_3 = \mu \cdot (m_1 + m_2)\, g + f - (m_1 + m_2) \cdot \alpha = -516 \text{ N}$$

During backward acceleration:

$$Fa_4 = -\mu \cdot (m_1 + m_2)\, g - f - (m_1 + m_2) \cdot \alpha = -550 \text{ N}$$

During uniform backward motion:

$$Fa_5 = -\mu \cdot (m_1 + m_2)\, g - f = -17 \text{ N}$$

During backward deceleration:

$$Fa_6 = -\mu \cdot (m_1 + m_2)\, g - f + (m_1 + m_2) \cdot \alpha = 516 \text{ N}$$

Thus, the maximum axial load applied on the Ball Screw is as follows:

$$Fa_{max} = Fa_1 = 550 \text{ N}$$

The smaller the screw shaft diameter, the smaller the permissible axial load on the shaft becomes. Therefore, if there is no problem with a shaft diameter of 20 mm and a lead of 20 mm (smallest thread minor diameter of 17.5 mm), then the screw shaft diameter of 30 mm should meet the requirements. Thus, the following calculations for the buckling load and the permissible compressive and tensile load of the screw shaft are performed while assuming a screw shaft diameter of 20 mm and a lead of 20 mm.

■Buckling load of the screw shaft

Coefficient determined by the mounting method: η_2=20(see page K-43)

Since the mounting method for the section between the nut and the bearing, where buckling is to be considered, is "fixed-fixed:"

Center distance: ℓ_a=1100 mm(estimate)

Thread minor diameter: d_1=17.5 mm

$$P_1 = \eta_2 \cdot \frac{d_1^4}{\ell_a^2} \times 10^4 = 20 \times \frac{17.5^4}{1100^2} \times 10^4 = 15500\ \mathrm{N}$$

■Permissible compressive and tensile load of the screw shaft

$$P_2 = 116 \times d_1^2 = 116 \times 17.5^2 = 35500\ \mathrm{N}$$

Thus, the buckling load and the permissible compressive and tensile load of the screw shaft are at least equal to the maximum axial load. Therefore, a Ball Screw that meets these requirements can be used without a problem.

●Studying the permissible rotation speed

■Maximum rotation speed

Screw shaft diameter: 20 mm; lead: 20 mm

Maximum speed: V_{max}=1 m/s

Lead: ℓ=20 mm

$$N_{max} = \frac{V_{max} \times 60 \times 10^3}{\ell} = 3000\ \mathrm{min}^{-1}$$

Screw shaft diameter: 20 mm; lead: 40 mm

Maximum speed: V_{max}=1 m/s

Lead: ℓ=40 mm

$$N_{max} = \frac{V_{max} \times 60 \times 10^3}{\ell} = 1500\ \mathrm{min}^{-1}$$

Screw shaft diameter: 30 mm; lead: 60 mm

Maximum speed: V_{max}=1 m/s

Lead: ℓ=60 mm

$$N_{max} = \frac{V_{max} \times 60 \times 10^3}{\ell} = 1000\ \mathrm{min}^{-1}$$

■Permissible rotation speed determined by the critical speed of the screw shaft

Coefficient determined by the mounting method: λ_2=15.1 (see page K-45)

Since the mounting method for the section between the nut and the bearing, where critical speed is to be considered, is "fixed-supported:"

Center distance: ℓ_b=1100 mm (estimate)

Screw shaft diameter: 20 mm; lead: 20mm and 40 mm

Screw shaft thread minor diameter: d_1=17.5mm

$$N_1 = \lambda_2 \times \frac{d_1}{\ell_b^{\,2}} 10^7 = 15.1 \times \frac{17.5}{1100^2} \times 10^7 = 2180 \text{ min}^{-1}$$

Screw shaft diameter: 30 mm; lead: 60 mm

Screw shaft thread minor diameter: d_1=26.4 mm

$$N_1 = \lambda_2 \times \frac{d_1}{\ell_b^{\,2}} 10^7 = 15.1 \times \frac{26.4}{1100^2} \times 10^7 = 3294 \text{ min}^{-1}$$

■Permissible rotation speed determined by the DN value

Screw shaft diameter: 20 mm; lead: 20 mm and 40mm (large-lead Ball Screw)

Ball center diameter: D=20.75 mm

$$N_2 = \frac{70000}{D} = \frac{70000}{20.75} = 3370 \text{ min}^{-1}$$

Screw shaft diameter: 30 mm; lead: 60 mm (large-lead Ball Screw)

Ball center diameter: D=31.25 mm

$$N_2 = \frac{70000}{D} = \frac{70000}{31.25} = 2240 \text{ min}^{-1}$$

Thus, with a Ball Screw having a screw shaft diameter of 20 mm and a lead of 20 mm, the maximum rotation speed exceeds the critical speed.

In contrast, a combination of a screw shaft diameter of 20 mm and a lead of 40 mm, and another of a screw shaft diameter of 30 mm and a lead of 60 mm, meet the critical speed and the DN value.

Accordingly, a Ball Screw with a screw shaft diameter of 20 mm and a lead of 40 mm, or with a screw shaft diameter of 30 mm and a lead of 60 mm, is selected.

12.1.5. Selecting a Nut

●Selecting a Nut Model Number

Roller Ball Screw models with a screw shaft diameter of 20 mm and a lead of 40 mm, or with a screw shaft diameter of 30 mm and a lead of 60 mm, are large-lead Rolled Ball Screw model WTF variations. The following variations are selected.

WTF2040−2
(C_a=5.4 kN, C_0a=13.6 kN)
WTF2040−3
(C_a=6.6 kN, C_0a=17.2 kN)
WTF3060−2
(C_a=11.8 kN, C_0a=30.6 kN)
WTF3060−3
(C_a=14.5 kN, C_0a=38.9 kN)

●Studying the Permissible Axial Load

Study the permissible axial load of model WTF2040-2 (C_0a = 13.6 kN).

Assuming that this model is used in a high-speed conveyance system and an impact load is applied during deceleration, set the static safety factor (f_S) at 2.5 (see table 1 on page K-54).

$$\frac{C_0a}{f_S} = \frac{13.6}{2.5} = 5.44\ \text{kN} = 5440\ \text{N}$$

The obtained permissible axial load is greater than the maximum axial load of 550 N, and therefore, there will be no problem with this model.

■Calculating the travel distance

Maximum speed: V_{max} =1 m/s
Acceleration time: t_1 =0.15 s
Deceleration time: t_3 =0.15 s

Travel distance during acceleration

$$\ell_{1,4} = \frac{V_{max} \cdot t_1}{2} \times 10^3 = \frac{1 \times 0.15}{2} \times 10^3 = 75\ \text{mm}$$

Travel distance during uniform motion

$$\ell_{2,5} = \ell_3 - \frac{V_{max} \cdot t_1 + V_{max} \cdot t_3}{2} \times 10^3 = 1000 - \frac{1 \times 0.15 + 1 \times 0.15}{2} \times 10^3 = 850\ \text{mm}$$

Travel distance during deceleration

$$\ell_{3,6} = \frac{V_{max} \cdot t_3}{2} \times 10^3 = \frac{1 \times 0.15}{2} \times 10^3 = 75\ \text{mm}$$

Based on the conditions above, the relationship between the applied axial load and the travel distance is shown in the table below.

Motion	Applied axial load Fa_N(N)	Travel distance ℓ_N(mm)
No.1: During forward acceleration	550	75
No.2: During forward uniform motion	17	850
No.3: During forward deceleration	–516	75
No.4: During backward acceleration	–550	75
No.5: During backward uniform motion	–17	850
No.6: During backward deceleration	516	75

* The subscript (N) indicates a motion number.

Since the load direction (as expressed in positive or negative sign) is reversed with Fa_3, Fa_4 and Fa_5, calculate the average axial load in the two directions.

■Average axial load

Average axial load in the positive direction

Since the load direction varies, calculate the average axial load while assuming $Fa_{3,4,5} = \text{ON}$.

$$F_{m1} = \sqrt[3]{\frac{Fa_1^{\,3} \times \ell_1 + Fa_2^{\,3} \times \ell_2 + Fa_6^{\,3} \times \ell_6}{\ell_1 + \ell_2 + \ell_3 + \ell_4 + \ell_5 + \ell_6}} = 225\ \text{N}$$

Average axial load in the negative direction

Since the load direction varies, calculate the average axial load while assuming $Fa_{1,2,6} = \text{ON}$.

$$F_{m2} = \sqrt[3]{\frac{|Fa_3|^3 \times \ell_3 + |Fa_4|^3 \times \ell_4 + |Fa_5|^3 \times \ell_5}{\ell_1 + \ell_2 + \ell_3 + \ell_4 + \ell_5 + \ell_6}} = 225\ \text{N}$$

Since $F_{m1} = F_{m2}$, assume the average axial load to be $F_m = F_{m1} = F_{m2} = 225$ N.

■Rated life

Load factor: $f_W = 1.5$ (see table 2 on page K-55)

Average load: $F_m = 225$ N

Rated life L (rev.)

$$L = \left(\frac{Ca}{f_W \cdot F_m}\right)^3 \times 10^6$$

Model No. under consideration	Dynamic load rating Ca(N)	Rated life L(rev.)
WTF 2040-2	5400	4.1×10^9
WTF 2040-3	6600	7.47×10^9
WTF 3060-2	11800	4.27×10^{10}
WTF 3060-3	14500	7.93×10^{10}

■Reciprocations per minute

Reciprocations per minute:	$n=8\ \text{min}^{-1}$
Stroke:	$\ell_s=1000$ mm

Lead : ℓ =40 mm

$$N_m = \frac{2 \times n \times \ell_s}{\ell} = \frac{2 \times 8 \times 1000}{40} = 400\ \text{min}^{-1}$$

Lead : ℓ =60 mm

$$N_m = \frac{2 \times n \times \ell_s}{\ell} = \frac{2 \times 8 \times 1000}{60} = 267\ \text{min}^{-1}$$

■Calculating the service life time on the basis of the rated life

WTF2040−2

Rated life:	$L=4.1\times10^9$ rev.
Average rotation speed per minute:	$N_m=400\ \text{min}^{-1}$

$$L_h = \frac{L}{60 \times N_m} = \frac{4.1 \times 10^9}{60 \times 400} = 171000\ \text{h}$$

WTF2040−3

Rated life:	$L=7.47\times10^9$ rev.
Average rotation speed per minute:	$N_m=400\ \text{min}^{-1}$

$$L_h = \frac{L}{60 \times N_m} = \frac{7.47 \times 10^9}{60 \times 400} = 311000\ \text{h}$$

WTF3060−2

Rated life:	$L=4.27\times10^{10}$ rev.
Average rotation speed per minute:	$N_m=267\ \text{min}^{-1}$

$$L_h = \frac{L}{60 \times N_m} = \frac{4.27 \times 10^{10}}{60 \times 267} = 2670000\ \text{h}$$

WTF3060−3

Rated life:	$L=7.93\times10^{10}$ rev.
Average rotation speed per minute:	$N_m=267\ \text{min}^{-1}$

$$L_h = \frac{L}{60 \times N_m} = \frac{7.93 \times 10^{10}}{60 \times 267} = 4950000\ \text{h}$$

■Calculating the service life in travel distance on the basis of the rated life

WTF2040−2

Rated life: $L = 4.1 \times 10^{9}$ rev.
Lead: $\ell = 40$ mm
$L_S = L \times \ell \times 10^{-6} = 164000$ km

WTF2040−3

Rated life: $L = 7.47 \times 10^{9}$ rev.
Lead: $\ell = 40$ mm
$L_S = L \times \ell \times 10^{-6} = 298800$ km

WTF3060−2

Rated life: $L = 4.27 \times 10^{10}$ rev.
Lead: $\ell = 60$ mm
$L_S = L \times \ell \times 10^{-6} = 2562000$ km

WTF3060−3

Rated life: $L = 7.93 \times 10^{10}$ rev.
Lead: $\ell = 60$ mm
$L_S = L \times \ell \times 10^{-6} = 4758000$ km

With all the conditions stated above, the following models satisfying the desired service life time of 30,000 hours are selected.

WTF 2040-2
WTF 2040-3
WTF 3060-2
WTF 3060-3

12.1.6. Studying the Rigidity

Since the conditions for selection do not include rigidity and this element is not particularly necessary, it is no described here.

12.1.7. Studying the Positioning Accuracy

●Studying the lead accuracy

Accuracy grade C7 was selected in Section 12.1.3.
C7 (travel distance error:±0.05mm/300mm)

●Studying the axial clearance

Since positioning is performed in a given direction only, axial clearance is not included in the positioning accuracy. As a result, there is no need to study the axial clearance.

WTF2040: axial clearance: 0.1 mm
WTF3060: axial clearance: 0.14 mm

●Studying the axial rigidity

Since the load direction does not change, it is unnecessary to study the positioning accuracy on the basis of the axial rigidity.

●Studying the thermal displacement due to heat

Assume the temperature rise during operation to be 5℃.
The positioning accuracy based on the temperature rise is obtained as follows:

$$\begin{aligned}\Delta \ell &= \rho \times \Delta t \times \ell \\ &= 12 \times 10^{-6} \times 5 \times 1000 \\ &= 0.06\ \text{mm}\end{aligned}$$

●Studying the orientation change during traveling

Since the ball screw center is 150 mm away from the point where the highest accuracy is required, it is necessary to study the orientation change during traveling. Assume that pitching can be done within ±10 seconds because of the structure. The positioning error due to the pitching is obtained as follows:

$$\begin{aligned}\Delta a &= \ell \times \sin\theta \\ &= 150 \times \sin(\pm 10'') \\ &= \pm\ 0.007\ \text{mm}\end{aligned}$$

Thus, the positioning accuracy (Δp) is obtained as follows:

$$\Delta p = \frac{\pm 0.05 \times 1000}{300} \pm 0.007 + 0.06 = 0.234\ \text{mm}$$

Accordingly, the selection requirements are met.
Since models WTF2040-2, WTF2040-3, WTF3060-2 and WTF3060-3 meet the selection requirements throughout the studying process in Section 12.1.3. to Section 12.1.7., the most compact model WTF2040-2 is selected.

12.1.8. Studying the Rotation Torque

●Friction torque due to an external torque

The friction torque is obtained as follows:

$$T_1 = \frac{Fa \cdot \ell}{2\pi \cdot \eta} \cdot A = \frac{17 \times 40}{2 \times \pi \times 0.9} \times 1 = 120\ \mathrm{N \cdot mm}$$

●Torque due to a preload on the Ball Screw

The Ball Screw is not provided with a preload.

●Torque required for acceleration

Inertial moment:

The inertial moment per unit length of the screw shaft can be specified as follows.

Since 1.23×10^{-3} kg·cm²/mm(see the dimensional table in the "THK General Catalog - Product Specifications," provided separately), the inertial moment of the screw shaft with an overall length of 1,200 mm is obtained as follows.

$$J_s = 1.23 \times 10^{-3} \times 1200 = 1.48\ \mathrm{kg \cdot cm^2}$$
$$= 1.48 \times 10^{-4}\ \mathrm{kg \cdot m^2}$$

$$J = (m_1 + m_2)\left(\frac{\ell}{2 \times \pi}\right)^2 \cdot A^2 \times 10^{-6} + J_s \cdot A^2 = (60 + 20)\left(\frac{40}{2 \times \pi}\right)^2 \times 1^2 \times 10^{-6} + 1.48 \times 10^{-4} \times 1^2$$

$$= 3.39 \times 10^{-3}\ \mathrm{kg \cdot m^2}$$

Angular acceleration:

$$\omega' = \frac{2\pi \cdot Nm}{60 \cdot t_1} = \frac{2\pi \times 1500}{60 \times 0.15} = 1050\ \mathrm{rad/s^2}$$

Based on the above, the torque required for acceleration is obtained as follows.

$$T_2 = (J + J_m) \times \omega' = (3.39 \times 10^{-3} + 1 \times 10^{-3}) \times 1050 = 4.61\mathrm{N \cdot m}$$
$$= 4.61 \times 10^3\ \mathrm{N \cdot mm}$$

Therefore, the required torque is specified as follows.

During acceleration:

$$T_k = T_1 + T_2 = 120 + 4.61 \times 10^3 = 4730\ \mathrm{N \cdot mm}$$

During uniform motion:

$$T_t = T_1 = 120\ \mathrm{N \cdot mm}$$

During deceleration:

$$T_g = T_1 - T_2 = 120 - 4.61 \times 10^3 = -4490\ \mathrm{N \cdot mm}$$

12.1.9. Studying the Driving Motor

●Rotation speed

Since the Ball Screw lead is selected based on the rated rotation speed of the motor, it is unnecessary to study the rotation speed of the motor.

Maximum working rotation speed:1500 min^{-1}
Rated rotation speed of the motor:3000 min^{-1}

●Minimum feed distance:

As with the rotation speed, the Ball Screw lead is selected based on the encoder normally used for an AC servomotor. Therefore, it is unnecessary to study this factor.

Encoder resolution:1000 p/rev
Doubled:2000 p/rev

●Motor torque:

The torque during acceleration calculated in Section 12.1.8. is the required maximum torque.

$T_{max} = 4730\ \text{N} \cdot \text{mm}$

Therefore, the instantaneous maximum torque of the AC servomotor needs to be at least 4,730 N-mm.

●Effective torque value

The selection requirements and the torque calculated in Section 12.1.8. can be expressed as follows.

During acceleration:

$T_k = 4730\ \text{N} \cdot \text{mm}$
$t_1 = 0.15\ \text{s}$

During uniform motion:

$T_t = 120\ \text{N} \cdot \text{mm}$
$t_2 = 0.85\ \text{s}$

During deceleration:

$T_g = 4490\ \text{N} \cdot \text{mm}$
$t_3 = 0.15\ \text{s}$

When stationary:

$T_S = 0$
$t_4 = 2.6\ \text{sec}$

Therefore, the effective torque is obtained as follows.

$$T_{rms} = \sqrt{\frac{T_k^2 \cdot t_1 + T_t^2 \cdot t_2 + T_g^2 \cdot t_3 + T_s^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}} = \sqrt{\frac{4730^2 \times 0.15 + 120^2 \times 0.85 + 4490^2 \times 0.15 + 0}{0.15 + 0.85 + 0.15 + 2.6}}$$

$$= 1305 \text{ N} \cdot \text{mm}$$

Accordingly, the rated torque of the motor must be 1,305 N-mm or greater.

●Inertial moment

The inertial moment applied to the motor equals to the inertial moment calculated in Section 12.1.8.

$$J = 3.39 \times 10^{-3} \text{ kg} \cdot \text{m}^2$$

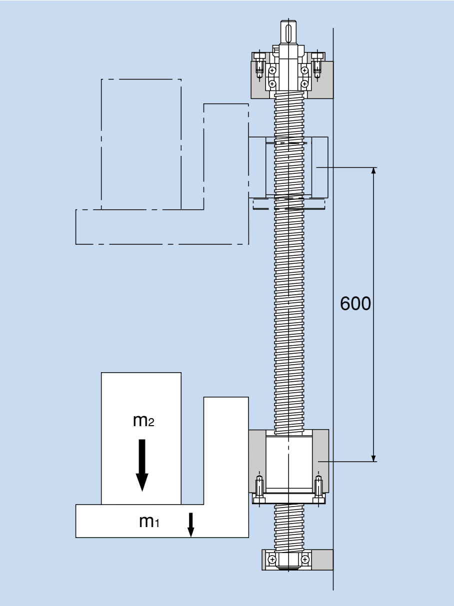
Normally, the motor needs to have an inertial moment at least one tenth of the inertial moment applied to the motor, although the specific value varies depending on the motor manufacturer. Therefore, the inertial moment of the AC servomotor must be 3.39×10^{-4}kg-m^2 or greater.

The selection has been completed.

12.2. Vertical Conveyance System

12.2.1. Selection Conditions

Table mass	m_1 $=40$ kg
Workpiece mass	m_2 $=10$ kg
Stroke length	ℓ_s $=600$ mm
Maximum speed	V_{max} $=0.3$ m/s
Acceleration time	t_1 $=0.2$ s
Deceleration time	t_3 $=0.2$ s
Reciprocations per minute	n $=5$ min^{-1}
Backlash	0.1 mm
Positioning accuracy	±0.7 mm/600 mm
Positioning repeatability	±0.05 mm
Minimum feed distance	s $=0.01$ mm/pulse
Service life time	20000 h
Driving motor	AC servomotor Rated rotation speed:3000 min^{-1}
Inertial moment of the motor	J_m $=5\times10^{-5}$ kg•m^2
Reduction mechanism	None (direct coupling)
Frictional coefficient of the guide surface	μ $=0.003$ (rolling)
Resistance of the guide surface	f $=20$ N (without load)



12.2.2. Selection Items

Screw shaft diameter
Lead
Nut model No.
Accuracy
Axial clearance
Screw shaft support method
Driving motor

12.2.3. Selecting Lead Accuracy and Axial Clearance

●Selecting lead accuracy

To achieve positioning accuracy of ±0.7 mm/600 mm:

$$\frac{\pm 0.7}{600} = \frac{\pm 0.35}{300}$$

The lead accuracy must be ±0.35 mm/300 mm or higher.

Therefore, the accuracy grade of the Ball Screw (see table 1 on page K-24) needs to be C10 (travel distance error: ±0.21 mm/300 mm).

Accuracy grade C10 is available for low-priced, Rolled Ball Screws. Assume that a Rolled Ball Screw is selected.

●Selecting axial clearance

The required backlashes is 0.1 mm or less. However, since an axial load is constantly applied in a single direction with vertical mount, the axial load does not serve as a backlash no matter how large it is.

Therefore, a low price, rolled Ball Screw is selected since there will not be a problem in axial clearance.

12.2.4. Selecting a Screw Shaft

●Assuming the screw shaft length

Assume the overall nut length to be 100 mm and the screw shaft end length to be 100 mm. Therefore, the overall length is determined as follows based on the stroke length of 600 mm.

$$600 + 200 = 800 \text{ mm}$$

Thus, the screw shaft length is assumed to be 800 mm.

●Selecting lead

With the driving motor's rated rotation speed being 3,000 min^{-1} and the maximum speed 0.3 m/s, the Ball Screw lead is obtained as follows:

$$\frac{0.3 \times 60 \times 1000}{3000} = 6 \text{ mm}$$

Therefore, it is necessary to select a type with a lead of 6 mm or longer.

In addition, the Ball Screw and the motor can be mounted in direct coupling without using a reduction gear. The minimum resolution per revolution of an AC servomotor is obtained based on the resolution of the encoder (1,000 p/rev; 1,500 p/rev) provided as a standard accessory for the AC servomotor, as indicated below.

1000 p/rev (without multiplication)
1500 p/rev (without multiplication)
2000 p/rev (doubled)
3000 p/rev (doubled)
4000 p/rev (quadrupled)
6000 p/rev (quadrupled)

To meet the minimum feed distance of 0.010 mm/pulse, which is the selection requirement, the following should apply.

Lead 6mm —— 3000 p/rev
8mm —— 4000 p/rev
10mm —— 1000 p/rev
20mm —— 2000 p/rev
40mm —— 2000 p/rev

However, with a lead being 6 mm or 8 mm, the feed distance is 0.002 mm/pulse, and the starting pulse of the controller that issues commands to the motor driver needs to be at least 150 kpps, and the cost of the controller may be higher.

In addition, if the lead of the Ball Screw is greater, the torque required for the motor is also greater, and thus the cost will be higher.

Therefore, select 10 mm for the Ball Screw lead.

●Selecting a screw shaft diameter

Those Ball Screw models that meet the lead being 10 mm as described in Section 12.2.3. and Section 12.2.4. (see table 4 on page K-40) are as follows.

Shaft diameter Lead
15mm —— 10mm
20mm —— 10mm
25mm —— 10mm

Accordingly, the combination of a screw shaft diameter of 15 mm and a lead 10 mm is selected.

●Selecting a screw shaft support method

Since the assumed Ball Screw has a stroke length of 600 mm and operates at a maximum speed of 0.3 m/s (Ball Screw rotation speed: 1,800 min^{-1}), select the fixed-supported configuration for the screw shaft support.

●Studying the permissible axial load

■Calculating the maximum axial load

Guide surface resistance	f	=20 N(without load)
Table mass	m_1	=40 kg
Workpiece mass	m_2	=10 kg
Maximum speed	V_{max}	=0.3 m/s
Acceleration time	t_1	=0.2 s

Hence,

Acceleration:

$$\alpha = \frac{V\text{max}}{t_1} = 1.5\ \text{m/s}^2$$

During upward acceleration:

$$Fa_1 = (m_1 + m_2) \cdot g + f + (m_1 + m_2) \cdot \alpha = 585\ \text{N}$$

During upward uniform motion:

$$Fa_2 = (m_1 + m_2) \cdot g + f = 510\ \text{N}$$

During upward deceleration:

$$Fa_3 = (m_1 + m_2) \cdot g + f - (m_1 + m_2) \cdot \alpha = 435\ \text{N}$$

During downward acceleration:

$$Fa_4 = (m_1 + m_2) \cdot g - f - (m_1 + m_2) \cdot \alpha = 395\ \text{N}$$

During downward backward motion:

$$Fa_5 = (m_1 + m_2) \cdot g - f = 470\ \text{N}$$

During downward deceleration:

$$Fa_6 = (m_1 + m_2) \cdot g - f + (m_1 + m_2) \cdot \alpha = 545\ \text{N}$$

Thus, the maximum axial load applied on the Ball Screw is as follows:

$$Fa_{max} = Fa_1 = 585\ \text{N}$$

■Buckling load of the screw shaft

Coefficient determined by the mounting method: η_2=20 (see page K-43)

Since the mounting method for the section between the nut and the bearing, where buckling is to be considerd, is "fixed-fixed:"

Center distance: ℓ_a=700 mm (estimate)

Thread minor diameter: d_1=12.5 mm

$$P_1 = \eta_2 \cdot \frac{d_1^{4}}{\ell_a^{2}} \times 10^4 = 20 \times \frac{12.5^4}{700^2} \times 10^4 = 9960\ \mathrm{N}$$

■Permissible compressive and tensile load of the screw shaft

$$P_2 = 116 d_1^2 = 116 \times 12.5^2 = 18100\ \mathrm{N}$$

Thus, the buckling load and the permissible compressive and tensile load of the screw shaft are at least equal to the maximum axial load. Therefore, a Ball Screw that meets these requirements can be used without a problem.

●Studying the permissible rotation speed

■Maximum rotation speed

Screw shaft diameter: 15 mm; lead: 10 mm

Maximum speed: V_{max}=0.3 m/s

Lead: ℓ=10 mm

$$N_{max} = \frac{V_{max} \times 60 \times 10^3}{\ell} = 1800\ \mathrm{min}^{-1}$$

■Permissible rotation speed determined by the critical speed of the screw shaft

Coefficient determined by the mounting method: λ_2=15.1 (see page K-45)

Since the mounting method for the section between the nut and the bearing, where critical speed is to be considered, is "fixed-supported:"

Center distance: ℓ_b=700 mm (estimate)

Screw shaft diameter: 15 mm; lead: 10 mm

Screw shaft thread minor diameter d_1=12.5 mm

$$N_1 = \lambda_2 \times \frac{d_1}{\ell_b^{2}} 10^7 = 15.1 \times \frac{12.5}{700^2} \times 10^7 = 3852\ \mathrm{min}^{-1}$$

■Permissible rotation speed determined by the DN value

Screw shaft diameter: 15 mm; lead: 10 mm (large-lead Ball Screw)

Ball center diameter: D=15.75 mm

$$N_2 = \frac{70000}{D} = \frac{70000}{15.75} = 4444\ \mathrm{min}^{-1}$$

Thus, the critical speed and the DN value of the screw shaft are met.

12.2.5. Selecting a Nut

●Selecting a Nut Model Number

The Roller Ball Screw model with a screw shaft diameter of 15 mm and a lead of 10 mm is large-lead Rolled Ball Screw model BLK1510-5.6.

(C_a=9.8 kN、C_0a=25.2 kN)

●Studying the Permissible Axial Load

Assuming that an impact load is applied during acceleration and deceleration, set the static safety factor (f_S) at 2 (see table 1 on page K-54).

$$Fa_{max} = \frac{C_0a}{f_S} = \frac{25.2}{2} = 12.6\ \text{kN} = 12600\ \text{N}$$

The obtained permissible axial load is greater than the maximum axial load of 585 N, and therefore, there will be no problem with this model.

●Studying the Service Life

■Calculating the travel distance

Maximum speed: V_{max} =0.3 m/s

Acceleration time: t_1 =0.2 s

Deceleration time: t_3 =0.2 s

Travel distance during acceleration

$$\ell_{1,4} = \frac{V_{max} \cdot t_1}{2} \times 10^3 = \frac{0.3 \times 0.2}{2} \times 10^3 = 30\ \text{mm}$$

Travel distance during uniform motion

$$\ell_{2,5} = \ell_S - \frac{V_{max} \cdot t_1 + V_{max} \cdot t_3}{2} \times 10^3 = 600 - \frac{0.3 \times 0.2 + 0.3 \times 0.2}{2} \times 10^3 = 540\ \text{mm}$$

Travel distance during deceleration

$$\ell_{3,6} = \frac{V_{max} \cdot t_3}{2} \times 10^3 = \frac{0.3 \times 0.2}{2} \times 10^3 = 30\ \text{mm}$$

Based on the conditions above, the relationship between the applied axial load and the travel distance is shown in the table below.

Motion	Applied axial load Fa_N(N)	Travel distance ℓ_N(mm)
No.1: During upward acceleration	585	30
No.2: During upward uniform motion	510	540
No.3: During upward deceleration	435	30
No.4: During downward acceleration	395	30
No.5: During downward uniform motion	470	540
No.6: During downward deceleration	545	30

* The subscript (N) indicates a motion number.

Average axial load

$$F_m = \sqrt[3]{\frac{1}{2 \times \ell_s}\left(Fa_1^3 \cdot \ell_1 + Fa_2^3 \cdot \ell_2 + Fa_3^3 \cdot \ell_3 + Fa_4^3 \cdot \ell_4 + Fa_5^3 \cdot \ell_5 + Fa_6^3 \cdot \ell_6\right)} = 492\text{N}$$

Rated life

Dynamic load rating: Ca=9800 N
Load factor: f_w=1.5(see table 2 on page K-55)
Average load: F_m=492 N
Rated life L(rev.)

$$L = \left(\frac{Ca}{f_w \cdot F_m}\right)^3 \times 10^6 = \left(\frac{9800}{1.5 \times 492}\right)^3 \times 10^6 = 2.34 \times 10^9 \text{ rev.}$$

Reciprocations per minute

Reciprocations per minute: n=5 min^{-1}
Stroke: ℓ_s=600 mm
Lead: ℓ=10 mm

$$N_m = \frac{2 \times n \times \ell_s}{\ell} = \frac{2 \times 5 \times 600}{10} = 600\text{min}^{-1}$$

Calculating the service life time on the basis of the rated life

Rated life: L=2.34×10^9 rev.
Average rotation speed per minute: N_m=600 min^{-1}

$$L_h = \frac{L}{60 \cdot N_m} = \frac{2.34 \times 10^9}{60 \times 600} = 65000\text{h}$$

Calculating the service life in travel distance on the basis of the rated life

Rated life: L=2.34×10^9 rev.
Lead: ℓ=10 mm

$$L_S = L \times \ell \times 10^{-6} = 23400 \text{ km}$$

With all the conditions stated above, model BLK1510-5.6 satisfies the desired service life time of 20,000 hours.

12.2.6. Studying the Rigidity

Since the conditions for selection do not include rigidity and this element is not particularly necessary, it is no described here.

12.2.7. Studying the Positioning Accuracy

●Studying the lead accuracy

Accuracy grade C10 was selected in Section 12.2.3.
C10 (travel distance error:±0.21mm/300mm)

●Studying the axial clearance

Since the axial load is constantly present in a given direction only because of vertical mount, there is no need to study the axial clearance.

●Studying the axial rigidity

Since the lead accuracy is achieved at a much higher degree than the required positioning accuracy, there is no need to study the positioning accuracy determined by axial rigidity.

●Studying the thermal displacement due to heat

Since the lead accuracy is achieved at a much higher degree than the required positioning accuracy, there is no need to study the positioning accuracy determined by heat generation.

●Studying the orientation change during traveling

Since the lead accuracy is achieved at a much higher degree than the required positioning accuracy, there is no need to study the positioning accuracy.

12.2.8. Studying the Rotation Torque

●Friction torque due to an external torque

During upward acceleration:

$$T_1 = \frac{Fa_1 \cdot \ell}{2 \times \pi \times \eta} = \frac{585 \times 10}{2 \times \pi \times 0.9} = 1030\ \mathrm{N \cdot mm}$$

During upward uniform motion:

$$T_2 = \frac{Fa_2 \cdot \ell}{2 \times \pi \times \eta} = \frac{510 \times 10}{2 \times \pi \times 0.9} = 900\ \mathrm{N \cdot mm}$$

Similarly,

During upward deceleration:

$T_3 = 770\ \mathrm{N \cdot mm}$

During downward acceleration:

$T_4 = 700\ \mathrm{N \cdot mm}$

During downward uniform motion:

$T_5 = 830\ \mathrm{N \cdot mm}$

During downward deceleration:

$T_6 = 960\ \mathrm{N \cdot mm}$

●Torque due to a preload on the Ball Screw

The Ball Screw is not provided with a preload.

●Torque required for acceleration

Inertial moment:

The inertial moment per unit length of the screw shaft can be specified as follows.

Since 3.9×10^{-4}kg-cm²/mm (see the dimensional table in the "THK General Catalog - Product Specifications," provided separately), the inertial moment of the screw shaft with an overall length of 800 mm is obtained as follows.

$$J_S = 3.9 \times 10^{-4} \times 800 = 0.31\ \mathrm{kg \cdot cm^2}$$

$$= 0.31 \times 10^{-4}\ \mathrm{kg \cdot m^2}$$

$$J = (m_1 + m_2)\left(\frac{\ell}{2 \times \pi}\right)^2 \cdot A^2\ 10^{-6} + J_S \cdot A^2 = (40 + 10)\left(\frac{10}{2 \times \pi}\right)^2 \times 1^2 \times 10^{-6} + 0.31 \times 10^{-4} \times 1^2$$

$$= 1.58 \times 10^{-4}\ \mathrm{kg \cdot m^2}$$

Angular acceleration:

$$\omega' = \frac{2\pi \cdot Nm}{60 \cdot t} = \frac{2\pi \times 1800}{60 \times 0.2} = 942\ \mathrm{rad/s^2}$$

Based on the above, the torque required for acceleration is obtained as follows.

$T_7 = (J + J_m) \cdot \omega' = (1.58 + 10^{-4} + 5 \times 10^{-5}) \times 942 = 0.2\ \mathrm{N \cdot m} = 200\ \mathrm{N \cdot mm}$

Therefore, the required torque is specified as follows.

During upward acceleration:

$T_{k1} = T_1 + T_7 = 1030 + 200 = 1230\ \mathrm{N \cdot mm}$

During upward uniform motion:

$T_{t1} = T_2 = 900\ \mathrm{N \cdot mm}$

During upward deceleration:

$T_{g1} = T_3 - T_7 = 770 - 200 = 570\ \mathrm{N \cdot mm}$

Similarly,

During downward acceleration:

$T_{k2} = 500\ N \cdot mm$

During downward uniform motion:

$T_{t2} = 830\ N \cdot mm$

During downward deceleration:

$T_{g2} = 1160\ N \cdot mm$

12.2.9. Studying the Driving Motor

●Rotation speed

Since the Ball Screw lead is selected based on the rated rotation speed of the motor, it is unnecessary to study the rotation speed of the motor.

Maximum working rotation speed :1800min^{-1}
Rated rotation speed of the motor :3000min^{-1}

●Minimum feed distance:

As with the rotation speed, the Ball Screw lead is selected based on the encoder normally used for an AC servomotor. Therefore, it is unnecessary to study this factor.

Encoder resolution :1000 p/rev.

●Motor torque:

The torque during acceleration calculated in Section 12.2.8. is the required maximum torque.

$T_{max} = T_{g2} = 1160\ N \cdot mm$

Therefore, the instantaneous maximum torque of the AC servomotor needs to be at least 1,160 N-mm.

●Effective torque value

The selection requirements and the torque calculated in Section 12.2.8. can be expressed as follows.

During upward acceleration:

$T_{k1} = 1100\ N \cdot mm$
$t_1 = 0.2\ s$

During upward uniform motion:

$T_{t1} = 900\ N \cdot mm$
$t_2 = 1.8\ s$

During upward deceleration:

$T_{g1} = 700\ N \cdot mm$
$t_3 = 0.2\ s$

During downward acceleration:

T_{k2} = 500 N · mm
t_1 = 0.2 s

During downward uniform motion:

T_{t2} = 830 N · mm
t_2 = 1.8 s

During downward deceleration:

T_{g2} = 1160 N · mm
t_3 = 0.2 s

When stationary (m_2=0):

T_S = 830 N · mm
t_4 = 7.6s

Therefore, the effective torque is obtained as follows.

$$T_{rms} = \sqrt{\frac{Tk_1^2 \cdot t_1 + Tt_1^2 \cdot t_2 + Tg_1^2 \cdot t_3 + Tk_2^2 \cdot t_1 + Tt_2^2 \cdot t_2 + Tg_2^2 \cdot t_3 + Ts^2 \cdot t_1}{t_1 + t_2 + t_3 + t_1 + t_2 + t_3 + t_7}}$$

$$= \sqrt{\frac{1100^2 \times 0.2 + 900^2 \times 1.8 + 700^2 \times 0.2 + 500^2 \times 0.2 + 830^2 \times 1.8 + 1160^2 \times 0.2 + 830^2 \times 7.6}{0.2 + 1.8 + 0.2 + 0.2 + 1.8 + 0.2 + 7.6}}$$

$$= 846 \text{ N} \cdot \text{mm}$$

Accordingly, the rated torque of the motor must be 846 N-mm or greater.

●Inertial moment

The inertial moment applied to the motor equals to the inertial moment calculated in Section 12.2.8.

$J = 1.58 \times 10^{-4}$ kg · m²

Normally, the motor needs to have an inertial moment at least one tenth of the inertial moment applied to the motor, although the specific value varies depending on the motor manufacturer. Therefore, the inertial moment of the AC servomotor must be 1.58×10^{-5}kg-m² or greater.

The selection has been completed.

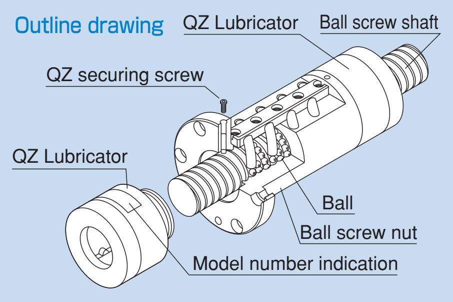
13. Safety Design

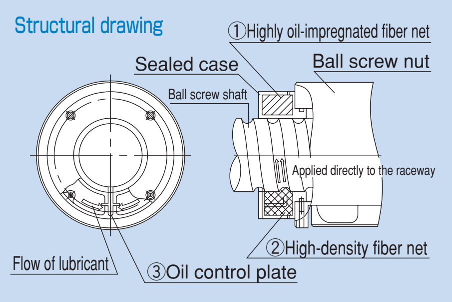
13.1. Lubrication

To maximize the performance of the Ball Screw, it is necessary to select a lubricant and a lubrication method according to the service conditions.
For types of lubricants, characteristics of lubricants and lubrication methods, see page A-109.
Also, QZ Lubricator is available as an optional accessory that significantly increases the maintenance interval.

13.1.1. QZ Lubricator™ for the Ball Screw

QZ Lubricator feeds a right amount of lubricant to the ball raceway of the ball screw shaft. This allows an oil film to be formed between the balls and the ball raceway and significantly extends the lubrication maintenance interval.
Its structure consists of major three components: ① a highly oil-impregnated fiber net (function to store a lubricant), ② a high-density fiber net (function to apply the lubricant to the raceway) and ③ an oil control plate (function to control the flow of the lubricant). The lubricant contained in QZ Lubricator is fed based on the principle of capillary action, which is used in felt-tip pens and other products.


Outline drawing


Structural drawing

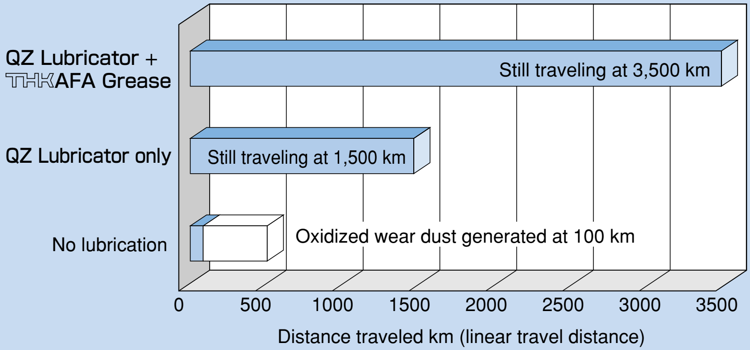
Features

- ●Since it supplements an oil loss, the lubrication maintenance interval can significantly be extended.
- ●Since the right amount of lubricant is applied to the ball raceway, an environmentally friendly lubrication system that does not contaminate the surroundings is achieved.
- ●Enables selection of a lubricant that meets the intended use.

Note: For model numbers supported for QZ Lubricator, see the section on the respective model number in the "THK General Catalog - Product Specifications," provided separately.

Significantly extended maintenance interval

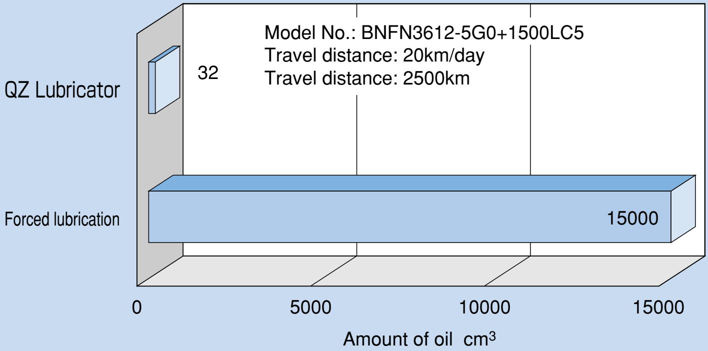
Since QZ Lubricator continuously feed a lubricant over a long period, the maintenance interval can significantly be extended.



Ball Screw	BIF2505-5
Rotation speed	3000min^{-1}
Stroke	500mm
Load	0.46kN (with an internal preload)

Environmentally friendly lubrication system

Since QZ Lubricator feeds the right amount of lubricant directly to the raceway, the lubricant can effectively be used without waste.



QZ Lubricator + THK AFA Grease
32cm^3
(QZ Lubricator attached to both ends of the ball screw nut)

Comparison

Forced lubrication
0.25cm^3/3min × 24hour × 125day
= 15000cm^3

13.1.2. Amount of Lubricant

If the amount of lubricant to the Ball Screw is insufficient, it may cause oil film break, and if it is excessive, it may cause heat to be generated and resistance to be increased. It is necessary to select an amount that meets the service conditions.

Grease

The feed amount of grease is generally approximately one third of the special volume inside the nut.

Oil

Table 1 shows a guideline for the feed amount of oil.
Note, however, that the amount varies according to the stroke, oil type and service conditions (e.g., suppressed heat generation).

Table 1 Guideline for the Feed Amount of Oil

(Interval: 3 minutes)

Shaft diameter (mm)	Amount of lubricant (cc)
4 to 8	0.03
10 to 14	0.05
15 to 18	0.07
20 to 25	0.1
28 to 32	0.15
36 to 40	0.25
45 to 50	0.3
55 to 63	0.4
70 to 100	0.5

13.2. Dust Prevention

Dust and foreign matter that enter the Ball Screw may cause accelerated wear and breakage, as with roller bearings. Therefore, where contamination by dust or foreign matter (e.g., cutting chips) is predicted, screw shafts must always be completely covered by dust prevention devices (e.g., bellows, screw cover, wiper ring).

If the Ball Screw is used in an atmosphere free from foreign matter but with suspended dust, a labyrinth seal (for precision Ball Screw) and a brush seal (for rolled Ball Screw) can be used in place of dust prevention devices. When placing an order, indicate the respective model number.

The labyrinth seal is designed to maintain a slight clearance between the seal and the screw shaft raceway so that torque does not develop and no heat is generated, though its effect in dust prevention is limited.

With Ball Screws except the large-lead and super-lead types, there is no difference in nut dimensions between those with and without a seal.

With the wiper ring, special resin with high wear resistance and low dust generation removes foreign matter while closely contacting the circumference of the ball screw shaft and the screw thread. It is capable of preventing foreign matter from entering the Ball Screw even in harsh environments.

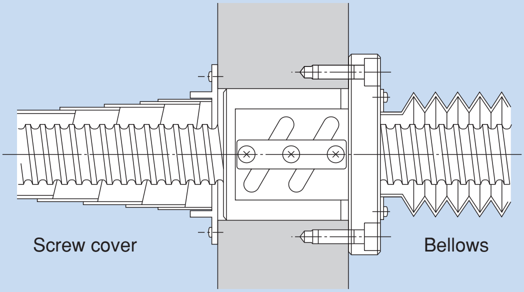
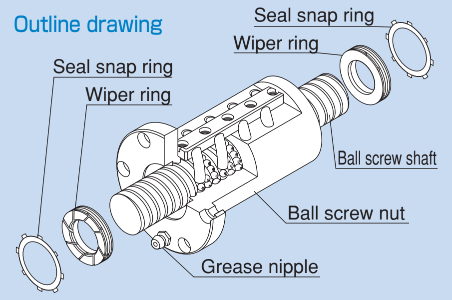
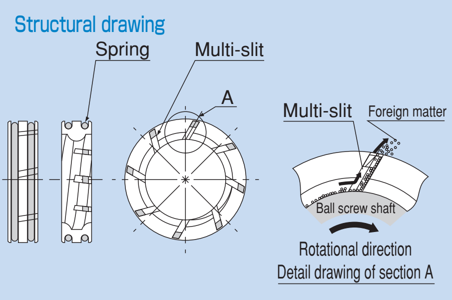


Fig. 1 Dust Prevention Cover

13.2.1. Wiper Ring W for the Ball Screw

With the wiper ring, special resin with high wear resistance and low dust generation removes foreign matter and prevents foreign matter from entering the ball screw nut while elastically contacting the circumference of the ball screw shaft and the screw thread.





Features

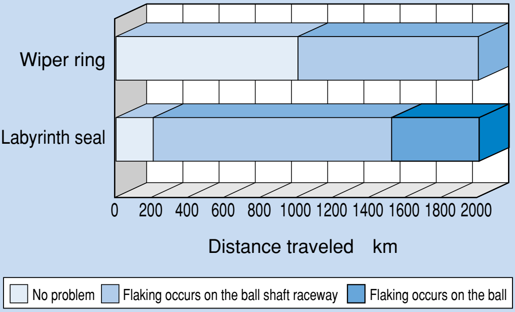
- ●A total of eight slits on the circumference remove foreign matter in succession, and prevents entrance of foreign matter.
- ●Contacts the ball screw shaft to reduce the flowing out of grease.
- ●Contacts the ball screw shaft at a constant pressure level using a spring, thus to minimize heat generation.
- ●Since the material is highly resistant to wear and chemicals, its performance will not easily be deteriorated even if it is used over a long period.

Test in an environment exposed to foreign matter

[Test conditions]

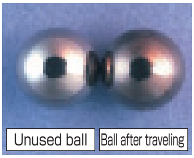
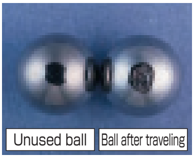
Item	Description
Model No.	BIF3210－5G0＋1500LC5
Maximum rotation speed	1000min^{-1}
Maximum speed	10m/min
Maximum circumferential speed	1.8m/s
Time constant	60ms
Dowel	1s
Stroke	900mm
Load (through internal load)	1.31kN
Grease	THK AFG Grease 8cm^3 Initial lubrication to the ball screw nut only.
Foundry dust	FCD400 average particle diameter: 250μm
Volume of foreign matter per shaft	5g/h

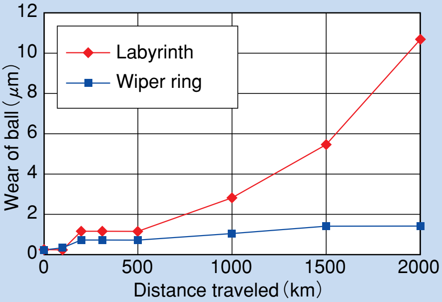
[Test result]



(1)Wiper ring specifications
Slight flaking occurred in the ball screw shaft at travel distant of 1,000 km.

(2)Labyrinth seal specifications
Flaking occurred throughout the circumference of the screw shaft raceway at travel distance of 200 km.
Flaking occurred on the balls after traveling 1,500 km.

	After traveling 2,000 km	
Ball	 ●Discolored, but no breakage	 ●Flaking occurs
	(1)Wiper ring type	(2)Labyrinth seal type



(1)Wiper ring type

Wear of balls at a travel distance of 2,000 km: 1.4μm.

(2)Labyrinth seal type

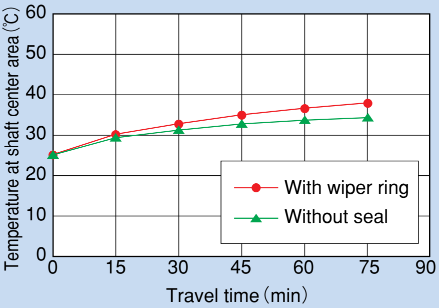
Starts to be worn rapidly after 500 km, and the ball wear amount at the travel distance of 2,000 km: 11 μm.

Heat generation test

[Test conditions]

Item	Description
Model No.	BLK3232DG0+1426LC5
Maximum rotation speed	1000min^{-1}
Maximum speed	32m/min
Maximum circumferential speed	1.7m/s
Time constant	100ms
Stroke	1000mm
Load (through internal load)	0.98kN
Grease	THK AFG Grease 5cm^3 (contained in the ball screw nut)

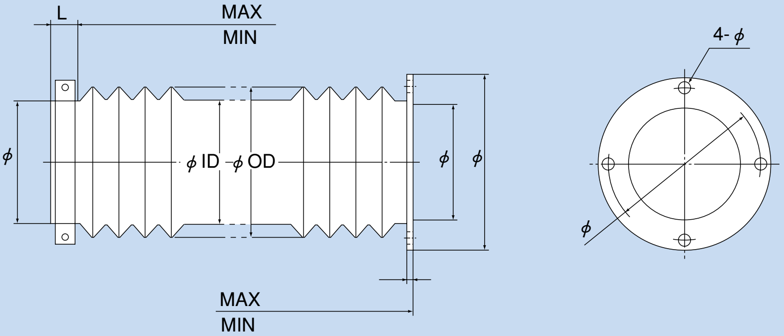
[Test result]



Unit: ℃

	With wiper ring	Without wiper ring
Heat generation temperature	37.1	34.5
Temperature rise	12.2	8.9

Bellows Specifications



(Band type) (Flanged type)

Bellows Dimensions

Stroke mm MAX. mm MIN. mm

Permissible outer diameter ϕOD Desired inner diameter ϕID

How It Is Used

Orientation (horizontal, vertical, slant) Speed ( ) mm/sec. min.

Motion (reciprocation, vibration)

Service Conditions

Oil/water resistance (necessary, not necessary) Oil name

Chemical resistance Name × %

Location (indoor, outdoor)

Remarks

Number of units to be manufactured

14. Precautions on Using the Ball Screw

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting the screw shaft and the ball screw nut may cause them to fall by their self-weights.
(3) Dropping or hitting the Ball Screw may damage the ball circulation section, which may cause functional loss. Giving an impact to the product could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Do not remove the ball screw nut from the ball screw shaft. Doing so may cause the balls or the nut to fall off.
(2) Entrance of foreign matter to the ball screw nut may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(3) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.
(4) When planning to use the product in an environment where the coolant penetrates the spline nut, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(5) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(6) If using the product with vertical mount, the ball screw nut may fall by its self-weight. Attach a mechanism to prevent it from falling.
(7) Using the product at speed exceeding the permissible rotation speed may cause breakage of a component or accident. Be sure to use the product within the specification range designated by THK.
(8) Forcibly driving in the ball screw shaft or the ball screw nut may cause an indentation on the raceway. Use care when mounting components.
(9) If an offset or skewing occurs with the ball screw shaft support and the ball screw nut, it may substantially shorten the service life. Pay much attention to components to be mounted and to the mounting accuracy.
(10) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(11) Letting the ball screw nut overrun will cause balls to fall off or the ball-circulating component to be damaged. Be sure not to let it overrun.

Storage

When storing the Ball Screw, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

1. Features of LM Guide Actuator Model KR

LM Guide + Ball Screw = Integral-structure Actuator

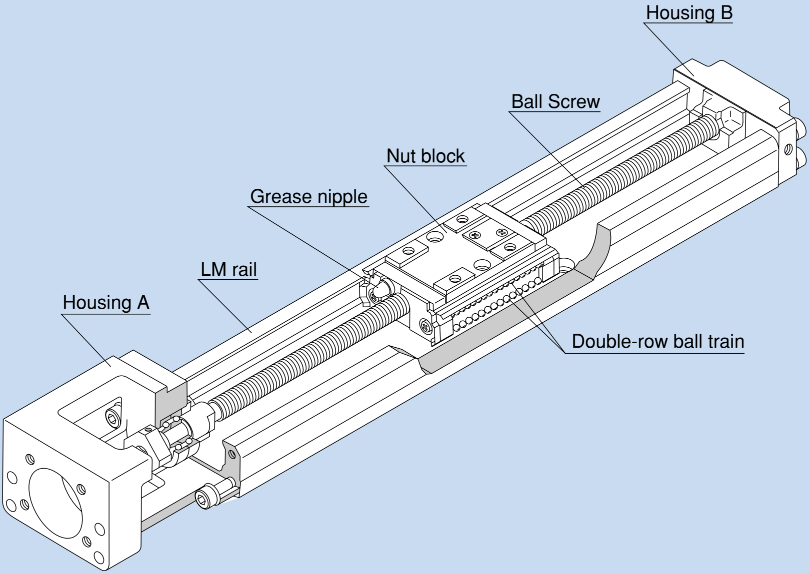


Fig. 1 Structure of LM Guide Actuator Model KR

1.1. Structure and Features of LM Guide Actuator Model KR

Because of its integral-structure nut block consisting of a highly rigid LM rail with a U-shaped cross section, LM Guide units on both side faces and a Ball Screw unit in the center, model KR achieves a highly rigid and highly accurate actuator in a minimal space.
Each train of balls is arranged at a contact angle of 45° so that the rated load on the nut block is uniform in the four directions (radial, reverse-radial and lateral directions). As a result, model KR can be used in any mounting orientation.

●Four-way Equal Load

The trains of loaded balls are arranged in a double-row angular contact structure where two trains are placed on each of the right and left sides. The equal load ratings are provided in the vertical and horizontal directions. Thus, this model can be mounted in any orientation and is optimal for locations with indeterminate loads such as the arms of a Cartesian coordinate robot.

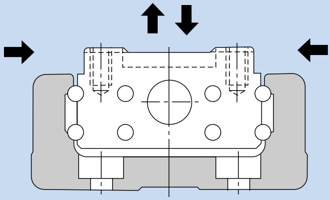


Fig. 2 Load Capacity of Model KR

●High rigidity

Unlike the conventional LM Guide, model KR uses an outer-rail structure to achieve higher rigidity against an overhung load.
The LM rail is a wide U-shaped cross section to reduce the weight and minimize deflection, enabling the LM Guide system to be used in both a cantilever and fixed-fixed structures.

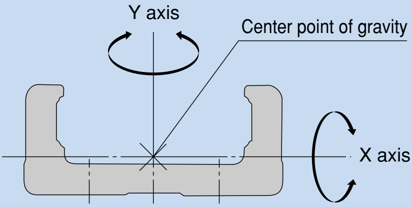


Fig. 3

Table 1 Cross-sectional Characteristics of the LM Rail

Unit: mm^4

Model No.	I_X	I_Y	Mass (kg/100 mm)
KR 15	9.08×10^2	1.42×10^4	0.104
KR 20	6.1×10^3	6.2×10^4	0.26
KR 26	1.7×10^4	1.5×10^5	0.39
KR 30H	2.7×10^4	2.8×10^5	0.5
KR 33	6.2×10^4	3.8×10^5	0.66
KR 45H	8.4×10^4	8.9×10^5	0.9
KR 46	2.4×10^5	1.5×10^6	1.26
KR 55	2.2×10^5	2.3×10^6	1.5
KR 65	4.6×10^5	5.9×10^6	2.31

I_X=geometrical moment of inertia around X axis

I_Y=geometrical moment of inertia around Y axis

●High Accuracy

The raceway of the four rows of balls is shaped into a circular-arc groove. This enables the guide system to smoothly travel and maintain high rigidity even under a preload. Fluctuation in frictional resistance caused by load fluctuation is minimized to allow the system to respond to sub-micron feed.

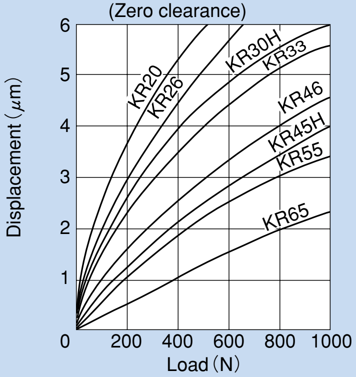


Fig. 4 Displacement of Model KR-A under a Radial Load

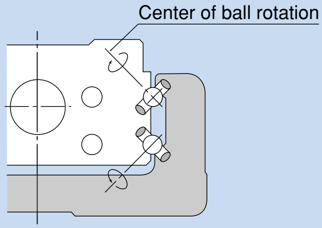


Fig. 5 Contact Structure of Model KR

●Space Saving

Use of a nut block integrating LM Guide units on both ends and a Ball Screw unit in the center makes model KR a highly rigid and highly accurate actuator in a minimal space.

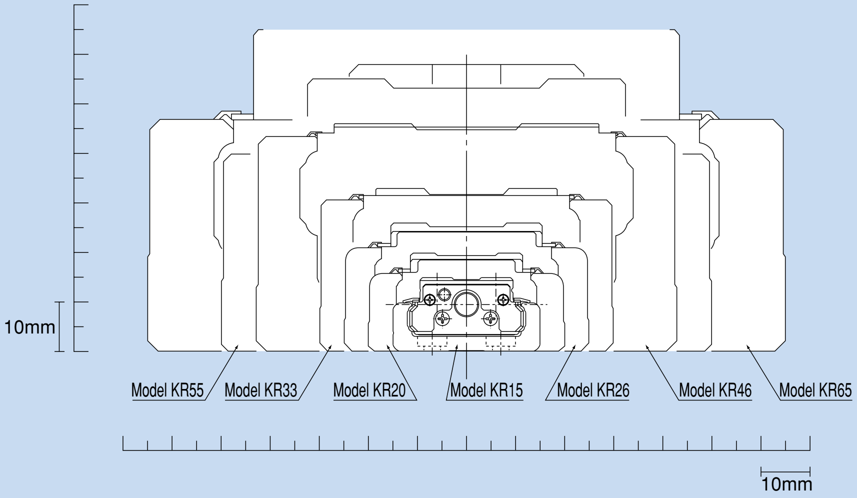


Fig. 6 Cross Sectional Drawing

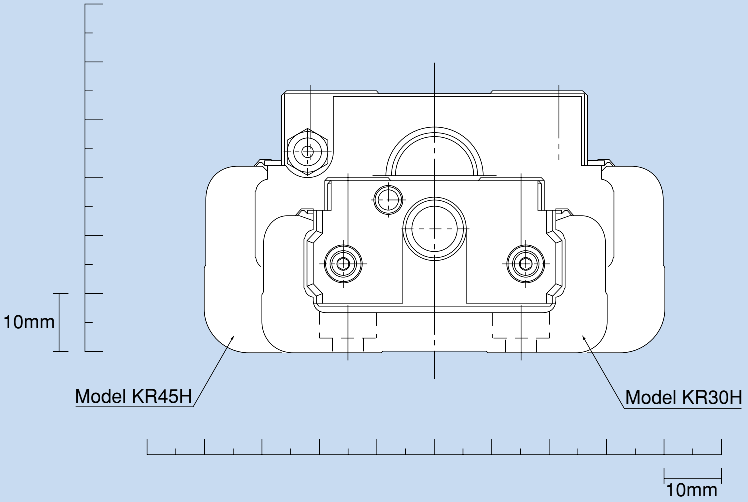
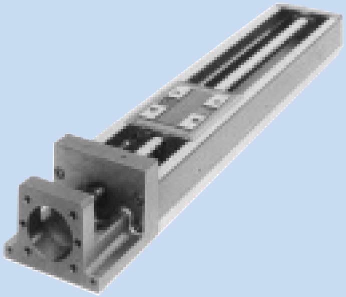


Fig. 7 Cross Sectional Drawing

1.2. Types and Features of LM Guide Actuator Model KR

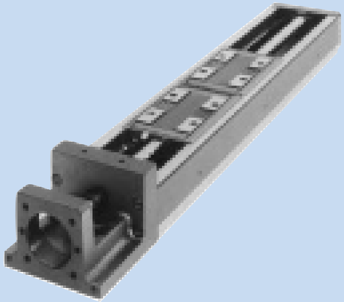
●Model KR-A (with a Single Long Nut Block)



Model KR-A

Representative model of KR

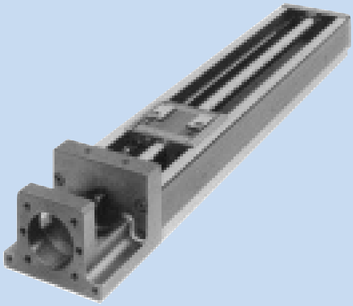
●Model KR-B (with Two Long Nut Blocks)



Model KR-B

Equipped with two units of the nut block of model KR-A, this model achieves higher rigidity, high load capacity and high accuracy.

●Model KR-C (with a Single Short Nut Block)

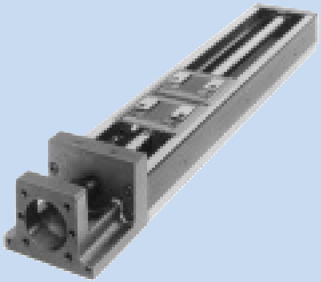


Model KR-C

This model has a shorter overall length of the nut block and a longer stroke than model KR-A.

(Applicable model numbers: KR30H, 33, 45H and 46)

●Model KR-D (with Two Short Nut Blocks)



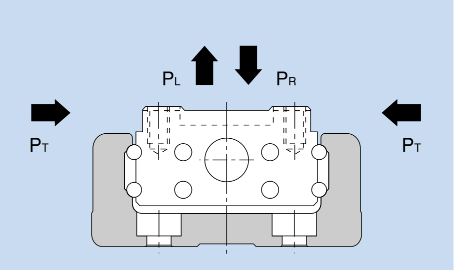
Model KR-D

Equipped with two units of the nut block of model KR-C, this design allows a span that suits the equipment, thus to achieve high rigidity.

(Applicable model numbers: KR30H, 33, 45H and 46)

1.3. Rated Loads in All Directions and Static Permissible Moment

Rated Load



●LM Guide Unit

Model KR is capable of receiving loads in all directions: radial, reverse-radial and lateral directions. Its basic load ratings are equal in all four directions (radial, reverse-radial and lateral directions), and their values are indicated in table 2 on page L-8.

●Ball Screw Unit

Since the nut block is incorporated with a Ball Screw, model KR is capable of receiving an axial load. The basic load rating value is indicated in table 2 on page L-8.

●Support Bearing Unit

Since housing A contains an angular bearing, model KR is capable of receiving an axial load. The basic load rating value is indicated in table 2 on page L-8.

Equivalent Load (LM Guide Unit)

The equivalent load when the LM Guide unit of model KR simultaneously receives loads in all directions is obtained from the following equation.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral directions

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Table 2 Rated Load of Model KR

Symbols in the parentheses indicate units.

Model No.			KR15		KR20	KR26	KR30H		KR33		KR45H		KR46		KR55	KR65
			KR1501	KR1502			KR30H06	KR30H10	KR3306	KR3310	KR45H10	KR45H20	KR4610	KR4620		
LM Guide unit	Basic dynamic load rating C (N)	Long nut block Types A, B	1930		3590	7240	11600		11600		23300		27400		38100	50900
		Short nut block Types C, D	—		—	—	4900		4900		11900		14000		—	—
	Basic static load rating C_0 (N)	Long nut block Types A, B	3450		6300	12150	20200		20200		39200		45500		61900	80900
		Short nut block Types C, D	—		—	—	10000		10000		19600		22700		—	—
	Radial clearance (mm)	Normal grade, high grade	−0.001 to +0.002		+0.002 to −0.003	+0.002 to −0.004	+0.002 to −0.004		+0.002 to −0.004		+0.003 to −0.006		+0.003 to −0.006		+0.004 to −0.007	+0.004 to −0.008
		Precision grade	−0.005 to −0.002		−0.003 to −0.007	−0.004 to −0.01	−0.004 to −0.012		−0.004 to −0.012		−0.006 to −0.016		−0.006 to −0.016		−0.007 to −0.019	−0.008 to −0.022
Ball Screw unit	Basic dynamic load rating C_a (N)	Normal grade, high grade	340	230	660	2350	2840	1760	2840	1760	3140	3040	3140	3040	3620	5680
		Precision grade	340	230	660	2350	2250	1370	2250	1370	2940	3430	2940	3430	3980	5950
	Basic static load rating C_{0a} (N)	Normal grade, high grade	660	410	1170	4020	4900	2840	4900	2840	6760	7150	6760	7150	9290	14500
		Precision grade	660	410	1170	4020	2740	1570	2740	1570	3720	5290	3720	5290	6850	10700
	Screw shaft diameter (mm)		5		6	8	10		10		15		15		20	25
	Lead (mm)		1	2	1	2	6	10	6	10	10	20	10	20	20	25
	Thread minor diameter (mm)		4.5		5.3	6.6	7.8		7.8		12.5		12.5		17.5	22
	Ball center diameter (mm)		5.15		6.15	8.3	10.5		10.5		15.75		15.75		20.75	26
Support bearing unit	Axial direction	Basic dynamic load rating C_a (N)	590		1000	1380	1790		1790		6660		6660		7600	13700
		Static permissible load P_{0a} (N)	290		1240	1760	2590		2590		3240		3240		3990	5830

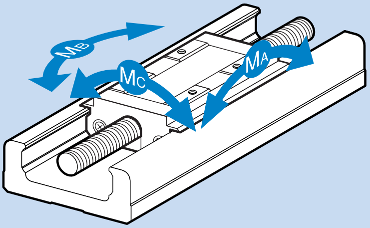
Note 1: The load ratings in the LM Guide unit each indicate the load rating per LM block.

Note 2: The Ball Screw of precision grade (grade P) for models KR30H, KR33, KR45H10 and KR4610 is incorporated with spacer balls in the proportion of one to one.

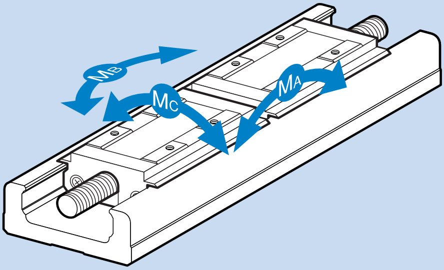
Note 3: The Ball Screw of precision grade (grade P) for models KR45H20, KR4620, KR55 and KR65 is incorporated with spacer balls in the proportion of one to one.

Static Permissible Moment (LM Guide Unit)

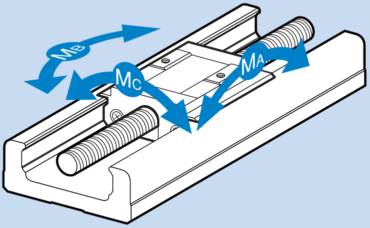
The LM Guide unit of model KR is capable of receiving moments in all directions only with a single nut block. Table 3 on page L-10 shows static permissible moments in the M_A, M_B and M_C directions.



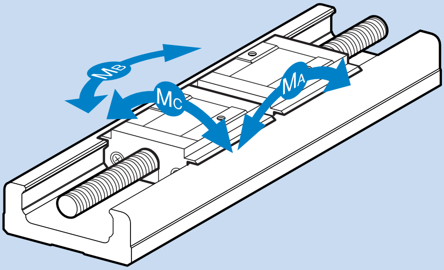
With a single long nut block (type A)



With two long nut blocks (type B)



With a single short nut block (type C)



With two short nut blocks (type D)

Table 3 Static Permissible Moments of Model KR

Unit: N-m

Model No.	Static permissible moment		
	M_A	M_B	M_C
KR 15-A	12.1	12.1	38
KR 15-B	70.3	70.3	76
KR 20-A	31	31	83
KR 20-B	176	176	165
KR 26-A	84	84	208
KR 26-B	480	480	416
KR 30H-A	166	166	428
KR 30H-B	908	908	857
KR 30H-C	44	44	214
KR 30H-D	319	319	427
KR 33-A	166	166	428
KR 33-B	908	908	857
KR 33-C	44	44	214
KR 33-D	319	319	427
KR 45H-A	486	486	925
KR 45H-B	2732	2732	1850
KR 45H-C	130	130	463
KR 45H-D	994	994	925
KR 46-A	547	547	1400
KR 46-B	2940	2940	2800
KR 46-C	149	149	700
KR 46-D	1010	1010	1400
KR 55-A	870	870	2280
KR 55-B	4890	4890	4570
KR 65-A	1300	1300	3920
KR 65-B	7230	7230	7840

Note: The values for models KR - B/D indicate the values when two nut blocks are used in close contact with each other.

1.4. Service Life

Model KR consists of an LM Guide, a Ball Screw and a support bearing. The rated life of each component can be obtained using the basic dynamic load rating indicated in Table 2 on page L-8 (Rated Load of Model KR).

LM Guide Unit

●Rated Life

$$L = \left(\frac{f_C \cdot C}{f_W \cdot P_C} \right)^3 \times 50$$

where

L : Rated life (km)

(The total travel distance that 90% of a group of identical LM Guide units independently operating under the same conditions can achieve without showing flaking)

C : Basic dynamic load rating (N)

P_C : Calculated applied load (N)

f_W : Load factor (see table 5 on page L-13)

f_C : Contact factor (see table 4 on page L-13)

●If a moment is applied to model KR-A/C or model KR-B/D using two nut blocks in close contact with each other, calculate the equivalent load by multiplying the applied moment by the equivalent factor indicated in table 6 on page L-13.

$$P_m = K \cdot M$$

where

P_m : Equivalent load (per nut block) (N)

K : Moment equivalent factor (see table 6 on page L-13)

M : Applied moment (N-mm)

(If planning to use three or more nut blocks, or use nut blocks with a wide span, contact THK .)

●If moment M_C is applied to model KR-B/D

$$P_m = \frac{K_C \cdot M_C}{2}$$

●If a radial load (P) and a moment are simultaneously applied to model KR

$$P_E = P_m + P$$

where

P_E : Total equivalent radial load (N)

Perform a rated life calculation using the above data.

●Service life time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \cdot \ell_s \cdot n_1 \times 60}$$

where

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})

Ball Screw Unit/Support Bearing Unit

●Rated life

$$L = \left(\frac{C_a}{f_W \cdot F_a} \right)^3 \times 10^6$$

where

L : Rated life (rev.)
(The total number of revolutions that 90% of a group of identical Ball Screw units independently operating under the same conditions can achieve without showing flaking)
C_a : Basic dynamic load rating (N)
F_a : Axial load (N)
f_W : Load factor (see table 5 on page L-13)

When the rated life has been obtained from the equation above, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

●Service life time

$$L_h = \frac{L \cdot \ell}{2 \cdot \ell_s \cdot n_1 \times 60}$$

where

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})
ℓ : Ball screw lead (mm)

■f_C : Contact factor

If two nut blocks are used in close contact with each other with model KR-B/D, multiply the basic load rating by the corresponding contact factor indicated in table 4.

Table 4 Contact Factor (f_C)

Block type	Contact factor f_C
Type A/C	1
Type B/D	0.81

■f_W : Load factor

Table 5 shows load factors.

Table 5 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low V≦0.25m/s	1 to 1.2
Weak	Slow 0.25<V≦1m/s	1.2 to 1.5
Medium	Medium 1<V≦2m/s	1.5 to 2
Strong	High V>2m/s	2 to 3.5

■K : Moment equivalent factor (LM Guide unit)

When model KR travels under a moment, the distribution of load applied to the LM Guide is locally large (see page A-51). In such cases, calculate the load by multiplying the moment value by the corresponding moment equivalent factor indicated in table 6.

Symbols K_A, K_B and K_C indicate the moment equivalent loads in the M_A, M_B and M_C directions, respectively.

Table 6 Moment Equivalent Factor (K)

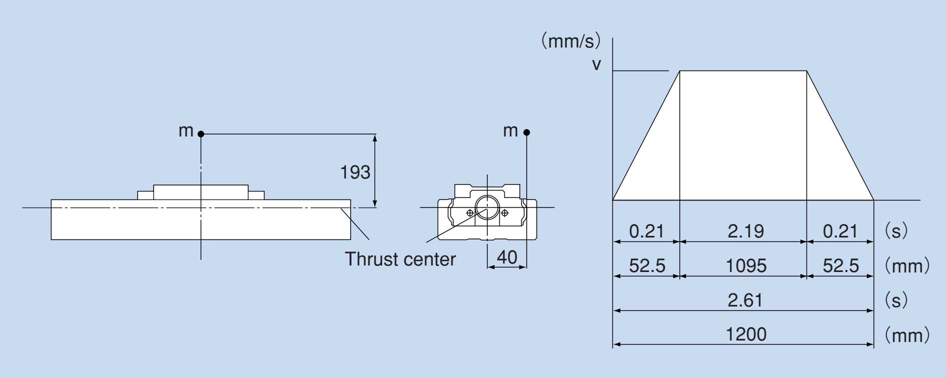
Model No.	K_A	K_B	K_C
KR 15-A	3.2×10^{-1}	3.2×10^{-1}	9.09×10^{-2}
KR 15-B	5.96×10^{-2}	5.96×10^{-2}	9.09×10^{-2}
KR 20-A	2.4×10^{-1}	2.4×10^{-1}	7.69×10^{-2}
KR 20-B	4.26×10^{-2}	4.26×10^{-2}	7.69×10^{-2}
KR 26-A	1.73×10^{-1}	1.73×10^{-1}	5.88×10^{-2}
KR 26-B	3.06×10^{-2}	3.06×10^{-2}	5.88×10^{-2}
KR 30H-A	1.51×10^{-1}	1.51×10^{-1}	4.78×10^{-2}
KR 30H-B	2.76×10^{-2}	2.76×10^{-2}	4.78×10^{-2}
KR 30H-C	2.77×10^{-1}	2.77×10^{-1}	4.78×10^{-2}
KR 30H-D	3.99×10^{-2}	3.99×10^{-2}	4.78×10^{-2}
KR 33-A	1.51×10^{-1}	1.51×10^{-1}	4.93×10^{-2}
KR 33-B	2.57×10^{-2}	2.57×10^{-2}	4.93×10^{-2}
KR 33-C	2.77×10^{-1}	2.77×10^{-1}	4.93×10^{-2}
KR 33-D	3.55×10^{-2}	3.55×10^{-2}	4.93×10^{-2}
KR 45H-A	9.83×10^{-2}	9.83×10^{-2}	3.45×10^{-2}
KR 45H-B	1.87×10^{-2}	1.87×10^{-2}	3.45×10^{-2}
KR 45H-C	1.83×10^{-1}	1.83×10^{-1}	3.45×10^{-2}
KR 45H-D	2.81×10^{-2}	2.81×10^{-2}	3.45×10^{-2}
KR 46-A	1.01×10^{-1}	1.01×10^{-1}	3.38×10^{-2}
KR 46-B	1.78×10^{-2}	1.78×10^{-2}	3.38×10^{-2}
KR 46-C	1.85×10^{-1}	1.85×10^{-1}	3.38×10^{-2}
KR 46-D	2.5×10^{-2}	2.5×10^{-2}	3.38×10^{-2}
KR 55-A	8.63×10^{-2}	8.63×10^{-2}	2.83×10^{-2}
KR 55-B	1.53×10^{-2}	1.53×10^{-2}	2.83×10^{-2}
KR 65-A	7.55×10^{-2}	7.55×10^{-2}	2.14×10^{-2}
KR 65-B	1.35×10^{-2}	1.35×10^{-2}	2.14×10^{-2}

Note: For model KR-B/D, values for two nut blocks used in close contact with each other apply.

1.5. Example of Calculating the Rated Life

1.5.1. Service Conditions

Assumed model number:	KR5520A
LM Guide unit	(C=38100N, C_0=61900N)
Ball Screw unit	(C_a=3620N, C_{0a}=9290N)
Support bearing	(C_a=7600N, P_{0a}=3990N)
Mass:	m=30kg
Speed:	v=500mm/s
Acceleration:	α=2.4m/s^2
Stroke:	ℓ_s=1200mm
Gravitational acceleration:	g=9.807m/s^2
Speed diagram:	See the figure below.



1.5.2. Examination

Studying the LM Guide Unit

●Load applied to the nut block

* Assuming that a single nut block is used, convert applied moments M_A and M_B into applied load by multiplying them by the moment equivalent factor (K_A=K_B=8.63×10^{-2}).

* Assuming that a single shaft is used, convert applied moment M_C into applied load by multiplying it by the moment equivalent factor (K_C=2.83×10^{-2}).

During even speed

$P_1 = mg + K_C \cdot mg \times 40 = 627\ \text{N}$

During acceleration

$P_{1a} = P_1 + K_A \cdot m\alpha \times 193 = 1826\ \text{N}$

$P_{1aT} = -K_B \cdot m\alpha \times 40 = -249\ \text{N}$

During deceleration

$P_{1d} = P_1 - K_A \cdot m\alpha \times 193 = -572\ \text{N}$

$P_{1dT} = K_B \cdot m\alpha \times 40 = 249\ \text{N}$

* Since the groove under a load is different from the assumed groove, give "0" (zero) to P_{1sT} and P_{1d}.

Resultant Load

During even speed

$P_{1E} = P_1 = 627\ \text{N}$

During acceleration

$P_{1aE} = P_{1a} + P_{1aT} = 1826\ \text{N}$

During deceleration

$P_{1dE} = P_{1d} + P_{1dT} = 249\ \text{N}$

Static Safety Factor

$$f_s = \frac{C_0}{P_{max}} = \frac{C_0}{P_{1aE}} = 33.9$$

Rated Life

Average load

$$P_m = \sqrt[3]{\frac{1}{\ell_S}(P_{1E}{}^3 \times 1095 + P_{1aE}{}^3 \times 52.5 + P_{1dE}{}^3 \times 52.5)} = 790\ \text{N}$$

Rated life

$$L = \left(\frac{C}{f_W \cdot P_m}\right)^3 \times 50 = 3.25 \times 10^6\ \text{km}$$

where

f_W : Load factor (1.2)

Studying the Ball Screw Unit

●Axial load

■During even-speed motion forward

$Fa_1 = \mu\text{-}mg + f = 4\ N$

μ : Friction coefficient (0.005)

f : Rolling resistance of one KR block + seal resistance (2.5 N)

■During forward acceleration

$Fa_2 = Fa_1 + m\alpha = 76\ N$

■During forward deceleration

$Fa_3 = Fa_1 - m\alpha = -68\ N$

■During even-speed motion backward

$Fa_4 = -Fa_1 = -4\ N$

■During backward acceleration

$Fa_5 = Fa_4 - m\alpha = -76\ N$

■During backward deceleration

$Fa_6 = Fa_4 + m\alpha = 68\ N$

* Since the groove under a load is different from the assumed groove, give "0" (zero) to Fa_3, Fa_4 and Fa_5.

●Static safety factor

$$f_s = \frac{C_{0a}}{Fa_{max}} = \frac{C_{0a}}{Fa_2} = 122.2$$

●Buckling load

$$P_1 = \frac{n \cdot \pi^2 \cdot E \cdot I}{\ell_a{}^2} \times 0.5 = 11000\ N$$

where

P_1 : Buckling load (N)

ℓ_a : Center distance (1300 mm)

E : Young's modulus (2.06×10^5 N/mm^2)

n : Factor for mounting method (fixed - fixed: 4.0; see page K-43)

0.5 : Safety factor

I : Minimum geometrical moment of inertia of the screw shaft (mm^4)

$$I = \frac{\pi}{64} \cdot d_1{}^4$$

d_1 : Screw-shaft thread minor diameter (17.5 mm)

●Permissible tensile and compressive load

$$P_2 = \delta \cdot \frac{\pi}{4} \cdot d_1^{2} = 35300 \text{ N}$$

where

P_2 : Permissible tensile and compressive load (N)

δ : Permissible tensile and compressive stress (147 N/mm^2)

d_1 : Screw-shaft thread minor diameter (17.5 mm)

●Critical speed

$$N_1 = \frac{60 \cdot \lambda^{2}}{2\pi \cdot \ell_b^{2}} \cdot \sqrt{\frac{E \times 10^{3} \cdot I}{\gamma \cdot A}} \times 0.8 = 1560 \text{ min}^{-1}$$

where

N_1 : Critical speed (min^{-1})

ℓ_b : Center distance (1300 mm)

γ : Density (7.85×10^{-6} kg/mm^3)

λ : Factor for mounting method (fixed - supports: 3.927; see page K-45)

0.8 : Safety factor

●DN value

DN = 31125 (≦50000)

where

D : Ball center diameter (20.75 mm)

N : Maximum working rotation speed (1500 min^{-1})

●Rated life

Average axial load

$$F_{am} = \sqrt[3]{\frac{1}{2 \cdot \ell_S} (F_{a1}^{3} \times 1095 + F_{a2}^{3} \times 52.5 + F_{a6}^{3} \times 52.5)} = 25.5 \text{ N}$$

Rated life

$$L = \left(\frac{C_a}{f_W \cdot F_{am}} \right)^{3} \cdot \ell = 3.32 \times 10^{7} \text{ km}$$

where

f_W : Load factor (1.2)

ℓ : Ball screw lead (20 mm)

Examining the Support Bearing Unit

●Axial load (same as the Ball Screw unit)

$Fa_1 = 4$ N

$Fa_2 = 76$ N

$Fa_3 = 0$ N

$Fa_4 = 0$ N

$Fa_5 = 0$ N

$Fa_6 = 68$ N

●Static safety factor

$$f_s = \frac{P_{0a}}{Fa_{max}} = \frac{P_{0a}}{Fa_2} = 52.5$$

●Rated life

■Average axial load

$$Fa_m = \sqrt[3]{\frac{1}{2 \cdot \ell_S}(Fa_1^{\,3} \times 1095 + Fa_2^{\,3} \times 52.5 + Fa_6^{\,3} \times 52.5)} = 25.5 \text{ N}$$

■Rated life

$$L = \left(\frac{Ca}{f_W \cdot Fa_m}\right)^3 \times 10^6 = 1.53 \times 10^{13} \text{ rev.}$$

where

f_W :Load factor (1.2)

* Convert the above rated life into the service life in travel distance of the Ball Screw.

$$L_S = L \cdot \ell \times 10^{-6} = 3.06 \times 10^8 \text{km}$$

1.5.3. Result

The table below shows the result of the examination.

KR5520A	LM Guide unit	Ball Screw unit	Support bearing unit
Static safety factor	33.9	122.2	52.5
Buckling load (N)	—	11000	—
Permissible tensile-compressive load (N)	—	35300	—
Critical speed (min^{-1})	—	1560	—
DN value	—	31125	—
Rated life (km)	3.25×10^6	3.32×10^7	3.06×10^8
Maximum axial load (N)	—	76	—
Maximum working rotation speed (min^{-1})	—	1500	—

From the static safety coefficient and other values above, it is judged that the assumed model can be used. Of the rated lives of the three components, the shortest value (of LM Guide unit) is considered the rated life of the assumed model KR5520A.

1.6. Accuracy Standards

The accuracy of model KR is defined in positioning repeatability, positioning accuracy, backlash and running parallelism.

●Positioning Repeatability

After repeating positioning to a given point in the same direction seven times, measure the halting point and obtain the value of half the maximum difference. Perform this measurement in the center and both ends of the travel distance, use the maximum value as the measurement value and express the value of half the maximum difference with symbol "±" as positioning repeatability.

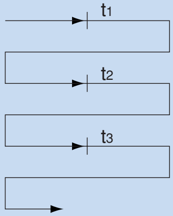


Fig. 8 Positioning Repeatability

●Positioning Accuracy

Using the maximum stroke as the reference length, express the maximum error between the actual distance traveled from the reference point and the command value in an absolute value as positioning accuracy.

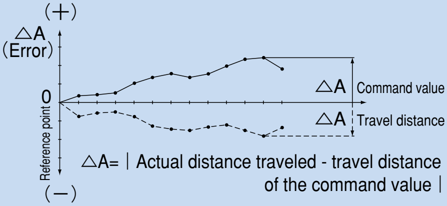


Fig. 9 Positioning Accuracy

●Backlash

Feed and slightly move the nut block and read the measurement on the test indicator as the reference value. Subsequently, apply a load to the nut block from the same direction (table feed direction), and then release the nut block from the load. Use the difference between the reference value and the return as the backlash measurement. Perform this measurement in the center and near both ends, use the maximum value as the measurement value.

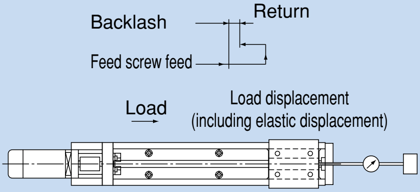


Fig. 10 Backlash

●Running Parallelism

Place a straightedge on the surface table where model KR is mounted, measure almost throughout the travel distance of the nut block using a test indicator. Use the maximum difference among the readings within the travel distance as the running parallelism measurement.

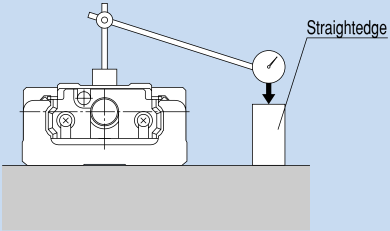


Fig. 11 Running Parallelism

The accuracies of model KR are classified into normal grade (no symbol), high grade (H) and precision grade (P). Tables below show standards for all the accuracies.

Table 7-1 Normal Grade (No Symbol)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 20	100	±0.01	No standard defined	No standard defined	0.02	0.5
	150					
	200					
KR 26	150	±0.01	No standard defined	No standard defined	0.02	1.5
	200					
	250					
	300					
KR 30H	150	±0.01	No standard defined	No standard defined	0.02	7
	200					
	300					
	400					
	500					
	600					
KR 33	150	±0.01	No standard defined	No standard defined	0.02	7
	200					
	300					
	400					
	500					
	600					
KR 45H	340	±0.01	No standard defined	No standard defined	0.02	10
	440					
	540					
	640					
	740					
	840					
	940					
KR 46	340	±0.01	No standard defined	No standard defined	0.02	10
	440					
	540					
	640					
	740					
	940					
KR 55	980	±0.01	No standard defined	No standard defined	0.05	12
	1080					
	1180					
	1280					
	1380					
KR 65	980	±0.01	No standard defined	No standard defined	0.05	12
	1180					
	1380					
	1680	±0.012				15

Note: The evaluation method complies with THK standards.

Note: For most models, the starting torque represents the value when lithium soap-group grease No. 2 is used.
However, that of models KR20 and KR26 represents the value when THK AFA Grease is used, and that of KR15 represents the value when THK AFF Grease is used.

Table 7-2 High Grade (H)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 15	75	±0.004	0.04	0.02	0.01	0.4
	100					
	125					
	150					
	175					
	200					
KR 20	100	±0.005	0.06	0.025	0.01	0.5
	150					
	200					
KR 26	150	±0.005	0.06	0.025	0.01	1.5
	200					
	250					
	300					
KR 30H	150	±0.005	0.06	0.025	0.02	7
	200					
	300					
	400					
	500		0.1	0.035		
	600					
KR 33	150	±0.005	0.06	0.025	0.02	7
	200					
	300					
	400					
	500		0.1	0.035		
	600					
KR 45H	340	±0.005	0.1	0.035	0.02	10
	440					
	540					
	640					
	740		0.12	0.04		
	840		0.15	0.05		
	940					
KR 46	340	±0.005	0.1	0.035	0.02	10
	440					
	540					
	640					
	740		0.12	0.04		
	940		0.15	0.05		
KR 55	980	±0.005	0.18	0.05	0.05	12
	1080					
	1180		0.25			
	1280					
	1380					
KR 65	980	±0.008	0.18	0.05	0.05	12
	1180		0.2			
	1380					
	1680		0.28	0.055		15

Note: If highly viscous grease such as vacuum grease and clean room grease is used, the actual starting torque may exceed the corresponding value in the table. Use much care in selecting a motor.

Table 7-3 Precision Grade (P)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 15	75	±0.003	0.02	0.01	0.002	0.8
	100					
	125					
	150					
	175					
	200					
KR 20	100	±0.003	0.02	0.01	0.003	1.2
	150					
	200					
KR 26	150	±0.003	0.02	0.01	0.003	4
	200					
	250					
	300					
KR 30H	150	±0.003	0.02	0.01	0.003	15
	200					
	300					
	400					
	500		0.025	0.015		
	600					
KR 33	150	±0.003	0.02	0.01	0.003	15
	200					
	300					
	400					
	500		0.025	0.015		
	600					
KR 45H	340	±0.003	0.025	0.015	0.003	15
	440					
	540					
	640					17
	740		0.03	0.02		
KR 46	340	±0.003	0.025	0.015	0.003	15
	440					
	540					
	640					17
	740		0.03	0.02		
KR 55	980	±0.005	0.035	0.025	0.003	17
	1080					
	1180		0.04	0.03		20
KR 65	980	±0.005	0.035	0.025	0.005	20
	1180					
	1380		0.04	0.03		22

Note: The evaluation method complies with THK standards.

Note: For most models, the starting torque represents the value when lithium soap-group grease No. 2 is used. However, that of models KR20 and KR26 represents the value when THK AFA Grease is used, and that of KR15 represents the value when THK AFF Grease is used.

Note: If highly viscous grease such as vacuum grease and clean room grease is used, the actual starting torque may exceed the corresponding value in the table. Use much care in selecting a motor.

2. Precautions on Using LM Guide Actuator Model KR

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting model KR may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(2) Do not mix lubricants of different physical properties.

(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

(5) When adopting oil lubrication, contact THK in advance.

(6) To maximize the performance of model KR, lubrication is required. Using the product without lubrication may increase wear of the rolling elements or shorten the service life.

In normal use, the lubricant must be replenished every 100 km as a guide. However, the greasing interval varies according to the service conditions. We recommend determining the greasing interval based on the result of the initial inspection.

Recommended grease: KR15: THK AFF Grease
KR20, 26: THK AFA Grease
KR30H to 65: THK AFB-LF Grease

For clean room applications, low dust-generative AFF Grease is available. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating component or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(2) When planning to use the product in an environment where the coolant penetrates the nut block, contact THK in advance.

(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product. For the type of the detergent to be used, contact THK.

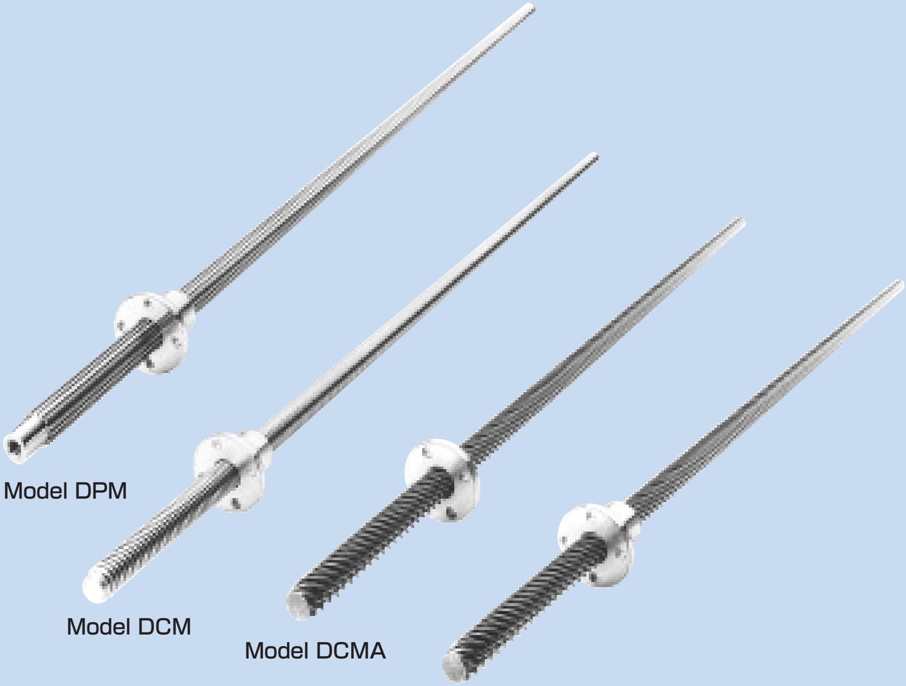
(5) Exceeding the permissible rotation speed may lead the components to be damaged or cause an accident. The rotation speed during operation must be within the THK specifications.

(6) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing model KR, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

1. Features of the Slide Series



1.1. Structure and Features of the Slide Series

The Slide Series are highly accurate, low price products that use a high-strength zinc alloy with high wear resistance and are formed by die-cast molding.
Since each model has a precision-machined shaft as the core and teeth are formed around it, the products are of high accuracy and of little unevenness in accuracy. Therefore, the teeth shapes match that of the corresponding dedicated spline shafts or screw shafts, and the backlash and axial clearance are kept minimum. As a result, the shafts and the nuts of this series are superbly interchangeable.

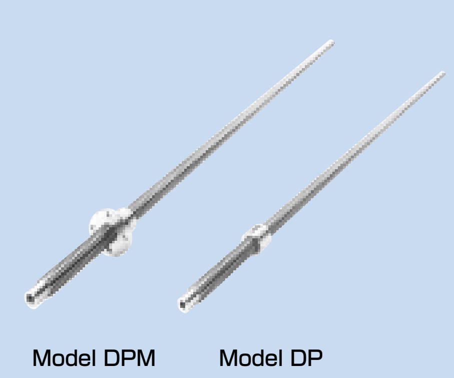
●Increased Wear Resistance, High Durability

Each tooth between the dedicated spline shaft and screw shaft has a large contact area, and the smooth surface of the ground or precision-ground or rolled core is transferred without change. Thus, high wear resistance and stable performance are achieved.

1.2. Types and Features of the Slide Series

●Spline Nut Models DPM and DP

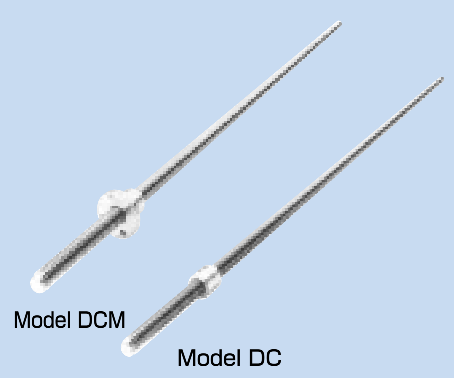
A combination of a spline nut, made of a highly wear resistant zinc alloy with high strength and molded by die-casting, and a precision-rolled spline shaft, achieves smooth linear motion and torque transmission.


Model DPM Model DP

●Screw Nut Models DCM and DC

These screw nuts have 30° trapezoidal threads. The high-performance feed screws achieve a 50% cost reduction from the conventional machined type by combining a die-cast molded screw nut and a highly accurate rolled screw shaft.

THK also manufactures small, wear resistant screw nuts made of oil-impregnated plastics at your request. Contact THK for details.

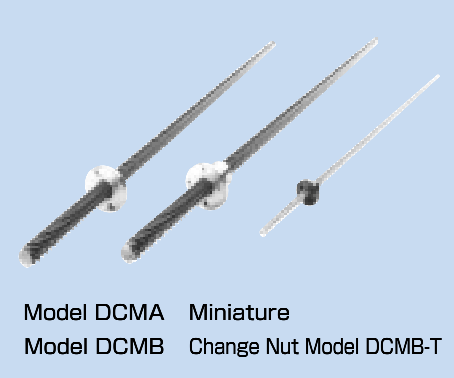

Model DCM

Model DC

●Change Nut Models DCMA and DCMB

These models are capable of converting linear motion to rotary motion, or vise versa, at 70% efficiency. They easily generate a torque as their multi-thread screws are pressed using a cylinder or the like. They are optimal also for fast feed mechanisms.

Oil-impregnated plastic miniature Change Nut model DCMB-T is optimal for a high-speed, small feed mechanism.


Model DCMA
Model DCMB

Miniature
Change Nut Model DCMB-T

1.3. Features of Dedicated Rolled Shafts

Dedicated rolled shafts with standardized lengths are available for the Slide Series models.

●Increased Wear Resistance

The shaft teeth are formed by cold gear rolling, and the surface of the teeth is hardened to over 250 HV and mirror-finished. As a result, the shafts are highly wear resistant and achieve significantly smooth motion when used in combination with nuts.

●Improved Mechanical Properties

Inside the teeth of the rolled shaft, a fiber flow occurs along the contour of the teeth of the shaft, making the structure around the teeth roots dense. As a result, the fatigue strength is increased.

●Additional Machining of the Shaft End Support

Since each shaft is rolled, additional machining of the support bearing of the shaft end can easily be performed by lathing or milling.

1.4. Alloy

High-strength Zinc Alloy

The high-strength zinc alloy used in the spline nuts, screw nuts and change nuts is a material that is highly resistant to seizure and wear and has a high load carrying capacity. Its composition, mechanical properties, physical properties and wear resistance are given below.

●Composition

Table 1 Composition of the High-strength Zinc Alloy Unit: %

A ℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

●Mechanical Properties

Tensile strength:	275 to 314 N/mm^2
Tensile yield strength (0.2%):	216 to 245 N/mm^2
Compressive strength:	539 to 686 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Fatigue strength:	132 $N/mm^2 \times 10^7$ (Schenck bending test)
Charpy impact strength:	0.098 to 0.49 N·m/mm^2
Elongation:	1 to 5 %
Hardness:	120 to 145 HV

●Physical Properties

Specific gravity:	6.8
Specific heat:	460 J/(kg·K)
Melting point:	390 ℃
Thermal-expansion coefficient	24×10^{-6}

●Wear Resistance

Amsler wear-tester:

Test piece rotation speed:	185 min^{-1}
Load	392 N
Lubricant:	Dynamo oil

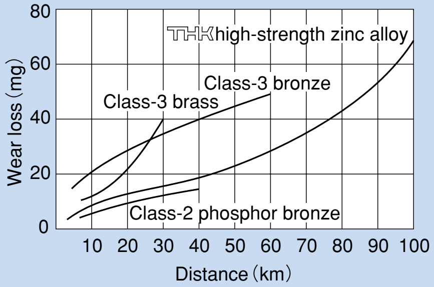


Fig. 1 Wear Resistance of the High-strength Zinc Alloy

1.5. Selecting a Nut

Dynamic Permissible Torque T and Dynamic Permissible Thrust F

The dynamic permissible torque (T) and the dynamic permissible thrust are the torque and the thrust at which the contact surface pressure on the tooth surface of the bearing is 9.8 N/mm². These values are used as a measuring stick for the strength of the nut.

pV Value

With a sliding bearing, a pV value, which is the product of the contact surface pressure (p) and the sliding speed (V), is used as a measuring stick to judge whether the assumed model can be used. Use the corresponding pV value indicated in Fig. 2 as a guide for selecting a slide series model. The pV value varies also according to the lubrication conditions.

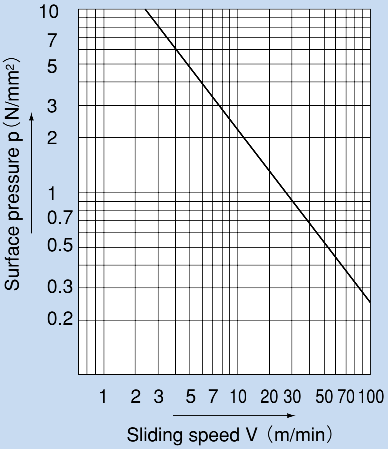


Fig. 2 pV Value

fs : Safety Factor

To calculate a load applied to the nut, it is necessary to accurately obtain the effect of the inertia that changes with the weight and dynamic speed of an object. In general, with reciprocating or rotating machines, it is not easy to accurately obtain all the factors such as the effect of the start and stop, which are always repeated. Therefore, if the actual load cannot be obtained, it is necessary to select a bearing while taking into account the empirically obtained safety factors shown in table 2.

Table 2 Safety Factor (f_S)

Type of load	Lower limit of f_S
For a static load less frequently used	1 to 2
For an ordinary single-directional load	2 to 3
For a load accompanied by vibrations/impact	4 or greater

■f_T : Temperature Factor

If the temperature of the nut exceeds the normal temperature range, the seizure resistance of the nut and the strength of the material will decrease. Therefore, it is necessary to multiply the dynamic permissible torque (T) and the dynamic permissible thrust (F) by the corresponding temperature factor indicated in Fig. 3.

Note: In the case of a miniature Change Nut, be sure to use it at 60℃ or below.

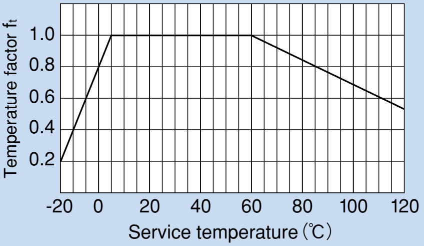


Fig. 3 Temperature Factor

Accordingly, when selecting a nut, the following equations need to be met in terms of its strength.

Dynamic permissible torque (T)

$$f_S \leqq \frac{f_T \cdot T}{P_T}$$

Static permissible thrust (F)

$$f_S \leqq \frac{f_T \cdot F}{P_F}$$

where

f_S	: Safety factor	(see table 2)
f_T	: Temperature factor	(see Fig. 3)
T	: Dynamic permissible torque	(N-m)
P_T	: Applied torque	(N-m)
F	: Dynamic permissible thrust	(N)
P_F	: Axial load	(N)

■Hardness of the Surface and Wear Resistance

The hardness of the shaft significantly affects the wear resistance of the nut. If the hardness is equal to or less than 250 HV, the abrasion loss increases as indicated in Fig. 4. The roughness of the surface should preferably be 0.80 a or less.

A dedicated rolled shaft achieves surface hardness of 250 HV or greater, through hardening as a result of rolling, and surface roughness of 0.20 a or less. Thus, the dedicated rolled shaft is highly wear resistant.

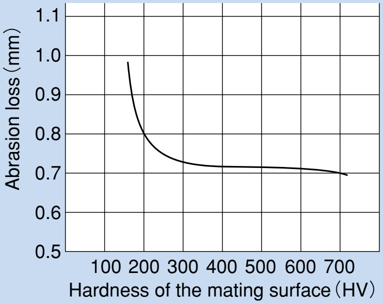


Fig. 4 Surface Roughness and Wear Resistance

1.6. Lubrication

Select a lubrication method according to the service conditions of the nut.

Oil Lubrication

For the lubrication of the nut, oil lubrication is recommended. Specifically, oil-bath lubrication or drop lubrication is particularly effective. Oil-bath lubrication is the most appropriate method since it meets harsh conditions such as high speed, heavy load or external heat transmission and it cools the nut. Drop lubrication suits low- to medium-speed and a light- to medium-load. Select a lubricant according to the service conditions as indicated in table 3.

Table 3 Selection of a Lubricant

Service conditions	Type of lubricant
Low speed, heavy load, high temperature	High-viscosity sliding surface oil or turbine oil
High speed, light load, low temperature	Low-viscosity sliding surface oil or turbine oil

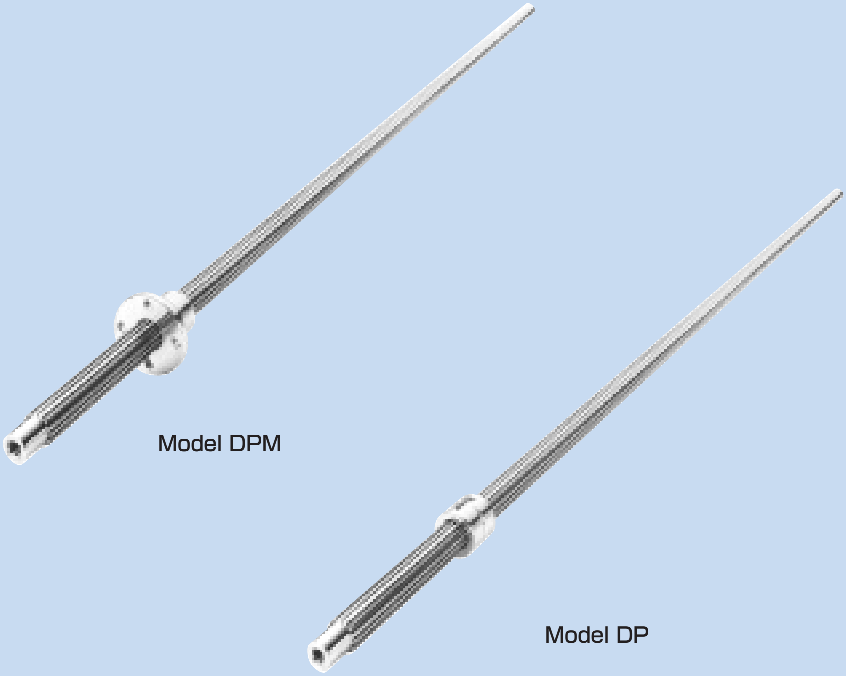
Grease Lubrication

In low-speed feed, which occurs less frequently, the user can lubricate the slide system by manually applying grease to the shaft on a regular basis or using the greasing hole on the nut. We recommend lithium soap group grease No. 2.

Initial Lubrication of the Miniature Change Nut

Since the Miniature Change Nut is made of oil-impregnated plastics, it can be used without lubrication during operation. For the initial lubrication, use oil or grease. Note, however, that lubricants containing much extreme pressure agent are not suitable.

2. Spline Nut Models DPM and DP



Model DPM

Model DP

2.1. Structure and Features of Spline Nut Models DPM and DP

Spline Nut models DPM and DP are low price bearings that are made of a special alloy (see page M-6) formed by die casting and use highly accurate spline shafts as the core. Unlike conventional machined spline nuts, the sliding surface of these models maintains a chill layer formed in the rolling process, thus to achieve high wear resistance.

The surface of the spline shafts to be used in combination with the nuts is hardened through rolling and is mirror finished. Accordingly, smooth sliding motion is achieved.

The specially designed teeth of the spline have large contact areas and as well as concentricity, which enables the shaft to automatically establish the center as a torque is applied. Therefore, the teeth demonstrate stable performance in transmitting a torque.

2.2. Clearance in the Rotation Direction

The clearance in the rotation direction: $\alpha \leqq 20'$ MAX

2.3. Selecting a Spline Nut

Use the dynamic permissible torque and the pV value as a measuring stick for selecting a spline nut. For details, see the section on the selection of a nut on page M-7.

The values p and V required to obtain the pV value of the Spline Nut is calculated from the following equation.

Calculating Contact Surface Pressure p

$$p = \frac{P_T}{T} \times 9.8$$

where

p : Contact surface pressure on the tooth under a load torque (P_T) (N/mm²)

T : Dynamic permissible torque (N-m)

P_T : Applied torque (N-m)

Calculating the Sliding Speed

With splines, the sliding speed of the teeth is equal to the feeding speed.

V : Sliding speed of the tooth (m/min)

[Example of calculation]

Use Spline Nut DPM and reciprocate it at speed in the axial direction of 5 m/min while transmitting a load torque of 78 N-m. Since the applied torque is not consistent in direction, it is important to select a spline nut that can be used in locations accompanied by vibrations and impact.

First, select a nut that has a dynamic permissible torque (T) at which it can be used.

$$T \geqq \frac{f_S \cdot P_T}{f_T} = \frac{4 \times 78}{1} = 312 \text{ N-m}$$

Safety factor (f_S) =4
Temperature factor (f_T) =1
Load torque (P_T) =78 N-m

Select Spline Nut model DPM3560 (dynamic permissible torque T = 443 N-m), which satisfies the dynamic permissible torque (T) above.

Second, obtain the pV value.

Obtain the contact surface pressure (p).

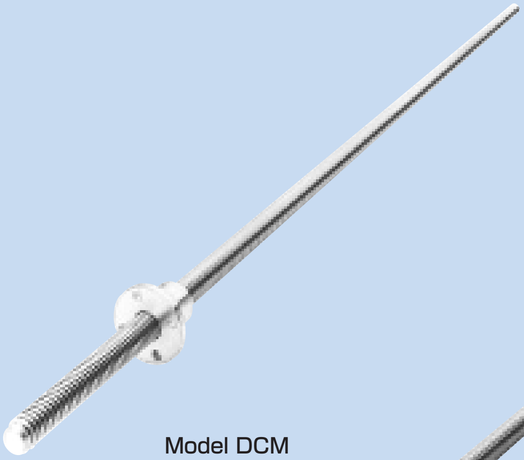
$$p = \frac{P_T}{T} \times 9.8 = \frac{78}{443} \times 9.8 \fallingdotseq 1.73 \text{ N/mm}^2$$

Obtain the sliding speed (V).

$$V = 5\text{m/min}$$

From the diagram of pV values (Fig. 2) on page M-7, it is judged that there will be no abnormal wear if the sliding speed (V) is 13.5 m/min or below against the "p" value of 1.73 N-m. Therefore, it is appropriate to select model DPM3560.

3. Screw Nut Models DCM and DC



Model DCM

Model DC

3.1. Structure and Features of Screw Nut Models DCM and DC

Screw Nut models DCM and DC are manufactured to meet the standards for 30° trapezoidal threads. They use a special alloy (see page M-6) for the nuts and have precision male thread, formed through die casting, as the core. As a result, these bearings achieve less unevenness in accuracy and higher accuracy and wear resistance than machined screw nuts.
In addition, cut screw shafts and ground screw shafts are also available according to the application. Contact THK for details.

3.2. Selecting a Screw Nut

Calculate the dynamic permissible thrust (F) and the pV value as a measuring stick for selecting a screw nut. For details, see the section "Selecting a Nut" on page M-7. The "p" and "V" values required to obtain the pV value of the nut are calculated from the following equations.

Calculating the Contact Surface Pressure p

The value of "p" is obtained as followed.

$$p = \frac{P_F}{F} \times 9.8$$

where

p : Contact surface pressure on the teeth from an axial load (P_F N) (N/mm^2)
F : Dynamic permissible thrust (N)
P_F : Axial load (N)

Calculating the Sliding Speed V on the Teeth

The value of "V" is obtained as followed.

$$V = \frac{\pi \cdot Do \cdot n}{\cos\alpha \times 10^3}$$

where

V : Sliding speed (m/min)
Do : Effective diameter (mm)
(See the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.)
n : Rotation speed per minute (min^{-1})
α : Lead angle (degree)
(See the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.)
R : Lead (mm)

[Example of calculation]

Assuming that Screw Nut model DCM is used, select a screw nut that travels at feed speed S = 3 m/min while receiving an axial load P_F = 1,080 N, which is applied in one direction.

First, tentatively select model DCM32 (dynamic permissible thrust F = 21,100 N).

Obtain the contact surface pressure (p).

$$p = \frac{P_F}{F} \times 9.8 = \frac{1080}{21100} \times 9.8 \fallingdotseq 0.50\ \mathrm{N/mm^2}$$

Obtain the sliding speed (V).

The rotation speed per minute (n) of the screw shaft needed to move it at feed speed S = 3 m/min is calculated as follows.

$$n = \frac{S}{\ell \times 10^{-3}} = \frac{3}{6 \times 10^{-3}} = 500\mathrm{min^{-1}}$$

$$V = \frac{\pi \cdot Do \cdot 500}{\cos\alpha \times 10^{3}} = \frac{\pi \times 29 \times 500}{\cos 3^\circ 46' \times 10^{3}} \fallingdotseq 45.6\ \mathrm{m/min}$$

From the diagram of pV values (Fig. 2) on page M-7, it is judged that there will be no abnormal wear if the sliding speed (V) is 47 m/min or below against the "p" value of 0.50 $\mathrm{N/mm^2}$.

Second, obtain the safety factor (f_S) against the dynamic permissible thrust (F). Given the service conditions: temperature factor f_T = 1 and applied load P_F = 1,080 N, the safety factor is calculated as follows.

$$f_S \leqq \frac{f_T \cdot F}{P_F} = \frac{1 \times 21100}{1080} = 19.5$$

Since the required strength will be met if "f_S" is at least 2 because of the type of load, it is appropriate to select model DCM32.

3.3. Efficiency and Thrust

The efficiency (η) at which the screw transfers a torque into thrust is obtained from the following equation.

$$\eta = \frac{1 - \mu\tan\alpha}{1 + \mu/\tan\alpha}$$

where

η : Efficiency

α : Lead angle

μ : Friction coefficient

Fig. 1 shows the result of the above equation.

The thrust generated when a torque is applied is obtained from the following equation.

$$Fa = \frac{2 \cdot \pi \cdot \eta \cdot T}{R \times 10^{-3}}$$

where

Fa	: Thrust generated	(N)
T	: Torque (input)	(N-m)
R	: Lead	(mm)

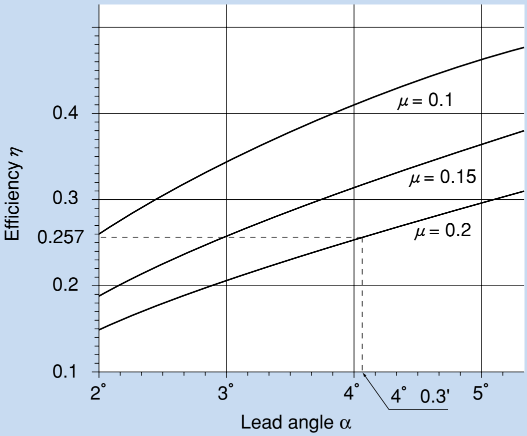


Fig. 1 Efficiency

[Example of calculation]

Assuming that Screw Nut model DCM20 is used and the input torque T = 19.6 N-m, obtain the thrust to be generated.

Calculate the efficiency (η) when $\mu = 0.2$.

The lead angle (α) of model DCM20: 4°03′

From the diagram in Fig. 1, the efficiency (η) when the friction coefficient $\mu = 0.2$ is obtained as $\eta = 0.257$.

Obtain the thrust generated.

$$Fa = \frac{2 \cdot \pi \cdot \eta \cdot T}{R \times 10^{-3}} = \frac{2 \times \pi \times 0.25 \times 19.6}{4 \times 10^{-3}} \fallingdotseq 7700\ \text{N}$$

3.4. Accuracy Standards

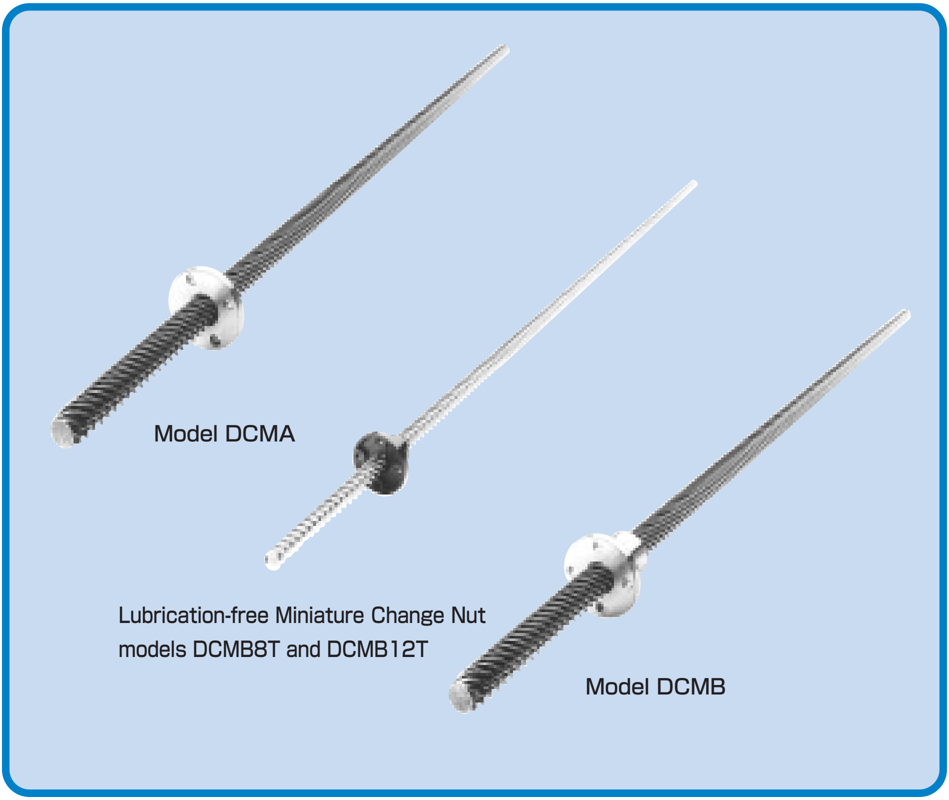
Table 1 Accuracy of the Screw Shaft of Models DCM and DC

Unit: mm

Shaft symbol / Accuracy	Rolled shaft	Cut shaft	Ground shaft
	T Note	K Note	G Note
Single pitch error (max)	±0.02	±0.015	±0.005
Accumulated pitch error (max)	±0.15/300	±0.05/300	±0.015/300

Note: Symbols T, K and G indicate machining methods for the screw shaft. The cut shafts and ground shafts are build-to-order.

4. Change Nut Models DCMA and DCMB



4.1. Structure and Features of Change Nut Models DCMA and DCMB

Change Nut models DCMA and DCMB have a lead angle of 45°, which is difficult to achieve through machining. Each model is capable of converting linear motion to rotary motion, or vise versa, at 70% efficiency. Because of the large leads, they are optimal for providing a fast feed mechanism at low-speed rotation. The multi-thread screw shafts to be combined with these change nuts are formed through cold gear rolling. The surface of the teeth is hardened to over 250 HV and mirror-finished. As a result, the shafts are highly wear resistant and achieve significantly smooth motion when used in combination with these change nuts. Models DCMA40, DCMB40 or higher are designed for use in combination with cut screw shafts.

The Miniature Change Nuts are made of oil-impregnated plastic, and have wear resistance and excel in lubricity especially in oil-less operation. In addition, since the high level of their performances can be maintained for a long period, they allow long-term maintenance-free operation.

4.2. Selecting a Change Nut

Calculate the dynamic permissible thrust (F) or dynamic permissible torque (T) and the pV value as a measuring stick for selecting a change nut. For details, see the section "Selecting a Nut" on page M-7.

The "p" and "V" values required to obtain the pV value of the change nut are calculated from the following equations.

Calculating the Contact Surface Pressure p

The value of "p" is obtained as followed.

●If an axial load is applied:

$$p = \frac{P_F}{F} \times 9.8$$

where

p : Contact surface pressure on the teeth from an axial load (P_F N) (N/mm²)

F : Dynamic permissible thrust (N)

P_F : Axial load (N)

●If a torque is applied:

$$p = \frac{P_T}{T} \times 9.8$$

where

p : Contact surface pressure on the teeth from a load torque (P_T N-m) (N/mm²)

T : Dynamic permissible torque (N-m)

P_T : Load torque (N-m)

Calculating the Sliding Speed V on the Teeth

The value of "V" is obtained as followed.

$$V = \frac{\sqrt{2} \cdot \pi \cdot Do \cdot n}{10^3}$$

where

V : Sliding speed (m/min)

Do : Effective diameter (mm)

(See the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.)

n : Rotation speed per minute (min^{-1})

R : Lead (mm)

[Example of calculation]

Assuming that Change Nut model DCMB is used, select a screw nut that travels at feed speed S = 10 m/min while receiving an axial load P_F = 1,760 N accompanied by vibrations.

First, tentatively select model DCMB25T (dynamic permissible thrust F = 12,700 N).

Obtain the contact surface pressure (p).

$$p = \frac{P_F}{F} \times 9.8 = \frac{1760}{12700} \times 9.8 \fallingdotseq 1.36\ \mathrm{N/mm^2}$$

Obtain the sliding speed (V).

The rotation speed per minute (n) of the screw shaft needed to move it at feed speed S = 10 m/min is calculated as follows.

$$n = \frac{S}{R \times 10^{-3}} = \frac{3}{73.3 \times 10^{-3}} \fallingdotseq 136\mathrm{min^{-1}}$$

$$V = \frac{\sqrt{2} \cdot \pi \cdot Do \cdot n}{10^3} = \frac{\sqrt{2} \times \pi \times 23.1 \times 136}{10^3} \fallingdotseq 14.0\ \mathrm{m/min}$$

From the diagram of pV values (Fig. 2) on page M-7, it is judged that there will be no abnormal wear if the sliding speed (V) is 16 m/min or below against the "p" value of 1.36 $\mathrm{N/mm^2}$.

Second, obtain the safety factor (f_S) against the dynamic permissible thrust (F). Given the service conditions:

Temperature factor f_T = 1, and

Applied load P_F = 1,760 N, the safety factor is calculated as follows.

$$f_S \leqq \frac{f_T \cdot F}{P_F} = \frac{1 \times 12700}{1760} = 7.2$$

Since the required strength will be met if "f_S" is at least 4 because of the type of load, it is appropriate to select model DCMB25T.

4.3. Efficiency, Thrust and Torque

The efficiency（η）of the change nut in relation to the friction coefficient（μ）is indicated in table 1.

Table 1 Friction Coefficient and Efficiency

Friction coefficient（μ）	0.1	0.15	0.2
Efficiency（η）	0.82	0.74	0.67

The thrust generated when a torque is applied is obtained from the following equation.

$$Fa = 2 \cdot \pi \cdot \eta \cdot T/R \times 10^{-3}$$

where

Fa	: Thrust generated	(N)
T	: Torque (input)	(N-m)
R	: Lead	(mm)

Also, the torque generated when a thrust is applied is obtained from the following equation.

$$T = \eta \cdot Fa \cdot R \times 10^{-3}/2\pi$$

where

T	: Torque generated	(N-m)
Fa	: Thrust (input)	(N)
R	: Lead	(mm)

[Example of calculation - 1]

Assuming that Change Nut model DCMB20T is used and the torque T is equal to 19.6 N-m, obtain the thrust to be generated.
If "μ" is 0.2, the efficiency "η" is 0.67 (see table 1), and the generated thrust (Fa) is calculated as follows.

$$Fa = 2 \cdot \pi \cdot \eta \cdot T/R \times 10^{-3} = \frac{2 \times \pi \times 0.67 \times 19.6}{60 \times 10^{-3}} \fallingdotseq 1370 \text{ N}$$

[Example of calculation - 2]

Assuming that Change Nut model DCMB20T is used and the thrust Fa is equal to 980 N, obtain the torque to be generated.
If "μ" is 0.2, the efficiency "η" is 0.67 (see table 1), and the generated torque (T) is calculated as follows.

$$T = \frac{\eta \cdot Fa \cdot R \times 10^{-3}}{2\pi} = \frac{0.67 \times 980 \times 60 \times 10^{-3}}{2\pi} = 6.27 \text{ N-m}$$

4.4. Accuracy Standards

Table 2 Accuracy of the Screw Shaft of Models DCMA and DCMB

Unit: mm

Shaft symbol / Accuracy	Rolled shaft
	T Note
Single pitch error (max)	±0.025
Accumulated pitch error (max)	±0.2/300

Note: Symbol T indicates the machining method for the screw shaft.

1. Features of Slide Pack Model FBW

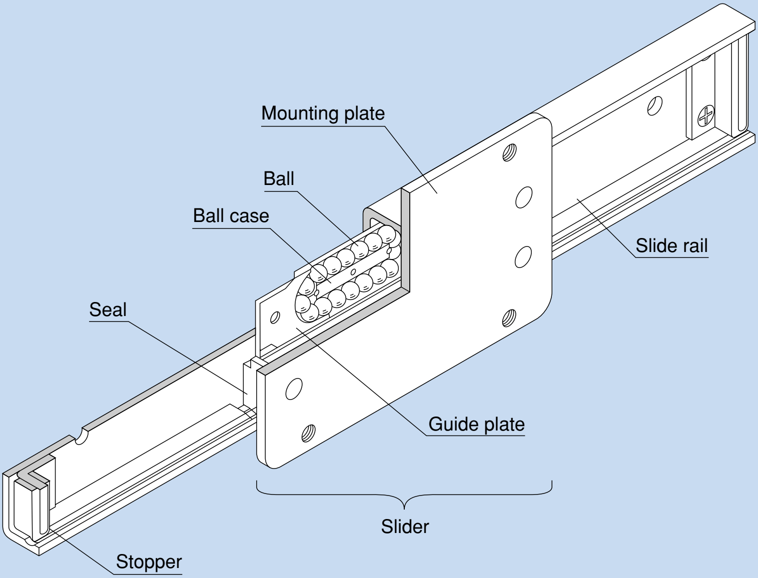


Fig. 1 Structure of Slide Pack Model FBW-RUU

1.1. Structure and Features of Slide Pack Model FBW

Slide Pack model FBW is an LM system in which a precision press molded slider that contains balls performs infinite linear motion. Used in combination with a slide rail, the Slide Pack achieves lightweight and compact design and smooth linear motion at a low price.

The ball case and the slide rail are nitrided to ensure high wear resistance (the slide rail of model FBW 2560R is made of stainless steel).

The Slide Pack is optimal for slide units of photocopiers, tool cabinets, electronic equipment cabinets, moving seats, automatic vending machines, machine tool slide covers, cash registers, heavy doors and curtain walls.

●Low Cost, Interchangeable

Since it is press molded with precision, this LM system achieves stable quality and interchangeability at low cost.

●Infinite Stroke Length

Unlike the conventional finite stroke type, the slider is capable of performing infinite motion. When connected with a slide rail, it can be used in long-stroke applications.

●Easy Installation and Handling

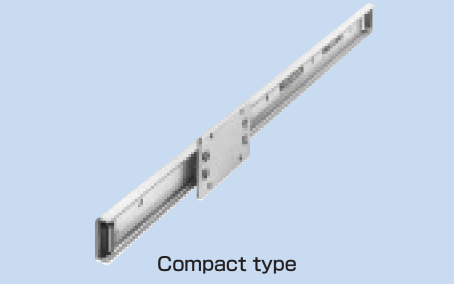
Because of the structure that prevents balls from falling off even if the slider is removed from the slide rail, this model can be used in a complex construction where it is impossible to install an LM system unless it is disassembled.

●A Type Equipped with a Dust Prevention Seal Also Standardized

A type equipped with a dust prevention seal is standardized for locations where cutting chips or dust may enter the system.

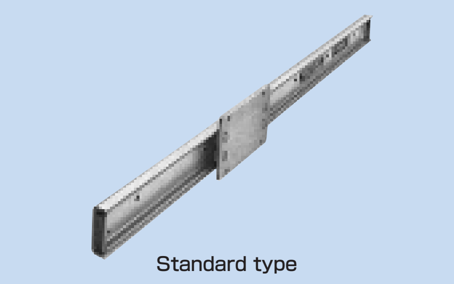
1.2. Types of Slide Pack Model FBW

●Model FBW 2560R



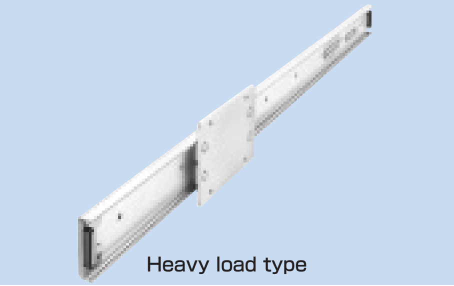
Compact type

●Model FBW 3590R



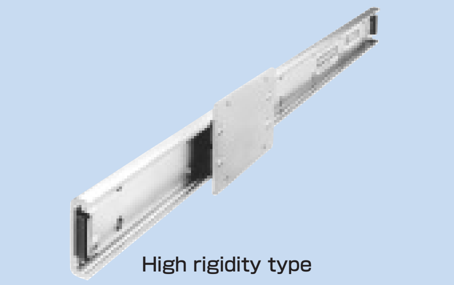
Standard type

●Model FBW 50110R



Heavy load type

●Model FBW 50110H



High rigidity type

1.3. Clearance

Model FBW is manufactured to the following accuracies.
Vertical clearance: 0.03 mm or less
Horizontal clearance: 0.1 mm or less
These specifications are values when the slide rail is attached to a rigid base.

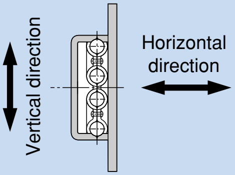


Fig. 2

1.4. Installation

Mounting Screws of the Slide Rail

Since the space for securing the mounting screws of the slide rail is small as shown in Fig. 3, we recommend using truss head screws or binder screws.

Note: The slide rail of model FBW 50110H is countersunk. We recommend mounting the slide rail using hexagon socket bolts (M5).

Unit : mm

Model No.	t
FBW 2560R	3.2
FBW 3590R	3.4
FBW 50110R	3.4
FBW 50110H	—

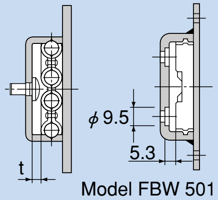


Fig. 3

Attaching the Stopper

If the slider may overrun and come off of the slide rail, attach the dedicated stopper to the slide rail end as shown in Fig. 4.

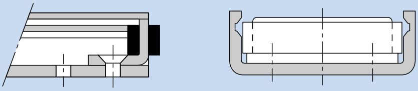


Fig. 4

Installing the Slider

With model FBW-R (H), balls will not fall off even if the slider is removed from the slide rail. However, they could fall if twisting the slider when reattaching it to the slide rail. Whenever possible, do not remove the slider from the slide rail when installing the Slide Pack.

Groove Dimensions

Fig. 5 shows the dimensions of grooves for applications where model FBW-R (H) is installed in a groove.

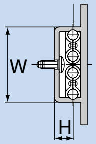


Fig. 5

Unit : mm

Model No.	W	H
FBW 2560R	$24.8^{+0.15}_{+0.1}$	7.4
FBW 3590R	$37^{+0.15}_{+0.1}$	10
FBW 50110R	$50^{+0.15}_{+0.1}$	10
FBW 50110H	$54.4^{+0.15}_{+0.1}$	13

1.5. Dust Prevention and Lubrication

For Slide Pack model FBW-R (H), a special synthetic rubber seal with high dust prevention characteristics, capable of preventing foreign matter from entering the slider and the lubricant from leaking, is available. The seal increases the dust prevention effect by contacting both the slide rail raceway where balls roll and the slide rail itself.

For lubrication, apply high-quality lithium soap group grease to the raceway.

2. Features of Slide Pack Model FBL

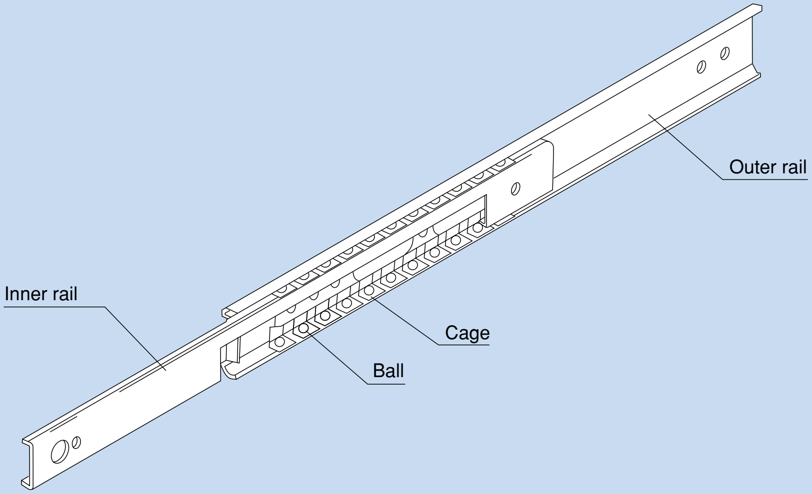


Fig. 1 Structure of Slide Pack Model FBL

2.1. Structure and Features of Slide Pack Model FBL

Slide Pack model FBL is a thin, compact and ultra-low price slide unit for finite motion. It has two rows of balls placed between an inner rail made of a steel sheet roll-formed with precision and an outer rail. The balls are evenly spaced by a cage press-molded with precision, thus eliminating friction between balls and achieving a smooth slide mechanism.
Since model FBL achieves smooth linear motion with easy installation, it can be used in a wide range of applications such as photocopiers, measuring instruments, telecommunication equipment, automatic vending machines and various types of office equipment.

●Unit Type That Allows Easy Installation

Since the clearance and the motion of the slide unit are optimally adjusted, simply mounting the unit onto the base or the table using screws will achieve a slide mechanism with virtually no running noise.

●Thin and Compact

Since the sectional shape is thinly designed, this slide pack only requires a small side space for installation. In addition, a desired number of slide pack units can be installed in parallel according to the load conditions.

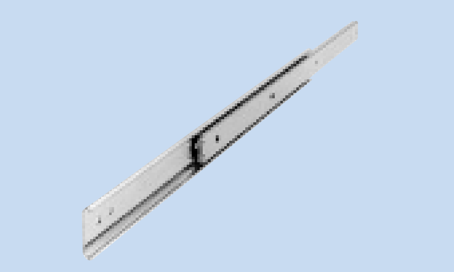
●Maintenance-free Operation

Since the slide rail is treated with zinc plating, it is highly resistant to corrosion. The slide unit contains grease, eliminating the need for further grease replenishment in normal use.

2.2. Types and Features of Slide Pack Model FBL

●Models FBL 27S and 35S

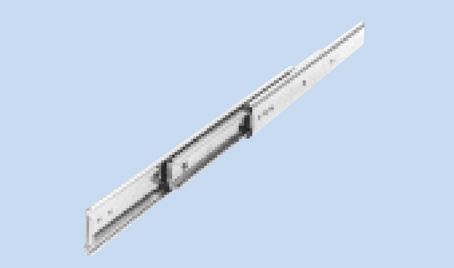
The basic unit type designed to have a stroke length approximately 70% of the overall rail length.



Models FBL 27S/35S

●Models FBL 27D and 35D

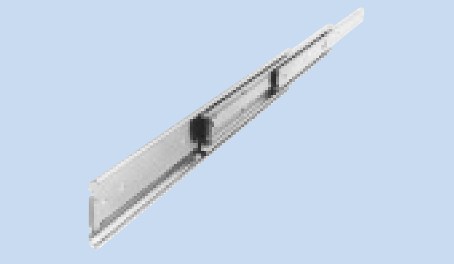
A two-stage, double-unit type that allows the stroke length to exceed the overall rail length.



Models FBL 27D/35D

●Models FBL 35E and 55E

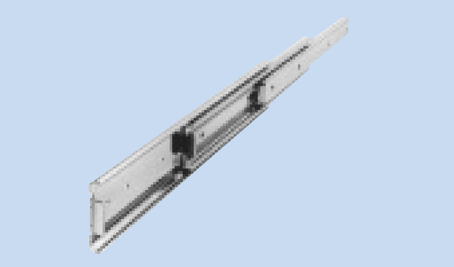
A two -stage slide unit type that allows the stroke length to exceed the overall rail length in a limited space.



Models FBL 35E/55E

●Model FBL 56H

A two-stage, high-load slide unit type with an even greater permissible load.



Model FBL 56H

2.3. Installation

Mounting Screws of the Slide Rail

The slide rail is to be mounted using M4 screws. Since the mounting space is small as shown in Fig. 2, we recommend using truss head screws or binder screws.

Note: For model FBL 35E, use M3 truss head screws or binder screws.

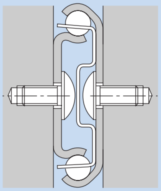


Fig. 2

Attaching the Slide Rail

While keeping the maximum stroke, mount the outer rail at the section where the inner rail and the outer rail overlap, slide the inner rail backward, and then secure the rail using a screw through the access hole.

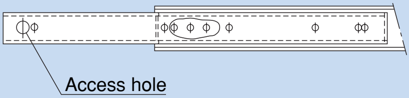


Fig. 3

Mounting Orientation

For use other than with the mounting orientation shown in Fig. 4, contact THK .

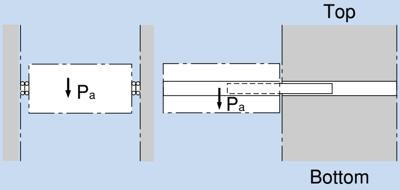


Fig. 4

2.4. Static Permissible Load

The static permissible load of model FBL varies with rail lengths and is indicated in the corresponding dimensional table in the "THK General Catalog- Product Specifications," provided separately. This value represents the static permissible load in the direction "P_a" per pair of slide pack units in the middle of the rail length at the maximum stroke. If a load other than in the direction "P_a" is applied, contact THK.

For the traveling section of a heavy object, THK also manufactures a special type stacking basic units as shown in Fig. 6 at your request.

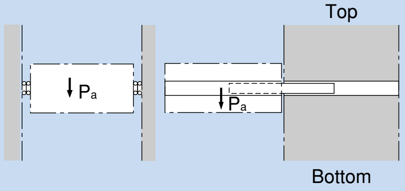


Fig. 5

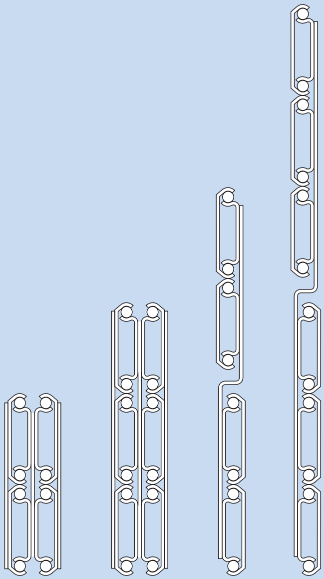


Fig. 6 Example of Combining Slide Pack Units

1. Features of the Cross-Roller Ring

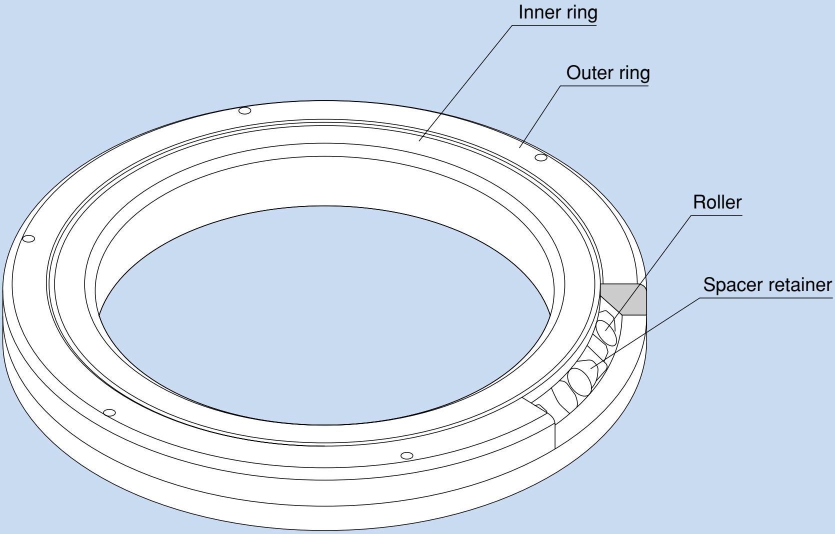


Fig. 1 Structure of Cross-Roller Ring Model RB

1.1. Structure and Features of the Cross-Roller Ring

With the Cross-Roller Ring, cylindrical rollers are arranged crosswise, with each roller perpendicular to the adjacent roller, in a 90° V groove, separated from each other by a spacer retainer. This design allows just one bearing to receive loads in all directions including radial, axial and moment loads.

Since the Cross-Roller Ring achieves high rigidity despite the minimum possible dimensions of the inner and outer rings, it is optimal for applications such as joints and swiveling units of industrial robots, swiveling tables of machining centers, rotary units of manipulators, precision rotary tables, medical equipment, measuring instruments and IC manufacturing machines.

●High Rotation Accuracy

The spacer retainer fitting among cross-arrayed rollers prevents rollers from skewing and the rotation torque from increasing due to friction between rollers. Unlike conventional types using steel sheet retainers, the Cross-Roller Ring does not cause unilateral contact of roller or locked rollers. Thus, even under a preload, the Cross-Roller Ring provides stable rotation.

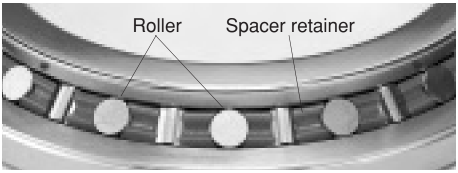
Since the inner and outer rings are designed to be separable, the bearing clearance can be adjusted. In addition, a preload can be applied. These features enable accurate rotation.

●Easy Handling

The inner and outer rings, which are separable, are secured to the Cross-Roller Ring body after being installed with rollers and spacer retainers in order to prevent the rings from separating from each other. Thus, it is easy to handle the rings when installing the Cross-Roller Ring.

●Skewing Prevention

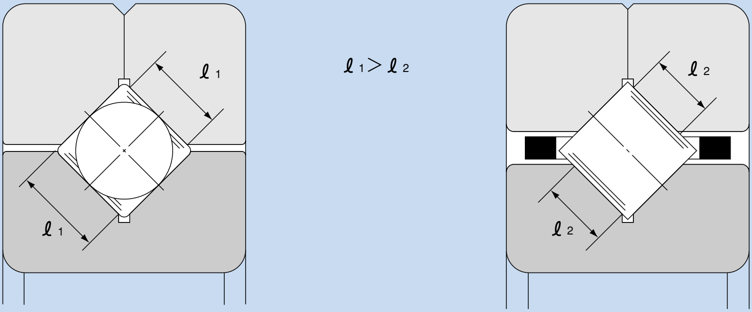
The spacer retainer keeps rollers in their proper position, thereby preventing them from skewing (tilted rollers). This eliminates friction between rollers, and therefore secures a stable rotation torque.



●Large Load Capacity

① Compared with conventional steel sheet retainers, the spacer retainer allows a longer effective contact length of each roller, thus to significantly increase the load capacity.
The spacer retainer guides rollers by holding them over the entire length of each roller, whereas the conventional type of retainer supports them only at a point at the center of each roller. Such one-point contact cannot sufficiently prevent skewing.

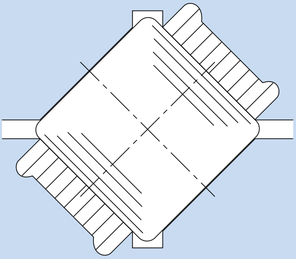
Roller contact length



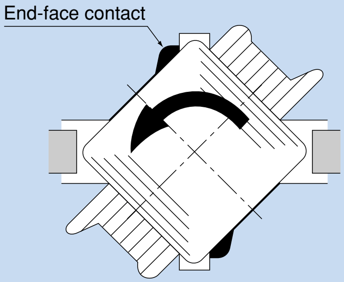
With a spacer retainer

With a steel sheet retainer (conventional type)

② In conventional types, the loaded areas are asymmetrical between the outer-ring and the inner-ring sides around the roller longitudinal axis. The greater the applied load is, the greater the moment becomes, leading end-face contact to occur. This causes frictional resistance, which hinders smooth rotation and quickens wear.



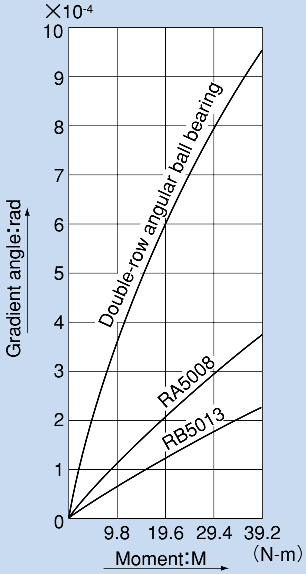
Loaded areas symmetrical
Design with a spacer retainer



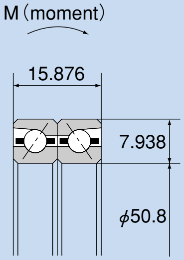
Loaded areas asymmetrical
Design with a steel sheet retainer (conventional type)

●Increased Rigidity (Three to Four Times Greater than the Conventional Type)

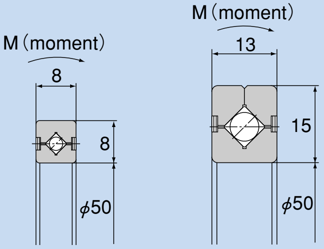
Unlike the thin angular ball bearings installed in double rows, the cross array of rollers allows a single Cross-Roller Ring unit to receive loads in all directions, increasing the rigidity to three to four times greater than the conventional type.



Moment Rigidity Diagram



Angular ball bearing



Model RA 5008 Model RB 5013

Cross-Roller Ring

1.2. Types and Features of the Cross-Roller Ring

●Model RB (Separable Outer Ring Type for Inner Ring Rotation)

The outer ring is separable while the inner ring is integrated with the main body. This model is used in locations where the rotational accuracy of the inner ring is required.

Standard Type

Model RB

●Model RE (Separable Inner Ring Type for Outer Ring Rotation)

The inner ring is separable while the outer ring is integrated with the main body. This model is used in locations where the rotational accuracy of the outer ring is required.

Standard Type

Model RE

●Model RA (Separable Outer Ring Type for Inner Ring Rotation)

Model RA is a lightweight, compact type with thinnest possible inner and outer rings.
It is used in locations where the rotational accuracy of the inner ring is required.

Thin Type

Model RA

●Model RA-C (Single-Split Type)

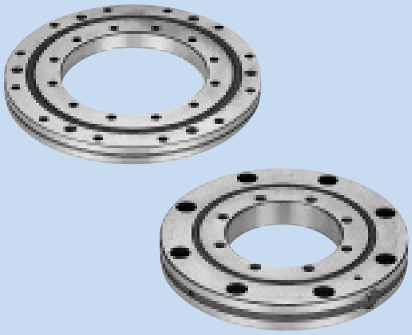
The major dimensions are the same as that of model RA. Since the outer ring is split as one point, this model is optimal for locations where the rigidity and accuracy of both the inner and outer rings are required.

Thin Type

Model RA-C

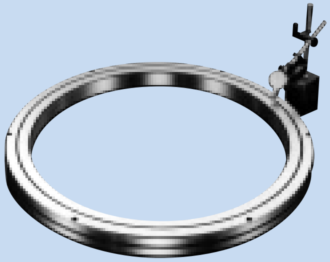
●Integrated Inner/Outer Ring Type (Special Type)

It achieves stable starting torque and eliminates a presser flange and a housing.
For inquiries about manufacturing this type, contact THK .



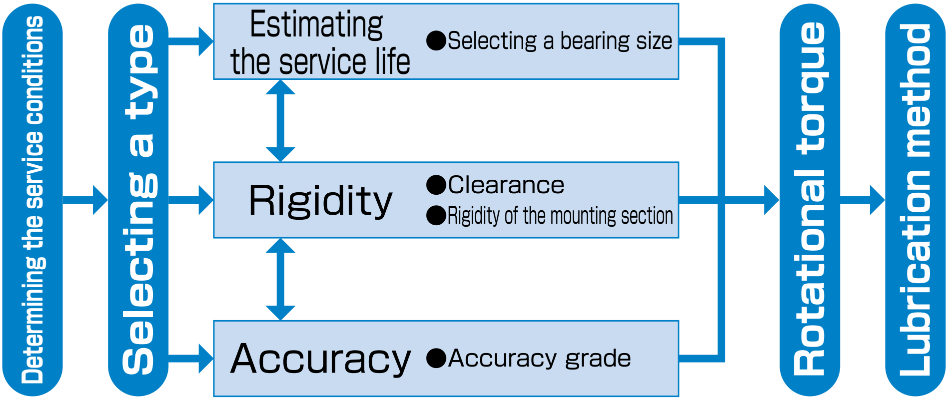
●USP-Grade Series of Models RB and RE

The rotation accuracy of the USP-Grade Series achieves the ultra-super-precision grade that surpasses the world's highest accuracy standards such as JIS Class 2, ISO Class 2, DIN P2 and AFBMA ABEC9.



1.3. Selecting a Cross-Roller Ring

The following diagram shows a typical procedure for selecting a Cross-Roller Ring.



- ● Inner-ring rotating ……model RB
- ● Outer-ring rotating ……model RE
- ● Mounting space…models RA-C and RA

1.4. Rated Life

The service life of the Cross-Roller Ring is obtained from the following equation.

$$L = \left(\frac{f_T \cdot C}{f_W \cdot P_C}\right)^{\frac{10}{3}} \times 10^6$$

where

L	:Rated life (The total number of revolutions that 90% of a group of identical Cross-Roller Ring units independently operating under the same conditions can achieve without showing flaking from rolling fatigue)	
C	:Basic dynamic load rating*	(N)
P_C	:Dynamic equivalent radial load	(N)
f_T	:Temperature factor	(see Fig. 2)
f_W	:Load factor	(see table 1)

* Note: The basic dynamic load rating (C) of the Cross-Roller Ring shows the radial load with constant direction and magnitude, under which the rated life (L) is 1 million revolutions when a group of identical Cross-Roller Ring units independently operate under the same conditions. The basic dynamic load rating (C) is indicated in the "THK General Catalog - Product Specifications," provided separately.

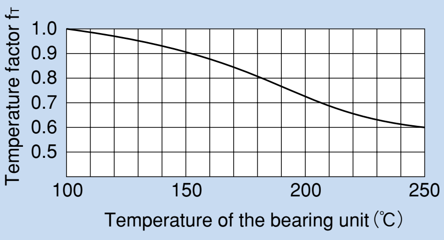


Fig. 2 Temperature Factor (f_T)

Note: The normal service temperature is 80℃ or below. If the product is to be used at a higher temperature, contact THK.

Table 1 Load Factor (f_W)

Service condition	f_W
Smooth motion without impact	1 to 1.2
Normal motion	1.2 to 1.5
Motion with severe impact	1.5 to 3

Dynamic Equivalent Radial Load P_C

The dynamic equivalent radial load of the Cross-Roller Ring is obtained from the following equation.

$$P_C = X \cdot \left(F_r + \frac{2M}{dp}\right) + Y \cdot F_a$$

where

P_C	:Dynamic equivalent radial load	(N)
Fr	:Radial load	(N)
Fa	:Axial load	(N)
M	:Moment	(N-mm)
X	:Dynamic radial factor	(see table 2)
Y	:Dynamic axial factor	(see table 2)
dp	:Roller pitch circle diameter	(mm)

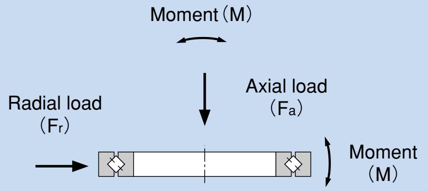


Fig. 3

Table 2 Dynamic Radial Factor and Dynamic Axial Factor

Classification	X	Y
$\frac{F_a}{F_r + 2M/dp} \leqq 1.5$	1	0.45
$\frac{F_a}{F_r + 2M/dp} > 1.5$	0.67	0.67

- ●If Fr = 0 and M = 0 N-mm, perform calculation while assuming that X = 0.67 and Y = 0.67.
- ●For service life calculation with a preload taken into account, contact THK.

[Example of calculating a service life]

Assuming that model RB25025 is used under the following conditions, calculate its rated life (L).

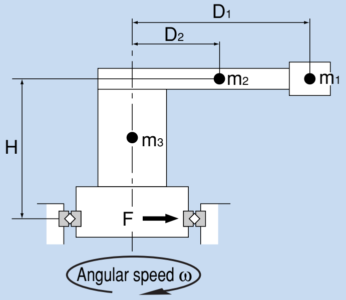


Fig. 4

m_1 =100 kg
m_2 =200 kg
m_3 =300 kg
D_1 =300 mm
D_2 =150 mm
H =200 mm
C =69.3 kN
C_0 =150 kN
dp =277.5 mm
F =100 N
ω =2 rad/s (ω: angular speed)

Radial load : $Fr = F + m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2$

$= 100 + 100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2$

$= 340$ N

Axial load : $Fa = (m_1 + m_2 + m_3) \times g$

$= (100 + 200 + 300) \times 9.807$

$= 5884.2$ N

Moment : $M = m_1 \cdot g \times D_1 + m_2 \cdot g \times D_2 + (m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2) \times H$

$= 100 \cdot 9.807 \times 300 + 200 \cdot 9.807 \times 150 +$
$(100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2) \times 200$

$= 636420$ N·mm

$$\frac{Fa}{Fr + 2M/dp} = \frac{5884.2}{340 + 2 \times 636420/277.5} = 1.19 \leqq 1.5$$

$\therefore X = 1$, $Y = 0.45$

Therefore, the dynamic equivalent radial load (P_C) is obtained as follows.

$$P_C = X\left(Fr + \frac{2M}{dp}\right) + Y \cdot Fa = 1 \times \left(340 + \frac{2 \cdot 636420}{277.5}\right) + 0.45 \times 5884.2 = 7574.7 \text{ N}$$

If f_W = 1.2, the rated life is calculated as follows.

$$L = \left(\frac{f_T \cdot C}{f_W \cdot P_C}\right)^{\frac{10}{3}} = \left(\frac{1 \times 69.3 \times 10^3}{1.2 \times 7574.7}\right)^{\frac{10}{3}} \times 10^6 = 8.7 \times 10^8 \text{ (revolutions)}$$

Thus, the rated life (L) is 8.7×10^8 revolutions.

1.5. Static Safety Factor

The basic static load rating C_0 refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the roller and the permanent deformation of the raceway accounts for 0.0001 times of the roller's diameter in the contact area where the maximum stress is applied (if the deformation exceeds this level, it will affect the rotation). This value is indicated as "C_0" in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately. When a load is statically or dynamically applied, it is necessary to consider the static safety factor as shown below.

$$\frac{C_0}{P_0} = f_S$$

where

f_S : Static safety factor (see table 3)
C_0 : Basic static load rating (N)
P_0 : Static radial load (N)

Table 3 Static Safety Factor (f_S)

Load conditions	Lower limit of f_S
Normal load	1 to 2
Impact load	2 to 3

Static Equivalent Radial Load P_0

The static equivalent radial load of the Cross-Roller Ring is obtained from the following equation.

$$P_0 = X_0 \cdot \left(Fr + \frac{2M}{dp} \right) + Y_0 \cdot Fa$$

where

P_0 : Static equivalent radial load (N)
Fr : Radial load (N)
Fa : Axial load (N)
M : Moment (N-mm)
X_0 : Static radial factor (X_0=1)
Y_0 : Static axial factor (Y_0=0.44)
dp : Roller pitch circle diameter (mm)

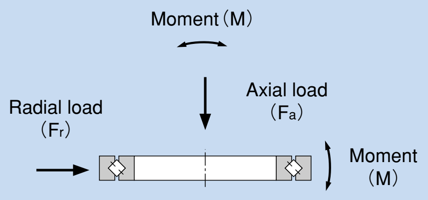


Fig. 5

[Example of calculating a static safety factor]

Assuming that model RB25025 is used under the following conditions, calculate its static safety factor (f_S).

$m_1 = 100$ kg

$m_2 = 200$ kg

$m_3 = 300$ kg

$D_1 = 300$ mm

$D_2 = 150$ mm

$H = 200$ mm

$C = 69.3$ kN

$C_0 = 150$ kN

$dp = 277.5$ mm

$F = 100$ N

$\omega = 2$ rad/s (ω: angular speed)

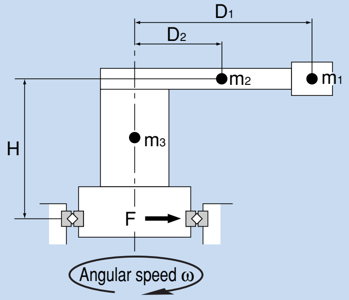


Fig. 6

Radial load : $Fr = F + m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2$

$= 100 + 100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2$

$= 340$ N

Axial load : $Fa = (m_1 + m_2 + m_3) \times g$

$= (100 + 200 + 300) \times 9.807$

$= 5884.2$ N

Moment : $M = m_1 \cdot g \times D_1 + m_2 \cdot g \times D_2 + (m_1 \cdot D_1 \times 10^{-3} \cdot \omega^2 + m_2 \cdot D_2 \times 10^{-3} \cdot \omega^2) \times H$

$= 100 \cdot 9.807 \times 300 + 200 \cdot 9.807 \times 150 +$

$(100 \cdot 300 \times 10^{-3} \cdot 2^2 + 200 \cdot 150 \times 10^{-3} \cdot 2^2) \times 200$

$= 636420$ N·mm

Therefore, the static equivalent radial load (P_0) is obtained as follows.

$$P_0 = X\left(Fr + \frac{2M}{dp}\right) + Y \cdot Fa = 1 \times \left(340 + \frac{2 \cdot 636420}{277.5}\right) + 0.44 \times 5884.2 = 7515.8\ \text{N}$$

$$\therefore f_S = \frac{150 \times 10^3}{7515.8} = 20$$

Thus, the static safety factor (f_S) is 20.

1.6. Static Permissible Moment

The static permissible moment (M_0) of the Cross-Roller Ring is obtained from the following equation.

$$M_0 = C_0 \cdot \frac{dp}{2} \times 10^{-3}$$

where

M_0	: Static permissible moment	(kN-m)
C_0	: Basic static load rating	(kN)
dp	: Roller pitch circle diameter	(mm)

[Example of calculating a static permissible moment]

Model No. RB25025

C =69.3 kN
C_0 =150 kN
dp =277.5 mm

The static permissible moment is calculated as follows.

$$M_0 = C_0 \cdot \frac{dp}{2} \times 10^{-3} = 150 \cdot \frac{277.5}{2} \times 10^{-3} = 20.8 \text{ kN-m}$$

1.7. Static Permissible Axial Load

The static permissible axial load (F_{a0}) of the Cross-Roller Ring is obtained from the following equation.

$$F_{a0} = \frac{C_0}{Y_0}$$

where

F_{a0} : Static permissible axial load (kN)

Y_0 : Static axial factor (Y_0=0.44)

[Example of calculating a static permissible axial load]

Model No. RB25025

C =69.3 kN

C_0 =150 kN

The static permissible axial load (F_{a0}) is calculated as follows.

$$F_{a0} = \frac{C_0}{Y_0} = \frac{150}{0.44} = 340.9\ \text{kN}$$

1.8. Accuracy Standards

The Cross-Roller Ring is manufactured with the accuracy and the dimensional tolerance according to tables 4 to 10.

Table 4 Rotational Accuracy of the Inner Ring of Model RB

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Radial run-out tolerance of the inner ring					Axial run-out tolerance of the inner ring				
Above	Or less	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2
18	30	13	8	4	3	2.5	13	8	4	3	2.5
30	50	15	10	5	4	2.5	15	10	5	4	2.5
50	80	20	10	5	4	2.5	20	10	5	4	2.5
80	120	25	13	6	5	2.5	25	13	6	5	2.5
120	150	30	18	8	6	2.5	30	18	8	6	2.5
150	180	30	18	8	6	5	30	18	8	6	5
180	250	40	20	10	8	5	40	20	10	8	5
250	315	50	25	13	10	—	50	25	13	10	—
315	400	60	30	15	12	—	60	30	15	12	—
400	500	65	35	18	14	—	65	35	18	14	—
500	630	70	40	20	16	—	70	40	20	16	—
630	800	80	—	—	—	—	80	—	—	—	—
800	1000	90	—	—	—	—	90	—	—	—	—
1000	1250	100	—	—	—	—	100	—	—	—	—

Table 5 Rotational Accuracy of the Outer Ring of Model RE

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Radial run-out tolerance of the outer ring					Axial run-out tolerance of the outer ring				
Above	Or less	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2
30	50	20	10	7	5	2.5	20	10	7	5	2.5
50	80	25	13	8	5	4	25	13	8	5	4
80	120	35	18	10	6	5	35	18	10	6	5
120	150	40	20	11	7	5	40	20	11	7	5
150	180	45	23	13	8	5	45	23	13	8	5
180	250	50	25	15	10	7	50	25	15	10	7
250	315	60	30	18	11	7	60	30	18	11	7
315	400	70	35	20	13	8	70	35	20	13	8
400	500	80	40	23	15	—	80	40	23	15	—
500	630	100	50	25	16	—	100	50	25	16	—
630	800	120	60	30	20	—	120	60	30	20	—
800	1000	120	75	—	—	—	120	75	—	—	—
1000	1250	120	—	—	—	—	120	—	—	—	—
1250	1600	120	—	—	—	—	120	—	—	—	—

Table 6 Rotational Accuracy of the Inner Ring of Model RA and RA-C

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Tolerance in radial run-out and axial run-out
Above	Or less	
40	65	13
65	80	15
80	100	15
100	120	20
120	140	25
140	180	25
180	200	30

Note: If higher accuracy than the above values is required for the inner ring in rotational accuracy for models RA and RA-C, contact THK.

Table 7 Rotational Accuracy of the Outer Ring of Model RA-C

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance in radial run-out and axial run-out
Above	Or less	
65	80	13
80	100	15
100	120	15
120	140	20
140	180	25
180	200	25
200	250	30

Note: The rotational accuracy of the outer ring for model RA-C indicates the value before separation.

Table 8 Dimensional Tolerance of the Bearing Inner Diameter for Models RB and RE

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Tolerance of dm (note 2)							
		Grades 0, P6, P5, P4, and P2		Grade PE6		Grade PE5		Grade PE4 and PE2	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
18	30	0	−10	0	−8	0	−6	0	−5
30	50	0	−12	0	−10	0	−8	0	−6
50	80	0	−15	0	−12	0	−9	0	−7
80	120	0	−20	0	−15	0	−10	0	−8
120	150	0	−25	0	−18	0	−13	0	−10
150	180	0	−25	0	−18	0	−13	0	−10
180	250	0	−30	0	−22	0	−15	0	−12
250	315	0	−35	0	−25	0	−18	—	—
315	400	0	−40	0	−30	0	−23	—	—
400	500	0	−45	0	−35	—	—	—	—
500	630	0	−50	0	−40	—	—	—	—
630	800	0	−75	—	—	—	—	—	—
800	1000	0	−100	—	—	—	—	—	—
1000	1250	0	−125	—	—	—	—	—	—

Note 1: Standard inner diameter accuracy of models RA and RA-C is 0. For higher accuracy than 0, contact THK.

Note 2: "dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner diameter at two points.

Note 3: For accuracy grades in bearing inner diameter with no values indicated in the table, the highest value among low accuracy grades applies.

Table 9 Dimensional Tolerance of the Bearing Outer Diameter for Models RB and RE

Unit: μm

Nominal dimension of bearing outer diameter (D) (mm)		Tolerance of Dm (note 2)							
		Grades 0, P6, P5, P4 and P2		Grade PE6		Grade PE5		Grades PE4 and PE2	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
30	50	0	–11	0	–9	0	–7	0	–6
50	80	0	–13	0	–11	0	–9	0	–7
80	120	0	–15	0	–13	0	–10	0	–8
120	150	0	–18	0	–15	0	–11	0	–9
150	180	0	–25	0	–18	0	–13	0	–10
180	250	0	–30	0	–20	0	–15	0	–11
250	315	0	–35	0	–25	0	–18	0	–13
315	400	0	–40	0	–28	0	–20	0	–15
400	500	0	–45	0	–33	0	–23	—	—
500	630	0	–50	0	–38	0	–28	—	—
630	800	0	–75	0	–45	0	–35	—	—
800	1000	0	–100	—	—	—	—	—	—
1000	1250	0	–125	—	—	—	—	—	—
1250	1600	0	–160	—	—	—	—	—	—

Note 1: Standard outer diameter accuracy of models RA and RA-C is 0. For higher accuracy than 0, contact THK.

Note 2: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

Note 3: For accuracy grades in bearing outer diameter with no values indicated in the table, the highest value among low accuracy grades applies.

Table 10 Tolerance in the Width of the Inner and Outer Rings (Common to All Grades)

Unit: μm

Nominal dimension of bearing inner diameter (D) (mm)		Tolerance of B		Tolerance of B1	
		Applied to the inner ring of RB and the outer ring of RE		Applied to the outer ring of RB and the inner ring of RE	
Above	Or less	Upper	Lower	Upper	Lower
18	30	0	–75	0	–100
30	50	0	–75	0	–100
50	80	0	–75	0	–100
80	120	0	–75	0	–100
120	150	0	–100	0	–120
150	180	0	–100	0	–120
180	250	0	–100	0	–120
250	315	0	–120	0	–150
315	400	0	–150	0	–200
400	500	0	–150	0	–200
500	630	0	–150	0	–200
630	800	0	–150	0	–200
800	1000	0	–300	0	–400
1000	1250	0	–300	0	–400

Note: All B and B1 types of models RA and RA-C are manufactured with tolerance between -0.120 and 0.

1.9. Radial Clearance

Table 11 shows radial clearances of thin-type Cross-Roller Ring models RA and RA-C, and table 12 shows that of models RB and RE.

Table 11 Radial Clearances of Models RA and RA-C

Unit: μm

Pitch circle diameter of the roller (dp) (mm)		CC0		C0	
Above	Or less	Min.	Max.	Min.	Max.
50	80	–8	0	0	15
80	120	–8	0	0	15
120	140	–8	0	0	15
140	160	–8	0	0	15
160	180	–10	0	0	20
180	200	–10	0	0	20
200	225	–10	0	0	20

Table 12 Radial Clearances of Models RB and RE

Unit: μm

Pitch circle diameter of the roller (dp) (mm)		CC0		C0		C1	
Above	Or less	Min.	Max.	Min.	Max.	Min.	Max.
18	30	–8	0	0	15	15	35
30	50	–8	0	0	25	25	50
50	80	–10	0	0	30	30	60
80	120	–10	0	0	40	40	70
120	140	–10	0	0	40	40	80
140	160	–10	0	0	40	40	90
160	180	–10	0	0	50	50	100
180	200	–10	0	0	50	50	110
200	225	–10	0	0	60	60	120
225	250	–10	0	0	60	60	130
250	280	–15	0	0	80	80	150
280	315	–15	0	30	100	100	170
315	355	–15	0	30	110	110	190
355	400	–15	0	30	120	120	210
400	450	–20	0	30	130	130	230
450	500	–20	0	30	130	130	250
500	560	–20	0	30	150	150	280
560	630	–20	0	40	170	170	310
630	710	–20	0	40	190	190	350
710	800	–30	0	40	210	210	390
800	900	–30	0	40	230	230	430
900	1000	–30	0	50	260	260	480
1000	1120	–30	0	60	290	290	530
1120	1250	–30	0	60	320	320	580
1250	1400	–30	0	70	350	350	630

1.10. Moment Rigidity

Figures 7 to 10 show moment rigidity diagrams for the Cross-Roller Ring as a separate unit. Rigidity is affected by the deformation of the housing, presser flange and bolts. Therefore, the strength of these parts must be taken into account.

(Radial clearance: 0)

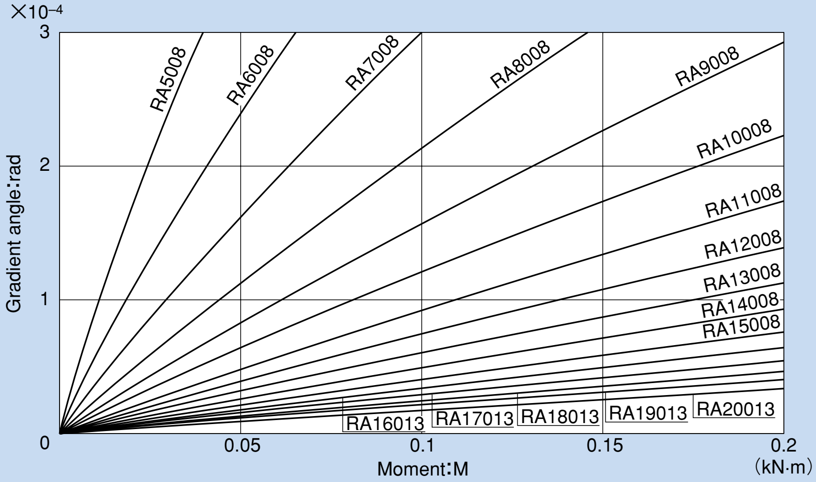


Fig. 7

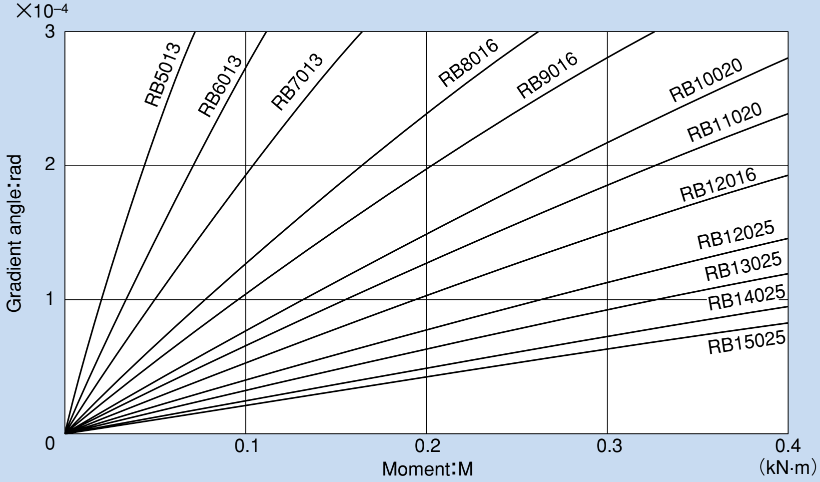


Fig. 8

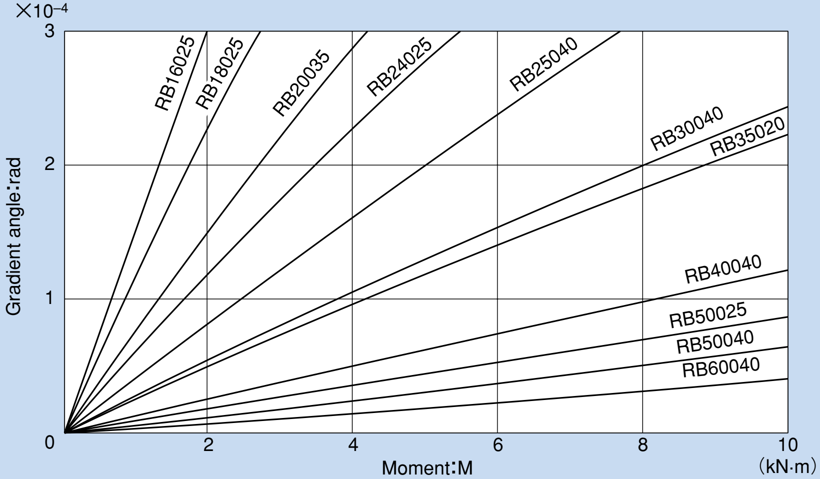

×10⁻⁴
3
2
1
0
Gradient angle:rad
RB16025
RB18025
RB20035
RB24025
RB25040
RB30040
RB35020
RB40040
RB50025
RB50040
RB60040
2
4
6
8
10
(kN·m)
Moment:M

Fig. 9

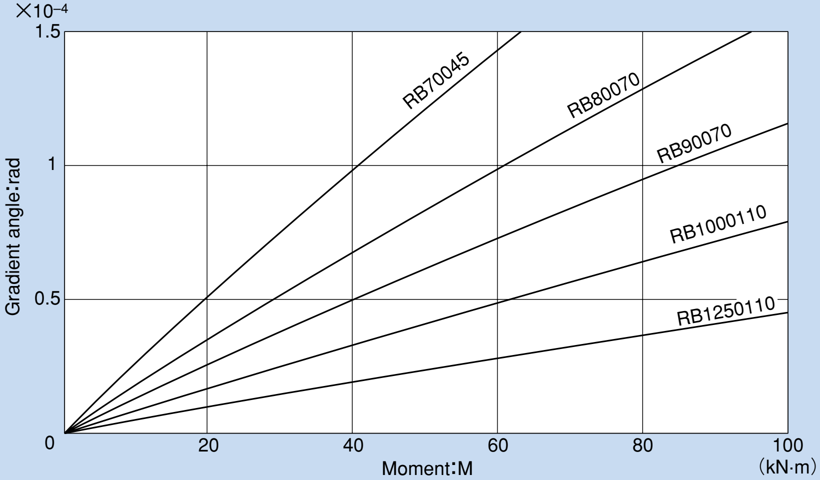

×10⁻⁴
1.5
1
0.5
0
Gradient angle:rad
RB70045
RB80070
RB90070
RB1000110
RB1250110
20
40
60
80
100
(kN·m)
Moment:M

Fig. 10

1.11. Fitting

Fitting of Models RB, RE and RA

For the fitting of models RB, RE and RA, we recommend using the combinations indicated in table 13.

Table 13 Fitting of Models RB, RE and RA

Radial clearance	Service conditions		Shaft	Housing
C0	Inner ring rotational load	Normal load	h5	H7
		Large impact and moment	h5	H7
	Outer ring rotational load	Normal load	g5	Js7
		Large impact and moment	g5	Js7
C1	Inner ring rotational load	Normal load	j5	H7
		Large impact and moment	k5	Js7
	Outer ring rotational load	Normal load	g6	Js7
		Large impact and moment	h5	K7

Note: For the fitting for clearance CC0, avoid interference because it will cause an excessive preload. As for the fitting when you have selected clearance CC0 for the joints or swiveling unit of a robot, the combination of g5 and H7 is recommended.

Fitting for Model RA-C

For the fitting of model RA-C, we recommend using the combinations indicated in table 14.

Table 14 Fitting for Model RA-C

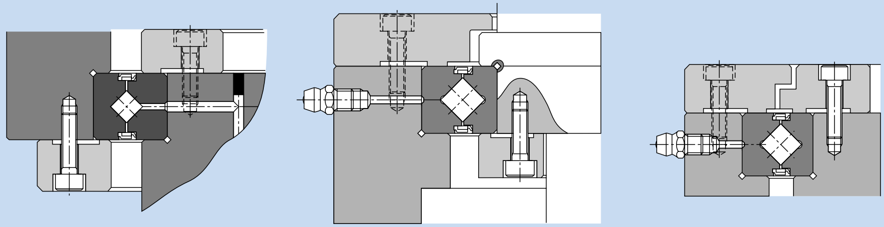
Radial clearance	Service conditions	Shaft	Housing
CC0	Inner ring rotational load	h5	J7
	Outer ring rotational load	g5	Js7
C0	Inner ring rotational load	j5	J7
	Outer ring rotational load	g5	K7

1.12. Designing the Housing and the Presser Flange

Since the Cross-Roller Ring is a compact, thin device, special consideration must be given to the rigidity of the housing and the presser flange.

With types having a separable outer ring, insufficiency in the strength of the housing, the flange or the presser bolt will result in the inability to evenly hold the inner or outer ring, or the deformation of the bearing when a moment load is applied. Consequently, the contact area of the rollers will become uneven, causing the bearing's performance to significantly be deteriorated.

Fig. 11 shows examples of installing the Cross-Roller Ring.



a. Outer ring rotating in the swiveling unit: A heavy body part is mounted after the inner and outer rings are secured.

b. Inner ring rotating in the swiveling unit (with seals attached)

c. Inner and outer rings secured in the same direction in the swiveling unit (with seals attached)

Fig. 11 Examples of Installation

Housing

When determining the thickness of the housing, be sure it must be at least 60% of the sectional height of the bearing as a guide.

$$\text{Housing thickness } T=\frac{D-d}{2}\times 0.6 \text{ or greater}$$

(D: outer diameter of the outer ring;
d: inner diameter of the inner ring)

If tapped holes for removing the inner or outer ring (Fig. 12) are provided, the ring can be removed without causing damage to the bearing. When removing the outer ring, do not press the inner ring, or vise versa. For the dimensions of the presser on the side(s), see the shoulder dimensions indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.

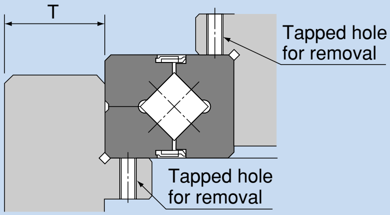
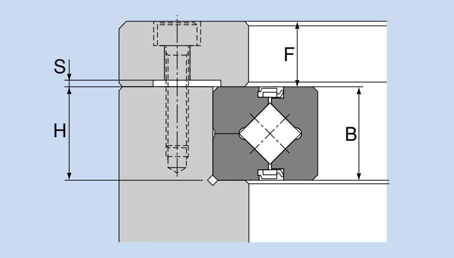


Fig. 12

Presser Flange and Presser Bolt

When determining the thickness of the presser flange (F) or the clearance of the flange section (S), refer to the dimensions indicated below as a guide. As for the number of the presser bolts, the greater the number of the bolts, the more stable the system becomes. As a guide, however, it is normally appropriate to use 12 bolts and equidistantly arrange them.



$F = B \times 0.5$ to $B \times 1.2$
$H = B^{\ 0}_{-0.1}$
$S = 0.5$ mm

Even if the shaft and the housing are made of light alloy, it is recommendable to select a steel-based material for the presser flange.

When tightening the presser bolts, firmly secure them using a torque wrench or the like so that they will not loosen.

Table 16 shows tightening torques for the housing and presser flanges made of typical steel materials with medium hardness.

Table 15 Number of Presser Bolts and Bolt Sizes
Unit: mm

Outer diameter of the outer ring (D)		No. of bolts	Bolt size (reference value)
Above	Or less		
—	100	8 or more	M3 to M5
100	200	12 or more	M4 to M8
200	500	16 or more	M5 to M12
500	—	24 or more	M12 or thicker

Table 16 Bolt Tightening Torque
Unit: mm

Nominal size of screw	Tightening torque	Nominal size of screw	Tightening torque
M3	2	M10	70
M4	4	M12	120
M5	9	M16	200
M6	14	M20	390
M8	30	M22	530

2. Precautions on Using the Cross-Roller Ring

Handling

(1) The separable inner or outer ring is fastened in place using special rivets, bolts or nuts when delivered. When installing it to the system, do not disassemble it. Also, erroneously installing the spacer retainer will significantly affect the rotational performance of the system. Do not disassemble the bearing.

(2) The matching mark of the inner or outer ring may be slightly misaligned when delivered. In that case, loosen the bolts that secure the inner or outer ring, and correct the alignment using a plastic hammer or the like, before installing it to the housing (let the securing rivets follow the housing).

(3) When installing or removing the Cross-Roller Ring, do not apply force to the securing rivets or the bolts.

(4) When mounting the presser flange, take into account the dimensional tolerances of the parts so that the flange firmly holds the inner and outer ring from the side.

(5) Dropping or hitting the Cross-Roller Ring may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

Lubrication

(1) Since each Cross-Roller Ring unit contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease. However, the product requires regular lubrication since it has a smaller internal space than ordinary roller bearings and because the rollers need frequent lubrication due to their rolling contact structure.

To replenish grease, it is necessary to secure greasing holes that lead to the oil grooves formed on the inner and outer rings. As for the lubrication interval, normally replenish grease of the same group so that it is distributed throughout the interior of the bearing at least every six to twelve months.

When the bearing is filled up with grease, the initial rotation torque temporarily increases. However, surplus grease will run off of the seals and the torque will return to the normal level in a short period.

The thin type does not have an oil groove. Secure an oil groove inside the housing for lubrication.

(2) Do not mix lubricants of different physical properties.

(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(2) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(3) If planning to use the Cross-Roller Ring in an environment where a coolant penetrates into the product, contact THK .

(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product with clean white kerosene.

(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

1. Features of the Cam Follower

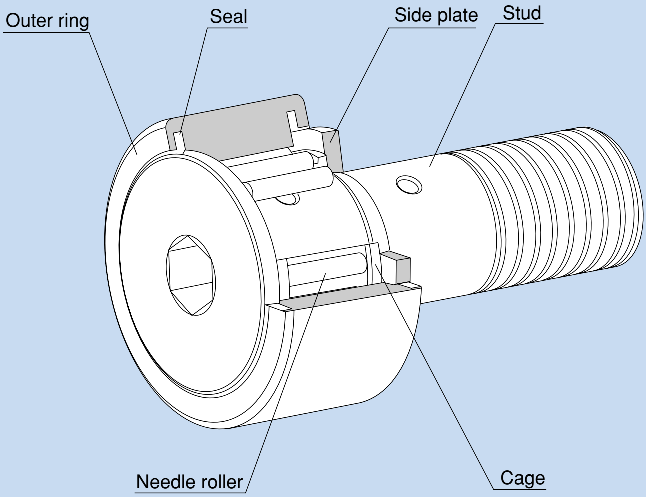


Fig. 1 Structure of Cam Follower Model CF···UU-A

1.1. Structure and Features of the Cam Follower

The Cam Follower is a compact and highly rigid bearing with a shaft. It contains needle bearings and is used as a guide roller for cam mechanisms or linear motion.

Since its outer ring rotates while keeping direct contact with the mating surface, this product is thick-walled and designed to bear an impact load.

Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.

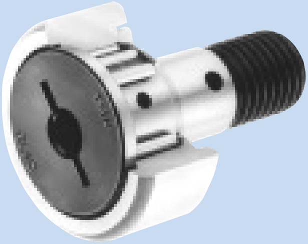
There are two types of the outer ring in shape: spherical and cylindrical. The spherical outer ring easily absorbs a distortion of the shaft center when the cam follower is installed and helps lighten a biased load.

The Cam Follower is used in a wide range of applications such as cam mechanisms of automatic machines, dedicated machines as well as carrier systems, conveyors, bookbinding machines, tool changers of machining centers, pallet changers, automatic coating machines, sliding forks of automatic warehouses.

1.2. Types and Features of the Cam Follower

●Popular Type Cam Follower Model CF

It is a popular type of Cam Follower provided with a driver groove on the head of the stud.
A highly corrosion resistant stainless steel type (symbol M) is also available.


Model CF

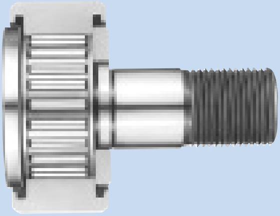
●Cam Follower with a Hexagon Socket Model CF-A

Since the stud head has a hexagon socket, this model can easily be installed using a hexagon wrench.
A type whose stud screw has a hexagon socket (CF-B) is also available (applicable to stud diameter of 12 or greater).


Model CF-A

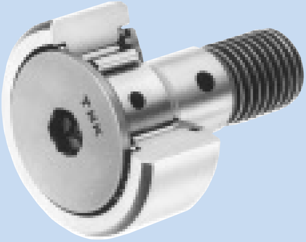
●Eccentric Cam Follower with a Hexagon Socket Model CFH-A

This model can be installed in the same mounting hole as that of model CF. Since the mounting shaft of the stud and the stud head are eccentric by 0.25 mm to 1.0 mm, the position of this model can easily be adjusted simply by turning the stud. Thus, it is a compact, highly accurate eccentric cam follower with an integral structure. As a result, the man-hours for machining and assembly can significantly be reduced because it is unnecessary to align the cam follower with the cam groove and machine the mounting-hole area with precision.


Model CFH-A

●Cam Follower Containing Thrust Balls Model CFN

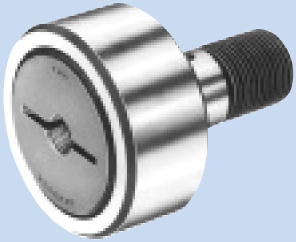
Based on the popular type Cam Follower, this model is incorporated with thrust load balls.
Model CFN is capable of receiving an axial load generated due to a mounting error.


Model CFN

●Cam Follower with a Tapped Hole for Greasing Model CFT

Basically the same as the popular type Cam Follower, this model is provided with tapped holes for piping on the stud head and the thread.

It is optimal for locations where an integrated piping for greasing is required.

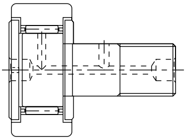
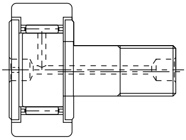
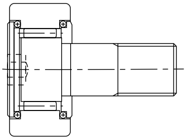


Model CFT

1.3. Types and Model Numbers of the Cam Follower

The Cam Follower is divided into several types as indicated in table 1.

Table 1 Types and Model Numbers of Cam Followers

Type		Popular type	Eccentric Cam Follower	Containing thrust balls
Shape				
Cylindrical outer ring	Stud with a hexagon socket	CF-A (CF…UU-A)	CFH-A (CFH…UU-A)	———
	Stud with a driver groove	CF (CF…UU)	CFH (CFH…UU)	———
	With a tapped hole for greasing	CFT (CFT…UU)	CFHT (CFHT…UU)	———
	Made of stainless steel	CF-M (CF…MUU)	CFH-M (CFH…MUU)	———
Spherical outer ring	Stud with a hexagon socket	CF-R-A (CF…UUR-A)	CFH-R-A (CFH…UUR-A)	CFN-R-A
	Stud with a driver groove	CF-R (CF…UUR)	CFH-R (CFH…UUR)	———
	With a tapped hole for greasing	CFT-R (CFT…UUR)	CFHT-R (CFHT…UUR)	———
	Made of stainless steel	CF-MR (CF…MUUR)	CFH-MR (CFH …MUUR)	———

Note 1: The symbols in the parentheses indicate model numbers of types with seals.
Note 2: THK also manufactures low-speed full-roller types with long service lives. For these full-roller types, symbol "V" is indicated.
Note 3: Symbol M indicates a stainless steel type.

Example : **CF 12 V UUR**

V — Full-roller type

1.4. Rated Life

Static Safety Factor

The basic static load rating C_0 refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the roller and the permanent deformation of the raceway accounts for 0.0001 times of the roller's diameter in the contact area where the maximum stress is applied (if the deformation exceeds this level, it will affect the rotation). This value is indicated as "C_0" in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately. When a load is statically or dynamically applied, it is necessary to consider the static safety factor as shown below.

$$\frac{C_0}{P_0} = f_S$$

where

f_S : Static safety factor in relation to C_0 (see table 2)
C_0 : Basic static load rating (kN)
P_0 : Radial load (kN)

The permissible load (F_0) indicates the permissible value of the applied load determined by the strength of the stud section of the Cam Follower. Therefore, it is necessary to consider the static safety factor f_M against F_0 as well as f_S.

$$\frac{F_0}{P_0} = f_M$$

where

f_M : Static safety factor in relation to F_0 (see table 2)
F_0 : Permissible load (kN)
P_0 : Radial load (kN)

Table 2 Static Safety Factor (f_S, f_M)

Load conditions	Lower limit of f_S and f_M
Normal load	1 to 2
Impact load	2 to 3

Rated Life

The service life of the Cam Follower is obtained from the following equation.

$$L = \left(\frac{f_T \cdot C}{f_W \cdot P_C}\right)^{\frac{10}{3}} \times 10^6$$

where

L : Rated life

(The total number of revolutions that 90% of a group of identical Cam Follower units independently operating under the same conditions can achieve without showing flaking from rolling fatigue)

C	: Basic dynamic load rating*	(kN)
P_c	: Radial load	(kN)
f_T	: Temperature factor	(see Fig. 2)
f_W	: Load factor	(see table 3)

* Note: The basic dynamic load rating (C) of the Cam Follower shows the load with constant direction and magnitude, under which the rated life (L) is 1 million revolutions when a group of identical Cam Follower units independently operate. The basic dynamic load rating (C) is indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.

Calculating the Service Life Time

When the rated life (L) has been obtained, the service life time (L_h) is obtained from the following equation.

●For Linear Motion

$$L_h = \frac{D \cdot \pi \cdot L}{2 \times \ell_S \cdot n_1 \times 60}$$

where

L_h	: Service life time	(h)
L	: Rated life	
D	: Bearing outer diameter	(mm)
ℓ_S	: Stroke length	(mm)
n_1	: Reciprocations per minute	(min^{-1})

●For Rotary Motion

$$L_h = \frac{D \cdot L \times 10^6}{D_1 \cdot n \times 60}$$

where

D_1	: Outer ring contact average diameter of the cam	(mm)
n	: Rotation speed per minute of the cam	(min^{-1})

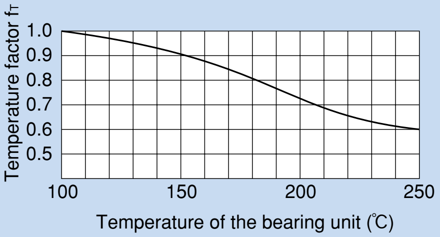


Fig. 2 Temperature Factor (f_T)

Note: The normal service temperature is 80℃ or below. If the product is to be used at a higher temperature, contact THK.

Table 3 Load Factor (f_W)

Service condition	f_W
Smooth motion without impact	1 to 1.2
Normal motion	1.2 to 1.5
Motion with severe impact	1.5 to 3

1.5. Accuracy Standards

Cam Followers are manufactured with accuracies according to table 4.

① Dimensional tolerance of the cylindrical outer ring in outer diameter D : table 4

② Dimensional tolerance of the spherical outer ring in outer diameter D : $^{0}_{-0.05}$

③ Dimensional tolerance of the Cam Follower in stud diameter d : h7

④ Dimensional tolerance of the outer ring in width B : $^{0}_{-0.12}$

Table 4 Accuracy of the Outer Ring (JIS Class 0)

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of the bearing in outer diameter (Dm) (note)		Tolerance of the outer ring in radial run-out (max)
Above	Or less	Upper	Lower	
6	18	0	− 8	15
18	30	0	− 9	15
30	50	0	−11	20
50	80	0	−13	25
80	120	0	−15	35

Note: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

1.6. Track Load Capacity

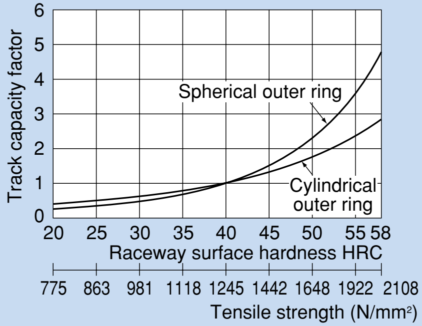


Fig. 3 Track Capacity Factor

The track load capacity means the permissible load at which the outer ring of a bearing and the mating surface are capable of withstanding repeated use over a long period. The track load capacity provided in the dimensional table in the "THK General Catalog - Product Specifications," provided separately, indicates the value when using a steel material with tensile strength of 1.24 kN/mm^2 as the mating material. Therefore, it is possible to increase the track load capacity by increasing the hardness of the material. Fig. 3 shows the hardness of the mating material and the track capacity factor in relation to tensile strength. To obtain the track load capacity of each mating material, multiply the track load capacity shown in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately, by the respective track load factor.

Note: For the mating material, we recommend using those materials with the raceway hardness of 20 HRC or higher and the tensile strength of 775 N/mm^3 or higher.

[Example of calculating a track load capacity]

Obtain the track load capacity when heat-treating the mating material, which a bearing whose outer ring has a track load capacity of 5.29 kN contacts, to hardness of 50 HRC. The track capacity factor when the hardness is 50 HRC is 2.32, as indicated in Fig. 3. Therefore, the desired track load capacity is calculated as follows.

The track load capacity=5.29kN×2.32=12.3kN

1.7. Radial Clearance

The radial clearances of Cam Followers meet clearance C2 (see table 5).
(Normal clearance applies to full-roller types.)

Table 5 Radial Clearance

Unit: μm

Model No.: CF, CFN, CFH and CFT	Clearance C2	
	Min.	Max.
3 to 4	3	17
5 to 8	5	20
10 to 12 - 1	5	25
16 to 20 - 1	10	30
24 to 30 - 2	10	40

1.8. Fitting

For the dimensional tolerance of the Cam Follower in stud-mounting hole, we recommend the following fitting.
The dimensional tolerance of the stud-mounting hole: H7

1.9. Dust Prevention and Lubrication

The Cam Follower models include seal types (model numbers: "…UU"), which are incorporated with special synthetic rubber seals that are highly resistant to wear in order to prevent foreign matter from entering the interior of the cam follower and the lubricant from leaking.

Since each Cam Follower unit with seals contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease.

If your Cam Follower does not have seals, fill grease from the greasing hole on the stud or the inner ring. However, some of the model numbers with stud diameters of 10 mm or less do not have a greasing hole and are provided with initial lubrication only, and therefore do not allow replenishment of grease.

The appropriate fill quantity is a half to one third of the space inside the bearing. The lubrication interval varies depending on the operating conditions. As a guide, however, replenish grease of the same group every six months to two years for types with a cage, or every one to 6 months for full-roller types.

Even with types equipped with seals ("…UU"), surplus grease may seep during the initial operation period or immediately after grease replenishment. If desiring to avoid contamination of the surrounding area of the machine by grease, first perform seasoning or the like in advance, and then wipe the seeping surplus grease.

1. Features of the Roller Follower

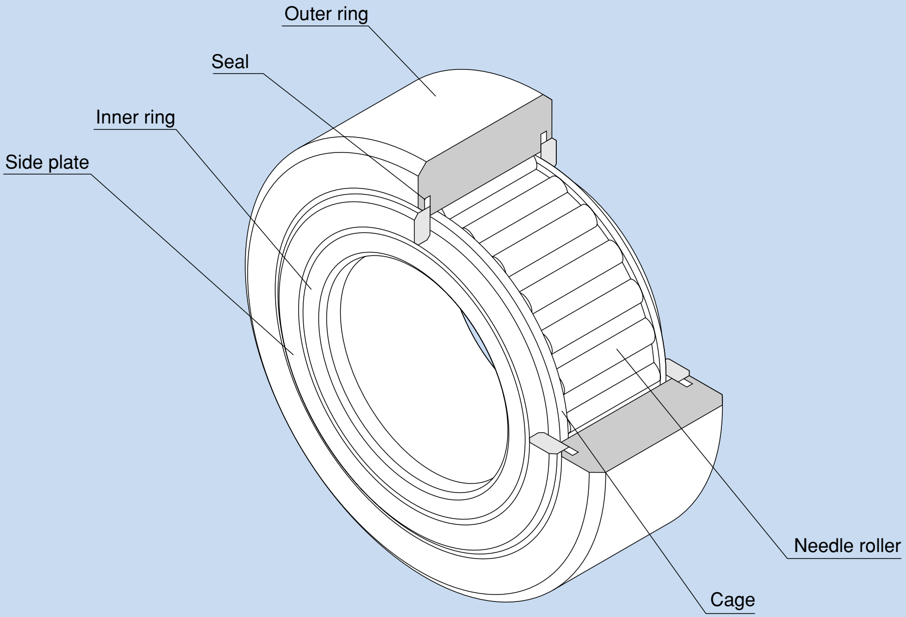


Fig. 1 Structure of Roller Follower Model NAST-ZZUU

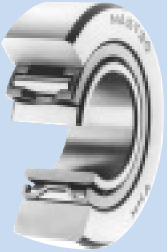
1.1. Structure and Features of the Roller Follower

The Roller Follower is a compact and highly rigid bearing system. It contains needle bearings and is used as a guide roller for cam discs and linear motion.
Since its outer ring rotates while keeping direct contact with the mating surface, this product is thick-walled and designed to bear an impact load.
Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.
Roller Followers are divided into two types: separable type whose inner ring can be separated, and non-separable type whose inner ring cannot be separated.
There are two types of the outer ring in shape: spherical and cylindrical. The spherical outer ring easily absorbs a distortion of the shaft center when the cam follower is installed and helps lighten a biased load.
The Roller Follower is used in a wide range of applications such as cam mechanisms of automatic machines, dedicated machines as well as carrier systems, conveyors, bookbinding machines, tool changers of machining centers, pallet changers, automatic coating machines, sliding forks of automatic warehouses.

1.2. Types and Features of the Roller Follower

●Model NAST (Separable Type)

Model NAST is a separable type of bearing system that combines a thick-wall outer ring, an inner ring and needle rollers equipped with a precision cage.

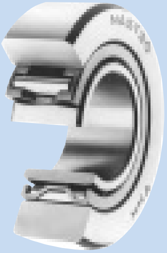


Model NAST

●Model NAST-R (Separable Type)

This model is a spherical outer ring type of model NAST.

It easily corrects a distortion of the shaft center when the roller follower is installed and helps lighten a biased load.



Model NAST-R

●Model NAST-ZZ (Separable Type)

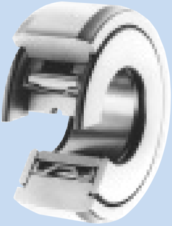
This separable type of bearing system has a labyrinth seal consisting of a pair of side plates formed on both sides of the inner ring of model NAST.

Model NAST-ZZ

●Model NAST- ZZR (Separable Type)

This model is a spherical outer ring type of model NAST-ZZ.

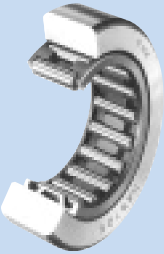
It easily corrects a distortion of the shaft center when the roller follower is installed.



Model NAST-ZZR

●Model RNAST (Separable Type)

This model is basically the same as model NAST, but does not have an inner ring.

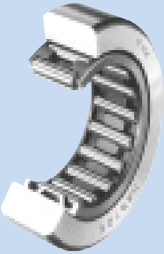


Model RNAST

●Model RNAST-R (Separable Type)

This model is basically the same as model NAST-R, but does not have an inner ring.

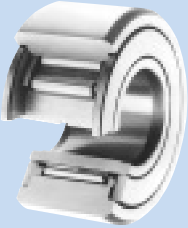
It easily corrects a distortion of the shaft center when the roller follower is installed.



Model RNAST-R

●Model NART-R (Non-separable Type)

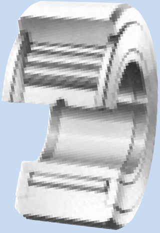
This model is a non-separable type of bearing system whose inner ring is fixed to the side plates. Since the circumference of the outer ring is spherically ground, it helps lighten a biased load.



Model NART-R

●Model NART-VR (Non-separable Type)

Based on model NART-R, this model is a full-roller bearing suitable for locations where a heavy load is applied in low speed operation.

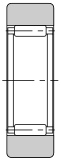
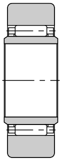
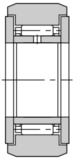
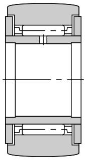


Model NART-VR

1.3. Types and Model Numbers of the Roller Follower

The Roller Follower is divided into several types as indicated in table 1.

Table 1 Types of Roller Follower

Classification		Separable type			Non-separable type
Main model No.		RNAST	NAST	NAST-ZZ	NART
Shape					
Cylindrical outer ring	Without seal	RNAST RNAST-M	NAST NAST-M	NAST-ZZ NAST-ZZM	—
	With seal	—	—	NAST-ZZUU NAST-ZZMUU	—
Spherical outer ring	Without seal	RNAST-R RNAST-MR	NAST-R NAST-MR	NAST-ZZR NAST-ZZMR	NART-R NART-MR
	With seal	—	—	NAST-ZZUUR NAST-ZZMUUR	NART-UUR NART-MUUR
Full rollers	Without seal	—	—	—	NART-VR NART-VMR
	With seal	—	—	—	NART-VUUR NART-VMUUR

Note: Symbol M indicates stainless steel type.

1.4. Rated Life

Static Safety Factor

The basic static load rating C_0 refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the roller and the permanent deformation of the raceway accounts for 0.0001 times of the roller's diameter in the contact area where the maximum stress is applied (if the deformation exceeds this level, it will affect the rotation). This value is indicated as "C_0" in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately. When a load is statically or dynamically applied, it is necessary to consider the static safety factor as shown below.

$$\frac{C_0}{P_0} = f_S$$

where

f_S : Static safety factor (see table 2)

C_0 : Basic static load rating (kN)

P_0 : Radial load (kN)

Table 2 Static Safety Factor (f_S)

Load conditions	Lower limit of f_S
Normal load	1 to 3
Impact load	3 to 5

Rated Life

The service life of the Roller Follower is obtained from the following equation.

$$L = \left(\frac{f_T \cdot C}{f_W \cdot P_C}\right)^{\frac{10}{3}} \times 10^6$$

where

L : Rated life

(The total number of revolutions that 90% of a group of identical Roller Follower units independently operating under the same conditions can achieve without showing flaking from rolling fatigue)

C : Basic dynamic load rating* (kN)

P_C : Dynamic equivalent radial load (kN)

f_T : Temperature factor (see Fig. 2 on page Q-8)

f_W : Load factor (see table 3 on page Q-8)

* Note: The basic dynamic load rating (C) of the Roller Follower shows the load with constant direction and magnitude, under which the rated life (L) is 1 million revolutions when a group of identical Roller Follower units independently operate. The basic dynamic load rating (C) is indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately.

Calculating the Service Life Time

When the rated life (L) has been obtained, the service life time (L_h) is obtained from the following equation.

●For Linear Motion

$$L_h = \frac{D \cdot \pi \cdot L}{2 \times \ell_s \cdot n_1 \times 60}$$

where

L_h : Service life time (h)
L : Rated life
D : Bearing outer diameter (mm)
ℓ_s : Stroke length (mm)
n_1 : Reciprocations per minute (min^{-1})

●For Rotary Motion

$$L_h = \frac{D \cdot L}{D_1 \cdot n \times 60}$$

where

D_1 : Outer ring contact average diameter of the cam (mm)
n : Rotation speed per minute of the cam (min^{-1})

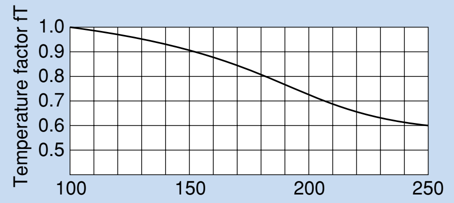


Fig. 2 Temperature Factor (f_T)

Note: The normal service temperature is 80℃ or below. If the product is to be used at a higher temperature, contact THK.

Table 3 Load Factor (f_W)

Service condition	f_W
Smooth motion without impact	1 to 1.2
Normal motion	1.2 to 1.5
Motion with severe impact	1.5 to 3

1.5. Accuracy Standards

Roller Followers are manufactured with accuracies in accordance with the following.

① Dimensional tolerance of the spherical outer ring in outer ring D : $^{0}_{-0.05}$
② Dimensional tolerance of model RNAST in inscribed circle diameter : F6
③ Dimensional tolerance of model NART in bearing width B1 : h12
④ Accuracy of the inner ring and accuracy of the outer ring in width : table 4
⑤ Accuracy of the outer ring : table 5

Table 4 Accuracy of the Inner Ring and Accuracy of the Outer Ring in Width (JIS Class 0)

Unit: μm

Nominal dimension of the bearing inner diameter (di) (mm)		Tolerance of the bearing in inner diameter (dm) (note)		Tolerance of the inner ring (or outer ring) in width		Tolerance of the inner ring in radial run-out (max)
Above	Or less	Upper	Lower	Upper	Lower	
2.5	10	0	− 8	0	−120	10
10	18	0	− 8	0	−120	10
18	30	0	−10	0	−120	13
30	50	0	−12	0	−120	15

Note: "dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner diameter at two points.

Table 5 Accuracy of the Outer Ring (JIS Class 0)

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of the bearing in outer diameter (Dm) (note)		Tolerance of the outer ring in radial run-out (max)
Above	Or less	Upper	Lower	
6	18	0	− 9	15
18	30	0	− 9	15
30	50	0	−11	20
50	80	0	−13	25
80	120	0	−15	35

Note: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

1.6. Track Load Capacity

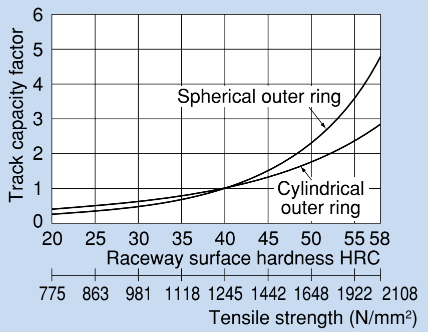


Fig. 3 Track Capacity Factor

The track load capacity means the permissible load at which the outer ring of a Roller Follower and the mating surface are capable of withstanding repeated use over a long period. The track load capacity provided in the dimensional table in the "THK General Catalog - Product Specifications," provided separately, indicates the value when using a steel material with tensile strength of 1.24 kN/mm² as the mating material. Therefore, it is possible to increase the track load capacity by increasing the hardness of the material. Fig. 3 shows the hardness of the mating material and the track capacity factor in relation to tensile strength. To obtain the track load capacity of each mating material, multiply the track load capacity shown in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately, by the respective track load factor.

Note: For the mating material, we recommend using those materials with the raceway hardness of 20 HRC or higher and the tensile strength of 775 N/mm3 or higher.

[Example of calculating a track load capacity]

Obtain the track load capacity when heat-treating the mating material, which a bearing whose outer ring has a track load capacity of 5.29 kN contacts, to hardness of 50 HRC. The track capacity factor when the hardness is 50 HRC is 2.32, as indicated in Fig. 3. Therefore, the desired track load capacity is calculated as follows.

The track capacity=5.29kN×2.32=12.3kN

1.7. Radial Clearance

The radial clearances of Roller Followers meet the clearance indicated in table 6 (normal clearance applies to full-roller types).

Table 6 Radial Clearance

Unit: μm

Nominal dimension of the bearing's inscribed circle diameter (dr) (mm)		Radial Clearance	
Above	Or less	Min.	Max.
6	10	5	20
10	18	5	25
18	30	10	30
30	50	10	40
50	80	15	50

1.8. Fitting

For the fitting of the Roller Follower with the shaft, we recommend the combinations indicated in table 7.

Table 7 Fitting with the Shaft

Without inner ring	With inner ring
k5, k6	G6, h6

1.9. Dust Prevention and Lubrication

The Roller Follower models include seal types (model numbers: "…UU"), which are incorporated with special synthetic rubber seals that are highly resistant to wear in order to prevent foreign matter from entering the interior of the roller follower and the lubricant from leaking.

Some models are not filled with grease when assembled. When using a model not filled with grease, apply and fill grease to the interior first (lithium-based grease with consistency of No. 2).

Model No.		Grease
NAST(R) RNAST(R)	No seal setting	Not filled with grease
NAST-ZZ(R)	Without seal	Filled with grease
NART-(V)R	With seal	

The lubrication interval varies depending on the operating conditions. As a guide, however, replenish grease of the same group every six months to two years for types with a cage, or every one to 6 months for full-roller types.

Even with types equipped with seals ("…UU"), surplus grease may seep during the initial operation period or immediately after resumption of grease replenishment. If desiring to avoid contamination of the surrounding area of the machine by grease, first perform seasoning or the like in advance, and then wipe the seeping surplus grease.

1.10. Installation

The structure of the Roller Follower is designed to receive a radial load. If it receives a thrust load, the side plates or the outer ring may be damaged.

It is necessary to minimize a component of thrust force, or prevent it from occurring, when designing the system and installing the Roller Follower.

If an external force is applied to either of the side plates of model NART, it may cause abnormal rotation. Use much care in installing the Roller Follower.

1. Features of the Spherical Bearing

1.1. Structure and Features of the Spherical Bearing

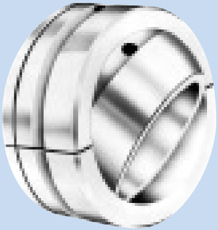
Spherical Bearings models SB and SA1 are self-aligning plain bearings designed for heavy loads. The inner and outer rings of these models use high-carbon chromium bearing steel that is hardened, ground, phosphate-coated and seized with molybdenum disulfide (MoS_2).

The Spherical Bearing is capable of receiving a large radial load and thrust loads in both directions. Furthermore, because of its high resistance to impact loads, the Spherical Bearing is optimal for low-speed, heavy-load rocking components such as the cylinder clevises or hinges of construction and civil-engineering machinery, the suspensions of trucks and the bolster anchors of electric cars.

1.2. Types and Features of the Spherical Bearing

●Model SB

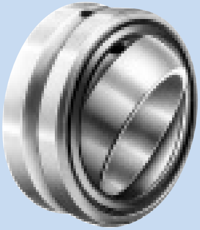
The most popular type of spherical bearing in Japan, model SB has wide spherical contact areas and is used as a bearing for heavy loads. The outer ring is split at two points, enabling the inner ring to be accommodated.



Model SB

●Model SA1

This type of spherical bearing is widely used in Europe. The outer ring is split at one point (outer rings with diameter of φ100 or thicker are split at two points), and the width and thickness are smaller than model SB. Thus, this model can be used in small spaces. Types attached with highly dust-preventive dust seals on both ends (model SA1···UU) are also available.



Model SA1

1.3. Selecting a Spherical Bearing

When selecting a Spherical Bearing, follow the instructions below while referring to the basic dynamic load rating (C) and the basic static load rating (C_0) indicated in the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately, as a measuring stick.

Spherical Bearing Service Life G

The basic dynamic load rating (C) is used to calculate the service life when the bearing rocks under a load.

The basic dynamic load rating is calculated based on the contact surface pressure of the spherical sliding section.

The bearing service life G is expressed in the total number of rocking motions until it becomes impossible for the bearing to perform normal operation due to the increase in the radial clearance or in the temperature of the bearing as a result of wear on the spherical sliding section.

Since the bearing service life is affected by various factors such as the material of the bearing, magnitude and direction of the load, lubrication conditions and sliding speed, the calculated value can be used as an empirical, practical value.

$$G = b_1 \cdot b_2 \cdot b_3 \cdot b_4 \cdot b_5 \frac{3}{Da \cdot \beta} \cdot \frac{C}{P} \times 10^8$$

where

G	: Bearing service life	(total number of rocking motions or total number of revolutions)
C	: Basic dynamic load rating	(N)
P	: Equivalent radial load	(N)
b_1	: Load direction factor	(see table 1)
b_2	: Lubrication factor	(see table 1)
b_3	: Temperature factor	(see table 1)
b_4	: Dimension factor	(see Fig. 1)
b_5	: Material factor	(see Fig. 2)
Da	: Spherical diameter (see the dimensional table in the "THK General Catalog - Product Specifications," provided separately)	(mm)
β	: Rocking radius	(degree) (for rotary motion, β=90°)

Table 1

Model No.		b_1 Load direction		b_2 Regular lubrication		b_3 Temperature ℃		
		Fixed	Alternating	Not provided	Provided	−30 +80	+ 80 +150	+150 +180
Spherical Bearing	Without seal	1	5	0.08	1	1	1	0.7
	With seal	1	5	0.08	1	1	—	—

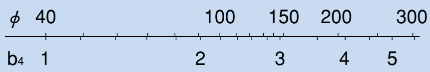


Fig. 1 Dimension Factor

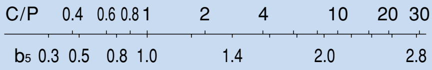


Fig. 2 Material Factor

Equivalent Radial Load

The Spherical Bearing is capable of receiving a radial load and a thrust load simultaneously. If the magnitude and direction of the load applied are constant, the equivalent radial load is obtained from the following equation.

$$P = Fr + YFa$$

where

P	: Equivalent radial load	(N)
Fr	: Radial load	(N)
Fa	: Thrust load	(N)
Y	: Thrust load factor	(see table 2)

Table 2 Thrust Load Factor

Fa/Fr≦	0.1	0.2	0.3	0.4	0.5
Thrust load factor (Y)	0.8	1	1.5	2.5	3

Static Safety Factor f_S

If the Spherical Bearing is to be used under a stationary load or in slight rocking motion, select a model using the basic static load rating (C_0) as a guide. The basic static load rating refers to the stationary load that the bearing can receive without damaging the bearing and without causing permanent deformation that would prevent smooth motion.

In general, set the safety factor at three or greater taking into account the rigidity of the shaft and the housing.

$$f_S = \frac{C_0}{P} \geqq 3$$

where

f_S : Static safety factor

C_0 : Basic static load rating

P : Equivalent radial load

pV Value

The permissible sliding speed at which the Spherical Bearing can be used varies depending on the load, lubrication conditions and cooling status. The recommended pV value for continuous motion under a load applied in a constant direction is calculated as follows.

$$pV \leqq 400\ \text{N/mm}^2 \cdot \text{mm/sec}$$

If the Spherical Bearing performs adiabatic operation or the load direction changes, the heat produced on the sliding surface easily radiates. Therefore, it is possible to set a higher pV value.

The contact surface pressure (p) of the Spherical Bearing is obtained from the following equation.

$$p = \frac{P}{Da \cdot B}$$

where

p : Contact surface pressure (N/mm²)

P : Equivalent radial load (N)

Da : Spherical diameter (see the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately) (mm)

B : Outer ring width (see the corresponding dimensional table in the "THK General Catalog - Product Specifications," provided separately) (mm)

The sliding speed is calculated as follows.

$$V = \frac{\pi \cdot Da \cdot \beta \cdot f}{90 \times 60}$$

where

V : Sliding speed (mm/sec)

β : Rocking half angle (degree)

f : Number of rocking motions per minute (min^{-1})

The Spherical Bearing can be used at sliding speed of up to 100 mm/sec in rocking motion, or up to 300 mm/sec in rotary motion in favorable lubrication status.

[Example of calculating a pV value]

Assuming that model SB25 is used in a location where the shaft rotates 60 turns per minute at an angle of 40° and the maximum varying load of 1,500 N is applied, determine whether the model number is appropriate and calculate the service life under these conditions. Assume that the bearing temperature is +80℃ or less and the product is regularly provided with sufficient lubrication.

Calculate the pV value and examine if the bearing size is appropriate.

The contact surface pressure (p) is calculated as follows.

$$p = \frac{P}{Da \cdot B} = \frac{1500}{36 \times 18} = 2.31\ \text{N/mm}^2 \qquad \left(\begin{array}{ll} B & : \text{outer ring width of model SB25} = 18 \\ \phi & : \text{spherical diameter of model SB25} = 36 \end{array}\right)$$

The sliding speed (V) is obtained from the following equation.

$$V = \frac{\pi \cdot Da \cdot \beta \cdot f}{90 \times 60} = \frac{3.14 \times 36 \times 20 \times 60}{90 \times 60} = 25.12\ \text{mm/sec}$$

The pV value is obtained from the following equation.

$$pV = 58.0\ \text{N/mm}^2 \cdot \text{mm/sec}$$

Since both the pV value and the sliding speed (V) meet the requirements, model SB25 can be used.

Next, calculate the service life of the bearing (G) as follows.

$$G = b_1 \cdot b_2 \cdot b_3 \cdot b_4 \cdot b_5 \frac{3}{Da \cdot \beta} \cdot \frac{C}{P} \times 10^8$$

$$= 5 \times 1 \times 1 \times 1 \times 2.2 \times \frac{3}{36 \times 20} \times \frac{15300}{1500} \times 10^8 = 4.7 \times 10^7\ \text{min}^{-1}$$

1.4. Accuracy Standards

The dimensional tolerances of the Spherical Bearing are defined as indicated in table 3.

Table 3 Accuracy of the Spherical Bearing

Unit: μm

Nominal dimension of the inner diameter (d) and the outer diameter (D) (mm)		Tolerance in inner diameter (dm)		Tolerance in outer diameter (Dm)		Tolerance of the inner or outer ring in width (B_1, B)	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower
10	18	0	− 8	—	—	0	−120
18	30	0	−10	0	− 9	0	−120
30	50	0	−12	0	−11	0	−120
50	80	0	−15	0	−13	0	−150
80	120	0	−20	0	−15	0	−200
120	150	0	−25	0	−18	0	−250
150	180	0	−25	0	−25	0	−250
180	250	0	−30	0	−30	0	−300
250	315	—	—	0	−35	0	−350
315	400	—	—	0	−40	0	−400

Note 1: "dm" and "Dm" represent the arithmetic averages of the maximum and minimum diameters obtained in measuring the inner and outer diameters at two points.

Note 2: The dimensional tolerances of the inner and outer diameters are the values before they are surface-treated.

Note 3: The dimensional tolerance of the outer ring is the value before it is split.

Note 4: Tolerances of the inner and outer diameters in width (B_1, B) are assumed to be equal, and obtained from the nominal dimension of the inner diameter of the inner ring.

1.5. Radial Clearance

Table 4 shows radial clearances of the Spherical Bearing.

Table 4 Radial Clearances of the Spherical Bearing

Unit: μm

Bearing inner diameter (d) (mm)		Radial clearance	
Above	Or less	Min.	Max.
—	17	70	125
17	30	75	140
30	50	85	150
50	65	90	160
65	80	95	170
80	100	100	185
100	120	110	200
120	150	120	215
150	240	130	230

Note 1: The radial clearance indicates the value before the outer ring is split.
Note 2: The axial clearance is approximately twice the radial clearance.

1.6. Fitting

The fitting between the Spherical Bearing and the shaft or the housing is selected according to the service conditions. Table 5 shows recommended values.

Table 5 Recommended Fitting Values

Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	k6	H7
	Indeterminate load	m6	H7
Outer ring rotational load	Normal load	g6	M7
	Indeterminate load	h6	N7

Note 1: If the product is to be installed so that the inner ring rotates and the fitting with the shaft is to be clearance fitting, harden the surface of the shaft in advance.
Note 2: "N7" is recommended for light alloy housings.

Shaft Designing

If the inner ring is to be fit onto the shaft in clearance fitting and the product is to be used under a heavy load, the shaft may slip on the inner circumference of the inner ring. To prevent the slippage, the shaft hardness must be 58 HRC or higher and the surface roughness must be 0.80 a or below.

1.7. Permissible Tilt Angle

The permissible tilt angle of the Spherical Bearing varies according to the shaft shape as indicated in table 6.

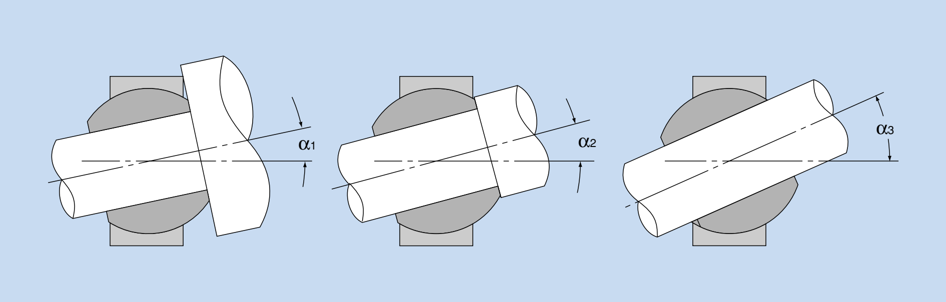


Table 6 Permissible Tilt Angle

Unit: degree

Model No.	Permissible tilt angle		
	α_1	α_2	α_3
SB 12	5	7	18
SB 15	4	6	18
SB 20	3	4	14
SB 22	4	6	16
SB 25	4	5	16
SB 30	4	6	17
SB 35	4	5	14
SB 40	4	6	12
SB 45	4	5	13
SB 50	4	5	16
SB 55	4	6	16
SB 60	4	6	18
SB 65	4	5	16
SB 70	4	5	15
SB 75	4	5	18
SB 80	4	5	18
SB 85	4	6	16
SB 90	4	5	16
SB 95	4	5	17
SB 100	4	5	18
SB 110	4	5	16
SB 115	4	5	14
SB 120	4	6	15
SB 130	4	5	14
SB 150	4	5	12

Unit: degree

Model No.	Permissible tilt angle		
	α_1	α_2 (note)	α_3
SA1 12	8	11(6)	25
SA1 15	6	8(5)	18
SA1 17	7	10(7)	23
SA1 20	6	9(6)	21
SA1 25	6	7(4)	18
SA1 30	4	6(4)	16
SA1 35	5	6(4)	16
SA1 40	5	7(4)	16
SA1 45	6	7(4)	16
SA1 50	5	6(4)	15
SA1 60	5	6(3)	14
SA1 70	5	6(4)	14
SA1 80	4	6(4)	14
SA1 90	4	5(3)	12
SA1 100	5	7(5)	14
SA1 110	5	6(4)	15
SA1 120	4	6(4)	15
SA1 140	5	7(5)	16
SA1 160	6	8(6)	13
SA1 180	5	6(5)	16
SA1 200	6	7(6)	13
SA1 220	6	8(6)	15
SA1 240	6	8(6)	17

Note: The values in the parentheses apply to types attached with a seal.

1.8. Lubrication

The spherical sliding surface of the Spherical Bearing is seized with a solid lubricant film of molybdenum disulfide. This enables the Spherical Bearing to be used over a relatively long period without further lubrication under a static load, in low-speed rocking motion or in intermittent rotary motion. However, it is generally necessary to replenish grease on a regular basis. If a heavy load is applied, consider using lithium soap group grease containing molybdenum disulfide. The inner and outer rings of the spherical bearing have greasing holes as a means to facilitate the flow of the lubricant inside the bearing.

Lubrication Interval

Since the Spherical Bearing is delivered without being applied with a lubricant, it is necessary to replenish an appropriate amount of grease after installing the Spherical Bearing.

We recommend filling grease also to the space surrounding the Spherical Bearing. It is also recommendable to shorten the lubrication interval in the start-up period in order to lighten the initial wear and extend the service life.

The lubrication interval varies according to the magnitude of the load, frequency of the vibrations and other conditions. Provide lubrication while referring to the values in table 7 as a guide.

Table 7 Lubrication Interval

Type of load	Required minimum lubrication interval
Unilateral load	G/ 40
Varying load	G/180

G: Service life of the bearing (total number of rocking motions or total number of revolutions)

1.9. Dust Prevention

Spherical Bearing model SA1 is provided with a seal designed to prevent humidity or other deleterious material from entering the bearing. This seal is effective in increasing the service life of the bearing.

The seal for Spherical Bearing model SA1 is made of oil-resistant synthetic rubber and has double lips as the sealing element. These lips closely contact the spherical inner ring.

The seal can be used within the temperature range between -30℃ and 80℃, and is highly resistant to wear and capable of operating for a long period of time.

If the product is used in an environment where sand or soil matter may enter the bearing, the service life of the seal is shortened. In such cases, we recommend lubricating the product on a regular basis.

1.10. Permissible Service Temperature

The permissible service temperature of the Spherical Bearing is limited between -30℃ and 80℃ depending on the seal material and determined by the permissible service temperature range of the grease used.

1.11. Installation

When installing the Spherical Bearing, pay attention to the mounting orientation so that the slit of the outer ring receives a minimum load. Also note that the Spherical Bearing cannot receive a thrust load alone.

1. Features of the Rod End

1.1. Structure and Features of the Rod End

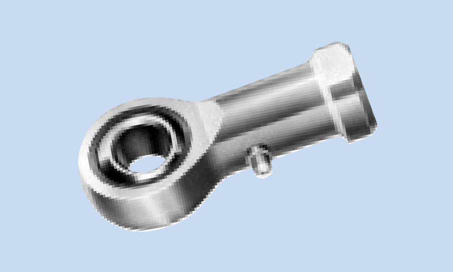
The Rod End is a self-aligning plain bearing that uses a spherical inner ring which has the same level of accuracy and hardness as bearing steel balls and in which only the spherical area is hard chrome plated. With the combination of a spherical inner ring whose sliding surface is mirror-finished and a rationally designed holder, the Rod End ensures play-free, extremely smooth rotary and rocking motion.

1.2. Types and Features of the Rod End

●Type Provided with a Female Thread - Model PHS

With model PHS, a special copper alloy with high conformability is inserted between the color chromate finished steel holder and the spherical inner ring in which only the spherical area is hard chrome plated. This structure ensures high rigidity, high wear resistance and high corrosion resistance.

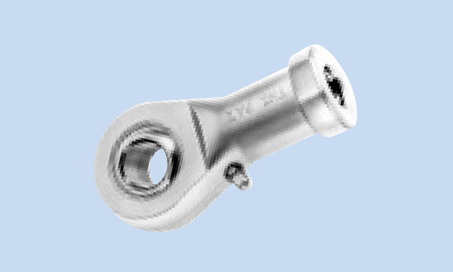
The grease nipple on the holder allows grease to be applied to the sliding surface as necessary.



Model PHS

●Die Cast, Low-price Type - Model RBH

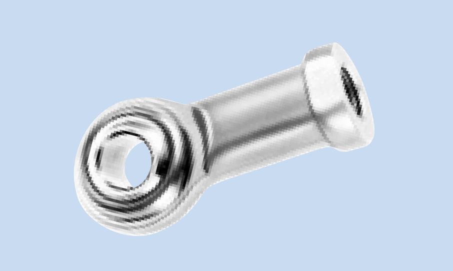
This model is a high-accuracy, low-cost rod end in which the spherical inner ring serves as the core and the holder is formed by die-casting. The holder is made of a high-strength zinc alloy (see page S-6), which is superb in mechanical properties and bearing characteristics.



Model RBH

●Lubrication-free Type - Model NHS-T

This lubrication-free rod end uses self-lubricating synthetic resin formed between the steel holder and the spherical inner ring. Since the clearance on the sliding surface is minimized, an accurate link motion is achieved.



Model NHS-T

●Lubrication-free, Corrosion-resistant Type - Model HS

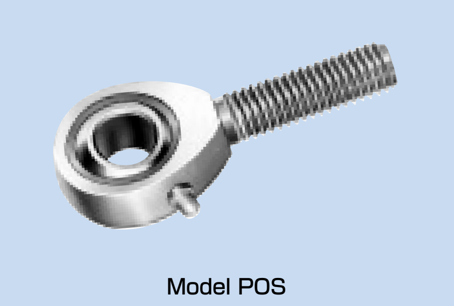
This lubrication-free rod end uses a special fluorocarbon sheet adhering to the holder's spherical area. It is more resistant to corrosion than a stainless steel type.

Since the holder is made of an aluminum alloy, this model is extremely light.

Model HS

●Male-thread Type - Model POS

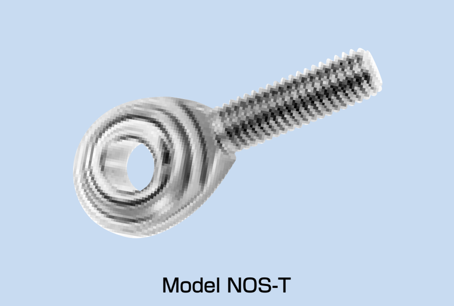
This model is a highly rigid rod end that is basically the same as the female-screw type model PHS, but has a male thread on the holder end.



Model POS

●Lubrication-free, Male-thread Type - Model NOS-T

This model is a lubrication-free rod end that is basically the same as the female-screw type model NHS-T, but has a male thread on the holder end.

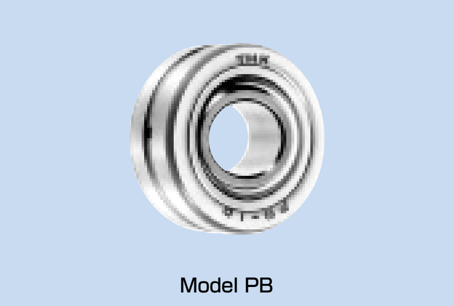


Model NOS-T

●Standard Type - Model PB

With model PB, a special copper alloy with high conformability is inserted between the steel outer ring and the spherical inner ring in which only the spherical area is hard chrome plated. This structure makes this model a high rigid spherical bearing with high corrosion resistance and high wear resistance.

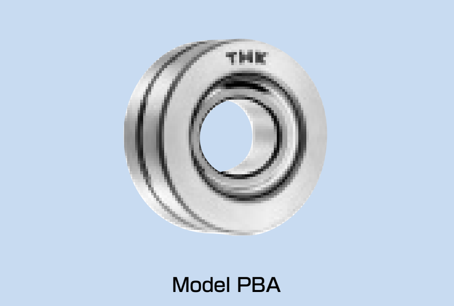
The oil groove and the greasing hole on the outer ring allow grease to be applied to the sliding surface as necessary.



Model PB

●Die Cast Type - Model PBA

This model is a high-accuracy, low-cost spherical bearing in which the spherical inner ring serves as the core and the outer ring is formed by die-casting. The outer ring is made of a high-strength zinc alloy (see page S-6), which is superb in bearing characteristics.



Model PBA

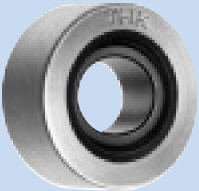
●Lubrication-free Type - Model NB-T

This lubrication-free bearing uses self-lubricating synthetic resin formed between the steel outer ring and the spherical inner ring.

Model NB-T

●Lubrication-free Type - Model HB

This lubrication-free spherical bearing uses a special fluorine sheet adhering to the outer ring's spherical area.



Model HB

1.3. Alloy

High-strength Zinc Alloy

The high-strength zinc alloy, developed as an alloy for bearings, is composed of Aℓ, Cu, Mg, Be and Ti as well as zinc as the base. It is excellent in mechanical properties, seizure resistance and wear resistance.

●Composition

Table 1 Composition of the High-strength Zinc Alloy

Unit: %

Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

●Mechanical Properties

Tensile strength:	275 to 314 N/mm^2
Tensile yield strength (0.2%):	216 to 245 N/mm^2
Compressive strength:	539 to 686 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Fatigue strength:	132 N/mm$^2 \times 10^7$ (Schenk bending test)
Charpy impact strength:	0.098 to 0.49 N•m/mm^2
Elongation:	1 to 5 %
Hardness:	120 to 145 HV

●Physical Properties

Specific gravity:	6.8
Melting point:	390 ℃
Specific heat:	460 J/(kg•k)
Linear expansion ratio:	24×10^{-6}

●Wear Resistance

The wear resistance of the high-strength zinc alloy is superior to that of class-3 brass and class-3 bronze, almost equal to that of class-2 phosphor bronze.

Amsler wear-tester:

Test piece rotation speed:	185 min^{-1}
Load:	392 N
Lubricant:	Dynamo oil

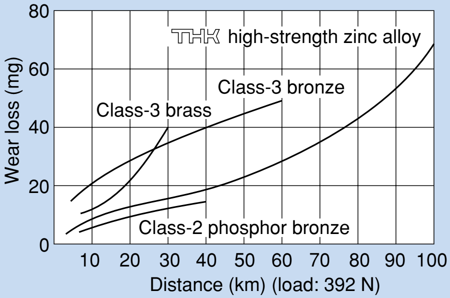


Fig. 1 Wear Resistance of the High-strength Zinc Alloy

1.4. Selecting a Rod End

Permissible Load P

The static load capacity (C_s) indicated in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately, is presented as a guide for the mechanical strength of the Rod End. Select a bearing while taking into account the safety factor (f_s) indicated in table 2 according to the type of the load.

Table 2 Safety Factor (f_s)

Type of load	Lower limit of f_s
Constant load in a constant direction	2 to 3
Varying load in a constant direction	3 to 5
Load in varying directions	5 to 8

According to the type of the load, select a bearing that satisfies the following equation from a mechanical strength's viewpoint.

$$P \leqq \frac{C_s}{f_s} \quad \cdots\cdots\cdots(1)$$

where

P : Permissible load (N)

C_s : Static load capacity (N)

f_s : Safety factor (see table 2)

Dynamic Load Capacity C_d

The dynamic load capacity refers to the upper limit of load that the spherical area can receive without showing seizure while the Rod End is rotating or rocking. The dynamic load capacity is obtained from the following approximation formula using the static load capacity (C_s) (note 1) indicated in the dimensional table in "THK General Catalog - Product Specifications," provided separately.

$$C_d = \frac{C_s}{\sqrt[3]{n}} \quad \cdots\cdots\cdots(2)$$

where

C_d : Dynamic load capacity (N)

C_s : Static load capacity (N)

n : Number of revolutions per minute (min^{-1})

The selected bearing must meet both the permissible load obtained from equation (1) and the dynamic load capacity obtained from equation (2).

Note 1: Static load capacity (C_s) refers to the value obtained by multiplying the projected area on the spherical section by the permissible surface pressure, and is used to obtain the dynamic load capacity.

1.5. Permissible Tilt Angle

The permissible tilt angles α_1, α_2 and α_3 of the Rod End are indicated in table 3.

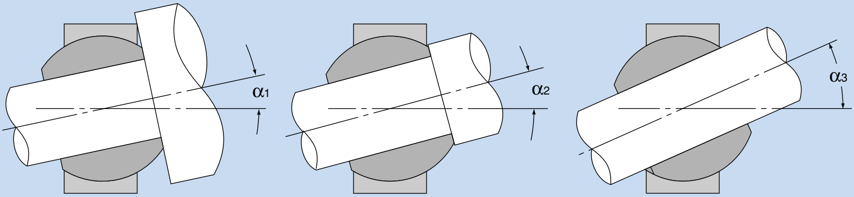


Table 3 Permissible Tilt Angles

Model No.	Permissible tilt angle (degree)		
	α_1	α_2	α_3
NHS 3T, NOS 3T	8	10	42
NHS 4T, NOS 4T	9	11	35
PHS 5, RBH 5, NHS 5T, POS 5, NOS 5T, PB 5, PBA 5	8	13	30
PHS 6, RBH 6, NHS 6T, POS 6, NOS 6T, PB 6, PBA 6	8	13	30
PHS 8, RBH 8, NHS 8T, POS 8, NOS 8T, PB 8, PBA 8	8	14	25
PHS 10, RBH 10, NHS 10T, POS 10, NOS 10T, PB 10, PBA 10	8	14	25
PHS 12, RBH 12, NHS 12T, POS 12, NOS 12T, PB 12, PBA 12	8	13	25
PHS 14, RBH 14, NHS 14T, POS 14, NOS 14T, PB 14, PBA 14, NB 14T	10	16	24
PHS 16, RBH 16, NHS 16T, POS 16, NOS 16T, PB 16, PBA 16, NB 16T	9	15	24
PHS 18, RBH 18, NHS 18T, POS 18, NOS 18T, PB 18, PBA 18, NB 18T	9	15	24
PHS 20, RBH 20, NHS 20T, POS 20, NOS 20T, PB 20, PBA 20, NB 20T	9	15	24
PHS 22, RBH 22, NHS 22T, POS 22, NOS 22T, PB 22, PBA 22, NB 22T	10	15	23
PHS 25, POS 25, PB 25	9	15	23
PHS 30, POS 30, PB 30	10	17	23

1.6. Service Temperature

If any of models RBH, PBA, HS and HB, all of which use the high-strength zinc alloy and an aluminum alloy in the holder and the outer ring, and of models NHS-T, NOS-T and NB-T, which use synthetic-resin bushes, is to be used at temperature of 80℃ or higher, or receives an impact at low temperature, contact THK .

1.7. Installation

Please note that the Rod End is not capable of receiving a thrust load indicated in Fig. 2.

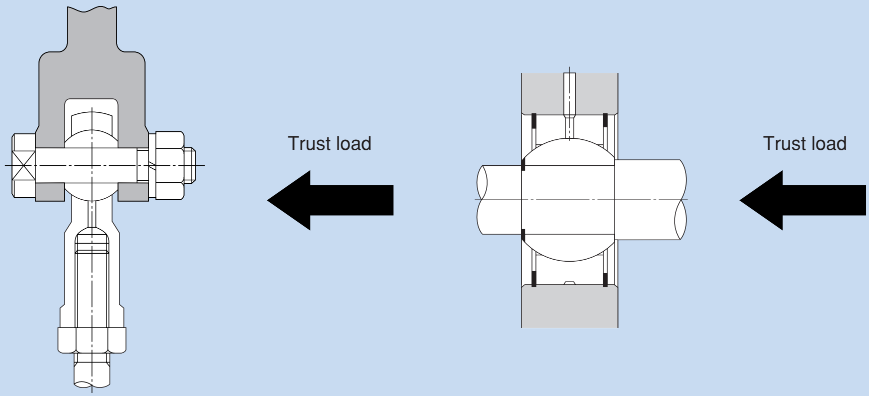


Fig. 2 Examples of Installing the Rod End

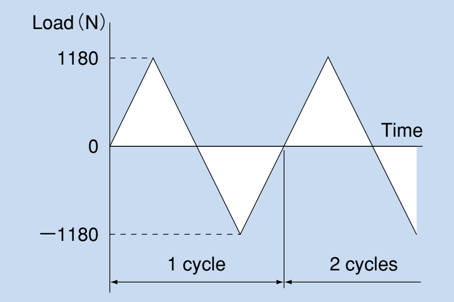
2. Performance Test with the Rod End

This test has been conducted to identify the difference in performance between THK Rod End model HS and an equivalent product by a competitor.

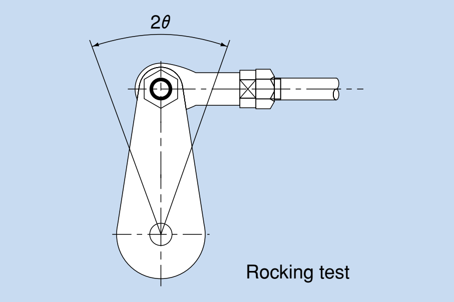
Wear Test Conditions

Subject Rod End	THK model HS8 Stainless steel model equivalent of the above
Type of test	Rocking test
Applied load	±1,180 N in the radial direction
Kinematic angle	Rocking angle: 2 θ=40°(±20°)
Lubrication	No lubrication
Number of cycles per minute	60 opm
Total number of cycles	1 million cycles
Testing equipment	Bench testing machine (normal temperature)

The applied load diagram is shown below.



The kinematic angle is shown below.



Result of the Wear Test

Table 1 Change in the Spherical Clearance

Unit: mm

Abrasion loss after 1-million-cycle test			
Model No.		Rocking test	
		Radial direction	Axial direction
HS 8	Initial stage (at start-up)	0.008	0.01
	1 million cycles	0.035	0.075
	Change	0.027	0.065
Stainless steel model equivalent of the above	Initial stage (at start-up)	0.005	0.005
	40,000 cycles	0.22	0.2
	Change after 40,000 cycles	0.215	0.065
	Note: The holder is elongated and fractured after 76,300 cycles.		

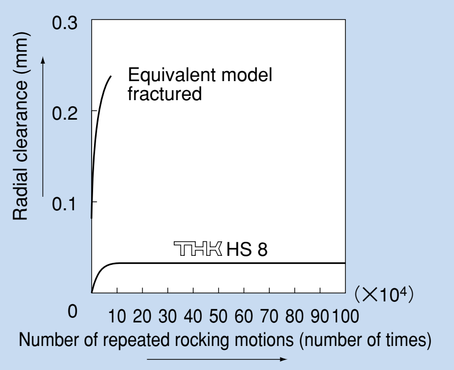


Fig. 1 Wear Diagram

① Although model HS8 withstood the repeated durability test with an applied load of ±1,180 N and the total number of cycles being 1 million, the holder of the stainless steel equivalent model was elongated and fractured after only 76,300 cycles.

② The result shows that the increase in wear of model HS8 in the radial direction since the initial wear (approximately 100,000 cycles) was minimal.

1. Features of the Link Ball®

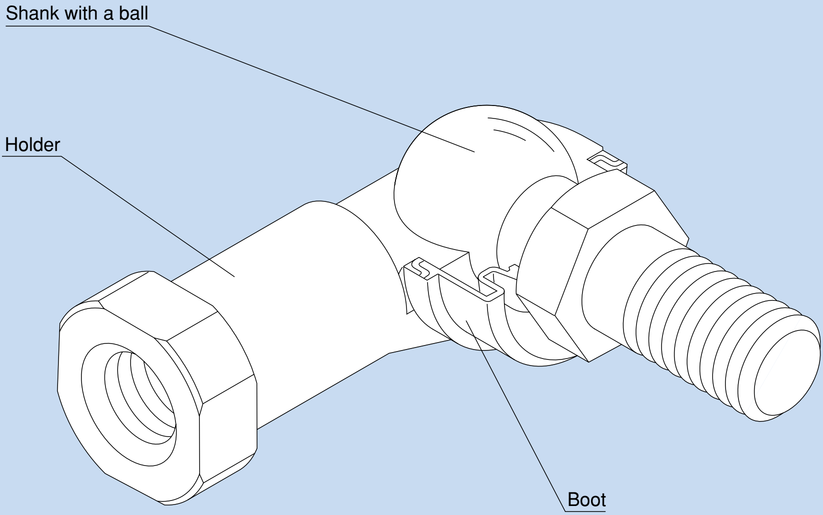


Fig. 1 Structure of Link Ball Model BL

1.1. Structure and Features of the Link Ball®

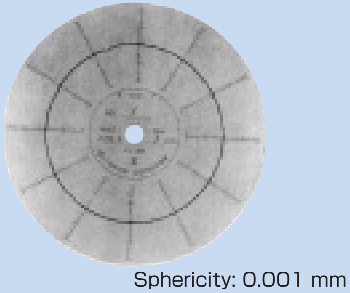
With the THK Link Ball, a highly accurate bearing steel ball used in the spherical area is first encased in the holder by die cast molding, and then is specially welded with the shank. This unique process enables the mirror surface of the steel ball to be transferred or duplicated on the spherical surface inside the holder to ensure full contact between the ball and the holder. As a result, smooth motion is achieved with a minimum clearance.

●Compact Design

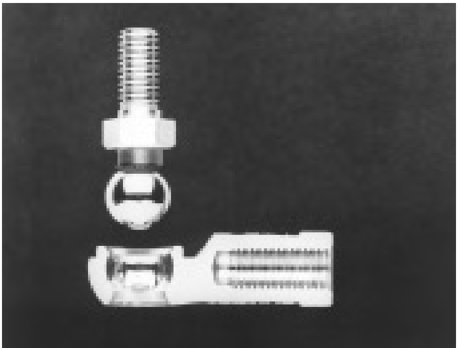
Model AL has an adequately firm and yet extremely compact shape because of highly balanced design. Together with use of an A-1 alloy, the compact design has achieved weight saving. Thus, this model is optimal for use in the stabilizer connecting rod and the transmission control of automobiles.

●Achieves Sphericity of 0.001 mm

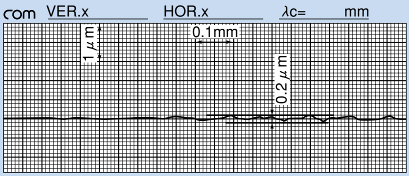
The spherical surface of the shank ball is transferred on the inner surface of the holder while maintaining the sphericity of the bearing steel ball. This allows smooth motion to be achieved with a minimum clearance and provides favorable operability and feel to the link motion.



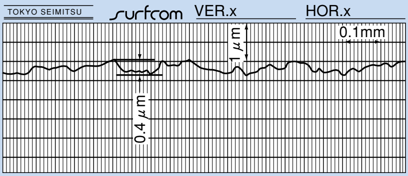
Sphericity of the spherical surface of the ball shank



Cut sample of the spherical area of model BL



Roughness of the spherical surface of the ball shank



Roughness of the spherical surface of the holder

●Two Types of Holder Material

Model AL uses the newly developed high-strength aluminum alloy "A-1 Alloy" (see page T-8), which is light and highly resistant to wear.

Models BL, RBL and RBI use the proven, high-strength zinc alloy (see page T-9).

●High Lubricity

Since models AL and BL and those models attached with boots contain grease, they have high lubricity and increased wear resistance.

●Large Hexagonal Bolt Seat

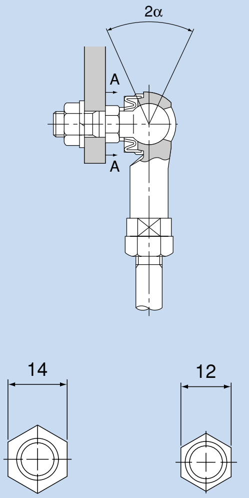
The hexagonal bolt seat of the shank has the same dimensions as the seating surface for small hexagon head bolts in accordance with automotive specifications. This prevents the seating surface from sinking and ensures a stable link motion mechanism.

●Lightweight, High Strength

Use of the A-1 Alloy enables the Link Ball to achieve mechanical strength approximately twice that of the commonly used aluminum die cast material ADC 12, or almost equal to the high-strength zinc alloy, while maintaining aluminum alloys' advantages: lightweight and corrosion resistance.

●Equipped with a Boot for Protection against Muddy Water

Use of a boot with high trackability in the ball shank prevents muddy water from entering the spherical area even in a muddy atmosphere. Accordingly, those types equipped with boots are used also in outdoor applications and automobile parts under the chassis. For details, see the muddy water test data (pages T-14 and 15).



Model AL10
Model BL10

Model equivalent
to similar product

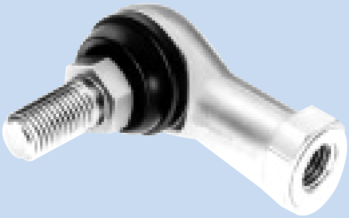
A-A cross section

Jaw Span for Wrenching

1.2. Types and Features of the Link Ball®

●Model AL

The holder is connected in perpendicular to the shank, which comprises a male thread specially welded with a highly accurate steel ball.
With a grease pocket formed on the top and bottom of the spherical area, this model achieves high lubricity and high wear-resistance.
Use of the A-1 alloy in the holder significantly reduces the weight.



Model AL

"A-1 Alloy," a high-strength aluminum alloy newly developed for the Link Ball, has yield strength approximately twice that of the commonly used aluminum die cast material ADC 12, and its strength and wear resistance are equivalent to the high-strength zinc alloy.
With its specific gravity less than that of the high-strength zinc alloy, model AL is optimal as an automotive part that requires lightweight, high strength, high corrosion resistance and high wear resistance.

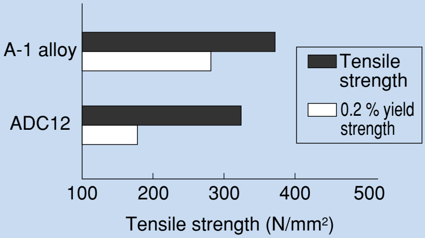
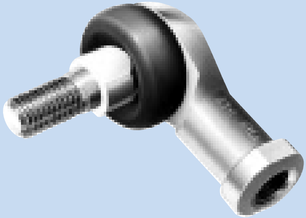


Fig. 2 Tensile Strength and Yield Strength of THK A-1 Alloy and ADC 12

●Model RBL

The holder made of the high-strength zinc alloy is connected in perpendicular to the shank, which is incorporated with a ball.

Since grease in contained in the boot, this model achieves high lubricity and high wear-resistance.

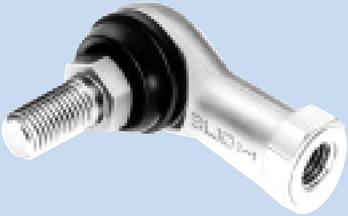


Model RBL

●Model BL

A compact type of model RBL, this model's holder made of the high-strength zinc alloy is connected in perpendicular to the shank, which is incorporated with a ball.

With a grease pocket formed on the top and bottom of the spherical area, this model achieves high lubricity and high wear-resistance.

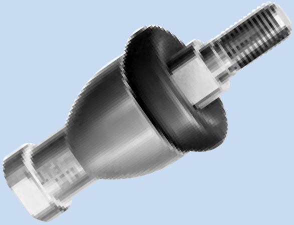


Model BL

●Model RBI

With this Link Ball model, the high-strength zinc alloy is used in its holder and the mounting bolt and the holder are arranged on the same axis, allowing this model to receive both a compressive load and a pulling load.

Since grease in contained in the boot, this model achieves high lubricity and high wear-resistance.

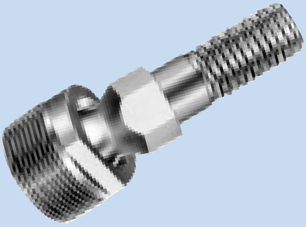


Model RBI

●Model TBS

The rolled thread on the circumference of the outer ring allows this model to easily be mounted on the housing. Simply by tightening the screw, the user can achieve play-free, firm installation.

Since the covering area of sphere is large, the model is capable of receiving a large axial load.



Model TBS

1.3. Alloy

High-strength Aluminum Alloy "A-1 Alloy"

"A-1 Alloy," a newly developed high-strength aluminum alloy, is an alloy with Aℓ-ZnSi3 being the main components, is used in the holder of model AL.

●Features of the A-1 Alloy

●Achieves one of the highest strengths among the existing aluminum die cast alloys.

●Has yield strength approximately twice that of the commonly used aluminum die cast alloy (ADC 12).

●Has hardness equal to the high-strength zinc alloy and achieves high wear resistance.

●Achieves specific gravity less than a half of the high-strength zinc alloy to allow significant weight saving.

●Highly resistant to corrosion and can be used as an automotive part related to wheel control.

●Mechanical Properties

Tensile strength:	343 to 392 N/mm^2
Tensile yield strength (0.2%):	245 to 294 N/mm^2
Compressive strength:	490 to 637 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Charpy impact strength:	0.098 to 0.196 $N\text{-}m/mm^2$
Elongation:	2 to 3 %
Hardness:	140 to 160 HV

●Physical Properties

Specific gravity:	3
Melting point:	570 ℃
Specific heat:	793 J/(kg·k)
Linear expansion ratio:	22×10^{-6}

●Wear Resistance

The result of our test has proven that the wear resistance of the A-1 alloy is equivalent to the high-strength zinc alloy.

Rotation-and-rocking comparative durability test between model AL10D (A-1 alloy) and model BL10D (high-strength zinc alloy)			
Test conditions	Ambient temperature	Normal temperature	
	Applied load	±1.9kN (perpendicular to axis) (note)	
	Loading frequency	0.6Hz	
	Kinematic angle	Rotation ±20°	Rocking ±20°
	No. of cycles	40 cycles per min.	40 cycles per min.
	Total No. of cycles	1,000,000 cycles	
Test result: change in clearance (mm)		AL10D (A-1 alloy)	BL10D (high-strength zinc alloy)
	Perpendicular to axis	0.036	0.033
	Axial direction	0.052	0.045

Note: For the load direction, see page T-11.

High-strength Zinc Alloy

The high-strength zinc alloy used in the holders of models BL, RBL, RBI and TBS has been developed as a bearing alloy by mixing Aℓ, Cu, Mg, Be and Ti as well as zinc as the base component. It is excellent in mechanical properties, seizure resistance and wear resistance.

●Composition

Table 1 Composition of the High-strength Zinc Alloy Unit:%

Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

●Mechanical Properties

Tensile strength: 275 to 314 N/mm^2
Tensile yield strength (0.2%): 216 to 245 N/mm$_2$
Compressive strength: 539 to 686 N/mm^2
Compressive yield strength (0.2%): 294 to 343 N/mm^2
Fatigue strength: 132 N/mm^2×10^7 (Schenk bending test)
Charpy impact strength: 0.098 to 0.49 N-m/mm^2
Elongation: 1 to 5 %
Hardness: 120 to 145 HV

●Physical Properties

Specific gravity: 6.8
Melting point: 390 ℃
Specific heat: 460 J/(kg･k)
Linear expansion ratio: 24×10^{-6}

●Wear Resistance

The wear resistance of the high-strength zinc alloy is superior to that of class-3 brass and class-3 bronze, almost equal to that of class-2 phosphor bronze.

Amsler wear-tester:
Test piece rotation speed: 185 min^{-1}
Load: 392 N
Lubricant: Dynamo oil

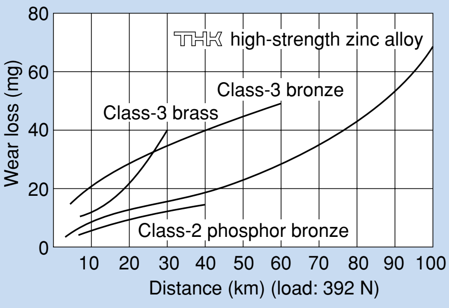


Fig. 3 Wear Resistance of the High-strength Zinc Alloy

1.4. Selecting a Link Ball®

A Link Ball model to be selected must satisfy both the permissible load obtained from equation (1) and the dynamic load capacity obtained from equation (2).

Permissible Load P

The yield point strength indicated in the dimensional tables in the "THK General Catalog - Product Specifications," provided separately, refers to the mechanical strength of the bearing. With models AL, BL and RBL, the yield point strength indicates the strength when a load is applied perpendicular to the ball shank axis. With mode RBI, it indicates the strength when an axial load is applied to the holder in the shank axis direction.

Table 2 Safety Factor (f_S)

Type of load	Lower limit of f_S
Constant load in a constant direction	2 to 3
Varying load in a constant direction	3 to 5
Load in varying directions	5 to 8

According to the type of the load, select a bearing that satisfies the following equation from a mechanical strength s viewpoint.

$$P \leqq \frac{P_k}{f_S} \quad \cdots\cdots\cdots(1)$$

where

P :Permissible load (N)

P_k :Yield point strength (N)

f_S :Safety factor (see table 2)

Dynamic Load Capacity C_d

The dynamic load capacity (C_d) refers to the upper limit of load that the spherical area of the Link Ball can receive without showing seizure while the Link Ball is rotating or rocking. The dynamic load capacity is obtained from the following approximation formula using the static load capacity (C_S) (note 1) indicated in the dimensional table in "THK General Catalog - Product Specifications," provided separately.

$$C_d = \frac{C_S}{\sqrt[3]{n}} \quad \cdots\cdots\cdots(2)$$

where

C_d :Dynamic load capacity (N)

C_s :Static load capacity (N)

n :Number of revolutions per minute (min^{-1})

Note 1: Static load capacity (C_S) refers to the value obtained by multiplying the projected area on the spherical section by the permissible surface pressure, and is used to obtain the dynamic load capacity.

1.5. Safety Design

Permissible Tilt Angle

The permissible tilt angles of Link Ball models are indicated in the corresponding dimensional tables in the "THK General Catalog - Product Specifications," provided separately.

Note: If the permissible tilt angle is exceeded, it may cause serious damage to the holder or the boot. Be sure to use the Link Ball within its permissible tilt angle.

Service Temperature

If the Link Ball is to be used at temperature of 80℃ or higher, or receives an impact at low temperature, it is necessary to consider the safety factor of the holder. Contact THK in advance. For details, see the data on durability tests conducted in high and low temperatures (page T-16 of the "THK General Catalog - Technical Descriptions of the Products," provided separately).

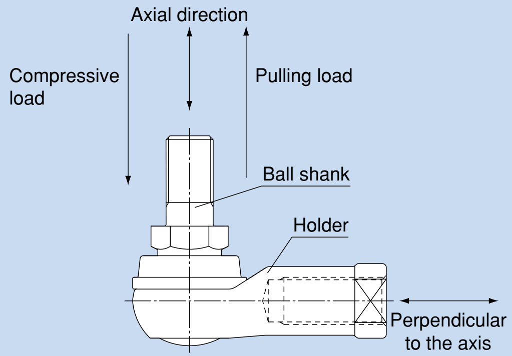
In an actual application, the Link Ball has been used as a ball joint for transmission control of a truck at service temperature between -40℃ and +140℃.

How Load Directions Are Called

Regardless of the shape, the direction of the load applied to the Link Ball is called "axial direction" if it is parallel to the axis of the ball shank, and "perpendicular-to-axis direction" if it is perpendicular to the axis.

Compressive Load and Pulling Load

Of the loads applied in the axial direction, the load in the direction of the ball shank being pressed toward the holder is called "compressive load" and the load in the direction of the ball shank being pulled from the holder is called "pulling load."



2. Performance Tests with the Link Ball®

2.1. Tensile Strength Test with Model AL10D

■Testing Method

Place model AL10D on an Amsler universal testing machine as shown in Fig. 1, then apply a load perpendicular to the axis to measure the tensile break load.

■Test Result

All samples are broken in the shank, indicating that the holder has sufficient strength.

Sample No.	Breaking load (kN)	Broken point
1	18.82	A
2	18.72	A
3	18.6	A
4	18.78	A
5	18.45	A
6	18.95	A
7	18.65	A
8	18.91	A
9	18.55	A
10	18.5	A
$\bar{X}$	18.693	—
R	0.5	—

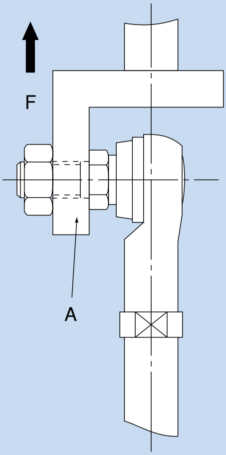


Fig. 1

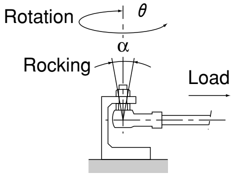
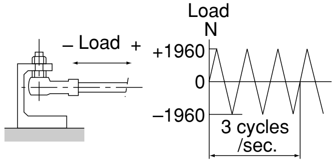
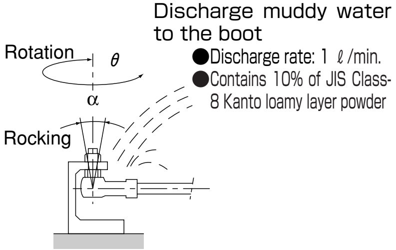
2.2. Durability Tests with Link Ball® Model AL

Purpose of the Tests

The tests were conducted to identify the durability of THK Link Ball model AL while assuming that it is used for automobile suspensions.

Tested Product: THK Link Ball model AL10D

Test Items, Test Conditions and Test Results

Test item	Test conditions						Test result	Evaluation
	Applied load	Rotation or rocking angle	Frequency	Total number of revolutions or time	Atmosphere	Load conditions, etc.		
Rotation-and-rocking durability	1960 N Load direction: Perpendicular to the axis (one direction)	Rotation angle: θ=±5° Rocking angle: θ=±10°	Rotation: 25 times/min. Rocking: 75 times/min.	500,000 cycles (rocking)	Normal temperature		Sample No. / Change in clearance (mm): Perpendicular to the axis / Axial direction ① 0.038 / 0.02 ② 0.04 / 0.03 ③ 0.042 / 0.04 ④ 0.038 / 0.03	●Despite harsh test conditions where complex link motion was required under an axial load, no anomaly was observed in the samples after the test, and the abrasion loss was minimal and consistent among the samples. This indicates that the Link Ball has superb wear resistance and stable quality.
Fatigue durability	±1960 N Load direction: Perpendicular to the axis (both directions)	—	180 times/min.	1 million cycles (rocking)	Normal temperature		●Appearance No anomaly was observed including fracture of the samples. ●Motion The ball shank was capable of smoothly rocking after the test, without any anomaly such as heavy and jerky motion.	●No anomaly in appearance or function was observed in the sample after the fatigue durability test involving 1 million cycles of rocking. This indicates that the product is sufficiently capable of continuously operating and has superb wear resistance.
Muddy-water rotation-and-rocking durability (identify sealability of the boot)	—	Rotation angle: θ=±12° Rocking angle: θ=±12°	Rotation: 25 times/min. Rocking: 75 times/min.	500,000 cycles (rocking)	Normal temperature		●Motion The ball shank was capable of smoothly rocking after the test, without any anomaly such as heavy and jerky motion. ●Muddy water penetration No muddy water penetration was observed in visual inspection with the boot removed. ●Boot status No breakage of the boot or abnormal wear of the lip was observed.	●No anomaly in motion was observed in the sample, and no muddy water penetration into the boot or no grease deterioration was found after the test. This verifies that the boot has reliable sealability.
Boot weatherability	—	—	—	96 hours	−30℃	Left standing	●Boot status The boot showed no harmful ozone crack and maintained its pre-test status, including softness, after the test.	●No anomaly was observed in the sample after the test. The fact that no muddy water penetration into the boot or no grease deterioration was found in the sample after the above durability test verifies that the boot has reliable weatherability.
				96 hours	70℃	Left standing		
		Rotation angle: θ=±10°	60 times/min.	144 hours	40℃	●Ozone concentration: 80pphm		
Salt-water spray resistance	—	—	—	200 hours	35℃	●Salt-water concentration: 5% ●Spray solution temperature:33 to 37℃ ●Spray pressure:0.098MPa ●Following spray test, apply compressive load to measure strength	●Appearance No erosion was observed in the holder, and no other anomaly including breakage was founds either. ●Appearance The ball shank was capable of smoothly rocking after the test.	●No erosion-based deterioration of the sample was observed in function and performance. This demonstrates that the A-1 alloy has superb corrosion resistance.

Comprehensive Evaluation

The results of the durability tests indicate that THK Link Ball model AL has sufficient strength, wear resistance, corrosion resistance and boot sealability.
This is attributable to the superb characteristics of the newly developed alloy A-1 and the effect of THK's unique manufacturing process. Thus, THK Link Ball model AL provides a high level of performance as a lightweight component.

2.3. Durability Tests with Link Ball® Model BL

■Purpose of the Tests

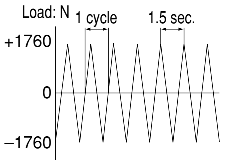
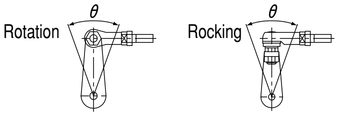
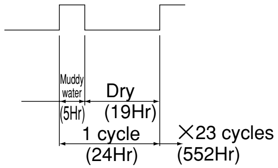
The tests were conducted to identify the performance difference between THK Link Ball model BL and an equivalent product of a competitor. As a result, model BL has been used in joints for transmission control units of automobiles, trucks and buses and for steering mechanisms of agricultural tractors.

■Comprehensive Evaluation

As a result of comparing THK Link Ball model BL10D and a competitor's product in representative durability tests, it is demonstrated that model BL10D is superior in strength and wear resistance of the holder and sealability of the boot.

These features are achieved through THK's unique manufacturing process for the holder and the shank, the material used, the structure of upper and lower grease pockets on the spherical area and the development of a highly sealable boot.

■Tested Product, Test Items, Test Conditions and Test Results

Test item	Tested model No.	Test conditions						Test result					Evaluation
		Applied load	Rotation or rocking angle	Frequency	Total number of revolutions or time	Atmosphere	Load conditions, etc.		Sample No.	Change in clearance (μm)		Conditions of the holder, etc.	
										Perpendicular to the axis	Axial direction		
Rotation-and-rocking durability	Comparison of THK Link Ball model BL10D and competitor's product	±1760 N (load direction: perpendicular to the axis)	Rotation angle: θ=±20° Rocking angle: α=±20°	40 times/min.	1 million cycles	Normal temperature	The loading diagram is as follows.  The motion direction is as follows: 	THK model BL10D	①	26	42	The shank was capable of smoothly rotating after the 1-million cycle test, and capable of continuously operating.	●Even in complex link motion, THK model BL10D demonstrated higher durability and wear resistance of the holder than competitor's product.
									②	25	40		
								Competitor's product	①	Broke in the holder neck after 8,600 cycles 154	60	Wear and damage were observed in the holder's spherical area in approx. 150,000-cycle operation.	●The abrasion loss of the competitor's product immediately before the breakage of the holder was 6 times greater than THK model BL10D (perpendicular to the axis).
									②	Broke in the holder neck after 151,300 cycles 62	20		
Low-temperature rotation durability	THK Link Ball model BL10D only	±1225 N (load direction: perpendicular to the axis)	Rotation angle: θ=±30°	60 times/min.		−30℃	Low-temperature retention time: 280 hours Motion in the rotational direction	THK model BL10D	①	63	65	The boot did not show a crack or the like at low temperature	●This indicates that THK model BL10D is sufficiently capable of operating in outdoor applications in cold climates.
									②	56	59		
High-temperature rotation durability						100℃	High-temperature retention time: 280 hours Motion in the rotational direction		①	79	84	The holder did not show abnormal wear and the boot did not show thermal deterioration at high temperature.	●This indicates that THK model BL10D is sufficiently capable of operating in hot areas of a truck engine.
									②	74	78		
Muddy-water rotation durability						Normal temperature	Motion: rotational direction and rocking on a separate basis Muddy water discharge pattern Muddy water concentration: 5 Wt% of salt and dust each in 1 liter of water Discharge direction: against the boot lip Discharge pressure: 5 kg/cm³ 		①	48	51	No muddy-water penetration that may cause wear was observed.	●This indicates that THK model BL10D is sufficiently capable of operating in environments subject to muddy water such as trucks, construction vehicles and agricultural machines since the sealing effect of the boot prevents penetration of muddy water.
									②	57	63		
									①	32	38		
									②	35	42		
Muddy-water rocking durability	Comparison of THK Link Ball model BL10D and competitor's product		Rocking angle: α=±20°					Competitor's product	①	240	105	Muddy water penetrated the boot, the spherical area showed chipping and the boot had cuts.	●The competitor's product cannot be used in environments subject to muddy water since chipping or the like may occur in such environments. In addition, wear of the spherical area reached 0.24 mm, 7.4 times greater than THK model BL10D.
									②	246	107		

Rated Load and Service Life of a Linear Motion System

1. Rated Load and Service Life

When selecting a specific linear motion (LM) system, you must first consider and determine its load capacity and service life.
To determine the rated load, use the basic static load rating to obtain the static safety factor.
To determine the service life, use the basic dynamic load rating to calculate the rated life. And then, judge if these values meet the required conditions.
The service life of an LM system refers to the total distance traveled until flaking occurs (scale-like exfoliation of the metal surface) due to rolling fatigue of the material as a result of repeated stress acting on the raceway or the rolling element.

2. Basic Load Rating

An LM system has two types of basic load ratings: basic static load rating (C_0), which defines the permissible static limit, and basic dynamic load rating (C), which is used to calculate the service life.

3. Basic Static Load Rating C_0

If an LM system receives an excessively large load or a large impact when it is stationary or operative, permanent deformation occurs between the raceway and the rolling element. If the permanent deformation exceeds a certain limit, it will prevent the LM system from performing smooth motion.

The basic static load rating refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the rolling element and the permanent deformation of the raceway accounts for 0.0001 times of the rolling element's diameter in the contact area where the maximum stress is applied. With an LM system, the basic static load rating is defined for the radial load.

Therefore, the basic static load rating is considered the limit of the permissible static load.

4. Permissible Static Moment M_0

When an LM system receives a moment, the rolling elements on both ends receive the maximum stress due to uneven distribution of the stress on the rolling elements within the LM system.

The permissible static moment (M_0) means the moment with constant direction and magnitude, under which the sum of the permanent deformation of the rolling element and the permanent deformation of the raceway accounts for 0.0001 times of the rolling element's diameter in the contact area where the maximum stress is applied.

With an LM system, the permissible static moment is defined in three directions: M_A, M_B and M_C.

Thus, the permissible static moment is considered the limit of the static moment applied.

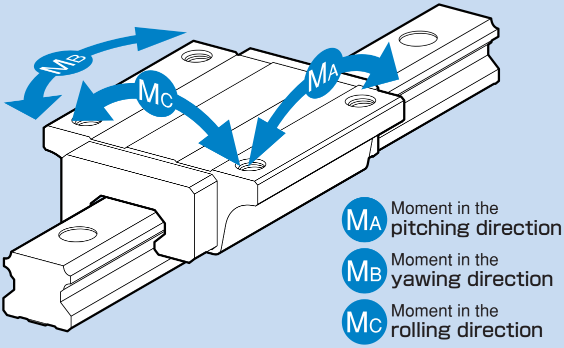


Fig. 1 Directions of Moment

5. Static Safety Factor f_S

When an LM system is stationary or operative, unexpected external force may be applied through inertia caused by vibrations, impact or start/stop. To cope with such an applied load, it is necessary to consider and determine the static safety factor.
The static safety factor (f_S) is determined by the ratio of the load capacity (basic static load rating) of an LM system to the load applied on the LM system.

$$f_s = \frac{C_O}{P} \quad \text{or} \quad f_s = \frac{M_O}{M} \qquad \cdots\cdots\cdots(1)$$

where

f_S	:Static safety factor	
C_O	:Basic static load rating	(N)
M_O	:Permissible static moment	(N-mm)
P	:Calculated load	(N)
M	:Calculated moment	(N-mm)

6. Basic Dynamic Load Rating C

The basic dynamic load rating (C) indicates the load with constant direction and magnitude, under which the rated life (L) is L = 50 km for an LM system using balls, or L = 100 km for an LM system using rollers, when a group of identical LM system units independently operating under the same conditions.

The basic dynamic load rating (C) is used to calculate the service life when an LM system operates under a load.

7. Rated Life

The service life of an LM system is subject to slight variations even under the same operational conditions. Therefore, it is necessary to use the rated life defined below as a reference value for obtaining the service life of the LM system.

The rated life means the total travel distance that 90% of a group of units of the same LM system model can achieve without flaking (scale-like exfoliation on the metal surface) after individually running under the same conditions.

The rated life (L) of an LM system is obtained from the following equation using the basic dynamic load rating (C) and the applied load (P).

7.1. LM System Using Balls

$$L = \left(\frac{C}{P}\right)^3 \times 50 \quad \cdots\cdots(2)$$

where

L	:Rated life	(km)
C	:Basic dynamic load rating	(N)
P	:Applied load	(N)

7.2. LM System Using Rollers

$$L = \left(\frac{C}{P}\right)^{\frac{10}{3}} \times 100 \quad \cdots\cdots(3)$$

where

L	:Rated life	(km)
C	:Basic dynamic load rating	(N)
P	:Applied load	(N)

8. Radial Clearance

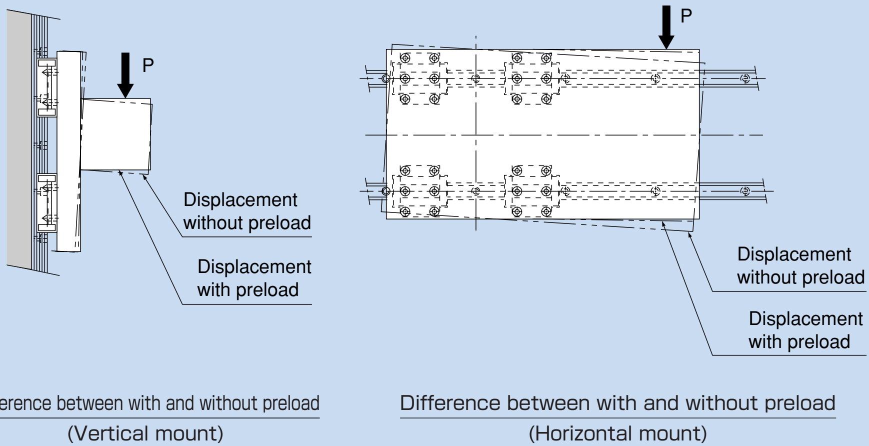
The radial clearance of an LM Guide indicates the travel distance in the radial direction in the middle of the LM block when the LM rail is fixed and the LM block is lightly moved up and down in the middle of the LM rail in the longitudinal direction.

The radial clearance is classified into normal clearance and negative clearances C1 (light preload) and C0 (medium preload). They can be selected according to the application and their values are standardized for each type.

Since the radial clearance of an LM Guide significantly affects the running parallelism, load carrying capacity and rigidity, it is particularly important to select an appropriate clearance according to the application. In general, selection of a negative clearance while taking into account possible vibrations and/or impact caused by reciprocating motion will favorably affect the service life and the accuracy.

9. Preload

Preload is an internal load applied to the rolling element in advance in order to increase the rigidity of the LM block or eliminate a clearance. The clearance symbols C1 and C0 for LM Guides indicate negative clearance as a result of applying a preload, and are expressed in negative values.
All LM Guide models (excluding separable types models HR and GSR) are shipped with their clearances adjusted at designated values. Therefore, it is unnecessary to adjust their preloads.



Difference between with and without preload (Vertical mount)

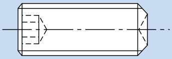
Difference between with and without preload (Horizontal mount)

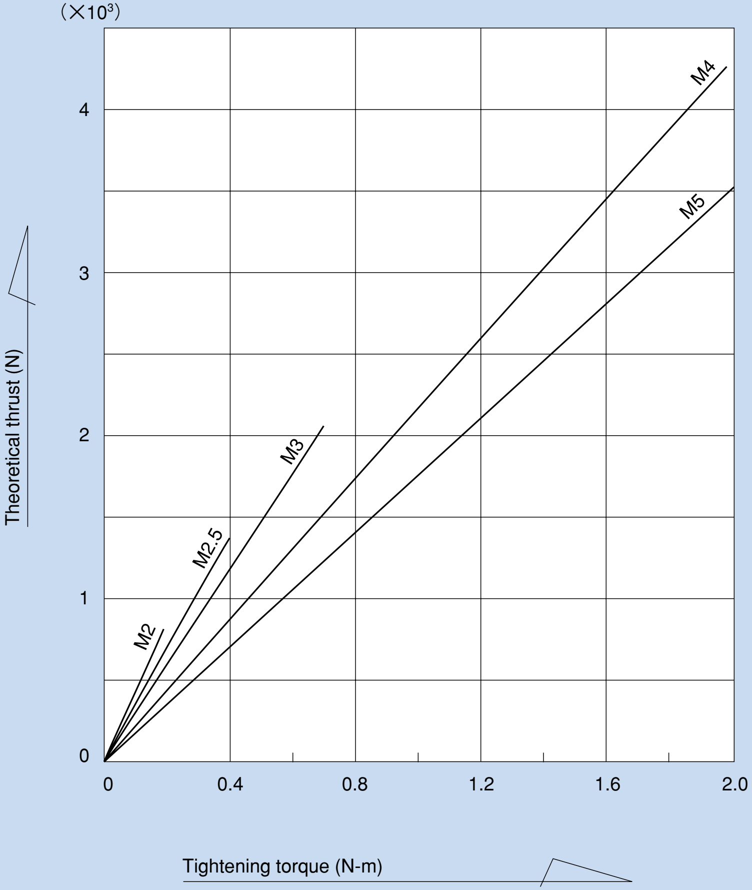
Fig. 2 Preload and Displacement

Appendix Tables

Tightening Torques and Theoretical Thrusts for Hexagon Socket Setscrews

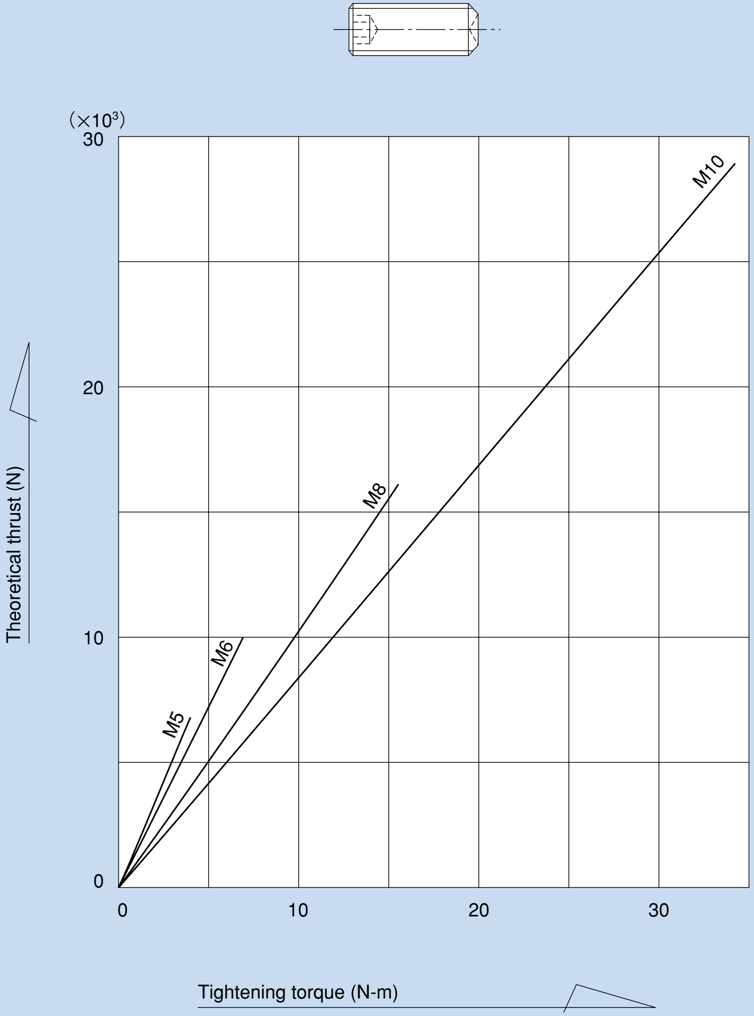
● M2 to M5, Cut-point





Note: The theoretical thrust may differ depending on the lubrication and the conditions of the surfaces of the setscrew or the reference surface (μ = 0.13).

● M5 to M10, Cut-point



Note: The theoretical thrust may differ depending on the lubrication and the conditions of the surfaces of the setscrew or the reference surface (μ= 0.13).

Dimensional Tolerances of Shafts

Unit: μm=0.001mm

Dimension classification (mm)		e	f		g		h						js			j		k			m		n		p		Dimension classification (mm)	
Above	Or less	e6	f5	f6	g5	g6	h5	h6	h7	h8	h9	h10	js5	js6	js7	j5	j6	k5	k6	k7	m5	m6	n5	n6	p5	p6	Above	Or less
3	6	−20 −28	−10 −15	−10 −18	−4 −9	−4 −12	0 −5	0 −8	0 −12	0 −18	0 −30	0 −48	±2.5	±4	±6	+3 −2	+6 −2	+6 +1	+9 +1	+13 +1	+9 +4	+12 +4	+13 +8	+16 +8	+17 +12	+20 +12	3	6
6	10	−25 −34	−13 −19	−13 −22	−5 −11	−5 −14	0 −6	0 −9	0 −15	0 −22	0 −36	0 −58	±3	±4.5	±7.5	+4 −2	+7 −2	+7 +1	+10 +1	+16 +1	+12 +6	+15 +6	+16 +10	+19 +10	+21 +15	+24 +15	6	10
10	14	−32 −43	−16 −24	−16 −27	−6 −14	−6 −17	0 −8	0 −11	0 −18	0 −27	0 −43	0 −70	±4	±5.5	±9	+5 −3	+8 −3	+9 +1	+12 +1	+19 +1	+15 +7	+18 +7	+20 +12	+23 +12	+26 +18	+29 +18	10	14
14	18																										14	18
18	24	−40 −53	−20 −29	−20 −33	−7 −16	−7 −20	0 −9	0 −13	0 −21	0 −33	0 −52	0 −84	±4.5	±6.5	±10.5	+5 −4	+9 −4	+11 +2	+15 +2	+23 +2	+17 +8	+21 +8	+24 +15	+28 +15	+31 +22	+35 +22	18	24
24	30																										24	30
30	40	−50 −66	−25 −36	−25 −41	−9 −20	−9 −25	0 −11	0 −16	0 −25	0 −39	0 −62	0 −100	±5.5	±8	±12.5	+6 −5	+11 −5	+13 +2	+18 +2	+27 +2	+20 +9	+25 +9	+28 +17	+33 +17	+37 +26	+42 +26	30	40
40	50																										40	50
50	65	−60 −79	−30 −43	−30 −49	−10 −23	−10 −29	0 −13	0 −19	0 −30	0 −46	0 −74	0 −120	±6.5	±9.5	±15	+6 −7	+12 −7	+15 +2	+21 +2	+32 +2	+24 +11	+30 +11	+33 +20	+39 +20	+45 +32	+51 +32	50	65
65	80																										65	80
80	100	−72 −94	−36 −51	−36 −58	−12 −27	−12 −34	0 −15	0 −22	0 −35	0 −54	0 −87	0 −140	±7.5	±11	±17.5	+6 −9	+13 −9	+18 +3	+25 +3	+38 +3	+28 +13	+35 +13	+38 +23	+45 +23	+52 +37	+59 +37	80	100
100	120																										100	120
120	140	−85 −110	−43 −61	−43 −68	−14 −32	−14 −39	0 −18	0 −25	0 −40	0 −63	0 −100	0 −160	±9	±12.5	±20	+7 −11	+14 −11	+21 +3	+28 +3	+43 +3	+33 +15	+40 +15	+45 +27	+52 +27	+61 +43	+68 +43	120	140
140	160																										140	160
160	180																										160	180
180	200	−100 −129	−50 −70	−50 −79	−15 −35	−15 −44	0 −20	0 −29	0 −46	0 −72	0 −115	0 −185	±10	±14.5	±23	+7 −13	+16 −13	+24 +4	+33 +4	+50 +4	+37 +17	+46 +17	+51 +31	+60 +31	+70 +50	+79 +50	180	200
200	225																										200	225
225	250																										225	250
250	280	−110 −142	−56 −79	−56 −88	−17 −40	−17 −49	0 −23	0 −32	0 −52	0 −81	0 −130	0 −210	±11.5	±16	±26	+7 −16	+16 −16	+27 +4	+36 +4	+56 +4	+43 +20	+52 +20	+57 +34	+66 +34	+79 +56	+88 +56	250	280
280	315																										280	315
315	355	−125 −161	−62 −87	−62 −98	−18 −43	−18 −54	0 −25	0 −36	0 −57	0 −89	0 −140	0 −230	±12.5	±18	±28.5	+7 −18	+18 −18	+29 +4	+40 +4	+61 +4	+46 +21	+57 +21	+62 +37	+73 +37	+87 +62	+98 +62	315	355
355	400																										355	400
400	450	−135 −175	−68 −95	−68 −108	−20 −47	−20 −60	0 −27	0 −40	0 −63	0 −97	0 −155	0 −250	±13.5	±20	±31.5	+7 −20	+20 −20	+32 +5	+45 +5	+68 +5	+50 +23	+63 +23	+67 +40	+80 +40	+95 +68	+108 +68	400	450
450	500																										450	500
500	560	−145 −189	−76 −106	−76 −120	−22 −52	−22 −66	0 −30	0 −44	0 −70	0 −110	0 −175	0 −280	±15	±22	±35	—	—	+30 0	+44 0	+70 0	+56 +26	+70 +26	+74 +44	+88 +44	+108 +78	+122 +78	500	560
560	630																										560	630
630	710	−160 −210	−80 −115	−80 −130	−24 −59	−24 −74	0 −35	0 −50	0 −80	0 −125	0 −200	0 −320	±17.5	±25	±40	—	—	+35 0	+50 0	+80 0	+65 +30	+80 +30	+85 +50	+100 +50	+123 +88	+138 +88	630	710
710	800																										710	800
800	900	−170 −226	−86 −126	−86 −142	−26 −66	−26 −82	0 −40	0 −56	0 −90	0 −140	0 −230	0 −360	±20	±28	±45	—	—	+40 0	+56 0	+90 0	+74 +34	+90 +34	+96 +56	+112 +56	+140 +100	+156 +100	800	900
900	1000																										900	1000
1000	1120	−195 −261	−98 −144	−98 −164	−28 −74	−28 −94	0 −46	0 −66	0 −105	0 −165	0 −260	0 −420	±23	±33	±52.5	—	—	+46 0	+66 0	+105 0	+86 +40	+106 +40	+112 +66	+132 +66	+166 +120	+186 +120	1000	1120
1120	1250																										1120	1250
1250	1400	−220 −298	−110 −164	−110 −188	−30 −84	−30 −108	0 −54	0 −78	0 −125	0 −195	0 −310	0 −500	±27	±39	±62.5	—	—	+54 0	+78 0	+125 0	+102 +48	+126 +48	+132 +78	+156 +78	+194 +140	+218 +140	1250	1400
1400	1600																										1400	1600

Dimensional Tolerances of Housing Holes

Unit: μm=0.001mm

Dimension classification (mm)		E		F			G		H							Js		J		K		M		N		P		Dimension classification (mm)	
Above	Or less	E6	E7	F6	F7	F8	G6	G7	H5	H6	H7	H8	H9	H10	Js6	Js7	J6	J7	K6	K7	M6	M7	N6	N7	P6	P7	Above	Or less
3	6	+28 +20	+32 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+5 0	+8 0	+12 0	+18 0	+30 0	+48 0	±4	±6	+5 −3	+6 −6	+2 −6	+3 −9	−1 −9	0 −12	−5 −13	−4 −16	−9 −17	−8 −20	3	6
6	10	+34 +25	+40 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+6 0	+9 0	+15 0	+22 0	+36 0	+58 0	±4.5	±7.5	+5 −4	+8 −7	+2 −7	+5 −10	−3 −12	0 −15	−7 −16	−4 −19	−12 −21	−9 −24	6	10
10	14	+43 +32	+50 +32	+27 +16	+34 +16	+48 +16	+17 +6	+24 +6	+8 0	+11 0	+18 0	+27 0	+43 0	+70 0	±5.5	±9	+6 −5	+10 −8	+2 −9	+6 −12	−4 −15	0 −18	−9 −20	−5 −23	−15 −26	−11 −29	10	14
14	18																										14	18
18	24	+53 +40	+61 +40	+33 +20	+41 +20	+53 +20	+20 +7	+28 +7	+9 0	+13 0	+21 0	+33 0	+52 0	+84 0	±6.5	±10.5	+8 −5	+12 −9	+2 −11	+6 −15	−4 −17	0 −21	−11 −24	−7 −28	−18 −31	−14 −35	18	24
24	30																										24	30
30	40	+66 +50	+75 +50	+41 +25	+50 +25	+64 +25	+25 +9	+34 +9	+11 0	+16 0	+25 0	+39 0	+62 0	+100 0	±8	±12.5	+10 −6	+14 −11	+3 −13	+7 −18	−4 −20	0 −25	−12 −28	−8 −33	−21 −37	−17 −42	30	40
40	50																										40	50
50	65	+79 +60	+90 +60	+49 +30	+60 +30	+76 +30	+29 +10	+40 +10	+13 0	+19 0	+30 0	+46 0	+74 0	+120 0	±9.5	±15	+13 −6	+18 −12	+4 −15	+9 −21	−5 −24	0 −30	−14 −33	−9 −39	−26 −45	−21 −51	50	65
65	80																										65	80
80	100	+94 +72	+107 +72	+58 +36	+71 +36	+90 +36	+34 +12	+47 +12	+15 0	+22 0	+35 0	+54 0	+87 0	+140 0	±11	±17.5	+16 −6	+22 −13	+4 −18	+10 −25	−6 −28	0 −35	−16 −38	−10 −45	−30 −52	−24 −59	80	100
100	120																										100	120
120	140	+110 +85	+125 +85	+68 +43	+83 +43	+106 +43	+39 +14	+54 +14	+18 0	+25 0	+40 0	+63 0	+100 0	+160 0	±12.5	±20	+18 −7	+26 −14	+4 −21	+12 −28	−8 −33	0 −40	−20 −45	−12 −52	−36 −61	−28 −68	120	140
140	160																										140	160
160	180																										160	180
180	200	+129 +100	+146 +100	+79 +50	+96 +50	+122 +50	+44 +15	+61 +15	+20 0	+29 0	+46 0	+72 0	+115 0	+185 0	±14.5	±23	+22 −7	+30 −16	+5 −24	+13 −33	−8 −37	0 −46	−22 −51	−14 −60	−41 −70	−33 −79	180	200
200	225																										200	225
225	250																										225	250
250	280	+142 +110	+162 +110	+88 +56	+108 +56	+137 +56	+49 +17	+69 +17	+23 0	+32 0	+52 0	+81 0	+130 0	+210 0	±16	±26	+25 −7	+36 −16	+5 −27	+16 −36	−9 −41	0 −52	−25 −57	−14 −66	−47 −79	−36 −88	250	280
280	315																										280	315
315	355	+161 +125	+182 +125	+98 +62	+119 +62	+151 +62	+54 +18	+75 +18	+25 0	+36 0	+57 0	+89 0	+140 0	+230 0	±18	±28.5	+29 −7	+39 −18	+7 −29	+17 −40	−10 −46	0 −57	−26 −62	−16 −73	−51 −87	−41 −98	315	355
355	400																										355	400
400	450	+175 +135	+198 +135	+108 +68	+131 +68	+165 +68	+60 +20	+83 +20	+27 0	+40 0	+63 0	+97 0	+155 0	+250 0	±20	±31.5	+33 −7	+43 −20	+8 −32	+18 −45	−10 −50	0 −63	−27 −67	−17 −80	−55 −95	−45 −108	400	450
450	500																										450	500
500	560	+189 +145	+215 +145	+120 +76	+146 +76	+186 +76	+66 +22	+92 +22	+30 0	+44 0	+70 0	+110 0	+175 0	+280 0	±22	±35	—	—	—	—	−26 −70	−26 −96	−44 −88	−44 −114	−78 −122	−78 −148	500	560
560	630																										560	630
630	710	+210 +160	+240 +160	+130 +80	+160 +80	+205 +80	+74 +24	+104 +24	+35 0	+50 0	+80 0	+125 0	+200 0	+320 0	±25	±40	—	—	—	—	−30 −80	−30 −110	−50 −100	−50 −130	−88 −138	−88 −168	630	710
710	800																										710	800
800	900	+226 +170	+260 +170	+142 +86	+176 +86	+226 +86	+82 +26	+116 +26	+40 0	+56 0	+90 0	+140 0	+230 0	+360 0	±28	±45	—	—	—	—	−34 −90	−34 −124	−56 −112	−56 −146	−100 −156	−100 −190	800	900
900	1000																										900	1000
1000	1120	+261 +195	+300 +195	+164 +98	+203 +98	+263 +98	+94 +28	+133 +28	+46 0	+66 0	+105 0	+165 0	+260 0	+420 0	±33	±52.5	—	—	—	—	−40 −106	−40 −145	−66 −132	−66 −171	−120 −186	−120 −225	1000	1120
1120	1250																										1120	1250
1250	1400	+298 +220	+345 +220	+188 +110	+235 +110	+305 +110	+108 +30	+155 +30	+54 0	+78 0	+125 0	+195 0	+310 0	+500 0	±39	±62.5	—	—	—	—	−48 −126	−48 −173	−78 −156	−78 −203	−140 −218	−140 −265	1250	1400
1400	1600																										1400	1600

SI Unit Conversion Table

●Conversion to SI Units

Amount	Name of unit	Symbol	Factor of conversion to SI	Name of SI unit	Symbol
Angle	Degree	·	$\pi/180$	Radian	rad
	Minute	·	$\pi/10800$		
	Second	·	$\pi/648000$		
Length	Meter	m		Meter	m
	Angstrom	Å	10^{-10}		
	X-ray unit		$\approx 1.00208\times10^{-13}$		
	Nautical mile	n mile	1852		
Area	Square meter	m^2	1	Square meter	m^2
	Are	a	10^2		
	Hectare	ha	10^4		
Volume	Cubic meter	m^3	1	Cubic meter	m^3
	Liter	ℓ (L)	10^{-3}		
Mass	Kilogram	kg	1	Kilogram	kg
	Ton	t	10^3		
	Atomic mass unit	u	$\approx 1.66057\times10^{-27}$		
Time	Second	s	1	Second	S
	Minute	min	60		
	Hour	h	3600		
	Day	d	86400		
Speed	Meter per second	m/s	1	Meter per second	m/s
	Knot	kn	1852/3600		
Frequency	Cycle	s^{-1}	1	Hertz	Hz
Rotation speed	Revolution per minute	rpm	1	Per minute	min^{-1}
Angular speed	Radian per minute	rad/s	1	Radian per minute	rad/s
Acceleration	Meter per second per second	m/s^2	1	Meter per second per second	m/s^2
	G	G	9.80665		
Force	Weight kilogram	kgf	9.80665	Newton	N
	Weight ton	tf	9806.65		
	Dyne	dyn	10^{-5}		
Moment of force	Weight kilogram meter	kgf-m	9.80665	Newton meter	N-m
Stress and pressure	Weight kilogram per square meter	kgf/m^2	9.80665	Pascal	Pa
	Weight kilogram per square centimeter	kgf/cm^2	9.80665×10^4		
	Weight kilogram per square millimeter	kgf/mm^2	9.80665×10^6		
Pressure	Water column meter	mH_2O	9806.65	Pascal	Pa
	Mercury column meter	mmHg	101325/760		
	Torr	Torr	101325/760		
	Atmospheric pressure	atm	101325		
	Bar	bar	10^5		
Energy	Erg	erg	10^{-7}	Joule	J
	IT calorie	cal_{IT}	4.1868		
	Weight kilogram meter	kgf-m	9.80665		
	Kilowatt hour	kW-h	3.600×10^6		
	French horsepower hour	PS-h	$\approx 2.64779\times10^6$		
	Electronic volt	eV	$\approx 1.60219\times10^{-19}$		
Power	Watt	W	1	Watt	W
	French horsepower	PS	≈ 735.5		
	Weight kilogram meter per second	kgf-m/s	9.80665		

Amount	Name of unit	Symbol	Factor of conversion to SI	Name of SI unit	Symbol
Viscosity	Poise	P	10^{-1}	Pascal second	Pa-s
	Centipoise	cP	10^{-3}		
	Weight kilogram second per square meter	kgf-s/m^2	9.80665		
Kinematic viscosity	Stokes	St	10^{-1}	Square meter per second	m^2/s
	Centistokes	cSt	10^{-6}		
Temperature	Degree	℃	+273.15	Kelvin	K
Radioactivity	Currie	Ci	3.7×10^{10}	Becquerel	Bq
Exposure	Roentgen	R	2.58×10^{-4}	Coulomb per kilogram	C/kg
Absorbed dose	Rad	rad	10^{-2}	Gray	Gy
Dose equivalent	Rem	rem	10^{-2}	Sievert	Sv
Magnetic flux	Maxwell	Mx	10^{-8}	Weber	Wb
Magnetic flux density	Gamma	γ	10^{-9}	Tesla	T
	Gauss	Gs	10^{-4}		
Magnetic-field intensity	Oersted	Oe	$10^3/4\pi$	Ampere per meter	A/m
Quantity of electricity	Coulomb	C	1	Coulomb	C
Potential difference	Volt	V	1	Volt	V
Capacitance	Farad	F	1	Farad	F
(Electric) resistance	Ohm	Ω	1	Ohm	Ω
(Electric) conductance	Siemens	S	1	Siemens	S
Inductance	Henry	H	1	Henry	H
Electric current	Ampere	A	1	Ampere	A

●Comparative Table of SI, CGS System and Gravitational System Units

Amount Unit system	Length L	Mass M	Time T	Acceleration	Force	Stress	Pressure	Energy
SI	m	kg	s	m/s^2	N	Pa	Pa	J
CGS system	cm	g	s	Gal	dyn	dyn/cm^2	dyn/cm^2	erg
Gravitational system	m	$kgf\text{-}s^2/m$	s	m/s^2	kgf	kgf/m^2	kgf/m^2	kgf-cm

Amount Unit system	Power	Temperature	Viscosity	Kinematic viscosity	Magnetic flux	Magnetic flux density	Magnetic-field intensity
SI	W	K	Pa-s	m^2/s	Wb	T	A/m
CGS system	erg/s	℃	P	St	Mx	Gs	Oe
Gravitational system	kgf-m/s	℃	$kgf\text{-}s/m^2$	m^2/s	—	—	—

●Integer Multipliers of 10 of SI Units

Number of digits multiplied to unit	Prefix		Number of digits multiplied to unit	Prefix	
	Name	Symbol		Name	Symbol
10^{18}	Exa	E	10^{-1}	Deci	d
10^{15}	Peta	P	10^{-2}	Centi	c
10^{12}	Tera	T	10^{-3}	Milli	m
10^{9}	Giga	G	10^{-6}	Micro	μ
10^{6}	Mega	M	10^{-9}	Nano	n
10^{3}	Kilo	k	10^{-12}	Pico	p
10^{2}	Hecto	h	10^{-15}	Femto	f
10	Deca	da	10^{-18}	Atto	a

●Hardness Conversion Table

Rockwell	Vickers harness	Brinell harness HB		Rockwell hardness		Shore harness
C-scale hardness HRC (load: 1471 N)	HV	Standard ball	Tungsten carbide ball	HRA A scale Load: 588.4N Barle indenter	HRB B scale Load: 980.7N Ball with diam .of 1/16 in.	HS
68	940	—	—	85.6	—	97
67	900	—	—	85.0	—	95
66	865	—	—	84.5	—	92
65	832	—	739	83.9	—	91
64	800	—	722	83.4	—	88
63	772	—	705	82.8	—	87
62	746	—	688	82.3	—	85
61	720	—	670	81.8	—	83
60	697	—	654	81.2	—	81
59	674	—	634	80.7	—	80
58	653	—	615	80.1	—	78
57	633	—	595	79.6	—	76
56	613	—	577	79.0	—	75
55	595	—	560	78.5	—	74
54	577	—	543	78.0	—	72
53	560	—	525	77.4	—	71
52	544	500	512	76.8	—	69
51	528	487	496	76.3	—	68
50	513	475	481	75.9	—	67
49	498	464	469	75.2	—	66
48	484	451	455	74.7	—	64
47	471	442	443	74.1	—	63
46	458	432	432	73.6	—	62
45	446	421	421	73.1	—	60
44	434	409	409	72.5	—	58
43	423	400	400	72.0	—	57
42	412	390	390	71.5	—	56
41	402	381	381	70.9	—	55
40	392	371	371	70.4	—	54
39	382	362	362	69.9	—	52
38	372	353	353	69.4	—	51
37	363	344	344	68.9	—	50
36	354	336	336	68.4	(109.0)	49
35	345	327	327	67.9	(108.5)	48
34	336	319	319	67.4	(108.0)	47
33	327	311	311	66.8	(107.5)	46
32	318	301	301	66.3	(107.0)	44
31	310	294	294	65.8	(106.0)	43
30	302	286	286	65.3	(105.5)	42
29	294	279	279	64.7	(104.5)	41
28	286	271	271	64.3	(104.0)	41
27	279	264	264	63.8	(103.0)	40
26	272	258	258	63.3	(102.5)	38
25	266	253	253	62.8	(101.5)	38
24	260	247	247	62.4	(101.0)	37
23	254	243	243	62.0	100.0	36
22	248	237	237	61.5	99.0	35
21	243	231	231	61.0	98.5	35
20	238	226	226	60.5	97.8	34
(18)	230	219	219	—	96.7	33
(16)	222	212	212	—	95.5	32
(14)	213	203	203	—	93.9	31
(12)	204	194	194	—	92.3	29
(10)	196	187	187	—	90.7	28
(8)	188	179	179	—	89.5	27
(6)	180	171	171	—	87.1	26
(4)	173	165	165	—	85.5	25
(2)	166	158	158	—	83.5	24
(0)	160	152	152	—	81.7	24

1. Lubrication

When using an LM system, it is necessary to provide effective lubrication. Without lubrication, the rolling elements or the raceway may be worn faster and the service life may be shortened.
A lubricant has effects such as the following.

① Minimizes friction in moving elements to prevent seizure and reduce wear.

② Forms an oil film on the raceway to decrease stress acting on the surface and extend rolling fatigue life.

③ Covers the metal surface to prevent rust formation.

To fully bring out an LM system's functions, it is necessary to provide lubrication according to the service conditions.
Even with an LM system with seals, the internal lubricant gradually seeps out during operation. Therefore, the system needs to be lubricated at an appropriate interval according to the service conditions.

1.1. Types of Lubricants

LM systems mainly use grease or sliding surface oil for their lubricants.
The requirements that lubricants need to satisfy generally consist of the following.

① High oil film strength
② Low friction
③ High wear resistance
④ High thermal stability
⑤ Non corrosive
⑥ Highly rust preventive
⑦ Minimal dust/water content
⑧ Consistency of grease must not be altered to a significant extent even after it is repeatedly stirred.

Lubricants that meet these requirements include the following products.

Grease Lubrication

Greasing intervals vary depending on the service conditions and service environments. For normal use, we recommend greasing the system approximately every 100 km of travel distance.

Be sure to continue using the same type of grease as initially inserted in the system. Introducing different types of grease will cause degradation in performance. Also, use only the recommended amount of grease at each lubrication interval.

Oil Lubrication

LM systems that require oil lubrication are shipped with only anticorrosive oil applied. When placing an order, specify the required lubricant oil. If the LM system is to be mounted other than in horizontal orientation, part of the raceway may be poorly lubricated. Therefore, be sure to inform us of the mounting orientation of the LM system (for details on mounting orientations, see page A-36 of the "THK General Catalog - Technical Descriptions of the Products").

- The amount of oil to be supplied varies with stroke length. For a long stroke, increase the lubrication frequency or the amount of oil so that an oil film reaches the end of stroke of the raceway.
- In environments where a liquid coolant is spattered, the lubricant will be mixed with the coolant, and this can result in the lubricant being emulsified or washed away, causing significantly degraded lubrication performance. In such settings, apply a lubricant with high viscosity (kinematic viscosity: approx. 68 cst) and high emulsification resistance, and adjust the lubrication frequency or the amount of the feed lubricant.

  For machine tools and similar devices that are subject to heavy loads and require high rigidity and operate at high speed, it is advisable to apply oil lubrication.
- Make sure that lubrication oil normally discharges from the ends of your lubrication piping, i.e., the oiling ports that connect to your LM system.

Table 1 Lubricants for General Use

Lubricant	Type	Brand name
Grease	Lithium-based grease (JIS No. 2) Urea-based grease (JIS No. 2)	*) AFB-LF Grease (THK) Albania Grease No. 2 (Showa-Shell) Daphne Exponex Grease No. 2 (Idemitsu) or equivalent
Oil	Sliding surface oil or turbine oil ISOVG32 to 68	Super Multi 32 to 68 (Idemitsu) Vactra No. 25 (ExxonMobil) DT Oil (ExxonMobil) Tonna Oil (Showa-Shell) or equivalent

For products marked with "*", see page a-10.

1.2. Lubrication under Special Environments

For use under special conditions, such as continual vibrations, clean room, vacuum, low temperature and high temperature, normal grease may not be used in some cases. For lubricants that meet such conditions, contact THK .

Table 2 Lubricants Used under Special Environments

Service environment	Lubricant characteristics	Brand name
High-speed moving parts	Grease with low torque and low heat generation	*) AFG Grease (THK) *) AFA Grease (THK) NBU 15 (NOK-KLUBER) Multemp (Kyodo Yushi) or equivalent
Vacuum	Fluorine-based vacuum grease or oil (vapor pressure varies by brand) Note 1	Fomblin Grease (Solvay Solexis) Fomblin Oil (Solvay Solexis) Barrierta IEL/V (NOK-KLUBER) Isoflex (NOK-KLUBER) Krytox (Dupont)
Clean rooms	Grease with very low dust generation	*) AFE Grease (THK) *) AFF Grease (THK) (The above vacuum grease products also applicable.)
Environments subject to microvibrations or microstrokes, which may cause fretting corrosion	Grease that easily forms an oil film and has high fretting resistance	*) AFC Grease (THK)
Environments subject to a spattering coolant such as machine tools	Highly anticorrosive, refined mineral oil or synthetic oil that forms a strong oil film and is not easily emulsified or washed away by coolant Water-resistant grease Note 2	Super Multi 68 (Idemitsu) Vactra No 25 (ExxonMobil) or equivalent
Mist lubrication	Oil that can easily be atomized and offers superb lubricity.	

For items marked with "*", see pages a-10 to a-18.

Note 1: When using a vacuum grease, be sure that some brands have starting resistances several times greater than ordinary lithium-based greases.

Note 2: In an environment subject to a spattering water-soluble coolant, some brands of intermediate viscosity significantly decrease their lubricity or do not properly form an oil film. Check the compatibility between the lubricant and the coolant.

Note 3: Do not mix greases with different physical properties.

1.3. Lubrication Methods

There are roughly three methods of lubricating LM systems: manual lubrication using a grease gun or manual pump; forced lubrication using an automated pump; and oil-bath lubrication.

Manual Lubrication

Generally, grease is replenished periodically, fed through a grease nipple provided on the LM system, using a grease gun (Fig. 1).

For systems that have many locations to be lubricated, establish a centralized piping system and periodically provide grease from a single point using a manual pump (Fig. 2).

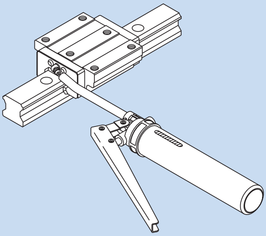


Fig. 1 Lubrication using a Grease Gun

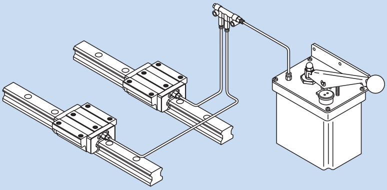


Fig. 2 Lubrication through a Centralized Piping System

Note 1: When a centralized piping system is used, lubricant may not reach the pipe end due to the viscous resistance inside the pipe. Select the right type of grease while taking into account the consistency of the grease and the pipe diameter.

Forced Lubrication

In this method, a given amount of lubricant is forcibly fed at a given interval. Normally, the lubricant is not collected after use (Fig. 3).

Although a special lubrication system using a piping or the like needs to be designed, this method reduces the likelihood of forgetting to replenish lubricant.

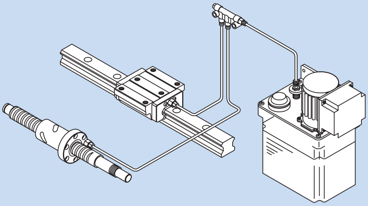


Fig. 3 Forced Lubrication Method

● THK Mist Lubrication

Unlike conventional mist lubrication, THK Mist Lubrication feeds micron-size lubricant mist in a constant and accurate rate through electronic control. Therefore, the interior of LM blocks and Ball Screws are uniformly lubricated. Such electronic control minimizes the adverse effects of oil temperature, ambient temperature and viscosity that are common in conventional mist lubrication. Leakage to the atmosphere is minimal as well. Also the mist and air cool the subject system and thus inhibit heat generation resulting from high-speed motion. Since coolant and other contaminants are unlikely to invade the lubrication unit, THK Mist Lubrication is highly suitable in harsh environments (Fig. 4).

Note 2: Some types of lubricant are difficult to atomize. Contact THK for details.

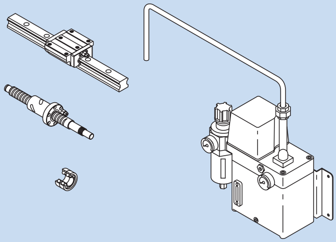


Fig. 4 Mist Lubrication

● THK Grease Gun Unit MG70

Grease Gun Unit MG70 is capable of lubricating small to large types of LM Guides by replacing dedicated nozzles. For small LM Guides, MG70 is provided with dedicated attachments. The user can select from these attachments according to the model number and the installation space.
MG70 has a slit window, allowing the user to check the remaining amount of grease.
It is equipped with a bellows-type cartridge that can hold 70 g of grease and is replaceable. It supports a wide range of grease products, including AFA Grease, AFB-LF Grease, AFC Grease and AFE Grease, to meet varied service conditions. This enables you to make a selection according to the area requiring grease (see pages A-117 to 125).

Table 3 Specifications of the Grease Gun

Discharge pressure	19.6 MPa max
Discharge rate	0.6 cc/stroke
Grease	70-g bellows cartridge
Overall length	235 mm (excluding the nozzle)
Weight	480 g (including the nozzle; excluding grease)

Table 4 Supported Model Numbers

Type N	LM Guides···Models SSR15, SHS15, SR15, HSR12, HSR15, CSR15, HRW17, GSR15, RSR15, RSH15, HCR12 and HCR15 Cam Followers···Models CF, CFN and CFH Rod Ends···Models PHS5 to 22, RBH and POS8 to 22
Type P	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type L	Models HSR8, HSR10, HRW12, HRW14, RSR12 and RSH12
Type H	LM Guides (models with grease nipple M6F or PT1/8) Ball Screws Rod Ends···Models PHS25, PHS30, POS25 and POS30

Note: Types P and L are also capable of greasing less accessible areas other than the model numbers above (by dropping grease on the raceway).

Grease Gun Unit MG70

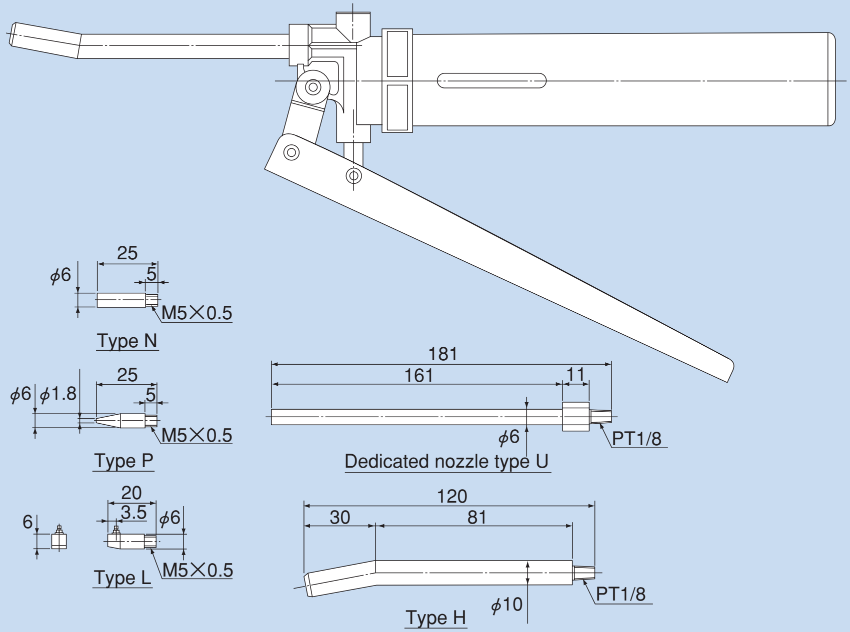
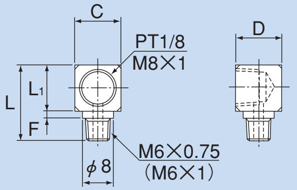


Fig. 5 Grease Gun Unit MG70

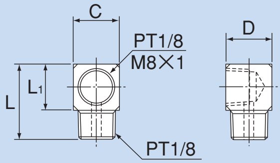
1.4. Accessories for Lubrication

Special Plumbing Fixtures

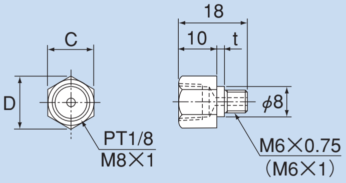
For centralized greasing and oil lubrication, special plumbing fixtures are available from THK . When ordering an LM system, specify the model number, mounting orientation and piping direction. We will ship the LM system attached with the corresponding fixture.



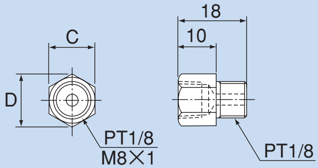
LF-A (PT1/8) L=20, L_1=12, F=2, C=12, D=12
LF-B (M8 x 1) L=18.5, L_1=10, F=2.5, C=9.5, D=18
(LF-E (PT1/8): the same size with LF-A; mounting screw: M6 x 1)



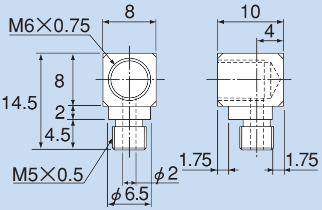
LF-C (PT1/8) L=20, L_1=12, C=12, D=12
LF-D (M8 x 1) L=18, L_1=10, C=10, D=18



SF-A (PT1/8) t=2, C=12, D=13.8
SF-B (M8 x 1) t=2, C=10, D=11.5
(SF-E (PT1/8): the same size with SF-A; mounting screw: M6 x 1)



SF-C (PT1/8) C=12, D=13.8
SF-D (M8x1) C=10, D=11.5

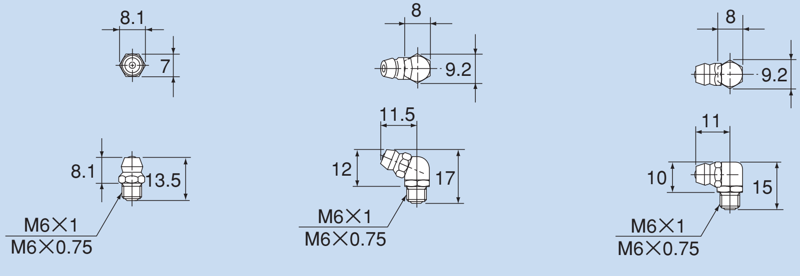


LD (M6 x 0.75)

Fig. 6 Special Plumbing Fixtures

Grease Nipples

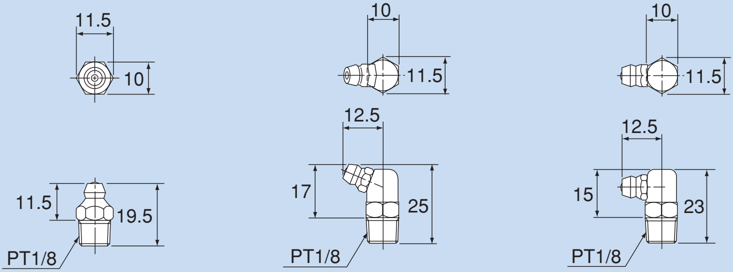
THK provides various types of grease nipples needed for the lubrication of LM systems.



A-MT6 x 1 (M6 x 1)
A-M6F (M6 x 0.75)

B-MT6 x 1 (M6 x 1)
B-M6F (M6 x 0.75)

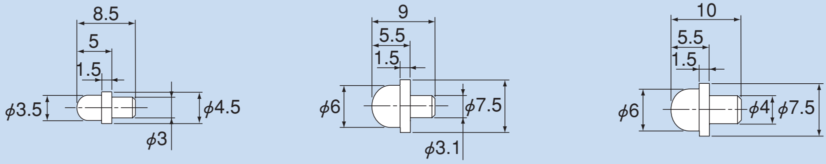
C-MT6 x 1 (M6 x 1)
C-M6F (M6 x 0.75)



A-PT1/8

B-PT1/8

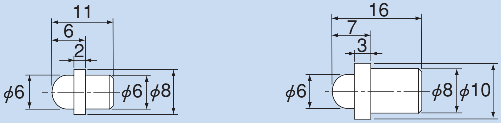
C-PT1/8



PB107

NP3.2 x 3.5

PB1021B



NP6 x 5

NP8 x 9

Fig. 7 Grease Nipples

1.5. THK Original Grease

AFA Grease

AFA Grease is a high-grade, long-life grease developed with a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

●Features

① Long service life

Unlike ordinary metal soap-based greases, AFA Grease excels in anti-oxidation stability and therefore can be used for a long period of time.

② Wide temperature range

The lubricating performance remains high over a wide range of temperatures from -45°C to +160°C. Even at low temperatures, AFA Grease requires only a low starting torque.

③ High water resistance

AFA Grease is less vulnerable to moisture penetration than other types of grease.

④ High mechanical stability

AFA Grease is not easily softened even when used for a long period of time.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration		285	JIS K 2220 5.3
Dropping point		261	JIS K 2220 5.4
Copper plate corrosion		Accepted	JIS K 2220 5.5
Evaporation		0.2	JIS K 2220 5.6
Oil separation rate		0.5	JIS K 2220 5.7
Stability of oxidation		0.08	JIS K 2220 5.8
Mixing stability		329	JIS K 2220 5.11
Resistance to removal of grease during the water rinse		0.6	JIS K 2220 5.12
Low-temperature torque	Start	0.17	JIS K 2220 5.14
	Rotation	0.07	
Anticorrosive test		Accepted	ASTM D1743
Service temperature range		−45～160	—

AFB-LF Grease

AFB-LF Grease is a general-purpose grease developed with a lithium-based consistency enhancer using refined mineral oil as the base oil. It excels in extreme pressure resistance and mechanical stability.

●Features

① High extreme pressure resistance

Compared with lithium-based greases available on the market, AFB-LF Grease has higher wear resistance and outstanding resistance to extreme pressure.

② High mechanical stability

AFB-LF Grease is not easily softened and demonstrates excellent mechanical stability even when used for a long period of time.

③ High water resistance

AFB-LF Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

●Representative Physical Properties

Test item	Representative value	Test method
Worked penetration	275	JIS K 2220 5.3
Dropping point	193	JIS K 2220 5.4
Copper plate corrosion	Accepted	JIS K 2220 5.5
Evaporation	0.36	JIS K 2220 5.6
Oil separation rate	0.6	JIS K 2220 5.7
Stability of oxidation	0.015	JIS K 2220 5.8
Mixing stability	335	JIS K 2220 5.11
Timken load capacity	45	JIS K 2220 5.16
Resistance to removal of grease during the water rinse	1.8	JIS K 2220 5.12
Anticorrosive test	Accepted	ASTM D1743
Service temperature range	−15～100	—

AFC Grease

AFC Grease has high fretting-corrosion resistance due to a special additive and a urea-based consistency enhancer using a high-grade synthetic oil as the base oil.

●Features

① High fretting-corrosion resistance

AFC Grease is designed to be highly effective in preventing fretting corrosion.

② Long service life

Unlike ordinary metal soap-based greases, AFC Grease excels in anti-oxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

③ Wide temperature range

Since a high-grade synthetic oil is used as the base oil, the lubricating performance remains high over a wide range of temperatures from -54℃ to +177℃.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration		288	JIS K 2220 5.3
Dropping point		269	JIS K 2220 5.4
Copper plate corrosion		Accepted	JIS K 2220 5.5
Evaporation		7.9	JIS K 2220 5.6
Oil separation rate		2	JIS K 2220 5.7
Stability of oxidation		0.065	JIS K 2220 5.8
No. of contaminants, pieces/cm³	25 - 75 µm	370	JIS K 2220 5.9
	75 µm or more	0	
Mixing stability (100,000 W)		341	JIS K 2220 5.11
Resistance to removal of grease during the water rinse		0.6	JIS K 2220 5.12
Low-temperature torque	Start	0.63	JIS K 2220 5.14
	Rotation	0.068	
Anticorrosive test		Accepted	ASTM D1743
Vibration test		Accepted	–
Service temperature range		−54～177	–

●Test Data on Fretting-corrosion Resistance

Due to its superior ingredients (urea-based consistency enhancer), high-grade synthetic oil and a special adhesive, AFC Grease provides high fretting-corrosion resistance.

The test data in Fig. 8 on page a-12 shows the result of comparing AFG Grease with an ordinary bearing grease.

Test conditions	
Item	**Description**
Stroke	3mm
No. of strokes per min	200min^{-1}
Total No. of strokes	2.88×10^{5} (24 hours)
Surface pressure	1118MPa
Amount of fed grease	12 g/LM block (replenished every 8 hours)

●Comparison of Raceway Conditions

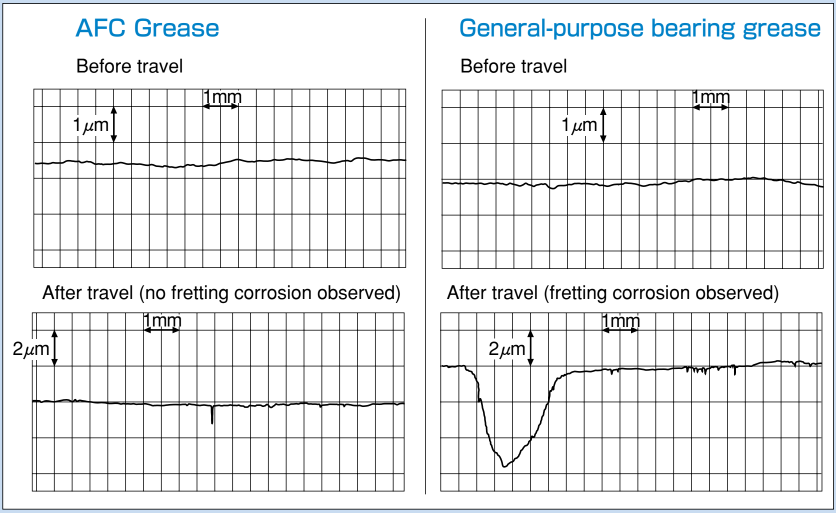


Fig. 8 Test Data on AFC Grease

AFE Grease

AFE Grease uses urea as a consistency enhancer and a high-grade synthetic oil as the base oil. It has low dust-generative characteristics and is therefore a suitable grease for clean room environments.

●Features

① Low dust generation

Compared with vacuum greases in conventional use, AFE Grease generates less dust and therefore is ideal for use in clean rooms.

② Long service life

Unlike ordinary metal soap-based greases, AFE Grease excels in anti-oxidation stability and therefore can be used for a long period of time. As a result, maintenance work is reduced.

③ Wide temperature range

The lubricating performance remains high over a wide range of temperatures from -40℃ to +200℃.

④ High chemical stability

AFE Grease has high resistance to chemicals, NOX and radiation.

●Representative physical properties

Test item	Representative value	Test method
Appearance	Light brown, viscous	–
Consistency enhancer	Urea	–
Base oil	Synthetic oil	–
Worked penetration	280	JIS K 2220 5.3
Dropping point	260<	JIS K 2220 5.4
Oil separation rate	1.8	JIS K 2220 5.7
Stability of oxidation	10 (0.1)	JIS K 2220 5.8
Bearing rust prevention	#1	ASTM D1743
Base oil kinematic viscosity	12.8 (12.8)	–
Service temperature range	−40～200	–

●Test Data on Low Dust Generation

Due to its high chemical stability and superior ingredients (urea-based consistency enhancer and high-grade synthetic oil), AFE Grease generates little dust. The test data in Fig. 9 on page a-14 shows the result of comparing dust accumulation between AFG Grease with another grease.

Test conditions	
Item	Description
Sample model No.	THK KR4610
Screw Ball rotational speed	1000min^{-1}
Strokes	210mm
Amount of fed grease	2 cc in both the Ball Screw and the LM Guide
Flow rate during measurement	1 ℓ/min
Measuring instrument	Dust counter
Dust particle diameter	0.5μm

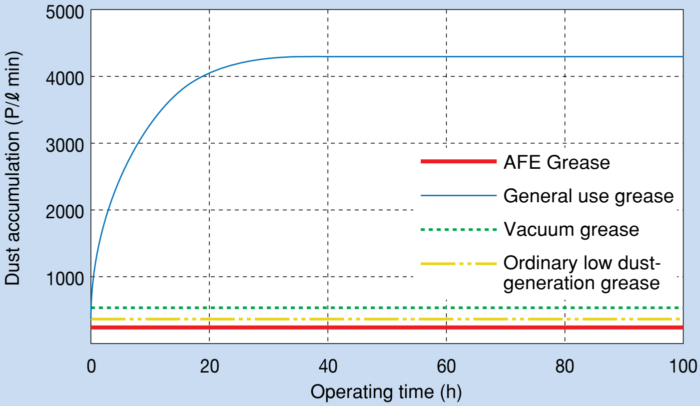


Fig. 9 Test Data on Dust Generation with AFE Grease

AFF Grease

AFF Grease uses a high-grade synthetic oil, lithium-based consistency enhancer and a special additive. It achieves stable rolling resistance, low dust generation and high fretting-corrosion resistance, at a level that conventional vacuum greases or low dust-generation greases have not reached.

●Features

① Stable rolling resistance

Since the viscous resistance is low, the rolling resistance fluctuation is also low. Thus, superb conformity is achieved at low speed.

② Low dust generation

AFF Grease generates little dust, making itself and ideal grease for use in clean rooms.

③ Fretting-corrosion resistance

Since AFF Grease is highly resistant to wear from microvibrations, it allows the lubrication interval to be extended.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration		315	JIS K 2220 5.3
Dropping point		216	JIS K 2220 5.4
Copper plate corrosion		Accepted	JIS K 2220 5.5
Evaporation		0.43	JIS K 2220 5.6
Oil separation rate		0.57	JIS K 2220 5.7
Stability of oxidation		39	JIS K 2220 5.8
No. of contaminants, pieces/cm^3	25 μm or more	0	JIS K 2220 5.9
	75 μm or more	0	
	125 μm or more	0	
Mixing stability (100,000 W)		329	JIS K 2220 5.11
Low temperature torque	Start	0.22	JIS K 2220 5.14
	Rotation	0.04	
Apparent viscosity		3400	JIS K 2220 5.15
Timken load capacity		88.2	JIS K 2220 5.16
4-ball testing (burn-in load)		3089	ASTM D2596
Fretting-corrosion resistance		3.8	ASTM D4170 compliant
Bearing rust prevention		#1	ASTM D1743
Service temperature range		−40～120	—

●Rolling Resistance Characteristics at Low Speed

The data in Fig. 10 on page a-16 represent the test results of comparing rolling resistances at low speed between AFF Grease and other greases.

Test conditions

Item	Description
Model No.	HSR35RC0+440LP
Grease quantity	4 cm^3/LM block (initial lubrication only)
Feed speed	1mm/s
Stroke	3mm

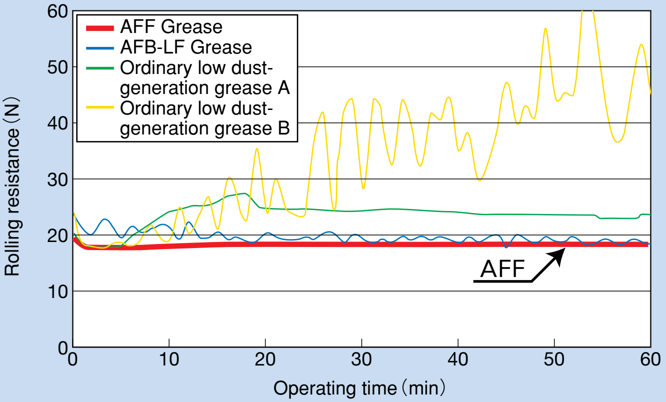


Fig. 10 Rolling Resistance at Low Speed

AFG Grease

THK AFG Grease is a high-grade grease for Ball Screws that uses a high-grade synthetic oil as the base oil and a urea-based consistency enhancer. It excels in low heat generation and supports a wide temperature range from low to high temperature.

●Features

① Low heat generation

Since the viscous resistance is low, the grease generates only a minimal level of heat even during high-speed operation.

② Low viscosity

Since the viscosity is low, a stable rotation torque is achieved.

③ Wide temperature range

Maintains a high level of lubricity in a wide temperature range of -45℃ to +160℃.

④ Long service life

AFG Grease is not easily softened and excels in stability in oxidation even after a long-term operation.

⑤ Water resistance

AFG Grease is a highly water resistant grease that is less vulnerable to moisture penetration and little decreases resistance to extreme pressure.

●Representative Physical Properties

Test item		Representative value	Test method
Worked penetration		285	JIS K 2220 5.3
Dropping point		261	JIS K 2220 5.4
Copper plate corrosion		Accepted	JIS K 2220 5.5
Evaporation		0.2	JIS K 2220 5.6
Oil separation rate		0.5	JIS K 2220 5.7
Stability of oxidation		0.029	JIS K 2220 5.8
Mixing stability (100,000 W)		329	JIS K 2220 5.11
Resistance to removal of grease during the water rinse		0.6	JIS K 2220 5.12
Low-temperature torque	Start	0.439	JIS K 2220 5.14
	Rotation	0.049	
Anticorrosive test		1,1,1	ASTM D1743
Service temperature range		−45～160	—

Test data on heat generation	
Item	Description
Shaft diameter	32/10mm
Feed speed	67～500mm/s
Shaft rotation speed	400～3000min^{-1}
Stroke	400mm
Grease quantity	12cm^3
Temperature measurement point	Nut circumference

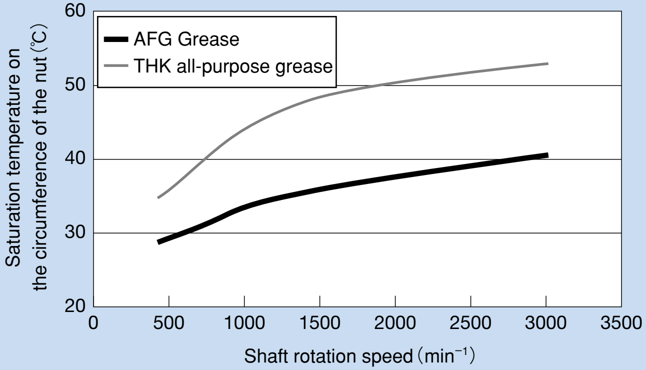


Fig. 11 Test Data on Heat Generation with AFG Grease

Model number coding

AFA Grease, AFB-LF Grease, AFC Grease,
AFE Grease, AFF Grease and AFG Grease

AFC+400
1 2

1 Type of grease 2 Cartridge capacity (400 g / 70 g)

- ●Type of packing: bellows cartridge
- ●Cartridge grease content

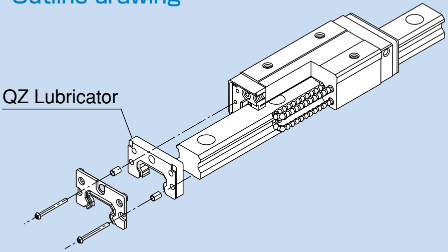
Grease capacity	AFA Grease	AFB-LF Grease	AFC Grease	AFE Grease	AFF Grease	AFG Grease
400g	○	○	○	○	○	○
70g	○	○	○	○	○	○

1.6. QZ Lubricator™ for the LM Guide®

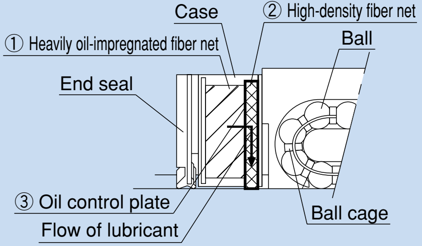
QZ Lubricator feeds the right amount of lubricant to the ball raceway on the LM rail. This allows an oil film to continuously be formed between the balls and the raceway, and drastically extends the lubrication and maintenance intervals.

The structure of QZ Lubricator consists of three major components: ① a heavy oil-impregnated fiber net (function to store lubricant), ② a high-density fiber net (function to apply lubricant to the raceway) and ③ an oil-control plate (function to adjust oil flow). The lubricant contained in QZ Lubricator is fed by the capillary phenomenon, which is used also in felt pens and many other products, as the fundamental principle.

Outline drawing



Structural drawing



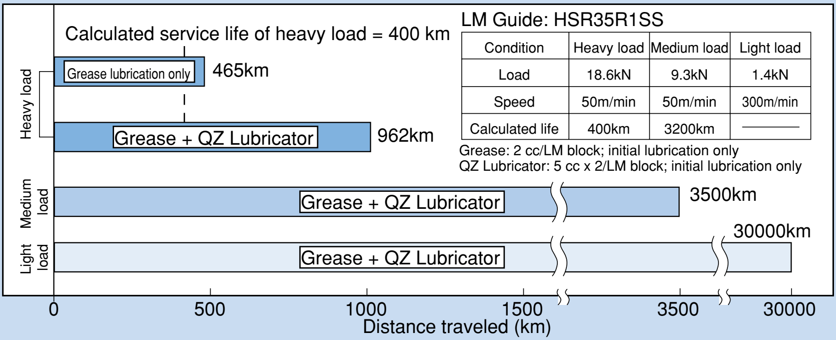
Features

- ●Supplements lost oil to drastically extend the lubrication/maintenance interval.
- ●Eco-friendly lubrication system that does not contaminate the surrounding area since it feeds the right amount of lubricant to the ball raceway.
- ●The user can select a type of lubricant that meets the intended use.

Note: For models that support QZ Lubricator, see the sections corresponding to the model numbers in the "THK General Catalog - Product Specifications," provided separately.

■Significant Extension of the Maintenance Interval

Attaching QZ Lubricator helps extend the maintenance interval throughout the whole load range from the light-load area to the heavy-load area.



LM Guide: HSR35R1SS

Condition	Heavy load	Medium load	Light load
Load	18.6kN	9.3kN	1.4kN
Speed	50m/min	50m/min	300m/min
Calculated life	400km	3200km	―――

Grease: 2 cc/LM block; initial lubrication only
QZ Lubricator: 5 cc x 2/LM block; initial lubrication only

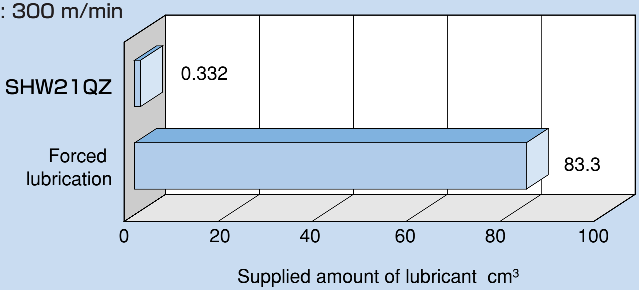
LM Guide Running Test without Replenishment of Lubricant

Effective Use of Lubricant

Since the lubricator feeds the right amount of lubricant to the ball raceway, lubricant can be used efficiently.

[Test conditions] speed: 300 m/min

Comparison of lubricant consumption after traveling 5,000 km



Amount of oil contained in QZ Lubricator
0.166 cm³ x 2 units (attached to both ends of the LM block)
= 0.332 cm³

Compared

Forced lubrication
0.03cm³/6min×16667min
=83.3cm³

Lubricant consumption is 1/250 less than forced lubrication.

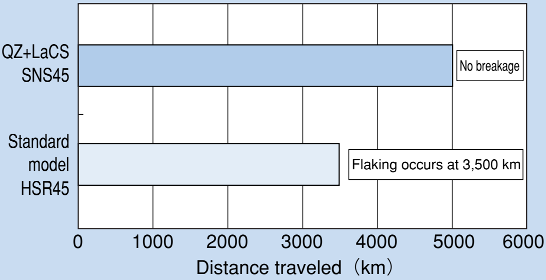
Effective in Helping Lubrication under Harsh Environments

A 5,000 km durability test was conducted under harsh environments (containing coolant and foreign matter).

[Test conditions]

Model No.	SNS45	HSR45
Load	8kN	6kN
Speed	60m/min	
Coolant	Immersed 48 hrs, dried 96 hrs	
Foreign matter	Foundry dust (125 μm or less)	
Lubrication	AFA Grease + QZ	Super Multi 68 Oiling cycle: 0.1cc/shot Periodically lubricated every 16 min

[Test result]



* When using the LM system under harsh environment, use QZ Lubricator and Laminated Contact Scraper LaCS (see page A-134) in combination.

2. Corrosion Prevention

2.1. Determining a Material

Any LM system requires a material that meets the service conditions. For use in environments where corrosion resistance is required, some LM system models can use martensitic stainless steel.

(Martensitic stainless steel can be used for LM Guide models SSR, SHW, SRS, HSR, SR, HR, HRW, RSR, RSR-Z, RSH and RSH-Z.)

The HSR series includes HSR-M2, a highly corrosion resistant LM Guide using austenitic stainless steel, which has high anti-corrosive effect. For details, see page a-328 of the "THK General Catalog - Product Specifications," provided separately.

2.2. Surface Treatment

The surfaces of the rails and shafts of LM systems can be treated for anti-corrosive or esthetic purposes.
THK offers THK -AP treatment, which is the optimum surface treatment for LM systems. The THK -AP treatment consists of the following 3 types.

AP-CF

A compound surface treatment that combines black chrome film coating and special fluorine resin coating and is suitable for applications requiring high corrosion resistance.

AP-C

A type of industrial-use black chrome film coating designed to increase corrosion resistance. It achieves lower cost and higher corrosion resistance than martensitic stainless steel.

AP-HC

Equivalent to industrial-use hard chrome plating, AP-HC achieves almost the same level of corrosion resistance as martensitic stainless steel.
In addition, it is highly wear resistant since the film hardness is extremely high, 850 HV or higher.

In addition to the above treatments, other surface treatments are sometimes performed on areas other than the raceways, such as alkali coloring treatment (black anodization) and color alumite treatment. However, some of them are not suitable for LM systems. For details, contact THK .
If using an LM system whose raceways are surface-treated, set a higher safety factor.

Model number coding

SR15 V 2 F + 640L F
1 2 3 4 5 6

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With surface treatment on the LM block* 5 LM rail length (in mm) 6 With surface treatment on the LM rail*
* Specify the type of the surface treatment when placing an order.

3. Dust Prevention

When foreign matter enters an LM system, it will cause abnormal wear or shorten the service life, and it is necessary to prevent foreign matter from entering the system. Therefore, when possible entrance of foreign matter is predicted, it is important to select an effective sealing device or dust-prevention device that meets the atmospheric conditions.

THK offers dust prevention accessories for LM Guides by model number, such as end seals made of special synthetic rubber with high wear resistance, and side seals and inner seals for further increasing dust-prevention effect.

In addition, for locations with adverse atmosphere, Laminated Contact Scraper LaCS and dedicated bellows are available by model number. Also, THK offers dedicated caps for LM rail mounting holes, designed to prevent cutting chips from entering the LM rail mounting holes.

When it is required to provide dust prevention for a Ball Screw in an atmosphere exposed to cutting chips and moisture, we recommend using a telescopic cover that protects the whole system or a large bellows.

3.1. Dust Prevention Accessories

THK offers various dust prevention accessories.

Dedicated Caps for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap.

Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

Different sizes of the dedicated cap C are in stock as standard for hexagon socket bolts of M3 to M22.

To attach the dedicated cap to the mounting hole, place a flat metal piece like one shown in Fig. 1 on the cap and gradually hammer in the cap until it is on the same level as the top face of the LM rail.

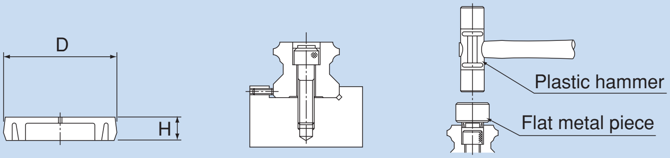


Fig. 1 Cap C

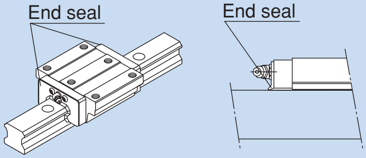
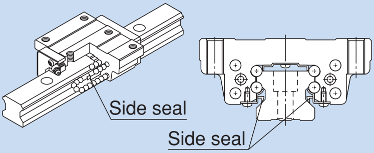
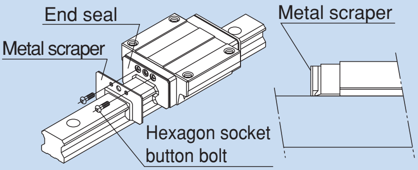
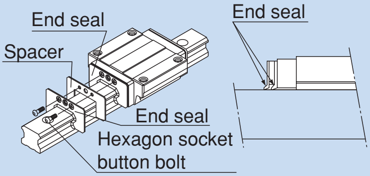
Note: When attaching the dedicated cap C for LM rail mounting holes, do not remove any of the LM blocks from the LM rail.

Table 1 List of Model Numbers Supported for the Dedicated Cap C for LM Rail Mounting Holes

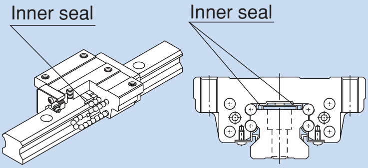
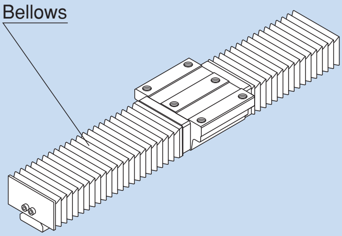
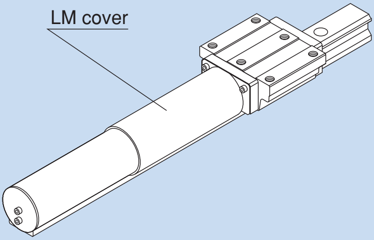
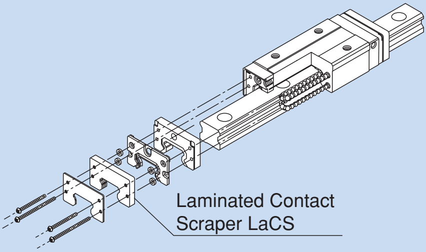
Model No.	Supported model No.											
	SSR	SR	SNR SNS	NR NRS	SHS, HSR CSR, HCR	SHW HRW	SRG SRN	GSR	HR	SRS RSR RSH	SRS-W RSR-W RSH-W	NSR-TBC
C3	—	15	—	—	12	—	—	—	1123 1530	12 15	9	—
C4	15Y	—	—	—	15	12, 14, 17, 21, 27,	—	15	—	—	—	—
C5	20	20	25	25X	20	—	—	20	2042	20	—	20
C6	25Y 30	25Y 30	30	30	25	35	25	25	—	25	—	25 30
C8	35	35	35	35	30 35	50	30 35	30	2555 3065	—	—	40
C10	—	45	—	—	—	60	—	35	3575	—	—	50
C12	—	55	45	45	45	—	45	—	4085	—	—	70
C14	—	—	55	55	55	—	55	—	—	—	—	—
C16	—	70 85	65	65	65	—	65	—	50105	—	—	—
C22	—	—	—	85	85	—	—	—	—	—	—	—

Seals, Scrapers and Bellows

The following dust prevention accessories are also available.

Item name	Schematic diagram / mounting location	Purpose/location of use
End seal		Used in locations exposed to dust
Side seal		Used in locations where dust may enter the LM block from the side or bottom surface, such as vertical, horizontal and inverted mounts
Metal scraper		Used in locations where welding spatter may adhere to the LM rail
Double seals		Used in locations exposed to much dust or many cutting chips

Note: Some of the dust prevention accessories cannot be used depending on the LM Guide model. For details, see the sections on the subject model.

Item name	Schematic diagram / mounting location	Purpose/location of use
Inner seal		Used in locations severely exposed to dust or cutting chips
Dedicated bellows		Used in locations exposed to dust or cutting chips
Dedicated LM cover		Used in locations exposed to dust or cutting chips Used in locations where high-temperature foreign matter such as spatter flies
Laminated Contact Scraper LaCS		Used in harsh environments exposed to foreign matter such as fine dust and liquids

Note: For details of dust prevention accessories, see the sections on the corresponding model numbers.

Plate Cover SV and Steel Tape SP

To increase the dust preventive capability of an LM Guide, it is necessary to increase sealability of the end seals and prevent foreign matter, such as cutting chips and dust, and a coolant from penetrating through the LM rail mounting holes. THK 's plate cover and steel tape outperform conventional bolt hole plugs in the following properties.

① Drastically increased workability (long-size)

② Drastically increased sealability

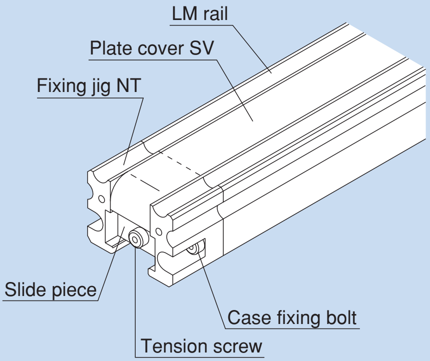
●The plate cover, made of a thin steel sheet, is secured with a tension given using a fixing jig.

●The steel tape, consisting of a thin steel sheet with an adhesive tape, is affixed using the adhesive tape and secured with end pieces on both ends.

The plate cover is available only for models SNR/SNS (35 to 65 and NR/NRS (35 to 100). The steel tape is available for small models SNR/SNS, SHS and NR/NRS as well as models HSR and SR.

●Plate Cover SV

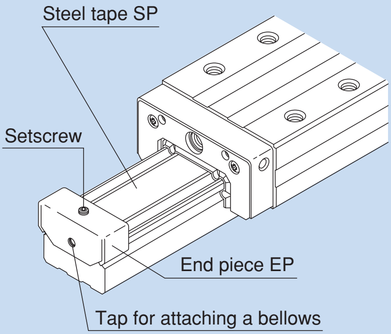
●Secured with fixing jig NT
(for SNR/SNS35 to 65)
(for NR/NRS35 to 100)



●Plate cover: SV
●Fixing jig : NT

●Steel Tape SP

●Secured with adhesive tape + end piece
(for SNR/SNS25 to 65)
(for NR/NRS25 to 100)
(for HSR15 to 100)
(for SR15 to 70)
(for SHS15 to 65)



●Steel tape: SP
●End piece : EP

■Plate Cover SV

For models SNR/SNS and NR/NRS, plate covers are available as an essential means of dust prevention for machine tools. By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the plate cover SV drastically increases sealability, thus to prevent the penetration of a coolant or cutting chips, which previously could not be stopped from entering the mounting holes.

Mounting procedure

① Attach slide pieces to the plate cover.
Place the slide pieces on the plate cover with their chamfered sides facing outward, hold the plate cover with the slide pieces and the securing plates, and then secure them with countersunk screws.

② Use an LM block mounting/removing jig to remove the LM block from the LM rail, and then mount the fixing jigs onto the LM rail.
Identify the positions of the mounting holes on the fixing jigs, then secure the jigs with hexagon socket bolts.

③ Temporarily secure either slide piece.
Insert either slide piece into one of the fixing jigs, then attach the slide piece to the LM rail's end face using the tension adjustment bolt and gently secure the bolt until the bolt head is inside the fixing jig.

④ Temporarily secure the other slide piece.
Temporarily secure the other slide piece in the same manner as above.

⑤ Apply tension to the plate cover.
Apply tension to the plate cover by evenly securing the tension adjustment bolts on both ends of the LM rail. Make sure there is only a small difference between the H and H' dimensions in Fig. 6. If the difference is too large, there may be no interference left on either end.

⑥ Mount the LM block on the LM rail.
Identity the datum planes of the LM rail and the LM block, then insert the LM rail into the LM block using the LM block mounting /removing jig.

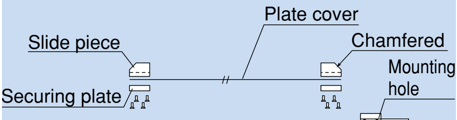


Fig. 2

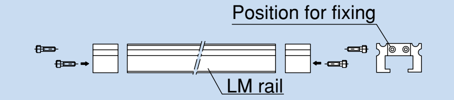


Fig. 3

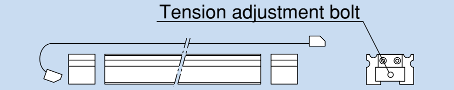


Fig. 4

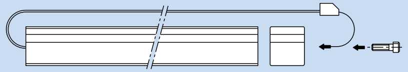


Fig. 5

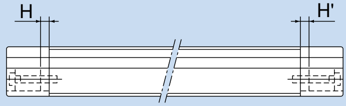


Fig. 6

Note 1: When removing or the mounting the LM block, use much care not to let the balls fall off.

Note 2: The plate cover is an ultra thin stainless steel (SUS304) plate. When handing it, use much care not to bend it.

Note 3: The plate cover is available for models SNR/SNS35 to 65 and models NR/NRS35 to 100.

■Steel Tape SP

By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the steel tape SP further increases sealability, thus to prevent the penetration of a coolant or cutting chips, which previously could not be stopped from entering the mounting holes (when mounting the steel tape, end piece EP can be used as a means to secure the cover).

Mounting procedure

① Use an LM block mounting/removing jig to remove the LM block from the LM rail.

② Thoroughly degrease and clean the top face of the LM rail, to which the steel tape is to be adhered. For degreasing, use an adequately volatile detergent (e.g., industrial alcohol).

③ Carefully adhere the steel tape from the end with care not to let it bend or sag, while gradually peeling the release paper from the steel tape.

④ Have the steel tape settle on the rail by rubbing the tape. The adhesive strength increases with time. The adhering tape can be peeled off by pulling its end upward.

⑤ Mount the LM block onto the LM rail using the LM block mounting/removing jig.

⑥ Attach the end pieces on both ends of the LM rail and further secure the steel tape. When securing the end pieces, fasten only the setscrew on the top face of each end piece.
(The tap on the end face of the end piece is used for mounting a bellows.)

Note 1: The setscrew on the side face is used to lightly secure the bent steel tape. Be sure to stop fastening the screw as soon as it hits the end face, and do not force the screw further.

Note 2: Since the steel tape is a thin steel plate, mishandling it may cause an accident such as cutting your finger. When handling it, take an effective safety measure such as wearing rubber gloves.

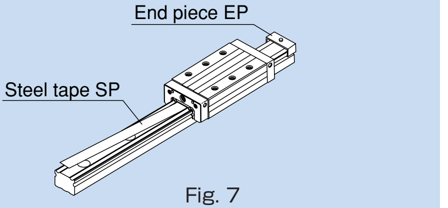


Fig. 7

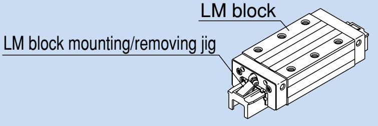


Fig. 8

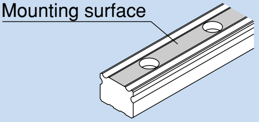


Fig. 9

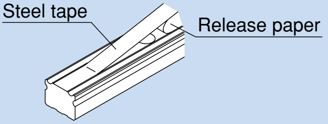


Fig. 10

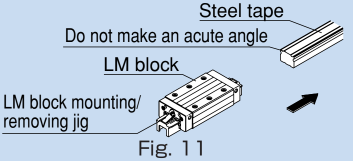


Fig. 11

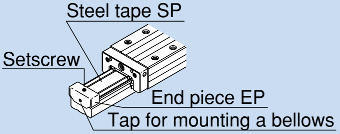
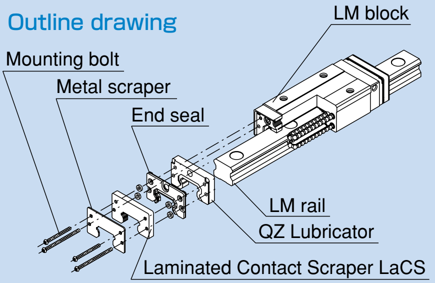


Fig. 12

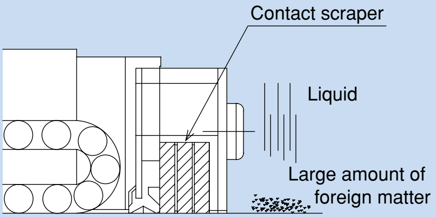
3.2. Laminated Contact Scraper LaCS® for the LM Guide®

LaCS removes minute foreign matter adhering to the LM rail in multiple stages and prevents it from entering the LM block with laminated contact structure (3-layer scraper).

Outline drawing



Structural drawing



Features

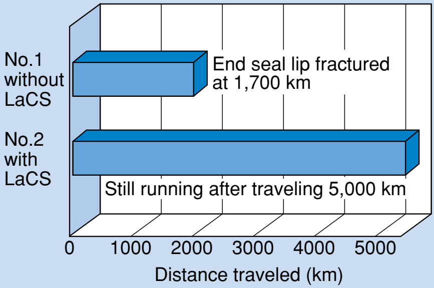
- ●Since the 3 layers of scrapers fully contact the LM rail, LaCS is highly capable of removing minute foreign matter.
- ●Since it uses oil-impregnated, foam synthetic rubber with a self-lubricating function, low friction resistance is achieved.

■Test under an Environment with a Water-soluble Coolant

[Test conditions] Test environment: water-soluble coolant

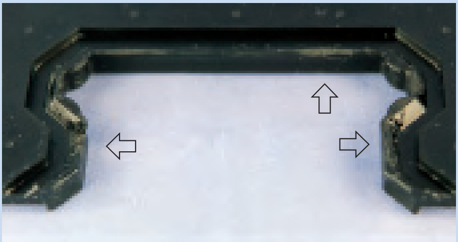
Item		Description
Tested model	No.1	SHS45R1SS+3000L (end seal only)
	No.2	SHS45R1SSHH+3000L (end seal and LaCS)
Max speed		200m/min
Environmental conditions		Coolant sprayed: 5 times per day

[Test result]



Magnified view of the end seal lip

No. 1: without LaCS; lip fractured at 1,700 km



⇦Areas marked with arrow are fractured

No. 2: with LaCS; no anomaly observed after traveling 5,000 km

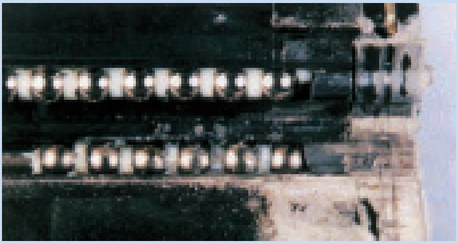
Lip has not been fractured

Test under an Environment with Minute Foreign Matter

[Test conditions] Test environment: minute foreign matter

Item		Description
Tested model	No. 1	SNR45R1DD+600L (double seals only)
	No. 2	SNR45R1HH+600L (LaCS only)
Max speed/acceleration		60m/min、1G
External load		9.6kN
Foreign matter conditions		Type:FCD450#115(particle diameter: 125 μm or less)
		Sprayed amount:1g/1hour (total sprayed amount: 120 g)

No. 1 Traveled 100 km (double-seal configuration)



Large amount of foreign matter has entered the ball raceway

[Test result] Amount of foreign matter entering the raceway

Seal configuration		Amount of foreign matter entering the raceway g
Double-seal configuration (2 end seals superposed with each other)	Tested model 1	0.3
	Tested model 2	0.3
	Tested model 3	0.3
LaCS	Tested model 1	0
	Tested model 2	0
	Tested model 3	0

No. 2 Traveled 100 km (LaCS only)

No foreign matter entering the ball raceway observed

4. Rigidity

4.1. Selecting a Radial Clearance (Preload)

Since the radial clearance of an LM Guide greatly affects the running accuracy, load carrying capacity and rigidity of the LM Guide, it is important to select an appropriate clearance according to the application. In general, selecting a negative clearance (i.e., a preload* is applied) while taking into account possible vibrations and impact generated from reciprocating motion favorably affects the service life and the accuracy.
For specific radial clearances, contact THK. We will help you select the optimal clearance according to the service conditions.
The clearances of all LM Guide models (except model HR, GSR and GSR-R, which are separate types) are adjusted as specified before shipment, and therefore they do not need further preload adjustment.

Table 1 Types of Radial Clearance

	Radial Clearance		
	Normal clearance	Clearance C1 (light preload)	Clearance C0 (moderate preload)
Service conditions	●The loading direction is fixed, impact and vibrations are minimal and 2 rails are installed in parallel. ●Very high precision is not required, and the sliding resistance must be as low as possible.	●An overhang load or moment load is applied. ●LM Guide is used in a single-rail configuration. ●Light weight and high accuracy are required.	●High rigidity is required and vibrations and impact are applied. ●Heavy-cutting machine tool
Sample applications	Beam-welding machine, bookbinding machine, automatic packaging machine, XY axes of general industrial machinery, automatic sash-manufacturing machine, welding machine, flame cutting machine, tool changer, material feeder	Grinding machine table feed axis, automatic coating machine, industrial robot, high-speed material feeder, NC drilling machine, vertical axis of general industrial machinery, printed circuit board drilling machine, electric discharge machine, measuring instrument, precision XY table	Machining center, NC lathe, grinding stone feed axis of grinding machine, milling machine, vertical/horizontal boring machine, tool rest guide, vertical axis of machine tool

* Preload is an internal load applied to the rolling elements (balls, rollers, etc.) of an LM block in advance in order to increase its rigidity.

4.2. Service Life with a Preload Considered

When using an LM Guide under a moderate preload (clearance C0), it is necessary to calculate the service life while taking into account the magnitude of the preload.
To identify the appropriate preload for any selected LM Guide model, contact THK .

4.3. Rigidity

When the LM Guide receives a load, its rolling element, LM blocks and LM rails are elastically deformed within a permissible load range. The ratio between the displacement and the load is called rigidity value (rigidity values are obtained using the equation shown below). The LM Guide's rigidity increases according to the magnitude of the preload. Fig. 1 shows rigidity difference between normal, C1 and C0 clearances.
The effect of a preload for a 4-way equal-load type is translated into the calculated load approx. 2.8 times greater than the magnitude of the preload.

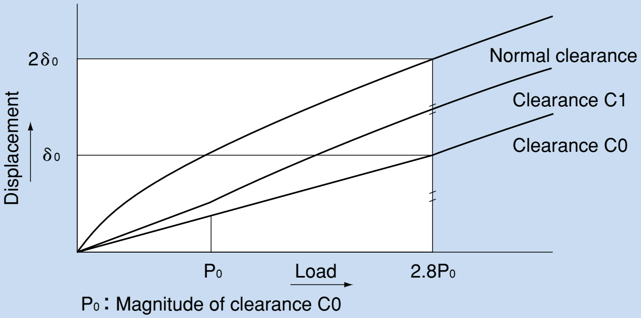
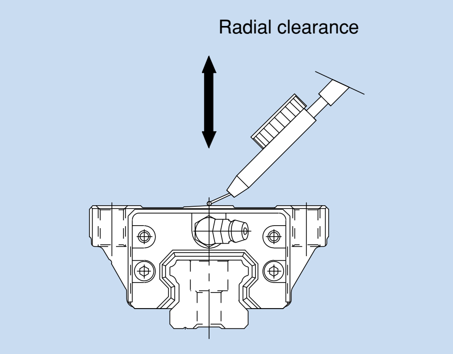


Fig. 1 Rigidity Data

$$K=\frac{P}{\delta} \qquad (N/\mu m)$$

K : Rigidity
δ : Displacement (μm)
P : Calculated load (N)

4.4. Radial Clearance Standard for Each Model



Radial clearance for model SSR

Unit: μm

Indication symbol / Model No.	Normal	Light load
	No symbol	C1
15	–4 to +2	–10 to –4
20	–5 to +2	–12 to –5
25	–6 to +3	–15 to –6
30	–7 to +4	–18 to –7
35	–8 to +4	–20 to –8

Radial clearance for model SR

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
15	– 4 to + 2	–10 to – 4	——
20	– 5 to + 2	–12 to – 5	– 17 to –12
25	– 6 to + 3	–15 to – 6	– 21 to –15
30	– 7 to + 4	–18 to – 7	– 26 to –18
35	– 8 to + 4	–20 to – 8	– 31 to –20
45	–10 to + 5	–24 to –10	– 36 to –24
55	–12 to + 5	–28 to –12	– 45 to –28
70	–14 to + 7	–32 to –14	– 50 to –32
85	–20 to + 9	–46 to –20	– 70 to –46
100	–22 to +10	–52 to –22	– 78 to –52
120	–25 to +12	–57 to –25	– 87 to –57
150	–29 to +14	–69 to –29	–104 to –69

Radial clearance for model SHS

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
15	– 5 to 0	–12 to – 5	——
20	– 6 to 0	–12 to – 6	–18 to –12
25	– 8 to 0	–14 to – 8	–20 to –14
30	– 9 to 0	–17 to – 9	–27 to –17
35	–11 to 0	–19 to –11	–29 to –19
45	–12 to 0	–22 to –12	–32 to –22
55	–15 to 0	–28 to –16	–38 to –28
65	–18 to 0	–34 to –22	–45 to –34

Radial clearance for models HSR and CSR

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
8	– 1 to + 1	– 4 to – 1	——
10	– 2 to + 2	– 5 to – 1	——
12	– 3 to + 3	– 6 to – 2	——
15	– 4 to + 2	–12 to – 4	——
20	– 5 to + 2	–14 to – 5	–23 to –14
25	– 6 to + 3	–16 to – 6	–26 to –16
30	– 7 to + 4	–19 to – 7	–31 to –19
35	– 8 to + 4	–22 to – 8	–35 to –22

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
45	–10 to + 5	–25 to –10	–40 to –25
55	–12 to + 5	–29 to –12	–46 to –29
65	–14 to + 7	–32 to –14	–50 to –32
85	–16 to + 8	–36 to –16	–56 to –36
100	–19 to + 9	–42 to –19	–65 to –42
120	–21 to +10	–47 to –21	–73 to –47
150	–23 to +11	–51 to –23	–79 to –51

■Radial clearance for model HSR-M2

Unit: μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
15	–4 to +2	–12 to –4
20	–5 to +2	–14 to –5
25	–6 to +3	–16 to –6

■Radial clearance for model HCR

Unit: μm

Indication symbol	Normal	Light load
Model No.	No symbol	C1
12	–3 to +3	–6 to –2
15	–4 to +2	–12 to –4
25	–6 to +3	–16 to –6
35	–8 to +4	–22 to –8
45	–10 to +5	–25 to –10
65	–14 to +7	–32 to –14

■Radial clearance for model JR

Unit: μm

Indication symbol	Normal
Model No.	No symbol
25	–6 to +3
35	–8 to +4
45	–10 to +5
55	–12 to +5

■Radial clearance for models NR/NRS and SNR/SNS

Unit: μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
25	–3 to +2	–6 to –3	–9 to –6
30	–4 to +2	–8 to –4	–12 to –8
35	–4 to +2	–8 to –4	–12 to –8
45	–5 to +3	–10 to –5	–15 to –10
55	–6 to +3	–11 to –6	–16 to –11
65	–8 to +3	–14 to –8	–20 to –14
75	–10 to +4	–17 to –10	–24 to –17
85	–13 to +4	–20 to –13	–27 to –20
100	–14 to +4	–24 to –14	–34 to –24

■Radial clearance for model SHW

Unit: μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
12	–1.5 to 0	–4 to –1	——
14	–2 to 0	–5 to –1	——
17	–3 to 0	–7 to –3	——
21	–4 to +2	–8 to –4	——
27	–5 to +2	–11 to –5	——
35	–8 to +4	–18 to –8	–28 to –18
50	–10 to +5	–24 to –10	–38 to –24

■Radial clearance for model HRW

Unit: μm

Indication symbol	Normal	Light load	Moderate load
Model No.	No symbol	C1	C0
12	–1.5 to +1.5	–4 to –1	——
14	–2 to +2	–5 to –1	——
17	–3 to +2	–7 to –3	——
21	–4 to +2	–8 to –4	——
27	–5 to +2	–11 to –5	——
35	–8 to +4	–18 to –8	–28 to –18
50	–10 to +5	–24 to –10	–38 to –24
60	–12 to +5	–27 to –12	–42 to –27

Radial clearance for model SRS

Unit: μm

Indication symbol / Model No.	Normal	Light load
	No symbol	C1
9	–2 to +2	– 4 to 0
12	–3 to +3	– 6 to 0
15	–5 to +5	–10 to 0
20	–5 to +5	–10 to 0
25	–7 to +7	–14 to 0

Radial clearance for model MX

Unit: μm

Indication symbol / Model No.	Normal	Light load
	No symbol	C1
5	0 to +1.5	–1 to 0
7	–2 to +2	–3 to 0

Radial clearance for models RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z

Unit: μm

Indication symbol / Model No.	Normal	Light load
	No symbol	C1
3	0 to +1	– 0.5 to 0
5	0 to +1.5	– 1 to 0
7	–2 to +2	– 3 to 0
9	–2 to +2	– 4 to 0
12	–3 to +3	– 6 to 0
15	–5 to +5	–10 to 0
20	–7 to +7	–14 to 0

Radial clearance for models SRG and SRN

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
25	–2 to –1	–3 to –2	–4 to –3
30	–2 to –1	–3 to –2	–4 to –3
35	–2 to –1	–3 to –2	–5 to –3
45	–2 to –1	–3 to –2	–5 to –3
55	–2 to –1	–4 to –2	–6 to –4
65	–3 to –1	–5 to –3	–8 to –5

Radial clearance for model NSR-TBC

Unit: μm

Indication symbol / Model No.	Normal	Light load	Moderate load
	No symbol	C1	C0
20	– 5 to + 5	–15 to – 5	–25 to –15
25	– 5 to + 5	–15 to – 5	–25 to –15
30	– 5 to + 5	–15 to – 5	–25 to –15
40	– 8 to + 8	–22 to – 8	–36 to –22
50	– 8 to + 8	–22 to – 8	–36 to –22
70	–10 to +10	–26 to –10	–42 to –26

5. Accuracy

5.1. Accuracy Standards

Accuracy of the LM Guide is specified in terms of running parallelism, dimensional tolerance for height and width, and height and width difference between a pair when 2 or more LM blocks are used on one rail or when 2 or more rails are mounted on the same plane.
For details, see pages a-38 to a-46.

●Running parallelism

It refers to a parallelism error between the LM block and the LM rail datum plane when the LM block travels the whole length of the LM rail with the LM rail secured on the reference datum plane using bolts.

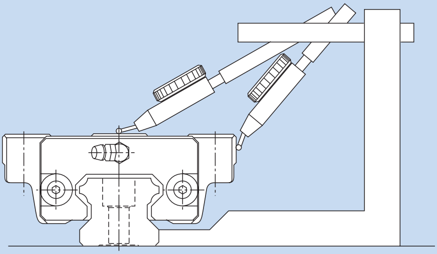


Fig. 1 Running Parallelism

●Difference in Height M

Indicates a difference between the minimum and maximum values of height (M) of each of the LM blocks used on the same plane in combination.

●Difference in Width W_2

Indicates a difference between the minimum and maximum values of the width (W_2) between each of the LM blocks, mounted on one LM rail in combination, and the LM rail.

Note 1: When 2 or more rails are used on the same plane in parallel, only the width (W_2) tolerance and the difference on the master rail apply. The master LM rail is imprinted with "KB" (except for normal grade products) following the serial number.

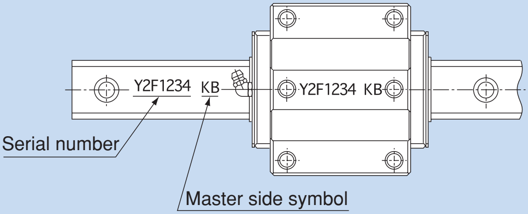


Fig. 2 Master LM Rail

Note 2: Accuracy measurements each represent the average value of the central point or the central area of the LM block.

Note 3: The LM rail is smoothly curved so that the required accuracy is easily achieved by pressing the rail to the datum plane of the machine.
If it is mounted on a less rigid base such as an aluminum base, the curve of the rail will affect the accuracy of the machine. Therefore, it is necessary to define straightness of the rail in advance.

5.2. Guidelines for Accuracy Grades by Machine Type

Table 1 shows guidelines for selecting an accuracy grade of the LM Guide according to the machine type.

Table 1 Guideline for Accuracy Grades by Machine Type

Type of machine		Machine tools															
		Machining center	Lathe	Milling machine	Boring machine	Jig borer	Drilling machine	Electric discharge machine	Punching press	Laser beam machine	Woodworking machine	NC drilling machine	Tapping center	Pallet changer	ATC	Wire cutting machine	Dressing machine
Accuracy grade	UP					●	●	●									●
	SP	●	●	●	●	●	●	●		●						●	●
	P	●	●	●	●			●	●	●	●	●	●			●	
	H								●	●	●	●	●				
	Normal										●			●	●		

Type of machine		Industrial robots		Semiconductor manufacturing machines				Other equipment									
		Cartesian coordinate	Cylindrical coordinate	Wire bonding machine	Prober	Electronic component inserter	Printed circuit board drilling machine	Injection molding machine	3D measuring instrument	Office equipment	Conveyance system	XY table	Coating machine	Welding machine	Medical equipment	Digitizer	Inspection machine
Accuracy grade	UP				●				●								●
	SP			●	●		●		●			●				●	●
	P	●		●		●	●					●				●	●
	H	●	●			●	●	●		●	●	●	●	●	●	●	
	Normal	●	●					●		●	●		●	●	●		

UP :Ultra-precision grade
SP :Super-precision grade
P :Precision grade
H :High-accuracy grade
Normal:Normal grade

5.3. Accuracy Standard for Each Model

- Accuracies of models SR, SSR, HSR, SHS, NR/NRS, SNR/SNS, HRW, SRG, SRN and NSR-TBC are categorized into Normal grade (no symbol), High-accuracy grade (H), Precision grade (P), Super-precision grade (SP) and Ultra-super-precision grade (UP) by model numbers, as indicated in Table 2.

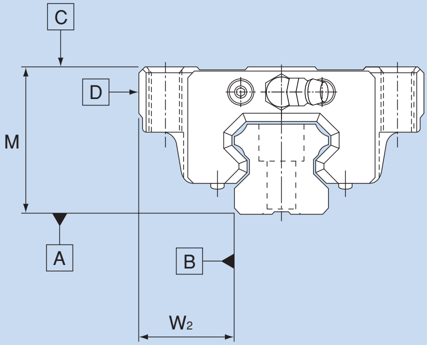


Fig. 3

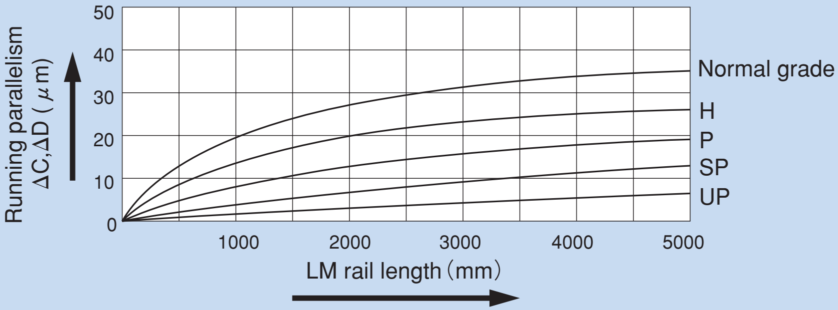


Fig. 4 LM Rail Length and Running Parallelism

Table 2 Accuracy Standards for Models SR, SSR, HSR, SHS, NR/NRS, SNR/SNS, HRW, SHW, SRG, SRN and NSR-TBC

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade	Super-precision grade	Ultra-super precision grade
	Item	No symbol	H	P	SP	UP
8 10 12 14	Dimensional tolerance for height M	± 0.08	± 0.04	± 0.02	± 0.01	――
	Difference in height M	0.015	0.007	0.005	0.003	――
	Dimensional tolerance for width W_2	± 0.05	± 0.025	± 0.015	± 0.01	――
	Difference in width W_2	0.02	0.01	0.007	0.005	――
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
15 17 20 21	Dimensional tolerance for height M	± 0.1	± 0.03	0 − 0.03	0 − 0.015	0 − 0.008
	Difference in height M	0.02	0.01	0.006	0.004	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.03	0 − 0.03	0 − 0.015	0 − 0.008
	Difference in width W_2	0.02	0.01	0.006	0.004	0.003
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
25 27 30 35	Dimensional tolerance for height M	± 0.1	± 0.04	0 − 0.04	0 − 0.02	0 − 0.01
	Difference in height M	0.02	0.015	0.007	0.005	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.04	0 − 0.04	0 − 0.02	0 − 0.01
	Difference in width W_2	0.03	0.015	0.007	0.005	0.003
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
40 45 50 55 60	Dimensional tolerance for height M	± 0.1	± 0.05	0 − 0.05	0 − 0.03	0 − 0.02
	Difference in height M	0.03	0.015	0.007	0.005	0.003
	Dimensional tolerance for width W_2	± 0.1	± 0.05	0 − 0.05	0 − 0.03	0 − 0.02
	Difference in width W_2	0.03	0.02	0.01	0.007	0.005
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				
65 70 75 85 100 120 150	Dimensional tolerance for height M	± 0.1	± 0.07	0 − 0.07	0 − 0.05	0 − 0.03
	Difference in height M	0.03	0.02	0.01	0.007	0.005
	Dimensional tolerance for width W_2	± 0.1	± 0.07	0 − 0.07	0 − 0.05	0 − 0.03
	Difference in width W_2	0.03	0.025	0.015	0.01	0.007
	Running parallelism of surface $\boxed{C}$ against surface $\boxed{A}$	ΔC (as shown in Fig. 4)				
	Running parallelism of surface $\boxed{D}$ against surface $\boxed{B}$	ΔD (as shown in Fig. 4)				

Note: For models SRG and SRN, only precision or higher grades apply (normal or high-accuracy grades are not available).

●Accuracies of model HCR are categorized into normal and high-accuracy grades by model number as indicated in Table 3.

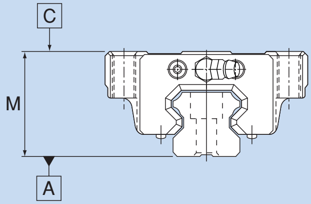


Fig. 5

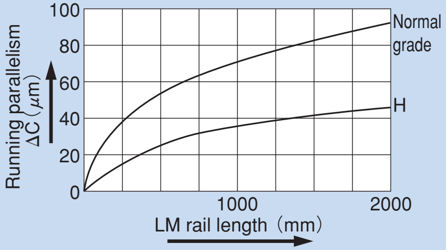


Fig. 6 LM Rail Length and Running Parallelism

Table 3 Accuracy Standard for Model HCR

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade
	Item	No symbol	H
12 15 25 35	Dimensional tolerance for height M	± 0.2	± 0.2
	Difference in height M	0.05	0.03
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 6)	
45 65	Dimensional tolerance for height M	± 0.2	± 0.2
	Difference in height M	0.06	0.04
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 6)	

●Accuracies of model JR are defined by model number as indicated in Table 4.

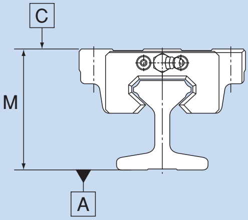


Fig. 7

Table 4 Accuracy Standard for Model JR

Unit: mm

Model No.	Accuracy standard	Normal grade
	Item	No symbol
25 35	Dimensional tolerance for height M	0.05
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 8)
45 55	Dimensional tolerance for height M	0.06
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 8)

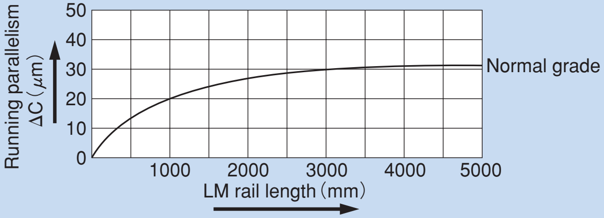


Fig. 8 LM Rail Length and Running Parallelism

- Accuracies of model CSR are categorized into precision, super-precision and ultra-precision grades by model number as indicated in Table 5.

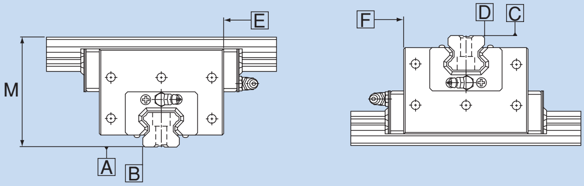


Fig. 9

Table 5 Accuracy Standard for Model CSR

Unit: mm

Model No.	Accuracy standard	Precision grade	Super-precision grade	Ultra-super precision grade
	Item	P	SP	UP
15 20	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.005	0.004	0.003
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
25	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.008	0.006	0.004
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
30 35	Difference in height M	0.01	0.007	0.005
	Perpendicularity of surface D against surface B	0.01	0.007	0.005
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		
45	Difference in height M	0.012	0.008	0.006
	Perpendicularity of surface D against surface B	0.012	0.008	0.006
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 10)		
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 10)		

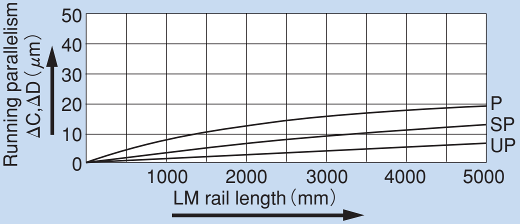


Fig. 10 LM Rail Length and Running Parallelism

●Accuracies of model HR are categorized into normal, high-accuracy, precision, super-precision and ultra-precision grades as indicated in Table 6.

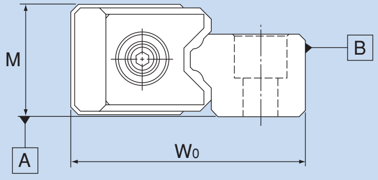


Fig. 11

Table 6 Accuracy Standard for Model HR

Unit: mm

Accuracy standard	Normal grade	High-accuracy grade	Precision grade	Super-precision grade	Ultra-super precision grade
Item	No symbol	H	P	SP	UP
Dimensional tolerance for height M	±0.1	±0.05	±0.025	±0.015	±0.01
Difference in height M[*1)]	0.03	0.02	0.01	0.005	0.003
Dimensional tolerance for total widthW_0	±0.1		±0.05		
Difference in total width W_0[*2)]	0.03	0.015	0.01	0.005	0.003
Running parallelism of surface B against surface A	ΔC (as shown in Fig. 12)				

Note 1: Difference in height M applies to a set of LM Guides used on the same plane.
Note 2: Difference in total width W_0 applies to LM blocks used in combination on one LM rail.
Note 3: Dimensional tolerance and difference in total width W_0 for precision and higher grades apply only to the master-rail side among a set of LM Guides. The master rail is imprinted with "KB" following a serial number.

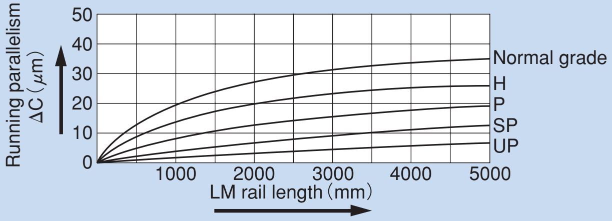


Fig. 12 LM Rail Length and Running Parallelism

- Accuracies of model GSR are categorized into normal, high-accuracy and precision grades by model number as indicated in Table 7.

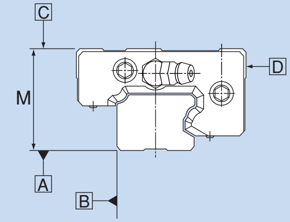


Fig. 13

Table 7 Accuracy Standard for Model GSR

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade
	Item	No symbol	H	P
15 20	Dimensional tolerance for height M	± 0.02		
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 14)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 14)		
25 30 35	Dimensional tolerance for height M	± 0.03		
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 14)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 14)		

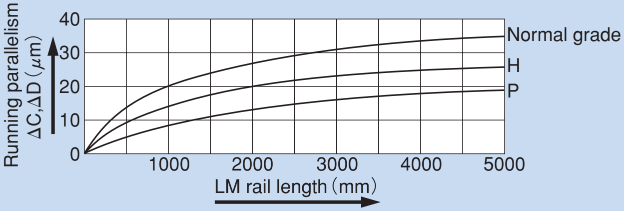


Fig. 14 LM Rail Length and Running Parallelism

- Accuracies of model GSR-R are categorized into normal and high-accuracy grades by model number as indicated in Table 8.

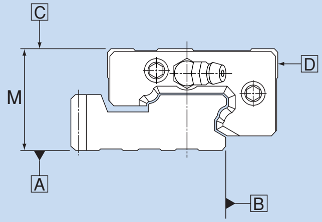


Fig. 15

Table 8 Accuracy Standard for GSR-R

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade
	Item	No symbol	H
25 30 35	Dimensional tolerance for height M	± 0.03	
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 16)	
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 16)	

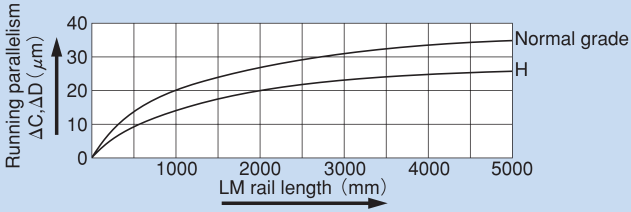


Fig. 16 LM Rail Length and Running Parallelism

●Accuracies of models SRS, RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z are categorized into normal, high-accuracy and precision grades by model number as indicated in Table 9.

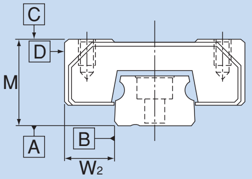


Fig. 17

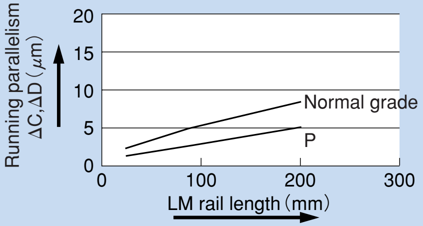


Fig. 18 LM Rail Length and Running Parallelism for Models RSR3 and 5

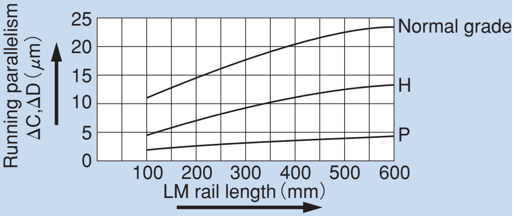


Fig. 19 LM Rail Length and Running Parallelism for Models RSR7 to 25

Table 9 Accuracy Standards for Models SRS, RSR, RSR-W, RSR-Z, RSR-WZ, RSH and RSH-Z

Unit: mm

Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade
	Item	No symbol	H	P
3 5	Dimensional tolerance for height M	±0.03	—	±0.015
	Difference in height M	0.015	—	0.005
	Dimensional tolerance for width W₂	±0.03	—	±0.015
	Difference in width W₂	0.015	—	0.005
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 18)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 18)		
7 9 12 15 20 25	Dimensional tolerance for height M	±0.04	±0.02	±0.01
	Difference in height M	0.03	0.015	0.007
	Dimensional tolerance for width W₂	±0.04	±0.025	±0.015
	Difference in width W₂	0.03	0.02	0.01
	Running parallelism of surface C against surface A	ΔC (as shown in Fig. 19)		
	Running parallelism of surface D against surface B	ΔD (as shown in Fig. 19)		

●Accuracies of model MX are categorized into normal and precision grades by model number as indicated in Table 10.

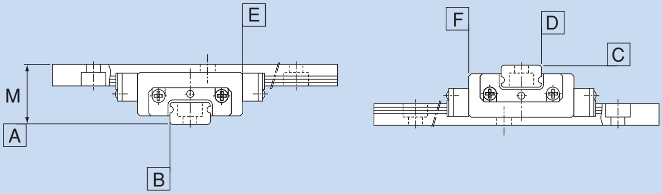


Fig. 20

Table 10 Accuracy Standard for Model MX

Unit: mm

Model No.	Accuracy standard	Normal grade	Precision grade
	Item	No symbol	P
5	Difference in height M	0.015	0.005
	Perpendicularity of surface D against surface B	0.003	0.002
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 21)	
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 21)	
7	Difference in height M	0.03	0.007
	Perpendicularity of surface D against surface B	0.01	0.005
	Running parallelism of surface E against surface B	ΔC (as shown in Fig. 22)	
	Running parallelism of surface F against surface D	ΔD (as shown in Fig. 22)	

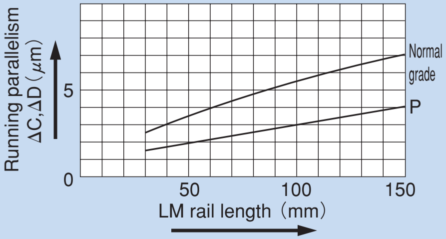


Fig. 21 LM Rail Length and Running Parallelism for Model MX5

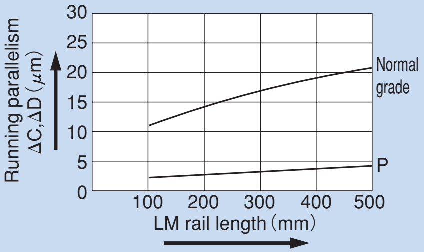


Fig. 22 LM Rail Length and Running Parallelism for Model MX7W

6. Designing a Guide Structure

THK offers various types of LM Guides in order to meet diversified service conditions. Supporting ordinary horizontal mount, vertical mount, inverted mount, slant mount wall mount and single-axis mount, the wide array of LM Guide types makes it easy to achieve a linear guide system with a long service life and high rigidity while minimizing the required space for installation.

6.1. Examples of the Guide Structure

The following are representative guide structures and arrangements when installing the LM Guide.

Examples of Arrangements of the Guide Structure

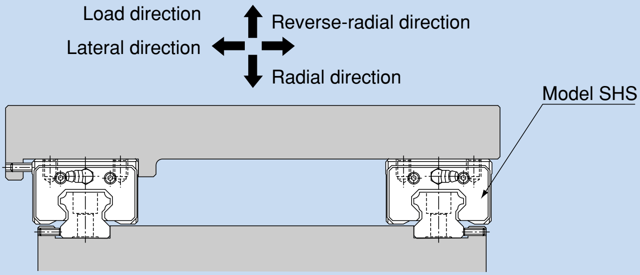


Fig. 1 Double-rail Configuration When High Rigidity is Required in All Directions

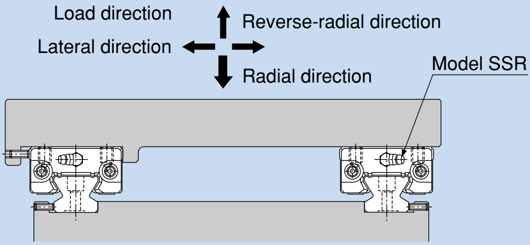


Fig. 2 Double-rail Configuration When High Rigidity is Required in the Radial Direction

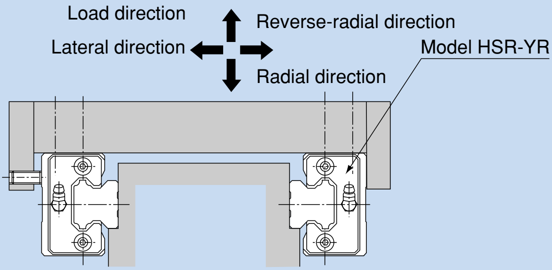


Fig. 3 When High Rigidity is Required in All Directions and the Installation Space is Limited in Height

Examples of Representative Arrangements of the Guide Structure

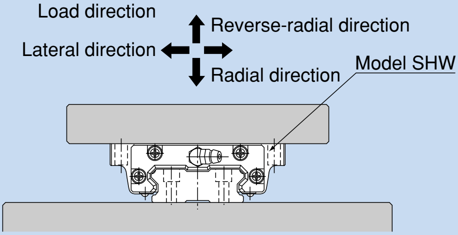


Fig. 4 Single-rail Configuration

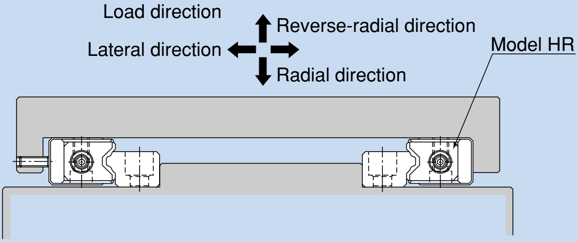


Fig. 5 When the Minimum Possible Height of the Equipment is Allowed (Adjustable Preload Type)

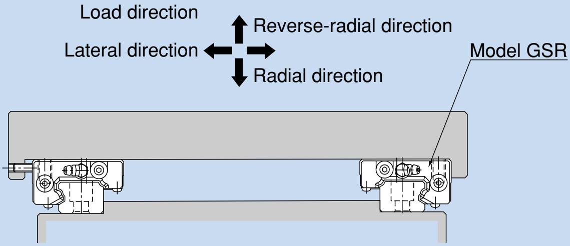


Fig. 6 When a Moderate Load is Applied and the Mounting Surface is Rough (Preload, Self-adjusting Type)

Examples of Arrangements of the Guide Structure

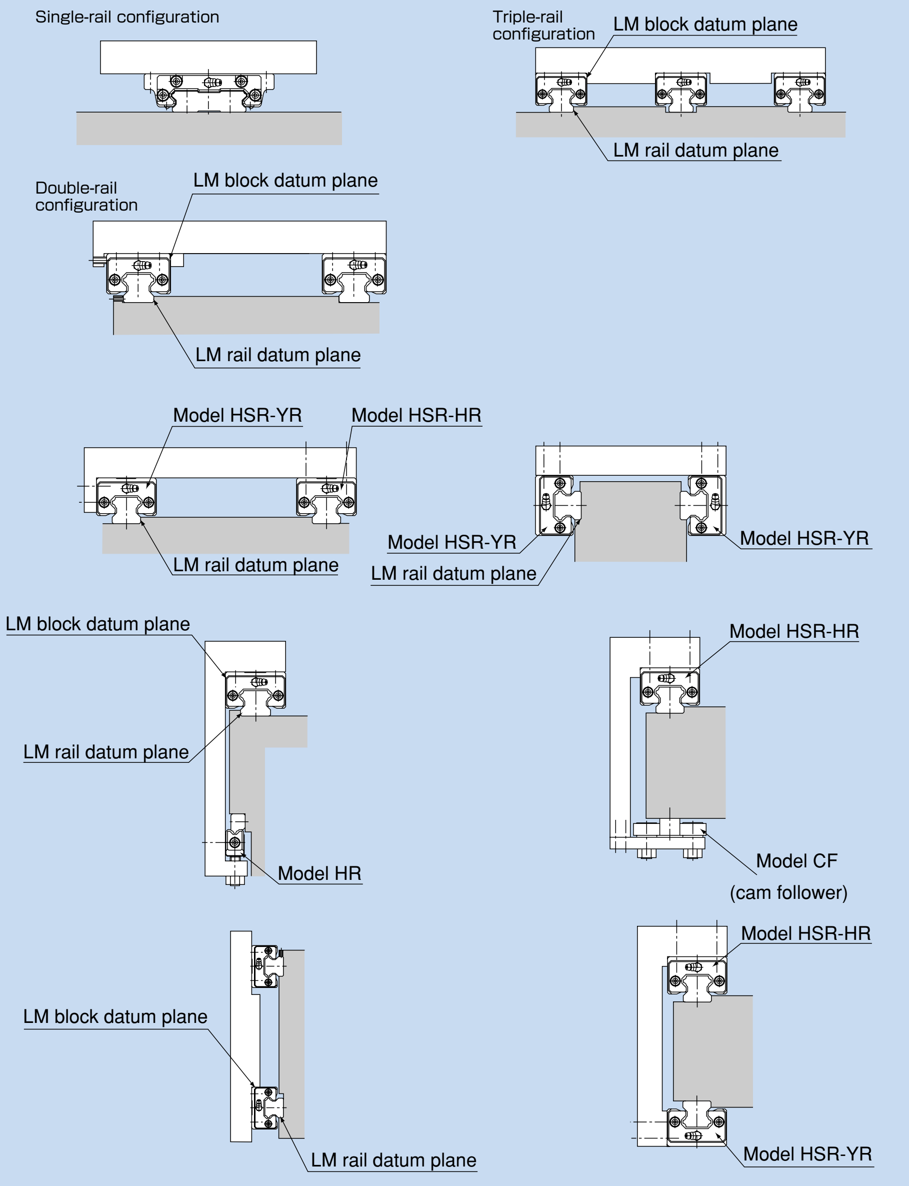


Fig. 7

Examples of Arrangements of the Guide Structure

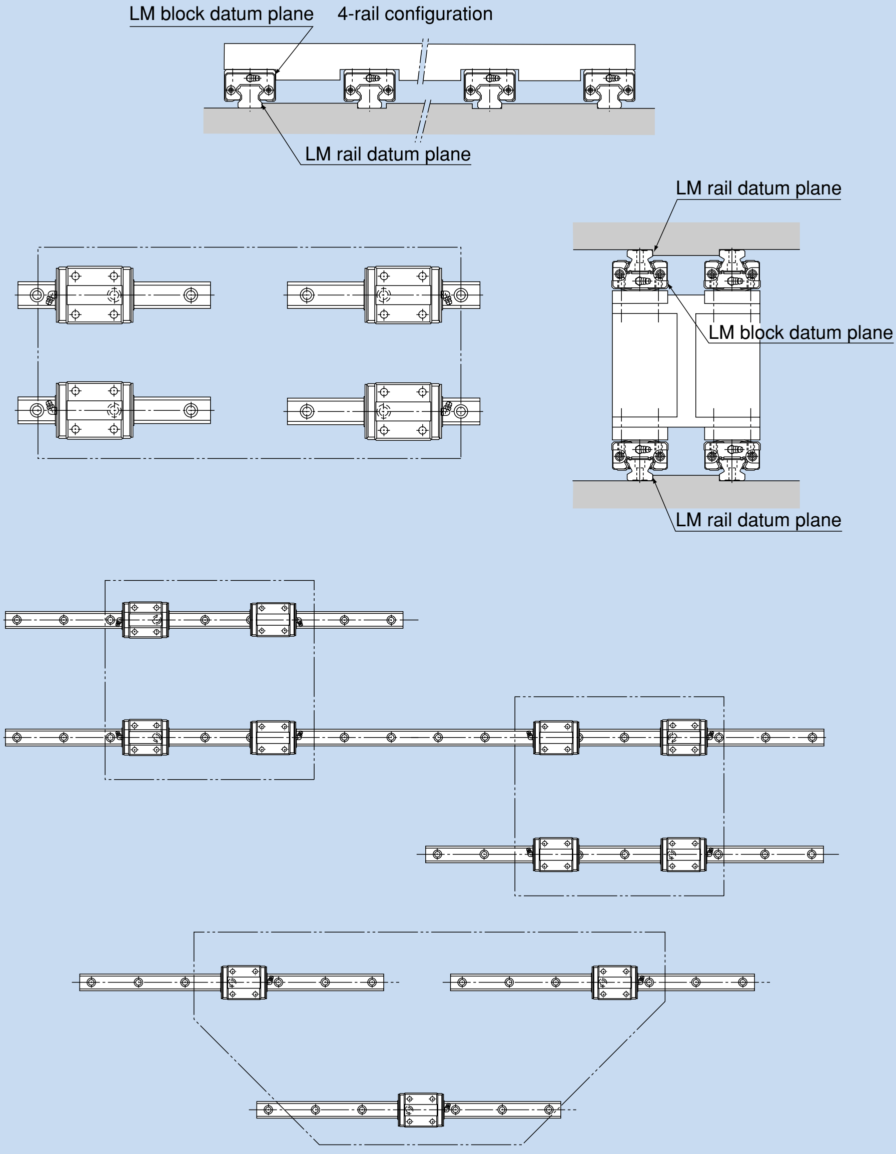


Fig. 8

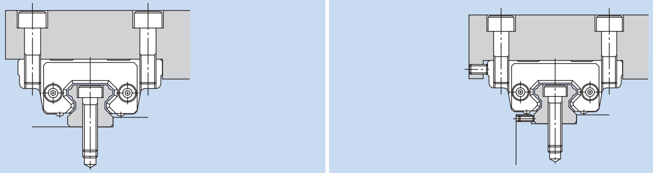
6.2. Method for Securing an LM Guide® to Meet the Service Conditions

LM Guides are categorized into groups of types by mounting space and structure: a group of types to be mounted with bolts from the top, and another of types to be mounted from the bottom. LM rails are also divided into types secured with bolts and those secured with clamps (model JR). This wide array of types allows you to make a choice according to the application. There are several ways of mounting the LM Guide as shown in Fig. 9. When the machine is subject to vibrations that may cause the LM rail(s) or LM blocks to loosen, we recommend the securing method indicated by Fig. 11 (if 2 or more rails are used in parallel, only the LM block on the master rail should be secured in the crosswise direction). If this method is not applicable for a structural reason, hammer in knock pins to secure the LM block(s) as shown in Fig. 10. When using knock pins, machine the top/bottom surfaces of the LM rail by 2 to 3 mm using a carbide end mill before drilling the holes since the surfaces are hardened.

Fig. 9 Major Securing Methods on the Master-rail Side

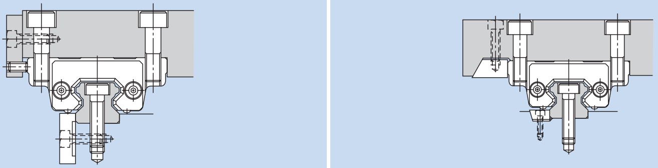
ⓐ Secured only with side datum planes

ⓑ Secured with setscrews



ⓒ Secured with a presser plate

ⓓ Secured with tapered gibs



ⓔ Secured with pins

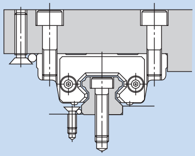
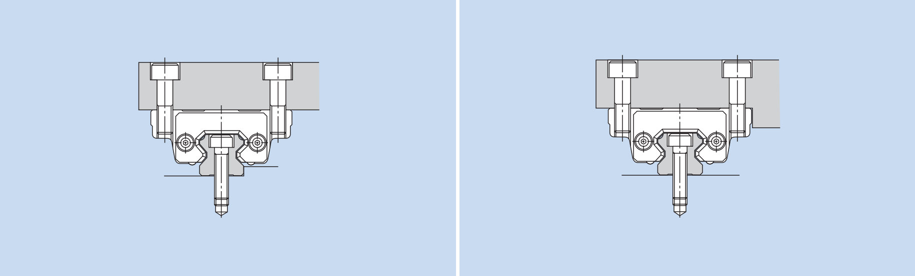


Fig. 10 Major Securing Methods on the Subsidiary-rail Side

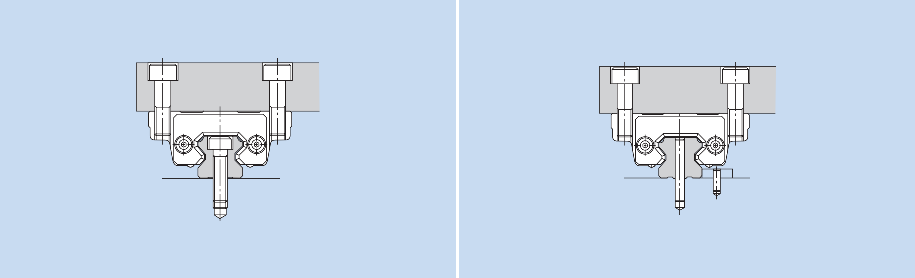
ⓐ Secured only with the side datum plane of the rail

ⓑ Secured only with the side datum plane of the block



ⓒ Secured without a side datum plane

ⓓ Secured with knock pins



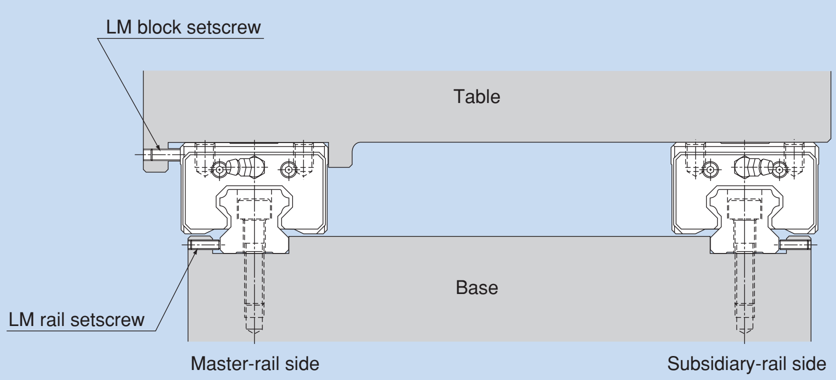
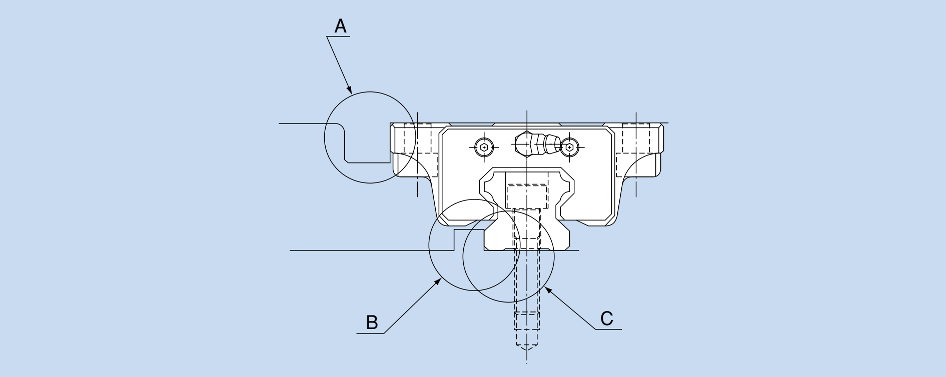


Fig. 11 When the Machine Receives Vibrations or Impact

7. Designing a Mounting Surface

7.1. Designing a Mounting Surface

If particularly high accuracy is required for the machine to which an LM Guide is to be mounted, it is necessary to mount the LM rail with high accuracy. To achieve the desired accuracy, be sure to design the mounting surface while taking the following points into account.



7.1.1. Corner Shape

If the corner on the surface on which the LM rail or LM block is to be mounted is machined to be shaped R, which is greater than the chamfer dimension of the LM rail or LM block, then the rail or the block may not closely contact its datum plane. Therefore, when designing a mounting surface, it is important to carefully read the description on the "corner shape" of the subject model (Fig. 1).

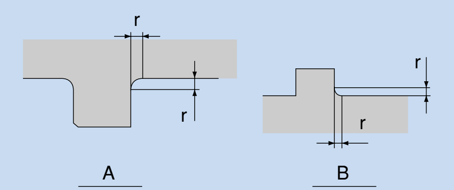


Fig. 1

7.1.2. Perpendicularity with the Datum Plane

If the perpendicularity between the base mounting surface for the LM rail or the LM block and the datum plane is not accurate, the rail or the block may not closely contact the datum plane. Therefore, it is important to take into account an error of the perpendicularity between the mounting surface and the datum plane (Fig. 2).

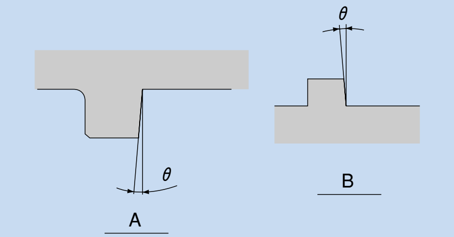


Fig. 2

7.1.3. Dimensions of the Datum Plane

When designing the datum plane, be sure to take into account the height and the thickness of the datum area. If the datum area is too high, it may interfere with the LM block. If it is too low, the LM rail or the LM block may not closely contact the datum plane depending on the chamfer of the rail or the block. Additionally, if the datum area is too thin, the desired accuracy may not be obtained due to poor rigidity of the datum area when a lateral load is applied or when performing positioning using a lateral mounting bolt (Fig. 3).

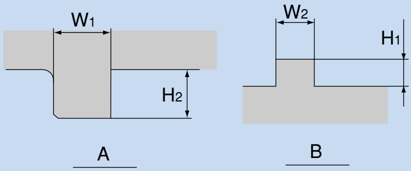


Fig. 3

7.1.4. Dimensional Tolerance between the Datum Plane and the Mounting Hole

If the dimensional tolerance between the datum plane of the LM rail or the LM block and the mounting hole is too large, the rail or the block may not closely contact the datum plane when mounted on the base. Normally, the tolerance should be within 0.1 mm depending on the model (Fig. 4).

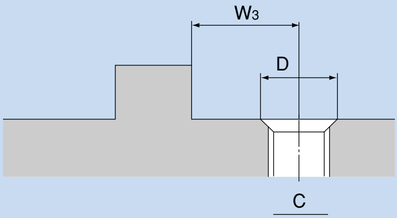


Fig. 4

7.1.5. Chamfer of the Tapped Mounting Hole

To mount the LM rail, the mounting surface needs to be tapped and the tapped hole has to be chamfered. If the chamfer of the tapped hole is too large or too small, it may affect the accuracy (Fig. 5).

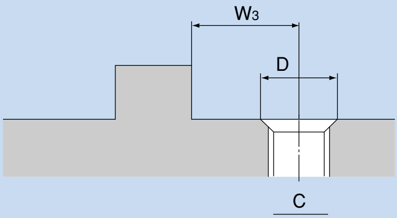


Fig. 5

Guidelines for the chamfer dimension:

Chamfer diameter D = nominal diameter of the bolt + pitch

Example: Chamfer diameter D with M6 (pitch: 1):

D=6+1=7

7.2. Shoulder Height of the Mounting Base and the Corner Radius

Normally, the mounting base for the LM rail and the LM block has a datum plane on the side face of the shoulder of the base in order to allow easy installation and highly accurate positioning.
The height of the datum shoulder varies with model numbers. See pages a-55 to a-61 for details.
The corner of the mounting shoulder must be machined to have a recess, or machined to be smaller than the corner radius "r," to prevent interference with the chamfer of the LM rail or the LM block.
The corner radius varies with model numbers. See pages a-55 to a-61 for details.

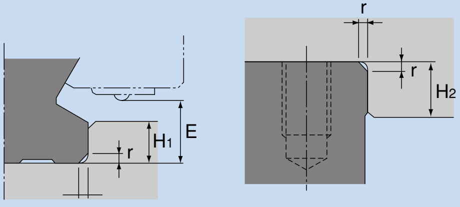


Fig. 6

Model SR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Maximum shoulder height for the LM block H_2	E
15	0.5	3.8	4	4.5
20	0.5	5	5	6
25	1	5.5	5	7
30	1	8	6	9.5
35	1	9	6	11.5
45	1	10	8	12.5
55	1.5	11	8	13.5
70	1.5	12	10	15
85	1.2	8	12	18.5
100	1.2	10	15	19
120	1.2	12	20	15
150	1.2	12	20	22

Model NSR-TBC

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
20	1	5	5	5.5
25	1	6	6	6.5
30	1	7	6	9
40	1	7	8	10.5
50	1	7	8	8
70	1	7	10	9.5

Model CSR

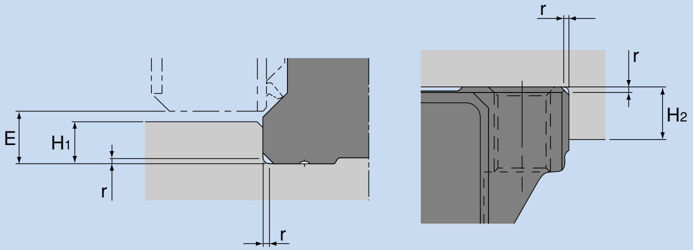
Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	E
15	0.5	3	3.5
20	0.5	3.5	4
25	1	5	5.5
30	1	5	7
35	1	6	7.5
45	1	8	10

Model JR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM block H_2
25	1	5
35	1	6
45	1	8
55	1.5	10



Shoulder for the LM rail   Shoulder for the LM block

Fig. 7

■Model SHS

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
15	0.5	2.5	4	3
20	0.5	3.5	5	4.6
25	1	5	5	5.8
30	1	5	5	7
35	1	6	6	7.5
45	1	7.5	8	8.9
55	1.5	10	10	12.7
65	1.5	15	10	19

■Models NR/NRS, SNR/SNS and SNR/SNS-H

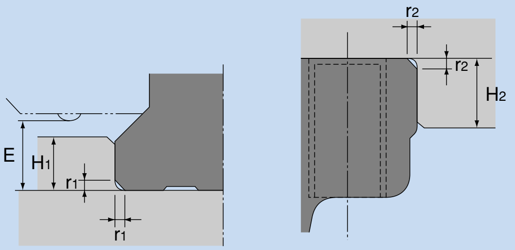
Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
25 X	0.5	5	5	5.5
30	1	5	5	7
35	1	6	6	9
45	1	8	8	11.5
55	1.5	10	10	14
65	1.5	10	10	15
75	1.5	12	12	15
85	1.5	14	14	17
100	2	16	16	20

■Model MX

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	E
5	0.1	1.2	1.5
7 W	0.1	1.7	2



Shoulder for the LM rail

Shoulder for the LM block

Fig. 8

■Model HCR

Unit: mm

Model No.	Corner radius for the LM rail r_1(max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Maximum shoulder for the LM block H_2	E
12	0.8	0.5	2.6	6	3.1
15	0.5	0.5	3	4	3.5
25	1	1	5	5	5.5
35	1	1	6	6	7.5
45	1	1	8	8	10
65	1.5	1.5	10	10	14

■Model HSR

Unit: mm

Model No.	Corner radius for the LM rail r_1(max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
8	0.3	0.5	1.6	6	2.1
10	0.3	0.5	1.7	5	2.2
12	0.8	0.5	2.6	4	3.1
15	0.5	0.5	3	4	4.7
20	0.5	0.5	3.5	5	4
25	1	1	5	5	5.5
30	1	1	5	5	7
35	1	1	6	6	7.5
45	1	1	8	8	10
55	1.5	1.5	10	10	13
65	1.5	1.5	10	10	14
85	1.5	1.5	12	14	16
100	2	2	16	16	20.5
120	2.5	2.5	17	18	20
150	2.5	2.5	20	20	22.5

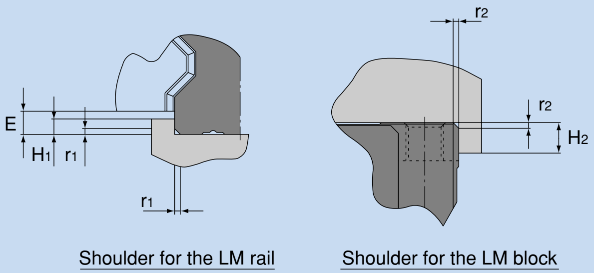


Fig. 9

Model SRG

Unit: mm

Model No.	Corner radius for the LM rail r_1 (max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
25	1	1	4	5	4.5
30	1	1	4.5	5	5
35	1	1	5	6	6
45	1.5	1.5	6	8	8
55	1.5	1.5	8	10	10
65	1.5	2	9	10	11.5

Model SRN

Unit: mm

Model No.	Corner radius for the LM rail r_1 (max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
35	1	1	5	6	6
45	1.5	1.5	6	8	7
55	1.5	1.5	8	10	10
65	1.5	2	8	10	10

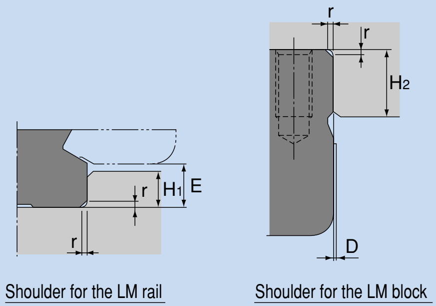


Fig. 10

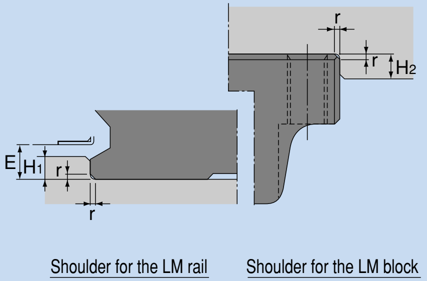


Fig. 11

Model SSR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Maximum shoulder height for the LM block H_2	E	D
15 X	0.5	3.8	5.5	4.5	0.3
20 X	0.5	5	7.5	6	0.3
25 X	1	5.5	8	6.8	0.4
30 X	1	8	11.5	9.5	0.4
35 X	1	9	16	11.5	0.4

Note: When closely contacting the LM block with the datum shoulder, the resin layer may stick out from the overall width of the LM block by the dimension D. To avoid this, machine the datum shoulder to have a recess or limit the datum shoulder's height below the dimension H_2.

Models HRW and SHW

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
12	0.5	1.5	4	2
14	0.5	1.5	5	2
17	0.4	2	4	2.5
21	0.4	2.5	5	3
27	0.4	2.5	5	3
35	0.8	3.5	5	4
50	0.8	3	6	3.4
60	1	5	8	6.5

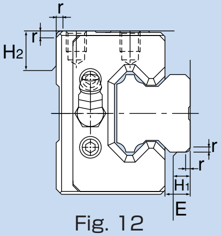


Fig. 12

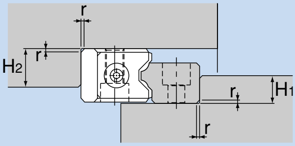


Fig. 13

Model HSR-YR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
15	0.5	3	4	3.5
20	0.5	3.5	5	4
25	1	5	5	5.5
30	1	5	5	7
35	1	6	6	7.5
45	1	8	8	10
55	1.5	10	10	13
65	1.5	10	10	14

Model HR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2
918	0.3	5	6
1123	0.5	6	7
1530	0.5	8	10
2042	0.5	11	15
2555	1	13	18
3065	1	16	20
3575	1	18	26
4085	1.5	21	30
50105	1.5	26	32
60125	1.5	31	40

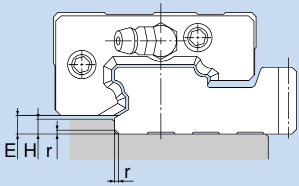


Fig. 14

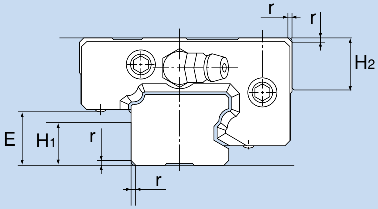


Fig. 15

Model GSR-R

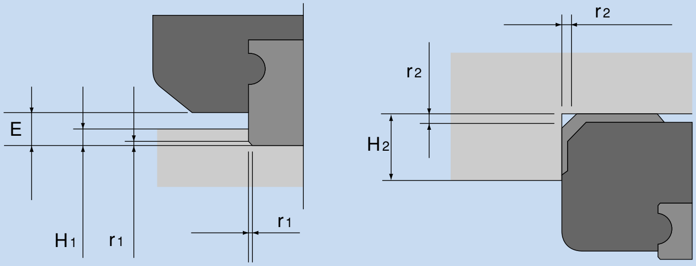
Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H	E
25	0.8	4	4.5
30	1.2	4	4.5
35	1.2	4.5	5.5

Model GSR

Unit: mm

Model No.	Corner radius r (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
15	0.6	7	7	8
20	0.8	9	8	10.4
25	0.8	11	11	13.2
30	1.2	11	13	15
35	1.2	13	14	17.5



Shoulder for the LM rail

Shoulder for the LM block

Fig. 16

Model SRS

Unit: mm

Model No.	Corner radius for the LM rail r_1(max)	Corner radius for the LM block r_2(max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
9 M	0.1	0.3	0.5	4.9	0.9
9 WM	0.1	0.5	2.5	4.9	2.9
12 M	0.3	0.2	1.5	5.7	2
12 WM	0.3	0.3	2.5	5.7	3
15 M	0.3	0.4	2.2	6.5	2.7
15 WM	0.3	0.3	2.2	6.5	2.7
20 M	0.3	0.5	3	8.7	3.4
25 M	0.5	0.5	4.5	10.5	5

Models RSR-Z and RSH-Z

Unit: mm

Model No.	Corner radius for the LM rail r_1(max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
7 Z	0.1	0.5	1.2	3	1.5
9 Z	0.3	0.5	1.9	3	2.2
12 Z	0.3	0.3	2.1	4	2.4
15 Z	0.3	0.3	2.5	5	3.4
7 WZ	0.1	0.1	1.7	3	2
9 WZ	0.1	0.1	2.5	3	2.9
12 WZ	0.3	0.3	3	4	3.4
15 WZ	0.3	0.3	3	5	3.4

Models RSR and RSH

Unit: mm

Model No.	Corner radius for the LM rail r_1(max)	Corner radius for the LM block r_2 (max)	Shoulder height for the LM rail H_1	Shoulder height for the LM block H_2	E
3	0.1	0.3	0.8	1.2	1
5	0.1	0.3	1.2	2	1.5
7	0.1	0.5	1.2	3	1.5
9	0.3	0.5	1.9	3	2.2
12	0.3	0.3	1.4	4	3
15	0.3	0.3	2.3	5	4
20	0.5	0.5	5.5	5	7.5
3 W	0.1	0.3	0.7	2	1
5 W	0.1	0.3	1.2	2	1.5
7 W	0.1	0.1	1.7	3	2
9 W	0.1	0.1	3.9	3	4.2
12 W	0.3	0.3	3.7	4	4
15 W	0.3	0.3	3.7	5	4

7.3. Permissible Error of the Mounting Surface

The LM Guide allows smooth linear motion through its self adjustment capability even when there is a slight distortion or error on the mounting surface.

7.3.1. Error Allowance in the Parallelism between Two Rails

The following tables show error allowances in parallelism between two rails that will not affect the service life in normal operation.

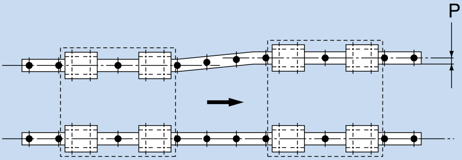


Fig. 17 Error Allowance in Parallelism (P) between Two Rails

Models SR and SSR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
15	—	25	35
20	25	30	40
25	30	35	50
30	35	40	60
35	45	50	70
45	55	60	80
55	65	70	100
70	65	80	110
85	80	90	120
100	90	100	130
120	100	110	140
150	110	120	150

Models NR, SNR and SNR-H

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
25	14	15	21
30	19	21	28
35	21	25	35
45	25	28	42
55	32	35	49
65	39	42	56
75	44	47	60
85	49	53	63
100	60	63	70

Model JR

Unit: μm

Model No.	—
25	100
35	200
45	300
55	400

Models HSR, SHS, HSR-YR and CSR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
8	—	10	13
10	—	12	16
12	—	15	20
15	—	18	25
20	18	20	25
25	20	22	30
30	27	30	40
35	30	35	50
45	35	40	60
55	45	50	70
65	55	60	80
85	70	75	90
100	85	90	100
120	100	110	120
150	115	130	140

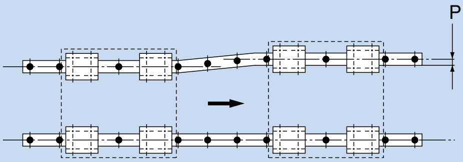


Fig. 18 Error Allowance in Parallelism (P) between Two Rails

■Models NRS, SNS and SNS-H

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
25	10	11	15
30	14	15	20
35	15	18	25
45	18	20	30
55	23	25	35
65	28	30	40
75	31	34	43
85	35	38	45
100	43	45	50

■Models HRW and SHW

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
12	—	10	13
14	—	12	16
17	—	15	20
21	—	18	25
27	—	20	25
35	20	22	30
50	27	30	40
60	30	35	50

■Model GSR

Unit: μm

Model No.	—
15	30
20	40
25	50
30	60
35	70

■Model HR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
918	—	7	10
1123	—	8	14
1530	—	12	18
2042	14	15	20
2555	20	24	35
3065	22	26	38
3575	24	28	42
4085	30	35	50
50105	38	42	55
60125	50	55	65

■Model NSR-TBC

Unit: μm

Model No.	Clearance C1	Normal clearance
20	40	50
25	50	70
30	60	80
40	70	90
50	80	110
70	90	130

■Models RSR, SRS, RSR-W and RSH

Unit: μm

Model No.	Gothic-arch groove		Circular-arc groove
	Clearance C1	Normal clearance	Normal clearance
3	—	2	—
5	—	2	—
7	—	3	—
9	3	4	11
12	5	9	15
15	6	10	18
20	8	13	25
25	10	15	30

7.3.2. Flatness of the Mounting Surface

The following tables show errors in flatness of the mounting surface with models SRS, RSR, RSR-W and RSH that will not affect their service lives in normal operation.

■Model SRS

Unit: mm

Model No.	Flatness error
9 M	0.035/200
9 WM	0.035/200
12 M	0.050/200
12 WM	0.050/200
15 M	0.060/200
15 WM	0.060/200
20 M	0.070/200
25 M	0.070/200

■Model RSR, RSR-W and RSH

Unit: mm

Model No.	Flatness error
3	0.012/200
5	0.015/200
7	0.025/200
9	0.035/200
12	0.050/200
15	0.060/200
20	0.110/200
7 A	0.100/200
9 A	0.160/200
12 A	0.200/200
15 A	0.250/200
20 A	0.300/200

Note 1: With the mounting surface, multiple accuracies are combined in many cases. Therefore, we recommend using 70% or less of the values above.

Note 2: The above figures apply to normal clearances. When using two or more rails with clearance C1, we recommend using 50% or less of the values above.

7.3.3. Error Allowance in Vertical Level between Two Rails

The values in the tables on pages a-65 and a-66 represent error allowances in vertical level between two rails per axis-to-axis distance of 500 mm and are proportionate to axis-to-axis distances (200 mm for model RSR).

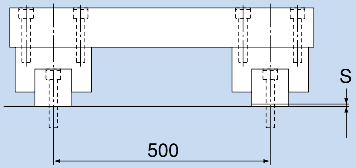


Fig. 19 Error Allowance in Vertical Level (S) between Two Rails

■Models SR and SSR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
15	—	100	180
20	80	100	180
25	100	120	200
30	120	150	240
35	170	210	300
45	200	240	360
55	250	300	420
70	300	350	480
85	350	420	540
100	400	480	600
120	450	540	720
150	500	600	780

■Models NR, SNR and SNR-H

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
25	35	43	65
30	45	55	85
35	60	75	105
45	70	85	125
55	85	105	150
65	100	125	175
75	110	135	188
85	120	145	200
100	140	165	225

■Model JR

Unit: μm

Model No.	—
25	400
35	500
45	800
55	1000

■Models HSR, SHS, HSR-YR and CSR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
8	—	11	40
10	—	16	50
12	—	20	65
15	—	85	130
20	50	85	130
25	70	85	130
30	90	110	170
35	120	150	210
45	140	170	250
55	170	210	300
65	200	250	350
85	240	290	400
100	280	330	450
120	320	370	500
150	360	410	550

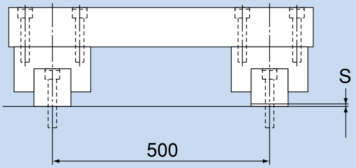


Fig. 20 Error Allowance in Vertical Level (S) between Two Rails

Models NRS, SNS and SNS-H

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
25	49	60	91
30	63	77	119
35	84	105	147
45	98	119	175
55	119	147	210
65	140	175	245
75	154	189	263
85	168	203	280
100	196	231	315

Models HRW and SHW

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
12	—	11	40
14	—	16	50
17	—	20	65
21	—	85	130
27	—	85	130
35	70	85	130
50	90	110	170
60	120	150	210

Model GSR

Unit: μm

Model No.	—
15	240
20	300
25	360
30	420
35	480

Model HR

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
918	—	15	45
1123	—	20	50
1530	—	60	90
2042	50	60	90
2555	85	100	150
3065	95	110	165
3575	100	120	175
4085	120	150	210
50105	140	175	245
60125	170	200	280

Model NSR-TBC

Unit: μm

Model No.	Clearance C1	Normal clearance
20	210	300
25	240	360
30	270	420
40	360	540
50	420	600
70	480	660

Models RSR, SRS, RSR-W and RSH

Unit: μm

Model No.	Gothic-arch groove		Circular-arc groove
	Clearance C1	Normal clearance	Normal clearance
3	—	15	—
5	—	20	—
7	—	25	—
9	6	35	160
12	12	50	200
15	20	60	250
20	30	70	300
25	40	80	350

7.3.4. Error Allowances on the Mounting Surface of Roller Guide Models SRG and SRN

The following tables show permissible errors on the mounting surface of model SRG and SRN that will not affect their service lives in normal operation.

Models SRG and SRN

Table 1 Error Allowance in Parallelism (P) between Rails

Unit: μm

Model No.	Clearance C0	Clearance C1	Normal clearance
25	5	7	9
30	6	8	11
35	7	10	14
45	9	13	17
55	11	14	21
65	14	18	21

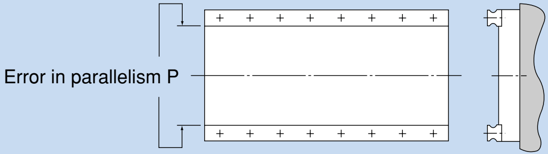


Fig. 21

Table 2 Error Allowance in Level (X) between Rails

Unit: mm

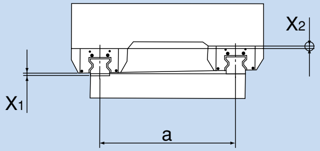
Radial clearance	Clearance C0	Clearance C1	Normal clearance
Permissible error on the mounting surface X	0.00011 a	0.00021 a	0.00030 a

$X=X_1+X_2$

Example of calculation

When the rail span : a=500 mm

Permissible error on the mounting surface : X=0.0003×500 =0.15



X_1 : Level difference on the rail mounting surface

X_2 : Level difference on the block mounting surface

Fig. 22

Table 3 Error Allowance in Level (Y) in the Axial Direction

Unit: mm

Permissible error on the mounting surface (mm)	0.000036 b

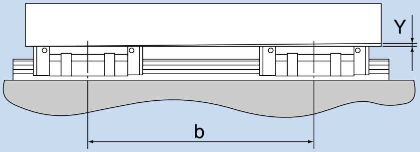


Fig. 23

7.4. Marking on the Master LM Guide® and Combined Use

7.4.1. Marking on the Master LM Guide®

All LM rails mounted on the same plane are marked with the same serial number. Of those LM rails, the one marked with "KB" after the serial number is the master LM rail. The LM block on the master LM rail has its datum plane finished to a designated accuracy, allowing it to serve as the positioning reference for the table (see Fig. 24). LM Guides of normal grade are not marked with "KB." Therefore, any one of the LM rails having the same serial number can be used as the master LM rail.

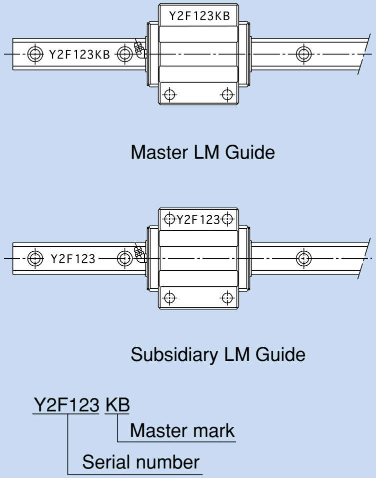


Fig. 24 Master LM Guide and Subsidiary LM Guide

7.4.2. Markings on the Datum Plane

In the LM Guide, the datum plane of the LM block is opposite the surface marked with the THK logo, and that of the LM rail is on the surface marked with a line (see Fig. 25). If it is necessary to reverse the datum plane of the LM rail and block, or if the grease nipple must be oriented in the opposite direction, specify it.

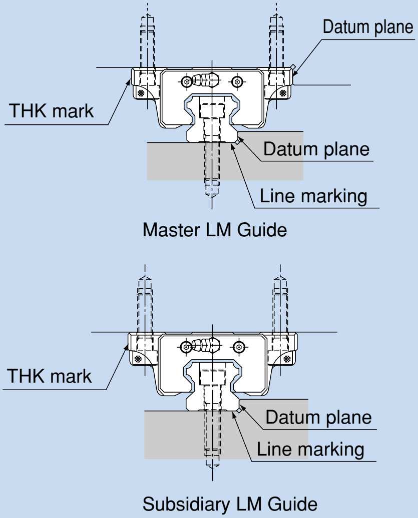


Fig. 25 Markings on the Datum Plane

7.4.3. Combined Use of an LM Rail and LM Block

An LM rail and LM block(s) used in combination must have the same serial number. When removing an LM block from the LM rail and reinstalling the LM block, make sure that they have the same serial number and the numbers are oriented in the same direction (Fig. 26).

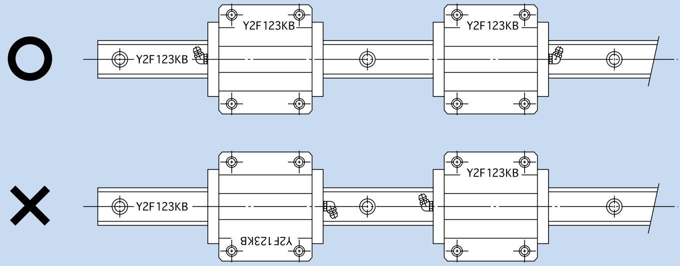


Fig. 26 Serial Number Marking and Combined Use of an LM Rail and LM Blocks

7.4.4. Use of Connected LM Rails

When a long LM rail is ordered, two or more rails will be connected together to the desired length. When connecting rails, make sure that the joint match marks shown in Fig. 27 are correctly positioned. When two LM Guides with connected rails are to be arranged in parallel to each other, the two LM Guides will be manufactured so that the two LM Guides are axisymmetrically aligned.

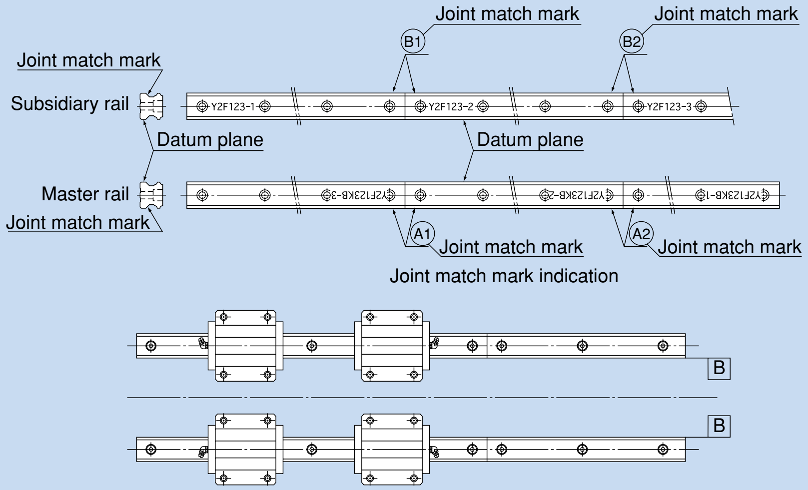


Fig. 27 Use of Connected Rails

8. Mounting the LM Guide®

8.1. Mounting Procedure

8.1.1. Example of Mounting the LM Guide When an Impact Load is Applied to the Machine and therefore Rigidity and High Accuracy are Required

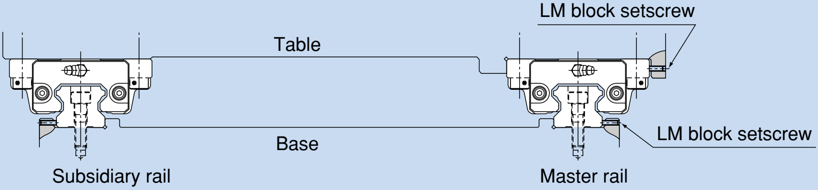


Fig. 1 When an Impact Load is Applied to the Machine

Mounting the LM Rail(s)

① Be sure to remove burr, indentations and dust from the mounting surface of the machine to which the LM Guide is to be mounted before installing the LM Guide (Fig. 2).

Note: Since the LM Guide is coated with anti-corrosion oil, remove it from the datum plane by wiping the surface with wash oil before using the guide. Once the anti-corrosion oil has been removed, the datum plane is prone to getting rusted. We recommend applying low-viscosity spindle oil.

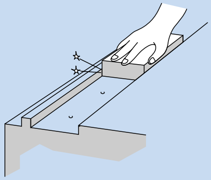


Fig. 2 Checking the Mounting Surface

② Gently place the LM rail onto the base, and temporarily secure the bolts to the extent that the LM rail lightly contacts the mounting surface (align the line-marked side of the LM rail with the side datum plane of the base) (Fig. 3).

Note: The bolts for securing the LM Guide must be clean. When placing the bolts into the mounting holes of the LM rail, check if the bolt holes are displaced (Fig. 4). Forcibly tightening the bolt into a displaced hole may deteriorate the accuracy.

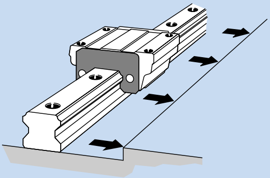


Fig. 3 Aligning the LM Rail with the Datum Plane

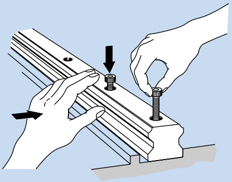


Fig. 4 Checking with the Bolt for an Allowance

③ Secure the setscrews for the LM rail in order with a tightening force just enough to have the rail closely contact the side mounting surface (Fig. 5).

④ Tighten the mounting bolts at the designated torque using a torque wrench (see Fig. 6, and tables 1 and 2 on page a-80).
Note: To achieve stable accuracy when tightening the LM rail mounting bolts, tighten them in order from the center to the rail ends.

⑤ Mount the other rail in the same manner to complete the installation of the LM rails.

⑥ Hammer in caps into the bolt holes on the top face of each LM rail until the top of the cap is on the same level as the top face of the rail.

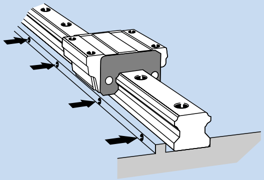


Fig. 5 Tightening the Setscrews

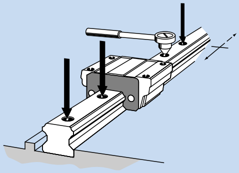


Fig. 6 Fully Tightening the Mounting Bolts

Mounting the LM Blocks

① Gently place the table on the LM blocks and temporarily secure the mounting bolts.

② Press the master side LM blocks to the side datum plane of the table using setscrews and position the table (Fig. 1).

③ Fully tighten the mounting bolts on the master side and the subsidiary side to complete the installation.
Note: To evenly secure the table, tighten the mounting bolts in diagonal order as shown in Fig. 7.

This method saves time in establishing straightness of the LM rail and eliminates the need to machine securing knock pins, thus to drastically shorten the installation man-hours.

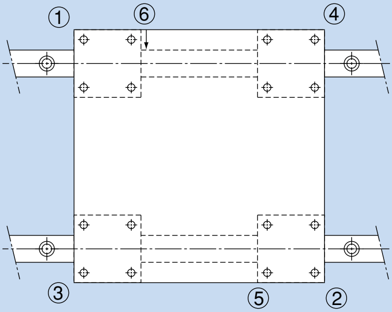


Fig. 7 Sequence of Tightening the LM Blocks

8.1.2. Example of Mounting the LM Guide When the Master LM Rail is not Provided with Setscrews

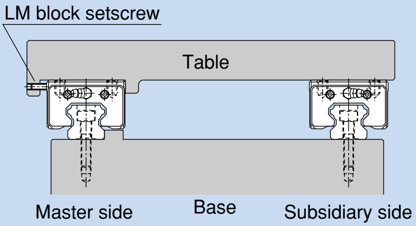


Fig. 8 When the Master LM Rail is not Provided with Setscrews

Mounting the Master LM Rail

After temporarily tightening the mounting bolts, firmly press the LM rail to the side datum plane at the position of each mounting bolt using a small vice and fully tighten the bolt. Perform this in order from either rail end to the other (Fig. 9).

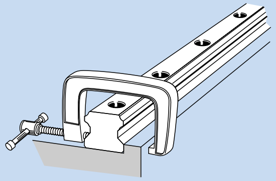


Fig. 9

Mounting the Subsidiary LM Rail

To mount the subsidiary LM rail in parallel with the master LM rail, which has been correctly installed, we recommend adopting the methods below.

● Use straight edges

Place straight edges between the two rails, and arrange the straight edges in parallel with the side datum plane of the master LM rail using a dial gauge. Then, secure the mounting bolts in order while achieving straightness of the subsidiary rail with the straight edge as the reference by using the dial gauge (Fig. 10).

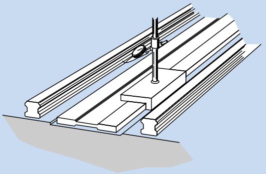


Fig. 10

● Use Parallelism of the Table

Secure the two LM blocks on the master LM rail with the table (or a temporary table for measurement), and temporarily fasten the LM rail and the LM block on the subsidiary LM rail with the table. Place a dial gauge to the side face of the LM block on the subsidiary rail from the dial stand fixed on the table top, then fasten the bolts in order while achieving parallelism of the subsidiary LM rail by moving the table from the rail end (Fig. 11).

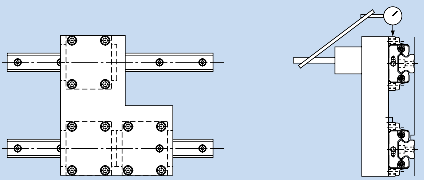


Fig. 11

● Having the Subsidiary LM Rail Follow the Master LM Rail

Place the table on the blocks of the correctly mounted master LM rail and the temporarily fastened subsidiary LM rail, and fully tighten the two LM blocks on the master rail and one of the two LM blocks on the subsidiary rail with bolts. Fully tighten the mounting bolts on the subsidiary LM rail in order while temporarily fastening the remaining LM block on the subsidiary LM rail (Fig. 12).

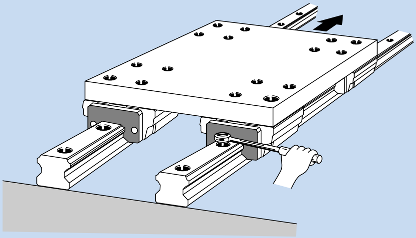
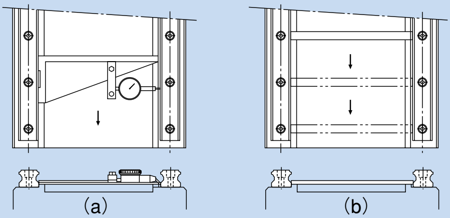


Fig. 12

● Use a Jig

Use a jig like the one shown in Fig. 13 to achieve parallelism of the datum plane on the subsidiary side against the side datum plane of the master side from one end of the rail by the mounting pitch, and at the same time, fully tighten the mounting bolts in order (Fig. 13).



(a)

(b)

Fig. 13

8.1.3. Example of Mounting the LM Guide When the Master LM Rail Does not Have a Side Datum Plane

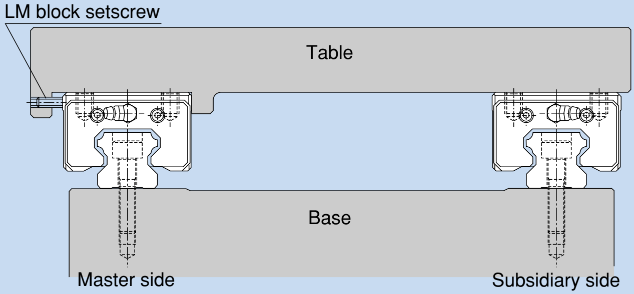


Fig. 14

Mounting the Master LM Rail

Use a temporary datum plane

You can temporarily set a datum plane near the LM rail mounting position on the base to achieve straightness of the LM rail from the rail end. In this method, two LM blocks must be joined together and attached to a measurement plate, as shown in Fig. 15.

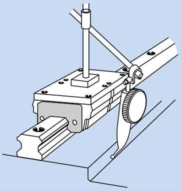


Fig. 15

Use a straight edge

After temporarily tightening the mounting bolts, use a dial gauge to check the straightness of the side datum plane of the LM rail from the rail end, and at the same time, fully tighten the mounting bolts.

To mount the subsidiary LM rail, follow the procedure described on page a-72.

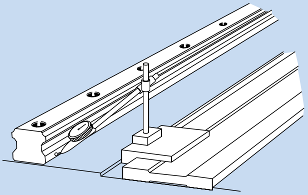


Fig. 16

8.1.4. Procedure for Assembling Model JR

Mounting the LM Rails

When two LM rails are to be used in parallel as shown in Fig. 17, first secure one LM rail on the base, and place a dial gauge on the LM block. Then, place the pointer of the dial gauge on the side face and top face of the other LM rail to simultaneously adjust the parallelism and the level, thus to complete mounting the LM rails.

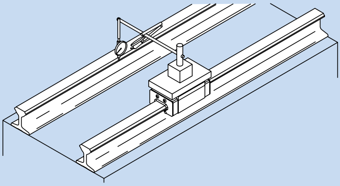


Fig. 17

Connecting LM Rails

When two or more LM rails are to be connected, a special metal fitting as shown in Fig. 18 is available. For such applications, specify this fitting when ordering the LM Guide.

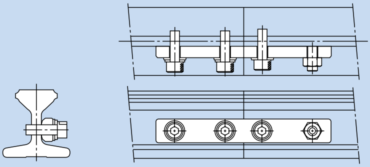


Fig. 18

Welding the LM Rail

When welding the LM rail, it is best to weld the LM rail while clamping it at the welding point with a small vice or the like as shown in Fig. 19. For effective welding, we recommend the following welding conditions (during welding the LM rail, take care to prevent spatter from contacting the LM rail raceway).

*Welding conditions:

●Preheating temperature :200℃

●Postheating temperature:350℃

Note: If the temperature exceeds 750℃, the LM rail may be hardened again.

● For shielded metal arc welding: welding rod
LB-52 (Kobelco)

● For CO_2-gas-shielded arc welding: wire: YGW12
Electric current: 200A

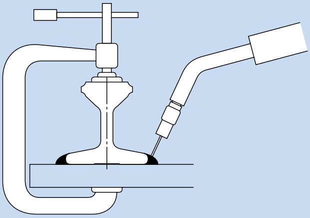


Fig. 19

8.1.5. Procedure for Assembling Model GSR

The procedure for assembling model GSR is as follows:

① Align the table with the reference surface of each LM block and fully tighten the mounting bolts to secure the blocks.
Both ends of the table must have a datum surface.

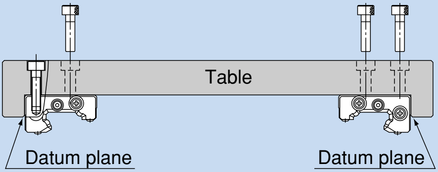


Fig. 20

② Place LM rail A onto the base and align the rail with a straight edge.
Fully tighten the mounting bolts using a torque wrench.

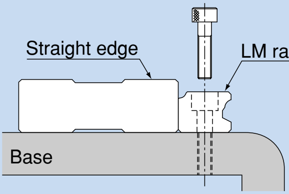


Fig. 21

③ Temporarily secure LM rail B onto the base, then mount the blocks on the rail by sliding the blocks.
Temporarily tighten LM rail B while pressing it toward the LM blocks.

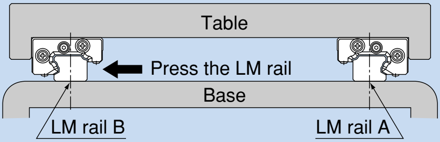


Fig. 22

④ Slide the table a few strokes to fit the LM blocks to LM rail B, then fully tighten LM rail B using a torque wrench.

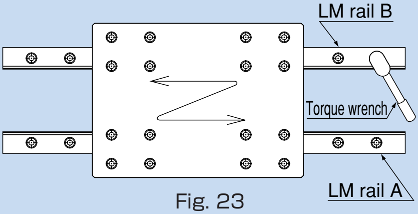


Fig. 23

If there are more GSR units to be assembled, we recommend producing a jig like the one shown in Fig. 24 first. You can easily mount LM rails while achieving parallelism of the LM rails using the jig.

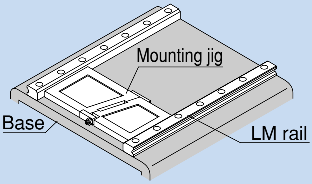


Fig. 24

8.1.6. Procedure for Assembling Model HR

The following procedure is recommended for assembling model HR.

① Remove burr from the LM rail mounting surface of the base using an oil stone.

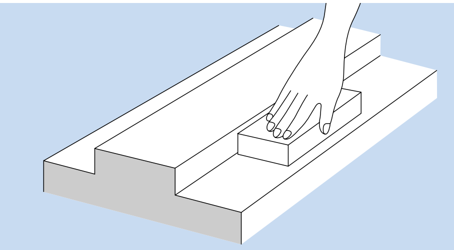


Fig. 25

② Use a small vice to press the two LM rails to the base so that they closely contact the datum planes, then tighten the mounting bolts to the recommended torque (see page a-80).

(a) Check if any of the bolts has a sinking.

(b) Use a torque wrench to tighten the bolts in order from the center to both ends.

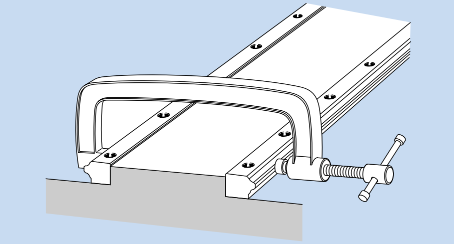


Fig. 26

③ Mount the LM blocks on the table, then install them onto the LM rails. Be sure the mounting bolts for the LM blocks are temporarily tightened.

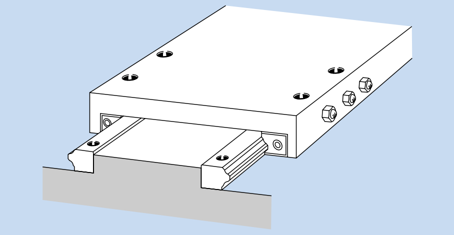


Fig. 27

④ Tighten the clearance-adjustment screws alternately to adjust the clearance. If a relatively large preload is applied in order to achieve high rigidity, control the tightening torque or the rolling resistance.

(a) It is preferable to use three clearance-adjustment screws for each LM block as shown in Fig. 27.

(b) To obtain a favorable result of the clearance adjustment, set the tightening torque of the two outside screws at approx. 90% of that of the enter screw.

⑤ Secure each LM block by gradually tightening the two LM block mounting bolts, which have temporarily been tightened, while sliding the table.

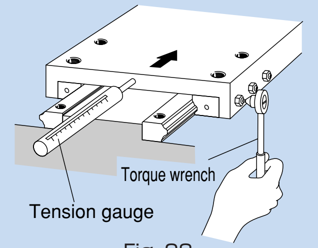


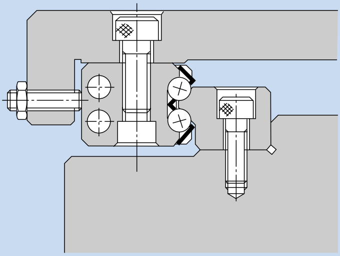
Fig. 28

●Example of Adjusting Clearance

The clearance-adjustment screw must be designed so that it presses the center of the LM block's side face.

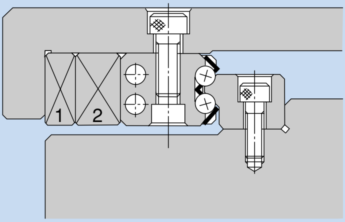
ⓐ Use an adjustment screw

Normally, an adjustment screw is used to press the LM block.



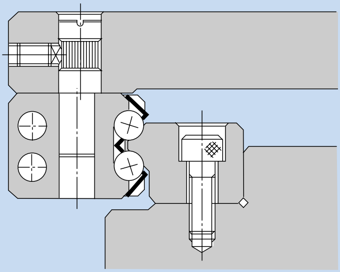
ⓑ Use tapered gibs

When high accuracy or high rigidity is required, use tapered gibs 1 and 2, as shown below.



ⓒ Use an eccentric pin

A type using an eccentric pin to adjust the clearance is also available.



8.1.7. Procedure for Assembling Model HCR

To install the LM rails of R Guide model HCR, we recommend having any form of datum point (such as a pin) on the reference side (inside) of the LM rail, and pressing the LM rail to the datum point then stopping the LM rail with a presser plate from the counter-reference surface.

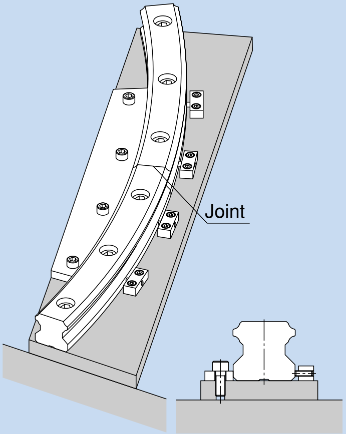


Fig. 29 Method for Securing the LM Rails at the Joint

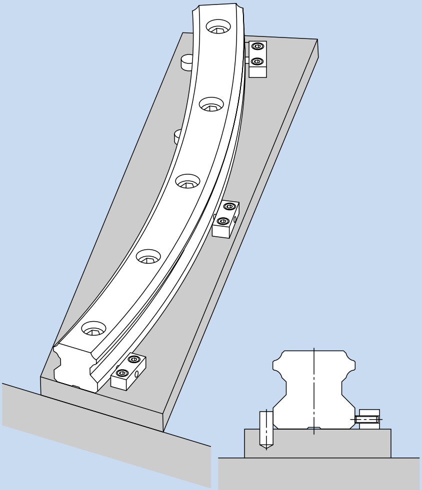
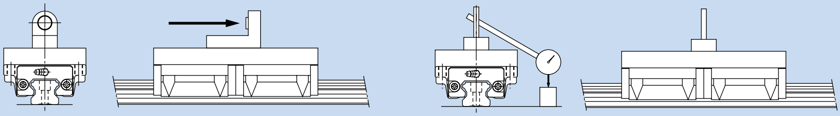


Fig. 30 Method for Securing the LM Rail using a Pin as a Datum Point

8.2. Methods for Measuring Accuracy after Installation

When Measuring Running Accuracy for Single Rail Application

When measuring running accuracy of the LM block, stable accuracy can be obtained by securing two LM blocks on an inspection plate, as shown in Fig. 31. When using a dial gauge, we recommend placing the straight edge as close as possible to the LM block in order to perform accurate measurement.



1） Measurement method using an auto-collimator　　2） Measurement method using a dial gauge

Fig. 31 Methods for Measuring Accuracy after Installation

8.3. Recommended Tightening Torque for LM Rails

With high-precision LM rails for the LM Guide, their raceways are ground and accuracy is inspected with the rails tightened with bolts. When mounting a high-precision LM rail on a machine, we recommend using the corresponding tightening torque indicated in table 1 or 2.

Table 1 Tightening Torques when Pan Head Screws are Used

Unit: N-cm

Screw model No.	Tightening torque	
	Not hardened	Hardened
M 2	17.6	21.6
M 2.3	29.4	35.3
M 2.6	44.1	52.9

Table 2 Tightening Torques when Hexagon Socket Screws are Used

Unit: N-cm

Screw model No.	Tightening torque		
	Iron	Casting	Aluminum
M 2	58.8	39.2	29.4
M 2.3	78.4	53.9	39.2
M 2.6	118	78.4	58.8
M 3	196	127	98
M 4	412	274	206
M 5	882	588	441
M 6	1370	921	686
M 8	3040	2010	1470
M 10	6760	4510	3330
M 12	11800	7840	5880
M 14	15700	10500	7840
M 16	19600	13100	9800
M 20	38200	25500	19100
M 22	51900	34800	26000
M 24	65700	44100	32800
M 30	130000	87200	65200

9. Precautions on Using the LM Guide®

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting an LM block or LM rail may cause them to fall by their own weight.
(3) Dropping or hitting the LM Guide may damage it. Giving an impact to the LM Guide could also cause damage to its function even if the guide looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, the lubricant may not be distributed throughout the LM system depending on the mounting orientation of the system. Contact THK for details.
(6) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball (roller) circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) When planning to use the LM system in an environment where the coolant penetrates the LM block, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(3) Do not use the LM system at a temperature of 80℃ or higher. When desiring to use the system at temperatures of 80℃ or higher, contact THK in advance.
(4) If foreign matter adheres to the LM system, replenish the lubricant after cleaning the product. For available types of detergent, contact THK .
(5) When using the LM Guide with inverted mount, breakage of the endplate due to an accident or the like may cause balls (rollers) to fall and the LM block to come off from the LM rail and fall. In these cases, take preventive measures such as adding a safety mechanism for preventing such falls.
(6) When using the LM system in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(7) When removing the LM block from the LM rail and then replacing the block, an LM block mounting/removing jig that facilitates such installation is available. Contact THK for details.

Storage

When storing the LM Guide, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

Radial-type LM Guide Model SSR

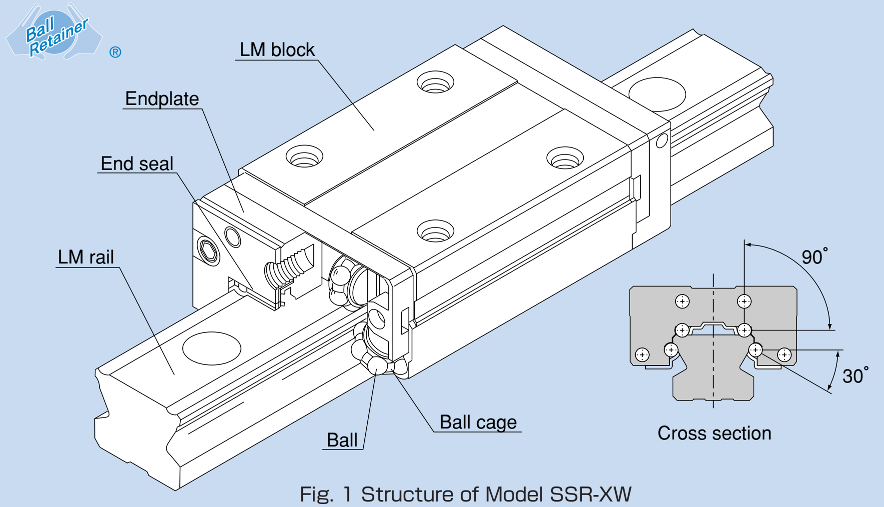


Fig. 1 Structure of Model SSR-XW

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and ball cages and endplates incorporated in the LM block allow the balls to circulate.
Use of the ball cage eliminates friction between balls and increases grease retention, thus to achieve low noise, high speed and long-term maintenance-free operation.

●Compact, radial type

The compact design with a low sectional height and the ball contact structure at 90° make SSR an optimal model for horizontal guides.

●Superb planar running accuracy

Use of a ball contact structure at 90° in the radial direction reduces displacement in the radial direction under a radial load and achieves highly accurate, smooth linear motion.

●Self-adjustment capability

The self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus to achieve stable accuracy.

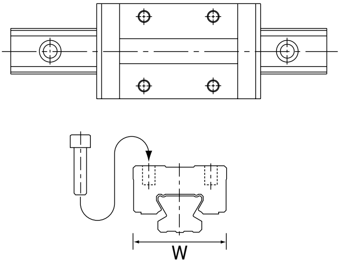
●Stainless steel type also available as standard

A stainless steel type with its LM block, LM rail and balls all made of stainless steel, which is superbly corrosion resistant, is also available as standard.

Types and Features

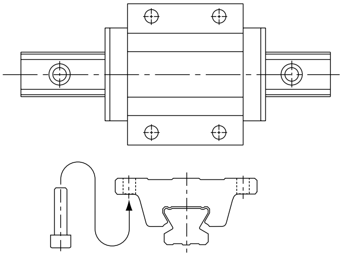
Model SSR-XW

With this type, the LM block has a smaller width (W) and tapped holes.



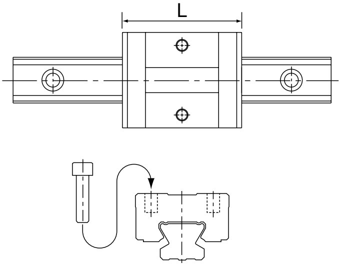
Model SSR-XTB

Since the LM block can be mounted from the bottom, this type is optimal for applications where through holes for mounting bolts cannot be drilled on the table.



Model SSR-XV

This type has the same sectional shape as SSR-XW but has a shorter overall LM block length (L).



Rated Loads in All Directions

Model SSR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
Its basic dynamic load rating is represented by the symbol in the radial direction indicated in Fig. 2, and the actual value is provided in the dimensional table for SSR. The values in the reverse-radial and lateral directions are obtained from table 1.

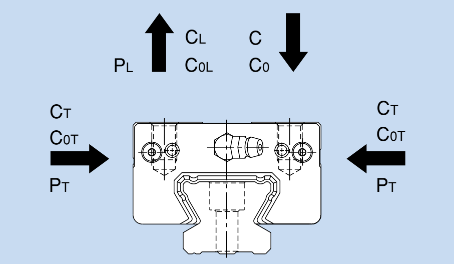


Fig. 2

Table 1 Rated Load of Model SSR in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.50C$	$C_{0L}=0.50C_0$
Lateral direction	$C_T=0.53C$	$C_{0T}=0.43C_0$

Equivalent Load

When the LM block of model SSR receives a reverse-radial direction and a lateral direction simultaneously, the equivalent load is obtained in the equation below.

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

where
P_E : Equivalent load (N)
- Reverse-radial direction
- Lateral direction

P_L : Reverse-radial direction (N)
P_T : Lateral direction (N)
X, Y : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model SSR

P_E	X	Y
Equivalent load in reverse-radial direction	1	1.155
Equivalent load in lateral direction	0.866	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SSR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-100.

Table 3 Symbols of Dust Prevention Accessories for Model SSR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper
SSHH	With end seal + side seal + LaCS
DDHH	With double seals + side seal + LaCS
ZZHH	With end seal + side seal + metal scraper + LaCS
KKHH	With double seals + side seal + metal scraper + LaCS

For model SSR, a light sliding-resistance contact seal LiCS, which is highly stable in sliding resistance, is also available. For details, contact THK.

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seal SSR ··· UU, refer to the corresponding value provided in table 4.

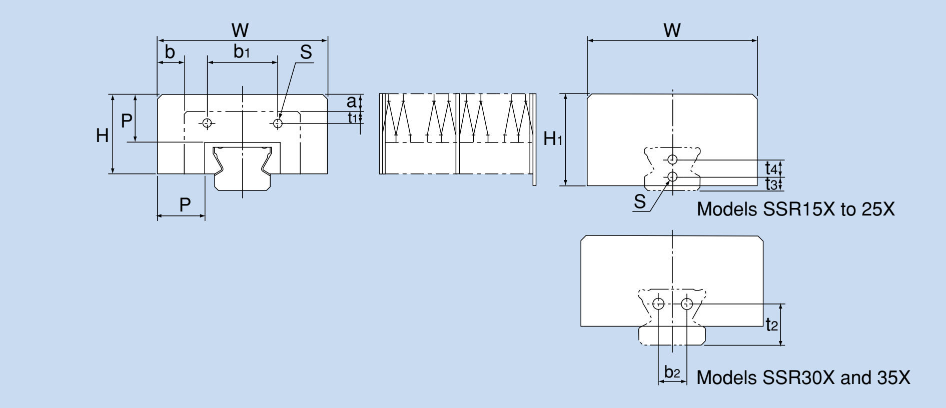
Table 4 Maximum Seal Resistance Value of Seal SSR ··· UU

Unit: N

Model No.	Seal resistance value
SSR 15X	2.0
SSR 20X	2.6
SSR 25X	3.5
SSR 30X	4.9
SSR 35X	6.3

●Dedicated Bellows JSSR-X for Model SSR

The table below shows the dimensions of dedicated bellows JSSR-X for model SSR. Specify the corresponding model number of the desired bellows from the table.



Models SSR15X to 25X

Models SSR30X and 35X

Unit: mm

Model No.	Major dimensions												b		A	Supported model
	W	H	H_1	P	b_1	t_1	b_2	t_2	t_3	t_4	Mounting bolt S	a	XW/XV	XTB	Lmax / Lmin	
JSSR 15X	51	24	26	15	20.5	4.7	—	—	8	—	M3×5 ℓ	5	8.5	–0.5	5	SSR 15X
JSSR 20X	58	26	30	15	25	4.2	—	—	6	6	M3×5 ℓ	4	8	–0.5	5	SSR 20X
JSSR 25X	71	33	38	20	29	5	—	—	6	7	M3×5 ℓ	7	11.5	–1	7	SSR 25X
JSSR 30X	76	37.5	37.5	20	35	9	12	17	—	—	M4×6 ℓ	3	8	—	7	SSR 30X
JSSR 35X	84	39	39	20	44	7	14	20	—	—	M5×10 ℓ	2	7	—	7	SSR 35X

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the dedicated bellows, contact THK.

Note 3: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering SSR.

Model number coding **JSSR35X-60/420**

$\underbrace{\text{JSSR35X}}_{1}\text{-}\underbrace{\text{60/420}}_{2}$

1 Model number ··· bellows for SSR35X

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)}$$

S: Stroke length (mm)

$$Lmax = Lmin \cdot A$$

A: Extension rate

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

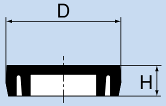
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SSR 15X	C4	M4	7.8	1.0
SSR 20X	C5	M5	9.8	2.4
SSR 25X	C6	M6	11.4	2.7
SSR 30X	C6	M6	11.4	2.7
SSR 35X	C8	M8	14.4	3.7



Dedicated Cap C

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 6 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-100.

Table 6 Parts Symbols for Model SSR with QZ Lubricator

Symbol	Dust prevention accessories for model SSR with QZ Lubricator
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + QZ Lubricator
QZDD	With double seals + side seal + QZ Lubricator
QZZZ	With end seal + side seal + metal scraper + QZ Lubricator
QZKK	With double seals + side seal + metal scraper + QZ Lubricator
QZSSHH	With end seal + side seal + LaCS + QZ Lubricator
QZDDHH	With double seals + side seal + LaCS + QZ Lubricator
QZZZHH	With end seal + side seal + metal scraper + LaCS + QZ Lubricator
QZKKHH	With double seals + side seal + metal scraper + LaCS + QZ Lubricator

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model SSR variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

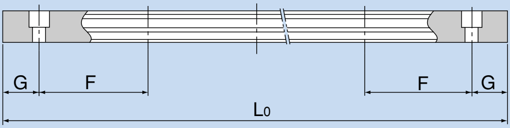


Table 7 Standard Length and Maximum Length of the LM Rail

Unit: mm

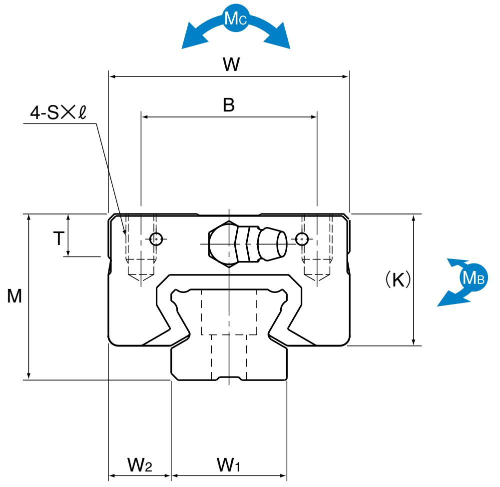
Model No.	SSR 15X	SSR 20X	SSR 25X	SSR 30X	SSR 35X
Standard LM rail length (L_0)	160	220	220	280	280
	220	280	280	360	360
	280	340	340	440	440
	340	400	400	520	520
	400	460	460	600	600
	460	520	520	680	680
	520	580	580	760	760
	580	640	640	840	840
	640	700	700	920	920
	700	760	760	1000	1000
	760	820	820	1080	1080
	820	940	940	1160	1160
	940	1000	1000	1240	1240
	1000	1060	1060	1320	1320
	1060	1120	1120	1400	1400
	1120	1180	1240	1480	1480
	1180	1240	1300	1640	1640
	1240	1300	1360	1720	1720
	1300	1360	1420	1800	1800
	1360	1420	1480	1880	1880
	1420	1480	1540	1960	1960
	1480	1540	1600	2040	2040
	1540	1600	1660	2120	2120
		1660	1720	2200	2200
		1720	1780	2280	2280
		1780	1840	2360	2360
		1840	1900	2440	2440
		1900	1960	2520	2520
		1960	2020	2600	2600
		2020	2080	2680	2680
		2080	2140	2760	2760
		2140	2200	2840	2840
			2260	2920	2920
			2320		
			2380		
			2440		
Standard pitchF	60	60	60	80	80
G	20	20	20	20	20
Max length	2500 (1240)	3000 (1480)	3000 (2020)	3000 (2520)	3000

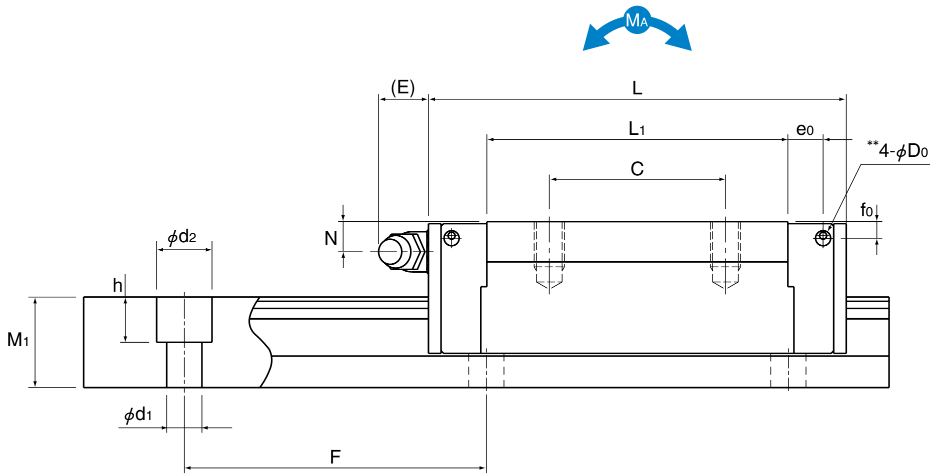
Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Note 3: The values in the parentheses indicate the maximum lengths of stainless steel types.

Models SSR-XW | SSR-SWM





Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease nipple	Width		Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	E	f_0	e_0	D_0		W_1 ±0.05	W_2	M_1	F	d_1×d_2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SSR 15XWY SSR 15XWMY	24	34	56.9	26	26	M4×7	39.9	6.5	19.5	4.5	5.5	2.7	4.5	3	PB1021B	15	9.5	12.5	60	4.5×7.5×5.3	14.7	16.5	0.0792	0.44	0.0486	0.274	0.0962	0.15	1.2
SSR 20XW SSR 20XWM	28	42	66.5	32	32	M5×8	46.6	8.2	22	5.5	12	2.8	5.2	3	B-M6F	20	11	15.5	60	6×9.5×8.5	19.6	23.4	0.138	0.723	0.0847	0.448	0.18	0.25	2.1
SSR 25XWY SSR 25XWMY	33	48	83	35	35	M6×9	59.8	8.4	26.2	6	12	3.3	7	3	B-M6F	23	12.5	18	60	7×11×9	31.5	36.4	0.258	1.42	0.158	0.884	0.33	0.4	2.7
SSR 30XW SSR 30XWM	42	60	97	40	40	M8×12	70.7	11.3	32.5	8	12	4.5	7.6	4	B-M6F	28	16	23	80	7×11×9	46.5	52.7	0.446	2.4	0.274	1.49	0.571	0.8	4.3
SSR 35XW	48	70	110.9	50	50	M8×12	80.5	13	36.5	8.5	12	4.7	8.8	4	B-M6F	34	18	27.5	80	9×14×12	64.6	71.6	0.711	3.72	0.437	2.31	0.936	1.1	6.4

Note Those models whose numbers contain symbol "M" use stainless steel in their LM blocks, LM rails and balls, and therefore are highly resistant to corrosion and environment.

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block : static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SSR20X W 2 UU C1 M +1200L P M - II
1 2 3 4 5 6 7 8 9 10

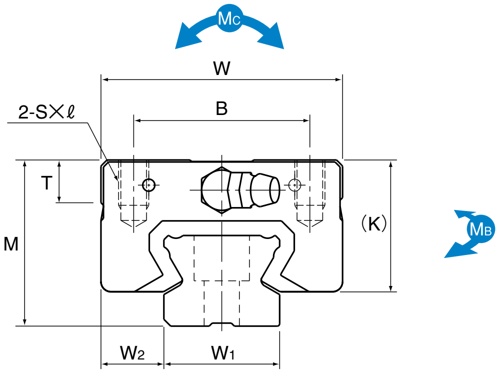
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-89) 5 Radial clearance symbol (see page a-33)
6 Stainless steel LM block 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 Stainless steel LM rail 10 No. of rails used on the same plane

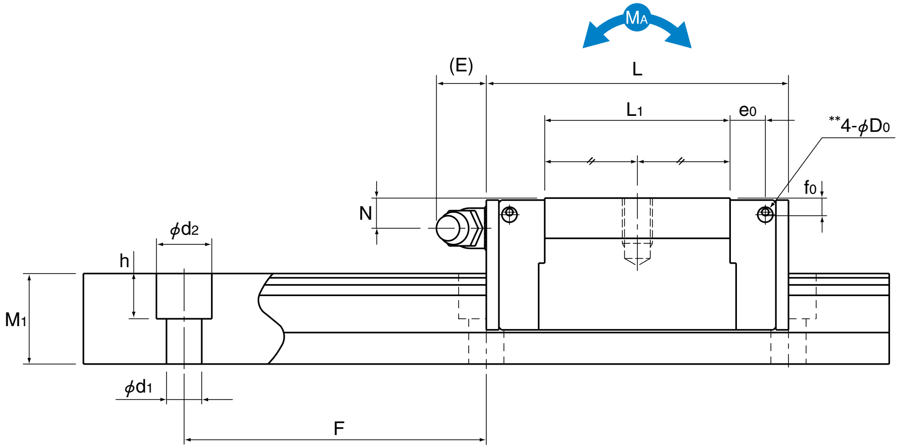
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-92

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SSR-XV | SSR-XVM





Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple	Width W₁ ±0.05	W₂	Height M₁	Pitch F	d₁×d₂×h	C	C₀	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	S×ℓ	L₁	T	K	N	E	f₀	e₀	D₀							kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SSR 15XVY SSR 15XVMY	24	34	40.3	26	M4×7	23.3	6.5	19.5	4.5	5.5	2.7	4.5	3	PB1021B	15	9.5	12.5	60	4.5×7.5×5.3	9.1	9.7	0.0303	0.192	0.0189	0.122	0.0562	0.08	1.2
SSR 20XV SSR 20XVM	28	42	47.7	32	M5×8	27.8	8.2	22	5.5	12	2.8	5.2	3	B-M6F	20	11	15.5	60	6×9.5×8.5	13.4	14.4	0.0523	0.336	0.0326	0.213	0.111	0.14	2.1
SSR 25XVY SSR 25XVMY	33	48	60	35	M6×9	36.8	8.4	26.2	6	12	3.3	7	3	B-M6F	23	12.5	18	60	7×11×9	21.7	22.5	0.104	0.661	0.0652	0.419	0.204	0.23	2.7

Note Those models whose numbers contain symbol "M" use stainless steel in their LM blocks, LM rails and balls, and therefore are highly resistant to corrosion and environment.

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block : static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

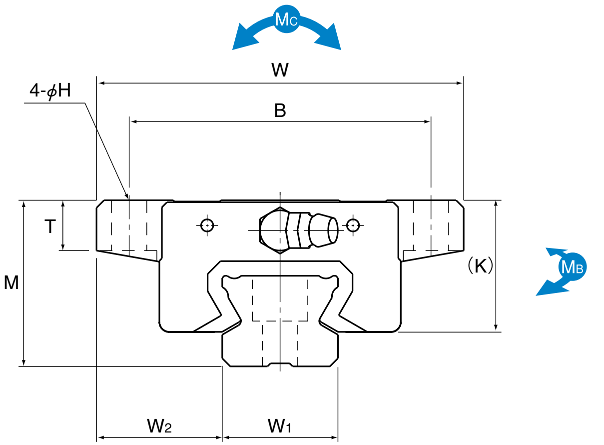
SSR25X	V	2	UU	C1	M	+1200L	Y	P	M	-Ⅲ
1	2	3	4	5	6	7	8	9	10	11

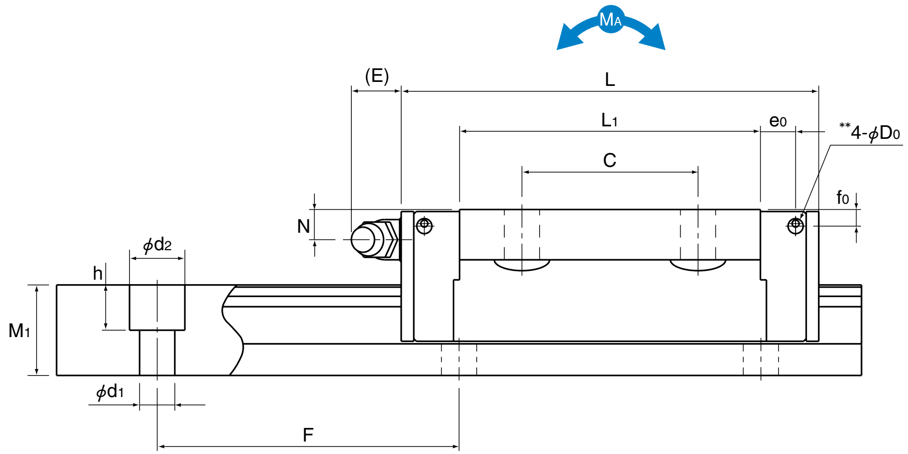
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-89) 5 Radial clearance symbol (see page a-33)
6 Stainless steel LM block 7 LM rail length (in mm) 8 Applied to only 15 and 25
9 Accuracy symbol (see page a-38) 10 Stainless steel LM rail 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 3 rails are used in parallel is 3 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-92
Selecting a Model Number | Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Model SSR-XTB





Unit: mm

Model No.	External dimensions Height M	Width W	Length L	LM block dimensions B	C	H	L1	T	K	N	E	f0	e0	D0	Grease nipple	LM rail dimensions Width W1 ±0.05	W2	Height M1	Pitch F	d1×d2×h	Basic load rating C kN	C0 kN	Static permissible moment kN-m* MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	Mass LM block kg	LM rail kg/m
SSR 15XTBY	24	52	56.9	41	26	4.5	39.9	6.1	20	4.5	5.5	2.7	4.5	3	PB1021B	15	18.5	12.5	60	4.5×7.5×5.3	14.7	16.5	0.0792	0.44	0.0486	0.274	0.0962	0.19	1.2
SSR 20XTB	28	59	66.5	49	32	5.5	46.6	9	22	5.5	12	2.8	5.2	3	B-M6F	20	19.5	15.5	60	6×9.5×8.5	19.6	23.4	0.138	0.723	0.0847	0.448	0.18	0.31	2.1
SSR 25XTBY	33	73	83	60	35	7	59.8	10	26.2	6	12	3.3	7	3	B-M6F	23	25	18	60	7×11×9	31.5	36.4	0.258	1.42	0.158	0.884	0.33	0.53	2.7

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block : static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SSR15X TB 2 SS C1 +820L Y -Ⅱ
1 2 3 4 5 6 7 8

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-89)
5 Radial clearance symbol (see page a-33) 6 LM rail length (in mm)
7 Applied to only 15 and 25 8 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-92

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SSR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SSR 15XVY	40.3	40.3	46.1	44.9	50.7	59.5	65.3	60.7	66.5
SSR 15XWY/XTBY	56.9	56.9	62.7	61.5	67.3	76.1	81.9	77.3	83.1
SSR 20XV	47.7	47.7	54.6	53.4	60.3	67.7	74.6	70.1	77
SSR 20XW/XTB	66.5	66.5	73.4	72.2	79.1	86.5	93.4	88.9	95.8
SSR 25XVY	60	60	67.4	65.7	73.1	80	87.4	82.4	89.8
SSR 25XWY/XTBY	83	83	90.4	88.7	96.1	103	110.4	105.4	112.8
SSR 30XW	97	97	105.1	102.7	110.7	121	129.1	123.4	131.5
SSR 35XW	110.9	110.9	119.9	117.7	126.7	136.9	145.9	139.3	148.3

Overall LM Block Length (Dimension L) of Model SSR with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SSR 15XVY	59.3	59.3	65.1	62.7	68.5	75.5	81.3	76.7	82.5
SSR 15XWY/XTBY	75.9	75.9	81.7	79.3	85.1	92.1	97.9	93.3	99.1
SSR 20XV	66.2	66.2	73.1	72.1	79	83.7	90.6	86.1	93
SSR 20XW/XTB	85	85	91.9	90.9	97.8	102.5	109.4	104.9	111.8
SSR 25XVY	82.6	82.6	90	88.4	95.8	100	107.4	102.4	109.8
SSR 25XWY/XTBY	105.6	105.6	113	111.4	118.8	123	130.4	125.4	132.8
SSR 30XW	119.7	119.7	127.8	125.4	133.4	141	149.1	143.4	151.5
SSR 35XW	134.3	134.3	143.3	141.3	150.3	156.9	165.9	159.3	168.3

Basic Specifications of LaCS®

① Service temperature range of LaCS:
-20°C to +80°C

② Resistance of LaCS: indicated in table 8

Table 8 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SSR 15X	5.9
SSR 20X	6.9
SSR 25X	8.1
SSR 30X	12.8
SSR 35X	15.1

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 3 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

■For LM Guides with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 3. Table 9 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SSR

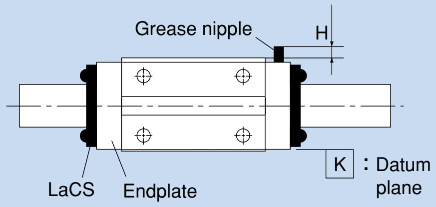


Fig. 3

Table 9

Unit: mm

Model No.	Incremental dimension with grease nipple H	Nipple type
SSR 15XVY/XWY	4.4	PB107
SSR 15XTBY	—	PB107
SSR 20XV/XW	4.6	PB107
SSR 20XTB	—	PB107
SSR 25XVY/XWY	4.5	PB107
SSR 25XTBY	—	PB107
SSR 30XW	5.0	PB1021B
SSR 35XW	5.0	PB1021B

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 3, contact THK.

■For LM Guides with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding table of dimensions.

■For LM Guides with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding SSR25X W 2 QZ SSHH C1 M +600L Y P M

1 (SSR25X W) 2 (QZ) 3 (SSHH) 4 (Y)

1 LM Guide model number
2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator, with grease nipple (see Fig. 3)
3 Dust prevention accessory symbol (see page a-89)
4 Note 3

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator do not have the grease nipple. When desiring both QZ Lubricator and the grease nipple to be attached, contact THK.
Note 3: For models SSR15XWY, SSR15XVY, SSR15XTBY, SSR25XWY, SSR25XVY and SSR25XTBY, beware of the position of the "Y" symbol in the model number code.

Precautions on Use

Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20°C and +80°C, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10°C and +50°C.

Use in a Special Environment

- When using it in a special environment, contact THK .

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Caged Ball® LM Guide®

Ultra-heavy Load Type LM Guide Models SNR/SNS

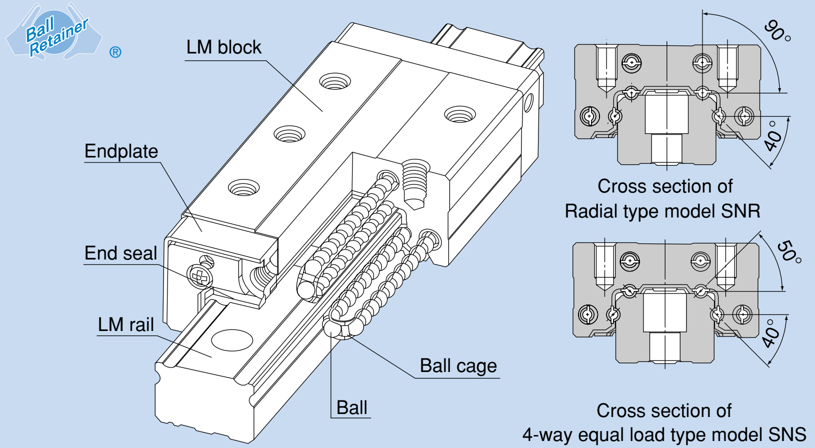


Fig. 1 Structure of Models SNR/SNS

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and ball cages and endplates incorporated in the LM block allow the balls to circulate. Use of the ball cage eliminates friction between balls and increases grease retention, thus to achieve low noise, high speed and long-term maintenance-free operation.

●High rigidity

Models SNR/SNS are the most rigid types among the Caged Ball LM Guide series.
Both the radial type SNR and the 4-way equal load type SNS are available for each size variation. Depending on the intended use, you can select either type.

●Ultra-heavy load

Since the curvature is approximated to the ball radius, the ball contact area under a load is increased and the capacity to carry ultra-heavy loads is achieved.

●Increased damping effect

In rapid traverse where the LM block travels at high speed, no differential slip occurs and smooth motion is maintained, thus achieving highly accurate positioning. In heavy cutting where the LM block travels at low speed, favorable differential slip according to the cutting load occurs to increase frictional resistance, thus increasing the damping capacity.

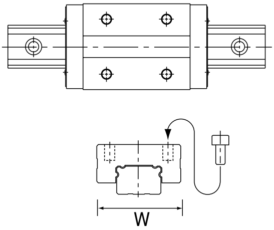
●Wide array of options

Various options are available, including end seal, inner seal, Laminated Contact Scraper LaCS and plate cover, to respond to diversified applications.

Types and Features

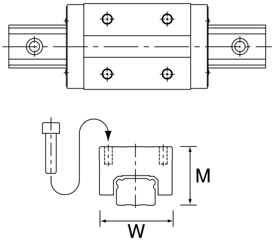
Models SNR-R/SNS-R

The LM block has a smaller width (W) and is equipped with tapped holes.
Suitable for places where space for the table width is limited.



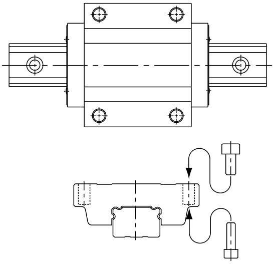
Models SNR-RH/SNS-RH (build to order)

The dimensions are almost the same as that of LM Guide models SHS and HSR, and the LM block has tapped holes.



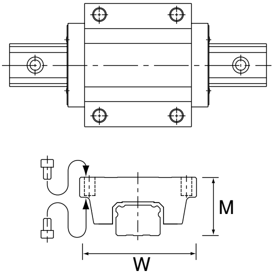
Models SNR-C/SNS-C

The flange of the LM block has tapped holes.
Can be mounted from the top or the bottom.
Used in places where the table cannot have through holes for mounting bolts.



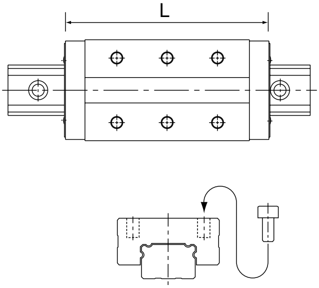
Models SNR-CH/SNS-CH (build to order)

The dimensions are almost the same as that of LM Guide models SHS and HSR, and the flange of the LM block has tapped holes.



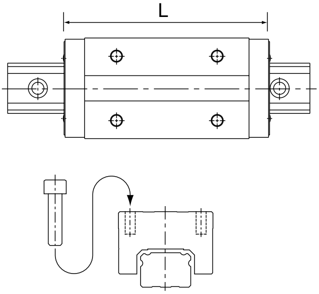
Models SNR-LR/SNS-LR

The LM block has the same sectional shape as models SNR-R/SNS-R, but has a longer overall LM block length (L) and a greater rated load.



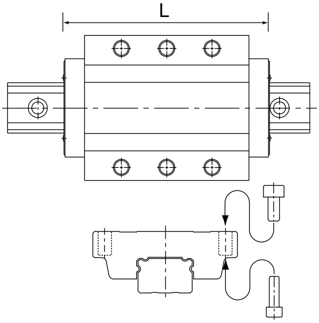
Models SNR-LRH/SNS-LRH (build to order)

The LM block has the same sectional shape as models SNR-RH/SNS-RH, but has a longer overall LM block length (L) and a greater rated load.



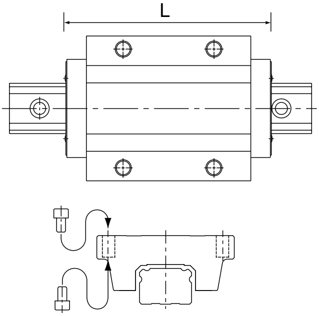
Models SNR-LC/SNS-LC

The LM block has the same sectional shape as models SNR-C/SNS-C, but has a longer overall LM block length (L) and a greater rated load.



Models SNR-LCH/SNS-LCH (build to order)

The LM block has the same sectional shape as models SNR-CH/SNS-LCH, but has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Models SNR/SNS are capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
Their basic dynamic load ratings are represented by the symbols in the radial direction indicated in Fig. 2, and the actual values are provided in the dimensional tables for SNR/SNS. The values in the reverse-radial and lateral directions are obtained from table 1.

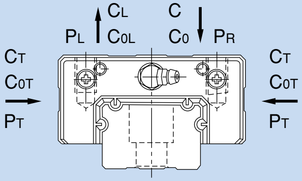


Fig. 2

Table 1 Rated Loads of Models SNR/SNS in All Directions

Direction	SNR	
	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.64C$	$C_{0L}=0.64C_0$
Lateral direction	$C_T=0.47C$	$C_{0T}=0.38C_0$

Direction	SNS	
	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.84C$	$C_{0L}=0.84C_0$
Lateral direction	$C_T=0.84C$	$C_{0T}=0.84C_0$

Equivalent Load

When the LM block of model SNR receives a reverse-radial load and a lateral load simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
·Reverse-radial direction
·Lateral direction
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X, Y : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model SNR

P_E	X	Y
Equivalent load in reverse-radial direction	1	1.678
Equivalent load in lateral direction	0.596	1

When the LM block of model SNS receives a radial load and a lateral load, or a reverse-radial load and a lateral load, simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X \cdot P_R(P_L)+Y \cdot P_T$$

where

P_E : Equivalent load (N)
·Radial direction
·Reverse-radial direction
·Lateral direction
P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X, Y : Equivalent factor (see tables 3 and 4)

Table 3 Equivalent Factor of Model SNS
(When radial load and lateral load are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.935
Equivalent load in lateral direction	1.07	1

Table 4 Equivalent Factor of Model SNS
(When reverse-radial load and lateral load are applied)

P_E	X	Y
Equivalent load in reverse-radial direction	1	1.02
Equivalent load in lateral direction	0.986	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for models SNR/SNS.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 5 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-130.

Table 5 Symbols of Dust Prevention Accessories for Models SNR/SNS

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper
SSHH	With end seal + side seal + inner seal + LaCS
DDHH	With double seals + side seal + inner seal + LaCS
ZZHH	With end seal + side seal + inner seal + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal + metal scraper + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seal SNR/SNS ··· SS, refer to the corresponding value provided in table 6.

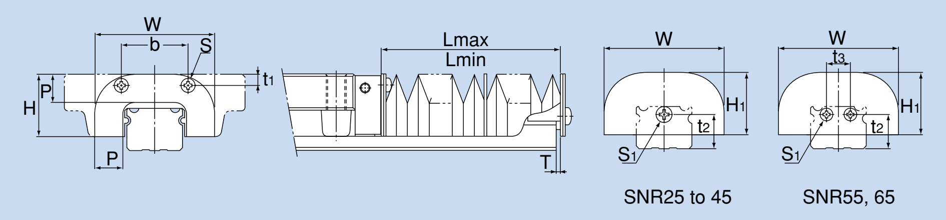
Table 6 Maximum Seal Resistance Value of Seal SNR/SNS ··· SS

Unit: N

Model No.	Seal resistance value
SNR/SNS 25	8
SNR/SNS 30	14
SNR/SNS 35	14
SNR/SNS 45	16
SNR/SNS 55	20
SNR/SNS 65	25

●Simplified Bellows JSN

For models SNR/SNS-C, SNR/SNS-LC, SNR/SNS-R and SNR/SNS-LR, a simplified bellows is available. Attach the simplified bellows when the LM Guide is used in locations subject to a coolant or the like. To gain a higher dust-prevention effect, attach a telescopic cover outside the simplified bellows after the bellows is mounted.



SNR25 to 45

SNR55, 65

Table 7 Dimensional Table for JSN

Unit: mm

Model No.	Major dimensions											A	Supported model
	W	H	H_1	P	b	t_1	t_2	t_3	Mounting bolt S	S_1	T	Lmax/Lmin	
JSN 25	50	25.5	24.5	10	26.6	4.6	13	—	M3×5ℓ	M4×4ℓ	1.5	7	SNR/SNS25
JSN 30	60	31	30	14	34	5.5	16.5	—	M4×8ℓ	M4×4ℓ	1.5	9	SNR/SNS30
JSN 35	70	35	34	15	36	6	20	—	M4×8ℓ	M5×4ℓ	2	10	SNR/SNS35
JSN 45	86	40.5	39.5	17	47	6.5	23.5	—	M5×10ℓ	M5×4ℓ	2	10	SNR/SNS45
JSN 55	100	49	48	19.5	54	10	30.6	18	M5×10ℓ	M5×4ℓ	2	13	SNR/SNS55
JSN 65	126	60	59	22	64	13.5	36.1	20	M6×12ℓ	M6×5ℓ	3.2	13	SNR/SNS65

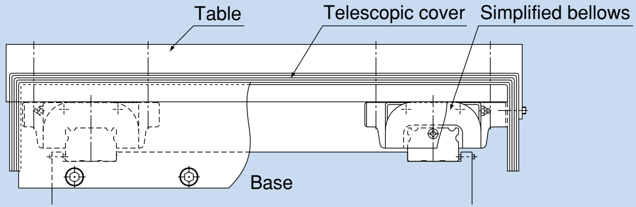


Fig. 3 Example of Mounting the Simplified Bellows

Note 1: When desiring to use the simplified bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the simplified bellows, contact THK.

Note 3: For the bellows for models SNR/SNS-CH, SNR/SNS-LCH, SNR/SNS-RH and SNR/SNS-LRH, contact THK.

Note 4: When using the simplified bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the simplified bellows is required when ordering the LM Guide.

Model number coding JSN25-60/420

1 2

1 Model number ··· bellows for SNR25

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$L_{min} = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$L_{max} = L_{min} \cdot A$$ A: Extension rate

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

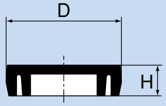
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap C model number indicated in table 8.

For the procedure for mounting the cap, see page a-22.

Table 8 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SNR/SNS 25	C 5	M 5	9.8	2.4
SNR/SNS 30	C 6	M 6	11.4	2.7
SNR/SNS 35	C 8	M 8	14.4	3.7
SNR/SNS 45	C12	M12	20.5	4.7
SNR/SNS 55	C14	M14	23.5	5.7
SNR/SNS 65	C16	M16	26.5	5.7



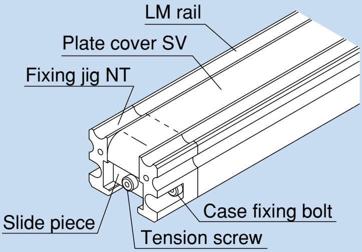
Dedicated Cap C

●Plate Cover SV

For models SNR/SNS, plate covers are available as an essential means of dust prevention for machine tools. By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the plate cover SV drastically increases sealability, thus to prevent the penetration of a coolant or cutting chips, which previously could not be stopped from entering the mounting holes.

For the mounting procedure, see page a-27.

Note: When mounting the plate cover, the LM rail needs to be machined. Indicate that the plate cover is required when ordering the LM Guide.



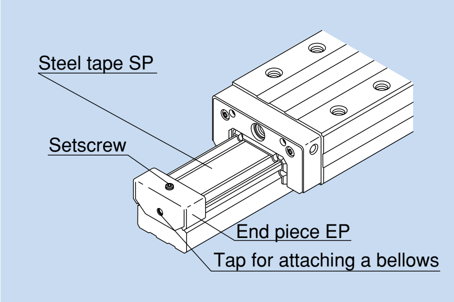
Note: The plate cover is available for models SNR/SNS35 to 65.

●Steel Tape SP

For models SNR/SNS, steel tapes are available as an essential means of dust prevention for machine tools. By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the steel tape SP further increases sealability, thus to prevent the penetration of a coolant or cutting chips, which previously could not be stopped from entering the mounting holes (when mounting the steel tape, end piece EP can be used as a means to secure the cover).

For the mounting procedure, see page a-28.

Note: When mounting the steel tape, the LM rail needs to be machined. Indicate that the steel tape is required when ordering the LM Guide.



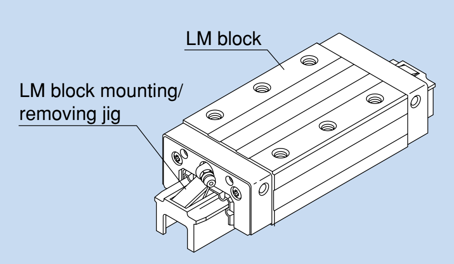


Fig. 4

Note 1: The steel tape is available for models SNR/SNS25 to 65.

Note 2: Since balls of models SNR/SNS are retained by ball cages, they will not fall off even if the LM block is removed from the LM rail.
However, if the LM block is twisted when reattaching it onto the LM rail, it may cause the balls to fall or damage the ball cage. We recommend using the LM block removing/mounting jig (for models receiving preloads, be sure to use the LM block removing/mounting jig).

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 9 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-131.

Table 9 Parts Symbols for Model SNR with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + inner seal + QZ Lubricator
QZDD	With double seals + side seal + inner seal + QZ Lubricator
QZZZ	With end seal + side seal + inner seal + metal scraper + QZ Lubricator
QZKK	With double seals + side seal + inner seal + metal scraper + QZ Lubricator
QZSSHH	With end seal + side seal + inner seal + LaCS + QZ Lubricator
QZDDHH	With double seals + side seal + inner seal + LaCS + QZ Lubricator
QZZZHH	With end seal + side seal + inner seal + metal scraper + LaCS + QZ Lubricator
QZKKHH	With double seals + side seal + inner seal + metal scraper + LaCS + QZ Lubricator

Standard Length and Maximum Length of the LM Rail

Table 10 shows the standard lengths and the maximum lengths of model SNR/SNS variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

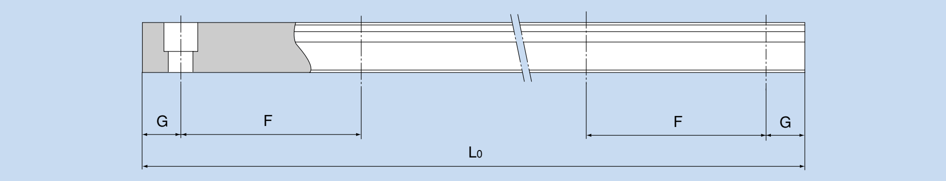


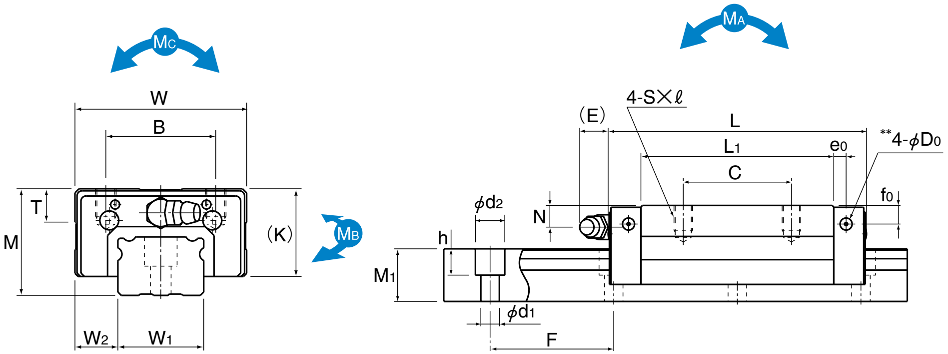
Table 10 Standard Length and Maximum Length of the LM Rail for Models SNR/SNS

Unit: mm

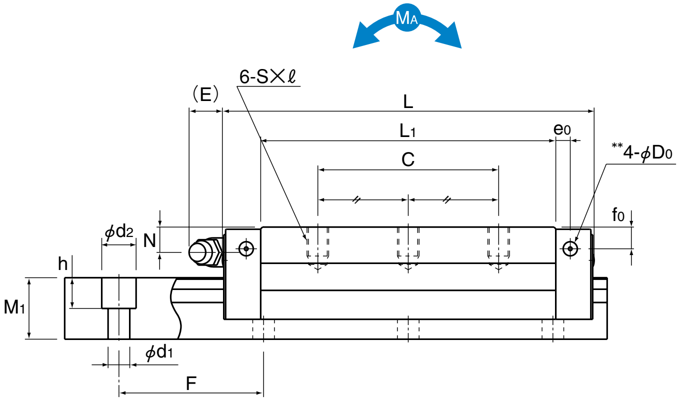
Model No.	SNR/SNS 25	SNR/SNS 30	SNR/SNS 35	SNR/SNS 45	SNR/SNS 55	SNR/SNS 65
Standard LM rail length (L_0)	230	280	280	570	780	1270
	270	360	360	675	900	1570
	350	440	440	780	1020	2020
	390	520	520	885	1140	2620
	470	600	600	990	1260	
	510	680	680	1095	1380	
	590	760	760	1200	1500	
	630	840	840	1305	1620	
	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	40	80	80	105	120	150
G	15	20	20	22.5	30	35
Max length	2500	3000	3000	3090	3060	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models SNR-R | SNR-LR



Model SNR-R



Model SNR-LR

Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L_1	T	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	d_1×d_2×h	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SNR 25R	31	50	83.6	32	35	M6×8	62.4	9.7	25.5	7	6	12	4	3.9	B-M6F	25	12.5	17	40	6×9.5×8.5	48	79	0.682	3.62	0.427	2.25	0.868	0.4	3.1
SNR 25LR			102.8		50		81.6														57	101	1.14	5.55	0.708	3.4	1.1	0.6	
SNR 30R	38	60	98	40	40	M8×10	72.1	9.7	31	7	7	12	6.5	3.9	B-M6F	28	16	21	80	7×11×9	68	106	1.04	5.7	0.653	3.56	1.3	0.7	4.4
SNR 30LR			120.5		60		94.6														81	138	1.81	8.89	1.12	5.47	1.69	0.9	
SNR 35R	44	70	110.3	50	50	M8×12	79	11.7	35	8	8	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	90	144	1.61	8.64	1.01	5.39	2.13	1	6.2
SNR 35LR			135.8		72		104.5														108	188	2.68	13.6	1.67	8.49	2.79	1.4	
SNR 45R	52	86	139	60	60	M10×17	105	14.7	40.4	10	8	16	8.5	5.2	B-PT1/8	45	20.5	29	105	14×20×17	132	216	3.29	16	2.03	9.86	4.21	1.9	9.8
SNR 45LR			171.8		80		137.8														161	288	5.4	26.2	3.35	16.2	5.64	2.4	
SNR 55R	63	100	163.3	65	75	M12×18	123.6	17.7	49	11	10	16	10	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	177	292	4.99	25.7	3.11	16	6.69	3.1	14.5
SNR 55LR			200.5		95		160.8														214	383	8.41	40.9	5.22	25.3	8.78	4	
SNR 65R	75	126	186.4	76	70	M16×20	143.6	21.6	60	16	15	16	9	8.2	B-PT1/8	63	31.5	43	150	18×26×22	260	409	8.05	41.2	5.03	25.6	11	5.6	20.5
SNR 65LR			246.4		110		203.6														340	572	15.9	74.5	9.84	45.7	15.4	8	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SNR45 LR 2 QZ KKHH C0 +1200L P Z - Ⅱ

1 2 3 4 5 6 7 8 9 10

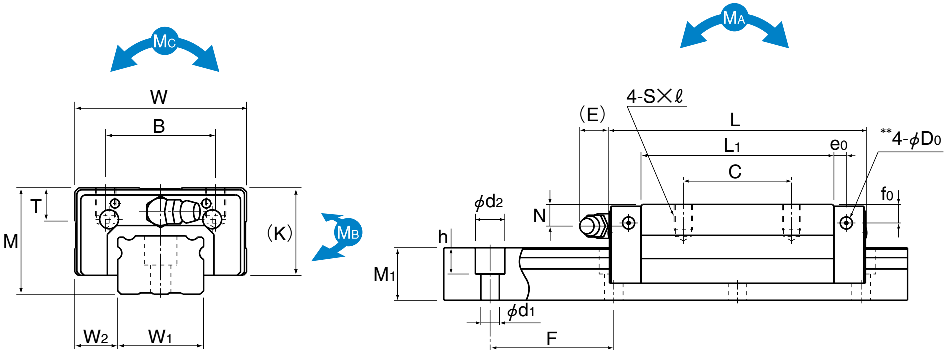
1 Model number **2** Type of LM block **3** No. of LM blocks used on the same rail **4** With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) **6** Radial clearance symbol (see page a-34)
7 LM rail length (in mm) **8** Accuracy symbol (see page a-38) **9** Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

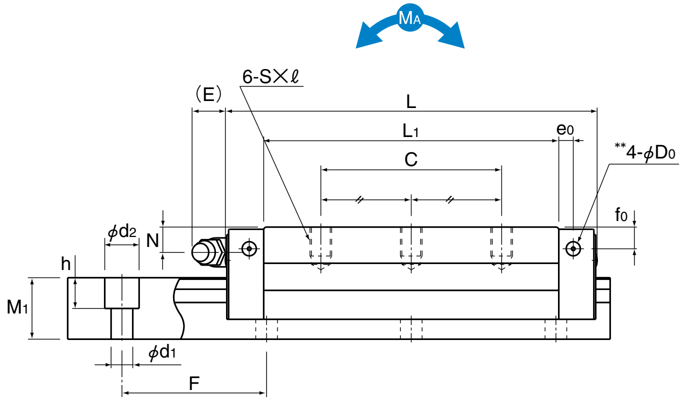
Standard Length and Maximum Length of the LM Rail P. a-112

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SNS-R | SNS-LR



Model SNS-R



Model SNS-LR

Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	f0	E	e0	D0	nipple	W1 0 −0.05	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SNS 25R	31	50	83.6	32	35	M6×8	62.4	9.7	25.5	7	6	12	4	3.9	B-M6F	25	12.5	17	40	6×9.5×8.5	37	61	0.544	2.88	0.504	2.67	0.648	0.4	3.1
SNS 25LR			102.8		50		81.6														44	78	0.915	4.41	0.847	4.09	0.826	0.6	
SNS 30R	38	60	98	40	40	M8×10	72.1	9.7	31	7	7	12	6.5	3.9	B-M6F	28	16	21	80	7×11×9	52	81	0.821	4.5	0.761	4.17	0.962	0.7	4.4
SNS 30LR			120.5		60		94.6														62	106	1.43	7.04	1.33	6.53	1.25	0.9	
SNS 35R	44	70	110.3	50	50	M8×12	79	11.7	35	8	8	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	69	110	1.27	6.81	1.17	6.32	1.56	1	6.2
SNS 35LR			135.8		72		104.5														83	144	2.11	10.7	1.96	10	2.05	1.4	
SNS 45R	52	86	139	60	60	M10×17	105	14.7	40.4	10	8	16	8.5	5.2	B-PT1/8	45	20.5	29	105	14×20×17	101	167	2.63	12.7	2.43	11.8	3.15	1.9	9.8
SNS 45LR			171.8		80		137.8														123	222	4.29	20.8	3.97	19.3	4.21	2.4	
SNS 55R	63	100	163.3	65	75	M12×18	123.6	17.7	49	11	10	16	10	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	136	225	3.96	20.4	3.67	19	4.97	3.1	14.5
SNS 55LR			200.5		95		160.8														164	295	6.66	32.4	6.17	30	6.52	4	
SNS 65R	75	126	186.4	76	70	M16×20	143.6	21.6	60	16	15	16	9	8.2	B-PT1/8	63	31.5	43	150	18×26×22	199	315	6.4	32.7	5.93	30.3	8.24	5.6	20.5
SNS 65LR			246.4		110		203.6														261	441	12.7	59.1	11.7	54.8	11.5	8	

Model number coding

SNS45	LR	2	QZ	KKHH	C0	+1200L	P	Z	- Ⅱ
1	2	3	4	5	6	7	8	9	10

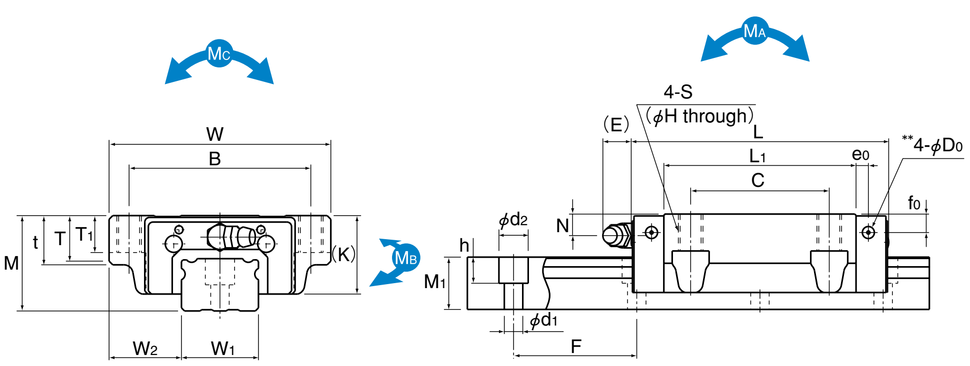
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

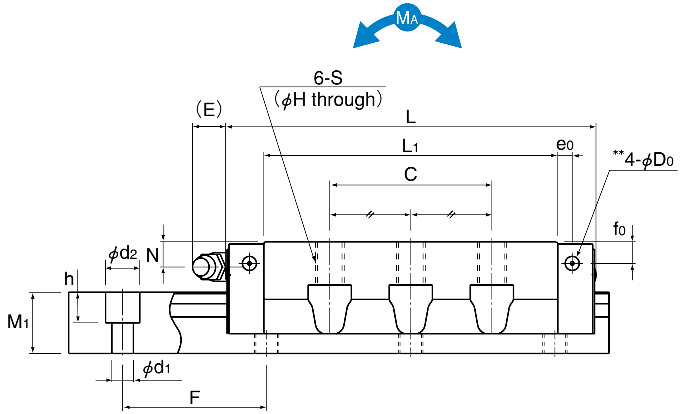
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Models SNR-C | SNR-LC



Model SNR-C



Model SNR-LC

Unit: mm

Model No.	External dimensions			LM block dimensions															LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S	H	L_1	t	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SNR 25C	31	72	83.6	59	45	M 8	6.8	62.4	16	14.8	12	25.5	7	6	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	48	79	0.682	3.62	0.427	2.25	0.868	0.6	3.1
SNR 25LC			102.8					81.6																57	101	1.14	5.55	0.708	3.4	1.1	0.8	
SNR 30C	38	90	98	72	52	M10	8.5	72.1	18	16.8	14	31	7	7	12	6.5	3.9	B-M6F	28	31	21	80	7×11×9	68	106	1.04	5.7	0.653	3.56	1.3	1	4.4
SNR 30LC			120.5					94.6																81	138	1.81	8.89	1.12	5.47	1.69	1.3	
SNR 35C	44	100	110.3	82	62	M10	8.5	79	20	18.8	16	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	90	144	1.61	8.64	1.01	5.39	2.13	1.5	6.2
SNR 35LC			135.8					104.5																108	188	2.68	13.6	1.67	8.49	2.79	2	
SNR 45C	52	120	139	100	80	M12	10.5	105	22	20.5	20	40.4	10	8	16	8.5	5.2	B-PT1/8	45	37.5	29	105	14×20×17	132	216	3.29	16	2.03	9.86	4.21	2.3	9.8
SNR 45LC			171.8					137.8																161	288	5.4	26.2	3.35	16.2	5.64	3.4	
SNR 55C	63	140	163.3	116	95	M14	12.5	123.6	24	22.5	22	49	11	10	16	10	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	177	292	4.99	25.7	3.11	16	6.69	3.6	14.5
SNR 55LC			200.5					160.8																214	383	8.41	40.9	5.22	25.3	8.78	5.5	
SNR 65C	75	170	186.4	142	110	M16	14.5	143.6	28	26	25	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	260	409	8.05	41.2	5.03	25.6	11	7.4	20.5
SNR 65LC			246.4					203.6																340	572	15.9	74.5	9.84	45.7	15.4	10.5	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SNR45 LC 2 QZ KKHH C0 +1200L P Z - Ⅱ

1 2 3 4 5 6 7 8 9 10

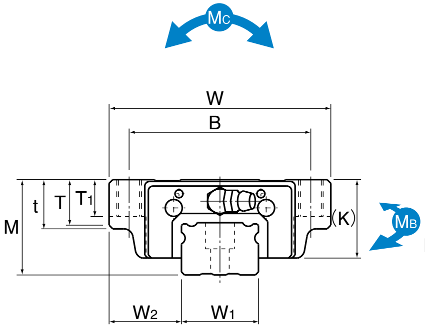
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

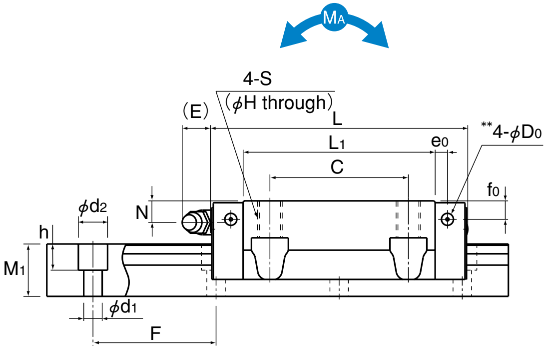
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-112

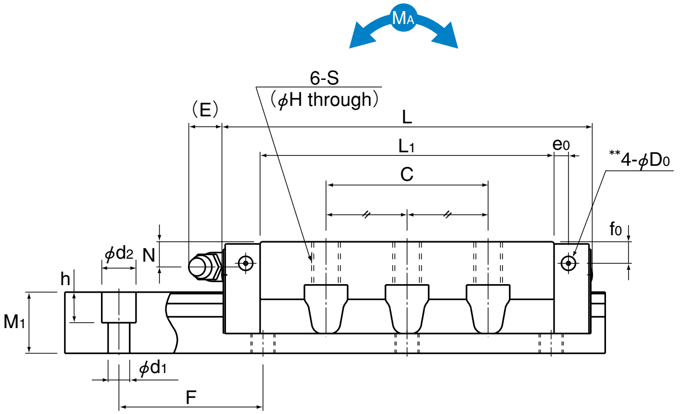
Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SNS-C | SNS-LC





Model SNS-C



Model SNS-LC

Unit: mm

Model No.	External dimensions Height M	Width W	Length L	LM block dimensions B	C	S	H	L_1	t	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	LM rail dimensions Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	Basic load rating C kN	C_0 kN	Static permissible moment kN-m* M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	Mass LM block kg	LM rail kg/m
SNS 25C	31	72	83.6	59	45	M 8	6.8	62.4	16	14.8	12	25.5	7	6	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	37	61	0.544	2.88	0.504	2.67	0.648	0.6	3.1
SNS 25LC			102.8					81.6																44	78	0.915	4.41	0.847	4.09	0.826	0.8	
SNS 30C	38	90	98	72	52	M10	8.5	72.1	18	16.8	14	31	7	7	12	6.5	3.9	B-M6F	28	31	21	80	7×11×9	52	81	0.821	4.5	0.761	4.17	0.962	1	4.4
SNS 30LC			120.5					94.6																62	106	1.43	7.04	1.33	6.53	1.25	1.3	
SNS 35C	44	100	110.3	82	62	M10	8.5	79	20	18.8	16	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	69	110	1.27	6.81	1.17	6.32	1.56	1.5	6.2
SNS 35LC			135.8					104.5																83	144	2.11	10.7	1.96	10	2.05	2	
SNS 45C	52	120	139	100	80	M12	10.5	105	22	20.5	20	40.4	10	8	16	8.5	5.2	B-PT1/8	45	37.5	29	105	14×20×17	101	167	2.63	12.7	2.43	11.8	3.15	2.3	9.8
SNS 45LC			171.8					137.8																123	222	4.29	20.8	3.97	19.3	4.21	3.4	
SNS 55C	63	140	163.3	116	95	M14	12.5	123.6	24	22.5	22	49	11	10	16	10	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	136	225	3.96	20.4	3.67	19	4.97	3.6	14.5
SNS 55LC			200.5					160.8																164	295	6.66	32.4	6.17	30	6.52	5.5	
SNS 65C	75	170	186.4	142	110	M16	14.5	143.6	28	26	25	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	199	315	6.4	32.7	5.93	30.3	8.24	7.4	20.5
SNS 65LC			246.4					203.6																261	441	12.7	59.1	11.7	54.8	11.5	10.5	

Model number coding SNS45 LC 2 QZ KKHH C0 +1200L P Z - Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

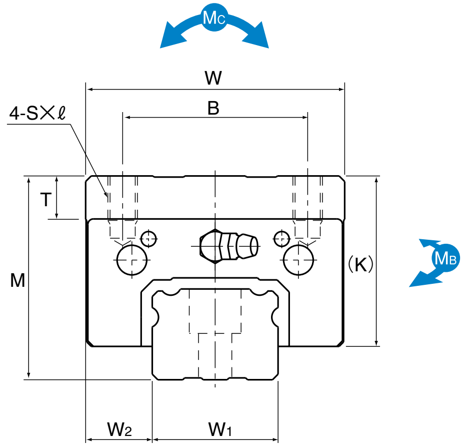
Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

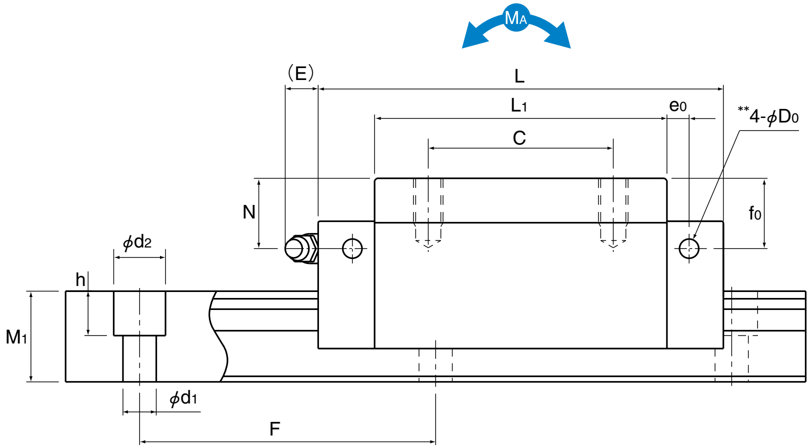
Standard Length and Maximum Length of the LM Rail P. a-112

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SNR-RH | SNR-LRH

build to order build to order





Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length													Width		Height	Pitch				M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	f_0	E	e_0	D_0	Grease nipple	W_1 $^{0}_{-0.05}$	W_2	M_1	F	$d_1 \times d_2 \times h$	C kN	C_0 kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SNR 35RH SNR 35LRH	55	70	110.3 135.8	50	50 72	M8×12	79 104.5	11.7	46	19	19	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	90 108	144 188	1.61 2.68	8.64 13.6	1.01 1.67	5.39 8.49	2.13 2.79	1.5 2	6.2
SNR 45RH SNR 45LRH	70	86	139 171.8	60	60 80	M10×17	105 137.8	14.7	58.4	28	26	16	8.5	5.2	B-PT1/8	45	20.5	29	105	14×20×17	132 161	216 288	3.29 5.4	16 26.2	2.03 3.35	9.86 16.2	4.21 5.64	3.2 4.1	9.8
SNR 55RH SNR 55LRH	80	100	163.3 200.5	75	75 95	M12×18	123.6 160.8	17.7	66	28	27	16	10	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	177 214	292 383	4.99 8.41	25.7 40.9	3.11 5.22	16 25.3	6.69 8.78	4.7 6.2	14.5

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SNR35 RH 2 QZ KKHH C0 +920L H Z - II

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-112

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SNS-RH | SNS-LRH

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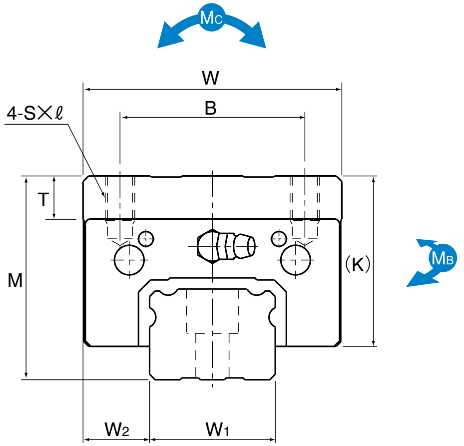
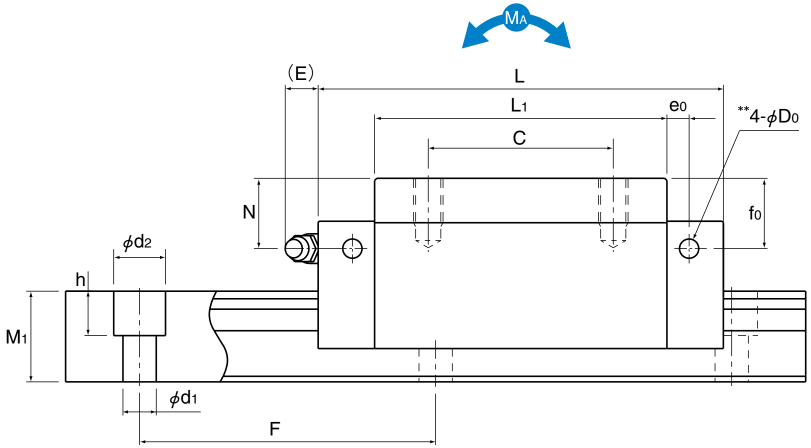




Unit: mm

Model No.	External dimensions Height M	Width W	Length L	LM block dimensions B	C	S×ℓ	L_1	T	K	N	f_0	E	e_0	D_0	Grease nipple	LM rail dimensions Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	Basic load rating C kN	C_0 kN	Static permissible moment kN-m* M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	Mass LM block kg	LM rail kg/m
SNS 35RH	55	70	110.3	50	50	M8×12	79	11.7	46	19	19	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	69	110	1.27	6.81	1.17	6.32	1.56	1.5	6.2
SNS 35LRH			135.8		72		104.5														83	144	2.11	10.7	1.96	10	2.05	2	
SNS 45RH	70	86	139	60	60	M10×17	105	14.7	58.4	28	26	16	8.5	5.2	B-PT1/8	45	20.5	29	105	14×20×17	101	167	2.63	12.7	2.43	11.8	3.15	3.2	9.8
SNS 45LRH			171.8		80		137.8														123	222	4.29	20.8	3.97	19.3	4.21	4.1	
SNS 55RH	80	100	163.3	75	75	M12×18	123.6	17.7	66	28	27	16	10	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	136	225	3.96	20.4	3.67	19	4.97	4.7	14.5
SNS 55LRH			200.5		95		160.8														164	295	6.66	32.4	6.17	30	6.52	6.2	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SNS35 RH 2 QZ KKHH C0 +920L H Z - II

SNS35	RH	2	QZ	KKHH	C0	+920L	H	Z	II
1	2	3	4	5	6	7	8	9	10

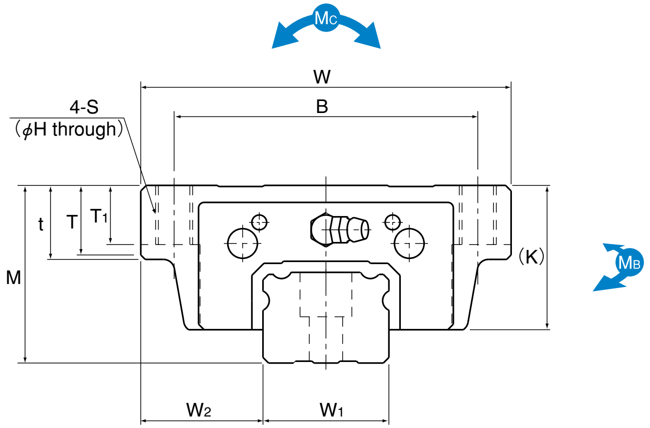
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

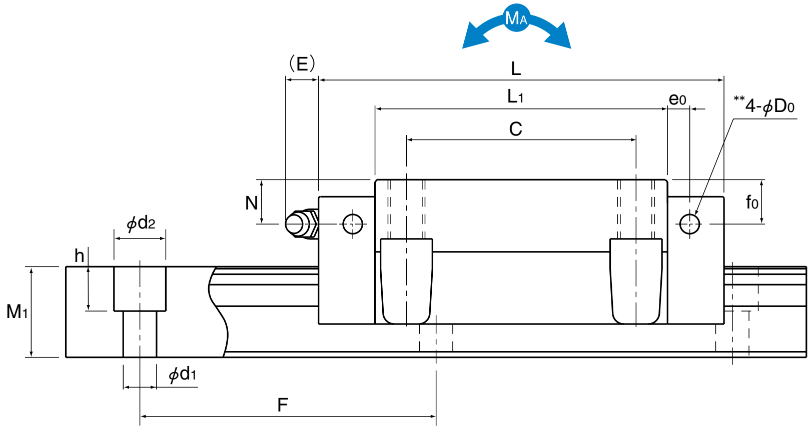
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-112

Models SNR-CH | SNR-LCH

build to order build to order





Unit: mm

Model No.	External dimensions			LM block dimensions															LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S	H	L_1	t	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1×d_2×h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SNR 35CH	48	100	110.3	82	62	M10	8.5	79	20	18.8	16	39	12	12	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	90	144	1.61	8.64	1.01	5.39	2.13	1.7	6.2
SNR 35LCH			135.8					104.5																108	188	2.68	13.6	1.67	8.49	2.79	2.2	
SNR 45CH	60	120	139	100	80	M12	10.5	105	22	20.5	20	48.4	18	16	16	8.5	5.2	B-PT1/8	45	37.5	29	105	14×20×17	132	216	3.29	16	2.03	9.86	4.21	3	9.8
SNR 45LCH			171.8					137.8																161	288	5.4	26.2	3.35	16.2	5.64	4.2	
SNR 55CH	70	140	163.3	116	95	M14	12.5	123.6	24	22.5	22	56	18	17	16	10	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	177	292	4.99	25.7	3.11	16	6.69	4.4	14.5
SNR 55LCH			200.5					160.8																214	383	8.41	40.9	5.22	25.3	8.78	6.5	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SNR45 LCH 2 QZ KK C0 +1000L P Z -Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

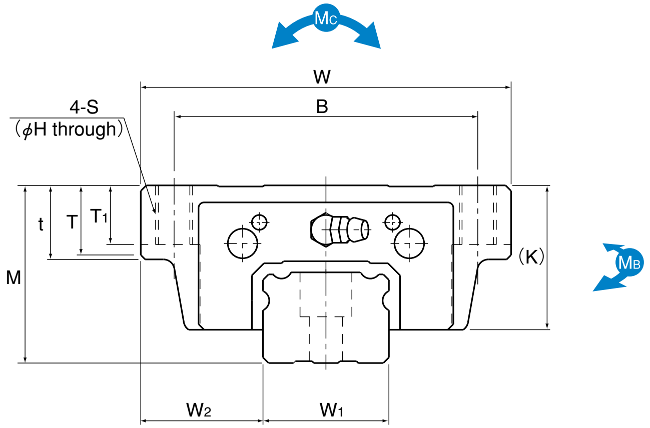
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

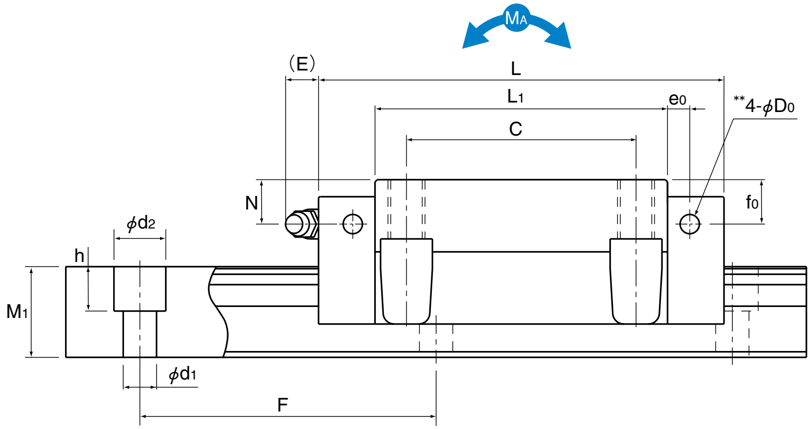
Standard Length and Maximum Length of the LM Rail P. a-112

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SNS-CH | SNS-LCH

build to order　build to order





Unit: mm

Model No.	External dimensions			LM block dimensions															LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S	H	L_1	t	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SNS 35CH	48	100	110.3	82	62	M10	8.5	79	20	18.8	16	39	12	12	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	69	110	1.27	6.81	1.17	6.32	1.56	1.7	6.2
SNS 35LCH			135.8					104.5																83	144	2.11	10.7	1.96	10	2.05	2.2	
SNS 45CH	60	120	139	100	80	M12	10.5	105	22	20.5	20	48.4	18	16	16	8.5	5.2	B-PT1/8	45	37.5	29	105	14×20×17	101	167	2.63	12.7	2.43	11.8	3.15	3	9.8
SNS 45LCH			171.8					137.8																123	222	4.29	20.8	3.97	19.3	4.21	4.2	
SNS 55CH	70	140	163.3	116	95	M14	12.5	123.6	24	22.5	22	56	18	17	16	10	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	136	225	3.96	20.4	3.67	19	4.97	4.4	14.5
SNS 55LCH			200.5					160.8																164	295	6.66	32.4	6.17	30	6.52	6.5	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SNS45 LCH 2 QZ KK C0 +1000L P Z -Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number　2 Type of LM block　3 No. of LM blocks used on the same rail　4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-108)　6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm)　8 Accuracy symbol (see page a-38)　9 Pate cover or steel tape*
10 No. of rails used on the same plane
* Specify either pate cover or steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Models SNR/SNS with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SNR/SNS 25R/C	83.6	83.6	91.2	90	97.6	100.1	107.7	102.5	110.1
SNR/SNS 25LR/LC	102.8	102.8	110.4	109.2	116.8	119.3	126.9	121.7	129.3
SNR/SNS 30R/C	98	98	107.8	105.2	115	118.5	128.3	120.9	130.7
SNR/SNS 30LR/LC	120.5	120.5	130.3	127.7	137.5	141	150.8	143.4	153.2
SNR/SNS 35R/C	110.3	110.3	120.5	118.1	128.3	131.1	141.3	133.5	143.7
SNR/SNS 35LR/LC	135.8	135.8	146	143.6	153.8	156.6	166.8	159	169.2
SNR/SNS 45R/C	139	139	149.2	147.6	157.8	163.2	173.4	166.4	176.6
SNR/SNS 45LR/LC	171.8	171.8	182	180.4	190.6	196	206.2	199.2	209.4
SNR/SNS 55R/C	163.3	163.3	173.5	171.9	182.1	187.8	198	191	201.2
SNR/SNS 55LR/LC	200.5	200.5	210.7	209.1	219.3	225	235.2	228.2	238.4
SNR/SNS 65R/C	186.4	186.4	197	195	205.6	214.3	224.9	217.5	228.1
SNR/SNS 65LR/LC	246.4	246.4	257	255	265.6	274.3	284.9	277.5	288.1

Overall LM Block Length (Dimension L) of Models SNR/SNS-H with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SNR/SNS 35RH/CH	110.3	110.3	120.5	118.1	128.3	131.1	141.3	133.5	143.7
SNR/SNS 35LRH/LCH	135.8	135.8	146	143.6	153.8	156.6	166.8	159	169.2
SNR/SNS 45RH/CH	139	139	149.2	147.6	157.8	163.2	173.4	166.4	176.6
SNR/SNS 45LRH/LCH	171.8	171.8	182	180.4	190.6	196	206.2	199.2	209.4
SNR/SNS 55RH/CH	163.3	163.3	173.5	171.9	182.1	187.8	198	191	201.2
SNR/SNS 55LRH/LCH	200.5	200.5	210.7	209.1	219.3	225	235.2	228.2	238.4

■Overall LM Block Length (Dimension L) of Models SNR/SNS with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SNR/SNS 25R/C	105.2	105.2	112.8	110.9	118.5	122.5	130.1	124.9	132.5
SNR/SNS 25LR/LC	124.4	124.4	132	130.1	137.7	141.7	149.3	144.1	151.7
SNR/SNS 30R/C	121.2	121.2	131	126.9	136.7	141.7	151.5	144.1	153.9
SNR/SNS 30LR/LC	143.7	143.7	153.5	149.4	159.2	164.2	174	166.6	176.4
SNR/SNS 35R/C	142.7	142.7	152.9	149.5	159.7	164.3	174.5	166.7	176.9
SNR/SNS 35LR/LC	168.2	168.2	178.4	175	185.2	189.8	200	192.2	202.4
SNR/SNS 45R/C	171.4	171.4	181.6	179	189.2	196.4	206.6	199.6	209.8
SNR/SNS 45LR/LC	204.2	204.2	214.4	211.8	222	229.2	239.4	232.4	242.6
SNR/SNS 55R/C	204.6	204.6	214.8	213.2	223.4	231	241.2	234.2	244.4
SNR/SNS 55LR/LC	241.8	241.8	252	250.4	260.6	268.2	278.4	271.4	281.6
SNR/SNS 65R/C	227.7	227.7	238.3	236.3	246.9	257.5	268.1	260.7	271.3
SNR/SNS 65LR/LC	287.7	287.7	298.3	296.3	306.9	317.5	328.1	320.7	331.3

■Overall LM Block Length (Dimension L) of Models SNR/SNS-H with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SNR/SNS 35RH/CH	142.7	142.7	152.9	149.5	159.7	164.3	174.5	166.7	176.9
SNR/SNS 35LRH/LCH	168.2	168.2	178.4	175	185.2	189.8	200	192.2	202.4
SNR/SNS 45RH/CH	171.4	171.4	181.6	179	189.2	196.4	206.6	199.6	209.8
SNR/SNS 45LRH/LCH	204.2	204.2	214.4	211.8	222	229.2	239.4	232.4	242.6
SNR/SNS 55RH/CH	204.6	204.6	214.8	213.2	223.4	231	241.2	234.2	244.4
SNR/SNS 55LRH/LCH	241.8	241.8	252	250.4	260.6	268.2	278.4	271.4	281.6

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 8

Table 11 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SNR/SNS 25	8.1
SNR/SNS 30	13.4
SNR/SNS 35	15.5
SNR/SNS 45	23.3
SNR/SNS 55	28.6
SNR/SNS 65	39.6

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 5 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 5. Table 12 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SNR/SNS

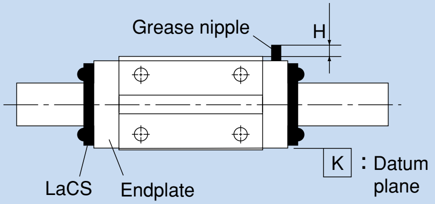


Fig. 5

Table 12

Unit: mm

Model No.	Incremental dimension with grease nipple H	Nipple type
SNR/SNS 25C/LC	—	PB1021B
SNR/SNS 25R/LR	4.9	PB1021B
SNR/SNS 30C/LC	—	PB1021B
SNR/SNS 30R/LR	4.5	PB1021B
SNR/SNS 35C/LC,CH/LCH	—	A-M6F
SNR/SNS 35R/LR,RH/LRH	7.8	A-M6F
SNR/SNS 45C/LC,CH/LCH	—	A-M6F
SNR/SNS 45R/LR,RH/LRH	7.9	A-M6F
SNR/SNS 55C/LC,CH/LCH	—	A-M6F
SNR/SNS 55R/LR,RH/LRH	7.7	A-M6F
SNR/SNS 65C/LC	—	A-PT1/8
SNR/SNS 65R/LR	15.8	A-PT1/8

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 3, contact THK.

For LM Guide Models with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding table of dimensions.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding

SNR30 R 2 QZ KKHH C0 +840L P -Ⅱ

$\underbrace{\text{SNR30}}_{1}$ R 2 $\underbrace{\text{QZ}}_{2}$ $\underbrace{\text{KKHH}}_{3}$

1 LM Guide model number
2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator, with grease nipple (see Fig. 5)
3 Dust prevention accessory symbol (see page a-108)

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and the grease nipple to be attached, contact THK.

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10℃ and +50℃.

Use in a special environment

- When using it in a special environment, contact THK.

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Caged Ball® LM Guide®

Global Standard Type LM Guide Model SHS

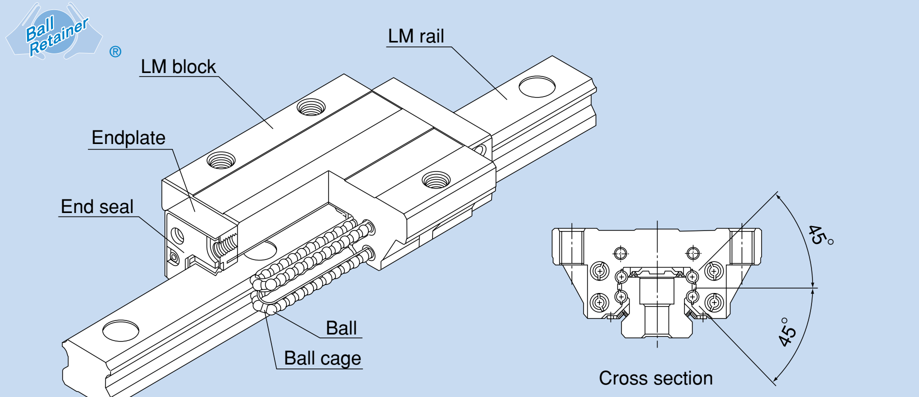


Fig. 1 Structure of Model SHS

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and ball cages and endplates incorporated in the LM block allow the balls to circulate.
Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations. In addition, the LM block can receive a well-balanced preload, increasing the rigidity in the four directions while maintaining a constant, low friction coefficient. With the low sectional height and the high rigidity design of the LM block, SHS achieves highly accurate and stable linear motion.

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●Self-adjustment capability

The self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus to achieve highly accurate, smooth linear motion.

●Global standard size

SHS is designed to have dimensions almost the same as that of model HSR, which THK as a pioneer of the linear motion system has developed and is practically a global standard model.

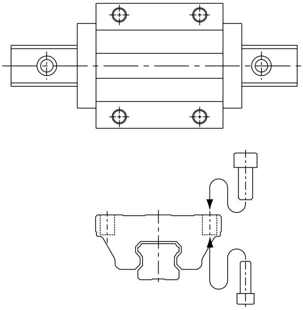
●Low gravity center, high rigidity

As a result of downsizing the LM rail section, the center of gravity is lowered and the rigidity is increased.

Types and Features

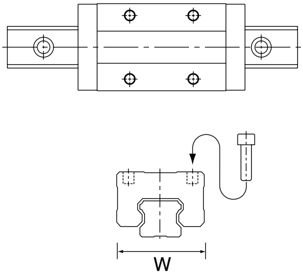
Model SHS-C

The flange of the LM block has tapped holes.
Can be mounted from the top or the bottom.
Used in places where the table cannot have through holes for mounting bolts.



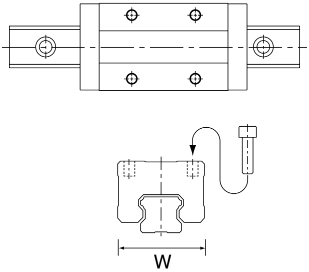
Model SHS-V

The LM block has a smaller width (W) and is equipped with tapped holes.
Suitable for places where space for the table width is limited.



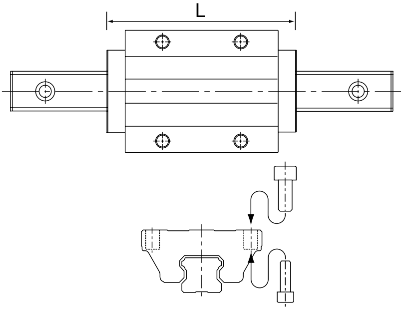
Model SHS-R

The LM block has a smaller width (W) and the mounting holes are tapped.
It succeeds the height dimension of full-ball type LM Guide HSR-R.



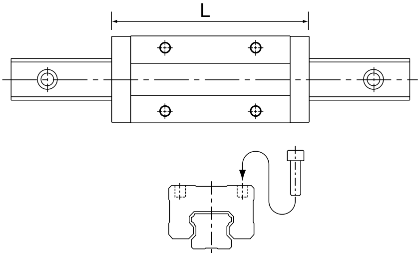
Model SHS-LC

The LM block has the same sectional shape as model SHS-C, but has a longer overall LM block length (L) and a greater rated load.



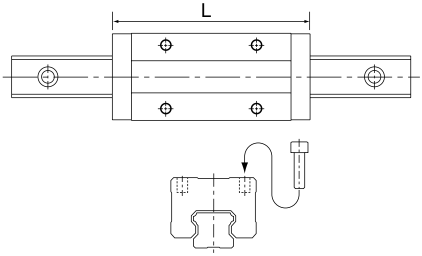
Model SHS-LV

The LM block has the same sectional shape as model SHS-V, but has a longer overall LM block length (L) and a greater rated load.



Model SHS-LR

The LM block has the same sectional shape as model SHS-R, but has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Model SHS is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for SHS.

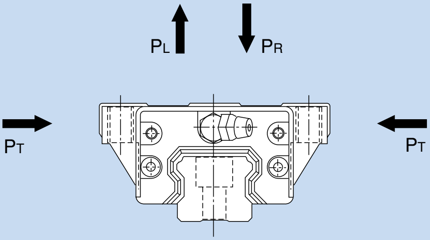


Fig. 2

Equivalent Load

When the LM block of model SHS receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SHS.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-150.

Table 1 Symbols of Dust Prevention Accessories for Model SHS

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper
SSHH	With end seal + side seal + inner seal + LaCS
DDHH	With double seals + side seal + inner seal + LaCS
ZZHH	With end seal + side seal + inner seal + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal + metal scraper + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seal SHS … SS, refer to the corresponding value provided in table 2.

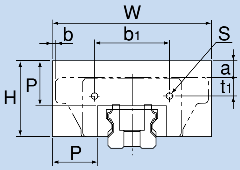
Table 2 Maximum Seal Resistance Value of Seal SHS … SS

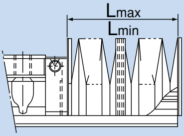
Unit: N

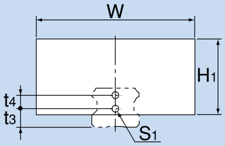
Model No.	Seal resistance value
SHS 15	4.5
SHS 20	7.0
SHS 25	10.5
SHS 30	17.0
SHS 35	20.5
SHS 45	30.0
SHS 55	31.5
SHS 65	43.0

●Dedicated Bellows JSH for Model SHS

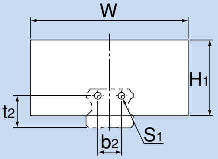
The table below shows the dimensions of dedicated bellows JSH for model SHS. Specify the corresponding model number of the desired bellows from the table.







Models SHS15 to 30



Models SHS35 to 65

Table 3 Dimensional Table for JSH

Model No.	Major dimensions (mm)												Supported model
	W	H	H_1	P	b_1	t_1 Type C	t_1 Type V	t_1 Type R	b_2	t_2	t_3	t_4	
JSH 15	53	26	26	15	22.4	4	4	8	—	—	8	—	SHS 15
JSH 20	60	30	30	17	27.6	7.5	7.5	—	—	—	8	6	SHS 20
JSH 25	75	36	36	20	38	9.1	9.1	13.1	—	—	9	7	SHS 25
JSH 30	80	38	38	20	44	11	11	14	—	—	11	8	SHS 30
JSH 35	86	40.5	40.5	20	50	11	11	18	20	21.5	—	—	SHS 35
JSH 45	97	46	46	20	64.6	13.5	13.5	23.5	26	26.5	—	—	SHS 45
JSH 55	105	48	48	20	68	13	13	23	30	31.5	—	—	SHS 55
JSH 65	126	63	63	25	80	18	18	—	34	45	—	—	SHS 65

Supported model	Other dimensions (mm)								A
	Mounting bolt S	Mounting bolt S_1	a Type C	a Type V	a Type R	b Type C	b Type V	b Type R	$\left(\frac{Lmax}{Lmin}\right)$
SHS 15	M2×8ℓ	M4×8ℓ	5	5	1	3	9.5	9.5	5
SHS 20	M2.6×8ℓ	M3×6ℓ	5	5	—	– 1.5	8	—	6
SHS 25	M3×8ℓ	M3×6ℓ	6	6	2	2.5	13.5	13.5	7
SHS 30	M3×10ℓ	M3×6ℓ	3	3	0	– 5	10	10	7
SHS 35	M4×10ℓ	M4×8ℓ	0	0	– 7	– 7	8	8	7
SHS 45	M4×12ℓ	M4×8ℓ	–5	–5	–15	–11.7	5.5	5.5	7
SHS 55	M5×12ℓ	M5×10ℓ	–9	–9	–19	–17.5	2.5	2.5	7
SHS 65	M6×14ℓ	M6×12ℓ	–8	–8	—	–22	0	—	9

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the dedicated bellows, contact THK.

Note 3: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering SHS.

Model number coding JSH35-60/420

$\underbrace{\text{JSH35}}_{1}\text{-}\underbrace{\text{60/420}}_{2}$

1 Model number ··· bellows for SHS35

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$Lmax = Lmin \cdot A$$ A: Extension rate

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

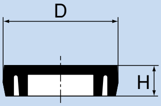
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 4.

For the procedure for mounting the cap, see page a-22.

Table 4 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SHS 15	C 4	M 4	7.8	1.0
SHS 20	C 5	M 5	9.8	2.4
SHS 25	C 6	M 6	11.4	2.7
SHS 30	C 8	M 8	14.4	3.7
SHS 35	C 8	M 8	14.4	3.7
SHS 45	C12	M12	20.5	4.7
SHS 55	C14	M14	23.5	5.7
SHS 65	C16	M16	26.5	5.7



Dedicated Cap C

●Steel Tape SP

By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the steel tape SP further increases sealability of the end seal, thus to prevent foreign matter and water from entering the top face of the LM rail.

For the mounting procedure, see page a-28.

Note 1: To mount the steel tape, the LM block needs to be removed from the LM rail. It requires an LM block removing/mounting jig. Contact THK for details.

Note 2: When mounting the steel tape, the LM rail needs to be machined. Indicate that the steel tape is required when ordering the LM Guide.

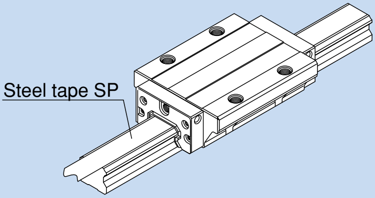


Fig. 3

Note: The steel tape is available for models SHS15 to 65.

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 5 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-150.

Table 5 Parts Symbols for Model SHS with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + inner seal + QZ Lubricator
QZDD	With double seals + side seal + inner seal + QZ Lubricator
QZZZ	With end seal + side seal + inner seal + metal scraper + QZ Lubricator
QZKK	With double seals + side seal + inner seal + metal scraper + QZ Lubricator
QZSSHH	With end seal + side seal + inner seal + LaCS + QZ Lubricator
QZDDHH	With double seals + side seal + inner seal + LaCS + QZ Lubricator
QZZZHH	With end seal + side seal + inner seal + metal scraper + LaCS + QZ Lubricator
QZKKHH	With double seals + side seal + inner seal + metal scraper + LaCS + QZ Lubricator

Standard Length and Maximum Length of the LM Rail

Table 6 shows the standard lengths and the maximum lengths of model SHS variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

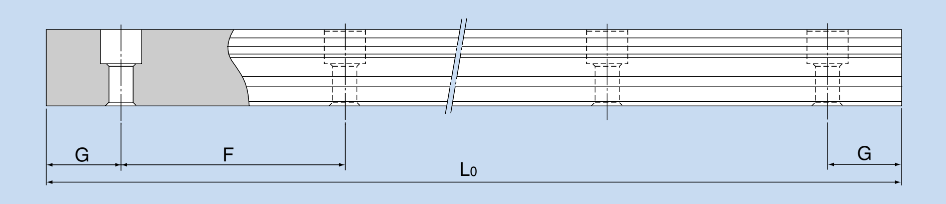


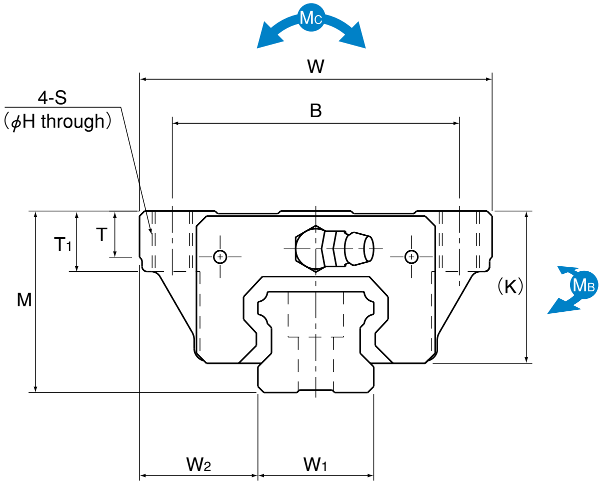
Table 6 Standard Length and Maximum Length of the LM Rail for Model SHS

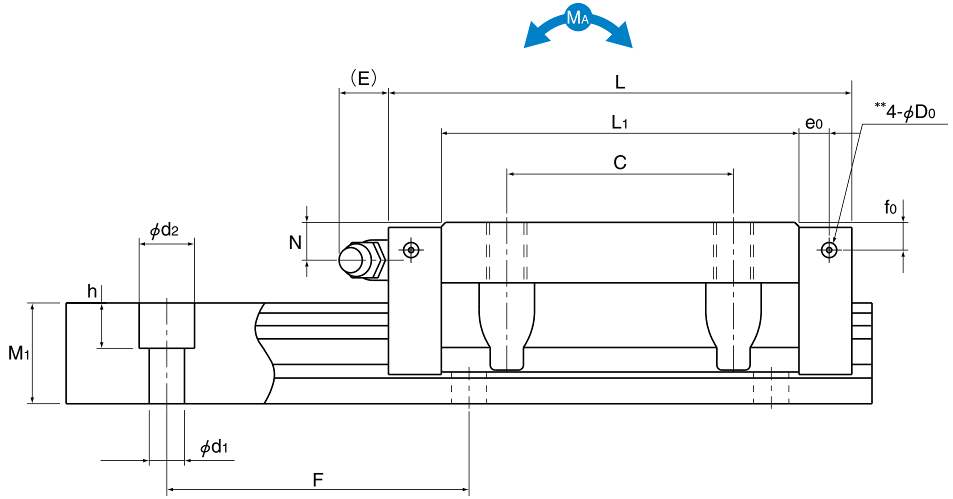
Unit: mm

Model No.	SHS 15	SHS 20	SHS 25	SHS 30	SHS 35	SHS 45	SHS 55	SHS 65
Standard LM rail length (L_0)	160	220	220	280	280	570	780	1270
	220	280	280	360	360	675	900	1570
	280	340	340	440	440	780	1020	2020
	340	400	400	520	520	885	1140	2620
	400	460	460	600	600	990	1260	
	460	520	520	680	680	1095	1380	
	520	580	580	760	760	1200	1500	
	580	640	640	840	840	1305	1620	
	640	700	700	920	920	1410	1740	
	700	760	760	1000	1000	1515	1860	
	760	820	820	1080	1080	1620	1980	
	820	940	940	1160	1160	1725	2100	
	940	1000	1000	1240	1240	1830	2220	
	1000	1060	1060	1320	1320	1935	2340	
	1060	1120	1120	1400	1400	2040	2460	
	1120	1180	1180	1480	1480	2145	2580	
	1180	1240	1240	1560	1560	2250	2700	
	1240	1360	1300	1640	1640	2355	2820	
	1360	1480	1360	1720	1720	2460	2940	
	1480	1600	1420	1800	1800	2565	3060	
	1600	1720	1480	1880	1880	2670		
		1840	1540	1960	1960	2775		
		1960	1600	2040	2040	2880		
		2080	1720	2200	2200	2985		
		2200	1840	2360	2360	3090		
			1960	2520	2520			
			2080	2680	2680			
			2200	2840	2840			
			2320	3000	3000			
			2440					
Standard pitch F	60	60	60	80	80	105	120	150
G	20	20	20	20	20	22.5	30	35
Max length	2500	3000	3000	3000	3000	3090	3060	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models SHS-C | SHS-LC





Unit: mm

Model No.	External dimensions			LM block dimensions											Pilot holes for side nipples**			LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple				Width		Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S	H	L_1	T	T_1	K	N	E		e_0	f_0	D_0	W_1 $^{0}_{-0.05}$	W_2	M_1	F	$d_1 \times d_2 \times h$	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SHS 15C SHS 15LC	24	47	64.4 79.4	38	30	M 5	4.4	48 63	5.9	8	21	5.5	5.5	PB1021B	4	4	3	15	16	13	60	4.5X7.5X5.3	14.2 17.2	24.2 31.9	0.175 0.296	0.898 1.43	0.175 0.296	0.898 1.43	0.16 0.212	0.23 0.29	1.3
SHS 20C SHS 20LC	30	63	79 98	53	40	M 6	5.4	59 78	7.2	10	25.4	6.5	12	B-M6F	4.3	5.3	3	20	21.5	16.5	60	6X9.5X8.5	22.3 28.1	38.4 50.3	0.334 0.568	1.75 2.8	0.334 0.568	1.75 2.8	0.361 0.473	0.46 0.61	2.3
SHS 25C SHS 25LC	36	70	92 109	57	45	M 8	6.8	71 88	9.1	12	30.2	7.5	12	B-M6F	6	5.5	3	23	23.5	20	60	7X11X9	31.7 36.8	52.4 64.7	0.566 0.848	2.75 3.98	0.566 0.848	2.75 3.98	0.563 0.696	0.72 0.89	3.2
SHS 30C SHS 30LC	42	90	106 131	72	52	M10	8.5	80 105	11.5	15	35	8	12	B-M6F	5.5	6	5.2	28	31	23	80	9X14X12	44.8 54.2	66.6 88.8	0.786 1.36	4.08 6.6	0.786 1.36	4.08 6.6	0.865 1.15	1.34 1.66	4.5
SHS 35C SHS 35LC	48	100	122 152	82	62	M10	8.5	93 123	11.5	15	40.5	8	12	B-M6F	6.5	5.5	5.2	34	33	26	80	9X14X12	62.3 72.9	96.6 127	1.38 2.34	6.76 10.9	1.38 2.34	6.76 10.9	1.53 2.01	1.9 2.54	6.2
SHS 45C SHS 45LC	60	120	140 174	100	80	M12	10.5	106 140	14.1	18	51.1	10.5	16	B-PT1/8	8	8	5.2	45	37.5	32	105	14X20X17	82.8 100	126 166	2.05 3.46	10.1 16.3	2.05 3.46	10.1 16.3	2.68 3.53	3.24 4.19	10.4
SHS 55C SHS 55LC	70	140	171 213	116	95	M14	12.5	131 173	16	21	57.3	11	16	B-PT1/8	10	8	5.2	53	43.5	38	120	16X23X20	128 161	197 259	3.96 6.68	19.3 31.1	3.96 6.68	19.3 31.1	4.9 6.44	5.35 6.97	14.5
SHS 65C SHS 65LC	90	170	221 272	142	110	M16	14.5	175 226	18.8	24	71	19	16	B-PT1/8	10	12	5.2	63	53.5	53	150	18X26X22	205 253	320 408	8.26 13.3	40.4 62.6	8.26 13.3	40.4 62.6	9.4 11.9	10.7 13.7	23.7

Model number coding SHS25 LC 2 QZ KKHH C0 +1200L P Z - Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-138) 6 Radial clearance symbol (see page a-33)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With steel tape
10 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

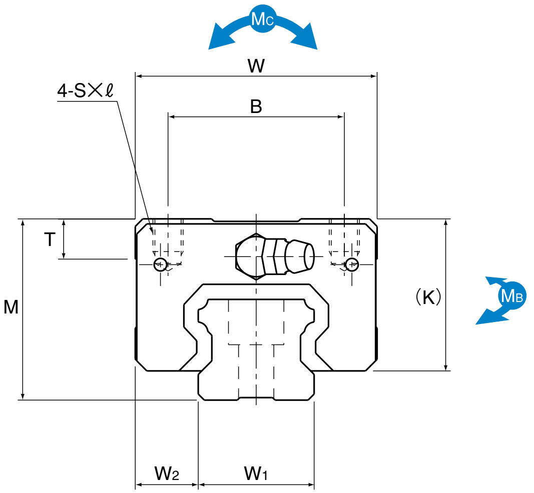
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product. the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

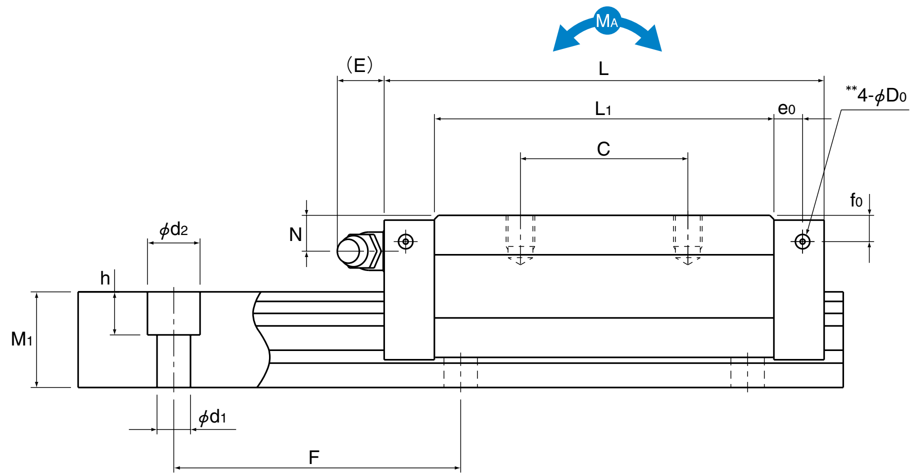
Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-142

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SHS-V | SHS-LV





Unit: mm

Model No.	External dimensions			LM block dimensions									Pilot holes for side nipples**			LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Grease nipple				Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	E		e0	f0	D0	W1 $^{0}_{-0.05}$	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SHS 15V SHS 15LV	24	34	64.4 79.4	26	26 34	M4×4	48 63	5.9	21	5.5	5.5	PB1021B	4	4	3	15	9.5	13	60	4.5×7.5×5.3	14.2 17.2	24.2 31.9	0.175 0.296	0.898 1.43	0.175 0.296	0.898 1.43	0.16 0.212	0.19 0.22	1.3
SHS 20V SHS 20LV	30	44	79 98	32	36 50	M5×5	59 78	8	25.4	6.5	12	B-M6F	4.3	5.3	3	20	12	16.5	60	6×9.5×8.5	22.3 28.1	38.4 50.3	0.334 0.568	1.75 2.8	0.334 0.568	1.75 2.8	0.361 0.473	0.35 0.46	2.3
SHS 25V SHS 25LV	36	48	92 109	35	35 50	M6×6.5	71 88	8	30.2	7.5	12	B-M6F	6	5.5	3	23	12.5	20	60	7×11×9	31.7 36.8	52.4 64.7	0.566 0.848	2.75 3.98	0.566 0.848	2.75 3.98	0.563 0.696	0.54 0.67	3.2
SHS 30V SHS 30LV	42	60	106 131	40	40 60	M8×8	80 105	8	35	8	12	B-M6F	5.5	6	5.2	28	16	23	80	9×14×12	44.8 54.2	66.6 88.8	0.786 1.36	4.08 6.6	0.786 1.36	4.08 6.6	0.865 1.15	0.94 1.16	4.5
SHS 35V SHS 35LV	48	70	122 152	50	50 72	M8×10	93 123	14.7	40.5	8	12	B-M6F	6.5	5.5	5.2	34	18	26	80	9×14×12	62.3 72.9	96.6 127	1.38 2.34	6.76 10.9	1.38 2.34	6.76 10.9	1.53 2.01	1.4 1.84	6.2
SHS 45V SHS 45LV	60	86	140 174	60	60 80	M10×15	106 140	14.9	51.1	10.5	16	B-PT1/8	8	8	5.2	45	20.5	32	105	14×20×17	82.8 100	126 166	2.05 3.46	10.1 16.3	2.05 3.46	10.1 16.3	2.68 3.53	2.54 3.19	10.4
SHS 55V SHS 55LV	70	100	171 213	75	75 95	M12×15	131 173	19.4	57.3	11	16	B-PT1/8	10	8	5.2	53	23.5	38	120	16×23×20	128 161	197 259	3.96 6.68	19.3 31.1	3.96 6.68	19.3 31.1	4.9 6.44	4.05 5.23	14.5
SHS 65V SHS 65LV	90	126	221 272	76	70 120	M16×20	175 226	19.5	71	19	16	B-PT1/8	10	12	5.2	63	31.5	53	150	18×26×22	205 253	320 408	8.26 13.3	40.4 62.6	8.26 13.3	40.4 62.6	9.4 11.9	8.41 10.7	23.7

Model number coding SHS30 V 2 QZ KKHH C1 +1240L P Z - Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-138) 6 Radial clearance symbol (see page a-33)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With steel tape
10 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

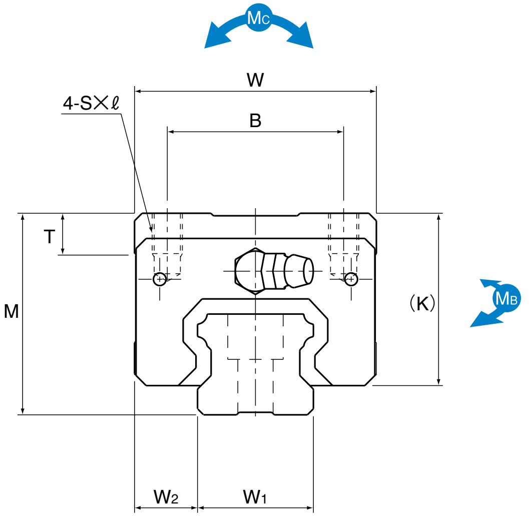
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

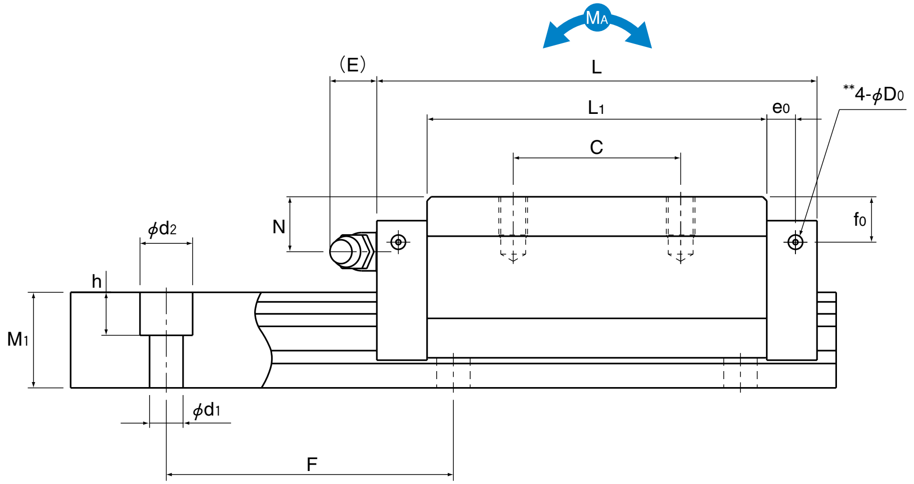
Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-142

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SHS-R | SHS-LR





Unit: mm

Model No.	External dimensions			LM block dimensions									Pilot holes for side nipples**			LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Grease nipple				Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	E		e_0	f_0	D_0						kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SHS 15R	28	34	64.4	26	26	M4×5	48	5.9	25	9.5	5.5	PB1021B	4	8	3	15	9.5	13	60	4.5×7.5×5.3	14.2	24.2	0.175	0.898	0.175	0.898	0.16	0.22	1.3
SHS 25R	40	48	92	35	35	M6×8	71	8	34.2	11.5	12	B-M6F	6	9.5	3	23	12.5	20	60	7×11×9	31.7	52.4	0.566	2.75	0.566	2.75	0.563	0.66	3.2
SHS 25LR			109		50		88														36.8	64.7	0.848	3.98	0.848	3.98	0.696	0.8	
SHS 30R	45	60	106	40	40	M8×10	80	8	38	11	12	B-M6F	5.5	9	5.2	28	16	23	80	9×14×12	44.8	66.6	0.786	4.08	0.786	4.08	0.865	1.04	4.5
SHS 30LR			131		60		105														54.2	88.8	1.36	6.6	1.36	6.6	1.15	1.36	
SHS 35R	55	70	122	50	50	M8×12	93	14.7	47.5	15	12	B-M6F	6.5	12.5	5.2	34	18	26	80	9×14×12	62.3	96.6	1.38	6.76	1.38	6.76	1.53	1.8	6.2
SHS 35LR			152		72		123														72.9	127	2.34	10.9	2.34	10.9	2.01	2.34	
SHS 45R	70	86	140	60	60	M10×17	106	14.9	61.1	20.5	16	B-PT1/8	8	18	5.2	45	20.5	32	105	14×20×17	82.8	126	2.05	10.1	2.05	10.1	2.68	3.24	10.4
SHS 45LR			174		80		140														100	166	3.46	16.3	3.46	16.3	3.53	4.19	
SHS 55R	80	100	171	75	75	M12×18	131	19.4	67.3	21	16	B-PT1/8	10	18	5.2	53	23.5	38	120	16×23×20	128	197	3.96	19.3	3.96	19.3	4.9	5.05	14.5
SHS 55LR			213		95		173														161	259	6.68	31.1	6.68	31.1	6.44	6.57	

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SHS45 LR 2 QZ KKHH C0 +1200L P - Ⅱ

1 2 3 4 5 6 7 8 9

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-138) 6 Radial clearance symbol (see page a-33)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-142

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SHS with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SHS 15C/V/R	64.4	64.4	69.8	66.8	72.2	78.9	84.4	79.9	85.2
SHS 15LC/LV	79.4	79.4	84.8	81.8	87.2	93.9	99.4	94.9	100.2
SHS 20C/V	79	79	85.4	83	89.4	94	100	96	102.5
SHS 20LC/LV	98	98	104.4	102	108.4	113	119	115	121.5
SHS 25C/V/R	92	92	101.6	100.4	107.6	112	119.2	114.4	121.6
SHS 25LC/LV/LR	109	109	118.6	117.4	124.6	129	136.2	131.4	138.6
SHS 30C/V/R	106	106	116	113.8	122.4	129.4	138	131.8	140.4
SHS 30LC/LV/LR	131	131	141	138.8	147.4	154.4	163	156.8	165.4
SHS 35C/V/R	122	122	134.8	132.4	142.2	148	157.8	150.4	160.2
SHS 35LC/LV/LR	152	152	164.8	162.4	172.2	178	187.8	180.4	190.2
SHS 45C/V/R	140	140	152.8	151.2	161	169	178.8	172.2	182
SHS 45LC/LV/LR	174	174	186.8	185.2	195	203	212.8	206.2	216
SHS 55C/V/R	171	171	186.6	184.2	195.4	202	213.2	205.2	216.4
SHS 55LC/LV/LR	213	213	228.6	226.2	237.4	244	255.2	247.2	258.4
SHS 65C/V	221	221	238.6	236.2	248.6	258	270.4	261.2	273.6
SHS 65LC/LV	272	272	289.6	287.2	299.6	309	321.4	312.2	324.6

Overall LM Block Length (Dimension L) of Model SHS with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SHS 15C/V/R	84.4	84.4	89.8	86.8	92.2	100.4	105.4	101.4	106.9
SHS 15LC/LV	99.4	99.4	104.8	101.8	107.2	115.4	120.4	116.4	121.9
SHS 20C/V	99	99	105.4	103	109.4	115.5	122	118	124.5
SHS 20LC/LV	118	118	124.4	122	128.4	134.5	141	137	143.5
SHS 25C/V/R	114.4	114.4	121.6	120.4	127.6	132	139.2	134.4	141.6
SHS 25LC/LV/LR	131.4	131.4	138.6	137.4	144.6	149	156.2	151.4	158.6
SHS 30C/V/R	127.4	127.4	136	133.8	142.4	149.4	158	151.8	160.4
SHS 30LC/LV/LR	152.4	152.4	161	158.8	167.4	174.4	183	176.8	185.4
SHS 35C/V/R	145	145	154.8	152.4	162.2	168	177.8	170.4	180.2
SHS 35LC/LV/LR	175	175	184.8	182.4	192.2	198	207.8	200.4	210.2
SHS 45C/V/R	173	173	182.8	181.2	191	199	208.8	202.2	212
SHS 45LC/LV/LR	207	207	216.8	215.2	225	233	242.8	236.2	246
SHS 55C/V/R	205.4	205.4	216.6	214.2	225.4	232	243.2	235.2	246.4
SHS 55LC/LV/LR	247.4	247.4	258.6	256.2	267.4	274	285.2	277.2	288.4
SHS 65C/V	256.2	256.2	268.6	266.2	278.6	288	300.4	291.2	303.6
SHS 65LC/LV	307.2	307.2	319.6	317.2	329.6	339	351.4	342.2	354.6

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 7

Table 7 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SHS 15	5.2
SHS 20	6.5
SHS 25	11.7
SHS 30	18.2
SHS 35	20.8
SHS 45	26.0
SHS 55	32.5
SHS 65	39.0

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 4 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 4.

Table 8 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SHS

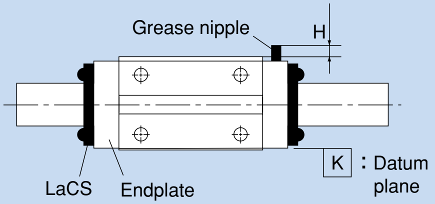


Fig. 4

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 4, contact THK.

Table 8

Unit: mm

Model No.	Incremental dimension with grease nipple H	Nipple type
SHS 15C/LC	—	PB107
SHS 15R/V/LV	4.7	PB107
SHS 20C/LC	—	PB107
SHS 20V/LV	4.5	PB107
SHS 25C/LC	—	PB107
SHS 25R/LR/V/LV	4.7	PB107
SHS 30C/LC	—	A-M6F
SHS 30R/LR/V/LV	7.4	A-M6F
SHS 35C/LC	—	A-M6F
SHS 35R/LR/V/LV	7.4	A-M6F
SHS 45C/LC	—	A-M6F
SHS 45R/LR/V/LV	7.7	A-M6F
SHS 55C/LC	—	A-M6F
SHS 55R/LR/V/LV	7.4	A-M6F
SHS 65C/LC	—	A-M6F
SHS 65V/LV	6.9	A-M6F

For LM Guide Models with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding table of dimensions.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding

$\underbrace{\text{SHS25}}_{1}\ \text{C 2}\ \underbrace{\text{QZ}}_{2}\ \underbrace{\text{KKHH}}_{3}\ \text{C1 +760L P}$

1 LM Guide model number
2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator, with grease nipple (see Fig. 4)
3 Dust prevention accessory symbol (see page a-138)

Note 1: QZ Lubricator and LaCS are not sold alone.

Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and LaCS to be attached, contact THK.

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10℃ and +50℃.

Use in a special environment

- When using it in a special environment, contact THK.

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Wide, Low Gravity Center Type LM Guide Model SHW

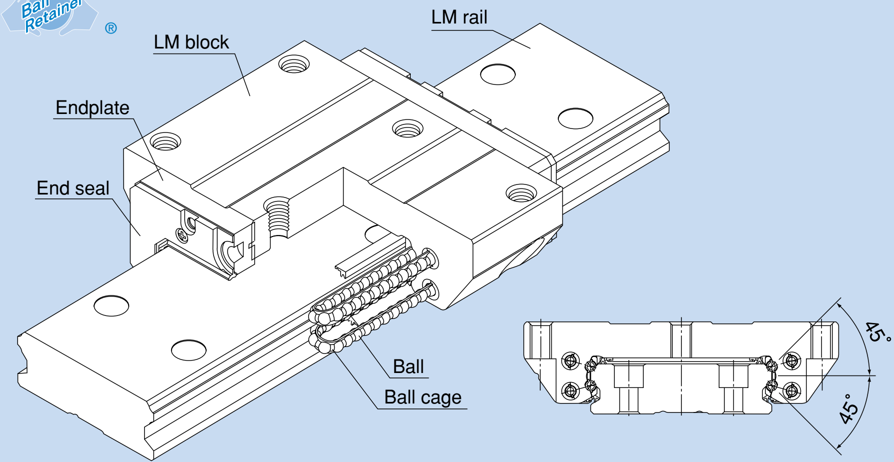


Fig. 1 Structure of Model SHW

Structure and Features

A wide and highly rigid LM Guide that uses ball cages to achieve low noise, long-term maintenance-free operation and high speed.

●Wide, low gravity center

Model SHW, which has a wide LM rail and a low gravity center, is optimal for locations requiring space saving and large MC moment rigidity.

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●Self-adjustment capability

The self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus to achieve highly accurate, smooth linear motion.

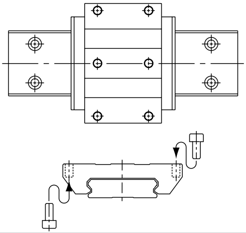
●Low dust generation

Use of ball cages eliminates friction between balls and retains lubricant, thus achieving low dust generation.

Types and Features

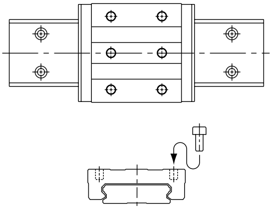
Model SHW-CA

The flange of the LM block has tapped holes.
Can be mounted from the top or the bottom.



Model SHW-CR

The LM block has tapped holes.



Rated Loads in All Directions

Model SHW is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for SHW.

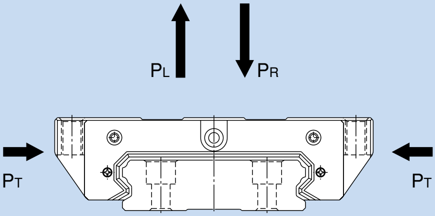


Fig. 2

Equivalent Load

When the LM block of model SHW receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E	: Equivalent load ・Radial direction ・Reverse-radial direction ・Lateral direction	(N)
P_R	: Radial load	(N)
P_L	: Reverse-radial load	(N)
P_T	: Lateral load	(N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SHW.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-166.

Table 1 Symbols of Dust Prevention Accessories for Model SHW

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper
SSHH	With end seal + side seal + inner seal + LaCS
DDHH	With double seals + side seal + inner seal + LaCS
ZZHH	With end seal + side seal + inner seal + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal + metal scraper + LaCS

Note: The inner seal and LaCS are not available for models SHW12, 14 and 17.

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals SHW ··· UU/SS, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals SHW ··· UU/SS

Unit: N

Model No.	Seal resistance value	
	UU	SS
SHW 12CA/CR	1.0	1.4
SHW 12HR	1.0	1.8
SHW 14	1.2	1.8
SHW 17	1.4	2.2
SHW 21	4.9	6.9
SHW 27	4.9	8.9
SHW 35	9.8	15.8
SHW 50	14.7	22.7

●Dedicated Bellows JSHW for Model SHW

Table 3 below shows the dimensions of dedicated bellows JSHW for model SHW. Specify the corresponding model number of the desired bellows from the table.

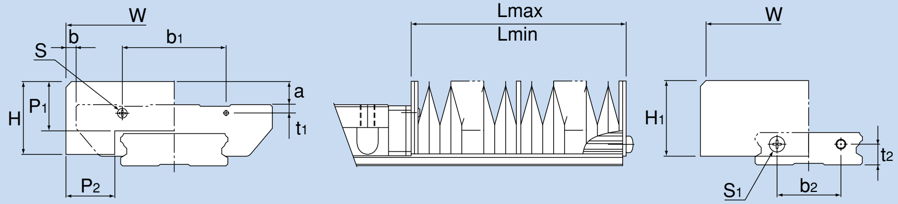


Fig. 3

Table 3 Dimensional Table for JSHW

Unit: mm

Model No.	Major dimensions									Supported model
	W	H	H_1	P_1	P_2	b_1	t_1	b_2	t_2	
JSHW 17	68	22	23	15	15.4	39	2.6	18	6	SHW 17
JSHW 21	75	25	26	17	17	35.8	2.9	22	7	SHW 21
JSHW 27	85	33.5	33.5	20	20	25	3.5	20	10	SHW 27
JSHW 35	120	35	35	20	20	75	7.5	40	13	SHW 35
JSHW 50	164	42	42	20	20	89.4	14	50	16	SHW 50

Model No.	Other dimensions					A
	Mounting bolt		a	b		$\left(\frac{Lmax}{Lmin}\right)$
	*S	S_1		Type CA	Type CR	
JSHW 17	M2×4 ℓ	M3×6 ℓ	8	4	9	5
JSHW 21	M2×5 ℓ	M3×6 ℓ	8	3.5	10.5	6
JSHW 27	M2.6×6 ℓ	M3×6 ℓ	10	2.5	11.5	7
JSHW 35	M3×8 ℓ	M3×6 ℓ	6	0	10	7
JSHW 50	M4×12 ℓ	M4×8 ℓ	—	1	17	7

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.
Note 2: For lubrication when using the dedicated bellows, contact THK.
Note 3: For the mounting bolts marked with "*", use tapping screws.
Note 4: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering SHS.

Model number coding JSHW21-60/360

1 2

1 Model number ··· bellows for SHW21
2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)} \qquad S: \text{Stroke length (mm)}$$

$$Lmax = Lmin \cdot A \qquad A: \text{Extension rate}$$

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

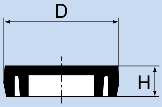
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 4.

For the procedure for mounting the cap, see page a-22.

Table 4 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SHW 12	C4	M4	7.8	1.0
SHW 14	C4	M4	7.8	1.0
SHW 17	C4	M4	7.8	1.0
SHW 21	C4	M4	7.8	1.0
SHW 27	C4	M4	7.8	1.0
SHW 35	C6	M6	11.4	2.7
SHW 50	C8	M8	14.4	3.7



Dedicated Cap C

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 5 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-166.

Table 5 Parts Symbols for Model SHW with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + QZ Lubricator
QZDD	With double seals + side seal + QZ Lubricator
QZZZ	With end seal + side seal + metal scraper + QZ Lubricator
QZKK	With double seals + side seal + metal scraper + QZ Lubricator
QZSSHH	With end seal + side seal + LaCS + QZ Lubricator
QZDDHH	With double seals + side seal + LaCS + QZ Lubricator
QZZZHH	With end seal + side seal + metal scraper + LaCS + QZ Lubricator
QZKKHH	With double seals + side seal + metal scraper + LaCS + QZ Lubricator

Note: The inner seal and LaCS are not available for models SHW12, 14 and 17.

Grease Nipple and Greasing Hole

Model SHW does not have a grease nipple as standard. Installation of a grease nipple and the drilling of a greasing hole is performed at THK. When ordering SHW, indicate that the desired model requires a grease nipple or greasing hole (for greasing hole dimensions and supported grease nipple types and dimensions, see table 6).

When using SHW under harsh conditions, use QZ Lubricator* (optional) or Laminated Contact Scraper LaCS* (optional).

Note 1: Grease nipple is not available for models SHW12, 14 and 17. They can have a greasing hole.

Note 2: Using a greasing hole other than for greasing may cause damage.

Note 3: For QZ Lubricator* and Laminated Contact Scraper LaCS*, see pages a-19 and a-20, and pages a-29 and a-30, respectively.

Note 4: When desiring a grease nipple for a model attached with QZ Lubricator, contact THK.

Table 6 Table of Grease Nipple and Greasing Hole Dimensions

Unit: mm

Model No.	E	Grease nipple or greasing hole
SHW 12	—	φ2.2 drilled hole
SHW 14	—	φ2.2 drilled hole
SHW 17	5	PB107
SHW 21	5.5	PB1021B
SHW 27	12	B-M6F
SHW 35	12	B-M6F
SHW 50	16	B-PT1/8

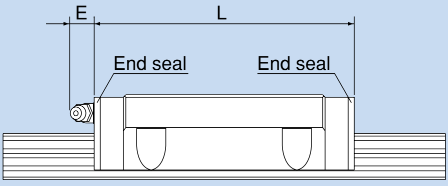


Fig. 4

Note: For the L dimension, see the corresponding dimension table.

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model SHW variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

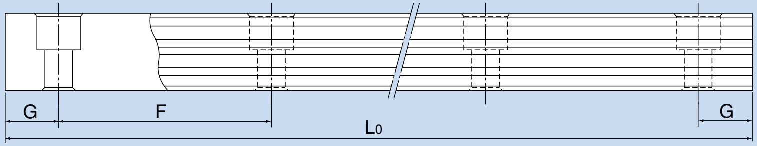


Table 7 Standard Length and Maximum Length of the LM Rail for Model SHW

Unit: mm

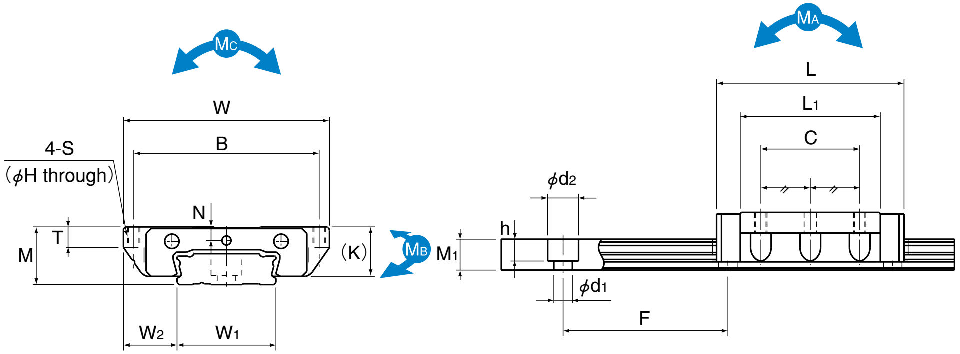
Model No.	SHW 12	SHW 14	SHW 17	SHW 21	SHW 27	SHW 35	SHW 50
Standard LM rail length (L_0)	70 110 150 190 230 270 310 390 470	70 110 150 190 230 270 310 390 470 550 670	110 190 310 470 550	130 230 380 480 580 780	160 280 340 460 640 820	280 440 760 1000 1240 1560	280 440 760 1000 1240 1640 2040
Standard pitch F	40	40	40	50	60	80	80
G	15	15	15	15	20	20	20
Max length	1000	1430	1800	1900	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

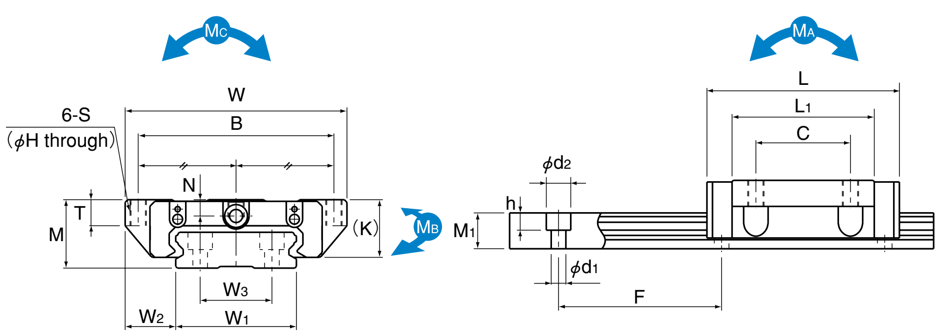
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Note 3: Models SHW12, 14 and 17 are made of stainless steel.

Model SHW-CA



Models SHW12CAM and SHW14CAM



Models SHW17CAM and SHW21 to 50CA

Unit: mm

Model No.	External dimensions			LM block dimensions								LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Width			Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S	H	L1	T	K	N	W1	W2	W3	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SHW 12CAM	12	40	37	35	18	M 3	2.5	27	4	10	2.8	18	11	—	6.6	40	4.5×7.5×5.3	4.31	5.66	0.0228	0.12	0.0228	0.12	0.0405	0.05	0.8
SHW 14CAM	14	50	45.5	45	24	M 3	2.5	34	5	12	3.3	24	13	—	7.5	40	4.5×7.5×5.3	7.05	8.98	0.0466	0.236	0.0466	0.236	0.0904	0.1	1.23
SHW 17CAM	17	60	51	53	26	M 4	3.3	38	6	14.5	4	33	13.5	18	8.6	40	4.5×7.5×5.3	7.65	10.18	0.0591	0.298	0.0591	0.298	0.164	0.15	1.9
SHW 21CA	21	68	59	60	29	M 5	4.4	43.6	8	17.7	5	37	15.5	22	11	50	4.5×7.5×5.3	8.24	12.8	0.0806	0.434	0.0806	0.434	0.229	0.24	2.9
SHW 27CA	27	80	72.8	70	40	M 6	5.3	56.6	10	23.5	6	42	19	24	15	60	4.5×7.5×5.3	16	22.7	0.187	0.949	0.187	0.949	0.455	0.47	4.5
SHW 35CA	35	120	107	107	60	M 8	6.8	83	14	31	7.6	69	25.5	40	19	80	7×11×9	35.5	49.2	0.603	3	0.603	3	1.63	1.4	9.6
SHW 50CA	50	162	141	144	80	M10	8.6	107	18	46	14	90	36	60	24	80	9×14×12	70.2	91.4	1.46	7.37	1.46	7.37	3.97	3.7	15

Note Since it uses stainless steel in the LM block, LM rail and balls, this model is highly resistant to corrosion and environment.

Model number coding SHW17 CA 2 QZ UU C1 M +580L P M - II

1 2 3 4 5 6 7 8 9 10 11

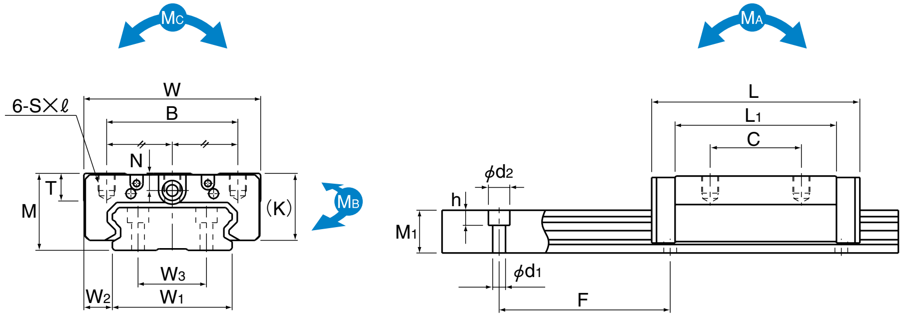
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-156) 6 Radial clearance symbol (see page a-34)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

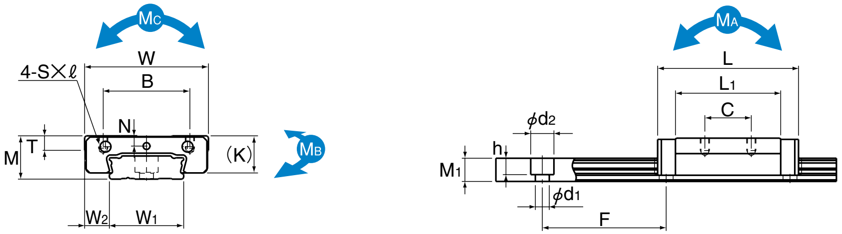
Note If a grease nipple is required, indicate "with grease nipple;" if a greasing hole is required, indicate "with greasing hole."

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

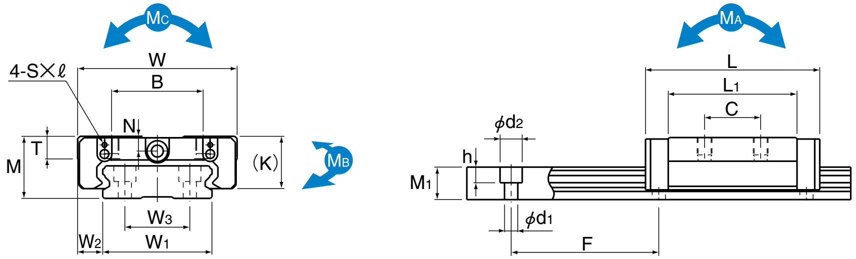
Models SHW-CR | SHW-HR



Models SHW27 to 50CR



Models SHW12CRM, SHW12HRM and SHW14CRM



Models SHW17CRM and SHW21CR

Unit: mm

Model No.	External dimensions			LM block dimensions							LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length								Width			Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	W_1	W_2	W_3	M_1	F	$d_1×d_2×h$	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SHW 12CRM	12	30	37	21	12	M3×3.5	27	4	10	2.8	18	6	—	6.6	40	4.5×7.5×5.3	4.31	5.66	0.0228	0.12	0.0228	0.12	0.0405	0.04	0.8
SHW 12HRM	12	30	50.4	21	24	M3×3.5	40.4	4	10	2.8	18	6	—	6.6	40	4.5×7.5×5.3	5.56	8.68	0.0511	0.246	0.0511	0.246	0.0621	0.06	0.8
SHW 14CRM	14	40	45.5	28	15	M3×4	34	5	12	3.3	24	8	—	7.5	40	4.5×7.5×5.3	7.05	8.98	0.0466	0.236	0.0466	0.236	0.0904	0.08	1.23
SHW 17CRM	17	50	51	29	15	M4×5	38	6	14.5	4	33	8.5	18	8.6	40	4.5×7.5×5.3	7.65	10.18	0.0591	0.298	0.0591	0.298	0.164	0.13	1.9
SHW 21CR	21	54	59	31	19	M5×6	43.6	8	17.7	5	37	8.5	22	11	50	4.5×7.5×5.3	8.24	12.8	0.0806	0.434	0.0806	0.434	0.229	0.19	2.9
SHW 27CR	27	62	72.8	46	32	M6×6	56.6	10	23.5	6	42	10	24	15	60	4.5×7.5×5.3	16	22.7	0.187	0.949	0.187	0.949	0.455	0.36	4.5
SHW 35CR	35	100	107	76	50	M8×8	83	14	31	7.6	69	15.5	40	19	80	7×11×9	35.5	49.2	0.603	3	0.603	3	1.63	1.2	9.6
SHW 50CR	50	130	141	100	65	M10×15	107	18	46	14	90	20	60	24	80	9×14×12	70.2	91.4	1.46	7.37	1.46	7.37	3.97	3	15

Note Since it uses stainless steel in the LM block, LM rail and balls, this model is highly resistant to corrosion and environment.

Model number coding

SHW27 CR 2 QZ KKHH C1 +820L P

SHW27	CR	2	QZ	KKHH	C1	+820L	P
1	2	3	4	5	6	7	8

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-156) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)

Note Those models equipped with QZ Lubricator cannot have a grease nipple.

Note If a grease nipple is required, indicate "with grease nipple;" if a greasing hole is required, indicate "with greasing hole."

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-160

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SHW with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SHW12 CAM/CRM	37	37	—	—	—	—	—	—	—
SHW12 HRM	50.4	50.4	—	—	—	—	—	—	—
SHW14 CAM/CRM	45.5	45.5	—	—	—	—	—	—	—
SHW17 CAM/CRM	51	51	54	53.4	56.4	—	—	—	—
SHW21 CA/CR	59	59	64	63.2	68.2	75.6	80.6	77.2	82.2
SHW27 CA/CR	72.8	72.8	78.6	77.8	83.6	89.4	95.2	91.8	97.6
SHW35 CA/CR	107	107	114.4	112	119.4	129	136.4	131.4	138.8
SHW50 CA/CR	141	141	149.2	147.4	155.6	166	174.2	168.4	176.6

Note: "—" indicates not available.

Overall LM Block Length (Dimension L) of Model SHW with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SHW12 CAM/CRM	47	47	—	—	—	—	—	—	—
SHW12 HRM	60.4	60.4	—	—	—	—	—	—	—
SHW14 CAM/CRM	55.5	55.5	—	—	—	—	—	—	—
SHW17 CAM/CRM	63	63	66	65.4	68.4	—	—	—	—
SHW21 CA/CR	75	75	80	77.8	82.8	91.6	96.6	93.2	98.2
SHW27 CA/CR	92.8	92.8	98.6	96.4	102.2	109.4	115.2	111.8	117.6
SHW35 CA/CR	127	127	134.4	132	134.4	149	156.4	151.4	158.8
SHW50 CA/CR	161	161	169.2	167.4	175.6	186	194.2	188.4	196.6

Note: "—" indicates not available.

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 8

Table 8 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SHW 21	3.9
SHW 27	6.5
SHW 35	13.0
SHW 50	19.5

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 5 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

■For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 5. Table 9 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SHW

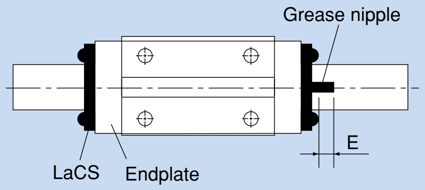


Fig. 5

Table 9

Unit: mm

Model No.	Incremental dimension with grease nipple E	Nipple type
SHW 21CA/CR	4.2	PB1021B
SHW 27CA/CR	10.7	B-M6F
SHW 35CA/CR	10.0	B-M6F
SHW 50CA/CR	21.0	B-PT1/8

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 5, contact THK.

■For LM Guide Models with Dust Prevention Accessories UU or SS

For the incremental dimension of the grease nipple when dust prevention accessories UU or SS are attached, see table 6 on page a-159.

■For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding

$$\underbrace{\text{SHW21}}_{1}\ \text{CA 2}\ \underbrace{\text{QZ}}_{2}\ \underbrace{\text{KKHH}}_{3}\ \text{C1 +780L P}$$

1 LM Guide model number
2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator (note 2)
3 Dust prevention accessory symbol (see page a-156)

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and LaCS to be attached, contact THK.
Note 3: When desiring a model without QZ Lubricator and with a grease nipple, indicate "with grease nipple" (otherwise, the grease nipple will not be provided).

Precautions on Use

Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10℃ and +50℃.

Use in a special environment

- When using it in a special environment, contact THK.

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Lightweight, Compact Type LM Guide Model SRS

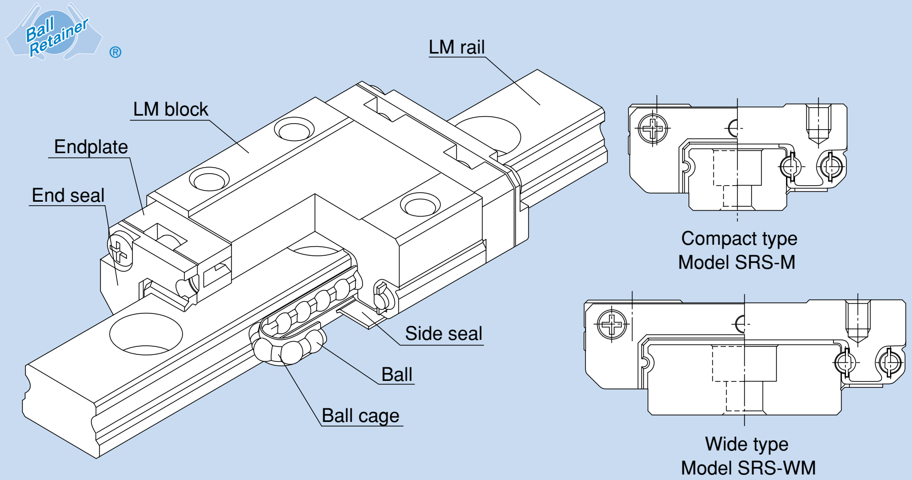


Fig. 1 Structure of Model SRS

Structure and Features

Caged Ball LM Guide model SRS has a structure where two raceways are incorporated into the compact body, enabling the model to receive loads in all directions, and to be used in locations where a moment is applied with a single rail. In addition, use of ball cages eliminates friction between balls, thus achieving high speed, low noise, acceptable running sound, long service life, and long-term maintenance-free operation.

●Low dust generation

Use of ball cages eliminates friction between balls and retains lubricant, thus achieving low dust generation. In addition, the LM block and LM rail use stainless steel, which is highly resistant to corrosion.

●4-way equal load type

Since the right and left rows of balls under a load contact the raceway at 45°, this LM Guide is capable of receiving loads in the radial, reverse-radial and lateral directions at equal values and being used in any orientations. With this well-balanced structure, this model can be used in extensive applications.

●Compact

Since SRS has a compact structure where the rail cross section is designed to be low and that contains only two rows of balls, it can be installed in space-saving locations.

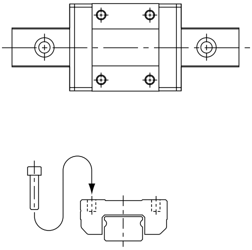
●Lightweight

Since part of the LM block (e.g., around the ball relief hole) is made of resin and formed through insert molding, SRS is a lightweight, low inertia type of LM Guide.

Types and Features

Model SRS-M

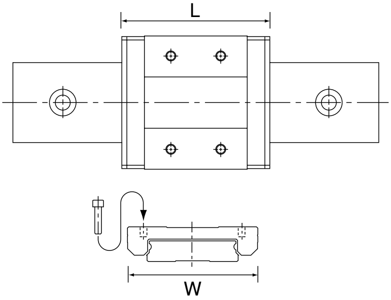
A standard type of SRS.



Note: In addition to model SRS-M, a full-ball type without ball cage is also available. If desiring this type, indicate type "SRS-G" when placing an order. However, since SRS-G does not have a ball cage, its dynamic load rating is smaller than SRS-M. See the table of basic load ratings for SRS-G on page a-179 for details.

Model SRS-WM

Has a longer overall LM block length (L), a greater width and a larger rated load and permissible moment than SRS-M.



Note: In addition to model SRS-MW, a full-ball type without ball cage is also available. If desiring this type, indicate type "SRS-G" when placing an order. However, since SRS-G does not have a ball cage, its dynamic load rating is smaller than SRS-MW. See the table of basic load ratings for SRS-G on page a-181 for details.

Rated Loads in All Directions

Model SRS is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

Their basic dynamic load ratings are represented by the symbols in the radial direction indicated in Fig. 2, and the actual values are provided in the dimensional table for SRS. The values in the reverse-radial and lateral directions are obtained from table 1.

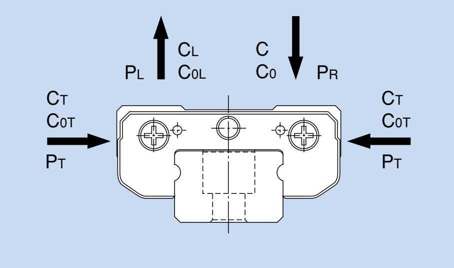


Fig. 2

Table 1 Rated Loads of Model SRS in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=C$	$C_{0L}=C_0$
Lateral direction (9M/9WM/20M)	$C_T=1.19C$	$C_{0T}=1.19C_0$
Lateral direction (12M/12WM/ 15M/15WM/25M)	$C_T=C$	$C_{0T}=C_0$

Equivalent Load

When the LM block of model SRS receives a reverse-radial load and a lateral load simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R\ (P_L)+Y\cdot P_T$$

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X, Y : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model SRS

Equivalent load P_E	Model No.	X	Y
Radial and reverse-radial directions	9M/9WM/ 20M	1	0.839
	12M/12WM/ 15M/ 15WM/25M	1	1
Lateral direction	9M/ 9WM/20M	1.192	1
	12M/12WM/15M/ 15WM/25M	1	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for models SRS.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-182.

Table 3 Symbols of Dust Prevention Accessories for Models SRS

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
SSHH	With end seal + side seal + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seal SRS ··· SS, refer to the corresponding value provided in table 4.

Table 4 Maximum Seal Resistance Value of Seal SRS ··· SS

Unit: N

Model No.	Seal resistance value
SRS 9M	0.2
SRS 9WM	1.0
SRS 12M	0.6
SRS 12WM	1.3
SRS 15M	1.0
SRS 15WM	1.6
SRS 20M	1.3
SRS 25M	1.6

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

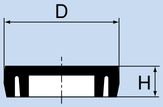
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SRS 9WM	C3	M3	6.3	1.2
SRS 12M	C3	M3	6.3	1.2
SRS 15M	C3	M3	6.3	1.2
SRS 20M	C5	M5	9.8	2.4
SRS 25M	C6	M6	11.4	2.7



Dedicated Cap C

QZ™ Lubricator

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 6 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-182.

Table 6 Parts Symbols for Model SRS with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + QZ Lubricator
QZSSHH	With end seal + side seal + LaCS + QZ Lubricator

Grease Nipple and Greasing Hole

Model SRS does not have a grease nipple as standard. Installation of a grease nipple and the drilling of a greasing hole is performed at THK. When ordering SRS, indicate that the desired model requires a grease nipple or greasing hole (for greasing hole dimensions and supported grease nipple types and dimensions, see table 7).

When using SRS under harsh conditions, use QZ Lubricator* (optional) or Laminated Contact Scraper LaCS* (optional).

Note 1: Grease nipple is not available for models SRS9M, SRS9WM, SRS12M and SRS12WM. They can have a greasing hole.

Note 2: Using a greasing hole other than for greasing may cause damage.

Note 3: For QZ Lubricator* and Laminated Contact Scraper LaCS*, see pages a-19 and a-20, and pages a-29 and a-30, respectively.

Note 4: When desiring a grease nipple for a model attached with QZ Lubricator, contact THK.

Table 7 Table of Grease Nipple and Greasing Hole Dimensions

Unit: mm

Model No.	E	Grease nipple or greasing hole
SRS 9M	—	φ1.5 drilled hole
SRS 9WM	—	φ1.6 drilled hole
SRS 12M	—	φ2.0 drilled hole
SRS 12WM	—	φ2.0 drilled hole
SRS 15M	4.0(5.0)	PB107
SRS 15WM	4.0(5.0)	PB107
SRS 20M	3.5(5.0)	PB107
SRS 25M	4.0(5.5)	PB1021B

Note: Figures in the parentheses indicate dimensions without a seal.

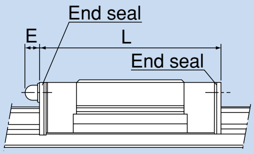


Fig. 3

Note: For the L dimension, see the corresponding dimension table.

Flatness of the LM Rail and the LM Block Mounting Surface

The values in table 8 apply when the clearance is a normal clearance. If the clearance is C1 clearance and two rails are used in combination, we recommend using 50% or less of the value in the table.

Note: Since SRS has Gothic-arch grooves, any accuracy error in the mounting surface may negatively affect the operation. Therefore, we recommend using SRS on a highly accurate mounting surface.

Table 8 Flatness of the LM Rail and the LM Block Mounting Surface

Unit: mm

Model No.	Flatness
SRS 9M	0.035/200
SRS 9WM	0.035/200
SRS 12M	0.050/200
SRS 12WM	0.050/200
SRS 15M	0.060/200
SRS 15WM	0.060/200
SRS 20M	0.070/200
SRS 25M	0.070/200

Standard Length and Maximum Length of the LM Rail

Table 9 shows the standard lengths and the maximum lengths of model SRS variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

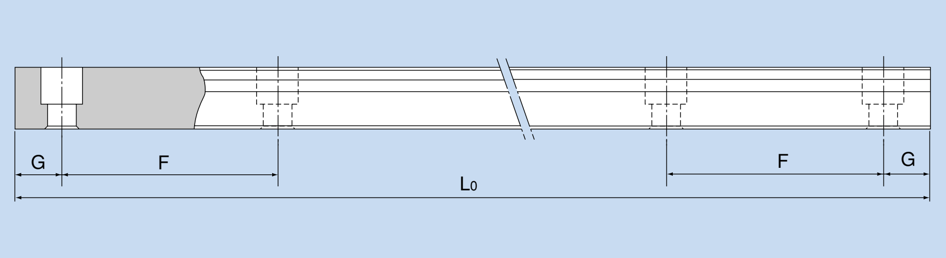


Table 9 Standard Length and Maximum Length of the LM Rail for Model SRS

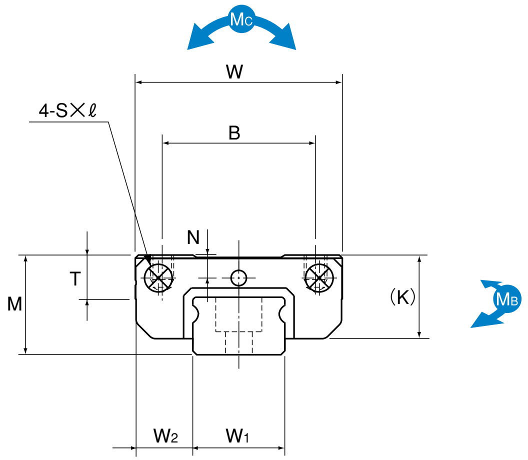
Unit: mm

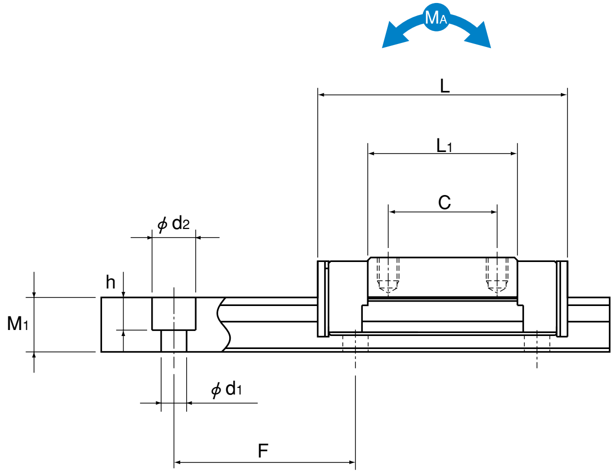
Model No.	SRS 9M	SRS 9WM	SRS 12M	SRS 12WM	SRS 15M	SRS 15WM	SRS 20M	SRS 25M
Standard LM rail length (L_0)	55 75 95 115 135 155 175 195 275 375	50 80 110 140 170 200 260 290 320	70 95 120 145 170 195 220 245 270 320 370 470 570	70 110 150 190 230 270 310 390 470 550	70 110 150 190 230 270 310 350 390 430 470 550 670 870	110 150 190 230 270 310 430 550 670 790	220 280 340 460 640 880 1000	220 280 340 460 640 880 1000
Standard pitch F	20	30	25	40	40	40	60	60
G	7.5	10	10	15	15	15	20	20
Max length	1000	1000	1340	1430	1430	1800	1800	1800

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Model SRS-M





Unit: mm

Model No.	External dimensions			LM block dimensions							LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L1	T	K	N	Width W1	W2	Height M1	Pitch F	d1×d2×h	C kN	C0 kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	LM block kg	LM rail kg/m
SRS 9M	10	20	30.8	15	10	M3×2.8	19.8	4.9	9.1	2.4	$9^{\ 0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	2.69	2.31	7.82	43.9	9.03	50.8	10.6	0.016	0.32
SRS 12M	13	27	34.4	20	15	M3×3.2	20.6	5.7	11	3	$12^{\ 0}_{-0.02}$	7.5	7.5	25	3.5×6×4.5	4	3.53	12	78.5	12	78.5	23.1	0.027	0.65
SRS 15M	16	32	43	25	20	M3×3.5	25.7	6.5	13.3	3	$15^{\ 0}_{-0.02}$	8.5	9.5	40	3.5×6×4.5	6.66	5.7	26.2	154	26.2	154	40.4	0.047	0.96
SRS 20M	20	40	50	30	25	M4×6	34	9	16.6	4	$20^{\ 0}_{-0.03}$	10	11	60	6×9.5×8	7.75	9.77	54.3	296	62.4	341	104	0.11	1.68
SRS 25M	25	48	77	35	35	M6×7	56	11	20	5	$23^{\ 0}_{-0.03}$	12.5	15	60	7×11×9	16.5	20.2	177	932	177	932	248	0.24	2.6

Note Since it uses stainless steel in the LM block, LM rail and balls, this model is highly resistant to corrosion and environment.

Model number coding

2 SRS20M QZ UU C1 +220L P M-Ⅱ
1 2 3 4 5 6 7 8 9

1 No. of LM blocks used on the same rail
2 Model number
3 With QZ Lubricator
4 Dust prevention accessory symbol (see page a-173)
5 Radial clearance symbol (see page a-35)
6 LM rail length (in mm)
7 Accuracy symbol (see page a-45)
8 LM rail is made of stainless steel
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

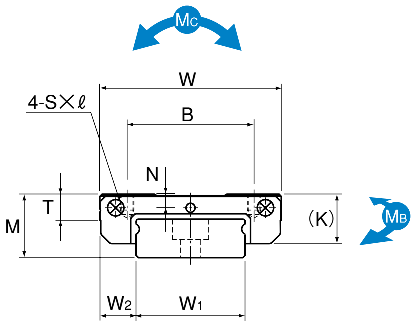
Note If a grease nipple is required, indicate "with grease nipple" (available for models SRS 15M/15WM/20M/25M).
If a greasing hole is required, indicate "with greasing hole" (available for models SRS 9M/9WM/12M/12WM).

Static permissible moment*:
1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

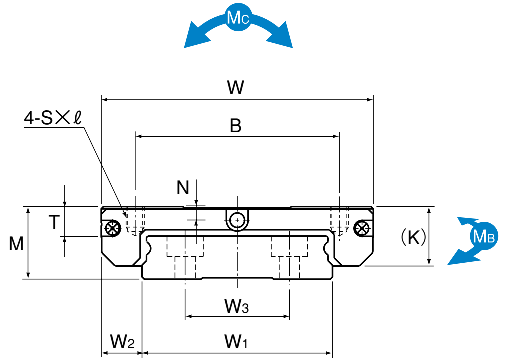
SRS-G Basic Load Ratings

Model No.	Basic load rating C kN	Basic load rating C0 kN
SRS 9MG	2.07	2.32
SRS 12MG	3.36	3.55
SRS 15MG	5.59	5.72
SRS 20MG	5.95	9.40
SRS 25MG	13.3	22.3

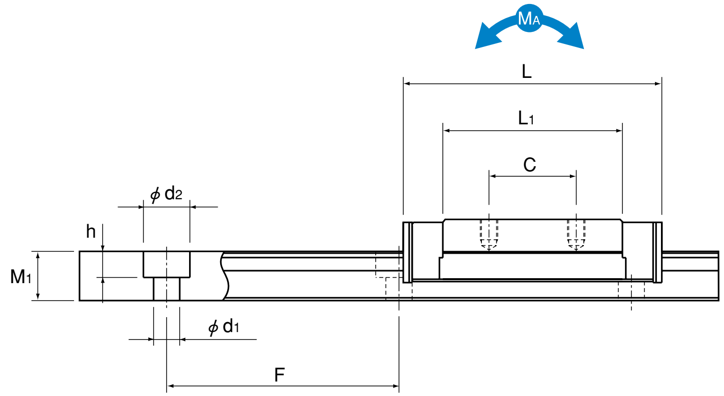
Model SRS-WM



Models SRS9WM and 12WM



Model SRS15WM



Unit: mm

Model No.	External dimensions			LM block dimensions							LM rail dimensions						Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length								Width			Height	Pitch		C	C0	MA		MB		Mc	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	W1	W2	W3	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SRS 9WM	12	30	39	21	12	M3×2.8	27	4.9	9.1	2.3	$18^{\ 0}_{-0.02}$	6	—	7.5	30	3.5×6×4.5	3.29	3.34	14	78.6	16.2	91	31.5	0.031	1.01
SRS 12WM	14	40	44.5	28	15	M3×3.5	30.9	5.7	11	3	$24^{\ 0}_{-0.02}$	8	—	8.5	40	4.5×8×4.5	5.48	5.3	26.4	143	26.4	143	66.5	0.055	1.52
SRS 15WM	16	60	55.5	45	20	M4×4.5	38.9	6.5	13.3	3	$42^{\ 0}_{-0.02}$	9	23	9.5	40	4.5×8×4.5	9.12	8.55	51.2	290	51.2	290	176	0.13	2.87

Note Since it uses stainless steel in the LM block, LM rail and balls, this model is highly resistant to corrosion and environment.

Note If a grease nipple is required, indicate "with grease nipple" (available for models SRS 15M/15WM/20M/25M).
If a greasing hole is required, indicate "with greasing hole" (available for models SRS 9M/9WM/12M/12WM).

Static permissible moment*:
1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

SRS-G Basic Load Ratings

Model No.	Basic load rating	
	C kN	C0 kN
SRS 9WM	2.67	3.35
SRS 12WM	4.46	5.32
SRS 15WM	7.43	8.59

Model number coding

2	SRS15WM	QZ	UU	C1	+550L	P	M-	II
1	2	3	4	5	6	7	8	9

1 No. of LM blocks used on the same rail 2 Model number 3 With QZ Lubricator
4 Dust prevention accessory symbol (see page a-173) 5 Radial clearance symbol (see page a-35)
6 LM rail length (in mm) 7 Accuracy symbol (see page a-45) 8 LM rail is made of stainless steel
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-176

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SRS with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	SSHH
SRS 9	30.8	30.8	—
SRS 9W	39	39	—
SRS 12	34.4	34.4	—
SRS 12W	44.5	44.5	—
SRS 15	43	43	—
SRS 15W	55.5	55.5	—
SRS 20	50	50	67.2
SRS 25	77	77	95.2

Note: "—" indicates not available.

Overall LM Block Length (Dimension L) of Model SRS with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZSSHH
SRS 9	40.8	40.8	—
SRS 9W	49	49	—
SRS 12	44.4	44.4	—
SRS 12W	54.5	54.5	—
SRS 15	55	55	—
SRS 15W	67.5	67.5	—
SRS 20	66	66	83.2
SRS 25	97	97	115.2

Note: "—" indicates not available.

Overall LM Block Length without Seal

Unit: mm

Model No.	Without seal	Model No.	Without seal
SRS 9	27.8	SRS 15	40
SRS 9W	36	SRS 15W	52.5
SRS 12	31.4	SRS 20	47
SRS 12W	41.5	SRS 25	73

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 10

Table 10 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SRS 20	5.2
SRS 25	7.8

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 4 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH

LM Guide models with dust prevention accessories SSHH have the grease nipple in the location indicated in Fig. 4. Table 11 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SRS

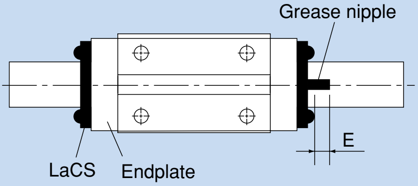


Fig. 4

Table 11

Unit: mm

Model No.	Incremental dimension with grease nipple E	Nipple type
SRS 25	4	PB1021B

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 4, contact THK.

For LM Guide Models with Dust Prevention Accessories UU or SS

For the incremental dimension of the grease nipple when dust prevention accessories UU or SS are attached, see table 7 on page a-175.

Model number coding

2SRS25M QZ SSHH +1000L P M-Ⅱ

1 (2SRS25M) 2 (QZ) 3 (SSHH)

1 LM Guide model number
2 QZ: with QZ Lubricator, without grease nipple No symbol: without QZ Lubricator
3 Dust prevention accessory symbol (see page a-173)

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and LaCS to be attached, contact THK.
Note 3: When desiring a model without QZ Lubricator and with a grease nipple, indicate "with grease nipple" (otherwise, the grease nipple will not be provided).

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

●Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

●The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

●The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

●When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

●Dropping or hitting this product may damage it. Take much care when handling it.

●Do not clean it with an organic solvent or white kerosene.

●Do not leave it unpacked for a long period of time.

●Do not block the air vent with grease or the like.

Service temperature range

●Be sure the service temperature of this product is between -10℃ and +50℃.

Use in a special environment

●When using it in a special environment, contact THK .

Precaution on selection

●Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

●QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Ultra-high Rigidity Type Roller Guide Model SRG

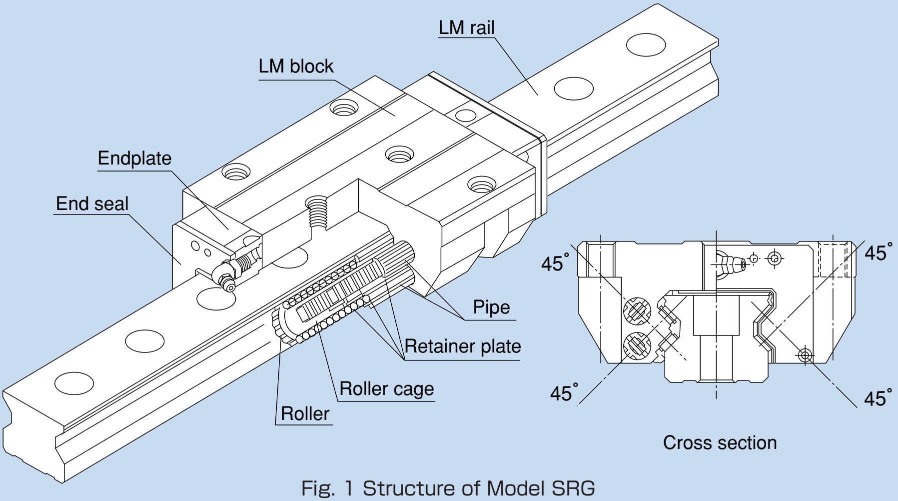


Fig. 1 Structure of Model SRG

Structure and Features

SRG is an ultra-high rigidity Roller Guide that uses roller cages to allow low-friction, smooth motion and achieve long-term maintenance-free operation.

●Ultra-high rigidity

To achieve ultra-high rigidity, it uses rollers, which are less subject to elastic deformation, for the rolling elements, and optimizes the roller diameter and the roller length.
In addition, each row of rollers is arranged at a contact angle of 45° so that the guide receives an equal load rating in all four directions (radial, reverse-radial and lateral directions).

●Smooth motion through skewing prevention

The roller cage allows rollers to form an evenly spaced line while circulating, thus preventing the rollers from skewing as the block enters an loaded area. As a result, fluctuation of the rolling resistance is minimized, and stable, smooth motion is achieved.

●Long-term maintenance-free operation

Use of roller cages eliminates friction between rollers and increases grease retention, enabling long-term maintenance-free operation to be achieved.

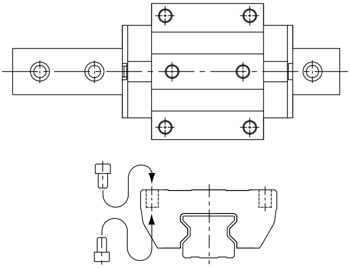
●Global standard size

SRG is designed to have dimensions almost the same as that of model HSR, which THK as a pioneer of the linear motion system has developed and is practically a global standard model.

Types and Features

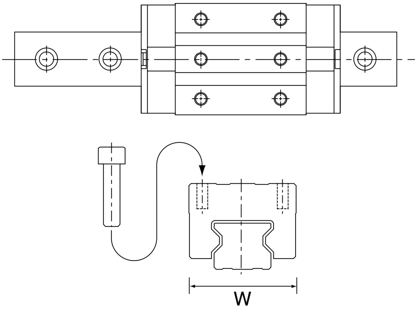
Model SRG-C

The flange of the LM block has tapped holes. Can be mounted from the top or the bottom. Used in places where the table cannot have through holes for mounting bolts.



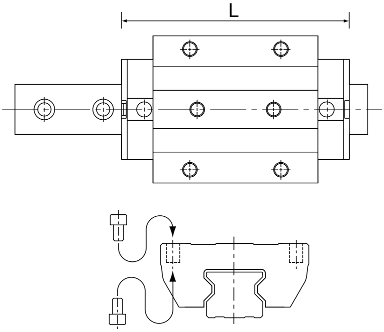
Model SRG-R

The LM block has a smaller width (W) and is equipped with tapped holes. Suitable for places where space for the table width is limited.



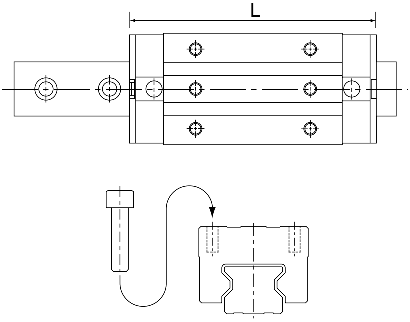
Model SRG-LC

The LM block has the same sectional shape as model SRG-C, but has a longer overall LM block length (L) and a greater rated load.



Model SRG-LR (LV)

The LM block has the same sectional shape as model SRG-R, but has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Model SRG is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for SRG.

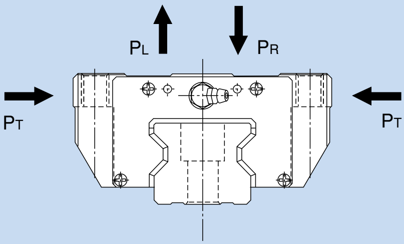


Fig. 2

Equivalent Load

When the LM block of model SRG receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SRG.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-200.

Table 1 Symbols of Dust Prevention Accessories for Model SRG

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper
SSHH	With end seal + side seal + inner seal + LaCS
DDHH	With double seals + side seal + inner seal + LaCS
ZZHH	With end seal + side seal + inner seal + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal + metal scraper + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals SRG ··· SS, refer to the corresponding value provided in table 2.

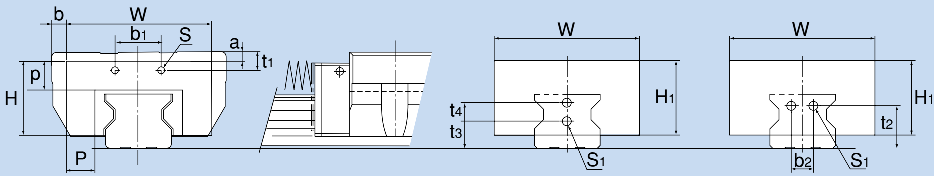
Table 2 Maximum Seal Resistance Value of Seals SRG ··· SS

Unit: N

Model No.	Seal resistance value
SRG 25	19
SRG 30	24
SRG 35	30
SRG 45	30
SRG 55	35
SRG 65	40

●Dedicated Bellows JSRG for Model SRG

The table below shows the dimensions of dedicated bellows JSRG for model SRG. Specify the corresponding model number of the desired bellows from the table.



Models SRG25 and 30

Models SRG35 to 65

Model No.	Major dimensions (mm)																		A $\left(\frac{\text{Lmax}}{\text{Lmin}}\right)$	Supported model
							t_1						Screw size	Mounting bolt	a		b			
	W	H	H_1	P	p	b_1	Type C	Type R	b_2	t_2	t_3	t_4	S	S_1	Type C	Type R/V	Type C	Type R/V		
JSRG 25	78	38	38	23	18	27.6	3.9	7.9	—	—	10	8	M2	M3×6ℓ	–6.5	–2.5	4	15	6	SRG 25
JSRG 30	84	42	42	22	19	37.4	10.4	13.4	—	—	11	10	M3	M4×8ℓ	–5	–2	3	12	7	SRG 30
JSRG 35	88	42	42	22	15	35	5	12	13	23	—	—	M3	M4×4ℓ	0	7	6	–9	5	SRG 35
JSRG 45	100	51	51	20	20	32	7	17	15	29	—	—	M3	M5×4ℓ	0	10	10	–7	7	SRG 45
JSRG 55	108	57	57	20	20	36	10	20	25	35	—	—	M3	M5×4ℓ	3	13	16	–4	7	SRG 55
JSRG 65	132	75.5	75.5	28.5	25	46	9	9	28	42	—	—	M4	M6×5ℓ	3	3	19	–3	9	SRG 65

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the dedicated bellows, contact THK.

Note 3: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering SRG.

Model number coding

JSRG35-60/420

1 (JSRG35) 2 (60/420)

1 Model number ··· bellows for SRG35

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$\text{Lmin} = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$\text{Lmax} = \text{Lmin}\cdot A$$ A: Extension rate

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same level as the LM rail top face.

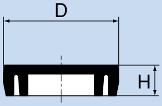
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

For the procedure for mounting the cap, see page a-22.

Table 3 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SRG 25	C 6	M 6	11.4	2.7
SRG 30	C 8	M 8	14.4	3.7
SRG 35	C 8	M 8	14.4	3.7
SRG 45	C12	M12	20.5	4.7
SRG 55	C14	M14	23.5	5.7
SRG 65	C16	M16	26.5	5.7



Dedicated Cap C

●Plate Cover

By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the plate cover drastically increases sealability of the end seal, thus to prevent the penetration of foreign matter or water from the top face of the LM rail.

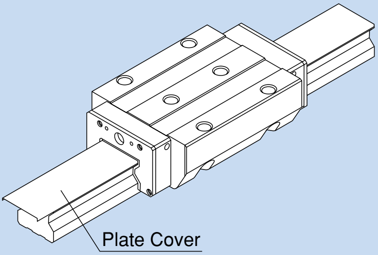


Fig. 3

Note 1: When mounting the plate cover, it is important to take into account the seal shape. Indicate that the plate cover is required when ordering the LM Guide.

Note 2: To mount the plate cover, it is necessary to remove the LM block from the LM rail using an LM block removing/mounting jig. Contact THK for details of the jig.

Note 3: If two or more rails are connected to exceed the maximum manufacturing length, it is necessary to also connect two or more plate covers. In such cases, the plate covers must closely contact with each other and there must be no level difference between the plate covers. Contact THK for details.

Note 4: The plate cover is not available for SRG25 and 30.

●Removing/mounting Jig

When assembling the guide, do not remove the LM block from the LM rail whenever possible. If it is inevitable to remove the LM block due to the plate cover type or the assembly procedure, be sure to use the removing/mounting jig.

Note: For details on the removing/mounting jig, contact THK.

QZ™ Lubricator

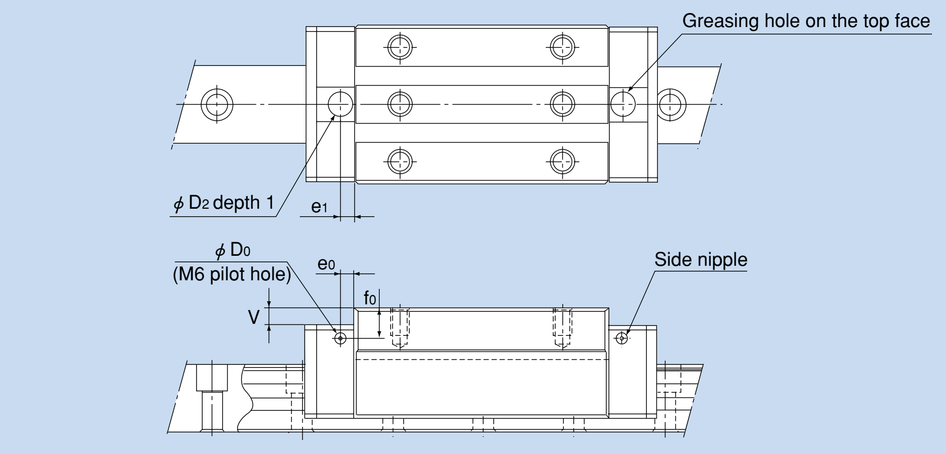
When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 4 (for details of QZ Lubricator, see pages a-19 and a-20).
For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-200.

Table 4 Parts Symbols for Model SRG with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ Lubricator
QZSS	With end seal + side seal + inner seal + QZ Lubricator
QZDD	With double seals + side seal + inner seal + QZ Lubricator
QZZZ	With end seal + side seal + inner seal + metal scraper + QZ Lubricator
QZKK	With double seals + side seal + inner seal + metal scraper + QZ Lubricator
QZSSHH	With end seal + side seal + inner seal + LaCS + QZ Lubricator
QZDDHH	With double seals + side seal + inner seal + LaCS + QZ Lubricator
QZZZHH	With end seal + side seal + inner seal + metal scraper + LaCS + QZ Lubricator
QZKKHH	With double seals + side seal + inner seal + metal scraper + LaCS + QZ Lubricator

Greasing Hole

Model SRG allows lubrication from both the side and top faces of the LM block. The greasing hole of standard types is not drilled through in order to prevent foreign matter from entering the LM block. When using the greasing hole, contact THK.
When using the greasing hole on the top face of models SRG-R and SRG-LR, a greasing adapter is separately required. Contact THK for details.



Model No.	Pilot hole for side nipple			Applicable nipple	Greasing hole on the top face			
	e_0	f_0	D_0		D_2	(O ring)	V	e_1
SRG 25C SRG 25LC	6	6.3	5.2	M6F	10.2	(P7)	0.5	6
SRG 30C SRG 30LC	6	5.8	5.2	M6F	10.2	(P7)	0.4	6
SRG 35C SRG 35LC	6	6	5.2	M6F	10.2	(P7)	0.4	6
SRG 45C SRG 45LC	7	7	5.2	M6F	10.2	(P7)	0.4	7
SRG 55C SRG 55LC	9	8.5	5.2	M6F	10.2	(P7)	0.4	11
SRG 65LC	9	13.5	5.2	M6F	10.2	(P7)	0.4	10

Model No.	Pilot hole for side nipple			Applicable nipple	Greasing hole on the top face			
	e_0	f_0	D_0		D_2	(O ring)	V	e_1
SRG 25R SRG 25LR	6	10.3	5.2	M6F	10.2	(P7)	4.5	6
SRG 30R SRG 30LR	6	8.8	5.2	M6F	10.2	(P7)	3.4	6
SRG 35R SRG 35LR	6	13	5.2	M6F	10.2	(P7)	7.4	6
SRG 45R SRG 45LR	7	17	5.2	M6F	10.2	(P7)	10.4	7
SRG 55R SRG 55LR	9	18.5	5.2	M6F	10.2	(P7)	10.4	11
SRG 65LV	9	13.5	5.2	M6F	10.2	(P7)	0.4	10

●Greasing

The greasing interval is longer than that of full-roller types because of the roller cage effect. However, the actual greasing interval may vary depending on the service environment, such as a high load and high speed. Contact THK for details.

Error Allowance of the Mounting Surface

The following tables show errors of the mounting surface that will not affect the rolling resistance or service life in normal operation.

Table 5 Error Allowance in Parallelism (P) between Two Rails

Unit: mm

Model No. \ Radial clearance	Normal	C1	C0
SRG 25	0.009	0.007	0.005
SRG 30	0.011	0.008	0.006
SRG 35	0.014	0.010	0.007
SRG 45	0.017	0.013	0.009
SRG 55	0.021	0.014	0.011
SRG 65	0.027	0.018	0.014

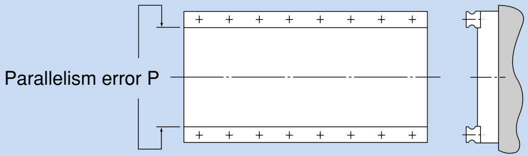


Fig. 4

Table 6 Error Allowance in Level (X) between the Rails

Unit: mm

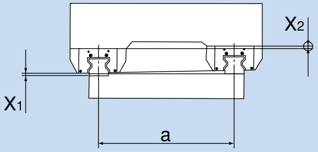
Radial clearance	Normal	C1	C0
Error allowance (X) of the mounting surface	0.00030 a	0.00021 a	0.00011 a

$X=X_1+X_2$

Example of calculation

Rail span when a=500mm

Error allowance of the mounting surface $X=0.0003\times500$ $=0.15$



X_1: Level difference on the rail mounting surface

X_2: Level difference on the block mounting surface

Fig. 5

Table 7 Error Allowance in Level (Y) in the Axial Direction

Unit: mm

Error allowance of the mounting surface (mm)	0.000036 b

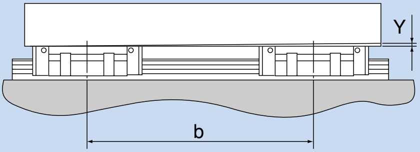


Fig. 6

Standard Length and Maximum Length of the LM Rail

Table 8 shows the standard lengths and the maximum lengths of model SRG variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

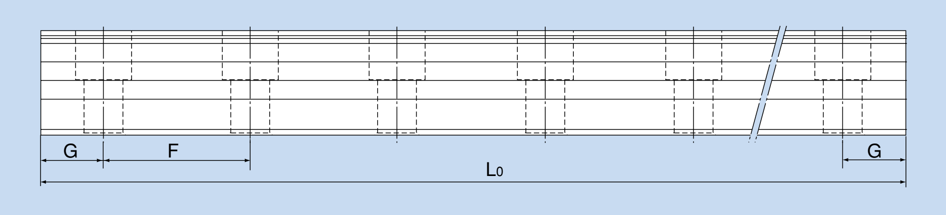


Table 8 Standard Length and Maximum Length of the LM Rail for Model SRG

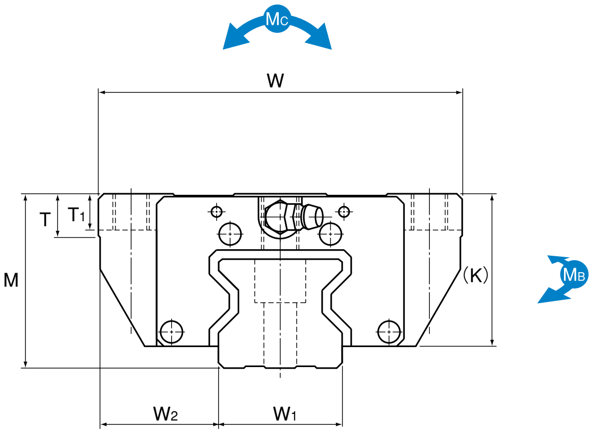
Unit: mm

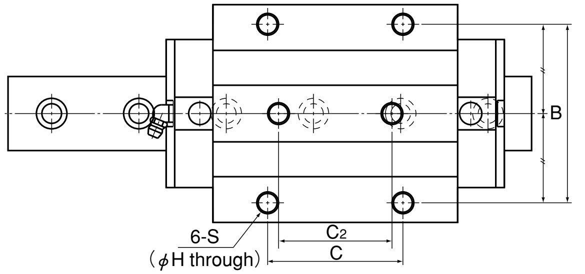
Model No.	SRG 25	SRG 30	SRG 35	SRG 45	SRG 55	SRG 65
Standard LM rail length (L_0)	220	280	280	570	780	1270
	280	360	360	675	900	1570
	340	440	440	780	1020	2020
	400	520	520	885	1140	2620
	460	600	600	990	1260	
	520	680	680	1095	1380	
	580	760	760	1200	1500	
	640	840	840	1305	1620	
	700	920	920	1410	1740	
	760	1000	1000	1515	1860	
	820	1080	1080	1620	1980	
	940	1160	1160	1725	2100	
	1000	1240	1240	1830	2220	
	1060	1320	1320	1935	2340	
	1120	1400	1400	2040	2460	
	1180	1480	1480	2145	2580	
	1240	1560	1560	2250	2700	
	1300	1640	1640	2355	2820	
	1360	1720	1720	2460	2940	
	1420	1800	1800	2565	3060	
	1480	1880	1880	2670		
	1540	1960	1960	2775		
	1600	2040	2040	2880		
	1720	2200	2200	2985		
	1840	2360	2360	3090		
	1960	2520	2520			
	2080	2680	2680			
	2200	2840	2840			
	2320	3000	3000			
	2440					
Standard pitch F	30	40	40	52.5	60	75
G	20	20	20	22.5	30	35
Max length	3000	3000	3000	3090	3060	3000

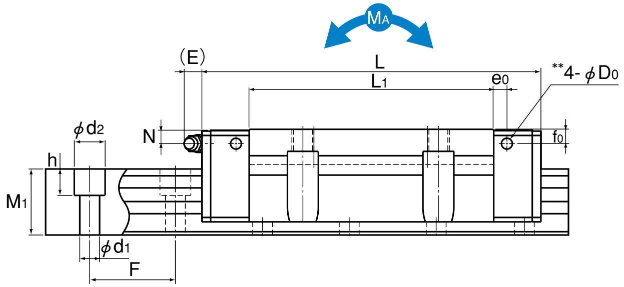
Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models SRG-C | SRG-LC







Unit: mm

Model No.	External dimensions			LM block dimensions															LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length															Grease nipple	Width W1 0 −0.05		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	C2	S	H	L1	T	T1	K	N	E	e0	f0	D0			W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SRG 25C SRG 25LC	36	70	95.5 115	57	45	40	M 8	6.8	65.5 85.1	9.5	10	31.5	5.5	12	6	6.3	5.2	B-M6F	23	23.5	23	30	7×11×9	27.9 34.2	57.5 75	0.641 1.07	3.7 5.74	0.641 1.07	3.7 5.74	0.795 1.03	0.7 0.9	3.6
SRG 30C SRG 30LC	42	90	111 135	72	52	44	M10	8.5	75 99	12	14	37	6.5	12	6	5.8	5.2	B-M6F	28	31	26	40	9×14×12	39.3 48.3	82.5 108	1.02 1.76	6.21 9.73	1.02 1.76	6.21 9.73	1.47 1.92	1.2 1.6	4.4
SRG 35C SRG 35LC	48	100	125 155	82	62	52	M10	8.5	82.2 112.2	11.5	10	42	6.5	12	6	6	5.2	B-M6F	34	33	30	40	9×14×12	59.1 76	119 165	1.66 3.13	10.1 17	1.66 3.13	10.1 17	2.39 3.31	1.9 2.4	6.9
SRG 45C SRG 45LC	60	120	155 190	100	80	60	M12	10.5	107 142	14.5	15	52	10	16	7	7	5.2	B-PT1/8	45	37.5	37	52.5	14×20×17	91.9 115	192 256	3.49 6.13	20 32.2	3.49 6.13	20 32.2	4.98 6.64	3.7 4.5	11.6
SRG 55C SRG 55LC	70	140	185 235	116	95	70	M14	12.5	129.2 179.2	17.5	18	60	12	16	9	8.5	5.2	B-PT1/8	53	43.5	43	60	16×23×20	131 167	266 366	5.82 10.8	33 57	5.82 10.8	33 57	8.19 11.2	5.9 7.8	15.8
SRG 65LC	90	170	303	142	110	82	M16	14.5	229.8	19.5	20	78.5	17	16	9	13.5	5.2	B-PT1/8	63	53.5	54	75	18×26×22	278	599	22.7	120	22.7	120	22.1	16.4	23.7

Note The greasing hole on the top face and the pilot hole of the side nipple** are not drilled through in order to prevent foreign matter from entering the block.
See pages a-192 and a-193 for details.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding SRG45 LC 2 QZ KKHH C0 +1200L P Z- II

1 2 3 4 5 6 7 8 9 10

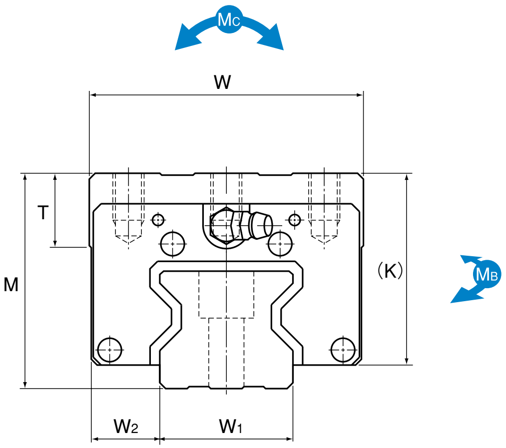
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-189) 6 Radial clearance symbol (see page a-35)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover
10 No. of rails used on the same plane

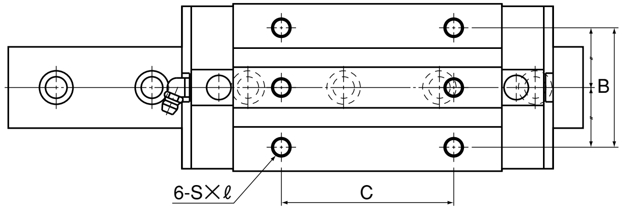
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

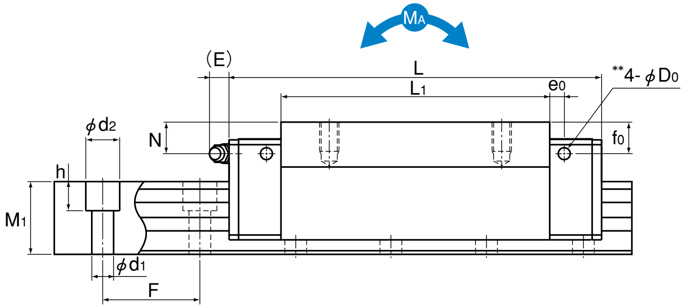
Standard Length and Maximum Length of the LM Rail P. a-195

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SRG-R | SRG-LR (LV)







Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease nipple	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	E	e0	f0	D0		W1 0 −0.05	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SRG 25R	40	48	95.5	35	35	M6×9	65.5	9.5	35.5	9.5	12	6	10.3	5.2	B-M6F	23	12.5	23	30	7×11×9	27.9	57.5	0.641	3.7	0.641	3.7	0.795	0.6	3.6
SRG 25LR			115		50		85.1														34.2	75	1.07	5.74	1.07	5.74	1.03	0.8	
SRG 30R	45	60	111	40	40	M8×10	75	12	40	9.5	12	6	8.8	5.2	B-M6F	28	16	26	40	9×14×12	39.3	82.5	1.02	6.21	1.02	6.21	1.47	0.9	4.4
SRG 30LR			135		60		99														48.3	108	1.76	9.73	1.76	9.73	1.92	1.2	
SRG 35R	55	70	125	50	50	M8×12	82.2	18.5	49	13.5	12	6	13	5.2	B-M6F	34	18	30	40	9×14×12	59.1	119	1.66	10.1	1.66	10.1	2.39	1.6	6.9
SRG 35LR			155		72		112.2														76	165	3.13	17	3.13	17	3.31	2.1	
SRG 45R	70	86	155	60	60	M10×20	107	24.5	62	20	16	7	17	5.2	B-PT1/8	45	20.5	37	52.5	14×20×17	91.9	192	3.49	20	3.49	20	4.98	3.2	11.6
SRG 45LR			190		80		142														115	256	6.13	32.2	6.13	32.2	6.64	4.1	
SRG 55R	80	100	185	75	75	M12×18	129.2	27.5	70	22	16	9	18.5	5.2	B-PT1/8	53	23.5	43	60	16×23×20	131	266	5.82	33	5.82	33	8.19	5	15.8
SRG 55LR			235		95		179.2														167	366	10.8	57	10.8	57	11.2	6.9	
SRG 65LV	90	126	303	76	120	M16×20	229.8	19.5	78.5	17	16	9	13.5	5.2	B-PT1/8	63	31.5	54	75	18×26×22	278	599	22.7	120	22.7	120	22.1	12.1	23.7

Note The greasing hole on the top face and the pilot hole of the side nipple** are not drilled through in order to prevent foreign matter from entering the block.
See pages a-192 and a-193 for details.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: tatic permissible moment value with 2 blocks closely contacting with each other

Model number coding SRG45 LR 2 QZ KKHH C0 +1200L P Z- II

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-189) 6 Radial clearance symbol (see page a-35)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover
10 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Standard Length and Maximum Length of the LM Rail P. a-195

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SRG with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
SRG 25C/R	95.5	95.5	100.5	100.5	105.5	—	—	—	—
SRG 25LC/LR	115	115	120.1	120.1	125.1	—	—	—	—
SRG 30C/R	111	111	118	116	123	—	—	—	—
SRG 30LC/LR	135	135	142	140	147	—	—	—	—
SRG 35C/R	125	125	132.8	131.4	139.2	148.6	156.4	151	158.8
SRG 35LC/LR	155	155	162.8	161.4	169.2	178.6	186.4	181	188.8
SRG 45C/R	155	155	164.2	162.2	171.4	182	191.2	185.2	194.4
SRG 45LC/LR	190	190	199.2	197.2	206.4	217	226.2	220.2	229.4
SRG 55C/R	185	185	194.2	192.2	201.4	212	221.2	215.2	224.4
SRG 55LC/LR	235	235	244.2	242.2	251.4	262	271.2	265.2	274.4
SRG 65LC/LV	303	303	314.2	311.4	322.6	335.4	346.6	338.6	349.8

Note: "—" indicates not available.

Overall LM Block Length (Dimension L) of Model SRG with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
SRG 35C/R	155	155	162.8	163.4	171.2	178.6	186.4	181	188.8
SRG 35LC/LR	185	185	192.8	193.4	201.2	208.6	216.4	211	218.8
SRG 45C/R	185	185	194.2	194.2	203.4	212	221.2	215.2	224.4
SRG 45LC/LR	220	220	229.2	229.2	238.4	247	256.2	250.2	259.4
SRG 55C/R	225	225	234.2	234.2	243.4	252	261.2	255.2	264.4
SRG 55LC/LR	275	275	284.2	284.2	293.4	302	311.2	305.2	314.4
SRG 65LC/LV	343	343	354.2	354.2	365.4	375.4	386.6	378.6	389.8

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 9

Table 9 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
SRG 35	9.1
SRG 45	14.3
SRG 55	18.2
SRG 65	26.0

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of the LM block, seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 7 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 7. Table 10 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model SRG

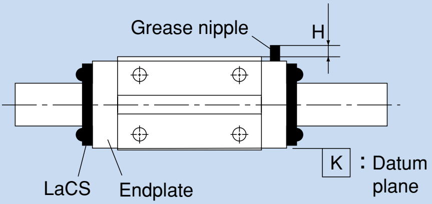


Fig. 7

Table 10

Unit: mm

Model No.	Incremental dimension with grease nipple H	Nipple type
SRG 25C/LC	—	A-M6F
SRG 25R/LR	7.2	A-M6F
SRG 30C/LC	—	A-M6F
SRG 30R/LR	7.2	A-M6F
SRG 35C/LC	—	A-M6F
SRG 35R/LR	7.2	A-M6F
SRG 45C/LC	—	A-M6F
SRG 45R/LR	7.2	A-M6F
SRG 55C/LC	—	A-M6F
SRG 55R/LR	7.2	A-M6F
SRG 65C/LC	—	A-M6F
SRG 65R/LR	6.2	A-M6F

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 7, contact THK.

For LM Guide Models with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding table of dimensions.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding

$$\underbrace{\text{SRG35}}_{1}\ \text{LR 2}\ \underbrace{\text{QZ}}_{2}\ \underbrace{\text{KKHH}}_{3}\ \text{C0 +1000L P - Ⅱ}$$

1 LM Guide model number
2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator, with grease nipple (see Fig. 7)
3 Dust prevention accessory symbol (see page a-189)

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and LaCS to be attached, contact THK.

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

●Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

●The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

●The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

●When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

●Dropping or hitting this product may damage it. Take much care when handling it.

●Do not clean it with an organic solvent or white kerosene.

●Do not leave it unpacked for a long period of time.

●Do not block the air vent with grease or the like.

Service temperature range

●Be sure the service temperature of this product is between -10℃ and +50℃. When using it beyond the service temperature range, contact THK .

Use in a special environment

●When using it in a special environment, contact THK .

Precaution on selection

●Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

●QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend taking an anti-corrosion measure.

Low Gravity Center, Ultra-high Rigidity Type Roller Guide Model SRN

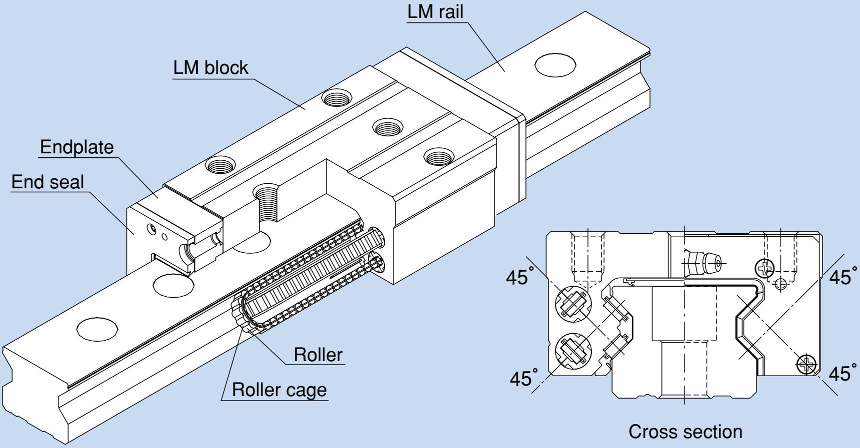


Fig. 1 Structure of Model SRN

Structure and Features

SRN is an ultra-high rigidity Roller Guide that uses roller cages to allow low-friction, smooth motion and achieve long-term maintenance-free operation.

●Thin, low gravity center

Since the overall height is lower than Caged Roller LM Guide model SRG, this model is optimal for compact design.

●Ultra-high rigidity

To achieve ultra-high rigidity, it uses rollers, which are less subject to elastic deformation, for the rolling elements, and optimizes the roller diameter and the roller length.
In addition, each row of rollers is arranged at a contact angle of 45° so that the guide receives an equal load rating in all four directions (radial, reverse-radial and lateral directions).

●Smooth motion through skewing prevention

The roller cage allows rollers to form an evenly spaced line while circulating, thus preventing the rollers from skewing as the block enters a loaded area. As a result, fluctuation of the rolling resistance is minimized, and stable, smooth motion is achieved.

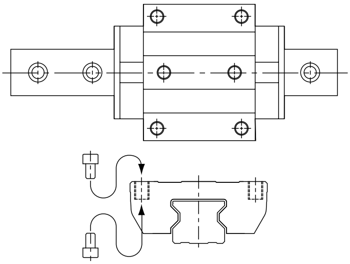
●Long-term maintenance-free operation

Use of roller cages eliminates friction between rollers and increases grease retention, enabling long-term maintenance-free operation to be achieved.

Types and Features

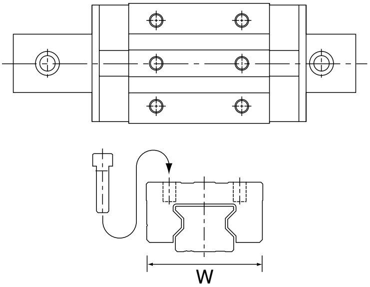
Model SRN-C

The flange of the LM block has tapped holes.
Can be mounted from the top or the bottom.
Used in places where the table cannot have through holes for mounting bolts.



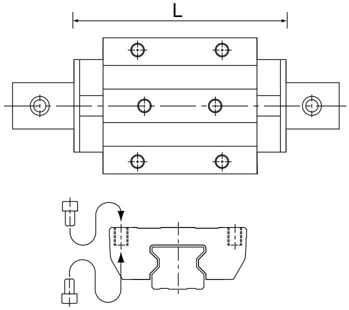
Model SRN-R

The LM block has a smaller width (W) and is equipped with tapped holes.
Suitable for places where space for the table width is limited.



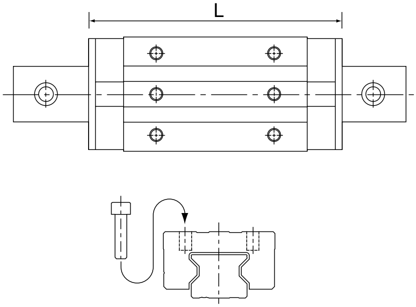
Model SRN-LC

The LM block has the same sectional shape as model SRN-C, but has a longer overall LM block length (L) and a greater rated load.



Model SRN-LR

The LM block has the same sectional shape as model SRN-R, but has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Model SRN is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for SRN.

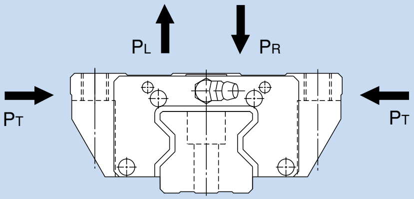


Fig. 2

Equivalent Load

When the LM block of model SRN receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SRN.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-218.

Table 1 Symbols of Dust Prevention Accessories for Model SRN

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals SRN···SS, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals SRN···SS

Unit: N

Model No.	Seal resistance value
SRN 35	30
SRN 45	30
SRN 55	35
SRN 65	40

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

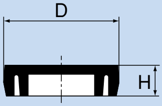
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

For the procedure for mounting the cap, see page a-22.

Table 3 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions (mm)	
			D	H
SRN 35	C 8	M 8	14.4	3.7
SRN 45	C12	M12	20.5	4.7
SRN 55	C14	M14	23.5	5.7
SRN 65	C16	M16	26.5	5.7



Dedicated Cap C

●Plate Cover

By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the plate cover drastically increases sealability of the end seal, thus to prevent the penetration of foreign matter or water from the top face of the LM rail.

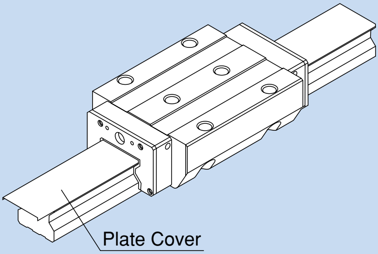


Fig. 3

Note 1: When mounting the plate cover, it is important to take into account the seal shape. Indicate that the plate cover is required when ordering the LM Guide.

Note 2: To mount the plate cover, it is necessary to remove the LM block from the LM rail using an LM block removing/mounting jig. Contact THK for details of the jig.

Note 3: If two or more rails are connected to exceed the maximum manufacturing length, it is necessary to also connect two or more plate covers. In such cases, the plate covers must closely contact with each other and there must be no level difference between the plate covers. Contact THK for details.

●Removing/mounting Jig

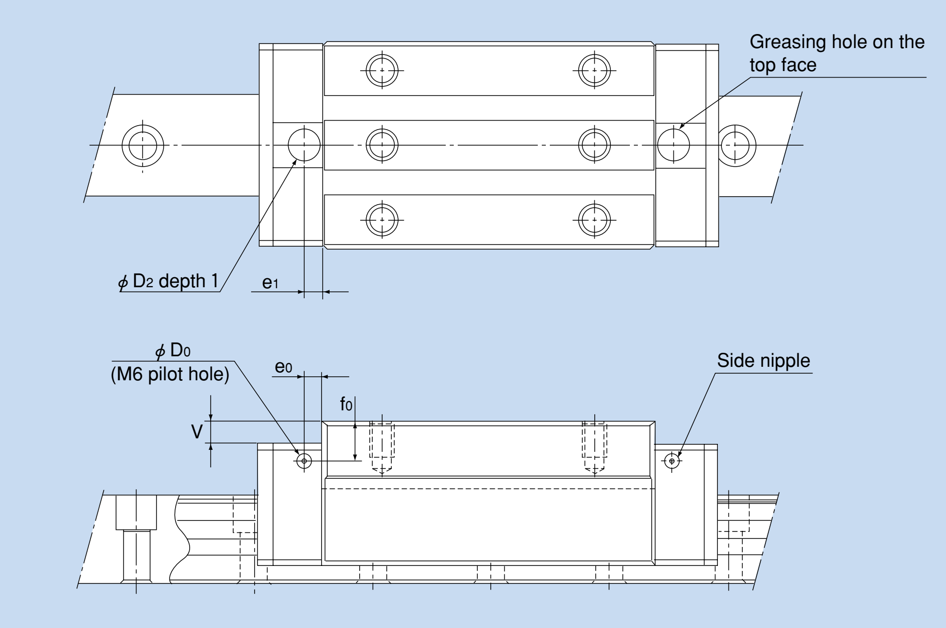
When assembling the guide, do not remove the LM block from the LM rail whenever possible. If it is inevitable to remove the LM block due to the plate cover type or the assembly procedure, be sure to use the removing/mounting jig.

Note: For details on the removing/mounting jig, contact THK.

Greasing Hole

Model SRN allows lubrication from both the side and top faces of the LM block. The greasing hole of standard types is not drilled through in order to prevent foreign matter from entering the LM block.

When using the greasing hole, contact THK.



Model No.	Pilot hole for side nipple			Applicable nipple	Greasing hole on the top face			
	e_0	f_0	D_0		D_2	(O ring)	V	e_1
SRN 35C SRN 35LC	8	6.5	5.2	M6F	10.2	(P7)	0.4	6
SRN 45C SRN 45LC	8.5	7	5.2	M6F	10.2	(P7)	0.4	7
SRN 55C SRN 55LC	10	8	5.2	M6F	10.2	(P7)	0.4	11
SRN 65LC	9	11	5.2	M6F	10.2	(P7)	0.4	10

Model No.	Pilot hole for side nipple			Applicable nipple	Greasing hole on the top face			
	e_0	f_0	D_0		D_2	(O ring)	V	e_1
SRN 35R SRN 35LR	8	6.5	5.2	M6F	10.2	(P7)	0.4	6
SRN 45R SRN 45LR	8.5	7	5.2	M6F	10.2	(P7)	0.4	7
SRN 55R SRN 55LR	10	8	5.2	M6F	10.2	(P7)	0.4	11
SRN 65LR	9	11	5.2	M6F	10.2	(P7)	0.4	10

●Greasing

The greasing interval is longer than that of full-roller types because of the roller cage effect. However, the actual greasing interval may vary depending on the service environment, such as a high load and high speed. Contact THK for details.

Error Allowance of the Mounting Surface

The following tables show error allowances of the mounting surface that will not affect the rolling resistance or service life in normal operation.

Table 4 Error Allowance in Parallelism (P) between Two Rails

Unit: mm

Radial clearance Model No.	Normal	C1	C0
SRN 35	0.014	0.010	0.007
SRN 45	0.017	0.013	0.009
SRN 55	0.021	0.014	0.011
SRN 65	0.027	0.018	0.014

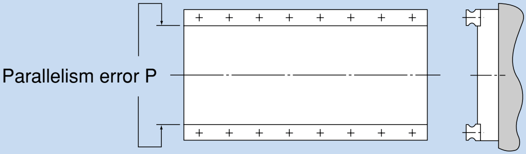


Fig. 4

Table 5 Error Allowance in Level (X) between the Rails

Unit: mm

Radial clearance	Normal	C1	C0
Error allowance (X) of the mounting surface	0.00030 a	0.00021 a	0.00011 a

$X = X_1 + X_2$

Example of calculation

Rail span when a = 500mm

Error allowance of the mounting surface

$X = 0.0003 \times 500$

$= 0.15$

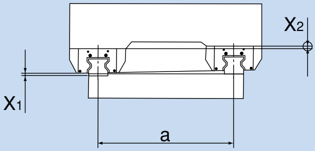


Fig. 5

X_1: Level difference on the rail mounting surface

X_2: Level difference on the block mounting surface

Table 6 Error Allowance in Level (Y) in the Axial Direction

Unit: mm

Error allowance of the mounting surface (mm)	0.000036 b

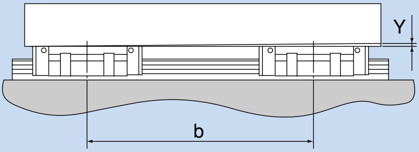


Fig. 6

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model SRN variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

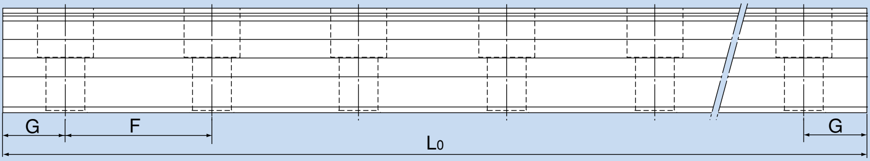


Table 7 Standard Length and Maximum Length of the LM Rail for Model SRN

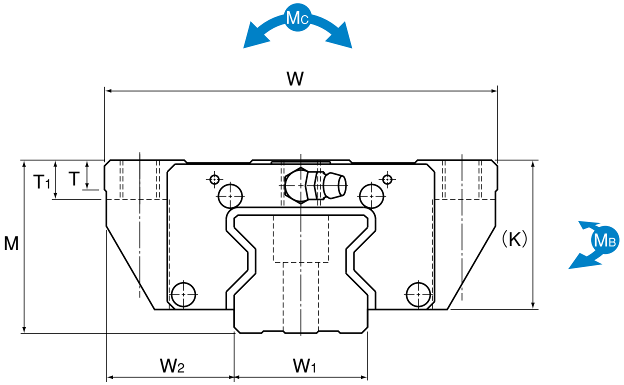
Unit: mm

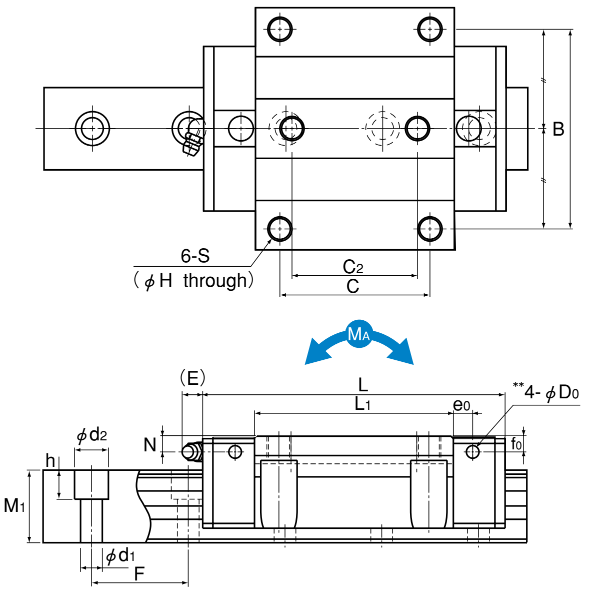
Model No.	SRN 35	SRN 45	SRN 55	SRN 65
Standard LM rail length (L_0)	280 360 440 520 600 680 760 840 920 1000 1080 1160 1240 1320 1400 1480 1560 1640 1720 1800 1880 1960 2040 2200 2360 2520 2680 2840 3000	570 675 780 885 990 1095 1200 1305 1410 1515 1620 1725 1830 1935 2040 2145 2250 2355 2460 2565 2670 2775 2880 2985 3090	780 900 1020 1140 1260 1380 1500 1620 1740 1860 1980 2100 2220 2340 2460 2580 2700 2820 2940 3060	1270 1570 2020 2620
Standard pitch F	40	52.5	60	75
G	20	22.5	30	35
Max length	3000	3090	3060	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models SRN-C | SRN-LC





Unit: mm

Model No.	External dimensions			LM block dimensions															LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length															Grease	Width		Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	C_2	S	H	L_1	T	T_1	K	N	E	e_0	f_0	D_0	nipple	W_1 $^{0}_{-0.05}$	W_2	M_1	F	d_1×d_2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SRN 35C	44	100	125	82	62	52	M10	8.5	82.2	7.5	10	38	6.5	12	8	6.5	5.2	B-M6F	34	33	30	40	9×14×12	59.1	119	1.66	10.1	1.66	10.1	2.39	1.6	6.9
SRN 35LC			155						112.2															76	165	3.13	17	3.13	17	3.31	2	
SRN 45C	52	120	155	100	80	60	M12	10.5	107	7.5	15	45	7	12	8.5	7	5.2	B-M6F	45	37.5	36	52.5	14×20×17	91.9	192	3.49	20	3.49	20	4.98	3	11.3
SRN 45LC			190						142															115	256	6.13	32.2	6.13	32.2	6.64	3.6	
SRN 55C	63	140	185	116	95	70	M14	12.5	129	10.5	18	53	8	16	10	8	5.2	PT1/8	53	43.5	43	60	16×23×20	131	266	5.82	33	5.82	33	8.19	4.9	15.8
SRN 55LC			235						179.2															167	366	10.8	57	10.8	57	11.2	6.4	
SRN 65LC	75	170	303	142	110	82	M16	14.5	229.8	19.5	20	65	14	16	9	11	5.2	PT1/8	63	53.5	49	75	18×26×22	278	599	22.7	120	22.7	120	22.1	12.7	21.3

Note The greasing hole on the top face and the pilot hole of the side nipple** are not drilled through in order to prevent foreign matter from entering the block.
See pages a-210 and a-211 for details.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

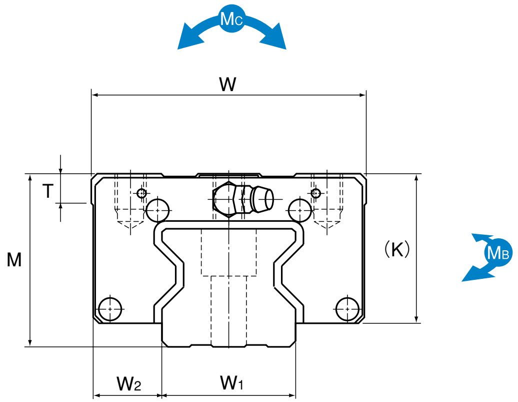
SRN45 C 2 KK C0 +1160L P Z- Ⅱ
1 2 3 4 5 6 7 8 9

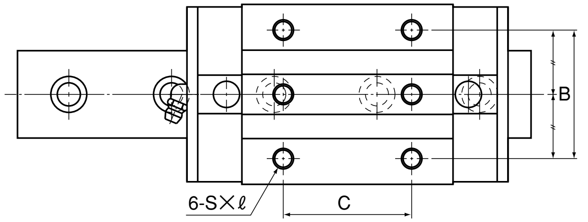
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-207) 5 Radial clearance symbol (see page a-35)
6 LM rail length (in mm) 7 Accuracy symbol (see page a-38) 8 With plate cover
9 No. of rails used on the same plane

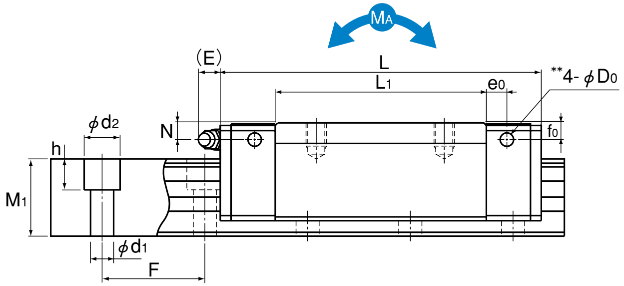
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-213

Models SRN-R | SRN-LR







Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease nipple	Width W1 0 −0.05	W2	Height M1	Pitch F	d1×d2×h	C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	E	e0	f0	D0							kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SRN 35R	44	70	125	50	50	M8×9	82.2	7.5	38	6.5	12	8	6.5	5.2	B-M6F	34	18	30	40	9×14×12	59.1	119	1.66	10.1	1.66	10.1	2.39	1.1	6.9
SRN 35LR			155		72		112.2														76	165	3.13	17	3.13	17	3.31	1.4	
SRN 45R	52	86	155	60	60	M10×11	107	7.5	45	7	12	8.5	7	5.2	B-M6F	45	20.5	36	52.5	14×20×17	91.9	192	3.49	20	3.49	20	4.98	1.9	11.3
SRN 45LR			190		80		142														115	256	6.13	32.2	6.13	32.2	6.64	2.5	
SRN 55R	63	100	185	75	75	M12×13	129	10.5	53	8	16	10	8	5.2	PT1/8	53	23.5	43	60	16×23×20	131	266	5.82	33	5.82	33	8.19	3.2	15.8
SRN 55LR			235		95		179.2														167	366	10.8	57	10.8	57	11.2	4.5	
SRN 65LR	75	126	303	76	120	M16×16	229.8	19.5	65	14	16	9	11	5.2	PT1/8	63	31.5	49	75	18×26×22	278	599	22.7	120	22.7	120	22.1	9.4	21.3

Note The greasing hole on the top face and the pilot hole of the side nipple** are not drilled through in order to prevent foreign matter from entering the block.
See pages a-210 and a-211 for details.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SRN45 LR 2 KK C0 +1200L P Z- II
1 2 3 4 5 6 7 8 9

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-207) 5 Radial clearance symbol (see page a-35)
6 LM rail length (in mm) 7 Accuracy symbol (see page a-38) 8 With plate cover
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-213

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model SRN with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK
SRN 35C/R	125	125	132.8	131.4	139.2
SRN 35LC/LR	155	155	162.8	161.4	169.2
SRN 45C/R	155	155	164.2	162.2	171.4
SRN 45LC/LR	190	190	199.2	197.2	206.4
SRN 55C/R	185	185	194.2	192.2	201.4
SRN 55LC/LR	235	235	244.2	242.2	251.4
SRN 65LC/LV	303	303	314.2	311.4	322.6

Radial Type LM Guide Model SR

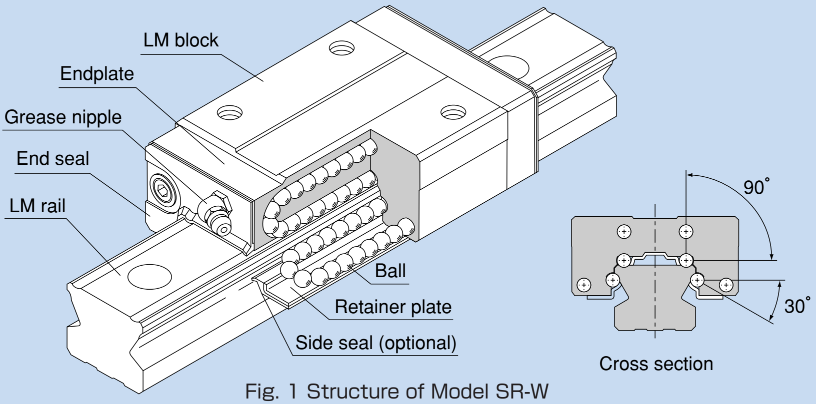


Fig. 1 Structure of Model SR-W

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since a retainer plate holds the balls, they will not fall off even if the LM block is removed from the LM rail. With the low sectional height and the high rigidity design of the LM block, this model achieves highly accurate and stable linear motion.

●Compact, heavy load

Since it is a compactly designed model that has a low sectional height and a ball contact structure rigid in the radial direction, this model is optimal for horizontal guide units.

●Mounting accuracy can easily be achieved

Since this model is a self-adjusting type capable of easily absorbing an accuracy error in parallelism and level between two rails, highly accurate and smooth motion can be achieved.

●Low noise

The guide-way of the endplate installed at each end of the LM block is designed to ensure the smooth and low-noise circulation of the rows of balls at the turning areas.

●High durability

Even under a preload or biased load, differential slip of balls is minimal. As a result, high wear resistance and long-term maintenance of accuracy are achieved.

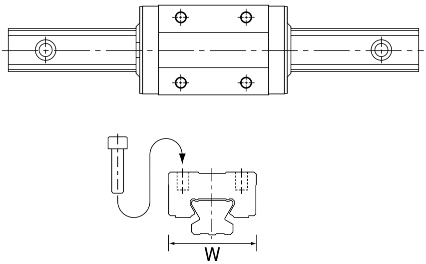
●Stainless steel type also available

A special type whose LM block, LM rail and balls are made of stainless steel is also available.

Types and Features

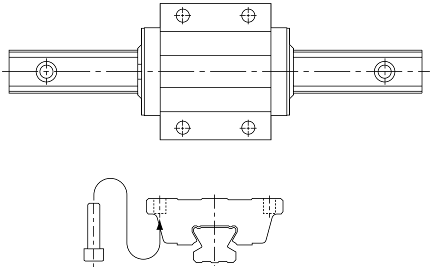
Model SR-W

The LM block has a smaller width (W) and is equipped with tapped holes.



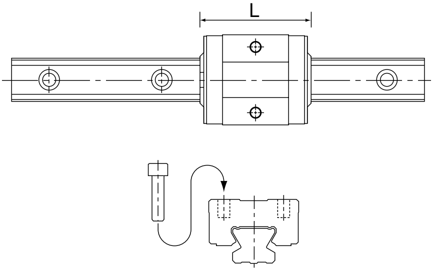
Model SR-TB

The LM block has the same height as model SR-W and can be mounted from the bottom.



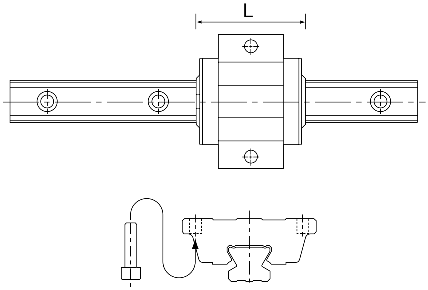
Model SR-V

A space-saving type whose LM block has the same sectional shape as model SR-W, but has a smaller overall LM block length (L).



Model SR-SB

A space-saving type whose LM block has the same sectional shape as model SR-TB, but has a smaller overall LM block length (L).



Characteristics of Model SR

When compared with models having a contact angle of 45°, model SR shows excellent characteristics as indicated below. Using these characteristics, you can design and manufacture highly accurate and highly rigid machines or equipment.

Difference in Rated Load and Service Life

Since SR has a contact angle of 90°, its rated load and service life are different from those with a contact angle of 45°. When comparing model SR with a model that has a contact angle of 45° and when the same radial load is applied to the two models with the same ball diameter as shown in the figure below, the load applied to SR is 70% of the other model. As a result, the service life of SR is more than twice that of the other model.

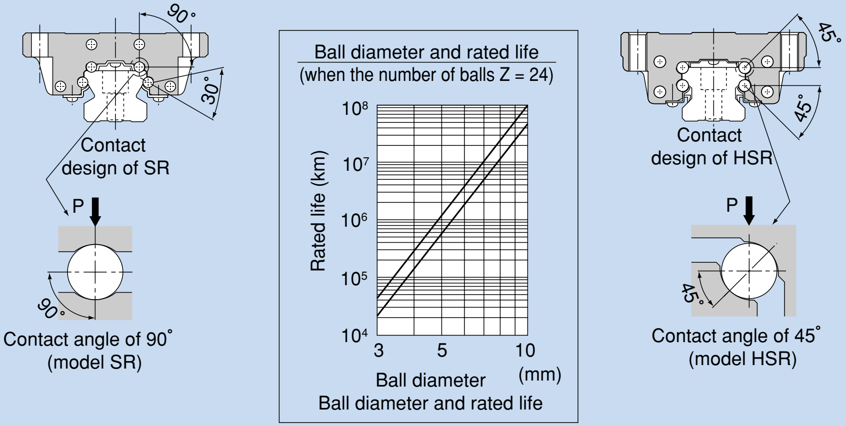


Fig. 2

Difference in Accuracy

If a machining error (grinding error) occurs in the LM rail or LM block, it will affect the running accuracy. Assuming that there is a machining error of Δ on the raceway, it results in an error in the radial direction, and the error with the contact angle of 45° (model HSR) is 1.4 times greater than that of the contact angle of 90° (model SR). As for the machining error resulting in an error the horizontal direction, the error with the contact angle of 45° is 1.22 times greater than the contact angle of 30°.

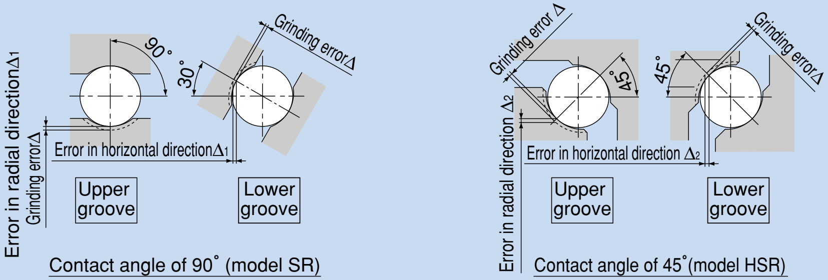


Fig. 3 Machining Error and Accuracy

Difference in Rigidity

The 90° contact angle adopted by model SR has a difference with the 45° contact angle also in rigidity.
When the same radial load "P" is applied, the displacement in the radial direction with model SR is only 56% of that with the contact angle of 45°. The figure below shows the difference in radial load and displacement. Accordingly, where high rigidity in the radial direction is required, model SR is more advantageous.

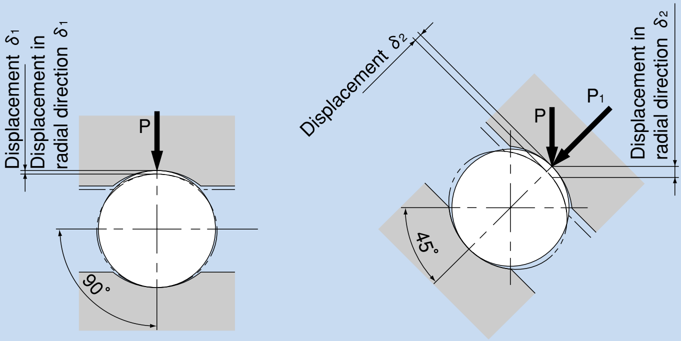


Fig. 4 Displacement under a Radial Load

Load and displacement when contact angles are not the same (Da=6.35mm)

(displacement per ball)

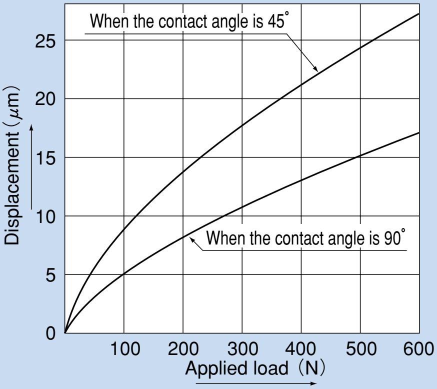


Fig. 5 Radial Load and Displacement

Conclusion

As suggested above, model SR, which has a contact angle of 90° in the radial direction, is optimal for locations where the radial load is large, high rigidity is required or high running accuracy in the vertical and horizontal directions is required.
However, if the reverse-radial load, the lateral load or the moment is large, we recommend model HSR, which has a contact angle of 45° (4-way equal load).

Rated Loads in All Directions

Model SR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings indicate the values in the radial directions in Fig. 6, and their actual values are provided in the dimensional table for SR. The values in the reverse-radial and lateral directions are obtained from table 1.

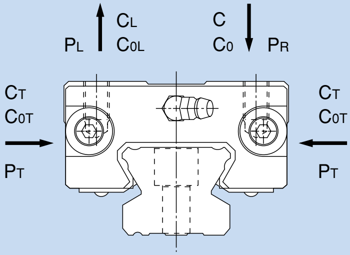


Fig. 6

Table 1 Rated Loads in All Directions with Model SR

Model No.	Direction	Basic dynamic load rating	Basic static load rating
SR 15 to 70	Radial direction	C	C_0
	Reverse-radial direction	$C_L=0.62C$	$C_{0L}=0.50C_0$
	Lateral direction	$C_T=0.56C$	$C_{0T}=0.43C_0$
SR 85 to 150	Radial direction	C	C_0
	Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.71C_0$
	Lateral direction	$C_T=0.48C$	$C_{0T}=0.35C_0$

Equivalent Load

When the LM block of model SR receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
・Reverse-radial direction
・Lateral direction
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model SR

Model No.	P_E	X	Y
SR 15 to 70	Equivalent load in reverse-radial direction	1	1.155
	Equivalent load in lateral direction	0.866	1
SR 85 to 150	Equivalent load in reverse-radial direction	1	2
	Equivalent load in lateral direction	0.5	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-236.

Table 3 Symbols of Dust Prevention Accessories for Model SR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper
LL	With low-resistance end seal
RR	With LL seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals SR … UU, refer to the corresponding value provided in table 4.

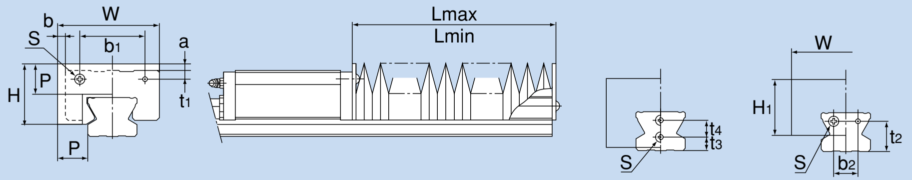
Table 4 Maximum Seal Resistance Value of Seals SR … UU

Unit: N

Model No.	Seal resistance value
SR 15	2.5
SR 20	3.4
SR 25	4.4
SR 30	8.8
SR 35	11.8
SR 45	12.7
SR 55	15.7
SR 70	19.6

●Dedicated Bellows JS for Model SR

The table below shows the dimensions of dedicated bellows JS for model SR. Specify the corresponding model number of the desired bellows from the table.



Models SR15 to 25 Models SR30 to 70

Unit: mm

Model No.	Major dimensions														A	Supported model
											Mounting bolt		b			
	W	H	H_1	P	b_1	t_1	b_2	t_2	t_3	t_4	S	a	Type W/V	Type TB/SB	$\left(\frac{L_{max}}{L_{min}}\right)$	
JS 15	51	24	26	15	22	3.4	—	—	8	—	M3×6 ℓ	5	8.5	− 0.5	5	SR 15
JS 20	58	26	30	15	25	4.2	—	—	6	6	M3×6 ℓ	4	8	− 0.5	5	SR 20
JS 25	71	33	38	20	29	5	—	—	6	7	M3×6 ℓ	7	11.5	− 1	7	SR 25
JS 30	76	37.5	37.5	20	42	5	12	17	—	—	M4×8 ℓ	3	8	− 7	7	SR 30
JS 35	84	39	39	20	44	6.5	14	20	—	—	M5×10 ℓ	1.5	7	− 8	7	SR 35
JS 45	95	47.5	47.5	20	60	8	22	27	—	—	M5×10 ℓ	−1.5	5	−12.5	7	SR 45
JS 55	108	55.5	55.5	25	70	10	24	28	—	—	M6×12 ℓ	−0.5	4	−16	9	SR 55
JS 70	144	67	67	30	90	13	34	35	—	—	M6×12 ℓ	−3	9	—	10	SR 70

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK .

Note 2: For lubrication when using the dedicated bellows, contact THK .

Note 3: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding **JS55-60/540**

$\underbrace{\text{JS55}}_{1}\text{-}\underbrace{\text{60/540}}_{2}$

1 Model number ··· bellows for SR55

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$L_{min} = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$L_{max} = L_{min} \cdot A$$ A: Extension rate

●Dedicated Bellows DS for Model SR

For models SR15, 20 and 25, bellows DS, which has the following features, is also available other than the dedicated bellows JS. When desiring bellows DS, specify the corresponding model number from the table below.

Features

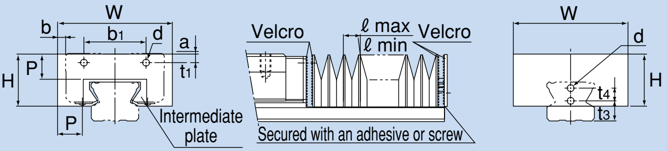
① Has a width and height smaller than the conventional product so that any part of the bellows does not stick out of the top face of the LM block. The extension rate is equal to or greater than that of the conventional type.

② Has an intermediate plate for each crest so that it will not easily lift and the bellows can be used with vertical mount, wall mount and slant mount.

③ Operable at high speed, at up to 120 m/min.

④ Since a Velcro tape can be used to install the bellows, a regular-size model can be cut to the desired length, or two or more regular-size bellows can be taped together.

⑤ Can be installed using screws just as the conventional type.
In this case, a plate (thickness: 1.6 mm) must be placed between the bellows and the LM bock. Contact THK for details.



Unit: mm

Model No.	Major dimensions																Supported model
										b				Extension rate		Factor	
	W	H	P	b_1	t_1	t_3	t_4	d	a	Type W/V	Type TB/SB	ℓ max	ℓ min	A	E	k	
DS 15	38	19	10	22	3.4	8	—	3.5	0	7	2	13	2.5	5	2	1.3	SR 15
DS 20	49	22	10	25	4.2	6	6	4	0	5	3.5	13	2.5	5	2	1.3	SR 20
DS 25	56	26	12	29	5	6	7	4	0	8.5	4	15	3	5	2	1.3	SR 25

Note 1: For lubrication when using the dedicated bellows, contact THK.

Note 2: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding DS20-50/250

$$\underbrace{\text{DS20}}_{1}-\underbrace{50/250}_{2}$$

1 Model number ··· bellows for SR20

2 Bellows dimensions (length when compressed / length when extended)

Note: The maximum length of the bellows itself is calculated as follows.
Lmax (Lmin) = ℓ max (ℓ mim) ×200
Example of calculating bellows dimensions:
When the stroke of model SR20 is: ℓ s = 530 mm

$$\text{Lmin} = \frac{\ell\text{s}}{(\text{A}-1)} = \frac{530}{4} = 132.5 \fallingdotseq 135$$

$$\text{Lmax} = \text{A}\cdot\text{Lmin} = 5\times135 = 675$$

Number of required crests n

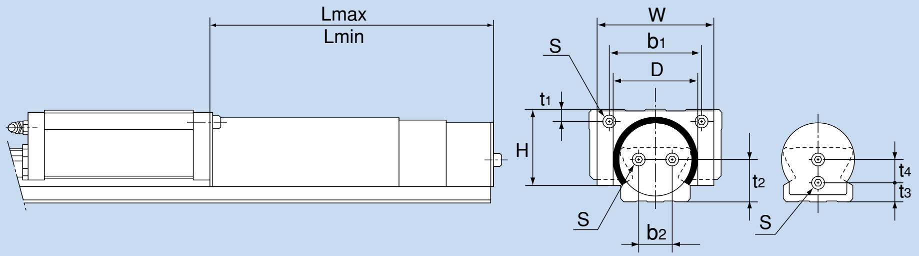
$$\text{n} = \frac{\text{Lmax}}{\text{P}\cdot\text{k}} = \frac{675}{10\times1.3} = 51.9 \fallingdotseq 52 \text{ crests}$$

$$\text{Lmin} = \text{n}\cdot\ell\text{min}+\text{E} = 52\times2.5+2 = 132$$

(E indicates the plate thickness of 2)
Therefore, the model number of the required bellows is DH20-132/675.

●Dedicated LM Cover TPS for Model SR

The tables below show the dimensions of dedicated LM cover TPS for model SR. Specify the corresponding model number of the desired bellows from the table.



Models SR30 to 55 Model SR25

Unit: mm

Model No.	Major dimensions									Mounting bolt S	Supported model
	W	D (max)	H	b_1	t_1	b_2	t_2	t_3	t_4		
TPS 25	42	30	26.5	29	5	—	—	6	7	M3×6 ℓ	SR 25
TPS 30	54	37	34.5	42	5	12	17	—	—	M4×8 ℓ	SR 30
TPS 35	64	42	38	44	6.5	14	20	—	—	M5×10 ℓ	SR 35
TPS 45	76	55	48	60	8	22	27	—	—	M5×10 ℓ	SR 45
TPS 55	90	61	54.5	70	10	24	28	—	—	M6×12 ℓ	SR 55

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TPS 25	3	200	530	330
	3	150	380	230
	3	100	230	130
TPS 30	3	250	680	430
	3	200	530	330
	3	150	380	230
TPS 35	3	300	830	530
	3	250	680	430
	3	200	530	330
	3	150	380	230

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TPS 45	3	350	980	630
	3	300	830	530
	3	250	680	430
	3	200	530	330
TPS 55	4	400	1460	1060
	4	350	1330	980
	4	300	1060	760
	4	250	860	610

Note 1: For lubrication when using the dedicated LM cover, contact THK.

Note 2: When using the dedicated LM cover, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding **TPS55-400/1460**

1 2 3

1 Model number … LM cover for SR55
2 Lmin(cover length when contracted)
3 Lmax(cover length when extended)

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

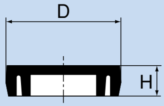
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

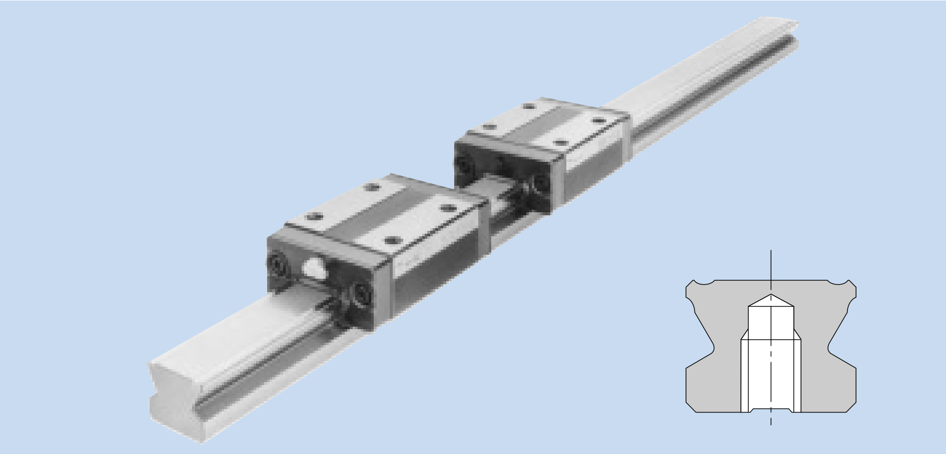
Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
SR 15	C 3	M 3	6.3	1.2
SR 20	C 5	M 5	9.8	2.4
SR 25	C 6	M 6	11.4	2.7
SR 30	C 6	M 6	11.4	2.7
SR 35	C 8	M 8	14.4	3.7
SR 45	C10	M10	18.0	3.7
SR 55	C12	M12	20.5	4.7
SR 70	C16	M16	26.5	5.7
SR 85	C16	M16	26.5	5.7

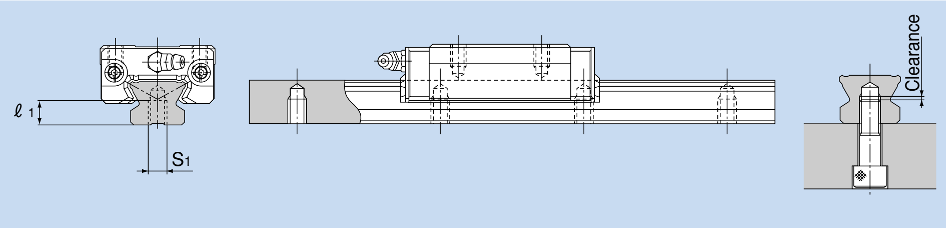


Dedicated Cap C

Tapped LM Rail Type of Model SR

The model SR variations include a type with its LM rail bottom tapped. This type is useful when desiring to mount the LM Guide from the bottom of the base and when desiring to increase the dust prevention effect.





① A tapped LM rail type is available only for high-accuracy or lower grades.

② Determine the bolt length so that a clearance of 2 to 5 mm is secured between the bolt end and the bottom of the tap (effective tap depth) (see figure above).

③ For standard pitches of the taps, see table 7 on page a-231.

Table 6 Dimensions of the LM Rail Tap

Unit: mm

Model No.	S_1	Effective tap depth ℓ_1
SR 15	M5	7
SR 20	M6	9
SR 25	M6	10
SR 30	M8	14
SR 35	M8	16
SR 45	M12	20
SR 55	M14	22

Model number coding SR30 W2UU+1000LH K

1

1 Symbol for tapped LM rail type

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model SR variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.
For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

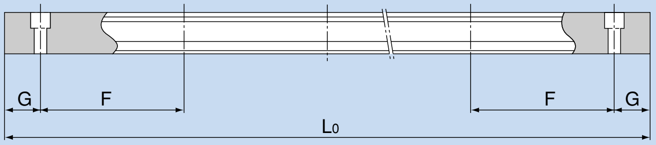


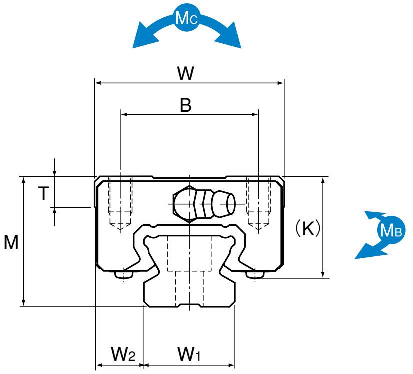
Table 7 Standard Length and Maximum Length of the LM Rail for Model SR

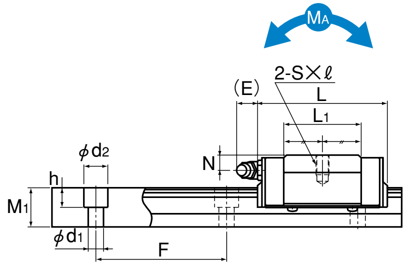
Unit: mm

Model No.	SR 15	SR 20	SR 25	SR 30	SR 35	SR 45	SR 55	SR 70
Standard LM rail length (L_0)	160	220	220	280	280	570	780	1270
	220	280	280	360	360	675	900	1570
	280	340	340	440	440	780	1020	2020
	340	400	400	520	520	885	1140	
	400	460	460	600	600	990	1260	
	460	520	520	680	680	1095	1380	
	520	580	580	760	760	1200	1500	
	580	640	640	840	840	1305	1740	
	640	700	700	920	920	1410	1860	
	700	760	760	1000	1000	1515	1980	
	760	820	820	1080	1080	1725	2100	
	820	940	940	1160	1160	1830	2220	
	940	1000	1000	1240	1240	1935	2340	
	1000	1060	1060	1320	1320	2040	2460	
	1060	1120	1120	1400	1400	2145	2580	
	1120	1180	1240	1480	1480	2250	2700	
	1180	1240	1300	1640	1640	2355	2820	
	1240	1300	1360	1720	1720	2460	2940	
	1300	1360	1420	1800	1800	2565		
	1360	1420	1480	1880	1880	2670		
	1420	1480	1540	1960	1960	2775		
	1480	1540	1600	2040	2040	2880		
	1540	1600	1660	2120	2120	2985		
		1660	1720	2200	2200			
		1720	1780	2280	2280			
		1780	1840	2360	2360			
		1840	1900	2440	2440			
		1900	1960	2520	2520			
		1960	2020	2600	2600			
		2020	2080	2680	2680			
		2080	2140	2760	2760			
		2140	2200	2840	2840			
			2260	2920	2920			
			2320					
			2380					
			2440					
Standard pitch F	60	60	60	80	80	105	120	150
G	20	20	20	20	20	22.5	30	35
Max length	2500 (1240)	3000 (1480)	3000 (2020)	3000 (2520)	3000 (2520)	3000	3000	3000

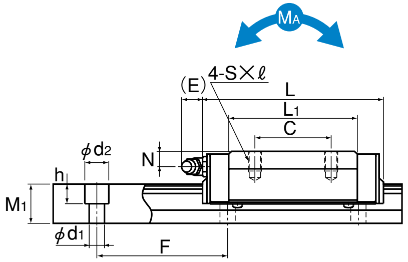
Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.
Note 3: Those model numbers including and greater than SR85T are semi-standard models. If desiring these models, contact THK.
Note 4: The figures in the parentheses indicate the maximum lengths of stainless steel made models.

Models SR-W | SR-WM, Models SR-V | SR-VM





Model SR-V



Model SR-W

Unit: mm

Model No.	External dimensions			LM block dimensions									LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S× ℓ	L_1	T	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SR 15W/WM SR 15V/VM	24	34	57 40.4	26	26 —	M4×7	39.5 22.9	5.7	19.5	6	5.5	PB1021B	15	9.5	12.5	60	3.5×6×4.5	9.51 5.39	19.3 11.1	0.0925 0.0326	0.516 0.224	0.0567 0.0203	0.321 0.143	0.113 0.0654	0.2 0.12	1.2
SR 20W/WM SR 20V/VM	28	42	66.2 47.3	32	32 —	M5×8	46.7 27.8	7.2	22	6	12	B-M6F	20	11	15.5	60	6×9.5×8.5	12.5 7.16	25.2 14.4	0.146 0.053	0.778 0.332	0.0896 0.0329	0.481 0.21	0.194 0.11	0.3 0.2	2.1
SR 25WY/WMY SR 25VY/VMY	33	48	83 59.2	35	35 —	M6×9	59 35.2	7.7	26	7	12	B-M6F	23	12.5	18	60	7×11×9	20.3 11.7	39.5 22.5	0.286 0.103	1.52 0.649	0.175 0.0642	0.942 0.41	0.355 0.201	0.4 0.3	2.7
SR 30W/WM SR 30V/VM	42	60	96.8 67.9	40	40 —	M8×12	69.3 40.4	8.5	32.5	8	12	B-M6F	28	16	23	80	7×11×9	30 17.2	56.8 32.5	0.494 0.163	2.55 1.08	0.303 0.102	1.57 0.692	0.611 0.352	0.8 0.5	4.3
SR 35W/WM SR 35V/VM	48	70	111 77.6	50	50 —	M8×12	79 45.7	12.5	36.5	8.5	12	B-M6F	34	18	27.5	80	9×14×12	41.7 23.8	77.2 44.1	0.74 0.259	4.01 1.68	0.454 0.161	2.49 1.07	1.01 0.576	1.2 0.8	6.4
SR 45W	60	86	126	60	60	M10×15	90.5	15	47.5	11.5	16	B-PT1/8	45	20.5	35.5	105	11×17.5×14	55.3	101	1.1	5.96	0.679	3.69	1.77	2.2	11.3
SR 55W	68	100	156	75	75	M12×20	117	16.7	54.5	12	16	B-PT1/8	48	26	38	120	14×20×17	89.1	157	2.27	11.3	1.39	6.98	2.87	3.6	12.8
SR 70T	85	126	194.6	90	90	M16×25	147.6	24.5	70	12	16	B-PT1/8	70	28	47	150	18×26×22	156	266	2.54	13.2	2.18	11.3	4.14	7	22.8
SR 85T	110	156	180	100	80	M18×30	130	25.5	91.5	27	12	A-PT1/8	85	35.5	65.5	180	18×26×22	120	224	2.54	15.1	1.25	7.47	5.74	10.1	34.9
SR 100T	120	178	200	120	100	M20×35	150	29.5	101	32	12	A-PT1/8	100	39	70.3	210	22×32×25	148	283	3.95	20.9	1.95	10.3	8.55	14.1	46.4
SR 120T	110	205	235	160	120	M20×35	180	24	95	14	13.5	B-PT1/4	114	45.5	65	230	26×39×30	279	377	5.83	32.9	2.87	16.2	13.7	—	—
SR 150T	135	250	280	200	160	M20×35	215	24	113	17	13.5	B-PT1/4	144	53	77	250	33×48×36	411	537	9.98	55.8	4.92	27.5	24.3	—	—

Model number coding

SR25	W	2	UU	C0	M	+1240L	Y	P	M-	II
1	2	3	4	5	6	7	8	9	10	11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-225) 5 Radial clearance symbol (see page a-33)
6 LM block is made of stainless steel 7 LM rail length (in mm) 8 Applicable only to 25
9 Accuracy symbol (see page a-38) 10 LM rail is made of stainless steel 11 No. of rails used on the same plane

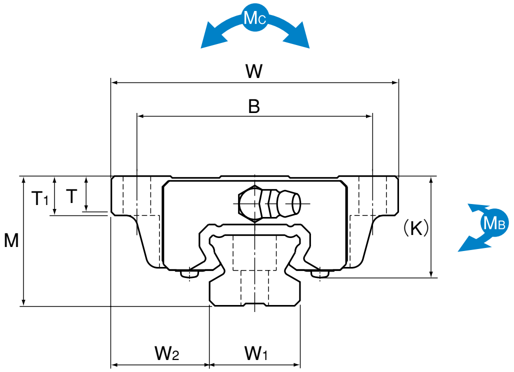
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

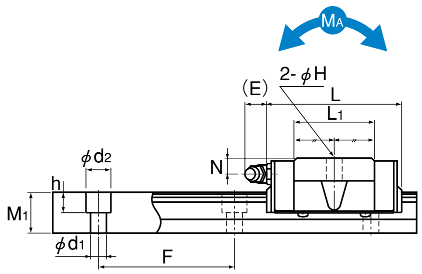
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.
Those model numbers including and greater than SR85T are semi-standard models. If desiring these models, contact THK.
Models SR85T and SR100T are equipped with grease nipple on the side face of the LM block.

Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

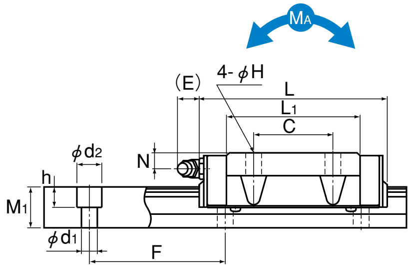
Standard Length and Maximum Length of the LM Rail P. a-231

Models SR-TB | SR-TBM, Models SR-SB | SR-SBM





Model SR-SB



Model SR-TB

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	H	L_1	T	T_1	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SR 15TB/TBM SR 15SB/SBM	24	52	57 40.4	41	26 —	4.5	39.5 22.9	6.1	7	19.5	6	5.5	PB1021B	15	18.5	12.5	60	3.5×6×4.5	9.51 5.39	19.3 11.1	0.0925 0.0326	0.516 0.224	0.0567 0.0203	0.321 0.143	0.113 0.0654	0.2 0.15	1.2
SR 20TB/TBM SR 20SB/SBM	28	59	66.2 47.3	49	32 —	5.5	46.7 27.8	8	9	22	6	12	B-M6F	20	19.5	15.5	60	6×9.5×8.5	12.5 7.16	25.2 14.4	0.146 0.053	0.778 0.332	0.0896 0.0329	0.481 0.21	0.194 0.11	0.4 0.3	2.1
SR 25TBY/TBMY SR 25SBY/SBMY	33	73	83 59.2	60	35 —	7	59 35.2	9.1	10	26	7	12	B-M6F	23	25	18	60	7×11×9	20.3 11.7	39.5 22.5	0.286 0.103	1.52 0.649	0.175 0.0642	0.942 0.41	0.355 0.201	0.6 0.4	2.7
SR 30TB/TBM SR 30SB/SBM	42	90	96.8 67.9	72	40 —	9	69.3 40.4	8.7	10	32.5	8	12	B-M6F	28	31	23	80	7×11×9	30 17.2	56.8 32.5	0.494 0.163	2.55 1.08	0.303 0.102	1.57 0.692	0.611 0.352	1.1 0.8	4.3
SR 35TB/TBM SR 35SB/SBM	48	100	111 77.6	82	50 —	9	79 45.7	11.2	13	36.5	8.5	12	B-M6F	34	33	27.5	80	9×14×12	41.7 23.8	77.2 44.1	0.74 0.259	4.01 1.68	0.454 0.161	2.49 1.07	1.01 0.576	1.5 1	6.4
SR 45TB	60	120	126	100	60	11	90.5	12.8	15	47.5	11.5	16	B-PT1/8	45	37.5	35.5	105	11×17.5×14	55.3	101	1.1	5.96	0.679	3.69	1.77	2.5	11.3
SR 55TB	68	140	156	116	75	14	117	15.3	17	54.5	12	16	B-PT1/8	48	46	38	120	14×20×17	89.1	157	2.27	11.3	1.39	6.98	2.87	4.2	12.8

Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Note Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SR30 TB 2 UU C1 +1200L H - Ⅱ
1 2 3 4 5 6 7 8

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-225) 5 Radial clearance symbol (see page a-33)
6 LM rail length (in mm) 7 Accuracy symbol (see page a-38) 8 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-231

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model SR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	LL	RR
SR 15W/TB	57	57	62.2	58.4*	63.6*	57	57
SR 15V/SB	40.4	40.4	45.6	41.8*	47 *	40.4	40.4
SR 20W/TB	66.2	66.2	72.8	70.6*	77.2*	66.2	66.2
SR 20V/SB	47.3	47.3	53.9	51.7*	58.3*	47.3	47.3
SR 25WY/TBY	83	83	90.6	87.4	95	83	83
SR 25VY/SBY	59.2	59.2	66.8	63.6	71.2	59.2	59.2
SR 30W/TB	96.8	96.8	104.4	99.4	107	—	—
SR 30V/SB	67.9	67.9	75.5	70.5	78.1	—	—
SR 35W/TB	111	111	118.6	113.6	121.2	—	—
SR 35V/SB	77.6	77.6	85.2	80.2	87.8	—	—
SR 45W/TB	126	126	134.6	129.4	138	—	—
SR 55W/TB	156	156	164.6	159.4	168	—	—
SR 70T	194.6	194.6	201.8	200.8	208	—	—
SR 85T	180	180	—	—	—	—	—
SR 100T	200	200	—	—	—	—	—
SR 120T	235	235	—	—	—	—	—
SR 150T	280	280	—	—	—	—	—

Note: "—" indicates not available.
"*"indicates available, but not support a grease nipple. Contact THK for details.

Grease Nipple

For LM Guide Models with Dust Prevention Accessories UU, SS, LL or RR

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories UU, SS, LL or RR are attached, see the corresponding dimension table.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories DD, ZZ or KK are attached, contact THK.

High Temperature Type LM Guide Model SR-M1

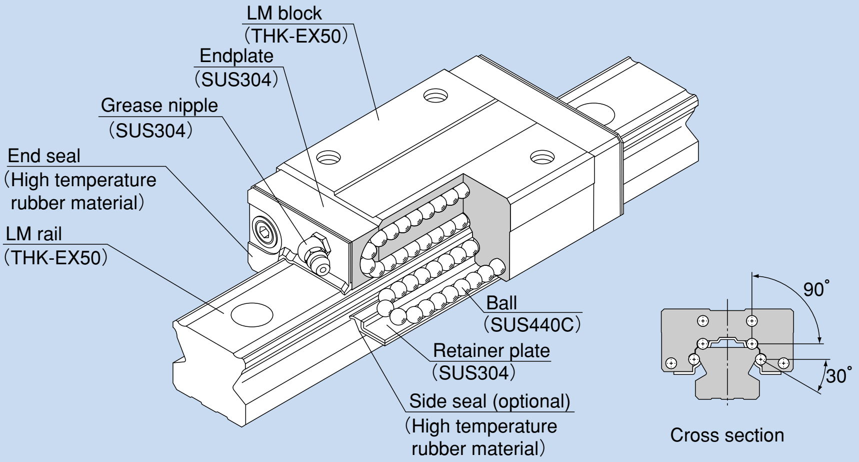


Fig. 1 Structure of Model SR-M1W

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.

Since it is a compactly designed model that has a low sectional height and a ball contact structure rigid in the radial direction, this model is optimal for horizontal guide units.

High temperature type LM Guide model SR-M1 is capable of being used at service temperature up to 150℃ thanks to THK 's unique technologies in material, heat treatment and lubrication.

●Maximum service temperature of 150°C

Use of stainless steel in the endplates and high-temperature rubber in the end seals achieves the maximum service temperature of 150°C.

●Dimensional stability

Since it is dimensionally stabilized, it demonstrates superb dimensional stability after being heated or cooled (note that it shows linear expansion at high temperature).

●Corrosion resistance

Since its LM block, LM rail and balls are made of stainless steel, this model is highly resistant to corrosion.

●High temperature grease

This model uses high temperature grease that shows little grease-based fluctuation in rolling resistance even if temperature changes from low to high levels.

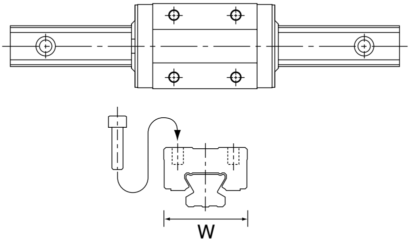
Thermal Characteristics of LM Rail and LM Block Materials

●Specific heat capacity : 0.481J/(g·K)
●Thermal conductivity : 20.67W/(m·K)
●Average coefficient of linear expansion : 11.8×10^{-6}/℃

Types and Features

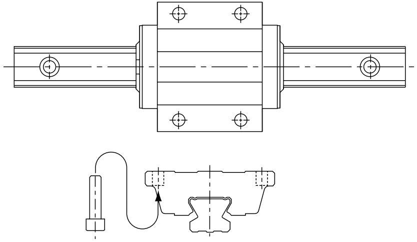
Model SR-M1W

The LM block has a smaller width (W) and is equipped with tapped holes.



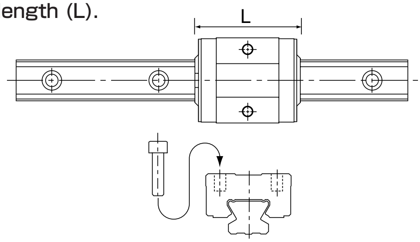
Model SR-M1TB

The LM block has the same height as model SR-M1W and can be mounted from the bottom.



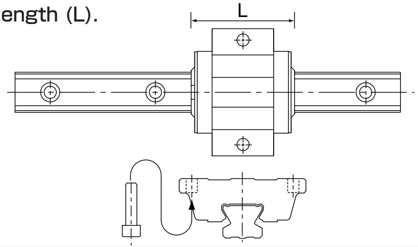
Model SR-M1V

A space-saving type whose LM block has the same sectional shape as model SR-M1W, but has a smaller overall LM block length (L).



Model SR- M1SB

A space-saving type whose LM block has the same sectional shape as model SR-M1TB, but has a smaller overall LM block length (L).



Rated Loads in All Directions

Model SR-M1 is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings indicate the values in the radial directions in Fig. 2, and their actual values are provided in the dimensional table for SR-M1. The values in the reverse-radial and lateral directions are obtained from table 1.

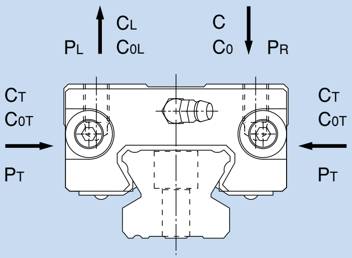


Fig. 2

Table 1 Rated Loads in All Directions with Model SR-M1

Model No.	Direction	Basic dynamic load rating	Basic static load rating
SR-M1 15 to 35	Radial direction	C	C_0
	Reverse-radial direction	$C_L=0.62C$	$C_{0L}=0.50C_0$
	Lateral direction	$C_T=0.56C$	$C_{0T}=0.43C_0$

Equivalent Load

When the LM block of model SR-M1 receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E :Equivalent load (N)
  ·Reverse-radial direction
  ·Lateral direction
P_L :Reverse-radial load (N)
P_T :Lateral load (N)
X/Y :Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model SR-M1

Model No.	P_E	X	Y
SR-M1 15 to 35	Equivalent load in reverse-radial direction	1	1.155
	Equivalent load in lateral direction	0.866	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model SR-M1.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see pages a-24 and a-25).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-248.

Table 1 Symbols of Dust Prevention Accessories for Model SR-M1

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals SR-M1···UU, refer to the corresponding value provided in table 4.

Table 4 Maximum Seal Resistance Value of Seals SR-M1···UU

Unit: N

Model No.	Seal resistance value
SR 15M1	2.5
SR 20M1	3.4
SR 25M1	4.4
SR 30M1	8.8
SR 35M1	11.8

Note: The seal resistance values above are values at normal temperature.

Standard Length and Maximum Length of the LM Rail

Table 5 shows the standard lengths and the maximum lengths of model SR-M1 variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

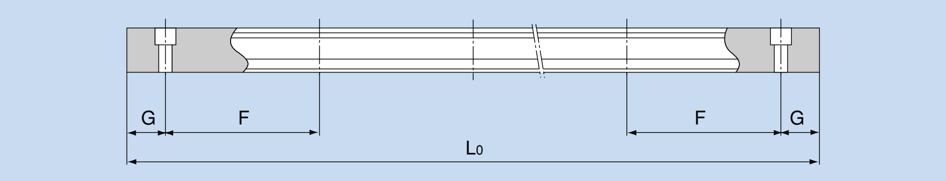


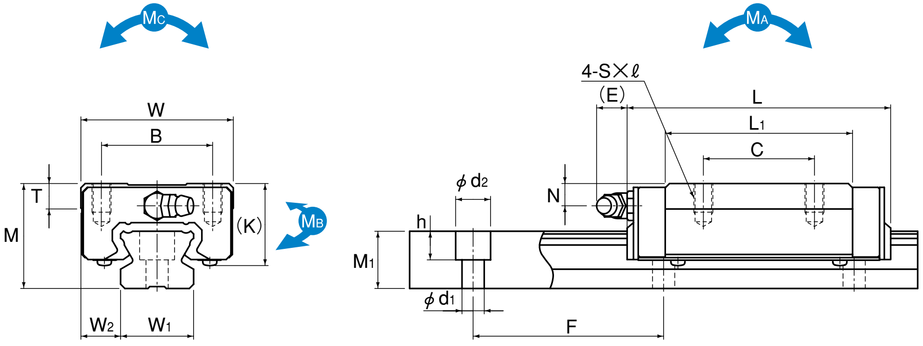
Table 5 Standard Length and Maximum Length of the LM Rail for Model SR-M1

Unit: mm

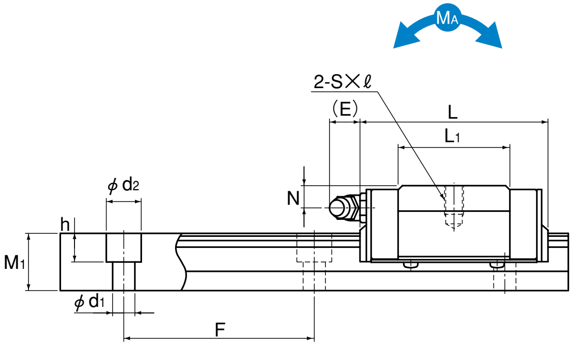
Model No.	SR 15M1	SR 20M1	SR 25M1	SR 30M1	SR 35M1
Standard LM rail length (L_0)	160 220 280 340 400 460 520 580 640 700 760 820 940 1000 1060 1120 1180 1240	220 280 340 400 460 520 580 640 700 760 820 940 1000 1060 1120 1180 1240 1300 1360 1420	220 280 340 400 460 520 580 640 700 760 820 940 1000 1060 1120 1240 1300 1360 1420 1480	280 360 440 520 600 680 760 840 920 1000 1080 1160 1240 1320 1400 1480	280 360 440 520 600 680 760 840 920 1000 1080 1160 1240 1320 1400 1480
Standard pitch F	60	60	60	80	80
G	20	20	20	20	20
Max length	1240	1500	1500	1500	1500

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models SR-M1W | SR-M1V



Model SR-M1W



Model SR-M1V

Unit: mm

Model No.	External dimensions			LM block dimensions									LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Grease nipple	Width W_1 ±0.05		Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	E			W_2	M_1	F	$d_1 \times d_2 \times h$	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
SR 15M1W SR 15M1V	24	34	57 40.4	26	26 —	M4×7	39.5 22.9	6	19.5	6	5.5	PB1021B	15	9.5	12.5	60	3.5×6×4.5	9.51 5.39	19.3 11.1	0.0925 0.0326	0.516 0.224	0.0567 0.0203	0.321 0.143	0.113 0.0654	0.2 0.12	1.2
SR 20M1W SR 20M1V	28	42	66.2 47.3	32	32 —	M5×8	46.7 27.8	7.5	22	6	12	B–M6F	20	11	15.5	60	6×9.5×8.5	12.5 7.16	25.2 14.4	0.146 0.053	0.778 0.332	0.0896 0.0329	0.481 0.21	0.194 0.11	0.3 0.2	2.1
SR 25M1WY SR 25M1VY	33	48	83 59.2	35	35 —	M6×9	59 35.2	8	26	7	12	B–M6F	23	12.5	18	60	7×11×9	20.3 11.7	39.5 22.5	0.286 0.103	1.52 0.649	0.175 0.0642	0.942 0.41	0.355 0.201	0.4 0.3	2.7
SR 30M1W SR 30M1V	42	60	96.8 67.9	40	40 —	M8×12	69.3 40.4	9	32.5	8	12	B–M6F	28	16	23	80	7×11×9	30 17.2	56.8 32.5	0.494 0.163	2.55 1.08	0.303 0.102	1.57 0.692	0.611 0.352	0.8 0.5	4.3
SR 35M1W SR 35M1V	48	70	111 77.6	50	50 —	M8×12	79 45.7	13	36.5	8.5	12	B–M6F	34	18	27.5	80	9×14×12	41.7 23.8	77.2 44.1	0.74 0.259	4.01 1.68	0.454 0.161	2.49 1.07	1.01 0.576	1.2 0.8	6.4

Note Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SR30 M1 W 2 UU C0 +1160L P- Ⅱ
1 2 3 4 5 6 7 8 9

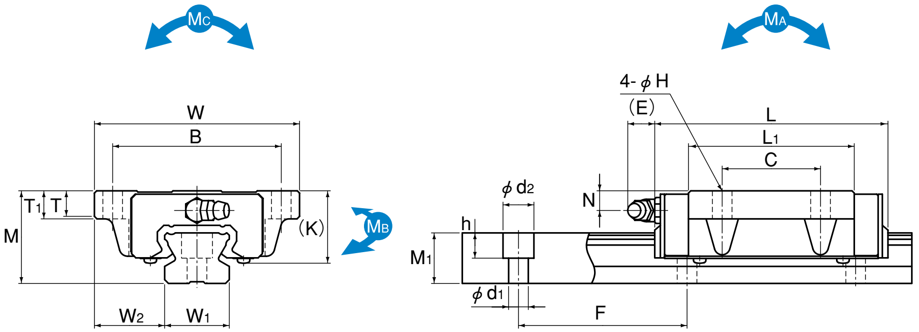
1 Model number 2 Symbol for high temperature LM Guide 3 Type of LM block
4 No. of LM blocks used on the same rail 5 Dust prevention accessory symbol (see page a-241)
6 Radial clearance symbol (see page a-33) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

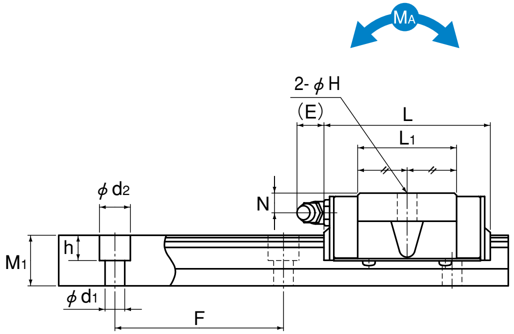
Standard Length and Maximum Length of the LM Rail P. a-242

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models SR-M1TB | SR-M1SB



Model SR- M1TB



Model SR-M1SB

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	H	L_1	T	T_1	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
SR 15M1TB	24	52	57	41	26	4.5	39.5	6.1	7	19.5	6	5.5	PB1021B	15	18.5	12.5	60	3.5×6×4.5	9.51	19.3	0.0926	0.516	0.0567	0.321	0.113	0.2	1.2
SR 15M1SB			40.4		—		22.9												5.39	11.1	0.0326	0.224	0.0203	0.143	0.0654	0.12	
SR 20M1TB	28	59	66.2	49	32	5.5	46.7	8	9	22	6	12	B-M6F	20	19.5	15.5	60	6×9.5×8.5	12.5	25.2	0.146	0.778	0.0896	0.481	0.194	0.3	2.1
SR 20M1SB			47.3		—		27.8												7.16	14.4	0.053	0.332	0.0329	0.21	0.11	0.2	
SR 25M1TBY	33	73	83	60	35	7	59	9	10	26	7	12	B-M6F	23	25	18	60	7×11×9	20.3	39.5	0.286	1.52	0.175	0.942	0.355	0.4	2.7
SR 25M1SBY			59.2		—		35.2												11.7	22.5	0.103	0.649	0.0642	0.41	0.201	0.3	
SR 30M1TB	42	90	96.8	72	40	9	69.3	8.7	10	32.5	8	12	B-M6F	28	31	23	80	7×11×9	30	56.8	0.494	2.55	0.303	1.57	0.611	0.8	4.3
SR 30M1SB			67.9		—		40.4												17.2	32.5	0.163	1.08	0.102	0.692	0.352	0.5	
SR 35M1TB	48	100	111	82	50	9	79	11.2	13	36.5	8.5	12	B-M6F	34	33	27.5	80	9×14×12	41.7	77.2	0.74	4.01	0.454	2.49	1.01	1.2	6.4
SR 35M1SB			77.6		—		45.7												23.8	44.1	0.259	1.68	0.161	1.07	0.576	0.8	

Note Static permissible moment*: 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

SR30 M1 W 2 UU C0 +1000L P- Ⅱ
1 2 3 4 5 6 7 8 9

1 Model number 2 Symbol for high temperature LM Guide 3 Type of LM block
4 No. of LM blocks used on the same rail 5 Dust prevention accessory symbol (see page a-241)
6 Radial clearance symbol (see page a-33) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-242

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model SR-M1 with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
SR 15M1W/M1TB	57	57
SR 15M1V/M1SB	40.4	40.4
SR 20M1W/M1TB	66.2	66.2
SR 20M1V/M1SB	47.3	47.3
SR 25M1W/M1TB	83	83
SR 25M1V/M1SB	59.2	59.2

Model No.	UU	SS
SR 30M1W/M1TB	96.8	96.8
SR 30M1V/M1SB	67.9	67.9
SR 35M1W/M1TB	111	111
SR 35M1V/M1SB	77.6	77.6

Precautions on Use

THK High Temperature LM Guide

Service Temperature of the High Temperature LM Guide

●Maximum service temperature: 150℃

Selection of a High Temperature LM Guide

●For selecting a model number of high temperature LM Guide model SR-M1, see section A of the “THK General Catalog - Technical Descriptions of the Products,” provided separately. When selecting a model number, also determine the temperature factor fT while referring to the corresponding graph, and set hardness factor fH at 1.0.

Dimensional Accuracy of the High Temperature LM Guide

●The high temperature LM Guide is manufactured with the same dimensional accuracy as a standard LM Guide. At high service temperature, however, the former shows thermal expansion, and therefore, its dimensional accuracy changes by the thermal expansion.

Calculation of Thermal Expansion of the High Temperature LM Guide

●Thermal expansion of the high temperature LM Guide is calculated in the following equation.

$$L_{2\text{-}1} = \alpha(t_2 - t_1)L_1$$

$L_{2\text{-}1}$: Thermal expansion by heating (mm)
α : Coefficient of linear expansion (see table 6)
t_2 : Heating temperature (℃)
t_1 : Normal temperature (℃)
L_1 : Length at normal temperature (mm)

Table 6 Coefficient of Linear Expansion by Material (x 10^{-6}/℃)

(The values other than high temperature LM Guide are excerpts from "Actual Designing - Part 2" by The Nikkan Kogyo Shimbun, Ltd.)

	High temperature LM Guide	SS400	FC25	SUS304	Aluminum
Coefficient of linear expansion	11.8	11.2 to 11.3	8.6 to 8.7	16.4	23

Note: If mounting the high temperature LM Guide on a material whose linear expansion coefficient is significantly different, or if the linear expansion coefficient is the same but the temperature is uneven, it may cause the LM rail to bend or the preload on the LM Guide to change (for preloads on the LM Guide, see page a-31).

Grease Used in the High Temperature LM Guide

●The LM Guide contains fluorinated grease as standard unless otherwise specified. The following table shows general properties of the grease for the high temperature LM Guide.

If other type of grease or lubricant is mixed with the high temperature grease, it may deteriorate the product performance. When using the LM Guide in a vacuum environment, contact THK.

Name: Krytox GPL225 (DuPont)

Base oil	GPL105
Base oil viscosity (20℃)	550(cSt)
Oil separation rate (30 hr, 99℃)	4%(wt)
Additive	Anticorrosive agent
Service temperature range	-35℃ to +205℃
Worked penetration	NLGI No.2

Change in Sliding Resistance due to Grease and Seal

●The sliding resistance of the LM Guide tends to increase in proportion to the increase in temperature due to high temperature grease or seal.

Lubrication of the High Temperature LM Guide

●The high temperature LM Guide needs to be greased roughly at an interval of every 100 km in travel distance. However, the greasing interval may vary depending on the service conditions, environment, atmosphere or temperature. It is necessary to adjust the greasing interval according to the circumstances.

Ultra-heavy-load, High-rigidity LM Guide Models NR and NRS

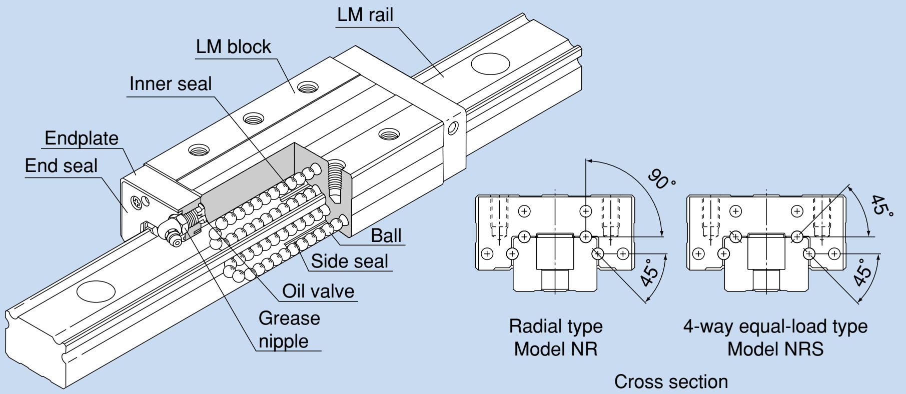


Fig. 1 Structure of Models NR and NRS

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the 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 extremely precise cutting technique. This design allows high rigidity, high vibration/impact resistance and high damping capacity, all of which are required for machine tools, thus making these models capable of bearing ultra-heavy loads.

●Improved damping capacity

While the machine tool (equipped with NR or NRS) is not cutting a workpiece during operation, the LM Guide travels normally and smoothly. While the machine tool is cutting the workpiece, the cutting load is applied to the LM Guide to increase and the contact area between the balls and the raceway, allowing an appropriate mixture of rolling and sliding motions to be achieved. Accordingly, the friction resistance is increased and the damping capacity is improved.
Since the absolute slip during the rolling and sliding motion is insignificant, it causes little wear and does not affect the service life.

●Highly rational LM Guide

The excessively large differential slip occurring in a Gothic-arch groove does not happen with these models. They smoothly travel and achieve high positioning accuracy during fast feeding. During the cutting operation, appropriate slip occurs according to the cutting load, the rolling resistance is increased and the damping capacity is increased. Thus, models NR and NRS are highly rational LM Guides.

●High rigidity

To increase the rigidity of the LM block and the LM rail, which may deteriorate the overall rigidity of the LM Guide in the reverse-radial and lateral directions, THK made full use of FEM to achieve optimal design within the limited dimensional range.

For both the radial type model NR and the four-way equal load type model NRS, THK offers two types with the same dimensions and different characteristics. It allows you to select the desired type according to the application.

●Ultra heavy load

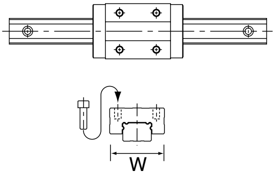
Since the curvature of the raceway is approximated to the ball diameter, the ball contact area under a load is increased and the LM Guide is capable of receiving an ultra-heavy load.

Types and Features

Models NR-R/NRS-R

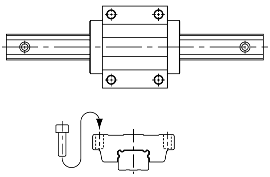
The LM block has a smaller width (W) and is equipped with tapped holes.

Suitable for places where space for the table width is limited.



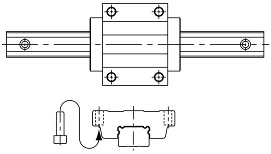
Models NR-A/NRS-A

The flange of the LM block has tapped holes.



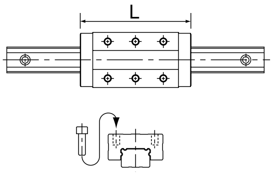
Models NR-B/NRS-B

The flange of the LM block has through holes. Used in places where the table cannot have through holes for mounting bolts.



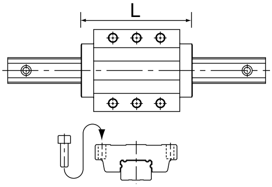
Models NR-LR/NRS-LR

The LM block has the same sectional shape as models NR-R/NRS-R, but has a longer overall LM block length (L) and a greater rated load.



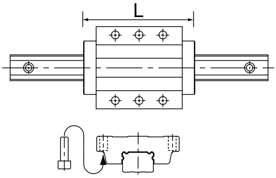
Models NR-LA/NRS-LA

The LM block has the same sectional shape as models NR-A/NRS-A, but has a longer overall LM block length (L) and a greater rated load.



Models NR-LB/NRS-LB

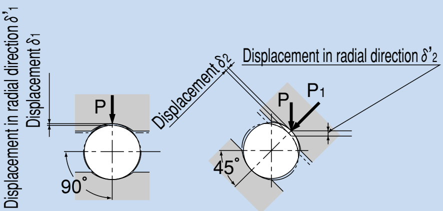
The LM block has the same sectional shape as models NR-B/NRS-B, but has a longer overall LM block length (L) and a greater rated load.



Characteristics of Models NR and NRS

●Increased Rigidity in Major Load Directions

The structure with a contact angle of 90° used in model NR differs from that with a 45° contact angle also in rigidity. Under the same radial load P, the displacement in the radial direction with model NR having a contact angle of 90° is 44% less than the 45°.



Contact angle of 90° (Model NR)

Contact angle of 45°

Fig. 2 Displacement under a Radial Load

The figure on the right shows the difference in radial load and displacement. Accordingly, where high rigidity in the radial direction is required, model NR is more advantageous.

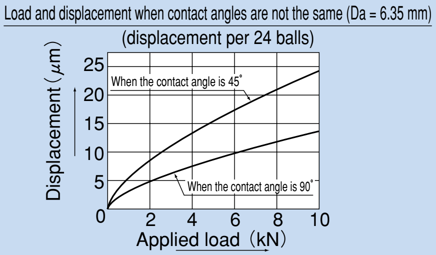
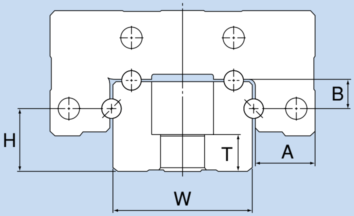


Fig. 3 Radial Load and Displacement (normal clearance, no preload)

●Increased Rigidity in the Lateral and Reverse-radial Directions

Since with LM Guide model NR, the distance "H" between the rail bottom and the lower-groove balls (balls receiving lateral loads) is short, the ratio between the rail width "W" and the distance "H" is small, and the distance "T" between the LM rail mounting bolt seat and the LM rail bottom is short. Accordingly, the deformation of the LM rail under a lateral load is minimal, and the rigidity in the lateral directions is increased.



Radial type contact structure

Fig. 4 Cross Section of Model NR

Also, since the dimension "B" of the LM block is short and the thickness "A" is large, the lateral extension of the LM block under a reverse-radial or lateral load is minimized. This structure allows the rigidity in the reverse-radial direction to be increased.

In comparison to the old model with the same model number, the ball diameter of NR is smaller and the effective number of balls is approximately 1.3 times greater, thus to increase static rigidity.

●Comparison of Contact Surface and Internal Stress between Different Contact Structures

As shown in Fig. 5, the contact area and the internal stress of a ball greatly vary depending on the shape of contact surface.

With the conventional roller guide, the effective length is shorter than the apparent value due to the retention of the rollers. Additionally, the change of stress distribution in the contact section caused by a mounting error significantly affects the differential slip.

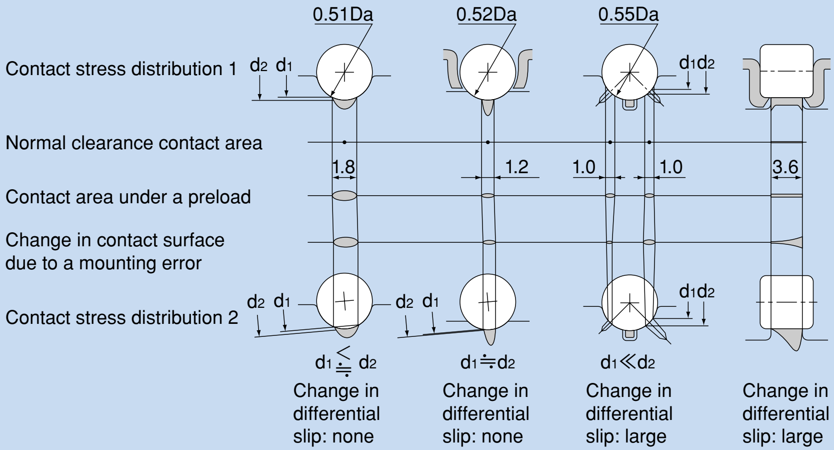


Fig. 5 Comparison of Contact Surface (ϕ6.350 ball, ϕ6 x 6 ℓ roller)

Rated Loads in All Directions

Models NR/NRS are capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of model NR are indicated by the values in the radial directions in Fig. 6, and their actual values are provided in the dimensional table for NR/NRS. The values in the reverse-radial and lateral directions are obtained from table 1.

The basic load ratings of model NRS are equal in all the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for NR/NRS.

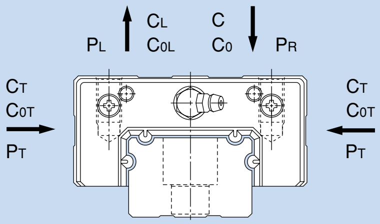


Fig. 6

Table 1 Rated Loads in All Directions with Model NR

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	C_L=0.78C	C_{0L}=0.71C_0
Lateral direction	C_T=0.48C	C_{0T}=0.45C_0

Equivalent Load

When the LM block of model NR receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
・Reverse-radial direction
・Lateral direction
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model NR

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

When the LM block of model NRS receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
・Radial direction
・Reverse-radial direction
・Lateral direction
P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for models NR and NRS.

When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see pages a-24 and a-25).

For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-274.

Table 3 Symbols of Dust Prevention Accessories for Models NR and NRS

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal + inner seal
DD	With double seals + side seal + inner seal
ZZ	With end seal + side seal + inner seal + metal scraper
KK	With double seals + side seal + inner seal + metal scraper
SSHH	With end seal + side seal + inner seal + LaCS
DDHH	With double seals + side seal + inner seal + LaCS
ZZHH	With end seal + side seal + inner seal + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal + metal scraper + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals NR/NRS···UU, refer to the corresponding value provided in table 4.

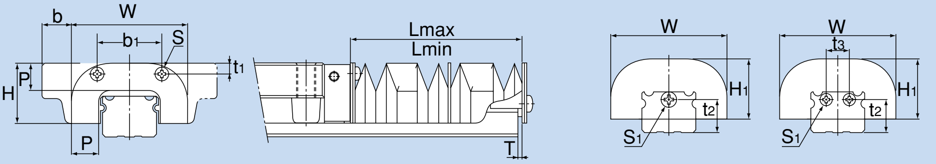
Table 4 Maximum Seal Resistance Value of Seals NR/NRS···UU

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

●Simplified Bellows JSN

For models NR/NRS, a simplified bellows is available. To gain a higher dust-prevention effect, attach a telescopic cover outside the simplified bellows after the bellows is mounted as shown in Fig. 7.



NR/NRS 25X to 45 NR/NRS 55 to 100

Unit: mm

Model No.	Major dimensions												A $\left(\frac{Lmax}{Lmin}\right)$	Supported model
	W	H	H_1	P	b_1	t_1	t_2	t_3	Mounting bolt S	Mounting bolt S_1	b A,LA B,LB	T		
JN 25	48	25.5	25.5	10	26.6	4.6	13	—	M3×5 ℓ	M4×4 ℓ	11	1.5	7	NR/NRS 25X
JN 30	60	31	31	14	34	5.5	17	—	M4×8 ℓ	M4×4 ℓ	15	1.5	9	NR/NRS 30
JN 35	70	35	35	15	36	6	20.5	—	M4×8 ℓ	M5×4 ℓ	15	2	10	NR/NRS 35
JN 45	86	40.5	40.5	17	47	6.5	24	—	M5×10 ℓ	M5×4 ℓ	17	2	10	NR/NRS 45
JN 55	100	49	49	20	54	10	29.5	18	M5×10 ℓ	M5×4 ℓ	20	2	13	NR/NRS 55
JN 65	126	57.5	57.5	20	64	13.5	36.2	20	M6×12 ℓ	M6×5 ℓ	22	3.2	13	NR/NRS 65
JN 75	145	64	64	30	80	10.5	34.2	26	M6×12 ℓ	M6×5 ℓ	25	3.2	20	NR/NRS 75
JN 85	156	70.5	70.5	30	110	15.5	39.5	28	M6×12 ℓ	M6×5 ℓ	39.5	3.2	20	NR/NRS 85
JN 100	200	82	82	30	140	15	40	34	M8×16 ℓ	M6×5 ℓ	30	3.2	20	NR/NRS 100

Note 1: When desiring to use the simplified bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the simplified bellows, contact THK.

Note 3: When using the simplified bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the simplified bellows is required when ordering the LM Guide.

Model number coding **JN25-60/420**

1 2

1 Model number···bellows for NR/NRS25X

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$Lmax = Lmin \cdot A$$ A: Extension rate

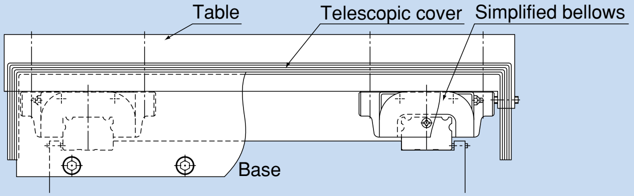


Fig. 7 Example of Mounting the Simplified Bellows

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

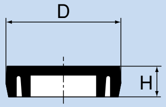
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
NR 25X	C 5	M 5	9.8	2.4
NR 30	C 6	M 6	11.4	2.7
NR 35	C 8	M 8	14.4	3.7
NR 45	C12	M12	20.5	4.7
NR 55	C14	M14	23.5	5.7
NR 65	C16	M16	26.5	5.7
NR 85	C22	M22	35.5	5.7



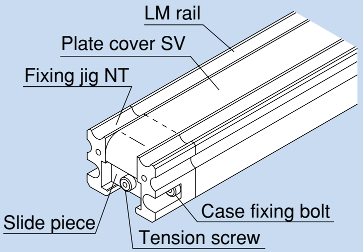
Dedicated Cap C

●Plate Cover SV

For models NR/NRS, plate covers are available as an essential means of dust prevention for machine tools. By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the plate cover SV drastically increases sealability, thus to prevent the penetration of a coolant or cutting chips from the top face of the LM rail, which was previously impossible.

For the mounting procedure, see page a-27.

Note: When mounting the plate cover, the LM rail needs to be machined. Indicate that the plate cover is required when ordering the LM Guide.



Note: The plate cover is available for models NR35 to 100 and NRS35 to 100.

●Steel Tape SP

For models NR/NRS, steel tapes are available as an essential means of dust prevention for machine tools. By covering the LM rail mounting holes with an ultra thin stainless steel (SUS304) plate, the steel tape SP further increases sealability, thus to prevent the penetration of a coolant or cutting chips from the top face of the LM rail, which was previously impossible (when mounting the steel tape, end piece EP can be used as a means to secure the cover).

For the mounting procedure, see page a-28.

Note: When mounting the steel tape, the LM rail needs to be machined. Indicate that the steel tape is required when ordering the LM Guide.

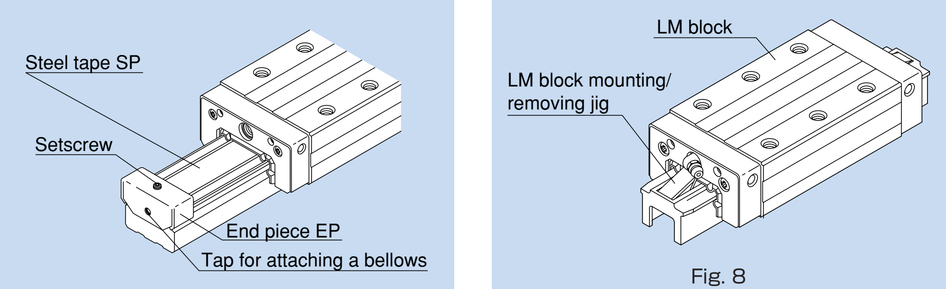


Fig. 8

Note 1: The steel tape is available for models NR25 to 100 and NRS25 to 100.

Note 2: With models NR/NRS, balls will fall off if the LM block is removed from the LM rail. Falling of balls may cause an accident. When removing the LM block from the LM rail, use the LM block removing/mounting jig.

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 6 (for details of QZ Lubricator, see pages a-19 and a-20).

For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-274.

Table 6 Parts Symbols for Models NR/NRS with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal
QZSS	With end seal + side seal + inner seal
QZDD	With double seals + side seal + inner seal
QZZZ	With end seal + side seal + inner seal + metal scraper + QZ
QZKK	With double seals + side seal + inner seal + metal scraper + QZ
QZSSHH	With end seal + side seal + inner seal + LaCS + QZ
QZDDHH	With double seals + side seal + inner seal + LaCS + QZ
QZZZHH	With end seal + side seal + inner seal + metal scraper + LaCS + QZ
QZKKHH	With double seals + side seal + inner seal + metal scraper + LaCS + QZ

Lubrication Adapter

An oil lubricant-only lubrication adapter is available for models NR/NRS.
Even if the LM Guide is installed in an orientation where oil lubrication is difficult, such as wall mount and inversed mount, the adapter is capable of feeding a constant quantity of lubricant to the four raceways.

Features

The dedicated lubrication adapter for models NR-NRS is built in with a constant quantity distributor. Therefore, the adapter can accurately feed a constant quantity of lubricant to each raceway regardless of the mounting orientation.
The adapter is economical since it is capable of constantly feeding the optimum amount of lubricant and helping eliminate the supply of surplus lubricant.
To provide pipe arrangement, simply connect an intermittent lubrication pump widely used for ordinary machine tools to the greasing holes (M8) on the front and the side of the lubrication adapter.

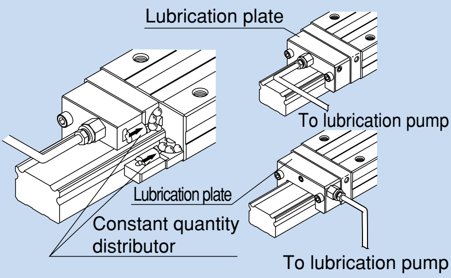


Fig. 9 Structural Drawing

Specifications

Viscosity range of lubricant used	32 to 64 ㎟/s recommended
Discharge	0.03×4, 0.06×4cc/1shot
Diameter of pipe connected	φ4, φ6
Material	Aluminum alloy

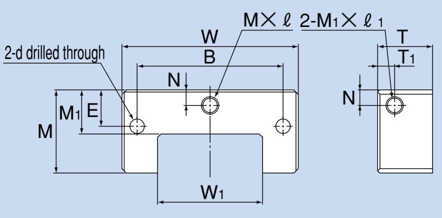


Fig. 10

Table 7 Dimension Table for Lubrication Adapter

Unit: mm

Model No.	Major dimensions												Quantity per shot (cc/shot)
	Width W	Height M	T	W_1	M_1	B	E	N	T_1	d	M×ℓ	M_1×$ℓ_1$	
A30N	56	29	25	29	14.5	46	14	5	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	

End Piece EP

With models NR-NRS, if the LM block is pulled out from the LM rail, balls will fall off. To prevent the LM block from being pulled out, end pieces are mounted before shipment. If removing the end piece when using the LM Guide, be sure that the LM block will not overrun.

The end piece can also be used as a fixing jig for a steel tape, and is available also for the LM rail of models SSR, SR and HSR.

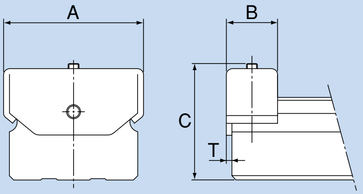


Fig. 11 End Piece EP for Models NR-NRS

Table 8 Dimension Table for End Piece RP for Models NR-NRS

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 100	106.4	25	73	3.2

Standard Length and Maximum Length of the LM Rail

Table 9 shows the standard lengths and the maximum lengths of models NR/NRS variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

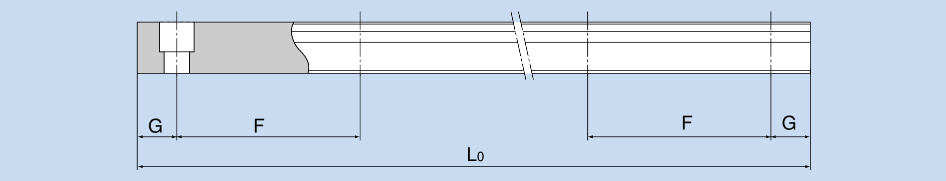


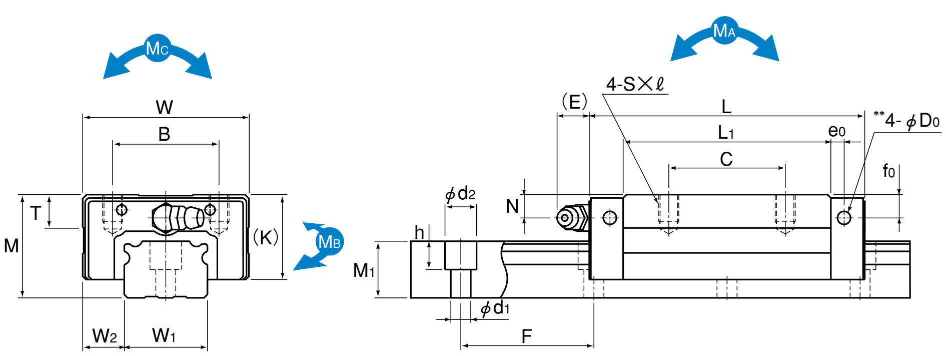
Table 9 Standard Length and Maximum Length of the LM Rail for Models NR/NRS Unit: mm

Model No.	NR/NRS25X	NR/NRS30	NR/NRS35	NR/NRS45	NR/NRS55	NR/NRS65	NR/NRS75	NR/NRS85	NR/NRS100
Standard LM rail length (L_0)	230 270 350 390 470 510 590 630 710 750 830 950 990 1070 1110 1190 1230 1310 1350 1430 1470 1550 1590 1710 1830 1950 2070 2190 2310 2430 2470	280 360 440 520 600 680 760 840 920 1000 1080 1160 1240 1320 1400 1480 1560 1640 1720 1800 1880 1960 2040 2200 2360 2520 2680 2840 3000	280 360 440 520 600 680 760 840 920 1000 1080 1160 1240 1320 1400 1480 1560 1640 1720 1800 1880 1960 2040 2200 2360 2520 2680 2840 3000	570 675 780 885 990 1095 1200 1305 1410 1515 1620 1725 1830 1935 2040 2145 2250 2355 2460 2565 2670 2775 2880 2985	780 900 1020 1140 1260 1380 1500 1620 1740 1860 1980 2100 2220 2340 2460 2580 2700 2820 2940	1270 1570 2020 2620	1280 1580 2030 2630	1530 1890 2250 2610	1340 1760 2180 2600
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

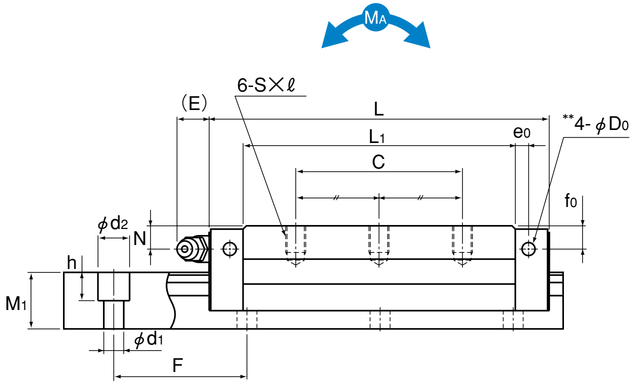
Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models NR-R | NR-LR



Model NR-R



Model NR-LR

Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease nipple	Width W1 (0 / −0.05)		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	f0	E	e0	D0			W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
NR 25XR	31	50	82.8	32	35	M6×8	62.4	9.7	25.5	7	7	12	4	3.9	B-M6F	25	12.5	17	40	6×9.5×8.5	33	84.6	0.771	3.86	0.469	2.33	0.91	0.43	3.1
NR 25XLR			102		50		81.6														44	113	1.26	6.29	0.775	3.82	1.21	0.55	
NR 30R	38	60	98	40	40	M8×10	70.9	9.7	31	7	7	12	5	3.9	B-M6F	28	16	21	80	7×11×9	48.7	122	1.26	6.63	0.778	4.05	1.47	0.74	4.3
NR 30LR			120.5		60		93.4														64.9	162	2.18	10.6	1.33	6.47	1.95	1	
NR 35R	44	70	109.5	50	50	M8×12	77.9	11.7	35	8	8	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	63.1	155	1.75	9.47	1.08	5.8	2.24	1.1	6.2
NR 35LR			135		72		103.4														85.7	210	3.14	15.5	1.92	9.43	3.03	1.4	
NR 45R	52	86	139	60	60	M10×17	105	14.7	40.5	10	8	16	7	5.2	B-PT1/8	45	20.5	29	105	14×20×17	96	231	3.37	17.7	2.07	10.8	4.45	2	9.8
NR 45LR			171		80		137														126	303	5.93	28	3.59	16.9	5.82	2.8	
NR 55R	63	100	162.8	65	75	M12×18	123.6	17.5	49	11	10	16	8	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	131	310	5.39	27.8	3.3	16.9	6.98	3.3	14.5
NR 55LR			200		95		160.8														170	402	8.87	43.8	5.41	26.6	9.05	4.3	
NR 65R	75	126	185.6	76	70	M16×20	143.6	21.5	60	16	15	16	9	8.2	B-PT1/8	63	31.5	43	150	18×26×22	189	436	8.76	44.7	5.39	27.3	11.6	6	20.3
NR 65LR			245.6		110		203.6														260	600	16.8	79.9	10.1	48	15.9	8.7	
NR 75R	83	145	218	95	80	M18×25	170.2	25.3	68	18	17	16	9	8.2	B-PT1/8	75	35	44	150	22×32×26	271	610	14.4	73.3	8.91	44.7	19.3	8.7	24.6
NR 75LR			274		130		226.2														355	800	25.4	118	15.4	71.4	25.2	11.6	
NR 85R	90	156	246.7	100	80	M18×25	194.9	27.3	73	20	20	16	10	8.2	B-PT1/8	85	35.5	48	180	24×35×28	336	751	20.3	102	12.4	62.6	26.8	12.3	30.5
NR 85LR			302.8		140		251														435	972	34.7	160	21	96.2	34.6	15.8	
NR 100R	105	200	288.8	130	150	M18×27	223.4	34.3	85	23	23	10	12	8.2	B-PT1/4	100	50	57	210	26×39×32	479	1040	34	167	20.7	101	43.4	21.8	42.6
NR 100LR			328.8		200		263.4														599	1300	47.3	238	29.2	146	54.6	26.1	

Model number coding

NR35 LR 2 QZ KKHH C0 +1240L P Z- Ⅱ
1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

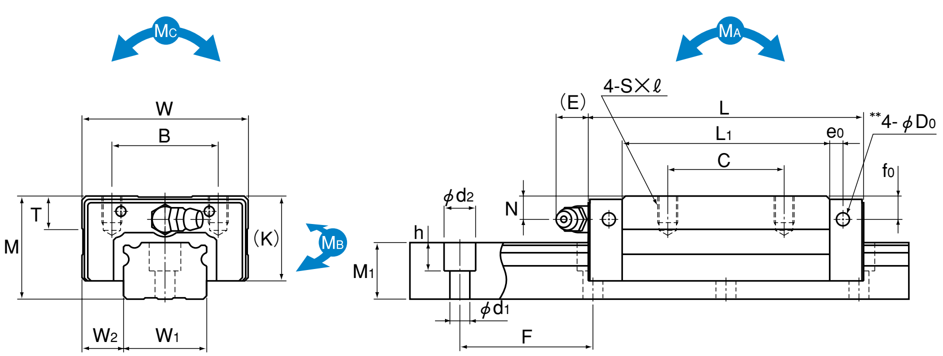
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

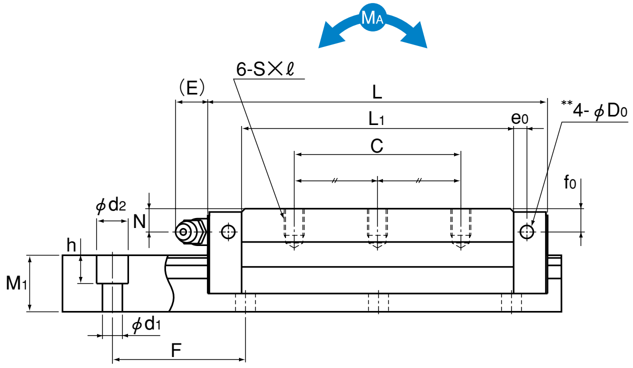
Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models NRS-R | NRS-LR



Model NRS-R



Model NRS-LR

Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L1	T	K	N	f0	E	e0	D0	Grease nipple	Width W1 $^{0}_{-0.05}$	W2	Height M1	Pitch F	d1×d2×h	C kN	C0 kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	LM block kg	LM rail kg/m
NRS 25XR	31	50	82.8	32	35	M6×8	62.4	9.7	25.5	7	7	12	4	3.9	B-M6F	25	12.5	17	40	6×9.5×8.5	25.9	59.8	0.568	2.84	0.568	2.84	0.633	0.43	3.1
NRS 25XLR			102		50		81.6														34.5	79.7	0.926	4.6	0.926	4.6	0.846	0.55	
NRS 30R	38	60	98	40	40	M8×10	70.9	9.7	31	7	7	12	5	3.9	B-M6F	28	16	21	80	7×11×9	38.2	86.1	0.926	4.86	0.926	4.86	1.02	0.74	4.3
NRS 30LR			120.5		60		93.4														51	115	1.6	7.83	1.6	7.83	1.36	1	
NRS 35R	44	70	109.5	50	50	M8×12	77.9	11.7	35	8	8	12	6	5.2	B-M6F	34	18	24.5	80	9×14×12	49.5	109	1.28	6.92	1.28	6.92	1.54	1.1	6.2
NRS 35LR			135		72		103.4														67.2	148	2.29	11.3	2.29	11.3	2.09	1.4	
NRS 45R	52	86	139	60	60	M10×17	105	14.7	40.5	10	8	16	7	5.2	B-PT1/8	45	20.5	29	105	14×20×17	75.3	163	2.47	13	2.47	13	3.09	2	9.8
NRS 45LR			171		80		137														98.8	214	4.34	20.5	4.34	20.5	4.06	2.8	
NRS 55R	63	100	162.8	65	75	M12×18	123.6	17.5	49	11	10	16	8	5.2	B-PT1/8	53	23.5	36.5	120	16×23×20	103	220	3.97	20.5	3.97	20.5	4.86	3.3	14.5
NRS 55LR			200		95		160.8														133	284	6.49	32	6.49	32	6.28	4.3	
NRS 65R	75	126	185.6	76	70	M16×20	143.6	21.5	60	16	15	16	9	8.2	B-PT1/8	63	31.5	43	150	18×26×22	148	309	6.45	32.9	6.45	32.9	8.11	6	20.3
NRS 65LR			245.6		110		203.6														204	425	12.3	58.6	12.3	58.6	11.1	8.7	
NRS 75R	83	145	218	95	80	M18×25	170.2	25.3	68	18	17	16	9	8.2	B-PT1/8	75	35	44	150	22×32×26	212	431	10.6	53.8	10.6	53.8	13.4	8.7	24.6
NRS 75LR			274		130		226.2														278	566	18.6	87	18.6	87	17.6	11.6	
NRS 85R	90	156	246.7	100	80	M18×25	194.9	27.3	73	20	20	16	10	8.2	B-PT1/8	85	35.5	48	180	24×35×28	264	531	14.9	75.3	14.9	75.3	18.7	12.3	30.5
NRS 85LR			302.8		140		251														342	687	25.4	117	25.4	117	24.2	15.8	
NRS 100R	105	200	288.8	130	150	M18×27	223.4	34.3	85	23	23	10	12	8.2	B-PT1/4	100	50	57	210	26×39×32	376	737	25.1	123	25.1	123	30.4	21.8	42.6
NRS 100LR			328.8		200		263.4														470	920	34.6	174	34.6	174	38.1	26.1	

Model number coding NRS45 LR 2 QZ ZZHH C0 +1200L P Z- Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

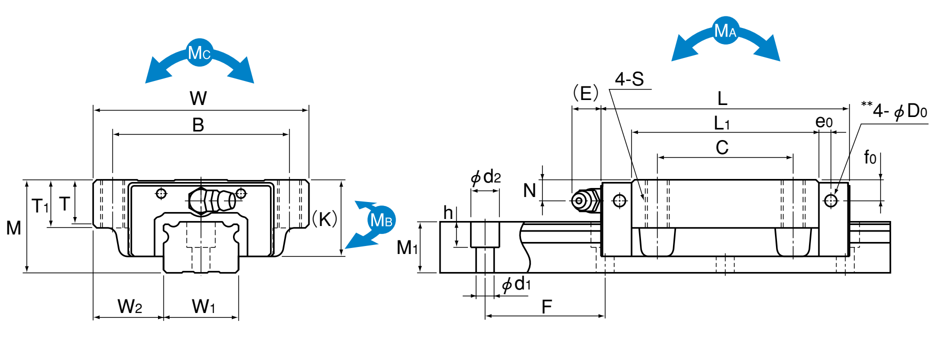
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

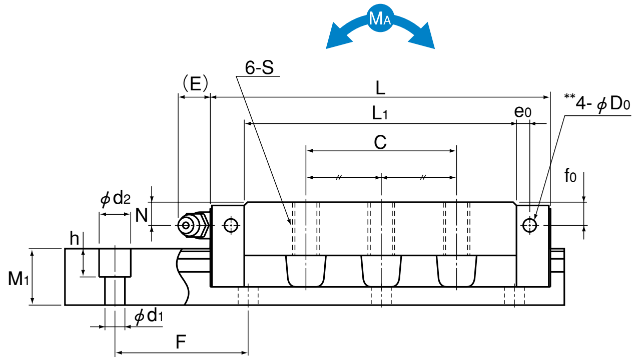
Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models NR-A | NR-LA



Model NR-A



Model NR-LA

Unit: mm

Model No.	External dimensions Height M	External dimensions Width W	External dimensions Length L	LM block dimensions B	C	S×ℓ	L1	T	T1	K	N	f0	E	e0	D0	Grease nipple	LM rail dimensions Width W1 (0/−0.05)	W2	Height M1	Pitch F	d1×d2×h	Basic load rating C kN	C0 kN	Static permissible moment kN-m* MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	Mass LM block kg	LM rail kg/m
NR 25XA NR 25XLA	31	72	82.8 102	59	45	M8×16	62.4 81.6	14.8	16	25.5	7	7	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	33 44	84.6 113	0.771 1.26	3.86 6.29	0.469 0.775	2.33 3.82	0.91 1.21	0.58 0.77	3.1
NR 30A NR 30LA	38	90	98 120.5	72	52	M10×18	70.9 93.4	16.8	18	31	7	7	12	5	3.9	B-M6F	28	31	21	80	7×11×9	48.7 64.9	122 162	1.26 2.18	6.63 10.6	0.778 1.33	4.05 6.47	1.47 1.95	1.1 1.4	4.3
NR 35A NR 35LA	44	100	109.5 135	82	62	M10×20	77.9 103.4	18.8	20	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	63.1 85.7	155 210	1.75 3.14	9.47 15.5	1.08 1.92	5.8 9.43	2.24 3.03	1.5 1.9	6.2
NR 45A NR 45LA	52	120	139 171	100	80	M12×22	105 137	20.5	22	40.5	10	8	16	7	5.2	B-PT1/8	45	37.5	29	105	14×20×17	96 126	231 303	3.37 5.93	17.7 28	2.07 3.59	10.8 16.9	4.45 5.82	2.7 3.5	9.8
NR 55A NR 55LA	63	140	162.8 200	116	95	M14×24	123.6 160.8	22.5	24	49	11	10	16	8	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	131 170	310 402	5.39 8.87	27.8 43.8	3.3 5.41	16.9 26.6	6.98 9.05	4.4 5.7	14.5
NR 65A NR 65LA	75	170	185.6 245.6	142	110	M16×28	143.6 203.6	26	28	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	189 260	436 600	8.76 16.8	44.7 79.9	5.39 10.1	27.3 48	11.6 15.9	7.6 10.9	20.3
NR 75A NR 75LA	83	195	218 274	165	130	M18×30	170.2 226.2	28	30	68	18	17	16	9	8.2	B-PT1/8	75	60	44	150	22×32×26	271 355	610 800	14.4 25.4	73.3 118	8.91 15.4	44.7 71.4	19.3 25.2	11.3 15	24.6
NR 85A NR 85LA	90	215	246.7 302.8	185	140	M20×34	194.9 251	32	34	73	20	20	16	10	8.2	B-PT1/8	85	65	48	180	24×35×28	336 435	751 972	20.3 34.7	102 160	12.4 21	62.6 96.2	26.8 34.6	16.2 20.7	30.5
NR 100A NR 100LA	105	260	288.8 328.8	220	150 200	M20×38	223.4 263.4	35	38	85	23	23	10	12	8.2	B-PT1/4	100	80	57	210	26×39×32	479 599	1040 1300	34 47.3	167 238	20.7 29.2	101 146	43.4 54.6	26.7 31.2	42.6

Model number coding

NR35 A 2 QZ KKHH C0 +1400L P Z- Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
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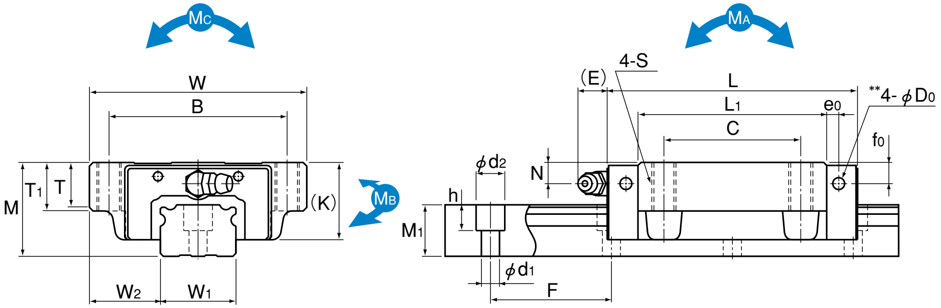
Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

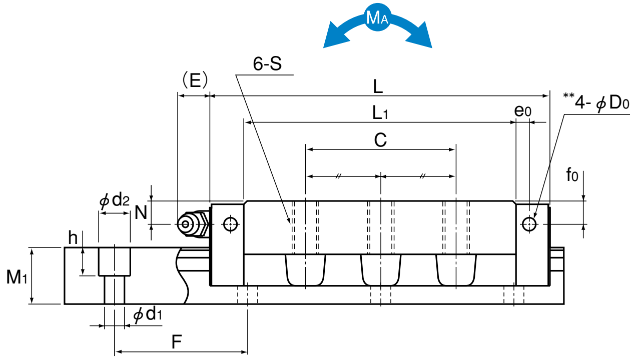
Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models NRS-A | NRS-LA



Model NRS-A



Model NRS-LA

Unit: mm

Model No.	External dimensions			LM block dimensions													LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L_1	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
NRS 25XA	31	72	82.8	59	45	M8×16	62.4	14.8	16	25.5	7	7	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	25.9	59.8	0.568	2.84	0.568	2.84	0.633	0.58	3.1
NRS 25XLA			102				81.6															34.5	79.7	0.926	4.6	0.926	4.6	0.846	0.77	
NRS 30A	38	90	98	72	52	M10×18	70.9	16.8	18	31	7	7	12	5	3.9	B-M6F	28	31	21	80	7×11×9	38.2	86.1	0.926	4.86	0.926	4.86	1.02	1.1	4.3
NRS 30LA			120.5				93.4															51	115	1.6	7.83	1.6	7.83	1.36	1.4	
NRS 35A	44	100	109.5	82	62	M10×20	77.9	18.8	20	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	49.5	109	1.28	6.92	1.28	6.92	1.54	1.5	6.2
NRS 35LA			135				103.4															67.2	148	2.29	11.3	2.29	11.3	2.09	1.9	
NRS 45A	52	120	139	100	80	M12×22	105	20.5	22	40.5	10	8	16	7	5.2	B-PT1/8	45	37.5	29	105	14×20×17	75.3	163	2.47	13	2.47	13	3.09	2.7	9.8
NRS 45LA			171				137															98.8	214	4.34	20.5	4.34	20.5	4.06	3.5	
NRS 55A	63	140	162.8	116	95	M14×24	123.6	22.5	24	49	11	10	16	8	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	103	220	3.97	20.5	3.97	20.5	4.86	4.4	14.5
NRS 55LA			200				160.8															133	284	6.49	32	6.49	32	6.28	5.7	
NRS 65A	75	170	185.6	142	110	M16×28	143.6	26	28	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	148	309	6.45	32.9	6.45	32.9	8.11	7.6	20.3
NRS 65LA			245.6				203.6															204	425	12.3	58.6	12.3	58.6	11.1	10.9	
NRS 75A	83	195	218	165	130	M18×30	170.2	28	30	68	18	17	16	9	8.2	B-PT1/8	75	60	44	150	22×32×26	212	431	10.6	53.8	10.6	53.8	13.4	11.3	24.6
NRS 75LA			274				226.2															278	566	18.6	87	18.6	87	17.6	15	
NRS 85A	90	215	246.7	185	140	M20×34	194.9	32	34	73	20	20	16	10	8.2	B-PT1/8	85	65	48	180	24×35×28	264	531	14.9	75.3	14.9	75.3	18.7	16.2	30.5
NRS 85LA			302.8				251															342	687	25.4	117	25.4	117	24.2	20.7	
NRS 100A	105	260	288.8	220	150	M20×38	223.4	35	38	85	23	23	10	12	8.2	B-PT1/4	100	80	57	210	26×39×32	376	737	25.1	123	25.1	123	30.4	26.7	42.6
NRS 100LA			328.8		200		263.4															470	920	34.6	174	34.6	174	38.1	31.2	

Model number coding

NRS45 LA 2 QZ SSHH C0 +2040L P Z- Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

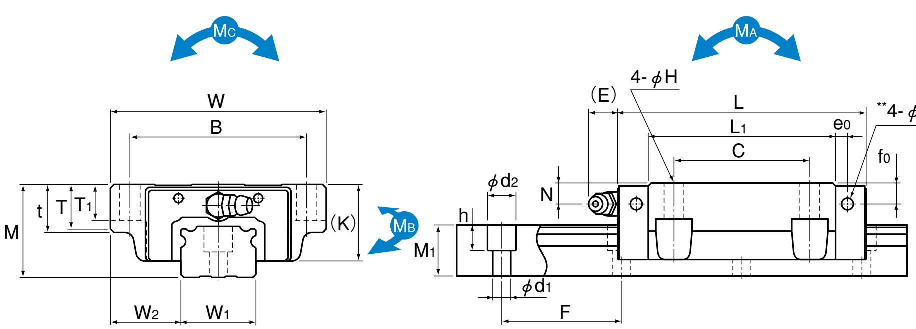
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

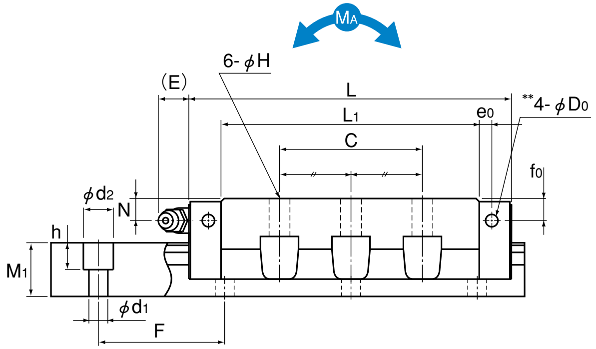
Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number | Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models NR-B | NR-LB



Model NR-B



Model NR-LB

Unit: mm

Model No.	External dimensions			LM block dimensions														LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length														Grease nipple	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	H	L1	t	T	T1	K	N	f0	E	e0	D0		W1 0 −0.05	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
NR 25XB	31	72	82.8	59	45	7	62.4	16	14.8	12	25.5	7	7	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	33	84.6	0.771	3.86	0.469	2.33	0.91	0.58	3.1
NR 25XLB			102				81.6																44	113	1.26	6.29	0.775	3.82	1.21	0.77	
NR 30B	38	90	98	72	52	9	70.9	18	16.8	14	31	7	7	12	5	3.9	B-M6F	28	31	21	80	7×11×9	48.7	122	1.26	6.63	0.778	4.05	1.47	1.1	4.3
NR 30LB			120.5				93.4																64.9	162	2.18	10.6	1.33	6.47	1.95	1.4	
NR 35B	44	100	109.5	82	62	9	77.9	20	18.8	16	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	63.1	155	1.75	9.47	1.08	5.8	2.24	1.5	6.2
NR 35LB			135				103.4																85.7	210	3.14	15.5	1.92	9.43	3.03	1.9	
NR 45B	52	120	139	100	80	11	105	22	20.5	20	40.5	10	8	16	7	5.2	B-PT1/8	45	37.5	29	105	14×20×17	96	231	3.37	17.7	2.07	10.8	4.45	2.7	9.8
NR 45LB			171				137																126	303	5.93	28	3.59	16.9	5.82	3.5	
NR 55B	63	140	162.8	116	95	14	123.6	24	22.5	22	49	11	10	16	8	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	131	310	5.39	27.8	3.3	16.9	6.98	4.4	14.5
NR 55LB			200				160.8																170	402	8.87	43.8	5.41	26.6	9.05	5.7	
NR 65B	75	170	185.6	142	110	16	143.6	28	26	25	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	189	436	8.76	44.7	5.39	27.3	11.6	7.6	20.3
NR 65LB			245.6				203.6																260	600	16.8	79.9	10.1	48	15.9	10.9	
NR 75B	83	195	218	165	130	18	170.2	30	28	26	68	18	17	16	9	8.2	B-PT1/8	75	60	44	150	22×32×26	271	610	14.4	73.3	8.91	44.7	19.3	11.3	24.6
NR 75LB			274				226.2																355	800	25.4	118	15.4	71.4	25.2	15	
NR 85B	90	215	246.7	185	140	18	194.9	34	32	28	73	20	20	16	10	8.2	B-PT1/8	85	65	48	180	24×35×28	336	751	20.3	102	12.4	62.6	26.8	16.2	30.5
NR 85LB			302.8				251																435	972	34.7	160	21	96.2	34.6	20.7	
NR 100B	105	260	288.8	220	150	20	223.4	38	35	32	85	23	23	10	12	8.2	B-PT1/4	100	80	57	210	26×39×32	479	1040	34	167	20.7	101	43.4	26.7	42.6
NR 100LB			328.8		200		263.4																599	1300	47.3	238	29.2	146	54.6	31.2	

Model number coding

NR35 B 2 QZ DDHH C0 +1080L P Z- Ⅱ
1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

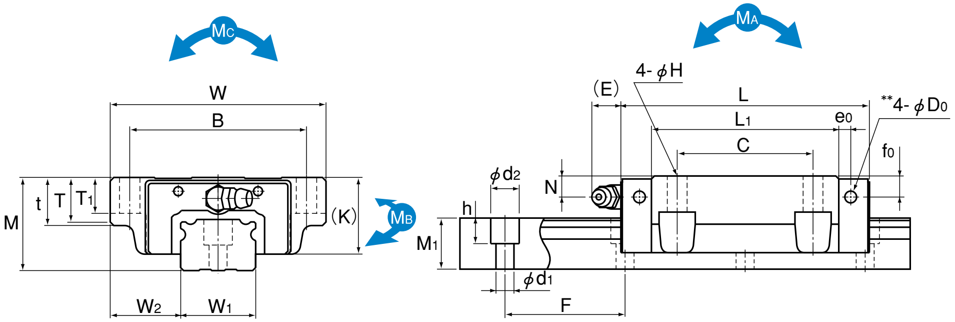
Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

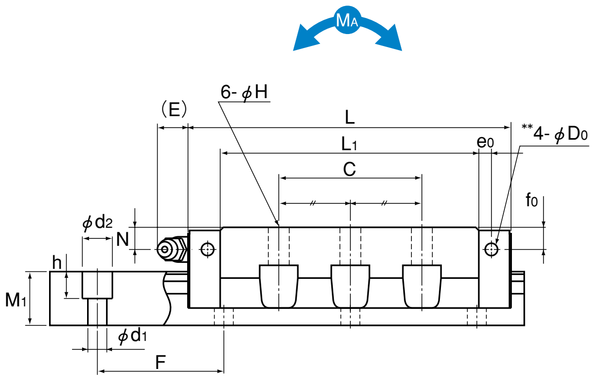
Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models NRS-B | NRS-LB



Model NRS-B



Model NRS-LB

Unit: mm

Model No.	External dimensions			LM block dimensions														LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	H	L_1	t	T	T_1	K	N	f_0	E	e_0	D_0	Grease nipple	Width W_1 $^{0}_{-0.05}$	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
NRS 25XB	31	72	82.8	59	45	7	62.4	16	14.8	12	25.5	7	7	12	4	3.9	B-M6F	25	23.5	17	40	6×9.5×8.5	25.9	59.8	0.568	2.84	0.568	2.84	0.633	0.58	3.1
NRS 25XLB			102				81.6																34.5	79.7	0.926	4.6	0.926	4.6	0.846	0.77	
NRS 30B	38	90	98	72	52	9	70.9	18	16.8	14	31	7	7	12	5	3.9	B-M6F	28	31	21	80	7×11×9	38.2	86.1	0.926	4.86	0.926	4.86	1.02	1.1	4.3
NRS 30LB			120.5				93.4																51	115	1.6	7.83	1.6	7.83	1.36	1.4	
NRS 35B	44	100	109.5	82	62	9	77.9	20	18.8	16	35	8	8	12	6	5.2	B-M6F	34	33	24.5	80	9×14×12	49.5	109	1.28	6.92	1.28	6.92	1.54	1.5	6.2
NRS 35LB			135				103.4																67.2	148	2.29	11.3	2.29	11.3	2.09	1.9	
NRS 45B	52	120	139	100	80	11	105	22	20.5	20	40.5	10	8	16	7	5.2	B-PT1/8	45	37.5	29	105	14×20×17	75.3	163	2.47	13	2.47	13	3.09	2.7	9.8
NRS 45LB			171				137																98.8	214	4.34	20.5	4.34	20.5	4.06	3.5	
NRS 55B	63	140	162.8	116	95	14	123.6	24	22.5	22	49	11	10	16	8	5.2	B-PT1/8	53	43.5	36.5	120	16×23×20	103	220	3.97	20.5	3.97	20.5	4.86	4.4	14.5
NRS 55LB			200				160.8																133	284	6.49	32	6.49	32	6.28	5.7	
NRS 65B	75	170	185.6	142	110	16	143.6	28	26	25	60	16	15	16	9	8.2	B-PT1/8	63	53.5	43	150	18×26×22	148	309	6.45	32.9	6.45	32.9	8.11	7.6	20.3
NRS 65LB			245.6				203.6																204	425	12.3	58.6	12.3	58.6	11.1	10.9	
NRS 75B	83	195	218	165	130	18	170.2	30	28	26	68	18	17	16	9	8.2	B-PT1/8	75	60	44	150	22×32×26	212	431	10.6	53.8	10.6	53.8	13.4	11.3	24.6
NRS 75LB			274				226.2																278	566	18.6	87	18.6	87	17.6	15	
NRS 85B	90	215	246.7	185	140	18	194.9	34	32	28	73	20	20	16	10	8.2	B-PT1/8	85	65	48	180	24×35×28	264	531	14.9	75.3	14.9	75.3	18.7	16.2	30.5
NRS 85LB			302.8				251																342	687	25.4	117	25.4	117	24.2	20.7	
NRS 100B	105	260	288.8	220	150	20	223.4	38	35	32	85	23	23	10	12	8.2	B-PT1/4	100	80	57	210	26×39×32	376	737	25.1	123	25.1	123	30.4	26.7	42.6
NRS 100LB			328.8		200		263.4																470	920	34.6	174	34.6	174	38.1	31.2	

Model number coding

NRS35 B 2 QZ KKHH C0 +2040L P Z- Ⅱ

1 2 3 4 5 6 7 8 9 10

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-255) 6 Radial clearance symbol (see page a-34)
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 With plate cover or steel tape**
10 No. of rails used on the same plane
**Specify the plate cover or the steel tape.

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

Note Pilot holes for side nipples** are not drilled through in order to prevent foreign matter from entering the product.
THK will mount grease nipples per your request. Therefore, do not use the side nipple pilot holes** for purposes other than mounting a grease nipple.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-261

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Models NR/NRS with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	SSHH	DDHH	ZZHH	KKHH
NR/NRS 25XR/XA/XB	82.8	82.8	90.4	89.2	96.8	100.1	107.7	102.5	110.1
NR/NRS 25XLR/XLA/XLB	102	102	109.6	108.4	116	119.3	126.9	121.7	129.3
NR/NRS 30R/A/B	98	98	107	104.4	113.4	119.3	128.3	121.7	130.7
NR/NRS 30LR/LA/LB	120.5	120.5	129.5	126.9	135.9	141.8	150.8	144.2	153.2
NR/NRS 35R/A/B	109.5	109.5	119.7	117.1	127.3	131.1	141.3	133.5	143.7
NR/NRS 35LR/LA/LB	135	135	145.2	142.6	152.8	156.6	166.8	159	169.2
NR/NRS 45R/A/B	139	139	149.2	147.4	157.6	164.4	174.6	167.6	177.8
NR/NRS 45LR/LA/LB	171	171	181.2	179.4	189.6	196.4	206.6	199.6	209.8
NR/NRS 55R/A/B	162.8	162.8	173	171.4	181.6	188.1	198.3	191.3	201.5
NR/NRS 55LR/LA/LB	200	200	210.2	208.6	218.8	225.3	235.5	228.5	238.7
NR/NRS 65R/A/B	185.6	185.6	196.2	194.2	204.8	214.9	225.5	218.1	228.7
NR/NRS 65LR/LA/LB	245.6	245.6	256.2	254.2	264.8	274.9	285.5	278.1	288.7
NR/NRS 75R/A/B	218	218	229	226.6	237.6	—	—	—	—
NR/NRS 75LR/LA/LB	274	274	285	282.6	293.6	—	—	—	—
NR/NRS 85R/A/B	246.7	246.7	257.7	256.1	267.1	—	—	—	—
NR/NRS 85LR/LA/LB	302.8	302.8	313.8	312.2	323.2	—	—	—	—
NR/NRS 100R/A/B	288.8	288.8	297.8	295.6	307.2	—	—	—	—
NR/NRS 100LR/LA/LB	328.8	328.8	337.8	335.6	347.2	—	—	—	—

Note: "—" indicates not available.

Overall LM Block Length (Dimension L) of Models NR/NRS with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
NR/NRS 25XR/XA/XB	105.2	105.2	112.8	110.9	118.5	122.5	130.1	124.9	132.5
NR/NRS 25XLR/XLA/XLB	124.4	124.4	132	130.1	137.7	141.7	149.3	144.1	151.7
NR/NRS 30R/A/B	120.4	120.4	129.4	126.1	135.1	141.7	150.7	144.1	153.1
NR/NRS 30LR/LA/LB	142.9	142.9	151.9	148.6	157.6	164.2	173.2	166.6	175.6
NR/NRS 35R/A/B	142.7	142.7	152.9	149.5	159.7	164.3	174.5	166.7	176.9
NR/NRS 35LR/LA/LB	168.2	168.2	178.4	175	185.2	189.8	200	192.2	202.4
NR/NRS 45R/A/B	172.2	172.2	182.4	179.8	190	197.6	207.8	200.8	211
NR/NRS 45LR/LA/LB	204.2	204.2	214.4	211.8	222	229.6	239.8	232.8	243
NR/NRS 55R/A/B	204.8	204.8	215	213.5	223.7	231.3	241.5	234.5	244.7
NR/NRS 55LR/LA/LB	242	242	252.2	250.7	260.9	268.5	278.7	271.7	281.9
NR/NRS 65R/A/B	227.6	227.6	238.2	236.3	246.9	258.1	268.7	261.3	271.9
NR/NRS 65LR/LA/LB	287.6	287.6	298.2	296.3	306.9	318.1	328.7	321.3	331.9

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 10

Table 10 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
NR/NRS 25	8.1
NR/NRS 30	13.4
NR/NRS 35	15.5
NR/NRS 45	23.3
NR/NRS 55	28.6
NR/NRS 65	39.6

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 12 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 12. Table 11 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for models NR-NRS

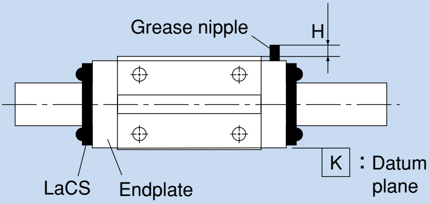


Fig. 12

Table 11

Unit: mm

Model No.	Incremental dimension with grease nipple H	Nipple type
NR/NRS 25X A/B/LA/LB	—	PB1021B
NR/NRS 25X R/LR	4.8	PB1021B
NR/NRS 30A/B/LA/LB	—	PB1021B
NR/NRS 30R/LR	4.5	PB1021B
NR/NRS 35A/B/LA/LB	—	A-M6F
NR/NRS 35R/LR	7.4	A-M6F
NR/NRS 45A/B/LA/LB	—	A-M6F
NR/NRS 45R/LR	7.4	A-M6F
NR/NRS 55A/B/LA/LB	—	A-M6F
NR/NRS 55R/LR	6.9	A-M6F
NR/NRS 65A/B/LA/LB	—	A-PT1/8
NR/NRS 65R/LR	15.3	A-PT1/8

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 12, contact THK.

For LM Guide Models with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding table of dimensions.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding NRS25 XA 2 QZ DDHH +1110L P - Ⅱ

1 2 3

1 LM Guide model number

2 QZ : with QZ Lubricator, without grease nipple
No symbol: without QZ Lubricator, with grease nipple (see Fig. 12)

3 Dust prevention accessory symbol (see page a-255)

Note 1: QZ Lubricator and LaCS are not sold alone.

Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and the grease nipple to be attached, contact THK.

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10℃ and +50℃. When using it beyond the service temperature range, contact THK.

Use in a special environment

- When using it in a special environment, contact THK.

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend applying grease or other anti-corrosion agent to the mounting base surface and the LM rail end surfaces of the LM Guide as an anti-corrosion measure.

LM Guide Model HSR

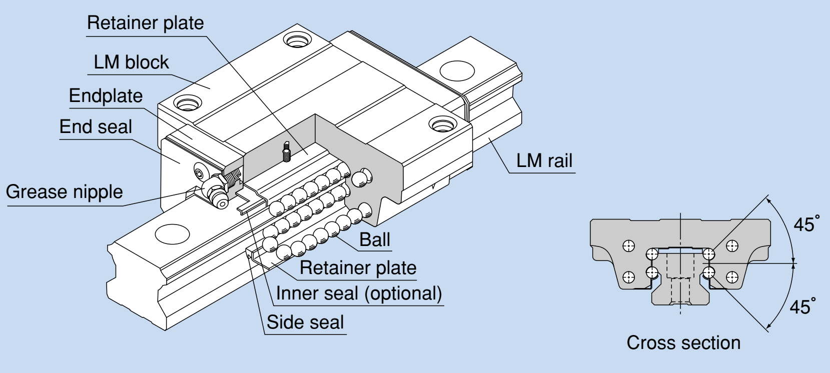


Fig. 1 Structure of Model SHS

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.

Since retainer plates hold the balls, they do not fall off even if the LM rail is pulled out (except models HSR 8, 10 and 12).

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations. In addition, the LM block can receive a well-balanced preload, increasing the rigidity in the four directions while maintaining a constant, low friction coefficient. With the low sectional height and the high rigidity design of the LM block, this model achieves highly accurate and stable linear motion.

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●High-rigidity type

Since balls are arranged in four rows in a well-balanced manner, a large preload can be applied and the rigidity in four directions can easily be increased.

●Self-adjustment capability

The self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus to achieve highly accurate, smooth linear motion.

●High durability

Even under a preload or biased load, differential slip of balls does not occur. As a result, smooth motion, high wear resistance, and long-term maintenance of accuracy are achieved.

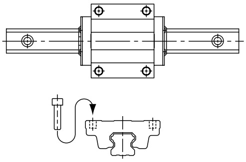
●Stainless steel type also available

A special type whose LM block, LM rail and balls are made of stainless steel is also available.

Types and Features

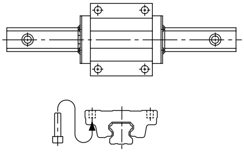
Model HSR-A

The flange of the LM block has tapped holes.



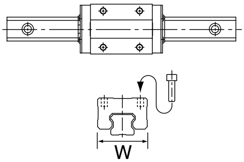
Model HSR-B

The flange of the LM block has through holes. Used in places where the table cannot have through holes for mounting bolts.

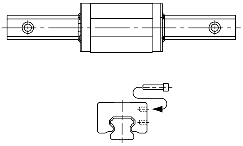


Model HSR-R

Having a smaller LM block width (W) and tapped holes, this model is optimal for compact design.



Model HSR-YR



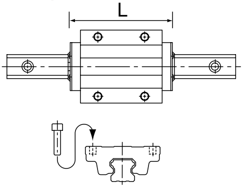
When using two units of LM Guide facing each other, the previous model required much time in machining the table and had difficulty achieving the desired accuracy and adjusting the clearance. Since Model HSR-YR has tapped holes on the side of the LM block, a simpler structure is gained and significant man-hour cutting and accuracy increase can be achieved.

Fig. 2 Conventional Structure

Fig. 3 Mounting Structure for Model HSR-YR

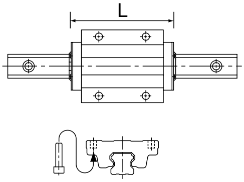
Model HSR-LA

The LM block has the same sectional shape as model HSR-A, but has a longer overall LM block length (L) and a greater rated load.



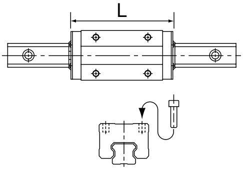
Model HSR-LB

The LM block has the same sectional shape as model HSR-B, but has a longer overall LM block length (L) and a greater rated load.



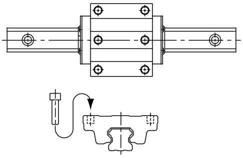
Model HSR-LR

The LM block has the same sectional shape as model HSR-R, but has a longer overall LM block length (L) and a greater rated load.



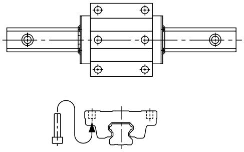
Model HSR-CA

Has six tapped holes on the LM block.



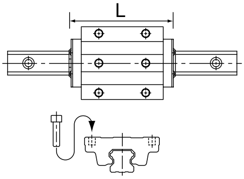
Model HSR-CB

Six-bolt type.
The LM block has six through holes. Used in places where the table cannot have through holes for mounting bolts.



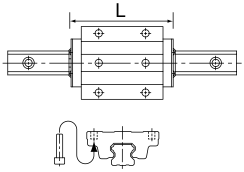
Model HSR-HA

The LM block has the same sectional shape as model HSR-CA, but has a longer overall LM block length (L) and a greater rated load.



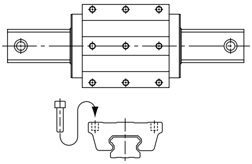
Model HSR-HB

The LM block has the same sectional shape as model HSR-CB, but has a longer overall LM block length (L) and a greater rated load.



Models HSR 100/120/150 HA/HB/HR

Large types of model HSR that can be used in large-scale machine tools and building structures.



Rated Loads in All Directions

Model HSR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for HSR.

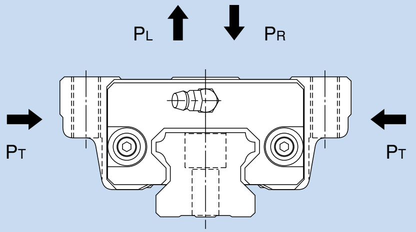


Fig. 4 Model HSR

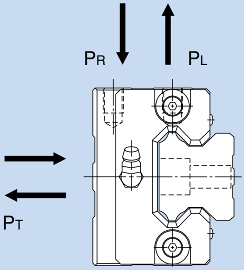


Fig. 5 Model HSR-YR

Equivalent Load

When the LM block of model HSR receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- ·Radial direction
- ·Reverse-radial direction
- ·Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model HSR.

When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see pages a-24 and a-25).

For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-306.

Table 1 Symbols of Dust Prevention Accessories for Model HSR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper
LL	With low-resistance end seal
RR	With LL seal + side seal
SSHH	With end seal + side seal + LaCS
DDHH	With double seals + side seal + LaCS
ZZHH	With end seal + side seal + metal scraper + LaCS
KKHH	With double seals + side seal + metal scraper + LaCS

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HSR … UU, refer to the corresponding value provided in table 2.

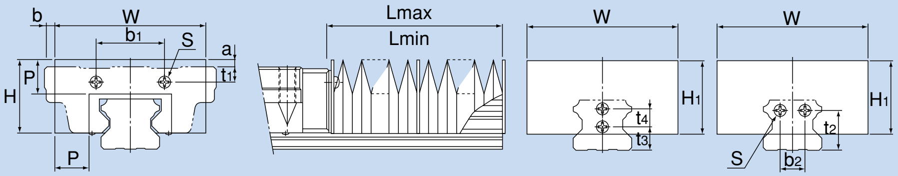
Table 2 Maximum Seal Resistance Value of Seals HSR … UU

Unit: N

Model No.	Seal resistance value
HSR 8	0.5
HSR 10	0.8
HSR 12	1.2
HSR 15	2.0
HSR 20	2.5
HSR 25	3.9
HSR 30	7.8
HSR 35	11.8
HSR 45	19.6
HSR 55	19.6
HSR 65	34.3
HSR 85	34.3

●Dedicated Bellows JH for Model HSR

The table below shows the dimensions of dedicated bellows JH for model HSR. Specify the corresponding model number of the desired bellows from the table.



Models HSR15 to 30 Models HSR35 to 85

Unit: mm

Model No.	Major dimensions																A	Supported model
	W	H	H_1	P	b_1	t_1 Type A/B	t_1 Type R	b_2	t_2	t_3	t_4	Mounting bolt S	a Type A/B	a Type R	b Type A/B	b Type R	$\left(\frac{Lmax}{Lmin}\right)$	
JH 15	55	27	30	15	25	2.5	6.5	—	—	10	—	∗M4X 8ℓ	7.5	3.5	–4	–10.5	5	HSR 15
JH 20	66	32	35	17	34	5	5	—	—	6	8	M3X 6ℓ	7	7	–1.5	–11	6	HSR 20
JH 25	78	38	38	20	30	7	11	—	—	10	8	M3X 6ℓ	8.5	4.5	–4	–15	7	HSR 25
JH 30	84	42	42	20	40	8	11	—	—	11	10	M4X 8ℓ	7	4	3	–12	7	HSR 30
JH 35	88	43	43	20	40	9	16	14	23	—	—	M4X 8ℓ	4	—	6	- 9	7	HSR 35
JH 45	100	51	51	20	58	10	20	20	29	—	—	M5X10ℓ	—	—	10	- 7	7	HSR 45
JH 55	108	54	54	20	66	11	21	26	35	—	—	M5X10ℓ	—	—	16	- 4	7	HSR 55
JH 65	132	68	68	20	80	19	19	32	42	—	—	M6X12ℓ	—	—	19	- 3	7	HSR 65
JH 85	170	88	88	30	105	23	23	44	50	—	—	M6X12ℓ	—	—	22.5	- 7	10	HSR 85

Note 1: For model JH15's location marked with "∗", mounting bolts are used only on the LM rail side while the LM block side uses M2 × 5 (nominal) tapped pins.

Note 2: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 3: For lubrication when using the dedicated bellows, contact THK.

Note 4: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding JH25-60/420

$\underbrace{\text{JH25}}_{1}-\underbrace{60/420}_{2}$

1 Model number ··· bellows for HSR25
2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)} \qquad \text{S: Stroke length (mm)}$$

$$Lmax = Lmin \cdot A \qquad \text{A: Extension rate}$$

●Dedicated Bellows DH for Model HSR

For models HSR15, 20 and 25, bellows DH, which has the following features, is also available other than the dedicated bellows JH. When desiring bellows DH, specify the corresponding model number from the table below.

Features

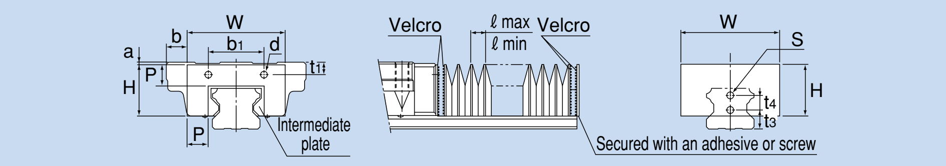
① Has a width and height smaller than the conventional product so that any part of the bellows does not stick out of the top face of the LM block. The extension rate is equal to or greater than that of the conventional type.

② Has an intermediate plate for each crest so that it will not easily lift and the bellows can be used with vertical mount, wall mount and slant mount.

③ Operable at high speed, at up to 120 m/min.

④ Since a Velcro tape can be used to install the bellows, a regular-size model can be cut to the desired length, or two or more regular-size bellows can be taped together.

⑤ Can be installed using screws just as bellows JH.
In this case, a plate (thickness: 1.6 mm) must be placed between the bellows and the LM bock. Contact THK for details.



Unit: mm

Model No.	Major dimensions																		Supported model
	W	H	P	b_1	t_1 Type A/B	t_1 Type R	t_3	t_4	d	a Type A/B	a Type R	b Type A/B	b Type R	ℓ max	ℓ min	Extension rate A	E	Factor k	
DH 15	35	19.5	8.5	25	2.5	6.5	10	—	3.5	0	4	6	–0.5	10	2.5	4	2	1.2	HSR 15
DH 20	45	25	10	34	5	5	6	8	4	0	0	9	–0.5	13	2.5	5	2	1.3	HSR 20
DH 25	52	29.5	12	30	7	11	10	8	4	0	4	9	–2	15	3	5	2	1.3	HSR 25

Note 1: For lubrication when using the dedicated bellows, contact THK.

Note 2: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding

DH20-50/250

1 DH20 2 50/250

1 Model number ··· bellows for HSR20
2 Bellows dimensions (length when compressed / length when extended)

Note: The maximum length of the bellows itself is calculated as follows.
Lmax (Lmin) = ℓ max (ℓ mim) ×200
Example of calculating bellows dimensions:
When the stroke of model SR20 is: ℓ s = 530 mm

$$L\min = \frac{\ell s}{(A-1)} = \frac{530}{4} = 132.5 \fallingdotseq 135$$

$$L\max = A \cdot L\min = 5 \times 135 = 675$$

Number of required crests n

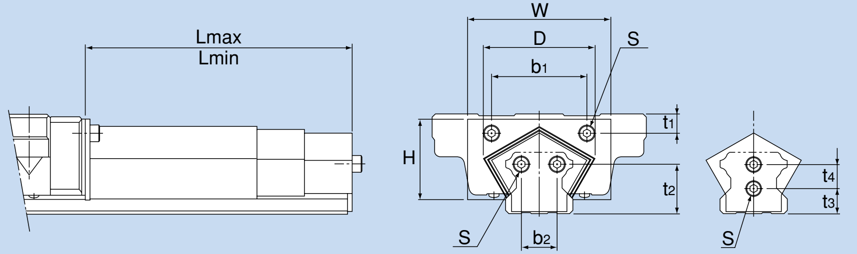
$$n = \frac{L\max}{P \cdot k} = \frac{675}{10 \times 1.3} = 51.9 \fallingdotseq 52 \text{ crests}$$

$$L\min = n \cdot \ell\min + E = 52 \times 2.5 + 2 = 132$$

(E indicates the plate thickness of 2)
Therefore, the model number of the required bellows is DH20-132/675.

●Dedicated LM Cover TPH for Model HSR

The tables below show the dimensions of dedicated LM cover TPH for model HSR. Specify the corresponding model number of the desired bellows from the table.



Models HSR25 and 30

Unit: mm

Model No.	Major dimensions									Mounting bolt S	Supported model
	W	D (max)	H	b_1	t_1	b_2	t_2	t_3	t_4		
TPH 25	55	42	28	30	7	—	—	10	8	M3× 6ℓ	HSR 25
TPH 30	60	48	34	40	8	—	—	11	10	M4× 8ℓ	HSR 30
TPH 35	70	55	38	40	9	14	23	—	—	M4× 8ℓ	HSR 35
TPH 45	90	75	48	58	10	20	29	—	—	M5×10ℓ	HSR 45
TPH 55	100	88	55	66	11	26	35	—	—	M5×10ℓ	HSR 55

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TPH 25	3	200	530	330
	3	150	380	230
	3	100	230	130
TPH 30	3	250	680	430
	3	200	530	330
	3	150	380	230
TPH 35	3	300	830	530
	3	250	680	430
	3	200	530	330
	3	150	380	230

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TPH 45	3	350	980	630
	3	300	830	530
	3	250	680	430
	3	200	530	330
TPH 55	4	400	1460	1060
	4	350	1330	980
	4	300	1060	760
	4	250	860	610

Note 1: For lubrication when using the dedicated LM cover, contact THK.

Note 2: When using the dedicated LM cover, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding **TPH55-400/1460**

1 2 3

1 Model number ··· LM cover for HSR55
2 Lmin(cover length when contracted)
3 Lmax(cover length when extended)

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

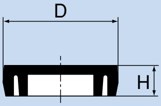
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

For the procedure for mounting the cap, see page a-22.

Table 3 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
HSR 12	C 3	M 3	6.3	1.2
HSR 15	C 4	M 4	7.8	1.0
HSR 20	C 5	M 5	9.8	2.4
HSR 25	C 6	M 6	11.4	2.7
HSR 30	C 8	M 8	14.4	3.7
HSR 35	C 8	M 8	14.4	3.7
HSR 45	C12	M12	20.5	4.7
HSR 55	C14	M14	23.5	5.7
HSR 65	C16	M16	26.5	5.7
HSR 85	C22	M22	35.5	5.7



Dedicated Cap C

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 4 (for details of QZ Lubricator, see pages a-19 and a-20).

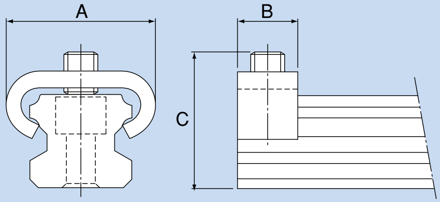
For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-307.

Table 4 Parts Symbols for Model HSR with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal
QZSS	With end seal + side seal
QZDD	With double seals + side seal
QZZZ	With end seal + side seal + metal scraper + QZ
QZKK	With double seals + side seal + metal scraper + QZ
QZSSHH	With end seal + side seal + LaCS + QZ
QZDDHH	With double seals + side seal + LaCS + QZ
QZZZHH	With end seal + side seal + metal scraper + LaCS + QZ
QZKKHH	With double seals + side seal + metal scraper + LaCS + QZ

Stopper

With miniature LM Guide models HSR8, 10 and 12, balls will fall off if the LM block is removed from the LM rail. To prevent the LM block from being pulled out, end pieces are mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.



Unit: mm

Model No.	A	B	C
HSR 8	12.5	6	10
HSR 10	15	6	11
HSR 12	18.5	7	16

Semi-standard Greasing Hole

For model HSR, a semi-standard greasing hole is available. Specify the appropriate model number according to the application.

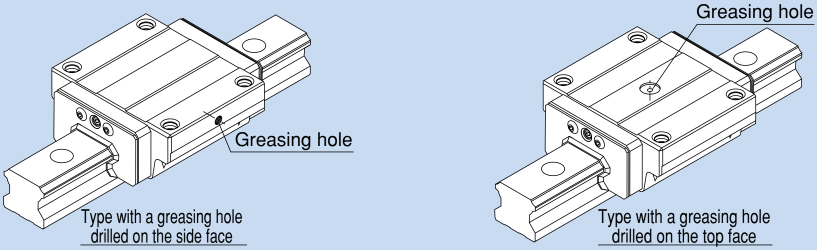
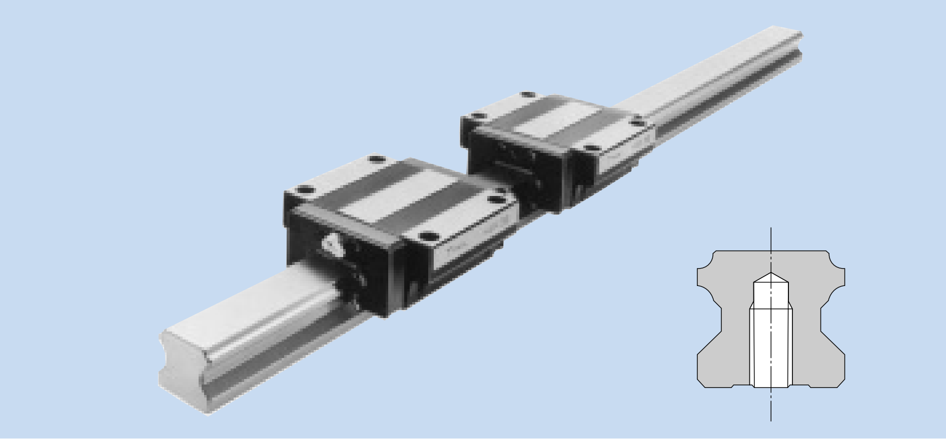


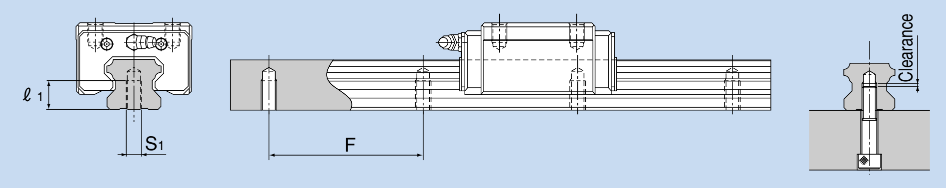
Fig. 6

Contact THK for details.

Tapped LM Rail Type of Model HSR

The model HSR variations include a type with its LM rail bottom tapped. This type is useful when desiring to mount the LM Guide from the bottom of the base and when desiring to increase the dust prevention effect.





① Determine the bolt length so that a clearance of 2 to 5 mm is secured between the bolt end and the bottom of the tap (effective tap depth) (see figure above).

② A tapped LM rail type is available also for model HSR-YR.

③ For standard pitches of the taps, see table 6 on page a-289.

Table 5 Dimensions of the LM Rail Tap

Unit: mm

Model No.	S_1	Effective tap depth ℓ_1
HSR 15	M5	8
HSR 20	M6	10
HSR 25	M6	12
HSR 30	M8	15
HSR 35	M8	17
HSR 45	M12	24
HSR 55	M14	24
HSR 65	M20	30

Model number coding HSR30 A2UU+1000LH K

1

1 Symbol for tapped LM rail type

Standard Length and Maximum Length of the LM Rail

Table 6 shows the standard lengths and the maximum lengths of model HSR variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

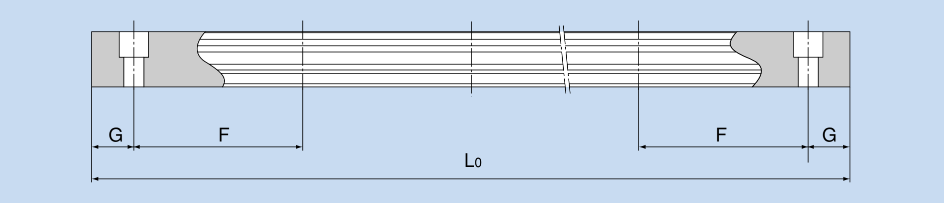


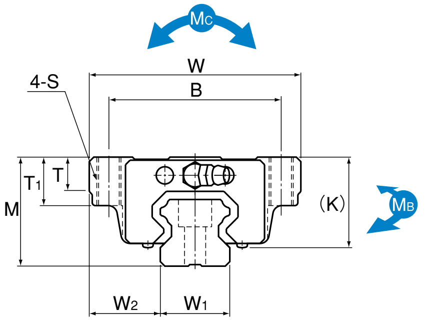
Table 6 Standard Length and Maximum Length of the LM Rail for Model HSR

Unit: mm

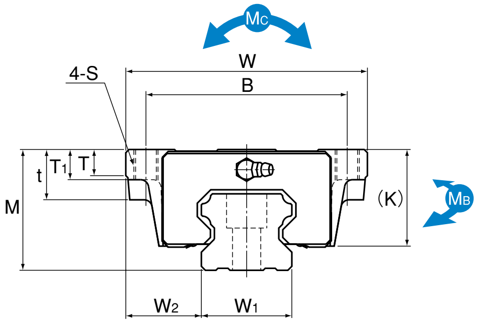
Model No.	HSR 8	HSR 10	HSR 12	HSR 15	HSR 20	HSR 25	HSR 30	HSR 35	HSR 45	HSR 55	HSR 65	HSR 85	HSR 100	HSR 120	HSR 150
Standard LM rail length (L_0)	35	45	70	160	220	220	280	280	570	780	1270	1530	1340	1470	1600
	55	70	110	220	280	280	360	360	675	900	1570	1890	1760	1930	2100
	75	95	150	280	340	340	440	440	780	1020	2020	2250	2180	2390	2350
	95	120	190	340	400	400	520	520	885	1140	2620	2610	2600		
	115	145	230	400	460	460	600	600	990	1260					
	135	170	270	460	520	520	680	680	1095	1380					
	155	195	310	520	580	580	760	760	1200	1500					
	175	220	350	580	640	640	840	840	1305	1620					
	195	245	390	640	700	700	920	920	1410	1740					
	215	270	430	700	760	760	1000	1000	1515	1860					
	235	295	470	760	820	820	1080	1080	1620	1980					
	255	320	510	820	940	940	1160	1160	1725	2100					
	275	345	550	940	1000	1000	1240	1240	1830	2220					
		370	590	1000	1060	1060	1320	1320	1935	2340					
		395	630	1060	1120	1120	1400	1400	2040	2460					
		420	670	1120	1180	1180	1480	1480	2145	2580					
		445		1180	1240	1240	1560	1560	2250	2700					
		470		1240	1360	1300	1640	1640	2355	2820					
				1360	1480	1360	1720	1720	2460	2940					
				1480	1600	1420	1800	1800	2565	3060					
				1600	1720	1480	1880	1880	2670						
					1840	1540	1960	1960	2775						
					1960	1600	2040	2040	2880						
					2080	1720	2200	2200	2985						
					2200	1840	2360	2360	3090						
						1960	2520	2520							
						2080	2680	2680							
						2200	2840	2840							
						2320	3000	3000							
						2440									
Standard pitch F	20	25	40	60	60	60	80	80	105	120	150	180	210	230	250
G	7.5	10	15	20	20	20	20	20	22.5	30	35	45	40	45	50
Max length	(275)	(470)	(670)	2500 (1240)	3000 (1480)	3000 (2020)	3000 (2520)	3000 (2520)	3090	3060	3000	3000	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.
Note 3: The figures in the parentheses indicate the maximum lengths of stainless steel made models.

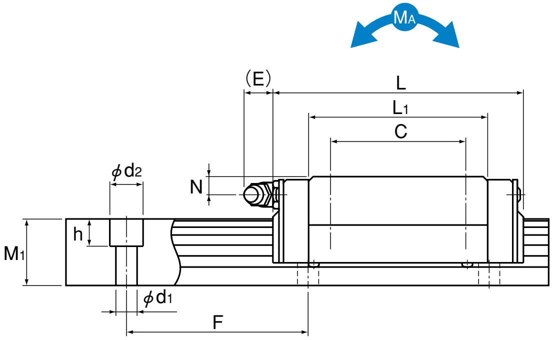
Models HSR-A | HSR-AM
Models HSR-LA | HSR-LAM



Models HSR15 to 35A/LA/AM/LAM



Models HSR45 to 85A/LA



Unit: mm

Model No.	External dimensions Height M	Width W	Length L	LM block dimensions B	C	S	L₁	t	T	T₁	K	N	E	Grease nipple	LM rail dimensions Width W₁ ±0.05	W₂	Height M₁	Pitch F	d₁×d₂×h	Basic load rating C kN	C₀ kN	Static permissible moment kN-m* MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	Mass LM block kg	LM rail kg/m
HSR 15A HSR 15AM	24	47	56.6	38	30	M5	38.8	—	7	11	19.3	4.3	5.5	PB1021B	15	16	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20A HSR 20AM	30	63	74	53	40	M6	50.8	—	10	9.5	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 20LA HSR 20LAM	30	63	90	53	40	M6	66.8	—	10	9.5	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	21.3	31.8	0.323	1.66	0.323	1.66	0.27	0.47	2.3
HSR 25A HSR 25AM	36	70	83.1	57	45	M8	59.5	—	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 25LA HSR 25LAM	36	70	102.2	57	45	M8	78.6	—	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	27.2	45.9	0.529	2.74	0.529	2.74	0.459	0.75	3.3
HSR 30A HSR 30AM	42	90	98	72	52	M10	70.4	—	9	18	35	7	12	B-M6F	28	31	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	1.1	4.8
HSR 30LA HSR 30LAM	42	90	120.6	72	52	M10	93	—	9	18	35	7	12	B-M6F	28	31	26	80	9×14×12	37.3	62.5	0.889	4.37	0.889	4.37	0.751	1.3	4.8
HSR 35A HSR 35AM	48	100	109.4	82	62	M10	80.4	—	12	21	40.5	8	12	B-M6F	34	33	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6
HSR 35LA HSR 35LAM	48	100	134.8	82	62	M10	105.8	—	12	21	40.5	8	12	B-M6F	34	33	29	80	9×14×12	50.2	81.5	1.32	6.35	1.32	6.35	1.2	2	6.6
HSR 45A HSR 45LA	60	120	139 170.8	100	80	M12	98 129.8	25	13	15	50	10	16	B-PT1/8	45	37.5	38	105	14×20×17	60 80.4	95.6 127	1.42 2.44	7.92 12.6	1.42 2.44	7.92 12.6	1.83 2.43	2.8 3.3	11
HSR 55A HSR 55LA	70	140	163 201.1	116	95	M14	118 156.1	29	13.5	17	57	11	16	B-PT1/8	53	43.5	44	120	16×23×20	88.5 119	137 183	2.45 4.22	13.2 21.3	2.45 4.22	13.2 21.3	3.2 4.28	4.5 5.7	15.1
HSR 65A HSR 65LA	90	170	186 245.5	142	110	M16	147 206.5	37	21.5	23	76	19	16	B-PT1/8	63	53.5	53	150	18×26×22	141 192	215 286	4.8 8.72	23.5 40.5	4.8 8.72	23.5 40.5	5.82 7.7	8.5 10.7	22.5
HSR 85A HSR 85LA	110	215	245.6 303	185	140	M20	178.6 236	55	28	30	94	23	16	B-PT1/8	85	65	65	180	24×35×28	210 282	310 412	8.31 14.2	45.6 72.5	8.31 14.2	45.6 72.5	11 14.7	17 23	35.2

Model number coding HSR25 A 2 QZ UU C0 M +1200L P M-Ⅱ

HSR25	A	2	QZ	UU	C0	M	+1200L	P	M-	Ⅱ
1	2	3	4	5	6	7	8	9	10	11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-282) 6 Radial clearance symbol (see page a-33)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

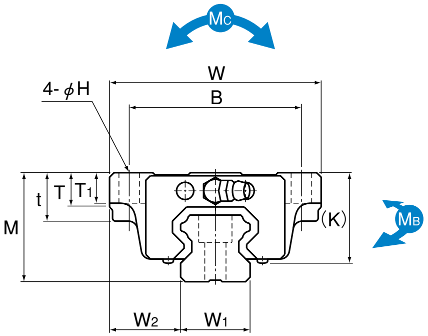
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

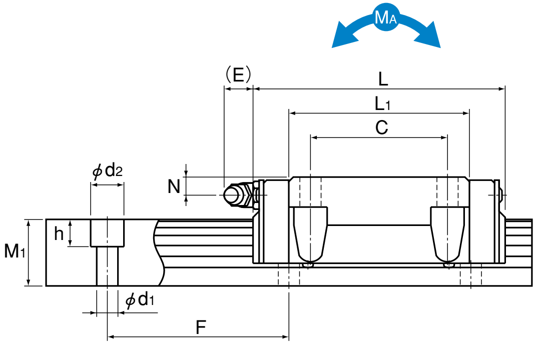
Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HSR-B | HSR-BM
Models HSR-LB | HSR-LBM





Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	H	L1	t	T	T1	K	N	E		W1 ±0.05	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 15B HSR 15BM	24	47	56.6	38	30	4.5	38.8	11	7	7	19.3	4.3	5.5	PB1021B	15	16	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20B HSR 20BM	30	63	74	53	40	6	50.8	10	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 20LB HSR 20LBM	30	63	90	53	40	6	66.8	10	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	21.3	31.8	0.323	1.66	0.323	1.66	0.27	0.47	2.3
HSR 25B HSR 25BM	36	70	83.1	57	45	7	59.5	16	11	10	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 25LB HSR 25LBM	36	70	102.2	57	45	7	78.6	16	11	10	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	27.2	45.9	0.529	2.74	0.529	2.74	0.459	0.75	3.3
HSR 30B HSR 30BM	42	90	98	72	52	9	70.4	18	9	10	35	7	12	B-M6F	28	31	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	1.1	4.8
HSR 30LB HSR 30LBM	42	90	120.6	72	52	9	93	18	9	10	35	7	12	B-M6F	28	31	26	80	9×14×12	37.3	62.5	0.889	4.37	0.889	4.37	0.751	1.3	4.8
HSR 35B HSR 35BM	48	100	109.4	82	62	9	80.4	21	12	13	40.5	8	12	B-M6F	34	33	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6
HSR 35LB HSR 35LBM	48	100	134.8	82	62	9	105.8	21	12	13	40.5	8	12	B-M6F	34	33	29	80	9×14×12	50.2	81.5	1.32	6.35	1.32	6.35	1.2	2	6.6
HSR 45B HSR 45LB	60	120	139 170.8	100	80	11	98 129.8	25	13	15	50	10	16	B-PT1/8	45	37.5	38	105	14×20×17	60 80.4	95.6 127	1.42 2.44	7.92 12.6	1.42 2.44	7.92 12.6	1.83 2.43	2.8 3.3	11
HSR 55B HSR 55LB	70	140	163 201.1	116	95	14	118 156.1	29	13.5	17	57	11	16	B-PT1/8	53	43.5	44	120	16×23×20	88.5 119	137 183	2.45 4.22	13.2 21.3	2.45 4.22	13.2 21.3	3.2 4.28	4.5 5.7	15.1
HSR 65B HSR 65LB	90	170	186 245.5	142	110	16	147 206.5	37	21.5	23	76	19	16	B-PT1/8	63	53.5	53	150	18×26×22	141 192	215 286	4.8 8.72	23.5 40.5	4.8 8.72	23.5 40.5	5.82 7.7	8.5 10.7	22.5
HSR 85B HSR 85LB	110	215	245.6 303	185	140	18	178.6 236	55	28	30	94	23	16	B-PT1/8	85	65	65	180	24×35×28	210 282	310 412	8.31 14.2	45.6 72.5	8.31 14.2	45.6 72.5	11 14.7	17 23	35.2

Model number coding HSR25 B 2 QZ UU C0 M +1200L P M-Ⅱ

1 2 3 4 5 6 7 8 9 10 11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-282) 6 Radial clearance symbol (see page a-33)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

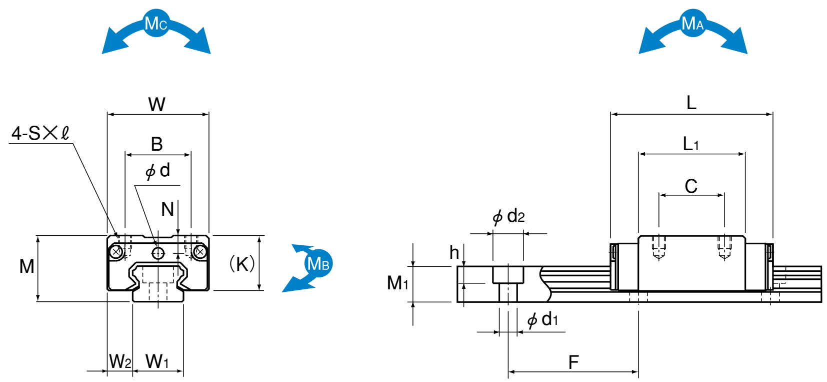
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

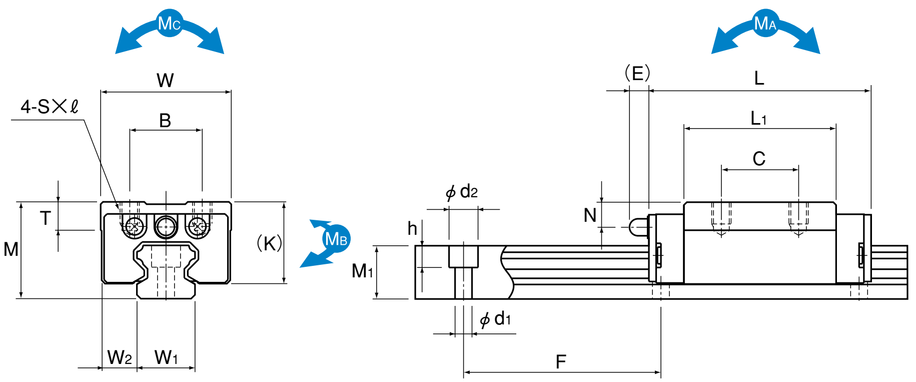
Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Model HSR-RM



Models HSR8RM and 10RM



Model HSR12RM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width		Height	Pitch				MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	E	d		W1 ±0.05	W2	M1	F	d1×d2×h	C kN	C0 kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 8RM	11	16	24	10	10	M2×2.5	15	—	8.9	2.6	—	2.2	—	8	4	6	20	2.4×4.2×2.3	1.08	2.16	0.00492	0.0319	0.00492	0.0319	0.00727	0.012	0.3
HSR 10RM	13	20	31	13	12	M2.6×2.5	20.1	—	10.8	3.5	—	2.5	—	10	5	7	25	3.5×6×3.3	1.96	3.82	0.0123	0.0716	0.0123	0.0716	0.0162	0.025	0.45
HSR 12RM	20	27	45	15	15	M4×4.5	30.5	6	16.9	5.2	4	—	PB107	12	7.5	11	40	3.5×6×4.5	4.7	8.53	0.0409	0.228	0.0409	0.228	0.0445	0.08	0.83

Note Stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR12 R 2 UU C1 M +670L H M- II
1 2 3 4 5 6 7 8 9 10

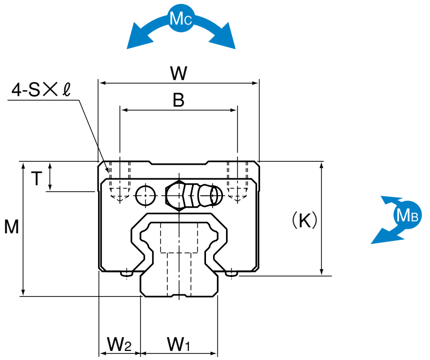
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-282) 5 Radial clearance symbol (see page a-33)
6 LM block is made of stainless steel 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 LM rail is made of stainless steel 10 No. of rails used on the same plane

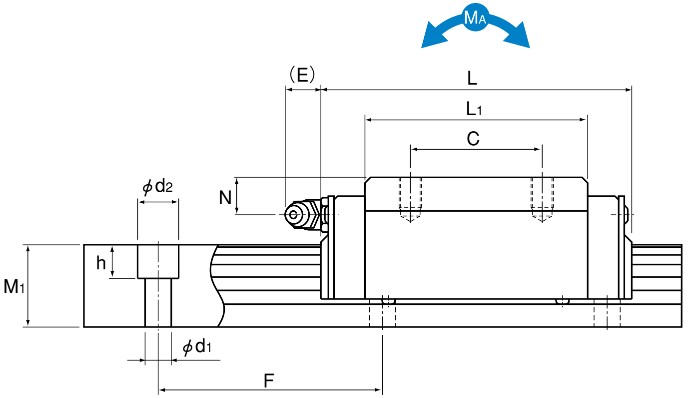
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HSR-R | HSR-RM
Models HSR-LR | HSR-LRM





Unit: mm

Model No.	External dimensions			LM block dimensions									LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length									Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S×ℓ	L_1	T	K	N	E							kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 15R HSR 15RM	28	34	56.6	26	26	M4×5	38.8	6	23.3	8.3	5.5	PB1021B	15	9.5	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.18	1.5
HSR 20R HSR 20RM	30	44	74	32	36	M5×6	50.8	8	26	5	12	B-M6F	20	12	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.25	2.3
HSR 20LR HSR 20LRM	30	44	90	32	50	M5×6	66.8	8	26	5	12	B-M6F	20	12	18	60	6×9.5×8.5	21.3	31.8	0.323	1.66	0.323	1.66	0.27	0.35	2.3
HSR 25R HSR 25RM	40	48	83.1	35	35	M6×8	59.5	9	34.5	10	12	B-M6F	23	12.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.54	3.3
HSR 25LR HSR 25LRM	40	48	102.2	35	50	M6×8	78.6	9	34.5	10	12	B-M6F	23	12.5	22	60	7×11×9	27.2	45.9	0.529	2.74	0.529	2.74	0.459	0.67	3.3
HSR 30R HSR 30RM	45	60	98	40	40	M8×10	70.4	9	38	10	12	B-M6F	28	16	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	0.9	4.8
HSR 30LR HSR 30LRM	45	60	120.6	40	60	M8×10	93	9	38	10	12	B-M6F	28	16	26	80	9×14×12	37.3	62.5	0.889	4.37	0.889	4.37	0.751	1.1	4.8
HSR 35R HSR 35RM	55	70	109.4	50	50	M8×12	80.4	11.7	47.5	15	12	B-M6F	34	18	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.5	6.6
HSR 35LR HSR 35LRM	55	70	134.8	50	72	M8×12	105.8	11.7	47.5	15	12	B-M6F	34	18	29	80	9×14×12	50.2	81.5	1.32	6.35	1.32	6.35	1.2	2	6.6
HSR 45R HSR 45LR	70	86	139 170.8	60	60 80	M10×17	98 129.8	15	60	20	16	B-PT1/8	45	20.5	38	105	14×20×17	60 80.4	95.6 127	1.42 2.44	7.92 12.6	1.42 2.44	7.92 12.6	1.83 2.43	2.6 3.1	11
HSR 55R HSR 55LR	80	100	163 201.1	75	75 95	M12×18	118 156.1	20.5	67	21	16	B-PT1/8	53	23.5	44	120	16×23×20	88.5 119	137 183	2.45 4.22	13.2 21.3	2.45 4.22	13.2 21.3	3.2 4.28	4.3 5.4	15.1
HSR 65R HSR 65LR	90	126	186 245.5	76	70 120	M16×20	147 206.5	23	76	19	16	B-PT1/8	63	31.5	53	150	18×26×22	141 192	215 286	4.8 8.72	23.5 40.5	4.8 8.72	23.5 40.5	5.82 7.7	7.3 9.3	22.5
HSR 85R HSR 85LR	110	156	245.6 303	100	80 140	M18×25	178.6 236	29	94	23	16	B-PT1/8	85	35.5	65	180	24×35×28	210 282	310 412	8.31 14.2	45.6 72.5	8.31 14.2	45.6 72.5	11 14.7	13 16	35.2

Model number coding

HSR35 R 2 QZ SS C0 M +1400L P M-Ⅱ
1 2 3 4 5 6 7 8 9 10 11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-282) 6 Radial clearance symbol (see page a-33)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

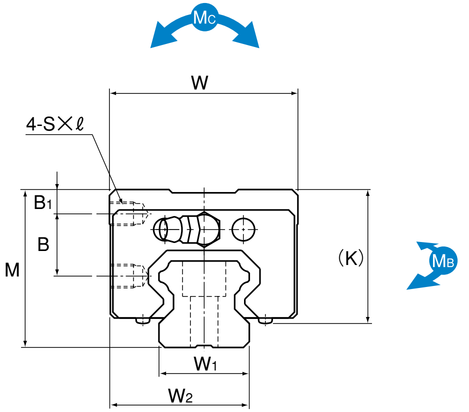
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

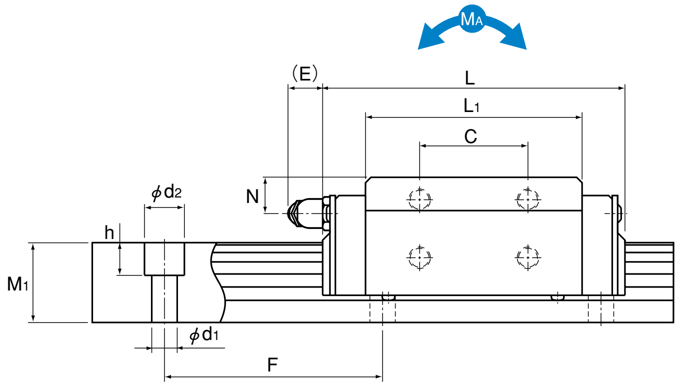
Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HSR-YR | HSR-YRM





Unit: mm

Model No.	External dimensions			LM block dimensions									LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B_1	B	C	S×ℓ	L_1	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	d_1×d_2×h	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
HSR 15YR HSR 15YRM	28	33.5	56.6	4.3	11.5	18	M4×5	38.8	23.3	8.3	5.5	PB1021B	15	24	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.18	1.5
HSR 20YR HSR 20YRM	30	43.5	74	4	11.5	25	M5×6	50.8	26	5	12	B-M6F	20	31.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.25	2.3
HSR 25YR HSR 25YRM	40	47.5	83.1	6	16	30	M6×6	59.5	34.5	10	12	B-M6F	23	35	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.54	3.3
HSR 30YR HSR 30YRM	45	59.5	98	8	16	40	M6×9	70.4	38	10	12	B-M6F	28	43.5	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	0.9	4.8
HSR 35YR HSR 35YRM	55	69.5	109.4	8	23	43	M8×10	80.4	47	15	12	B-M6F	34	51.5	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.5	6.6
HSR 45YR	70	85.5	139	10	30	55	M10×14	98	60	20	16	B-PT1/8	45	65	38	105	14×20×17	60	95.6	1.42	7.92	1.42	7.92	1.83	2.6	11
HSR 55YR	80	99.5	163	12	32	70	M12×15	118	67	21	16	B-PT1/8	53	76	44	120	16×23×20	88.5	137	2.45	13.2	2.45	13.2	3.2	4.3	15.1
HSR 65YR	90	124.5	186	12	35	85	M16×22	147	76	19	16	B-PT1/8	63	93	53	150	18×26×22	141	215	4.8	23.5	4.8	23.5	5.82	7.3	22.5

Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR25 YR 2 UU C0 M +1200L P M-Ⅱ
1 2 3 4 5 6 7 8 9 10

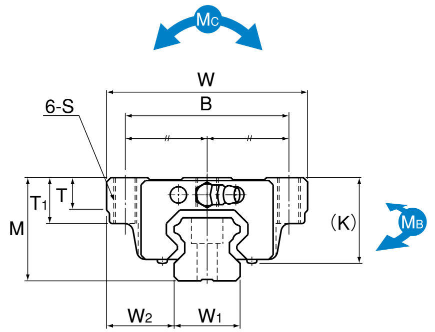
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-282) 5 Radial clearance symbol (see page a-33)
6 LM block is made of stainless steel 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 LM rail is made of stainless steel 10 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

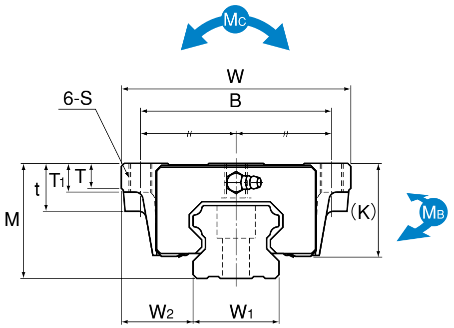
Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

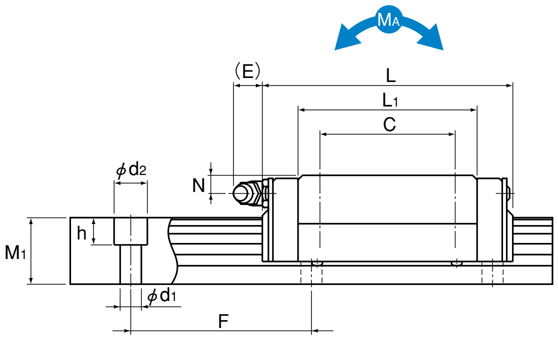
Models HSR-CA | HSR-CAM
Models HSR-HA | HSR-HAM



Models HSR20 to 35CA/HA/CAM/HAM



Models HSR45 to 85CA/HA



Unit: mm

Model No.	External dimensions Height	External dimensions Width	External dimensions Length	LM block dimensions										Grease nipple	LM rail dimensions Width		Height	Pitch		Basic load rating C	Basic load rating C₀	Static permissible moment kN-m* M_A		M_B		M_C	Mass LM block	Mass LM rail
	M	W	L	B	C	S	L_1	t	T	T_1	K	N	E		W_1 ±0.05	W_2	M_1	F	$d_1 \times d_2 \times h$	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 20CA HSR 20CAM	30	63	74	53	40	M6	50.8	—	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 20HA HSR 20HAM	30	63	90	53	40	M6	66.8	—	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	21.3	31.8	0.323	1.66	0.323	1.66	0.27	0.47	2.3
HSR 25CA HSR 25CAM	36	70	83.1	57	45	M8	59.5	—	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 25HA HSR 25HAM	36	70	102.2	57	45	M8	78.6	—	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	27.2	45.9	0.529	2.74	0.529	2.74	0.459	0.75	3.3
HSR 30CA HSR 30CAM	42	90	98	72	52	M10	70.4	—	9	18	35	7	12	B-M6F	28	31	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	1.1	4.8
HSR 30HA HSR 30HAM	42	90	120.6	72	52	M10	93	—	9	18	35	7	12	B-M6F	28	31	26	80	9×14×12	37.3	62.5	0.889	4.37	0.889	4.37	0.751	1.3	4.8
HSR 35CA HSR 35CAM	48	100	109.4	82	62	M10	80.4	—	12	21	40.5	8	12	B-M6F	34	33	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6
HSR 35HA HSR 35HAM	48	100	134.8	82	62	M10	105.8	—	12	21	40.5	8	12	B-M6F	34	33	29	80	9×14×12	50.2	81.5	1.32	6.35	1.32	6.35	1.2	2	6.6
HSR 45CA HSR 45HA	60	120	139 170.8	100	80	M12	98 129.8	25	13	15	50	10	16	B-PT1/8	45	37.5	38	105	14×20×17	60 80.4	95.6 127	1.42 2.44	7.92 12.6	1.42 2.44	7.92 12.6	1.83 2.43	2.8 3.3	11
HSR 55CA HSR 55HA	70	140	163 201.1	116	95	M14	118 156.1	29	13.5	17	57	11	16	B-PT1/8	53	43.5	44	120	16×23×20	88.5 119	137 183	2.45 4.22	13.2 21.3	2.45 4.22	13.2 21.3	3.2 4.28	4.5 5.7	15.1
HSR 65CA HSR 65HA	90	170	186 245.5	142	110	M16	147 206.5	37	21.5	23	76	19	16	B-PT1/8	63	53.5	53	150	18×26×22	141 192	215 286	4.8 8.72	23.5 40.5	4.8 8.72	23.5 40.5	5.82 7.7	8.5 10.7	22.5
HSR 85CA HSR 85HA	110	215	245.6 303	185	140	M20	178.6 236	55	28	30	94	23	16	B-PT1/8	85	65	65	180	24×35×28	210 282	310 412	8.31 14.2	45.6 72.5	8.31 14.2	45.6 72.5	11 14.7	17 23	35.2

Model number coding HSR25 HA 2 QZ KKHH C0 M +1300L P M-Ⅱ

1 2 3 4 5 6 7 8 9 10 11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-282) 6 Radial clearance symbol (see page a-33)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

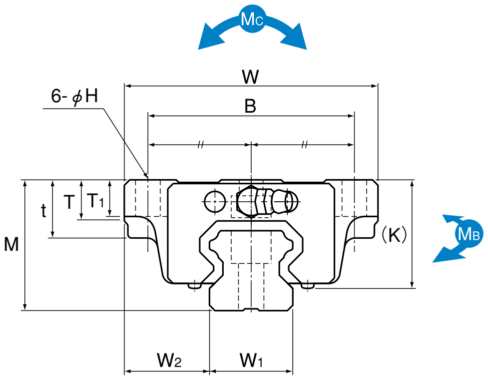
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

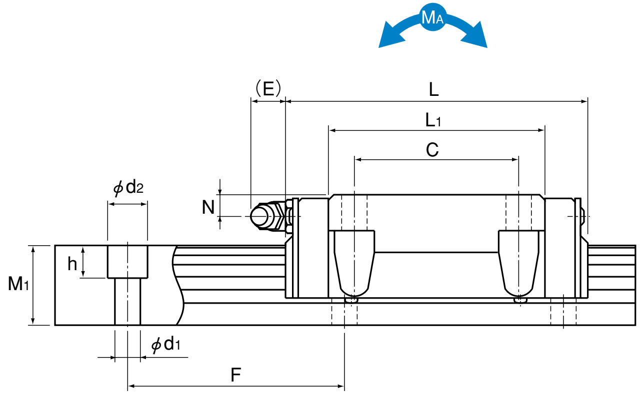
Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HSR-CB | HSR-CBM
Models HSR-HB | HSR-HBM





Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple	Width W1 ±0.05	W2	Height M1	Pitch F	d1×d2×h	C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	H	L1	t	T	T1	K	N	E							kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 20CB HSR 20CBM	30	63	74	53	40	6	50.8	10	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 20HB HSR 20HBM	30	63	90	53	40	6	66.8	10	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	21.3	31.8	0.323	1.66	0.323	1.66	0.27	0.47	2.3
HSR 25CB HSR 25CBM	36	70	83.1	57	45	7	59.5	16	11	10	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 25HB HSR 25HBM	36	70	102.2	57	45	7	78.6	16	11	10	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	27.2	45.9	0.529	2.74	0.529	2.74	0.459	0.75	3.3
HSR 30CB HSR 30CBM	42	90	98	72	52	9	70.4	18	9	10	35	7	12	B-M6F	28	31	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	1.1	4.8
HSR 30HB HSR 30HBM	42	90	120.6	72	52	9	93	18	9	10	35	7	12	B-M6F	28	31	26	80	9×14×12	37.3	62.5	0.889	4.37	0.889	4.37	0.751	1.3	4.8
HSR 35CB HSR 35CBM	48	100	109.4	82	62	9	80.4	21	12	13	40	8	12	B-M6F	34	33	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6
HSR 35HB HSR 35HBM	48	100	134.8	82	62	9	105.8	21	12	13	40	8	12	B-M6F	34	33	29	80	9×14×12	50.2	81.5	1.32	6.35	1.32	6.35	1.2	2	6.6
HSR 45CB HSR 45HB	60	120	139 170.8	100	80	11	98 129.8	25	13	15	50	10	16	B-PT1/8	45	37.5	38	105	14×20×17	60 80.4	95.6 127	1.42 2.44	7.92 12.6	1.42 2.44	7.92 12.6	1.83 2.43	2.8 3.3	11
HSR 55CB HSR 55HB	70	140	163 201.1	116	95	14	118 156.1	29	13.5	17	57	11	16	B-PT1/8	53	43.5	44	120	16×23×20	88.5 119	137 183	2.45 4.22	13.2 21.3	2.45 4.22	13.2 21.3	3.2 4.28	4.5 5.7	15.1
HSR 65CB HSR 65HB	90	170	186 245.5	142	110	16	147 206.5	37	21.5	23	76	19	16	B-PT1/8	63	53.5	53	150	18×26×22	141 192	215 286	4.8 8.72	23.5 40.5	4.8 8.72	23.5 40.5	5.82 7.7	8.5 10.7	22.5
HSR 85CB HSR 85HB	110	215 110	245.6 303	185	140	18	178.6 236	55	28	30	94	23	16	B-PT1/8	85	65	65	180	24×35×28	210 282	310 412	8.31 14.2	45.6 72.5	8.31 14.2	45.6 72.5	11 14.7	17 23	35.2

Model number coding HSR35 CB 2 QZ ZZHH C0 M +1400L P M- Ⅱ

1 2 3 4 5 6 7 8 9 10 11

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail 4 With QZ Lubricator
5 Dust prevention accessory symbol (see page a-282) 6 Radial clearance symbol (see page a-33)
7 LM block is made of stainless steel 8 LM rail length (in mm) 9 Accuracy symbol (see page a-38)
10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).
Those models equipped with QZ Lubricator cannot have a grease nipple.

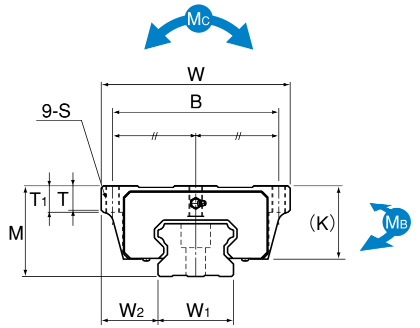
Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

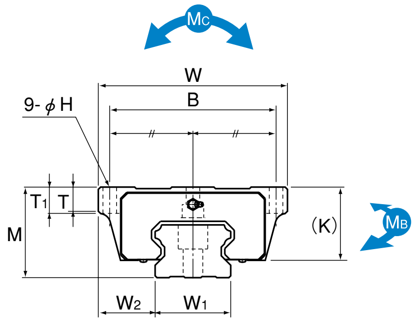
Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

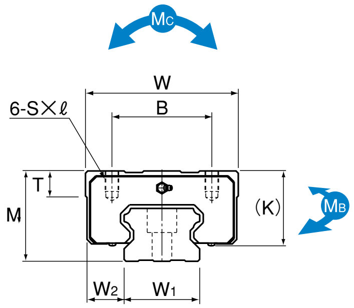
Models HSR-HA | HSR-HB HSR-HR



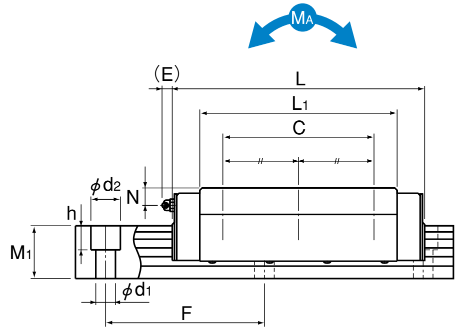
Models HSR100 to 150HA



Models HSR100 to 150HB



Models HSR100 to 150 HR



Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	H	S×ℓ	L₁	T	T₁	K	N	E	Grease nipple	Width W₁ ±0.05	W₂	Height M₁	Pitch F	d₁×d₂×h	C kN	C₀ kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	Mc 1 block	LM block kg	LM rail kg/m
HSR 100HA	120	250	334	220	200	—	M18 **	261	32	35	100	23	16	B-PT1/4	100	75	70	210	26×39×32	351	506	19.4	98.2	19.4	98.2	22.4	32	49
HSR 100HB		250		220		20	—		32	35						75												
HSR 100HR		200		130		—	M18×27		33	—						50												
HSR 120HA	130	290	365	250	210	—	M20 **	287	34	38	110	26.5	16	B-PT1/4	114	88	75	230	33×48×43	429	612	25.9	129	25.9	129	31.1	43	61
HSR 120HB		290		250		22	—		34	38						88												
HSR 120HR		220		146		—	M20×30		33.7	—						53												
HSR 150HA	145	350	396	300	230	—	M24 **	314	36	40	123	29	16	B-PT1/4	144	103	85	250	39×58×46	518	728	33.6	167	33.6	167	45.2	62	87
HSR 150HB		350		300		26	—		36	40						103												
HSR 150HR		266		180		—	M24×35		33	—						61												

Note "**" indicates a through hole.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR150 HR 2 UU C1 +2350L H- Ⅱ
1 2 3 4 5 6 7 8

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-282) 5 Radial clearance symbol (see page a-33)
6 LM rail length (in mm) 7 Accuracy symbol (see page a-38) 8 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-289

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model HSR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	LL	RR	SSHH	DDHH	ZZHH	KKHH
HSR 8RM	24	—	—	—	—	—	—	—	—	—	—
HSR 10RM	31	—	—	—	—	—	—	—	—	—	—
HSR 12RM	45	—	—	—	—	—	—	—	—	—	—
HSR 15A/B/R/YR	56.6	56.6	61.8	58.2*	63.4*	56.6	56.6	76	81.2	77.2	82.4
HSR 20A/B/R/CA/CB/YR	74	74	80.6	76.6	83.2	74	74	92	98.6	95.2	101.8
HSR 20LA/LB/LR/HA/HB	90	90	96.6	92.6	99.2	90	90	108	114.6	111.2	117.8
HSR 25A/B/R/CA/CB/YR	83.1	83.1	90.7	86.7	94.3	83.1	83.1	101	108.6	105.3	112.9
HSR 25LA/LB/LR/HA/HB	102.2	102.2	109.8	105.8	113.4	102.2	102.2	120.1	127.7	124.4	132
HSR 30A/B/R/CA/CB/YR	98	98	105.6	101.6	109.2	98	98	119.9	127.5	124.2	131.8
HSR 30LA/LB/LR/HA/HB	120.6	120.6	128.2	124.2	131.8	120.6	120.6	142.5	150.1	146.8	154.4
HSR 35A/B/R/CA/CB/YR	109.4	109.4	117	113	120.6	109.4	109.4	132.4	140	135.6	143.2
HSR 35LA/LB/LR/HA/HB	134.8	134.8	142.4	138.4	146	134.8	134.8	157.8	165.4	161	168.6
HSR 45A/B/R/CA/CB/YR	139	139	146.2	144.2	151.4	139	139	—	—	—	—
HSR 45LA/LB/LR/HA/HB	170.8	170.8	178	176	183.2	170.8	170.8	—	—	—	—
HSR 55A/B/R/CA/CB/YR	163	163	170.2	168.2	175.4	163	163	—	—	—	—
HSR 55LA/LB/LR/HA/HB	201.1	201.1	208.3	206.3	213.5	201.1	201.1	—	—	—	—
HSR 65A/B/R/CA/CB/YR	186	186	193.2	191.2	198.4	186	186	—	—	—	—
HSR 65LA/LB/LR/HA/HB	245.5	245.5	252.7	250.7	257.9	245.5	245.5	—	—	—	—
HSR 85A/B/R/CA/CB/YR	245.6	245.6	252.8	252.4	259.6	—	—	—	—	—	—
HSR 85LA/LB/LR/HA/HB	303	303	310.2	309.8	317	—	—	—	—	—	—
HSR 100HA/HB/HR	334	334	—	—	—	—	—	—	—	—	—
HSR 120HA/HB/HR	365	365	—	—	—	—	—	—	—	—	—
HSR 150HA/HB/HR	396	396	—	—	—	—	—	—	—	—	—

Note: "—" indicates not available.
"*" indicates available, but not support a grease nipple. Contact THK for details.

■Overall LM Block Length (Dimension L) of Model HSR with QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
HSR 15A/B/R/YR	79.6	79.6	87.6	84.2	92.2	98.8	106.8	100	108
HSR 20A/B/R/CA/CB/YR	96.2	96.2	104.4	102	110.2	113.6	121.8	116	124.2
HSR 20LA/LB/LR/HA/HB	112.2	112.2	120.4	118	126.2	129.6	137.8	132	140.2
HSR 25A/B/R/CA/CB/YR	104.1	104.1	112.1	109.8	117.8	121.4	129.4	123.8	131.8
HSR 25LA/LB/LR/HA/HB	123.2	123.2	131.2	128.9	136.9	140.5	148.5	142.9	150.9
HSR 30A/B/R/CA/CB/YR	119	119	127	124.7	132.7	140.3	148.3	142.7	150.7
HSR 30LA/LB/LR/HA/HB	141.6	141.6	149.6	147.3	155.3	162.9	170.9	165.3	173.3
HSR 35A/B/R/CA/CB/YR	132.2	132.2	142	139	148.8	154.6	164.4	157	166.8
HSR 35LA/LB/LR/HA/HB	157.6	157.6	167.4	164.4	174.2	180	189.8	182.4	192.2
HSR 45A/B/R/CA/CB/YR	174.8	174.8	181.6	176.6	186.4	—	—	—	—
HSR 45LA/LB/LR/HA/HB	206.6	206.6	213.4	208.4	218.2	—	—	—	—
HSR 55A/B/R/CA/CB/YR	197.2	197.2	208.4	202	213.2	—	—	—	—
HSR 55LA/LB/LR/HA/HB	235.3	235.3	246.5	240.1	251.3	—	—	—	—
HSR 65A/B/R/CA/CB/YR	221.4	221.4	233.8	226.6	239	—	—	—	—
HSR 65LA/LB/LR/HA/HB	280.9	280.9	293.3	286.1	298.5	—	—	—	—

Basic Specifications of LaCS®

① Service temperature range of LaCS: -20℃ to +80℃

② Resistance of LaCS: indicated in table 7

Table 7 Resistance of LaCS

Unit: N

Model No.	Resistance of LaCS
HSR 15	3.8
HSR 20	5.6
HSR 25	7.5
HSR 30	14.9
HSR 35	22.4

Note 1: Each resistance value in the table only consists of that of LaCS, and does not include sliding resistances of seals and other accessories.

Note 2: For the maximum service speed of LaCS, contact THK.

Grease Nipple

Those LM Guide models without QZ Lubricator are equipped with a grease nipple. Fig. 7 shows the mounting location for the grease nipple. Please note that attaching the grease nipple increases the LM block width.

For LM Guide Models with Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH

LM Guide models with dust prevention accessories SSHH, DDHH, ZZHH or KKHH have the grease nipple in the location indicated in Fig. 7.
Table 8 shows incremental dimensions with the grease nipple.

Grease nipple mounting location for model HSR

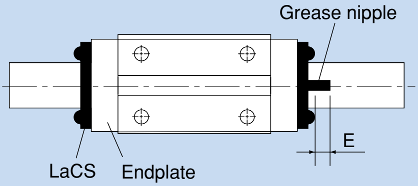


Fig. 7

Table 8

Unit: mm

Model No.	Incremental dimension with grease nipple E	Nipple type
HSR 15A/B/R/YR	2.9	PB1021B
HSR 20A/B/R/CA/CB/YR HSR 20LA/LB/LR/HA/HB	9.4	B-M6F
HSR 25A/B/R/CA/CB/YR HSR 25LA/LB/LR/HA/HB	9.0	B-M6F
HSR 30A/B/R/CA/CB/YR HSR 30LA/LB/LR/HA/HB	9.0	B-M6F
HSR 35A/B/R/CA/CB/YR HSR 35LA/LB/LR/HA/HB	8.0	B-M6F

Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 7, contact THK.

For LM Guide Models with Dust Prevention Accessories UU or SS

For the mounting location of the grease nipple (N) and its incremental dimension (E) when dust prevention accessories UU or SS are attached, see the corresponding tables of dimensions on pages a-290 to a-305.

For LM Guide Models with Dust Prevention Accessories DD, ZZ or KK

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK.

Model number coding

HSR25 A 2 QZ KKHH C1 +760L P
1 (HSR25) 2 (QZ) 3 (KKHH)

1 LM Guide model number
2 QZ: with QZ Lubricator, without grease nipple　No symbol: without QZ Lubricator (note 2)
3 Dust prevention accessory symbol (see page a-282)

Note 1: QZ Lubricator and LaCS are not sold alone.
Note 2: Those models equipped with QZ Lubricator cannot have a grease nipple. When desiring both QZ Lubricator and the grease nipple to be attached, contact THK.

Precautions on Use

■Laminated Contact Scraper LaCS for THK LM Guides

Service environment

- Be sure the service temperature range of Laminated Contact Scraper LaCS is between -20℃ and +80℃, and do not clean LaCS in an organic solvent or white kerosene, or leave it unpacked.

Impregnating oil

- The lubricant impregnated into Laminated Contact Scraper LaCS is used to increase the sliding capability of LaCS itself. For lubrication of the LM Guide, attach QZ Lubricator or the grease nipple.

Function

- The intended role of Laminated Contact Scraper LaCS is to remove foreign matter or liquids. To seal oils, end seals are needed.

Design

- When using Laminated Contact Scraper LaCS, be sure to use the dedicated cap C for LM rail mounting holes or an appropriate form of cover.

■QZ Lubricator for THK LM Guides

Handling

- Dropping or hitting this product may damage it. Take much care when handling it.
- Do not clean it with an organic solvent or white kerosene.
- Do not leave it unpacked for a long period of time.
- Do not block the air vent with grease or the like.

Service temperature range

- Be sure the service temperature of this product is between -10℃ and +50℃. When using it beyond the service temperature range, contact THK .

Use in a special environment

- When using it in a special environment, contact THK .

Precaution on selection

- Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

- QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend applying grease or other anti-corrosion agent to the mounting base surface and the LM rail end surfaces of the LM Guide as an anti-corrosion measure.

Four-way Equal Load Type

High Temperature LM Guide Model HSR-M1

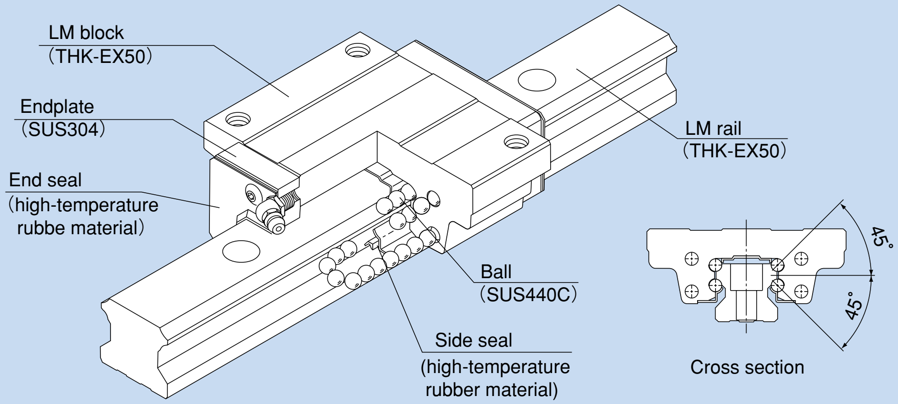


Fig. 1 Structure of Model HSR-M1

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and end-plates incorporated in the LM block allow the balls to circulate.

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations.

The High temperature type LM Guide is capable of being used at service temperature up to 150℃ thanks to THK 's unique technologies in material, heat treatment and lubrication.

●Maximum service temperature of 150℃

Use of stainless steel in the endplates and high-temperature rubber in the end seals achieves the maximum service temperature of 150℃.

●Dimensional stability

Since it is dimensionally stabilized, it demonstrates superb dimensional stability after being heated or cooled (note that it shows linear expansion at high temperature).

●Corrosion resistance

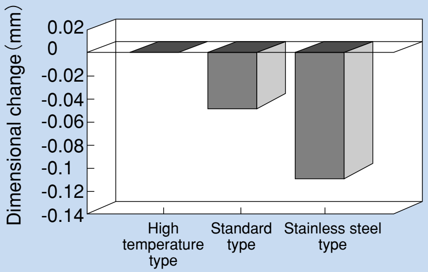
Since its LM block, LM rail and balls are made of stainless steel, this model is highly resistant to corrosion.

●High temperature grease

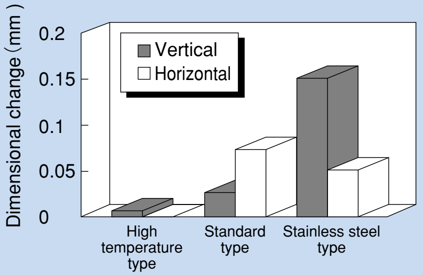
This model uses high temperature grease that shows little grease-based fluctuation in rolling resistance even if temperature changes from low to high levels.

Dimensional Stability Data

Since this model has been treated for dimensional stability, its dimensional change after being cooled or heated is only minimal.



Overall LM rail length

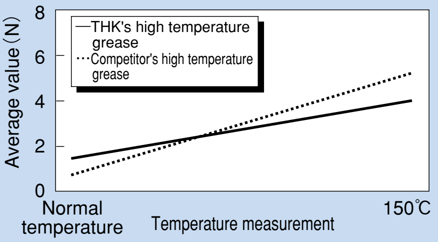


Curvature of the LM rail

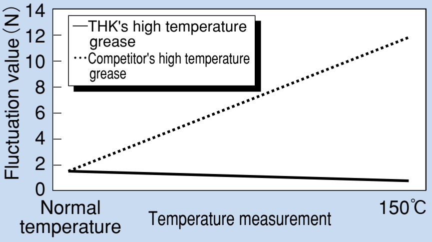
Note 1: The above data on overall length and curvature indicate dimensional change when the LM rail is cooled to normal temperature after being heated at 150℃ for 100 hours.
Note 2: The samples consist of high-temperature, standard and stainless steel types of model HSR25 + 580L.

Rolling Resistance Data in Relation to Grease

This model uses high temperature grease that shows little grease-based fluctuation in rolling resistance even if temperature changes from low to high levels.



Average value



Fluctuation value

For the measurements above, model HSR25M1R1C1 is used.

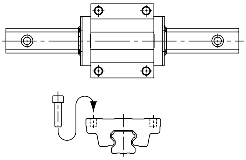
Thermal Characteristics of LM Rail and LM Block Materials

- Specific heat capacity : 0.481J/(g･K)
- Thermal conductivity : 20.67W/(m･K)
- Average coefficient of linear expansion : 11.8×10^{-6}/℃

Types and Features

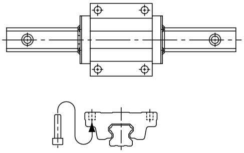
Model HSR-M1A

The flange of the LM block has tapped holes.



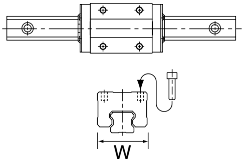
Model HSR-M1B

The flange of the LM block has through holes. Used in places where the table cannot have through holes for mounting bolts.

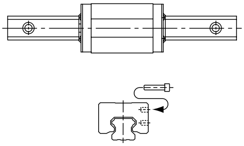


Model HSR-M1R

Having a smaller LM block width (W) and tapped holes, this model is optimal for compact design.



Model HSR-M1YR



When using two units of LM Guide facing each other, the previous model required much time in machining the table and had difficulty achieving the desired accuracy and adjusting the clearance. Since Model HSR-M1YR has tapped holes on the side of the LM block, a simpler structure is gained and significant man-hour cutting and accuracy increase can be achieved.

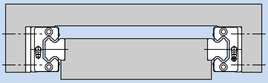
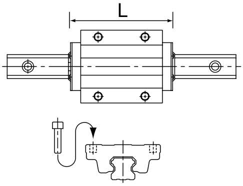


Fig. 2 Conventional Structure

Fig. 3 Mounting Structure for Model HSR-M1YR

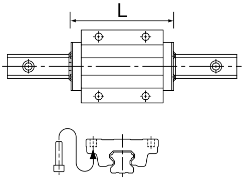
Model HSR-M1LA

The LM block has the same sectional shape as model HSR-M1A, but has a longer overall LM block length (L) and a greater rated load.



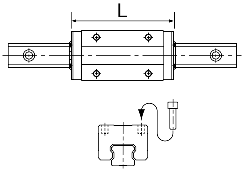
Model HSR-M1LB

The LM block has the same sectional shape as model HSR-M1B, but has a longer overall LM block length (L) and a greater rated load.



Model HSR-M1LR

The LM block has the same sectional shape as model HSR-M1R, but has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Model HSR-M1 is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for HSR-M1.

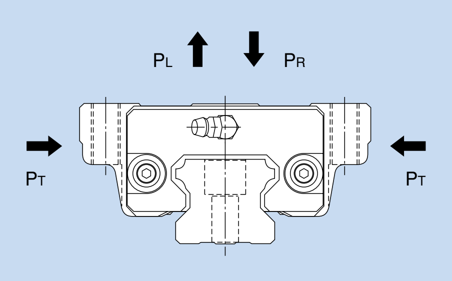


Fig. 4 Model HSR-M1

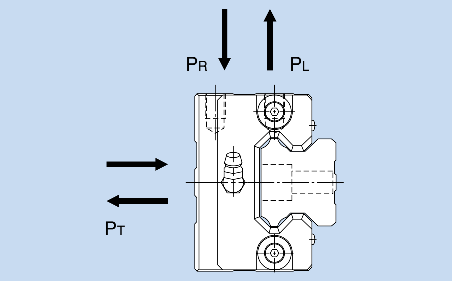


Fig. 5 Model HSR-M1YR

Equivalent Load

When the LM block of model HSR-M1 receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model HSR-M1.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-326.

Table 1 Symbols of Dust Prevention Accessories for Model HSR-M1

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HSR-M1···UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals HSR-M1···UU

Unit: N

Model No.	Seal resistance value
HSR 15M1	2.0
HSR 20M1	2.5
HSR 25M1	3.9
HSR 30M1	7.8
HSR 35M1	11.8

Note 1: The above seal resistances are values at normal temperature.
Note 2: The values for HSR-M1 also apply to HSR-M1YR.

Standard Length and Maximum Length of the LM Rail

Table 3 shows the standard lengths and the maximum lengths of model HSR-M1 variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

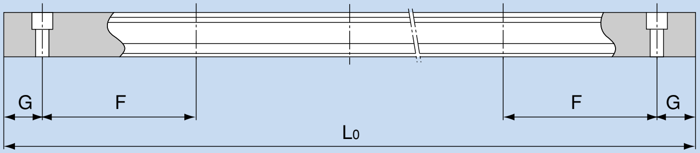


Table 3 Standard Length and Maximum Length of the LM Rail for Model HSR-M1

Unit: mm

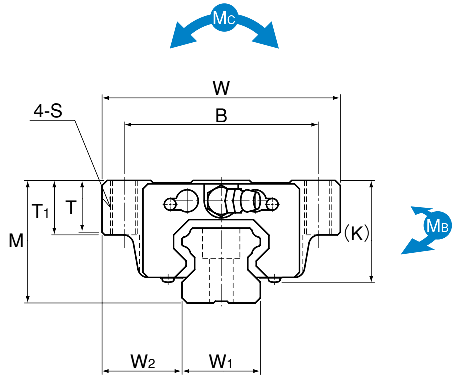
Model No.	HSR 15M1	HSR 20M1	HSR 25M1	HSR 30M1	HSR 35M1
Standard LM rail length (L_0)	160	220	220	280	280
	220	280	280	360	360
	280	340	340	440	440
	340	400	400	520	520
	400	460	460	600	600
	460	520	520	680	680
	520	580	580	760	760
	580	640	640	840	840
	640	700	700	920	920
	700	760	760	1000	1000
	760	820	820	1080	1080
	820	940	940	1160	1160
	940	1000	1000	1240	1240
	1000	1060	1060	1320	1320
	1060	1120	1120	1400	1400
	1120	1180	1180	1480	1480
	1180	1240	1240		
	1240	1360	1300		
		1480	1360		
			1420		
			1480		
Standard pitch F	60	60	60	80	80
G	20	20	20	20	20
Max length	1240	1500	1500	1500	1500

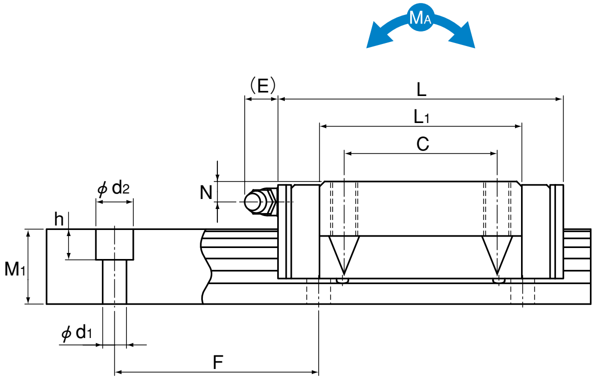
Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Note 3: The values for HSR-M1 also apply to HSR-M1YR.

Models HSR-M1A | HSR-M1LA





Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S	L1	T	T1	K	N	E	Grease nipple	Width W1 ±0.05	W2	Height M1	Pitch F	d1×d2×h	C kN	C0 kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	LM block kg	LM rail kg/m
HSR 15M1A	24	47	59.6	38	30	M5	38.8	6.5	11	19.3	4.3	5.5	PB1021B	15	16	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20M1A HSR 20M1LA	30	63	76 92	53	40	M6	50.8 66.8	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8 21.3	23.8 31.8	0.19	1.04	0.19	1.04	0.201	0.35 0.47	2.3
HSR 25M1A HSR 25M1LA	36	70	83.9 103	57	45	M8	59.5 78.6	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9 27.2	34.4 45.9	0.307	1.71	0.307	1.71	0.344	0.59 0.75	3.3
HSR 30M1A HSR 30M1LA	42	90	98.8 121.4	72	52	M10	70.4 93	9	18	35	7	12	B-M6F	28	31	26	80	9×14×12	28 37.3	46.8 62.5	0.524	2.7	0.524	2.7	0.562	1.1 1.3	4.8
HSR 35M1A HSR 35M1LA	48	100	112 137.4	82	62	M10	80.4 105.8	12	21	40.5	8	12	B-M6F	34	33	29	80	9×14×12	37.3 50.2	61.1 81.5	0.782	3.93	0.782	3.93	0.905	1.6 2	6.6

Note The length L of the high temperature type LM Guide model HSR is longer than normal type of model HSR (dimension L1 is the same).

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

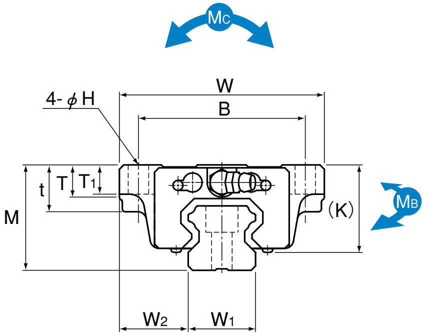
HSR25 M1 A 2 UU C1 +1240L P- II
1 2 3 4 5 6 7 8 9

1 Model number 2 Symbol for high temperature LM Guide 3 Type of LM block
4 No. of LM blocks used on the same rail 5 Dust prevention accessory symbol (see page a-315)
6 Radial clearance symbol (see page a-33) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

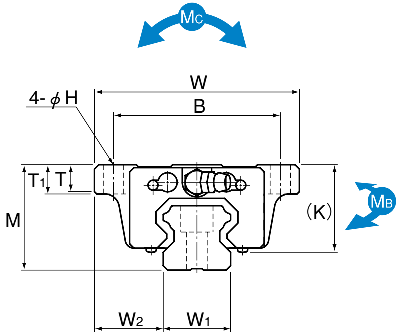
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-316

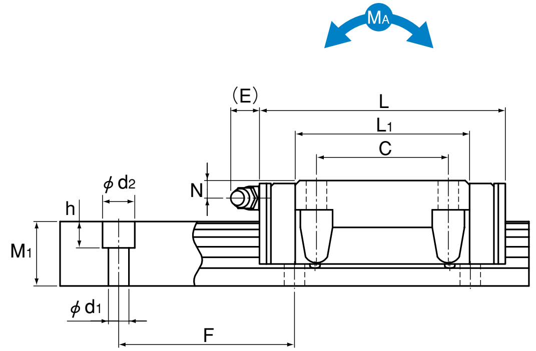
Models HSR-M1B | HSR-M1LB



Models HSR15, 25 to 35M1B/M1LB



Models HSR20M1B/M1LB



Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple	Width W1 ±0.05	W2	Height M1	Pitch F	d1×d2×h	C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	H	L1	t	T	T1	K	N	E							kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HSR 15M1B	24	47	59.6	38	30	4.5	38.8	11	6.5	7	19.3	4.3	5.5	PB1021B	15	16	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20M1B HSR 20M1LB	30	63	76 92	53	40	6	50.8 66.8	—	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	13.8 21.3	23.8 31.8	0.19	1.04	0.19	1.04	0.201	0.35 0.47	2.3
HSR 25M1B HSR 25M1LB	36	70	83.9 103	57	45	7	59.5 78.6	16	11	10	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	19.9 27.2	34.4 45.9	0.307	1.71	0.307	1.71	0.344	0.59 0.75	3.3
HSR 30M1B HSR 30M1LB	42	90	98.8 121.4	72	52	9	70.4 93	18	9	10	35	7	12	B-M6F	28	31	26	80	9×14×12	28 37.3	46.8 62.5	0.524	2.7	0.524	2.7	0.562	1.1 1.3	4.8
HSR 35M1B HSR 35M1LB	48	100	112 137.4	82	62	9	80.4 105.8	21	12	13	40.5	8	12	B-M6F	34	33	29	80	9×14×12	37.3 50.2	61.1 81.5	0.782	3.93	0.782	3.93	0.905	1.6 2	6.6

Note The length L of the high temperature type LM Guide model HSR is longer than normal type of model HSR (dimension L_1 is the same).

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR20 M1 LB 2 UU C0 +1000L P- Ⅱ
1 2 3 4 5 6 7 8 9

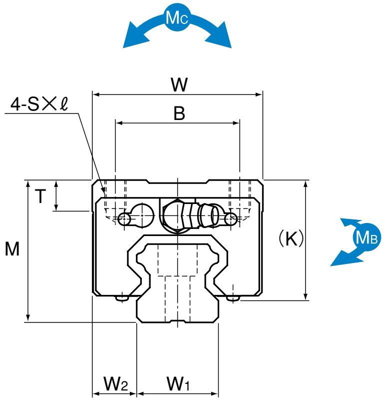
1 Model number 2 Symbol for high temperature LM Guide 3 Type of LM block
4 No. of LM blocks used on the same rail 5 Dust prevention accessory symbol (see page a-315)
6 Radial clearance symbol (see page a-33) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

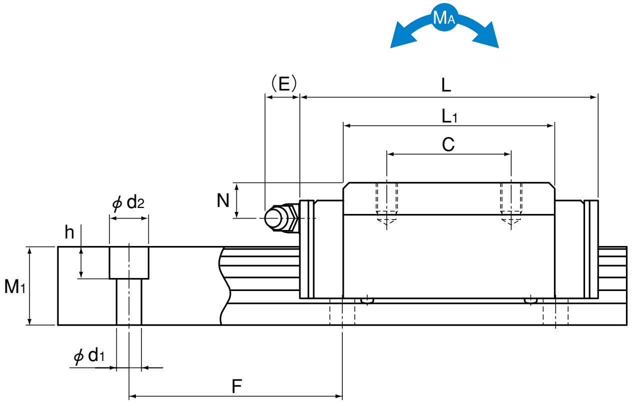
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-316

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HSR-M1R | HSR-M1LR





Unit: mm

Model No.	External dimensions			LM block dimensions									LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L_1	T	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	d_1×d_2×h	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
HSR 15M1R	28	34	59.6	26	26	M4×5	38.8	6	23.3	8.3	5.5	PB1021B	15	9.5	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20M1R	30	44	76	32	36	M5×6	50.8	8	26	5	12	B-M6F	20	12	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 20M1LR			92		50		66.8											21.3	31.8						0.47	
HSR 25M1R	40	48	83.9	35	35	M6×8	59.5	8	34.5	10	12	B-M6F	23	12.5	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 25M1LR			103		50		78.6											27.2	45.9						0.75	
HSR 30M1R	45	60	98.8	40	40	M8×10	70.4	8	38	10	12	B-M6F	28	16	26	80	9×14×12	28	46.8	0.524	2.7	0.524	2.7	0.562	1.1	4.8
HSR 30M1LR			121.4		60		93											37.3	62.5						1.3	
HSR 35M1R	55	70	112	50	50	M8×12	80.4	10	47.5	15	12	B-M6F	34	18	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6
HSR 35M1LR			137.4		72		105.8											50.2	81.5						2	

Note The length L of the high temperature type LM Guide model HSR is longer than normal type of model HSR (dimension L_1 is the same).

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

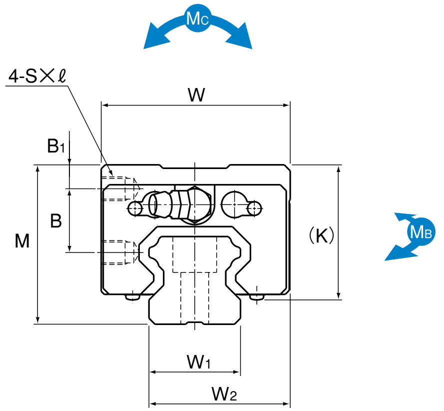
HSR35	M1	R	2	UU	C0	+1080L	P-	Ⅱ
1	2	3	4	5	6	7	8	9

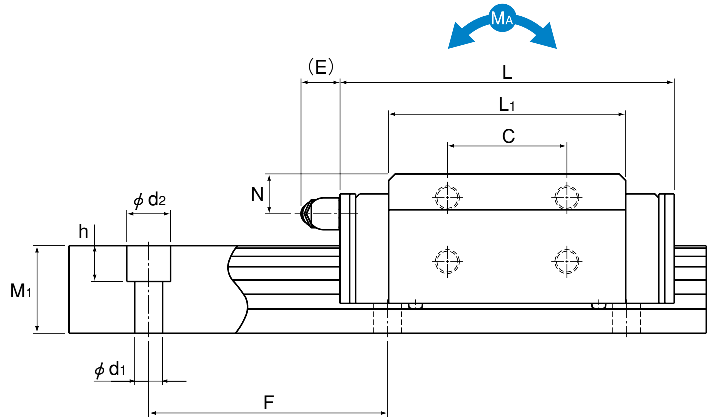
1 Model number **2** Symbol for high temperature LM Guide **3** Type of LM block
4 No. of LM blocks used on the same rail **5** Dust prevention accessory symbol (see page a-315)
6 Radial clearance symbol (see page a-33) **7** LM rail length (in mm) **8** Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-316

Model HSR-M1YR





Unit: mm

Model No.	External dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B_1	B	C	S×ℓ	L_1	K	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
HSR 15M1YR	28	33.5	59.6	4.3	11.5	18	M4×5	38.8	23.3	8.3	5.5	PB1021B	15	24	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.457	0.0805	0.457	0.0844	0.2	1.5
HSR 20M1YR	30	43.5	76	4	11.5	25	M5×6	50.8	26	5	12	B-M6F	20	31.5	18	60	6×9.5×8.5	13.8	23.8	0.19	1.04	0.19	1.04	0.201	0.35	2.3
HSR 25M1YR	40	47.5	83.9	6	16	30	M6×6	59.5	34.5	10	12	B-M6F	23	35	22	60	7×11×9	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	3.3
HSR 30M1YR	45	59.5	98.8	8	16	40	M6×9	70.4	38	10	12	B-M6F	28	43.5	26	80	9×14×12	37.3	62.5	0.524	2.7	0.524	2.7	0.562	1.3	4.8
HSR 35M1YR	55	69.5	112	8	23	43	M8×10	80.4	47	15	12	B-M6F	34	51.5	29	80	9×14×12	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	6.6

Note The length L of the high temperature type LM Guide model HSR-YR is longer than normal type of model HSR-YR (dimension L_1 is the same).

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR25	M1	YR	2	UU	C0	+1200L	P-	Ⅱ
1	2	3	4	5	6	7	8	9

1 Model number 2 Symbol for high temperature LM Guide 3 Type of LM block
4 No. of LM blocks used on the same rail 5 Dust prevention accessory symbol (see page a-315)
6 Radial clearance symbol (see page a-33) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-316

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model HSR-M1 with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
HSR 15M1A/M1B/M1R/M1YR	59.6	59.6
HSR 20M1A/M1B/M1R/M1YR	76	76
HSR 20M1LA/M1LB/M1LR	92	92
HSR 25M1A/M1B/M1R/M1YR	83.9	83.9
HSR 25M1LA/M1LB/M1LR	103	103
HSR 30M1A/M1B/M1R/M1YR	98.8	98.8
HSR 30M1LA/M1LB/M1LR	121.4	121.4
HSR 35M1A/M1B/M1R/M1YR	112	112
HSR 35M1LA/M1LB/M1LR	137.4	137.4

Precautions on Use

THK High Temperature LM Guide

Service Temperature of the High Temperature LM Guide

●Maximum service temperature: 150℃

Selection of a High Temperature LM Guide

●For selecting a model number of high temperature LM Guide model HSR-M1, see section A of the "THK General Catalog - Technical Descriptions of the Products," provided separately. When selecting a model number, also determine the temperature factor f_T while referring to the corresponding graph, and set hardness factor f_H at 1.0.

Dimensional Accuracy of the High Temperature LM Guide

●The high temperature LM Guide is manufactured with the same dimensional accuracy as a standard LM Guide. At high service temperature, however, the former shows thermal expansion, and therefore, its dimensional accuracy changes by the thermal expansion.

Calculation of Thermal Expansion of the High Temperature LM Guide

●Thermal expansion of the high temperature LM Guide is calculated in the following equation.

$$L_{2\text{-}1} = \alpha (t_2 - t_1) L_1$$

$L_{2\text{-}1}$: Thermal expansion by heating (mm)

α : Coefficient of linear expansion (see table 4)

t_2 : Heating temperature (℃)

t_1 : Normal temperature (℃)

L_1 : Length at normal temperature (mm)

Table 4 Coefficient of Linear Expansion by Material ($\times10^{-6}$/℃)
(The values other than high temperature LM Guide are excerpts from "Actual Designing - Part 2" by The Nikkan Kogyo Shimbun, Ltd.)

	High temperature LM Guide	SS400	FC25	SUS304	Aluminum
Coefficient of linear expansion	11.8	11.2 to 11.3	8.6 to 8.7	16.4	23

Note: If mounting the high temperature LM Guide on a material whose linear expansion coefficient is significantly different, or if the linear expansion coefficient is the same but the temperature is uneven, it may cause the LM rail to bend or the preload on the LM Guide to change (for preloads on the LM Guide, see page a-31).

Grease Used in the High Temperature LM Guide

●The LM Guide contains fluorinated grease as standard unless otherwise specified. The following table shows general properties of the grease for the high temperature LM Guide.

If other type of grease or lubricant is mixed with the high temperature grease, it may deteriorate the product performance.
When using the LM Guide in a vacuum environment, contact THK.

Name: Krytox GPL225 (DuPont)

Base oil	GPL105
Base oil viscosity (20℃)	550(mm^2/s)
Oil separation rate (30 hr, 99℃)	4%(wt)
Additive	Anticorrosive agent
Service temperature range	-35℃ to +205℃
Worked penetration	NLGI No.2

Change in Sliding Resistance due to Grease and Seal

●The sliding resistance of the LM Guide tends to increase in proportion to the increase in temperature due to high temperature grease or seal.

Lubrication of the High Temperature LM Guide

●The high temperature LM Guide needs to be greased roughly at an interval of every 100 km in travel distance. However, the greasing interval may vary depending on the service conditions, environment, atmosphere or temperature. It is necessary to adjust the greasing interval according to the circumstances.

High Corrosion Resistance Type LM Guide Model HSR-M2

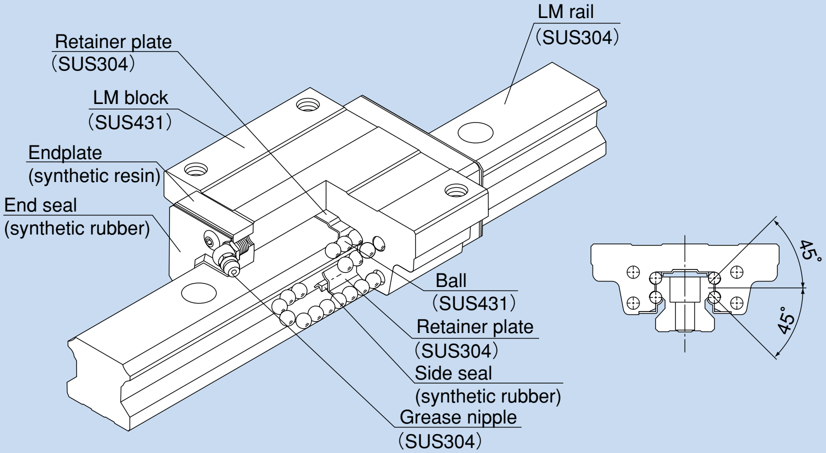


Fig. 1 Structure of Model HSR-M2A

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations.

The LM rail, LM block and balls are made of highly corrosion resistant stainless steel and the other metal parts are made of stainless steel, allowing superb corrosion resistance to be achieved. As a result, the need for surface treatment is eliminated.

Rated Loads in All Directions

Model HSR-M2 is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for HSR-M2.

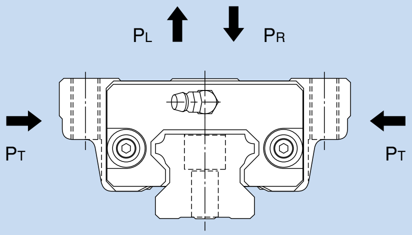


Fig. 2 Model HSR-M2

Equivalent Load

When the LM block of model HSR-M2 receives loads in all directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model HSR-M2.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-334.

Table 1 Symbols of Dust Prevention Accessories for Model HSR-M2

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HSR-M2···UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals HSR-M2···UU

Unit: N

Model No.	Seal resistance value
HSR 15M2	2.0
HSR 20M2	2.5
HSR 25M2	3.9
HSR 30M2	7.8
HSR 35M2	11.8

Standard Length and Maximum Length of the LM Rail

Table 3 shows the standard lengths and the maximum lengths of model HSR-M2 variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

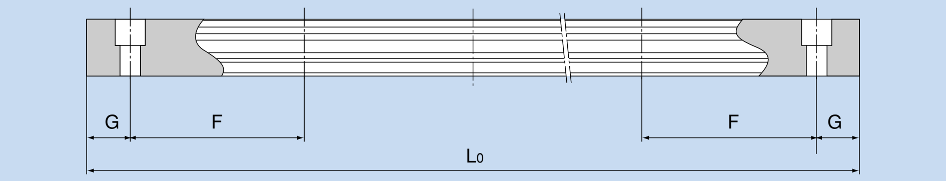


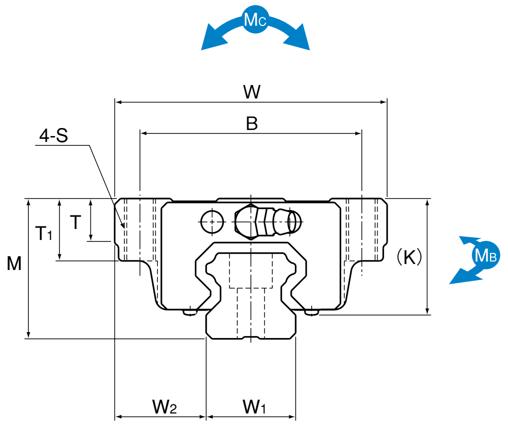
Table 3 Standard Length and Maximum Length of the LM Rail for Model HSR-M2

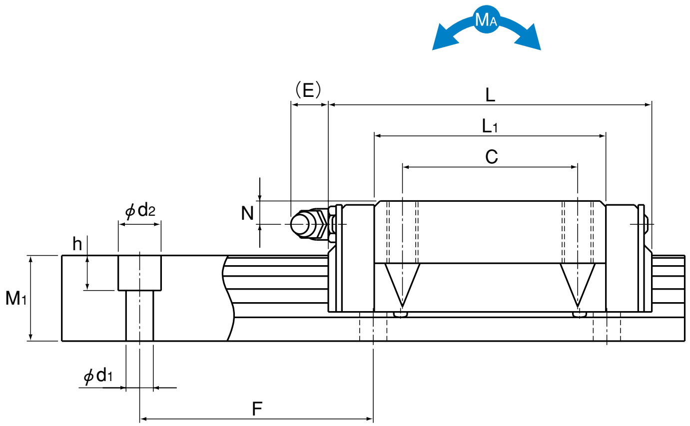
Unit: mm

Model No.	HSR 15M2	HSR 20M2	HSR 25M2
Standard LM rail length (L_0)	160 280 460 640	280 460 640 820	280 460 640 820 1000
Standard pitch F	60	60	60
G	20	20	20
Max length	1000	1000	1000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Model HSR-M2A





Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S	L1	T	T1	K	N	E	Grease nipple	Width W1 ±0.05	W2	Height M1	Pitch F	d1×d2×h	C kN	C0 kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	LM block kg	LM rail kg/m
HSR 15M2A	24	47	56.6	38	30	M5	38.8	6.5	11	19.3	4.5	5.5	PB1021B	15	16	15	60	4.5×7.5×5.3	2.33	2.03	12.3	70.3	12.3	70.3	10.8	0.2	1.5
HSR 20M2A	30	63	74	53	40	M6	50.8	9.5	10	26	5	12	B-M6F	20	21.5	18	60	6×9.5×8.5	3.86	3.57	29	160	29	160	26.5	0.35	2.3
HSR 25M2A	36	70	83.1	57	45	M8	59.5	11	16	30.5	6	12	B-M6F	23	23.5	22	60	7×11×9	5.57	5.16	46.9	261	46.9	261	45.1	0.59	3.3

Note For the high corrosion resistance type LM Guide, a stainless steel end plate is optionally available.(symbol…I)

Note The basic load rating of the high corrosion resistance type LM Guide is smaller than ordinary stainless steel LM Guides.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HSR20M2 A 2 UU C1 I +820L P- Ⅱ
1 2 3 4 5 6 7 8 9

1 Model number (high corrosion resistance type LM Guide) 2 Type of LM block
3 No. of LM blocks used on the same rail 4 Dust prevention accessory symbol (see page a-330)
5 Radial clearance symbol (see page a-34) 6 End plate is made of stainless steel
7 LM rail length (in mm) 8 Accuracy symbol (see page a-38) 9 No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-331

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model HSR-M2 with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
HSR 15M2A	56.6	56.6
HSR 20M2A	74	74
HSR 25M2A	83.1	83.1

Structural Member Rail, Four-way Equal Load Type

LM Guide Model JR

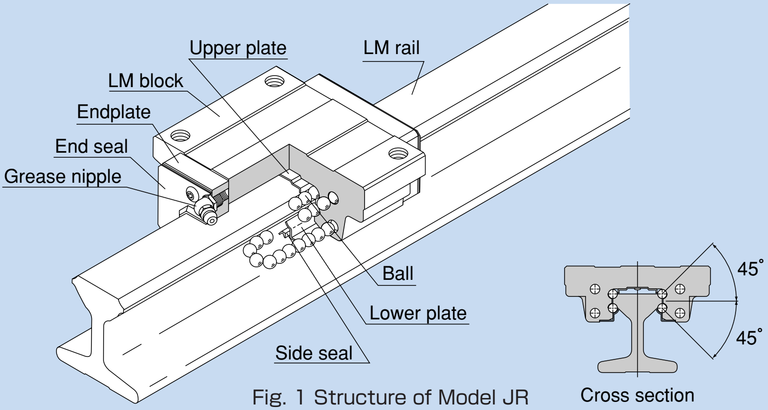


Fig. 1 Structure of Model JR

Cross section

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since retainer plates hold the balls, they do not fall off even if the LM rail is pulled out.
Model JR uses the same LM block as model HSR, which has a proven track record and is highly reliable. The LM rail has a sectional shape with high flexural rigidity, and therefore can be used as a structural member.
Unlike the conventional LM Guide type, whose LM rail was secured onto the base with bolts when installed, model JR s LM rail is integrated with the mounting base, and the top of the LM rail has the same structure as LM Guide model HSR. The lower part of the LM rail has a hardness of HRC25 or less, making it easy to cut the rail and enabling the rail to be welded.
When welding the rail, we recommend using welding rods compliant with JIS D 5816 (suggested manufacturer and model number: Kobelco LB-52).

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●Can be mounted even under rough conditions

Since the central part of the LM rail is slightly thinner than the ends, even if the parallelism between two rails is poor the LM rail is capable of absorbing the error by bending inward or outward.

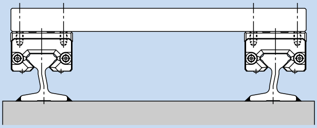


Fig. 2

●Sectional shape with high flexural rigidity

Since the LM rail has a sectional shape with high flexural rigidity, it can also be used as a structural member. In addition, even when the LM rail is partially fastened or supported in cantilever, the distortion is minimal.

Second Moment of Inertia of the LM Rail

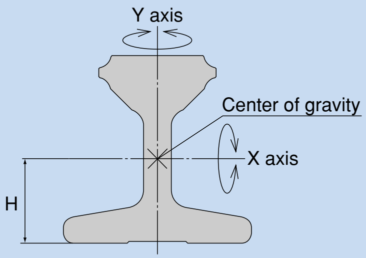


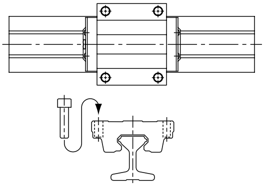
Fig. 3

	Second moment of inertia I [×10^5 mm^4]		Cross-section factor Z [×10^4 mm^3]		Height of gravitational center H [mm]
	About X axis	About Y axis	About X axis	About Y axis	
JR 25	1.90	0.51	0.69	0.21	19.5
JR 35	4.26	1.32	1.43	0.49	24.3
JR 45	12.1	3.66	3.31	1.04	33.1
JR 55	27.6	6.54	5.89	1.40	43.3

Types and Features

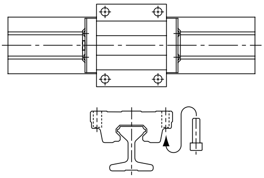
Model JR-A

The flange of the LM block has tapped holes.



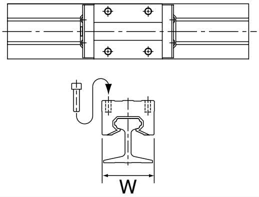
Model JR-B

The flange of the LM block has through holes. Used in places where the table cannot have through holes for mounting bolts.



Model JR-R

Has a smaller LM block width (W) and tapped holes. Used in places where the space for table width is limited.



Rated Loads in All Directions

Model JR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for JR.

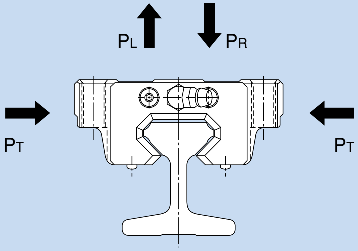


Fig. 4

Equivalent Load

When the LM block of model JR receives loads in the radial, reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model JR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-344.

Table 1 Symbols of Dust Prevention Accessories for Model JR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper

Seal resistance value

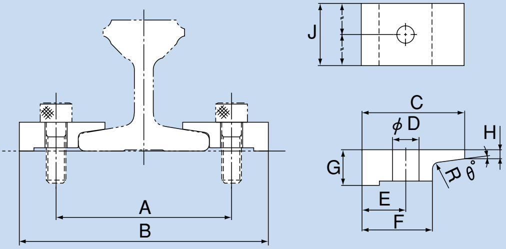
For the maximum seal resistance value per LM block when a lubricant is applied on seals JR ··· UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals JR···UU

Unit: N

Model No.	Seal resistance value
JR 25	3.9
JR 35	11.8
JR 45	19.6
JR 55	19.6

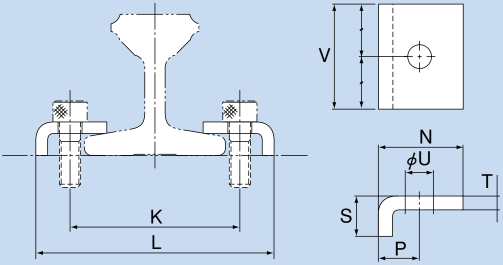
LM Rail Clamping Piece JB



Unit: mm

Model No.	Mounting dimensions		Clamper dimensions									Bolt used
	A	B	C	D	E	F	G	H	R	J	θ°	
JB 25	57	78	25	7	10.5	15	10	3.8	R2	25	10	M 6
JB 35	72	102	35	9	15	24	12	3.1	R2	32	8	M 8
JB 45	90	130	45	11	20	30	16	5.4	R2	40	8	M10
JB 55	115	155	50	14	20	30	17	8.2	R2	50	10	M12

LM Rail Clamping Iron Plate JT



Unit: mm

Model No.	Mounting dimensions		Clamper dimensions						Bolt used
	K	L	N	P	S	T	U	V	
JT 25	57	79	25	11	10	4	7	25	M 6
JT 35	65	91	27	13	13	4.5	9	40	M 8
JT 45	84	114	33	15	16	6	11	50	M10
JT 55	110	148	50	19	15	6	14	50	M12

Standard Length and Maximum Length of the LM Rail

Table 3 shows the standard lengths and the maximum lengths of model JR variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

Table 3 Standard Length and Maximum Length of the LM Rail for Model JR

Unit: mm

Model No.	JR 25	JR 35	JR 45	JR 55
Standard LM rail length (L_0)	1000 1500 2000	1000 2000 4000	1000 2000 4000	1000 2000 4000
Max length	2000	4000	4000	4000

Note 1: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Note 2: For connecting two or more rails, a metal fitting like the one shown in Fig. 5 is available. Contact THK for details.

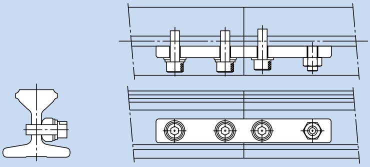
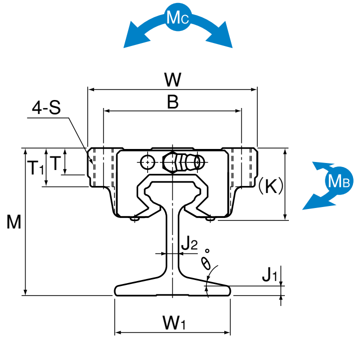
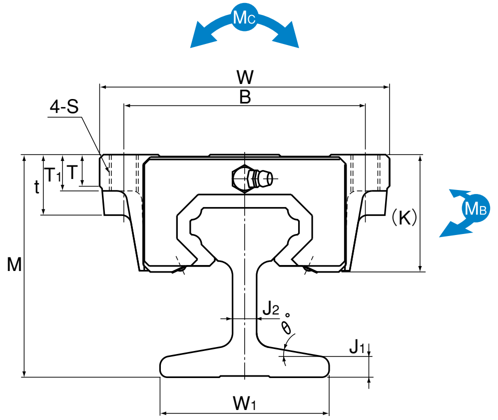


Fig. 5

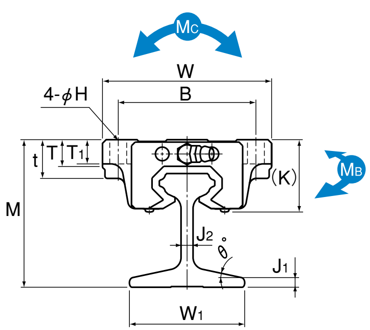
Model JR-A
Model JR-B
Model JR-R



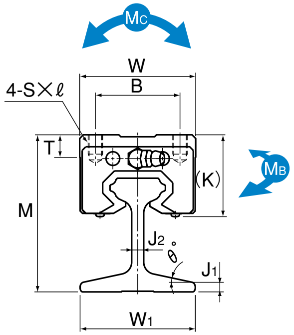
Models JR25, 35-A



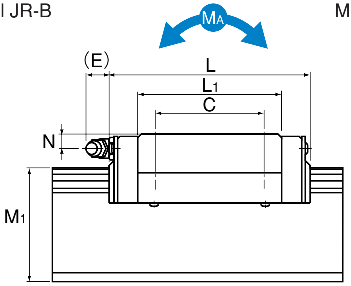
Models JR45, 55-A



Model JR-B



Model JR-R



Unit: mm

Model No.	External dimensions			LM block dimensions																	Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length												Grease nipple	Width				Height	C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	H	S×ℓ	L1	t	T	T1	K	N	E		W1	J1	J2	θ°	M1	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
JR 25A	61	70	83.1	57	45	—	M8 **	59.5	—	11	16	30.5	6	12	B-M6F	48	4	5	12	47	19.9	34.4	0.307	1.71	0.307	1.71	0.344	0.59	4.2
JR 25B	61	70		57	45	7	—		16	11	10	30.5	6															0.59	
JR 25R	65	48		35	35	—	M6×8		—	9	—	34.5	10															0.54	
JR 35A	73	100	113.6	82	62	—	M10 **	80.4	—	12	21	40	8	12	B-M6F	54	7	8	10	54	37.3	61.1	0.782	3.93	0.782	3.93	0.905	1.6	8.6
JR 35B	73	100		82	62	9	—		21	12	13	40	8															1.6	
JR 35R	80	70		50	50	—	M8×12		—	11.7	—	47.4	15															1.5	
JR 45A	92	120	145	100	80	—	M12 **	98	25	13	15	50	10	16	B-PT1/8	70	8	10	10	70	60	95.6	1.42	7.92	1.42	7.92	1.83	2.8	15.2
JR 45B	92	120		100	80	11	—		25	13	15	50	10															2.8	
JR 45R	102	86		60	60	—	M10×17		—	15	—	59.4	20															2.6	
JR 55A	114	140	165	116	95	—	M14 **	118	29	13.5	17	57	11	16	B-PT1/8	93	4.8	11.6	12	90	88.5	137	2.45	13.2	2.45	13.2	3.2	4.5	18.3
JR 55B	114	140		116	95	14	—		29	13.5	17	57	11															4.5	
JR 55R	124	100		75	75	—	M12×18		—	20.5	—	67	21															4.3	

Note "**" indicates a through hole.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

JR35 R 2 UU +1000L
1 2 3 4 5

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-339) 5 LM rail length (in mm)

Standard Length and Maximum Length of the LM Rail P. a-341

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model JR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK
JR 25A/B/R	83.1	83.1	90.7	89.4	97
JR 35A/B/R	113.6	113.6	125.6	122	134 *
JR 45A/B/R	145	145	159	150.8	164.8*
JR 55A/B/R	165	165	175.4	170.4	180.8*

Note: "*" indicates available, but not support a grease nipple. Contact THK for details.

Cross LM Guide Model CSR

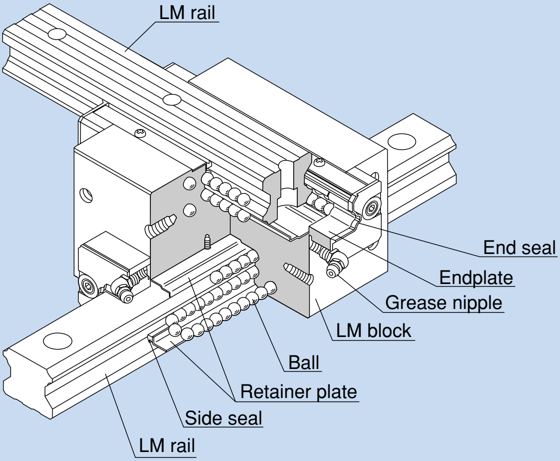


Fig. 1 Structure of Model CSR

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since retainer plates hold the balls, they do not fall off even if the LM rail is pulled out.

This model is an integral type of LM Guide that squares an internal structure similar to model HSR, which has a proven track record and is highly reliable, with another and uses two LM rails in combination. It is machined with so high precision that the perpendicularity of the hexahedron of the LM block is within 2 μm per 100 mm in error. The two rails are also machined with high precision in relative straightness. As a result, extremely high accuracy in orthogonality is achieved. Since an orthogonal LM system can be achieved with model CSR alone, a conventionally required saddle is no longer necessary, the structure for X-Y motion can be simplified and the whole system can be downsized.

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●High rigidity

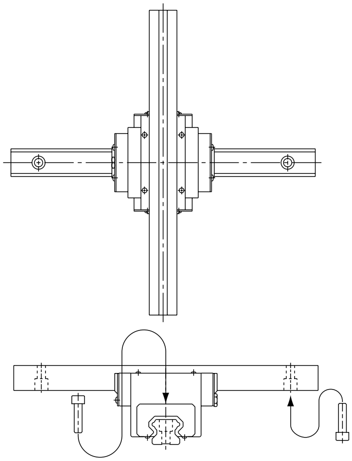
Since balls are arranged in four rows in a well-balanced manner, this model is stiff against a moment, and smooth linear motion is ensured even a preload is applied to increase the rigidity.

The rigidity of the LM blocks is 50% higher than that of a combination of two HSR LM blocks secured together back-to-back with bolts. Thus, CSR is an optimal LM Guide for building an X-Y table that requires high rigidity.

Types and Features

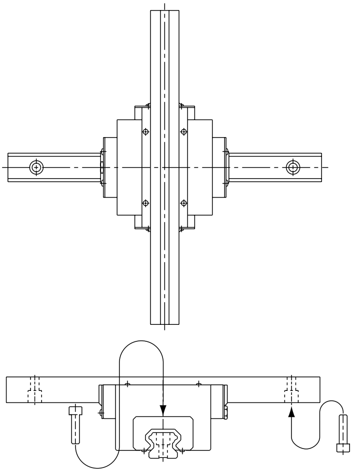
Model CSR-S

CSR-S is a standard type.



Model CSR

It has a longer overall LM block length (L) and a greater rated load.



Rated Loads in All Directions

Model CSR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings are defined with an LM rail and two LM blocks, and uniform in the four directions (radial, reverse-radial and lateral directions). Their actual values are provided in the dimensional table for CSR.

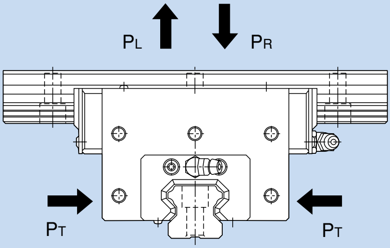


Fig. 2

Equivalent Load

When the LM block of model CSR receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model CSR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-354.

Table 1 Symbols of Dust Prevention Accessories for Model CSR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper
LL	With low-resistance end seal
RR	With LL seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals CSR…UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals CSR…UU

Unit: N

Model No.	Seal resistance value
CSR 15	2.0
CSR 20	2.5
CSR 25	3.9
CSR 30	7.8
CSR 35	11.8
CSR 45	19.6

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

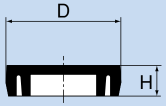
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

For the procedure for mounting the cap, see page a-22.

Table 3 Major Dimensions of Dedicated Cap C

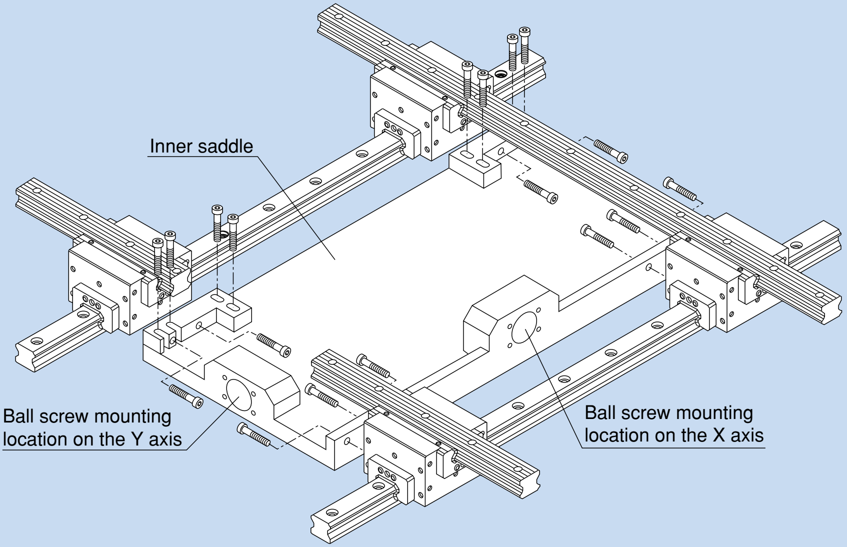
Model No.	Cap C model No.	Bolt used	Major dimensions mm D	H
CSR 15	C 4	M 4	7.8	1.0
CSR 20	C 5	M 5	9.8	2.4
CSR 25	C 6	M 6	11.4	2.7
CSR 30	C 8	M 8	14.4	3.7
CSR 35	C 8	M 8	14.4	3.7
CSR 45	C12	M12	20.5	4.7



Dedicated Cap C

Example of Application

Model CSR can easily be installed and adjusted using an inner saddle mechanism that links four LM blocks together via a square plate. When installed on the inner saddle, model CSR achieves a highly accurate X-Y guide and high moment rigidity in the yawing direction.



Inner Saddle (with an adjustment mechanism)

Standard Length and Maximum Length of the LM Rail

Table 4 shows the standard lengths and the maximum lengths of model CSR variations.
For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

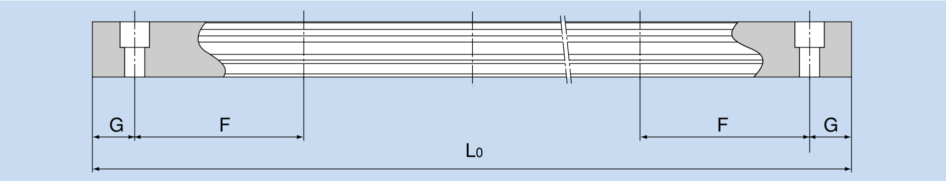


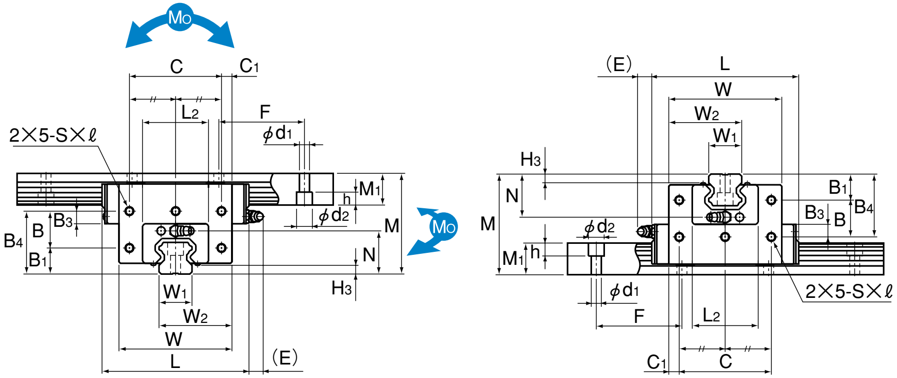
Table 4 Standard Length and Maximum Length of the LM Rail for Model CSR

Unit: mm

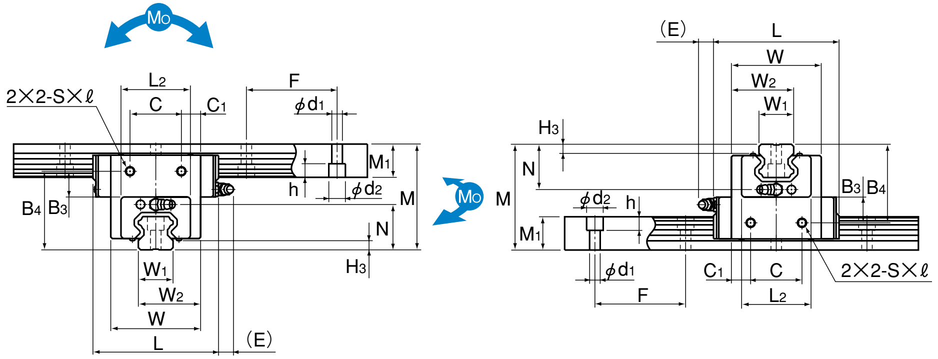
Model No.	CSR 15	CSR 20	CSR 25	CSR 30	CSR 35	CSR 45
Standard LM rail length (L_0)	160	220	220	280	280	570
	220	280	280	360	360	675
	280	340	340	440	440	780
	340	400	400	520	520	885
	400	460	460	600	600	990
	460	520	520	680	680	1095
	520	580	580	760	760	1200
	580	640	640	840	840	1305
	640	700	700	920	920	1410
	700	760	760	1000	1000	1515
	760	820	820	1080	1080	1620
	820	940	940	1160	1160	1725
	940	1000	1000	1240	1240	1830
	1000	1060	1060	1320	1320	1935
	1060	1120	1120	1400	1400	2040
	1120	1180	1180	1480	1480	2145
	1180	1240	1240	1560	1560	2250
	1240	1360	1300	1640	1640	2355
	1360	1480	1360	1720	1720	2460
	1480	1600	1420	1800	1800	2565
	1600	1720	1480	1880	1880	2670
		1840	1540	1960	1960	2775
		1960	1600	2040	2040	2880
		2080	1720	2200	2200	2985
		2200	1840	2360	2360	3090
			1960	2520	2520	
			2080	2680	2680	
			2200	2840	2840	
			2320	3000	3000	
			2440			
Standard pitch F	60	60	60	80	80	105
G	20	20	20	20	20	22.5
Max length	2500	3000	3000	3000	3000	3090

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Model CSR



Models CSR20 to 45



Models CSR15, 20S to 30S

Unit: mm

Model No.	External dimensions			LM block dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*	Mass	
	Height M	Width W	Length L	B_1	B_3	B_4	B	C	C_1	S× ℓ	L_2	H_3	N	E	Grease nipple	Width W_1 ±0.05	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_0	LM block kg	LM rail kg/m
CSR 15	47	38.8	56.6	—	11.3	34.8	—	20	9.4	M4×6	32	3.5	19.5	5.5	PB1021B	15	26.9	15	60	4.5×7.5×5.3	8.33	13.5	0.0805	0.34	1.5
CSR 20S CSR 20	57	50.8 66.8	74 90	— 13	13.3 7.8	42.5 37	— 24	30 56	10.4 5.4	M5×8	42	4	25	12	B-M6F	20	35.4 43.4	18	60	6×9.5×8.5	13.8 21.3	23.8 31.8	0.19 0.27	0.73 1.3	2.3
CSR 25S CSR 25	70	59.5 78.6	83.1 102.2	— 18	17 9	52 44	— 26	34 64	12.75 7.3	M6×10	46	5.5	30	12	B-M6F	23	41.25 50.8	22	60	7×11×9	19.9 27.2	34.4 45.9	0.307 0.459	1.2 2.2	3.3
CSR 30S CSR 30	82	70.4 93	98 120.6	— 21	20 12	61 53	— 32	40 76	15.2 8.5	M6×10	58	7	35	12	B-M6F	28	49.2 60.5	26	80	9×14×12	28 37.3	46.8 62.5	0.524 0.751	2 3.6	4.8
CSR 35	95	105.8	134.8	24	14	61	37	90	7.9	M8×14	68	7.5	40	12	B-M6F	34	69.9	29	80	9×14×12	50.2	81.5	1.2	5.3	6.6
CSR 45	118	129.8	170.8	30	16	75	45	110	9.9	M10×15	84	10	50	16	B-PT1/8	45	87.4	38	105	14×20×17	80.4	127.5	2.43	9.8	11

Note Static permissible moment*:static permissible moment value with 1 LM block

Model number coding

4 CSR25 UU C0 +1200/1000L P

1 2 3 4 5 6 7

1 Total No. of LM blocks 2 Model number 3 Dust prevention accessory symbol (see page a-348)
4 Radial clearance symbol (see page a-33) 5 LM rail length on the X axis (in mm)
6 LM rail length on the Y axis (in mm) 7 Accuracy symbol (see page a-41)

Standard Length and Maximum Length of the LM Rail P. a-350

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model CSR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	LL	RR
CSR 15	56.6	56.6	61.8	58.2*	63.4*	56.6	56.6
CSR 20S	74	74	80.6	76.6	83.2	74	74
CSR 20	90	90	96.6	92.6	99.2	90	90
CSR 25S	83.1	83.1	90.7	86.7	94.3	83.1	83.1
CSR 25	102.2	102.2	109.8	105.8	113.4	102.2	102.2
CSR 30S	98	98	105.6	101.6	109.2	98	98
CSR 30	120.6	120.6	128.2	124.2	131.8	120.6	120.6
CSR 35	134.8	134.8	142.4	138.4	146	134.8	134.8
CSR 45	170.8	170.8	178	176	183.2	170.8	170.8

Note: "*" indicates available, but not support a grease nipple. Contact THK for details.

Wide Rail, Four-way Equal Load LM Guide Model HRW

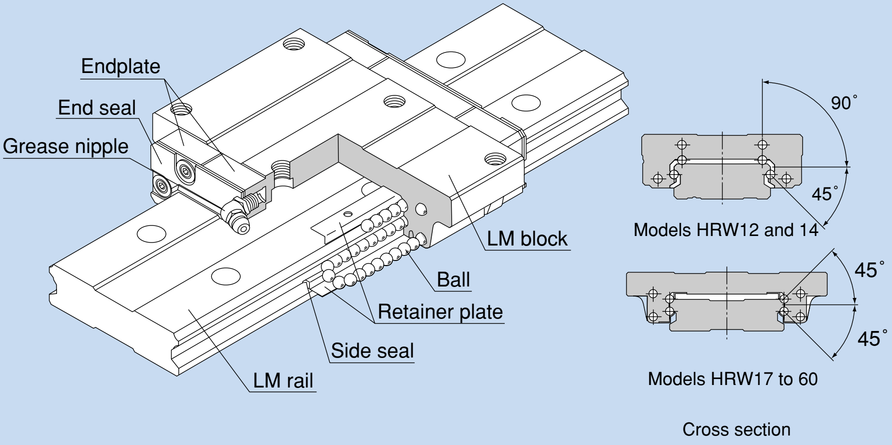


Fig. 1 Structure of Model HRW

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.

Since retainer plates hold the balls, they do not fall off even if the LM rail is pulled out (except models HRW 12 and 14LR).

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations. In addition, the LM block can receive a well-balanced preload, increasing the rigidity in the four directions while maintaining a constant, low friction coefficient.

In a low gravitational center structure with a large rail width and a low overall height, this model can be used in places where space saving is required or high rigidity against a moment is required even in a single axis configuration.

●Compact, heavy load

Since the number of effective balls is large, this model is highly rigid in all directions. It can adequately receive a moment even in a single rail configuration.

Additionally, since the second moment of inertia of the rail is large, the rigidity in the lateral directions is also high. Accordingly, it does not need reinforcement such as a side support.

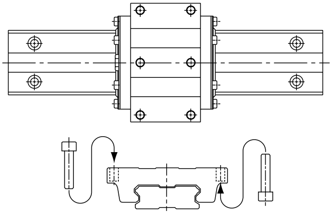
●Self-adjustment capability

The self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus to achieve highly accurate, smooth linear motion.

Types and Features

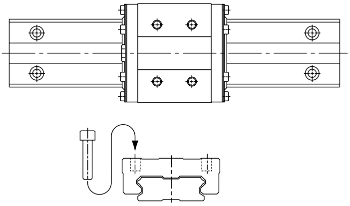
Model HRW-CA

The flange of the LM block has tapped holes.
Can be mounted from the top or the bottom.



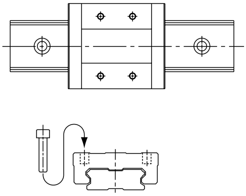
Model HRW-CR

The LM block has tapped holes.



Miniature Type Model HRW-LR

The LM block has tapped holes.



Rated Loads in All Directions

Model HRW is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of model HRW 17 to 60 are equal in all the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for HRW. The basic load ratings of models HRW 12 and 14 indicate the values in the radial directions in Fig. 2, and their actual values are provided in the dimensional table for HRW. The values in the reverse-radial and lateral directions are obtained from table 1.

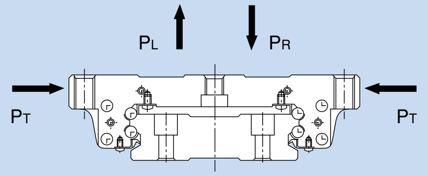


Fig. 2

Table 1 Rated Loads in All Directions with Models HRW 12 and 14

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	C_L=0.78C	C_{0L}=0.71C_0
Lateral direction	C_T=0.48C	C_{0T}=0.35C_0

Equivalent Load

When the LM block of models HRW 17 to 60 receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

When the LM block of models HRW 12 and 14 receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- Reverse-radial direction
- Lateral direction

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

X/Y axes : Equivalent factor (see table 2)

Table 2 Equivalent Factors of Models HRW 12 and 14

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

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model HRW.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-368.

Table 3 Symbols of Dust Prevention Accessories for Model HRW

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal (note)
ZZ	With end seal + side seal + metal scraper (note)
KK	With double seals + side seal + metal scraper (note)

Note: The side seal is not available for models HRW17 and 21.

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HRW···UU, refer to the corresponding value provided in table 4.

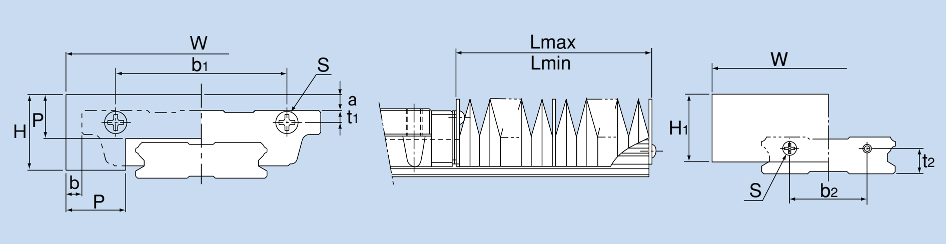
Table 4 Maximum Seal Resistance Value of Seals HRW···UU

Unit: N

Model No.	Seal resistance value
HRW 12	0.2
HRW 14	0.3
HRW 17	2.9
HRW 21	4.9
HRW 27	4.9
HRW 35	9.8
HRW 50	14.7
HRW 60	19.6

●Dedicated Bellows JHRW for Model HRW

The table below shows the dimensions of dedicated bellows JHRW for model HRW. Specify the corresponding model number of the desired bellows from the table.



Unit: mm

Model No.	Major dimensions												A $\left(\frac{Lmax}{Lmin}\right)$	Supported model
	W	H	H_1	P	b_1	t_1	b_2	t_2	Mounting bolt S	a	b			
											Type CA	Type CR		
JHRW 17	68	22	23	15	43	3	18	6	∗M3×6 ℓ	8	4	9	5	HRW 17
JHRW 21	75	25	26	17	48	3	22	7	M3×6 ℓ	8	3.5	10.5	6	HRW 21
JHRW 27	85	33.5	33.5	20	48	3	20	10	M3×6 ℓ	10	2.5	11.5	7	HRW 27
JHRW 35	120	35	35	20	75	3.5	40	13	M3×6 ℓ	6	0	10	7	HRW 35
JHRW 50	164	42	42	20	100	9	50	16	M4×8 ℓ	–3	1	17	7	HRW 50

Note 1: For model JH17's location marked with "∗", mounting bolts are used only on the LM rail side while the LM block side uses M2.5 x 8 (nominal) tapped pins.

Note 2: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 3: For lubrication when using the dedicated bellows, contact THK.

Note 4: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding **JHRW21-60/360**

1 2

1 Model number···bellows for HRW21

2 Bellows dimensions (length when compressed / length when extended)

Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$Lmax = Lmin \cdot A$$ A: Extension rate

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

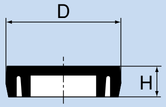
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

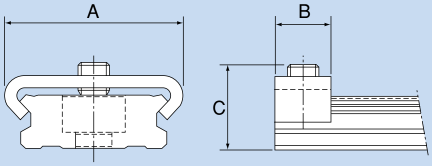
Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
HRW 14	C 4	M 4	7.8	1.0
HRW 17	C 4	M 4	7.8	1.0
HRW 21	C 4	M 4	7.8	1.0
HRW 27	C 4	M 4	7.8	1.0
HRW 35	C 6	M 6	11.4	2.7
HRW 50	C 8	M 8	14.4	3.7
HRW 60	C10	M10	18.0	3.7



Dedicated Cap C

Stopper

With miniature LM Guide models HRW12 and 14, balls will fall off if the LM block is removed from the LM rail. To prevent the LM block from being pulled out, end pieces are mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.



Unit: mm

Model No.	A	B	C
HRW 12	22.0	7.0	10.5
HRW 14	28.6	7.6	11.2

Standard Length and Maximum Length of the LM Rail

Table 6 shows the standard lengths and the maximum lengths of model HRW variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

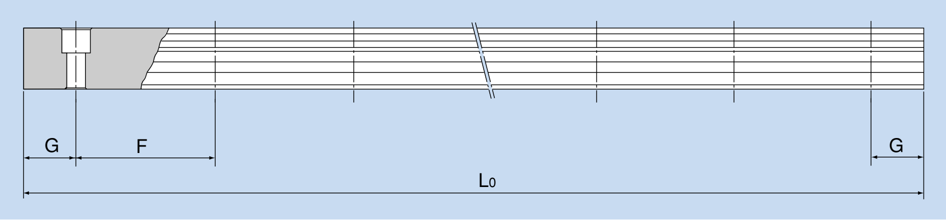


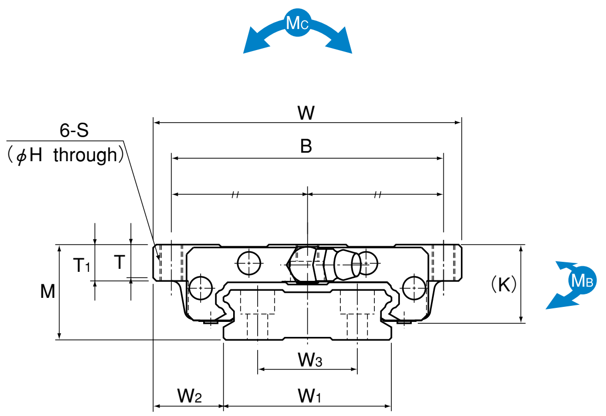
Table 6 Standard Length and Maximum Length of the LM Rail for Model HRW

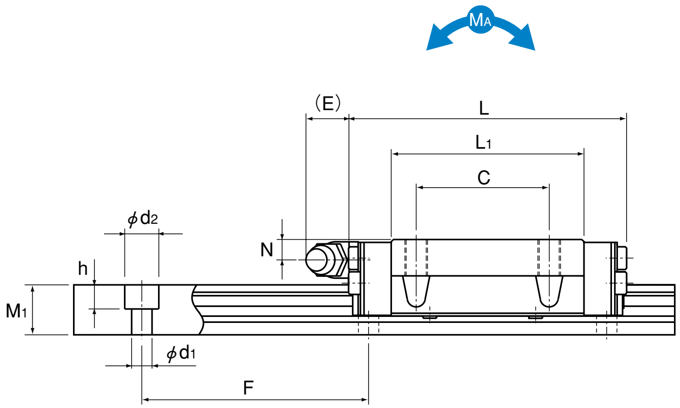
Unit: mm

Model No.	HRW 12	HRW 14	HRW 17	HRW 21	HRW 27	HRW 35	HRW 50	HRW 60
Standard LM rail length (L_0)	70 110 150 190 230 270 310 390 470	70 110 150 190 230 270 310 390 470 550 670	110 190 310 470 550	130 230 380 480 580 780	160 280 340 460 640 820	280 440 760 1000 1240 1560	280 440 760 1000 1240 1640 2040	570 885 1200 1620 2040 2460
Standard pitch F	40	40	40	50	60	80	80	105
G	15	15	15	15	20	20	20	22.5
Max length	(1000)	(1430)	1900 (800)	1900 (1000)	3000 (1200)	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.
Note 3: The figures in the parentheses indicate the maximum lengths of stainless steel made models.

Models HRW-CA | HRW-CAM





Unit: mm

Model No.	External dimensions			LM block dimensions											LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Height	Width	Length											Grease nipple	Width			Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	H	S	L_1	T	T_1	K	N	E		W_1 ±0.05	W_2	W_3	M_1	F	$d_1 \times d_2 \times h$	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HRW 17CA HRW 17CAM	17	60	50.8	53	26	3.3	M4	33.6	5.5	6	14.5	4	2	PB107	33	13.5	18	9	40	4.5×7.5×5.3	4.31	8.14	0.0417	0.244	0.0417	0.244	0.128	0.15	2.1
HRW 21CA HRW 21CAM	21	68	58.8	60	29	4.4	M5	40	7.3	8	18	4.5	12	B-M6F	37	15.5	22	11	50	4.5×7.5×5.3	6.18	11.5	0.0701	0.398	0.0701	0.398	0.194	0.25	2.9
HRW 27CA HRW 27CAM	27	80	72.8	70	40	5.3	M6	51.8	9.5	10	24	6	12	B-M6F	42	19	24	15	60	4.5×7.5×5.3	11.5	20.4	0.156	0.874	0.156	0.874	0.398	0.5	4.3
HRW 35CA HRW 35CAM	35	120	106.6	107	60	6.8	M8	77.6	13	14	31	8	12	B-M6F	69	25.5	40	19	80	7×11×9	27.2	45.9	0.529	2.89	0.529	2.89	1.49	1.4	9.9
HRW 50CA	50	162	140.5	144	80	8.6	M10	103.5	16.5	18	46.6	14	16	B-PT1/8	90	36	60	24	80	9×14×12	50.2	81.5	1.25	6.74	1.25	6.74	3.46	4	14.6
HRW 60CA	60	200	158.9	180	80	10.5	M12	117.5	23.5	25	53.5	15	16	B-PT1/8	120	40	80	31	105	11×17.5×14	63.8	102	1.76	12.3	1.76	12.3	5.76	5.7	27.8

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

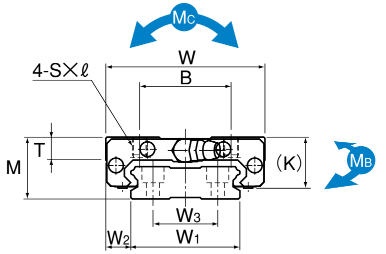
HRW35 CA 2 UU C1 M +1000L P M

1 HRW35 · 2 CA · 3 2 · 4 UU · 5 C1 · 6 M · 7 +1000L · 8 P · 9 M

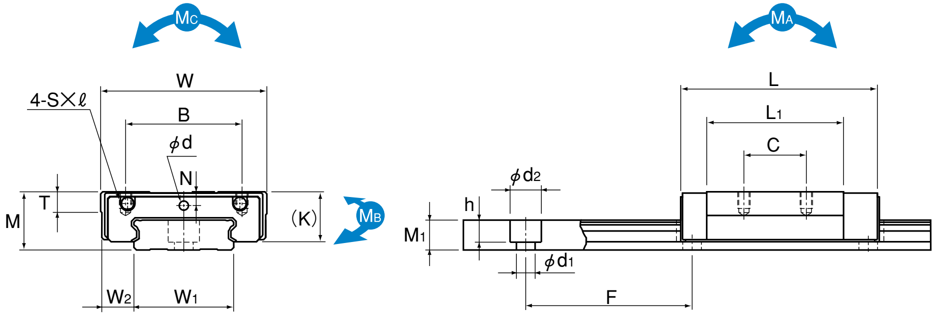
1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-359) 5 Radial clearance symbol (see page a-34)
6 LM block is made of stainless steel 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 LM rail is made of stainless steel

Standard Length and Maximum Length of the LM Rail P. a-362

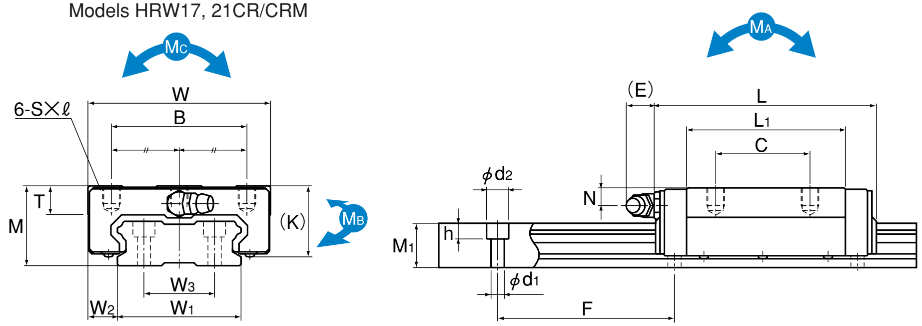
Models HRW-CR | HRW-CRM HRW-LRM



Models HRW17, 21CR/CRM



Models HRW12, 14LRM



Models HRW27 to 50CR/CRM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Height M	Width W	Length L	B	C	S× ℓ	L_1	T	K	N	E	Greasing hole d	Grease nipple	Width W_1 ±0.05	W_2	W_3	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A		M_B		M_C	LM block	LM rail
																						1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
HRW 12LRM	12	30	37	21	12	M3×3.5	27	4	10	2.8	—	2.2	—	18	6	—	6.5	40	4.5×8×4.5	3.29	7.16	0.0262	0.138	0.013	0.069	0.051	0.045	0.79
HRW 14LRM	14	40	45.5	28	15	M3×4	32.9	5	12	3.3	—	2.2	—	24	8	—	7.2	40	4.5×7.5×5.3	5.38	11.4	0.0499	0.273	0.025	0.137	0.112	0.08	1.2
HRW 17CR HRW 17CRM	17	50	50.8	29	15	M4×5	33.6	6	14.5	4	2	—	PB107	33	8.5	18	9	40	4.5×7.5×5.3	4.31	8.14	0.0417	0.244	0.0417	0.244	0.128	0.12	2.1
HRW 21CR HRW 21CRM	21	54	58.8	31	19	M5×6	40	8	18	4.5	12	—	B-M6F	37	8.5	22	11	50	4.5×7.5×5.3	6.18	11.5	0.0701	0.398	0.0701	0.398	0.194	0.19	2.9
HRW 27CR HRW 27CRM	27	62	72.8	46	32	M6×6	51.8	10	24	6	12	—	B-M6F	42	10	24	15	60	4.5×7.5×5.3	11.5	20.4	0.156	0.874	0.156	0.874	0.398	0.37	4.3
HRW 35CR HRW 35CRM	35	100	106.6	76	50	M8×8	77.6	14	31	8	12	—	B-M6F	69	15.5	40	19	80	7×11×9	27.2	45.9	0.529	2.89	0.529	2.89	1.49	1.2	9.9
HRW 50 CR	50	130	140.5	100	65	M10×15	103.5	18	46.6	14	16	—	B-PT1/8	90	20	60	24	80	9×14×12	50.2	81.5	1.25	6.74	1.25	6.74	3.46	3.2	14.6

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HRW27 CR 2 UU C1 M +820L P M
1 2 3 4 5 6 7 8 9

1 Model number 2 Type of LM block 3 No. of LM blocks used on the same rail
4 Dust prevention accessory symbol (see page a-359) 5 Radial clearance symbol (see page a-34)
6 LM block is made of stainless steel 7 LM rail length (in mm) 8 Accuracy symbol (see page a-38)
9 LM rail is made of stainless steel

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model HRW with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK
HRW 12LRM	37	37	—	—	—
HRW 14LRM	45.5	45.5	—	—	—
HRW 17CA/CR	50.8	—	54.8	54.4	60.2
HRW 21CA/CR	58.8	—	64.2	62.8	69
HRW 27CA/CR	72.8	72.8	79	75.6	81.8
HRW 35CA/CR	106.6	106.6	113.8	112	119.2
HRW 50CA/CR	140.5	140.5	147.7	143.3	150.5
HRW 60CA	158.9	158.9	169.7	165.1	175.9

Note: "—" indicates not available.

Interchangeable, Self-adjusting Type LM Guide Model GSR

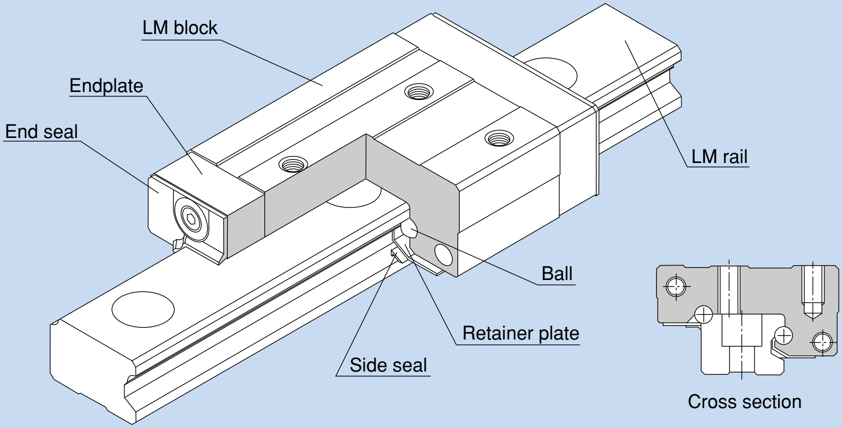


Fig. 1 Structure of Model GSR

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and end-plates incorporated in the LM block allow the balls to circulate. Since retainer plates hold the balls, they do not fall off even if the LM rail is pulled out.

As the top face of the LM block is inclined, a clearance is removed and an appropriate preload is applied simply by securing the LM block with mounting bolts.

Model GSR has a special contact structure using circular-arc grooves. This increases self-adjusting capability and makes GSR an optimal model for places associated with difficulty establishing high accuracy and for general industrial machinery.

●Interchangeability

Both the LM block and LM rail are interchangeable and can be stored separately. Therefore, it is possible to store a long-size LM rail and cut it to a desired length before using it.

●Compact design

Since model GSR has a low gravitational center structure with a low overall height, the machine can be downsized.

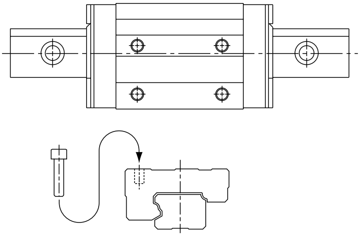
●Capable of receiving a load in any direction

The ball contact angle is designed so that this model can receive a load in any direction. As a result, it can be used in places where a reverse-radial load, lateral load or a moment in any direction is applied.

Types and Features

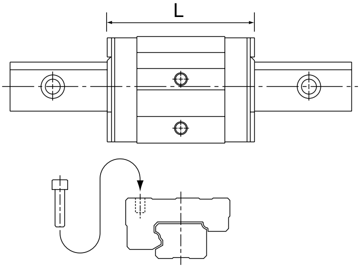
Model GSR-T

Model GSR-T is a standard type.



Model GSR-V

A space-saving type that has the same sectional shape as GSR-T, but has a shorter overall LM block length (L).



Rated Loads in All Directions

Model GSR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for GSR. The values in the radial direction, tensile lateral direction and compressive lateral direction are obtained from table 1.

Note: Not available for a single-axis configuration.

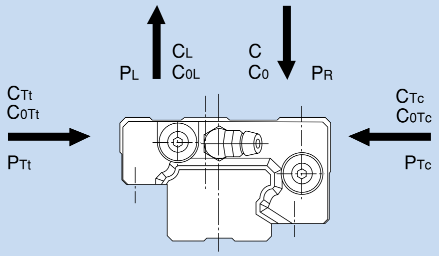


Fig. 2

Table 1 Basic Load Ratings of Model GSR in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.93C$	$C_{0L}=0.90C_0$
Tensile lateral direction	$C_{Tt}=0.84C$	$C_{0Tt}=0.78C_0$
Compressive lateral direction	$C_{Tc}=0.93C$	$C_{0Tc}=0.90C_0$

Equivalent Load

When the LM block of model GSR receives loads in the radial, tensile lateral, reverse-radial and compressive lateral directions simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R+Y\cdot P_{Tt}$$
$$P_E=P_L+P_{Tc}$$

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Tensile lateral direction
- Compressive lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_{Tt} : Tensile lateral load (N)
P_{Tc} : Compressive lateral load (N)
X/Y axes : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model GSR
(When radial and tensile lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	1.28
Equivalent load in tensile lateral direction	0.781	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model GSR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-378.

Table 3 Symbols of Dust Prevention Accessories for Model GSR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals GSR···UU, refer to the corresponding value provided in table 4.

Table 4 Maximum Seal Resistance Value of Seals GSR···UU

Unit: N

Model No.	Seal resistance value
GSR 15	2.5
GSR 20	3.1
GSR 25	4.4
GSR 30	6.3
GSR 35	7.6

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

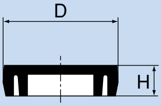
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
GSR 15	C 4	M 4	7.8	1.0
GSR 20	C 5	M 5	9.8	2.4
GSR 25	C 6	M 6	11.4	2.7
GSR 30	C 8	M 8	14.4	3.7
GSR 35	C10	M10	18.0	3.7



Dedicated Cap C

Example of Clearance Adjustment

By providing a butt on the side face of each LM block and pressing either LM block with a bolt, a preload is applied and the rigidity is increased.

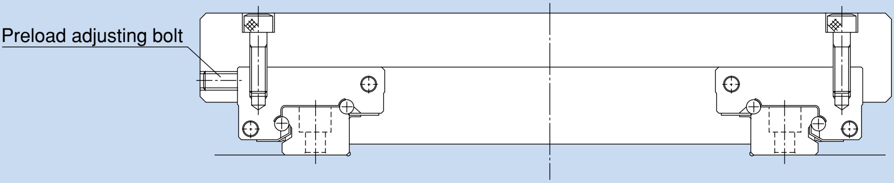


Fig. 3 Example of Adjusting a Preload with a Push Bolt

Tapped LM Rail Type of Model GSR-K

- ●Since the bottom of the LM rail has a tapped hole, this model can easily be installed on an H-section steel and channel.
- ●Since the top face of the LM rail has no mounting hole, the sealabilitiy is increased and entrance of foreign matter (e.g., cutting chips) can be prevented.

① Determine the bolt length so that a clearance of 2 to 3 mm is secured between the bolt end and the bottom of the tap (effective tap depth).

② As shown in Fig. 4, a tapered washer is also available that allows GSR to be mounted on a section steel.

③ For model number coding, see pages a-376 and a-377.

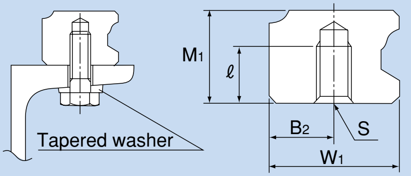


Fig. 4

Table 6 Tap Position and Depth Shape

Model No.	W_1	B_2	M_1	S× ℓ
GSR 15	15	7.5	11.5	M4×7
GSR 20	20	10	13	M5×8
GSR 25	23	11.5	16.5	M6×10
GSR 30	28	14	19	M8×12
GSR 35	34	17	22	M10×14

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model GSR variations.
In case the required quantity is large and the lengths are not the same, we recommend preparing an LM rail of the maximum length in stock. This is economical since it allows you to cut the rail to the desired length as necessary.

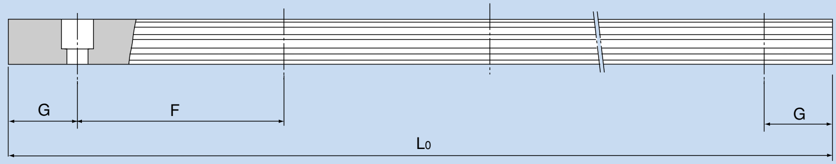


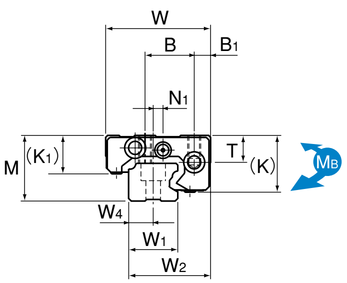
Table 7 Standard Length and Maximum Length of the LM Rail for Model GSR

Unit: mm

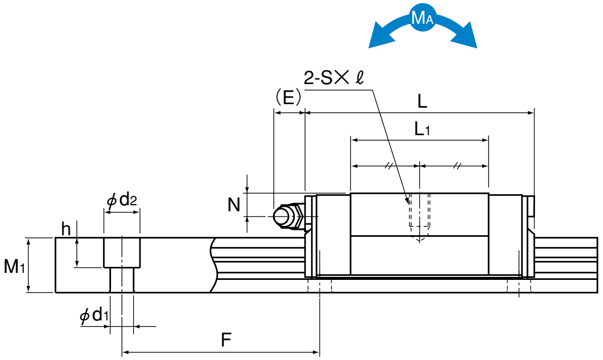
Model No.	GSR 15	GSR 20	GSR 25	GSR 30	GSR 35
Standard LM rail length (L_0)	460 820 1060 1600	460 820 1060 1600	460 820 1060 1600	1240 1720 2200 3000	1240 1720 2200 3000
Standard pitch F	60	60	60	80	80
G	20	20	20	20	20
Max length	2000	3000	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

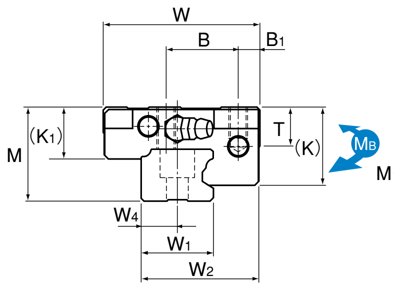
Models GSR-T | GSR-V



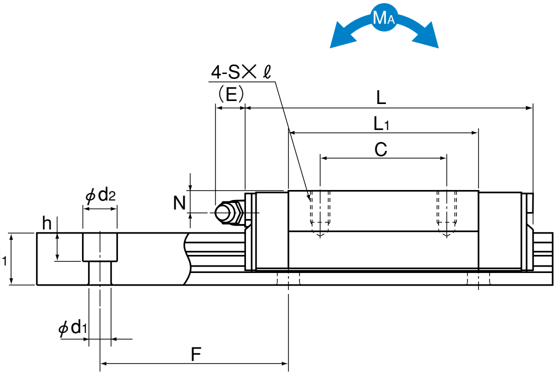
Model GSR15T/V



Models GSR15 to 25V



Models GSR20 to 35T
Models GSR20, 25V



Models GSR15 to 35T

Unit: mm

Model No.	External dimensions			LM block dimensions													LM rail dimensions						Basic load rating		Static permissible moment kN-m*				Mass	
	Height	Width	Length												Grease nipple	Width			Height	Pitch		C	C_0	M_A		M_B		LM block	LM rail
	M	W	L	B_1	B	C	S×ℓ	L_1	T	K	K_1	N	N_1	E		W_1	W_2	W_4	M_1	F	d_1×d_2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	kg	kg/m
GSR 15T GSR 15V	20	32	59.8 47.1	5	15	26 —	M4×7	40.2 27.5	8.25	17.5	12	4.5	3	5.5	PB107	15	25	7.5	11.5	60	4.5×7.5×5.3	5.69 4.31	8.43 5.59	0.0525 0.0252	0.292 0.158	0.0452 0.0218	0.252 0.136	0.13 0.08	1.2
GSR 20T GSR 20V	24	43	74 58.1	7	20	30 —	M5×8	50.2 34.3	9.7	20.6	13.6	5	—	12	B-M6F	20	33	10	13	60	6×9.5×8.5	9.22 7.01	13.2 8.82	0.102 0.0498	0.564 0.307	0.0885 0.0431	0.486 0.265	0.25 0.17	1.8
GSR 25T GSR 25V	30	50	88 69	7	23	40 —	M6×10	60.2 41.2	12.7	25.5	16.8	7	—	12	B-M6F	23	38	11.5	16.5	60	7×11×9	13.5 10.29	19 12.65	0.177 0.0858	0.965 0.522	0.152 0.0742	0.831 0.451	0.5 0.29	2.6
GSR 30T	33	57	103	8	26	45	M8×12	70.3	14.6	28.5	18	7	—	12	B-M6F	28	44.5	14	19	80	9×14×12	18.8	25.9	0.282	1.54	0.243	1.32	0.6	3.6
GSR 35T	38	68	117	9	32	50	M8×15	80.3	15.6	32.5	20.5	8	—	12	B-M6F	34	54	17	22	80	11×17.5×14	25.1	33.8	0.421	2.28	0.362	1.96	1	5

Note A moment in the direction M_C can be received if two rails are used in parallel. However, since it depends on the distance between the two rails, the moment in the direction M_C is omitted here.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

Combination of LM rail and LM block

GSR25 T 2 UU +1060L H K
1 2 3 4 5 6 7

1 Model number 2 Type of LM block 3 No. of LM blocks
4 Dust prevention accessory symbol (see page a-373) 5 LM rail length (in mm)
6 Accuracy symbol (see page a-43) 7 Symbol for tapped LM rail type

Note One set of model GSR: state where two LM rails and an LM block are used in combination on the same plane.

Model number coding

LM block

GSR25 T UU
1 2 3

1 Model number 2 Type of LM block
3 Dust prevention accessory symbol (see page a-373)

Model number coding

LM rail

GSR25 -1060L H K
1 2 3 4

1 LM rail model number 2 LM rail length (in mm)
3 Accuracy symbol (see page a-43)
4 Symbol for tapped LM rail type

Standard Length and Maximum Length of the LM Rail P. a-375

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model GSR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK
GSR 15T	59.8	59.8	65	65.8	71
GSR 15V	47.1	47.1	52.3	53.1	58.3
GSR 20T	74	74	80.6	77.6	84.2
GSR 20V	58.1	58.1	64.7	61.7	68.3
GSR 25T	88	88	95	91.6	98.6
GSR 25V	69	69	76	72.6	79.6
GSR 30T	103	103	110.6	107.2	114.8
GSR 35T	117	117	124.6	121.2	128.8

Rack-toothed Rail Type LM Guide Model GSR-R

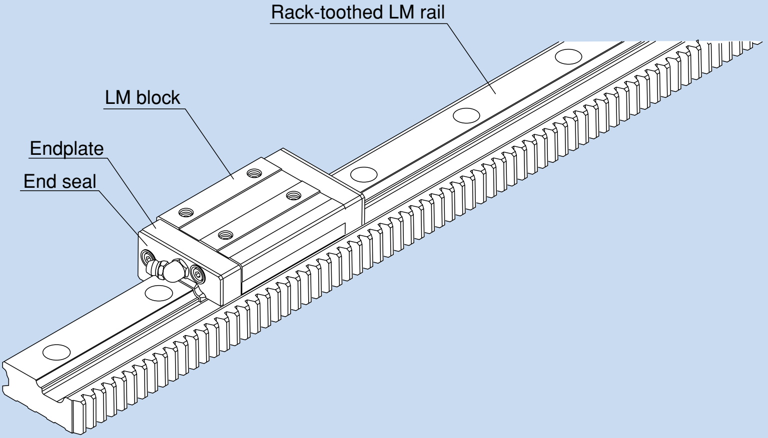


Fig1. Structure of Model GSR-R

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since retainer plates hold the balls, they do not fall off.
As the top face of the LM block is inclined, a clearance is eliminated and an appropriate preload is applied simply by securing the LM block with mounting bolts.
Model GSR-R is based on model GSR, but has rack teeth on the LM rail. This facilitates the design and assembly of drive mechanisms.

●Reduced machining and assembly costs

The single-piece structure integrating the LM rail (linear guide) and rack (drive) reduces labor and time for machining the rack mounting surface and assembling and adjusting the guide system, thus to achieve significant cost reduction.

●Easy designing

The travel distance per turn of the pinion is specified by the integer value. This makes it easy to calculate the travel distance per pulse when the LM Guide is used in combination with a stepping motor or servomotor.

●Space saving

Since the LM rail has rack teeth, the machine size can be reduced.

●Long stroke

The end faces of the LM rail are machined for connected use. To obtain a long stroke, simply connect LM rails of the standard length.

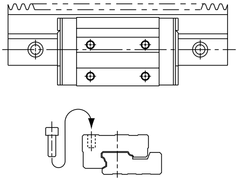
●High durability

The rack tooth has a width equal to the LM rail height, the rack uses high-grade steel with proven performance and the teeth are heat-treated, thereby to ensure high durability.

Type and Features

Model GSR-R (with a rack-teethed LM rail)

Since the thrust load on the pinion shaft can be kept low due to rack-pinion meshing, it is easy to design systems with pinion shaft bearings and tables that are not so rigid.



Rated Loads in All Directions

Model GSR-R is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for GSR-R. The values in the radial direction, tensile lateral direction and compressive lateral direction are obtained from table 1.

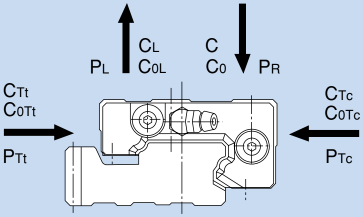


Fig. 2

Table 1 Basic Load Ratings of Model GSR-R in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.93C$	$C_{0L}=0.90C_0$
Tensile lateral direction	$C_{Tt}=0.84C$	$C_{0Tt}=0.78C_0$
Compressive lateral direction	$C_{Tc}=0.93C$	$C_{0Tc}=0.90C_0$

Equivalent Load

When the LM block of model GSR-R receives loads in the radial, tensile lateral, reverse-radial and compressive lateral directions simultaneously, the equivalent load is obtained from the equation below.

$$P_E = X \cdot P_R + Y \cdot P_{Tt}$$

$$P_E = P_L + P_{Tc}$$

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Tensile lateral direction
- Compressive lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_{Tt} : Tensile lateral load (N)
P_{Tc} : Compressive lateral load (N)
X/Y axes : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model GSR-R
(When radial and tensile lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	1.28
Equivalent load in tensile lateral direction	0.781	1

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model GSR-R.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-391.

Table 3 Symbols of Dust Prevention Accessories for Model GSR-R

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals GSR-R···UU, refer to the corresponding value provided in table 4.

Table 4 Maximum Seal Resistance Value of Seals GSR-R···UU

Unit: N

Model No.	Seal resistance value
GSR 25-R	4.4
GSR 30-R	6.3
GSR 35-R	7.6

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

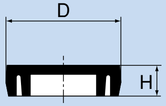
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
GSR 25-R	C 6	M 6	11.4	2.7
GSR 30-R	C 8	M 8	14.4	3.7
GSR 35-R	C10	M10	18.0	3.7



Dedicated Cap C

Rack and Pinion

●Joining two or more rails

The end faces of the rack-toothed LM rail are machined so that a clearance is left after assembly in order to facilitate the assembly. Use of a special jig as shown in Fig. 3 will make the connection easier.
(THK also offers the rack-aligning jig.)

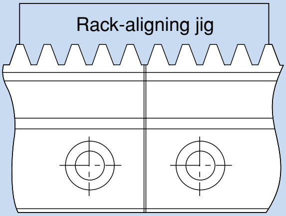


Fig. 3. Rack Connection Method

●Reworking the pinion hole

Only the teeth of the reworkable pinion-hole-diameter type (type C) are heat-treated. The hole and keyway can therefore be reworked by the user to the desired diameter and shape.

When reworking the pinion hole, be sure to take the following into account.

The material of the reworkable hole-diameter type (type C): S45C

① When chucking the teeth of a reworkable hole-diameter type, use a jaw scroll chuck or the like to maintain the tooth profile.

② The pinion is produced using the center of the hole as a reference point. The center of the hole should therefore be used as a reference point when the pinion is aligned. When checking the pinion run-out, refer to the boss sides.

③ Keep the reworked hole-diameter within roughly 60 to 70% of the boss diameter.

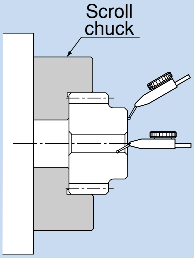


Fig. 4

●Lubricating the rack and pinion

To ensure smooth sliding on tooth surfaces and prevent wear, the teeth should be provided with a lubricant.

*Use a lubricant of the same type as that contained in the LM Guide.

●Checking strength

The strength of the assembled rack and pinion must be checked in advance.

① Calculated the maximum thrust acting on the pinion.

② Divide the permissible power-transmission capacity of the pinion to be used (table 6) by an overload factor (table 7).

③ By comparing the thrust acting on the pinion obtained in step 1 with the pinion power-transmission capacity obtained in step 2, make sure the applied thrust does not exceed the permissible power-transmission capacity.

[Example of calculation]

Model GSR-R is used in a horizontal conveyance system receiving a medium impact (assuming external load to be zero).

Conditions

Subject model No. (pinion)	GP6-20A
Mass (table + workpiece)	$m=100\text{kg}$
Speed	$v=1$ m/s
Acceleration/deceleration time	$T_1=0.1$ s

Consideration

① Calculating the maximum thrust

Calculated the thrust during acceleration/deceleration.

$$F\text{max} = m \cdot \frac{v}{T_1} = 1.00\text{kN}$$

② Permissible power-transmission capacity of the pinion

$$P\text{max} = \frac{\text{permissible power-transmission capacity (see table 6)}}{\text{overload factor (see table 7)}}$$

$$= \frac{2.33}{1.25}$$

$$= 1.86\text{kN}$$

③ Comparison between the maximum thrust and the permissible power-transmission capacity of the pinion

$F\text{max} < P\text{max}$

Therefore, it is judged that the subject model number can be used.

Table 6 Permissible Power-transmission Capacity

Unit: kN

Model No.	Permissible power-transmission capacity	Supported model
GP 6-20A	2.33	GSR 25-R
GP 6-20C	2.05	
GP 6-25A	2.73	
GP 6-25C	2.23	
GP 8-20A	3.58	GSR 30-R
GP 8-20C	3.15	
GP 8-25A	4.19	
GP 8-25C	3.42	
GP10-20A	5.19	GSR 35-R
GP10-20C	4.57	
GP10-25A	6.06	
GP10-25C	4.96	

Table 7 Overload Factor

Impact from the prime mover	Impact from the driven machine		
	Uniform load	Medium impact	Large impact
Uniform load (prime mover, turbine, hydraulic motor, etc.)	1.0	1.25	1.75

(Excerpt from JGMA401-01)

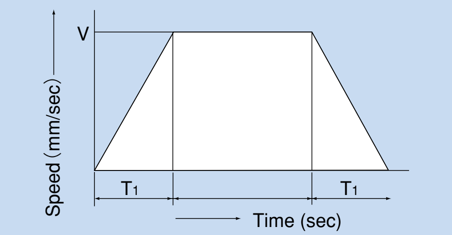
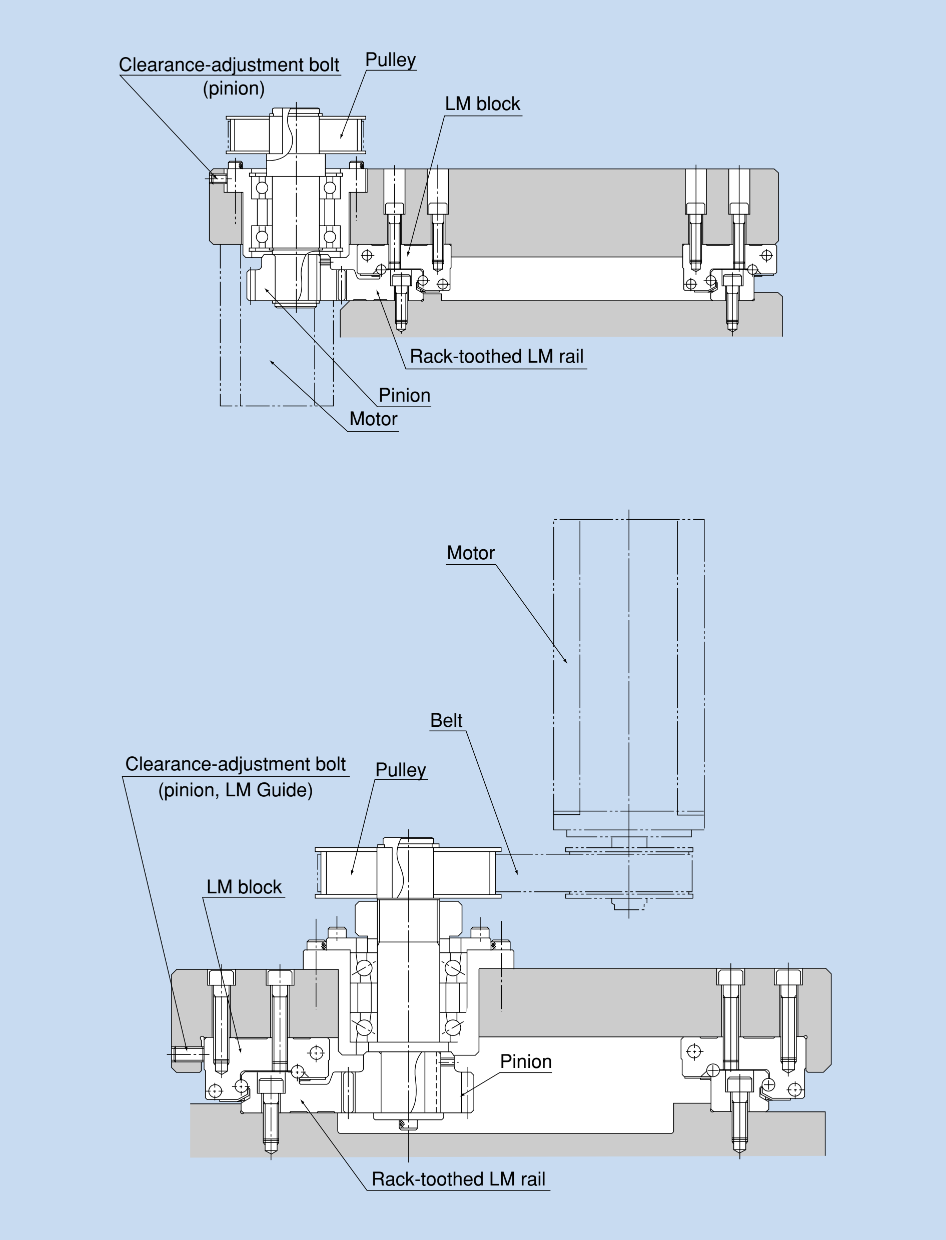


Fig. 5

●Example of Assembling Model GSR-R with the Table



Standard Length of the LM Rail

Table 8 shows the standard LM rail lengths of model GSR-R variations.

Since both end faces of the LM rail of model GSR-R are machined, it can be joined with another rail without additional machining.

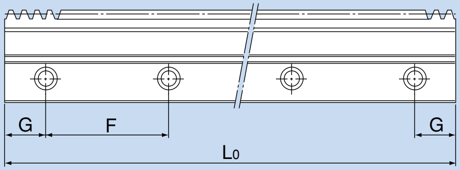
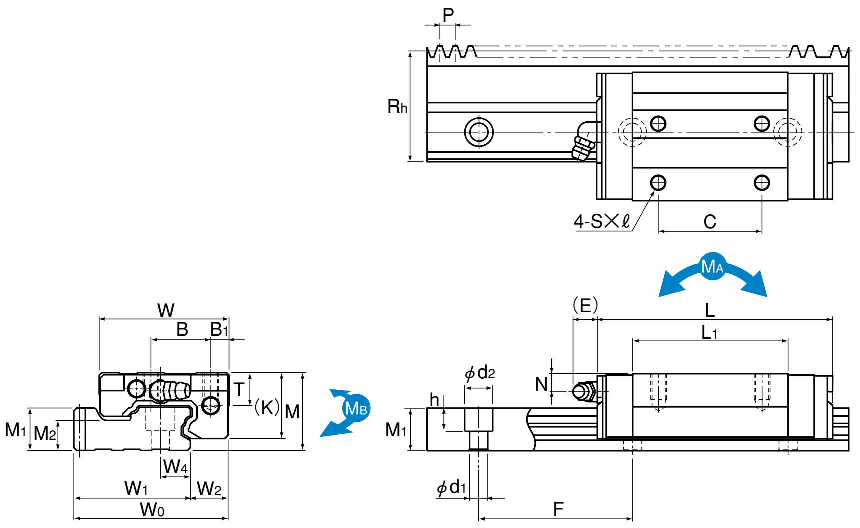


Table 8 Standard Length of the LM Rail for Model GSR-R

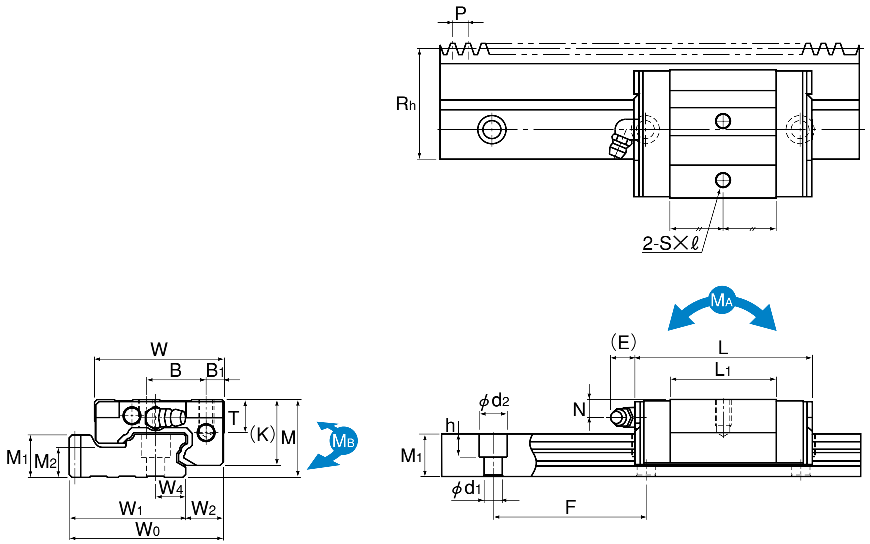
Unit: mm

Model No.	GSR 25-R		GSR 30-R		GSR 35-R	
Standard LM rail length (L0)	1500	2004	1504	2000	1500	2000
Standard pitch F	60	60	80	80	80	80
G	30	42	32	40	30	40

Models GSR-R



Model GSR-T-R



Model GSR25V-R

Unit: mm

Model No.	Rack			External dimensions				LM block dimensions										LM rail dimensions							Basic load rating		Static permissible moment kN-m*				Mass	
	Reference pitch dimension P	Module	Pitch line height Rh	Height M	Width W	W_0	Length L	B_1	B	C	S×ℓ	L_1	T	K	N	E	Grease nipple	Width W_1	W_2	W_4	Height M_1	Pitch F	M_2	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	LM block kg	LM rail kg/m
GSR 25T-R GSR 25V-R	6	1.91	43	30	50	59.91	88 69	7	23	40 —	M6×10	60.2 41.2	12.7	25.5	7	12	B-M6F	44.91	15	11.5	16.5	60	11.5	7×11×9	13.5 10.29	19 12.65	0.177 0.0858	0.965 0.522	0.152 0.0742	0.831 0.451	0.5 0.29	4.7
GSR 30T-R	8	2.55	48	33	57	67.05	103	8	26	45	M8×12	70.3	14.6	28.5	7	12	B-M6F	50.55	16.5	14	19	80	12	9×14×12	18.8	25.9	0.282	1.54	0.243	1.32	0.6	5.9
GSR 35T-R	10	3.18	57	38	68	80.18	117	9	32	50	M8×15	80.3	15.6	32.5	8	12	B-M6F	60.18	20	17	22	80	14.5	11×17.5×14	25.1	33.8	0.421	2.28	0.362	1.96	1	8.1

Note A special type with a module pitch is also available. Contact THK for details.
For checking the pinion strength, see pages a-385.

Note A moment in the direction MC can be received if two rails are used in parallel. However, since it depends on the distance between the two rails, the moment in the direction MC is omitted here.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding GSR25T 2 UU +5000L H R T

Single-rail LM Guide

1 2 3 4 5 6 7

1 Model number 2 No. of LM blocks 3 Dust prevention accessory symbol (see page a-382)
4 LM rail length (in mm) 5 Accuracy symbol (see page a-44) 6 Symbol for rack-toothed LM rail type
7 Symbol for connected use**
**For combinations of lengths when rails are connected, contact THK.

Note This model number indicates that a single-rail unit constitutes one set.

Model number coding GSR25T UU

LM block

1 2

1 Model number
2 Dust prevention accessory symbol
(see page a-382)

Model number coding GSR25-2004L H R

Rack-toothed LM rail

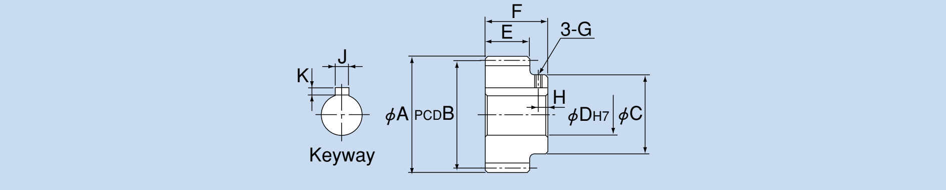
1 2

1 Accuracy symbol (see page a-44)
2 R: Symbol for rack-toothed LM rail type

Pinion

Pinion Type A for the Rack

Keyway type



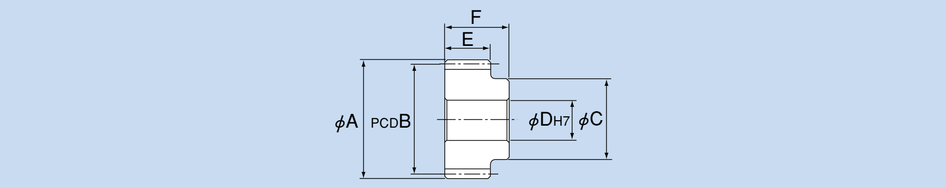
Unit: mm

Model No.	Pitch	No. of teeth	Tip circle diameter A	Meshing PCD B	Boss diameter C	Hole diameter D	Tooth width E	Total length F	G	H	Keyway J×K	Supported model
GP 6-20A	6	20	42.9	39	30	18	16.5	24.5	M3	4	6×2.8	GSR 25-R
GP 6-25A		25	51.9	48	35	18						
GP 8-20A	8	20	57.1	52	40	20	19	26	M3	5	8×3.3	GSR 30-R
GP 8-25A		25	69.1	64	40	20			M4			
GP10-20A	10	20	70.4	64	45	25	22	30	M4	5	8×3.3	GSR 35-R
GP10-25A		25	86.4	80	60	25					10×3.3	

Note 1: When making an order, specify the corresponding model number from the table.
Note 2: Non-standard (e.g., number of teeth) types of pinion are also available. Contact THK for details.

Pinion Type C for the Rack

Reworkable hole-diameter type

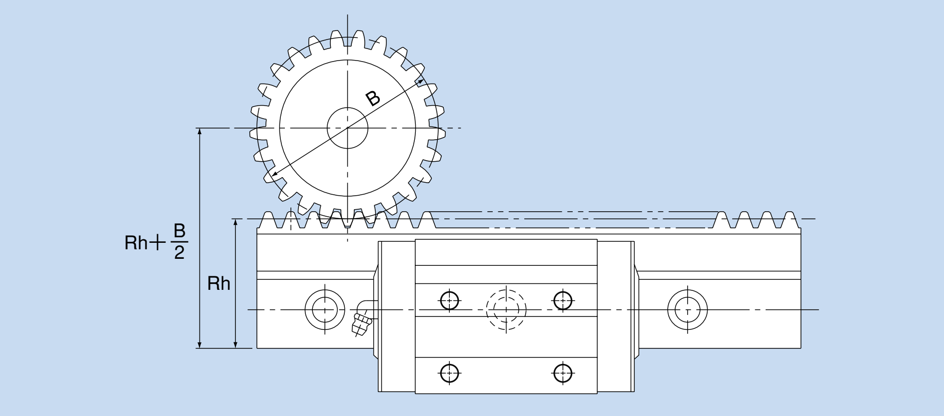


Unit: mm

Model No.	Pitch	No. of teeth	Tip circle diameter A	Meshing PCD B	Boss diameter C	Hole diameter D	Tooth width E	Total length F	Supported model
GP 6-20C	6	20	42.9	39	30	12	16.5	24.5	GSR 25-R
GP 6-25C		25	51.9	48	35	15		24.5	
GP 8-20C	8	20	57.1	52	40	18	19	26	GSR 30-R
GP 8-25C		25	69.1	64	40	18		26	
GP10-20C	10	20	70.4	64	45	18	22	30	GSR 35-R
GP10-25C		25	86.4	80	60	18		30	

Note 1: When making an order, specify the corresponding model number from the table.
Note 2: Non-standard (e.g., number of teeth) types of pinion are also available. Contact THK for details.

■Dimensions When the LM Rail Is Used in Combination with a Pinion



Unit: mm

GSR model No.	Pinion model No.	LM rail pitch line height Rh	Pinion meshing PCD B	Rh+B/2
GSR 25-R	GP 6-20A	43	39	62.5
	GP 6-20C			
	GP 6-25A		48	67
	GP 6-25C			
GSR 30-R	GP 8-20A	48	52	74
	GP 8-20C			
	GP 8-25A		64	80
	GP 8-25C			
GSR 35-R	GP 10-20A	57	64	89
	GP 10-20C			
	GP 10-25A		80	97
	GP 10-25C			

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model GSR-R with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK
GSR 25T-R	88	88	95	91.6	98.6
GSR 25V-R	69	69	76	72.6	79.6
GSR 30T-R	103	103	110.6	107.2	114.8
GSR 35T-R	117	117	124.6	121.2	128.8

Separate Type LM Guide Model HR

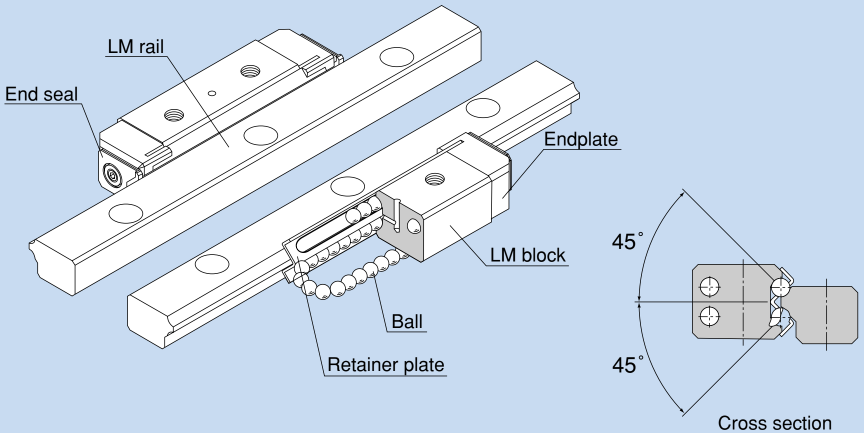


Fig. 1 Structure of Model HR

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since retainer plates hold the balls, they do not fall off.

Because of the angular contact structure where two rows of balls rolling on the LM rail each contact the raceway at 45°, the same load can be applied in four directions (radial, reverse-radial and lateral directions) if a set of LM rails and LM block is mounted on the same plane (i.e., when two LM rails are combined with an LM block on the same plane). Furthermore, since the sectional height is low, a compact and stable linear guide mechanism is achieved.

This structure makes clearance adjustment relatively easy, and is highly capable of absorbing a mounting error.

●Easy installation

Model HR is easier to adjust a clearance and achieve accuracy than cross-roller guides.

●Self-adjustment capability

Even if the parallelism or the level between the two rails is poorly established, the self-adjustment capability through front-to-front configuration of THK 's unique circular-arc grooves (DF set) enables a mounting error to be absorbed and smooth linear motion to be achieved even under a preload.

●4-way equal load

When the two rails are mounted in parallel, each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

●Sectional dimensions approximate to that of cross-roller guides

Since model HR is an infinite motion type whose retainer plate does not move, it is not associated with cage displacement that occurs with cross-roller guides. In addition, the sectional shape of model HR is approximate to that of cross-roller guides, and therefore, its components are interchangeable with that of cross-roller guides.

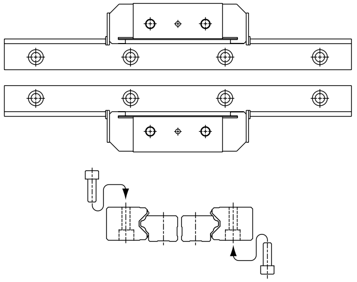
●Stainless steel type also available

A special type whose LM block, LM rail and balls are made of stainless steel is also available.

Types and Features

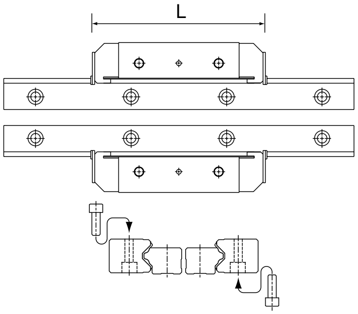
Model HR - Heavy-load Type

The LM blocks can be mounted from the top and the bottom.



Model HR-T-Ultra-heavy Load Type

Has the same sectional shape as model HR, but has a greater overall LM block length (L) and a higher load rating.



Rated Loads in All Directions

When installed, one set of model HR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings of an installed set of model HR are equal in all four directions (radial, reverse-radial and lateral directions). The basic load ratings in the dimensional table for model HR indicate the values in the radial direction per LM block as shown in Fig. 2.

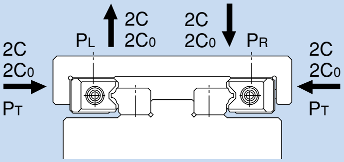


Fig. 2

Equivalent Load

When the LM block of model HR receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

$$P_E = P_R\ (P_L) + \frac{1}{2} P_T$$

where

P_E : Equivalent load (N)

- ･Radial direction
- ･Reverse-radial direction
- ･Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers an end seal for model HR as a dust prevention accessory.
(For details of the end seal, see page a-24).

Table 1 Symbol of Dust Prevention Accessory for Model HR

Symbol	Dust prevention accessory
UU	With end seal

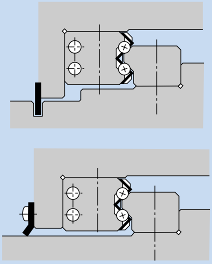


Fig. 3 Dust Prevention Method

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HR…UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals HR…UU

Unit: N

Model No.	Seal resistance value
HR 918	0.5
HR 1123	0.7
HR 1530	1.0
HR 2042	2.0
HR 2555	2.9
HR 3065	3.4
HR 3575	3.9
HR 4085	4.4
HR 50105	5.9
HR 60125	9.8

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

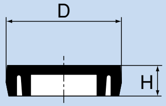
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

For the procedure for mounting the cap, see page a-22.

Table 3 Major Dimensions of Dedicated Cap C

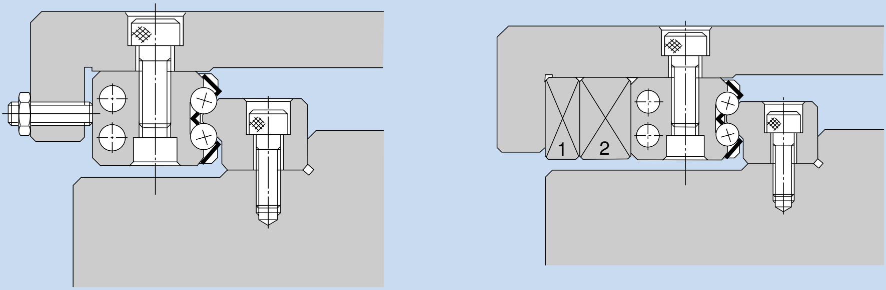
Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
HR 1123	C 3	M 3	6.3	1.2
HR 1530	C 3	M 3	6.3	1.2
HR 2042	C 5	M 5	9.8	2.4
HR 2555	C 8	M 8	14.4	3.7
HR 3065	C 8	M 8	14.4	3.7
HR 3575	C10	M10	18.0	3.7
HR 4085	C12	M12	20.5	4.7
HR 50105	C16	M16	26.5	5.7



Dedicated Cap C

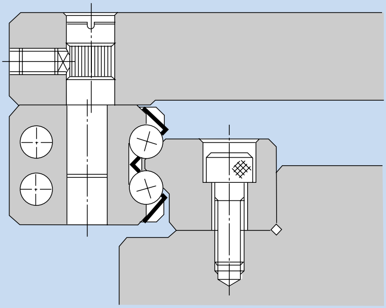
Example of Clearance Adjustment

Design the clearance adjustment screw so that it presses the center of the side face of the LM block.



ⓐ Using a clearance screw
Normally, press the LM block with an adjusting screw.

ⓑ Using tapered gibs
When high accuracy and high rigidity are required, use tapered gibs 1) and 2).



ⓒ Using an eccentric pin
THK manufactures a type whose clearances are adjusted with an eccentric pin.

Fig. 4

Attachment

●Dedicated Mounting Bolt

Normally, when mounting the LM block with which to adjust a clearance, use the tapped hole provided on the LM block to secure it as shown in Fig. 5.

In this case, the hole must be machined so that its diameters d_1 and D_1 are larger by the adjustment allowance.

If it is inevitable to use the mounting method as indicated by Fig. 6 for a structural reason, the dedicated mounting bolt as shown in Fig. 7 is required for securing the LM block. Be sure to specify that the dedicated mounting bolt is required when ordering the LM Guide.

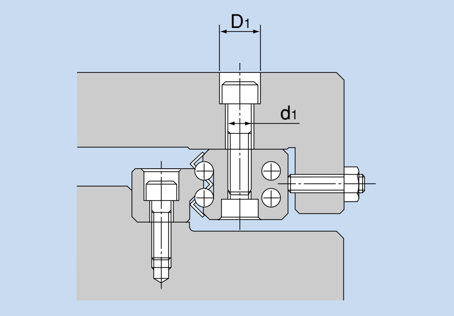


Fig. 5

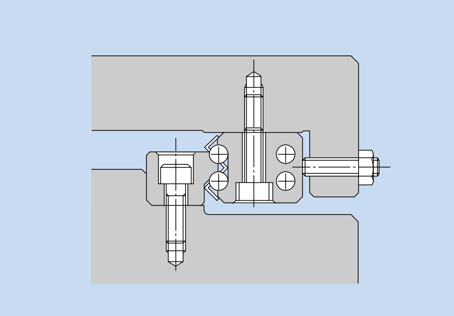


Fig. 6

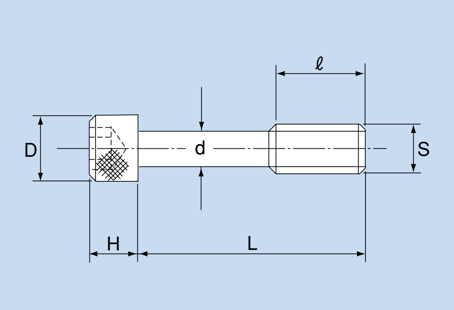


Fig. 7

Table 4 Dedicated Mounting Bolt

Unit: mm

Model No.	S	d	D	H	L	ℓ	Supported model
B 3	M3	2.4	5.5	3	17	5	HR 1530
B 5	M5	4.1	8.5	5	22	7	HR 2042
B 6	M6	4.9	10	6	28	9	HR 2555
B 8	M8	6.6	13	8	34	12	HR 3065
B10	M10	8.3	16	10	39	15	HR 3575
B12	M12	10.1	18	12	45	18	HR 4085
B14	M14	11.8	21	14	55	21	HR 50105
B16	M16	13.8	24	16	66	24	HR 60125

Comparison of Model Numbers with Cross-roller Guides

Each type of LM Guide model HR has sectional dimensions approximate to that of the corresponding cross roller guide model.

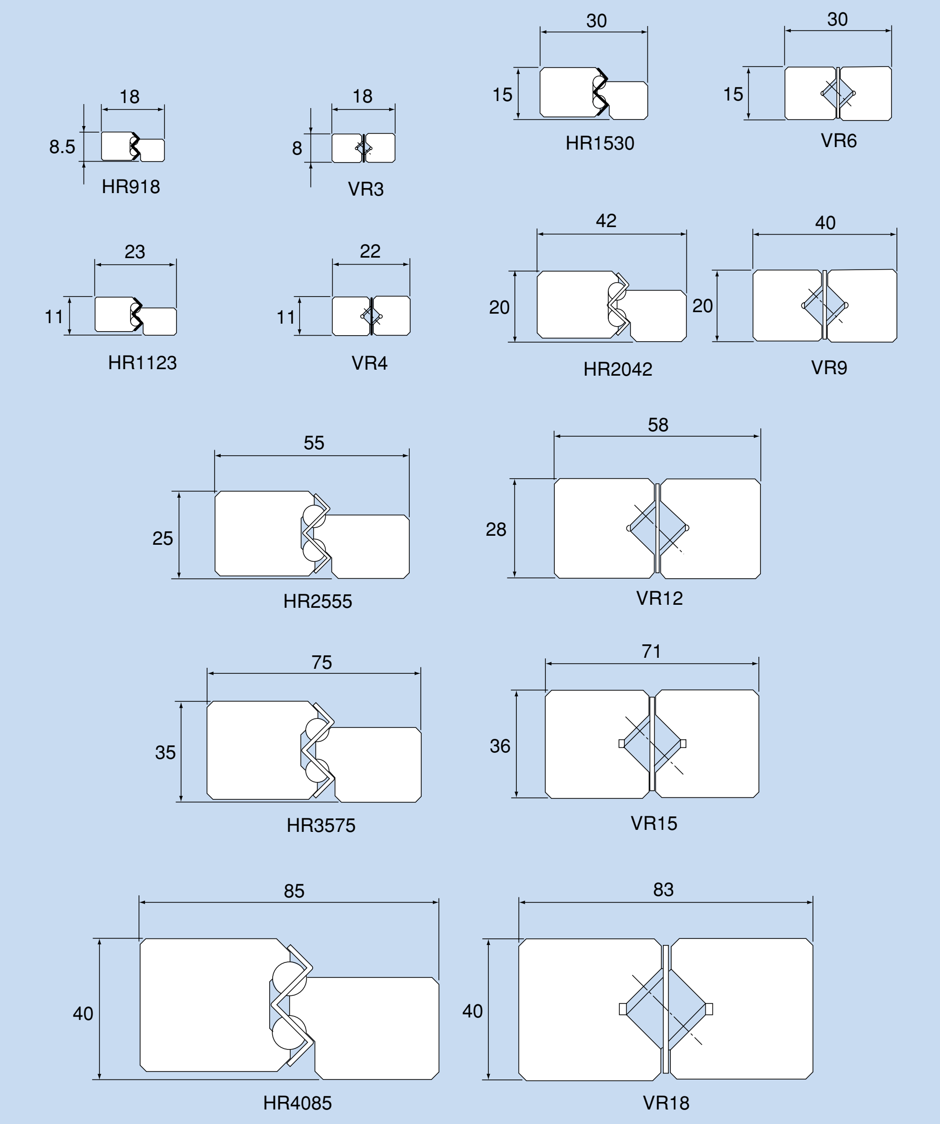


Fig. 8

Lubrication

The LM block has a greasing hole in the center of its top face. To provide lubrication through this hole, the table must be machined to also have a greasing hole as shown in Fig. 9 and attach a grease nipple or the like. When using oil lubrication, it is necessary to identify the lubrication route. Contact THK for details.

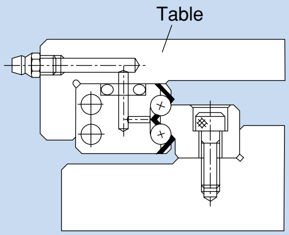


Fig. 9 Example of Machining a Greasing Hole

Standard Length and Maximum Length of the LM Rail

Table 5 shows the standard lengths and the maximum lengths of model HR variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

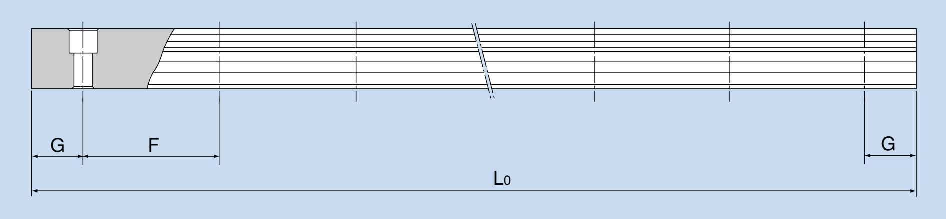


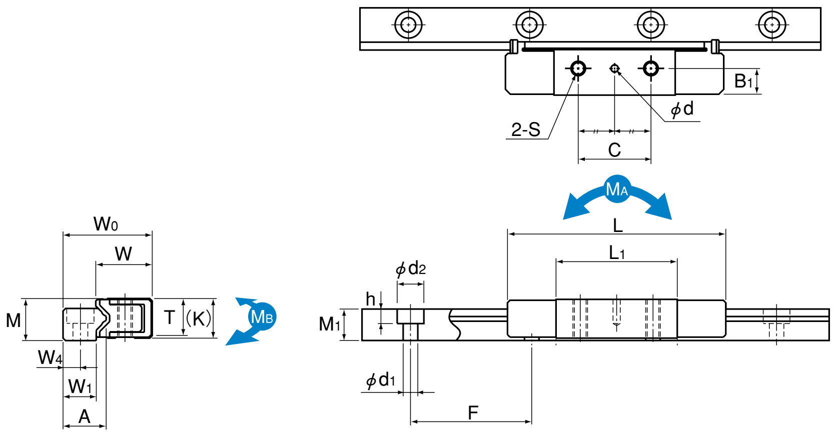
Table 5 Standard Length and Maximum Length of the LM Rail for Model HR

Unit: mm

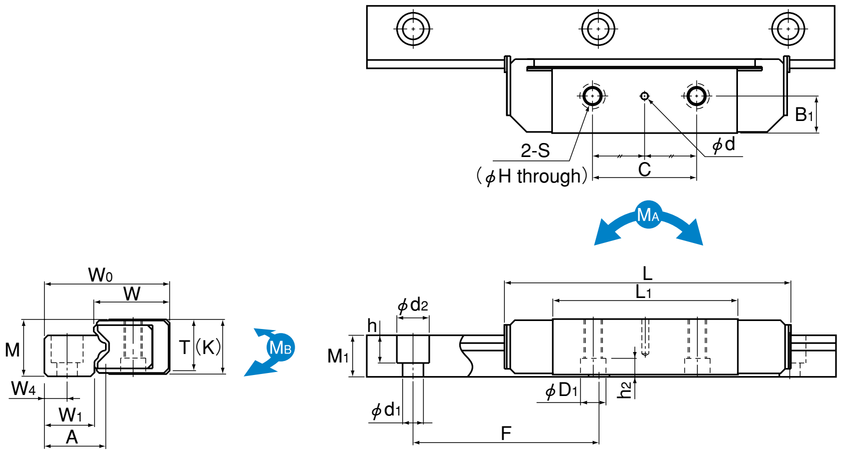
Model No.	HR 918	HR 1123	HR 1530	HR 2042	HR 2555	HR 3065	HR 3575	HR 4085	HR 50105	HR 60125
Standard LM rail length (L_0)	70 120 220 295	110 230 310 390	160 280 340 460 580	220 280 340 460 640	280 440 600 760 1000 1240	280 440 600 760 1000 1240	570 885 1200 1620 2040 2460	780 1020 1260 1500 1980 2580	1270 1570 2020 2620	1530 1890 2250 2610
Standard pitch F	25	40	60	60	80	80	105	120	150	180
G	10	15	20	20	20	20	22.5	30	35	45
Max length	300	500	1600	2200	2600	3000	3000	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Models HR | HR-T
Models HR-M | HR-TM



Models HR918, 918M



Model HR1123 to 2555M/T/TM

Unit: mm

Model No.	External dimensions				LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment kN-m*				Mass	
	Height	Width		Length									Greasing hole		Width			Height	Pitch		C	C0	MA		MB		LM block	LM rail
	M	W	W0	L	B1	C	H	S	h2	L1	T	K	d	D1	W1	W4	A	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	kg	kg/m
HR 918 HR 918M	8.5	11.4	18	45	5.5	15	—	M3	—	25	7.5	8	1.5	—	6.7	3.5	8.7	6.5	25	3×5.5×3	1.57	3.04	0.0229	0.17	0.0229	0.17	0.01	0.3
HR 1123 HR 1123M	11	13.7	23	52	7	15	2.55	M3	3	30	9.5	10	2	5	9.5	5	11.6	8	40	3.5×6×4.5	2.35	4.31	0.0414	0.272	0.0414	0.272	0.03	0.5
HR 1530 HR 1530M	15	19.2	30	69	10	20	3.3	M4	3.5	40	13	14	2	6.5	10.7	6	13.5	11	60	3.5×6×4.5	4.31	7.65	0.0982	0.641	0.0982	0.641	0.08	1
HR 2042 HR 2042M	20	26.3	42	91.6	13	35	5.3	M6	5.5	56.6	17.5	19	3	10	15.6	8	19.5	14.5	60	6×9.5×8.5	9.9	17.2	0.308	1.91	0.308	1.91	0.13	1.8
HR 2042T HR 2042TM	20	26.3	42	110.7	13	50	5.3	M6	5.5	75.7	17.5	19	3	10	15.6	8	19.5	14.5	60	6×9.5×8.5	13.6	22.9	0.53	2.99	0.53	2.99	0.26	1.8
HR 2555 HR 2555M	25	33.3	55	121	16	45	6.8	M8	7	80	22.5	24	3	11	22	10	27	18	80	9×14×12	18.6	30.5	0.783	4.41	0.783	4.41	0.43	3.2
HR 2555T HR 2555TM	25	33.3	55	146.4	16	72	6.8	M8	7	105.4	22.5	24	3	11	22	10	27	18	80	9×14×12	25.1	40.8	1.33	6.95	1.33	6.95	0.5	3.2

Note Symbol M indicates that stainless steel is used in the LM block, LM rail and balls. Those models marked with this symbol are therefore highly resistant to corrosion and environment.

Model number coding

2 HR2555 UU M +1000L P M
1 2 3 4 5 6 7

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-395) 4 LM block is made of stainless steel
5 LM rail length (in mm) 6 Accuracy symbol (see page a-42) 7 LM rail is made of stainless steel

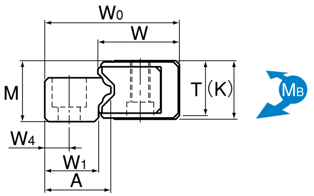
Note One set of model HR means a combination of two LM rails and an LM blocks used on the same plane.

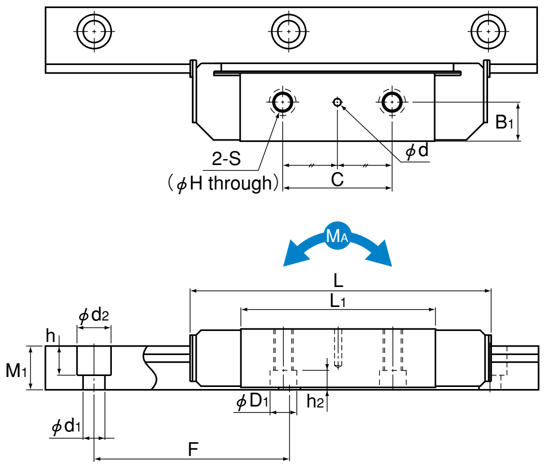
Note A moment in the direction M_C can be received if two rails are used in parallel. However, since it depends on the distance between the two rails, the moment in the direction M_C is omitted here.
Static permissible moment*: Static permissible moment value with one set of model HR

Standard Length and Maximum Length of the LM Rail P. a-401

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Models HR | HR-T
Models HR-M | HR-TM





Unit: mm

Model No.	External dimensions				LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment kN-m*				Mass	
	Height M	Width W	W_0	Length L	B_1	C	H	S	h_2	L_1	T	K	Greasing hole d	D_1	Width W_1	W_4	A	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	LM block kg	LM rail kg/m
HR 3065 HR 3065T	30	40.3	65	145 173.5	19	50 80	8.6	M10	9	90 118.5	27.5	29	4	14	25	12	31.5	22.5	80	9×14×12	24.2 32.1	38.6 51.6	1.11 1.89	6.72 10.4	1.11 1.89	6.72 10.4	0.7 0.9	4.6
HR 3575 HR 3575T	35	44.9	75	154.8 182.5	21.5	60 92.5	10.5	M12	12	103.8 131.5	32	34	4	18	30.5	14.5	37	26	105	11×17.5×14	30 40.2	47.8 63.6	1.53 2.59	8.84 13.5	1.53 2.59	8.84 13.5	1.05 1.4	6.4
HR 4085 HR 4085T	40	50.4	85	177.8 215.9	24	70 110	12.5	M14	13	120.8 158.9	36	38	4	20	35	16	42.5	29	120	14×20×17	44.1 59.5	68.6 91.7	2.64 4.48	14.4 23	2.64 4.48	14.4 23	1.53 1.7	8
HR 50105 HR 50105T	50	63.4	105	227 274.5	30	85 130	14.5	M16	15.5	150 197.5	45	48	5	23	42	20	51.5	37	150	18×26×22	70.7 96	107 143	5.15 8.74	28.9 45.7	5.15 8.74	28.9 45.7	3.06 3.5	12.1
HR 60125	60	74.4	125	329	35	160	18	M20	18	236	55	58	5	26	51	25	65	45	180	22×32×25	141	206	14.3	79.6	14.3	79.6	7.5	19.3

Note A moment in the direction M_C can be received if two rails are used in parallel. However, since it depends on the distance between the two rails, the moment in the direction M_C is omitted here.
Static permissible moment*: Static permissible moment value with one set of model HR

Model number coding

2 HR4085T UU +1500L P
1 2 3 4 5

1 No. of LM blocks used on the same rail
2 Model number
3 Dust prevention accessory symbol (see page a-395)
4 LM rail length (in mm)
5 Accuracy symbol (see page a-42)

Note One set of model HR means a combination of two LM rails and an LM blocks used on the same plane.

Standard Length and Maximum Length of the LM Rail P. a-401

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model HR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU
HR 918	45
HR 1123	52
HR 1530	69
HR 2042	91.6
HR 2042T	110.7
HR 2555	121
HR 2555T	146.4
HR 3065	145
HR 3065T	173.5

Model No.	UU
HR 3575	154.8
HR 3575T	182.5
HR 4085	177.8
HR 4085T	215.9
HR 50105	227
HR 50105T	274.5
HR 60125	329

Miniature Type LM Guide® Models RSR/RSR-W

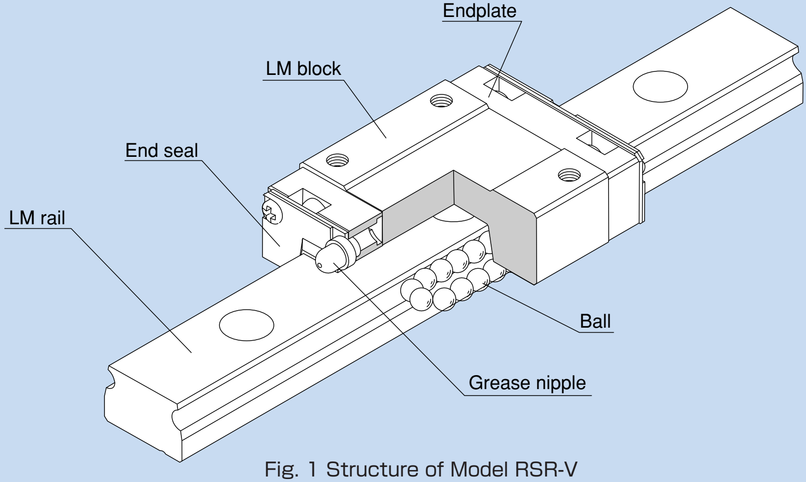


Fig. 1 Structure of Model RSR-V

Structure and Features

With models RSR and RSR-W, balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.
Balls circulate in a compact structure and perform infinite linear motion with no limit in stroke.
The LM block is designed to have a shape with high rigidity in a limited space, and in combination with large-diameter balls, demonstrates high rigidity in all directions.

●Ultra compact

The absence of cage displacement, a problem that cross-roller guides and types of ball slides with limited stroke tend to cause, make these models highly reliable LM systems.

●Capable of receiving loads in all directions

These models are capable of receiving loads in all directions, and a single-rail guide can adequately operate under a small moment load. Model RSR-W, in particular, has a greater number of effective balls and a broader LM rail to increase its rigidity against a moment. Thus, it achieves a more compact structure and more durable linear motion than a pair of linear bushes in parallel use.

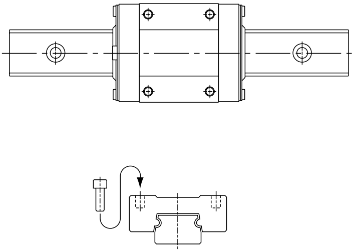
●Stainless steel type also available

A special type whose LM block, LM rail and balls are made of stainless steel is also available.

Types and Features

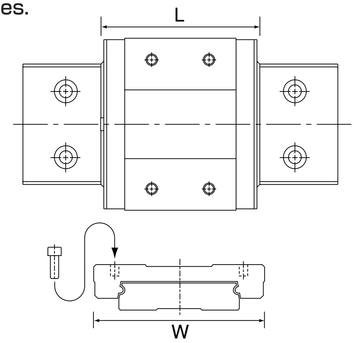
Models RSR/RSR-K/RSR-V

These models are standard types.



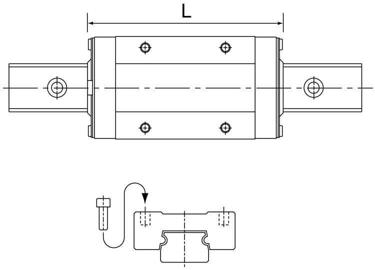
Models RSR-W/WV

It has a longer overall LM block length (L), a broader width (W) and greater rated load and permissible moment than standard types.



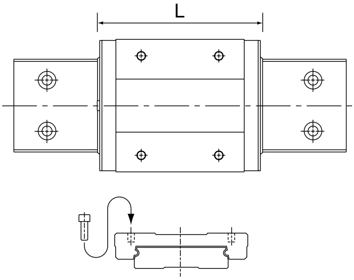
Model RSR-N

It has a longer overall LM block length (L) and a greater rated load than standard types.



Model RSR-WN

It has a longer overall LM block length (L), a greater rated load than standard types. Achieves the greatest load capacity among the miniature type LM Guide models.



Comparison of Model RSR-W with Other Model Numbers

Locations where a Pair of Linear Bushes Are Used

- Unlike the linear bushes, model RSR-W can be used in a single-rail configuration and allows space saving.
- Since model RSR-W has more load-bearing balls per row and wider LM block and LM rail, thus to achieve high rigidity against an overhung load.
- Accuracy can be achieved simply by mounting the LM rail using bolts. Therefore, the assembly time can be shortened.

Example of comparing model RSR12W with model LM 10 in use

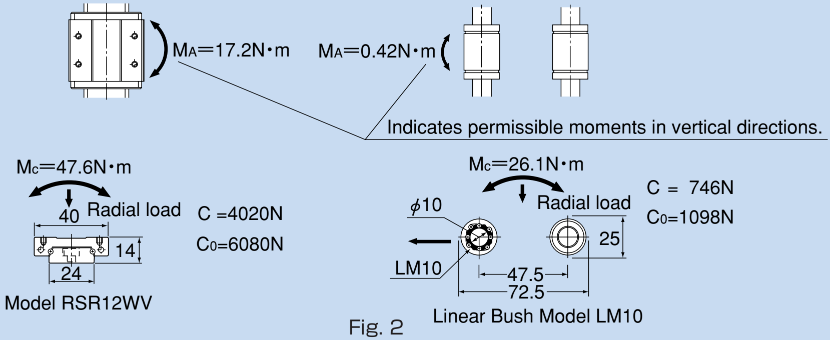


Fig. 2

Locations where a Cross-roller Table Is Used

- Does not show cage displacement even with vertical mount, and capable of performing infinite linear motion.
- Eliminates the need for difficult clearance adjustment and achieves long-term, smooth motion over a long period of time.
- Since the LM block width is large, the model can be used as a miniature table without any modification.

Example of comparing model RSR9WV with model VRM1035 in use

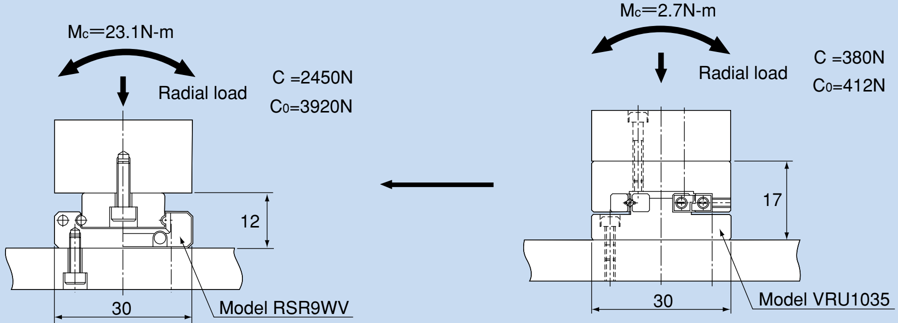


Fig. 3

Rated Loads in All Directions

Model RSR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of models RSR3 to 9 are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for RSR.

The basic load ratings of models RSR12 to 20 indicate the values in the radial direction in Fig. 4, and their actual values are provided in the dimensional table for RSR. The values in the reverse-radial and lateral directions are obtained from table 1.

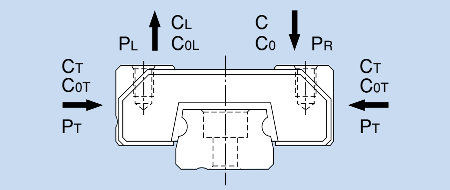


Fig. 4

Table 1 Basic Load Ratings of Models RSR12 to 20 in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.70C_0$
Lateral direction	$C_T=0.78C$	$C_{0T}=0.71C_0$

Equivalent Load

When the LM block of models RSR3 to 9 receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

When the LM block of model RSR12 to 20 receives loads in the radial and lateral directions, or the reverse-radial and lateral directions, simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R\ (P_L)+Y\cdot P_T$$

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see tables 2 and 3)

Table 2 Equivalent Factor of Models RSR12 to 20
(When radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.83
Equivalent load in lateral direction	1.2	1

Table 3 Equivalent Factor of Models RSR12 to 20
(When reverse-radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.99
Equivalent load in lateral direction	1.01	1

Options

Dust Prevention Accessories

THK offers an end seal for model RSR as a dust prevention accessory.
(For details of the end seal, see page a-24.)

Table 4 Symbol of Dust Prevention Accessory for Model RSR

Symbol	Dust prevention accessory
UU	With end seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals RSR···UU, refer to the corresponding value provided in table 5.

Table 5 Maximum Seal Resistance Value of Seals RSR···UU

Unit: N

Model No.	Seal resistance value
RSR 5	0.06
RSR 7	0.08
RSR 9	0.1
RSR 12	0.4
RSR 15	0.8
RSR 20	1.0
RSR 3W	0.2
RSR 5W	0.3
RSR 7W	0.4
RSR 9W	0.8
RSR 12W	1.1
RSR 15W	1.3

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

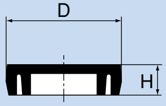
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 6.

For the procedure for mounting the cap, see page a-22.

Table 6 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
RSR 9W	C3	M3	6.3	1.2
RSR 12	C3	M3	6.3	1.2
RSR 15	C3	M3	6.3	1.2
RSR 20	C5	M5	9.8	2.4



Dedicated Cap C

QZ Lubricator™

When QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 7 (for details of QZ Lubricator, see pages a-19 and a-20).
For supported LM Guide model numbers for QZ Lubricator and overall LM block length with QZ Lubricator attached (dimension L), see page a-422.

Table 7 Parts Symbol for Model RSR with QZ Lubricator Attached

Symbol	Dust prevention accessories for LM Guide with QZ Lubricator attached
QZUU	With end seal + QZ

Stopper

With miniature LM Guide models RSR/RSR-W, balls will fall off if the LM block is removed from the LM rail.
To prevent the LM block from being pulled out, end pieces are mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.

Table 8 Dimensional Table for Stopper (Type C) for Model RSR

Unit: mm

Model No.	A	B	C
RSR 7	11	5	7.7
RSR 9	13	6	9.5
RSR 12	16	7	12.5
RSR 15	19	7	14.5
RSR 20	25	7	20.0
RSR 7W	18	6	8.2
RSR 9W	23	7	11.5
RSR 12W	29	7	13.5
RSR 15W	46	7	14.5

Note: The stopper for models RSR3M/N, 5M/N and 5W uses an O-ring, while that for model RSR3W uses a silicone tube.

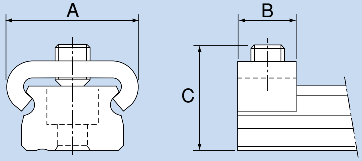


Fig. 5 Stopper (Type C) for Model RSR

Accuracy of the Mounting Surface

Model RSR uses Gothic arch grooves in the ball raceways. When two rails of RSR are used in parallel, any error in accuracy of the mounting surface may increase rolling resistance and negatively affect the smooth motion of the guide. For specific accuracy of the mounting surface, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

When using this model in locations where it is difficult to obtain satisfactory accuracy of the mounting surface, we recommend using types RSR…A (semi standard) whose ball raceways have circular-arc grooves (avoid using these types in a single-rail configuration).

For specific accuracy of the mounting surface for types RSR…A, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

Standard Length and Maximum Length of the LM Rail

Table 9 shows the standard lengths and the maximum lengths of model RSR variations.

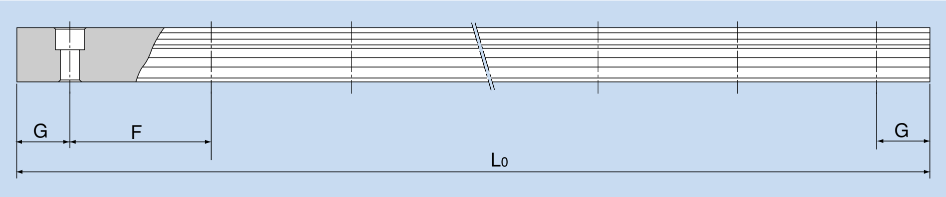


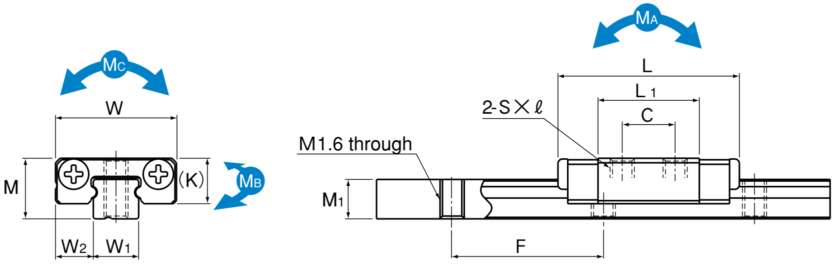
Table 9 Standard Length and Maximum Length of the LM Rail for Model RSR/RSR-W

Unit: mm

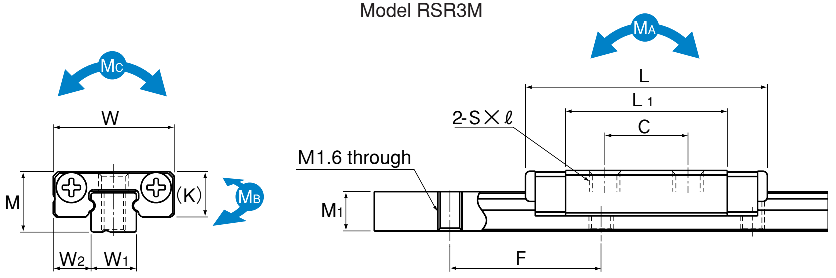
Model No.	RSR 3	RSR 5	RSR 7	RSR 9	RSR 12	RSR 15	RSR 20	RSR 3W	RSR 5W	RSR 7W	RSR 9W	RSR 12W	RSR 15W
Standard LM rail length (L_0)	30 40 60 80 100	40 55 70 100 130 160	40 55 70 85 100 130	55 75 95 115 135 155 175 195 275 375	70 95 120 145 170 195 220 245 270 320 370 470 570	70 110 150 190 230 270 310 350 390 430 470 550 670 870	220 280 340 460 640 880 1000	40 55 70	50 70 90 110 130 150 170	50 80 110 140 170 200 260 290	50 80 110 140 170 200 260 290 320	70 110 150 190 230 270 310 390 470 550	110 150 190 230 270 310 430 550 670 790
Standard pitch F	10	15	15	20	25	40	60	15	20	30	30	40	40
G	5	5	5	7.5	10	15	20	5	5	10	10	15	15
Max length	200	200	300	1000	1340	1430	1800	100	200	400	1000	1430	1800

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: The LM rail mounting hole of model RSR3 is an M1.6 through hole.

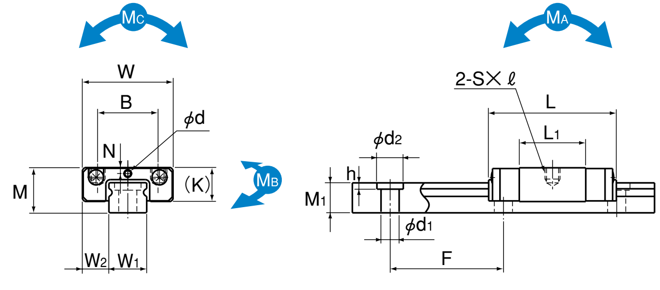
Model RSR-M
Model RSR-N



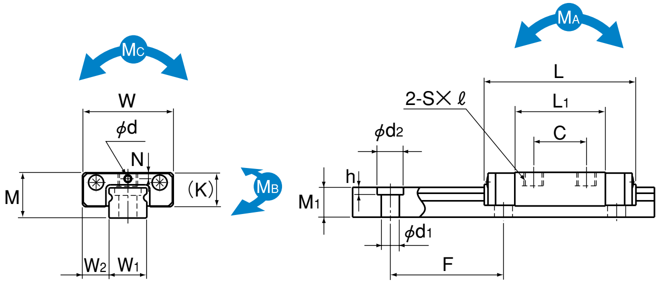
Model RSR3M



Model RSR3N



Model RSR5M



Model RSR5N

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width		Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	M	W	L	B	C	S× ℓ	L_1	T	K	N	E	d		W_1	W_2	M_1	F	d_1×d_2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
RSR 3M	4	8	12	—	3.5	M1.6×1.3	6.7	—	3	—	—	—	—	$3^{0}_{-0.02}$	2.5	2.6	10	—	0.18	0.27	0.293	2.11	0.293	2.11	0.45	0.0011	0.055
RSR 3N			16		5.5	M2×1.3	10.7												0.3	0.44	0.726	4.33	0.726	4.33	0.73	0.0016	
RSR 5M	6	12	16.9	8	—	M2×1.5	8.8	—	4.5	0.8	—	0.8	—	$5^{0}_{-0.02}$	3.5	4	15	2.4×3.5×1	0.32	0.59	0.884	6.51	0.884	6.51	1.53	0.003	0.14
RSR 5N			20.1	—	7	M2.6×1.8	12												0.55	0.96	1.84	11.9	1.84	11.9	2.49	0.004	

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.
Models RSR3M and 3N do not have a greasing hole. When lubricating them, apply a lubricant directly to the LM rail raceways.
To secure the LM rail of models RSR5M and 5N, use cross-recessed head screws for precision equipment (No. 0 pan head screw, class 1) M2.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR5 M UU C1 +130L P M-Ⅱ
1 2 3 4 5 6 7 8

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-412) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel
8 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

■Recommended tightening torque when mounting the LM rail/block

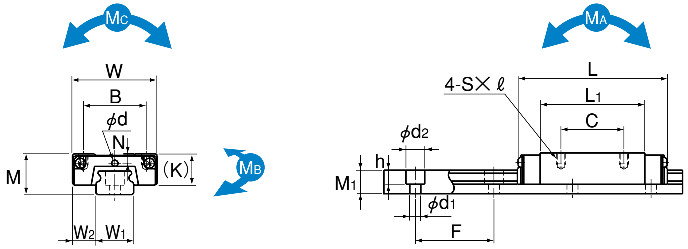
Table 10 shows recommended bolt tightening torques when mounting the LM block and LM rail of models RSR3M/3N.

Table 10 Recommended Tightening Torques of Mounting Bolts

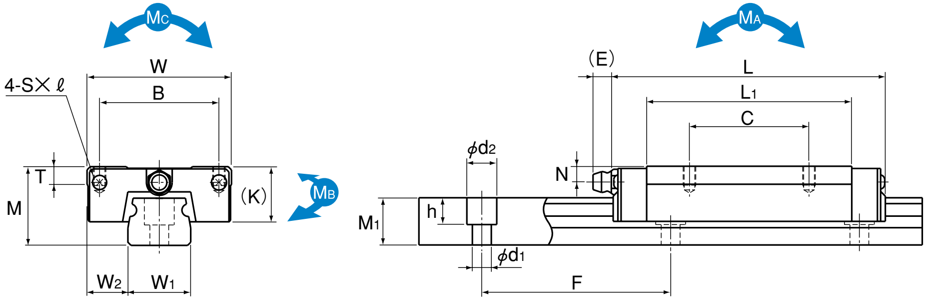
Model No. of screw	Recommended tightening torque (N-m)
M1.6	0.09
M2	0.19

Note: Applicable to austenitic stainless steel hexagon socket bolts.

Model RSR-M
Model RSR-KM
Model RSR-VM
Model RSR-N



Models RSR7 to 12N/7M/9KM/12VM



Models RSR15,20VM/N

Unit: mm

Model No.	External dimensions Height M	External dimensions Width W	External dimensions Length L	LM block dimensions B	C	S×ℓ	L1	T	K	N	E	Greasing hole d	Grease nipple	LM rail dimensions Width W1	W2	Height M1	Pitch F	d1×d2×h	Basic load rating C kN	C0 kN	Static permissible moment N-m* MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	Mass LM block kg	Mass LM rail kg/m
RSR 7M	8	17	23.4	12	8	M2×2.5	13.4	—	6.5	1.7	—	1.2	—	7 $^{0}_{-0.02}$	5	4.7	15	2.4×4.2×2.3	0.88	1.37	2.93	20.8	2.93	20.8	5	0.013	0.23
RSR 7N			33		13		23												1.59	2.5	8.68	49.9	8.68	49.9	9.12	0.018	
RSR 9KM	10	20	30.8	15	10	M3×3	19.8	—	7.8	2.4	—	1.5	—	9 $^{0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	1.47	2.25	7.34	43.3	7.34	43.3	10.4	0.018	0.32
RSR 9N			41		16		29.8												2.6	3.96	18.4	97	18.4	97	18.4	0.027	
RSR 12VM	13	27	35	20	15	M3×3.5	20.6	—	10	3	—	2	—	12 $^{0}_{-0.025}$	7.5	7.5	25	3.5×6×4.5	2.65	4.02	11.4	74.9	10.1	67.7	19.2	0.037	0.58
RSR 12N			47.7		20		33.3												4.3	6.65	28.9	163	25.5	145	31.8	0.055	
RSR 15VM	16	32	43	25	20	M3×4	25.7	—	12	3.5	3.6	—	PB107	15 $^{0}_{-0.025}$	8.5	9.5	40	3.5×6×4.5	4.41	6.57	23.7	149	21.1	135	38.8	0.069	0.925
RSR 15N			61		25		43.5				3.7								7.16	10.7	63.1	330	55.6	293	63	0.093	
RSR 20VM	25	46	66.5	38	38	M4×6	45.2	5.7	17.5	5	6.4	—	A-M6F	20 $^{0}_{-0.03}$	13	15	60	6×9.5×8.5	8.82	12.7	75.4	435	66.7	389	96.6	0.245	1.95
RSR 20N			86.3				65												14.2	20.6	171	897	151	795	157	0.337	

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR15V M UU C1 +230L P M- II

1 2 3 4 5 6 7 8

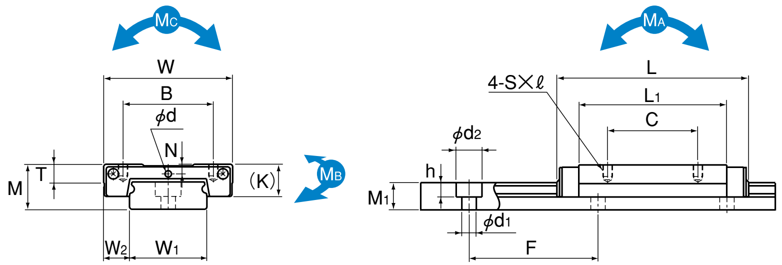
1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-412) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel
8 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

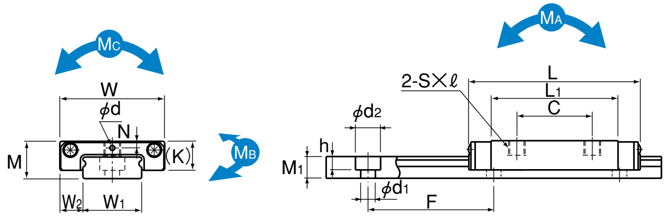
Standard Length and Maximum Length of the LM Rail P. a-414

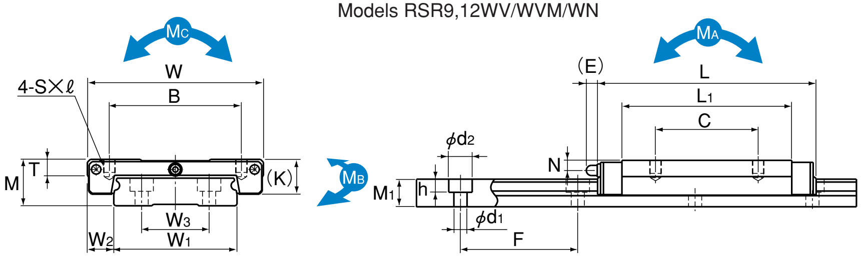
Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Model RSR-WM (WV)
Model RSR-WVM
Model RSR-WM



Models RSR9,12WV/WVM/WN





Models RSR3 to 7WM/WN

Models RSR15WV/WVM/WN

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment N-m*					Mass	
	Height M	Width W	Length L	B	C	S× ℓ	L_1	T	K	N	E	Greasing hole d	Grease nipple	Width W_1	W_2	W_3	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
**RSR 3WM	4.5	12	14.9	—	4.5	M2×1.7	8.5	—	3.5	0.8	—	0.8	—	$6^{\ 0}_{-0.02}$	3	—	2.6	15	2.4×4×1.5	0.25	0.47	0.668	4.44	0.668	4.44	1.48	0.002	0.12
**RSR 3WN			19.9		8		13.3													0.39	0.75	1.57	9.06	1.57	9.06	2.36	0.003	
**RSR 5WM	6.5	17	22.1	—	6.5	M3×2.3	13.7	—	5	1.1	—	0.8	—	$10^{\ 0}_{-0.025}$	3.5	—	4	20	3×5.5×3	0.51	0.96	1.97	13.1	1.97	13.1	4.89	0.007	0.28
**RSR 5WN			28.1		11		19.7													0.75	1.4	4.06	23.5	4.06	23.5	7.13	0.01	
**RSR 7WM	9	25	31	—	12	M4×3.5	20.4	—	7	1.6	—	1.2	—	$14^{\ 0}_{-0.05}$	5.5	—	5.2	30	3.5×6×3.2	1.37	2.16	7.02	40.7	7.02	40.7	15.4	0.021	0.51
**RSR 7WN			40.9		18		30.3													2.04	3.21	14.7	77.6	14.7	77.6	22.9	0.026	
RSR 9WV	12	30	39	21	12	M2.6×3	27	—	7.8	2	—	1.6	—	$18^{\ 0}_{-0.05}$	6	—	7.5	30	3.5×6×4.5	2.45	3.92	16	92.9	16	92.9	36	0.035	1.08
**RSR 9WVM			39	21	12	M2.6×3	27													2.45	3.92	16	92.9	16	92.9	36	0.035	
**RSR 9WN			50.7	23	24	M3×3	38.7													3.52	5.37	31	161	31	161	49.4	0.051	
RSR 12WV	14	40	44.5	28	15	M3×3.5	30.9	4.5	10	3	—	2	—	$24^{\ 0}_{-0.05}$	8	—	8.5	40	4.5×8×4.5	4.02	6.08	24.5	138	21.7	123	59.5	0.075	1.5
**RSR 12WVM			44.5		15		30.9													4.02	6.08	24.5	138	21.7	123	59.5	0.075	
**RSR 12WN			59.5		28		45.9													5.96	9.21	53.9	274	47.3	242	90.1	0.101	
RSR 15WV	16	60	55.5	45	20	M4×4.5	38.9	5.6	12	3.5	3	—	PB107	$42^{\ 0}_{-0.05}$	9	23	9.5	40	4.5×8×4.5	6.66	9.8	50.3	278	44.4	248	168	0.17	3
**RSR 15WVM			55.5		20		38.9													6.66	9.8	50.3	278	44.4	248	168	0.17	
**RSR 15WN			74.5		35		57.9													9.91	14.9	110	555	97.3	490	255	0.21	

Note "**" indicates that since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.
To secure the LM rail of models RSR3WM and 3WN, use cross-recessed head screws for precision equipment (No. 0 pan head screw, class 1) M2.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR12WV M UU C1 +310L H M
1 2 3 4 5 6 7

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-412) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel

Standard Length and Maximum Length of the LM Rail P. a-414

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model RSR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU
RSR 3M	—
RSR 3N	—
RSR 3WM	14.9
RSR 3WN	19.9
RSR 5M	16.9
RSR 5N	20.1
RSR 5WM	22.1
RSR 5WN	28.1
RSR 7M	23.4
RSR 7N	33
RSR 7WM	31
RSR 7WN	40.9
RSR 9KM	30.8
RSR 9N	41
RSR 9WV	39
RSR 9WVM	39
RSR 9WN	50.7

Model No.	UU
RSR 12VM	35
RSR 12N	47.7
RSR 12WV	44.5
RSR 12WVM	44.5
RSR 12WN	59.5
RSR 15VM	43
RSR 15N	61
RSR 15WV	55.5
RSR 15WVM	55.5
RSR 15WN	74.5
RSR 20VM	66.5
RSR 20N	86.3

Note: " — " indicates not available.

Overall LM Block Length (Dimension L) of Model RSR with QZ Lubricator Attached

Unit: mm

Model No.	QZUU
RSR 9	41
RSR 9N	51
RSR 9W	49
RSR 9WN	61
RSR 12	45
RSR 12N	58
RSR 12W	54.5
RSR 12WN	69.5
RSR 15	55
RSR 15N	73
RSR 15W	67.5
RSR 15WN	86.5

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
RSR 3M	12
RSR 3N	16
RSR 3WM	14.1
RSR 3WN	19.1
RSR 5M	15.5
RSR 5N	18.7
RSR 5WM	20.7
RSR 5WN	26.7
RSR 7M	22
RSR 7N	31.6
RSR 7WM	30
RSR 7WN	39.9
RSR 9KM	27.8
RSR 9N	37.8
RSR 9WV	36
RSR 9WVM	36
RSR 9WN	47.7

Model No.	Without seal
RSR 12VM	31
RSR 12N	43.7
RSR 12WV	41.3
RSR 12WVM	41.3
RSR 12WN	56.3
RSR 15VM	38.9
RSR 15N	56.5
RSR 15WV	51.5
RSR 15WVM	51.5
RSR 15WN	70.5
RSR 20VM	61.5
RSR 20N	81.3

Precautions on Use

■QZ Lubricator for THK LM Guides

Handling

●Dropping or hitting this product may damage it. Take much care when handling it.

●Do not clean it with an organic solvent or white kerosene.

●Do not leave it unpacked for a long period of time.

●Do not block the air vent with grease or the like.

Service temperature range

●Be sure the service temperature of this product is between -10℃ and +50℃. When using it beyond the service temperature range, contact THK .

Use in a special environment

●When using it in a special environment, contact THK .

Precaution on selection

●Be sure the stroke is longer than the overall length of the LM block length attached with QZ Lubricator.

Corrosion prevention of LM Guides

●QZ Lubricator is a lubricating device designed to feed a minimum amount of oil to the ball raceway of LM rails, and does not provide corrosion prevention to the whole LM Guide. When using it in an environment subject to a coolant or the like, we strongly recommend applying grease or other anti-corrosion agent to the mounting base surface and the LM rail end surfaces of the LM Guide as an anti-corrosion measure.

Miniature Type LM Guide® Model RSR-Z

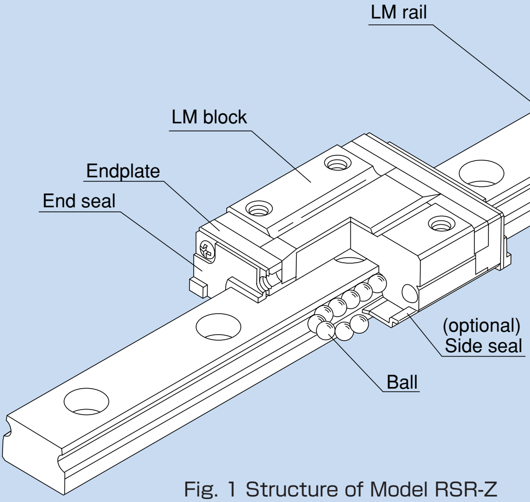


Fig. 1 Structure of Model RSR-Z

Structure and Features

With model RSR-Z, balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.
Balls of model RSR-Z circulate in a compact structure and perform infinite linear motion with no limit in stroke.
Also, it has the same dimensions as models RSR/RSR-W, but achieves a lighter weight and a lower price.

●Weight saving

Since part of the LM block body uses a resin material, the block mass is reduced by up to 28% from the conventional type model SRS-V. This makes RSR-Z a low-inertia type.

●Smooth motion

The unique structure of the endplate allows the balls to circulate smoothly and infinitely.

●Highly corrosion resistant

Since the LM block, LM rail and balls use stainless steel, this model is highly resistant to corrosion.

●Low noise

Since the unloaded ball path is made of resin, there is no metallic contact and low noise is achieved.

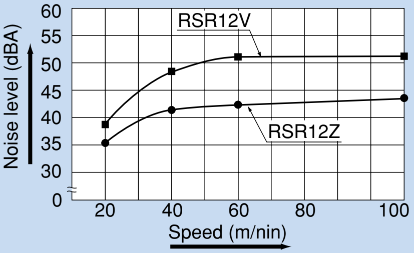
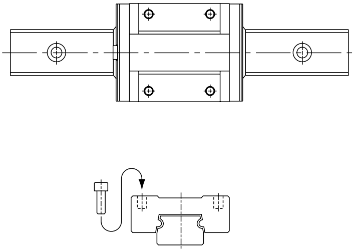


Fig. 2 Noise Levels of Models RSR12Z and RSR12V

Types and Features

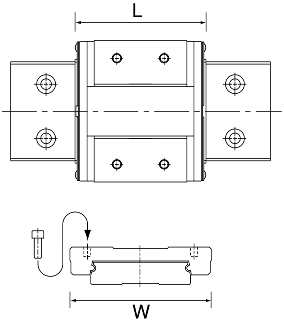
Model RSR-Z

Model RSR-Z is a standard type.



Models RSR-WZ

It has a longer overall LM block length (L), a broader width (W) and greater rated load and permissible moment than RSR-Z.



Rated Loads in All Directions

Model RSR-Z is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of models RSR7Z/WZ and 9Z/WZ are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for RSR-Z.

The basic load ratings of models RSR12Z/WZ and 15Z/WZ indicate the values in the radial direction in Fig. 3, and their actual values are provided in the dimensional table for RSR-Z. The values in the reverse-radial and lateral directions are obtained from table 1.

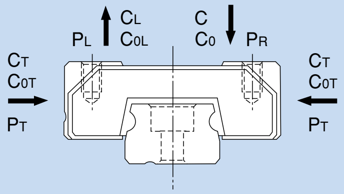


Fig. 3

Table 1 Basic Load Ratings of Models RSR12Z/WZ and 15Z/WZ in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.70C_0$
Lateral direction	$C_T=0.78C$	$C_{0T}=0.71C_0$

Equivalent Load

When the LM block of models RSR7Z/WZ and 9Z/WZ receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

When the LM block of model RSR12Z/WZ and 15Z/WZ receives loads in the radial and lateral directions, or the reverse-radial and lateral directions, simultaneously, the equivalent load is obtained from the equation below.

$$P_E = X \cdot P_R\ (P_L) + Y \cdot P_T$$

where

P_E : Equivalent load (N)

- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)

P_L : Reverse-radial load (N)

P_T : Lateral load (N)

X/Y axes : Equivalent factor (see tables 2 and 3)

Table 2 Equivalent Factor of Models RSR12Z/WZ and 15Z/WZ (When radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.83
Equivalent load in lateral direction	1.2	1

Table 3 Equivalent Factor of Models RSR12Z/WZ and 15Z/WZ (When reverse-radial and lateral loads are applied)

P_E	X	Y
Equivalent load in reverse-radial direction	1	0.99
Equivalent load in lateral direction	1.01	1

Options

Dust Prevention Accessories

THK offers dust prevention accessories for models RSR-Z/WZ.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 4 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-436.

Table 4 Symbols of Dust Prevention Accessories for Model RSR-Z

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals RSR-Z···UU, refer to the corresponding value provided in table 5.

Table 5 Maximum Seal Resistance Value of Seals RSR-Z···UU

Unit: N

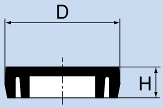
Model No.	Seal resistance value
RSR 7Z	0.08
RSR 9Z	0.1
RSR 12Z	0.4
RSR 15Z	0.8
RSR 7WZ	0.4
RSR 9WZ	0.8
RSR 12WZ	1.1
RSR 15WZ	1.3

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.
When placing an order, specify the desired cap type with the corresponding cap number indicated in table 6.
For the procedure for mounting the cap, see page a-22.

Table 6 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
RSR 9WZ	C3	M3	6.3	1.2
RSR 12Z	C3	M3	6.3	1.2
RSR 15Z	C3	M3	6.3	1.2



Dedicated Cap C

Stopper

With models RSR-Z/WZ, balls will fall off if the LM block is removed from the LM rail. To prevent the LM block from being pulled out, a stopper is mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.

Table 7 Dimensional Table for Stopper (Type C) for Model RSR-Z/WZ

Unit: mm

Model No.	A	B	C
RSR 7Z	11	5	7.7
RSR 9Z	13	6	9.5
RSR 12Z	16	7	12.5
RSR 15Z	19	7	14.5
RSR 7WZ	18	6	8.2
RSR 9WZ	23	7	11.5
RSR 12WZ	29	7	13.5
RSR 15WZ	46	7	14.5

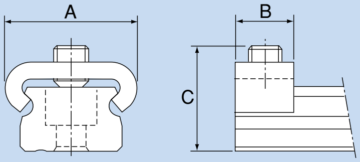


Fig. 4 Stopper (Type C) for Model RSR-Z

Accuracy of the Mounting Surface

Model RSR-Z uses Gothic arch grooves in the ball raceways. When two rails of RSR are used in parallel, any error in accuracy of the mounting surface may increase rolling resistance and negatively affect the smooth motion of the guide. For specific accuracy of the mounting surface, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

Standard Length and Maximum Length of the LM Rail

Table 8 shows the standard lengths and the maximum lengths of model RSR-Z/WZ variations.

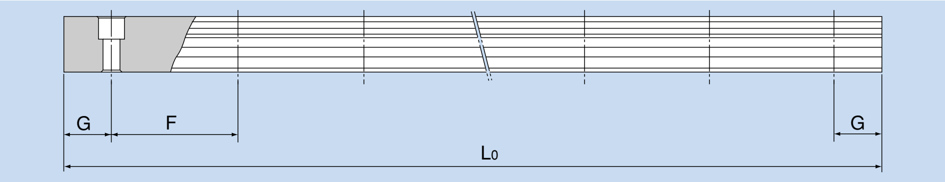


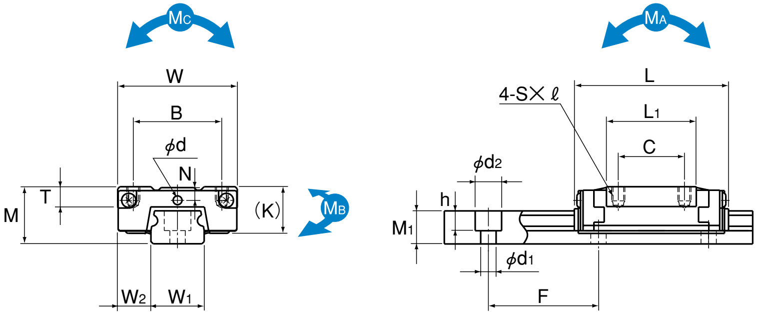
Table 8 Standard Length and Maximum Length of the LM Rail for Model RSR-Z/WZ

Unit: mm

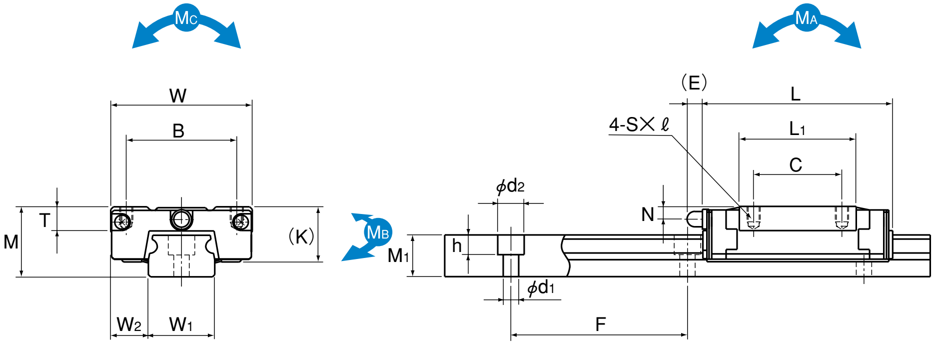
Model No.	RSR 7Z	RSR 9Z	RSR 12Z	RSR 15Z	RSR 7WZ	RSR 9WZ	RSR 12WZ	RSR 15WZ
Standard LM rail length (L_0)	40 55 70 85 100 130	55 75 95 115 135 155 175 195 275 375	70 95 120 145 170 195 220 245 270 320 370 470 570	70 110 150 190 230 270 310 350 390 430 470 550 670 870	50 80 110 140 170 200 260 290	50 80 110 140 170 200 260 290 320	70 110 150 190 230 270 310 390 470 550	110 150 190 230 270 310 430 550 670 790
Standard pitch F	15	20	25	40	30	30	40	40
G	5	7.5	10	15	10	10	15	15
Max length	300	1000	1340	1430	400	1000	1430	1800

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: The LM rails of these models are all made of stainless steel.

Model RSR-ZM



Models RSR7 to 12ZM



Model RSR15ZM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S×ℓ	L1	T	K	N	E	d		W1	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
RSR 7ZM	8	17	23.4	12	8	M2×2.5	13.2	3.4	6.5	1.6	—	1.5	—	$7^{\ 0}_{-0.02}$	5	4.7	15	2.4×4.2×2.3	0.88	1.37	2.93	20.7	2.93	20.7	5	0.008	0.23
RSR 9ZM	10	20	30.8	15	10	M3×2.7	19.4	4.6	7.8	2.4	—	1.6	—	$9^{\ 0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	1.47	2.25	7.34	43	7.34	43	10.4	0.014	0.32
RSR 12ZM	13	27	35	20	15	M3×3.2	20.4	4.5	10.6	3.1	—	2	—	$12^{\ 0}_{-0.025}$	7.5	7.5	25	3.5×6×4.5	2.65	4.02	11.4	74.9	10.1	67.7	19.2	0.028	0.58
RSR 15ZM	16	32	43	25	20	M3×3.5	26.5	5.5	12.6	2.9	3.6	—	PB107	$15^{\ 0}_{-0.025}$	8.5	9.5	40	3.5×6×4.5	4.41	6.57	23.7	149	21.1	135	38.8	0.05	0.925

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

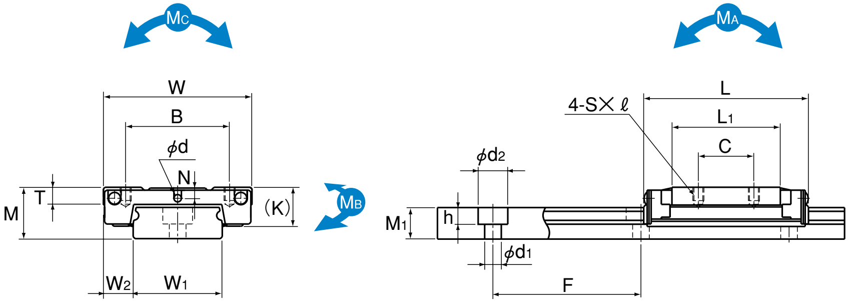
Model number coding

2 RSR15Z M UU C1 +230L P M-Ⅱ
1 2 3 4 5 6 7 8

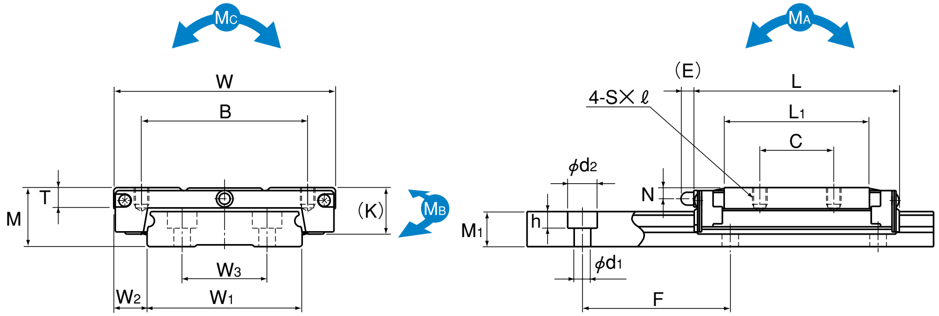
1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-429) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel
8 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Model RSR-WZM



Models RSR7 to 12WZM



Model RSR15WZM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width			Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S× ℓ	L1	T	K	N	E	d		W1	W2	W3	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
RSR 7WZM	9	25	31.5	19	10	M3×2.8	19.7	3.4	7	1.8	—	1.6	—	$14^{\ 0}_{-0.05}$	5.5	—	5.2	30	3.5×6×3.2	1.37	2.16	6.54	42.1	6.54	42.1	15.4	0.018	0.51
RSR 9WZM	12	30	39	21	12	M3×2.8	27	3.9	9.1	2.3	—	1.6	—	$18^{\ 0}_{-0.05}$	6	—	7.5	30	3.5×6×4.5	2.45	3.92	16	92.9	16	92.9	36	0.03	1.08
RSR 12WZM	14	40	44.5	28	15	M3×3.6	29.3	4.5	10.6	3	—	2	—	$24^{\ 0}_{-0.05}$	8	—	8.5	40	4.5×8×4.5	4.02	6.08	24.5	138	21.7	123	59.5	0.06	1.5
RSR 15WZM	16	60	55.5	45	20	M4×4.5	39.3	5.4	12.6	3	3.6	—	PB107	$42^{\ 0}_{-0.05}$	9	23	9.5	40	4.5×8×4.5	6.66	9.8	50.3	278	44.4	248	168	0.135	3

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR12WZ M SS C1 +390L H M
1 2 3 4 5 6 7

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-429) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel

Standard Length and Maximum Length of the LM Rail P. a-431

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Models RSR-Z and RSR-WZ with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
RSR 7ZM	23.4	—
RSR 9ZM	30.8	—
RSR 12ZM	35	35
RSR 15ZM	43	43

Model No.	UU	SS
RSR 7WZM	31.5	—
RSR 9WZM	39	39
RSR 12WZM	44.5	44.5
RSR 15WZM	55.5	55.5

Note: "—" indicates not available.

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
RSR 7ZM	20.4
RSR 9ZM	29.1
RSR 12ZM	32.6
RSR 15ZM	40.2

Model No.	Without seal
RSR 7WZM	28
RSR 9WZM	37.6
RSR 12WZM	42.1
RSR 15WZM	53.1

High Temperature Type Miniature LM Guide® Model RSR-M1

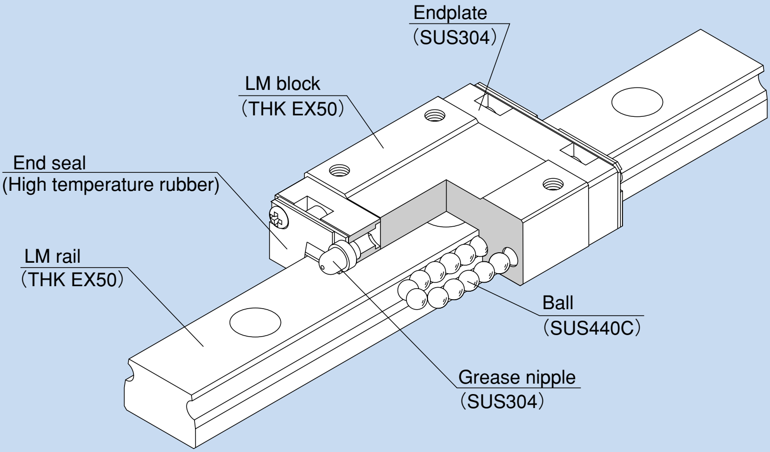


Fig. 1 Structure of Model RSR-M1V

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.
High temperature type miniature LM Guide model RSR-M1 is capable of being used at service temperature up to 150℃ thanks to THK 's unique technologies in material, heat treatment and lubrication.

●Maximum service temperature of 150℃

Use of stainless steel in the endplates and high-temperature rubber in the end seals achieves the maximum service temperature of 150℃.

●Dimensional stability

Since it is dimensionally stabilized, it demonstrates superb dimensional stability after being heated or cooled (note that it shows linear expansion at high temperature).

●Corrosion resistance

Since its LM block, LM rail and balls are made of stainless steel, this model is highly resistant to corrosion.

●High temperature grease

This model uses high temperature grease that shows little grease-based fluctuation in rolling resistance even if temperature changes from low to high levels.

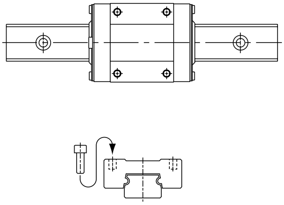
Thermal Characteristics of LM Rail and LM Block Materials

●Specific heat capacity	:0.481J/(g･K)
●Thermal conductivity	:20.67W/(m･K)
●Average coefficient of linear expansion	:11.8×10⁻⁶/℃

Types and Features

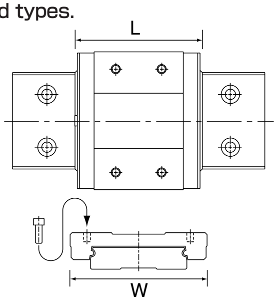
Models RSR-M1/RSR-M1K/M1V

These models are standard types.



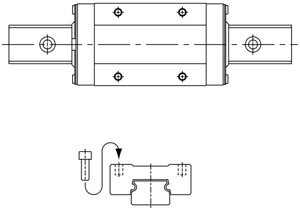
Models RSR-M1W/M1WV

These models have greater overall LM block lengths (L), broader widths (W) and greater rated loads and permissible moments than standard types.



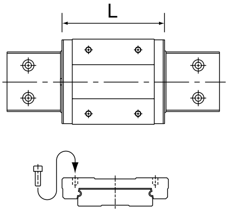
Model RSR-M1N

It has a greater overall LM block length (L) and a greater rated load than standard types.



Model RSR-M1WN

It has a longer overall LM block length (L), a greater rated load than standard types. Achieves the greatest load capacity among the high-temperature type miniature LM Guide models.



Rated Loads in All Directions

Model RSR-M1 is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of models RSR9M1/M1W are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for RSR-M1.

The basic load ratings of models RSR12M1 to 20M1 indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for RSR-M1. The values in the reverse-radial and lateral directions are obtained from table 1.

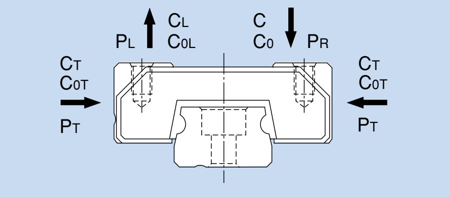


Fig. 2

Table 1 Basic Load Ratings of Models RSR12M1 to 20M1 in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.70C_0$
Lateral direction	$C_T=0.78C$	$C_{0T}=0.71C_0$

Equivalent Load

When the LM block of models RSR9M1/M1W receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
・Radial direction
・Reverse-radial direction
・Lateral direction
P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

When the LM block of models RSR12M1 to 20M1 receives loads in the radial and lateral directions, or the reverse-radial and lateral directions, simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R\,(P_L)+Y\cdot P_T$$

where

P_E : Equivalent load (N)
・Radial direction
・Reverse-radial direction
・Lateral direction
P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see tables 2 and 3)

Table 2 Equivalent Factor of Models RSR12M1 to 20M1 (When radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.83
Equivalent load in lateral direction	1.2	1

Table 3 Equivalent Factor of Models RSR12M1 to 20M1 (When reverse-radial and lateral loads are applied)

P_E	X	Y
Equivalent load in reverse-radial direction	1	0.99
Equivalent load in lateral direction	1.01	1

Options

Dust Prevention Accessories

THK offers an end seal for model RSR-M1 as a dust prevention accessory.
(For details of the end seal, see page a-24).

Table 4 Symbol of Dust Prevention Accessory for Model RSR-M1

Symbol	Dust prevention accessory
UU	With end seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals RSR-M1···UU, refer to the corresponding value provided in table 5.

Table 5 Maximum Seal Resistance Value of Seals RSR-M1···UU

Unit: N

Model No.	Seal resistance value
RSR 9M1	0.1
RSR 12M1	0.4
RSR 15M1	0.8
RSR 20M1	1.0
RSR 9M1W	0.8
RSR 12M1W	1.1
RSR 15M1W	1.3

Note: The seal resistance values above are values at normal temperature.

Stopper

With models RSR-M1, balls will fall off if the LM block is removed from the LM rail. To prevent the LM block from being pulled out, a stopper is mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.

Table 6 Dimensional Table for Stopper (Type C) for Model RSR-M1

Unit: mm

Model No.	A	B	C
RSR 9M1	13	6	9.5
RSR 12M1	16	7	12.5
RSR 15M1	19	7	14.5
RSR 20M1	25	7	20.0
RSR 9M1W	23	7	11.5
RSR 12M1W	29	7	13.5
RSR 15M1W	46	7	14.5

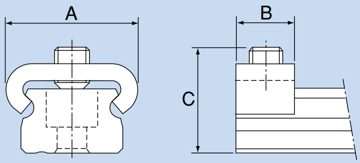


Fig. 3 Stopper (Type C) for Model RSR-M1

Accuracy of the Mounting Surface

Model RSR-M1 uses Gothic arch grooves in the ball raceways. When two rails of RSR are used in parallel, any error in accuracy of the mounting surface may increase rolling resistance and negatively affect the smooth motion of the guide. For specific accuracy of the mounting surface, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model RSR-M1 variations.

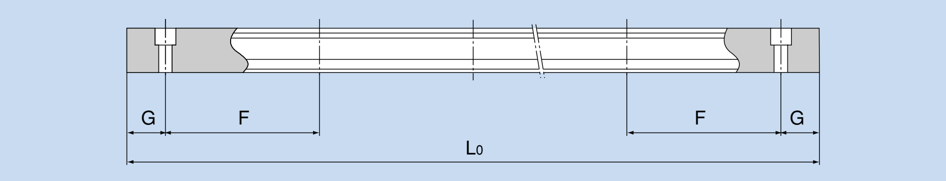


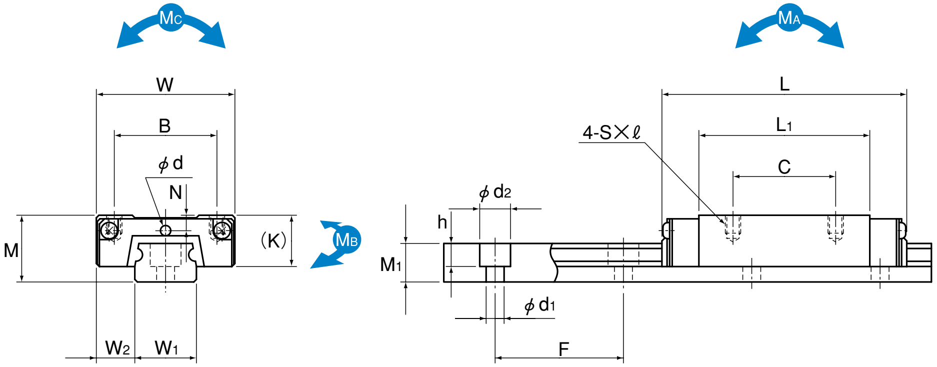
Table 7 Standard Length and Maximum Length of the LM Rail for Model RSR-M1

Unit: mm

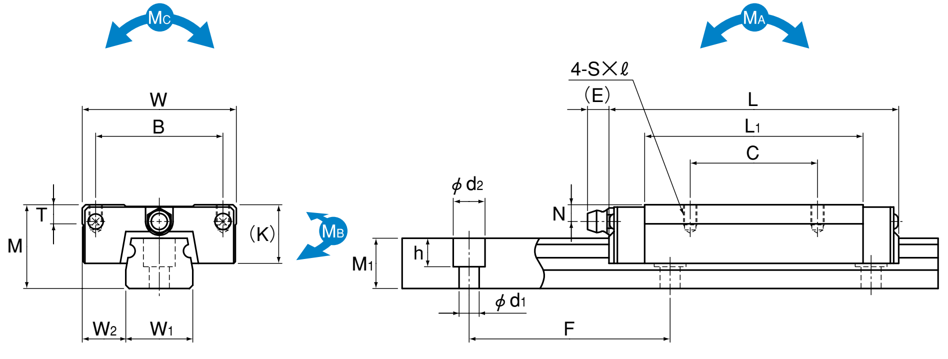
Model No.	RSR 9M1	RSR 12M1	RSR 15M1	RSR 20M1	RSR 9M1W	RSR 12M1W	RSR 15M1W
Standard LM rail length (L_0)	55	70	70	220	50	70	110
	75	95	110	280	80	110	150
	95	120	150	340	110	150	190
	115	145	190	460	140	190	230
	135	170	230	640	170	230	270
	155	195	270	880	200	270	310
	175	220	310	1000	260	310	430
	195	245	350		290	390	550
	275	270	390		320	470	670
	375	320	430			550	790
		370	470				
		470	550				
		570	670				
			870				
Standard pitch F	20	25	40	60	30	40	40
G	7.5	10	15	20	10	15	15
Max length	1000	1340	1430	1800	1000	1430	1800

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Model RSR-M1K
Model RSR-M1V
Model RSR-M1N



Models RSR9M1K/9M1N and RSR12M1V/M1N



Models RSR15, 20M1V/M1N

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width		Height	Pitch		C	C0	MA		MB		MC	LM block	LM rail
	M	W	L	B	C	S× ℓ	L1	T	K	N	E	d		W1	W2	M1	F	d1×d2×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
RSR 9M1K	10	20	30.8	15	10	M3×3	19.8	—	7.8	—	—	—	—	9 $^{0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	1.47	2.25	7.34	43.3	7.34	43.3	10.4	0.018	0.32
RSR 9M1N			41		16		29.8												2.6	3.96	18.4	97	18.4	97	18.4	0.027	
RSR 12M1V	13	27	35	20	15	M3×3.5	20.6	—	10	3	—	2	—	12 $^{0}_{-0.025}$	7.5	7.5	25	3.5×6×4.5	2.65	4.02	11.4	74.9	10.1	67.7	19.2	0.037	0.58
RSR 12M1N			47.7		20		33.3												4.3	6.65	28.9	163	25.5	145	31.8	0.055	
RSR 15M1V	16	32	43	25	20	M3×4	25.7	—	12	3.5	3.6	—	PB107	15 $^{0}_{-0.025}$	8.5	9.5	40	3.5×6×4.5	4.41	6.57	23.7	149	21.1	135	38.8	0.069	0.925
RSR 15M1N			61		25		43.5				3.7								7.16	10.7	63.1	330	55.6	293	63	0.093	
RSR 20M1V	25	46	66.5	38	38	M4×6	45.2	5.7	17.5	5	6.4	—	A-M6F	20 $^{0}_{-0.03}$	13	15	60	6×9.5×8.5	8.82	12.7	75.4	435	66.7	389	96.6	0.245	1.95
RSR 20M1N			86.3				65												14.2	20.6	171	897	151	795	157	0.337	

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR15 M1 V UU C1 +230L P- Ⅱ
1 2 3 4 5 6 7 8 9

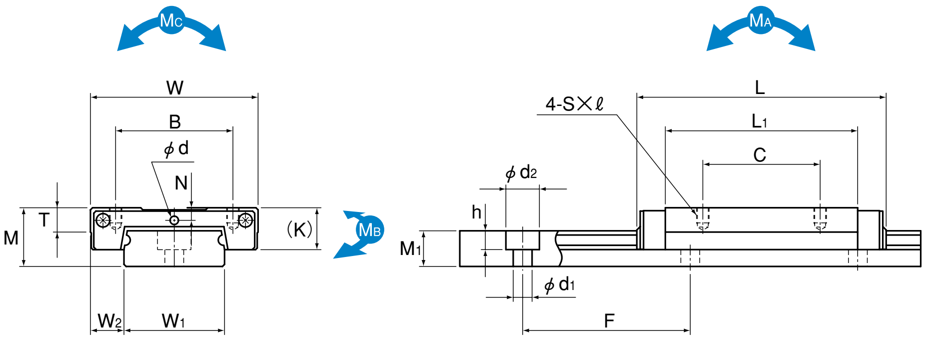
1 No. of LM blocks used on the same rail 2 Model number 3 Symbol for high-temperature type LM Guide
4 Type of LM block 5 Dust prevention accessory symbol (see page a-441)
6 Radial clearance symbol (see page a-35) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-45)
9 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

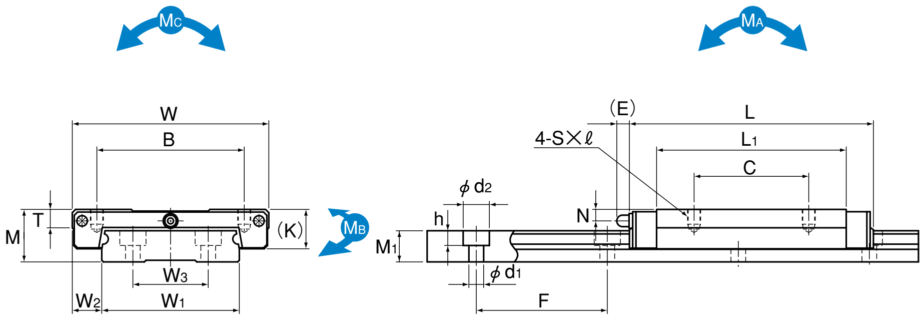
Standard Length and Maximum Length of the LM Rail P. a-442

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Model RSR-M1WV
Model RSR-M1WN



Models RSR9, 12M1WV/M1WN



Models RSR15M1WV/M1WN

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment N-m*					Mass	
	Height M	Width W	Length L	B	C	S×ℓ	L_1	T	K	N	E	Greasing hole d	Grease nipple	Width W_1	W_2	W_3	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
RSR 9M1WV	12	30	39	21	12	M2.6×3	27	—	7.8	2	—	1.6	—	$18^{\,0}_{-0.05}$	6	—	7.5	30	3.5×6×4.5	2.45	3.92	16	92.9	16	92.9	36	0.035	1.08
RSR 9M1WN			50.7	23	24	M3×3	38.7													3.52	5.37	31	161	31	161	49.4	0.051	
RSR 12M1WV	14	40	44.5	28	15	M3×3.5	30.9	4.5	10	3	—	2	—	$24^{\,0}_{-0.05}$	8	—	8.5	40	4.5×8×4.5	4.02	6.08	24.5	138	21.7	123	59.5	0.075	1.5
RSR 12M1WN			59.5		28		45.9													5.96	9.21	53.9	274	47.3	242	90.1	0.101	
RSR 15M1WV	16	60	55.5	45	20	M4×4.5	38.9	5.6	12	3.5	3	—	PB107	$42^{\,0}_{-0.05}$	9	23	9.5	40	4.5×8×4.5	6.66	9.8	50.3	278	44.4	248	168	0.17	3
RSR 15M1WN			74.5		35		57.9													9.91	14.9	110	555	97.3	490	255	0.21	

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSR12 M1 WN UU C1 +310L P
1 2 3 4 5 6 7 8

1 No. of LM blocks used on the same rail 2 Model number 3 Symbol for high-temperature type LM Guide
4 Type of LM block 5 Dust prevention accessory symbol (see page a-441)
6 Radial clearance symbol (see page a-35) 7 LM rail length (in mm) 8 Accuracy symbol (see page a-45)

Standard Length and Maximum Length of the LM Rail P. a-442

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model RSR-M1 with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU
RSR 9M1K	30.8
RSR 9M1N	41
RSR 9M1WV	39
RSR 9M1WN	50.7
RSR 12M1V	35
RSR 12M1N	47.7
RSR 12M1WV	44.5
RSR 12M1WN	59.5
RSR 15M1V	43
RSR 15M1N	61
RSR 15M1WV	55.5
RSR 15M1WN	74.5
RSR 20M1V	66.5
RSR 20M1N	86.3

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
RSR 9M1K	27.8
RSR 9M1N	37.8
RSR 9M1WV	36
RSR 9M1WN	47.7
RSR 12M1V	31
RSR 12M1N	43.7
RSR 12M1WV	41.3
RSR 12M1WN	56.3
RSR 15M1V	38.9
RSR 15M1N	56.5
RSR 15M1WV	51.5
RSR 15M1WN	70.5
RSR 20M1V	61.5
RSR 20M1N	81.3

Precautions on Use

THK High Temperature LM Guide

Service Temperature of the High Temperature LM Guide

●Maximum service temperature: 150℃

Selection of a High Temperature LM Guide

● For selecting a model number of high temperature LM Guide model RSR-M1, see section A of the "THK General Catalog - Technical Descriptions of the Products," provided separately. When selecting a model number, also determine the temperature factor fT while referring to the corresponding graph, and set hardness factor fH at 1.0.

Dimensional Accuracy of the High Temperature LM Guide

●The high temperature LM Guide is manufactured with the same dimensional accuracy as a standard LM Guide. At high service temperature, however, the former shows thermal expansion, and therefore, its dimensional accuracy changes by the thermal expansion.

Calculation of Thermal Expansion of the High Temperature LM Guide

●Thermal expansion of the high temperature LM Guide is calculated in the following equation.

$$L_{2\text{-}1} = \alpha (t_2 - t_1) L_1$$

$L_{2\text{-}1}$: Thermal expansion by heating (mm)
α : Coefficient of linear expansion (see table 8)
t_2 : Heating temperature (℃)
t_1 : Normal temperature (℃)
L_1 : Length at normal temperature (mm)

Table 8 Coefficient of Linear Expansion by Material ($\times 10^{-6}$/℃)
(The values other than high temperature LM Guide are excerpts from "Actual Designing - Part 2" by The Nikkan Kogyo Shimbun, Ltd.)

	High temperature LM Guide	SS400	FC25	SUS304	Aluminum
Coefficient of linear expansion	11.8	11.2 to 11.3	8.6 to 8.7	16.4	23

Note: If mounting the high temperature LM Guide on a material whose linear expansion coefficient is significantly different, or if the linear expansion coefficient is the same but the temperature is uneven, it may cause the LM rail to bend or the preload on the LM Guide to change (for preloads on the LM Guide, see page a-31).

Grease Used in the High Temperature LM Guide

●The LM Guide contains fluorinated grease as standard unless otherwise specified. The following table shows general properties of the grease for the high temperature LM Guide.

If other type of grease or lubricant is mixed with the high temperature grease, it may deteriorate the product performance.
When using the LM Guide in a vacuum environment, contact THK.

Name: Krytox GPL225 (DuPont)

Base oil	GPL105
Base oil viscosity (20℃)	550(mm²/s)
Oil separation rate (30 hr, 99℃)	4%(wt)
Additive	Anticorrosive agent
Service temperature range	-35℃ to +205℃
Worked penetration	NLGI No.2

Change in Sliding Resistance due to Grease and Seal

●The sliding resistance of the LM Guide tends to increase in proportion to the increase in temperature due to high temperature grease or seal.

Lubrication of the High Temperature LM Guide

●The high temperature LM Guide needs to be greased roughly at an interval of every 100 km in travel distance. However, the greasing interval may vary depending on the service conditions, environment, atmosphere or temperature. It is necessary to adjust the greasing interval according to the circumstances.

Miniature Type LM Guide® with a Ball-fall-preventing Retainer Model RSH

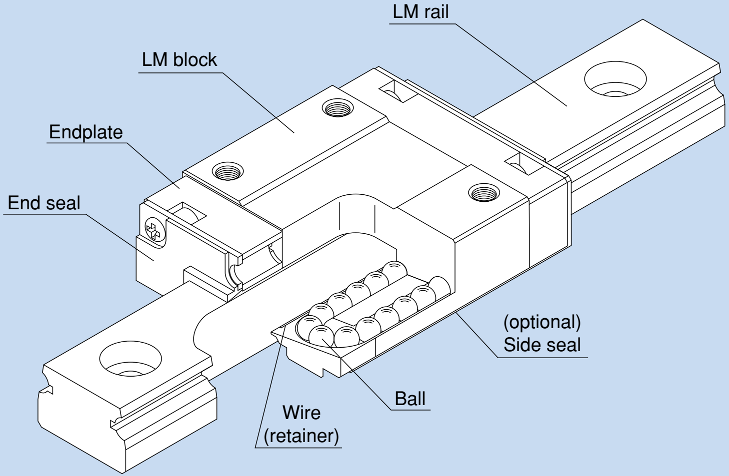


Fig. 1 Structure of Model RSH

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since a retainer holds the balls, they will not fall.

With the Miniature Type LM Guide with a Ball-fall-preventing Retainer Model RSH, balls circulate in a compact structure and perform infinite linear motion with no limit in stroke. The LM block is designed to have a shape with high rigidity in a limited space, and in combination with large-diameter balls, demonstrates high rigidity in all directions.

●Miniature size

This model is a highly reliable, ultra compact LM Guide that responds to weight saving and space saving.

●Capable of receiving loads in all directions

This model is capable of receiving loads in all directions, and has a high load capacity because of large-diameter balls incorporated in two rows of raceways.

●Highly corrosion resistant

Since the LM block, LM rail and balls use stainless steel, which is highly resistant to corrosion, it is optimal for clean-room applications.

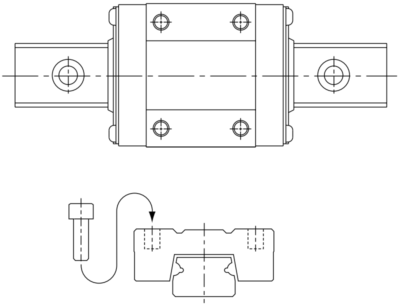
●Equipped with a ball-fall-preventing retainer

The LM block contains a retainer capable of preventing balls from falling off. Since the balls will not fall even if the LM block is removed from the LM rail, you can use this LM Guide at ease.

Type and Features

Model RSH

This model is a standard type.



Rated Loads in All Directions

Model RSH is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of models RSH7 and 9 are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for RSH.

The basic load ratings of model RSH12 indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for RSH. The values in the reverse-radial and lateral directions are obtained from table 1.

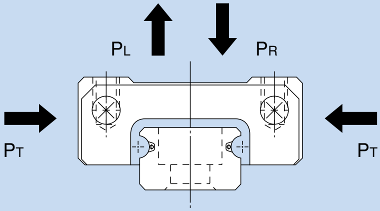


Fig. 2

Table 1 Basic Load Ratings of Model RSH12 in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.70C_0$
Lateral direction	$C_T=0.78C$	$C_{0T}=0.71C_0$

Equivalent Load

When the LM block of models RSH7 and 9 receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

When the LM block of model RSH12 receives loads in the radial and lateral directions, or the reverse-radial and lateral directions, simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R\,(P_L)+Y\cdot P_T$$

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see tables 2 and 3)

Table 2 Equivalent Factor of Model RSH12
(When radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.83
Equivalent load in lateral direction	1.2	1

Table 3 Equivalent Factor of Model RSH12
(When reverse-radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.99
Equivalent load in lateral direction	1.01	1

Options

Dust Prevention Accessories

THK offers an end seal for model RSH as a dust prevention accessory.
When the end seal is required, specify the desired item with the corresponding symbol provided in table 4.
(For details of the end seal, see page a-24.)

Table 4 Symbol of Dust Prevention Accessory for Model RSH

Symbol	Dust prevention accessory
UU	With end seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals RSH···UU, refer to the corresponding value provided in table 5.

Table 5 Maximum Seal Resistance Value of Seals RSR···UU

Unit: N

Model No.	Seal resistance value
RSH 7	0.08
RSH 9	0.1
RSH 12	0.4

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

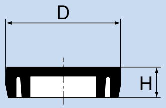
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 6.

For the procedure for mounting the cap, see page a-22.

Table 6 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
RSH 12	C3	M3	6.3	1.2



Dedicated Cap C

Accuracy of the Mounting Surface

Model RSH uses Gothic arch grooves in the ball raceways. When two rails of RSH are used in parallel, any error in accuracy of the mounting surface may increase rolling resistance and negatively affect the smooth motion of the guide. For specific accuracy of the mounting surface, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of model RSH variations.

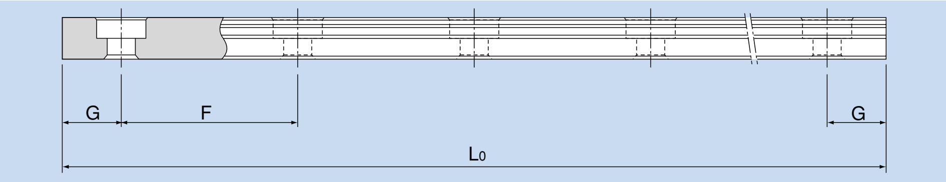


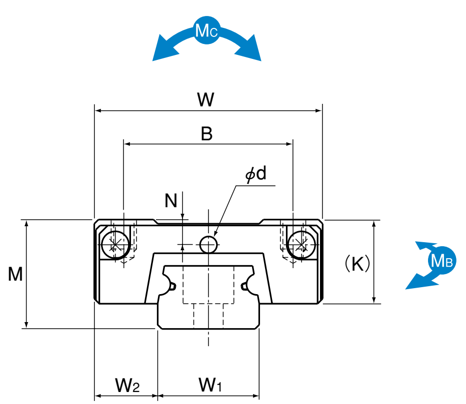
Table 7 Standard Length and Maximum Length of the LM Rail for Model RSH

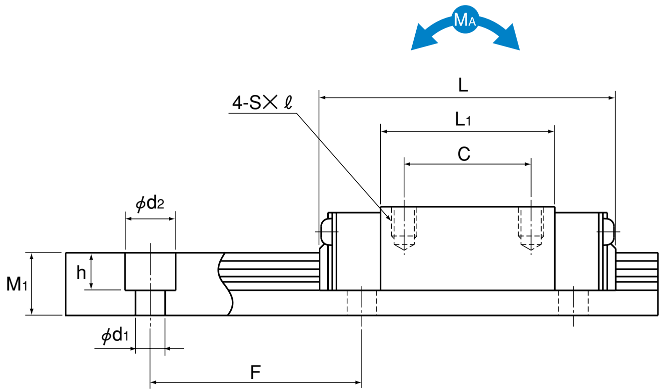
Unit: mm

Model No.	RSH 7	RSH 9	RSH 12
Standard LM rail length (L_0)	40 55 70 85 100 130	55 75 95 115 135 155 175 195 275 375	70 95 120 145 170 195 220 245 270 320 370 470 570
Standard pitch F	15	20	25
G	5	7.5	10
Max length	300	1000	1340

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Model RSH-M
Model RSH-KM
Model RSH-VM





Unit: mm

Model No.	External dimensions			LM block dimensions							LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height M	Width W	Length L	B	C	S× ℓ	L₁	K	N	Greasing hole d	Width W₁	W₂	Height M₁	Pitch F	d₁×d₂×h	C kN	C₀ kN	MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block	LM block kg	LM rail kg/m
RSH 7M	8	17	23.4	12	8	M2×2.5	13.4	6.5	1.7	1.2	$7^{\ 0}_{-0.02}$	5	4.7	15	2.4×4.2×2.3	0.88	1.37	2.93	20.8	2.93	20.8	5	0.01	0.23
RSH 9KM	10	20	30.8	15	10	M3×3	19.8	7.8	2.4	1.5	$9^{\ 0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	1.47	2.25	7.34	43.3	7.34	43.3	10.4	0.018	0.32
RSH 12VM	13	27	35	20	15	M3×3.5	20.6	10	3	2	$12^{\ 0}_{-0.025}$	7.5	7.5	25	3.5×6×4.5	2.65	4.02	11.4	74.9	10.1	67.7	19.2	0.037	0.58

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSH9K M UU C1 +100L P M-Ⅱ

1 2 3 4 5 6 7 8

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-453) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel
8 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-454

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model RSH with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU
RSH 7M	23.4
RSH 9KM	30.8
RSH 12VM	35

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
RSH 7M	20.4
RSH 9KM	27.8
RSH 12VM	31

Miniature Type LM Guide® with a Ball-fall-preventing Retainer Model RSH-Z

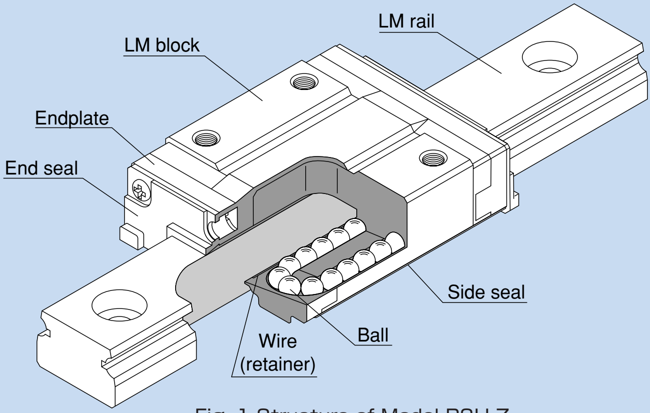


Fig. 1 Structure of Model RSH-Z

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. Since a retainer holds the balls, they will not fall off even if the LM block is removed from the LM rail.
With model RSH-Z, balls circulate in a compact structure and perform infinite linear motion with no limit in stroke.
Also, it has the same dimensions as the conventional model, but achieves a lower price.

●Equipped with a ball-fall-preventing retainer

Model RSH-Z has a retainer capable of preventing balls from falling off. Since the balls will not fall even if the LM block is removed from the LM rail, you can use this LM Guide at ease.

●Weight saving

Since part of the LM block body uses a resin material, the block mass is reduced by up to 30% from the conventional type. This makes RSH-Z a low-inertia type.

●Highly corrosion resistant

Since the LM block, LM rail and balls use stainless steel, which is highly resistant to corrosion, this model is optimal for clean-room applications.

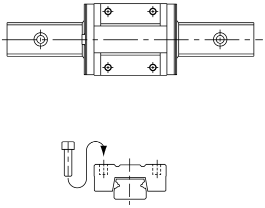
●Low noise

Since the unloaded ball path is made of resin, there is no metallic contact and low noise is achieved.

Types and Features

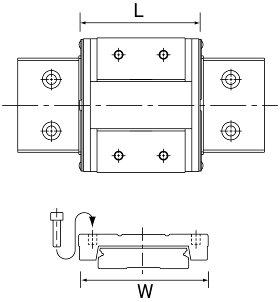
Model RSH-Z

This model is a standard type.



Model RSH-WZ

This model has a greater overall LM block length (L), broader width (W) and greater rated load and permissible moment than model RSH-Z.



Rated Loads in All Directions

Model RSH-Z is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings of models RSH7Z/WZ and 9Z/WZ are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for RSH-Z.

The basic load ratings of models RSH12Z/WZ and 15Z/WZ indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for RSH-Z. The values in the reverse-radial and lateral directions are obtained from table 1.

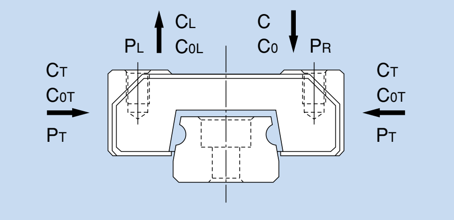


Fig. 2

Table 1 Basic Load Ratings of Models RSH12Z/WZ and 15Z/WZ in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.78C$	$C_{0L}=0.70C_0$
Lateral direction	$C_T=0.78C$	$C_{0T}=0.71C_0$

Equivalent Load

When the LM block of models RSH7Z/WZ and 9Z/WZ receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- ·Radial direction
- ·Reverse-radial direction
- ·Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

When the LM block of models RSH12Z/WZ and 15Z/WZ receives loads in the radial and lateral directions, or the reverse-radial and lateral directions, simultaneously, the equivalent load is obtained from the equation below.

$$P_E=X\cdot P_R\,(P_L)+Y\cdot P_T$$

where

P_E : Equivalent load (N)
- ·Radial direction
- ·Reverse-radial direction
- ·Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see tables 2 and 3)

Table 2 Equivalent Factor of Models RSH12Z/WZ and 15Z/WZ
(When radial and lateral loads are applied)

P_E	X	Y
Equivalent load in radial direction	1	0.83
Equivalent load in lateral direction	1.2	1

Table 3 Equivalent Factor of Models RSH12Z/WZ and 15Z/WZ
(When reverse-radial and lateral loads are applied)

P_E	X	Y
Equivalent load in reverse-radial direction	1	0.99
Equivalent load in lateral direction	1.01	1

Options

Dust Prevention Accessories

THK offers dust prevention accessories for models RSH-Z and WZ.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 4 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-470.

Table 4 Symbols of Dust Prevention Accessories for Models RSH-Z and WZ

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals RSH-Z···UU, refer to the corresponding value provided in table 5.

Table 5 Maximum Seal Resistance Value of Seals RSH-Z, WZ···UU

Unit: N

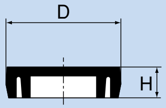
Model No.	Seal resistance value
RSH 7Z	0.08
RSH 9Z	0.1
RSH 12Z	0.4
RSH 15Z	0.8
RSH 7WZ	0.4
RSH 9WZ	0.8
RSH 12WZ	1.1
RSH 15WZ	1.3

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.
When placing an order, specify the desired cap type with the corresponding cap number indicated in table 6.
For the procedure for mounting the cap, see page a-22.

Table 6 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
RSH 9WZ	C3	M3	6.3	1.2
RSH 12Z	C3	M3	6.3	1.2
RSH 15Z	C3	M3	6.3	1.2



Dedicated Cap C

Accuracy of the Mounting Surface

Models RSH-Z and WZ use Gothic arch grooves in the ball raceways. When two rails of RSH-Z or WZ are used in parallel, any error in accuracy of the mounting surface may increase rolling resistance and negatively affect the smooth motion of the guide. For specific accuracy of the mounting surface, see Section 7.3 "Permissible Error of the Mounting Surface" on page a-62.

Standard Length and Maximum Length of the LM Rail

Table 7 shows the standard lengths and the maximum lengths of models RSH-Z and WZ variations.

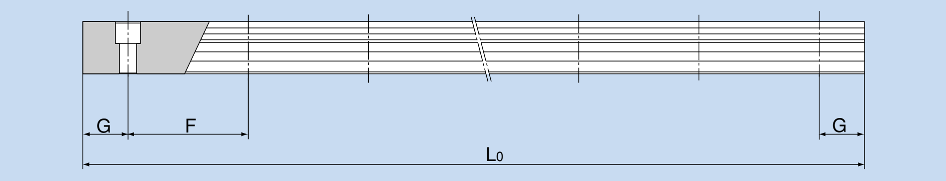


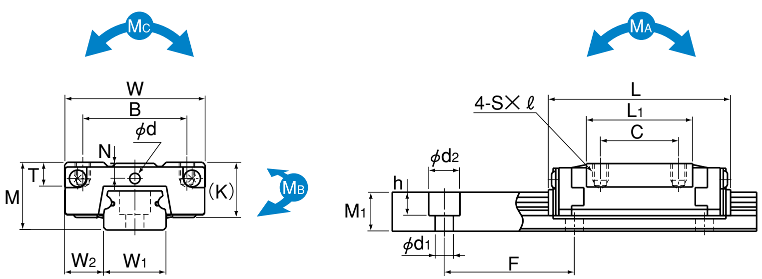
Table 7 Standard Length and Maximum Length of the LM Rail for Models RSH-Z and WZ

Unit: mm

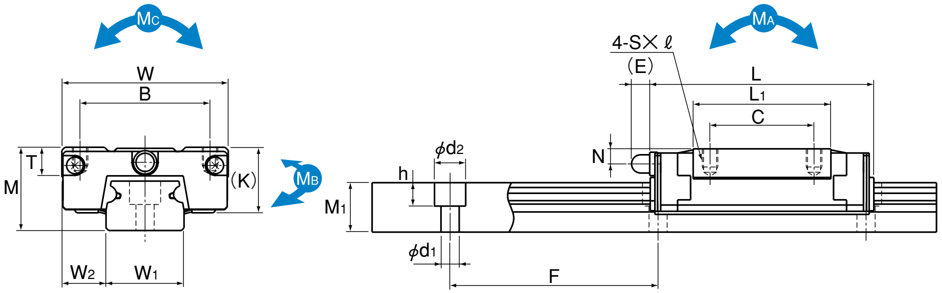
Model No.	RSH 7Z	RSH 9Z	RSH 12Z	RSH 15Z	RSH 7WZ	RSH 9WZ	RSH 12WZ	RSH 15WZ
Standard LM rail length (L_0)	40	55	70	70	50	50	70	110
	55	75	95	110	80	80	110	150
	70	95	120	150	110	110	150	190
	85	115	145	190	140	140	190	230
	100	135	170	230	170	170	230	270
	130	155	195	270	200	200	270	310
		175	220	310	260	260	310	430
		195	245	350	290	290	390	550
		275	270	390		320	470	670
		375	320	430			550	790
			370	470				
			470	550				
			570	670				
				870				
Standard pitch F	15	20	25	40	30	30	40	40
G	5	7.5	10	15	10	10	15	15
Max length	300	1000	1340	1430	400	1000	1430	1800

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Model RSH-ZM



Models RSH7 to 12ZM



Model RSH15ZM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions					Basic load rating		Static permissible moment N-m*					Mass	
	Height M	Width W	Length L	B	C	S× ℓ	L_1	T	K	N	E	Greasing hole d	Grease nipple	Width W_1	W_2	Height M_1	Pitch F	$d_1 \times d_2 \times h$	C kN	C_0 kN	M_A 1 block	M_A 2 blocks in close contact	M_B 1 block	M_B 2 blocks in close contact	M_C 1 block	LM block kg	LM rail kg/m
RSH 7ZM	8	17	23.4	12	8	M2×2.5	13.2	3.4	6.5	1.6	—	1.5	—	$7^{0}_{-0.02}$	5	4.7	15	2.4×4.2×2.3	0.88	1.37	2.93	20.7	2.93	20.7	5	0.008	0.23
RSH 9ZM	10	20	30.8	15	10	M3×2.8	19.4	4.6	7.8	2.4	—	1.6	—	$9^{0}_{-0.02}$	5.5	5.5	20	3.5×6×3.3	1.47	2.25	7.34	43	7.34	43	10.4	0.014	0.32
RSH 12ZM	13	27	35	20	15	M3×3.2	20.4	4.5	10.6	3.1	—	2	—	$12^{0}_{-0.025}$	7.5	7.5	25	3.5×6×4.5	2.65	4.02	11.4	74.9	10.1	67.7	19.2	0.028	0.58
RSH 15ZM	16	32	43	25	20	M3×3.5	26.5	5.5	12.6	2.9	3.6	—	PB107	$15^{0}_{-0.025}$	8.5	9.5	40	3.5×6×4.5	4.41	6.57	23.7	149	21.1	135	38.8	0.05	0.925

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSH15Z M UU C1 +230L P M- Ⅱ

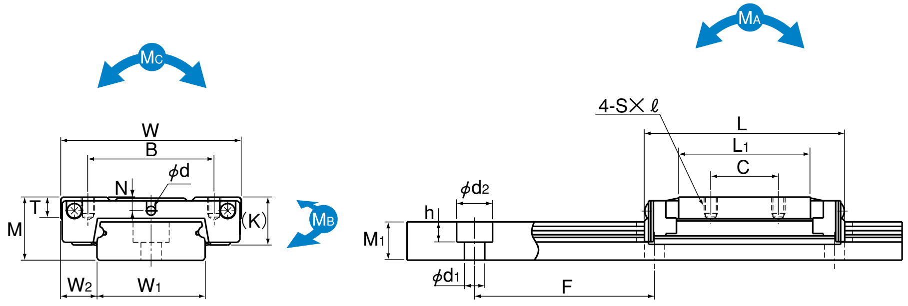
1 2 3 4 5 6 7 8

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-463)
4 Radial clearance symbol (see page a-35) 5 LM rail length (in mm) 6 Accuracy symbol (see page a-45)
7 LM rail is made of stainless steel 8 Symbol for No. of rails used on the same plane

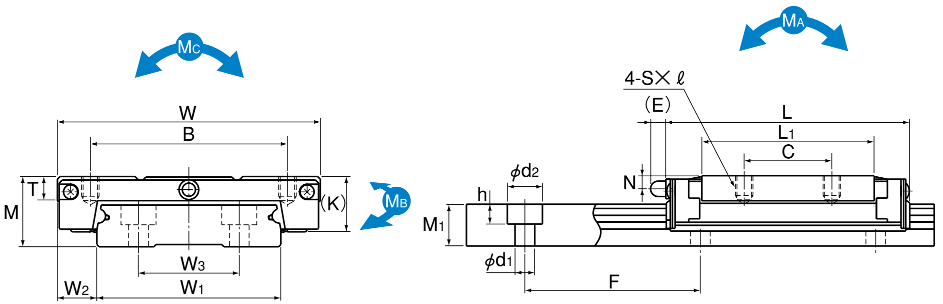
Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-464

Model RSH-WZM



Models RSH7 to 12WZM



Model RSH15WZM

Unit: mm

Model No.	External dimensions			LM block dimensions										LM rail dimensions						Basic load rating		Static permissible moment N-m*					Mass	
	Height	Width	Length									Greasing hole	Grease nipple	Width			Height	Pitch		C	C₀	MA		MB		Mc	LM block	LM rail
	M	W	L	B	C	S×ℓ	L₁	T	K	N	E	d		W₁	W₂	W₃	M₁	F	d₁×d₂×h	kN	kN	1 block	2 blocks in close contact	1 block	2 blocks in close contact	1 block	kg	kg/m
RSH 7WZM	9	25	31.5	19	10	M3×2.5	19.7	3.4	7	1.8	—	1.5	—	$14^{0}_{-0.05}$	5.5	—	5.2	30	3.5×6×3.2	1.37	2.16	6.54	42.1	6.54	42.1	15.4	0.018	0.51
RSH 9WZM	12	30	39	21	12	M3×2.8	27	3.9	9.1	2.3	—	1.6	—	$18^{0}_{-0.05}$	6	—	7.5	30	3.5×6×4.5	2.45	3.92	16	92.9	16	92.9	36	0.03	1.08
RSH 12WZM	14	40	44.5	28	15	M3×3.6	29.3	4.5	10.6	3	—	2	—	$24^{0}_{-0.05}$	8	—	8.5	40	4.5×8×4.5	4.02	6.08	24.5	138	21.7	123	59.5	0.06	1.5
RSH 15WZM	16	60	55.5	45	20	M4×4.5	39.3	5.4	12.6	3	3.6	—	PB107	$42^{0}_{-0.05}$	9	23	9.5	40	4.5×8×4.5	6.66	9.8	50.3	278	44.4	248	168	0.135	3

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

2 RSH9WZ M SS C1 +170L P M
1 2 3 4 5 6 7

1 No. of LM blocks used on the same rail 2 Model number
3 Dust prevention accessory symbol (see page a-463) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-45) 7 LM rail is made of stainless steel

Standard Length and Maximum Length of the LM Rail P. a-464

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model RSR-M1 with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
RSH 7ZM	23.4	—
RSH 9ZM	30.8	—
RSH 12ZM	35	35
RSH 15ZM	43	43
RSH 7WZM	31.5	—
RSH 9WZM	39	39
RSH 12WZM	44.5	44.5
RSH 15WZM	55.5	55.5

Note: "—" indicates not available.

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
RSH 7ZM	20.4
RSH 9ZM	29.1
RSH 12ZM	32.6
RSH 15ZM	40.2
RSH 7WZM	28
RSH 9WZM	37.6
RSH 12WZM	42.1
RSH 15WZM	53.1

Miniature Cross LM Guide® Model MX

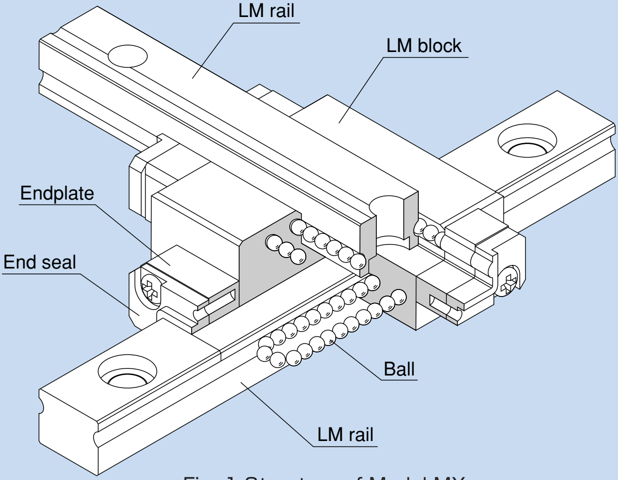


Fig. 1 Structure of Model MX

Structure and Features

Balls roll in two rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate. This model is an integral type of LM Guide that squares a unit of miniature LM Guide model RSR with another and uses two LM rails in combination. Since an orthogonal LM system with an extremely low height can be achieved with model MX alone, a conventionally required saddle is no longer necessary and the whole system can be downsized.

●4-way equal load

Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

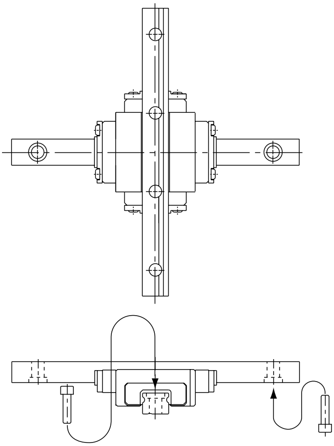
●Tapped LM rail type

There are two types of the LM rail: one designed to be mounted from the top with bolts, and a semi-standard type whose bottom face has tapped holes, allowing the rail to be mounted from the bottom.

Types and Features

Model MX

MX is divided into two types: RSR5M cross type and RSR7WM cross type.



Rated Loads in All Directions

Model MX is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings are defined with an LM rail and an LM block, and uniform in the four directions (radial, reverse-radial and lateral directions). Their actual values are provided in the dimensional table for MX.

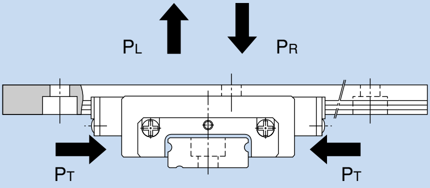


Fig. 2

Equivalent Load

When the LM block of model MX receives loads in the radial, reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where
P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessory

THK offers an end seal for model MX as a dust prevention accessory.
When the end seal is required, specify the desired item with the corresponding symbol provided in table 1.
(For details of the end seal, see page a-24.)

Table 1 Symbol of Dust Prevention Accessory for Model MX

Symbol	Dust prevention accessory
UU	With end seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals MX···UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals MX···UU

Unit: N

Model No.	Seal resistance value
MX 5	0.06
MX 7W	0.4

Stopper

With model MX, balls will fall off if the LM block is removed from the LM rail. To prevent the LM block from being pulled out, a stopper is mounted before shipment. If removing the stopper when using the LM Guide, be sure that the LM block will not overrun.

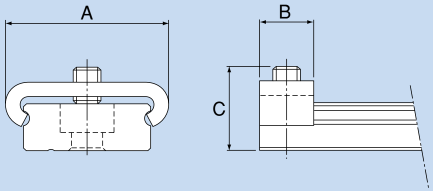


Fig. 3 Stopper (Type C) for Model MX

Table 3 Dimensional Table for Stopper (Type C) for Model MX

Unit: mm

Model No.	A	B	C
MX 7W	18	6	9.2

Note: The stopper for model MX uses an O-ring.

Standard Length and Maximum Length of the LM Rail

Table 4 shows the standard lengths and the maximum lengths of model MX variations.

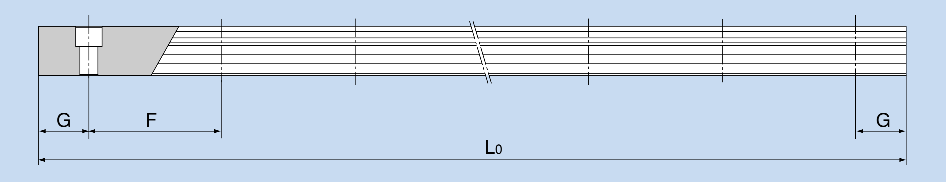


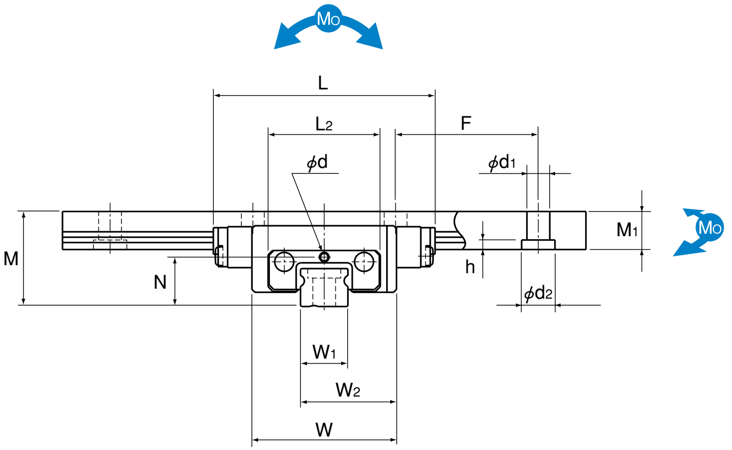
Table 4 Standard Length and Maximum Length of the LM Rail for Model MX

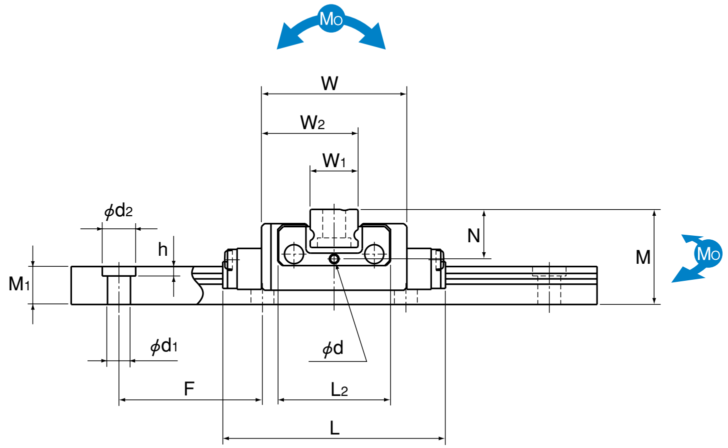
Unit: mm

Model No.	MX 5	MX 7W
Standard LM rail length (L_0)	40 55 70 100 130 160	50 80 110 140 170 200 260 290
Standard pitch F	15	30
G	5	10
Max length	200	400

Note 1: The maximum length varies with accuracy grades. Contact THK for details.

Model MX





Unit: mm

Model No.	External dimensions Height M	External dimensions Width W	External dimensions Length L	LM block dimensions L_2	LM block dimensions N	LM block dimensions Greasing hole d	LM rail dimensions Width W_1	LM rail dimensions W_2	LM rail dimensions Height M_1	LM rail dimensions Pitch F	LM rail dimensions $d_1 \times d_2 \times h$	Basic load rating C kN	Basic load rating C_0 kN	Static permissible moment* N-m M_0	Mass LM block kg	Mass LM rail kg/m
MX 5M	10	15.2	23.3	11.8	5.2	0.8	$5\ ^{0}_{-0.02}$	10.1	4	15	2.4×3.5×1	0.59	1.1	2.57	0.01	0.14
MX 7WM	14.5	30.2	40.8	24.6	7.4	1.2	$14\ ^{0}_{-0.025}$	22.1	5.2	30	3.5×6×3.2	2.04	3.21	14.7	0.051	0.51

Note Since stainless steel is used in the LM block, LM rail and balls, these models are highly resistance to corrosion and environment.

Note Static permissible moment*: Static permissible moment value with 1 LM block

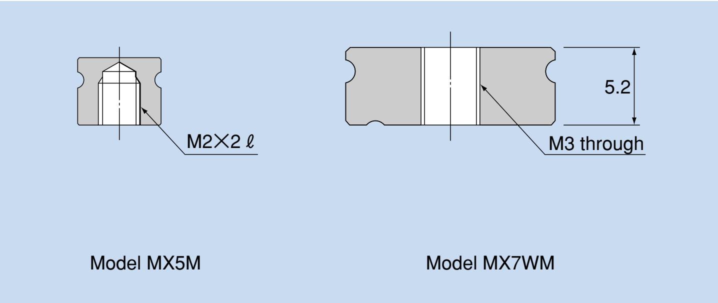
Model number coding

4 MX7W M UU C1 +120/100L P M
1 2 3 4 5 6 7 8

1 Total No. of LM blocks 2 Model number 3 Dust prevention accessory symbol (see page a-475)
4 Radial clearance symbol (see page a-35) 5 X-axis LM rail length (in mm)
6 Y-axis LM rail length (in mm) 7 Accuracy symbol (see page a-46) 8 LM rail is made of stainless steel

Note If the LM rail mount of a semi-standard model is of a tapped LM rail type, add symbol "K" after the accuracy symbol.
Example:···4 MX7W M UU C1+120/100 L P K M
└ Add symbol K

For the LM rail mounting hole, a tapped LM rail type is available as semi-standard.



Model MX5M Model MX7WM

When mounting the LM rail of model MX7WM, take into account the thread length of the mounting bolt in order not to let the bolt end stick out of the top face of the LM rail.

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model MX with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU
MX 5M	23.3
MX 7WM	40.8

Overall LM Block Length without a Seal

Unit: mm

Model No.	Without seal
MX 5M	22.3
MX 7WM	39.8

R Guide Model HCR

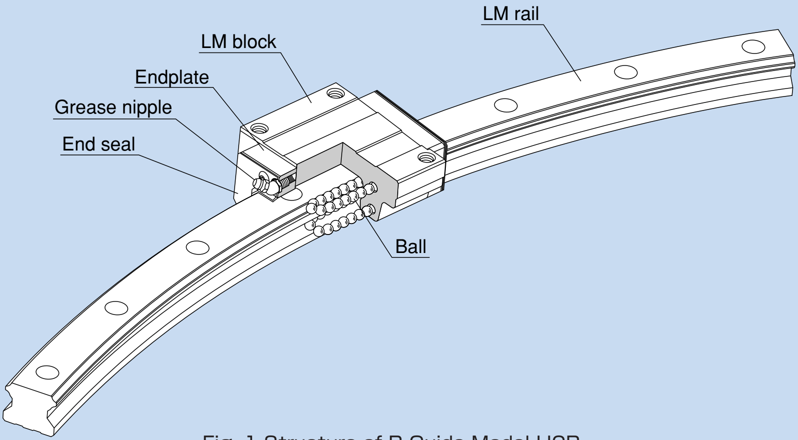


Fig. 1 Structure of R Guide Model HCR

Structure and Features

Balls roll in four rows of raceways precision-ground on an LM rail and an LM block, and endplates incorporated in the LM block allow the balls to circulate.
With a structure that is basically the same as four-way equal load type LM Guide model HSR, which has a proven track record, this R Guide is a new concept product that allows highly accurate circular-arc motion.

●Freedom of design

Multiple LM blocks can individually move on the same rail. By arranging LM blocks on the load points, efficient structural design is achieved.

●Shortened assembly time

This model allows clearance-free, highly accurate circular motion as opposed to sliding guides or cam followers. You can easily assemble this model simply by mounting the LM rail and LM blocks with bolts.

●Allows circular motion of 5 m or longer

It allows circular motion of 5 m or longer, which is impossible with swivel bearings.
In addition, use of this model makes it easy to assemble, disassemble and reassemble equipment that circularly moves.

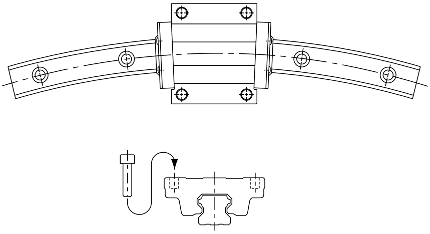
●Capable of receiving loads in all directions

This model is capable of receiving loads in all directions since it has a structure that is basically the same as model HSR.

Type and Features

Model HCR

The flange of its LM block has tapped holes.



Rated Loads in All Directions

Model HCR is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.
The basic load ratings are uniform in the four directions (radial, reverse-radial and lateral directions), and their actual values are provided in the dimensional table for HCR.

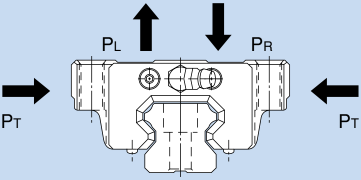


Fig. 2

Equivalent Load

When the LM block of model HCR receives loads in all four directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
- Radial direction
- Reverse-radial direction
- Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Options

Dust Prevention Accessories

THK offers various dust prevention accessories for model HCR.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 1 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-488.

Table 1 Symbols of Dust Prevention Accessories for Model HCR

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal
DD	With double seals + side seal
ZZ	With end seal + side seal + metal scraper
KK	With double seals + side seal + metal scraper
LL	With low-resistance seal
RR	With LL seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals HCR···UU, refer to the corresponding value provided in table 2.

Table 2 Maximum Seal Resistance Value of Seals HCR···UU

Unit: N

Model No.	Seal resistance value
HCR 12	1.2
HCR 15	2.0
HCR 25	3.9
HCR 35	11.8
HCR 45	19.6
HCR 65	34.3

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

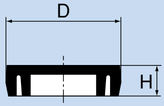
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 3.

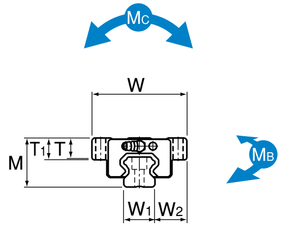
For the procedure for mounting the cap, see page a-22.

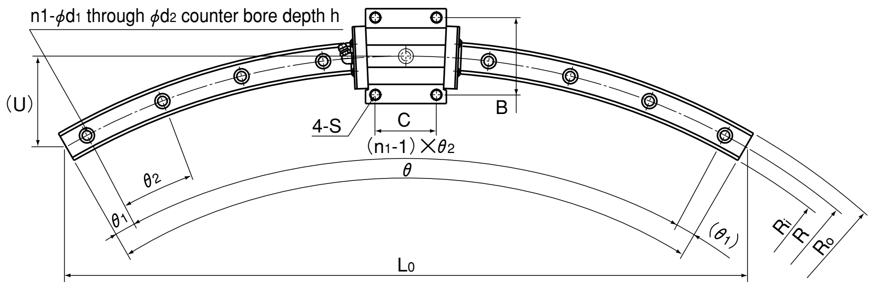
Table 3 Major Dimensions of Dedicated Cap C

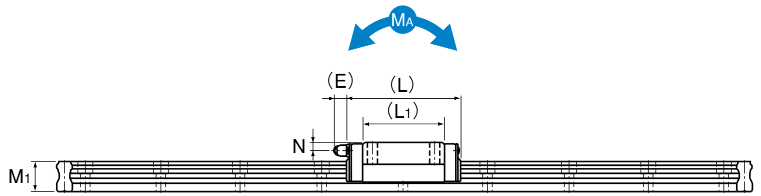
Model No.	Cap C model No.	Bolt used	Major dimensions mm	
			D	H
HCR 12	C 3	M 3	6.3	1.2
HCR 15	C 4	M 4	7.8	1.0
HCR 25	C 6	M 6	11.4	2.7
HCR 35	C 8	M 8	14.4	3.7
HCR 45	C12	M12	20.5	4.7
HCR 65	C16	M16	26.5	5.7



Dedicated Cap C







Unit: mm

Model No.	External dimensions Height M	External dimensions Width W	External dimensions Length L	LM block dimensions B	C	S	L1	T	T1	N	E	Grease nipple	LM rail dimensions R	R0	Ri	L0	U	Width W1	W2	Height M1	d1×d2×h	n1	θ°	θ1°	θ2°	Basic load rating C kN	C0 kN	Static permissible moment kN-m* MA 1 block	MA 2 blocks in close contact	MB 1 block	MB 2 blocks in close contact	MC 1 block
HCR 12A+60/100R	18	39	44.6	32	18	M4	30.5	4.5	5	3.4	3.5	PB1021B	100	106	94	100	13.4	12	13.5	11	3.5X6X5	3	60	7	23	4.7	8.53	0.0409	0.228	0.0409	0.228	0.0445
HCR 15A+60/150R	24	47	56.2	38	24	M5	38.8	10.3	11	4.5	5.5	PB1021B	150	157.5	142.5	150	20.1	15	16	15	4.5X7.5X5.3	3	60	7	23	6.66	10.8	0.0805	0.457	0.0805	0.457	0.0844
HCR 15A+60/300R			56.4		28								300	307.5	292.5	300	40					5		6	12	8.33	13.5					
HCR 15A+60/400R			56.5		28								400	407.5	392.5	400	54					7		3	9	8.33	13.5					
HCR 25A+60/500R	36	70	83	57	45	M8	59.5	14.9	16	6	12	B-M6F	500	511.5	488.5	500	67	23	23.5	22	7X11X9	9	60	2	7	19.9	34.4	0.307	1.71	0.307	1.71	0.344
HCR 25A+60/750R													750	761.5	738.5	750	100					12		2.5	5							
HCR 25A+60/1000R													1000	1011.5	988.5	1000	134					15		2	4							
HCR 35A+60/600R	48	100	109.2	82	58	M10	80.4	19.9	21	8	12	B-M6F	600	617	583	600	80	34	33	29	9X14X12	7	60	3	9	37.3	61.1	0.782	3.93	0.782	3.93	0.905
HCR 35A+60/800R			109.3										800	817	783	800	107					11		2.5	5.5							
HCR 35A+60/1000R			109.3										1000	1017	983	1000	134					12		2.5	5							
HCR 35A+60/1300R			109.3										1300	1317	1283	1300	174					17		2	3.5							
HCR 45A+60/800R	60	120	138.7	100	70	M12	98	23.9	25	10	16	B-PT1/8	800	822.5	777.5	800	107	45	37.5	38	14X20X17	8	60	2	8	60	95.6	1.42	7.92	1.42	7.92	1.83
HCR 45A+60/1000R			138.8										1000	1022.5	977.5	1000	134					10		3	6							
HCR 45A+60/1200R			138.8										1200	1222.5	1177.5	1200	161					12		2.5	5							
HCR 45A+60/1600R			138.9										1600	1622.5	1577.5	1600	214					15		2	4							
HCR 65A+60/1000R	90	170	197.8	142	106	M16	147	34.9	37	19	16	B-PT1/8	1000	1031.5	968.5	1000	134	63	53.5	53	18X26X22	8	60	2	8	141	215	2.45	13.2	2.45	13.2	3.2
HCR 65A+60/1500R			197.9										1500	1531.5	1468.5	1500	201					10	60	3	6							
HCR 65A+45/2000R			197.9										2000	2031.5	1968.5	1531	152					12	45	0.5	4							
HCR 65A+45/2500R			197.9										2500	2531.5	2468.5	1913	190					13	45	1.5	3.5							
HCR 65A+30/3000R			197.9										3000	3031.5	2968.5	1553	102					10	30	1.5	3							

Note LM rail radiuses other than the radiuses in the above table are also available. Contact THK for details.
The R-Guide center angles in the table are maximum manufacturing angles. To obtain angles greater than them, rails must additionally be connected. Contact THK for details.

Static permissible moment* 1 block: static permissible moment value with 1 LM block
2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

HCR25A 2 UU +60/1000R
1 2 3 4 5

1 Model number 2 No. of LM blocks used on the same rail
3 Dust prevention accessory symbol (see page a-484) 4 R-Guide center angle 5 LM rail radius (in mm)

Overall LM Block Length with Options

Overall LM Block Length (Dimension L) of Model HCR with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS	DD	ZZ	KK	LL	RR
HCR 12A+60/ 100R	44.6	—	—	—	—	—	—
HCR 15A+60/ 150R	56.2	56.2	61.8	57.8	63	56.2	56.2
HCR 15A+60/ 300R	56.4	56.4	62	58	63.2	56.4	56.4
HCR 15A+60/ 400R	56.5	56.5	62.1	58.1	63.3	56.5	56.5
HCR 25A+60/ 500R	83	83	90.6	86.6	94.2	83	83
HCR 25A+60/ 750R	83	83	90.6	86.6	94.2	83	83
HCR 25A+60/1000R	83	83	90.6	86.6	94.2	83	83
HCR 35A+60/ 600R	109.2	109.2	116.7	112.7	120.3	109.2	109.2
HCR 35A+60/ 800R	109.3	109.3	116.8	112.8	120.4	109.3	109.3
HCR 35A+60/1000R	109.3	109.3	116.8	112.8	120.4	109.3	109.3
HCR 35A+60/1300R	109.3	109.3	116.8	112.8	120.4	109.3	109.3
HCR 45A+60/ 800R	138.7	138.7	145.9	143.9	151.1	138.7	138.7
HCR 45A+60/1000R	138.8	138.8	146	144	151.2	138.8	138.8
HCR 45A+60/1200R	138.8	138.8	146	144	151.2	138.8	138.8
HCR 45A+60/1600R	138.9	138.9	146.1	144.1	151.3	138.9	138.9
HCR 65A+60/1000R	197.8	197.8	204.7	202.7	209.9	197.8	197.8
HCR 65A+60/1500R	197.9	197.9	204.8	202.8	210	197.9	197.9
HCR 65A+60/2000R	197.9	197.9	204.8	202.8	210	197.9	197.9
HCR 65A+60/2500R	197.9	197.9	204.9	202.9	210.1	197.9	197.9
HCR 65A+60/3000R	197.9	197.9	204.9	202.9	210.1	197.9	197.9

Note: "—" indicates not available.
Applicability of DD, ZZ and KK depends on the LM rail radius. Contact THK for details.

Precautions on Use

With model HCR, balls will fall off if the LM block is removed from the LM rail. Use much care in handling this model.

Self-aligning Type LM Guide Model NSR-TBC

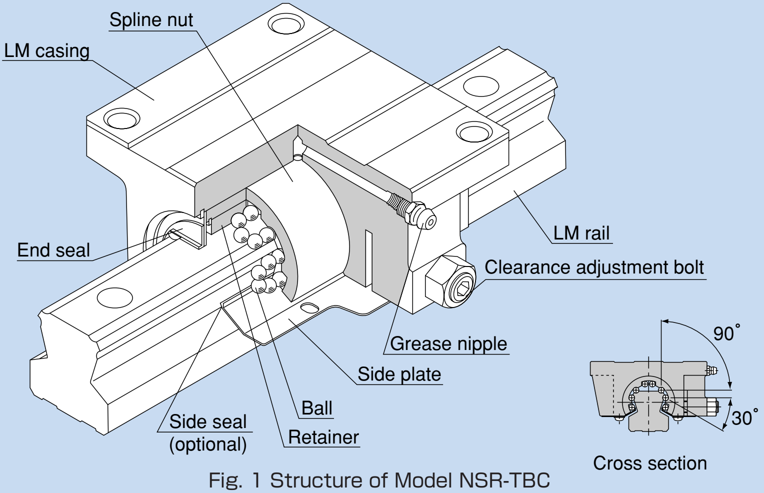


Fig. 1 Structure of Model NSR-TBC

Structure and Features

Model NSR-TBC is the only LM Guide whose casing consists of two pieces instead of a single-piece LM block. The rigid, cast iron casing contains a cylindrical spline nut that is partially cut at an angle of 120°. This enables the model to self align on the fitting surface with the casing, thus to permit rough installation.

●Capable of receiving loads in all directions

NSR-TBC has four rows of balls. The balls are arranged in two rows on each shoulder of the LM rail, and can receive loads in all four directions: upward, downward and lateral directions. Due to the self-adjustment structure, however, a rotational moment (MC) cannot be applied in a single-rail configuration.

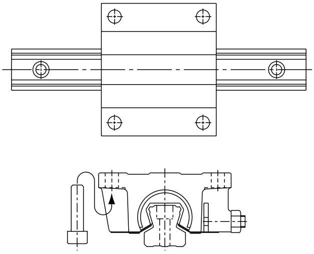
●Easy installation and accuracy establishment

Model NSR-TBC is highly capable of performing self-adjustment and self-alignment. As a result, even if two rails are not mounted with accuracy, the LM block absorbs the error and it does not affect the traveling performance. Accordingly, the machine performance will not be deteriorated.

Type and Features

Model NSR-TBC

The flange of the LM casing has through holes, allowing the LM Guide to be mounted from the bottom.



Rated Loads in All Directions

Model NSR-TBC is capable of receiving loads in all four directions: radial, reverse-radial and lateral directions.

The basic load ratings indicate the values in the radial direction in Fig. 2, and their actual values are provided in the dimensional table for NSR-TBC. The values in the radial and reverse-radial directions are obtained from table 1.

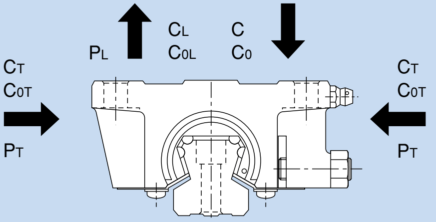


Fig. 2

Table 1 Basic Load Ratings of Model NSR-TBC in All Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=0.62C$	$C_{0L}=0.50C_0$
Lateral direction	$C_T=0.56C$	$C_{0T}=0.43C_0$

Equivalent Load

When the LM block of model NSR-TBC receives loads in the reverse-radial and lateral directions simultaneously, the equivalent load is obtained from the equation below.

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

where

P_E : Equivalent load (N)
·Reverse-radial direction
·Lateral direction
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X/Y axes : Equivalent factor (see table 2)

Table 2 Equivalent Factor of Model NSR-TBC

P_E	X	Y
Equivalent load in reverse-radial direction	1	1.155
Equivalent load in lateral direction	0.866	1

Options

Dust Prevention Accessories

THK offers dust prevention accessories for model NSR-TBC.
When a dust prevention accessory is required, specify the desired item with the corresponding symbol provided in table 3 (for details of dust prevention accessories, see page a-24).
For supported model numbers for dust prevention accessories and overall LM block length with dust prevention accessories attached (dimension L), see page a-500.

Table 3 Symbols of Dust Prevention Accessories for Model NSR-TBC

Symbol	Dust prevention accessory
UU	With end seal
SS	With end seal + side seal

Seal resistance value

For the maximum seal resistance value per LM block when a lubricant is applied on seals NSR-TBC···UU, refer to the corresponding value provided in table 4.

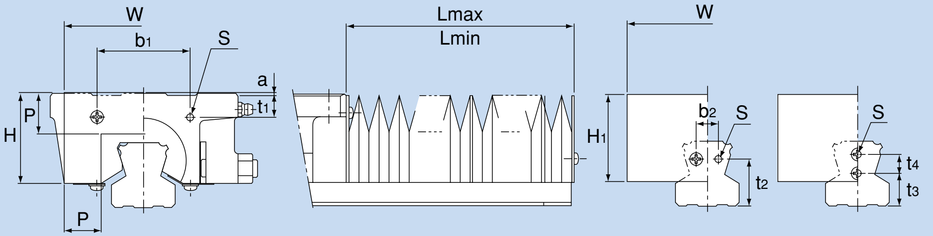
Table 4 Maximum Seal Resistance Value of Seals NSR-TBC···UU

Unit: N

Model No.	Seal resistance value
NSR 20TBC	4.9
NSR 25TBC	4.9
NSR 30TBC	6.9
NSR 40TBC	9.8
NSR 50TBC	14.7
NSR 70TBC	24.5

●Dedicated Bellows J for Model NSR-TBC

The table below shows the dimensions of dedicated bellows J for model NSR-TBC. Specify the corresponding model number of the desired bellows from the table.



Models NSR30 to 70TBC   Models NSR20 and 25TBC

Unit: mm

Model No.	Major dimensions												A $\left(\frac{Lmax}{Lmin}\right)$	Supported model
	W	H	H_1	P	b_1	t_1	b_2	t_2	t_3	t_4	Mounting bolt S	a		
J 20	65	39	43	20	26	8	—	—	9	8	M4×8ℓ	8	7	NSR 20TBC
J 25	75	43	45	20	40	11	—	—	12	8	M4×8ℓ	3	7	NSR 25TBC
J 30	85	46	46	20	50	12	12	25	—	—	M4×8ℓ	—	7	NSR 30TBC
J 40	115	59	59	25	60	13	16	32	—	—	M5×10ℓ	—	9	NSR 40TBC
J 50	115	66	66	25	75	11	20	32	—	—	M5×10ℓ	—	9	NSR 50TBC
J 70	124	84	78	25	96	16	36	40	—	—	M6×12ℓ	—	9	NSR 70TBC

Note 1: When desiring to use the dedicated bellows other than in horizontal mount (i.e., vertical, wall and inverted mount), or when desiring a heat-resistant type of bellows, contact THK.

Note 2: For lubrication when using the dedicated bellows, contact THK.

Note 3: When using the dedicated bellows, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

Model number coding

J50-60/540

1 2

1 Model number···bellows for NSR50TBC

2 Bellows dimensions
(length when compressed / length when extended)

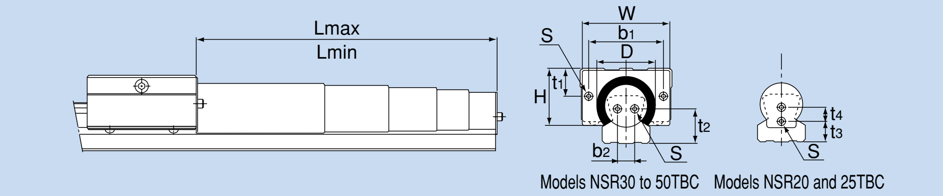
Note: The length of the bellows is calculated as follows.

$$Lmin = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$$Lmax = Lmin \cdot A$$ A: Extension rate

●Dedicated LM Cover TP for Model NSR-TBC

The tables below show the dimensions of dedicated LM cover TP for model NSR-TBC. Specify the corresponding model number of the desired bellows from the table.



Models NSR30 to 50TBC Models NSR20 and 25TBC

Unit: mm

Model No.	Major dimensions										Supported model
	W	D (max)	H	b_1	t_1	b_2	t_2	t_3	t_4	Mounting bolt S	
TP 20	44	31	32	26	8	—	—	9	8	M4×8ℓ	NSR 20TBC
TP 25	56	36	40	40	11	—	—	12	8	M4×8ℓ	NSR 25TBC
TP 30	66	44	47	50	12	12	25	—	—	M4×8ℓ	NSR 30TBC
TP 40	62	57	58.5	60	13	16	32	—	—	M5×10ℓ	NSR 40TBC
TP 50	94	66	67	75	11	20	32	—	—	M5×10ℓ	NSR 50TBC

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TP 20	4	200	690	490
	4	150	490	340
	3	200	530	330
	3	150	380	230
	4	100	290	190
	3	100	230	130
TP 25	4	250	890	640
	4	200	690	490
	3	250	680	430
	4	150	490	340
	3	200	530	330
	3	150	380	230

Unit: mm

Model No.	Stage	L		Stroke
		min	max	
TP 30	4	300	1090	790
	4	250	890	640
	3	300	830	530
	4	200	690	490
	3	250	680	430
	4	150	490	340
	3	150	380	230
	4	100	290	190
TP 40 TP 50	5	400	1790	1390
	5	350	1540	1190
	4	400	1460	1060
	5	300	1290	990
	5	250	1040	790
	4	300	1060	760
	4	250	860	610
	4	200	660	460
	5	150	540	390
	4	150	460	310

Model number coding **TP50-400/1460**
1 2 3

1 Model number…LM cover for NSR50TBC
2 Lmin (cover length when contracted)
3 Lmax (cover length when extended)

Note 1: For lubrication when using the dedicated LM cover, contact THK.

Note 2: When using the dedicated LM cover, the LM block and LM rail need to be machined so that the bellows can be mounted. Be sure to indicate that the dedicated bellows is required when ordering the LM Guide.

●Dedicated Cap C for LM Rail Mounting Holes

If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes is on the same level as the LM rail top face.

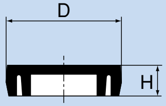
Since the dedicated cap C for LM rail mounting holes uses a special synthetic resin with high oil resistance and high wear resistance, it is highly durable.

When placing an order, specify the desired cap type with the corresponding cap number indicated in table 5.

For the procedure for mounting the cap, see page a-22.

Table 5 Major Dimensions of Dedicated Cap C

Model No.	Cap C model No.	Bolt used	Major dimensions (mm) D	H
NSR 20TBC	C 5	M 5	9.8	2.4
NSR 25TBC	C 6	M 6	11.4	2.7
NSR 30TBC	C 6	M 6	11.4	2.7
NSR 40TBC	C 8	M 8	14.4	3.7
NSR 50TBC	C10	M10	18.0	3.7
NSR 70TBC	C12	M12	20.5	4.7



Dedicated Cap C

Standard Length and Maximum Length of the LM Rail

Table 6 shows the standard lengths and the maximum lengths of model NSR-TBC variations. If the maximum length of the desired LM rail exceeds them, connected rails will be used. Contact THK for details.

For the G dimension when a special length is required, we recommend selecting the corresponding G value from the table. The longer the G dimension is, the less stable the G area may become after installation, thus causing an adverse impact to accuracy.

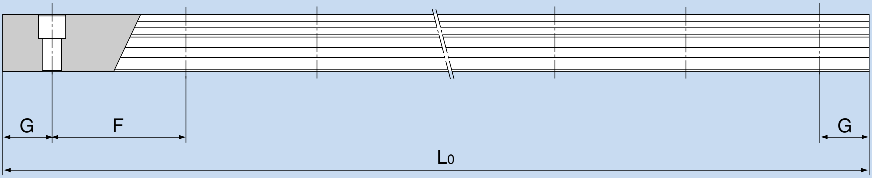
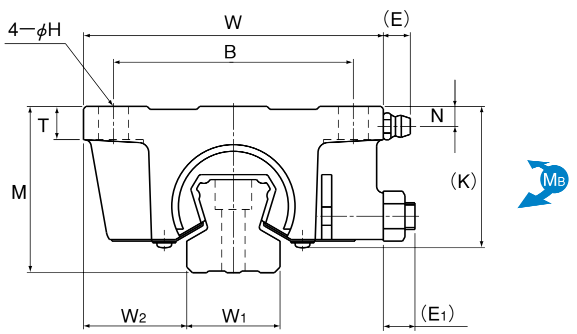


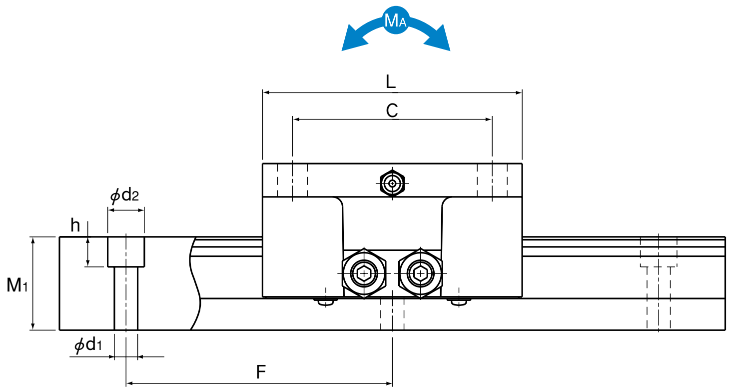
Table 6 Standard Length and Maximum Length of the LM Rail for Model NSR-TBC Unit: mm

Model No.	NSR 20TBC	NSR 25TBC	NSR 30TBC	NSR 40TBC	NSR 50TBC	NSR 70TBC
Standard LM rail length (L_0)	220 280 340 460 640 820 1000 1240 1600	280 440 600 760 1000 1240 1640 2040 2520 3000	280 440 600 760 1000 1240 1640 2040 2520 3000	570 885 1200 1620 2040 2460 2985	780 1020 1260 1500 1980 2580 2940	1270 1570 2020 2620
Standard pitch F	60	80	80	105	120	150
G	20	20	20	22.5	30	35
Max length	2200	3000	3000	3000	3000	3000

Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contact THK.

Model NSR-TBC





Unit: mm

Model No.	External dimensions												LM rail dimensions					Basic load rating		Static permissible moment kN-m*		Mass	
	Height M	Width W	Length L	B	C	H	T	K	N	E	E₁	Grease nipple	Width W₁ ±0.05	W₂	Height M₁	Pitch F	d₁×d₂×h	C kN	C₀ kN	MA 2 blocks in close contact	MB 2 blocks in close contact	LM block kg	LM rail kg/m
NSR 20TBC	40	70	67	55	50	6.6	8	34.5	5.5	8.5	7	A-M6F	23	23.5	23	60	6×9.5×8.5	9.41	18.6	0.31	0.27	0.62	3.1
NSR 25TBC	50	90	78	72	60	9	10	43.5	6	8.5	7.5	A-M6F	28	31	28	80	7×11×9	14.9	26.7	0.53	0.46	1.13	4.7
NSR 30TBC	60	100	90	82	72	9	12	51	8	8.5	9.5	A-M6F	34	33	34.5	80	7×11×9	22.5	38.3	0.85	0.74	1.8	7.2
NSR 40TBC	75	120	110	100	80	11	13	64	10	8.5	12	A-M6F	45	37.5	44.5	105	9×14×12	37.1	62.2	1.7	1.5	3.5	12.2
NSR 50TBC	82	140	123	116	95	14	15	74	9	15	15	A-PT1/8	48	46	47.5	120	11×17.5×14	55.1	87.4	2.7	2.4	5.2	14.3
NSR 70TBC	105	175	150	150	110	14	18	95.5	10	15	16.5	A-PT1/8	63	56	62	150	14×20×17	90.8	152	9.8	4.9	9.4	27.6

Note Static permissible moment*: 2 blocks: static permissible moment value with 2 blocks closely contacting with each other

Model number coding

NSR50TBC 2 UU C1 +1200 P- Ⅱ
1 2 3 4 5 6 7

1 Model number 2 No. of LM blocks used on the same rail
3 Dust prevention accessory symbol (see page a-493) 4 Radial clearance symbol (see page a-35)
5 LM rail length (in mm) 6 Accuracy symbol (see page a-38)
7 Symbol for No. of rails used on the same plane

Note This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Standard Length and Maximum Length of the LM Rail P. a-497

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Overall LM Block Length with Options

■Overall LM Block Length (Dimension L) of Model NSR-TBC with a Dust Prevention Accessory Attached

Unit: mm

Model No.	UU	SS
NSR 20TBC	67	—
NSR 25TBC	78	—
NSR 30TBC	90	—
NSR 40TBC	110	110
NSR 50TBC	123	123
NSR 70TBC	150	150

Note: "—" indicates not available.

1. Preload of the Ball Spline

A preload on the Ball Spline significantly affects its accuracy, load resistance and rigidity. Therefore, it is necessary to select the most appropriate clearance according to the intended use.

Specific clearance values are standardized for each model, allowing you to select a clearance that meets the service conditions.

1.1. Clearance in the Rotational Direction

With the Ball Spline, the sum of clearances in the circumferential direction is standardized as the clearance in the rotational direction. For models LBS and LT, which are especially suitable for transmission of rotational torque, clearances in the rotational directions are defined.

Clearance in the rotational direction (BCD)

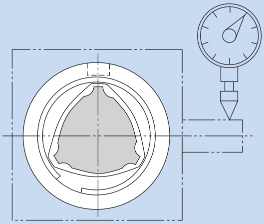


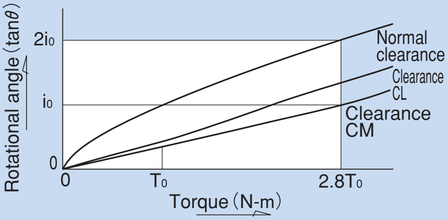
Fig. 1 Measurement of Clearance in the Rotational Direction

1.2. Preload and Rigidity

Preload is defined as the load preliminarily applied to the ball in order to eliminate angular backlash (clearance in the rotational direction) and increase rigidity.

When given a preload, the Ball Spline is capable of increasing its rigidity by eliminating the angular backlash according to the magnitude of the preload. Fig. 2 shows the displacement in the rotational direction when a rotational torque is applied.

Thus, the effect of a preload can be obtained up to 2.8 times of the applied preload. When given the same rotational torque, the displacement when a preload is applied is 0.5 or less of that without a preload. The rigidity with a preload is at least twice greater than that without a preload.



T_0 : Applied preload

Fig. 2

1.3. Service Conditions and Selection of a Preload

Table 1 provides guidelines for selecting a clearance in the rotational direction with given service conditions of the Ball Spline.

The rotational clearance of the Ball Spline significantly affects the accuracy and rigidity of the spline nut.

Therefore, it is essential to select a correct clearance according to the intended use. Generally, the Ball Spline is preloaded during operation. When it is used in repeated circular motion or reciprocating linear motion, the Ball Spline is subject to a large vibration impact, and therefore, its service life and accuracy are significantly increased with a preload.

Table 1 Guidelines for Selecting a Clearance in the Rotational Direction for the Ball Spline

		Service conditions	Example of application
Clearance in rotational direction	CM	●High rigidity is required and vibration impact is present. ●Receives a moment load with a single spline nut.	Steering shaft of construction vehicle; shaft of spot-welding machine; indexing shaft of automatic lathe tool rest
	CL	●An overhang load or moment is present. ●High positioning accuracy is required. ●Alternating load is applied.	Industrial robot arm; automatic loaders; guide shaft of automatic coating machine; main shaft of electric discharge machine; guide shaft for press die setting; main shaft of drilling machine
	Normal	●Smooth motion with a small force is desired. ●A torque is always applied in the same direction.	Measuring instruments; automatic drafting machine; geometrical measuring equipment; dynamometer; wire winder; automatic welding machine; main shaft of horning machine; automatic packing machine

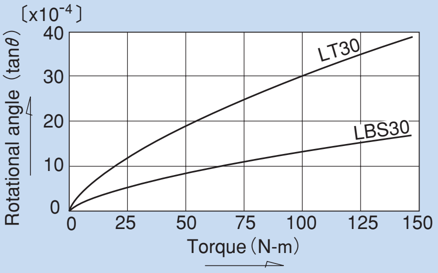


Fig. 3 Comparison between LBS and LT for Zero Clearance

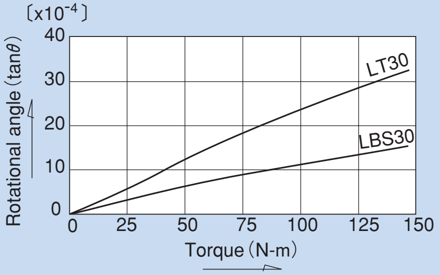


Fig. 4 Comparison between LBS and LT for Clearance CL

Table 2 Clearance in the Rotational Direction for Models LBS, LBF, LBST, LBR and LBH

Unit: μm

Symbol Nominal shaft diameter	Normal	Light preload	Medium preload
	No symbol	CL	CM
6 8	– 2 to +1	– 6 to – 2	
10 15	– 3 to +2	– 9 to – 3	–15 to – 9
20 25 30	– 4 to +2	–12 to – 4	–20 to –12
40 50 60	– 6 to +3	–18 to – 6	–30 to –18
70 85	– 8 to +4	–24 to – 8	–40 to –24
100 120	–10 to +5	–30 to –10	–50 to –30
150	–15 to +7	–40 to –15	–70 to –40

Table 3 Clearance in the Rotational Direction for Models LT and LF

Unit: μm

Symbol Nominal shaft diameter	Normal	Light preload	Medium preload
	No symbol	CL	CM
4 5 6 8 10 13	– 2 to +1	– 6 to – 2	
16 20	– 2 to +1	– 6 to – 2	– 9 to – 5
25 30	– 3 to +2	–10 to – 4	–14 to – 8
40 50	– 4 to +2	–16 to – 8	–22 to –14
60 80	– 5 to +2	–22 to –12	–30 to –20
100	– 6 to +3	–26 to –14	–36 to –24

Table 4 Clearance in the Rotational Direction for Models LBG and LBGT

Unit: μm

Symbol Nominal shaft diameter	Normal	Light preload	Medium preload
	No symbol	CL	CM
20 25 30	– 4 to +2	–12 to – 4	–20 to –12
40 50 60	– 6 to +3	–18 to – 6	–30 to –18
70 85	– 8 to +4	–24 to – 8	–40 to –24

Table 5 Clearance in the Rotational Direction for Model LTR

Unit: μm

Symbol Nominal shaft diameter	Normal	Light preload	Medium preload
	No symbol	CL	CM
8 10	– 2 to +1	– 6 to – 2	
16 20	– 2 to +1	– 6 to – 2	– 9 to – 5
25 32	– 3 to +2	–10 to – 4	–14 to – 8
40 50	– 4 to +2	–16 to – 8	–22 to –14
60	– 5 to +2	–22 to –12	–30 to –20

2. Accuracy of the Ball Spline

2.1. Accuracy Grades

The accuracy of the Ball Spline is classified into three grades: normal grade (no symbol), high grade (H) and precision grade (P), according to the run-out of spline nut circumference in relation to the support of the spline shaft. Fig. 1 shows measurement items.

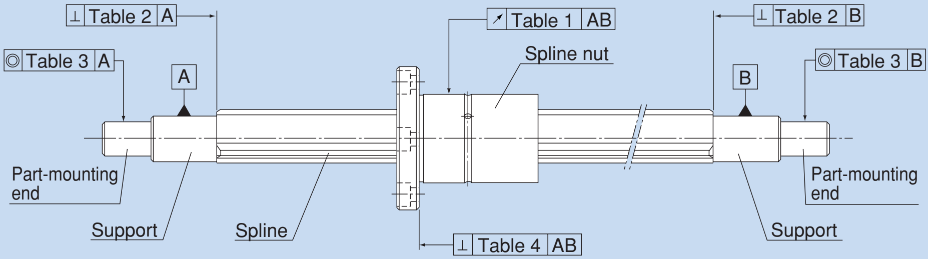


Fig. 1 Accuracy Measurement Items of the Ball Spline

2.2. Accuracy Standards

Tables 1 to 4 show measurement items of the Ball Spline.

Table 1 Run-out of the Spline Nut Circumference in Relation to the Support of the Spline Shaft

Unit: μm

Accuracy Nominal shaft diameter Overall spline shaft length (mm)		Run-out (max)																							
		4 to 8 (note)			10			13 to 20			25 to 32			40, 50			60 to 80			85 to 120			150		
Above	Or less	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision	Normal	High	Precision
–	200	72	46	26	59	36	20	56	34	18	53	32	18	53	32	16	51	30	16	51	30	16	–	–	–
200	315	133	(89)	–	83	54	32	71	45	25	58	39	21	58	36	19	55	34	17	53	32	17	–	–	–
315	400	–	–	–	103	68	–	83	53	31	70	44	25	63	39	21	58	36	19	55	34	17	–	–	–
400	500	–	–	–	123	–	–	95	62	38	78	50	29	68	43	24	61	38	21	57	35	19	46	36	19
500	630	–	–	–	–	–	–	112	–	–	88	57	34	74	47	27	65	41	23	60	37	20	49	39	21
630	800	–	–	–	–	–	–	–	–	–	103	68	42	84	54	32	71	45	26	64	40	22	53	43	24
800	1000	–	–	–	–	–	–	–	–	–	124	83	–	97	63	38	79	51	30	69	43	24	58	48	27
1000	1250	–	–	–	–	–	–	–	–	–	–	–	–	114	76	47	90	59	35	76	48	28	63	55	32
1250	1600	–	–	–	–	–	–	–	–	–	–	–	–	139	93	–	106	70	43	86	55	33	80	65	40
1600	2000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	128	86	54	99	65	40	100	80	50
2000	2500	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	156	–	–	117	78	49	125	100	68
2500	3000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	143	96	61	150	129	84

Note: Dimensions in parentheses do not apply to nominal shaft diameter of 4.
Note: Applicable to models LBS, LBST, LBF, LBR, LT and LF.

Table 2 Perpendicularity of the Spline Shaft End Face in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Perpendicularity (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4 5 6 8 10	22	9	6
13 15 16 20	27	11	8
25 30 32	33	13	9
40 50	39	16	11
60 70 80	46	19	13
85 100 120	54	22	15
150	63	25	18

Table 3 Concentricity of the Part-mounting in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Concentricity (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4 5 6 8	33	14	8
10	41	17	10
13 15 16 20	46	19	12
25 30 32	53	22	13
40 50	62	25	15
60 70 80	73	29	17
85 100 120	86	34	20
150	100	40	23

Table 4 Straightness of the Flange-mounting Surface of the Spline Nut in Relation to the Support of the Spline Shaft Unit: μm

Accuracy / Nominal shaft diameter	Straightness (max)		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
6 8	27	11	8
10 13	33	13	9
15 16 20 25 30	39	16	11
40 50	46	19	13
60 70 80 85	54	22	15
100	63	25	18

Note: This table does not apply to models LBG, LBGT, LTR and LTR-A.

2.3. Maximum Manufacturing Length by Accuracy

Tables 5 and 6 show the maximum manufacturing lengths of ball spline shafts by accuracy.

Table 5 Maximum Manufacturing Length of Models LBS, LBST, LBF, LBR, LBH, LBG and LBGT by Accuracy Unit: mm

Nominal shaft diameter	Accuracy		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
6	200	150	100
8	300	200	150
10	500	400	300
15	1800	600	600
20	2500	700	700
25	3000	1400	1400
30	4200	1400	1400
40	4200	1400	1400
50	4200	1400	1400
60	3000	2500	2000
70	3000	2500	2000
85	3000	3000	3000
100	3000	3000	3000
120	3000	3000	3000
150	3000	3000	3000

Table 6 Maximum Manufacturing Length of Models LT, LF, LTR and LTR-A by Accuracy Unit: mm

Nominal shaft diameter	Accuracy		
	Normal grade (no symbol)	High grade (H)	Precision grade (P)
4	200	150	100
5	250	200	100
6	600	600	600
8	1000	1000	1000
10	1000	1000	1000
13	1000	1000	1000
16	1500	1500	1500
20	2000	2000	2000
25	3000	3000	3000
30	3000	3000	3000
40	3000	3000	3000
50	3000	3000	3000
60	3000	3000	2500
80	3000	3000	2500
100	3000	3000	3000

3. Lubrication

To prevent foreign matter from entering the spline nut and the lubricant from leaking, special synthetic resin seals with high wear resistance are available for the Ball Spline.

Spline nuts with seals (seal for both ends type UU, and seal for one end) contain high-quality lithium-soap group grease No. 2. However, if using them at high speed or with a long stroke, replenish grease of the same type through the greasing hole on the spline nut after running in.

Afterward, replenish grease of the same type as necessary according to the status of use.

The greasing interval differs depending on the service conditions. Normally, replenish the lubricant (or replace the product) roughly every 100 km of travel distance (six months to one year) as a rule of thumb.

For a Ball Spline model type without a seal, apply grease to the interior of the spline nut or to the raceways of the spline shaft.

4. Dust Prevention

Entrance of dust or other foreign matter into the spline nut will cause abnormal wear or shorten the service life. Therefore, it is necessary to prevent detrimental foreign matter from entering the Ball Spline. When entrance of dust or other foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions.

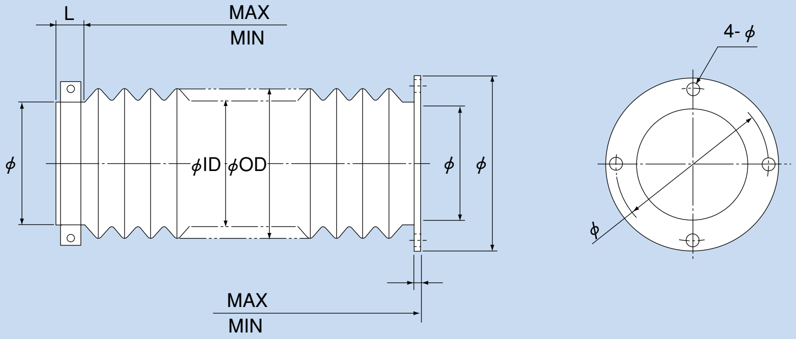
For the Ball Spline, a special synthetic rubber seal that is highly resistant to wear is available as a dust prevention accessory. If desiring a higher dust prevention effect, a felt seal is also available for some types.

In addition, THK produces round bellows. Contact us for details.

5. Material and Surface Treatment

Depending on the service environment, the Ball Spline requires anticorrosive treatment or a different material. For details of anticorrosive treatment and material change, contact THK .

6. Specifications of the Bellows



(Band type) (Flange type)

Dimensions of the Bellows

Stroke mm MAX. mm MIN. mm

Permissible outer diameter ϕOD or less Desired inner diameter ϕID or less

How It Is Used

Orientation (horizontal, vertical, slant) Speed ( ) mm/sec. min.

Motion (reciprocation, vibration)

Service Conditions

Oil/water resistance (necessary, unnecessary) Oil name

Chemical resistance Name × %

Location (indoor, outdoor)

Remarks

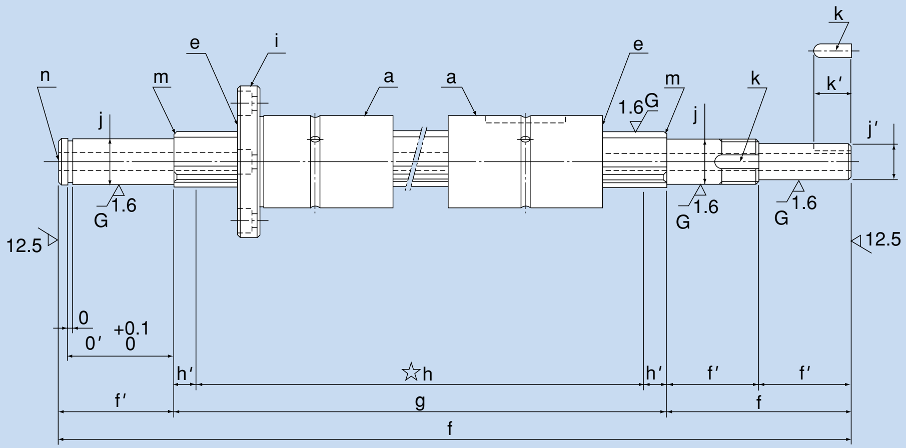
Number of Units To Be Manufactured

* Please use a duplicate copy.

7. Check Manual for the Shape of the Spline Shaft End

If desiring a ball spline type with its end specially machined, check the following items when placing an order.

The diagram below shows a basic configuration of the Ball Spline.



●Check Items

a) Type of the spline nut to be fit

b) Number of spline nuts

c) Clearance in the rotational direction

d) Accuracy

e) With/without a seal (for a single seal, check its orientation)

f) Overall length (including all dimensions? Total value correct?)

g) Effective spline length

h) Hardened area (mark the location with symbol ☆, and indicate the purpose of hardening)

i) Orientation of the flange (for flanged type)

j) Shape of the spline shaft end (thicker than the minimum spline diameter?) (black, mill scale)

k) Positional relationship between the spline nut and the spline shaft end (keyway of the spline nut, flange mounting hole)

l) Indication of chamfering for each part

m) Shape of chamfer on the spline shaft end (see page b-24)

n) Intended purpose of the though hole in the spline shaft if any

o), o') Groove for snap ring

p) Maximum manufacturing length

q) Precedented or not

8. Assembling the Ball Spline

8.1. Housing Inner-diameter Tolerance

When fitting the spline nut with the housing, tight fitting is normally recommended. If the accuracy of the Ball Spline does not need to be very high, clearance fitting is also acceptable.

Table 1 Housing Inner-diameter Tolerance

Housing inner-diameter tolerance	General service conditions	H7
	When clearance needs to be small	J6

Note: For the housing inner-diameter tolerance of Rotary Ball Spline model LTR, H7 is recommended.

8.2. Mounting the Spline

Figures 1 and 2 show examples of mounting the spline nut. Although the Ball Spline does not require a large strength for securing it in the spline shaft direction, do not support the spline only with driving fitting.

Straight nut type

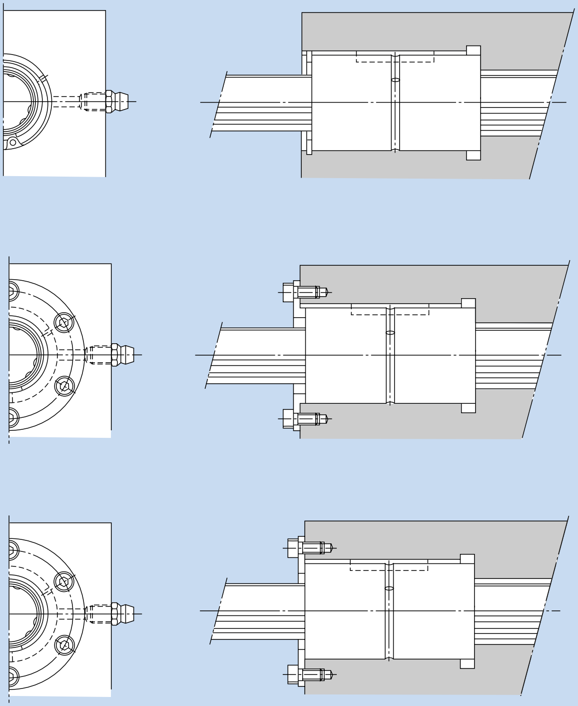
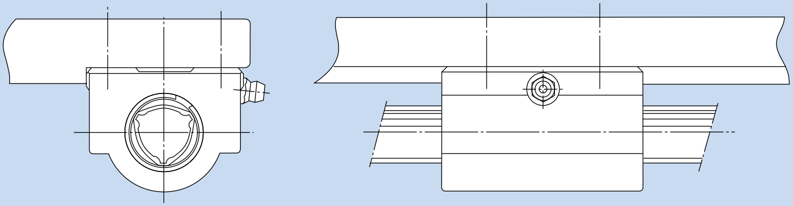
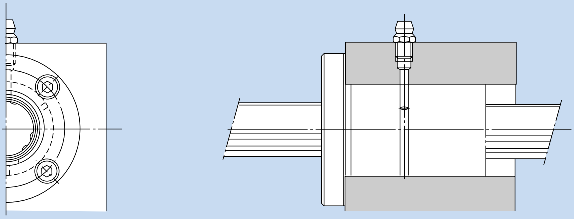


Fig. 1 Exampling of Fitting the Spline Nut

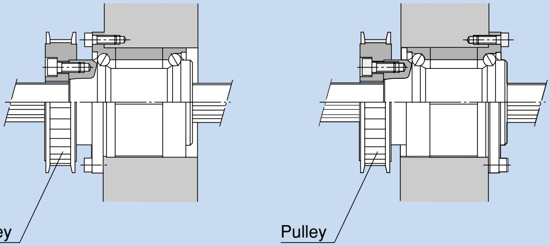
Model LBH



Flanged type



Model LTR



Model LBG

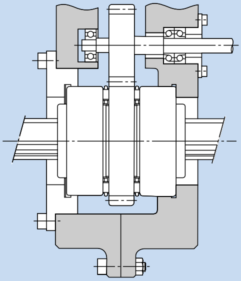


Fig. 2 Examples of Fitting the Spline Nut

8.2.1. Installing the Spline Nut

When installing the spline nut into the housing, do not hit the side plate or the seal, but gently insert it using a jig (Fig. 3).

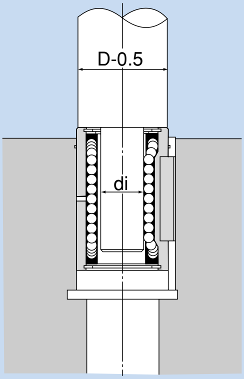


Fig. 3

8.2.2. Installation of the Spline Shaft

When installing the spline shaft into the spline nut, identify the matching marks (Fig. 4) on the spline shaft and the spline nut, and then insert the shaft straightforward while checking their relative positions.

Note that forcibly inserting the shaft may cause balls to fall off.

If the spline nut is attached with a seal or given a preload, apply a lubricant to the outer surface of the spline shaft.

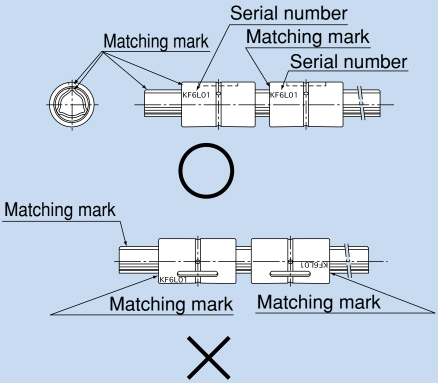


Fig. 4

Table 2 Dimensions of the Jig for Model LBS

Unit: mm

Model No.	15	20	25	30	40	50	60	70	85	100	120	150
di	12.5	16.1	20.3	24.4	32.4	40.1	47.8	55.9	69.3	83.8	103.8	131.8

Table 3 Dimensions of the Jig for Model LT

Unit: mm

Model No.	6	8	10	13	16	20	25	30	40	50	60	80	100
di	5.0	7	8.5	11.5	14.5	18.5	23	28	37.5	46.5	56	75.5	94.5

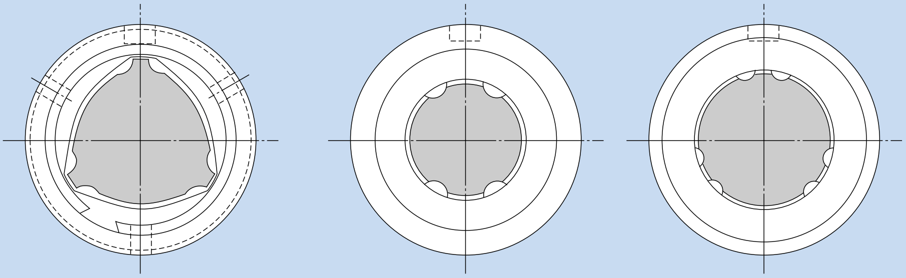
8.3. Precautions on Use

8.3.1. Positions of the Keyways and the Mounting Holes of the Spline Nut

The keyways formed on the outer surface of straight nuts for Ball Spline models are positioned where balls under a load are placed as shown in Fig. 5.

The flange-mounting holes of the flange types are positioned as shown in Fig. 6.

When placing an order, indicate their positions in relation to the keyway or the like to be formed on the spline shaft.



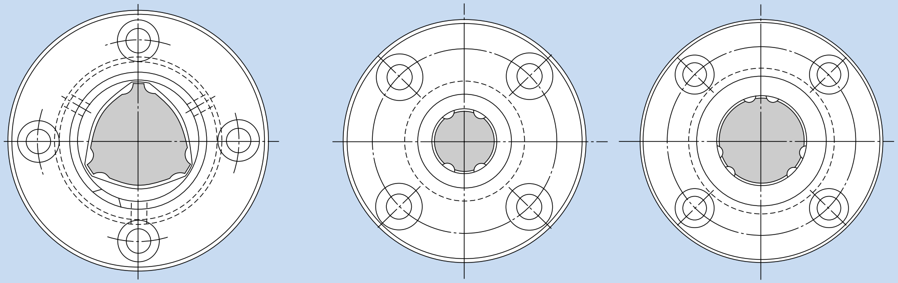
Model LT13 or smaller

Model LT16 or greater

Model LBS

Model LT

Fig. 5 Positions of Keyways



Model LF13 or smaller

Model LF16 or greater

Model LBF

Model LF

Fig. 6 Positions of Flange Mounting Holes

9. Precautions on Using the Ball Spline

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting a spline nut or spline shaft may cause them to fall by their self-weights.
(3) Dropping or hitting the Ball Spline may damage it. Giving an impact to the Ball Spline could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, the lubricant may not be distributed throughout the product depending on the mounting orientation of the system. Contact THK for details.
(6) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(3) When planning to use the product in an environment where the coolant penetrates the spline nut, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.
(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Ball Spline, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

High Torque Type Ball Spline

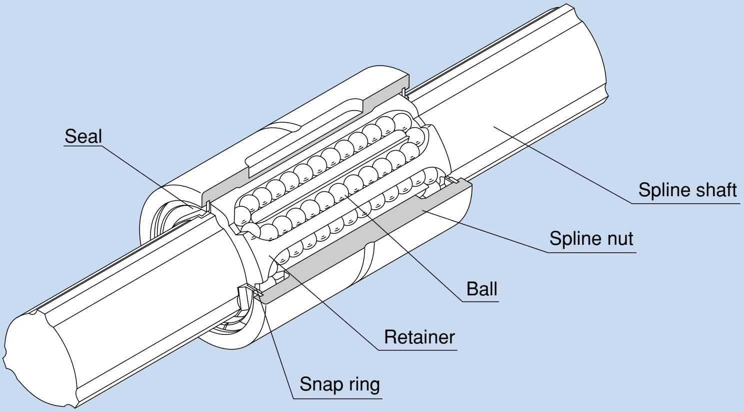


Fig. 1 Structure of High Torque Type Ball Spline Model LBS

Structure and Features

With the high torque type Ball Spline, the spline shaft has three crests positioned equidistantly at 120°, and along both sides of each crest, two rows of balls (six rows in total) are arranged so as to hold the crest, as shown in Fig. 1.

The raceways are precision ground into R-shaped grooves whose diameters are approximate to the ball diameter. When a torque is generated from the spline shaft or the spline nut, the three rows of balls on the load-bearing side evenly receive the torque, and the center of rotation is automatically determined. When the rotation reverses, the remaining three rows of balls on the unloaded side receive the torque.

The rows of balls are held in a retainer incorporated in the spline nut so that they smoothly roll and circulate. With this design, balls will not fall even if the spline shaft is removed from the nut.

●No Angular Backlash

With the high torque type Ball Spline, a single spline nut provides a preload to eliminate angular backlash and increase the rigidity.

Unlike conventional ball splines with circular-arc groove or Gothic-arch groove, the high torque type Ball Spline eliminates the need for twisting two spline nuts to provide a preload, thus allowing compact design to be achieved easily.

●High Rigidity and Accurate Positioning

Since this model has a large contact angle and provides a preload from a single spline nut, the initial displacement is minimal and high rigidity and high positioning accuracy are achieved.

●High-speed motion, high-speed rotation

Adoption of a structure with high grease retention and a rigid retainer enables the ball spline to operate over a long period with grease lubrication even in high-speed linear motion. Since the distance in the radius direction is almost uniform between the loaded balls and the unloaded balls, the balls are little affected by the centrifugal force and smooth linear motion is achieved even during high-speed rotation.

●Compact design

Unlike conventional ball splines, unloaded balls do not circulate on the outer surface of the spline nut with this model. As a result, the outer diameter of the spline nut is reduced and a space-saving and compact design is achieved.

●Easy installation

When installing this model with blind holes or in complex structures, balls will not fall off even if the spline nut is removed from the spline shaft. Thus, it is easy to mount, maintain and inspect this model.

●Can be used as a linear bush for heavy loads

Since the ball raceways are machined into R grooves whose diameter is almost equal to the ball diameter, the contact area of the ball is large and the load capacity is large also in the radial direction.

●Double, parallel shafts can be replaced with a single shaft

Since a single shaft is capable of receiving a load in the torque direction and the radial direction, double shafts in parallel configuration can be replaced with a single-shaft configuration. This allows easy installation and achieves space-saving design.

Applications

The high torque type Ball Spline is a reliable linear motion system used in a wide array of applications such as the columns and arms of industrial robot, automatic loader, transfer machine, automatic conveyance system, tire forming machine, spindle of spot welding machine, guide shaft of high-speed automatic coating machine, riveting machine, wire winder, work head of electric discharge machine, spindle drive shaft of grinding machine, speed gears and precision indexing shaft.

Types and Features

●Types of Spline Nuts

Cylindrical Type Ball Spline Model LBS (Medium Load Type)

The most compact type with a straight cylindrical spline nut. When transmitting a torque, a key is driven into the body. The outer surface of the spline nut is provided with anti-carbonation treatment.

Cylindrical Type Ball Spline Model LBST (Heavy Load Type)

A heavy load type that has the same spline nut diameter as model LBS, but has a longer spline nut length. It is optimal for locations where the space is small, a large torque is applied, and an overhang load or moment load is applied.

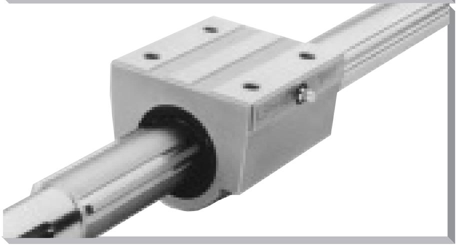
Flanged Type Ball Spline Model LBF

The spline nut can be attached to the housing via the flange, making assembly simple. It is optimal for locations where the housing may be deformed if a keyway is machined on its surface, and where the housing width is small. Since it allows a knock pin to be driven into the flange, angular backlash occurring in the fitting can completely be eliminated.

Flanged Type Ball Spline Model LBR

Based on the heavy load type model LBST, this model has a flange in the central area, making itself optimal for locations under a moment load such as arms of industrial robots.

Square Type Ball Spline Model LBH



Its rigid square spline nut does not require a housing and can be directly mounted on the machine body. Thus, a compact, highly rigid linear guide system is achieved.

●Types of Spline Shafts

Precision Solid Spline Shaft (Standard Type)

The spline shaft is cold-drawn and its raceway is precision ground. It is used in combination with a spline nut.

Special Spine Shaft

THK manufactures a spline shaft with thicker ends or thicker middle area through special processing at your request.

Hollow Spline Shaft (Type K)

A drawn, hollow spline shaft is available for requirements such as piping, wiring, air-vent and weight reduction.

Housing Inner-diameter Tolerance

When fitting the spline nut with the housing, tight fitting is normally recommended. If the accuracy of the Ball Spline does not need to be very high, clearance fitting is also acceptable.

Table 1 Housing Inner-diameter Tolerance

Housing inner-diameter tolerance	General service conditions	H7
	When clearance needs to be small	J6

Spline Shaft

Spline shafts are divided in shape into precision solid spline shaft, special spline shaft and hollow spline shaft (type K), as described on page b-21.

Since production of a spline shaft with a specific shape is performed at your request, provide a drawing of the desired shaft shape when asking an estimate or placing an order.

●Sectional Shape of the Spline Shaft

Table 2 shows the sectional shape of a spline shaft. If the spline shaft ends need to be cylindrical, the minor diameter (d) value should not be exceeded if possible.

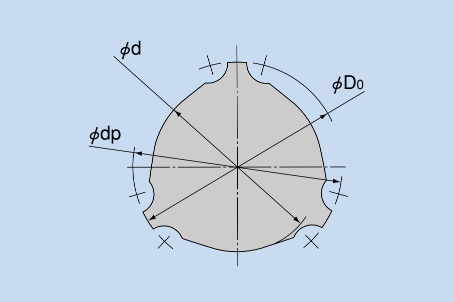


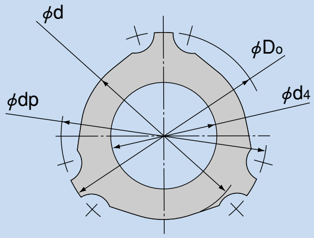
Table 2 Sectional Shape of the Spline Shaft

Unit: mm

Nominal shaft diameter	15	20	25	30	40	50	60	70	85	100	120	150
Minor diameter d	11.7	15.3	19.5	22.5	31	39	46.5	54.5	67	81	101	130
Major diameter D_0	14.5	19.7	24.5	29.6	39.8	49.5	60	70	84	99	117	147
Ball center diameter dp	15	20	25	30	40	50	60	70	85	100	120	150
Mass (kg/m)	1	1.8	2.7	3.8	6.8	10.6	15.6	21.3	32	45	69.5	116.6

●Hole Shape of the Standard Hollow Type Spline Shaft

Table 3 shows the hole shape of the standard hollow type spline shaft. Use this table when a requirement such as piping, wiring, air-vent or weight reduction needs to be met.



Type K

Table 3 Sectional Shape of the Standard Hollow Type Spline Shaft

Unit: mm

Nominal shaft diameter	20	25	30	40	50	60	70	85	100	120	150
Minor diameter d	15.3	19.5	22.5	31	39	46.5	54.5	67	81	101	130
Major diameter D$_0$	19.7	24.5	29.6	39.8	49.5	60	70	84	99	117	147
Ball center diameter dp	20	25	30	40	50	60	70	85	100	120	150
Hole diameter d$_4$	6	8	12	18	24	30	35	45	56	60	80
Mass (kg/m)	1.6	2.3	2.9	4.9	7	10	13.7	19.5	25.7	47.3	77.1

●Chamfering of the Spline Shaft Ends

To facilitate the insertion of the spline shaft into a spline nut, the shaft ends are normally chamfered with dimensions as indicated below unless otherwise specified.

■Chamfer A

If the spline shaft ends are stepped, tapped or drilled for specific use, they are machined with chamfer A dimensions indicated in table 4.

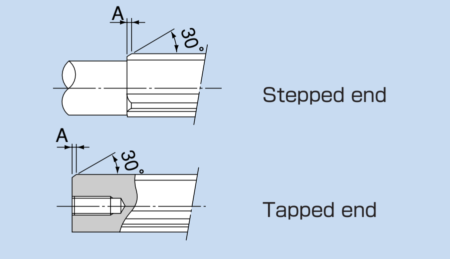


Fig. 2 Chamfer A

■Chamfer B

If either end of the spline shaft is not used, such as cantilever support, it is machined with chamfer B dimensions indicated in table 4.

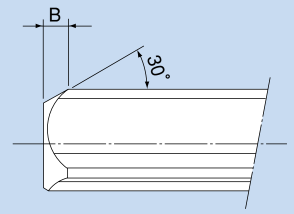


Fig. 3 Chamfer B

Table 4 Chamfer Dimensions of Spline Shaft Ends

Unit: mm

Nominal shaft diameter	15	20	25	30	40	50	60	70	85	100	120	150
Chamfer A	1	1	1.5	2.5	3	3.5	5	6.5	7	7	7.5	8
Chamfer B	3.5	4.5	5.5	7	8.5	10	13	15	16	17	17	18

Note: Spline shafts with nominal diameters 6, 8 and 10 are chamfered to C0.5.

●Length of Incomplete Section of a Special Spline Shaft

If the middle area or the end of a spline shaft is to be thicker than the minor diameter (d), an incomplete spline section is required to secure a recess for grinding. Table 5 shows the relationship between the length of the incomplete section (S) and the flange diameter (df). (This table does not apply to overall length of 1500 mm or greater. Contact THK for details.)

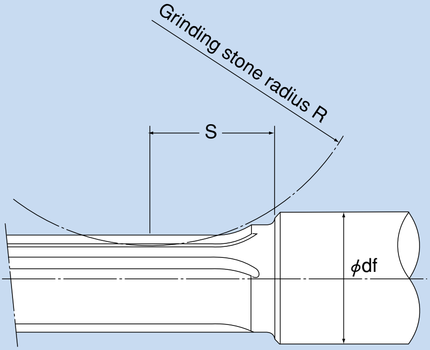


Table 5 Length of Incomplete Spline Section: S

Unit: mm

Flange diameter df / Nominal shaft diameter	15	20	25	30	35	40	50	60	80	100	120	140	160	180	200
15	23	35	42	47	52	—	—	—	—	—	—	—	—	—	—
20	—	25	36	43	48	53	—	—	—	—	—	—	—	—	—
25	—	—	32	46	55	62	73	—	—	—	—	—	—	—	—
30	—	—	—	35	48	56	69	78	—	—	—	—	—	—	—
40	—	—	—	—	—	38	59	71	88	—	—	—	—	—	—
50	—	—	—	—	—	—	42	61	82	96	—	—	—	—	—
60	—	—	—	—	—	—	—	45	74	91	102	—	—	—	—
70	—	—	—	—	—	—	—	—	64	85	98	108	—	—	—
85	—	—	—	—	—	—	—	—	34	72	90	102	—	—	—
100	—	—	—	—	—	—	—	—	—	70	110	134	153	—	—
120	—	—	—	—	—	—	—	—	—	—	72	112	137	155	—
150	—	—	—	—	—	—	—	—	—	—	—	42	103	133	153

Accessory

Ball Spline models LBS and LBST are provided with a standard key as indicated in table 6.

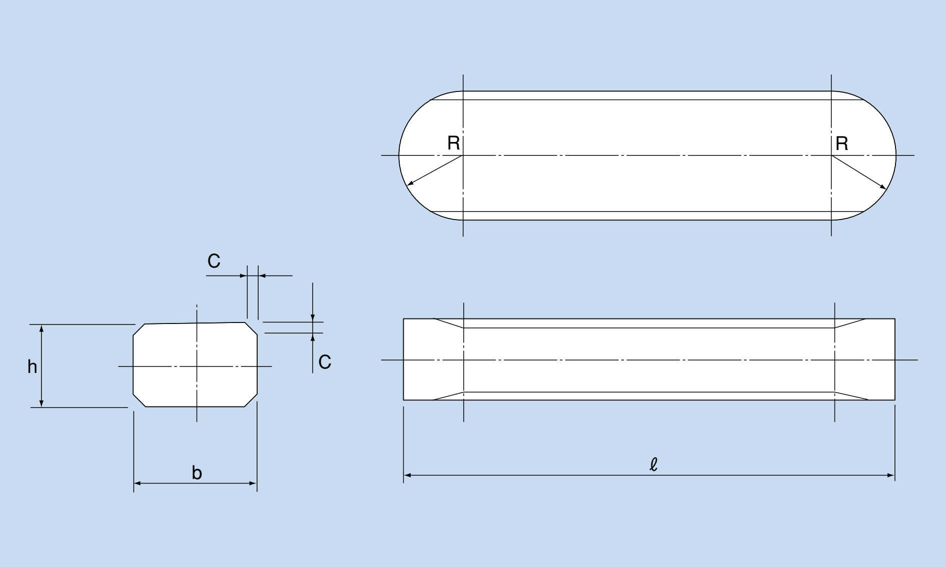


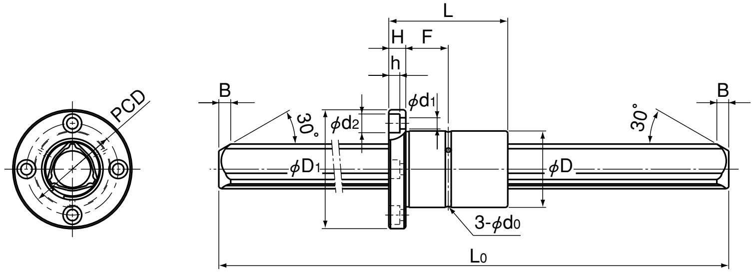
Table 6 Standard Keys for Models LBS and LBST

Unit: mm

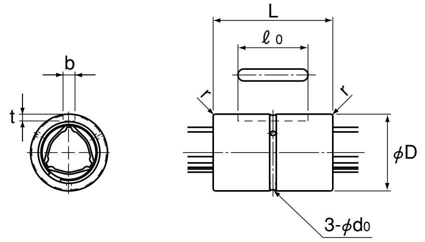
Nominal shaft diameter	Width b		Height h		Length ℓ		R	C
		Tolerance (p7)		Tolerance (h9)		Tolerance (h12)		
LBS 6	2	+0.016 +0.006	1.3	0 –0.025	10	0 –0.150	1	0.3
LBS 8	2.5		2		12.5	0 –0.180	1.25	
LBS 10	3		2.5		17		1.5	
LBS 15	3.5	+0.024 +0.012	3.5	0 –0.030	20	0 –0.210	1.75	0.5
LBS 20 LBST 20	4		4		26		2	
LBS 25 LBST 25	5		5		33	0 –0.250	2.5	
LBS 30 LBST 30	7	+0.030 +0.015	7	0 –0.036	41		3.5	
LBS 40 LBST 40	10		8		55	0 –0.300	5	0.8
LBS 50 LBST 50	15	+0.036 +0.018	10		60		7.5	
LBST 60 LBS 70 LBST 70	18		12	0 –0.043	68		9	1.2
LBS 85 LBST 85	20	+0.043 +0.022	13		80		10	
LBS 100 LBST 100	28		18		93	0 –0.350	14	
LBST 120	28		18		123	0 –0.400	14	
LBST 150	32	+0.051 +0.026	20	0 –0.052	157		16	2

Standard Off-the-shelf Ball Spline Models LBS / LBF

Full spline



Model LBF



Model LBS

Unit: mm

Model No.	Spline nut dimensions															Spline shaft dimensions		Basic torque rating		Basic load rating (radial)	
	Outer diameter		Length		Flange diameter					Mounting hole	Keyway dimensions			Greasing hole							
	D	Tolerance	L	Tolerance	D_1	Tolerance	H	F	PCD	$d_1 \times d_2 \times h$	b H8	t +0.05 0	ℓ_0	d_0	r	Length* L_0	Chamfer B	C_T* N·m	C_{0T}* N·m	C* kN	C_0* kN
LBS 15	23	0 –0.013	40	0 –0.2	—	0 –0.2	—	—	—	—	3.5	2	20	2	0.5	1600	3.5	30.4	74.5	4.4	8.4
LBF 15					43		7	13	32	4.5×8×4.4	—	—	—		—						
LBS 20	30	0 –0.016	50		—		—	—	—	—	4	2.5	26		0.5	1800	4.5	74.5	160	7.8	14.9
LBF 20					49		7	18	38	4.5×8×4.4	—	—	—		—						
LBS 25	37		60	0 –0.3	—		—	—	—	—	5	3	33		0.5	2500	5.5	154	307	13	23.5
LBF 25					60		9	21	47	5.5×9.5×5.4	—	—	—		—						
LBS 30	45		70		—		—	—	—	—	7	4	41	3	1		7	273	538	19.3	33.8
LBF 30					70		10	25	54	6.6×11×6.5	—	—	—		—						
LBS 40	60	0 –0.019	90		—		—	—	—	—	10	4.5	55		1		8.5	599	1140	31.9	53.4
LBF 40	57				90		14	31	70	9×14×8.6	—	—	—		—						
LBS 50	75		100		—	0 –0.3	—	—	—	—	15	5	60	4	1.5	3000	10	1100	1940	46.6	73
LBF 50	70				108		16	34	86	11×17.5×11	—	—	—		—						

These standard off-the-shelf models are shipped in short delivery time.
You can also specify the number of spline nuts.

***Note** The values for the basic torque rating and basic load rating apply to single-nut configurations.
The clearance in the rotational direction is assumed to be normal clearance, and the accuracy to be normal grade.
If a greater length than the standard length is required, contact THK.

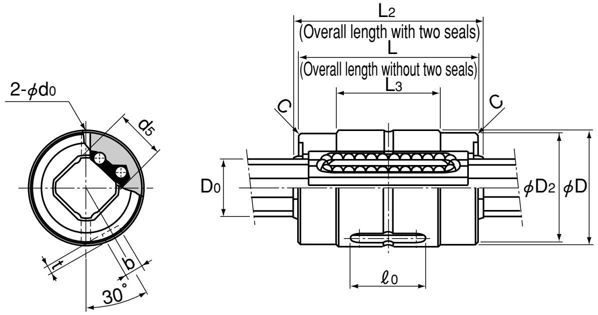
Model number coding

4 LBS20 UU +1800L

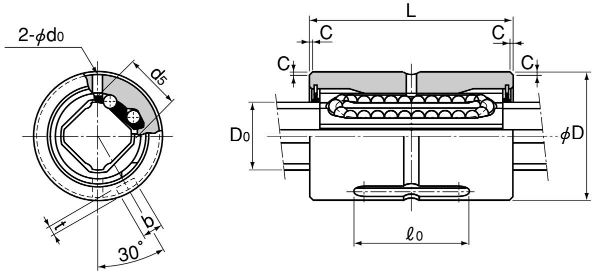
1 2 3 4

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - UU: rubber seal attached on both ends of spline nut
4 Overall spline shaft length (in mm)

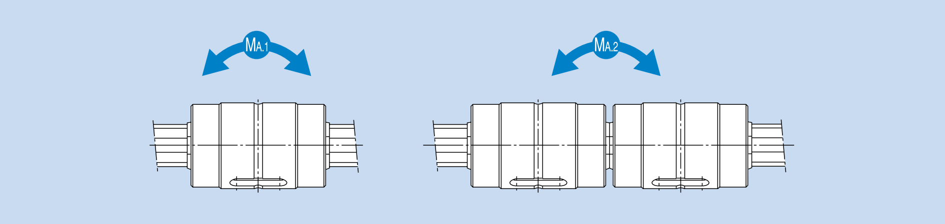
Miniature Ball Spline



Models LBS6 and 8



Model LBS10



Unit: mm

Model No.	Spline nut dimensions												Spline shaft outer diameter		Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length					Keyway dimensions				Greasing hole										
	D	Tolerance	L	Tolerance	L_2	L_3	D_2	b H8	t $^{+0.05}_{0}$	ℓ_0	C	d_0	D_0	d_5	C_T N·m	C_{0T} N·m	C N	C_0 N	M_{A1}* N·m	M_{A2}* N·m	Spline nut g	Spline shaft kg/m
LBS 6	12	0 −0.011	20	0 −0.2	20.8	11	11.5	2	0.8	10	0.3	1.2	6	5.3	1.53	2.41	637	785	2.2	19.4	6.6	0.22
LBS 8	16		25		26.4	14.5	15.5	2.5	1.2	12.5	0.3	1.2	8	7.3	4.07	6.16	1180	1420	5.1	39.6	15.4	0.42
LBS 10	19	0 −0.013	30		—	—	—	3	1.5	17	0.3	1.5	10	8.3	7.02	10.4	1620	1960	8.1	67.6	36.7	0.55

Note Models LBS6 and 8 are of end-cap type.
Keep the end caps of models LBS6 and 8 from impact.
THK does not offer a high-temperature type of miniature Ball Spline.

***Note** M_{A1} indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
M_{A2} indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.
(Single spline nut configuration is not stable in accuracy. We recommend using two spline nuts in close contact with each other.)

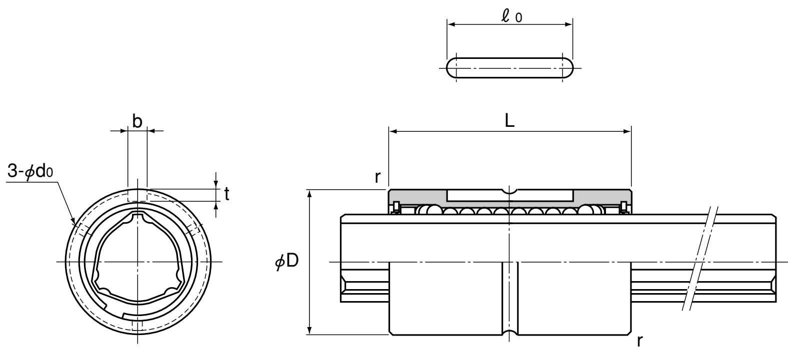
Model number coding

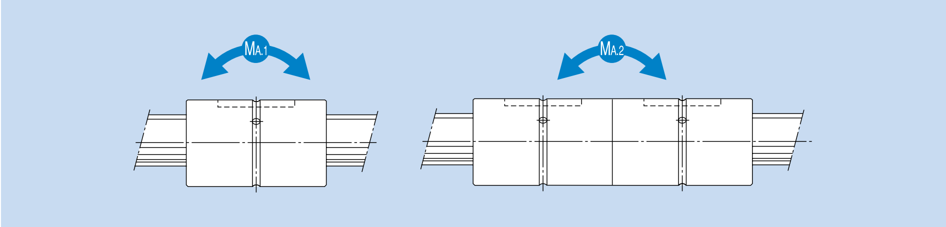
2 LBS6 UU CL +200L H
1 2 3 4 5 6

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)

Model LBS

Medium load type





Unit: mm

Model No.	Spline nut dimensions									Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length		Keyway dimensions				Greasing hole								
	D	Tolerance	L	Tolerance	b H8	t $^{+0.05}_{0}$	ℓ0	r	d_0	C_T N·m	C_{0T} N·m	C kN	C_0 kN	M_{A1}* N·m	M_{A2}* N·m	Spline nut kg	Spline shaft kg/m
LBS 15	23	$^{0}_{-0.013}$	40	$^{0}_{-0.2}$	3.5	2	20	0.5	2	30.4	74.5	4.4	8.4	25.4	185	0.06	1
○ ● LBS 20	30	$^{0}_{-0.016}$	50		4	2.5	26	0.5	2	74.5	160	7.8	14.9	60.2	408	0.14	1.8
○ ● LBS 25	37		60	$^{0}_{-0.3}$	5	3	33	0.5	2	154	307	13	23.5	118	760	0.25	2.7
○ ● LBS 30	45		70		7	4	41	1	3	273	538	19.3	33.8	203	1270	0.44	3.8
○ ● LBS 40	60	$^{0}_{-0.019}$	90		10	4.5	55	1	3	599	1140	31.9	53.4	387	2640	1	6.8
○ ● LBS 50	75		100		15	5	60	1.5	4	1100	1940	46.6	73	594	4050	1.7	10.6
○ ● LBS 70	100	$^{0}_{-0.022}$	110		18	6	68	2	4	2190	3800	66.4	102	895	6530	3.1	21.3
○ ● LBS 85	120		140	$^{0}_{-0.4}$	20	7	80	2.5	5	3620	6360	90.5	141	2000	12600	5.5	32
○ ● LBS 100	140	$^{0}_{-0.025}$	160		28	9	93	3	5	5910	12600	126	237	3460	20600	9.5	45

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).

(Example) LBS20 A CL+500L H

└── High temperature type symbol

● indicates model numbers for which felt seal types are available (see page b-8). A felt seal cannot be attached to Ball Spline models using metal retainer.

***Note** M_{A1} indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

M_{A2} indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

(Single LBS-unit configuration is not stable in accuracy. We recommend using a single LBST unit or two LBS units in close contact with each other.)

Model number coding

2 LBS40 UU CL +1000L P K

1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)

2 Model No.

3 Dust prevention accessory symbol - no symbol: without seal

UU: rubber seal attached on both ends of spline nut

U: rubber seal attached on either end of spline nut

DD: felt seal attached on both ends of spline nut

D: felt seal attached on either end of spline nut

4 Symbol for clearance in the rotational direction (see page b-4)

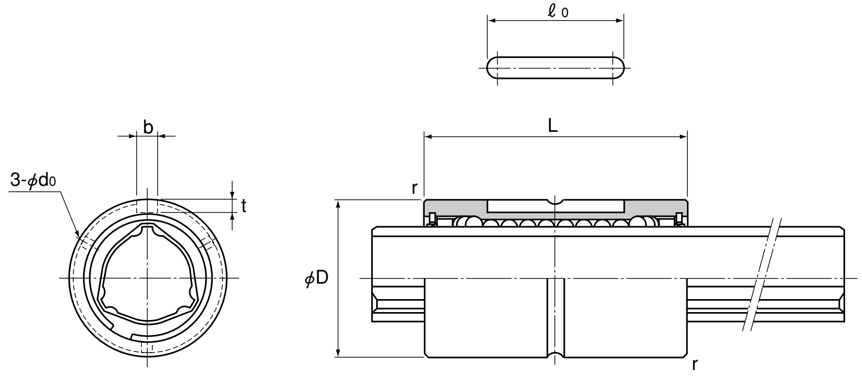
5 Overall spline shaft length (in mm)

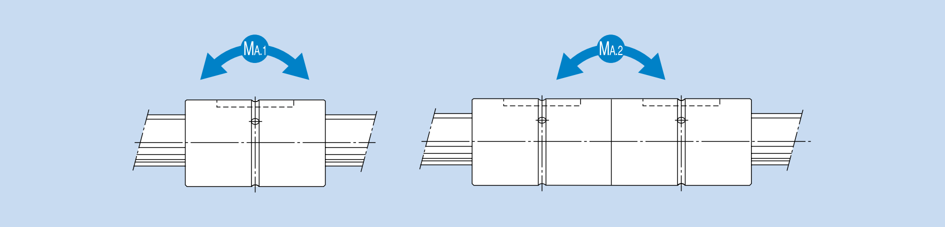
6 Accuracy symbol (see page b-5)

7 Symbol for standard hollow spline shaft (see page b-23) (no symbol: solid spline shaft)

Model LBST

Heavy load type





Unit: mm

Model No.	Spline nut dimensions									Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length		Keyway dimensions				Greasing hole								
	D	Tolerance	L	Tolerance	b H8	t $^{+0.05}_{0}$	ℓ o	r	d_0	C_T N·m	C_{0T} N·m	C kN	C_0 kN	$M_{A.1}$* N·m	$M_{A.2}$* N·m	Spline nut kg	Spline shaft kg/m
○ ● LBST 20	30	$^{0}_{-0.016}$	60	$^{0}_{-0.2}$	4	2.5	26	0.5	2	90.2	213	9.4	20.1	103	632	0.17	1.8
○ ● LBST 25	37		70	$^{0}_{-0.3}$	5	3	33	0.5	2	176	381	14.9	28.7	171	1060	0.29	2.7
○ ● LBST 30	45		80		7	4	41	1	3	312	657	22.5	41.4	295	1740	0.5	3.8
○ ● LBST 40	60	$^{0}_{-0.019}$	100		10	4.5	55	1	3	696	1420	37.1	66.9	586	3540	1.1	6.8
○ ● LBST 50	75		112		15	5	60	1.5	4	1290	2500	55.1	94.1	941	5610	1.9	10.6
○ LBST 60	90	$^{0}_{-0.022}$	127		18	6	68	1.5	4	1870	3830	66.2	121	1300	8280	3.3	15.6
○ ● LBST 70	100		135		18	6	68	2	4	3000	6090	90.8	164	2080	11800	3.8	21.3
○ ● LBST 85	120		155	$^{0}_{-0.4}$	20	7	80	2.5	5	4740	9550	119	213	3180	17300	6.1	32
○ ● LBST 100	140	$^{0}_{-0.025}$	175		28	9	93	3	5	6460	14400	137	271	4410	25400	10.4	45
○ LBST 120	160		200	$^{0}_{-0.5}$	28	9	123	3.5	6	8380	19400	148	306	5490	32400	12.9	69.5
○ LBST 150	205	$^{0}_{-0.029}$	250		32	10	157	3.5	6	13900	32200	196	405	8060	55400	28	116.6

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LBST25 A CM+400L H
└ High temperature type symbol
● indicates model numbers for which felt seal types are available (see page b-8).
A felt seal cannot be attached to Ball Spline models using metal retainer.

***Note** $M_{A.1}$ indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
$M_{A.2}$ indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

Model number coding

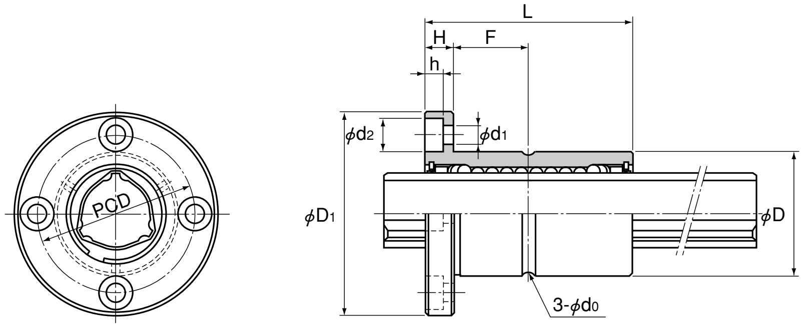
2 LBST50 UU CM +800L H K
1 2 3 4 5 6 7

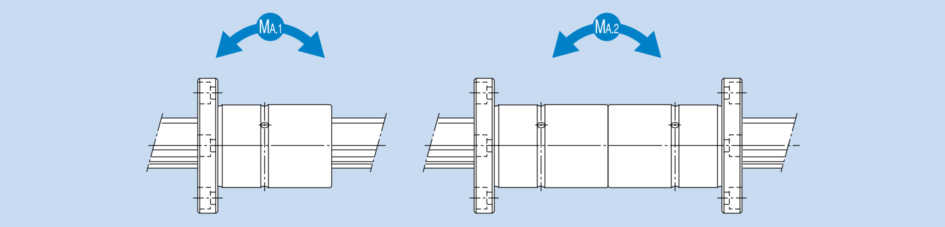
1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut

4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-23) (no symbol: solid spline shaft)

Model LBF

Medium load type





Unit: mm

Model No.	Spline nut dimensions											Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length		Flange diameter						Mounting hole								
	D	Tolerance	L	Tolerance	D_1	Tolerance	H	F	Greasing hole d_0	PCD	$d_1 \times d_2 \times h$	C_T N·m	C_{OT} N·m	C kN	C_0 kN	M_{A1}* N·m	M_{A2}* N·m	Spline nut kg	Spline shaft kg/m
LBF 15	23	0 −0.013	40	0 −0.2	43	0 −0.2	7	13	2	32	4.5×8×4.4	30.4	74.5	4.4	8.4	25.4	185	0.11	1
○ ● LBF 20	30	0 −0.016	50		49		7	18	2	38	4.5×8×4.4	74.5	160	7.8	14.9	60.2	408	0.2	1.8
○ ● LBF 25	37		60	0 −0.3	60		9	21	2	47	5.5×9.5×5.4	154	307	13	23.5	118	760	0.36	2.7
○ ● LBF 30	45		70		70		10	25	3	54	6.6×11×6.5	273	538	19.3	33.8	203	1270	0.6	3.8
○ ● LBF 40	57	0 −0.019	90		90		14	31	3	70	9×14×8.6	599	1140	31.9	53.4	387	2640	1.2	6.8
○ ● LBF 50	70		100		108	0 −0.3	16	34	4	86	11×17.5×11	1100	1940	46.6	73	594	4050	1.9	10.6
○ LBF 60	85		127		124		18	45.5	4	102	11×17.5×11	1870	3830	66.2	121	1300	8280	3.5	15.6
○ ● LBF 70	95	0 −0.022	110		142		20	35	4	117	14×20×13	2190	3800	66.4	102	895	6530	3.6	21.3
○ ● LBF 85	115		140	0 −0.4	168		22	48	5	138	16×23×15.2	3620	6360	90.5	141	2000	12600	6.2	32
○ ● LBF 100	135	0 −0.025	160		195	0 −0.4	25	55	5	162	18×26×17.5	5910	12600	126	237	3460	20600	11	45

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LBF20 A CL+500L H
A: High temperature type symbol
● indicates model numbers for which felt seal types are available (see page b-8).
A felt seal cannot be attached to Ball Spline models using metal retainer.

***Note** M_{A1} indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
M_{A2} indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.
(Single spline nut configuration is not stable in accuracy. We recommend using two spline nuts in close contact with each other.)

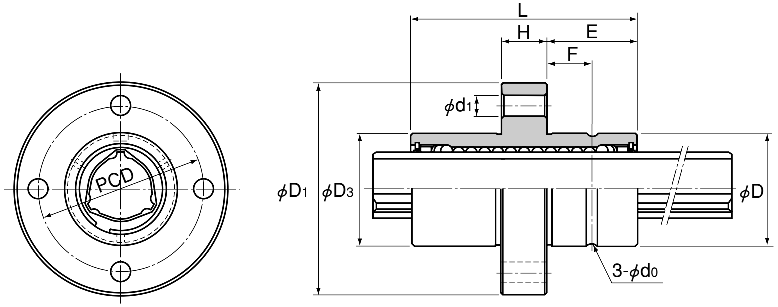
Model number coding

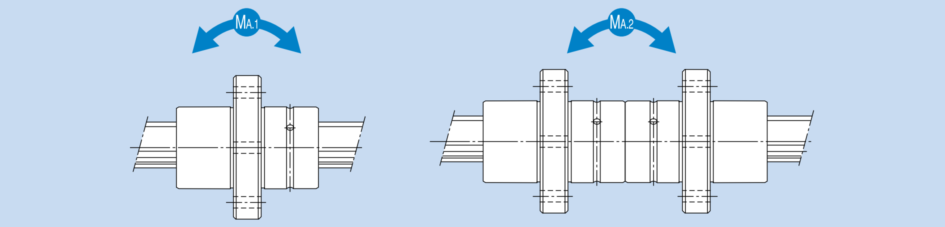
2 LBF20 DD CL +900L P K

2	LBF20	DD	CL	+900L	P	K
1	2	3	4	5	6	7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-23) (no symbol: solid spline shaft)

Model LBR





Unit: mm

Model No.	Spline nut dimensions												Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Outer diameter	Length		Flange diameter				Mounting hole		Greasing hole								
	D	Tolerance	D_3	L	Tolerance	D_1	H	E	PCD	d_1	F	d_0	C_T N·m	C_{0T} N·m	C kN	C_0 kN	M_{A1}* N·m	M_{A2}* N·m	Spline nut kg	Spline shaft kg/m
LBR 15	25	0 –0.013	25.35	40	0 –0.2	45.4	9	15.5	34	4.5	7.5	2	30.4	74.5	4.4	8.4	25.4	185	0.14	1
○ ● LBR 20	30	0 –0.016	30.35	60		56.4	12	24	44	5.5	12	2	90.2	213	9.4	20.1	103	632	0.33	1.8
○ ● LBR 25	40		40.35	70	0 –0.3	70.4	14	28	54	5.5	14	2	176	381	14.9	28.7	171	1060	0.54	2.7
○ ● LBR 30	45		45.4	80		75.4	16	32	61	6.6	16	3	312	657	22.5	41.4	295	1740	0.9	3.8
○ ● LBR 40	60	0 –0.019	60.4	100		96.4	18	41	78	9	20.5	3	696	1420	37.1	66.9	586	3540	1.7	6.8
○ ● LBR 50	75		75.4	112		112.4	20	46	94	11	23	4	1290	2500	55.1	94.1	941	5610	2.7	10.6
○ LBR 60	90	0 –0.022	90.5	127		134.5	22	52.5	112	11	26	4	1870	3830	66.2	121	1300	8280	3.7	15.6
○ ● LBR 70	95		95.6	135		140.6	24	55.5	117	14	27	4	3000	6090	90.8	164	2080	11800	6	21.3
○ ● LBR 85	120		120.6	155	0 –0.4	170.6	26	64.5	146	16	32	5	4740	9550	119	213	3180	17300	8.3	32
○ ● LBR 100	140	0 –0.025	140.6	175		198.6	34	70.5	170	18	35	5	6460	14400	137	271	4410	25400	14.2	45

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LBR40 A CM+600L H
High temperature type symbol

● indicates model numbers for which felt seal types are available (see page b-8).
A felt seal cannot be attached to Ball Spline models using metal retainer.

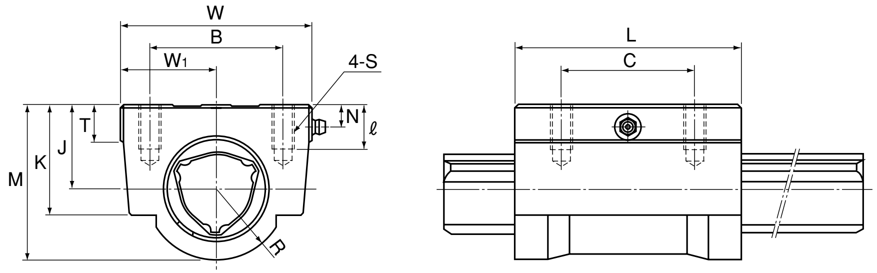
***Note** M_{A1} indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
M_{A2} indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

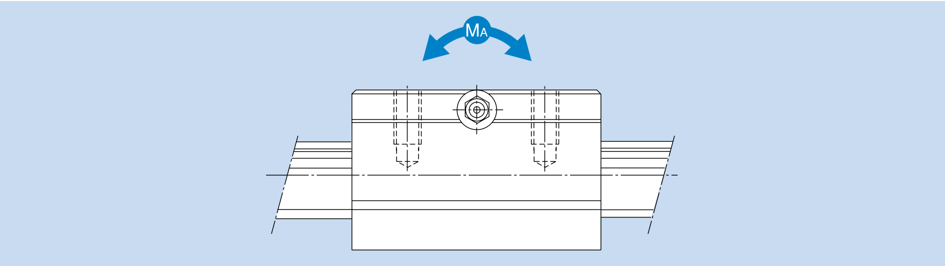
Model number coding

2 LBR30 UU CM +700L H K
1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-23) (no symbol: solid spline shaft)

Model LBH





Unit: mm

Model No.	Spline nut dimensions													Basic torque rating		Basic load rating (radial)		Permissible static moment	Mass	
	Height M	Width W	Length L	B	C	S×ℓ	J ±0.15	W_1 ±0.15	T	K	R	N	Greasing nipple	C_T N·m	C_{0T} N·m	C kN	C_0 kN	M_A* N·m	Spline nut kg	Spline shaft kg/m
○ LBH 15	29	34	43	26	26	M4×10	15	17	6	20	14	5	φ4 drive nipple	30.4	74.5	4.4	8.4	25.4	0.23	1
○ ● LBH 20	38	48	62	35	35	M6×12	20	24	7	26	18	7	A-M6F	90.2	213	9.4	20.1	103	0.58	1.8
○ ● LBH 25	47.5	60	73	40	40	M8×16	25	30	8	33	22	6	A-M6F	176	381	14.9	28.7	171	1.1	2.7
○ ● LBH 30	57	70	83	50	50	M8×16	30	35	10	39	26	8	A-M6F	312	657	22.5	41.4	295	1.73	3.8
○ ● LBH 40	70	86	102	60	60	M10×20	38	43	15	50	32	10	A-M6F	696	1420	37.1	66.9	586	3.18	6.8
○ ● LBH 50	88	100	115	75	75	M12×25	48	50	18	63	40	13.5	A-PT1/8	1290	2500	55.1	94.1	941	5.1	10.6

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LBH30 A CM+600L H
└High temperature type symbol

● indicates model numbers for which felt seal types are available (see page b-8).
A felt seal cannot be attached to Ball Spline models using metal retainer.

***Note** M_A indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

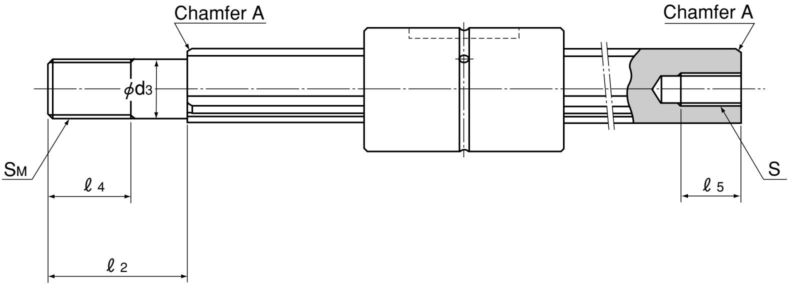
Model number coding

2 LBH40 UU CL +700L P K
1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-23) (no symbol: solid spline shaft)

Model LBS with Recommended Shaft End Shape

For support



Unit: mm

Model No.	d_3	Tolerance	ℓ_2	S_M	ℓ_4	S× ℓ_5
LBS 15	10	$^{0}_{-0.015}$	23	M10×1.25	14	M6×10
LBS 20	14	$^{0}_{-0.018}$	30	M14×1.5	18	M8×15
LBS 25	18		42	M18×1.5	25	M10×18
LBS 30	20	$^{0}_{-0.021}$	46	M20×1.5	27	M12×20
LBS 40	30		70	M30×2	40	M18×30
LBS 50	36	$^{0}_{-0.025}$	80	M36×3	46	M20×35

Note For details of chamfer A, see page b-24.

Medium Torque Type Ball Spline

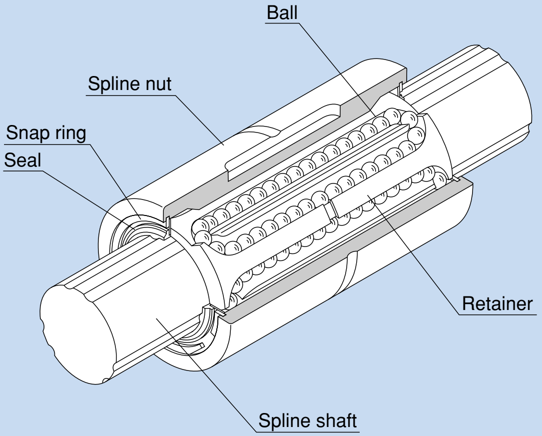


Fig. 1 Structure of Medium Torque Type Ball Spline Model LT

Structure and Features

With the medium torque type Ball Spline, the spline shaft has two to three crests on the circumference, and along both sides of each crest, two rows of balls (four or six rows in total) are arranged to hold the crest so that a reasonable preload is applied.

The rows of balls are held in a special resin retainer incorporated in the spline nut so that they smoothly roll and circulate. With this design, balls will not fall even if the nut is removed from the spline shaft.

●Large load capacity

The ball raceways are formed into circular-arc grooves approximate to the ball curvature and ensure angular contact. Thus, this model has a large load capacity in the radial and torque directions.

●No Angular Backlash

Two rows of balls facing one another hold a crest, formed on the circumference of the spline nut, at a contact angle of 20° to provide a preload in an angular-contact structure. This eliminates an angular backlash in the rotational direction and increases the rigidity.

●High Rigidity

Since the contact angle is large and an appropriate preload is provided, high rigidity against torque and moment is achieved.

●Easy installation

Since the balls will not fall off even if the spline nut is removed from the spline shaft, thus, it is easy to install and maintain this model (except for models LT4 and 5).

Types and Features

●Types of Spline Nuts

Cylindrical Type Ball Spline Model LT

The most compact type with a straight cylindrical spline nut. When transmitting a torque, a key is driven into the body.

Flanged Type Ball Spline Model LF

The spline nut can be attached to the housing via the flange, making assembly simple. It is optimal for locations where the housing may be deformed if a keyway is machined on its surface, and where the housing width is small. Since it allows a knock pin to be driven into the flange, angular backlash occurring in the fitting can completely be eliminated.

●Types of Spline Shafts

Precision Solid Spline Shaft (Standard Type)

The raceway of the spline shaft is precision ground. It is used in combination with a spline nut.

Special Spine Shaft

THK manufactures a spline shaft with thicker ends or thicker middle area through special processing at your request.

Hollow Spline Shaft (Type K)

(Thick)

A drawn, hollow spline shaft is available for requirements such as piping, wiring, air-vent and weight reduction.

Hollow Spline Shaft (Type N)

(Thin)

A drawn, hollow spline shaft is available for requirements such as piping, wiring, air-vent and weight reduction.

Housing Inner-diameter Tolerance

When fitting the Ball Spline with the housing, tight fitting is normally recommended. If the accuracy of the Ball Spline does not need to be very high, clearance fitting is also acceptable.

Table 1 Housing Inner-diameter Tolerance

Housing inner-diameter tolerance	General service conditions	H7
	When clearance needs to be small	J6

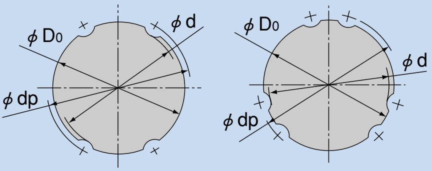
Spline Shaft

Spline shafts are divided in shape into precision solid spline shaft, special spline shaft and hollow spline shaft (types K and N), as described on page b-45.

Since production of a spline shaft with a specific shape is performed at your request, provide a drawing of the desired shaft shape when asking an estimate or placing an order.

●Sectional Shape of the Spline Shaft

Table 2 shows the sectional shape of a spline shaft. If the spline shaft ends need to be cylindrical, the minor diameter (d) value should not be exceeded if possible.



Model LT13 or smaller   Model LT16 or greater

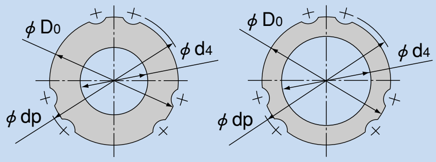
Table 2 Sectional Shape of the Spline Shaft

Unit: mm

Nominal shaft diameter	4	5	6	8	10	13	16	20	25	30	40	50	60	80	100
Minor diameter d	3.5	4.5	5	7	8.5	11.5	14.5	18.5	23	28	37.5	46.5	56.5	75.5	95
Major diameter D_0 h7	4	5	6	8	10	13	16	20	25	30	40	50	60	80	100
Ball center diameter dp	4.6	5.7	7	9.3	11.5	14.8	17.8	22.1	27.6	33.2	44.2	55.2	66.3	87.9	109.5
Mass (kg/m)	0.1	0.15	0.23	0.4	0.62	1.1	1.6	2.5	3.9	5.6	9.9	15.5	22.3	39.6	61.8

●Hole Shape of the Standard Hollow Type Spline Shaft

Table 3 shows the hole shape of the standard hollow type spline shaft (types K and N). Use this table when a requirement such as piping, wiring, air-vent or weight reduction needs to be met.



Type K (Thick) Type N (Thin)

Table 3 Sectional Shape of the Standard Hollow Type Spline Shaft

Unit: mm

Nominal shaft diameter		6	8	10	13	16	20	25	30	40	50	60	80	100
Major diameter D_0		6	8	10	13	16	20	25	30	40	50	60	80	100
Ball center diameter dp		7	9.3	11.5	14.8	17.8	22.1	27.6	33.2	44.2	55.2	66.3	87.9	109.5
Type K	Hole diameter d_4	2.5	3	4	5	7	10	12	16	22	25	32	52.5	67.5
	Mass (kg/m)	0.2	0.35	0.52	0.95	1.3	1.8	3	4	6.9	11.6	16	22.6	33.7
Type N	Hole diameter d_4	—	—	—	—	11	14	18	21	29	36	—	—	—
	Mass (kg/m)	—	—	—	—	0.8	1.3	1.9	2.8	4.7	7.4	—	—	—

Note: The standard hollow type Spline Shaft is divided into types K and N. Indicate "K" or "N" at the end of the model number to distinguish between them when placing an order.

●Chamfering of the Spline Shaft Ends

For details of chamfering of the spline nut ends, see page b-24.

●Length of Incomplete Section of a Special Spline Shaft

If the middle area or the end of a spline shaft is to be thicker than the minor diameter (d), an incomplete spline section is required to secure a recess for grinding. Table 4 shows the relationship between the length of the incomplete section (S) and the flange diameter (df). (This table does not apply to overall length of 1,500 mm or greater. Contact THK for details.)

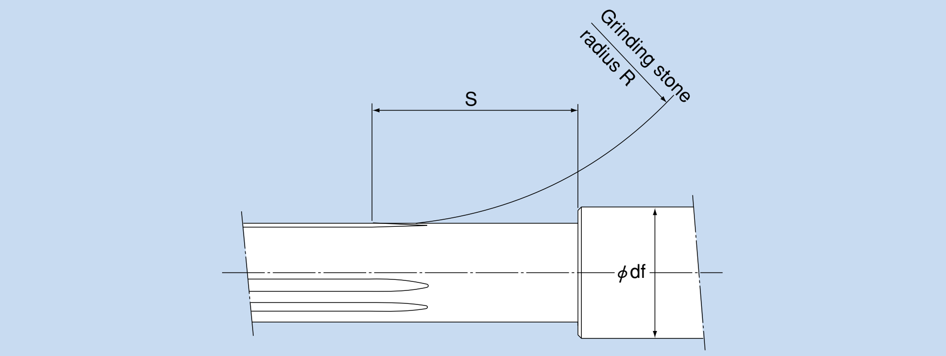


Table 4 Length of Incomplete Spline Section: S

Miniature type Unit: mm

Flange diameter df Nominal shaft diameter	4	5	6	8	10
4	13	20	24	31	—
5	—	14	21	28	33

Standard type: Unit: mm

Flange diameter df Nominal shaft diameter	6	8	10	13	16	20	25	30	40	50	60	80	100	120	140	160
6	16	24	28	33	—	—	—	—	—	—	—	—	—	—	—	—
8	—	16	24	30	35	—	—	—	—	—	—	—	—	—	—	—
10	—	—	17	27	32	37	—	—	—	—	—	—	—	—	—	—
13	—	—	—	17	27	34	40	—	—	—	—	—	—	—	—	—
16	—	—	—	—	21	36	46	54	—	—	—	—	—	—	—	—
20	—	—	—	—	—	21	38	48	62	—	—	—	—	—	—	—
25	—	—	—	—	—	—	23	39	56	67	—	—	—	—	—	—
30	—	—	—	—	—	—	—	24	49	62	72	—	—	—	—	—
40	—	—	—	—	—	—	—	—	27	50	63	81	—	—	—	—
50	—	—	—	—	—	—	—	—	—	29	51	74	89	—	—	—
60	—	—	—	—	—	—	—	—	—	—	28	56	71	82	—	—
80	—	—	—	—	—	—	—	—	—	—	—	31	57	72	83	—
100	—	—	—	—	—	—	—	—	—	—	—	—	33	58	73	83

Accessory

Ball Spline model LT is provided with a standard key as indicated in table 5.

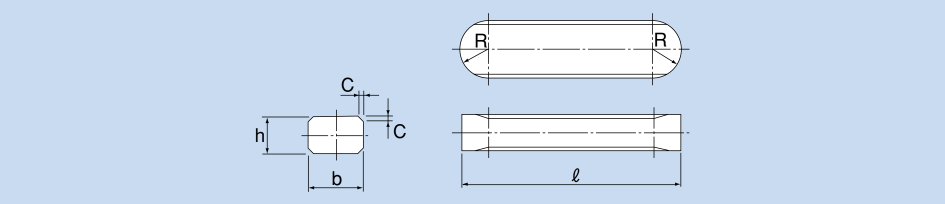


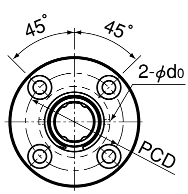
Table 5 Standard Key for Model LT

Unit: mm

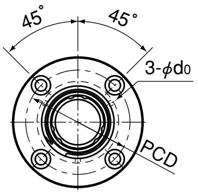
Nominal shaft diameter	Width b		Height h		Length ℓ		R	C
		Tolerance (p7)		Tolerance (h9)		Tolerance (h12)		
LT 4	2	+0.016 +0.006	2	0 −0.025	6	0 −0.120	1	0.3
LT 5	2.5		2.5		8	0 −0.150	1.25	0.5
LT 6 LT 8	2.5		2.5		10.5	0 −0.180	1.25	0.5
LT 10	3		3		13		1.5	
LT 13	3		3		15		1.5	
LT 16	3.5	+0.024 +0.012	3.5	0 −0.030	17.5		1.75	
LT 20	4		4		29	0 −0.210	2	
LT 25	4		4		36	0 −0.250	2	
LT 30	4		4		42		2	
LT 40	6		6		52	0 −0.300	3	
LT 50	8	+0.030 +0.015	7	0 −0.036	58		4	
LT 60	12	+0.036 +0.018	8		67		6	0.8
LT 80	16		10		76		8	
LT 100	20	+0.043 +0.022	13	0 −0.043	110	0 −0.350	10	

Standard Off-the-shelf Ball Spline Models LT / LF

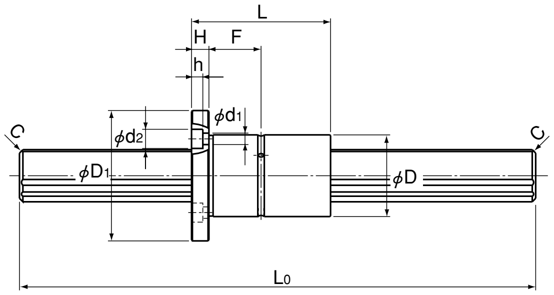
Full spline



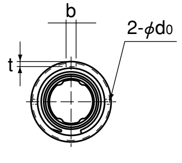
Model LF13 or smaller



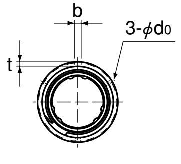
Model LF16 or greater



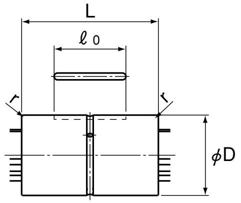
Model LF



Model LT13 or smaller



Model LT16 or greater



Model LT

Unit: mm

Model No.	Spline nut dimensions: Outer diameter D	Outer diameter Tolerance	Length L	Length Tolerance	Flange diameter D₁	Flange diameter Tolerance	H	F	PCD	Mounting hole $d_1 \times d_2 \times h$	Keyway dimensions b H8	Keyway dimensions t $^{+0.05}_{0}$	Keyway dimensions ℓ₀	Greasing hole d₀	r	Spline shaft dimensions: Length* L₀	Spline shaft dimensions: Chamfer C	Basic torque rating C_T* N·m	Basic torque rating C_{0T}* N·m	Basic load rating (radial) C* kN	Basic load rating (radial) C_0* kN
LT 6	14	0 −0.011	25	0 −0.2	—	0 −0.2	—	—	—	—	2.5	1.2	10.5	1	0.5	600	0.5	0.98	1.96	1.18	2.16
LF 6					30		5	7.5	22	3.4×6.5×3.3	—	—	—	1.5							
LT 8	16				—		—	—	—	—	2.5	1.2	10.5			1000		1.96	2.94	1.47	2.55
LF 8					32		5	7.5	24	3.4×6.5×3.3	—	—	—								
LT 10	21	0 −0.013	33		—		—	—	—	—	3	1.5	13					3.92	7.84	2.84	4.9
LF 10					42		6	10.5	32	4.5×8×4.4	—	—	—								
LT 13	24		36		—		—	—	—	—	3	1.5	15					5.88	10.8	3.53	5.78
LF 13					44		7	11	33	4.5×8×4.4	—	—	—								
LT 16	31		50		—		—	—	—	—	3.5	2	17.5	2		1500		31.4	34.3	7.06	12.6
LF 16					51		7	18	40	4.5×8×4.4	—	—	—								
LT 20	35	0 −0.016	63		—		—	—	—	—	4	2.5	29			2000		56.9	55.9	10.2	17.8
LF 20					58		9	22.5	45	5.5×9.5×5.4	—	—	—								
LT 25	42		71	0 −0.3	—		—	—	—	—	4	2.5	36	3		3000		105	103	15.2	25.8
LF 25					65		9	26.5	52	5.5×9.5×5.4	—	—	—								
LT 30	47		80		—		—	—	—	—	4	2.5	42					171	148	20.5	34
LF 30					75		10	30	60	6.6×11×6.5	—	—	—								
LT 40	64	0 −0.019	100		—		—	—	—	—	6	3.5	52	4			1	419	377	37.8	60.5
LF 40					100		14	36	82	9×14×8.6	—	—	—								
LT 50	80		125		—		—	—	—	—	8	4	58		1			842	769	60.9	94.5
LF 50					124		16	46.5	102	11×17.5×11	—	—	—								

These standard off-the-shelf models are shipped in short delivery time.
You can also specify the number of spline nuts.

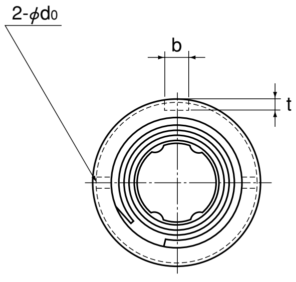
Note The values for the basic torque rating and basic load rating apply to single-nut configurations.
The clearance in the rotational direction is assumed to be normal clearance, and the accuracy to be normal grade.
If a greater length than the standard length is required, contact THK.

Model number coding

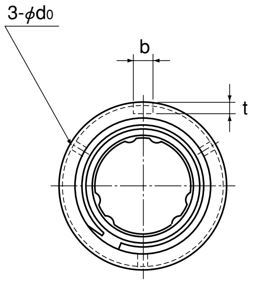
5 LT30 UU +3000L
1 2 3 4

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - UU: rubber seal attached on both ends of spline nut
4 Overall spline shaft length (in mm)

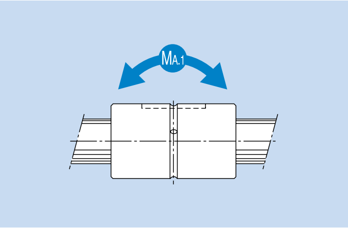
Model LT

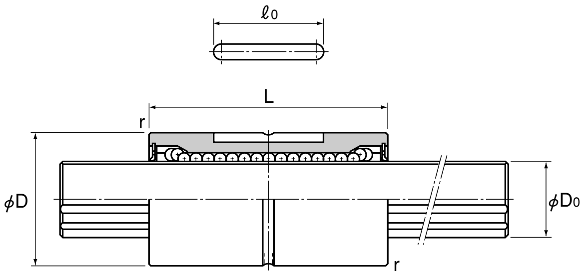


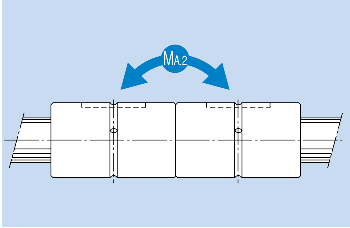
Model LT13 or smaller



Model LT16 or greater







Unit: mm

Model No.	Spline nut dimensions									Spline shaft diameter	No. of rows of balls	Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length			Keyway dimensions			Greasing hole										
	D	Tolerance	L	Tolerance	b H8	t $^{+0.05}_{0}$	ℓ₀	r	d₀	D₀ h7		C_T N·m	C_{0T} N·m	C kN	C_0 kN	M_{A1}** N·m	M_{A2}** N·m	Spline nut g	Spline shaft kg/m
*LT 4	10	$^{0}_{-0.009}$	16	$^{0}_{-0.2}$	2	1.2	6	0.5	—	4	4	0.59	0.78	0.44	0.61	0.88	6.4	5.2	0.1
*LT 5	12	$^{0}_{-0.011}$	20		2.5	1.2	8	0.5	—	5	4	0.88	1.37	0.66	0.88	1.5	11.6	9.1	0.15
LT 6	14		25		2.5	1.2	10.5	0.5	1	6	4	0.98	1.96	1.18	2.16	4.9	36.3	17	0.23
LT 8	16		25		2.5	1.2	10.5	0.5	1.5	8	4	1.96	2.94	1.47	2.55	5.9	44.1	18	0.4
LT 10	21	$^{0}_{-0.013}$	33		3	1.5	13	0.5	1.5	10	4	3.92	7.84	2.84	4.9	15.7	98	50	0.62
LT 13	24		36		3	1.5	15	0.5	1.5	13	4	5.88	10.8	3.53	5.78	19.6	138	55	1.1
○LT 16	31		50		3.5	2	17.5	0.5	2	16	6	31.4	34.3	7.06	12.6	67.6	393	165	1.6
○LT 20	35	$^{0}_{-0.016}$	63		4	2.5	29	0.5	2	20	6	56.9	55.9	10.2	17.8	118	700	225	2.5
○LT 25	42		71	$^{0}_{-0.3}$	4	2.5	36	0.5	3	25	6	105	103	15.2	25.8	210	1140	335	3.9
○LT 30	47		80		4	2.5	42	0.5	3	30	6	171	148	20.5	34	290	1710	375	5.6
○LT 40	64	$^{0}_{-0.019}$	100		6	3.5	52	0.5	4	40	6	419	377	37.8	60.5	687	3760	1000	9.9
○LT 50	80		125		8	4	58	1	4	50	6	842	769	60.9	94.5	1340	7350	1950	15.5
○LT 60	90	$^{0}_{-0.022}$	140	$^{0}_{-0.4}$	12	5	67	1	5	60	6	1220	1040	73.5	111.7	1600	9990	2500	22.3
○LT 80	120		160		16	6	76	2	5	80	6	2310	1920	104.9	154.8	2510	16000	4680	39.6
○LT 100	150	$^{0}_{-0.025}$	185		20	7	110	2.5	5	100	6	3730	3010	136.2	195	3400	24000	9550	61.8

***Note** Models LT4 and 5 do not have a retainer. Do not remove the shaft from the spline nut (it will cause balls to fall off).
○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LT20 A CL+500L H
└ High temperature type symbol

****Note** M_{A1} indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
M_{A2} indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.
(Single LT-unit configuration is not stable in accuracy. We recommend using two units in close contact with each other.)

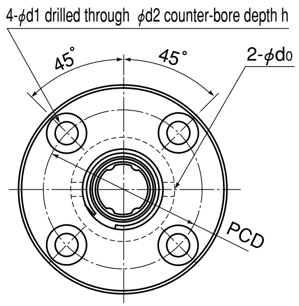
Model number coding

2 LT30 UU CL +500L H K
1 2 3 4 5 6 7

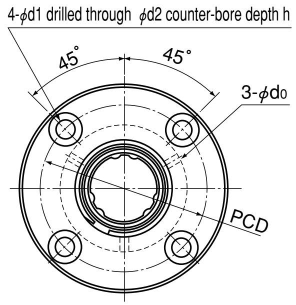
1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-47) (no symbol: solid spline shaft)

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

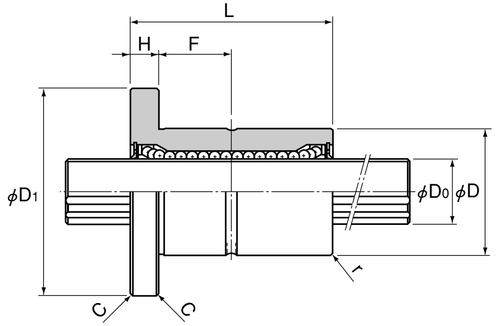
Model LF

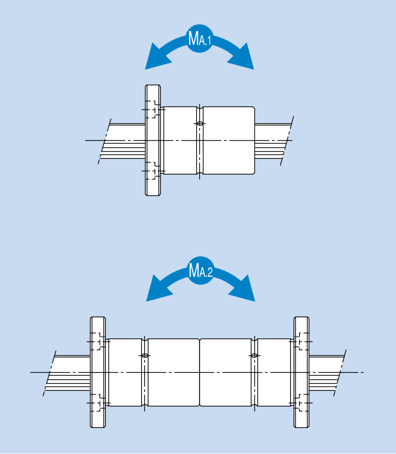


Model LF13 or smaller



Model LF16 or greater





Unit: mm

Model No.	Spline nut dimensions													Spline shaft diameter	No. of rows of balls	Basic torque rating		Basic load rating (radial)		Permissible static moment		Mass	
	Outer diameter		Length		Flange diameter						Greasing hole		Mounting hole										
	D	Tolerance	L	Tolerance	D_1	Tolerance	H	F	C	r	d_0	PCD	d_1×d_2×h	D_0 h7		C_T N·m	C_{0T} N·m	C kN	C_0 kN	$M_{A.1}$* N·m	$M_{A.2}$* N·m	Spline nut g	Spline shaft kg/m
LF 6	14	0 –0.011	25	0 –0.2	30	0 –0.2	5	7.5	0.5	0.5	1.5	22	3.4×6.5×3.3	6	4	0.98	1.96	1.18	2.16	4.9	36.3	35	0.23
LF 8	16		25		32		5	7.5	0.5	0.5	1.5	24	3.4×6.5×3.3	8	4	1.96	2.94	1.47	2.55	5.9	44.1	37	0.4
LF 10	21	0 –0.013	33		42		6	10.5	0.5	0.5	1.5	32	4.5×8×4.4	10	4	3.92	7.84	2.84	4.9	15.7	98	90	0.62
LF 13	24		36		44		7	11	0.5	0.5	1.5	33	4.5×8×4.4	13	4	5.88	10.8	3.53	5.78	19.6	138	110	1.1
○ LF 16	31		50		51		7	18	0.5	0.5	2	40	4.5×8×4.4	16	6	31.4	34.3	7.06	12.6	67.6	393	230	1.6
○ LF 20	35	0 –0.016	63		58		9	22.5	0.5	0.5	2	45	5.5×9.5×5.4	20	6	56.9	55.9	10.2	17.8	118	700	330	2.5
○ LF 25	42		71	0 –0.3	65		9	26.5	0.5	0.5	3	52	5.5×9.5×5.4	25	6	105	103	15.2	25.8	210	1140	455	3.9
○ LF 30	47		80		75		10	30	0.5	0.5	3	60	6.6×11×6.5	30	6	171	148	20.5	34	290	1710	565	5.6
○ LF 40	64	0 –0.019	100		100		14	36	1	0.5	4	82	9×14×8.6	40	6	419	377	37.8	60.5	687	3760	1460	9.9
○ LF 50	80		125		124		16	46.5	1	1	4	102	11×17.5×11	50	6	842	769	60.9	94.5	1340	7350	2760	15.5

Note ○ indicates model numbers for which high temperature types are available (with metal retainer; service temperature: up to 100℃).
(Example) LF30 A CL+700L H
High temperature type symbol

***Note** $M_{A.1}$ indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
$M_{A.2}$ indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.
(Single LF-unit configuration is not stable in accuracy. We recommend using two units in close contact with each other.)

Model number coding

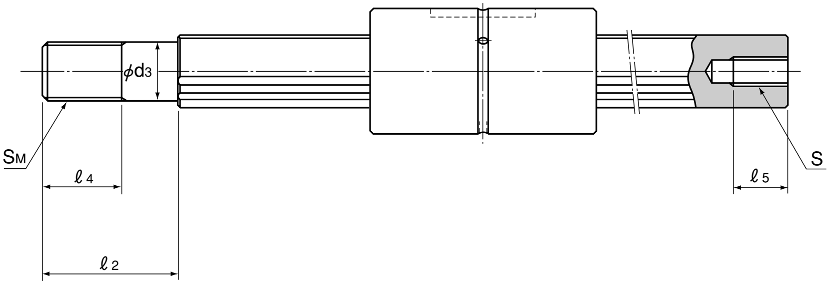
2 LF20 UU CM +400L P N

1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-47) (no symbol: solid spline shaft)

Model LT with Recommended Shaft End Shape

For support



Unit: mm

Model No.	d$_3$	Tolerance	ℓ$_2$	S$_M$	ℓ$_4$	S×ℓ$_5$
LT 6	5	0 –0.012	12	M5×0.8	7	M2.5×4
LT 8	6		14	M6×1	8	M3×5
LT 10	8	0 –0.015	18	M8×1	11	M4×6
LT 13	10		23	M10×1.25	14	M5× 8
LT 16	14	0 –0.018	30	M14×1.5	18	M6×10
LT 20	16		38	M16×1.5	22	M8×15
LT 25	22	0 –0.021	50	M22×1.5	28	M10×18
LT 30	27		60	M27×2	34	M14×25
LT 40	36	0 –0.025	80	M36×3	45	M18×30
LT 50	45		100	M45×4.5	58	M22×40

Rotary Ball Spline Models LBG and LBGT

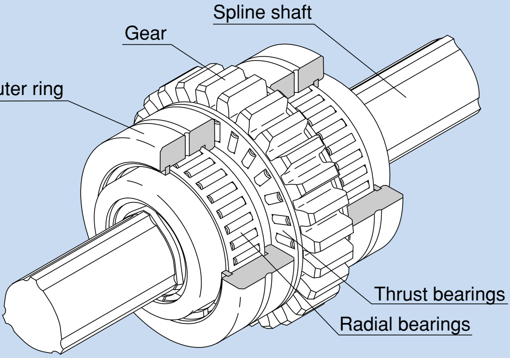


Fig. 1 Structure of Rotary Ball Spline Model LBG

Structure and Features

With rotary Ball Spline models LBG and LBGT, the spline shaft has three crests on the circumference, and along both sides of each crest, two rows of balls (six rows in total) are arranged to hold the crest so that a reasonable preload is applied.
These models are unit types based on model LBR, but have gear teeth on the flange circumference and radial and thrust bearings on the spline nut, all compactly integrated.
The rows of balls are held in a special resin retainer so that they smoothly roll and circulate. With this design, balls will not fall even if the spline shaft is removed.

●No Angular Backlash

The spline shaft has three crests positioned equidistantly at 120°, and along both sides of each crest, two rows of balls (six rows in total) are arranged so as to hold the crest at a contact angle of 45° and provide a preload. As a result, backlash in the rotational direction is eliminated and the rigidity is increased.

●Compact design

The spline nut is compactly integrated with radial and thrust bearings, allowing compact design to be achieved.

●High Rigidity

Since the contact angle is large and an appropriate preload is given, high rigidity against torque and moment is achieved. Use of needle bearings in the support unit achieves a rigid nut support strong against a radial load.

●Optimal for Torque Transmission with Spline Nut Drive

Since the support bearings allow a rigid nut support, these models are optimal for torque transmission with spline nut drive.

Types and Features

●Types of Spline Nuts

Ball Spline with Gears Model LBG

Without a thrust raceway

A unit type based on model LBR, but has gear teeth on the flange circumference and radial and thrust needle bearings on the spline nut, all compactly integrated. It is optimal for a torque transmission mechanism with spline nut drive.

Ball Spline with Gears Model LBGT

With a thrust raceway

A unit type based on model LBR, but has gear teeth on the flange circumference and radial and thrust needle bearings on the spline nut, all compactly integrated. It is optimal for a torque transmission mechanism with spline nut drive.

●Types of Spline Shafts

For details on spline shaft types, see page b-21.

Housing Inner-diameter Tolerance

Table 1 shows housing inner-diameter tolerance for models LBG and LBGT.

Table 1 Housing Inner-diameter Tolerance

Housing inner-diameter tolerance	General service conditions	H7
	When clearance needs to be small	J6

Spline Shaft

Spline shafts are divided in shape into precision solid spline shaft, special spline shaft and hollow spline shaft (type K), as described on page b-21.

Since production of a spline shaft with a specific shape is performed at your request, provide a drawing of the desired shaft shape when asking an estimate or placing an order.

●Sectional Shape of the Spline Shaft

Table 2 shows the sectional shape of a spline shaft. If the spline shaft ends need to be cylindrical, the minor diameter (d) value should not be exceeded if possible.

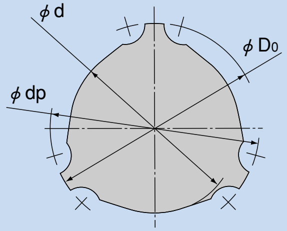


Table 2 Sectional Shape of the Spline Shaft

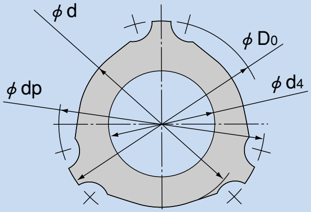
Unit: mm

Nominal shaft diameter	20	25	30	40	50	60	85
Minor diameter d	15.3	19.5	22.5	31	39	46.5	67
Major diameter D_0	19.7	24.5	29.6	39.8	49.5	60	84
Ball center diameter dp	20	25	30	40	50	60	85
Mass (kg/m)	1.8	2.7	3.8	6.8	10.6	15.6	32

●Hole Shape of the Standard Hollow Type Spline Shaft

Table 3 shows the hole shape of the standard hollow type spline shaft (type K) for models LBG and LBGT.

Use this table when a requirement such as piping, wiring, air-vent or weight reduction needs to be met.



Type K

Table 3 Sectional Shape of the Standard Hollow Type Spline Shaft

Unit: mm

Nominal shaft diameter	20	25	30	40	50	60	85
Minor diameter d	15.3	19.5	22.5	31	39	46.5	67
Major diameter D_0	19.7	24.5	29.6	39.8	49.5	60	84
Ball center diameter dp	20	25	30	40	50	60	85
Hole diameter d_4	6	8	12	18	24	30	45
Mass (kg/m)	1.6	2.3	2.9	4.9	7	10	19.5

●Chamfering of the Spline Shaft Ends

For details on chamfering of the spline shaft ends, see page b-24.

●Length of Incomplete Section of a Special Spline Shaft

If the middle area or the end of a spline shaft is to be thicker than the minor diameter (d), an incomplete spline section is required to secure a recess for grinding. Table 4 shows the relationship between the length of the incomplete section (S) and the flange diameter (df). (This table does not apply to overall length of 1,500 mm or greater. Contact THK for details.)

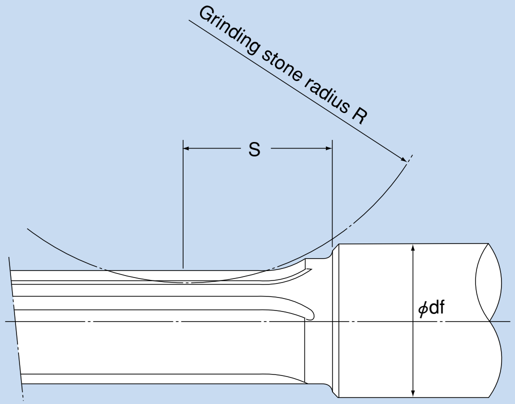
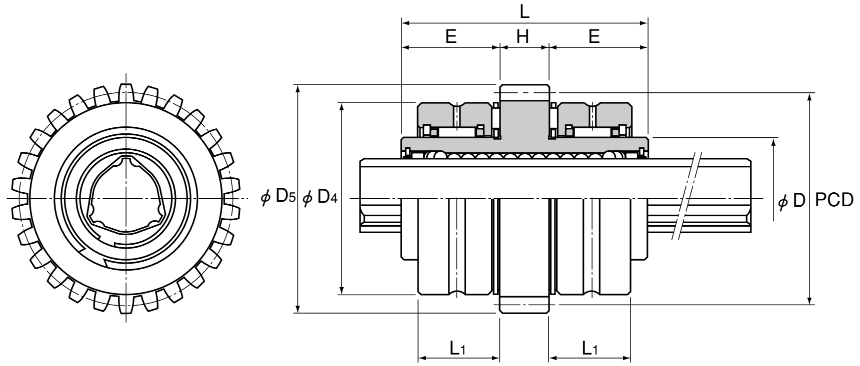


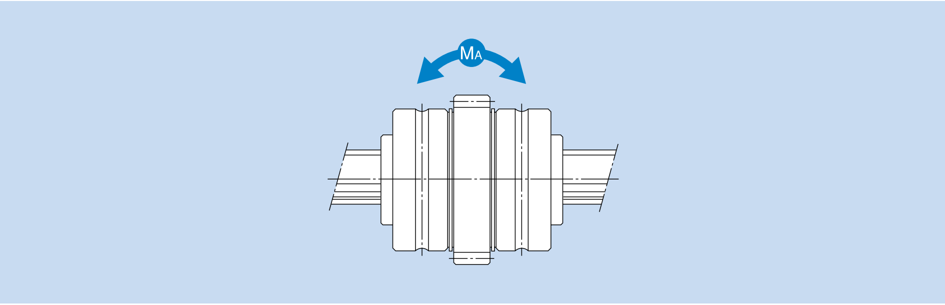
Table 4 Length of Incomplete Spline Section: S

Unit: mm

Flange diameter df / Nominal shaft diameter	20	25	30	35	40	50	60	80	100	120	140
20	25	36	43	48	53	—	—	—	—	—	—
25	—	32	46	55	62	73	—	—	—	—	—
30	—	—	35	48	56	69	78	—	—	—	—
40	—	—	—	—	38	59	71	88	—	—	—
50	—	—	—	—	—	42	61	82	96	—	—
60	—	—	—	—	—	—	45	74	91	102	—
70	—	—	—	—	—	—	—	64	85	98	108
85	—	—	—	—	—	—	—	34	72	90	102

Model LBG





Unit: mm

Model No.	Spline nut dimensions										Gear specifications*				Basic torque rating		Basic load rating		Permissible static moment	Mass	
	Spline nut outer diameter		Length		Outer diameter		Width														
	D	Tolerance	L	Tolerance	D4	Tolerance	L1	Tolerance	H	E	Tooth end diameter D5	Standard pitch diameter PCD	Module m	No. of teeth z	CT N·m	C0T N·m	C kN	C0 kN	MA** N·m	Spline nut unit kg	Spline shaft kg/m
● LBG 20	30	0 −0.009	60	0 −0.2	47	0 −0.011	20	0 −0.16	12	24	56	52	2	26	90.2	213	9.4	20.1	103	0.61	1.8
● LBG 25	40	0 −0.011	70		60	0 −0.013	23	0 −0.19	14	28	70	65	2.5	26	176	381	14.9	28.7	171	1.4	2.7
● LBG 30	45		80		65		27		16	32	75	70	2.5	28	312	657	22.5	41.4	295	2.1	3.8
● LBG 40	60	0 −0.013	100		85	0 −0.015	31	0 −0.25	18	41	96	90	3	30	696	1420	37.1	66.9	586	3	6.8
● LBG 50	75		112	0 −0.3	100		32		20	46	111	105	3	35	1290	2500	55.1	94.1	941	4.1	10.6
LBG 60	90	0 −0.015	127		120		38		22	52.5	133	126	3.5	36	1870	3830	66.2	121	1300	6.3	15.6
● LBG 85	120		155		150	0 −0.025	40		26	64.5	168	160	4	40	4740	9550	119	213	3180	11.8	32

Note ● indicates model numbers for which felt seal types are available (see page b-8).

Note *The gear specifications in the table represent the dimensions with maximum module. Special gear types such as helical gear and worm gear can also be manufactured at your request.

**M_A indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

Model number coding

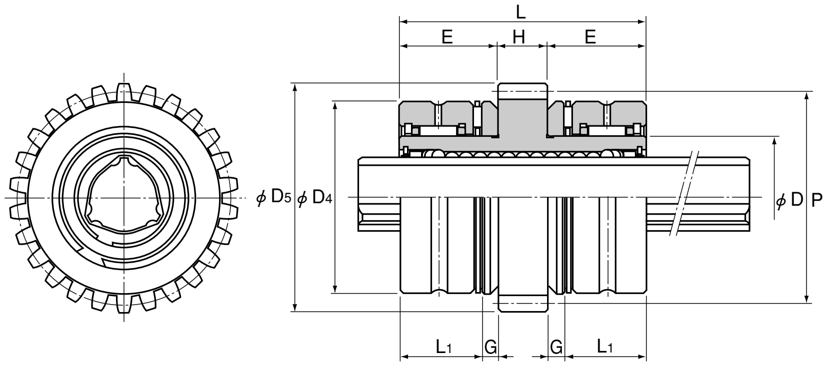
2 LBG50 DD CM +700L H K

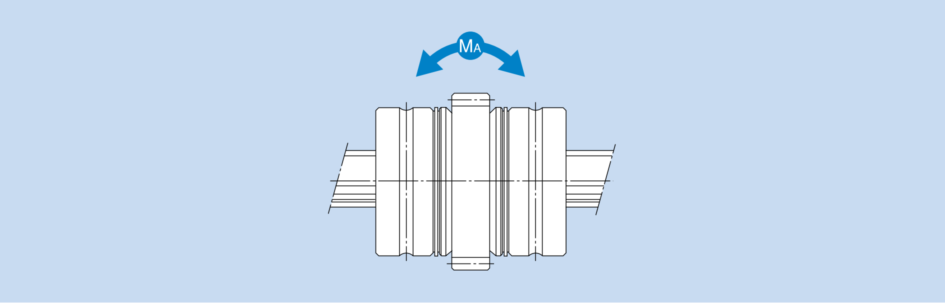
1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut

4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-60) (no symbol: solid spline shaft)

Model LBGT





Unit: mm

Model No.	Spline nut dimensions											Gear specifications*				Basic torque rating		Basic load rating		Permissible static moment	Mass	
	Spline nut outer diameter		Length		Outer diameter		Width		Thrust raceway width													
	D	Tolerance	L	Tolerance	D4	Tolerance	L1	Tolerance	G	H	E	Tooth end diameter D5	Standard pitch diameter PCD	Module m	No. of teeth z	CT N·m	COT N·m	C kN	C0 kN	MA** N·m	Spline nut unit kg	Spline shaft kg/m
● LBGT 20	30	0 −0.009	60	0 −0.2	47	0 −0.011	20	0 −0.16	4	12	24	56	52	2	26	90.2	213	9.4	20.1	103	0.67	1.8
● LBGT 25	40	0 −0.011	70		60	0 −0.013	23	0 −0.19	5	14	28	70	65	2.5	26	176	381	14.9	28.7	171	1.5	2.7
● LBGT 30	45		80		65		27		5	16	32	75	70	2.5	28	312	657	22.5	41.4	295	2.2	3.8
● LBGT 40	60	0 −0.013	100		85	0 −0.015	31	0 −0.25	8	18	41	96	90	3	30	696	1420	37.1	66.9	586	3.3	6.8
● LBGT 50	75		112	0 −0.3	100		32		10	20	46	111	105	3	35	1290	2500	55.1	94.1	941	4.8	10.6
LBGT 60	90	0 −0.015	127		120		38		12	22	52.5	133	126	3.5	36	1870	3830	66.2	121	1300	7.2	15.6
● LBGT 85	120		155		150	0 −0.025	40		16	26	64.5	168	160	4	40	4740	9550	119	213	3180	13.4	32

Note ● indicates model numbers for which felt seal types are available (see page b-8).

Note *The gear specifications in the table represent the dimensions with maximum module.
Special gear types such as helical gear and worm gear can also be manufactured at your request.
**MA indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

Model number coding

2 LBGT40 UU CL +700L P K

1 2 3 4 5 6 7

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
DD: felt seal attached on both ends of spline nut
D: felt seal attached on either end of spline nut

4 Symbol for clearance in the rotational direction (see page b-4)
5 Overall spline shaft length (in mm)
6 Accuracy symbol (see page b-5)
7 Symbol for standard hollow spline shaft (see page b-60) (no symbol: solid spline shaft)

Rotary Ball Spline Model LTR

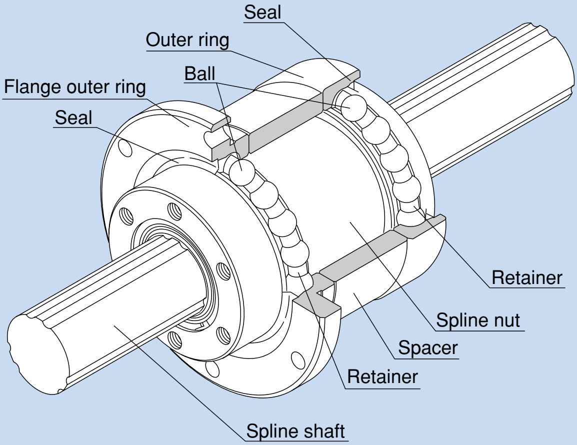


Fig. 1 Structure of Rotary Ball Spline Model LTR

Structure and Features

With rotary Ball Spline model LTR, the spline shaft has three crests on the circumference, and along both sides of each crest, two rows of balls (six rows in total) are arranged to hold the crest so that a reasonable preload is applied.
Angular-contact ball raceways are machined on the outer surface of the spline nut to constitute support bearings, allowing the whole body to be compactly and lightly designed.
The rows of balls are held in a special resin retainer so that they smoothly roll and circulate. With this design, balls will not fall even if the spline shaft is removed.
In addition, a dedicated seal for preventing foreign matter from entering the support bearings is available.

●No Angular Backlash

Two rows of balls facing one another hold a crest, formed on the circumference of the spline nut, at a contact angle of 20° to provide a preload in an angular-contact structure. This eliminates an angular backlash in the rotational direction and increases the rigidity.

●Compact design

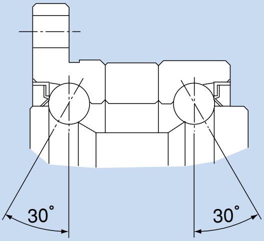
The spline nut is integrated with the support bearings, allowing highly accurate, compact design to be achieved.

●Easy installation

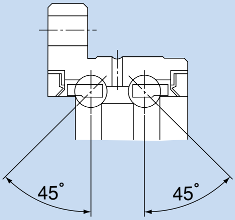
This ball spline can easily be installed by simply securing it to the housing using bolts.

●High Rigidity

Since the contact angle is large and an appropriate preload is given, high rigidity against torque and moment is achieved. The support bearing has a contact angle of 30° to secure high rigidity against a moment load, thus to achieve a rigid shaft support.
Model LTR-A, a compact type of LTR, has a contact angle of 45°.



Model LTR



Model LTR-A

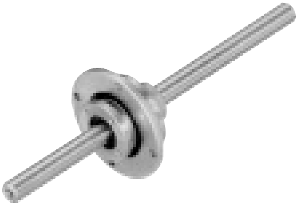
Types and Features

●Types of Spline Nuts

Ball Spline Model LTR

A compact unit type whose support bearings are directly integrated with the outer surface of the spline nut.

Ball Spline Model LTR-A



A compact type even smaller than LTR.

●Types of Spline Shafts

For details on spline shaft types, see page b-45.

Housing Inner-diameter Tolerance

For the housing inner-diameter tolerance for model LTR, class H7 is recommended.

Spline Shaft

Spline shafts are divided in shape into precision solid spline shaft, special spline shaft and hollow spline shaft (types K and N), as described on page b-45.
Since production of a spline shaft with a specific shape is performed at your request, provide a drawing of the desired shaft shape when asking an estimate or placing an order.

●Sectional Shape of the Spline Shaft

Table 1 shows the sectional shape of a spline shaft. If the spline shaft ends need to be cylindrical, the minor diameter (d) value should not be exceeded if possible.

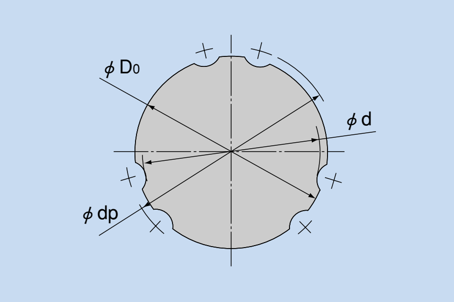


Table 1 Sectional Shape of the Spline Shaft

Unit: mm

Nominal shaft diameter	8	10	16	20	25	32	40	50	60
Minor diameter d	7	8.5	14.5	18.5	23	30	37.5	46.5	56.5
Major diameter D_0 h7	8	10	16	20	25	32	40	50	60
Ball center diameter dp	9.3	11.5	17.8	22.1	27.6	35.2	44.2	55.2	66.3
Mass (kg/m)	0.4	0.62	1.6	2.5	3.9	5.6	9.9	15.5	22.3

●Hole Shape of the Standard Hollow Type Spline Shaft

Table 2 shows the hole shape of the standard hollow type spline shaft (types K and N). Use this table when a requirement such as piping, wiring, air-vent or weight reduction needs to be met.

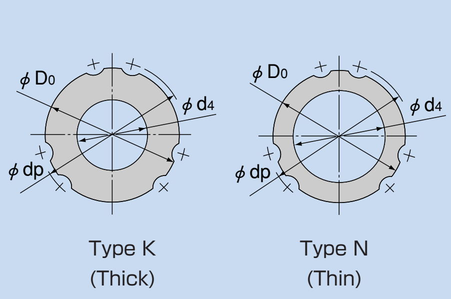


Table 2 Sectional Shape of the Standard Hollow Type Spline Shaft

Unit: mm

Nominal shaft diameter		8	10	16	20	25	32	40	50	60
Major diameter D_0		8	10	16	20	25	32	40	50	60
Ball center diameter dp		9.3	11.5	17.8	22.1	27.6	35.2	44.2	55.2	66.3
Type K	Hole diameter d_4	3	4	7	10	12	18	22	25	32
	Mass (kg/m)	0.35	0.52	1.3	1.8	3	4.3	6.9	11.6	16
Type N	Hole diameter d_4	—	—	11	14	18	23	29	36	—
	Mass (kg/m)	—	—	0.8	1.3	1.9	3.1	4.7	7.4	—

Note: The standard hollow type Spline Shaft is divided into types K and N. Indicate "K" or "N" at the end of the model number to distinguish between them when placing an order.

●Chamfering of the Spline Shaft Ends

For details of chamfering of the spline nut ends, see page b-24.

●Length of Incomplete Section of a Special Spline Shaft

If the middle area or the end of a spline shaft is to be thicker than the minor diameter (d), an incomplete spline section is required to secure a recess for grinding. Table 3 shows the relationship between the length of the incomplete section (S) and the flange diameter (df). (This table does not apply to overall length of 1,500 mm or greater. Contact THK for details.)

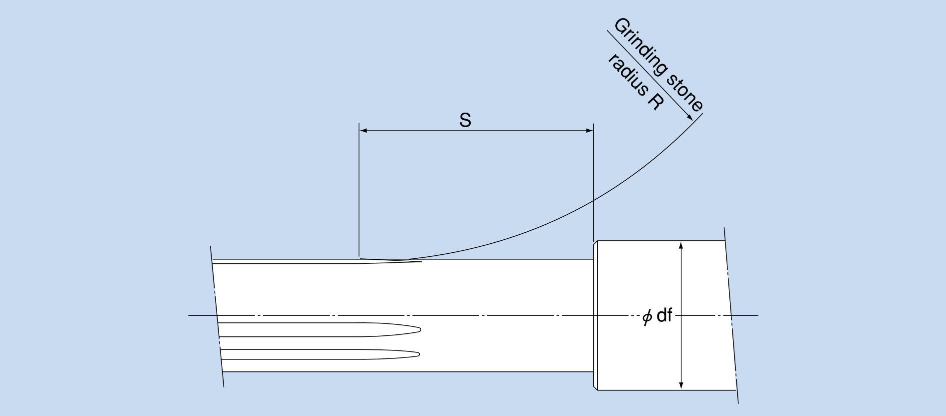


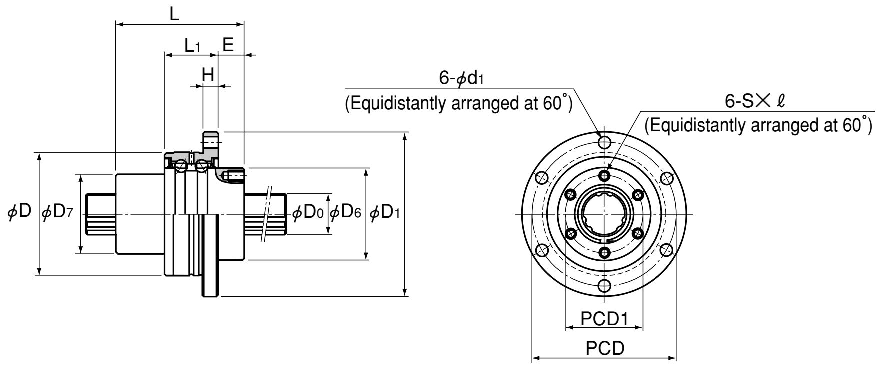
Table 3 Length of Incomplete Spline Section: S

Unit: mm

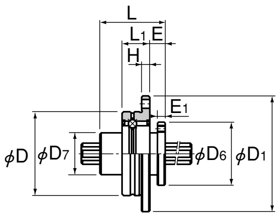
Flange diameter df / Nominal shaft diameter	6	8	10	13	16	20	25	30	40	50	60	80	100	120	140	160
8	—	16	24	30	35	—	—	—	—	—	—	—	—	—	—	—
10	—	—	17	27	32	37	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	21	36	46	54	—	—	—	—	—	—	—	—
20	—	—	—	—	—	21	38	48	62	—	—	—	—	—	—	—
25	—	—	—	—	—	—	23	39	56	67	—	—	—	—	—	—
32	—	—	—	—	—	—	—	24	49	62	72	—	—	—	—	—
40	—	—	—	—	—	—	—	—	27	50	63	81	—	—	—	—
50	—	—	—	—	—	—	—	—	—	29	51	74	89	—	—	—
60	—	—	—	—	—	—	—	—	—	—	28	56	71	82	—	—

Models LTR-A

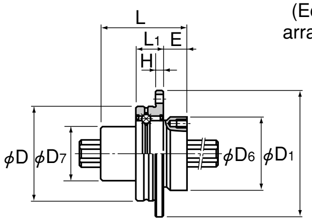
Compact type



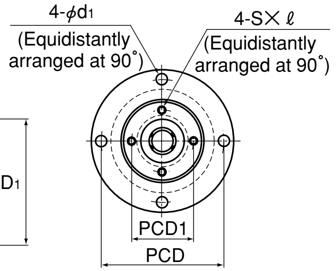
Model LTR16A or greater



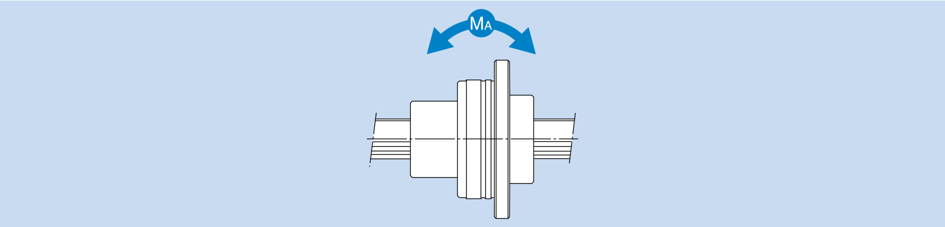
Model LTR8A



Model LTR10A



Model LTR8A Model LTR10A



Unit: mm

Model No.	Spline nut dimensions														Spline shaft diameter		Basic torque rating		Basic load rating		Permissible static moment	Support bearings basic load rating		Mass	
	Outer diameter		Length	Flange diameter																					
	D	Tolerance	L	D_1	D_6 h7	D_7	H	L_1	E	E_1	PCD	PCD1	S×ℓ	d_1	D_0 h7	No. of rows of balls	C_T N·m	C_{0T} N·m	C KN	C_0 KN	M_A* N·m	C kN	C_0 kN	Spline nut kg	Spline shaft kg/m
LTR 8A	32	−0.009 −0.025	25	44	24	16	3	10.5	6	3	38	19	M2.6×3	3.4	8	4	1.96	2.94	1.47	2.55	5.9	0.69	0.24	0.08	0.4
LTR 10A	36		33	48	28	21	3	10.5	9	—	42	23	M3×4	3.4	10	4	3.92	7.84	2.84	4.9	15.7	0.77	0.3	0.13	0.62
LTR 16A	48		50	64	36	31	6	21	10	—	56	30	M4×6	4.5	16	6	31.3	34.3	7.05	12.6	67.6	6.7	6.4	0.35	1.6
LTR 20A	56	−0.010 −0.029	63	72	43.5	35	6	21	12	—	64	36	M5×8	4.5	20	6	56.8	55.8	10.2	17.8	118	7.4	7.8	0.51	2.5
LTR 25A	66		71	86	52	42	7	25	13	—	75	44	M5×8	5.5	25	6	105	103	15.2	25.8	210	9.7	10.6	0.79	3.9
LTR 32A	78		80	103	63	52	8	25	17	—	89	54	M6×10	6.6	32	6	180	157	20.5	34	290	10.5	12.5	1.25	5.6
LTR 40A	100	−0.012 −0.034	100	130	79.5	64	10	33	20	—	113	68	M6×10	9	40	6	418	377	37.8	60.4	687	16.5	20.7	2.51	9.9

***Note** M_A indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

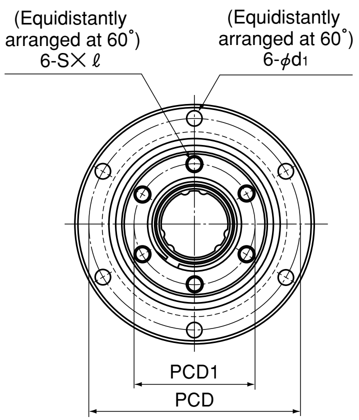
Model number coding

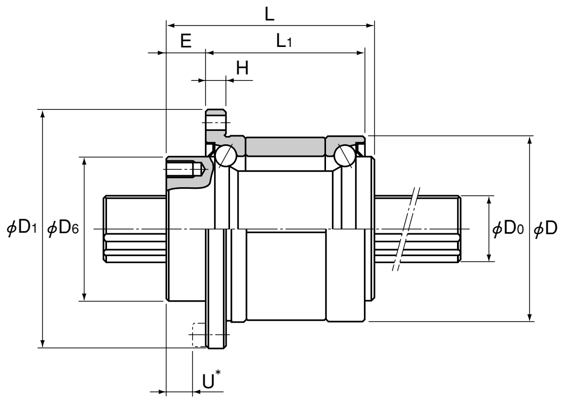
2	LTR32A	K	UU	ZZ	CL	+500L	P	K
1	2	3	4	5	6	7	8	9

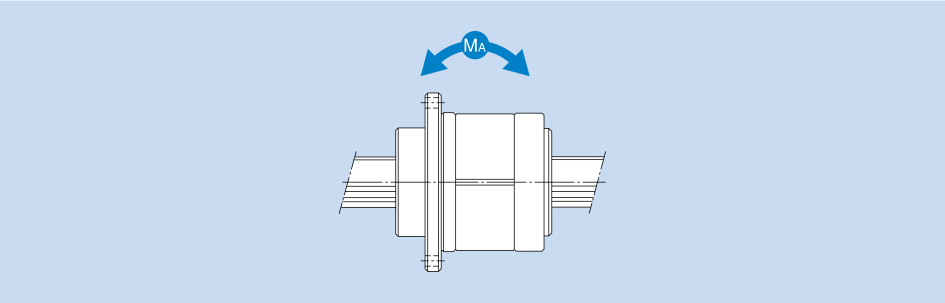
1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Flange orientation symbol - no symbol: standard; K: flange inversed
4 Spline nut dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
5 Support bearings dust prevention accessory symbol - no symbol: without seal
ZZ: rubber seal attached on both ends of support bearings
Z: rubber seal attached on either end of support bearings

6 Symbol for clearance in the rotational direction (see page b-4)
7 Overall spline shaft length (in mm)
8 Accuracy symbol (see page b-5)
9 Symbol for standard hollow spline shaft (see page b-69) (no symbol: solid spline shaft)

Models LTR







Unit: mm

Model No.	Spline nut dimensions													Spline shaft diameter		Basic torque rating		Basic load rating		Permissible static moment	Support bearings basic load rating		Mass	
	Outer diameter		Length	Flange diameter																				
	D	Tolerance	L	D_1	D_6 h7	H	L_1	E	PCD	PCD1	S×ℓ	d_1	U*	D_0 h7	No. of rows of balls	C_T N·m	C_{0T} N·m	C KN	C_0 KN	M_A* N·m	C kN	C_0 kN	Spline nut kg	Spline shaft kg/m
LTR 16	52	0 −0.007	50	68	39.5	5	37	10	60	32	M5×8	4.5	5	16	6	31.4	34.3	7.06	12.6	67.6	12.7	11.8	0.51	1.6
LTR 20	56		63	72	43.5	6	48	12	64	36	M5×8	4.5	7	20	6	56.9	55.9	10.2	17.8	118	16.3	15.5	0.7	2.5
LTR 25	62		71	78	53	6	55	13	70	45	M6×8	4.5	8	25	6	105	103	15.2	25.8	210	17.6	18	0.93	3.9
LTR 32	80		80	105	65.5	9	60	17	91	55	M6×10	6.6	10	32	6	180	157	20.5	34	290	20.1	24	1.8	5.6
LTR 40	100	0 −0.008	100	130	79.5	11	74	23	113	68	M6×10	9	13	40	6	419	377	37.8	60.5	687	37.2	42.5	3.9	9.9
LTR 50	120		125	156	99.5	12	97	25	136	85	M10×15	11	13	50	6	842	769	60.9	94.5	1340	41.7	54.1	6.7	15.5
LTR 60	134	0 −0.009	140	170	115	12	112	25	150	100	M10×15	11	13	60	6	1220	1040	73.5	111.7	1600	53.1	68.4	8.8	22.3

***Note** M_A indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.
Dimension U represents the dimension from the head of the hexagon socket screw to the spline nut end.

Model number coding

2 LTR50 K UU ZZ CM +1000L H K

1 2 3 4 5 6 7 8 9

1 Number of spline nuts on one shaft (no symbol for one nut)
2 Model No.
3 Flange orientation symbol - no symbol: standard; K: flange inversed
4 Spline nut dust prevention accessory symbol - no symbol: without seal
UU: rubber seal attached on both ends of spline nut
U: rubber seal attached on either end of spline nut
5 Support bearings dust prevention accessory symbol - no symbol: without seal
ZZ: rubber seal attached on both ends of support bearings
Z: rubber seal attached on either end of support bearings

6 Symbol for clearance in the rotational direction (see page b-4)
7 Overall spline shaft length (in mm)
8 Accuracy symbol (see page b-5)
9 Symbol for standard hollow spline shaft (see page b-69) (no symbol: solid spline shaft)

Linear Bush

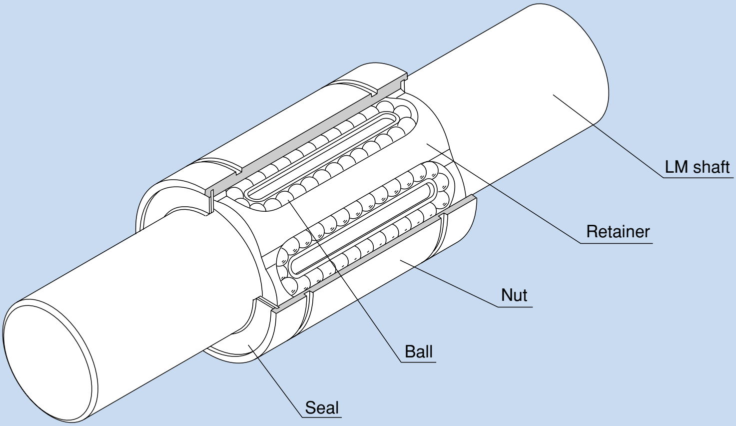


Fig. 1 Structure of Linear Bush Model LM ··· UU

Structure and Features

Linear Bush model LM is a linear motion system used in combination with a cylindrical LM shaft to perform infinite linear motion. The balls under a load are in point contact with the LM shaft. This allows linear motion with minimal friction resistance and achieves highly accurate and smooth motion despite, the small permissible load.

The nut uses high-carbon chromium bearing steel and its outer and inner surfaces are ground after being heat-treated.

●Interchangeability

Since the dimensional tolerances of the Linear Bush's components are standardized, they are interchangeable. The LM shaft is machined through cylindrical grinding, which can easily be performed, and it allows highly accurate fitting clearance to be achieved.

●Highly accurate retainer plate

Since the retainer, which guides three to eight rows of balls, is integrally molded, it is capable of accurately guiding the balls in the traveling direction and achieving stable running accuracy.

Small-diameter types use integrally molded retainers made of synthetic resin. It reduces noise generated during operation and allows superb lubrication.

●Wide array of types

A wide array of types are available, such as standard type, clearance-adjustable type, open type, long type and flanged LM case unit, allowing the user to select a type that meets the intended use.

Applications

The Linear Bush is used in a wide array of applications such as precision equipment including OA equipment and peripherals, measuring machines, automatic recorder and digital 3D measurement machine, and the slide units of industrial machinery including multi-axis drilling machine, punching press, tool grinder, automatic gas cutting machine, printing machine, card selector and food packing machine.

Types and Features

Standard Type

With the Linear Bush nut having the most accurate cylindrical shape, this type is widely used.

There are two series of the Linear Bush in dimensional group.

Type LM	Millimeter-dimension series used most widely in Japan
Type LM-MG	Stainless steel version of type LM
Type ME	Millimeter-dimension series commonly used in Europe

Seal Type

This type has the same dimensions as the standard type, but a special synthetic rubber seal is incorporated into both ends or either end of the linear bush, thus to prevent foreign matter from entering the linear bush and minimize leaking of the grease.

Models LM ··· UU/LME ··· UU/LM ··· MGUU

(The symbol for type with its one side having a seal: "U")

A seal is also available for some of the clearance-adjustable types and the open types.

Long Type

Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present and reduces man-hours in installation.

Model LM-L ········· standard type

Open Type

The nut is partially cut open by one row of balls (50° to 80°). This enables the Linear Bush to be used even in locations where the LM shaft is supported by a column or fulcrum. In addition, a clearance can easily be adjusted.

Types LM-OP/LME-OP

Type LM-MG-OP

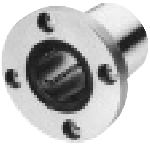
Clearance-adjustable Type

This type has the same dimensions as the standard type, but the nut has a slit in the direction of the LM shaft. This allows the linear bush to be installed in a housing whose inner diameter is adjustable, and enables the clearance between the LM shaft and the housing to easily be adjusted.

Models LM-AJ/LME-AJ

Model LM-MG-AJ

Flanged Type (Circular)

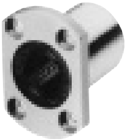


The nut of the standard type Linear Bush is integrated with a flange. This enables the Linear Bush to be directly mounted onto the housing with bolts, thus achieving easy installation.
Model LMF ············ standard type
Model LMF-M ········· made of stainless steel

Flanged Type (Circular) - Long

The nut of the long type Linear Bush is integrated with a flange. This enables the Linear Bush to be directly mounted onto the housing with bolts, thus achieving easy installation. Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present.
Model LMF-L ············ standard type
Model LMF-ML ········· made of stainless steel

Flanged Type (Small)



The nut is integrated with a small flange. Since the height is lower than model LMK, compact design is allowed. Since the rows of balls in the Linear Bush are arranged so that two rows receive the load from the flat side, a long service life can be achieved.
Model LMH ········· standard type

Flanged Type (Square)

Like model LMF, this type also has a flange, but the flange is cut to a square shape. Since the height is lower than the circular flange type, compact design is allowed.
Model LMK ············ standard type
Model LMK-M ········· made of stainless steel

Flanged Type (Square) - Long

Like model LMF-L, this type also has a flange, but the flange is cut to a square shape. Since the height is lower than the circular flange type, compact design is allowed.
Model LMK-L ············ standard type
Model LMK-ML ········· made of stainless steel

Flanged Type (Small) - Long

The flange is smaller and lower than model LMK-L, allowing compact design. Containing two units of the standard retainer plate, this type is optimal for locations where a moment load is present. Since the rows of balls in the Linear Bush are arranged so that two rows receive the load from the flat side, a long service life can be achieved.
Model LMH-L ········· standard type

LM Case Unit Type Model SC

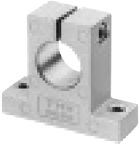
It is a case unit where the standard type of Linear Bush is incorporated into a small, lightweight aluminum casing. This model can easily be mounted simply by securing it to the table with bolts.

LM Case Unit Type Model SH

Flexibly mountable type

It is a case unit where the standard type of Linear Bush is incorporated into a smaller and lighter aluminum casing than model SC. This model allows even more compact design than model SC. It also has flexibility in mounting orientation. Additionally, it is structured so that two rows of balls receive the load from the top of the casing, allowing a long service life to be achieved.

LM Shaft Support Type Model SK



An aluminum-made light fulcrum for securing an LM shaft. The LM shaft mounting section has a slit, enabling the linear bush to firmly secure an LM shaft using bolts.

LM Case Unit Type (Long) Model SL

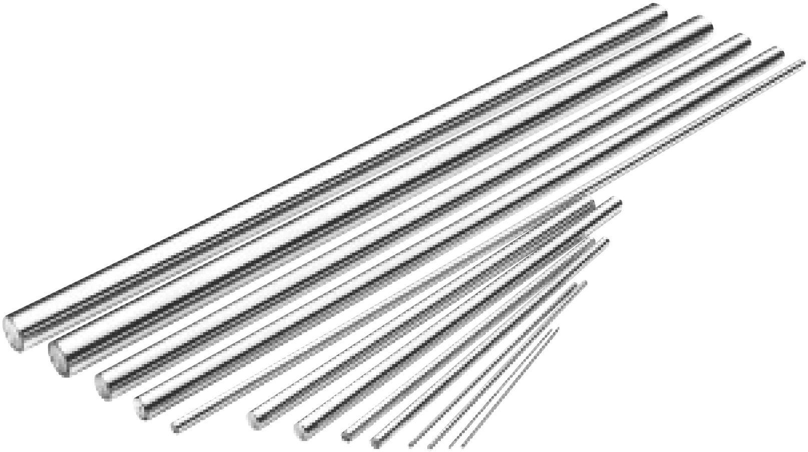
A long version of model SC, this model contains two units of the standard type Linear Bush in an aluminum casing.

LM Case Unit Type (Long) Model SH-L

Flexibly mountable type

A long version of model SH, this model is a case unit that contains two units of the standard type Linear Bush in an aluminum casing.

Standard LM Shafts



THK manufactures high quality, dedicated LM shafts for Linear Bush model LM series in short delivery time.

Build-to-order LM Shafts

THK also manufactures hollow LM shafts and those LM shafts with their ends specially treated like ones shown in the photo at your request.

Accuracy Standards

The accuracy of the Linear Bush in inscribed circle diameter, outer diameter, width and eccentricity is described in the corresponding dimensional table. The accuracy of model LM in inscribed circle diameter and eccentricity is classified into high grade (no symbol) and precision grade (P) (accuracy symbol is expressed at the end of each model number).
The accuracy of clearance-adjustment type (-A-J) and open type (-OP) in inscribed circle diameter and eccentricity indicates the value before division.

Dedicated Shafts for Model LM

The LM shaft of the Linear Bush needs to be manufactured with much consideration for hardness, surface roughness and dimensional accuracy of the shaft since balls roll directly on it.
THK manufactures dedicated LM shafts for the Linear Bush. See the dimensional table for standard LM shafts on page c-11.
Among other factors, the surface hardness of an LM shaft affects the service life of your Linear Bush system most significantly. Therefore, take much care in selecting a material and a heat treatment method when assembling the system. In addition, as the surface hardness of the LM shaft greatly affects the service life as stated above, use care in selecting and/or handling a material and heat treatment.

●Material

Generally, the following materials are used as suitable for surface hardening through induction quenching.

SUJ2	(JIS G 4805, high-carbon chromium bearing steel)
SK3 to 6	(JIS G 4401, carbon tool steel)
S55C	(JIS G 4051, carbon steel for machine structural use)

For special applications, martensitic stainless steel SUS440C, which is corrosion resistant, may also be used.

●Hardness

We recommend surface hardness of 58 HRC (≒ 653 HV) or higher. The depth of the hardened layer is determined by the size of the Linear Bush; we recommend approximately 2 mm for general use.

●Roughness of the surface

To achieve smooth motion, the surface should preferably be finished to 0.40a or less.

●Dimensions of a Hollow LM Shaft

If a hollow LM shaft is required for purposes such as weight reduction, use the desired material from table 1 of dimensions of hollow LM shafts that THK keeps in stock.
Models marked with "**" are build-to-order items.

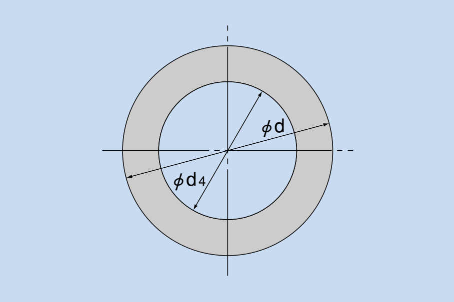


Table 1 Dimensions of Hollow LM Shafts

Unit: mm

Model No.	LM shaft outer diameter d	Inner diameter d_4	Mass (kg/m)
LM 8	8	3	0.4
LM 10	10	4	0.6
LM 12	12	6	0.7
LM 13	13	7	0.8
LM 16	16	9	1.1
LM 20	20	10	1.9
LM 20	20	14	1.3
LM 25	25	15	2.5
LM 30	30	16	4
LM 35	35	20	5.1
**LM 38	38	22	6
LM 40	40	22	6.9
LM 50	50	25	11.6
LM 60	60	32	16
**LM 80	80	52.5	22.6
**LM 100	100	67.5	33.7

Standard LM Shafts

THK manufactures high quality, dedicated LM shafts for Linear Bush model LM series in short delivery time.

Model number coding SF25 g6 -500L K

1 2 3 4

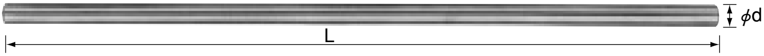
1 Model number
2 LM shaft outer diameter tolerance
3 Overall LM shaft length (in mm)
4 Special symbol - no symbol: solid shaft;
K : standard hollow shaft
M: special material;
F : with surface treatment
*If two or more symbols are given, they are shown in an alphabetical order.

① ·Major materials: THK5SP (THK standard material)
SUJ2 (high-carbon chromium bearing steel)
·Hardness: HRC58 to 64
·Hardened layer depth: 0.8 to 2.5 mm (varies with shaft diameter)
·Surface roughness: 0.20a to 0.40a
·Straightness of the LM shaft: 50 μm/300 mm or less

② Precision-grade LM shafts with shaft diameter tolerance of g5 or h5 are also manufactured as standard.

③ Corrosion-resistant, martensitic stainless steel LM shafts are also available.

④ When asking an estimate or placing an order, refer to the model number coding shown on the left.



Model No.	Shaft diameter d	Tolerance g6μm	Overall LM shaft length: L mm 100	200	300	400	500	600	700	800	1000	1200	1300	1500	2000	3000	Supported model
SF 3	3	−2 −8	◎	◎													LM 3
SF 4	4	−4 −12	◎	◎													LM 4
SF 5	5		◎	◎	◎												LM 5
SF 6	6		◎	◎	◎	◎											LM 6
SF 8	8	−5 −14	◎	◎	◎	◎	◎										LM 8, 8S
SF 10	10		◎	◎	◎	◎	◎	◎	◎	◎							LM 10
SF 12	12	−6 −17		◎	◎	◎	◎	◎		◎	◎						LM 12
SF 13	13		◎	◎	◎	◎	◎	◎	◎	◎	◎						LM 13
SF 16	16		◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		◎			LM 16
SF 20	20	−7 −20		◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎			LM 20
SF 25	25			◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎			LM 25
SF 30	30				◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		LM 30
SF 35	35	−9 −25					◎	◎		◎	◎	◎		◎	◎		LM 35
SF 38	38							○			○	○			○		LM 38
SF 40	40						◎	◎	◎	◎	◎	◎	◎	◎	◎	○	LM 40
SF 50	50						◎	◎		◎	◎	◎	◎	◎	◎	○	LM 50
SF 60	60	−10 −29									○	○			○	○	LM 60
SF 80	80										○	○			○	○	LM 80
SF 100	100	−12 −34									○	○			○	○	LM 100

Note: ◎ indicates standard stock; ○ indicates semi-standard stock.

Specially Machined Types

THK also supports special machining processes such as tapping, milling, threading, through drilling and joggling, as shown in the figure below, at your request.

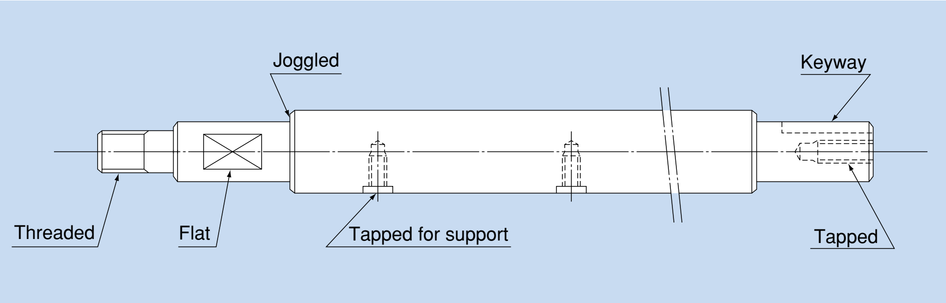


Table of Rows of Balls and Masses for Clearance-adjustable Types and Open Types of the Linear Bush

Shaft diameter	Clearance-adjustable type			Open type		
	Model No.	Rows of balls	Mass g	Model No.	Rows of balls	Mass g
6	LM 6-AJ	4	7.8	—	—	—
8	LM 8S-AJ	4	10	—	—	—
	LM 8-AJ	4	14.7	—	—	—
10	LM 10-AJ	4	29	—	—	—
12	LM 12-AJ	4	31	LM 12-OP	3	25
13	LM 13-AJ	4	42	LM 13-OP	3	34
16	LM 16-AJ	5(4)	68	LM 16-OP	4(3)	52
20	LM 20-AJ	5	85	LM 20-OP	4	69
25	LM 25-AJ	6(5)	216	LM 25-OP	5(4)	188
30	LM 30-AJ	6	245	LM 30-OP	5	210
35	LM 35-AJ	6	384	LM 35-OP	5	350
38	LM 38-AJ	6	475	LM 38-OP	5	400
40	LM 40-AJ	6	579	LM 40-OP	5	500
50	LM 50-AJ	6	1560	LM 50-OP	5	1340
60	LM 60-AJ	6	1820	LM 60-OP	5	1650
80	LM 80-AJ	6	4320	LM 80-OP	5	3750
100	LM 100-AJ	6	8540	LM 100-OP	5	7200
120	LM 120-AJ	8	14900	LM 120-OP	6	11600

Note: The numbers of ball rows in the table apply to types using a resin retainer. Those of types using a metal retainer are indicated in parentheses.

Selection by Service Environment

●Lubrication

The Linear Bush operates using grease or oil lubrication.

■Grease Lubrication

When installing a type attached with seals on both sides (··· UU) to the LM shaft, apply grease to rows of balls in the Linear Bush.
When installing a standard type (without seal), perform the same as above or apply grease to the LM shaft.
Afterward, replenish grease of the same type as necessary according to the service conditions.
For grease, we recommend high-quality lithium-soap group grease No. 2.

■Oil Lubrication

Turbine oil, machine oil and spindle oil are commonly used.
When oiling the Linear Bush, drop oil on the LM shaft, or infuse it from the greasing hole on the housing as shown in Fig. 2.

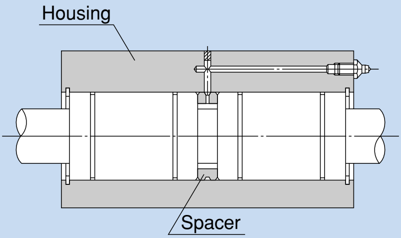


Fig. 2

●Dust Prevention

Entrance of dust or other foreign matter into the Linear Bush will cause abnormal wear or shorten the service life. When entrance of dust or other foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions.
For the Linear Bush, a special synthetic rubber seal that is highly resistant to wear and a felt seal (highly dust preventive with low seal resistance) are available as dust prevention accessories.
In addition, THK produces round bellows. Contact us for details.

■Felt Seal Model FLM

Linear Bush model LM series include types equipped with a special synthetic rubber seal (LM ···UU, U). If desiring to have an additional dust prevention measure, or desiring to lower the seal resistance, use the felt seal model FLM (see table 5 on page c-20).

Material and Surface Treatment

For the Linear Bush and the LM shaft, stainless steel types are available for some models. It is also possible to provide surface treatment to the LM shaft. However, surface treatment may not be suitable for some types. Contact THK for details.

Assembling the Linear Bush

Housing Inner-diameter Dimensions

Table 2 shows housing inner-diameter tolerances recommended for the Linear Bush. When fitting the Linear Bush with the housing, clearance fitting is normally recommended. If the clearance needs to be smaller, provide transition fitting.

Table 2 Housing Inner-diameter Tolerance

Type		Housing	
Model No.	Accuracy	Clearance fitting	Transition fitting
LM	High grade (no symbol)	H7	J7
	Precision grade (P)	H6	J6
LME	—	H7	K6,J6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	High grade (no symbol)	H7	J7

Clearance between the Nut and LM Shaft

When using the Linear Bush with an LM shaft in combination, normal clearance applies. If the clearance needs to be smaller, close clearance applies.

Note 1: If the clearance after installation is to be negative, it is preferable not to exceed the radial clearance tolerance indicated in the dimensional table.

Note 2: The tolerance of the shaft for case unit models SC, SL, SH and SH-L falls under high grade (no symbol).

Table 3. Shaft Outer-diameter Tolerance

Type		LM shaft	
Model No.	Accuracy	Normal clearance	Close clearance
LM	High grade (no symbol)	f6, g6	h6
	Precision grade (P)	f5, g5	h5
LME	—	h7	k6
LMF LMK LMH LM-L LMF-L LMK-L LMH-L	High grade (no symbol)	f6, g6	h6

●Installing the Nut

Although the Linear Bush does not require a large strength for securing it in the LM shaft direction, do not support the nut only with driving fitting.

For the housing inner-diameter tolerance, see table 2.

■Installing the Standard Type

Figures 3 and 4 show examples of installing the standard type Linear Bush.

When securing the Linear Bush, use snap rings or stopper plates.

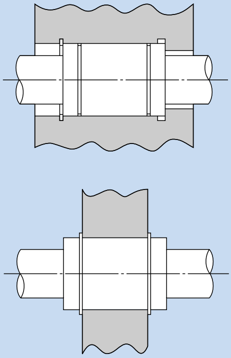


Fig. 3 Snap Ring

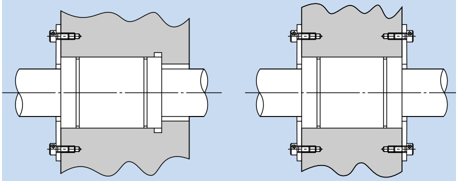


Fig. 4 Stopper Plate

Snap Ring for Installation

To secure Linear Bush model LM, snap rings indicated in table 4 are available.

Note 1: For models indicated with parentheses, use C-shape concentric snap rings.
Note 2: The table commonly applies to models LM, LM-GA, LM-MG and LM-L.

Table 4 Types of Snap Rings

Model No.	Snap ring			
	For outer surface		For inner surface	
	Needle snap ring	C-shape snap ring	Needle snap ring	C-shape snap ring
LM 3	—	—	AR 7	—
4	—	—	8	—
5	WR 10	10	10	10
6	12	12	12	12
8	—	15	15	15
8S	—	15	15	15
10	19	19	19	19
12	21	21	21	21
13	23	22	23	—
16	28	—	28	28
20	32	—	32	32
25	40	40	40	40
30	45	45	45	45
35	52	52	52	52
38	—	56・58	57	—
40	—	60	60	60
50	—	80	80	80
60	—	90	90	90
80A	—	120	120	120
100A	—	(150)	150	—
120A	—	(180)	180	—

Setscrews Not Allowed

Securing the nut by pressing the outer surface with one setscrew as shown in Fig. 5 will cause the nut to be deformed.

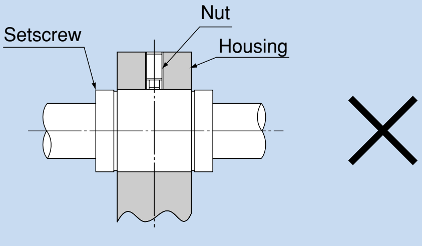
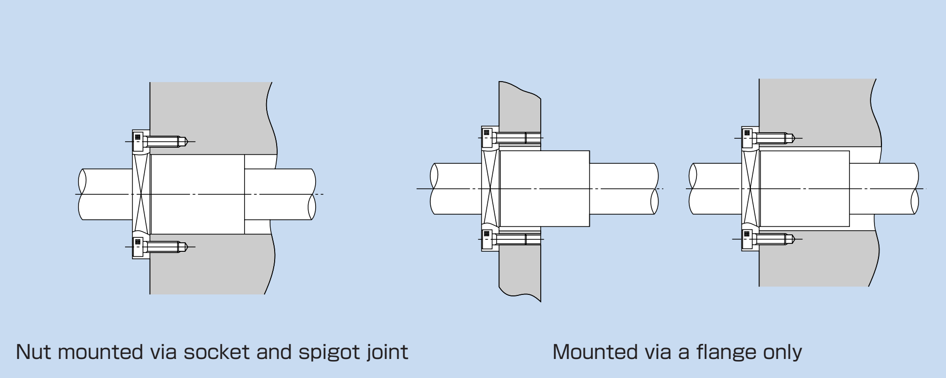


Fig. 5

■Installing a Flanged Type

With models LMF, LMK and LMH, the nut is integrated with a flange. Therefore, the Linear Bush can be mounted only via the flange.



Nut mounted via socket and spigot joint

Mounted via a flange only

■Installing a Clearance-adjustable Type

To adjust the clearance of a clearance-adjustable type (-AJ), use a housing that allows adjustment of the nut outer diameter so as to facilitate the adjustment of the clearance between the Linear Bush and the LM shaft. Positioning the slit of the Linear Bush at an angle of 90° with the housing's slit will provide uniform deformation in the circumferential direction (see Fig. 6).

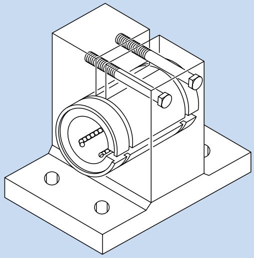


Fig. 6

■Installing an Open Type

For an open type (-OP), also use a housing that allows adjustment of the nut outer diameter as shown in Fig. 7.

Open types are normally used with a light preload. Be sure not to give an excessive preload.

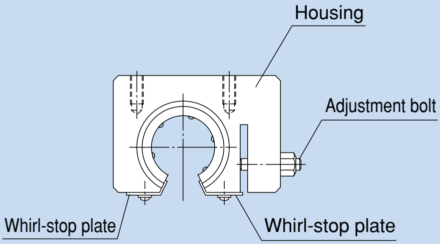
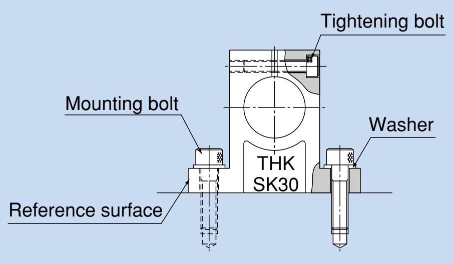


Fig. 7

●Installing the Shaft Support

Shaft support model SK can easily be secured to the table using mounting bolts. Model SK enables the LM shaft to firmly be secured using tightening bolts.



●Installing an LM Case Unit

■Attaching Model SC (SL)

Since models SC and SL can be attached from the top or bottom by simply tightening it using bolts, the installation time can be shortened (see Fig. 8).

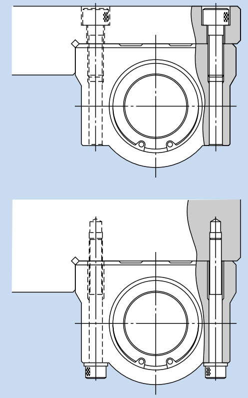


Fig. 8

■Attaching Model SH (SH-L)

Since models SH and SHL can be attached from the top or bottom by simply tightening it using bolts, the installation time can be shortened (see Fig. 9).

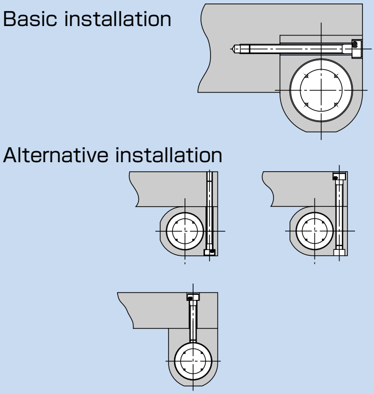
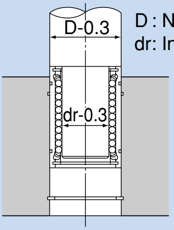


Fig. 9

●Incorporating the Nut

When incorporating the standard Linear Bush into a housing, use a jig and drive in the nut, or use a flatter plate and gently hit the nut, instead of directly hitting the side plate or the seal (see Fig. 10).



D : Nut outer diameter
dr: Inscribed circle diameter

Fig. 10

●Inserting the LM Shaft

When inserting the LM shaft into the Linear Bush, align the center of the shaft with that of the nut and gently insert the shaft straightforward into the nut. If the shaft is slanted while it is inserted, balls may fall off or the retainer may be deformed (see Fig. 11).

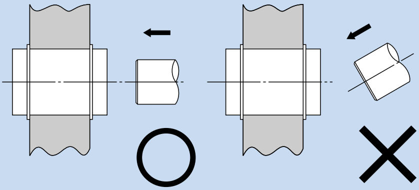


Fig. 11

●When Under a Moment Load

When using the Linear Bush, make sure the load is evenly distributed on the whole ball raceway. In particular, if a moment load is applied, use two or more Linear Bush units on the same LM shaft and secure an adequately large distance between the units.

If using the Linear Bush under a moment load, also calculate the equivalent radial load and identify the correct model number (see page C-11 of the "THK General Catalog - Technical Descriptions of the Products," provided separately).

●Rotational Use Not Allowed

The Linear Bush is not suitable for rotational use for a structural reason (see Fig. 12).
Forcibly rotating it may cause an unexpected accident.

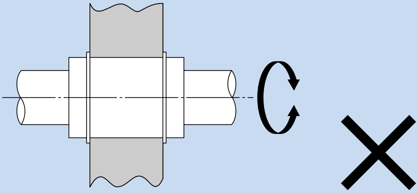


Fig. 12

●Precautions on Installing an Open Three-ball-row Type Linear Bush

When installing an open three-ball-row type Linear Bush, mount it while taking into account the load distribution as indicated in Fig. 13.

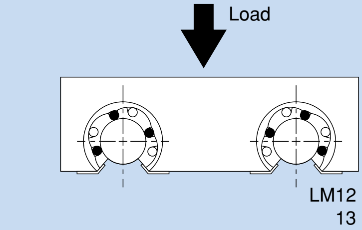
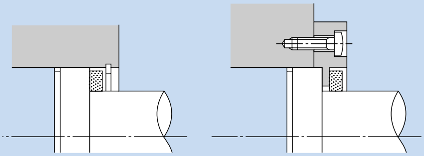


Fig. 13

●Attaching Felt Seal Model FLM

The felt seal can be press-fit into a housing finished to H7, but cannot be used as a stopper for preventing the Linear Bush from coming off. Be sure to use the felt seal by attaching it as indicated in the figure on the right.

Also make sure to impregnate the felt with sufficient lubricant before attaching it.



■Dimensions of the Felt Seal

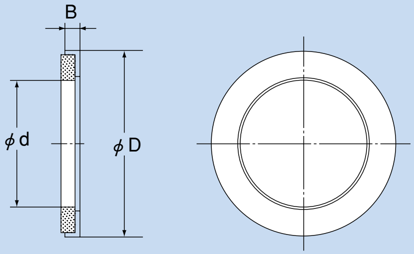
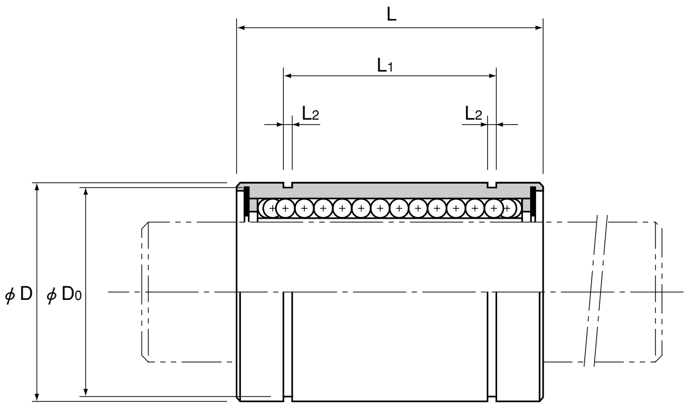


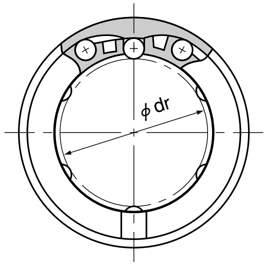
Table 5 Major Dimensions of FLM

Unit: mm

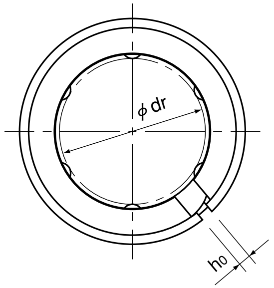
Applicable model No.	Major dimensions			Supported Linear Bush model
	d	D	B	
FLM 6	6	12	2	LM 6
FLM 8	8	15	2	LM 8
FLM 10	10	19	3	LM 10
FLM 12	12	21	3	LM 12
FLM 13	13	23	3	LM 13
FLM 16	16	28	4	LM 16
FLM 20	20	32	4	LM 20
FLM 25	25	40	5	LM 25
FLM 30	30	45	5	LM 30
FLM 35	35	52	5	LM 35
FLM 38	38	57	5	LM 38
FLM 40	40	60	5	LM 40
FLM 50	50	80	10	LM 50
FLM 60	60	90	10	LM 60
FLM 80	80	120	10	LM 80
FLM 100	100	150	10	LM 100

Model LM

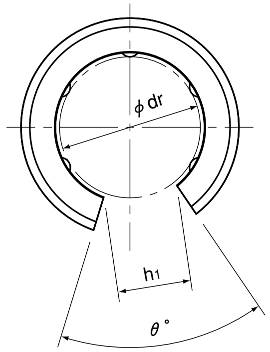




Model LM



Model LM-AJ



Model LM-OP

Unit: mm

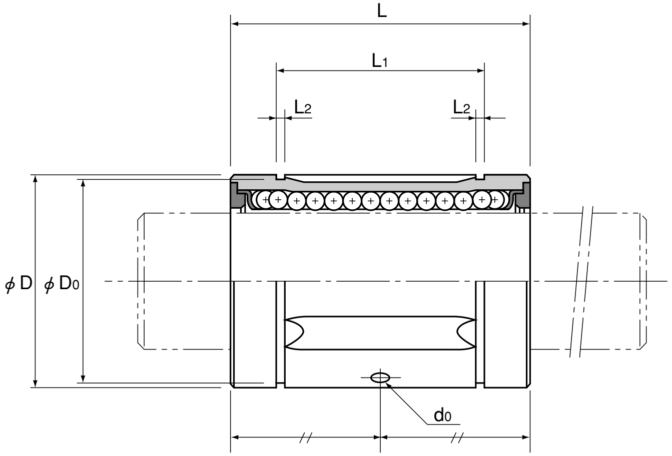
Model No.			Ball rows	Mass g	Major dimensions														Eccentricity (max) µm		Radial clearance tolerance	Basic load rating	
					Inscribed circle diameter			Outer diameter		Length													
Standard type	Clearance-adjustable type	Open type			dr	Tolerance Precision	Tolerance High	D	Tolerance Precision/high	L	Tolerance	L1	Tolerance	L2	D0	h0	h1	θ°	Precision	High	µm	C N	C0 N
LM 3	—	—	4	1.4	3	0 −0.005	0 −0.008	7	0 −0.009	10	0 −0.12	—	—	—	—	—	—	—	4	8	− 2	88.2	108
LM 4	—	—	4	1.9	4			8		12		—	—	—	—	—	—	—	4	8	− 3	88.2	127
LM 5	—	—	4	4	5			10		15		10.2	0 −0.2	1.1	9.6	—	—	—	4	8	− 3	167	206
LM 6	LM 6-AJ	—	4	8	6	0 −0.006	0 −0.009	12	0 −0.011	19	0 −0.2	13.5		1.1	11.5	1	—	—	8	12	− 5	206	265
LM 8S	LM 8S-AJ	—	4	11	8			15		17		11.5		1.1	14.3	1	—	—	8	12	− 5	176	225
LM 8	LM 8-AJ	—	4	16	8			15		24		17.5		1.1	14.3	1	—	—	8	12	− 5	265	402
LM 10	LM 10-AJ	—	4	30	10			19	0 −0.013	29		22		1.3	18	1	—	—	8	12	− 5	373	549
LM 12	LM 12-AJ	LM 12-OP	4	31.5	12			21		30		23		1.3	20	1.5	8	80	8	12	− 5	412	598
LM 13	LM 13-AJ	LM 13-OP	4	43	13			23		32		23		1.3	22	1.5	9	80	8	12	− 7	510	775
LM 16	LM 16-AJ	LM 16-OP	5	69	16			28		37		26.5		1.6	27	1.5	11	60	8	12	− 7	775	1180
LM 20	LM 20-AJ	LM 20-OP	5	87	20	0 −0.007	0 −0.010	32	0 −0.016	42		30.5		1.6	30.5	1.5	11	60	10	15	− 9	863	1370
LM 25	LM 25-AJ	LM 25-OP	6	220	25			40		59	0 −0.3	41	0 −0.3	1.85	38	2	12	50	10	15	− 9	980	1570
LM 30	LM 30-AJ	LM 30-OP	6	250	30			45		64		44.5		1.85	43	2.5	15	50	10	15	− 9	1570	2750
LM 35	LM 35-AJ	LM 35-OP	6	390	35	0 −0.008	0 −0.012	52	0 −0.019	70		49.5		2.1	49	2.5	17	50	12	20	−13	1670	3140
LM 40	LM 40-AJ	LM 40-OP	6	585	40			60		80		60.5		2.1	57	3	20	50	12	20	−13	2160	4020
LM 50	LM 50-AJ	LM 50-OP	6	1580	50			80	0 −0.022	100		74		2.6	76.5	3	25	50	12	20	−13	3820	7940
LM 60	LM 60-AJ	LM 60-OP	6	2000	60	0 −0.009	0 −0.015	90		110		85		3.15	86.5	3	30	50	17	25	−16	4710	10000

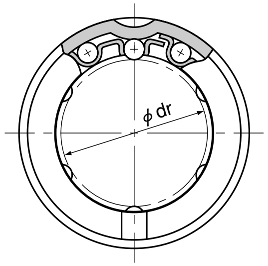
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If the ambient temperature exceeds 80℃, use the type equipped with a metal retainer (model LM-GA).
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LM13 UU
Seal attached on both ends of the nut

Note When using the Linear Bush on a single shaft, use two or more units (instead of one unit) on the same shaft to avoid a moment load, and secure a large distance between the units.

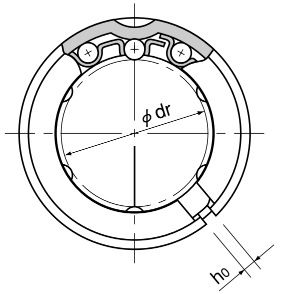
Model LM-GA

Metal retainer type

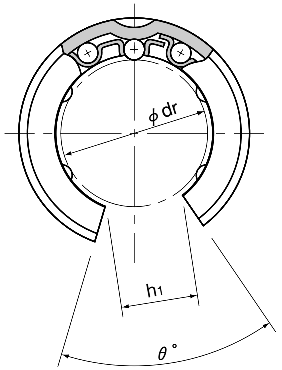




Model LM-GA



Model LM-GA-AJ



Model LM-GA-OP

Unit: mm

Model No.					Major dimensions														Greasing hole	Eccentricity (max) μm		Radial clearance tolerance	Basic load rating	
					Inscribed circle diameter			Outer diameter		Length														
Standard type	Clearance-adjustable type	Open type	Ball rows	Mass g	dr	Tolerance Precision	Tolerance High	D	Tolerance Precision/high	L	Tolerance	L_1	Tolerance	L_2	D_0	h_0	h_1	θ°	d_0	Precision	High	μm	C N	C_0 N
LM 6GA	—	—	3	8	6	0 –0.006	0 –0.009	12	0 –0.011	19	0 –0.2	13.5	0 –0.2	1.1	11.5	—	—	—	—	8	12	– 5	206	265
LM 8SGA	—	—	3	11	8			15		17		11.5		1.1	14.3	—	—	—	—	8	12	– 5	176	225
LM 8GA	—	—	3	16	8			15		24		17.5		1.1	14.3	—	—	—	—	8	12	– 5	265	402
LM 10GA	—	—	3	30	10			19	0 –0.013	29		22		1.3	18	—	—	—	2	8	12	– 5	373	549
LM 12GA	LM 12GA-AJ	LM 12GA-OP	4	31.5	12			21		30		23		1.3	20	1.5	7.5	80	2	8	12	– 5	412	598
LM 13GA	LM 13GA-AJ	LM 13GA-OP	4	43	13			23		32		23		1.3	22	1.5	9	80	2	8	12	– 7	510	775
LM 16GA	LM 16GA-AJ	LM 16GA-OP	4	69	16			28		37		26.5		1.6	27	1.5	11	60	2.3	8	12	– 7	775	1180
LM 20GA	LM 20GA-AJ	LM 20GA-OP	5	87	20	0 –0.007	0 –0.010	32	0 –0.016	42		30.5		1.6	30.5	2	11	60	2.3	10	15	– 9	863	1370
LM 25GA	LM 25GA-AJ	LM 25GA-OP	5	220	25			40		59	0 –0.3	41	0 –0.3	1.85	38	2	13	60	3	10	15	– 9	980	1570
LM 30GA	LM 30GA-AJ	LM 30GA-OP	6	250	30			45		64		44.5		1.85	43	2.5	15	50	3	10	15	– 9	1570	2750
LM 35GA	LM 35GA-AJ	LM 35GA-OP	6	390	35	0 –0.008	0 –0.012	52	0 –0.019	70		49.5		2.1	49	2.5	17	50	3	12	20	–13	1670	3140
LM 38GA	LM 38GA-AJ	LM 38GA-OP	6	565	38			57		76		58.5		2.1	54.5	3	18	50	3	12	20	–13	2160	4020
LM 40GA	LM 40GA-AJ	LM 40GA-OP	6	585	40			60		80		60.5		2.1	57	3	20	50	3	12	20	–13	2160	4020
LM 50GA	LM 50GA-AJ	LM 50GA-OP	6	1580	50			80		100		74		2.6	76.5	3	25	50	3	12	20	–13	3820	7940
LM 60GA	LM 60GA-AJ	LM 60GA-OP	6	2000	60	0 –0.009	0 –0.015	90	0 –0.022	110		85		3.15	86.5	3	30	50	4	17	25	–16	4710	10000
LM 80GA	LM 80GA-AJ	LM 80GA-OP	6	4520	80			120		140	0 –0.4	105.5	0 –0.4	4.15	116	3	40	50	4	17	25	–16	7350	16000
LM 100GA	LM 100GA-AJ	LM 100GA-OP	6	8600	100	0 –0.010	0 –0.020	150	0 –0.025	175		125.5		4.15	145	3	50	50	4	20	30	–20	14100	34800
LM 120A	LM 120A-AJ	LM 120A-OP	8	15000	120			180		200		158.6		4.15	175	4	85	80	5	20	30	–25	16400	40000

Note If requiring a type equipped with a seal, indicate it when placing an order (seal heat resistance: 80℃.)

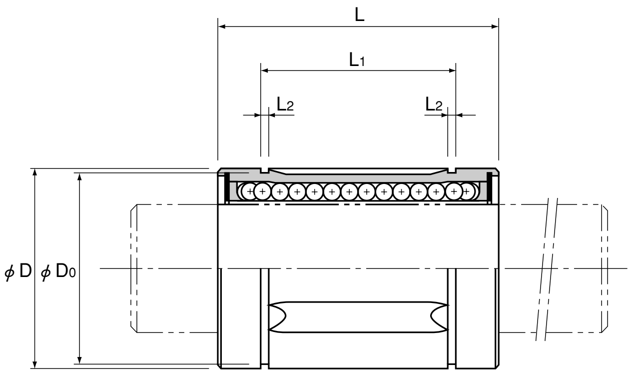
(Example) LM50GA UU

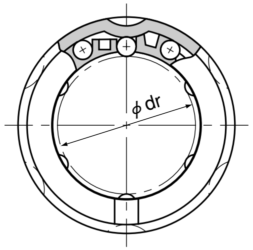
Seal attached on both ends of the nut

Note When using the Linear Bush on a single shaft, use two or more units (instead of one unit) on the same shaft to avoid a moment load, and secure a large distance between the units.

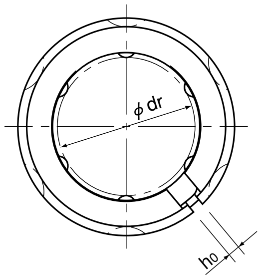
Model LM-MG

Stainless steel type

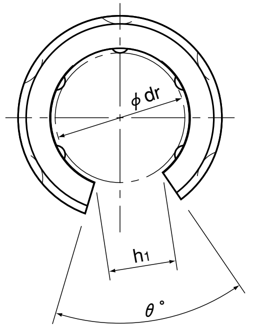




Model LM-MG



Model LM-MG-AJ



Model LM-MG-OP

Unit: mm

Model No.			Ball rows	Mass	Major dimensions														Eccentricity (max) µm		Radial clearance tolerance	Basic load rating	
					Inscribed circle diameter			Outer diameter		Length													
Standard type	Clearance-adjustable type	Open type	Ball rows	g	dr	Tolerance Precision	Tolerance High	D	Tolerance Precision/high	L	Tolerance	L1	Tolerance	L2	D0	h0	h1	θ°	Precision	High	µm	C N	C0 N
LM 3M	—	—	4	1.4	3	0 −0.005	0 −0.008	7	0 −0.009	10	0 −0.12	—	—	—	—	—	—	—	4	8	− 2	88.2	108
LM 4M	—	—	4	1.9	4			8		12		—	—	—	—	—	—	—	4	8	− 3	88.2	127
LM 5M	—	—	4	4	5			10		15		10.2	0 −0.2	1.1	9.6	—	—	—	4	8	− 3	167	206
∗LM 6MG	LM 6MG-AJ	—	4	8	6	0 −0.006	0 −0.009	12	0 −0.011	19	0 −0.2	13.5		1.1	11.5	1	—	—	8	12	− 5	206	265
∗LM 8SMG	LM 8SMG-AJ	—	4	11	8			15		17		11.5		1.1	14.3	1	—	—	8	12	− 5	176	225
∗LM 8MG	∗LM 8MG-AJ	—	4	16	8			15		24		17.5		1.1	14.3	1	—	—	8	12	− 5	265	402
∗LM 10MG	∗LM 10MG-AJ	—	4	30	10			19	0 −0.013	29		22		1.3	18	1	—	—	8	12	− 5	373	549
∗LM 12MG	∗LM 12MG-AJ	—	4	31.5	12			21		30		23		1.3	20	1.5	—	—	8	12	− 5	412	598
∗LM 13MG	∗LM 13MG-AJ	∗LM 13MG-OP	4	43	13			23		32		23		1.3	22	1.5	9	80	8	12	− 7	510	775
∗LM 16MG	∗LM 16MG-AJ	∗LM 16MG-OP	4	69	16			28		37		26.5		1.6	27	1.5	11	80	8	12	− 7	775	1180
∗LM 20MG	∗LM 20MG-AJ	∗LM 20MG-OP	5	87	20	0 −0.007	0 −0.010	32	0 −0.016	42		30.5		1.6	30.5	1.5	11	60	10	15	− 9	863	1370
∗LM 25MG	∗LM 25MG-AJ	∗LM 25MG-OP	5	220	25			40		59	0 −0.3	41	0 −0.3	1.85	38	2	12	50	10	15	− 9	980	1570
∗LM 30MG	∗LM 30MG-AJ	∗LM 30MG-OP	6	250	30			45		64		44.5		1.85	43	2.5	15	50	10	15	− 9	1570	2750
∗LM 35MG	∗LM 35MG-AJ	∗LM 35MG-OP	6	390	35	0 −0.008	0 −0.012	52	0 −0.019	70		49.5		2.1	49	2.5	17	50	12	20	−13	1670	3140
∗LM 40MG	∗LM 40MG-AJ	∗LM 40MG-OP	6	585	40			60		80		60.5		2.1	57	3	20	50	12	20	−13	2160	4020

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃. If the ambient temperature exceeds 80℃, use the type equipped with a metal retainer and indicate "A" at the end of the model number (for those marked with ∗ in the table, metal retainers are available).

(Example) LM30MG A
└High temperature symbol

If requiring a type equipped with a seal, indicate it when placing an order (seal heat resistance: 80℃).

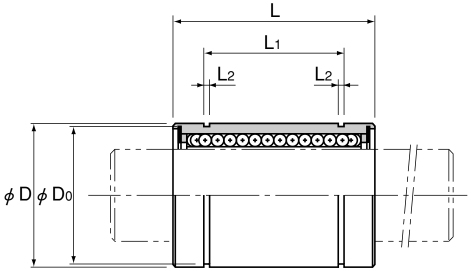
For an open type, only type A is available.

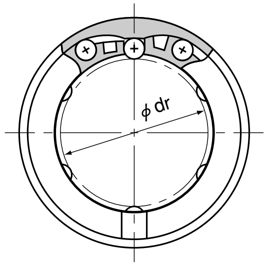
(Example) LM30MG UU
└Seal attached on both ends of the nut

Note Since the nut and the balls use stainless steel, these models are highly resistant to corrosion and environment.

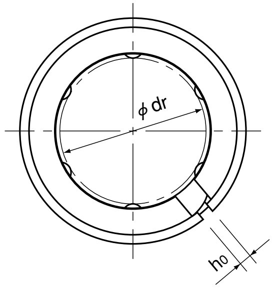
When using the Linear Bush on a single shaft, use two or more units (instead of one unit) on the same shaft to avoid a moment load, and secure a large distance between the units.

Model LME

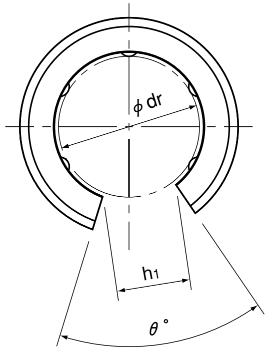




Model LME



Model LME-AJ



Model LME-OP

Unit: mm

Model No.			Ball rows	Mass	Major dimensions													Eccentricity (max)	Radial clearance tolerance	Basic load rating	
					Inscribed circle diameter		Outer diameter		Length												
Standard type	Clearance-adjustable type	Open type		g	dr	Tolerance	D	Tolerance	L	Tolerance	L_1	Tolerance	L_2	D_0	h_0	h_1	θ°	μm	μm	C N	C_0 N
LME 5	LME 5-AJ	—	4	11	5	+0.008 0	12	0 –0.008	22	0 –0.2	14.5	0 –0.2	1.1	11.5	1	—	—	12	– 5	206	265
LME 8	LME 8-AJ	—	4	20	8		16		25		16.5		1.1	15.2	1	—	—	12	– 5	265	402
LME 12	LME 12-AJ	LME 12-OP	4	41	12		22	0 –0.009	32		22.9		1.3	21	1.5	7.5	78	12	– 7	510	775
LME 16	LME 16-AJ	LME 16-OP	5	57	16	+0.009 –0.001	26		36		24.9		1.3	24.9	1.5	10	78	12	– 7	775	1180
LME 20	LME 20-AJ	LME 20-OP	5	91	20		32	0 –0.011	45		31.5		1.6	30.3	2	10	60	15	– 9	863	1370
LME 25	LME 25-AJ	LME 25-OP	6	215	25	+0.011 –0.001	40		58	0 –0.3	44.1	0 –0.3	1.85	37.5	2	12.5	60	15	– 9	980	1570
LME 30	LME 30-AJ	LME 30-OP	6	325	30		47		68		52.1		1.85	44.5	2	12.5	50	15	– 9	1570	2750
LME 40	LME 40-AJ	LME 40-OP	6	705	40	+0.013 –0.002	62	0 –0.013	80		60.6		2.15	59	3	16.8	50	17	–13	2160	4020
LME 50	LME 50-AJ	LME 50-OP	6	1130	50		75		100		77.6		2.65	72	3	21	50	17	–13	3820	7940
LME 60	LME 60-AJ	LME 60-OP	6	2220	60		90	0 –0.015	125	0 –0.4	101.7	0 –0.4	3.15	86.5	3	27.2	54	20	–16	4710	10000
LME 80	LME 80-AJ	LME 80-OP	6	5140	80	+0.016 –0.004	120		165		133.7		4.15	116	3	36.3	54	20	–16	7350	16000

Note Since Linear Bush models LME50 or smaller are incorporated with a synthetic resin retainer, do not use them at temperature exceeding 80℃.

If the ambient temperature exceeds 80℃, use the type equipped with a metal retainer and indicate "A" at the end of the model number.

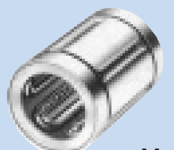
(Example) LME20G A
└ High temperature symbol

If requiring a type equipped with a seal, indicate it when placing an order (seal heat resistance: 80℃).

(Example) LME16 UU
└ Seal attached on both ends of the nut

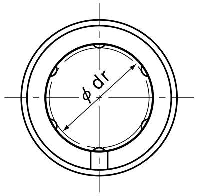
Note If a metal retainer is used, the Linear Bush has the shape as shown below.

When using the Linear Bush on a single shaft, use two or more units (instead of one unit) on the same shaft to avoid a moment load, and secure a large distance between the units.

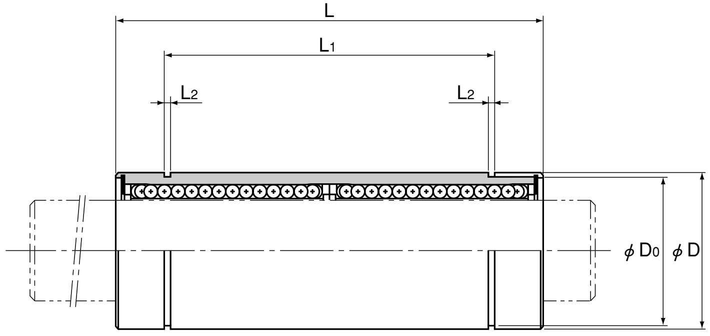


Model LME-GA

Model LM-L



Model LM-L



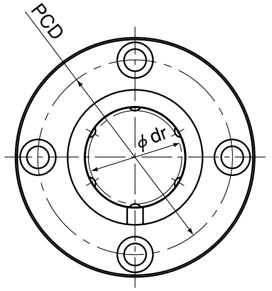
Unit: mm

Model No.			Major dimensions										Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length									
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	L_1	Tolerance	L_2	D_0	μm	μm	C N	C_0 N
LM 3L	4	3	3	0 −0.010	7	0 −0.013	19	0 −0.3	—	—	—	—	10	− 2	139	216
LM 4L	4	4	4		8		23		—		—	—	10	− 3	139	254
LM 5L	4	8	5		10		29		20	0 −0.3	1.1	9.6	10	− 3	263	412
LM 6L	4	16	6		12		35		27		1.1	11.5	15	− 5	324	529
LM 8L	4	31	8		15		45		35		1.1	14.3	15	− 5	431	784
LM 10L	4	62	10		19	0 −0.016	55		44		1.3	18	15	− 5	588	1100
LM 12L	4	80	12		21		57		46		1.3	20	15	− 5	657	1200
LM 13L	4	90	13		23		61		46		1.3	22	15	− 7	814	1570
LM 16L	5	145	16		28		70		53		1.6	27	15	− 7	1230	2350
LM 20L	5	180	20	0 −0.012	32	0 −0.019	80		61		1.6	30.5	20	− 9	1400	2750
LM 25L	6	440	25		40		112	0 −0.4	82	0 −0.4	1.85	38	20	− 9	1560	3140
LM 30L	6	580	30		45		123		89		1.85	43	20	− 9	2490	5490
LM 35L	6	795	35	0 −0.015	52	0 −0.022	135		99		2.1	49	25	−13	2650	6270
LM 40L	6	1170	40		60		154		121		2.1	57	25	−13	3430	8040
LM 50L	6	3100	50		80		192		148		2.6	76.5	25	−13	6080	15900
LM 60L	6	3500	60	0 −0.020	90	0 −0.025	211		170		3.15	86.5	25	−16	7650	20000

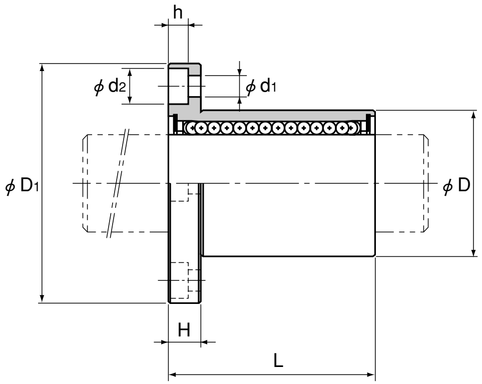
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LM13L UU
Seal attached on both ends of the nut

Note A stainless steel type is also available. Contact THK for details.

Model LMF



Model LMF



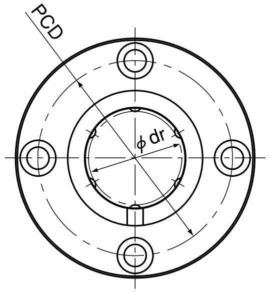
Unit: mm

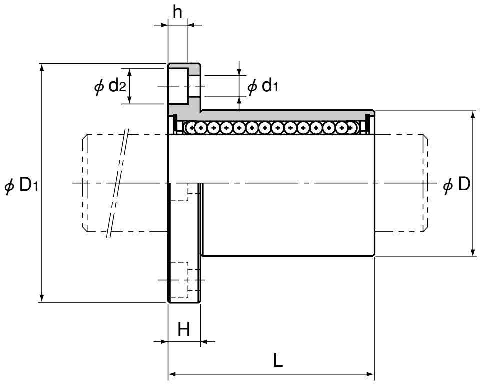
Model No. Standard type	Ball rows	Mass g	Major dimensions Inscribed circle diameter dr	Tolerance	Outer diameter D	Tolerance	Length L	Tolerance	Flange diameter D_1	Tolerance	H	PCD	Mounting hole $d_1 \times d_2 \times h$	Flange perpendicularity μm	Eccentricity (max) μm	Radial clearance tolerance μm	Basic load rating C N	C_0 N
LMF 6	4	26.5	6	0 −0.009	12	0 −0.011	19	0 −0.2	28	0 −0.2	5	20	3.4×6.5×3.3	12	12	−5	206	265
LMF 8S	4	34	8		15		17		32		5	24	3.4×6.5×3.3	12	12	−5	176	225
LMF 8	4	40	8		15		24		32		5	24	3.4×6.5×3.3	12	12	−5	265	402
LMF 10	4	78	10		19	0 −0.013	29		39		6	29	4.5×8×4.4	12	12	−5	373	549
LMF 12	4	76	12		21		30		42		6	32	4.5×8×4.4	12	12	−5	412	598
LMF 13	4	94	13		23		32		43		6	33	4.5×8×4.4	12	12	−7	510	775
LMF 16	5	134	16		28		37		48		6	38	4.5×8×4.4	12	12	−7	775	1180
LMF 20	5	180	20	0 −0.010	32	0 −0.016	42		54		8	43	5.5×9.2×5.4	15	15	−9	863	1370
LMF 25	6	340	25		40		59	0 −0.3	62		8	51	5.5×9.2×5.4	15	15	−9	980	1570
LMF 30	6	460	30		45		64		74		10	60	6.6×11×6.5	15	15	−9	1570	2750
LMF 35	6	795	35	0 −0.012	52	0 −0.019	70		82		10	67	6.6×11×6.5	20	20	−13	1670	3140
LMF 40	6	1054	40		60		80		96	0 −0.3	13	78	9×14×8.6	20	20	−13	2160	4020
LMF 50	6	2200	50		80		100		116		13	98	9×14×8.6	20	20	−13	3820	7940
LMF 60	6	2960	60	0 −0.015	90	0 −0.022	110		134		18	112	11×17.5×10.8	25	25	−13	4710	10000

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMF25 UU
Seal attached on both ends of the nut

Model LMF-M

Stainless type





Model LMF-M

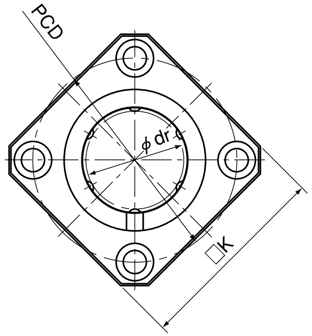
Unit: mm

Model No.			Major dimensions											Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter				Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D_1	Tolerance	H	PCD	d_1×d_2×h	µm	µm	µm	C N	C_0 N
LMF 6M	4	26.5	6	0 –0.009	12	0 –0.011	19	0 –0.2	28	0 –0.2	5	20	3.4×6.5×3.3	12	12	–5	206	265
LMF 8SM	4	34	8		15		17		32		5	24	3.4×6.5×3.3	12	12	–5	176	225
LMF 8M	4	40	8		15		24		32		5	24	3.4×6.5×3.3	12	12	–5	265	402
LMF 10M	4	78	10		19	0 –0.013	29		39		6	29	4.5×8×4.4	12	12	–5	373	549
LMF 12M	4	76	12		21		30		42		6	32	4.5×8×4.4	12	12	–5	412	598
LMF 13M	4	94	13		23		32		43		6	33	4.5×8×4.4	12	12	–7	510	775
LMF 16M	5	134	16		28		37		48		6	38	4.5×8×4.4	12	12	–7	775	1180
LMF 20M	5	180	20	0 –0.010	32	0 –0.016	42		54		8	43	5.5×9.2×5.4	15	15	–9	863	1370
LMF 25M	6	340	25		40		59	0 –0.3	62		8	51	5.5×9.2×5.4	15	15	–9	980	1570
LMF 30M	6	460	30		45		64		74		10	60	6.6×11×6.5	15	15	–9	1570	2750

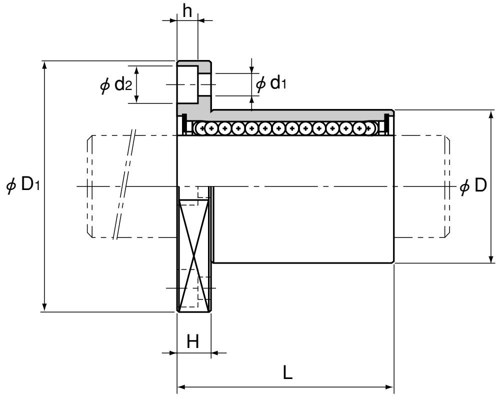
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMF20M UU
Seal attached on both ends of the nut

Note Since the nut and the balls use stainless steel, these models are highly resistant to corrosion and environment.

Model LMK



Model LMK



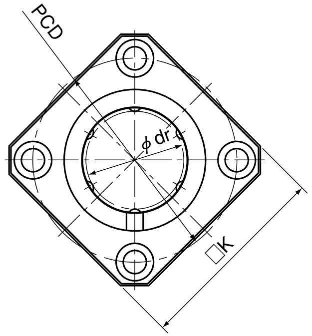
Unit: mm

Model No.			Major dimensions												Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter					Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D₁	Tolerance	K	H	PCD	d₁×d₂×h	µm	µm	µm	C N	C₀ N
LMK 6	4	18.5	6	0 −0.009	12	0 −0.011	19	0 −0.2	28	0 −0.2	22	5	20	3.4×6.5×3.3	12	12	−5	206	265
LMK 8S	4	23	8		15		17		32		25	5	24	3.4×6.5×3.3	12	12	−5	176	225
LMK 8	4	29	8		15		24		32		25	5	24	3.4×6.5×3.3	12	12	−5	265	402
LMK 10	4	61	10		19	0 −0.013	29		39		30	6	29	4.5×8×4.4	12	12	−5	373	549
LMK 12	4	56	12		21		30		42		32	6	32	4.5×8×4.4	12	12	−5	412	598
LMK 13	4	75	13		23		32		43		34	6	33	4.5×8×4.4	12	12	−7	510	775
LMK 16	5	104	16		28		37		48		37	6	38	4.5×8×4.4	12	12	−7	775	1180
LMK 20	5	145	20	0 −0.010	32	0 −0.016	42		54		42	8	43	5.5×9.2×5.4	15	15	−9	863	1370
LMK 25	6	300	25		40		59	0 −0.3	62		50	8	51	5.5×9.2×5.4	15	15	−9	980	1570
LMK 30	6	375	30		45		64		74		58	10	60	6.6×11×6.5	15	15	−9	1570	2750
LMK 35	6	692	35	0 −0.012	52	0 −0.019	70		82		64	10	67	6.6×11×6.5	20	20	−13	1670	3140
LMK 40	6	864	40		60		80		96	0 −0.3	75	13	78	9×14×8.6	20	20	−13	2160	4020
LMK 50	6	2020	50		80		100		116		92	13	98	9×14×8.6	20	20	−13	3820	7940
LMK 60	6	2520	60	0 −0.015	90	0 −0.022	110		134		106	18	112	11×17.5×10.8	25	25	−13	4710	10000

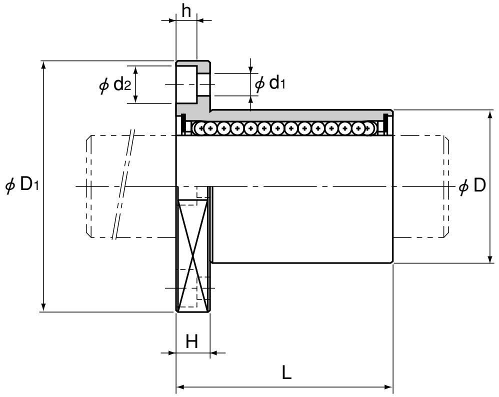
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMK13 UU
Seal attached on both ends of the nut

Model LMK-M

Stainless type



Model LMK-M



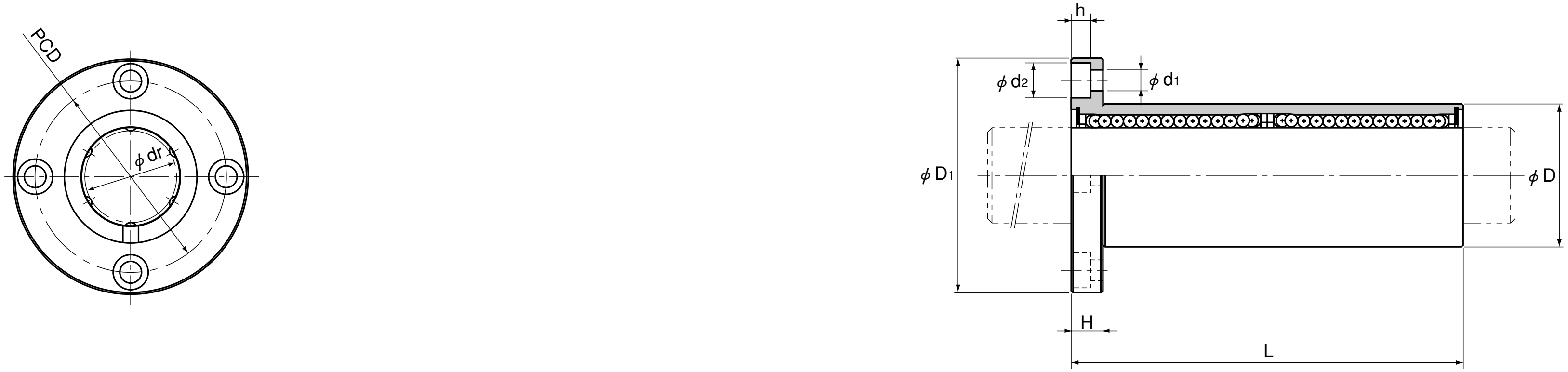
Unit: mm

Model No.			Major dimensions												Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter					Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D₁	Tolerance	K	H	PCD	d₁×d₂×h	μm	μm	μm	C N	C₀ N
LMK 6M	4	18.5	6	0 −0.009	12	0 −0.011	19	0 −0.2	28	0 −0.2	22	5	20	3.4×6.5×3.3	12	12	−5	206	265
LMK 8SM	4	23	8		15		17		32		25	5	24	3.4×6.5×3.3	12	12	−5	176	225
LMK 8M	4	29	8		15		24		32		25	5	24	3.4×6.5×3.3	12	12	−5	265	402
LMK 10M	4	61	10		19	0 −0.013	29		39		30	6	29	4.5×8×4.4	12	12	−5	373	549
LMK 12M	4	56	12		21		30		42		32	6	32	4.5×8×4.4	12	12	−5	412	598
LMK 13M	4	75	13		23		32		43		34	6	33	4.5×8×4.4	12	12	−7	510	775
LMK 16M	5	104	16		28		37		48		37	6	38	4.5×8×4.4	12	12	−7	775	1180
LMK 20M	5	145	20	0 −0.010	32	0 −0.016	42		54		42	8	43	5.5×9.2×5.4	15	15	−9	863	1370
LMK 25M	6	300	25		40		59	0 −0.3	62		50	8	51	5.5×9.2×5.4	15	15	−9	980	1570
LMK 30M	6	375	30		45		64		74		58	10	60	6.6×11×6.5	15	15	−9	1570	2750

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMK25M UU
Seal attached on both ends of the nut

Note Since the nut and the balls use stainless steel, these models are highly resistant to corrosion and environment.

Model LMF-L



Model LMF-L

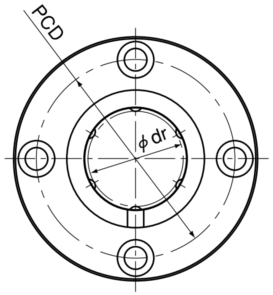
Unit: mm

Model No. Standard type	Ball rows	Mass g	Major dimensions Inscribed circle diameter dr	Tolerance	Outer diameter D	Tolerance	Length L	Tolerance	Flange diameter D_1	Tolerance	H	PCD	Mounting hole $d_1 \times d_2 \times h$	Flange perpendicularity µm	Eccentricity (max) µm	Radial clearance tolerance µm	Basic load rating C N	C_0 N
LMF 6L	4	32	6	0 −0.010	12	0 −0.013	35	0 −0.3	28	0 −0.2	5	20	3.4×6.5×3.3	15	15	− 5	324	529
LMF 8L	4	53	8		15		45		32		5	24	3.4×6.5×3.3	15	15	− 5	431	784
LMF 10L	4	105	10		19	0 −0.016	55		39		6	29	4.5×8×4.4	15	15	− 5	588	1100
LMF 12L	4	100	12		21		57		42		6	32	4.5×8×4.4	15	15	− 5	657	1200
LMF 13L	4	130	13		23		61		43		6	33	4.5×8×4.4	15	15	− 7	814	1570
LMF 16L	5	187	16		28		70		48		6	38	4.5×8×4.4	15	15	− 7	1230	2350
LMF 20L	5	260	20	0 −0.012	32	0 −0.019	80		54		8	43	5.5×9.2×5.4	20	20	− 9	1400	2750
LMF 25L	6	515	25		40		112	0 −0.4	62		8	51	5.5×9.2×5.4	20	20	− 9	1560	3140
LMF 30L	6	655	30		45		123		74		10	60	6.6×11×6.5	20	20	− 9	2490	5490
LMF 35L	6	970	35	0 −0.015	52	0 −0.022	135		82		10	67	6.6×11×6.5	25	25	−13	2650	6270
LMF 40L	6	1560	40		60		154		96	0 −0.3	13	78	9×14×8.6	25	25	−13	3430	8040
LMF 50L	6	3500	50		80		192		116		13	98	9×14×8.6	25	25	−13	6080	15900
LMF 60L	6	4500	60	0 −0.020	90	0 −0.025	211		134		18	112	11×17.5×10.8	25	25	−13	7650	20000

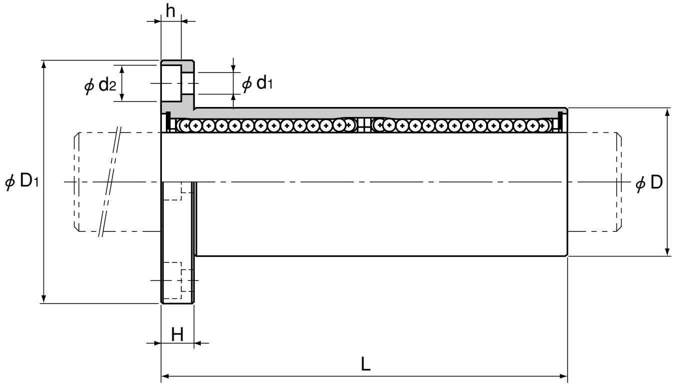
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMF35L UU
Seal attached on both ends of the nut

Model LMF-ML

Stainless type



Model LMF-ML



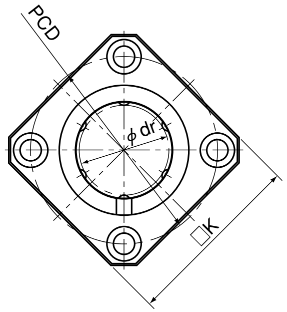
Unit: mm

Model No.			Major dimensions											Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter				Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D₁	Tolerance	H	PCD	d₁×d₂×h	µm	µm	µm	C N	C₀ N
LMF 6ML	4	32	6	0 −0.010	12	0 −0.013	35	0 −0.3	28	0 −0.2	5	20	3.4×6.5×3.3	15	15	−5	324	529
LMF 8ML	4	53	8		15		45		32		5	24	3.4×6.5×3.3	15	15	−5	431	784
LMF 10ML	4	105	10		19	0 −0.016	55		39		6	29	4.5×8×4.4	15	15	−5	588	1100
LMF 12ML	4	100	12		21		57		42		6	32	4.5×8×4.4	15	15	−5	657	1200
LMF 13ML	4	130	13		23		61		43		6	33	4.5×8×4.4	15	15	−7	814	1570
LMF 16ML	5	187	16		28		70		48		6	38	4.5×8×4.4	15	15	−7	1230	2350
LMF 20ML	5	260	20	0 −0.012	32	0 −0.019	80		54		8	43	5.5×9.2×5.4	20	20	−9	1400	2750
LMF 25ML	6	515	25		40		112	0 −0.4	62		8	51	5.5×9.2×5.4	20	20	−9	1560	3140
LMF 30ML	6	655	30		45		123		74		10	60	6.6×11×6.5	20	20	−9	2490	5490

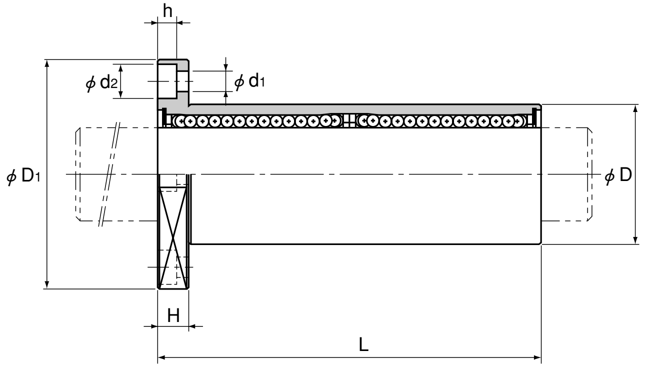
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMF13ML UU
Seal attached on both ends of the nut

Note Since the nut and the balls use stainless steel, these models are highly resistant to corrosion and environment.

Model LMK-L



Model LMK-L



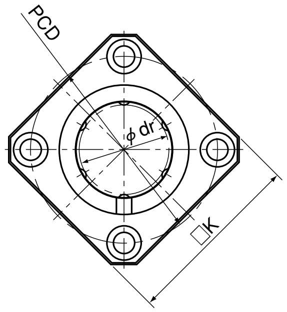
Unit: mm

Model No.			Major dimensions												Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter					Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D_1	Tolerance	K	H	PCD	$d_1 \times d_2 \times h$	µm	µm	µm	C N	C_0 N
LMK 6L	4	26	6	0 −0.010	12	0 −0.013	35	0 −0.3	28	0 −0.2	22	5	20	3.4×6.5×3.3	15	15	− 5	324	529
LMK 8L	4	46	8		15		45		32		25	5	24	3.4×6.5×3.3	15	15	− 5	431	784
LMK 10L	4	88	10		19	0 −0.016	55		39		30	6	29	4.5×8×4.4	15	15	− 5	588	1100
LMK 12L	4	82	12		21		57		42		32	6	32	4.5×8×4.4	15	15	− 5	657	1200
LMK 13L	4	108	13		23		61		43		34	6	33	4.5×8×4.4	15	15	− 7	814	1570
LMK 16L	5	160	16		28		70		48		37	6	38	4.5×8×4.4	15	15	− 7	1230	2350
LMK 20L	5	230	20	0 −0.012	32	0 −0.019	80		54		42	8	43	5.5×9.2×5.4	20	20	− 9	1400	2750
LMK 25L	6	475	25		40		112	0 −0.4	62		50	8	51	5.5×9.2×5.4	20	20	− 9	1560	3140
LMK 30L	6	575	30		45		123		74		58	10	60	6.6×11×6.5	20	20	− 9	2490	5490
LMK 35L	6	870	35	0 −0.015	52	0 −0.022	135		82		64	10	67	6.6×11×6.5	25	25	−13	2650	6270
LMK 40L	6	1380	40		60		154		96	0 −0.3	75	13	78	9×14×8.6	25	25	−13	3430	8040
LMK 50L	6	3300	50		80		192		116		92	13	98	9×14×8.6	25	25	−13	6080	15900
LMK 60L	6	4060	60	0 −0.020	90	0 −0.025	211		134		106	18	112	11×17.5×10.8	25	25	−13	7650	20000

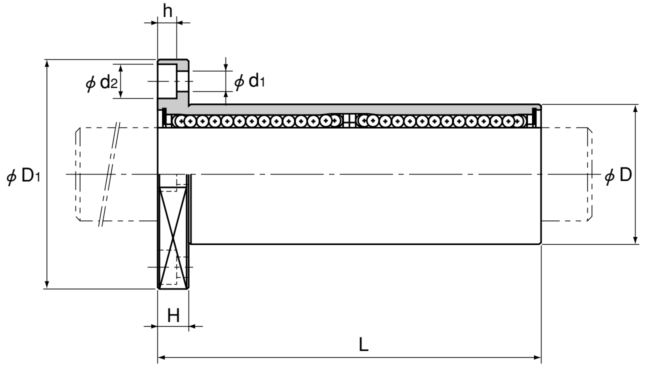
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMK50L UU
└ Seal attached on both ends of the nut

Model LMK-ML

Stainless type



Model LMK-ML



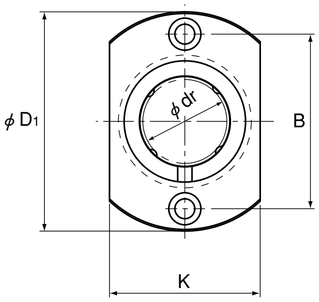
Unit: mm

Model No.			Major dimensions											Mounting hole	Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
Standard type	Ball rows	Mass g	Inscribed circle diameter dr	Tolerance	Outer diameter D	Tolerance	Length L	Tolerance	Flange diameter D_1	Tolerance	K	H	PCD	$d_1 \times d_2 \times h$	μm	μm	μm	C N	C_0 N
LMK 6ML	4	26	6	0 −0.010	12	0 −0.013	35	0 −0.3	28	0 −0.2	22	5	20	3.4×6.5×3.3	15	15	−5	324	529
LMK 8ML	4	46	8		15		45		32		25	5	24	3.4×6.5×3.3	15	15	−5	431	784
LMK 10ML	4	88	10		19	0 −0.016	55		39		30	6	29	4.5×8×4.4	15	15	−5	588	1100
LMK 12ML	4	82	12		21		57		42		32	6	32	4.5×8×4.4	15	15	−5	657	1200
LMK 13ML	4	108	13		23		61		43		34	6	33	4.5×8×4.4	15	15	−7	814	1570
LMK 16ML	5	160	16		28		70		48		37	6	38	4.5×8×4.4	15	15	−7	1230	2350
LMK 20ML	5	230	20	0 −0.012	32	0 −0.019	80		54		42	8	43	5.5×9.2×5.4	20	20	−9	1400	2750
LMK 25ML	6	475	25		40		112	0 −0.4	62		50	8	51	5.5×9.2×5.4	20	20	−9	1560	3140
LMK 30ML	6	575	30		45		123		74		58	10	60	6.6×11×6.5	20	20	−9	2490	5490

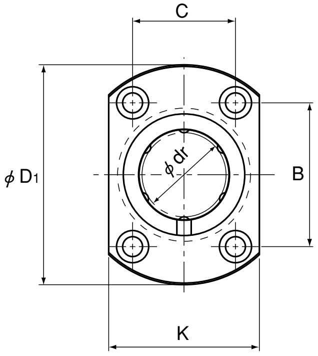
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMK8ML UU
Seal attached on both ends of the nut

Note Since the nut and the balls use stainless steel, these models are highly resistant to corrosion and environment.

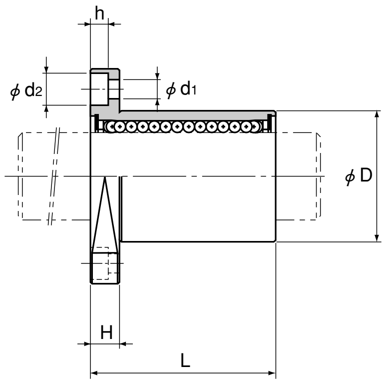
Model LMH



Models LMH6 to 13



Models LMH16 to 30

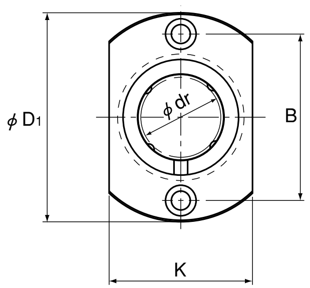


Unit: mm

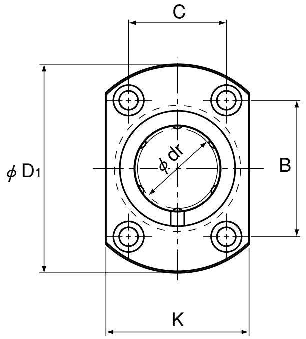
Model No.			Major dimensions													Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter						Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D1	Tolerance	K	H	B	C	$d_1 \times d_2 \times h$	µm	µm	µm	C N	C_0 N
LMH 6	4	18	6	0 −0.009	12	0 −0.011	19	0 −0.2	28	0 −0.2	18	5	20	—	3.4×6.5×3.3	12	12	−5	206	265
LMH 8	4	28	8		15		24		32		21	5	24	—	3.4×6.5×3.3	12	12	−5	265	402
LMH 10	4	50	10		19	0 −0.013	29		39		25	6	29	—	4.5×8×4.4	12	12	−5	373	549
LMH 12	4	55	12		21		30		42		27	6	32	—	4.5×8×4.4	12	12	−5	412	598
LMH 13	4	70	13		23		32		43		29	6	33	—	4.5×8×4.4	12	12	−7	510	775
LMH 16	5	95	16		28		37		48		34	6	31	22	4.5×8×4.4	12	12	−7	775	1180
LMH 20	5	150	20	0 −0.010	32	0 −0.016	42		54		38	8	36	24	5.5×9.2×5.4	15	15	−9	863	1370
LMH 25	6	275	25		40		59	0 −0.3	62		46	8	40	32	5.5×9.2×5.4	15	15	−9	980	1570
LMH 30	6	350	30		45		64		74		51	10	49	35	6.6×11×6.5	15	15	−9	1570	2750

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMH16 UU
Seal attached on both ends of the nut

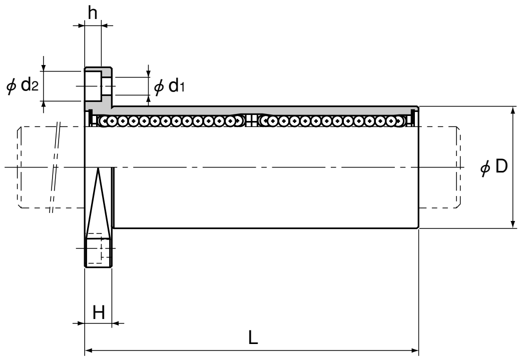
Model LMH-L



Models LMH6L to 13L



Models LMH16L to 30L

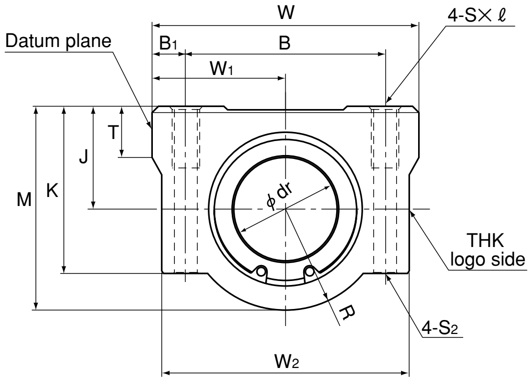


Unit: mm

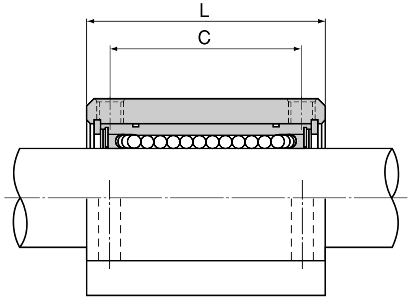
Model No.			Major dimensions													Flange perpendicularity	Eccentricity (max)	Radial clearance tolerance	Basic load rating	
			Inscribed circle diameter		Outer diameter		Length		Flange diameter						Mounting hole					
Standard type	Ball rows	Mass g	dr	Tolerance	D	Tolerance	L	Tolerance	D_1	Tolerance	K	H	B	C	$d_1 \times d_2 \times h$	µm	µm	µm	C N	C_0 N
LMH 6L	4	28	6	0 –0.010	12	0 –0.013	35	0 –0.3	28	0 –0.2	18	5	20	—	3.4×6.5×3.3	15	15	–5	324	529
LMH 8L	4	40	8		15		45		32		21	5	24	—	3.4×6.5×3.3	15	15	–5	431	784
LMH 10L	4	75	10		19	0 –0.016	55		39		25	6	29	—	4.5×8×4.4	15	15	–5	588	1100
LMH 12L	4	82	12		21		57		42		27	6	32	—	4.5×8×4.4	15	15	–5	657	1200
LMH 13L	4	107	13		23		61		43		29	6	33	—	4.5×8×4.4	15	15	–7	814	1570
LMH 16L	5	143	16		28		70		48		34	6	31	22	4.5×8×4.4	15	15	–7	1230	2350
LMH 20L	5	225	20	0 –0.012	32	0 –0.019	80		54		38	8	36	24	5.5×9.2×5.4	20	20	–9	1400	2750
LMH 25L	6	450	25		40		112	0 –0.4	62		46	8	40	32	5.5×9.2×5.4	20	20	–9	1560	3140
LMH 30L	6	575	30		45		123		74		51	10	49	35	6.6×11×6.5	20	20	–9	2490	5490

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
If requiring a type equipped with a seal, indicate it when placing an order.
(Example) LMH20L UU
Seal attached on both ends of the nut

Models SC6 to 30



Models SC6 to 30



Unit: mm

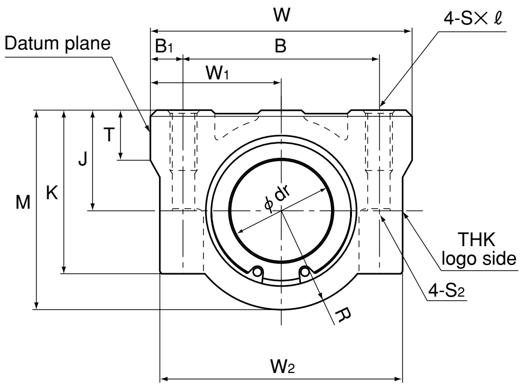
Model No.	Outer dimensions			LM case dimensions													Unit mass	Model No. of Linear Bush to be combined	Basic load rating	
	Height	Width	Length	Mounting hole position			Tap	Through bolt	Center height J ±0.02	W₁ ±0.02	K	W₂	T	R	Inscribed circle diameter				C	C₀
	M	W	L	B	B₁	C	S× ℓ	model No.S₂							dr	Tolerance	g		N	N
SC 6UU	18	30	25	20	5	15	M4×8	M3	9	15	15	28	6	9	6	0 −0.009	34	LM 6UU	206	265
SC 8UU	22	34	30	24	5	18	M4×8	M3	11	17	18	32	6	11	8		52	LM 8UU	265	402
SC 10UU	26	40	35	28	6	21	M5×12	M4	13	20	22	37	8	13	10		92	LM 10UU	373	549
SC 12UU	29	42	36	30.5	5.75	26	M5×12	M4	15	21	25	39	8	14	12		102	LM 12UU	412	598
SC 13UU	30	44	39	33	5.5	26	M5×12	M4	15	22	26	41	8	15	13		123	LM 13UU	510	775
SC 16UU	38.5	50	44	36	7	34	M5×12	M4	19	25	35	46	9	19.5	16		189	LM 16UU	775	1180
SC 20UU	42	54	50	40	7	40	M6×12	M5	21	27	36	52	11	21	20	0 −0.010	237	LM 20UU	863	1370
SC 25UU	51.5	76	67	54	11	50	M8×18	M6	26	38	41	68	12	25.5	25		555	LM 25UU	980	1570
SC 30UU	59.5	78	72	58	10	58	M8×18	M6	30	39	49	72	15	29.5	30		685	LM 30UU	1570	2750

Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
A stainless steel Linear Bush model LM-MG, highly corrosion resistant, can also be incorporated at your request.

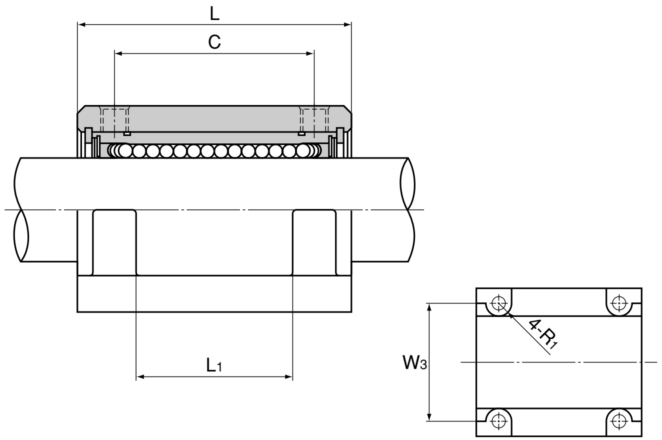
Example of Model Number for Use in Combination with Linear Bush Units

Linear Bush to be combined	Example of model No.	
Both ends attached with seal	SC 13UU	Standard stock
Without seal	SC 13	Build to order
Made of stainless steel; both ends attached with seal	SC 13MUU	Build to order

Models SC35 to 50



Models SC35 to 50



Unit: mm

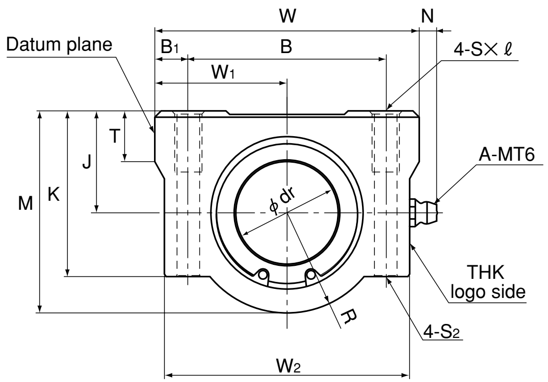
Model No.	Outer dimensions			LM case dimensions																Unit mass	Model No. of Linear Bush to be combined	Basic load rating	
	Height	Width	Length	Mounting hole position			Tap	Through bolt	Center height J									Inscribed circle diameter					
	M	W	L	B	B1	C	S×ℓ	model No.S2	±0.02	W1 ±0.02	K	W2	W3	L1	T	R	R1	dr	Tolerance	g		C N	C0 N
SC 35UU	68	90	80	70	10	60	M8×18	M6	34	45	54	85	60	42	18	34	5	35	0 −0.012	1100	LM 35UU	1670	3140
SC 40UU	78	102	90	80	11	60	M10×25	M8	40	51	62	96	80	44	20	38	8	40		1600	LM 40UU	2160	4020
SC 50UU	102	122	110	100	11	80	M10×25	M8	52	61	80	116	100	64	25	50	8	50		3350	LM 50UU	3820	7940

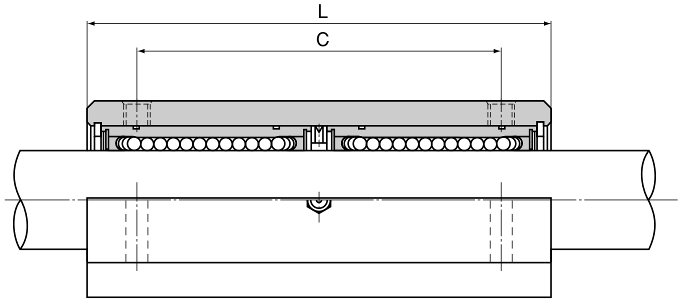
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
A stainless steel Linear Bush model LM-MG, highly corrosion resistant, can also be incorporated at your request.
(Model SC50 does not include a stainless type.)

Example of Model Number for Use In Combination with Linear Bush Units

Linear Bush to be combined	Example of model No.	
Both ends attached with seal	SC 40UU	Standard stock
Without seal	SC 40	Build to order
Made of stainless steel; both ends attached with seal	SC 40MUU	Build to order

Model SL





Unit: mm

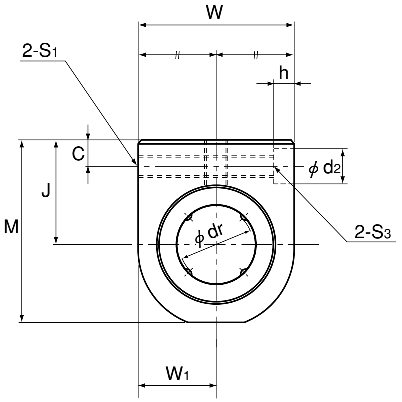
Model No.	Outer dimensions			LM case dimensions														Unit mass	Model No. of Linear Bush to be combined	Basic load rating	
	Height	Width	Length	Mounting hole position			Tap	Through bolt	Center							Inscribed circle diameter					
	M	W	L	B	B₁	C	S× ℓ	model No.S₂	height J ±0.02	W₁ ±0.02	K	W₂	T	R	N	dr	Tolerance	g		C N	C₀ N
SL 6UU	18	30	48	20	5	36	M4×8	M3	9	15	15	28	6	9	7	6	0 −0.009	68	LM 6U	324	529
SL 8UU	22	34	58	24	5	42	M4×8	M3	11	17	18	32	6	11	7	8		105	LM 8U	431	784
SL 10UU	26	40	68	28	6	46	M5×12	M4	13	20	22	37	8	13	7	10		185	LM 10U	588	1100
SL 12UU	29	42	70	30.5	5.75	50	M5×12	M4	15	21	25	39	8	14	6.5	12		205	LM 12U	657	1200
SL 13UU	30	44	75	33	5.5	50	M5×12	M4	15	22	26	41	8	15	6.5	13		242	LM 13U	814	1570
SL 16UU	38.5	50	85	36	7	60	M5×12	M4	19	25	35	46	9	19.5	6	16		403	LM 16U	1230	2350
SL 20UU	42	54	96	40	7	70	M6×12	M5	21	27	36	52	11	21	7	20	0 −0.010	520	LM 20U	1400	2750
SL 25UU	51.5	76	130	54	11	100	M8×18	M6	26	38	41	68	12	25.5	4	25		1120	LM 25U	1560	3140
SL 30UU	59.5	78	140	58	10	110	M8×18	M6	30	39	49	72	15	29.5	5	30		1440	LM 30U	2490	5490

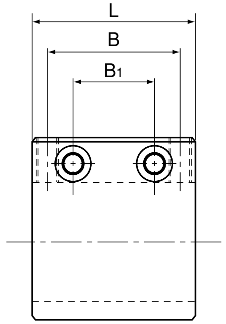
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
A stainless steel Linear Bush model LM-MG, highly corrosion resistant, can also be incorporated at your request.

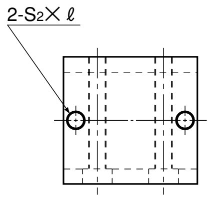
Example of Model Number for Use In Combination with Linear Bush Units

Linear Bush to be combined	Example of model No.	
Both ends attached with seal	SL 13UU	Standard stock
Without seal	SL 13	Build to order
Made of stainless steel; both ends attached with seal	SL 13MUU	Build to order

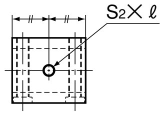
Model SH







Top surface of models SH6 to SH20



Top surface of models SH3 to SH5

Unit: mm

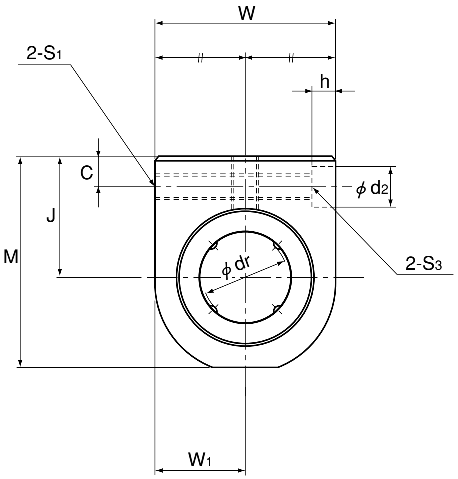
Model No.	Outer dimensions			LM case dimensions												Unit mass	Model No. of Linear Bush to be combined	Basic load rating	
	Height	Width	Length	Mounting hole position			Tap		Through bolt	Center height J	W1	d2	h	Inscribed circle diameter					
	M	W	L	B	B1	C	S1	S2× ℓ	model No.S3	±0.02	±0.02			dr	Tolerance	g		C N	C0 N
SH 3UU	14	10	13	—	8	3	M3	M3×5.5	M2	9	5	4.2	1.5	3	0 −0.008	4.5	LM 3UU	88.2	108
SH 4UU	16	12	15	—	10	3	M3	M3×6	M2	10	6	4.2	1.5	4		7	LM 4UU	88.2	127
SH 5UU	18	14	17	—	12	3	M3	M3×6	M2	11	7	4.2	1.5	5		11	LM 5UU	167	206
SH 6UU	22	16	24	18	9	5	M4	M4×8	M3	14	8	6.5	3.3	6	0 −0.009	21.6	LM 6UU	206	265
SH 8UU	26	20	27	20	10	5	M4	M5×8.5	M3	16	10	6.5	3.3	8		32	LM 8UU	265	402
SH 10UU	32	26	35	27	15	6	M5	M6×9.5	M4	19	13	8	4.4	10		65	LM 10UU	373	549
SH 12UU	34	28	35	27	15	6	M5	M6×9.5	M4	20	14	8	4.4	12		81	LM 12UU	412	598
SH 13UU	36	30	36	28	16	6	M5	M6×9.5	M4	21	15	8	4.4	13		90	LM 13UU	510	775
SH 16UU	42	36	40	32	18	6	M5	M6×10	M4	24	18	8	4.4	16		150	LM 16UU	775	1180
SH 20UU	49	42	44	36	22	7	M6	M6×12	M5	28	21	9.5	5.4	20	0 −0.010	215	LM 20UU	863	1370

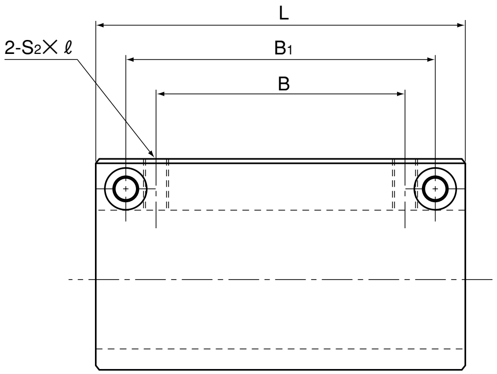
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃.
A stainless steel Linear Bush model LM-MG, highly corrosion resistant, can also be incorporated at your request.

Example of Model Number for Use in Combination with Linear Bush Units

Linear Bush to be combined	Example of model No.	
Both ends attached with seal	SH 13UU	Standard stock
Without seal	SH 13	Build to order
Made of stainless steel; both ends attached with seal	SH 13MUU	Build to order

Model SH-L





Unit: mm

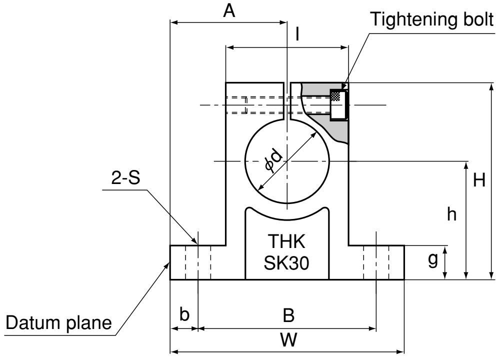
Model No.	Outer dimensions			LM case dimensions												Unit mass	Model No. of Linear Bush to be combined	Basic load rating	
	Height	Width	Length	Mounting hole position			Tap		Through bolt	Center height J	W_1			Inscribed circle diameter					
	M	W	L	B	B_1	C	S_1	S_2×ℓ	model No.S_3	±0.02	±0.02	d_2	h	dr	Tolerance	g		C N	C_0 N
SH 3LUU	14	10	23	10	18	3	M3	M3×5.5	M2	9	5	4.2	1.5	3	0 −0.008	8.5	LM 3U	139	216
SH 4LUU	16	12	27	14	22	3	M3	M3×6	M2	10	6	4.2	1.5	4		13	LM 4U	139	254
SH 5LUU	18	14	32	18	26	3	M3	M3×6	M2	11	7	4.2	1.5	5		22	LM 5U	263	412
SH 6LUU	22	16	40	20	30	5	M4	M4×8	M3	14	8	6.5	3.3	6	0 −0.009	35	LM 6U	324	529
SH 8LUU	26	20	52	30	42	5	M4	M5×8.5	M3	16	10	6.5	3.3	8		65	LM 8U	431	784
SH 10LUU	32	26	60	36	50	6	M5	M6×9.5	M4	19	13	8	4.4	10		125	LM 10U	588	1100
SH 12LUU	34	28	62	36	50	6	M5	M6×9.5	M4	20	14	8	4.4	12		155	LM 12U	657	1200
SH 13LUU	36	30	66	40	54	6	M5	M6×9.5	M4	21	15	8	4.4	13		190	LM 13U	814	1570
SH 16LUU	42	36	76	52	66	6	M5	M6×10	M4	24	18	8	4.4	16		295	LM 16U	1230	2350
SH 20LUU	49	42	86	58	72	7	M6	M6×12	M5	28	21	9.5	5.4	20	0 −0.010	425	LM 20U	1400	2750

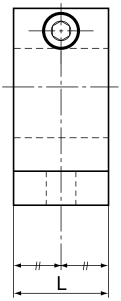
Note Since this model contains a synthetic resin retainer, do not use it at temperature exceeding 80℃. A stainless steel Linear Bush model LM-MG, highly corrosion resistant, can also be incorporated at your request.

Example of Model Number for Use in Combination with Linear Bush Units

Linear Bush to be combined	Example of model No.	
Both ends attached with seal	SH13 LUU	Standard stock
Without seal	SH13 L	Build to order
Made of stainless steel; both ends attached with seal	SH13 MLUU	Build to order

Model SK





Unit: mm

Model No.	Major dimensions													
	H	W	L	B	S	Mounting bolt model No.	h ±0.02	A ±0.05	b	g	l	Shaft diameter d	Tightening bolt model No.	Mass g
SK 10	32.8	42	14	32	5.5	M 5	20	21	5	6	18	10	M4	24
SK 12	37.5	42	14	32	5.5	M 5	23	21	5	6	20	12	M4	30
SK 13	37.5	42	14	32	5.5	M 5	23	21	5	6	20	13	M4	30
SK 16	44	48	16	38	5.5	M 5	27	24	5	8	25	16	M4	40
SK 20	51	60	20	45	6.6	M 6	31	30	7.5	10	30	20	M5	70
SK 25	60	70	24	56	6.6	M 6	35	35	7	12	38	25	M6	130
SK 30	70	84	28	64	9	M 8	42	42	10	12	44	30	M6	180
SK 35	83	98	32	74	11	M10	50	49	12	15	50	35	M8	270
SK 40	96	114	36	90	11	M10	60	57	12	15	60	40	M8	420

Precautions on Using the Linear Bush

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Linear Bush may damage it. Giving an impact to the Linear Bush could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(3) When planning to use the product in an environment where the coolant penetrates the Linear Bush, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.
(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Linear Bush, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

LM Stroke

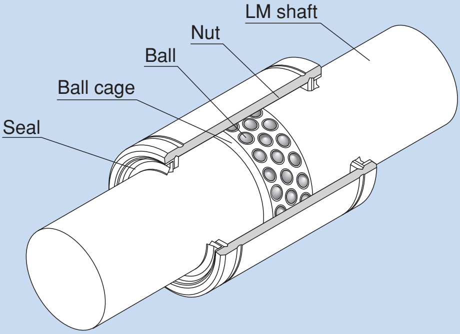


Fig. 1 Structure of LM Stroke Model ST

Structure and Features

LM Stroke model ST has a ball cage and balls both incorporated into a precision-ground cylindrical nut as shown in Fig. 1. The balls are arranged in zigzags so as to evenly receive a load. The ball cage is a drilled cage made of a light alloy with high rigidity, and capable of follow high-speed motion. A thrust ring and a snap ring are installed on both sides of the inner surface of the nut to prevent the ball cage from overrunning.
This structure allows rotational motion, reciprocal motion and complex motion with a small friction coefficient. Model ST has a stroke length up to twice the range within which the ball cage can travel. The maximum stroke of each model is indicated in the corresponding dimensional table.

●Minimal Friction Coefficient

The balls and the ball raceway are in point contact, which causes the smallest rolling loss, and the balls are individually retained in the ball cage. This allows the LM stroke to perform rolling motion at a minimal friction coefficient (μ = 0.0006 to 0.0012).

●Compact Design

Since it consists only of a thin nut and balls, the outer diameter of the bearing is minimized and a light, space-saving, compact design is achieved.

●High Accuracy at a Low Price

A highly accurate slide unit can be produced at a low price.

Applications

The LM Stroke is used in a wide array of applications such as press die setting, ink roll unit of printing machine, workpiece chuck unit of punching press, press feeder, work head of electric discharge machine, wound roll corrector, spinning and weaving machine, distortion measuring equipment, spindle of optical measuring instrument, and photocopiers.

Types and Features

Light Load Type Model ST

Model ST is a light load type that allows a long stroke.
Shaft diameter: φ6 to φ100

Medium Load Type Model ST-B

It has the same dimensions as model ST, but has a shorter stroke and achieves a rated load twice that of ST.
Shaft diameter: φ8 to φ100

Inner Ring Type Model STI

If the LM shaft cannot be hard quenched, STI allows an inner ring to be incorporated. The inner ring is available build-to-order.

Seal Type Models ST … UU/ST … UUB

A special synthetic rubber seal, attached to moth ends of the nut, prevents foreign matter from entering the interior of the LM Stroke and grease from leaking.
When desiring lower seal resistance, a felt seal is available for some types (models ST … DD/ST … DDB).

Accuracy Standards

The tolerance value in inscribed circle diameter (dr), nut outer diameter (D) and nut length (L) is indicated in the corresponding dimensional table.

The end of the nut may be deformed due to tension of the snap ring. Therefore, when measuring the nut outer diameter, it is necessary to calculate the measurement range using the following equation, and obtain the average diameter value within the range.

The tolerance value in the nut outer diameter is equal to the calculated average value of the maximum diameter and the minimum diameter obtained through two-point measurement of the outer diameter.

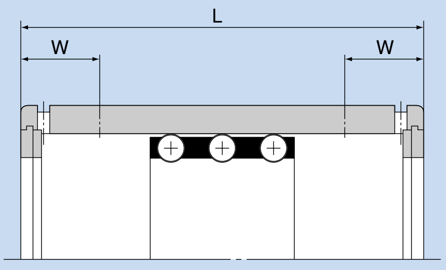


Fig. 2 Measurement Range of the Nut

$$W = 4 + \frac{L}{8}$$

W : Length out of the measurement range (mm)
L : Nut length (mm)

Fitting

In theory, the ball cage of LM Stroke model ST moves in the same direction as the ST shaft by 1/2 of the shaft (or nut). However, to minimize the travel distance error caused by uneven load distribution or vibrations, it is necessary to reduce the clearance. If high accuracy is required or if the LM Stroke is used on a vertical shaft, we recommend setting the radial clearance between 0 and 10 μm.

Normal service conditions		Vertical shaft or high accuracy	
ST shaft	Housing	ST shaft	Housing
k5, m5	H6, H7	n5, p5	J6, J7

ST Shaft

With the ST shaft, used in LM Stroke model ST, balls roll directly on the shaft surface. Therefore, it is necessary to pay much attention to the hardness, surface roughness and dimensional accuracy when manufacturing it.

Since the hardness of the ST shaft has especially large impact on the service life, use much care in selecting a material and heat treatment method.

THK also manufactures high-quality ST shafts. Contact us for details.

●Material

The following materials are generally used as suitable for surface hardening through induction quenching.

SUJ2	(JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6	(JIS G 4401: carbon-tool steel)
S55C	(JIS G 4051: carbon steel for machine structural use)

●Hardness

We recommend surface hardness of 58 HRC (≒ 653 HV) or higher. The depth of the hardened layer is determined by the shaft diameter; we recommend approximately 2 mm for general use. The ST shaft can have a hardened inner ring attached on the shaft raceway.

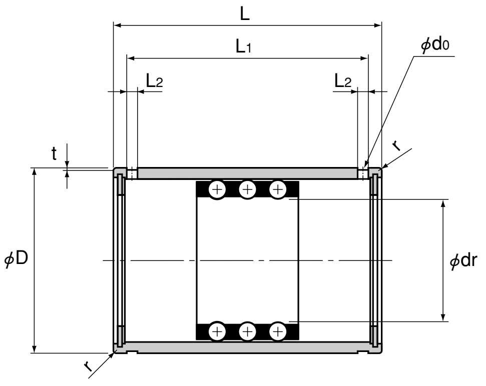
●Roughness of the surface

To achieve smooth motion, the surface is normally finished to 0.4a or less. If higher wear resistance is required, finish the surface to 0.2a or less.

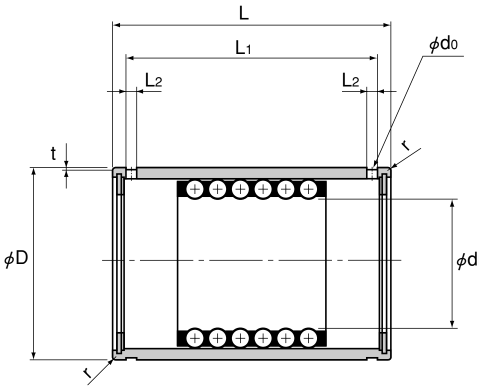
Installation of the ST Shaft

To install the ST shaft, drive it in to the designated depth. If the clearance is negative, a large driving force is required. However, do not forcibly hammer the shaft. Instead, apply a lubricant on the ST shaft first, and then gradually drive it in with a slight back action.

Models ST / ST-B



Model ST
(For light load)

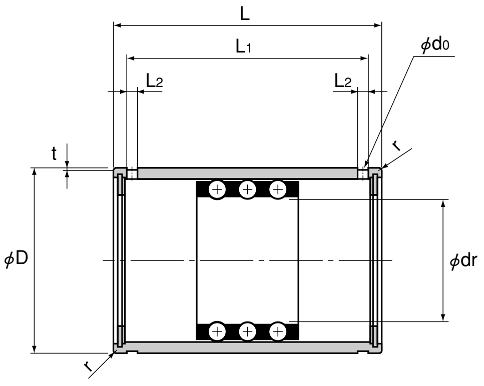


Model ST-B
(For medium load)

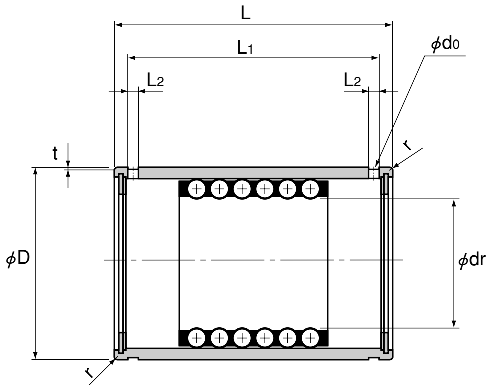
Unit: mm

Model No.	Maximum stroke	Inscribed circle diameter		Outer diameter		Length							Basic dynamic load rating	Basic static load rating	Mass
		dr	Tolerance	D	Tolerance	L	Tolerance	L_1	L_2	t	d_0	r	C kN	C_0 kN	g
ST 6	14	6	$^{+0.018}_{+0.010}$	12	0 –0.008	19	0 –0.2	13.5	1.1	0.25	—	0.3	0.98	0.23	8
ST 8 ST 8B	24 8	8	+0.022 +0.013	15		24		20.1	1.5	0.5	1.5	0.5	0.98 2.06	0.27 0.55	16.4 17.6
ST 10 ST 10B	30 8	10		19	0 –0.009	30		25.7	1.5	0.5	1.5	0.5	2.35 4.61	0.62 1.27	31.5 34.5
ST 12 ST 12B	32 8	12	+0.027 +0.016	23		32		27.5	1.5	0.5	1.5	0.5	4.02 8.14	1.08 2.25	47 53.5
ST 16 ST 16B	40 16	16		28		37		32.1	1.5	0.5	1.5	0.5	4.02 8.04	1.27 2.65	77 85
ST 20 ST 20B	54 28	20	+0.033 +0.020	32	0 –0.011	45		39.8	2	0.5	2	0.5	4.12 8.33	1.57 3.24	109 120
ST 25 ST 25B	54 28	25		37		45	0 –0.3	39.8	2	0.5	2	1	4.12 8.14	1.76 3.63	128 142
ST 30 ST 30B	82 44	30		45		65		58.5	2.5	0.5	2.5	1	9.31 18.7	4.12 8.14	240 275
ST 35 ST 35B	92 54	35	+0.041 +0.025	52	0 –0.013	70		63.5	2.5	0.7	2.5	1.5	9.41 18.7	4.51 9.02	370 410

Models ST / ST-B



Model ST
(For light load)

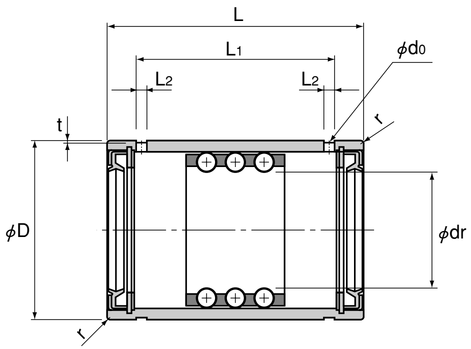


Model ST-B
(For medium load)

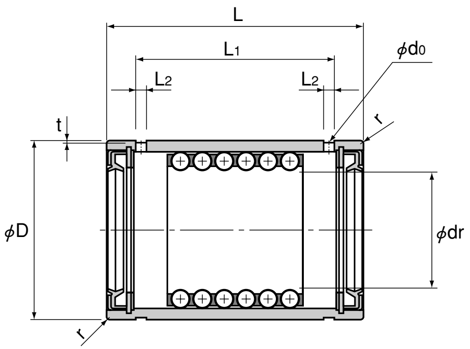
Unit: mm

Model No.	Maximum stroke	Inscribed circle diameter		Outer diameter		Length							Basic dynamic load rating	Basic static load rating	Mass
		dr	Tolerance	D	Tolerance	L	Tolerance	L_1	L_2	t	d_0	r	C kN	C_0 kN	g
ST 40	108	40	+0.041 +0.025	60	0 −0.013	80	0 −0.3	73.3	2.5	0.7	2.5	1.5	12.5	6.18	570
ST 40B	66												25	12.4	635
ST 45	108	45		65		80		73.3	2.5	0.7	2.5	1.5	12.6	6.76	625
ST 45B	66												25.2	13.5	695
ST 50	138	50		72		100		92.4	3	1	3	1.5	16.3	8.82	910
ST 50B	88												32.5	17.7	1020
ST 55	138	55	+0.049 +0.030	80		100		92.4	3	1	3	2	16.6	9.71	1270
ST 55B	88												33	19.3	1380
ST 60	138	60		85	0 −0.015	100		92.4	3	1	3	2	16.8	10.5	1360
ST 60B	88												33.6	21	1480
ST 70	138	70		95		100	0 −0.4	92.4	3	1	3	2	16.9	11.7	1530
ST 70B	88												33.8	23.3	1670
ST 80	132	80		110		100		92	3	1.5	3	2	21.3	15.3	2220
ST 80B	76												42.5	30.6	2430
ST 90	132	90	+0.058 +0.036	120		100		92	3	1.5	3	2	21.7	16.9	2440
ST 90B	76												43.3	33.7	2670
ST 100	132	100		130	0 −0.018	100		92	3	1.5	3	2	22	18.3	2670
ST 100B	76												43.9	36.8	2910

Models ST···UU / ST···UUB



Model ST···UU
(For light load)

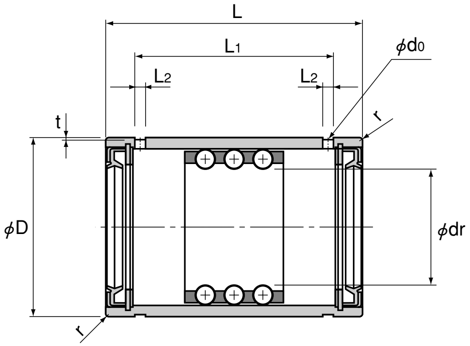


ST···UUB
(For medium load)

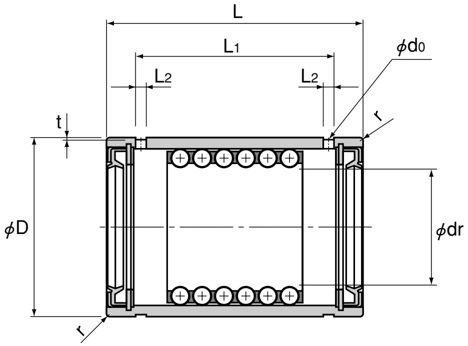
Unit: mm

Model No.	Maximum stroke	Inscribed circle diameter		Outer diameter		Length							Basic dynamic load rating	Basic static load rating	Mass
		dr	Tolerance	D	Tolerance	L	Tolerance	L_1	L_2	t	d_0	r	C kN	C_0 kN	g
ST 8UU	14	8	+0.022 +0.013	15	0 −0.008	24	0 −0.2	15.3	1.5	0.5	1.5	0.5	0.98	0.27	17
ST 10UU	16	10		19	0 −0.009	30		18.5	1.5	0.5	1.5	0.5	2.35	0.62	31
ST 12UU	17	12	+0.027 +0.016	23		32		20.1	1.5	0.5	1.5	0.5	4.02	1.08	49
ST 16UU	24	16		28		37		24.1	1.5	0.5	1.5	0.5	4.02	1.27	80
ST 20UU	32	20	+0.033 +0.020	32	0 −0.011	45		30.8	2	0.5	2	0.5	4.12	1.57	112
ST 20UUB	12												8.33	3.24	125
ST 25UU	32	25		37		45	0 −0.3	30.8	2	0.5	2	1	4.12	1.76	132
ST 25UUB	12												8.14	3.63	145
ST 30UU	65	30		45		65		50.1	2.5	0.5	2.5	1	9.31	4.12	245
ST 30UUB	27												18.7	8.14	280
ST 35UU	75	35	+0.041 +0.025	52	0 −0.013	70		55.1	2.5	0.7	2.5	1.5	9.41	4.51	375
ST 35UUB	37												18.7	9.02	420
ST 40UU	91	40		60		80		64.9	2.5	0.7	2.5	1.5	12.5	6.18	580
ST 40UUB	49												25	12.4	640
ST 45UU	91	45		65		80		64.9	2.5	0.7	2.5	1.5	12.6	6.76	635
ST 45UUB	49												25.2	13.5	705

Models ST···UU / ST···UUB



Model ST···UU
(For light load)



ST···UUB
(For medium load)

Unit: mm

Model No.	Maximum stroke	Inscribed circle diameter		Outer diameter		Length							Basic dynamic load rating	Basic static load rating	Mass
		dr	Tolerance	D	Tolerance	L	Tolerance	L_1	L_2	t	d_0	r	C kN	C_0 kN	g
ST 50UU	120	50	+0.041 +0.025	72	0 −0.013	100	0 −0.3	83.4	3	1	3	1.5	16.3	8.82	920
ST 50UUB	70												32.5	17.7	1030
ST 55UU	120	55	+0.049 +0.030	80		100		83.4	3	1	3	2	16.6	9.71	1280
ST 55UUB	70												33	19.3	1400
ST 60UU	120	60		85	0 −0.015	100		83.4	3	1	3	2	16.8	10.5	1370
ST 60UUB	70												33.6	21	1490
ST 70UU	120	70		95		100	0 −0.4	83.4	3	1	3	2	16.9	11.7	1540
ST 70UUB	70												33.8	23.3	1680
ST 80UU	114	80		110		100		83	3	1.5	3	2	21.3	15.3	2240
ST 80UUB	58												42.5	30.6	2450
ST 90UU	114	90	+0.058 +0.036	120		100		83	3	1.5	3	2	21.7	16.9	2470
ST 90UUB	58												43.3	33.7	2700
ST 100UU	114	100		130	0 −0.018	100		83	3	1.5	3	2	22	18.3	2700
ST 100UUB	58												43.9	36.8	2940

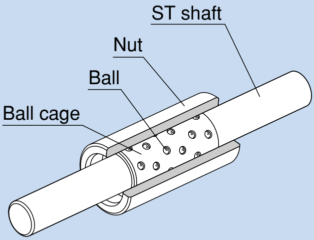


Fig. 1 Structure of Miniature Stroke Model MST

Structure and Features

Miniature Stroke model MST consists of an ST shaft, ball cage and nut. These components can freely be combined according to the application.

●Highly accurate bearing

Precision steel balls (sphericity in mutual difference: 0.0003 mm) compliant with JIS B 1501 are incorporated in a copper alloy ball cage to ensure high accuracy.

The ball cage serves to prevent the balls from falling off with a unique ball-retaining design.

●Highly durable bearing

The nut of the ST shaft uses a selected material, and is heat-treated and ground. In addition, the raceways are finished with ultra precision. The rows of balls are densely arranged in the ball cage, and the balls are placed so that the ball raceways do not overlap with each other. It enables this model to be used over a long period without wear and to demonstrate high durability.

●Compact bearing

Use of a combination of balls with a 1-mm diameter and a thin nut allows a small sectional shape and space-saving design.

●Bearing with extremely low frictional resistance

Since the balls are in point-contact with the raceways, rolling loss is minimal and rolling motion with low-friction is achieved.

Applications

The Miniature Stroke can be used in small, precision measuring equipment such as optic measuring instruments' spindle, pen plotter, OA equipment, computer terminals, automatic scale, digital length measuring machine and solenoid valve.

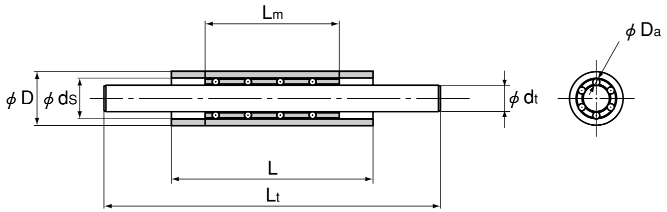
Fitting

The inner surface of the housing must be finished to H6 to H7, and secured with an adhesive after the nut is inserted.
When press fitting is required, mounting the nut to the hole will reduce the inner diameter. Therefore, be sure to check the inner diameter after press fitting the nut and adjust the shaft diameter so that a correct preload is achieved. Also make sure that the preload must not exceed -2 μm.

Travel Distance of the Ball Cage

The ball cage can travel by rolling up to 1/2 of the stroke length (ℓs) of the nut or the ST shaft in the same direction.

Model MST



Unit: mm

Combined model No.	Ball cage				Nut				ST shaft			Combined radial clearance μm
	Model No.	D_a	L_m $\boxed{\text{A}}$	Permissible load C_0 N	Model No.	D	d_s	L $\boxed{\text{B}}$	Model No.	d_t	L_t $\boxed{\text{C}}$	
MST 3-A·B·C	M3510	1	10	68.6	S 5710	$7^{\ 0}_{-0.006}$	5 ±0.002	10	T350 T360	$3^{\ 0}_{-0.003}$	50 60	-2 to +5
	M3515		15	98	S 5720			20				
	M3520		20	137	S 5730			30				
MST 4-A·B·C	M4610	1	10	78.4	S 6810	$8^{\ 0}_{-0.006}$	6 ±0.002	10	T450 T460	$4^{\ 0}_{-0.003}$	50 60	-2 to +5
	M4615		15	118	S 6820			20				
	M4620		20	157	S 6830			30				
MST 5-A·B·C	M5710	1	10	98	S71010	$10^{\ 0}_{-0.006}$	7 ±0.002	10	T550 T580	$5^{\ 0}_{-0.003}$	50 80	-2 to +5
	M5715		15	137	S71020			20				
	M5720		20	186	S71030			30				
MST 6-A·B·C	M6810	1	10	108	S81120	$11^{\ 0}_{-0.011}$	8 ±0.002	20	T650 T680	$6^{\ 0}_{-0.003}$	50 80	-2 to +5
	M6815		15	157	S81130			30				
	M6820		20	216	S81140			40				

Note If the radial clearance needs to be zero or below, add symbol "C1" at the end of the model number.
(Example) MST5-203080 C1

C1 — Combined radial clearance
Symbol for zero or below

MST5-203080 — Combination of models M5720, S71030 and T580.

Model number coding

MST 4-10 20 60 M

1 2 3 4 5 6

1 Combined model number - (ball cage) : M4610
(Nut) : S6820
(ST shaft) : T 460
} Combination of these components

2 St shaft outer diameter dimension (mm) 3 Ball cage length (mm) $\boxed{\text{A}}$ 4 Nut length (mm) $\boxed{\text{B}}$
5 ST shaft length (mm) $\boxed{\text{C}}$ 6 Using stainless steel

Note The model numbers of ball cage, nut and ST shaft are indicated in the corresponding dimensional table.

Die-setting Ball Cage

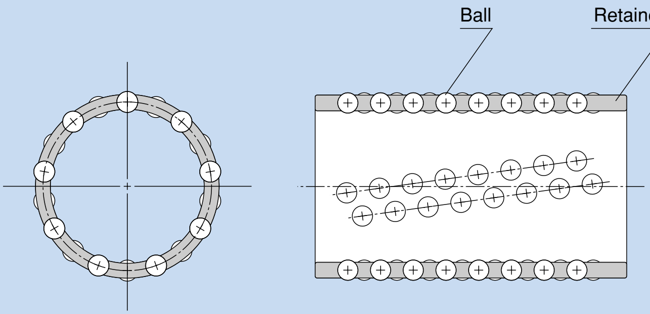


Fig. 1 Structure of Die-setting Ball Cage Model KS

Structure and Features

With Die-setting Ball Cage models KS and BS, a large number of precision steel balls (sphericity in mutual difference: 0.0005 mm) compliant with JIS B 1501 are incorporated in a lightweight, highly rigid ball cage. The balls are arranged along the circumference of the ball cage in spirals so that the ball raceways do not overlap with each other. It enables these models to be used over a long period without wear and to demonstrate high durability.

In addition, the ball pockets, which hold the balls, are finished with precision and continuously caulked with a unique process, enabling them to prevent the balls from falling. It allows the system to travel smoothly even if the ball cage is longer than the housing.

Applications

These ball cages are used in precision press die set, spinning and weaving machine, precision measuring instrument, automatic recorder, medical equipment and various machine tools.

Rated Load and Service Life

The rated loads of Die-setting Ball Cage models KS and BS are indicated in the respective dimensional tables. Their service lives are obtained using the service life equation for LM Stroke model ST on page D-6 in the "THK General Catalog - Technical Descriptions of the Products," provided separately.

Fitting

When using the Die-setting Ball Cage in the guide unit of the guide post of a precision press die set, normally select a negative clearance in order to increase the accuracy and the ball cage rigidity. Table 1 shows typical fitting between the hole and the shaft. Select a combination of a hole and a shaft so that the clearance does not exceed the tolerance value of the radial clearance indicated in the dimensional table.

Table 1 Fitting between Holes and Shaft

Tolerance in hole dimensions: D	K 5
Tolerance in shaft dimensions: d	h 5

Installation of the Ball Cage

Fig. 2 shows examples of mounting the Die-setting Ball Cage.

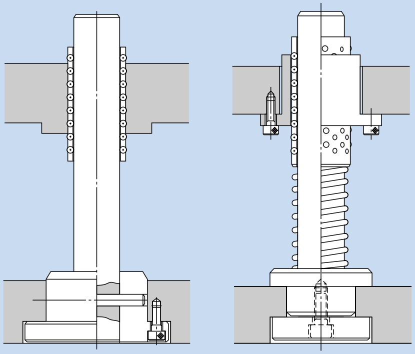
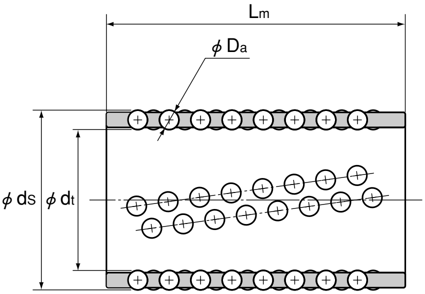


Fig. 2 Examples of Installation



Unit: mm

Combined model No.	Major dimensions				Radial clearance tolerance	Basic load rating	
	d_t	D_a (inch)	d_s	L_m	µm	C kN	C_0 kN
KS 1955	19	3	25	55	− 7	10.3	3.82
BS 1955	19	3.175 (1/8)	25.35	55	− 7	11.7	4.22
KS 2260	22	3	28	60	− 7	10.7	4.22
BS 2260	22	3.175 (1/8)	28.35	60	− 7	12.2	4.71
KS 2565	25	3	31	65	− 7	11.7	5
BS 2565	25	3.175 (1/8)	31.35	65	− 7	13.2	5.59
KS 2870	28	4	36	70	− 9	18	7.65
BS 2870	28	3.969 (5/32)	35.938	70	− 9	17.7	7.55
KS 3275	32	4	40	75	− 9	19.7	9.12
BS 3275	32	3.969 (5/32)	39.938	75	− 9	19.3	8.92
KS 3880	38	5	48	80	−10	25	12
BS 3880	38	4.762 (3/16)	47.525	80	−10	22.5	10.9

Note The outer surface of model BS has a groove to help distinguish it from KS.
Shafts for models KS and BS are also manufactured. Contact THK for details.

Precautions on Using the LM Stroke

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the LM Stroke may damage it. Giving an impact to the LM Stroke could also cause damage to its function even if the product looks intact.

Lubrication

(1) LM Stroke model ST can use either oil or grease as a lubricant. Select either lubricant according to the DN value. When using grease, we recommend high-quality lithium-soap group grease No. 2.

(2) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

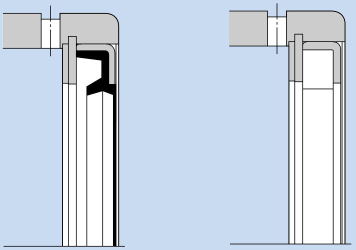
(3) Do not mix lubricants of different physical properties.

(4) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(5) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter into LM Stroke model ST may cause abnormal wear or shorten the service life. When entrance of foreign matter is predicted, it is important to select an effective sealing device or dust-control device that meets the atmospheric conditions. For LM Stroke model ST, a special synthetic rubber seal (ST … UU) that is highly resistant to wear and a felt seal with high dust prevention effect and low seal resistance (ST … DD) are available for some types as dust prevention accessories.


Rubber seal (standard)

Felt seal (designated)

Fig. 1 Types of the Seal for the LM Stroke

(2) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.

(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(4) When planning to use the product in an environment where the coolant penetrates the LM Stroke, contact THK in advance.

(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the LM Stroke, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

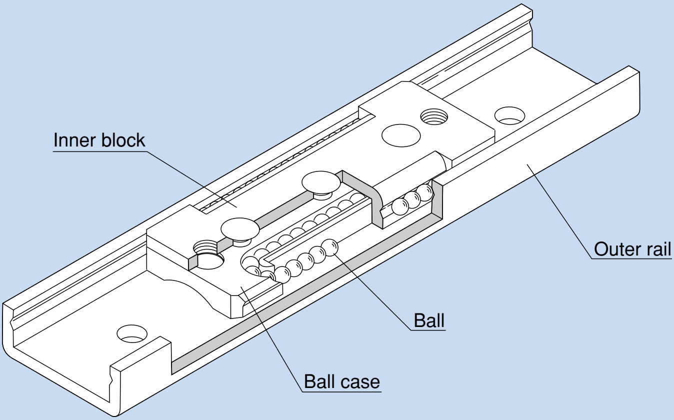


Fig. 1 Structure of Precision Linear Pack Model ER

Structure and Features

Precision Linear Pack model ER is a slide unit using a stainless steel plate that is precision formed, heat-treated and then ground. It has a structure where balls rolls between the V-shaped grooves machined on the outer rail and the inner block to allow the system to slide. It is an ultra-thin, lightweight unit in which the balls circulate in a ball case incorporated in the inner block to perform infinite linear motion.

●Reduced design and assembly costs

It provides a highly accurate linear guide system with lower design cost and fewer man-hours than the conventional miniature ball bearings used in precision machines and other equipment.

●Maintains long-term stability

It is a ball-circulating type slide unit with an extremely small friction coefficient. This slide unit maintains stable performance over a long period of time.

●Light weight, compact design and high-speed response

The outer rail and the inner block are composed of very thin stainless steel plates.

Since the linear pack is light, it has a small inertial moment and demonstrates superbly high-speed response.

Applications

The Precision Linear Pack is used in extensive applications such as magnetic disc device, electronic equipment, semiconductor manufacturing machine, medical equipment, measuring equipment, plotting machine and photocopier.

Rated Loads in All Directions

Model ER is capable of receiving loads in all directions: radial, reverse radial and lateral directions.
The basic load rating in the dimensional table in the "THK General Catalog - Product Specifications," provided separately, indicates the rated load in the radial direction as shown in Fig. 2. The rated loads in the reverse-radial and lateral directions are obtained from table 1 below.

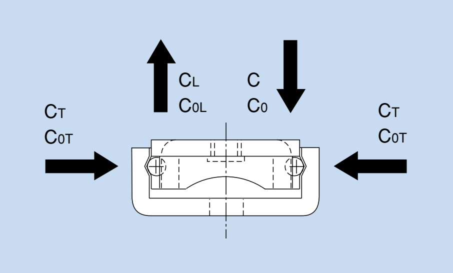


Fig. 2 Directions of the Rated Loads

Table 1 Rated Loads in All Directions

	Basic dynamic load rating	Basic static load rating
Radial direction	C	C_0
Reverse-radial direction	$C_L=C$	$C_{0L}=C_0$
Lateral direction	$C_T=1.47C$	$C_{0T}=1.73C_0$

Accuracy Standards

The running straightness of Linear Pack model ER is indicated in table 2 (see Fig. 3).

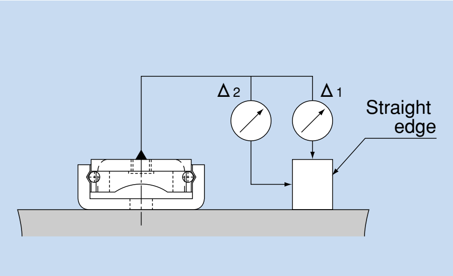


Fig. 3 Method for Measuring Running Straightness

Table 2 Running Straightness

Unit: mm

Stroke length		Running straightness of inner block in vertical directions Δ1	Running straightness of inner block in horizontal directions Δ2
Above	Or less		
–	20	0.002	0.004
20	40	0.003	0.006
40	60	0.004	0.008
60	80	0.005	0.010
80	100	0.006	0.012
100	120	0.008	0.016

Radial Clearance

The radial clearance of model ER means the value for the motion of the central part of the inner block when the inner block is slightly moved with a vertically constant force in the middle of the outer rail in the longitudinal direction. The negative values in table 3 indicate that the respective models are provided with a preload when assembled and have no clearance between their inner blocks and the outer rails.

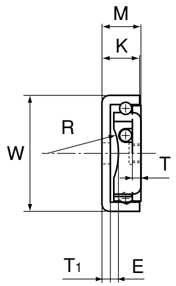
Table 3 Radial Clearance

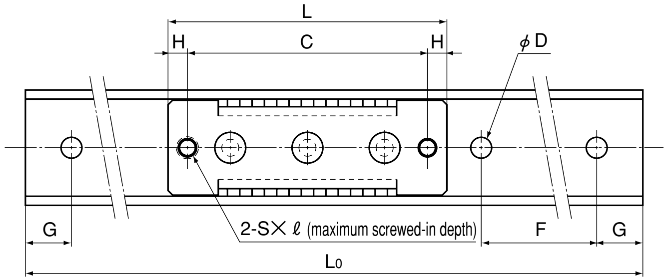
Unit: μm

Model No.	Radial clearance	
	Normal	C1
ER 513	±2	–2 to 0
ER 616	±2	–3 to 0
ER 920	±2	–4 to 0
ER 1025	±3	–6 to 0

Note: When desiring normal clearance, add no symbol; when desiring C1 clearance, indicate "C1" in the model number (see "Model number coding" on page e-6).

Model ER





Unit: mm

Model No.	Inner block dimensions										Outer rail dimensions						Basic load rating		Mass	
	Width W	Height M ±0.05	Length L	C	H	E	R	S	Maximum screwed-in depth ℓ	T	K	T_1	D	L_0	F	G	C N	C_0 N	Inner block g	Outer rail g/m
ER 513	13	4.5	22	7	7.5	1.1	4.2	M2	1.3	0.9	4	1.1	2.4	40, 60, 80	20	10	54.9	72.5	2.4	166
ER 616	15.6	6	36	29	3.5	1.7	9.2	M3	1.8	1.1	5.5	1.4	2.9	45, 70, 95	25	10	71.6	125	5.6	268
ER 920	20	8.5	46	40	3	2.3	7.3	M3	2.5	1.9	7.5	1.9	3.5	50, 80, 110	30	10	144	201	14.4	474
ER 1025	25	10	56	48	4	2.9	9.3	M4	2.8	2.2	9	2.2	4.5	60, 100, 140	40	10	215	315	27	677

Note To secure the outer rail of models ER513 and ER616, use cross-recessed screws for precision equipment (No. 0 screw).
Japan Camera Industry Association Standard JCIS 10-70
Cross-recessed screw for precision equipment (No. 0 screw)

Type		Nominal number of screw × pitch
No. 0 pan-head screw (class 1)	For model ER513	M2×0.4
	For model ER616	M2.6×0.45

Model number coding

2 ER616 C1 +95L

1 2 3 4

1 Number of inner blocks used on the same rail 2 Model number
3 Radial clearance symbol (see page e-5) 4 Outer rail length (in mm)

Precautions on Using the Precision Linear Pack

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Precision Linear Pack may damage it. Giving an impact to the Precision Linear Pack could also cause damage to its function even if the product looks intact.
(3) Removing the inner block of the Precision Linear Pack from the outer rail or letting it overrun will cause balls to fall off.

Lubrication

(1) Thoroughly remove anti-corrosion oil with a cleaning detergent and apply lubricant before using the product (note that grease is not fed when the product is shipped). As the most suitable grease, we recommend THK AFC Grease, which maintains lubricity over a long period of time. For lubrication in a clean room, low dust generation THK AFE Grease and THK AFF Grease are recommended.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Installation

The mounting surface of Precision Linear Pack model ER must be finished to the maximum accuracy.
For securing the outer rail of models ER513 and ER613, also purchase and use No. 0 screws for precision equipment (see table 1) (if using ordinary screws, the inner block may hit the screw head).

Table 1 Outer Rail Securing Screws for Models ER513 and ER616

Model No.	Type	Nominal number of screw × pitch
ER513	No. 0 pan-head screw (class 1)	M2×0.4
ER616		M2.6×0.45

Japan Camera Industry Association Standard JCIS 10-70
Cross-recessed screw for precision equipment (No. 0 screw)

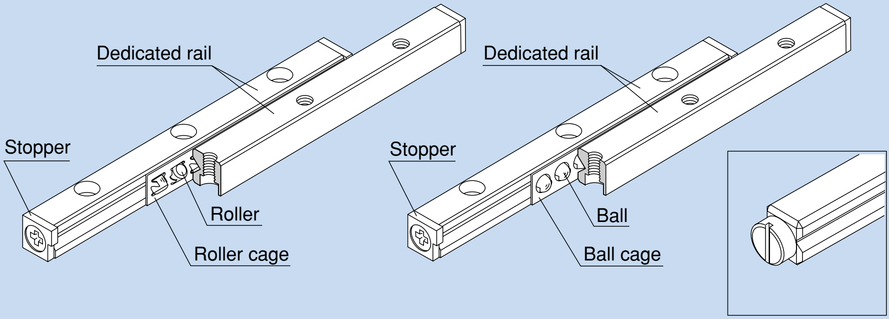
Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) If foreign such as dust or cutting chips matter adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Precision Linear Pack, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

Cross Roller Guide/Ball Guide



Stoppers of models V1 to V4 have round shapes.

Fig. 1 Structure of Cross Roller Guide Model VR

Fig. 2 Structure of Ball Guide Model VB

Structure and Features

In Cross Roller Guide model VR, precision rollers orthogonally are aligned one after another in a roller cage that is combined with a dedicated rail having a raceway cut into a V-shape groove. When two units of the Cross Roller Guide are mounted in parallel, the guide system is capable of receiving loads in all directions. In addition, since the Cross Roller Guide can be given a pre-load, a clearance-free, highly rigid and smooth slide mechanism is achieved.
Ball Guide model VB is a low-friction, high-accuracy, finite LM system consisting of precision steel balls, arranged in short pitches in a ball cage model B, and a dedicated rail model V.

●Long service life, high rigidity

With a unique roller retaining mechanism, the effective contact length of the rollers is 1.7 greater than the conventional type. Furthermore, the roller pitch interval is short and a sufficient number of rollers are installed, thus increasing the rigidity by twice and the service life by six times greater than the conventional type. As a result, a safety-oriented design against vibrations and impact, which commonly occur in ordinary linear motion mechanisms, can be achieved.

●Smooth motion

With Cross Roller Guide model VR, the rollers are individually held in a cage and roller pockets formed on the cage are in surface contact with the rollers to increase grease retention. Thus, smooth motion with little wear and friction is achieved.

●High corrosion resistance

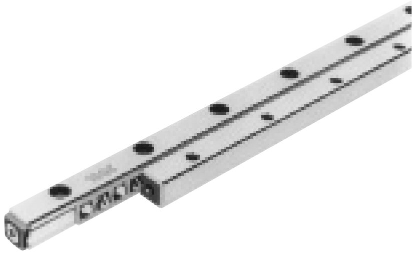
The Cross Roller Guide model VR series and the Ball Guide model VB series both include types made of stainless steel, which is highly resistant to corrosion.

Applications

The Cross Roller Guide and the Ball Guide are used in the slide unit of various devices such as OA equipment and its peripherals, measuring instruments, precision equipment including a printed-board drilling machine, optic measuring machine, optic stage, handling mechanism and X-ray machine.

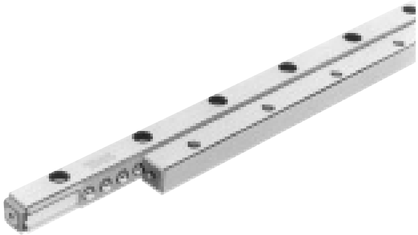
Types and Features

Cross Roller Guide Model VR



A compact, highly rigid LM system whose roller cage holding precision rollers orthogonally aligned one after another travels by half the stroke on a V-shaped groove formed on a rail.

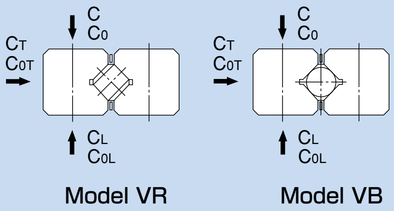
Ball Guide Model VB



A low-friction, highly accurate LM system whose ball cage holding precision balls in short pitches travels by half the stroke on a V-shaped groove formed on a rail.

Rated Loads in All Directions

The basic load ratings (C_Z and C_{0Z}) in the dimensional table indicate the values per rolling element in the directions shown in Fig. 3. When obtaining the rated life, calculate the basic load ratings (C and C_0) of the actually used rolling elements from the equation below.



Model VR

Model VB

Fig. 3

●For Cross Roller Guide Model VR

$$C=C_L=\left(\frac{Z}{2}\right)^{\frac{3}{4}}\times C_Z,\ C_T=2C$$

$$C_0=C_{0L}=\frac{Z}{2}\times C_{0Z},\ C_{0T}=2C_0$$

(For $\frac{Z}{2}$, truncate the decimals.)

●For Ball Guide Model VB

$$C=C_L=Z^{\frac{2}{3}}\times C_Z,\ C_T=2C$$

$$C_0=C_{0L}=Z\times C_{0Z},\ C_{0T}=2C_0$$

C :Basic dynamic load rating (kN)
C_0 :Basic static load rating (kN)
C_Z :Basic dynamic load rating in the dimensional table (kN)
C_{0Z} :Basic static load rating in the dimensional table (kN)
Z :Number of rolling elements used (Number of rolling elements within the effective load range)

Accuracy Standards

The accuracy of the dedicated rail for the Cross Roller Guide is classified into high grade (H) and precision grade (P) as shown in table 1.

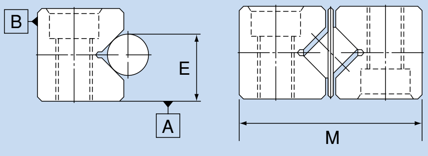


Fig. 4

Table 1 Accuracy Standards for Dedicated Rail Model V

Unit: mm

Accuracy symbol	High grade	Precision grade
Symbol / Item	H	P
Parallelism of the raceway against surfaces A and B	As per Fig. 5	
Dimensional tolerance in height E	±0.02	±0.01
Difference in height E (note)	0.01	0.005
Dimensional tolerance in width M	0 –0.2	0 –0.1

Note: The difference in height E applies to four rails used on the same plane.

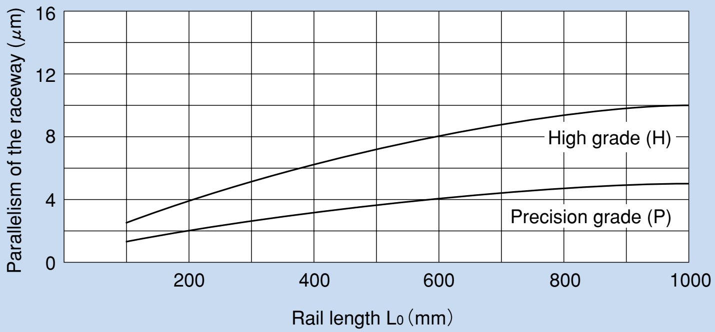


Fig. 5 Rail Length and Parallelism of the Raceway

Procedure for Mounting the Cross Roller Guide

When using clearance-adjustment bolts:

① Closely contact rails 2 and 3 onto the base, and rail 1 onto the table, and then firmly tighten the rail mounting bolts.

② Temporarily secure rail 4 to the table.

Note: The rail mounting bolts must be designed so that they can be fully tightened while maintaining the rail installed.

③ Place the base and the tables as shown in Fig. 6, and then insert the roller cage from the end. If the cage does not enter because there is no clearance, slide rail 4 toward the adjustment bolt first, and then insert the cage again.

④ Place a dial gauge as shown in Fig. 6. Then, lightly screw all adjustment bolts evenly until the clearance is almost eliminated while gently pressing the table sideways.

⑤ Attach the stopper to the rail end.

⑥ Slide the table and adjust the cage position so as to achieve the required stroke.

⑦ Position the roller cage in the center of the rail as shown in Fig. 7-1. Then, evenly tighten the adjustment bolts (b, c and d) that are within the area where the roller is present until the dial gauge indicates the required displacement. Fully tighten the mounting bolts where adjustment was performed.

Note: The displacement indicated on the gauge represents the preload per roller cage.

⑧ Slide the table as shown in Fig. 7-2, and adjust the remaining adjustment bolts (a and e) in the same manner.

Note: When installing two or more units, first measure the tightening torque of the adjustment bolts for the first unit or the sliding resistance of the fist unit. Then, install the second (and later) unit so that its/their tightening torque(s) or sliding resistance(s) equal(s) that of the first unit. In this way, almost uniform preloads can be provided.

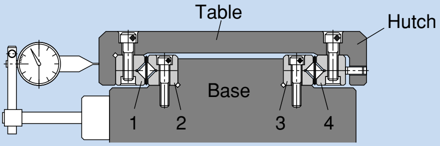


Fig. 6 Installation of the Cross Roller Guide

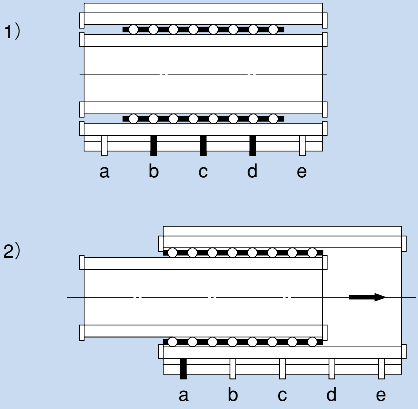
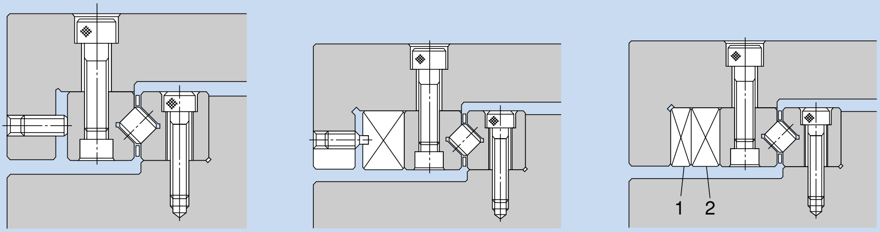


Fig. 7 Sequence of Tightening the Adjustment Bolts

Examples of Adjusting the Clearance

Design the adjustment bolt so that it presses the rail on the same level as the roller.



Normally, press the rail with the adjustment bolt.

When a certain level of accuracy and rigidity is required, use a presser plate.

When high accuracy and high rigidity are required, use tapered gibs 1 and 2.

Fig. 8 Examples of Adjusting the Clearance

Preload of the Cross Roller Guide

An excessive preload may cause indentation, shorten the service life or cause trouble. The permissible preload per roller cage is indicated in the dimensional table. Tighten the adjustment bolts while monitoring the displacement of the roller contact area.

Accuracy of the Mounting Surface

To achieve a high level of running accuracy, it is also necessary to establish a certain level of accuracy in parallelism and straightness. Preferably, the parallelism and the flatness of the rail-mounting surface should be finished by grinding or similar machining to at least the same degree as the parallelism of the rail (see page f-6). Also, mount the rail so that it closely contacts the mounting surface.

Accessory

To mount the rail where normal clearance is to be adjusted, use the screw hole drilled on the rail as shown in Fig. 9. The holes of the bolt (d_1 and D_1) must be machined so that they are greater by the adjustment allowance.

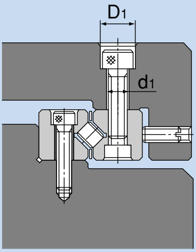


Fig. 9

If it is inevitable to adopt a mounting method like the one shown in Fig. 10 for a structural reason, use the dedicated mounting bolt (S) indicated in Fig. 11.

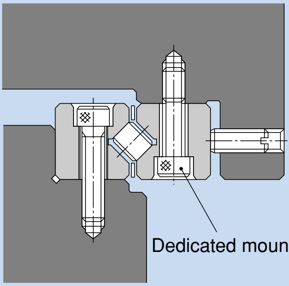


Fig. 10

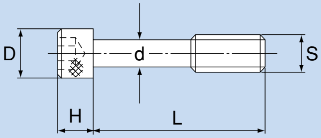


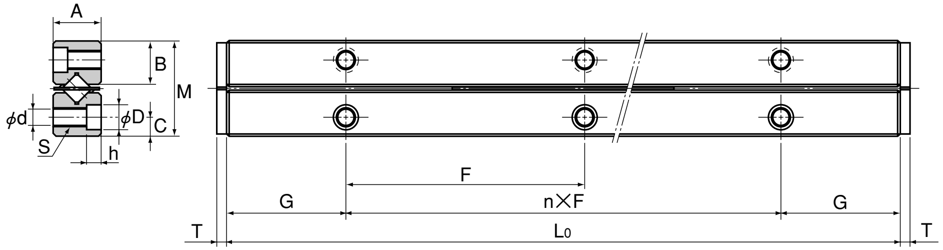
Fig. 11 Dedicated Mounting Bolt

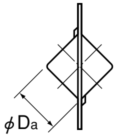
Table 2 Dedicated Mounting Bolt

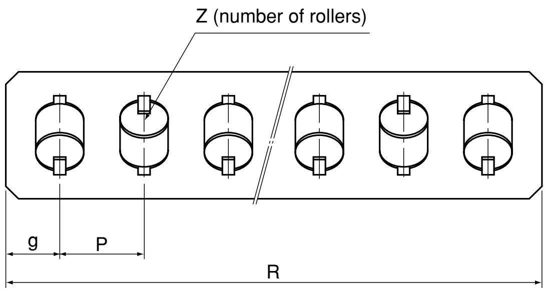
Unit: mm

Model No.	S	d	D	H	L	Supported rail
S 3	M3	2.3	5	3	12	V3
S 4	M4	3.1	5.8	4	15	V4
S 6	M5	3.9	8	5	20	V6
S 9	M6	4.6	8.5	6	30	V9
S12	M8	6.25	11.3	8	40	V12
S15	M10	7.9	13.9	10	45	V15
S18	M12	9.6	15.8	12	50	V18

Cross Roller Guide Model VR (VR1)







Unit: mm

Model No.	Maximum stroke	Major dimensions																	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions													Number of rollers	δ	Cz	C0z	
		M	A	L0	n×F	G	B	C	S	d	D	h	T	Da	R	g	P	Z	μm	kN	kN	kg/m
VR 1-20× 5Z	12	8.5	4	20	1×10	5	3.9	1.8	M2	1.65	3	1.4	1.6	1.5	14	2	2.5	5	–2	0.098	0.069	0.11
VR 1-30× 7Z	22			30	2×10										19			7				
VR 1-40×10Z	27			40	3×10										26.5			10				
VR 1-50×13Z	32			50	4×10										34			13				
VR 1-60×16Z	37			60	5×10										41.5			16				
VR 1-70×19Z	42			70	6×10										49			19				
VR 1-80×21Z	52			80	7×10										54			21				

Note When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB1-50H ×12Z
Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR1M).
To secure the dedicated rail of model VR1, use cross-recessed screws for precision equipment (No. 0 screw).
Japan Camera Industry Association Standard JCIS 10-70
Cross-recessed screw for precision equipment (No. 0 screw)

Type		Nominal number of screw × pitch
No. 0 pan-head screw (class 3)	For model VR1	M1.4×0.3

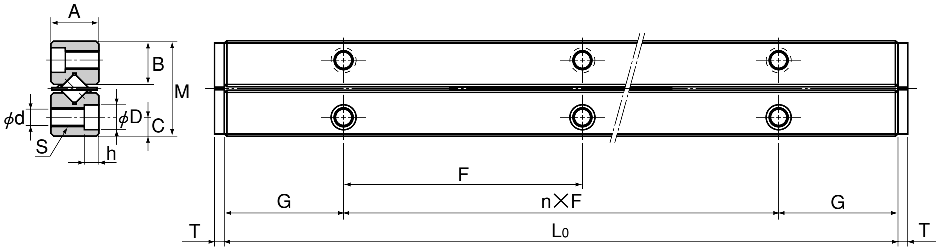
Model number coding

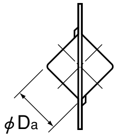
VR1 -30 H × 8Z
1 2 3 4

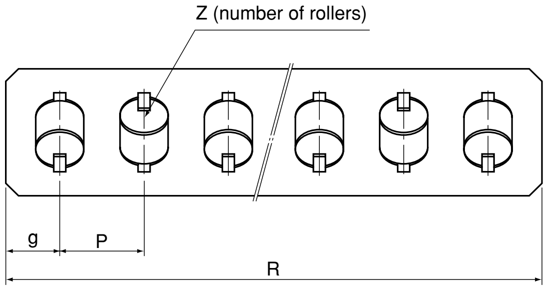
1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 40/50)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR2)







Unit: mm

Model No.	Maximum stroke	Major dimensions																	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions													Number of rollers	δ	Cz	C0z	
		M	A	L0	n×F	G	B	C	S	d	D	h	T	Da	R	g	P	Z	μm	kN	kN	kg/m
VR 2- 30× 5Z	18	12	6	30	1×15	7.5	5.6	2.5	M3	2.55	4.4	2	2	2	21	2.5	4	5	–3	0.176	0.127	0.23
VR 2- 45× 8Z	24			45	2×15										33			8				
VR 2- 60×11Z	30			60	3×15										45			11				
VR 2- 75×13Z	44			75	4×15										53			13				
VR 2- 90×16Z	50			90	5×15										65			16				
VR 2-105×18Z	64			105	6×15										73			18				
VR 2-120×21Z	70			120	7×15										85			21				
VR 2-135×23Z	84			135	8×15										93			23				
VR 2-150×26Z	90			150	9×15										105			26				
VR 2-165×29Z	96			165	10×15										117			29				
VR 2-180×32Z	102			180	11×15										129			32				

Model number coding

VR2 -30 H ×6Z
1 2 3 4

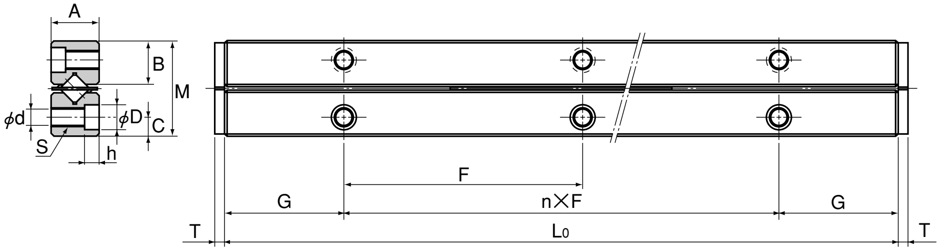
1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 90/105)
3 Accuracy symbol 4 Number of rollers or balls

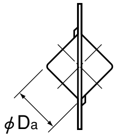
Note "One set" in the model number above indicates a combination of four rails and two cages.

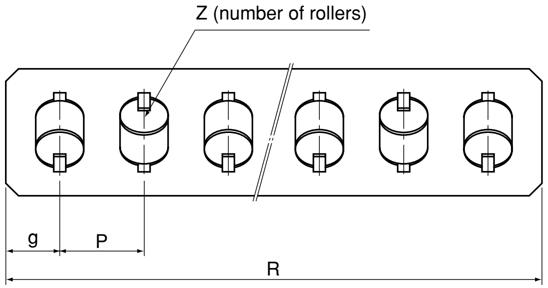
Note When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB2-90H ×15Z
Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR2M).
To secure the dedicated rail of model VR2, use cross-recessed screws for precision equipment (No. 0 screw).
Cross-recessed screw JCIS B 1111 (pan head screw)

Type		Nominal number of screw × pitch
No. 0 pan-head screw (class 3)	For model VR2	M2×0.4

Cross Roller Guide Model VR (VR3)







Unit: mm

Model No.	Maximum stroke	Major dimensions																Number of rollers	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions														δ	Cz	Coz	
		M	A	L0	n×F	G	B	C	S	d	D	h	T	Da	R	g	P	Z	µm	kN	kN	kg/m
VR 3- 50× 7Z	28	18	8	50	1×25	12.5	8.3	3.5	M4	3.3	6	3.1	2	3	36	3	5	7	–4	0.363	0.275	0.45
VR 3- 75×10Z	48			75	2×25										51			10				
VR 3-100×14Z	58			100	3×25										71			14				
VR 3-125×17Z	78			125	4×25										86			17				
VR 3-150×21Z	88			150	5×25										106			21				
VR 3-175×24Z	108			175	6×25										121			24				
VR 3-200×28Z	118			200	7×25										141			28				
VR 3-225×31Z	138			225	8×25										156			31				
VR 3-250×35Z	148			250	9×25										176			35				
VR 3-275×38Z	168			275	10×25										191			38				
VR 3-300×42Z	178			300	11×25										211			42				

Note When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB3-150H ×20Z
Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR3M).

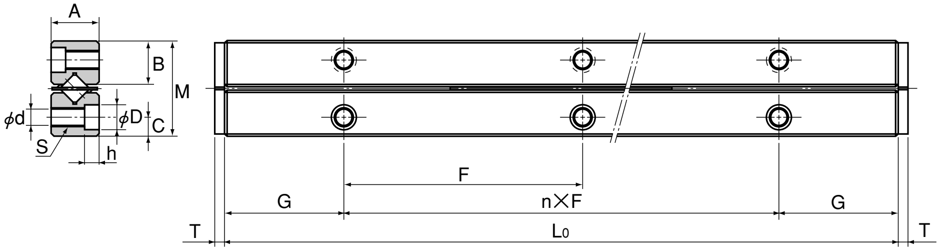
Model number coding

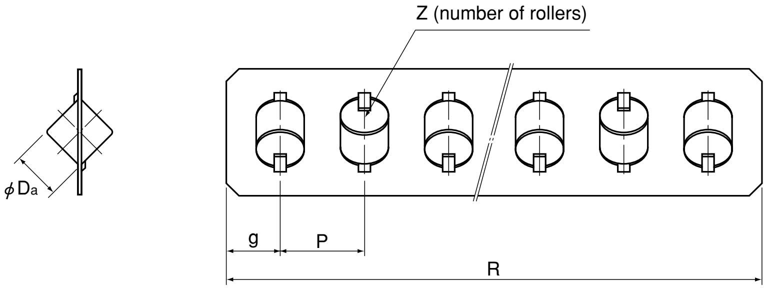
VR3 -75 H × 9Z
1 2 3 4

1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 100/125)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR4)





Unit: mm

Model No.	Maximum stroke	Major dimensions																	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions													Number of rollers				
		M	A	L_0	n×F	G	B	C	S	d	D	h	T	D_a	R	g	P	Z	δ μm	C_z kN	C_{0z} kN	kg/m
VR 4- 80× 7Z	58	22	11	80	1×40	20	10.2	4.5	M5	4.3	8	4.2	2	4	51	4.5	7	7	–5	0.764	0.637	0.8
VR 4-120×11Z	82			120	2×40										79			11				
VR 4-160×15Z	106			160	3×40										107			15				
VR 4-200×19Z	130			200	4×40										135			19				
VR 4-240×23Z	154			240	5×40										163			23				
VR 4-280×27Z	178			280	6×40										191			27				
VR 4-320×31Z	202			320	7×40										219			31				
VR 4-360×35Z	226			360	8×40										247			35				
VR 4-400×39Z	250			400	9×40										275			39				
VR 4-440×43Z	274			440	10×40										303			43				
VR 4-480×47Z	298			480	11×40										331			47				

Note When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.

(Example) VB4-200H ×17Z
Number of balls

The mass in the table indicates the value per rail/m.

Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR4M).

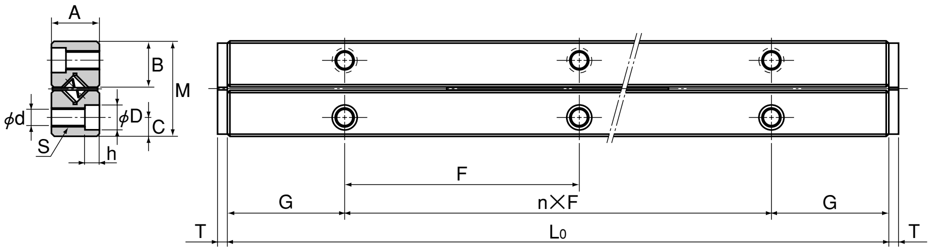
Model number coding

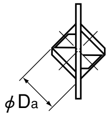
VR4 -80 P × 9Z
1 2 3 4

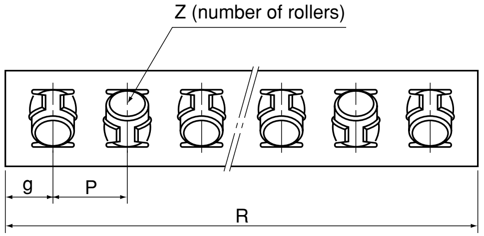
1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 120/160)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR6)







Unit: mm

Model No.	Maximum stroke	Major dimensions																	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions													Number of rollers	δ	C_z	C_{oz}	
		M	A	L_0	n×F	G	B	C	S	d	D	h	T	D_a	R	g	P	Z	μm	kN	kN	kg/m
VR 6-100× 7Z	56	30	15	100	1×50	25	14.4	6	M6	5.2	9.5	5.2	3.2	6	72	6	10	7	–7	1.91	1.76	1.5
VR 6-150×10Z	96			150	2×50										102			10				
VR 6-200×13Z	136			200	3×50										132			13				
VR 6-250×17Z	156			250	4×50										172			17				
VR 6-300×20Z	196			300	5×50										202			20				
VR 6-350×24Z	216			350	6×50										242			24				
VR 6-400×27Z	256			400	7×50										272			27				
VR 6-450×31Z	276			450	8×50										312			31				
VR 6-500×34Z	316			500	9×50										342			34				
VR 6-550×38Z	336			550	10×50										382			38				
VR 6-600×41Z	376			600	11×50										412			41				

Note When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB6-300H ×18Z
└── Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR6M).

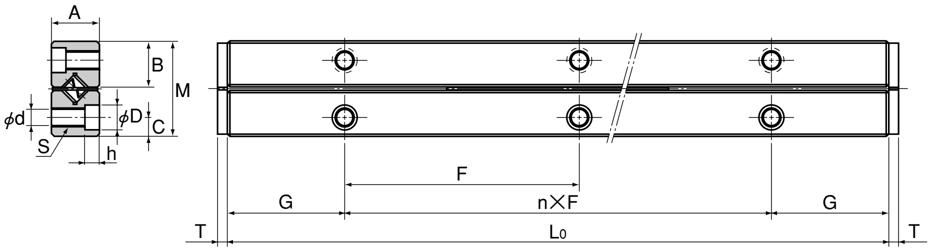
Model number coding

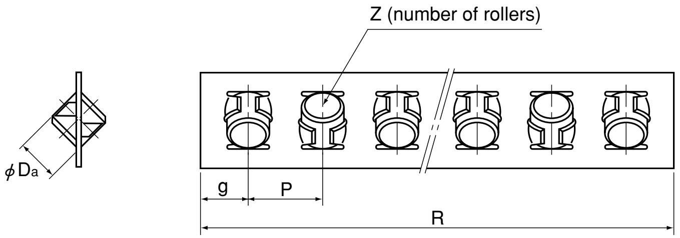
VR6 -100 P × 6Z
1 2 3 4

1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 300/400)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR9)





Unit: mm

Model No.	Maximum stroke	Major dimensions																	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions													Number of rollers	δ	C_z	C_{0z}	
		M	A	L_0	n×F	G	B	C	S	d	D	h	T	D_a	R	g	P	Z	μm	kN	kN	kg/m
VR 9- 200×10Z	118	40 (40.74)	20	200	1×100	50	19.2	8	M8	6.8	10.5	6.2	4	9 (9.525)	141	7.5	14	10	−10	4.31	4.36	3.2
VR 9- 300×15Z	178			300	2×100										211			15				
VR 9- 400×20Z	238			400	3×100										281			20				
VR 9- 500×25Z	298			500	4×100										351			25				
VR 9- 600×30Z	358			600	5×100										421			30				
VR 9- 700×35Z	418			700	6×100										491			35				
VR 9- 800×40Z	478			800	7×100										561			40				
VR 9- 900×45Z	538			900	8×100										631			45				
VR 9-1000×50Z	598			1000	9×100										701			50				
VR 9-1100×55Z	658			1100	10×100										771			55				
VR 9-1200×60Z	718			1200	11×100										841			60				

Note The dimensions in the parentheses above indicate the dimensions of the Ball Guide.
When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB9-700H ×<u>33Z</u>
└── Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR12M).

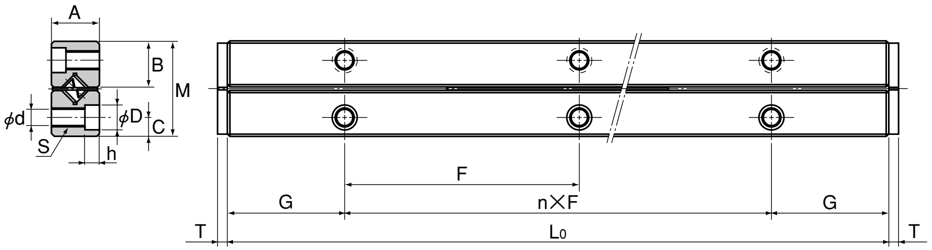
Model number coding

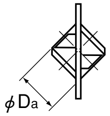
VR9 -600 H × 30Z
1 2 3 4

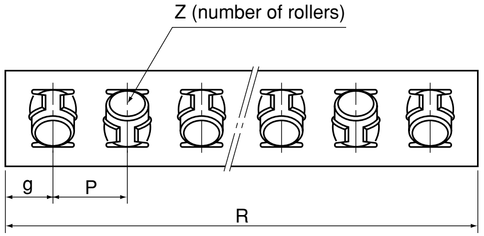
1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 300/400)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR12)







Unit: mm

Model No.	Maximum stroke	Major dimensions																Number of rollers	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions														δ	C_z	C_{0z}	
		M	A	L_0	n×F	G	B	C	S	d	D	h	T	D_a	R	g	P	Z	μm	kN	kN	kg/m
VR12- 200× 7Z	110	58 (57.86)	28	200	1×100	50	28	12	M10	8.5	14	8.2	5	12 (11.906)	145	12.5	20	7	−13	7.25	7.65	5.3
VR12- 300×10Z	190			300	2×100										205			10				
VR12- 400×14Z	230			400	3×100										285			14				
VR12- 500×17Z	310			500	4×100										345			17				
VR12- 600×21Z	350			600	5×100										425			21				
VR12- 700×24Z	430			700	6×100										485			24				
VR12- 800×28Z	470			800	7×100										565			28				
VR12- 900×31Z	550			900	8×100										625			31				
VR12-1000×34Z	630			1000	9×100										685			34				
VR12-1100×38Z	670			1100	10×100										765			38				
VR12-1200×41Z	750			1200	11×100										825			41				

Note The dimensions in the parentheses above indicate the dimensions of the Ball Guide.
When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB12-700H ×20Z
Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR12M).

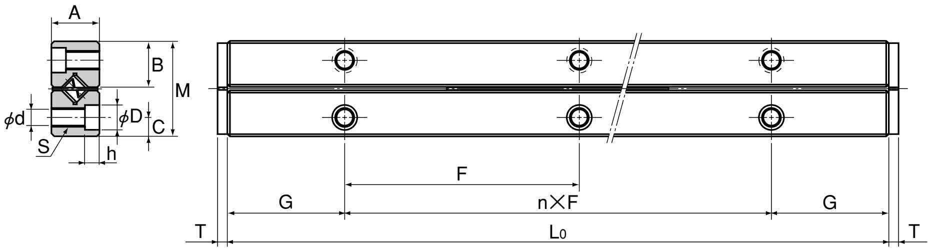
Model number coding

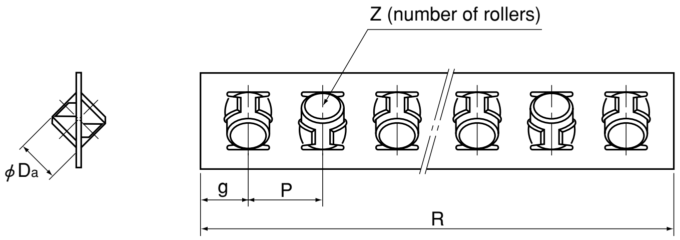
VR12 -200 P × 9Z
1 2 3 4

1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 300/400)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR15)





Unit: mm

Model No.	Maximum stroke	Major dimensions																Number of rollers	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions														δ	C_z	C_{0z}	
		M	A	L_0	n×F	G	B	C	S	d	D	h	T	D_a	R	g	P	Z	μm	kN	kN	kg/m
VR15- 300× 8Z	190	71 (71.11)	36	300	2×100	50	34.4	14	M12	10.5	17.5	10.2	6	15 (15.081)	205	15	25	8	–16	11.3	12.4	8.3
VR15- 400×11Z	240			400	3×100										280			11				
VR15- 500×13Z	340			500	4×100										330			13				
VR15- 600×16Z	390			600	5×100										405			16				
VR15- 700×19Z	440			700	6×100										480			19				
VR15- 800×22Z	490			800	7×100										555			22				
VR15- 900×25Z	540			900	8×100										630			25				
VR15-1000×27Z	640			1000	9×100										680			27				
VR15-1100×30Z	690			1100	10×100										755			30				
VR15-1200×33Z	740			1200	11×100										830			33				

Note The dimensions in the parentheses above indicate the dimensions of the Ball Guide.
When desiring a Ball Guide in combination with a ball cage, refer to Ball Cage model B on page f-28 and indicate the required number of balls.
(Example) VB15-800H ×20Z
└─Number of balls
The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR15M).

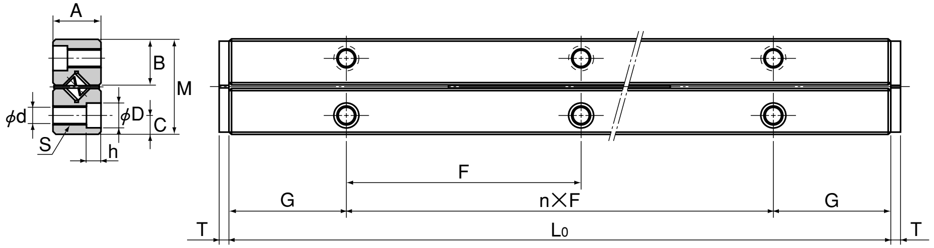
Model number coding

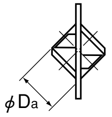
VR15 -300 H × 10Z
1 2 3 4

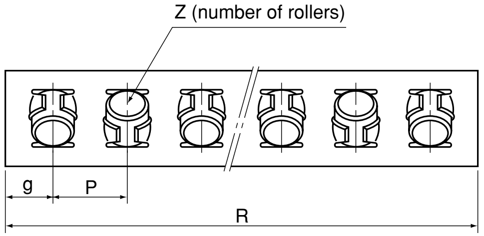
1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 300/400)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Cross Roller Guide Model VR (VR18)







Unit: mm

Model No.	Maximum stroke	Major dimensions																Number of rollers	Permissible preload	Basic load rating (per roller)		Mass (rail)
		Combined dimensions			Mounting dimensions														δ	Cz	Coz	
		M	A	L0	n×F	G	B	C	S	d	D	h	T	Da	R	g	P	Z	μm	kN	kN	kg/m
VR18- 300× 6Z	228	83	40	300	2×100	50	40.2	18	M14	12.5	20	12.2	6	18	186	18	30	6	−18	15.9	17.8	10.5
VR18- 400× 9Z	248			400	3×100										276			9				
VR18- 500×11Z	328			500	4×100										336			11				
VR18- 600×13Z	408			600	5×100										396			13				
VR18- 700×16Z	428			700	6×100										486			16				
VR18- 800×18Z	508			800	7×100										546			18				
VR18- 900×20Z	588			900	8×100										606			20				
VR18-1000×23Z	608			1000	9×100										696			23				
VR18-1100×25Z	688			1100	10×100										756			25				
VR18-1200×27Z	768			1200	11×100										816			27				

Note The mass in the table indicates the value per rail/m.
Stainless steel type highly resistant to corrosion is also available (symbol M, e.g., VR18M).

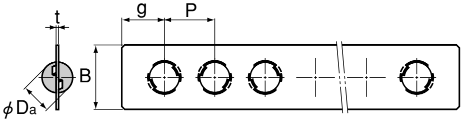
Model number coding

VR18 -400 H × 10Z
1 2 3 4

1 Combined model number (for Ball Guide: VB)
2 Dedicated rail dimension in mm (example of indication for a combination of different overall lengths: 300/400)
3 Accuracy symbol 4 Number of rollers or balls

Note "One set" in the model number above indicates a combination of four rails and two cages.

Ball Cage Model B



Unit: mm

Model No.	Major dimensions					Basic load rating (per ball)		Combined rail
	D_a	t	B	P	g	C_z N	C_{0z} N	
B 1	1.5	0.2	3.5	2.5	2	7.84	21.6	V 1
B 2	2	0.3	5	4	3	12.7	39.2	V 2
B 3	3	0.4	7	6	4.5	27.5	87.3	V 3
B 4	4	0.5	9	7	4.5	45.1	155	V 4
B 6	6	0.6	13.5	10	6	98	353	V 6
B 9	9.525	1	19	14	8.5	216	784	V 9
B 12	11.906	1	25	20	12.5	324	1420	V 12
B 15	15.081	1.2	31	25	15	490	2160	V 15

Precautions on Using the Cross Roller Guide/Ball Guide

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Cross Roller Guide/Ball Guide may damage it. Giving an impact to the Cross Roller Guide/Ball Guide could also cause damage to its function even if the product looks intact.

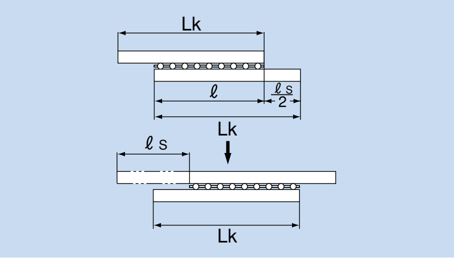
Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Rail Length

The roller cage and the ball cage move half the travel distance of the table in the same direction. To prevent the cage from overhanging from the raceway base when the cage length is "ℓ" and the stroke length is "ℓ_s," the rail length (Lk) must be at least the following.

$$Lk \geqq \ell + \frac{\ell_s}{2}$$



Offset of the Cage

The cage, which retains rollers (or balls), demonstrates extremely accurate motion. However, it may be offset as affected by driving vibrations, inertia or impact.
If using the Cross Roller Guide or Ball Guide in the following conditions, contact THK .

●Vertical use
●Pneumatic cylinder drive
●Cam drive
●High-speed crank drive
●Under a large moment load
●Butting the guide's external stopper with the table

Stopper

Stoppers are attached to the rail ends in order to prevent the cage from falling off. Note, however, that frequently colliding the cage with the stopper may cause wear of the stopper and loosening of the stopper fastening screws, and may cause the cage to fall off.

Dust Prevention

As a means to prevent foreign matter from entering the Cross Roller Guide or the Ball Guide, dust prevention accessories for the side faces as shown in Fig. 1 are available. For dust prevention in the front and rear directions, consider using a bellows or a telescopic cover.

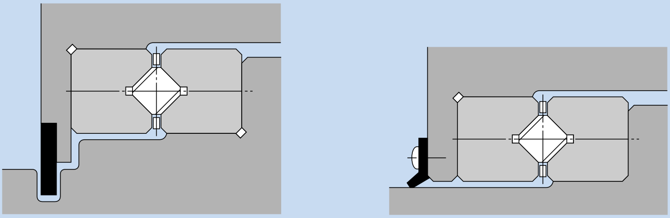

Labyrinth cover
Wiper seal

Fig. 1 Dust Prevention Methods

Precautions on Use

(1) If foreign such as dust or cutting chips matter adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(2) When desiring to use the system at temperature of 100℃ or higher, contact THK in advance.
(3) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Cross Roller Guide/Ball Guide, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

Cross Roller Table

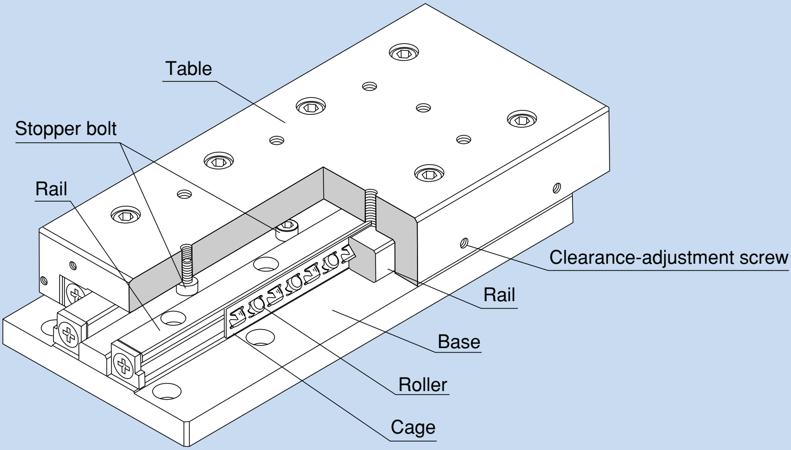


Fig. 1 Structure of the Cross Roller Table

Structure and Features

The Cross Roller Table is a compact, highly rigid finite linear guide unit that has the Cross Roller Guide(s) between the precision-machined table and base.

●Easy Installation

Since the Cross Roller Guide(s) is installed between the precision-machined table and base, a highly accurate linear guide mechanism is achieved simply by mounting the product with bolts.

●Large Permissible Load

Sine rollers with large rated loads are installed in short pitches, the cross roller guide is capable of bearing a heavy load, achieving a highly rigid linear guide mechanism and gaining a long service life.

●Diversified Usage

Since the rollers are orthogonally arranged one after another, the guide system is capable of evenly receiving loads in all directions applied on the table (Fig. 2).

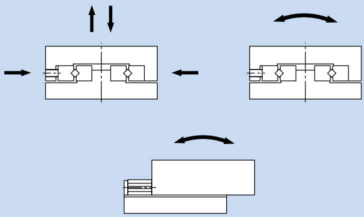


Fig. 2 Load Directions

●High Corrosion Resistance

The base and the table of models VRT-M and VRT-AM use stainless steel. Their rails, rollers, roller cages and screws are also made of stainless steel. As a result, these guide systems have significantly high corrosion resistance.

The base and the table of model VRU-M are made of aluminum.

Applications

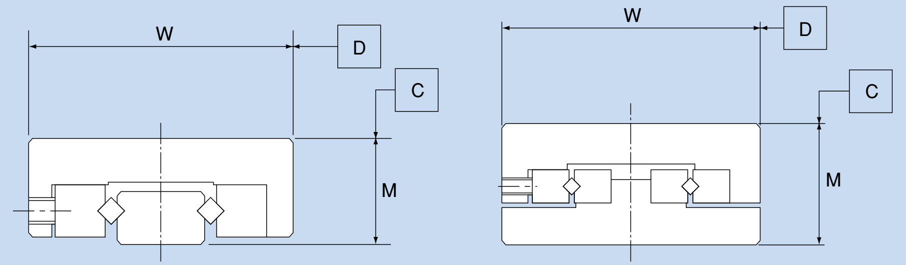
The Cross Roller Table is used in extensive applications such as OA equipment and peripherals, measuring instruments and printed board drilling machine.

Rated Loads in All Directions

The rated loads of models VRT, VRT-A and VRU are equal in four directions (radial, reverse-radial and lateral directions), and their values are expressed as C and C_0 in the corresponding dimensional tables.

Accuracy Standards

The dimensional tolerances of Cross Roller Table models VRT, VRT-A and VRU in height (M) and width (W), and the running accuracy of the base against the mounting surfaces $\boxed{C}$ and $\boxed{D}$ are indicated in the corresponding dimensional tables.



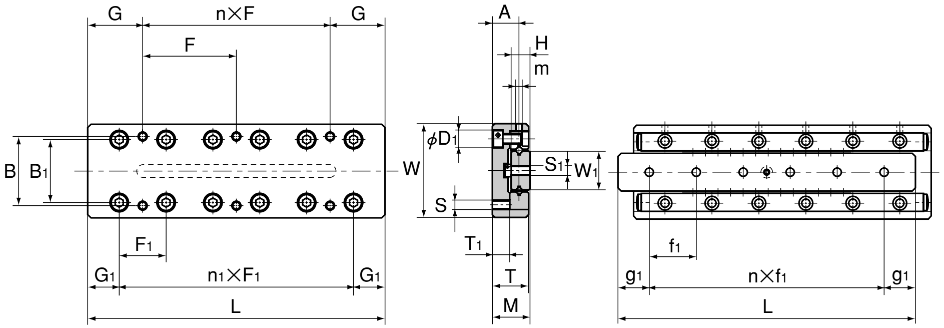
Models VRT and VRT-A

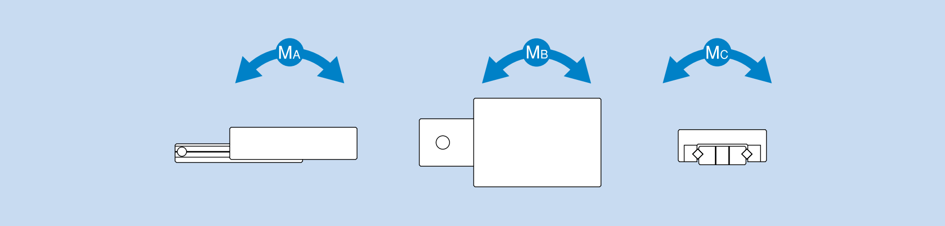
Model VRU

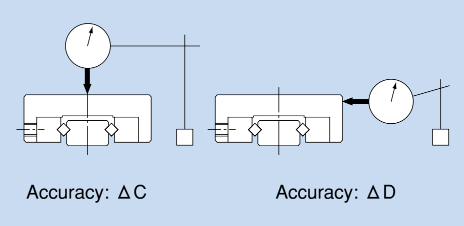
Fig. 3 Accuracy Standards

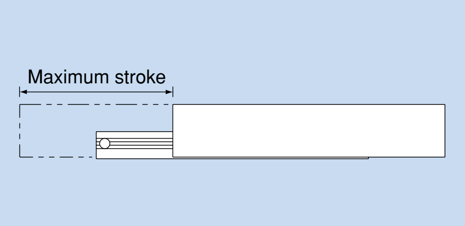
Model VRT

Miniature type (tapped base type)









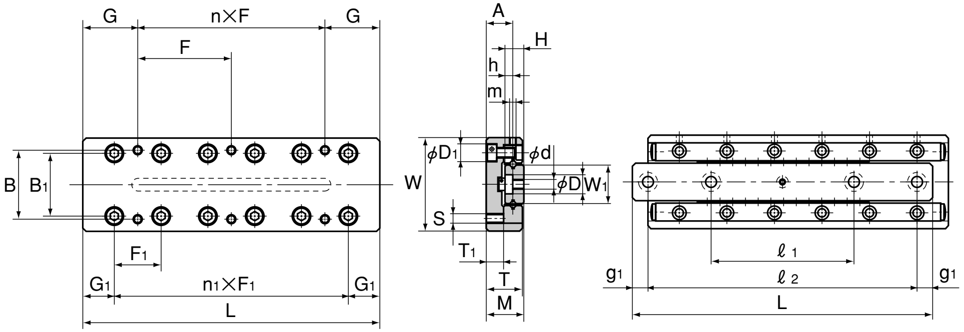
Unit: mm

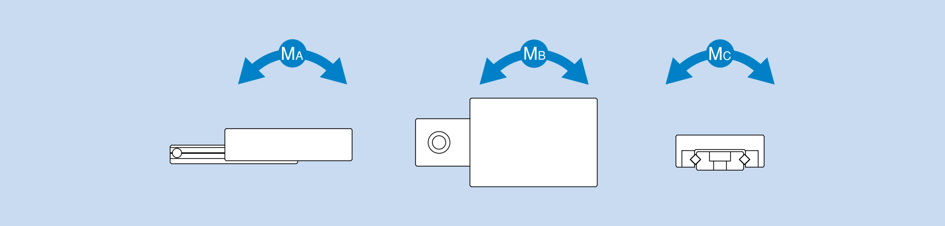
Model No.	Major dimensions					Table surface dimensions								Side surface dimensions						Base surface dimensions Mounting hole position				Basic load rating		Permissible static moment			Accuracy μm	
	Maximum stroke	Width W ±0.1	Height M ±0.1	Length L	Mass g	Table mounting tap position B	n×F	G	S	$n_1×F_1$	B_1	D_1	G_1	T	T_1	H	W_1	A	m	S_1	$n×f_1$	g_1	No. of rollers Z	C kN	C_0 kN	M_A N·m	M_B N·m	M_C N·m	ΔC	ΔD
VRT 1025	12	20	8	25	23	14	1×18	3.5	M2.6	1×10	12.4	4.1	7.5	7.5	3.5	4	6.6	5.5	M2	M2.6	2×7.5	5	5	0.28	0.27	0.75	0.46	0.69	2	4
VRT 1035	18			35	32		1×28	3.5		2×10											2×10	7.5	7	0.38	0.41	1.23	0.85	1.03		
VRT 1045	25			45	42		1×20	12.5		3×10											3×10		10	0.56	0.69	2.18	1.67	1.72		5
VRT 1055	32			55	52		1×30	12.5		4×10											4×10		12	0.65	0.82	2.97	2.35	2.06		
VRT 1065	40			65	62		2×20	12.5		5×10											5×10		14	0.73	0.96	3.87	3.17	2.4		
VRT 1075	45			75	72		1×30	22.5		6×10											6×10		18	0.87	1.27	6.05	5.16	3.19		
VRT 1085	50			85	82		2×30	12.5		7×10											7×10		20	0.94	1.37	7.32	6.37	3.43		
VRT 2035	18	30	12	35	78	22	1×28	3.5	M3	1×15	20	6	10	11.5	5.5	6	12	8.5		M3	1×20		5	0.51	0.51	2.29	1.37	2.21		4
VRT 2050	30			50	113		1×43	3.5		2×15											2×15	10	7	0.69	0.76	3.76	2.65	3.32		
VRT 2065	40			65	147		1×30	17.5		3×15											3×15		9	0.85	0.98	5.62	4.22	4.25		5
VRT 2080	50			80	184		1×45	17.5		4×15											4×15		12	0.98	1.27	9.1	7.26	5.52		
VRT 2095	60			95	220		2×30	17.5		5×15											5×15		14	1.18	1.57	11.8	9.71	6.8		
VRT 2110	70			110	257		1×45	32.5		6×15											6×15		17	1.47	2.06	16.7	14.1	8.93		
VRT 2125	80			125	290		2×45	17.5		7×15											7×15		19	1.57	2.25	20.4	17.5	9.77		
VRT 3055	30	40	16	55	229	30	1×40	7.5	M4	1×25	28.4	7.5	15	15.5	7.5	8	16	11.5		M4	1×35		6	1.27	1.37	9.85	6.57	7.97		
VRT 3080	45			80	336		1×65	7.5		2×25											2×25	15	10	2.16	2.84	22.2	17	16.5		
VRT 3105	60			105	442		1×50	27.5		3×25											3×25		13	2.94	4.22	34.8	28.1	24.4	3	6
VRT 3130	75			130	551		1×75	27.5		4×25											4×25		17	3.63	5.69	55.8	47.1	33.3		
VRT 3155	90			155	657		2×50	27.5		5×25											5×25		20	3.92	6.37	74.7	64.6	36.9		
VRT 3180	105			180	766		1×75	52.5		6×25											6×25		24	4.02	6.57	104	92.3	38.1		
VRT 3205	130			205	871		2×75	27.5		7×25											7×25		26	4.22	7.16	120	107	41.5		

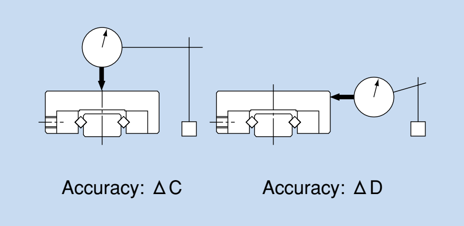
Note All stainless steel type highly resistant to corrosion is also available.
(Example) VRT 2035 M
Symbol for stainless steel type

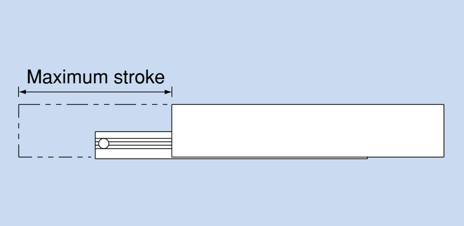
Model VRT-A

Miniature type (tapped base type)







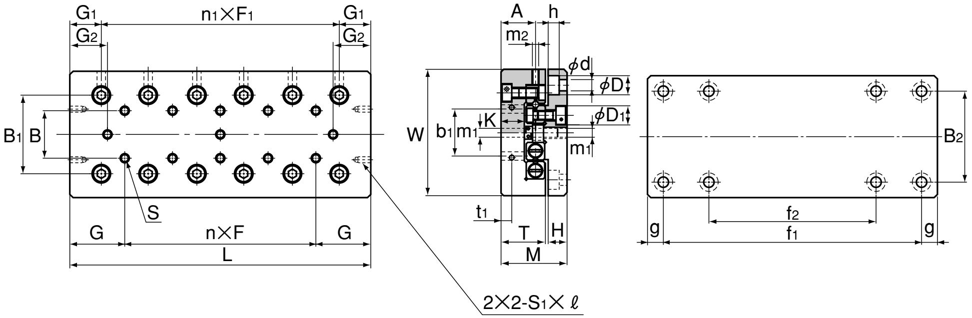


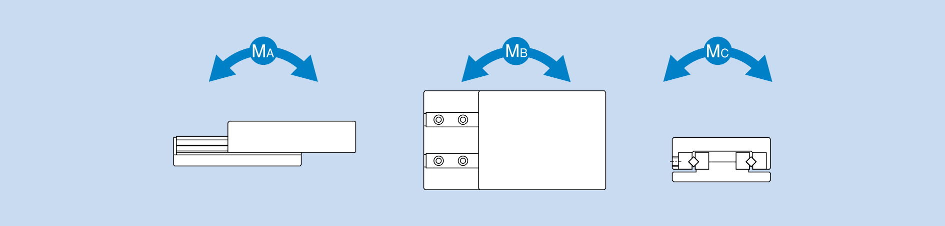
Unit: mm

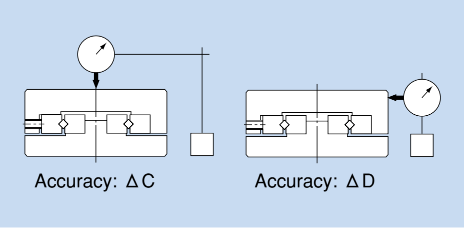
Model No.	Major dimensions					Table surface dimensions								Side surface dimensions						Base surface dimensions Mounting hole position					Basic load rating		Permissible static moment			Accuracy µm	
	Maximum stroke	Width W ±0.1	Height M ±0.1	Length L	Mass g	Table mounting tap position B	n×F	G	S	n1×F1	B1	D1	G1	T	T1	H	W1	A	m	d×D×h	ℓ1	ℓ2	g1	No. of rollers Z	C kN	C0 kN	MA N·m	MB N·m	MC N·m	ΔC	ΔD
VRT 1025A	12	20	8	25	23	14	1×18	3.5	M2.6	1×10	12.4	4.1	7.5	7.5	3.5	4	6.6	5.5	M2	2.5×4.1×2.2	—	18	3.5	5	0.28	0.27	0.75	0.46	0.69	2	4
VRT 1035A	18			35	32		1×28	3.5		2×10											—	25	5	7	0.38	0.41	1.23	0.85	1.03		
VRT 1045A	25			45	42		1×20	12.5		3×10											25	38	3.5	10	0.56	0.69	2.18	1.67	1.72		5
VRT 1055A	32			55	52		1×30	12.5		4×10											29	48	3.5	12	0.65	0.82	2.97	2.35	2.06		
VRT 1065A	40			65	62		2×20	12.5		5×10											31	55	5	14	0.73	0.96	3.87	3.17	2.4		
VRT 1075A	45			75	72		1×30	22.5		6×10											35	65	5	18	0.87	1.27	6.05	5.16	3.19		
VRT 1085A	50			85	82		2×30	12.5		7×10											40	75	5	20	0.94	1.37	7.32	6.37	3.43		
VRT 2035A	18	30	12	35	78	22	1×28	3.5	M3	1×15	20	6	10	11.5	5.5	6	12	8.5		3.5×6×3.2	—	25	5	5	0.51	0.51	2.29	1.37	2.21		4
VRT 2050A	30			50	113		1×43	3.5		2×15											—	35	7.5	7	0.69	0.76	3.76	2.65	3.32		
VRT 2065A	40			65	147		1×30	17.5		3×15											33	55	5	9	0.85	0.98	5.62	4.22	4.25		5
VRT 2080A	50			80	181		1×45	17.5		4×15											40	70	5	12	0.98	1.27	9.1	7.26	5.52		
VRT 2095A	60			95	217		2×30	17.5		5×15											45	85	5	14	1.18	1.57	11.8	9.71	6.8		
VRT 2110A	70			110	254		1×45	32.5		6×15											50	95	7.5	17	1.47	2.06	16.7	14.1	8.93		
VRT 2125A	80			125	287		2×45	17.5		7×15											55	110	7.5	19	1.57	2.25	20.4	17.5	9.77		
VRT 3055A	30	40	16	55	226	30	1×40	7.5	M4	1×25	28.4	7.5	15	15.5	7.5	8	16	11.5		4.5×7.5×4.2	—	40	7.5	6	1.27	1.37	9.85	6.57	7.97		
VRT 3080A	45			80	333		1×65	7.5		2×25											43	68	6	10	2.16	2.84	22.2	17	16.5		
VRT 3105A	60			105	439		1×50	27.5		3×25											55	90	7.5	13	2.94	4.22	34.8	28.1	24.4	3	6
VRT 3130A	75			130	548		1×75	27.5		4×25											65	115		17	3.63	5.69	55.8	47.1	33.3		
VRT 3155A	90			155	652		2×50	27.5		5×25											95	140		20	3.92	6.37	74.7	64.6	36.9		
VRT 3180A	105			180	761		1×75	52.5		6×25											85	165		24	4.02	6.57	104.3	92.3	38.1		
VRT 3205A	130			205	866		2×75	27.5		7×25											90	190		26	4.22	7.16	120.8	107.9	41.5		

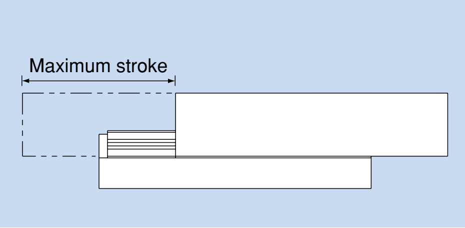
Note All stainless steel type highly resistant to corrosion is also available.
(Example) VRT 2035A M
Symbol for stainless steel type

Model VRU







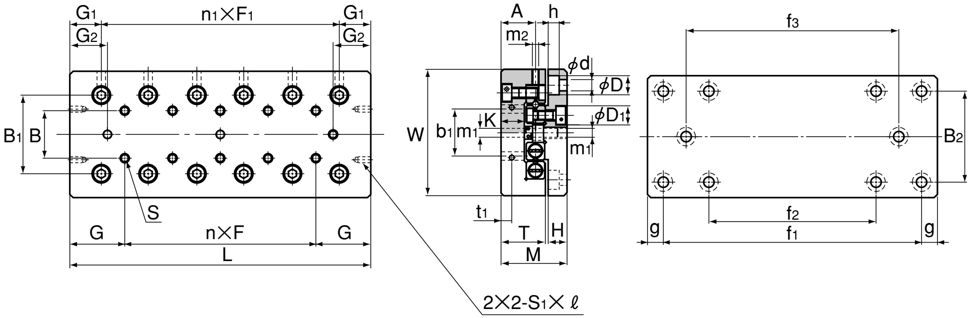


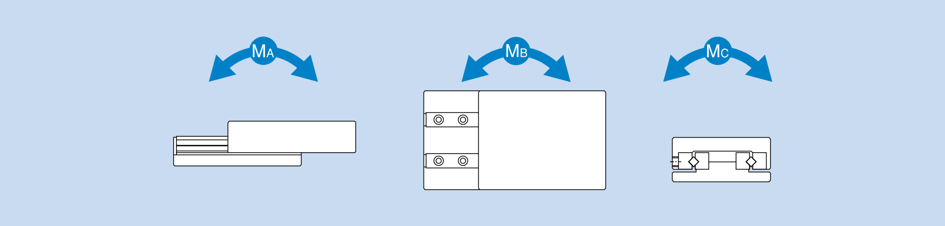
Unit: mm

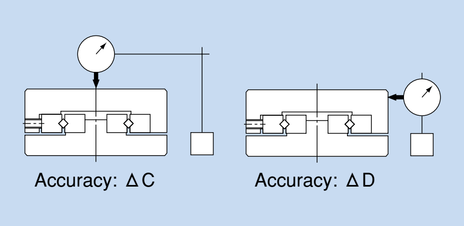
Model No.	Major dimensions					Table surface dimensions																			Base surface dimensions Mounting hole position					Basic load rating		Permissible static moment			Accuracy µm	
	Maximum stroke	Width	Height	Length	Mass*	Table mounting tap position				Side surface mounting tap positon																			No. of rollers							
		W $^{-0.2}_{-0.4}$	M ±0.1	L	kg	B	n×F	G	S	B_1	n_1×F_1	G_1	G_2	b_1	t_1	S_1×ℓ	T	H	K	d×D×h	D_1	m_1	A	m_2	B_2	f_1	f_2	g	Z	C kN	C_0 kN	M_A N·m	M_B N·m	M_C N·m	ΔC	ΔD
VRU 1025	12	30	17	25	0.08(0.04)	10	—	12.5	M2	18.4	1×10	7.5	2.5	12	2.5	M2×4	11	5.5	6.5	2.55×4.1×2.5	4.1	M2	9	M2	22	18	—	3.5	5	0.28	0.27	0.75	0.46	1.24	2	4
VRU 1035	18			35	0.11(0.05)		1×10				2×10		4.5													28	—		7	0.38	0.41	1.23	0.85	1.85		
VRU 1045	25			45	0.15(0.07)		2×10				3×10		6													38	—		10	0.56	0.69	2.18	1.67	3.09		
VRU 1055	32			55	0.18(0.09)		3×10				4×10		7.5													48	28		12	0.65	0.82	2.97	2.35	3.71		5
VRU 1065	40			65	0.21(0.1)		4×10				5×10		8.5													58	38		14	0.73	0.96	3.87	3.17	4.33		
VRU 1075	45			75	0.24(0.12)		5×10				6×10		11													68	48		18	0.87	1.27	6.05	5.16	5.74		
VRU 1085	50			85	0.27(0.13)		6×10				7×10		13.5													78	58		20	0.94	1.37	7.32	6.34	6.18		
VRU 2035	18	40	21	35	0.2 (0.09)	15	—	17.5	M3	25	1×15	10	3	16	3.4		14	6.5	7.5	3.5×6×3.5	6	M3	11	M3	30	25	—	5	5	0.51	0.51	2.29	1.4	3.06		4
VRU 2050	30			50	0.26(0.13)		1×15				2×15		4.5													40	—		7	0.69	0.76	3.76	2.6	4.59		
VRU 2065	40			65	0.34(0.17)		2×15				3×15		7													55	—		9	0.85	0.98	5.62	4.17	5.89		5
VRU 2080	50			80	0.42(0.21)		3×15				4×15		9.5													70	40		12	1.18	1.57	9.1	7.22	9.42		
VRU 2095	60			95	0.5 (0.25)		4×15				5×15		12													85	55		14	1.27	1.76	11.8	9.7	10.5		
VRU 2110	70			110	0.58(0.29)		5×15				6×15		14.5													100	70		17	1.47	2.06	16.7	14.1	12.3	3	6
VRU 2125	80			125	0.66(0.33)		6×15				7×15		17													115	85		19	1.57	2.25	20.4	17.5	13.5		

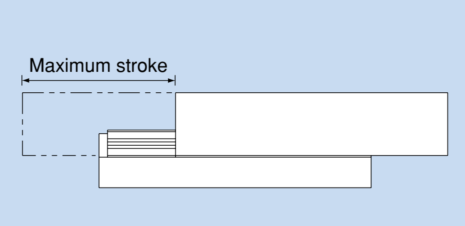
***Note** Stainless steel type highly resistant to corrosion is also available.
The values in the parentheses are masses of stainless steel types.
(Example) VRU 2035 M
Symbol for stainless steel type
(table base: aluminum)

Model VRU







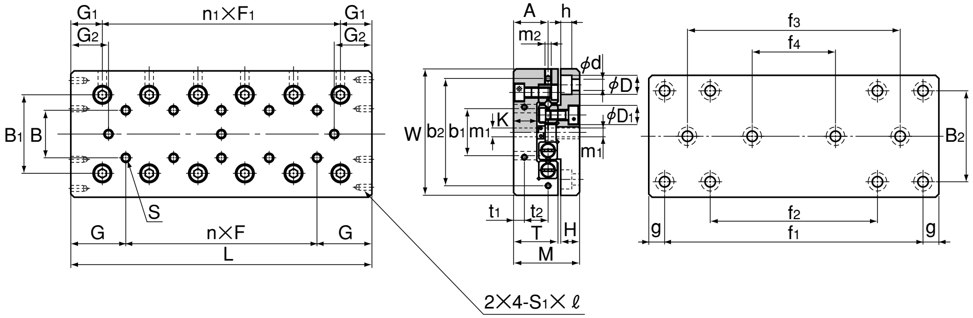


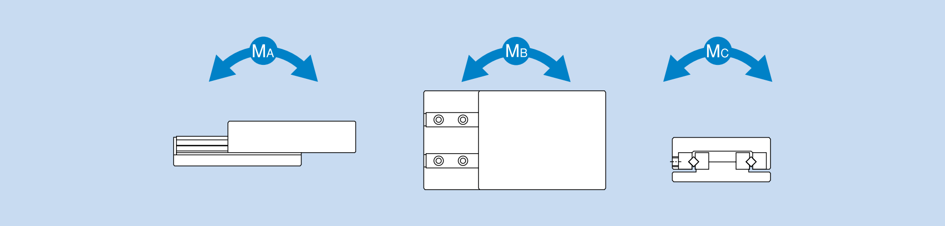
Unit: mm

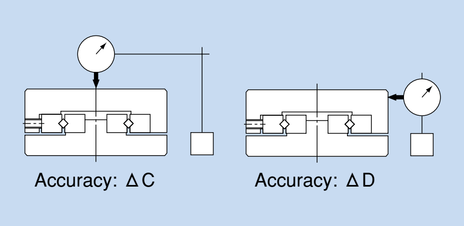
Model No.	Major dimensions					Table surface dimensions																			Base surface dimensions Mounting hole position						Basic load rating		Permissible static moment			Accuracy µm	
	Maximum stroke	Width W ±0.1	Height M ±0.1	Length L	Mass* kg	Table mounting tap position				Side surface mounting tap positon																				No. of rollers							
						B	n×F	G	S	B_1	$n_1 \times F_1$	G_1	G_2	b_1	t_1	$S_1 \times \ell$	T	H	K	d×D×h	D_1	m_1	A	m_2	B_2	f_1	f_2	f_3	g	Z	C kN	C_0 kN	M_A N·m	M_B N·m	M_C N·m	ΔC	ΔD
VRU 3055	30	60	28	55	0.57 (0.3)	25	—	27.5	M4	39	1×25	15	5.5	40	5.5	M3×6	18.5	9	10	4.5×7.5×5	7.5	M4	14.5	M4	40	35	—	—	10	6	1.47	1.67	9.85	6.54	15.5	2	5
VRU 3080	45			80	0.8 (0.4)		1×25				2×25		10.5													60	—	—		10	2.06	2.75	22.2	17	25.6		
VRU 3105	60			105	1.03 (0.6)		2×25				3×25		15.5													85	—	—		13	2.35	3.33	34.8	28.1	31.1	3	6
VRU 3130	75			130	1.26 (0.7)		3×25				4×25		20.5													110	—	—		17	2.94	4.41	55.8	47.1	41.2		
VRU 3155	90			155	1.49 (0.9)		4×25				5×25		25.5													135	—	85		20	3.53	5.49	74.7	64.6	51.2		
VRU 3180	105			180	1.72 (1)		5×25				6×25		30.5													160	—	110		24	4.02	6.57	104	92.3	61.3		7
VRU 3205	130			205	1.95 (1.1)		6×25				7×25		30.5													185	85	135		26	4.22	7.16	120	107	66.8		
VRU 4085	50	80	35	85	1.5 (0.8)	40	—	42.5	M5	53	1×40	22.5	10.5	55	6.5		24	10.5	12.5	5.5×9.5×6	9.5		18.5		60	65	—	—	10	7	3.53	4.8	48.7	33.7	64	2	5
VRU 4125	75			125	2.3 (1.2)		1×40				2×40		18													80	—	—	22.5	11	5.2	8.04	101	79.1	107	3	6
VRU 4165	105			165	3.1 (1.5)		2×40				3×40		23													120	—	—		14	6.77	11.3	153	125	150		7
VRU 4205	135			205	3.8 (1.9)		3×40				4×40		30.5													160	80	—		18	8.14	14.5	239	204	193		
VRU 4245	155			245	4.6 (2.2)		4×40				5×40		38													200	120	—		22	9.42	17.7	344	302	235		
VRU 4285	185			285	5.3 (2.6)		5×40				6×40		43													240	160	—		26	10.7	20.9	468	418	278		

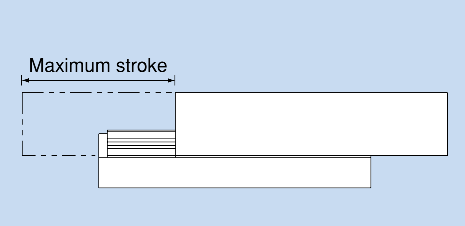
***Note** Stainless steel type highly resistant to corrosion is also available.
The values in the parentheses are masses of stainless steel types.
(Example) VRU 3080 M
Symbol for stainless steel type
(table base: aluminum)

Model VRU









Unit: mm

Model No.	Major dimensions					Table surface dimensions: Table mounting tap position				Table surface dimensions: Side surface mounting tap positon																		Base surface dimensions Mounting hole position						Basic load rating		Permissible static moment			Accuracy μm	
	Maximum stroke	Width W ±0.1	Height M ±0.1	Length L	Mass* kg	B	n×F	G	S	B_1	n_1×F_1	G_1	G_2	b_1	b_2	t_1	t_2	S_1×ℓ	T	H	K	d×D×h	D_1	m_1	A	m_2	B_2	f_1	f_2	f_3	f_4	g	No. of rollers Z	C kN	C_0 kN	M_A N·m	M_B N·m	M_C N·m	ΔC	ΔD
VRU 6110	60	100	45	110	3.2(1.7)	50	—	55	M6	63	1×50	30	16	60	92	8	15	M4×8	31	13	15	7×11×7	11	M5	23.5	M5	60	90	—	—	—	10	6	7.45	10.6	121	80.5	158	3	6
VRU 6160	95			160	4.6(2.5)		1×50				2×50		23.5															140	—	—	—		9	9.31	14.1	231	171	211	3	6
VRU 6210	130			210	6 (3.2)		2×50				3×50		31															190	—	90	—		13	12.5	21.1	428	345	317	3	7
VRU 6260	165			260	7.4(4)		3×50				4×50		38.5															240	—	140	—		16	15.6	28.2	616	516	423	3	7
VRU 6310	200			310	8.7(4.8)		4×50				5×50		46															290	—	190	—		19	17.1	31.8	838	720	476	4	8
VRU 6360	235			360	10.1(5.6)		5×50				6×50		53.5															340	140	240	—		22	19.8	38.8	1090	958	582	4	8
VRU 6410	265			410	11.5(6.4)		6×50				7×50		63.5															390	190	290	—		26	22.5	45.9	1480	1320	688	4	8
VRU 9210	130	145	60	210	12 (7.1)	85	—	105	M8	96	1×100	55	27	90	135	11	20		43	16	21	9×14×9	14	M8	32	M6	90	100	—	—	—	55	9	20.9	34.9	837	622	838	3	7
VRU 9310	180			310	17.6(7.9)		1×100				2×100		52															200	—	—	—		14	31.9	61.1	1760	1440	1460	3	7
VRU 9410	350			410	23.2(—)		2×100				3×100		17															300	—	100	—		15	31.9	61.1	1990	1650	1460	4	8
VRU 9510	450			510	28.8(—)		3×100				4×100																	400	—	200	—		19	38.4	78.5	3030	2600	1880	4	8
VRU 9610	550			610	34.4(—)		4×100				5×100																	500	100	300	—		22	44.7	96	3950	3460	2300	4	9
VRU 9710	650			710	40 (—)		5×100				6×100																	600	200	400	—		26	50.6	114	5380	4810	2730	4	9
VRU 9810	750			810	45.6(—)		6×100				7×100																	700	300	500	100		29	53.5	123	6600	5960	2940	5	10
*VRU 9910	850			910	51.2(—)		7×100				8×100																	800	400	600	200		33	59.1	139	8410	7680	3340	5	10
*VRU 91010	950			1010	56.8(—)		8×100				9×100																	900	500	700	300		37	64.6	157	10400	9620	3760	5	10

***Note** Stainless steel type highly resistant to corrosion is also available.
The value in the parentheses represents the mass of a stainless steel type.
Models VRU9910 and VRU91010 are build to order.
(Example) VRU 6310 M
Symbol for stainless steel type
(table base: aluminum)

Precautions on Using the Cross Roller Table

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the Cross Roller Table may damage it. Giving an impact to the Cross Roller Table could also cause damage to its function even if the product looks intact.

Lubrication

(1) For lubrication of the Cross Roller Table, use lithium-soap group grease or oil when it is necessary as with ordinary bearings.

(2) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(3) Do not mix lubricants of different physical properties.

(4) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(5) When planning to use a special lubricant, contact THK before using it.

Additional Machining of the Table and the Base

When additionally machining the table and the base of the Cross Roller Table according to the service conditions such as drilling mounting holes, adhere to the following precautions.

(1) Do not let cutting chips enter the Cross Roller Guide unit.

(2) Machine the mounting holes as blind holes, not though holes.

THK can perform additional machining such as mounting holes as requested.

The clearance of the Cross Roller Table is adjusted to the appropriate preload. Do not touch the clearance adjustment screw.

Offset of the Cage

The cage, which retains rollers (or balls), demonstrates extremely accurate motion. However, it may be offset as affected by driving vibrations, inertia or impact.

If using the Cross Roller Guide or Ball Guide in the following conditions, contact THK .

- Vertical use
- Pneumatic cylinder drive
- Cam drive
- High-speed crank drive
- Under a large moment load
- Butting the guide's external stopper with the table

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) If foreign such as dust or cutting chips matter adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(3) When desiring to use the system at temperature of 100℃ or higher, contact THK in advance.
(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the Cross Roller Table, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

Linear Ball Slide

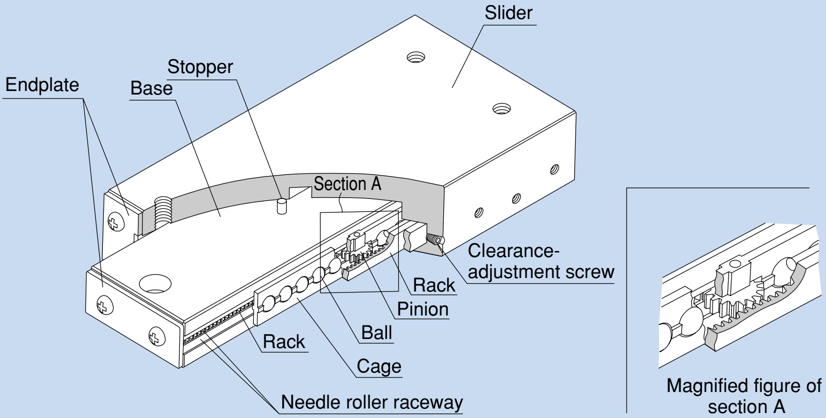


Fig. 1 Structure of Linear Ball Slide Model LSP

Structure and Features

The Linear Ball Slide is a highly corrosion resistant slide unit that has an extremely low friction coefficient because stainless steel balls roll on four stainless steel needle roller raceways that are hardened and ground.

In addition, model LSP has a pinion gear in the center and a rack on the base to prevent the cage from slipping.

A ball slide equipped with a cylinder model LSC has a cylinder for drive in the base to downsize the system and reduce the space and the weight.

It components are all made of stainless steel, which is highly resistant to corrosion. Furthermore, since its inertia is small, the slide system is highly responsive to high speed.

●A Unit Type That Allows Easy Installation

The clearance and motion of the slider is adjusted to the best state. Therefore, a highly accurate slide mechanism can be gained by simply mounting the unit on the flat-finished mounting surface.

●Lightweight and Compact

A light aluminum alloy is used in the base and the slider to reduce the weight.

●Smooth Motion

The balls and the raceway (needle roller raceway) are in point contact, which causes the smallest rolling loss, and the balls are evenly retained in the ball cage. This allows the slide system to perform rolling motion at a minimal coefficient of friction (μ = 0.0006 to 0.0012).

●Highly Corrosion Resistant

The base and the slider are made of an aluminum alloy and their surfaces are anodized.
The balls, needle roller raceways and screws are made of stainless steel, making the system highly resistant to corrosion.

Applications

The Linear Ball Slide is optimal for locations requiring high accuracy, such as optic measuring machines, automatic recorder, small electronic-parts assembling machine, OA equipment and its peripherals.

Types and Features

Linear Ball Slide with a Rack Model LSP

With Linear Ball Slide model LSP, the cage has a rack & pinion mechanism, thus to prevent the cage from slipping.
Also, since the cage does not slip even in vertical mount, this model is used in an even broader range of applications.

Note: Do not use the stopper as a mechanical stopper.

Linear Ball Slide Model LS

Linear Ball Slide model LS is a unit-type linear system for finite motion that has a structure where balls are arranged between the base and the slider via a needle roller raceway.
It is incorporated with a stopper mechanism, thus to prevent damage deformation caused by collision between the cage and the endplate.

Note: Do not use the stopper as a mechanical stopper.

Linear Ball Slide with a Cylinder Model LSC

Linear Ball Slide with a cylinder model LSC contains an air cylinder for drive inside the base. Feeding air from the two ports on the side face of the base allows the slide to perform reciprocating motion. Since the cylinder is of double-acting type, horizontal traveling speed can be adjusted using the speed controller. The cylinder and the piston are made of a corrosion resistant aluminum alloy, and their surfaces are specially treated to increase wear resistance and durability. Additionally, the cage has a rack & pinion mechanism, thus enabling the cage to operate without slipping. Air-feeding ports for piping are provided on one side face, ensuring a certain degree of operability and easy assembly even if the installation site has a limited space and is complex.
The table on the right shows the specifications of the air cylinder incorporated in model LSC.

Note: Do not use the stopper as a mechanical stopper.

Cylinder specifications

Type of action:	double-acting
Fluid used:	air (un-lubricated)
Working pressure:	100 kPa to 700 kPa (1 kgf/cm² to 7 kgf/cm²)
Stroke speed:	50 to 300 mm/s

Speed Controller

Fig. 2 shows the shape of the speed controller.

Note: The speed controller is optional.
(control method: meter-out)

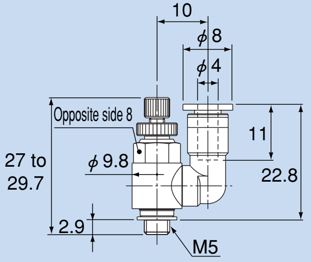


Fig. 2 Shape of the Speed Controller (common to all model numbers)

Dedicated Unit Base Model B

With Linear Ball Slide model LSC, a limit switch for detecting the stroke end can be mounted using a dedicated unit base. When fine positioning is required, a dedicated stopper can be mounted on the unit base to adjust the position (excluding model LSC1015).

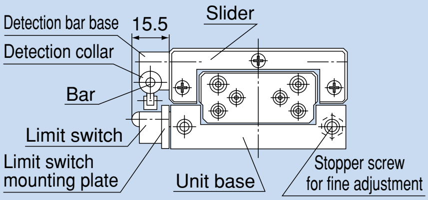


Fig. 3 Unit Base and Limit Switch Installation

Rated Loads in All Directions

The rated loads of Linear Ball Slide models LS, LSP and LSC are identical in the vertical and horizontal directions.

Accuracy Standards

The accuracies of Linear Ball Slide models LS, LSP and LSC are defined as follows.

Running parallelism of the top face of the slide

:0.010mm MAX/10mm

Positioning repeatability of the top face of the slide

:0.0015mm MAX

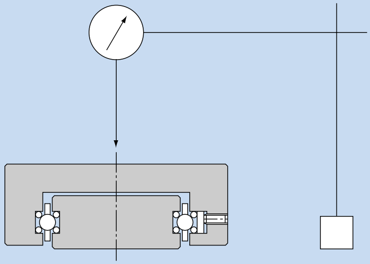
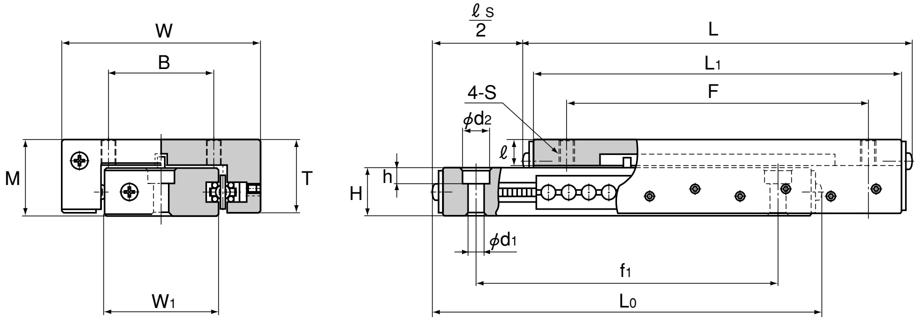
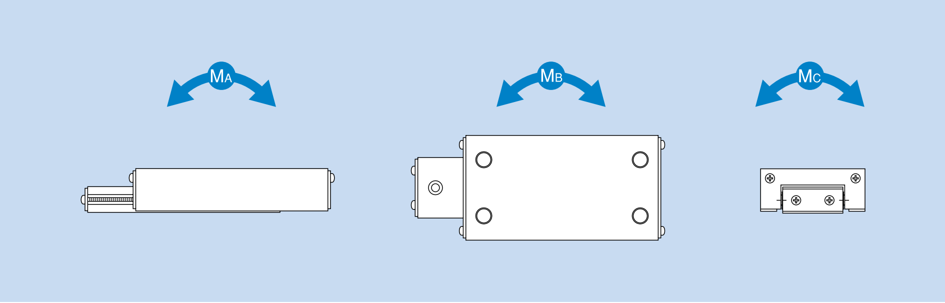


Fig. 4 Accuracy Standards

Model LSP



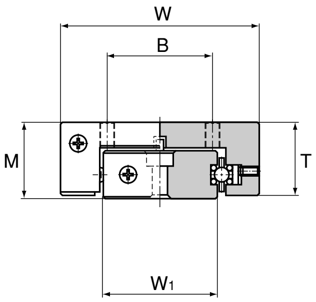


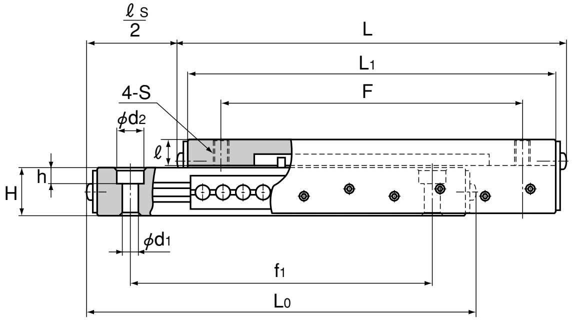
Unit: mm

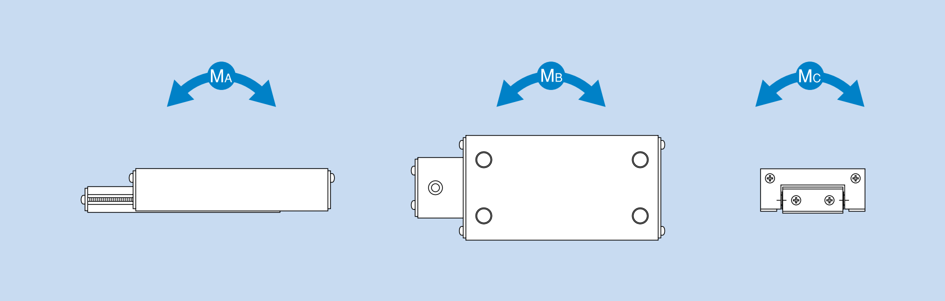
Model No.	Slider dimensions									Base dimensions					Permissible static moment*		Basic load rating		Mass
	Maximum stroke ℓs	Height M ±0.25	Width W ±0.25	Length L	T	L_1	B	F	S×ℓ	Width W_1	Height H	$d_1 \times d_2 \times h$	Length L_0	f_1	M_A,M_B N·m	M_C N·m	C N	C_0 N	g
LSP 1340	15	13	25	42.6	12.5	39	11	30	M3×5	12.2	7.7	3.3×6×3.3	42.6	30	0.88	0.49	68.6	118	37
LSP 1365	25	13	25	67.6	12.5	64	11	55	M3×5	12.2	7.7	3.3×6×3.3	67.6	55	1.76	0.98	118	206	60
LSP 1390	50	13	25	92.6	12.5	89	11	80	M3×5	12.2	7.7	3.3×6×3.3	92.6	80	3.04	1.27	157	275	85
LSP 2050	25	20	44	54	18.3	47	20	35	M5×8.4	22.3	11	5.3×9×5.3	54	35	1.37	2.25	157	284	114
LSP 2080	50	20	44	84	18.3	77	20	65	M5×8.4	22.3	11	5.3×9×5.3	84	65	3.53	4.51	304	559	184
LSP 20100	75	20	44	104	18.3	97	20	85	M5×8.4	22.3	11	5.3×9×5.3	104	85	5	5.69	392	706	231
LSP 25100	50	25	66	105.2	24	97	35	75	M5×8.5	38	16	5.3×9×5.3	105.2	75	9.22	14.5	588	1069	433
LSP 25125	75	25	66	130.2	24	122	35	100	M5×8.5	38	16	5.3×9×5.3	130.2	100	12.9	18.1	735	1333	547
LSP 25150	100	25	66	155.2	24	147	35	125	M5×8.5	38	16	5.3×9×5.3	155.2	125	17.5	21.9	882	1598	652

Note M_A, M_B and M_C each indicate the permissible moment per LM system, as shown in the figure above.

Model LS





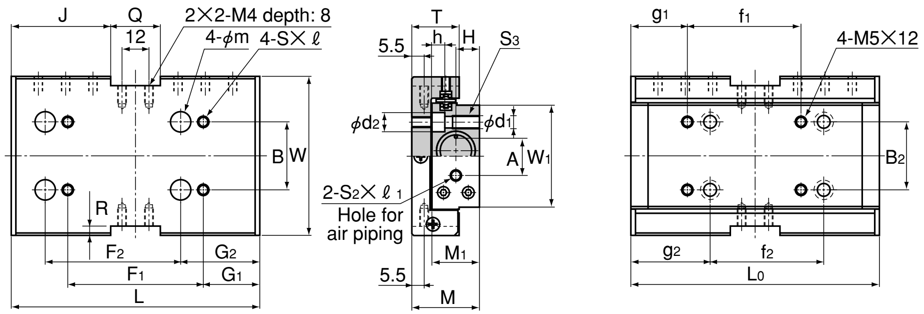


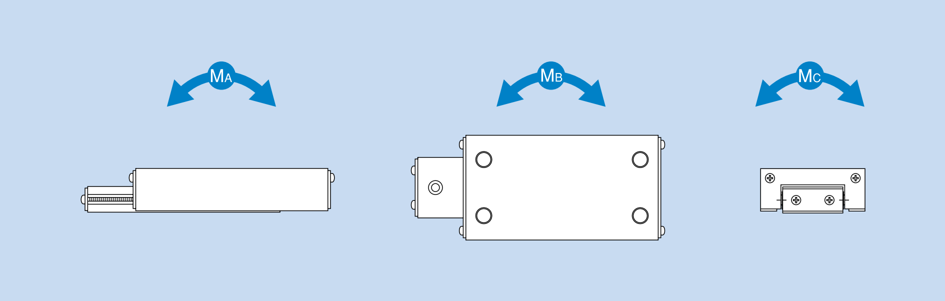
Unit: mm

Model No.	Slider dimensions									Base dimensions					Permissible static moment*		Basic load rating		Mass
	Maximum stroke ℓs	Height M ±0.25	Width W ±0.25	Length L	T	L_1	B	F	S×ℓ	Width W_1	Height H	d_1×d_2×h	Length L_0	f_1	M_A,M_B N·m	M_C N·m	C N	C_0 N	g
LS 827	13	8	14.2	29.6	7.6	26	5.5	16	M2×2.7	6.2	4.7	2.2×3.9×1.4	29.6	19	0.2	0.29	39.2	68.6	9
LS 852	25	8	14.2	54.6	7.6	51	5.5	41	M2×2.7	6.2	4.7	2.2×3.9×1.4	54.6	35	0.49	0.39	68.6	118	15
LS 877	50	8	14.2	79.6	7.6	76	5.5	66	M2×2.7	6.2	4.7	2.2×3.9×1.4	79.6	60	0.88	0.59	98	167	21
LS 1027	13	10	19	29.6	9.2	26	8.5	16	M3×3.2	9.6	6.2	3.3×6×3.1	29.6	19	0.29	0.59	58.8	108	13
LS 1052	25	10	19	54.6	9.2	51	8.5	41	M3×3.2	9.6	6.2	3.3×6×3.1	54.6	35	0.78	1.08	108	186	23
LS 1077	50	10	19	79.6	9.2	76	8.5	66	M3×3.2	9.6	6.2	3.3×6×3.1	79.6	60	1.47	1.57	157	275	34

Note M_A, M_B and M_C each indicate the permissible moment per LM system, as shown in the figure above.

Model LSC





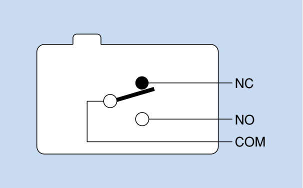
Unit: mm

Model No.	Maximum stroke $\ell s^{+0.5}_{0}$	Cylinder inner diameter	Slider dimensions						Slider dimensions										
			Logical thrust (at 500 kPa) N	Height M ±0.05	Width W	L	T	B	F_1	G_1	S×ℓ	m	G_2	F_2	J	Q	R	M_1	W_1
LSC 1015	15	10	38.2	25	50	80	24	20	40	20	M4×7	5.5	12.5	40	—	—	—	16.5	31.2
LSC 1515	15	15	86.3	30	70	80	21	30	40	19	M5×8	9	28.5	40	29	22	4	21	45
LSC 1530	30	15	86.3	30	70	110	21	30	60	25	M5×8	9	35	60	44	22	4	21	45
LSC 1550	50	15	86.3	30	70	150	21	30	100	25	M5×8	9	50	50	64	22	4	21	45

Model No.	Slider dimensions									Base dimensions		Permissible static moment*		Basic load rating		Mass
	L_0	B_2	f_2	$d_1 \times d_2 \times h$	S_3	g_2	f_1	g_1	A	H	$S_2 \times \ell_1$	M_A,M_B N·m	M_C N·m	C N	C_0 N	kg
LSC 1015	80	20	40	3.3×5.5×3.5	M4	20	—	—	13	5.5	M5×5	4.9	7.45	392	676	0.25
LSC 1515	80	30	40	5.2×9×5.5	M6	21	23	29.5	17	10.5	M5×4.5	4.9	11.1	392	676	0.37
LSC 1530	110	30	60	5.2×9×5.5	M6	25	40	35	17	10.5	M5×4.5	8.43	15.4	549	951	0.52
LSC 1550	150	30	100	5.2×9×5.5	M6	25	78	36	17	10.5	M5×4.5	15.4	22.1	794	1350	0.72

Note M_A, M_B and M_C each indicate the permissible moment per LM system, as shown in the figure above.

Limit switch specifications
Type: D2VW-5L2A-1 (Omron)
Contact type: contact
(1C contact)



Rated Specifications

Item / Model No.	Rated voltage (V)	Non-inductive load (A)				Inductive load (A)	
		Resistance load		Ramp load		Inductive load	
		Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open
D2VW-5	AC125	5		0.5		4	
	250	5		0.5		4	
	DC 30	5		3		4	
	125	0.4		0.1		0.4	

Note 1: The above figures indicate the constant current.
Note 2: Inductive load refers to power factor of 0.7 or greater (alternate current) and time constant of 7 ms or less (direct current).
Note 3: Ramp load implies a rush current 10 times greater.
Note 4: The above rated values apply when a test is conducted with the following conditions in accordance with JIS C 4505.
1) Ambient temperature: 20℃ ±2℃
2) Ambient humidity: 65% ±5% RH
3) Operating frequency: 30 times/min

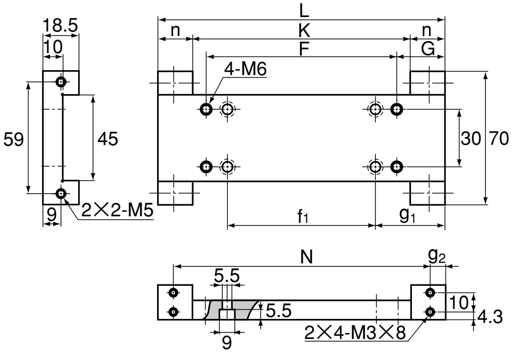
Model number coding

LSC1515 B S L
1 2 3 4

1 Model number 2 With unit base 3 With external stopper 4 with limit switch

Note Unit base, external stopper and limit switch are not available for model LSC1015.
Speed controller is optional.

Unit Base for Model LSC



Unit: mm

Model No.	Unit base dimensions									Mass kg
	Length L	F	G	f_1	g_1	K	n	N	g_2	
1515 B	80	40	19	23	27.5	56	12	68	6	0.12
1530 B	110	60	25	40	35	74	18	94	8	0.16
1550 B	150	100	25	78	36	114	18	134	8	0.21

Note Unit base is not available for model LSC1015.
External stopper and limit switch are optional.

Precautions on Using the Linear Ball Slide

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Linear Ball Slide may damage it. Giving an impact to the Linear Ball Slide could also cause damage to its function even if the product looks intact.

Lubrication

(1) Apply lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) If foreign matter such as dust of cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(5) The Linear Ball Slide is incorporated with a stopper mechanism that prevents the slider from coming off. If impact is given, the stopper may be damaged. Do not use this stopper as a mechanical stopper.

Storage

When storing the Linear Ball Slide, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

LM Roller

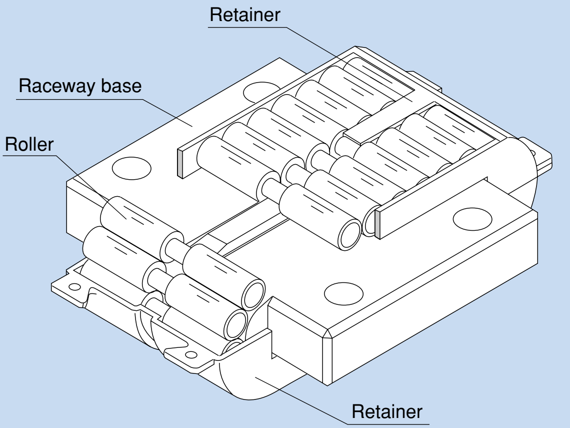


Fig. 1 Structure of LM Roller Model LR

Structure and Features

In the LM Roller, dual rollers assembled on the circumference of the precision-ground, rigid raceway base travel in infinite circulation while being held by a retainer. A center guide integrated with the raceway base is formed in the central part of the loaded area of the raceway base to constantly correct skewing of the rollers. This unique structure ensures smooth rolling motion.

●Supports an Ultra Heavy Load and Ensures Smooth Motion

The LM Roller is compact and capable of carrying a heavy load, and one unit of model LR50130 (length: 130 mm; width: 82 mm; height: 42 mm) is capable of receiving a 255-kN load. Moreover, because of rolling motion, this model has a low friction coefficient (μ = 0.005 to 0.01) and is free from stick slip, thus to achieve highly accurate linear motion.

●High Combined Accuracy

In general, when supporting a single plane with LM rollers, multiple units of LM rollers are combined on the same plane, and therefore, the height difference between the rollers significantly affects the machine accuracy's and service life. With THK LM Roller, the user can select a combination of models with a height difference of up to 2 μm.

●Rational Skewing-preventing Structure

With an LM system using rollers, once the rollers skew, it increases friction resistance or decreases running accuracy. To prevent skewing, THK LM Roller has roller guides on the center of the retainer full circle, and in the center of the loaded area on the raceway base. This structure enables the LM Roller to automatically correct skewing caused by a mounting accuracy error and the rollers to travel in an orderly manner. It also allows the LM Roller to be installed with slant mount or wall mount while demonstrating high performance.

Applications

The LM Roller is used in applications such as the XYZ guide of NC machine tools, precision press ram guides, press dies changers and heavy-load conveyance systems.

Types and Features

Model LR

This model is designed to be fit into a groove machined on the mounting surface. By screwing bolts into four holes on the raceway base, it is secured on the mounting surface.
(fixtures SM and SE are also available.)

Model LR-Z

A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LR.
Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.

Model LRA

Just like model LR, this model is also designed to be fit into a groove. It is a compact type that can be mounted using fixture SM or SE and bolts.

Model LRA-Z

A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LRA.
Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.

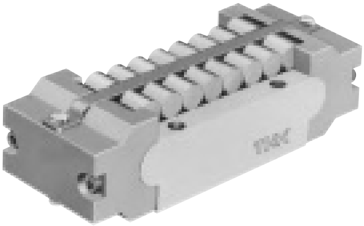
Model LRB

Since this model does not require a groove on the mounting surface, man-hours for machining can be reduced. It can be mounted using fixture SM or SE and bolts.

Model LRB-Z

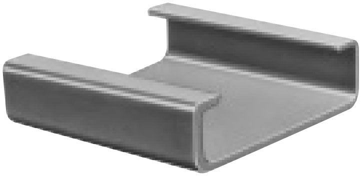
A lighter type that uses a resin-made retainer and is designed to be mounted in the same manner as model LRB.
Since it has a groove for installing a seal, a special rubber seal with a high dust prevention effect can easily be attached. In addition, this model is capable of high-speed traveling at 1 m/s.

Model LRU



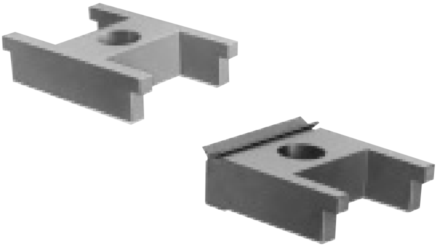
Since this model does not require a groove on the mounting surface, man-hours for machining can be reduced. By screwing bolts into four holes on the raceway base, it is secured on the mounting surface.

Spring Pad Model PA



By attaching this spring pad to the back of the LM Roller as shown in Fig. 5.ⓐ on page i-10, and turning the adjustment bolt, adjustment of a clearance and a preload can easily be done.

Fixture Models SM/SMB and SE/SEB



Use of fixture model SM or SE eliminates the need to machine thin tapped holes for mounting the LM Roller, and allows the roller to firmly be secured.

Models SE and SEB each have a special rubber wiper with double lips to achieve a high dust prevention effect.

Hardened Raceway Base

THK manufactures a heat-treated, ground raceway base that allows the LM Roller to demonstrate maximum performance upon request.

Accuracy Standards

When multiple LM Roller units are arranged on the same plane, the mounting heights of the LM Roller units must be identical in order to achieve uniform load distribution. The dimensional tolerance of the LM Roller in height (A) is defined as indicated in table 4. When ordering LM Roller units to be used on the same plane, specify their tolerances with the same classification symbol.

Each classification symbol is marked on the package box and on the side face of the LM Roller's raceway base as indicated in Fig. 5 (except for normal class).

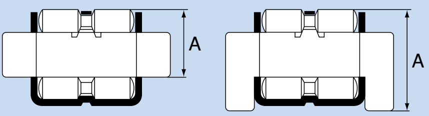


Fig. 2 Mounting Height (A) of the LM Roller

Table 1 Classification of Dimensional Tolerances in Height (A)

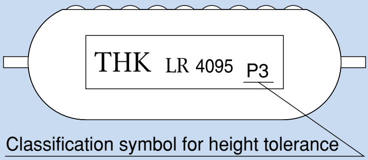
Unit: μm

Accuracy class	Dimensional tolerance for A	Classification symbol
Normal grade	0 to –10	No symbol
High grade	0 to – 5	H 5
	–5 to –10	H 10
Precision grade	0 to – 3	P 3
	–3 to – 6	P 6
	–6 to – 9	P 9
	–9 to –12	P 12
Ultra-precision grade	0 to – 2	SP 2
	–2 to – 4	SP 4
	–4 to – 6	SP 6
	–6 to – 8	SP 8
	–8 to –10	SP 10

Model number coding LR2055Z UU P3

1 Model number
2 With end seal on both ends (without seal: no symbol)
3 Classification symbol for height (A) tolerance

Note: The end seal is available only for Z types.



Classification symbol for height tolerance

Fig. 3

Raceway

To maximize the performance of the LM Roller, it is necessary to take into account the hardness, roughness and accuracy of the raceway, on which the rollers directly roll, when manufacturing the product. In particular, the hardness significantly affects the service life. Therefore, it is important to take much care in selecting a material and heat treatment method.

●Hardness

We recommend surface hardness of 58 HRC (≒ 653 HV) or higher. The depth of the hardened layer is determined by the size of the LM Roller; we recommend approximately 2 mm for general use. If the hardness of the raceway is lower or the raceway cannot be hardened, multiply the load rating by the corresponding hardness factor (see page I-9 in the "THK General Catalog - Technical Descriptions of the Products," provided separately).

●Material

The following materials are generally used as suitable for surface hardening through induction quenching and flame quenching.

SUJ2	(JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6	(JIS G 4401: carbon-tool steel)
S55C	(JIS G 4051: carbon steel for machine structural use)

If the machine body is a mold, depending on the service conditions, a hardened steel plate may not be used and instead, the surface of mold itself may be hardened.

●Roughness of the surface

To achieve smooth motion, the surface should preferably be finished to 0.4a or less. If slight wear is allowed in the initial stage, the surface may be finished to approximately 0.8a.

●Accuracy

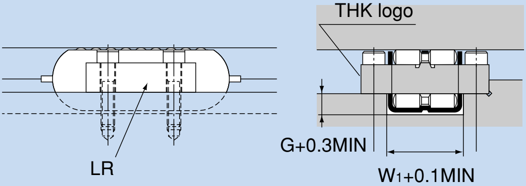
When high accuracy is required, securing a hardened steel plate to the machine body may cause undulation on the raceway. To avoid this, secure the LM Roller with bolts before grinding the hardened steel plate as with when mounting the product, or tightening it to the machine body before grinding and finishing the raceway, to produce a good result.

Installing the LM Roller

Fig. 4 shows examples of installing the LM Roller. To minimize the gradient of the LM Roller in the traveling direction, provide a datum plane on the mounting surface and press the LM Roller toward it. The mounting reference surface of the LM Roller is opposite of the THK logo marked on the raceway base.

ⓐ Installing models LR, LRU and LR-Z

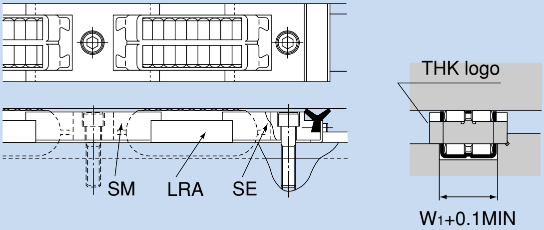
Use the four mounting bolt holes on the raceway base to mount the LM Roller.



For G and W_1, see the dimensional table.

ⓑ Installing models LRA and LRA-Z

The LM Roller can easily be secured using fixture SM or SE. SE is provided with a wiper to increase dust-prevention effect.



For W_1, see the dimensional table.

ⓒ Installing models LRB and LRB-Z

The LM Roller can easily be secured using fixture SMB or SEB. SEB is provided with a wiper to increase dust-prevention effect.

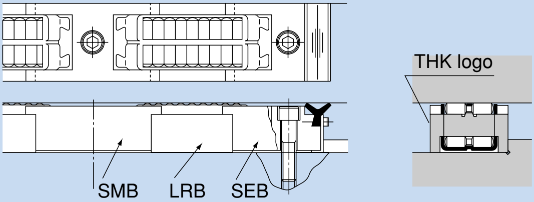


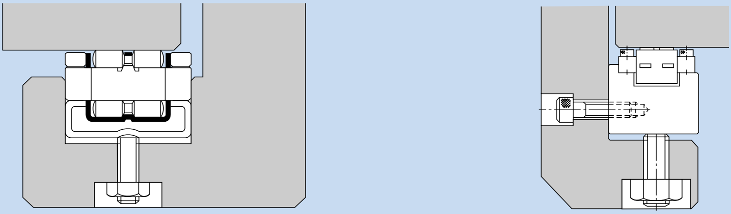
Fig. 4 Installing the LM Roller

Guidance for Adjusting the Clearance

To secure stable accuracy during operation, the LM Roller is provided with a light preload. Provision of a preload is especially effective also in increasing the service life for applications where a vibration impact load or overhang load is applied.

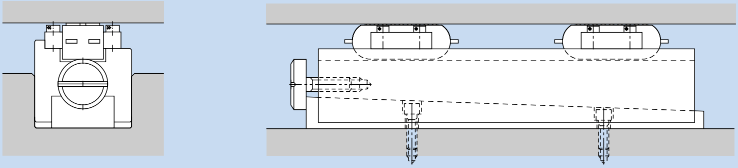
Fig. 5 shows clearance adjusting methods that are commonly practiced.

Normally, it is preferable to provide a preload that is approximately 3% of the basic dynamic load rating (C). Providing a preload to the LM Roller will stabilize the accuracy.



ⓐ Using a dedicated stopper

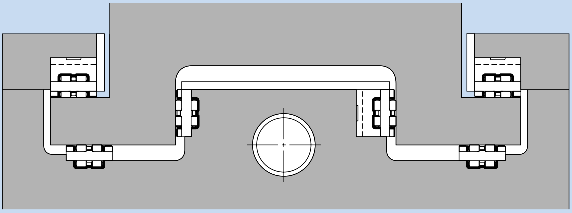
ⓑ Using a setscrew

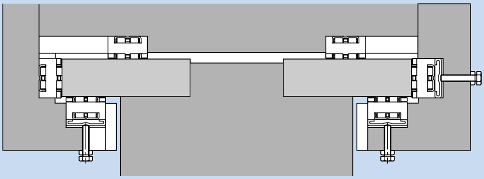


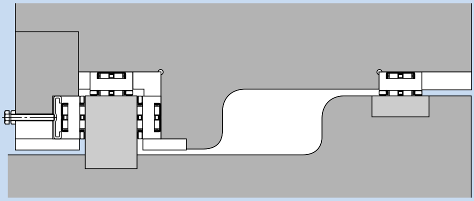
ⓒ Adjusting a tapered gib

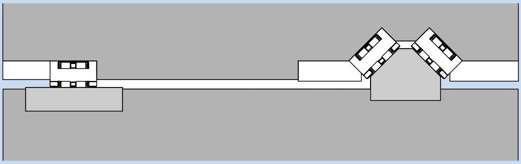
Fig. 5 Methods for Adjusting the Clearance of the LM Roller

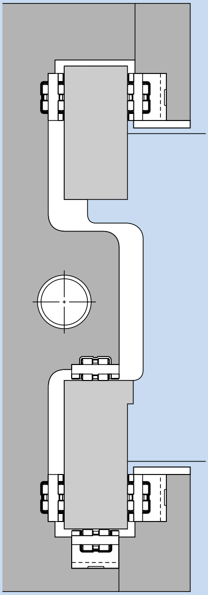
Examples of Arranging LM Roller Units





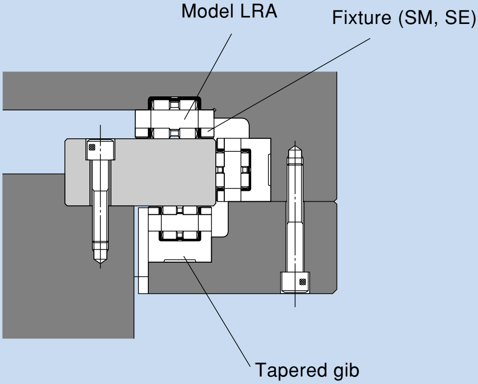




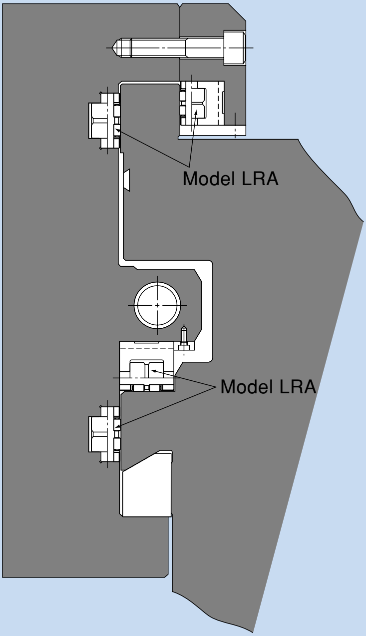


Examples of Installing the LM Roller

Assembling the slide section



Using the cross rail of a vertical lathe



Guidance for Using the Spring Pad

Spring pad model PA is a low-cost item that enables easy adjustment and achieves self-alignment. A preload can easily be adjusted by installing the spring pad to the machine and externally tightening the adjustment bolt using a torque wrench. As a result, the need for troublesome shim adjustment and machining for matching is eliminated.

●Example of Using the Spring Pad

① When using the spring pad in the opposite position to provide a preload

To prevent the table from lifting or guiding it horizontally, use the spring pad on one side as shown in Fig. 6 will easily provide a preload and eliminate vibrations and play of the machine.

② When applying both sliding and rolling on the same plane

When desiring to increase friction resistance because the table inertia is large, or desiring to increase rigidity under a heavy load, the spring pad can be used in combination with the sliding surface. To do so, install the LM Roller and the spring pad to several locations on the table as shown in Fig. 7, and then tighten the adjustment bolt by the load to be allocated to the LM Roller.

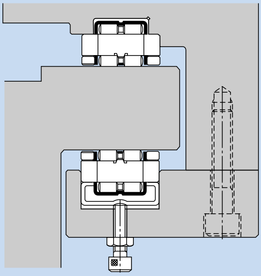


Fig. 6

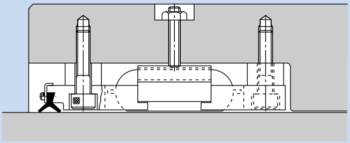


Fig. 7

●Guidance for Installing the Spring Pad

Fig. 8 shows examples of installing the spring pad PA to the bottom of the LM Roller and adjusting the clearance and providing a preload.

The dimensions is this example are indicated in the dimensional table for the spring pad PA.

The following is the procedure for the installation.

① Secure the fixture and the spacer. Adjust them so that the LM Roller can move vertically.

② Turn the adjustment bolt until the LM Roller hits the raceway.

③ Turn the adjustment bolt using a torque wrench and tighten it until the desired torque is reached. A preload is provided via the spring pad PA.

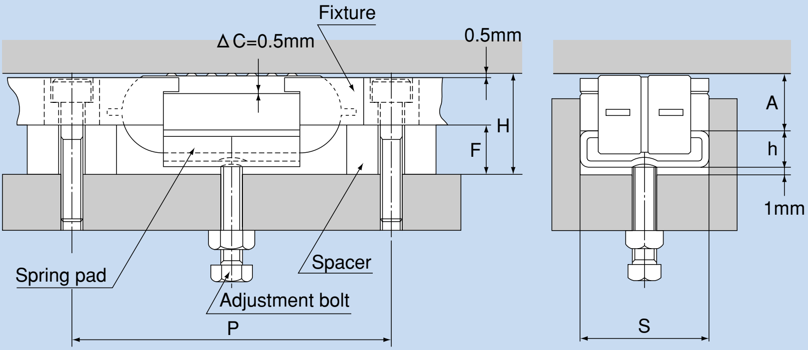
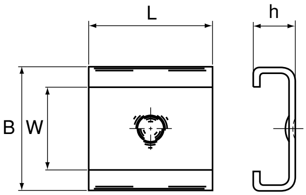


Fig. 8

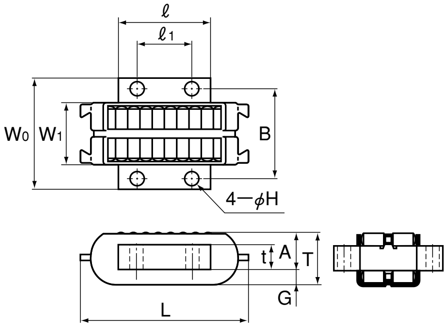
Spring Pad



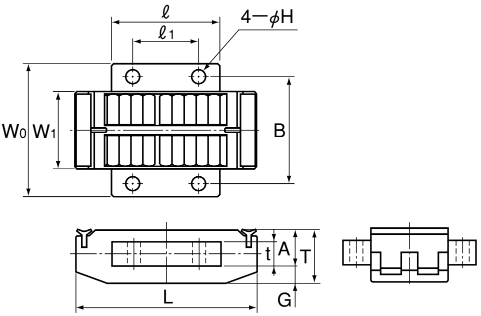
Unit: mm

Model No.	Major dimensions				Installation related dimensions (see Fig. 8)					Maximum permissible load	Spring constant	Supported LM Roller
	W	B	L	h	H	S $^{+0.15}_{+0.05}$	F	P	Adjustment bolt	kN	kN/mm	
PA 15	15	22.2	20	9	21	22.2	11.5	65	M5	1.02	5.4	LRA 1547Z
PA 20	20	30	30	9.5	22.5	30	12	75	M6	2.74	7.5	LRA 2055Z
PA 25	25	38.1	35	12	27	38.1	14.5	90	M8	4.11	9.1	LRA 2565Z
PA 32	32	45	45	12.5	28.5	45	15	100	M8	4.11	11.2	LRA 3275Z
PA 40	40	55	55	16	38	55	18.5	126	M10	4.8	15.3	LRA 4095
PA 50	50	76.2	78	21	52	76.2	23.5	170	M12	6.86	15.5	LRA 50130

Models LR | LR-Z



Model LR

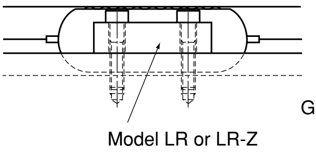


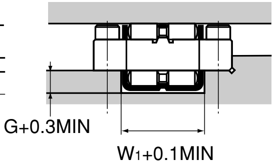
Model LR-Z

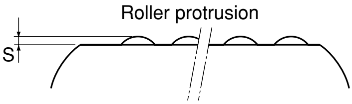
Unit: mm

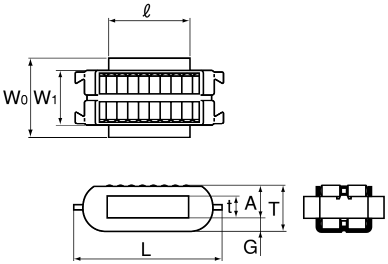
Model No.	Major dimensions													Mass	Basic dynamic load rating	Basic static load rating
	W1 0 −0.1	Length L	Thickness T	Width W0	A	t	G	ℓ 0 −0.2	Mounting hole pitch ℓ1	B	H	S	Mounting bolt	g	C kN	C0 kN
LR 1547Z	15	47	16	30	11	7	5	20	12	23	3.4	0.2	M3*	60	15.2	17.6
LR 2055Z	20	55	17.3	36	12	8	5.3	30	18	29	4.5	0.2	M4*	110	26	37.8
LR 2565Z	25	65	20.6	45	14	9	6.6	35	20	36	5.5	0.1	M5*	190	40.4	61.1
LR 3275Z	32	75	21.6	55	15	10	6.6	45	27	44	5.5	0.1	M5*	320	52.5	91
LR 4095	40	95	30	68	21	14	9	55	35	54	6.6	0.3	M6	800	84.5	140
LR 50130	50	130	42	82	30	20	12	78	50	66	9	0.3	M8	1810	149	255

Note Using a hexagon socket bolt as the mounting bolt marked with * may cause interference.

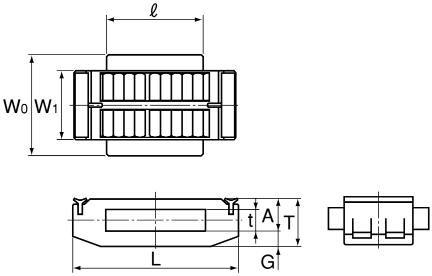








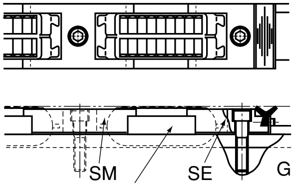
Model LRA



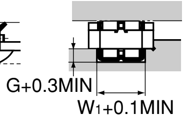
Model LRA-Z

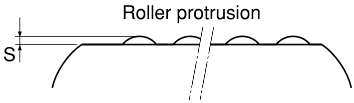
Unit: mm

Model No.	Major dimensions									Mass	Basic dynamic load rating	Basic static load rating
	W_1 $^{0}_{-0.1}$	Length L	Thickness T	Width W_0	A	t	G	ℓ $^{0}_{-0.2}$	S	g	C kN	C_0 kN
LRA 1547Z	15	47	16	22.2	11	7	5	20	0.2	54	15.2	17.6
LRA 2055Z	20	55	17.3	30	12	8	5.3	30	0.2	104	26	37.8
LRA 2565Z	25	65	20.6	38.1	14	9	6.6	35	0.1	180	40.4	61.1
LRA 3275Z	32	75	21.6	45	15	10	6.6	45	0.1	310	52.5	91
LRA 4095	40	95	30	55	21	14	9	55	0.3	740	84.5	140
LRA 50130	50	130	42	76.2	30	20	12	78	0.3	1770	149	255

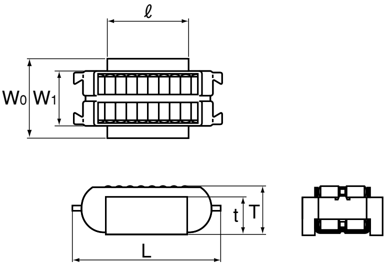


Model LRA or LRA-Z

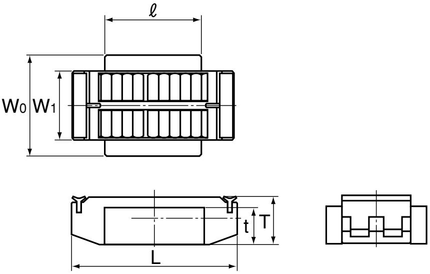




Models LRB | LRB-Z



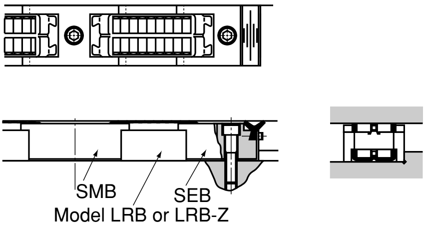
Model LRB

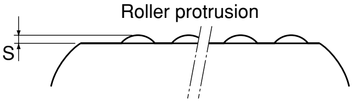


Model LRB-Z

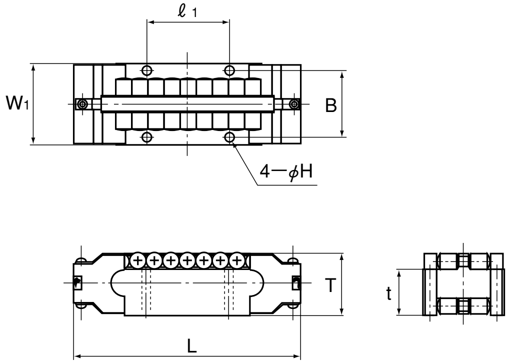
Unit: mm

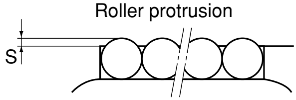
Model No.	Major dimensions							Mass	Basic dynamic load rating	Basic static load rating
	W_1 $^{0}_{-0.1}$	Length L	Width W_0	Thickness T	t	ℓ $^{0}_{-0.2}$	S	g	C kN	C_0 kN
LRB 1547Z	15	47	22.2	17	13	20	0.2	60	15.2	17.6
LRB 2055Z	20	55	30	18	14	30	0.2	117	26	37.8
LRB 2565Z	25	65	38.1	21	16	35	0.1	205	40.4	61.1
LRB 3275Z	32	75	45	22	17	45	0.1	340	52.5	91
LRB 4095	40	95	55	31	24	55	0.3	800	84.5	140
LRB 50130	50	130	76.2	43	33	78	0.3	1970	149	255





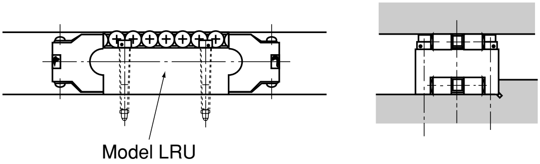
Model LRU



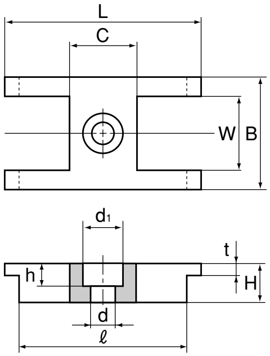


Unit: mm

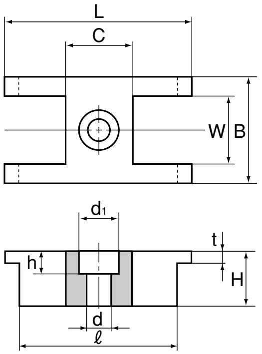
Model No.	Major dimensions									Mass	Basic dynamic load rating	Basic static load rating
	Thickness	Width			Length						C	C_0
	T	W_1	Tolerance	t	L	ℓ_1	B	H	S	kg	kN	kN
LRU 22.2	14.283	22.23	$^{0}_{-0.050}$	10.48	51	19.05	17.07	3	0.253	0.09	11.9	14.5
LRU 25.4	19.05	25.4	$^{0}_{-0.050}$	13.97	73	25.4	20.6	3.4	0.2	0.22	28.1	39.8
LRU 38.1	28.573	38.1	$^{0}_{-0.050}$	20.953	101.6	38.1	30.96	4.5	0.22	0.7	59.4	88.2
LRU 50.8	38.098	50.8	$^{0}_{-0.075}$	27.938	139.7	50.8	41.28	5.6	0.46	1.7	103	159
LRU 76.2	57.15	76.2	$^{0}_{-0.075}$	41.15	206.4	76.2	61.9	6.6	0.5	5.7	245	402



Models SM | SMB



Model SM



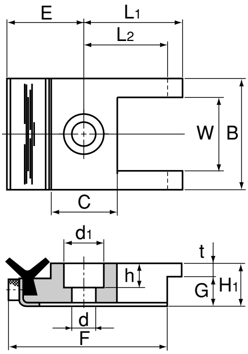
Model SMB

Unit: mm

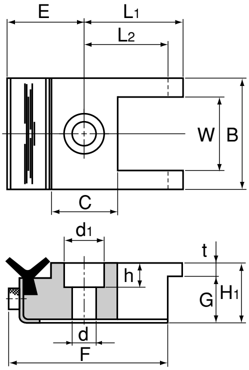
Model No.	Major dimensions										Mass
	W	B	L	C	ℓ	H	t	d	d_1	h	g
SM 15	15	22.2	53	16	45	9	3	5.5	9.5	5.4	38
SMB 15	15	22.2	53	16	45	15	3	5.5	9.5	5.4	60
SM 20	20	30	53	18	45	10	3	6.6	11	6.5	60
SMB 20	20	30	53	18	45	16	3	6.6	11	6.5	95
SM 25	25	38.1	65	23	55	12	4	9	14	8.6	115
SMB 25	25	38.1	65	23	55	19	4	9	14	8.6	120
SM 32	32	45	65	23	55	13	4	9	14	8.6	135
SMB 32	32	45	65	23	55	20	4	9	14	8.6	215
SM 40	40	55	81	28	71	19	6	11	17.5	10.8	290
SMB 40	40	55	81	28	71	29	6	11	17.5	10.8	455
SM 50	50	76.2	102	38	92	28	9	14	20	13	890
SMB 50	50	76.2	102	38	92	41	9	14	20	13	1320

Models SE | SEB

i. Dimensions of the LM Roller



Model SE



Model SEB

Unit: mm

Model No.	Major dimensions													Mass
	W	B	L_1	L_2	E	F	C	H_1	G	t	d	d_1	h	g
SE 15	15	22.2	26.5	22.5	18	40.5	16	10	7	3	5.5	9.5	5.4	35
SEB 15	15	22.2	26.5	22.5	18	40.5	16	16	13	3	5.5	9.5	5.4	64
SE 20	20	30	26.5	22.5	19	41.5	18	11	8	3	6.6	11	6.5	60
SEB 20	20	30	26.5	22.5	19	41.5	18	17	14	3	6.6	11	6.5	105
SE 25	25	38.1	32.5	27.5	21.5	49	23	13	9	4	9	14	8.6	110
SEB 25	25	38.1	32.5	27.5	21.5	49	23	20	16	4	9	14	8.6	175
SE 32	32	45	32.5	27.5	21.5	49	23	14	10	4	9	14	8.6	140
SEB 32	32	45	32.5	27.5	21.5	49	23	21	17	4	9	14	8.6	220
SE 40	40	55	40.5	35.5	24	59.5	28	20	14	6	11	17.5	10.8	295
SEB 40	40	55	40.5	35.5	24	59.5	28	30	24	6	11	17.5	10.8	415
SE 50	50	76.2	51	46	29	75	38	29	20	9	14	20	13	840
SEB 50	50	76.2	51	46	29	75	38	42	33	9	14	20	13	1245

Precautions on Using the LM Roller

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Dropping or hitting the LM Roller may damage it. Giving an impact to the LM Roller could also cause damage to its function even if the product looks intact.

Dust Prevention and Lubrication

With the LM Roller, once foreign matter enters the raceway due to poor dust prevention, it cannot be removed easily and tends to severely damage the raceway or the LM rollers. Therefore, use much care in dust prevention.

Fixture for the LM Roller models SE and SEB each have a special rubber wiper with double lips to achieve a high dust prevention effect. Feeding grease between the double lips when attaching the fixture, as shown in Fig. 1, will further increase the effect.

For locations subject to cutting chips or welding spatter, it is necessary to use a dust prevention cover such as a bellows and a telescopic cover, or a wiper reinforced with a metal plate as indicated in Fig. 2.

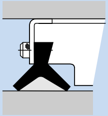


Fig. 1 Wiper of Fixture Models SE and SEB

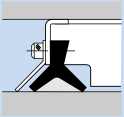


Fig. 2 Reinforced Wiper

For dust prevention of the side faces, items as shown in Fig. 3 are available.

The required quantity of lubricant is much smaller than sliding guides, making the lubrication control easy.

As for the lubricant, the same type of grease or lubricant as that of ordinary bearings will be adequately effective. To achieve a high level of grease retention, it is preferable to use lithium-soap group grease No. 1 or 2, or slightly viscous sliding surface oil or turbine oil.

To replenish the lubricant to the LM Roller, drop the lubricant from the greasing hole provided on the back of the retainer as necessary, or directly drop it to the raceway. If the LM Roller is not used frequently, it is also possible to apply grease to the rollers of the product.

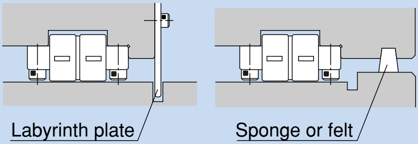


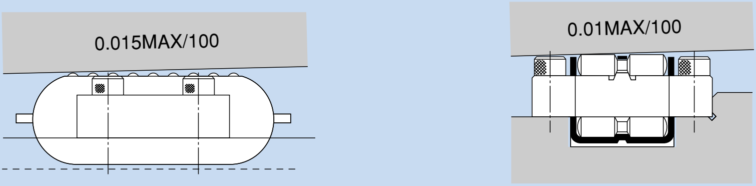
Fig. 3

Mounting Reference Surface

To help correctly mount the LM Roller in the traveling direction, it has a mounting reference surface on the side face of the raceway base. The reference surface is on the opposite side of the THK logo.

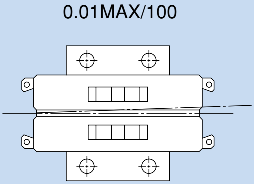
Mounting Accuracy

To maximize the performance of the LM Roller, it is necessary to distribute the load as evenly as possible when mounting the product. For the parallelism between the roller and the raceway indicated in Fig. 4, we recommend 0.015 mm or less against 100 mm. For the allowable tilt of the roller in the longitudinal direction, 0.01 mm or less against 100 mm is recommended.



ⓐ Parallelism between the LM Roller and the raceway

ⓑ Allowable tilt of the roller in the longitudinal direction



ⓒ Parallelism between the LM Roller and the raceway in the horizontal direction

Fig. 4 LM Roller and Mounting Accuracy

Precautions on Use

(1) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.

(2) Do not use the resin retainer for LM Roller model LR (A, B)-Z and seals (including SE and SEB) in an atmosphere at temperature of 80℃ or higher.

(3) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing the LM Roller, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

Flat Roller

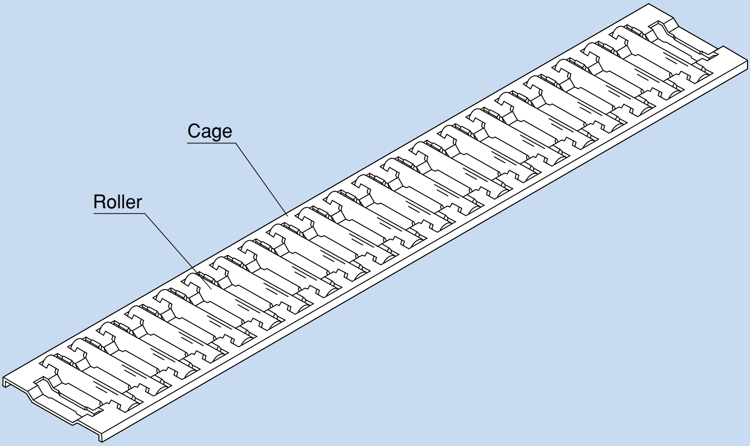


Fig. 1 Structure of LM Flat Roller Model FT

Structure and Features

With the Flat Roller, precision rollers compliant with JIS B 1506 are installed in pockets of a cage made of a thin steel plate pressed into M shape (in cross section) to increase its rigidity. Thanks to its structural design, the rollers do not fall off because they are held in cage pockets. Since the cage, which is incorporated with rollers having a diameter of 5 mm or larger, is of roller-lifter type, smooth motion is achieved without damaging the raceway even if the hardness of the raceway is low. The Flat Roller is sandwiched between the two raceways. As the table moves, the Flat Roller travels by half the distance of the table in the same direction. For example, if the table moves 500 mm, the Flat Roller travels 250 mm in the same direction.

●Large Load Capacity

Sine rollers are installed in short pitches, the Flat Roller has a large load capacity, and depending on the conditions, it can be used on the raceway of a mold that is little hardened. In addition, the deflection rigidity of the table is almost the same as that of a sliding surface.

●Combined Accuracy of 90° V Surface and Flat Surface Supported as Standard

The Flat Roller is designed so that it can be mounted on the 90° V-flat sliding surface, which is the most common configuration among narrow guide types of tables and saddles of machinery. It allows the product to be used without major design change.

●Lowest Friction among Roller Type LM Systems

Since the rollers are evenly held in a light, rigid cage, friction between rollers is eliminated and skewing of the rollers is minimized. As a result, a small friction coefficient (μ = 0.001 to 0.0025) is achieved, and stick slip, which is problematic with sliding surfaces, does not occur.

●Instant Connection of the Cage

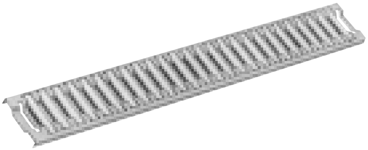
When installing the Flat Roller in a large machine, it can easily be connected on the bed. This allows the Flat Roller to be installed even with the longest type.

Applications

The Flat Roller is optimal for large machine tools such as planer, plano-miller and roll-grinding machine, and for locations requiring high accuracy such as surface grinding machine, cylindrical grinder and optic measuring machine.

Types and Features

Models FT and FT-V



These models have a single row of rollers and are mainly used on the flat surface.

Models FTW and FTW-V

These models have two or more rows of rollers, and their cages are shaped to bend at 90°. It uses rollers with a diameter 0.7071 times greater than that of the rollers on the flat surface so that model FT or FT-V can be mounted on the 90° V surface at the same height if model FT or FT-V is used on the flat surface.

Accuracy Standards

The accuracy of the Flat Roller is classified into normal grade, high grade and precision grade according to the difference in diameter between the rollers incorporated in a single cage. When it is necessary to specify the dimensional tolerance in the roller diameter for reasons related to the required accuracy or combination, select the desired accuracy from table 1 and specify the corresponding accuracy symbol. When placing an order, refer to the section on model number coding (pages j-10 and j-11).

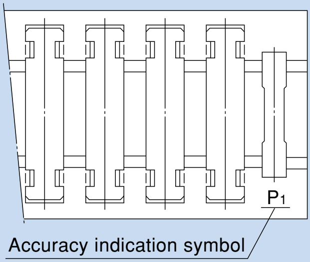


Fig. 2

Table 1 Classification of Roller Diameters for Selection

Unit: μm

Accuracy class	Diameter difference	Dimensional tolerance in diameter	Accuracy indication symbol
Normal grade	3	0 to –3	No symbol
High grade	2	0 to –2	H2
		–2 to –4	H4
		–4 to –6	H6
Precision grade	1	0 to –1	P1

Note: The accuracy indication symbol is marked on the end of the cage as shown in Fig. 2.

Raceway

To maximize the performance of the Flat Roller, it is necessary to take into account the hardness, roughness and accuracy of the raceway, on which the rollers directly roll, when manufacturing the product. In particular, the hardness significantly affects the service life. Therefore, it is important to take much care in selecting a material and heat treatment method.

●Hardness

We recommend surface hardness of 58 HRC (≒ 653 HV) or higher. The depth of the hardened layer is determined by the size of the Flat Roller; we recommend approximately 2 mm for general use. If the hardness of the raceway is lower or the raceway cannot be hardened, multiply the load rating by the corresponding hardness factor (see page J-8 in the "THK General Catalog - Technical Descriptions of the Products," provided separately).

●Material

The following materials are generally used as suitable for surface hardening through induction quenching and flame quenching.

SUJ2	(JIS G 4805: high-carbon chromium bearing steel)
SK3 to 6	(JIS G 4401: carbon-tool steel)
S55C	(JIS G 4051: carbon steel for machine structural use)

If the machine body is a mold, depending on the service conditions, a hardened steel plate may not be used and instead, the surface of mold itself may be hardened.

●Roughness of the surface

To achieve smooth motion, the surface should preferably be finished to 0.4a or less. If slight wear is allowed in the initial stage, the surface may be finished to approximately 0.8a.

●Accuracy

When high accuracy is required, securing a hardened steel plate to the machine body may cause undulation on the raceway. To avoid this, secure the Flat Roller with bolts before grinding the hardened steel plate as with when mounting the product, or tightening it to the machine body before grinding and finishing the raceway, to produce a good result.

Installing the Flat Roller

●Combination of 90˚ V Surface and Flat Surface

The Flat Roller can be mounted directly onto the guide surface on the 90˚ V surface and flat surface. Table 2 shows examples of their combinations.

Note: The roller diameter (Da) for model numbers containing symbol V at the end represents the value $\frac{1}{\sqrt{2}}$ times that of types for the same model number with no symbol.
The diameter of the roller to be combined with 90˚ V surface will be $\frac{1}{\sqrt{2}}$ times that of the roller on the flat surface. For example, when using model FT4035 (roller diameter: ϕ4) on the flat surface, use model FTW4030V (roller diameter: ϕ2.828) on the V surface. Performance of the Flat Roller is significantly affected by the contact state of the upper and lower raceways. You can check the fit before installing the Flat Roller by designing the raceways as indicated in Fig. 3.

Table 2 Examples of Combinations

90˚ V surface		Flat surface	
Model No.	Roller diameter Da	Model No.	Roller diameter Da
FTW 4030V	2.828	FT 4030	4
FTW 4030V	2.828	FT 4035	4
FTW 5035V	3.535	FT 5038	5
FTW 5035V	3.535	FT 5043	5
FTW 5045	5	FT 10060V	7.071
FTW 5050	5	FT 10060V	7.071
FTW 10070V	7.071	FT 10080	10

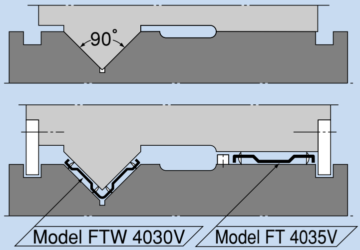


Fig. 3 Example of Combination

●Other Example of Installation

In locations where a lifting load or an overhang load is applied, the Flat Roller can be installed as shown in Fig. 4.
For details on clearance adjustment from the side face, see "Examples of Adjusting the Clearance" for the Cross Roller Guide on page f-8.

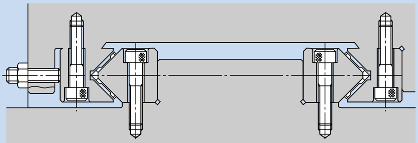


Fig. 4 Location where a Lifting Load is Applied

●Determining the Flat Roller Length

The Flat Roller travels 1/2 of the travel distance of the table in the same direction. Therefore, it is necessary to calculate the stroke length and the Flat Roller length as indicated below.

To keep the Flat Roller stayed under the table, obtain Flat Roller length as follows.

$\ell_S \leqq L_B - L_T$

The Flat Roller length:

$$\ell = L_T + \frac{\ell_S}{2} = 0.5\,(L_B + L_T)$$

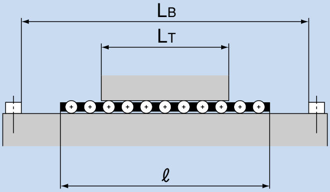


Fig. 5

●Connecting Flat Roller Units

When it is necessary to connect two or more Flat Roller units, use a joint plate as shown in Fig. 6 to connect them on the base. When placing an order, indicate the overall length for actual use.

Note, however, that model FT2010 units cannot be joined together.

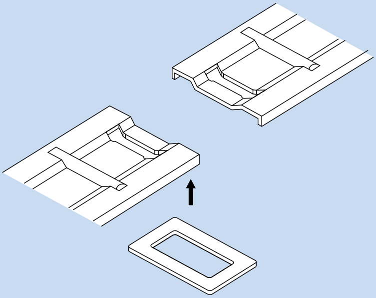
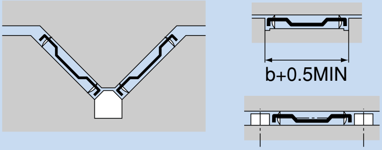


Fig. 6 Connection of Model FT Units

●Guiding the Flat Roller

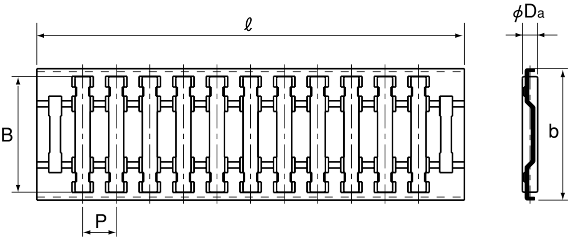
To guide model FT or FT-V, follow the instruction as shown in Fig. 7.



For "b," see the dimensional table.

Fig. 7 Guiding the Flat Roller

Model FT



Unit: mm

Model No.	Major dimensions		Roller dimensions				Basic dynamic load rating	Basic static load rating	Mass
	Width	Length	Diameter	Length	No. of rollers	Pitch	C	C_0	
	b	ℓ	D_a	B	Z	P	kN	kN	g
FT 2010- 32	10	32	2	7.8	7	4	5.2	10.4	1.9
FT 2515- 45	15	45	2.5	11.8	7	4.75	10.9	25.2	5.6
FT 3020- 60	20	60	3	15.8	8	5.51	17.4	42.8	12.5
FT 3525- 75	25	75	3.5	19.8	8	7	27.4	72.7	23
FT 4030-150	30	150	4	25.8	18	7.3	55.7	176	73
FT 4035-150	35	150	4	30.8	18	7.3	64.2	212	86
FT 4026V-150	26	150	2.828	22.8	22	6	45.1	155	45
FT 5038-250	38	250	5	32.8	21	11	109	387	195
FT 5043-250	43	250	5	37.8	21	11	122	449	200
FT 5030V-250	30	250	3.535	21.8	33	7	78	290	103
FT 10054-400	54	400	10	46	24	15.8	279	1000	870
FT 10080-500	80	500	10	71.8	29	16	459	1900	1610
FT 10060V-500	60	500	7.071	52.8	35	13.5	301	1270	870

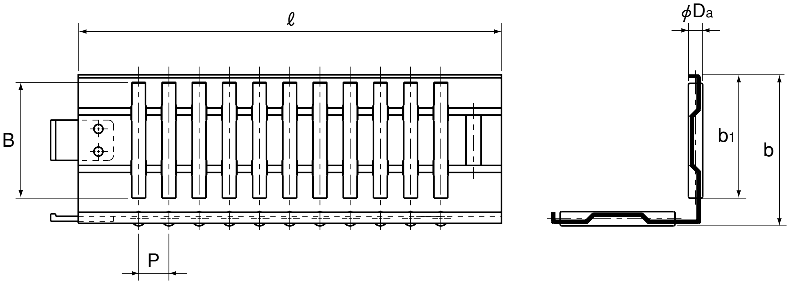
Model number coding

FT5038 P1 -750L

1 2 3

1 Model number 2 Accuracy symbol 3 Overall cage length (in mm)

Model FTW



Unit: mm

Model No.	Major dimensions Width b	b1	Length ℓ	Roller dimensions Diameter D_a	Length B	No. of rollers Z	Pitch P	Basic dynamic load rating C kN	Basic static load rating C_0 kN	Mass g
FTW 4030V-150	30	24.5	150	2.828	22.8	22×2	6	59	220	94
FTW 5045-250	45	35.5	250	5	32.8	23×2	10	142	548	410
FTW 5050-250	50	40.5	250	5	37.8	23×2	10	160	634	460
FTW 5035V-250	35	29	250	3.535	26.8	33×2	7	102	411	220
FTW 6022.4-320	22.4	14.4	320	6	12.8	16×2	19	53	141	180
FTW 10036V-380	36	26.6	380	7.071	25	23×2	16	149	507	700
FTW 10043.5V-380	43.5	34	380	7.071	31.8	23×2	16	182	660	845
FTW 10070V-500	70	56.5	500	7.071	52.8	35×2	13.5	394	1804	1790

Model number coding

FTW5050 P1 -750L

1 2 3

1 Model number 2 Accuracy symbol 3 Overall cage length (in mm)

Precautions on Using the Flat Roller

Handling

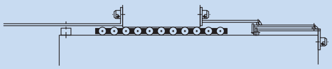
(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting the Flat Roller may damage it. Giving an impact to the Flat Roller could also cause damage to its function even if the product looks intact.

Dust Prevention and Lubrication

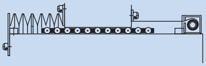
With the Flat Roller, once foreign matter enters the raceway due to poor dust prevention, it cannot be removed easily and tends to severely damage the raceway or the Flat rollers. Therefore, use much care in dust prevention. Normally, for dust prevention of the Flat Roller, a bellows or a telescopic cover that covers the whole sliding surface, as shown in Fig. 1, is effective.

The required quantity of lubricant is much smaller than sliding metals, making the lubrication control easy.

Since the Flat Roller has high lubricant retention, it is suitable for grease lubrication. It is preferable to use lithium-soap group grease No. 1 or 2, or slightly viscous sliding surface oil or turbine oil.



ⓐ Copper cover or telescopic cover



ⓑ Bellows or roller blind

Fig. 1 Dust Prevention Method

Attaching a Stopper

Although the Flat Roller performs extremely accurate motion, it may cause a traveling error due to uneven load distribution or un-uniform stop. Therefore, we recommend attaching a stopper on the end of the base or the table.

Chamfering the End Face of the Table

If the Flat Roller is longer than the overall table length, finely chamfer the end face of the table so that the rollers are easily fed to the table.

Mounting Accuracy

To maximize the performance of the Flat Roller, it is necessary to distribute the load as evenly as possible when mounting the product. For the allowable tilt as shown in Fig. 2, we recommend 0.1 mm or less against 1,000 mm.

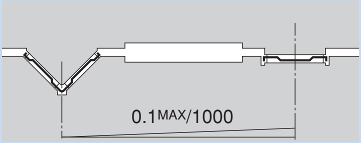


Fig. 2 Mounting Accuracy

Precautions on Use

(1) If foreign matter such as dust or cutting chips adheres to the product, replenish the lubricant after cleaning the product with pure white kerosene.
(2) If desiring to use the product at temperature of 100℃ or higher, contact THK in advance.
(3) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(4) The Flat Roller cannot be used as a roller conveyor.

Storage

When storing the Flat Roller, enclose it in a package designated by THK and store it while avoiding high temperature, low temperature and high humidity.

1. Types of Ball Screws

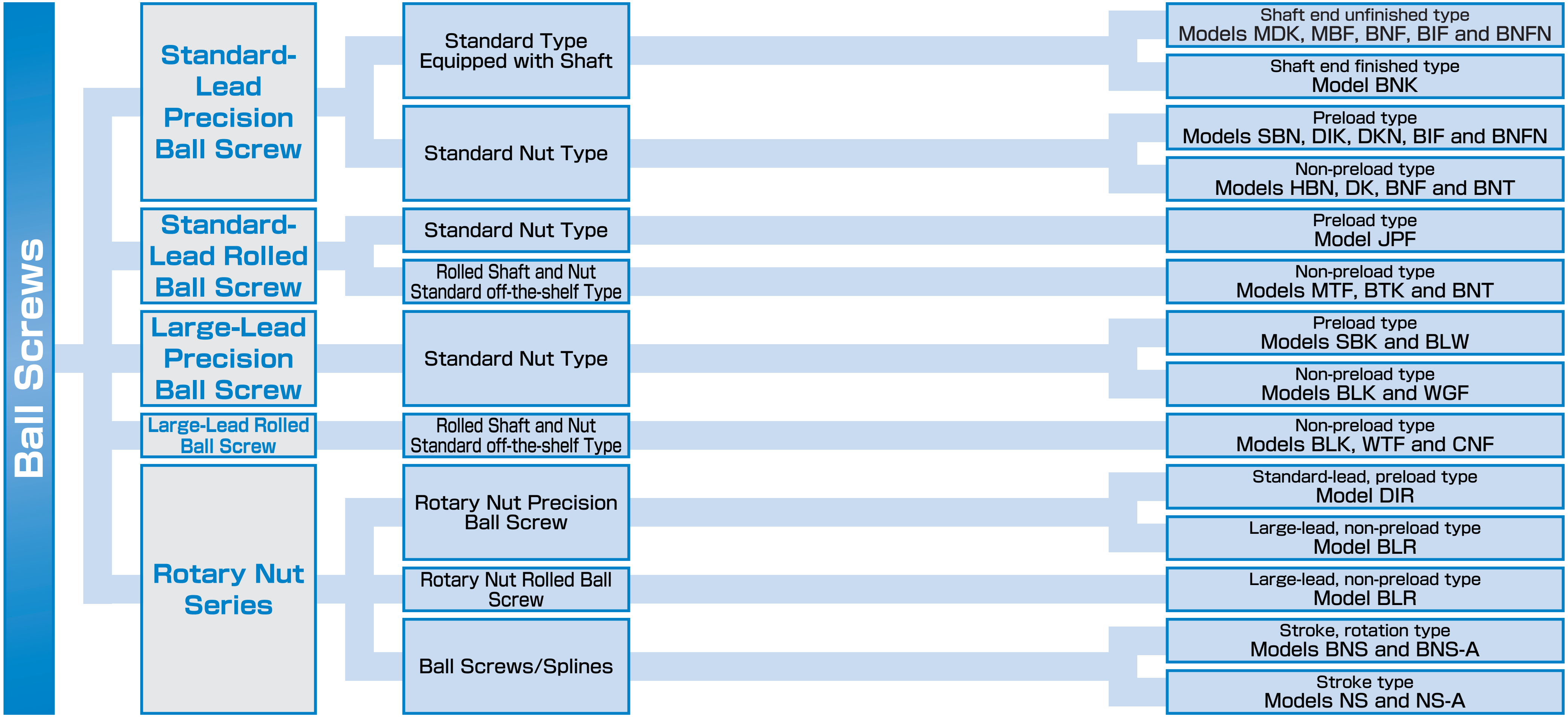
Classification of Ball Screws

For THK Ball Screws, a broad array of types are offered as standard so that the optimal product can be selected to meet diversified applications. By ball circulation method, the Ball Screws are divided into return-pipe type, deflector type and end-cap type. And by preloading method, fixed-point preloading (double-nut method, offset preloading) and constant-pressure preloading are selectable.

By screw shaft, they are divided into precision Ball Screws, which are ground with precision (six accuracy grades from C7 to C0), and rolled Ball Screws, which are formed through rolling with high accuracy (three accuracy grades from C10 to C7).

Also, a series of nut-rotating Ball Screws, which are optimal for usage based on nut rotation, are also offered in addition to those types designed for conventional use based on axial rotation.

In addition, THK also offers support units, which are incorporated with nut bracket, rock nut and support bearing, as peripherals for Ball Screws as standard.



2. Types of Ball Screw Nuts

Nuts of Ball Screws are categorized by ball circulation method into return-pipe type, deflector type and end cap type. These three nut types are described as follows.

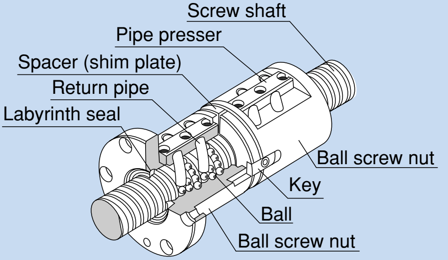
In addition to circulation methods, Ball Screws are categorized also by preloading method.

2.1. Types by Ball Circulation

Return-pipe Type
(Models SBN, BNF, BNT, BNFN, BIF and BTK)

Return-piece Type
(Model HBN)

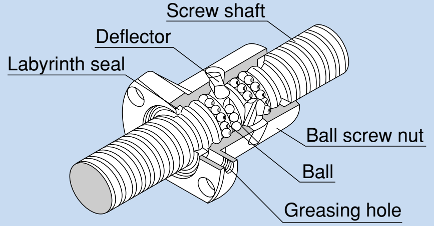
These are most common types of nuts that use a return pipe for ball circulation. The return pipe allows balls to be picked up, pass through the pipe, and return to their original positions to complete infinite motion.



Example of Structure of Return-pipe Nut

Deflector Type: Simple Nut
(Models DK, DKN, DIK, JPF and DIR)

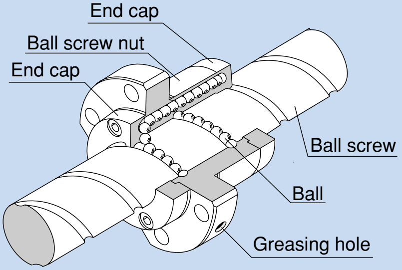
These are the most compact type of nut. Balls change their traveling direction with a deflector, pass over the circumference of the screw shaft, and return to their original positions to complete infinite motion.



Example of Structure of Simple Nut

End-cap Type: Large-lead Nut
(Models SBK, BLK, WGF, BLW, WTF, CNF and BLR)

These nuts are most suitable for fast feed. Balls are picked up with an end cap, pass through the through hole of the nut, and return to their original positions to complete infinite motion.



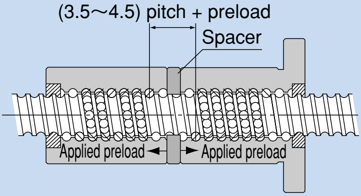
Example of Structure of Large-lead Nut

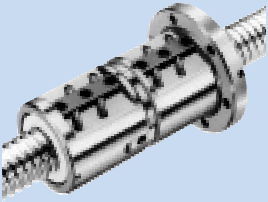
2.2. Types by Preloading Method

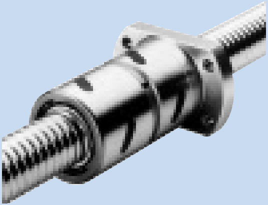
Fixed-point Preloading

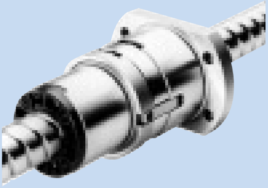
●Double-nut Method (Models BNFN, DKN and BLW)

A spacer is inserted between two nuts to provide a preload.



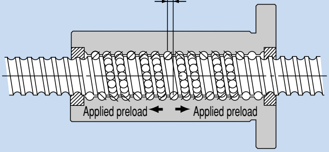

Model BNFN

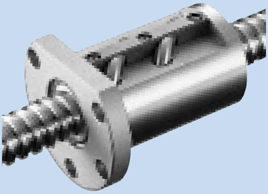

Model DKN

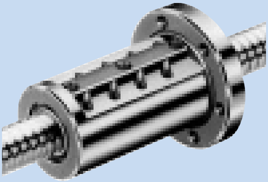

Model BLW

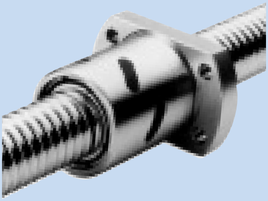
●Offset Preloading (Models SBN, BIF, DIK, SBK and DIR)

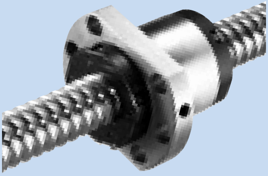
It allows more compact design than the double-nut method. This method provides a preload by changing the groove pitch in the middle of the nut without using a spacer.

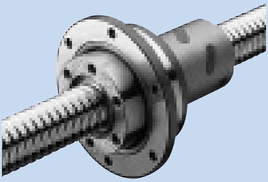



Model SBN


Model BIF

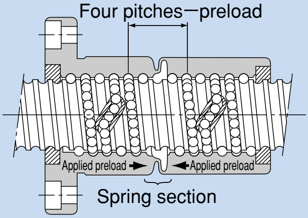

Model DIK

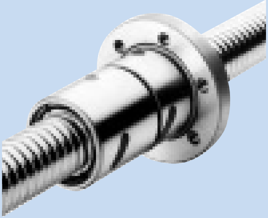

Model SBK


Model DIR

Constant-pressure Preloading (Model JPF)

With this method, a spring structure is installed almost in the middle of the nut, and it provides a preload by changing the groove pitch in the middle of the nut.




Model JPF

3. Accuracy of the Ball Screw

3.1. Lead Accuracy

The accuracy of the Ball Screw in lead is controlled in accordance with JIS standards (JIS B 1192 - 1997). Accuracy grades C0 to C5 are defined in linearity and directional property, and C7 to C10 in travel distance error in relation to 300 mm.

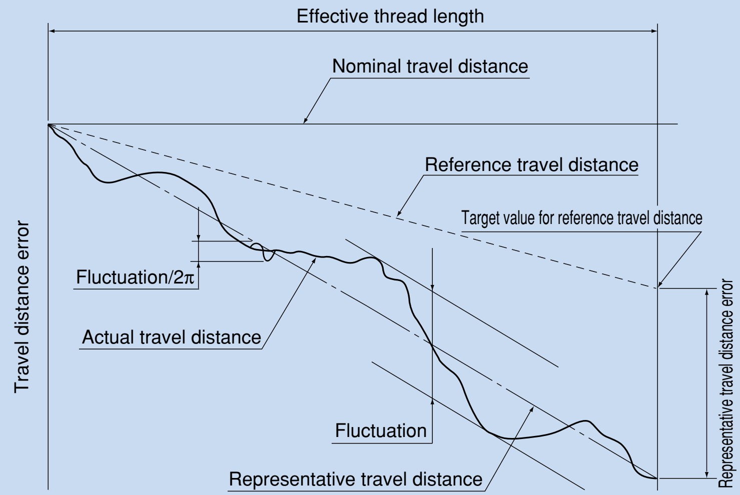


Fig. 1 Terms on Lead Accuracy

●Actual travel distance

An error in travel distance measured with an actual Ball Screw.

●Reference travel distance

Generally, it is the same as nominal travel distance, but can be an intentionally corrected value of nominal travel distance according to the intended use.

●Target value for reference travel distance

You may provide tension in order to prevent the screw shaft from running out, or set the reference travel distance in "negative" or "positive" value in advance given possible expansion/contraction from external load or temperature. In such cases, indicate a target value for the reference travel distance.

●Representative travel distance

It is a straight line representing the tendency in actual travel distance, and obtained with the least squares method from the curb that indicates the actual travel distance.

●Representative travel distance error (in ±)

Difference between the representative travel distance and the reference travel distance.

●Fluctuation

It is the maximum width of the actual travel distance between two straight lines drawn in parallel with the representative travel distance.

●Fluctuation/300

It indicates a fluctuation against a given thread length of 300 mm.

●Fluctuation/2π

It is a fluctuation in one revolution of the screw shaft.

Table 1 Lead Accuracy (Permissible Value)

Unit: μm

		Precision Ball Screw												
												Rolled Ball Screw		
Accuracy grade		C0		C1		C2		C3		C5		C7	C8	C10
Effective thread length		Represent active travel distance error	Fluctuation	Represent active travel distance error	Fluctuation	Represent active travel distance error	Fluctuation	Represent active travel distance error	Fluctuation	Represent active travel distance error	Fluctuation	Travel distance error	Travel distance error	Travel distance error
Above	Or less													
—	100	3	3	3.5	5	5	7	8	8	18	18	±50/300mm	±100/300mm	±210/300mm
100	200	3.5	3	4.5	5	7	7	10	8	20	18			
200	315	4	3.5	6	5	8	7	12	8	23	18			
315	400	5	3.5	7	5	9	7	13	10	25	20			
400	500	6	4	8	5	10	7	15	10	27	20			
500	630	6	4	9	6	11	8	16	12	30	23			
630	800	7	5	10	7	13	9	18	13	35	25			
800	1000	8	6	11	8	15	10	21	15	40	27			
1000	1250	9	6	13	9	18	11	24	16	46	30			
1250	1600	11	7	15	10	21	13	29	18	54	35			
1600	2000	—	—	18	11	25	15	35	21	65	40			
2000	2500	—	—	22	13	30	18	41	24	77	46			
2500	3150	—	—	26	15	36	21	50	29	93	54			
3150	4000	—	—	30	18	44	25	60	35	115	65			
4000	5000	—	—	—	—	52	30	72	41	140	77			
5000	6300	—	—	—	—	65	36	90	50	170	93			
6300	8000	—	—	—	—	—	—	110	60	210	115			
8000	10000	—	—	—	—	—	—	—	—	260	140			

Note: Unit of effective thread length: mm

Table 2 Fluctuation in Thread Length of 300 mm and in One Revolution (permissible value)

Unit: μm

Accuracy grade	C0	C1	C2	C3	C5	C7	C8	C10
Fluctuation/300 mm	3.5	5	7	8	18	—	—	—
Fluctuation/2π	3	4	5	6	8	—	—	—

Example: When the lead of a Ball Screw manufactured is measured with a target value for reference travel distance being -9 µm/500 mm, the following data are obtained.

Table 3 Measurement Data on Travel Distance Error

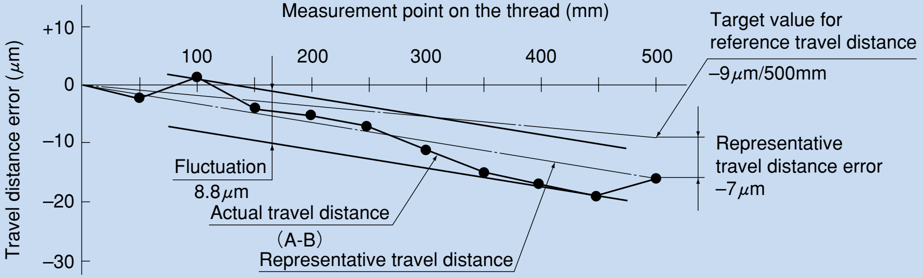
Unit: mm

Command position (A)	0	50	100	150	200	250	300	350	400	450	500
Travel distance (B)	0	49.998	100.001	149.996	199.995	249.993	299.989	349.885	399.983	449.981	499.984
Travel distance error (A-B)	0	–0.002	+0.001	–0.004	–0.005	–0.007	–0.011	–0.015	–0.017	–0.019	–0.016

The measurement data are expressed in a graph as shown in Fig. 2.

The positioning error (A-B) is indicated as the actual travel distance while the straight line representing the tendency of the (A-B) graph refers to the representative travel distance.

The difference between the reference travel distance and the representative travel distance appears as the representative travel distance error.



Measurement result — representative travel distance:–7µm
Fluctuation:8.8µm

Fig. 2 Measurement Data on Travel Distance Error

3.2. Accuracy of the Mounting Section

The accuracy of the Ball Screw mounting section complies with JIS standard (JIS B 1192).

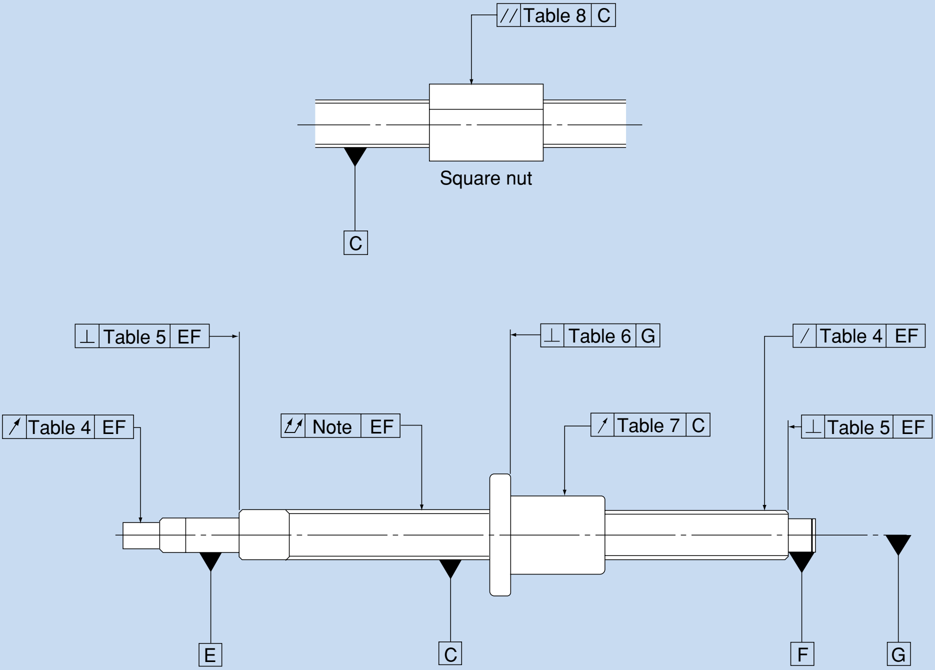


Fig. 3 Accuracy of the Mounting Section of the Ball Screw

Note: For the overall run-out of the screw shaft axis in the radial direction, refer to JIS B 1192.

3.2.1. Accuracy Standards for the Mounting Section

Tables 4 to 8 show accuracy standards for the mounting sections of the precision Ball Screw.

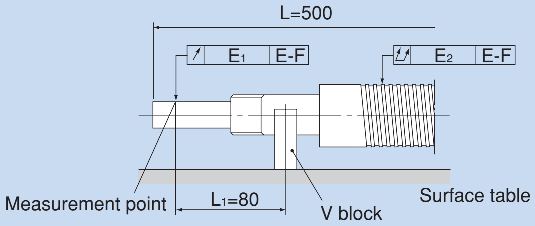
Table 4 Radial Run-out of the Circumference of the Thread Root in Relation to the Support Portion Axis of the Screw Shaft

Unit: μm

Screw shaft outer diameter (mm)		Run-out (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	8	3	5	7	8	10	14
8	12	4	5	7	8	11	14
12	20	4	6	8	9	12	14
20	32	5	7	9	10	13	20
32	50	6	8	10	12	15	20
50	80	7	9	11	13	17	20
80	100	—	10	12	15	20	30

Note: The measurements on these items include the effect of the run-out of the screw shaft diameter. Therefore, it is necessary to obtain the correction value from the overall run-out of the screw shaft axis, using the ratio of the distance between the fulcrum and measurement point to the overall screw shaft length, and add the obtained value to the table above.

Example: model No. DIK2005-6RRGO+500LC5



where

$E_1 = e + \Delta e$

e : Standard value in table 4 (0.012)

Δe: Correction value

where

$$\Delta e = \frac{L_1}{L} \times E_2$$

E_2: Overall radial run-out of the screw shaft axis (0.06)

$$= \frac{80}{500} \times 0.06$$

$$= 0.01$$

$$E_1 = 0.012 + 0.01$$

$$= 0.022$$

Table 5 Perpendicularity of the Supporting Portion End of the Screw Shaft to the Supporting Portion Axis

Unit: μm

Screw shaft outer diameter (mm)		Perpendicularity (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	8	2	3	3	4	5	7
8	12	2	3	3	4	5	7
12	20	2	3	3	4	5	7
20	32	2	3	3	4	5	7
32	50	2	3	3	4	5	8
50	80	3	4	4	5	7	10
80	100	—	4	5	6	8	11

Table 6 Perpendicularity of the Flange Mounting Surface of the Screw Shaft to the Screw Shaft Axis

Unit: μm

Nut outer diameter (mm)		Perpendicularity (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	20	5	6	7	8	10	14
20	32	5	6	7	8	10	14
32	50	6	7	8	8	11	18
50	80	7	8	9	10	13	18
80	125	7	9	10	12	15	20
125	160	8	10	11	13	17	20
160	200	—	11	12	14	18	25

Table 7 Radial Run-out of the Nut Circumference in Relation to the Screw Shaft Axis

Unit: μm

Nut outer diameter (mm)		Run-out (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	20	5	6	7	9	12	20
20	32	6	7	8	10	12	20
32	50	7	8	10	12	15	30
50	80	8	10	12	15	19	30
80	125	9	12	16	20	27	40
125	160	10	13	17	22	30	40
160	200	—	16	20	25	34	50

Table 8 Parallelism of the Nut Circumference (Flat Mounting Surface) to the Screw Shaft Axis

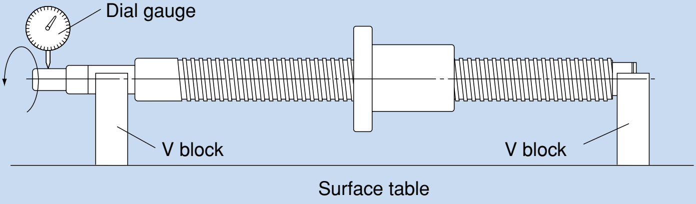
Unit: μm

Mounting reference length (mm)		Parallelism (Maximum)					
Above	Or less	C0	C1	C2	C3	C5	C7
—	50	5	6	7	8	10	17
50	100	7	8	9	10	13	17
100	200	—	10	11	13	17	30

3.2.2. Method for Measuring Accuracy of the Mounting Section

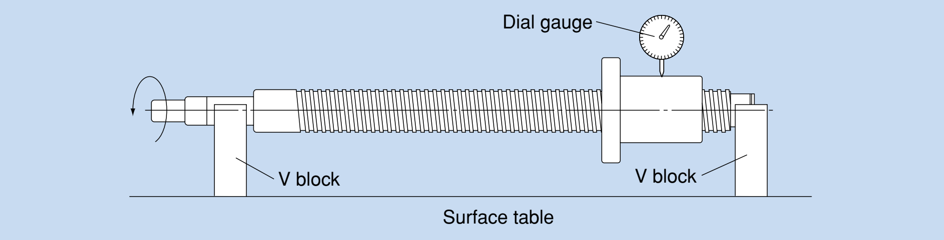
●Radial Run-out of the Circumference of the Part Mounting Section in Relation to the Supporting Portion Axis of the Screw Shaft (Table 4)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the part mounting section, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution.



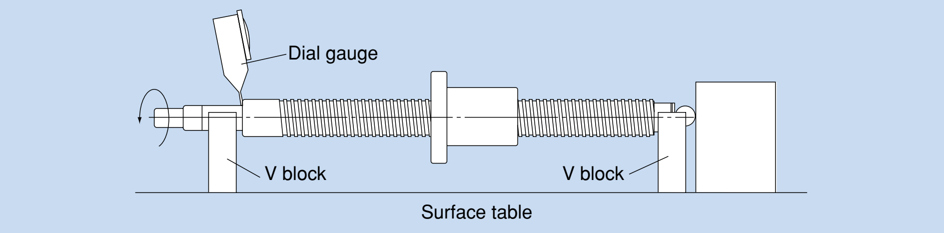
●Radial Run-out of the Circumference of the Thread Root in Relation to the Support Portion Axis of the Screw Shaft (Table 4)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the nut, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution without turning the nut.



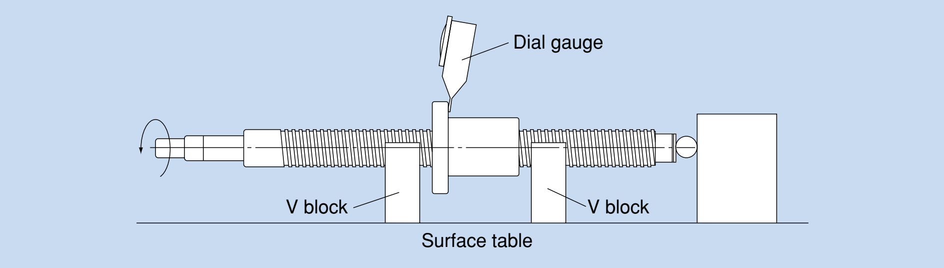
●Perpendicularity of the Supporting Portion End of the Screw Shaft to the Supporting Portion Axis (Table 5)

Support the supporting portion of the screw shaft with V blocks. Place a probe on the screw shaft's supporting portion end, and read the largest difference on the dial gauge as a measurement when turning the screw shaft by one revolution.



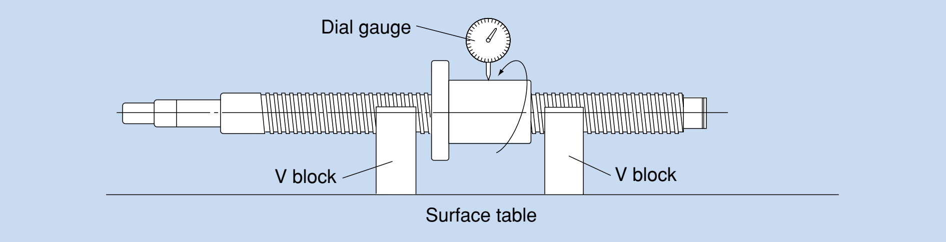
●Perpendicularity of the Flange Mounting Surface of the Screw Shaft to the Screw Shaft Axis (Table 6)

Support the nut of the screw shaft with V blocks. Place a probe on the flange end, and read the largest difference on the dial gauge as a measurement when simultaneously turning the screw shaft and the nut by one revolution.



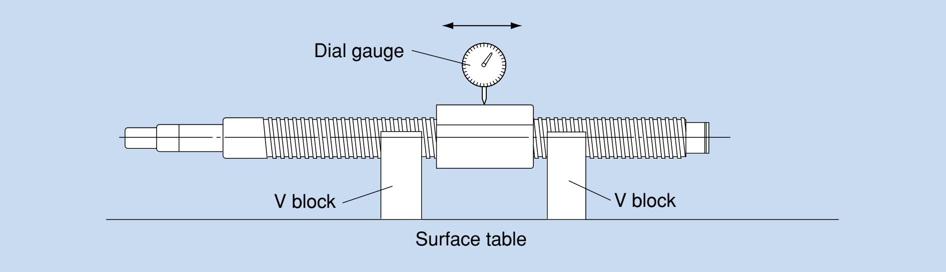
●Radial Run-out of the Nut Circumference in Relation to the Screw Shaft Axis (Table 7)

Support the thread of the screw shaft with V blocks near the nut. Place a probe on the circumference of the nut, and read the largest difference on the dial gauge as a measurement when turning the nut by one revolution without turning the screw shaft.



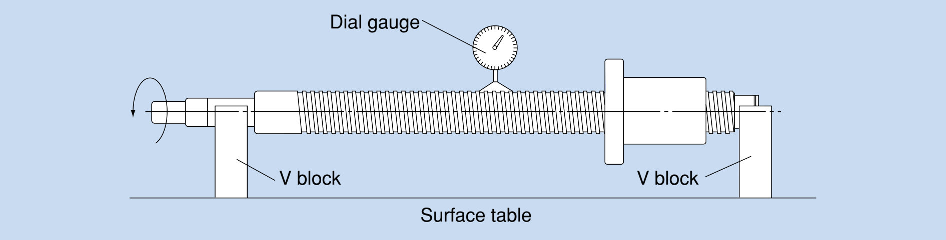
●Parallelism of the Nut Circumference (Flat Mounting Surface) to the Screw Shaft Axis (Table 8)

Support the thread of the screw shaft with V blocks near the nut. Place a probe on the circumference of the nut (flat mounting surface), and read the largest difference on the dial gauge as a measurement when moving the dial gauge in parallel with the screw shaft.



●Overall Radial Run-out of the Screw Shaft Axis

Support the supporting portion of the screw shaft with V blocks. Place a probe on the circumference of the screw shaft, and read the largest difference on the dial gauge at several points in the axial directions as a measurement when turning the screw shaft by one revolution.



Note: For the overall radial run-out of the screw shaft axis, refer to JIS B 1192.

4. Axial Clearance of the Ball Screw

4.1. Axial Clearance of the Precision Ball Screw

Table 1 shows axial clearance of the precision Screw Ball. If the manufacturing length exceeds the value in table 2, the resultant clearance may partially be negative (preload applied).

Table 1 Axial Clearance of the Precision Ball Screw

Unit: mm

Clearance symbol	G0	GT	G1	G2	G3
Axial clearance	0 or less	0 to 0.005	0 to 0.01	0 to 0.02	0 to 0.05

Table 2 Manufacturing-limit Length of the Precision Ball Screw in Axial Clearance

Unit: mm

Screw shaft outer diameter	Overall thread length						
	Clearance GT		Clearance G1		Clearance G2		
	C0 to C3	C5	C0 to C3	C5	C0 to C3	C5	C7
4 to 6	80	100	80	100	80	100	120
8 to 10	250	200	250	250	250	300	300
12 to 16	500	400	500	500	700	600	500
18 to 25	800	700	800	700	1000	1000	1000
28 to 32	900	800	1100	900	1400	1200	1200
36 to 45	1000	800	1300	1000	2000	1500	1500
50 to 70	1200	1000	1600	1300	2500	2000	2000
80 to 100	—	—	1800	1500	4000	3000	3000

* When manufacturing the Ball Screw of precision-grade accuracy with clearance GT or G1, the resultant clearance is partially negative.

4.2. Axial Clearance of the Rolled Ball Screw

Table 3 shows axial clearance of the rolled Ball Screw.

Table 3 Axial Clearance of the Rolled Ball Screw

Unit: mm

Screw shaft outer diameter	Axial clearance (maximum)
6 to 12	0.05
14 to 28	0.1
30 to 32	0.14
36 to 45	0.17
50	0.2

5. Maximum Manufacturing Length of the Ball Screw Shaft

The manufacturing limit length of the precision Ball Screw by accuracy grade is shown in table 1, and that of the rolled Ball Screw in table 2 on page K-38.
If the shaft dimensions exceed the manufacturing limit in table 1 or 2, contact THK.

Table 1 Manufacturing Limit Length of the Precision Ball Screw by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length					
	C0	C1	C2	C3	C5	C7
4	90	110	120	120	120	120
6	150	170	210	210	210	210
8	230	270	340	340	340	340
10	350	400	500	500	500	500
12	440	500	630	680	680	680
13	440	500	630	680	680	680
14	530	620	770	870	890	890
15	570	670	830	950	980	1100
16	620	730	900	1050	1100	1400
18	720	840	1050	1220	1350	1600
20	820	950	1200	1400	1600	1800
25	1100	1400	1600	1800	2000	2400
28	1300	1600	1900	2100	2350	2700
30	1450	1700	2050	2300	2570	2950
32	1600	1800	2200	2500	2800	3200
36	2000	2100	2550	2950	3250	3650
40		2400	2900	3400	3700	4300
45		2750	3350	3950	4350	5050
50		3100	3800	4500	5000	5800
55		3450	4150	5300	6050	6500
63		4000	5200	5800	6700	7700
70			6300	6450	7650	9000
80				7900	9000	10000
100				10000	10000	

Table 2 Manufacturing Limit Length of the Rolled Ball Screw by Accuracy Grade

Unit: mm

Screw shaft outer diameter	Overall screw shaft length		
	C7	C8	C10
6 to 8	320	320	—
10 to 12	500	1000	—
14 to 15	1500	1500	1500
16 to 18	1500	1800	1800
20	2000	2200	2200
25	2000	3000	3000
28	3000	3000	3000
30	3000	3000	4000
32 to 36	3000	4000	4000
40	3000	5000	5000
45	3000	5500	5500
50	3000	6000	6000

6. Standard Combinations of Shaft Diameter and Lead for the Precision Ball Screw

Table 1 shows standard combinations of shaft diameter and lead for the precision Ball Screw. If desiring a Ball Screw not covered by the table, contact THK .

Table 1 Standard Combinations of Screw Shaft and Lead (Precision Ball Screw)

Screw shaft outer diameter	Lead																					
	1	2	4	5	6	8	10	12	15	16	20	24	25	30	32	36	40	50	60	80	90	100
4	●																					
5	●																					
6	●																					
8	●	●					●	○														
10		●	●				●		○													
12		●		●		●																
13											○											
14		●	●	●		●																
15							●				●			○			○					
16			○	●	○		○			●												
18							●															
20			○	●	○	○	●	○			●						○		○			
25			○	●	○	○	●	○		○	●		○					○				
28				○	●	○	○															
30																			○		○	
32			○	●	●	○	●	○			○				○							
36					○	○	●	○		○	○	○				○						
40				○	○	○	●	●		○	○			○			○			○		
45					○	○	○	○		○	○											
50				○		○	●	○		○	○			○		○		○				○
55							○	○		○	○			○		○						
63							○	○		○	○											
70							○	○			○											
80							○	○			○											
100											○											

For combinations marked with "●," off-the-shelf products (standard-stock products equipped with standardized screw shafts shaft ends unfinished and finished) are available.

7. Standard Combinations of Shaft Diameter and Lead for the Rolled Ball Screw

Table 1 shows standard combinations of shaft diameter and lead for the rolled Ball Screw.

Table 1 Standard Combinations of Screw Shaft and Lead (Rolled Ball Screw)

Screw shaft outer diameter	Lead																			
	1	2	4	5	6	8	10	12	16	20	24	25	30	32	36	40	50	60	80	100
6	●																			
8		●																		
10		●			○															
12		●				○														
14			●	●																
15							●			●			●							
16				●					●											
18						●														
20				●			●			●						●				
25				●			●					●					●			
28					●															
30																		●		
32							●							●						
36							●			●	●				●					
40							●									●			●	
45								●												
50									●								●			●

For combinations marked with "●," off-the-shelf products are available.

8. Method for Mounting the Ball Screw Shaft

Figures 1 to 4 show representative mounting methods for the screw shaft.
Permissible axial load and permissible rotation speed vary with mounting methods for the screw shaft. Therefore, it is necessary to select an appropriate mounting method according to the service conditions.

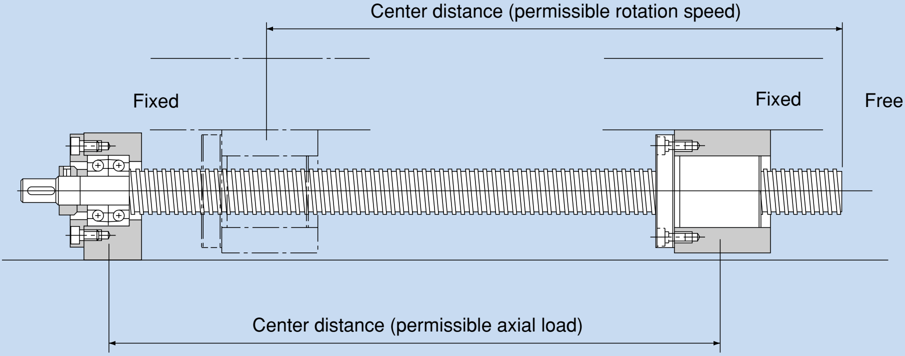


Fig. 1 Screw Shaft Mounting Method: Fixed - Free

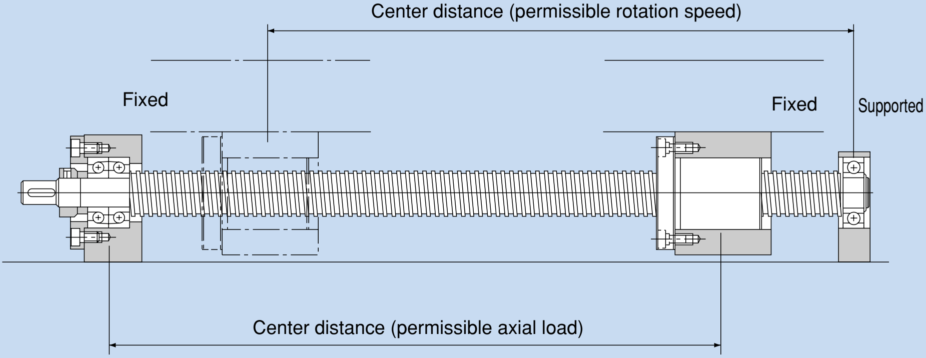


Fig. 2 Screw Shaft Mounting Method: Fixed - Supported

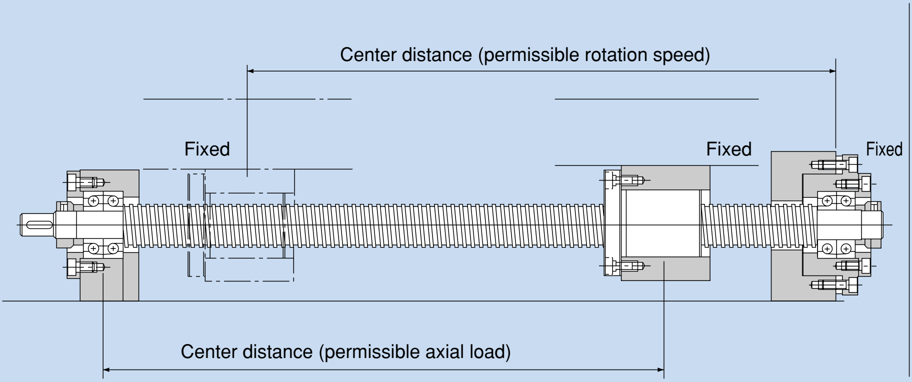


Fig. 3 Screw Shaft Mounting Method: Fixed - Fixed

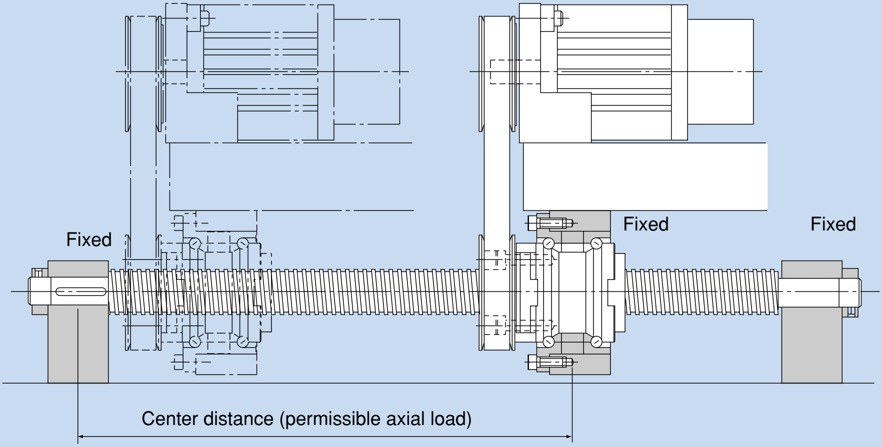


Fig. 4 Screw Shaft Mounting Method for Rotary Nut Ball Screw: Fixed - Fixed

9. Lubrication

To maximize the performance of the Ball Screw, it is necessary to select a lubricant and a lubrication method according to the service conditions.
For types of lubricants, characteristics of lubricants and lubrication methods, see page a-2.
Also, QZ Lubricator is available as an optional accessory that significantly increases the maintenance interval.

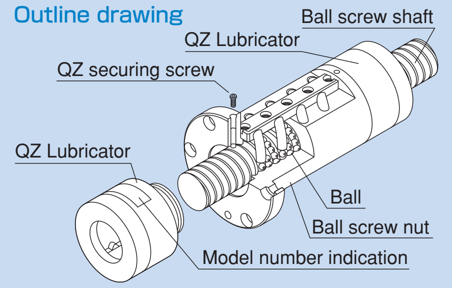
9.1. QZ Lubricator™ for the Ball Screw

Japanese Patent No.: 3288961, 3367911, 3454502

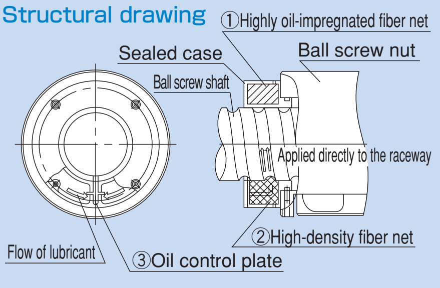
QZ Lubricator feeds a right amount of lubricant to the ball raceway of the ball screw shaft. This allows an oil film to be formed between the balls and the ball raceway and significantly extends the lubrication maintenance interval.

Its structure consists of major three components: ① a highly oil-impregnated fiber net (function to store a lubricant), ② a high-density fiber net (function to apply the lubricant to the raceway) and ③ an oil control plate (function to control the flow of the lubricant). The lubricant contained in QZ Lubricator is fed based on the principle of capillary action, which is used in felt-tip pens and other products.

Outline drawing



Structural drawing



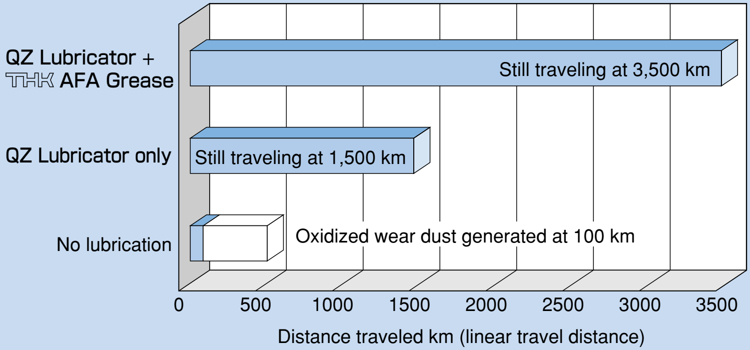
Features

- ●Since it supplements an oil loss, the lubrication maintenance interval can be significantly extended.
- ●Since the right amount of lubricant is applied to the ball raceway, an environmentally friendly lubrication system that does not contaminate the surroundings is achieved.
- ●Enables selection of a lubricant that meets the intended use.

Note: For model numbers supported for QZ Lubricator, see the section on the respective model number.

■Significantly extended maintenance interval

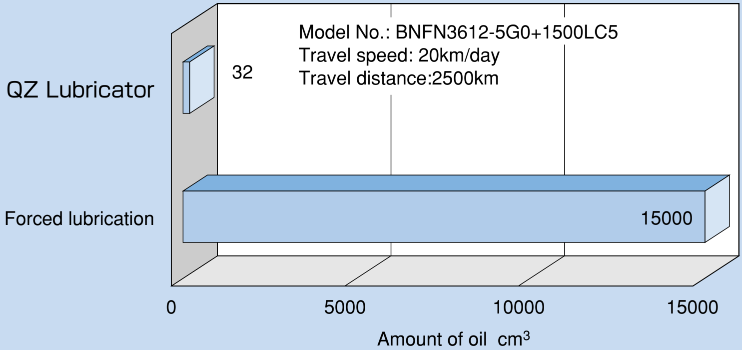
Since QZ Lubricator continuously feed a lubricant over a long period, the maintenance interval can be significantly extended.



Ball Screw	BIF2505-5
Rotation speed	3000min^{-1}
Stroke	500mm
Load	0.46 kN (with an internal preload)

■Environmentally friendly lubrication system

Since QZ Lubricator feeds the right amount of lubricant directly to the raceway, the lubricant can effectively be used without waste.



QZ Lubricator + THK AFA Grease
32 cm^3
(QZ Lubricator attached to both ends of the ball screw nut)

Comparison

Forced lubrication
0.25cm^3/3min×24hour×125day
=15000cm^3

9.2. Amount of Lubricant

If the amount of lubricant to the Ball Screw is insufficient, it may cause oil film breakdown, and if it is excessive, it may cause heat to be generated and resistance to be increased. It is necessary to select an amount that meets the service conditions.

Grease

The feed amount of grease is generally approximately one third of the special volume inside the nut.

Oil

Table 1 shows a guideline for the feed amount of oil.

Note, however, that the amount varies according to the stroke, oil type and service conditions (e.g., suppressed heat generation).

Table 1 Guideline for the Feed Amount of Oil
(Interval: 3 minutes)

Shaft diameter (mm)	Amount of lubricant (cc)
4 to 8	0.03
10 to 14	0.05
15 to 18	0.07
20 to 25	0.1
28 to 32	0.15
36 to 40	0.25
45 to 50	0.3
55 to 63	0.4
70 to100	0.5

10. Dust Prevention

Dust and foreign matter that enter the Ball Screw may cause accelerated wear and breakage, as with roller bearings. Therefore, where contamination by dust or foreign matter (e.g., cutting chips) is predicted, screw shafts must always be completely covered by dust prevention devices (e.g., bellows, screw cover, wiper ring).

If the Ball Screw is used in an atmosphere free from foreign matter but with suspended dust, a labyrinth seal (for precision Ball Screw) and a brush seal (for rolled Ball Screw) can be used in place of dust prevention devices. When placing an order, indicate the respective model number.

The labyrinth seal is designed to maintain a slight clearance between the seal and the screw shaft raceway so that torque does not develop and no heat is generated, though its effect in dust prevention is limited.

With Ball Screws except the large-lead and super-lead types, there is no difference in nut dimensions between those with and without a seal.

With the wiper ring, special resin with high wear resistance and low dust generation removes foreign matter while closely contacting the circumference of the ball screw shaft and the screw thread. It is capable of preventing foreign matter from entering the Ball Screw even in harsh environments.

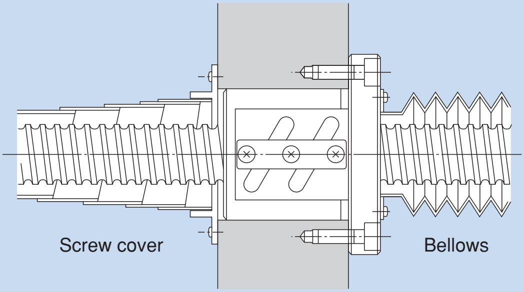
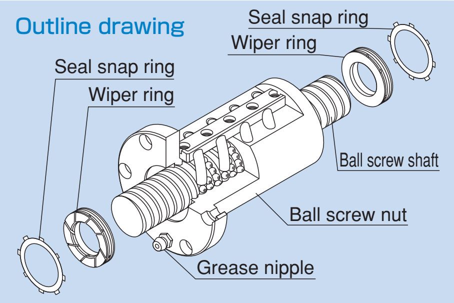


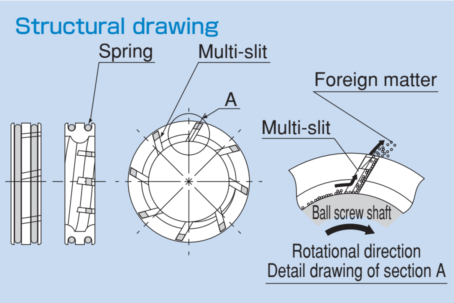
Fig.1 Dust Prevention Cover

10.1. Wiper Ring W for the Ball Screw

With the wiper ring, special resin with high wear resistance and low dust generation removes foreign matter and prevents foreign matter from entering the ball screw nut while elastically contacting the circumference of the ball screw shaft and the screw thread.



Outline drawing



Structural drawing

Detail drawing of section A

Features

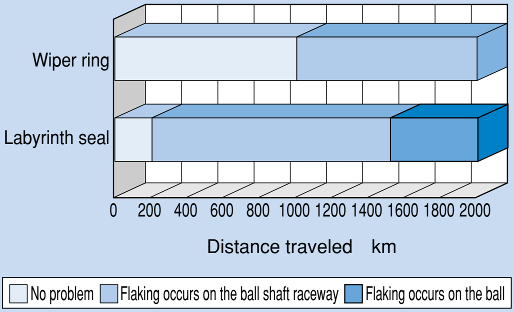
- ●A total of eight slits on the circumference remove foreign matter in succession, and prevents entrance of foreign matter.
- ●Contacts the ball screw shaft to reduce the flowing out of grease.
- ●Contacts the ball screw shaft at a constant pressure level using a spring, thus to minimize heat generation.
- ●Since the material is highly resistant to wear and chemicals, its performance will not easily be deteriorated even if it is used over a long period.

■Test in an environment exposed to foreign matter

[Test conditions]

Item	Description
Model No.	BIF3210－5G0＋1500LC5
Maximum rotation speed	1000min^{-1}
Maximum speed	10m/min
Maximum circumferential speed	1.8m/s
Time constant	60ms
Dowel	1s
Stroke	900mm
Load (through internal load)	1.31kN
Grease	THK AFG Grease 8cm^3 Initial lubrication to the ball screw nut only.
Foundry dust	FCD400 average particle diameter: 250μm
Volume of foreign matter per shaft	5g/h

[Test result]

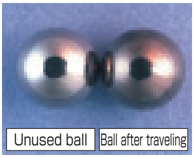
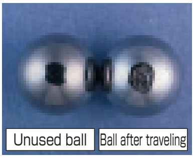


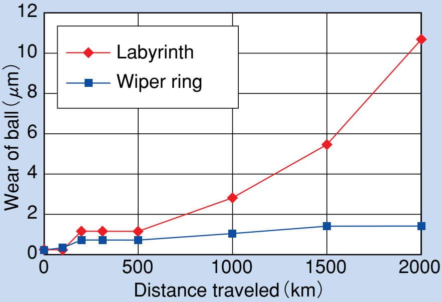
(1) Wiper ring specifications

Slight flaking occurred in the ball screw shaft at travel distant of 1,000 km.

(2) Labyrinth seal specifications

Flaking occurred throughout the circumference of the screw shaft raceway at travel distance of 200 km. Flaking occurred on the balls after traveling 1,500 km.

	After traveling 2,000 km	
Ball	 ●Discolored, but no breakage	 ●Flaking occurs
	(1) Wiper ring type	(2) Labyrinth seal type



(1) Wiper ring type

Wear of balls at a travel distance of 2,000 km: 1.4 μm.

(2) Labyrinth seal type

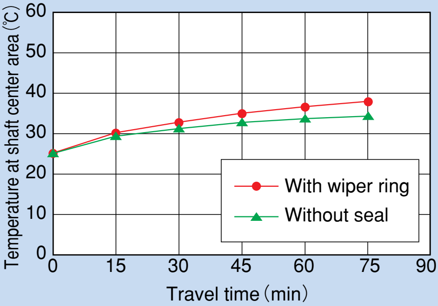
Starts to be worn rapidly after 500 km, and the ball wear amount at the travel distance of 2,000 km: 11 μm

■Heat generation test

[Test conditions]

Item	Description
Model No.	BLK3232DG0+1426LC5
Maximum rotation speed	1000min^{-1}
Maximum speed	32m/min
Maximum circumferential speed	1.7m/s
Time constant	100ms
Stroke	1000mm
Load (through internal load)	0.98kN
Grease	THK AFG Grease 5cm^3 (contained in the ball screw nut)

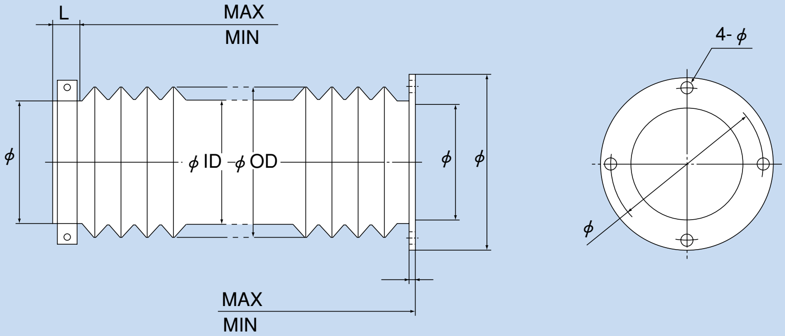
[Test result]



Unit:℃

	With wiper ring	Without wiper ring
Heat generation temperature	37.1	34.5
Temperature rise	12.2	8.9

Bellows Specifications



(Band type)

(Flanged type)

Bellows Dimensions

Stroke mm MAX. mm MIN. mm

Permissible outer diameter φ OD Desired inner diameter φ ID

How It Is Used

Orientation (horizontal, vertical, slant) Speed ( ) mm/sec. min.

Motion (reciprocation, vibration)

Service Conditions

Oil/water resistance (necessary, not necessary)

Oil name

Chemical resistance Name × %

Location (indoor, outdoor)

Remarks

Number of units to be manufactured

1 1 . Precautions on Using the Ball Screw

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.

(2) Tilting the screw shaft and the ball screw nut may cause them to fall by their self-weights.

(3) Dropping or hitting the Ball Screw may damage the ball circulation section, which may cause functional loss. Giving an impact to the product could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.

(2) Do not mix lubricants of different physical properties.

(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

(5) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Do not remove the ball screw nut from the ball screw shaft. Doing so may cause the balls or the nut to fall off.

(2) Entrance of foreign matter to the ball screw nut may cause damage to the ball circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(3) If foreign matter adheres to the product, replenish the lubricant after cleaning the product.

(4) When planning to use the product in an environment where the coolant penetrates the spline nut, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.

(5) Do not use the product at temperature of 80℃ or higher. When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(6) If using the product with vertical mount, the ball screw nut may fall by its self-weight. Attach a mechanism to prevent it from falling.

(7) Using the product at speed exceeding the permissible rotation speed may cause breakage of a component or accident. Be sure to use the product within the specification range designated by THK .

(8) Forcibly driving in the ball screw shaft or the ball screw nut may cause an indentation on the raceway. Use care when mounting components.

(9) If an offset or skewing occurs with the ball screw shaft support and the ball screw nut, it may substantially shorten the service life. Pay much attention to components to be mounted and to the mounting accuracy.

(10) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

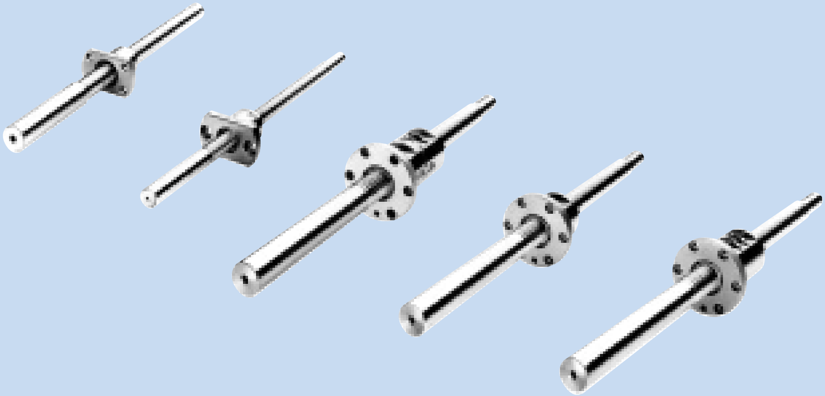
(11) Letting the ball screw nut overrun will cause balls to fall off or the ball-circulating component to be damaged. Be sure not to let it overrun.

Storage

When storing the Ball Screw, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

Standard-Lead Precision Ball Screw

Standard-Stock Type with Screw Shaft (with Unfinished Shaft Ends)



Structure and Features

This type of Ball Screw is mass manufactured by cutting standardized screw shafts of Precision Ball Screws to regular lengths. Additional machining of the shaft ends can easily be performed.
To meet various intended purposes, THK offers several Ball Screw models with different types of nuts: double-nut type (model BNFN), single-nut type (BNF), offset preload-nut type (model BIF) and miniature Ball Screw (models MDK and MBF).

●Dust Prevention

Nuts of the following model numbers are attached with a labyrinth seal.

- All variations of models BNFN, BNF and BIF
- Model MDK0802/1002/1202/1402/1404/1405

When dust or other foreign matter may enter the Ball Screw, it is necessary to use a dust-prevention device (e.g., bellows) to completely protect the screw shaft.

●Lubrication

Ball screw nuts are supplied with lithium soap-group grease with shipment.
(Model MBF is applied only with anti-corrosion oil.)

●Additional Machining of the Shaft End

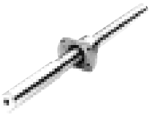
Since only the effective thread of the screw shaft is surface-treated with induction hardening (all variations of models BNFN, BNF and BIF; model MDK 1405) or carburizing (all variations of model MBF; model MDK0401 to 1404), the shaft ends can additionally be machined easily either by grinding or milling.
In addition, since both ends of the screw shaft have a center hole, they can be cylindrically ground.

Surface hardness of the effect thread: 58 to 64 HRC
Hardness of the screw shaft ends
All variation of models BNFN, BNF and BIF; model MDK 1405: 22 to 27 HRC
All variations of model MBF; model MDK0401 to 1404: 35 HRC or below

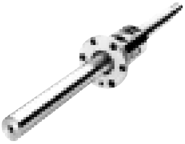
THK has standardized the shapes of the screw shaft ends in order to allow speedy estimation and manufacturing of Ball Screws.

The shapes of shaft ends are divided into those allowing standard support units to be used (symbols H, K and J) and those compliant with JIS B 1192 (symbols A, B and C). See page k-303 for details.

Nut Types and Axial Clearance

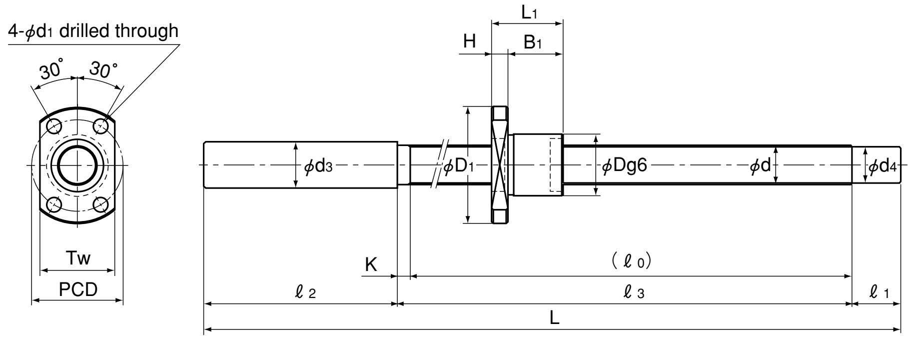
Screw shaft out diameter (mm)	φ4 to 14			
	Model MDK		Model MBF	
Nut type	 Non-preload type		 Non-preload type	
Accuracy grade	C3, C5	C7	C3, C5	C7
Axial clearance (mm)	0.005 or less (GT)	0.02 or less (G2)	0.005 or less (GT)	0.02 or less (G2)
Preload	—		—	

Note: The symbols in the parentheses indicate axial clearance symbols.

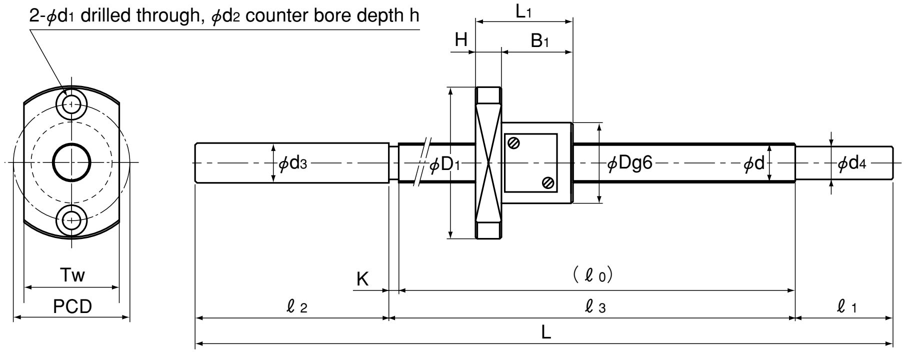
Screw shaft out diameter (mm)	φ16 to 50					
	Model BIF		Model BNFN		Model BNF	
Nut type	 Preload type		 Preload type		 Non-preload type	
Accuracy grade	C5	C7	C5	C7	C5	C7
Axial clearance (mm)	0 or less (G0)	0 or less (G0)	0 or less (G0)	0 or less (G0)	0.01 or less (G1)	0.02 or less (G2)
Preload	0.05Ca	0.05Ca	0.05Ca	0.05Ca	—	—

Note 1: The symbols in the parentheses indicate axial clearance symbols.
Note 2: Symbol "Ca" for preload indicates the basic dynamic load rating.

Type with Unfinished Shaft Ends



Model MDK



Model MBF

Unit: mm

Model No.	Ball Screw specifications							Nut dimensions										Screw shaft dimensions								
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Tw	Standard-stock symbol	Overall length L	ℓ_0	ℓ_1	ℓ_2	ℓ_3	d_3	d_4	K
MDK 0401-3	4	1	4.15	3.4	3×1	0.29	0.42	9	19	13	3	10	14	2.9	—	—	13	A	95	47	10	35	50	6.2	3.2	3
																			115	67	10	35	70	6.2	3.2	3
																			145	97	10	35	100	6.2	3.2	3
MBF 0401-3.7	4	1	4.15	3.2	1×3.7	0.59	0.93	11	24	18	4	14	17	3.4	6.5	2.5	13	A	90	48	10	30	50	4.3	3.2	2
																			110	68	10	30	70	4.3	3.2	2
																			130	88	10	30	90	4.3	3.2	2
MDK 0601-3	6	1	6.2	5.3	3×1	0.54	1	11	23	14.5	3.5	11	17	3.4	—	—	15	A	120	67	10	40	70	8.2	5.3	3
																			150	97	10	40	100	8.2	5.3	3
																			180	127	10	40	130	8.2	5.3	3
MBF 0601-3.7	6	1	6.15	5.2	1×3.7	0.74	1.5	13	30	21	5	16	21.5	3.4	6.5	3	17	A	131	58	20	50	61	6.3	5.2	3
																			161	88	20	50	91	6.3	5.2	3
																			201	128	20	50	131	6.3	5.2	3

Note Models MDK/MBF 0401 and 0601 are not provided with a labyrinth seal.

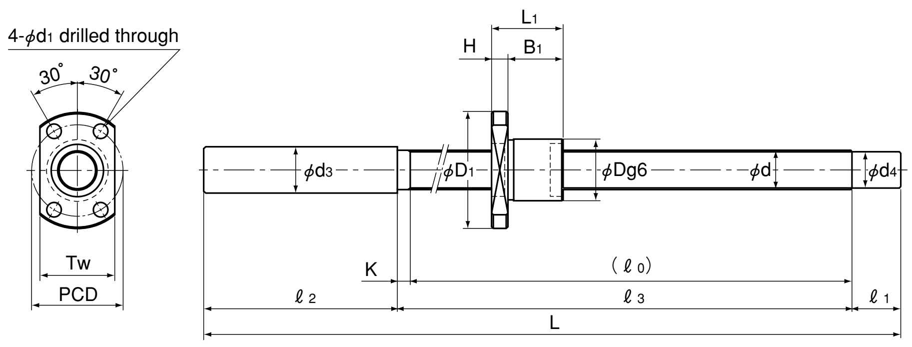
Model number coding

MDK0401-3 GT +95L C5 A

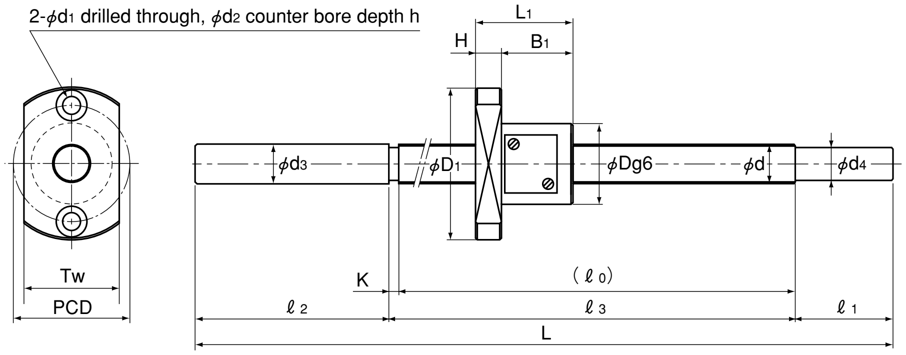
1 2 3 4 5

1 Model number 2 Axial clearance symbol (see page k-15) 3 Overall screw shaft length (in mm)
4 Accuracy symbol (see page k-8) 5 Symbol for standard-stock type (A: with unfinished shaft ends)

Type with Unfinished Shaft Ends



Model MDK



Model MBF

Unit: mm

Model No.	Ball Screw specifications							Nut dimensions											Screw shaft dimensions								
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1	d2	h	Tw	Standard-stock symbol	Overall length L	ℓ0	ℓ1	ℓ2	ℓ3	d3	d4	K
MDK 0801-3	8	1	8.2	7.3	3×1	0.64	1.4	13	26	15	4	11	20	3.4	—	—	17	A	130	67	15	45	70	10.2	7.3	3
																			160	97	15	45	100	10.2	7.3	3
																			190	127	15	45	130	10.2	7.3	3
																			240	177	15	45	180	10.2	7.3	3
MDK 0802-3	8	2	8.3	7	3×1	1.4	2.3	15	28	22	5	17	22	3.4	—	—	19	A	140	76	15	45	80	10.2	7	4
																			170	106	15	45	110	10.2	7	4
																			200	136	15	45	140	10.2	7	4
																			250	186	15	45	190	10.2	7	4
MBF 0802-3.7	8	2	8.3	6.4	1×3.7	2.5	4.2	20	40	28	6	22	30	4.5	8	4	24	A	168	85	25	55	88	8.3	6.2	3
																			193	110	25	55	113	8.3	6.2	3
																			218	135	25	55	138	8.3	6.2	3

Note Model MDK 0801 is not provided with a labyrinth seal.

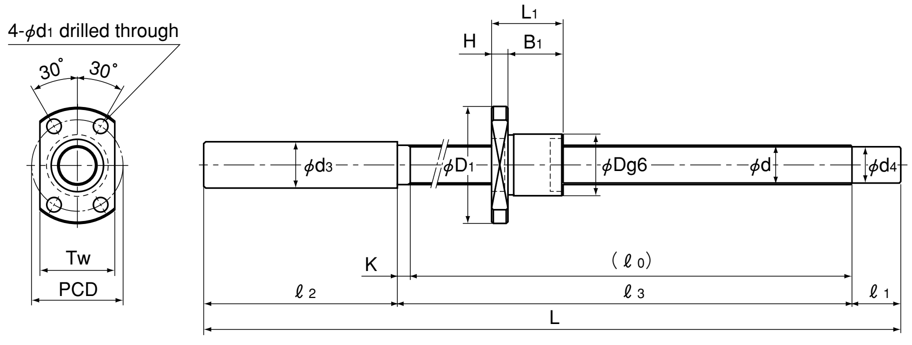
Model number coding

MBF0802-3.7 RR GT +218L C5 A

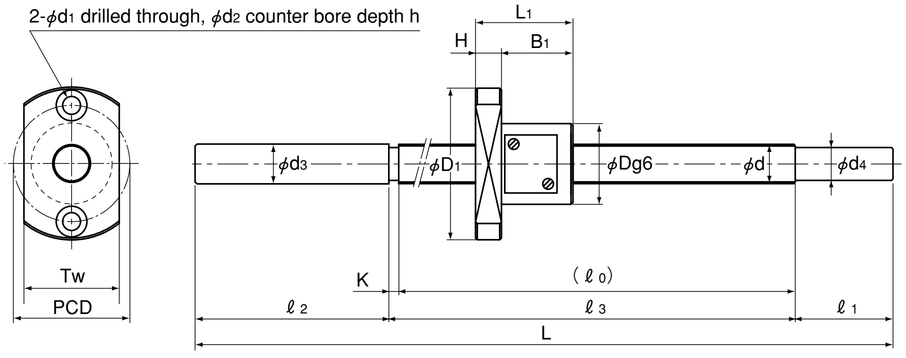
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (A: with unfinished shaft ends)

Type with Unfinished Shaft Ends



Model MDK



Model MBF

Unit: mm

Model No.	Ball Screw specifications							Nut dimensions										Screw shaft dimensions								
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C₀a kN	Outer diameter D	Flange diameter D₁	Overall length L₁	H	B₁	PCD	d₁	d₂	h	Tw	Standard-stock symbol	Overall length L	ℓ₀	ℓ₁	ℓ₂	ℓ₃	d₃	d₄	K
MDK 1002-3	10	2	10.3	9	3×1	1.5	2.9	17	34	22	5	17	26	4.5	—	—	21	A	160	86	15	55	90	12.2	9	4
																			210	136	15	55	140	12.2	9	4
																			260	186	15	55	190	12.2	9	4
																			310	236	15	55	240	12.2	9	4
MBF 1002-3.7	10	2	10.3	8.6	1×3.7	2.8	5.3	23	43	28	6	22	33	4.5	8	4	27	A	183	95	25	60	98	10.3	8.2	3
																			223	135	25	60	138	10.3	8.2	3
																			273	185	25	60	188	10.3	8.2	3
MDK 1202-3	12	2	12.3	11	3×1	1.7	3.6	19	36	22	5	17	28	4.5	—	—	23	A	165	86	15	60	90	14.2	11	4
																			215	136	15	60	140	14.2	11	4
																			265	186	15	60	190	14.2	11	4
																			315	236	15	60	240	14.2	11	4
																			365	286	15	60	290	14.2	11	4
MBF 1202-3.7	12	2	12.3	10.6	1×3.7	3	6.5	25	47	30	8	22	36	5.5	9.5	5.5	29	A	210	117	30	60	120	12.3	10.2	3
																			235	142	30	60	145	12.3	10.2	3
																			285	192	30	60	195	12.3	10.2	3

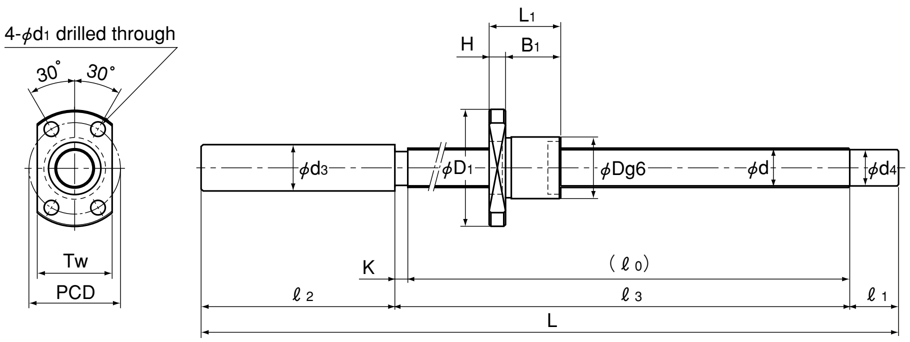
Model number coding

MDK1202-3 RR GT +165L C5 A

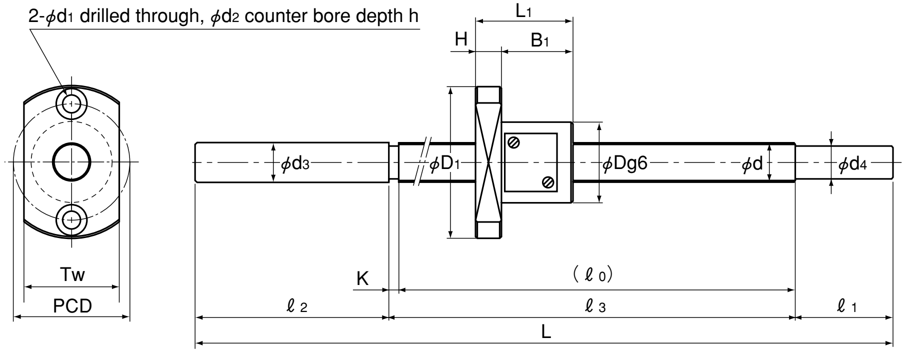
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (A: with unfinished shaft ends)

Type with Unfinished Shaft Ends



Model MDK



Model MBF

Unit: mm

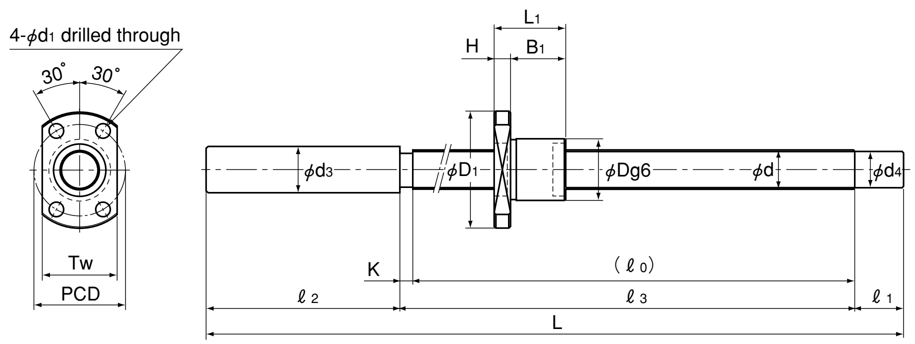
Model No.	Ball Screw specifications							Nut dimensions										Screw shaft dimensions								
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Tw	Standard-stock symbol	Overall length L	ℓ_0	ℓ_1	ℓ_2	ℓ_3	d_3	d_4	K
MDK 1402-3	14	2	14.3	13	3×1	1.8	4.3	21	40	23	6	17	31	5.5	—	—	26	A	175	86	25	60	90	15.2	13	4
																			225	136	25	60	140	15.2	13	4
																			275	186	25	60	190	15.2	13	4
																			325	236	25	60	240	15.2	13	4
																			425	336	25	60	340	15.2	13	4
MBF 1402-3.7	14	2	14.3	12.5	1×3.7	3.3	7.5	26	48	30	8	22	37	5.5	9.5	5.5	32	A	205	102	40	60	105	14.3	12.2	3
																			245	142	40	60	145	14.3	12.2	3
																			295	192	40	60	195	14.3	12.2	3
																			345	242	40	60	245	14.3	12.2	3

Model number coding

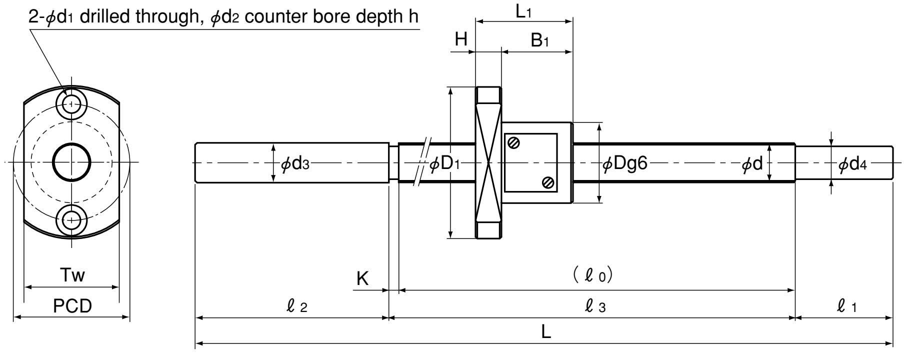
MBF1402-3.7 RR GT +245L C3 A
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (A: with unfinished shaft ends)

Type with Unfinished Shaft Ends



Model MDK



Model MBF

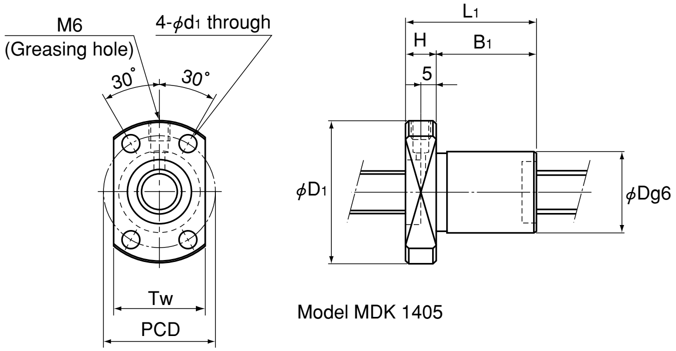
Unit: mm

Model No.	Ball Screw specifications							Nut dimensions											Screw shaft dimensions								
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Tw	Standard-stock symbol	Overall length L	ℓ_0	ℓ_1	ℓ_2	ℓ_3	d_3	d_4	K
MDK 1404-3	14	4	14.65	11.6	3×1	4.2	7.6	26	45	33	6	27	36	5.5	—	—	28	A	240	150	25	60	155	15.2	11.9	5
																			290	200	25	60	205	15.2	11.9	5
																			340	250	25	60	255	15.2	11.9	5
																			440	350	25	60	355	15.2	11.9	5
																			540	450	25	60	455	15.2	11.9	5
MBF 1404-3.7	14	4	14.3	11.8	1×3.7	5.7	11.1	30	54	38	8	30	42	5.5	9.5	5.5	34	A	233	129	40	60	133	14.3	11.2	4
																			293	189	40	60	193	14.3	11.2	4
																			353	249	40	60	253	14.3	11.2	4
																			413	309	40	60	313	14.3	11.2	4
MDK 1405-3	14	5	14.75	11.2	3×1	7	11.6	26	45	42	10	32	36	5.5	—	—	28	A	250	160	25	60	165	14	11.2	5
																			300	210	25	60	215	14	11.2	5
																			350	260	25	60	265	14	11.2	5
																			450	360	25	60	365	14	11.2	5
																			550	460	25	60	465	14	11.2	5

Model number coding

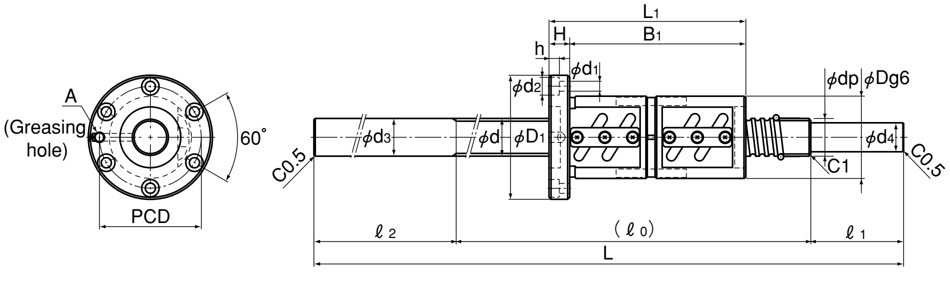
MDK1404-3 RR G2 +240L C7 A
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (A: with unfinished shaft ends)

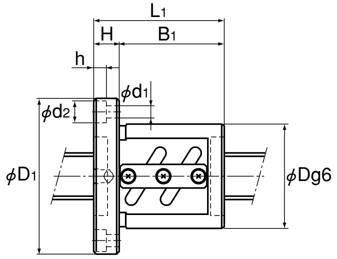


Model MDK 1405

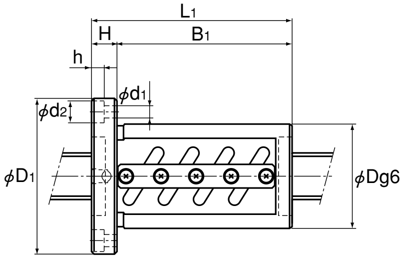
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

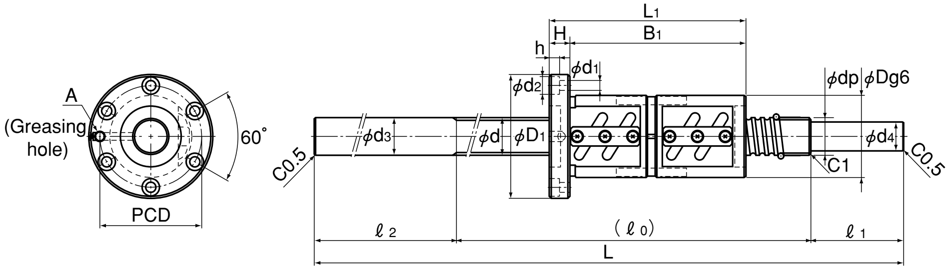
Model No.	Ball Screw specifications: Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Applied preload N	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Greasing hole A	Screw shaft dimensions: Standard-stock symbol	Overall length L	$ℓ_0$	$ℓ_1$	$ℓ_2$	d_3	d_4
BNFN 1605-2.5 BNF 1605-2.5 BIF 1605-5	16	5	16.75	13.2	1×2.5	7.4	13.9	390 — 390	40	60	76 41 56	10	66 31 46	50	4.5	8	4.5	M6	A	410	200	50	160	16	12.8
																				510	300	50	160	16	12.8
																				610	400	50	160	16	12.8
																				710	500	50	160	16	12.8
BNFN 1810-2.5 BNF 1810-2.5 BIF 1810-3	18	10	18.8	15.5	1×2.5 1×2.5 1×1.5	7.8 7.8 5.1	15.9 15.9 9.6	390 — 250	42	65	119 69 75	12	107 57 63	53	5.5	9.5	5.5	M6	A	410	200	50	160	18	15.3
																				510	300	50	160	18	15.3
																				610	400	50	160	18	15.3
																				710	500	50	160	18	15.3
																				810	600	50	160	18	15.3
BNFN 2005-5 BNF 2005-5 BIF 2005-5	20	5	20.75	17.2	2×2.5 2×2.5 1×2.5	15.1 15.1 8.3	35 35 17.4	740 — 440	44	67	106 56 56	11	95 45 45	55	5.5	9.5	5.5	M6	A	410	200	50	160	20	15.3
																				510	300	50	160	20	15.3
																				610	400	50	160	20	15.3
																				710	500	50	160	20	15.3
																				810	600	50	160	20	16.8
																				1010	800	50	160	20	16.8
																			B	610	300	50	260	20	16.8
																				710	400	50	260	20	16.8

Model number coding

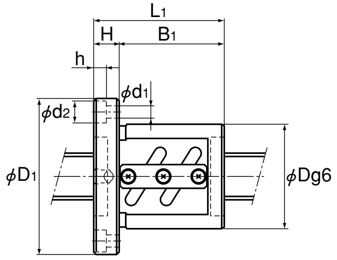
$\underbrace{\text{BNFN2005-5}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G0}}_{3}\ \underbrace{\text{+610L}}_{4}\ \underbrace{\text{C5}}_{5}\ \underbrace{\text{A}}_{6}$

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (symbol A or B)

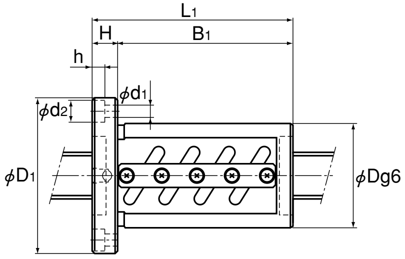
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

Model No.	Ball Screw specifications								Nut dimensions										Screw shaft dimensions						
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Applied preload N	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Greasing hole A	Standard-stock symbol	Overall length L	$ℓ_0$	$ℓ_1$	$ℓ_2$	d_3	d_4
BNFN 2505-5 BNF 2505-5 BIF 2505-5	25	5	25.75	22.2	2×2.5 2×2.5 1×2.5	16.7 16.7 9.2	44 44 22	830 — 440	50	73	105 55 55	11	94 44 44	61	5.5	9.5	5.5	M6	A	520	300	60	160	25	20.3
																				620	400	60	160	25	20.3
																				720	500	60	160	25	20.3
																				820	600	60	160	25	20.3
																				1020	800	60	160	25	21.8
																				1220	1000	60	160	25	21.8
																				1420	1200	60	160	25	21.8
																			B	720	400	60	260	25	21.8
																				820	500	60	260	25	21.8
BNFN 2510A-2.5 BNF 2510A-2.5 BIF 2510A-5	25	10	26.3	21.4	1×2.5	15.8	33	780 — 780	58	85	120 70 100	18	102 52 82	71	6.6	11	6.5	M6	A	620	400	60	160	25	20.3
																				820	600	60	160	25	20.3
																				1020	800	60	160	25	20.3
																				1220	1000	60	160	25	20.3
																				1420	1200	60	160	25	20.3

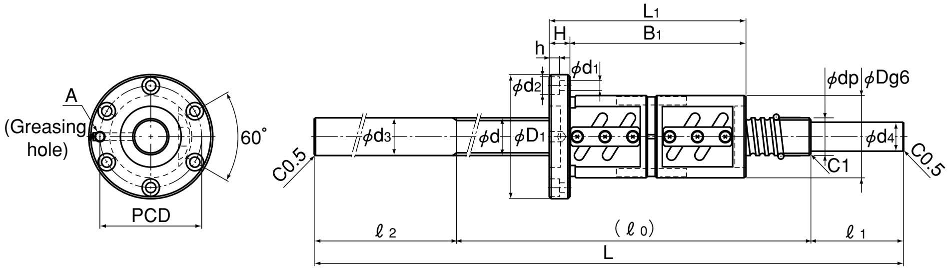
Model number coding

BIF2505-5 RR G0 +720L C5 B

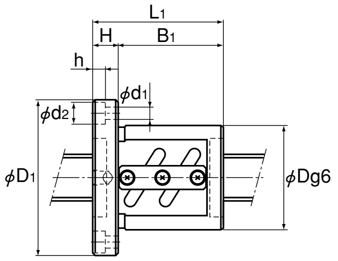
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (Symbol A or B)

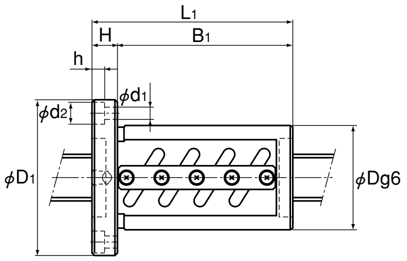
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

Model No.	Ball Screw specifications								Nut dimensions										Screw shaft dimensions						
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Applied preload N	Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1	d2	h	Greasing hole A	Standard-stock symbol	Overall length L	ℓ0	ℓ1	ℓ2	d3	d4
BNFN 2806-5 BNF 2806-5 BIF 2806-5 BIF 2806-10	28	6	28.75	25.2	2×2.5 2×2.5 1×2.5 2×2.5	17.5 17.5 9.6 17.5	49.4 49.4 24.6 49.4	880 — 490 880	55	85	122 68 68 104	12	110 56 56 92	69	6.6	11	6.5	M6	A	520	300	60	160	28	20.3
																				620	400	60	160	28	20.3
																				720	500	60	160	28	20.3
																				920	700	60	160	28	20.3
																				1020	800	60	160	28	24.8
																				1220	1000	60	160	28	24.8
																				1420	1200	60	160	28	24.8
																			B	720	400	70	250	28	24.8
																				920	500	70	350	28	24.8
																				1100	700	70	330	28	24.8
BNFN 3205-5 BNF 3205-5 BIF 3205-5 BIF 3205-10	32	5	32.75	29.2	2×2.5 2×2.5 1×2.5 2×2.5	18.5 18.5 10.2 18.5	56.4 56.4 28.1 56.4	930 — 490 930	58	85	106 56 56 86	12	94 44 44 74	71	6.6	11	6.5	M6	A	730	500	70	160	32	25.3
																				930	700	70	160	32	25.3
																				1230	1000	70	160	32	25.3
																				1430	1200	70	160	32	25.3
																				1630	1400	70	160	32	27.8
																				1830	1600	70	160	32	27.8

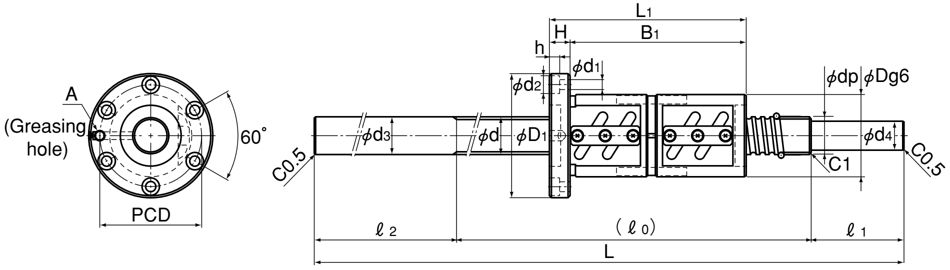
Model number coding

BNFN2806-5 RR G0 +1020L C5 A

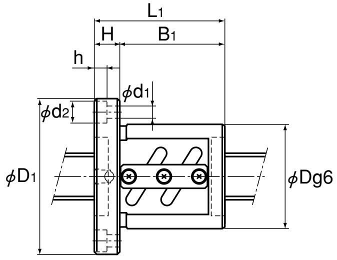
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (Symbol A or B)

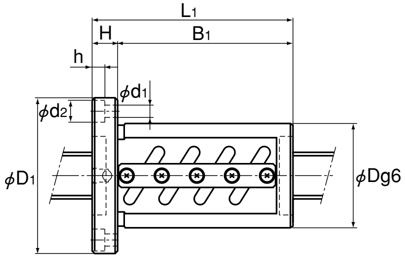
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

Model No.	Ball Screw specifications								Nut dimensions											Screw shaft dimensions						
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Applied preload N	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	d_2	h	Greasing hole A	Standard-stock symbol	Overall length L	ℓ0	ℓ1	ℓ2	d_3	d_4
BNFN 3206-5 BNF 3206-5 BIF 3206-5 BIF 3206-10	32	6	33	28.4	2×2.5 2×2.5 1×2.5 2×2.5	25.2 25.2 13.9 25.2	70.4 70.4 35.2 70.4	1270 — 690 1270	62	89	123 63 63 99	12	111 51 51 87	75	6.6	11	6.5	M6	A	730	500	70	160	32	25.3
																				930	700	70	160	32	25.3
																				1230	1000	70	160	32	25.3
																				1430	1200	70	160	32	25.3
																				1630	1400	70	160	32	27.8
																				1830	1600	70	160	32	27.8
																			B	930	500	70	360	32	27.8
																				1100	700	70	330	32	27.8
																				1430	1000	70	360	32	27.8
BNFN 3210A-5 BNF 3210A-5 BIF 3210A-5	32	10	33.75	26.4	2×2.5 2×2.5 1×2.5	47.2 47.2 26.1	112.7 112.7 56.2	2350 — 1270	74	108	190 100 100	15	175 85 85	90	9	14	8.5	M6	A	730	500	70	160	32	25.3
																				930	700	70	160	32	25.3
																				1430	1200	70	160	32	25.3
																				1830	1600	70	160	32	25.3

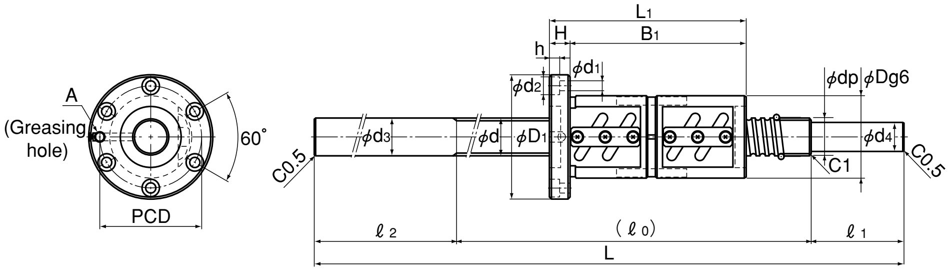
Model number coding

BNFN3206-5 RR G0 +1100L C5 B

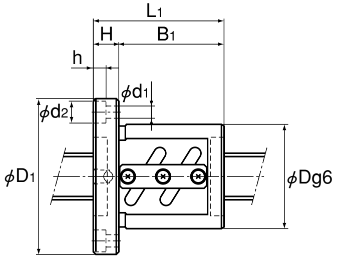
1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (Symbol A or B)

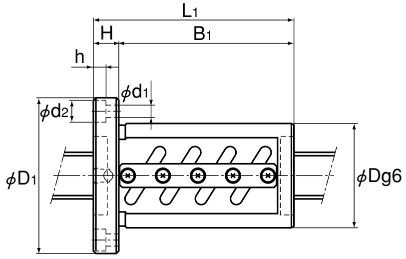
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

Model No.	Ball Screw specifications								Nut dimensions											Screw shaft dimensions						
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Applied preload N	Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1	d2	h	Greasing hole A	Standard-stock symbol	Overall length L	ℓ0	ℓ1	ℓ2	d3	d4
BNFN 3610-5 BNF 3610-5 BIF 3610-5 BIF 3610-10	36	10	37.75	30.5	2×2.5 2×2.5 1×2.5 2×2.5	50.1 50.1 27.6 50.1	126.4 126.4 63.3 126.4	2500 — 1370 2500	75	120	201 111 111 171	18	183 93 93 153	98	11	17.5	11	M6	A	730	500	70	160	36	30.3
																				930	700	70	160	36	30.3
																				1430	1200	70	160	36	30.3
																				1830	1600	70	160	36	30.3
																			B	930	500	100	330	36	30.3
																				1100	700	100	300	36	30.3
																				1830	1200	100	530	36	30.3
BNFN 4010-5 BNF 4010-5 BIF 4010-5 BIF 4010-10	40	10	41.75	34.4	2×2.5 2×2.5 1×2.5 2×2.5	52.7 52.7 29 52.7	141.1 141.1 70.4 141.1	2650 — 1470 2650	82	124	193 103 103 163	18	175 85 85 145	102	11	17.5	11	M6	A	1230	1000	70	160	40	30.3
																				1730	1500	70	160	40	30.3
																				2030	1800	70	160	40	30.3
																				2230	2000	70	160	40	30.3

Model number coding

BIF3610-5 RR G0 +1830L C5 A

1 2 3 4 5 6

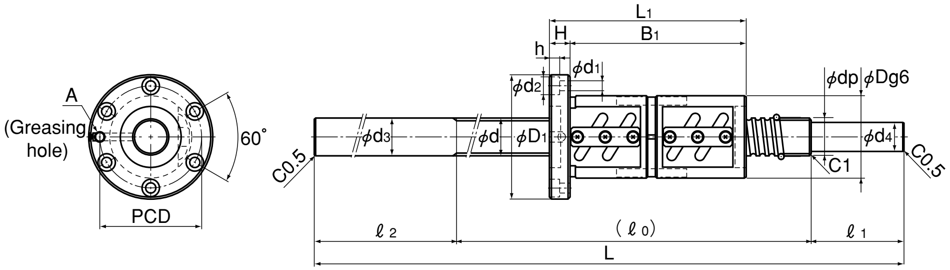
1 Model number

2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)

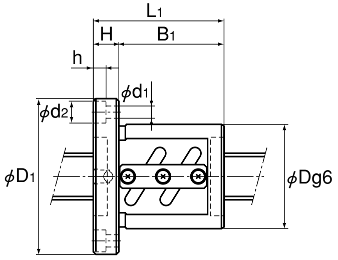
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)

5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (Symbol A or B)

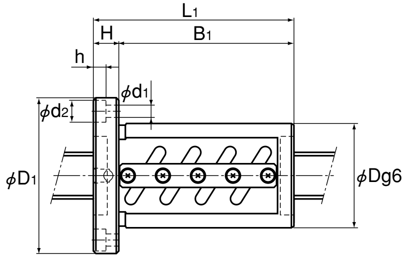
Type with Unfinished Shaft Ends



Model BNFN



Model BNF



Model BIF

Unit: mm

Model No.	Ball Screw specifications								Nut dimensions										Screw shaft dimensions						
	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Applied preload N	Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1	d2	h	Greasing hole A	Standard-stock symbol	Overall length L	ℓ0	ℓ1	ℓ2	d3	d4
BNFN 4012-5 BNF 4012-5 BIF 4012-5 BIF 4012-10	40	12	42	34.1	2×2.5 2×2.5 1×2.5 2×2.5	61.6 61.6 33.9 61.6	158.8 158.8 79.2 158.8	3090 — 1720 3090	84	126	227 119 119 191	18	209 101 101 173	104	11	17.5	11	M6	A	1230	1000	70	160	40	30.3
																				1730	1500	70	160	40	30.3
																				2030	1800	70	160	40	30.3
																				2230	2000	70	160	40	30.3
																			B	1730	1200	100	430	40	33.8
																				2030	1200	100	730	40	33.8
BNFN 5010-5 BNF 5010-5 BIF 5010-5 BIF 5010-10	50	10	51.75	44.4	2×2.5 2×2.5 1×2.5 2×2.5	58.2 58.2 32 58.2	176.4 176.4 88.2 176.4	2890 — 1620 2890	93	135	193 103 103 163	18	175 85 85 145	113	11	17.5	11	PT1/8	A	1300	1000	100	200	50	40.3
																				1800	1500	100	200	50	40.3
																				2300	2000	100	200	50	40.3
																				2800	2500	100	200	50	40.3

Model number coding

BNFN4012-5 RR G0 +1230L C5 A

1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) 6 Symbol for standard-stock type (Symbol A or B)

Standard-Lead Precision Ball Screw

Standard-Stock Type with Screw Shaft (with Finished Shaft Ends)

To meet the space-saving requirement, this type of Ball Screw has a standardized screw shaft and a ball screw nut. The ends of the screw shaft are standardized to fit the corresponding support unit. The shaft support method with models BNK0401, 0501 and 0601 is "fixed-free," while other models use the "fixed-supported" method with the shaft directly coupled with the motor.

Screw shafts and nuts are compactly designed. When a support unit and a nut bracket are combined with a Ball Screw, the assembly can be mounted on your machine as it is. Thus, a high-accuracy deed mechanism can easily be achieved.

Dust Prevention and Lubrication

Each ball screw nut contains a right amount of grease. In addition, the ball nuts of model BNK0802 or higher contain a labyrinth seal (with models BNK1510, BNK1520, BNK1616, BNK2020 and BNK2520, the end cap also serves as a labyrinth seal).

When foreign matter may enter the screw nut, it is necessary to use a dust-prevention device (e.g., bellows) to completely protect the screw shaft.

■Table of Ball Screw Types with Finished Shaft Ends and the Corresponding Support Units and Nut Brackets

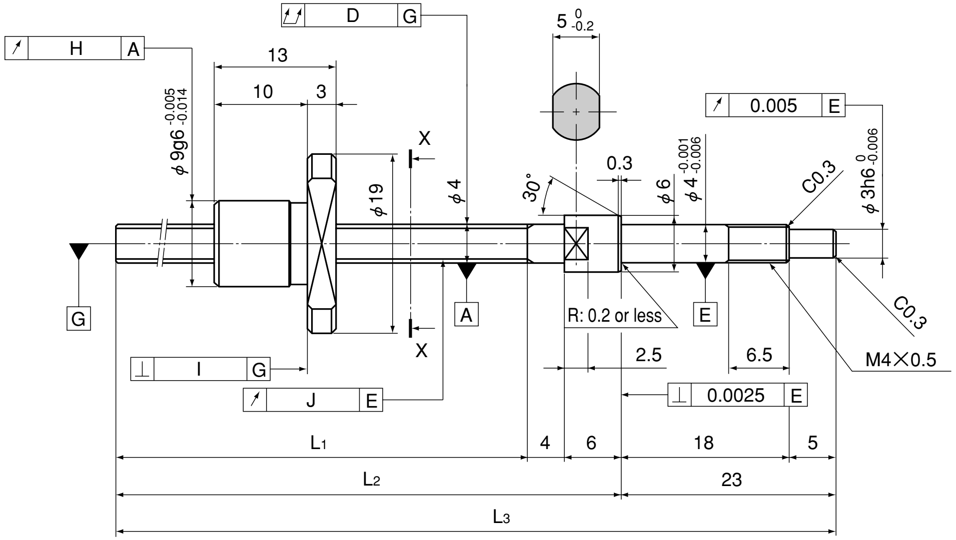
Model No.		BNK									BNK											
		0401	0501	0601	0801	0802	0810	1002	1004	1010	1202	1205	1208	1402	1404	1408	1510	1520	1616	2010	2020	2520
Accuracy grade		C3, C5, C7	C3, C5, C7	C3, C5, C7	C3, C5, C7	C3, C5, C7	C5, C7	C3, C5, C7	C3, C5, C7	C5, C7	C3, C5, C7	C3, C5, C7	C7	C3, C5, C7	C3, C5, C7	C5, C7	C5, C7	C5, C7	C5, C7	C5, C7	C5, C7	C5, C7
Axial clearance*		G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	— GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	— — G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2	G0 GT G2
Stroke (mm)	20	●	●																			
	30		●																			
	40	●	●	●	●	●																
	50		●					●	●		●	●	●	●								
	60		●																			
	70	●	●	●	●	●							●									
	100			●	●	●	●	●	●	●	●	●	●	●	●							
	120						●						●									
	150				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	170						●						●									
	200						●	●	●	●	●	●	●	●	●	●	●	●	●			
	250						●		●	●	●	●	●			●	●	●	●			
	300						●			●				●	●	●	●	●	●	●	●	
	350															●	●	●	●			
	400														●	●	●	●	●	●	●	
	450															●	●	●	●			
	500															●	●	●	●	●	●	●
	550															●	●	●	●			
	600															●	●	●	●	●	●	●
	700															●	●	●	●	●	●	
	800																●	●	●	●	●	●
	900																			●	●	
	1000																			●	●	●
	1100																			●	●	●
	1200																			●	●	
	1400																					●
	1600																					●
Support unit: square on fixed side		EK4	EK4	EK5	EK6	EK6	EK6	EK8	EK10	EK10	EK10	EK10	EK10	EK12	EK12	EK12	EK12	EK12	EK12	EK15	EK15	EK20
Support unit: round on fixed side		FK4	FK4	FK5	FK6	FK6	FK6	FK8	FK10	FK10	FK10	FK10	FK10	FK12	FK12	FK12	FK12	FK12	FK12	FK15	FK15	FK20
Support unit: square on supported side		—	—	—	EF6	EF6	EF6	EF8	EF10	EF10	EF10	EF10	EF10	EF12	EF12	EF12	EF12	EF12	EF12	EF15	EF15	EF20
Support unit: round on supported side		—	—	—	FF6	FF6	FF6	FF6	FF10	FF10	FF10	FF10	FF10	FF12	FF12	FF12	FF12	FF12	FF12	FF15	FF15	FF20
Nut bracket		—	—	—	—	—	—	—	MC1004	MC1004	—	MC1205	MC1205	—	—	MC1408	MC1408	MC1408	MC1408	MC2010	MC2020	—

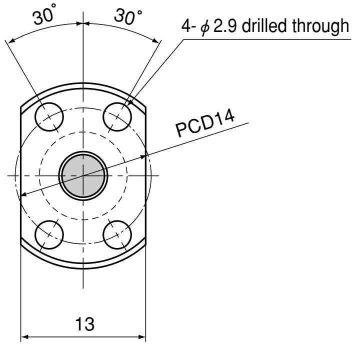
Note: Axial clearance G0: 0 or less
GT: 0.005 mm or less
G2: 0.02 mm or less

For details of the support unit and the nut bracket, see pages k-274 - and pages k-296 -, respectively.

Model BNK0401-3

Shaft diameter: 4; lead: 1





X-X arrow view

Ball Screw Specifications			
Lead (mm)	1		
BCD (mm)	4.15		
Thread minor diameter (mm)	3.4		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	0.29	0.29	0.29
Basic static load rating C_0a (kN)	0.42	0.42	0.42
Preload torque (N-m)	9.8×10^{-3} max	—	—
Spacer ball	None	None	None

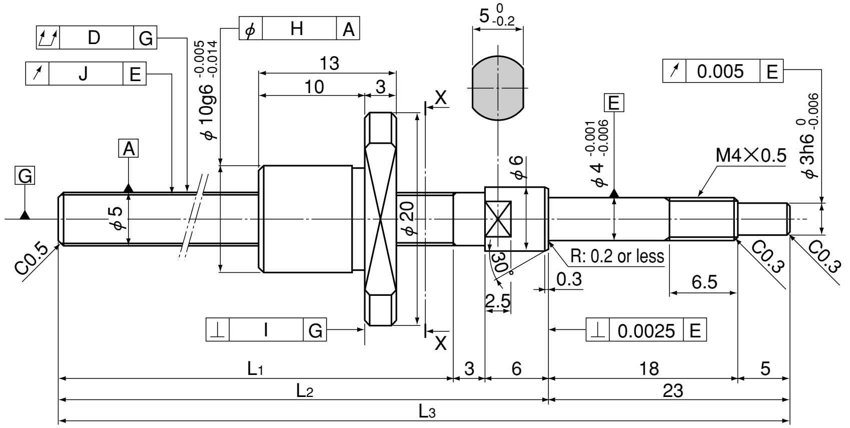
Unit: mm

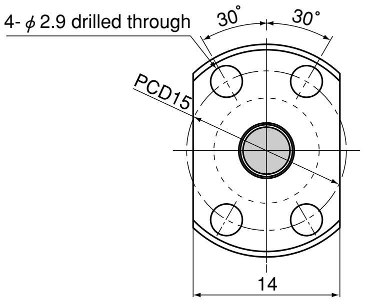
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 0401-3G0+77LC3Y	20	44	54	77	0.015	0.009	0.008	0.008	±0.008	0.008
BNK 0401-3G0+77LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0401-3G2+77LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0401-3G0+97LC3Y	40	64	74	97	0.02	0.009	0.008	0.008	±0.008	0.008
BNK 0401-3G0+97LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0401-3G2+97LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0401-3G0+127LC3Y	70	94	104	127	0.025	0.009	0.008	0.008	±0.008	0.008
BNK 0401-3G0+127LC5Y					0.035	0.012	0.01	0.01	±0.018	0.018
BNK 0401-3G2+127LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK0401. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK0401-3G0+77LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK0501-3

Shaft diameter: 5; lead: 1





X-X arrow view

Ball Screw Specifications			
Lead (mm)	1		
BCD (mm)	5.15		
Thread minor diameter (mm)	4.4		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	0.32	0.32	0.32
Basic static load rating C_0a (kN)	0.55	0.55	0.55
Preload torque (N-m)	9.8×10^{-3} max	—	—
Spacer ball	None	None	None

Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 0501-3G0+77LC3Y	20	45	54	77	0.015	0.009	0.008	0.008	±0.008	0.008
BNK 0501-3G0+77LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0501-3G2+77LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0501-3G0+97LC3Y	40	65	74	97	0.02	0.009	0.008	0.008	±0.008	0.008
BNK 0501-3G0+97LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0501-3G2+97LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0501-3G0+127LC3Y	70	95	104	127	0.025	0.009	0.008	0.008	±0.008	0.008
BNK 0501-3G0+127LC5Y					0.035	0.012	0.01	0.01	±0.018	0.018
BNK 0501-3G2+127LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK0501. When placing an order, add symbol "M" to the end of the model number.

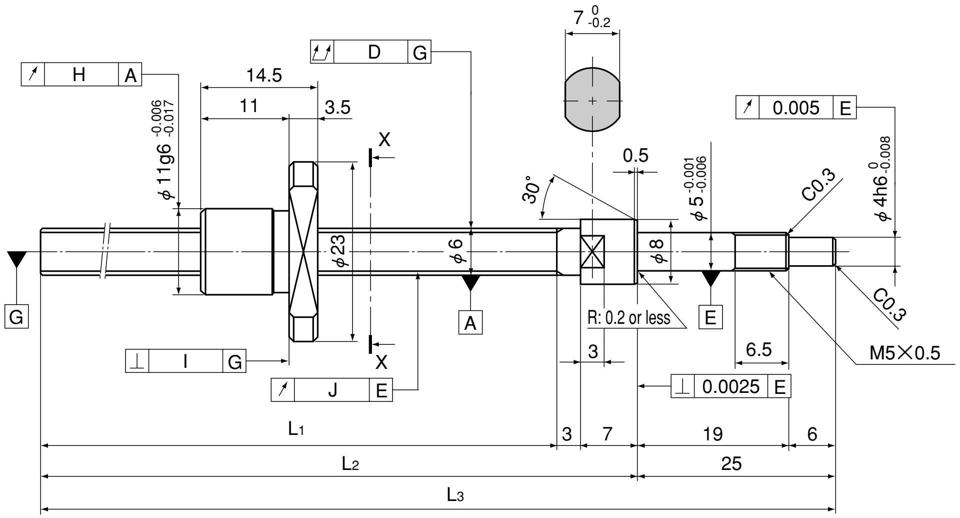
(Example) BNK0501-3G0+77LC3Y M

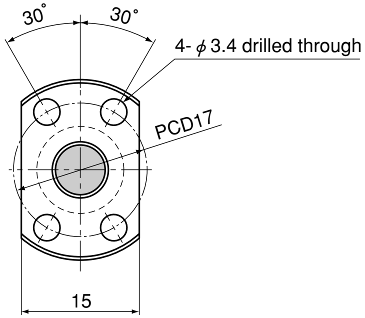
Symbol for stainless steel type

For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK0601-3

Shaft diameter: 6; lead: 1





X-X arrow view

Ball Screw Specifications			
Lead (mm)	1		
BCD (mm)	6.2		
Thread minor diameter (mm)	5.3		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	0.54	0.54	0.54
Basic static load rating C₀a (kN)	0.94	0.94	0.94
Preload torque (N-m)	1.3 x 10⁻² max	—	—
Spacer ball	None	None	None

Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 0601-3G0+100LC3Y	40	65	75	100	0.015	0.009	0.008	0.008	±0.008	0.008
BNK 0601-3G0+100LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0601-3G2+100LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0601-3G0+130LC3Y	70	95	105	130	0.02	0.009	0.008	0.008	±0.008	0.008
BNK 0601-3G0+130LC5Y					0.035	0.012	0.01	0.01	±0.018	0.018
BNK 0601-3G2+130LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0601-3G0+160LC3Y	100	125	135	160	0.025	0.009	0.008	0.008	±0.01	0.008
BNK 0601-3G0+160LC5Y					0.035	0.012	0.01	0.01	±0.02	0.018
BNK 0601-3G2+160LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK0601. When placing an order, add symbol "M" to the end of the model number.

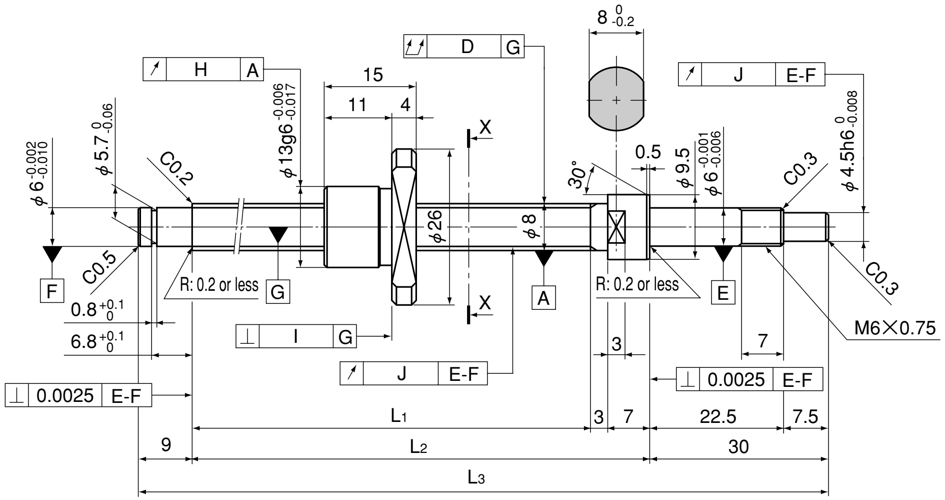
(Example) BNK0601-3G0+100LC3Y M

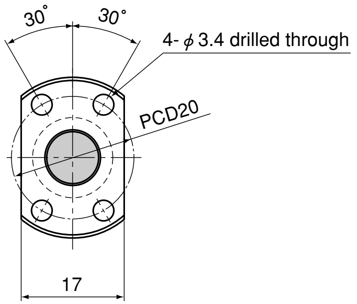
Symbol for stainless steel type

For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK0801-3

Shaft diameter: 8; lead: 1





X-X arrow view

Ball Screw Specifications			
Lead (mm)	1		
BCD (mm)	8.2		
Thread minor diameter (mm)	7.3		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	0.64	0.64	0.64
Basic static load rating C_0a (kN)	1.4	1.4	1.4
Preload torque (N-m)	1.8 x 10^{-2} max	—	—
Spacer ball	None	None	None

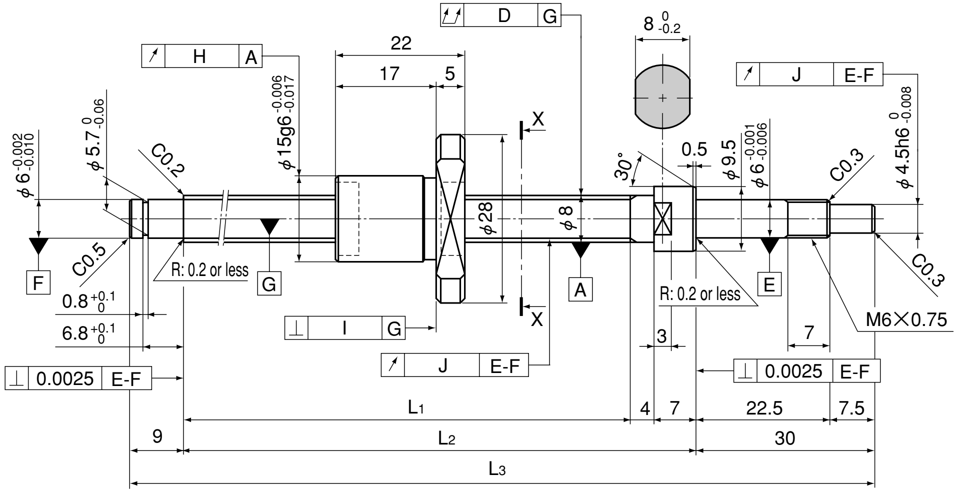
Unit: mm

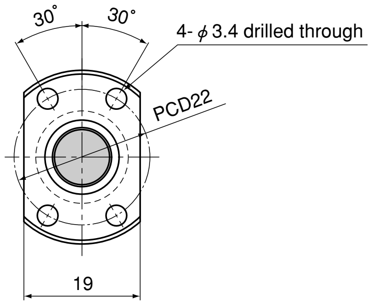
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy	
		L_1	L_2	L_3					Representative travel distance error	Fluctuation
BNK 0801-3G0+115LC3Y	40	66	76	115	0.025	0.009	0.008	0.008	±0.008	0.008
BNK 0801-3G0+115LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0801-3G2+115LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0801-3G0+145LC3Y	70	96	106	145	0.03	0.009	0.008	0.008	±0.008	0.008
BNK 0801-3G0+145LC5Y					0.035	0.012	0.01	0.01	±0.018	0.018
BNK 0801-3G2+145LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0801-3G0+175LC3Y	100	126	136	175	0.03	0.009	0.008	0.008	±0.01	0.008
BNK 0801-3G0+175LC5Y					0.035	0.012	0.01	0.01	±0.02	0.018
BNK 0801-3G2+175LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0801-3G0+225LC3Y	150	176	186	225	0.035	0.009	0.008	0.008	±0.01	0.008
BNK 0801-3G0+225LC5Y					0.05	0.012	0.01	0.01	±0.02	0.018
BNK 0801-3G2+225LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK0801. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK0801-3G0+115LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK0802-3

Shaft diameter: 8; lead: 2





X-X arrow view

Ball Screw Specifications			
Lead (mm)	2		
BCD (mm)	8.3		
Thread minor diameter (mm)	7		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	1.4	1.4	1.4
Basic static load rating C_{0a} (kN)	2.3	2.3	2.3
Preload torque (N-m)	2×10^{-2} max	—	—
Spacer ball	None	None	None

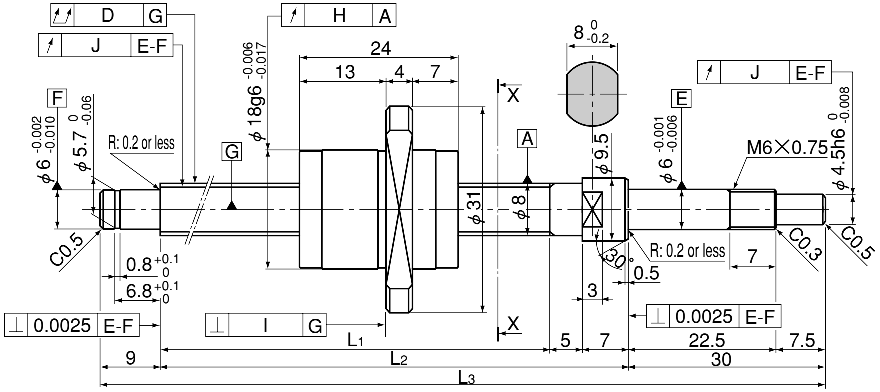
Unit: mm

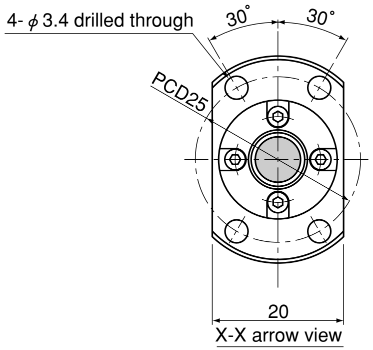
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L1	L2	L3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 0802-3RRG0+125LC3Y	40	75	86	125	0.025	0.009	0.008	0.008	±0.008	0.008
BNK 0802-3RRG0+125LC5Y					0.025	0.012	0.01	0.01	±0.018	0.018
BNK 0802-3RRG2+125LC7Y					0.035	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0802-3RRG0+155LC3Y	70	105	116	155	0.03	0.009	0.008	0.008	±0.01	0.008
BNK 0802-3RRG0+155LC5Y					0.035	0.012	0.01	0.01	±0.02	0.018
BNK 0802-3RRG2+155LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0802-3RRG0+185LC3Y	100	135	146	185	0.03	0.009	0.008	0.008	±0.01	0.008
BNK 0802-3RRG0+185LC5Y					0.035	0.012	0.01	0.01	±0.02	0.018
BNK 0802-3RRG2+185LC7Y					0.05	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0802-3RRG0+235LC3Y	150	185	196	235	0.035	0.009	0.008	0.008	±0.01	0.008
BNK 0802-3RRG0+235LC5Y					0.05	0.012	0.01	0.01	±0.02	0.018
BNK 0802-3RRG2+235LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK0802. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK0802-3RRG0+125LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK0810-3

Shaft diameter: 8; lead: 10





X-X arrow view

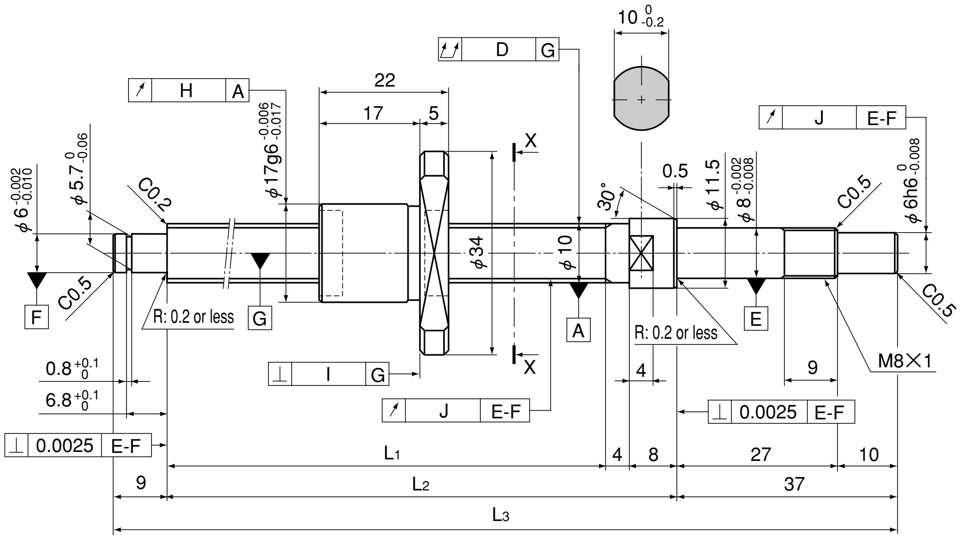
Ball Screw Specifications		
Lead (mm)	10	
BCD (mm)	8.4	
Thread minor diameter (mm)	6.7	
Threading direction, No. of threaded grooves	Rightward, 2	
No. of circuits	1.5 turn x 2 rows	
Clearance symbol	GT	G2
Axial clearance (mm)	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	2.16	2.16
Basic static load rating C_0a (kN)	3.82	3.82
Preload torque (N-m)	—	—
Spacer ball	None	None

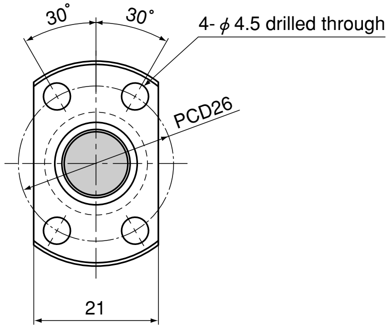
Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy	
		L_1	L_2	L_3					Representative travel distance error	Fluctuation
BNK 0810-3GT+205LC5Y	100	154	166	205	0.05	0.012	0.01	0.01	±0.02	0.018
BNK 0810-3G2+205LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0810-3GT+255LC5Y	150	204	216	255	0.05	0.012	0.01	0.01	±0.023	0.018
BNK 0810-3G2+255LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0810-3GT+305LC5Y	200	254	266	305	0.05	0.012	0.01	0.01	±0.023	0.018
BNK 0810-3G2+305LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0810-3GT+355LC5Y	250	304	316	355	0.06	0.012	0.01	0.01	±0.023	0.018
BNK 0810-3G2+355LC7Y					0.075	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 0810-3GT+405LC5Y	300	354	366	405	0.07	0.012	0.01	0.01	±0.025	0.018
BNK 0810-3G2+405LC7Y					0.09	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Model BNK1002-3

Shaft diameter: 10; lead: 2





X-X arrow view

Ball Screw Specifications			
Lead (mm)	2		
BCD (mm)	10.3		
Thread minor diameter (mm)	9		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	1.5	1.5	1.5
Basic static load rating C_0a (kN)	2.9	2.9	2.9
Preload torque (N-m)	2.5×10^{-2} max	—	—
Spacer ball	None	None	None

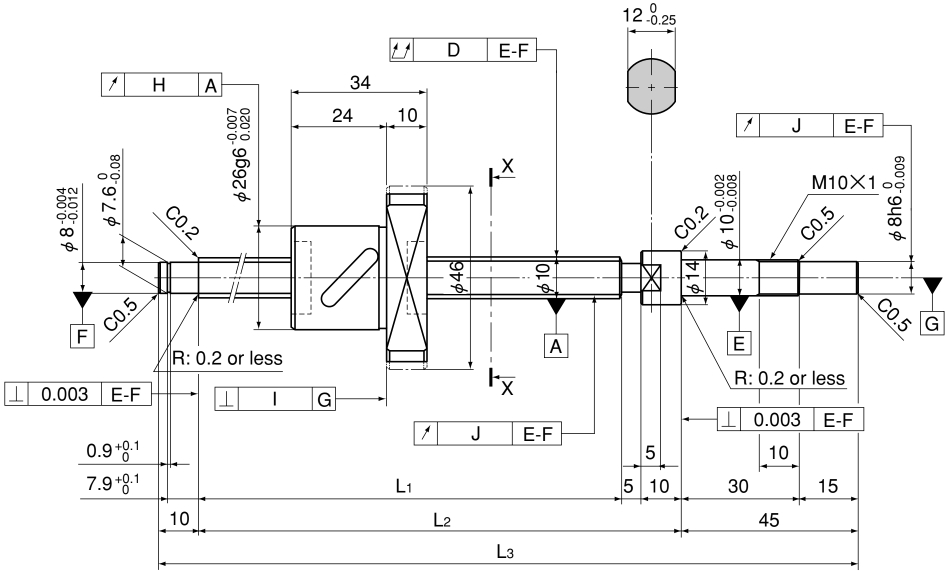
Unit: mm

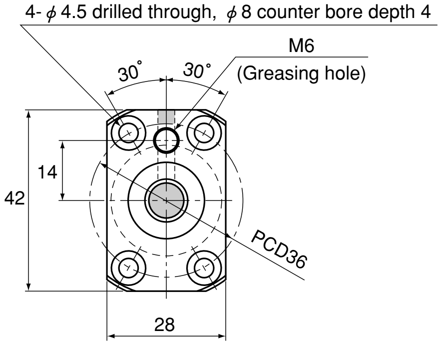
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1002-3RRG0+143LC3Y	50	85	97	143	0.02	0.009	0.008	0.007	±0.008	0.008
BNK 1002-3RRG0+143LC5Y					0.035	0.012	0.01	0.011	±0.018	0.018
BNK 1002-3RRG2+143LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1002-3RRG0+193LC3Y	100	135	147	193	0.03	0.009	0.008	0.007	±0.01	0.008
BNK 1002-3RRG0+193LC5Y					0.035	0.012	0.01	0.011	±0.02	0.018
BNK 1002-3RRG2+193LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1002-3RRG0+243LC3Y	150	185	197	243	0.03	0.009	0.008	0.007	±0.01	0.008
BNK 1002-3RRG0+243LC5Y					0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1002-3RRG2+243LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1002-3RRG0+293LC3Y	200	235	247	293	0.03	0.009	0.008	0.007	±0.012	0.008
BNK 1002-3RRG0+293LC5Y					0.04	0.012	0.01	0.011	±0.023	0.018
BNK 1002-3RRG2+293LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK1002. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK1002-3RRG0+143LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1004-2.5

Shaft diameter: 10; lead: 4





X-X arrow view

Ball Screw Specifications			
Lead (mm)	4		
BCD (mm)	10.5		
Thread minor diameter (mm)	7.8		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	2.5 turn x 1 row		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	2.1	3.4	3.4
Basic static load rating C_0a (kN)	2.7	5.4	5.4
Preload torque (N-m)	9.8×10^{-3} to 4.9×10^{-2}	—	—
Spacer ball	1:1	None	None

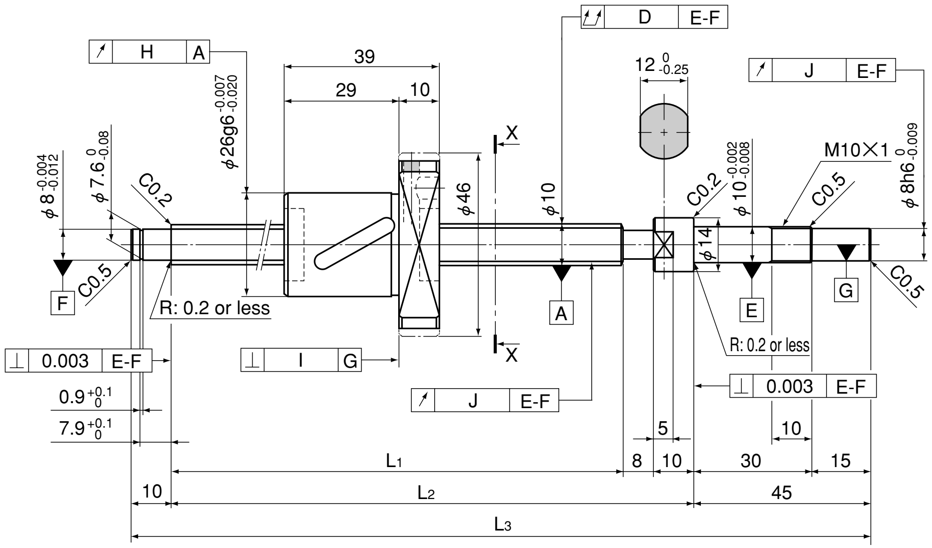
Unit: mm

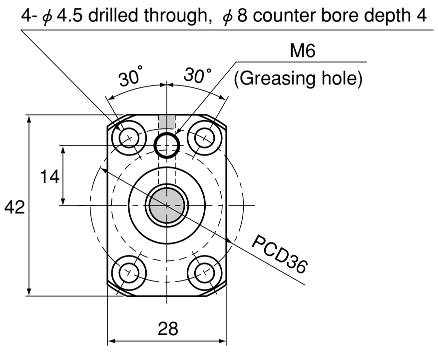
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1004-2.5RRG0+180LC3Y	50	110	125	180	0.02	0.009	0.008	0.008	±0.01	0.008
BNK 1004-2.5RRG0+180LC5Y					0.035	0.012	0.01	0.011	±0.02	0.018
BNK 1004-2.5RRG2+180LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1004-2.5RRG0+230LC3Y	100	160	175	230	0.03	0.009	0.008	0.008	±0.01	0.008
BNK 1004-2.5RRG0+230LC5Y					0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1004-2.5RRG2+230LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1004-2.5RRG0+280LC3Y	150	210	225	280	0.03	0.009	0.008	0.008	±0.012	0.008
BNK 1004-2.5RRG0+280LC5Y					0.04	0.012	0.01	0.011	±0.023	0.018
BNK 1004-2.5RRG2+280LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1004-2.5RRG0+330LC3Y	200	260	275	330	0.04	0.009	0.008	0.008	±0.012	0.008
BNK 1004-2.5RRG0+330LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1004-2.5RRG2+330LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1004-2.5RRG0+380LC3Y	250	310	325	380	0.04	0.009	0.008	0.008	±0.012	0.008
BNK 1004-2.5RRG0+380LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1004-2.5RRG2+380LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1010-1.5

Shaft diameter: 10; lead: 10





X-X arrow view

Ball Screw Specifications			
Lead (mm)	10		
BCD (mm)	10.5		
Thread minor diameter (mm)	7.8		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1.5 turn x 1 row		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	1.3	2.1	2.1
Basic static load rating C_0a (kN)	1.6	3.1	3.1
Preload torque (N-m)	9.8×10^{-3} to 4.9×10^{-2}	—	—
Spacer ball	1:1	None	None

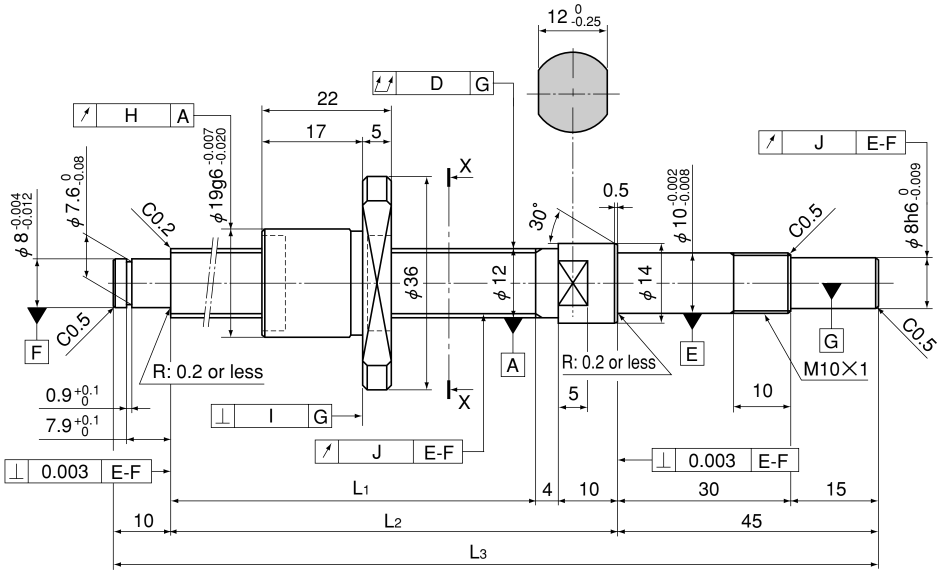
Unit: mm

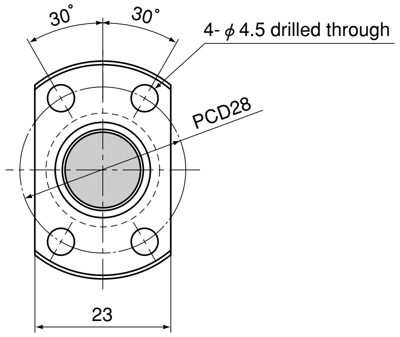
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1010-1.5RRG0+240LC5Y	100	167	185	240	0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1010-1.5RRG2+240LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1010-1.5RRG0+290LC5Y	150	217	235	290	0.04	0.012	0.01	0.011	±0.023	0.018
BNK 1010-1.5RRG2+290LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1010-1.5RRG0+340LC5Y	200	267	285	340	0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1010-1.5RRG2+340LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1010-1.5RRG0+390LC5Y	250	317	335	390	0.05	0.012	0.01	0.011	±0.025	0.02
BNK 1010-1.5RRG2+390LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1010-1.5RRG0+440LC5Y	300	367	385	440	0.065	0.012	0.01	0.011	±0.025	0.02
BNK 1010-1.5RRG2+440LC7Y					0.08	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Model BNK1202-3

Shaft diameter: 12; lead: 2





X-X arrow view

Ball Screw Specifications			
Lead (mm)	2		
BCD (mm)	12.3		
Thread minor diameter (mm)	11		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	1.7	1.7	1.7
Basic static load rating C_0a (kN)	3.6	3.6	3.6
Preload torque (N-m)	3.9×10^{-3} to 3.4×10^{-2}	—	—
Spacer ball	None	None	None

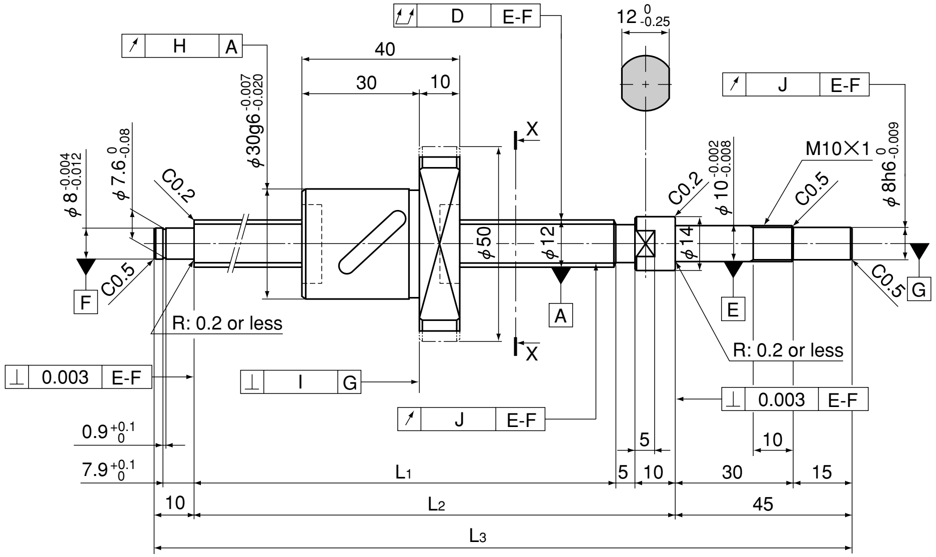
Unit: mm

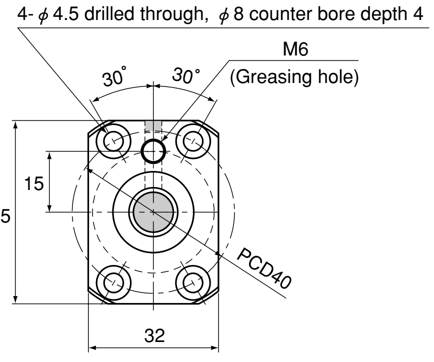
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1202-3RRG0+154LC3Y	50	85	99	154	0.02	0.01	0.008	0.007	±0.008	0.008
BNK 1202-3RRG0+154LC5Y					0.035	0.012	0.01	0.011	±0.018	0.018
BNK 1202-3RRG2+154LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1202-3RRG0+204LC3Y	100	135	149	204	0.03	0.01	0.008	0.007	±0.01	0.008
BNK 1202-3RRG0+204LC5Y					0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1202-3RRG2+204LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1202-3RRG0+254LC3Y	150	185	199	254	0.03	0.01	0.008	0.007	±0.01	0.008
BNK 1202-3RRG0+254LC5Y					0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1202-3RRG2+254LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1202-3RRG0+304LC3Y	200	235	249	304	0.04	0.01	0.008	0.007	±0.012	0.008
BNK 1202-3RRG0+304LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1202-3RRG2+304LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1202-3RRG0+354LC3Y	250	285	299	354	0.04	0.01	0.008	0.007	±0.012	0.008
BNK 1202-3RRG0+354LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1202-3RRG2+354LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK1202. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK1202-3RRG0+154LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1205-2.5

Shaft diameter: 12; lead: 5





X-X arrow view

Ball Screw Specifications			
Lead (mm)	5		
BCD (mm)	12.3		
Thread minor diameter (mm)	9.6		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	2.5 turns x 1 row		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	2.3	3.7	3.7
Basic static load rating C_0a (kN)	3.2	6.4	6.4
Preload torque (N-m)	9.8×10^{-3} to 4.9×10^{-2}	—	—
Spacer ball	1:1	None	None

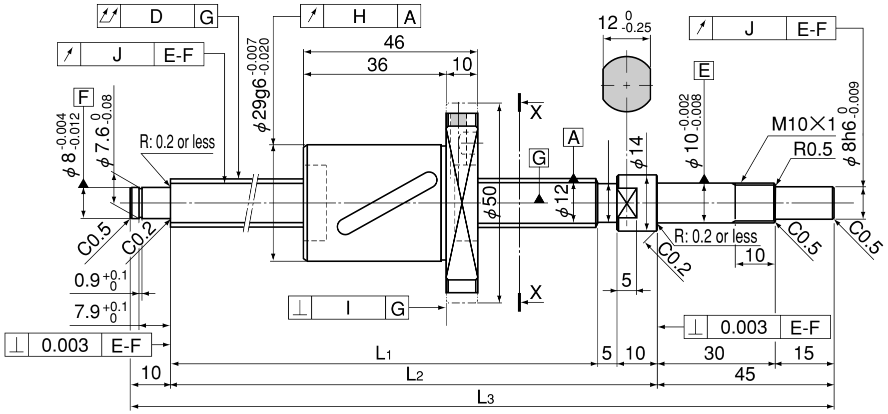
Unit: mm

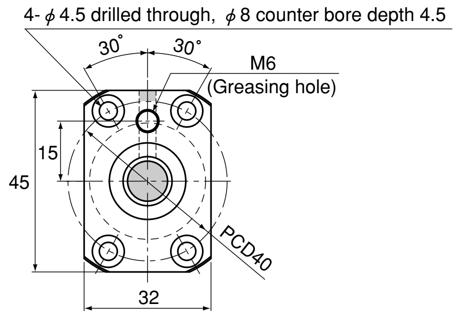
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1205-2.5RRG0+180LC3Y	50	110	125	180	0.02	0.009	0.008	0.008	±0.01	0.008
BNK 1205-2.5RRG0+180LC5Y					0.035	0.012	0.01	0.011	±0.02	0.018
BNK 1205-2.5RRG2+180LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1205-2.5RRG0+230LC3Y	100	160	175	230	0.03	0.009	0.008	0.008	±0.01	0.008
BNK 1205-2.5RRG0+230LC5Y					0.04	0.012	0.01	0.011	±0.02	0.018
BNK 1205-2.5RRG2+230LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1205-2.5RRG0+280LC3Y	150	210	225	280	0.03	0.009	0.008	0.008	±0.012	0.008
BNK 1205-2.5RRG0+280LC5Y					0.04	0.012	0.01	0.011	±0.023	0.018
BNK 1205-2.5RRG2+280LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1205-2.5RRG0+330LC3Y	200	260	275	330	0.04	0.009	0.008	0.008	±0.012	0.008
BNK 1205-2.5RRG0+330LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1205-2.5RRG2+330LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1205-2.5RRG0+380LC3Y	250	310	325	380	0.04	0.009	0.008	0.008	±0.012	0.008
BNK 1205-2.5RRG0+380LC5Y					0.05	0.012	0.01	0.011	±0.023	0.018
BNK 1205-2.5RRG2+380LC7Y					0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1208-2.6

Shaft diameter: 12; lead: 8





X-X arrow view

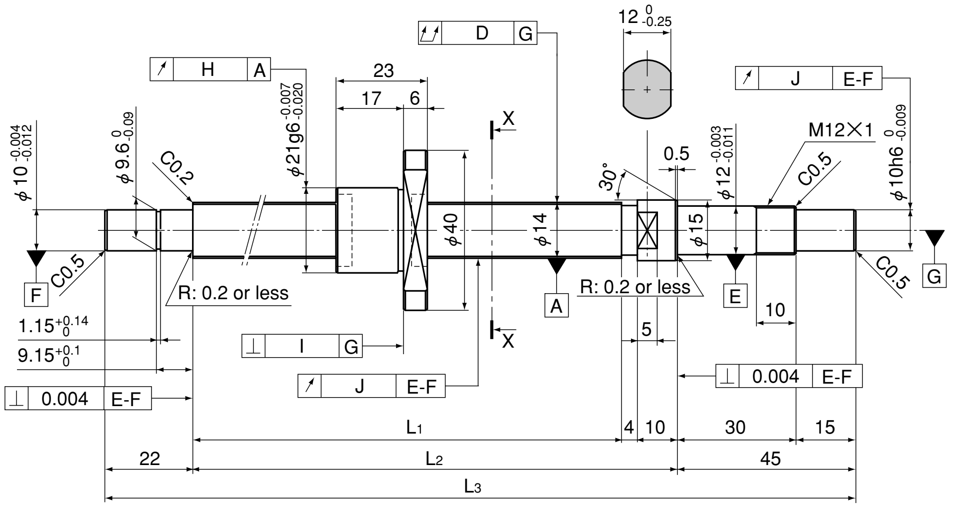
Ball Screw Specifications	
Lead (mm)	8
BCD (mm)	12.65
Thread minor diameter (mm)	9.7
Threading direction, No. of threaded grooves	Rightward, 1
No. of circuits	2.6 turns x 1 row
Clearance symbol	G2
Axial clearance (mm)	0.02 or less
Basic dynamic load rating Ca (kN)	4.7
Basic static load rating C0a (kN)	7.5
Preload torque (N-m)	—
Spacer ball	None

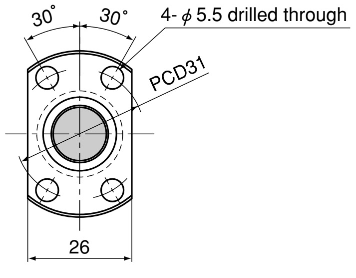
Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy
		L1	L2	L3					
BNK 1208-2.6RRG2+180LC7Y	50	110	125	180	0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300
BNK 1208-2.6RRG2+230LC7Y	100	160	175	230	0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300
BNK 1208-2.6RRG2+280LC7Y	150	210	225	280	0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300
BNK 1208-2.6RRG2+330LC7Y	200	260	275	330	0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300
BNK 1208-2.6RRG2+380LC7Y	250	310	325	380	0.065	0.02	0.014	0.014	Travel distance error: ±0.05/300

Model BNK1402-3

Shaft diameter: 14; lead: 2





X-X arrow view

Ball Screw Specifications			
Lead (mm)	2		
BCD (mm)	14.3		
Thread minor diameter (mm)	13		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	1.8	1.8	1.8
Basic static load rating C_0a (kN)	4.3	4.3	4.3
Preload torque (N-m)	4.9×10^{-3} to 4.9×10^{-2}	—	—
Spacer ball	None	None	None

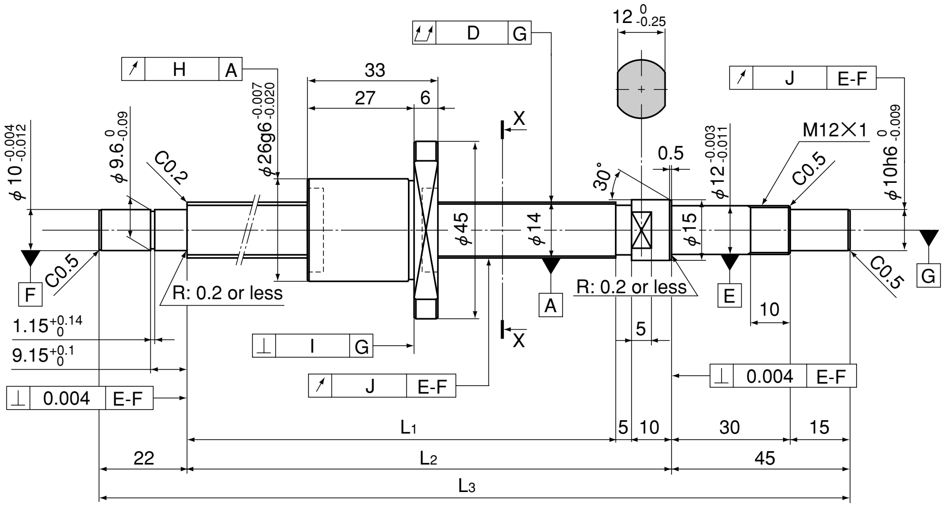
Unit: mm

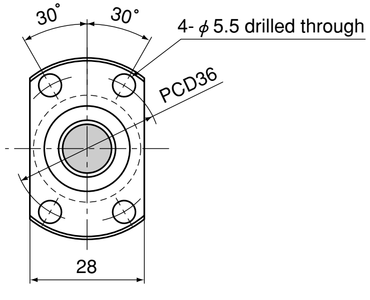
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1402-3RRG0+166LC3Y	50	85	99	166	0.02	0.01	0.008	0.009	±0.008	0.008
BNK 1402-3RRG0+166LC5Y					0.025	0.012	0.01	0.012	±0.018	0.018
BNK 1402-3RRG2+166LC7Y					0.04	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1402-3RRG0+216LC3Y	100	135	149	216	0.025	0.01	0.008	0.009	±0.01	0.008
BNK 1402-3RRG0+216LC5Y					0.03	0.012	0.01	0.012	±0.02	0.018
BNK 1402-3RRG2+216LC7Y					0.045	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1402-3RRG0+266LC3Y	150	185	199	266	0.025	0.01	0.008	0.009	±0.01	0.008
BNK 1402-3RRG0+266LC5Y					0.03	0.012	0.01	0.012	±0.02	0.018
BNK 1402-3RRG2+266LC7Y					0.045	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1402-3RRG0+316LC3Y	200	235	249	316	0.03	0.01	0.008	0.009	±0.012	0.008
BNK 1402-3RRG0+316LC5Y					0.04	0.012	0.01	0.012	±0.023	0.018
BNK 1402-3RRG2+316LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1402-3RRG0+416LC3Y	300	335	349	416	0.04	0.01	0.008	0.009	±0.013	0.01
BNK 1402-3RRG0+416LC5Y					0.05	0.012	0.01	0.012	±0.025	0.02
BNK 1402-3RRG2+416LC7Y					0.06	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK1402. When placing an order, add symbol "M" to the end of the model number.
(Example) BNK1402-3RRG0+166LC3Y M
Symbol for stainless steel type
For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1404-3

Shaft diameter: 14; lead: 4





X-X arrow view

Ball Screw Specifications			
Lead (mm)	4		
BCD (mm)	14.65		
Thread minor diameter (mm)	11.9		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	1 turn x 3 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	4.2	4.2	4.2
Basic static load rating C_0a (kN)	7.6	7.6	7.6
Preload torque (N-m)	9.8×10^{-3} to 6.9×10^{-2}	—	—
Spacer ball	None	None	None

Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1404-3RRG0+230LC3Y	100	148	163	230	0.025	0.01	0.008	0.009	±0.01	0.008
BNK 1404-3RRG0+230LC5Y					0.03	0.012	0.01	0.012	±0.02	0.018
BNK 1404-3RRG2+230LC7Y					0.045	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1404-3RRG0+280LC3Y	150	198	213	280	0.025	0.01	0.008	0.009	±0.01	0.008
BNK 1404-3RRG0+280LC5Y					0.03	0.012	0.01	0.012	±0.02	0.018
BNK 1404-3RRG2+280LC7Y					0.045	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1404-3RRG0+330LC3Y	200	248	263	330	0.03	0.01	0.008	0.009	±0.012	0.008
BNK 1404-3RRG0+330LC5Y					0.04	0.012	0.01	0.012	±0.023	0.018
BNK 1404-3RRG2+330LC7Y					0.055	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1404-3RRG0+430LC3Y	300	348	363	430	0.04	0.01	0.008	0.009	±0.013	0.01
BNK 1404-3RRG0+430LC5Y					0.05	0.012	0.01	0.012	±0.025	0.02
BNK 1404-3RRG2+430LC7Y					0.06	0.02	0.014	0.014	Travel distance error: ±0.05/300	
BNK 1404-3RRG0+530LC3Y	400	448	463	530	0.045	0.01	0.008	0.009	±0.015	0.01
BNK 1404-3RRG0+530LC5Y					0.055	0.012	0.01	0.012	±0.027	0.02
BNK 1404-3RRG2+530LC7Y					0.075	0.02	0.014	0.014	Travel distance error: ±0.05/300	

Note A stainless steel type is also available for model BNK1404. When placing an order, add symbol "M" to the end of the model number.

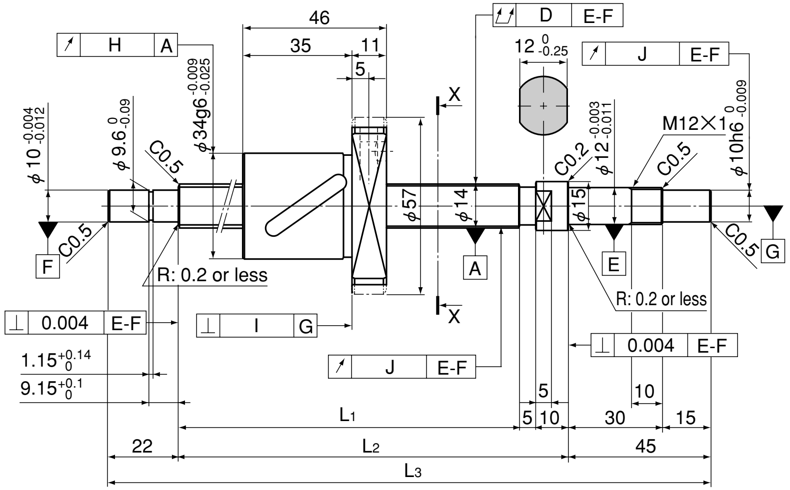
(Example) BNK1404-3RRG0+230LC3Y M

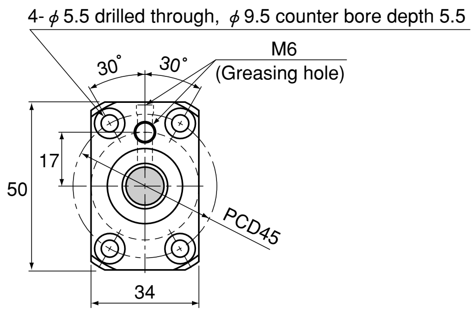
Symbol for stainless steel type

For accuracy grades C3 and C5, clearance GT is also standardized.

Model BNK1408-2.5

Shaft diameter: 14; lead: 8





X-X arrow view

Ball Screw Specifications			
Lead (mm)	8		
BCD (mm)	14.75		
Thread minor diameter (mm)	11.2		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	2.5 turns x 1 row		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	4.3	6.9	6.9
Basic static load rating C₀a (kN)	5.8	11.5	11.5
Preload torque (N-m)	2 x 10^{-2} to 7.8 x 10^{-2}	—	—
Spacer ball	1:1	None	None

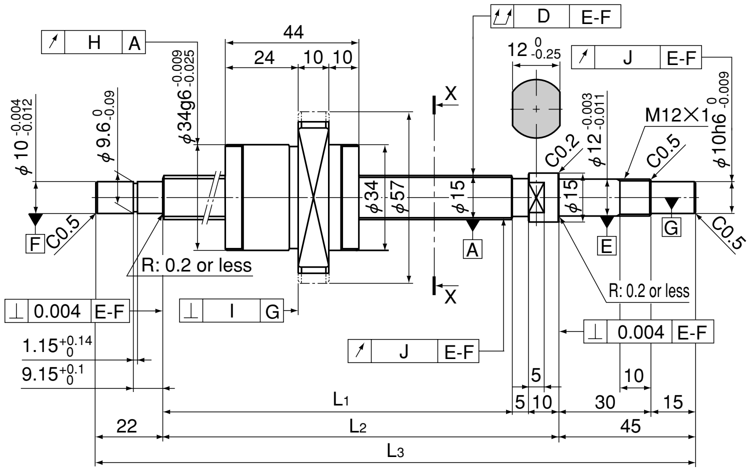
Unit: mm

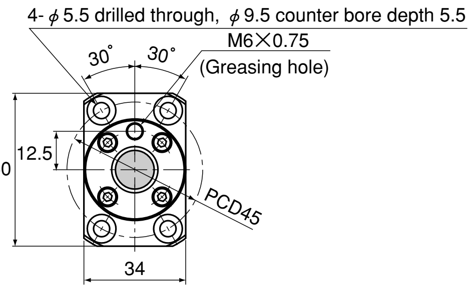
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy	
		L₁	L₂	L₃					Representative travel distance error	Fluctuation
BNK 1408-2.5RRG0+321LC5Y	150	239	254	321	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1408-2.5RRG2+321LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+371LC5Y	200	289	304	371	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1408-2.5RRG2+371LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+421LC5Y	250	339	354	421	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1408-2.5RRG2+421LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+471LC5Y	300	389	404	471	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1408-2.5RRG2+471LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+521LC5Y	350	439	454	521	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1408-2.5RRG2+521LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+571LC5Y	400	489	504	571	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1408-2.5RRG2+571LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+621LC5Y	450	539	554	621	0.05	0.015	0.011	0.012	±0.03	0.023
BNK 1408-2.5RRG2+621LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+671LC5Y	500	589	604	671	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 1408-2.5RRG2+671LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+721LC5Y	550	639	654	721	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1408-2.5RRG2+721LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+771LC5Y	600	689	704	771	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1408-2.5RRG2+771LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1408-2.5RRG0+871LC5Y	700	789	804	871	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 1408-2.5RRG2+871LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Model BNK1510-5.6

Shaft diameter: 15; lead: 10





X-X arrow view

Ball Screw Specifications			
Lead (mm)	10		
BCD (mm)	15.75		
Thread minor diameter (mm)	12.5		
Threading direction, No. of threaded grooves	Rightward, 2		
No. of circuits	2.8 turns x 2 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	9	14.3	14.3
Basic static load rating C_0a (kN)	13.9	27.9	27.9
Preload torque (N-m)	2×10^{-2} to 9.8×10^{-2}	—	—
Spacer ball	1:1	None	None

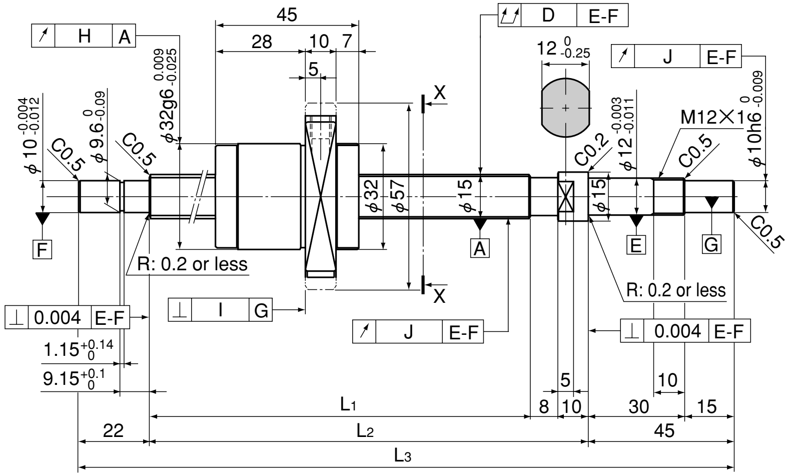
Unit: mm

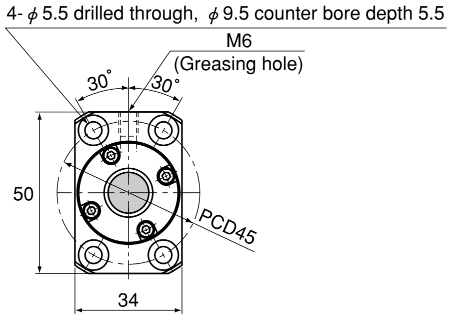
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L_1	L_2	L_3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1510-5.6G0+321LC5Y	150	239	254	321	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1510-5.6G2+321LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+371LC5Y	200	289	304	371	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1510-5.6G2+371LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+421LC5Y	250	339	354	421	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1510-5.6G2+421LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+471LC5Y	300	389	404	471	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1510-5.6G2+471LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+521LC5Y	350	439	454	521	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1510-5.6G2+521LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+571LC5Y	400	489	504	571	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1510-5.6G2+571LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+621LC5Y	450	539	554	621	0.05	0.015	0.011	0.012	±0.03	0.023
BNK 1510-5.6G2+621LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+671LC5Y	500	589	604	671	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 1510-5.6G2+671LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+721LC5Y	550	639	654	721	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1510-5.6G2+721LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+771LC5Y	600	689	704	771	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1510-5.6G2+771LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+871LC5Y	700	789	804	871	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 1510-5.6G2+871LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1510-5.6G0+971LC5Y	800	889	904	971	0.085	0.015	0.011	0.012	±0.04	0.027
BNK 1510-5.6G2+971LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Model BNK1520-3

Shaft diameter: 15; lead: 20





X-X arrow view

Ball Screw Specifications			
Lead (mm)	20		
BCD (mm)	15.75		
Thread minor diameter (mm)	12.5		
Threading direction, No. of threaded grooves	Rightward, 2		
No. of circuits	1.5 turns x 2 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	5.1	8	8
Basic static load rating C0a (kN)	7.9	15.8	15.8
Preload torque (N-m)	2×10^{-2} to 9.8×10^{-2}	—	—
Spacer ball	1:1	None	None

Unit: mm

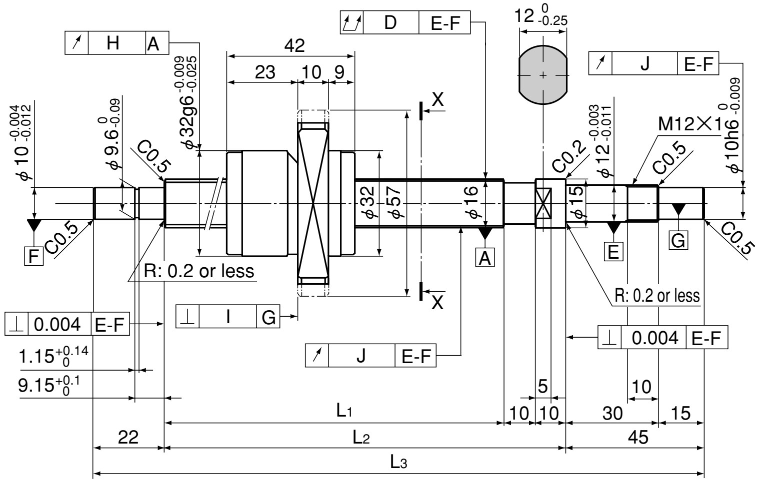
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L1	L2	L3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1520-3G0+321LC5Y	150	236	254	321	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1520-3G2+321LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+371LC5Y	200	286	304	371	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1520-3G2+371LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+421LC5Y	250	336	354	421	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1520-3G2+421LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+471LC5Y	300	386	404	471	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1520-3G2+471LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+521LC5Y	350	436	454	521	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1520-3G2+521LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+571LC5Y	400	486	504	571	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1520-3G2+571LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+621LC5Y	450	536	554	621	0.05	0.015	0.011	0.012	±0.03	0.023
BNK 1520-3G2+621LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+671LC5Y	500	586	604	671	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 1520-3G2+671LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+721LC5Y	550	636	654	721	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1520-3G2+721LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+771LC5Y	600	686	704	771	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1520-3G2+771LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+871LC5Y	700	786	804	871	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 1520-3G2+871LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1520-3G0+971LC5Y	800	886	904	971	0.085	0.015	0.011	0.012	±0.04	0.027
BNK 1520-3G2+971LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	

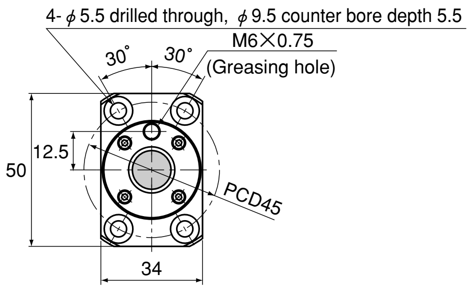
Note For accuracy grade C5, clearance GT is also standardized.

Selecting a Model Number Refer to the " THK General Catalog - Technical Descriptions of the Products," provided separately

Model BNK1616-3.6

Shaft diameter: 16; lead: 16





X-X arrow view

Ball Screw Specifications			
Lead (mm)	16		
BCD (mm)	16.65		
Thread minor diameter (mm)	13.7		
Threading direction, No. of threaded grooves	Rightward, 2		
No. of circuits	1.8 turns x 2 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	4.4	7.1	7.1
Basic static load rating C_0a (kN)	7.2	14.3	14.3
Preload torque (N-m)	2×10^{-2} to 9.8×10^{-2}	—	—
Spacer ball	1:1	None	None

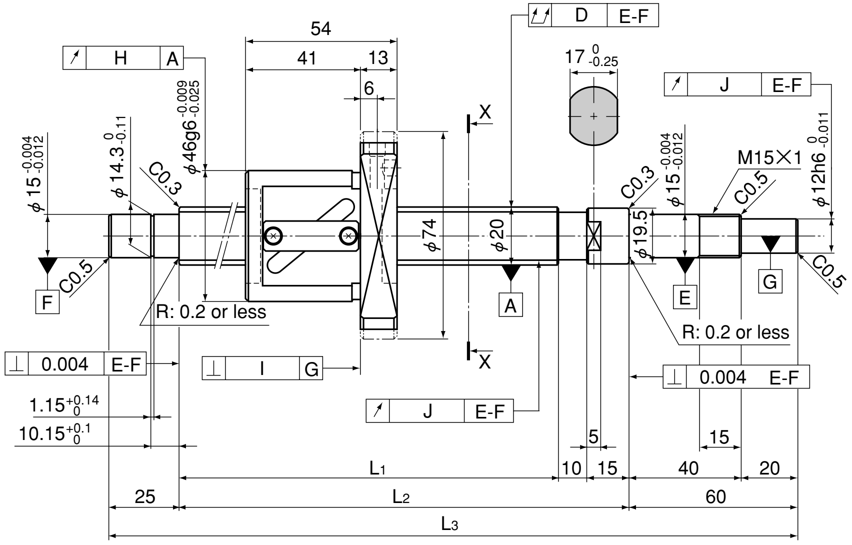
Unit: mm

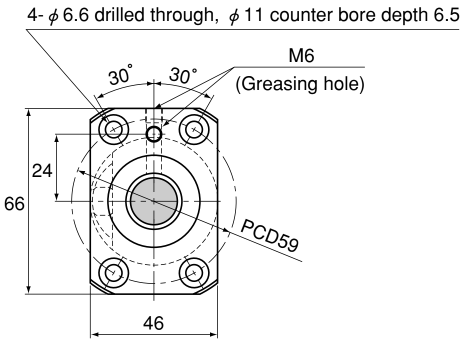
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L1	L2	L3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 1616-3.6G0+321LC5Y	150	234	254	321	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1616-3.6G2+321LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+371LC5Y	200	284	304	371	0.035	0.015	0.011	0.012	±0.023	0.018
BNK 1616-3.6G2+371LC7Y					0.055	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+421LC5Y	250	334	354	421	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1616-3.6G2+421LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+471LC5Y	300	384	404	471	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 1616-3.6G2+471LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+521LC5Y	350	434	454	521	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1616-3.6G2+521LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+571LC5Y	400	484	504	571	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 1616-3.6G2+571LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+621LC5Y	450	534	554	621	0.05	0.015	0.011	0.012	±0.03	0.023
BNK 1616-3.6G2+621LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+671LC5Y	500	584	604	671	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 1616-3.6G2+671LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+721LC5Y	550	634	654	721	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1616-3.6G2+721LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+771LC5Y	600	684	704	771	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 1616-3.6G2+771LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+871LC5Y	700	784	804	871	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 1616-3.6G2+871LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 1616-3.6G0+971LC5Y	800	884	904	971	0.085	0.015	0.011	0.012	±0.04	0.027
BNK 1616-3.6G2+971LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Model BNK2010-2.5

Shaft diameter: 20; lead: 10





X-X arrow view

Ball Screw Specifications			
Lead (mm)	10		
BCD (mm)	21		
Thread minor diameter (mm)	16.4		
Threading direction, No. of threaded grooves	Rightward, 1		
No. of circuits	2.5 turns x 1 row		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	7	11.1	11.1
Basic static load rating C₀a (kN)	11	22	22
Preload torque (N-m)	2 x 10^{-2} to 9.8 x 10^{-2}	—	—
Spacer ball	1:1	None	None

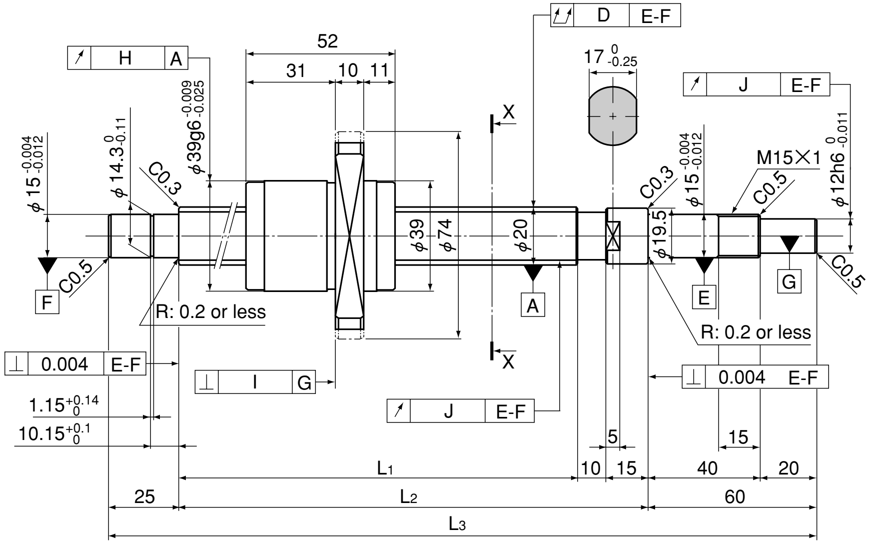
Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy	
		L₁	L₂	L₃					Representative travel distance error	Fluctuation
BNK 2010-2.5RRG0+499LC5Y	300	389	414	499	0.04	0.015	0.011	0.012	±0.025	0.02
BNK 2010-2.5RRG2+499LC7Y					0.06	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+599LC5Y	400	489	514	599	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 2010-2.5RRG2+599LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+699LC5Y	500	589	614	699	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 2010-2.5RRG2+699LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+799LC5Y	600	689	714	799	0.065	0.015	0.011	0.012	±0.035	0.025
BNK 2010-2.5RRG2+799LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+899LC5Y	700	789	814	899	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 2010-2.5RRG2+899LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+999LC5Y	800	889	914	999	0.085	0.015	0.011	0.012	±0.04	0.027
BNK 2010-2.5RRG2+999LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+1099LC5Y	900	989	1014	1099	0.11	0.015	0.011	0.012	±0.04	0.027
BNK 2010-2.5RRG2+1099LC7Y					0.15	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+1199LC5Y	1000	1089	1114	1199	0.11	0.015	0.011	0.012	±0.046	0.03
BNK 2010-2.5RRG2+1199LC7Y					0.15	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2010-2.5RRG0+1299LC5Y	1100	1189	1214	1299	0.15	0.015	0.011	0.012	±0.046	0.03
BNK 2010-2.5RRG2+1299LC7Y					0.19	0.03	0.018	0.014	Travel distance error: ±0.05/300	

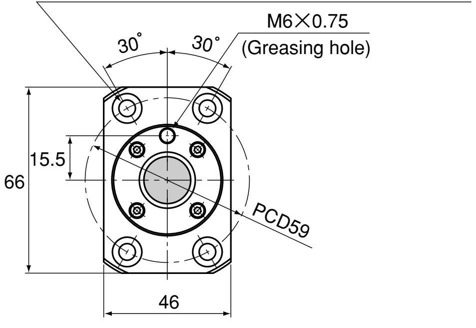
Note For accuracy grade C5, clearance GT is also standardized.

Model BNK2020-3.6

Shaft diameter: 20; lead: 20



4-φ6.6 drilled through, φ11 counter bore depth 6.5



X-X arrow view

Ball Screw Specifications			
Lead (mm)	20		
BCD (mm)	20.75		
Thread minor diameter (mm)	17.5		
Threading direction, No. of threaded grooves	Rightward, 2		
No. of circuits	1.8 turns x 2 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	7	11.1	11.1
Basic static load rating C_0a (kN)	12.3	24.7	24.7
Preload torque (N-m)	2×10^{-2} to 9.8×10^{-2}	—	—
Spacer ball	1:1	None	None

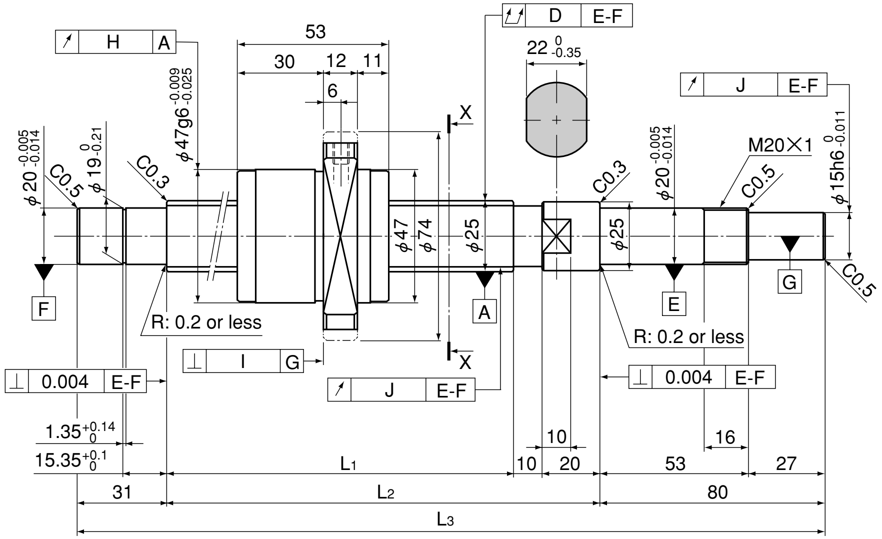
Unit: mm

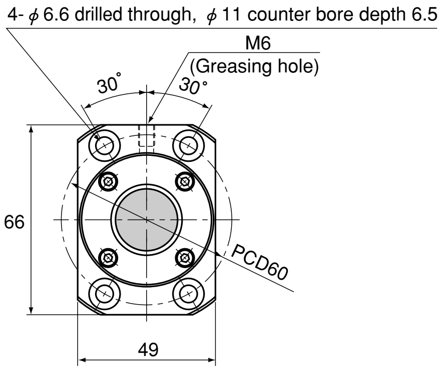
Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis D	Run-out of the nut circumference H	Flange perpendicularity I	Run-out of the thread groove surface J	Lead accuracy	
		L_1	L_2	L_3					Representative travel distance error	Fluctuation
BNK 2020-3.6G0+520LC5Y	300	410	435	520	0.05	0.015	0.011	0.012	±0.027	0.02
BNK 2020-3.6G2+520LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+620LC5Y	400	510	535	620	0.05	0.015	0.011	0.012	±0.03	0.023
BNK 2020-3.6G2+620LC7Y					0.075	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+720LC5Y	500	610	635	720	0.065	0.015	0.011	0.012	±0.03	0.023
BNK 2020-3.6G2+720LC7Y					0.09	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+820LC5Y	600	710	735	820	0.085	0.015	0.011	0.012	±0.035	0.025
BNK 2020-3.6G2+820LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+920LC5Y	700	810	835	920	0.085	0.015	0.011	0.012	±0.04	0.027
BNK 2020-3.6G2+920LC7Y					0.12	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+1020LC5Y	800	910	935	1020	0.11	0.015	0.011	0.012	±0.04	0.027
BNK 2020-3.6G2+1020LC7Y					0.15	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+1120LC5Y	900	1010	1035	1120	0.11	0.015	0.011	0.012	±0.046	0.03
BNK 2020-3.6G2+1120LC7Y					0.15	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+1220LC5Y	1000	1110	1135	1220	0.11	0.015	0.011	0.012	±0.046	0.03
BNK 2020-3.6G2+1220LC7Y					0.15	0.03	0.018	0.014	Travel distance error: ±0.05/300	
BNK 2020-3.6G0+1320LC5Y	1100	1210	1235	1320	0.15	0.015	0.011	0.012	±0.046	0.03
BNK 2020-3.6G2+1320LC7Y					0.19	0.03	0.018	0.014	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Model BNK2520-3.6

Shaft diameter: 25; lead: 20





X-X arrow view

Ball Screw Specifications			
Lead (mm)	20		
BCD (mm)	26		
Thread minor diameter (mm)	21.9		
Threading direction, No. of threaded grooves	Rightward, 2		
No. of circuits	1.8 turns x 2 rows		
Clearance symbol	G0	GT	G2
Axial clearance (mm)	0	0.005 or less	0.02 or less
Basic dynamic load rating Ca (kN)	10.5	16.7	16.7
Basic static load rating C0a (kN)	19	38	38
Preload torque (N-m)	4.9 x 10^{-2} to 2.2 x 10^{-2}	—	—
Spacer ball	1:1	None	None

Unit: mm

Model No.	Stroke	Screw shaft length			Run-out of the screw shaft axis	Run-out of the nut circumference	Flange perpendicularity	Run-out of the thread groove surface	Lead accuracy	
		L1	L2	L3	D	H	I	J	Representative travel distance error	Fluctuation
BNK 2520-3.6G0+751LC5Y	500	610	640	751	0.055	0.015	0.011	0.013	±0.03	0.023
BNK 2520-3.6G2+751LC7Y					0.07	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+851LC5Y	600	710	740	851	0.065	0.015	0.011	0.013	±0.035	0.025
BNK 2520-3.6G2+851LC7Y					0.085	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+1051LC5Y	800	910	940	1051	0.085	0.015	0.011	0.013	±0.04	0.027
BNK 2520-3.6G2+1051LC7Y					0.1	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+1251LC5Y	1000	1110	1140	1251	0.11	0.015	0.011	0.013	±0.046	0.03
BNK 2520-3.6G2+1251LC7Y					0.13	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+1451LC5Y	1200	1310	1340	1451	0.11	0.015	0.011	0.013	±0.054	0.035
BNK 2520-3.6G2+1451LC7Y					0.13	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+1651LC5Y	1400	1510	1540	1651	0.14	0.015	0.011	0.013	±0.054	0.035
BNK 2520-3.6G2+1651LC7Y					0.17	0.03	0.018	0.02	Travel distance error: ±0.05/300	
BNK 2520-3.6G0+1851LC5Y	1600	1710	1740	1851	0.14	0.015	0.011	0.013	±0.065	0.04
BNK 2520-3.6G2+1851LC7Y					0.17	0.03	0.018	0.02	Travel distance error: ±0.05/300	

Note For accuracy grade C5, clearance GT is also standardized.

Standard-Lead Precision Ball Screw

High-Speed Ball Screw with Ball Cage Model SBN

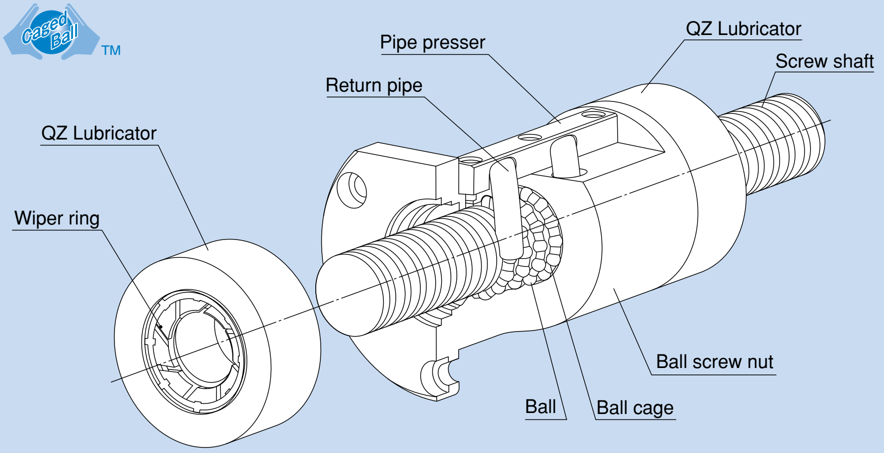


Fig. 1 Structure of High-Speed Ball Screw with Ball Cage Model SBN

Structure and Features

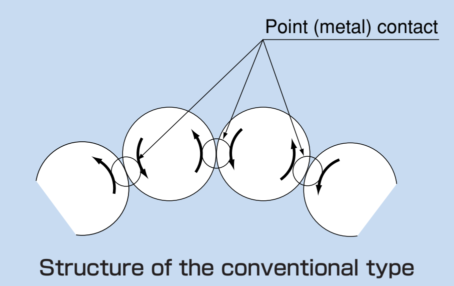
With High-Speed Ball Screw with Ball Cage model SBN, balls are evenly spaced by a ball cage to eliminate friction between the balls.

Additionally, the grease retained in the space between the ball circulation path and the ball cage (grease pocket) is drawn to the contact surface between the balls and the ball cage to form an oil film on the surface of the ball. As a result, an oil film is not easily broken.

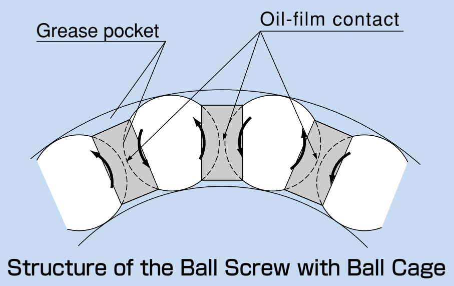
Model SBN has an optimum circulation structure where balls are picked up at the tangential direction by a return pipe (Fig. 2) and is provided with a strengthened circulation path, thus to achieve a DN value* of 130,000 (* DN value = ball center diameter x rotation speed per minute).

As a result of adopting the offset preloading method (Fig. 4), which shifts the lead in the central area of the ball screw nut, its overall ball screw nut length is shorter and its body is more compact than the double-nut type, which uses the spacer-based preloading method.

Optionally, QZ Lubricator for Ball Screws, which has been developed for long-term maintenance-free operation, and a wiper ring, which prevents foreign matter from entering the ball screw nut, are available.



Structure of the conventional type



Structure of the Ball Screw with Ball Cage

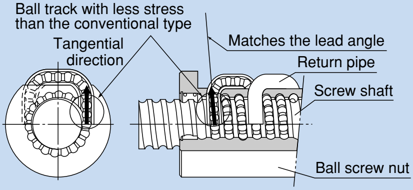


Fig. 2 Circulation Structure of Model SBN

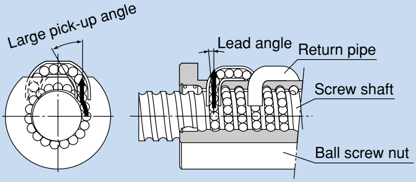


Fig. 3 Circulation Structure of Conventional Type

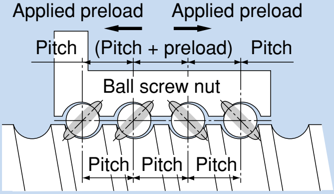


Fig. 4 Offset Preloading Method

Ball Cage Effect

●Low noise, acceptable running sound

Use of a ball cage eliminates collision noise between balls.

In addition, the fact that balls are picked up at the tangential direction also contributes to eliminating collision noise generated from circulating balls.

●Long-term, maintenance-free operation

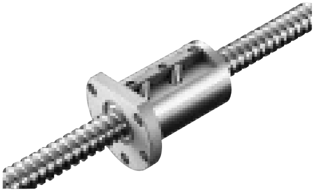
Since friction between balls is eliminated and grease is retained in the grease pocket, long-term, maintenance-free operation (replenishment of grease is unnecessary for a long period) is achieved.

●Smooth motion

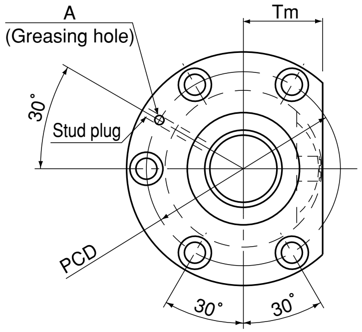
Use of a ball cage eliminates friction between balls and minimizes torque fluctuation, thus allowing smooth motion to be achieved.

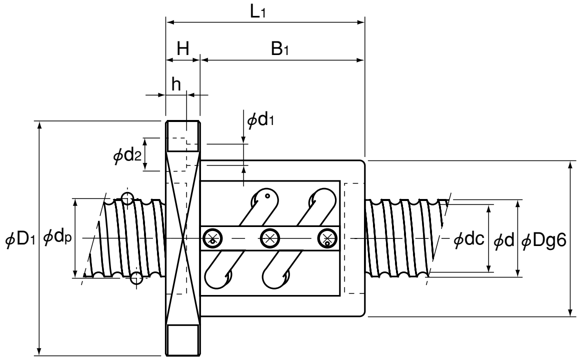
Type

Offset-preload Type Model SBN



Model SBN





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Tm	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
○ SBN 3210-7	32	10	33.75	26.4	1×3.5	43	73.1	836.7	74	108	120	15	105	90	9×14×8.5	38	M6	8.08×10^{-3}
○ SBN 3212-5	32	12	34	26.1	1×2.5	37.4	58.7	612.2	76	121	117	18	99	98	11×17.5×11	39	M6	8.08×10^{-3}
○ SBN 3610-7	36	10	37.75	30.4	1×3.5	45.6	82.3	920.9	77	120	123	18	105	98	11×17.5×11	40	M6	1.29×10^{-2}
○ SBN 3612-7	36	12	38	30.1	1×3.5	53.2	92.6	934.5	81	124	140	18	122	102	11×17.5×11	42	M6	1.29×10^{-2}
○ SBN 3616-5	36	16	38	30.1	1×2.5	39.7	66.4	676	81	124	140	18	122	102	11×17.5×11	42	M6	1.29×10^{-2}
○ SBN 4012-5	40	12	42	34.1	1×2.5	42	73.6	735.4	84	126	119	18	101	104	11×17.5×11	43	M6	1.97×10^{-2}
○ SBN 4016-5	40	16	42	34.1	1×2.5	41.9	73.8	736.6	84	126	144	18	126	104	11×17.5×11	43	M6	1.97×10^{-2}
○ SBN 4512-5	45	12	47	39.2	1×2.5	44.4	82.9	809.1	90	130	119	18	101	110	11×17.5×11	46	PT 1/8	3.16×10^{-2}
○ SBN 4516-5	45	16	47	39.2	1×2.5	44.3	83.1	810.1	90	130	140	18	122	110	11×17.5×11	46	PT 1/8	3.16×10^{-2}
○ SBN 5012-5	50	12	52	44.1	1×2.5	46.6	92.2	880.9	95	141	119	22	97	117	14×20×13	48	PT 1/8	4.82×10^{-2}
○ SBN 5016-5	50	16	52	44.1	1×2.5	46.6	92.4	881.7	95	141	143	22	121	117	14×20×13	48	PT 1/8	4.82×10^{-2}
○ SBN 5020-5	50	20	52	44.1	1×2.5	46.5	92.6	882.8	95	141	169	22	147	117	14×20×13	48	PT 1/8	4.82×10^{-2}

Note With model SBN, the raising of both ends of the thread groove is not available.
When designing your system this way, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-110.

Model number coding

SBN4012-5 RR G0 +1400L C5
1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (G0 for all SBN variations) (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the rigidity and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

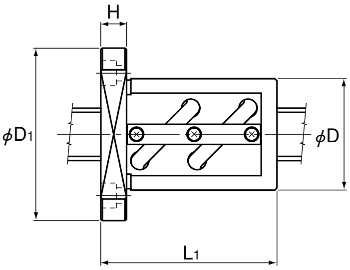
where

$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

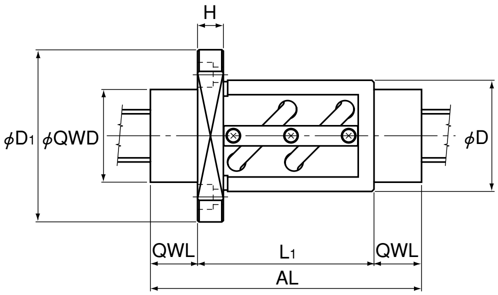
K: Rigidity value in the dimensional table.

Model SBN

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
SBN 3210-7	120	15	108	74	31	73	182
SBN 3212-5	117	18	121	76	33	73	183
SBN 3610-7	123	18	120	77	33	64	189
SBN 3612-7	140	18	124	81	35	64	210
SBN 3616-5	140	18	124	81	32	64	204
SBN 4012-5	119	18	126	84	38	66	195
SBN 4016-5	144	18	126	84	42	66	228
SBN 4512-5	119	18	130	90	35.5	79	190
SBN 4516-5	140	18	130	90	35.5	79	211
SBN 5012-5	119	22	141	95	38.5	79	196
SBN 5016-5	143	22	141	95	38.5	79	220
SBN 5020-5	169	22	141	95	40.5	79	250

Model number coding

SBN3210-7 QZ WW G0 +1200L C5

1 2 3 4 5 6

1 Model number 2 With QZ Lubricator (see page k-22)
3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4 Axial clearance symbol (see page k-15) 5 Overall screw shaft length (in mm)
6 Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Precautions on Use

THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

High-Load Ball Screw with Ball Cage Model HBN

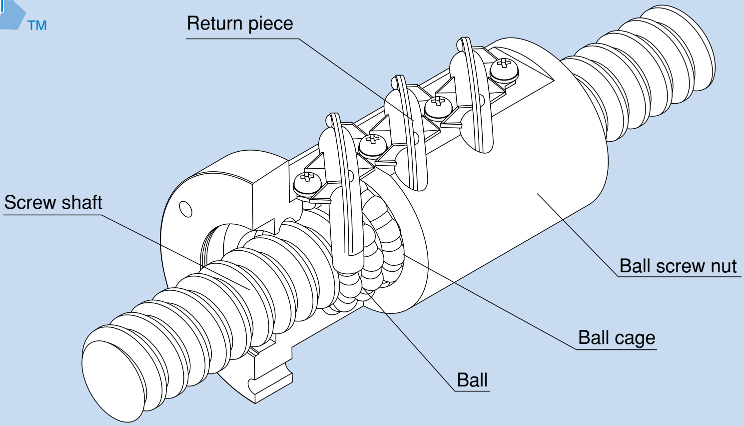


Fig. 1 Structure of High-Load Ball Screw with Ball Cage Model HBN

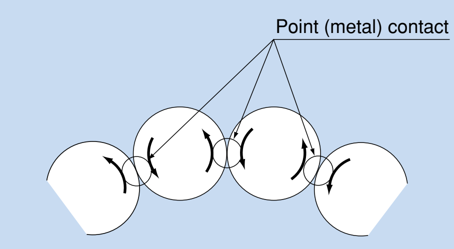
Structure and Features

With High-Load Ball Screw with Ball Cage model HBN, balls are evenly spaced by a ball cage to eliminate friction between the balls.

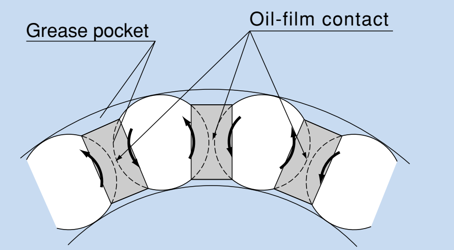
Additionally, the grease retained in the space between the ball circulation path and the ball cage (grease pocket) is drawn to the contact surface between the balls and the ball cage to form an oil film on the surface of the ball. As a result, an oil film is not easily broken.

With the optimal design (ball cage, ball diameter, groove curvature radius, contact angle between the ball and the groove, number of turns, etc.) for high loads, model HBN achieves a rated load more than twice the conventional type.

It has a ball circulation structure where balls are picked up at the tangential direction by a return piece (Fig. 2) and is provided with a strengthened circulation path, thus to enable the Ball Screw to operate at a DN value of 130,000.



Structure of the conventional type



Structure of the Ball Screw with Ball Cage

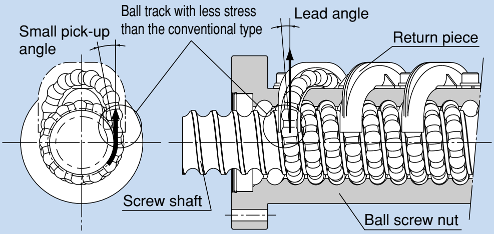


Fig. 2 Circulation Structure of Model HBN

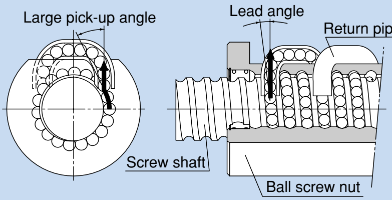


Fig. 3 Circulation Structure of Conventional Type

Ball Cage Effect

●Low noise, acceptable running sound

Use of a ball cage eliminates collision noise between balls.

In addition, the fact that balls are picked up at the tangential direction also contributes to eliminating collision noise generated from circulating balls.

●Long-term maintenance-free operation

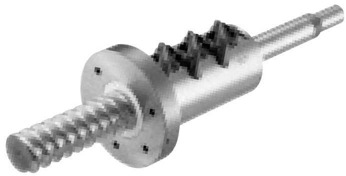
Since friction between balls is eliminated and grease is retained in the grease pocket, long-term maintenance-free operation (replenishment of grease is unnecessary for a long period) is achieved.

●Smooth motion

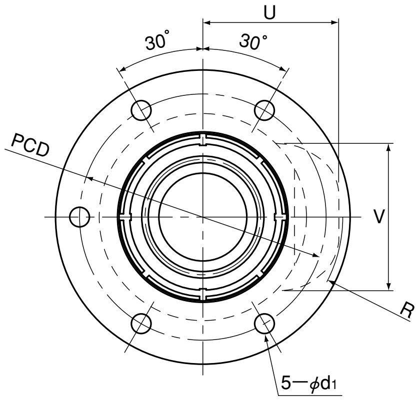
Use of a ball cage eliminates friction between balls and minimizes torque fluctuation, thus allowing smooth motion to be achieved.

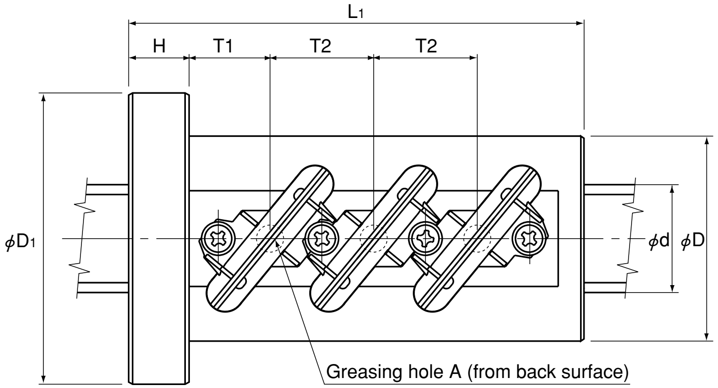
Type

Non-preload Type Model HBN



Model HBN





Unit: mm

Model No.	Screw shaft outer diameter	Lead	Ball center diameter	Thread minor diameter	No. of loaded circuits	Basic load rating		Permissible load*	Rigidity	Nut dimensions												Screw shaft inertial moment/mm
	d	R	dp	dc	Rows x turns	Ca kN	C_{0a} kN	F_P kN	K N/μm	Outer diameter D	Flange diameter D_1	Overall length L_1	H	PCD	d_1	T1	T2	U_{MAX}	V_{MAX}	R_{MAX}	Greasing hole A	kg·cm²/mm
HBN 3210-5	32	10	34	26	2×2.5	102.9	191.3	31.9	1077	58	85	98	15	71	6.6	22	30	42	46	43.5	M6	8.08×10^{-3}
HBN 3610-5	36	10	38	30	2×2.5	108.2	220.4	33.5	1176	62	89	98	15	75	6.6	22	30	44	50	46	M6	1.29×10^{-2}
HBN 3612-5	36	12	38.4	29	2×2.5	141.1	267.7	43.7	1207	66	100	116	18	82	9	26	36	48	52.5	50	M6	1.29×10^{-2}
HBN 4010-7.5	40	10	42	34	3×2.5	162.6	336	50.4	1910	66	100	135	18	82	9	23.5	30	45.5	54	48	M6	1.97×10^{-2}
HBN 4012-7.5	40	12	42.4	33	3×2.5	212.4	441.6	65.8	1922	70	104	152	18	86	9	26	36	50	56	52	M6	1.97×10^{-2}
HBN 5010-7.5	50	10	52	44	3×2.5	179.1	462.7	55.5	2279	78	112	135	18	94	9	23.5	30	51	63.5	54.5	M6	4.82×10^{-2}
HBN 5012-7.5	50	12	52.4	43	3×2.5	235.7	572.2	73.1	2345	80	114	152	18	96	9	26	36	55	66	58.5	M6	4.82×10^{-2}
HBN 5016-7.5	50	16	53	39.6	3×2.5	379.6	820.9	117.7	2392	95	135	211	28	113	9	37.5	48	63.4	69.6	65.2	PT 1/8	4.82×10^{-2}
HBN 6316-7.5	63	16	66	52.6	3×2.5	427.1	1043.8	132.4	2898	105	139	211	28	122	9	37.5	48	69.5	82	72.5	PT 1/8	1.21×10^{-1}
HBN 6316-10.5	63	16	66	52.6	3×3.5	577.1	1461.3	178.9	4029	105	139	259	28	122	9	53.5	64	69.5	82	73	PT 1/8	1.21×10^{-1}
HBN 6320-7.5	63	20	66.5	49.6	3×2.5	578.8	1283.1	179.4	3030	117	157	252	32	137	11	44	60	78	86.5	80	PT 1/8	1.21×10^{-1}

Note The permissible load F_P indicates the maxim axial load that the Ball Screw can receive.
This model is capable of achieving a longer service life than the conventional Ball Screw under a high load.
For the axial clearance, this model has clearance G2 as standard. Other clearance is also available at your request. Contact THK for details.

Model number coding

HBN3210-5 RR G2 +1200L C7
(1: HBN3210-5; 2: RR; 3: G2; 4: +1200L; 5: C7)

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Standard-Lead Precision Ball Screw

Return-Pipe Nut

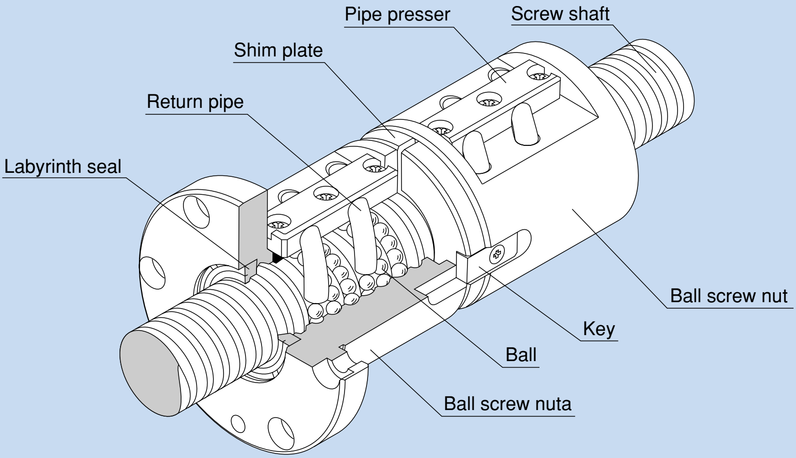


Fig. 1 Structure of the Return-Pipe Nut

Structure and Features

With the Return-Pipe Nut, balls under a load roll around the circumference of the screw shaft, while receiving an axial load on the ball raceways formed between the screw shaft and the ball screw nut, then pass through the return pipe incorporated in the ball screw nut and circulate back to the loaded area, thus to achieve infinite motion. Being the most common type is the series with the broadest range of variations, it can be used in a wide array of applications.

Types and Features

Offset-Preload Type Model BIF

The right and left screws are provided with a phase in the middle of the ball screw nut, and an axial clearance is set at a below-zero value (under a preload). This compact model is capable of smooth motion.

Double-nut Preload Type Model BNFN

The most common type with a preload provided via a spacer between the two combined ball screw nuts to eliminate backlash. It can be mounted using the bolt holes drilled on the flange.

Non-preload Type Model BNF

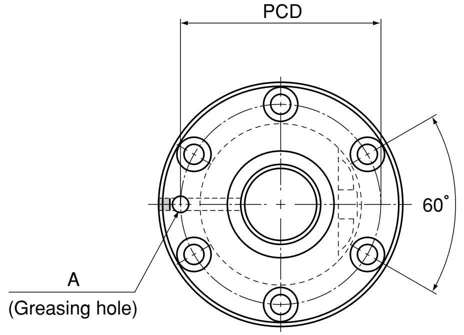
The simplest type with a single ball screw nut. It is designed to be mounted using the bolt holes drilling on the flange.

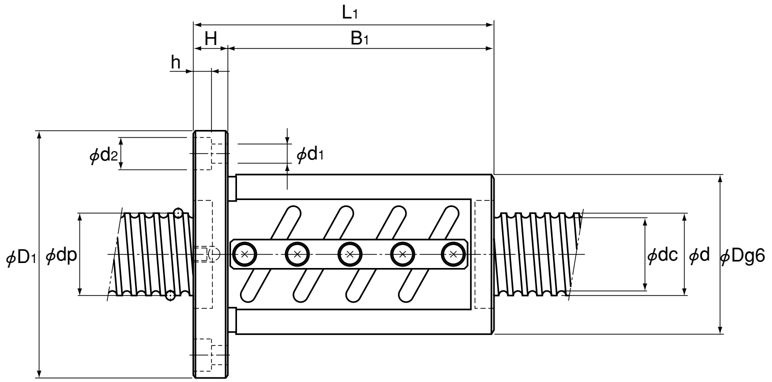
Non-preload Type with a Square Ball Screw Nut Model BNT

Since mounting screw holes are machined on the square ball screw nut, this model can compactly be mounted on the machine without a housing.

Model BIF

Offset-preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BIF 1605-5	16	5	16.75	13.2	1×2.5	7.4	13.9	330	40	60	56	10	46	50	4.5×8×4.5	M6	5.05×10^{-4}
BIF 1606-5		6	16.8	13.2	1×2.5	7.5	14	330	40	60	62	10	52	50	4.5×8×4.5	M6	5.05×10^{-4}
BIF 1810-3	18	10	18.8	15.5	1×1.5	5.1	9.6	230	42	65	75	12	63	53	5.5×9.5×5.5	M6	8.09×10^{-4}
BIF 2004-5	20	4	20.5	17.8	1×2.5	4.8	10.9	360	40	63	53	11	42	51	5.5×9.5×5.5	M6	1.23×10^{-3}
BIF 2005-5		5	20.75	17.2	1×2.5	8.3	17.4	390	44	67	56	11	45	55	5.5×9.5×5.5	M6	1.23×10^{-3}
BIF 2006-3		6	20.75	17.2	1×1.5	5.4	10.5	250	48	71	56	11	45	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BIF 2006-5			20.75	17.2	1×2.5	8.3	17.5	390	48	71	62	11	51	59	5.5×9.5×5.5	M6	1.23×10^{-3}
○ BIF 2505-3	25	5	25.75	22.2	1×1.5	6	13.1	280	50	73	52	11	41	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BIF 2505-5			25.75	22.2	1×2.5	9.2	22	470	50	73	55	11	44	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BIF 2508-5		8	26.25	20.5	1×2.5	15.8	32.8	500	58	85	82	15	67	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BIF 2510A-5		10	26.3	21.4	1×2.5	15.8	33	500	58	85	100	18	82	71	6.6×11×6.5	M6	3.01×10^{-3}
BIF 2805-5	28	5	28.75	25.2	1×2.5	9.7	24.6	520	55	85	59	12	47	69	6.6×11×6.5	M6	4.74×10^{-3}
BIF 2805-10			28.75	25.2	2×2.5	17.4	49.4	1000	55	85	89	12	77	69	6.6×11×6.5	M6	4.74×10^{-3}
BIF 2806-5		6	28.75	25.2	1×2.5	9.6	24.6	520	55	85	68	12	56	69	6.6×11×6.5	M6	4.74×10^{-3}
BIF 2806-10			28.75	25.2	2×2.5	17.5	49.4	1000	55	85	104	12	92	69	6.6×11×6.5	M6	4.74×10^{-3}
BIF 2810-3		10	29.75	22.4	2×1.5	15.7	29.4	350	65	106	88	18	70	85	11×17.5×11	M6	4.74×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-122.

Model number coding

BIF2005-5 RR G0 +1000L C3

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

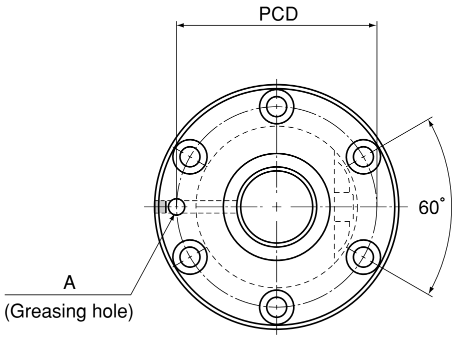
where

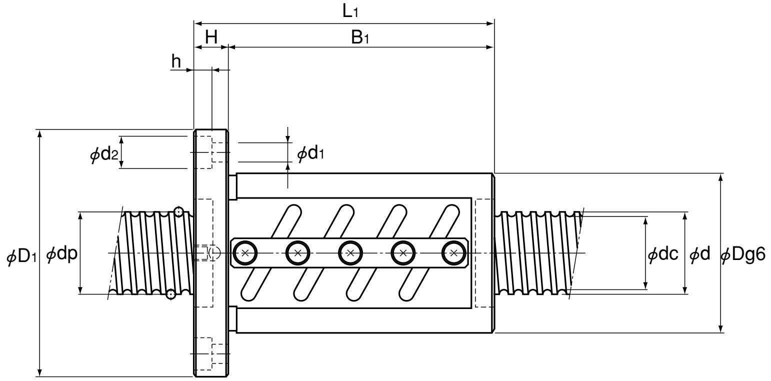
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BIF

Offset-preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1×d2×h	Greasing hole A	Screw shaft inertial moment/mm kg•cm²/mm
BIF 3204-10	32	4	32.5	30.1	2×2.5	10.5	35.4	1010	54	81	76	11	65	67	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3205-5		5	32.75	29.2	1×2.5	10.2	28.1	570	58	85	56	12	44	71	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3205-10			32.75	29.2	2×2.5	18.5	56.4	1110	58	85	86	12	74	71	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3206-5		6	33	28.4	1×2.5	13.9	35.2	600	62	89	63	12	51	75	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3206-7			33	28.4	1×3.5	18.5	49.2	810	62	89	75	12	63	75	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3206-10			33	28.4	2×2.5	25.2	70.4	1150	62	89	99	12	87	75	6.6×11×6.5	M6	8.08×10⁻³
○ BIF 3208A-5		8	33.25	27.5	1×2.5	17.8	42.2	610	66	100	82	15	67	82	9×14×8.5	M6	8.08×10⁻³
○ BIF 3208A-7			33.25	27.5	1×3.5	23.8	59.1	840	66	100	98	15	83	82	9×14×8.5	M6	8.08×10⁻³
○ BIF 3210A-5		10	33.75	26.4	1×2.5	26.1	56.2	640	74	108	100	15	85	90	9×14×8.5	M6	8.08×10⁻³
○ BIF 3610-5	36	10	37.75	30.5	1×2.5	27.6	63.3	700	75	120	111	18	93	98	11×17.5×11	M6	1.29×10⁻²
○ BIF 3610-10			37.75	30.5	2×2.5	50.1	126.4	1350	75	120	171	18	153	98	11×17.5×11	M6	1.29×10⁻²
○ BIF 4010-5	40	10	41.75	34.4	1×2.5	29	70.4	750	82	124	103	18	85	102	11×17.5×11	M6	1.97×10⁻²
○ BIF 4010-10			41.75	34.4	2×2.5	52.7	141.1	1470	82	124	163	18	145	102	11×17.5×11	M6	1.97×10⁻²
○ BIF 4012-5		12	42	34.1	1×2.5	33.9	79.2	770	84	126	119	18	101	104	11×17.5×11	M6	1.97×10⁻²
○ BIF 4012-10			42	34.1	2×2.5	61.6	158.8	1490	84	126	191	18	173	104	11×17.5×11	M6	1.97×10⁻²
○ BIF 5010-5	50	10	51.75	44.4	1×2.5	32	88.2	900	93	135	103	18	85	113	11×17.5×11	PT 1/8	4.82×10⁻²
○ BIF 5010-10			51.75	44.4	2×2.5	58.2	176.4	1750	93	135	163	18	145	113	11×17.5×11	PT 1/8	4.82×10⁻²

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-122.

Model number coding

BIF3206-10 RR G0 +1200L C3

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.

These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

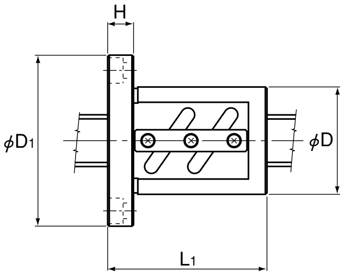
where

$$K_N = K\left(\frac{F_{a0}}{0.1Ca}\right)^{\frac{1}{3}}$$

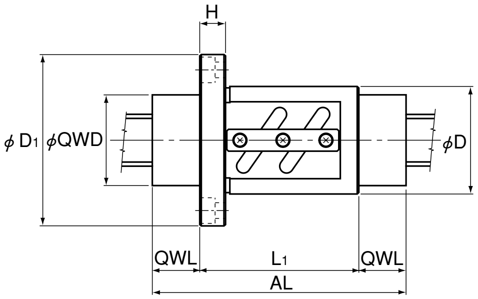
K: Rigidity value in the dimensional table.

Model BIF

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
BIF 2505-3	52	11	73	50	32.5	45	117
BIF 2505-5	55						120
BIF 2508-5	82	15	85	58	34	45	150
BIF 2510A-5	100	18	85	58	37	45	174
BIF 3205-5	56	12	85	58	32	57	120
BIF 3205-10	86						150
BIF 3206-5	63	12	89	62	32	57	127
BIF 3206-7	75						139
BIF 3206-10	99						163
BIF 3208A-5	82	15	100	66	34	57	150
BIF 3208A-7	98						166
BIF 3210A-5	100	15	108	74	31	73	162
BIF 3610-5	111	18	120	75	33	64	177
BIF 3610-10	171						237
BIF 4010-5	103	18	124	82	37	66	177
BIF 4010-10	163						237
BIF 4012-5	119	18	126	84	38	66	195
BIF 4012-10	191						267
BIF 5010-10	163	18	135	93	37.5	79	238

Model number coding

BIF2505-3 QZ WW G0 +1000L C5

1 2 3 4 5 6

1 Model number 2 With QZ Lubricator (see page k-22)

3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)

4 Axial clearance symbol (see page k-15) 5 Overall screw shaft length (in mm)

6 Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Precautions on Use

THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

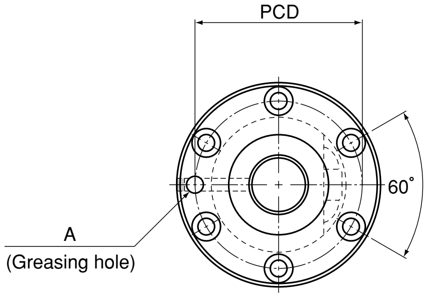
- When desiring to use the product in a special environment, contact THK.

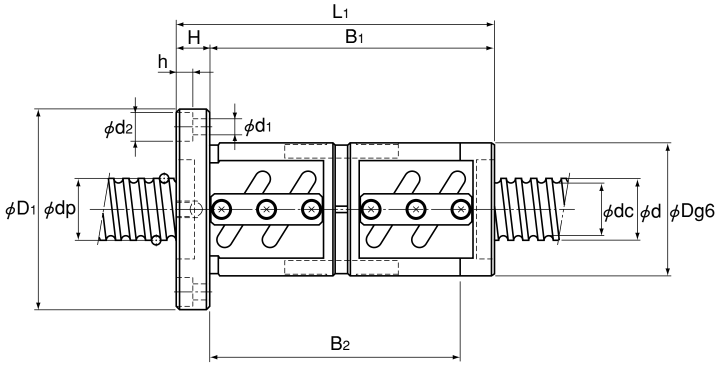
Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions									Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C0a kN		Outer diameter D	Flange diameter D1	Overall length L1	H	B1	B2	PCD	d1×d2×h	Greasing hole A	
BNFN 1604-3	16	4	16.5	13.8	2×1.5	5.1	10.5	350	36	59	85	11	74	—	47	5.5×9.5×5.5	M6	5.05×10⁻⁴
BNFN 1605-2.5		5	16.75	13.2	1×2.5	7.4	13.9	330	40	60	76	10	66	55	50	4.5×8×4.5	M6	5.05×10⁻⁴
BNFN 1605-3			16.75	13.2	2×1.5	8.7	16.8	390	40	60	96	10	86	75	50	4.5×8×4.5	M6	5.05×10⁻⁴
BNFN 1605-5			16.75	13.2	2×2.5	13.5	27.8	640	40	60	106	10	96	85	50	4.5×8×4.5	M6	5.05×10⁻⁴
BNFN 1610-1.5		10	16.8	13.2	1×1.5	4.8	8.5	210	40	63	72	11	61	—	51	5.5×9.5×5.5	M6	5.05×10⁻⁴
BNFN 1810-2.5	18	10	18.8	15.5	1×2.5	7.8	15.9	360	42	65	119	12	107	94	53	5.5×9.5×5.5	M6	8.09×10⁻⁴
BNFN 1810-3			18.8	15.5	2×1.5	9.2	19.1	430	42	65	135	12	123	110	53	5.5×9.5×5.5	M6	8.09×10⁻⁴
BNFN 2004-2.5	20	4	20.5	17.8	1×2.5	4.8	10.9	360	40	63	69	11	58	—	51	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2004-5			20.5	17.8	2×2.5	8.6	21.8	700	40	63	93	11	82	—	51	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2005-2.5		5	20.75	17.2	1×2.5	8.3	17.4	390	44	67	76	11	65	53	55	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2005-3			20.75	17.2	2×1.5	9.7	21	470	44	67	97	11	86	74	55	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2005-3.5			20.75	17.2	1×3.5	11.1	24.5	550	44	67	85	11	74	62	55	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2005-5			20.75	17.2	2×2.5	15.1	35	760	44	67	106	11	95	83	55	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2006-2.5		6	20.75	17.2	1×2.5	8.3	17.5	390	48	71	86	11	75	—	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2006-3			20.75	17.2	2×1.5	9.7	21	470	48	71	110	11	99	—	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2006-3.5			20.75	17.2	1×3.5	11.1	24.5	550	48	71	98	11	87	—	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2006-5			20.75	17.2	2×2.5	15.1	35	760	48	71	122	11	111	—	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2008-2.5		8	21	16.4	1×2.5	15.1	35	760	46	74	100	15	85	—	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2010A-1.5		10	21	16.4	1×1.5	7.2	13.2	250	46	74	98	15	83	67	59	5.5×9.5×5.5	M6	1.23×10⁻³
BNFN 2012-1.5		12	21	16.4	1×1.5	7.1	12.5	250	48	71	100	18	82	—	59	5.5×9.5×5.5	M6	1.23×10⁻³

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNFN1810-2.5 RR G0 +900L C3

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

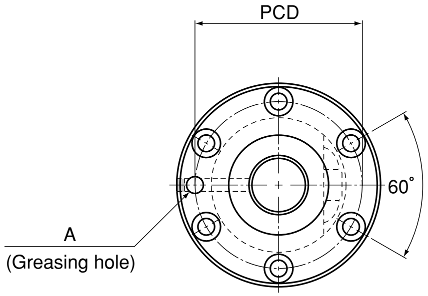
where

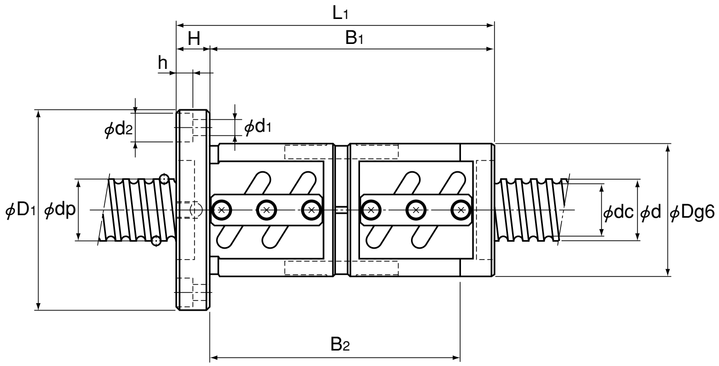
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity	Nut dimensions									Screw shaft inertial moment kg·cm²/mm
						Ca kN	C_{0a} kN	K N/μm	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1\times d_2\times h$	Greasing hole A	
○ BNFN 2504-2.5	25	4	25.5	22.8	1×2.5	5.2	13.7	420	46	69	68	11	57	—	57	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2504-5			25.5	22.8	2×2.5	9.5	27.3	820	46	69	92	11	81	—	57	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2505-2.5		5	25.75	22.2	1×2.5	9.2	22	470	50	73	75	11	64	52	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2505-3			25.75	22.2	2×1.5	10.8	26.4	560	50	73	102	11	91	79	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ **BNFN 2505-3.5**			25.75	22.2	1×3.5	12.3	30.7	650	50	73	85	11	74	62	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ **BNFN 2505-5**			25.75	22.2	2×2.5	16.7	44	910	50	73	105	11	94	82	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2506-2.5		6	26	21.4	1×2.5	12.5	27.3	490	53	76	86	11	75	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2506-3			26	21.4	2×1.5	14.6	32.8	580	53	76	110	11	99	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2506-3.5			26	21.4	1×3.5	15.1	35.9	670	53	76	98	11	87	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2506-5			26	21.4	2×2.5	22.5	54.8	940	53	76	122	11	111	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2508-2.5		8	26.25	20.5	1×2.5	15.8	32.8	500	58	85	106	15	91	—	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNFN 2508-3			26.25	20.5	2×1.5	18.5	39.4	600	58	85	135	15	120	—	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNFN 2508-3.5			26.25	20.5	1×3.5	21.2	46	690	58	85	122	15	107	—	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNFN 2508-5			26.25	20.5	2×2.5	28.7	65.8	970	58	85	154	15	139	—	71	6.6×11×6.5	M6	3.01×10^{-3}
○ **BNFN 2510A-2.5**		10	26.3	21.4	1×2.5	15.8	33	500	58	85	120	18	102	83	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNFN 2512-2.5		12	26	21.9	1×2.5	12.3	27.6	490	53	76	108	11	97	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNFN 2516-1.5		16	26	21.4	1×1.5	7.9	16.7	300	53	76	108	11	97	—	64	5.5×9.5×5.5	M6	3.01×10^{-3}
BNFN 2805-2.5	28	5	28.75	25.2	1×2.5	9.7	24.6	520	55	85	74	12	62	49	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2805-3			28.75	25.2	2×1.5	11.3	29.5	620	55	85	94	12	82	69	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2805-3.5			28.75	25.2	1×3.5	12.9	34.4	720	55	85	84	12	72	59	69	6.6×11×6.5	M6	4.74×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

BNFN2505-5 RR G0 +1000L C5

1 BNFN2505-5 — 2 RR — 3 G0 — 4 +1000L — 5 C5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

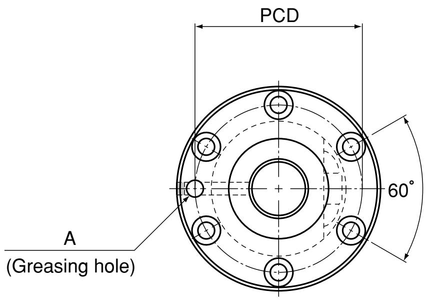
where

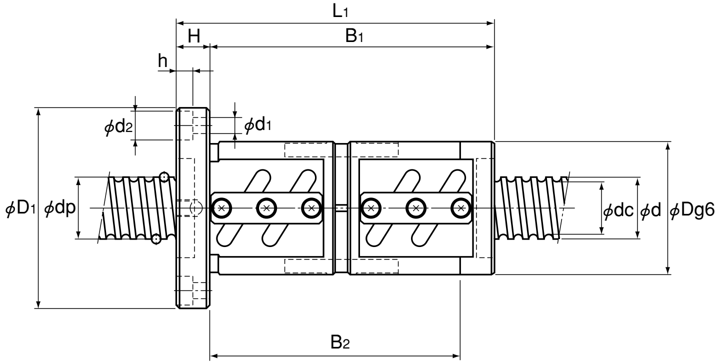
$$K_N = K\left(\frac{F_{a0}}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNFN 2805-5	28	5	28.75	25.2	2×2.5	17.5	49.4	1000	55	85	104	12	92	79	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2805-7.5			28.75	25.2	3×2.5	24.8	73.8	1470	55	85	134	12	122	109	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2806-2.5		6	28.75	25.2	1×2.5	9.6	24.6	520	55	85	86	12	74	61	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2806-3.5			28.75	25.2	1×3.5	12.9	34.5	710	55	85	98	12	86	73	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2806-5			28.75	25.2	2×2.5	17.5	49.4	1000	55	85	122	12	110	97	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2806-7.5			28.75	25.2	3×2.5	24.8	73.8	1470	55	85	158	12	146	133	69	6.6×11×6.5	M6	4.74×10^{-3}
BNFN 2808-2.5		8	29.25	23.6	1×2.5	16.8	36.8	550	60	104	116	18	98	—	82	11×17.5×11	M6	4.74×10^{-3}
BNFN 2808-3			29.25	23.6	2×1.5	19.6	44.2	660	60	104	144	18	126	—	82	11×17.5×11	M6	4.74×10^{-3}
BNFN 2808-5			29.25	23.6	2×2.5	30.4	73.7	1060	60	104	164	18	146	—	82	11×17.5×11	M6	4.74×10^{-3}
BNFN 2810-2.5		10	29.75	22.4	1×2.5	24	48.2	560	65	106	146	18	128	—	85	11×17.5×11	M6	4.74×10^{-3}
○ BNFN 3205-2.5	32	5	32.75	29.2	1×2.5	10.2	28.1	570	58	85	76	12	64	51	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3205-3			32.75	29.2	2×1.5	12	33.8	690	58	85	103	12	91	78	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3205-4.5			32.75	29.2	3×1.5	17	50.7	1000	58	85	123	12	111	98	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3205-5			32.75	29.2	2×2.5	18.5	56.4	1110	58	85	106	12	94	81	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3205-7.5			32.75	29.2	3×2.5	26.3	84.5	1640	58	85	136	12	124	111	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3206-2.5		6	33	28.4	1×2.5	13.9	35.2	600	62	89	87	12	75	62	75	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3206-3			33	28.4	2×1.5	16.3	42.2	710	62	89	111	12	99	86	75	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3206-5			33	28.4	2×2.5	25.2	70.4	1150	62	89	123	12	111	98	75	6.6×11×6.5	M6	8.08×10^{-3}
○ BNFN 3208A-2.5		8	33.25	27.5	1×2.5	17.8	42.2	610	66	100	106	15	91	—	82	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3208A-3			33.25	27.5	2×1.5	20.9	50.7	730	66	100	135	15	120	—	82	9×14×8.5	M6	8.08×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

BNFN2805-5 RR G0 +1200L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

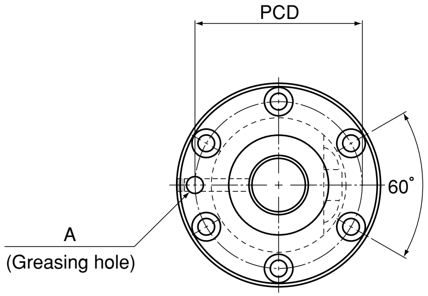
where

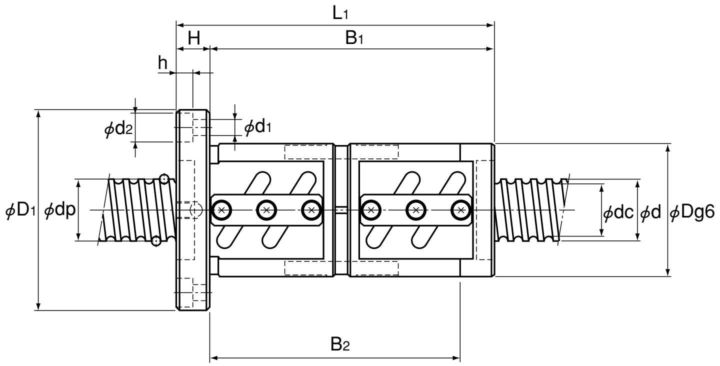
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D1	Overall length L1	H	B1	B2	PCD	d1×d2×h	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
○ **BNFN 3208A-4.5**	32	8	33.25	27.5	3×1.5	29.5	76	1070	66	100	167	15	152	—	82	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3208A-5			33.25	27.5	2×2.5	32.3	84.4	1180	66	100	154	15	139	—	82	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3210A-2.5		10	33.75	26.4	1×2.5	26.1	56.2	640	74	108	130	15	115	99	90	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3210A-3			33.75	26.4	2×1.5	30.5	67.4	750	74	108	167	15	152	136	90	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3210A-3.5			33.75	26.4	1×3.5	34.8	78.6	870	74	108	150	15	135	119	90	9×14×8.5	M6	8.08×10^{-3}
○ **BNFN 3210A-5**			33.75	26.4	2×2.5	47.2	112.7	1230	74	108	190	15	175	159	90	9×14×8.5	M6	8.08×10^{-3}
○ BNFN 3212-3.5		12	34	26.1	1×3.5	40.4	88.5	890	76	121	170	18	152	—	98	11×17.5×11	M6	8.08×10^{-3}
○ BNFN 3606-2.5	36	6	36.75	33.2	1×2.5	10.7	31.8	630	65	100	89	15	74	58	82	9×14×8.5	M6	1.29×10^{-2}
○ BNFN 3606-3			36.75	33.2	2×1.5	12.5	38	740	65	100	110	15	95	79	82	9×14×8.5	M6	1.29×10^{-2}
○ **BNFN 3606-5**			36.75	33.2	2×2.5	19.4	63.4	1220	65	100	125	15	110	94	82	9×14×8.5	M6	1.29×10^{-2}
○ BNFN 3606-7.5			36.75	33.2	3×2.5	27.5	95.2	1790	65	100	161	15	146	130	82	9×14×8.5	M6	1.29×10^{-2}
○ BNFN 3608-2.5		8	37.25	31.6	1×2.5	18.8	47.5	670	70	114	116	18	98	—	92	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3608-5			37.25	31.6	2×2.5	34.1	95.1	1290	70	114	164	18	146	—	92	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3608-7.5			37.25	31.6	3×2.5	48.3	142.1	1910	70	114	212	18	194	—	92	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3610-2.5		10	37.75	30.5	1×2.5	27.6	63.3	700	75	120	141	18	123	104	98	11×17.5×11	M6	1.29×10^{-2}
○ **BNFN 3610-5**			37.75	30.5	2×2.5	50.1	126.4	1350	75	120	201	18	183	164	98	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3610-7.5			37.75	30.5	3×2.5	71.1	190.1	1990	75	120	261	18	243	224	98	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3612-2.5		12	38	30.1	1×2.5	32.1	71.4	720	78	123	147	18	129	—	100	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3612-5			38	30.1	2×2.5	58.4	142.1	1370	78	123	219	18	201	—	100	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3616-2.5		16	38	30.1	1×2.5	32.1	71.4	720	78	123	172	18	154	—	100	11×17.5×11	M6	1.29×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

BNFN3610-5 RR G0 +1400L C5

1 BNFN3610-5 · 2 RR · 3 G0 · 4 +1400L · 5 C5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

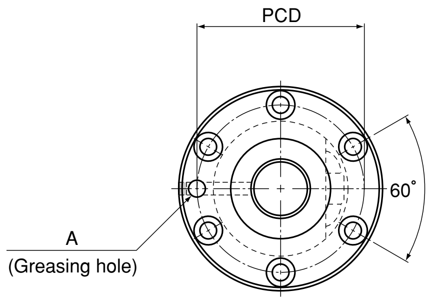
where

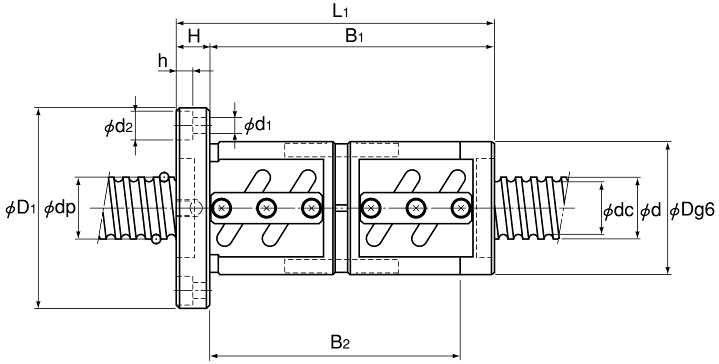
$$K_N = K\left(\frac{F_{a0}}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions									Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN		Outer diameter D	Flange diameter D₁	Overall length L₁	H	B₁	B₂	PCD	d₁×d₂×h	Greasing hole A	
○ BNFN 3616-5	36	16	38	30.1	2×2.5	58.3	143.1	1380	78	123	268	18	250	—	100	11×17.5×11	M6	1.29×10^{-2}
○ BNFN 3620-1.5		20	37.75	30.5	1×1.5	17.6	38.3	430	70	103	135	15	120	—	85	9×14×8.5	M6	1.29×10^{-2}
○ BNFN 4005-3	40	5	40.75	37.2	2×1.5	13	42.3	810	67	101	106	15	91	—	83	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4005-4.5			40.75	37.2	3×1.5	18.5	63.5	1200	67	101	126	15	111	—	83	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4005-5			40.75	37.2	2×2.5	20.3	70.6	1320	67	101	109	15	94	—	83	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4005-6			40.75	37.2	4×1.5	23.7	84.7	1580	67	101	156	15	141	—	83	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4006-2.5		6	41	36.4	1×2.5	15.3	44.1	710	70	104	90	15	75	—	86	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4006-5			41	36.4	2×2.5	27.7	88.1	1360	70	104	126	15	111	—	86	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4006-7.5			41	36.4	3×2.5	39.2	132.3	2010	70	104	162	15	147	—	86	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4008-2.5		8	41.25	35.5	1×2.5	19.6	52.8	730	74	108	106	15	91	—	90	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4008-3			41.25	35.5	2×1.5	22.9	63.4	860	74	108	135	15	120	—	90	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4008-5			41.25	35.5	2×2.5	35.7	105.8	1410	74	108	154	15	139	—	90	9×14×8.5	M6	1.97×10^{-2}
○ BNFN 4010-2.5		10	41.75	34.4	1×2.5	29	70.4	750	82	124	133	18	115	96	102	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4010-3			41.75	34.4	2×1.5	33.8	84.5	900	82	124	170	18	152	133	102	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4010-3.5			41.75	34.4	1×3.5	38.8	99	1050	82	124	153	18	135	116	102	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4010-5			41.75	34.4	2×2.5	52.7	141.1	1470	82	124	193	18	175	156	102	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4012-2.5		12	42	34.1	1×2.5	33.9	79.2	770	84	126	155	18	137	118	104	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4012-3.5			42	34.1	1×3.5	45.4	110.7	1070	84	126	179	18	161	142	104	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4012-5			42	34.1	2×2.5	61.6	158.8	1490	84	126	227	18	209	190	104	11×17.5×11	M6	1.97×10^{-2}
○ BNFN 4016-5		16	42	34.1	2×2.5	61.4	158.8	1500	84	126	280	22	258	—	104	11×17.5×11	M6	1.97×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

BNFN4006-5 RR G0 +2000L C3
1 (BNFN4006-5) 2 (RR) 3 (G0) 4 (+2000L) 5 (C3)

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

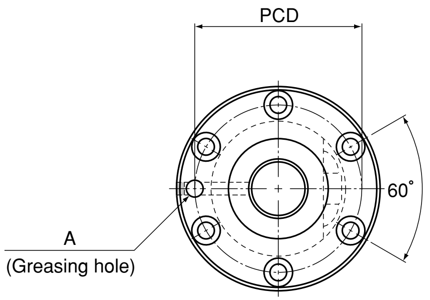
where

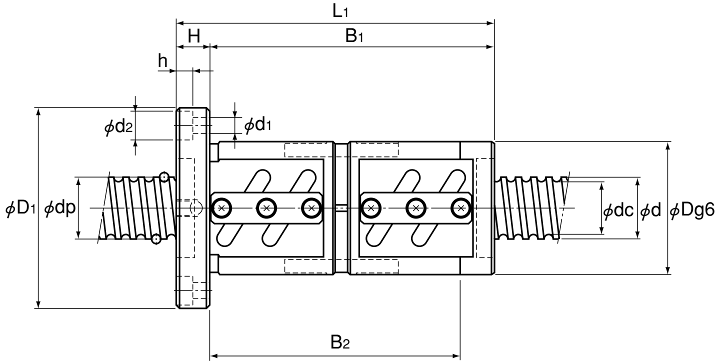
$$K_N = K\left(\frac{F_{a0}}{0.1\,Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNFN 4506A-2.5	45	6	46	41.4	1×2.5	16	49.6	770	80	114	89	15	74	—	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNFN 4506A-5			46	41.4	2×2.5	29	99	1500	80	114	125	15	110	—	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNFN 4506A-7.5			46	41.4	3×2.5	41.2	150	2210	80	114	161	15	146	—	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNFN 4508-2.5		8	46.25	40.6	1×2.5	20.7	59.5	790	85	127	116	18	98	—	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4508-5			46.25	40.6	2×2.5	37.4	118.6	1540	85	127	164	18	146	—	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4508-7.5			46.25	40.6	3×2.5	53.1	178.4	2270	85	127	212	18	194	—	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4510-2.5		10	46.75	39.5	1×2.5	30.7	79.3	830	88	132	141	18	123	104	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4510-3			46.75	39.5	2×1.5	35.9	95.2	990	88	132	164	18	146	127	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4510-5			46.75	39.5	2×2.5	55.6	158.8	1610	88	132	201	18	183	164	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4510-7.5			46.75	39.5	3×2.5	78.8	238.1	2370	88	132	261	18	243	224	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4512-5		12	47	39.2	2×2.5	65.2	178.4	1640	90	130	227	18	209	—	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNFN 4520-1.5		20	47.7	37.9	1×1.5	44.2	99	690	98	142	175	20	155	—	120	11×17.5×11	PT 1/8	3.16×10^{-2}
○ BNFN 5005-3	50	5	50.75	47.2	2×1.5	14.2	53	970	80	114	108	15	93	—	96	9×14×8.5	PT 1/8	4.82×10^{-2}
○ BNFN 5005-4.5			50.75	47.2	3×1.5	20.2	79.5	1420	80	114	128	15	113	—	96	9×14×8.5	PT 1/8	4.82×10^{-2}
○ BNFN 5008-2.5		8	51.25	45.5	1×2.5	21.6	66.2	860	87	129	109	18	91	—	107	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5008-5			51.25	45.5	2×2.5	39.1	132.3	1680	87	129	157	18	139	—	107	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5008-7.5			51.25	45.5	3×2.5	55.4	198.9	2470	87	129	205	18	187	—	107	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5010-2.5		10	51.75	44.4	1×2.5	32	88.2	900	93	135	133	18	115	96	113	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5010-3			51.75	44.4	2×1.5	37.5	105.8	1080	93	135	170	18	152	133	113	11×17.5×11	PT 1/8	4.82×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

BNFN5005-4.5 RR G0 +2500L C3

1 (BNFN5005-4.5) 2 (RR) 3 (G0) 4 (+2500L) 5 (C3)

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

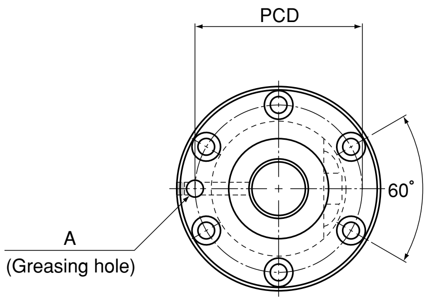
where

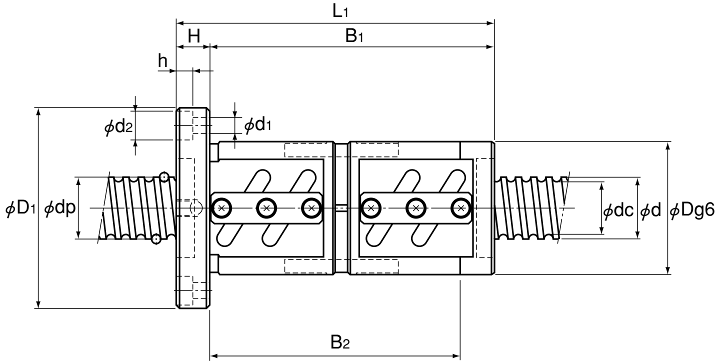
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions									Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Greasing hole A	
○ BNFN 5010-3.5	50	10	51.75	44.4	1×3.5	42.8	123.5	1240	93	135	153	18	135	116	113	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5010-5			51.75	44.4	2×2.5	58.2	176.4	1750	93	135	193	18	175	156	113	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5010-7.5			51.75	44.4	3×2.5	82.5	264.6	2580	93	135	253	18	235	216	113	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNFN 5012-2.5		12	52.25	43.3	1×2.5	43.4	109.8	930	100	146	159	22	137	114	122	14×20×13	PT 1/8	4.82×10^{-2}
○ BNFN 5012-3.5			52.25	43.3	1×3.5	58	153.9	1280	100	146	183	22	161	138	122	14×20×13	PT 1/8	4.82×10^{-2}
○ BNFN 5012-5			52.25	43.3	2×2.5	78.8	220.5	1810	100	146	231	22	209	186	122	14×20×13	PT 1/8	4.82×10^{-2}
○ BNFN 5016-2.5		16	52.7	42.9	1×2.5	72.6	183.3	1230	105	152	196	25	171	—	128	14×20×13	PT 1/8	4.82×10^{-2}
○ BNFN 5016-5			52.7	42.9	2×2.5	132.3	366.5	2360	105	152	292	25	267	—	128	14×20×13	PT 1/8	4.82×10^{-2}
○ BNFN 5020-2.5		20	52.7	42.9	1×2.5	72.5	183.3	1230	105	152	241	28	213	—	128	14×20×13	PT 1/8	4.82×10^{-2}
BNFN 5510-2.5	55	10	56.75	49.5	1×2.5	33.4	97	970	102	144	141	18	123	—	122	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5510-5			56.75	49.5	2×2.5	60.7	194	1890	102	144	201	18	183	—	122	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5510-7.5			56.75	49.5	3×2.5	85.9	291.1	2770	102	144	261	18	243	—	122	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5512-2.5		12	57	49.2	1×2.5	39.3	108.8	990	105	147	165	18	147	—	125	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5512-3			57	49.2	2×1.5	46	131.3	1180	105	147	191	18	173	—	125	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5512-3.5			57	49.2	1×3.5	52.4	152.9	1360	105	147	189	18	171	—	125	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5512-5			57	49.2	2×2.5	71.3	218.5	1920	105	147	237	18	219	—	125	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5512-7.5			57	49.2	3×2.5	100.9	327.3	2830	105	147	309	18	291	—	125	11×17.5×11	PT 1/8	7.05×10^{-2}
BNFN 5516-2.5		16	57.7	47.9	1×2.5	76.1	201.9	1310	110	158	196	25	171	—	133	14×20×13	PT 1/8	7.05×10^{-2}
BNFN 5516-5			57.7	47.9	2×2.5	138.2	402.8	2550	110	158	292	25	267	—	133	14×20×13	PT 1/8	7.05×10^{-2}
BNFN 5520-2.5		20	57.7	47.9	1×2.5	76	201.9	1320	112	158	227	28	199	—	134	14×20×13	PT 1/8	7.05×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-142 and k-143.

Model number coding

$\underbrace{\text{BNFN5510-2.5}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G0}}_{3}\ \underbrace{\text{+2500L}}_{4}\ \underbrace{\text{C3}}_{5}$

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

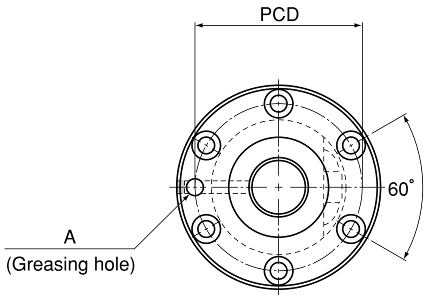
where

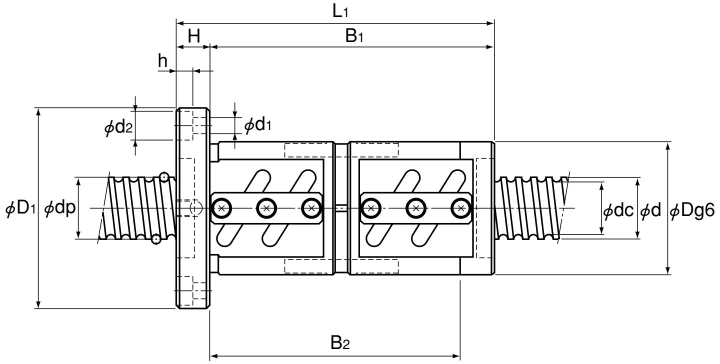
$$K_N = K\left(\frac{F_{a0}}{0.1\,Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1×d_2×h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNFN 5520-5	55	20	57.7	47.9	2×2.5	138.2	403.8	2550	112	158	347	28	319	—	134	14×20×13	PT 1/8	$7.05×10^{-2}$
BNFN 6310-2.5	63	10	64.75	57.7	1×2.5	35.4	111.7	1090	108	154	137	22	115	—	130	14×20×13	PT 1/8	$1.21×10^{-1}$
BNFN 6310-5			64.75	57.7	2×2.5	64.2	222.5	2100	108	154	197	22	175	—	130	14×20×13	PT 1/8	$1.21×10^{-1}$
BNFN 6310-7.5			64.75	57.7	3×2.5	90.9	334.2	3090	108	154	257	22	235	—	130	14×20×13	PT 1/8	$1.21×10^{-1}$
BNFN 6312A-2.5		12	65.25	56.3	1×2.5	48.1	139.2	1120	115	161	159	22	137	—	137	14×20×13	PT 1/8	$1.21×10^{-1}$
BNFN 6312A-5			65.25	56.3	2×2.5	87.4	278.3	2160	115	161	231	22	209	—	137	14×20×13	PT 1/8	$1.21×10^{-1}$
BNFN 6316-2.5		16	65.7	55.9	1×2.5	81.1	231.3	1470	122	184	208	24	184	—	152	18×26×17.5	PT 1/8	$1.21×10^{-1}$
BNFN 6316-5			65.7	55.9	2×2.5	147	462.6	2840	122	184	304	24	280	—	152	18×26×17.5	PT 1/8	$1.21×10^{-1}$
BNFN 6320-2.5		20	65.7	55.9	1×2.5	81	231.3	1470	122	180	227	28	199	—	150	18×26×17.5	PT 1/8	$1.21×10^{-1}$
BNFN 6320-5			65.7	55.9	2×2.5	147	463.5	2640	122	180	347	28	319	—	150	18×26×17.5	PT 1/8	$1.21×10^{-1}$
BNFN 7010-2.5	70	10	71.75	64.5	1×2.5	36.8	123.5	1180	125	167	141	18	123	—	145	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7010-5			71.75	64.5	2×2.5	66.9	247	2280	125	167	201	18	183	—	145	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7010-7.5			71.75	64.5	3×2.5	94.9	371.4	3350	125	167	261	18	243	—	145	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7012-2.5		12	72	64.2	1×2.5	43.5	139.2	1200	128	170	165	18	147	—	148	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7012-5			72	64.2	2×2.5	78.9	278.3	2320	128	170	237	18	219	—	148	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7012-7.5			72	64.2	3×2.5	111.7	417.5	3420	128	170	309	18	291	—	148	11×17.5×11	PT 1/8	$1.85×10^{-1}$
BNFN 7020-5		20	72.7	62.9	2×2.5	153.9	514.5	3090	130	186	325	28	297	—	158	18×26×17.5	PT 1/8	$1.85×10^{-1}$
BNFN 8010-2.5	80	10	81.75	75.2	1×2.5	38.9	141.1	1300	130	176	137	22	115	—	152	14×20×13	PT 1/8	$3.16×10^{-1}$
BNFN 8010-5			81.75	75.2	2×2.5	70.6	283.2	2530	130	176	197	22	175	—	152	14×20×13	PT 1/8	$3.16×10^{-1}$
BNFN 8010-7.5			81.75	75.2	3×2.5	100	424.3	3720	130	176	257	22	235	—	152	14×20×13	PT 1/8	$3.16×10^{-1}$

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNFN6320-5 RR G0 +3500L C3
1 BNFN6320-5 · 2 RR · 3 G0 · 4 +3500L · 5 C3

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

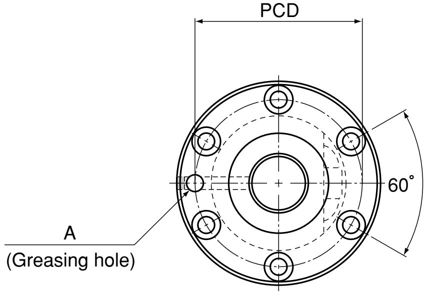
where

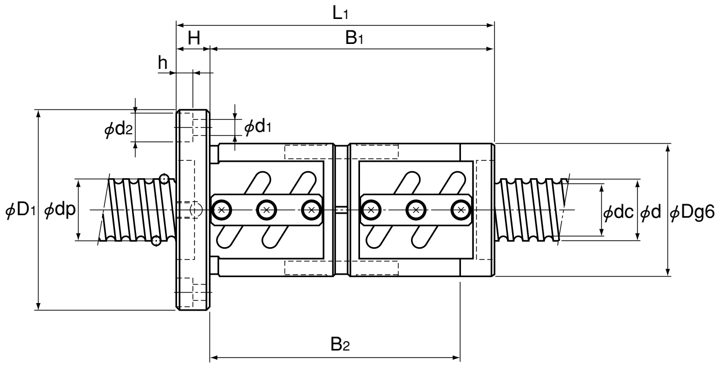
$$K_N = K\left(\frac{F_{a0}}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNFN

Double-nut Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/µm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNFN 8012-5	80	12	82.3	74.1	2×2.5	96.5	353.8	2620	135	181	231	22	209	—	157	14×20×13	PT 1/8	3.16×10^{-1}
BNFN 8020A-2.5		20	82.7	72.9	1×2.5	90.1	294	1770	143	204	227	28	199	—	172	18×26×17.5	PT 1/8	3.16×10^{-1}
BNFN 8020A-5			82.7	72.9	2×2.5	163.7	589	3430	143	204	347	28	319	—	172	18×26×17.5	PT 1/8	3.16×10^{-1}
BNFN 10020A-2.5	100	20	102.7	92.9	1×2.5	99	368.5	2110	170	243	231	32	199	—	205	22×32×21.5	PT 1/8	7.71×10^{-1}
BNFN 10020A-5			102.7	92.9	2×2.5	179.3	737	4080	170	243	351	32	319	—	205	22×32×21.5	PT 1/8	7.71×10^{-1}
BNFN 10020A-7.5			102.7	92.9	3×2.5	253.8	1105.4	6010	170	243	471	32	439	—	205	22×32×21.5	PT 1/8	7.71×10^{-1}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNFN8012-5 RR G0 +4800L C5
1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

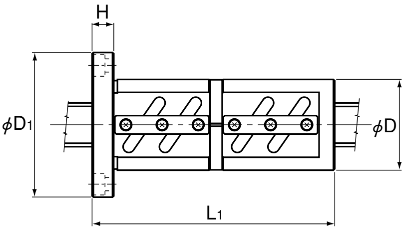
where

$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

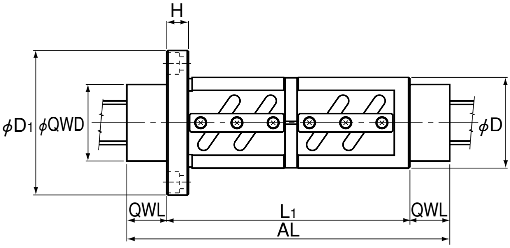
K: Rigidity value in the dimensional table.

Model BNFN

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L1	H	D1	Dg6	QWL	QWD	AL
BNFN 2504-2.5	68	11	69	46	32.5	45	133
BNFN 2504-5	92						157
BNFN 2505-2.5	75	11	73	50	32.5	45	140
BNFN 2505-3	102						167
BNFN 2505-3.5	85						150
BNFN 2505-5	105						170
BNFN 2506-2.5	86	11	76	53	33	45	152
BNFN 2506-3	110						176
BNFN 2506-3.5	98						164
BNFN 2506-5	122						188
BNFN 2508-2.5	106	15	85	58	34	45	174
BNFN 2508-3	135						203
BNFN 2508-3.5	122						190
BNFN 2508-5	154						222
BNFN 2510A-2.5	120	18	85	58	37	45	194
BNFN 2512-2.5	108	11	76	53	33	45	174
BNFN 2516-1.5	108	11	76	53	35	45	178
BNFN 3205-2.5	76	12	85	58	32	57	140
BNFN 3205-3	103						167
BNFN 3205-4.5	123						187
BNFN 3205-5	106						170
BNFN 3205-7.5	136						200
BNFN 3206-2.5	87	12	89	62	32	57	151
BNFN 3206-3	111						175
BNFN 3206-5	123						187
BNFN 3208A-2.5	106	15	100	66	34	57	174
BNFN 3208A-3	135						203
BNFN 3208A-4.5	167						235
BNFN 3208A-5	154						222

Model number coding BNFN2505-5 QZ WW G0 +1000L C5

1 2 3 4 5 6

1 Model number 2 With QZ Lubricator (see page k-22)
3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4 Axial clearance symbol (see page k-15) 5 Overall screw shaft length (in mm)
6 Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
BNFN 3210A-2.5	130	15	108	74	31	73	192
BNFN 3210A-3	167						229
BNFN 3210A-3.5	150						212
BNFN 3210A-5	190						252
BNFN 3212-3.5	170	18	121	76	33	73	236
BNFN 3606-2.5	89	15	100	65	30	64	149
BNFN 3606-3	110						170
BNFN 3606-5	125						185
BNFN 3606-7.5	161						221
BNFN 3608-2.5	116	18	114	70	31	64	178
BNFN 3608-5	164						226
BNFN 3608-7.5	212						274
BNFN 3610-2.5	141	18	120	75	33	64	207
BNFN 3610-5	201						267
BNFN 3610-7.5	261						327
BNFN 3612-2.5	147	18	123	78	35	64	217
BNFN 3612-5	219						289
BNFN 3616-2.5	172	18	123	78	32	64	236
BNFN 3616-5	268						332
BNFN 3620-1.5	135	15	103	70	32	64	199
BNFN 4005-3	106	15	101	67	33	66	172
BNFN 4005-4.5	126						192
BNFN 4005-5	109						175
BNFN 4005-6	156						222
BNFN 4006-2.5	90	15	104	70	35	66	160
BNFN 4006-5	126						196
BNFN 4006-7.5	162						232
BNFN 4008-2.5	106	15	108	74	35	66	176
BNFN 4008-3	135						205
BNFN 4008-5	154						224
BNFN 4010-2.5	133	18	124	82	37	66	207
BNFN 4010-3	170						244
BNFN 4010-3.5	153						227
BNFN 4010-5	193						267
BNFN 4012-2.5	155	18	126	84	38	66	231
BNFN 4012-3.5	179						255
BNFN 4012-5	227						303
BNFN 4016-5	280	22	126	84	42	66	364
BNFN 5005-3	108	15	114	80	35.5	79	179
BNFN 5005-4.5	128						199
BNFN 5008-2.5	109	18	129	87	36.5	79	182
BNFN 5008-5	157						230
BNFN 5008-7.5	205						278
BNFN 5010-2.5	133	18	135	93	37.5	79	208
BNFN 5010-3	170						245
BNFN 5010-3.5	153						228
BNFN 5010-5	193						268
BNFN 5010-7.5	253						328
BNFN 5012-2.5	159	22	146	100	38.5	79	236
BNFN 5012-3.5	183						260
BNFN 5012-5	231						308
BNFN 5016-2.5	196	25	152	105	38.5	79	273
BNFN 5016-5	292						369
BNFN 5020-2.5	241	28	152	105	40.5	79	322

Precautions on Use

■THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK .

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK .

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

■THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK .

Use in a Special Environment

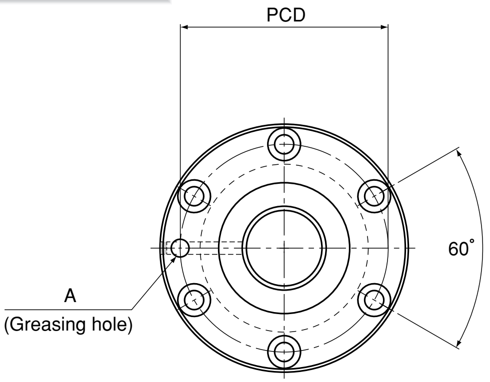
- When desiring to use the product in a special environment, contact THK .

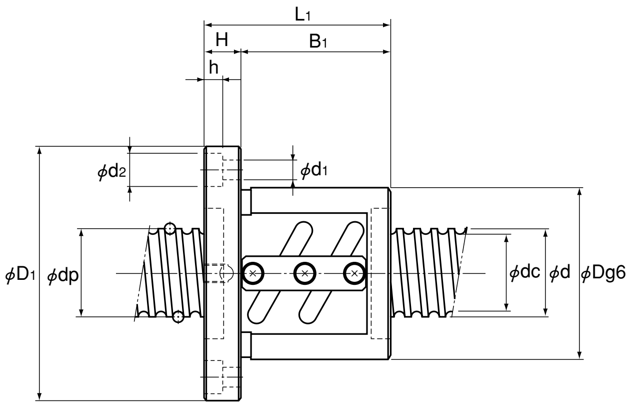
Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model BNF

Single-nut Non-preload Type





Unit: mm

Model No.	Screw shaft outer diameter	Lead	Ball center diameter	Thread minor diameter	No. of loaded circuits	Basic load rating		Rigidity	Nut dimensions								Screw shaft inertial moment/mm
	d	R	dp	dc	Rows x turns	Ca kN	C0a kN	K N/μm	Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1×d2×h	Greasing hole A	kg·cm²/mm
BNF 1604-3	16	4	16.5	13.8	2×1.5	5.1	10.5	180	36	59	45	11	34	47	5.5×9.5×5.5	M6	5.05×10^{-4}
BNF 1605-2.5		5	16.75	13.2	1×2.5	7.4	13.9	170	40	60	41	10	31	50	4.5×8×4.5	M6	5.05×10^{-4}
BNF 1605-3			16.75	13.2	2×1.5	8.7	16.8	200	40	60	51	10	41	50	4.5×8×4.5	M6	5.05×10^{-4}
BNF 1605-5			16.75	13.2	2×2.5	13.5	27.8	320	40	60	56	10	46	50	4.5×8×4.5	M6	5.05×10^{-4}
BNF 1606-2.5		6	16.8	13.2	1×2.5	7.5	14	170	40	60	44	10	34	50	4.5×8×4.5	M6	5.05×10^{-4}
BNF 1606-5			16.8	13.2	2×2.5	13.5	28	320	40	60	62	10	52	50	4.5×8×4.5	M6	5.05×10^{-4}
BNF 1610-1.5		10	16.8	13.5	1×1.5	4.8	8.5	100	40	63	42	11	31	51	5.5×9.5×5.5	M6	5.05×10^{-4}
BNF 1810-2.5	18	10	18.8	15.5	1×2.5	7.8	15.9	190	42	65	69	12	57	53	5.5×9.5×5.5	M6	8.09×10^{-4}
BNF 1810-3			18.8	15.5	2×1.5	9.2	19.1	220	42	65	75	12	63	53	5.5×9.5×5.5	M6	8.09×10^{-4}
BNF 2004-2.5	20	4	20.5	17.8	1×2.5	4.8	10.9	180	40	63	37	11	26	51	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2004-5			20.5	17.8	2×2.5	8.6	21.8	350	40	63	49	11	38	51	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2005-2.5		5	20.75	17.2	1×2.5	8.3	17.4	200	44	67	41	11	30	55	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2005-3			20.75	17.2	2×1.5	9.7	21	240	44	67	52	11	41	55	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2005-3.5			20.75	17.2	1×3.5	11.1	24.5	270	44	67	45	11	34	55	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2005-5			20.75	17.2	2×2.5	15.1	35	380	44	67	56	11	45	55	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2006-2.5		6	20.75	17.2	1×2.5	8.3	17.5	200	48	71	44	11	33	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2006-3			20.75	17.2	2×1.5	9.7	21	240	48	71	56	11	45	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2006-3.5			20.75	17.2	1×3.5	11.1	24.5	270	48	71	50	11	39	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2006-5			20.75	17.2	2×2.5	15.1	35	380	48	71	62	11	51	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2008-2.5		8	21	16.4	1×2.5	11.1	21.9	210	46	74	60	15	45	59	5.5×9.5×5.5	M6	1.23×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNF1810-2.5 RR G1 +900L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

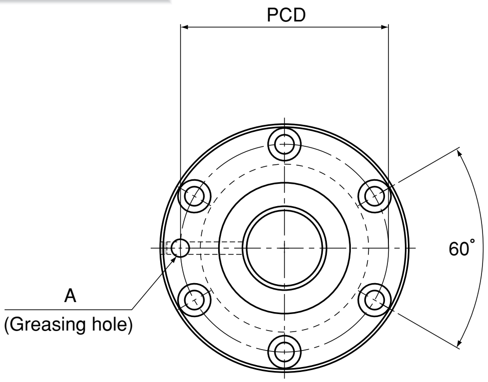
where

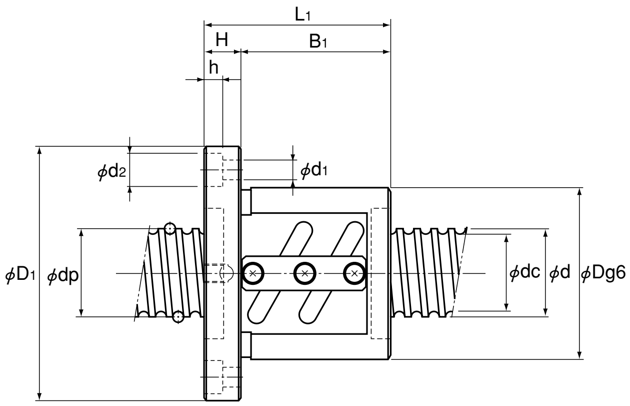
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/µm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNF 2010A-1.5	20	10	21	16.4	1×1.5	7.2	13.2	130	46	74	58	15	43	59	5.5×9.5×5.5	M6	1.23×10^{-3}
BNF 2012-1.5		12	21	16.4	1×1.5	7.1	13.2	130	48	71	64	18	46	59	5.5×9.5×5.5	M6	1.23×10^{-3}
○ BNF 2504-2.5	25	4	25.5	22.8	1×2.5	5.2	13.7	210	46	69	36	11	25	57	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2504-5			25.5	22.8	2×2.5	9.5	27.3	410	46	69	48	11	37	57	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2505-2.5		5	25.75	22.2	1×2.5	9.2	22	240	50	73	40	11	29	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2505-3			25.75	22.2	2×1.5	10.8	26.4	280	50	73	52	11	41	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2505-3.5			25.75	22.2	1×3.5	12.3	30.7	320	50	73	45	11	34	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ **BNF 2505-5**			25.75	22.2	2×2.5	16.7	44	460	50	73	55	11	44	61	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2506-2.5		6	26	21.4	1×2.5	12.5	27.3	250	53	76	44	11	33	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2506-3			26	21.4	2×1.5	14.6	32.8	290	53	76	56	11	45	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2506-3.5			26	21.4	1×3.5	15.1	35.9	330	53	76	50	11	39	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2506-5			26	21.4	2×2.5	22.5	54.8	470	53	76	62	11	51	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2508-2.5		8	26.25	20.5	1×2.5	15.8	32.8	250	58	85	58	15	43	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNF 2508-3			26.25	20.5	2×1.5	18.5	39.4	290	58	85	71	15	56	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNF 2508-3.5			26.25	20.5	1×3.5	21.2	46	340	58	85	66	15	51	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNF 2508-5			26.25	20.5	2×2.5	28.7	65.8	480	58	85	82	15	67	71	6.6×11×6.5	M6	3.01×10^{-3}
○ **BNF 2510A-2.5**		10	26.3	21.4	1×2.5	15.8	33	250	58	85	70	18	52	71	6.6×11×6.5	M6	3.01×10^{-3}
○ BNF 2512-2.5		12	26	21.9	1×2.5	12.3	27.6	250	53	76	60	11	49	64	5.5×9.5×5.5	M6	3.01×10^{-3}
○ BNF 2516-1.5		16	26	21.4	1×1.5	7.9	16.7	150	53	76	60	11	49	64	5.5×9.5×5.5	M6	3.01×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

BNF2505-5 RR G1 +1200L C5
1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

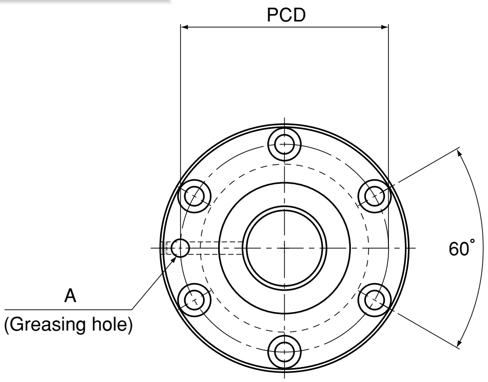
where

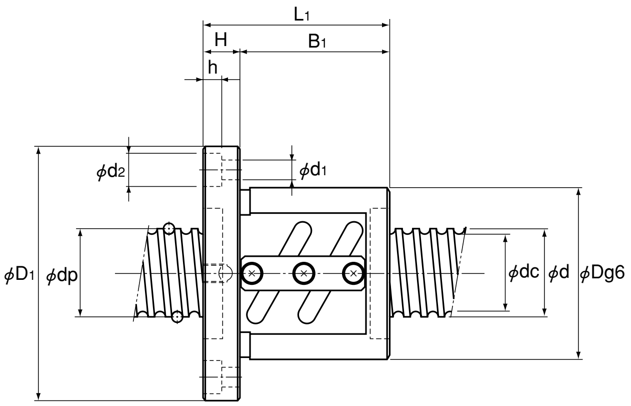
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_{0a} kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNF 2805-2.5	28	5	28.75	25.2	1×2.5	9.7	24.6	250	55	85	44	12	32	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2805-3			28.75	25.2	2×1.5	11.3	29.5	300	55	85	54	12	42	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2805-3.5			28.75	25.2	1×3.5	12.9	34.4	350	55	85	49	12	37	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2805-5			28.75	25.2	2×2.5	17.5	49.4	500	55	85	59	12	47	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2805-7.5			28.75	25.2	3×2.5	24.8	73.8	740	55	85	74	12	62	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2806-2.5		6	28.75	25.2	1×2.5	9.6	24.6	250	55	85	50	12	38	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2806-3.5			28.75	25.2	1×3.5	12.9	34.5	350	55	85	56	12	44	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2806-5			28.75	25.2	2×2.5	17.5	49.4	500	55	85	68	12	56	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2806-7.5			28.75	25.2	3×2.5	24.8	73.8	740	55	85	86	12	74	69	6.6×11×6.5	M6	4.74×10^{-3}
BNF 2808-2.5		8	29.25	23.6	1×2.5	16.8	36.8	270	60	104	68	18	50	82	11×17.5×11	M6	4.74×10^{-3}
BNF 2808-3			29.25	23.6	2×1.5	19.6	44.2	320	60	104	80	18	62	82	11×17.5×11	M6	4.74×10^{-3}
BNF 2808-5			29.25	23.6	2×2.5	30.4	73.7	530	60	104	92	18	74	82	11×17.5×11	M6	4.74×10^{-3}
BNF 2810-2.5		10	29.75	22.4	1×2.5	24	48.2	280	65	106	86	18	68	85	11×17.5×11	M6	4.74×10^{-3}
BNF 3204-7.5	32	4	32.5	30	3×2.5	14.8	52.7	740	54	81	60	11	49	67	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3205-2.5		5	32.75	29.2	1×2.5	10.2	28.1	280	58	85	41	12	29	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3205-3			32.75	29.2	2×1.5	12	33.8	340	58	85	53	12	41	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3205-4.5			32.75	29.2	3×1.5	17	50.7	500	58	85	63	12	51	71	6.6×11×6.5	M6	8.08×10^{-3}
○ **BNF 3205-5**			32.75	29.2	2×2.5	18.5	56.4	560	58	85	56	12	44	71	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3205-7.5			32.75	29.2	3×2.5	26.3	84.5	810	58	85	71	12	59	71	6.6×11×6.5	M6	8.08×10^{-3}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

$$\underbrace{\text{BNF2806-5}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G1}}_{3}\ \underbrace{\text{+1200L}}_{4}\ \underbrace{\text{C5}}_{5}$$

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

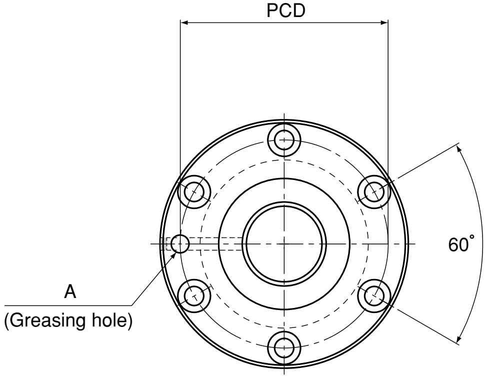
where

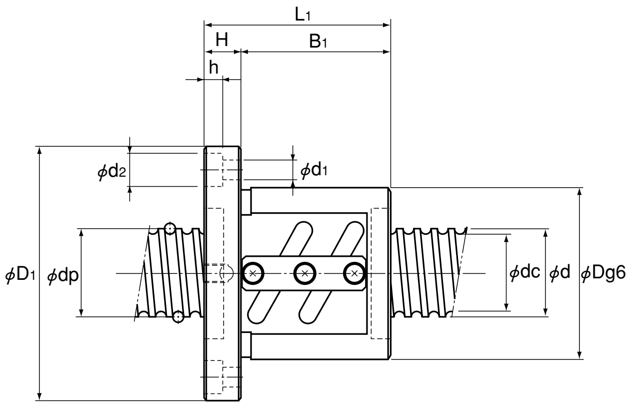
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions								Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	
○ BNF 3206-2.5	32	6	33	28.4	1×2.5	13.9	35.2	290	62	89	45	12	33	75	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3206-3			33	28.4	2×1.5	16.3	42.2	350	62	89	57	12	45	75	6.6×11×6.5	M6	8.08×10^{-3}
○ **BNF 3206-5**			33	28.4	2×2.5	25.2	70.4	580	62	89	63	12	51	75	6.6×11×6.5	M6	8.08×10^{-3}
○ BNF 3208A-2.5		8	33.25	27.5	1×2.5	17.8	42.2	300	66	100	58	15	43	82	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3208A-3			33.25	27.5	2×1.5	20.9	50.7	360	66	100	71	15	56	82	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3208A-4.5			33.25	27.5	3×1.5	29.5	76	530	66	100	87	15	72	82	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3208A-5			33.25	27.5	2×2.5	32.3	84.4	590	66	100	82	15	67	82	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3210A-2.5		10	33.75	26.4	1×2.5	26.1	56.2	310	74	108	70	15	55	90	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3210A-3			33.75	26.4	2×1.5	30.5	67.4	380	74	108	87	15	72	90	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3210A-3.5			33.75	26.4	1×3.5	34.8	78.6	440	74	108	80	15	65	90	9×14×8.5	M6	8.08×10^{-3}
○ **BNF 3210A-5**			33.75	26.4	2×2.5	47.2	112.7	620	74	108	100	15	85	90	9×14×8.5	M6	8.08×10^{-3}
○ BNF 3212-3.5		12	34	26.1	1×3.5	40.4	88.5	440	76	121	98	18	80	98	11×17.5×11	M6	8.08×10^{-3}
○ BNF 3606-2.5	36	6	36.75	33.2	1×2.5	10.7	31.8	310	65	100	53	15	38	82	9×14×8.5	M6	1.29×10^{-2}
○ BNF 3606-3			36.75	33.2	2×1.5	12.5	38	370	65	100	62	15	47	82	9×14×8.5	M6	1.29×10^{-2}
○ **BNF 3606-5**			36.75	33.2	2×2.5	19.4	63.4	610	65	100	71	15	56	82	9×14×8.5	M6	1.29×10^{-2}
○ BNF 3606-7.5			36.75	33.2	3×2.5	27.5	95.2	890	65	100	89	15	74	82	9×14×8.5	M6	1.29×10^{-2}
○ BNF 3608-2.5		8	37.25	31.6	1×2.5	18.8	47.5	330	70	114	68	18	50	92	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3608-5			37.25	31.6	2×2.5	34.1	95.1	650	70	114	92	18	74	92	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3608-7.5			37.25	31.6	3×2.5	48.3	142.1	950	70	114	116	18	98	92	11×17.5×11	M6	1.29×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

BNF3206-5 RR G2 +1500L C7

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW: Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

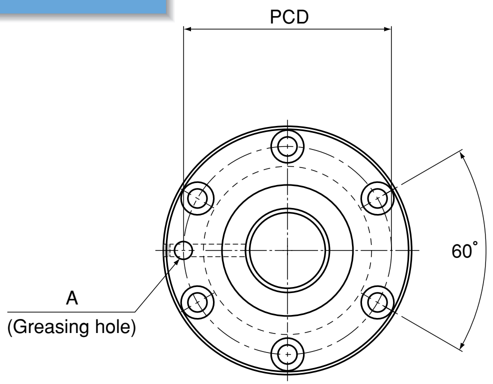
where

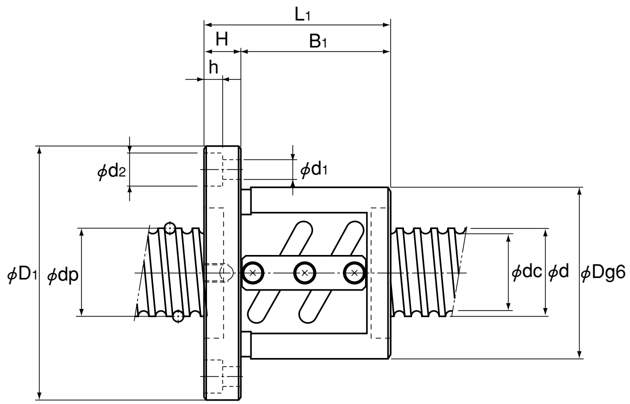
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions								Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1\times d_2\times h$	Greasing hole A	
○ BNF 3610-2.5	36	10	37.75	30.5	1×2.5	27.6	63.3	350	75	120	81	18	63	98	11×17.5×11	M6	1.29×10^{-2}
○ **BNF 3610-5**			37.75	30.5	2×2.5	50.1	126.4	680	75	120	111	18	93	98	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3610-7.5			37.75	30.5	3×2.5	71.1	190.1	990	75	120	141	18	123	98	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3612-2.5		12	38	30.1	1×2.5	32.1	71.4	350	78	123	87	18	69	100	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3612-5			38	30.1	2×2.5	58.4	142.1	690	78	123	123	18	105	100	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3616-2.5		16	38	30.1	1×2.5	32.1	71.4	350	78	123	92	18	74	100	11×17.5×11	M6	1.29×10^{-2}
○ BNF 3620-1.5		20	37.75	30.5	1×1.5	17.6	38.3	220	70	103	75	15	60	85	9×14×8.5	M6	1.29×10^{-2}
○ BNF 4005-3	40	5	40.75	37.2	2×1.5	13	42.3	400	67	101	56	15	41	83	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4005-4.5			40.75	37.2	3×1.5	18.5	63.5	600	67	101	66	15	51	83	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4005-6			40.75	37.2	4×1.5	23.7	84.7	780	67	101	81	15	66	83	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4006-2.5		6	41	36.4	1×2.5	15.3	44.1	350	70	104	48	15	33	86	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4006-5			41	36.4	2×2.5	27.7	88.1	690	70	104	66	15	51	86	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4006-7.5			41	36.4	3×2.5	39.2	132.3	1010	70	104	84	15	69	86	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4008-2.5		8	41.25	35.5	1×2.5	19.6	52.8	360	74	108	58	15	43	90	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4008-3			41.25	35.5	2×1.5	22.9	63.4	430	74	108	71	15	56	90	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4008-5			41.25	35.5	2×2.5	35.7	105.8	710	74	108	82	15	67	90	9×14×8.5	M6	1.97×10^{-2}
○ BNF 4010-2.5		10	41.75	34.4	1×2.5	29	70.4	380	82	124	73	18	55	102	11×17.5×11	M6	1.97×10^{-2}
○ BNF 4010-3			41.75	34.4	2×1.5	33.8	84.5	450	82	124	90	18	72	102	11×17.5×11	M6	1.97×10^{-2}
○ BNF 4010-3.5			41.75	34.4	1×3.5	38.8	99	520	82	124	83	18	65	102	11×17.5×11	M6	1.97×10^{-2}
○ **BNF 4010-5**			41.75	34.4	2×2.5	52.7	141.1	740	82	124	103	18	85	102	11×17.5×11	M6	1.97×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

$$\underbrace{\text{BNF3610-5}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G1}}_{3}\ \underbrace{\text{+1800L}}_{4}\ \underbrace{\text{C5}}_{5}$$

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

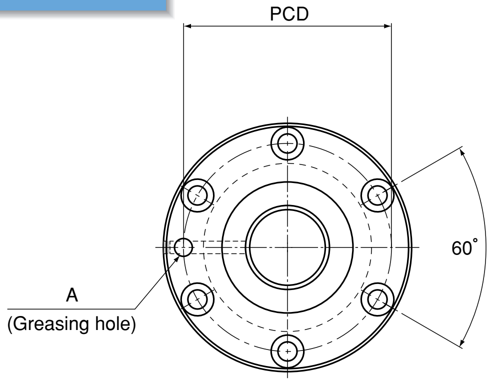
where

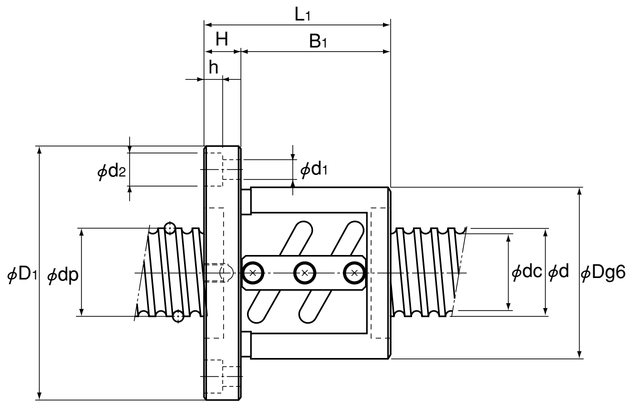
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1×d2×h	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
○ BNF 4012-2.5	40	12	42	34.1	1×2.5	33.9	79.2	390	84	126	83	18	65	104	11×17.5×11	M6	1.97×10^{-2}
○ BNF 4012-3.5			42	34.1	1×3.5	45.4	110.7	530	84	126	95	18	77	104	11×17.5×11	M6	1.97×10^{-2}
○ **BNF 4012-5**			42	34.1	2×2.5	61.6	158.3	750	84	126	119	18	101	104	11×17.5×11	M6	1.97×10^{-2}
○ **BNF 4016-5**		16	42	34.1	2×2.5	61.4	158.8	740	84	126	152	22	130	104	11×17.5×11	M6	1.97×10^{-2}
BNF 4506A-2.5	45	6	46	41.4	1×2.5	16	49.6	390	80	114	53	15	38	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNF 4506A-5			46	41.4	2×2.5	29	99	750	80	114	71	15	56	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNF 4506A-7.5			46	41.4	3×2.5	41.2	150	1100	80	114	89	15	74	96	9×14×8.5	PT 1/8	3.16×10^{-2}
BNF 4508-2.5		8	46.25	40.6	1×2.5	20.7	59.5	400	85	127	68	18	50	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4508-5			46.25	40.6	2×2.5	37.4	118.6	770	85	127	92	18	74	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4508-7.5			46.25	40.6	3×2.5	53.1	178.4	1140	85	127	116	18	98	105	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4510-2.5		10	46.75	39.5	1×2.5	30.7	79.3	420	88	132	81	18	63	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4510-3			46.75	39.5	2×1.5	35.9	95.2	500	88	132	94	18	76	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4510-5			46.75	39.5	2×2.5	55.6	158.8	800	88	132	111	18	93	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4510-7.5			46.75	39.5	3×2.5	78.8	238.1	1190	88	132	141	18	123	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4512-5		12	47	39.2	2×2.5	65.2	178.4	820	90	130	119	18	101	110	11×17.5×11	PT 1/8	3.16×10^{-2}
BNF 4520-1.5		20	47.7	37.9	1×1.5	44.2	99	350	98	142	95	20	75	120	11×17.5×11	PT 1/8	3.16×10^{-2}
○ BNF 5005-4.5	50	5	50.75	47.2	3×1.5	20.2	79.5	710	80	114	68	15	53	96	9×14×8.5	PT 1/8	4.82×10^{-2}
○ BNF 5008-2.5		8	51.25	45.5	1×2.5	21.6	66.2	430	87	129	61	18	43	107	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNF 5008-5			51.25	45.5	2×2.5	39.1	132.3	840	87	129	85	18	67	107	11×17.5×11	PT 1/8	4.82×10^{-2}
○ BNF 5008-7.5			51.25	45.5	3×2.5	55.4	198.9	1230	87	129	109	18	91	107	11×17.5×11	PT 1/8	4.82×10^{-2}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

BNF4510-5 RR G1 +2000L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

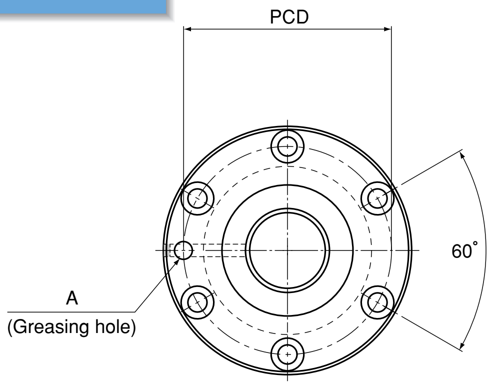
where

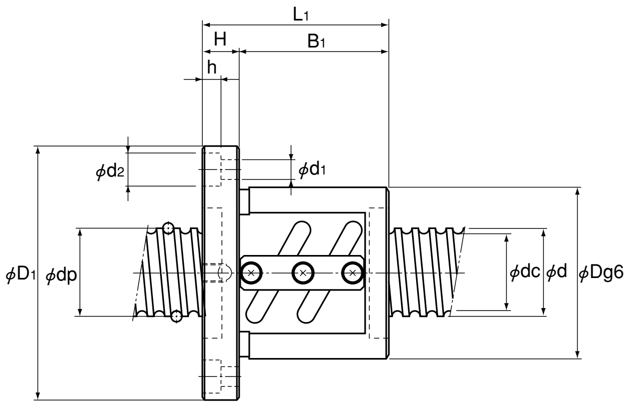
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1×d2×h	Greasing hole A	Screw shaft inertial moment/mm kg・cm²/mm
○ BNF 5010-2.5	50	10	51.75	44.4	1×2.5	32	88.2	450	93	135	73	18	55	113	11×17.5×11	PT 1/8	$4.82×10^{-2}$
○ BNF 5010-3			51.75	44.4	2×1.5	37.5	105.8	540	93	135	90	18	72	113	11×17.5×11	PT 1/8	$4.82×10^{-2}$
○ BNF 5010-3.5			51.75	44.4	1×3.5	42.8	123.5	620	93	135	83	18	65	113	11×17.5×11	PT 1/8	$4.82×10^{-2}$
○ **BNF 5010-5**			51.75	44.4	2×2.5	58.2	176.4	880	93	135	103	18	85	113	11×17.5×11	PT 1/8	$4.82×10^{-2}$
○ BNF 5010-7.5			51.75	44.4	3×2.5	82.5	264.6	1290	93	135	133	18	115	113	11×17.5×11	PT 1/8	$4.82×10^{-2}$
○ BNF 5012-2.5		12	52.25	43.3	1×2.5	43.4	109.8	470	100	146	87	22	65	122	14×20×13	PT 1/8	$4.82×10^{-2}$
○ BNF 5012-3.5			52.25	43.3	1×3.5	58	153.9	640	100	146	99	22	77	122	14×20×13	PT 1/8	$4.82×10^{-2}$
○ BNF 5012-5			52.25	43.3	2×2.5	78.8	220.5	910	100	146	123	22	101	122	14×20×13	PT 1/8	$4.82×10^{-2}$
○ BNF 5016-2.5		16	52.7	42.9	1×2.5	72.6	183.3	620	105	152	116	25	91	128	14×20×13	PT 1/8	$4.82×10^{-2}$
○ BNF 5016-5			52.7	42.9	2×2.5	132.3	366.5	1180	105	152	164	25	139	128	14×20×13	PT 1/8	$4.82×10^{-2}$
○ BNF 5020-2.5		20	52.7	42.9	1×2.5	72.5	183.3	620	105	152	141	28	113	128	14×20×13	PT 1/8	$4.82×10^{-2}$
BNF 5510-2.5	55	10	56.75	49.5	1×2.5	33.4	97	490	102	144	81	18	63	122	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5510-5			56.75	49.5	2×2.5	60.7	194	950	102	144	111	18	93	122	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5510-7.5			56.75	49.5	3×2.5	85.9	291.1	1390	102	144	141	18	123	122	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5512-2.5		12	57	49.2	1×2.5	39.3	108.8	500	105	147	93	18	75	125	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5512-3			57	49.2	2×1.5	46	131.3	590	105	147	107	18	89	125	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5512-3.5			57	49.2	1×3.5	52.4	152.9	680	105	147	105	18	87	125	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5512-5			57	49.2	2×2.5	71.3	218.5	960	105	147	129	18	111	125	11×17.5×11	PT 1/8	$7.05×10^{-2}$
BNF 5512-7.5			57	49.2	3×2.5	100.9	327.3	1420	105	147	165	18	147	125	11×17.5×11	PT 1/8	$7.05×10^{-2}$

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.
Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see pages k-164 and k-165.

Model number coding

BNF5010-5 RR G1 +2500L C5
1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

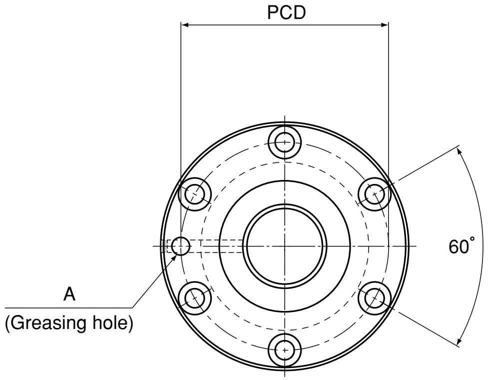
where

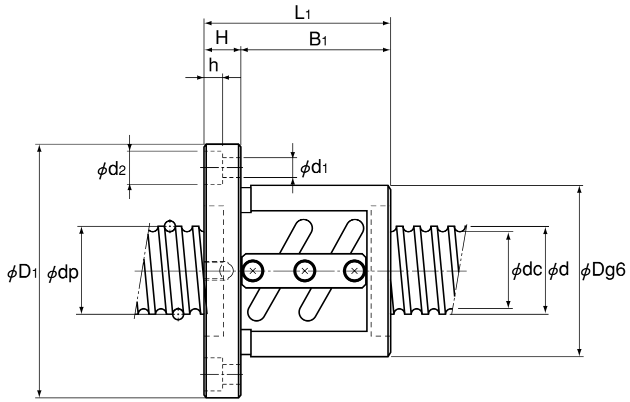
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNF 5516-2.5	55	16	57.7	47.9	1×2.5	76.1	201.9	650	110	158	116	25	91	133	14×20×13	PT 1/8	7.05×10^{-2}
BNF 5516-5			57.7	47.9	2×2.5	138.2	402.8	1280	110	158	164	25	139	133	14×20×13	PT 1/8	7.05×10^{-2}
BNF 5520-2.5		20	57.7	47.9	1×2.5	76	201.9	660	112	158	127	28	99	134	14×20×13	PT 1/8	7.05×10^{-2}
BNF 5520-5			57.7	47.9	2×2.5	138.2	403.8	1280	112	158	187	28	159	134	14×20×13	PT 1/8	7.05×10^{-2}
BNF 6310-2.5	63	10	64.75	57.7	1×2.5	35.4	111.7	550	108	154	77	22	55	130	14×20×13	PT 1/8	1.21×10^{-1}
BNF 6310-5			64.75	57.7	2×2.5	64.2	222.5	1050	108	154	107	22	85	130	14×20×13	PT 1/8	1.21×10^{-1}
BNF 6310-7.5			64.75	57.7	3×2.5	90.9	334.2	1550	108	154	137	22	115	130	14×20×13	PT 1/8	1.21×10^{-1}
BNF 6312A-2.5		12	65.25	56.3	1×2.5	48.1	139.2	560	115	161	87	22	65	137	14×20×13	PT 1/8	1.21×10^{-1}
BNF 6312A-5			65.25	56.3	2×2.5	87.4	278.3	1090	115	161	123	22	101	137	14×20×13	PT 1/8	1.21×10^{-1}
BNF 6316-5		16	65.7	55.9	2×2.5	147	462.6	1420	122	184	160	24	136	152	18×26×17.5	PT 1/8	1.21×10^{-1}
BNF 6320-2.5		20	65.7	55.9	1×2.5	81	231.3	740	122	180	127	28	99	150	18×26×17.5	PT 1/8	1.21×10^{-1}
BNF 6320-5			65.7	55.9	2×2.5	147	463.5	1420	122	180	187	28	159	150	18×26×17.5	PT 1/8	1.21×10^{-1}
BNF 7010-2.5	70	10	71.75	64.5	1×2.5	36.8	123.5	590	125	167	81	18	63	145	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7010-5			71.75	64.5	2×2.5	66.9	247	1140	125	167	111	18	93	145	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7010-7.5			71.75	64.5	3×2.5	94.9	371.4	1680	125	167	141	18	123	145	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7012-2.5		12	72	64.2	1×2.5	43.5	139.2	600	128	170	93	18	75	148	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7012-5			72	64.2	2×2.5	78.9	278.3	1160	128	170	129	18	111	148	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7012-7.5			72	64.2	3×2.5	111.7	417.5	1710	128	170	165	18	147	148	11×17.5×11	PT 1/8	1.85×10^{-1}
BNF 7020-5		20	72.7	62.9	2×2.5	153.9	514.5	1550	130	186	185	28	157	158	18×26×17.5	PT 1/8	1.85×10^{-1}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNF6310-5 RR G2 +3500L C7

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

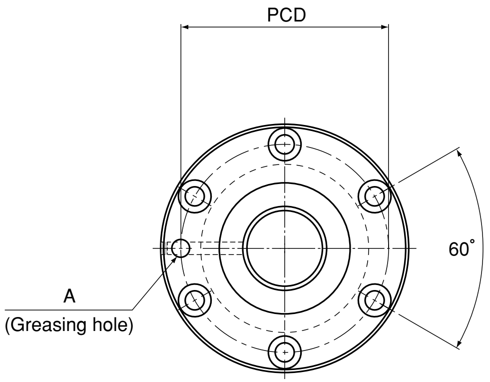
where

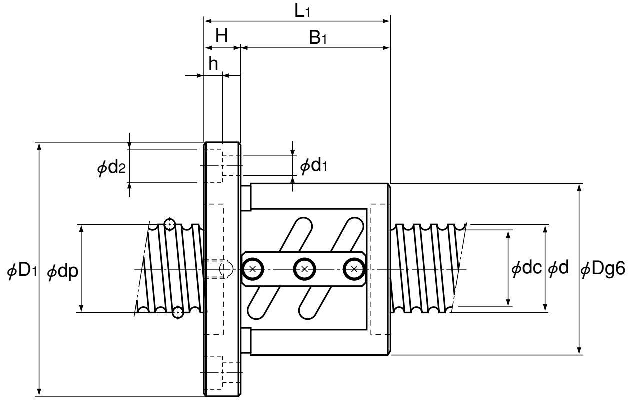
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BNF

Single-nut Non-Preload Type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	$d_1 \times d_2 \times h$	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BNF 8010-2.5	80	10	81.75	75.2	1×2.5	38.9	141.1	650	130	176	77	22	55	152	14×20×13	PT 1/8	3.16×10^{-1}
BNF 8010-5			81.75	75.2	2×2.5	70.6	283.2	1270	130	176	107	22	85	152	14×20×13	PT 1/8	3.16×10^{-1}
BNF 8010-7.5			81.75	75.2	3×2.5	100	424.3	1860	130	176	137	22	115	152	14×20×13	PT 1/8	3.16×10^{-1}
BNF 8020A-2.5		20	82.7	72.9	1×2.5	90.1	294	890	143	204	127	28	99	172	18×26×17.5	PT 1/8	3.16×10^{-1}
BNF 8020A-5			82.7	72.9	2×2.5	163.7	589	1720	143	204	187	28	159	172	18×26×17.5	PT 1/8	3.16×10^{-1}
BNF 8020A-7.5			82.7	72.9	3×2.5	231.6	883.2	2520	143	204	247	28	219	172	18×26×17.5	PT 1/8	3.16×10^{-1}
BNF 10020A-2.5	100	20	102.7	92.9	1×2.5	99	368.5	2110	170	243	131	32	99	205	22×32×21.5	PT 1/8	7.71×10^{-1}
BNF 10020A-5			102.7	92.9	2×2.5	179.3	737	4080	170	243	191	32	159	205	22×32×21.5	PT 1/8	7.71×10^{-1}
BNF 10020A-7.5			102.7	92.9	3×2.5	253.8	1105.4	6010	170	243	251	32	219	205	22×32×21.5	PT 1/8	7.71×10^{-1}

Note The model number in a light face type indicate semi-standard types.
If desiring them, contact THK.

Model number coding

BNF8010-5 RR G2 +5000L C7

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

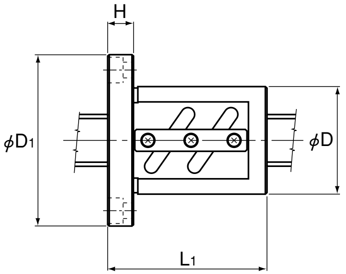
Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

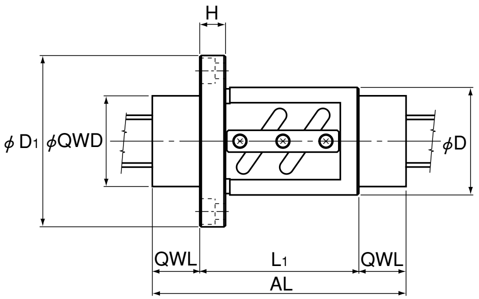
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
BNF 2504-2.5	36	11	69	46	32.5	45	101
BNF 2504-5	48						113
BNF 2505-2.5	40	11	73	50	32.5	45	105
BNF 2505-3	52						117
BNF 2505-3.5	45						110
BNF 2505-5	55						120
BNF 2506-2.5	44	11	76	53	33	45	110
BNF 2506-3	56						122
BNF 2506-3.5	50						116
BNF 2506-5	62						128
BNF 2508-2.5	58	15	85	58	34	45	126
BNF 2508-3	71						139
BNF 2508-3.5	66						134
BNF 2508-5	82						150
BNF 2510A-2.5	70	18	85	58	37	45	144
BNF 2512-2.5	60	11	76	53	33	45	126
BNF 2516-1.5	60	11	76	53	35	45	130
BNF 3205-2.5	41	12	85	58	32	57	105
BNF 3205-3	53						117
BNF 3205-4.5	63						127
BNF 3205-5	56						120
BNF 3205-7.5	71						135
BNF 3206-2.5	45	12	89	62	32	57	109
BNF 3206-3	57						121
BNF 3206-5	63						127
BNF 3208A-2.5	58	15	100	66	34	57	126
BNF 3208A-3	71						139
BNF 3208A-4.5	87						155
BNF 3208A-5	82						150

Model number coding

BNF2505-5 QZ WW G1 +1000L C5

1 2 3 4 5 6

1Model number 2With QZ Lubricator (see page k-22)
3Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4Axial clearance symbol (see page k-15) 5Overall screw shaft length (in mm)
6Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
BNF 3210A-2.5	70	15	108	74	31	73	132
BNF 3210A-3	87						149
BNF 3210A-3.5	80						142
BNF 3210A-5	100						162
BNF 3212-3.5	98	18	121	76	33	73	164
BNF 3606-2.5	53	15	100	65	30	64	113
BNF 3606-3	62						122
BNF 3606-5	71						131
BNF 3606-7.5	89						149
BNF 3608-2.5	68	18	114	70	31	64	130
BNF 3608-5	92						154
BNF 3608-7.5	116						178
BNF 3610-2.5	81	18	120	75	33	64	147
BNF 3610-5	111						177
BNF 3610-7.5	141						207
BNF 3612-2.5	87	18	123	78	35	64	157
BNF 3612-5	123						193
BNF 3616-2.5	92	18	123	78	32	64	156
BNF 3620-1.5	75	15	103	70	32	64	139
BNF 4005-3	56	15	101	67	33	66	122
BNF 4005-4.5	66						132
BNF 4005-6	81						147
BNF 4006-2.5	48	15	104	70	35	66	118
BNF 4006-5	66						136
BNF 4006-7.5	84						154
BNF 4008-2.5	58	15	108	74	35	66	128
BNF 4008-3	71						141
BNF 4008-5	82						152
BNF 4010-2.5	73	18	124	82	37	66	147
BNF 4010-3	90						164
BNF 4010-3.5	83						157
BNF 4010-5	103						177
BNF 4012-2.5	83	18	126	84	38	66	159
BNF 4012-3.5	95						171
BNF 4012-5	119						195
BNF 4016-5	152	22	126	84	42	66	236
BNF 5005-4.5	68	15	114	80	35.5	79	139
BNF 5008-2.5	61	18	129	87	36.5	79	134
BNF 5008-5	85						158
BNF 5008-7.5	109						182
BNF 5010-2.5	73	18	135	93	37.5	79	148
BNF 5010-3	90						165
BNF 5010-3.5	83						158
BNF 5010-5	103						178
BNF 5010-7.5	133						208
BNF 5012-2.5	87	22	146	100	38.5	79	164
BNF 5012-3.5	99						176
BNF 5012-5	123						200
BNF 5016-2.5	116	25	152	105	38.5	79	193
BNF 5016-5	164						241
BNF 5020-2.5	141	28	152	105	40.5	79	222

Precautions on Use

■THK QZ Lubricator for the Ball Screw

Handling

●Dropping or hitting the product may damage it. Use much care when handling it.

●Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.

●Do not clean the product with an organic solvent or white kerosene.

●Do not leave the product package open over a long period of time.

●Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

●Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

●When desiring to use the product in a special environment, contact THK.

Corrosion Prevention

●QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

■THK Wiper Ring for the Ball Screw

Handling

●Dropping or hitting the product may damage it. Use much care when handling it.

●Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.

●When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

●Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

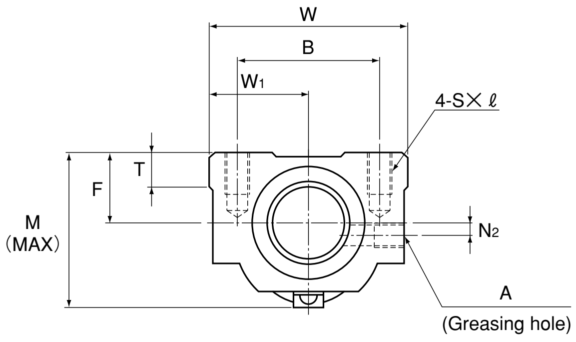
●When desiring to use the product in a special environment, contact THK.

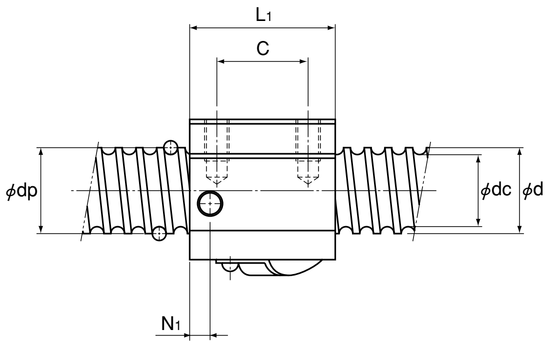
Chemical Resistance

●Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model BNT

Non-preload Type with a Square Ball Screw Nut





Unit: mm

Model No.	Screw shaft outer diameter	Lead	Ball center diameter	Thread minor diameter	No. of loaded circuits	Basic load rating		Rigidity	Nut dimensions												Screw shaft inertial moment/mm
	d	R	dp	dc	Rows x turns	Ca kN	C_0a kN	K N/μm	Outer diameter W	Center height F	Overall length L_1	Mounting hole B	C	S× ℓ	W_1	T	M	N_1	N_2	Greasing hole A	kg·cm²/mm
BNT 1404-3.6	14	4	14.4	11.5	1×3.65	6.8	12.6	190	34	13	35	26	22	M4×7	17	6	30	6	2	M6	$2.96×10^{-4}$
BNT 1405-2.6		5	14.5	11.2	1×2.65	7.2	12.6	150	34	13	35	26	22	M4×7	17	6	31	6	2	M6	$2.96×10^{-4}$
BNT 1605-2.6	16	5	16.75	13.5	1×2.65	7.8	14.7	170	42	16	36	32	22	M5×8	21	21.5	32.5	6	2	M6	$5.05×10^{-4}$
BNT 1808-3.6	18	8	19.3	14.4	1×3.65	18.2	34.4	270	48	17	56	35	35	M6×10	24	10	44	8	3	M6	$8.09×10^{-4}$
BNT 2005-2.6	20	5	20.5	17.2	1×2.65	8.7	18.3	200	48	17	35	35	22	M6×10	24	9	39	5	3	M6	$1.23×10^{-3}$
BNT 2010-2.6		10	21.25	16.4	1×2.65	14.7	27.8	220	48	18	58	35	35	M6×10	24	9	46	10	2	M6	$1.23×10^{-3}$
BNT 2505-2.6	25	5	25.5	22.2	1×2.65	9.6	23	240	60	20	35	40	22	M8×12	30	9.5	45	7	5	M6	$3.01×10^{-3}$
BNT 2510-5.3		10	26.8	20.2	2×2.65	43.4	92.8	520	60	23	94	40	60	M8×12	30	10	55	10	—	M6	$3.01×10^{-3}$
BNT 2806-2.6	28	6	28.5	25.2	1×2.65	10.1	25.8	270	60	22	42	40	18	M8×12	30	10	50	8	—	M6	$4.74×10^{-3}$
BNT 2806-5.3			28.5	25.2	2×2.65	18.3	51.6	510	60	22	67	40	40	M8×12	30	10	50	8	—	M6	$4.74×10^{-3}$
BNT 3210-2.6	32	10	33.75	27.2	1×2.65	27.3	59.5	330	70	26	64	50	45	M8×12	35	12	62	10	—	M6	$8.08×10^{-3}$
BNT 3210-5.3			33.75	27.2	2×2.65	49.6	118.9	640	70	26	94	50	60	M8×12	35	12	62	10	—	M6	$8.08×10^{-3}$
BNT 3610-2.6	36	10	37	30.5	1×2.65	28.7	65.6	360	86	29	64	60	45	M10×16	43	17	67	11	—	M6	$1.29×10^{-2}$
BNT 3610-5.3			37	30.5	2×2.65	52.1	131.2	700	86	29	96	60	60	M10×16	43	17	67	11	—	M6	$1.29×10^{-2}$
BNT 4512-5.3	45	12	46.5	39.2	2×2.65	68.1	186.7	860	100	36	115	75	75	M12×20	50	20.5	80	13	—	M6	$3.16×10^{-2}$

Model number coding

$$\underbrace{\text{BNT2510-5.3}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G2}}_{3}\ \underbrace{\text{+1000L}}_{4}\ \underbrace{\text{C5}}_{5}$$

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Standard-Lead Precision Ball Screw

Simple Nut

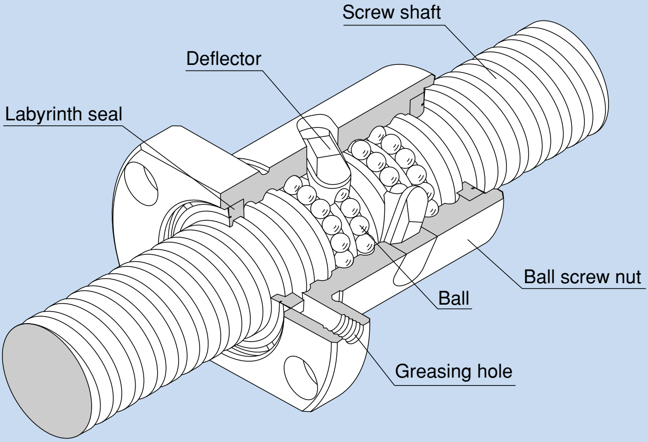


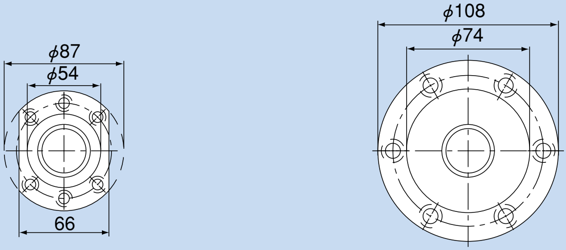
Fig. 1 Structure of the Simple Nut

Structure and Features

With the Simple Nut, balls under a load roll while receiving an axial load on the ball raceways formed between the screw shaft and the ball screw nut, then pass along the groove of a deflector incorporated in the ball screw nut and circulate back to the loaded area, thus to achieve infinite motion.

●Compact

Because of the internal circulation mechanism using a deflector, the outer diameter of the Simple Nut is only 70 to 80% of that of the Return-pipe Nut.



Model DIK 3210-6 (Simple Nut)

Model BNFN 3210 A-3 (Return-pipe Nut)

Fig. 2 Comparison of the Simple Nut with the Return-pipe Nut Unit: mm

●More than 50% Lighter Mass

Because of the compact structure, the ball screw nut mass is approximately 50% (model DK), and approximately 70% (model DIK), less than that of the Return-pipe Nut, thus to reduce the inertia during acceleration and deceleration.

●Well Balanced

Since the deflector is evenly placed along the circumference, superb balance is ensured while the ball screw nut is rotating.

●Pipe-less Design

The absence of a return pipe eliminates the possibility of damaging a pipe due to unexpected external impact.

Types and Features

Double-nut Preload Type Model DKN

A preload is provided via a spacer between the two combined ball screw nuts to achieve a below-zero axial clearance (under a preload).

Offset-Preload Type Model DIK

The right and left screws are provided with a phase in the middle of the ball screw nut, and an axial clearance is set at a below-zero value (under a preload). This compact model is capable of smooth motion.

Non-preload Type Model DK

The most compact type, with a ball screw nut diameter 70 to 80% of that of the return-pipe nut.

Non-preload Type Model MDK

This model is a miniature nut with a screw shaft diameter of $\phi4$ to 14 mm and a lead of 1 to 5 mm.

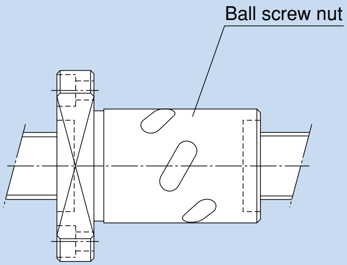
Structure and Features of Offset-Preload Type Simple-Nut Ball Screw Model DIK

Simple-Nut Ball Screw model DIK is an offset-preload type in which a phase is provided in the middle of a single ball screw nut, and an axial clearance is set at a below-zero value (under a preload).

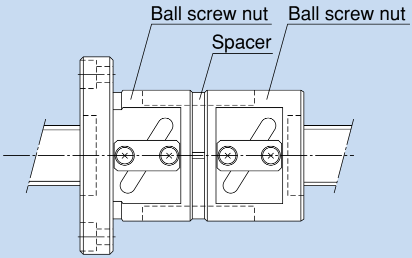
Model DIK has a more compact structure and allows smoother motion than the conventional double-nut type (spacer inserted between two nuts).

Comparison between the Simple Nut and the Double Nuts

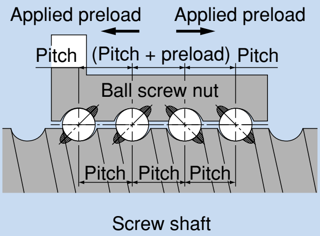
Simple-Nut Ball Screw Model DIK

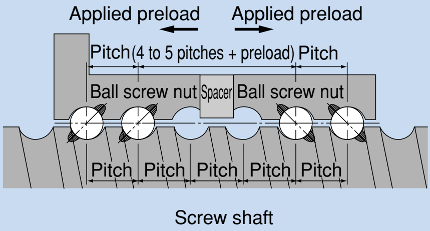


Conventional Double-Nut Type Ball Screw Model BNFN



Preloading Structure



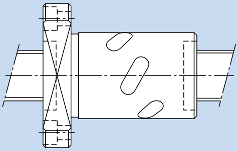


Simple-Nut Ball Screw Model DIK

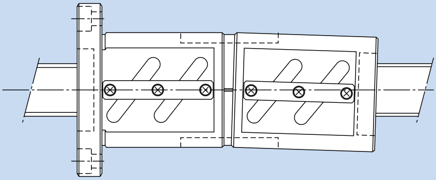
Conventional Double-Nut Type Ball Screw Model BNFN

Rotational performance

The preload adjustment with Simple-Nut Ball Screw model DIK is performed not according to the thickness of a spacer, but according to the ball diameter. This eliminates inconsistency in the contact angle, which is the most important factor Ball Screw performance. It also ensures high rigidity, smooth motion and high wobbling accuracy.



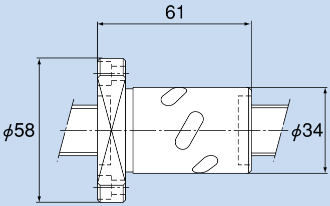
Use of a spacer in the double nuts tends to cause inconsistency in the contact angle due to inaccurate flatness of the spacer surface and inaccurate perpendicularity of the nut. This results in non-uniform ball contact, inferior rotation performance and low wobbling accuracy.



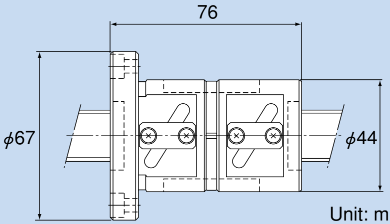
Dimensions

Since Simple-Nut Ball Screw model DIK is based on a preloading mechanism that does not require a spacer, the overall nut length can be kept short.

As a result, the whole nut can be lightly and compactly designed.



Model DIK 2005-6

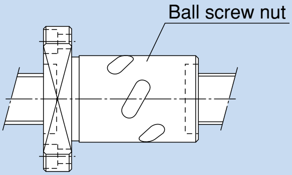


Unit: mm

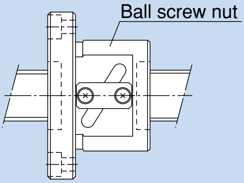
Model BNFN 2005-2.5

Comparison between the Offset Preload Type of Simple-Nut Ball Screw and the Oversize Preload Nut Ball Screw

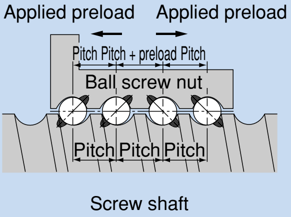
Simple-Nut Ball Screw Model DIK

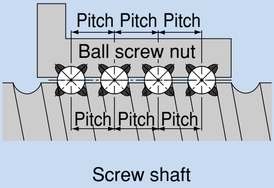


Conventional Oversize Preload Nut Ball Screw Model BNF



Preloading Structure

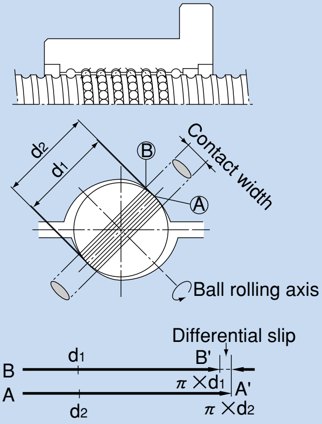




Accuracy life

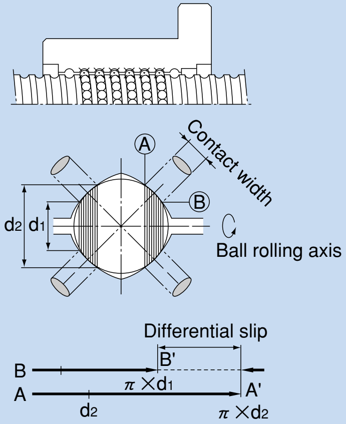
Simple-Nut Ball Screw model DIK has a similar preloading structure to that of the double-nut type although the former has only one ball screw shaft. As a result, no differential slip or spin occurs, thus to minimize the increase in the rotation torque and the generation of heat. Accordingly, a high level of accuracy can be maintained over a long period.

Two-point contact structure



With the oversize preload nut Ball Screw, a preload is provided through the balls each in contact with the raceway at four points. This causes differential slip and spin to increase the rotation torque, resulting in accelerated wear and heat generation. Therefore, the accuracy deteriorates in a short period.

Four-point contact structure



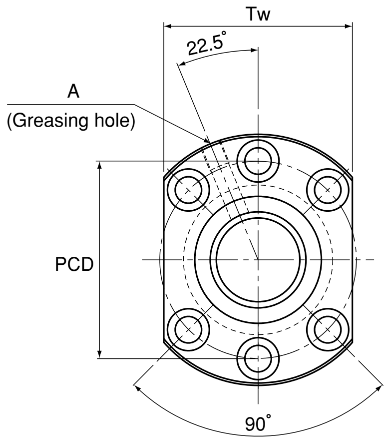
Precautions

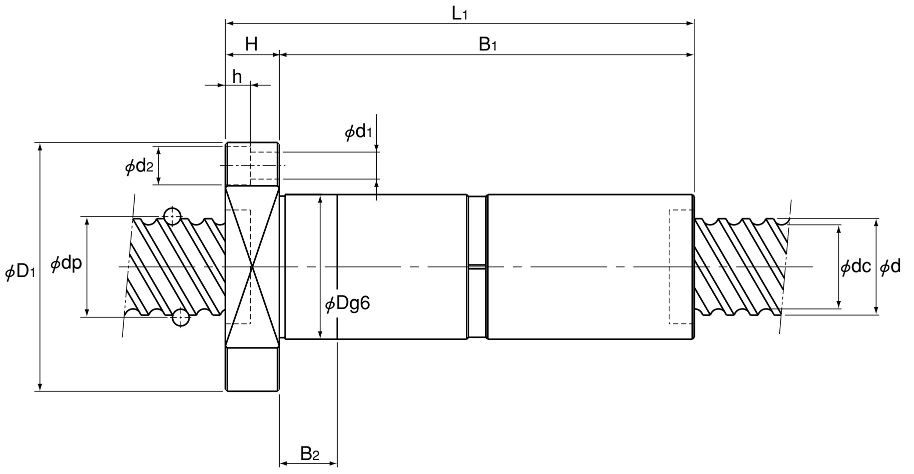
1) The Simple-Nut Ball Screw cannot be manufactured unless either end of the screw shaft is cut off or the screw shaft end diameter is smaller than the thread minor diameter.

2) A labyrinth seal cannot be attached to models MDK0401, 0601 and 0801.

Model DKN

Double-nut preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Tw	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
○ DKN 4020-3	40	20	41.75	34.7	3×1	29.4	69.3	750	62	104	223	18	205	25	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
DKN 5020-3	50	20	52.25	43.6	3×1	44.2	108.8	930	75	129	243	28	215	30	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DKN 6320-3	63	20	65.7	55.9	3×1	83.5	229.3	1470	95	159	243	28	215	30	129	18×26×17.5	121	PT 1/8	1.21×10^{-1}

Note Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-184.

Model number coding

DKN4020-3 RR G0 +1400L C3
1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

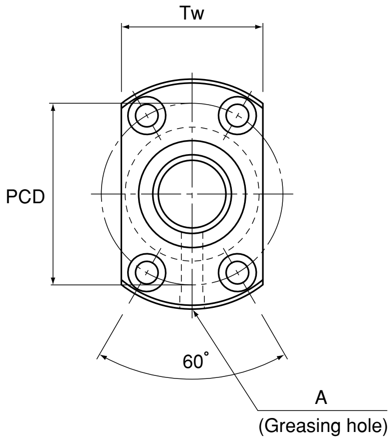
where

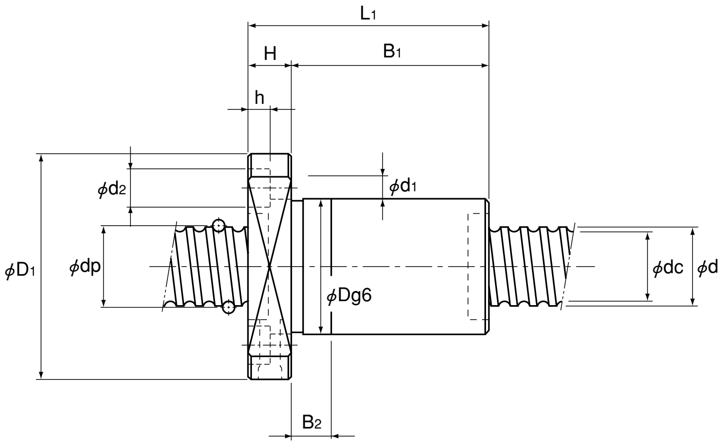
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model DIK

Simple-nut preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D1	Overall length L1	H	B1	B2	PCD	d1×d2×h	Tw	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
DIK 1404-4	14	4	14.5	11.8	2×1	3	5.1	190	26	45	48	10	38	10	35	4.5×8×4.5	29	M6	2.96×10^{-4}
DIK 1404-6			14.5	11.8	3×1	4.2	7.7	280	26	45	60	10	50	10	35	4.5×8×4.5	29	M6	2.96×10^{-4}
DIK 1605-6	16	5	16.75	13.2	3×1	7.4	13	310	30	49	60	10	50	10	39	4.5×8×4.5	31	M6	5.05×10^{-4}
DIK 2004-6	20	4	20.5	17.8	3×1	5.2	11.6	380	32	56	62	11	51	15	44	5.5×9.5×5.5	35	M6	1.23×10^{-3}
DIK 2004-8			20.5	17.8	4×1	6.6	15.5	510	32	56	70	11	59	15	44	5.5×9.5×5.5	35	M6	1.23×10^{-3}
DIK 2005-6		5	20.75	17.2	3×1	8.5	17.3	310	34	58	61	11	50	10	46	5.5×9.5×5.5	36	M6	1.23×10^{-3}
DIK 2006-6		6	21	16.4	3×1	11.4	21.5	410	35	58	76	11	65	15	46	5.5×9.5×5.5	36	M6	1.23×10^{-3}
DIK 2008-4		8	21	16.4	2×1	8.1	14.4	280	35	58	69	11	58	15	46	5.5×9.5×5.5	36	M6	1.23×10^{-3}
DIK 2504-6	25	4	25.5	22.8	3×1	5.7	15	470	38	63	63	11	52	15	51	5.5×9.5×5.5	39	M6	3.01×10^{-3}
DIK 2504-8			25.5	22.8	4×1	7.4	19.9	620	38	63	71	11	60	15	51	5.5×9.5×5.5	39	M6	3.01×10^{-3}
DIK 2505-6		5	25.75	22.2	3×1	9.7	22.6	490	40	63	61	11	50	10	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}
DIK 2506-4		6	26	21.4	2×1	9.1	18	330	40	63	60	11	49	10	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}
DIK 2506-6			26	21.4	3×1	12.8	27	490	40	63	72	11	61	15	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}
DIK 2508-4		8	26	21.4	2×1	9.2	18.8	340	40	63	71	12	59	15	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}
DIK 2508-6			26	21.4	3×1	13.1	28.1	500	40	63	94	12	82	25	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}
DIK 2510-4		10	26	21.6	2×1	9	18	330	40	63	85	15	70	20	51	5.5×9.5×5.5	41	M6	3.01×10^{-3}

Model number coding

DIK1404-4 RR G0 +700L C3

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload. These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value. If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

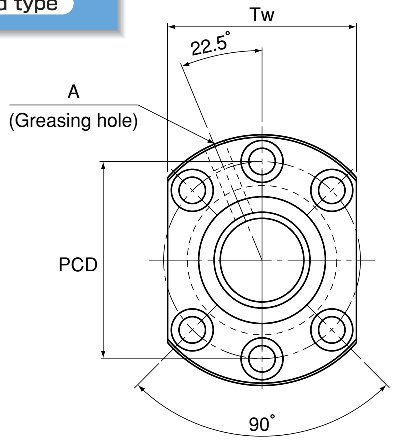
where

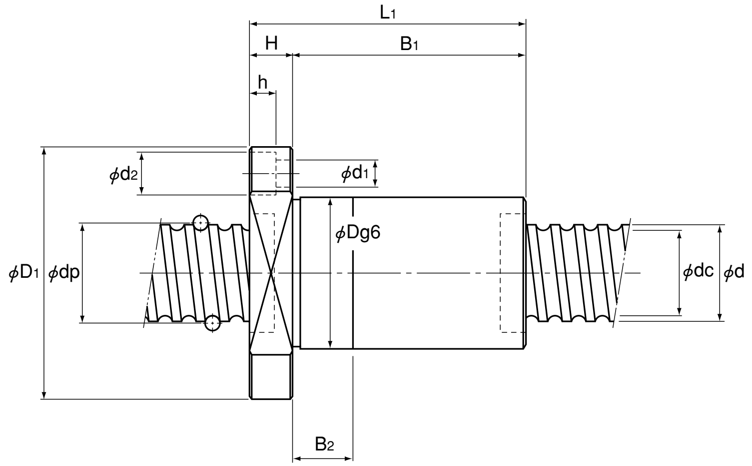
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model DIK

Simple-nut preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C₀a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D₁	Overall length L₁	H	B₁	B₂	PCD	d₁×d₂×h	Tw	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
DIK 2805-6	28	5	28.75	25.2	3×1	10.5	26.4	560	43	71	69	12	57	15	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DIK 2805-8			28.75	25.2	4×1	13.4	35.2	730	43	71	79	12	67	20	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DIK 2806-6		6	29	24.4	3×1	14	32	530	43	71	73	12	61	15	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DIK 2810-4		10	29.25	23.6	2×1	12.3	25	380	45	71	84	15	69	20	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DIK 3204-6	32	4	32.5	30.1	3×1	6.4	19.6	580	45	76	64	11	53	15	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3204-8			32.5	30.1	4×1	8.2	26.1	760	45	76	72	11	61	15	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3204-10			32.5	30.1	5×1	10	32.7	940	45	76	80	11	69	20	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3205-6		5	32.75	29.2	3×1	11.1	30.2	620	46	76	62	12	50	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3205-8			32.75	29.2	4×1	14.2	40.3	810	46	76	73	12	61	15	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3206-6		6	33	28.4	3×1	14.9	37.1	630	48	76	73	12	61	15	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3206-8			33	28.4	4×1	19.1	49.5	820	48	76	87	12	75	20	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DIK 3210-6		10	33.75	26.4	3×1	25.7	52.2	600	54	87	110	15	95	25	69	9×14×8.5	66	M6	8.08×10^{-3}
DIK 3212-4		12	33.75	26.4	2×1	18.8	37	430	54	87	98	15	83	25	69	9×14×8.5	66	M6	8.08×10^{-3}
DIK 3610-6	36	10	37.75	30.5	3×1	28.8	63.8	710	58	98	122	18	104	30	77	11×17.5×11	75	M6	1.29×10^{-2}
DIK 3610-8			37.75	30.5	4×1	36.8	85	940	58	98	143	18	125	35	77	11×17.5×11	75	M6	1.29×10^{-2}
DIK 3610-10			37.75	30.5	5×1	44.6	106.3	1160	58	98	164	18	146	45	77	11×17.5×11	75	M6	1.29×10^{-2}
○ DIK 4010-6	40	10	41.75	34.7	3×1	29.8	69.3	750	62	104	113	18	95	25	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DIK 4010-8			41.75	34.7	4×1	38.1	92.4	1000	62	104	137	18	119	35	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DIK 4012-6		12	41.75	34.4	3×1	30.6	72.3	790	62	104	138	18	120	35	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DIK 4012-8			41.75	34.4	4×1	39.2	96.4	1030	62	104	163	18	145	45	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DIK 4016-4		16	41.75	34.4	2×1	21.5	68.4	540	62	104	120	18	102	30	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}

Note Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-184.

Model number coding

DIK2810-4 RR G0 +1500L C3

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the rigidity and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload. These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

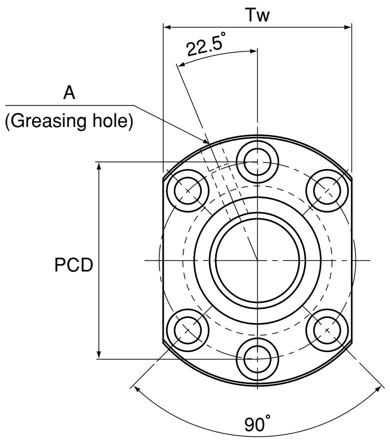
where

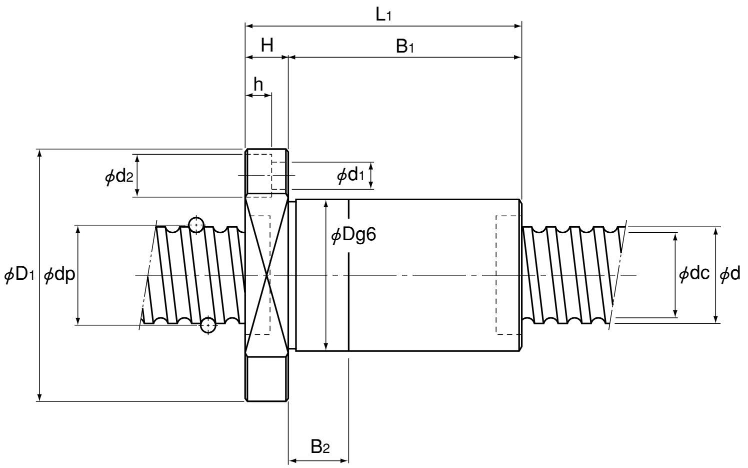
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model DIK

Simple-nut preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Tw	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
DIK 5010-6	50	10	51.75	44.4	3×1	33.9	90.7	940	72	123	114	18	96	30	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DIK 5010-8			51.75	44.4	4×1	43.4	120.5	1230	72	123	137	18	119	35	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DIK 5010-10			51.75	44.4	5×1	52.5	150.9	1530	72	123	160	18	142	45	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DIK 5012-6		12	52.25	43.3	3×1	45.8	113	970	75	129	145	22	123	35	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DIK 5012-8			52.25	43.3	4×1	58.6	150.6	1270	75	129	170	22	148	45	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DIK 5016-4		16	52.25	43.3	2×1	32.3	75.5	660	75	129	129	22	107	30	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DIK 5016-6			52.25	43.3	3×1	45.7	113.3	970	75	129	175	22	153	45	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DIK 6310-8	63	10	64.75	57.7	4×1	49.5	160.7	1550	85	146	141	22	119	35	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DIK 6312-6		12	65.25	56.3	3×1	51.9	147.4	1200	90	146	146	22	124	35	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DIK 6312-8			65.25	56.3	4×1	66.4	196.6	1570	90	146	171	22	149	45	122	14×20×13	110	PT 1/8	1.21×10^{-1}

Model number coding

$$\underbrace{\text{DIK6312-6}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G0}}_{3}\ \underbrace{\text{+3500L}}_{4}\ \underbrace{\text{C3}}_{5}$$

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the rigidity and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

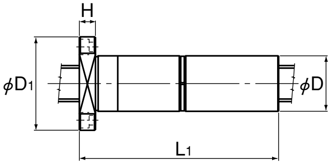
where

$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

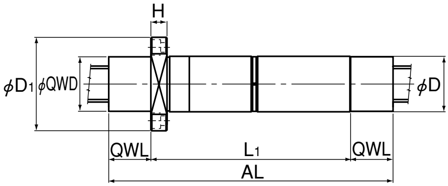
K: Rigidity value in the dimensional table.

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)

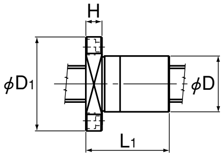
Model
DKN



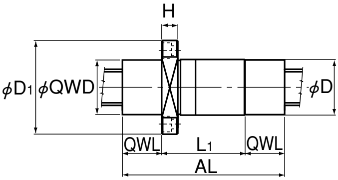
Model
DKN



Model
DIK



Model
DIK



With WW (without QZ)

With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut outer diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
DKN 4020-3	223	18	104	62	47	61	317
DIK 4010-6	113	18	104	62	44	61	201
DIK 4010-8	137						225
DIK 4012-6	138						226
DIK 4012-8	163						251
DIK 4016-4	120						208

Model number coding

DKN4020-3 QZ WW G0 +1800L C3

1 2 3 4 5 6

1 Model number 2 With QZ Lubricator (see page k-22)
3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4 Axial clearance symbol (see page k-15) 5 Overall screw shaft length (in mm)
6 Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Precautions on Use

■THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

■THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

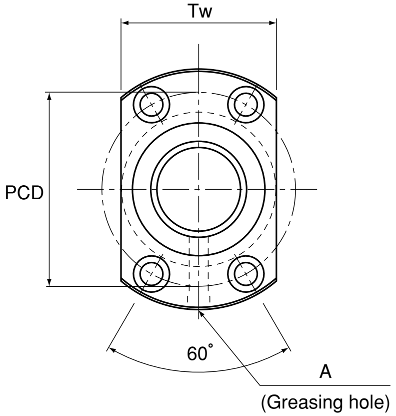
- When desiring to use the product in a special environment, contact THK.

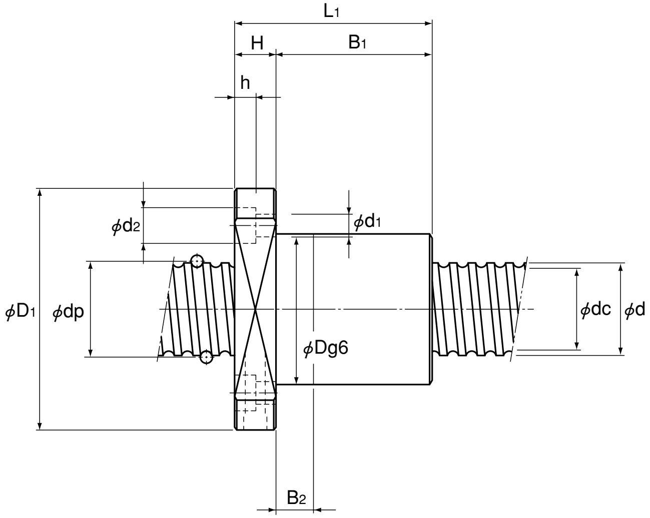
Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model DK

Single-nut non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating C_a kN		Rigidity K N/μm	Nut dimensions										Screw shaft inertial moment/mm kg·cm²/mm
						C_a kN	C_{0a} kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1×d_2×h$	Tw	Greasing hole A	
DK 1404-4	14	4	14.5	11.8	4×1	5.4	10.2	180	26	45	48	10	38	10	35	4.5×8×4.5	29	M6	$2.96×10^{-4}$
DK 1404-6			14.5	11.8	6×1	7.7	15.4	270	26	45	60	10	50	10	35	4.5×8×4.5	29	M6	$2.96×10^{-4}$
DK 1605-3	16	5	16.75	13.1	3×1	7.4	13	160	30	49	45	10	35	10	39	4.5×8×4.5	31	M6	$5.05×10^{-4}$
DK 1605-4			16.75	13.1	4×1	9.5	17.4	210	30	49	50	10	40	10	39	4.5×8×4.5	31	M6	$5.05×10^{-4}$
DK 2004-3	20	4	20.5	17.8	3×1	5.2	11.6	190	32	56	42	11	31	10	44	5.5×9.5×5.5	35	M6	$1.23×10^{-3}$
DK 2004-4			20.5	17.8	4×1	6.6	15.5	250	32	56	46	11	35	10	44	5.5×9.5×5.5	35	M6	$1.23×10^{-3}$
DK 2005-3		5	20.75	17.1	3×1	8.5	17.3	200	34	58	46	11	35	10	46	5.5×9.5×5.5	36	M6	$1.23×10^{-3}$
DK 2005-4			20.75	17.1	4×1	11	23.1	260	34	58	51	11	40	10	46	5.5×9.5×5.5	36	M6	$1.23×10^{-3}$
DK 2006-3		6	21	16.4	3×1	11.4	21.5	410	35	58	52	11	41	10	46	5.5×9.5×5.5	36	M6	$1.23×10^{-3}$
DK 2006-4			21	16.4	4×1	14.6	28.6	540	35	58	59	11	48	10	46	5.5×9.5×5.5	36	M6	$1.23×10^{-3}$
DK 2008-4		8	21	16.4	4×1	14.6	28.8	270	35	58	69	11	58	15	46	5.5×9.5×5.5	36	M6	$1.23×10^{-3}$
DK 2504-3	25	4	25.5	22.8	3×1	5.7	15	230	38	63	43	11	32	10	51	5.5×9.5×5.5	39	M6	$3.01×10^{-3}$
DK 2504-4			25.5	22.8	4×1	7.4	19.9	310	38	63	47	11	36	10	51	5.5×9.5×5.5	39	M6	$3.01×10^{-3}$
DK 2505-3		5	25.75	22.1	3×1	9.7	22.6	250	40	63	46	11	35	10	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2505-4			25.75	22.1	4×1	12.4	30.3	320	40	63	51	11	40	10	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2506-3		6	26	21.4	3×1	12.8	27	250	40	63	52	11	41	10	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2506-4			26	21.4	4×1	16.8	37.4	330	40	63	60	11	49	10	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2508-3		8	26	21.4	3×1	13.1	28.1	500	40	63	62	12	50	10	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2508-4			26	21.4	4×1	16.8	37.5	330	40	63	71	12	59	15	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2510-3		10	26	21.6	3×1	12.7	27	250	40	63	80	15	65	15	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$
DK 2510-4			26	21.6	4×1	16.7	37.6	330	40	63	85	15	70	20	51	5.5×9.5×5.5	41	M6	$3.01×10^{-3}$

Model number coding

DK1605-4 RR G1 +900L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

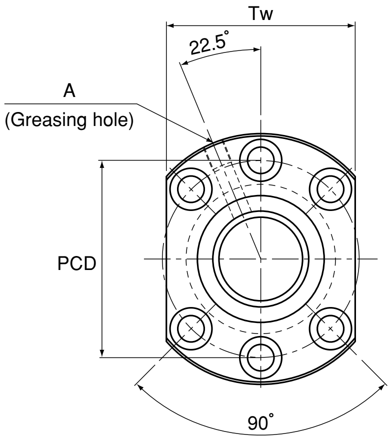
where

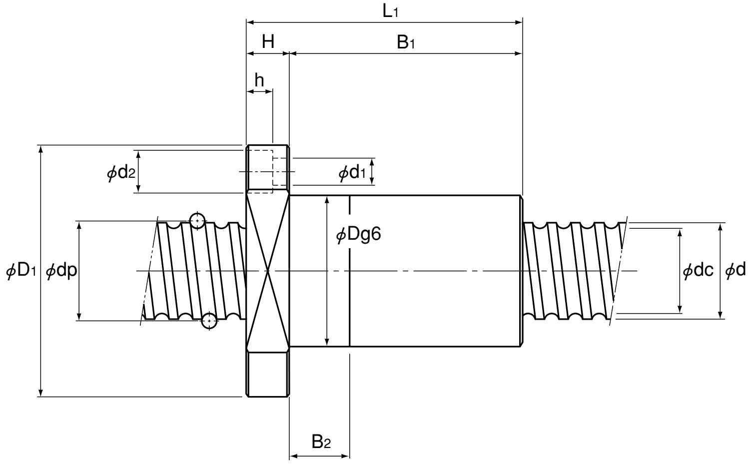
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model DK

Single-nut non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions										Screw shaft inertial moment/mm kg·cm²/mm
						C_a kN	C_{0a} kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1\times d_2\times h$	Tw	Greasing hole A	
DK 2805-3	28	5	28.75	25.2	3×1	10.5	26.4	270	43	71	49	12	37	10	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DK 2805-4			28.75	25.2	4×1	13.4	35.2	360	43	71	54	12	42	10	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DK 2806-3		6	29	24.4	3×1	14	32	280	43	71	53	12	41	10	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DK 2806-4			29	24.4	4×1	13.5	35.5	370	43	71	61	12	49	10	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DK 2810-4		10	29.25	23.6	4×1	22.4	50	370	45	71	84	15	69	20	57	6.6×11×6.5	55	M6	4.74×10^{-3}
DK 3204-3	32	4	32.5	30.1	3×1	6.4	19.6	290	45	76	44	11	33	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3204-4			32.5	30.1	4×1	8.2	26.1	380	45	76	48	11	37	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3205-3		5	32.75	29.2	3×1	11.1	30.2	300	46	76	47	12	35	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3205-4			32.75	29.2	4×1	14.2	40.3	400	46	76	52	12	40	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3205-6			32.75	29.2	6×1	20.1	60.4	600	46	76	62	12	50	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3206-3		6	33	28.4	3×1	14.9	37.1	310	48	76	53	12	41	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3206-4			33	28.4	4×1	19.1	49.5	410	48	76	61	12	49	10	63	6.6×11×6.5	59	M6	8.08×10^{-3}
DK 3210-3		10	33.75	26.4	3×1	25.7	52.2	300	54	87	80	15	65	15	69	9×14×8.5	66	M6	8.08×10^{-3}
DK 3210-4			33.75	26.4	4×1	33	69.7	390	54	87	90	15	75	20	69	9×14×8.5	66	M6	8.08×10^{-3}
DK 3212-4		12	33.75	26.4	4×1	34.2	73.9	420	54	87	98	15	83	25	69	9×14×8.5	66	M6	8.08×10^{-3}
DK 3610-3	36	10	37.75	30.5	3×1	28.8	63.8	350	58	98	82	18	64	15	77	11×17.5×11	75	M6	1.29×10^{-2}
DK 3610-4			37.75	30.5	4×1	36.8	85	470	58	98	93	18	75	20	77	11×17.5×11	75	M6	1.29×10^{-2}

Model number coding

DK3204-4 RR G1 +1800L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

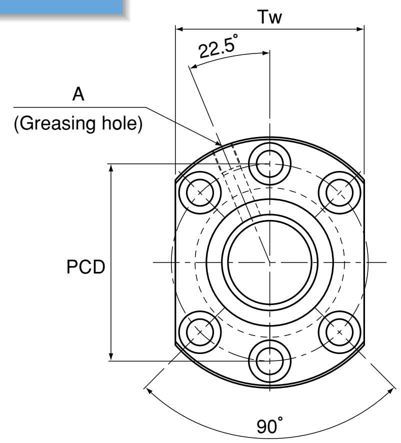
where

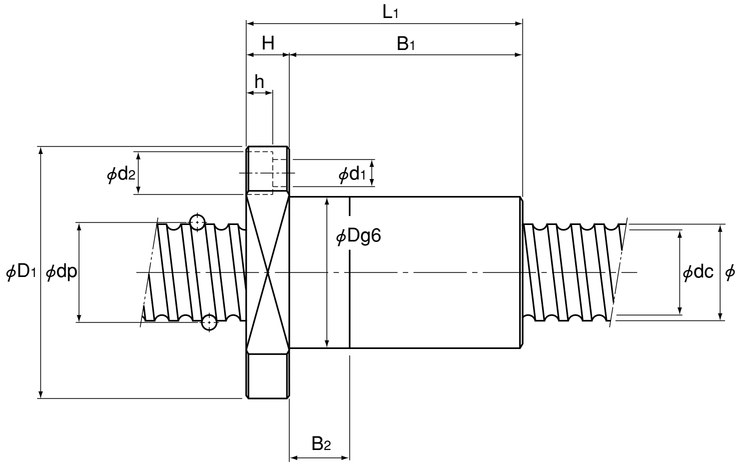
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model DK

Single-nut non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Tw	Greasing hole A	Screw shaft inertial moment/mm kg・cm²/mm
○ DK 4010-3	40	10	41.75	34.4	3×1	29.8	69.3	380	62	104	83	18	65	15	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DK 4010-4			41.75	34.4	4×1	38.1	92.4	500	62	104	93	18	75	20	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DK 4012-3		12	41.75	34.4	3×1	30.6	72.3	390	62	104	90	18	72	20	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DK 4012-4			41.75	34.4	4×1	39.2	96.4	520	62	104	103	18	85	25	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DK 4016-4		16	41.75	34.4	4×1	39.1	96.8	520	62	104	120	18	102	30	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
○ DK 4020-3		20	41.75	34.7	3×1	29.4	69.3	750	62	104	123	18	105	30	82	11×17.5×11	79	PT 1/8	1.97×10^{-2}
DK 5010-3	50	10	51.75	44.4	3×1	33.9	90.7	470	72	123	83	18	65	15	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DK 5010-4			51.75	44.4	4×1	43.4	120.5	610	72	123	93	18	75	20	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DK 5010-6			51.75	44.4	6×1	62.7	186.8	930	72	123	114	18	96	30	101	11×17.5×11	92	PT 1/8	4.82×10^{-2}
DK 5012-3		12	52.25	43.3	3×1	45.8	113	490	75	129	97	22	75	20	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DK 5012-4			52.25	43.3	4×1	58.6	150.6	640	75	129	110	22	88	25	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DK 5016-3		16	52.25	43.3	3×1	45.7	113.3	490	75	129	111	22	89	25	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DK 5016-4			52.25	43.3	4×1	58.5	151	640	75	129	129	22	107	30	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DK 5020-3		20	52.25	43.6	3×1	44.2	108.8	470	75	129	136	28	108	30	105	14×20×13	98	PT 1/8	4.82×10^{-2}
DK 6310-4	63	10	64.75	57.7	4×1	49.5	160.7	780	85	146	97	22	75	20	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DK 6310-6			64.75	57.7	6×1	70.3	242.1	1140	85	146	118	22	96	30	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DK 6312-3		12	65.25	56.3	3×1	51.9	147.4	600	90	146	98	22	76	20	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DK 6312-4			65.25	56.3	4×1	66.4	196.6	785	90	146	111	22	89	25	122	14×20×13	110	PT 1/8	1.21×10^{-1}
DK 6320-3		20	65.7	55.9	3×1	83.5	229.3	1470	95	159	136	28	108	30	129	18×26×17.5	121	PT 1/8	1.21×10^{-1}

Note Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-192.

Model number coding

DK4020-3 RR GT +2000L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca). These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

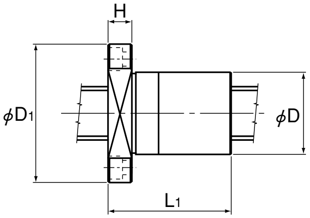
where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

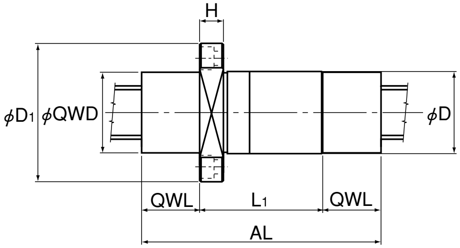
K: Rigidity value in the dimensional table.

Model DK

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut outer diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L1	H	D1	Dg6	QWL	QWD	AL
DK 4010-3	83	18	104	62	44	61	171
DK 4010-4	93						181
DK 4012-3	90						178
DK 4012-4	103						191
DK 4016-4	120						208
DK 4020-3	123	18	104	62	47	61	217

Model number coding

DK4010-3 QZ WW G1 +1500L C5

1 2 3 4 5 6

1 Model number 2 With QZ Lubricator (see page k-22)
3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4 Axial clearance symbol (see page k-15) 5 Overall screw shaft length (in mm)
6 Accuracy symbol (see page k-8)

Note QZ Lubricator and wiper ring are not sold alone.

Precautions on Use

■THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK .

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK .

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

■THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK .

Use in a Special Environment

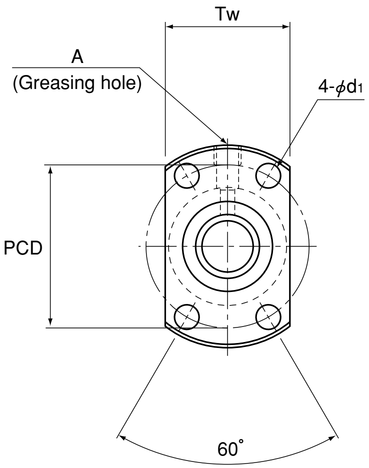
- When desiring to use the product in a special environment, contact THK .

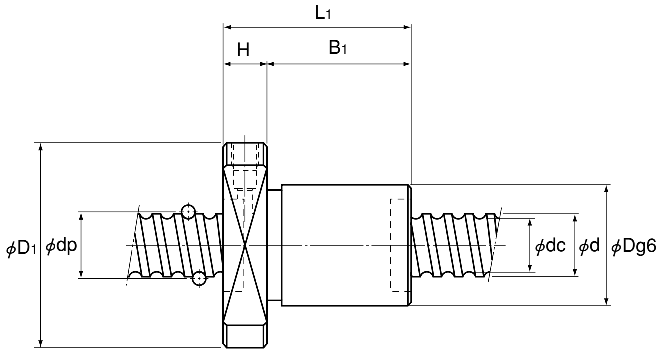
Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model MDK

Miniature-nut non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/µm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
MDK 0401-3	4	1	4.15	3.4	3×1	0.29	0.42	35	9	19	13	3	10	14	2.9	13	—	1.97×10^{-6}
MDK 0601-3	6	1	6.2	5.3	3×1	0.54	0.94	60	11	23	14.5	3.5	11	17	3.4	15	—	9.99×10^{-6}
MDK 0801-3	8	1	8.2	7.3	3×1	0.64	1.4	80	13	26	15	4	11	20	3.4	17	—	3.16×10^{-5}
MDK 0802-3		2	8.3	7	3×1	1.4	2.3	80	15	28	22	5	17	22	3.4	19	—	3.16×10^{-5}
MDK 1002-3	10	2	10.3	9	3×1	1.5	2.9	100	17	34	22	5	17	26	4.5	21	—	7.71×10^{-5}
MDK 1202-3	12	2	12.3	11	3×1	1.7	3.6	120	19	36	22	5	17	28	4.5	23	—	1.6×10^{-4}
MDK 1402-3	14	2	14.3	13	3×1	1.8	4.3	190	21	40	23	6	17	31	5.5	26	—	2.96×10^{-4}
MDK 1404-3		4	14.65	11.9	3×1	4.2	7.6	190	26	45	33	6	27	36	5.5	28	—	2.96×10^{-4}
MDK 1405-3		5	14.75	11.2	3×1	7	11.6	140	26	45	42	10	32	36	5.5	28	M6	2.96×10^{-4}

Note A labyrinth seal cannot be attached to models MDK0401, 0601 and 0801.

Model number coding

MDK1405-3 RR GT +450L C5

1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{F_a}{0.3C_a}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Large-Lead Precision Ball Screw

High-Speed Ball Screw with Ball Cage Model SBK

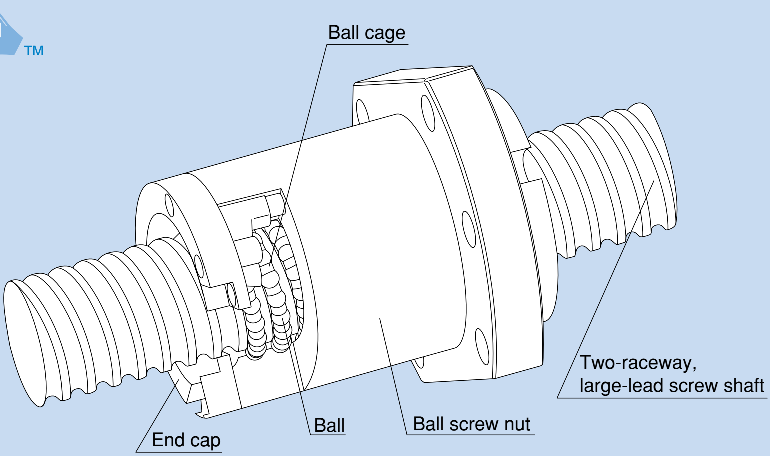


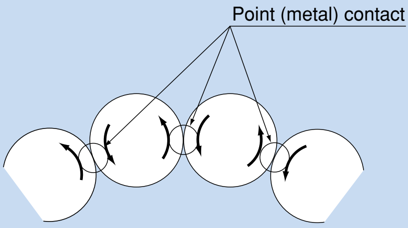
Fig. 1 Structure of High-Speed Ball Screw with Ball Cage Model SBK

Structure and Features

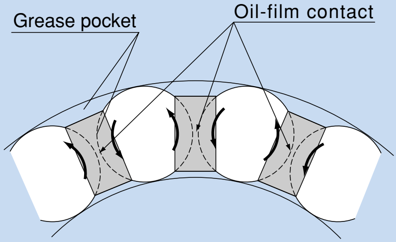
With High-Speed Ball Screw with Ball Cage model SBK, balls are evenly spaced by a ball cage to eliminate collision and friction between the balls ensure and a high level of grease retention. As a result, low noise, low torque fluctuation and long-term maintenance-free operation are achieved.

In addition, this model has a circulation structure where balls are picked up at the tangential direction by a return pipe (Fig. 2), thus to achieve a DN value* of 160,000 (* DN value = ball center diameter x rotation speed per minute) in high-speed operation.

As a result of adopting the offset preloading method, which shifts the lead in the central area of the ball screw nut, its overall ball screw nut length is shorter and its body is more compact than the double-nut type, which uses the spacer-based preloading method.



Structure of the conventional type



Structure of the Ball Screw with Ball Cage

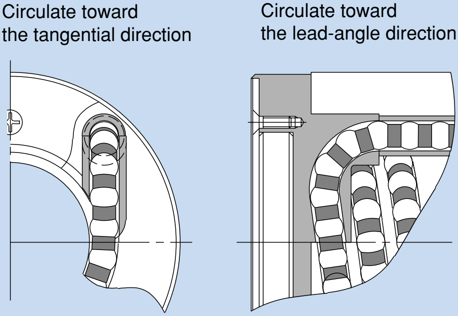


Fig. 2 Circulation Structure of Model SBK

Ball Cage Effect

●Low noise, acceptable running sound

Use of a ball cage eliminates collision noise between balls.

In addition, the fact that balls are picked up at the tangential direction also contributes to eliminating collision noise generated from circulating balls.

●Long-term maintenance-free operation

Since friction between balls is eliminated and grease is retained in the grease pocket, long-term maintenance-free operation (replenishment of grease is unnecessary for a long period) is achieved.

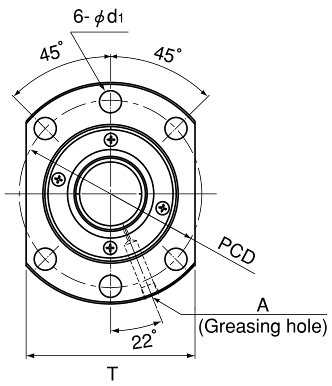
●Smooth motion

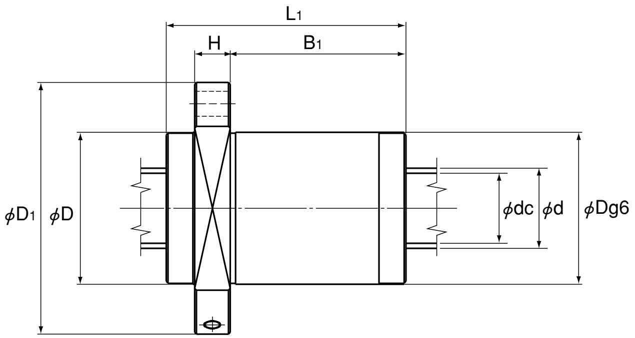
Use of a ball cage eliminates friction between balls and minimizes torque fluctuation, thus allowing smooth motion to be achieved.

Type

Offset-preload Type Model SBK

Model SBK





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D1	Overall length L1	H	B1	PCD	d1	T	Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
SBK 3620-7.6	36	20	37.75	30.4	2×3.8	48.5	85	870	73	114	110	18	81	93	11	86	PT1/8	1.29×10^{-2}
SBK 4020-7.6	40	20	42	34.1	2×3.8	59.7	112.7	970	80	136	110	20	79	112	14	103	PT1/8	1.97×10^{-2}
SBK 4030-7.6	40	30	42	34.1	2×3.8	59.2	107.5	970	80	136	148	20	117	112	14	103	PT1/8	1.97×10^{-2}
SBK 5030-7.6	50	30	52	44.1	2×3.8	66.5	135	1170	90	146	149	22	116	122	14	110	PT1/8	4.82×10^{-2}
SBK 5036-7.6	50	36	52	44.1	2×3.8	65.9	135	1170	90	146	172	22	139	122	14	110	PT1/8	4.82×10^{-2}
SBK 5530-7.6	55	30	57	49.1	2×3.8	69.2	147	1250	96	152	149	22	116	128	14	114	PT1/8	7.05×10^{-2}
SBK 5536-7.6	55	36	57	49.1	2×3.8	69.1	148.7	1260	96	152	172	22	139	128	14	114	PT1/8	7.05×10^{-2}

Model number coding

$$\underbrace{\text{SBK3620-7.6}}_{1}\ \underbrace{\text{RR}}_{2}\ \underbrace{\text{G0}}_{3}\ \underbrace{\text{+1500L}}_{4}\ \underbrace{\text{C5}}_{5}$$

1 Model number
2 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (F_{a0}) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{F_{a0}}{0.1\,Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Large-Lead Precision Ball Screw

Models BLW, BLK and WGF

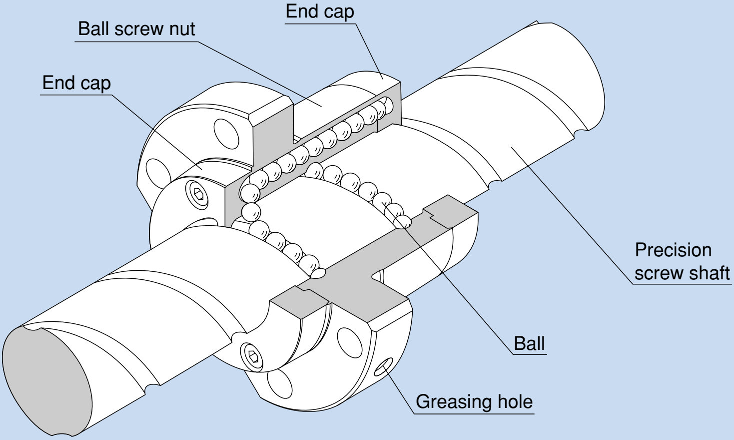


Fig. 1 Structure of the Large-Lead Precision Ball Screw

Structure and Features

With the Large-Lead Precision Ball Screw, balls under a load roll in the raceways formed on the screw shaft and the ball screw nut while receiving an axial load, are picked up with an end cap attached to the ball screw nut ends, and then fed from the other end cap to the loaded area again after passing through the ball screw nut, thus to complete infinite rotary motion.

These models have either one ball raceway or two raceways.

●Optimal for Fast Feed

Use of the end cap increases the strength of the ball pick-up section in comparison to the conventional return-pipe type, and achieves stable motion even in high-speed rotation. In addition, the double-nut type is capable of fast feed with no backlash because it is provided with a preload.

●Quiet Running Sound

Use of the end cap minimizes the level of noise produced when the balls are picked up. In addition, the balls pass inside the ball screw nut, thus to achieve very low noise even in high-speed rotation.

●A Long-size Type Can be Used with a Thin Ball Screw Shaft

Replacing a standard Ball Screw, used in a location where high-speed operation is required, with one of these models will allow the rotation speed of the screw shaft to be decreased. Therefore, it eliminates the need to use a thicker screw shaft given the critical speed of the screw shaft and the need for choosing a difficult method for securing the screw shaft, thus to reduce the cost.

●Compact Installation

The end cap attached to the ball screw nut ends serves also as a ball circulation guide and a seal. This allows the ball screw nut to be shortened. In addition, the absence of a return pipe minimizes the outer diameter of the ball screw shaft and enables compact installation.
Moreover, since the flange circumference is cut flat at the top and bottom, the Ball Screw center height is lower than the round-flange type and the overall machine height is kept low.

Types and Features

Preload Type Model BLW

A preload is provided through a spacer between two combined nuts.

Non-preload Type Models BLK and WGF

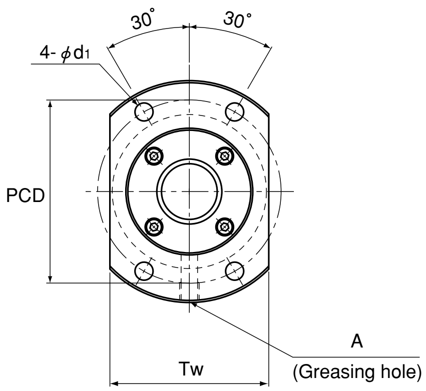
With model BLK, the shaft diameter is equal to the lead dimension. Model WGF has a lead dimension 1.5 to 3 times longer than the shaft diameter.

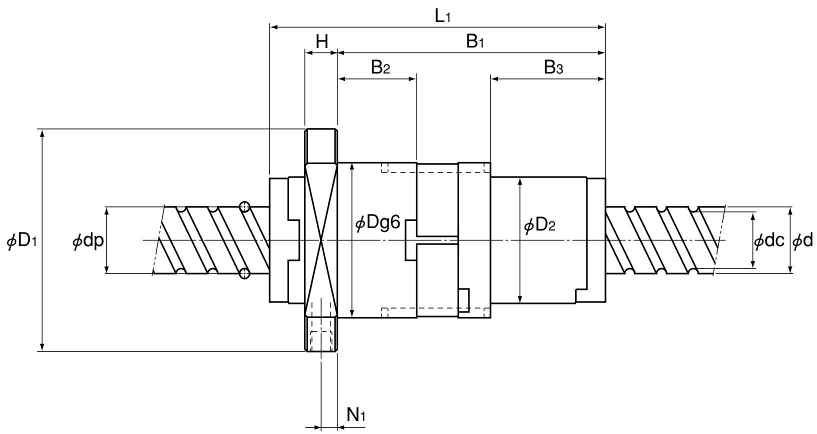
Precautions

The Large-Lead Precision Ball Screw cannot be manufactured unless either end of the screw shaft is cut off or the screw shaft end diameter is smaller than the thread minor diameter.

Model BLW

Large-lead double-nut preload type





Unit: mm

Model No.	Screw shaft outer diameter	Lead	Ball center diameter	Thread minor diameter	No. of loaded circuits	Basic load rating		Rigidity	Nut dimensions														Screw shaft inertial moment/mm
	d	R	dp	dc	Rows x turns	Ca kN	C_0a kN	K N/μm	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	D_2	B_3	PCD	d_1	Tw	N_1	Greasing hole A		kg·cm²/mm
BLW 1510-5.6	15	10	15.75	12.5	2×2.8	14.3	27.8	680	43	64	89	10	69	18.7	34	28.6	52	5.5	46	5	M6		3.9×10^{-4}
BLW 1616-3.6	16	16	16.65	13.7	2×1.8	7.1	14.3	440	41	60	84.5	10	65.5	18.1	32	27.1	49	4.5	44	6	M6		5.05×10^{-4}
BLW 2020-3.6	20	20	20.75	17.5	2×1.8	11.1	24.7	570	48	69	105	10	84	25	39	36	57	5.5	50	5	M6		1.23×10^{-3}
BLW 2525-3.6	25	25	26	22	2×1.8	16.6	38.7	700	57	82	124.5	12	101.5	33	47	44	68	6.6	60	5	M6		3.01×10^{-3}
BLW 3232-3.6	32	32	33.25	28.3	2×1.8	23.7	59.5	880	68	99	155	15	127	42.4	58	55.4	81	9	70	6	M6		8.08×10^{-3}
BLW 3636-3.6	36	36	37.4	31.7	2×1.8	30.8	78	980	79	116	181	17	147.9	49.4	66	65.4	95	11	82	7	M6		1.29×10^{-2}
BLW 4040-3.6	40	40	41.75	35.2	2×1.8	38.7	99.2	1090	84	121	191	17	158	54.5	73	70.5	100	11	87	7	M6		1.97×10^{-2}
BLW 5050-3.6	50	50	52.2	44.1	2×1.8	57.8	155	1340	106	149	245	20	203.8	70.7	90	91.7	126	14	108	8	M6		4.82×10^{-2}

Model number coding

BLW1616-3.6 G0 +900L C3
1 2 3 4

1 Model number 2 Axial clearance symbol (see page k-15) 3 Overall screw shaft length (in mm)
4 Accuracy symbol (see page k-8)

Note A seal cannot be attached to model BLW.

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

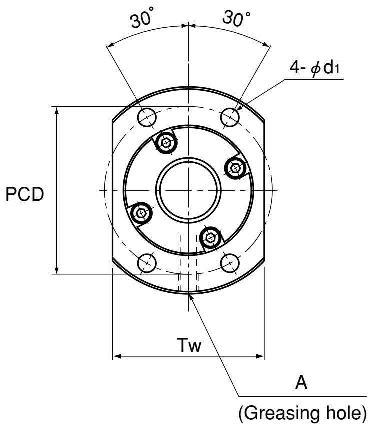
where

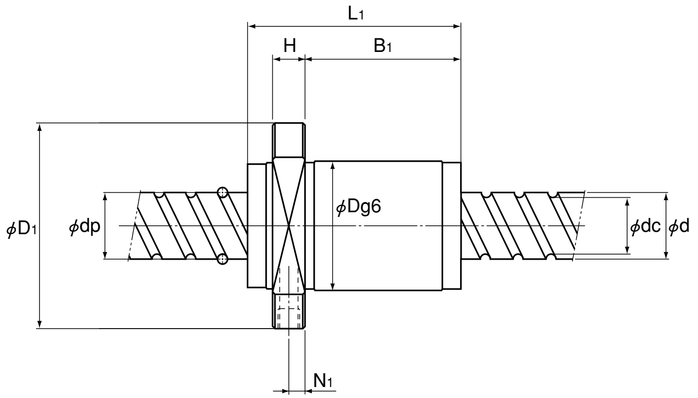
$$K_N = K\left(\frac{Fa_0}{0.1Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model BLK

Large-lead non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Nut dimensions Flange diameter D_1	Nut dimensions Overall length L_1	Nut dimensions H	Nut dimensions B_1	Nut dimensions PCD	Nut dimensions d_1	Nut dimensions Tw	Nut dimensions N_1	Nut dimensions Greasing hole A	Screw shaft inertial moment/mm kg·cm²/mm
BLK 1510-5.6	15	10	15.75	12.5	2×2.8	14.3	27.8	340	34	57	44	10	24	45	5.5	40	5	M6	3.9×10^{-4}
BLK 1616-2.8	16	16	16.65	13.7	1×2.8	5.2	9.9	180	32	53	54	10	37.5	42	4.5	38	5	M6	5.05×10^{-4}
BLK 1616-3.6			16.65	13.7	2×1.8	7.1	14.3	220	32	53	38	10	21.5	42	4.5	38	5	M6	5.05×10^{-4}
BLK 2020-2.8	20	20	20.75	17.5	1×2.8	8.1	17.2	230	39	62	65	10	47.5	50	5.5	46	5	M6	1.23×10^{-3}
BLK 2020-3.6			20.75	17.5	2×1.8	11.1	24.7	290	39	62	45	10	27.5	50	5.5	46	5	M6	1.23×10^{-3}
BLK 2525-2.8	25	25	26	22	1×2.8	12.2	26.9	270	47	74	80	12	60	60	6.6	56	6	M6	3.01×10^{-3}
BLK 2525-3.6			26	22	2×1.8	16.6	38.7	350	47	74	55	12	35	60	6.6	56	6	M6	3.01×10^{-3}
BLK 3232-2.8	32	32	33.25	28.3	1×2.8	17.3	41.4	340	58	92	102	15	77	74	9	68	7.5	M6	8.08×10^{-3}
BLK 3232-3.6			33.25	28.3	2×1.8	23.7	59.5	440	58	92	70	15	45	74	9	68	7.5	M6	8.08×10^{-3}
BLK 3620-5.6	36	20	37.75	31.2	2×2.8	54.9	134.3	760	70	110	78	17	45	90	11	80	8.5	M6	1.29×10^{-2}
BLK 3624-5.6		24	38	30.7	2×2.8	63.8	151.9	770	75	115	94	18	59	94	11	86	9	M6	1.29×10^{-2}
BLK 3636-2.8		36	37.4	31.7	1×2.8	22.4	54.1	390	66	106	113	17	86	85	11	76	8.5	M6	1.29×10^{-2}
BLK 3636-3.6			37.4	31.7	2×1.8	30.8	78	490	66	106	77	17	50	85	11	76	8.5	M6	1.29×10^{-2}
BLK 4040-2.8	40	40	41.75	35.2	1×2.8	28.2	68.9	430	73	114	125	17	96.5	93	11	84	8.5	M6	1.97×10^{-2}
BLK 4040-3.6			41.75	35.2	2×1.8	38.7	99.2	550	73	114	85	17	56.5	93	11	84	8.5	M6	1.97×10^{-2}
BLK 5050-2.8	50	50	52.2	44.1	1×2.8	42.2	107.8	530	90	135	156	20	122	112	14	104	10	M6	4.82×10^{-2}
BLK 5050-3.6			52.2	44.1	2×1.8	57.8	155	670	90	135	106	20	72	112	14	104	10	M6	4.82×10^{-2}

Model number coding

$$\underbrace{\text{BLK2525-3.6}}_{1}\ \underbrace{\text{G2}}_{2}\ \underbrace{\text{+1500L}}_{3}\ \underbrace{\text{C5}}_{4}$$

1 Model number 2 Axial clearance symbol (see page k-15) 3 Overall screw shaft length (in mm)

4 Accuracy symbol (see page k-8)

Note A seal cannot be attached to Large-Lead Precision Ball Screw model BLK.

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).

These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

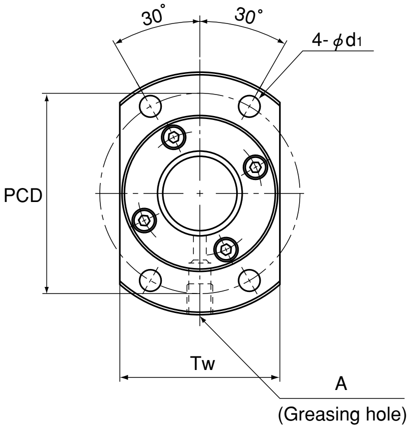
where

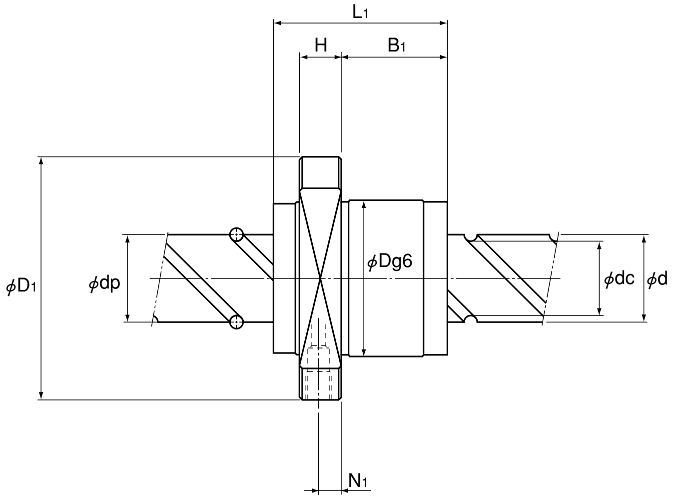
$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Model WGF

Super-lead non-preload type





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity K N/μm	Nut dimensions										Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN		Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw	N_1	Greasing hole A	
WGF 0812-3	8	12	8.4	6.6	2×1.65	2.2	3.9	110	18	31	27	4	17	25	3.4	20	—	—	3.16×10^{-5}
WGF 1015-3	10	15	10.5	8.3	2×1.65	3.3	6.2	140	23	40	33	5	22	32	4.5	25	—	—	7.71×10^{-5}
WGF 1320-3	13	20	13.5	10.8	2×1.65	4.7	9.6	180	28	45	43	5	29	37	4.5	30	—	—	2.2×10^{-4}
WGF 1520-1.5	15	20	15.75	12.5	1×1.5	4.4	7.9	100	32	53	45	10	28	43	5.5	33	5	M6	3.9×10^{-4}
WGF 1520-3			15.75	12.5	2×1.5	8.1	15.8	190	32	53	45	10	28	43	5.5	33	5	M6	3.9×10^{-4}
WGF 1530-1		30	15.75	12.5	2×0.6	3.5	5.4	90	32	53	33	10	17	43	5.5	33	5	M6	3.9×10^{-4}
WGF 1530-3			15.75	12.5	2×1.6	8.1	14.6	220	32	53	63	10	47	43	5.5	33	5	M6	3.9×10^{-4}
WGF 1540-1.5		40	15.75	12.5	2×0.75	3.9	7.4	110	32	53	42	10	26.3	43	5.5	33	5	M6	3.9×10^{-4}
WGF 2040-1	20	40	20.75	17.5	2×0.65	4.3	8	110	37	57	41	10	25	47	5.5	38	5.5	M6	1.23×10^{-3}
WGF 2040-3			20.75	17.5	2×1.65	9.5	20.2	280	37	57	81	10	65	47	5.5	38	5.5	M6	1.23×10^{-3}
WGF 2060-1.5		60	20.75	17.5	2×0.75	4.5	11	140	37	57	60	10	40.1	47	5.5	38	5	M6	1.23×10^{-3}
WGF 2550-1	25	50	26	21.9	2×0.65	6.4	12.5	140	45	69	52	12	31.5	57	6.6	46	7	M6	3.01×10^{-3}
WGF 2550-3			26	21.9	2×1.65	14.3	31.7	340	45	69	102	12	81.5	57	6.6	46	7	M6	3.01×10^{-3}
WGF 3060-1	30	60	31.25	26.4	2×0.65	8.9	18	170	55	89	62	15	37	71	9	56	9	M6	6.24×10^{-3}
WGF 3060-3			31.25	26.4	2×1.65	19.9	45.7	410	55	89	122	15	97	71	9	56	9	M6	6.24×10^{-3}
WGF 3090-1.5		90	31.25	26.4	2×0.75	9.7	25.8	200	55	89	92	15	61.3	71	9	56	9	M6	6.24×10^{-3}
WGF 4080-1	40	80	41.75	35.2	2×0.65	15	32.1	220	73	114	79	17	50.5	93	11	74	8.5	M6	1.97×10^{-2}
WGF 4080-3			41.75	35.2	2×1.65	33.4	81.4	530	73	114	159	17	130.5	93	11	74	8.5	M6	1.97×10^{-2}
WGF 50100-1	50	100	52.2	44.1	2×0.65	22.4	50.1	270	90	135	98	20	64	112	14	92	10	M6	4.82×10^{-2}
WGF 50100-3			52.2	44.1	2×1.65	49.9	127.2	650	90	135	198	20	164	112	14	92	10	M6	4.82×10^{-2}

Model number coding

WGF1540-1.5 G2 +900L C7

1 2 3 4

1 Model number 2 Axial clearance symbol (see page k-15) 3 Overall screw shaft length (in mm)
4 Accuracy symbol (see page k-8)

Note A seal cannot be attached to model WGF.

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Rotary Nut Series

Rotary Ball Screw Model BLR

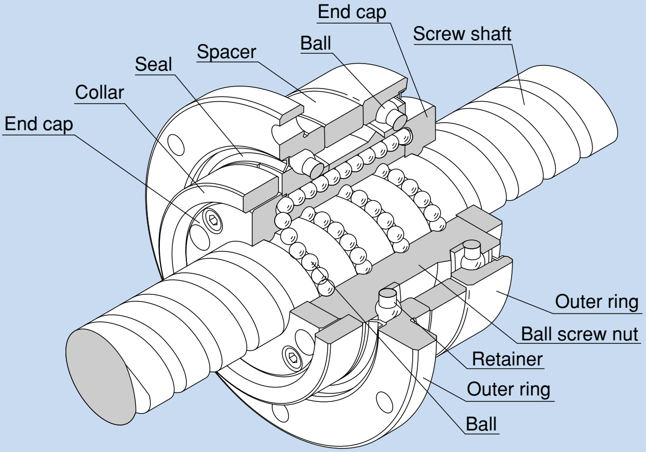


Fig. 1 Structure of Large-Lead Rotary Nut Ball Screw Model BLR

Structure and Features

The Rotary Ball Screw is a nut-rotating ball screw unit that has an integrated structure consisting of a ball screw nut and a support bearing. The support bearing is an angular bearing that has a contact angle of 60°, contains an increased number of balls and achieves large axial rigidity.
Model BLR is divided into two types: Precision Ball Screw and Roller Screw Ball.

●Capable of Fast Feed

Since the ball screw nut rotates with the screw shaft being secured, it can be fed at high speed with a thin screw shaft. It allows a small driving motor to be used.

●Smooth Motion

It achieves smoother motion than rack-and-pinion based linear motion. Also, since the screw shaft does not rotate because of the ball screw nut drive, this model does not show skipping, produces low noise and generates little heat.

●Low Noise even in High-speed Rotation

Model BLR produces very low noise when the balls are picked up along the end cap. In addition, the balls circulate by passing through the ball screw nut, allowing this model to be used at high speed.

●High Rigidity

The support bearing of this model is larger than that of the screw shaft rotation type. Thus, it axial rigidity is significantly increased.

●Compact

Since the nut and the support bearing are integrated, highly accurate, compact design is achieved.

●Easy Installation

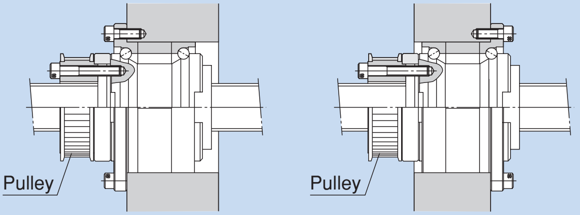
By simply mounting this model to the housing using bolts, a ball screw nut rotating mechanism can be obtained (for the housing's inner-diameter tolerance, H7 is recommended).

Types

Rotary Ball Screw Model BLR (Precision Type)

Rotary Ball Screw Model BLR (Rolled Type)

Example of Mounting Ball Screw Nut Model BLR



Standard installation method   Flange inverted

Note: If the flange is to be inverted, indicate "K" in the model number (applicable only to model BLR).
Example: BLR 2020-3.6 K UU
Symbol for inverted flange
(No symbol for standard flange orientation)

Example of Mounting Model BLR on the Table

(1) Screw shaft free, ball screw nut fixed
(Suitable for a long table)

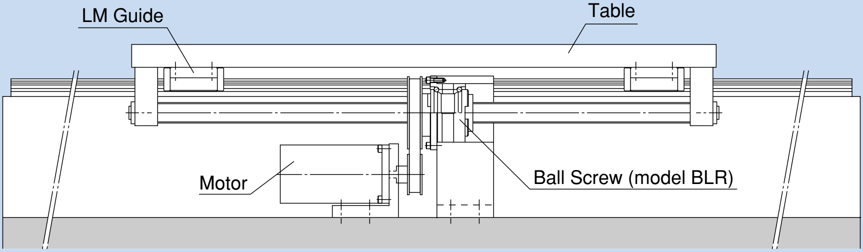


Fig. 2 Example of Installation on the Table (Ball Screw Nut Fixed)

(2) Ball screw nut free, screw shaft fixed
(Suitable for a short table and a long stroke)

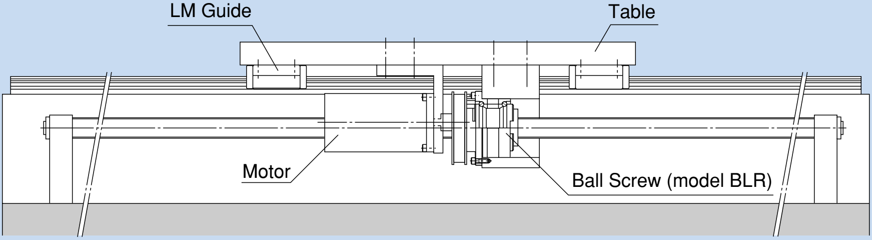
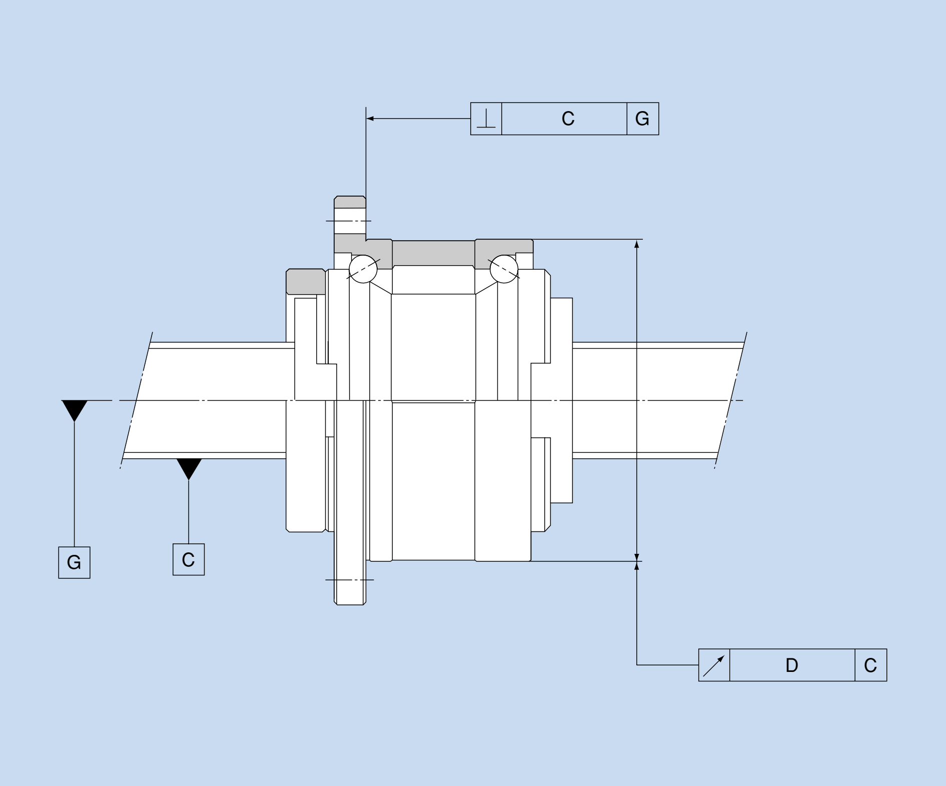


Fig. 3 Example of Installation on the Table (Screw Shaft Fixed)

Accuracy Standard for Model BLR

The accuracy of model BLR is compliant with a JIS standard (JIS B 1192) except for the radial run-out of the circumference of the ball screw nut from the screw axis (D) and the perpendicularity of the flange-mounting surface against the screw axis (C).

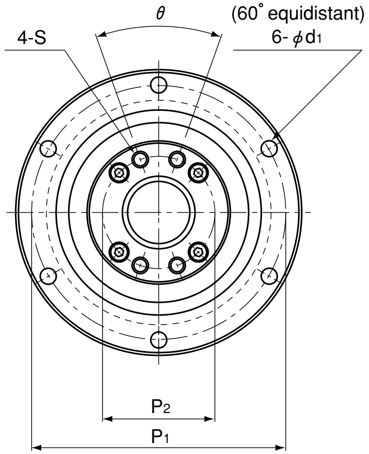


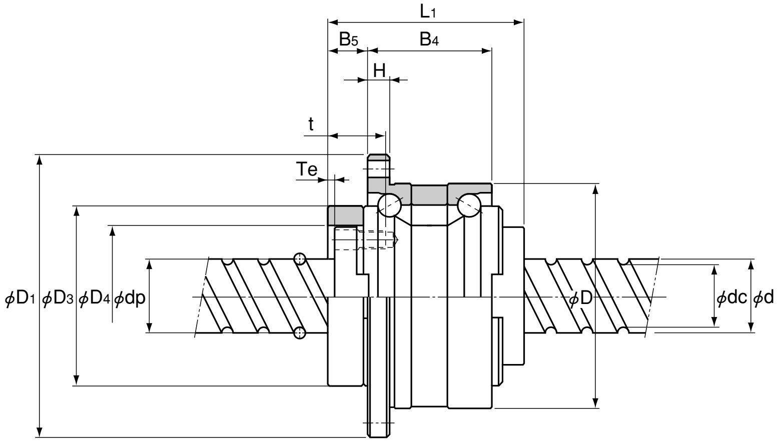
Unit: mm

Accuracy grade	C3		C5		C7		C10	
Model No.	C	D	C	D	C	D	C	D
BLR 1616	0.013	0.017	0.016	0.020	0.023	0.035	0.035	0.065
BLR 2020	0.013	0.017	0.016	0.020	0.023	0.035	0.035	0.065
BLR 2525	0.015	0.020	0.018	0.024	0.023	0.035	0.035	0.065
BLR 3232	0.015	0.020	0.018	0.024	0.023	0.035	0.035	0.065
BLR 3636	0.016	0.021	0.019	0.025	0.024	0.036	0.036	0.066
BLR 4040	0.018	0.026	0.021	0.033	0.026	0.046	0.046	0.086
BLR 5050	0.018	0.026	0.021	0.033	0.026	0.046	0.046	0.086

Model BLR

Large-Lead Rotary Nut Precision Ball Screw





Unit: mm

Model No.	Screw shaft outer diameter d	Thread minor diameter dc	Lead R	Ball center diameter dp	Basic load rating Ca kN	Basic load rating C₀a kN	Ball screw dimensions: Outer diameter D	Flange diameter D₁	Overall length L₁	D₃	D₄	H	B₄	B₅	Te	P₁	P₂	S	t	d₁	θ°	Support bearing basic load rating Ca kN	Support bearing basic load rating C₀a kN	Nut inertial moment kg·cm²
BLR 1616-3.6	16	13.7	16	16.65	7.1	14.3	$52^{\ 0}_{-0.007}$	68	43.5	$40^{\ 0}_{-0.025}$	$32^{+0.025}_{\ 0}$	5	27.5	9	2	60	25	M4	12	4.5	40	19.4	19.2	0.48
BLR 2020-3.6	20	17.5	20	20.75	11.1	24.7	$62^{\ 0}_{-0.007}$	78	54	$50^{\ 0}_{-0.025}$	$39^{+0.025}_{\ 0}$	6	34	11	2	70	31	M5	16	4.5	40	26.8	29.3	1.44
BLR 2525-3.6	25	22	25	26	16.6	38.7	$72^{\ 0}_{-0.007}$	92	65	$58^{\ 0}_{-0.03}$	$47^{+0.025}_{\ 0}$	8	43	12.5	3	81	38	M6	19	5.5	40	28.2	33.3	3.23
BLR 3232-3.6	32	28.3	32	33.25	23.7	59.5	$80^{\ 0}_{-0.007}$	105	80	$66^{\ 0}_{-0.03}$	$58^{+0.03}_{\ 0}$	9	55	14	3	91	48	M6	19	6.6	40	30	39	6.74
BLR 3636-3.6	36	31.7	36	37.4	30.8	78	$100^{\ 0}_{-0.008}$	130	93	$80^{\ 0}_{-0.03}$	$66^{+0.03}_{\ 0}$	11	62	17	3	113	54	M8	22	9	40	56.4	65.2	16.8
BLR 4040-3.6	40	35.2	40	41.75	38.7	99.2	$110^{\ 0}_{-0.008}$	140	98	$90^{\ 0}_{-0.035}$	$73^{+0.03}$	11	68	16.5	3	123	61	M8	22	9	50	59.3	74.1	27.9
BLR 5050-3.6	50	44.1	50	52.2	57.8	155	$120^{\ 0}_{-0.008}$	156	126	$100^{\ 0}_{-0.035}$	$90^{+0.035}_{\ 0}$	12	80	25	4	136	75	M10	28	11	50	62.2	83	58.2

Model number coding

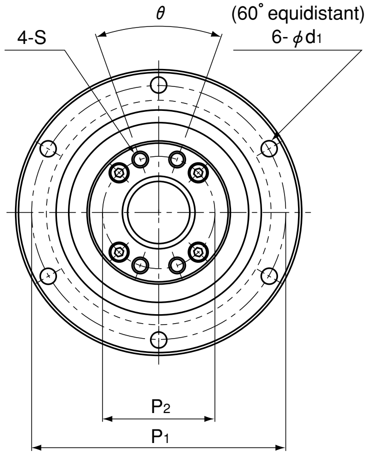
BLR2020-3.6 K UU G1 +1000L C5

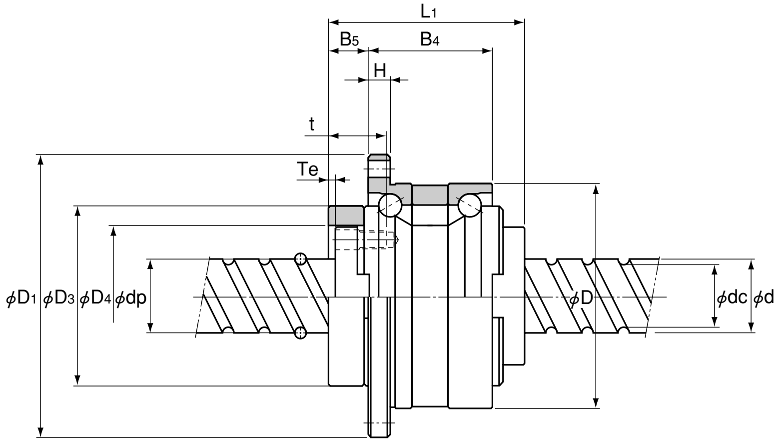
1 2 3 4 5 6

1Model number 2Flange orientation symbol (see page k-210) - K: Flange inversed
No symbol: Standard
3Symbol for support bearing seal - UU: Seal attached on both ends
No symbol: Without seal
4Symbol for axial clearance (see page k-15) 5Overall screw shaft (in mm)
6Accuracy symbol (see page k-8)

Model BLR

Large-Lead Rotary Nut Rolled Ball Screw





Unit: mm

Model No.	Screw shaft outer diameter	Thread minor diameter	Lead	Ball center diameter	Basic load rating		Ball screw dimensions															Support bearing basic load rating		Nut inertial moment
	d	dc	R	dp	Ca kN	C_0a kN	Outer diameter D	Flange diameter D_1	Overall length L_1	D_3	D_4	H	B_4	B_5	Te	P_1	P_2	S	t	d_1	θ°	Ca kN	C_0a kN	kg·cm²
BLR 1616-3.6	16	13.7	16	16.65	5.8	12.9	$52^{\ 0}_{-0.007}$	68	43.5	$40^{\ 0}_{-0.025}$	$32^{+0.025}_{\ 0}$	5	27.5	9	2	60	25	M4	12	4.5	40	19.4	19.2	0.48
BLR 2020-3.6	20	17.5	20	20.75	7.7	22.3	$62^{\ 0}_{-0.007}$	78	54	$50^{\ 0}_{-0.025}$	$39^{+0.025}_{\ 0}$	6	34	11	2	70	31	M5	16	4.5	40	26.8	29.3	1.44
BLR 2525-3.6	25	22	25	26	12.1	35	$72^{\ 0}_{-0.007}$	92	65	$58^{\ 0}_{-0.03}$	$47^{+0.025}_{\ 0}$	8	43	12.5	3	81	38	M6	19	5.5	40	28.2	33.3	3.23
BLR 3232-3.6	32	28.3	32	33.25	17.3	53.9	$80^{\ 0}_{-0.007}$	105	80	$66^{\ 0}_{-0.03}$	$58^{+0.03}_{\ 0}$	9	55	14	3	91	48	M6	19	6.6	40	30	39	6.74
BLR 3636-3.6	36	31.7	36	37.4	22.4	70.5	$100^{\ 0}_{-0.008}$	130	93	$80^{\ 0}_{-0.03}$	$66^{+0.03}_{\ 0}$	11	62	17	3	113	54	M8	22	9	40	56.4	65.2	16.8
BLR 4040-3.6	40	35.2	40	41.75	28.1	89.8	$110^{\ 0}_{-0.008}$	140	98	$90^{\ 0}_{-0.035}$	$73^{+0.03}$	11	68	16.5	3	123	61	M8	22	9	50	59.3	74.1	27.9
BLR 5050-3.6	50	44.1	50	52.2	42.1	140.4	$120^{\ 0}_{-0.008}$	156	126	$100^{\ 0}_{-0.035}$	$90^{+0.035}_{\ 0}$	12	80	25	4	136	75	M10	28	11	50	62.2	83	58.2

Model number coding

BLR2020-3.6 K UU +1000L C7 T

1 2 3 4 5 6

1 Model number
2 Flange orientation symbol (see page k-210) - K: Flange inversed
No symbol: Standard
3 Symbol for support bearing seal - UU: Seal attached on both ends
No symbol: Without seal
4 Overall screw shaft (in mm)
5 Accuracy symbol (see page k-8) (no symbol for class C10)
6 Symbol for rolled Ball Screw

Note For axial clearance, see page k-15.

Dust Prevention and Lubrication

Dust Prevention

For the outer ring of the support bearing, a highly wear-resistant special synthetic rubber seal is available in order to prevent foreign matter from entering the bearing system and the lubricant from leaking (type BLR···UU).
Every THK Precision Ball Screw has labyrinth seals attached on both ends of the ball screw nut to prevent foreign matter such as cutting chips from entering the nut.
A slight clearance is secured between the labyrinth seal and the screw shaft to maintain the efficiency of the seal. For a bellows and a screw cover, contact THK .

Lubrication

When lubricating the Rotary Ball Screw, attach the greasing plate to the housing in advance.
THK Precision Ball Screws require appropriate lubrication in order to maintain their efficiencies, service lives and accuracies and to protect them from temperature rise. In particular, when the heat generation of the ball screw unit would affect the accuracy due to high-speed rotation and a heavy load, it is also important to consider selecting a lubricant and cooling the system by forced lubrication.

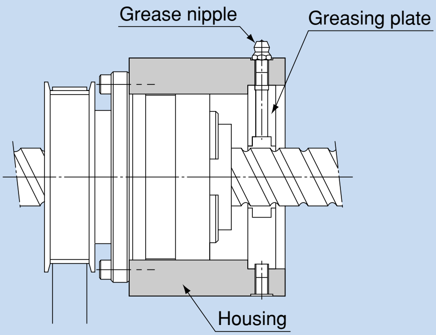


Fig. 4 Lubrication Method

Precautions on Use

Do not separate the ball screw nut of THK Precision Ball Screw from the screw shaft. In the event you have separated the nut from the shaft, check the serial number and the model number indicated on the ball screw nut, and then contact THK .
Note that the screw shaft cannot be assembled unless either end is cut off or its diameter is smaller than the thread minor diameter.

Rotary Nut Series

Rotary Ball Screw Model DIR

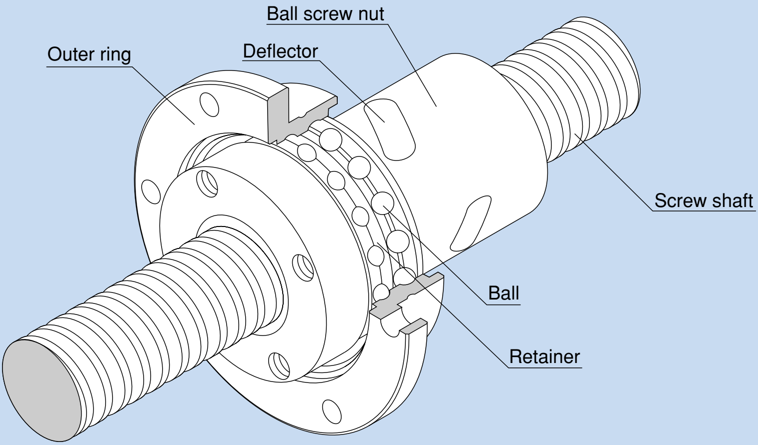


Fig. 1 Structure of Standard-Lead Rotary-Nut Ball Screw Model DIR

Structure and Features

Standard-Lead Rotary-Nut Ball Screw model DIR is rotary nut Ball Screw that has a structure where a simple-nut Ball Screw is integrated with a support bearing.

Its ball screw nut serves as a ball circulation mechanism using deflectors. Balls travel along the groove of the deflector mounted in the ball screw nut to the adjacent raceway, and then circulate back to the loaded area to complete infinite rolling motion.

Being an offset preload nut, the single ball screw nut provides different phases to the right and left thread in the middle of the nut, thus to set the axial clearance below zero (a preload is provided). This allows more compact, smoother motion to be achieved than the conventional double-nut type (a spacer is inserted between two nuts).

The support bearing comprises two rows of DB type angular bearings with a contact angle of 45° to provide a preload. The collar, previously used to mount a pulley, is integrated with the ball screw nut.

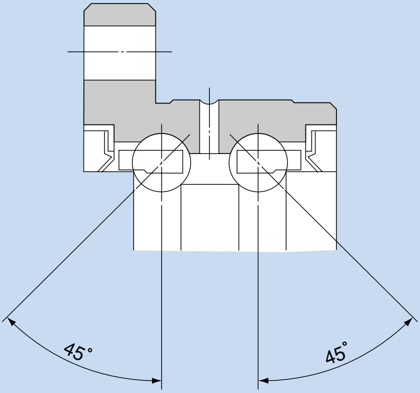


Fig. 2 Structure of the Support Bearing

●Compact

Because of the internal circulation mechanism using a deflector, the outer diameter is only 70 to 80%, and the overall length is 60 to 80%, of that of the Return-pipe Nut, thus to reduce the weight and decrease the inertia during acceleration.

Since the ball screw nut is integrated with the support bearing, highly accurate, compact design is allowed. In addition, small inertia because of the lightweight ball screw nut ensures high responsiveness.

●Capable of High-speed Rotation

Since the screw shaft is fixed and the ball screw nut is free, the Ball Screw is capable of rotating at high speed even if the shaft diameter is small. It allows a small driving motor to be used.

●Capable of Fine Positioning

Being a Standard-Lead Ball Screw, it is capable of fine positioning despite that the ball screw nut rotates.

●Accuracy can Easily be Established

As the support bearing is integrated with the outer ring, the bearing can be assembled with the nut housing on the end face of the outer ring flange. This makes it easy to center the ball screw nut and establish accuracy.

●Well Balanced

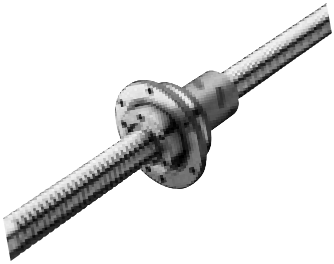
Since the deflector is evenly placed along the circumference, superb balance is ensured while the ball screw nut is rotating.

●Stability in the Low-speed Range

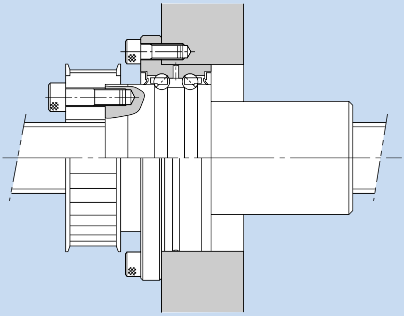
Traditionally, motors tend to have uneven torque and speed in the low-speed range due to external causes. With model DIR, the motor can be connected independently with the screw shaft and the ball screw nut, thus to allow fine feed within the motor's stable rotation range.

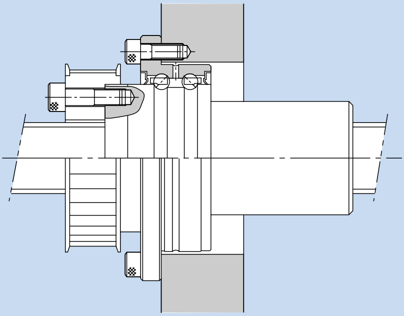
Types

Rotary Ball Screw Model DIR



Example of Mounting Ball Screw Nut Model DIR

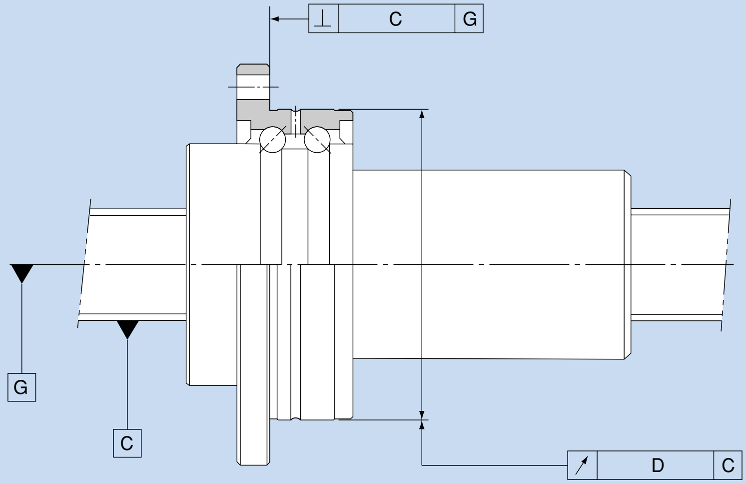




Installation to the housing can be performed on the end face of the outer ring flange.

Accuracy Standards for Model DIR

The accuracy of model DIR is compliant with a JIS standard (JIS B 1192) except for the radial run-out of the circumference of the ball screw nut from the screw axis (D) and the perpendicularity of the flange-mounting surface against the screw axis (C).

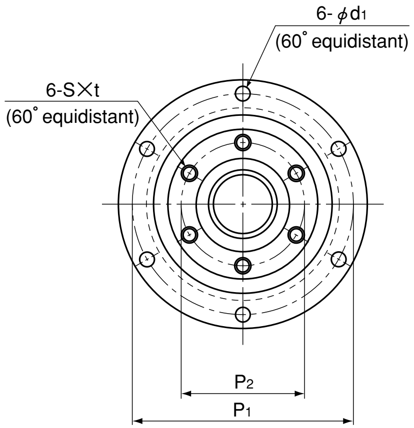


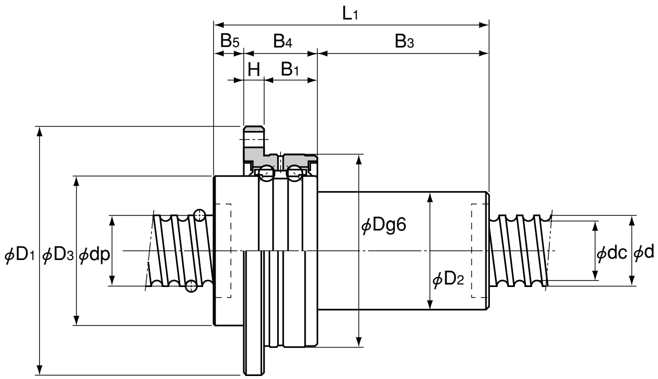
Unit: mm

Accuracy grade	C3		C5		C7	
Model No.	C	D	C	D	C	D
DIR 16□□	0.013	0.017	0.016	0.020	0.023	0.035
DIR 20□□	0.013	0.017	0.016	0.020	0.023	0.035
DIR 25□□	0.015	0.020	0.018	0.024	0.023	0.035
DIR 32□□	0.015	0.020	0.018	0.024	0.023	0.035
DIR 36□□	0.016	0.021	0.019	0.025	0.024	0.036
DIR 40□□	0.018	0.026	0.021	0.033	0.026	0.036

Model DIR

Standard-Lead Rotary Nut Ball Screw





Unit: mm

Model No.	Screw shaft outer diameter d	Thread minor diameter dc	Lead R	Ball center diameter dp	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Ball screw dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	D_3 h7	D_2	B_5	B_4	B_3	P_1	P_2	H	B_1	S	t	d_1	Support bearing basic load rating Ca kN	Support bearing basic load rating C_0a kN	Nut inertial moment kg·cm²
DIR 1605-6	16	13.2	5	16.75	7.4	13	310	48	64	79	36	30	8	21	50	56	30	6	15	M4	6	4.5	8.7	10.5	0.61
DIR 2005-6	20	17.2	5	20.75	8.5	17.3	310	56	72	80	43.5	34	9	21	50	64	36	6	15	M5	8	4.5	9.7	13.4	1.18
DIR 2505-6	25	22.2	5	25.75	9.7	22.6	490	66	86	88	52	40	13	25	50	75	43	7	18	M6	10	5.5	12.7	18.2	2.65
DIR 2510-4		21.6	10	26	9	18	330	66	86	106	52	40	11	25	70	75	43	7	18	M6	10	5.5	12.7	18.2	2.84
DIR 3205-6	32	29.2	5	32.75	11.1	30.2	620	78	103	86	63	46	11	25	50	89	53	8	17	M6	10	6.6	13.6	22.3	5.1
DIR 3206-6		28.4	6	33	14.9	37.1	630	78	103	97	63	48	11	25	61	89	53	8	17	M6	10	6.6	13.6	22.3	5.68
DIR 3210-6		26.4	10	33.75	25.7	52.2	600	78	103	131	63	54	11	25	95	89	53	8	17	M6	10	6.6	13.6	22.3	8.13
DIR 3610-6	36	30.5	10	37.75	28.8	63.8	710	92	122	151	72	58	14	33	104	105	61	10	23	M8	12	9	20.4	32.3	14.7
DIR 4010-6	40	34.7	10	41.75	29.8	69.3	750	100	130	142	79.5	62	14	33	95	113	67	10	23	M8	12	9	21.5	36.8	20.6
DIR 4012-6		34.4	12	41.75	30.6	72.3	790	100	130	167	79.5	62	14	33	120	113	67	10	23	M8	12	9	21.5	36.8	22.5

Model number coding

DIR2005-6 RR G0 +520L C1
1 2 3 4 5

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Symbol for axial clearance (see page k-15) 4 Overall screw shaft (in mm)
5 Accuracy symbol (see page k-8)

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing a preload 10% of the basic dynamic load rating (Ca) and applying an axial load three times greater than the preload.

These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the applied preload (Fa_0) is not 0.1 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa_0}{0.1\,Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.

Dust Prevention and Lubrication

Dust Prevention

Every THK Precision Ball Screw has labyrinth seals attached on both ends of the ball screw nut to prevent foreign matter such as cutting chips from entering the nut.

A slight clearance is secured between the labyrinth seal and the screw shaft to maintain the efficiency of the seal.

For a bellows and a screw cover, contact THK .

Lubrication

When lubricating the Rotary Ball Screw, attach the greasing plate to the housing in advance.

THK Precision Ball Screws require appropriate lubrication in order to maintain their efficiencies, service lives and accuracies and to protect them from temperature rise. In particular, when the heat generation of the ball screw unit would affect the accuracy due to high-speed rotation and a heavy load, it is also important to consider selecting a lubricant and cooling the system by forced lubrication.

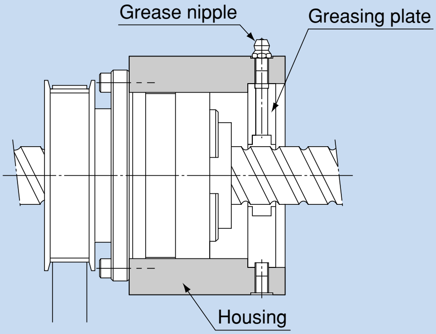


Fig. 3 Lubrication Method

Precautions on Use

Do not separate the ball screw nut of THK Precision Ball Screw from the screw shaft. In the event you have separated the nut from the shaft, check the serial number and the model number indicated on the ball screw nut, and then contact THK .

Note that the screw shaft cannot be assembled unless either end is cut off or its diameter is smaller than the thread minor diameter.

Rotary Nut Series

Ball Screw/Spline

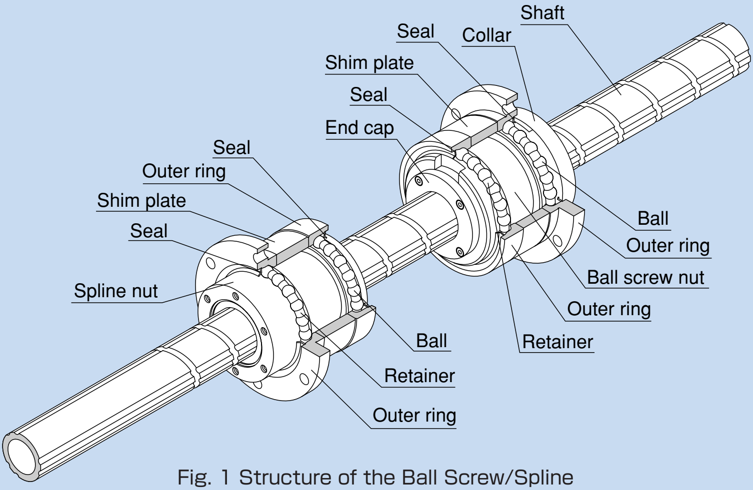


Fig. 1 Structure of the Ball Screw/Spline

Structure and Features

The Ball Screw/Spline contains Ball Screw grooves and Ball Spline groove crossing one another. The nuts of the Ball Screw and the Ball Spline have dedicated support bearings directly embedded on the circumference of the nuts.

The Ball Screw/Spline is capable of performing three (rotational, linear and spiral) modes of motion with a single shaft by rotating or stopping the spline nut.

It is optimal for machines using a combination of rotary and linear motions, such as scholar robot's Z-axis, assembly robot, automatic loader, and machining center's ATC equipment.

●Zero Axial Clearance

The Ball Spline has an angular-contact structure that causes no backlash in the rotational direction, enabling highly accurate positioning.

●Lightweight and Compact

Since the ball screw nut is integrated with the support bearing, highly accurate, compact design is allowed. In addition, small inertia because of the lightweight ball screw nut ensures high responsiveness.

●Easy Installation

The Ball Spline nut is designed so that balls do not fall off even if the spline nut is removed from the shaft, making installation easy. The Ball Screw/Spline can easily be mounted simply by securing it to the housing with bolts (for the housing's inner-diameter tolerance, H7 is recommended).

●Smooth Motion with Low Noise

As the Ball Screw is based on an end-cap mechanism, smooth motion with low noise is achieved.

●Highly Rigid Support Bearing

The support bearing on the Ball Screw has a contact angle of 60° in the axial direction while that on the Ball Spline has a contact angle of 30° in the moment direction, thus to provide a highly rigid shaft support.

In addition, a dedicated rubber seal is attached as standard to prevent entry of foreign matter.

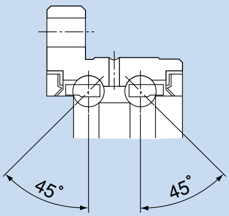


Fig. 2 Structure of Support Bearing Model BNS-A

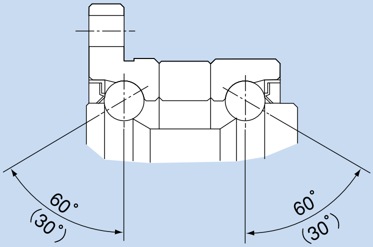


Fig. 3 Structure of Support Bearing Model BNS

Types

Model BNS-A

(Compact type: linear motion + rotary motion)

Model BNS

(Heavy-load type: linear motion + rotary motion)

Model NS-A

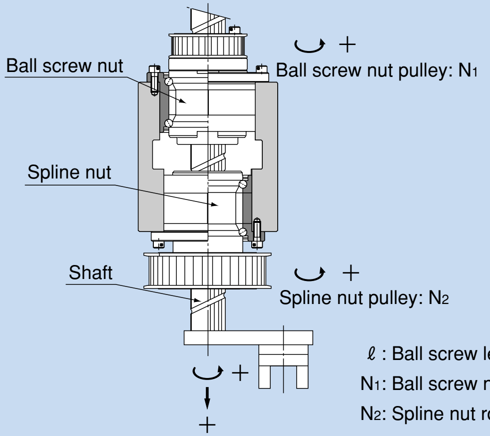
(Compact type: linear motion)

Model NS

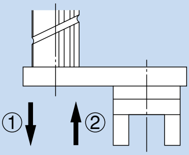
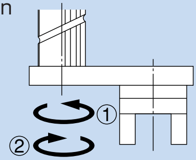
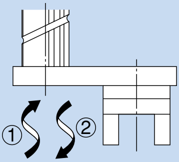
(Heavy-load type: linear motion)

Action Patterns

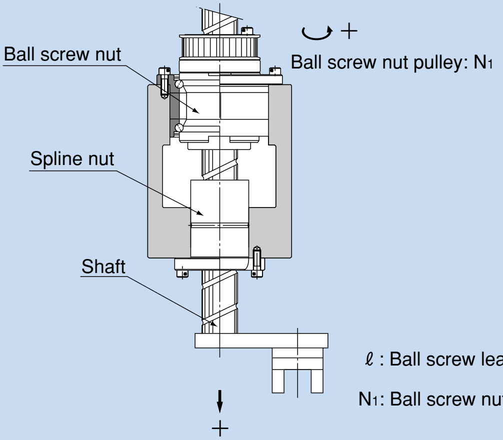
Model BNS Basic Actions



ℓ : Ball screw lead (mm)
N_1: Ball screw nut rotation speed (min^{-1})
N_2: Spline nut rotation speed (min^{-1})

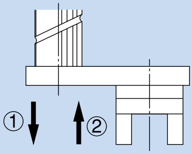
Motion		Action direction	Input		Shaft motion	
			Ball screw pulley	Ball spline pulley	Vertical direction (speed)	Rotational direction (rotation speed)
1. Vertical 	①	Vertical direction → down Rotational direction → 0	N_1 (Forward)	0	$V=N_1\cdot\ell$ $(N_1\neq0)$	0
	②	Vertical direction → up Rotational direction → 0	$-N_1$ (Reverse)	0	$V=-N_1\cdot\ell$ $(N_1\neq0)$	0
2. Rotation 	①	Vertical direction → 0 Rotational direction → forward	N_1	N_2 (Forward)	0	N_2 (Forward) $(N_1=N_2\neq0)$
	②	Vertical direction → 0 Rotational direction → reverse	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$ (Reverse) $(-N_1=-N_2\neq0)$
3. Spiral 	①	Vertical direction → up Rotational direction → forward	0	N_2 $(N_2\neq0)$	$V=N_2\cdot\ell$	N_2 (Forward)
	②	Vertical direction → down Rotational direction → reverse	0	$-N_2$ $(-N_2\neq0)$	$V=-N_2\cdot\ell$	$-N_2$ (Reverse)

Model NS Basic Actions

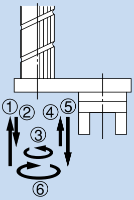
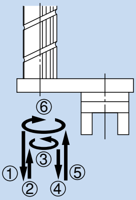
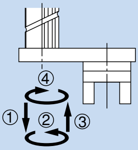
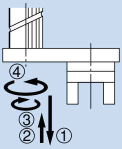


ℓ : Ball screw lead (mm)

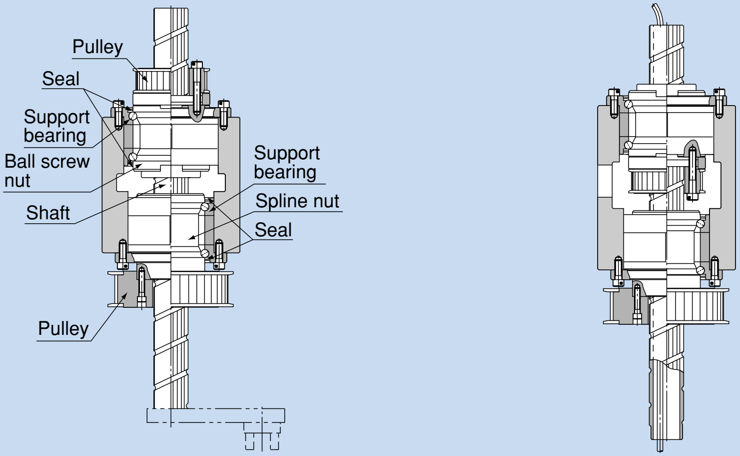
N_1: Ball screw nut rotation speed (min^{-1})

Motion		Action direction	Input Ball screw pulley	Shaft motion Vertical direction (speed)
1. Vertical 	①	Vertical direction → down	N_1 (Forward)	$V=N_1 \cdot \ell$ $(N_1 \neq 0)$
	②	Vertical direction → up	$-N_1$ (Reverse)	$V=-N_1 \cdot \ell$ $(N_1 \neq 0)$

Model BNS Extended Actions

Motion		Action direction	Input		Shaft motion	
			Ball screw pulley	Ball spline pulley	Vertical direction (speed)	Rotational direction (rotation speed)
1. Up → down → forward → up → down → reverse 	①	Vertical direction → up	$-N_1$ (Reverse)	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	②	Vertical direction → down	N_1 (Forward)	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	③	Rotational direction → forward	N_1	N_2 (Forward)	0	N_2(Forward) ($N_1=N_2\neq0$)
	④	Vertical direction → up	$-N_1$	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	⑤	Vertical direction → down	N_1	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	⑥	Rotational direction → reverse	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$(Reverse) ($-N_1=N_2\neq0$)
2. Down → up → forward → down → up → reverse 	①	Vertical direction → down	N_1	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	②	Vertical direction → up	$-N_1$	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	③	Rotational direction → forward	N_1	N_2	0	N_2 ($N_1=N_2\neq0$)
	④	Vertical direction → up	N_1	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	⑤	Vertical direction → down	$-N_1$	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	⑥	Rotational direction → reverse	$-N_1$	$-N_2$	0	$-N_2$ ($-N_1=N_2\neq0$)
3. Down → forward → up → reverse 	①	Vertical direction → down	N_1	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	②	Rotational direction → forward	N_1	N_2	0	N_2 ($N_1=N_2\neq0$)
	③	Vertical direction → up	$-N_1$	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	④	Rotational direction → reverse	$-N_1$	$-N_2$	0	$-N_2$ ($-N_1=N_2\neq0$)
4. Down → up → forward → reverse 	①	Vertical direction → down	N_1	0	$V=N_1\cdot\ell$ ($N_1\neq0$)	0
	②	Vertical direction → up	$-N_1$	0	$V=-N_1\cdot\ell$ ($N_1\neq0$)	0
	③	Rotational direction → reverse	$-N_1$	$-N_2$	0	$-N_2$ ($-N_1=N_2\neq0$)
	④	Rotational direction → forward	N_1	N_2	0	N_2 ($N_1=N_2\neq0$)

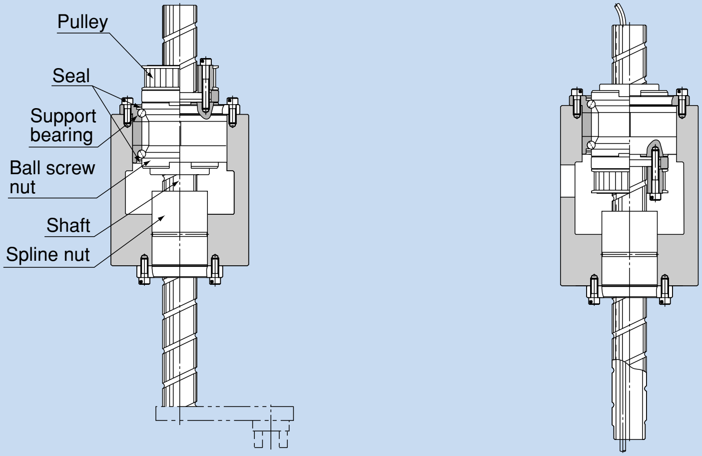
Example of Assembly



●Example of installing the ball screw nut and the spline nut input pulley both outside the housing.
The housing length is minimized.

●Example of installing the ball screw nut pulley inside the housing.

Fig. 4 Example of Assembling Model BNS



●Example of installing the ball screw nut pulley outside the housing.
The housing length is minimized.

●Example of installing the ball screw nut pulley inside the housing.

Fig. 5 Example of Assembling Model NS

Accuracy

The Ball Screw/Spline is manufactured with the following specifications.

Ball Screw

Axial clearance: 0 or less

Lead accuracy : C5

(For detailed specifications, see page k-8.)

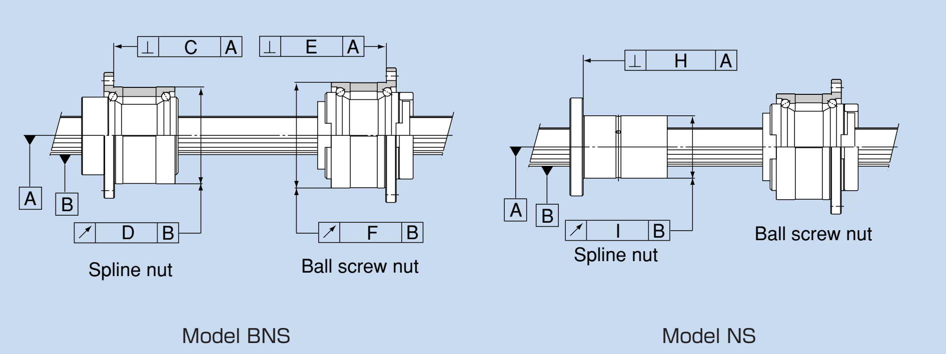
Ball Spline

Axial clearance: 0 or less (CL: light preload)

(For detailed specifications, see page b-4.)

Lead accuracy : class H

(For detailed specifications, see page b-5.)



Model BNS

Model NS

Unit: mm

Model No.	C	D	E	F	H	I
BNS 0812 NS 0812	0.014	0.017	0.014	0.016	0.010	0.013
BNS 1015 NS 1015	0.014	0.017	0.014	0.016	0.010	0.013
BNS 1616 NS 1616	0.018	0.021	0.016	0.020	0.013	0.016
BNS 2020 NS 2020	0.018	0.021	0.016	0.020	0.013	0.016
BNS 2525 NS 2525	0.021	0.021	0.018	0.024	0.016	0.016
BNS 3232 NS 3232	0.021	0.021	0.018	0.024	0.016	0.016
BNS 4040 NS 4040	0.025	0.025	0.021	0.033	0.019	0.019
BNS 5050 NS 5050	0.025	0.025	0.021	0.033	0.019	0.019

Example of Use

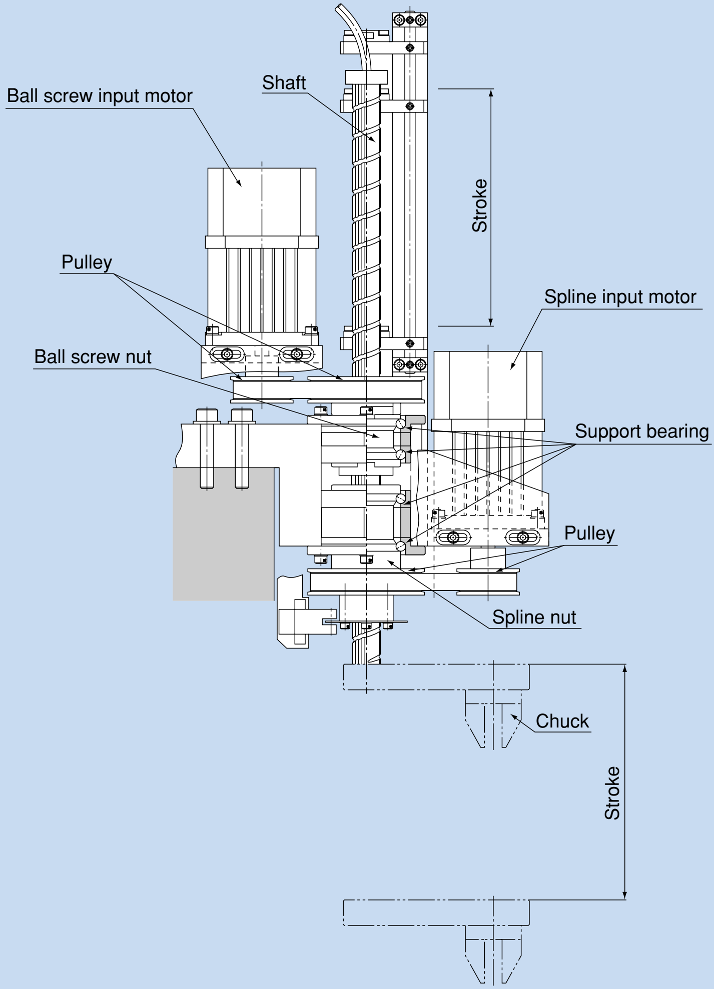


Fig. 6 Example of Using Model BNS

Precautions on Use

Lubrication

When lubricating the Ball Screw/Spline, attach the greasing plate to the housing in advance.

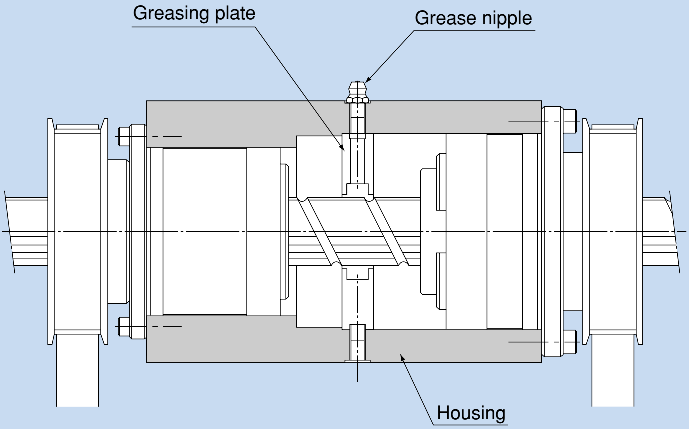
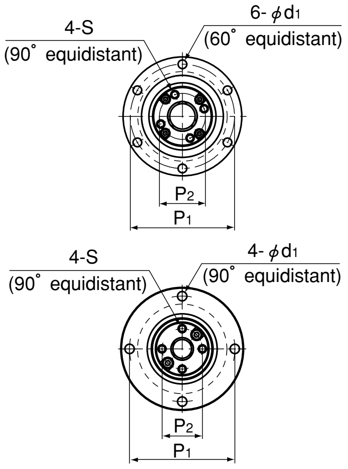


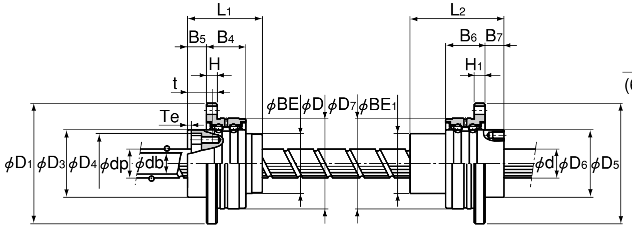
Fig. 7 Lubrication Method

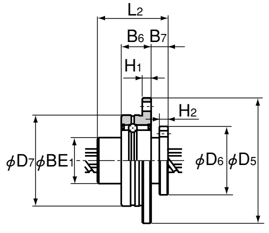
Model BNS-A

Compact Type: Linear Motion + Rotary Motion

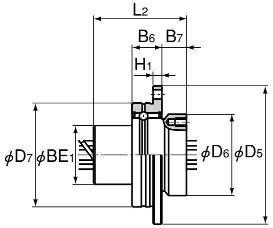


Models BNS 0812A and 1015A

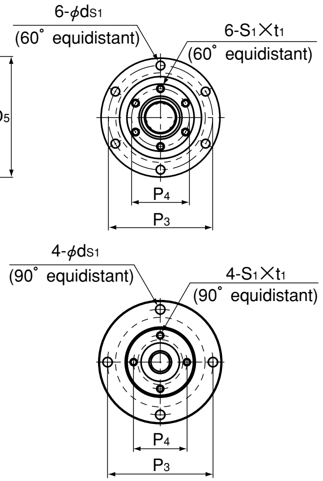




Model BNS 0812A



Model BNS 1015A



Models BNS 0812A and 1015A

Unit: mm

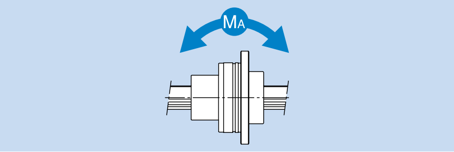
Model No.	Screw shaft outer diameter d	Screw shaft inner diameter dp	Lead R	Ball screw dimensions: Basic load rating Ca kN	Basic load rating C_0a kN	Ball center diameter dp	Thread minor diameter dc	Outer diameter D g6	Flange diameter D_1	Overall length L_1	D_3 h7	D_4 H7	BE	H	B_4	B_5	Te	P_1	P_2	S	t	d_1	Support bearing basic load rating Ca kN	Support bearing basic load rating C_0a kN	Nut inertial moment kg·cm²	Screw shaft inertial moment J kg·cm²/mm
BNS 0812A	8	—	12	1.1	1.8	8.4	6.6	32	44	28.5	22	19	19	3	10.5	7	1.5	38	14.5	M2.6	10	3.4	0.8	0.5	0.03	3.16×10^{-5}
BNS 1015A	10	—	15	1.7	2.7	10.5	8.3	36	48	34.5	26	23	23	3	10.5	8	1.5	42	18	M3	11.5	3.4	0.9	0.7	0.08	7.71×10^{-5}
BNS 1616A	16	11	16	3.9	7.2	16.65	13.7	48	64	40	36	32	32	6	21	10	2	56	25	M4	13.5	4.5	8.7	10.5	0.35	3.92×10^{-4}
BNS 2020A	20	14	20	6.1	12.3	20.75	17.5	56	72	48	43.5	39	39	6	21	11	2.5	64	31	M5	16.5	4.5	9.7	13.4	0.85	9.37×10^{-4}
BNS 2525A	25	18	25	9.1	19.3	26	22	66	86	58	52	47	47	7	25	13	3	75	38	M6	20	5.5	12.7	18.2	2.12	2.2×10^{-3}
BNS 3232A	32	23	32	13	29.8	33.25	28.3	78	103	72	63	58	58	8	25	14	3	89	48	M6	21	6.6	13.6	22.3	5.42	5.92×10^{-3}
BNS 4040A	40	29	40	21.4	49.7	41.75	35.2	100	130	88	79.5	73	73	10	33	16.5	3	113	61	M8	24.5	9	21.5	36.8	17.2	1.43×10^{-2}

Model No.	Ball spline dimensions: Basic load rating C kN	Basic load rating C_0 kN	Permissible static moment M_A N·m	Basic torque rating C_T N·m	Basic torque rating C_{0T} N·m	Outer diameter D_7 g6	Flange diameter D_5	Overall length L_2	D_6 h7	BE_1	H_1	B_6	B_7	H_2	P_3	P_4	$S_1\times t_1$	d_{s1}	Support bearing basic load rating C kN	Support bearing basic load rating C_0 kN	Nut inertial moment kg·cm²
BNS 0812A	1.5	2.6	5.9	2	2.9	32	44	25	24	16	3	10.5	6	3	38	19	M2.6×3	3.4	0.6	0.2	0.03
BNS 1015A	2.7	4.9	15.7	3.9	7.8	36	48	33	28	21	3	10.5	9	—	42	23	M3×4	3.4	0.8	0.3	0.08
BNS 1616A	7.1	12.6	67.6	31.4	34.3	48	64	50	36	31	6	21	10	—	56	30	M4×6	4.5	6.7	6.4	0.44
BNS 2020A	10.2	17.8	118	56.8	55.8	56	72	63	43.5	35	6	21	12	—	64	36	M5×8	4.5	7.4	7.8	0.99
BNS 2525A	15.2	25.8	210	105	103	66	86	71	52	42	7	25	13	—	75	44	M5×8	5.5	9.7	10.6	2.2
BNS 3232A	20.5	34	290	180	157	78	103	80	63	52	8	25	17	—	89	54	M6×10	6.6	10.5	12.5	5.17
BNS 4040A	37.8	60.5	687	418	377	100	130	100	79.5	64	10	33	20	—	113	68	M6×10	9	16.5	20.7	16.1

Model number coding

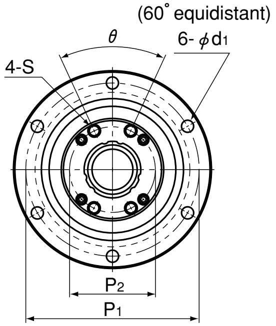
$\underbrace{\text{BNS2020A}}_{1}\ \underbrace{\text{+500L}}_{2}$

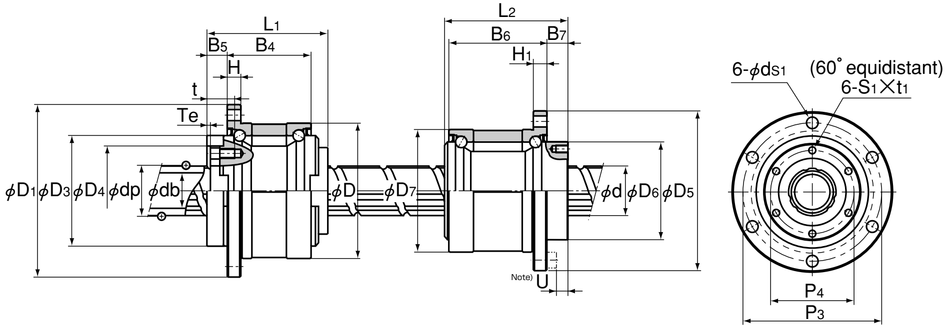
1 Model number 2 Overall shaft length (in mm)



Model BNS

Heavy-load Type: Linear Motion + Rotary Motion



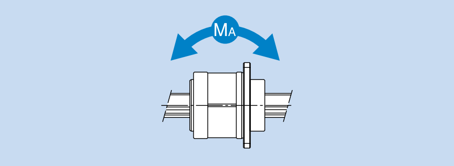


Unit: mm

Model No.	Screw shaft outer diameter d	Screw shaft inner diameter dp	Lead R	Ball screw dimensions Basic load rating Ca kN	C0a kN	Ball center diameter dp	Thread minor diameter dc	Outer diameter D	Flange diameter D1	Overall length L1	D3 h7	D4 H7	H	B4	B5	Te	P1	P2	S	t	d1	θ°	Support bearing basic load rating Ca kN	C0a kN	Nut inertial moment kg・cm²	Screw shaft inertial moment J kg・cm²/mm
BNS 1616	16	11	16	3.9	7.2	16.65	13.7	$52^{\ 0}_{-0.007}$	68	43.5	40	32	5	27.5	9	2	60	25	M4	12	4.5	40	19.4	19.2	0.48	3.92×10^{-4}
BNS 2020	20	14	20	6.1	12.3	20.75	17.5	$62^{\ 0}_{-0.007}$	78	54	50	39	6	34	11	2	70	31	M5	16	4.5	40	26.8	29.3	1.44	9.37×10^{-4}
BNS 2525	25	18	25	9.1	19.3	26	22	$72^{\ 0}_{-0.007}$	92	65	58	47	8	43	12.5	3	81	38	M6	19	5.5	40	28.2	33.3	3.23	2.2×10^{-3}
BNS 3232	32	23	32	13	29.8	33.25	28.3	$80^{\ 0}_{-0.007}$	105	80	66	58	9	55	14	3	91	48	M6	19	6.6	40	30	39	6.74	5.92×10^{-3}
BNS 4040	40	29	40	21.4	49.7	41.75	35.2	$110^{\ 0}_{-0.008}$	140	98	90	73	11	68	16.5	3	123	61	M8	22	9	50	59.3	74.1	27.9	1.43×10^{-2}
BNS 5050	50	36	50	31.8	77.6	52.2	44.1	$120^{\ 0}_{-0.008}$	156	126	100	90	12	80	25	4	136	75	M10	28	11	50	62.2	83	58.2	3.52×10^{-2}

Model No.	Ball spline dimensions Basic load rating C kN	C0 kN	Permissible static moment MA N・m	Basic torque rating CT N・m	C0T N・m	Outer diameter D7	Flange diameter D5	Overall length L2	D6 h7	H1	B6	B7	P3	P4	S1×t1	ds1	U	Support bearing basic load rating C kN	C0 kN	Nut inertial moment kg・cm²
BNS 1616	7.1	12.6	67.6	31.4	34.3	$52^{\ 0}_{-0.007}$	68	50	39.5	5	37	10	60	32	M5×8	4.5	5	12.7	11.8	0.52
BNS 2020	10.2	17.8	118	56.8	55.8	$56^{\ 0}_{-0.007}$	72	63	43.5	6	48	12	64	36	M5×8	4.5	7	16.2	15.5	0.87
BNS 2525	15.2	25.8	210	105	103	$62^{\ 0}_{-0.007}$	78	71	53	6	55	13	70	45	M6×8	4.5	8	17.6	18	1.72
BNS 3232	20.5	34	290	180	157	$80^{\ 0}_{-0.007}$	105	80	65.5	9	60	17	91	55	M6×10	6.6	10	20.1	24	5.61
BNS 4040	37.8	60.5	687	418	377	$100^{\ 0}_{-0.008}$	130	100	79.5	11	74	23	113	68	M6×10	9	13	37.2	42.5	14.7
BNS 5050	60.9	94.5	1340	842	768	$120^{\ 0}_{-0.008}$	156	125	99.5	12	97	25	136	85	M10×15	11	13	41.6	54.1	62.5

Note Dimension U indicates the length from the head of the hexagon socket bolt to the ball screw nut end.



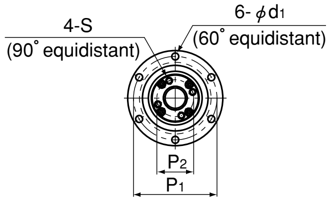
Model number coding

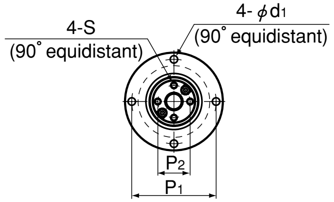
BNS2525 +600L
1 2

1 Model number 2 Overall shaft length (in mm)

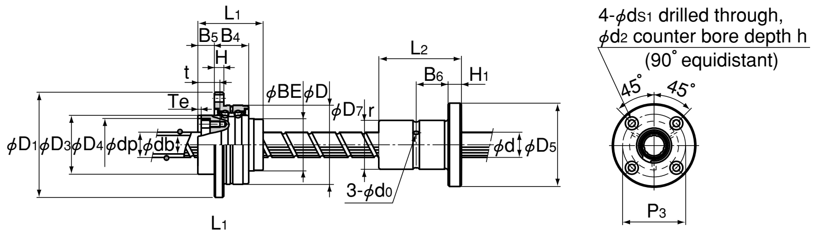
Model NS-A

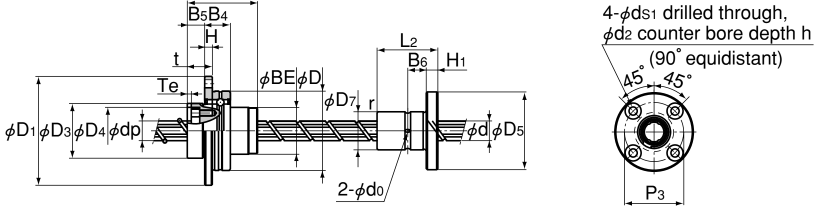
Compact Type: Linear Motion





Models NS 0812A and 1015A





Models NS 0812A and 1015A

Unit: mm

Model No.	Screw shaft outer diameter d	Screw shaft inner diameter dp	Lead R	Ball screw dimensions																				Support bearing basic load rating		Nut inertial moment	Screw shaft inertial moment
				Basic load rating Ca kN	C_0a kN	Ball center diameter dp	Thread minor diameter dc	Outer diameter D g6	Flange diameter D_1	Overall length L_1	D_3 h7	D_4 H7	BE	H	B_4	B_5	Te	P_1	P_2	S	t	d_1	Ca kN	C_0a kN	kg·cm²	J kg·cm²/mm
NS 0812A	8	—	12	1.1	1.8	8.4	6.6	32	44	28.5	22	19	19	3	10.5	7	1.5	38	14.5	M2.6	10	3.4	0.8	0.5	0.03	3.16×10^{-5}
NS 1015A	10	—	15	1.7	2.7	10.5	8.3	36	48	34.5	26	23	23	3	10.5	8	1.5	42	18	M3	11.5	3.4	0.9	0.7	0.08	7.71×10^{-5}
NS 1616A	16	11	16	3.9	7.2	16.65	13.7	48	64	40	36	32	32	6	21	10	2	56	25	M4	13.5	4.5	8.7	10.5	0.35	3.92×10^{-4}
NS 2020A	20	14	20	6.1	12.3	20.75	17.5	56	72	48	43.5	39	39	6	21	11	2.5	64	31	M5	16.5	4.5	9.7	13.4	0.85	9.37×10^{-4}
NS 2525A	25	18	25	9.1	19.3	26	22	66	86	58	52	47	47	7	25	13	3	75	38	M6	20	5.5	12.7	18.2	2.12	2.2×10^{-3}
NS 3232A	32	23	32	13	29.8	33.25	28.3	78	103	72	63	58	58	8	25	14	3	89	48	M6	21	6.6	13.6	22.3	5.42	5.92×10^{-3}
NS 4040A	40	29	40	21.4	49.7	41.75	35.2	100	130	88	79.5	73	73	10	33	16.5	3	113	61	M8	24.5	9	21.5	36.8	17.2	1.43×10^{-2}

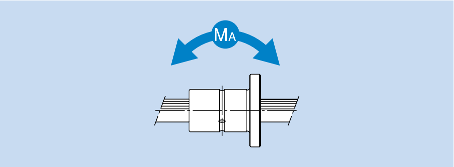
Model No.	Ball spline dimensions													
	Basic load rating C kN	C_0 kN	Permissible static moment M_A N·m	Basic torque rating C_T N·m	C_{0T} N·m	Outer diameter D_7	Flange diameter $D_5{}^{\ 0}_{-0.2}$	Overall length L_2	H_1	B_6	r	Greasing hole d_0	P_3	Mounting hole d_{s1}	d_2	h
NS 0812A	1.5	2.6	5.9	2	2.9	$16\ {}^{\ 0}_{-0.011}$	32	25	5	7.5	0.5	1.5	24	3.4	6.5	3.3
NS 1015A	2.8	4.9	15.7	3.9	7.8	$21\ {}^{\ 0}_{-0.013}$	42	33	6	10.5	0.5	1.5	32	4.5	8	4.4
NS 1616A	7.1	12.6	67.6	31.4	34.3	$31\ {}^{\ 0}_{-0.013}$	51	$50\ {}^{\ 0}_{-0.2}$	7	18	0.5	2	40	4.5	8	4.4
NS 2020A	10.2	17.8	118	56.8	55.8	$35\ {}^{\ 0}_{-0.016}$	58	$63\ {}^{\ 0}_{-0.2}$	9	22.5	0.5	2	45	5.5	9.5	5.4
NS 2525A	15.2	25.8	210	105	103	$42\ {}^{\ 0}_{-0.016}$	65	$71\ {}^{\ 0}_{-0.3}$	9	26.5	0.5	3	52	5.5	9.5	5.4
NS 3232A	20.5	34	290	180	157	$49\ {}^{\ 0}_{-0.016}$	77	$80\ {}^{\ 0}_{-0.3}$	10	30	0.5	3	62	6.6	11	6.5
NS 4040A	37.8	60.5	687	418	377	$64\ {}^{\ 0}_{-0.019}$	100	$100\ {}^{\ 0}_{-0.3}$	14	36	0.5	4	82	9	14	8.6

Model number coding

NS2020A +500L

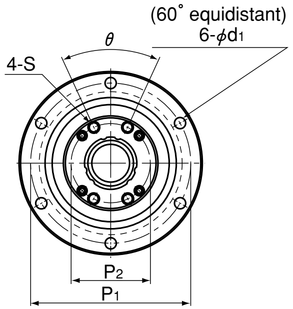
1 2

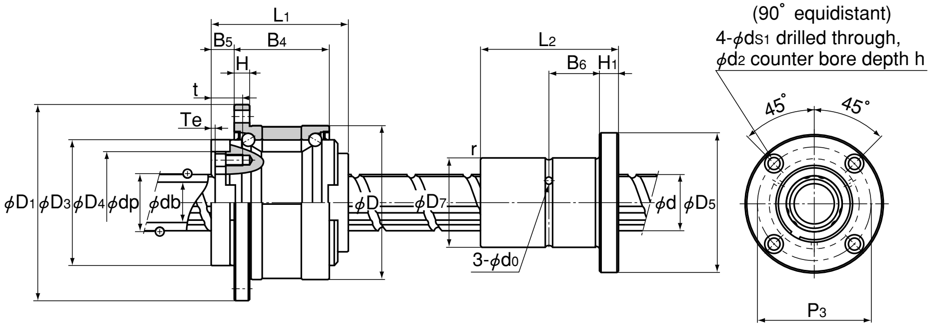
1 Model number 2 Overall shaft length (in mm)



Model NS

Heavy-load Type: Linear Motion





Unit: mm

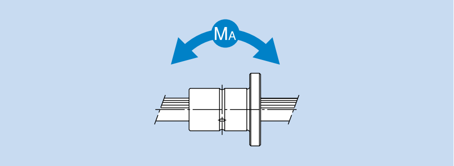
Model No.	Screw shaft outer diameter d	Screw shaft inner diameter dp	Lead R	Ball screw dimensions: Basic load rating Ca kN	Basic load rating C0a kN	Ball center diameter dp	Thread minor diameter dc	Outer diameter D	Flange diameter D1	Overall length L1	D3 h7	D4 H7	H	B4	B5	Te	P1	P2	S	t	d1	θ°	Support bearing basic load rating Ca kN	Support bearing basic load rating C0a kN	Nut inertial moment kg·cm²	Screw shaft inertial moment J kg·cm²/mm
NS 1616	16	11	16	3.9	7.2	16.65	13.7	52 $^{0}_{-0.007}$	68	43.5	40	32	5	27.5	9	2	60	25	M4	12	4.5	40	19.4	19.2	0.48	3.92×10^{-4}
NS 2020	20	14	20	6.1	12.3	20.75	17.5	62 $^{0}_{-0.007}$	78	54	50	39	6	34	11	2	70	31	M5	16	4.5	40	26.8	29.3	1.44	9.37×10^{-4}
NS 2525	25	18	25	9.1	19.3	26	22	72 $^{0}_{-0.007}$	92	65	58	47	8	43	12.5	3	81	38	M6	19	5.5	40	28.2	33.3	3.23	2.2×10^{-3}
NS 3232	32	23	32	13	29.8	33.25	28.3	80 $^{0}_{-0.007}$	105	80	66	58	9	55	14	3	91	48	M6	19	6.6	40	30	39	6.74	5.92×10^{-3}
NS 4040	40	29	40	21.4	49.7	41.75	35.2	110 $^{0}_{-0.008}$	140	98	90	73	11	68	16.5	3	123	61	M8	22	9	50	59.3	74.1	27.9	1.43×10^{-2}
NS 5050	50	36	50	31.8	77.6	52.2	44.1	120 $^{0}_{-0.008}$	156	126	100	90	12	80	25	4	136	75	M10	28	11	50	62.2	83	58.2	3.52×10^{-2}

Model No.	Ball spline dimensions: Basic load rating C kN	Basic load rating C0 kN	Permissible static moment MA N·m	Basic torque rating CT N·m	Basic torque rating C0T N·m	Outer diameter D7	Flange diameter D5	Overall length L2	H1	B6	r	Greasing hole d0	P3	Mounting hole ds1	Mounting hole d2	Mounting hole h
NS 1616	7.1	12.6	67.6	31.4	34.3	31 $^{0}_{-0.013}$	51	50 $^{0}_{-0.2}$	7	18	0.5	2	40	4.5	8	4.4
NS 2020	10.2	17.8	118	56.9	55.9	35 $^{0}_{-0.016}$	58	63 $^{0}_{-0.2}$	9	22.5	0.5	2	45	5.5	9.5	5.4
NS 2525	15.2	25.8	210	105	103	42 $^{0}_{-0.016}$	65	71 $^{0}_{-0.3}$	9	26.5	0.5	3	52	5.5	9.5	5.4
NS 3232	20.5	34	290	180	157	49 $^{0}_{-0.016}$	77	80 $^{0}_{-0.3}$	10	30	0.5	3	62	6.6	11	6.5
NS 4040	37.8	60.5	687	419	377	64 $^{0}_{-0.019}$	100	100 $^{0}_{-0.3}$	14	36	0.5	4	82	9	14	8.6
NS 5050	60.9	94.5	1340	842	769	80 $^{0}_{-0.019}$	124	125 $^{0}_{-0.3}$	16	46.5	1	4	102	11	17.5	11

Model number coding

$\underbrace{\text{NS2525}}_{1}\ \underbrace{\text{+600L}}_{2}$

1 Model number 2 Overall shaft length (in mm)



Rolled Ball Screw

THK Rolled Ball Screws are low-priced feed screws that use a screw shaft rolled with high accuracy and specially surface-ground, instead of an expensive thread-ground shaft used in Precision Ball Screws.
The ball raceways of the ball screw nut are all thread-ground, thus to achieve a smaller axial clearance and smoother motion than the conventional rolled ball screw.
In addition, a wide array of types are offered as standard in order to allow optimal products to be selected according to the application.

Structure and Features

●Achieves Lead Accuracy of Class C7

Screw shafts with travel distance error of classes C7 and C8 are also manufactured as standard in addition to class C10 to meet a broad range of applications.

Travel distance error: C7 :±0.05/300(mm)
C8 :±0.10/300(mm)
C10 :±0.21/300(mm)

(For manufacturing length limits of screw shaft by accuracy grade, see page k-17.)

●Achieves Roughness of the Ball Raceways of the Screw Shaft at 0.20 a or Less

The surface of the screw shaft's ball raceways is specially ground after the shaft is rolled to ensure surface roughness of 0.20 a or less, which is equal to that of the ground thread of Precision Ball Screw.

●The Ball Raceways of the Ball Screw Nut are All Finished by Grinding

THK finishes the ball raceways of Rolled Ball Screw nuts by grinding, just as Precision Ball Screws, to secure durability and smooth motion.

●Low Price

The screw shaft is induction-hardened or carburized after being rolled, and its surface is then specially ground. This allows the rolled Ball Screw to be priced lower than the Precision Ball Screw with a ground thread.

●High Dust-prevention Effect

The ball screw nut is incorporated with a compact labyrinth seal or a brush seal. This achieves low friction, high dust-prevention effect and a longer service life of the Ball Screw.

Machining of the Screw Shaft Ends

To facilitate additional machining of the screw shaft of the Rolled Ball Screw after it is delivered, the screw shaft is separated from the ball screw nut, which is installed on a temporary shaft, when delivered.
However, model MTF is delivered with the nut installed on the screw shaft as shown in Fig. 1.
A part (ℓ_1) of the end section of the shaft on the flange side of the nut is not hardened so that it can additionally be machined easily through lathe turning, milling or the like.
When setting a stroke, be sure it is within the hardened area shown in Fig. 1

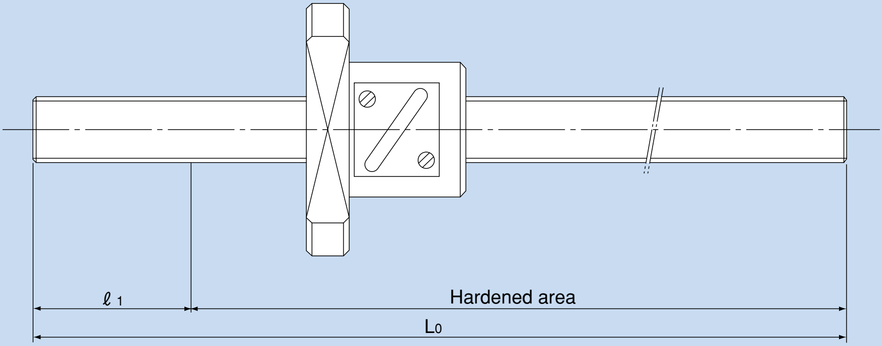


Fig. 1

Model No.	Standard shaft length L_0	ℓ_1
MTF 0601-3.7	150, 250	50
MTF 0802-3.7	150, 250	55
MTF 1002-3.7	200, 300	60
MTF 1202-3.7	200, 300	60

Procedure for Additionally Machining the Screw Shaft Ends

For model MTF, follow the procedure below before performing the additional machining.

Steps for Additional Machining (Lathe Turning, Cylindrical Grinding)

1. Firmly fasten the ball screw nut in place by binding both ends with a tape or the like together with the plastic wrapping so that the nut does not move when the shaft is rotated.
2. Slide the plastic wrapping covering the portion to be additionally machined toward the ball screw nut, and secure the wrapping with a tape or the like to prevent cutting chips or other foreign matter from entering the wrapping.

When additionally machining the screw shaft ends, identify the center from the screw shaft outer diameter before performing the additional machining.

The screw surface is surface-hardened (58 to 64 HRC) by induction or carburizing. Removing the hardened surface through lathing (using a carbide tool) or grinding will facilitate the additional machining of the end section.

Alternatively, the shaft ends can be annealed. When annealing the shaft end, be sure to keep the remaining portion of the shaft cool using water or the like to prevent the heat on the shaft end from transmitting to the area of the shaft where the ball screw nut will rotate.

Adjusting the tool feed to the lead will facilitate the lathing or grinding.

Make sure the outer diameter of the shaft end must be smaller than the thread minor diameter indicated in the dimensional table.

* THK will perform the additional machining of the screw shaft ends at your request.
Contact THK for details.

Assembly

When transferring the nut of the Rolled Ball Screw from the temporary shaft to the screw shaft, make sure the dimensions and the shape of the linking section are appropriate. If they are not, an accident such as falling balls may occur.

When butting the temporary shaft directly against the screw shaft end, firmly hold the temporary shaft against the screw shaft so that the centers of both shafts are matched, then lightly pressing the nut against the screw shaft and turn it in the advancing direction to move the nut onto the screw shaft (Fig. 2). If the nut does not transfer to the screw shaft smoothly or is blocked halfway, do not force the screw shaft into the nut, and recheck the status.

If the temporary shaft cannot be butted directly against the screw shaft as a result of additionally machining the shaft ends, wrap the newly machined section of the shaft with a tape or the like so that the diameter of the screw shaft end including the tape match that of the temporary shaft, and then follow the steps above to transfer the nut to the screw shaft (Fig. 3).

If there is a groove or notch in the screw shaft end, fill the recess before transferring the nut.

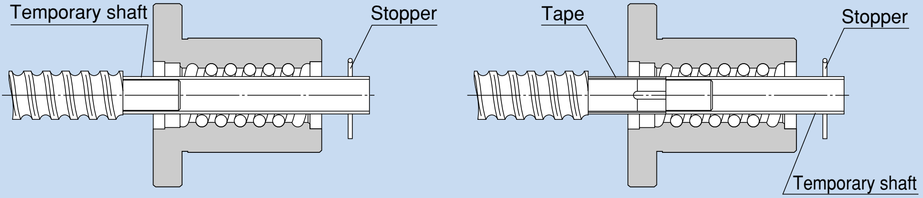


Fig. 2
Fig. 3

Examples of Assembling the Ball Screw

Standard-Lead Rolled Ball Screw

Constant-Pressure Preload Type Ball Screw Model JPF

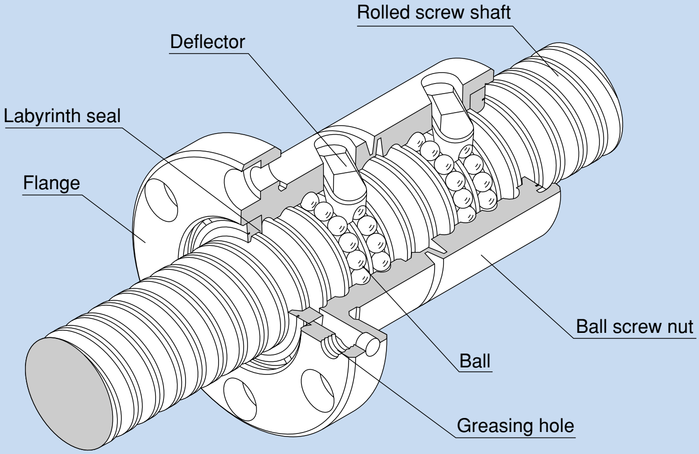


Fig. 1 Structure of Model JPF

Structure and Features

With Constant-Pressure Preload Type Ball Screw model JPF, a phase difference is provided between the right and left threads of the ball screw nut, which are precision-ground, and a rolled screw shaft is installed into the ball screw nut. Since it adopts the constant-pressure preloading method based on a spring structure formed in the middle of the ball screw nut, model JPF is capable of absorbing a pitch error and eccentricity of the ball screw nut and the screw shaft. As a result, this model achieves no torque fluctuation and no backlash.

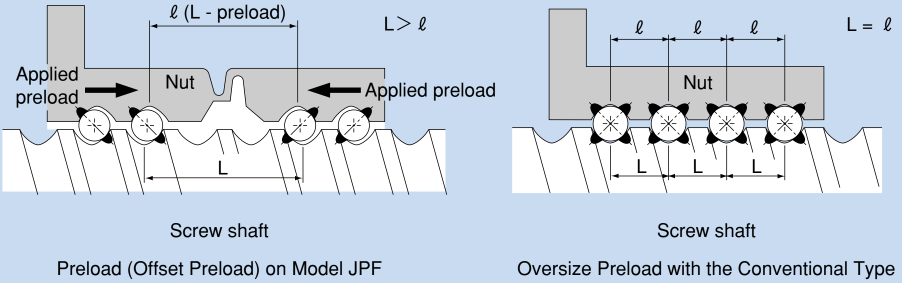


Fig. 2 Preloading Mechanisms

●No Backlash

The spring structure incorporated into the nut absorbs the pitch error between the ball screw nut and the screw shaft, the taper of the screw shaft and the eccentricity of the screw shaft, thus allowing zero-backlash to be achieved despite a low-price rolled shaft.

Backlash Measurements

[Sample model]	JPF2505-6	
	Shaft diameter:	25mm
	Lead:	5mm

[Measurement procedure]

① Mount model JPF onto a single-axis table.
② Place a laser displacement meter, and measure the table position at that time as the origin (reset the laser displacement meter to zero).
③ Apply an axial load to the table from the positive direction, then release the axial load and measure the table position at that time with the laser displacement meter.
④ Apply an axial load to the table from the negative direction, then release the axial load and measure the table position at that time with the laser displacement meter.

The maximum difference between the measurements obtained in steps ③ and ④ is regarded as the backlash.

[Measurements]

Table 1 Backlash Measurements

Unit: mm

Item	Position measurement
Origin	+0.0000
Load applied in the positive direction, then released	+0.0003
Load applied in the negative direction, then released	−0.0001
Backlash	0.0004

●Smooth Motion Even under a Preload

The spring structure incorporated in the nut provides a constant preload thereby to absorb the pitch error between the ball screw nut and the screw shaft, the taper of the screw shaft and the eccentricity of the screw shaft. Thus, smooth motion without a backlash is achieved.

Rotation Torque Measurements

[Sample model] JPF2505-6G0+500LT
Shaft diameter: 25mm
Lead: 5mm
Stroke length: 450mm

[Measurement conditions]
Measurement method: Torque measurement machine
Rotation speed per minute: 100min^{-1}
Lubrication method: Grease lubrication
[Measurement result]
Forward rotation: 0.07 to 0.10 N-m
Reverse rotation: 0.07 to 0.11 N-m

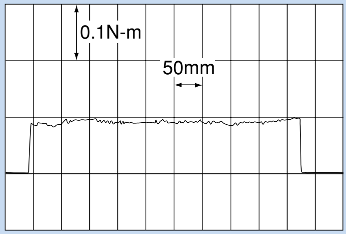


Fig. 3 Rotation Torque Measurements
(Forward Rotation)

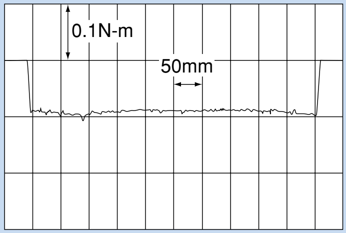


Fig. 4 Rotation Torque Measurements
(Reverse Rotation)

●Highly Accurate Positioning Repeatability

Since model JPF has no axial clearance, using THK LM Guide on the guide surface will achieve highly accurate positioning repeatability without stick slip.

Positioning Repeatability Measurements

[Sample model] JPF2505-6
Shaft diameter: 25mm
Lead: 5mm
Guide surface: LM Guide model SR25W

[Measurement procedure]

① Mount model JPF onto a single-axis table.
② Place a laser displacement meter.
③ Move the table 50 mm from the motor side, and reset the laser displacement meter to zero as the origin.
④ Move the table 50 mm toward the motor and move back the table 50 mm toward the motor. Measure the position of the table using the laser displacement meter.
⑤ Repeat steps ③ and ④ seven times.

Divide the maximum difference in the measurements above by two; the result obtained is the positioning repeatability.

[Measurement result]

Table 2 Positioning Repeatability Measurements

Unit: mm

Item	Position measurement
After 1 reciprocation	+0.0000
After 2 reciprocations	+0.0002
After 3 reciprocations	+0.0000
After 4 reciprocations	−0.0001
After 5 reciprocations	−0.0001
After 6 reciprocations	−0.0002
After 7 reciprocations	−0.0001
Positioning repeatability	±0.0002

●High Wobbling (Fluctuation/2π) Accuracy

Since the screw shaft raceways are rolled with highly accuracy, high wobbling (fluctuation/2π) accuracy is achieved although the screw shaft is rolled.

Wobbling (fluctuation/2π): fluctuation in lead accuracy during one rotation of the screw shaft

Wobbling (Fluctuation/2π) Measurements

[Sample model] JPF2505-6
Shaft diameter: 25mm
Lead: 5mm

[Measurement procedure]

① Mount model JPF onto a single-axis table.
② Place a laser displacement meter.
③ Move the table 50 mm from the motor side, and reset the laser displacement meter to zero as the origin.
④ Rotate the motor by 1/10 revolution (equivalent to 0.5 mm) at a time. Measure the difference between the position of the table and the designated value using the laser displacement meter.
⑤ Repeat step ④ until the motor rotates one revolution.

The fluctuation in the measurements above is the wobbling (fluctuation/2π).

[Measurement result]

Table 3 Wobbling Accuracy Measurements

Unit: mm

Stroke position	Position error measurement
Origin	+0.0000
+0.500	+0.0002
+1.000	+0.0009
+1.500	+0.0015
+2.000	+0.0023
+2.500	+0.0021
+3.000	+0.0013
+3.500	+0.0004
+4.000	−0.0005
+4.500	−0.0002
+5.000	+0.0000
Wobbling	0.0028

●Absorbs Misalignment

Since the ball screw nut contacts the balls in DF (face-to-face duplex) configuration, the moment load on the ball screw nut caused by misalignment in mounting accuracy (e.g., perpendicularity of the flange mounting surface and misalignment between the LM Guide and the screw shaft) is minimized to suppress the torque fluctuation after assembly.

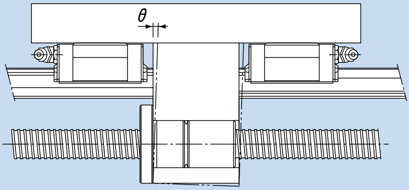


Fig. 5 Misalignment of the Flange Mounting Surface

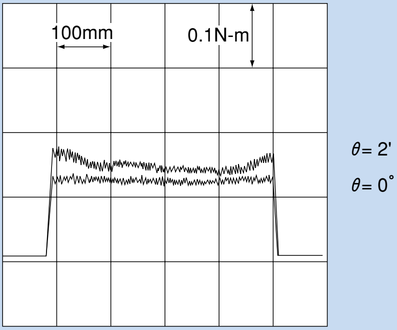


Fig. 6 Torque Fluctuation with DF Configuration (Model JPF)

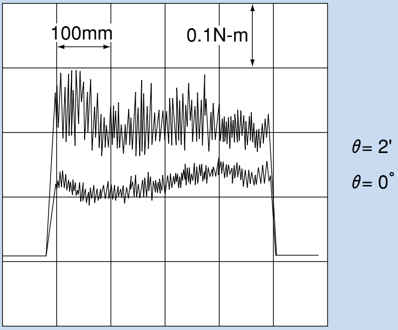


Fig. 7 Torque Fluctuation of a Ball Screw with DB Configuration

●Compact

The internal circulation structure using a deflector reduces the outer diameter of the ball screw nut to 70 to 80% of a return-pipe type Ball Screw.

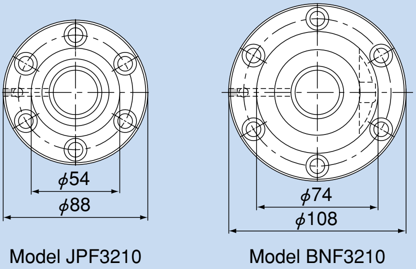


Fig. 8 Comparison of Outer Diameter of the Ball Screw Nut

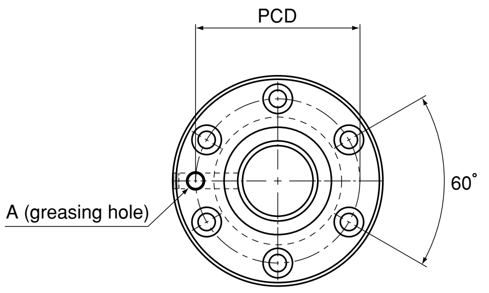
Type

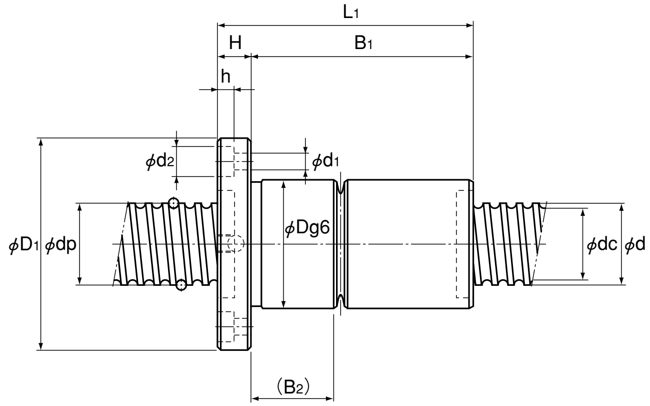
Constant-Pressure Preload Type Model JPF

Axial clearance: 0 or less

Model JPF

Constant-Pressure Preload Type Rolled Ball Screw





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Nut dimensions									Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_{0a} kN	Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	B_2	PCD	$d_1 \times d_2 \times h$	Greasing hole A	
JPF 1404-4	14	4	14.4	11.5	2×1	2.8	5.1	26	46	52	10	42	16.5	36	4.5×8×4.5	M6	2.96×10^{-4}
JPF 1405-4		5	14.5	11.2	2×1	3.9	8.6	26	46	60	10	50	20	36	4.5×8×4.5	M6	2.96×10^{-4}
JPF 1605-4	16	5	16.75	13.5	2×1	3.7	8.2	30	49	60	10	50	19.5	39	4.5×8×4.5	M6	5.05×10^{-4}
JPF 2005-6	20	5	20.5	17.2	3×1	6	16	34	57	80	11	69	26.5	45	5.5×9.5×5.5	M6	1.23×10^{-3}
JPF 2505-6	25	5	25.5	22.2	3×1	6.9	20.8	40	66	80	11	69	26	51	5.5×9.5×5.5	M6	3.01×10^{-3}
JPF 2510-4		10	26.8	20.2	2×1	11.4	24.5	47	72	112	12	100	42	58	6.6×11×6.5	M6	3.01×10^{-3}
JPF 2805-6	28	5	28.75	25.2	3×1	7.3	23.9	43	69	80	12	68	25	55	6.6×11×6.5	M6	4.74×10^{-3}
JPF 2806-6		6	28.5	25.2	3×1	7.3	23.9	43	69	90	12	78	35	55	6.6×11×6.5	M6	4.74×10^{-3}
JPF 3210-6	32	10	33.75	27.2	3×1	19.3	49.9	54	88	135	15	120	53.5	70	9×14×8.5	M6	8.08×10^{-3}
JPF 3610-6	36	10	37	30.5	3×1	20.6	56.2	58	98	138	18	120	53.5	77	11×17.5×11	M6	1.29×10^{-2}
JPF 4010-6	40	10	41.75	35.2	3×1	22.2	65.3	62	104	138	18	120	53.5	82	11×17.5×11	PT 1/8	1.97×10^{-2}

Note The ball screw nut and the screw shaft of model JPF are not sold alone.

Model number coding

JPF2005-6 RR G0 +500L C7 T

1 2 3 4 5 6

1 Model number
2 Seal symbol - RR: Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
3 Axial clearance symbol (see page k-15) 4 Overall screw shaft length (mm)
5 Accuracy symbol (see page k-8) (no symbol for class C10) 6 Symbol for rolled shaft

Standard-Lead Rolled Ball Screw

Return-Pipe Nut

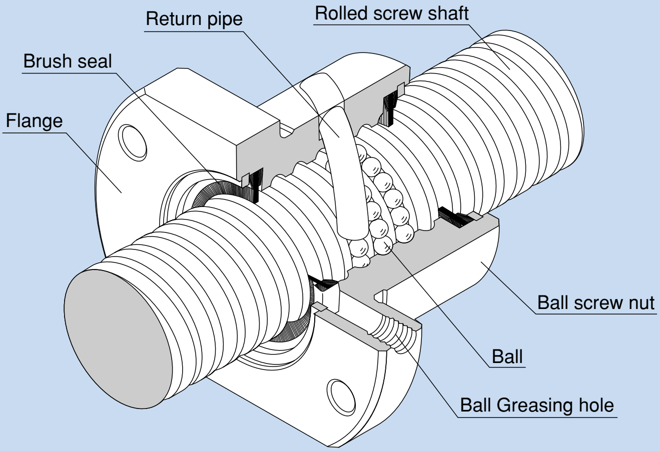


Fig. 1 Structure of the Return-Pipe Nut

Structure and Features

With the Return-Pipe Nut, balls under a load roll around the circumference of the screw shaft, while receiving an axial load on the ball raceways formed between the screw shaft and the ball screw nut, then pass through the return pipe incorporated in the ball screw nut and circulate back to the loaded area, thus to achieve infinite motion.

●Allows Easy Machining of the Ball Screw Nut Mounting Holes

Since model BTK has a return pipe incorporated in the ball screw nut, its exterior is compact and space saving. As opposed to the conventional model whose return pipe sticks out of the circumference, the mounting holes on the housing of model BTK can easily be formed through simple lathing because it is unnecessary to cut a recess for the return pipe by milling. As a result, the required man-hours can be reduced.

●Allows Low Shaft Center Position

With models BTK and MTF, the flange circumference is cut flat at the top and bottom, allowing the shaft center to be positioned lower than the conventional type with a round flange.

●Easy Installation

Model BNT has a square ball screw nut equipped with screw holes for installation to eliminate the need for a housing and allows compact design.

●High Dust Prevention Effect

The ball screw nut of models BTK and BNT is incorporated with a highly dust preventive brush seal.

Types and Features

Non-preload Type Model BTK

A compact type with a round nut incorporated with a return pipe. The flange circumference is cut flat at the top and bottom, allowing the shaft center to be positioned low.

Non-preload Type Model MTF

A miniature type with a screw shaft diameter of ϕ6 to ϕ12 mm and a lead of 1 to 2 mm.

Square Ball Screw Nut, Non-preload Type Model BNT

Since it has a square ball screw nut equipped with screw holes for installation, this model can compactly be installed directly to the machine body without a housing.

Model BTK

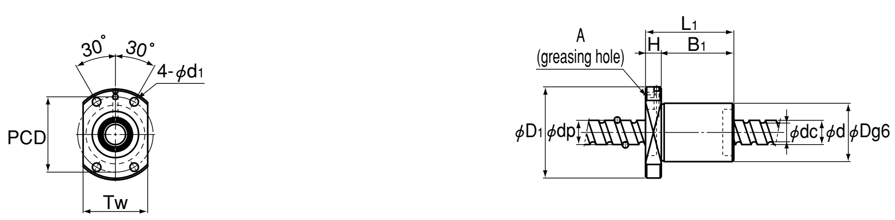
Rolled Ball Screw

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

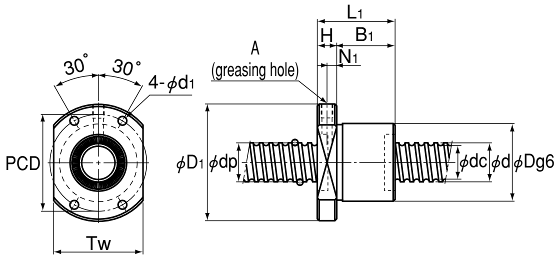
where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.



Models BTK 1006 and 1208



Models BTK 1404 to 5016

Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/µm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw	Greasing hole N_1	Greasing hole A	Axial clearance	Standard shaft length	Screw shaft inertial moment/mm kg·cm²/mm
BTK 1006-2.6	10	6	10.5	7.8	1×2.65	2.8	4.9	88	26	42	36	8	28	34	4.5	29	—	3	0.05	200,300	$7.71×10^{-5}$
BTK 1208-2.6	12	8	12.65	9.7	1×2.65	3.8	6.8	108	29	45	44	8	36	37	4.5	32	—	3	0.05		$1.6×10^{-4}$
BTK 1404-3.6	14	4	14.4	11.5	1×3.65	5.5	11.5	150	31	50	40	10	30	40	4.5	37	5	M6	0.1	500,1000	$2.96×10^{-4}$
BTK 1405-2.6		5	14.5	11.2	1×2.65	5	11.4	116	32	50	40	10	30	40	4.5	38	5	M6	0.1		$2.96×10^{-4}$
BTK 1605-2.6	16	5	16.75	13.5	1×2.65	5.4	13.3	130	34	54	40	10	30	44	4.5	40	5	M6	0.1		$5.05×10^{-4}$
BTK 1808-3.6	18	8	19.3	14.4	1×3.65	13.1	31	210	50	80	61	12	49	65	6.6	60	5	M6	0.1		$8.09×10^{-4}$
BTK 2005-2.6	20	5	20.5	17.2	1×2.65	6	16.5	150	40	60	40	10	30	50	4.5	46	5	M6	0.1	500,1000 1500	$1.23×10^{-3}$
BTK 2010-2.6		10	21.25	16.4	1×2.65	10.6	25.1	160	52	82	61	12	49	67	6.6	64	5	M6	0.1		$1.23×10^{-3}$
BTK 2505-2.6	25	5	25.5	22.2	1×2.65	6.7	20.8	180	43	67	40	10	30	55	5.5	50	5	M6	0.1		$3.01×10^{-3}$
○ BTK 2510-5.3		10	26.8	20.2	2×2.65	31.2	83.7	400	60	96	98	15	83	78	9	72	5	M6	0.1		$3.01×10^{-3}$
BTK 2806-2.6	28	6	28.5	25.2	1×2.65	7	23.4	200	50	80	47	12	35	65	6.6	60	6	M6	0.1	500,1000 2000,2500	$4.74×10^{-3}$
BTK 2806-5.3			28.5	25.2	2×2.65	12.8	46.8	390	50	80	65	12	53	65	6.6	60	6	M6	0.1		$4.74×10^{-3}$
○ BTK 3210-2.6	32	10	33.75	27.2	1×2.65	19.8	53.8	250	67	103	68	15	53	85	9	78	5	M6	0.14		$8.08×10^{-3}$
○ BTK 3210-5.3			33.75	27.2	2×2.65	36	107.5	490	67	103	98	15	83	85	9	78	5	M6	0.14		$8.08×10^{-3}$
○ BTK 3610-2.6	36	10	37	30.5	1×2.65	20.8	59.8	270	70	110	70	17	53	90	11	82	7	M6	0.17	500,1000,2000, 2500,3000	$1.29×10^{-2}$
○ BTK 3610-5.3			37	30.5	2×2.65	37.8	118.7	530	70	110	100	17	83	90	11	82	7	M6	0.17		$1.29×10^{-2}$
○ BTK 4010-5.3	40	10	41.75	35.2	2×2.65	40.3	134.9	590	76	116	100	17	83	96	11	88	7	M6	0.17	1000,1500 2000,3000 3500	$1.97×10^{-2}$
BTK 4512-5.3	45	12	46.5	39.2	2×2.65	49.5	169	650	82	128	118	20	98	104	14	94	8	M6	0.17		$3.16×10^{-2}$
○ BTK 5016-5.3	50	16	52.7	42.9	2×2.65	93.8	315.2	930	102	162	145	25	120	132	18	104	12.5	PT 1/8	0.2		$4.82×10^{-2}$

Note Those models marked with ○ can be attached with QZ Lubricator or the wiper ring.
For dimensions of the ball screw nut with either accessory being attached, see page k-260.

Model number coding BTK1405-2.6 ZZ

Ball Screw Nut

BTK1405-2.6 ①, ZZ ②

1. Model number
2. Seal symbol - no symbol: without seal;
   ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

Model number coding TS 14 05 +500L C7

Screw Shaft

TS ①, 14 ②, 05 ③, +500L ④, C7 ⑤

1. Symbol for rolled ball screw shaft
2. Screw shaft outer diameter (in mm)
3. Lead (in mm)
4. Overall screw shaft length (in mm)
5. Accuracy symbol (see page k-8) (no symbol for class C10)

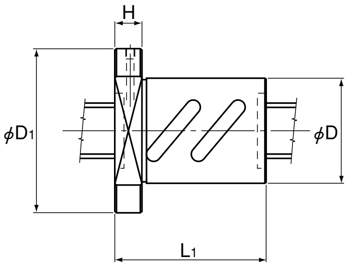
Model number coding BTK1405-2.6 ZZ +500L C7 T

Combination of the Ball Screw Nut and the Screw Shaft

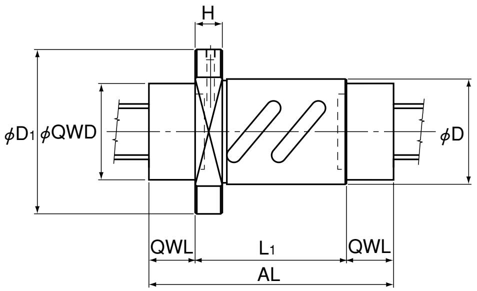
BTK1405-2.6 ①, ZZ ②, +500L ③, C7 ④, T ⑤

1. Model number
2. Seal symbol - no symbol: without seal;
   ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)
3. Overall shaft length (in mm)
4. Accuracy symbol (see page k-8) (no symbol for class C10)
5. Symbol for rolled shaft

Dimensions of the Ball Screw Nut Attached with Wiper Ring (WW) and QZ Lubricator (QZ)



With WW (without QZ)



With QZ + WW

Unit: mm

Model No.	Dimensions including WW				Dimensions including QZ and WW		
	Nut length	Flange width	Flange diameter	Nut diameter	Length	Outer diameter	Overall length incl. QZ and WW
	L_1	H	D_1	Dg6	QWL	QWD	AL
BTK 2510-5.3	98	15	96	60	32.5	45	163
BTK 3210-2.6	68	15	103	67	32	57	132
BTK 3210-5.3	98						162
BTK 3610-2.6	70	17	110	70	31	64	132
BTK 3610-5.3	100						162
BTK 4010-5.3	100	17	116	76	34	66	168
BTK 5016-5.3	145	25	162	102	35	79	215

Model number coding

$$\underbrace{\text{BTK2510-5.3}}_{1}\ \underbrace{\text{QZ}}_{2}\ \underbrace{\text{WW}}_{3}\ \underbrace{\text{+1000L}}_{4}\ \underbrace{\text{C7}}_{5}\ \underbrace{\text{T}}_{6}$$

1 Model number 2 With QZ Lubricator (see page k-22)
3 Seal symbol - RR : Labyrinth seal attached to both ends of the ball screw nut (see page k-25)
WW : Wiper ring attached to both ends of the ball screw nut (see page k-26)
4 Overall screw shaft length (mm) 5 Accuracy symbol (see page k-8) (no symbol for class C10)
6 Symbol for rolled shaft

Note QZ Lubricator and wiper ring are not sold alone.

Precautions on Use

THK QZ Lubricator for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- Do not clean the product with an organic solvent or white kerosene.
- Do not leave the product package open over a long period of time.
- Do not block the hole for air vent near the model number indication with grease or the like.

Service Temperature Range

- Use this product within a temperature range of -10℃ to +50℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Corrosion Prevention

- QZ Lubricator is designed to provide the essential minimum amount of a lubricant to the ball raceway. It does not provide a corrosion-prevention effect to the whole Ball Screw.

THK Wiper Ring for the Ball Screw

Handling

- Dropping or hitting the product may damage it. Use much care when handling it.
- Unduly disassembling the product may cause foreign matter from entering the product or degrade the accuracy. Do not disassemble the product unless it is inevitable.
- When using this product in a harsh environment, we recommend using it in combination with QZ Lubricator.

Service Temperature Range

- Use this product within a temperature range of -20℃ to +80℃. When desiring to use the product out of this temperature range, contact THK.

Use in a Special Environment

- When desiring to use the product in a special environment, contact THK.

Chemical Resistance

- Avoid using the product in an atmosphere containing an acid or alkali solvent.

Model MTF

Miniature Rolled Ball Screw

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).

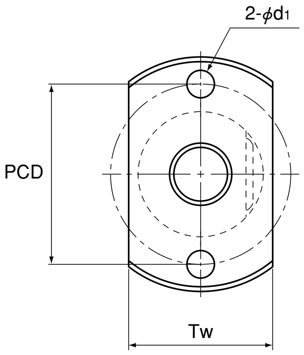
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

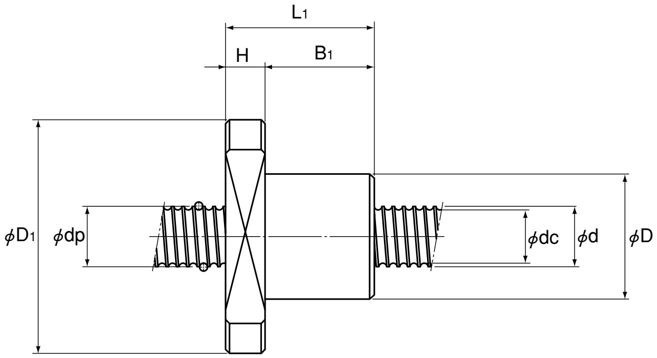
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating		Rigidity	Outer diameter	Nut dimensions							Axial clearance	Standard shaft length	Screw shaft inertial moment/mm kg·cm²/mm
						Ca kN	C_0a kN	K N/μm	$D^{-0.05}_{-0.10}$	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw			
MTF 0601-3.7	6	1	6.15	5.3	1×3.7	0.7	1.2	70	13	30	21	5	16	21.5	3.4	17	0.05	150,250	9.99×10^{-6}
MTF 0802-3.7	8	2	8.3	6.6	1×3.7	2.1	3.8	90	20	40	28	6	22	30	4.5	24	0.05		3.16×10^{-5}
MTF 1002-3.7	10	2	10.3	8.6	1×3.7	2.3	4.8	110	23	43	28	6	22	33	4.5	27	0.05	200,300	7.71×10^{-5}
MTF 1202-3.7	12	2	12.3	10.6	1×3.7	2.5	5.8	130	25	47	30	8	22	36	5.5	29	0.05		1.6×10^{-4}

Note Model MTF cannot be attached with a seal.

Note The ball screw nut and the screw shaft of model MTF are not sold alone.
Model MTF is applied only with anti-corrosive oil.

Model number coding

$$\underbrace{\text{MTF0601-3.7}}_{1}\ \underbrace{\text{+250L}}_{2}\ \underbrace{\text{C7}}_{3}\ \underbrace{\text{T}}_{4}$$

1 Model number 2 Overall screw shaft length (in mm)
3 Accuracy symbol (see page k-8) (no symbol for class C10) 4 Symbol for rolled shaft

Model BNT

Square-nut, Non-preload Type

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).

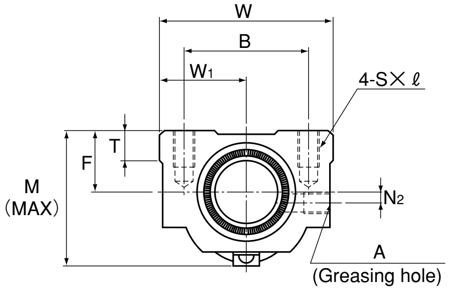
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

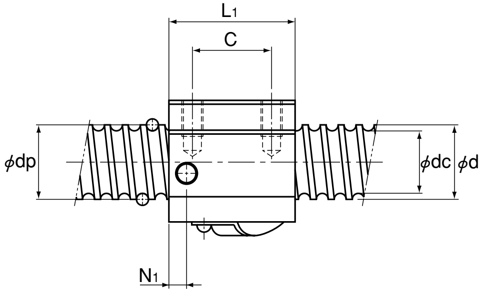
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Width W	Center height F	Overall length L_1	Mounting hole B	Mounting hole C	Mounting hole S×ℓ	W_1	T	M	N_1	N_2	A	Axial clearance	Screw shaft inertial moment/mm kg·cm²/mm
BNT 1404-3.6	14	4	14.4	11.5	1×3.65	5.5	11.5	150	34	13	35	26	22	M4×7	17	6	30	6	2	M6	0.1	2.96×10^{-4}
BNT 1405-2.6		5	14.5	11.2	1×2.65	5	11.4	110	34	13	35	26	22	M4×7	17	6	31	6	2	M6	0.1	2.96×10^{-4}
BNT 1605-2.6	16	5	16.75	13.5	1×2.65	5.4	13.3	130	42	16	36	32	22	M5×8	21	21.5	32.5	6	2	M6	0.1	5.05×10^{-4}
BNT 1808-3.6	18	8	19.3	14.4	1×3.65	13.1	31	210	48	17	56	35	35	M6×10	24	10	44	8	3	M6	0.1	8.09×10^{-4}
BNT 2005-2.6	20	5	20.5	17.2	1×2.65	6	16.5	150	48	17	35	35	22	M6×10	24	9	39	5	3	M6	0.1	1.23×10^{-3}
BNT 2010-2.6		10	21.25	16.4	1×2.65	10.6	25.1	160	48	18	58	35	35	M6×10	24	9	46	10	2	M6	0.1	1.23×10^{-3}
BNT 2505-2.6	25	5	25.5	22.2	1×2.65	6.7	20.8	180	60	20	35	40	22	M8×12	30	9.5	45	7	5	M6	0.1	3.01×10^{-3}
BNT 2510-5.3		10	26.8	20.2	2×2.65	31.2	83.7	400	60	23	94	40	60	M8×12	30	10	55	10	—	M6	0.1	3.01×10^{-3}
BNT 2806-2.6	28	6	28.5	25.2	1×2.65	7	23.4	200	60	22	42	40	18	M8×12	30	10	50	8	—	M6	0.1	4.74×10^{-3}
BNT 2806-5.3			28.5	25.2	2×2.65	12.8	46.8	390	60	22	67	40	40	M8×12	30	10	50	8	—	M6	0.1	4.74×10^{-3}
BNT 3210-2.6	32	10	33.75	27.2	1×2.65	19.8	53.8	250	70	26	64	50	45	M8×12	35	12	62	10	—	M6	0.14	8.08×10^{-3}
BNT 3210-5.3			33.75	27.2	2×2.65	36	107.5	490	70	26	94	50	60	M8×12	35	12	62	10	—	M6	0.14	8.08×10^{-3}
BNT 3610-2.6	36	10	37	30.5	1×2.65	20.8	59.3	270	86	29	64	60	45	M10×16	43	17	67	11	—	M6	0.17	1.29×10^{-2}
BNT 3610-5.3			37	30.5	2×2.65	37.8	118.7	530	86	29	96	60	60	M10×16	43	17	67	11	—	M6	0.17	1.29×10^{-2}
BNT 4512-5.3	45	12	46.5	39.2	2×2.65	49.5	169	650	100	36	115	75	75	M12×20	50	20.5	80	13	—	M6	0.2	3.16×10^{-2}

Model number coding BNT1405-2.6 ZZ

Ball Screw Nut

1 2

1 Model number
2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

Model number coding TS 14 05 +500L C7

Screw Shaft

1 2 3 4 5

1 Symbol for rolled ball screw shaft
2 Screw shaft outer diameter (in mm) 3 Lead (in mm)
4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) (no symbol for class C10)

Model number coding BNT1405-2.6 ZZ +500L C7 T

Combination of the Ball Screw Nut and the Screw Shaft

1 2 3 4 5

1 Model number
2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)
3 Overall length (in mm) 4 Accuracy symbol (see page k-8) (no symbol for class C10)
5 Symbol for rolled shaft

Large-Lead Rolled Ball Screw

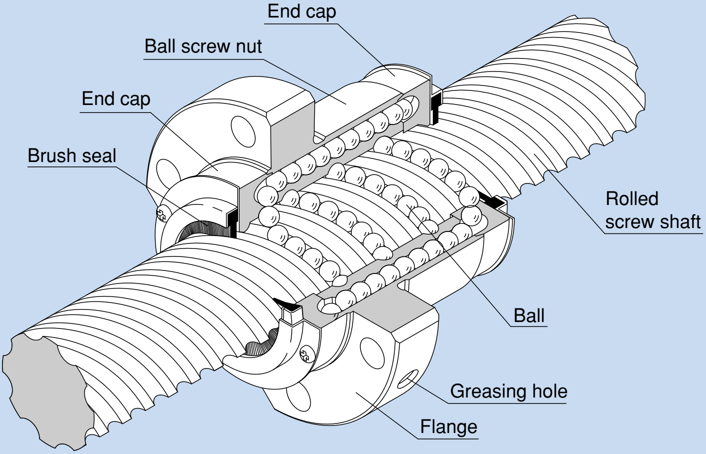


Fig. 1 Structure of the Large-Lead Nut Rolled Ball Screw

Structure and Features

With the Large-Lead Rolled Ball Screw, balls under a load roll along the circumference of the screw shaft and in the raceways formed on the screw shaft and the ball screw nut while receiving an axial load, are picked up with an end cap attached to the ball screw nut ends, and then circulate from the other end cap to the loaded area again after passing through the ball screw nut, thus to complete infinite rotary motion.

This model has two, four or eight raceway grooves formed by rolling into right-hand threads. Balls roll in the second or fourth groove.

●Optimal for Fast Feed

Use of the end cap increases the strength of the ball pick-up section in comparison to the conventional return-pipe type, and achieves stable motion even in high-speed rotation.

●Quiet Running Sound

Use of the end cap minimizes the level of noise produced when the balls are picked up. In addition, the balls pass inside the ball screw nut, thus to achieve low noise even in high-speed rotation.

●A Long-size Type Can be Used with a Thin Ball Screw Shaft

Replacing a standard Ball Screw, used in a location where high-speed operation is required, with one of these models will allow the rotation speed of the screw shaft to be decreased. Therefore, it eliminates the need to use a thicker screw shaft given the critical speed of the screw shaft and the need for choosing a difficult method for securing the screw shaft, thus to reduce the cost.

●Compact

Use of a ball circulation structure based on end caps allows the ball screw nut to be shortened and minimizes the outer diameter. Moreover, since the flange circumference is cut flat at the top and bottom, the center height is lowered and the structure is compactly made.

●Greater Turning Force with Small Thrust

The turning force generated when a thrust is given to the screw shaft or the ball screw nut is more than three times greater than a small-lead ball screw. Therefore, the Large-Lead Rolled Ball Screw is optimal for applications such as an actuator.

●High Dust Prevention Effect

It is incorporated with a highly dust preventive brush seal.

●Achieves Lead Accuracy of Class C7

Thanks to the rolling process for precision threads, screw shafts with travel distance error of classes C7 and C8 are also manufactured as standard in addition to class C10 to meet a broad range of applications.

Travel distance error: C7 :±0.05/300(mm)
C8 :±0.10/300(mm)
C10 :±0.21/300(mm)

(For manufacturing length limits of screw shaft by accuracy grade, see page k-17.)

Types and Features

Non-preload Type Models BLK and WTF

Non-preload Type Model CNF

Model BLK

Large-Lead Rolled Ball Screw

Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).

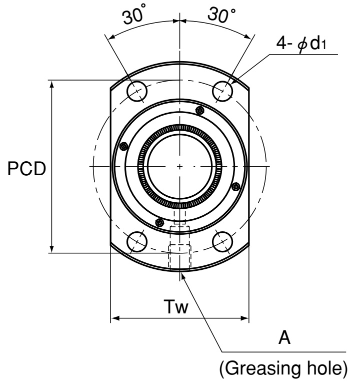
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

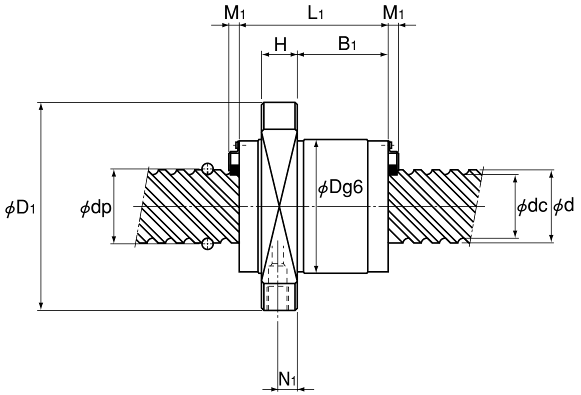
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions: Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw	Greasing hole N_1	Greasing hole A	Seal M_1	Axial clearance	Standard shaft length	Screw shaft inertial moment/mm kg·cm²/mm
BLK 1510-5.6	15	10	15.75	12.5	2×2.8	9.8	25.2	260	34	57	44	10	24	45	5.5	40	5	M6	3.5	0.1	500,1000	3.9×10^{-4}
BLK 1616-3.6	16	16	16.65	13.7	2×1.8	5.8	12.9	170	32	53	38	10	21.5	42	4.5	38	5	M6	3.5	0.1		5.05×10^{-4}
BLK 1616-7.2			16.65	13.7	4×1.8	10.5	25.9	340	32	53	38	10	21.5	42	4.5	38	5	M6	3.5	0.1		5.05×10^{-4}
BLK 2020-3.6	20	20	20.75	17.5	2×1.8	7.7	22.3	210	39	62	45	10	27.5	50	5.5	46	5	M6	3.5	0.1	500,1000 1500	1.23×10^{-3}
BLK 2020-7.2			20.75	17.5	4×1.8	13.9	44.6	410	39	62	45	10	27.5	50	5.5	46	5	M6	3.5	0.1		1.23×10^{-3}
BLK 2525-3.6	25	25	26	22	2×1.8	12.1	35	270	47	74	55	12	35	60	6.6	56	6	M6	3.5	0.1	1000,1500 2000	3.01×10^{-3}
BLK 2525-7.2			26	22	4×1.8	21.9	69.9	520	47	74	55	12	35	60	6.6	56	6	M6	3.5	0.1		3.01×10^{-3}
BLK 3232-3.6	32	32	33.25	28.3	2×1.8	17.3	53.9	330	58	92	70	15	45	74	9	68	7.5	M6	3.8	0.14	1000,1500 2000,2500	8.08×10^{-3}
BLK 3232-7.2			33.25	28.3	4×1.8	31.3	107.8	650	58	92	70	15	45	74	9	68	7.5	M6	3.8	0.14		8.08×10^{-3}
BLK 3620-5.6	36	20	37.75	31.2	2×2.8	39.8	121.7	570	70	110	78	17	45	90	11	80	8.5	M6	5	0.17	1000,1500 2000,3000	1.29×10^{-2}
BLK 3624-5.6		24	38	30.7	2×2.8	46.2	137.4	590	75	115	94	18	59	94	11	86	9	M6	5	0.17		1.29×10^{-2}
BLK 3636-3.6		36	37.4	31.7	2×1.8	22.4	70.5	370	66	106	77	17	50	85	11	76	8.5	M6	5	0.17		1.29×10^{-2}
BLK 3636-7.2			37.4	31.7	4×1.8	40.6	141.1	730	66	106	77	17	50	85	11	76	8.5	M6	5	0.17		1.29×10^{-2}
BLK 4040-3.6	40	40	41.75	35.2	2×1.8	28.1	89.8	420	73	114	85	17	56.5	93	11	84	8.5	M6	5.4	0.17		1.97×10^{-2}
BLK 4040-7.2			41.75	35.2	4×1.8	51.1	179.6	810	73	114	85	17	56.5	93	11	84	8.5	M6	5.4	0.17		1.97×10^{-2}
BLK 5050-3.6	50	50	52.2	44.1	2×1.8	42.1	140.4	510	90	135	106	20	72	112	14	104	10	M6	5.4	0.2		4.82×10^{-2}
BLK 5050-7.2			52.2	44.1	4×1.8	76.3	280.7	1000	90	135	106	20	72	112	14	104	10	M6	5.4	0.2		4.82×10^{-2}

Model number coding BLK1510-5.6 ZZ

Ball Screw Nut

1 2

1 Model number

2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

Model number coding TS 15 10 +1000L C7

Screw Shaft

1 2 3 4 5

1 Symbol for rolled ball screw shaft

2 Screw shaft outer diameter (in mm) 3 Lead (in mm)

4 Overall screw shaft length (in mm)

5 Accuracy symbol (see page k-8) (no symbol for class C10)

Model number coding BLK1510-5.6 ZZ +1000L C7 T

Combination of the Ball Screw Nut and the Screw Shaft

1 2 3 4 5

1 Model number

2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

3 Overall shaft length (in mm) 4 Accuracy symbol (see page k-8) (no symbol for class C10)

5 Symbol for rolled shaft

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Model WTF

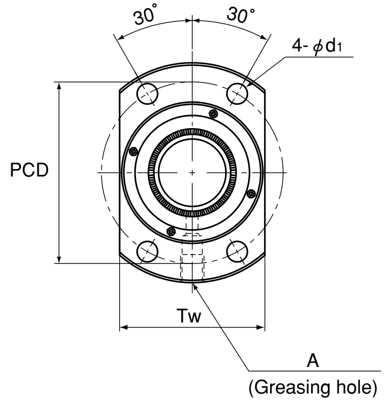
Super-Lead Rolled Ball Screw

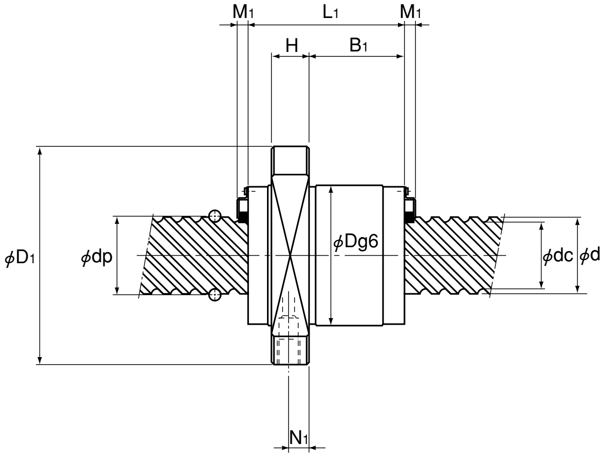
Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.
If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{F_a}{0.3C_a}\right)^{\frac{1}{3}}$$

K: Rigidity value in the dimensional table.





Unit: mm

Model No.	Screw shaft outer diameter d	Lead R	Ball center diameter dp	Thread minor diameter dc	No. of loaded circuits Rows x turns	Basic load rating Ca kN	Basic load rating C_0a kN	Rigidity K N/μm	Nut dimensions Outer diameter D	Flange diameter D_1	Overall length L_1	H	B_1	PCD	d_1	Tw	Greasing hole N_1	Greasing hole A	Seal M_1	Axial clearance	Standard shaft length	Screw shaft inertial moment/mm kg·cm²/mm
WTF 1520-3	15	20	15.75	12.5	2×1.5	5.5	14.2	140	32	53	45	10	28	43	5.5	33	5	M6	3.5	0.1	500,1000	3.9×10^{-4}
WTF 1520-6			15.75	12.5	4×1.5	10.1	28.5	280	32	53	45	10	28	43	5.5	33	5	M6	3.5	0.1		3.9×10^{-4}
WTF 1530-2		30	15.75	12.5	4×0.6	4.3	9.3	120	32	53	33	10	17	43	5.5	33	5	M6	3.5	0.1		3.9×10^{-4}
WTF 1530-3			15.75	12.5	2×1.6	5.6	12.4	160	32	53	63	10	47	43	5.5	33	5	M6	3.5	0.1		3.9×10^{-4}
WTF 2040-2	20	40	20.75	17.5	4×0.65	5.4	13.6	160	37	57	41.5	10	25.5	47	5.5	38	5.5	M6	3.5	0.1	500,1000 1500	1.23×10^{-3}
WTF 2040-3			20.75	17.5	2×1.65	6.6	17.2	200	37	57	81.5	10	65.5	47	5.5	38	5.5	M6	3.5	0.1		1.23×10^{-3}
WTF 2550-2	25	50	26	21.9	4×0.65	8.5	21.2	200	45	69	52	12	31.5	57	6.6	46	7	M6	3.5	0.1	1000,1500 2000	3.01×10^{-3}
WTF 2550-3			26	21.9	2×1.65	10.4	26.9	260	45	69	102	12	81.5	57	6.6	46	7	M6	3.5	0.1		3.01×10^{-3}
WTF 3060-2	30	60	31.25	26.4	4×0.65	11.8	30.6	240	55	89	62.5	15	37.5	71	9	56	9	M6	3.8	0.14	1000,2000 3000,4000	6.24×10^{-3}
WTF 3060-3			31.25	26.4	2×1.65	14.5	38.9	310	55	89	122.5	15	97.5	71	9	56	9	M6	3.8	0.14		6.24×10^{-3}
WTF 4080-2	40	80	41.75	35.2	4×0.65	19.8	54.5	320	73	114	79	17	50.5	93	11	74	8.5	M6	5.4	0.17	1000,1500 2000,3000	1.97×10^{-2}
WTF 4080-3			41.75	35.2	2×1.65	24.3	69.2	400	73	114	159	17	130.5	93	11	74	8.5	M6	5.4	0.17		1.97×10^{-2}
WTF 50100-2	50	100	52.2	44.1	4×0.65	29.6	85.2	390	90	135	98	20	64	112	14	92	10	M6	5.4	0.2		4.82×10^{-2}
WTF 50100-3			52.2	44.1	2×1.65	36.3	108.1	500	90	135	198	20	164	112	14	92	10	M6	5.4	0.2		4.82×10^{-2}

Model number coding WTF1520-3 ZZ

Ball Screw Nut

1 2

1 Model number
2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

Model number coding TS 15 20 +1000L C7

Screw Shaft

1 2 3 4 5

1 Symbol for rolled ball screw shaft
2 Screw shaft outer diameter (in mm)
3 Lead (in mm) 4 Overall screw shaft length (in mm)
5 Accuracy symbol (see page k-8) (no symbol for class C10)

Model number coding WTF1520-3 ZZ +1000L C7 T

Combination of the Ball Screw Nut and the Screw Shaft

1 2 3 4 5

1 Model number
2 Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)
3 Overall shaft length (in mm) 4 Accuracy symbol (see page k-8) (no symbol for class C10)
5 Symbol for rolled shaft

Model CNF

Change-Nut Rolled Ball Screw

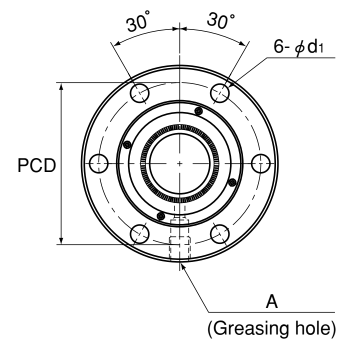
Note The rigidity values in the table represent spring constants each obtained from the load and the elastic displacement when providing an axial load 30% of the basic dynamic load rating (Ca).

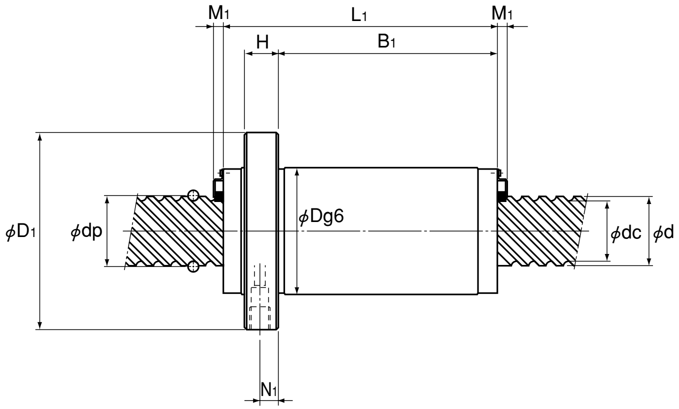
These values do not include the rigidity of the components related to mounting the ball screw nut. Therefore, it is normally appropriate to regard roughly 80% of the value in the table as the actual value.

If the axial load (Fa) is not 0.3 Ca, the rigidity value (K_N) is obtained from the following equation.

where

$$K_N = K\left(\frac{Fa}{0.3Ca}\right)^{\frac{1}{3}}$$ K: Rigidity value in the dimensional table.





Unit: mm

Model No.	Screw shaft outer diameter	Lead	Ball center diameter	Thread minor diameter	No. of loaded circuits	Basic load rating		Rigidity	Nut dimensions										Axial clearance	Standard shaft length	Screw shaft inertial moment/mm
						Ca	C_0a	K	Outer diameter	Flange diameter	Overall length	H	B_1	PCD	d_1	Greasing hole		Seal			
	d	R	dp	dc	Rows x turns	kN	kN	N/μm	D	D_1	L_1					N_1	A	M_1			kg·cm²/mm
CNF 1530-6	15	30	15.75	12.5	4×1.6	10.1	24.7	310	32	53	63	10	47	43	5.5	5	M6	3.5	0.1	500,1000	3.9×10^{-4}
CNF 2040-6	20	40	20.75	17.5	4×1.65	12	34.4	400	37	57	81	10	65	47	5.5	5.5	M6	3.5	0.1	500,1000,1500	1.23×10^{-3}
CNF 2550-6	25	50	26	21.9	4×1.65	18.9	53.9	460	45	69	102	12	81.5	57	6.6	7	M6	3.5	0.1	1000,1500,2000	3.01×10^{-3}
CNF 3060-6	30	60	31.25	26.4	4×1.65	26.2	77.7	600	55	89	122	15	97	71	9	9	M6	3.8	0.14	1000,2000 3000,4000	6.24×10^{-3}

Model number coding CNF1530-6 ZZ

Ball Screw Nut ① ②

①Model number
②Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)

Model number coding TS 15 30 +1000L C7

Screw Shaft ① ② ③ ④ ⑤

①Symbol for rolled ball screw shaft
②Screw shaft outer diameter (in mm)
③Lead (in mm) ④Overall screw shaft length (in mm)
⑤Accuracy symbol (see page k-8) (no symbol for class C10)

Model number coding CNF1530-6 ZZ +1000L C7 T

Combination of the Ball Screw Nut and the Screw Shaft ① ② ③ ④ ⑤

①Model number
②Seal symbol - no symbol: without seal;
ZZ: brush seal attached to both ends of the ball screw nut (see page k-25)
③Overall shaft length (in mm) ④Accuracy symbol (see page k-8) (no symbol for class C10)
⑤Symbol for rolled shaft

Ball Screw Peripherals

Support Unit

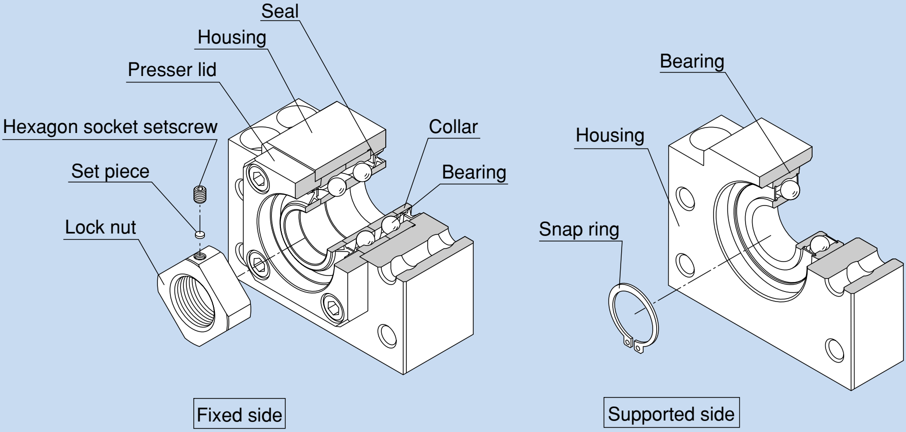


Fig. 1 Structure of the Support Unit

Structure and Features

The Support Unit comes in six types: models EK, FK, EF, and FF, which are standardized for standard-stock Ball Screws provided with finished shaft ends, and models BK and BF, which are standardized for ball screws in general.

The Support Unit on the fixed side contains a JIS Class 5-compliant angular bearing provided with an adjusted preload. The miniature type Support Unit models EK/FK 4, 5, 6 and 8, in particular, incorporate a miniature bearing with a contact angle of 45° developed exclusively for miniature Ball Screws. This provides stable rotation performance with high rigidity and accuracy.

The Support Unit on the supported side uses a deep-groove ball bearing.

The internal bearings of Support Unit models EK, FK and BK contain an appropriate amount of lithium soap-group grease that is sealed with a special seal. Thus, these models are capable of operating over a long period.

●Uses the Optimal Bearing

To ensure rigidity balance with the Ball Screw, the Support Unit uses an angular bearing (contact angle: 30° ; DF configuration) with high rigidity and low torque. Miniature Support Unit models EK/FK 4, 5, 6 and 8 are incorporated with a miniature angular bearing with a contact angle of 45° developed exclusively for miniature Ball Screws. This bearing has a greater contact angle of 45° and an increased number of balls with a smaller diameter. The high rigidity and accuracy of the miniature angular bearing provides stable rotation performance.

●Support Unit Shapes

Square and round shapes are available for the Support Unit to allow selection according to the intended use.

●Compact and Easy Installation

The Support Unit is compactly designed to accommodate the space in the installation site. As the bearing is provided with an appropriately adjusted preload, the Support Unit can be assembled with a Ball Screw unit with no further machining. Accordingly, the required man-hours in assembly can be reduced and the assembly accuracy can be increased.

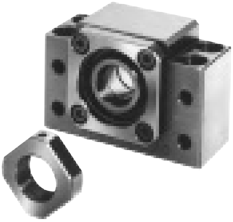
Types

For the Fixed Side

Square Type Model EK

(Inner diameter: ϕ4 to ϕ20)

Square Type Model BK



(Inner diameter: ϕ10 to ϕ40)

Round Type Model FK

(Inner diameter: ϕ4 to ϕ30)

For the Supported Side

Square Type Model EF

(Inner diameter: ϕ6 to ϕ20)

Square Type Model BF

(Inner diameter: ϕ8 to ϕ40)

Round Type Model FF

(Inner diameter: ϕ6 to ϕ30)

Types of Support Units and Applicable Screw Shaft Outer Diameters

Inner diameter of the fixed-side Support Unit (mm)	Applicable model No. of the fixed-side Support Unit	Inner diameter of the supported-side Support Unit (mm)	Applicable model No. of the supported-side Support Unit	Applicable screw shaft outer diameter (mm)
4	EK 4 FK 4	—	—	ø4
5	EK 5 FK 5	—	—	ø6
6	EK 6 FK 6	6	EF 6 FF 6	ø8
8	EK 8 FK 8	6	EF 8 FF 6	ø10
10	EK 10 FK 10 BK 10	8	EF 10 FF 10 BF 10	ø10, ø12, ø14
12	EK 12 FK 12 BK 12	10	EF 12 FF 12 BF 12	ø14, ø15, ø16
15	EK 15 FK 15 BK 15	15	EF 15 FF 15 BF 15	ø20
17	BK 17	17	BF 17	ø20, ø25
20	EK 20 FK 20 BK 20	20	EF 20 FF 20 BF 20	ø25, ø28, ø32
25	FK 25 BK 25	25	FF 25 BF 25	ø36
30	FK 30 BK 30	30	FF 30 BF 30	ø40, ø45
35	BK 35	35	BF 35	ø45
40	BK 40	40	BF 40	ø50

Note: The Supports Units in this table apply only to those Ball Screw models with recommended shaft ends shapes H, J and K, indicated in page k-302.

Model Numbers of Bearings and Characteristic Values

Angular ball bearing on the fixed side					Deep-groove ball bearing on the supported side			
Support Unit model No.	Bearing model No.	Axial direction			Support Unit model No.	Bearing model No.	Radial direction	
		Basic dynamic load rating Ca(kN)	*Permissible load (kN)	Rigidity (N/μm)			Basic dynamic load rating C(kN)	Basic static load rating C₀ (kN)
EK 4 FK 4	AC4-12P5	0.93	1.1	27	—	—	—	—
EK 5 FK 5	AC5-14P5	1	1.24	29	—	—	—	—
EK 6 FK 6	AC6-16P5	1.38	1.76	35	EF 6 FF 6	606ZZ	2.19	0.87
EK 8 FK 8	79M8DF GMP5	3.6	2.15	49	EF 8	606ZZ	2.19	0.87
EK10 FK10 BK10	7000HTDF GMP5	6.08	3.1	65	EF10 FF10 BF10	608ZZ	3.35	1.4
EK12 FK12 BK12	7001HTDF GMP5	6.66	3.25	88	EF12 FF12 BF12	6000ZZ	4.55	1.96
EK15 FK15 BK15	7002HTDF GMP5	7.6	4	100	EF15 FF15 BF15	6002ZZ	5.6	2.84
BK17	7203HTDF GMP5	13.7	5.85	125	BF17	6203ZZ	9.6	4.6
EK20 FK20	7204HTDF GMP5	17.9	9.5	170	EF20 FF20	6204ZZ	12.8	6.65
BK20	7004HTDF GMP5	12.7	7.55	140	BF20	6004ZZ	9.4	5.05
FK25 BK25	7205HTDF GMP5	20.2	11.5	190	FF25 BF25	6205ZZ	14	7.85
FK30 BK30	7206HTDF GMP5	28	16.3	195	FF30 BF30	6206ZZ	19.5	11.3
BK35	7207DF GMP5	37.2	5.83	255	BF35	6207ZZ	25.7	15.3
BK40	7208HTDF GMP5	44.1	27.1	270	BF40	6208ZZ	29.1	17.8

* Note: "Permissible load" indicates the static permissible load.

Examples of Installation

Square Type Support Unit

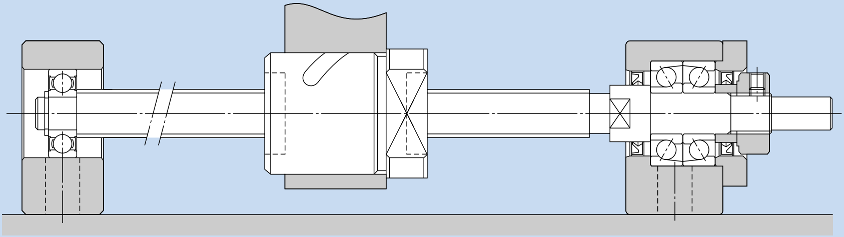


Fig. 2 Example of Installing a Square Type Support Unit

Round Type Support Unit

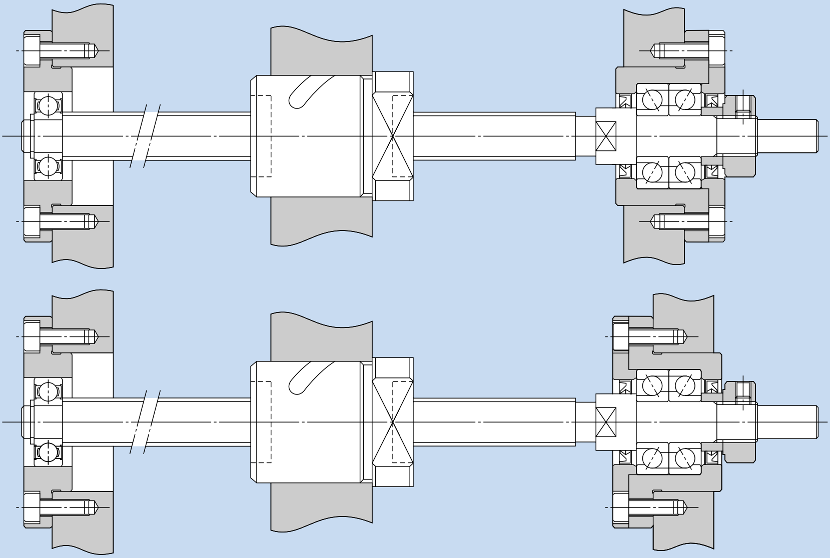


Fig. 3 Example of Installing a Round Type Support Unit

Mounting Procedure

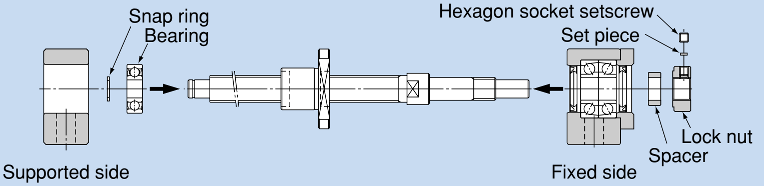
Installing the Support Unit

① Install the fixed-side Support Unit with the screw shaft.

② After inserting the fixed-side Support Unit, secure the lock nut using the fastening set piece and hexagon socket setscrews.

③ Attach the supported-side bearing to the screw shaft and secure the bearing using the snap ring, and then install the assembly to the housing on the supported side.

Note 1: Do no disassemble the Support Unit.
Note 2: When inserting the screw shaft to the Support Unit, take care not to let the oil seal lip turn outward.
Note 3: When securing the set piece with a hexagon socket screw, apply an adhesive to the hexagon socket screw before tightening it in order to prevent the screw from loosening. If planning to use the product in a harsh environment, it is also necessary to take a measure to prevent other components/parts from loosening. Contact THK for details.



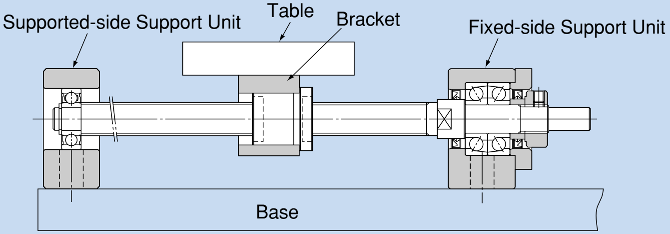
Installation onto the Table and the Base

① If using a bracket when mounting the ball screw nut to the table, insert the nut into the bracket and temporarily secure it.

② Temporarily secure the fixed-side Support Unit to the base.
In doing so, press the table toward the fixed-side Support Unit to align the axial center, and adjust the table so that it can freely travel.

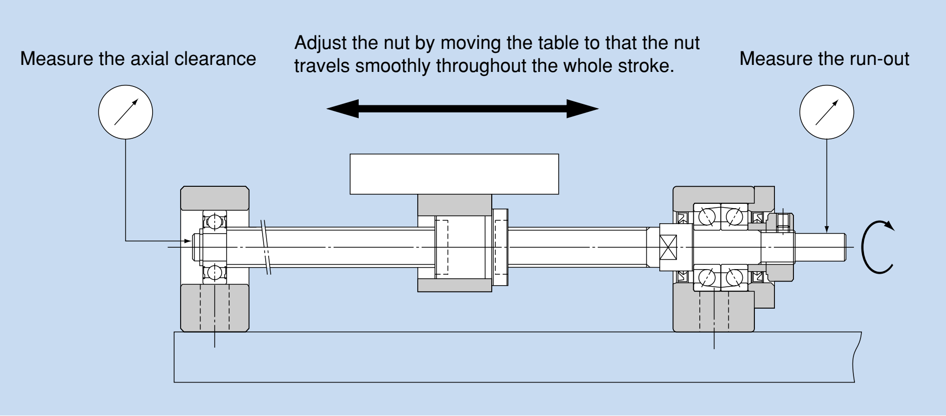
- ●If using the fixed-side Support Unit as the reference point, secure a clearance between the ball screw nut and the table or inside the bracket when making adjustment.
- ●If using the table as the reference point, make adjustment either by using the shim (for a square type Support Unit), or securing a clearance between the outer surface of the nut and the inner surface of the mounting section (for a round type Support Unit).

③ Press the table toward the fixed-side Support Unit to align the axial center. Make adjustment by reciprocating the table several times so that the nut travels smoothly throughout the whole stroke, and temporarily secure the Support Unit to the base.



Checking the Accuracy and Fully Tightening the Support Unit

While checking the run-out of the ball screw shaft end and the axial clearance using a dial gauge, fully tighten the ball screw nut, the nut bracket, the fixed-side Support Unit and the supported-side Support Unit, in this order.

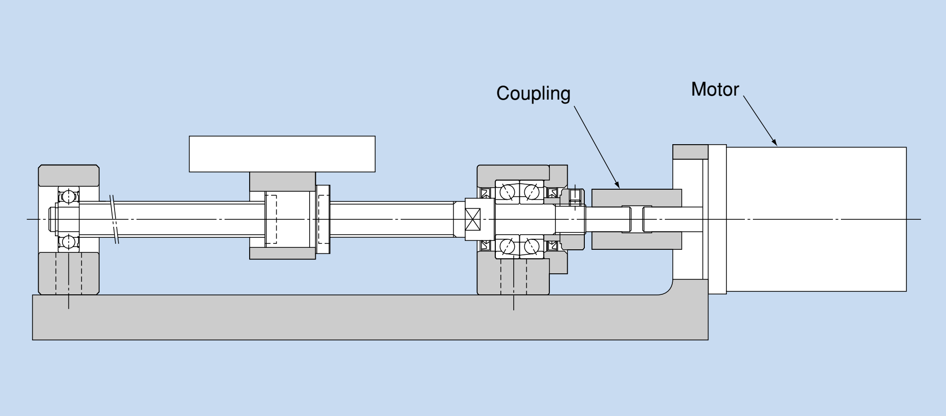


Connection with the Motor

① Mount the motor bracket to the base.

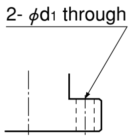
② Connect the motor and the ball screw using a coupling.
  Note: Make sure the mounting accuracy is maintained.

③ Thoroughly perform break-in of the system.

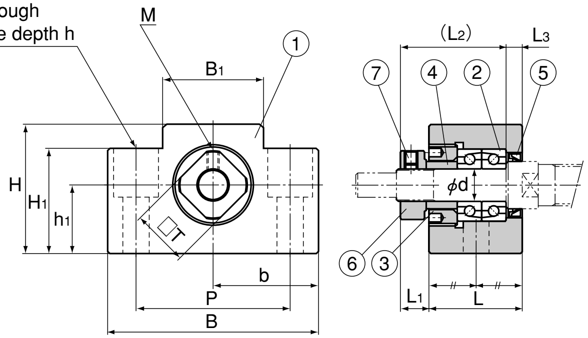


Model EK

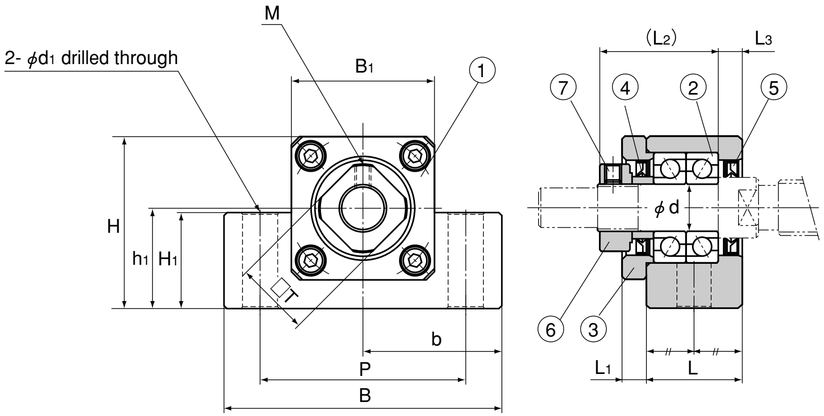
Square Type Support Unit on the Fixed Side



Models EK 4 and 5



Models EK 6 and 8



Models EK 10 to 20

Unit: mm

Model No.	Shaft diameter d	L	L_1	L_2	L_3	B	H	b ±0.02	h_1 ±0.02	B_1	H_1	P	d_1	d_2	h	M	T	Bearing used
EK 4	4	15	5.5	17.5	3	34	19	17	10	18	7	26	4.5	—	—	M2.6	10	AC4-12P5
EK 5	5	16.5	5.5	18.5	3.5	36	21	18	11	20	8	28	4.5	—	—	M2.6	11	AC5-14P5
EK 6	6	20	5.5	22	3.5	42	25	21	13	18	20	30	5.5	9.5	11	M3	12	AC6-16P5
EK 8	8	23	7	26	4	52	32	26	17	25	26	38	6.6	11	12	M3	14	79M8DFGMP5
EK 10	10	24	6	29.5	6	70	43	35	25	36	24	52	9	—	—	M3	16	7000HTDFGMP5
EK 12	12	24	6	29.5	6	70	43	35	25	36	24	52	9	—	—	M3	19	7001HTDFGMP5
EK 15	15	25	6	36	5	80	49	40	30	41	25	60	11	—	—	M3	22	7002HTDFGMP5
EK 20	20	42	10	50	10	95	58	47.5	30	56	25	75	11	—	—	M4	30	7204HTDFGMP5

Models EK 4 to 8

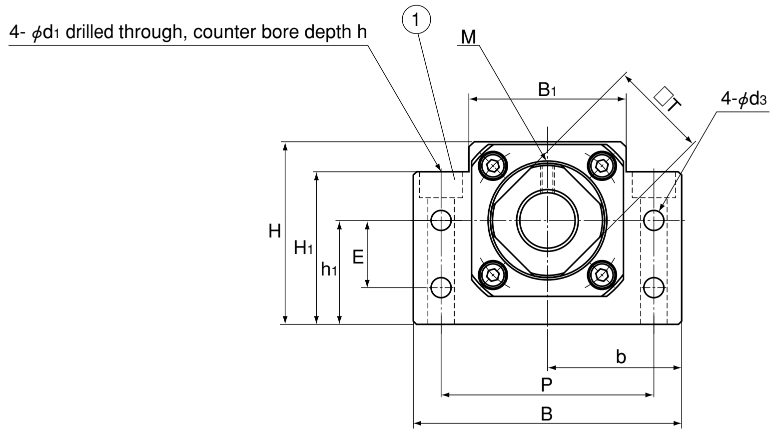
Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1 set
③	Presser nut	1
④	Collar	2
⑤	Seal	1
⑥	Lock nut	1
⑦	Hexagon socket setscrew (with a set piece)	1

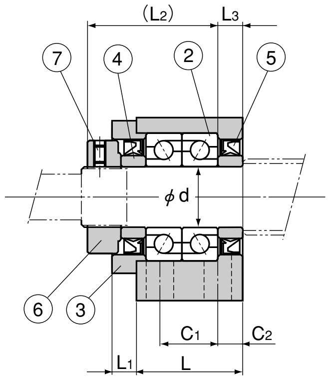
Models EK 10 to 20

Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1 set
③	Presser lid	1
④	Collar	2
⑤	Seal	2
⑥	Lock nut	1
⑦	Hexagon socket setscrew (with a set piece)	1

Model BK

Square Type Support Unit on the Fixed Side





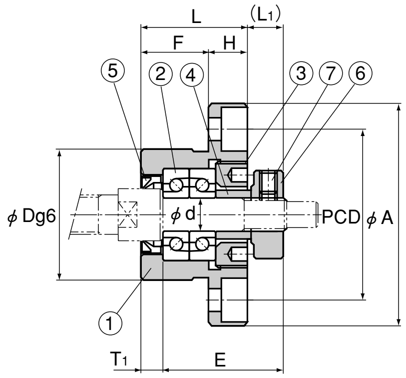
Unit: mm

Model No.	Shaft diameter d	L	L_1	L_2	L_3	B	H	b ±0.02	h_1 ±0.02	B_1	H_1	E	P	C_1	C_2	d_3	d_1	d_2	h	M	T	Bearing used
BK 10	10	25	5	29	5	60	39	30	22	34	32.5	15	46	13	6	5.5	6.6	10.8	5	M3	16	7000HTDFGMP5
BK 12	12	25	5	29	5	60	43	30	25	35	32.5	18	46	13	6	5.5	6.6	10.8	1.5	M3	19	7001HTDFGMP5
BK 15	15	27	6	32	6	70	48	35	28	40	38	18	54	15	6	5.5	6.6	11	6.5	M3	22	7002HTDFGMP5
BK 17	17	35	9	44	7	86	64	43	39	50	55	28	68	19	8	6.6	9	14	8.5	M4	24	7203HTDFGMP5
BK 20	20	35	8	43	8	88	60	44	34	52	50	22	70	19	8	6.6	9	14	8.5	M4	30	7004HTDFGMP5
BK 25	25	42	12	54	9	106	80	53	48	64	70	33	85	22	10	9	11	17.5	11	M5	35	7205HTDFGMP5
BK 30	30	45	14	61	9	128	89	64	51	76	78	33	102	23	11	11	14	20	13	M6	40	7206HTDFGMP5
BK 35	35	50	14	67	12	140	96	70	52	88	79	35	114	26	12	11	14	20	13	M8	50	7207DFGMP5
BK 40	40	61	18	76	15	160	110	80	60	100	90	37	130	33	14	14	18	26	17.5	M8	50	7208HTDFGMP5

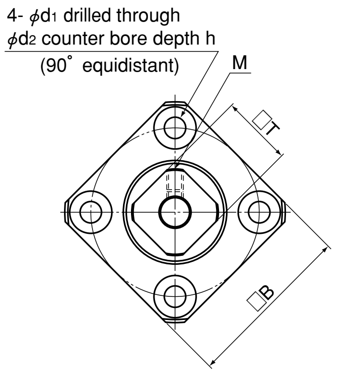
Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1 set
③	Presser lid	1
④	Collar	2
⑤	Seal	2
⑥	Lock nut	1
⑦	Hexagon socket setscrew (with a set piece)	1

Model FK

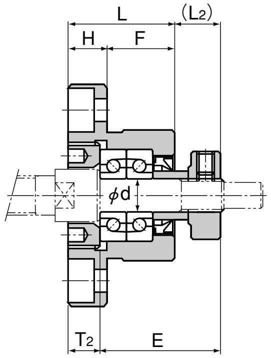
Round Type Support Unit on the Fixed Side



Mounting method A



Models FK 4 to 8



Mounting method B

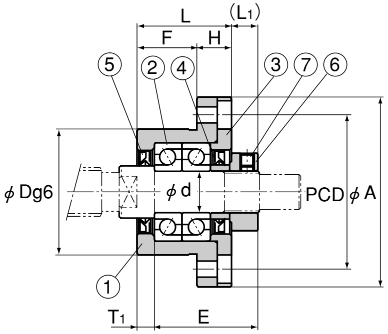
Unit: mm

Model No.	Shaft diameter									Mounting method A		Mounting method B							Bearing used
	d	L	H	F	E	D	A	PCD	B	L_1	T_1	L_2	T_2	d_1	d_2	h	M	T	
FK 4	4	15	6	9	17.5	$18^{-0.006}_{-0.017}$	32	24	25	5.5	3	6.5	4	3.4	6.5	4	M2.6	10	AC4-12P5
FK 5	5	16.5	6	10.5	18.5	$20^{-0.007}_{-0.02}$	34	26	26	5.5	3.5	7	5	3.4	6.5	4	M2.6	11	AC5-14P5
FK 6	6	20	7	13	22	$22^{-0.007}_{-0.02}$	36	28	28	5.5	3.5	8.5	6.5	3.4	6.5	4	M3	12	AC6-16P5
FK 8	8	23	9	14	26	$28^{-0.007}_{-0.02}$	43	35	35	7	4	10	7	3.4	6.5	4	M3	14	79M8DFGMP5

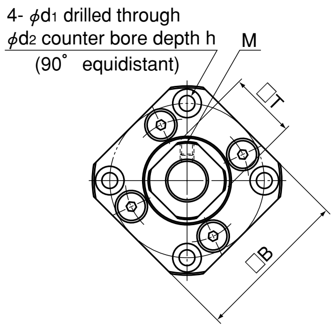
Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1 set
③	Presser nut	1
④	Collar	2
⑤	Seal	1
⑥	Lock nut	1
⑦	Hexagon socket setscrew (with a set piece)	1

Model FK

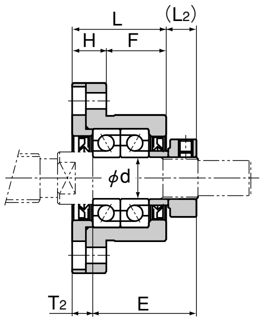
Round Type Support Unit on the Fixed Side



Mounting method A



Models FK 10 to 30



Mounting method B

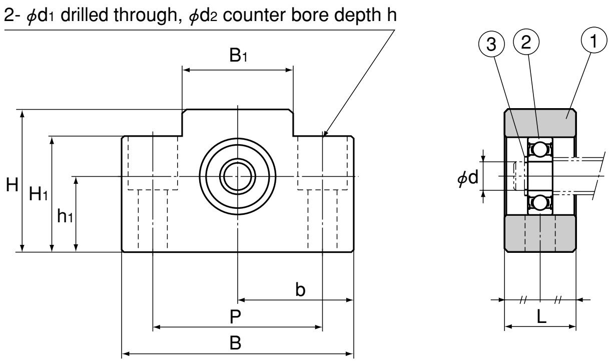
Unit: mm

Model No.	Shaft diameter									Mounting method A		Mounting method B							Bearing used
	d	L	H	F	E	D	A	PCD	B	L_1	T_1	L_2	T_2	d_1	d_2	h	M	T	
FK 10	10	27	10	17	29.5	$34^{-0.009}_{-0.025}$	52	42	42	7.5	5	8.5	6	4.5	8	4	M3	16	7000HTDFGMP5
FK 12	12	27	10	17	29.5	$36^{-0.009}_{-0.025}$	54	44	44	7.5	5	8.5	6	4.5	8	4	M3	19	7001HTDFGMP5
FK 15	15	32	15	17	36	$40^{-0.009}_{-0.025}$	63	50	52	10	6	12	8	5.5	9.5	6	M3	22	7002HTDFGMP5
FK 20	20	52	22	30	50	$57^{-0.01}_{-0.029}$	85	70	68	8	10	12	14	6.6	11	10	M4	30	7204HTDFGMP5
FK 25	25	57	27	30	60	$63^{-0.01}_{-0.029}$	98	80	79	13	10	20	17	9	15	13	M5	35	7205HTDFGMP5
FK 30	30	62	30	32	61	$75^{-0.01}_{-0.029}$	117	95	93	11	12	17	18	11	17.5	15	M6	40	7206HTDFGMP5

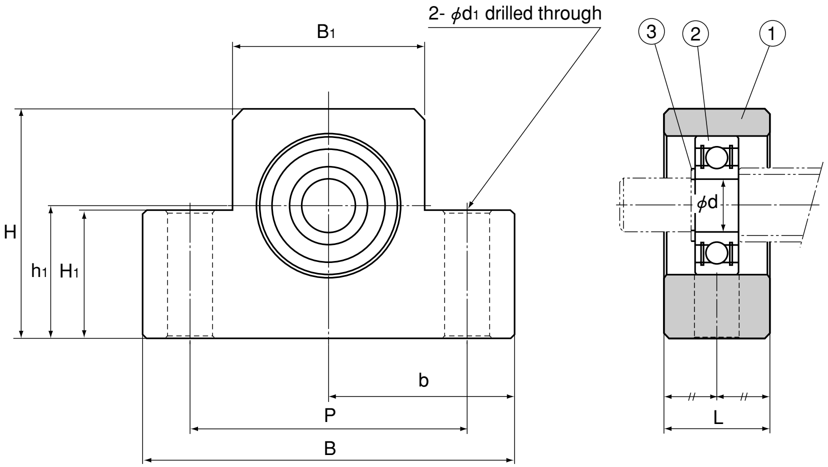
Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1 set
③	Presser lid	1
④	Collar	2
⑤	Seal	2
⑥	Lock nut	1
⑦	Hexagon socket setscrew (with a set piece)	1

Model EF

Square Type Support Unit on the Supported Side



Models EF 6 and 8



Models EF 10 to 20

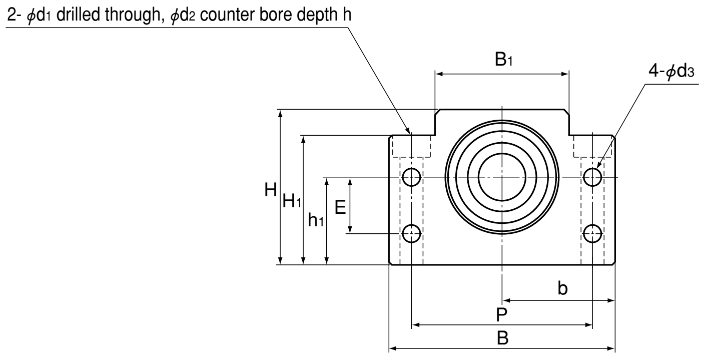
Unit: mm

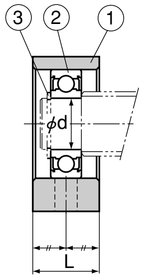
Model No.	Shaft diameter d	L	B	H	b ±0.02	h_1 ±0.02	B_1	H_1	P	d_1	d_2	h	Bearing used	Snap ring used
EF 6	6	12	42	25	21	13	18	20	30	5.5	9.5	11	606ZZ	C6
EF 8	6	14	52	32	26	17	25	26	38	6.6	11	12	606ZZ	C6
EF 10	8	20	70	43	35	25	36	24	52	9	—	—	608ZZ	C8
EF 12	10	20	70	43	35	25	36	24	52	9	—	—	6000ZZ	C10
EF 15	15	20	80	49	40	30	41	25	60	9	—	—	6002ZZ	C15
EF 20	20	26	95	58	47.5	30	56	25	75	11	—	—	6204ZZ	C20

Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1
③	Snap ring	1

Model BF

Square Type Support Unit on the Supported Side





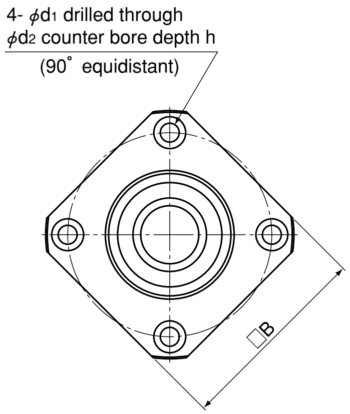
Unit: mm

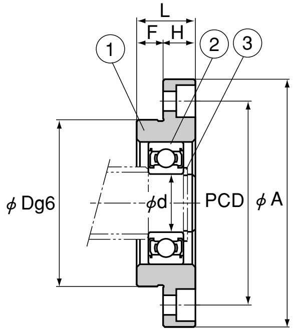
Model No.	Shaft diameter d	L	B	H	b ±0.02	h_1 ±0.02	B_1	H_1	E	P	d_3	d_1	d_2	h	Bearing used	Snap ring used
BF 10	8	20	60	39	30	22	34	32.5	15	46	5.5	6.6	10.8	5	608ZZ	C8
BF 12	10	20	60	43	30	25	35	32.5	18	46	5.5	6.6	10.8	1.5	6000ZZ	C10
BF 15	15	20	70	48	35	28	40	38	18	54	5.5	6.6	11	6.5	6002ZZ	C15
BF 17	17	23	86	64	43	39	50	55	28	68	6.6	9	14	8.5	6203ZZ	C17
BF 20	20	26	88	60	44	34	52	50	22	70	6.6	9	14	8.5	6004ZZ	C20
BF 25	25	30	106	80	53	48	64	70	33	85	9	11	17.5	11	6205ZZ	C25
BF 30	30	32	128	89	64	51	76	78	33	102	11	14	20	13	6206ZZ	C30
BF 35	35	32	140	96	70	52	88	79	35	114	11	14	20	13	6207ZZ	C35
BF 40	40	37	160	110	80	60	100	90	37	130	14	18	26	17.5	6208ZZ	C40

Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1
③	Snap ring	1

Model FF

Round Type Support Unit on the Supported Side





Unit: mm

Model No.	Shaft diameter d	L	H	F	D	A	PCD	B	d_1	d_2	h	Bearing used	Snap ring used
FF 6	6	10	6	4	$22^{-0.007}_{-0.02}$	36	28	28	3.4	6.5	4	606ZZ	C6
FF 10	8	12	7	5	$28^{-0.007}_{-0.02}$	43	35	35	3.4	6.5	4	608ZZ	C8
FF 12	10	15	7	8	$34^{-0.009}_{-0.025}$	52	42	42	4.5	8	4	6000ZZ	C10
FF 15	15	17	9	8	$40^{-0.009}_{-0.025}$	63	50	52	5.5	9.5	5.5	6002ZZ	C15
FF 20	20	20	11	9	$57^{-0.01}_{-0.029}$	85	70	68	6.6	11	6.5	6204ZZ	C20
FF 25	25	24	14	10	$63^{-0.01}_{-0.029}$	98	80	79	9	14	8.5	6205ZZ	C25
FF 30	30	27	18	9	$75^{-0.01}_{-0.029}$	117	95	93	11	17.5	11	6206ZZ	C30

Part No.	Part name	No. of units
①	Housing	1
②	Bearing	1
③	Snap ring	1

Ball Screw Peripherals

Nut Bracket

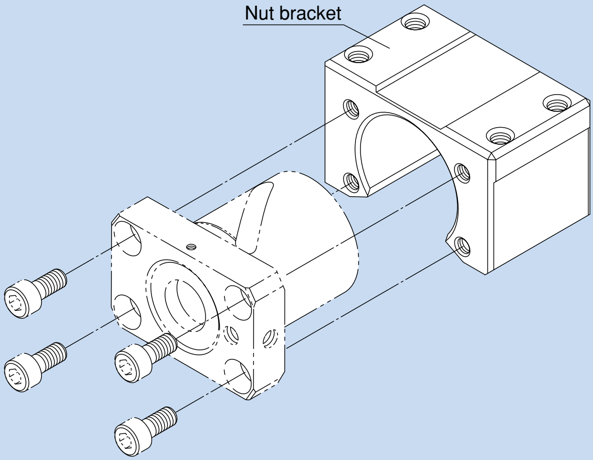


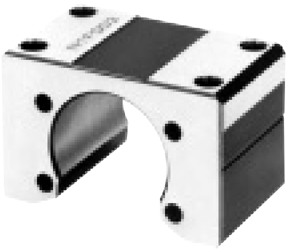
Fig. 1 Structure of the Nut Bracket

Structure and Features

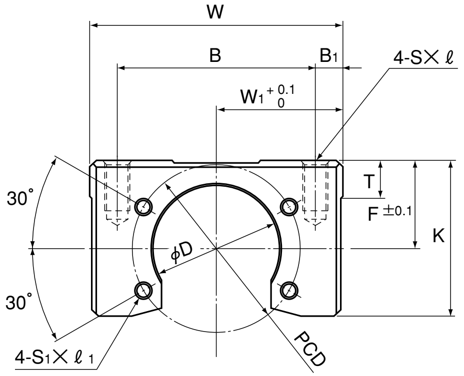
The Nut Bracket is standardized for standard-stock Ball Screws provided with finished shaft ends. It is designed to be secured directly on the table using bolts. Since the height is low, it can be mounted on the table only using bolts.

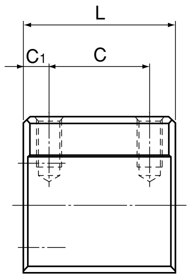
Type

Nut Bracket Model MC



Nut Bracket





Unit: mm

Model No.	Width				Overall length										For factory automation equipment
	W	W_1	B	B_1	L	C	C_1	F	K	T	D	PCD	$S\times\ell$	$S_1\times\ell_1$	Supported Ball Screw models
MC 1004	48	24	40	4	32	16	10	20	32.5	9	26.4	36	M5×10	M4×7	BNK1004,BNK1010
MC 1205	60	30	47	6.5	36	24	6	21	37	9	30.4	40	M6×12	M4×7	BNK1205
MC 1408	60	30	50	5	36	20	10	21.5	37	9	34.4	45	M6×12	M5×7	BNK1408,BNK1510,BNK1520,BNK1616
MC 2010	86	43	70	8	50	30	10	31	54	16	46.4	59	M10×20	M6×10	BNK2010
MC 2020	86	43	70	8	40	24	8	28	51	16	39.4	59	M10×20	M6×10	BNK2020

Lock Nut

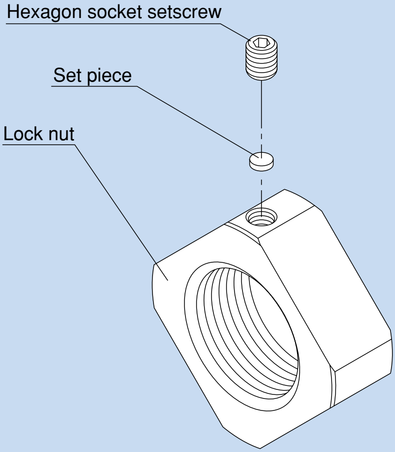


Fig. 1 Structure of the Lock Nut

Structure and Features

The Lock Nut for Ball Screws is capable of fastening the screw shaft and the bearing with high accuracy.

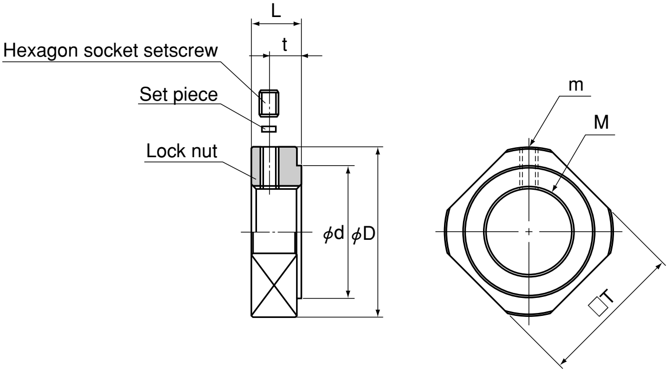
The provided hexagon socket setscrew and the set piece prevent the Lock Nut from loosening and ensure firm fastening.

The Lock Nut comes in various types ranging from model M4 to model M40.

Type

Lock Nut Model RN

Lock Nut



Unit: mm

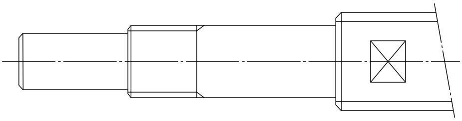
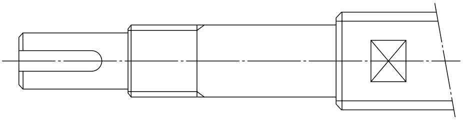
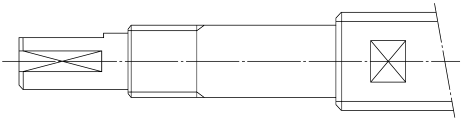
Model No.	M	m	D	d	L	t	T
RN 4	M4×0.5	M2.6	11.5	8	5	2.7	10
RN 5	M5×0.5	M2.6	13.5	9	5	2.7	11
RN 6	M6×0.75	M3	14.5	10	5	2.7	12
RN 8	M8×1	M3	17	13	6.5	4	14
RN 10	M10×1	M3	20	15	8	5.5	16
RN 12	M12×1	M3	22	17	8	5.5	19
RN 15	M15×1	M3	25	21	8	4.5	22
RN 17	M17×1	M4	30	25	13	9	24
RN 20	M20×1	M4	35	26	11	7	30
RN 25	M25×1.5	M5	43	33	15	10	35
RN 30	M30×1.5	M6	48	39	20	14	40
RN 35	M35×1.5	M8	60	46	21	14	50
RN 40	M40×1.5	M8	63	51	25	18	50

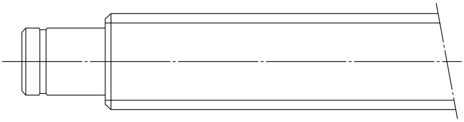
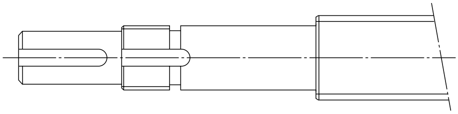
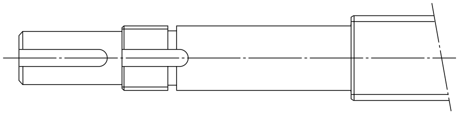
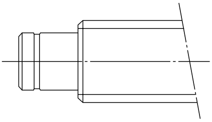
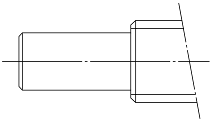
Recommended Shapes of Shaft Ends

To ensure speedy estimate and manufacturing of Ball Screws, THK has standardized the shaft end shapes of the screw shafts.

The recommended shaft end shapes are divided into two groups: shapes H, K and J, which allow standard Support Units to be used, and shapes A, B and C, which are compliant with JIS B 1192.

Types of Recommended Shapes of the Shaft Ends

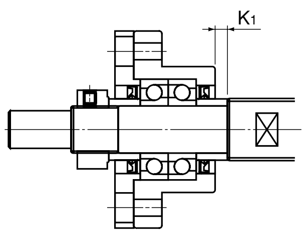
Mounting method	Symbol for shaft end shape		Shape	Supported Support Unit
Fixed	H J	H1		FK EK
		J1		BK
		H2		FK EK
		J2		BK
		H3		FK EK
		J3		BK

Mounting method	Symbol for shaft end shape	Shape	Supported Support Unit
Supported	K		FF EF BF
Fixed	A		—
	B		—
Supported	C	 Screw shaft diameter: 20 to 45 mm  Screw shaft diameter: 14 to 18 mm	—

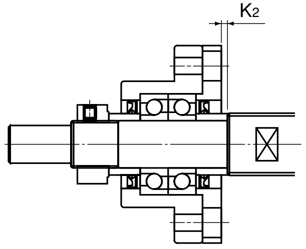
Note: For the dimensions of Support Units, see page k-282.

Recommended Shapes of Shaft Ends - Shape H (H1, H2 and H3)

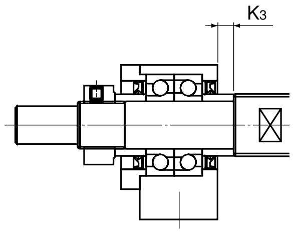
For Support Unit Models FK and EK



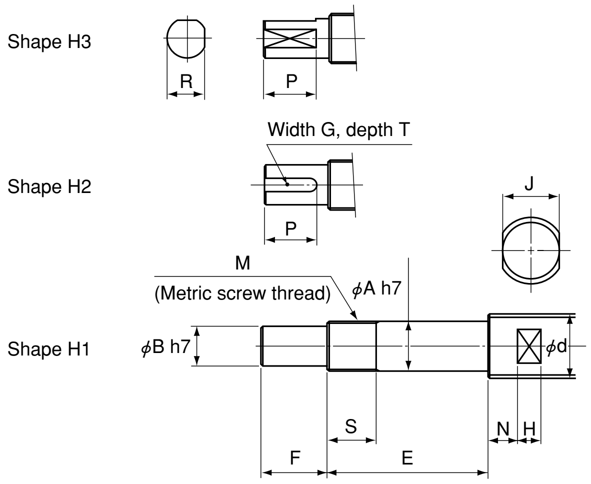
Model FK



Model FK



Model EK



Unit: mm

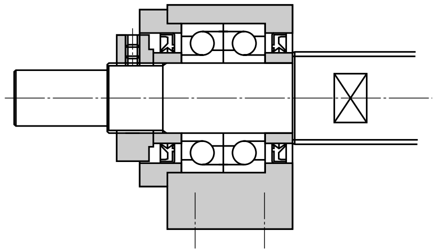
Support Unit model No.		Ball screw shaft outer diameter	Shaft outer diameter of the bearing				Metric screw thread		Width across flat			Shape H2 Keyway			Shape H3 Cut flat on two sides		Support Unit position Model FK		Model EK
Model FK	Model EK	d	A	B	E	F	M	S	J	N	H	G N9	$T^{+0.1}_{0}$	P	R	P	K_1	K_2	K_3
FK 4	EK 4	6	4	3	23	5	M4×0.5	7	4	4	4	—	—	—	2.7	4	1.5	0.5	1.5
FK 5	EK 5	8	5	4	25	6	M5×0.5	7	5	4	4	—	—	—	3.7	5	2	0.5	2
FK 6	EK 6	8	6	4	30	8	M6×0.75	8	5	4	4	—	—	—	3.7	6	3.5	0.5	3.5
FK 8	EK 8	12	8	6	35	9	M8×1	10	8	5	5	—	—	—	5.6	7	3.5	0.5	3.5
FK 10	EK 10	14	10	8	36	15	M10×1	11	10	5	7	2	1.2	11	7.5	11	0.5	–0.5	–0.5
FK 10	EK 10	15	10	8	36	15	M10×1	11	10	5	7	2	1.2	11	7.5	11	0.5	–0.5	–0.5
FK 12	EK 12	16	12	10	36	15	M12×1	11	13	6	8	3	1.8	12	9.5	12	0.5	–0.5	–0.5
FK 12	EK 12	18	12	10	36	15	M12×1	11	13	6	8	3	1.8	12	9.5	12	0.5	–0.5	–0.5
FK 15	EK 15	20	15	12	49	20	M15×1	13	16	6	9	4	2.5	16	11.3	16	4	2	5
FK 15	EK 15	25	15	12	49	20	M15×1	13	18	7	10	4	2.5	16	11.3	16	4	2	5
FK 20	EK 20	28	20	17	64	25	M20×1	17	21	8	11	5	3	21	16	21	1	–3	1
FK 20	EK 20	30	20	17	64	25	M20×1	17	24	8	12	5	3	21	16	21	1	–3	1
FK 20	EK 20	32	20	17	64	25	M20×1	17	27	9	13	5	3	21	16	21	1	–3	1
FK 25	—	36	25	20	76	30	M25×1.5	20	27	10	13	6	3.5	25	19	25	5	–2	—
FK 30	—	40	30	25	72	38	M30×1.5	25	32	10	15	8	4	32	23.5	32	–3	–9	—

Note Support Units are designed to have dimensions so that combinations of models FK and FF, models EK and EF or models BK and BF are used on the same shaft.
If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS2505+500L-H2K
(Shape H2 on the fixed side; shape K on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

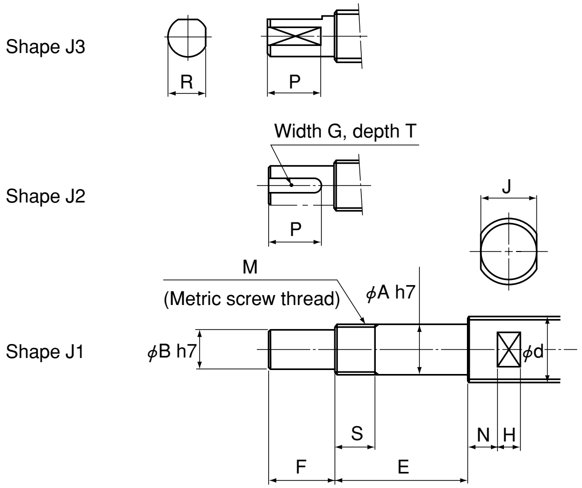
Note The flange of ball screw nut faces the fixed side unless otherwise specified.
If desiring the flange to face the supported side, add symbol G in the end of the Ball Screw model number when placing an order.
(Example) BNFN2505-5RRG0+420LC5-H2KG

Recommended Shapes of Shaft Ends - Shape J (J1, J2 and J3)

For Support Unit Model BK



Model BK



Unit: mm

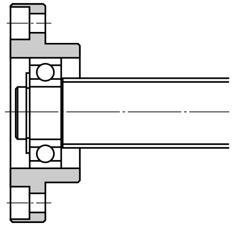
Support Unit model No.	Ball screw shaft outer diameter	Shaft outer diameter of the bearing				Metric screw thread		Width across flat			Shape J2 Keyway			Shape J3 Cut flat on two sides	
Model BK	d	A	B	E	F	M	S	J	N	H	G N9	T $^{+0.1}_{0}$	P	R	P
BK 10	14	10	8	39	15	M10×1	16	10	5	7	2	1.2	11	7.5	11
BK 10	15	10	8	39	15	M10×1	16	10	5	7	2	1.2	11	7.5	11
BK 12	16	12	10	39	15	M12×1	14	13	6	8	3	1.8	12	9.5	12
BK 12	18	12	10	39	15	M12×1	14	13	6	8	3	1.8	12	9.5	12
BK 15	20	15	12	40	20	M15×1	12	16	6	9	4	2.5	16	11.3	16
BK 17	25	17	15	53	23	M17×1	17	18	7	10	5	3	21	14.3	21
BK 20	28	20	17	53	25	M20×1	15	21	8	11	5	3	21	16	21
BK 20	30	20	17	53	25	M20×1	15	24	8	12	5	3	21	16	21
BK 20	32	20	17	53	25	M20×1	15	27	9	13	5	3	21	16	21
BK 25	36	25	20	65	30	M25×1.5	18	27	10	13	6	3.5	25	19	25
BK 30	40	30	25	72	38	M30×1.5	25	32	10	15	8	4	32	23.5	32
BK 35	45	35	30	83	45	M35×1.5	28	36	12	15	8	4	40	28.5	40
BK 40	50	40	35	98	50	M40×1.5	35	41	14	19	10	5	45	33	45
BK 40	55	40	35	98	50	M40×1.5	35	46	14	20	10	5	45	33	45

Note Support Units are designed to have dimensions so that combinations of models FK and FF, models EK and EF or models BK and BF are used on the same shaft.
If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS2505+500L-J2K
(Shape J2 on the fixed side; shape K on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

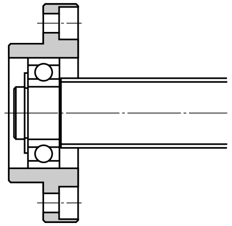
Note The ball nut flange faces the fixed side unless otherwise specified.
If desiring the flange to face the supported side, add symbol G in the end of the Ball Screw model number when placing an order.
(Example) BNFN2505-5RRG0+420LC5-J2KG

Recommended Shapes of Shaft Ends - Shape K

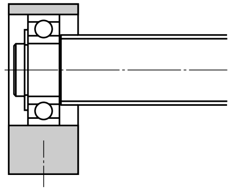
For Support Unit Models FF, EF and BF



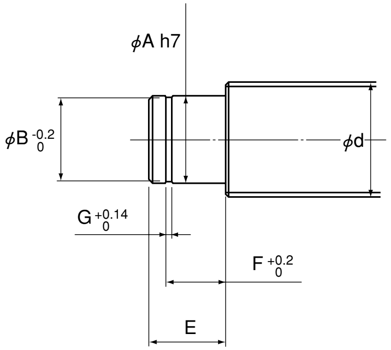
Model FF



Model FF



Model EF
Model BF



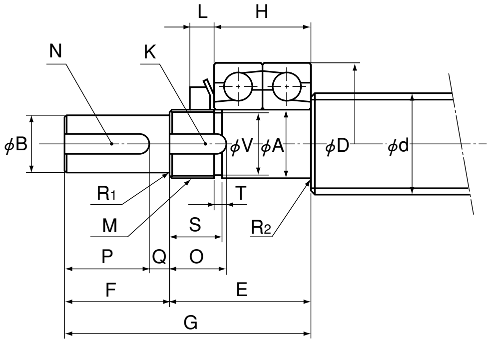
Unit: mm

Support Unit model No.			Ball screw shaft outer diameter	Shaft outer diameter of the bearing		Snap ring groove		
Model FF	Model EF	Model BF	d	A	E	B	F	G
FF 10	EF 10	BF 10	14	8	10	7.6	7.9	0.9
FF 10	EF 10	BF 10	15	8	10	7.6	7.9	0.9
FF 12	EF 12	BF 12	16	10	11	9.6	9.15	1.15
FF 12	EF 12	BF 12	18	10	11	9.6	9.15	1.15
FF 15	EF 15	BF 15	20	15	13	14.3	10.15	1.15
FF 15	EF 15	BF 15	25	15	13	14.3	10.15	1.15
—	—	BF 17*	25	17	16	16.2	13.15	1.15
FF 20	EF 20	BF 20**	28	20	19 (16)	19	15.35 (13.35)	1.35
FF 20	EF 20	BF 20**	30	20	19 (16)	19	15.35 (13.35)	1.35
FF 20	EF 20	BF 20**	32	20	19 (16)	19	15.35 (13.35)	1.35
FF 25	—	BF 25	36	25	20	23.9	16.35	1.35
FF 30	—	BF 30	40	30	21	28.6	17.75	1.75
—	—	BF 35	45	35	22	33	18.75	1.75
—	—	BF 40	50	40	23	38	19.95	1.95
—	—	BF 40	55	40	23	38	19.95	1.95

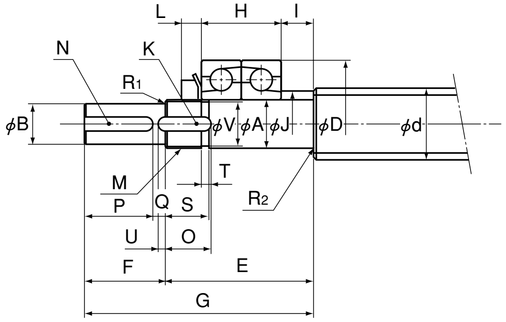
Note Support Units are designed to have dimensions so that combinations of models FK and FF, models EK and EF or models BK and BF are used on the same shaft.
If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS2505+500L-H2K
(Shape H2 on the fixed side; shape K on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

Note * When model BK17 (shaft end shape: J) is used on the fixed side for a Ball Screw with a shaft outer diameter of 25 mm, the shaft end shape on the supported side is that for model BF17.
** The dimensions in the parentheses in the table above are that of model BF20. They differ from those of models FF20 and EF20. When placing an order, be sure to specify the model number of the Support Unit to be used.

Recommended Shapes of Shaft Ends - Shape A



Shaft diameter: 20 to 45



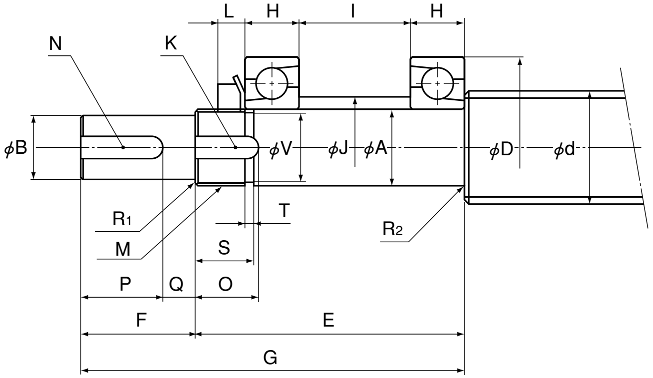
Shaft diameter: 14 to 18

Unit: mm

Screw shaft outer diameter	Shaft end dimensions																	Collar dimensions (Reference values)			Nut for rotary bearing	Washer for rotary bearing	Example of rotary bearing used		
	A	B				Metric screw thread				Washer groove for bearing			Keyway			Corner radius								Outer diameter	Width
d	h6	h7	E	F	G	M	S	T	V	K (width x depth)	O	U	N (width x depth)	P	Q	R_1	R_2MAX	J	I	L			Model No.	D	H
14	10	8	34	16	50	M10×0.75	11	2	8.5	3.5×1.5	13	2	—	—	—	0.3	0.2	15	7	5	AN00	AW00	7200	30	18
16	12	10	37	20	57	M12×1	11	2	10.5	3.5×1.5	13	2	3×1.8	17	3	0.3	0.2	17	8	5	AN01	AW01	7201	32	20
18	12	10	37	20	57	M12×1	11	2	10.5	3.5×1.5	13	2	3×1.8	17	3	0.3	0.2	17	8	5	AN01	AW01	7201	32	20
20	15	12	33	25	58	M15×1	13	2	13.5	4.5×1.5	16	—	4×2.5	21	4	0.5	0.2	—	—	6	AN02	AW02	7202	35	22
25	17	14	35	25	60	M17×1	13	2	15.5	4.5×1.5	16	—	5×3	21	4	0.5	0.2	—	—	6	AN03	AW03	7203	40	24
28	20	16	41	28	69	M20×1	15	2	18.5	4.5×1.5	18	—	5×3	24	4	0.5	0.5	—	—	7	AN04	AW04	7204	47	28
32	20	16	41	28	69	M20×1	15	2	18.5	4.5×1.5	18	—	5×3	24	4	0.5	0.5	—	—	7	AN04	AW04	7204	47	28
36	25	20	48	36	84	M25×1.5	21	3	23	5.5×2	24	—	6×3.5	32	4	0.5	0.5	—	—	8.2	AN05	AW05	7205	52	30
40	30	25	50	42	92	M30×1.5	21	3	28	5.5×2.5	24	—	8×4	37	5	0.5	0.5	—	—	8.2	AN06	AW06	7206	62	32
45	35	30	63	58	121	M35×1.5	24	3	33	6.5×2.5	28	—	8×4	53	5	0.5	0.9	—	—	9.2	AN07	AW07	7307	80	42

Note If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS1404+500L-AC
(Shape A on the fixed side; shape C on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

Recommended Shapes of Shaft Ends - Shape B

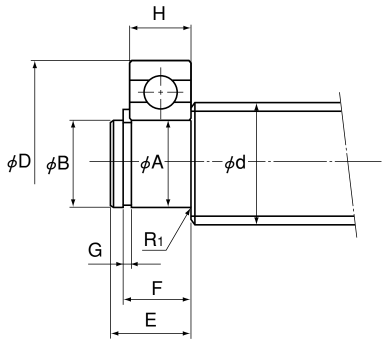


Unit: mm

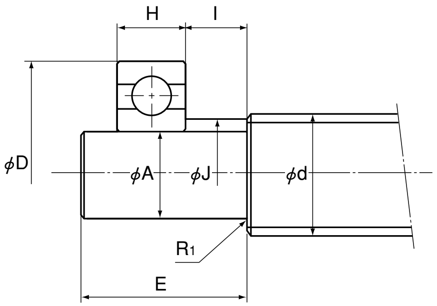
Screw shaft outer diameter	Shaft end dimensions																Collar dimensions (Reference values)			Nut for rotary bearing	Washer for rotary bearing	Example of rotary bearing used		
	A	B				Metric screw thread				Washer groove for bearing		Keyway			Corner radius								Outer diameter	Width
d	h6	h7	E	F	G	M	S	T	V	K (width x depth)	O	N (width x depth)	P	Q	R1	R2MAX	J	I	L			Model No.	D	H
20	15	12	55	25	80	M15×1	13	2	13.5	4.5×1.5	16	4×2.5	21	4	0.5	0.2	20	22	6	AN02	AW02	7202	35	11
25	17	14	59	25	84	M17×1	13	2	15.5	4.5×1.5	16	5×3	21	4	0.5	0.2	22	24	6	AN03	AW03	7203	40	12
28	20	16	69	28	97	M20×1	15	3	18.5	4.5×1.5	18	5×3	24	4	0.5	0.5	26	28	7	AN04	AW04	7204	47	14
32	20	16	69	28	97	M20×1	15	3	18.5	4.5×1.5	18	5×3	24	4	0.5	0.5	26	28	7	AN04	AW04	7204	47	14
36	25	20	81	36	117	M25×1.5	21	3	23	5.5×2	24	6×3.5	32	4	0.5	0.5	31	33	8.2	AN05	AW05	7205	52	15
40	30	25	88	42	130	M30×1.5	21	3	28	5.5×2.5	24	8×4	37	5	0.5	0.5	36	38	8.2	AN06	AW06	7206	62	16
45	35	30	105	58	163	M35×1.5	24	3	33	6.5×2.5	28	8×4	53	5	0.5	0.9	43.5	42	9.2	AN07	AW07	7307	80	21

Note If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS2005+1000L-BC
(Shape B on the fixed side; shape C on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

Recommended Shapes of Shaft Ends - Shape C



Shaft diameter: 20 to 45



Shaft diameter: 14 to 18

Unit: mm

Screw shaft outer diameter	Shaft end dimensions						Collar dimensions (Reference values)		Snap ring type C (concentric) for the shaft	Example of rotary bearing used		
	A		Snap ring groove			Corner radius					Outer diameter	Width
d	js7	E	F $^{+0.2}_{0}$	G $^{+0.14}_{0}$	B $^{0}_{-0.2}$	R_1 MAX	J	I		Model No.	D	H
14	10	19	—	—	—	0.5	15	7	—	6200	30	9
16	12	21	—	—	—	0.5	17	8	—	6201	32	10
18	12	21	—	—	—	0.5	17	8	—	6201	32	10
20	15	14	12.1	1.15	14.3	0.5	—	—	15	6202	35	11
25	17	15	13.1	1.15	16.2	0.5	—	—	17	6203	40	12
28	20	18	15.3	1.35	19	0.9	—	—	20	6204	47	14
32	20	18	15.3	1.35	19	0.9	—	—	20	6204	47	14
36	25	19	16.3	1.35	23.9	0.9	—	—	25	6205	52	15
40	30	21	17.6	1.75	28.6	0.9	—	—	30	6206	62	16
45	35	26	18.6	1.75	33	1	—	—	35	6207	72	17

Note If desiring the shaft end to be machined at THK, add the shape symbol in the end of the Ball Screw model number.
(Example) TS2505+1000L-AC
(Shape A on the fixed side; shape C on the supported side)
For the perpendicularity of the end face of the bearing, refer to JIS B 1192.

LM Guide + Ball Screw = Integral-structure Actuator

LM Guide Actuator Model KR

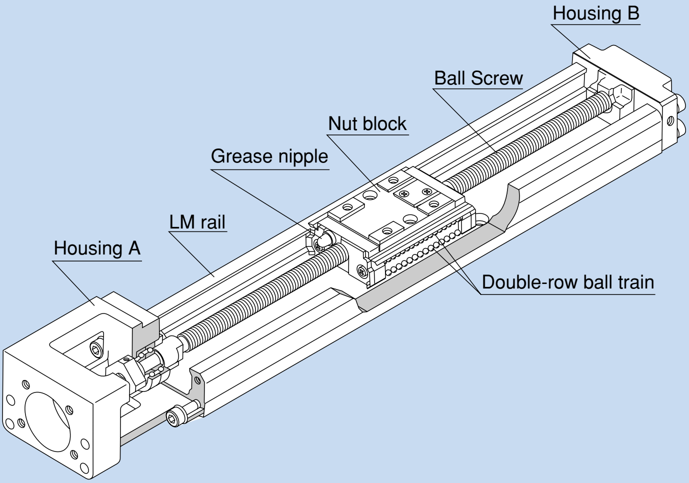


Fig. 1 Structure of LM Guide Actuator Model KR

Structure and Features

Because of its integral-structure nut block consisting of a highly rigid LM rail with a U-shaped cross section, LM Guide units on both side faces and a Ball Screw unit in the center, model KR achieves a highly rigid and highly accurate actuator in a minimal space.

Each train of balls is arranged at a contact angle of 45° so that the rated load on the nut block is uniform in the four directions (radial, reverse-radial and lateral directions). As a result, model KR can be used in any mounting orientation.

●Four-way Equal Load

The trains of loaded balls are arranged in a double-row angular contact structure where two trains are placed on each of the right and left sides. The equal load ratings are provided in the vertical and horizontal directions. Thus, this model can be mounted in any orientation and is optimal for locations with indeterminate loads such as the arms of a Cartesian coordinate robot.

●High rigidity

Unlike the conventional LM Guide, model KR uses an outer-rail structure to achieve higher rigidity against an overhung load.

The LM rail is a wide U-shaped cross section to reduce the weight and minimize deflection, enabling the LM Guide system to be used in both a cantilever and fixed-fixed structures.

Table 1 Cross-sectional Characteristics of the LM Rail

Unit: mm⁴

Model No.	I_X	I_Y	Mass (kg/100 mm)
KR 15	9.08×10^2	1.42×10^4	0.104
KR 20	6.1×10^3	6.2×10^4	0.26
KR 26	1.7×10^4	1.5×10^5	0.39
KR 30H	2.7×10^4	2.8×10^5	0.5
KR 33	6.2×10^4	3.8×10^5	0.66
KR 45H	8.4×10^4	8.9×10^5	0.9
KR 46	2.4×10^5	1.5×10^6	1.26
KR 55	2.2×10^5	2.3×10^6	1.5
KR 65	4.6×10^5	5.9×10^6	2.31

I_X = geometrical moment of inertia around X axis
I_Y = geometrical moment of inertia around Y axis

●High Accuracy

The raceway of the four rows of balls is shaped into a circular-arc groove. This enables the guide system to smoothly travel and maintain high rigidity even under a preload. Fluctuation in frictional resistance caused by load fluctuation is minimized to allow the system to respond to sub-micron feed.

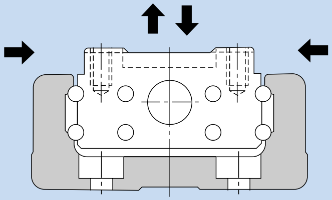


Fig. 2 Load Capacity of Model KR

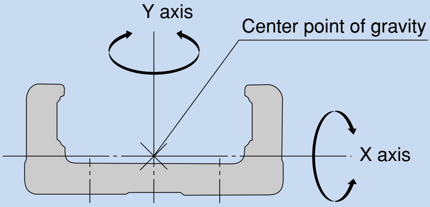


Fig. 3

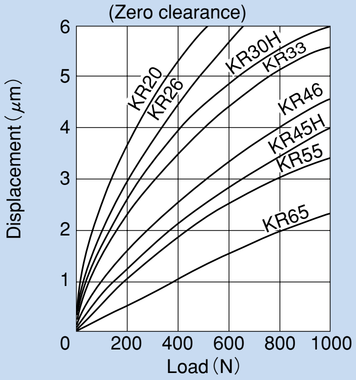


Fig. 4 Displacement of Model KR-A under a Radial Load

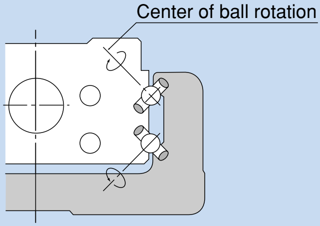


Fig. 5 Contact Structure of Model KR

●Space Saving

Use of a nut block integrating LM Guide units on both ends and a Ball Screw unit in the center makes model KR a highly rigid and highly accurate actuator in a minimal space.

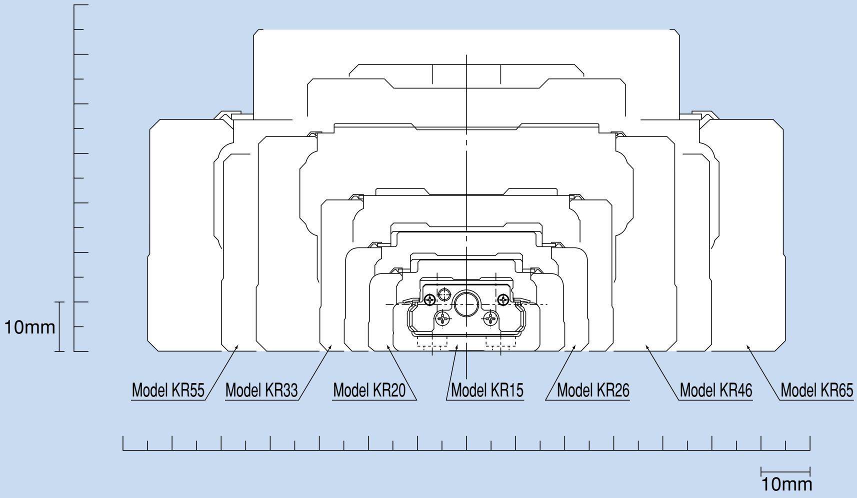


Fig. 6 Cross Sectional Drawing

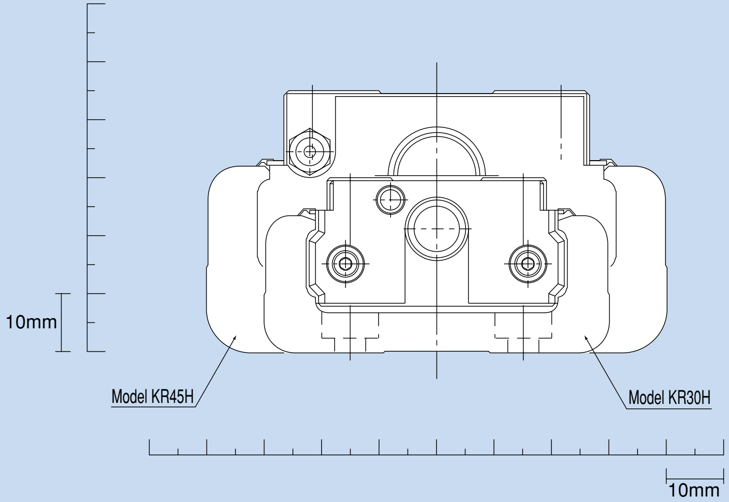


Fig. 7 Cross Sectional Drawing

Types and Features

Model KR-A (with a Single Long Nut Block)

Representative model of KR.

Model KR-B (with Two Long Nut Blocks)

Equipped with two units of the nut block of model KR-A, this model achieves higher rigidity, high load capacity and high accuracy.

Model KR-C (with a Single Short Nut Block)

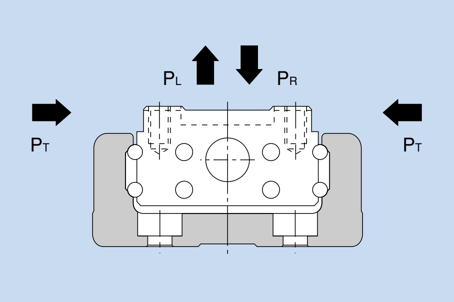
This model has a shorter overall length of the nut block and a longer stroke than model KR-A.
(Applicable model numbers: KR30H, 33, 45H and 46)

Model KR-D (with Two Short Nut Blocks)

Equipped with two units of the nut block of model KR-C, this design allows a span that suits the equipment, thus to achieve high rigidity.
(Applicable model numbers: KR30H, 33, 45H and 46)

Rated Loads in All Directions and Static Permissible Moment

●Rated Load



●LM Guide Unit

Model KR is capable of receiving loads in all directions: radial, reverse-radial and lateral directions. Its basic load ratings are equal in all four directions (radial, reverse-radial and lateral directions), and their values are indicated in table 2 on page 1-8.

●Ball Screw Unit

Since the nut block is incorporated with a Ball Screw, model KR is capable of receiving an axial load. The basic load rating value is indicated in table 2 on page 1-8.

●Support Bearing Unit

Since housing A contains an angular bearing, model KR is capable of receiving an axial load. The basic load rating value is indicated in table 2 on page 1-8.

●Equivalent Load (LM Guide Unit)

The equivalent load when the LM Guide unit of model KR simultaneously receives loads in all directions is obtained from the following equation.

where

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

P_E : Equivalent load (N)
- ・Radial direction
- ・Reverse-radial direction
- ・Lateral directions

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

Table 2 Rated Load of Model KR

Symbols in the parentheses indicate units.

Model No.			KR15		KR20	KR26	KR30H		KR33		KR45H		KR46		KR55	KR65
			KR1501	KR1502			KR30H06	KR30H10	KR3306	KR3310	KR45H10	KR45H20	KR4610	KR4620		
LM Guide unit	Basic dynamic load rating C (N)	Long nut block Types A, B	1930		3590	7240	11600		11600		23300		27400		38100	50900
		Short nut block Types C, D	—		—	—	4900		4900		11900		14000		—	—
	Basic static load rating C_0 (N)	Long nut block Types A, B	3450		6300	12150	20200		20200		39200		45500		61900	80900
		Short nut block Types C, D	—		—	—	10000		10000		19600		22700		—	—
	Radial clearance (mm)	Normal grade, high grade	–0.001 to +0.002		+0.002 to –0.003	+0.002 to –0.004	+0.002 to –0.004		+0.002 to –0.004		+0.003 to –0.006		+0.003 to –0.006		+0.004 to –0.007	+0.004 to –0.008
		Precision grade	–0.005 to –0.002		–0.003 to –0.007	–0.004 to –0.01	–0.004 to –0.012		–0.004 to –0.012		–0.006 to –0.016		–0.006 to –0.016		–0.007 to –0.019	–0.008 to –0.022
Ball Screw unit	Basic dynamic load rating Ca (N)	Normal grade, high grade	340	230	660	2350	2840	1760	2840	1760	3140	3040	3140	3040	3620	5680
		Precision grade	340	230	660	2350	2250	1370	2250	1370	2940	3430	2940	3430	3980	5950
	Basic static load rating C_{0a} (N)	Normal grade, high grade	660	410	1170	4020	4900	2840	4900	2840	6760	7150	6760	7150	9290	14500
		Precision grade	660	410	1170	4020	2740	1570	2740	1570	3720	5290	3720	5290	6850	10700
	Screw shaft diameter (mm)		5		6	8	10		10		15		15		20	25
	Lead (mm)		1	2	1	2	6	10	6	10	10	20	10	20	20	25
	Thread minor diameter (mm)		4.5		5.3	6.6	7.8		7.8		12.5		12.5		17.5	22
	Ball center diameter (mm)		5.15		6.15	8.3	10.5		10.5		15.75		15.75		20.75	26
Support bearing unit	Axial direction	Basic dynamic load rating Ca (N)	590		1000	1380	1790		1790		6660		6660		7600	13700
		Static permissible load P_{0a} (N)	290		1240	1760	2590		2590		3240		3240		3990	5830
Reference pages for outer dimensions			P. 1-16,32		P. 1-17,33	P. 1-18,34	P. 1-20,36		P. 1-22,38		P. 1-24,40		P. 1-26,42		P. 1-28,44	P. 1-29,45

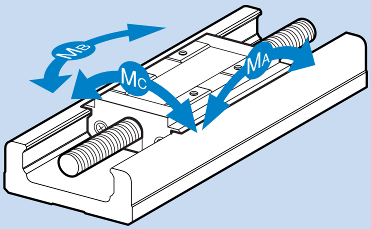
Note 1: The load ratings in the LM Guide unit each indicate the load rating per LM block.

Note 2: The Ball Screw of precision grade (grade P) for models KR30H, KR33, KR45H10 and KR4610 is incorporated with spacer balls in the proportion of one to one.

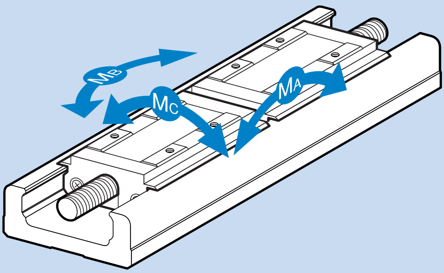
Note 3: The Ball Screw of precision grade (grade P) for models KR45H20, KR4620, KR55 and KR65 is incorporated with spacer balls in the proportion of one to one.

●Permissible Moment (LM Guide Unit)

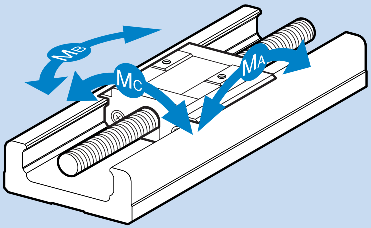
The LM Guide unit of model KR is capable of receiving moments in all directions only with a single nut block. Table 3 on page 1-10 shows static permissible moments in the M_A, M_B and M_C directions.



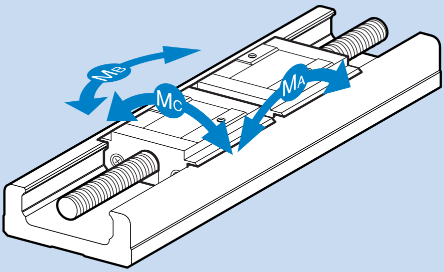
With a single long nut block (type A)



With two long nut blocks (type B)



With a single short nut block (type C)



With two short nut blocks (type D)

Table 3 Static Permissible Moments of Model KR

Unit: N-m

Model No.	Static permissible moment		
	M_A	M_B	M_C
KR 15-A	12.1	12.1	38
KR 15-B	70.3	70.3	76
KR 20-A	31	31	83
KR 20-B	176	176	165
KR 26-A	84	84	208
KR 26-B	480	480	416
KR 30H-A	166	166	428
KR 30H-B	908	908	857
KR 30H-C	44	44	214
KR 30H-D	319	319	427
KR 33-A	166	166	428
KR 33-B	908	908	857
KR 33-C	44	44	214
KR 33-D	319	319	427
KR 45H-A	486	486	925
KR 45H-B	2732	2732	1850
KR 45H-C	130	130	463
KR 45H-D	994	994	925
KR 46-A	547	547	1400
KR 46-B	2940	2940	2800
KR 46-C	149	149	700
KR 46-D	1010	1010	1400
KR 55-A	870	870	2280
KR 55-B	4890	4890	4570
KR 65-A	1300	1300	3920
KR 65-B	7230	7230	7840

Note: The values for models KR - B/D indicate the values when two nut blocks are used in close contact with each other.

Maximum Travel Speed and the Manufacturing Limit Length

The maximum travel speed of model KR is limited by the critical speed of the ball screw shaft and the DN value regardless of the maximum rotation speed of the motor. These factors must be taken into account especially when model KR operates at high speed.
The manufacturing limit lengths are indicated in terms of LM rail length.

Table 4 Maximum Travel Speed and the Manufacturing Limit Length

Symbols in the parentheses indicate units

Model No.	Ball screw lead (mm)	LM rail length (mm)	Maximum travel speed (mm/ss)			Manufacturing limit length (mm)	
			Precision grade	High grade	Normal grade	Precision grade	High/normal grade
KR 15	01	—	160	160	—	250	250
	02	—	330	330			
KR 20	01	—	190	190		200	200
KR 26	02	—	280	280		300	300
KR 30H	06	150	660	470		600	600
		200	660	470			
		300	660	470			
		400	660	470			
		500	590	470			
		600	390	390			
	10	150	1100	790			
		200	1100	790			
		300	1100	790			
		400	1100	790			
		500	980	790			
		600	650	650			
KR 33	06	150	660	470		600	600
		200	660	470			
		300	660	470			
		400	660	470			
		500	590	470			
		600	390	390			
	10	150	1100	790			
		200	1100	790			
		300	1100	790			
		400	1100	790			
		500	980	790			
		600	650	650			
KR 45H	10	340	740	520		800	1200
		440	740	520			
		540	740	520			
		640	740	520			
		740	730	520			
		840	—	520			
		940	—	430			
	20	340	1080	1050			
		440	1480	1050			
		540	1480	1050			
		640	1480	1050			
		740	1460	1050			
		840	—	1050			
		940	—	860			
KR 46	10	340	740	520		800	1200
		440	740	520			
		540	740	520			
		640	740	520			
		740	740	520			
		940	—	430			
	20	340	1480	1050			
		440	1480	1050			
		540	1480	1050			
		640	1480	1050			
		740	1480	1050			
		940	—	860			
KR 55	20	980	1120	800		1180	2000
		1080	900	800			
		1180	740	740			
		1280	—	620			
		1380	—	530			
KR 65	25	980	1120	800		1380	2000
		1180	1120	800			
		1380	840	800			
		1680	—	550			

Accuracy Standards

The accuracy of model KR is defined in positioning repeatability, positioning accuracy, backlash and running parallelism.

●Positioning Repeatability

After repeating positioning to a given point in the same direction seven times, measure the halting point and obtain the value of half the maximum difference. Perform this measurement in the center and both ends of the travel distance, use the maximum value as the measurement value and express the value of half the maximum difference with symbol "±" as positioning repeatability.

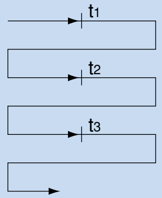


Fig. 8 Positioning Repeatability

●Positioning Accuracy

Using the maximum stroke as the reference length, express the maximum error between the actual distance traveled from the reference point and the command value in an absolute value as positioning accuracy.

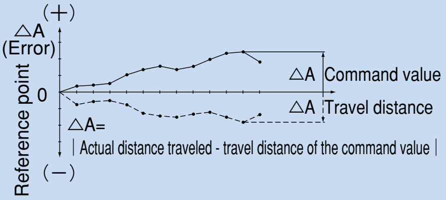


Fig. 9 Positioning Accuracy

●Backlash

Feed and slightly move the nut block and read the measurement on the test indicator as the reference value. Subsequently, apply a load to the nut block from the same direction (table feed direction), and then release the nut block from the load. Use the difference between the reference value and the return as the backlash measurement.

Perform this measurement in the center and near both ends, use the maximum value as the measurement value.

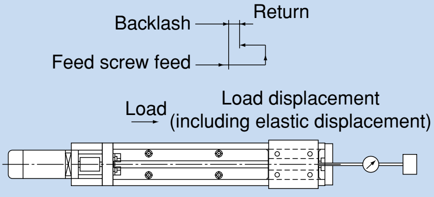


Fig. 10 Backlash

●Running Parallelism

Place a straightedge on the surface table where model KR is mounted, measure almost throughout the travel distance of the nut block using a test indicator. Use the maximum difference among the readings within the travel distance as the running parallelism measurement.

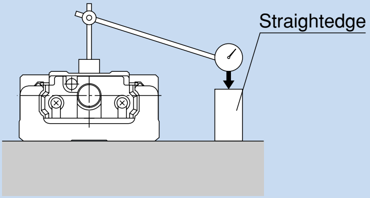


Fig. 11 Running Parallelism

The accuracies of model KR are classified into normal grade (no symbol), high grade (H) and precision grade (P). Tables below show standards for all the accuracies.

Table 5-1 Normal Grade (No Symbol)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 20	100	±0.01	No standard defined	No standard defined	0.02	0.5
	150					
	200					
KR 26	150	±0.01	No standard defined	No standard defined	0.02	1.5
	200					
	250					
	300					
KR 30H	150	±0.01	No standard defined	No standard defined	0.02	7
	200					
	300					
	400					
	500					
	600					
KR 33	150	±0.01	No standard defined	No standard defined	0.02	7
	200					
	300					
	400					
	500					
	600					
KR 45H	340	±0.01	No standard defined	No standard defined	0.02	10
	440					
	540					
	640					
	740					
	840					
	940					
KR 46	340	±0.01	No standard defined	No standard defined	0.02	10
	440					
	540					
	640					
	740					
	940					
KR 55	980	±0.01	No standard defined	No standard defined	0.05	12
	1080					
	1180					
	1280					
	1380					
KR 65	980	±0.01	No standard defined	No standard defined	0.05	12
	1180					
	1380					
	1680	±0.012				15

Table 5-2 High Grade (H)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 15	75	±0.004	0.04	0.02	0.01	0.4
	100					
	125					
	150					
	175					
	200					
KR 20	100	±0.005	0.06	0.025	0.01	0.5
	150					
	200					
KR 26	150	±0.005	0.06	0.025	0.01	1.5
	200					
	250					
	300					
KR 30H	150	±0.005	0.06	0.025	0.02	7
	200					
	300					
	400					
	500		0.1	0.035		
	600					
KR 33	150	±0.005	0.06	0.025	0.02	7
	200					
	300					
	400					
	500		0.1	0.035		
	600					
KR 45H	340	±0.005	0.1	0.035	0.02	10
	440					
	540					
	640					
	740		0.12	0.04		
	840		0.15	0.05		
	940					
KR 46	340	±0.005	0.1	0.035	0.02	10
	440					
	540					
	640					
	740		0.12	0.04		
	940		0.15	0.05		
KR 55	980	±0.005	0.18	0.05	0.05	12
	1080					
	1180		0.25			
	1280					
	1380					
KR 65	980	±0.008	0.18	0.05	0.05	12
	1180		0.2			
	1380					
	1680		0.28	0.055		15

Note: The evaluation method complies with THK standards.

Note: For most models, the starting torque represents the value when lithium soap-group grease No. 2 is used. However, that of models KR20 and KR26 represents the value when THK AFA Grease is used, and that of KR15 represents the value when THK AFF Grease is used.

Note: If highly viscous grease such as vacuum grease and clean room grease is used, the actual starting torque may exceed the corresponding value in the table. Use much care in selecting a motor.

Table 5-3 Precision Grade (P)

Unit: mm

Model No.	LM rail length	Positioning repeatability	Positioning accuracy	Running parallelism	Backlash	Starting torque (N-cm)
KR 15	75	±0.003	0.02	0.01	0.002	0.8
	100					
	125					
	150					
	175					
	200					
KR 20	100	±0.003	0.02	0.01	0.003	1.2
	150					
	200					
KR 26	150	±0.003	0.02	0.01	0.003	4
	200					
	250					
	300					
KR 30H	150	±0.003	0.02	0.01	0.003	15
	200					
	300					
	400					
	500		0.025	0.015		
	600					
KR 33	150	±0.003	0.02	0.01	0.003	15
	200					
	300					
	400					
	500		0.025	0.015		
	600					
KR 45H	340	±0.003	0.025	0.015	0.003	15
	440					
	540					
	640					17
	740		0.03	0.02		
KR 46	340	±0.003	0.025	0.015	0.003	15
	440					
	540					
	640					17
	740		0.03	0.02		
KR 55	980	±0.005	0.035	0.025	0.003	17
	1080					
	1180		0.04	0.03		20
KR 65	980	±0.005	0.035	0.025	0.005	20
	1180					
	1380		0.04	0.03		22

Note: The evaluation method complies with THK standards.

Note: For most models, the starting torque represents the value when lithium soap-group grease No. 2 is used.
However, that of models KR20 and KR26 represents the value when THK AFA Grease is used, and that of KR15 represents the value when THK AFF Grease is used.

Note: If highly viscous grease such as vacuum grease and clean room grease is used, the actual starting torque may exceed the corresponding value in the table. Use much care in selecting a motor.

Model number coding

11

KR33 10 A +400L P 0-0 0 0 0

1 2 3 4 5 6 7 8 9 10

1Model number 2Ball screw lead (in mm) 3Nut block type 4LM rail length (in mm)
5Accuracy grade (see table 6) 6With/without a motor (see table 6) 7With/without a cover (see table 6)
8With/without a sensor (see table 6) 9Type of housing A (see page 1-52)
10With/without an intermediate flange (see page 1-56) 11Administration number

Note For model KR15 □□□, the nut block and the LM rail are made of stainless steel (as standard).
(Example) KR1501AM+150LPM0-0000
Symbol for stainless steel component

Table 6

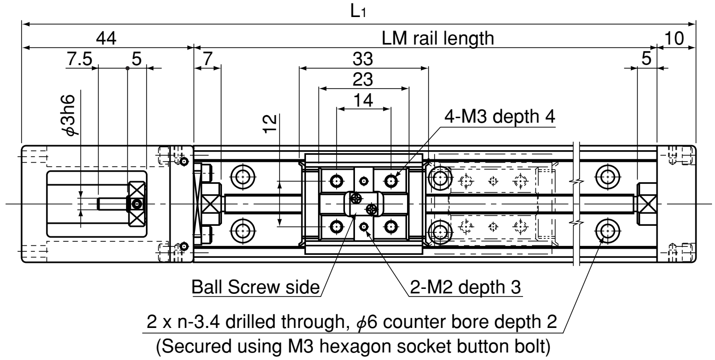
Accuracy grade		With/without a motor		With/without a cover		With/without a sensor	
Symbol	Content	Symbol	Content	Symbol	Content	Symbol	Content
No symbol	Normal grade	0	Without a motor	0	Without a cover	0	Without a sensor
						1	With sensor rail
						2	Photo sensor EE-SX 671 (OMRON)
H	High grade			1	With a cover	4	Proximity sensor GL-12F (SUNX)
		1	With a motor			5	Proximity sensor *GXL-N12F (SUNX)
P	Precision grade			2	With a bellows	6	Photo sensor EE-SX 674 (OMRON)
						7	Proximity sensor *APM-D3A1-001 (Yamatake)

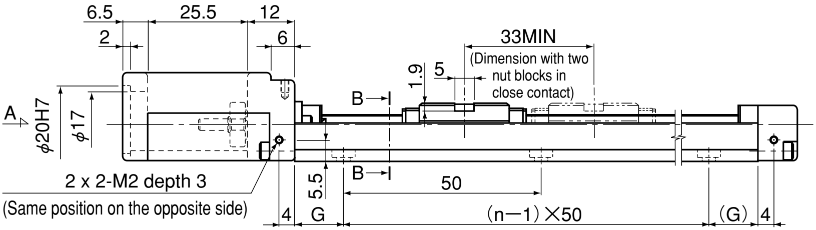
* Note: For APM-D3A1-001 (Yamatake) and GXL-N12F (SUNX), b-contact (NC) types are also available. Contact THK for details.

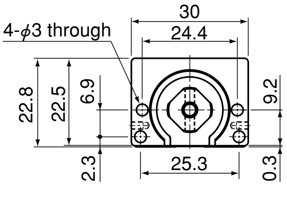
Model KR15 □□□ Standard Type

Model KR15 □□ A (with a Single Nut Block)

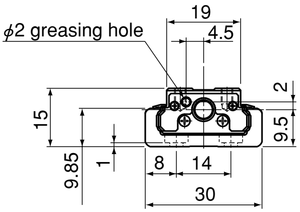
Model KR15 □□ B (with Two Nut Blocks)







A arrow view



B-B cross section

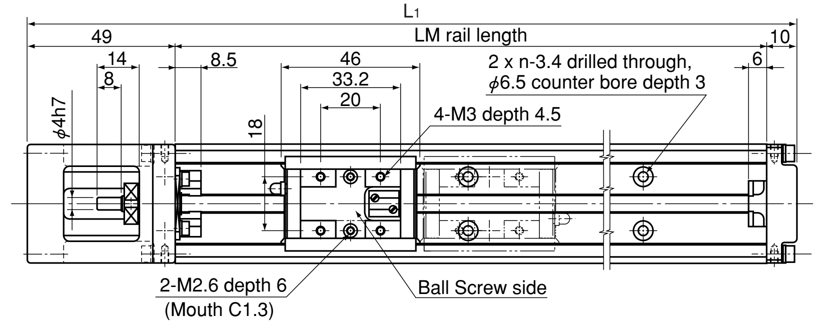
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		G (mm)	n	Overall unit mass (kg)	
		Type A	Type B			Type A	Type B
75	129	31.4	—	12.5	2	0.19	—
100	154	56.4	—	25	2	0.22	—
125	179	81.4	48.4	12.5	3	0.25	0.292
150	204	106.4	73.4	25	3	0.28	0.322
175	229	131.4	98.4	12.5	4	0.31	0.352
200	254	156.4	123.4	25	4	0.34	0.382

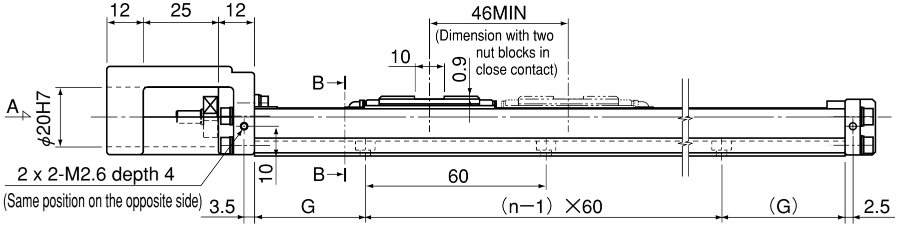
Note The available stroke range of model KR15 □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

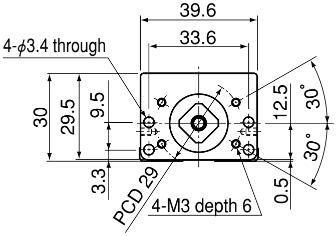
Model KR2001 □ Standard Type

Model KR2001 A (with a Single Nut Block)

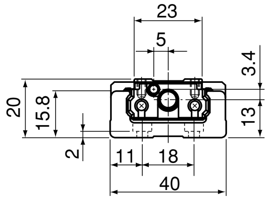
Model KR2001 B (with Two Nut Blocks)



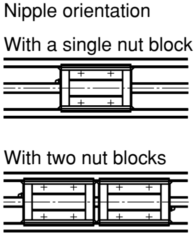




A arrow view



B-B cross section



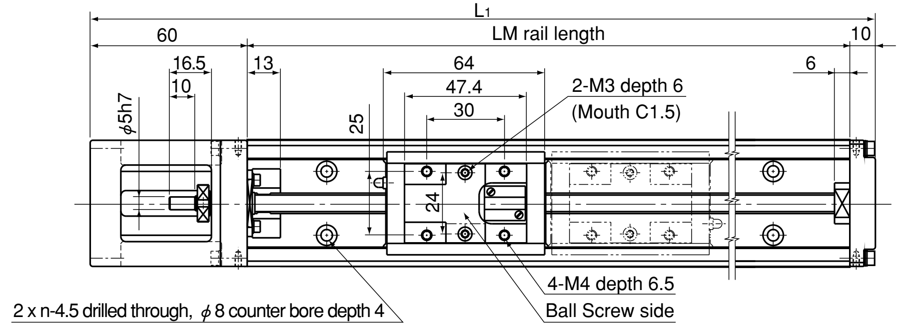
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		G (mm)	n	Overall unit mass (kg)	
		Type A	Type B			Type A	Type B
100	159	41.5	—	20	2	0.45	—
150	209	91.5	45.5	15	3	0.58	0.655
200	259	141.5	95.5	40	3	0.72	0.795

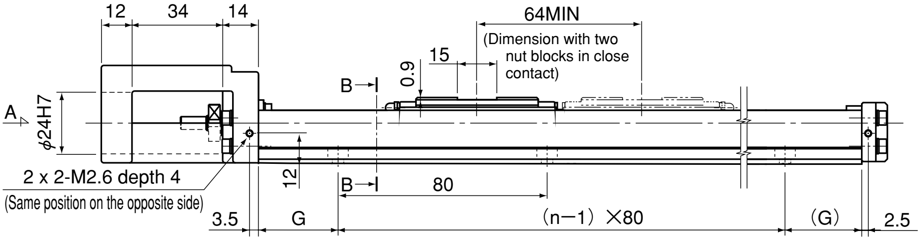
Note The available stroke range of model KR2001B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

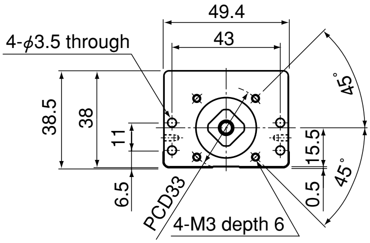
Model KR2602 □ Standard Type

Model KR2602 A (with a Single Nut Block)

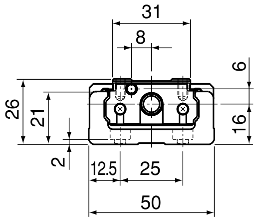
Model KR2602 B (with Two Nut Blocks)





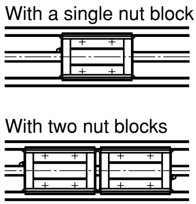


A arrow view



B-B cross section

Nipple orientation


With a single nut block

With two nut blocks

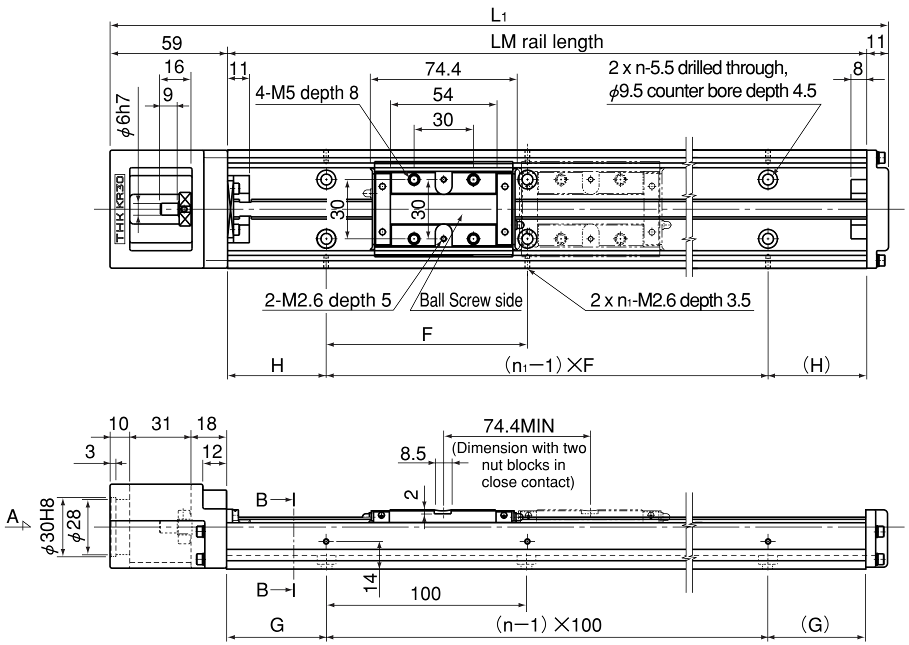
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		G (mm)	n	Overall unit mass (kg)	
		Type A	Type B			Type A	Type B
150	220	69	—	35	2	0.99	—
200	270	119	55	20	3	1.2	1.38
250	320	169	105	45	3	1.41	1.59
300	370	219	155	30	4	1.62	1.8

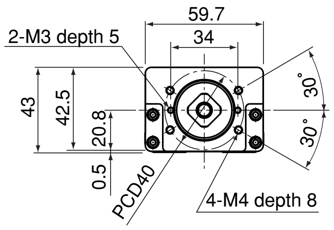
Note The available stroke range of model KR2602B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR30H □□□ Standard Type

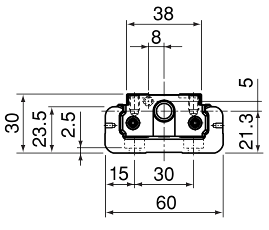
Model KR30H □□ A (with a Single Long Nut Block)

Model KR30H □□ B (with Two Long Nut Blocks)

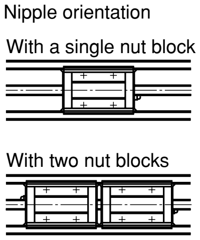




A arrow view



B-B cross section

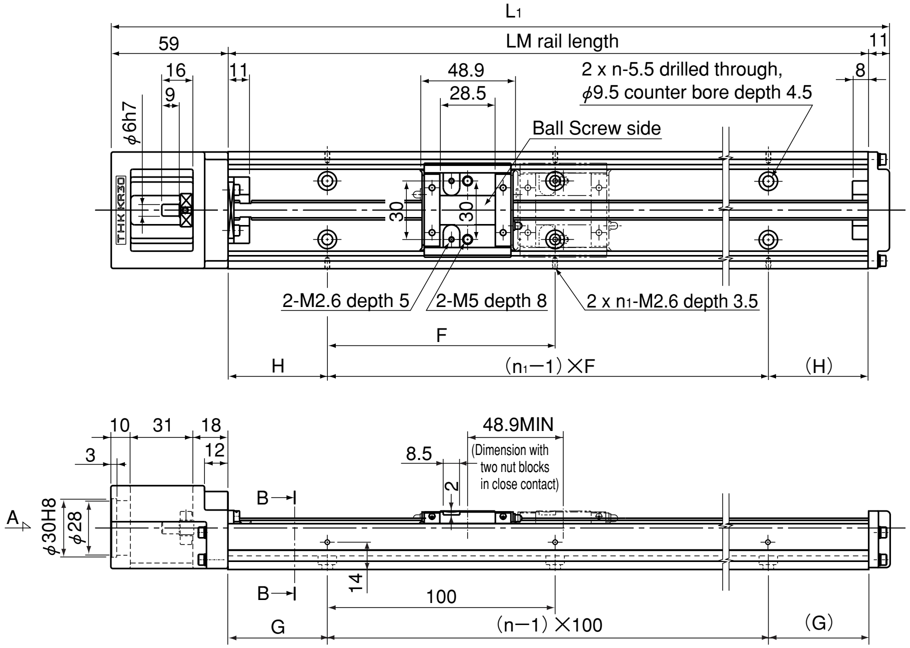


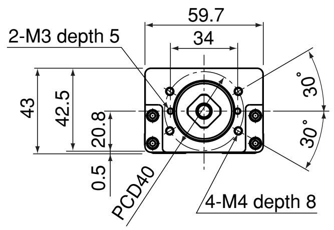
LM rail length (mm)	Overall length L_1 (mm)	Available stroke range (mm)		H (mm)	G (mm)	F (mm)	n	n_1	Overall unit mass (kg)	
		Type A	Type B						Type A	Type B
150	220	58.8	—	25	25	100	2	2	1.4	—
200	270	108.8	—	50	50	100	2	2	1.6	—
300	370	208.8	134.4	50	50	200	3	2	2.2	2.5
400	470	308.8	234.4	100	50	200	4	2	2.7	3
500	570	408.8	334.4	50	50	200	5	3	3.2	3.5
600	670	508.8	434.4	100	50	200	6	3	3.8	4.1

Note The available stroke range of model KR30H □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

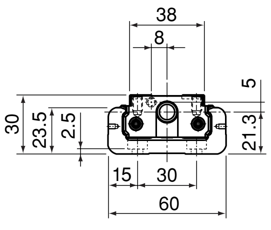
Model KR30H □□ C (with a Single Short Nut Block)

Model KR30H □□ D (with Two Short Nut Blocks)

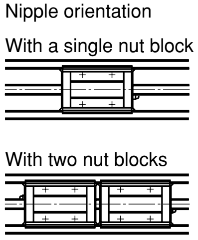




A arrow view



B-B cross section



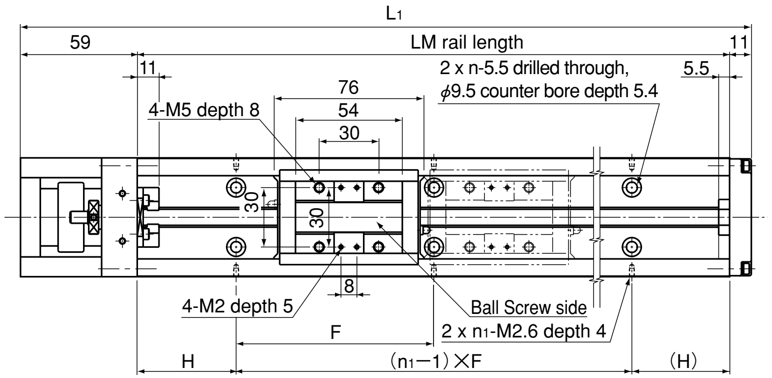
LM rail length (mm)	Overall length L_1 (mm)	Available stroke range (mm)		H (mm)	G (mm)	F (mm)	n	n_1	Overall unit mass (kg)	
		Type C	Type D						Type C	Type D
150	220	84.3	35.4	25	25	100	2	2	1.3	1.47
200	270	134.3	85.4	50	50	100	2	2	1.5	1.67
300	370	234.3	185.4	50	50	200	3	2	2.1	2.27
400	470	334.3	285.4	100	50	200	4	2	2.6	2.77
500	570	434.3	385.4	50	50	200	5	3	3.1	3.27
600	670	534.3	485.4	100	50	200	6	3	3.7	3.87

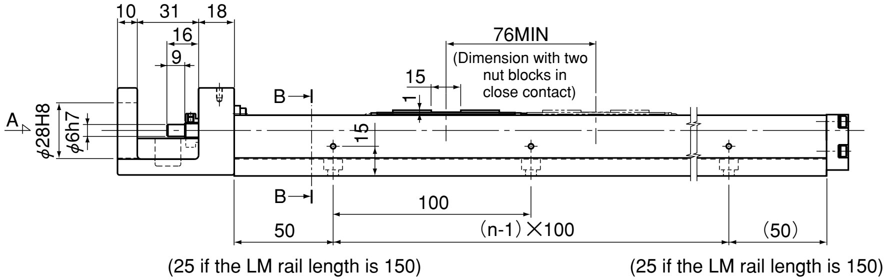
Note The available stroke range of model KR30H □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

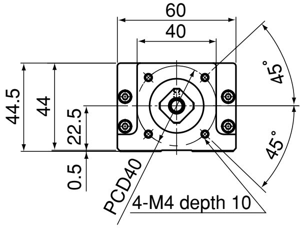
Model KR33 □□□ Standard Type

Model KR33 □□ A (with a Single Long Nut Block)

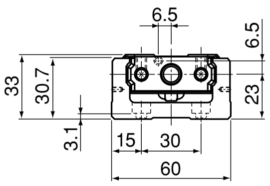
Model KR33 □□ B (with Two Long Nut Blocks)



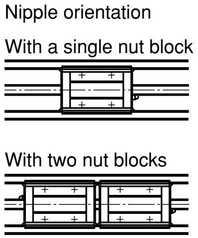




A arrow view



B-B cross section

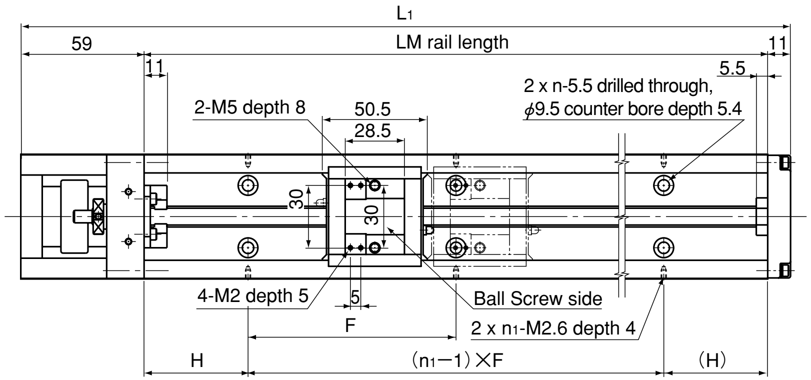


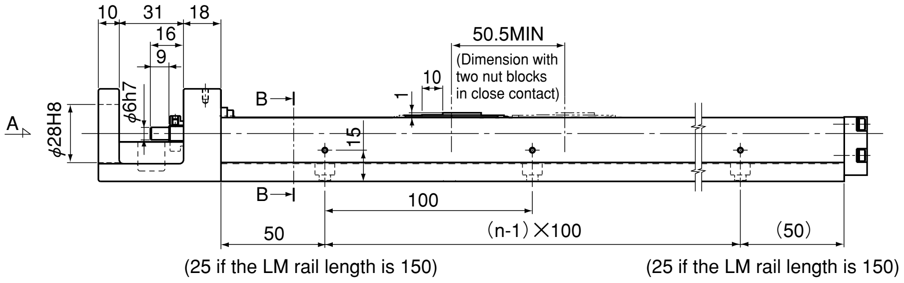
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	F (mm)	n	n1	Overall unit mass (kg)	
		Type A	Type B					Type A	Type B
150	220	61.5	—	25	100	2	2	1.7	—
200	270	111.5	—	50	100	2	2	2	—
300	370	211.5	135.5	50	200	3	2	2.6	2.95
400	470	311.5	235.5	100	200	4	2	3.2	3.55
500	570	411.5	335.5	50	200	5	3	3.9	4.25
600	670	511.5	435.5	100	200	6	3	4.5	4.85

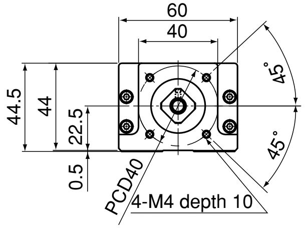
Note The available stroke range of model KR33 B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR33 □□ C (with a Single Short Nut Block)

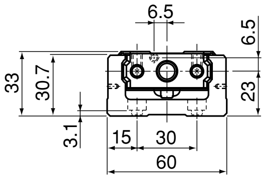
Model KR33 □□ D (with Two Short Nut Blocks)



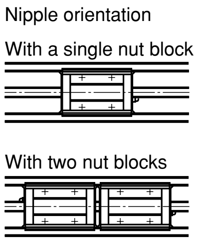




A arrow view



B-B cross section



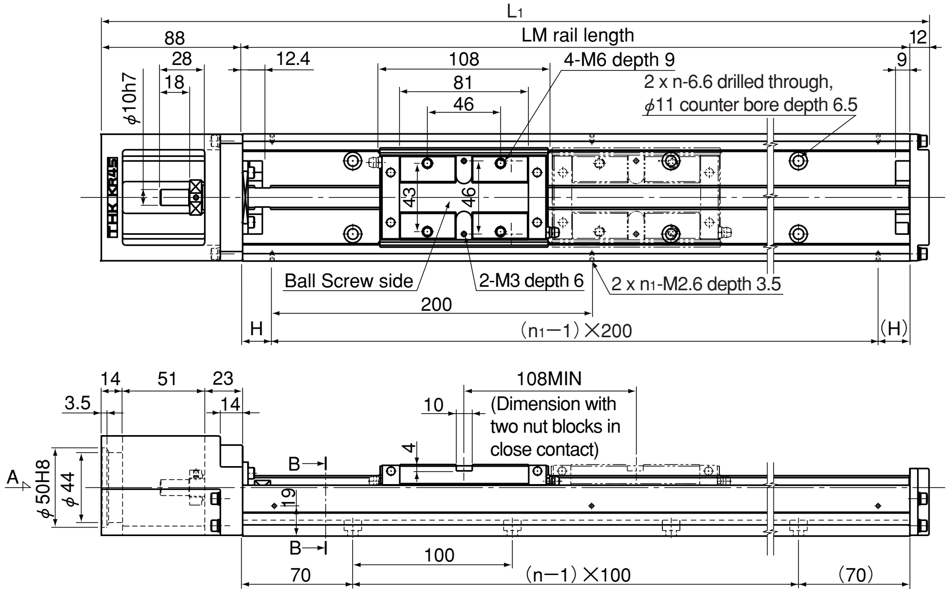
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	F (mm)	n	n1	Overall unit mass (kg)	
		Type C	Type D					Type C	Type D
150	220	87	36.5	25	100	2	2	1.6	1.83
200	270	137	86.5	50	100	2	2	1.9	2.13
300	370	237	186.5	50	200	3	2	2.5	2.73
400	470	337	286.5	100	200	4	2	3.1	3.33
500	570	437	386.5	50	200	5	3	3.8	4.03
600	670	537	486.5	100	200	6	3	4.4	4.63

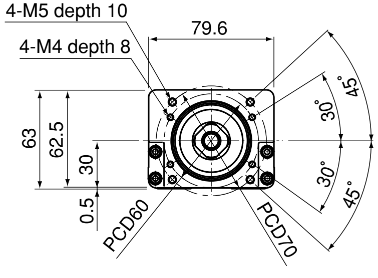
Note The available stroke range of model KR33 □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR45H □□□ Standard Type

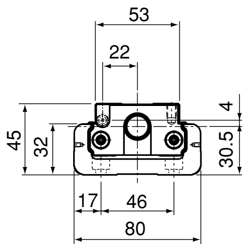
Model KR45H □□ A (with a Single Long Nut Block)

Model KR45H □□ B (with Two Long Nut Blocks)

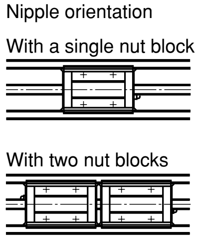




A arrow view



B-B cross section

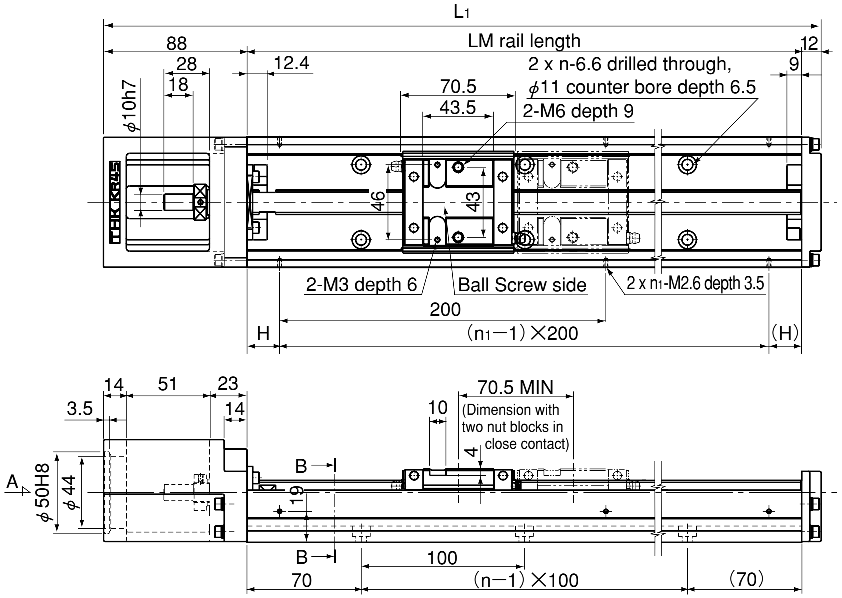


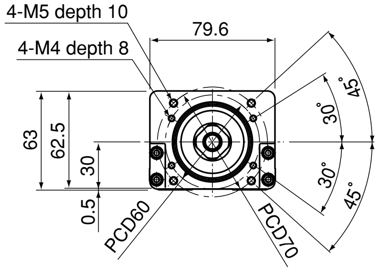
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	n	n1	Overall unit mass (kg)	
		Type A	Type B				Type A	Type B
340	440	213	105	70	3	2	5.1	6.05
440	540	313	205	20	4	3	6.1	7.05
540	640	413	305	70	5	3	7.1	8.05
640	740	513	405	20	6	4	8.1	9.05
740	840	613	505	70	7	4	9.1	10.05
840	940	713	605	20	8	5	10.1	11.05
940	1040	813	705	70	9	5	11.2	12.15

Note The available stroke range of model KR45H □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

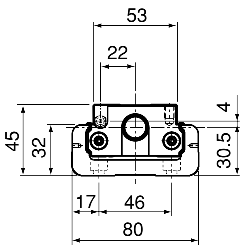
Model KR45H □□ C (with a Single Short Nut Block)

Model KR45H □□ D (with Two Short Nut Blocks)

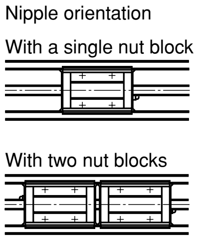




A arrow view



B-B cross section



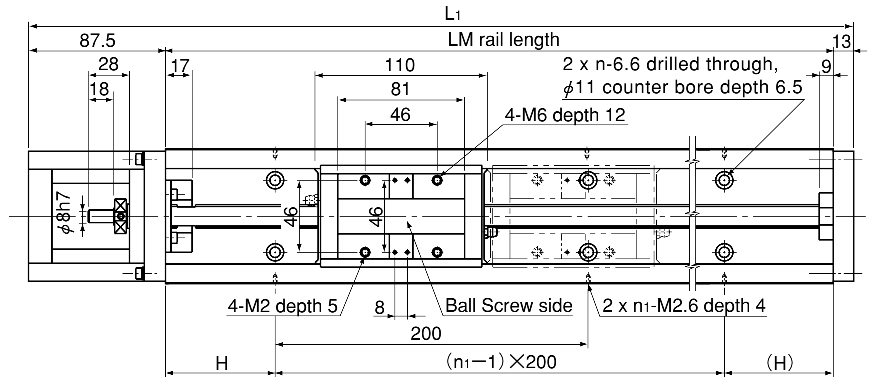
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	n	n1	Overall unit mass (kg)	
		Type C	Type D				Type C	Type D
340	440	250.5	180	70	3	2	4.7	5.23
440	540	350.5	280	20	4	3	5.7	6.23
540	640	450.5	380	70	5	3	6.7	7.23
640	740	550.5	480	20	6	4	7.7	8.23
740	840	650.5	580	70	7	4	8.7	9.23
840	940	750.5	680	20	8	5	9.7	10.23
940	1040	850.5	780	70	9	5	10.8	11.33

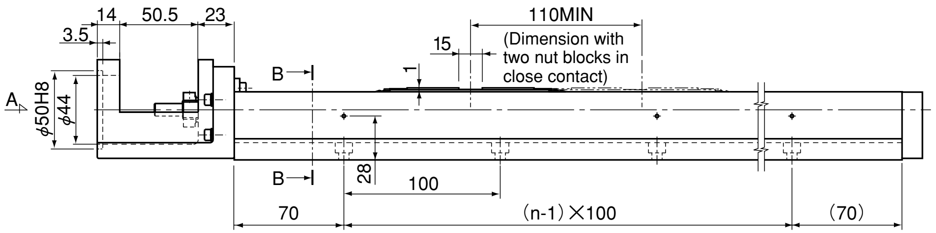
Note The available stroke range of model KR45H □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

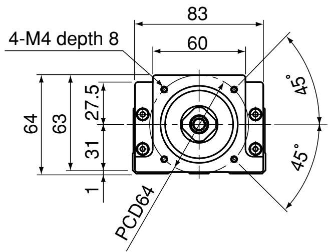
Model KR46 □□□ Standard Type

Model KR46 □□ A (with a Single Long Nut Block)

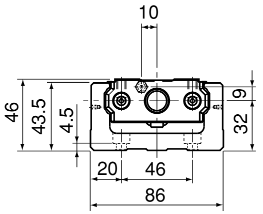
Model KR46 □□ B (with Two Long Nut Blocks)







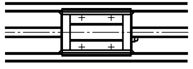
A arrow view



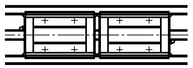
B-B cross section

Nipple orientation

With a single nut block



With two nut blocks

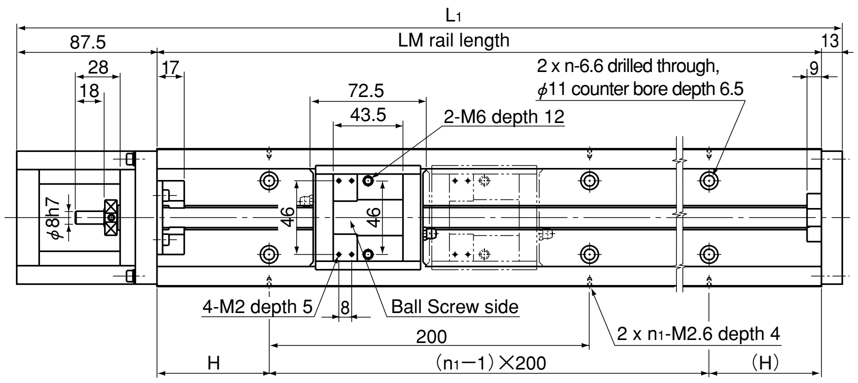


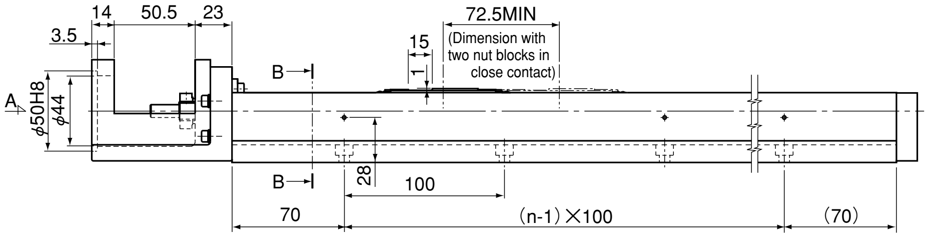
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	n	n1	Overall unit mass (kg)	
		Type A	Type B				Type A	Type B
340	440.5	208	98	70	3	2	7.7	8.9
440	540.5	308	198	20	4	3	9	10.2
540	640.5	408	298	70	5	3	10.3	11.5
640	740.5	508	398	20	6	4	11.6	12.8
740	840.5	608	498	70	7	4	12.8	14
940	1040.5	808	698	70	9	5	15.3	16.5

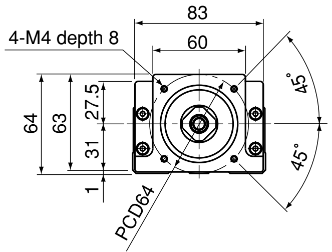
Note The available stroke range of model KR46 □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR46 □□ C (with a Single Short Nut Block)

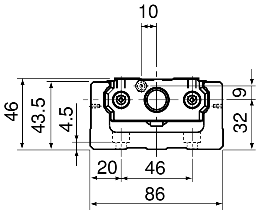
Model KR46 □□ D (with Two Short Nut Blocks)







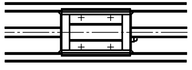
A arrow view



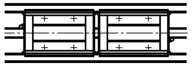
B-B cross section

Nipple orientation

With a single nut block



With two nut blocks



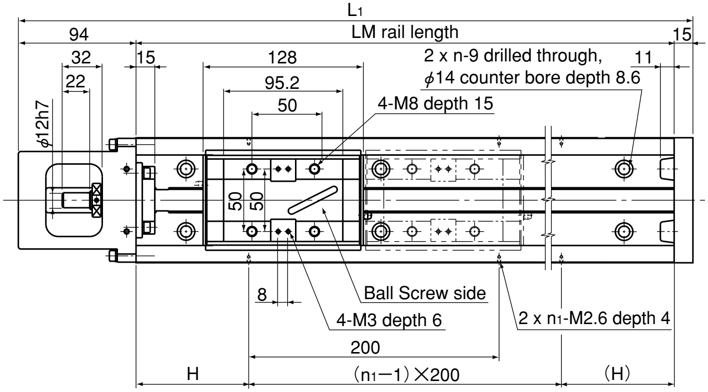
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	n	n1	Overall unit mass (kg)	
		Type C	Type D				Type C	Type D
340	440.5	245.5	173	70	3	2	7.3	8.1
440	540.5	345.5	273	20	4	3	8.6	9.4
540	640.5	445.5	373	70	5	3	9.9	10.7
640	740.5	545.5	473	20	6	4	11.2	12
740	840.5	645.5	573	70	7	4	12.4	13.2
940	1040.5	845.5	773	70	9	5	14.9	15.7

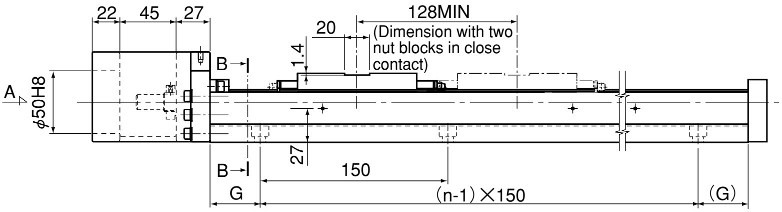
Note The available stroke range of model KR46 □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

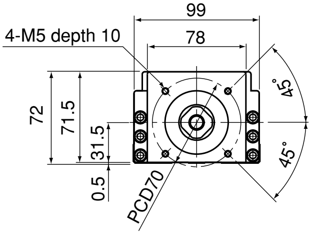
Model KR5520 – Standard Type

Model KR5520A (with a Single Long Nut Block)

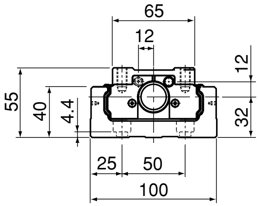
Model KR5520B (with Two Long Nut Blocks)







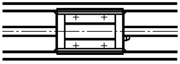
A arrow view



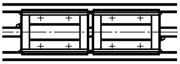
B-B cross section

Nipple orientation

With a single nut block



With two nut blocks



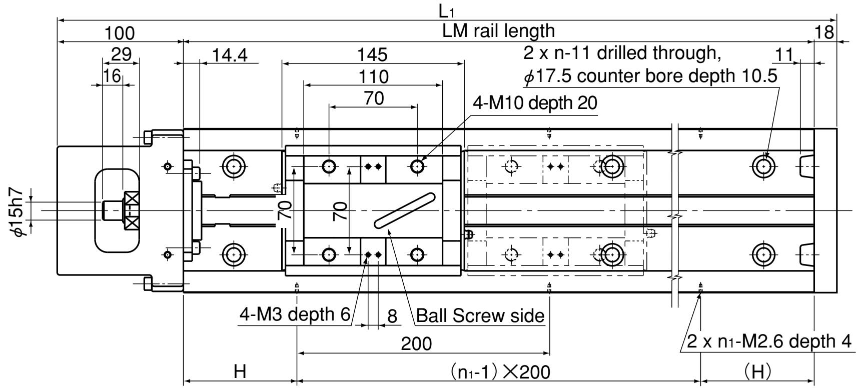
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	G (mm)	n	n1	Overall unit mass (kg)	
		Type A	Type B					Type A	Type B
980	1089	826	698	90	40	7	5	19.9	21.6
1080	1189	926	798	40	15	8	6	21.7	23.4
1180	1289	1026	898	90	65	8	6	23.4	25.1
1280	1389	1126	998	40	40	9	7	25.1	26.8
1380	1489	1226	1098	90	15	10	7	26.9	28.6

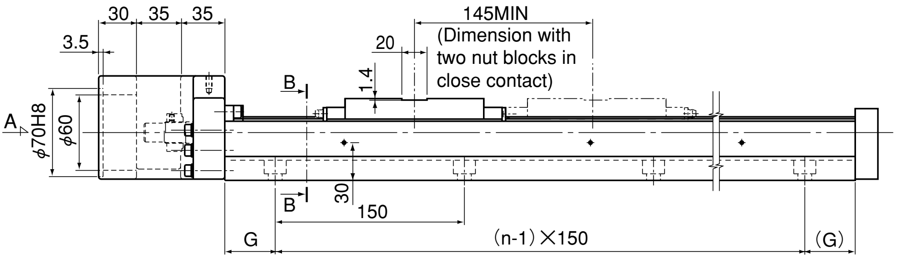
Note The available stroke range of model KR5520B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

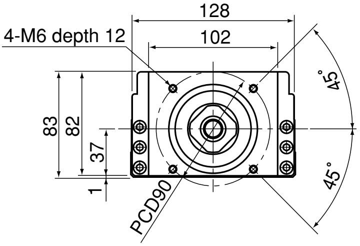
Model KR6525 □ Standard Type

Model KR6525A (with a Single Short Nut Block)

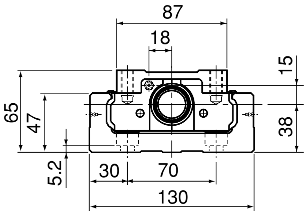
Model KR6525B (with Two Short Nut Blocks)







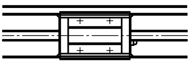
A arrow view



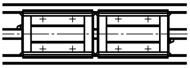
B-B cross section

Nipple orientation

With a single nut block



With two nut blocks

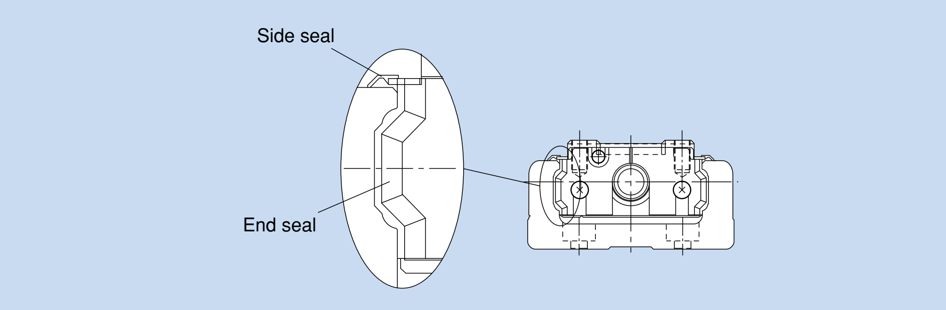


LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		H (mm)	G (mm)	n	n1	Overall unit mass (kg)	
		Type A	Type B					Type A	Type B
980	1098	810	665	90	40	7	5	31.6	34.6
1180	1298	1010	865	90	65	8	6	67	40
1380	1498	1210	1065	90	90	9	7	42.4	45.4
1680	1798	1510	1365	40	90	11	9	50.5	53.5

Note The available stroke range of model KR6525B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Seal

Model KR is equipped with end seals and side seals for dust prevention as standard.



Option

Various types of options are available for model KR.

Name		Overview
Cover	P. 1-32	Serve as dust prevention accessories or the likes
Bellows	P. 1-46	
Proximity sensor	P. 1-50	Supporting manufacturer: Yamatake, SUNX
Photo sensor	P. 1-51	Supporting manufacturer: OMRON
Sensor rail	P. 1-51	For mounting the sensor
Housing A	P. 1-52	For standard-type model KR without a motor
Housing A for a separate motor	P. 1-52	If the customer manufactures a motor bracket
Turnaround housing A	P. 1-52	For motor turnaround type
Intermediate flange	P. 1-56	For standard-type model KR without a motor
Motor turnaround type	P. 1-75	For motor turnaround type
XY bracket	P. 1-76	Bracket for a single shaft and a combination of X and Y axes

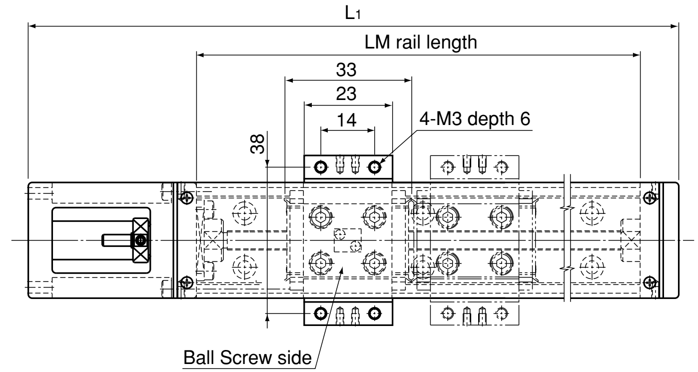
Table 7 Table of Applicable Options

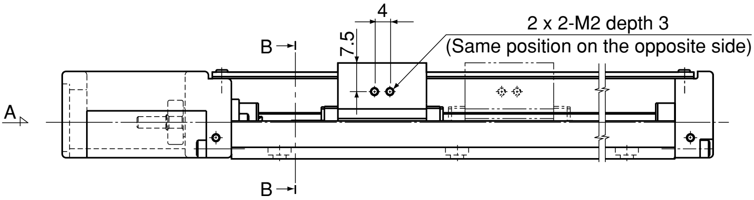
Model No.	Cover	Bellows	Proximity sensor	Photo sensor	Housing A	Housing A for separate motor	Turnaround hosing A	Intermediate flange	Motor turnaround type	XY bracket
KR15 - A	○	—	○	—	—	—	—	○	—	—
KR15 - B	○	—	○	—	—	—	—	○	—	—
KR20 - A	○	—	○	—	—	—	—	○	—	—
KR20 - B	○	—	○	—	—	—	—	○	—	—
KR26 - A	○	—	○	—	—	—	—	○	—	—
KR26 - B	○	—	○	—	—	—	—	○	—	—
KR30H - A	○	—	○	○	—	—	—	○	—	—
KR30H - B	○	—	○	○	—	—	—	○	—	—
KR30H - C	○	—	○	○	—	—	—	○	—	—
KR30H - D	○	—	○	○	—	—	—	○	—	—
KR33 - A	○	○	○	○	○	○	○	○	○	○
KR33 - B	○	○	○	○	○	○	○	○	○	○
KR33 - C	○	○	○	○	○	○	○	○	○	○
KR33 - D	○	○	○	○	○	○	○	○	○	○
KR45H - A	○	—	○	○	—	—	—	○	—	—
KR45H - B	○	—	○	○	—	—	—	○	—	—
KR45H - C	○	—	○	○	—	—	—	○	—	—
KR45H - D	○	—	○	○	—	—	—	○	—	—
KR46 - A	○	○	○	○	○	○	○	○	○	○
KR46 - B	○	○	○	○	○	○	○	○	○	○
KR46 - C	○	○	○	○	○	○	○	○	○	○
KR46 - D	○	○	○	○	○	○	○	○	○	○
KR55 - A	○	○	○	○	—	—	○	○	—	—
KR55 - B	○	○	○	○	—	—	○	○	—	—
KR65 - A	○	○	○	○	○	—	○	○	—	—
KR65 - B	○	○	○	○	○	—	○	○	—	—

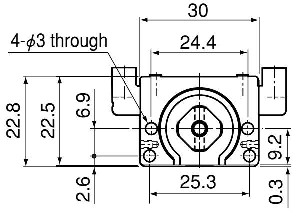
Model KR15 □□□ (with a Cover)

Model KR15 □□ A (with a Single Nut Block)

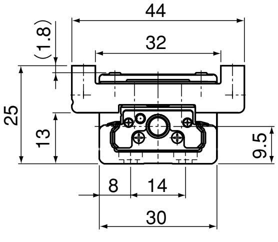
Model KR15 □□ B (with Two Nut Blocks)







A arrow view



B-B cross section

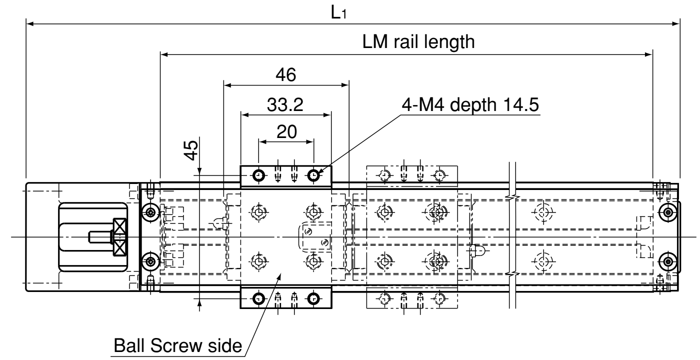
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
75	129	31.4	—	0.23	—
100	154	56.4	—	0.26	—
125	179	81.4	48.4	0.3	0.364
150	204	106.4	73.4	0.33	0.394
175	229	131.4	98.4	0.36	0.424
200	254	156.4	123.4	0.4	0.464

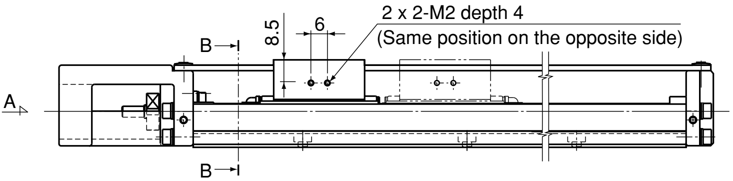
Note The available stroke range of model KR15 □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

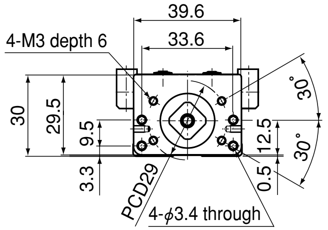
Model KR2001 □ (with a Cover)

Model KR2001A (with a Single Nut Block)

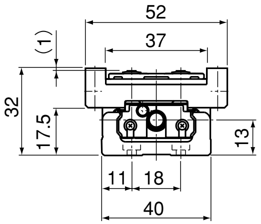
Model KR2001B (with Two Nut Blocks)







A arrow view



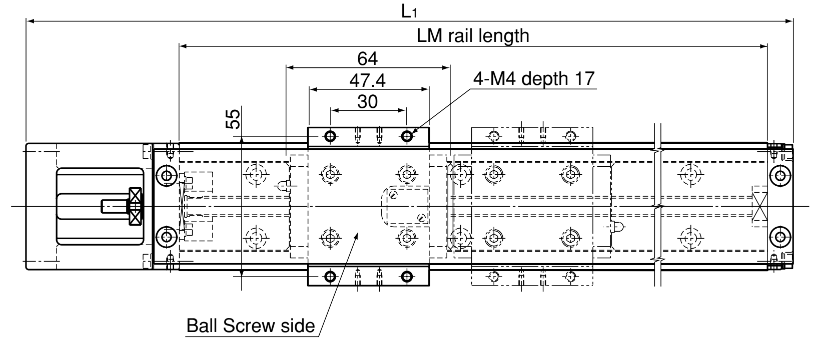
B-B cross section

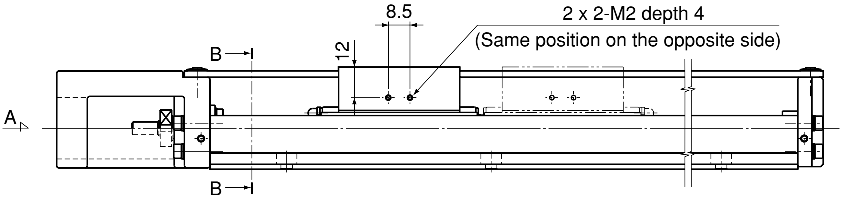
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
100	159	41.5	—	0.51	—
150	209	91.5	45.5	0.66	0.78
200	259	141.5	95.5	0.8	0.92

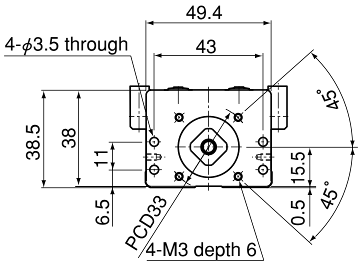
Note The available stroke range of model KR2001B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR2602A (with a Single Nut Block)

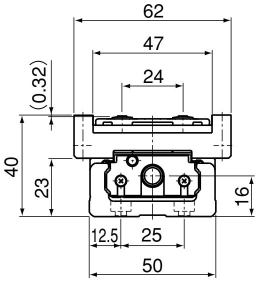
Model KR2602B (with Two Nut Blocks)







A arrow view



B-B cross section

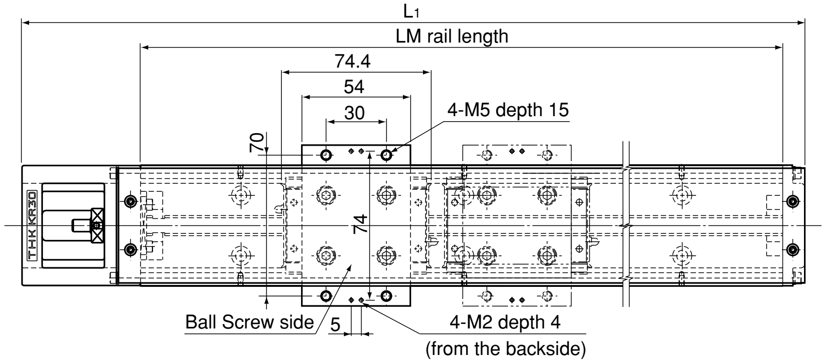
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
150	220	69	—	1.12	—
200	270	119	55	1.34	1.605
250	320	169	105	1.56	1.825
300	370	219	155	1.78	2.045

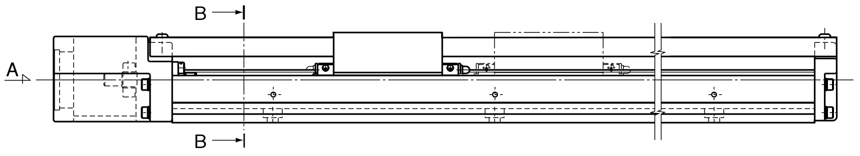
Note The available stroke range of model KR2602B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

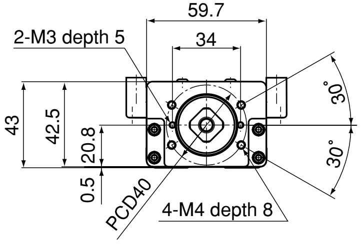
Model KR30H □□□ (with a Cover)

Model KR30H □□ A (with a Single Long Nut Block)

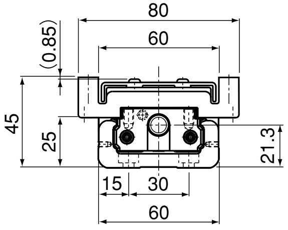
Model KR30H □□ B (with Two Long Nut Blocks)







A arrow view



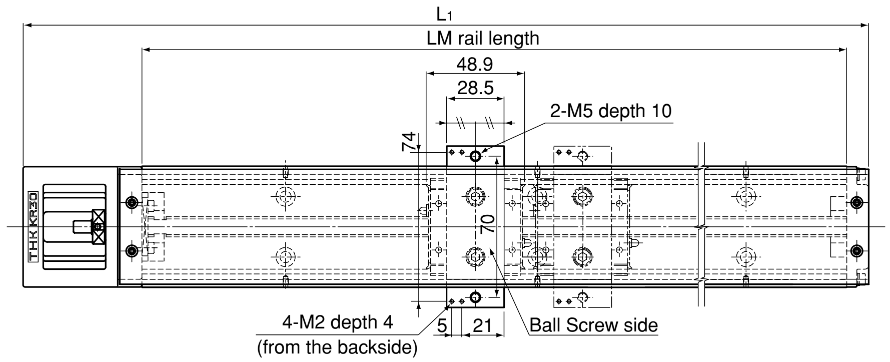
B-B cross section

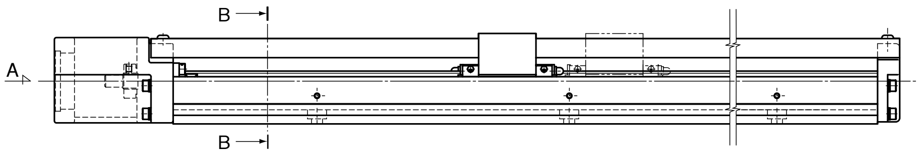
LM rail length (mm)	Overall length L₁ (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
150	220	58.8	—	1.6	—
200	270	108.8	—	1.8	—
300	370	208.8	134.4	2.4	2.83
400	470	308.8	234.4	3	3.43
500	570	408.8	334.4	3.5	3.93
600	670	508.8	434.4	4.1	4.53

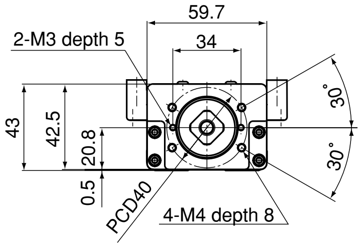
Note The available stroke range of model KR30H □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR30H □□ C (with a Single Short Nut Block)

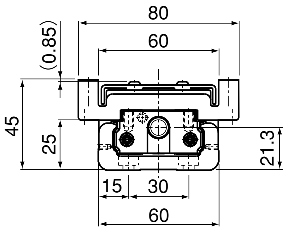
Model KR30H □□ D (with Two Short Nut Blocks)







A arrow view



B-B cross section

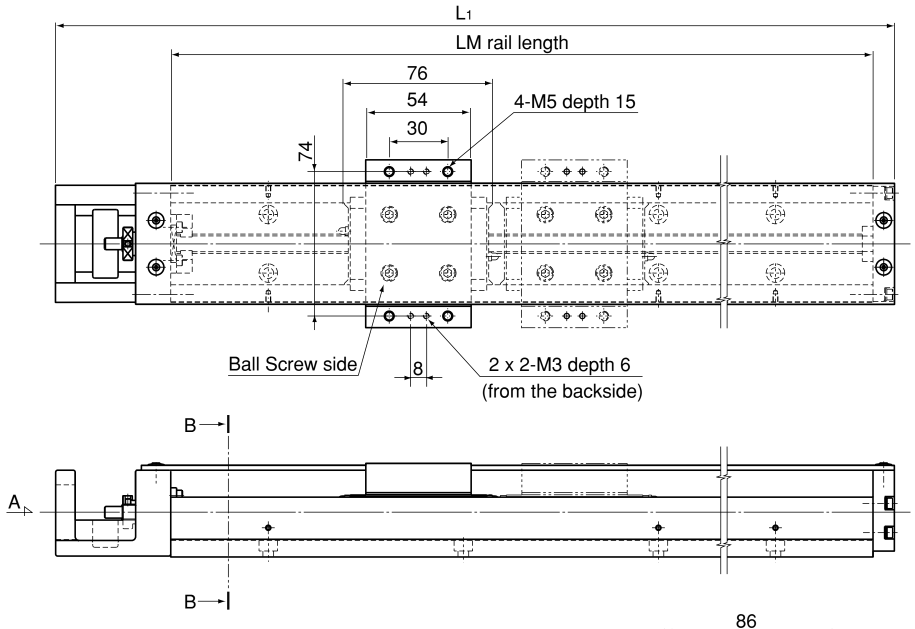
LM rail length (mm)	Overall length L₁ (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type C	Type D	Type C	Type D
150	220	84.3	35.4	1.4	1.64
200	270	134.3	85.4	1.6	1.84
300	370	234.3	185.4	2.2	2.44
400	470	334.3	285.4	2.8	3.04
500	570	434.3	385.4	3.3	3.54
600	670	534.3	485.4	3.9	4.14

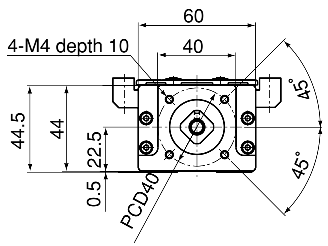
Note The available stroke range of model KR30H □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR33 □□□ (with a Cover)

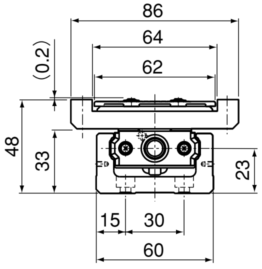
Model KR33 □□ A (with a Single Long Nut Block)

Model KR33 □□ B (with Two Long Nut Blocks)





A arrow view



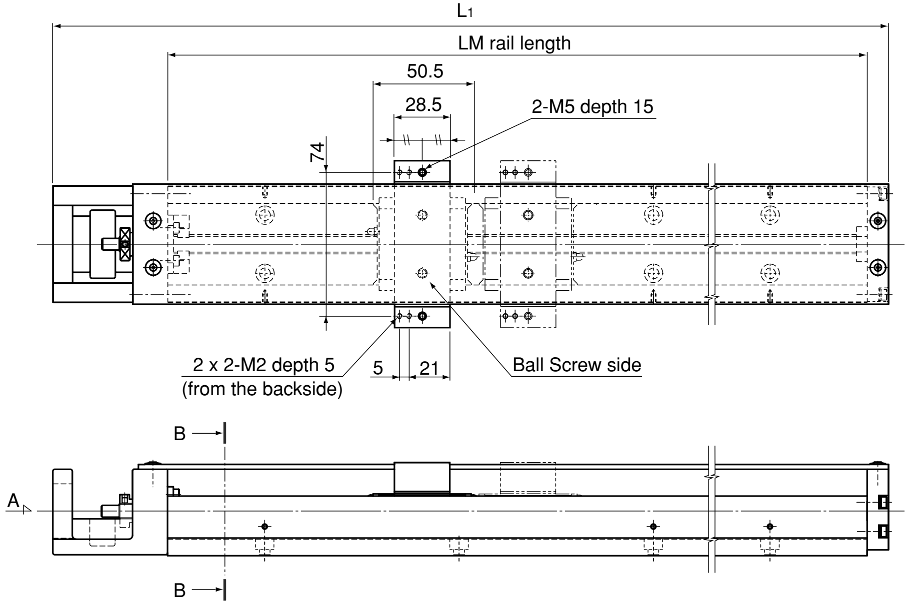
B-B cross section

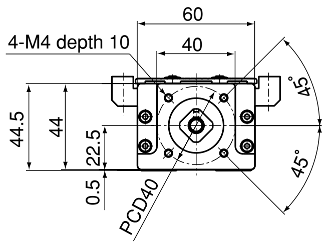
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
150	220	61.5	—	1.9	—
200	270	111.5	—	2.2	—
300	370	211.5	135.5	2.8	3.28
400	470	311.5	235.5	3.5	3.98
500	570	411.5	335.5	4.2	4.68
600	670	511.5	435.5	4.8	5.28

Note The available stroke range of model KR33 □□ B indicates the value when two nut blocks are used in close contact with each other.
It must be noted that the cover-mounting bolt is 0.2 mm higher than the top face of the top table.
For model number coding, see page 1-15.

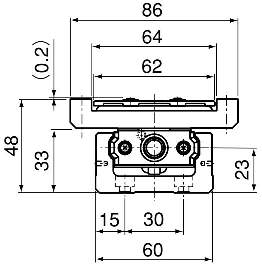
Model KR33 □□ C (with a Single Short Nut Block)

Model KR33 □□ D (with Two Short Nut Blocks)





A arrow view



B-B cross section

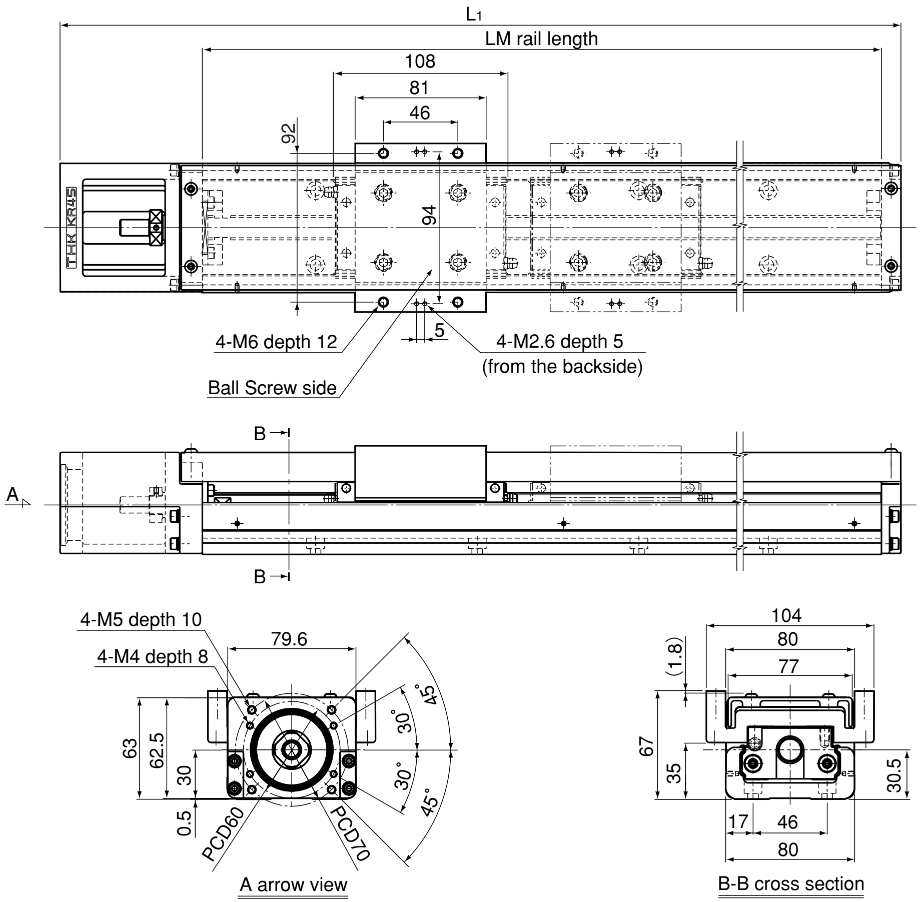
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type C	Type D	Type C	Type D
150	220	87	36.5	1.7	2
200	270	137	86.5	2.1	2.4
300	370	237	186.5	2.7	3
400	470	337	286.5	3.3	3.6
500	570	437	386.5	4	4.3
600	670	537	486.5	4.7	5

Note The available stroke range of model KR33 □□ D indicates the value when two nut blocks are used in close contact with each other.
It must be noted that the cover-mounting bolt is 0.2 mm higher than the top face of the top table.
For model number coding, see page 1-15.

Model KR45H □□□ (with a Cover)

Model KR45H □□ A (with a Single Long Nut Block)

Model KR45H □□ B (with Two Long Nut Blocks)

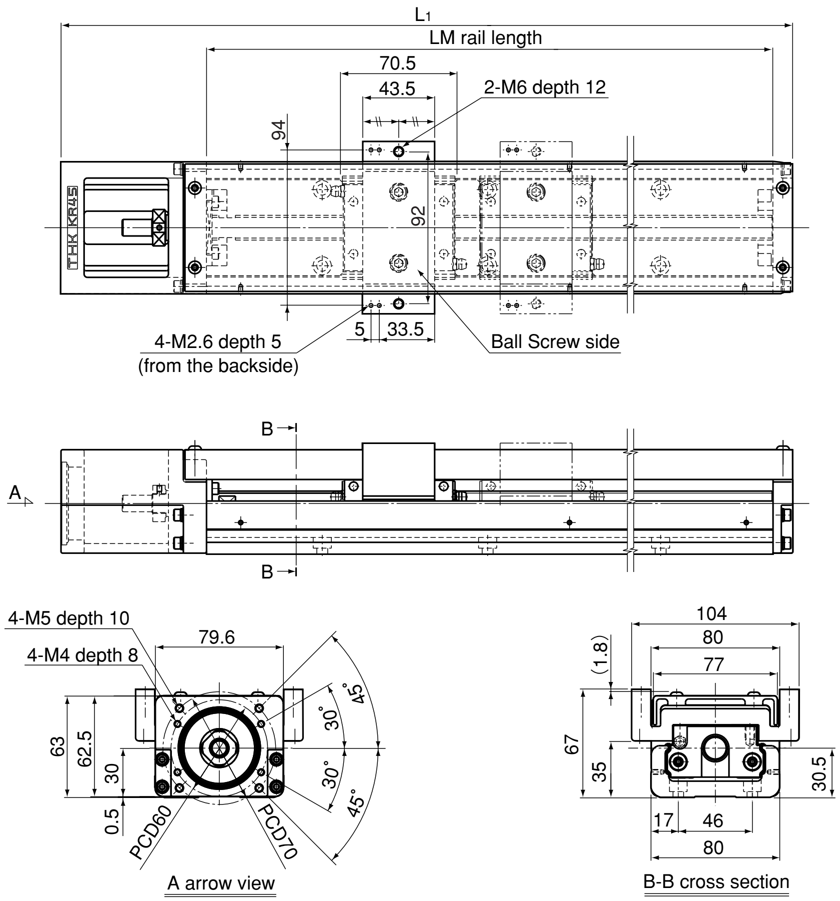


LM rail length (mm)	Overall length L₁ (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
340	440	213	105	5.7	7.01
440	540	313	205	6.8	8.11
540	640	413	305	7.9	9.21
640	740	513	405	9	10.31
740	840	613	505	10.1	11.41
840	940	713	605	11.2	12.51
940	1040	813	705	12.3	13.61

Note The available stroke range of model KR45H □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR45H □□ C (with a Single Short Nut Block)

Model KR45H □□ D (with Two Short Nut Blocks)



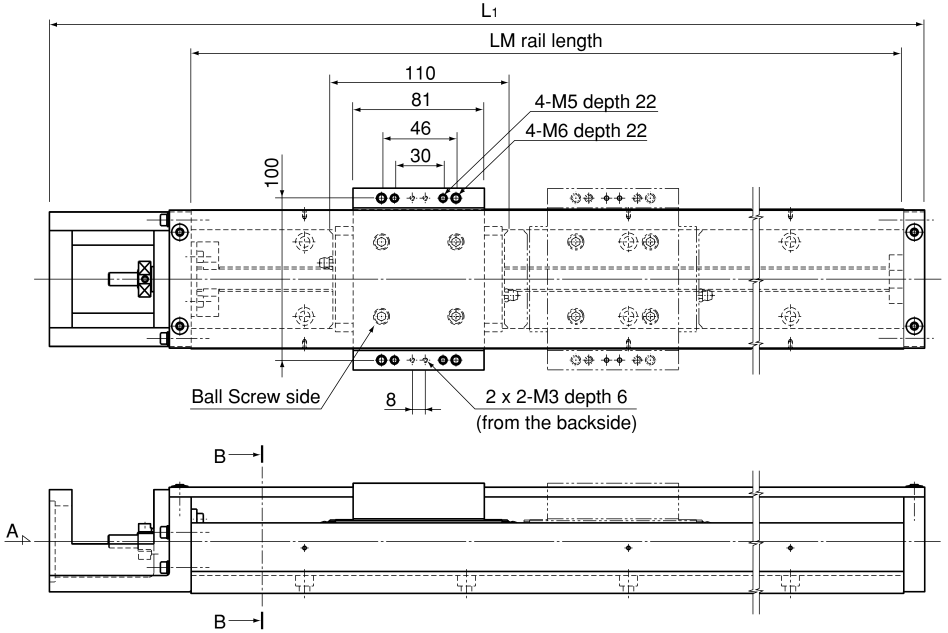
LM rail length (mm)	Overall length L₁ (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type C	Type D	Type C	Type D
340	440	250.5	180	5.1	5.82
440	540	350.5	280	6.2	6.92
540	640	450.5	380	7.3	8.02
640	740	550.5	480	8.4	9.12
740	840	650.5	580	9.5	10.22
840	940	750.5	680	10.6	11.32
940	1040	850.5	780	11.7	12.42

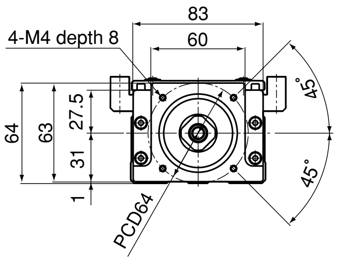
Note The available stroke range of model KR45H □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR46 □□□ (with a Cover)

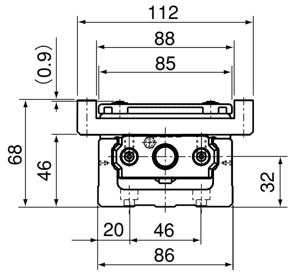
Model KR46 □□ A (with a Single Long Nut Block)

Model KR46 □□ B (with Two Long Nut Blocks)





A arrow view



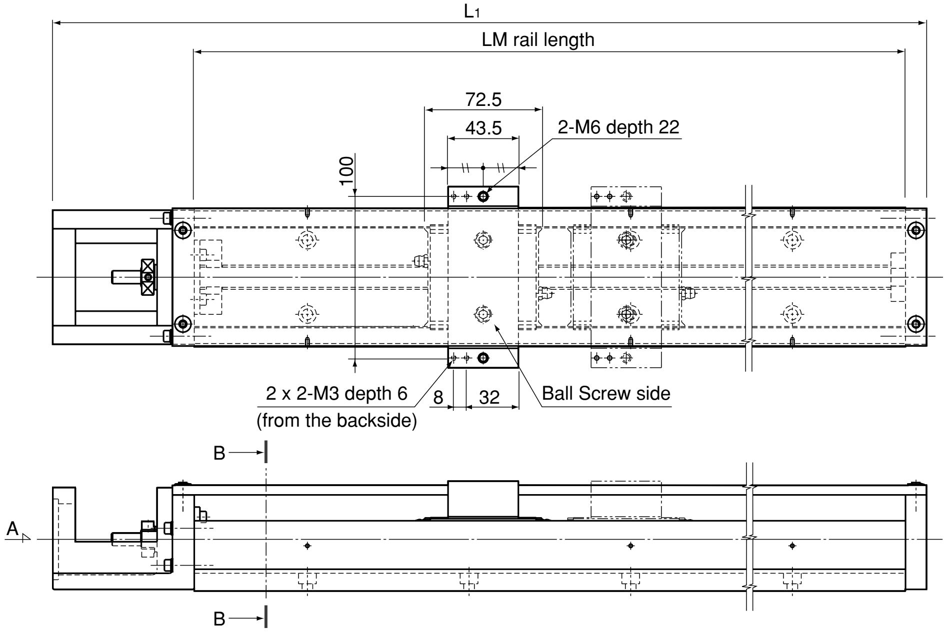
B-B cross section

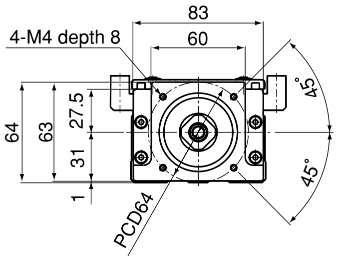
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
340	440.5	208	98	8.3	9.79
440	540.5	308	198	9.7	11.19
540	640.5	408	298	11	12.49
640	740.5	508	398	12.4	13.89
740	840.5	608	498	13.7	15.19
940	1040.5	808	698	16.3	17.79

Note The available stroke range of model KR46 □□ B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

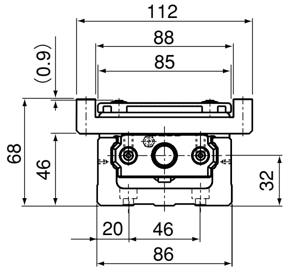
Model KR46 □□ C (with a Single Short Nut Block)

Model KR46 □□ D (with Two Short Nut Blocks)





A arrow view



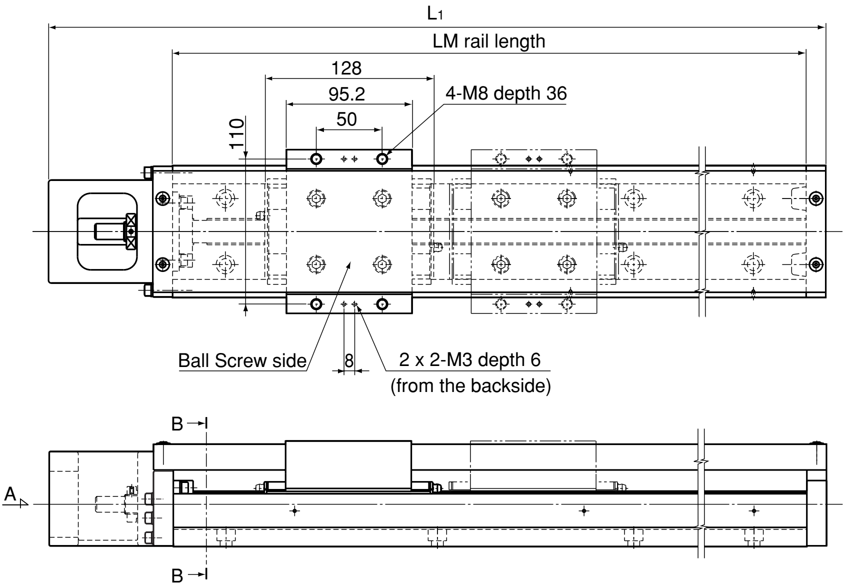
B-B cross section

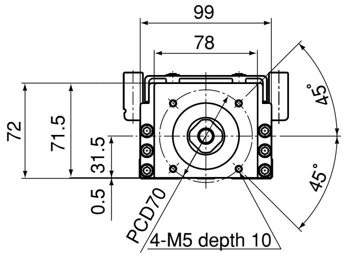
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type C	Type D	Type C	Type D
340	440.5	245.5	173	7.8	8.79
440	540.5	345.5	273	9.1	10.09
540	640.5	445.5	373	10.5	11.49
640	740.5	545.5	473	11.9	12.89
740	840.5	645.5	573	13.2	14.19
940	1040.5	845.5	773	15.8	16.79

Note The available stroke range of model KR46 □□ D indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

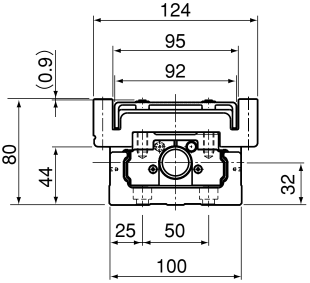
Model KR5520A (with a Single Nut Block)

Model KR5520B (with Two Nut Blocks)





A arrow view



B-B cross section

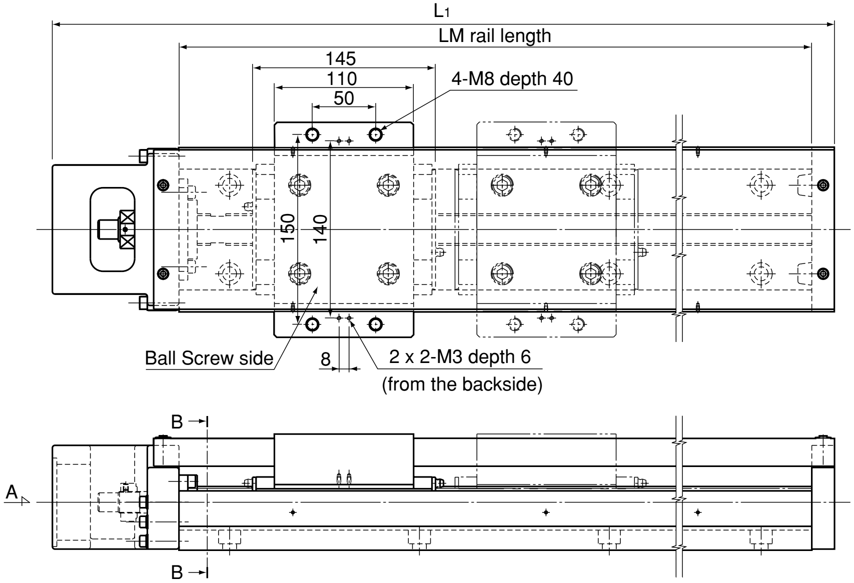
LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
980	1089	826	698	22.7	26.2
1080	1189	926	798	24.6	28.1
1180	1289	1026	898	26.4	29.9
1280	1389	1126	998	28.1	31.6
1380	1489	1226	1098	30	33.5

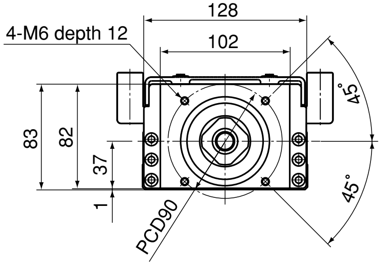
Note The available stroke range of model KR5520B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Model KR6525 □ (with a Cover)

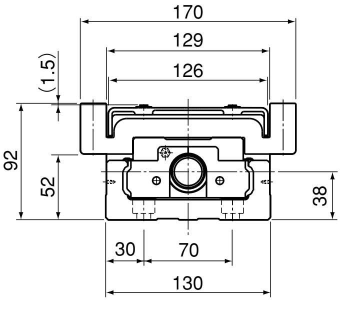
Model KR6525A (with a Single Nut Block)

Model KR6525B (with Two Nut Blocks)





A arrow view



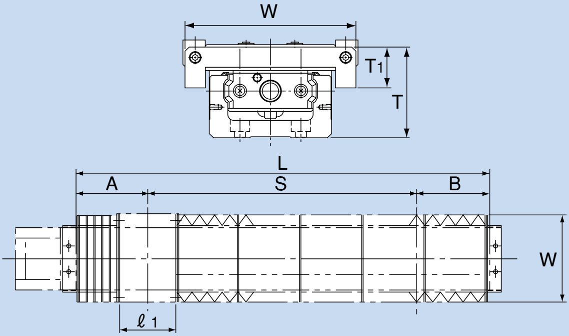
B-B cross section

LM rail length (mm)	Overall length L1 (mm)	Available stroke range (mm)		Overall unit mass (kg)	
		Type A	Type B	Type A	Type B
980	1098	810	665	36.3	43
1180	1298	1010	865	42	48.7
1380	1498	1210	1065	47.6	54.3
1680	1798	1510	1365	56.1	62.8

Note The available stroke range of model KR6525B indicates the value when two nut blocks are used in close contact with each other.
For model number coding, see page 1-15.

Bellows

●Block A Type



Unit: mm

Model No.	LM rail length L	Stroke length S	MIN/MAX	Motor side A	Counter-motor side B	ℓ1	W	T	T1
KR 33	150	57	14 / 76	48	45	54	84	44.5	20
	200	104	17 / 123	48	48				
	300	180	30 / 210	59	61				
	400	260	40 / 300	69	71				
	500	330	55 / 385	84	86				
	600	410	65 / 475	94	96				
KR 46	340	178	29.5/ 207.5	81	81	81	110	56	20
	440	258	39.5/ 297.5	91	91				
	540	328	54.5/ 382.5	106	106				
	640	418	59.5/ 477.5	111	111				
	740	488	74.5/ 562.5	126	126				
	940	648	94.5/ 742.5	146	146				
KR 55	980	770	55.4/ 825.4	105	105	95.2	154	77	42
	1080	856	62.4/ 918.4	112	112				
	1180	944	68.4/1012.4	118	118				
	1280	1030	75.4/1105.4	125	125				
	1380	1116	82.4/1198.4	132	132				
KR 65	980	746.5	58 / 804.5	115	118.5	110	184	87	49
	1180	914.5	74 / 988.5	131	134.5				
	1380	1082.5	90 /1172.5	147	150.5				
	1680	1334.5	114 /1448.5	171	174.5				

Note 1: If desiring to grease the actuator from the grease nipple without removing the bellows, an intermediate plate is available. Contact THK for details.

Note 2: For use other than in horizontal mount (e.g., vertical mount and wall mount), the extension rate differs from the specification value. Contact THK for details.

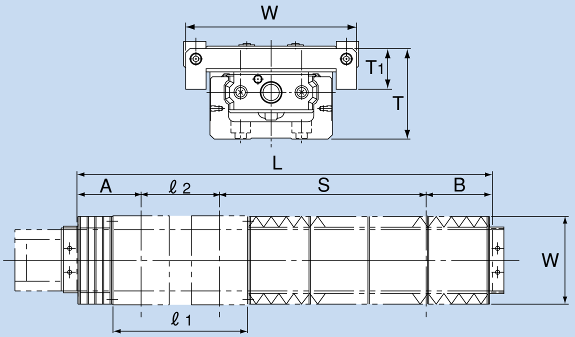
Note: The length of the bellows is calculated as follows.

$$L_{min} = \frac{S}{(A-1)}$$ S: Stroke length

$$L_{max} = L_{min} \cdot A$$ A: Extension rate (table on the right)

	A (extension rate)
KR 33	7
KR 46	7
KR 55	13
KR 65	13

●Block B Type



Unit: mm

Model No.	LM rail length L	Stroke length S	MIN/MAX	Motor side A	Counter-motor side B	ℓ1	ℓ2	W	T	T1
KR 33	300	114	25 /139	54	56	130	76	84	44.5	20
	400	194	35 /229	64	66					
	500	264	50 /321	79	81					
	600	344	60 /404	89	91					
KR 46	340	90	15.5/111.5	73	67	191	110	110	56	20
	440	168	29.5/197.5	81	81					
	540	248	39.5/287.5	91	91					
	640	318	54.5/372.5	106	106					
	740	408	59.5/467.5	111	111					
	940	548	89.5/637.5	141	141					
KR 55	980	652	50.4/702.4	100	100	223.1	128	154	77	42
	1080	738	57.4/795.4	107	107					
	1180	826	63.4/889.4	113	113					
	1280	912	70.4/982.4	120	120					
	1380	998	77.4/1075.4	127	127					
KR 65	980	625.5	46 / 671.5	103	106.5	225	145	184	87	49
	1180	795.5	61 / 856.5	118	121.5					
	1380	959.5	79 /1038.5	136	139.5					
	1680	1211.5	103 /1314.5	160	163.5					

Note 1: If desiring to grease the actuator from the grease nipple without removing the bellows, an intermediate plate is available. Contact THK for details.

Note 2: For use other than in horizontal mount (e.g., vertical mount and wall mount), the extension rate differs from the specification value. Contact THK for details.

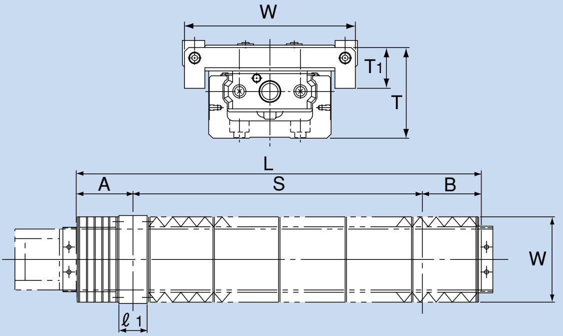
Note: The length of the bellows is calculated as follows.

$\mathrm{Lmin} = \frac{S}{(A-1)}$ S: Stroke length

$\mathrm{Lmax} = \mathrm{Lmin} \cdot A$ A: Extension rate (table on the right)

	A (extension rate)
KR 33	7
KR 46	7
KR 55	13
KR 65	13

●Block C Type



Unit: mm

Model No.	LM rail length L	Stroke length S	MIN/MAX	Motor side A	Counter-motor side B	ℓ1	W	T	T_1
KR 33	150	78.7	17 / 98.5	36	35.3	28.5	84	44.5	20
	200	119.4	23 / 142.5	39.3	41.3				
	300	195.4	35 / 230.5	51.3	53.3				
	400	269.4	48 / 317.5	64.3	66.3				
	500	345.4	60 / 405.5	76.3	78.3				
	600	425.4	70 / 495.5	86.3	88.3				
KR 46	340	205.4	34.5/ 240	67.3	67.3	43.5	110	56	20
	440	279.4	47.5/ 327	80.3	80.3				
	540	355.4	59.5/ 415	92.3	92.3				
	640	439.4	67.5/ 507	100.3	100.3				
	740	509.4	82.5/ 592	115.3	115.3				
	940	675.4	99.5/ 775	132.3	132.3				

Note 1: If desiring to grease the actuator from the grease nipple without removing the bellows, an intermediate plate is available. Contact THK for details.

Note 2: For use other than in horizontal mount (e.g., vertical mount and wall mount), the extension rate differs from the specification value. Contact THK for details.

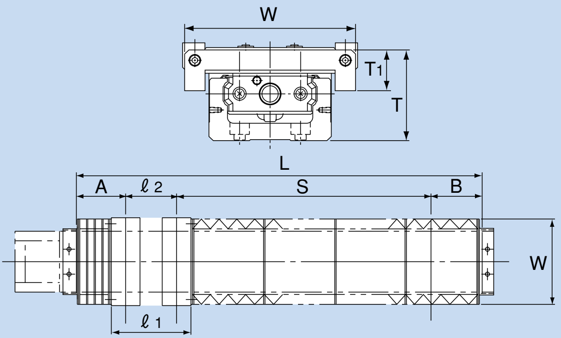
Note: The length of the bellows is calculated as follows.

$$L_{min} = \frac{S}{(A-1)}$$ S: Stroke length

$L_{max} = L_{min} \cdot A$ A: Extension rate (table on the right)

	A (extension rate)
KR 33	7
KR 46	7

●Block D Type



Unit: mm

Model No.	LM rail length L	Stroke length S	MIN/MAX	Motor side A	Counter-motor side B	ℓ 1	ℓ 2	W	T	T 1
KR 33	150	31.2	14 / 51	36	32.3	79	50.5	84	44.5	20
	200	78.2	17 / 98	36	35.3					
	300	154.9	30 /185	46.3	48.3					
	400	234.9	40 /275	56.3	58.3					
	500	304.9	55 /360	71.3	73.3					
	600	384.9	65 /450	81.3	83.3					
KR 46	340	142.9	29.5 /167.5	62.3	62.3	116	72.5	110	56	20
	440	222.9	39.5 /262.5	72.3	72.3					
	540	292.9	54.5 /347.5	87.3	87.3					
	640	382.9	59.5 /442.5	92.3	92.3					
	740	452.9	74.5 /527.5	107.3	107.3					
	940	612.9	94.5 /707.5	127.3	127.3					

Note 1: If desiring to grease the actuator from the grease nipple without removing the bellows, an intermediate plate is available. Contact THK for details.

Note 2: For use other than in horizontal mount (e.g., vertical mount and wall mount), the extension rate differs from the specification value. Contact THK for details.

Note: The length of the bellows is calculated as follows.

$$\text{Lmin} = \frac{S}{(A-1)}$$ S: Stroke length

$$\text{Lmax} = \text{Lmin} \cdot A$$ A: Extension rate (table on the right)

	A (extension rate)
KR 33	7
KR 46	7

Sensor

Optional proximity sensors and photo sensors are available for model KR. Models equipped with a sensor are also provided with a dedicated sensor rail/sensor dog (detecting plate).

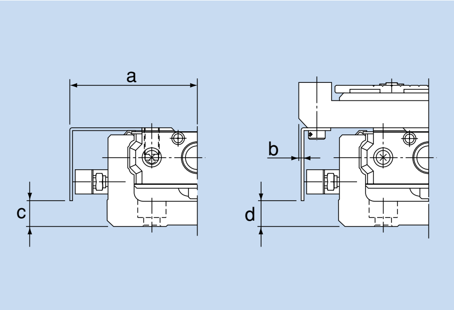
●Proximity Sensor

APM-D3A1-001 (Yamatake)	3 units
GL-12F (SUNX)	3 units
GXL-N12F (SUNX)	3 units

Note: For APM-D3A1-001 (Yamatake) and GXL-N12F (SUNX), b-contact (NC) types are also available. Contact THK for details.

■Proximity Sensor: APM-D3A1-001 (Yamatake)

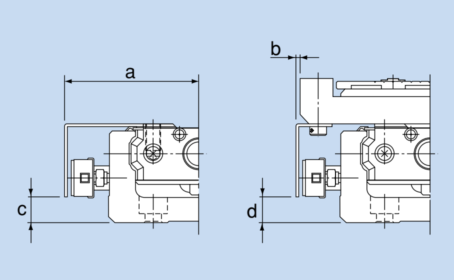
Unit: mm



Model No.	a	b	c	d
KR 15	27.8	–5.8	1.4	1.4
KR 20	32.5	6.6	6	6
KR 26	37.5	6.4	8	8
KR 30H	43.3	3.3	8.8	9
KR 33	42.5	–0.6	8.8	9
KR 45H	53.2	1.2	14	14
KR 46	55.4	–0.6	21.8	22
KR 55	62.4	0.4	22	22
KR 65	77.4	–7.5	25.1	25

■Proximity Sensor: GL-12F (SUNX), GXL-N12F (SUNX)

Unit: mm



Model No.	a	b	c	d
KR 30H	45	5	8.8	9
KR 33	44.5	1.5	8.8	9
KR 45H	54.8	2.8	13.8	14
KR 46	57.4	1.5	21.8	22
KR 55	63.5	1.5	22	22
KR 65	79	–6	25.1	25

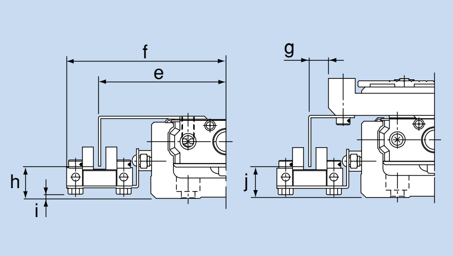
●Photo Sensor

	EE-SX671 (OMRON)	3 units
	EE-SX674 (OMRON)	3 units
Connector	EE-1001 (OMRON)	3 units

Note: The connector is a standard attachment to the photo sensor.

■Photo Sensor: EE-SX671 (OMRON)

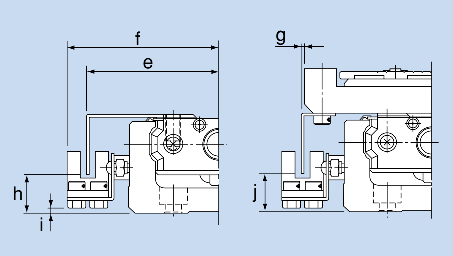
Unit: mm



Model No.	e	f	g	h	i	j
KR 30H	51.3	64.3	11.3	13.8	1.4	13.5
KR 33	50.8	63.7	7.8	12.8	1.6	13
KR 45H	61.2	74.2	9.3	18.3	6.4	18.5
KR 46	63.6	76.6	7.6	25.8	14.6	26
KR 55	70.7	83.5	8.6	24.5	13.6	25
KR 65	85.5	98.5	0.6	28.1	16.6	28

■Photo Sensor: EE-SX674 (OMRON)

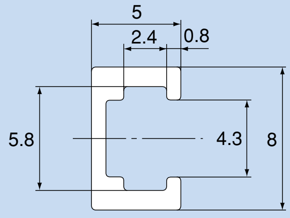
Unit: mm



Model No.	e	f	g	h	i	j
KR 30H	46.2	52.8	6.3	13.8	1.1	14
KR 33	43.9	50.3	0.9	12.8	1.6	13
KR 45H	56.2	62.7	4.2	19	6.1	19
KR 46	56.7	63.2	0.7	25.8	14.6	26
KR 55	63.8	70.1	1.8	24.5	13.6	25
KR 65	78.8	85.1	–6.2	28.1	16.6	28

●Sensor Rail

The sensor rail can be attached alone.



Sensor rail

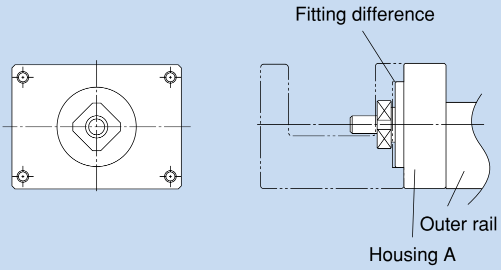
Housing

●Housing A

THK also offers Housing A for a separate motor and Turnaround Housing A as options in order to support a motor bracket or a turnaround section produced that the customer individually manufactures.

●Housing A for a Separate Motor

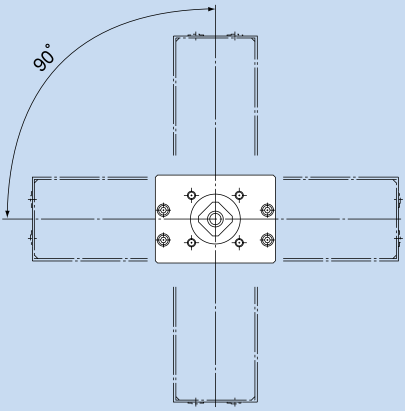
By using the fitting difference, the user can easily mount a separately manufactured motor bracket.



For detailed dimensions, see page 1-53 to 1-55.

●Turnaround Housing A

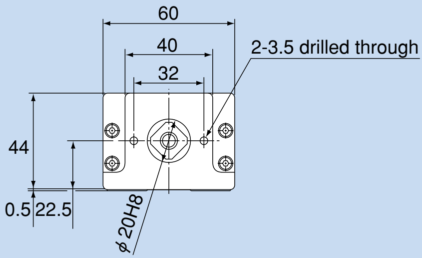
Since the mounting holes are drilled in constant pitches, the user can select how to mount the motor bracket.



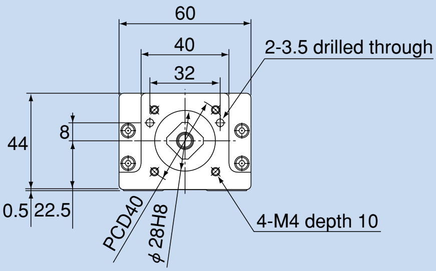
For detailed dimensions, see page 1-53 to 1-55.

For Model KR33

Housing A

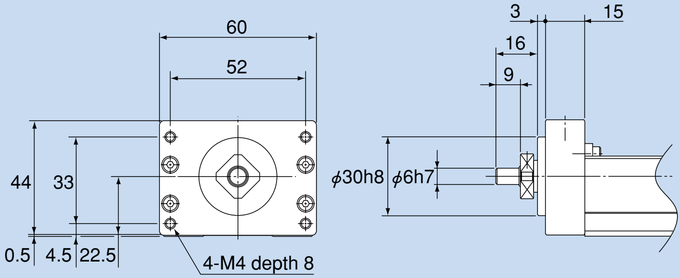


Administration number 1□



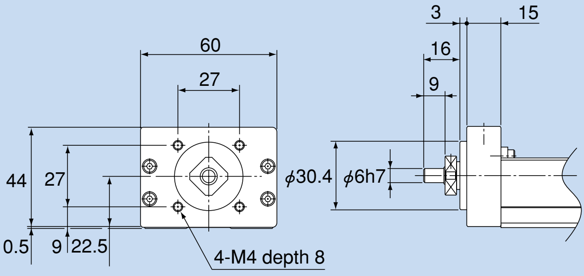
Administration number 5□

Housing A for a Separate Motor



Administration number 3□

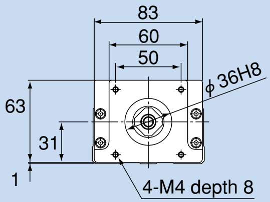
Turnaround Housing A



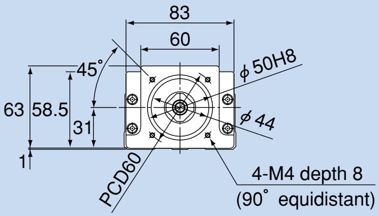
Administration number 4□

For Model KR46

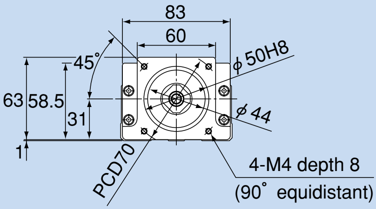
Housing A



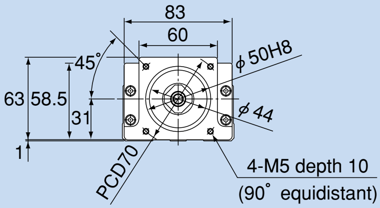
Administration number 1☐



Administration number 2☐

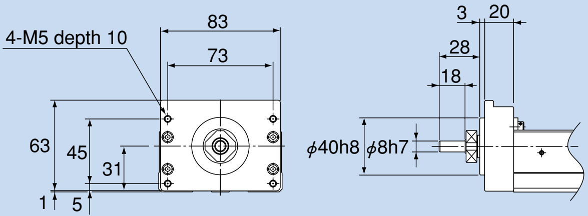


Administration number 3☐



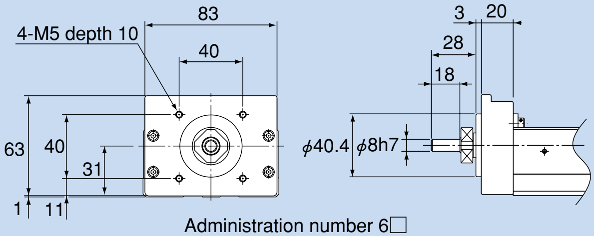
Administration number 4☐

Housing A for a Separate Motor



Administration number 5☐

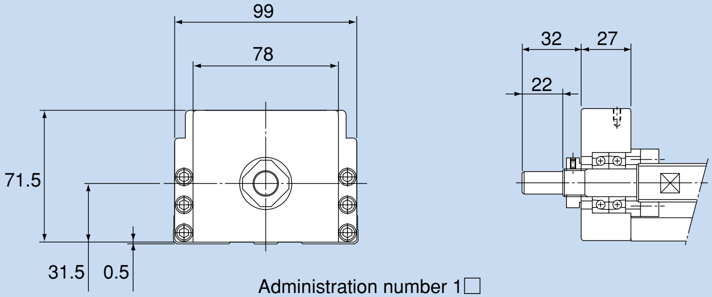
Turnaround Housing A



Administration number 6☐

■For Model KR55

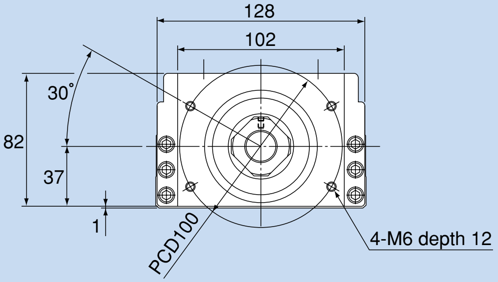
Turnaround Housing A



Administration number 1□

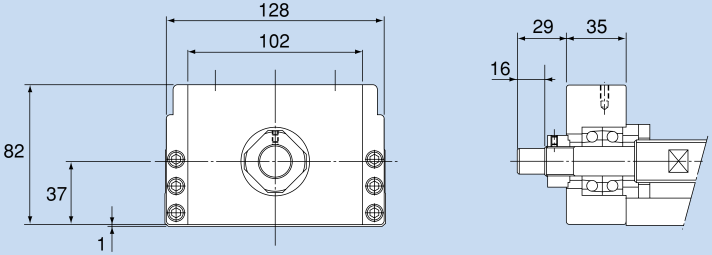
■For Model KR65

Housing A



Administration number 2□

Turnaround Housing A



Administration number 1□

Intermediate Flange

●Motors and Applicable Intermediate Flanges

Several types of intermediate flanges for mounting motors are available for model KR. Each intermediate flange model has an administration number according to the motor to be used and to the actuator model number. Specify the corresponding administration number when placing an order.

Table 8 Table of Motors Used and the Corresponding Flanges

Motor model No.					Model No. Flange angle	KR 15	KR 20	KR 26	KR 30H	KR 33	KR 45H	KR 46	KR 55	KR 65
AC servomotor	Yaskawa Electric	Σ-mini		SGMM-A1 (10W)	□25	0B	3N	0N	—	—	—	—	—	—
				SGMM-A2 (20W)		0B	3N	0N	—	—	—	—	—	—
				SGMM-A3 (30W)		—	3N	0N	—	—	—	—	—	—
		Σ-II		SGMAH-A3 (30W)	□40	—	0B	0B	0B	5H	0B	0F	—	—
				SGMAH-A5 (50W)		—	0B	0B	0B	5H	0B	0F	—	—
				SGMAH-01 (100W)		—	—	—	0B	5H	0B	0F	—	—
				SGMPH-01 (100W)	□60	—	—	—	—	—	0D	40	00	0A
				SGMAH-02 (200W)		—	—	—	—	—	0D	40	00	0A
				SGMAH-04 (400W)		—	—	—	—	—	0D	40	00	0A
				SGMPH-02 (200W)	□80	—	—	—	—	—	—	—	0B	00
				SGMPH-04 (400W)		—	—	—	—	—	—	—	0B	00
				SGMAH-08 (750W)		—	—	—	—	—	—	—	0B	0G
	Mitsubishi Electric	MELSERVO	J2-Jr	HC-AQ013 (10W)	□28	0A	3M	0M	—	—	—	—	—	—
				HC-AQ023 (20W)		0A	3M	0M	—	—	—	—	—	—
				HC-AQ033 (30W)		—	3M	0M	—	—	—	—	—	—
			J2 Super	HC-MFS053 (50W)	□40	—	0B	0B	0B	5H	0B	0F	—	—
				HC-MFS13 (100W)		—	—	—	0B	5H	0B	0F	—	—
				HC-MFS23 (200W)	□60	—	—	—	—	—	0D	40	00	0A
				HC-KFS23 (200W)		—	—	—	—	—	0D	40	00	0A
				HC-MFS43 (400W)		—	—	—	—	—	0D	40	00	0A
				HC-KFS43 (400W)		—	—	—	—	—	0D	40	00	0A
				HC-MFS73 (750W)	□80	—	—	—	—	—	—	—	0B	0G
				HC-KFS73 (750W)		—	—	—	—	—	—	—	0B	0G
	Matsushita Electric	μMINAS		MSM 5B (5W)	φ20	0C	0G	0G	—	—	—	—	—	—
				MSM 1A (10W)		0C	0G	0G	—	—	—	—	—	—
				MSM 2A (20W)		0C	0G	0G	—	—	—	—	—	—
		MINAS A		MSMA3A (30W)	□38	—	0A	0A	0A	5K	0A	0G	—	—
				MSMA5A (50W)		—	0A	0A	0A	5K	0A	0G	—	—
				MSMA01 (100W)		—	—	—	0A	5K	0A	0G	—	—
				MQMA01 (100W)	□60	—	—	—	—	—	0C	30	—	—
				MSMA02 (200W)		—	—	—	—	—	0C	30	—	—
				MSMA04 (400W)		—	—	—	—	—	0C	30	—	—
				MQMA02 (200W)	□80	—	—	—	—	—	—	—	0A	2B
				MQMA04 (400W)		—	—	—	—	—	—	—	0A	2B
				MSMA08 (750W)		—	—	—	—	—	—	—	0A	2B
	SANYO Electric	BL Super P3		P30B04003 (30W)	□40	—	0B	0B	0B	5H	0B	0F	—	—
				P30B04005 (50W)		—	0B	0B	0B	5H	0B	0F	—	—
				P30B04010 (100W)		—	—	—	0B	5H	0B	0F	—	—
				P30B06020 (200W)	□60	—	—	—	—	—	0D	40	00	0A
				P30B06040 (400W)		—	—	—	—	—	0D	40	00	0A
				P30B08075 (750W)	□80	—	—	—	—	—	—	—	0B	0G
	OMRON	OMNUC W		R88M-W03030 (30W)	□40	—	0B	0B	0B	5H	0B	0F	—	—
				R88M-W05030 (50W)		—	0B	0B	0B	5H	0B	0F	—	—
				R88M-W10030 (100W)		—	—	—	0B	5H	0B	0F	—	—
				R88M-W20030 (200W)	□60	—	—	—	—	—	0D	40	00	0A
				R88M-W40030 (400W)		—	—	—	—	—	0D	40	00	0A
				R88M-W75030 (750W)	□80	—	—	—	—	—	—	—	0B	0G
	Fanuc	βM series		βM0.2/4000 (50W)	□40	—	0B	0B	0B	5H	0B	0F	—	—
				βM0.3/4000 (100W)		—	—	—	0B	5H	0B	0F	—	—
				βM0.4/4000 (125W)	□60	—	—	—	—	—	0D	40	00	0A
				βM0.5/4000 (200W)		—	—	—	—	—	0D	40	00	0A
				βM1/4000 (400W)		—	—	—	—	—	0D	40	00	0A
Stepping motor	Oriental Motor	α Step		ASC3*	□28	0D	0F	0F	—	—	—	—	—	—
				AS 46 , ASC46	□42	—	0E	0E	XC	5I	—	—	—	—
				AS 6* , ASC66	□60	—	—	—	0E	5G	0F	10	—	—
				AS 9*	□85	—	—	—	—	—	—	—	0G	2F
		5 phase	UPK · WPMU	PMU33/35 (PMM33/35)	□28	0D	0F	0F	—	—	—	—	—	—
				PMC33/35 (PMM33/35)		0D	0F	0F	—	—	—	—	—	—
				UPK54* (PK54*)	□42	—	0E	0E	XC	5I	—	—	—	—
				UPK56* (PK56*)	□60	—	—	—	0E	5G	0F	10	—	—
				UPK59* (PK59*)	□85	—	—	—	—	—	—	—	0G	2F
		2 phase	UMK	UMK24* (PK24*)	□42	—	0E	0E	XC	5I	—	—	—	—
				UMK26* (PK26*)	□56.4	—	—	—	0D	5F	—	—	—	—

Note 1: The symbols in the table each indicate the last two digits of an administration number.

Note 2: Model KR15 has a limit in input torque. The permissible input torque for model KR1501 is 51 N-mm at a maximum and that for model KR1502 is 103 N-mm at a maximum. If the maximum torque of the motor mounted to model KR15 exceeds the permissible input torque, take a safety measure such as setting a torque limit.

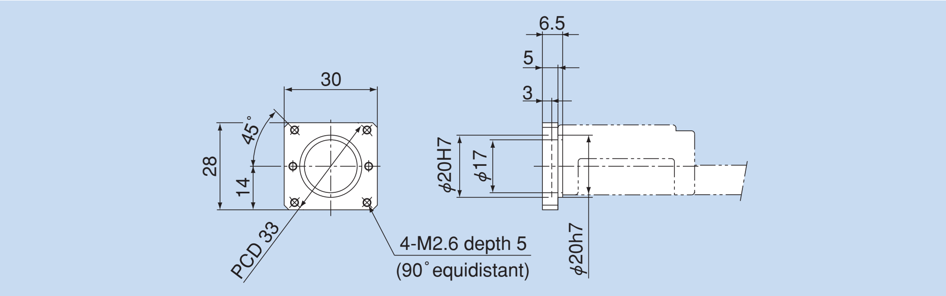
Note 3: Each intermediate flange is made of steel and provided with THK AP-C treatment, a surface treatment for high corrosion resistance.

●Dimensional Drawings of Intermediate Flanges

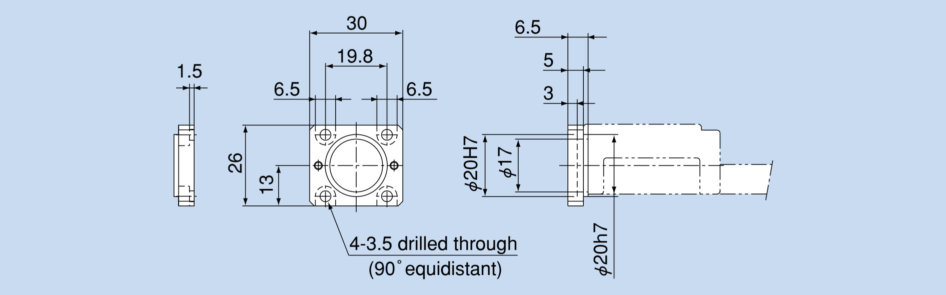
■For Model KR15

F□□-□	···Intermediate flange model number
□□	···Last two digits of administration number

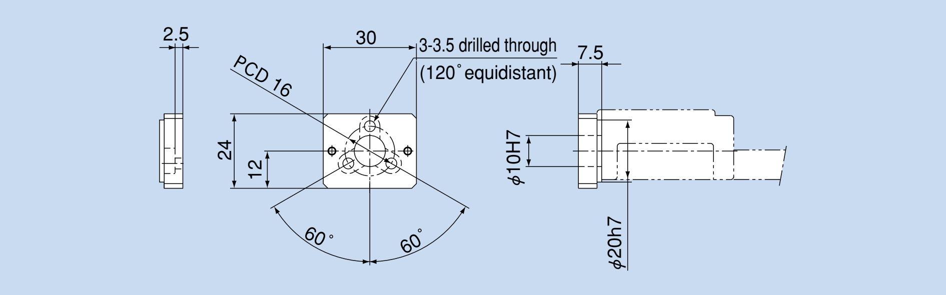
F15-A
0A



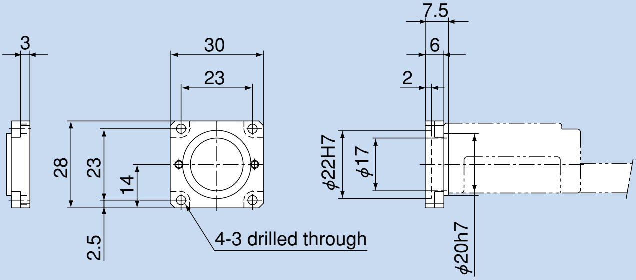
F15-B
0B



F15-C
0C



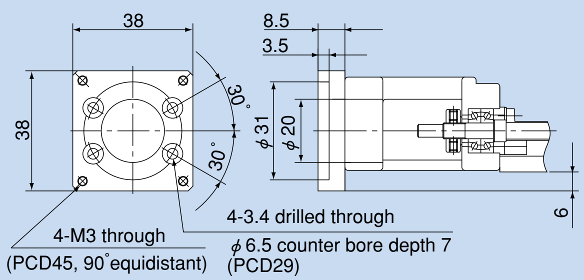
F15-D
0D



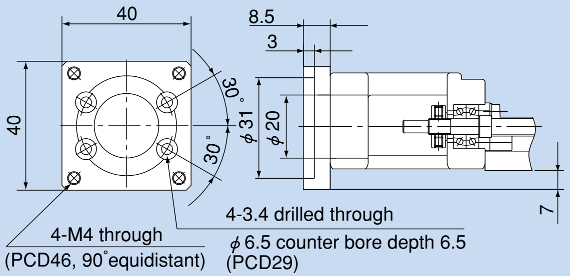
F□□-□ …Intermediate flange model number
□□ …Last two digits of administration number

For Model KR20

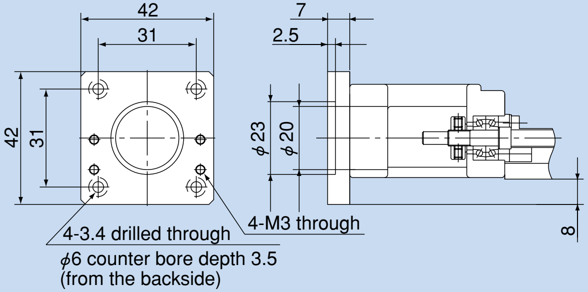
F20-A
0A



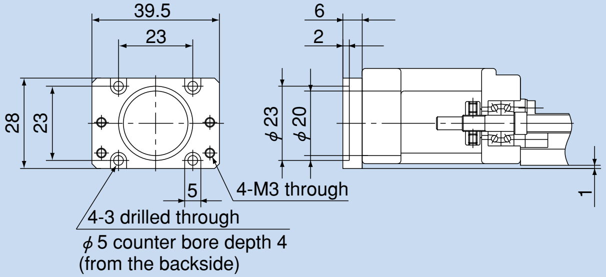
F20-B
0B



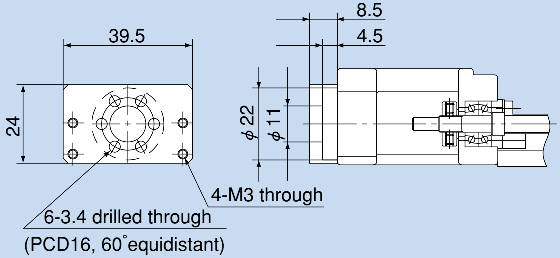
F20-E
0E



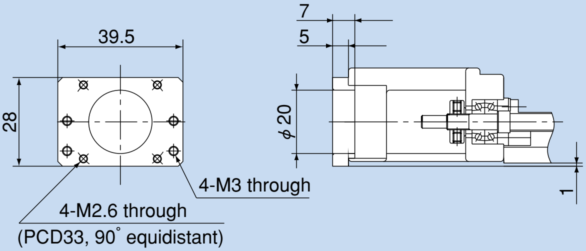
F20-F
0F



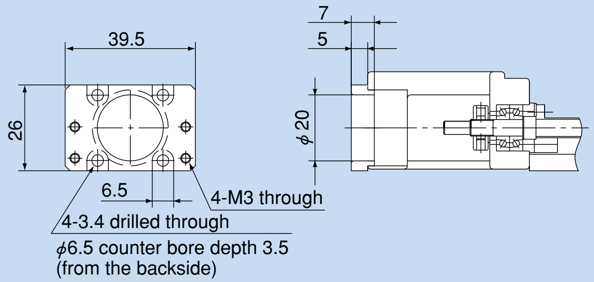
F20-G
0G



F20-M
3M



F20-N
3N

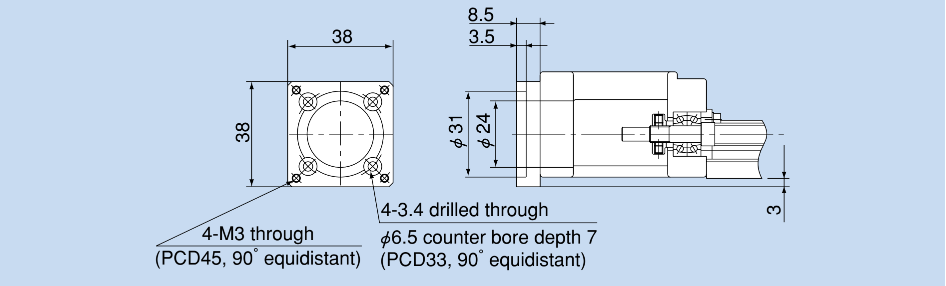


4-3.4 drilled through
ϕ6.5 counter bore depth 3.5
(from the backside)

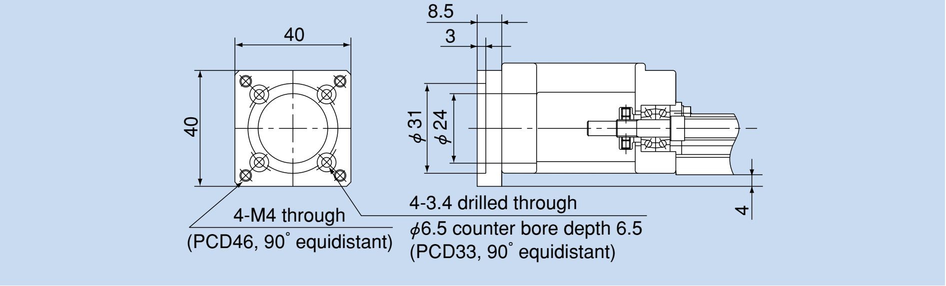
F□□-□	…Intermediate flange model number
□□	…Last two digits of administration number

■For Model KR26

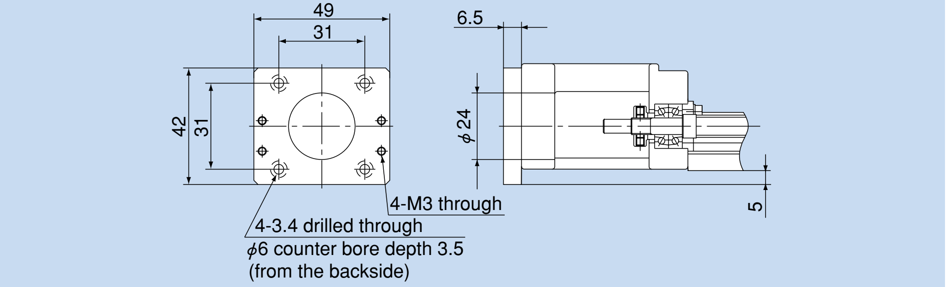
F26-A
0A



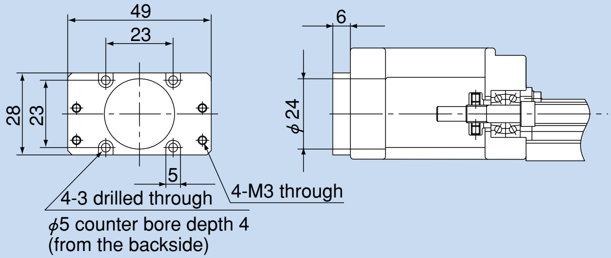
F26-B
0B



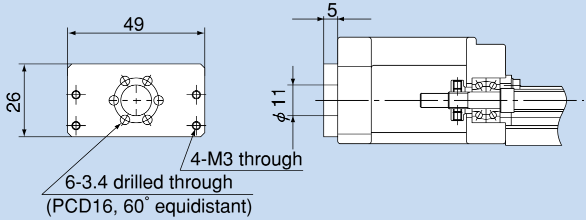
F26-E
0E



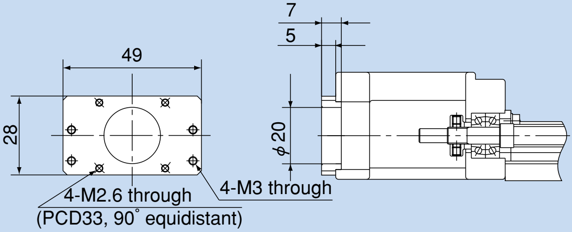
F26-F
0F



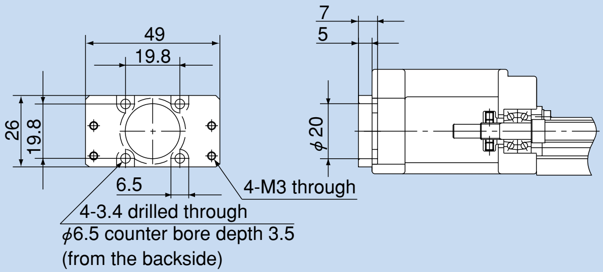
F26-G
0G



F26-M
0M



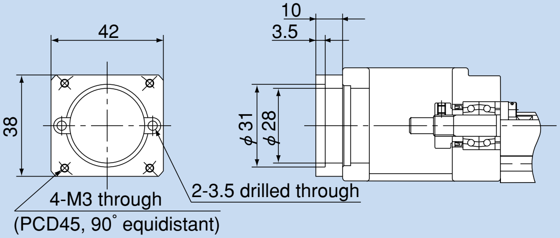
F26-N
ON


49
19.8
26
19.8
6.5
4-M3 through
4-3.4 drilled through
ϕ6.5 counter bore depth 3.5
(from the backside)
7
5
ϕ20

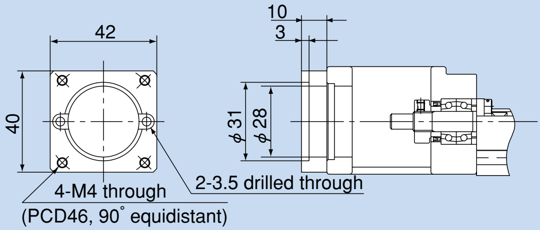
F□□-□ …Intermediate flange model number
□□ …Last two digits of administration number

For Model KR30H

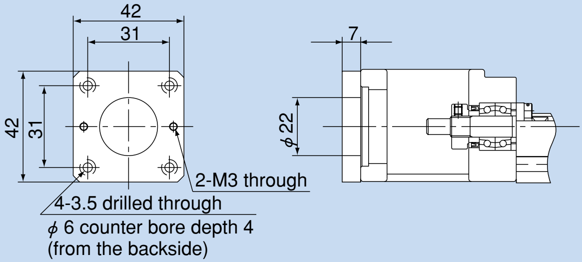
F30-A
0A



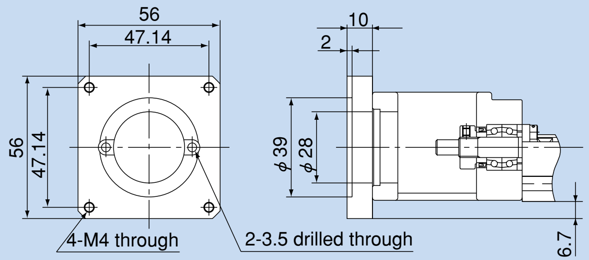
F30-B
0B



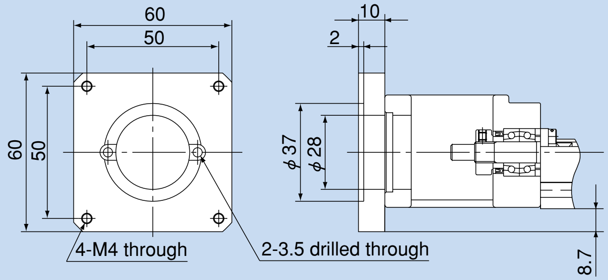
F30-C
XC



F30-D
0D



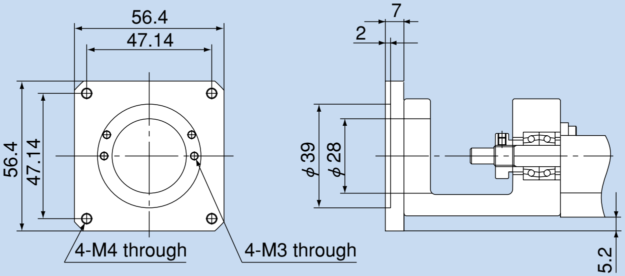
F30-E
0E



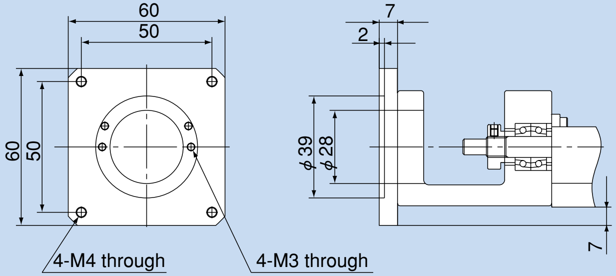
For Model KR33

F□□-□	…Intermediate flange model number
□□	…Last two digits of administration number

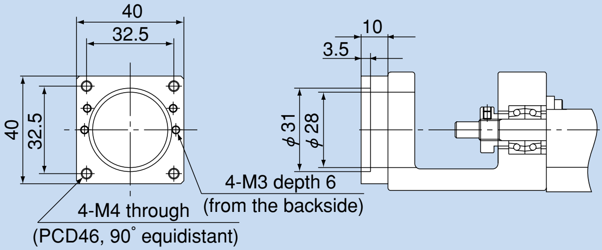
F33-F
5F



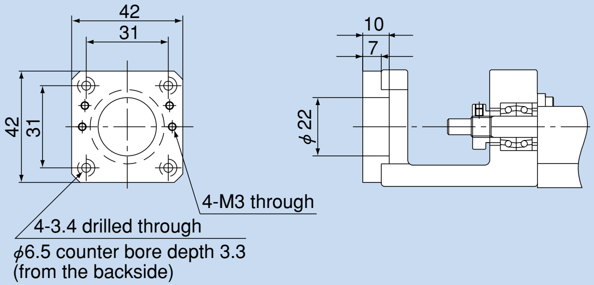
F33-G
5G



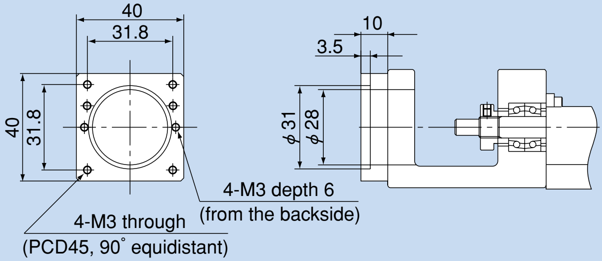
F33-H
5H



F33-I
5I



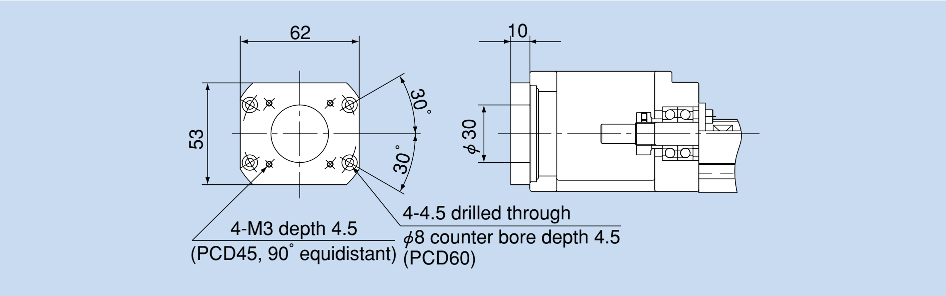
F33-K
5K



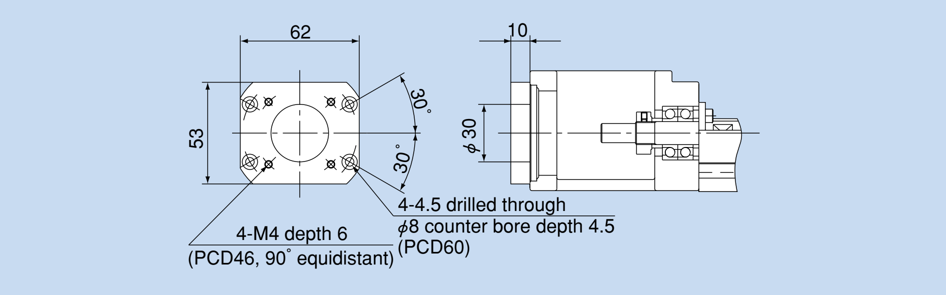
F□□-□ …Intermediate flange model number
□□ …Last two digits of administration number

For Model KR45H

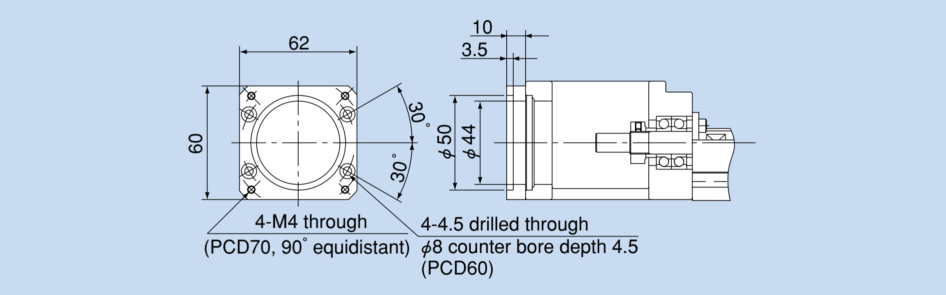
F45-A
0A



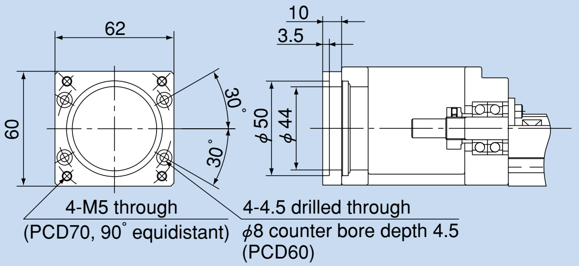
F45-B
0B



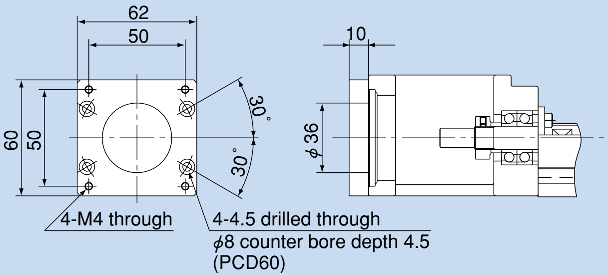
F45-C
0C



F45-D
OD



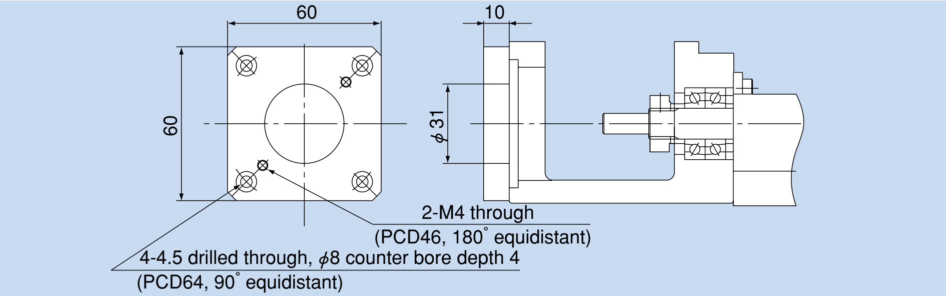
F45-F
OF



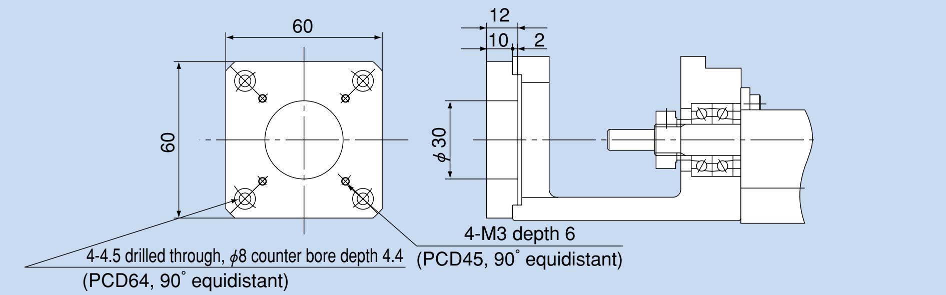
F□□-□	…Intermediate flange model number
□□	…Last two digits of administration number

For Model KR46

F46-F
0F



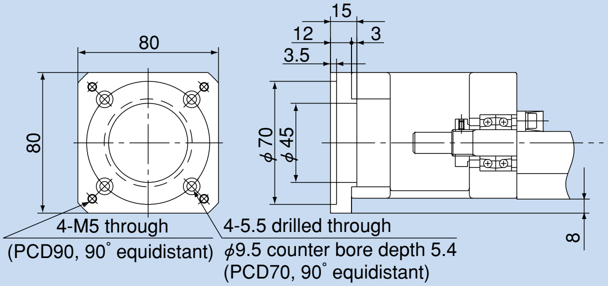
F46-G
0G



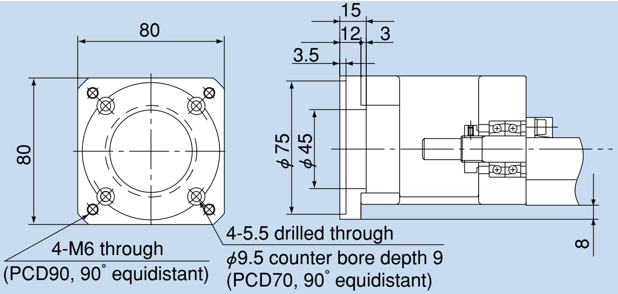
F□□-□	…Intermediate flange model number
□□	…Last two digits of administration number

■For Model KR55

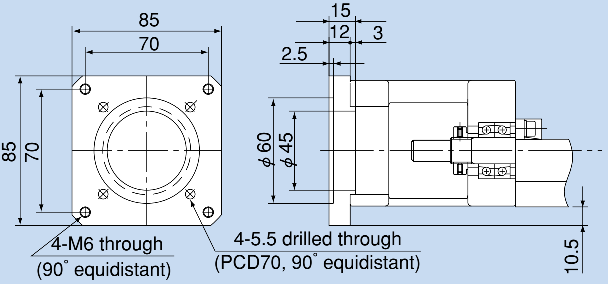
F55-A
0A



F55-B
0B



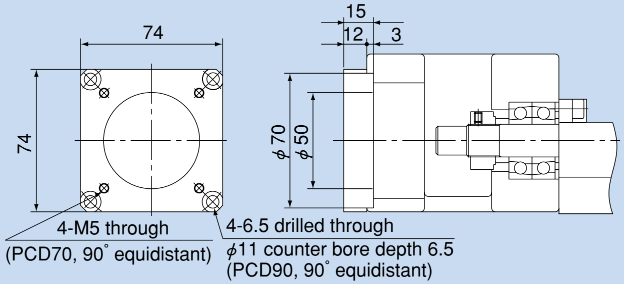
F55-G
0G



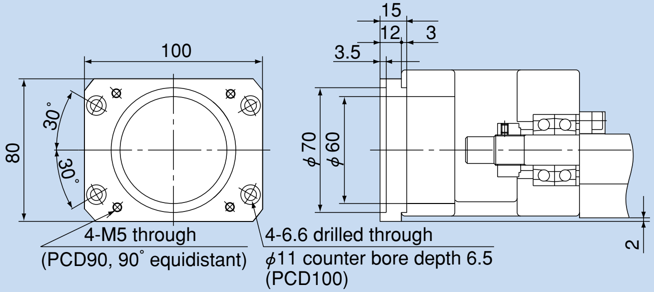
F□□-□	…Intermediate flange model number
□□	…Last two digits of administration number

■For Model KR65

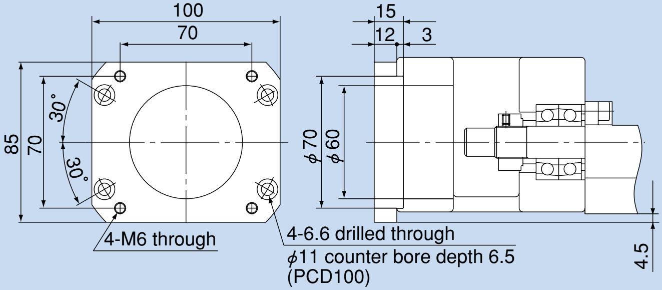
F65-A
0A



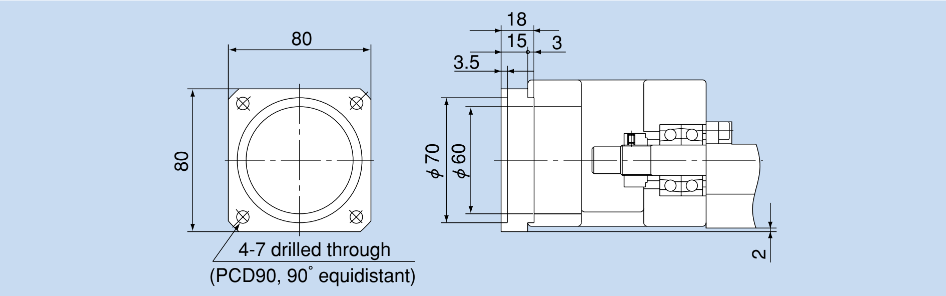
F65-B
2B



F65-F
2F



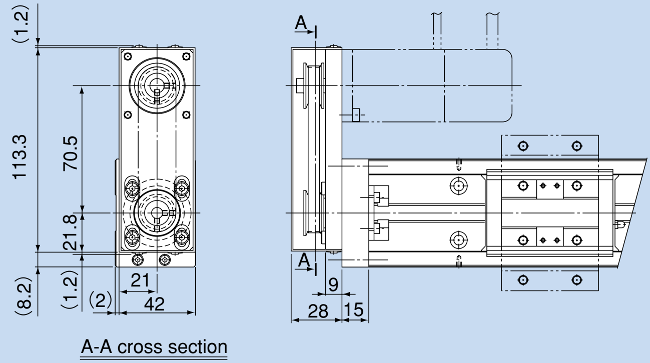
F65-G
OG


80
80
4-7 drilled through
(PCD90, 90˚ equidistant)
18
15
3
3.5
ϕ70
ϕ60
2

Motor Turnaround Type

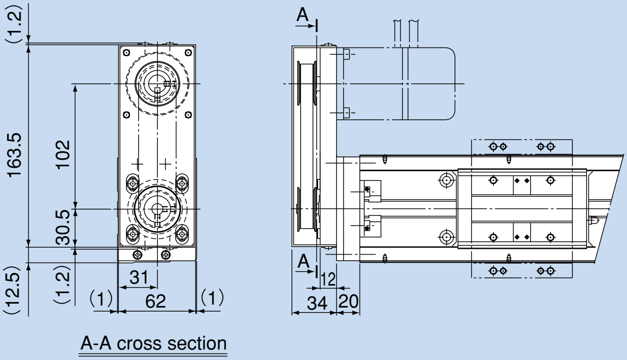
For model KR, motor turnaround types are also available as options for purposes such as minimizing the longitudinal dimensions (pulley ratio: 1:1)

●Example of Motor Turnaround with Model KR33



A-A cross section

●Example of Motor Turnaround with Model KR46



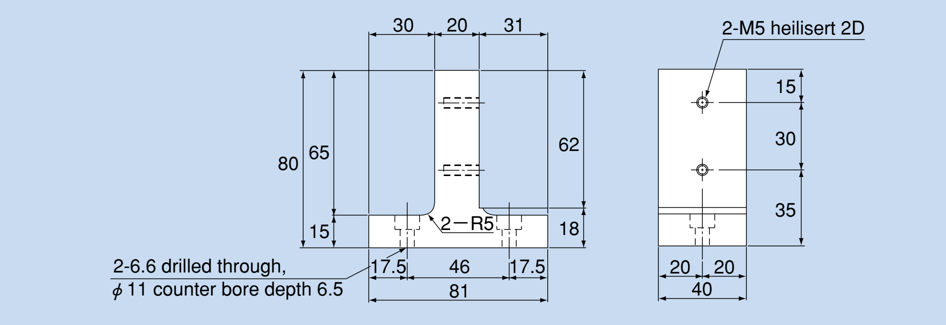
A-A cross section

Note: The specifications vary according to the motor. Contact THK for details.

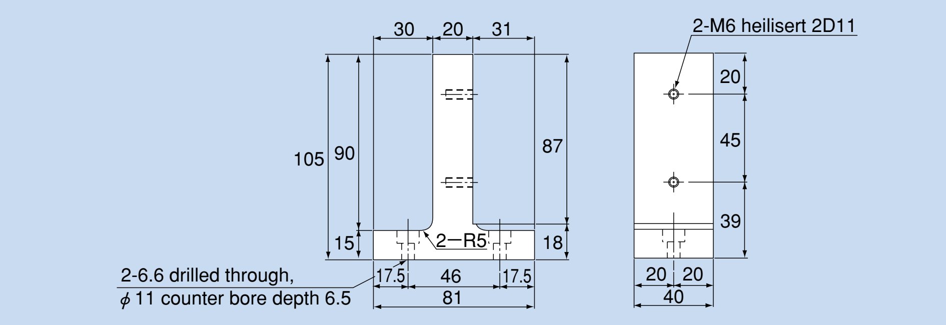
XY Bracket

Brackets for installing LM Guide Actuator model KR are standardized. The brackets use aluminum to reduce the weights and keep the inertia as low as possible.

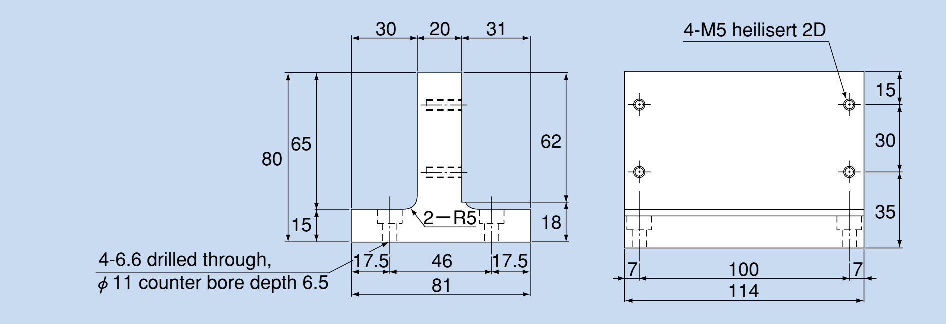
■KR-008XS (for Model KR33, Single-Shaft Type)



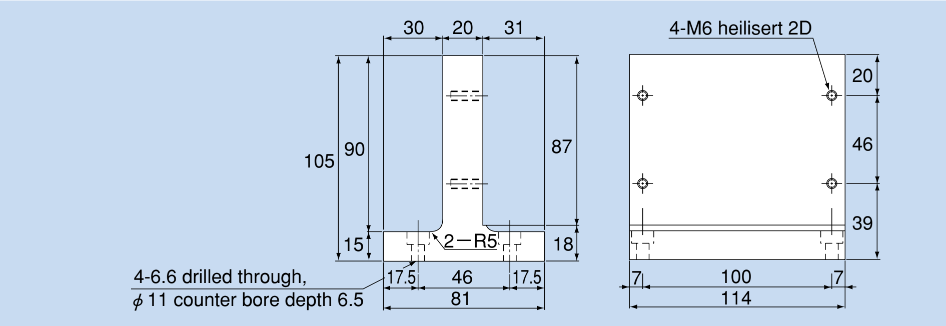
■KR-008XL (for Model KR46, Single-Shaft Type)



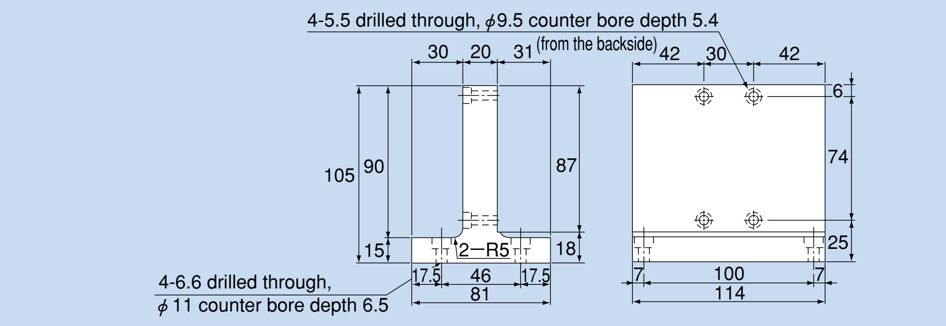
■KR-003XS (for Model KR33, LM Rail Fixed)



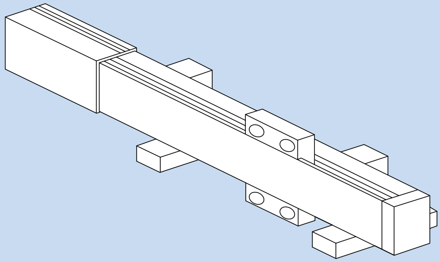
■KR-003XL (for Model KR46, LM Rail Fixed)

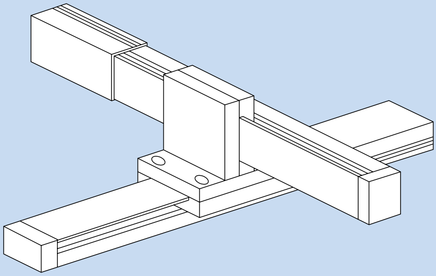


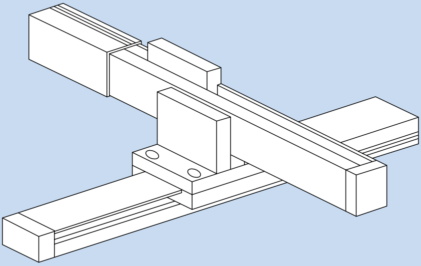
■KR-002XS (for Model KR33, Slider Fixed)



●Examples of Combinational Use


For single shaft


Slider fixed


Rail fixed

Precautions on Using the LM Guide Actuator Model KR

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Dropping or hitting model KR may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, contact THK in advance.
(6) To maximize the performance of model KR, lubrication is required. Using the product without lubrication may increase wear of the rolling elements or shorten the service life.
In normal use, the lubricant must be replenished every 100 km as a guide. However, the greasing interval varies according to the service conditions. We recommend determining the greasing interval based on the result of the initial inspection.

Recommended grease:	KR15:	THK AFF Grease
	KR20, 26:	THK AFA Grease
	KR30H to 65:	THK AFB-LF Grease

For clean room applications, low dust-generative AFF Grease is available. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball circulating component or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) When planning to use the product in an environment where the coolant penetrates the nut block, contact THK in advance.
(3) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.
(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product. For the type of the detergent to be used, contact THK .
(5) Exceeding the permissible rotation speed may lead the components to be damaged or cause an accident. The rotation speed during operation must be within the THK specifications.
(6) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Storage

When storing model KR, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

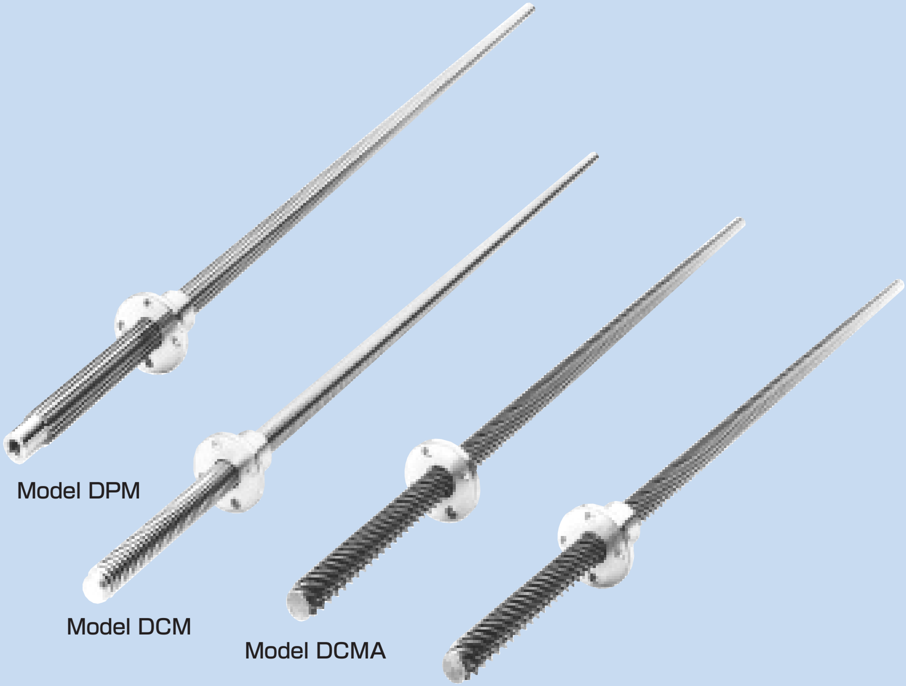


Fig. 1 Structure of the Slide Series Models

Structure and Features

The Slide Series are highly accurate, low price products that use a high-strength zinc alloy with high wear resistance and are formed by die-cast molding.
Since each model has a precision-machined shaft as the core and teeth are formed around it, the products are of high accuracy and of little unevenness in accuracy. Therefore, the teeth shapes match that of the corresponding dedicated spline shafts or screw shafts, and the backlash and axial clearance are kept minimum. As a result, the shafts and the nuts of this series are superbly interchangeable.

●Increased Wear Resistance, High Durability

Each tooth between the dedicated spline shaft and screw shaft has a large contact area, and the smooth surface of the ground or precision-ground or rolled core is transferred without change. Thus, high wear resistance and stable performance are achieved.

Types and Features

Spline Nut Models DPM and DP

Model DPM Model DP

A combination of a spline nut, made of a highly wear resistant zinc alloy with high strength and molded by die-casting, and a precision-rolled spline shaft, achieves smooth linear motion and torque transmission.

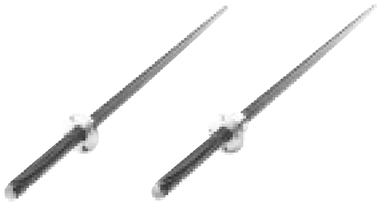
Screw Nut Models DCM and DC

Model DCM Model DC

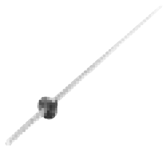
These screw nuts have 30° trapezoidal threads. The high-performance feed screws achieve a 50% cost reduction from the conventional machined type by combining a die-cast molded screw nut and a highly accurate rolled screw shaft.

THK also manufactures small, wear resistant screw nuts made of oil-impregnated plastics at your request. Contact THK for details.

Change Nut Models DCMA and DCMB



Models DCMA and DCMB



Miniature Change Nut Model DCMB-T

These models are capable of converting linear motion to rotary motion, or vise versa, at 70% efficiency. They easily generate a torque as their multi-thread screws are pressed using a cylinder or the like. They are optimal also for fast feed mechanisms.

Oil-impregnated plastic miniature Change Nut model DCMB-T is optimal for a high-speed, small feed mechanism.

Features of the Dedicated Rolled Shafts

Dedicated rolled shafts with standardized lengths are available for the Slide Series models.

●Increased Wear Resistance

The shaft teeth are formed by cold gear rolling, and the surface of the teeth are hardened to over 250 HV and mirror-finished. As a result, the shafts are highly wear resistant and achieve significantly smooth motion when used in combination with nuts.

●Improved Mechanical Properties

Inside the teeth of the rolled shaft, a fiber flow occurs along the contour of the teeth of the shaft, making the structure around the teeth roots dense. As a result, the fatigue strength is increased.

●Additional Machining of the Shaft End Support

Since each shaft is rolled, additional machining of the support bearing of the shaft end can easily be performed by lathing or milling.

High-strength Zinc Alloy

The high-strength zinc alloy used in the spline nuts, screw nuts and change nuts is a material that is highly resistant to seizure and wear and has a high load carrying capacity. Its composition, mechanical properties, physical properties and wear resistance are given below.

Composition

Table 1 Composition of the High-strength Zinc Alloy

Unit: %

Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

Mechanical Properties

Tensile strength:	275 to 314 N/mm^2
Tensile yield strength (0.2%):	216 to 245 N/mm^2
Compressive strength:	539 to 686 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Fatigue strength:	132 $N/mm^2 \times 10^7$ (Schenck bending test)
Charpy impact strength:	0.098 to 0.49 N·m/mm^2
Elongation:	1 to 5 %
Hardness:	120 to 145 HV

Physical Properties

Specific gravity:	6.8
Specific heat:	460 J/(kg·K)
Melting point:	390 ℃
Thermal-expansion coefficient:	24×10^{-6}

Wear Resistance

Amsler wear-tester

Test piece rotation speed:	185 min^{-1}
Load:	392 N
Lubricant:	Dynamo oil

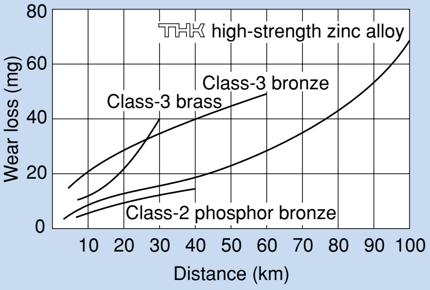


Fig. 2 Wear Resistance of the High-strength Zinc Alloy

Fit

For the fitting between the nut circumference and the housing, we recommend clearance fitting or tight fitting.
Housing inner-diameter tolerance: H8 or J8

Lubrication

Select a lubrication method according to the service conditions of the nut.

●Oil Lubrication

For the lubrication of the nut, oil lubrication is recommended. Specifically, oil-bath lubrication or drop lubrication is particularly effective. Oil-bath lubrication is the most appropriate method since it meets harsh conditions such as high speed, heavy load or external heat transmission and it cools the nut. Drop lubrication suits low- to medium-speed and a light- to medium-load. Select a lubricant according to the service conditions as indicated in table 2.

Table 2 Selection of a Lubricant

Service conditions	Type of lubricant
Low speed, heavy load, high temperature	High-viscosity sliding surface oil or turbine oil
High speed, light load, low temperature	Low-viscosity sliding surface oil or turbine oil

●Grease Lubrication

In low-speed feed, which occurs less frequently, the user can lubricate the slide system by manually applying grease to the shaft on a regular basis or using the greasing hole on the nut. We recommend lithium soap group grease No. 2.

●Initial Lubrication of the Miniature Change Nut

Since the Miniature Change Nut is made of oil-impregnated plastics, it can be used without lubrication during operation. For the initial lubrication, use oil or grease. Note, however, that lubricants containing much extreme pressure agent are not suitable.

Accuracy Standards

Table 3 Accuracy of the Screw Shaft of Models DCM and DC

Unit: mm

Shaft symbol / Accuracy	Rolled shaft	Cut shaft	Ground shaft
	T*	K*	G*
Single pitch error (max)	±0.020	±0.015	±0.005
Accumulated pitch error (max)	±0.15/300	±0.05/300	±0.015/300

Note: Symbols T, K and G indicate machining methods for the screw shaft. The cut shafts and ground shafts are build-to-order.

Table 4 Accuracy of the Screw Shaft of Models DCMA and DCMB

Unit: mm

Shaft symbol / Accuracy	Rolled shaft
	T*
Single pitch error (max)	±0.025
Accumulated pitch error (max)	±0.2/300

Note: Symbol T indicates the machining method for the screw shaft.

Installation

●Chamfer Dimensions of the Housing's Mouth

To increase the strength of the root of the flange of the nut, the corner is machined to have an R shape. Therefore, it is necessary to chamfer the inner edge of the housing's mouth.

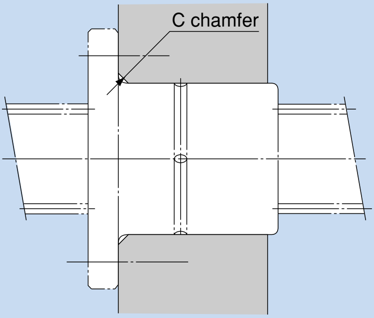


Fig. 3

Table 5 Dimensions of the Chamfer of the Housing's Mouth

Unit: mm

Model No.			Chamfer of the mouth C (minimum)
DPM	DCM	DCMA DCMB	
—	—	8	1.2
		12	1.5
12	12	15	2
15	14	17	
17	16	20	
20	18		
	20		
25	22	25	2.5
30	25	30	
	28		
	32		
35	36	35	3
40	40	40	
45	45	45	
50	50	50	

●Recommended Mounting Orientation

When vertically conveying a heavy object using the screw shaft, it is safe to mount the screw as shown in Fig. 4 where supports are provided on the mounting holes to prevent the moving object will not fall even if the screw nut is broken due to overload or impact (applied to models DCM, DCMA and DCMB).

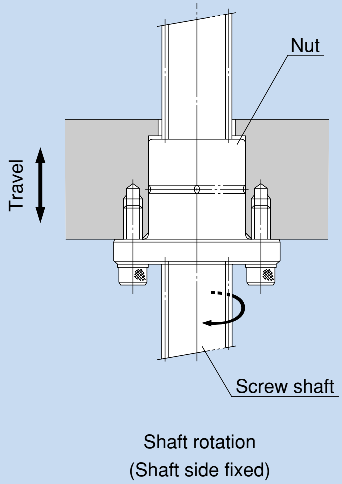


Fig. 4 Recommended Mounting Orientation

●Examples of Mounting the Nut

Fig. 5 shows examples of mounting the nuts. When mounting a screw nut or a change nut, secure sufficient tightening strength in the axial direction. For the housing inner-diameter tolerance, see the section concerning fitting on page m-7.

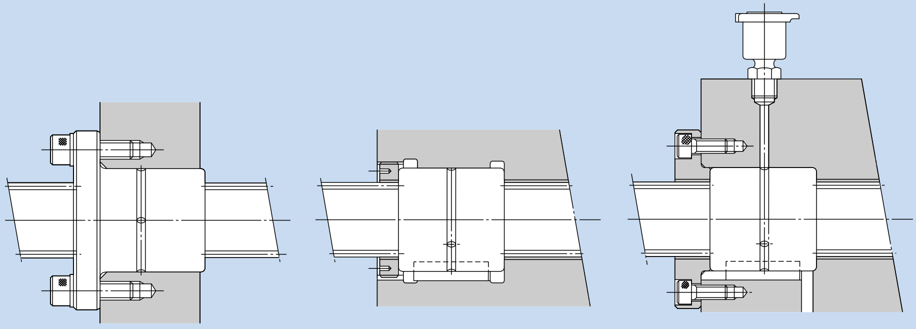
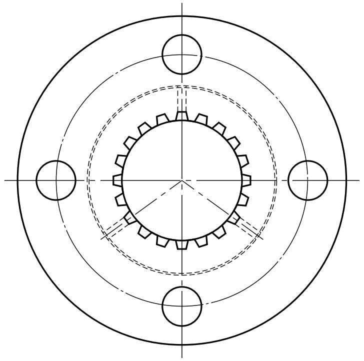
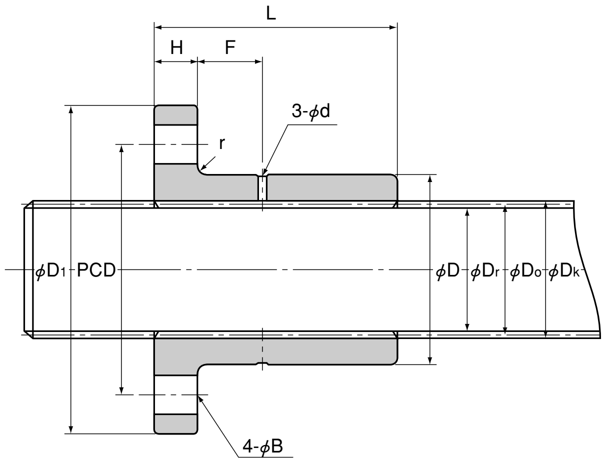


Fig. 5 Examples of Mounting the Nut

Model DPM





Unit: mm

Spline nut model No.	Outer dimensions: Outer diameter D	Outer diameter Tolerance h9	Length L	Spline nut dimensions: Flange diameter D_1	H	B	PCD	r	F	d	Spline shaft model No.	Spline details: Pitch diameter D_0	Major diameter D_k	Minor diameter D_r	No. of teeth Z	Standard shaft length	Maximum shaft length	Dynamic permissible torque T(note) N·m	Mass: Spline nut g	Mass: Spline shaft kg/m
DPM 1220	22	0 −0.052	20	44	6	5.4	31	1.5	7	1.5	SS 12	12	12.8	10.9	16	1500	1500	17.6	80	0.9
DPM 1230			30															26.5	90	
DPM 1520	22		20	44	6	5.4	31	1.5	7	1.5	SS 15	15	16.1	13.5	16	1500	2000	30.4	70	1.4
DPM 1530			30															46.1	80	
DPM 1723	28		23	51	7	6.6	38	1.5	8	1.5	SS 17	17	18.2	15.4	16	1500	2000	43.1	120	1.7
DPM 1735			35															65.7	150	
DPM 2028	32	0 −0.062	28	56	7	6.6	42	1.5	10.5	1.5	SS 20	20	21.5	18.3	16	1500	3200	70.6	160	2.5
DPM 2040			40															100	200	
DPM 2536	36		36	61	8	6.6	47	2	14	2	SS 25	25	26.9	22.6	16	1500	3200	152	220	3.8
DPM 2550			50															211	270	
DPM 3040	44		40	76	10	9	58	2	15	2	SS 30	30	31.8	28.2	20	1500	3200	212	400	5.5
DPM 3056			56															297	480	
DPM 3544	52	0 −0.074	44	84	10	9	66	2.5	17	2.5	SS 35	35	37.1	32.8	20	1500	3200	325	560	7.5
DPM 3560			60															443	670	
DPM 4050	58		50	98	12	11	76	2.5	19	3	SS 40	40	42.4	37.5	20	1500	3200	480	830	9.8
DPM 4068			68															673	970	
DPM 4555	64		55	104	12	11	80	2.5	21.5	3	SS 45	45	47.7	42.1	20	1500	3200	680	980	12.4
DPM 4575			75															927	1110	
DPM 5060	68		60	109	12	11	85	2.5	24	3.5	SS 50	50	53	46.8	20	1500	3200	910	1080	15.4
DPM 5080			80															1220	1290	

Note The dynamic permissible torque (T) indicates the torque at which the contact surface pressure on the spline teeth is 9.8 N/mm².
Rotational clearance: α≦20′ MAX

Model number coding

Combination of spline nut and spline shaft

2 DPM2040 +360L

1 2 3

1 Number of spline nuts used on the same shaft 2 Model No. of spline nut

3 Overall spline shaft length (in mm)

Model number coding

Spline shaft

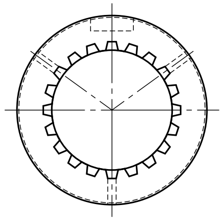
SS20 +360L

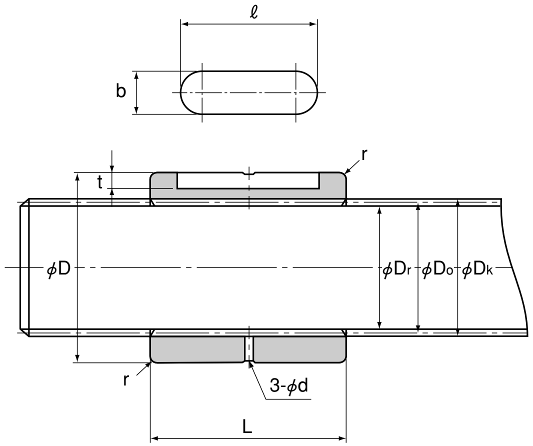
1 2

1 Model number of spline shaft

2 Overall spline shaft length (in mm)

Model DP





Unit: mm

Spline nut model No.	Outer dimensions			Spline nut dimensions						Spline shaft model No.	Spline details				Standard shaft length	Maximum shaft length	Dynamic permissible torque T(note) N·m	Mass	
	Outer diameter		L	Keyway dimensions							Pitch diameter D_0	Major diameter D_k	Minor diameter D_r	No. of teeth Z				Spline nut g	Spline shaft kg/m
	D	Tolerance h9	0 −0.3	b	Tolerance N9	t	ℓ	d	r										
DP 12	22	0 –0.052	22	4	0 –0.030	2	16	1.5	1	SS 12	12	12.8	10.9	16	1500	1500	19.6	40	0.9
DP 15	22		22	4		2	16	1.5	1	SS 15	15	16.1	13.5	16	1500	2000	33.3	30	1.4
DP 17	28		26	5		2.5	18	1.5	1	SS 17	17	18.2	15.4	16	1500	2000	48	65	1.7
DP 20	32	0 –0.062	31	7	0 –0.036	2.5	22	1.5	1	SS 20	20	21.5	18.3	16	1500	3200	77.5	100	2.5
DP 25	36		40	7		2.5	26	2	1	SS 25	25	26.9	22.6	16	1500	3200	169	135	3.8
DP 30	44		45	10		4	32	2	1.5	SS 30	30	31.8	28.2	20	1500	3200	238	230	5.5
DP 35	52	0 –0.074	49	12	0 –0.043	4.5	40	2.5	1.5	SS 35	35	37.1	32.8	20	1500	3200	362	360	7.5
DP 40	58		57	15		5	42	3	1.5	SS 40	40	42.4	37.5	20	1500	3200	547	510	9.8
DP 45	64		62	15		5	48	3	1.5	SS 45	45	47.7	42.1	20	1500	3200	767	640	12.4
DP 50	68		67	15		5	52	3.5	1.5	SS 50	50	53	46.8	20	1500	3200	1020	710	15.4

Note The dynamic permissible torque (T) indicates the torque at which the contact surface pressure on the spline teeth is 9.8 N/mm².
Rotational clearance: α≦20′ MAX

Model number coding

Combination of spline nut and spline shaft

2 DP20 +360L

1 2 3

1 Number of spline nuts used on the same shaft 2 Model No. of spline nut
3 Overall spline shaft length (in mm)

Model number coding

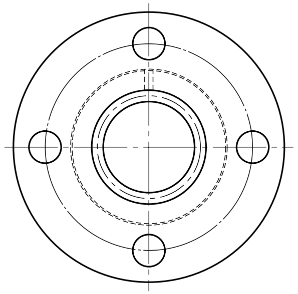
Spline shaft

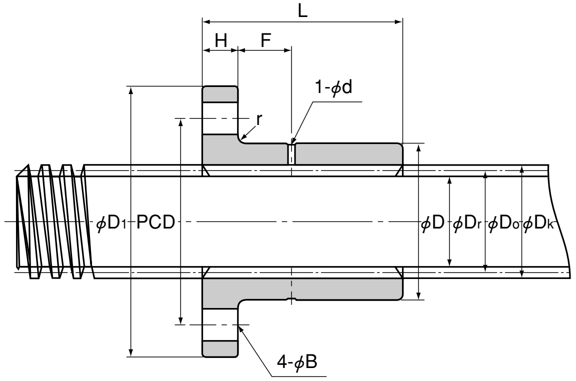
SS20 +360L

1 2

1 Model number of spline shaft
2 Overall spline shaft length (in mm)

Model DCM

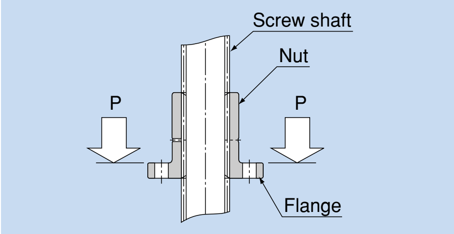




Unit: mm

Screw nut model No.	Outer dimensions Outer diameter D	Tolerance h9	Length L	Screw nut dimensions Flange diameter D_1	H	B	PCD	r	F	d	Screw shaft model No.(note)	Screw shaft details Outer diameter D_k	Effective diameter D_o	Thread minor diameter D_r	Lead R	Lead angle α	Standard shaft length	Max shaft length	Dynamic permissible thrust F(note) N	Static permissible load of the flange P(note) N	Mass Screw nut g	Screw shaft kg/m
DCM 12	22	0 –0.052	30	44	6	5.4	31	1.5	7	1.5	CS 12	12	11	9.5	2	3°19′	1000	1500	3920	20200	100	0.8
DCM 14	22		30	44	6	5.4	31	1.5	7	1.5	CS 14	14	12.5	10.5	3	4°22′	1000	1500	4900	16900	85	1
DCM 16	28		35	51	7	6.6	38	1.5	8	1.5	CS 16	16	14.5	12.5	3	3°46′	1000	1500	6670	31500	160	1.3
DCM 18	32	0 –0.062	40	56	7	6.6	42	1.5	10.5	2	CS 18	18	16	13.5	4	4°33′	1000	2000	8730	42000	230	1.6
DCM 20	32		40	56	7	6.6	42	1.5	10.5	2	CS 20	20	18	15.5	4	4°03′	1500	2000	9800	37200	210	2
DCM 22	36		50	61	8	6.6	47	2	14	2.5	CS 22	22	19.5	16.5	5	4°40′	1500	2500	12400	48600	320	2.3
DCM 25	36		50	61	8	6.6	47	2	14	2.5	CS 25	25	22.5	19.5	5	4°03′	1500	3000	14200	39800	290	3.1
DCM 28	44		56	76	10	9	58	2	15	2.5	CS 28	28	25.5	22.5	5	3°34′	2000	3000	17900	69200	550	4
DCM 32	44		56	76	10	9	58	2	15	2.5	CS 32	32	29	25.5	6	3°46′	2000	4000	21100	54200	490	5.2
DCM 36	52	0 –0.074	60	84	10	9	66	2.5	17	3	CS 36	36	33	29.5	6	3°19′	2000	4000	25800	84500	670	6.7
DCM 40	58		70	98	12	11	76	2.5	19	3	CS 40	40	37	33.5	6	2°57′	2000	4000	33800	106000	980	8.4
DCM 45	64		75	104	12	11	80	2.5	21.5	4	CS 45	45	41	36.5	8	3°33′	3000	5000	42100	125000	1310	10.4
DCM 50	68		80	109	12	11	85	2.5	24	4	CS 50	50	46	41.5	8	3°10′	3000	5000	50100	128000	1430	13

Note Cut shafts (K) and ground shafts (G) are build-to-order.
The dynamic permissible thrust (F) indicates the torque at which the contact surface pressure on the screw teeth is 9.8 N/mm².
The static permissible load (P) of the flange indicates the strength of the flange against the load as shown in the figure on the right.



Model number coding

Combination of screw nut and screw shaft

2 DCM20 +360L T
1 2 3 4

1 Number of screw nuts used on the same shaft 2 Model No. of screw nut
3 Overall screw shaft length (in mm) 4 How the screw shaft is processed (T: rolled shaft)

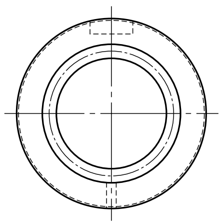
Model number coding

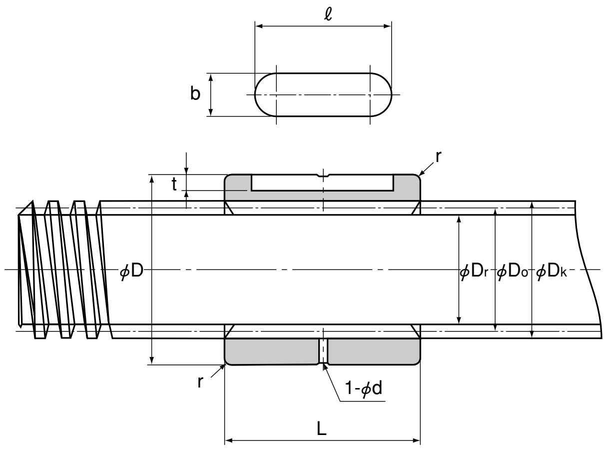
Screw shaft

CS20 T +360L
1 2 3

1 Model number of screw shaft 2 How the screw shaft is processed (T: rolled shaft)
3 Overall screw shaft length (in mm)

Model DC





Unit: mm

Screw nut model No.	Outer dimensions			Screw nut dimensions						Screw shaft model No.(note)	Screw shaft details					Standard shaft length	Max shaft length	Dynamic permissible thrust F(note) N	Mass	
	Outer diameter		L	Keyway dimensions															Screw nut g	Screw shaft kg/m
	D	Tolerance h9	0 −0.3	b	Tolerance N9	t	ℓ	d	r		Outer diameter Dk	Effective diameter Do	Thread minor diameter Dr	Lead R	Lead angle α					
DC 12	22	0 −0.052	22	4	0 −0.030	2	16	1.5	1	CS 12	12	11	9.5	2	3°19′	1000	1500	2840	40	0.8
DC 14	22		22	4		2	16	1.5	1	CS 14	14	12.5	10.5	3	4°22′	1000	1500	3630	45	1
DC 16	28		26	5		2.5	18	1.5	1	CS 16	16	14.5	12.5	3	3°46′	1000	1500	4900	75	1.3
DC 18	32	0 −0.062	31	7	0 −0.036	2.5	22	2	1	CS 18	18	16	13.5	4	4°33′	1000	2000	6860	120	1.6
DC 20	32		31	7		2.5	22	2	1	CS 20	20	18	15.5	4	4°03′	1500	2000	7650	110	2
DC 22	36		40	7		2.5	26	2.5	1	CS 22	22	19.5	16.5	5	4°40′	1500	2500	9900	180	2.3
DC 25	36		40	7		2.5	26	2.5	1	CS 25	25	22.5	19.5	5	4°03′	1500	3000	11400	155	3.1
DC 28	44		45	10		4	32	2.5	1.5	CS 28	28	25.5	22.5	5	3°34′	2000	3000	14400	280	4
DC 32	44		45	10		4	32	2.5	1.5	CS 32	32	29	25.5	6	3°46′	2000	4000	17100	230	5.2
DC 36	52	0 −0.074	49	12	0 −0.043	4.5	40	3	1.5	CS 36	36	33	29.5	6	3°19′	2000	4000	21200	380	6.7
DC 40	58		57	15		5	42	3	1.5	CS 40	40	37	33.5	6	2°57′	2000	4000	27500	520	8.4
DC 45	64		62	15		5	48	4	1.5	CS 45	45	41	36.5	8	3°33′	3000	5000	34900	730	10.4
DC 50	68		67	15		5	52	4	1.5	CS 50	50	46	41.5	8	3°10′	3000	5000	42100	810	13

Note Cut shafts (K) and ground shafts (G) are build-to-order.
The dynamic permissible thrust (F) indicates the torque at which the contact surface pressure on the screw teeth is 9.8 N/mm².

Model number coding

Combination of screw nut and screw shaft

2 DC20 +360L T
1 2 3 4

1 Number of screw nuts used on the same shaft 2 Model No. of screw nut
3 Overall screw shaft length (in mm) 4 How the screw shaft is processed (T: rolled shaft)

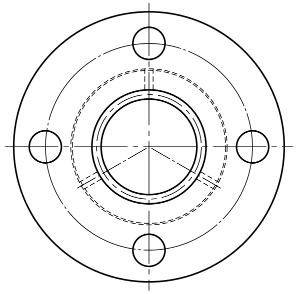
Model number coding

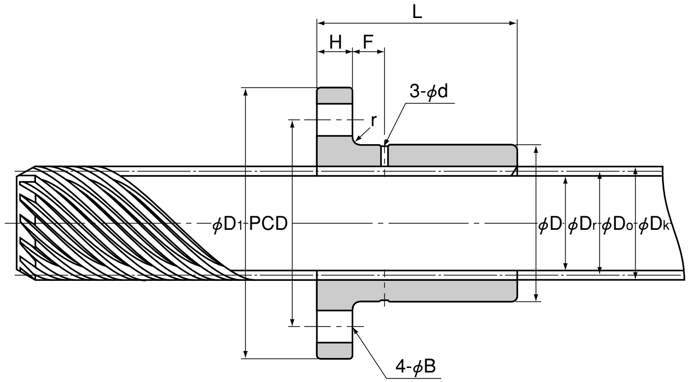
Screw shaft

CS20 T +360L
1 2 3

1 Model number of screw shaft 2 How the screw shaft is processed (T: rolled shaft)
3 Overall screw shaft length (in mm)

Models DCMA and DCMB

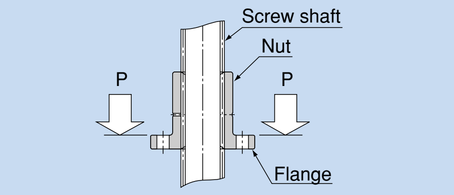




Unit: mm

Change Nut model No.(note)	Outer dimensions: Outer diameter D	Outer diameter Tolerance h9	Length L	Change Nut dimensions: Flange diameter D_1	H	B	PCD	r	F	d	Screw shaft model No.(note)	Multi-thread screw shaft details: Outer diameter D_k	Effective diameter D_o	Thread minor diameter D_r	Lead R	Lead angle α°	No. of rows Z	Std shaft length	Max shaft length	Dynamic permissible torque T(note) N·m	Dynamic permissible thrust F(note) N	Static permissible load of the flange P(note) N	Mass: Change nut g	Mass: Screw shaft kg/m
DCMB 8T (note)	15	0 –0.1	16	28	4	3.4	21	0.8	—	—	CT 8T	9	7.6	6.2	24	(45)	6	500	1000	3.24	863	1800	5	0.36
DCMB 12T (note)	20		25	36	5	4.5	27	1	—	—	CT 12T	13.3	11.5	9.7	36	(45)	7	500,1000	1500	12.7	1370	2800	10	0.82
DCMA 15T	22	0 –0.052	15	44	6	5.4	31	1.5	4.5	1.5	CT 15T	15.8	13.7	11.6	44.4	(45)	8	500,1000	1500	16.7	2300	13800	60	1.2
DCMB 15T			30																	32.4	4610		85	
DCMA 17T	28		15	51	7	6.6	38	1.5	4.5	1.5	CT 17T	17.8	15.7	13.6	50	(45)	9	500,1000	1500	20.6	2600	28100	95	1.5
DCMB 17T			35																	48	6080		140	
DCMA 20T	32	0 –0.062	20	56	7	6.6	42	1.5	6.5	2	CT 20T	21.2	18.7	16.2	60	(45)	9	500,1000 1500	3000	40.2	4170	34600	135	2.6
DCMB 20T			40																	79.4	8330		210	
DCMA 25T	36		25	61	8	6.6	47	2	8.5	2	CT 25T	25.6	23.1	20.6	73.3	(45)	11	500,1000 1500	3000	74.5	6370	38500	175	3.3
DCMB 25T			50																	148	12700		280	
DCMA 30T	44		28	76	10	9	58	2	9	2	CT 30T	31.9	29.4	26.9	93.3	(45)	14	500,1000 2000	4000	130	8090	55400	290	5.3
DCMB 30T			56																	269	16200		465	
DCMA 35T	52	0 –0.074	30	84	10	9	66	2.5	10	3	CT 35T	34.1	31.1	28.1	97.7	(45)	11	500,1000 2000	4000	144	9260	84500	425	5.8
DCMB 35T			60																	287	18500		670	
DCMA 40	58		35	98	12	11	76	2.5	11.5	3	☆CT 40	44	38.18	33.3	119.9	(45)	12	500,1000 2000	—	381	20000	85200	715	9
DCMB 40			70																	763	40000		1065	
DCMA 45	64		37	104	12	11	80	2.5	12.5	3	☆CT 45	47	41.37	36.4	129.9	(45)	13	1000,2000 3000	—	474	22900	115000	820	10.6
DCMB 45			75																	960	46600		1270	
DCMA 50	68		40	109	12	11	85	2.5	14	3	☆CT 50	52	47.73	42.9	149.9	(45)	15	1000,2000 3000	—	681	28500	108000	925	14
DCMB 50			80																	1360	57100		1375	

Note Symbol T indicates that a rolled shaft is used in combination with the change nut.
The dynamic permissible torque (T) and the dynamic permissible thrust (F) indicate the values at which the contact surface pressure on the screw teeth is 9.8 N/mm².
Miniature Change Nut models DCMB8T and DCMB12T use oil-impregnated plastics (outer-diameter tolerance: special).
The screw shafts marked with "☆" are build-to-order.
The static permissible load (P) of the flange indicates the strength of the flange against the load as shown in the figure on the right.



Model number coding

Combination of change nut and screw shaft

2 DCMA20 +360L T
1 2 3 4

1 Number of nuts used on the same screw shaft 2 Change Nut model number
3 Overall screw shaft length (in mm) 4 How the screw shaft is processed (T: rolled shaft)

Model number coding

Multi-thread screw shaft

CT20 T +360L
1 2 3

1 Model number of screw shaft 2 How the screw shaft is processed (T: rolled shaft)
3 Overall screw shaft length (in mm)

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

Slide Pack Model FBW

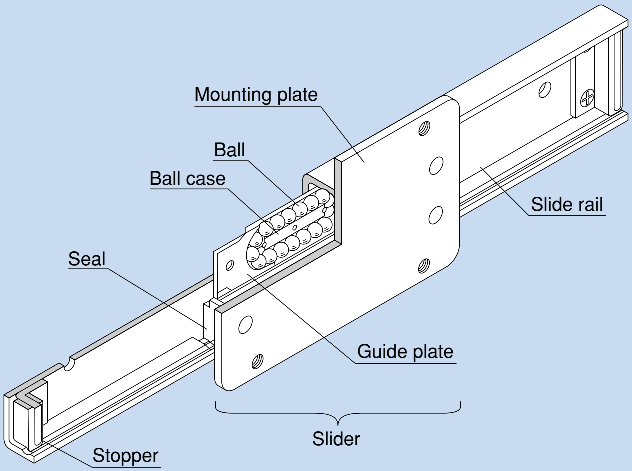


Fig. 1 Structure of Slide Pack Model FBW-R (H) UU

Structure and Features

Slide Pack model FBW is an LM system in which a precision press molded slider that contains balls performs infinite linear motion. Used in combination with a slide rail, the Slide Pack achieves lightweight and compact design and smooth linear motion at a low price.

The ball case and the slide rail are nitrided to ensure high wear resistance (the slide rail of model FBW 2560R is made of stainless steel).

●Low Cost, Interchangeable

Since it is press molded with precision, this LM system achieves stable quality and interchangeability at low cost.

●Infinite Stroke Length

Unlike the conventional finite stroke type, the slider is capable of performing infinite motion. When connected with a slide rail, it can be used in long-stroke applications.

●Easy Installation and Handling

Because of the structure that prevents balls from falling off even if the slider is removed from the slide rail, this model can be used in a complex construction where it is impossible to install an LM system unless it is disassembled.

●A Type Equipped with a Dust Prevention Seal Also Standardized

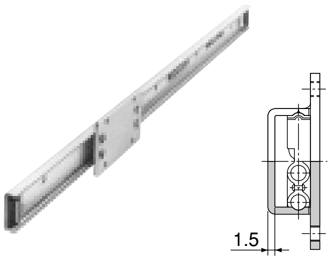
A type equipped with a dust prevention seal is standardized for locations where cutting chips or dust may enter the system.

Applications

The Slide Pack is optimal for slide units of photocopiers, tool cabinets, electronic equipment cabinets, moving seats, automatic vending machines, machine tool slide covers, cash registers, heavy doors and curtain walls.

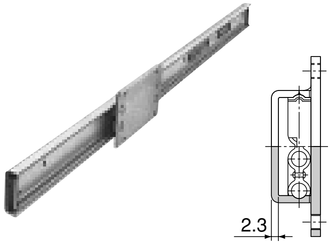
Types and Features

Model FBW 2560R



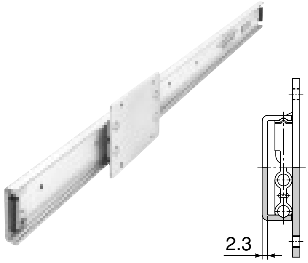
Compact type

Model FBW 3590R



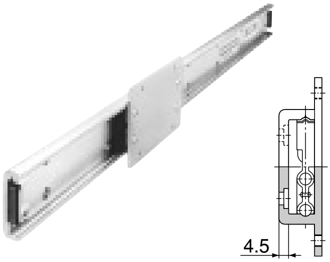
Standard type

Model FBW 50110R



Heavy load type

Model FBW 50110H



High rigidity type

The slide rails are roll-formed to achieve stable quality, interchangeability, highly accurate finish and smooth motion.

Clearance

Model FBW is manufactured to the following accuracies.

Vertical clearance: 0.03 mm or less
Horizontal clearance: 0.1 mm or less

These specifications are values when the slide rail is attached to a rigid base.

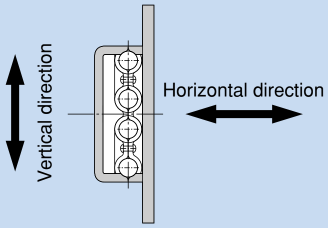
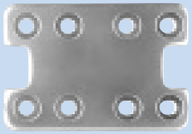
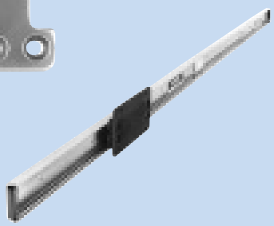


Fig. 2

Connected Rails (Optional)

If the required specifications exceed the standard stroke, two or more slide rails can be connected. When placing an order, indicate the overall length.



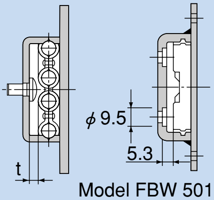


Installation

●Mounting Screws of the Slide Rail

Since the space for securing the mounting screws of the slide rail is small as shown in Fig. 3, we recommend using truss head screws or binder screws.

Note: The slide rail of model FBW 50110H is countersunk. We recommend mounting the slide rail using hexagon socket bolts (M5).



Model FBW 50110H

Fig. 3

Unit: mm

Model No.	t
FBW 2560R	3.2
FBW 3590R	3.4
FBW 50110R	3.4
FBW 50110H	—

●Attaching the Stopper

If the slider may overrun and come off of the slide rail, attach the dedicated stopper to the slide rail end as shown in Fig. 4.

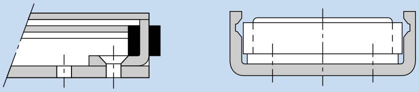


Fig. 4

●Installing the Slider

With model FBW-R (H), balls will not fall off even if the slider is removed from the slide rail. However, they could fall if twisting the slider when reattaching it to the slide rail. Whenever possible, do not remove the slider from the slide rail when installing the Slide Pack.

●Groove Dimensions

Fig. 5 shows the dimensions of grooves for applications where model FBW-R (H) is installed in a groove.

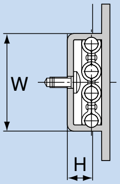


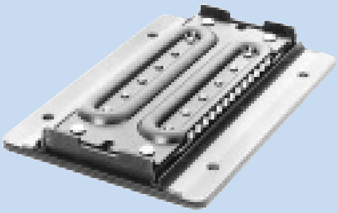
Fig. 5

Unit: mm

Model No.	W	H
FBW 2560R	24.8 $^{+0.15}_{+0.10}$	7.4
FBW 3590R	37 $^{+0.15}_{+0.10}$	10
FBW 50110R	50 $^{+0.15}_{+0.10}$	10
FBW 50110H	54.4 $^{+0.15}_{+0.10}$	13

Dust Prevention and Lubrication

For Slide Pack model FBW-R (H), a special synthetic rubber seal with high dust prevention characteristics, capable of preventing foreign matter from entering the slider and the lubricant from leaking, is available. The seal increases the dust prevention effect by contacting both the slide rail raceway where balls roll and the slide rail itself.

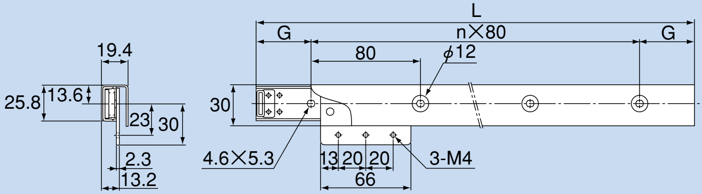


For lubrication, apply high-quality lithium soap group grease to the raceway.

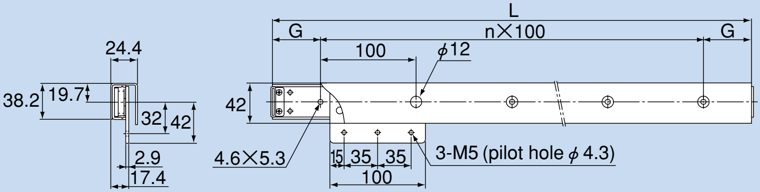
Slide Pack Equipped with a Metal Dustproof Cover

For Slide Pack model FBW, steel covers that cover the whole slide rail to prevent foreign matter from entering the slide are available.

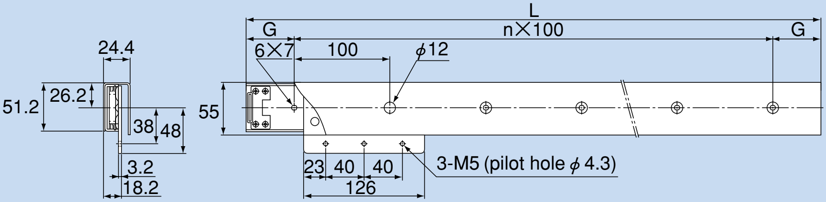
Model FBW 2560RG
(Equipped with a dustproof cover)



Model FBW 3590RG
(Equipped with a dustproof cover)



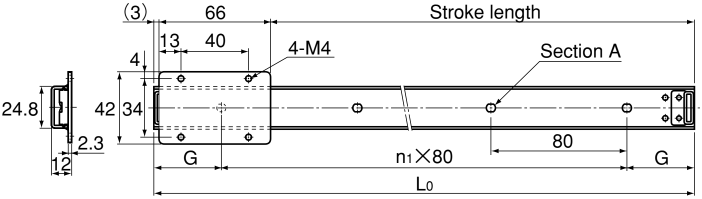
Model FBW 50110RG
(Equipped with a dustproof cover)



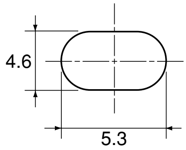
Note: For models equipped with a dustproof cover, the rubber seal is not available.

Models FBW 2560R and 3590R

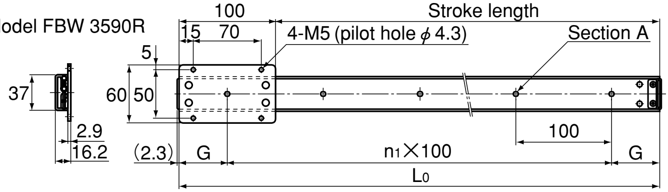
Model FBW 2560R



Magnified view of section A



Model FBW 3590R

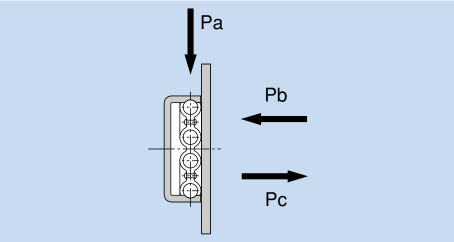


Model FBW 2560R (Made of Stainless Steel)

Unit: mm

Slide rail length L_0	Major dimensions n_1	G	Stroke length Without seal	With seal	Slide rail mass g (70)
160	1	40	88	83	70
240	2	40	168	163	110
320	3	40	248	243	140
400	4	40	328	323	180
480	5	40	408	403	210
560	6	40	488	483	250
640	7	40	568	563	290
720	8	40	648	643	320
800	9	40	728	723	360
880	10	40	808	803	390
960	11	40	888	883	430
1040	12	40	968	963	460
1200	14	40	1128	1123	540

Note THK also manufactures a long-size type at your request.
The values in the parentheses each indicate a slider mass.



Model FBW 3590R

Unit: mm

Slide rail length L_0	Major dimensions n_1	G	Stroke length Without seal	With seal	Slide rail mass g (250)
300	2	50	200	195	260
350	3	25	250	245	300
400	3	50	300	295	350
450	4	25	350	345	390
500	4	50	400	395	430
550	5	25	450	445	480
600	5	50	500	495	520
650	6	25	550	545	560
700	6	50	600	595	600
750	7	25	650	645	650
800	7	50	700	695	690
900	8	50	800	795	780
1000	9	50	900	895	860
1200	11	50	1100	1095	1000
1500	14	50	1400	1395	1300
1800	17	50	1700	1695	1600

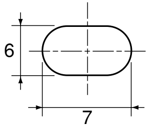
Table 1 Static Permissible Load

Unit: N

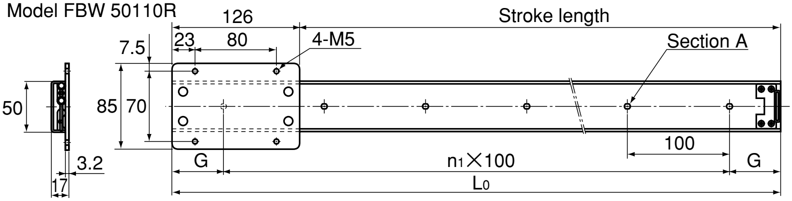
Model No.	Static permissible load Pa	Pb	Pc
FBW 2560R	590	150	70
FBW 3590R	880	200	100
FBW 50110R FBW 50110H	1960	500	390

Models FBW 50110R and 50110H

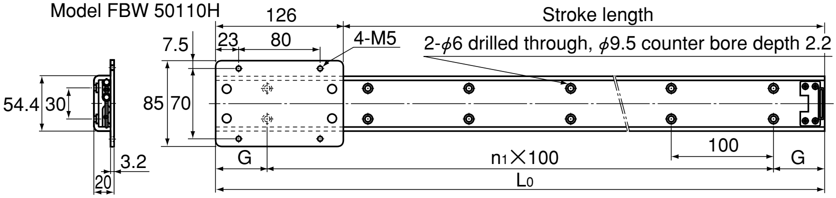
Magnified view of section A



Model FBW 50110R



Model FBW 50110H



Models FBW 50110R and 50110H

Unit: mm

Slide rail length L_0	Major dimensions		Stroke length		Slide rail mass g	
	n_1	G	Without seal	With seal	FBW50110R (420)	FBW50110H (420)
300	2	50	170	164	360	740
350	3	25	220	214	420	870
400	3	50	270	264	480	990
450	4	25	320	314	540	1100
500	4	50	370	364	600	1200
600	5	50	470	464	720	1400
700	6	50	570	564	840	1700
800	7	50	670	664	960	2000
900	8	50	770	764	1100	2200
1000	9	50	870	864	1200	2500
1200	11	50	1070	1064	1400	3000
1500	14	50	1370	1364	1800	3700
1800	17	50	1670	1664	2200	4400

Note THK also manufactures a long-size type at your request.
The values in the parentheses each indicate a slider mass.

Model number coding

2 FBW50110R UU +800L

1 2 3 4

1 No. of sliders connected on the same rail (no symbol for a single slider)
2 Model number
3 With seal (no symbol for without seal)
4 Overall slide rail length (in mm)

Slide Pack Model FBL

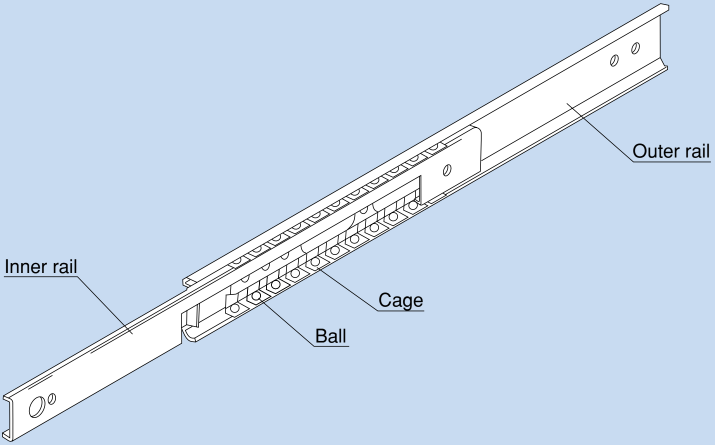


Fig. 1 Structure of Slide Pack Model FBL

Structure and Features

Slide Pack model FBL is a thin, compact and ultra-low price slide unit for finite motion. It has two rows of balls placed between an inner rail made of a steel sheet roll-formed with precision and an outer rail. The balls are evenly spaced by a cage press-molded with precision, thus eliminating friction between balls and achieving a smooth slide mechanism.

●Unit Type That Allows Easy Installation

Since the clearance and the motion of the slide unit are optimally adjusted, simply mounting the unit onto the base or the table using screws will achieve a slide mechanism with virtually no running noise.

●Thin and Compact

Since the sectional shape is thinly designed, this slide pack only requires a small side space for installation. In addition, a desired number of slide pack units can be installed in parallel according to the load conditions.

●Maintenance-free Operation

Since the slide rail is treated with zinc plating, it is highly resistant to corrosion. The slide unit contains grease, eliminating the need for further grease replenishment in normal use.

Applications

Model FBL can be used in a wide range of applications such as photocopiers, measuring instruments, telecommunication equipment, automatic vending machines and various types of office equipment.

Types of Features

Models FBL 27S and 35S

The basic unit type designed to have a stroke length approximately 70% of the overall rail length.

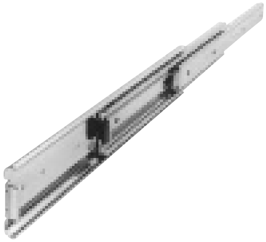
Models FBL 27D and 35D

A two-stage, double-unit type that allows the stroke length to exceed the overall rail length.

Models FBL 35E and 55E

A two -stage slide unit type that allows the stroke length to exceed the overall rail length in a limited space.

Model FBL 56H



A two-stage, high-load slide unit type with an even greater permissible load.

Installation

●Mounting Screws of the Slide Rail

The slide rail is to be mounted using M4 screws. Since the mounting space is small as shown in Fig. 2, we recommend using truss head screws or binder screws.

Note: For model FBL 35E, use M3 truss head screws or binder screws.

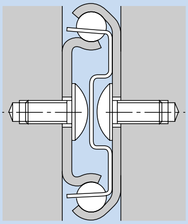


Fig. 2

●Attaching the Slide Rail

While keeping the maximum stroke, mount the outer rail at the section where the inner rail and the outer rail overlap, slide the inner rail backward, and then secure the rail using a screw through the access hole.

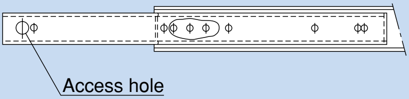


Fig. 3

●Mounting Orientation

For use other than with the mounting orientation shown in Fig. 4, contact THK .

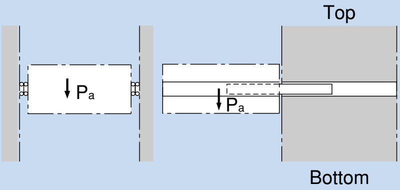


Fig. 4

Static Permissible Load

The static permissible load of model FBL varies with rail lengths and is indicated in the corresponding dimensional table. This value represents the static permissible load in the direction "P_a" per pair of slide pack units in the middle of the rail length at the maximum stroke. If a load other than in the direction "P_a" is applied, contact THK.

For the traveling section of a heavy object, THK also manufactures a special type stacking basic units as shown in Fig. 6 at your request.

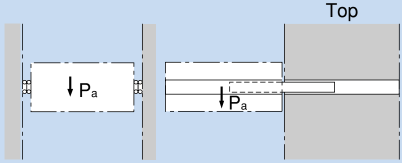


Fig. 5

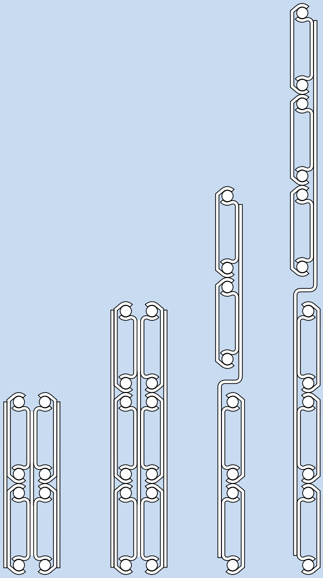
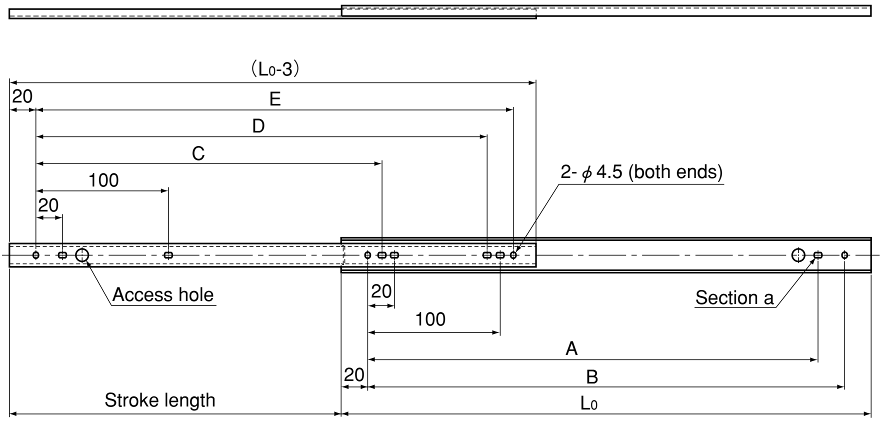
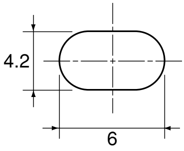


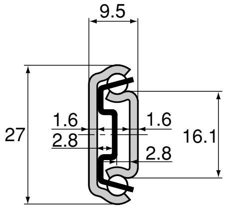
Fig. 6 Example of Combining Slide Pack Units

Model FBL 27S





Magnified view of section a



Unit: mm

Rail length L0 (±0.8)	Stroke length (±3)	Mounting hole dimensions					Permissible load N/pair	Mass Kg/pair
		A	B	C	D	E		
200	135	140	160	—	140	160	260	0.32
250	185	190	210	150	190	210	240	0.4
300	222	240	260	190	240	260	240	0.48
350	260	290	310	225	290	310	230	0.56
400	297	340	360	265	340	360	210	0.64
450	334	390	410	300	390	410	200	0.72
500	371	440	460	337	440	460	180	0.8

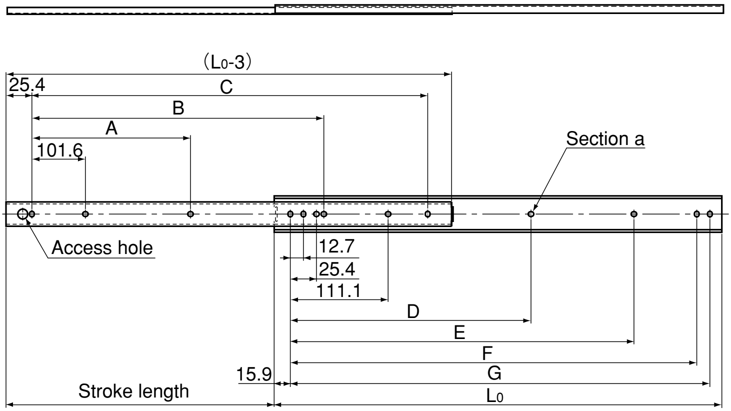
Model number coding

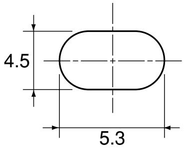
FBL27S +300L

1 2

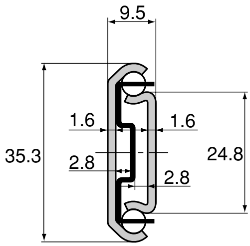
1 Model number 2 Overall rail length (in mm)

Model FBL 35S





Magnified view of section a



Unit: mm

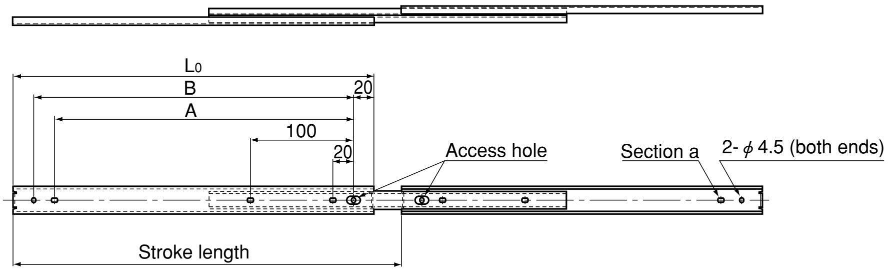
Rail length L0 (±0.8)	Stroke length (±3)	Mounting hole dimensions							Permissible load N/pair	Mass Kg/pair
		A	B	C	D	E	F	G		
305	229	—	152.4	254	—	149.2	260.3	273	490	0.6
356	279	—	203.2	304.8	—	200	311.1	323.8	400	0.72
406	305	—	254	355.6	—	250.8	361.9	374.6	390	0.84
457	330	203.2	304.8	406.4	212.7	301.6	412.7	425.4	380	0.96
508	381	228.6	355.6	457.2	238.1	352.4	463.5	476.2	330	1.04
559	406	254	406.4	508	263.5	403.2	514.3	527	320	1.16
610	432	279.4	457.2	558.8	288.9	454	565.1	577.8	310	1.24
660	483	304.8	508	609.6	314.3	504.8	615.9	628.6	280	1.36
711	508	330.2	558.8	660.4	339.7	555.6	666.7	679.4	270	1.48

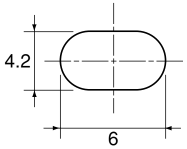
Model number coding

$\underbrace{\text{FBL35S}}_{1}\ \underbrace{\text{+457L}}_{2}$

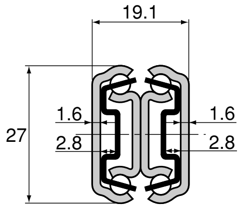
1 Model number 2 Overall rail length (in mm)

Model FBL 27D





Magnified view of section a



Unit: mm

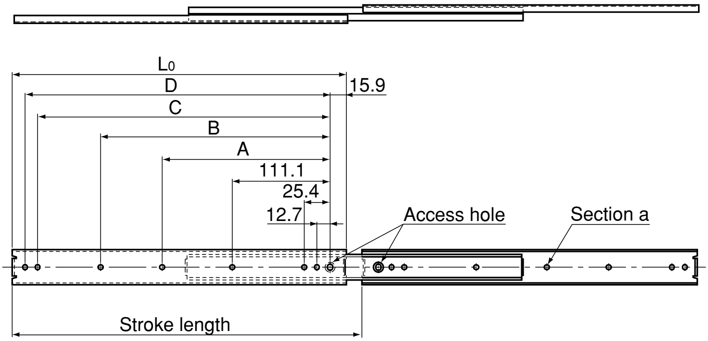
Rail length L0 (±0.8)	Stroke length (±3)	Mounting hole dimensions		Permissible load N/pair	Mass Kg/pair
		A	B		
200	229	140	160	370	0.64
250	276	190	210	360	0.8
300	327	240	260	350	0.96
350	376	290	310	330	1.12
400	426	340	360	310	1.28
450	475	390	410	290	1.46
500	524	440	460	280	1.6

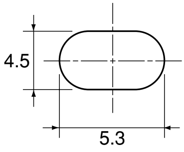
Model number coding

FBL27D +200L
1 2

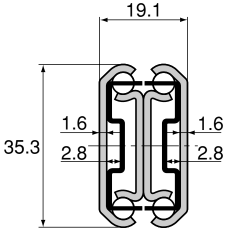
1 Model number 2 Overall rail length (in mm)

Model FBL 35D





Magnified view of section a



Unit: mm

Rail length L0 (±0.8)	Stroke length (±3)	Mounting hole dimensions				Permissible load N/pair	Mass Kg/pair
		A	B	C	D		
305	327	—	149.2	260.3	273	588	1.28
356	378	—	200	311.1	323.8	578	1.48
406	429	—	250.8	361.9	374.6	559	1.72
457	480	212.7	301.6	412.7	425.4	549	1.96
508	530	238.1	352.4	463.6	476.2	529	2.12
559	581	263.5	403.2	514.3	527	500	2.4
610	632	288.9	454	565.1	577.8	480	2.56
660	683	314.3	504.8	615.9	628.6	461	2.8
711	734	339.7	555.6	666.7	679.4	441	3

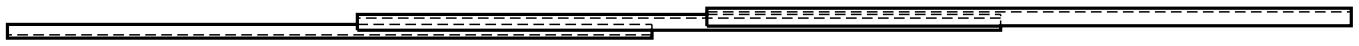
Model number coding

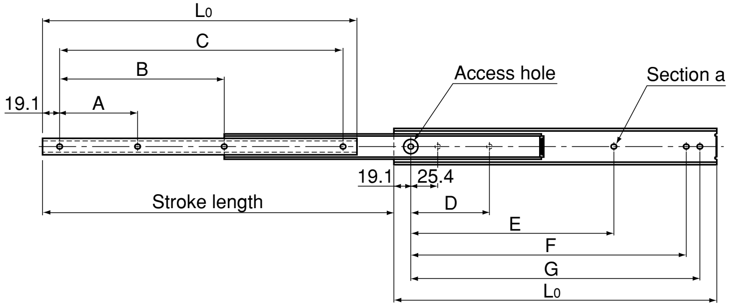
FBL35D +356L

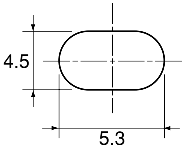
1 2

1 Model number 2 Overall rail length (in mm)

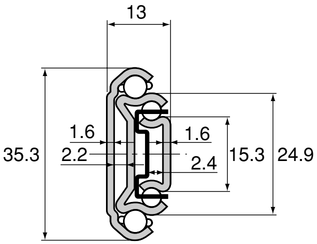
Model FBL 35E







Magnified view of section a



Unit: mm

Rail length L0 (±0.8)	Stroke length (±3)	Mounting hole dimensions							Permissible load N/pair	Mass Kg/pair
		A	B	C	D	E	F	G		
305	330	76.2	—	154.9	76.2	190.5	241.3	266.7	290	0.6
356	381	127	—	266.7	88.9	215.9	292.1	317.5	280	0.7
406	432	152.4	—	317.5	127	241.3	342.9	368.3	270	0.9
457	483	177.8	—	368.3	127	292.1	393.7	419.1	250	1.1
508	533	152.4	342.9	419.1	152.4	317.5	444.5	469.9	240	1.3

Note When mounting model FBL 35E, use M3 truss head screws or binder screws.

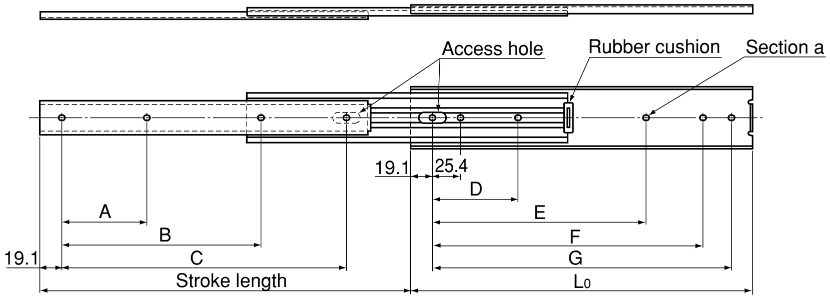
Model number coding

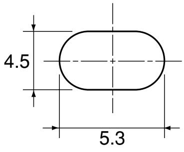
FBL35E +406L

1 2

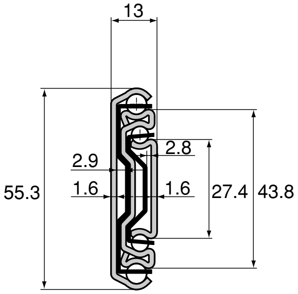
1 Model number 2 Overall rail length (in mm)

Model FBL 55E





Magnified view of section a



Unit: mm

Rail length L_0 (±0.8)	Stroke length (±3)	Mounting hole dimensions							Permissible load N/pair	Mass Kg/pair
		A	B	C	D	E	F	G		
305	330	76.2	177.8	254	76.2	190.5	241.3	266.7	620	1.44
356	381	101.6	203.2	304.8	88.9	215.9	292.1	317.5	620	1.68
406	432	127	228.6	355.6	127	241.3	342.9	368.3	610	1.96
457	483	127	279.4	406.4	127	292.1	393.7	419.1	610	2.24
508	533	152.4	304.8	457.2	152.4	317.5	444.5	469.9	600	2.44
559	584	177.8	330.2	508	177.8	342.9	495.3	520.7	580	2.72
610	635	177.8	381	558.8	177.8	393.7	546.1	571.5	570	3
660	686	203.2	406.4	609.6	203.2	419.1	596.9	622.3	550	3.24
711	737	228.6	431.8	660.4	228.6	444.5	647.7	673.1	530	3.48
762	787	228.6	457.2	711.2	228.6	469.9	698.5	723.9	500	3.72

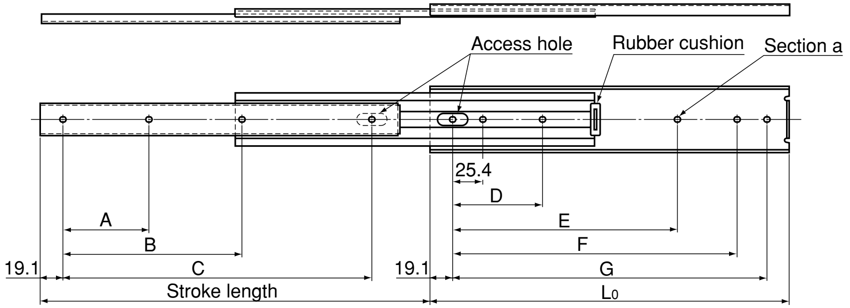
Model number coding

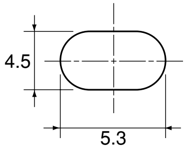
FBL55E +711L

1 2

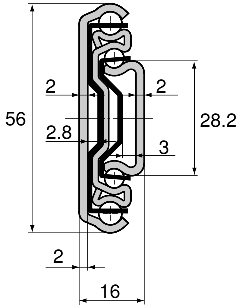
1 Model number 2 Overall rail length (in mm)

Model FBL 56H





Magnified view of section a



Unit: mm

Rail length L_0 (±0.8)	Stroke length (±3)	Mounting hole dimensions							Permissible load N/pair	Mass Kg/pair
		A	B	C	D	E	F	G		
305	330	76.2	177.8	254	76.2	190.5	241.3	266.7	960	1.76
356	381	101.6	203.2	304.8	88.9	215.9	292.1	317.5	950	2.04
406	432	127	228.6	355.6	127	241.3	342.9	368.3	940	2.36
457	483	127	279.4	406.4	127	292.1	393.7	419.1	920	2.64
508	533	152.4	304.8	457.2	152.4	317.5	444.5	469.9	900	2.96
559	584	177.8	330.2	508	177.8	342.9	495.3	520.7	880	3.24
610	635	177.8	381	558.8	177.8	393.7	546.1	571.5	860	3.6
660	686	203.2	406.4	609.6	203.2	419.1	596.9	622.3	840	3.84
711	737	228.6	431.8	660.4	228.6	444.5	647.7	673.1	820	4.06
762	787	228.6	457.2	711.2	228.6	469.9	698.5	723.9	784	4.44

Model number coding

FBL56H +610L

1 2

1 Model number 2 Overall rail length (in mm)

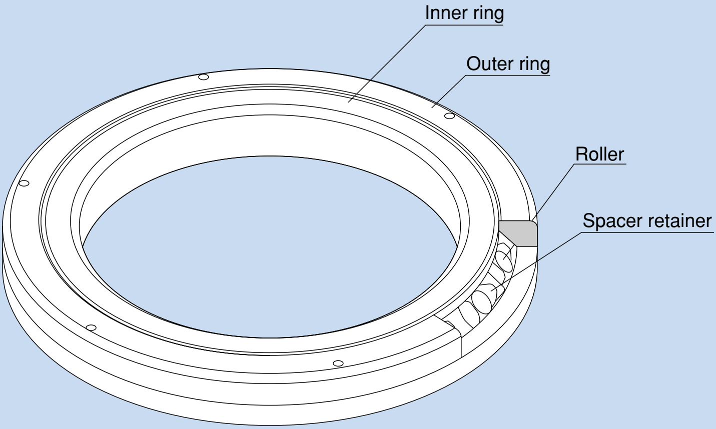


Fig. 1 Structure of Cross-Roller Ring Model RB

Structure and Features

With the Cross-Roller Ring, cylindrical rollers are arranged crosswise, with each roller perpendicular to the adjacent roller, in a 90° V groove, separated from each other by a spacer retainer. This design allows just one bearing to receive loads in all directions including radial, axial and moment loads.

●High Rotation Accuracy

The spacer retainer fitting among cross-arrayed rollers prevents rollers from skewing and the rotation torque from increasing due to friction between rollers. Unlike conventional types using steel sheet retainers, the Cross-Roller Ring does not cause unilateral contact of roller or locked rollers. Thus, even under a preload, the Cross-Roller Ring provides stable rotation.

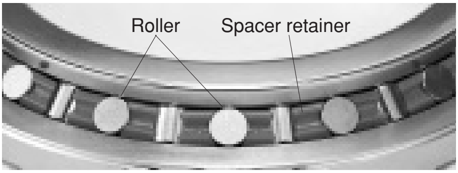
Since the inner and outer rings are designed to be separable, the bearing clearance can be adjusted. In addition, a preload can be applied. These features enable accurate rotation.

●Easy Handling

The inner and outer rings, which are separable, are secured to the Cross-Roller Ring body after being installed with rollers and spacer retainers in order to prevent the rings from separating from each other. Thus, it is easy to handle the rings when installing the Cross-Roller Ring.

●Skewing Prevention

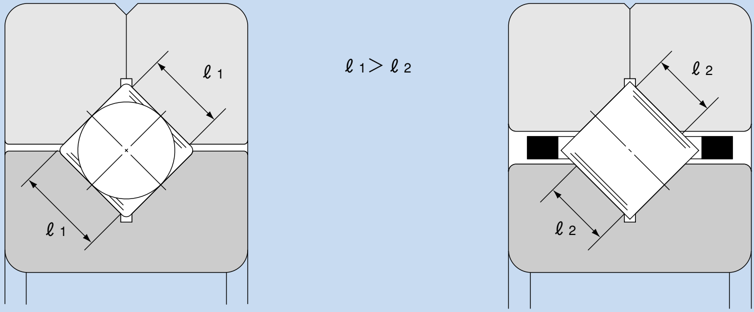
The spacer retainer keeps rollers in their proper position, thereby preventing them from skewing (tilted rollers). This eliminates friction between rollers, and therefore secures a stable rotation torque.



●Large Load Capacity

① Compared with conventional steel sheet retainers, the spacer retainer allows a longer effective contact length of each roller, thus to significantly increase the load capacity.
The spacer retainer guides rollers by holding them over the entire length of each roller, whereas the conventional type of retainer supports them only at a point at the center of each roller. Such one-point contact cannot sufficiently prevent skewing.

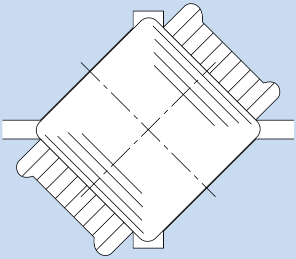
Roller contact length



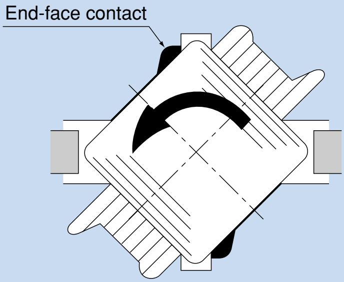
With a spacer retainer

With a steel sheet retainer
(conventional type)

② In conventional types, the loaded areas are asymmetrical between the outer-ring and the inner-ring sides around the roller longitudinal axis. The greater the applied load is, the greater the moment becomes, leading end-face contact to occur. This causes frictional resistance, which hinders smooth rotation and quickens wear.



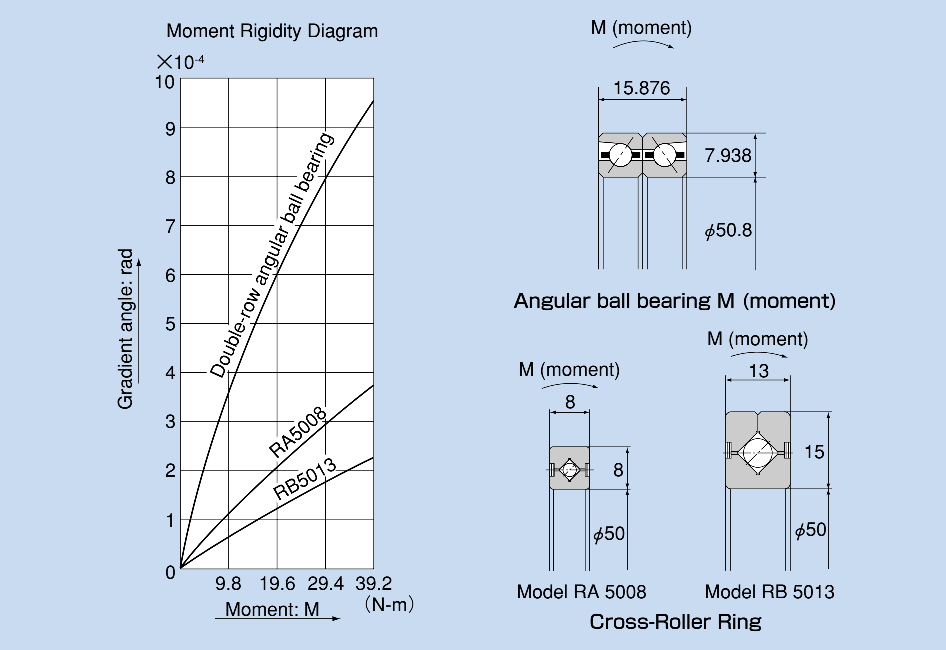
Loaded areas symmetrical
Design with a spacer retainer



Loaded areas asymmetrical
Design with a steel sheet retainer
(conventional type)

●Increased Rigidity (Three to Four Times Greater than the Conventional Type)

Unlike the thin angular ball bearings installed in double rows, the cross array of rollers allows a single Cross-Roller Ring unit to receive loads in all directions, increasing the rigidity to three to four times greater than the conventional type.



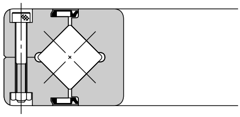
Applications

It is optimal for applications such as joints and swiveling units of industrial robots, swiveling tables of machining centers, rotary units of manipulators, precision rotary tables, medical equipment, measuring instruments and IC manufacturing machines.

Types and Features

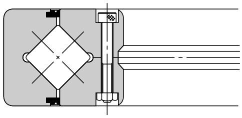
●Standard Type

Model RB (Separable Outer Ring Type for Inner Ring Rotation)



The outer ring is separable while the inner ring is integrated with the main body. This model is used in locations where the rotational accuracy of the inner ring is required.

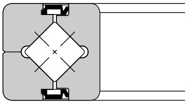
Model RE (Separable Inner Ring Type for Outer Ring Rotation)



The inner ring is separable while the outer ring is integrated with the main body. This model is used in locations where the rotational accuracy of the outer ring is required.

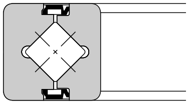
●Thin Type

Model RA (Separable Outer Ring Type for Inner Ring Rotation)



Model RA is a lightweight, compact type with thinnest possible inner and outer rings.
It is used in locations where the rotational accuracy of the inner ring is required.

Model RA-C (Single-Split Type)



The major dimensions are the same as that of model RA. Since the outer ring is split as one point, this model is optimal for locations where the rigidity and accuracy of both the inner and outer rings are required.

Accuracy Standards

The Cross-Roller Ring is manufactured with the accuracy and the dimensional tolerance according to tables 1 to 7.

Table 1 Rotational Accuracy of the Inner Ring of Model RB

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Radial run-out tolerance of the inner ring					Axial run-out tolerance of the inner ring				
Above	Or less	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2
18	30	13	8	4	3	2.5	13	8	4	3	2.5
30	50	15	10	5	4	2.5	15	10	5	4	2.5
50	80	20	10	5	4	2.5	20	10	5	4	2.5
80	120	25	13	6	5	2.5	25	13	6	5	2.5
120	150	30	18	8	6	2.5	30	18	8	6	2.5
150	180	30	18	8	6	5	30	18	8	6	5
180	250	40	20	10	8	5	40	20	10	8	5
250	315	50	25	13	10	—	50	25	13	10	—
315	400	60	30	15	12	—	60	30	15	12	—
400	500	65	35	18	14	—	65	35	18	14	—
500	630	70	40	20	16	—	70	40	20	16	—
630	800	80	—	—	—	—	80	—	—	—	—
800	1000	90	—	—	—	—	90	—	—	—	—
1000	1250	100	—	—	—	—	100	—	—	—	—

Table 2 Rotational Accuracy of the Outer Ring of Model RE

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Radial run-out tolerance of the outer ring					Axial run-out tolerance of the outer ring				
Above	Or less	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2	Grade 0	Grade PE 6 Grade P6	Grade PE 5 Grade P5	Grade PE 4 Grade P4	Grade PE 2 Grade P2
30	50	20	10	7	5	2.5	20	10	7	5	2.5
50	80	25	13	8	5	4	25	13	8	5	4
80	120	35	18	10	6	5	35	18	10	6	5
120	150	40	20	11	7	5	40	20	11	7	5
150	180	45	23	13	8	5	45	23	13	8	5
180	250	50	25	15	10	7	50	25	15	10	7
250	315	60	30	18	11	7	60	30	18	11	7
315	400	70	35	20	13	8	70	35	20	13	8
400	500	80	40	23	15	—	80	40	23	15	—
500	630	100	50	25	16	—	100	50	25	16	—
630	800	120	60	30	20	—	120	60	30	20	—
800	1000	120	75	—	—	—	120	75	—	—	—
1000	1250	120	—	—	—	—	120	—	—	—	—
1250	1600	120	—	—	—	—	120	—	—	—	—

Table 3 Rotational Accuracy of the Inner Ring of Model RA and RA-C

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Tolerance in radial run-out and axial run-out
Above	Or less	
40	65	13
65	80	15
80	100	15
100	120	20
120	140	25
140	180	25
180	200	30

Note: If higher accuracy than the above values is required for the inner ring in rotational accuracy for models RA and RA-C, contact THK.

Table 4 Rotational Accuracy of the Outer Ring of Model RA-C

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance in radial run-out and axial run-out
Above	Or less	
65	80	13
80	100	15
100	120	15
120	140	20
140	180	25
180	200	25
200	250	30

Note: The rotational accuracy of the outer ring for model RA-C indicates the value before separation.

Table 5 Dimensional Tolerance of the Bearing Inner Diameter for Models RB and RE

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Tolerance of dm (note 2)							
		Grades 0, P6, P5, P4, and P2		Grade PE6		Grade PE5		Grade PE4 and PE2	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
18	30	0	– 10	0	– 8	0	– 6	0	– 5
30	50	0	– 12	0	–10	0	– 8	0	– 6
50	80	0	– 15	0	–12	0	– 9	0	– 7
80	120	0	– 20	0	–15	0	–10	0	– 8
120	150	0	– 25	0	–18	0	–13	0	–10
150	180	0	– 25	0	–18	0	–13	0	–10
180	250	0	– 30	0	–22	0	–15	0	–12
250	315	0	– 35	0	–25	0	–18	—	—
315	400	0	– 40	0	–30	0	–23	—	—
400	500	0	– 45	0	–35	—	—	—	—
500	630	0	– 50	0	–40	—	—	—	—
630	800	0	– 75	—	—	—	—	—	—
800	1000	0	–100	—	—	—	—	—	—
1000	1250	0	–125	—	—	—	—	—	—

Note 1: Standard inner diameter accuracy of models RA and RA-C is 0. For higher accuracy than 0, contact THK.

Note 2: "dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner diameter at two points.

Note 3: For accuracy grades in bearing inner diameter with no values indicated in the table, the highest value among low accuracy grades applies.

Table 6 Dimensional Tolerance of the Bearing Outer Diameter for Models RB and RE

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of Dm (note 2)							
		Grades 0, P6, P5, P4 and P2		Grade PE6		Grade PE5		Grades PE4 and PE2	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
30	50	0	– 11	0	– 9	0	– 7	0	– 6
50	80	0	– 13	0	–11	0	– 9	0	– 7
80	120	0	– 15	0	–13	0	–10	0	– 8
120	150	0	– 18	0	–15	0	–11	0	– 9
150	180	0	– 25	0	–18	0	–13	0	–10
180	250	0	– 30	0	–20	0	–15	0	–11
250	315	0	– 35	0	–25	0	–18	0	–13
315	400	0	– 40	0	–28	0	–20	0	–15
400	500	0	– 45	0	–33	0	–23	—	—
500	630	0	– 50	0	–38	0	–28	—	—
630	800	0	– 75	0	–45	0	–35	—	—
800	1000	0	–100	—	—	—	—	—	—
1000	1250	0	–125	—	—	—	—	—	—
1250	1600	0	–160	—	—	—	—	—	—

Note 1: Standard outer diameter accuracy of models RA and RA-C is 0. For higher accuracy than 0, contact THK.

Note 2: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

Note 3: For accuracy grades in bearing outer diameter with no values indicated in the table, the highest value among low accuracy grades applies.

Table 7 Tolerance in the Width of the Inner and Outer Rings (Common to All Grades)

Unit: μm

Nominal dimension of the bearing inner diameter (d) (mm)		Tolerance of B		Tolerance of B1	
		Applied to the inner ring of RB and the outer ring of RE		Applied to the outer ring of RB and the inner ring of RE	
Above	Or less	Upper	Lower	Upper	Lower
18	30	0	– 75	0	–100
30	50	0	– 75	0	–100
50	80	0	– 75	0	–100
80	120	0	– 75	0	–100
120	150	0	–100	0	–120
150	180	0	–100	0	–120
180	250	0	–100	0	–120
250	315	0	–120	0	–150
315	400	0	–150	0	–200
400	500	0	–150	0	–200
500	630	0	–150	0	–200
630	800	0	–150	0	–200
800	1000	0	–300	0	–400
1000	1250	0	–300	0	–400

Note: All B and B1 types of models RA and RA-C are manufactured with tolerance between -0.120 and 0.

Radial Clearance

Table 8 shows radial clearances of thin-type Cross-Roller Ring models RA and RA-C, and table 9 shows that of models RB and RE.

Table 8 Radial Clearances of Models RA and RA-C

Unit: μm

Pitch circle diameter of the roller (dp) (mm)		CC0		C0	
Above	Or less	Min.	Max.	Min.	Max.
50	80	– 8	0	0	15
80	120	– 8	0	0	15
120	140	– 8	0	0	15
140	160	– 8	0	0	15
160	180	–10	0	0	20
180	200	–10	0	0	20
200	225	–10	0	0	20

Table 9 Radial Clearances of Models RB and RE

Unit: μm

Pitch circle diameter of the roller (dp) (mm)		CC0		C0		C1	
Above	Or less	Min.	Max.	Min.	Max.	Min.	Max.
18	30	– 8	0	0	15	15	35
30	50	– 8	0	0	25	25	50
50	80	–10	0	0	30	30	60
80	120	–10	0	0	40	40	70
120	140	–10	0	0	40	40	80
140	160	–10	0	0	40	40	90
160	180	–10	0	0	50	50	100
180	200	–10	0	0	50	50	110
200	225	–10	0	0	60	60	120
225	250	–10	0	0	60	60	130
250	280	–15	0	0	80	80	150
280	315	–15	0	30	100	100	170
315	355	–15	0	30	110	110	190
355	400	–15	0	30	120	120	210
400	450	–20	0	30	130	130	230
450	500	–20	0	30	130	130	250
500	560	–20	0	30	150	150	280
560	630	–20	0	40	170	170	310
630	710	–20	0	40	190	190	350
710	800	–30	0	40	210	210	390
800	900	–30	0	40	230	230	430
900	1000	–30	0	50	260	260	480
1000	1120	–30	0	60	290	290	530
1120	1250	–30	0	60	320	320	580
1250	1400	–30	0	70	350	350	630

Moment Rigidity

Figures 2 to 5 show moment rigidity diagrams for the Cross-Roller Ring as a separate unit. Rigidity is affected by the deformation of the housing, presser flange and bolts. Therefore, the strength of these parts must be taken into account.

(Radial clearance: 0)

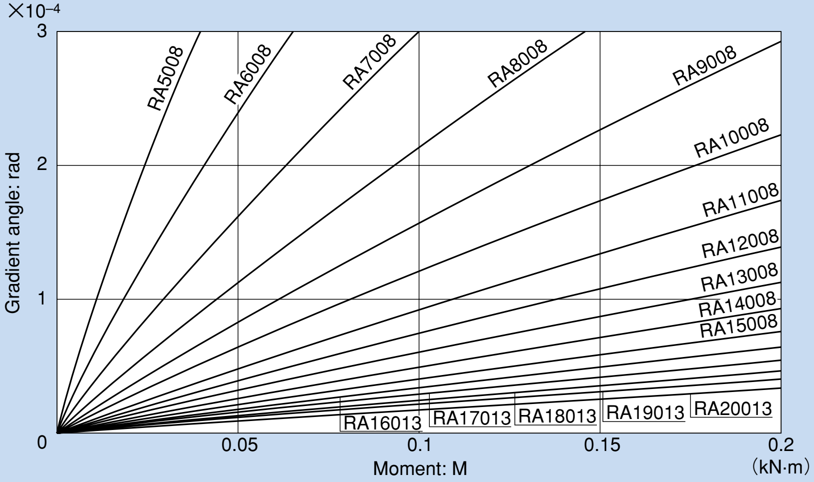


Fig. 2

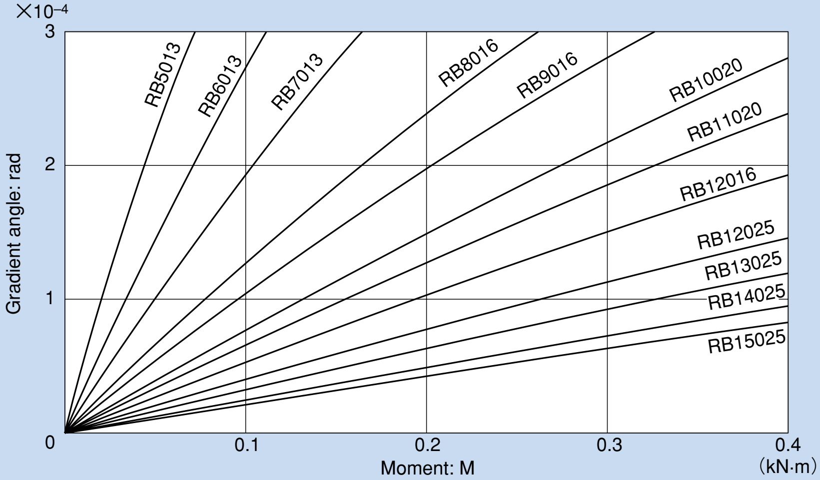


Fig. 3

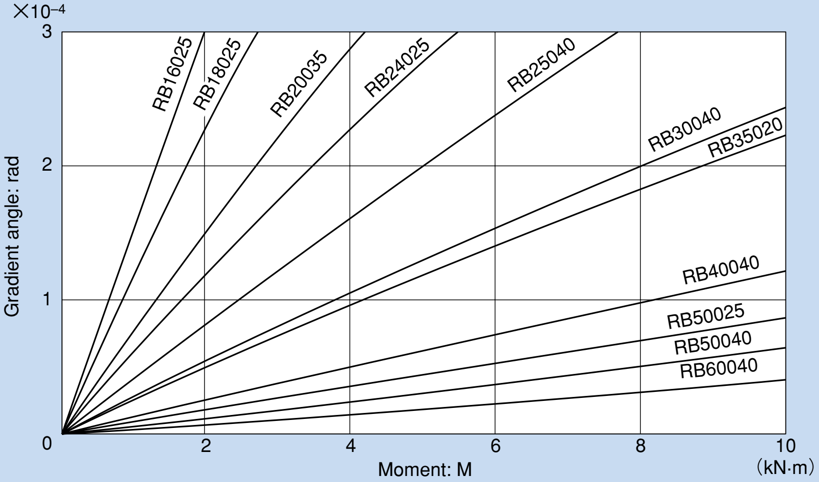

×10⁻⁴
3
2
1
0
Gradient angle: rad
RB16025
RB18025
RB20035
RB24025
RB25040
RB30040
RB35020
RB40040
RB50025
RB50040
RB60040
2
4
6
8
10
(kN·m)
Moment: M

Fig. 4

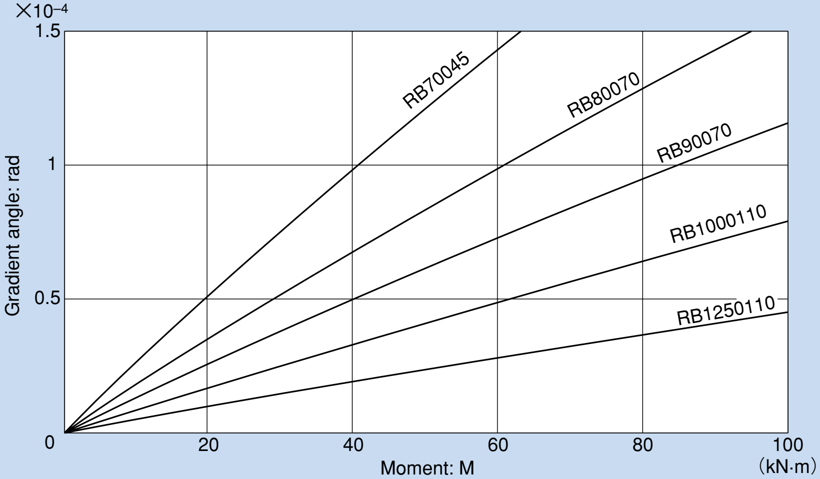

×10⁻⁴
1.5
1
0.5
0
Gradient angle: rad
RB70045
RB80070
RB90070
RB1000110
RB1250110
20
40
60
80
100
(kN·m)
Moment: M

Fig. 5

Fitting

●Fitting of Models RB, RE and RA

For the fitting of models RB, RE and RA, we recommend using the combinations indicated in table 10.

Table 10 Fitting of Models RB, RE and RA

Radial clearance	Service conditions		Shaft	Housing
C0	Inner ring rotational load	Normal load	h5	H7
		Large impact and moment	h5	H7
	Outer ring rotational load	Normal load	g5	Js7
		Large impact and moment	g5	Js7
C1	Inner ring rotational load	Normal load	j5	H7
		Large impact and moment	k5	Js7
	Outer ring rotational load	Normal load	g6	Js7
		Large impact and moment	h5	K7

Note: For the fitting for clearance CC0, avoid interference because it will cause an excessive preload. As for the fitting when you have selected clearance CC0 for the joints or swiveling unit of a robot, the combination of g5 and H7 is recommended.

●Fitting for Model RA-C

For the fitting of model RA-C, we recommend using the combinations indicated in table 11.

Table 11 Fitting for Model RA-C

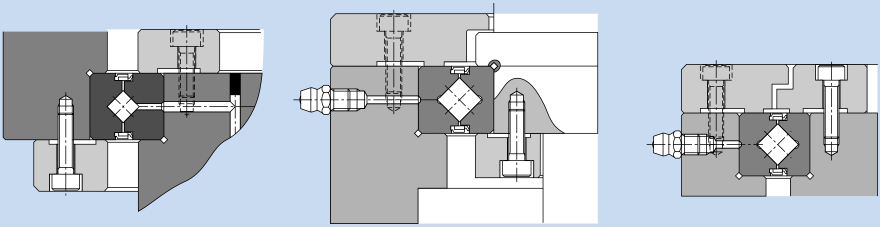
Radial clearance	Service conditions	Shaft	Housing
CC0	Inner ring rotational load	h5	J7
	Outer ring rotational load	g5	Js7
C0	Inner ring rotational load	j5	J7
	Outer ring rotational load	g5	K7

Designing the Housing and the Presser Flange

Since the Cross-Roller Ring is a compact, thin device, special consideration must be given to the rigidity of the housing and the presser flange.

With types having a separable outer ring, insufficiency in the strength of the housing, the flange or the presser bolt will result in the inability to evenly hold the inner or outer ring, or the deformation of the bearing when a moment load is applied. Consequently, the contact area of the rollers will become uneven, causing the bearing's performance to significantly be deteriorated.

Fig. 6 shows examples of installing the Cross-Roller Ring.



a. Outer ring rotating in the swiveling unit: A heavy body part is mounted after the inner and outer rings are secured.

b. Inner ring rotating in the swiveling unit (with seals attached)

c. Inner and outer rings secured in the same direction in the swiveling unit (with seals attached)

Fig. 6 Examples of Installation

●Housing

When determining the thickness of the housing, be sure it must be at least 60% of the sectional height of the bearing as a guide.

$$\text{Housing thickness } T = \frac{D-d}{2} \times 0.6 \text{ or greater}$$

(D: outer diameter of the outer ring; d: inner diameter of the inner ring)

If tapped holes for removing the inner or outer ring (Fig. 7) are provided, the ring can be removed without causing damage to the bearing. When removing the outer ring, do not press the inner ring, or vise versa. For the dimensions of the presser on the side(s), see the shoulder dimensions indicated in the corresponding dimensional table.

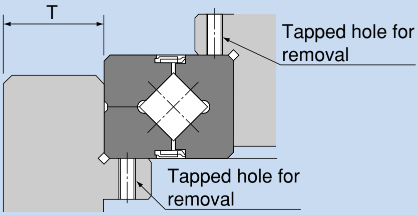


Fig. 7

●Presser Flange and Presser Bolt

When determining the thickness of the presser flange (F) or the clearance of the flange section (S), refer to the dimensions indicated below as a guide. As for the number of the presser bolts, the greater the number of the bolts, the more stable the system becomes. As a guide, however, it is normally appropriate to use 12 bolts and equidistantly arrange them.

F = B x 0.5 to B x 1.2
$H = B^{\ 0}_{-0.1}$
S = 0.5 mm

Even if the shaft and the housing are made of light alloy, it is recommendable to select a steel-based material for the presser flange.
When tightening the presser bolts, firmly secure them using a torque wrench or the like so that they will not loosen.
Table 13 shows tightening torques for the housing and presser flanges made of typical steel materials with medium hardness.

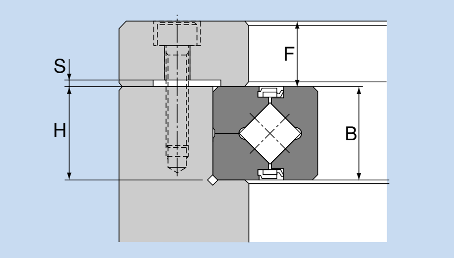


Table 12 Number of Presser Bolts and Bolt Sizes
Unit: mm

Outer diameter of the outer ring (D)		No. of bolts	Bolt size (reference value)
Above	Or less		
—	100	8 or more	M3 to M5
100	200	12 or more	M4 to M8
200	500	16 or more	M5 to M12
500	—	24 or more	M12 or thicker

Table 13 Bolt Tightening Torque
Unit: N-m

Nominal size of screw	Tightening torque	Nominal size of screw	Tightening torque
M3	2	M10	70
M4	4	M12	120
M5	9	M16	200
M6	14	M20	390
M8	30	M22	530

Procedure for Assembly

When assembling the Cross-Roller Ring, follow the steps below.

●Inspecting the Parts before Assembling Them

Thoroughly clean the housing and other parts to be assembled, and check if there is no burr or flush.

●Installing the Cross-Roller Ring into the Housing or onto the Shaft

Since the Cross-Roller Ring is a thin bearing, it tends to tilt as it is installed. To prevent it, gradually drive the Cross-Roller Ring into the housing or onto the shaft by gently hitting it with a plastic hammer while keeping it horizontal. Be sure to keep hammering it with much care until you hear it fully contact the reference surface.

●Attaching the Presser Flange

① Place the presser flange onto the Cross-Roller Ring. Rock the flange several times to match the bolt holes.

② Insert the presser bolts into the holes. Manually turn the bolts and make sure they do not show skewing caused by misalignment of the holes.

③ Tighten the presser bolts in three to four steps from temporary to full tightening by repeatedly securing the bolts in the diagonal order, as shown in Fig. 8. When tightening the separable inner or outer ring, slightly turning the integral outer or inner ring will correct the dislocation between the ring and the body.

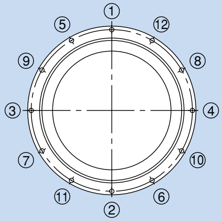
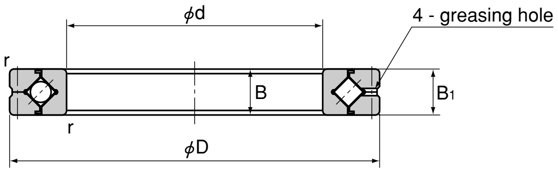
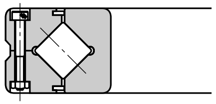


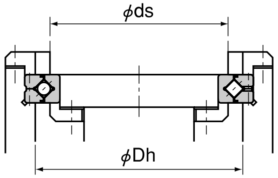
Fig. 8 Tightening Sequence

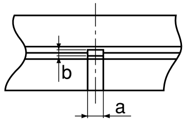
Model RB (Separable Outer Ring Type)



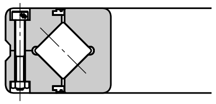


Model RB





Detail view of the greasing hole

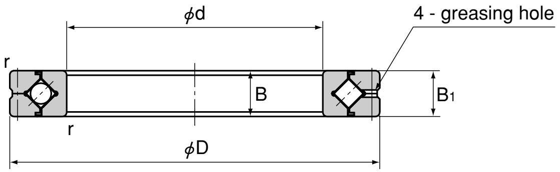


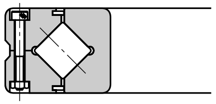
Model RB ⋯ UU

Unit: mm

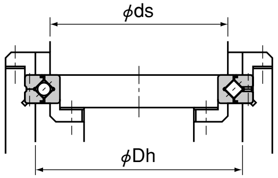
Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter	Outer diameter	Roller pitch circle diameter	Width	Greasing hole					C	C_0	
		d	D	dp	B B_1	a	b	r	ds	Dh	kN	kN	kg
20	RB 2008	20	36	27	8	2	0.8	0.8	23.5	30.5	3.23	3.1	0.04
25	RB 2508	25	41	32	8	2	0.8	0.8	28.5	35.5	3.63	3.83	0.05
30	RB 3010	30	55	41.5	10	2.5	1	1	37	47	7.35	8.36	0.12
35	RB 3510	35	60	46.5	10	2.5	1	1	41	51.5	7.64	9.12	0.13
40	RB 4010	40	65	51.5	10	2.5	1	1	47.5	57.5	8.33	10.6	0.16
45	RB 4510	45	70	56.5	10	2.5	1	1	51	61.5	8.62	11.3	0.17
50	RB 5013	50	80	64	13	2.5	1.6	1	57.4	72	16.7	20.9	0.27
60	RB 6013	60	90	74	13	2.5	1.6	1	68	82	18	24.3	0.3
70	RB 7013	70	100	84	13	2.5	1.6	1	78	92	19.4	27.7	0.35
80	RB 8016	80	120	98	16	3	1.6	1	91	111	30.1	42.1	0.7
90	RB 9016	90	130	108	16	3	1.6	1.5	98	118	31.4	45.3	0.75
100	RB 10016	100	140	119.3	16	3.5	1.6	1.5	109	129	31.7	48.6	0.83
	RB 10020		150	123	20	3.5	1.6	1.5	113	133	33.1	50.9	1.45
110	RB 11012	110	135	121.8	12	2.5	1	1	117	127	12.5	24.1	0.4
	RB 11015		145	126.5	15	3.5	1.6	1	122	136	23.7	41.5	0.75
	RB 11020		160	133	20	3.5	1.6	1.5	120	140	34	54	1.56
120	RB 12016	120	150	134.2	16	3.5	1.6	1	127	141	24.2	43.2	0.72
	RB 12025		180	148.7	25	3.5	2	2	133	164	66.9	100	2.62
130	RB 13015	130	160	144.5	15	3.5	1.6	1	137	152	25	46.7	0.72
	RB 13025		190	158	25	3.5	2	2	143	174	69.5	107	2.82

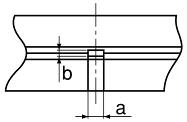
Note The model number of a type with seals attached is RB ⋯ UU.
If a certain level of accuracy is required, this model is used for inner ring rotation.



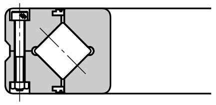


Model RB





Detail view of the greasing hole



Model RB ⋯ UU

Unit: mm

Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter	Outer diameter	Roller pitch circle diameter	Width	Greasing hole					C	C_0	
		d	D	dp	B B_1	a	b	r	ds	Dh	kN	kN	kg
140	RB 14016	140	175	154.8	16	2.5	1.6	1.5	147	162	25.9	50.1	1
	RB 14025		200	168	25	3.5	2	2	154	185	74.8	121	2.96
150	RB 15013	150	180	164	13	2.5	1.6	1	157	172	27	53.5	0.68
	RB 15025		210	178	25	3.5	2	2	164	194	76.8	128	3.16
	RB 15030		230	188	30	4.5	3	2	173	211	100	156	5.3
160	RB 16025	160	220	188.6	25	3.5	2	2	173	204	81.7	135	3.14
170	RB 17020	170	220	191	20	3.5	1.6	2	184	198	29	62.1	2.21
180	RB 18025	180	240	210	25	3.5	2	2	195	225	84	143	3.44
190	RB 19025	190	240	211.9	25	3.5	1.6	1.5	202	222	41.7	82.9	2.99
200	RB 20025	200	260	230	25	3.5	2	2.5	215	245	84.2	157	4
	RB 20030		280	240	30	4.5	3	2.5	221	258	114	200	6.7
	RB 20035		295	247.7	35	5	3	2.5	225	270	151	252	9.6
220	RB 22025	220	280	250.1	25	3.5	2	2.5	235	265	92.3	171	4.1
240	RB 24025	240	300	269	25	3.5	2	3	256	281	68.3	145	4.5
250	RB 25025	250	310	277.5	25	3.5	2	3	265	290	69.3	150	5
	RB 25030		330	287.5	30	4.5	3	3	269	306	126	244	8.1
	RB 25040		355	300.7	40	6	3.5	3	275	326	195	348	14.8
300	RB 30025	300	360	328	25	3.5	2	3	315	340	76.3	178	5.9
	RB 30035		395	345	35	5	3	3	322	368	183	367	13.4
	RB 30040		405	351.6	40	6	3.5	3	326	377	212	409	17.2
350	RB 35020	350	400	373.4	20	3.5	1.6	3	363	383	54.1	143	3.9

Note The model number of a type with seals attached is RB ⋯ UU.
If a certain level of accuracy is required, this model is used for inner ring rotation.

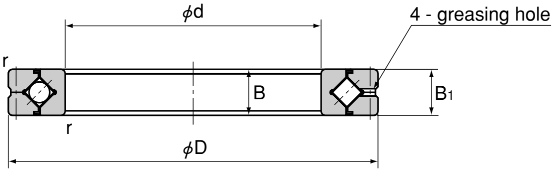
Model number coding

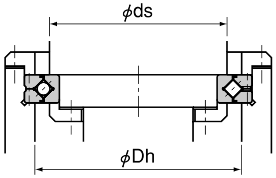
RB3010 UU CC0 P5

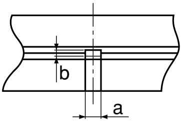
1 2 3 4

1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11) 4 Accuracy symbol (see page o-8)

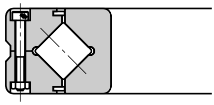
Model RB (Separable Outer Ring Type)



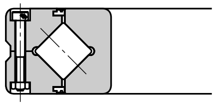




Detail view of the greasing hole



Model RB



Model RB ··· UU

Unit: mm

Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B₁	Greasing hole a	b	r	ds	Dh	C kN	C₀ kN	kg
400	RB 40035	400	480	440.3	35	5	3	3.5	422	459	156	370	14.5
	RB 40040		510	453.4	40	6	3.5	3.5	428	479	241	531	23.5
450	RB 45025	450	500	474	25	3.5	1.6	1.5	464	484	61.7	182	6.6
500	RB 50025	500	550	524.2	25	3.5	1.6	1.5	514	534	65.5	201	7.3
	RB 50040		600	548.8	40	6	3	3.5	526	572	239	607	26
	RB 50050		625	561.6	50	6	3.5	3.5	536	587	267	653	41.7
600	RB 60040	600	700	650	40	6	3	4	627	673	264	721	29
700	RB 70045	700	815	753.5	45	6	3	4	731	777	281	836	46
800	RB 80070	800	950	868.1	70	6	4	5	836	900	468	1330	105
900	RB 90070	900	1050	969	70	6	4	5	937	1001	494	1490	120
1000	RB 1000110	1000	1250	1114	110	6	6	6	1057	1171	1220	3220	360
1250	RB 1250110	1250	1500	1365.8	110	6	6	6	1308	1423	1350	3970	440

Note The model number of a type with seals attached is RB ··· UU.
If a certain level of accuracy is required, this model is used for inner ring rotation.

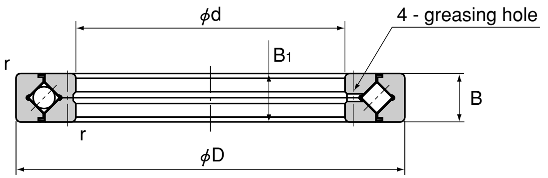
Model number coding

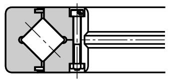
RB40040 UU C0 PE5

1 2 3 4

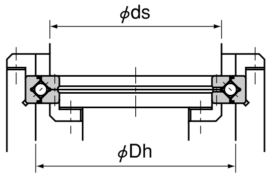
1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11) 4 Accuracy symbol (see page o-8)

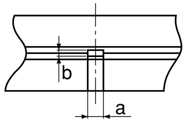
Model RE (Separable Inner Ring Type)



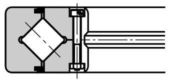


Model RE





Detail view of the greasing hole

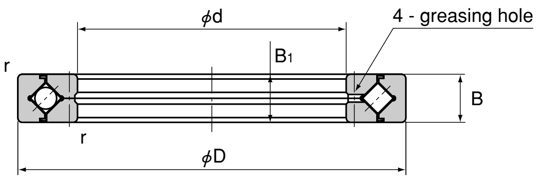


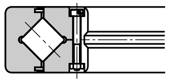
Model RE ··· UU

Unit: mm

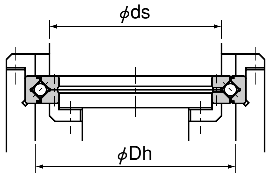
Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B₁	Greasing hole a	b	r	ds	Dh	C kN	C₀ kN	kg
20	RE 2008	20	36	29	8	2	0.8	0.8	23.5	30.5	3.23	3.1	0.04
25	RE 2508	25	41	34	8	2	0.8	0.8	28.5	35.5	3.63	3.83	0.05
30	RE 3010	30	55	43.5	10	2.5	1	1	37	47	7.35	8.36	0.12
35	RE 3510	35	60	48.5	10	2.5	1	1	41	51.5	7.64	9.12	0.13
40	RE 4010	40	65	53.5	10	2.5	1	1	47.5	58	8.33	10.6	0.16
45	RE 4510	45	70	58.5	10	2.5	1	1	51	61.5	8.62	11.3	0.17
50	RE 5013	50	80	66	13	2.5	1.6	1	57.5	72	16.7	20.9	0.27
60	RE 6013	60	90	76	13	2.5	1.6	1	68	82	18	24.3	0.3
70	RE 7013	70	100	86	13	2.5	1.6	1	78	92	19.4	27.7	0.35
80	RE 8016	80	120	101.4	16	3	1.6	1	91	111	30.1	42.1	0.7
90	RE 9016	90	130	112	16	3	1.6	1.5	98	118	31.4	45.3	0.75
100	RE 10016	100	140	121.1	16	3	1.6	1.5	109	129	31.7	48.6	0.83
	RE 10020		150	127	20	3.5	1.6	1.5	113	133	33.1	50.9	1.45
110	RE 11012	110	135	123.3	12	2.5	1	1	117	127	12.5	24.1	0.4
	RE 11015		145	129	15	3	1.6	1	122	136	23.7	41.5	0.75
	RE 11020		160	137	20	3.5	1.6	1.5	120	140	34	54	1.56
120	RE 12016	120	150	136	16	3	1.6	1	127	141	24.2	43.2	0.72
	RE 12025		180	152	25	3.5	2	2	133	164	66.9	100	2.62
130	RE 13015	130	160	146	15	3	1.6	1	137	152	25	46.7	0.72
	RE 13025		190	162	25	3.5	2	2	143	174	69.5	107	2.82

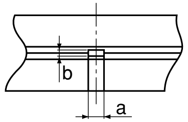
Note The model number of a type with seals attached is RE ··· UU.
If a certain level of accuracy is required, this model is used for outer ring rotation.



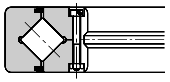


Model RE





Detail view of the greasing hole



Model RE ··· UU

Unit: mm

Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B₁	Greasing hole a	b	r	ds	Dh	C kN	C₀ kN	kg
140	RE 14016	140	175	160	16	3	1.6	1.5	147	162	25.9	50.1	1
	RE 14025		200	172	25	3.5	2	2	154	185	74.8	121	2.96
150	RE 15013	150	180	166	13	2.5	1.6	1	158	172	27	53.5	0.68
	RE 15025		210	182	25	3.5	2	2	164	194	76.8	128	3.16
	RE 15030		230	192	30	4.5	3	2	173	210	100	156	5.3
160	RE 16025	160	220	192	25	3.5	2	2	173	204	81.7	135	3.14
170	RE 17020	170	220	196.1	20	3.5	1.6	2	184	198	29	62.1	2.21
180	RE 18025	180	240	210	25	3.5	2	2	195	225	84	143	3.44
190	RE 19025	190	240	219	25	3.5	1.6	1.5	202	222	41.7	82.9	2.99
200	RE 20025	200	260	230	25	3.5	2	2.5	215	245	84.2	157	4
	RE 20030		280	240	30	4.5	3	2.5	221	258	114	200	6.7
	RE 20035		295	247.7	35	5	3	2.5	225	270	151	252	9.6
220	RE 22025	220	280	250.1	25	3.5	2	2.5	235	265	92.3	171	4.1
240	RE 24025	240	300	272.5	25	3.5	2	3	256	281	68.3	145	4.5
250	RE 25025	250	310	280.9	25	3.5	2	3	268	293	69.3	150	5
	RE 25030		330	287.5	30	4.5	3	3	269	306	126	244	8.1
	RE 25040		355	300.7	40	6	3.5	3	275	326	195	348	14.8
300	RE 30025	300	360	332	25	3.5	2	3	319	344	75.5	178	5.9
	RE 30035		395	345	35	5	3	3	322	368	183	367	13.4
	RE 30040		405	351.6	40	6	3.5	3	326	377	212	409	17.2
350	RE 35020	350	400	376.6	20	3.5	1.6	3	363	383	54.1	143	3.9

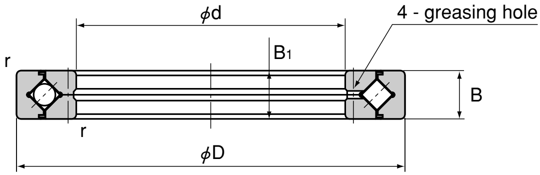
Note The model number of a type with seals attached is RE ··· UU.
If a certain level of accuracy is required, this model is used for outer ring rotation.

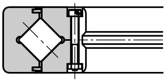
Model number coding

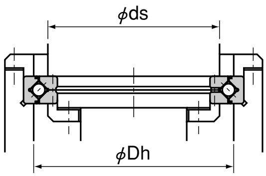
RE8016 UU CC0 P4
1 2 3 4

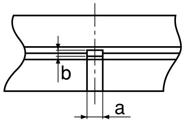
1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11) 4 Accuracy symbol (see page o-8)

Model RE (Separable Inner Ring Type)

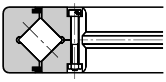



Model RE





Detail view of the greasing hole


Model RE ··· UU

Unit: mm

Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B_1	Greasing hole a	b	r	ds	Dh	C kN	C_0 kN	kg
400	RE 40035	400	480	440.3	35	5	3	3.5	422	459	156	370	14.5
	RE 40040		510	453.4	40	6	3.5	3.5	428	479	241	531	23.5
450	RE 45025	450	500	476.6	25	3.5	1.6	1.5	464	484	61.7	182	6.6
500	RE 50025	500	550	526.6	25	3.5	1.6	1.5	514	534	65.5	201	7.3
	RE 50040		600	548.8	40	6	3	3.5	526	572	239	607	26
	RE 50050		625	561.6	50	6	3.5	3.5	536	587	267	653	41.7
600	RE 60040	600	700	650	40	6	3	4	627	673	264	721	29

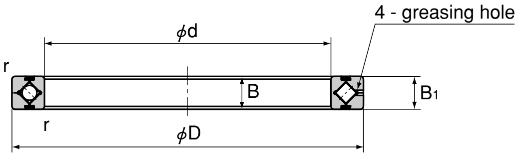
Note The model number of a type with seals attached is RE ··· UU.
If a certain level of accuracy is required, this model is used for outer ring rotation.

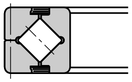
Model number coding

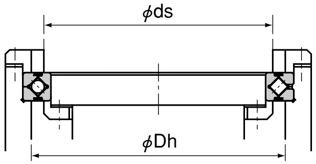
RE50025 UU CC0 P6
1 2 3 4

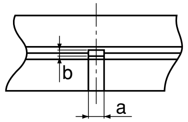
1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11) 4 Accuracy symbol (see page o-8)

Model RA (Separable Outer Ring Type)

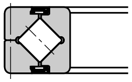



Model RA





Detail view of the greasing hole


Model RA ··· UU

Unit: mm

Shaft diameter	Model No.	Major dimensions							Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B1	Greasing hole a	b	r	ds	Dh	C kN	C0 kN	kg
50	RA 5008	50	66	57	8	2	0.8	0.8	53.5	60.5	5.1	7.19	0.08
60	RA 6008	60	76	67	8	2	0.8	0.8	63.5	70.5	5.68	8.68	0.09
70	RA 7008	70	86	77	8	2	0.8	0.8	73.5	80.5	5.98	9.8	0.1
80	RA 8008	80	96	87	8	2	0.8	0.8	83.5	90.5	6.37	11.3	0.11
90	RA 9008	90	106	97	8	2	0.8	0.8	93.5	100.5	6.76	12.4	0.12
100	RA 10008	100	116	107	8	2	0.8	0.8	103.5	110.5	7.15	13.9	0.16
110	RA 11008	110	126	117	8	2	0.8	0.8	113.5	120.5	7.45	15	0.15
120	RA 12008	120	136	127	8	2	0.8	0.8	123.5	130.5	7.84	16.5	0.17
130	RA 13008	130	146	137	8	2	0.8	0.8	133.5	140.5	7.94	17.6	0.18
140	RA 14008	140	156	147	8	2	0.8	0.8	143.5	150.5	8.33	19.1	0.19
150	RA 15008	150	166	157	8	2	0.8	0.8	153.5	160.5	8.82	20.6	0.2
160	RA 16013	160	186	172	13	2.5	1.6	1.2	165	179	23.3	44.9	0.59
170	RA 17013	170	196	182	13	2.5	1.6	1.2	175	189	23.5	46.5	0.64
180	RA 18013	180	206	192	13	2.5	1.6	1.2	185	199	24.5	49.8	0.68
190	RA 19013	190	216	202	13	2.5	1.6	1.2	195	209	24.9	51.5	0.69
200	RA 20013	200	226	212	13	2.5	1.6	1.2	205	219	25.8	54.7	0.71

Note The model number of a type with seals attached is RA ··· UU.
If a certain level of accuracy is required, this model is used for inner ring rotation.

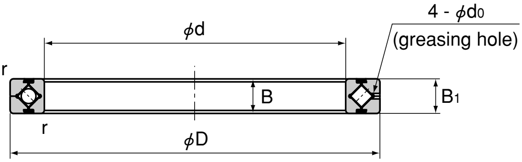
Model number coding

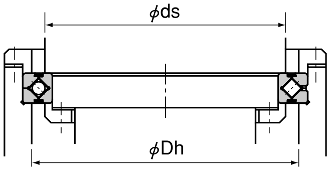
RA7008 UU CC0

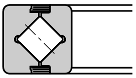
1 2 3

1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11)

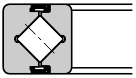
Model RA-C (Singe-split Type)







Model RA ··· C



Model RA ··· CUU

Unit: mm

Shaft diameter	Model No.	Major dimensions						Shoulder dimensions		Basic load rating (radial)		Mass
		Inner diameter d	Outer diameter D	Roller pitch circle diameter dp	Width B B_1	Greasing hole d_0	r	ds	Dh	C kN	C_0 kN	kg
50	RA 5008C	50	66	57	8	1.5	0.8	53.5	60.5	5.1	7.19	0.08
60	RA 6008C	60	76	67	8	1.5	0.8	63.5	70.5	5.68	8.68	0.09
70	RA 7008C	70	86	77	8	1.5	0.8	73.5	80.5	5.98	9.8	0.1
80	RA 8008C	80	96	87	8	1.5	0.8	83.5	90.5	6.37	11.3	0.11
90	RA 9008C	90	106	97	8	1.5	0.8	93.5	100.5	6.76	12.4	0.12
100	RA 10008C	100	116	107	8	1.5	0.8	103.5	110.5	7.15	13.9	0.16
110	RA 11008C	110	126	117	8	1.5	0.8	113.5	120.5	7.45	15	0.15
120	RA 12008C	120	136	127	8	1.5	0.8	123.5	130.5	7.84	16.5	0.17
130	RA 13008C	130	146	137	8	1.5	0.8	133.5	140.5	7.94	17.6	0.18
140	RA 14008C	140	156	147	8	1.5	0.8	143.5	150.5	8.33	19.1	0.19
150	RA 15008C	150	166	157	8	1.5	0.8	153.5	160.5	8.82	20.6	0.2
160	RA 16013C	160	186	172	13	2	1.2	165	179	23.3	44.9	0.59
170	RA 17013C	170	196	182	13	2	1.2	175	189	23.5	46.5	0.64
180	RA 18013C	180	206	192	13	2	1.2	185	199	24.5	49.8	0.68
190	RA 19013C	190	216	202	13	2	1.2	195	209	24.9	51.5	0.69
200	RA 20013C	200	226	212	13	2	1.2	205	219	25.8	54.7	0.71

Note The model number of a type with seals attached is RA ··· CUU.
If a certain level of accuracy is required, this model is used for inner ring rotation.

Model number coding

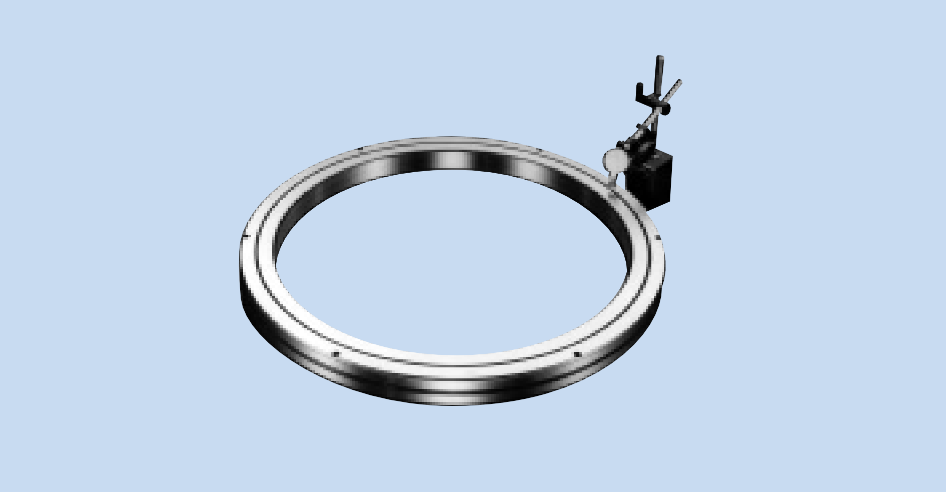
RA6008C UU C0

1 2 3

1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-11)

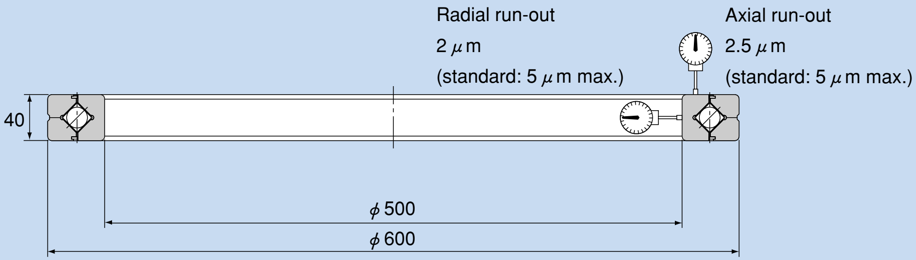
USP-Grade Series of Models RB and RE

THK has standardized an ultra-super-precision-grade (USP-grade) series of Cross-Roller Ring models, which achieve rotational accuracies much higher than the conventional standards for large-diameter bearings, by introducing multi-spindle grinding machines dedicated for large-scale Cross-Roller Rings. The inner and outer rings are minimized in size, and yet ensure high rigidity. Accordingly, this series is optimal for swiveling tables of machine tools and the likes.



Examples of Rotational Accuracy of the USP-Grade Series Cross-Roller Rings

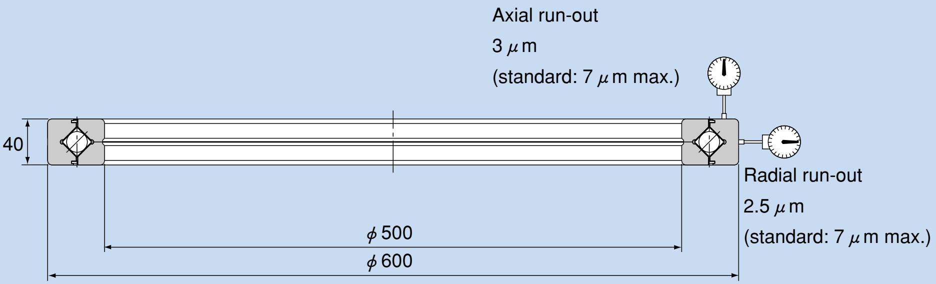
The rotational accuracy of the USP-grade series achieves ultra-super precision to a level exceeding the world's most stringent accuracy standards such as JIS Class 2, ISO Class 2, DIN P2 and AFBMA ABEC9.



Radial run-out
2 μm
(standard: 5 μm max.)

Axial run-out
2.5 μm
(standard: 5 μm max.)

Rotational accuracy of the inner ring of model RB50040CC0USP



Axial run-out
3 μm
(standard: 7 μm max.)

Radial run-out
2.5 μm
(standard: 7 μm max.)

Rotational accuracy of the outer ring of model RE50040CC0USP

Accuracy Standards

The USP-grade series of models RB and RE are manufactured with run-out accuracies according to table 1.

Table 1 Run-out Accuracies of the USP-grade Series

Unit: μm

Nominal inner diameter (d) and outer diameter (D) (mm)		Run-out accuracy of the inner ring of model RB		Run-out accuracy of the outer ring of model RE	
Above	Or less	Radial run-out tolerance	Axial run-out tolerance	Radial run-out tolerance	Axial run-out tolerance
80	180	2.5	2.5	3	3
180	250	3	3	4	4
250	315	4	4	4	4
315	400	4	4	5	5
400	500	5	5	5	5
500	630	6	6	7	7
630	800	—	—	8	8

Radial Clearance

Table 2 shows the radial clearances of the USP-grade series of models RB and RE.

Table 2 Radial Clearances

Unit: μm

Roller pitch circle diameter (dp) (mm)		CC0		C0	
Above	Or less	Min.	Max.	Min.	Max.
120	160	–10	0	0	40
160	200	–10	0	0	50
200	250	–10	0	0	60
250	280	–15	0	0	80
280	315	–15	0	0	100
315	355	–15	0	0	110
355	400	–15	0	0	120
400	500	–20	0	0	130
500	560	–20	0	0	150
560	630	–20	0	0	170
630	710	–20	0	0	190

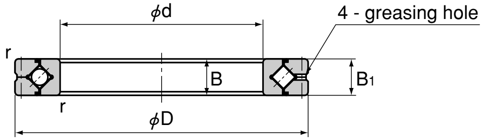
Fitting

For the fitting of the USP-grade series of models RB and RE, we recommend using the combinations indicated in table 3.

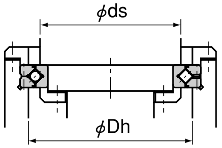
Table 3 Fitting

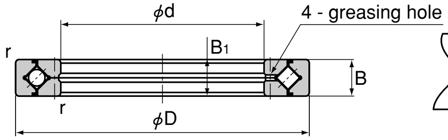
Radial clearance	Service conditions	Shaft	Housing
CCO	Inner ring rotational load	h5	J7
	Outer ring rotational load	g5	Js7
CO	Inner ring rotational load	j5	J7
	Outer ring rotational load	g5	K7

USP-Grade Models RB and RE

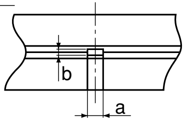


Model RB-USP (RB ··· UU-USP)





Model RE-USP (RE ··· UU-USP)



Detail view of the greasing hole

Unit: mm

Model No.	Major dimensions												Shoulder dimensions		Basic load rating Radial		Mass
	Inner diameter		Outer diameter		Roller pitch circle diameter dp		Width			Greasing hole					C	C0	
	d	Tolerance*	D	Tolerance*	RB	RE	B,B1	Tolerance of B	Tolerance of B1	a	b	r**	ds	Dh	kN	kN	kg
RB 10020USP RE 10020USP	100	0 −0.020	150	0 −0.018	123	127	20	0 −0.075	0 −0.100	3.5	1.6	1	113	133	33.1	50.9	1.45
RB 12025USP RE 12025USP	120		180	0 −0.025	148.7	152	25			3.5	2	1.5	133	164	66.9	100	2.62
RB 15025USP RE 15025USP	150	0 −0.025	210	0 −0.030	178	182	25	0 −0.100	0 −0.120				164	194	76.8	128	3.16
RB 20030USP RE 20030USP	200	0 −0.030	280	0 −0.035	240	240	30			4.5	3	2	221	258	114	200	6.7
RB 25030USP RE 25030USP	250		330	0 −0.040	287.5	287.5	30					2.5	269	306	126	244	8.1
RB 30035USP RE 30035USP	300	0 −0.035	395		345	345	35	0 −0.120	0 −0.150	5	3		322	368	183	367	13.4
RB 40040USP RE 40040USP	400	0 −0.040	510	0 −0.050	453.4	453.4	40	0 −0.150	0 −0.200	6	3.5		428	479	241	531	23.5
RB 50040USP RE 50040USP	500	0 −0.045	600		548.8	548.8	40			6	3		526	572	239	607	26
RB 60040USP RE 60040USP	600	0 −0.050	700	0 −0.075	650	650	40					3	627	673	264	721	29

Note Symbol ** indicates the minimum permissible dimension of the chamfer dimension "r."
The dimensional tolerance in inner/outer diameter "*" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner/outer diameter at two points.
The model number of a type with seals attached is RB ··· UU-USP or RE ··· UU-USP.
If a certain level of rotational accuracy is required for the inner ring, select model RB; if a certain level of rotational accuracy is required for the outer ring, select model RE.

Model number coding

RB50040 UU CC0 USP

1 2 3 4

1 Model number 2 Seal attached on both ends (seal attached on either end: U)
3 Radial clearance symbol (see page o-30) 4 Accuracy symbol (ultra-super-precision grade)

Precautions on Using the Cross-Roller Ring

Handling

(1) The separable inner or outer ring is fastened in place using special rivets, bolts or nuts when delivered. When installing it to the system, do not disassemble it. Also, erroneously installing the spacer retainer will significantly affect the rotational performance of the system. Do not disassemble the bearing.

(2) The matching mark of the inner or outer ring may be slightly misaligned when delivered. In that case, loosen the bolts that secure the inner or outer ring, and correct the alignment using a plastic hammer or the like, before installing it to the housing (let the securing rivets follow the housing).

(3) When installing or removing the Cross-Roller Ring, do not apply force to the securing rivets or the bolts.

(4) When mounting the presser flange, take into account the dimensional tolerances of the parts so that the flange firmly holds the inner and outer ring from the side.

(5) Dropping or hitting the Cross-Roller Ring may damage it. Giving an impact to it could also cause damage to its function even if the product looks intact.

Lubrication

(1) Since each Cross-Roller Ring unit contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease. However, the product requires regular lubrication since it has a smaller internal space than ordinary roller bearings and because the rollers need frequent lubrication due to their rolling contact structure.

To replenish grease, it is necessary to secure greasing holes that lead to the oil grooves formed on the inner and outer rings. As for the lubrication interval, normally replenish grease of the same group so that it is distributed throughout the interior of the bearing at least every six to twelve months.

When the bearing is filled up with grease, the initial rotation torque temporarily increases. However, surplus grease will run off of the seals and the torque will return to the normal level in a short period. The thin type does not have an oil groove. Secure an oil groove inside the housing for lubrication.

(2) Do not mix lubricants of different physical properties.

(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.

(4) When planning to use a special lubricant, contact THK before using it.

Precautions on Use

(1) Entrance of foreign matter may cause functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.

(2) When desiring to use the system at temperature of 80℃ or higher, contact THK in advance.

(3) If planning to use the Cross-Roller Ring in an environment where a coolant penetrates into the product, contact THK.

(4) If foreign matter adheres to the product, replenish the lubricant after cleaning the product with clean white kerosene.

(5) When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.

Cam Follower

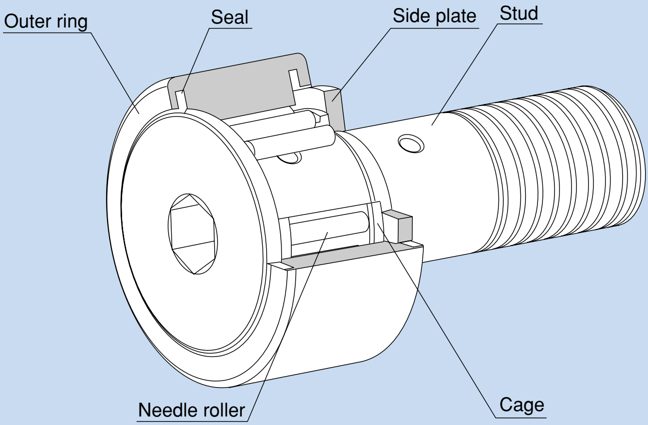


Fig. 1 Structure of Cam Follower Model CF ··· UU-A

Structure and Features

The Cam Follower is a compact and highly rigid bearing with a shaft. It contains needle bearings and is used as a guide roller for cam mechanisms or linear motion.

Since its outer ring rotates while keeping direct contact with the mating surface, this product is thick-walled and designed to bear an impact load.

Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.

There are two types of the outer ring in shape: spherical and cylindrical. The spherical outer ring easily absorbs a distortion of the shaft center when the cam follower is installed and helps lighten a biased load.

Applications

The Cam Follower is used in a wide range of applications such as cam mechanisms of automatic machines, dedicated machines as well as carrier systems, conveyors, bookbinding machines, tool changers of machining centers, pallet changers, automatic coating machines, sliding forks of automatic warehouses.

Types and Features

●Popular Type Cam Follower

Model CF

It is a popular type of Cam Follower provided with a driver groove on the head of the stud. A highly corrosion resistant stainless steel type (symbol M) is also available.

●Cam Follower with a Hexagon Socket

Model CF-A

Since the stud head has a hexagon socket, this model can easily be installed using a hexagon wrench.

A type whose stud screw has a hexagon socket (CF-B) is also available (applicable to stud diameter of 12 or greater).

●Eccentric Cam Follower with a Hexagon Socket

Model CFH-A

This model can be installed in the same mounting hole as that of model CF. Since the mounting shaft of the stud and the stud head are eccentric by 0.25 mm to 1.0 mm, the position of this model can easily be adjusted simply by turning the stud. Thus, it is a compact, highly accurate eccentric cam follower with an integral structure. As a result, the man-hours for machining and assembly can significantly be reduced because it is unnecessary to align the cam follower with the cam groove and machine the mounting-hole area with precision.

●Cam Follower Containing Thrust Balls

Model CFN

Based on the popular type Cam Follower, this model is incorporated with thrust load balls.

Model CFN is capable of receiving an axial load generated due to a mounting error.

●Cam Follower with a Tapped Hole for Greasing

Model CFT

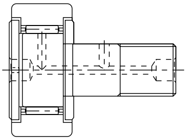
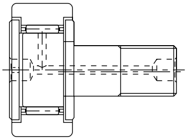
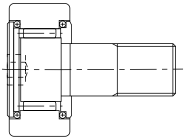
Basically the same as the popular type Cam Follower, this model is provided with tapped holes for piping on the stud head and the thread.

It is optimal for locations where an integrated piping for greasing is required.

Types and Model Numbers

The Cam Follower is divided into several types as indicated in table 1.

Table 1 Types and Model Numbers of Cam Followers

Type		Popular type	Eccentric Cam Follower	Containing thrust balls
Shape				
Cylindrical outer ring	Stud with a hexagon socket	CF-A(CF···UU-A)	CFH-A(CFH···UU-A)	—
	Stud with a driver groove	CF(CF···UU)	CFH(CFH···UU)	—
	With a tapped hole for greasing	CFT(CFT···UU)	CFHT(CFHT···UU)	—
	Made of stainless steel	CF-M(CF···MUU)	CFH-M(CFH···MUU)	—
Spherical outer ring	Stud with a hexagon socket	CF-R-A(CF···UUR-A)	CFH-R-A(CFH···UUR-A)	CFN-R-A
	Stud with a driver groove	CF-R(CF···UUR)	CFH-R(CFH···UUR)	—
	With a tapped hole for greasing	CFT-R(CFT···UUR)	CFHT-R(CFHT···UUR)	—
	Made of stainless steel	CF-MR(CF···MUUR)	CFH-MR(CFH ···MUUR)	—

Note 1: The symbols in the parentheses indicate model numbers of types with seals.
Note 2: THK also manufactures low-speed full-roller types with long service lives. For these full-roller types, symbol "V" is indicated.
Note 3: Symbol M indicates a stainless steel type.

Example: **CF 12 V UUR**
V: Full-roller type

Accuracy Standards

Cam Followers are manufactured with accuracies according to table 2.

① Dimensional tolerance of the cylindrical outer ring in outer diameter D: table 2

② Dimensional tolerance of the spherical outer ring in outer diameter D: $^{\ \ 0}_{-0.05}$

③ Dimensional tolerance of the Cam Follower in stud diameter d: h7

④ Dimensional tolerance of the outer ring in width B: $^{\ \ 0}_{-0.12}$

Table 2 Accuracy of the Outer Ring (JIS Class 0)
Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of the bearing in outer diameter (Dm) (note)		Tolerance of the outer ring in radial run-out (max)
Above	Or less	Upper	Lower	
6	18	0	− 8	15
18	30	0	− 9	15
30	50	0	−11	20
50	80	0	−13	25
80	120	0	−15	35

Note: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

Radial Clearance

The radial clearances of Cam Followers meet clearance C2 (see table 3).
(Normal clearance applies to full-roller types.)

Table 3 Radial Clearance

Unit: μm

Model No.: CF, CFN, CFH and CFT	Clearance C2		Normal clearance	
	Min.	Max.	Min.	Max.
3 to 4	3	17	10	25
5 to 8	5	20	15	30
10 to 12-1	5	25	15	35
16 to 20-1	10	30	20	40
24 to 30-2	10	40	25	55

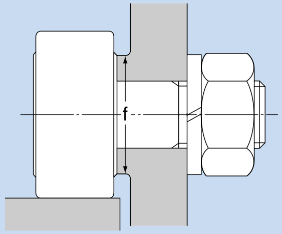
Fitting

For the dimensional tolerance of the Cam Follower in stud-mounting hole, we recommend the following fitting.
The dimensional tolerance of the stud-mounting hole: H7

Installation

●Installing the Cam Follower

Establish perpendicularity between the stud-mounting hole and the mounting surface, and chamfer the mouth of the hole to the smallest possible radius, preferably C0.5. Also, the diameter of the mounting surface should preferably be at least equal to the dimension "f" indicated in the dimensional table.



If the Cam Follower is to be used under a heavy load, it is necessary to install the product so that the greasing hole on the stud is out of the loaded area. To help identify the position of the greasing hole, the THK logo is marked on the side face of the stud collar (see Fig. 2). The vertical hole in the middle of the stud is used as a whirl stop or a greasing hole.

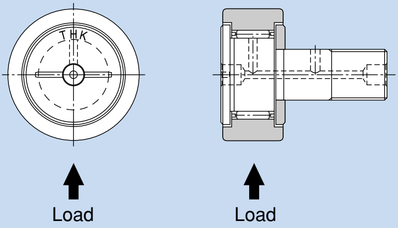


Fig. 2 Positions of the THK Logo and the Greasing Holes

Make sure that the outer ring is evenly in contact with the mating surface. If the outer ring unilaterally or unevenly contacts the mating surface, we recommend using model CF-R, whose outer ring circumference is spherically ground. When installing the Cam Follower, also make sure its axis is perpendicular to the traveling direction.

Tightening Torque for the Stud

Since the stud of the Cam Follower receives bending stress and tensile stress caused by a bearing load, it is necessary to keep the tightening torque of the screw from exceeding the values indicated in table 4.

If the mounting screw may be loosened due to vibrations or impact, use a spring washer, thin nuts of JIS B 1811 Class 3 as double nuts or a special nut capable of preventing itself from loosening.

Table 4 Maximum Tightening Torque of the Screw

Model No.: CF, CFN, CFH and CFT	Maximum tightening torque N-m
3	0.392
4	0.98
5	1.96
6	2.94
8	7.84
10 10−1	16.7
12 12−1	29.4
16	70.6
18	98
20 20−1	137
24 24−1	245
30 30−1 30−2	480

Note: 1 N-m equals to 0.102 kgf-m.

●Installing the Eccentric Cam Follower

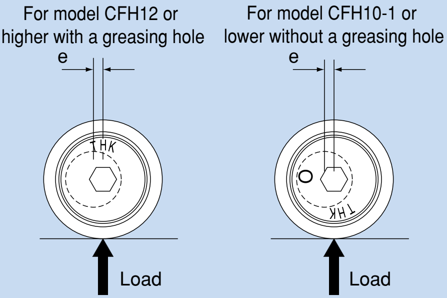
The eccentricity is adjusted in the following steps.

① Insert the stud into the mounting hole, and lightly tighten the nut until the nut starts turning. In doing so, position the THK logo in relation to the load direction as shown in Fig. 3.

② Use the hexagon socket on the stud head to turn the stud and adjust the clearance between the stud and the mating contact surface.

③ After adjusting the clearance, tighten the nut while keeping the stud from turning. Be sure the maximum tightening torque in table 4 is not exceeded.

The surface of the Cam Follower stud is hardened. Take this into account when machining the stud.



The figure shows the position of the THK logo in relation to the eccentricity direction for model CFH12 or higher with a greasing hole.

For model CFH10-1 or lower without a greasing hole, the "○" mark indicates the eccentricity direction. There is not relationship between the THK logo and the eccentricity direction.

Fig. 3

Cam Follower with a Hexagon Socket

For Cam Follower model CF, Cam Follower Containing Thrust Balls model CFN and Eccentric Cam Follower model CFH, hexagon socket studs that allow easy eccentricity adjustment are available. If desiring a hexagon socket on the stud head, add "A" to the end of the model number. If desiring a hexagon socket on the stud thread, add "B" ("B" applies to model CF12 or higher).

Cam Follower Containing Thrust Balls

Even a slight mounting error in a high-speed cam mechanism operating in a harsh environment could cause abnormal wear to the thrust unit of the cam follower. In such a case, using Cam Follower Containing Thrust Balls model CFN will bring about a significant effect in increasing the durability.

Models CFN5 to 12 are standard-stock items. If desiring a size other than the standard items, contact THK .

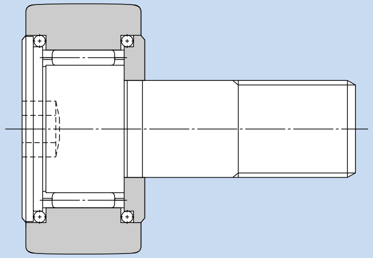


Fig. 4

Model CFN is capable of receiving a thrust load caused by a slight mounting error. However, it is necessary to minimize a component of thrust force, or prevent it from occurring, when designing the cam mechanism and installing the Cam Follower.

Dust Prevention and Lubrication

The Cam Follower models include seal types (model numbers: "…UU"), which are incorporated with special synthetic rubber seals that are highly resistant to wear in order to prevent foreign matter from entering the interior of the cam follower and the lubricant from leaking.

Since each Cam Follower unit with seals contains high-quality lithium soap group grease No. 2, you can start using the product without replenishing grease. Exceptionally, model CFN contains AFC Grease.

If your Cam Follow does not have seals, fill grease from the greasing hole on the stud or the inner ring. However, some of the model numbers with stud diameters of 10 mm or less do not have a greasing hole and are provided with initial lubrication only, and therefore do not allow replenishment of grease.

The appropriate fill quantity is a half to one third of the space inside the bearing. The lubrication interval varies depending on the operating conditions. As a guide, however, replenish grease of the same group every six months to two years for types with a cage, or every one to 6 months for full-roller types.

Even with types equipped with seals ("…UU"), surplus grease may seep during the initial operation period or immediately after grease replenishment. If desiring to avoid contamination of the surrounding area of the machine by grease, first perform seasoning or the like in advance, and then wipe the seeping surplus grease.

When driving the dedicated grease nipple onto the Cam Follower, use a jig like the one shown in Fig. 5 to provide pressure to the flange of the nipple.

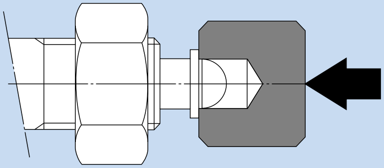


Fig. 5

Accessories for the Cam Follower

Table 5 shows accessories for standard types of Cam Followers. The dedicated grease nipple is attached at your request. If desiring the dedicated grease nipple, add symbol "N" to the end of the model number.
Example: CF12UUR-N

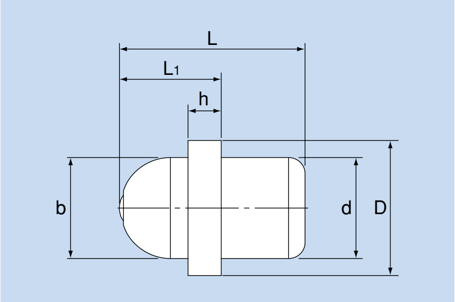


Table 5 Accessories

Model No.		Stopper cap (note 1)	Stud plug (note 2)	Nut JIS Class 2	Grease (note 3)
CF CFH	Without seal	Included in package	Included in package	Included in package	Not contained
	With seal	Included in package	Included in package	Included in package	Contained
CFN		Included in package	Included in package	Included in package	Contained
CFT	Without seal	—	—	Included in package	Not contained
	With seal	—	—	Included in package	Contained

Note 1: The stopper cap is used to prevent grease from leaking. However, it is not included in the packages of model CF5, and hexagon socket types of models CFN10 (R)-A and CF (CFH) 10-1 (R)-A or lower.

Note 2: The stud plug is used to close an unused greasing hole. However, it is not attached to model CF (CFH) 10-1 -A or lower.

Note 3: All models without a greasing hole are filled with grease when assembled regardless of whether a seal is attached or not.

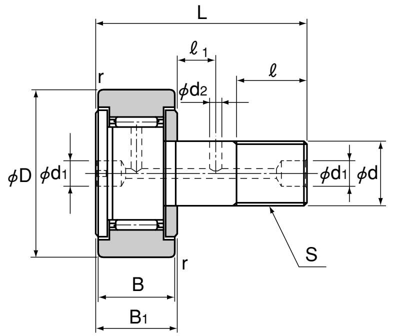
Table 6 Dimensional Table for Grease Nipples

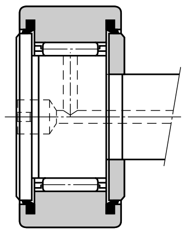
Supported models	Nipple dimensions						Nipple model No.
CF, CFN and CFH	d	b	D	h	L	L_1	
5	3.1	6	7.5	1.5	9	5.5	NP3.2X3.5
6 to 10	4	6	7.5	1.5	10	5.5	PB1021B
12 to 18	6	6	8	2	11	6	NP6X5
20 to 30	8	6	10	3	16	7	NP8X9

Note: The grease nipple is not attached to models CFN10 (R)-A and CF (CFH) 10-1 (R)-A or lower.

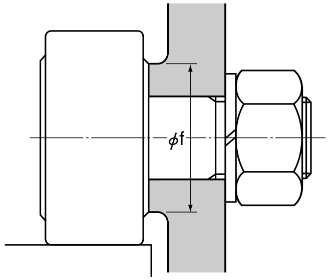
Model CF | Model CF-M

Popular Type (Cylindrical Outer Ring) | Stainless Steel Type





Model CF ··· UU



Unit: mm

Stud diameter	Model No.	Major dimensions											Basic load rating		Maximum permissible load	Track load capacity	Rotational speed limit**	Mass
d	Cylindrical outer ring	Outer diameter D	Thread S	Outer ring width B	B_1	Overall length L	d_1	d_2	ℓ	$ℓ_1$	r	Shoulder height f (Min.)	C kN	C_0 kN	F_0 kN	kN	min^{-1}	g
5	CF 5	13	M5×0.8	9	10	23	3.1 *	—	7.5	—	0.5	9.7	3.14	2.77	1.42	2.25	29000	10.5
6	CF 6	16	M6×1	11	12	28	4 *	—	9	—	0.5	11	3.59	3.58	2.11	3.43	25000	18.5
8	CF 8	19	M8×1.25	11	12	32	4 *	—	11	—	0.5	13	4.17	4.65	4.73	4.02	20000	28.5
10	CF 10	22	M10×1.25	12	13	36	4 *	—	13	—	1	15	5.33	6.78	5.81	4.7	17000	45
10	CF 10-1	26	M10×1.25	12	13	36	4 *	—	13	—	1	15	5.33	6.78	5.81	5.49	17000	60
12	CF 12	30	M12×1.5	14	15	40	6	3	14	6	1.5	20	7.87	9.79	9.37	7.06	14000	95
12	CF 12-1	32	M12×1.5	14	15	40	6	3	14	6	1.5	20	7.87	9.79	9.37	7.45	14000	105
16	CF 16	35	M16×1.5	18	19.5	52	6	3	18	8	1.5	24	12	18.3	17.3	11.2	10000	170
18	CF 18	40	M18×1.5	20	21.5	58	6	3	20	8	1.5	26	14.7	25.2	26.1	14.4	8500	250
20	CF 20	52	M20×1.5	24	25.5	66	8	4	22	9	1.5	36	20.7	34.8	32.1	23.2	7000	460
20	CF 20-1	47	M20×1.5	24	25.5	66	8	4	22	9	1.5	36	20.7	34.8	32.1	21	7000	385
24	CF 24	62	M24×1.5	29	30.5	80	8	4	25	11	1.5	40	30.6	53.2	49.5	34.2	6500	815
24	CF 24-1	72	M24×1.5	29	30.5	80	8	4	25	11	1.5	40	30.6	53.2	49.5	39.8	6500	1140
30	CF 30	80	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	52.6	5000	1870
30	CF 30-1	85	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	56	5000	2030
30	CF 30-2	90	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	59.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" have a greasing hole only on the head.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types (stud diameter: 6 to 30 mm).
For the basic load ratings of full-roller types, see page p-21.

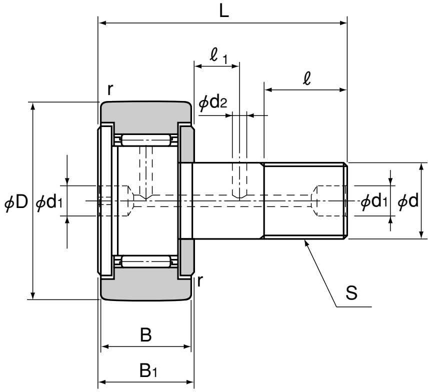
Model number coding

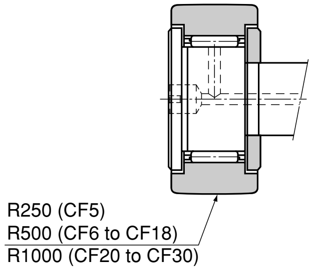
CF10 M UU
1 2 3

1 Model number 2 Made of stainless steel 3 With seal

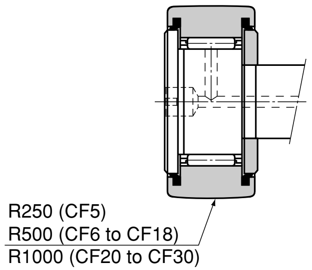
Model CF-R | Model CF-MR

Popular Type (Spherical Outer Ring) | Stainless Steel Type

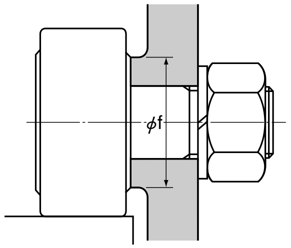




Model CF-R



Model CF ··· UUR



Unit: mm

Stud diameter d	Model No. Spherical outer ring	Major dimensions Outer diameter D	Thread S	Outer ring width B	B1	Overall length L	d1	d2	ℓ	ℓ1	r	Shoulder height f (Min.)	Basic load rating C kN	C0 kN	Maximum permissible load F0 kN	Track load capacity kN	Rotational speed limit** min-1	Mass g
5	CF 5R	13	M5×0.8	9	10	23	3.1 *	—	7.5	—	0.5	9.7	3.14	2.77	1.42	0.53	29000	10.5
6	CF 6R	16	M6×1	11	12	28	4 *	—	9	—	0.5	11	3.59	3.58	2.11	1.08	25000	18.5
8	CF 8R	19	M8×1.25	11	12	32	4 *	—	11	—	0.5	13	4.17	4.65	4.73	1.37	20000	28.5
10	CF 10R	22	M10×1.25	12	13	36	4 *	—	13	—	1	15	5.33	6.78	5.81	1.67	17000	45
10	CF 10-1R	26	M10×1.25	12	13	36	4 *	—	13	—	1	15	5.33	6.78	5.81	2.06	17000	60
12	CF 12R	30	M12×1.5	14	15	40	6	3	14	6	1.5	20	7.87	9.79	9.37	2.45	14000	95
12	CF 12-1R	32	M12×1.5	14	15	40	6	3	14	6	1.5	20	7.87	9.79	9.37	2.74	14000	105
16	CF 16R	35	M16×1.5	18	19.5	52	6	3	18	8	1.5	24	12	18.3	17.3	3.14	10000	170
18	CF 18R	40	M18×1.5	20	21.5	58	6	3	20	8	1.5	26	14.7	25.2	26.1	3.72	8500	250
20	CF 20R	52	M20×1.5	24	25.5	66	8	4	22	9	1.5	36	20.7	34.8	32.1	8.23	7000	460
20	CF 20-1R	47	M20×1.5	24	25.5	66	8	4	22	9	1.5	36	20.7	34.8	32.1	7.15	7000	385
24	CF 24R	62	M24×1.5	29	30.5	80	8	4	25	11	1.5	40	30.6	53.2	49.5	10.5	6500	815
24	CF 24-1R	72	M24×1.5	29	30.5	80	8	4	25	11	1.5	40	30.6	53.2	49.5	12.9	6500	1140
30	CF 30R	80	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	14.9	5000	1870
30	CF 30-1R	85	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	16.1	5000	2030
30	CF 30-2R	90	M30×1.5	35	37	100	8	4	32	15	2	46	45.4	87.6	73.7	17.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" have a greasing hole only on the head.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types (stud diameter: 6 to 30 mm).
For the basic load ratings of full-roller types, see page p-21.

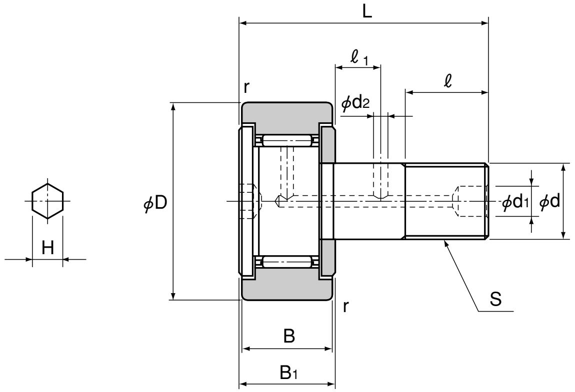
Model number coding

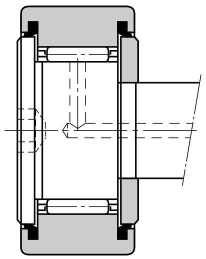
CF5 M UU R
1 2 3 4

1 Model number 2 Made of stainless steel 3 With seal 4 Spherical outer ring

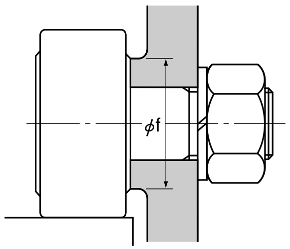
Model CF-A | Model CF-M-A

Cam Follower with Hexagon Socket (Spherical Outer Ring) | Stainless Steel Type





Model CF ··· UU-A



Unit: mm

Stud diameter	Model No.	Major dimensions												Basic load rating		Maximum permissible load	Track load capacity	Rotational speed limit**	Mass
d	Cylindrical outer ring	Outer diameter D	Thread S	Outer ring width B	B_1	Overall length L	d_1	d_2	ℓ	$ℓ_1$	H★	r	Shoulder height f (Min.)	C kN	C_0 kN	F_0 kN	kN	min^{-1}	g
3	CF 3-A	10	M3×0.5	7	8	17	—*	—	5	—	2(1.5)	0.3	6.8	1.47	1.18	0.36	1.37	47000	4.5
4	CF 4-A	12	M4×0.7	8	9	20	—*	—	6	—	2.5(2)	0.5	8.6	2.06	2.05	0.78	1.76	37000	7.5
5	CF 5-A	13	M5×0.8	9	10	23	—*	—	7.5	—	3(2.5)	0.5	9.7	3.14	2.77	1.42	2.25	29000	10.5
6	CF 6-A	16	M6×1	11	12	28	—*	—	9	—	3	0.5	11	3.59	3.58	2.11	3.43	25000	18.5
8	CF 8-A	19	M8×1.25	11	12	32	—*	—	11	—	4	0.5	13	4.17	4.65	4.73	4.02	20000	28.5
10	CF 10-A	22	M10×1.25	12	13	36	—*	—	13	—	5	1	15	5.33	6.78	5.81	4.7	17000	45
10	CF 10-1-A	26	M10×1.25	12	13	36	—*	—	13	—	5	1	15	5.33	6.78	5.81	5.49	17000	60
12	CF 12-A	30	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	7.87	9.79	9.37	7.06	14000	95
12	CF 12-1-A	32	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	7.87	9.79	9.37	7.45	14000	105
16	CF 16-A	35	M16×1.5	18	19.5	52	6	3	18	8	6	1.5	24	12	18.3	17.3	11.2	10000	170
18	CF 18-A	40	M18×1.5	20	21.5	58	6	3	20	8	6	1.5	26	14.7	25.2	26.1	14.4	8500	250
20	CF 20-A	52	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	20.7	34.8	32.1	23.2	7000	460
20	CF 20-1-A	47	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	20.7	34.8	32.1	21	7000	385
24	CF 24-A	62	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	30.6	53.2	49.5	34.2	6500	815
24	CF 24-1-A	72	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	30.6	53.2	49.5	39.8	6500	1140
30	CF 30-A	80	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	52.6	5000	1870
30	CF 30-1-A	85	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	56	5000	2030
30	CF 30-2-A	90	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	59.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note "★" indicates that the dimensions in the parentheses in this row apply to stainless steel types.
The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types (stud diameter: 6 to 30 mm).
For the basic load ratings of full-roller types, see page p-21.

Model number coding

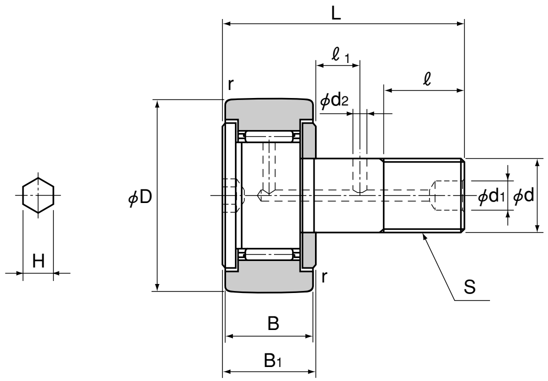
CF10 M UU -A

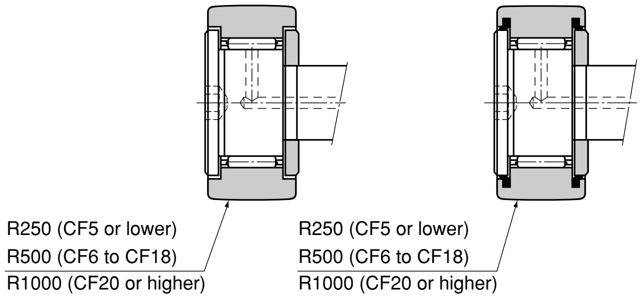
1 2 3 4

1 Model number 2 Made of stainless steel 3 With seal 4 With hexagon socket stud

Model CF-R-A | Model CF-MR-A

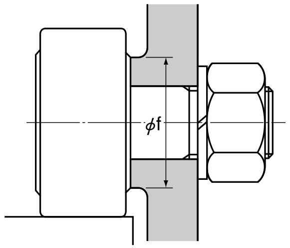
Cam Follower with Hexagon Socket (Spherical Outer Ring) | Stainless Steel Type





Model CF-R-A

Model CF ··· UUR-A



Unit: mm

Stud diameter d	Model No. Spherical outer ring	Major dimensions Outer diameter D	Thread S	Outer ring width B	B1	Overall length L	d1	d2	ℓ	ℓ1	H ★	r	Shoulder height f (Min.)	Basic load rating C kN	C0 kN	Maximum permissible load F0 kN	Track load capacity kN	Rotational speed limit** min-1	Mass g
3	CF 3R-A	10	M3×0.5	7	8	17	—*	—	5	—	2(1.5)	0.3	6.8	1.47	1.18	0.36	0.37	47000	4.5
4	CF 4R-A	12	M4×0.7	8	9	20	—*	—	6	—	2.5(2)	0.5	8.6	2.06	2.05	0.78	0.47	37000	7.5
5	CF 5R-A	13	M5×0.8	9	10	23	—*	—	7.5	—	3(2.5)	0.5	9.7	3.14	2.77	1.42	0.53	29000	10.5
6	CF 6R-A	16	M6×1	11	12	28	—*	—	9	—	3	0.5	11	3.59	3.58	2.11	1.08	25000	18.5
8	CF 8R-A	19	M8×1.25	11	12	32	—*	—	11	—	4	0.5	13	4.17	4.65	4.73	1.37	20000	28.5
10	CF 10R-A	22	M10×1.25	12	13	36	—*	—	13	—	5	1	15	5.33	6.78	5.81	1.67	17000	45
10	CF 10-1R-A	26	M10×1.25	12	13	36	—*	—	13	—	5	1	15	5.33	6.78	5.81	2.06	17000	60
12	CF 12R-A	30	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	7.87	9.79	9.37	2.45	14000	95
12	CF 12-1R-A	32	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	7.87	9.79	9.37	2.74	14000	105
16	CF 16R-A	35	M16×1.5	18	19.5	52	6	3	18	8	6	1.5	24	12	18.3	17.3	3.14	10000	170
18	CF 18R-A	40	M18×1.5	20	21.5	58	6	3	20	8	6	1.5	26	14.7	25.2	26.1	3.72	8500	250
20	CF 20R-A	52	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	20.7	34.8	32.1	8.23	7000	460
20	CF 20-1R-A	47	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	20.7	34.8	32.1	7.15	7000	385
24	CF 24R-A	62	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	30.6	53.2	49.5	10.5	6500	815
24	CF 24-1R-A	72	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	30.6	53.2	49.5	12.9	6500	1140
30	CF 30R-A	80	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	14.9	5000	1870
30	CF 30-1R-A	85	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	16.1	5000	2030
30	CF 30-2R-A	90	M30×1.5	35	37	100	8	4	32	15	8	2	46	45.4	87.6	73.7	17.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note "★" indicates that the dimensions in the parentheses in this row apply to stainless steel types.
The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types (stud diameter: 6 to 30 mm).
For the basic load ratings of full-roller types, see page p-21.

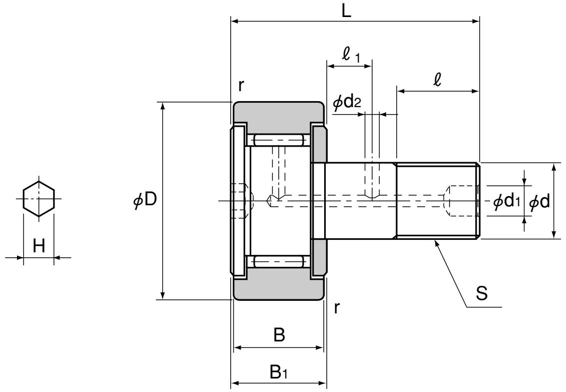
Model number coding

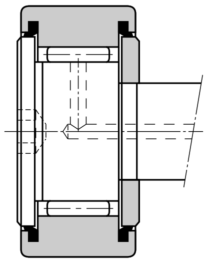
CF10 M UU R -A
1 2 3 4 5

1 Model number 2 Made of stainless steel 3 With seal 4 Spherical outer ring
5 With hexagon socket stud

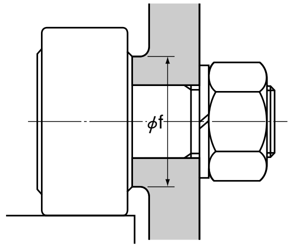
Model CF-V-A | Model CF-VM-A

Cam Follower with Hexagon Socket (Spherical Outer Ring) | **Stainless Steel Type**





Model CF ··· VUU-A



Unit: mm

Stud diameter d	Model No. Cylindrical outer ring	Major dimensions												Basic load rating		Maximum permissible load	Track load capacity	Rotational speed limit**	Mass
		Outer diameter D	Thread S	Outer ring width B	B_1	Overall length L	d_1	d_2	ℓ	$ℓ_1$	H	r	Shoulder height f (Min.)	C kN	C_0 kN	F_0 kN	kN	min^{-1}	g
6	CF 6V-A	16	M6×1	11	12	28	—*	—	9	—	3	0.5	11	6.94	8.5	2.11	3.43	11000	19
8	CF 8V-A	19	M8×1.25	11	12	32	—*	—	11	—	4	0.5	13	8.13	11.2	4.73	4.02	8700	29
10	CF 10V-A	22	M10×1.25	12	13	36	—*	—	13	—	5	1	15	9.42	14.3	5.81	4.7	7200	46
10	CF 10-1V-A	26	M10×1.25	12	13	36	—*	—	13	—	5	1	15	9.42	14.3	5.81	5.49	7200	61
12	CF 12V-A	30	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	13.4	19.8	9.37	7.06	5800	97
12	CF 12-1V-A	32	M12×1.5	14	15	40	6	3	14	6	6	1.5	20	13.4	19.8	9.37	7.45	5800	107
16	CF 16V-A	35	M16×1.5	18	19.5	52	6	3	18	8	6	1.5	24	20.6	37.6	17.3	11.2	4500	173
18	CF 18V-A	40	M18×1.5	20	21.5	58	6	3	20	8	6	1.5	26	25.2	51.3	26.1	14.4	3800	255
20	CF 20V-A	52	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	33.2	64.8	32.1	23.2	3400	465
20	CF 20-1V-A	47	M20×1.5	24	25.5	66	8	4	22	9	8	1.5	36	33.2	64.8	32.1	21	3400	390
24	CF 24V-A	62	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	46.7	92.9	49.5	34.2	2900	820
24	CF 24-1V-A	72	M24×1.5	29	30.5	80	8	4	25	11	8	1.5	40	46.7	92.9	49.5	39.8	2900	1140
30	CF 30V-A	80	M30×1.5	35	37	100	8	4	32	15	8	2	46	67.6	145	73.7	52.6	2300	1870
30	CF 30-1V-A	85	M30×1.5	35	37	100	8	4	32	15	8	2	46	67.6	145	73.7	56	2300	2030
30	CF 30-2V-A	90	M30×1.5	35	37	100	8	4	32	15	8	2	46	67.6	145	73.7	59.3	2300	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 40% of this value is permitted.

Model number coding

CF6 V M UU -A
1 2 3 4 5

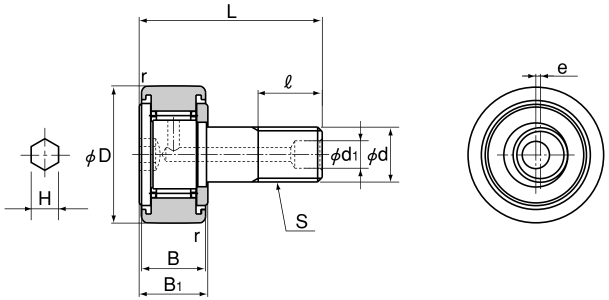
1 Model number 2 Full-roller type 3 Made of stainless steel 4 With seal 5 With hexagon socket stud

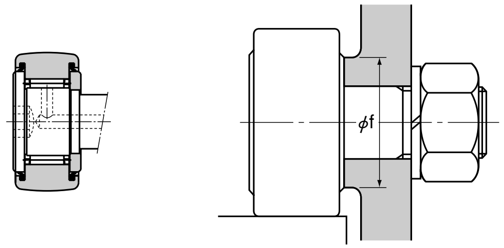
Model CFH-A

Cam Follower with Hexagon Socket (Cylindrical Outer Ring)

Model CFH-M-A

Stainless Steel Type





Model CFH ··· UU-A

Unit: mm

Stud diameter	Model No.	Major dimensions											Basic load rating		Maximum permissible load	Track load capacity	Rotational speed limit**	Mass
d	Cylindrical outer ring	Outer diameter D	Thread S	Outer ring width B	B_1	Overall length L	d_1	ℓ	Run-out e	H	r	Shoulder height f (Min.)	C kN	C_0 kN	F_0 kN	kN	min^{-1}	g
6	CFH 6-A	16	M6×1	11	12	28	—*	9	0.25	3	0.5	11	3.59	3.58	2.11	3.43	25000	18.5
8	CFH 8-A	19	M8×1.25	11	12	32	—*	11	0.25	4	0.5	13	4.17	4.65	4.73	4.02	20000	28.5
10	CFH 10-A	22	M10×1.25	12	13	36	—*	13	0.3	5	1	15	5.33	6.78	5.81	4.7	17000	45
10	CFH 10-1-A	26	M10×1.25	12	13	36	—*	13	0.3	5	1	15	5.33	6.78	5.81	5.49	17000	60
12	CFH 12-A	30	M12×1.5	14	15	40	6	14	0.4	6	1.5	20	7.87	9.79	9.37	7.06	14000	95
12	CFH 12-1-A	32	M12×1.5	14	15	40	6	14	0.4	6	1.5	20	7.87	9.79	9.37	7.45	14000	105
16	CFH 16-A	35	M16×1.5	18	19.5	52	6	18	0.5	6	1.5	24	12	18.3	17.3	11.2	10000	170
18	CFH 18-A	40	M18×1.5	20	21.5	58	6	20	0.6	6	1.5	26	14.7	25.2	26.1	14.4	8500	250
20	CFH 20-A	52	M20×1.5	24	25.5	66	8	22	0.7	8	1.5	36	20.7	34.8	32.1	23.2	7000	460
20	CFH 20-1-A	47	M20×1.5	24	25.5	66	8	22	0.7	8	1.5	36	20.7	34.8	32.1	21	7000	385
24	CFH 24-A	62	M24×1.5	29	30.5	80	8	25	0.8	8	1.5	40	30.6	53.2	49.5	34.2	6500	815
24	CFH 24-1-A	72	M24×1.5	29	30.5	80	8	25	0.8	8	1.5	40	30.6	53.2	49.5	39.8	6500	1140
30	CFH 30-A	80	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	52.6	5000	1870
30	CFH 30-1-A	85	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	56	5000	2030
30	CFH 30-2-A	90	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	59.3	5000	2220

Note THK also manufactures types that have a driver groove and a greasing hole on the head (model numbers of types with a driver groove do not include symbol "A" in the end).
The seal must be used at temperature of 80℃ or below.
Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types.
For the basic load ratings of full-roller types, see page p-21.

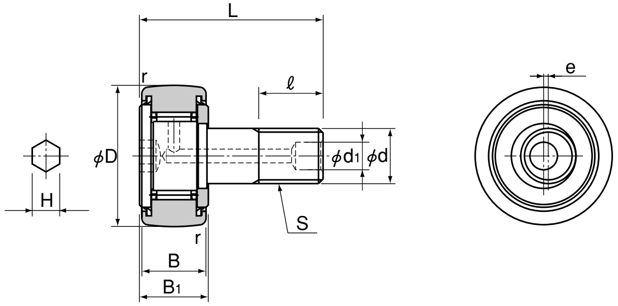
Model number coding

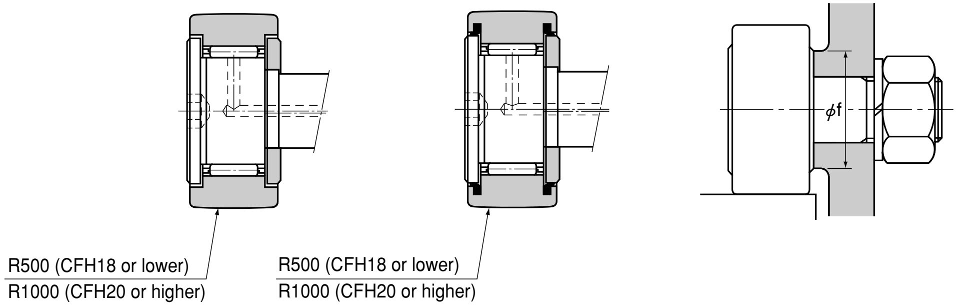
CFH24-1 M UU -A
1 2 3 4

1 Model number 2 Made of stainless steel 3 With seal 4 With hexagon socket stud

Model CFH-R-A | Model CFH-MR-A

Cam Follower with Hexagon Socket (Spherical Outer Ring) | Stainless Steel Type





Model CFH-R

Model CFH ··· UUR

Unit: mm

Stud diameter d	Model No. Spherical outer ring	Major dimensions Outer diameter D	Thread S	Outer ring width B	B1	Overall length L	d1	ℓ	Run-out e	H	r	Shoulder height f (Min.)	Basic load rating C kN	C0 kN	Maximum permissible load F0 kN	Track load capacity kN	Rotational speed limit** min-1	Mass g
6	CFH 6R-A	16	M6×1	11	12	28	—*	9	0.25	3	0.5	11	3.59	3.58	2.11	1.08	25000	18.5
8	CFH 8R-A	19	M8×1.25	11	12	32	—*	11	0.25	4	0.5	13	4.17	4.65	4.73	1.37	20000	28.5
10	CFH 10R-A	22	M10×1.25	12	13	36	—*	13	0.3	5	1	15	5.33	6.78	5.81	1.67	17000	45
10	CFH 10-1R-A	26	M10×1.25	12	13	36	—*	13	0.3	5	1	15	5.33	6.78	5.81	2.06	17000	60
12	CFH 12R-A	30	M12×1.5	14	15	40	6	14	0.4	6	1.5	20	7.87	9.79	9.37	2.45	14000	95
12	CFH 12-1R-A	32	M12×1.5	14	15	40	6	14	0.4	6	1.5	20	7.87	9.79	9.37	2.74	14000	105
16	CFH 16R-A	35	M16×1.5	18	19.5	52	6	18	0.5	6	1.5	24	12	18.3	17.3	3.14	10000	170
18	CFH 18R-A	40	M18×1.5	20	21.5	58	6	20	0.6	6	1.5	26	14.7	25.2	26.1	3.72	8500	250
20	CFH 20R-A	52	M20×1.5	24	25.5	66	8	22	0.7	8	1.5	36	20.7	34.8	32.1	8.23	7000	460
20	CFH 20-1R-A	47	M20×1.5	24	25.5	66	8	22	0.7	8	1.5	36	20.7	34.8	32.1	7.15	7000	385
24	CFH 24R-A	62	M24×1.5	29	30.5	80	8	25	0.8	8	1.5	40	30.6	53.2	49.5	10.5	6500	815
24	CFH 24-1R-A	72	M24×1.5	29	30.5	80	8	25	0.8	8	1.5	40	30.6	53.2	49.5	12.9	6500	1140
30	CFH 30R-A	80	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	14.9	5000	1870
30	CFH 30-1R-A	85	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	16.1	5000	2030
30	CFH 30-2R-A	90	M30×1.5	35	37	100	8	32	1	8	2	46	45.4	87.6	73.7	17.3	5000	2220

Note THK also manufactures types that have a driver groove and a greasing hole on the head (model numbers of types with a driver groove do not include symbol "A" in the end).
The seal must be used at temperature of 80℃ or below.
Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types.
For the basic load ratings of full-roller types, see page p-21.

Model number coding

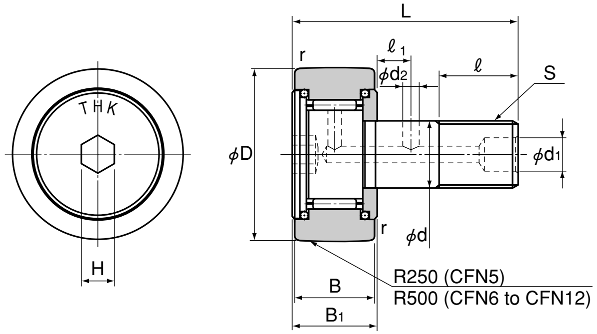
CFH12 UU R -A

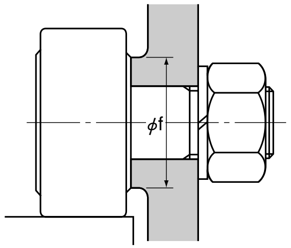
1 2 3 4

1 Model number 2 With seal 3 Spherical outer ring 4 With hexagon socket stud

Model CFN-R-A

Cam Follower Containing Thrust Balls





Unit: mm

Stud diameter	Model No.	Major dimensions												Basic load rating		Permissible thrust load	Maximum permissible load	Track load capacity	Rotational speed limit**	Mass
d	Spherical outer ring	Outer diameter D	Thread S	Outer ring width B	B1	Overall length L	d1	d2	ℓ	ℓ1	H	r	Shoulder height f (Min.)	C kN	C0 kN	N	F0 kN	kN	min-1	g
5	CFN 5R-A	13	M5×0.8	9	10	23	—*	—*	7.5	—	3	0.5	10	3.14	2.77	160	1.42	0.53	29000	10.5
6	CFN 6R-A	16	M6×1	11	12	28	—*	—*	9	—	3	0.5	12	3.59	3.58	250	2.11	1.08	25000	18.5
8	CFN 8R-A	19	M8×1.25	11	12	32	—*	—*	11	—	4	0.5	14	4.17	4.65	290	4.73	1.37	20000	28.5
10	CFN 10R-A	22	M10×1.25	12	13	36	—*	—*	13	—	5	1	16.5	5.33	6.78	400	5.81	1.67	17000	45
12	CFN 12R-A	30	M12×1.5	14	15	40	6	3	14	6	6	1.5	21.5	7.87	9.79	680	9.37	2.45	14000	95

Note Those models marked with "*" do not have a greasing hole and cannot be replenished with grease.

Note The rotation speed limit value in the table (**) applies to models using grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted.

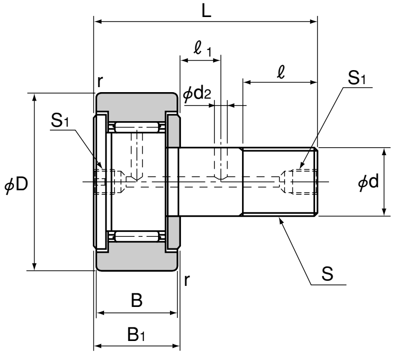
Model number coding

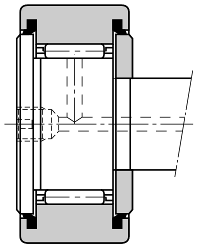
CFN12 R -A
1 2 3

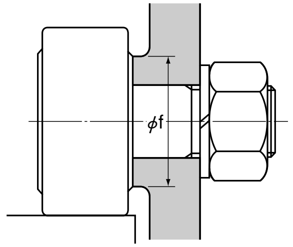
1 Model number 2 Spherical outer ring 3 With hexagon socket stud

Model CFT
Cam Follower with Tapped Greasing Hole (Cylindrical Outer Ring)

Model CFT-M
Stainless Steel Type




Model CFT ··· UU



Unit: mm

Stud diameter d	Model No. Cylindrical outer ring	Major dimensions Outer diameter D	Thread S	Outer ring width B	B1	Overall length L	S1	d2	ℓ	ℓ 1	r	Shoulder height f (Min.)	Basic load rating C kN	C0 kN	Maximum permissible load F0 kN	Track load capacity kN	Rotational speed limit** min-1	Mass g
6	CFT 6	16	M6×1	11	12	28	M6×0.75 *	—	9	—	0.5	11	3.59	3.58	2.11	3.43	25000	18.5
8	CFT 8	19	M8×1.25	11	12	32	M6×0.75 *	—	11	—	0.5	13	4.17	4.65	4.73	4.02	20000	28.5
10	CFT 10	22	M10×1.25	12	13	36	M6×0.75 *	—	13	—	1	15	5.33	6.78	5.81	4.7	17000	45
10	CFT 10-1	26	M10×1.25	12	13	36	M6×0.75 *	—	13	—	1	15	5.33	6.78	5.81	5.49	17000	60
12	CFT 12	30	M12×1.5	14	15	40	M6×0.75	3	14	6	1.5	20	7.87	9.79	9.37	7.06	14000	95
12	CFT 12-1	32	M12×1.5	14	15	40	M6×0.75	3	14	6	1.5	20	7.87	9.79	9.37	7.45	14000	105
16	CFT 16	35	M16×1.5	18	19.5	52	PT 1/8	3	18	8	1.5	24	12	18.3	17.3	11.2	10000	170
18	CFT 18	40	M18×1.5	20	21.5	58	PT 1/8	3	20	8	1.5	26	14.7	25.2	26.1	14.4	8500	250
20	CFT 20	52	M20×1.5	24	25.5	66	PT 1/8	4	22	9	1.5	36	20.7	34.8	32.1	23.2	7000	460
20	CFT 20-1	47	M20×1.5	24	25.5	66	PT 1/8	4	22	9	1.5	36	20.7	34.8	32.1	21	7000	385
24	CFT 24	62	M24×1.5	29	30.5	80	PT 1/8	4	25	11	1.5	40	30.6	53.2	49.5	34.2	6500	815
24	CFT 24-1	72	M24×1.5	29	30.5	80	PT 1/8	4	25	11	1.5	40	30.6	53.2	49.5	39.8	6500	1140
30	CFT 30	80	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	52.6	5000	1870
30	CFT 30-1	85	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	56	5000	2030
30	CFT 30-2	90	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	59.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" have a greasing hole only on the head.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types.
For the basic load ratings of full-roller types, see page p-21.

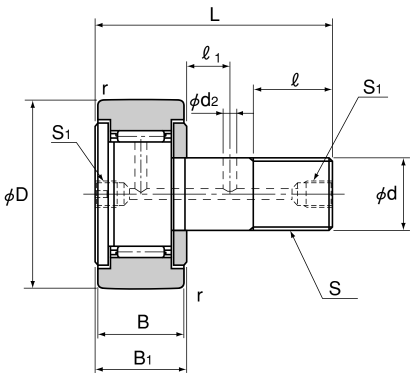
Model number coding

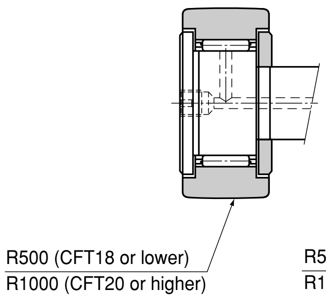
CFT10 M UU
1 2 3

1 Model number 2 Made of stainless steel 3 With seal

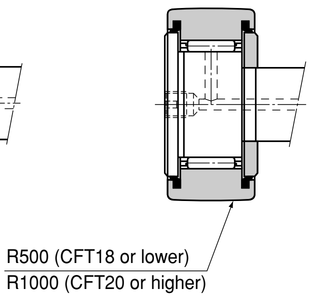
Model CFT-R | Model CFT-MR

Cam Follower with Tapped Greasing Hole (Spherical Outer Ring) | Stainless Steel Type

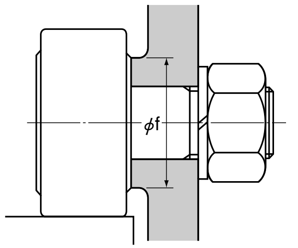




Model CFT-R



Model CFT ··· UUR



Unit: mm

Stud diameter d	Model No. Spherical outer ring	Major dimensions Outer diameter D	Thread S	Outer ring width B	B_1	Overall length L	S_1	d_2	ℓ	$ℓ_1$	r	Shoulder height f (Min.)	Basic load rating C kN	C_0 kN	Maximum permissible load F_0 kN	Track load capacity kN	Rotational speed limit** min^{-1}	Mass g
6	CFT 6R	16	M6×1	11	12	28	M6×0.75*	—	9	—	0.5	11	3.59	3.58	2.11	1.08	25000	18.5
8	CFT 8R	19	M8×1.25	11	12	32	M6×0.75*	—	11	—	0.5	13	4.17	4.65	4.73	1.37	20000	28.5
10	CFT 10R	22	M10×1.25	12	13	36	M6×0.75*	—	13	—	1	15	5.33	6.78	5.81	1.67	17000	45
10	CFT 10-1R	26	M10×1.25	12	13	36	M6×0.75*	—	13	—	1	15	5.33	6.78	5.81	2.06	17000	60
12	CFT 12R	30	M12×1.5	14	15	40	M6×0.75	3	14	6	1.5	20	7.87	9.79	9.37	2.45	14000	95
12	CFT 12-1R	32	M12×1.5	14	15	40	M6×0.75	3	14	6	1.5	20	7.87	9.79	9.37	2.74	14000	105
16	CFT 16R	35	M16×1.5	18	19.5	52	PT 1/8	3	18	8	1.5	24	12	18.3	17.3	3.14	10000	170
18	CFT 18R	40	M18×1.5	20	21.5	58	PT 1/8	3	20	8	1.5	26	14.7	25.2	26.1	3.72	8500	250
20	CFT 20R	52	M20×1.5	24	25.5	66	PT 1/8	4	22	9	1.5	36	20.7	34.8	32.1	8.23	7000	460
20	CFT 20-1R	47	M20×1.5	24	25.5	66	PT 1/8	4	22	9	1.5	36	20.7	34.8	32.1	7.15	7000	385
24	CFT 24R	62	M24×1.5	29	30.5	80	PT 1/8	4	25	11	1.5	40	30.6	53.2	49.5	10.5	6500	815
24	CFT 24-1R	72	M24×1.5	29	30.5	80	PT 1/8	4	25	11	1.5	40	30.6	53.2	49.5	12.9	6500	1140
30	CFT 30R	80	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	14.9	5000	1870
30	CFT 30-1R	85	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	16.1	5000	2030
30	CFT 30-2R	90	M30×1.5	35	37	100	PT 1/8	4	32	15	2	46	45.4	87.6	73.7	17.3	5000	2220

Note The seal must be used at temperature of 80℃ or below.
Those models marked with "*" have a greasing hole only on the head.

Note The rotation speed limit value in the table (**) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 70% of this value is permitted.
THK also manufactures full-roller types.
For the basic load ratings of full-roller types, see page p-21.

Model number coding

CFT30-1 M UU R
1 2 3 4

1 Model number 2 Made of stainless steel 3 With seal 4 Spherical outer ring

Roller Follower

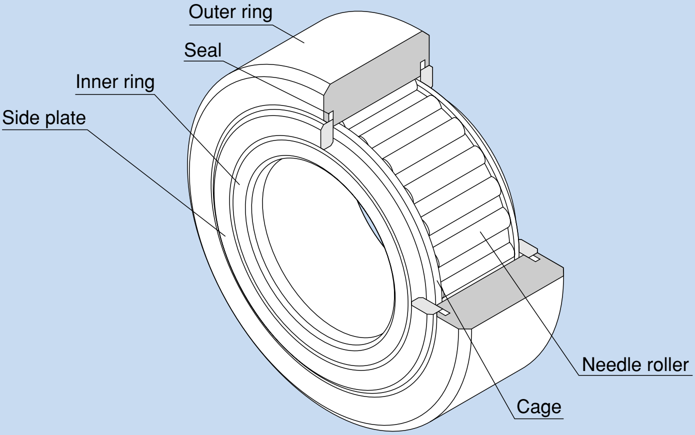


Fig. 1 Structure of Roller Follower Model NAST-ZZUU

Structure and Features

The Roller Follower is a compact and highly rigid bearing system. It contains needle bearings and is used as a guide roller for cam discs and linear motion.

Since its outer ring rotates while keeping direct contact with the mating surface, this product is thick-walled and designed to bear an impact load.

Inside the outer ring, needle rollers and a precision cage are incorporated. This prevents the product from skewing and achieves a superb rotation performance. And, as a result, the product is capable of easily withstanding high-speed rotation.

Roller Followers are divided into two types: separable type whose inner ring can be separated, and non-separable type whose inner ring cannot be separated.

There are two types of the outer ring in shape: spherical and cylindrical. The spherical outer ring easily absorbs a distortion of the shaft center when the cam follower is installed and helps lighten a biased load.

Applications

The Roller Follower is used in a wide range of applications such as cam mechanisms of automatic machines, dedicated machines as well as carrier systems, conveyors, bookbinding machines, tool changers of machining centers, pallet changers, automatic coating machines, sliding forks of automatic warehouses.

Types and Features

●Separable Roller Followers

Model NAST

Model NAST is a separable type of bearing system that combines a thick-wall outer ring, an inner ring and needle rollers equipped with a precision cage.

Model NAST-R

This model is a spherical outer ring type of model NAST. It easily corrects a distortion of the shaft center when the roller follower is installed and helps lighten a biased load.

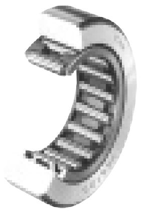
Model NAST-ZZ

This separable type of bearing system has a labyrinth seal consisting of a pair of side plates formed on both sides of the inner ring of model NAST.

Model NAST- ZZR

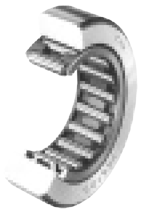
This model is a spherical outer ring type of model NAST-ZZ. It easily corrects a distortion of the shaft center when the roller follower is installed.

Model RNAST



This model is basically the same as model NAST, but does not have an inner ring.

Model RNAST-R



This model is basically the same as model NAST-R, but does not have an inner ring. It easily corrects a distortion of the shaft center when the roller follower is installed.

●Non-separable Roller Followers

Model NART-R

This model is a non-separable type of bearing system whose inner ring is fixed to the side plates. Since the circumference of the outer ring is spherically ground, it helps lighten a biased load.

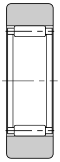
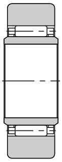
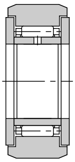
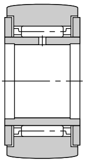
Model NART-VR

Based on model NART-R, this model is a full-roller bearing suitable for locations where a heavy load is applied in low speed operation.

Types and Model Numbers

The Roller Follower is divided into several types as indicated in table 1.

Table 1 Types of Roller Follower

Classification		Separable type			Non-separable type
Main model No.		RNAST	NAST	NAST-ZZ	NART
Shape					
Cylindrical outer ring	Without seal	RNAST RNAST-M	NAST NAST-M	NAST-ZZ NAST-ZZM	—
	With seal	—	—	NAST-ZZUU NAST-ZZMUU	—
Spherical outer ring	Without seal	RNAST-R RNAST-MR	NAST-R NAST-MR	NAST-ZZR NAST-ZZMR	NART-R NART-MR
	With seal	—	—	NAST-ZZUUR NAST-ZZMUUR	NART-UUR NART-MUUR
Full rollers	Without seal	—	—	—	NART-VR NART-VMR
	With seal	—	—	—	NART-VUUR NART-VMUUR

Note: Symbol M indicates stainless steel type.

Accuracy Standards

Roller Followers are manufactured with accuracies in accordance with the following.

① Dimensional tolerance of the spherical outer ring in outer ring D: $^{0}_{-0.05}$
② Dimensional tolerance of model RNAST in inscribed circle diameter dr: F6
③ Dimensional tolerance of model NART in bearing width B_1: h12
④ Accuracy of the inner ring and accuracy of the outer ring in width: table 2
⑤ Accuracy of the outer ring: table 3

Table 2 Accuracy of the Inner Ring and Accuracy of the Outer Ring in Width (JIS Class 0)

Unit: μm

Nominal dimension of the bearing inner diameter (di) (mm)		Tolerance of the bearing in inner diameter (dm) (note)		Tolerance of the inner ring (or outer ring) in width		Tolerance of the inner ring in radial run-out (max)
Above	Or less	Upper	Lower	Upper	Lower	
2.5	10	0	− 8	0	−120	10
10	18	0	− 8	0	−120	10
18	30	0	−10	0	−120	13
30	50	0	−12	0	−120	15

Note: "dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing inner diameter at two points.

Table 3 Accuracy of the Outer Ring (JIS Class 0)

Unit: μm

Nominal dimension of the bearing outer diameter (D) (mm)		Tolerance of the bearing in outer diameter (Dm) (note)		Tolerance of the outer ring in radial run-out (max)
Above	Or less	Upper	Lower	
6	18	0	− 9	15
18	30	0	− 9	15
30	50	0	−11	20
50	80	0	−13	25
80	120	0	−15	35

Note: "Dm" represents the arithmetic average of the maximum and minimum diameters obtained in measuring the bearing outer diameter at two points.

Radial Clearance

The radial clearances of Roller Followers meet clearance C2 indicated in table 4 (normal clearance applies to full-roller types).

Table 4 Radial Clearance

Unit: μm

Nominal dimension of the bearing's inscribed circle diameter (dr) (mm)		Clearance C2		Normal clearance	
Above	Or less	Min.	Max.	Min.	Max.
6	10	5	20	15	30
10	18	5	25	15	35
18	30	10	30	20	40
30	50	10	40	25	55
50	80	15	50	30	65

Fitting

For the fitting of the Roller Follower with the shaft, we recommend the combinations indicated in table 5.

Table 5 Fitting with the Shaft

Without inner ring	With inner ring
k5, k6	g6, h6

Dust Prevention and Lubrication

The Roller Follower models include seal types (model numbers: "…UU"), which are incorporated with special synthetic rubber seals that are highly resistant to wear in order to prevent foreign matter from entering the interior of the roller follower and the lubricant from leaking.

Some models are not filled with grease when assembled. When using a model not filled with grease, apply and fill grease to the interior first (lithium-based grease with consistency of No. 2).

Model No.		Grease
NAST(R)	No seal setting	Not filled with grease
RNAST(R)		
NAST-ZZ(R)	Without seal	Filled with grease
NART-(V)R	With seal	

The lubrication interval varies depending on the operating conditions. As a guide, however, replenish grease of the same group every six months to two years for types with a cage, or every one to 6 months for full-roller types.

Even with types equipped with seals ("…UU"), surplus grease may seep during the initial operation period or immediately after resumption of grease replenishment. If desiring to avoid contamination of the surrounding area of the machine by grease, first perform seasoning or the like in advance, and then wipe the seeping surplus grease.

Installation

Fig. 2 shows examples of installing the Roller Follower.

- To protect the side plates, the height of the mounting portion needs to be equal or greater than the dimension "a" in the corresponding dimensional table.
- If the Roller Follower is to be used under a heavy load, it is necessary to install the product so that the greasing hole of the inner ring is out of the loaded area.

Note 1: The structure of the Roller Follower is designed to receive a radial load. If it receives a thrust load, the side plates or the outer ring may be damaged.
It is necessary to minimize a component of thrust force, or prevent it from occurring, when designing the system and installing the Roller Follower.

Note 2: If an external force is applied to either of the side plates of model NART, it may cause abnormal rotation. Use much care in installing the Roller Follower.

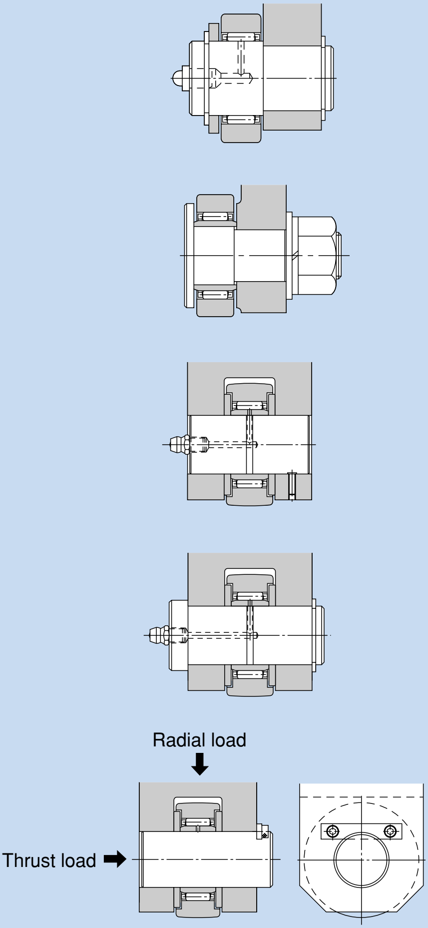
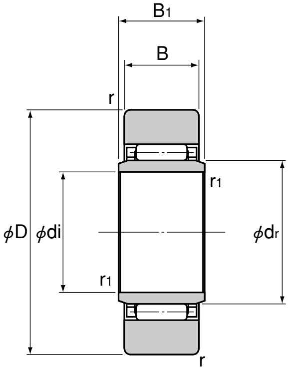


Fig. 2 Examples of Installing the Roller Follower

Model NAST

Separable Type with a Cylindrical Outer Ring



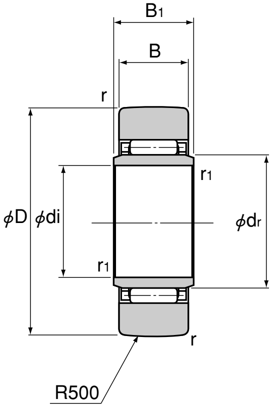
Unit: mm

Model No.	Major dimensions							Basic load rating		Track load capacity	Rotation speed limit*	Mass
Cylindrical outer ring	Inner diameter di	Inscribed circle diameter dr	Outer diameter D	B_1	B	r	r_1	C kN	C_0 kN	kN	min^{-1}	g
NAST 6	6	10	19	10	9.8	0.5	0.5	4.12	4.55	3.53	20000	17.8
NAST 8	8	12	24	10	9.8	1	0.5	5.68	5.89	4.02	17000	28
NAST 10	10	14	30	12	11.8	1.5	0.5	9.7	9.67	5.59	15000	50
NAST 12	12	16	32	12	11.8	1.5	0.5	10.4	10.9	5.98	13000	58
NAST 15	15	20	35	12	11.8	1.5	0.5	12.3	14.3	6.57	10000	62
NAST 17	17	22	40	16	15.8	1.5	0.5	17.4	20.9	10.9	9500	110
NAST 20	20	25	47	16	15.8	1.5	0.5	19.2	24.5	12.7	8500	155
NAST 25	25	30	52	16	15.8	1.5	0.5	20.7	28.4	14.1	7000	180
NAST 30	30	38	62	20	19.8	1.5	1	30.3	45.4	22.1	5500	320
NAST 35	35	42	72	20	19.8	1.5	1	32.2	50.6	25.7	5000	440
NAST 40	40	50	80	20	19.8	2	1.5	35.7	61.6	26.9	4000	530
NAST 45	45	55	85	20	19.8	2	1.5	37.1	66.4	28.5	4000	580
NAST 50	50	60	90	20	19.8	2	1.5	38.7	71.8	30.2	3500	635

Note The rotation speed limit value in the table (*) applies to models using grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted.
Stainless steel types are also available. Contact THK for details.

Model NAST-R

Separable Type with a Spherical Outer Ring



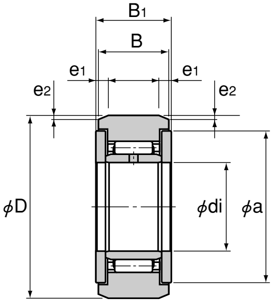
Unit: mm

Model No.	Major dimensions							Basic load rating		Track load capacity	Rotation speed limit*	Mass
Cylindrical outer ring	Inner diameter d_i	Inscribed circle diameter d_r	Outer diameter D	B_1	B	r	r_1	C kN	C_0 kN	kN	min^{-1}	g
NAST 6R	6	10	19	10	9.8	0.5	0.5	4.12	4.55	1.37	20000	17.8
NAST 8R	8	12	24	10	9.8	1	0.5	5.68	5.89	1.86	17000	28
NAST 10R	10	14	30	12	11.8	1.5	0.5	9.7	9.67	2.45	15000	50
NAST 12R	12	16	32	12	11.8	1.5	0.5	10.4	10.9	2.74	13000	58
NAST 15R	15	20	35	12	11.8	1.5	0.5	12.3	14.3	3.14	10000	62
NAST 17R	17	22	40	16	15.8	1.5	0.5	17.4	20.9	3.72	9500	110
NAST 20R	20	25	47	16	15.8	1.5	0.5	19.2	24.5	4.61	8500	155
NAST 25R	25	30	52	16	15.8	1.5	0.5	20.7	28.4	5.29	7000	180
NAST 30R	30	38	62	20	19.8	1.5	1	30.3	45.4	6.66	5500	320
NAST 35R	35	42	72	20	19.8	1.5	1	32.2	50.6	8.13	5000	440
NAST 40R	40	50	80	20	19.8	2	1.5	35.7	61.6	9.31	4000	530
NAST 45R	45	55	85	20	19.8	2	1.5	37.1	66.4	10.1	4000	580
NAST 50R	50	60	90	20	19.8	2	1.5	38.7	71.8	11	3500	635

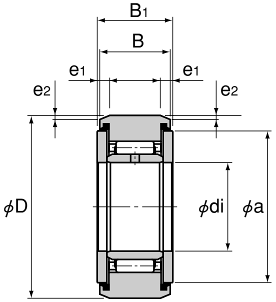
Note The rotation speed limit value in the table (*) applies to models using grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted.
Stainless steel types are also available. Contact THK for details.

Model NAST-ZZ

Separable Type with a Cylindrical Outer Ring and Side Plates



Model NAST-ZZ



Model NAST-ZZUU

Unit: mm

Model No.	Major dimensions							Basic load rating		Track load capacity	Rotation speed limit*	Mass
Spherical outer ring	Inner diameter di	Outer diameter D	B_1	B	a	e_1	e_2	C kN	C_0 kN	kN	min^{-1}	g
NAST 6ZZ	6	19	14	13.8	14	2.5	0.8	4.12	4.55	3.53	20000	24.5
NAST 8ZZ	8	24	14	13.8	17.5	2.5	0.8	5.68	5.89	4.51	17000	39
NAST 10ZZ	10	30	16	15.8	23.5	2.5	0.8	9.7	9.67	6.86	15000	65
NAST 12ZZ	12	32	16	15.8	25.5	2.5	0.8	10.4	10.9	7.35	13000	75
NAST 15ZZ	15	35	16	15.8	29	2.5	0.8	12.3	14.3	8.04	10000	83
NAST 17ZZ	17	40	20	19.8	32.5	3	1	17.4	20.9	11.8	9500	135
NAST 20ZZ	20	47	20	19.8	38	3	1	19.2	24.5	13.8	8500	195
NAST 25ZZ	25	52	20	19.8	43	3	1	20.7	28.4	15.3	7000	225
NAST 30ZZ	30	62	25	24.8	50.5	4	1.2	30.3	45.4	22.1	5500	400
NAST 35ZZ	35	72	25	24.8	53.5	4	1.2	32.2	50.6	25.7	5000	550
NAST 40ZZ	40	80	26	25.8	61.5	4	1.2	35.7	61.1	30.3	4000	710
NAST 45ZZ	45	85	26	25.8	66.5	4	1.2	37.1	66.4	31.1	4000	760
NAST 50ZZ	50	90	26	25.8	76	4	1.2	38.7	71.8	34	3500	830

Note The rotation speed limit value in the table (*) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 40% of this value is permitted.
Stainless steel types are also available. Contact THK for details.
The seal must be used at temperature of 80℃ or below.

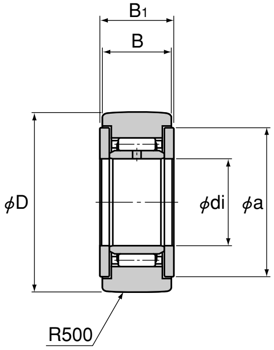
Model number coding

NAST 20 ZZ UU
1

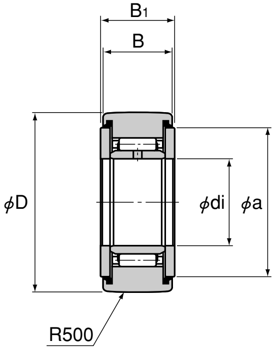
1 With seal

Model NAST-ZZR

Separable Type with a Spherical Outer Ring and Side Plates



Model NAST-ZZR



Model NAST-ZZUUR

Unit: mm

Model No.	Major dimensions					Basic load rating		Track load capacity	Rotation speed limit*	Mass
Spherical outer ring	Inner diameter di	Outer diameter D	B_1	B	a	C kN	C_0 kN	kN	min^{-1}	g
NAST 6ZZR	6	19	14	13.8	14	4.12	4.55	1.37	20000	24.5
NAST 8ZZR	8	24	14	13.8	17.5	5.68	5.89	1.86	17000	39
NAST 10ZZR	10	30	16	15.8	23.5	9.7	9.67	2.45	15000	65
NAST 12ZZR	12	32	16	15.8	25.5	10.4	10.9	2.74	13000	75
NAST 15ZZR	15	35	16	15.8	29	12.3	14.3	3.14	10000	83
NAST 17ZZR	17	40	20	19.8	32.5	17.4	20.9	3.72	9500	135
NAST 20ZZR	20	47	20	19.8	38	19.2	24.5	4.61	8500	195
NAST 25ZZR	25	52	20	19.8	43	20.7	28.4	5.29	7000	225
NAST 30ZZR	30	62	25	24.8	50.5	30.3	45.4	6.66	5500	400
NAST 35ZZR	35	72	25	24.8	53.5	32.2	50.6	8.13	5000	550
NAST 40ZZR	40	80	26	25.8	61.5	35.7	61.1	9.31	4000	710
NAST 45ZZR	45	85	26	25.8	66.5	37.1	66.4	10.1	4000	760
NAST 50ZZR	50	90	26	25.8	76	38.7	71.8	11	3500	830

Note The rotation speed limit value in the table (*) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. With those attached with seals, up to 40% of this value is permitted.
Stainless steel types are also available. Contact THK for details.
The seal must be used at temperature of 80℃ or below.

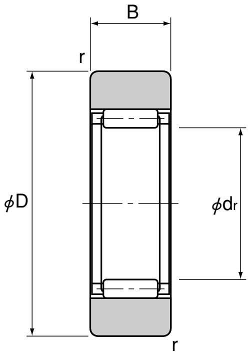
Model number coding

NAST 25 ZZ UU R
1 (UU)

1 With seal

Model RNAST

Separable Type with a Cylindrical Outer Ring and No Inner Ring



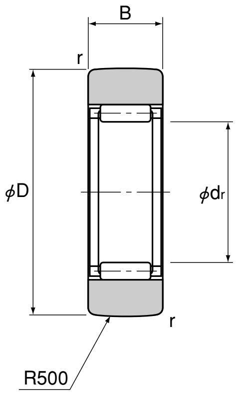
Unit: mm

Model No.	Major dimensions				Basic load rating		Track load capacity	Rotation speed limit*	Mass
Cylindrical outer ring	Inscribed circle diameter dr	Outer diameter D	B	r	C kN	C_0 kN	kN	min^{-1}	g
RNAST 5	7	16	7.8	0.5	2.74	2.39	2.35	30000	8.9
RNAST 6	10	19	9.8	0.5	4.12	4.55	3.53	20000	13.9
RNAST 8	12	24	9.8	1	5.68	5.89	4.02	17000	23.5
RNAST 10	14	30	11.8	1.5	9.7	9.67	5.59	15000	42.5
RNAST 12	16	32	11.8	1.5	10.4	10.9	5.98	13000	49.5
RNAST 15	20	35	11.8	1.5	12.3	14.3	6.57	10000	50
RNAST 17	22	40	15.8	1.5	17.4	20.9	10.9	9500	90
RNAST 20	25	47	15.8	1.5	19.2	24.5	12.7	8500	135
RNAST 25	30	52	15.8	1.5	20.7	28.4	14.1	7000	152
RNAST 30	38	62	19.8	1.5	30.3	45.4	22.1	5500	255
RNAST 35	42	72	19.8	1.5	32.2	50.6	25.7	5000	375
RNAST 40	50	80	19.8	2	35.7	61.6	26.9	4000	420
RNAST 45	55	85	19.8	2	37.1	66.4	28.5	4000	460
RNAST 50	60	90	19.8	2	38.7	71.8	30.2	3500	500

Note The rotation speed limit value in the table (*) applies to models using grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted.
Stainless steel types are also available. Contact THK for details.

Model RNAST-R

Separable Type with a Spherical Outer Ring and No Inner Ring



Unit: mm

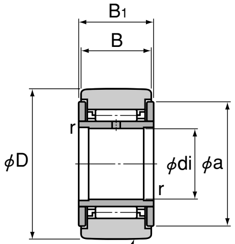
Model No.	Major dimensions				Basic load rating		Track load capacity	Rotation speed limit*	Mass
Spherical outer ring	Inscribed circle diameter dr	Outer diameter D	B	r	C kN	C_0 kN	kN	min^{-1}	g
RNAST 5R	7	16	7.8	0.5	2.74	2.39	1.08	30000	8.9
RNAST 6R	10	19	9.8	0.5	4.12	4.55	1.37	20000	13.9
RNAST 8R	12	24	9.8	1	5.68	5.89	1.86	17000	23.5
RNAST 10R	14	30	11.8	1.5	9.7	9.67	2.45	15000	42.5
RNAST 12R	16	32	11.8	1.5	10.4	10.9	2.74	13000	49.5
RNAST 15R	20	35	11.8	1.5	12.3	14.3	3.14	10000	50
RNAST 17R	22	40	15.8	1.5	17.4	20.9	3.72	9500	90
RNAST 20R	25	47	15.8	1.5	19.2	24.5	4.61	8500	135
RNAST 25R	30	52	15.8	1.5	20.7	28.4	5.29	7000	152
RNAST 30R	38	62	19.8	1.5	30.3	45.4	6.66	5500	255
RNAST 35R	42	72	19.8	1.5	32.2	50.6	8.13	5000	375
RNAST 40R	50	80	19.8	2	35.7	61.6	9.31	4000	420
RNAST 45R	55	85	19.8	2	37.1	66.4	10.1	4000	460
RNAST 50R	60	90	19.8	2	38.7	71.8	11	3500	500

Note The rotation speed limit value in the table (*) applies to models using grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted.
Stainless steel types are also available. Contact THK for details.

Roller Follower
q
15

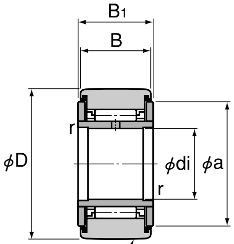
Model NART-R

Non-separable Type with a Spherical Outer Ring



R500 (model NART17 or lower)
R1000 (model NART20 or higher)

Model NART-R



R500 (model NART17 or lower)
R1000 (model NART20 or higher)

Model NART-UUR

Unit: mm

Model No.	Major dimensions						Basic load rating		Track load capacity	Rotation speed limit*	Mass
Spherical outer ring	Inner diameter di	Outer diameter D	B_1	B	a	r	C kN	C_0 kN	kN	min^{-1}	g
NART 5R	5	16	12	11	12	0.5	2.84	2.65	1.08	25000	14.5
NART 6R	6	19	12	11	14	0.5	3.33	3.35	1.37	20000	20.5
NART 8R	8	24	15	14	17.5	0.5	5.68	5.89	1.86	17000	41.5
NART 10R	10	30	15	14	23.5	0.5	7.94	7.59	2.45	15000	64.5
NART 12R	12	32	15	14	25.5	0.5	8.53	8.44	2.74	13000	71
NART 15R	15	35	19	18	29	0.5	13.7	16.4	3.14	10000	102
NART 17R	17	40	21	20	32.5	0.5	17.4	19.3	3.72	9500	149
NART 20R	20	47	25	24	38	0.5	22.9	30.6	7.15	8000	250
NART 25R	25	52	25	24	43	0.5	24.6	33.3	8.23	7000	285
NART 30R	30	62	29	28	50.5	0.5	33.4	51.4	10.5	5500	470
NART 35R	35	72	29	28	53.5	1	35.5	57.3	12.9	5000	640
NART 40R	40	80	32	30	61.5	1	44.6	81.4	14.9	4000	845
NART 45R	45	85	32	30	66.5	1	46.6	88.6	16.1	4000	915
NART 50R	50	90	32	30	76	1	48.3	95.7	17.3	3500	980

Note The rotation speed limit value in the table (*) applies to models that have no seal and use grease lubrication. With those models using oil lubrication, up to 130% of this value is permitted. Whit those attached with seals, up to 70% of this value is permitted.

Stainless steel types are also available. Contact THK for details.

The seal must be used at temperature of 80℃ or below.

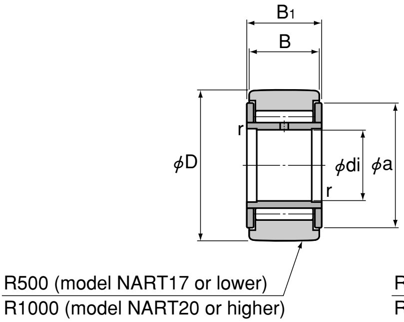
Model number coding

NART 17 $\underbrace{\text{UU}}_{1}$ R

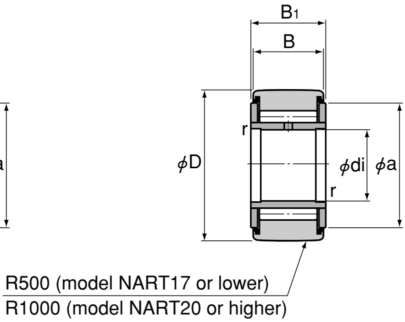
1 With seal

Model NART-VR

Non-separable Type with a Spherical Outer Ring and Full Balls



Model NART-VR



Model NART-VUUR

Unit: mm

Model No.	Major dimensions						Basic load rating		Track load capacity	Rotation speed limit*	Mass
Spherical outer ring	Inner diameter di	Outer diameter D	B_1	B	a	r	C kN	C_0 kN	kN	min^{-1}	g
NART 5VR	5	16	12	11	12	0.5	6.46	7.81	1.08	10500	15.1
NART 6VR	6	19	12	11	14	0.5	7.58	10.2	1.37	8700	21.5
NART 8VR	8	24	15	14	17.5	0.5	11.7	15.6	1.86	7000	42.5
NART 10VR	10	30	15	14	23.5	0.5	15.8	18.5	2.45	5700	66.5
NART 12VR	12	32	15	14	25.5	0.5	17	21	2.74	5200	73
NART 15VR	15	35	19	18	29	0.5	25.3	36.9	3.14	4300	106
NART 17VR	17	40	21	20	32.5	0.5	32	46.6	3.72	3900	155
NART 20VR	20	47	25	24	38	0.5	41.7	67.7	7.15	3400	255
NART 25VR	25	52	25	24	43	0.5	45.4	79.5	8.23	3000	295
NART 30VR	30	62	29	28	50.5	0.5	60	111	10.5	2400	485
NART 35VR	35	72	29	28	53.5	1	63.2	123	12.9	2200	655
NART 40VR	40	80	32	30	61.5	1	76.4	166	14.9	1900	865
NART 45VR	45	85	32	30	66.5	1	80.5	183	16.1	1700	935
NART 50VR	50	90	32	30	76	1	84.4	200	17.3	1600	1010

Note The rotation speed limit value in the table (*) applies to models that have seals and use grease lubrication. With those models have no seal and use oil lubrication, up to 130% of this value is permitted.
Stainless steel types are also available. Contact THK for details.
The seal must be used at temperature of 80℃ or below.

Model number coding

$\text{NART 15 V }\underbrace{\text{UU}}_{1}\text{ R}$

1 With seal

Structure and Features

Spherical Bearings models SB and SA1 are self-aligning plain bearings designed for heavy loads. The inner and outer rings of these models use high-carbon chromium bearing steel that is hardened, ground, phosphate-coated and seized with molybdenum disulfide (MoS_2).

The Spherical Bearing is capable of receiving a large radial load and thrust loads in both directions. Furthermore, because of its high resistance to impact loads, the Spherical Bearing is optimal for low-speed, heavy-load rocking components such as the cylinder clevises or hinges of construction and civil-engineering machinery, the suspensions of trucks and the bolster anchors of electric cars.

Types and Features

Model SB

The most popular type of spherical bearing in Japan, model SB has wide spherical contact areas and is used as a bearing for heavy loads. The outer ring is split at two points, enabling the inner ring to be accommodated.

Model SA1

This type of spherical bearing is widely used in Europe. The outer ring is split at one point (outer rings with diameter of φ 100 or thicker are split at two points), and the width and thickness are smaller than model SB. Thus, this model can be used in small spaces. Types attached with highly dust-preventive dust seals on both ends (model SA1 ··· UU) are also available.

Accuracy Standards

The dimensional tolerances of the Spherical Bearing are defined as indicated in table 1.

Table 1 Accuracy of the Spherical Bearing

Unit: μm

Nominal dimension of the inner diameter (d) and the outer diameter (D) (mm)		Tolerance in inner diameter (dm)		Tolerance in outer diameter (Dm)		Tolerance of the inner or outer ring in width (B_1, B)	
Above	Or less	Upper	Lower	Upper	Lower	Upper	Lower
10	18	0	− 8	—	—	0	−120
18	30	0	−10	0	− 9	0	−120
30	50	0	−12	0	−11	0	−120
50	80	0	−15	0	−13	0	−150
80	120	0	−20	0	−15	0	−200
120	150	0	−25	0	−18	0	−250
150	180	0	−25	0	−25	0	−250
180	250	0	−30	0	−30	0	−300
250	315	—	—	0	−35	0	−350
315	400	—	—	0	−40	0	−400

Note 1: "dm" and "Dm" represent the arithmetic averages of the maximum and minimum diameters obtained in measuring the inner and outer diameters at two points.

Note 2: The dimensional tolerances of the inner and outer diameters are the values before they are surface-treated.

Note 3: The dimensional tolerance of the outer ring is the value before it is split.

Note 4: Tolerances of the inner and outer diameters in width (B_1, B) are assumed to be equal, and obtained from the nominal dimension of the inner diameter of the inner ring.

Radial Clearance

Table 2 shows radial clearances of the Spherical Bearing.

Table 2 Radial Clearances of the Spherical Bearing

Unit: μm

Bearing inner diameter (d) (mm)		Radial clearance	
Above	Or less	Min.	Max.
—	17	70	125
17	30	75	140
30	50	85	150
50	65	90	160
65	80	95	170
80	100	100	185
100	120	110	200
120	150	120	215
150	240	130	230

Note 1: The radial clearance indicates the value before the outer ring is split.

Note 2: The axial clearance is approximately twice the radial clearance.

Fitting

The fitting between the Spherical Bearing and the shaft or the housing is selected according to the service conditions. Table 3 shows recommended values.

Table 3 Recommended Fitting Values

Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	k6	H7
	Indeterminate load	m6	H7
Outer ring rotational load	Normal load	g6	M7
	Indeterminate load	h6	N7

Note 1: If the product is to be installed so that the inner ring rotates and the fitting with the shaft is to be clearance fitting, harden the surface of the shaft in advance.

Note 2: "N7" is recommended for light alloy housings.

●Shaft Designing

If the inner ring is to be fit onto the shaft in clearance fitting and the product is to be used under a heavy load, the shaft may slip on the inner circumference of the inner ring. To prevent the slippage, the shaft hardness must be 58 HRC or higher and the surface roughness must be 0.80 a or below.

Permissible Tilt Angle

The permissible tilt angle of the Spherical Bearing varies according to the shaft shape as indicated in table 4.

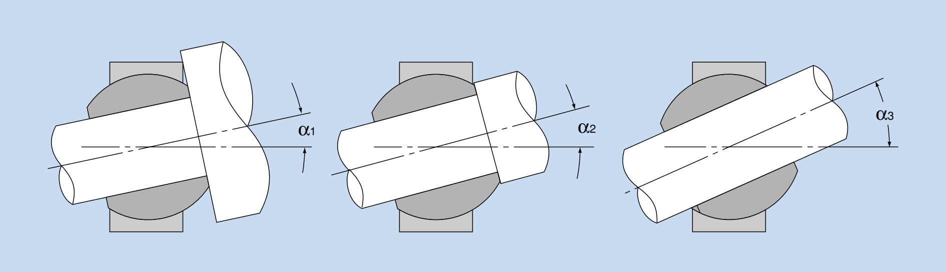


Table 4 Permissible Tilt Angle

Unit: degree

Model No.	Permissible tilt angle		
	α_1	α_2	α_3
SB 12	5	7	18
SB 15	4	6	18
SB 20	3	4	14
SB 22	4	6	16
SB 25	4	5	16
SB 30	4	6	17
SB 35	4	5	14
SB 40	4	6	12
SB 45	4	5	13
SB 50	4	5	16
SB 55	4	6	16
SB 60	4	6	18
SB 65	4	5	16
SB 70	4	5	15
SB 75	4	5	18
SB 80	4	5	18
SB 85	4	6	16
SB 90	4	5	16
SB 95	4	5	17
SB 100	4	5	18
SB 110	4	5	16
SB 115	4	5	14
SB 120	4	6	15
SB 130	4	5	14
SB 150	4	5	12

Unit: degree

Model No.	Permissible tilt angle		
	α_1	α_2 (note)	α_3
SA1 12	8	11(6)	25
SA1 15	6	8(5)	18
SA1 17	7	10(7)	23
SA1 20	6	9(6)	21
SA1 25	6	7(4)	18
SA1 30	4	6(4)	16
SA1 35	5	6(4)	16
SA1 40	5	7(4)	16
SA1 45	6	7(4)	16
SA1 50	5	6(4)	15
SA1 60	5	6(3)	14
SA1 70	5	6(4)	14
SA1 80	4	6(4)	14
SA1 90	4	5(3)	12
SA1 100	5	7(5)	14
SA1 110	5	6(4)	15
SA1 120	4	6(4)	15
SA1 140	5	7(5)	16
SA1 160	6	8(6)	13
SA1 180	5	6(5)	16
SA1 200	6	7(6)	13
SA1 220	6	8(6)	15
SA1 240	6	8(6)	17

Note: The values in the parentheses apply to types attached with a seal.

Lubrication

The spherical sliding surface of the Spherical Bearing is seized with a solid lubricant film of molybdenum disulfide. This enables the Spherical Bearing to be used over a relatively long period without further lubrication under a static load, in low-speed rocking motion or in intermittent rotary motion. However, it is generally necessary to replenish grease on a regular basis. If a heavy load is applied, consider using lithium soap group grease containing molybdenum disulfide. The inner and outer rings of the spherical bearing have greasing holes as a means to facilitate the flow of the lubricant inside the bearing.

●Lubrication Interval

Since the Spherical Bearing is delivered without being applied with a lubricant, it is necessary to replenish an appropriate amount of grease after installing the Spherical Bearing.
We recommend filling grease also to the space surrounding the Spherical Bearing. It is also recommendable to shorten the lubrication interval in the start-up period in order to lighten the initial wear and extend the service life.
The lubrication interval varies according to the magnitude of the load, frequency of the vibrations and other conditions. Provide lubrication while referring to the values in table 5 as a guide.

Table 5 Lubrication Interval

Type of load	Required minimum lubrication interval
Unilateral load	G/40
Varying load	G/180

G: Service life of the bearing (total number of rocking motions or total number of revolutions)

Dust Prevention

Spherical Bearing model SA1 is provided with a seal designed to prevent humidity or other deleterious material from entering the bearing. This seal is effective in increasing the service life of the bearing.
The seal for Spherical Bearing model SA1 is made of oil-resistant synthetic rubber and has double lips as the sealing element. These lips closely contact the spherical inner ring.
The seal can be used within the temperature range between -30℃ and 80℃, and is highly resistant to wear and capable of operating for a long period of time.
If the product is used in an environment where sand or soil matter may enter the bearing, the service life of the seal is shortened. In such cases, we recommend lubricating the product on a regular basis.

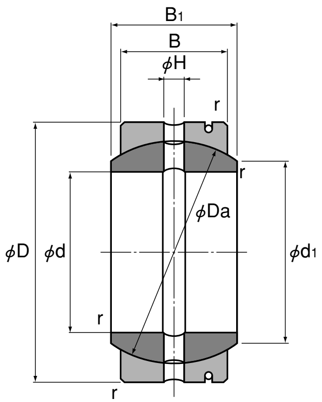
Permissible Service Temperature

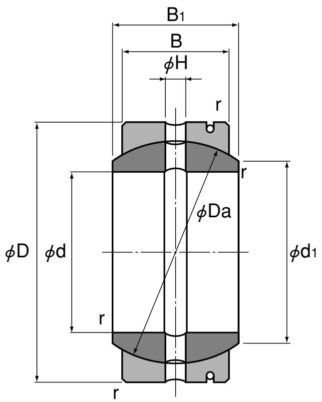
The permissible service temperature of the Spherical Bearing is limited between -30℃ and 80℃ depending on the seal material and determined by the permissible service temperature range of the grease used.

Installation

When installing the Spherical Bearing, pay attention to the mounting orientation so that the slit of the outer ring receives a minimum load. Also note that the Spherical Bearing cannot receive a thrust load alone.

Model SB





Unit: mm

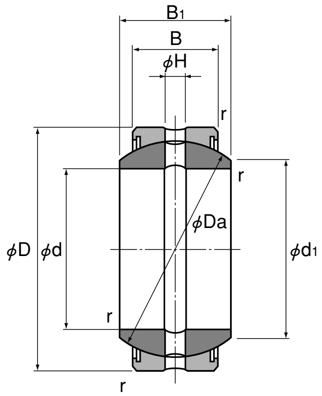
Model No.	Major dimensions								Basic load rating		Mass
	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B_1	d_1	Da	H	r	C kN	C_0 kN	kg
SB 12	12	22	9	11	14	18	1.5	0.5	3.82	95.3	0.019
SB 15	15	26	11	13	17.5	22	2.5	0.5	5.69	142	0.028
SB 20	20	32	14	16	23	28	2.5	0.5	9.22	230	0.053
SB 22	22	37	16	19	25.5	32	2.5	0.5	12.1	301	0.085
SB 25	25	42	18	21	29	36	4	0.5	15.3	381	0.116
SB 30	30	50	23	27	36	45	4	1	24.3	609	0.225
SB 35	35	55	26	30	40	50	4	1	30.6	765	0.3
SB 40	40	62	28	33	44	55	4	1	36.3	906	0.375
SB 45	45	72	31	36	50.5	62	6	1	45.2	1130	0.6
SB 50	50	80	36	42	58.5	72	6	1	61	1530	0.87
SB 55	55	90	40	47	64.5	80	6	1	75.3	1880	1.26
SB 60	60	100	45	53	72.5	90	6	1	95.3	2380	1.7
SB 65	65	105	47	55	76	94	6	1	104	2600	2.05

Unit: mm

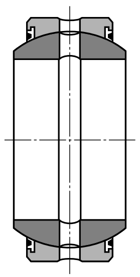
Model No.	Major dimensions								Basic load rating		Mass
	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B_1	d_1	Da	H	r	C kN	C_0 kN	kg
SB 70	70	110	50	58	81.5	100	8	1	118	2940	2.22
SB 75	75	120	55	64	89.5	110	8	1	142	3560	3.02
SB 80	80	130	60	70	97.5	120	8	1	170	4240	3.98
SB 85	85	135	63	74	100.5	125	8	1	185	4640	4.29
SB 90	90	140	65	76	105.5	130	8	1	199	4970	4.71
SB 95	95	150	70	82	113.5	140	8	1	230	5760	6.05
SB 100	100	160	75	88	121.5	150	10	1.5	265	6620	7.42
SB 110	110	170	80	93	130	160	10	1.5	301	7530	8.55
SB 115	115	180	85	98	132.5	165	10	1.5	330	8250	10.3
SB 120	120	190	90	105	140	175	10	1.5	371	9260	12.4
SB 130	130	200	95	110	148.5	185	10	1.5	414	10300	13.8
SB 150	150	220	105	120	166	205	10	1.5	507	12600	17

Selecting a Model Number Refer to the "THK General Catalog - Technical Descriptions of the Products," provided separately

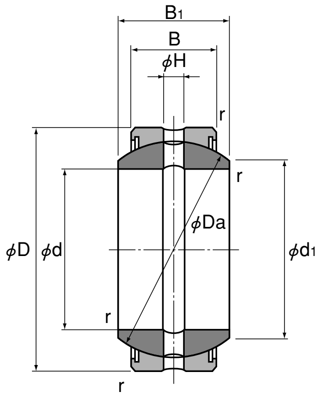
Model SA1



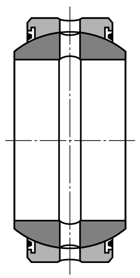
Model SA1



Model SA1-UU



Model SA1



Model SA1-UU

Unit: mm

Model No.		Major dimensions								Basic load rating		Mass
Standard type	Seal type	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B_1	d_1	Da	H	r	C kN	C_0 kN	kg
SA1 12	SA1 12UU	12	22	7	10	15	18	1.5	0.3	2.94	74.1	0.017
SA1 15	SA1 15UU	15	26	9	12	18.4	22	2.5	0.3	4.7	117	0.032
SA1 17	SA1 17UU	17	30	10	14	20.7	25	2.5	0.3	5.88	147	0.049
SA1 20	SA1 20UU	20	35	12	16	24.2	29	2.5	0.3	8.23	205	0.065
SA1 25	SA1 25UU	25	42	16	20	29.3	35.5	4	0.3	13.3	334	0.115
SA1 30	SA1 30UU	30	47	18	22	34.2	40.7	4	0.3	17.3	431	0.16
SA1 35	SA1 35UU	35	55	20	25	39.8	47	4	1	22.1	553	0.258
SA1 40	SA1 40UU	40	62	22	28	45	53	4	1	27.5	686	0.315
SA1 45	SA1 45UU	45	68	25	32	50.8	60	6	1	35.3	882	0.413
SA1 50	SA1 50UU	50	75	28	35	56	66	6	1	43.5	1090	0.56
SA1 60	SA1 60UU	60	90	36	44	66.8	80	6	1.5	67.7	1700	1.1
SA1 70	SA1 70UU	70	105	40	49	77.9	92	8	1.5	86.6	2170	1.54

Unit: mm

Model No.		Major dimensions								Basic load rating		Mass
Standard type	Seal type	Inner diameter d	Outer diameter D	Outer ring width B	Inner ring width B_1	d_1	Da	H	r	C kN	C_0 kN	kg
SA1 80	SA1 80UU	80	120	45	55	89.4	105	8	1.5	111	2780	2.29
SA1 90	SA1 90UU	90	130	50	60	98.1	115	8	2	135	3380	2.84
SA1 100	SA1 100UU	100	150	55	70	109.5	130	8	2	169	4210	4.43
SA1 110	SA1 110UU	110	160	55	70	121.2	140	8	2	181	4530	4.94
SA1 120	SA1 120UU	120	180	70	85	135.6	160	8	2	264	6590	8.12
SA1 140	SA1 140UU	140	210	70	90	155.9	180	8	3	296	7410	11.3
SA1 160	SA1 160UU	160	230	80	105	170.2	200	10	3	376	9410	14.4
SA1 180	SA1 180UU	180	260	80	105	199	225	10	3	424	10600	18.9
SA1 200	SA1 200UU	200	290	100	130	213.5	250	10	3	588	14700	28.1
SA1 220	SA1 220UU	220	320	100	135	239.6	275	10	3.5	647	16200	36.1
SA1 240	SA1 240UU	240	340	100	140	265.3	300	10	3.5	706	17600	40.4

Note Model numbers "…100" or higher have double-slit outer rings.

Structure and Features

The Rod End is a self-aligning plain bearing that uses a spherical inner ring which has the same level of accuracy and hardness as bearing steel balls and in which only the spherical area is hard chrome plated. With the combination of a spherical inner ring whose sliding surface is mirror-finished and a rationally designed holder, the Rod End ensures play-free, extremely smooth rotary and rocking motion.

Types and Features

Model PHS (Provided with a Female Thread)

With model PHS, a special copper alloy with high conformability is inserted between the color chromate finished steel holder and the spherical inner ring in which only the spherical area is hard chrome plated. This structure ensures high rigidity, high wear resistance and high corrosion resistance.

The grease nipple on the holder allows grease to be applied to the sliding surface as necessary.

Model RBH (Die Cast, Low-price Type)

This model is a high-accuracy, low-cost rod end in which the spherical inner ring serves as the core and the holder is formed by die-casting. The holder is made of a high-strength zinc alloy (see page s-5), which is superb in mechanical properties and bearing characteristics.

Model NHS-T (Lubrication-free Type)

This lubrication-free rod end uses self-lubricating synthetic resin formed between the steel holder and the spherical inner ring. Since the clearance on the sliding surface is minimized, an accurate link motion is achieved.

Model HS (Lubrication-free, Corrosion-resistant Type)

This lubrication-free rod end uses a special fluorocarbon sheet adhering to the holder's spherical area. It is more resistant to corrosion than a stainless steel type.

Since the holder is made of an aluminum alloy, this model is extremely light.

Model POS (Male-thread Type)

This model is a highly rigid rod end that is basically the same as the female-screw type model PHS, but has a male thread on the holder end.

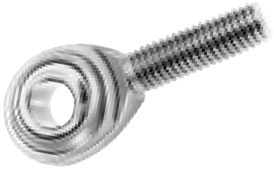
Model PB (Standard Type)

With model PB, a special copper alloy with high conformability is inserted between the steel outer ring and the spherical inner ring in which only the spherical area is hard chrome plated. This structure makes this model a high rigid spherical bearing with high corrosion resistance and high wear resistance.
The oil groove and the greasing hole on the outer ring allow grease to be applied to the sliding surface as necessary.

Model NB-T (Lubrication-free Type)

This lubrication-free bearing uses self-lubricating synthetic resin formed between the steel outer ring and the spherical inner ring.

Model NOS-T (Lubrication-free, Male-thread Type)



This model is a lubrication-free rod end that is basically the same as the female-screw type model NHS-T, but has a male thread on the holder end.

Model PBA (Die Cast Type)

This model is a high-accuracy, low-cost spherical bearing in which the spherical inner ring serves as the core and the outer ring is formed by die-casting.
The outer ring is made of a high-strength zinc alloy (see page s-5), which is superb in bearing characteristics.

Model HB (Lubrication-free Type)

This lubrication-free spherical bearing uses a special fluorine sheet adhering to the outer ring's spherical area.

High-strength Zinc Alloy

The high-strength zinc alloy, developed as an alloy for bearings, is composed of Aℓ, Cu, Mg, Be and Ti as well as zinc as the base. It is excellent in mechanical properties, seizure resistance and wear resistance.

Composition

Table 1 Composition of the High-strength Zinc Alloy

Unit: %

Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

Mechanical Properties

Tensile strength: 275 to 314 N/mm^2
Tensile yield strength (0.2%): 216 to 245 N/mm^2
Compressive strength: 539 to 686 N/mm^2
Compressive yield strength (0.2%): 294 to 343 N/mm^2
Fatigue strength 132 N/mm$^2 \times 10^7$ (Schenk bending test)
Charpy impact strength: 0.098 to 0.49 N-m/mm^2
Elongation: 1 to 5 %
Hardness: 120 to 145 HV

Physical Properties

Specific gravity: 6.8
Melting point: 390 ℃
Specific heat: 460 J/(kg·k)
Linear expansion ratio: 24×10^{-6}

Wear Resistance

The wear resistance of the high-strength zinc alloy is superior to that of class-3 brass and class-3 bronze, almost equal to that of class-2 phosphor bronze.

Amsler wear-tester:
Test piece rotation speed: 185 min^{-1}
Load: 392 N
Lubricant: Dynamo oil

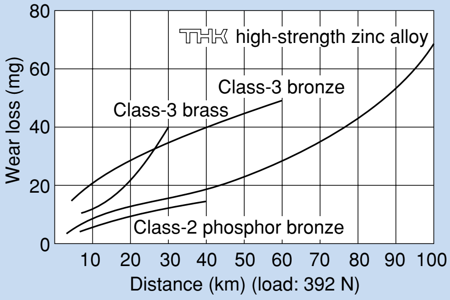


Fig. 1 Wear Resistance of the High-strength Zinc Alloy

Service Temperature

If any of models RBH, PBA, HS and HB, all of which use the high-strength zinc alloy and an aluminum alloy in the holder and the outer ring, and of models NHS-T, NOS-T and NB-T, which use synthetic-resin bushes, is to be used at temperature of 80℃ or higher, or receives an impact at low temperature, contact THK .

Installation

Please note that the Rod End is not capable of receiving a thrust load indicated in Fig. 2.

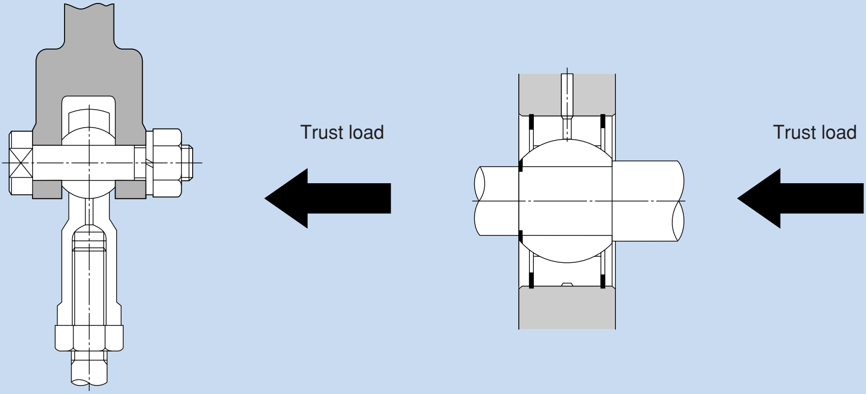
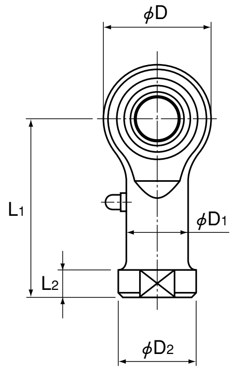
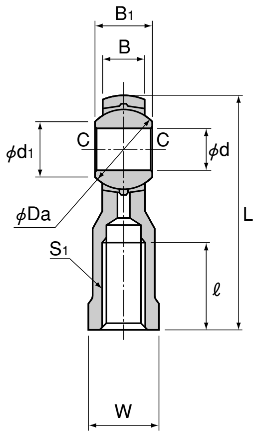


Fig. 2 Examples of Installing the Rod End

Model PHS

Female-thread Type





Unit: mm

Model No.	Outer dimensions			Thread	Holder dimensions							Grease nipple	Spherical inner ring dimensions				Permissible tilt angle			Static applied load Radial	Mass
	Length L	Diameter D	Width B1 $^{0}_{-0.1}$	S1 JIS Class 2	W $^{0}_{-0.2}$	D1	D2	B ±0.1	L1	L2	ℓ		d H7	Ball diameter Da mm (inch)	d1	C	α_1°	α_2°	α_3°	Cs N	g
PHS 5	35	16	8	M5×0.8	9	9	11	6	27	4	14	PB107	5	11.112 (7/16)	7.7	0.3	8	13	30	5590	16.5
PHS 6	39	18	9	M6×1	11	10	13	6.75	30	5	14		6	12.7 (1/2)	9	0.3	8	13	30	6860	25
PHS 8	47	22	12	M8×1.25	14	12.5	16	9	36	5	17		8	15.875 (5/8)	10.4	0.5	8	14	25	9800	43
PHS 10	56	26	14	M10×1.5	17	15	19	10.5	43	6.5	21		10	19.05 (3/4)	12.9	0.5	8	14	25	13200	72
PHS 12	65	30	16	M12×1.75	19	17.5	22	12	50	6.5	24		12	22.225 (7/8)	15.4	0.5	8	13	25	16700	107
PHS 14	74	34	19	M14×2	22	20	25	13.5	57	8	27		14	25.4 (1)	16.9	0.7	10	16	24	20600	160
PHS 16	83	38	21	M16×2	22	22	27	15	64	8	33		16	28.575 (1 1/8)	19.4	0.7	9	15	24	25000	210
PHS 18	92	42	23	M18×1.5	27	25	31	16.5	71	10	36		18	31.75 (1 1/4)	21.9	0.7	9	15	24	29400	295
PHS 20	100	46	25	M20×1.5	30	27.5	34	18	77	10	40		20	34.925 (1 3/8)	24.4	0.7	9	15	24	34300	380
PHS 22	109	50	28	M22×1.5	32	30	37	20	84	12	43		22	38.1 (1 1/2)	25.8	0.7	10	15	23	41200	490
PHS 25	124	60	31	M24×2	36	33.5	42	22	94	12	48	A-M6F	25	42.862 (1 11/16)	29.6	0.8	9	15	23	72500	750
PHS 30	145	70	37	M30×2	41	40	50	25	110	15	56		30	50.8 (2)	34.8	0.8	10	17	23	92200	1130

■Material

Holder:	S35C (color chromate finish)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Special copper alloy

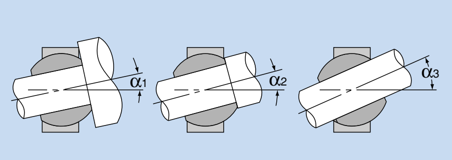
■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	p6

■Clearance

Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Lubrication

The holder has a greasing hole and an oil groove; they allow grease to be replenished through the grease nipple as necessary.

■Identification of Left-hand Thread

If the female thread is left-hand, symbol "L" is added.

The actual product is marked with symbol "L" on the holder.

Model number coding

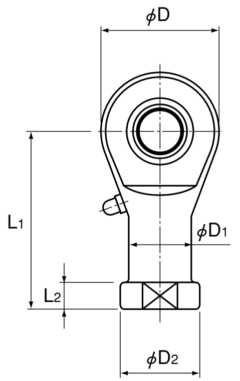
PHS10 L

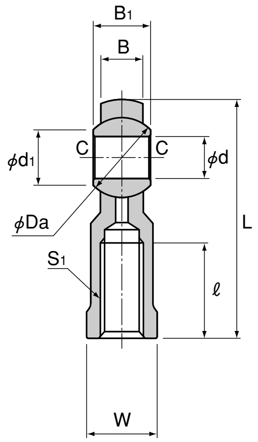
1 2

1 Model number 2 Left-hand thread

Model RBH

Die Cast, Low-price Type





Unit: mm

Model No.	Outer dimensions Length L	Diameter D	Width B1 0 −0.1	Screw S1 JIS Class 2	Holder dimensions W 0 −0.3	D1	D2	B	L1	L2	ℓ	Grease nipple	Spherical inner ring dimensions d H7	Ball diameter Da mm (inch)	d1	C	Permissible tilt angle α_1°	α_2°	α_3°	Static applied load Radial C_s N	Mass g
RBH 5	35.5	17	8	M5×0.8	9	9	11	6	27	4	16	PB107	5	11.112 (7/16)	7.7	0.3	8	13	30	5490	16
RBH 6	39.7	19.5	9	M6×1	11	10	13	6.75	30	5	16		6	12.7 (1/2)	9	0.3	8	13	30	6760	21
RBH 8	48	24	12	M8×1.25	14	12.5	16	9	36	5	19		8	15.875 (5/8)	10.4	0.5	8	14	25	9610	43
RBH 10	57	28	14	M10×1.5	17	15	19	10.5	43	6.5	23		10	19.05 (3/4)	12.9	0.5	8	14	25	13000	68
RBH 12	66	32	16	M12×1.75	19	17.5	22	12	50	6.5	27		12	22.225 (7/8)	15.4	0.5	8	13	25	16400	100
RBH 14	75	36	19	M14×2	22	20	25	13.5	57	8	30		14	25.4 (1)	16.9	0.7	10	16	24	20200	142
RBH 16	84	40	21	M16×2	22	22	27	15	64	8	36		16	28.575 (1 1/8)	19.4	0.7	9	15	24	24600	185
RBH 18	93.5	45	23	M18×1.5	27	25	31	16.5	71	10	40		18	31.75 (1 1/4)	21.9	0.7	9	15	24	28800	265
RBH 20	101.5	49	25	M20×1.5	30	27.5	34	18	77	10	43		20	34.925 (1 3/8)	24.4	0.7	9	15	24	33600	334
RBH 22	111	54	28	M22×1.5	32	30	37	20	84	12	47		22	38.1 (1 1/2)	25.8	0.7	10	15	23	40400	454

■Material

Holder:	High-strength zinc alloy (see page s-5)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)

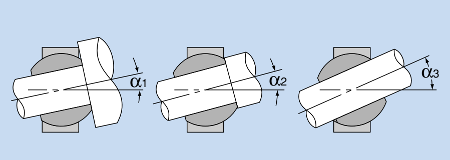
■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	p6

■Clearance

Unit: mm

Radial clearance	0.03 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Lubrication

The holder has a greasing hole and an oil groove; they allow grease to be replenished through the grease nipple as necessary.

■Identification of Left-hand Thread

If the female thread is left-hand, symbol "L" is added.

The actual product is marked with symbol "L" on the holder.

Model number coding

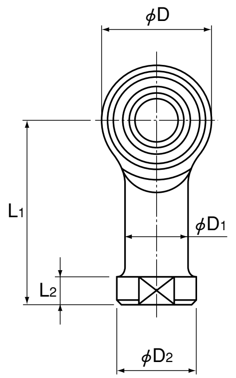
RBH10 L

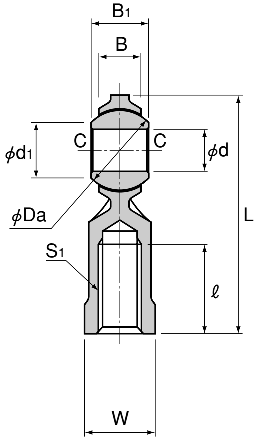
1 2

1 Model number 2 Left-hand thread

Model NHS-T

Lubrication-free Type





Unit: mm

Model No.	Outer dimensions			Screw	Holder dimensions							Spherical inner ring dimensions				Permissible tilt angle			Static applied load Radial	Mass
	Length L	Diameter D	Width B1 $^{0}_{-0.1}$	S1 JIS Class 2	W $^{0}_{-0.2}$	D1	D2	B $^{+0.1}_{-0.4}$	L1	L2	ℓ	d H7	Ball diameter Da mm (inch)	d1	C	α_1°	α_2°	α_3°	Cs N	g
NHS 3T	27	12	6	M3×0.5	7	6.5	8	4.5	21	3	10	3	9.525 (3/8)	7.4	0.3	8	10	42	1570	6.5
NHS 4T	31	14	7	M4×0.7	8	8	9.5	5.3	24	4	12	4	10.319 (13/32)	7.6	0.3	9	11	35	2250	10
NHS 5T	35	16	8	M5×0.8	9	9	11	6	27	4	14	5	11.112 (7/16)	7.7	0.3	8	13	30	3920	16.5
NHS 6T	39	18	9	M6×1	11	10	13	6.75	30	5	14	6	12.7 (1/2)	9	0.3	8	13	30	5000	25
NHS 8T	47	22	12	M8×1.25	14	12.5	16	9	36	5	17	8	15.875 (5/8)	10.4	0.5	8	14	25	7450	43
NHS 10T	56	26	14	M10×1.5	17	15	19	10.5	43	6.5	21	10	19.05 (3/4)	12.9	0.5	8	14	25	9410	72
NHS 12T	65	30	16	M12×1.75	19	17.5	22	12	50	6.5	24	12	22.225 (7/8)	15.4	0.5	8	13	25	11000	107
NHS 14T	74	34	19	M14×2	22	20	25	13.5	57	8	27	14	25.4 (1)	16.9	0.7	10	16	24	15200	160
NHS 16T	83	38	21	M16×2	22	22	27	15	64	8	33	16	28.575 (1 1/8)	19.4	0.7	9	15	24	20200	210
NHS 18T	92	42	23	M18×1.5	27	25	31	16.5	71	10	36	18	31.75 (1 1/4)	21.9	0.7	9	15	24	25200	295
NHS 20T	100	46	25	M20×1.5	30	27.5	34	18	77	10	40	20	34.925 (1 3/8)	24.4	0.7	9	15	24	27800	380
NHS 22T	109	50	28	M22×1.5	32	30	37	20	84	12	43	22	38.1 (1 1/2)	25.8	0.7	10	15	23	35900	490

■Material

Holder:	S35C (color chromate finish)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Self-lubricating synthetic resin

■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	p6

Model number coding

NHS10T L

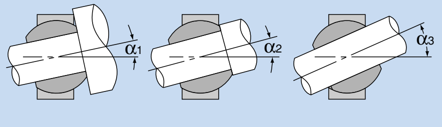
1 2

1 Model number 2 Left-hand thread

■Clearance

Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Initial Lubrication

This model can be used without lubrication. However, if desiring to provide initial lubrication, apply oil or grease to the spherical area.

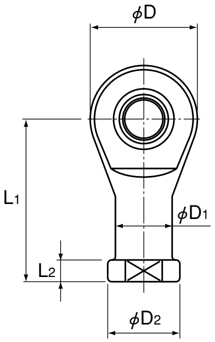
■Identification of Left-hand Thread

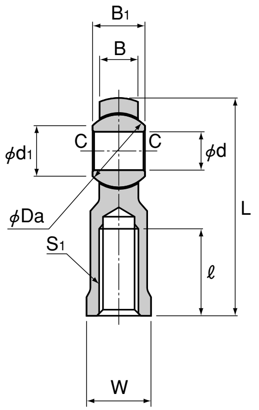
If the female thread is left-hand, symbol "L" is added.

The actual product is marked with symbol "L" on the holder.

Model HS

Lubrication-free, Corrosion-resistant Type





Unit: mm

Model No.	Outer dimensions			Screw	Holder						dimensions	Spherical inner ring dimensions				Permissible tilt angle			Static applied load Radial	Yield point strength	Mass
	Length L	Diameter D	Width B_1 $^{0}_{-0.1}$	S_1 JIS Class 2	W $^{0}_{-0.3}$	D_1	D_2	B	L_1	L_2	ℓ	d G7	Ball diameter Da mm (inch)	d_1	C	α_1°	α_2°	α_3°	C_S N	P_K N	g
HS 5	35.5	17	8	M5×0.8	9	9	11	6	27	4	16	5	11.112 $(^7/_{16})$	7.7	0.3	7	13	30	5590	3920	9
HS 6	39.7	19.5	9	M6×1	11	10	13	6.75	30	5	16	6	12.7 $(^1/_2)$	9	0.3	7	13	30	6860	5290	15
HS 8	48	24	12	M8×1.25	14	12.5	16	9	36	5	19	8	15.875 $(^5/_8)$	10.4	0.5	8	14	25	9800	8330	26
HS 10	57	28	14	M10×1.5	17	15	19	10.5	43	6.5	23	10	19.05 $(^3/_4)$	12.9	0.5	8	14	25	13200	10800	41
HS 12	66	32	16	M12×1.75	19	17.5	22	12	50	6.5	27	12	22.225 $(^7/_8)$	15.4	0.5	8	13	25	16700	14700	60

■Material

Holder:	A-1 alloy
Spherical inner ring:	SUJ2, 600 Hv or higher (corrosion resistant coated)
Bush:	Special fluorine resin with net

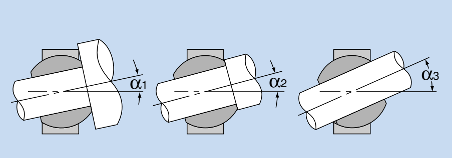
■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	n6,p6

■Clearance

Unit: mm

Radial clearance	0.03 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Identification of Left-hand Thread

If the female thread is left-hand, symbol "L" is added.

The actual product is marked with symbol "L" on the holder.

Model number coding

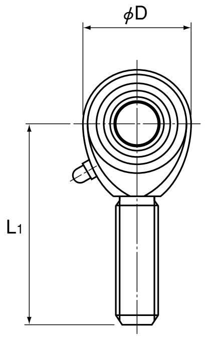
HS10 L

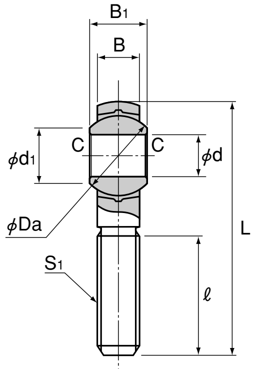
1 2

1Model number 2Left-hand thread

Model POS

Male-thread Type





Unit: mm

Model No.	Outer dimensions			Screw	Holder dimensions				Spherical inner ring dimensions				Permissible tilt angle			Static applied load Radial	Mass
	Length L	Diameter D	Width B_1 $^{0}_{-0.1}$	S_1 JIS Class 2	B ±0.1	L_1	ℓ	Grease nipple	d H7	Ball diameter Da mm (inch)	d_1	C	α_1°	α_2°	α_3°	C_S N	g
POS 5	41	16	8	M5×0.8	6	33	20	—	5	11.112 (7/16)	7.7	0.3	8	13	30	3430	12.5
POS 6	45	18	9	M6×1	6.75	36	22		6	12.7 (1/2)	9	0.3	8	13	30	4900	19
POS 8	53	22	12	M8×1.25	9	42	25	PB107	8	15.875 (5/8)	10.4	0.5	8	14	25	6860	32
POS 10	61	26	14	M10×1.5	10.5	48	29		10	19.05 (3/4)	12.9	0.5	8	14	25	10800	54
POS 12	69	30	16	M12×1.75	12	54	33		12	22.225 (7/8)	15.4	0.5	8	13	25	16700	85
POS 14	77	34	19	M14×2	13.5	60	36		14	25.4 (1)	16.9	0.7	10	16	24	20600	126
POS 16	85	38	21	M16×2	15	66	40		16	28.575 (1 1/8)	19.4	0.7	9	15	24	25000	185
POS 18	93	42	23	M18×1.5	16.5	72	44		18	31.75 (1 1/4)	21.9	0.7	9	15	24	29400	260
POS 20	101	46	25	M20×1.5	18	78	47		20	34.925 (1 3/8)	24.4	0.7	9	15	24	34300	340
POS 22	109	50	28	M22×1.5	20	84	51		22	38.1 (1 1/2)	25.8	0.7	10	15	23	41200	435
POS 25	124	60	31	M24×2	22	94	57	A-M6F	25	42.862 (1 11/16)	29.6	0.8	9	15	23	72500	650
POS 30	145	70	37	M30×2	25	110	66		30	50.8 (2)	34.8	0.8	10	17	23	92200	1070

■Material

Holder:	S35C (color chromate finish)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Special copper alloy

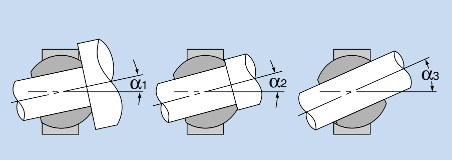
■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	p6

■Clearance

Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Lubrication

The holder has a greasing hole and an oil groove; they allow grease to be replenished through the grease nipple as necessary. To lubricate the product, replenish grease from the holder greasing hole for models POS5 and 6, or from the grease nipple for other models.

■Identification of Left-hand Thread

If the male thread is left-hand, symbol "L" is added. The actual product is marked with symbol "L" on the holder.

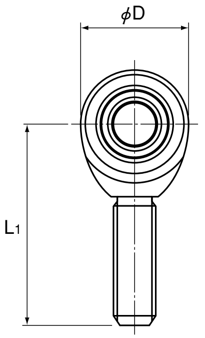
Model number coding

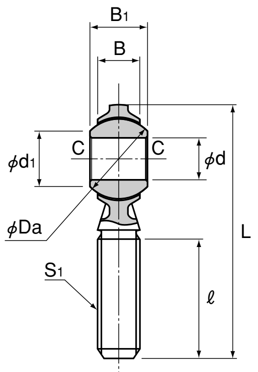
POS10 L
1 2

1 Model number 2 Left-hand thread

Model NOS-T

Lubrication-free, Male-thread Type





Unit: mm

Model No.	Outer dimensions			Screw	Holder dimensions			Spherical inner ring dimensions				Permissible tilt angle			Static applied load	Mass
	Length L	Diameter D	Width B_1 $^{0}_{-0.1}$	S_1 JIS Class 2	B $^{+0.1}_{-0.4}$	L_1	ℓ	d H7	Ball diameter Da mm (inch)	d_1	C	α_1°	α_2°	α_3°	Radial C_S N	g
NOS 3 T	33	12	6	M3×0.5	4.5	27	15	3	9.525 (3/8)	7.4	0.3	8	10	42	1570	4.5
NOS 4 T	37	14	7	M4×0.7	5.3	30	17	4	10.319 (13/32)	7.6	0.3	9	11	35	2250	7
NOS 5 T	41	16	8	M5×0.8	6	33	20	5	11.112 (7/16)	7.7	0.3	8	13	30	3430	12.5
NOS 6 T	45	18	9	M6×1	6.75	36	22	6	12.7 (1/2)	9	0.3	8	13	30	4900	19
NOS 8 T	53	22	12	M8×1.25	9	42	25	8	15.875 (5/8)	10.4	0.5	8	14	25	6860	32
NOS 10 T	61	26	14	M10×1.5	10.5	48	29	10	19.05 (3/4)	12.9	0.5	8	14	25	9410	54
NOS 12 T	69	30	16	M12×1.75	12	54	33	12	22.225 (7/8)	15.4	0.5	8	13	25	11000	85
NOS 14 T	77	34	19	M14×2	13.5	60	36	14	25.4 (1)	16.9	0.7	10	16	24	15200	126
NOS 16 T	85	38	21	M16×2	15	66	40	16	28.575 (1 1/8)	19.4	0.7	9	15	24	20200	185
NOS 18 T	93	42	23	M18×1.5	16.5	72	44	18	31.75 (1 1/4)	21.9	0.7	9	15	24	25200	260
NOS 20 T	101	46	25	M20×1.5	18	78	47	20	34.925 (1 3/8)	24.4	0.7	9	15	24	27800	340
NOS 22 T	109	50	28	M22×1.5	20	84	51	22	38.1 (1 1/2)	25.8	0.7	10	15	23	35900	435

■Material

Holder:	S35C (color chromate finish)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Self-lubricating synthetic resin

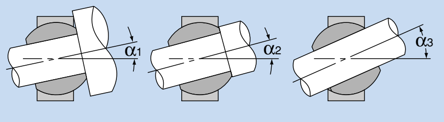
■Fitting with the Shaft

Service conditions	Dimensional tolerance of the shaft
Normal load	h7
Indeterminate load	p6

■Clearance

Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less



Permissible tilt angle

■Initial Lubrication

This model can be used without lubrication. However, if desiring to provide initial lubrication, apply oil or grease to the spherical area.

■Identification of Left-hand Thread

If the male thread is left-hand, symbol "L" is added.

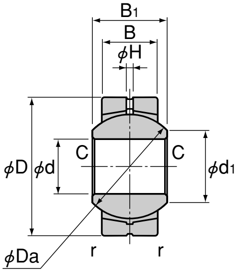
Model number coding

NOS10T L
1 2

1 Model number 2 Left-hand thread

Model PB

Standard Type



Unit: mm

Model No.	Major dimensions							Ball diameter	Permissible tilt angle			Static applied load Radial	Mass
	Inner diameter d H7	Outer diameter D h6	Outer ring width B ±0.1	Inner ring width B_1 $^{0}_{-0.1}$	d_1	H	C,r	Da mm (inch)	α_1°	α_2°	α_3°	C_s N	g
PB 5	5	16	6	8	7.7	1	0.3	11.112 (7/16)	8	13	30	7840	8.5
PB 6	6	18	6.75	9	9	1	0.3	12.7 (1/2)	8	13	30	9800	13
PB 8	8	22	9	12	10.4	1	0.5	15.875 (5/8)	8	14	25	16700	24
PB 10	10	26	10.5	14	12.9	1.2	0.5	19.05 (3/4)	8	14	25	23500	39
PB 12	12	30	12	16	15.4	1.5	0.5	22.225 (7/8)	8	13	25	31400	58
PB 14	14	34	13.5	19	16.9	1.5	0.7	25.4 (1)	10	16	24	40200	84
PB 16	16	38	15	21	19.4	2.5	0.7	28.575 (1 1/8)	9	15	24	50000	111
PB 18	18	42	16.5	23	21.9	2.5	0.7	31.75 (1 1/4)	9	15	24	61800	160
PB 20	20	46	18	25	24.4	2.5	0.7	34.925 (1 3/8)	9	15	24	73500	210
PB 22	22	50	20	28	25.8	2.5	0.7	38.1 (1 1/2)	10	15	23	88200	265
PB 25	25	56	22	31	29.6	3	0.8	42.862 (1 11/16)	9	15	23	111000	390
PB 30	30	66	25	37	34.8	3	0.8	50.8 (2)	10	17	23	148000	610

■Material

Outer ring:	S35C
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Special copper alloy

■Clearance

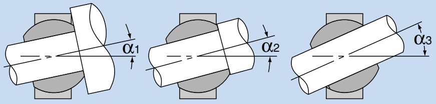
Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less

■Fitting with the Shaft

For the fitting between the shaft and the housing, the following values are recommended.

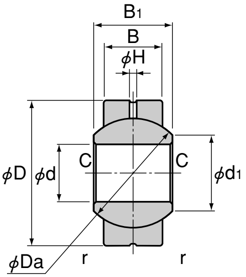
Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	m6	H7
	Indeterminate load	n6	
Outer ring rotational load	Normal load	h7	M7
	Indeterminate load	k6	



Permissible tilt angle

Model PBA

Die Cast Type



Unit: mm

Model No.	Major dimensions							Ball diameter	Permissible tilt angle			Static applied load Radial	Mass
	Inner diameter d H7	Outer diameter D h8	Outer ring width B ±0.1	Inner ring width B_1 $^{0}_{-0.1}$	d_1	H	C,r	Da mm (inch)	α_1°	α_2°	α_3°	C_S N	g
PBA 5	5	16	6	8	7.7	1	0.3	11.112 $(^{7}/_{16})$	8	13	30	7840	8.5
PBA 6	6	18	6.75	9	9	1	0.3	12.7 $(^{1}/_{2})$	8	13	30	9800	13
PBA 8	8	22	9	12	10.4	1	0.5	15.875 $(^{5}/_{8})$	8	14	25	16700	24
PBA 10	10	26	10.5	14	12.9	1.2	0.5	19.05 $(^{3}/_{4})$	8	14	25	23500	39
PBA 12	12	30	12	16	15.4	1.5	0.5	22.225 $(^{7}/_{8})$	8	13	25	31400	58
PBA 14	14	34	13.5	19	16.9	1.5	0.7	25.4 (1)	10	16	24	40200	84
PBA 16	16	38	15	21	19.4	2.5	0.7	28.575 $(1^{1}/_{8})$	9	15	24	50000	111
PBA 18	18	42	16.5	23	21.9	2.5	0.7	31.75 $(1^{1}/_{4})$	9	15	24	61800	160
PBA 20	20	46	18	25	24.4	2.5	0.7	34.925 $(1^{3}/_{8})$	9	15	24	73500	210
PBA 22	22	50	20	28	25.8	2.5	0.7	38.1 $(1^{1}/_{2})$	10	15	23	88200	265

■Material

Outer ring:	High-strength zinc alloy (see page s-5)
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)

■Clearance

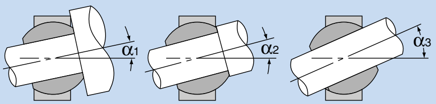
Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less

■Fitting with the Shaft

For the fitting between the shaft and the housing, the following values are recommended.

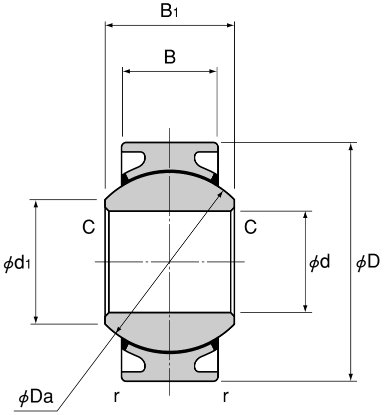
Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	m6	H7
	Indeterminate load	n6	
Outer ring rotational load	Normal load	h7	M7
	Indeterminate load	k6	



Permissible tilt angle

Model NB-T

Lubrication-free Type



Unit: mm

Model No.	Major dimensions						Ball diameter	Permissible tilt angle			Static applied load Radial	Mass
	Inner diameter d H7	Outer diameter D h7	Outer ring width B ±0.1	Inner ring width B_1 $^{0}_{-0.1}$	d_1	C,r	Da mm (inch)	α_1°	α_2°	α_3°	C_S N	g
NB 14T	14	34	13.5	19	16.9	0.7	25.4 (1)	10	16	24	20200	84
NB 16T	16	38	15	21	19.4	0.7	28.575 ($1^{1}/_{8}$)	9	15	24	25200	111
NB 18T	18	42	16.5	23	21.9	0.7	31.75 ($1^{1}/_{4}$)	9	15	24	30800	160
NB 20T	20	46	18	25	24.4	0.7	34.925 ($1^{3}/_{8}$)	9	15	24	36900	210
NB 22T	22	50	20	28	25.8	0.7	38.1 ($1^{1}/_{2}$)	10	15	23	44800	265

■Material

Outer ring:	S35C
Spherical inner ring:	SUJ2, 58 HRC or higher (hard chrome plated)
Bush:	Self-lubricating synthetic resin

■Clearance

Unit: mm

Radial clearance	0.035 or less
Axial clearance	0.1 or less

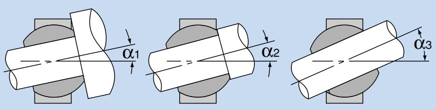
■Fitting with the Shaft

For the fitting between the shaft and the housing, the following values are recommended.

Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	m6	H7
	Indeterminate load	n6	
Outer ring rotational load	Normal load	h7	M7
	Indeterminate load	k6	

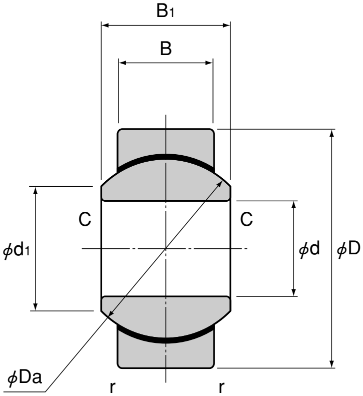
■Initial Lubrication

This model can be used without lubrication. However, if desiring to provide initial lubrication, apply oil or grease to the spherical area.



Permissible tilt angle

Model HB
Lubrication-free Type



Unit: mm

Model No.	Major dimensions						Ball diameter	Permissible tilt angle			Static applied load Radial	Mass
	Inner diameter d H7	Outer diameter D h7	Outer ring width B ±0.1	Inner ring width B1 $^{0}_{-0.1}$	d1	C,r	Da mm (inch)	α_1°	α_2°	α_3°	Cs N	g
HB 5	5	16	6	8	7.7	0.3	11.112 (7/16)	7	13	30	13100	8.5
HB 6	6	18	6.75	9	9	0.3	12.7 (1/2)	7	13	30	16900	13
HB 8	8	22	9	12	10.4	0.5	15.875 (5/8)	8	14	25	28000	24
HB 10	10	26	10.5	14	12.9	0.5	19.05 (3/4)	8	14	25	39200	39
HB 12	12	30	12	16	15.4	0.5	22.225 (7/8)	8	13	25	52500	58

■Material

Outer ring:	Zinc alloy
Spherical inner ring:	SUJ2, 600 Hv or higher (corrosion resistant coated)
Bush:	Special fluorine resin with net

■Clearance

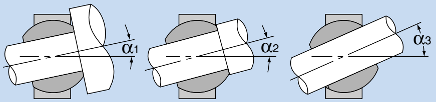
Unit: mm

Radial clearance	0.03 or less
Axial clearance	0.1 or less

■Fitting with the Shaft

For the fitting between the shaft and the housing, the following values are recommended.

Service conditions		Shaft	Housing
Inner ring rotational load	Normal load	m6	H7
	Indeterminate load	n6	
Outer ring rotational load	Normal load	h7	M7
	Indeterminate load	k6	



Permissible tilt angle

Link Ball®

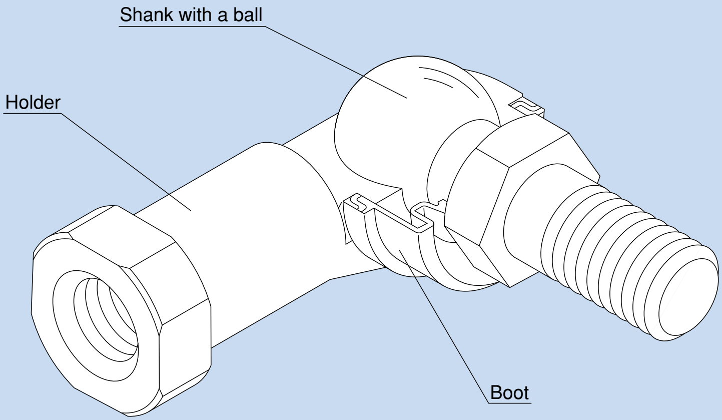


Fig. 1 Structure of Link Ball Model BL

Structure and Features

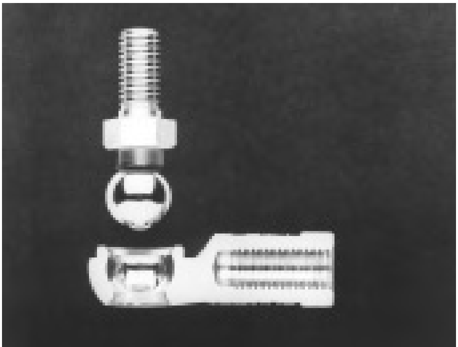
With the THK Link Ball, a highly accurate bearing steel ball used in the spherical area is first encased in the holder by die cast molding, and then is specially welded with the shank. This unique process enables the mirror surface of the steel ball to be transferred or duplicated on the spherical surface inside the holder to ensure full contact between the ball and the holder. As a result, smooth motion is achieved with a minimum clearance.

●Compact Design

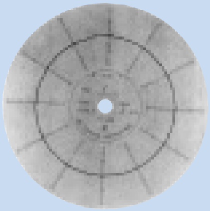
Model AL has an adequately firm and yet extremely compact shape because of highly balanced design. Together with use of an A-1 alloy, the compact design has achieved weight saving. Thus, this model is optimal for use in the stabilizer connecting rod and the transmission control of automobiles.

●Achieves Sphericity of 0.001 mm

The spherical surface of the shank ball is transferred on the inner surface of the holder while maintaining the sphericity of the bearing steel ball. This allows smooth motion to be achieved with a minimum clearance and provides favorable operability and feel to the link motion.

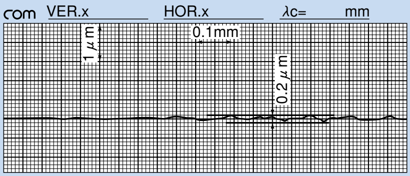


Cut sample of the spherical area of model BL



Sphericity: 0.001 mm

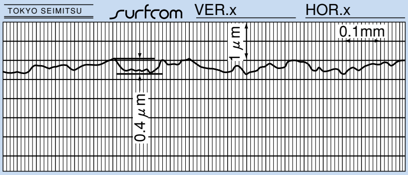
Sphericity of the spherical surface of the ball shank



Roughness of the spherical surface of the ball shank

●Two Types of Holder Material

Model AL uses the newly developed high-strength aluminum alloy "A-1 Alloy" (see page t-7), which is light and highly resistant to wear. Models BL, RBL and RBI use the proven, high-strength zinc alloy (see page t-8).



Roughness of the spherical surface of the holder

●High Lubricity

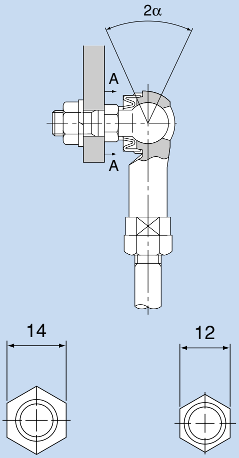
Since models AL and BL and those models attached with boots contain grease, they have high lubricity and increased wear resistance.

●Large Hexagonal Bolt Seat

The hexagonal bolt seat of the shank has the same dimensions as the seating surface for small hexagon head bolts in accordance with automotive specifications. This prevents the seating surface from sinking and ensures a stable link motion mechanism.

●Lightweight, High Strength

Use of the A-1 Alloy enables the Link Ball to achieve mechanical strength approximately twice that of the commonly used aluminum die cast material ADC 12, or almost equal to the high-strength zinc alloy, while maintaining aluminum alloys' advantages: lightweight and corrosion resistance.



Model AL10 Model equivalent to
Model BL10 similar product
A-A cross section

Jaw Span for Wrenching

●Equipped with a Boot for Protection against Muddy Water

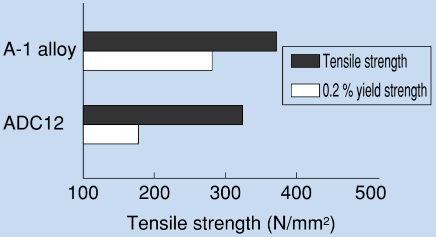
Use of a boot with high trackability in the ball shank prevents muddy water from entering the spherical area even in a muddy atmosphere. Accordingly, those types equipped with boots are used also in outdoor applications and automobile parts under the chassis.

Types and Features

●High-strength Aluminum Alloy

"A-1 Alloy," a high-strength aluminum alloy newly developed for the Link Ball, has yield strength approximately twice that of the commonly used aluminum die cast material ADC 12, and its strength and wear resistance are equivalent to the high-strength zinc alloy.

With its specific gravity less than that of the high-strength zinc alloy, model AL is optimal as an automotive part that requires light-weight, high strength, high corrosion resistance and high wear resistance.



Tensile Strength and Yield Strength of THK A-1 Alloy and ADC 12

Model AL

The holder is connected in perpendicular to the shank, which comprises a male thread specially welded with a highly accurate steel ball.

With a grease pocket formed on the top and bottom of the spherical area, this model achieves high lubricity and high wear-resistance.

Use of the A-1 alloy in the holder significantly reduces the weight.

●High-strength Zinc Alloy Series

Model RBL

The holder made of the high-strength zinc alloy is connected in perpendicular to the shank, which is incorporated with a ball.

Since grease in contained in the boot, this model achieves high lubricity and high wear-resistance.

Model BL

A compact type of model RBL, this model's holder made of the high-strength zinc alloy is connected in perpendicular to the shank, which is incorporated with a ball.

With a grease pocket formed on the top and bottom of the spherical area, this model achieves high lubricity and high wear-resistance.

Model RBI

With this Link Ball model, the high-strength zinc alloy is used in its holder and the mounting bolt and the holder are arranged on the same axis, allowing this model to receive both a compressive load and a pulling load.

Since grease in contained in the boot, this model achieves high lubricity and high wear-resistance.

Model TBS

The rolled thread on the circumference of the outer ring allows this model to easily be mounted on the housing. Simply by tightening the screw, the user can achieve play-free, firm installation.

Since the covering area of sphere is large, the model is capable of receiving a large axial load.

High-strength Aluminum Alloy "A-1 Alloy"

"A-1 Alloy," a newly developed high-strength aluminum alloy, is an alloy with Aℓ-Zn-Si3 being the main components, is used in the holder of model AL.

●Features of the A-1 Alloy

- ●Achieves one of the highest strengths among the existing aluminum die cast alloys.
- ●Has yield strength approximately twice that of the commonly used aluminum die cast alloy (ADC 12)
- ●Has hardness equal to the high-strength zinc alloy and achieves high wear resistance.
- ●Achieves specific gravity less than a half of the high-strength zinc alloy to allow significant weight saving.
- ●Highly resistant to corrosion and can be used as an automotive part related to wheel control.

●Mechanical Properties

Tensile strength:	343 to 392 N/mm^2
Tensile yield strength (0.2%):	245 to 294 N/mm^2
Compressive strength:	490 to 637 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Charpy impact strength:	0.098 to 0.196 $N\text{-}m/mm^2$
Elongation:	2 to 3 %
Hardness:	140 to 160 HV

●Physical Properties

Specific gravity:	3
Melting point:	570 ℃
Specific heat:	793 J/(kg·k)
Linear expansion ratio:	22×10^{-6}

●Wear Resistance

The result of our test has proven that the wear resistance of the A-1 alloy is equivalent to the high-strength zinc alloy.

Rotation-and-rocking comparative durability test between model AL10D (A-1 alloy) and model BL10D (high-strength zinc alloy)

Test conditions	Ambient temperature	Normal temperature	
	Applied load	±1.9kN (perpendicular to axis) (note)	
	Loading frequency	0.6Hz	
	Kinematic angle	Rotation ±20°	Rocking ±20°
	No. of cycles	40 cycles per min.	40 cycles per min.
	Total No. of cycles	1,000,000 cycles	
Test result: change in clearance (mm)		AL10D (A-1 alloy)	BL10D (high-strength zinc alloy)
	Perpendicular to axis	0.036	0.033
	Axial direction	0.052	0.045

Note: For the load direction, see page t-9.

High-strength Zinc Alloy

The high-strength zinc alloy used in the holders of models BL, RBL, RBI and TBS has been developed as a bearing alloy by mixing Aℓ, Cu, Mg, Be and Ti as well as zinc as the base component. It is excellent in mechanical properties, seizure resistance and wear resistance.

●Composition

Table 1 Composition of the High-strength Zinc Alloy

Unit: %

Aℓ	3 to 4
Cu	3 to 4
Mg	0.03 to 0.06
Be	0.02 to 0.06
Ti	0.04 to 0.12
Zn	Remaining portion

●Mechanical Properties

Tensile strength:	275 to 314 N/mm^2
Tensile yield strength (0.2%):	216 to 245 N/mm^2
Compressive strength:	539 to 686 N/mm^2
Compressive yield strength (0.2%):	294 to 343 N/mm^2
Fatigue strength	132 N/mm^2×10^7 (Schenk bending test)
Charpy impact strength:	0.098 to 0.49 N-m/mm^2
Elongation:	1 to 5 %
Hardness:	120 to 145 HV

●Physical Properties

Specific gravity:	6.8
Melting point:	390 ℃
Specific heat:	460 J/(kg·k)
Linear expansion ratio:	24×10^{-6}

●Wear Resistance

The wear resistance of the high-strength zinc alloy is superior to that of class-3 brass and class-3 bronze, almost equal to that of class-2 phosphor bronze.

Amsler wear-tester:	
Test piece rotation speed:	185 min^{-1}
Load:	392 N
Lubricant:	Dynamo oil

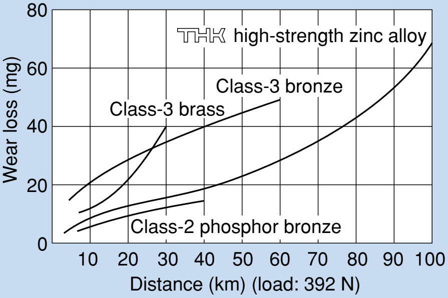


Fig. 2 Wear Resistance of the High-strength Zinc Alloy

Safety Design

●Permissible Tilt Angle

The permissible tilt angles of Link Ball models are indicated in the corresponding dimensional tables.

Note: If the permissible tilt angle is exceeded, it may cause serious damage to the holder or the boot. Be sure to use the Link Ball within its permissible tilt angle.

●Service Temperature

If the Link Ball is to be used at temperature of 80℃ or higher, or receives an impact at low temperature, it is necessary to consider the safety factor of the holder. Contact THK in advance. For details, see the data on durability tests conducted in high and low temperatures (page T-16 of the "THK General Catalog - Technical Descriptions of the Products," provided separately).

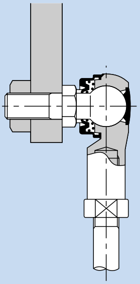
In an actual application, the Link Ball has been used as a ball joint for transmission control of a truck at service temperature between -40℃ and +140℃.

●How Load Directions Are Called

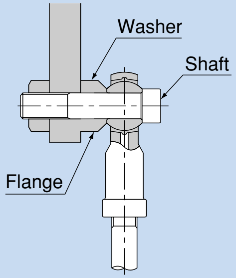
Regardless of the shape, the direction of the load applied to the Link Ball is called "axial direction" if it is parallel to the axis of the ball shank, and "perpendicular-to-axis direction" if it is perpendicular to the axis.

Examples of Installation

●Comparison of THK Link Ball and the Conventional Rod End



THK model BL

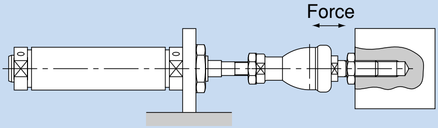


Conventional Rod End model PHS

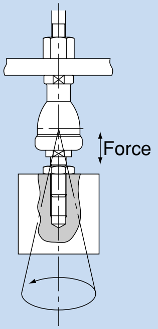
- ●Sine it has a shaft, model BL can easily be installed (especially useful for rod assembly).
- ●Because of the improved shape of the boot lip, the spherical area is protected from muddy water even in a muddy atmosphere.
- ●Since it contains grease, it can be used without further lubrication (superb in lubricity).
- ●Unlike the conventional type, which has a clearance between the shaft and the inner circumference of the ring and cannot be fixed completely, model BL has minimum distortion and high rigidity since the shank is integrated with the ball.

●Examples of Installing Model RBI

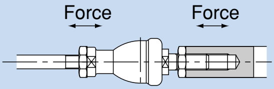
Joint for cylinder end metal fitting



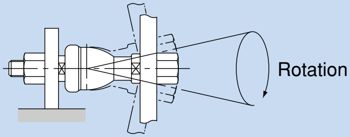
Suspending a light object



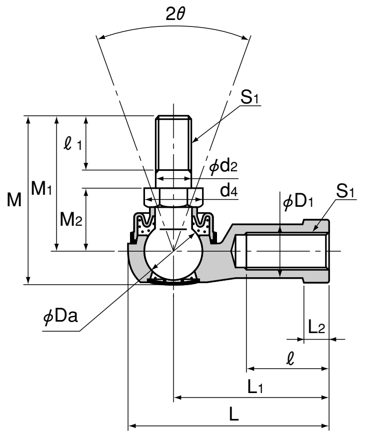
Connecting a rod in the axial direction

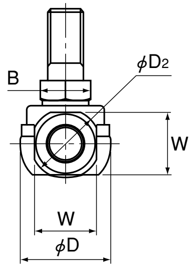


Rotation support



Model AL





Unit: mm

Model No.	Outer dimensions Length L	Diameter D	Height M	Thread S1 JIS Class 2	Holder dimensions L1	ℓ	L2	D1	D2	W 0 −0.3	Ball shank dimensions d2 h9	M1	M2 ±0.3	ℓ1	Hexagon B 0 −0.3	d4	Ball diameter Da	Permissible tilt angle 2θ°	Applied static load Cs N	Yield point strength Pk N	Mass g
AL 4D	24.5	13	20	M4×0.7	18	8	4	7.5	9.5	8	4	15	7	6	7	8.1	7.938	40	4510	1370	7
AL 5D	34.5	15	26.7	M5×0.8	27	15	4	9	12	10	5	21	10	8	8	9.2	9.525	40	6470	2250	12
AL 6D	38.5	17	32.6	M6×1	30	16	5	10	13	11	6	26	11	11	10	11.6	11.112	40	9900	3920	18
AL 8D	46	20	38.6	M8×1.25	36	19	6	13	16	14	8	31	14	12	12	13.8	12.7	40	12500	6570	32
AL 10D	56	26	46.3	M10×1.25	43	23	7	15.5	19	17	10	37	17	15	14	16.2	15.875	40	18300	11300	65
AL 10BD	56	26	52.3	M10×1.5	43	23	7	15.5	19	17	10	43	17	21	14	16.2	15.875	40	18300	11300	68

■Material

Holder: A-1 alloy (see page t-7)

Ball shank: Bearing steel ball
Hardness: 650 Hv or higher
Shank S35C (20 to 28 HRC)
Color chromate finish

Boot: NBR-based special synthetic rubber

■Spherical Clearance

Perpendicular to axis: 0.02 mm to 0.06 mm
Axial direction: 0.3 mm or less

■Tolerance of the Mating Hole of the Ball Shank

H10 is recommended.

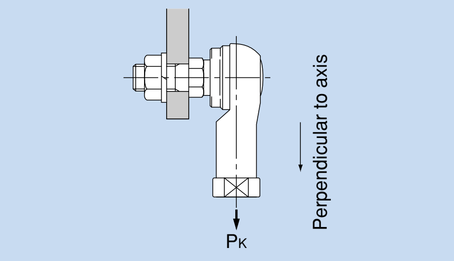
Model number coding

AL6 D L
1 2 3

1 Model number 2 With boot attached 3 Left-hand thread

■Yield Point Strength

It indicates the strength in the direction shown in the figure below.



■Lubrication

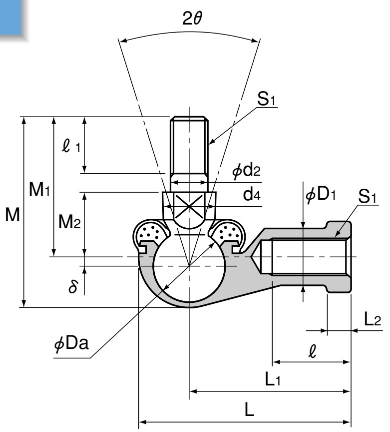
Lithium soap group grease No. 2 is contained in the boot and the cap.

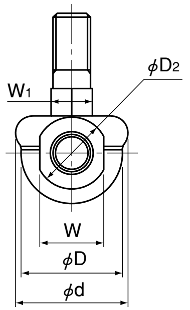
■Identification of Left-hand Thread

If the female thread is left-hand, its identification depends on the cap color and marking.

Thread	Identification Cap color	Cap marking
Right-hand	White	–
Left-hand	Yellow	"L" mark

Model RBL





Unit: mm

Model No.	Outer dimensions			Thread	Holder dimensions						Ball shank dimensions						Boot	Eccentricity	Ball diameter	Permissible tilt angle	Applied static load	Yield point strength	Mass
	Length L	Diameter D	Height M	S_1 JIS Class 2	L_1	L_2	ℓ	D_1	D_2	W $^{0}_{-0.3}$	d_2 h9	M_1	M_2 ±0.3	$ℓ_1$	W_1 $^{0}_{-0.3}$	d_4	d	δ	Da	2θ°	C_s N	P_K N	g
RBL 5D	35	16	29	M5×0.8	27	4	14	9	11	9	5	21	10	8	7	9	19	1	11.112	45	9220	2250	24
RBL 6D	40	19	35.5	M6×1	30	5	14	10	13	11	6	26	11	11	8	10	20	1.2	12.7	45	12100	3530	37
RBL 8D	48	23	42.5	M8×1.25	36	5	17	12.5	16	14	8	31	14	12	10	12	24	2	15.875	45	19100	6570	67
RBL 10D	57	27	50.5	M10×1.25	43	6.5	21	15	19	17	10	37	17	15	11	14	30	2.5	19.05	45	27500	10700	110
RBL 10BD	57	27	56.5	M10×1.5	43	6.5	21	15	19	17	10	43	17	21	11	14	30	2.5	19.05	45	27500	10700	113
RBL 12D	66	31	57.5	M12×1.25	50	6.5	25	17.5	22	19	12	42	19	17	17	19	32	2	22.225	45	37500	16400	165
RBL 12BD	66	31	64.5	M12×1.75	50	6.5	25	17.5	22	19	12	49	19	24	17	19	32	2	22.225	45	37500	16400	170
RBL 14D	75	35	73.5	M14×1.5	57	8	26	20	25	22	14	56	21.5	22	17	19	38	2	25.4	45	48900	19800	255
RBL 14BD	75	35	79.5	M14×2	57	8	26	20	25	22	14	62	21.5	28	17	19	38	2	25.4	45	48900	19800	260
RBL 16D	84	39	79.5	M16×1.5	64	8	32	22	27	22	16	60	23.5	23	19	22	44	2	25.4	35	48900	26900	335
RBL 16BD	84	39	85.5	M16×2	64	8	32	22	27	22	16	66	23.5	29	19	22	44	2	25.4	35	48900	26900	340
RBL 18D	93	44	90	M18×1.5	71	10	34	25	31	27	18	68	26.5	25	20	23	48	4.5	28.575	35	61900	33300	465
RBL 20D	99	44	90	M20×1.5	77	10	35	27.5	34	30	20	68	27	25	24	29	50	2	28.575	35	61900	45900	540
RBL 22D	109	50	95	M22×1.5	84	12	41	30	37	32	22	70	28	26	24	27	54	5	31.75	27	75400	48000	715

Note The fine letters in the model numbers represent semi-standard types. We recommend using model BL on page t-16.

Note The permissible tilt angle of types without boot are greater by approximately 5°.

■Material

Holder: High-strength zinc alloy (see page t-8)

Ball shank: Bearing steel ball

Hardness: 650 Hv or higher

Shank S35C (color chromate finish)

Boot: NBR-based special synthetic rubber

■Spherical Clearance

Perpendicular to axis: 0.02 mm to 0.06 mm

Axial direction: 0.3 mm or less

Model number coding

RBL10 D L

1 2 3

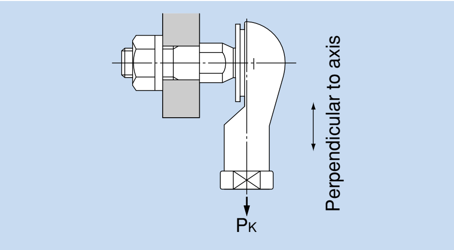
1Model number 2With boot attached 3Left-hand thread

■Tolerance of the Mating Hole of the Ball Shank

H10 is recommended.

■Yield Point Strength

It indicates the strength in the direction shown in the figure below.



■Lubrication

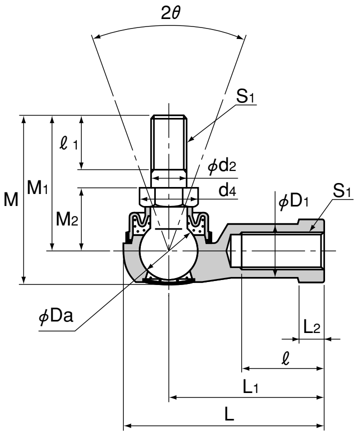
Lithium soap group grease No. 2 is contained in the boot.

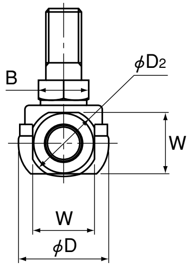
■Identification of Left-hand Thread

If the female thread is left-hand, symbol "L" is added.

The actual product is marked with symbol "L" on the wrench jaw area of the holder.

Model BL





Unit: mm

Model No.	Outer dimensions			Thread	Holder dimensions						Ball shank dimensions						Ball diameter	Permissible tilt angle	Applied static load	Yield point strength	Mass
	Length L	Diameter D	Height M	S_1 JIS Class 2	L_1	ℓ	L_2	D_1	D_2	W $^{0}_{-0.3}$	d_2 h9	M_1	M_2 ±0.3	ℓ_1	Hexagon B $^{0}_{-0.3}$	d_4	Da	$2\theta°$	C_S N	P_K N	g
BL 6D	38	16	32.6	M6×1	30	16	5	10	13	11	6	26	11	11	10	11.6	11.112	40	9900	3920	26
BL 8D	45.5	19	38.6	M8×1.25	36	19	6	12.5	16	14	8	31	14	12	12	13.8	12.7	40	12500	6570	49
BL 10D	55.5	25	46.3	M10×1.25	43	23	7	14.5	19	17	10	37	17	15	14	16.2	15.875	40	18300	11300	87
BL 10BD	55.5	25	52.3	M10×1.5	43	23	7	14.5	19	17	10	43	17	21	14	16.2	15.875	40	18300	11300	90
BL 12D	64.5	29	52.7	M12×1.25	50	26	8	17.5	22	19	12	42	19	17	17	19.6	19.05	40	26700	16400	143
BL 12BD	64.5	29	59.7	M12×1.75	50	26	8	17.5	22	19	12	49	19	24	17	19.6	19.05	40	26700	16400	148
BL 14D	74	34	68.4	M14×1.5	57	30	10	20	25	22	14	56	21.5	22	19	21.9	22.225	40	36400	19800	235
BL 14BD	74	34	74.4	M14×2	57	30	10	20	25	22	14	62	21.5	28	19	21.9	22.225	40	36400	19800	245
BL 16D	83	38	74	M16×1.5	64	34	11	22	27	24	16	60	23.5	23	22	25.4	22.225	30	36400	26900	315
BL 16BD	83	38	80	M16×2	64	34	11	22	27	24	16	66	23.5	29	22	25.4	22.225	30	36400	26900	325

■Material

Holder: High-strength zinc alloy (see page t-8)

Ball shank: Bearing steel ball

Hardness: 650 Hv or higher

Shank S35C (20 to 28 HRC)

Color chromate finish

Boot: NBR-based special synthetic rubber

■Spherical Clearance

Perpendicular to axis: 0.02 mm to 0.06 mm

Axial direction: 0.3 mm or less

Model number coding

BL6 D L

1 2 3

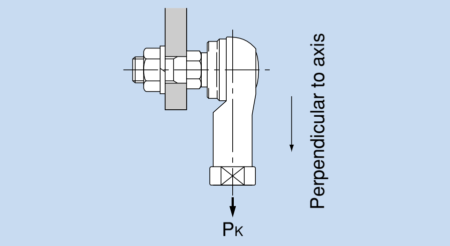
1 Model number 2 With boot attached 3 Left-hand thread

■Tolerance of the Mating Hole of the Ball Shank

H10 is recommended.

■Yield Point Strength

It indicates the strength in the direction shown in the figure below.



■Lubrication

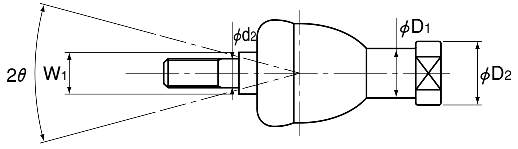
Lithium soap group grease No. 2 is contained in the boot and the cap.

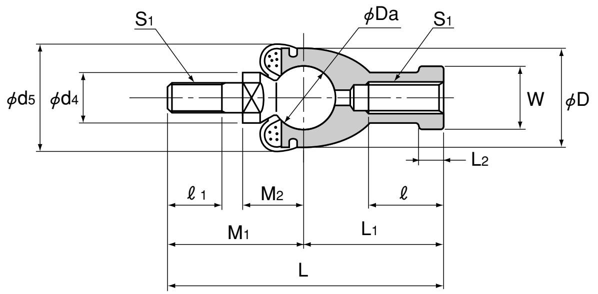
■Identification of Left-hand Thread

If the female thread is left-hand, its identification depends on the cap color and marking.

Thread	Identification	
	Cap color	Cap marking
Right-hand	White	–
Left-hand	Yellow	"L" marking

Model RBI





Unit: mm

Model No.	Outer dimensions		Thread	Holder dimensions						Shaft diameter	Ball shank dimensions					Boot	Ball diameter	Permissible tilt angle	Applied static load		Yield point strength	Mass
	Length L	Diameter D	S_1 JIS Class 2	L_1	L_2	ℓ	D_1	D_2	W $^{0}_{-0.3}$	d_2 h9	M_1	M_2 ±0.3	$ℓ_1$	W_1 $^{0}_{-0.3}$	d_4	d_5	Da	2θ°	Tensile C_S N	Compressive C_S N	P_K N	g
RBI 5D	46	17	M5×0.8	24	4	12	9	11	9	5	22	11	8	7	9	20	11.112	25	5690	11400	2840	25
RBI 6D	55.2	20	M6×1	28	5	15	10	13	11	6	27.2	12.2	11	8	10	20	12.7	25	7450	14900	3730	40
RBI 8D	65	24	M8×1.25	32	5	16	12.5	16	14	8	33	16	12	10	12	24	15.875	25	11700	23200	5880	75
RBI 10D	74.5	28	M10×1.25	35	6.5	18	15	19	17	10	39.5	19.5	15	11	14	30	19.05	25	16800	33500	8430	120
RBI 10BD	80.5	28	M10×1.5	35	6.5	18	15	19	17	10	45.5	19.5	21	11	14	30	19.05	25	16800	33500	8430	123
RBI 12D	84	32	M12×1.25	40	6.5	20	17.5	22	19	12	44	21	17	17	19	32	22.225	25	22800	45600	11400	185
RBI 12BD	91	32	M12×1.75	40	6.5	20	17.5	22	19	12	51	21	24	17	19	32	22.225	25	22800	45600	11400	190
RBI 14D	103	36	M14×1.5	45	8	25	20	25	22	14	58	23.5	22	17	19	38	25.4	17	29800	59600	14900	275
RBI 14BD	109	36	M14×2	45	8	25	20	25	22	14	64	23.5	28	17	19	38	25.4	17	29800	59600	14900	280
RBI 16D	112	40	M16×1.5	50	8	27	22	27	22	16	62	25.5	23	19	22	44	25.4	17	29800	59600	14900	360
RBI 16BD	118	40	M16×2	50	8	27	22	27	22	16	68	25.5	29	19	22	44	25.4	17	29800	59600	14900	370
RBI 18D	130.5	45	M18×1.5	58	10	32	25	31	27	18	72.5	31	25	20	23	45	28.575	17	37700	75400	18900	535
RBI 20D	133	45	M20×1.5	63	10	38	27.5	34	30	20	70	29	25	24	29	50	28.575	10	37700	75400	18900	570
RBI 22D	145	50	M22×1.5	70	12	43	30	37	32	22	75	33	26	24	27	52	31.75	10	46600	93100	23500	755

Note The permissible tilt angle of types without boot are greater by approximately 5°.

■Material

Holder: High-strength zinc alloy (see page t-8)

Ball shank: Bearing steel ball

Hardness: 650 Hv or higher

Shank S35C (color chromate finish)

Boot: NBR-based special synthetic rubber

■Spherical Clearance

Perpendicular to axis: 0.03 mm or less

Axial direction: 0.1 mm or less

■Tolerance of the Mating Hole of the Ball Shank

H10 is recommended.

Model number coding

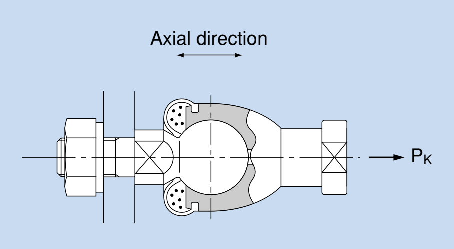
RBI10 D L

1 2 3

1 Model number 2 With boot attached 3 Left-hand thread

■Yield Point Strength

It indicates the strength in the direction shown in the figure below.



■Lubrication

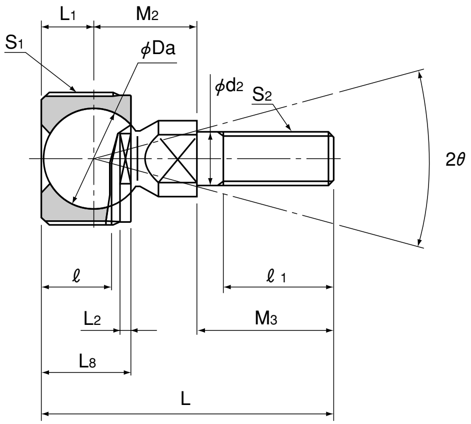
Lithium soap group grease No. 2 is contained in the boot.

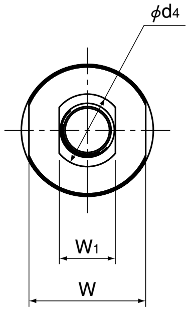
■Identification of Left-hand Thread

If the female thread is left-hand, symbol "L' is added.

The actual product is marked with symbol "L" on the holder.

Model TBS





Unit: mm

Model No.	Outer dimensions		Holder dimensions					Shaft diameter		Ball shank dimensions					Ball diameter	Permissible tilt angle	Applied static load			Yield point strength	Mass
	Thread S₁ JIS Class 2	Length L	L₈	ℓ	L₁	L₂	W 0 −0.3	d₂ h9	Thread S₂ JIS Class 2	d₄	M₂	M₃	ℓ₁	W₁ 0 −0.3	Da	2θ°	Perpendicular to axis Cs N	Axial direction CSa (Tensile) N	Axial direction CSa (Compressive) N	PK N	g
TBS 6	M20×1.5	34.2	11.5	8	7	2	17	6	M6×1	10	12.2	15	11	8	12.7	30	13700	4900	12000	2450	30
TBS 8	M22×1.5	41.5	14.5	11	8.5	2	19	8	M8×1.25	12	16	17	12	10	15.875	30	24600	10400	17600	5200	50
TBS 10	M25×1.5	55.5	17	13.5	10	2	22	10	M10×1.5	14	19.5	26	21	11	19.05	30	32700	14400	25000	7250	80
TBS 12	M30×1.5	63	20	15.5	12	3	27	12	M12×1.75	19	21	30	24	17	22.225	30	44000	18300	35000	9220	130

■Material

Holder:	High-strength zinc alloy (see page t-8)
Ball shank:	Bearing steel ball
	Hardness: 650 Hv or higher
	Shank S35C (color chromate finish)

■Spherical Clearance

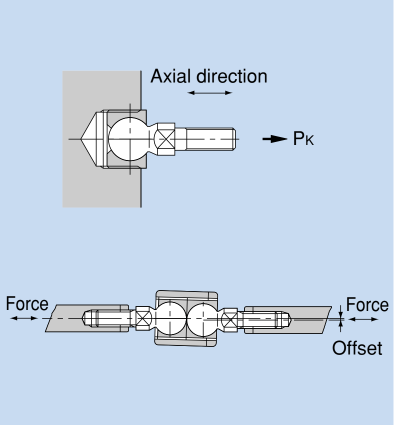
Perpendicular to axis: 0.03 or less
Axial direction: 0.1 mm or less

■Female Thread for Attaching the Outer Ring

JIS Class 2 thread

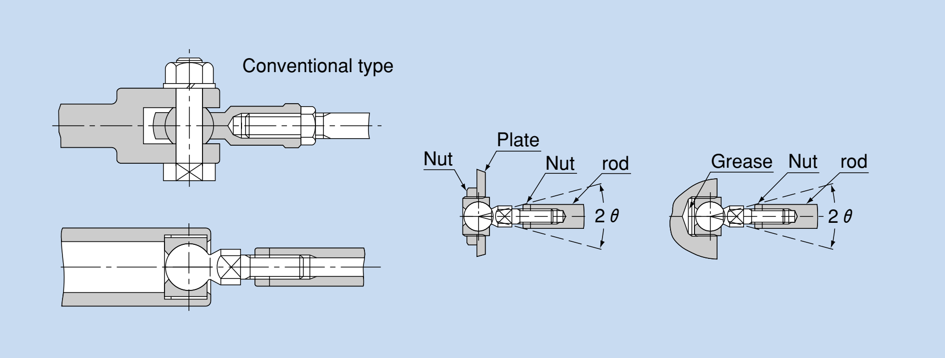
■Yield Point Strength

It indicates the strength in the direction shown in the figure below.



■Example of Installation

As shown in the figure below, compared with the conventional installation using a frog-shaped joint, model TBS can be installed more compactly and more easily.



■Lubrication

Since the holder has an oil pocket, it allows grease to be replenished as necessary.

Rated Load and Service Life of a Linear Motion System

1. Rated Load and Service Life

When selecting a specific linear motion (LM) system, you must first consider and determine its load capacity and service life.

To determine the rated load, use the basic static load rating to obtain the static safety factor.

To determine the service life, use the basic dynamic load rating to calculate the rated life. And then, judge if these values meet the required conditions.

The service life of an LM system refers to the total distance traveled until flaking occurs (scale-like exfoliation of the metal surface) due to rolling fatigue of the material as a result of repeated stress acting on the raceway or the rolling element.

2. Basic Load Rating

An LM system has two types of basic load ratings: basic static load rating (C_0), which defines the permissible static limit, and basic dynamic load rating (C), which is used to calculate the service life.

3. Basic Static Load Rating C_0

If an LM system receives an excessively large load or a large impact when it is stationary or operative, permanent deformation occurs between the raceway and the rolling element. If the permanent deformation exceeds a certain limit, it will prevent the LM system from performing smooth motion.

The basic static load rating refers to the static load with constant direction and magnitude, under which the sum of the permanent deformation of the rolling element and the permanent deformation of the raceway accounts for 0.0001 times of the rolling element's diameter in the contact area where the maximum stress is applied. With an LM system, the basic static load rating is defined for the radial load.

Therefore, the basic static load rating is considered the limit of the permissible static load.

4. Permissible Static Moment M_0

When an LM system receives a moment, the rolling elements on both ends receive the maximum stress due to uneven distribution of the stress on the rolling elements within the LM system.

The permissible static moment (M_0) means the moment with constant direction and magnitude, under which the sum of the permanent deformation of the rolling element and the permanent deformation of the raceway accounts for 0.0001 times of the rolling element's diameter in the contact area where the maximum stress is applied.

With an LM system, the permissible static moment is defined in three directions: M_A, M_B and M_C. Thus, the permissible static moment is considered the limit of the static moment applied.

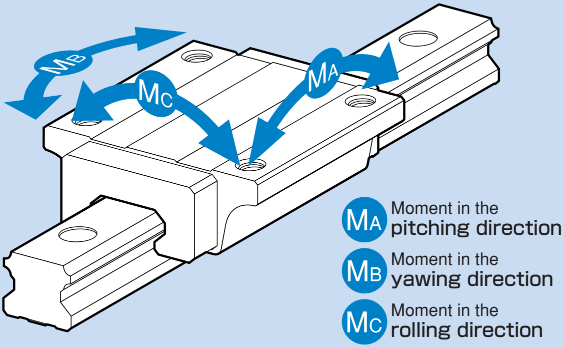


Fig. 1 Directions of Moment

5. Static Safety Factor f_s

When an LM system is stationary or operative, unexpected external force may be applied through inertia caused by vibrations, impact or start/stop. To cope with such an applied load, it is necessary to consider and determine the static safety factor.
The static safety factor (f_s) is determined by the ratio of the load capacity (basic static load rating) of an LM system to the load applied on the LM system.

$$f_s = \frac{C_0}{P} \quad \text{or} \quad f_s = \frac{M_0}{M} \quad \cdots\cdots\cdots\cdots(1)$$

where

f_s:	Static safety factor	
C_0:	Basic static load rating	(N)
M_0:	Permissible static moment	(N-mm)
P:	Calculated load	(N)
M:	Calculated moment	(N-mm)

6. Basic Dynamic Load Rating C

The basic dynamic load rating (C) indicates the load with constant direction and magnitude, under which the rated life (L) is L = 50 km for an LM system using balls, or L = 100 km for an LM system using rollers, when a group of identical LM system units independently operating under the same conditions.

The basic dynamic load rating (C) is used to calculate the service life when an LM system operates under a load.

7. Rated Life

The service life of an LM system is subject to slight variations even under the same operational conditions. Therefore, it is necessary to use the rated life defined below as a reference value for obtaining the service life of the LM system.

The rated life means the total travel distance that 90% of a group of units of the same LM system model can achieve without flaking (scale-like exfoliation on the metal surface) after individually running under the same conditions.

The rated life (L) of an LM system is obtained from the following equation using the basic dynamic load rating (C) and the applied load (P).

7.1. LM System Using Balls

$$L = \left(\frac{C}{P}\right)^3 \times 50 \quad \cdots\cdots(2)$$

where

L:	Rated life	(km)
C:	Basic dynamic load rating	(N)
P:	Applied load	(N)

7.2. LM System Using Rollers

$$L = \left(\frac{C}{P}\right)^{\frac{10}{3}} \times 100 \quad \cdots\cdots\cdots (3)$$

where

L:	Rated life	(km)
C:	Basic dynamic load rating	(N)
P:	Applied load	(N)

8. Radial Clearance

The radial clearance of an LM Guide indicates the travel distance in the radial direction in the middle of the LM block when the LM rail is fixed and the LM block is lightly moved up and down in the middle of the LM rail in the longitudinal direction.

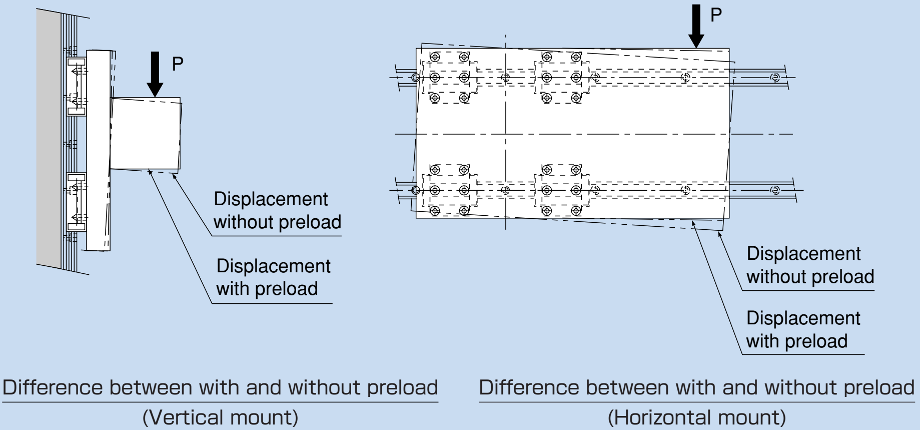
The radial clearance is classified into normal clearance and negative clearances C1 (light preload) and C0 (medium preload). They can be selected according to the application and their values are standardized for each type.

Since the radial clearance of an LM Guide significantly affects the running parallelism, load carrying capacity and rigidity, it is particularly important to select an appropriate clearance according to the application. In general, selection of a negative clearance while taking into account possible vibrations and/or impact caused by reciprocating motion will favorably affect the service life and the accuracy.

9. Preload

Preload is an internal load applied to the rolling element in advance in order to increase the rigidity of the LM block or eliminate a clearance. The clearance symbols C1 and C0 for LM Guides indicate negative clearance as a result of applying a preload, and are expressed in negative values.

All LM Guide models (excluding separable types models HR and GSR) are shipped with their clearances adjusted at designated values. Therefore, it is unnecessary to adjust their preloads.



Difference between with and without preload (Vertical mount)

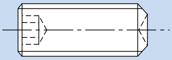
Difference between with and without preload (Horizontal mount)

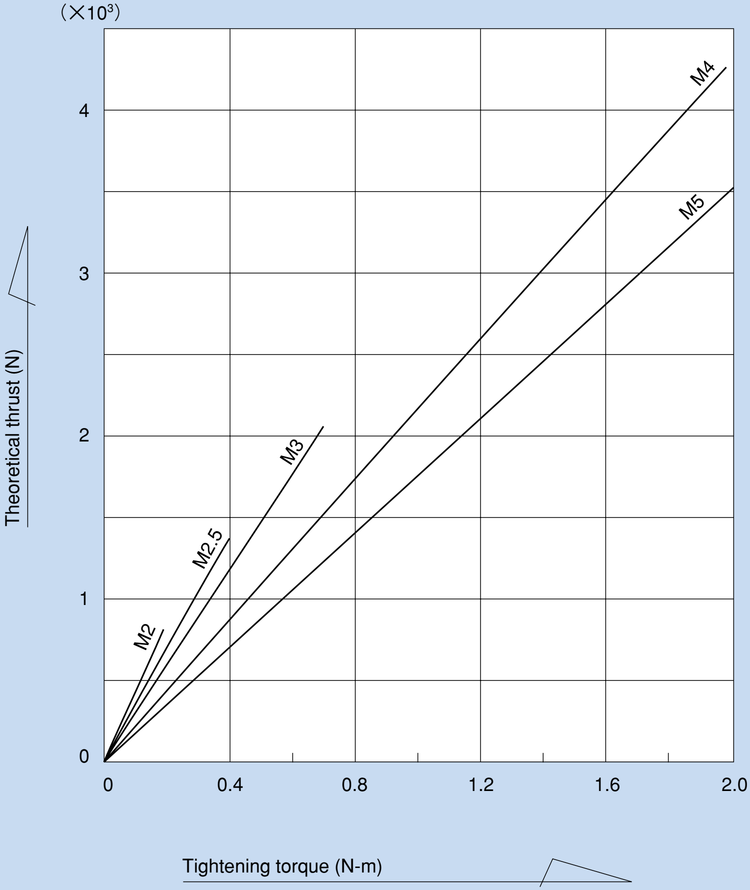
Fig. 2 Preload and Displacement

Appendix Tables

Tightening Torques and Theoretical Thrusts for Hexagon Socket Setscrews

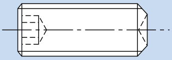
● M2 to M5, Cut-point

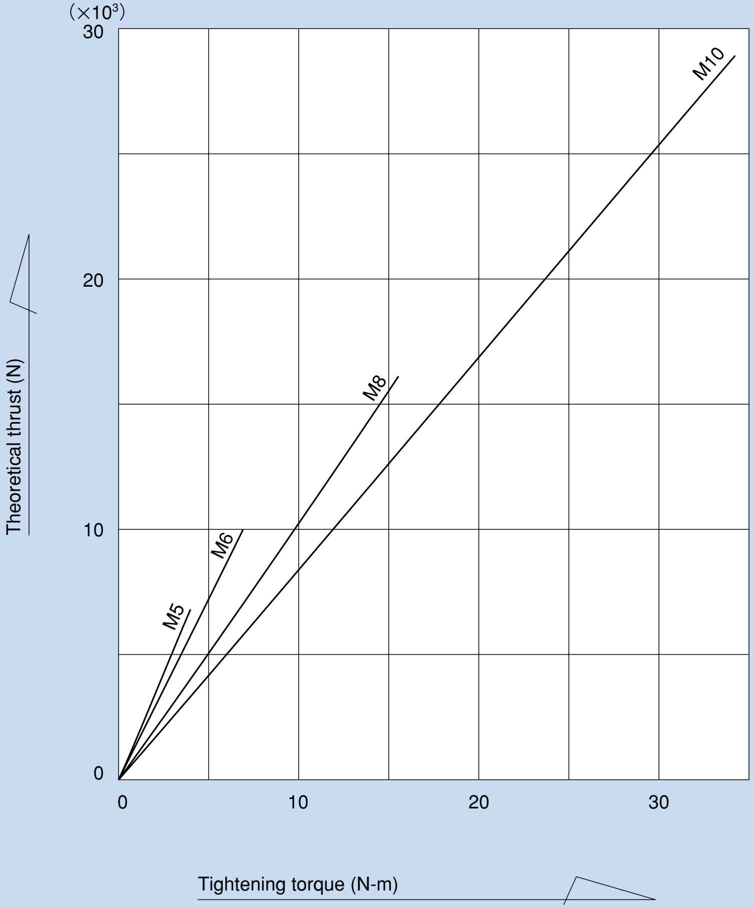




Note: The theoretical thrust may differ depending on the lubrication and the conditions of the surfaces of the setscrew or the reference surface ($\mu = 0.13$).

● M5 to M10, Cut-point





Note: The theoretical thrust may differ depending on the lubrication and the conditions of the surfaces of the setscrew or the reference surface ($\mu = 0.13$).

Dimensional Tolerances of Shafts

Unit: μm=0.001mm

Dimension classification (mm)		e	f		g		h						js			j		k			m		n		p		Dimension classification (mm)	
Above	Or less	e6	f5	f6	g5	g6	h5	h6	h7	h8	h9	h10	js5	js6	js7	j5	j6	k5	k6	k7	m5	m6	n5	n6	p5	p6	Above	Or less
3	6	– 20 – 28	– 10 – 15	– 10 – 18	– 4 – 9	– 4 – 12	0 – 5	0 – 8	0 – 12	0 – 18	0 – 30	0 – 48	± 2.5	± 4	± 6	+ 3 – 2	+ 6 – 2	+ 6 + 1	+ 9 + 1	+ 13 + 1	+ 9 + 4	+ 12 + 4	+ 13 + 8	+ 16 + 8	+ 17 + 12	+ 20 + 12	3	6
6	10	– 25 – 34	– 13 – 19	– 13 – 22	– 5 – 11	– 5 – 14	0 – 6	0 – 9	0 – 15	0 – 22	0 – 36	0 – 58	± 3	± 4.5	± 7.5	+ 4 – 2	+ 7 – 2	+ 7 + 1	+ 10 + 1	+ 16 + 1	+ 12 + 6	+ 15 + 6	+ 16 + 10	+ 19 + 10	+ 21 + 15	+ 24 + 15	6	10
10	14	– 32 – 43	– 16 – 24	– 16 – 27	– 6 – 14	– 6 – 17	0 – 8	0 – 11	0 – 18	0 – 27	0 – 43	0 – 70	± 4	± 5.5	± 9	+ 5 – 3	+ 8 – 3	+ 9 + 1	+ 12 + 1	+ 19 + 1	+ 15 + 7	+ 18 + 7	+ 20 + 12	+ 23 + 12	+ 26 + 18	+ 29 + 18	10	14
14	18																										14	18
18	24	– 40 – 53	– 20 – 29	– 20 – 33	– 7 – 16	– 7 – 20	0 – 9	0 – 13	0 – 21	0 – 33	0 – 52	0 – 84	± 4.5	± 6.5	±10.5	+ 5 – 4	+ 9 – 4	+ 11 + 2	+ 15 + 2	+ 23 + 2	+ 17 + 8	+ 21 + 8	+ 24 + 15	+ 28 + 15	+ 31 + 22	+ 35 + 22	18	24
24	30																										24	30
30	40	– 50 – 66	– 25 – 36	– 25 – 41	– 9 – 20	– 9 – 25	0 – 11	0 – 16	0 – 25	0 – 39	0 – 62	0 –100	± 5.5	± 8	±12.5	+ 6 – 5	+ 11 – 5	+ 13 + 2	+ 18 + 2	+ 27 + 2	+ 20 + 9	+ 25 + 9	+ 28 + 17	+ 33 + 17	+ 37 + 26	+ 42 + 26	30	40
40	50																										40	50
50	65	– 60 – 79	– 30 – 43	– 30 – 49	– 10 – 23	– 10 – 29	0 – 13	0 – 19	0 – 30	0 – 46	0 – 74	0 –120	± 6.5	± 9.5	±15	+ 6 – 7	+ 12 – 7	+ 15 + 2	+ 21 + 2	+ 32 + 2	+ 24 + 11	+ 30 + 11	+ 33 + 20	+ 39 + 20	+ 45 + 32	+ 51 + 32	50	65
65	80																										65	80
80	100	– 72 – 94	– 36 – 51	– 36 – 58	– 12 – 27	– 12 – 34	0 – 15	0 – 22	0 – 35	0 – 54	0 – 87	0 –140	± 7.5	±11	±17.5	+ 6 – 9	+ 13 – 9	+ 18 + 3	+ 25 + 3	+ 38 + 3	+ 28 + 13	+ 35 + 13	+ 38 + 23	+ 45 + 23	+ 52 + 37	+ 59 + 37	80	100
100	120																										100	120
120	140	– 85 –110	– 43 – 61	– 43 – 68	– 14 – 32	– 14 – 39	0 – 18	0 – 25	0 – 40	0 – 63	0 –100	0 –160	± 9	±12.5	±20	+ 7 – 11	+ 14 – 11	+ 21 + 3	+ 28 + 3	+ 43 + 3	+ 33 + 15	+ 40 + 15	+ 45 + 27	+ 52 + 27	+ 61 + 43	+ 68 + 43	120	140
140	160																										140	160
160	180																										160	180
180	200	–100 –129	– 50 – 70	– 50 – 79	– 15 – 35	– 15 – 44	0 – 20	0 – 29	0 – 46	0 – 72	0 –115	0 –185	±10	±14.5	±23	+ 7 – 13	+ 16 – 13	+ 24 + 4	+ 33 + 4	+ 50 + 4	+ 37 + 17	+ 46 + 17	+ 51 + 31	+ 60 + 31	+ 70 + 50	+ 79 + 50	180	200
200	225																										200	225
225	250																										225	250
250	280	–110 –142	– 56 – 79	– 56 – 88	– 17 – 40	– 17 – 49	0 – 23	0 – 32	0 – 52	0 – 81	0 –130	0 –210	±11.5	±16	±26	+ 7 – 16	+ 16 – 16	+ 27 + 4	+ 36 + 4	+ 56 + 4	+ 43 + 20	+ 52 + 20	+ 57 + 34	+ 66 + 34	+ 79 + 56	+ 88 + 56	250	280
280	315																										280	315
315	355	–125 –161	– 62 – 87	– 62 – 98	– 18 – 43	– 18 – 54	0 – 25	0 – 36	0 – 57	0 – 89	0 –140	0 –230	±12.5	±18	±28.5	+ 7 – 18	+ 18 – 18	+ 29 + 4	+ 40 + 4	+ 61 + 4	+ 46 + 21	+ 57 + 21	+ 62 + 37	+ 73 + 37	+ 87 + 62	+ 98 + 62	315	355
355	400																										355	400
400	450	–135 –175	– 68 – 95	– 68 –108	– 20 – 47	– 20 – 60	0 – 27	0 – 40	0 – 63	0 – 97	0 –155	0 –250	±13.5	±20	±31.5	+ 7 – 20	+ 20 – 20	+ 32 + 5	+ 45 + 5	+ 68 + 5	+ 50 + 23	+ 63 + 23	+ 67 + 40	+ 80 + 40	+ 95 + 68	+108 + 68	400	450
450	500																										450	500
500	560	–145 –189	– 76 –106	– 76 –120	– 22 – 52	– 22 – 66	0 – 30	0 – 44	0 – 70	0 –110	0 –175	0 –280	±15	±22	±35	—	—	+ 30 0	+ 44 0	+ 70 0	+ 56 + 26	+ 70 + 26	+ 74 + 44	+ 88 + 44	+108 + 78	+122 + 78	500	560
560	630																										560	630
630	710	–160 –210	– 80 –115	– 80 –130	– 24 – 59	– 24 – 74	0 – 35	0 – 50	0 – 80	0 –125	0 –200	0 –320	±17.5	±25	±40	—	—	+ 35 0	+ 50 0	+ 80 0	+ 65 + 30	+ 80 + 30	+ 85 + 50	+100 + 50	+123 + 88	+138 + 88	630	710
710	800																										710	800
800	900	–170 –226	– 86 –126	– 86 –142	– 26 – 66	– 26 – 82	0 – 40	0 – 56	0 – 90	0 –140	0 –230	0 –360	±20	±28	±45	—	—	+ 40 0	+ 56 0	+ 90 0	+ 74 + 34	+ 90 + 34	+ 96 + 56	+112 + 56	+140 +100	+156 +100	800	900
900	1000																										900	1000
1000	1120	–195 –261	– 98 –144	– 98 –164	– 28 – 74	– 28 – 94	0 – 46	0 – 66	0 –105	0 –165	0 –260	0 –420	±23	±33	±52.5	—	—	+ 46 0	+ 66 0	+105 0	+ 86 + 40	+106 + 40	+112 + 66	+132 + 66	+166 +120	+186 +120	1000	1120
1120	1250																										1120	1250
1250	1400	–220 –298	–110 –164	–110 –188	– 30 – 84	– 30 –108	0 – 54	0 – 78	0 –125	0 –195	0 –310	0 –500	±27	±39	±62.5	—	—	+ 54 0	+ 78 0	+125 0	+102 + 48	+126 + 48	+132 + 78	+156 + 78	+194 +140	+218 +140	1250	1400
1400	1600																										1400	1600

Dimensional Tolerances of Housing Holes

Unit: μm=0.001mm

Dimension classification (mm)		E		F			G		H							Js		J		K		M		N		P		Dimension classification (mm)	
Above	Or less	E6	E7	F6	F7	F8	G6	G7	H5	H6	H7	H8	H9	H10	Js6	Js7	J6	J7	K6	K7	M6	M7	N6	N7	P6	P7	Above	Or less
3	6	+28 +20	+32 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+5 0	+8 0	+12 0	+18 0	+30 0	+48 0	±4	±6	+5 −3	+6 −6	+2 −6	+3 −9	−1 −9	0 −12	−5 −13	−4 −16	−9 −17	−8 −20	3	6
6	10	+34 +25	+40 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+6 0	+9 0	+15 0	+22 0	+36 0	+58 0	±4.5	±7.5	+5 −4	+8 −7	+2 −7	+5 −10	−3 −12	0 −15	−7 −16	−4 −19	−12 −21	−9 −24	6	10
10	14	+43 +32	+50 +32	+27 +16	+34 +16	+48 +16	+17 +6	+24 +6	+8 0	+11 0	+18 0	+27 0	+43 0	+70 0	±5.5	±9	+6 −5	+10 −8	+2 −9	+6 −12	−4 −15	0 −18	−9 −20	−5 −23	−15 −26	−11 −29	10	14
14	18																										14	18
18	24	+53 +40	+61 +40	+33 +20	+41 +20	+53 +20	+20 +7	+28 +7	+9 0	+13 0	+21 0	+33 0	+52 0	+84 0	±6.5	±10.5	+8 −5	+12 −9	+2 −11	+6 −15	−4 −17	0 −21	−11 −24	−7 −28	−18 −31	−14 −35	18	24
24	30																										24	30
30	40	+66 +50	+75 +50	+41 +25	+50 +25	+64 +25	+25 +9	+34 +9	+11 0	+16 0	+25 0	+39 0	+62 0	+100 0	±8	±12.5	+10 −6	+14 −11	+3 −13	+7 −18	−4 −20	0 −25	−12 −28	−8 −33	−21 −37	−17 −42	30	40
40	50																										40	50
50	65	+79 +60	+90 +60	+49 +30	+60 +30	+76 +30	+29 +10	+40 +10	+13 0	+19 0	+30 0	+46 0	+74 0	+120 0	±9.5	±15	+13 −6	+18 −12	+4 −15	+9 −21	−5 −24	0 −30	−14 −33	−9 −39	−26 −45	−21 −51	50	65
65	80																										65	80
80	100	+94 +72	+107 +72	+58 +36	+71 +36	+90 +36	+34 +12	+47 +12	+15 0	+22 0	+35 0	+54 0	+87 0	+140 0	±11	±17.5	+16 −6	+22 −13	+4 −18	+10 −25	−6 −28	0 −35	−16 −38	−10 −45	−30 −52	−24 −59	80	100
100	120																										100	120
120	140	+110 +85	+125 +85	+68 +43	+83 +43	+106 +43	+39 +14	+54 +14	+18 0	+25 0	+40 0	+63 0	+100 0	+160 0	±12.5	±20	+18 −7	+26 −14	+4 −21	+12 −28	−8 −33	0 −40	−20 −45	−12 −52	−36 −61	−28 −68	120	140
140	160																										140	160
160	180																										160	180
180	200	+129 +100	+146 +100	+79 +50	+96 +50	+122 +50	+44 +15	+61 +15	+20 0	+29 0	+46 0	+72 0	+115 0	+185 0	±14.5	±23	+22 −7	+30 −16	+5 −24	+13 −33	−8 −37	0 −46	−22 −51	−14 −60	−41 −70	−33 −79	180	200
200	225																										200	225
225	250																										225	250
250	280	+142 +110	+162 +110	+88 +56	+108 +56	+137 +56	+49 +17	+69 +17	+23 0	+32 0	+52 0	+81 0	+130 0	+210 0	±16	±26	+25 −7	+36 −16	+5 −27	+16 −36	−9 −41	0 −52	−25 −57	−14 −66	−47 −79	−36 −88	250	280
280	315																										280	315
315	355	+161 +125	+182 +125	+98 +62	+119 +62	+151 +62	+54 +18	+75 +18	+25 0	+36 0	+57 0	+89 0	+140 0	+230 0	±18	±28.5	+29 −7	+39 −18	+7 −29	+17 −40	−10 −46	0 −57	−26 −62	−16 −73	−51 −87	−41 −98	315	355
355	400																										355	400
400	450	+175 +135	+198 +135	+108 +68	+131 +68	+165 +68	+60 +20	+83 +20	+27 0	+40 0	+63 0	+97 0	+155 0	+250 0	±20	±31.5	+33 −7	+43 −20	+8 −32	+18 −45	−10 −50	0 −63	−27 −67	−17 −80	−55 −95	−45 −108	400	450
450	500																										450	500
500	560	+189 +145	+215 +145	+120 +76	+146 +76	+186 +76	+66 +22	+92 +22	+30 0	+44 0	+70 0	+110 0	+175 0	+280 0	±22	±35	—	—	—	—	−26 −70	−26 −96	−44 −88	−44 −114	−78 −122	−78 −148	500	560
560	630																										560	630
630	710	+210 +160	+240 +160	+130 +80	+160 +80	+205 +80	+74 +24	+104 +24	+35 0	+50 0	+80 0	+125 0	+200 0	+320 0	±25	±40	—	—	—	—	−30 −80	−30 −110	−50 −100	−50 −130	−88 −138	−88 −168	630	710
710	800																										710	800
800	900	+226 +170	+260 +170	+142 +86	+176 +86	+226 +86	+82 +26	+116 +26	+40 0	+56 0	+90 0	+140 0	+230 0	+360 0	±28	±45	—	—	—	—	−34 −90	−34 −124	−56 −112	−56 −146	−100 −156	−100 −190	800	900
900	1000																										900	1000
1000	1120	+261 +195	+300 +195	+164 +98	+203 +98	+263 +98	+94 +28	+133 +28	+46 0	+66 0	+105 0	+165 0	+260 0	+420 0	±33	±52.5	—	—	—	—	−40 −106	−40 −145	−66 −132	−66 −171	−120 −186	−120 −225	1000	1120
1120	1250																										1120	1250
1250	1400	+298 +220	+345 +220	+188 +110	+235 +110	+305 +110	+108 +30	+155 +30	+54 0	+78 0	+125 0	+195 0	+310 0	+500 0	±39	±62.5	—	—	—	—	−48 −126	−48 −173	−78 −156	−78 −203	−140 −218	−140 −265	1250	1400
1400	1600																										1400	1600

SI Unit Conversion Table

●Conversion to SI Units

Amount	Name of unit	Symbol	Factor of conversion to SI	Name of SI unit	Symbol
Angle	Degree Minute Second	· · ·	$\pi/180$ $\pi/10800$ $\pi/648000$	Radian	rad
Length	Meter Angstrom X-ray unit Nautical mile	m Å n mile	 10^{-10} $\approx 1.00208\times10^{-13}$ 1852	Meter	m
Area	Square meter Are Hectare	m^2 a ha	1 10^2 10^4	Square meter	m^2
Volume	Cubic meter Liter	m^3 ℓ (L)	1 10^{-3}	Cubic meter	m^3
Mass	Kilogram Ton Atomic mass unit	kg t u	1 10^3 $\approx 1.66057\times10^{-27}$	Kilogram	kg
Time	Second Minute Hour Day	s min h d	1 60 3600 86400	Second	S
Speed	Meter per second Knot	m/s kn	1 1852/3600	Meter per second	m/s
Frequency	Cycle	s^{-1}	1	Hertz	Hz
Rotation speed	Revolution per minute	rpm	1	Per minute	min^{-1}
Angular speed	Radian per minute	rad/s	1	Radian per minute	rad/s
Acceleration	Meter per second per second G	m/s^2 G	1 9.80665	Meter per second per second	m/s^2
Force	Weight kilogram Weight ton Dyne	kgf tf dyn	9.80665 9806.65 10^{-5}	Newton	N
Moment of force	Weight kilogram meter	kgf-m	9.80665	Newton meter	N-m
Stress and pressure	Weight kilogram per square meter Weight kilogram per square centimeter Weight kilogram per square millimeter	kgf/m^2 kgf/cm^2 kgf/mm^2	9.80665 9.80665×10^4 9.80665×10^6	Pascal	Pa
Pressure	Water column meter Mercury column meter Torr Atmospheric pressure Bar	mH_2O mmHg Torr atm bar	9806.65 101325/760 101325/760 101325 10^5	Pascal	Pa
Energy	Erg IT calorie Weight kilogram meter Kilowatt hour French horsepower hour Electronic volt	erg cal_{IT} kgf-m kW-h PS-h eV	10^{-7} 4.1868 9.80665 3.600×10^6 $\approx 2.64779\times10^6$ $\approx 1.60219\times10^{-19}$	Joule	J
Power	Watt French horsepower Weight kilogram meter per second	W PS kgf-m/s	1 ≈735.5 9.80665	Watt	W

Amount	Name of unit	Symbol	Factor of conversion to SI	Name of SI unit	Symbol
Viscosity	Poise	P	10^{-1}	Pascal second	Pa-s
	Centipoise	cP	10^{-3}		
	Weight kilogram second per square meter	kgf-s/m^2	9.80665		
Kinematic viscosity	Stokes	St	10^{-1}	Square meter per second	m^2/s
	Centistokes	cSt	10^{-6}		
Temperature	Degree	℃	+273.15	Kelvin	K
Radioactivity	Currie	Ci	3.7×10^{10}	Becquerel	Bq
Exposure	Roentgen	R	2.58×10^{-4}	Coulomb per kilogram	C/kg
Absorbed dose	Rad	rad	10^{-2}	Gray	Gy
Dose equivalent	Rem	rem	10^{-2}	Sievert	Sv
Magnetic flux	Maxwell	Mx	10^{-8}	Weber	Wb
Magnetic flux density	Gamma	γ	10^{-9}	Tesla	T
	Gauss	Gs	10^{-4}		
Magnetic-field intensity	Oersted	Oe	$10^{3}/4\pi$	Ampere per meter	A/m
Quantity of electricity	Coulomb	C	1	Coulomb	C
Potential difference	Volt	V	1	Volt	V
Capacitance	Farad	F	1	Farad	F
(Electric) resistance	Ohm	Ω	1	Ohm	Ω
(Electric) conductance	Siemens	S	1	Siemens	S
Inductance	Henry	H	1	Henry	H
Electric current	Ampere	A	1	Ampere	A

●Comparative Table of SI, CGS System and Gravitational System Units

Amount / Unit system	Length L	Mass M	Time T		Acceleration	Force	Stress	Pressure	Energy
SI	m	kg	s		m/s^2	N	Pa	Pa	J
CGS system	cm	g	s		Gal	dyn	dyn/cm^2	dyn/cm^2	erg
Gravitational system	m	kgf-s^2/m	s		m/s^2	kgf	kgf/m^2	kgf/m^2	kgf-cm

Amount / Unit system	Power	Temperature	Viscosity	Kinematic viscosity	Magnetic flux	Magnetic flux density	Magnetic-field intensity
SI	W	K	Pa-s	m^2/s	Wb	T	A/m
CGS system	erg/s	℃	P	St	Mx	Gs	Oe
Gravitational system	kgf-m/s	℃	kgf-s/m^2	m^2/s	—	—	—

●Integer Multipliers of 10 of SI Units

Number of digits multiplied to unit	Prefix		Number of digits multiplied to unit	Prefix	
	Name	Symbol		Name	Symbol
10^{18}	Exa	E	10^{-1}	Deci	d
10^{15}	Peta	P	10^{-2}	Centi	c
10^{12}	Tera	T	10^{-3}	Milli	m
10^{9}	Giga	G	10^{-6}	Micro	μ
10^{6}	Mega	M	10^{-9}	Nano	n
10^{3}	Kilo	k	10^{-12}	Pico	p
10^{2}	Hecto	h	10^{-15}	Femto	f
10	Deca	da	10^{-18}	Atto	a

●Hardness Conversion Table

Rockwell C-scale hardness HRC (load: 1471 N)	Vickers harness HV	Brinell harness HB		Rockwell hardness		Shore harness HS
		Standard ball	Tungsten carbide ball	HRA A scale Load: 588.4 N Barle indenter	HRB B scale Load: 980.7 N Ball with diam .of 1/16 in.	
68	940	—	—	85.6	—	97
67	900	—	—	85.0	—	95
66	865	—	—	84.5	—	92
65	832	—	739	83.9	—	91
64	800	—	722	83.4	—	88
63	772	—	705	82.8	—	87
62	746	—	688	82.3	—	85
61	720	—	670	81.8	—	83
60	697	—	654	81.2	—	81
59	674	—	634	80.7	—	80
58	653	—	615	80.1	—	78
57	633	—	595	79.6	—	76
56	613	—	577	79.0	—	75
55	595	—	560	78.5	—	74
54	577	—	543	78.0	—	72
53	560	—	525	77.4	—	71
52	544	500	512	76.8	—	69
51	528	487	496	76.3	—	68
50	513	475	481	75.9	—	67
49	498	464	469	75.2	—	66
48	484	451	455	74.7	—	64
47	471	442	443	74.1	—	63
46	458	432	432	73.6	—	62
45	446	421	421	73.1	—	60
44	434	409	409	72.5	—	58
43	423	400	400	72.0	—	57
42	412	390	390	71.5	—	56
41	402	381	381	70.9	—	55
40	392	371	371	70.4	—	54
39	382	362	362	69.9	—	52
38	372	353	353	69.4	—	51
37	363	344	344	68.9	—	50
36	354	336	336	68.4	(109.0)	49
35	345	327	327	67.9	(108.5)	48
34	336	319	319	67.4	(108.0)	47
33	327	311	311	66.8	(107.5)	46
32	318	301	301	66.3	(107.0)	44
31	310	294	294	65.8	(106.0)	43
30	302	286	286	65.3	(105.5)	42
29	294	279	279	64.7	(104.5)	41
28	286	271	271	64.3	(104.0)	41
27	279	264	264	63.8	(103.0)	40
26	272	258	258	63.3	(102.5)	38
25	266	253	253	62.8	(101.5)	38
24	260	247	247	62.4	(101.0)	37
23	254	243	243	62.0	100.0	36
22	248	237	237	61.5	99.0	35
21	243	231	231	61.0	98.5	35
20	238	226	226	60.5	97.8	34
(18)	230	219	219	—	96.7	33
(16)	222	212	212	—	95.5	32
(14)	213	203	203	—	93.9	31
(12)	204	194	194	—	92.3	29
(10)	196	187	187	—	90.7	28
(8)	188	179	179	—	89.5	27
(6)	180	171	171	—	87.1	26
(4)	173	165	165	—	85.5	25
(2)	166	158	158	—	83.5	24
(0)	160	152	152	—	81.7	24