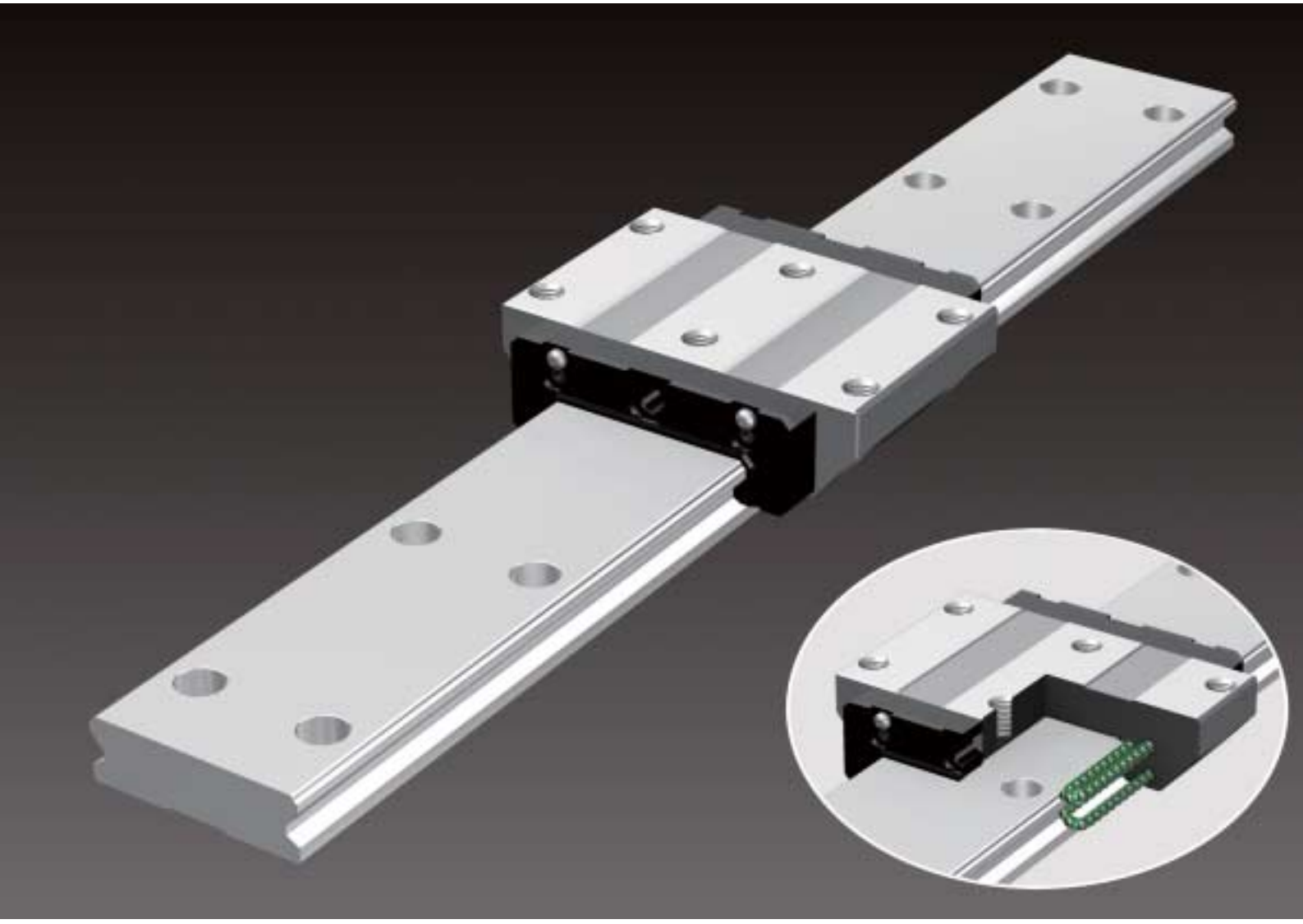
Caged Ball LM Guide

Ball Cage Effect
Wide, Low Center of Gravity Type

SHW



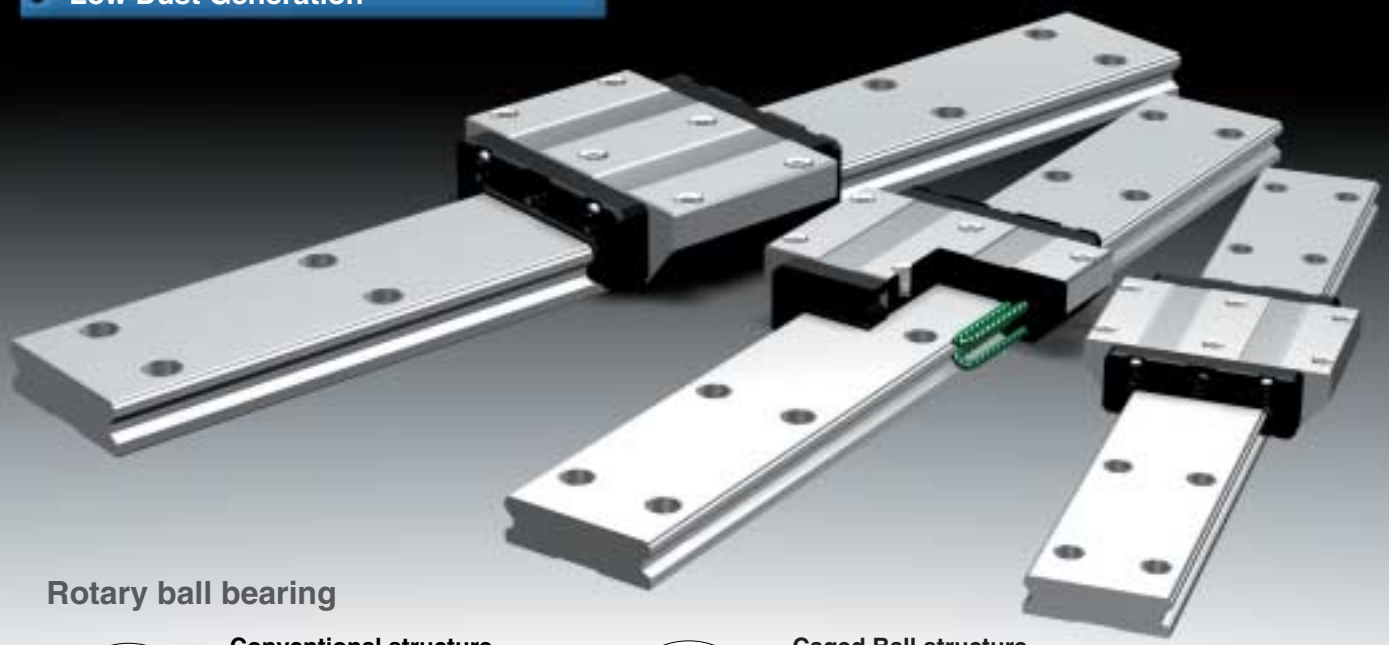
THK CO., LTD.
TOKYO. JAPAN

CATALOG No.248-5E

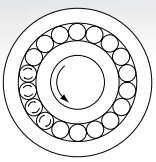
Ball Cage Effect

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 Caged Ball design was developed for ball bearings. The new design enabled high-speed rotation at a low noise level, and extended the service life despite the reduced number of balls used. It marked a major development in the history of ball bearings.
Similarly, the quality of needle bearings was significantly improved by the caged needle structure.
With cage-less, full-ball types of ball bearings, balls make metallic contact with one another and produce loud noise. In addition, they rotate in opposite directions, causing the sliding contact between two adjacent balls to occur at a speed twice the ball-spinning rate. It results in severe wear and shortens the service life.
In addition, without a cage, balls make point contact to increase bearing stress, thus facilitating breakage of the oil film. In contrast, each caged ball contacts 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.

- **Long Service Life and Long-term Maintenance-free Operation**
- **Superbly High Speed**
- **Low Noise, Acceptable Running Sound**
- **Smooth Motion**
- **Low Dust Generation**

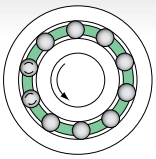


Rotary ball bearing



Conventional structure

- 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.

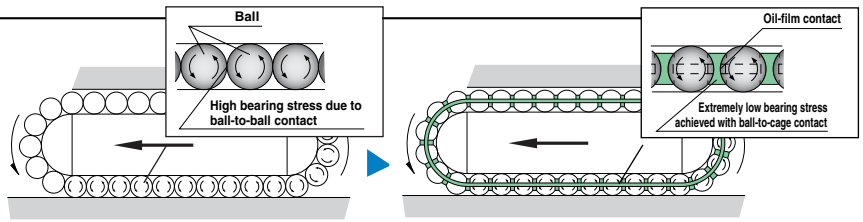


Caged Ball structure

- 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.
- The even spacing of the balls enables them to move smoothly.
- Retention of lubricant in the ball cage ensures a long service life.

Caged Ball LM Guide

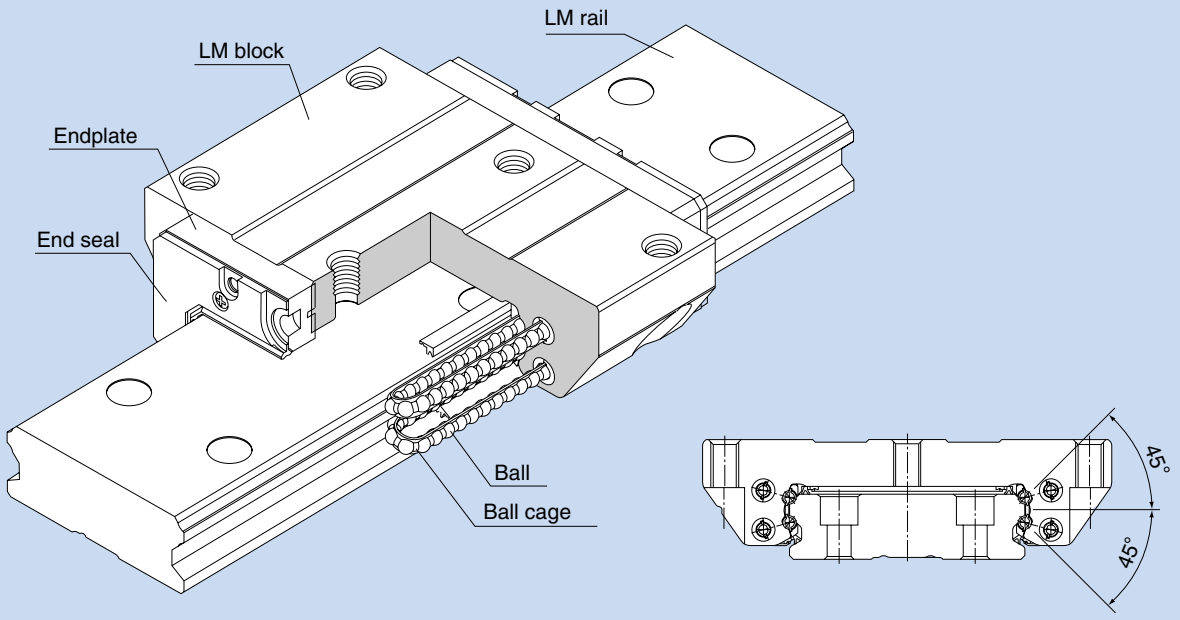
With the Caged Ball LM Guide, the use of a ball cage allows lines of evenly spaced balls to circulate, thus eliminating friction between the balls.
In addition, grease held in a space between the ball circulation path and the ball cage (grease pocket) is applied on the contact surface between each ball and the ball cage as the ball rotates, forming an oil film on the ball surface. This minimizes the risk of oil-film break.



Conventional structure **Caged Ball structure**

Wide, Low Center of Gravity Type Caged Ball LM Guide

SHW



Structure of Model SHW

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.
This model is 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 center of gravity

Model SHW, which has a wide LM rail and a low center of gravity, is optimal for locations requiring space saving and large Mc moment rigidity.

● 4-way equal load

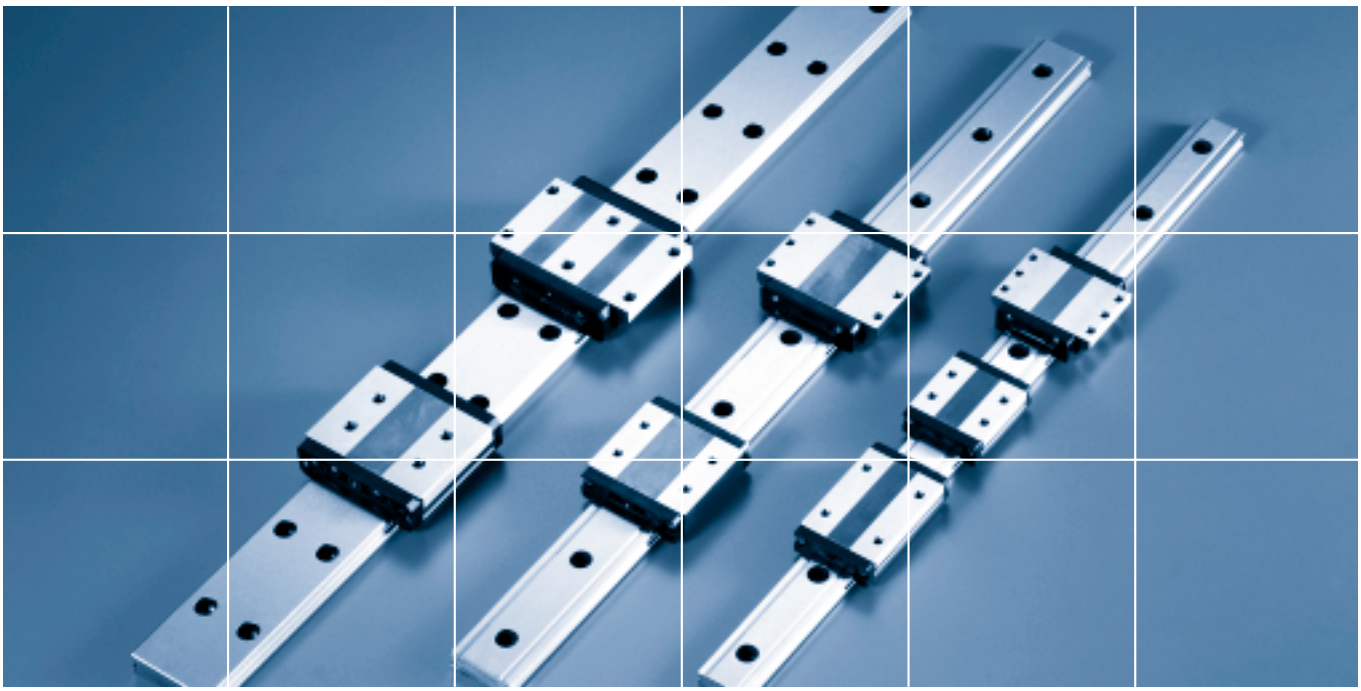
Each row of balls is placed at a contact angle of 45° so that the rated loads applied to the LM block are uniform in the four directions (radial, reverse-radial and lateral directions), enabling the LM Guide to be used in all orientations and in extensive applications.

● Self-adjustment capability

The self-adjustment capability through Face-to-Face configuration of THK's unique circular-arc grooves (DF set) enables a mounting error to be absorbed even under a preload, thus achieving highly accurate, smooth linear motion.

● Low dust generation

Use of ball cages eliminates friction between balls and retains lubricant, thus achieving low dust generation.



SHW Outline

Model SHW - Product Overview

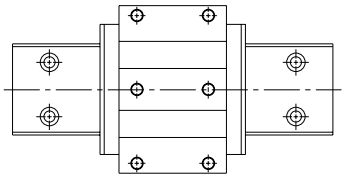
This model is capable of receiving a large moment with a single rail due to a 4-way equal-load, wide, low center of gravity structure. In addition, the geometrical moment of inertia of the LM rail is large and the lateral rigidity is high.

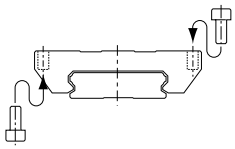
Major applications **Printed circuit board drilling machine / semiconductor manufacturing machine / electric discharge machine / insertion machine / optical stage**

Model SHW-CA

The flange of the LM block has tapped holes.
It can be mounted from the top or the bottom.

- SHW 12CAM
- SHW 14CAM
- SHW 17CAM
- SHW 21CA
- SHW 27CA
- SHW 35CA
- SHW 50CA

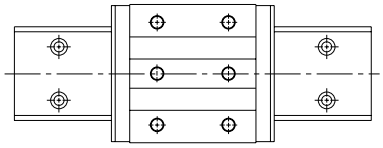


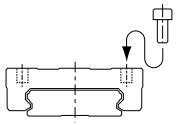


Model SHW-CR

The LM block has tapped holes.

- SHW 12CRM
- SHW 12HRM
- SHW 14CRM
- SHW 17CRM
- SHW 21CR
- SHW 27CR
- SHW 35CR
- SHW 50CR

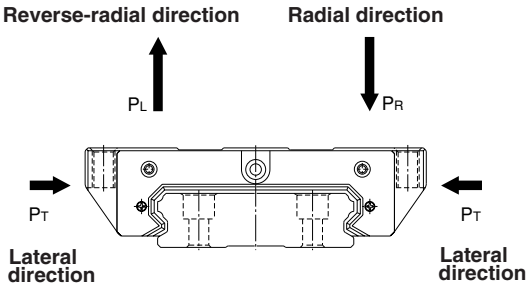




Rated Loads in All Directions

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*1 for SHW.



*1: Dimensional table for model SHW

Model SHW-CA
→ pages 9-10
Model SHW-CR/SHW-HR
→ pages 11-12

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 (N)
·Radial direction
·Reverse-radial direction
·Lateral direction

P_R : Radial load (N)
P_L : Reverse-radial load (N)
P_T : Lateral load (N)

*1: Basic dynamic load rating (C)

It refers to a load with a constant magnitude and direction under which the rated life (L) of a group of identical LM Guide units independently operating is 50 km.

Service 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.

Rated life

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.

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

L	: Rated life	(km)
C	: Basic dynamic load rating*1	(N)
P_C	: Calculated load	(N)
f_H	: Hardness factor	(see Fig. 1)
f_T	: Temperature factor	(see Fig. 2)
f_C	: Contact factor	(see Table 1)
f_W	: Load factor	(see Table 2)

Service life time

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

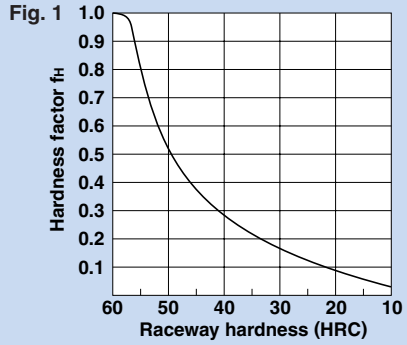
$$L_h = \frac{L \times 10^6}{2 \times \ell_s \times n_1 \times 60}$$

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.

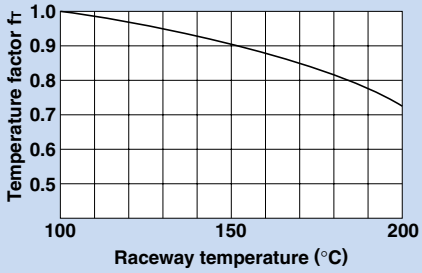
Fig. 1



f_T : Temperature factor

Since the service temperature of Caged Ball LM Guides is normally 80°C or below, the f_T value is 1.0.

Fig. 2



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 1.

Note: When uneven load distribution is expected in a large machine, consider using a contact factor from Table 1.

Table 1 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. 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 2, which contains empirically obtained data.

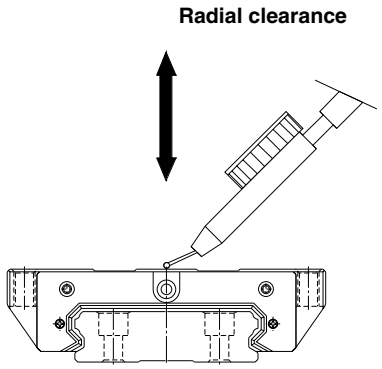
Table 2 Load Factor (f_W)

Vibration/impact	Speed (V)	f_W
Faint	Very slow V≦0.25m/s	1 to 1.2
Weak	Slow 0.25<V≦1m/s	1.2 to 1.5
Moderate	Medium 1<V≦2m/s	1.5 to 2
Strong	Fast V>2m/s	2 to 3.5

Radial Clearance Standard

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[*1] is applied) while taking into account possible vibrations and impact generated from reciprocating motion favorably affects the service life and the accuracy.



Unit: μm

Indication symbol / Model No.	Normal	Light preload	Moderate preload
	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	– 1 to +4	–18 to – 8	–28 to –18
50	–10 to +5	–24 to –10	–38 to –24

***1: Preload**

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.
The clearance of all model SHW units is adjusted to the designated value before being shipped. Therefore, it is unnecessary to adjust the preload.

***1: Running parallelism**

It refers to the 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.

***2: Difference in height M**

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

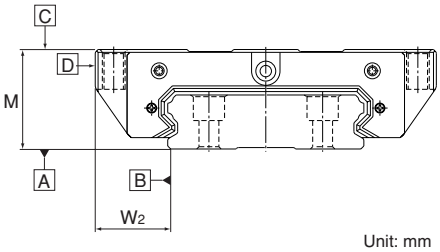
***3: Difference in width W_2**

It indicates the 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.

Accuracy Standard

The accuracy of model SHW is specified in terms of running parallelism (*1), dimensional tolerance for height and width, and height and width difference between a pair (*2, *3) when two or more LM blocks are used on one rail or when two or more rails are mounted on the same plane.

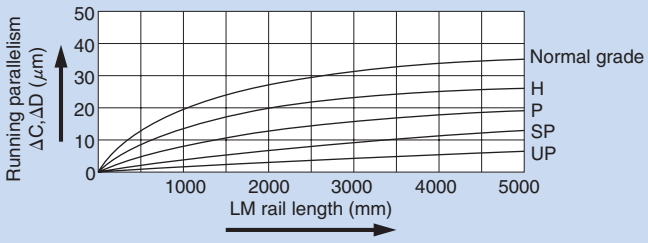
The accuracy of model SHW is categorized into Normal grade (no symbol), High-accuracy grade (H), Precision grade (P), Super-precision grade (SP) and Ultra-super-precision grade (UP) by model numbers,as indicated in the table below.



Unit: mm

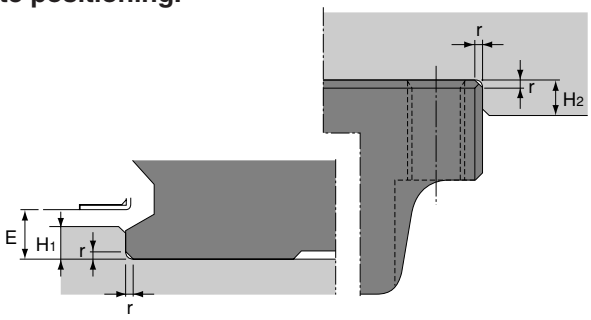
Model No.	Accuracy standard	Normal grade	High-accuracy grade	Precision grade	Super-precision grade	Ultra-super precision grade
	Item	No symbol	H	P	SP	UP
12 14	Dimensional tolerance for height M	± 0.08	± 0.04	± 0.02	± 0.01	—
	Difference in height M	0.015	0.007	0.005	0.003	—
	Dimensional tolerance for 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 C against surface A	ΔC (as shown in the figure below)				
	Running parallelism of surface D against surface B	ΔD (as shown in the figure below)				
17 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 C against surface A	ΔC (as shown in the figure below)				
	Running parallelism of surface D against surface B	ΔD (as shown in the figure below)				
27 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 C against surface A	ΔC (as shown in the figure below)				
	Running parallelism of surface D against surface B	ΔD (as shown in the figure below)				
50	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 C against surface A	ΔC (as shown in the figure below)				
	Running parallelism of surface D against surface B	ΔD (as shown in the figure below)				

LM Rail Length and Running Parallelism for Model SHW



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.



Shoulder for the LM rail **Shoulder for the LM block**

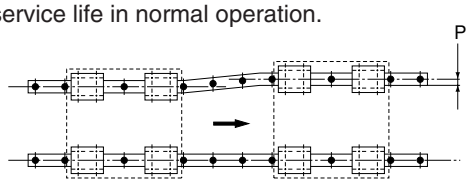
The corner of the mounting shoulder must be machined to have a recess, or machined to be smaller than the corner radius "r," to prevent interference with the chamfer of the LM rail or the LM block.

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

Error Allowance in the Parallelism Between Two Rails

The table shows error allowances in parallelism (P) between two rails that will not affect the service life in normal operation.

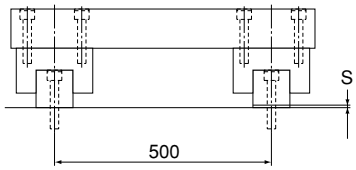


Unit: μm

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

Error Allowance in Vertical Level Between Two Rails

The values in the table indicate the error allowance in vertical level between two rails per 500 mm of the axis-to-axis distance, and are proportional to the axis-to-axis distance.

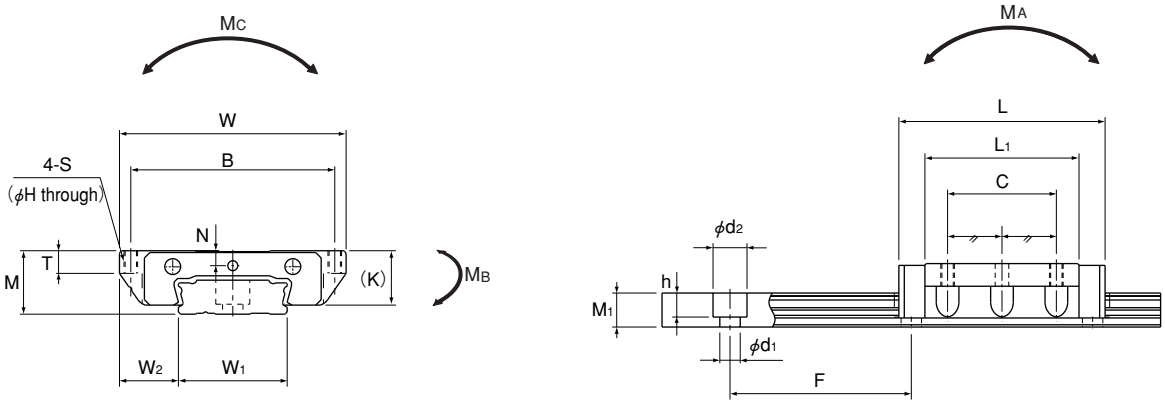


Unit: μm

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

Model SHW-CA

Dimensional Table for Model SHW-CA



Models SHW12CAM and SHW14CAM

Model No.	External dimensions			LM block dimensions							
	Height M	Width W	Length L	B	C	S	H	L_1	T	K	N
SHW 12CAM	12	40	37	35	18	M 3	2.5	27	4	10	2.8
SHW 14CAM	14	50	45.5	45	24	M 3	2.5	34	5	12	3.3
SHW 17CAM	17	60	51	53	26	M 4	3.3	38	6	14.5	4
SHW 21CA	21	68	59	60	29	M 5	4.4	43.6	8	17.7	5
SHW 27CA	27	80	72.8	70	40	M 6	5.3	56.6	10	23.5	6
SHW 35CA	35	120	107	107	60	M 8	6.8	83	14	31	7.6
SHW 50CA	50	162	141	144	80	M10	8.6	107	18	46	14

Note Since the LM block, LM rail, and balls are stainless steel, this model is highly resistant to corrosion and the environment.

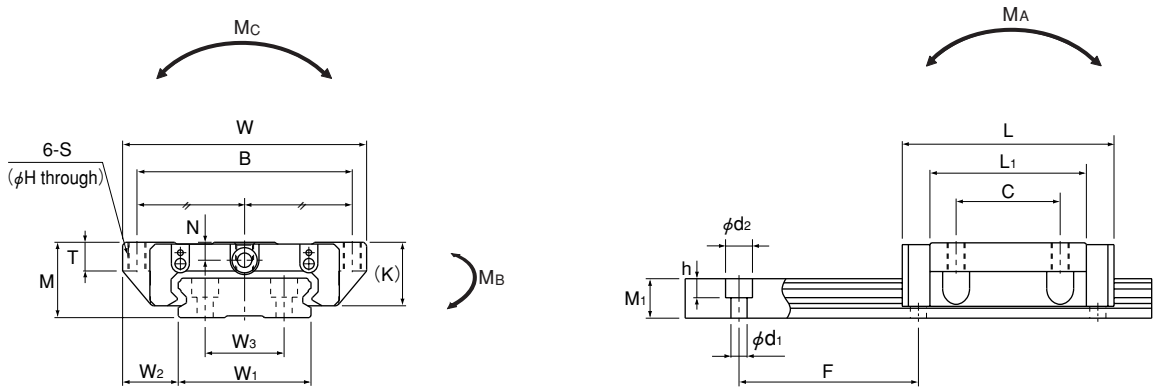
■ Example of model number coding

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 15) 6 Radial clearance symbol (see page 6) 7 LM block is made of stainless steel
8 LM rail length (in mm) 9 Accuracy symbol (see page 7) 10 LM rail is made of stainless steel 11 No. of rails used on the same plane

Note This model number indicates that an LM block and an LM rail constitute one set (i.e., the required number of sets when 2 rails are used in parallel is 2).
Those models equipped with QZ Lubricator cannot have a grease nipple.



Models SHW17CAM and SHW21 to 50CA

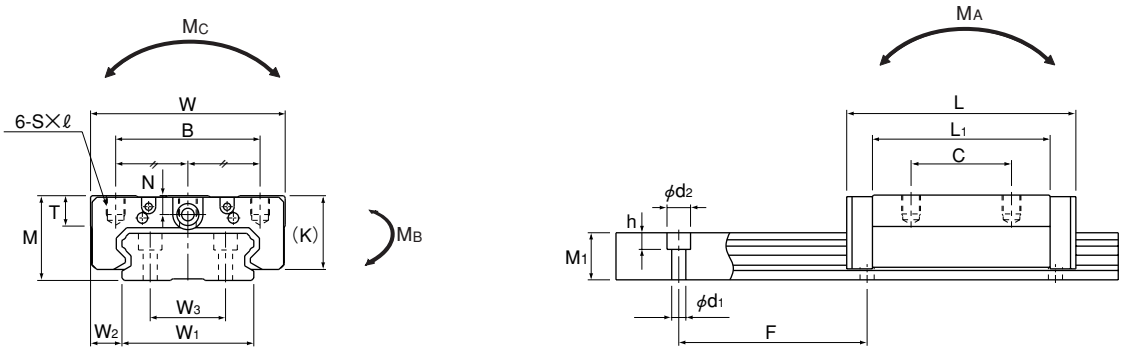
Unit: mm

	LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Width			Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	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
	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
	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
	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
	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
	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
	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
	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 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

Dimensional Table for Models SHW-CR/SHW-HR



Models SHW27 to 50CR

Model No.	External dimensions			LM block dimensions						
	Height M	Width W	Length L	B	C	S×ℓ	L1	T	K	N
SHW 12CRM	12	30	37	21	12	M3×3.5	27	4	10	2.8
SHW 12HRM	12	30	50.4	21	24	M3×3.5	40.4	4	10	2.8
SHW 14CRM	14	40	45.5	28	15	M3×4	34	5	12	3.3
SHW 17CRM	17	50	51	29	15	M4×5	38	6	14.5	4
SHW 21CR	21	54	59	31	19	M5×6	43.6	8	17.7	5
SHW 27CR	27	62	72.8	46	32	M6×6	56.6	10	23.5	6
SHW 35CR	35	100	107	76	50	M8×8	83	14	31	7.6
SHW 50CR	50	130	141	100	65	M10×15	107	18	46	14

Note Since the LM block, LM rail, and balls are stainless steel, this model is highly resistant to corrosion and the environment.

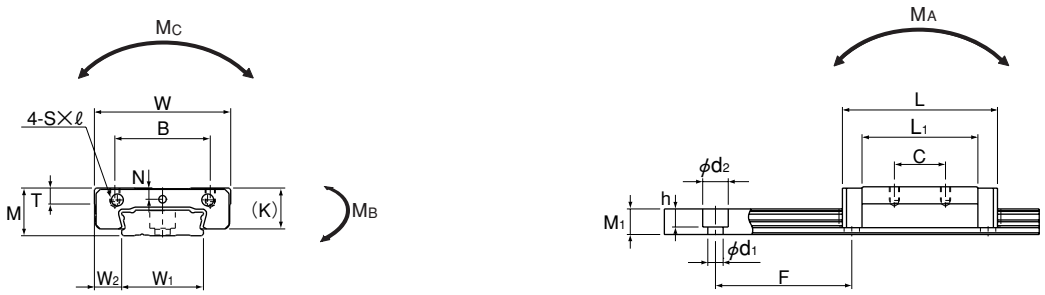
■ Example of model number coding

SHW27 CR 2 QZ KKHH C1 +820L P

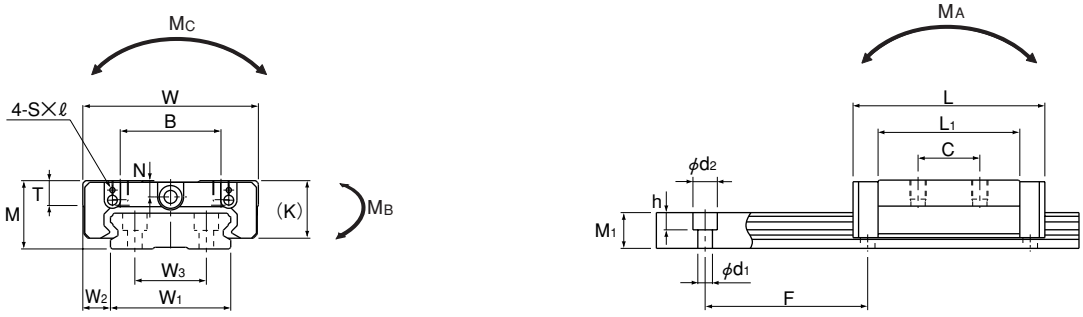
1 2 3 4 5 6 7 8

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 15) 6 Radial clearance symbol (see page 6) 7 LM rail length (in mm)
8 Accuracy symbol (see page 7)

Note Those models equipped with QZ Lubricator cannot have a grease nipple.



Models SHW12CRM, SHW12HRM and SHW14CRM



Models SHW17CRM and SHW21CR

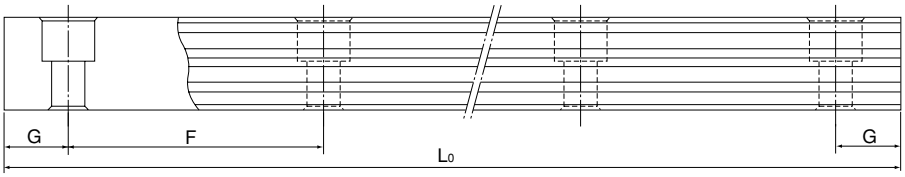
Unit: mm

	LM rail dimensions						Basic load rating		Static permissible moment kN-m*					Mass	
	Width			Height	Pitch		C	C_0	M_A		M_B		M_C	LM block	LM rail
	W_1	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
	18	6	—	6.6	40	4.5X7.5X5.3	4.31	5.66	0.0228	0.12	0.0228	0.12	0.0405	0.04	0.8
	18	6	—	6.6	40	4.5X7.5X5.3	5.56	8.68	0.0511	0.246	0.0511	0.246	0.0621	0.06	0.8
	24	8	—	7.5	40	4.5X7.5X5.3	7.05	8.98	0.0466	0.236	0.0466	0.236	0.0904	0.08	1.23
	33	8.5	18	8.6	40	4.5X7.5X5.3	7.65	10.18	0.0591	0.298	0.0591	0.298	0.164	0.13	1.9
	37	8.5	22	11	50	4.5X7.5X5.3	8.24	12.8	0.0806	0.434	0.0806	0.434	0.229	0.19	2.9
	42	10	24	15	60	4.5X7.5X5.3	16	22.7	0.187	0.949	0.187	0.949	0.455	0.36	4.5
	69	15.5	40	19	80	7X11X9	35.5	49.2	0.603	3	0.603	3	1.63	1.2	9.6
	90	20	60	24	80	9X14X12	70.2	91.4	1.46	7.37	1.46	7.37	3.97	3	15

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

SHW
Standard Length and Maximum Length of the LM Rail

The table below shows the standard LM rail 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 adversely affecting accuracy.

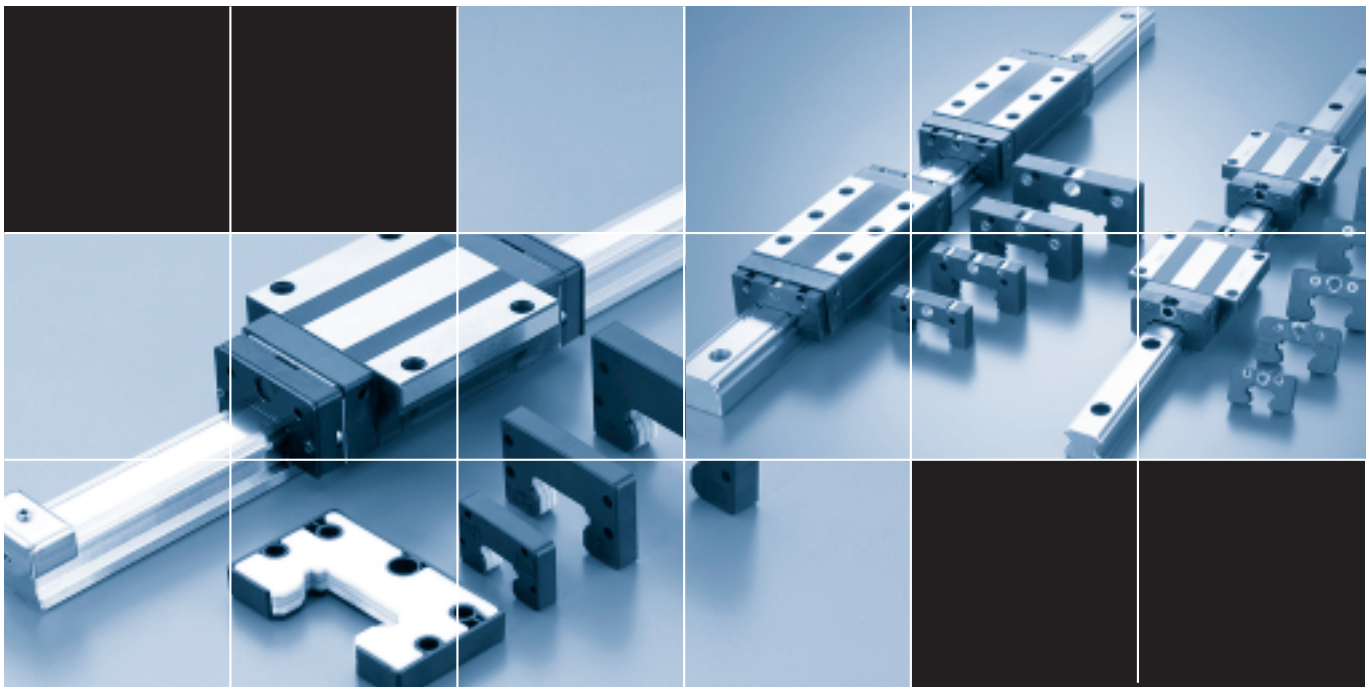


Standard Length and Maximum Length of the LM Rail for Model SHW

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

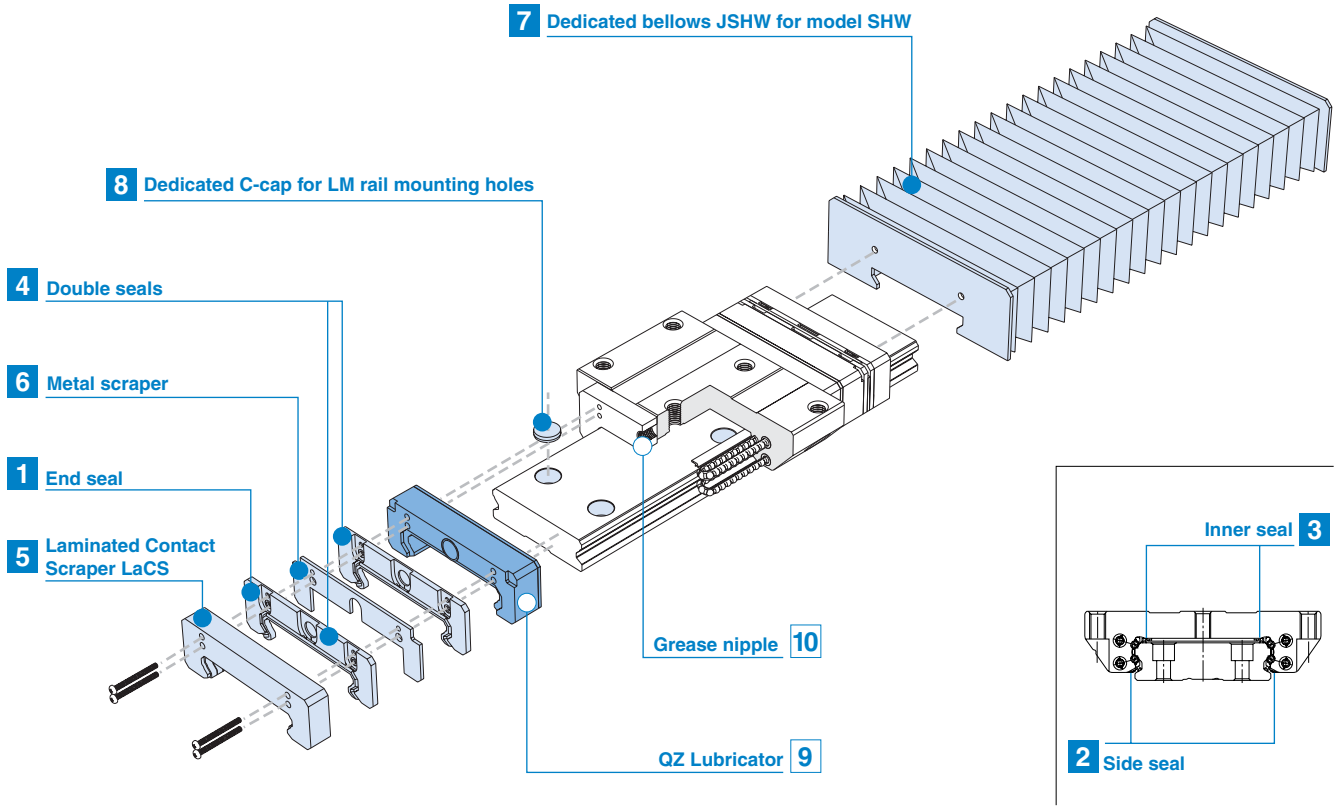
Note 1: The maximum length varies with accuracy grades. Contact THK for details.
Note 2: If connected rails are not allowed and a greater length than the maximum values above is required, contactTHK.
Note 3: Models SHW12, 14 and 17 are made of stainless steel.



SHW OPTIONS

Options

For model SHW, dust-prevention and lubrication accessories are available. Make a selection according to the application and the installation site.

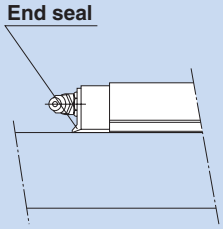


Dust Prevention Accessories

When foreign matter enters an LM system, it will cause abnormal wear or shorten the service life. 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 working conditions.

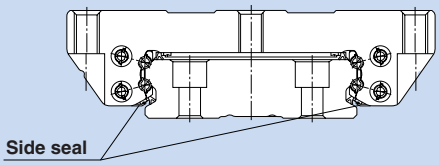
1 End seal

Used in locations exposed to dust.



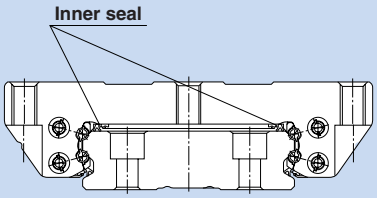
2 Side seal

Used in locations where dust may enter the LM block from the side or bottom surface, such as vertical, horizontal and inverted mounts.



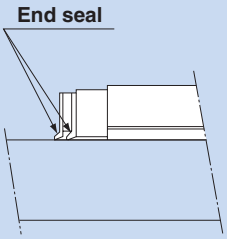
3 Inner seal

Used in locations severely exposed to dust or cutting chips.



4 Double seals

Used in locations exposed to much dust or many cutting chips.



Seals and Scrapers

1 to 4 Seals

Highly wear-resistant end seals made of special resin rubber and side seals for increased dust-prevention effect are available.

If desiring a dust-prevention accessory, specify it with the corresponding symbol indicated in table 3.
For the supported model numbers for dust-prevention accessories and the overall LM block length with a dust-prevention accessory attached (dimension L), see table 4.

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 1.

Table 1 Maximum Seal Resistance Value of Seals SHW ··· UU/SS Unit: N

Model No.	Seal resistance value	
	UU	SS
12CA/CR	1.0	1.4
12HR	1.0	1.8
14	1.2	1.8
17	1.4	2.2
21	4.9	6.9
27	4.9	8.9
35	9.8	15.8
50	14.7	22.7

5 6 Scrapers

Laminated Contact Scraper LaCS®

For locations with an even more adverse working conditions, the Laminated Contact Scraper LaCS is available. LaCS prevents minute foreign matter from entering the LM block by removing such foreign matter adhering to the LM rail in multiple stages through a laminated contact structure (3-layered scraper).

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.

Basic Specifications of LaCS

① Service temperature range of LaCS: -20°C to +80°C
② Resistance of LaCS: indicated in table 2

*Note that LaCS is not sold alone.

Table 2 Resistance of LaCS Unit: N

Model No.	Resistance of LaCS
21	3.9
27	6.5
35	13.0
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.

Table 3 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.

Table 4 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
12 CAM/CRM	37	37	—	—	—	—	—	—	—
12 HRM	50.4	50.4	—	—	—	—	—	—	—
14 CAM/CRM	45.5	45.5	—	—	—	—	—	—	—
17 CAM/CRM	51	51	54	53.4	56.4	—	—	—	—
21 CA/CR	59	59	64	63.2	68.2	75.6	80.6	77.2	82.2
27 CA/CR	72.8	72.8	78.6	77.8	83.6	89.4	95.2	91.8	97.6
35 CA/CR	107	107	114.4	112	119.4	129	136.4	131.4	138.8
50 CA/CR	141	141	149.2	147.4	155.6	166	174.2	168.4	176.6

Note: "—" indicates not available.

7 Dedicated Bellows JSHW for Model SHW

For locations with an even more adverse working conditions, dedicated bellows are available. The dimensions of the dedicated bellows are provided below. When placing an order, specify the desired bellows type with the corresponding bellows model number indicated below.

Dimensional Table for JSHW

Model No.	Major dimensions(mm)									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(mm)					A $\left(\frac{\text{Lmax}}{\text{Lmin}}\right)$
	Mounting bolt		a	b		
	*S	S_1		Type CA	Type CR	
JSHW 17	M2 × 4ℓ	M3×6ℓ	8	4	9	5
JSHW 21	M2 × 5ℓ	M3×6ℓ	8	3.5	10.5	6
JSHW 27	M2.6× 6ℓ	M3×6ℓ	10	2.5	11.5	7
JSHW 35	M3 × 8ℓ	M3×6ℓ	6	0	10	7
JSHW 50	M4 ×12ℓ	M4×8ℓ	—	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.

■ Example of model number coding

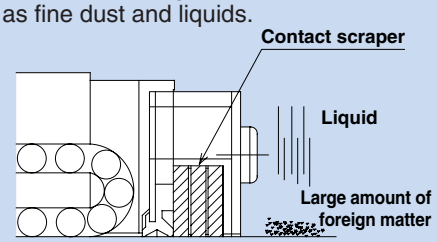
JSHW21-60/360

1 2

1 Model number ··· bellows for SHW21
2 Bellows dimensions (length when compressed / length when extended)

LaCS 5

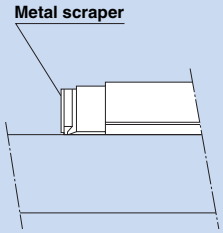
Used in harsh environments exposed to foreign matter such as fine dust and liquids.



Structural drawing

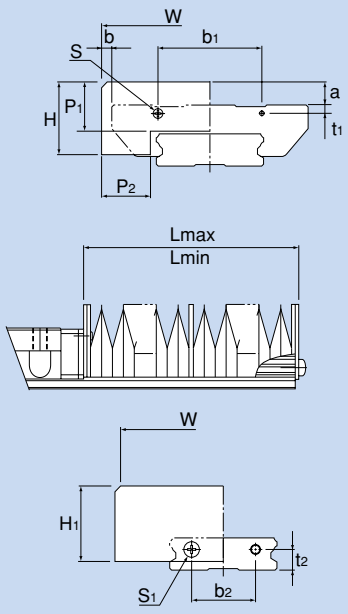
Metal scraper 6

Used in locations where welding spatter may adhere to the LM rail.



Dedicated bellows JSHW for model SHW 7

Used in locations exposed to dust or cutting chips.



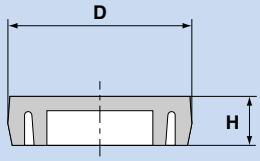
Note: The length of the bellows is calculated as follows.

$$\text{Lmin} = \frac{S}{(A-1)}$$ **S: Stroke length (mm)**

$$\text{Lmax} = \text{Lmin} \cdot A$$ **A: Extension rate**

8 Dedicated C-cap

It prevents cutting chips from entering the LM rail mounting holes.



8 Dedicated C-cap for LM Rail Mounting Holes

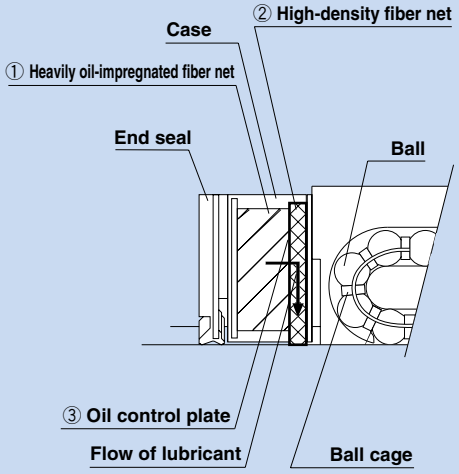
If any of the LM rail mounting holes of an LM Guide is filled with cutting chips or foreign matter, they may enter the LM block structure. Entrance of such foreign matter can be prevented by covering each LM rail mounting hole with the dedicated cap so that the top of the mounting holes are on the same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

The dedicated C-cap for LM rail mounting holes is highly durable since it uses a special synthetic resin with high oil resistance and high wear resistance. When placing an order, specify the desired cap type with the corresponding cap number indicated in the table on the right.

Model No.	C-cap model No.	Bolt used	Major dimensions mm	
			D	H
12	C4	M4	7.8	1.0
14	C4	M4	7.8	1.0
17	C4	M4	7.8	1.0
21	C4	M4	7.8	1.0
27	C4	M4	7.8	1.0
35	C6	M6	11.4	2.7
50	C8	M8	14.4	3.7

Lubrication Accessories

9 QZ Lubricator



9 QZ Lubricator™

The 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.

When the QZ Lubricator is required, specify the desired type with the corresponding symbol indicated in table 1. For supported LM Guide model numbers for the QZ Lubricator and overall LM block length with the QZ Lubricator attached (dimension L), see table 2.

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.

Significant Extension of the Maintenance Interval

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

*Note that the QZ Lubricator is not sold alone.
*Those models equipped with the QZ Lubricator cannot have a grease nipple. When desiring both the QZ Lubricator and a grease nipple to be attached, contact THK .

Table 1 Parts Symbols for Model SHW with the 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

Note: The inner seal and LaCS are not available for models SHW12, 14 and 17.

Table 2 Overall LM Block Length (Dimension L) of Model SHW with the QZ Lubricator Attached

Unit: mm

Model No.	QZUU	QZSS	QZDD	QZZZ	QZKK	QZSSHH	QZDDHH	QZZZHH	QZKKHH
12 CAM/CRM	47	47	—	—	—	—	—	—	—
12 HRM	60.4	60.4	—	—	—	—	—	—	—
14 CAM/CRM	55.5	55.5	—	—	—	—	—	—	—
17 CAM/CRM	63	63	66	65.4	68.4	—	—	—	—
21 CA/CR	75	75	80	77.8	82.8	91.6	96.6	93.2	98.2
27 CA/CR	92.8	92.8	98.6	96.4	102.2	109.4	115.2	111.8	117.6
35 CA/CR	127	127	134.4	132	134.4	149	156.4	151.4	158.8
50 CA/CR	161	161	169.2	167.4	175.6	186	194.2	188.4	196.6

Note: "—" indicates not available.

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

10 Grease Nipple and Greasing Hole

Model SHW does not have a grease nipple as standard. For the location for attaching the grease nipple, see Fig. 1. Note that attaching the grease nipple will increase the overall LM rail length. The installation of a grease nipple and the drilling of a greasing hole are performed at THK. When ordering SHW, indicate that the desired model requires a grease nipple or greasing hole (for greasing hole dimensions, supported LM Guide model numbers for grease nipples and incremental dimensions, see table 1).

Note 1: The 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.

■When Dust Prevention Accessories SSHH, DDHH, ZZHH or KKHH are Attached

When dust prevention accessories SSHH, DDHH, ZZHH or KKHH are attached, the grease nipple is in the location indicated in Fig. 2. Table 2 shows incremental dimensions with the grease nipple.

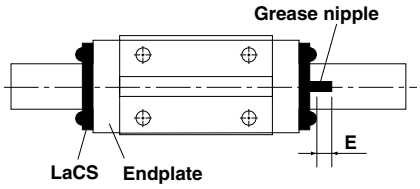
■When Dust Prevention Accessories UU or SS are Attached

For the incremental dimension of the grease nipple when dust prevention accessories UU or SS are attached, see table 1.

■When Dust Prevention Accessories DD, ZZ or KK are Attached

For the mounting location of the grease nipple and its incremental dimension when dust prevention accessories DD, ZZ or KK are attached, contact THK .

Fig. 2



Note: When desiring the mounting location for the grease nipple other than the one indicated in Fig. 2, contact THK.

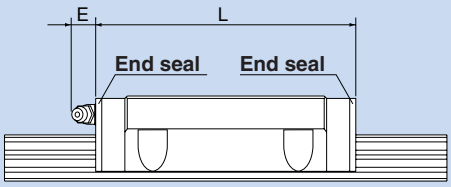
Table 2

Unit: mm

Model No.	Incremental dimension with grease nipple E	Nipple type
21CA/CR	4.2	PB1021B
27CA/CR	10.7	B-M6F
35CA/CR	10.0	B-M6F
50CA/CR	21.0	B-PT1/8

Grease nipple 10

Fig. 1



Note: For the dimension L, see the corresponding dimension table.

Table 1 Table of Grease Nipple and Greasing Hole Dimensions

Unit: mm

Model No.	E	Grease nipple or greasing hole
12	—	ϕ2.2 drilled hole
14	—	ϕ2.2 drilled hole
17	5	PB107
21	5.5	PB1021B
27	12	B-M6F
35	12	B-M6F
50	16	B-PT1/8

THK Caged Ball LM Guide Model SHW

⚠ Precautions on use

● Handling
- Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
- Tilting an LM block or LM rail may cause them to fall by their own weight.
- 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
- Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
- Do not mix lubricants of different physical properties.
- 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.
- When planning to use a special lubricant, contact THK before using it.
- 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.
- Lubrication interval varies according to the service conditions. Contact THK for details.

● Precautions on Use
- 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.
- When planning to use the LM system in an environment where coolant penetrates the LM block, it may cause trouble to product functions depending on the type of coolant. Contact THK for details.
- 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.
- If foreign matter adheres to the LM system, replenish the lubricant after cleaning the product. For available types of detergent, contact THK .
- When using the LM Guide with an inverted mount, breakage of the endplate due to an accident or the like may cause balls to fall out 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.
- 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.
- 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.

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