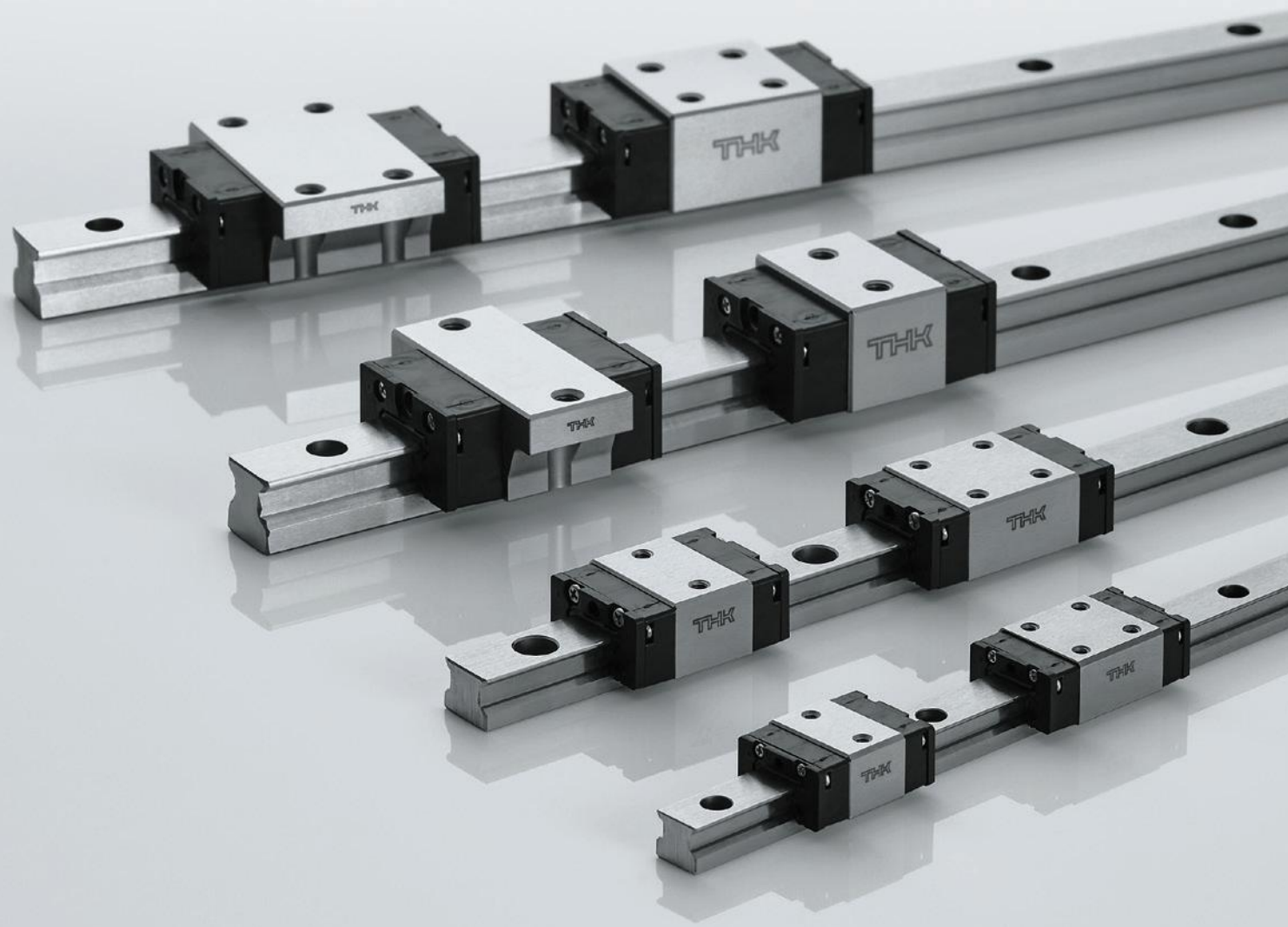
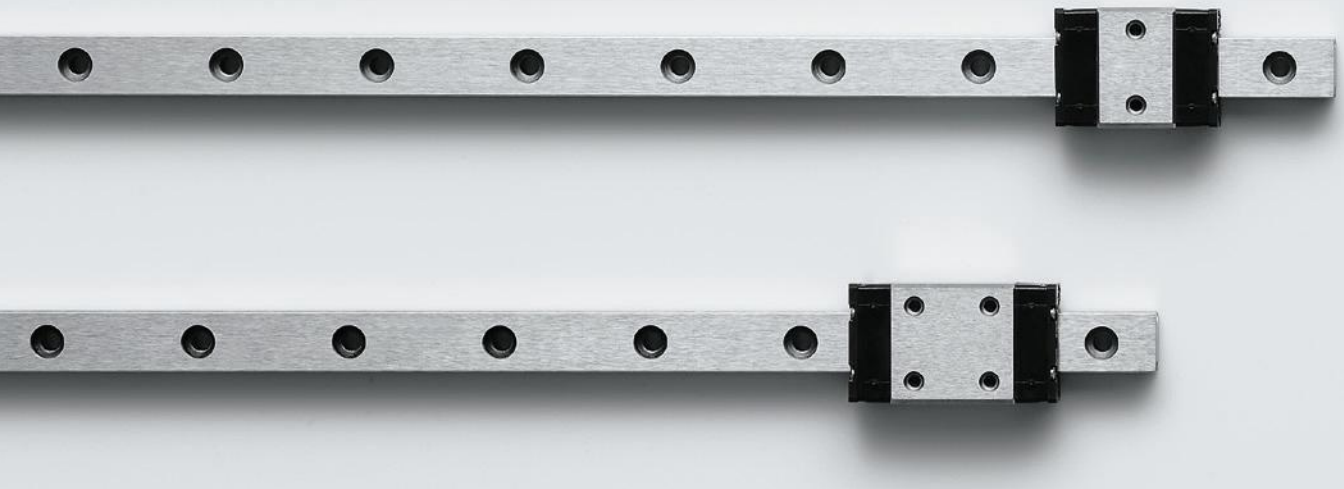
Miniature Roller Type LM Guide

HRG



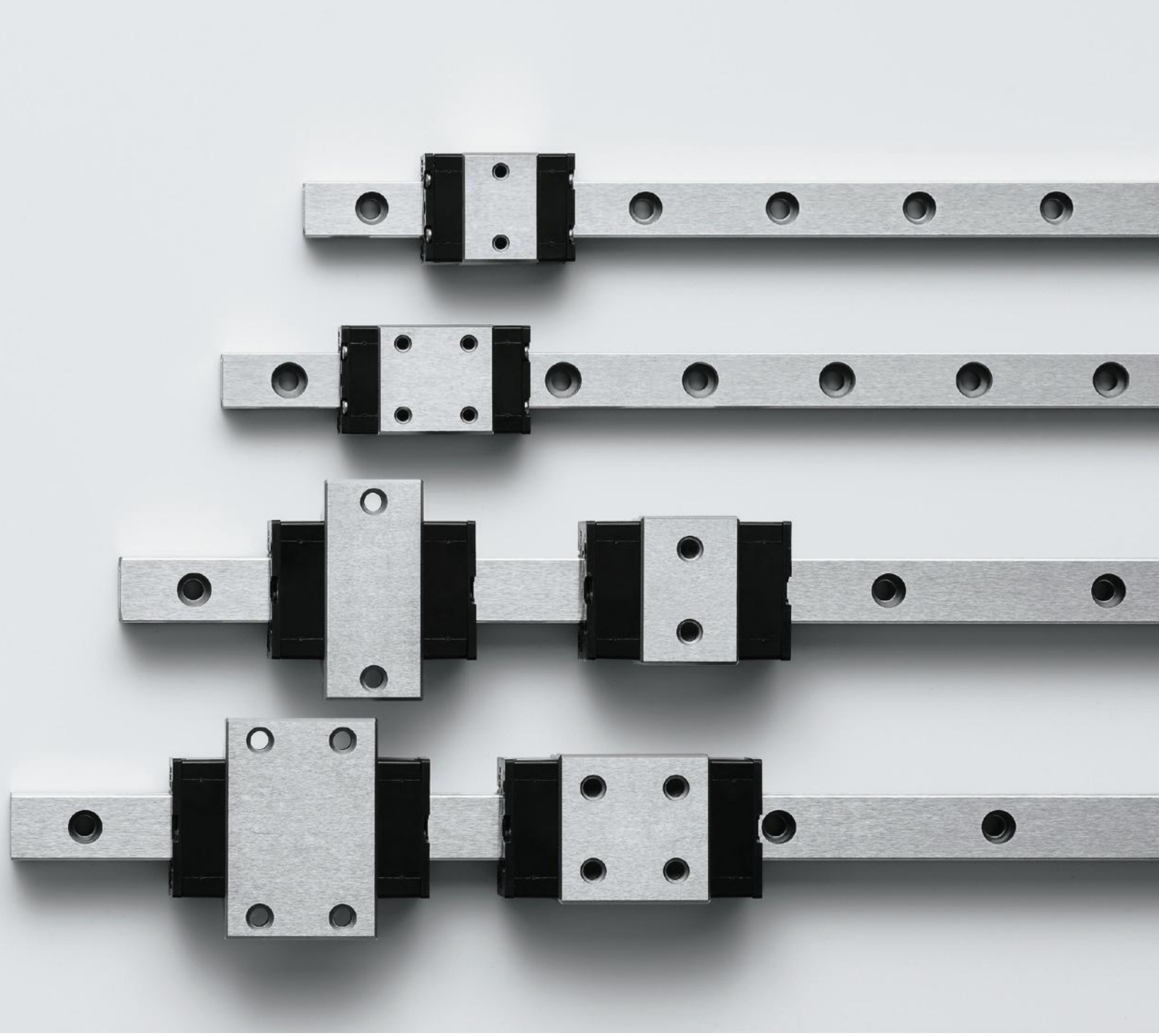
The smallest roller guide, featuring light weight and high rigidity

Introducing the smallest roller type LM Guide



Miniature Roller Type LM Guide

HRG



Feature 1 **Smallest Roller Guide**

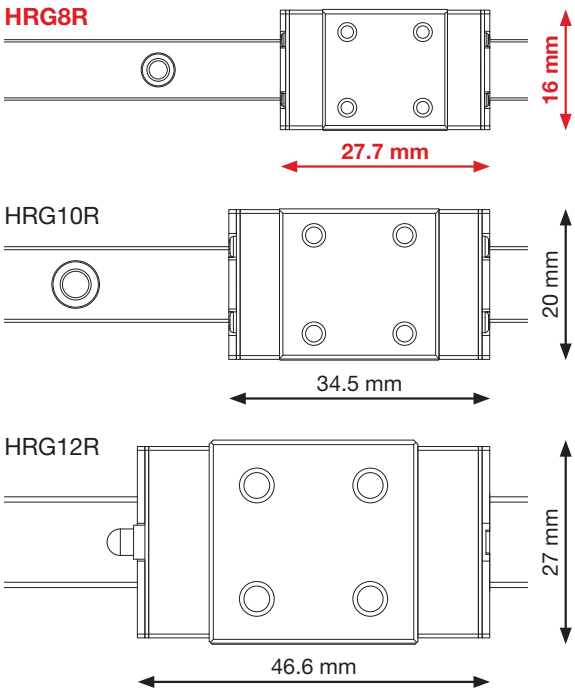
Feature 2 **Long Service Life**

Feature 3 **4-Way Equal Load**

The roller type LM Guide is now available in miniature size

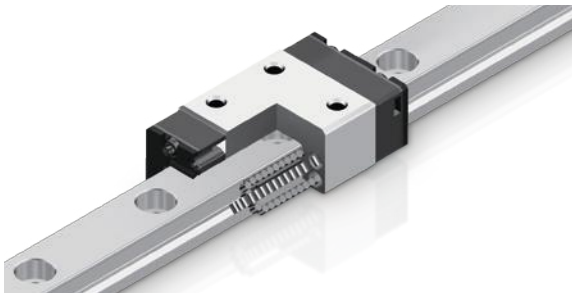
Feature 1 Smallest Roller Guide

The Model HRG uses the technology THK has cultivated with its roller type LM Guide products in order to achieve miniature model sizes. These compact external dimensions make the Model HRG perfect for applications that need to save on space.



Feature 2 Long Service Life

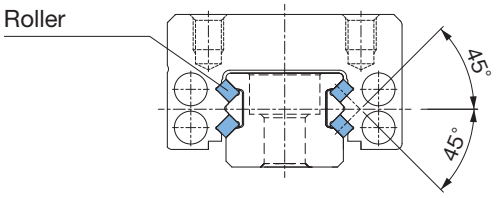
The Model HRG uses rollers as the rolling element, granting it a longer service life than even THK's previous miniature LM Guide products. In addition, the use of rollers enables it to achieve high rigidity.

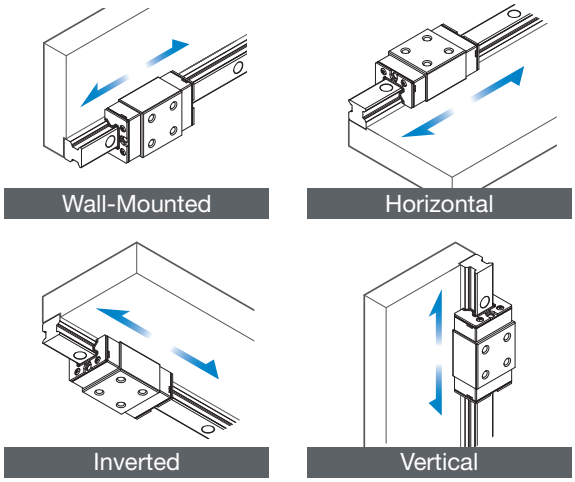


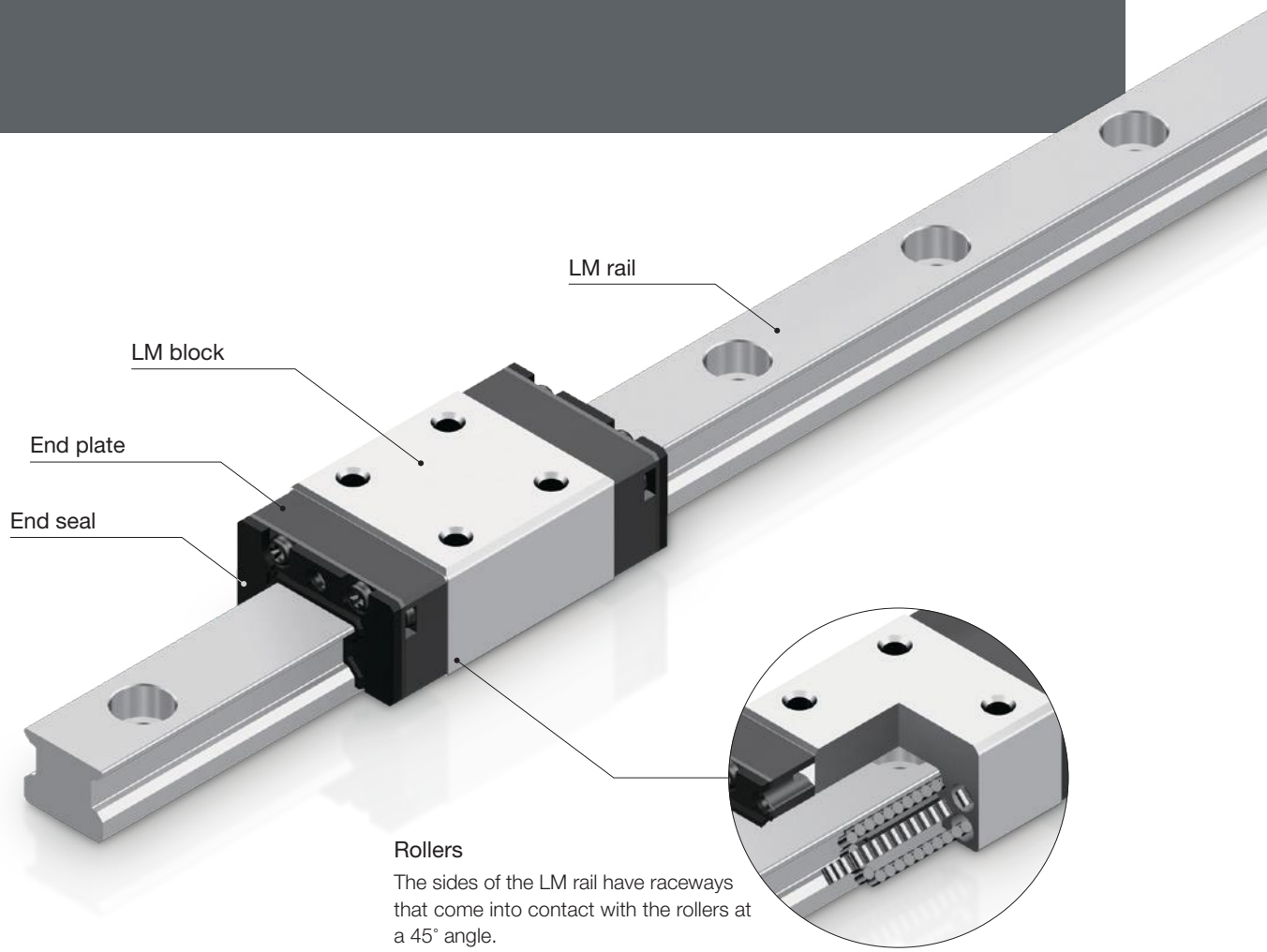
Feature 3 4-Way Equal Load

The Model HRG is designed to have an equal basic load rating on the LM block for all four directions.* As a result, this model can be used in any orientation, enabling a wide variety of applications.

* Four directions: radial, reverse-radial, and horizontal







Rollers

The sides of the LM rail have raceways that come into contact with the rollers at a 45° angle.

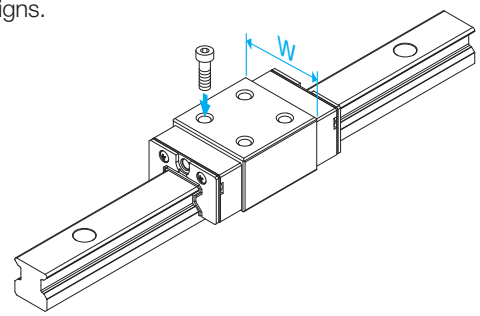
Lineup

Block type		HRG8	HRG10	HRG12
Short type	SR	○	○	○
	SC	—	—	○
Standard type	R	○	○	○
	C	—	—	○
Long type	LR	○	○	○
	LC	—	—	○

○: Available, —: Not available

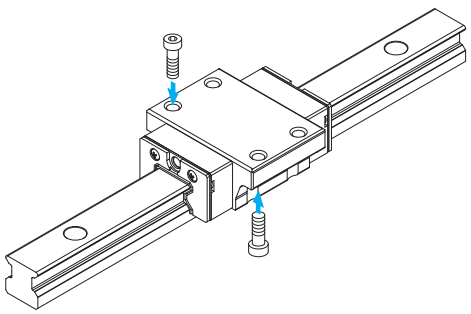
Model HRG-SR/R/LR

The LM block width (W) is narrow, making it easy to mount from the top surface. It is ideal for compact designs.



Model HRG-SC/C/LC

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



Lubrication

Standard Grease

AFF Grease uses a high-grade synthetic oil for the base oil, a lithium-based consistency enhancer, and a special additive. As a result, it achieves stable rolling resistance, low dust generation, and high fretting resistance at a level that conventional vacuum greases or low dust-generating greases have not.

* Non-standard greases are also available. Contact THK for details.

AFF Representative Physical Properties

Item		Representative property	Testing method
Consistency enhancer		Lithium-based	
Base oil		High-grade synthetic oil	
Base oil kinematic viscosity: mm^2/s (40℃)		100	JIS K 2220 23
Worked penetration (25°C, 60 W)		315	JIS K 2220 7
Mixing stability (100,000 W)		345	JIS K 2220 15
Dropping point: ˚C		220	JIS K 2220 8
Evaporation volume: mass% (99°C, 22 h)		0.7	JIS K 2220 10
Oil separation rate: mass% (100°C, 24 h)		2.6	JIS K 2220 11
Copper plate corrosion (B method, 100°C, 24 h)		Passed	JIS K 2220 9
Low-temperature torque: mN·m (-20°C)	Starting	220	JIS K 2220 18
	Rotational	60	
4-ball testing (welding load): N		1236	ASTM D2596
Operating temperature range: ˚C		-40 to 120	
Color		Reddish brown	

Static Safety Factor

To calculate a load applied to the LM Guide, you must first obtain the average load required to determine the service life and the maximum load needed to determine the static safety factor. In particular, if the system starts and stops frequently, if a cutting load acts on the system, or if a large moment caused by an overhanging load is applied, it may experience an unexpectedly large load. When selecting a model number, make sure that the desired model is capable of supporting the required maximum load (whether stationary or in motion).
Estimates for the static safety factor are shown in the table to the right.

Estimates of the Static Safety Factor (f_S)

Load conditions*	Lower limit of f_S
Without vibrations or impacts	4
With vibrations or impacts	4

* Vibrations and impacts are typically caused by factors such as acceleration and deceleration, sudden starting and stopping, vibrations and impacts from an external machine, and changes in processing power over time.

$$f_S = \frac{C_0}{P_{max}}$$

f_S: Static safety factor
C_0: Basic static load rating (N)
P_{max}: Maximum applied load (N)

Nominal Life and Service Life Time

The service life of the LM Guide varies from unit to unit even if they are manufactured through the same process and used in the same operating conditions. Therefore, the modified nominal life defined here is typically used as a guideline for obtaining the service life of the LM Guide.

■ Nominal Life

The nominal life is the total travel distance that 90% of a group of units can achieve without flaking (scale-like pieces on the metal surface peeling off) after individually running under the same conditions.

* Basic dynamic load rating (C)
Indicates the load for which the nominal life (L_{10m}) is 100 km when the load is applied with a constant direction and size to a group of identical LM Guide units individually running under the same conditions.

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

L_{10m}: Modified nominal life (km)
C: Basic dynamic load rating* (N)
P_C: Calculated load (N)
f_H: Hardness factor
f_T: Temperature factor
f_C: Contact factor
f_W: Load factor

■ Service Life Time

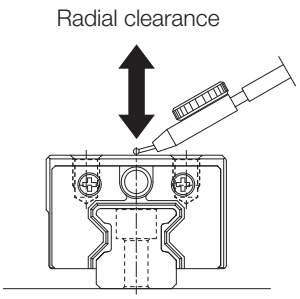
Once the nominal life (L_{10m}) has been obtained, the service life time can be obtained using the equation shown on the right if the stroke length and the number of cycles are constant.

$$L_h = \frac{L_{10m} \times 10^6}{2 \times \ell_S \times n_1 \times 60}$$

L_h: Service life time (h)
ℓ_S: Stroke length (mm)
n_1: Cycles per minute (min^{-1})

Radial Clearance Specifications

The radial clearance significantly affects the running accuracy, load resistance, and rigidity. Therefore, it is necessary to select a clearance that is appropriate for the application. An appropriate radial clearance will prevent vibrations and impacts from occurring when the device is running, as well as improve the service life and accuracy of the LM Guide. The Model HRG has three types of radial clearance (preload): normal, light preload, and medium preload.



Radial Clearance Specifications Unit: μm

Model	Normal	Light preload	Medium preload
	No symbol	C1	C0
HRG8	-0.5 to 0	-0.9 to -0.5	–
HRG10	-0.5 to 0	-0.8 to -0.5	–
HRG12	-0.5 to 0	-1.0 to -0.5	-1.4 to -1.0

Accuracy Standards

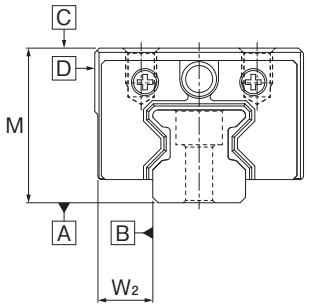
The accuracy of the LM Guide is specified for each model in terms of the dimensional tolerance for height and width, the difference between height and width in a pair, and running parallelism. The Model HRG has three types of accuracy standards: High Accuracy grade, Precision grade, and Super Precision grade.

Difference in Height M

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

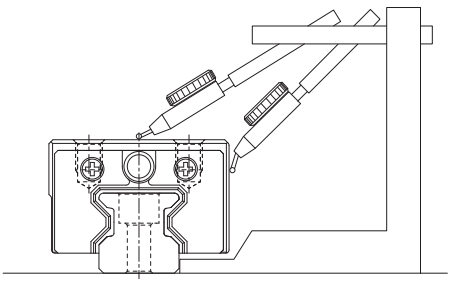
Difference in Width W_2

The difference in width W_2 indicates the difference between the minimum and maximum values of the width (W_2) between an LM rail and each of the LM blocks mounted together on the LM rail.



Running Parallelism

Running parallelism refers to the tolerance for parallelism between the LM block and the LM rail datum surface when the LM block travels the whole length of the LM rail with the LM rail bolted to a reference surface.



Accuracy Standards Unit: mm

Model	Item	High Accuracy grade	Precision grade	Super Precision grade
		H	P	SP
HRG8 HRG10 HRG12	Dimensional tolerance in height M	±0.03	±0.015	±0.007
	Difference in height M	0.007	0.005	0.003
	Dimensional tolerance in width W_2	±0.02	±0.01	±0.007
	Difference in width W_2	0.01	0.006	0.004
	Running parallelism of surface C against surface A	See the table below for LM rail length and running parallelism by accuracy standard		
	Running parallelism of surface D against surface B	See the table below for LM rail length and running parallelism by accuracy standard		

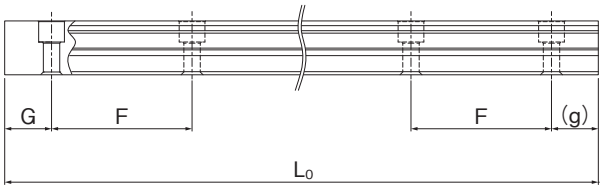
LM Rail Length and Running Parallelism by Accuracy Standard Unit: μm

LM rail length (mm)		Running parallelism value		
Above	Or less	High Accuracy grade	Precision grade	Super Precision grade
–	50	3	2	1.5
50	80	3	2	1.5
80	125	3	2	1.5
125	200	3.5	2	1.5
200	250	4	2.5	1.5
250	315	4.5	3	1.5
315	400	5	3.5	2
400	500	6	4.5	2.5
500	630	7	5	3
630	800	8.5	6	3.5
800	1000	9	6.5	4
1000	1250	11	7.5	4.5
1250	1600	12	8	5

Standard and Maximum Lengths of the LM Rail

The standard and maximum lengths of Model HRG LM rails are shown in the following table. If the maximum length of the desired LM rail exceeds these values, joint rails will be used. Contact THK for details. For special rail lengths, it is recommended to use a value corresponding to the G and g dimensions from the table. As the G and g dimensions increase, that portion becomes less stable, and the accuracy may be negatively affected.

* If it would be difficult to use joint rails, and a length greater than the maximum value is required, contact THK.

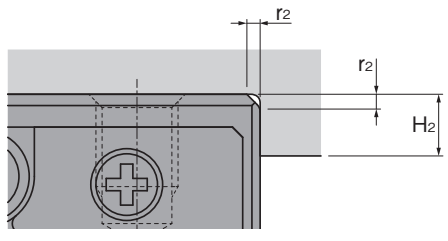


Standard and Maximum Lengths of the LM Rail Unit: mm

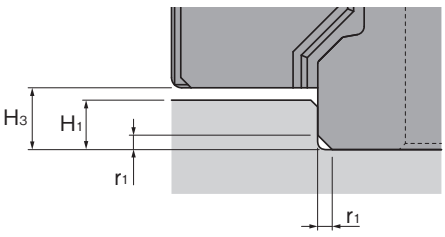
Model	HRG8	HRG10	HRG12
LM rail standard length (L_0)	35	45	70
	55	70	110
	75	95	150
	95	120	190
	115	145	230
	135	170	270
	155	195	310
	175	220	350
	195	245	390
	215	270	430
	235	295	470
	255	320	510
	275	345	550
	–	370	590
	–	395	630
	–	420	670
	–	445	–
	–	470	–
Standard pitch F	20	25	40
G, g dimension	7.5	10	15
Maximum length	975	995	1240

Shoulder Height of the Mounting Base and the Corner Radius

The LM rail and LM block ordinarily have a reference surface on the side face to allow easy installation and highly accurate positioning. 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.



LM block



LM rail

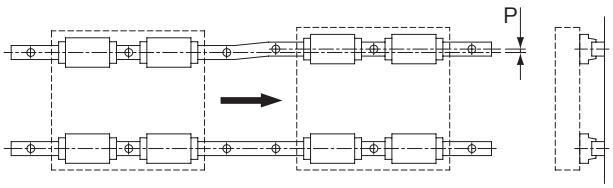
Shoulder Height of the Mounting Base and the Corner Radius Unit: mm

Model	LM rail corner radius r_1 (max)	LM block corner radius r_2 (max)	LM rail shoulder height H_1	LM block shoulder height H_2	H_3
HRG8	0.2	0.5	1	6	1.5
HRG10	0.2	0.5	1	5	1.5
HRG12	0.8	0.5	2	4	3

Reference Error Tolerance for the Mounting Surface

Reference Horizontal Error Tolerance between Two Rails

Mounting surface error may affect the service life of the LM Guide. The table below shows the approximate value (P) of the reference horizontal error tolerance between two rails under normal use for each model number.



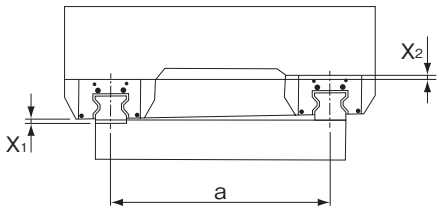
Unit: μm

Model	Normal	Light preload	Medium preload
	No symbol	C1	C0
HRG8	4	3	–
HRG10	4	3	–
HRG12	5	3	3

Reference Vertical Error Tolerance between Two Rails

The table shows the value (X) of the reference vertical error tolerance in the axial direction for rail span (a), which is proportional to the rail span (a).

$X=X_1+X_2$ X_1: Difference in rail mounting surface height
X_2: Difference in block mounting surface height

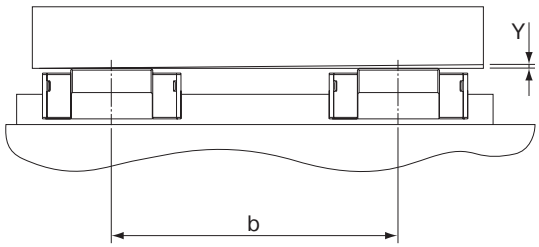


Unit: mm

Model	Normal	Light preload	Medium preload
	No symbol	C1	C0
HRG8	0.00016a	0.00011a	–
HRG10	0.00016a	0.00011a	–
HRG12	0.00016a	0.00011a	0.00006a

Reference Vertical Error Tolerance in the Axial Direction

The table below shows the value (Y) of the reference vertical error tolerance in the axial direction for block span (b), which is proportional to the block span (b).



Unit: mm

Model	Normal	Light preload	Medium preload
	No symbol	C1	C0
HRG8	0.000032b	0.000022b	–
HRG10	0.000032b	0.000022b	–
HRG12	0.000032b	0.000022b	0.000012b

Permissible Load and Maximum Moment During Use

The Model HRG has a set permissible load. The maximum moment during use is calculated based on the permissible load. The permissible load and maximum moment during use are shown in the table to the right.

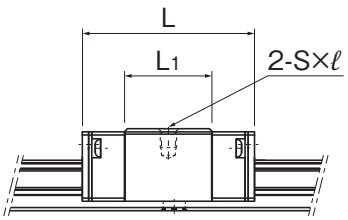
Model	Permissible load (kN)	Maximum moment during use* (N·m)				
		M_A		M_B		M_C
		1 block	2 blocks	1 block	2 blocks	1 block
HRG8SR	0.2	0.4	2.78	0.4	2.78	1.04
HRG8R	0.29	0.83	4.92	0.83	4.92	1.46
HRG8LR	0.36	1.4	7.56	1.4	7.56	1.85
HRG10SR	0.38	0.97	6.55	0.97	6.55	2.5
HRG10R	0.53	1.94	11.26	1.94	11.26	3.42
HRG10LR	0.66	3.19	17.03	3.19	17.03	4.28
HRG12SR/SC	0.74	2.32	18.17	2.32	18.17	5.96
HRG12R/C	1.04	4.86	31.32	4.86	31.32	8.36
HRG12LR/LC	1.32	8.18	47.32	8.18	47.32	10.57

* Maximum moment during use 1 block: Maximum moment during use with 1 LM block
2 blocks: Maximum moment during use with 2 LM blocks in close contact with each other

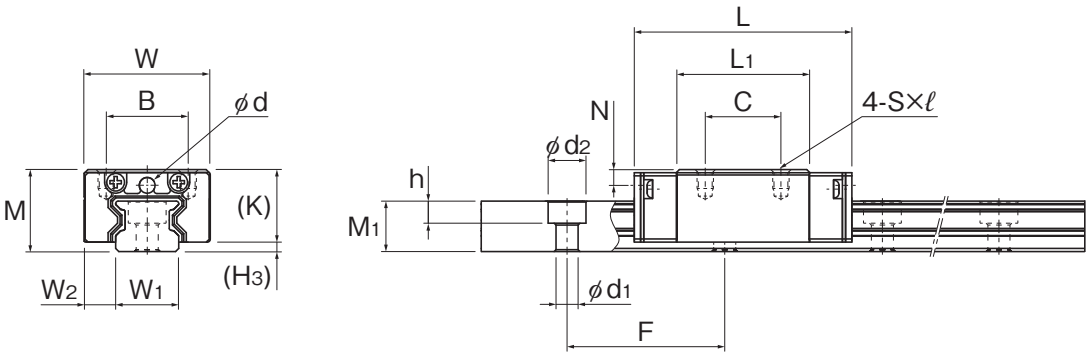
When using the Model HRG, do not exceed the permissible load and maximum moment during use. Additionally, if the load applied to the Model HRG varies during actual use due to being struck, etc., consider a safety factor for the permissible load.

Dimensional Table

HRG-SR/R/LR



HRG8SR, 10SR



HRG8R/LR, 10R/LR

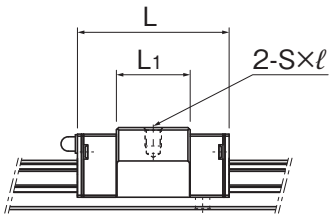
Model		External dimensions			LM block dimensions										
		M	W	L	B	C	S×ℓ	L_1	T	K	N	Lubrication hole d	E	Grease nipple	
HRG8	SR	11	16	21.7	10	–	M2×2.5	10.5	–	9.5	2	1.6	–	–	
	R	11	16	27.7	10	10	M2×2.5	16.5	–	9.5	2	1.6	–	–	
	LR	11	16	33.7	10	10	M2×2.5	22.5	–	9.5	2	1.6	–	–	
HRG10	SR	13	20	27.3	13	–	M2.6×3	13.9	–	11.5	2.5	2.5	–	–	
	R	13	20	34.5	13	12	M2.6×3	21.1	–	11.5	2.5	2.5	–	–	
	LR	13	20	41.7	13	12	M2.6×3	28.3	–	11.5	2.5	2.5	–	–	
HRG12	SR	20	27	37	15	–	M4×4.5	18	8.2	17	4	–	4	PB107	
	R	20	27	46.6	15	15	M4×4.5	27.6	8.2	17	4	–	4	PB107	
	LR	20	27	56.2	15	15	M4×4.5	37.2	8.2	17	4	–	4	PB107	

Model Number Coding

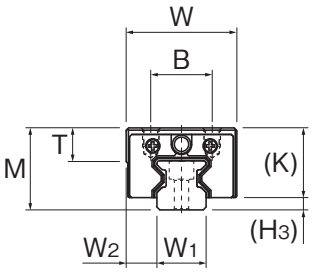
Select an option Fixed symbol

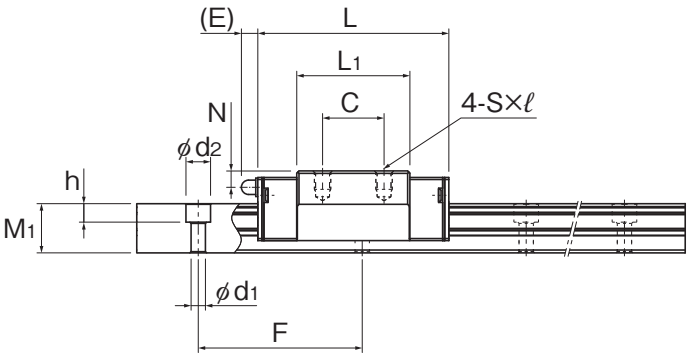
HRG12 LR 2 UU C0 M + 670L P T M - II

- HRG12: Model
- LR: LM block type
- 2: Number of LM blocks used on a single rail
- UU: Contamination protection accessory symbol (UU only)
  Without seal (no symbol)
- C0: Radial clearance symbol:
  Normal (no symbol)
  Light preload (C1)
  Medium preload (C0)
  * HRG10 normally comes with a light preload. (Medium preload is not available.)
- M: Stainless steel LM block
- 670L: LM rail length (in mm)
- P: Accuracy symbol:
  High Accuracy (H)
  Precision grade (P)
  Super Precision grade (SP)
- T: Joint LM rail symbol
- M: Stainless steel LM rail
- II: Symbol for number of rails used on the same plane



HRG12SR





HRG12R/LR

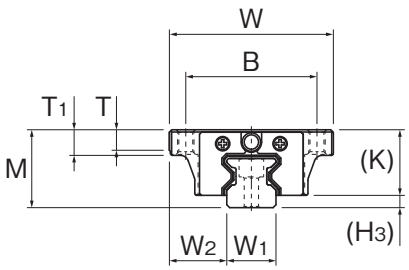
Unit: mm

	H_3	LM rail dimensions					Basic load rating (kN)		Permissible load (kN)	Static permissible moment* (N·m)					Mass	
		W_1	W_2	M_1	F	$d_1 \times d_2 \times h$	C_{100}	C_0		M_A		M_B		M_C	LM block	LM rail
										1 block	2 blocks	1 block	2 blocks		kg	kg/m
	1.5	8	4	7	20	2.4 × 4.2 × 2.3	1.02	2.29	0.2	4.47	31.33	4.47	31.33	11.74	0.009	0.35
	1.5	8	4	7	20	2.4 × 4.2 × 2.3	1.43	3.54	0.29	10.32	61.14	10.32	61.14	18.14	0.013	0.35
	1.5	8	4	7	20	2.4 × 4.2 × 2.3	1.8	4.79	0.36	18.58	100.52	18.58	100.52	24.55	0.018	0.35
	1.5	10	5	8	25	3.5 × 6 × 3.5	1.92	4.57	0.38	11.57	77.95	11.57	77.95	29.71	0.018	0.49
	1.5	10	5	8	25	3.5 × 6 × 3.5	2.63	6.86	0.53	25.29	146.73	25.29	146.73	44.57	0.026	0.49
	1.5	10	5	8	25	3.5 × 6 × 3.5	3.29	9.15	0.66	44.29	236.53	44.29	236.53	59.43	0.034	0.49
	3	12	7.5	12	40	3.5 × 6 × 4.5	3.72	8.71	0.74	27.15	213.02	27.15	213.02	69.87	0.051	0.91
	3	12	7.5	12	40	3.5 × 6 × 4.5	5.21	13.47	1.04	62.73	404.58	62.73	404.58	107.98	0.075	0.91
	3	12	7.5	12	40	3.5 × 6 × 4.5	6.59	18.22	1.32	112.97	653.96	112.97	653.96	146.09	0.099	0.91

* Static permissible moment 1 block: Static permissible moment value with 1 LM block
2 blocks: Maximum moment during use with 2 LM blocks in close contact with each other

Dimensional Table

HRG-SC/C/LC



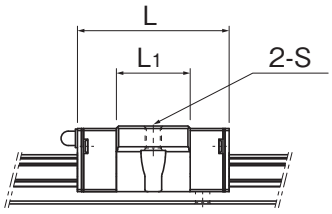
Model		External dimensions			LM block dimensions									
		M	W	L	B	C	S	L_1	T	T_1	K	N	E	Grease nipple
HRG12	SC	19	40	37	32	–	M4	18	5	6	16	3	4	PB107
	C	19	40	46.6	32	15	M4	27.6	5	6	16	3	4	PB107
	LC	19	40	56.2	32	15	M4	37.2	5	6	16	3	4	PB107

Model Number Coding

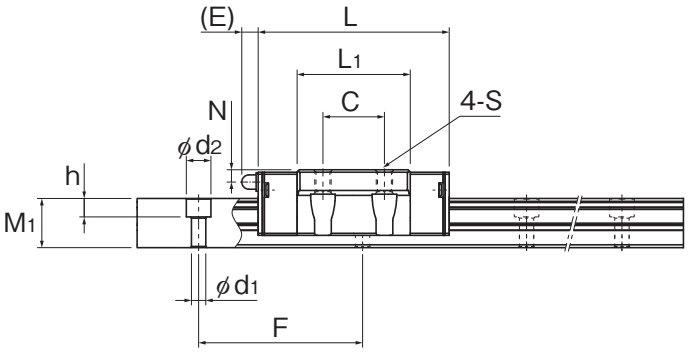
Select an option Fixed symbol

HRG12 LC 2 UU C0 M + 670L P T M - II

- HRG12: Model
- LC: LM block type
- 2: Number of LM blocks used on a single rail
- UU: Contamination protection accessory symbol (UU only)
  Without seal (no symbol)
- C0: Radial clearance symbol:
  Normal (no symbol)
  Light preload (C1)
  Medium preload (C0)
- M: Stainless steel LM block
- 670L: LM rail length (in mm)
- P: Accuracy symbol:
  High Accuracy (H)
  Precision grade (P)
  Super Precision grade (SP)
- T: Joint LM rail symbol
- M: Stainless steel LM rail
- II: Symbol for number of rails used on the same plane



HRG12SC



HRG12C/LC

Unit: mm

	H_3	LM rail dimensions					Basic load rating (kN)		Permissible load (kN)	Static permissible moment* (N·m)					Mass	
		W_1	W_2	M_1	F	$d_1 \times d_2 \times h$	C_{100}	C_0		M_A		M_B		M_C	LM block	LM rail
										1 block	2 blocks	1 block	2 blocks		kg	kg/m
	3	12	14	12	40	3.5 × 6 × 4.5	3.72	8.71	0.74	27.15	213.02	27.15	213.02	69.87	0.061	0.91
	3	12	14	12	40	3.5 × 6 × 4.5	5.21	13.47	1.04	62.73	404.58	62.73	404.58	107.98	0.089	0.91
	3	12	14	12	40	3.5 × 6 × 4.5	6.59	18.22	1.32	112.97	653.96	112.97	653.96	146.09	0.119	0.91

* Static permissible moment 1 block: Static permissible moment value with 1 LM block
2 blocks: Maximum moment during use with 2 LM blocks in close contact with each other

Handling

(1) Please use at least two people to move any product weighing 20 kg or more, or use a cart or another method of conveyance. Otherwise, it may cause injury or damage the unit.
(2) Do not disassemble the parts. This may result in loss of functionality.
(3) Tilting an LM block or LM rail may cause it to fall by its own weight.
(4) Take care not to drop or strike the LM Guide. Otherwise, it may cause injury or damage the unit. Even if there is no outward indication of damage, a sudden impact could prevent the unit from functioning properly.
(5) When installing the LM Guide, be sure not to remove the LM block from the LM rail.
(6) Placing a hand inside the LM rail mounting hole may lead to the hand being caught between the block and rail and cause injury.
(7) Wear appropriate safety gear, such as protective gloves and safety shoes, when handling the product.

Use

(1) Prevent foreign materials, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
(2) Prevent foreign materials, such as cutting chips, coolant, corrosive solvents, or water from getting in the product by using a bellows or cover when the product is used in an environment where such a thing is likely.
(3) Do not use this product if the external temperature exceeds 80°C. If used in excess of this temperature, there is a risk that the resin and rubber parts may deform or become damaged (except the heat-resistant type).
(4) If foreign materials such as cutting chips adhere to the product, replenish the lubricant after cleaning the product.
(5) Very small strokes can inhibit the formation of an oil film between the raceways and the area of contact for the rollers, resulting in fretting. Therefore, be sure to use a type of grease with high fretting resistance properties if the stroke will be small. We recommend periodically allowing the LM block to stroke a distance roughly equal to its length to help ensure that a film forms between the raceways and rollers.
(6) Do not forcibly drive a pin, key, or any other positioning device into the product. This could create indentations on the raceway and impair the product's function.
(7) If the operation requires the LM block to be removed from the LM rail, please use a removing/mounting jig. (The removing/mounting jig is not provided as standard. To obtain one, contact THK.)
(8) When using a removing/mounting jig, align the ends of the LM rail and the jig and mount the block when the jig and rail are parallel.
(9) Mounting the block while it is tilted can lead to contamination by foreign materials, damage to internal components, or dropped rollers.
(10) Inserting and using the LM block on the LM rail while rollers are missing could lead to premature failure of the product.
(11) If any rollers fall out of the LM block, contact THK. Do not use the product in that condition.
(12) If the LM Guide breaks due to an accident or another cause, the LM block may become dislodged from the LM rail and fall. For the safe use of these products, take precautions such as adding a mechanism to prevent blocks from falling.
(13) For bolt length, select a length that will leave a clearance at the bolt tip in relation to the effective tap depth.
(14) If the mounting material lacks sufficient rigidity or accuracy, the bearing load may be focused in one area, and bearing functionality will dramatically decrease. Therefore, carefully consider the rigidity and accuracy of the housing and base, and the strength of the securing bolts.

Lubrication

(1) Thoroughly wipe off anti-rust oil and feed lubricant before using the product.
(2) Do not mix different lubricants. Even grease containing the same type of thickening agent may, if mixed, interact negatively due to disparate additives or other ingredients.
(3) When using the product in locations exposed to constant vibrations or in special environments such as in clean rooms, vacuums, and extreme heat or cold, use a lubricant suitable for its use/environment.
(4) When lubricating products that do not feature a grease nipple or lubrication hole, directly coat the raceways with lubricant and perform several warm-up strokes to ensure that the grease permeates the interior.
(5) Grease viscosity can vary depending on the temperature. Please keep in mind that the LM Guide's sliding resistance may be affected by changes in viscosity.
(6) After lubrication, the sliding resistance of the LM Guide may increase due to the stirring resistance of the grease. Be sure to perform a warm-up operation and allow the grease to break in sufficiently before operating the machinery.
(7) Excess grease may spatter after lubrication. Wipe off spattered grease as necessary.
(8) Grease deteriorates over time, which decreases the lubricity, so perform regular grease inspections and replenish grease based on frequency of use.
(9) How often grease should be replenished varies depending on the operating conditions and environment. We recommend greasing the system approximately every 100 km traveled (3 to 6 months). The final greasing interval/amount should be set at the actual machine.
(10) The lubricant may not reach the raceway if the LM Guide is not installed in a horizontal orientation.
(11) When adopting oil lubrication, the lubricant may not be distributed throughout the LM system depending on the mounting orientation of the LM block. Contact THK for details.

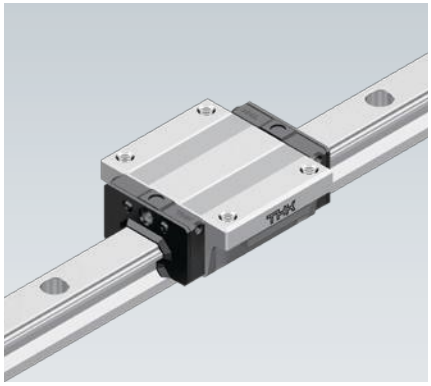
Storage

When storing the LM Guide, pack it as designated by THK and store it indoors in a horizontal position away from high or low temperatures and high humidity.
Please note that if the product has been kept in storage for an extended period, the lubricant inside may have deteriorated. Please ensure that you replenish the lubricant before using.

Disposal

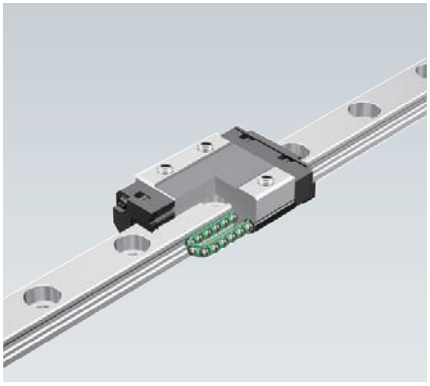
The product should be treated as industrial waste and disposed of appropriately.

Recommended Products



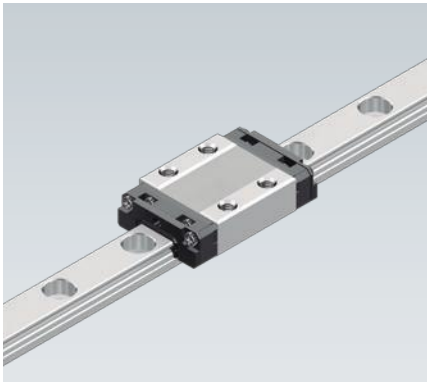
LM Guide
HSR

- ○ De facto global standard
- ○ 4-way equal load
- ○ Automatic adjustment capabilities
- ○ Sizes range from #8 to 150, with 23 block types for a total lineup of 129 products



Caged Ball Miniature LM Guide
SRS

- ○ Thin and compact
- ○ Low dust generation
- ○ Long-term maintenance-free operation
- ○ Sizes range from #5 to 20, with 6 block types for a total lineup of 30 products



Miniature LM Guide
RSX

- ○ Thin and compact
- ○ Customizable
- ○ Sizes range from #5 to 15, with 6 block types for a total lineup of 28 products

Miniature Roller Type LM Guide **HRG**

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