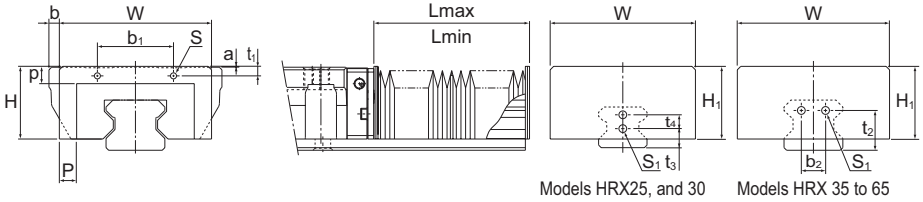
Dedicated Bellows JHRX for Model HRX

The table below shows the dimensions of dedicated bellows JHRX for model HRX. Specify the corresponding model number of the desired bellows from the table.



Models HRX25, and 30 Models HRX 35 to 65

Unit: mm

Model No.		Main dimensions																		A (Lmax / Lmin)	Supported model numbers	
								t_1						Screw size	Mounting bolt	a		b				
		W	H	H_1	P	p	b_1	C	R	b_2	t_2	t_3	t_4	S	S_1	C	R	C	R			
JHRX	25	78	38	38	16	15	29	3.7	7.7	—	—	10	8	M2	M3	−7	−3	−4	−15	6	HRX	25
	30	84	42	42	13.5	15	40	4	7	—	—	11	8	M2	M3	−5	−2	3	−12	7		30
	35	88	42	42	10	10	44	5	12	14	23	—	—	M3	M4	−0.5	6.5	6	−9	5		35
	45	100	51	51	20	12	52	5.2	15.2	20	29	—	—	M3	M5	0.5	10.5	10	−7	7		45
	55	108	57	57	20	13	54	7.3	17.3	26	35	—	—	M3	M5	2	12	16	−4	7		55
	65	132	75.5	75.5	25	20	80	9	19	32	42	—	—	M4	M6	2.5	12.5	19	−3	9		65

Notes: Please contact THK if you will be using the dedicated bellows in anything other than a horizontal orientation (i.e., vertical, wall-mounted, or inverted), or if you require heat-resistant specifications.
When using the bellows, lubrication is possible through methods such as a side nipple.
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

JHRX25 - 60/360

- JHRX25: Model number of bellows for HRX25
- 60/360: Dimensions of the bellows (length when compressed / length when extended)

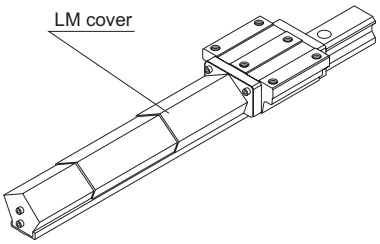
Note: The length of the bellows is calculated as follows.

$$L_{min} = \frac{S}{(A-1)}$$ S: Stroke length (mm)

$L_{max} = L_{min} \cdot A$ A: Extension rate

Dedicated LM Cover

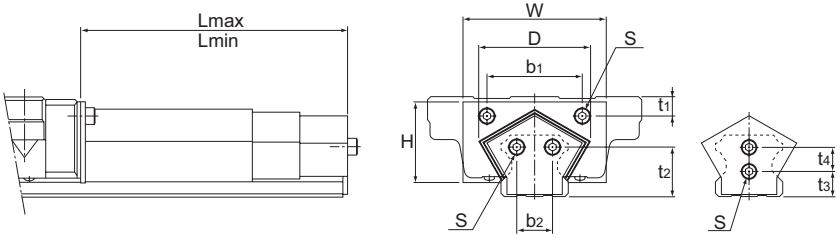
●For the supported models, see the table of options by model number on A1-542.
●For the dedicated LM cover dimensions, see A1-603.

Item name	Schematic diagram/mounting location	Purpose/location of use
Dedicated LM Cover		Used in locations exposed to dust or cutting chips Used in locations with high-temperature foreign material such as flying spatter

LM Cover

Dedicated LM Cover TPH for Model HSR

The tables below show the dimensions of the 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.		Main dimensions										Supported model numbers	
		W	D (max)	H	b_1	t_1	b_2	t_2	t_3	t_4	Mounting bolt S		
TPH	25	55	42	28	30	7	—	—	10	8	M3×6ℓ	HSR	25
	30	60	48	34	40	8	—	—	11	10	M4×8ℓ		30
	35	70	55	38	40	9	14	23	—	—	M4×8ℓ		35
	45	90	75	48	58	10	20	29	—	—	M5×10ℓ		45
	55	100	88	55	66	11	26	35	—	—	M5×10ℓ		55

Unit: mm

Model No.		Stage	L		Stroke
			min	max	
TPH	25	3	200	530	330
		3	150	380	230
		3	100	230	130
	30	3	250	680	430
		3	200	530	330
		3	150	380	230
	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
	55	4	400	1460	1060
		4	350	1330	980
		4	300	1060	760
		4	250	860	610

Notes: For lubrication when using the dedicated LM cover, contact THK.
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.

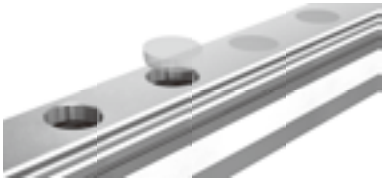
Model number coding

TPH55 - 400/1460

- TPH55: Model number of LM cover for HSR55
- 400: Lmin (cover length when compressed)
- 1460: Lmax (cover length when extended)

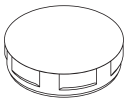
Dedicated Cap for LM Rail Mounting Holes

Using dedicated caps to cover the LM rail mounting holes helps prevent foreign material from entering the mounting holes and LM block.

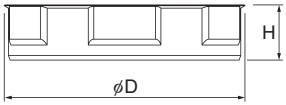


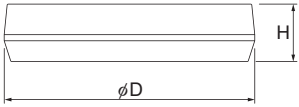
● CV Caps/C Caps

The caps are made of a special synthetic resin.
The CV cap is the successor to the C cap, and its new structure makes it easier to insert.



CV Cap





C Cap

Dimensions and Supported Model Numbers

Model No.	Bolt used	Main dimensions(mm)		Supported model number																	
		D	H	SSR	SR	SVR SVS NR-X NRS-X	NR NRS	SHS HSR SCR CSR HCR	HMG	SHW HRW	SRG SRN	SRW	GSR	HR	SRS RSR	SRS-W RSR-W	RSX	RSX-W	HRX	NSR-TBC	HDR
CV3	M3	6.3	1.2	—	15	—	—	12	—	—	—	—	—	1123 1530	12 15	9	12 15	9	—	—	—
CV4	M4	7.9	1	15Y	—	—	—	15	15	12[1], 14, 17, 21, 27	15	—	15	—	—	14	—	—	—	—	15
CV5	M5	9.8	2.6	20 25	20 25	25	—	20	—	—	20	—	20	2042	20	—	20	—	—	20	20
CV6	M6	11.4	2.6	25Y 30	25Y 30	30	—	25	25	35	25	—	25	—	25	—	25	—	25	25 30	25
CV8	M8	14.4	3.3	35	35	35	—	30 35	35	50	30 35	—	30	2555 3065	—	—	—	—	30 35	40	30 35
CV10	M10	17.9	3.3	—	45	—	—	—	—	60	—	70	35	3575	—	—	—	—	—	50	—
CV12	M12	20.4	3.4	—	55	45	—	45	45	—	45	85	—	4085	—	—	—	—	45	70	45
CV14	M14	23.4	5.5	—	—	55	—	55	—	—	55	100	—	—	—	—	—	—	55	—	55
CV16	M16	26.4	5.6	—	70 85	65	—	65	65	—	65	130	—	50105	—	—	—	—	65	—	65
C20	M20	32.3	5.7	—	—	—	75	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C22	M22	35.5	5.7	—	—	—	85	85	—	—	85	150	—	—	—	—	—	—	—	—	—
C24	M24	39.5	7.7	—	—	—	100	100	—	—	100	—	—	—	—	—	—	—	—	—	—

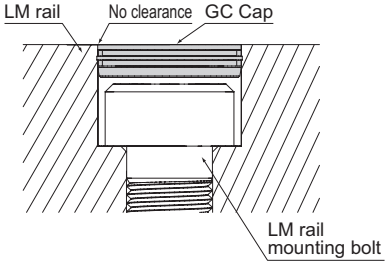
[1] #12 applies to SHW only.

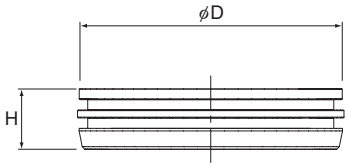
Notes: Contact THK if this product will be used in special environments such as in a vacuum, at very low or high temperatures, or with coolants or corrosive solvents.
CV caps and C caps must be arranged separately from the LM Guide.
Contact THK if caps C3 to 16 are desired.

● GC Caps

GC caps are made of metal. (They are RoHS compliant.)

GC caps adhere closer to the counterbore than CV caps and C caps, so there is no clearance once they are inserted.





Dimensions and Supported Model Numbers

Model No.	Bolt used	Main dimensions(mm)		Supported model number													
		D	H	SSR	SR	SVR SVS NR-X NRS-X	NR NRS	SHS HSR HCR	SCR CSR	SHW HRW	SRG SRN	SRW	HRX	GSR	HR	NSR-TBC	HDR
GC5	M5	9.86	2.5	20	20	25	—	20	20	—	20	—	—	20	2042	20	20
GC6	M6	11.36	2.5	25Y 30	25Y 30	30	—	25	25	35	25	—	25	25	—	25 30	25
GC8	M8	14.36	3.5	35	35	35	—	30 35	30 35	50	30 35	—	30 35	30	2555 3065	40	30 35
GC10	M10	17.86	3.5	—	45	—	—	—	—	60	—	70	—	35	3575	50	—
GC12	M12	20.36	4.6	—	55	45	—	45	45	—	45	85	45	—	4085	70	45
GC14	M14	23.36	5	—	—	55	—	55	—	—	55	100	55	—	—	—	55
GC16	M16	26.36	5	—	70 85	65	—	65	65	—	65	130	65	—	50105	—	65
GC22	M22	35.36	5	—	—	—	85	85	—	—	85	150	—	—	—	—	—
GC24	M24	39.36	5	—	120	—	100	100	—	—	100	—	—	—	—	—	—

Notes: GC caps are only sold with an LM Guide. They are not sold separately.
The LM Guide model number code will have “GC” at the end when it is delivered.

(Example 1) Multiple axes: SVR45LR+1200L - Ⅱ GC
- GC caps attached
- Symbol for No. of rails used on the same plane (2 axes)

(Example 2) One axis: SVR45LR+1200L GC
- GC caps attached

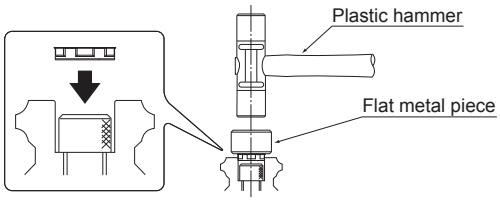
GC caps cannot be used with LM rails that are made of stainless steel or rails that have undergone surface treatment.
LM rail mounting holes for GC caps are special. (The mouth is not chamfered.)
Be careful not to injure your hand when inserting GC caps.
Be sure to make the GC caps level with the upper surface of the LM rail and clean (wipe) that surface after insertion.
If this product will be used in special environments, such as in a vacuum or at very low or high temperatures, contact THK.

● Guidelines for Use in Extreme Environments

Extreme environment		C cap CV cap	GC cap	Example applications
Foreign matter concentration: low	Metal powder, spatter	○	◎	Welding machines, robots
	Wood shavings, coolant (Environments that strip away oils)	○	◎	Woodworking machinery, washers
	Metal powder + coolant	○	◎	Lathes, machining centers
Foreign matter concentration: high	Metal powder, spatter	△	◎	Welding machines, robots
	Wood shavings, coolant (Environments that strip away oils)	△	◎	Woodworking machinery, washers
	Metal powder + coolant	△	◎	Lathes, machining centers

◎: Particularly effective; ○: Effective; △: Not particularly effective

● Cap Insertion Method



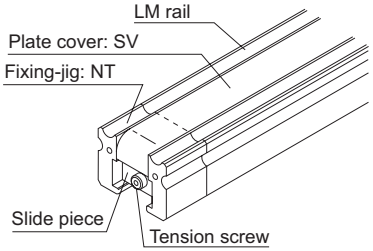
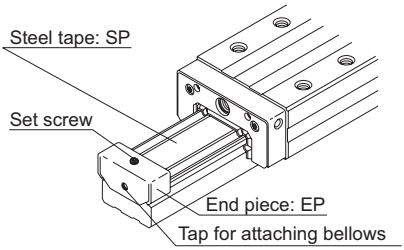
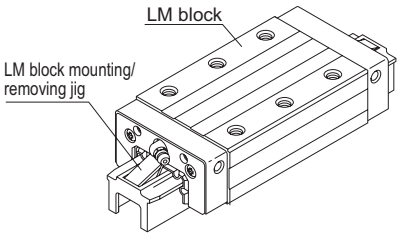
For best performance, caps must be inserted so that they are level with the rail surface. Have a flat alignment plate and plastic hammer available.

① Set the cap on the LM rail mounting hole and place the alignment plate on top.
② Use the plastic hammer to gradually drive the cap in until it is level with the upper surface of the LM rail.
③ As necessary, remove any slight burrs that appear.

Note: During installation or removal, burrs and small debris from the cap may scatter, so be sure to wear protective goggles and avoid using sharp tools during work.

Plate Cover SV and Steel Tape SP

●For the supported models, see the table of options by model number on A1-542.

Item name	Schematic diagram/mounting location	Purpose/location of use
Plate Cover SV		A plate cover is available as a means of essential contamination protection for LM Guide units intended for use in machine tools. By covering the LM rail mounting holes with ultra-thin stainless steel (SUS304), the plate cover SV drastically increases the effectiveness of the seal and prevents the penetration of coolant or cutting chips from the top face of the LM rail. For the mounting method, see A1-608. 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.
Steel Tape SP	 	Steel tape is available as a means of essential contamination protection for LM Guide units intended for use in machine tools. By covering the LM rail mounting holes with ultra-thin stainless steel (SUS304), the steel tape SP drastically increases the effectiveness of the seal and prevents the penetration of coolant or cutting chips from the top face of the LM rail. (When mounting the steel tape, end piece EP can be used as a means to secure the cover.) For the mounting method, see A1-609. 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.

Mounting Procedure for Plate Cover SV

(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.

(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. 5. If the difference is too large, one end may have insufficient interference.

(6) Mount the LM block on the LM rail.
Identify the reference surface of the LM rail and the LM block, then insert the LM rail into the LM block using the LM block mounting/removing jig.

Notes: When removing or mounting the LM block, use much care not to let the balls fall out.
The plate cover is an ultra-thin stainless steel (SUS304) plate. When handling it, use much care not to bend it.
The plate cover is available for model NR/NRS 75.

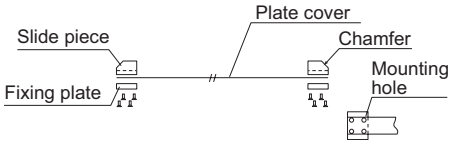


Fig. 1

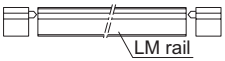


Fig. 2

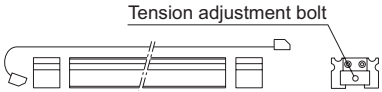


Fig. 3

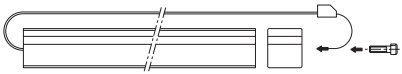


Fig. 4

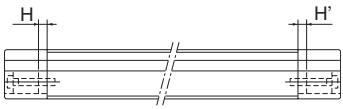


Fig. 5

Mounting Procedure for Steel Tape SP

(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) Secure the steel tape to the rail by pressing it down and rubbing it. The adhesive strength increases with time. However, if you wish to remove the tape, it can be removed by pulling it upward from the end.
(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 set screw on the top face of each end piece.
(The tap on the end face of the end piece is used for mounting bellows.)

Notes: The set screw 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.
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.

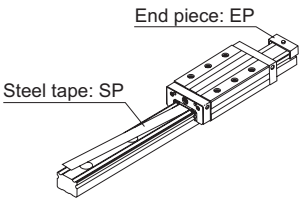


Fig. 6

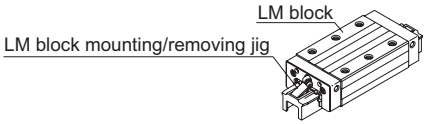


Fig. 7

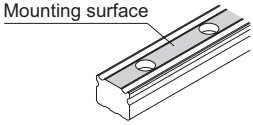


Fig. 8

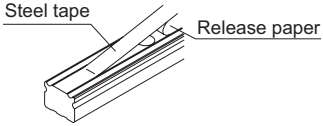


Fig. 9

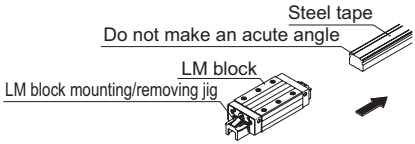


Fig. 10

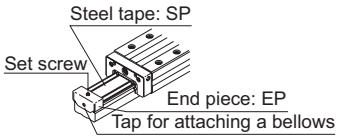


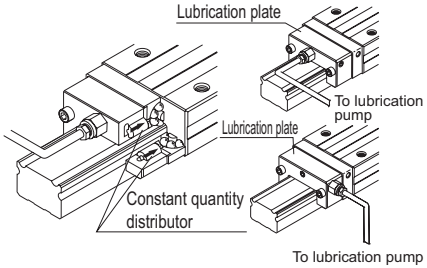
Fig. 11

Lubrication Adapter

An oil-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 a wall mount or inversed mount, the adapter is capable of feeding a constant quantity of lubricant to the four raceways.

Features

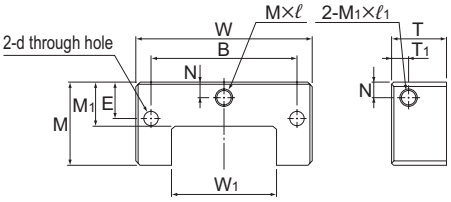
The dedicated lubrication adapter for models NR/NRS is built in with a constant quantity distributor. Therefore, the adapter can accurately feed a constant quantity of lubricant to each raceway regardless of the mounting orientation.
The adapter is economical since it constantly feeds the optimum amount of lubricant and can eliminate the supply of surplus lubricant.
To arrange the piping, simply connect an intermittent lubrication pump widely used for ordinary machine tools to the lubrication holes (M8) on the front and the side of the lubrication adapter.



Structural Drawing

Specifications

Viscosity range of lubricant used	32 to 64 mm²/s recommended
Discharge	0.03×4, 0.06×4 cc/1 shot
Diameter of pipe connected	ϕ 4, ϕ 6
Material	Aluminum alloy



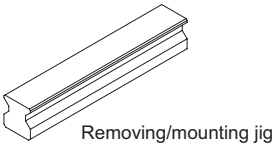
Dimensional Table

Unit: mm

Model No.	Main dimensions												Quantity per shot (cc)
	Width W	Height M	T	W_1	M_1	B	E	N	T_1	d	M×ℓ	$M_1 \times \ell_1$	
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	

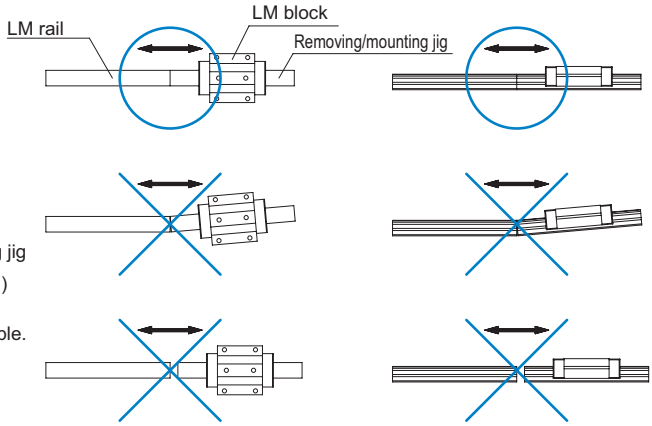
Removing/Mounting Jig

When assembling the guide, do not remove the LM block from the LM rail whenever possible. If removing the LM block is inevitable due to the plate cover type or the assembly procedure, be sure to use the removing/mounting jig.
Mounting the LM block without using the removing/mounting jig may cause rolling elements to fall from the LM block due to contamination by foreign material, damage to internal components, or slight inclination. Mounting the LM block with some of the rolling elements missing may also cause premature damage to the LM block.
When using the removing/mounting jig, fit its end directly to the end of the LM rail and do not incline the jig.
Depending on the model, a removing/mounting jig may not be available. If this is the case, use a spare LM rail. Contact THK for details.
If any of the rolling elements fall from the LM block, contact THK. Do not use the product in that condition.
Note that the removing/mounting jig is not included in the LM Guide package as standard. To obtain one, contact THK.



Removing/mounting jig
(Material: ABS resin)

This image shows one example.



End Piece EP

For models that can use the end piece, see the table below.
If removing the end piece when using the LM Guide, be sure that the LM block will not overshoot the rail.
The end piece can also be used as a fixing jig for steel tape protectors, and can also be used on LM rails of models SSR, SR, and HSR.

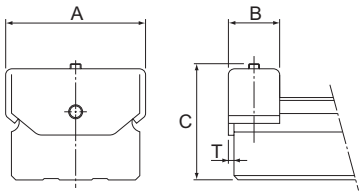


Fig. 1: End Piece EP for Models NR/NRS

Table 1: Dimensional Table for End Piece EP 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

Model Number Coding

Model number configurations differ depending on the model features. Refer to the corresponding sample model number configuration.

LM Guide

● **Models SHS, SSR, SVR/SVS, SHW, HSR, SR, NR-X/NRS-X, NR/NRS, HRW, JR, NSR-TBC, HDR, HSR-M1, SR-M1, and HSR-M2**

SHS25 LC 2 QZ KKHH C0 F S +1240L P Z T F S -II

- SHS25: Model No.
- LC: Type of LM block
- 2: No. of LM blocks used on the same rail
- QZ: With QZ Lubricator
- KKHH: Contamination protection accessory symbol [1]
- C0: Radial clearance symbol [2]
  Normal (No symbol)
  Light preload (C1)
  Medium preload (C0)
- F: LM block with surface treatment [3]
- S: LM block special feature symbol
  Standard (No Symbol)/E/S
- +1240L: LM rail length (in mm)
- P: Accuracy symbol [4]
  Normal grade (No Symbol)
  High accuracy grade (H)
  Precision grade (P)
  Super precision grade (SP)
  Ultra precision grade (UP)
- Z: With steel tape
- T: Symbol for LM rail jointed use
- F: LM rail with surface treatment [3]
- S: LM rail special feature symbol
  Standard (No Symbol)/E/S
- -II: Symbol for No. of rails used on the same plane [5]

[1] See contamination protection accessory on A1-584. [2] See A1-75.
[3] See B0-20. [4] See A1-80. [5] See A1-13.

Notes: 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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

● **Model EPF**

EPF7M 16 +55L P M

- EPF7M: Model No.
- 16: Guaranteed stroke (in mm)
- +55L: LM rail length (in mm)
- P: Accuracy symbol[1]
- M: Rail material:
  Stainless steel (standard)

[1] See A1-90.

Note: This model number indicates that a single-rail unit constitutes one set.

Roller Type LM Guide

● Models SRG, SRN, SRW, and HRX

SRG45 LC 2 QZ TTHH C0 F S +1200L P Z T F S -Ⅱ

- SRG45: Model No.
- LC: Type of LM block
- 2: No. of LM blocks used on the same rail
- QZ: With QZ Lubricator
- TTHH: Contamination protection accessory symbol[1]
- C0: Radial clearance symbol[2]
  - Normal (No symbol)
  - Light preload (C1)
  - Medium preload (C0)
  - Heavy preload (CN1)
  - Super heavy preload (CN2)
- F: LM block with surface treatment[3]
- S: LM block special feature symbol
  - Standard (No Symbol)/E/S
- +1200L: LM rail length (in mm)
- P: Accuracy symbol[4]
  - High accuracy grade (H)
  - Precision grade (P)
  - Super precision grade (SP)
  - Ultra precision grade (UP)
- Z: With plate cover
- T: Symbol for LM rail jointed use
- F: LM rail with surface treatment[3]
- S: LM rail special feature symbol
  - Standard (No Symbol)/E/S
- -Ⅱ: Symbol for No. of rails used on the same plane[5]

[1] See contamination protection accessory on A1-584. [2] See A1-75.
[3] See B0-20. [4] See A1-80. [5] See A1-13.

Notes: Models SRG15 to 65 are available in High Accuracy grade and above. Other models are only available in Precision grade and above. (Normal grade is not available.)
Model SRN is available in High Accuracy grade and above. (Normal grade is not available.)
Model SRW is available in precision grade and above. (Normal and high accuracy grade are not available.)
The Model HRX is only available in High Accuracy grade and Precision grade.
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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

Miniature LM Guide

● Models SRS, RSX, RSR, RSX-M1, and RSR-M1

2 SRS20M QZ UU C1 F S +220L P M F S -Ⅱ

- 2: No. of LM blocks used on the same rail [1]
- SRS20M: Model No.
- QZ: With QZ Lubricator
- UU: Contamination protection accessory symbol [2]
- C1: Radial clearance symbol [3]
  - Normal (No symbol)
  - Light preload (C1)
- F: LM block with surface treatment [4]
- S: LM block special feature symbol
  - Standard (No Symbol)/E/S
- +220L: LM rail length (in mm)
- P: Accuracy symbol [5]
  - Normal grade (No Symbol)
  - High accuracy grade (H)
  - Precision grade (P)
- M: Stainless steel LM rail
- F: LM rail with surface treatment[4]
- S: LM rail special feature symbol
  - Standard (No Symbol)/E/S
- -Ⅱ: Symbol for No. of rails used on the same plane[6]

[1] No symbol for 1 LM block. [2] See contamination protection accessories on A1-584.
[3] See A1-75. [4] See B0-20. [5] See A1-80. [6] See A1-13.

Notes: 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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

Cross LM Guide

● Models SCR, CSR, and MX

4 SCR25 QZ KKHH C0 +1240/1000L P

- 4: Total No. of LM blocks
- SCR25: Model No.
- QZ: With QZ Lubricator
- KKHH: Contamination protection accessory symbol [1]
- C0: Radial clearance symbol [2]
  - Normal (No symbol)/Light preload (C1)
  - Medium preload (C0)
- +1240/1000L: LM rail length on the X axis (in mm) / LM rail length on the Y axis (in mm)
- P: Accuracy symbol [3]
  - Precision grade (P)/Super precision grade (SP)
  - Ultra precision grade (UP)

[1] See contamination protection accessory on A1-584. [2] See A1-75. [3] See A1-80.

Note: Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.

Separate Type LM Guide

● Model HR

2 HR2555 UU M +1000L P T M

- 2: No. of LM blocks used on the same rail
- HR2555: Model No.
- UU: Contamination protection accessory symbol [1]
- M: Stainless steel LM block
- +1000L: LM rail length (in mm)
- P: Accuracy symbol [2] Normal grade (No Symbol)/High accuracy grade (H)/Precision grade (P) Super precision grade (SP)/Ultra precision grade (UP)
- T: Symbol for LM rail jointed use
- M: Stainless steel LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Note: One set of model HR means a combination of two LM rails and LM blocks used on the same plane.

● Model GSR

- Combination of LM rail and LM block

GSR25 T 2 UU +1060L H T K

- GSR25: Model No.
- T: Type of LM block
- 2: No. of LM blocks used on the same rail
- UU: Contamination protection accessory symbol [1]
- +1060L: LM rail length (in mm)
- H: Accuracy symbol [2] Normal grade (No Symbol)/High accuracy grade (H)/Precision grade (P)
- T: Symbol for LM rail jointed use
- K: Symbol for tapped-hole LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Note: One set of model GSR: This model number indicates that a single-rail unit constitutes one set.

- LM block

GSR25 T UU

- GSR25: Model number
- T: Type of LM block
- UU: Contamination protection accessory symbol[1]

- LM rail

GSR25 -1060L H K

- GSR25: Model number
- -1060L: LM rail length (in mm)
- H: Accuracy symbol[2] Normal grade (No Symbol) High accuracy grade (H) Precision grade (P)
- K: Symbol for tapped-hole LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Curved Guide

● Model HCR

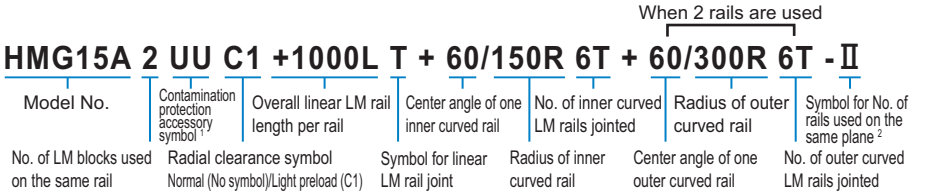
HCR25A 2 UU C1 +60 / 1000R H 6 T

- HCR25A: Model No.
- 2: No. of LM blocks used on the same rail
- UU: Contamination protection accessory symbol [1]
- C1: Radial clearance symbol [2] Normal (No symbol)/Light preload (C1)
- +60: R-Guide center angle
- 1000R: LM rail radius (in mm)
- H: Accuracy symbol [3] Normal grade (No Symbol)/High accuracy grade (H)
- 6: Number of LM rail joints used on one axis[4]
- T: Symbol for LM rail jointed use[5]

[1] See A1-584 (contamination protection accessories). [2] See A1-75. [3] See A1-80.
[4] Number of LM rails used for one arc. Contact THK for details.
[5] When using joined LM rails for models HCR15 to 65, the end seal utilized for contamination protection options will be a low-resistance end seal.

Straight-and-Curved Guide

● Model HMG

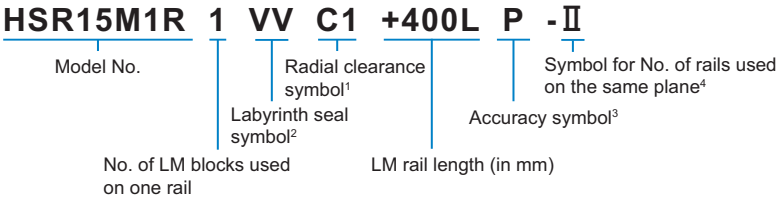


[1] See contamination protection accessory on **A1-584**. [2] See **A1-13**.

Notes: This model number denotes one set consists of an LM block and LM rail (i.e. If you are using 2 shafts, the required number of sets is 2).
The standard Model HMG does not have a seal. To attach a seal, make sure to specify a straight-and-curved seal (code: UU).

LM Guide for Medium-to-Low Vacuums

● Model HSR-M1VV

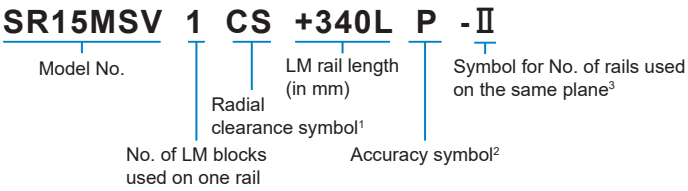


[1] See **A1-75**. [2] See **A1-431**. [3] See **A1-80**. [4] See **A1-13**.

Notes: The radial clearance, maximum LM rail length and accuracy class are equal to that of Model HSR.
With this model, a single-rail unit constitutes one set (i.e., the required number of sets when 2 rails are used in parallel is 2).

Oil-Free LM Guide for Special Environments

● Model SR-MS



[1] See **A1-75**. [2] See **A1-80**. [3] See **A1-13**.

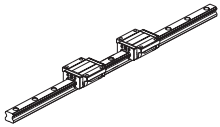
Note: This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Notes on Ordering

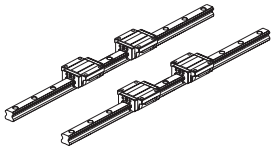
Order Units

Note that the number of items that constitute one set differs depending on the type of LM guide. Check the sample model number configurations and the accompanying notes.

- **Sample LM Guide Orders**

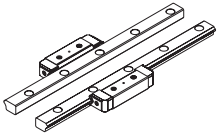


SHS25C2SSC1+640L 1 set



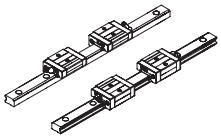
SHS25C2SSC1+640L-Ⅱ2 sets

- **Sample Model HR Orders**



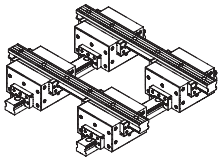
HR2555UU+600L 1 set

- **Sample Model GSR and GSR-R Orders**



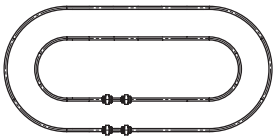
GSR25T2UU+1060L 2 sets

- **Sample Cross LM Guide Orders (SCR, CSR, and MX)**



4SCR25UU+1240/1000LP 1 set

- **Sample Model HMG Orders**



HMG15A 2 UU C1 +1000L T + 60/150R 6T + 60/300R 6T - Ⅱ 2 sets

Note: When ordering Model HMG, attach a reference diagram clearly showing the positioning of the LM block and LM rail.

Mounting Orientation and Lubrication Method

When placing an order, be sure to let THK know the mounting orientation and the exact position on each LM block where the grease nipple or the piping joint should be attached.
For the mounting orientation and the lubrication, see **A1-12** and **A24-2**, respectively.

Supported Options

The supported options differ depending on the model number. Check the available options when ordering.
See **A1-542**.

Maximum Manufactured Lengths for LM Rails

Where a high degree of precision is required, limits apply to the maximum manufactured lengths for LM rails. In such situations, contact THK.

LM Guide Handling Precautions

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 will 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.

Precautions on Use

(1) Prevent foreign material, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
(2) If the product is used in an environment where cutting chips, coolant, corrosive solvents, water, etc., may enter the product, use bellows, covers, etc., to prevent them from entering the product.
(3) Do not use the product at temperatures of 80℃ or higher. Unless the unit is specially designed to be heat-resistant, exposure to such temperatures may deform or damage plastic and rubber parts.
(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 areas of contact on the rolling elements, 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 nut to stroke a distance roughly equal to its length to help ensure that a film forms between the raceways and rolling elements.
(6) Do not forcibly drive a pin, key, or 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) Take care to keep the LM block straight. Loading the block at an angle can introduce foreign matter, damage internal components, or cause balls to fall out.
(10) The LM block must contain all its internal rolling elements when mounted on the LM rail. Using a block with any balls or rollers removed may result in premature damage.
(11) If any of the rolling elements fall from the LM block, contact THK. Do not use the product in that condition.

(12) If the LM Guide breaks due to an accident or other cause, the block may come off of the rail and fall. For the safe use of these products, take precautions such as adding a mechanism to prevent the block from falling.
(13) For the 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 remove anti-rust oil and apply lubricant before using the product.
(2) Do not mix different lubricants. Even greases 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 clean rooms, vacuums, and extreme heat or cold, use a lubricant suitable for its use/environment.
(4) When lubricating the product having no grease nipple or lubrication hole, apply grease directly on the raceway and stroke the product several times to let the grease spread inside.
(5) The consistency of grease changes according to the temperature. Take note that the slide resistance of the LM Guide may be affected by changes in viscosity.
(6) After lubrication, the slide 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) Although the lubrication interval may vary according to operating conditions and the service environment, lubrication should be performed approximately every 100 km in travel distance (three to six 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. For the mounting orientation and the lubrication, see B**1-28** and B**24-2**, respectively.
(11) When using oil lubrication, the lubricant may not be distributed throughout the LM block due to the mounting orientation of the block. Contact THK in advance 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 use.
If you request that we do not apply anti-rust oil to a product, please be aware that it may rust due to the storage environment or length of storage.

Disposal

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

Handling Precautions for LM Guide Models for Special Environments

LM Guide for Medium-to-Low Vacuums

Handling

(1) This product has been thoroughly cleaned and degreased and then sealed in moisture-proof packaging. If possible, open the package immediately prior to using the product.
(2) Once the packaging has been opened, store the product inside a clean, dry receptacle accompanied by silica gel or another drying agent. Do not use anti-rust oil or volatile corrosion inhibitor paper (or other VCI material) with this product.
(3) Wear protective rubber or vinyl gloves while handling this product and make sure the surrounding environment is relatively clean.

Oil-Free LM Guide

Handling

(1) The oil-free LM Guide is suitable for use at high temperatures, under atmospheric pressure or in a high-vacuum environment of 10^{-6}Pa, and is designed for ultra-low dust emission. It is not intended for use in locations requiring rigidity. Because a preload would affect the strength of its S-Coating Dry Film Lubricant, it does not support preloads.
(2) The product can be used in temperatures ranging from -20°C to 150°C.
(3) To ensure proper function of the S-Coating Dry Film Lubricant, use this product in an environment free from condensation, at a humidity level of 40% or less.
(4) This product is not intended for joint use.
(5) Great care must be taken in the installation of the oil-free LM Guide, which requires greater precision compared to standard LM Guides.
(6) If the LM block is removed from the LM rail, balls may fall out, and the S-Coating Dry Film Lubricant can be damaged when the block is remounted. If it becomes necessary to remove the LM block from the LM rail, please contact THK.
(7) This product should be stored in a horizontal position, in its original wrapping and package, in a controlled, stable environment free from abnormal high or low temperatures or high humidity. THK recommends storing it at room temperature (25±5°C), with a humidity level of 40% RH or lower and an air-purity level of 10,000 or lower.
(8) This product has been thoroughly cleaned and degreased and then sealed in moisture-proof packaging. If possible, open the package immediately prior to using the product.
(9) Once the packaging has been opened, store the product inside a clean, dry receptacle accompanied by silica gel or another drying agent. Do not use anti-rust oil or volatile corrosion inhibitor paper (or other VCI material) with this product.
(10) Wear protective rubber or vinyl gloves while handling this product and make sure the surrounding environment is relatively clean.

Handling Precautions for Optional Accessories for the LM Guide

QZ Lubricator for the LM Guide

For details regarding the QZ Lubricator, see A1-575.

Selection Precautions

Secure a stroke longer than the overall LM block with QZ Lubricator attached.

Handling

Take care not to drop or strike this product. Otherwise, it may cause injury or damage the unit.
Do not block the vent hole with grease or the like.
The QZ Lubricator supplies oil only to the raceway, so use it in combination with regular greasing/oil lubrication. If the product is used in an environment exposed to coolant, cutting chips, or other foreign material, oil on the raceway is lost easily. Accordingly, be sure to also use covers, bellows, etc.

Service Environment

Be sure the service temperature of this product is between -10℃ and 50℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

Laminated Contact Scraper LaCS, Side Scraper for the LM Guide

For details regarding the Laminated Contact Scraper LaCS, see A1-548. For details regarding the side scraper, see A1-550.

Handling

The lubricant impregnated into the scraper is used to increase its sliding capability. For lubrication of the LM Guide, attach a QZ Lubricator or grease nipple to the side face of the end plate of the LM block before providing a lubricant.
When using these products, be sure to attach C caps or a plate cover to the rail.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

Notes on Product Functions

It is specifically designed to provide dust prevention capability to remove foreign material and liquid. To seal oil, an end seal is required.

Light Contact Seal LiCS for the LM Guide

For details regarding the Light-Resistance Contact Seal LiCS, see A1-553.

Handling

The lubricant impregnated into Light-Resistance Contact Seal LiCS is used to increase its sliding capability. For lubrication of the LM Guide, attach the grease nipple on the end plate of the LM block before lubricating.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.
It only makes contact with the LM rail raceway. Do not use it in harsh environments.

High Chemical Resistance Fluorine Seal FS for the LM Guide

For details about the high chemical-resistance fluorine seal, see A1-554.

Handling

Be careful not to twist the seal portion when attaching the high chemical-resistance fluorine seal to the LM Guide. Also, do not store the product in a way that may deform the seal, such as by stacking it. This may cause damage or reduce the seal's functionality.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

GC Cap

For details regarding the GC cap, see A1-605.

Handling

If GC caps are specified for the product, the edges of the LM rail mounting hole openings will be sharp. Take great care not to injure your fingers or hands while working.
When fitting GC caps, use a flat aligning tool to gradually punch the cap into the hole until it is level with the upper surface of the LM rail. Then run an oil stone over the rail until the upper surface of the rail and the GC caps are completely flat.
During installation or removal, burrs and small debris on the cap may scatter, so be sure to wear protective goggles and avoid using sharp tools during work.



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Features of the LM Guide

Functions Required from a Linear Guide Surface

Large permissible load	Smooth motion with no clearance
Highly rigid in all directions	Superb high-speed performance
High positioning repeatability	Easy maintenance
Running accuracy can be obtained easily	Can be used in various environments
High accuracy can be maintained over a long period	

Features of the LM Guide

Large permissible load and high rigidity

Averages accuracy by absorbing mounting surface error

Ideal structure with four raceways, circular-arc grooves, and two-point contact

Superb error-absorbing capability with DF design

Low friction coefficient

Wide array of options (QZ lubricator, Laminated Contact Scraper LaCS, etc.)

As a result, the following features are achieved.

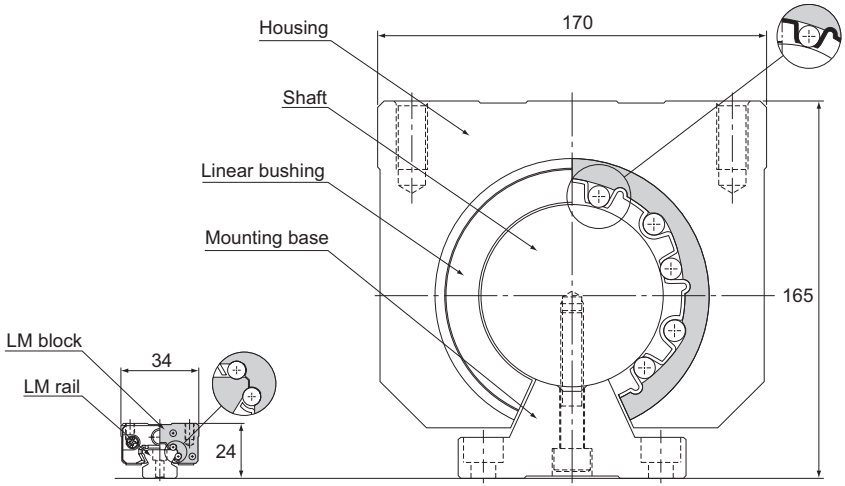
Easy maintenance
Improved productivity of the machine
Substantial energy savings
Low total cost
Higher accuracy of the machine
Higher efficiency in machine design

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 a significant difference from products such as a linear bushing. Fig. 1 compares LM Guide units and linear bushings with similar basic dynamic load ratings. The marked difference in size indicates that more compact design can be achieved with the LM Guide.

This is because the structure of the curved groove (with a radius equal to 52% of the ball diameter) allows each ball to bear a load 13 times greater than it could in a structure in which the balls contact a flat surface. 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 times that of a linear bushing.



LM Guide Model SSR15XW
Basic dynamic load rating: 14.7 kN

Linear Bushing Model LM80 OP
Basic dynamic load rating: 7.35 kN

Fig. 1: Comparison between the LM Guide and the Linear Bushing

Table 1: Load Capacity per Ball (P and P_1)
Permissible contact surface pressure: 4,200 MPa

Ball diameter	R-groove (P)	Flat surface (P_1)	P/P_1
ϕ3.175 mm (1/8″)	0.90 kN	0.07 kN	13
ϕ4.763 mm (3/16″)	2.03 kN	0.16 kN	13
ϕ6.350 mm (1/4″)	3.61 kN	0.28 kN	13
ϕ7.938 mm (5/16″)	5.64 kN	0.44 kN	13
ϕ11.906 mm (15/32″)	12.68 kN	0.98 kN	13

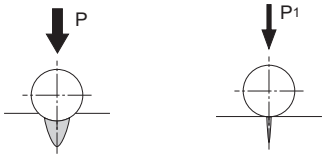


Fig. 2: Load Capacity per Ball

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: SVR45LC/C0
(C0 clearance: preload = 11.11 kN)
Ball Screw: BNFN4010-5/G0
(G0 clearance: preload = 2.64 kN)
Spindle: general-purpose cutting spindle

Table 2: Comparison of Static Rigidity

Unit: N/μm

Components	X-axis direction	Y-axis direction	Z-axis direction
LM Guide	—	2400	9400 (radial) 7400 (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.

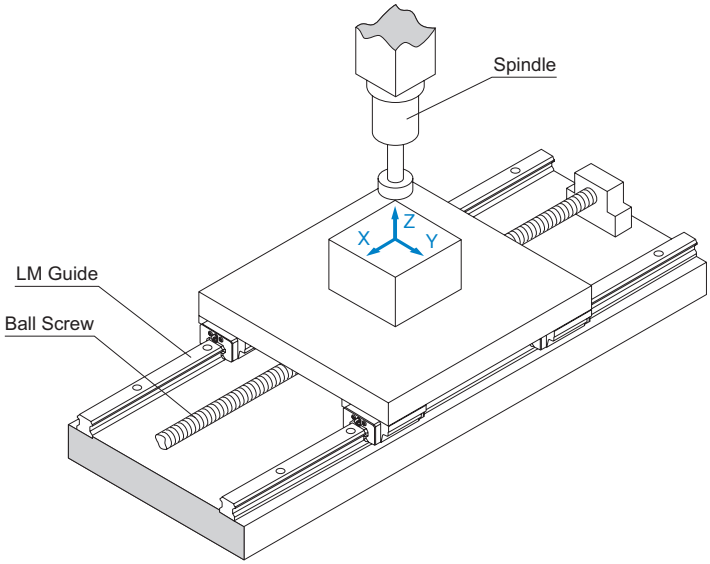
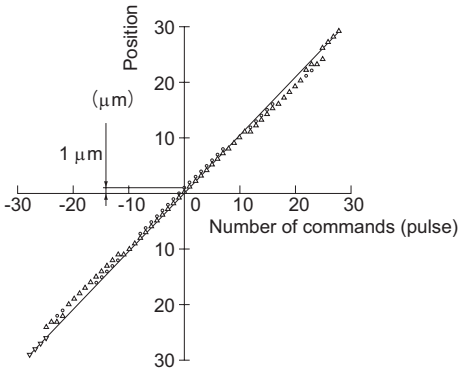


Fig. 3

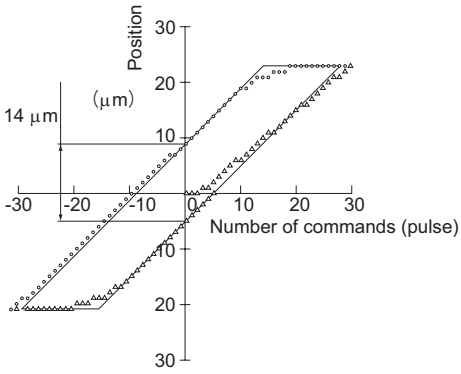
High Precision of Motion

Minimal Lost Motion

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



LM Guide Model HSR45



Square Slide + Turcite

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

Fig. 4: Comparison of Lost Motion between an LM Guide and a Slide Guide

Table 3: Lost Motion Comparison

Unit: μm

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

[1] See Table 4 for the radial clearance of the LM Guide.

Table 4: Radial Clearance of the LM Guide

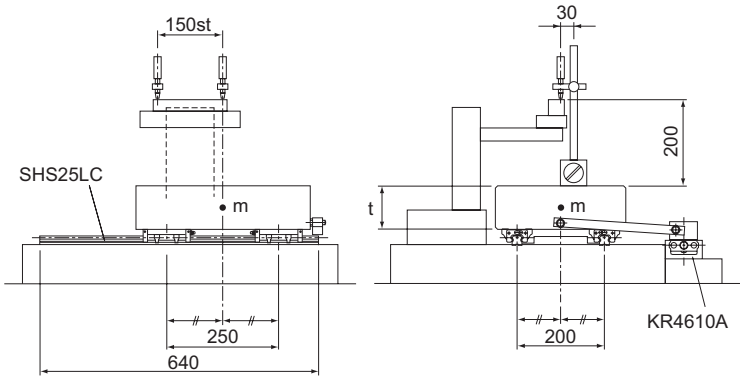
Unit: μm

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

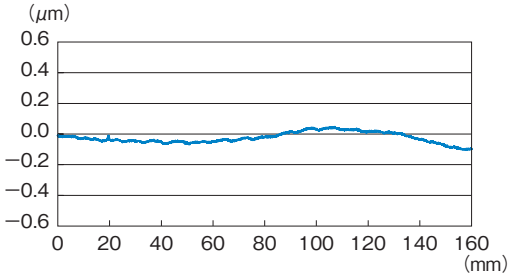
High Running Accuracy

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

Measurement method



Pitching accuracy



Yawing accuracy

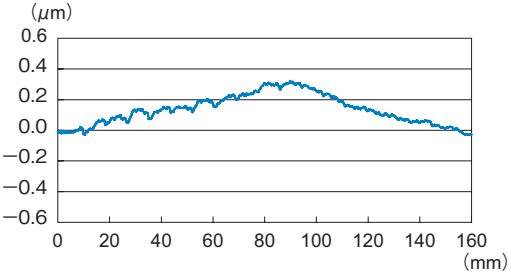


Fig. 5: Dynamic Accuracy of a Single-Axis Table

High Accuracy Maintained over a Long Period

The LM Guide employs an ideal rolling mechanism with negligible wear and high precision that is maintained over a long period of time. As shown in Fig. 6, 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.

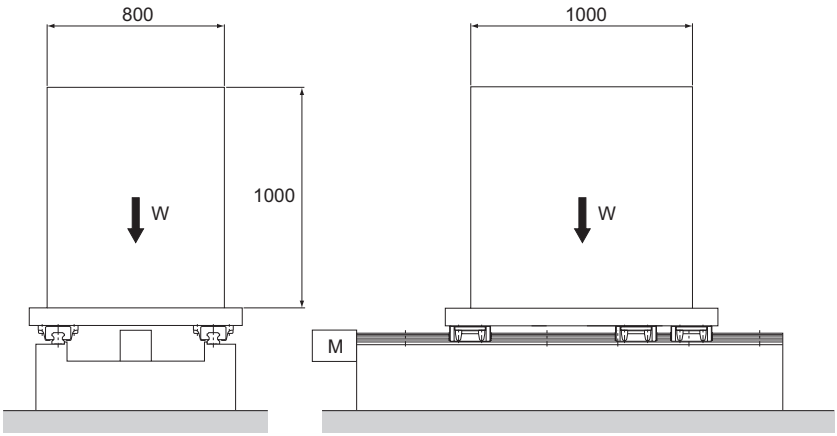


Fig. 6: Operating Conditions

Operating conditions
Model No. : HSR65L
Radial clearance
: C0 (preload: 15.7 kN)
Stroke : 1,050 mm
Speed : 15 m/min (stops 5 sec at both ends)
Acceleration/deceleration time in rapid motion
: 300 ms (acceleration: α = 0.833 m/s^2)
Mass : 6000 kg
Drive : Ball screw
Lubrication : Lithium soap-based grease No. 2
(greased every 100 km)

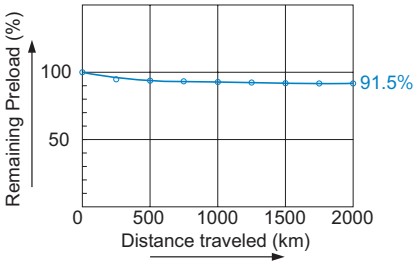


Fig. 7: Distance Traveled and Remaining Preload

Averages Accuracy by Absorbing Mounting Surface Error

The LM Guide contains highly spherical balls and has a self-contained structure with no clearance. In addition, because several LM rails can be used in parallel to form a multiple-axis guide system, the LM Guide is capable of averaging and absorbing straightness, flatness, or parallelism errors that might occur in the machining of the base to which the LM Guide is to be mounted or in the installation of the LM Guide.

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. 8, the magnitude of misalignment and the actual dynamic accuracy of the table (straightness in the horizontal direction) are as shown in Fig. 9.

By applying such characteristics obtained with the averaging effect, you can easily establish a guide system with highly precise motion.

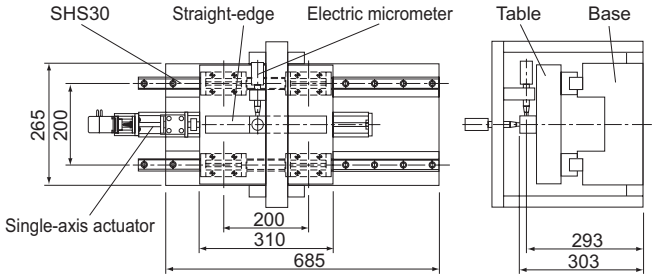


Fig. 8

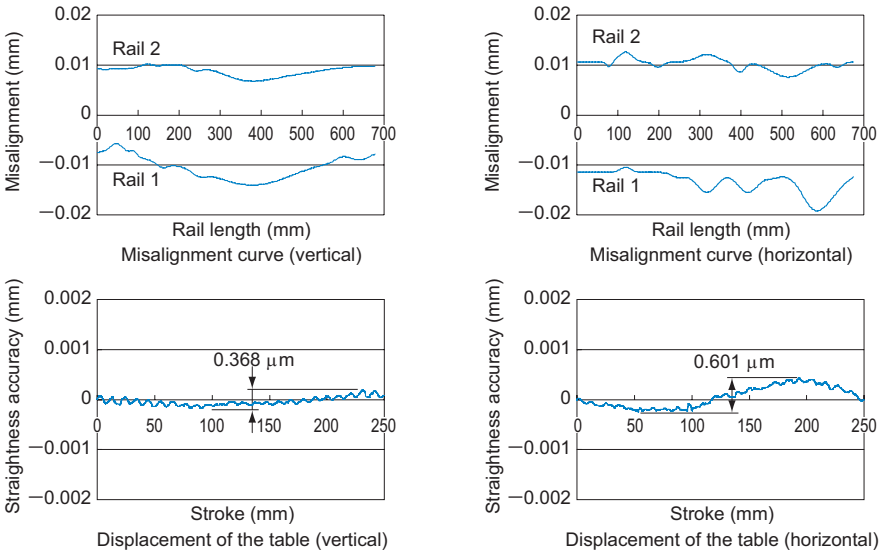


Fig. 9

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

Installation Example

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 5: Actual Measurement of Mounting Surface Accuracy

Unit: μm

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

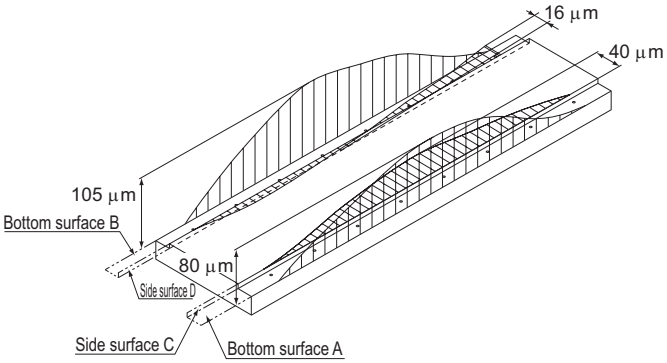


Fig. 10: Surface Accuracy of the LM Guide Mounting Base (Milled Surface Only)

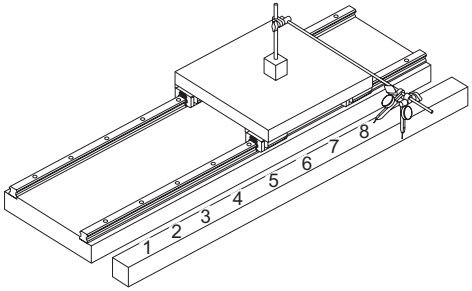


Fig. 11: Running Accuracy After the LM Guide Is Mounted

Table 6: Actual Measurement of Running Accuracy on the Table (Based on Measurement in Fig. 10 and Fig. 11)

Unit: μm

Direction	Measurement point								
	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

Easy Maintenance

Unlike with sliding guides, the LM Guide does not incur uneven wear. As a result, sliding surfaces do not need to be reconditioned, and precision does not need to 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. This makes maintenance simple and also helps keep the work environment clean.

Substantial Energy Savings

As shown in Table 7, the LM Guide has a substantial energy saving effect.

Table 7: Comparative Data on Sliding and Rolling Characteristics

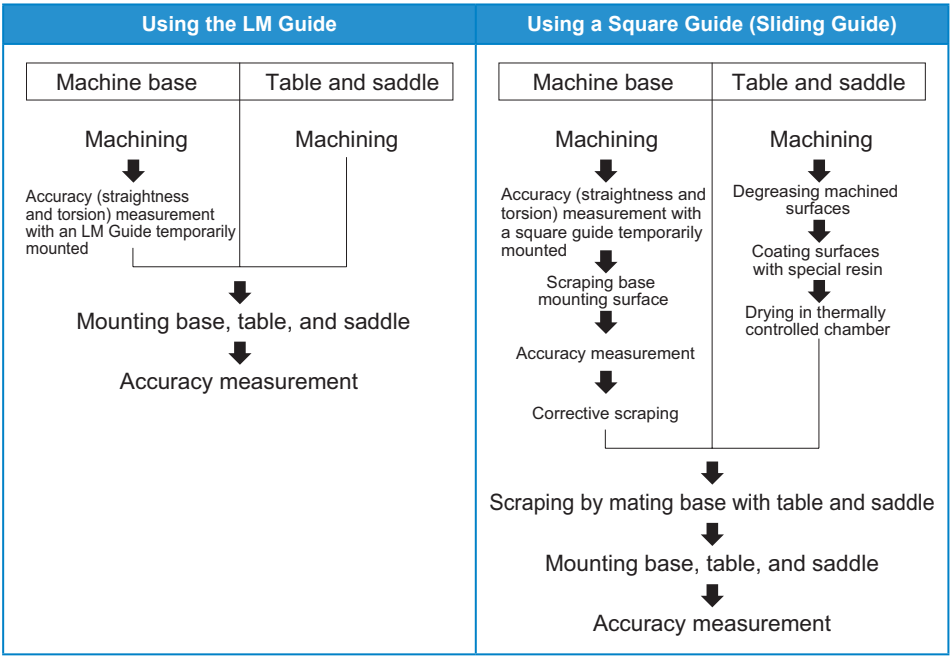
Machine specifications		
Type of machine	Single-axis surface grinding machine (sliding guide)	Three-axis surface grinding machine (rolling guide)
Overall length × overall width	13 m×3.2 m	12.6 m×2.6 m
Total mass	17000 kg	16000 kg
Table mass	5000 kg	5000 kg
Grinding area	0.7 m×5 m	0.7 m×5 m
Table guide	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	38.05 kW	3.7 kW	10.3
Drive hydraulic pressure	Bore diameter ϕ 160×1.2 MPa	Bore diameter ϕ 65×0.7 MPa	—
Thrust	23600 N	2270 N	10.4
Electric power consumption	38 kWH	3.7 kWH	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

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. This reduces assembly labor and allows machines and systems incorporating the LM Guide to be produced at a lower cost. The figure below shows an example of the difference in the assembly procedures for machining centers that use sliding guides and those that use LM Guides.
Normally, with a sliding guide, the surface on which the guide is installed must be ground to a very smooth finish. 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 labor and lowers machining costs as a whole.

Assembly Procedure for a Machining Center



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

Ideal Structure with Four Raceways, Circular-Arc Grooves, and Two-Point Contact

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

Comparison of Characteristics between the LM Guide and Similar Products

LM Guide: structure with four raceways, circular-arc grooves, and two-point contact	Other Product: structure with two raceways, Gothic-arch grooves, and four-point contact
LM Guide Model HSR	**Two-row Gothic-arch groove product**

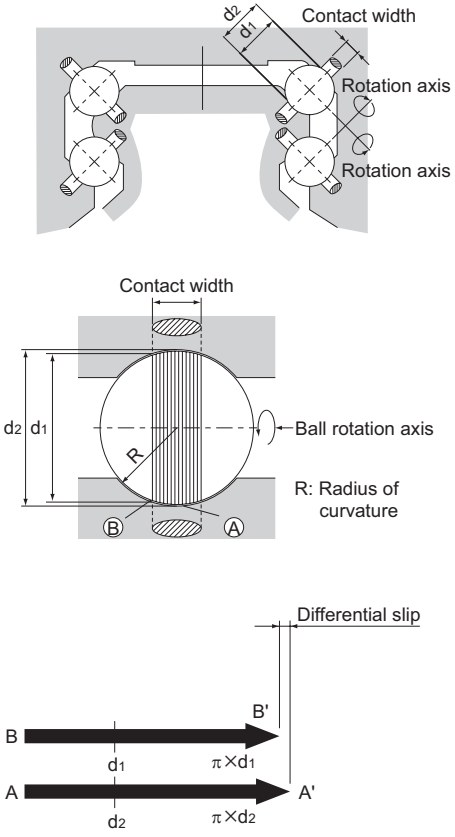


Fig. 12

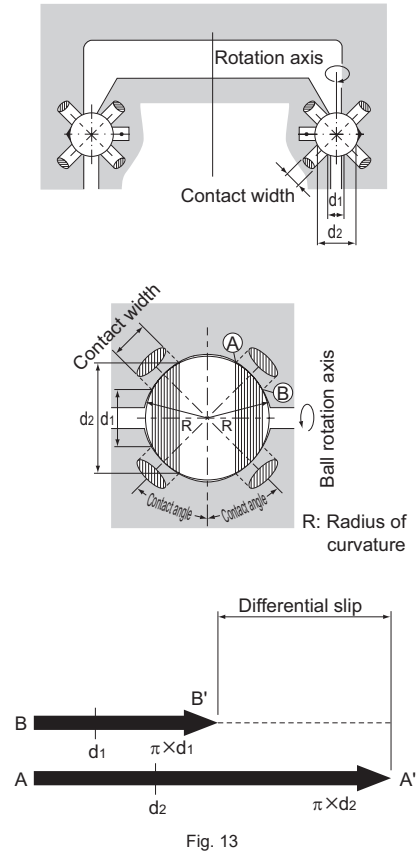
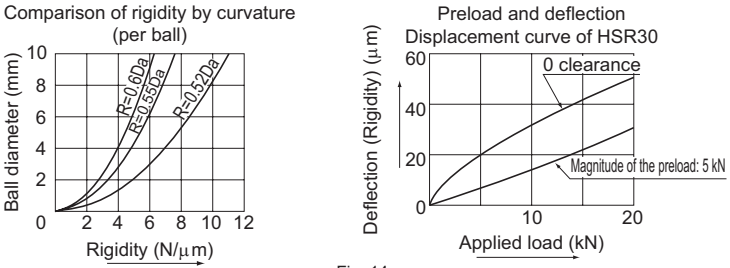


Fig. 13

As indicated in Fig. 12 and Fig. 13, for each revolution, the ball slips a distance equal to the difference between the circumference of the inner contact diameter (πd_1) and the circumference 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.

Structure with four raceways, circular-arc grooves, and two-point contact	Structure with two raceways, Gothic-arch grooves, and four-point contact
Smooth Motion	
Since the balls contact the raceway at two points in the load direction, as shown in Fig. 12 and Fig. 13 on B**1-19**, whether under preload or normal load, the difference between d_1 and d_2 is small, as is the differential slip, allowing a smooth rolling motion.	The difference between d_1 and d_2 in the contact area is large as shown in Fig. 12 and Fig. 13 on B**1-19**. 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 life as a result of abnormal wear. (1) A preload is applied (2) A lateral load is applied. (3) If two or more rails are mounted and they are not properly aligned (4) If spinning occurs
Accuracy 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 is 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 conveyance systems.	In a product with Gothic-arch grooves, each ball contacts the groove at four points, which inhibits elastic deformation in the ball and prevents the contact points from moving (i.e., the product has 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 two-point contact, even if a relatively large preload is applied, the rolling resistance does not abnormally increase and high rigidity can be obtained. Since differential slip occurs due to four-point contact, a sufficient preload cannot be applied and high rigidity cannot be obtained.	Since differential slip occurs due to the four-point contact, a sufficient preload cannot be applied and high rigidity cannot be obtained.
Load Rating	
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 approximately 50% of that of the circular arc groove.
Difference in Rigidity	
As shown in Fig. 14, the rigidity widely varies according to the difference in curvature radius or difference in preload. **Curvature Radius and Rigidity**  Fig. 14	
Difference in Service Life	
Since the load rating of the Gothic-arch groove is reduced to approximately 50% of that of the circular-arc groove, the service life also decreases to 87.5%.	

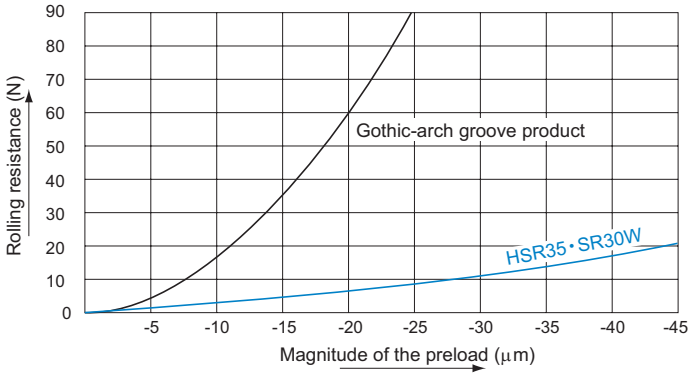
Accuracy Error of the Mounting Surface and Test Data on Rolling Resistance

The difference between the contact structures translates into rolling resistance.
In the Gothic-arch groove contact structure, each ball makes contact at four points and differential slip or spinning occurs if a preload is applied to increase rigidity or if there is large error in the mounting precision. This sharply increases the rolling resistance and causes abnormal wear at an early stage.
The following are test data obtained by comparing an LM Guide with the four-raceway, circular-arc groove, two-point contact structure and a product with a two-raceway, Gothic-arch, four-point contact structure.

Sample		Conditions
(1) LM Guide		Radial clearance: ±0 μm
SR30W (self-adjusting type)	2 sets	Without seal
HSR35 (4-way equal-load type)	2 sets	Without lubrication
(2) Two-row, Gothic-arch groove product		Load: table mass of 30 kg
Type with dimensions similar to HSR30	2 sets	

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 between Two Axes and Rolling Resistance

As shown in Fig. 15, part of the rails mounted in parallel is displaced along the parallel axis and the rolling resistance at that point is measured.
With the Gothic-arch groove product, the rolling resistance is 34 N when the error in parallelism 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.

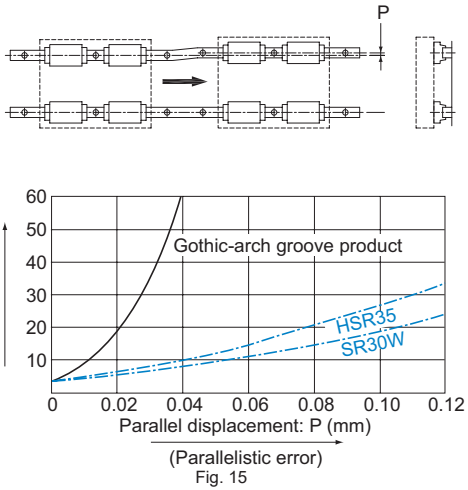
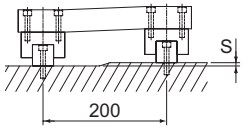
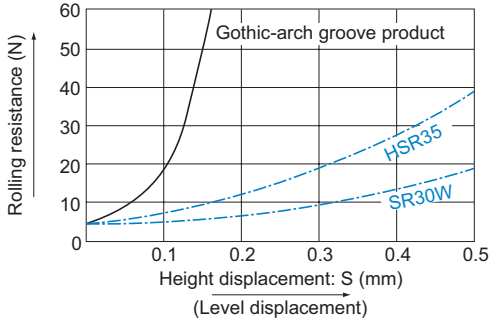


Fig. 15

Data 3: Difference between the Levels of the Top and Bottom Rails and Rolling Resistance

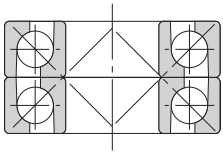
Displace the bottom of either rail vertically by S and create the height difference between the two axes. Then, measure the rolling resistance. If the LM Guide has a Gothic-arch groove, this will cause spinning. An LM Guide with a circular-arc groove is capable of absorbing the error caused by a height difference between rails as great as 0.3/200 mm, where its rolling resistance will not increase significantly.



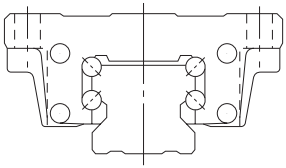


Superb Error-Absorbing Capability with DF Design

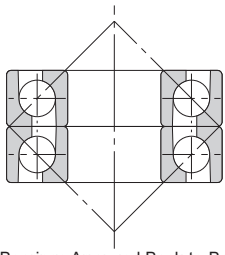
Since the LM Guide has a contact structure similar to the front-to-front mount of angular ball bearings, it has superb self-adjusting capability.



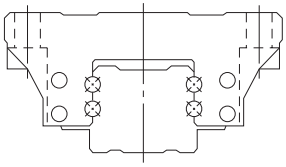
Angular Ball Bearings Arranged Front-to-Front (DF Type)
As the distance between the application points is small, the permissible tilt angle is large (this provides a high degree of self-adjustment).



DF Type Four-Row Angular Contact (LM Guide)
It has an internal structure that will not be easily affected by inconsistencies on the mounting surface.

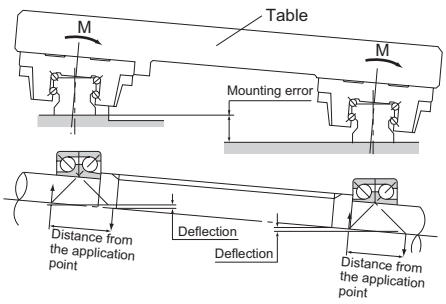
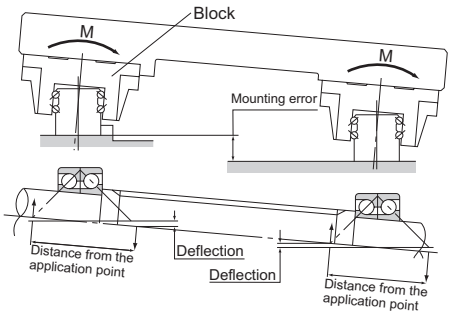


Angular Ball Bearings Arranged Back-to-Back (DB Type)
As the distance between the application points is large, the permissible tilt angle is small.

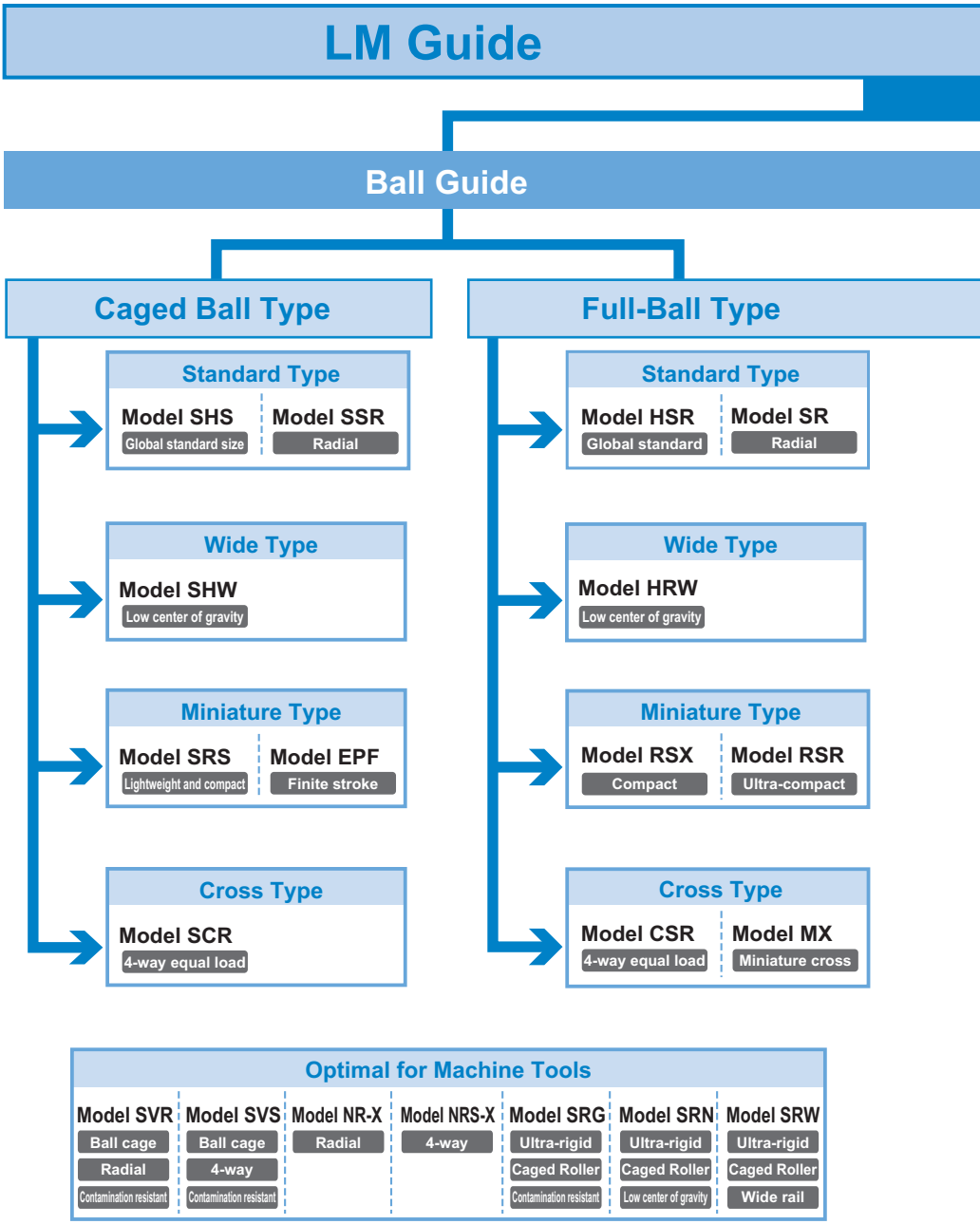


Four-Row Gothic-Arch Contact
It requires high mounting precision.

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

LM Guide Model HSR	Similar Product of a Competitor
	
Since the distance between the application points of the bearings is small, the internal load generated from inconsistencies in the mounting surface is small, allowing movement to remain smooth.	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 approximately six 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.

LM Guide Classification Table



Roller Guide

Caged Roller Type

Standard Type
- **Model SRG** — Ultra-high rigidity
- **Model SRN** — Ultra-high rigidity; Low center of gravity

Wide Type
- **Model SRW** — Ultra-high rigidity

Full-Roller Type

Standard Type
- **Model HRX** — Super-high rigidity

Curved Type
- **Model HCR** — Curved type
- **Model HMG** — Straight-curved type

Separate Type
- **Model HR** — Heavy load
- **Model GSR** — Interchangeable, self-aligning
- **Model GSR-R** — Interchangeable, self-aligning; With rack

Model JR Type
- **Model JR** — Structural member rail; 4-way equal load

Self-Aligning Type
- **Model NSR-TBC**

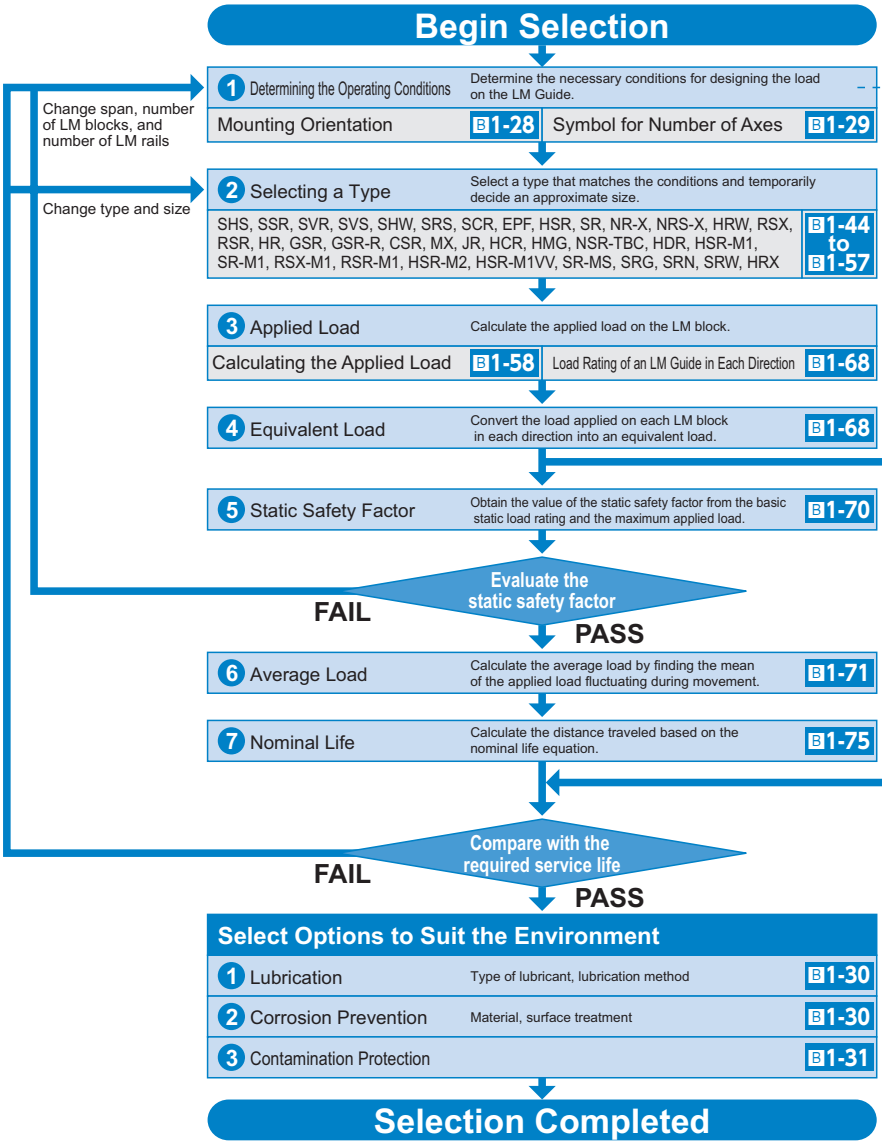
DB Configuration Type
- **Model HDR** — 4-way equal load

Models with Special Environment Specifications
- **Model HSR-M1** — High temperature; 4-way equal load
- **Model SR-M1** — High temperature; Radial
- **Model RSX-M1** — High temperature; Compact
- **Model RSR-M1** — High temperature; Compact
- **Model HSR-M2** — High corrosion resistance; 4-way equal load
- **Model HSR-M1VV** — Medium-to-low vacuum; 4-way equal load
- **Model SR-MS** — Oil-free

Flowchart for Selecting an LM Guide

Steps for Selecting an LM Guide

The following flowchart can be used as reference for selecting an LM Guide.



- Space in which the guide will be used
- 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 service life
- Precision of motion
- Environment
- In a special environment (vacuum, clean room, high temperature, environment exposed to contamination, etc.), it is necessary to take into account material, surface treatment, lubrication, and contamination protection.

Predicting the Rigidity

1	Selecting a Radial Clearance (Preload)	B1-87
2	Service Life with a Preload Considered	B1-88
3	Rigidity	B1-88
4	Radial Clearance Standard for Each Model	A1-75
5	Designing the Guide System	A1-516

Determining the Accuracy

1	Accuracy Standards	B1-89
2	Guidelines for Accuracy Grades by Machine Type	B1-90
3	Accuracy Standard for Each Model	A1-80~

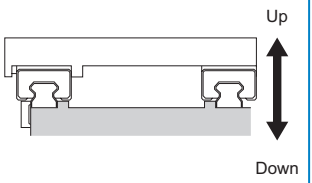
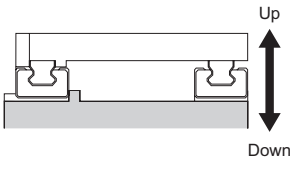
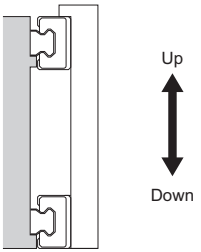
Determining the Operating Conditions

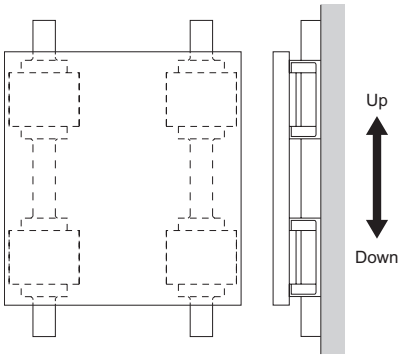
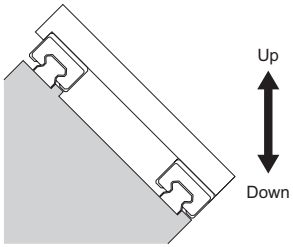
Operating Conditions of the LM Guide

Mounting Orientation

The LM Guide can be mounted in the following five orientations.
The lubricant may not reach the raceway if the LM Guide is not installed in a horizontal orientation. Be sure to let THK know the installation direction and the exact position in each LM block where the grease nipple or the piping joint should be attached.
For the lubrication, see A24-2.

Mounting Orientation

Horizontal (symbol: H)	Inverted (symbol: R)	Wall mount (symbol: K)
		

Vertical (symbol: V)	Slant mount (symbol: T)
	

Symbol for Number of Axes

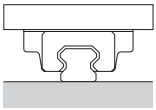
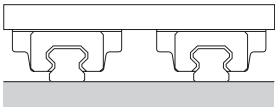
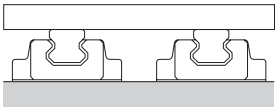
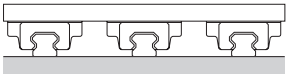
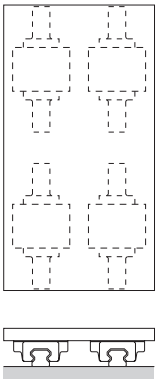
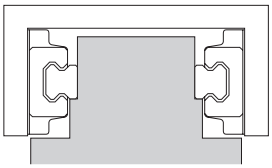
If two or more LM Guide units are used in a parallel combination on the same plane, specify in advance the number of the LM rails (symbol for number of axes) used in combination.
For accuracy standards and radial clearance standards, see A**1-80** and A**1-75**, respectively.

Model number coding

SHS25C2SSC0+1000LP -II

- Model number (details are given on the corresponding page of the model)
- 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	Symbol for number of axes: II	Symbol for number of axes: II
Required number of axes: 1	Required number of axes: 2	Required number of axes: 2
	 Note: When placing an order, specify the number in multiples of 2 axes.	 Note: When placing an order, specify the number in multiples of 2 axes.
Symbol for number of axes: III	**Symbol for number of axes: IV**	**Other**
Required number of axes: 3	Required number of axes: 4	Required number of axes: 2
 Note: When placing an order, specify the number in multiples of 3 axes.	 Note: When placing an order, specify the number in multiples of 4 axes.	 Using 2 axes opposed to each other

Service Environment

● Lubrication

When using an LM System, it is necessary to provide effective lubrication. Using the product without lubrication may increase wear on the rolling elements and shorten the service life.
A lubricant has effects such as the following.
(1) Minimizes friction on 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 metal surfaces with an oil film to prevent the formation of rust.
To optimize an LM Guide's functionality, it is necessary to provide lubrication according to the operating conditions.
The lubricant may not reach the raceway if the LM Guide is not installed in a horizontal orientation.
Be sure to let THK know the mounting orientation and the exact position in each LM block where the grease nipple or the piping joint should be attached. For the mounting orientation and the lubrication, see B**1-28** and B**24-2**, respectively.
Even with an LM Guide with seals, the internal lubricant gradually seeps out during operation. Therefore, the system needs to be lubricated at an appropriate interval according to the operating conditions.

● Corrosion Prevention

■Determining a Material

Any LM System requires a material that suits the operating environment. 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 SHS, SSR, SHW, SRS, HSR, SR, HRW, RSX, RSR, and HR.)
The HSR series includes HSR-M2, a highly corrosion-resistant LM Guide using anti-corrosive austenitic stainless steel. For details, see A**1-424**.

■Surface Treatment

The surfaces of the rails and shafts of the LM System can be treated for anti-corrosive or aesthetic purposes.
THK offers THK-AP treatment, which is the optimum surface treatment for the LM System.
There are roughly three types of THK-AP treatment: AP-HC, AP-C, and AP-CF. (See B**0-20**.)

● Contamination Protection

It is necessary to prevent foreign materials from getting inside the product, as it will lead to abnormal wear and a shortened service life. Therefore, when entrance of dust or other foreign material is a possibility, it is necessary to select a sealing device or contamination protection option suited to the operating environment and conditions.

THK offers contamination protection accessories for each model of the LM Guide, such as end seals made of a special synthetic rubber with high wear resistance, and side seals and inner seals that provide further contamination protection.

In addition, for applications in adverse environments, a Laminated Contact Scraper LaCS and dedicated bellows are available for various model numbers.

Also, THK offers dedicated caps designed to prevent cutting chips from entering the LM rail mounting holes.

When it is necessary to provide contamination protection for a ball screw in an environment exposed to cutting chips and moisture, we recommend using a telescopic cover that protects the whole system or a large bellows.

For the options, see B**1-105**.

Special Environments

Clean Room

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

Dust Generation from the LM System

■Measures to prevent dust generation resulting from spattering grease

THK AFE-CA, AFF, and L100 Grease
Use grease that produces little dust and is suited to a clean environment.

■Measures to reduce dust generation resulting from metallic abrasion

Caged Ball LM Guide
Dust generation can be reduced by using a Caged Ball LM Guide, which has no friction between balls and generates little metallic abrasion dust.

Corrosion Prevention

■Material-based measures

Stainless steel LM Guide
This LM Guide uses corrosion-resistant martensitic stainless steel.

Corrosion-resistant LM Guide
The LM rail uses austenitic stainless steel, which has a high corrosion-resistant effect.

■Surface treatment measures

THK AP-HC, AP-C, and AP-CF Treatment
The LM System is surface-treated to increase corrosion resistance.

Caged Ball LM Guide
Supported models: SHS SSR SVR/SVS SHW SRS SCR EPF

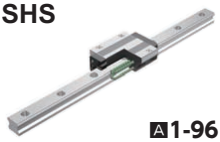
Caged Roller LM Guide
Supported models: SRG SRN SRW

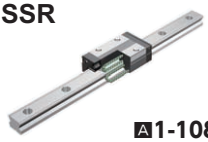
Stainless Steel LM Guide
Supported models: SHS SSR SHW SRS HSR SR HRW HR RSX RSR

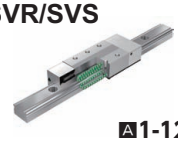
LM Guide Models for Special Environments
Supported models: Corrosion-Resistant HSR-M2 Oil-Free SR-MS

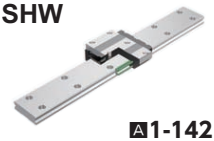
Surface Treatment

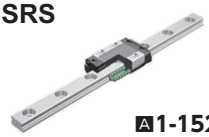
Grease

SHS

A1-96

SSR

A1-108

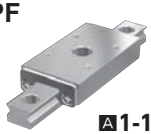
SVR/SVS

A1-122

SHW

A1-142

SRS

A1-152

SCR

A1-168

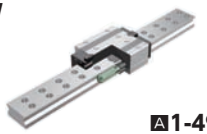
EPF

A1-176

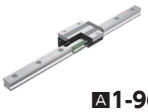
SRG

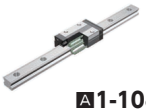
A1-450

SRN

A1-476

SRW

A1-494

SHS

A1-96

SSR

A1-108

SHW

A1-142

SRS

A1-152

HSR

A1-184

SR

A1-216

HRW

A1-250

HR

A1-282

RSX

A1-260

RSR

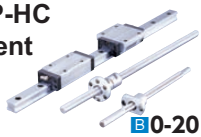
A1-274

HSR-M2

A1-424

SR-MS

A1-438

THK AP-HC Treatment

B0-20

THK AP-C Treatment

B0-20

THK AP-CF Treatment

B0-20

THK AFE-CA Grease

A24-13

THK AFF Grease

A24-15

L100 Grease

A24-25

Vacuum

In a vacuum environment, measures are required to prevent resin from emitting gas and grease from spattering. Anti-rust oil cannot be used, so it is necessary to select a product with high corrosion resistance.

■Measures to prevent resin from emitting gas

Stainless steel LM Guide

The end plate (ball circulation path normally made of resin) of the LM block is made of stainless steel to reduce emission of gas.

■Measures to prevent grease from evaporating

Vacuum grease

If a general-purpose grease is used in a vacuum environment, oil contained in the grease spatters and the grease loses lubricity. Therefore, use a vacuum grease made with low-vapor-pressure fluorine-based oil.

■Corrosion prevention

Stainless steel LM Guide

In a vacuum environment, use a corrosion-resistant stainless steel LM Guide.

High-temperature LM Guide

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

Corrosion-resistant LM Guide

This LM Guide uses highly corrosion-resistant austenitic stainless steel in the LM rail.

Oil-Free

In environments susceptible to liquid lubricants, a lubrication method other than grease or oil is required.

■Dry Lubricant

S-Coating Dry Film Lubricant

This dry film lubricant is a molybdenum disulfide compound developed for a wide range of conditions, from atmospheric pressure to high-vacuum environments. It provides better load carrying capacity, wear resistance, and seal strength than other forms of dry lubrication.

High-Temperature LM Guide

Supported models: HSR-M1 SR-M1 RSX-M1 RSR-M1

LM Guide Models for Special Environments

Supported models: Medium-to-Low Vacuum HSR-M1VV, Oil-Free SR-MS

Corrosion-Resistant LM Guide

Supported models: HSR-M2

Stainless Steel LM Guide

Supported models: HSR SR HRW HR RSX RSR

Vacuum Grease

Oil-Free LM Guide

Supported models: Oil-Free SR-MS

HSR-M1

A1-382

SR-M1

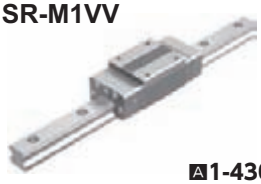
A1-396

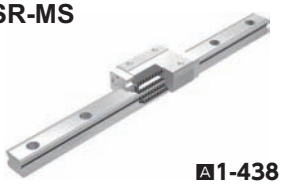
RSX-M1

A1-406

RSR-M1

A1-416

HSR-M1VV

A1-430

SR-MS

A1-438

HSR-M2

A1-424

HSR

A1-184

SR

A1-216

HRW

A1-250

HR

A1-282

RSX

A1-260

RSR

A1-274

SR-MS

A1-438

Corrosion Prevention

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

■Material-based measures

Stainless steel LM Guide

This LM Guide uses corrosion-resistant martensitic stainless steel.

Corrosion-resistant LM Guide

This LM Guide uses highly corrosion-resistant austenitic stainless steel in the LM rail.

■Surface treatment measures

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

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

Stainless Steel LM Guide

Supported models: SHS SSR SHW SRS HSR SR HRW HR RSX RSR

Corrosion-Resistant LM Guide

Supported models: HSR-M2

Surface Treatment

SHS

A1-96

SSR

A1-108

SHW

A1-142

SRS

A1-152

HSR

A1-184

SR

A1-216

HRW

A1-250

HR

A1-282

RSX

A1-260

RSR

A1-274

HSR-M2

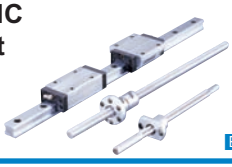
A1-424

THK AP-CF Treatment

B0-20

THK AP-C Treatment

B0-20

THK AP-HC Treatment

B0-20

High Speed

In a high-speed environment, it is necessary to apply an optimal 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, contributing to long service life and high-speed operation.

THK AFA Grease, AFJ Grease

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

■Measures to improve lubrication

QZ Lubricator

Continuous oil lubrication ensures that the lubrication and maintenance interval can be significantly 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 Guide

Supported models: SHS SSR SVR/SVS SHW SRS SCR EPF

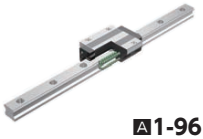
Caged Roller LM Guide

Supported models: SRG SRN SRW

QZ Lubricator

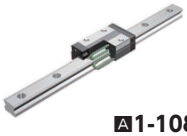
Grease

SHS



A1-96

SSR



A1-108

SVR/SVS



A1-122

SHW



A1-142

SRS



A1-152

SCR



A1-168

EPF



A1-176

SRG



A1-450

SRN



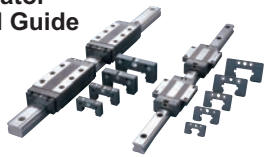
A1-476

SRW



A1-494

QZ Lubricator for the LM Guide



A1-575

THK AFA Grease



A24-7

THK AFJ Grease



A24-21

High Temperature

In a high-temperature environment, dimensional variations caused by heat are problematic. Use a high-temperature LM Guide, which is heat resistant and has minimal dimensional variation when heated. Also, use a high-temperature grease.

■Heat resistance

High-temperature LM Guide

A special heat treatment to maintain dimensional stability minimizes dimensional variations due to heating and cooling.

■Grease

High-temperature grease

Use a high-temperature grease to maintain consistent rolling resistance in the LM System even at high temperatures.

Low Temperature

In a low-temperature environment, use an LM System with a minimal amount of resin components and a grease that minimizes fluctuations in rolling resistance, even at low temperature.

■Impact of low temperature on resin components

Stainless steel LM Guide

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

■Corrosion prevention

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

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

■Grease

THK AFC Grease

This grease has little rolling resistance fluctuation even in cold temperatures.

Micro Motion

Micro strokes cause the oil film to break, resulting in poor lubrication and early wear. In such applications, select a grease with high oil film strength that can easily form an oil film.

■Grease

THK AFC Grease

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

High-Temperature LM Guide

Supported models: HSR-M1 SR-M1 RSX-M1 RSR-M1 HSR-M1VV

High-Temperature Grease

Stainless Steel LM Guide

Supported models: SHS SSR SHW SRS HSR SR HRW HR RSX RSR

Surface Treatment

Low-Temperature Grease

Grease

HSR-M1

A1-382

SR-M1

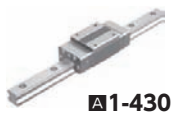
A1-396

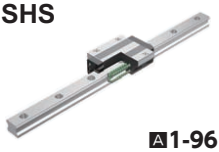
RSX-M1

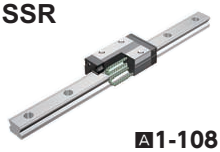
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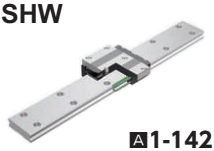
RSR-M1

A1-416

HSR-M1VV

A1-430

SHS

A1-96

SSR

A1-108

SHW

A1-142

SRS

A1-152

HSR

A1-184

SR

A1-216

HRW

A1-250

HR

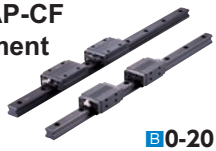
A1-282

RSX

A1-260

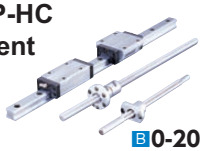
RSR

A1-274

THK AP-CF Treatment

B0-20

THK AP-C Treatment

B0-20

THK AP-HC Treatment

B0-20

THK AFC Grease

A24-11

THK AFC Grease

A24-11

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 small foreign matter or a water-soluble coolant that a telescopic cover or a bellows cannot block, it is necessary to attach a contamination protection accessory capable of efficiently removing foreign matter.

■Metal scraper

It removes relatively large foreign objects such as cutting chips, spatter, sand, or hard foreign materials that adhere to the LM rail.

■Laminated Contact Scraper LaCS

Unlike a metal scraper, it removes foreign matter while making contact with the LM rail. Therefore, it is more effective at preventing contamination by small foreign matter that is difficult to remove with conventional metal scrapers.

■QZ Lubricator

The QZ Lubricator is a lubrication system that feeds the right amount of lubricant to the ball raceway through direct contact with a highly oil-impregnated fiber net.

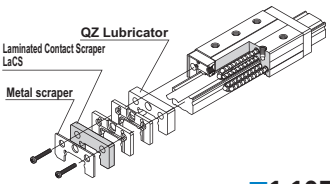
■Dedicated metal caps for LM rail mounting holes - GC caps

GC caps are metal caps that plug LM rail mounting holes (compliant with the RoHS Directives). In harsh environments they prevent the entrance of foreign material and coolant from the top face of the LM rail (mounting holes) and significantly increase contamination protection of the LM Guide if used with a dust seal.

■Protector

The protector minimizes the entrance of foreign material even in harsh environments where foreign material such as fine particles and liquids are present.

LM Guide
+Metal scraper
+Laminated Contact Scraper LaCS
+GC cap etc.

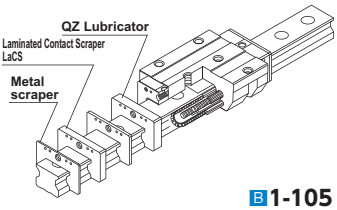


B1-105

Supported models

Caged Ball LM Guide
SHS SSR SVR/SVS SHW SRS
Full-Ball LM Guide
HSR NR-X/NRS-X HDR

Roller Type LM Guide
+Metal scraper
+Laminated Contact Scraper LaCS
+GC cap etc.



B1-105

Supported models

SRG HRX

Caged Ball LM Guide

SHS



A1-96

SSR



A1-108

SHW



A1-142

SRS



A1-152

SVR/SVS



Compatible with protector A1-122

Full-Ball LM Guide

HSR



A1-184

NR-X/NRS-X



A1-228

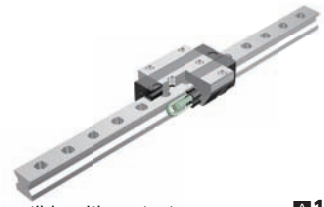
HDR



A1-360

Caged Roller LM Guide

SRG



Compatible with protector A1-450

Full-Roller LM Guide

HRX

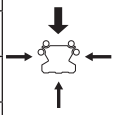
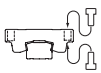
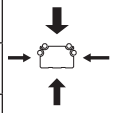
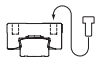
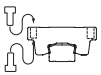
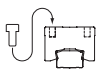


Compatible with protector A1-502

Selecting a Type

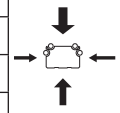
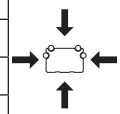
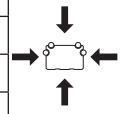
Types of LM Guide

THK offers the LM Guide in a wide array of standard types and dimensions so that you can select the optimal product for any application. The unit structure of the LM Guide allows for high running accuracy with no clearance simply by mounting the product to a flat surface with bolts. We have a proven track record and know-how in extensive applications.

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
Radial type	Caged Ball LM Guide models		SSR-XW	▶A1-112		14.7 to 64.6	16.5 to 71.6
			SSR-XV	▶A1-114		9.1 to 48.3	9.7 to 46.7
			SSR-XTB	▶A1-116		14.7 to 64.6	16.5 to 71.6
			SSR-XSB	▶A1-118		9.1 to 48.3	9.7 to 46.7
	Full-Ball LM Guide models		SR-W	▶A1-222		13.8 to 411	20.5 to 537
			SR-M1W	▶A1-400		13.8 to 60.4	20.5 to 81.8
			SR-V	▶A1-222		9.1 to 40.9	11.7 to 46.7
			SR-M1V	▶A1-400		9.1 to 40.9	11.7 to 46.7
			SR-TB	▶A1-224		13.8 to 136	20.5 to 179
			SR-M1TB	▶A1-402		13.8 to 60.4	20.5 to 81.8
			SR-SB	▶A1-224		9.1 to 40.9	11.7 to 46.7
			SR-M1SB	▶A1-402		9.1 to 40.9	11.7 to 46.7
	Oil-Free LM Guide for Special Environments		SR-MSV	▶A1-442		—	—
			SR-MSW	▶A1-442		—	—
	Caged Ball LM Guide models for machine tools High-rigidity models for super-heavy loads		SVR-C	▶A1-132		48 to 260	68 to 328
			SVR-LC	▶A1-132		57 to 340	86 to 481
			SVR-R	▶A1-128		48 to 260	68 to 328
			SVR-LR	▶A1-128		57 to 340	86 to 481
			SVR-CH	▶A1-138		90 to 177	115 to 238
			SVR-LCH	▶A1-138		108 to 214	159 to 312
			SVR-RH	▶A1-136		90 to 177	115 to 238
			SVR-LRH	▶A1-136		108 to 214	159 to 312

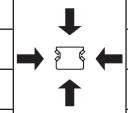
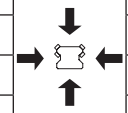
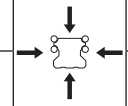
[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	24 to 48	34 to 70	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Thin and compact design with large radial load capacity • Superb in planar running accuracy • Superb capability to absorb mounting error • Stainless steel type also available as standard	• Surface grinder tables • Tool grinder tables • Electric discharge machines • Printed circuit board drilling machines • Chip mounters • High-speed transfer equipment • Robot travel units • Machining centers • NC lathes • Five axis milling machines • Conveyance systems • Pressing machine mold guides • Inspection equipment • Testing machines • Food-related machines • Medical equipment • 3D measuring instruments • Packaging machines • Injection molding machines • Woodworking machines • Ultra precision tables • Semiconductor/liquid crystal manufacturing equipment
	24 to 48	34 to 70		
	24 to 48	52 to 100		
	24 to 48	52 to 100		
	24 to 135	34 to 250	• Thin and compact design with a large radial load capacity • Superb planar running accuracy • Superb capability to absorb mounting error • Stainless steel type also available as standard • Type M1, achieving max service temperature of 150℃, also available	
	24 to 48	34 to 70		
	24 to 48	34 to 70		
	24 to 48	34 to 70		
	24 to 68	52 to 140		
	24 to 48	52 to 100		
	24 to 48	52 to 100		
	24 to 48	52 to 100		
	24 to 28	34 to 42	• Minimum outgassing (water, organic matter) • Can be used at high temperature (up to 150℃)	• Exposure machine • Organic EL manufacturing machine • Ion injection machine
	24 to 28	34 to 42		
	31 to 75	72 to 170	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • Thin and compact design with large radial load capacity • High vibration resistance and impact resistance due to improved damping characteristics • Superb planar running accuracy	• Machining centers • NC lathes • Grinding machines • Five axis milling machines • Jig borers • Drilling machines • NC milling machines • Horizontal milling machines • Mold processing machines • Graphite working machines • Electric discharge machines • Wire-cut electric discharge machines
	31 to 75	72 to 170		
	31 to 75	50 to 126		
	31 to 75	50 to 126		
	48 to 70	100 to 140	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • Large radial load capacity • High vibration resistance and impact resistance due to improved damping characteristics • Superb planar running accuracy • Has dimensions nearly equal to the Full-Ball LM Guide Model HSR, the de facto global standard	
	48 to 70	100 to 140		
	55 to 80	70 to 100		
	55 to 80	70 to 100		

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
Radial type	Full-Ball LM Guide models for machine tools High-rigidity models for super-heavy loads		NR-RX	▶A1-234		37.1 to 208.7	68.1 to 351.7
			NR-LRX	▶A1-234		45.4 to 268.9	90.8 to 505.5
			NR-SLRX	▶A1-234		71 to 423.1	172.6 to 967.1
			NR-CX	▶A1-240		37.1 to 208.7	68.1 to 351.7
			NR-LCX	▶A1-240		45.4 to 268.9	90.8 to 505.5
			NR-SLCX	▶A1-240		71 to 423.1	172.6 to 967.1
			NR-R	▶A1-238		271 to 479	610 to 1040
			NR-LR	▶A1-238		355 to 599	800 to 1300
			NR-A	▶A1-244		271 to 479	610 to 1040
			NR-LA	▶A1-244		355 to 599	800 to 1300
			NR-B	▶A1-246		271 to 479	610 to 1040
			NR-LB	▶A1-246		355 to 599	800 to 1300
4-way type	Caged Ball LM Guide Models for machine tools High-rigidity models for super-heavy loads		SVS-R	▶A1-130		37 to 199	52 to 251
			SVS-LR	▶A1-130		44 to 261	66 to 368
			SVS-C	▶A1-134		37 to 199	52 to 251
			SVS-LC	▶A1-134		44 to 261	66 to 368
			SVS-RH	▶A1-136		69 to 136	88 to 182
			SVS-LRH	▶A1-136		83 to 164	122 to 239
			SVS-CH	▶A1-138		69 to 136	88 to 182
			SVS-LCH	▶A1-138		83 to 164	122 to 239
	Full-Ball LM Guide models for machine tools High-rigidity models for super-heavy loads		NRS-RX	▶A1-236		28.4 to 159.8	52.2 to 269.4
			NRS-LRX	▶A1-236		34.7 to 206	69.6 to 387.2
			NRS-SLRX	▶A1-236		54.4 to 324.1	132.2 to 740.8
			NRS-CX	▶A1-242		28.4 to 159.8	52.2 to 269.4
			NRS-LCX	▶A1-242		34.7 to 206	69.6 to 387.2
			NRS-SLCX	▶A1-242		54.4 to 324.1	132.2 to 740.8
4-way equal load type	Full-Ball LM Guide models for machine tools High-rigidity models for super-heavy loads		NRS-A	▶A1-244		212 to 376	431 to 737
			NRS-LA	▶A1-244		278 to 470	566 to 920
			NRS-B	▶A1-246		212 to 376	431 to 737
			NRS-LB	▶A1-246		278 to 470	566 to 920
			NRS-R	▶A1-238		212 to 376	431 to 737
			NRS-LR	▶A1-238		278 to 470	566 to 920

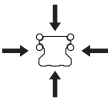
[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	31 to 75	50 to 126	• Low dust generation, low noise, and acceptable running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • Thin and compact design with large radial load capacity • High vibration resistance and impact resistance due to improved damping characteristics • Superb planar running accuracy	• Machining centers • NC lathes • Grinding machines • Five axis milling machines • Jig borers • Drilling machines • NC milling machines • Horizontal milling machines • Mold processing machines • Graphite working machines • Electric discharge machines • Wire-cut electric discharge machines
	31 to 75	50 to 126		
	31 to 75	50 to 126		
	31 to 75	72 to 170		
	31 to 75	72 to 170		
	31 to 75	72 to 170		
	83 to 105	145 to 200	• Super-heavy load capacity optimal for machine tools • High vibration resistance and impact resistance due to improved damping characteristics • Thin and compact design with large radial load capacity • Superb planar running accuracy	
	83 to 105	145 to 200		
	83 to 105	195 to 260		
	83 to 105	195 to 260		
	83 to 105	195 to 260		
	83 to 105	195 to 260		
	31 to 75	50 to 126	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • Thin and compact design with 4-way equal load capacity • High vibration resistance and impact resistance due to improved damping characteristics	
	31 to 75	50 to 126		
	31 to 75	72 to 170		
	31 to 75	72 to 170		
	55 to 80	70 to 100	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • 4-way type • High vibration resistance and impact resistance due to improved damping characteristics • Has dimensions nearly equal to the Full-Ball LM Guide Model HSR, the de facto global standard	
	55 to 80	70 to 100		
	48 to 70	100 to 140		
	48 to 70	100 to 140		
	31 to 75	50 to 126	• Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Super-heavy load capacity optimal for machine tools • Thin and compact design with 4-way equal load capacity • High vibration resistance and impact resistance due to improved damping characteristics	
	31 to 75	50 to 126		
	31 to 75	50 to 126		
	31 to 75	72 to 170		
	31 to 75	72 to 170		
	31 to 75	72 to 170		
	83 to 105	195 to 260	• Super-heavy load capacity optimal for machine tools • High vibration resistance and impact resistance due to improved damping characteristics • Thin and compact design with 4-way equal load capacity	
	83 to 105	195 to 260		
	83 to 105	195 to 260		
	83 to 105	195 to 260		
	83 to 105	145 to 200		
	83 to 105	145 to 200		

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
4-way equal load type	Caged Roller LM Guide models Ultra-heavy load, high-rigidity types		SRG-A, C	▶A1-456		11.3 to 219	25.8 to 511
			SRG-LA, LC	▶A1-456		25.9 to 601	63.8 to 1170
			SRG-SLC	▶A1-458		83.4 to 352	199 to 899
			SRG-R, V	▶A1-464		11.3 to 219	25.8 to 511
			SRG-LR, LV	▶A1-464		25.9 to 278	63.8 to 670
			SRG-SLR, SLV	▶A1-466		83.4 to 352	199 to 899
			SRN-C	▶A1-482		55.3 to 219	119 to 511
			SRN-LC	▶A1-482		71.4 to 278	165 to 670
			SRN-SLC	▶A1-482		83.4 to 352	199 to 899
			SRN-R	▶A1-486		55.3 to 219	119 to 511
			SRN-LR	▶A1-486		71.4 to 278	165 to 670
			SRN-SLR	▶A1-486		83.4 to 352	199 to 899
			SRW-LR	▶A1-498		115 to 601	256 to 1170
	Full-Roller LM Guide high-rigidity models for super-heavy loads		HRX-C	▶A1-508		26.3 to 205.5	73.1 to 567
			HRX-LC	▶A1-508		30.8 to 257	89.3 to 756
			HRX-R	▶A1-510		26.3 to 205.5	73.1 to 567
			HRX-LR	▶A1-510		30.8 to 257	89.3 to 756
	Caged Ball LM Guide models Heavy-load, high-rigidity types		SHS-C	▶A1-100		14.2 to 205	24.2 to 320
			SHS-LC	▶A1-100		17.2 to 253	31.9 to 408
			SHS-V	▶A1-102		14.2 to 205	24.2 to 320
			SHS-LV	▶A1-102		17.2 to 253	31.9 to 408
			SHS-R	▶A1-104		14.2 to 128	24.2 to 197
			SHS-LR	▶A1-104		36.8 to 161	64.7 to 259

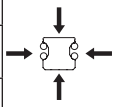
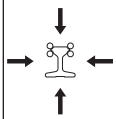
[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	24 to 90	47 to 170	• Long service life and long-term maintenance-free operation • Low noise and reduced running sound • Superb high-speed performance • Smooth motion due to prevention of rollers from skewing • Ultra-heavy load capacity optimal for machine tools	• Machining centers • NC lathes • Grinding machines • Five axis milling machines • Jig borers • Drilling machines • NC milling machines • Horizontal milling machines • Mold processing machines • Graphite working machines • Electric discharge machines • Wire-cut electric discharge machines
	30 to 120	63 to 250		
	48 to 90	100 to 170		
	24 to 90	34 to 126		
	30 to 90	44 to 126		
	55 to 90	70 to 126		
	44 to 75	100 to 170	• Long service life and long-term maintenance-free operation • Low noise and reduced running sound • Superb high-speed performance • Smooth motion due to prevention of rollers from skewing • Ultra-heavy load capacity optimal for machine tools • Low center of gravity and ultra-high rigidity	
	44 to 75	100 to 170		
	44 to 75	100 to 170		
	44 to 75	70 to 126		
	44 to 75	70 to 126		
	44 to 75	70 to 126		
	70 to 150	135 to 300		
	36 to 90	70 to 170	• Long service life • Superbly high speed • 4-way equal load type • Stable and smooth operation can be achieved by suppressing roller skew • Ultra-heavy load capacity optimal for machine tools	
	36 to 90	70 to 170		
	40 to 100	48 to 126		
	40 to 100	48 to 126		
	24 to 90	47 to 170	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Heavy load and high rigidity • Has dimensions nearly equal to the Full-Ball LM Guide Model HSR, the de facto global standard • Superb capability to absorb mounting error	• Machining centers • NC lathes • XYZ axes of heavy cutting machine tools • Grinding head feeding axes of grinding machines • Components requiring a heavy moment and high accuracy • NC milling machines • Horizontal milling machines • Gantry five-axis milling machines • Z axes of electric discharge machines • Wire-cut electric discharge machines • Car elevators • Food-related machines • Testing machines • Vehicle doors • Printed circuit board drilling machines • Automatic tool changers • Construction equipment • Shield machines • Semiconductor/liquid crystal manufacturing equipment
	24 to 90	47 to 170		
	24 to 90	34 to 126		
	24 to 90	34 to 126		
	28 to 80	34 to 100		
	28 to 80	34 to 100		

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
4-way equal load type	Full-Ball LM Guide models Heavy-load, high-rigidity types		HSR-XSC	▶A1-192		0.85 to 3.95	1.24 to 5.39
			HSR-C/XC	▶A1-194		1.2 to 195	2.02 to 228
			HSR-M1C	▶A1-388		10.9 to 53.9	15.7 to 70.2
			HSR-LC/XLC	▶A1-194		1.5 to 249	2.8 to 323
			HSR-M1LC	▶A1-388		14.2 to 65	22.9 to 91.7
			HSR-A	▶A1-206		304	355
			HSR-LA	▶A1-206		367	464
			HSR-CA/XCA	▶A1-202		19.8 to 304	27.4 to 355
			HSR-HA/XHA	▶A1-202		23.9 to 518	35.8 to 728
			HSR-B	▶A1-206		304	355
			HSR-LB	▶A1-206		367	464
			HSR-CB/XCB	▶A1-204		19.8 to 304	27.4 to 355
			HSR-HB/XHB	▶A1-204		23.9 to 518	35.8 to 728
			HSR-XSR	▶A1-196		0.85 to 3.95	1.24 to 5.39
			HSR-R/XR	▶A1-198		1.2 to 304	2.02 to 355
			HSR-M1R	▶A1-390		10.9 to 53.9	15.7 to 70.2
			HSR-LR/XLR	▶A1-198		1.5 to 367	2.8 to 464
			HSR-M1LR	▶A1-390		14.2 to 65	22.9 to 91.7
			HSR-HR	▶A1-208		441 to 518	540 to 728
	LM Guide for medium-to-low vacuums		HSR-M1VV	▶A1-434		10.9	15.7
	Full-Ball LM Guide models Side-mount types		HSR-YR/XYR	▶A1-200		10.9 to 195	15.7 to 228
			HSR-M1YR	▶A1-392		10.9 to 53.9	15.7 to 70.2

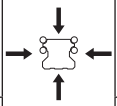
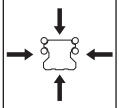
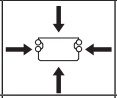
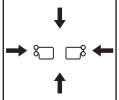
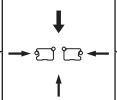
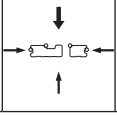
[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	10 to 19	24 to 40	• Heavy load and high rigidity • De facto global standard • Superb capability to absorb mounting error • Stainless steel type also available as standard • Type M1, achieving max service temperature of 150℃, also available • Type M2, with high corrosion resistance, also available (Basic dynamic load rating: 2.11 to 5.57 kN) (Basic static load rating: 2.04 to 5.15 kN)	• Machining centers • NC lathes • XYZ axes of heavy cutting machine tools • Grinding head feeding axes of grinding machines • Components requiring a heavy moment and high accuracy • NC milling machines • Horizontal milling machines • Gantry five axis milling machines • Z axis of electric discharge machines • Wire-cut electric discharge machines • Car elevators • Food-related machines • Testing machines • Vehicle doors • Printed circuit board drilling machines • Automatic tool changers • Construction equipment • Shield machines • Semiconductor/liquid crystal manufacturing equipment
	10 to 90	24 to 170		
	24 to 48	47 to 100		
	10 to 90	24 to 170		
	24 to 48	47 to 100		
	110	215		
	110	215		
	30 to 110	63 to 215		
	30 to 145	63 to 350		
	110	215		
	110	215		
	30 to 110	63 to 215		
	30 to 145	63 to 350		
	11 to 20	16 to 27		
	11 to 110	16 to 156		
	28 to 55	34 to 70		
	11 to 110	16 to 156		
	28 to 55	34 to 70		
	120 to 145	200 to 266		
	28	34	• Can be used in a range of environments from atmospheric pressure to a vacuum of (10^{-3} Pa) • Allows baking temperatures of up to 200℃. If the baking temperature exceeds 100℃, multiply the basic load rating with the temperature coefficient.	• Medical equipment • Semiconductor/liquid crystal manufacturing equipment
	28 to 90	33.5 to 124.5	• Mounting holes on the side faces of the LM block allow for easy mounting and reduced mounting height when using two units facing each other • Heavy load and high rigidity • Superb capability to absorb mounting error • Stainless steel type also available as standard • Type M1, achieving max service temperature of 150℃, also available	• Cross rails of gantry machine tools • Z axes of woodworking machines • Z axes of measuring instruments • Components opposed to each other
	28 to 55	33.5 to 69.5		

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
4-way equal load type	Full-Ball LM Guide models with high rigidity in the rolling direction		HDR-SC	▶A1-366		7.07 to 38.3	8.43 to 43.2
			HDR-C	▶A1-366		10.9 to 195	15.7 to 228
			HDR-LC	▶A1-366		13.7 to 249	21.7 to 323
			HDR-SR	▶A1-368		15.3	19
			HDR-R	▶A1-368		10.9 to 195	15.7 to 228
			HDR-LR	▶A1-368		13.7 to 249	21.7 to 323
			HDR-SV	▶A1-370		7.07 to 38.3	8.43 to 43.2
			HDR-V	▶A1-370		10.9 to 135	15.7 to 170
			HDR-LV	▶A1-370		13.7 to 161	21.7 to 219
			HDR-US	▶A1-372		12.8 to 18.9	14.8 to 21.3
			HDR-UT	▶A1-372		18.7 to 27.6	25.3 to 36.4
			HDR-UV	▶A1-374		12.8 to 18.9	14.8 to 21.3
			HDR-UW	▶A1-374		18.7 to 27.6	25.3 to 36.4
	Full-Ball LM Guide models Special LM rail types		JR-A	▶A1-334		27.6 to 121	36.4 to 146
			JR-B	▶A1-334		27.6 to 121	36.4 to 146
			JR-R	▶A1-334		27.6 to 121	36.4 to 146

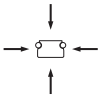
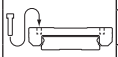
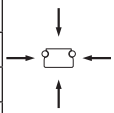
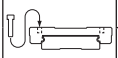
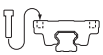
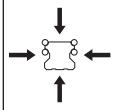
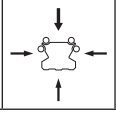
[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	24 to 48	47 to 82	• High rigidity in the rolling direction • Has dimensions nearly equal to the Full-Ball LM Guide Model HSR, the de facto global standard • 4-way equal load type	• Machining centers • NC lathes • XYZ axes of heavy cutting machine tools • Grinding head feeding axes of grinding machines • Single-axis rolling applications with rolling moments that require high rigidity • Woodworking machines • Platform doors • Conveyance systems • Semiconductor/liquid crystal manufacturing equipment • Vehicle doors • Door closing devices
	24 to 90	47 to 170		
	24 to 90	47 to 170		
	30	44		
	28 to 90	34 to 126		
	28 to 90	34 to 126		
	24 to 48	34 to 70		
	24 to 70	34 to 100		
	24 to 70	34 to 100		
	28 to 33	59 to 73	• High rigidity in the rolling direction • Thin and compact design with 4-way equal load capacity	
	28 to 33	59 to 73		
	28 to 33	42 to 48		
	28 to 33	42 to 48		
	61 to 114	70 to 140	• The thin center of the LM rail allows these models to absorb error and provide smooth motion even if two rails used together are not completely parallel. • Since the LM rail has a highly rigid cross-sectional shape, it can be used as a structural component	• Automated warehouses • Garages • Gantry robots • FMS traveling rails • Elevators • Conveyance systems • Welding machines • Lifters • Cranes • Forklifts • Coating machines • Shield machines • Stage settings
	61 to 114	70 to 140		
	65 to 124	48 to 100		

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
4-way equal load type	Caged Ball Cross LM Guide		SCR	▶A1-172		36.8 to 253	64.7 to 408
	Full-Ball LM Guide Orthogonal type		CSR	▶A1-320		10.9 to 100	15.7 to 135
	Caged Ball LM Guide models Wide types with low centers of gravity		SHW-CA	▶A1-146		4.31 to 70.2	5.66 to 91.4
			SHW-CR, HR	▶A1-148		4.31 to 70.2	5.66 to 91.4
	Full-Ball LM Guide models Wide types with low centers of gravity		HRW-CA	▶A1-254		5.53 to 80.3	9.1 to 109
			HRW-CR, LRM	▶A1-256		3.29 to 62.4	7.16 to 86.3
	Full-Ball Straight-and-curved Guide		HMG	▶A1-350		2.56 to 66.2	Straight section 4.23 to 66.7 Curved section 0.44 to 36.2
	Caged Ball LM Guide finite stroke		EPF	▶A1-180		0.90 to 3.71	1.60 to 5.88
	Full-Ball LM Guide models Separate types		HR, HR-T	▶A1-288		2.82 to 226	3.48 to 232
Interchangeable designs			GSR-T	▶A1-300		8.42 to 37	9.77 to 39.1
			GSR-V	▶A1-300		6.51 to 15.5	6.77 to 15.2
	Full-Ball LM Guide Integrated-rack LM rail type		GSR-R	▶A1-308		15.5 to 37	15.2 to 39.1

[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	70 to 180	88 to 226	• An XY orthogonal, single-piece LM block allows for a compact XY structure • The possibility of a saddle-less structure allows for machines with lightweight and compact design • Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance	• Low-center-of-gravity precision XY tables • NC lathes • Optical measuring instruments • Automatic lathes • Inspection equipment • Cartesian coordinate robots • Bonding machines • Wire-cut electric discharge machines • Hollow tables • Printed circuit board assemblers • Machine tool tables • Electric discharge machines • XY axes of horizontal machining centers
	47 to 118	38.8 to 129.8	• An XY orthogonal, single-piece LM block allows for a compact XY structure • The possibility of a saddle-less structure allows for machines with lightweight and compact design	
	12 to 50	40 to 162	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Wide, space-saving structure with a low center of gravity • Stainless steel type also available as standard	• Z axes of IC printed circuit board drilling machines • Z axes of small electric discharge machines • Loaders • Machining centers • NC lathes • Robots • Wire-cut electric discharge machines • APC • Semiconductor/liquid crystal manufacturing equipment • Measuring instruments • Wafer transfer equipment • Construction equipment • Railroad vehicles
	12 to 50	30 to 130		
	17 to 60	60 to 200	• 4-way equal load capacity, thin, and highly rigid • Wide, space-saving structure with a low center of gravity • Stainless steel type also available as standard	
	12 to 50	30 to 130		
	24 to 90	47 to 170	• Freedom of design • Cost reduction through simplified structure	• Large swivel bases • Pendulum cars for railroads • Pantagraphs • Control units • Optical measuring machines • Tool grinders • X-Ray machines • CT scanners • Medical equipment • Stage settings • Car elevators • Amusement machines • Turntables • Tool changers
	8 to 16	17 to 32	• Caged Ball effect through use of a retainer • Smooth movement with minimal rolling variation • 4-groove construction in a compact body	• Semiconductor manufacturing equipment • Medical equipment • Inspection equipment • Industrial machinery
	8.5 to 60	18 to 125	• Low-profile and highly rigid with a space-saving structure • Interchangeable with cross-roller guide • Adjustable preload • Stainless steel type also available as standard	• XYZ axes of electric discharge machines • Precision tables • XZ axes of NC lathes • Assembly robots • Conveyance systems • Machining centers • Wire-cut electric discharge machines • Tool changers • Woodworking machines
	20 to 38	32 to 68	• LM block and LM rail are both interchangeable • Adjustable preload • Capable of absorbing error in vertical level and horizontal parallelism	• Industrial robots • Various conveyance systems • Automated warehouses • Palette changers • Automatic tool changers • Door closing devices • Guides using molded aluminum bases • Welding machines • Coating machines • Car washing machines
	20 to 30	32 to 50		
	30 to 38	59.91 to 80.18	• Integrated-rack LM rail design eliminates assembly and adjustment work • Integrated-rack LM rail design enables a space-saving structure • Capable of supporting long strokes	

Classification		Type		Dimensional table[1]	Load capacity diagram	Basic load rating (kN)	
						Basic dynamic load rating	Basic static load rating
Miniature types	Caged Ball LM Guide models		SRS-S	▶A1-158		1.09 to 4.5	0.964 to 3.39
			SRS-M			0.439 to 16.5	0.468 to 20.2
			SRS-N			0.515 to 9.71	0.586 to 8.55
			SRS-WS	▶A1-162		1.38 to 6.64	1.35 to 5.94
			SRS-WM			0.584 to 9.12	0.703 to 8.55
			SRS-WN			0.746 to 12.4	0.996 to 12.1
	Full-Ball LM Guide models		RSX-SM	▶A1-266		0.95 to 9.02	1.16 to 10.6
			RSX-M	▶A1-266		1.16 to 13.3	1.54 to 18.6
			RSX-M1	▶A1-410		2.22 to 5.59	3.06 to 6.78
			RSX-NM	▶A1-266		0.45 to 16.5	0.70 to 25.2
			RSX-M1N	▶A1-410		2.94 to 8.27	4.59 to 11.8
			RSX-WSM	▶A1-270		1.06 to 5.59	1.35 to 6.78
			RSX-WM	▶A1-270		1.63 to 7.43	2.51 to 10.1
			RSX-M1W	▶A1-412		2.80 to 7.43	4.28 to 10.1
			RSX-WNM	▶A1-270		0.64 to 9.87	1.17 to 15.2
			RSX-M1WN	▶A1-412		3.48 to 9.87	5.81 to 15.2
			RSR-M	▶A1-278		0.18 to 8.82	0.27 to 12.7
			RSR-M1V	▶A1-420		8.82	12.7
			RSR-N	▶A1-278		0.3 to 14.2	0.44 to 20.6
			RSR-M1N	▶A1-420		14.2	20.6
	Full-Ball LM Guide models Wide types		RSR-WM/WV	▶A1-278		0.25 to 6.66	0.47 to 9.8
			RSR-WN	▶A1-278		0.39 to 9.91	0.75 to 14.9
	Full-Ball LM Guide Orthogonal type		MX	▶A1-326		0.59 to 2.04	1.1 to 3.21
Circular arc type	Full-Ball LM Guide		HCR	▶A1-342		4.7 to 141	8.53 to 215
Self-aligning type	Full-Ball LM Guide		NSR-TBC	▶A1-356		9.41 to 90.8	18.6 to 152

[1] For specification tables for each model, please see "A Product Descriptions."

	External dimensions (mm)		Features	Major applications
	Height	Width		
	8 to 16	17 to 32	• Long service life and long-term maintenance-free operation • Low dust generation, low noise, and reduced running sound • Superb high-speed performance • Smooth motion in all mounting orientations • Stainless steel type also available as standard • Lightweight and compact	• IC/LSI manufacturing machines • Hard disc drives • Slide units of OA equipment • Wafer transfer equipment • Printed circuit board assembly tables • Medical equipment • Electronic components of electron microscopes • Optical stages • Steppers • Plotting machines • IC bonding machine feed mechanisms • Inspection equipment
	6 to 25	17 to 48		
	6 to 16	12 to 32		
	9 to 16	25 to 60		
	6.5 to 16	17 to 60		
	8 to 25	17 to 48	• Lightweight and compact • Smooth motion in all mounting orientations • Stainless steel type also available as standard • Type M1, achieving max service temperature of 150°C, also available	• IC/LSI manufacturing machines • Hard disc drives • Slide units of OA equipment • Wafer transfer equipment • Printed circuit board assembly tables • Medical equipment • Electronic components of electron microscopes • Optical stages • Steppers • Plotting machines • IC bonding machine feed mechanisms • Inspection equipment
	8 to 25	17 to 48		
	10 to 16	20 to 32		
	6 to 25	12 to 48		
	10 to 16	20 to 32		
	9 to 16	25 to 60		
	9 to 16	25 to 60		
	12 to 16	30 to 60		
	6.5 to 16	17 to 60		
	12 to 16	30 to 60		
	4 to 25	8 to 46	• Ultra-compact • Stainless steel type also available as standard • Long type with increased load capacity also offered as standard • Type M1, achieving max service temperature of 150°C, also available	
	25	46		
	4 to 25	8 to 46		
	25	46		
	4.5 to 16	12 to 60	• Stainless steel type also available as standard • Long type with increased load capacity also offered as standard	
	4.5 to 16	12 to 60		
	10 to 14.5	15.2 to 30.2	• An XY orthogonal, single-piece LM block allows for a compact XY structure • Stainless steel type also available as standard	• IC/LSI manufacturing machines • Inspection equipment • Slide units of OA equipment • Wafer transfer equipment • IC bonding machine feed mechanisms • Printed circuit board assembly tables • Medical equipment • Electronic components of electron microscopes • Optical stages
	18 to 90	39 to 170	• Circular motion guide in a 4-way equal load design • Highly accurate circular motion without play • Allows efficient design with the LM block placed in the load point • Easily achieves large circular motion	• Large swivel bases • Pendulum cars for railroads • Pantagraphs • Control units • Optical measuring machines • Tool grinders • X-Ray machines • CT scanners • Medical equipment • Stage settings • Car elevators • Amusement machines • Turntables • Tool changers
	40 to 105	70 to 175	• Self-aligns on the mounting surface allowing for use after rough installation • Adjustable preload • Can be mounted on a black steel plate	• XY axes of ordinary industrial machinery • Various conveyance systems • Automated warehouses • Palette changers • Automatic coating machines • Various welding machines

Applied Load

The LM Guide is capable of receiving loads and moments in all directions whether they are generated by the mounting orientation and position, the location of the center of gravity of the moving object, the position of the thrust, the acceleration, or the cutting resistance.

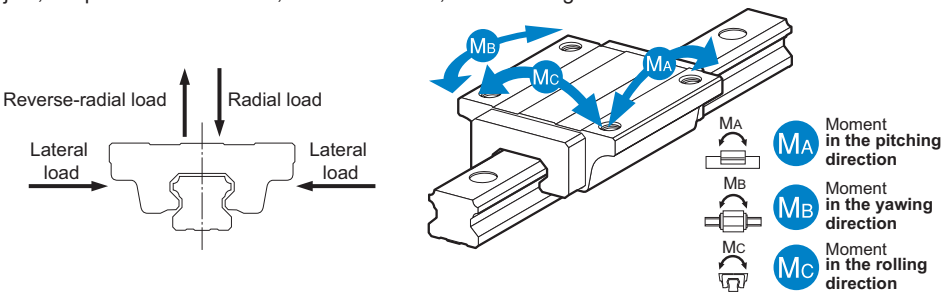


Fig. 1: Directions of the Loads Applied on the LM Guide

Calculating an Applied Load

Single-Axis Use

● **Moment Equivalence**

When the space to install the LM Guide is limited, you may have to use only one LM block, or two LM blocks in close contact with each other. In such a setting, the load distribution is not uniform. As a result, an excessive load is applied in localized areas (i.e., both 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 Table 1 to Table 6 A1-45.

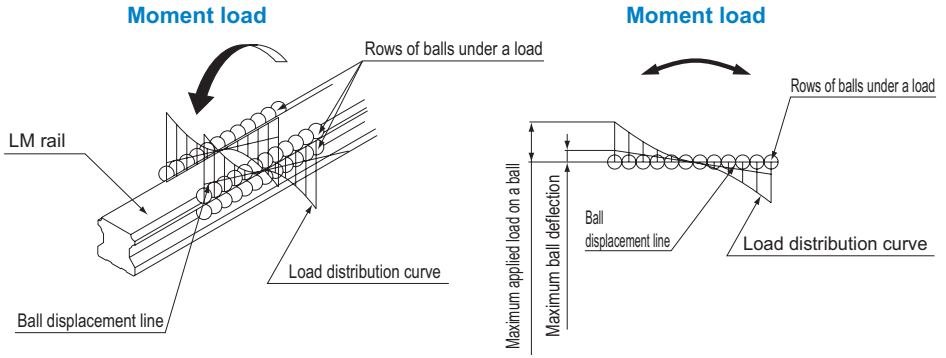


Fig. 2: Ball Load when a Moment is Applied

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 : Applied 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 models other than 4-way equal load types, however, the load ratings 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

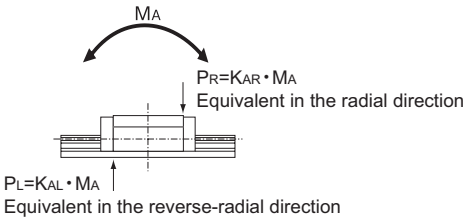


Fig. 3: Equivalent Factors for the M_A Moment

Equivalent factors for the M_A Moment

- Equivalent factor in the radial direction: $K_{AR}=\frac{C_0}{M_A}$
- Equivalent factor in the reverse-radial direction: $K_{AL}=\frac{C_{0L}}{M_A}$

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

■Equivalent Factors for the M_B Moment

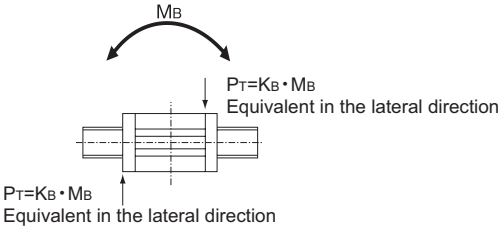


Fig. 4: Equivalent Factors for the M_B Moment

Equivalent factors for the M_B Moment

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

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

■Equivalent Factors for the M_C Moment

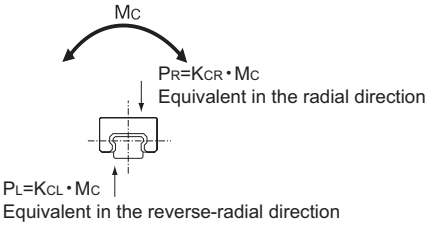


Fig. 5: Equivalent Factors for the M_C Moment

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 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)

Example Calculations

When One LM Block is Used

Model No.: SSR20XV1

Gravitational acceleration g = 9.8 (m/s^2)
Mass m = 10 (kg)
ℓ_1 = 200 (mm)
ℓ_2 = 100 (mm)

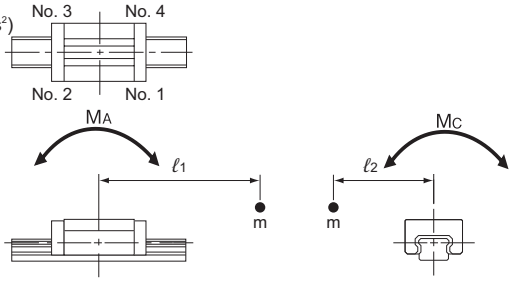


Fig. 6: When One LM Block is Used

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.: SVS25R2

Gravitational acceleration g = 9.8 (m/s^2)
Mass m = 5 (kg)
ℓ_1 = 200 (mm)
ℓ_2 = 150 (mm)

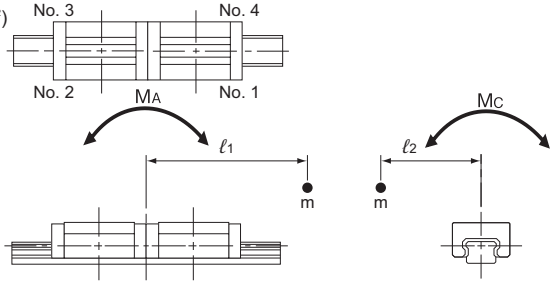


Fig. 7: When Two LM Blocks are Used in Close Contact with Each Other

No.1 $P_1 = \frac{mg}{2}+K_{AR2}\cdot mg\cdot\ell_1+K_{CR}\cdot\frac{mg\cdot\ell_2}{2} = \frac{49}{2}+0.0217\times49\times200+0.0995\times\frac{49\times150}{2} = 602.9$ (N)

No.2 $P_2 = \frac{mg}{2}-K_{AL2}\cdot mg\cdot\ell_1+K_{CR}\cdot\frac{mg\cdot\ell_2}{2} = \frac{49}{2}-0.0182\times49\times200+0.0995\times\frac{49\times150}{2} = 211.9$ (N)

No.3 $P_3 = \frac{mg}{2}-K_{AL2}\cdot mg\cdot\ell_1-K_{CL}\cdot\frac{mg\cdot\ell_2}{2} = \frac{49}{2}-0.0182\times49\times200-0.0835\times\frac{49\times150}{2} = -460.7$ (N)

No.4 $P_4 = \frac{mg}{2}+K_{AR2}\cdot mg\cdot\ell_1-K_{CL}\cdot\frac{mg\cdot\ell_2}{2} = \frac{49}{2}+0.0217\times49\times200-0.0835\times\frac{49\times150}{2} = -69.7$ (N)

Note: Since an LM Guide used in vertical installation receives only a moment load, there is no need to apply a load force (mg).

Double-Axis Use

● Determining the Operating Conditions

Set the conditions needed to calculate the applied load and service life in hours for the LM System.

(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) Velocity diagram
Speed: V (mm/s)
Time constant: t_n (s)
Acceleration: α_n (mm/s^2)

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

(7) Duty cycle
Number 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)

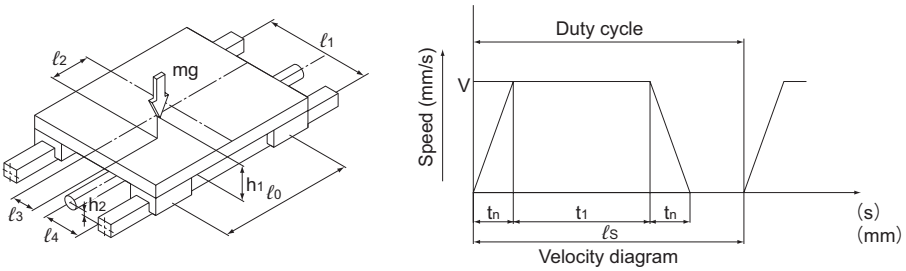


Fig. 8: Operating Conditions

● Applied Load Equation

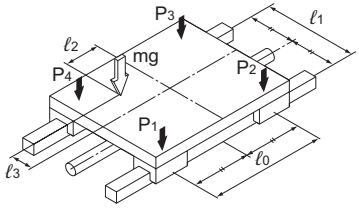
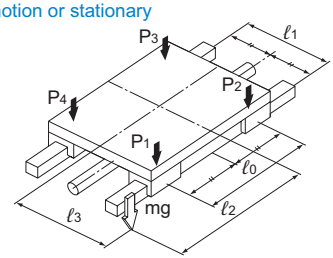
The load applied to the LM Guide varies with external forces such as the location of the center of gravity of the load, the position of the thrust, inertia generated by acceleration and deceleration during starts and stops, and cutting resistance.
In selecting an LM Guide, it is necessary to obtain the 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.

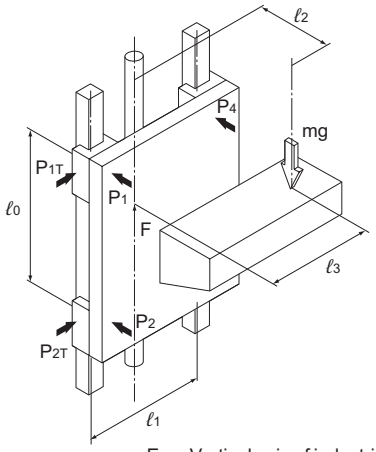
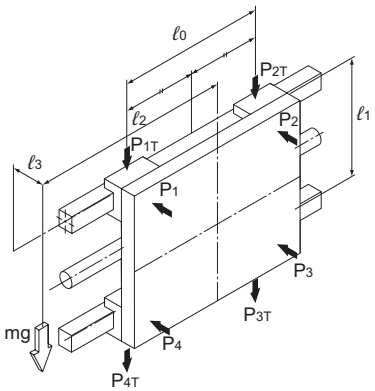
m	:	Mass	(kg)
ℓ_n	:	Distance	(mm)
F_n	:	External force	(N)
P_n	:	Applied load (radial/reverse-radial direction)	(N)
P_{nT}	:	Applied load (lateral directions)	(N)
g	:	Gravitational acceleration ($g = 9.8\ m/s^2$)	(m/s^2)
V	:	Speed	(m/s)
t_n	:	Time constant	(s)
α_n	:	Acceleration	(m/s^2)

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

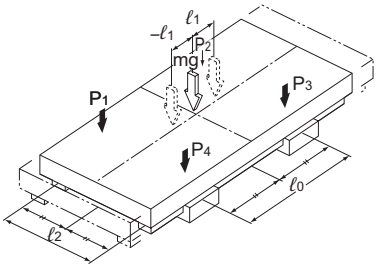
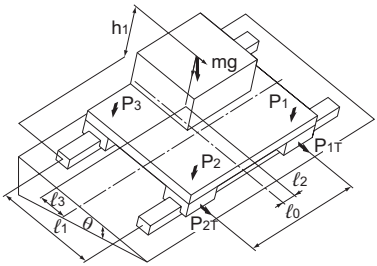
Example

	Operating conditions	Applied load equation
1	Horizontal mount (with the block moving) Uniform motion or stationary 	$P_1 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_2 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_3 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_4 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$
2	Horizontal mount, overhung (with the block moving) Uniform motion or stationary 	$P_1 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_2 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_3 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_4 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$

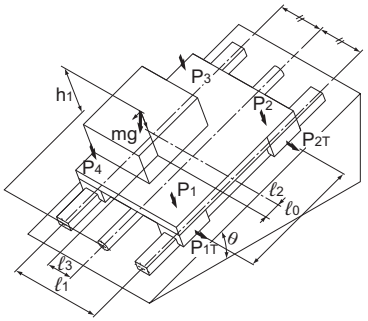
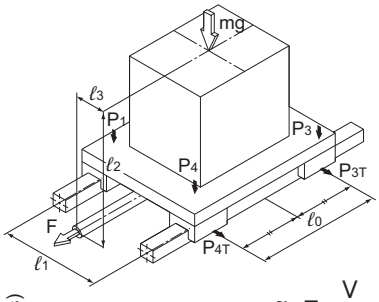
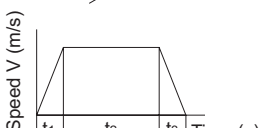
Note: Load is positive in the direction of the arrow.

	Operating conditions	Applied load equation
3	**Vertical mount** **Uniform motion or stationary**  E.g.: Vertical axis of industrial robot, automatic coating machine, lifter	$P_1 = P_4 = -\frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_2 = P_3 = \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_{1T} = P_{4T} = \frac{mg \cdot \ell_3}{2 \cdot \ell_0}$ $P_{2T} = P_{3T} = -\frac{mg \cdot \ell_3}{2 \cdot \ell_0}$
4	**Wall mount** **Uniform motion or stationary**  E.g.: Travel axis of cross-rail loader	$P_1 = P_2 = -\frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_3 = P_4 = \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_{1T} = P_{4T} = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_{2T} = P_{3T} = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$

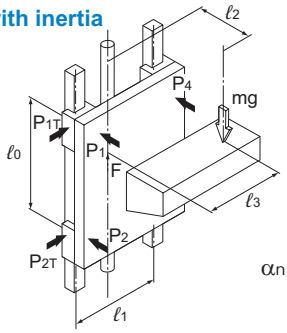
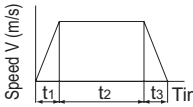
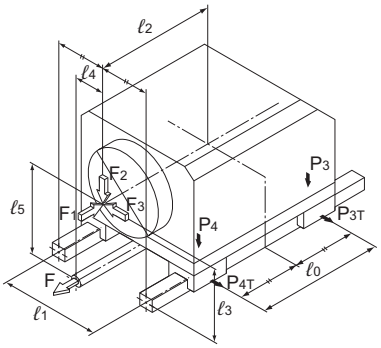
Note: Load is positive in the direction of the arrow.

	Operating conditions	Applied load equation
5	**With the LM rails moving** **Horizontal mount**  E.g.: XY table sliding fork	P_1 to P_4 (max) $= \frac{mg}{4} + \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$ P_1 to P_4 (min) $= \frac{mg}{4} - \frac{mg \cdot \ell_1}{2 \cdot \ell_0}$
6	**Lateral tilt mount**  E.g.: NC lathe carriage	$P_1 = + \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{1T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_2 = + \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{2T} = \frac{mg \cdot \sin\theta}{4} - \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_3 = + \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{3T} = \frac{mg \cdot \sin\theta}{4} - \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_4 = + \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{4T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$

Note: Load is positive in the direction of the arrow.

	Operating conditions	Applied load equation
7	**Longitudinal tilt mount**  E.g.: NC lathe tool rest	$P_1 = +\frac{mg\cdot\cos\theta}{4} + \frac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \frac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{1T} = +\frac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_2 = +\frac{mg\cdot\cos\theta}{4} - \frac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} - \frac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \frac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{2T} = -\frac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_3 = +\frac{mg\cdot\cos\theta}{4} - \frac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} - \frac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{3T} = -\frac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$ $P_4 = +\frac{mg\cdot\cos\theta}{4} + \frac{mg\cdot\cos\theta\cdot\ell_2}{2\cdot\ell_0} + \frac{mg\cdot\cos\theta\cdot\ell_3}{2\cdot\ell_1} + \frac{mg\cdot\sin\theta\cdot h_1}{2\cdot\ell_0}$ $P_{4T} = +\frac{mg\cdot\sin\theta\cdot\ell_3}{2\cdot\ell_0}$
8	**Horizontal mount with inertia**  $\alpha_n = \frac{V}{t_n}$  Velocity diagram E.g.: Conveyance truck	During acceleration $P_1 = P_4 = \frac{mg}{4} - \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{mg}{4} + \frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = \frac{m\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{m\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0}$ During uniform motion P_1 to $P_4 = \frac{mg}{4}$ During deceleration $P_1 = P_4 = \frac{mg}{4} + \frac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{mg}{4} - \frac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = -\frac{m\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = \frac{m\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0}$

Note: Load is positive in the direction of the arrow.

	Operating conditions	Applied load equation
9	**Vertical mount with inertia**  $\alpha_n = \frac{V}{t_n}$  Velocity diagram E.g.: Conveyance lift	During acceleration $P_1 = P_4 = -\frac{m(g+\alpha_1)\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{m(g+\alpha_1)\ell_2}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = \frac{m(g+\alpha_1)\ell_3}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{m(g+\alpha_1)\ell_3}{2\cdot\ell_0}$ During uniform motion $P_1 = P_4 = -\frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = \frac{mg\cdot\ell_3}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{mg\cdot\ell_3}{2\cdot\ell_0}$ During deceleration $P_1 = P_4 = -\frac{m(g-\alpha_3)\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{m(g-\alpha_3)\ell_2}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = \frac{m(g-\alpha_3)\ell_3}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{m(g-\alpha_3)\ell_3}{2\cdot\ell_0}$
10	**Horizontal mount with external force**  E.g.: Drill unit, milling machine, lathe, machining center, and other cutting machines	Under force F_1 $P_1 = P_4 = -\frac{F_1\cdot\ell_5}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{F_1\cdot\ell_5}{2\cdot\ell_0}$ $P_{1T} = P_{4T} = \frac{F_1\cdot\ell_4}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{F_1\cdot\ell_4}{2\cdot\ell_0}$ Under force F_2 $P_1 = P_4 = \frac{F_2}{4} + \frac{F_2\cdot\ell_2}{2\cdot\ell_0}$ $P_2 = P_3 = \frac{F_2}{4} - \frac{F_2\cdot\ell_2}{2\cdot\ell_0}$ Under force F_3 $P_1 = P_2 = \frac{F_3\cdot\ell_3}{2\cdot\ell_1}$ $P_3 = P_4 = -\frac{F_3\cdot\ell_3}{2\cdot\ell_1}$ $P_{1T} = P_{4T} = -\frac{F_3}{4} - \frac{F_3\cdot\ell_2}{2\cdot\ell_0}$ $P_{2T} = P_{3T} = -\frac{F_3}{4} + \frac{F_3\cdot\ell_2}{2\cdot\ell_0}$

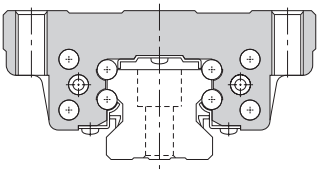
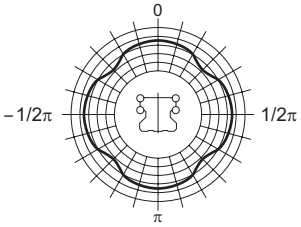
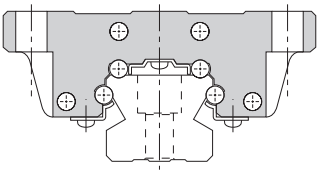
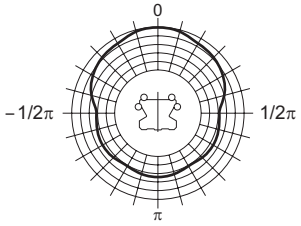
Note: Load is positive in the direction of the arrow.

Equivalent Load

Load Ratings 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 load rating in the radial, reverse-radial, and lateral directions; and the radial type, which has a large load rating in the radial direction. With the radial type LM Guide, the load rating in the radial direction is different from that in the reverse-radial and lateral directions. The basic load rating in the radial direction is indicated in the specification table. The values in the reverse-radial and lateral directions are obtained from Table 7 on A1-63.

Load Ratings in Each Direction

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

Equivalent Load P_E

The LM Guide can bear loads and moments in all directions, including a radial load (PR), reverse-radial load (PL), and lateral loads (PT), simultaneously.

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 load or reverse-radial load.

Equivalent Load Equation

When the LM block receives loads simultaneously in the radial and lateral directions, or the reverse-radial and lateral directions, the equivalent load is obtained from the equation below.

$$P_E = X \cdot P_{R(L)} + Y \cdot P_T$$

P_E : Equivalent load (N)
·Radial direction
·Reverse-radial direction
P_L : Reverse-radial load (N)
P_T : Lateral load (N)
X,Y : Equivalent factor
(see Table 8 on A1-65)

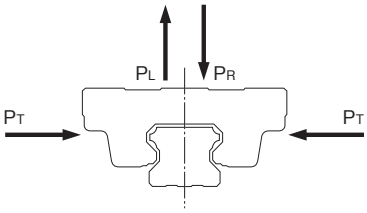


Fig. 9: Equivalent Load of the LM Guide

Static Safety Factor

During actual operation, damage may be caused by an unexpectedly large load acting on the LM Guide that is caused by particularly sudden starting and stopping, vibrations due to a cutting load, or a large moment created by an overhang. Therefore, a static safety factor (f_S) must be considered. The static safety factor (f_S) is obtained from the formulas in Table 1 based on the relationship between the applied load and the basic static load rating. Estimates for the static safety factor based on operating conditions are shown in Table 2. In addition, the static safety factor (f_S) must also be considered for each direction (radial, reverse-radial, and horizontal) individually.

Table 1: Static Safety Factor Formulas per Load Direction

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	$\frac{f_H \cdot f_T \cdot f_C \cdot C_{0T}}{P_T} \geqq f_S$

Table 2: Guideline for the Static Safety Factor (f_S)

Load conditions[2]	Lower Limit of (f_S)
Without vibrations or impacts	2
With vibrations or impacts	5

f_S : Static safety factor
C_0[1] : Basic static load rating (radial direction) (N)
C_{0L}[1] : Basic static load rating (reverse-radial direction) (N)
C_{0T}[1] : 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. 10 on B1-77)
f_T : Temperature factor (see Fig. 11 on B1-77)
f_C : Contact factor (see Table 3 on B1-77)

[1] The basic static load rating is a static load with a constant direction and size where 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.
[2] 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.

Average Load

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

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

P_m	: Average load	(N)
P_n	: Varying load	(N)
L	: Total travel distance	(mm)
L_n	: Distance traveled under load P_n	(mm)
i	: Constant determined by rolling element	

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

(1) With stepwise load fluctuation

LM Guide Using Balls (i=3)

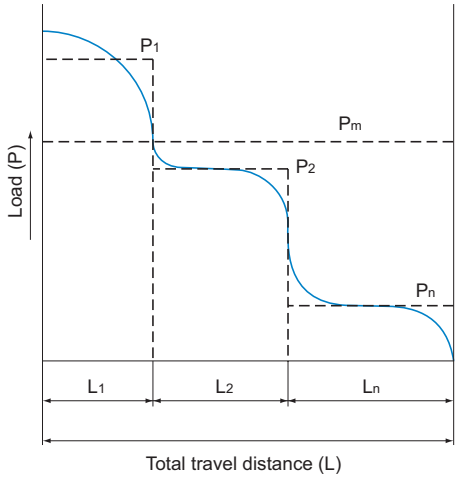
$$P_m = \sqrt[3]{\frac{1}{L}(P_1{}^3 \cdot L_1 + P_2{}^3 \cdot L_2 \cdots\cdots + P_n{}^3 \cdot L_n)} \quad \cdots\cdots\cdots\cdots (1)$$

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

LM Guide Using Rollers ($i = \frac{10}{3}$)

$$P_m = \sqrt[\frac{10}{3}]{\frac{1}{L}(P_1{}^{\frac{10}{3}} \cdot L_1 + P_2{}^{\frac{10}{3}} \cdot L_2 \cdots\cdots + P_n{}^{\frac{10}{3}} \cdot L_n)} \quad \cdots\cdots\cdots\cdots (2)$$

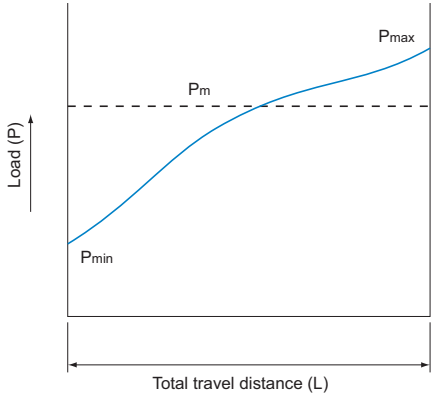
P_m	: Average load	(N)
P_n	: Varying load	(N)
L	: Total travel distance	(mm)
L_n	: Distance traveled under P_n	(mm)



(2) With monotone load fluctuation

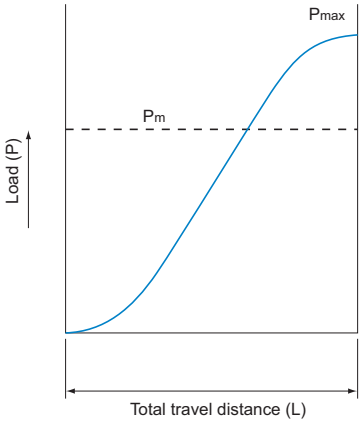
$$P_m \fallingdotseq \frac{1}{3}(P_{min} + 2 \cdot P_{max}) \quad \cdots\cdots (3)$$

P_{min} : Minimum load (N)
P_{max} : Maximum load (N)

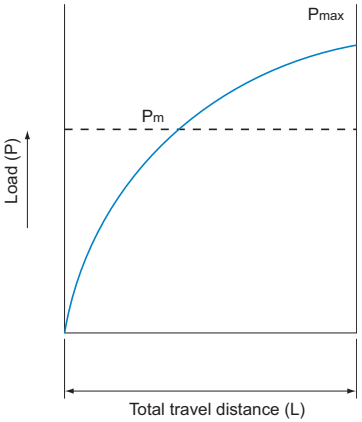


(3) With sinusoidal load fluctuation

(a) $P_m \fallingdotseq 0.65P_{max}$ ····· (4)

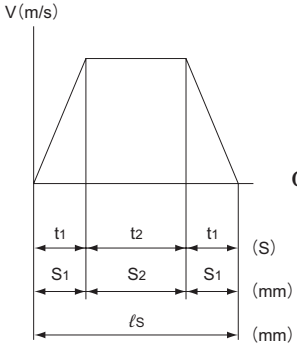


(b) $P_m \fallingdotseq 0.75P_{max}$ ····· (5)

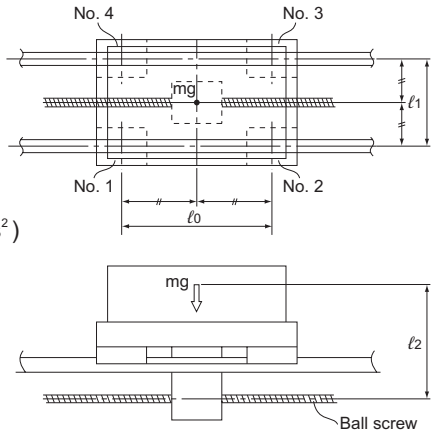


Example of Calculating the Average Load (1)
- with Horizontal Mount and Acceleration/Deceleration Considered -

Conditions



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



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

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

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

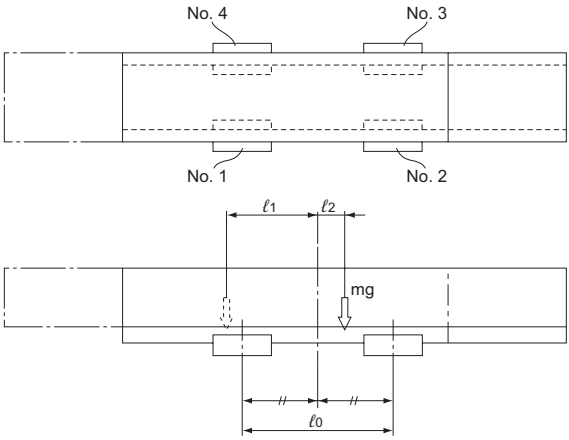
$$P_{m3} = \sqrt[3]{\frac{1}{\ell_s}\left(Pa_3^3 \cdot s_1 + P_3^3 \cdot s_2 + Pd_3^3 \cdot s_3\right)}$$

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

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

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

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.

Nominal Life

An LM Guide in motion under an external load receives repeated stress on its raceways and rolling elements. When the stress reaches the limit, the surface of the raceways and rolling elements flake in places due to rolling fatigue. This phenomenon is called flaking. The service life of an LM Guide is the total travel distance until the first flaking occurs on any of the raceways or the rolling elements as a result of rolling fatigue of the material.
The nominal life defined below is typically used as a guideline for obtaining the service life of the LM Guide.
The nominal life means the total travel distance that 90% of a group of units of the same LM Guide model can achieve without flaking after individually running under the same conditions.

Calculating the Nominal Life

The nominal life (L_{10}) of an LM Guide is obtained from the following formula using the basic dynamic load rating (C), which is based on a reference distance of 50 km for an LM Guide with balls and 100 km for an LM Guide with rollers, and the calculated load acting on the LM Guide (P_C).

●LM Guide with balls (using a basic dynamic load rating based on a nominal life of 50 km)

$$L_{10} = \left(\frac{C}{P_C}\right)^3 \times 50 \quad \cdots\cdots\cdots\cdots (1)$$

L_{10} : Nominal life (km)
C : Basic dynamic load rating (N)
P_C : Calculated load (N)

●LM Guide with rollers (using a basic dynamic load rating based on a nominal life of 100 km)

$$L_{10} = \left(\frac{C}{P_C}\right)^{\frac{10}{3}} \times 100 \quad \cdots\cdots\cdots\cdots (2)$$

Note: These nominal life formulas may not apply if the length of the stroke is less than or equal to twice the length of the LM block.

When comparing the nominal life (L_{10}), you must take into account whether the basic dynamic load rating was defined based on 50 km or 100 km. Convert the basic dynamic load rating based on ISO 14728-1 as necessary.

ISO-regulated basic dynamic load rating conversion formulas:

• LM Guide with balls

$$C_{100} = \frac{C_{50}}{1.26}$$

C_{50} : Basic dynamic load rating based on a nominal life of 50 km
C_{100} : Basic dynamic load rating based on a nominal life of 100 km

• LM Guide with rollers

$$C_{100} = \frac{C_{50}}{1.23}$$

Calculating the Modified Nominal Life

During use, an LM Guide may be subjected to vibrations and shocks as well as fluctuating loads, which are difficult to detect. In addition, the surface hardness of the raceways, the operating temperature, and having LM blocks arranged directly behind one another will have a decisive impact on the service life. Taking these factors into account, the modified nominal life (L_{10m}) can be calculated according to the following formulas (3) and (4).

●Modified factor α

$$\alpha = \frac{f_H \cdot f_T \cdot f_C}{f_W}$$

α : Modified factor
f_H : Hardness factor (see Fig. 10 on B**1-77**)
f_T : Temperature factor (see Fig. 11 on B**1-77**)
f_C : Contact factor (see Table 3 on B**1-77**)
f_W : Load factor (see Table 4 on B**1-78**)

●Modified nominal life L_{10m}

• LM Guide with balls

$$L_{10m} = \left(\alpha \times \frac{C}{P_C}\right)^3 \times 50 \quad \cdots\cdots\cdots\cdots\cdots (3)$$

• LM Guide with rollers

$$L_{10m} = \left(\alpha \times \frac{C}{P_C}\right)^{\frac{10}{3}} \times 100 \quad \cdots\cdots\cdots\cdots (4)$$

L_{10m} : Modified nominal life (km)
C : Basic dynamic load rating (N)
P_C : Calculated load (N)

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

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

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 ensure that the LM Guide achieves optimum load capacity, the raceway hardness must be between 58 and 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).

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

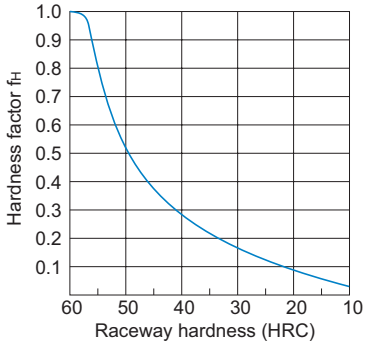


Fig. 10: Hardness Factor (f_H)

f_T: Temperature Factor

If the temperature of the operating environment surrounding the LM Guide exceeds 100°C, take into account the adverse effect of the high temperature and multiply the basic load ratings by the temperature factor indicated in Fig. 11.

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

Note: An LM Guide not designed to withstand high temperatures should be used at 80°C or less. Please contact THK if application requirements exceed 80°C.

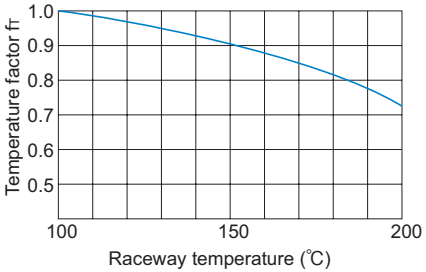


Fig. 11: Temperature Factor (f_T)

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 3.

Note: If uneven load distribution is expected in a large machine, take into account the respective contact factor indicated in Table 3.

Table 3: 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 greater	0.6
Normal use	1

f_w: Load Factor

In general, reciprocating machines tend to involve vibrations or impacts during operation. It is extremely difficult to accurately determine vibrations generated during high-speed operation and impacts that occur during frequent 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 4, which contains empirically obtained data.

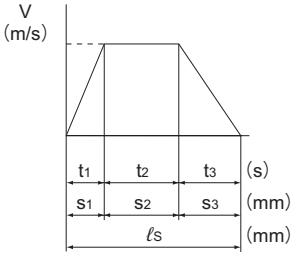
Table 4: Load Factor (f_w)

Vibrations/ impacts	Speed (V)	f_w
Faint	Very low V≦0.25 m/s	1 to 1.2
Weak	Low 0.25 m/s<V≦1 m/s	1.2 to 1.5
Medium	Medium 1 m/s<V≦2 m/s	1.5 to 2
Strong	High V>2 m/s	2 to 3.5

Example of Calculating the Nominal Life (1) - with Horizontal Mount and High-Speed Acceleration

Conditions
Model No. : HSR35L
(basic dynamic load rating: C = 65.0 kN)
(basic static load rating: C_0 = 91.7 kN)

Mass	: m_1 = 800 kg	Distance: ℓ_0 = 600 mm	
	m_2 = 500 kg	ℓ_1 = 400 mm	
Speed	: V = 0.5 m/s	ℓ_2 = 120 mm	
Time	: t_1 = 0.05 s	ℓ_3 = 50 mm	
	t_2 = 2.8 s	ℓ_4 = 200 mm	
	t_3 = 0.15 s	ℓ_5 = 350 mm	
Acceleration	: α_1 = 10 m/s^2		
	α_3 = 3.333 m/s^2		
Stroke	: ℓ_S = 1450 mm		



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

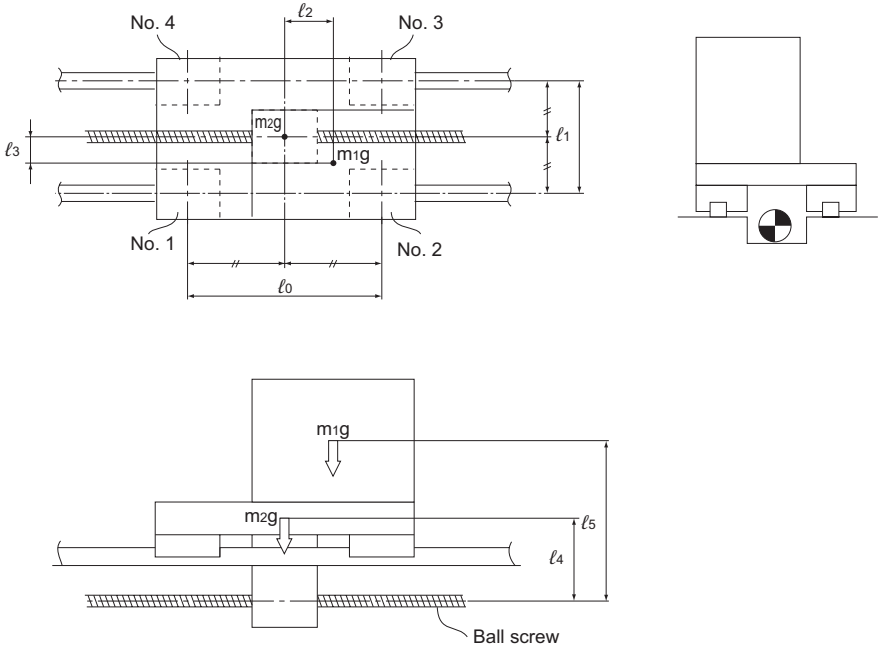


Fig. 12: Operating Conditions

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 $Pt\ell d_n$

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

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

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

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

● During rightward acceleration

■Applied load in the radial direction Pra_n

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

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

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

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

■Applied load in the lateral direction $Ptra_n$

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

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

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

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

● During rightward deceleration

■Applied load in the radial direction Prd_n

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

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

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

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

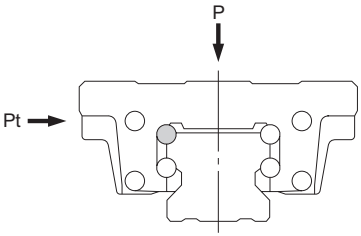
■Applied load in the lateral direction $Ptrd_n$

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

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

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

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



Combined Radial and Thrust Load

The combined radial and thrust load is calculated for each block only on the groove where the load is greatest.

Under these operating conditions, for each block, the groove for which the load is greatest is groove 1.[1] Because groove 1 bears $P^{2}>0$ and $Pt>0$ loads, it is 0 N when $P<0$ and $Pt<0$ loads are applied.

When calculating for the groove that will bear $P<0$ and $Pt<0$ loads, use the absolute value of the load.

[1] The reason that groove 1 has the greatest load is that mass m_1 is applied unevenly to the table and is not distributed equally to all grooves in the block.
[2] P refers to the radial load that each groove bears.

● During uniform motion

$P_{E1} = P_1 = 2891$ N
$P_{E2} = P_2 = 4459$ N
$P_{E3} = P_3 = 3479$ N
$P_{E4} = P_4 = 1911$ N

● During leftward acceleration

$P_E\ell a_1 = |\ P\ell a_1\ | + |\ Pt\ell a_1\ | = 0$ N
$P_E\ell a_2 = |\ P\ell a_2\ | + |\ Pt\ell a_2\ | = 7958.9$ N
$P_E\ell a_3 = |\ P\ell a_3\ | + |\ Pt\ell a_3\ | = 6978.9$ N
$P_E\ell a_4 = |\ P\ell a_4\ | + |\ Pt\ell a_4\ | = 0$ N
$P\ell a_1$, $Pt\ell a_1$, $P\ell a_4$, and $Pt\ell a_4 = 0$ N

● During leftward deceleration

$P_E\ell d_1 = |\ P\ell d_1\ | + |\ Pt\ell d_1\ | = 4057.7$ N
$P_E\ell d_2 = |\ P\ell d_2\ | + |\ Pt\ell d_2\ | = 3403.4$ N
$P_E\ell d_3 = |\ P\ell d_3\ | + |\ Pt\ell d_3\ | = 2423.4$ N
$P_E\ell d_4 = |\ P\ell d_4\ | + |\ Pt\ell d_4\ | = 3077.7$ N
$Pt\ell d_2$ and $Pt\ell d_3 = 0$ N

● During rightward acceleration

$P_Era_1 = |\ Pra_1\ | + |\ Ptra_1\ | = 6390.9$ N
$P_Era_2 = |\ Pra_2\ | + |\ Ptra_2\ | = 1292.4$ N
$P_Era_3 = |\ Pra_3\ | + |\ Ptra_3\ | = 312.4$ N
$P_Era_4 = |\ Pra_4\ | + |\ Ptra_4\ | = 5410.9$ N
$Ptra_2$ and $Ptra_3 = 0$ N

● During rightward deceleration

$P_Erd_1 = |\ Prd_1\ | + |\ Ptrd_1\ | = 1835.4$ N
$P_Erd_2 = |\ Prd_2\ | + |\ Ptrd_2\ | = 5625.7$ N
$P_Erd_3 = |\ Prd_3\ | + |\ Ptrd_3\ | = 4645.7$ N
$P_Erd_4 = |\ Prd_4\ | + |\ Ptrd_4\ | = 855.4$ N
$Ptrd_1$ and $Ptrd_4 = 0$ 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 by the following equation.

$$f_S = \frac{C_0}{P_E\ell a_2} = \frac{91.7\times10^3}{7958.9} = 11.5$$

Average Load P_{mn}

Obtain the average load applied to each LM block.

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

$$= \sqrt[3]{\frac{1}{2\times1450}(0\times12.5+2891^3\times1400+4057.7^3\times37.5+6390.9^3\times12.5+2891^3\times1400+1835.4^3\times37.5)}$$

$$= 2939.5\ \text{N}$$

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

$$= \sqrt[3]{\frac{1}{2\times1450}(7958.9^3\times12.5+4459^3\times1400+3403.4^3\times37.5+1292.4^3\times12.5+4459^3\times1400+5625.7^3\times37.5)}$$

$$= 4491.2\ \text{N}$$

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

$$= \sqrt[3]{\frac{1}{2\times1450}(6978.9^3\times12.5+3479^3\times1400+2423.4^3\times37.5+312.4^3\times12.5+3479^3\times1400+4645.7^3\times37.5)}$$

$$= 3519.7\ \text{N}$$

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

$$= \sqrt[3]{\frac{1}{2\times1450}(0\times12.5+1911^3\times1400+3077.7^3\times37.5+5410.9^3\times12.5+1911^3\times1400+855.4^3\times37.5)}$$

$$= 1983.7\ \text{N}$$

Nominal Life L_{10mn}

The nominal life of the four LM blocks is obtained from the corresponding nominal life equations shown below.

$$L_{10m1} = \left(\alpha\times\frac{C}{P_{m1}}\right)^3\times50 = 160100\ \text{km}$$

$$L_{10m2} = \left(\alpha\times\frac{C}{P_{m2}}\right)^3\times50 = 44900\ \text{km}$$

$$L_{10m3} = \left(\alpha\times\frac{C}{P_{m3}}\right)^3\times50 = 93300\ \text{km}$$

$$L_{10m4} = \left(\alpha\times\frac{C}{P_{m4}}\right)^3\times50 = 521000\ \text{km}$$

$$\alpha = \frac{1}{f_W}\ (\text{where } f_W = 1.5)$$

Therefore, the service life of the LM Guide used in a machine or equipment under the conditions stated above is equivalent to the nominal life of the second LM block, which is 44,900 km.

Example of Calculating the Nominal Life (2) - with Vertical Mount

Operating Conditions

Model No. : HSR25CA2SS+1500L-Ⅱ
(basic dynamic load rating: C = 27.6 kN)
(basic static load rating: C_0 = 36.4 kN)

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

Stroke : ℓ_S = 1000 mm

Distance : ℓ_0 = 300 mm
ℓ_1 = 80 mm
ℓ_2 = 50 mm
ℓ_3 = 280 mm
ℓ_4 = 150 mm
ℓ_5 = 250 mm

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

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

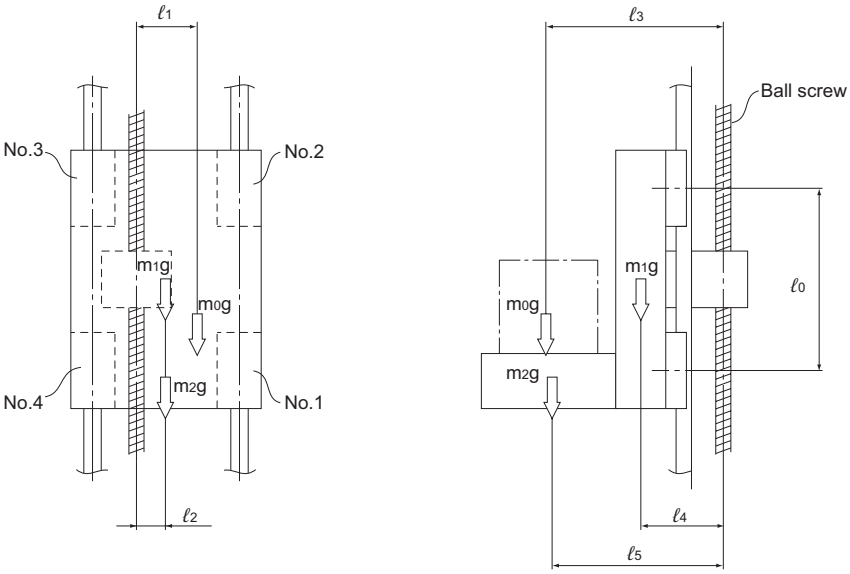


Fig. 13: Operating Conditions

Load Applied to the LM Block

● During Ascent

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

$$Pu_1 = +\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} + \frac{m_0 g \cdot \ell_3}{2 \cdot \ell_0} = +1355.6\ \mathrm{N}$$

$$Pu_2 = -\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} - \frac{m_0 g \cdot \ell_3}{2 \cdot \ell_0} = -1355.6\ \mathrm{N}$$

$$Pu_3 = -\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} - \frac{m_0 g \cdot \ell_3}{2 \cdot \ell_0} = -1355.6\ \mathrm{N}$$

$$Pu_4 = +\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} + \frac{m_0 g \cdot \ell_3}{2 \cdot \ell_0} = +1355.6\ \mathrm{N}$$

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

$$Ptu_1 = +\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_0 g \cdot \ell_1}{2 \cdot \ell_0} = +375.7\ \mathrm{N}$$

$$Ptu_2 = -\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_0 g \cdot \ell_1}{2 \cdot \ell_0} = -375.7\ \mathrm{N}$$

$$Ptu_3 = -\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_0 g \cdot \ell_1}{2 \cdot \ell_0} = -375.7\ \mathrm{N}$$

$$Ptu_4 = +\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_0 g \cdot \ell_1}{2 \cdot \ell_0} = +375.7\ \mathrm{N}$$

● During Descent

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

$$Pd_1 = +\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} = +898.3\ \mathrm{N}$$

$$Pd_2 = -\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} = -898.3\ \mathrm{N}$$

$$Pd_3 = -\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} = -898.3\ \mathrm{N}$$

$$Pd_4 = +\frac{m_1 g \cdot \ell_4}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_5}{2 \cdot \ell_0} = +898.3\ \mathrm{N}$$

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

$$Ptd_1 = +\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} = +245\ \mathrm{N}$$

$$Ptd_2 = -\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} = -245\ \mathrm{N}$$

$$Ptd_3 = -\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} - \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} = -245\ \mathrm{N}$$

$$Ptd_4 = +\frac{m_1 g \cdot \ell_2}{2 \cdot \ell_0} + \frac{m_2 g \cdot \ell_2}{2 \cdot \ell_0} = +245\ \mathrm{N}$$

Combined Radial and Thrust Load

● During Ascent

$P_{Eu1} = |P_{u1}| + |Pt_{u1}| = 1731.3$ N
$P_{Eu2} = |P_{u2}| + |Pt_{u2}| = 1731.3$ N
$P_{Eu3} = |P_{u3}| + |Pt_{u3}| = 1731.3$ N
$P_{Eu4} = |P_{u4}| + |Pt_{u4}| = 1731.3$ N

● During Descent

$P_{Ed1} = |Pd_1| + |Ptd_1| = 1143.3$ N
$P_{Ed2} = |Pd_2| + |Ptd_2| = 1143.3$ N
$P_{Ed3} = |Pd_3| + |Ptd_3| = 1143.3$ N
$P_{Ed4} = |Pd_4| + |Ptd_4| = 1143.3$ N

Static Safety Factor

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

$$f_S = \frac{C_0}{P_{EU2}} = \frac{36.4\times10^3}{1731.3} = 21.0$$

Average Load P_{mn}

Obtain the average load applied to each LM block.

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

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

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

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

Nominal Life L_{10mn}

The nominal life of the four LM blocks is obtained from the corresponding nominal life equations shown below.

$$L_{10m1} = \left(\alpha\times\frac{C}{P_{m1}}\right)^3\times50 = 182000 \text{ km}$$

$$L_{10m2} = \left(\alpha\times\frac{C}{P_{m2}}\right)^3\times50 = 182000 \text{ km}$$

$$L_{10m3} = \left(\alpha\times\frac{C}{P_{m3}}\right)^3\times50 = 182000 \text{ km}$$

$$L_{10m4} = \left(\alpha\times\frac{C}{P_{m4}}\right)^3\times50 = 182000 \text{ km}$$

$$\alpha = \frac{1}{f_W} \text{ (where } f_W = 1.2)$$

Therefore, the service life of the LM Guide used in a machine or equipment under the conditions stated above is 182,000 km.

Predicting the Rigidity

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, the service life and accuracy are favorably affected by selecting a negative clearance (i.e., applying a preload[1]) while taking into account possible vibrations and impacts generated from reciprocating motion.

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

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

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

Table 5: Types of Radial Clearance

	Normal clearance	Clearance C1 (light preload)	Clearance C0 (medium preload)
Condition	● 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. ● The LM Guide is used in a single-rail configuration. ● Light load and high accuracy are required.	● High rigidity is required and vibrations and impact are applied. ● Heavy-cutting machine tools
Examples of applications	• Beam-welding machines • Book-binding machines • Automatic packaging machines • XY axes of general industrial machinery • Automatic sash-manufacturing machines • Welding machines • Flame cutting machines • Tool changers • Various kinds of material feeders	• Grinding machine table feed axes • Automatic coating machines • Industrial robots • Various kinds of high-speed material feeders • NC drilling machines • Vertical axes of general industrial machinery • Printed circuit board drilling machines • Electric discharge machines • Measuring instruments • Precision XY tables	• Machining centers • NC lathes • Grinding stone feed axes of grinding machines • Milling machines • Vertical/horizontal boring machines • Tool rest guides • Vertical axes of machine tools

Service Life with a Preload Considered

When using an LM Guide under a medium 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.

Rigidity

When a load is applied to an LM Guide, the bearings and LM block will undergo elastic deformation within the allowable load range. The ratio of displacement to applied load is referred to as “rigidity.” The radial internal clearance (preload) for the LM Guide can be specified in order to reduce displacement.
By using balls larger than the width of the raceway, they will naturally deform elastically as they roll, allowing the load to be maintained for longer while limiting displacement in the LM Guide.
The effect of the preload can be up to 2.8 times greater than the size of the preload itself. If that level is exceeded, the preload is released and the effect of the preload is lost.
When a preloaded LM Guide takes an external load, the displacement will be linear. The level of displacement will be approximately half that of an LM Guide with no preload.
The preload, in addition to reducing displacement, helps prevent premature failure due to vibration and impact/shock.

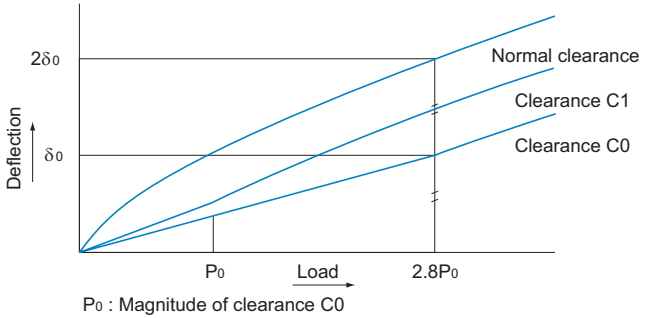


Fig. 14: Rigidity Data

$$K=\frac{P}{\delta}$$

K	: Rigidity value	(N/μm)
δ	: Deflection	(μm)
P	: Calculated load	(N)

Determining the Accuracy

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 two or more LM blocks are used on one rail or when two or more rails are mounted on the same plane.
For details, see “Accuracy Standards for Each Model” on A1-80 to A1-90.

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.

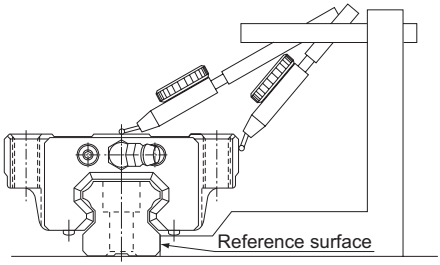


Fig. 15: Running Parallelism

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.

Notes: When two or more rails are used on the same plane in parallel, this applies only to the difference in width (W_2) and dimensional tolerance of the master rail. Please specify if you wish for it to apply to the difference in width and dimensional tolerance of the subsidiary rail as well. Master LM rails will have a serial number ending with “KB” printed on them. However, this is not the case for Normal grade products.

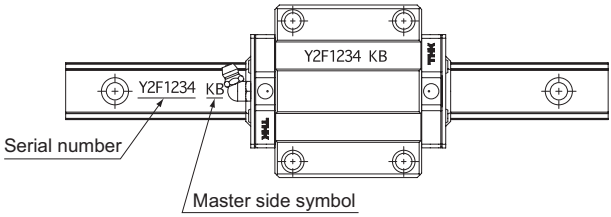


Fig. 16: Master LM Rail (E.g. Model HSR-C)

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

Guidelines for Accuracy Grades by Machine Type

Table 6 shows guidelines for selecting an accuracy grade of the LM Guide according to the machine type.

Table 6: Guidelines for Accuracy Grades by Machine Type

Type of machine		Accuracy grades				
		Normal	H	P	SP	UP
Machine tools	Machining center			●	●	
	Lathe			●	●	
	Milling machine			●	●	
	Boring machine			●	●	
	Jig borer				●	●
	Grinding machine				●	●
	Electric discharge machine			●	●	●
	Punching press		●	●		
	Laser beam machine		●	●	●	
	Woodworking machine	●	●	●		
	NC drilling machine		●	●		
	Tapping center		●	●		
	Palette changer	●				
	ATC	●				
	Wire cutting machine			●	●	
	Dressing machine				●	●
Industrial robots	Cartesian coordinate	●	●	●		
	Cylindrical coordinate	●	●			
Semiconductor manufacturing equipment	Wire bonding machine			●	●	
	Prober				●	●
	Electronic component inserter		●	●		
	Printed circuit board drilling machine		●	●	●	
Other equipment	Injection molding machine	●	●			
	3D measuring instrument				●	●
	Office equipment	●	●			
	Conveyance system	●	●			
	XY table		●	●	●	
	Coating machine	●	●			
	Welding machine	●	●			
	Medical equipment	●	●			
	Digitizer		●	●	●	
	Inspection equipment			●	●	●

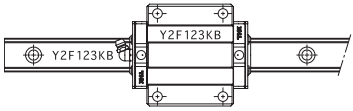
Normal : Normal grade
H : High Accuracy grade
P : Precision grade
SP : Super Precision grade
UP : Ultra Precision grade

Mounting the LM Guide

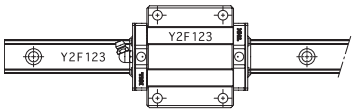
Master LM Guide Indicators and Combined Use

Master LM Guide Indicators

All LM rails mounted on the same plane are marked with the same serial number. The LM rail marked with “KB” after the serial number is the master LM rail. The LM block on the master LM rail has its reference surface finished to a designated precision, allowing it to serve as the positioning reference for tables (see Fig. 1).
Normal grade LM Guides 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.



Master LM Guide



Subsidiary LM Guide

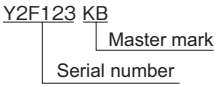
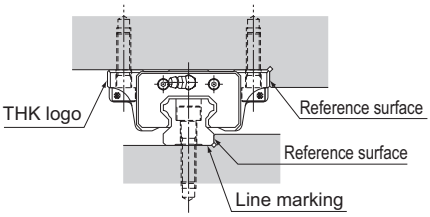


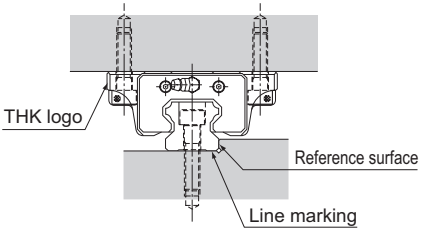
Fig. 1: Master and Subsidiary LM Guide Units (e.g. Model HSR-C)

Reference Surface Indicators

In the LM Guide, the reference surface 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. 2). Please specify if it is necessary to reverse the reference surface of the LM rail and block or if the grease nipple must be oriented in the opposite direction.



Master LM Guide



Subsidiary LM Guide

Fig. 2: Reference Surface Indicators

Serial Number Marking and Combined Use of an LM Rail and LM Blocks

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. 3)

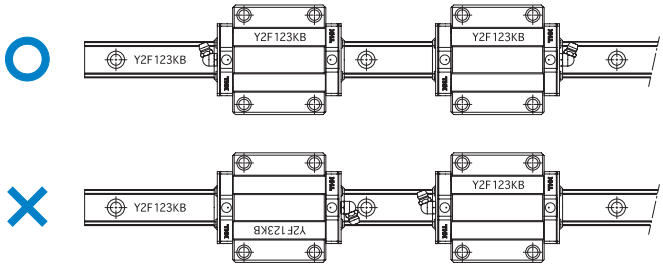


Fig. 3: Serial Number Marking and Combined Use of an LM Rail and LM Blocks (E.g. Model HSR-C)

Use of Jointed Rails

When a long LM rail is ordered, two or more rails will be jointed together to the desired length. When jointing rails, make sure that the joint match marks shown in Fig. 4 are correctly positioned.

When two LM Guide units with jointed rails are to be arranged parallel to each other, they will be manufactured so that they have axial symmetry (are mirror images of each other) as a set.

If a large load is applied near the LM rail joint, the LM rail may deflect and cause misalignment. Therefore, we recommend securely fastening the joint section by pressing the LM rail against the datum plane using a set screw or the like and keeping the L dimension as short as possible. (Fig. 4)

For details, contact THK.

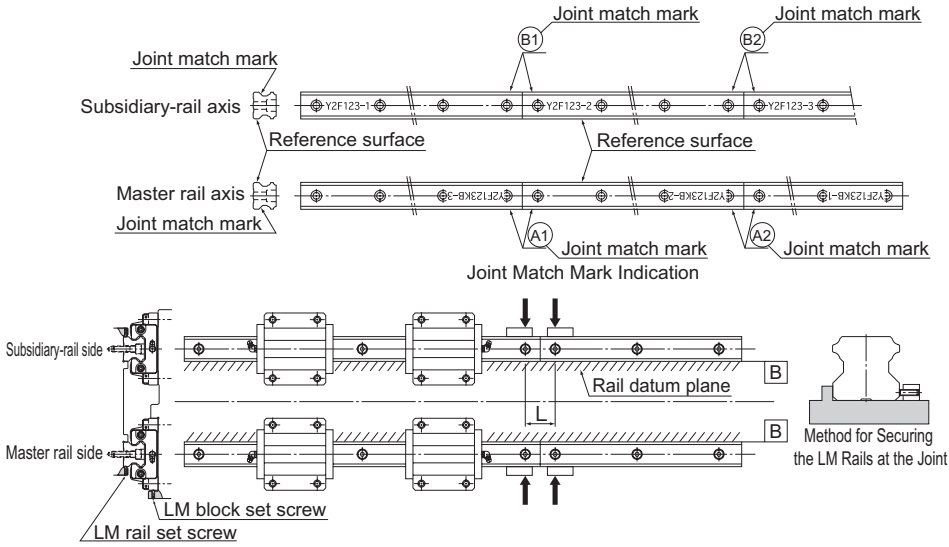


Fig. 4: Use of Jointed Rails

Mounting Procedure

LM Guide Mounting Example Requiring Rigidity and Accuracy Because of Impact Loads Applied to the Machine

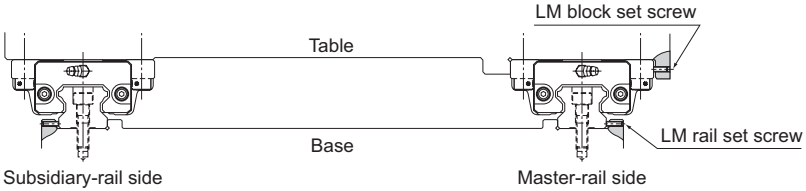


Fig. 5: When an Impact Load is Applied to the Machine

● Mounting the LM Rail(s)

(1) Be sure to remove burrs, dents, and dust from the mounting surface of the machine to which the LM Guide is to be mounted before installing the LM Guide. (Fig. 6)

Note: Since the LM Guide is coated with anti-rust oil, remove the oil from the reference surface by wiping it with washing oil before using the guide. Once the anti-rust oil has been removed, the reference surface is prone to rusting. We recommend applying low-viscosity spindle oil.

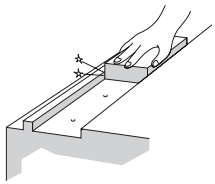


Fig. 6: Checking the Mounting Surface

(2) Gently place the LM rail onto the base, and temporarily secure the bolts so that the LM rail lightly contacts the mounting surface (align the line-marked side of the LM rail with the side reference-surface of the base). (Fig. 7)

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. 8) Forcibly tightening the bolt into a displaced hole may lower the accuracy.

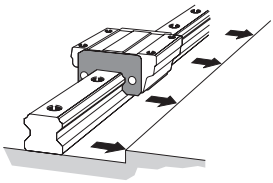


Fig. 7: Aligning the LM Rail with the Reference Surface

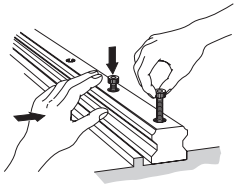


Fig. 8: Checking Slack in the Bolt

(3) Secure the LM rail set screws in order with a tightening force just enough to have the rail closely contact the side mounting surface. (Fig. 9)

(4) Tighten the mounting bolts at the designated torque using a torque wrench. (See Fig. 10, and Table 1 and Table 2 on B1-103.)

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 caps into the bolt holes on the top face of each LM rail until the top of the cap is flush with the top face of the rail.

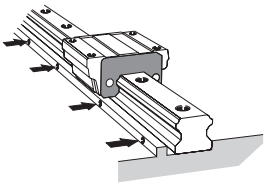


Fig. 9: Tightening the Set Screws

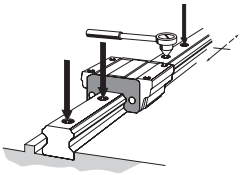


Fig. 10: Fully Fastening the Mounting Bolts

● Mounting the LM Blocks

(1) Gently place the table on the LM blocks and temporarily fasten the mounting bolts.

(2) Press the master side LM blocks to the side reference surface of the table using set screws and position the table. (See Fig. 5 on B1-93.)

(3) Fully fasten 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. 11.

This method saves time in establishing straightness of the LM rail and eliminates the need to machine securing dowel pins, thus drastically reducing the labor required for installation.

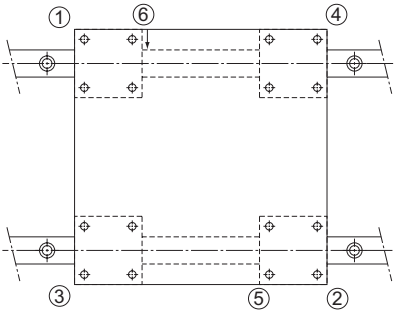


Fig. 11: Sequence for Tightening the LM Blocks

Example of Mounting the LM Guide When the Master LM Rail is not Provided with Set Screws

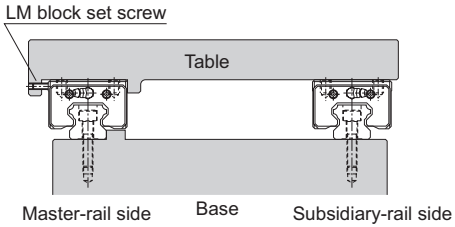


Fig. 12: When the Master LM Rail is not Provided with Set Screws

● Mounting the Master LM Rail

After temporarily fastening the mounting bolts, firmly press the LM rail to the side reference surface at the position of each mounting bolt using a small vice and fully fasten the bolt. Perform this in order from either rail end to the other. (Fig. 13)

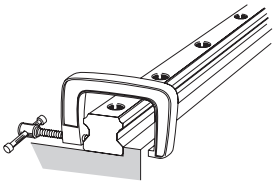


Fig. 13

● 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.

■Using a Straightedge

Place a straightedge between the two rails, and arrange it in parallel with the side reference surface 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 straightedge as the reference by using the dial gauge. (Fig. 14)

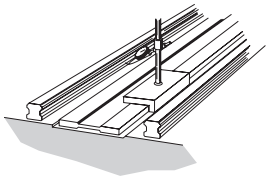


Fig. 14

■Using the Parallelism of the Table

Secure the two LM blocks on the master LM rail to the table (or a temporary table for measurement), and temporarily fasten the LM rail and the LM block on the subsidiary side to the base and the table. From a dial gauge stand fixed to the upper surface of the table, position the gauge so that it contacts the side face of the LM block on the subsidiary rail. Then beginning at one end of the rail, confirm the parallelism of the subsidiary rail by moving the table and fasten the bolts in order as you go. (Fig. 15)

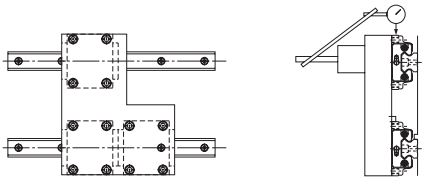


Fig. 15

■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 fasten 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. 16)

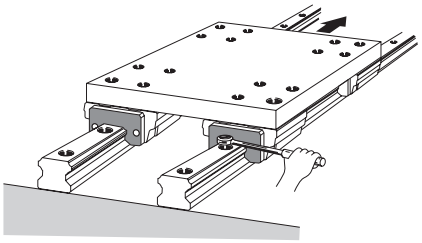


Fig. 16

■Using a Jig

Use a jig like the one shown in Fig. 17 to achieve parallelism between the reference surface on the subsidiary side and the side reference surface of the master side. Beginning at one end of the rail, confirm the parallelism at each mounting hole, and fully fasten the mounting bolts in order. (Fig. 17)

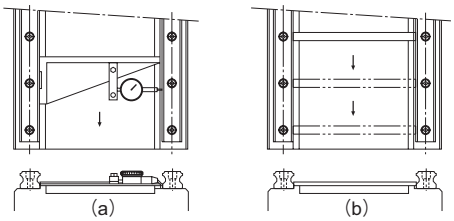


Fig. 17

Example of Mounting the LM Guide When the Master LM Rail Does not Have a Reference Surface

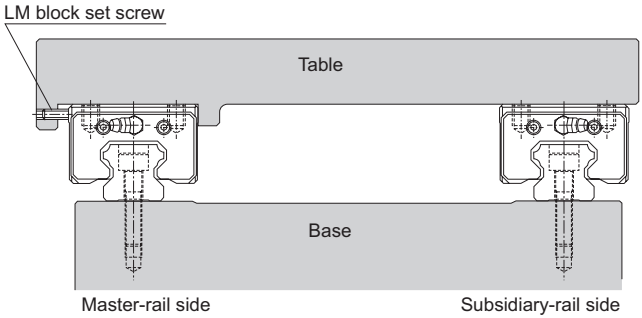


Fig. 18

● Mounting the Master LM Rail

■Using a Temporary Reference Surface

It is possible to achieve straightness of the LM rail by starting from one end and using a reference surface built into the base near the LM rail mounting position. In this method, two LM blocks must be joined together and attached to a measurement plate, as shown in Fig. 19.

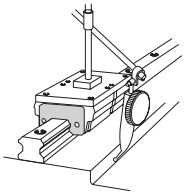


Fig. 19

■Using a Straightedge

After temporarily fastening the mounting bolts, use a dial gauge to check the straightness of the side reference surface of the LM rail from the rail end, and at the same time, fully fasten the mounting bolts. (Fig. 20)
To mount the subsidiary LM rail, follow the procedure described on B**1-95**.

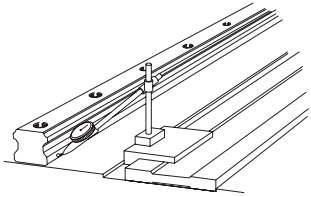


Fig. 20

Procedure for Assembling Model HR

The following procedure is recommended for assembling model HR.

(1) Use an oilstone to remove burrs or knots from the LM rail mounting surface on the base. (Fig. 21)

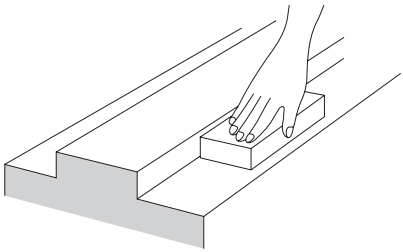


Fig. 21

(2) Use a small vice to press the two LM rails to the base so that they closely contact the reference surface, then tighten the mounting bolts to the recommended torque (see B1-103). (Fig. 22)
   a. Check if any of the bolts protrude.
   b. Use a torque wrench to tighten the bolts in order from the center to both ends.

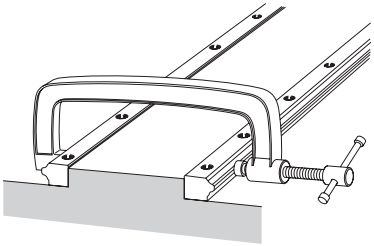


Fig. 22

(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 fastened.

(4) Alternate between adjustment bolts to tighten them gradually and 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 bolts for each LM block as shown in Fig. 23.
   b. For optimal clearance adjustment results, set the tightening torque of the two outside screws to approximately 90% of that of the center screw.

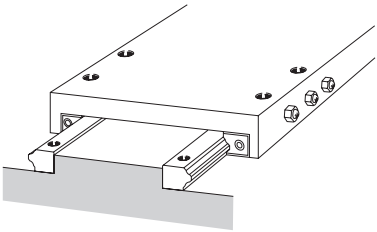


Fig. 23

(5) Secure each LM block by gradually tightening the two temporarily fastened LM block mounting bolts while sliding the table. (Fig. 24)

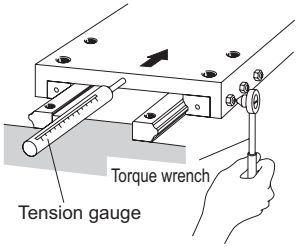
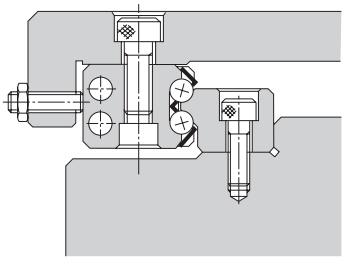


Fig. 24

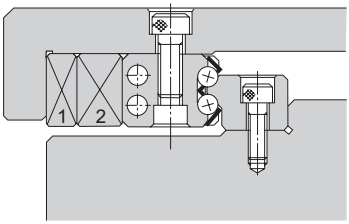
● **Example of Clearance Adjustment**

Design the clearance adjustment bolt so that it presses the center of the side face of the LM block.

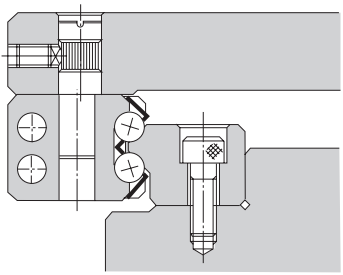
a. Using an adjustment screw
Normally, an adjustment screw is used to press the LM block.



b. Using tapered gibs
When high accuracy and high rigidity are required, use tapered gibs 1) and 2).



c. Using an eccentric pin
A type using an eccentric pin to adjust the clearance is also available.



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 fasten the mounting bolts to secure the blocks.
Both ends of the table must have a datum surface. (Fig. 25)

(2) Place LM rail A onto the base and align the rail with a straightedge.
Fully fasten the mounting bolts using a torque wrench. (Fig. 26)

(3) Temporarily secure LM rail B onto the base, then mount the blocks on the rail.
Temporarily fasten LM rail B while pressing it toward the LM blocks. (Fig. 27)

(4) Move the table a few strokes to warm up the LM blocks, then fully fasten LM rail B using a torque wrench. (Fig. 28)

If there are more GSR units to be assembled, we recommend producing a jig like the one shown in Fig. 29 first. You can easily mount LM rails while achieving parallelism of the LM rails using the jig.

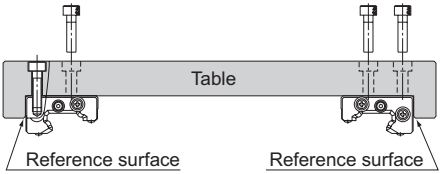


Fig. 25

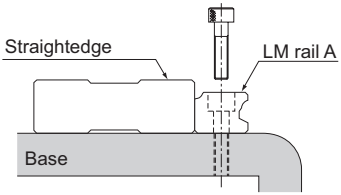


Fig. 26

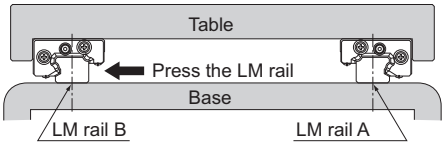


Fig. 27

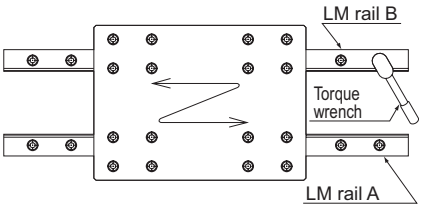


Fig. 28

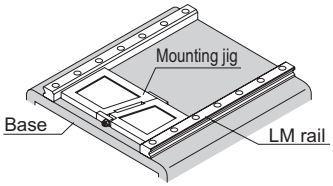


Fig. 29

Procedure for Assembling Model JR

● Mounting the LM Rails

When two LM rails are to be used in parallel as shown in Fig. 30, 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 while mounting the rail.

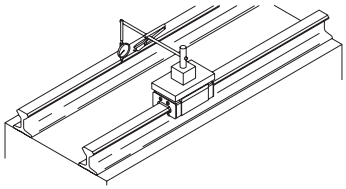


Fig. 30

● Jointing LM Rails

When two or more LM rails are to be jointed, a special metal fitting as shown in Fig. 31 is available. For such applications, specify this fitting when ordering the LM Guide (the rail will be tapped for attaching a joint fitting).

Installation Procedure

(1) Temporarily fasten the rail presser bolt.
(2) Secure rail A and the joint fitting with bolts C and D.
(3) Apply a dial gauge to side G of the joint between rails A and B. Adjust the left and right level differences using bolt E and set screw F on rail B.
If bolt E is tightened, rail B will move to the b side.
If set screw F is tightened, rail B will move to the a side.
(4) When the adjustment using set screw F is finished, secure set screw F with the nut.
(5) Adjust and secure the vertical direction using the rail presser.

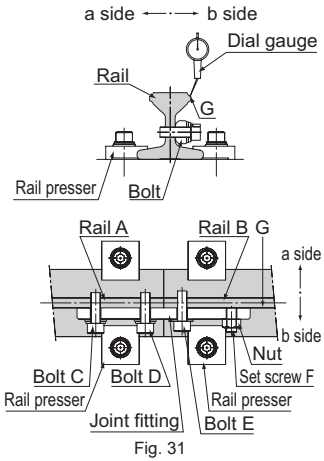


Fig. 31

● **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. 32. For effective welding, we recommend the following welding conditions. (When 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 carbon dioxide arc welding
Wire: YGW12
Electric current: 200 A

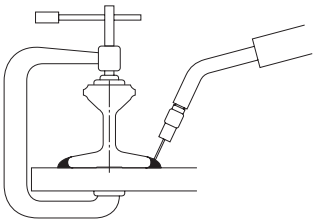


Fig. 32

Procedure for Assembling Model HCR

To install the LM rails of Curved Guide Model HCR, we recommend having some form of datum point (such as a pin) on the reference side (inside) of the LM rail, then pressing the LM rail to the datum point and securing it from the counter-reference surface with a presser plate or brace.

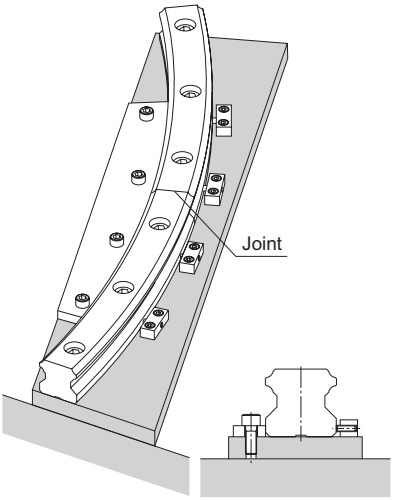


Fig. 33: Method for Securing the LM Rails at the Joint

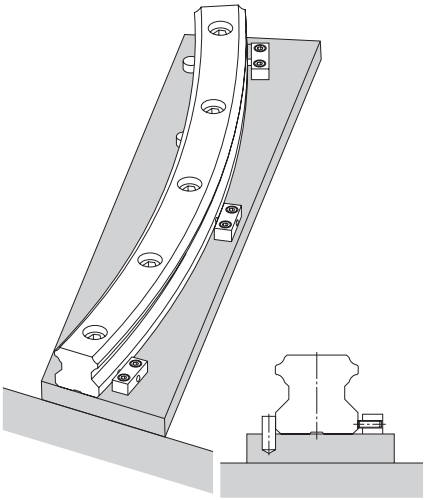
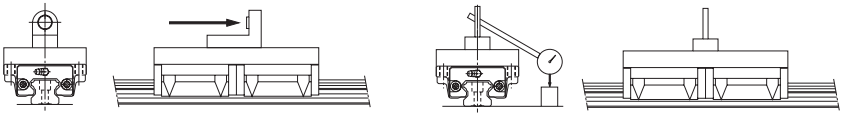


Fig. 34: Method for Securing the LM Rail Using a Pin as a Datum Point

Methods for Measuring Accuracy after Installation

When Measuring Running Accuracy for a 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. 35. When using a dial gauge, we recommend placing the straightedge 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. 35: Methods for Measuring Accuracy after Installation

Recommended Tightening Torque for LM Rails

LM rails for high-precision LM Guide units have their raceways ground and accuracy inspected while the rails are secured with bolts. When mounting a high-precision LM rail on a machine, we recommend using the corresponding tightening torque indicated in Table 1 or Table 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

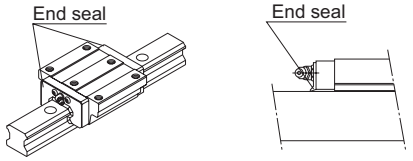
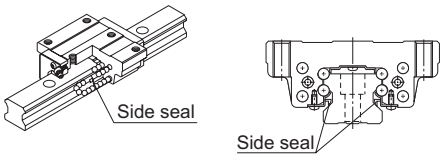
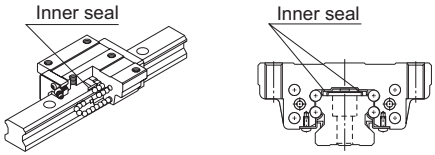
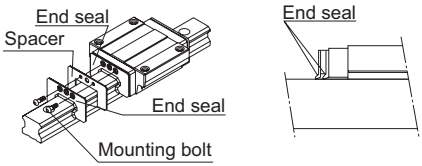
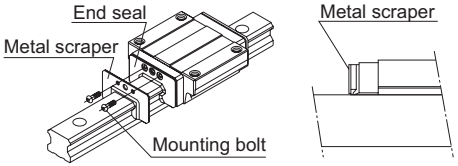
Table 2: Tightening Torques when Hexagonal-Socket-Head Type Bolts are Used
Unit: N·cm

Screw model No.	Tightening torque		
	Steel	Cast iron	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

LM Guide
Options

Seal and Metal Scraper

- For supported model numbers, see the table of options by model number on A1-542.
- For the LM block length (dimension L) with seal attached, see A1-555 to A1-563.
- For the maximum seal resistance, see A1-570 to A1-572.

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
Inner seal		Used in locations exposed to extremely large amounts of dust or cutting chips
Double seals		Used in locations exposed to excessive dust or cutting chips
Metal scraper (non-contact)		Used in locations where welding spatter may adhere to the LM rail

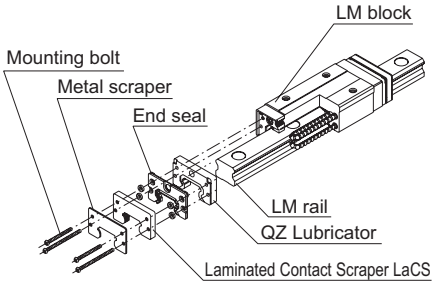
Symbol	Contamination protection accessories
UU	With end seal
SS	With end seal + side seal + inner seal[1]
DD	With double seals + side seal + inner seal[1]
ZZ	With end seal + side seal + inner seal[1] + metal scraper
KK	With double seals + side seal + inner seal[1] + metal scraper

[1] Some models are not equipped with inner seals.(See A1-542.)

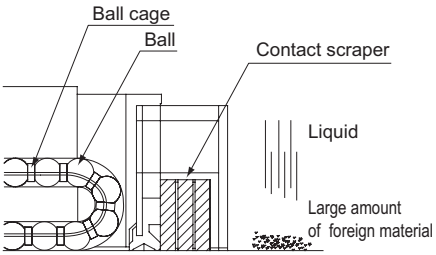
Laminated Contact Scraper LaCS

- For the supported models, see the table of options by model number on A1-542.
- For the LM block dimension (L dimension) with Laminated Contact Scraper LaCS attached, see A1-555 to A1-563.
- For the resistance value of the Laminated Contact Scraper LaCS, see A1-573.
- For precautions on using the Laminated Contact Scraper LaCS, see B1-135.

For locations with an adverse environment, Laminated Contact Scraper LaCS is available. Minute foreign material adhering to the LM rail is removed in multiple stages and prevented from entering the LM block with a laminated contact structure (3-layer scraper).



External View



Structural Drawing

Features

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

Symbol	Contamination protection accessories
UUHH	With end seal + LaCS
SSHH	With end seal + side seal + inner seal[1] + LaCS
DDHH	With double seals + side seal + inner seal[1] + LaCS
ZZHH	With end seal + side seal + inner seal[1] + metal scraper + LaCS
KKHH	With double seals + side seal + inner seal[1] + metal scraper + LaCS
JJHH[2]	With end seal + side seal + inner seal[1] + LaCS + protector (serving also as metal scraper)
TTHH[2]	With double seals + side seal + inner seal[1] + LaCS + protector (serving also as metal scraper)

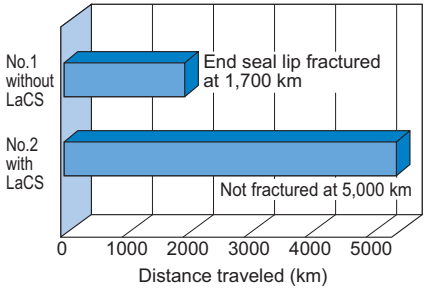
[1] Some models are not equipped with inner seals.(See A1-542)
[2] JJHH and TTHH are only available for models SVR/SVS, NR-X/NRS-X, SRG, and HRX.
Note: For models SVR/SVS, NR-X/NRS-X, SRG, and HRX with HH specifications (with LaCS), a protector (B1-111) can be installed. Contact THK if you want to use the protector with other options.

● Test in an environment with a water-soluble coolant

Test environment: water-soluble coolant

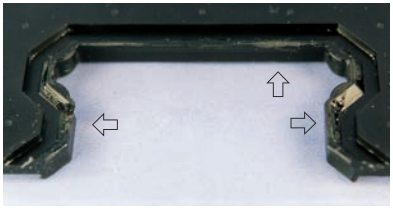
Item		Description
Tested model	No. 1	SHS45R1SS+3000L (end seal only)
	No. 2	SHS45R1SSHH+3000L (end seal and LaCS)
Maximum speed		200 m/min
Environmental conditions		Coolant spray amount: 5 times per 24 h

Test results



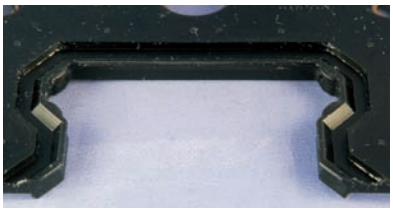
Magnified view of the end seal lip

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 in an environment with minute foreign material

Test environment: minute foreign material

Item		Description
Tested model	No. 1	Caged Ball LM Guide #45 (DD+600L) double seals only
	No. 2	Caged Ball LM Guide #45 (HH+600L) LaCS only
Max speed/ acceleration		60 m/min, 1 G
External load		9.6 kN
Foreign material conditions		Type: FCD450#115 (particle diameter: 125 μm or less)
		Spray amount: 1 g/1 h (Total: 120 g)

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



Large amount of foreign matter has entered the raceway

Test results: Amount of foreign material entering the raceway

Seal configuration		Mass (g) of foreign material entering the raceway
Double-seal configuration (2 layers of end seals)	Tested model 1	0.3
	Tested model 2	0.3
	Tested model 3	0.3
Laminated Contact Scraper LaCS specification	Tested model 1	0
	Tested model 2	0
	Tested model 3	0

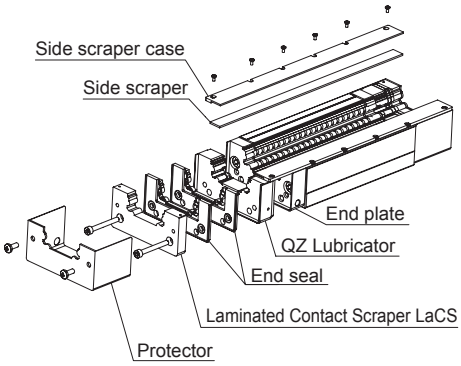
No. 2 Traveled 100 km (LaCS only)



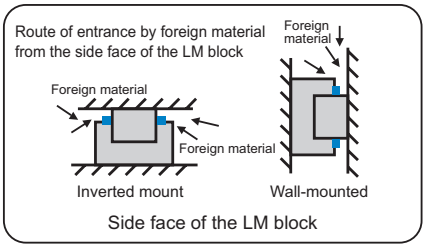
No foreign matter entering the raceway observed

Side Scraper

- Applicable models: models SVR/SVS, NR-X/NRS-X, and SRG
- For the resistance of the side scraper, see A1-574.
- For the LM block length (dimension L) with side scraper attached, see A1-555.
- For notes regarding how to handle the side scraper, see B1-135.



External View
(Ex: in case of QZTTHHYY type)



Features

- Minimizes foreign material entering from the side of the LM Guide in a harsh environment.
- This is effective at contamination protection when the system is inverted or mounted on a wall.

Model number coding

SVR45 LR 1 QZ JJHH YY C1 +1200L

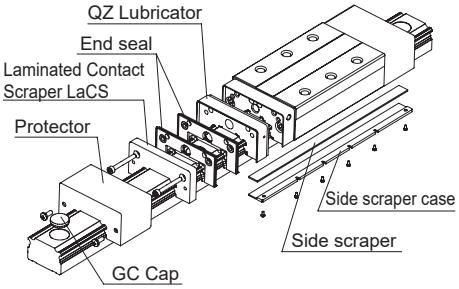
YY: With side scraper[1]

[1] The side scraper can accommodate various options of dust control accessories and lubrication accessories. For details, contact THK.

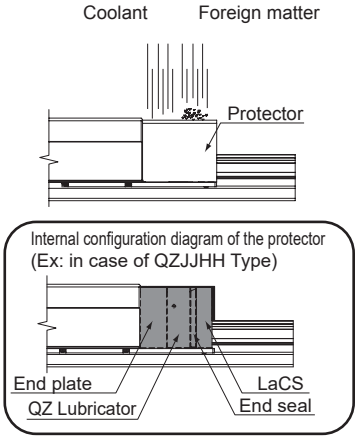
Notes: The side scraper is not sold alone.
Models NR-SLRX/NRS-SLRX and NR-SLCX/NRS-SLCX are not supported.

Protector

●Applicable models: models SVR/SVS, NR-X/NRS-X, SRG, and HRX
●HH type (with LaCS) for models SVR/SVS, NR-X/NRS-X, SRG, and HRX is provided with the protector.
●For the LM block length (dimension L) with protector attached, see A1-555.



External View
(Ex: in case of QZTTHHYY type)



Features

- The protector minimizes the entrance of foreign material even in harsh environments where foreign material such as fine particles and liquids are present.

Notes: Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK if you want to use the protector with other options.

Light-Resistance Contact Seal LiCS

- For the supported models, see the table of options by model number on A1-542.
- For the LM block dimension (L dimension) with Light-Resistance Contact Seal LiCS attached, see A1-567.
- For the resistance value of the Light-Resistance Contact Seal LiCS, see A1-574.
- For precautions on using the Light-Resistance Contact Seal LiCS, see B1-136.

LiCS is a light sliding resistance contact seal. It is effective in removing dust on the raceway and retaining a lubricant such as grease. It achieves extremely low drag and smooth, stable motion.

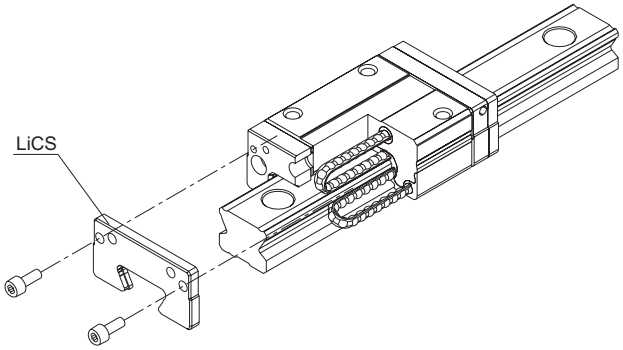


Fig. 1: Structural Drawing of SSR + LiCS

Features

Light-Resistance Contact Seal LiCS is a seal that uses a light-resistance material in its sealing element and contacts the LM rail raceway to achieve low sliding resistance. It is optimal for applications where low sliding resistance is required in a clean environment, such as semiconductor-related devices, inspection devices, and OA equipment.

- Since the sealing element contacts the LM rail raceway, it is effective in removing dust on the raceway.
- Use of oil-impregnated, expanded synthetic rubber, which has excellent self-lubricating properties, achieves low drag resistance.

Model number coding

SSR20 XW 2 GG C1 +640L P -II

Light-Resistance Contact Seal LiCS on both ends

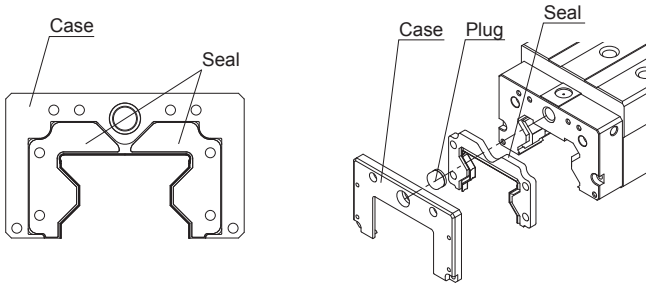
Symbol	Contamination protection accessories
GG	LiCS
PP	With LiCS + side seal + inner seal[1]

[1] Some models are not equipped with inner seals.(See A1-542)

High Chemical Resistance Fluorine Seal FS

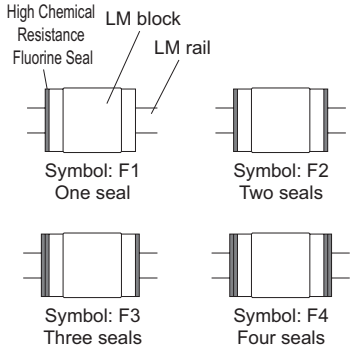
- Applicable models: models SRG35, SRG45, SRG55, and SRG65
- For the LM block dimension (L dimension) with a high chemical resistance fluorine seal attached, see A1-569.
- For the resistance value of the high chemical resistance fluorine seal , see A1-574.
- For precautions on using the high chemical resistance fluorine seal , see B1-136.

The high chemical-resistance fluorine seal is made of fluororubber and has excellent chemical resistance. The fluorine seal can be inserted from the upper surface of the LM rail and is easy to install.



Components/Structure

Symbol	Contamination protection accessories
F2	Fluorine seals + side seals + inner seals
FZ2	Fluorine seals + side seals + inner seals + metal scrapers
FJ2	Fluorine seals + side seals + inner seals + protectors
F4	Fluorine seals (double) + side seals + inner seals
FZ4	Fluorine seals (double) + side seals + inner seals + metal scrapers
FJ4	Fluorine seals (double) + side seals + inner seals + protectors
QZF2	Fluorine seals + side seals + inner seals + QZ
QZFZ2	Fluorine seals + side seals + inner seals + metal scrapers + QZ
QZFJ2	Fluorine seals + side seals + inner seals + QZ + protectors
QZF4	Fluorine seals (double) + side seals + inner seals + QZ
QZFZ4	Fluorine seals (double) + side seals + inner seals + metal scrapers + QZ
QZFJ4	Fluorine seals (double) + side seals + inner seals + QZ + protectors



Standard Assemblies

Model number coding

When purchasing in a set with an LM Guide

(Example) SRG45LR2QZ **F2** C0 + 1200LZ-Ⅱ

High chemical resistance fluorine seal symbol (see the standard assemblies diagram)

Note: Contact THK if you require seals on individual blocks in configurations that differ from those in the standard assemblies diagram.

When purchasing high chemical resistance fluorine seals individually

(Example) SRG45-F1-Z

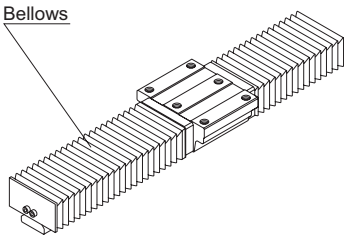
High chemical resistance fluorine seal symbol (F1 only for individual purchase)

Note: Individual purchases come in a set with the high chemical resistance fluorine seal, a case, and a plug.

Notes: If this product will be used in special environments, such as in a vacuum or at very low or high temperatures, contact THK.
This seal cannot be used in combination with an end seal or a Laminated Contact Scraper (LaCS).
Even with specifications for high chemical-resistance fluorine seals, use a bellows or cover to prevent machining chips and coolant from entering the product.

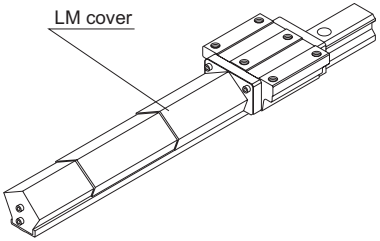
Dedicated Bellows

●For supported model numbers, see the table of options by model number on A1-542.
●For the dimensions of the dedicated bellows, see A1-588 to A1-600.

Item name	Schematic diagram/mounting location	Purpose/location of use
Dedicated bellows		Used in locations exposed to dust or cutting chips

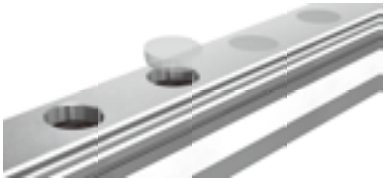
Dedicated LM Cover

●For supported model numbers, see the table of options by model number on A1-542.
●For the dedicated LM cover dimensions, see A1-603.

Item name	Schematic diagram/mounting location	Purpose/location of use
Dedicated LM cover		Used in locations exposed to dust or cutting chips Used in locations with high temperature foreign material such as flying spatter

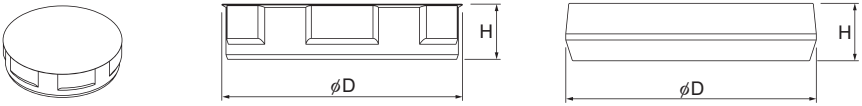
Dedicated Caps for LM Rail Mounting Holes

Using dedicated caps to cover the LM rail mounting holes helps prevent foreign material from entering the mounting holes and LM block.



● CV Caps and C Caps

The caps are made of a special synthetic resin.
The CV cap is the successor to the C cap, and its new structure makes it easier to insert.

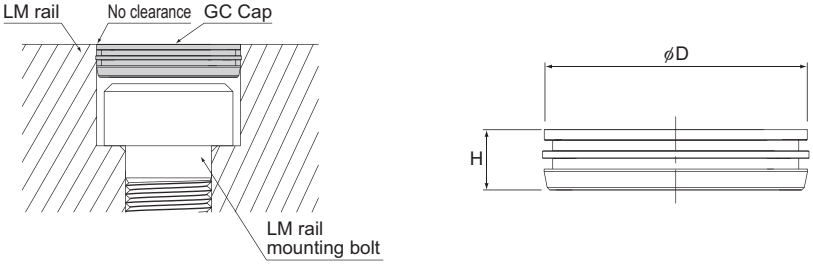


CV cap　　C cap

Notes: Contact THK if this product will be used in special environments such as in a vacuum, at very low or high temperatures, or with coolants or corrosive solvents.
CV caps and C caps must be acquired separately from the LM Guide.

● GC Caps

GC caps are made of metal. (They are RoHS compliant.)
GC caps adhere closer to the counterbore than CV caps and C caps, so there is no clearance once they are inserted.



Notes: GC caps are only sold with LM Guides. They are not sold separately.
The LM Guide model number code will have “GC” at the end when it is delivered.
(Example 1) Multiple axes: SVR45LR+1200L-Ⅱ GC
GC caps attached
Symbol for No. of rails used on the same plane (2 axes)

(Example 2) One axis: SVR45LR+1200L GC
GC caps attached

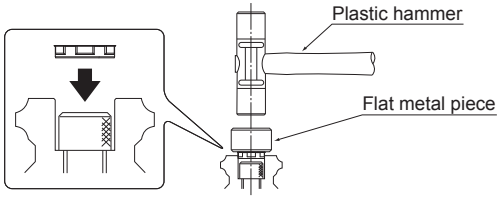
GC caps cannot be used with LM rails that are made of stainless steel or rails that have undergone surface treatment.
LM rail mounting holes for GC caps are special. (The mouth is not chamfered.)
Be careful not to injure your hand when inserting GC caps.
Be sure to make the GC caps level with the upper surface of the LM rail and clean (wipe) that surface after insertion.
If this product will be used in special environments, such as in a vacuum or at very low or high temperatures, contact THK.

● Guidelines for Use in Extreme Environments

Extreme environment		C caps CV caps	GC caps	Example applications
Foreign matter concentration: low	Metal powder, spatter	○	◎	Welding machines, robots
	Wood shavings, coolant (Environments that strip away oils)	○	◎	Woodworking machinery, washers
	Metal powder + coolant	○	◎	Lathes, machining centers
Foreign matter concentration: high	Metal powder, spatter	△	◎	Welding machines, robots
	Wood shavings, coolant (Environments that strip away oils)	△	◎	Woodworking machinery, washers
	Metal powder + coolant	△	◎	Lathes, machining centers

◎: Particularly effective ○: Effective △: Not particularly effective

● Cap Insertion Method



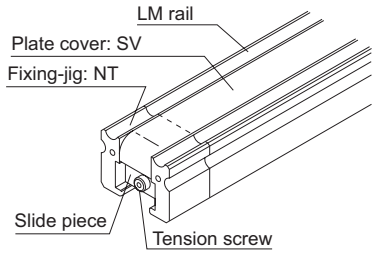
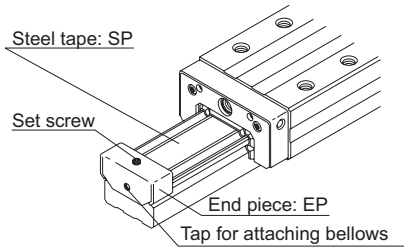
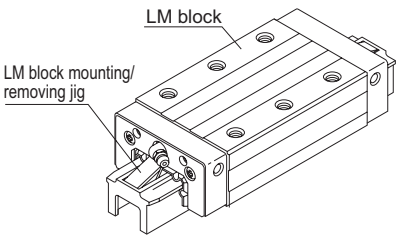
For best performance, caps must be inserted so that they are level with the rail surface. Have a flat alignment plate and plastic hammer available.

① Set the cap on the LM rail mounting hole and place the alignment plate on top.
② Use the plastic hammer to gradually drive the cap in until it is level with the upper surface of the LM rail.
③ As necessary, remove any slight burrs that appear.

Note: During installation or removal, burrs and small debris from the cap may scatter, so be sure to wear protective goggles and avoid using sharp tools during work.

Plate Cover SV and Steel Tape SP

●For supported model numbers, see the table of options by model number on A1-542.

Item name	Schematic diagram/mounting location	Purpose/location of use
Plate cover SV		A plate cover is available as a means of essential contamination protection for LM Guide units intended for use in machine tools. By covering the LM rail mounting holes with ultra-thin stainless steel (SUS304), the plate cover SV drastically increases the effectiveness of the seal and prevents the penetration of coolant or cutting chips from the top face of the LM rail. For the mounting method, see B1-118. 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.
Steel tape SP	 	Steel tape is available as a means of essential contamination protection for LM Guide units intended for use in machine tools. By covering the LM rail mounting holes with ultra-thin stainless steel (SUS304), the steel tape SP drastically increases the effectiveness of the seal and prevents the penetration of coolant or cutting chips from the top face of the LM rail. (When mounting the steel tape, end piece EP can be used as a means to secure the cover.) For the mounting method, see B1-119. 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.

Mounting Procedure for Plate Cover SV

(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.

(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. 5. If the difference is too large, one end may have insufficient interference.

(6) Mount the LM block on the LM rail.
Identify the reference surface of the LM rail and the LM block, then insert the LM rail into the LM block using the LM block mounting/removing jig.

Notes: When removing or mounting the LM block, be careful to not let the balls fall out.
The plate cover is an ultra-thin stainless steel (SUS304) plate. When handling it, be careful to avoid bending it.
The plate cover is available for model NR/NRS 75.

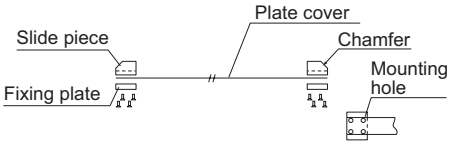


Fig. 1

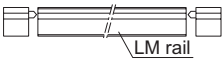


Fig. 2

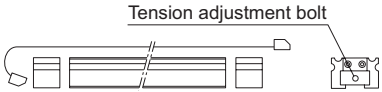


Fig. 3

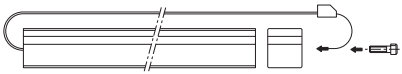


Fig. 4

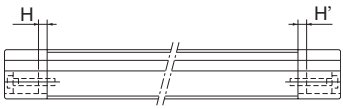


Fig. 5

Mounting Procedure for Steel Tape SP

(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 will be attached. For degreasing, use an adequately volatile detergent (e.g., industrial alcohol).
(3) Peel the release paper from the steel tape a little bit at a time while gradually adhering the tape from one end, taking care to not let it bend or sag.
(4) Secure the steel tape to the rail by pressing it down and rubbing it. The adhesive strength increases with time. However, if you wish to remove the tape, it can be removed by pulling it upward from the end.
(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 set screw on the top face of each end piece.
(The tap on the end face of the end piece is used for mounting bellows.)

Notes: The set screw 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.
Since the steel tape is a thin steel plate, mishandling it may cause an accident such as cutting your finger. When handling it, take effective safety measures such as wearing rubber gloves.

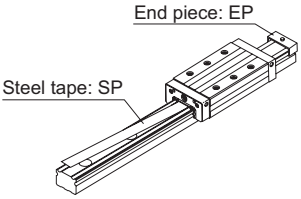


Fig. 6



Fig. 7

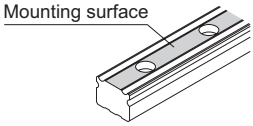


Fig. 8

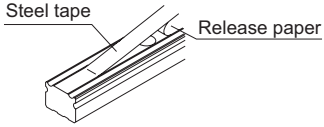


Fig. 9

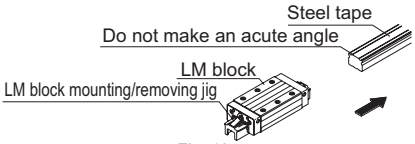


Fig. 10

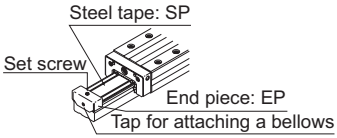
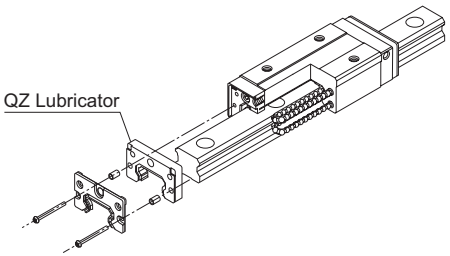


Fig. 11

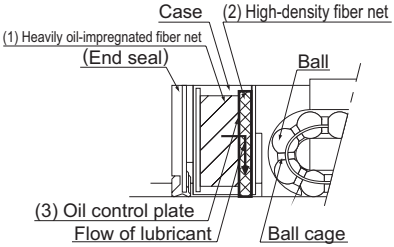
QZ Lubricator

●For the supported models, see the table of options by model number on A1-542.
●For the LM block dimension (L dimension) with a QZ Lubricator attached, see A1-578 to A1-583.
●For details regarding the QZ Lubricator, see B1-135.

The QZ Lubricator feeds the right amount of lubricant to the raceway on the LM rail. This allows an oil film to continuously form between the rolling element and the raceway, and it significantly extends the lubrication maintenance intervals.
The structure of the QZ Lubricator consists of three major components: (1) a heavily oil-impregnated fiber net (functions to store lubricant), (2) a high-density fiber net (functions to apply lubricant to the raceway) and (3) an oil-control plate (functions to adjust oil flow). The lubricant contained in the QZ Lubricator is primarily fed by capillary action, which is also used in devices such as felt-tip pens.



External View



Structural Drawing

Features

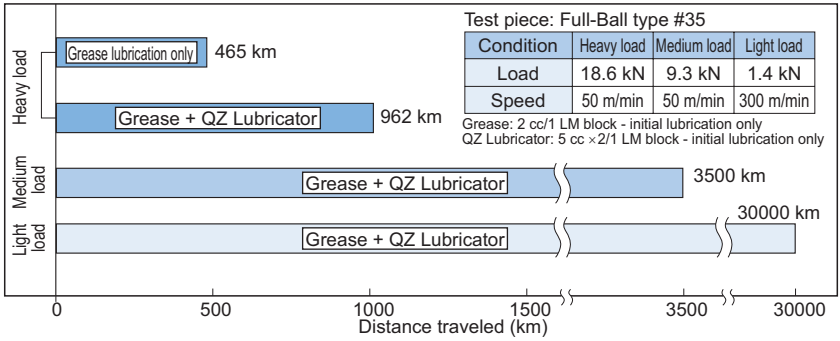
- Since it compensates for oil loss, the lubrication maintenance interval can be significantly extended.
- Because it feeds the appropriate amount of lubricant directly to the ball raceway, it is an environmentally-friendly lubrication system that does not contaminate the surrounding area.

Symbol	Contamination protection accessories
QZUU	With end seal + QZ
QZSS	With end seal + side seal + inner seal[1] + QZ
QZDD	With double seals + side seal + inner seal[1] + QZ
QZZZ	With end seal + side seal + inner seal[1] + metal scraper + QZ
QZKK	With double seals + side seal + inner seal[1] + metal scraper + QZ
QZGG	With LiCS + QZ
QZPP	With LiCS + side seal + inner seal[1] + QZ
QZUUHH	With end seal + LaCS + QZ
QZSSHH	With end seal + side seal + inner seal[1] + LaCS + QZ
QZDDHH	With double seals + side seal + inner seal[1] + LaCS + QZ
QZZZHH	With end seal + side seal + inner seal[1] + metal scraper + LaCS + QZ
QZKKHH	With double seals + side seal + inner seal[1] + metal scraper + LaCS + QZ
QZJJHH[2]	With end seal + side seal + inner seal[1] + LaCS + QZ + protector (serving also as metal scraper)
QZTTHH[2]	With double seals + side seal + inner seal[1] + LaCS + QZ + protector (serving also as metal scraper)

[1] Some models are not equipped with inner seals. (See A1-542)
[2] QZJJHH and QZTTHH are only available for models SVR/SVS, NR-X/NRS-X, SRG, and HRX.
Notes: For models SVR/SVS, NR-X/NRS-X, SRG, and HRX with HH specifications (with LaCS), a protector (B1-111) can be installed.
Contact THK if you want to use the protector with other options.
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.

● Significantly Extended 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.



Test piece: Full-Ball type #35

Condition	Heavy load	Medium load	Light load
Load	18.6 kN	9.3 kN	1.4 kN
Speed	50 m/min	50 m/min	300 m/min

Grease: 2 cc/1 LM block - initial lubrication only
QZ Lubricator: 5 cc ×2/1 LM block - initial lubrication only

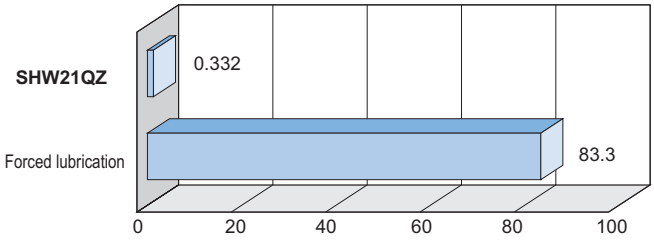
LM Guide Running Test without Replenishment of Lubricant

● Effective Use of Lubricant

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

Test speed: 300 m/min

Comparison of lubricant consumption after traveling 5,000 km



Amount of oil contained in QZ Lubricator
0.166 cm³/ 2 units
(attached to both ends of the LM block)
= 0.332 cm³

Compared

Forced lubrication
0.03 cm³/6 min×16667 min
= 83.3 cm³

Lubricant consumption is 1/250 that of forced lubrication

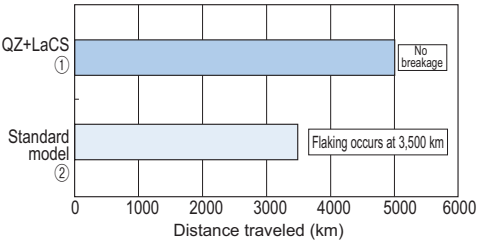
● Assists with Lubrication in Severe Environments

A 5,000 km durability test was conducted in severe environments (exposed to coolant and contaminants).

Test conditions

Model No.	① Caged Ball LM Guide #45	② Full-ball type #45
Load	8 kN	6 kN
Speed	60 m/min	
Coolant	Immersed 48 h, dried 96 h	
Foreign material	Foundry dust (125 μm or less)	
Lubrication	AFA Grease + QZ	Super Multi 68 Oiling cycle: 0.1 cc/shot Periodically lubricated every 16 min

Test results



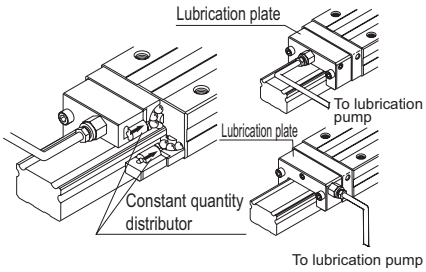
Note: When using the LM System in a severe environment, use a combination of a QZ Lubricator and a Laminated Contact Scraper LaCS (see “Laminated Contact Scraper LaCS” on B1-108).

Lubrication Adapter

An oil-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 a wall mount or inversed mount, the adapter is capable of feeding a constant quantity of lubricant to the four raceways.

Features

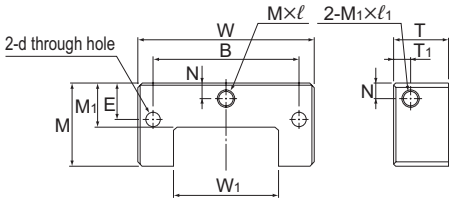
The dedicated lubrication adapter for models NR/NRS is built in with a constant quantity distributor. Therefore, the adapter can accurately feed a constant quantity of lubricant to each raceway regardless of the mounting orientation.
The adapter is economical since it constantly feeds the optimum amount of lubricant and can eliminate the supply of surplus lubricant.
To provide pipe arrangement, simply connect an intermittent lubrication pump widely used for ordinary machine tools to the lubrication holes (M8) on the front and the side of the lubrication adapter.



Structural Drawing

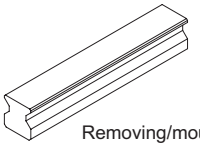
Specifications

Viscosity range of lubricant used	32 to 64 mm^2/s recommended
Discharge	0.03×4, 0.06×4 cc/1shot
Diameter of pipe connected	ϕ 4, ϕ 6
Material	Aluminum alloy



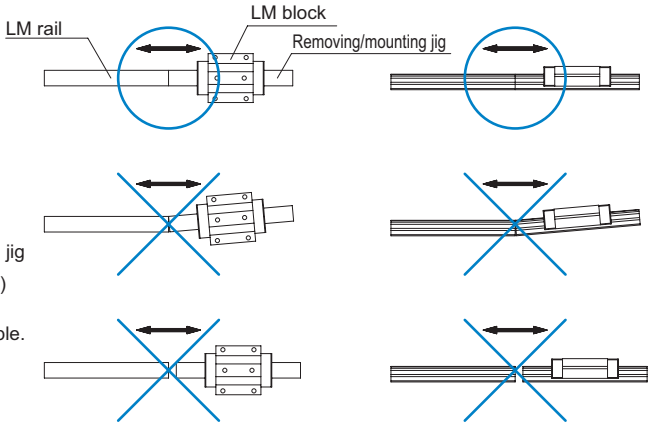
Removing/Mounting Jig

Do not remove the LM block from the LM rail during setup. If removing the LM block is inevitable due to the plate cover type or the assembly procedure, be sure to use the removing/mounting jig.
Mounting the LM block without using the removing/mounting jig may cause rolling elements to fall from the LM block due to contamination by foreign material, damage to internal components, or slight inclination. Mounting the LM block with some of the rolling elements missing may also cause premature damage to the LM block.
When using the removing/mounting jig, fit its end directly to the end of the LM rail and do not incline the jig.
If any of the rolling elements fall from the LM block, contact THK. Do not use the product in that condition.
Note that the removing/mounting jig is not included in the LM Guide package as standard. To obtain one, contact THK.



Removing/mounting jig
(Material: ABS resin)

This image shows one example.



End Piece EP

If removing the end piece when using the LM Guide, be sure that the LM block will not overshoot the rail.
The end piece can also be used as a fixing jig for steel tape protectors, and can also be used on LM rails of models SSR, SR, and HSR.

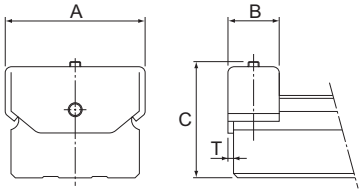


Fig. 1: End Piece EP for Models NR/NRS

Model Number Coding

Model number configurations differ depending on the model features. Refer to the corresponding sample model number configuration.

LM Guide

● **Models SHS, SSR, SVR/SVS, SHW, HSR, SR, NR-X/NRS-X, NR/NRS, HRW, JR, NSR-TBC, HDR, HSR-M1, SR-M1, and HSR-M2**

SHS25 LC 2 QZ KKHH C0 F S +1240L P Z T F S -II

- SHS25: Model No.
- LC: Type of LM block
- 2: No. of LM blocks used on the same rail
- QZ: With QZ Lubricator
- KKHH: Contamination protection accessory symbol [1]
- C0: Radial clearance symbol [2]
  Normal (No symbol)
  Light preload (C1)
  Medium preload (C0)
- F: LM block with surface treatment [3]
- S: LM block special feature symbol
  Standard (No Symbol)/E/S
- +1240L: LM rail length (in mm)
- P: Accuracy symbol [4]
  Normal grade (No Symbol)
  High accuracy grade (H)
  Precision grade (P)
  Super precision grade (SP)
  Ultra precision grade (UP)
- Z: With steel tape
- T: Symbol for LM rail jointed use
- F: LM rail with surface treatment [3]
- S: LM rail special feature symbol
  Standard (No Symbol)/E/S
- -II: Symbol for No. of rails used on the same plane [5]

[1] See contamination protection accessory on A1-584. [2] See A1-75.
[3] See B0-20. [4] See A1-80. [5] See A1-13.

Notes: 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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

● **Model EPF**

EPF7M 16 +55L P M

- EPF7M: Model No.
- 16: Guaranteed stroke (in mm)
- +55L: LM rail length (in mm)
- P: Accuracy symbol [1]
- M: Rail material:
  Stainless steel (standard)

[1] See A1-90.

Note: This model number indicates that a single-rail unit constitutes one set.

Roller Type LM Guide

● Models SRG, SRN, SRW, and HRX

SRG45 LC 2 QZ TTHH C0 F S +1200L P Z T F S -Ⅱ

- SRG45: Model No.
- LC: Type of LM block
- 2: No. of LM blocks used on the same rail
- QZ: With QZ Lubricator
- TTHH: Contamination protection accessory symbol[1]
- C0: Radial clearance symbol [2]
  Normal (No symbol)
  Light preload (C1)
  Medium preload (C0)
  Heavy preload (CN1)
  Super heavy preload (CN2)
- F: LM block with surface treatment [3]
- S: LM block special feature symbol
  Standard (No Symbol)/E/S
- +1200L: LM rail length (in mm)
- P: Accuracy symbol [4]
  High accuracy grade (H)
  Precision grade (P)
  Super precision grade (SP)
  Ultra precision grade (UP)
- Z: With plate cover
- T: Symbol for LM rail jointed use
- F: LM rail with surface treatment[3]
- S: LM rail special feature symbol
  Standard (No Symbol)/E/S
- -Ⅱ: Symbol for No. of rails used on the same plane [5]

[1] See contamination protection accessory on A1-584. [2] See A1-75.
[3] See B0-20. [4] See A1-80. [5] See A1-13.

Notes: Models SRG15 to 65 are available in High Accuracy grade and above. Other models are only available in Precision grade and above. (Normal grade is not available.)
Model SRN is available in high accuracy grade or above. (Normal grade is not available.)
Model SRW is available in precision grade and above. (Normal and high accuracy grade are not available.)
The Model HRX is only available in High Accuracy grade and Precision grade.
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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

Miniature LM Guide

● Models SRS, RSX, RSR, RSX-M1, and RSR-M1

2 SRS20M QZ UU C1 F S +220L P M F S -Ⅱ

- 2: No. of LM blocks used on the same rail [1]
- SRS20M: Model No.
- QZ: With QZ Lubricator
- UU: Contamination protection accessory symbol [2]
- C1: Radial clearance symbol [3]
  Normal (No symbol)
  Light preload (C1)
- F: LM block with surface treatment [4]
- S: LM block special feature symbol
  Standard (No Symbol)/E/S
- +220L: LM rail length (in mm)
- P: Accuracy symbol [5]
  Normal grade (No Symbol)
  High accuracy grade (H)
  Precision grade (P)
- M: Stainless steel LM rail
- F: LM rail with surface treatment[4]
- S: LM rail special feature symbol
  Standard (No Symbol)/E/S
- -Ⅱ: Symbol for No. of rails used on the same plane[6]

[1] No symbol for 1 LM block. [2] See contamination protection accessories on A1-584.
[3] See A1-75. [4] See B0-20. [5] See A1-80. [6] See A1-13.

Notes: 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).
Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.
Contact THK for details about the special features of LM blocks and LM rails.

Cross LM Guide

● Models SCR, CSR, and MX

4 SCR25 QZ KKHH C0 +1240/1000L P

- 4: Total No. of LM blocks
- SCR25: Model No.
- QZ: With QZ Lubricator
- KKHH: Contamination protection accessory symbol [1]
- C0: Radial clearance symbol [2]
  Normal (No symbol)/Light preload (C1)
  Medium preload (C0)
- +1240/1000L: LM rail length on the X axis (in mm) / LM rail length on the Y axis (in mm)
- P: Accuracy symbol [3]
  Precision grade (P)/Super precision grade (SP)
  Ultra precision grade (UP)

[1] See contamination protection accessory on A1-584. [2] See A1-75. [3] See A1-80.

Note: Grease nipples are not installed when there is a QZ Lubricator. Contact THK if you want to use a grease nipple for a model with a QZ.

Separate Type LM Guide

● Model HR

2 HR2555 UU M +1000L P T M

- 2: No. of LM blocks used on the same rail
- HR2555: Model No.
- UU: Contamination protection accessory symbol [1]
- M: Stainless steel LM block
- +1000L: LM rail length (in mm)
- P: Accuracy symbol [2] Normal grade (No Symbol)/High accuracy grade (H)/Precision grade (P) Super precision grade (SP)/Ultra precision grade (UP)
- T: Symbol for LM rail jointed use
- M: Stainless steel LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Note: One set of model HR means a combination of two LM rails and LM blocks used on the same plane.

● Model GSR

- Combination of LM rail and LM block

GSR25 T 2 UU +1060L H T K

- GSR25: Model No.
- T: Type of LM block
- 2: No. of LM blocks used on the same rail
- UU: Contamination protection accessory symbol [1]
- +1060L: LM rail length (in mm)
- H: Accuracy symbol [2] Normal grade (No Symbol)/High accuracy grade (H)/Precision grade (P)
- T: Symbol for LM rail jointed use
- K: Symbol for tapped-hole LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Note: One set of model GSR: This model number indicates that a single-rail unit constitutes one set.

- LM block

GSR25 T UU

- GSR25: Model number
- T: Type of LM block
- UU: Contamination protection accessory symbol[1]

- LM rail

GSR25 -1060L H K

- GSR25: Model number
- -1060L: LM rail length (in mm)
- H: Accuracy symbol[2] Normal grade (No Symbol) High accuracy grade (H) Precision grade (P)
- K: Symbol for tapped-hole LM rail

[1] See contamination protection accessory on A1-584. [2] See A1-80.

Curved Guide

● Model HCR

HCR25A 2 UU C1 +60 / 1000R H 6 T

- HCR25A: Model No.
- 2: No. of LM blocks used on the same rail
- UU: Contamination protection accessory symbol [1]
- C1: Radial clearance symbol [2] Normal (No symbol)/Light preload (C1)
- +60 / 1000R: R-Guide center angle / LM rail radius (in mm)
- H: Accuracy symbol [3] Normal grade (No Symbol)/High accuracy grade (H)
- 6: Number of LM rail joints used on one axis[4]
- T: Symbol for LM rail jointed use[5]

[1] See A1-584 (contamination protection accessories). [2] See A1-75. [3] See A1-80.
[4] Number of LM rails used for one arc. Contact THK for details.
[5] When using joined LM rails for models HCR15 to 65, the end seal utilized for contamination protection options will be a low-resistance end seal.

Straight-and-Curved Guide

● Model HMG

When 2 rails are used

HMG15A 2 UU C1 +1000L T + 60/150R 6T + 60/300R 6T -Ⅱ

- Model No.
- Contamination protection accessory symbol [1]
- Overall linear LM rail length per rail
- Center angle of one inner curved rail
- No. of inner curved LM rails jointed
- Radius of outer curved rail
- Symbol for No. of rails used on the same plane [2]
- No. of LM blocks used on the same rail
- Radial clearance symbol: Normal (No symbol)/Light preload (C1)
- Symbol for linear LM rail joint
- Radius of inner curved rail
- Center angle of one outer curved rail
- No. of outer curved LM rails jointed

[1] See contamination protection accessory on A1-584. [2] See A1-13.

Notes: This model number denotes one set consists of an LM block and LM rail (i.e. If you are using 2 shafts, the required number of sets is 2).
The standard Model HMG does not have a seal. To attach a seal, make sure to specify a straight-and-curved seal (code: UU).

LM Guide for Medium-to-Low Vacuums

● Model HSR-M1VV

HSR15M1R 1 VV C1 +400L P -Ⅱ

- Model No.
- No. of LM blocks used on one rail
- Labyrinth seal symbol[2]
- Radial clearance symbol[1]
- LM rail length (in mm)
- Accuracy symbol[3]
- Symbol for No. of rails used on the same plane[4]

[1] See A1-75. [2] See A1-431. [3] See A1-80. [4] See A1-13.

Notes: The radial clearance, maximum LM rail length and accuracy class are equal to that of Model HSR.
With this model, a single-rail unit constitutes one set (i.e., the required number of sets when 2 rails are used in parallel is 2).

Oil-Free LM Guide for Special Environments

● Model SR-MS

SR15MSV 1 CS +340L P -Ⅱ

- Model No.
- No. of LM blocks used on one rail
- Radial clearance symbol[1]
- LM rail length (in mm)
- Accuracy symbol[2]
- Symbol for No. of rails used on the same plane[3]

[1] See A1-75. [2] See A1-80. [3] See A1-13.

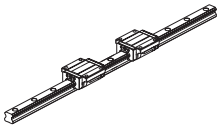
Note: This model number indicates that a single-rail unit constitutes one set (i.e., required number of sets when 2 rails are used in parallel is 2 at a minimum).

Notes on Ordering

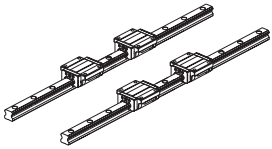
Order Units

Note that the number of items that constitute one set differs depending on the type of LM guide. Check the sample model number configurations and the accompanying notes.

- **Sample LM Guide Orders**

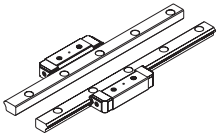


SHS25C2SSC1+640L 1 set



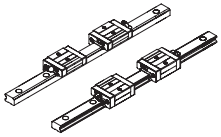
SHS25C2SSC1+640L-Ⅱ2 sets

- **Sample Model HR Orders**



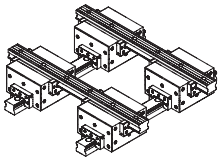
HR2555UU+600L 1 set

- **Sample Model GSR and GSR-R Orders**



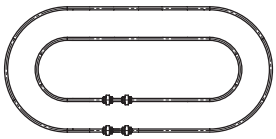
GSR25T2UU+1060L 2 sets

- **Sample Cross LM Guide Orders (SCR, CSR, and MX)**



4SCR25UU+1240/1000LP 1 set

- **Sample Model HMG Orders**



HMG15A 2 UU C1 +1000L T + 60/150R 6T + 60/300R 6T - Ⅱ 2 sets

Note: When ordering Model HMG, attach a reference diagram clearly showing the positioning of the LM block and LM rail.

Mounting Orientation and Lubrication Method

When placing an order, be sure to let THK know the mounting orientation and the exact position on each LM block where the grease nipple or the piping joint should be attached.
For the mounting orientation and the lubrication, see B1-28 and B24-2, respectively.

Supported Options

The supported options differ depending on the model number. Check the available options when ordering.
See A1-542.

Maximum Manufactured Lengths for LM Rails

Where a high degree of precision is required, limits apply to the maximum manufactured lengths for LM rails. In such situations, contact THK.

LM Guide Handling Precautions

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 will 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.

Precautions on Use

(1) Prevent foreign material, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
(2) If the product is used in an environment where cutting chips, coolant, corrosive solvents, water, etc., may enter the product, use bellows, covers, etc., to prevent them from entering the product.
(3) Do not use the product at temperatures of 80℃ or higher. Unless the unit is specially designed to be heat-resistant, exposure to such temperatures may deform or damage plastic and rubber parts.
(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 areas of contact on the rolling elements, 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 nut to stroke a distance roughly equal to its length to help ensure that a film forms between the raceways and rolling elements.
(6) Do not forcibly drive a pin, key, or 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) Take care to keep the LM block straight. Loading the block at an angle can introduce foreign matter, damage internal components, or cause balls to fall out.
(10) The LM block must contain all its internal rolling elements when mounted on the LM rail. Using a block with any balls or rollers removed may result in premature damage.
(11) If any of the rolling elements fall from the LM block, contact THK. Do not use the product in that condition.

(12) If the LM Guide breaks due to an accident or other cause, the block may come off of the rail and fall. For the safe use of these products, take precautions such as adding a mechanism to prevent the block from falling.
(13) For the 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 remove anti-rust oil and apply lubricant before using the product.
(2) Do not mix different lubricants. Even greases 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 clean rooms, vacuums, and extreme heat or cold, use a lubricant suitable for its use/environment.
(4) When lubricating the product having no grease nipple or lubrication hole, apply grease directly on the raceway and stroke the product several times to let the grease spread inside.
(5) The consistency of grease changes according to the temperature. Take note that the slide resistance of the LM Guide may be affected by changes in viscosity.
(6) After lubrication, the slide 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) Although the lubrication interval may vary according to operating conditions and the service environment, lubrication should be performed approximately every 100 km in travel distance (three to six 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. For the mounting orientation and the lubrication, see B**1-28** and B**24-2**, respectively.
(11) When using oil lubrication, the lubricant may not be distributed throughout the LM block due to the mounting orientation of the block. Contact THK in advance 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 use.
If you request that we do not apply anti-rust oil to a product, please be aware that it may rust due to the storage environment or length of storage.

Disposal

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

Handling Precautions for LM Guide Models for Special Environments

LM Guide for Medium-to-Low Vacuums

Handling

(1) This product has been thoroughly cleaned and degreased and then sealed in moisture-proof packaging. If possible, open the package immediately prior to using the product.
(2) Once the packaging has been opened, store the product inside a clean, dry receptacle accompanied by silica gel or another drying agent. Do not use anti-rust oil or volatile corrosion inhibitor paper (or other VCI material) with this product.
(3) Wear protective rubber or vinyl gloves while handling this product and make sure the surrounding environment is relatively clean.

Oil-Free LM Guide

Handling

(1) The oil-free LM Guide is suitable for use at high temperatures, under atmospheric pressure or in a high-vacuum environment of 10^{-6}Pa, and is designed for ultra-low dust emission. It is not intended for use in locations requiring rigidity. Because a preload would affect the strength of its S-Coating Dry Film Lubricant, it does not support preloads.
(2) The product can be used in temperatures ranging from -20°C to 150°C.
(3) To ensure proper function of the S-Coating Dry Film Lubricant, use this product in an environment free from condensation, at a humidity level of 40% or less.
(4) This product is not intended for joint use.
(5) Great care must be taken in the installation of the oil-free LM Guide, which requires greater precision compared to standard LM Guides.
(6) If the LM block is removed from the LM rail, balls may fall out, and the S-Coating Dry Film Lubricant can be damaged when the block is remounted. If it becomes necessary to remove the LM block from the LM rail, please contact THK.
(7) This product should be stored in a horizontal position, in its original wrapping and package, in a controlled, stable environment free from abnormal high or low temperatures or high humidity. THK recommends storing it at room temperature (25±5°C), with a humidity level of 40% RH or lower and an air-purity level of 10,000 or lower.
(8) This product has been thoroughly cleaned and degreased and then sealed in moisture-proof packaging. If possible, open the package immediately prior to using the product.
(9) Once the packaging has been opened, store the product inside a clean, dry receptacle accompanied by silica gel or another drying agent. Do not use anti-rust oil or volatile corrosion inhibitor paper (or other VCI material) with this product.
(10) Wear protective rubber or vinyl gloves while handling this product and make sure the surrounding environment is relatively clean.

Handling Precautions for Optional Accessories for the LM Guide

QZ Lubricator for the LM Guide

For details regarding the QZ Lubricator, see B1-120.

Selection Precautions

Secure a stroke longer than the overall LM block with QZ Lubricator attached.

Handling

Take care not to drop or strike this product. Otherwise, it may cause injury or damage the unit.
Do not block the vent hole with grease or the like.
The QZ Lubricator supplies oil only to the raceway, so use it in combination with regular greasing/oil lubrication. If the product is used in an environment exposed to coolant, cutting chips, or other foreign material, oil on the raceway is lost easily. Accordingly, be sure to also use covers, bellows, etc.

Service Environment

Be sure the service temperature of this product is between -10℃ and 50℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

Laminated Contact Scraper LaCS, Side Scraper for the LM Guide

For details regarding the Laminated Contact Scraper LaCS, see B1-108. For details regarding the side scraper, see B1-110.

Handling

The lubricant impregnated into the scraper is used to increase its sliding capability. For lubrication of the LM Guide, attach a QZ Lubricator or grease nipple to the side face of the end plate of the LM block before providing a lubricant.
When using these products, be sure to attach C caps or a plate cover to the rail.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

Notes on Product Functions

It is specifically designed to provide dust prevention capability to remove foreign material and liquid. To seal oil, an end seal is required.

Light Contact Seal LiCS for the LM Guide

For details regarding the Light-Resistance Contact Seal LiCS, see B1-112.

Handling

The lubricant impregnated into Light-Resistance Contact Seal LiCS is used to increase its sliding capability. For lubrication of the LM Guide, attach the grease nipple on the end plate of the LM block before lubricating.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.
It only makes contact with the LM rail raceway. Do not use it in harsh environments.

High Chemical Resistance Fluorine Seal FS for the LM Guide

For details about the high chemical-resistance fluorine seal, see B1-113.

Handling

Be careful not to twist the seal portion when attaching the high chemical-resistance fluorine seal to the LM Guide. Also, do not store the product in a way that may deform the seal, such as by stacking it. This may cause damage or reduce the seal's functionality.

Service Environment

Be sure the service temperature of this product is between -20℃ and +80℃. Do not clean the product by immersing it in an organic solvent or kerosene, or leave it unpacked.

GC Cap

For details regarding the GC cap, see B1-115.

Handling

If GC caps are specified for the product, the edges of the LM rail mounting hole openings will be sharp. Take great care not to injure your fingers or hands while working.
When fitting GC caps, use a flat aligning tool to gradually punch the cap into the hole until it is level with the upper surface of the LM rail. Then run an oil stone over the rail until the upper surface of the rail and the GC caps are completely flat.
During installation or removal, burrs and small debris on the cap may scatter, so be sure to wear protective goggles and avoid using sharp tools during work.