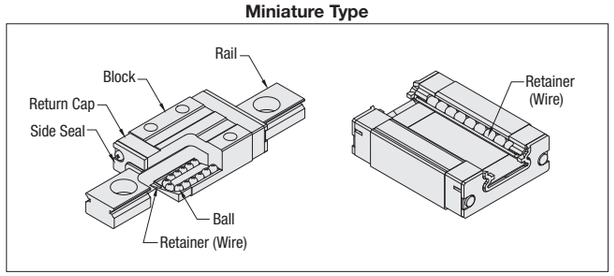
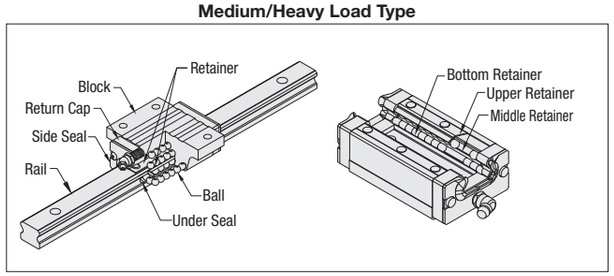
Structure and Precision of Linear Guides

■Linear Guide - Structure and Features

Miniature Type

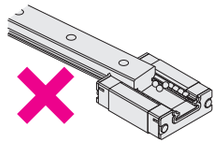


Medium/Heavy Load Type



· Linear guides utilize steel balls rolling on ground raceways, and the balls are recirculated using plastic return caps.
· End seals prevent foreign substances from intruding into the blocks.
· Miniature Type has two rows of contacting steel balls in a 4-point raceway contact design.
· Medium/Heavy Load Types have four rows of contacting steel balls in a 2-point raceway contact design.
· Load ratings are the same for all four directions (radial, reverse-radial, and lateral directions). Can be used in any orientation.
· MISUMI-manufactured Blocks and rails guarantee their own radial clearances (preload) and accuracies as sets of blocks and rails. Be sure to use the blocks and rails in sets.
· Cautions

Balls do not fall out of MISUMI linear guides when removed from rails as the blocks are equipped with ball-retainers. However, the balls may fall out by rapidly removing blocks from the rail or inserting the rail into the block at a angle. Remove and install the blocks with caution.



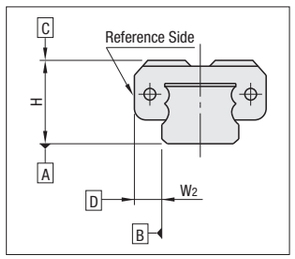
■Precision

· **Dimensional Accuracy** Unit: μm

Type	Accuracy Standards		Precision Grade	High Grade	Standard Grade
Miniature Type	Height H Tolerance		±10	±20	±20
	Pair Variation of Height H		7	15	40
	Width W_2 Tolerance		±15	±25	±25
	Pair Variation of Width W_2		10	20	40
Linear Guides for Medium/ Heavy Load Type	**Accuracy Standards**		High Grade	Interchangeable	Standard Grade
	Height H Tolerance		±40	±20	±100
	Pair Variation of Height H		15	15	20
	Width W_2 Tolerance		±20	±30	±100
	Pair Variation of Width W_2	24, 28	15	25	20
		33, 42	15	25	30
		30, 36, 40, 42	-	25	-

[Pair Variation of Height H]
Difference between the min. / max. values of Height (H) Dimension for a number of blocks combined on one rail.

[Pair Variation of Width W_2]
Difference between the min. / max. values of Width (W) Dimension for a number of blocks combined on one rail.

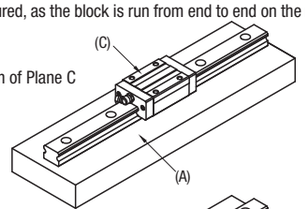


· **Running Parallelism** Unit: μm

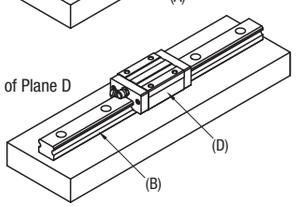
Rail Length (mm)		Miniature			Linear Guides for Medium/Heavy Load		
Over	or Less	Precision Grade	High Grade	Standard Grade	High Grade	Interchangeable	Standard Grade
	50	2	3	13	7	6	7
50	80	2	3	13	7	6	7
80	125	3	7	15	7	6.5	7
125	200	3	7	15	7	7	7
200	250	3.5	9	17	7	8	7
250	315	4	11	18	8	9	12
315	400	5	11	18	8	11	12
400	500	5	12	19	9	12	14
500	630	6	13.5	21	11	14	18
630	800	6	14	21.5	13	16	21
800	1000	-			14.5	18	23
1000	1250	-			16	20	25
1250	1600	-			-	23	27
1600	2000	-			-	26	28.5

[Running Parallelism]
Measured while the rail is bolted firmly to a standard reference surface base. A relative variation of block's top surface C against the rail's bottom surface A, and a relative variation of block's datum surface C against the rail's datum surface D are measured, as the block is run from end to end on the rail.

· Running Parallelism of Plane C against Plane A



· Running Parallelism of Plane D against Plane B



Linear Guide Preload and Allowable Load

■Selection of Radial Clearance (Preload)

Type	Preload	Size (Height H Dimension)	Radial Clearance (μm)
Miniature	Light Preload	6~20	-3~0
	Slight Clearance		0~+15
Linear Guides for Medium/ Heavy Load	Normal Clearance	24	-4~+2
		28	-5~+2
		33	-6~+3
	Interchangeable, Light Preload	24, 28	-4~0
		30, 36, 40, 42	-5~0
		*42	-7~0

* marked size is for Ultra Heavy / Extra Super Heavy Load.

· Clearance and preload of MISUMI Linear Guides are controlled with minute ball size adjustments.
· Increased rigidity and reduced elastic deformation will result by preloading (negative clearance).
· Generally, selecting some preloads would cause favorable effects on accuracy and life of Linear Guides.
· MISUMI-manufactured Blocks and rails guarantee their own radial clearances (preload) and accuracies as sets of blocks and rails. Be sure to use the blocks and rails in sets.

■Friction Force (Required Thrust Force)

Linear Guide friction force (required thrust) varies depending on load, speed and lubricant property. Especially when moment load is applied, Preload Type friction force increases.
Although seal resistance varies according to seal lip press-fit allowance and lubrication conditions, it is not proportionate to load and keeps a constant value.
Friction force is obtained by the following formula.

$$F = \mu \cdot W + f$$

F : Friction (N)
μ : Dynamic Friction Coefficient
W : Applied Load
f : Seal Resistance (2N~5N)

Table-1 Dynamic Friction Coefficient

Type	Dynamic Friction Coefficient (μ)
Miniature Linear Guides	0.004~0.006
Linear Guides for Medium Load	0.002~0.003

■Allowable Load

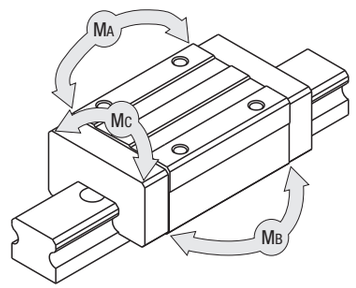
· Basic Dynamic Load Rating (C)
Basic dynamic load rating is defined as: a load applied in a constant direction and ran under equal condition on a group of linear guide specimen where 90% of specimen will reach $50x10^3$m without experiencing any damages due to rolling fatigues.

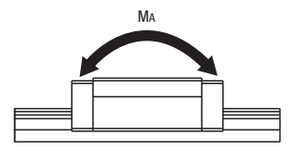
· Basic Static Load Rating (Co)
Basic static load rating is defined as: a load applied on non-moving linear guides where a sum of rolling element plastic deformation amount and rolling surface plastic deformation amount becomes equal to 0.0001 times that of the diameter of the rolling element (balls).

· Allowable Static Moment (M_A, M_B, M_C)
Allowable static moment is a critical static moment load defined by permanent deformation value similar to basic static load rating Co.

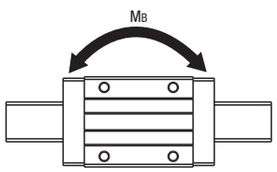
Allowable Load (N)≤Co/fs
Allowable Moment (N·m)≤(M_A, M_B, M_C) / fs

fs: Statistic Safety Factor Co: Basic Static Load Rating (N)
M_A, M_B, M_C: Static Allowable Moment (N·m)

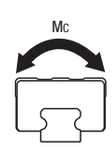




Pitch Direction



Yaw Direction



Roll Direction

· Static Safety Factor (fs)
Basic Static Load Rating Co, in the static state or in low speed, is divided by Static Safety Factor fs in **Table 2** depending on operating conditions.

Table-2 Static Safety Factor (fs Lower Limit)

Condition of Use	Lower Limits of fs
For normal operating condition	1~2
When smooth running performance is required	2~4
When vibrations and impacts exist	3~5