4-1 TM Miniature Wide Linear Guide

■ 4-1-1 The Characteristics of TM Series

High Accuracy: The miniature linear guide is manufactured to high precision standards, which enables accurate positioning and motion control.

Excellent Stability: The surfaces of the miniature linear guide undergo specialized treatments that result in a low friction coefficient, ensuring smooth operation and extended service life.

Robust Load Capacity: Despite its compact size, the miniature linear guide features an enhanced load capacity due to material optimization and specialized surface treatments, allowing it to withstand significant forces.

Low Noise: The special surface treatment minimizes friction, ensuring smooth movement and reducing operational noise.

Space Efficiency: The compact design of the miniature linear guide facilitates the use of smaller actuators and motors, effectively saving space while supporting substantial loads.

Easy Maintenance: The simple design of the miniature linear guide makes maintenance convenient and improves the efficiency of the replacement and cleaning processes.

High Accuracy

Customized high-accuracy machining equipment and processes are utilized to manufacture linear guides with an accuracy of ±1μm/1000mm.

Interchangeability

Precision control of machining tolerances allows for interchangeability of rails and blocks across different batches, significantly reducing inventory pressure.

High Speed

Extremely low surface roughness provides a smooth rolling track, contributing to high durability and enabling exceptional smoothness and speed.

High Rigidity

The use of large steel balls enhances circulation smoothness, increasing rigidity and torque while extending service life.

4-1 TM Miniature Wide Linear Guide

■ 4-1-2 Selection Process

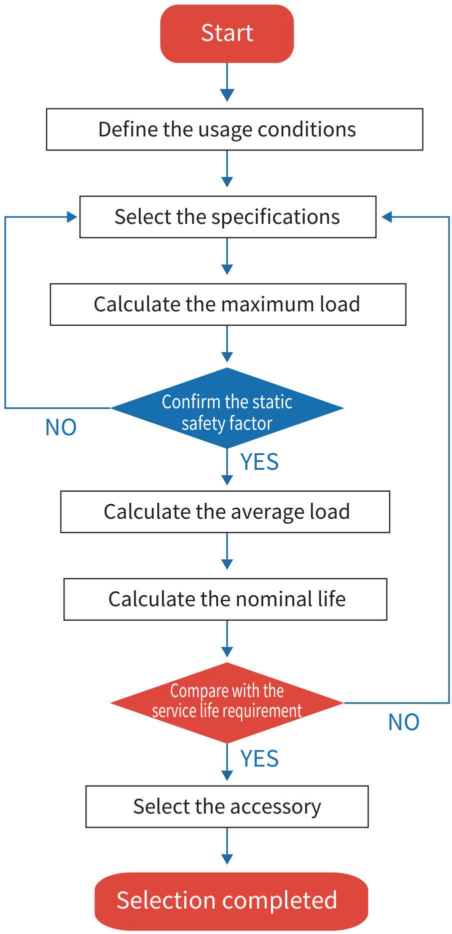
Please note the following information regarding usage requirements:

A. Combination Methods (span dimensions, number of blocks, number of rails)

B. Installation Directions (horizontal, vertical, tilted, wall-mounted)

C. Load Requirements (magnitude, direction, point of application; confirm if it includes fictitious forces)

D. Usage Frequency (load cycle)



A. Combination Methods

A-1 Span Dimensions:

Relative position of the blocks (as shown in fig 4-1-1):

L0: Distance between blocks on the same rail

L1: Distance between dual rails

A-2. Number of blocks: Increasing the number of blocks enhances load capacity, rigidity, and service life, but shortens the available travel space.

A-3. Number of rails: Using dual rails can improve the MR capability for the system.

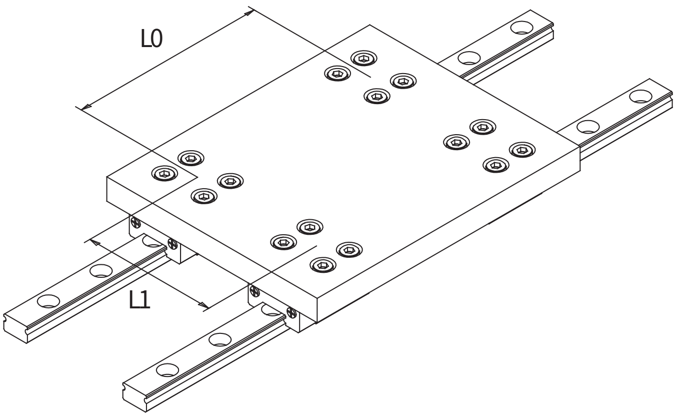


Fig 4.1.1 Span Dimensions

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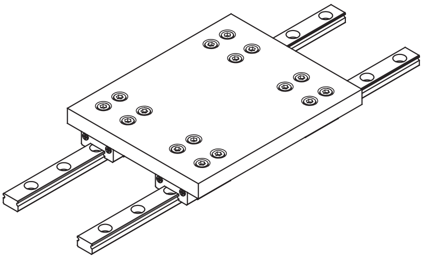
B. Installation Directions

Choosing the ideal installation type can significantly reduce the impact of load moments on the linear motion system. Generally, the rail and block assembly methods can be categorized into the following types:

1. Horizontal Position
2. Wall-Mounted Position
3. Vertical Position
4. Other Methods (such as tilted position, inverted position)

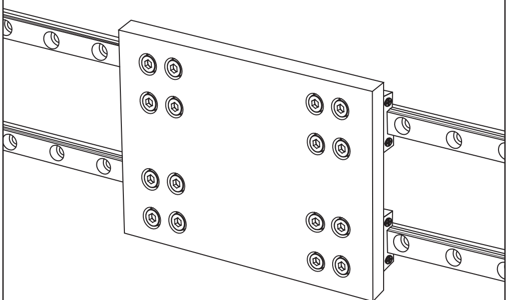
Horizontal Position

The most commonly used assembly method is the horizontal position, which better withstands vertical loads and is frequently employed in general positioning and feeding machines.



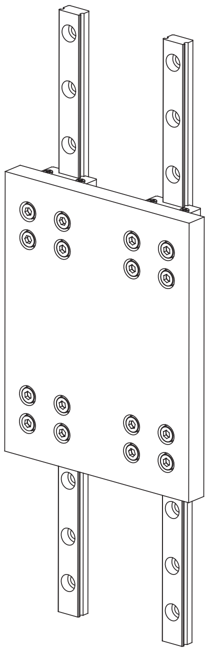
Wall-Mounted Position

It is important to consider the reactive moment caused by gravity when selecting this method. Increasing the distance between the rails can enhance load distribution.



Vertical Position

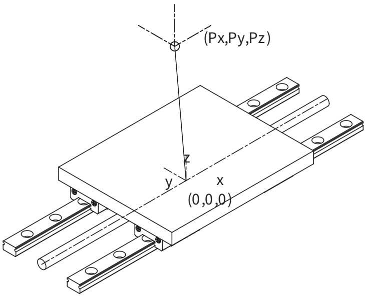
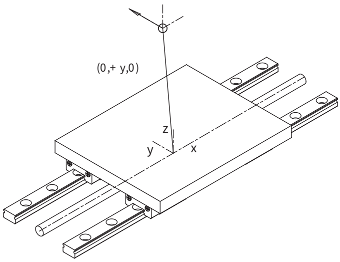
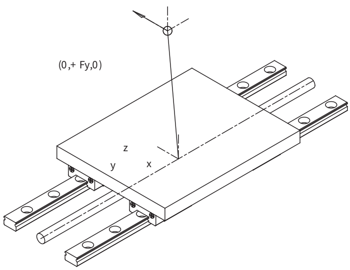
Typically used in lifting mechanisms. Attention should be paid to the gravitational load when extending the plate length. Increasing the distance between blocks on the same rail can enhance load distribution.



C. Load Requirements

Definition of a load requires three key elements:

1. Magnitude
2. Direction
3. Point of application

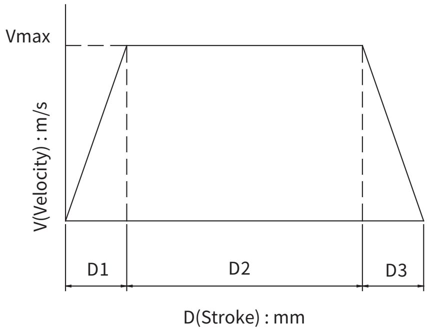
The point of application is shown as the right diagram.	
The direction is shown as the right diagram.	
The force and direction are shown as the right diagram.	

4-1 TM Miniature Wide Linear Guide

D. Velocity

V_{max}: Maximum speed during the process

D: Length of the travel (D1, D2, D3 are the distances for acceleration, constant speed and deceleration.)



Statistics on the usage of the mechanism within a unit of time help to evaluate whether the system meets actual demands.

Example:

There is a machine that operates 100 km daily with a service life requirement of three years and 300 working days per year.

Required service life: 3 years

Usage Frequency: 100 km/day

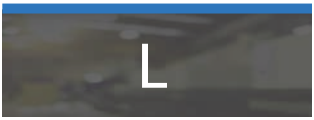
The required lifespan is calculated as follows:

3 years × 300 days/year × 100 km/day = 90,000 km

■ 4-1-3 Load and Service Life

During load movements on linear guides, the rolling elements and rolling surfaces experience compressive force and corresponding tensile force. When these forces are applied repeatedly over a certain number of cycles and distance, fatigue damage may occur in the rolling surfaces or rolling elements. This results in metal flakes resembling fish scales, referred to as metal flaking. When this happens, the system cannot maintain accuracy anymore, which means the product's lifespan has ended.

Below are explanations of the key parameters:



Nominal Life (km)

Linear guides are mass-produced products. Even under the same conditions, they may not have the same service life. The nominal life is defined as the operation of a batch of linear guides under the same conditions, where 90% of the products in the same batch meet the standard and do not experience the metal flaking over a specified total travel distance.

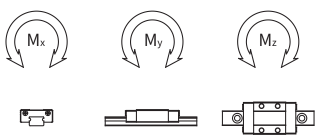
Basic Static Load Rating (N)

The load value that causes a permanent deformation of 0.0001 times the diameter of the rolling elements and the rolling surfaces, under constant direction and magnitude. This is used to calculate the static safety factor for the linear guide.

Basic Dynamic Load Rating (N)

The same specifications for each batch of linear guides with individual operational tests which are conducted under consistent conditions, where the load and direction remain unchanged. In this context, 90% of the products in the batch demonstrate a nominal life corresponding to a load value of 50 km.

M_x, M_y, M_z Permissible Moment (N-m):



The total moment value causes a permanent deformation of 0.0001 times the diameter of the rolling elements and the rolling surfaces, under constant direction and magnitude. Define M_x, M_y, and M_z in three axes when calculating the static safety factor.

4-1 TM Miniature Wide Linear Guide

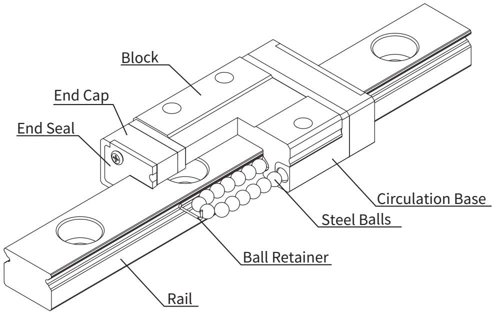


Fig 4.1.2 Structure of TM

fs: Static Safety Factor

It is the ratio of the load capacity of linear guides (basic static load rating) and the maximum calculated load.

The formula is as follows:

$$f_s = \frac{f_c \cdot C_0}{P} \qquad f_s = \frac{f_c \cdot M_0}{M}$$

f_s: Static Safety Factor
C_0: Basic Static Load Rating
M_0: Static Permissible Moment
P: Design Load
M: Design Moment
f_c: Contact Factor

Operating Conditions	Loading Conditions	Minimum fs
General Static Conditions	Minor impacts and offsets	1.0~1.3
	Heavy impacts and vibrations	2.0~3.0
General Motion Conditions	Minor impacts and twists	1.0~1.5
	Heavy impacts and vibrations	2.5~5.0

Additional Influence Parameters

Additional influence parameters mainly address variations in usage methods and environmental conditions, allowing for appropriate adjustments to correct calculation errors.

f_c: Contact Factor
f_h: Hardness Factor
f_t: Temperature Factor
f_w: Load Factor

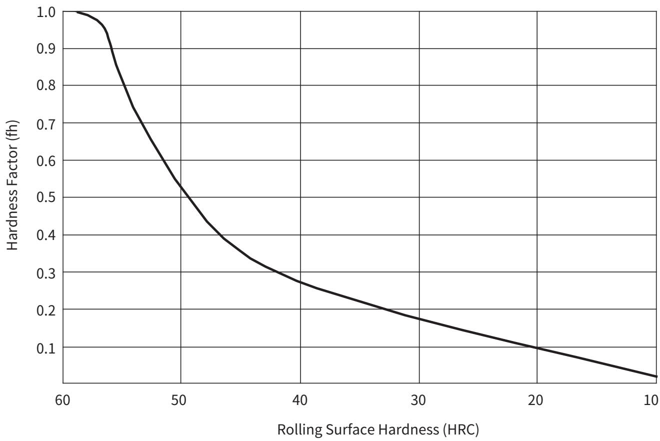
f_c: Contact Factor

Contact Factor: When multiple blocks are closely arranged with each other, the load distribution on the steel balls becomes uneven. Therefore, a correction factor needs to be included in the lifespan calculation.

Number of Used Blocks	Contact Factor fc
In normal use	1
2	0.81
3	0.72
4	0.66
5	0.61

f_h: Hardness Factor

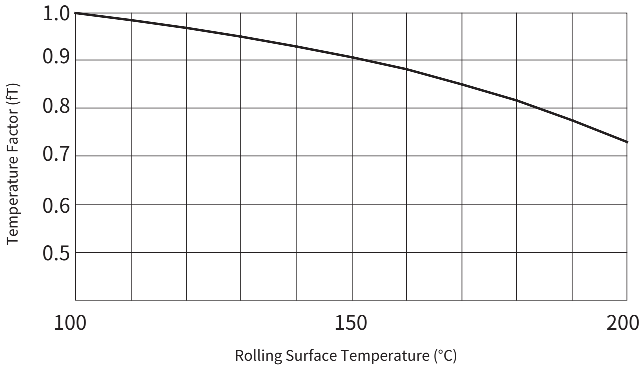
Hardness Factor: The hardness for the rolling elements and rolling surfaces of linear guides is between 58~62 HRC. If any conditions lead to a decrease in hardness, a correction factor needs to be included in the lifespan calculation.



4-1 TM Miniature Wide Linear Guide

f_t: Temperature Factor

Temperature Factor: When rolling surfaces and rolling elements are in high-temperature environments, their lifespan diminishes as the operating temperature increases. If the ambient temperature exceeds the conditions shown in the diagram, it should be considered when evaluating lifespan. For linear guide with plastic components and end seals, it is advisable to keep the operating temperature below 80°C.



f_w: Load Factor

Load Factor: Reciprocating mechanisms can easily generate vibrations or impacts, especially during high-speed operations or frequent starts and stops, which produce inertial shocks. Estimating a reasonable load under these conditions can be quite challenging. Therefore, when the impact of speed vibrations is significant, please refer to the following load coefficients, based on empirical data, and divide them by the basic dynamic load rating (C).

Vibration and Impact	Velocity(V)	Measured Vibration(G)	fw
Very Slight	V≤15m/min	G≤0.5	1~1.5
Slight	15<V≤60m/min	0.5<G≤1.0	1.5~2.0
Strong	V>60m/min	1.0<G≤2.0	2.0~3.5

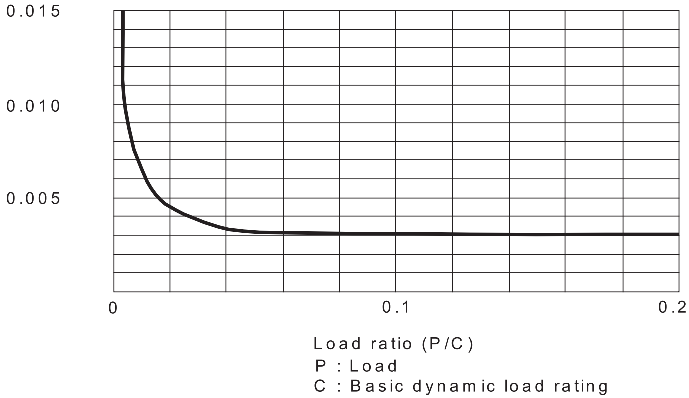
The formula is as follows:

$$L = \left[\frac{f_h \cdot f_t \cdot f_c}{f_w} \cdot \frac{C}{P} \right]^3 \cdot 50km$$

C: Basic Dynamic Load Rating
P: Calculated Load
f_h: Hardness Factor
f_t: Temperature Factor
f_c: Contact Factor
f_w: Load Factor

(The selection process section will provide a more in-depth introduction.)

Friction



Linear guides enable load movement using rolling elements like balls or rollers, resulting in friction that is 1/40th of the one found in traditional sliding systems. The causes of friction include the viscous resistance of lubricants, preload friction resistance, and friction generated by the applied force. The diagram above illustrates the coefficient of friction when the linear guide is subjected to force.

F=uW+f
F: Friction
W: Load
u: Friction Factor
f: Friction Resistance from Block Accessory

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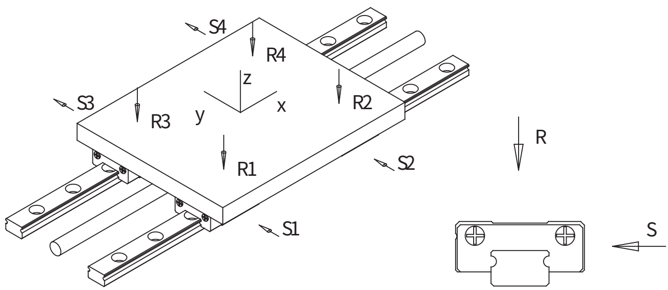
Load Calculation

The definition of load calculation is shown in the diagram below. The letter “R” represents the radial load on the block, and “S” represents the lateral load on the block, with numbers indicating their positions. The load calculation for the block is as follows:



$$R_1 = \frac{-F_z}{4} + \frac{(F_z \cdot P_y - F_y \cdot P_z)}{2 \cdot L1} - \frac{(F_x \cdot P_z - F_z \cdot P_x)}{2 \cdot L0}$$

$$R_2 = \frac{-F_z}{4} + \frac{(F_z \cdot P_y - F_y \cdot P_z)}{2 \cdot L1} - \frac{(F_x \cdot P_z - F_z \cdot P_x)}{2 \cdot L0}$$

$$R_3 = \frac{-F_z}{4} + \frac{(F_z \cdot P_y - F_y \cdot P_z)}{2 \cdot L1} - \frac{(F_x \cdot P_z - F_z \cdot P_x)}{2 \cdot L0}$$

$$R_4 = \frac{-F_z}{4} + \frac{(F_z \cdot P_y - F_y \cdot P_z)}{2 \cdot L1} - \frac{(F_x \cdot P_z - F_z \cdot P_x)}{2 \cdot L0}$$

$$S_1 = \frac{F_y}{4} + \frac{(F_y \cdot P_x - F_x \cdot P_y)}{2 \cdot L0}$$

$$S_2 = \frac{F_y}{4} + \frac{(F_y \cdot P_x - F_x \cdot P_y)}{2 \cdot L0}$$

$$S_3 = \frac{F_y}{4} + \frac{(F_y \cdot P_x - F_x \cdot P_y)}{2 \cdot L0}$$

$$S_4 = \frac{F_y}{4} + \frac{(F_y \cdot P_x - F_x \cdot P_y)}{2 \cdot L0}$$

■ 4-1-4 Preload

Preload is crucial to the overall precision performance of the mechanism. The mechanism may experience overall oscillation due to external forces or inertia from accelerations. Below are reference preload levels for various types of machinery.

Preload	Slight Clearance	Zero Clearance	Light Preload
Operating Conditions	1. Slight impact	1. Slight impact	1. Cantilever
	2. One-axis usage	2. Two-axes usage in parallel	2. One-axis usage
	3. High smoothness requirement	3. High smoothness requirement	3. Light load
	4. Slight sliding resistance	4. Low sliding resistance	4. High accuracy
	5. Low reciprocating load case	5. Low reciprocating load case	
Application Examples	1. Conveyor	1. Welding machine	1. NC lathe
	2. Fully automatic sewing machine	2. Cutting machine	2. Electrical discharge machine
	3. Vending machine	3. Material feeding systems	3. Precision XY table
	4. Laser engraving machine	4. Automatic tool changer	4. Z-axis for general machinery
	5. Banner printing machine	5. XY-axis for general machinery	5. Industrial robotic arm
	6. Screen printing equipment	6. Packing machine	6. PCB drilling machine

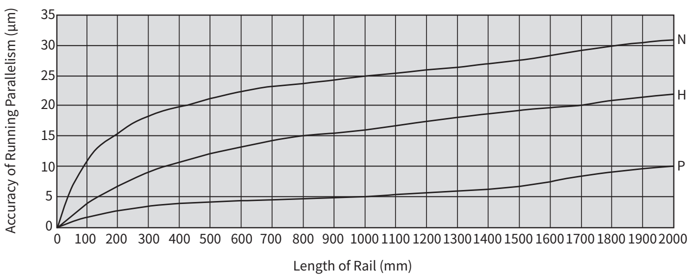
Preload and Clearance

When selecting preload, it is important to consider the potential for clearance or additional preload forces. Be sure to assess the impact on precision and lifespan during the selection process. Miniature linear guides are generally not suitable for medium to high preload applications involving heavier loads because of the limitations in its profile and rigidity.

Preload	Mark	Clearance or Preload Force
Slight Clearance	F	4~10μm
No Clearance	0	2μm~0.01C
Light Preload	1	0.01C~0.02C

Note. The letter "C" in preload force is Dynamic Load Rating.

The running parallelism of the block relative to the reference surface of the guide rail.



4-1 TM Miniature Wide Linear Guide

■ 4-1-5 Accuracy

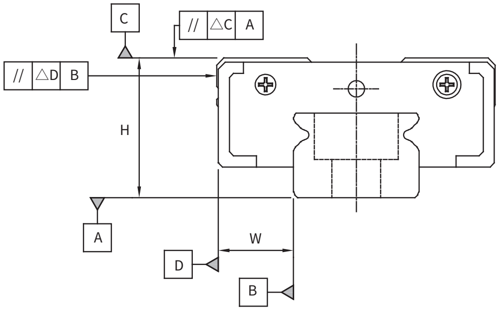


Table 4.1.1 Assembly Accuracy (Non-Interchangeable Type)

Type	Item	Accuracy Level		
		Normal "N"	High "H"	Precision "P"
07 09 12 15	Tolerance for Height H	±0.04	±0.02	±0.01
	Tolerance for Width W	±0.04	±0.025	±0.015
	Tolerance for Height H difference among the blocks	0.03	0.015	0.007
	Tolerance for Width W difference among the blocks	0.03	0.02	0.01
	Running parallelism of block surface "C" against surface "A"	Running parallelism (Table 4.1.3)		
	Running parallelism of block surface "D" against surface "B"	Running parallelism (Table 4.1.3)		

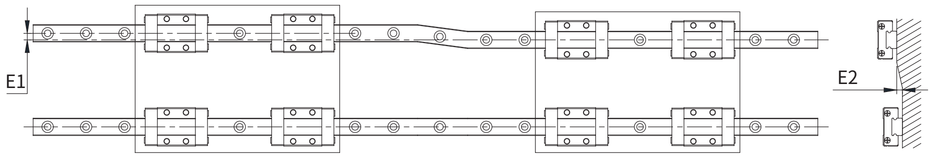
Flatness of the Mounting Surfaces of the Block and Guide Rail

Due to the Gothic structure of miniature linear guides, any accuracy errors in the mounting surfaces may negatively affect their operation.

Table 4.1.2 Flatness of the Mounting Surfaces of the Block and Guide Rail **Unit: mm**

Model No.	Flatness Tolerance
07	0.025/200
09	0.035/200
12	0.050/200
15	0.060/200

Note.1. For installation surfaces, accuracy can be influenced by a combination of factors in different cases. Therefore, it is recommended to use values below 70% of those listed in the table.
Note.2. The values mentioned above apply to slight clearances. When using a zero-clearance two-axes system, it is recommended to use values below 50% of those specified above.



Unit: μm

	Tolerance for Dual-Axis Parallelism Error E1			Tolerance for Dual-Axis Levelness Error E2		
Model No.	Slight Clearance	Zero Clearance	Light Preload	Slight Clearance	Zero Clearance	Light Preload
7	3	3	3	25	25	3
9	4	4	3	35	35	6
12	9	9	5	50	50	12
15	10	10	6	60	60	20

A Linear Guide

4-1 TM Miniature Wide Linear Guide

■ 4-1-6 Accuracy Standard

Table 4.1.3 Rail Length for TM Series and Running Parallelism

Rail Length for TM Series		Running Parallelism (μm)		
Above	Below	N	H	P
	40	8	4	1
40	70	10	4	1
70	100	11	4	2
100	130	12	5	2
130	160	13	6	2
160	190	14	7	2
190	220	15	7	3
220	250	16	8	3
250	2803	17	8	3
280	310	17	9	3
310	340	18	9	3
340	370	18	10	3
370	400	19	10	3
400	430	20	11	4
430	460	20	12	4
460	490	21	12	4
490	520	21	12	4
520	550	22	12	4
550	580	22	13	4
580	610	22	13	4
610	640	22	13	4
640	670	23	13	4
670	700	23	13	5
700	730	23	14	5
730	760	23	14	5
760	790	23	14	5
790	820	23	14	5
820	850	24	14	5
850	880	24	15	5
880	910	24	15	5
910	940	24	15	5
940	970	24	15	5
970	1000	25	16	5
1000	1030	25	16	5

Table 4.1.3 Rail Length for TM Series and Running Parallelism

Rail Length for TM Series		Running Parallelism (μm)		
Above	Below	N	H	P
1030	1060	25	16	6
1060	1090	25	16	6
1090	1120	25	16	6
1120	1150	25	16	6
1150	1180	26	17	6
1180	1210	26	17	6
1210	1240	26	17	6
1240	1270	26	17	6
1270	1300	26	17	6
1300	1330	26	17	6
1330	1360	27	18	6
1360	1390	27	18	6
1390	1420	27	18	6
1420	1450	27	18	7
1450	1480	27	18	7
1480	1510	27	18	7
1510	1540	28	19	7
1540	1570	28	19	7
1570	1600	28	19	7
1600	1700	29	20	8
1700	1800	30	21	9
1800	1900	30	21	9
1900	2000	31	22	10

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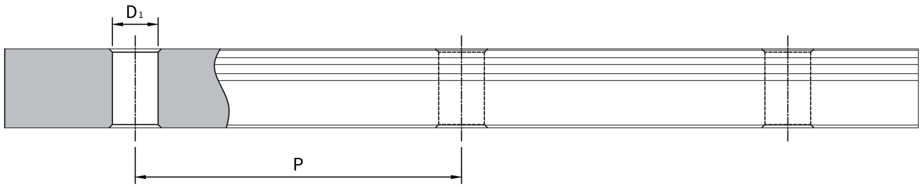
■ 4-1-7 Mounting Type of Linear Rail



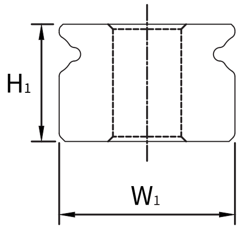


Fig 4.1.3 Mounting from Below

Table 4.1.4 Rail Size

Unit: mm

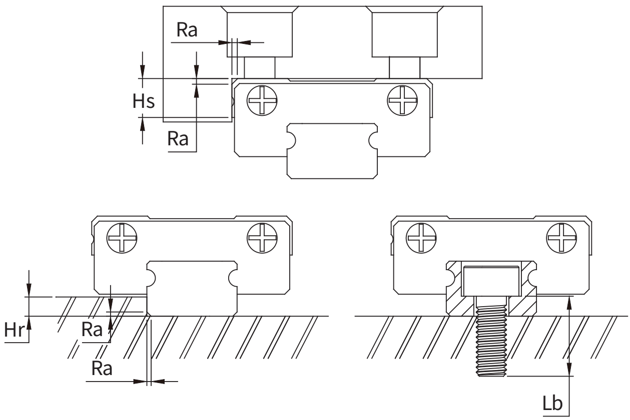
Model No.	Rail Size			
	H1	W1	P	D1
TM07W	5.2	14	30	M4*0.7
TM09W	6.5	18	30	M4*0.7
TM12W	8.5	24	40	M5*0.8
TM15W	9.5	42	40	M5*0.8

■ 4-1-8 Installation

Installation Process

Good installation quality is built on detailed planning during the design phase and the implementation of installation processes. The following are dimensions and design considerations that should be noted in the early design phase, as well as detailed tasks that need to be considered during the installation process.

Dimensions to Consider in the Design Phase

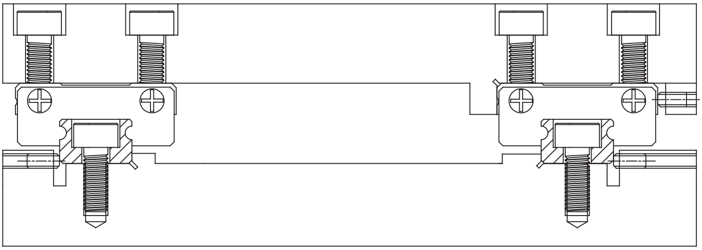


Item	Hr	Hs	Ra	Lb
TM07W	1.7	3	0.2	M3×10L
TM09W	2.5	3.2	0.2	M3×10L
TM12W	3.5	4	0.3	M4×12L
TM15W	3.5	4	0.4	M4×14L

Hr: Maximum height of the rail support surface (mm)
Hs: Recommended height for block support (mm)
Ra: Maximum fillet radius for the support corner (mm)
Lb: Recommended specifications for fixed screws

4-1 TM Miniature Wide Linear Guide

Basic Structure



The above image provides a basic introduction to the application of linear guides.

The basic structure is mainly divided into:

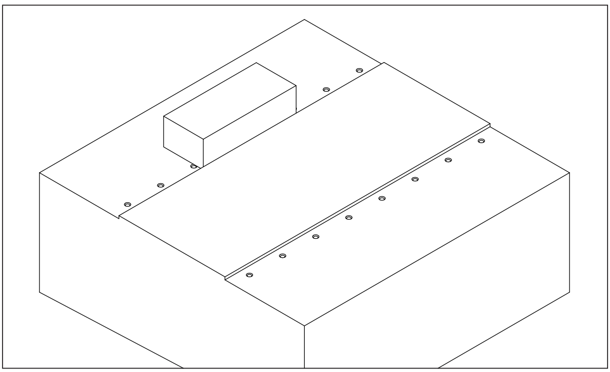
1. Fixed Platform: The above image features a rail mounting surface, with lateral set screws that securely align the rail with the reference surface.

2. Moving Platform: The above image includes a mounting surface for the block, with lateral set screws tightened to ensure the accuracy and stability between the block and the moving platform.

3. Rake Angle Design: Rails and blocks feature basic chamfers to prevent assembly interference. However, to facilitate maintenance, incorporating a rake angle design can also be beneficial.

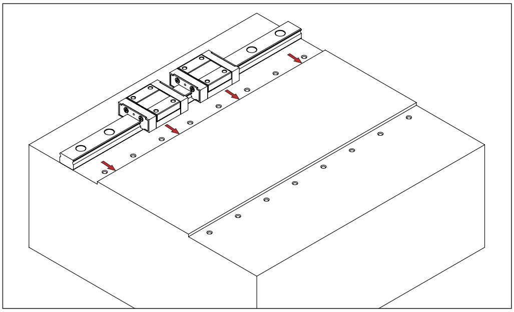
Step 1.

Basic Preparatory Work: To achieve good installation quality, use a cleaning oil to remove the rust-proof oil layer from the reference surface before installation. Additionally, use a honing stone to eliminate any machining burrs or surface defects.



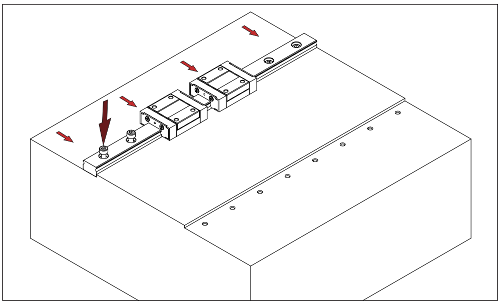
Step 2.

Installation Reference Surface Confirmation: Verify the installation orientation of the reference surface for the rail and block to ensure precise positioning accuracy.



Step 3.

Rail Pre-Positioning: Place the rail onto the reference surface, ensuring it rests against the side installation reference surface. Tighten the set screws to maintain clamping force without fully locking them. Follow the specified sequence for tightening screws, ensuring that the rotation direction aligns the linear guide with the holes of the adjacent reference surface. Proceed in sequence to avoid any misalignment.



4-1 TM Miniature Wide Linear Guide

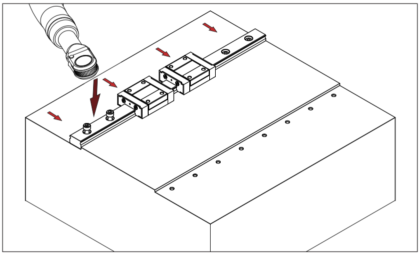
Step 4.

Selection of Tightening Torque: Please confirm the material of the installation platform and the size of the set screws. Then, select the appropriate tightening torque accordingly.

Model No.	Tightening Torque (kg-cm)		
	Steel	Cast Iron	Aluminum
M2	6.3	4.2	3.1
M2.3	8.4	5.7	4.2
M2.6	12.6	8.4	6.3
M3	21	13.6	10.5
M4	44.1	29.3	22
M5	94.5	63	47.2
M6	146.7	98.6	73.5
M8	325.7	215.3	157.5

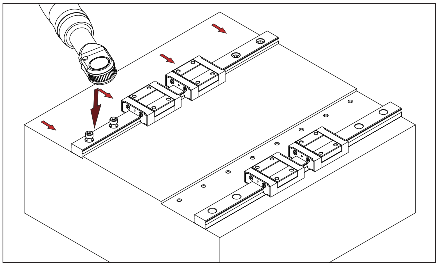
Step 5.

Tightening with Torque Wrench: Use a torque wrench to tighten the screws in stages for accurate positioning. This can be done in two or three stages (with a three-stage tightening distribution of 40%, 70%, and 100% of the final torque output).



Step 6.

Sub-Rail Installation: Follow the same steps as above, paying attention to the torque and the selected order of tightening for the supporting surfaces. Tighten in stages for accurate positioning.



Step 7.

Installation of Moving Platform:

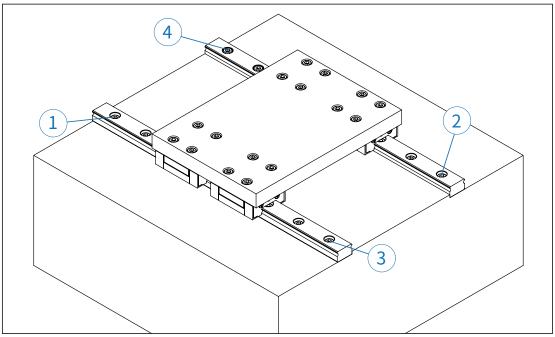
1.Carefully place the moving platform on the assembled block, ensuring that the mounting surface aligns with the lateral clamping position.

2. Tightening can be done in two or three stages (with a three-stage tightening distribution of 40%, 70%, and 100% of the final torque output).

3. Follow a diagonal tightening sequence for the set screws, proceeding in stages as shown in installation step 6.

4. After completing the first stage of tightening at 30%, proceed to apply lateral clamping for the first stage output.

5. After completing the first stage, continue to the next stage, progressing to 100% completion.



4-1 TM Miniature Wide Linear Guide

■ 4-1-9 Nominal Model Code for TM Series

Length of Rail

If the required length exceeds 1300 mm, it will be assembled using two or more sections. Please contact TBI MOTION for detailed information.

T	M	07	W	L	S	-	2	-		-	1000	-	N	S	-	Z0	-	II	-	K
①	②	③	④	⑤	⑥		⑦		⑧		⑨		⑩	⑪		⑫		⑬		⑭

①

Nominal Model
T

②

Block Type
M: Miniature
X: Special

(Drawing will be provided for special item in order to distinguish the height of the rail.)

③

Dimension
07, 09, 12, 15

④

Width of Rail
W: Wide

⑤

Length of Block
N: Standard
L: Long

⑥

Material of Block
S: Stainless Steel

⑦

Number of Block Per Rail
(Mark 1 when there is only 1 block)

⑧

Accessory Code
□ : Standard (End seal + Bottom seal)

⑨

Length of Rail
Unit: mm

⑩

Accuracy Grade
N: Normal
H: High
P: Precision

⑪

Material of Rail
S: Stainless steel

⑫

Preload
ZF: Slight Clearance
Z0: Zero Clearance
Z1: Light Preload

⑬

Two Sets per Axis
(No need to be marked when there is only one rail) II

⑭

Rail Special Machining
K: Mounting from Bottom
X: Rail with Special Machining
□: Mounting from Top

※There is no surface treatment for Miniature Wide Series.

Interchangeable Type of Block:

T M 07 W L - N S - Z0

①②③④⑤ ⑥⑦ ⑧

① Nominal Model
T

② Block Type
M: Miniature
X: Special

(Drawing will be provided for special item in order to distinguish the height of the rail.)

③ Dimension
07, 09, 12, 15

④ Width of Rail
W: Wide

⑤ Length of Block
N: Standard
L: Long

⑥ Accuracy Grade
N: Normal
H: High
P: Precision

⑦ Material of Block
S: Stainless steel

⑧ Preload
ZF: Slight Clearance
Z0: Zero Clearance
Z1: Light Preload

Interchangeable Type of Rail:

T M 07 W - 1000 - N S - K

①②③④ ⑤ ⑥⑦ ⑧

① Nominal Model
T

② Block Type
M: Miniature
X: Special

(Drawing will be provided for special item in order to distinguish the height of the rail.)

③ Dimension
07, 09, 12, 15

④ Width of Rail
W: Wide

⑤ Length of Rail
Unit: mm

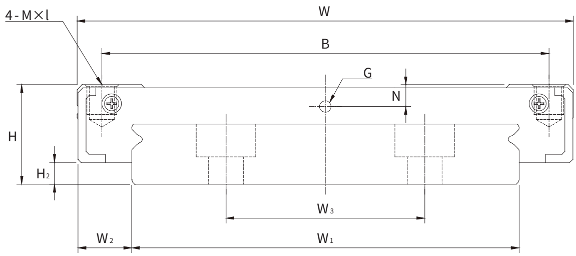
⑥ Accuracy Grade
N: Normal
H: High
P: Precision

⑦ Material of Rail
S: Stainless steel

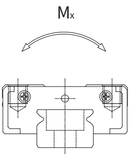
⑧ Rail Special Machining
K: Mounting from Bottom
X: Rail with Special Machining
□: Mounting from Top

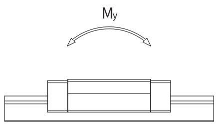
2-1 The Types of *TBI MOTION* Linear Guide

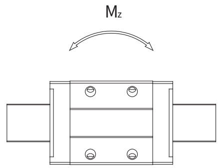
TM-W Series Specification

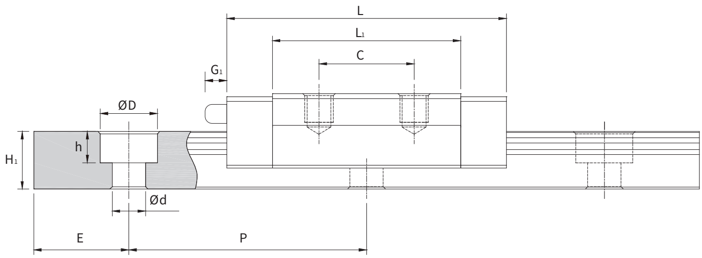


Model No.	Assembly (mm)			Block Dimension (mm)								
	H	H2	W2	W	L	L1	B	C	M×l	N	G	G1
TM07WN	9	2	5.5	25	30.6	21	19	10	M3x3	1.8	1.2	-
TM07WL	9	2	5.5	25	40.4	30.8	19	19	M3x3	1.8	1.2	-
TM09WN	12	3	6	30	38.7	26.1	21	12	M3x3	2.8	1.2	-
TM09WL	12	3	6	30	50.5	37.9	23	24	M3x3	2.8	1.2	-
TM12WN	14	4	8	40	44	29.4	28	15	M3x4	2.85	1.2	-
TM12WL	14	4	8	40	59	44.4	28	28	M3x4	2.85	1.2	-
TM15WN	16	4	9	60	54.8	37.8	45	20	M4x4.5	3	M3	4.5
TM15WL	16	4	9	60	73.8	56.8	45	35	M4x4.5	3	M3	4.5









Rail Dimension (mm)						Load Rating (kgf)		Static Permissible Moment (kg-mm)					Weight	
								M_x	M_y		M_z		Block (g)	Rail (kg/m)
W1	W3	H1	P	D×h×d	E	C	C0	Single Block	Single Block	Double Block	Single Block	Double Block		
14	-	5.2	30	6x3.2x3.5	10	139	209	1601	728	3753	728	3753	0.02	0.52
14	-	5.2	30	6x3.2x3.5	10	180	320	2391	1581	8392	1581	8392	0.029	
18	-	6.5	30	6x3.5x3.5	10	279	368	4093	1935	9514	1935	9514	0.035	0.95
18	-	6.5	30	6x3.5x3.5	10	354	604	5588	3489	18385	3489	18385	0.048	
24	-	8.5	40	8x4.5x4.5	15	402	571	7174	2839	14918	2839	14918	0.06	1.53
24	-	8.5	40	8x4.5x4.5	15	525	847	10493	5864	29806	5864	29806	0.086	
42	23	9.5	40	8x4.5x4.5	15	694	942	20440	5919	31988	5919	31988	0.122	2.9
42	23	9.5	40	8x4.5x4.5	15	918	1375	30642	12634	61937	12634	61937	0.174	