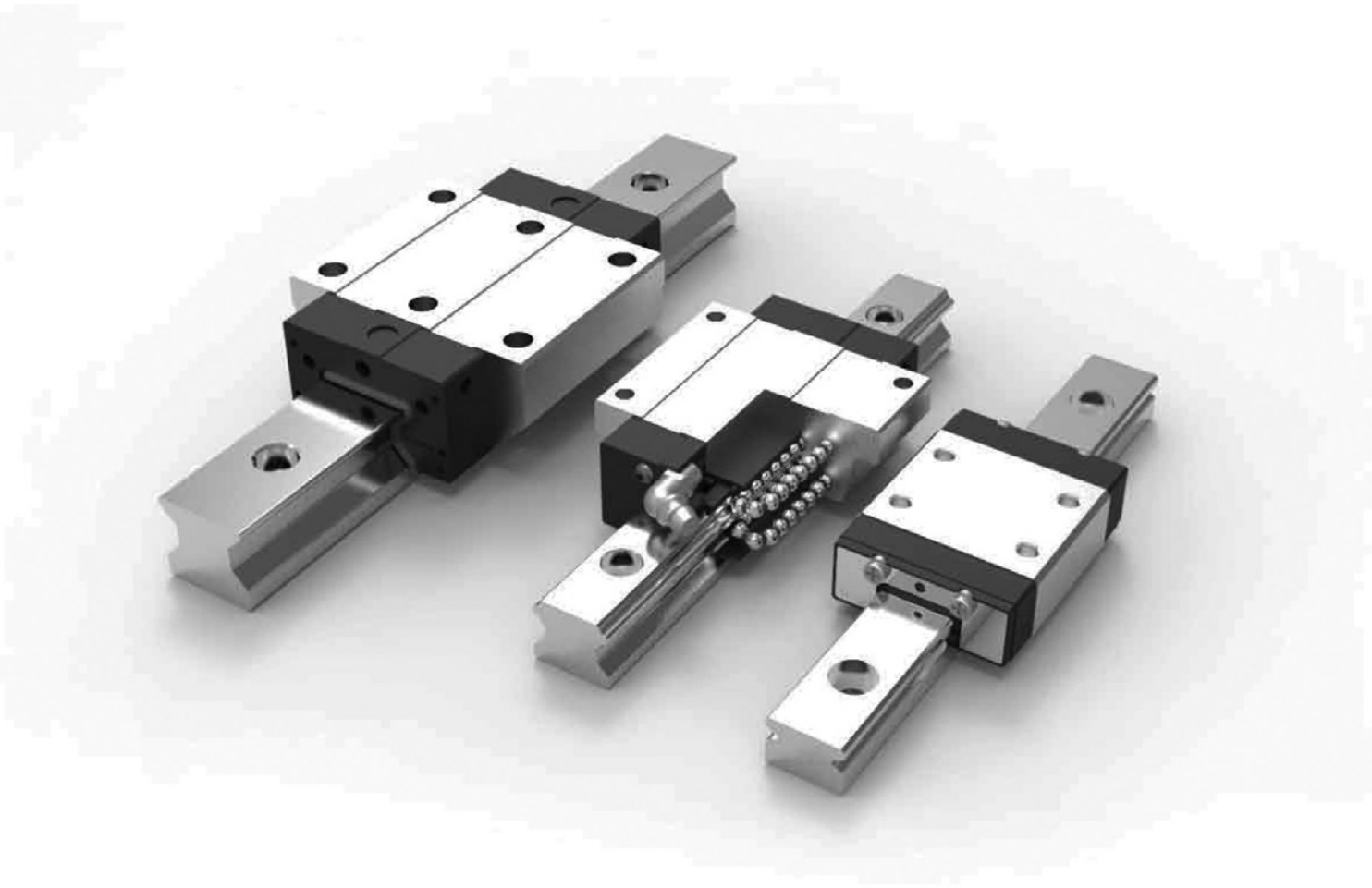
Dr. TRETTER AG



PERSÖNLICHE BERATUNG

SCHNELLE LIEFERUNG

HÖCHSTE QUALITÄT

LINEAR MOTION GUIDE

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CONTENTS

1 LINEAR MOTION GUIDE

1. Characteristics

Linear Motion Guide is a straight-line motion bearing with the structure in which rolling elements such as balls or rollers softly circulate the inner part of the block and the block can make an infinite straight-line motion along the raceway surface of a rail.

2. Strengths

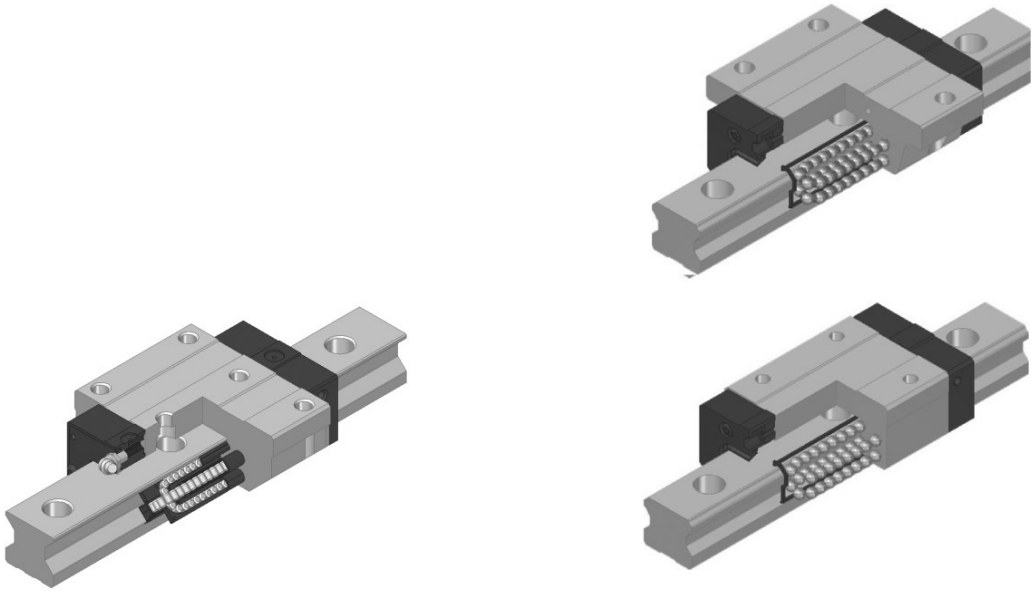
1. Able to make a precise positioning
   Since there is less difference between static friction and kinetic friction as well as in speed-induced friction fluctuation, it excellently responds even to micro-migration, allowing precise positioning.

2. Able to maintain accuracy stably for a long time
   Less friction coefficient and wear due to ideal rolling motion allows the stable maintenance of accuracy for a long time.

3. Able to eliminate clearance or increase rigidity by preloading
   It is possible to eliminate clearance by using rolling elements such as a ball or a roller or increase rigidity of Linear Motion Guide by preloading.

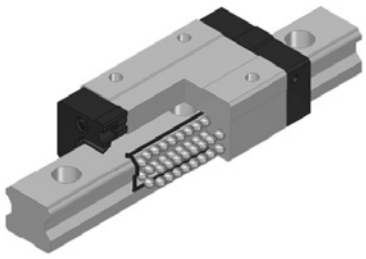
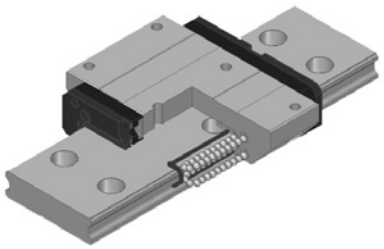
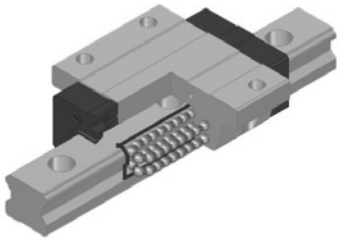
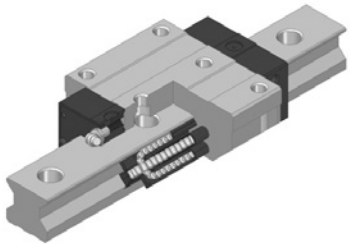
4. Lubrication is simple
   Lubrication is simple but it uses grease or oil which makes it convenient to maintain.

5. Able to compact equipment and save cost for operating electricity
   It can be made into compact miniaturized equipment because friction is low despite highly-rigid high-loading, which saves manufacturing costs and energy.



3. Types

Tretter offers various types of Linear Motion guide from miniature types to general ball Linear Motion guide to low-sound linear motion guide to ultra high-rigid roller linear motion guide. Since each supports different shapes and sizes according to service conditions, you can select the optimal linear motion guide to each usage.

Linear Motion Guide		• World standard ball Linear Motion guide • 4-direction equal load type with 45° contact angle • Great error-absorbing ability with D/F combination • High-rigid highly accurate straight-line motion through ideal rolling motion
Wide Linear Motion Guide		• It is a compact highly-rigid 4-direction equal load type with 45 degrees, and suitable for use in a one-axis type since it is wider and lower heights than the general miniature linear motion guide and rigidity increased.
Spacer Chain Linear Motion Guide		• World standard ball Linear Motion guide • 4-direction equal load type with 45° contact angle • Great error-absorbing ability with D/F combination • High-rigid highly accurate straight-line motion through ideal rolling motion
Roller Linear Motion Guide		• World standard ball Linear Motion guide • 4-direction equal load type with 45° contact angle • Great error-absorbing ability with D/F combination • High-rigid highly accurate straight-line motion through ideal rolling motion

2 SELECTION OF LINEAR MOTION GUIDE

1. Overview

To select Linear Motion guide, most of all identify detailed requirements and prioritize the requirements to select the Linear Motion Guide suitable for the service conditions.

2. Procedure

1 Identify service conditions	equipment, maintenance structure, installation space, assembly status, functional requirements, service conditions
2 Select the type of Linear Motion guide	Select the appropriate type by considering motion condition, load level, rigidity, friction, and assembly
3 Select the model number of Linear Motion guide	Determine the model number and the quantity of blocks by considering the space and load
4 Calculate load	Calculate the load in vertical and horizontal directions and moment
5 Calculate equivalent load	Calculate each load applied to the block by converting it into equivalent load
6 Calculate mean load	Calculate each load applied to the block and variable load during deceleration by converting them into mean load
7 Calculate static safety factor	Calculate the static safety factor identified by basic load rating and max. equivalent load and check if it fits for service conditions
8 Calculate life	Check if it fits for service conditions by calculating load rating and life
9 Review preload & clearance	Select the preload and clearance suitable for service conditions
10 Determine the class of precision	Determine the class of precision required by Linear Motion guide while driving
11 Lubrication, dust proof, surface handling	Select lubricant suitable for the environment using grease, oil, and special grease lubrication and select seal for dust proof / determine the method of surface handing for rust prevention and low dust raise
12 Complete selection	Complete the decision of final specifications of Linear Motion guide

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3 LIFE CALCULATION

1. Load rating and life

(1) Life
If external load is applied to Linear Motion guide while driving, fatigue fracture occurs by stress created as load is repeatedly applied to the raceway surface and rolling elements, and flaking -peeling off in scale-like flakes arises. A total driving distance until flaking occurs due to initial fatigue fracture is the life of a linear motion guide.

Defects may occur in Linear Motion guide earlier than when flaking normally occurs due to wear or fatigue in the following cases:

a. Excess load by the imprecise assembly following a difference in temperature or tolerance
b. If Linear Motion guide is contaminated with foreign substance
c. Driving with insufficient lubrication
d. Reciprocating motion in a very short distance in the form of vibration or wave during the halt or drive
e. Excessive load to Linear Motion guide
f. Deformation of plastic end-plate

2) Rating fatigue life L
Generally Linear Motion guide does not always have same life even though the products are manufactured in the same way because of the difference in scattering of raw material's original fatigue. For this reason, the reference value of life is defined as the rating fatigue life which is a total driving distance that flaking does not occur in 90% of Linear Motion guides in a group when having them run under the same conditions by grouping multiple Linear Motion guides with same specifications into a group.

When using a ball

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

When using a roller

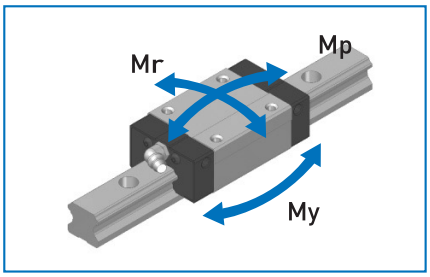
$$L = \left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P_C} \right)^{\frac{10}{3}} \times 100$$

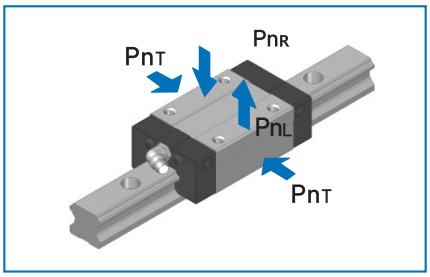
(3) Basic dynamic load rating C
Basic dynamic load rating is Linear Motion guide's bearing of load which represents an applicable constant load in direction and magnitude when the rated life is 50KM. The reference value of Tretter Linear Motion Guide's basic dynamic load rating is 50KM (ball type) and 100KM (roller type). It is used for calculating Linear Motion guide's life while driving under constant load in magnitude from the center of a block to bottom.
Each value of basic dynamic load rating (C) is stated in the catalogue.

(4) Basic static load rating C0
If Linear Motion guide is applied by excessive load or attached instantly by big impact load, a partially permanent deformation occurs between a rolling element and the raceway surface. If deformation reaches to a certain extent, it hinders a smooth driving. Basic static load rating is defined as the constant static load in direction and magnitude with the permanent deformation that occurs between a rolling element like a ball or a roller and the raceway surface of block and rail 0.0001 times bigger than the diameter of the rolling element. In Linear Motion guide, it is the load applied from top to bottom based on the center of the block. Each value of basic static load rating (C0) is stated in the specification table.

(5) Static allowable moment Mo
Moment load can be applied to Linear Motion guide. Here, a ball or a roller both at the ends is most stressed due to the stress distribution of a ball or a roller which is the rolling element inside Linear Motion guide. Static allowable moment refers to the constant moment load in direction and magnitude when the permanent deformation between a ball or a roller applied with the biggest stress and the raceway surface of a block or a rail is less than 0.0001 of the diameter of the rolling element. Moment values of three directions (Mp, My, Mr) are stated in the specification sheet. Static allowable moment (Mo) and static moment load rating (Mp) can be reviewed by applying safety factor (fs).

Directions of
load and moment





$$fs = \frac{Mp}{Mo}$$

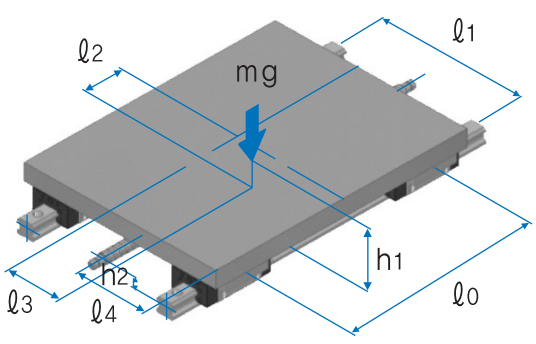
2. Load Calculation

Linear Motion guide bears basic dynamic load rating (C) and basic static load rating (C_0). But compression load applied from top to down due to inertia force created by the center of gravity, positioning thrust, acceleration, cutting force, and deceleration as well as various loads including tensile load, horizontal load, and moment load can be applied to Linear Motion guide depending on the service conditions. In this case, load of Linear Motion guide changes. When selecting Linear Motion guide, it is required to review these conditions and calculate proper load.

3. Service Condition Setting

Service conditions necessary for calculating the load and life of Linear Motion guide :

1. Mass : m(kg)
2. Applicable load direction
3. Point of application : ℓ_2, ℓ_3, h_1(mm)
   (center of gravity)
4. Point of thrust : ℓ_4, h_2(mm)
5. Composition of Linear Motion guide : ℓ_0, ℓ_1(mm)
   (No. of block & rail)
6. Velocity diagram — Velocity : V(mm/s)
   Time constant : tn(s)
   Acceleration : α_n(mm/s)
7. No. of reciprocating motion/second : N_1(min^{-1})
8. Stroke : Ls(mm)
9. Avg. velocity : V_m(m/s)
10. Required life : L_h(h)



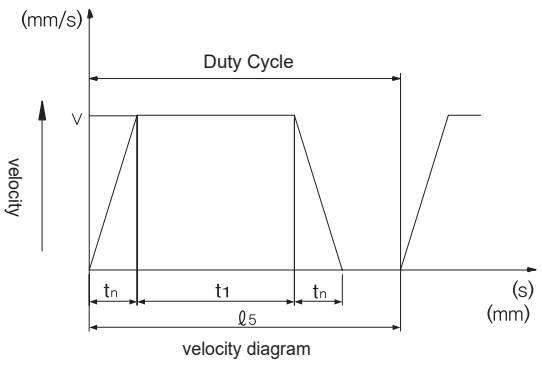


Figure 1. Service Condition

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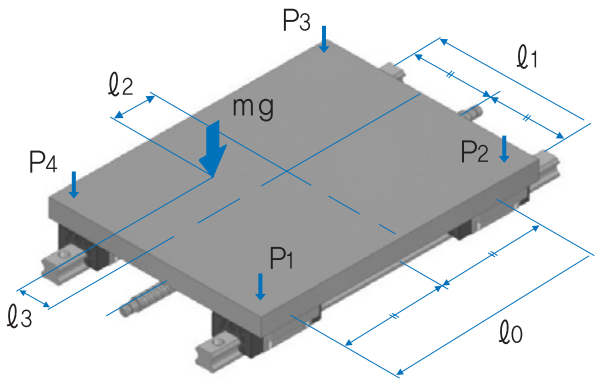
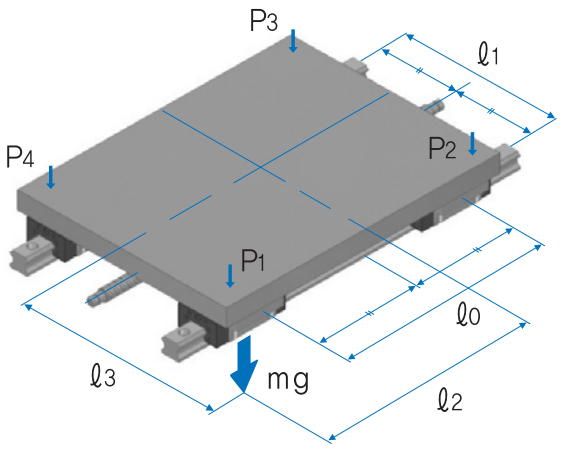
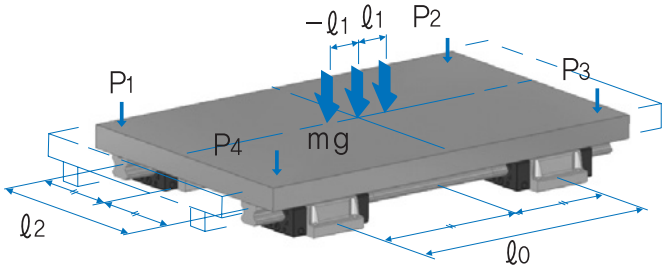
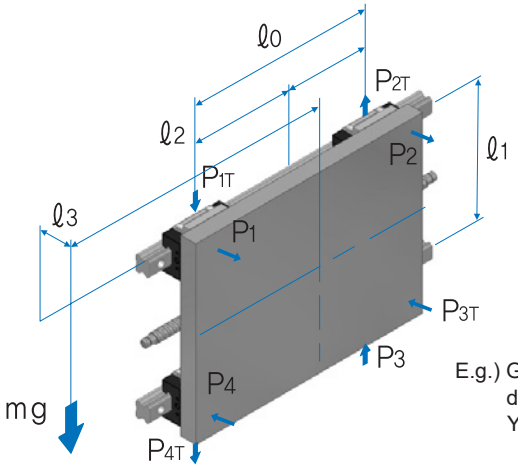
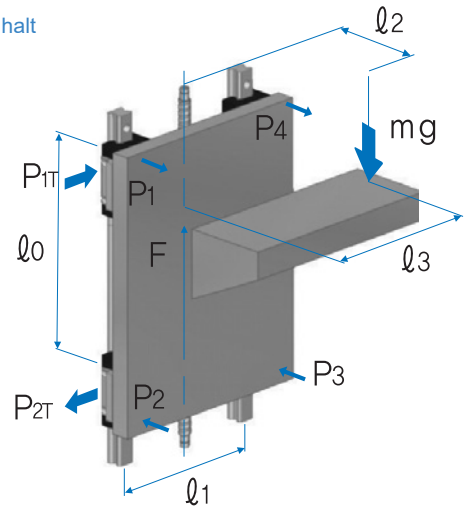
4. Load Calculation Formula

Load applied to Linear Motion guide changes due to external forces such as the center of gravity, position of thrust, acceleration, and cutting resistance. To select Linear Motion guide, you should calculate load applied to the block by fully considering the conditions below.

m : Mass	(kg)	g : Acceleration of gravity(g : 9.8m/s^2)	(m/s^2)
ℓ_n : Distance	(mm)	V : Velocity	(m/s)
F_n : Thrust	(N)	tn : Time constant	(s)
P_n : Load (vertical, reverse-vertical)	(N)	αn : Acceleration	(m/s^2)
P_{nT} : Load (horizontal)	(N)		

Case	Service Conditions	Load Calculation Formula
1	Block move Horizontal / uniform motion / halt 	$P_1 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_2 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_3 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_4 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$
2	Block move Overhang-horizontal / uniform motion / halt 	$P_1 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_2 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_3 = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_4 = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$

Case	Service Conditions	Load Calculation Formula
3	Rail move Horizontal / uniform motion / halt  E.g.) X or Z axis Loader/unLoader	$P_1 = \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{1T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_2 = \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{2T} = \frac{mg \cdot \sin\theta}{4} - \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$
4	Block move Wall installation / uniform motion / halt  E.g.) Gantry-type device Y-axis drive	$P_1 \sim P_4 = \frac{mg \cdot \ell_3}{2 \cdot \ell_1}$ $P_{1T} = P_{4T} = \frac{mg}{4} + \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_{2T} = P_{3T} = \frac{mg}{4} - \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$
5	Block move Vertical / uniform motion / halt  E.g.) Industrial robot Z-axis Auto-painting spray, lifter	$P_1 \sim P_4 = \frac{mg \cdot \ell_2}{2 \cdot \ell_0}$ $P_{1T} \sim P_{4T} = \frac{mg \cdot \ell_3}{2 \cdot \ell_0}$

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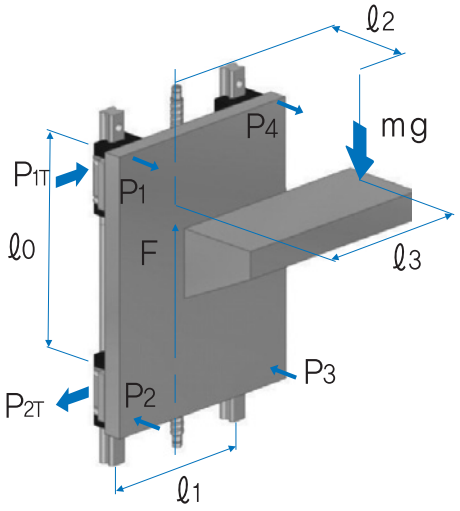
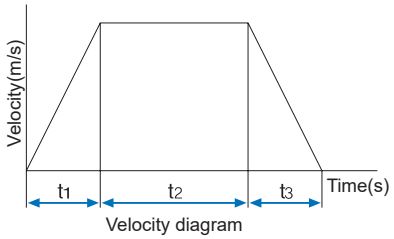
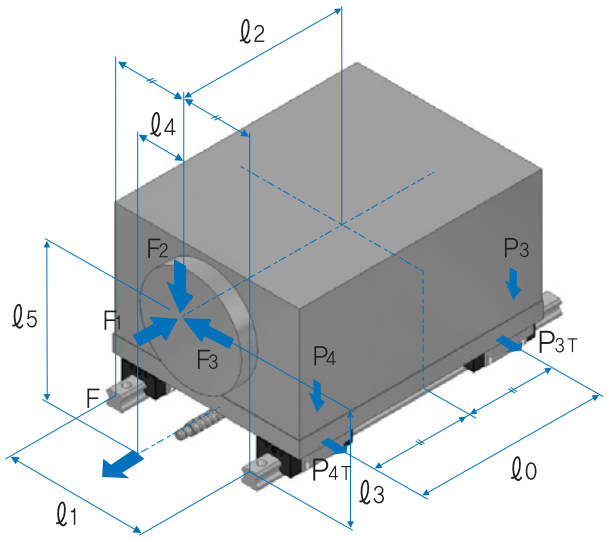
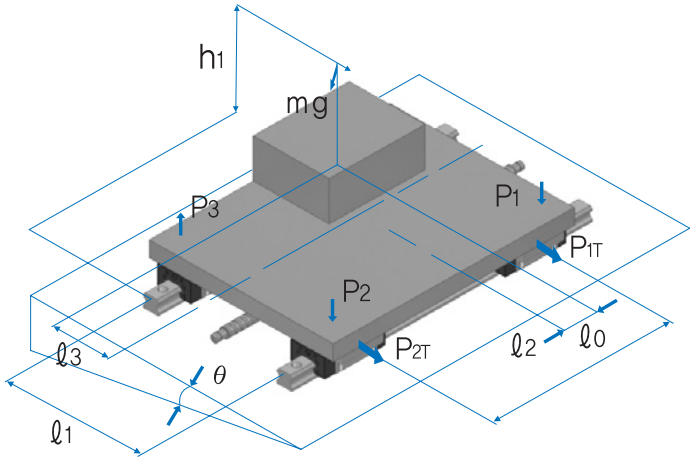
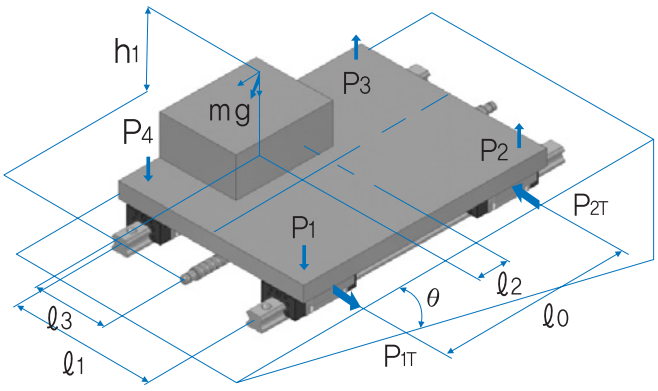
Case	Service Conditions	Load Calculation Formula
6	Block move Vertical/moment of inertia  $\alpha n = \frac{V}{tn}$  Velocity diagram E.g.) Conveyance robot, LTR robot 2-axis	Acceleration $P_1=P_4=-\frac{m(g-\alpha_1)\ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{m(g-\alpha_1)\ell_2}{2\cdot\ell_0}$ $P_{1T}=P_{4T}=\frac{m(g-\alpha_1)\ell_3}{2\cdot\ell_0}$ $P_{2T}=P_{3T}=-\frac{m(g-\alpha_1)\ell_3}{2\cdot\ell_0}$ Uniform motion $P_1=P_4=-\frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{mg\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T}=P_{4T}=\frac{mg\cdot\ell_3}{2\cdot\ell_0}$ $P_{2T}=P_{3T}=-\frac{mg\cdot\ell_3}{2\cdot\ell_0}$ Deceleration $P_1=P_4=-\frac{m(g-\alpha_3)\ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{m(g-\alpha_3)\ell_2}{2\cdot\ell_0}$ $P_{1T}=P_{4T}=\frac{m(g-\alpha_3)\ell_3}{2\cdot\ell_0}$ $P_{2T}=P_{3T}=-\frac{m(g-\alpha_3)\ell_3}{2\cdot\ell_0}$
7	Block move Cutting load / complex external load  E.g.) Machine tool, CNC shelf, machining center, NC milling machine	F1 application $P_1=P_4=-\frac{F_1\cdot\ell_5}{2\cdot\ell_0}$ $P_2=P_3=\frac{F_1\cdot\ell_5}{2\cdot\ell_0}$ $P_{1T}=P_{4T}=\frac{F_1\cdot\ell_4}{2\cdot\ell_0}$ $P_{2T}=P_{3T}=-\frac{F_1\cdot\ell_4}{2\cdot\ell_0}$ F2 application $P_1=P_4=\frac{F_2}{4^+}\quad\frac{F_2\cdot\ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{F_2}{4^-}\quad\frac{F_2\cdot\ell_2}{2\cdot\ell_0}$ F3 application $P_1=P_4=-\frac{F_3\cdot\ell_3}{2\cdot\ell_1}$ $P_2=P_3=\frac{F_3\cdot\ell_3}{2\cdot\ell_1}$ $P_{1T}=P_{4T}=\frac{F_3}{4^-}\quad\frac{F_3\cdot\ell_2}{2\cdot\ell_0}$ $P_{2T}=P_{3T}=\frac{F_2}{4^-}\quad\frac{F_3\cdot\ell_2}{2\cdot\ell_0}$

Case	Service Conditions	Load Calculation Formula
8	Block move Moment load in case of application to side slope / cutting load  E.g.) CNC shelf, reciprocating carriage	$P_1 = \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{1T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_2 = \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{2T} = \frac{mg \cdot \sin\theta}{4} - \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_3 = \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{3T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$ $P_4 = \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_1}$ $P_{4T} = \frac{mg \cdot \sin\theta}{4} + \frac{mg \cdot \sin\theta \cdot \ell_2}{2 \cdot \ell_0}$
9	Block move Moment load in case of application to front slope / cutting load  E.g.) CNC shelf, tool rest	$P_1 = \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_0}$ $P_{1T} = \frac{mg \cdot \sin\theta \cdot \ell_3}{2 \cdot \ell_0}$ $P_2 = \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} - \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_0}$ $P_{2T} = -\frac{mg \cdot \sin\theta \cdot \ell_3}{2 \cdot \ell_0}$ $P_3 = \frac{mg \cdot \cos\theta}{4} - \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} - \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_0}$ $P_{3T} = -\frac{mg \cdot \sin\theta \cdot \ell_3}{2 \cdot \ell_0}$ $P_4 = \frac{mg \cdot \cos\theta}{4} + \frac{mg \cdot \cos\theta \cdot \ell_2}{2 \cdot \ell_0} + \frac{mg \cdot \cos\theta \cdot \ell_3}{2 \cdot \ell_1} + \frac{mg \cdot \sin\theta \cdot h_1}{2 \cdot \ell_0}$ $P_{4T} = \frac{mg \cdot \sin\theta \cdot \ell_3}{2 \cdot \ell_0}$

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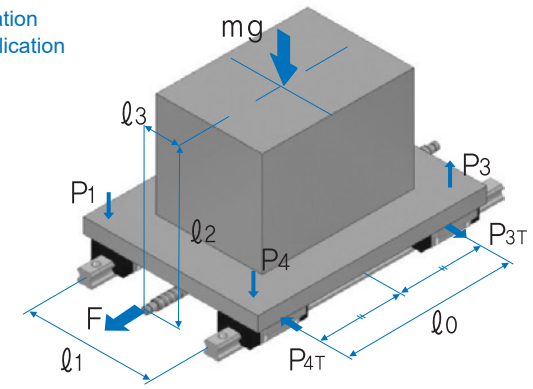
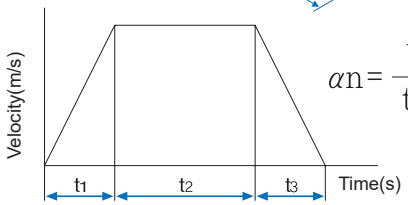
Case	Service Conditions	Load Calculation Formula
10	Block move Horizontal application / inertia force application   Velocity diagram $\alpha n = \frac{V}{tn}$ E.g.) Industrial robot carriage, LCD test device	Acceleration $P_1=P_4=\frac{mg}{4}-\frac{m\ \alpha_1\ \ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{mg}{4}+\frac{m\cdot\alpha_1\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T}\sim P_{4T}=\frac{m\cdot\alpha_1\cdot\ell_3}{2\cdot\ell_0}$ Constant velocity $P_1\sim P_4=\frac{mg}{4}$ Deceleration $P_1=P_4=\frac{mg}{4}+\frac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_2=P_3=\frac{mg}{4}-\frac{m\cdot\alpha_3\cdot\ell_2}{2\cdot\ell_0}$ $P_{1T}\sim P_{4T}=\frac{m\cdot\alpha_3\cdot\ell_3}{2\cdot\ell_0}$

5. Equivalent Load Calculation

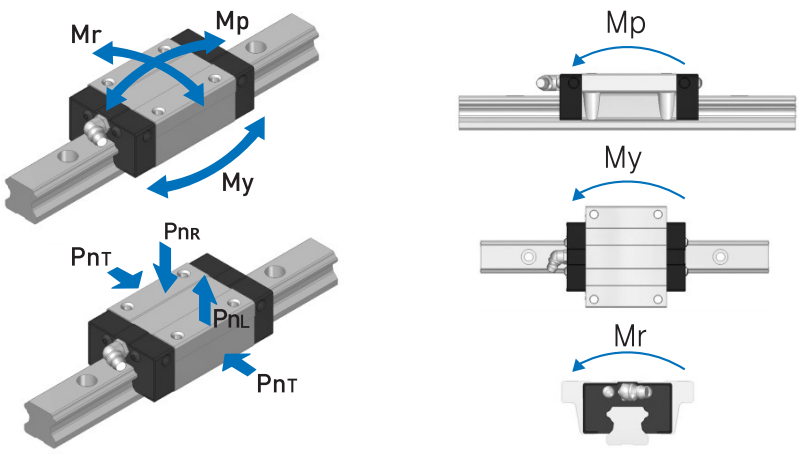
There are diverse kinds of load applied to Linear Motion guide, such as compression load in vertical direction, tensile load, horizontal load, moment load, etc. There is also combined load of them and sometimes the magnitude and direction of load change. Since it is hard to calculate the variable load when calculating the life of Linear Motion guide, it is required to use equivalent load which is converted to compression load or tensile load in vertical direction in order to produce life or static safety factor.

6. Equivalent Load Calculation Formula

If Linear Motion guide bears vertical compression load or tensile load or horizontal load simultaneously, or the magnitude or direction of load changes, equivalent load is calculated using the following formula.

P_E(equivalent load) = $P_n + P_{nT}$

P_n : Compression load
P_{nT} : Horizontal load



P_n : Compression load
P_L : Tensile load
P_{nT} : Horizontal load
M_p : Pitching moment
M_y : Yawing moment
M_r : Rolling moment

Figure 2.

7. Static Safety Factor Calculation

Unexpected big load may be applied to Linear Motion guide due to inertia force caused by vibration impact or quick braking and moment load of mechanical structure. When selecting Linear Motion guide, static safety factor must be taken into account to be ready for such load. Static safety factor (fs) is shown in value obtained by dividing basic static load rating by the calculated load. To see the baseline of static safety factor by service condition, please refer to Table 1-1. and Table 1-2.

Table 1-1. Baseline of static safety factor(fs)

Type of rolling element	Service condition	Static safety factor (f_S)
Ball	There is no vibration and impact.	1.0 ~ 1.5
	Great travel performance is needed.	1.5 ~ 2.0
	There are moment load, violation, and impact.	2.5 ~ 7.0
Roller	There is no vibration and impact.	2.0 ~ 3.0
	Great travel performance is needed.	3.0 ~ 5.0
	There are moment load, violation, and impact.	4.0 ~ 7.0

Table 1-2.

If compression load is big	$\frac{f_H \cdot f_T \cdot f_C \cdot C_0}{P_n} \geqq f_S$
If tensile load is big	$\frac{f_H \cdot f_T \cdot f_C \cdot C_{0L}}{P_L} \geqq f_S$
If horizontal load is big	$\frac{f_H \cdot f_T \cdot f_C \cdot C_{0T}}{P_{nT}} \geqq f_S$

f_S : Static safety factor
C_0 : Basic static load rating(vertical) (N)
C_{0L} : Basic static load rating(reverse-vertical) (N)
C_{0T} : Basic static load rating(horizontal) (N)
P_n : Calculated load(vertical) (N)
P_L : Calculated load (reverse-vertical) (N)
P_{nT} : Calculated load (horizontal) (N)
f_H : Hardness factor
f_T : Temperature factor
f_C : Contact factor

8. Mean Load Calculation

Load applied to the block of Linear Motion guide is not constant, but differs according to service conditions. Here the load that becomes equal to life under variable load is used. This is called mean load. If the load applied to block is changed due to external condition, it is required to calculate life as mean load that includes various conditions as below.
If load applied to block varies with different conditions, life should be calculated by including this variable load condition. Mean load (P_m) refers to constant load that becomes equal to life under this variable load when the load applied to block changes with various conditions while traveling.

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

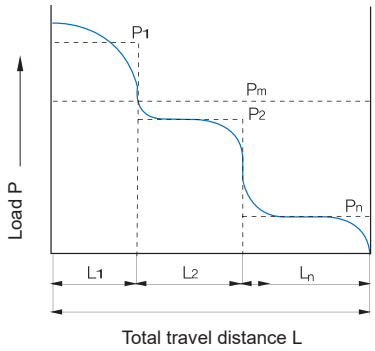
P_m : Mean load	(N)
P_n : Variable load	(N)
L : Total travel distance	(mm)
L_n : Travel distance by loading P_n	(mm)
i : Ball - 3, Roller - 10/3	

Note) the formula above or formula (1) below is applied to a ball.

1) Change in phase

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

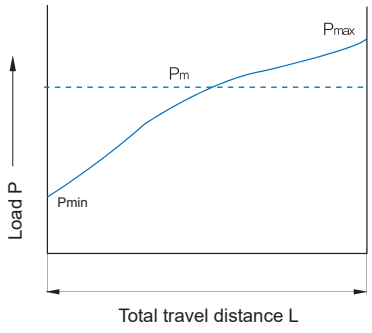
Pm : Mean load	(N)
Pn : Variable load	(N)
L : Total travel distance	(mm)
Ln : Travel distance by loading Pn	(mm)



2) Change monotonously

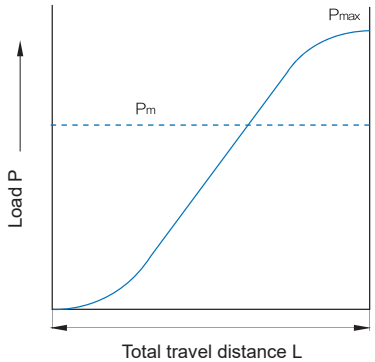
$$P_m \fallingdotseq \frac{1}{3}(P_{min} + 2 \cdot P_{max}) \cdots\cdots (2)$$

Pmin : Minimum load	(N)
Pmax : Maximum load	(N)

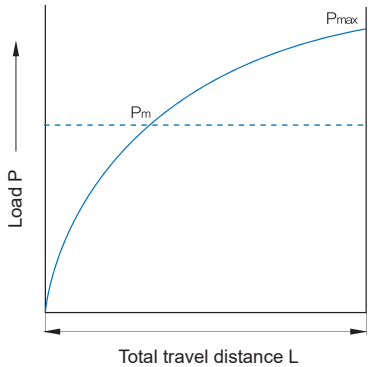


3) Change in a sine curve

a) $P_m \fallingdotseq 0.65 P_{max}$ ..... (3)



b) $P_m \fallingdotseq 0.75 P_{min}$ ..... (4)



9. Rating Life Calculation

Rating life needs to be calculated because Linear Motion guide's life differs even under same working conditions. Rating life of Linear Motion guide is the total travel distance that a Linear Motion guide system composed of a certain number of units can drive until flaking does not occur in 90% of the raceway surface or rolling elements after being run under same working conditions. If a ball or a roller is used as a rolling element, rating life can be calculated using the following formula.

► Calculation formula of the rating life of ball-enabled Linear Motion guide

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

L	: Rating life	(km)
C	: Basic dynamic load rating	(N)
P_C	: Calculated load	(N)
f_H	: Hardness factor	See Fig. 3
f_T	: Temperature factor	See Fig. 4
f_C	: Contact factor	See Table 2
f_W	: Load factor	See Table 3

►Calculation formula of the rating life of roller-enabled Linear Motion guide

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

L	: Rating life	(km)
C	: Basic dynamic load rating	(N)
P_C	: Calculated load	(N)
f_H	: Hardness factor	See Fig. 3
f_T	: Temperature factor	See Fig. 4
f_C	: Contact factor	See Table 2
f_W	: Load factor	See Table 3

►If the length of stroke and the number of reciprocating motion are constant, life time can be calculated using rating life (L) by the formula below.

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

L_h	: Life time	(N)
ℓ_s	: Length of stroke	(mm)
n_1	: No. of reciprocating motion per minute	(mm^{-1})

1) Hardness factor (f_H)
To realize the best performance of Linear Motion guide, the proper hardness and depth should be maintained between the block contacting a rolling element (ball or roller) and the raceway surface of rail.
Tretter Linear Motion guide has HRC58-64 surface hardness, so there is no need to consider hardness factor. But if the hardness is lowered than baseline, Linear Motion guide's load capacity decreases so hardness factor needs to be reflected in calculating life.

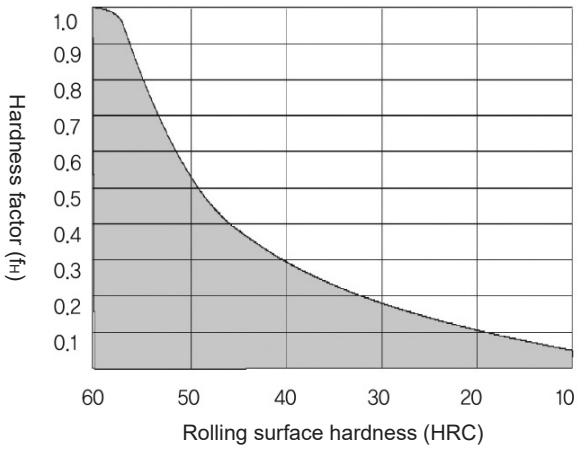


Figure 3. Hardness factor (f_H)

2) Temperature factor (f_T)
If high temperature over 100°C is applied to Linear Motion guide, temperature factor (f_T) needs to be taken into account when selecting Linear Motion guide. Tretter Linear Motion guide must be used at less than 80°C. But you have to use it at over 80°C, please use a high-temp Linear Motion guide – Tretter's specially customized product.

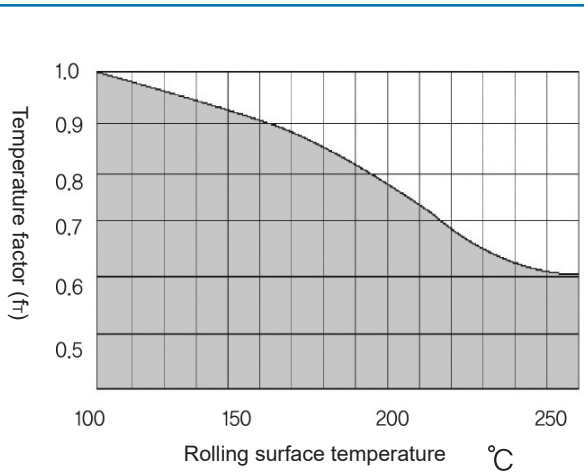


Figure 4. Temperature factor (f_T)

Note) In ambient temperature of over 80°C, materials for seal, end plate, and support plate should be changed to the specifications for high temperature.

3) Contact factor (f_c)
If over two blocks of Linear Motion guide are closely assembled, since uniform load may not be applied to blocks due to difference among mounting surfaces, you have to multiply basic static load rating (C) and basic dynamic load rating (C_0) by contact factor shown in Table 2.

Table 2.

No. of blocks contacted	Contact factor (f_c)
2	0.81
3	0.72
4	0.66
5	0.61
Over 6	0.6
Common use	1.0

4) Load factor (f_w)
Generally the static load applied to the block of Linear Motion guide can be calculated by formula. But the load applied to the block while running the machine tends to come from vibration or impact. Therefore, you have to consider load factor (f_w) shown in Table 3 for the vibration or impact load during the speedy running of the machine. It can be calculated by dividing the basic dynamic load rating of Linear Motion guide by load factor (f_w).

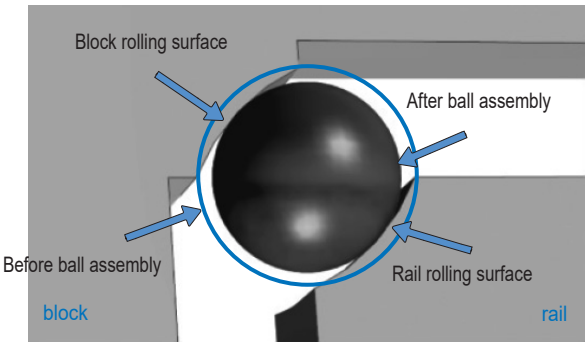
Table 3.

External condition	Service conditions	Load factor (f_w)
Low	There is no external vibration or impact due to the smooth running of machine at mild speed.	1.0 ~ 1.3
Moderate	There is moderate external vibration or impact due to the running of machine at low speed.	1.2 ~ 1.5
Big	There is strong vibration or impact due to the running of machine at fast speed.	1.5 ~ 2.0
Very big	There is strong vibration or impact due to the running of machine at very fast speed.	2.0 ~ 4.0

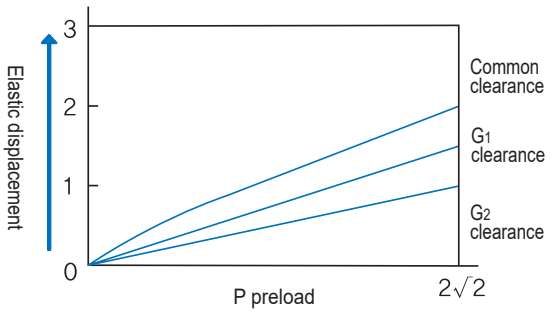
4 RIGIDITY & PRELOAD

1. Preload

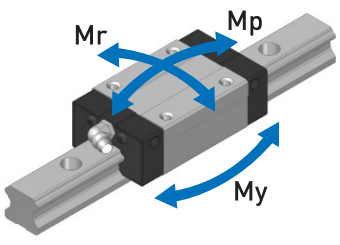
Linear Motion guide is preloaded in a way that improves mechanical precision by eliminating clearance using the rolling element (ball or roller) inserted into the space between rail and the block or in a way that applies load to the rolling element in advance by inserting the rolling element larger in size than the clearance of raceway between rail and the block. This process will enhance the rigidity of Linear Motion guide and lessen the displacement level caused by external load.



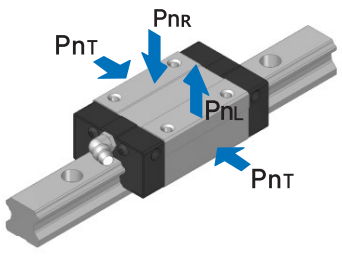
Preload setting



Data of preload and rigidity



Moment rigidity



Radial rigidity

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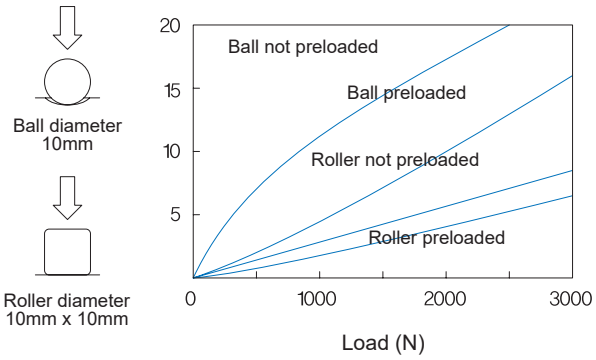
2. Radial Clearance

Radial clearance refers to the total travel distance in a radial direction from the center of the block of Linear Motion guide when mild load is applied to the block up and down from the center part of the rail length after the block is assembled in the rail which is then fixed to base.
Radial clearance is usually classified into common clearance (no symbol), G_1 clearance (light preload), G_2 clearance (heavy load), and G_s clearance (special preload), and are optional depending on usage. The values are standardized by form.

Preload & elastic displacement



	Preload type	Preload symbol	Preload
H	Moderate	No symbol	0 ~ 0.03 x C
	Light	G_1	0.04 ~ 0.08 x C
	Heavy	G_2	0.09 ~ 0.13 x C
S	Moderate	No symbol	0 ~ 0.03 x C
	Light	G_1	0.03 ~ 0.05 x C
	Heavy	G_2	0.06 ~ 0.08 x C
R	Light	G_1	0.03C Substantial
	Heavy	G_2	0.08C Substantial
	Strong	G_3	0.13C Substantial

Table 4. Service condition for radial clearance (preload)

Type	Preload status	Symbol	Service Conditions	Use
1. Moderate	Plus-minus clearance	No (1)	· Load is applied in uniform direction and smooth running is needed. · There is almost no vibration or impact and precise running is required.	Welding machine, textile machinery, packaging machinery, various conveyors, medical equipment, woodworking machine, glass cutting machine, take-out robots, ATC, winding machine
2. Light	Minus clearance in small amount	G_1 (2)	· There is a little vibration or impact and moment load. · Light load is applied, yet high precision is required.	Various industrial robots, measuring equipment, inspection equipment, 3D processor, laser processor, PCB drilling machine, various assembling machine, electric spark machine, punching press
3. Heavy	Minus clearance in large amount	G_2 (3)	· There is mild impact load or overhang load and moment load. Rigidity and high precision are required.	CNC shelf, machining center, milling machine, grinding machine, tapping center, drilling machine, hobbing machine, various special equipment
4. Special	Minus clearance in small or large amount	G_s (4)	· With smaller clearance than that of G_1 preload, light and precise operation is required.	No preload, ultra-light preload, larger-than-moderate preload, special preload customized to user's conditions, special processing machine for heavy-duty cutting

Note (1) No clearance or very small clearance.
(2) Very small minus clearance.
(3) Quiet large minus clearance to enhance rigidity
(4) Preload below G_1 or over G_2 to meet service conditions

Table 5. Radial clearance of TWH & TWS & TWHS Series Unit : μm

Model No.			Symbol		
			Moderate	Light preload	Heavy preload
			No symbol	G_1	G_2
TWH15	TWS15	-	-4 ~ +2	-12 ~ -4	-
TWH20	TWS20	-	-5 ~ +2	-14 ~ -5	-23 ~ -14
TWH25	TWS25	TWHS25	-6 ~ +3	-16 ~ -6	-26 ~ -16
TWH30	-	TWHS30	-7 ~ +4	-19 ~ -7	-31 ~ -19
TWH35	-	TWHS35	-8 ~ +4	-22 ~ -8	-35 ~ -22
TWH45	-	-	-10 ~ +5	-25 ~ -10	-40 ~ -25
TWH55	-	-	-12 ~ +5	-29 ~ -12	-46 ~ -29

Table 6. Radial clearance of TWHW Series Unit : μm

Model No.	Symbol		
	Moderate	Light preload	Heavy preload
	No symbol	G_1	G_2
TWHW17	-3 ~ 0	-7 ~ -3	-
TWHW21	-4 ~ +2	-8 ~ -4	-
TWHW27	-5 ~ +2	-11 ~ -5	-
TWHW35	-8 ~ +4	-18 ~ -8	-28 ~ -18

Table 7. Radial clearance of TWR & TWRS Series Unit : μm

Model No.	Symbol		
	Light	Heavy	Strong
	G_1	G_2	G_3
TWR25	-2 ~ -1	-3 ~ -2	-4 ~ -3
TWR30	-2 ~ -1	-3 ~ -2	-4 ~ -3
TWR35	-2 ~ -1	-3 ~ -2	-5 ~ -3

Model No.	Symbol		
	Light	Heavy	Strong
	G_1	G_2	G_3
TWR45	-2 ~ -1	-3 ~ -2	-5 ~ -3
TWR55	-2 ~ -1	-4 ~ -2	-6 ~ -4
TWR65	-3 ~ -1	-5 ~ -3	-8 ~ -5

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5 FRICTION

1. Friction

Linear Motion guide's friction resistance occurs to the level of 1/20~1/40 compared to existing sliding guide since the rolling element (ball or roller) is assembled between the rail and the block which is the raceway surface. Also starting torque is low because the difference between static friction and kinetic friction is very small. Its low power loss and temperature rise in the part of linear motion are of advantage to speedy operation. Its high conformability and response realize the highly precise positioning.

2. Friction Coefficient

Friction resistance of Linear Motion guide relies on the load applied to Linear Motion guide, speed, lubrication or form. In case of light load or high-speedy motion, lubrication or seal is the main cause of friction resistance. In case of heavy load or slow motion, the magnitude of load affects friction resistance.

$$F = \mu P$$

F : Friction resistance (N)
μ : Kinetic friction factor
P : Load (N)

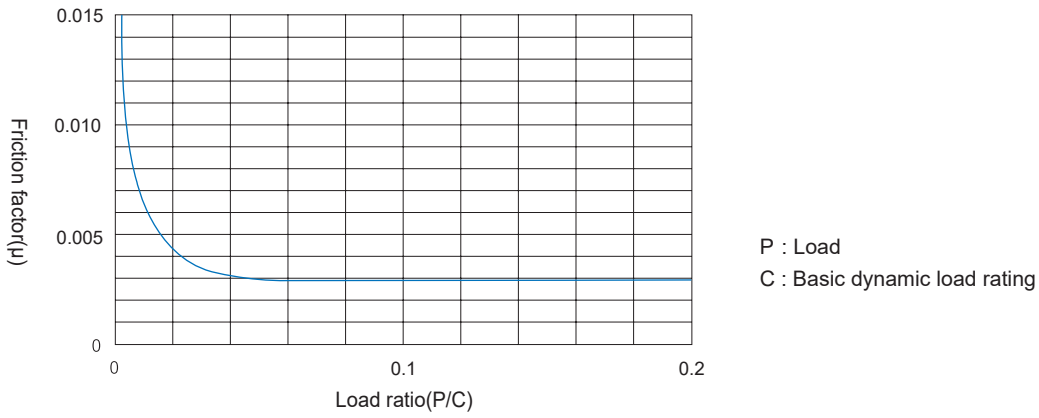

Figure 5. Relation between load ratio and friction factor

Common friction factors of various operating systems are shown in a table below and applied in case of proper lubrication or assembly and normal load.

Type of operating system	Major model number	Friction factor μ
Linear Motion Guide	TWH, TWH-S, TWHW, TWS, TWS-S, TWHS, TWHS-S	0.002 ~ 0.003
	TWR, TWRS	0.001 ~ 0.002

6 PRECISION

1. Precision Specification

The degree of travel of Linear Motion guide is measured as below. (See Figure 6.)
a. Tighten rail to the mounting surface of the bed using a bolt at the prescribed torque.
b. Draw a measuring jig right up against the datum plane of the block as shown in Figure.
c. Measure it by having the block and measuring jig travel the whole section from the starting point to the end point of the rail.
d. The value measured by the measuring jig is the error in the parallelism of motion of the block.

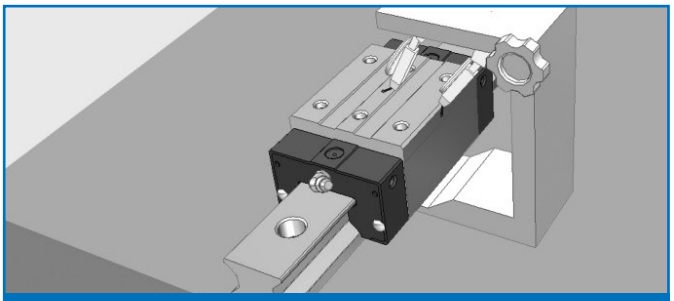

Figure 6. Parallelism of motion

Measuring the error in the degree of parallelization between the datum plane of block and that of rail

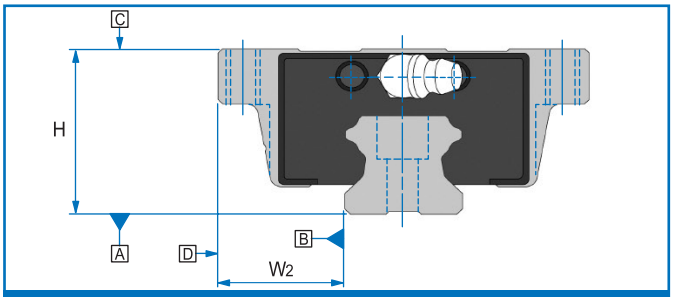

Figure 7. Difference of block

Difference between the maximum difference and minimum difference of blocks in each height and dimension installed to surface

2. Precision Design

Table 8. Classification of precision

Dimension	Terms
Dimension tolerance of height H	Distance from the base side of rail A to the top side of block C
Difference in height H	Difference in the height of blocks combined from each rail on the same plane
Dimension tolerance of width W2	Distance between the datum plane of rail B and the reference side of block D
Difference in width W2	Difference of the reference axis of rail B and the reference side of block D of blocks combined to the rail
Parallelism of motion of C against A	Change in the top side of block C based on the base side of rail A during the motion of block combined to the rail
Parallelism of motion of D gainst B	Change in the reference side of block D based on the reference side of rail B during the motion of block combined to the rail

3. Dimension Tolerance and Difference

Table 9. Specifications for precision of Linear Motion guide (TWH, TWH-S, TWHW, TWS, TWS-S, TWHS, TWHS-S) Unit : mm

Dimension	Terms	High	Precision	Super precision	Ultra precision
	No symbol	H	P	SP	UP
		P6	P5	P4	P3
Dimension tolerance of height H	±0.080	±0.042	±0.020	±0.010	±0.008
Difference in height H	0.025	0.015	0.007	0.005	0.003
Dimension tolerance of width W2	±0.100	±0.050	±0.025	±0.015	±0.010
Difference in width W2	0.030	0.020	0.010	0.007	0.003
Parallelism of motion of C against A	See Table 10				
Parallelism of motion of D against B	See Table 10				

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Table 10. Length of rail and parallelism of motion of Linear Motion guide (TWH, TWH-S, TWHW, TWS, TWS-S, TWHS, TWHS-S)

Unit : μm

Length of rail		Terms				
Above	Below	Moderate	High	Precision	Super precision	Ultra precision
		No symbol	P6	P5	P4	P3
-	50	5	3	2	1.5	1
50	80	5	3	2	1.5	1
80	125	5	3	2	1.5	1
125	200	5	3.5	2	1.5	1
200	250	6	4	2.5	1.5	1
250	315	7	4.5	3	1.5	1
315	400	8	5	3.5	2	1.5
400	500	9	6	4.5	2.5	1.5
500	630	11	7	5	3	2
630	800	12	8.5	6	3.5	2
800	1000	13	9	6.5	4	2.5
1000	1250	15	11	7.5	4.5	3
1250	1600	16	12	8	5	4
1600	2000	18	13	8.5	5.5	4.5
2000	2500	20	14	9.5	6	5
2500	3150	21	16	11	6.5	5.5
3150	4000	23	17	12	7.5	6

Table 11. Specifications for precision of roller Linear Motion guide (TWR, TWRS) Unit : mm

Dimension	High	Precision	Super Precision	Ultra Precision
	H	P	SP	UP
	P6	P5	P4	P3
Dimension tolerance of height H	±0.042	±0.020	±0.010	±0.008
Difference in height H	0.015	0.007	0.005	0.003
Dimension tolerance of width W_2	±0.050	±0.025	±0.015	±0.010
Difference in width W_2	0.020	0.010	0.007	0.003
Parallelism of motion of C against A	See Table 12			
Parallelism of motion of D against B	See Table 12			

Table 12. Length of rail and parallelism of motion of roller Linear Motion guide (TWR, TWRS) Unit : μm

Length of rail		Parallelism of motion			
Above	Below	High	Precision	Super precision	Ultra precision
		P6	P5	P4	P3
-	50	3	2	1.5	1
50	80	3	2	1.5	1
80	125	3	2	1.5	1
125	200	3.5	2	1.5	1
200	250	4	2.5	1.5	1
250	315	4.5	3	1.5	1
315	400	5	3.5	2	1.5
400	500	6	4.5	2.5	1.5
500	630	7	5	3	2
630	800	8.5	6	3.5	2
800	1000	9	6.5	4	2.5
1000	1250	11	7.5	4.5	3
1250	1600	12	8	5	4
1600	2000	13	8.5	5.5	4.5
2000	2500	14	9.5	6	5
2500	3150	16	11	6.5	5.5
3150	4000	17	12	7.5	6

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4. Selection of Precision Class

Table 13. For the selection of precision class of Linear Motion guide by unit, please refer to the table below.

Application	Unit	Precision class					Preload		
		Moderate	High	Precision	Super precision	Ultra precision	Moderate	Light preload	Heavy preload
		No sigh	H	P	SP	UP	No symbol	G1	G2
			P6	P5	P4	P3			
Machine Tool	CNC shelf		●	●	●				●
	Machining center		●	●	●				●
	NC milling machine		●	●	●				●
	CNC tapping machine		●	●	●				●
	NC boring machine		●	●	●				●
	NC drilling machine		●	●	●				●
	3D engraving machine		●	●	●				●
	Jig boring machine		●	●	●				●
	EDM electric spark machine			●	●	●		●	●
	Grinding machine			●	●	●			●
Semiconductor equipment	Prober equipment					●		●	●
	Wire bonder				●	●		●	●
	Sliding machine				●	●		●	
	Dicing saw machine				●	●		●	
	IC test handler			●	●			●	
	PCB laser via-hole driller				●			●	
	PCB inspection equipment			●	●			●	
	Laser marker			●				●	
	Chip mounter			●	●			●	
FPD	Mac/Mic inspection equipment				●	●		●	
	Pattern test system				●	●		●	
	Exposure				●	●		●	
	Laser repair			●	●	●		●	
	Lighting test equipment		●	●				●	
	Coder equipment			●	●			●	
	Chip bonding equipment		●	●				●	
	Dispenser equipment		●	●				●	

Application	Unit	Precision class					Preload		
		Moderate	High	Precision	Super precision	Ultra precision	Moderate	Light preload	Heavy preload
		No sigh	H	P	SP	UP	No symbol	G1	G2
			P6	P5	P4	P3			
FPD	Scriber		●	●				●	
	Glass edge grinding machine		●	●				●	
	FPD measuring/test equipment			●	●			●	
	Laminating equipment		●	●				●	
	Indentation test equipment								
	Prober equipment								
Industrial machine	Punching press		●					●	
	Tire molder	●						●	
	Tire valcanizer	●						●	
	Auto-shearing machine	●						●	
	Auto-welding machine	●					●	●	
	Conveyor	●					●		
	Textile machine	●					●		
	Injection molding machine	●					●	●	
Industrial robot	Cartesian coordinated robot	●	●	●				●	
	Gantry robot	●	●					●	
	LTR robot		●	●				●	
	Take-out robot	●						●	
	Cylindrical coordinated robot		●					●	
	Vacuum robot		●	●				●	
	Robot carriage	●						●	
	Linear actuator		●	●	●		●	●	
Others	Office machine	●					●		
	FA transport system	●					●		
	Medical equipment	●					●	●	
	Welding machine	●					●		
	Painting machine	●					●		
	Precision XY table		●	●	●			●	
	UVW stage		●	●				●	
	3D measuring machine			●	●	●		●	

7 LUBRICATION

1. Purpose

The purpose of lubricating Linear Motion guide is to create an oil film between rail, the raceway surface of block and a rolling element to avoid the direct contact of metals and reduce friction and wear, preventing the raceway surface and the rolling element from being overheated and melted to be adhered to each other.
Moreover, the oil film created between the raceway surface and a ball decreases load-induced contact stress to improve the rolling contact fatigue life and prevent rust.
Linear Motion guide is equipped with seal but grease inside the block is leaking little by little during the operation. Therefore it is required to lubricate it at a time and interval appropriate to each service condition.

2. Selection of lubricant

To achieve the best performance of Linear Motion guide, you have to select the lubricant suitable for service conditions.
Lubricants used for Linear Motion guide include grease and oil. You can select the lubricant and lubrication method that fit your service conditions, load, operating speed, assembly type, etc.

3. Grease lubrication

Grease is a semisolid lubricant consisting of base oil, thickener, and additives.
In case of using grease for Linear Motion guide, lithium soap grease is commonly used, but grease mixed with extreme-pressure additive is used under high load or according to use. If you want to use Linear Motion guide in a high-vacuum environment or a clean room, it's desirable to choose grease with excellent performance in low evaporation and low dust raise.

1) Refilling of grease
To refill grease to Linear Motion guide, supply a sufficient amount of grease through the nipple until remaining grease is discharged. It is appropriate to fill grease up to 50% of the volume of the block. To reduce rolling resistance which may increase after grease is filled, it is better to take a test run about 20 times prior to the operation.

2) Refill interval
If Linear Motion guide's travel exceeds a certain time, its lubricating performance declines. So it is required to refill an appropriate amount of grease at a proper time depending on service conditions and environment. Usually grease is to be filled when the travel distance reaches 100KM.

$$T = \frac{100 \times 6000}{Ve \times 60} \text{ hr}$$

T : Oil refilling cycle (time)
Ve : Velocity (m/min)

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4. Oil lubrication

In case of using oil for Linear Motion guide, it is recommended to use oil lubricant with high viscosity (68mm2/sec) under higher load while oil lubricant with low-viscosity (13mm2/sec) at high velocity.
It is appropriate to refill 0.3cm3 of oil per hour for each one block.

Table 14. Inspection and refilling time of lubricant

Type	Inspection item	Inspection period	Refiling time
Grease	• Status of mixing with cutting chip, dust, foreign substance • Status of contamination by other substances	3~6 months	• Generally 1-2 times per year • Usually more than once per year if travel exceeds 100km/year • Refill depending on the situation after checking the status of grease
Oil	Lubricant quantity, contamination, foreign substance	3~6 months	• Refill depending on the results of inspection, and determine the optimal amount to refill depending on the capacity of oil tank
	Check oil level (supply oil mist)	Before every operation	• Refill an appropriate amount after identifying the consumption • Standardize the optimal amount after identifying the consumption

※ Please do not use oil that may affect synthetic resin which is the material of Linear Motion guide units.

Table 15. Lubricants used for Linear Motion guide

Application	Main use	Product name	Manufacturer	Temp. in use (°C)	Base oil	Type of thickener
Common use (etreme-pressure additive incl.)	Industrial machine, machine tool	BW EP NO.2	BWC	-20 ~ +105	Mineral oil	Lithium
Common use	Machine tool, electric spark machine, industrial robots, etc.	GADUS S2 V220 00	SHELL	-30 ~ +110	Mineral oil	Lithium
Clean & low dust raise	Semiconductor, FPD equipment	SNG 5050 DEMNUM	NTG DAIKIN	-40 ~ +1200 -50 ~ +300	Synthetic oil	Urea
Eco-friendly	Semiconductor AMOLED process equipment, driving gear in vacuum chamber	FOMBLIN Krytox High vacuum grease	AUSIMONT DuPont Dow Corning	-20 ~ +250	Synthetic oil	Ethylene fluorinated
Machine tool	Excellent in preventing rust and oil film strength Suitable for machine tools because it is hardly emulsified to clearance	VACTRA No.2 SLC DTE Oil	Exxon Mobil	-20 ~ +100	Oil	Way oil Turbine oil
Specialuse	Corrosion proofing	6459 Grease	SHELL	-20 ~ +100	Mineral oil	Polyurethane

8 SURFACE TREATMENT

1. Surface Treatment

Tretter uses the following methods for the optimal treatment of surfaces of Linear Motion guide in order to prevent rust and enhance appearance.

2. Types of Surface Treatment

1) Electrolytic rust-preventive black coating (black Cr plating)
This is an industrial black chrome coating which is used to improve the corrosion resistance at low cost. It can achieve better corrosion resistance than martensite stainless steel and be used to enhance appearance and prevent the reflection of light.

2) Industrial hard Cr plating
The film's hardness is over 850HV so its wear resistance is excellent and the corrosion resistance is comparable with that of martensite stainless steel.
Tretter offers surface treatments such as alkakine coloring or color alumite treatment if a customer requests. If you want use Linear Motion Guide by treating its surface, you have to set the safety factor high.

3) Fluoride low-temperature Cr plating
It is also called "Raydent." This is a combined surface treatment of black Cr coating with special fluoride resin coating which is used in where corrosion resistance or low dust raise is needed - for instance clean room.

9 DUST PROOF

1. Dust Proof

To make use of the characteristics and performance of Linear Motion guide, it is important to protect the unit from external foreign substances which are likely to cause abnormal wear or shorten life. If dust or foreign substance is expected to be mixed in, it is required to use the effective sealing or dust-proofing system.

2. Types of Dust Proof

Tretter Linear Motion guide is basically equipped with seal but if a customer request, a metal scraper can be additionally mounted on the unit before shipment.

1) Exclusive seal
The block is equipped with end seals, side seals and inner seals to protect the bearing from foreign substances.

2) Metal scraper
A metal scraper is installed outside the end seals and effective in preventing foreign substances such as hot spatter or slag created during a welding process from entering into the unit.

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10 MEASURE TO USE IN SPECIAL ENVIRONMENT

Tretter Linear Motion guide is useful in various special applications if being used in accordance with service conditions including material, surface treatment, dust proof, grease, etc.

Table 16.

Application	Conditions of use	Countermeasure	
Clean (clean room) - Semiconductor, FPD, medical equipment -	• If used in a clean environment, dust or particles generated in Linear Motion guide should be minimized.	Lubricant	• For use in a clean environment • Use low dust raise grease
		Rust prevention	• Black Cr coating • Fluoride low-temperature colorimetric Cr plating (Raydent treatment) • Use high-corrosion resistant stainless steel as material
Vacuum - Semiconductor, FPD deposition equipment –	• If used in a vacuum environment, out gas discharged from Linear Motion guide should be tightly controlled to maintain the vacuum status. • Great rust prevention is required since rust-prone parts cannot be used in this environment.	Lubricant	• Use grease for a vacuum environment
		Rust prevention (Out Gas)	• Use high-corrosion resistant stainless steel as material • Use a self oiling agent using special coatings such as fluoroplastic coating • Use ceramic as material
High- temperature environment	• If used in higher temperature than general environment, the material's heat resistance is important and plastic synthetic resin used for parts should be replaced with metal.	Lubricant	• Use grease for high-temperature environ-ments
		Material	• Use an end seal, side seal + double seal • Use a double seal • Use a special seal for high temperature
Dust	• If used in an environment filled with cutting chips, wood dust, and dust, it is required to develop a measure to protect the block from foreign substances.	Seal	• Use a plastic synthetic resin cap • Use a metal cap • Use a metal scraper
		Cap	• Use a plastic synthetic resin cap • Use a metal cap • Use a seal plate
		Holding door	• Use an exclusive holding door • Use an sealing all-in-one holding oor
Spatter	• If exposed to a spot welding or arc welding environment, hot spatters may be fixed onto the	Spatter	• Fluoride black Cr coating
		Seal	• Use a metal scraper
		Dust proof	• Use a metal cap • Use a seal plate

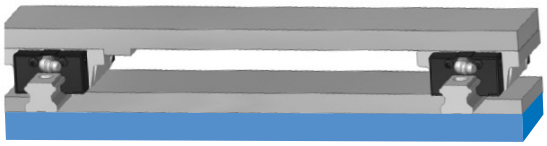
11 PLACEMENT AND INSTALLATION

1. Placement and Structure

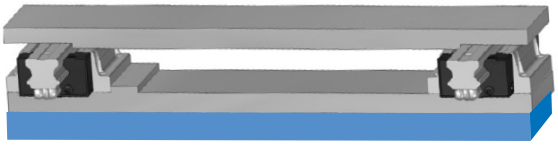
To place Linear Motion guide in the equipment, first identify the overall structure of the equipment, then check the size of the base and a transfer table and consider load applied according to mounting directions such as placing vertically, in slope, or in the back as well as required life to make sure Linear Motion guide is optimally installed.

Placement of Linear Motion guide (example)

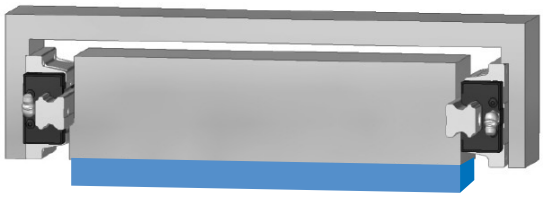
(1) Assembly of the top side of block, block transfer



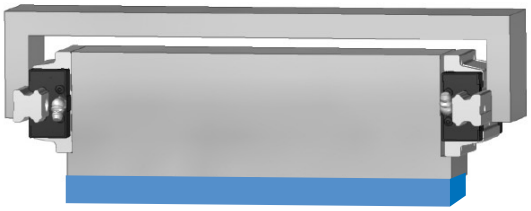
(2) Assembly of the back side of block, rail transfer



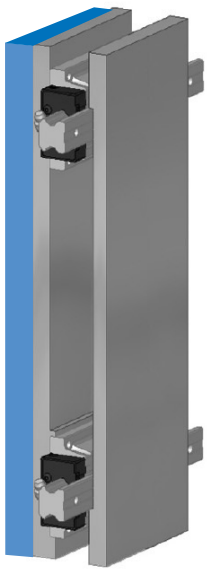
(3) Assembly of the flank of block, block transfer



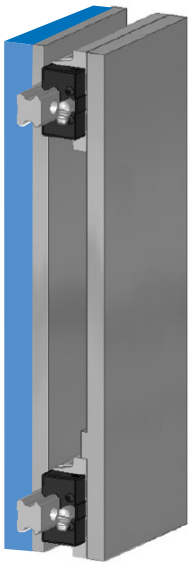
(4) Assembly of the flank of block, rail transfer



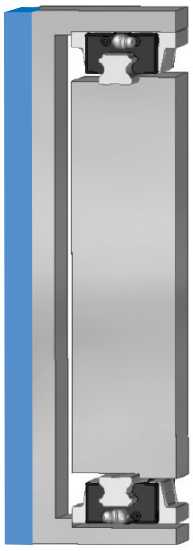
(5) Assembly of the wall side of block, rail transfer



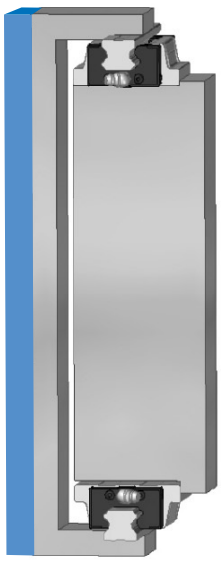
(6) Assembly of the wall side of block, block transfer



(7) Symmetrical assembly of the top and bottom of block, rail transfer



(8) Symmetrical assembly of the top and bottom of block, block transfer



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2. Mounting and Fixation

In the structure that vibration or impact is applied or where combined load or moment load is applied, Linear Motion guide should be fixed in a different way from a general method.

As a widely used method, push a pressure plate from the flank after slightly protruding the block and rail of LM unit.

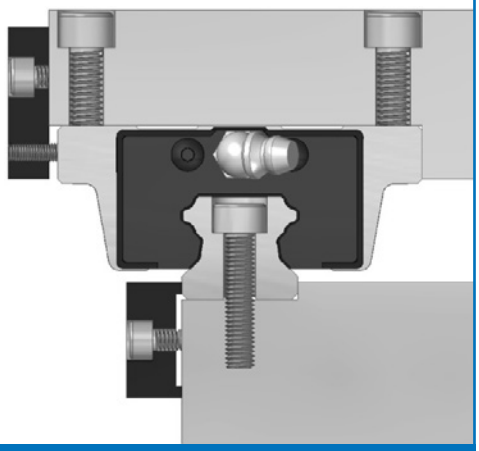


Figure 8. Pushing a pressure plate from the flank

Fasten a tapered fixture with a bolt. Even slight bolting up generates big force in a horizontal direction. If it is bolted up too much, deformation may occur in rail, for instance, which needs to be taken a caution.

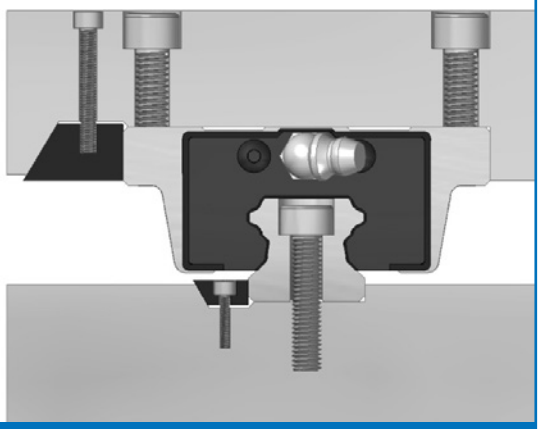


Figure 9. Pushing a tapered plate

Need to use miniature bolts due to space constraint when pushing the rail and useful if having many bolts for pushing.

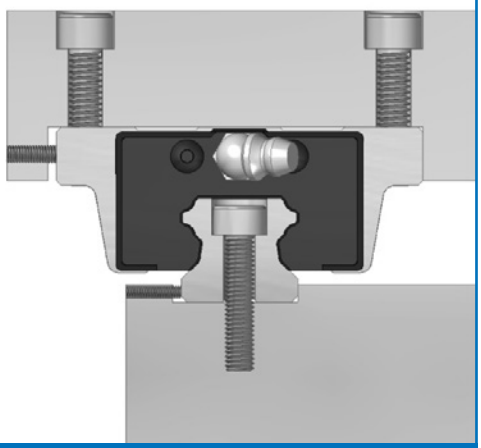


Figure 10. Pushing a bolt from the flank

Push a needle roller with the head of a countersunk screw using a roller of the bed.You must be careful to push it to fit the screw.

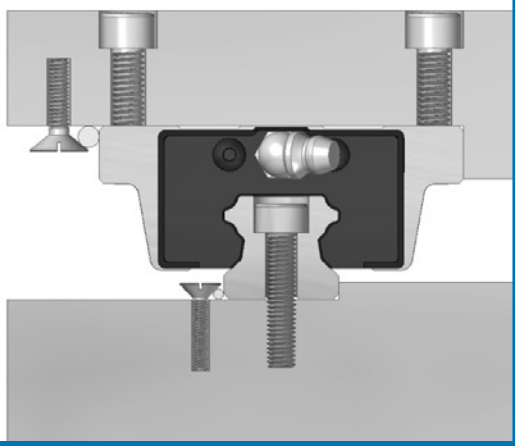


Figure 11. Pushing a roller

3. Design of mounting surface during installation

Design and management of mounting surface

The precision of mounting surface of Linear Motion guide and the error in installation generate unexpected load and stress to the unit, therefore it is required to take caution to prevent the harmful effects on the unit's travel and life.

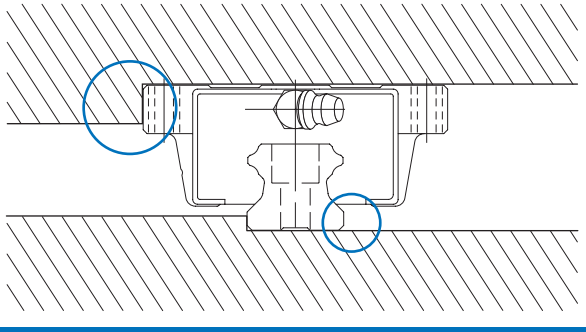


Figure 12. Shape of edges

Management of vertical angle of datum plane for installation

If the vertical angle of the installation surface and of a rail or a block is inaccurate, it cannot be assembled precisely. So you need to review the vertical angel and error during design.

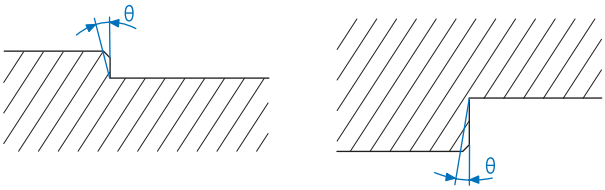


Figure 13.

Management of datum plane for assembly

It is important to manage the height and thickness of datum plane during design.
If the height is too high or low, a rail or a block cannot be assembled precisely due to its surface attachment. Or the application of eccentric load, horizontal load and moment load may loosen the strength of joint and result infaulty assembly which will be unable to meet the precision requirements. So attention must be paid

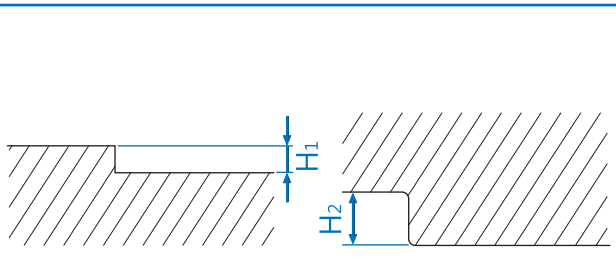


Figure 14. Vertical angle of contact datum plane

Management of the shape of contact corner

If the right-angled corner of a rail or a block installed to the mounting surface of Linear Motion guide is processed in R-shape and R value is bigger than the dimension of the surface of the rail or the block, it may not be assembled precisely to the datum plane. So attention must be paid.

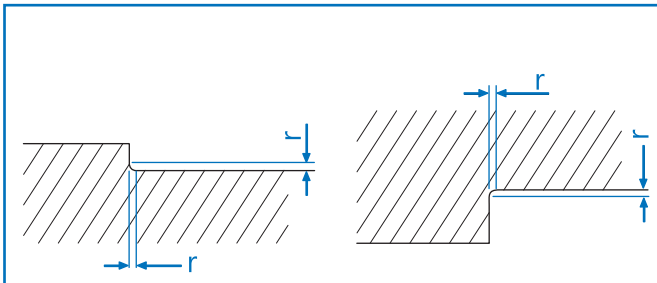


Figure 15. Dimension of contact datum plane

Management of dimensional tolerance between datum plane and bolt during design

If the dimensional tolerance from the contact datum plane to the mounting hole of a rail or a block of Linear Motion guide is too big, precise assembly is impossible so attention must be paid.
Generally the dimensional tolerance is ±0.1mm.
If the distance tolerance from the assembly datum plane to the assembly bolt roll of a rail and a block is too wide or narrow, precise assembly is impossible. So the tolerance must be W3±0.1mm during design.

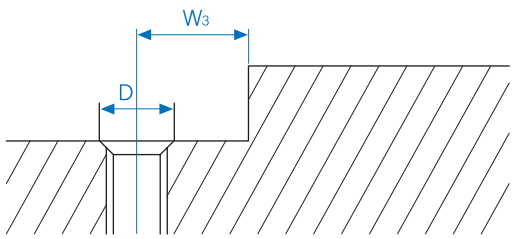
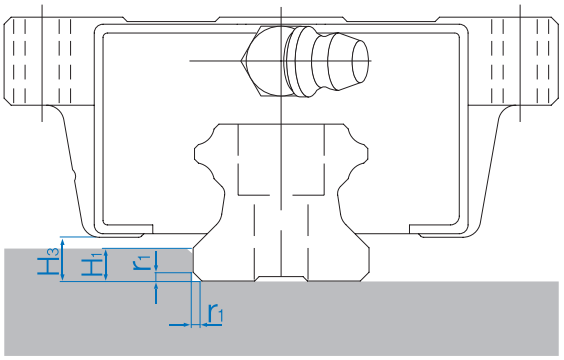
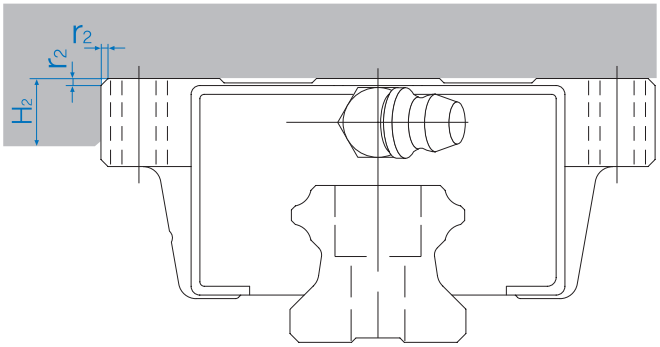


Figure 16. Dimensional tolerance between contact datum plane and mounting hole



Assembly of rail datum plane



Assembly of block datum plane

Figure 17. Height of the raised spot of mounting surface and radius of corner R

- Make a datum plane which can contact the flank in order to secure convenience in assembly of and precision positioning of a rail and a block during the installation of Linear Motion guide.
- The height of the raised spot of contact datum plane or the radius of corner may vary depending on the specifications of Linear Motion guide so please see the table below.
- To prevent deformation of the raised spot by pressing force from above or pushing force from side, sufficient thickness must be secured during design.

TWH Series, TWH-S Series, TWHS Series, TWHS-S Series — Unit : mm

Model No.	Radius of corner of the installation to rail r_1(max.)	Radius of corner of the installation to block r_2(max.)	Height of raised spot of the installation to rail H_1	Height of raised spot of the installation to block H_2	H_3
15	0.5	0.5	3	4	4.7
20	0.5	0.5	3.5	5	6
25	1	1	5	5	7
30	1	1	5	5	7.5
35	1	1	6	6	9
45	1	1	8	8	10
55	1.5	1.5	10	10	13

TWHW Series

Unit : mm

Model No.	Radius of corner of the installation to rail r_1(max.)	Radius of corner of the installation to block r_2(max.)	Height of raised spot of the installation to rail H_1	Height of raised spot of the installation to block H_2	H_3
17	0.4	0.4	2	4	2.5
21	0.4	0.4	2.5	5	3.3
27	0.4	0.4	2.5	5	3.5
35	0.8	0.8	3.5	5	4

TWS Series, TWS-S Series

Unit : mm

Model No.	Radius of corner of the installation to rail r_1(max.)	Radius of corner of the installation to block r_2(max.)	Height of raised spot of the installation to rail H_1	Height of raised spot of the installation to block H_2	H_3
15	0.5	0.1	2.5	4	4.5
20	0.5	1	4	5	6
25	1	1	5	5	7

TWR Series, TWR-S Series

Unit : mm

Model No.	Radius of corner of the installation to rail r_1(max.)	Radius of corner of the installation to block r_2(max.)	Height of raised spot of the installation to rail H_1	Height of raised spot of the installation to block H_2	H_3
25	1	1	4	5	6.5
30	1	1	4.5	5	7
35	1	1	5	6	7
45	1.5	1.5	6	8	9.5
55	1.5	1.5	8	10	10
65	1.5	2	9	10	13

4. Error tolerance of mounting surface during installation

1) Auto-adjusting and error-absorbing abilities
Linear Motion guide has an excellent auto-adjusting ability so that even though the structure to be assembled to a rail is slightly deformed or processing error may occur, the straightness or parallelism of a table after assembly will be better than the precision in processing before assembly and the quite straight-line running is available.

2) Error tolerance of the degree of parallelization when using 2-axis assembly (P_1)
The error in the degree of parallelization when using a 2-axis assembly is as shown below.

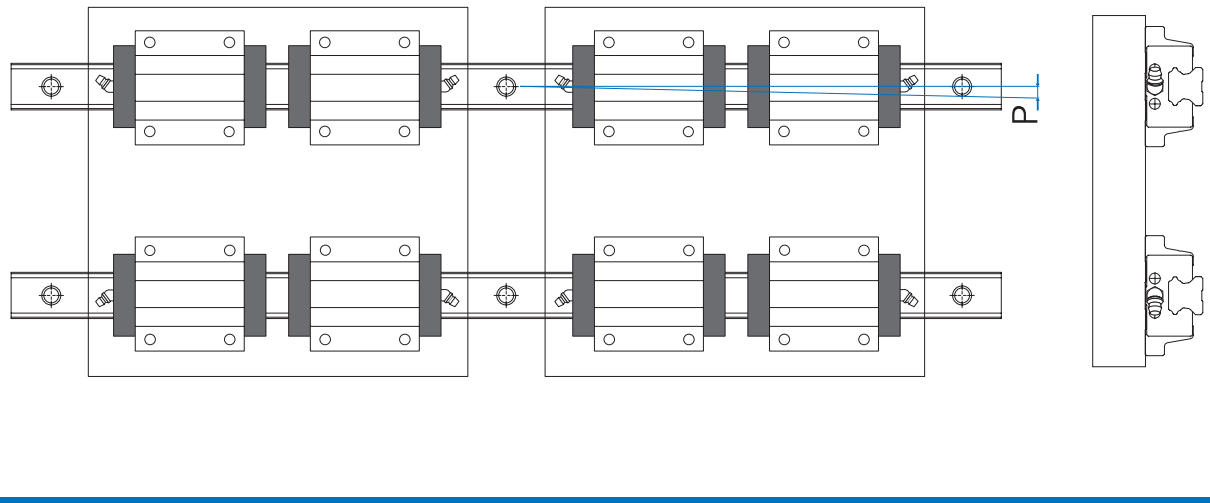


Figure 18. Error tolerance of the degree of parallelization (P)

TWH Series, TWH-S Series, TWHS Series, TWHS-S Series

Unit : μm

Model No.	Common clearance	G_1 clearance	G_2 clearance
15	25	18	-
20	25	20	18
25	30	22	20
30	40	30	27
35	50	35	30
45	60	40	35
55	70	50	45

TWHW Series

Unit : μm

Model No.	Common clearance	G_1 clearance	G_2 clearance
17	20	15	-
21	25	18	-
27	30	20	-
35	30	22	20

TWS Series, TWS-S Series

Unit : μm

Model No.	Common clearance	G_1 clearance	G_2 clearance
15	25	18	-
20	25	20	18
25	30	22	20

TWR Series, TWR-S Series

Unit : μm

Model No.	G_2 clearance	G_3 clearance
25	7	5
30	9	6
35	10	7
45	12	9
55	16	11
65	22	16

3) Error tolerance of height during 2-axis assembly (P_2)
If the error in height is too big, the block may be distorted and its rigidity may be affected as the raceway groove of the block and the contact angle of a ball or a roller which is the rolling element are altered.

The error tolerance of height level in using 2-axis Linear Motion guides is as follows.

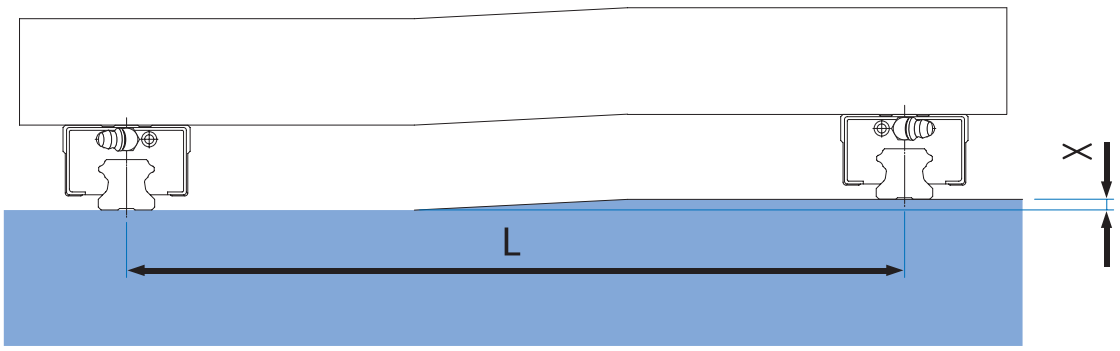


Figure 19. Error tolerance of height level in 2-axis (X)

TWH Series, TWH-S Series, TWS Series, TWS-S Series, TWHS Series, TWHS-S Series

Unit : μm

Model No.	Common clearance	G_1 clearance	G_2 clearance
15	0.26L	0.17L	-
20	0.26L	0.17L	0.10L
25	0.26L	0.17L	0.14L
30	0.34L	0.22L	0.18L
35	0.42L	0.30L	0.24L
45	0.50L	0.34L	0.28L
55	0.60L	0.42L	0.34L

TWHW Series

Unit : μm

Model No.	Common clearance	G_1 clearance	G_2 clearance
17	0.13L	0.04L	-
21	0.26L	0.17L	-
27	0.26L	0.17L	-
35	0.26L	0.17L	0.14L

TWR Series, TWR-S Series

Unit : μm

Model No.	G_2 clearance	G_3 clearance
25, 30, 35, 45, 55, 65	0.17L	0.12L

5. Marking of datum plane during installation

The datum plane of Tretter's Linear Motion guide is the ground surface on the opposite side of Tretter mark shown in the block.

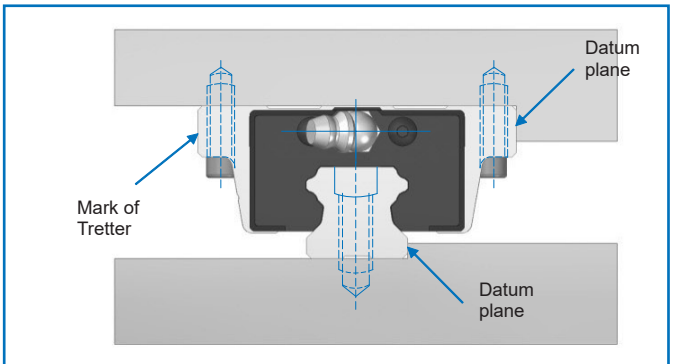


Figure 20. Linear Motion guide on the reference axis

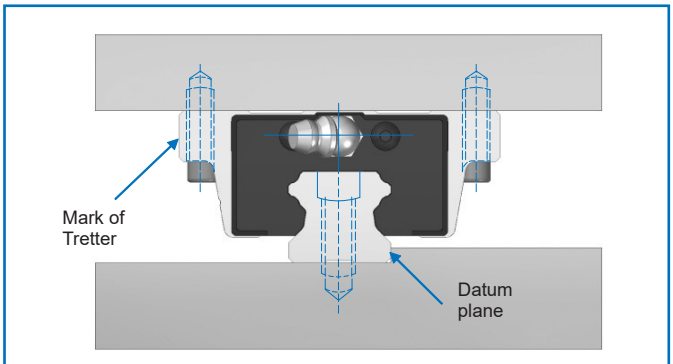
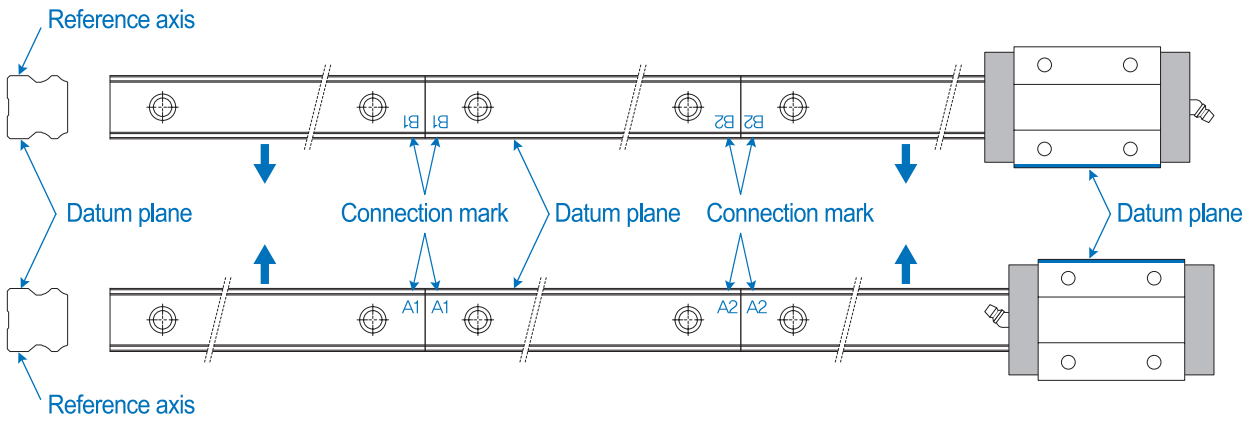


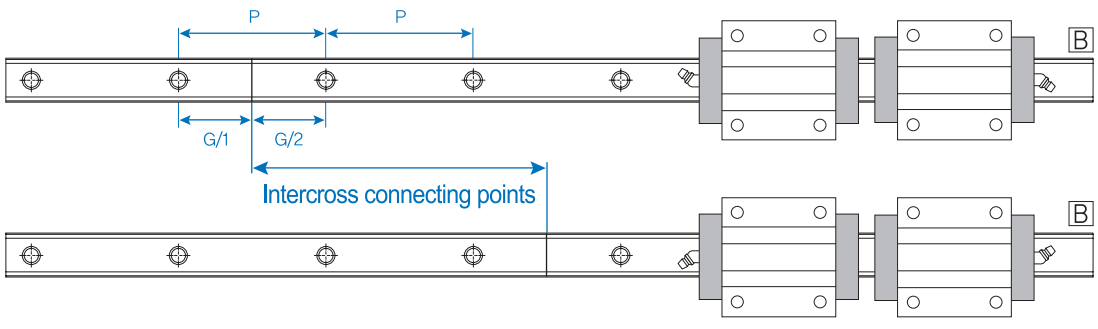
Figure 21. Linear Motion guide on the driven shaft

6. Connection of rails

If you need a longer rail than the one supplied, you can connect rails for the purpose of use.
The mark on the rail indicates the point where rails should be linked.
If the block passes through the connecting points simultaneously, they may affect the unit's travel and cause a delicate hitch. To solve this problem, it is recommended to make sure the connecting points intercrossed



Connection of rails

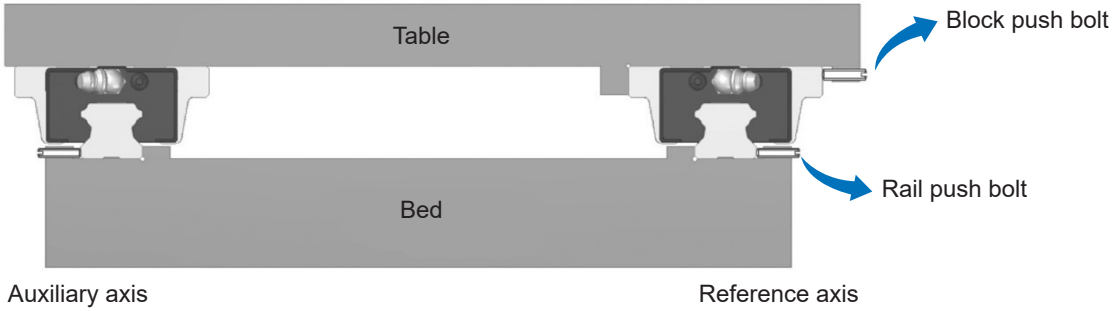


Intercross connecting points

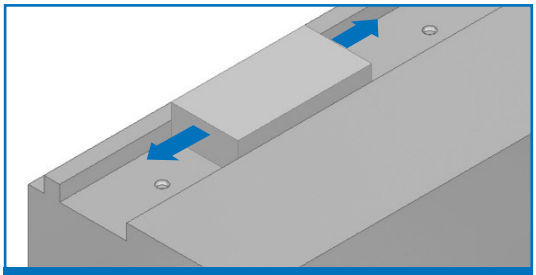
Figure 22. Connection of rails

7. Installation of Linear Motion Guide

1. Installation of Linear Motion guide in the equipment exposed to vibration and impact

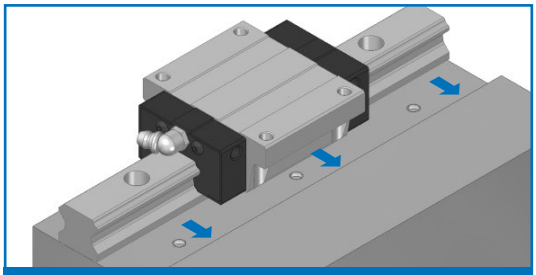


1) Install a rail



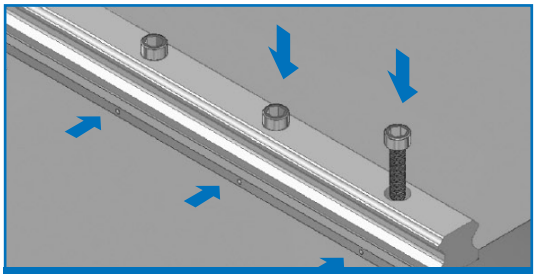
Step 1: Check the surface to be installed with a rail

Prior to installation, thoroughly remove burr, dust, rust preventive oil, etc.



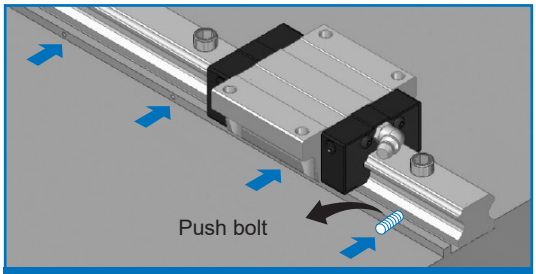
Step 2: Draw a rail tightly to the datum plane

Gently place Linear Motion guideon the bed and push it in the opposite direction of the bed's datum plane



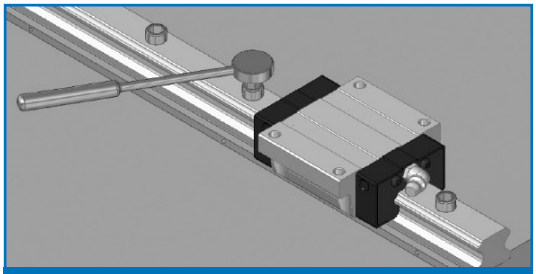
Step 3: Fasten bolts temporarily

Check the status of bolts and fasten every bolt temporarily



Step 4: Fasten push bolts

Fix push bolts to make sure that the rail is parallel with the datum plane of the bed.

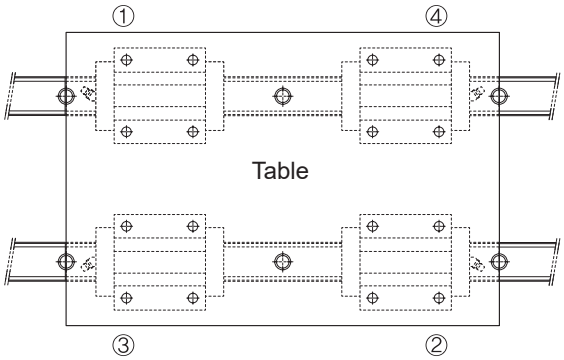


Step 5: Fix and fasten assembly bolts using a torque wrench

• Step 5 :
Fasten all bolts using the recommended torque.
Fasten the bolt in the center first and then continue fastening each bolt toward both ends in order to maintain the precision of rail during assembly.

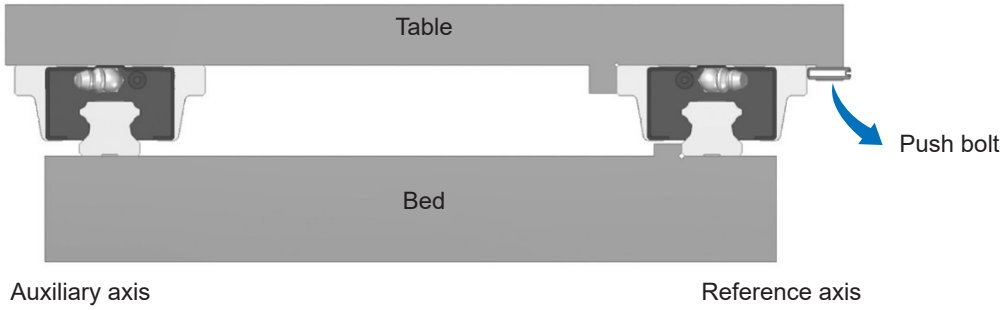
• Step 6 :
Assemble an auxiliary axis
Repeat the procedure above for the installation of an auxiliary axis.

2) Install a block

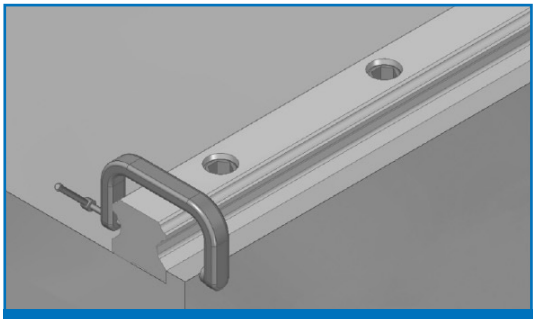


- Step 1: Assembly bolts temporarily
  Place a table on the block and fasten all bolts temporarily
- Step 2: Fasten bolts tightly
  Fix the main rail block to the opposite side of the table's datum plane using a push bolt and adjust the position of the table.
- Step 3: Fix and fasten assembly bolts
  Completely fasten all bolts on the datum plane and subsidiary side in the order of 1 to 2.

2. Installation of Linear Motion guide without a push bolt



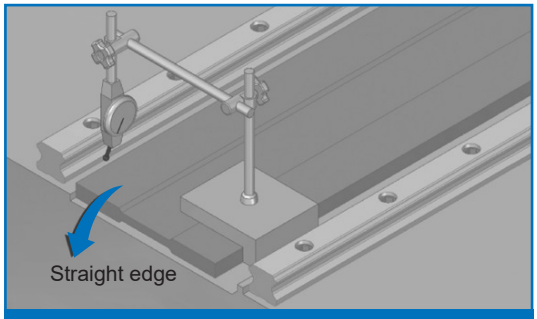
1) Install a master rail



Use a vise

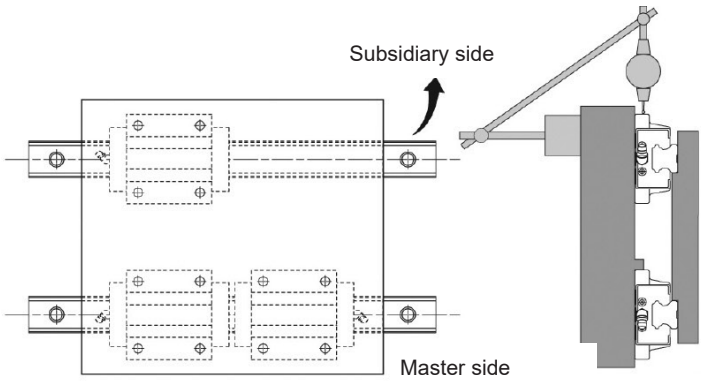
Fasten bolts temporarily and push a master rail toward the datum plane using a C-vise. Fasten the bolts according to the prescribed torque and order.

2) Install an auxiliary rail



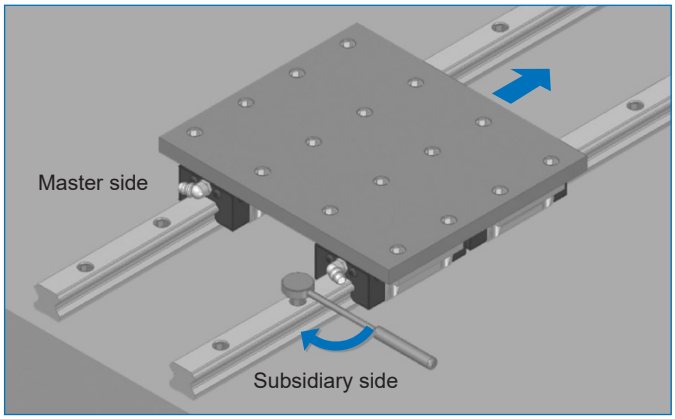
Straight edge

Place a straight edge between two rails and make sure it is parallel with the master rail that is fixed temporarily.
Check the degree of parallelism with the dial gauge and adjust the rail if needed. Then, fasten bolts in order.



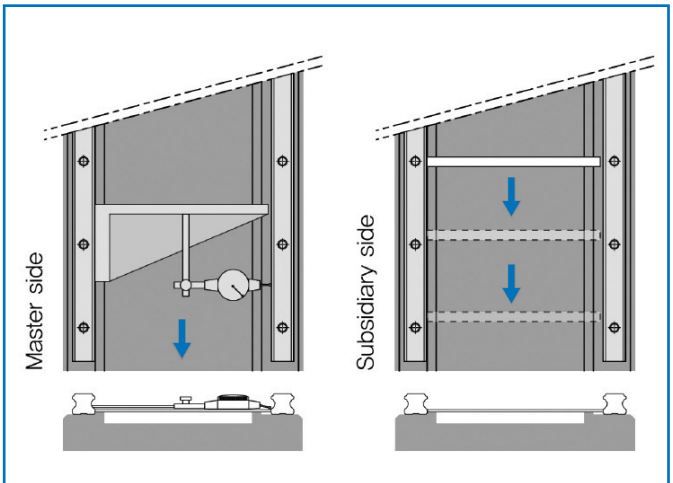
- Assembly using a table

1. Fix two blocks on the datum plane and one block on the subsidiary side to a table.
2. Fix another auxiliary block and rail to the table and bed temporarily.
3. Place a dial gauge on the table and make sure a prober of the gauge contact the subsidiary side of the block.
4. Separate the table from the end of the rail and check the degree of parallelization of the block with the auxiliary rail.
5. Fasten bolts in order.



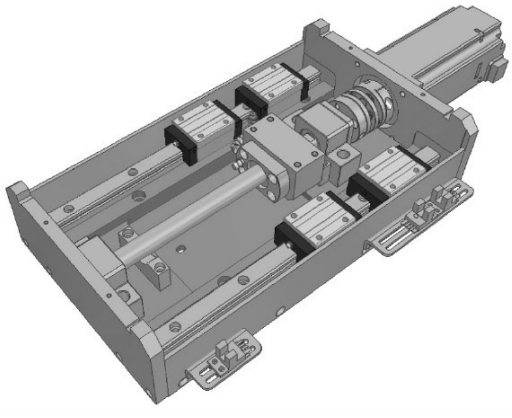
- Assembly using a rail on the datum plane

1. Fix two blocks on the datum plane and one block on the subsidiary side to a table.
2. Fix another auxiliary block and rail to the table and bed temporarily.
3. Separate the table from one rail and make an adjustment by considering the rolling resistance during the movement and checking the degree of parallelization of the auxiliary rail.
4. Fasten bolts in order.



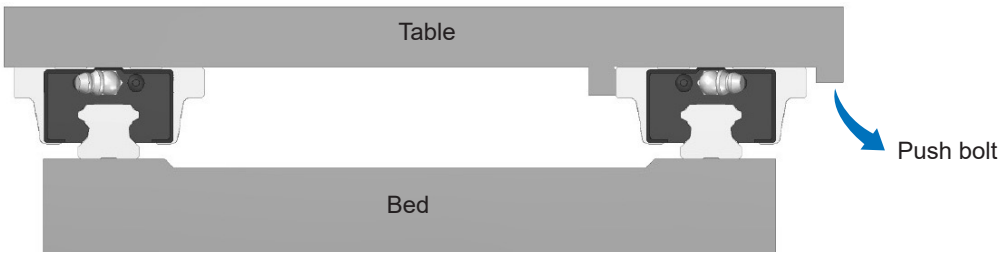
Assembly using a jig

Move the position of a block in every bolt pitch at the end of the rail in consecutive order and fasten bolts in order by adjusting the degree of parallelism between the datum plane of a reference rail and that of an auxiliary rail using a special jig.



Installation completion of Linear Motion guide

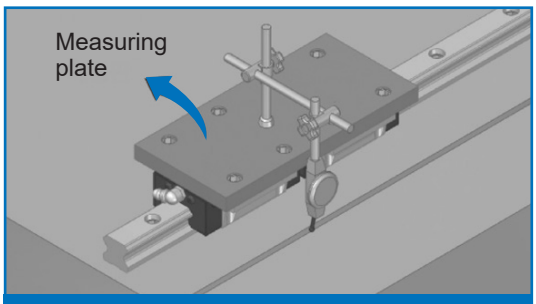
3. Installation of Linear Motion guide without the datum plane for a reference rail



Subsidiary side

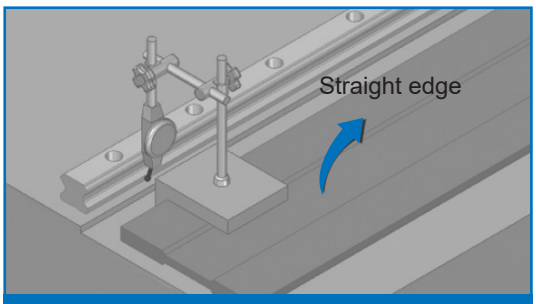
Datum plane

1) Install a reference rail



Use a temporary datum plane

Fix two blocks together onto the measuring plate and install the temporary datum plane near the surface where a rail is to be installed on the bed. Then check and adjust the degree of parallelism of the rail and fasten bolts in order.



Use a straight edge

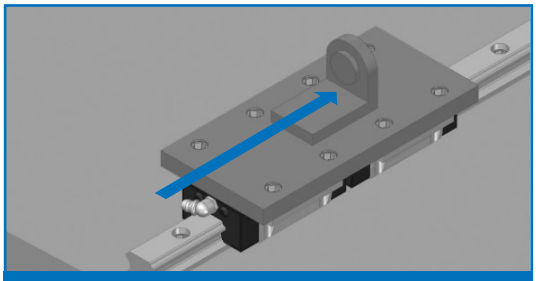
Fix a rail to the bed temporarily and adjust it to be straight using a dial gauge and then fasten bolts in order.

2) Apply the same method when installing the auxiliary block and rail

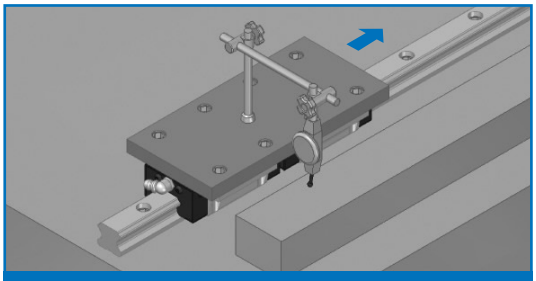
4. Measure precision after installation

You can check the precision of travel by fixing two blocks onto the measuring plate. Use a dial gauge with a straight edge or a laser interferometer to measure the precision.

In case of using a dial gauge, you have to place the straight edge as close to the block as possible in order to accurately measure it.



Measure using a laser interferometer



Measure using a dial gauge with a straight edge

8. Torque used to fasten bolts during the assembly of Linear Motion guide

1) Select the optimal torque for bolts
For the assembly of the rail of Linear Motion guide, the optimal clamping torque must be used depending on the materials of mounting surface or bolts. Inaccurate clamping torque may affect the mounting precision of the rail so please use a torque wrench.

2) Recommended torques by the material of mounting base of Linear Motion guide

Unit : N•m

Bolt specification	Torque value (Unit : N·m)		
	Steel	Casting	Aluminum
M3	2	1.3	1
M4	4	2.7	2
M5	8.8	5.9	4.4
M6	13.7	9.2	6.8
M8	30	20	15
M10	68	45	33
M12	120	78	58
M14	157	105	78
M16	196	131	98
M20	382	255	191

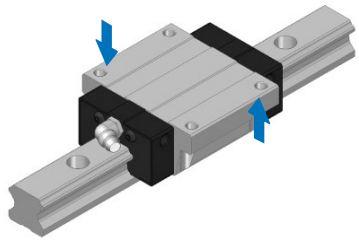
3) Recommended torques by the material of bolts

Unit : N•m

Bolt specification	Clamping torque		Bolt specification	Clamping torque	
	Carbon steel bolt	SCM steel bolt		Carbon steel bolt	SCM steel bolt
M2.3	-	0.4	M12	108	76
M2.5	-	0.6	M14	172	122
M3	1.7	1.1	M16	263	196
M4	4.0	2.5	M18	-	265
M5	7.9	5.1	M20	512	-
M6	13.3	8.6	M22	-	520
M8	32.0	22.0	M24	882	-
M10	62.7	43.0	M30	1750	-

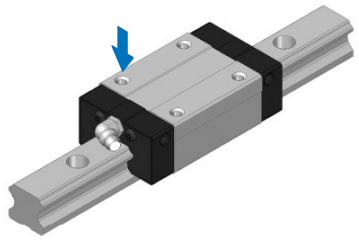
Tretter AG // Schaffhauserstrasse 96 // CH-8222 Beringen // Tel. +41 52 670 06 10 // info@tretter.ch // www.tretter.ch

9. Directions of bolt fastening by Linear Motion guide type



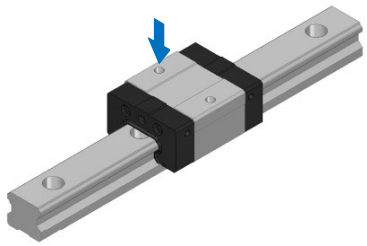
TWH-F, TWH-FL, TWH-SF, TWH-SFL

Since the flange of a block is tapped and the counter bore is processed in the bottom, bolts can be assembled both from bottom to top and from top to bottom as indicated by arrows.
But, if bolts are fastened from bottom to top, it is recommended to use one size smaller bolts.



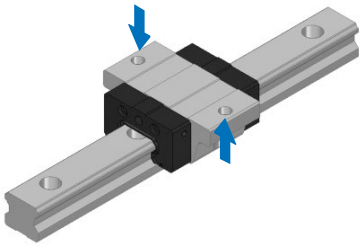
TWH-R, TWH-RL, TWH-SR, TWH-SRL

Since tap is processed in the square body of the block, it is used when bolts are fastened from top to bottom as indicated by arrows.



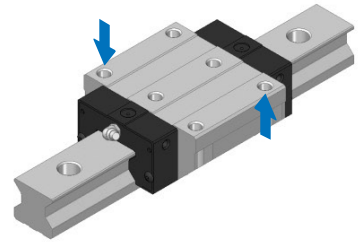
TWS-C, TWS-R, TWS-SC, TWS-SR

Since tap is processed in the rectangular body of the block, it is used when bolts are fastened from top to bottom as indicated by arrows.



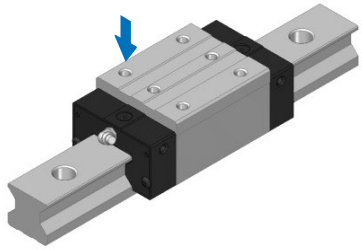
TWS-CF, TWS-F, TWS-SCF, TWS-SF

Since the flange of a block is tapped and the counter bore is processed in the bottom, bolts can be assembled both from bottom to top and from top to bottom as indicated by arrows.
But, if bolts are fastened from bottom to top, it is recommended to use one size smaller bolts.



TWR-F, TWR-FL

Since the flange of a block is tapped and the counter bore is processed in the bottom, bolts can be assembled both from bottom to top and from top to bottom as indicated by arrows.
But, if bolts are fastened from bottom to top, it is recommended to use one size smaller bolts.



TWR-R, TWR-RL

Since the rectangular body of a block is tapped, it is used when bolts are fastened from top to bottom as indicated by arrows

12 TYPES OF LINEAR MOTION GUIDE

1. Linear Motion Guide TWH Series

1) Structure of TWH Series

Tretter Linear Motion Guide TWH Series has a four-row circular arc-groove structure in the raceway groove of a rail or a block and is a 4-direction equal load type which can bear equal load rating for vertical compression load, tensile load, and horizontal load as the rolling element is combined with balls at 45 degree, which reduces friction resistance to ensure smooth motion and long life.
Also if the ball is preloaded, it can enhance the rigidity of Linear Motion guide and minimize Linear Motion guide's displacement for external load.

2) Features of TWH Series

a. High quality and very effective in realizing high precision and elimination of labor
b. High rigidity and high precision which can realize the stable travel for a longtime
c. Great wear resistance and friction resistance which ensures a long life
d. Great auto-adjusting and error-absorbing abilities with the face-to-face duplex structure same to D/F combination of ball bearing
e. Various specifications for easy design
f. Easy to use due to great compatibility between a rail and a block

2. Spacer Chain Guide TWH-S Series

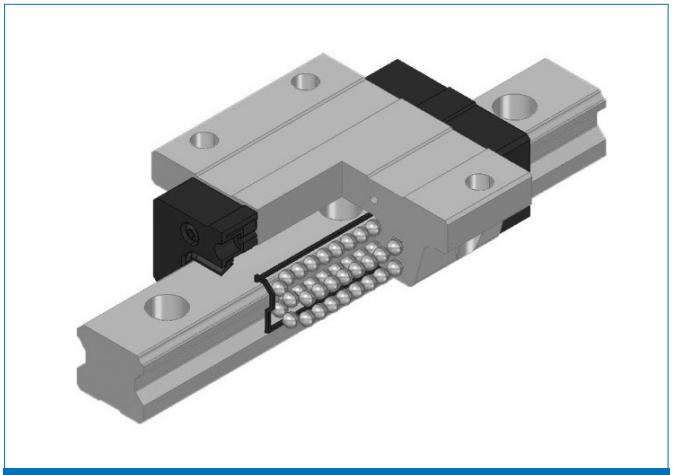
1) Structure of TWH-S Series

Linear Motion Guide TWH-S Series has a 4-direction equal load type which is identical to TWH Series and has an auto-adjusting face-to-face D/F structure. It uses balls as a rolling element and combines a spacer between balls to prevent them from colliding each other during the rolling motion. Therefore it makes less noise and more stable circulating motion than a full-ball type to realize quiet running and the spacer act as the pocket of lubricant to obtain longer life than TWH Series.

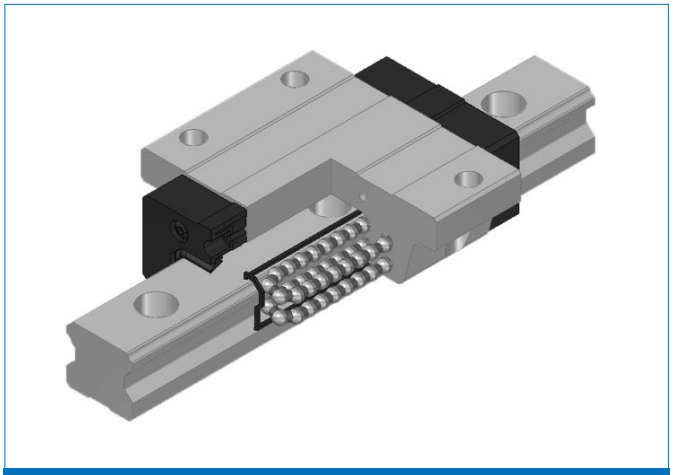
2) Features of TWH-S Series

a. As a spacer-incorporated type which improves frictional properties and prevents the collision of balls, it not only allows stable circulating motion and smooth running but also reduces noise. If special lubric ating seal is attached to lengthen life, maintenance-free operations can be achieved.
b. Collision between balls and the loss of oil film are prevented by applying a resin spacer to improve life and generate less particles and dust.
c. High quality in realizing high precision and high velocity so it could create large effect on elimination of power loss.
d. High rigidity and high precision which can realize the stable travel for a long time
e. Great wear resistance and friction resistance which ensures a long life
f. Great auto-adjusting and error-absorbing abilities with the face-to-face duplex structure same to D/F combination of ball bearing
g. Various specifications for easy design
h. Easy to use due to great compatibility between a rail and a block

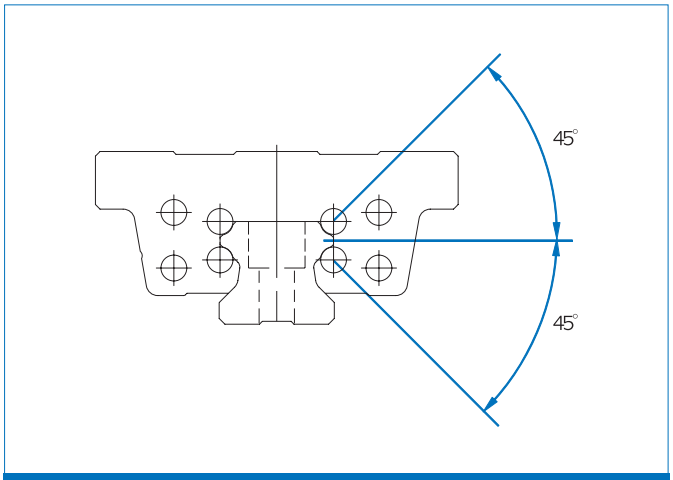
Linear Motion Guide



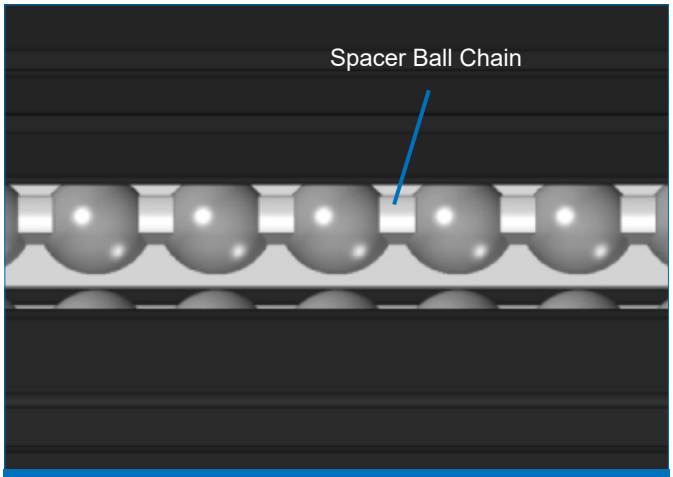
TWH Series (Full-ball Type)



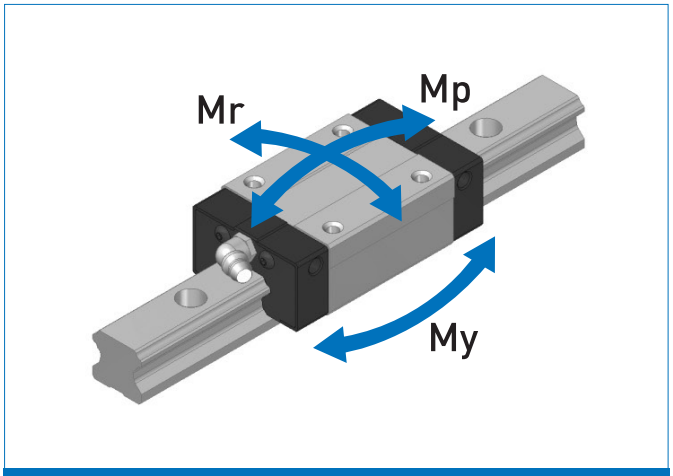
TWH-S Series (Spacer Chain Type)



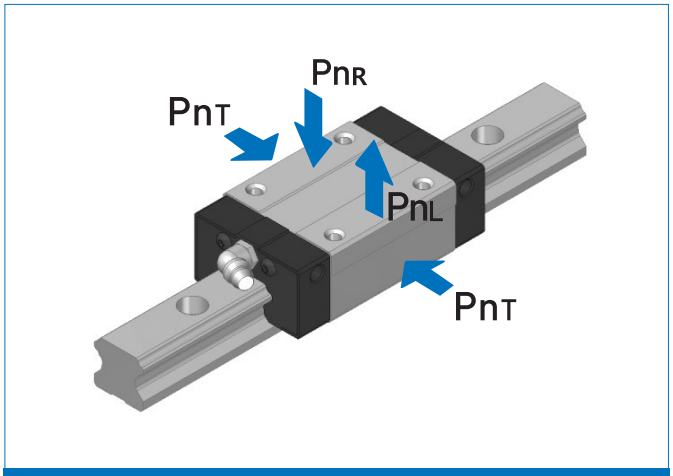
Cross Section



Detail of Raceway of TWH-S Series

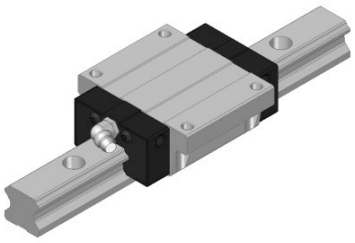
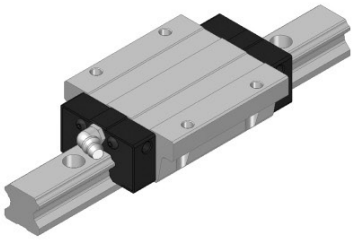
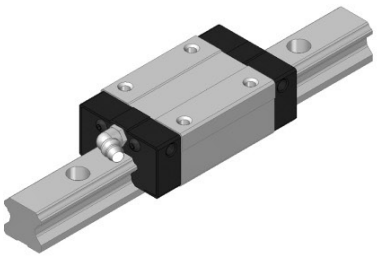
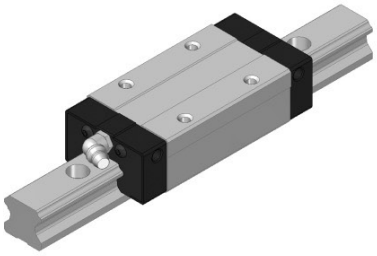


Moment Rigidity

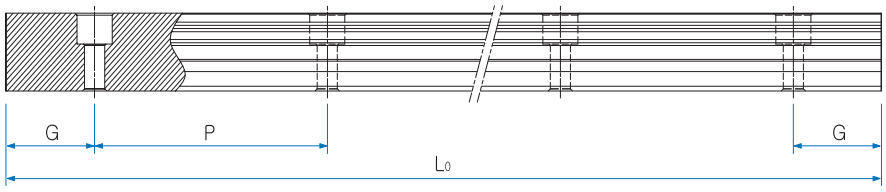


Radial Rigidity

Types and Features

Category	Type	Shape & Features		
Flange type	TWH-F TWH-SF		- With the tapped flange of a block, a general type which can be assembled both from bottom to top and from top to bottom - A 4-direction equal load type with high rigidity and high load S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer retainer is applied.	Machine tool X, Y, Z axis, CNC machining center, CNC shelf, CNC tapping center, Electric injection machine, 3D engraving machine, laser processer, milling machine, welder for exclusive use, EDM electric spark machine, automation device, Various transport system, FPD inspection equipment, Industrial robots, ATC, Precision X-Y table, Various industrial machine
	TWH-FL TWH-SFL		- Having the cross section identical to that of H-F Series, it increased load rating by extending the whole length (L_1) of Linear Motion guide block - A 4-direction equal load type with high rigidity and high load S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer retainer is applied.	
Compact type	TWH-R TWH-SR		- With the tapped top side of a block, a compact type that the width of Linear Motion guide block is minimized - A 4-direction equal load type with high rigidity and high load S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer retainer is applied.	
	TWH-RL TWH-SRL		- Having the cross section identical to that of TWH-R Series, it increased load rating by extending the whole length (L_1) of Linear Motion guide block - A 4-direction equal load type with high rigidity and high load S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer retainer is applied.	

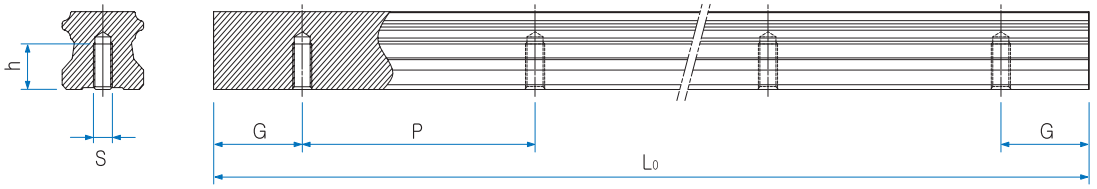
Standard and maximum length of a rail



Unit : mm

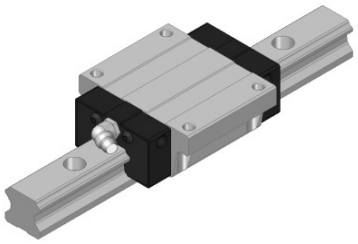
Model No.	TWH15	TWH20	TWH25	TWH30	TWH35	TWH45	TWH55
Standard length	160	160	220	280	440	570	780
	220	220	280	360	520	675	900
	280	280	340	440	600	780	1020
	⋮	340	400	520	680	885	⋮
	1360	⋮	460	600	760	⋮	2820
	1480	1960	⋮	⋮	⋮	2880	2940
	1600	2080	2200	2520	2680	2985	3060
		2200	2320	2680	2840	3090	
			2440	2840	3000		
				3000			
Standard pitch P	60	60	60	80	80	105	120
G	20	20	20	20	20	22.5	30
Max. length	4000						

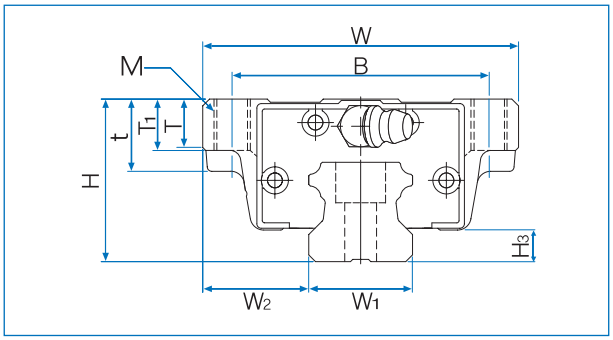
Standard tap hole type of a rail



Model No.	S	h(mm)
TWH15	M5	8
TWH20	M6	10
TWH25	M6	12
TWH30	M8	15
TWH35	M8	17
TWH45	M12	24
TWH55	M14	24

TWH-F Series, TWH-FL Series





Model No.	External dimensions			Dimensions of block										H_3
	Height H	Width L	Length L	B	C	M	L_1	t	T	T_1	N	E	Grease nipple	
TWH 15F	24	47	57	38	30	M5	40.8	–	7	11	6	6	A–M4	4.7
TWH 15FL	24	47	65.3	38	30	M5	49.1	–	7	11	6	6	A–M4	4.7
TWH 20F	30	63	72.7	53	40	M6	53.1	–	9.2	10	7.5	12	B–M6F	6
TWH 20FL	30	63	88.6	53	40	M6	69	–	9.2	10	7.5	12	B–M6F	6
TWH 25F	36	70	83	57	45	M8	58.3	–	11.5	16	9	12	B–M6F	7
TWH 25FL	36	70	102.9	57	45	M8	78.2	–	11.5	16	9	12	B–M6F	7
TWH 30F	42	90	97.8	72	52	M10	70.8	–	9.5	18	7.3	12	B–M6F	7.5
TWH 35FL	42	90	120	72	52	M10	93	–	9.5	18	7.3	12	B–M6F	7.5
TWH 35F	48	100	110	82	62	M10	80.8	–	12.5	21	8	12	B–M6F	9
TWH 35FL	48	100	135.4	82	62	M10	106.2	–	12.5	21	8	12	B–M6F	9
TWH 45F	60	120	139	100	80	M12	101.9	25	13	15	10	16	B–PT1/8	10
TWH 45FL	60	120	170.8	100	80	M12	133.7	25	13	15	10	16	B–PT1/8	10
TWH 55F	70	140	163	116	95	M14	117.5	29	19	17	11	16	B–PT1/8	13
TWH 55FL	70	140	201.1	116	95	M14	155.6	29	19	17	11	16	B–PT1/8	13

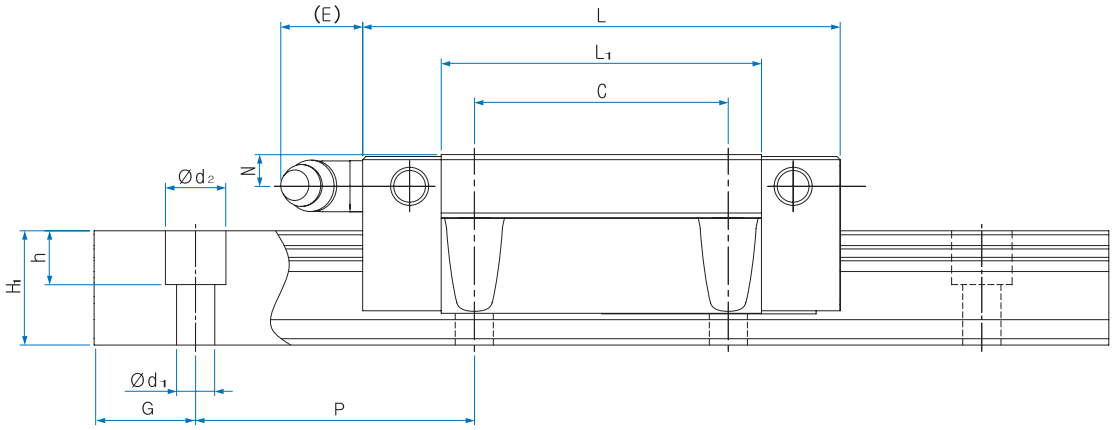
Composition of Model No.

TWH35			F	SS	2	G_2		–	1000L		20/40	P	A	T	Z	–	2
1	2	3	4	5	6	7	8		9	10	11	12	13	14	15		16

1. Model No. of Linear Motion Guide
2. Material of block : No symbol – Carbon steel / M – Stainless steel
3. Type of block : No symbol – Full-ball type / S – Spacer Chain type
4. Form of block : R – Rectangular standard type / RL – Rectangular long type / F – Flange standard type / FL – Flange long type
5. Type of seal : UU – End seal / SS – End seal+Inside seal / ZZ – End seal + Inside seal + metal scraper
   UULF-End seal+LF seal / SSLF- End seal+Inside seal+LF seal / ZZLF - End seal + Inside seal + metal scraper + LF seal (*1)
6. Number of blocks combined in 1 rail
7. Symbol of clearance : No symbol–Normal preload / G1–Light preload / G2–Heavy preload / GS–Special preload (*2)
8. Material of end plate : No symbol–Synthetic resin / I–Stainless steel / N–Aluminum
9. Length of rail
10. Material of rail : No symbol – Carbon steel / M – Stainless steel
11. Size of G value : Standard G value has no symbol
12. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
13. No symbol–Rail counter bore type (A topside assembly) / A– Rail tap hole type (an underside assembly) (*4)
14. Connection symbol
15. Special symbol
16. Number of axis used on the same surface

(*1) See 94/95 Symbol List of Optional Parts
(*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class
(*4) See P51 Standard tap hole type of a rail

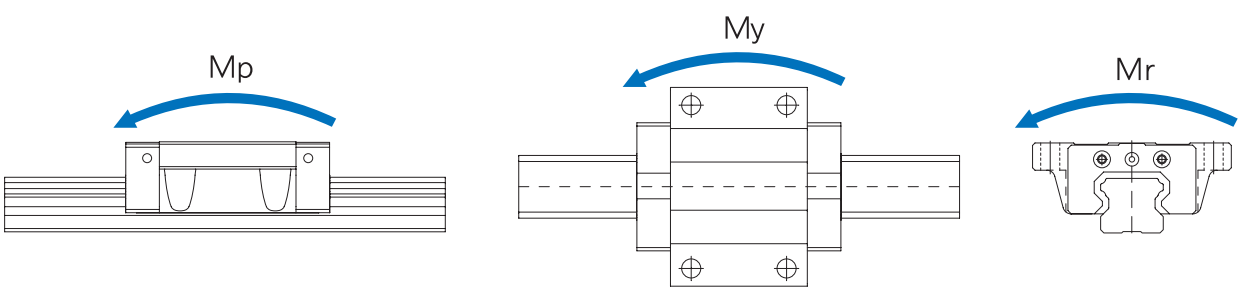
Tretter AG // Schaffhauserstrasse 96 // CH-8222 Beringen // Tel. +41 52 670 06 10 // info@tretter.ch // www.tretter.ch



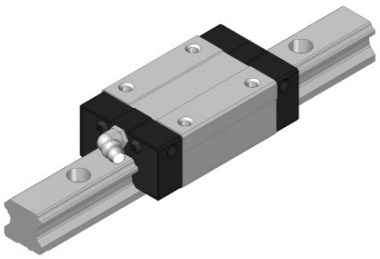
Unit : mm

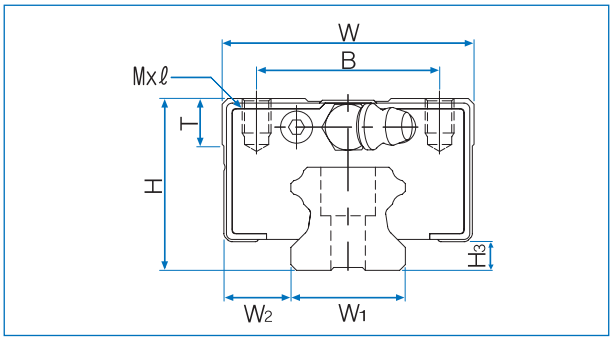
Dimensions of Rail						Basic load rating		Static allowance moment kN·m					Mass	
Width W1 ± 0.05	W2	Height H1	Value G	Pitch P	d1 × d2 × h	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(contact)	1	2(contact)	1		
15	16	13	20	60	4.5×7.5×5.3	12.6	16.2	0.115	0.552	0.115	0.552	0.129	0.19	1.3
15	16	13	20	60	4.5×7.5×5.3	14.3	19.3	0.165	0.769	0.165	0.769	0.154	0.24	1.3
20	21.5	16.5	20	60	6×9.5×8.5	18.3	23.9	0.221	1.049	0.221	1.049	0.251	0.41	2.2
20	21.5	16.5	20	60	6×9.5×8.5	21.8	30.7	0.370	1.692	0.370	1.692	0.322	0.54	2.2
23	23.5	20	20	60	7×11×9	27.0	33.1	0.337	1.636	0.337	1.636	0.398	0.61	3.0
23	23.5	20	20	60	7×11×9	32.8	43.6	0.596	2.760	0.596	2.760	0.525	0.82	3.0
28	31	26	20	80	9×14×12	50.4	57.1	0.711	3.384	0.711	3.384	0.828	1.1	4.85
28	31	26	20	80	9×14×12	60.3	73.6	1.203	5.506	1.203	5.506	1.067	1.3	4.85
34	33	29	20	80	9×14×12	67.0	74.6	1.062	5.012	1.062	5.012	1.298	1.6	6.58
34	33	29	20	80	9×14×12	80.2	96.2	1.797	8.172	1.797	8.172	1.674	2.01	6.58
45	37.5	38	22.5	105	14×20×17	108.5	116.4	2.860	9.912	2.860	9.912	2.275	2.83	11.03
45	37.5	38	22.5	105	14×20×17	129.7	150.1	4.533	16.161	4.533	16.161	2.935	3.70	11.03
53	43.5	44	30	120	16×23×20	155.9	161.5	4.654	16.016	4.654	16.016	3.779	4.36	15.26
53	43.5	44	30	120	16×23×20	187.5	210.1	7.468	26.493	7.468	26.493	4.916	5.76	15.26

1N≒0.102kgf

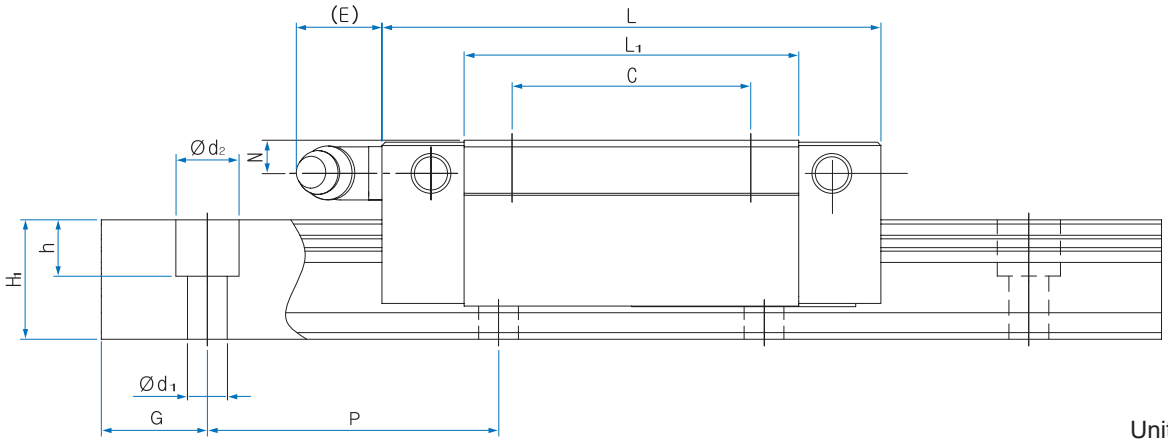


TWH-R Series, TWH-RL Series





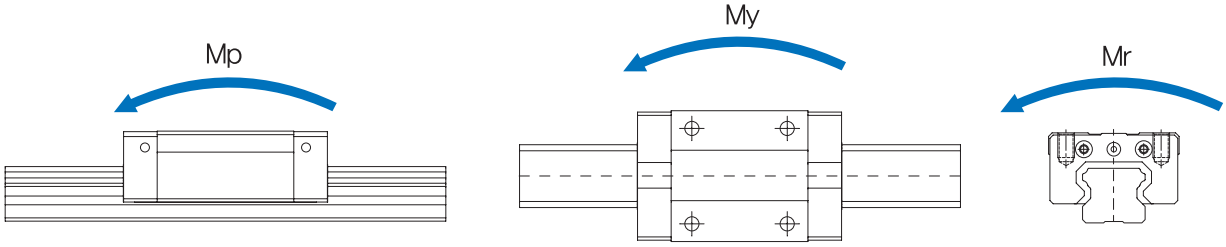
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M × ℓ	L_1	T	N	E	Grease nipple	
TWH15R	28	34	57	26	26	M4×5	40.8	6	10	6	A–M4	4.7
TWH15RL	28	34	65.3	26	26	M4×5	49.1	6	10	6	A–M4	4.7
TWH20R	30	44	72.7	32	36	M5×6	53.1	8	7.5	12	B–M6F	6
TWH20RL	30	44	88.6	32	50	M5×6	69	8	7.5	12	B–M6F	6
TWH25R	40	48	83	35	35	M6×8	58.3	8	13	12	B–M6F	7
TWH25RL	40	48	102.9	35	50	M6×8	78.2	8	13	12	B–M6F	7
TWH30R	45	60	97.8	40	40	M8×10	70.8	8	10.3	12	B–M6F	7.5
TWH30RL	45	60	120	40	60	M8×10	93	8	10.3	12	B–M6F	7.5
TWH35R	55	70	110	50	50	M8×12	80.8	10	15	12	B–M6F	9
TWH35RL	55	70	135.4	50	72	M8×12	106.2	10	15	12	B–M6F	9
TWH45R	70	86	139	60	60	M10×17	101.9	15	20	16	B–PT1/8	10
TWH45RL	70	86	170.8	60	80	M10×17	133.7	15	20	16	B–PT1/8	10
TWH55R	80	100	163	75	75	M12×18	117.5	18	21	16	B–PT1/8	13
TWH55RL	80	100	201.1	75	95	M12×18	155.6	18	21	16	B–PT1/8	13



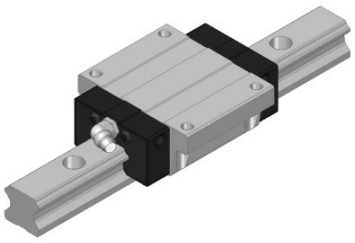
Unit : mm

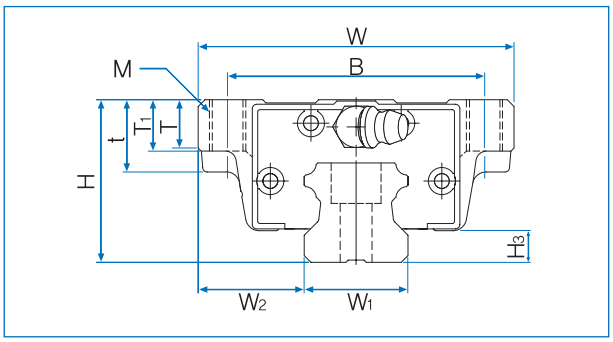
Dimensions of Rail						Basic load rating		Static allowance moment kN·m					Mass	
Width W1 ± 0.05	W2	Height H1	Value G	Pitch P	d1 × d2 × h	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(contact)	1	2(contact)	1		
15	9.5	13	20	60	4.5×7.5×5.3	12.6	16.2	0.115	0.552	0.115	0.552	0.129	0.18	1.3
15	9.5	13	20	60	4.5×7.5×5.3	14.3	19.3	0.165	0.769	0.165	0.769	0.154	0.23	1.3
20	12	16.5	20	60	6×9.5×8.5	18.3	23.9	0.221	1.049	0.221	1.049	0.251	0.31	2.2
20	12	16.5	20	60	6×9.5×8.5	21.8	30.7	0.370	1.692	0.370	1.692	0.322	0.41	2.2
23	12.5	20	20	60	7×11×9	27.0	33.1	0.337	1.636	0.337	1.636	0.398	0.53	3.0
23	12.5	20	20	60	7×11×9	32.8	43.6	0.596	2.760	0.596	2.760	0.525	0.71	3.0
28	16	26	20	80	9×14×12	50.4	57.1	0.711	3.384	0.711	3.384	0.828	0.9	4.85
28	16	26	20	80	9×14×12	60.3	73.6	1.203	5.506	1.203	5.506	1.067	1.1	4.85
34	18	29	20	80	9×14×12	67.0	74.6	1.062	5.012	1.062	5.012	1.298	1.5	6.58
34	18	29	20	80	9×14×12	80.2	96.2	1.797	8.172	1.797	8.172	1.674	2.01	6.58
45	20.5	38	22.5	105	14×20×17	108.5	116.4	2.860	9.912	2.860	9.912	2.275	2.89	11.03
45	20.5	38	22.5	105	14×20×17	129.7	150.1	4.533	16.161	4.533	16.161	2.935	3.74	11.03
53	23.5	44	30	120	16×23×20	155.9	161.5	4.654	16.016	4.654	16.016	3.779	4.28	15.26
53	23.5	44	30	120	16×23×20	187.5	210.1	7.468	26.493	7.468	26.493	4.916	5.59	15.26

1N≒0.102kgf

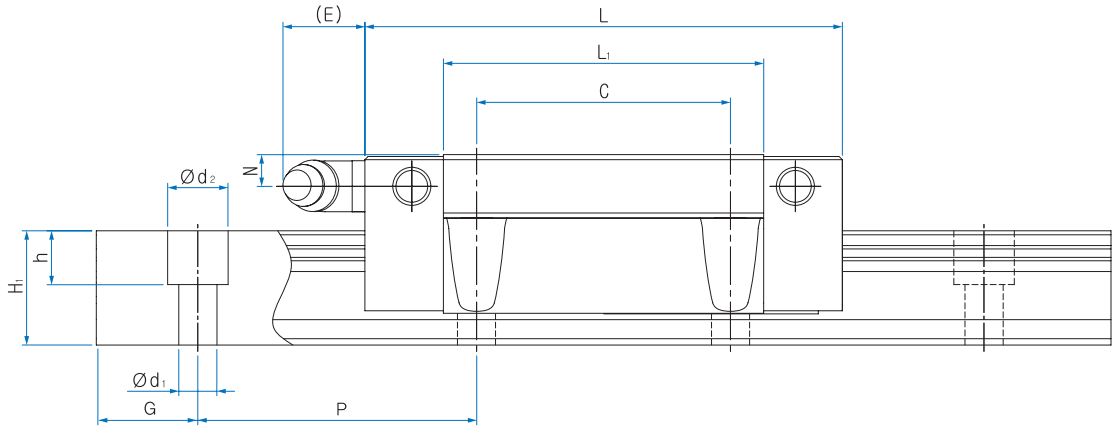


TWH-SF Series, TWH-SFL Series





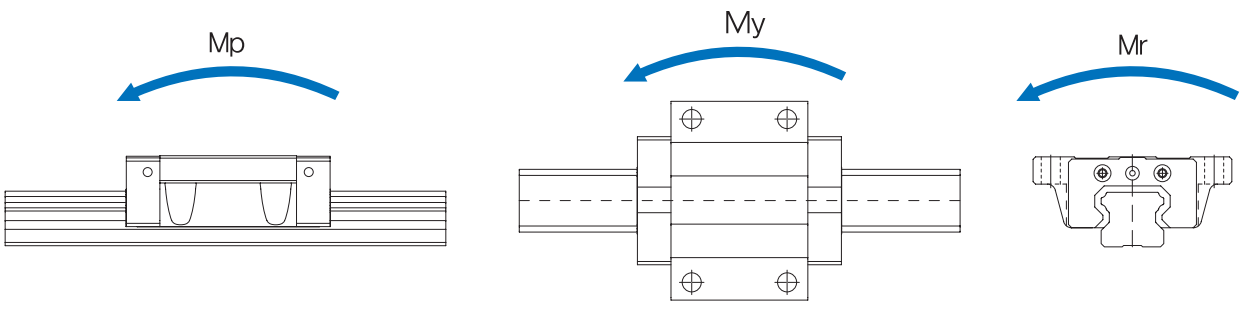
Model No.	External dimensions			Dimensions of block										H_3
	Height H	Width W	Length L	B	C	M	L_1	t	T	T_1	N	E	Grease nipple	
TWH 15SF	24	47	57	38	30	M5	40.7	-	7	11	6	6	A-M4	4.5
TWH 15SFL	24	47	65.3	38	30	M5	49.1	-	7	11	6	6	A-M4	4.5
TWH 20SF	30	63	72.7	53	40	M6	53.1	-	9.2	10	7.5	12	B-M6F	6
TWH 20SFL	30	63	88.6	53	40	M6	69	-	9.2	10	7.5	12	B-M6F	6
TWH 25SF	36	70	83	57	45	M8	58.3	-	11.5	16	9	12	B-M6F	7
TWH 25SFL	36	70	102.9	57	45	M8	78.2	-	11.5	16	9	12	B-M6F	7
TWH 30SF	42	90	97.8	72	52	M10	70.8	-	9.5	18	7.3	12	B-M6F	7.5
TWH 30SFL	42	90	120	72	52	M10	93	-	9.5	18	7.3	12	B-M6F	7.5
TWH 35SF	48	100	110	82	62	M10	80.8	-	12.5	21	8	12	B-M6F	9
TWH 35SFL	48	100	135.4	82	62	M10	106.2	-	12.5	21	8	12	B-M6F	9
TWH 45SF	60	120	138.5	100	80	M12	106	25	13	18	10.5	13	B-PT1/8	10
TWH 45SFL	60	120	170.2	100	80	M12	137.8	25	13	18	10.5	13	B-PT1/8	13
TWH 55SF	70	140	171	116	95	M14	132.6	29	19	21	11	13	B-PT1/8	13
TWH 55SFL	70	140	210.6	116	95	M14	172.2	29	19	21	11	13	B-PT1/8	13



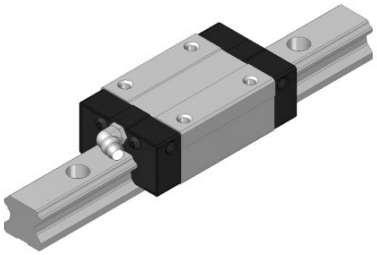
Unit : mm

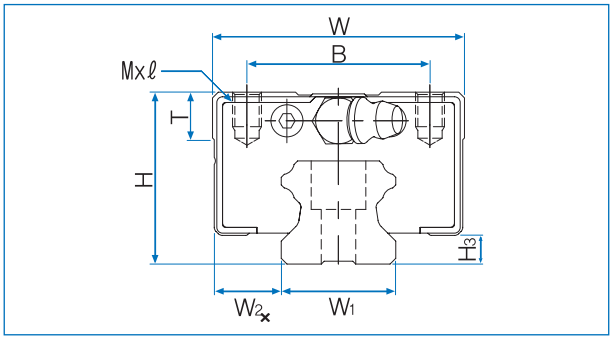
Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W1 ±0.05	W2	Heigh H1	Value G	Pitch P	d1×d2×h	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
15	16	13	20	60	4.5×7.5×5.3	12.1	16.2	0.115	0.552	0.115	0.552	0.129	0.19	1.3
15	16	13	20	60	4.5×7.5×5.3	13.7	19.3	0.165	0.769	0.165	0.769	0.154	0.24	1.3
20	21.5	16.5	20	60	6×9.5×8.5	17.6	23.9	0.221	1.049	0.221	1.049	0.251	0.41	2.2
20	21.5	16.5	20	60	6×9.5×8.5	21.1	30.7	0.370	1.692	0.370	1.692	0.322	0.54	2.2
23	23.5	20	20	60	7×11×9	25.8	33.1	0.337	1.636	0.337	1.636	0.398	0.61	3.0
23	23.5	20	20	60	7×11×9	31.7	43.6	0.596	2.760	0.596	2.760	0.525	0.82	3.0
28	31	26	20	80	9×14×12	48	57.1	0.711	3.384	0.711	3.384	0.828	1.1	4.85
28	31	26	20	80	9×14×12	58	73.6	1.203	5.506	1.203	5.506	1.067	1.3	4.85
34	33	29	20	80	9×14×12	63.7	74.6	1.062	5.012	1.062	5.012	1.298	1.6	6.58
34	33	29	20	80	9×14×12	77.1	96.2	1.797	8.172	1.797	8.172	1.674	2.01	6.58
45	37.5	38	22.5	105	14×20×17	82.9	95.5	1.789	8.251	1.789	8.251	1.992	3.15	9.75
45	37.5	38	22.5	105	14×20×17	99.7	122.5	2.984	13.341	2.984	13.341	2.556	4.07	9.75
53	43.5	44	30	120	16×23×20	133.5	149.2	3.495	16.007	3.495	16.007	3.608	5.30	13.75
53	43.5	44	30	120	16×23×20	160.4	191.4	5.826	25.899	5.826	25.899	4.627	6.84	13.75

1N≒0.102kgf

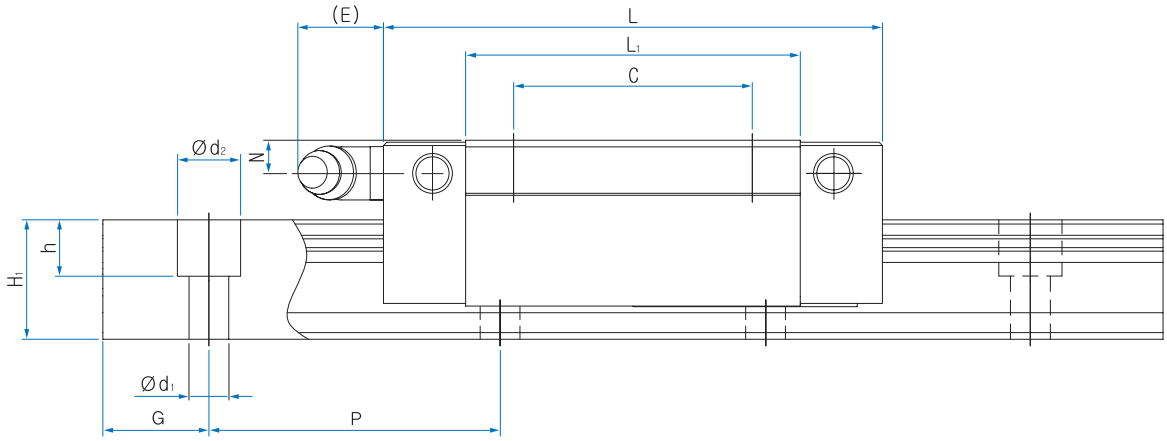


TWH-SR Series, TWH-SRL Series





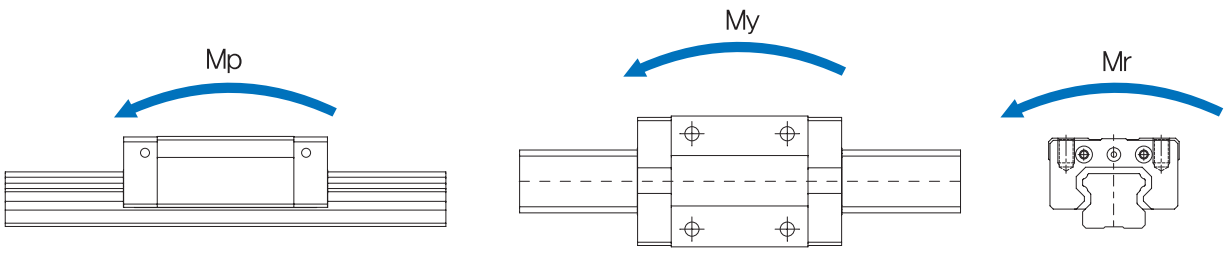
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M × ℓ	L_1	T	N	E	Grease nipple	
TWH 15SR	28	34	57	26	26	M4 × 5	40.7	6	10	6	A-M4	4.5
TWH 15SRL	28	34	65.3	26	26	M4 × 5	49.1	6	10	6	A-M4	4.5
TWH 20SR	30	44	72.7	32	36	M5 × 6	53.1	8	7.5	12	B-M6F	6
TWH 20SRL	30	44	88.6	32	50	M5 × 6	69	8	7.5	12	B-M6F	6
TWH 25SR	40	48	83	35	35	M6 × 8	58.3	8	13	12	B-M6F	7
TWH 25SRL	40	48	102.9	35	50	M6 × 8	78.2	8	13	12	B-M6F	7
TWH 30SR	45	60	97.8	40	40	M8 × 10	70.8	8	10.3	12	B-M6F	7.5
TWH 30SRL	45	60	120	40	60	M8 × 10	93	8	10.3	12	B-M6F	7.5
TWH 35SR	55	70	110	50	50	M8 × 12	80.8	10	15	12	B-M6F	9
TWH 35SRL	55	70	135.4	50	72	M8 × 12	106.2	10	15	12	B-M6F	9
TWH 45SR	70	86	138.5	60	60	M10 × 17	106	15	20.5	13	B-PT1/8	10
TWH 45SRL	70	86	170.2	60	80	M10 × 17	137.8	15	20.5	13	B-PT1/8	10
TWH 55SR	80	100	171	75	75	M12 × 18	132.6	20	21	13	B-PT1/8	13
TWH 55SRL	80	100	210.6	75	95	M12 × 18	172.2	20	21	13	B-PT1/8	13



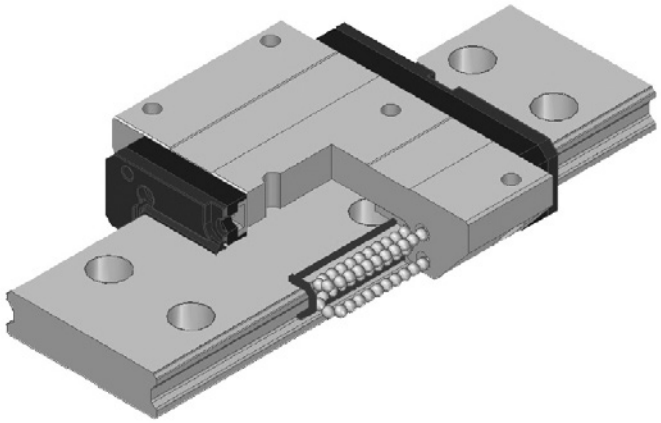
Unit : mm

Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W1 ±0.05	W2	Heigh H1	Value G	Pitch P	d1×d2×h	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
15	9.5	13	20	60	4.5×7.5×5.3	12.1	16.2	0.115	0.552	0.115	0.552	0.129	0.18	1.3
15	9.5	13	20	60	4.5×7.5×5.3	13.7	19.3	0.165	0.769	0.165	0.769	0.154	0.23	1.3
20	12	16.5	20	60	6×9.5×8.5	17.6	23.9	0.221	1.049	0.221	1.049	0.251	0.31	2.2
20	12	16.5	20	60	6×9.5×8.5	21.1	30.7	0.370	1.692	0.370	1.692	0.322	0.41	2.2
23	12.5	20	20	60	7×11×9	25.8	33.1	0.337	1.636	0.337	1.636	0.398	0.53	3.0
23	12.5	20	20	60	7×11×9	31.7	43.6	0.596	2.760	0.596	2.760	0.525	0.71	3.0
28	16	26	20	80	9×14×12	48	57.1	0.711	3.384	0.711	3.384	0.828	0.9	4.85
28	16	26	20	80	9×14×12	58	73.6	1.203	5.506	1.203	5.506	1.067	1.1	4.85
34	18	29	20	80	9×14×12	63.7	74.6	1.062	5.012	1.062	5.012	1.298	1.5	6.58
34	18	29	20	80	9×14×12	77.1	96.2	1.797	8.172	1.797	8.172	1.674	2.01	6.58
45	20.5	38	22.5	105	14×20×17	82.9	95.5	1.789	8.251	1.789	8.251	1.992	3.20	9.75
45	20.5	38	22.5	105	14×20×17	99.7	122.5	2.984	13.341	2.984	13.341	2.556	4.10	9.75
53	23.5	44	30	120	16×23×20	133.5	149.2	3.495	16.007	3.495	16.007	3.608	5.16	13.75
53	23.5	44	30	120	16×23×20	160.4	191.4	5.826	25.899	5.826	25.899	4.627	6.61	13.75

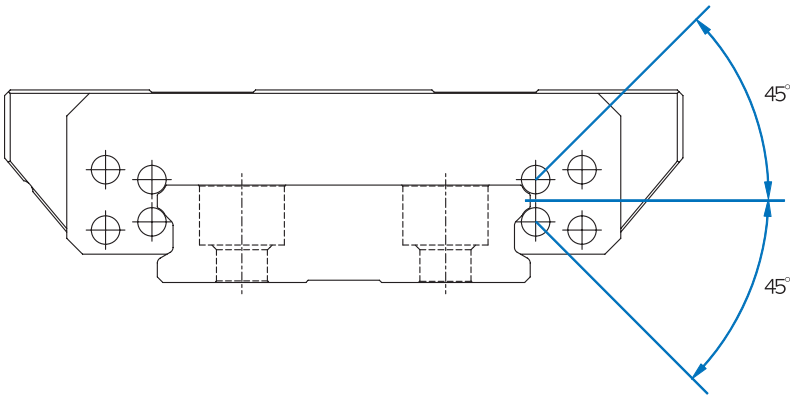
1N≒0.102kgf



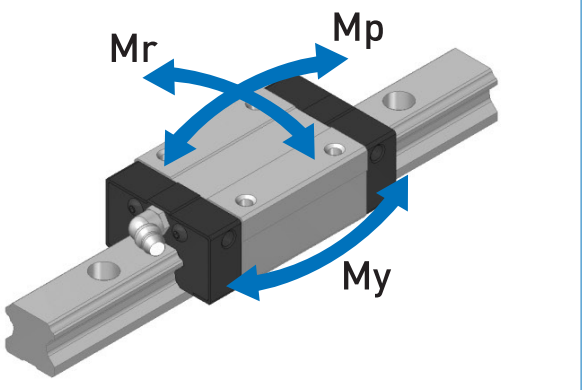
3. Wide Linear Motion Guide TWHW Series



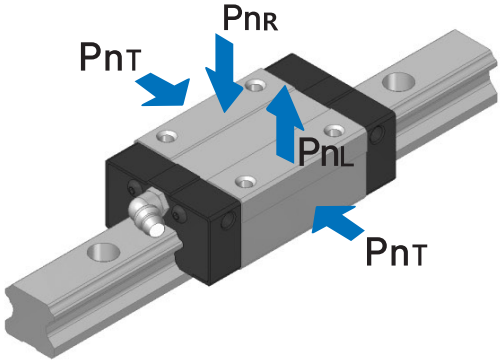
TWHW Series (Full-ball Type)



Cross Section

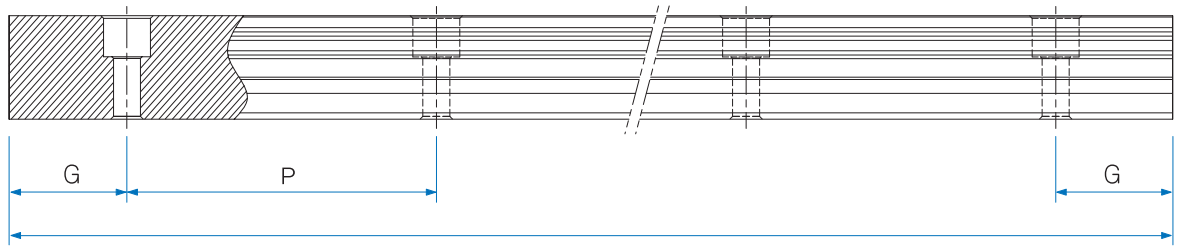


Moment Rigidity



Radial Rigidity

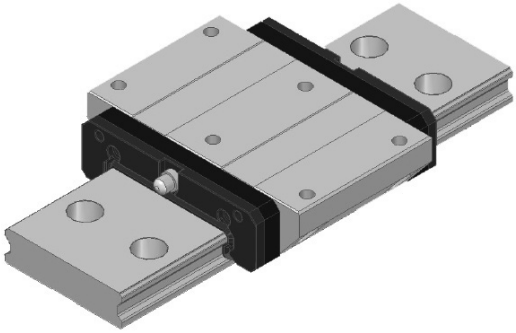
Standard and maximum length of a rail

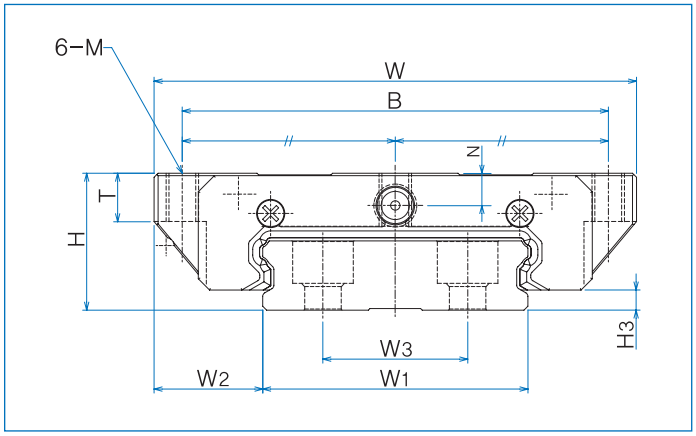


Unit : mm

Model No.	TWHW17	TWHW21	TWHW27	TWHW35
Standard length	110	130	160	280
	230	230	280	440
	350	380	340	680
	470	480	460	840
	550	580	520	1000
	630	630	640	1240
	⋮	780	700	1480
		⋮	820	1640
			⋮	1800
Standard pitch P	40	50	60	80
G	15	15	20	20
Max. length	2000		3000	

TWHW-F Series





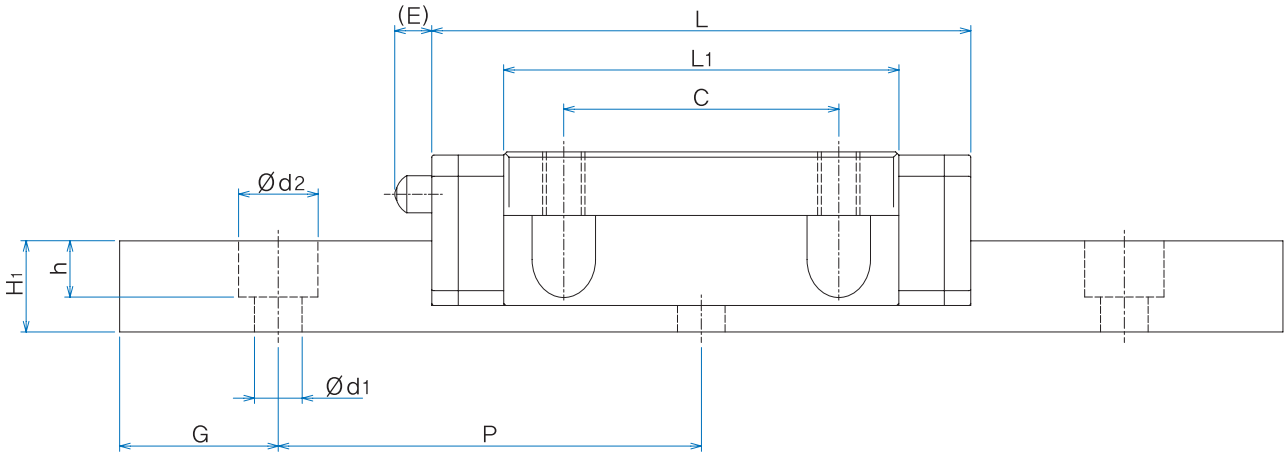
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M	L_1	T	N	E	Grease nipple	
TWHW17F	17	60	51	53	26	M4	37.4	6	4	3.5	A-Ø3	2.5
TWHW21F	21	68	59	60	29	M5	45.4	8	5	3.5	A-Ø3	3.3
TWHW27F	27	80	72.5	70	40	M6	54.7	10	6	10.3	B-M6F	3.5
TWHW35F	35	120	105.3	107	60	M8	82.1	14	7.6	10.3	B-M6F	4

Composition of Model No.

TWHW17		F	UU		G_2	—	1000L	20/30	P		T	Z	—	2
1	2	3	4	5	6		7	8	9	10	11	12		13

1. Model No. of Linear Motion Guide
2. Type of block : No symbol–Full-ball type
3. Form of block : F–Flange standard type / R–Rectangular standard type
4. Type of seal : UU–End seal / SS–End seal + Inside seal / ZZ–End seal + Inside seal + Metal scraper (*1)
5. Number of blocks combined in 1 rail
6. Symbol of clearance : No symbol–Normal preload / G1–Light preload / G2–Heavy preload / Gs–Special preload (*2)
7. Length of rail
8. Size of G value : standard G value has no symbol.
9. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
10. No symbol–Rail counter bore type (A topside assembly)
11. Connection symbol
12. Special symbol
13. Number of axis used on the same surface

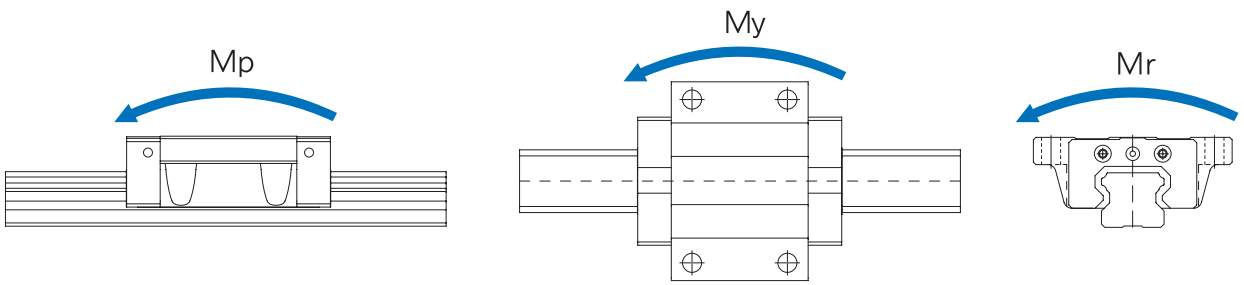
(*1) See P94/95 Symbol List of Optional Parts (*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class



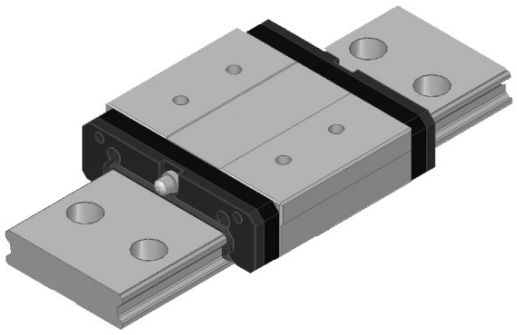
Unit : mm

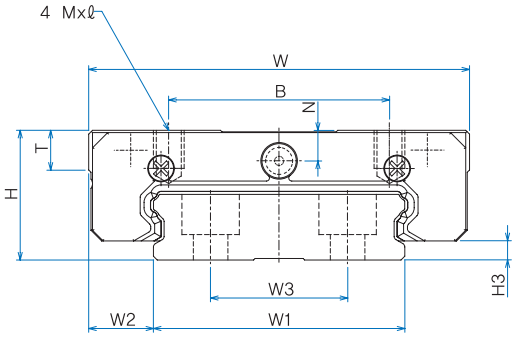
Dimensions of Rail							Basic load rating		Static allowance morment kN·m					Mass	
Width W1 ± 0.05	W2	W3	Heigh H1	Value G	Pitch P	d1xd2xh	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
									1	2(Contact)	1	2(Contact)	1		
33	13.5	18	8.6	15	40	4.5x7.5x5.3	7.3	12.2	0.081	0.381	0.081	0.381	0.205	0.15	1.9
37	15.5	22	11	15	50	4.5x7.5x5.3	8.4	14.8	0.119	0.547	0.119	0.547	0.278	0.24	2.9
42	19	24	15	20	60	4.5x7.5x5.3	15.3	24.8	0.239	1.114	0.239	1.114	0.527	0.47	4.5
69	25.5	40	19	20	80	7x11x9	33.9	53.2	0.773	3.528	0.773	3.528	1.851	1.40	9.6

1N≒0.102kgf

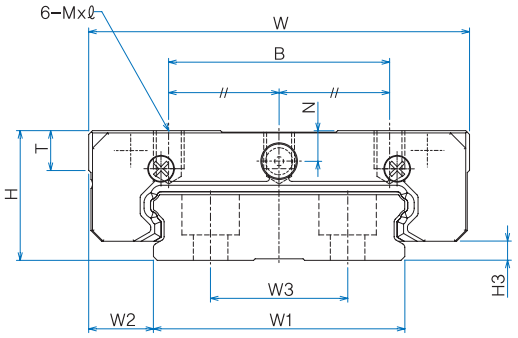


TWHW-R Series



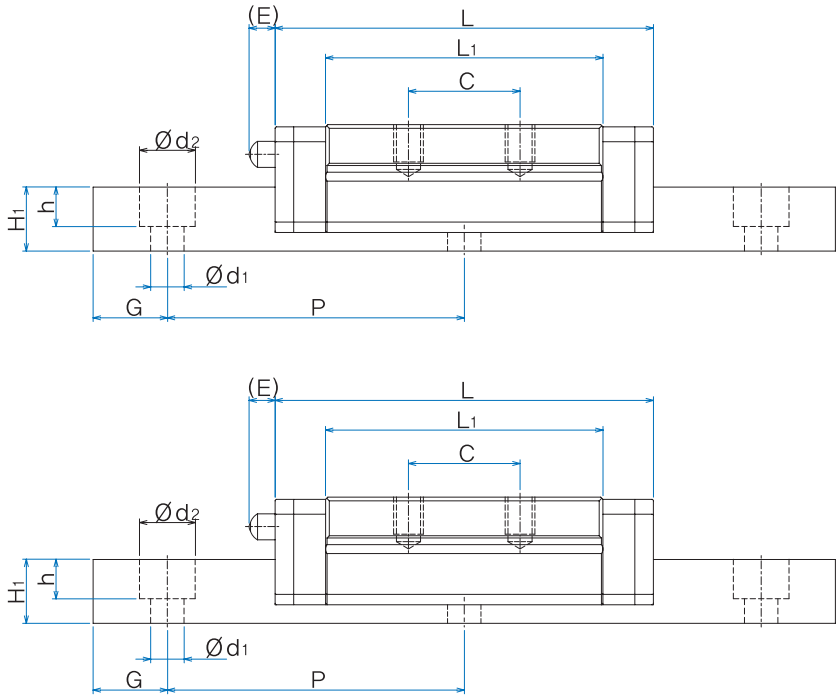


TW HW17R , TWHW21R



TWHW27R, TWHW35R

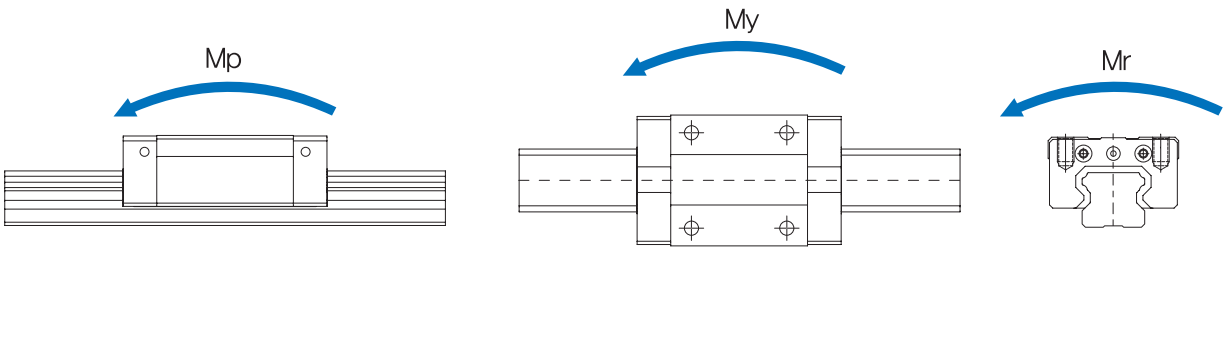
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M×ℓ	L_1	T	N	E	Grease nipple	
TWHW17R	17	50	51	29	15	M4 × 5	37.4	5.2	4	3.5	A-Ø3	2.5
TWHW21R	21	54	59	31	19	M5 × 6	45.4	8	5	3.5	A-Ø3	3.3
TWHW27R	27	62	72.5	46	32	M6 × 6	54.7	10	6	10.3	B-M6F	3.5
TWHW35R	35	100	105.3	76	50	M8 × 8	82.1	14	7.6	10.3	B-M6F	4



Unit : mm

Dimensions of Rail							Basic load rating		Static allowance morment kN·m					Mass	
Width W_1 ± 0.05	W_2	W_3	Height H_1	Value G	Pitch P	d1xd2xh	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
									1	2(Contact)	1	2(Contact)	1		
33	8.5	18	8.6	15	40	4.5x7.5x5.3	7.3	12.2	0.081	0.381	0.081	0.381	0.205	0.13	1.9
37	8.5	22	11	15	50	4.5x7.5x5.3	8.4	14.8	0.119	0.547	0.119	0.547	0.278	0.19	2.9
42	10	24	15	20	60	4.5x7.5x5.3	15.3	24.8	0.239	1.114	0.239	1.114	0.527	0.36	4.5
69	15.5	40	19	20	80	7x11x9	33.9	53.2	0.773	3.528	0.773	3.528	1.851	1.20	9.6

1N≒0.102kgf



4. SLIM LINEAR MOTION GUIDE TWS SERIES

1) Structure of TWS Series
Linear Motion Guide TWS Series has a four-row circular arc-groove structure and is a 4-direction equal load type. It also has an auto-adjusting face-to-face D/F structure. It uses balls as a rolling element and is a slim-type guide with a low sectional height as well as high rigidity and less noise.

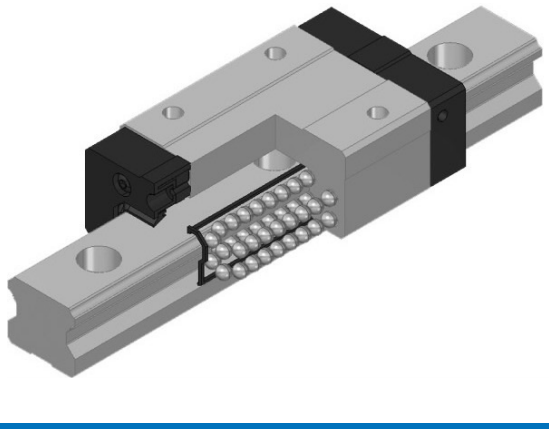
2) Features of TWS Series
a. High quality and very effective in realizing high precision and elimination of labor
b. High rigidity and high precision which can realize the stable travel for a long time
c. Great wear resistance and friction resistance which ensures a long life
d. Great auto-adjusting and error-absorbing abilities with the face-to-face duplex structure same to D/F combination of ball bearing
e. Various specifications for easy design
f. Easy to use due to great compatibility between a rail and a block
g. 4-direction equal load and high-rigidity structure
h. Slim shape suitable for horizontal motion to ensure stable running

5. SLIM SPACER CHAIN LINEAR MOTION GUIDE TWS-S SERIES

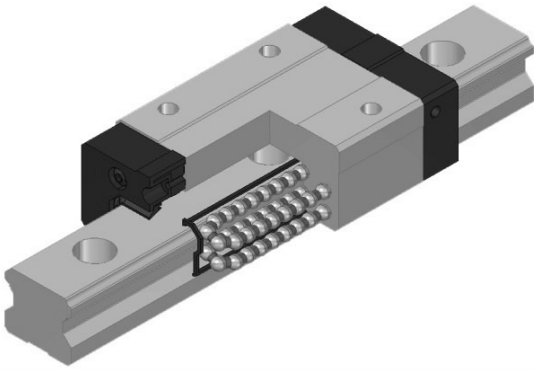
1) Structure of TWS Series
Linear Motion Guide TWS-S Series has a 4-direction equal load type which is identical to TWS Series and has an auto-adjusting face-to-face D/F structure.
It uses balls as a rolling element and combines a spacer between balls to prevent them from colliding each other during the rolling motion.
Therefore it makes less noise and more stable circulating motion than a full-ball type to realize quiet running even in high velocity movement and the spacer act as the pocket of lubricant to obtain longer life than TWH Series.

2) Features of TWS-S Series
a. As a spacer-incorporated type which improves frictional properties and prevents the collision of balls, it not only allows stable circulating motion and smooth running but also reduces noise. If special lubricating seal is attached to lengthen life, maintenance-free operations can be achieved.
b. Collision between balls and the loss of oil film are preveted by applying a resin spacer to improve life and generate less particles and dust.
c. High quality in realizing high precision and high velocity so it could create large effec on elimination of power loss.
d. High rigidity and high precision which can realize the stable travel for a long time
e. Great wear resistance and friction resistance which ensures a long life
f. Great auto-adjusting and error-absorbing abilities with the face-to-face duplex structure same to D/F combi nation of ball bearing
g. Various specifications for easy design
h. Easy to use due to great compatibility between a rail and a block

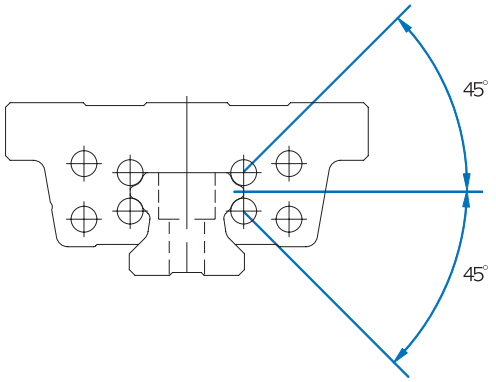
Slim Linear Motion Guide TWS, TWS-S Series



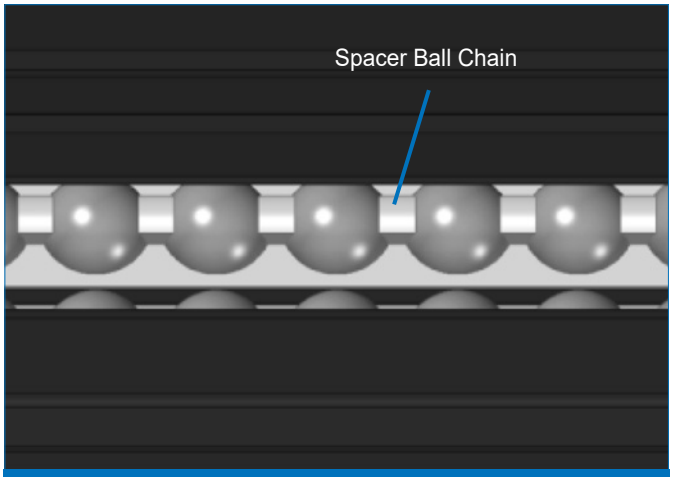
TWS Series (Full-ball Type)



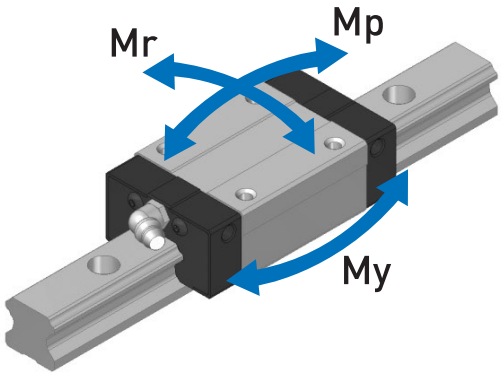
TWS-S Series (Spacer Chain Type)



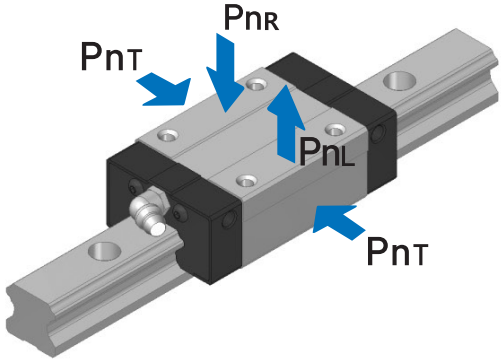
Cross Section



Detail of Raceway of TWS-S Series

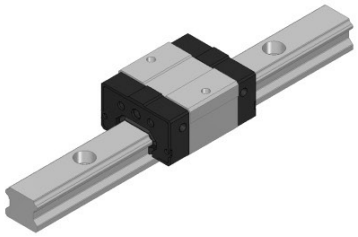
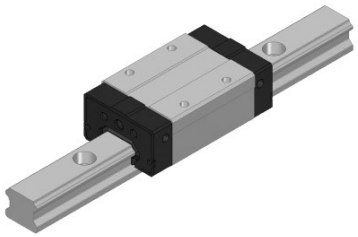
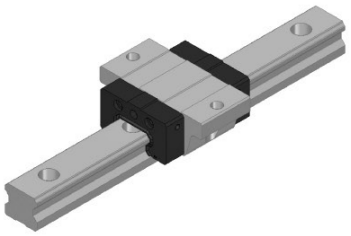
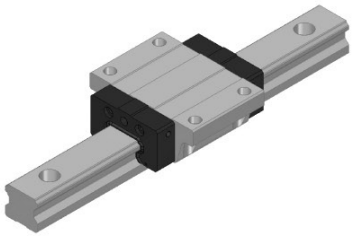


Moment Rigidity

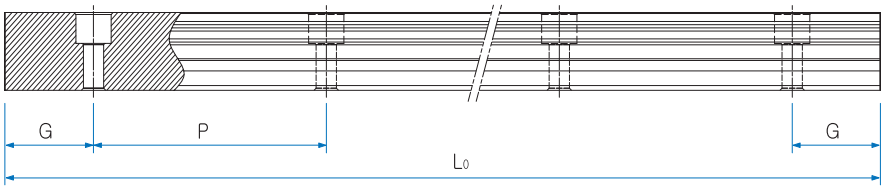


Radial Rigidity

Types and Features

Category	Type	Shape & Features		
Compact type	TWS-C TWS-SC		- With the tapped flange of a block, a slim compact that the width and length of Linear Motion guide block is minimized - A 4-direction equal load type with 45° contact angle S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer chain is applied.	Cartesian coordinated robot, linear actuator, automation system, semiconductor/display manufacturing system, LED inspection equipment, dispenser equipment, medical Equipment, high-speed transport system, woodworking machine, take-out robots, small machine tool, laser processor, precision measurement equipment
	TWS-R TWS-SR		- Having the cross section identical to that of TWS-C Series, a slim compact type that the width and length of Linear Motion guide block is minimized - A 4-direction equal load type with 45° contact angle S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer chain is applied.	
Flange type	TWS-CF TWS-SCF		- With the tapped flange of a block, a slim compact type that the width and length of Linear Motion guide block is minimized - A 4-direction equal load type with 45° contact angle S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer chain is applied.	
	TWS-F TWS-SF		- Having the cross section identical to that of TWS-CF Series, a slim compact type that the width and length of Linear Motion guide block is minimized - A 4-direction equal load type with 45° contact angle S Series is a low-noise low-dust raise type with improved life due to zero friction between balls since a spacer chain is applied.	

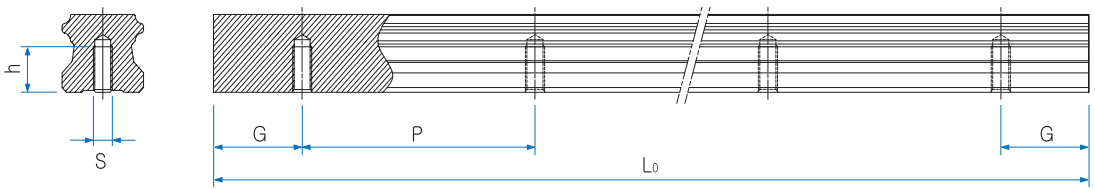
Standard and maximum length of a rail



Unit : mm

Model No.	TWS15	TWS20	TWS25
Standard length	160	160	220
	220	220	280
	280	280	340
	⋮	340	400
	1360	⋮	460
	1480	1960	⋮
	1600	2080	2200
		2200	2320
			2440
Standard pitch P	60	60	60
G	20	20	20
Max. length	4000		

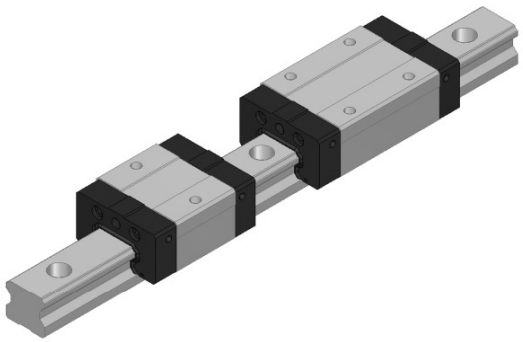
Standard tap hole type of a rail

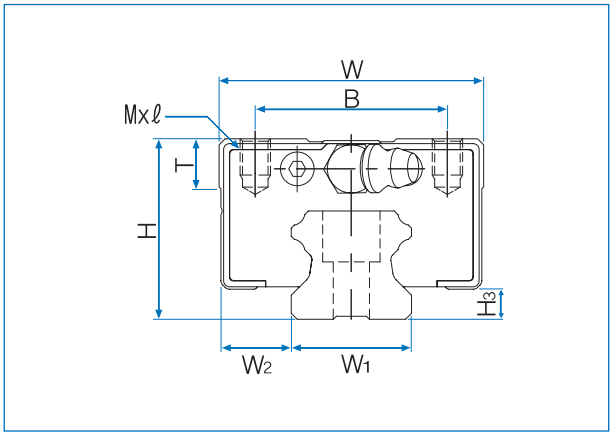


Unit : mm

Model No.	S	h(mm)
TWS15	M5	8
TWS20	M6	10
TWS25	M6	12

TWS-C Series, TWS-R Series





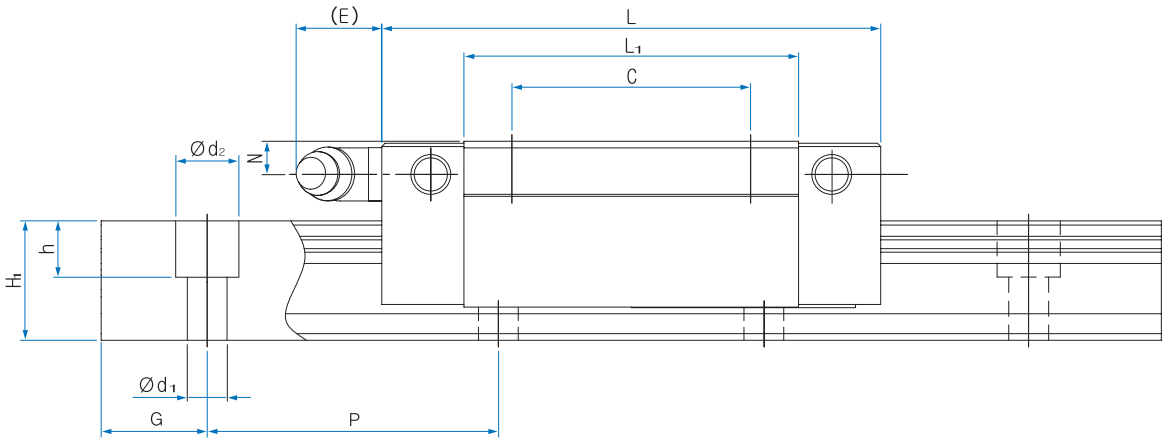
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M×ℓ	L_1	T	N	E	Grease nipple	
TWS 15C	24	34	40.2	26	–	M4×6	24	6	6	6	A–M4	4.5
TWS 15R			56.9		26		40.7					
TWS 20C	28	42	47.2	32	–	M5×7	27.6	7.5	5.5	12	B–M6F	6
TWS 20R			66.3		32		46.7					
TWS 25C	33	48	59.1	35	–	M6×9	34.4	8	6	12	B–M6F	7
TWS 25R			83		35		58.2					

Composition of Model No.

TWS15 [1] [2] F [3] UU [4] [5] G_2 [6] — 1000L [7] 20/30 [8] P [9] [10] T [11] Z [12] — 2 [13]

1. Model No. of Linear Motion Guide
2. Type of block : No symbol–Full-ball type
3. Form of block : F–Flange standard type / R–Rectangular standard type
4. Type of seal : UU–End seal / SS–End seal + Inside seal / ZZ–End seal + Inside seal + Metal scraper (*1)
5. Number of blocks combined in 1 rail
6. Symbol of clearance : No symbol–Normal preload / G1–Light preload / G2–Heavy preload / Gs–Special preload (*2)
7. Length of rail
8. Size of G value : standard G value has no symbol.
9. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
10. No symbol–Rail counter bore type (A topside assembly) / A-Rail tap hole type (an underside assembly) (*4)
11. Connection symbol
12. Special symbol
13. Number of axis used on the same surface

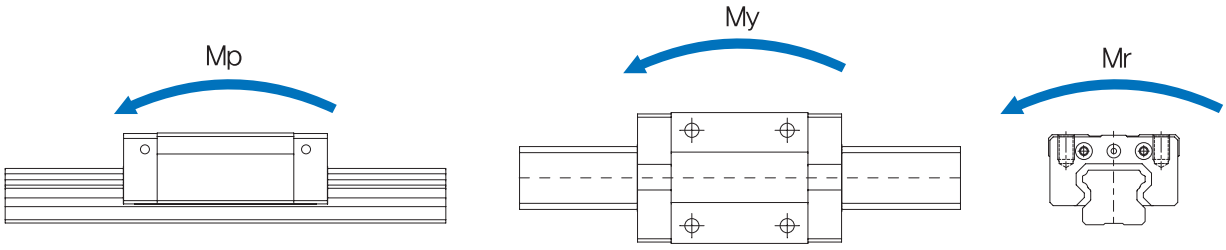
(*1) See P94/95 Symbol List of Optional Parts (*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class (*4) See P67 The reference for standard tap hole type of a rail



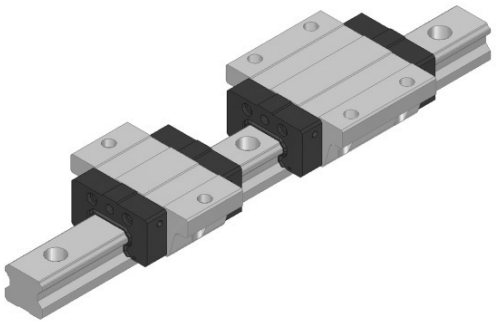
Unit : mm

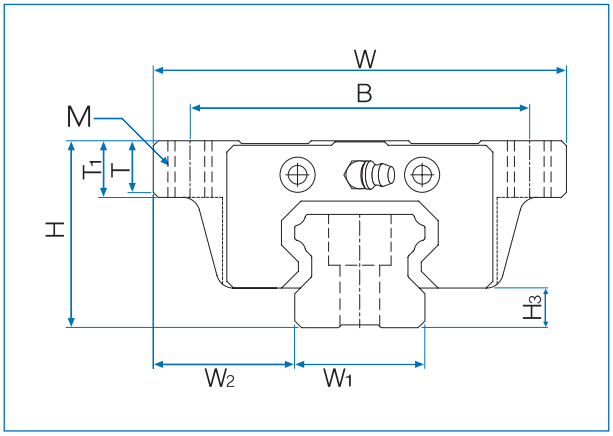
Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W1 ± 0.05	W2	Heigh H1	Value G	Pitch P	d1xd2xh	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
15	9.5	13	20	60	4.5×7.5×5.3	9.0	10.0	0.042	0.224	0.042	0.224	0.079	0.096	1.3
						12.6	16.2	0.115	0.552	0.115	0.552	0.129	0.156	
20	11	16.5	20	60	6×9.5×8.5	12.0	13.1	0.063	0.342	0.063	0.342	0.137	0.153	2.2
						16.8	21.2	0.173	0.838	0.173	0.838	0.223	0.246	
23	12.5	20	20	60	7×11×9	19.2	20.4	0.123	0.670	0.123	0.670	0.246	0.254	3.0
						27.0	33.1	0.337	1.636	0.337	1.636	0.393	0.413	

1N≒0.102kgf



TWS-CF Series, TWS-F Series





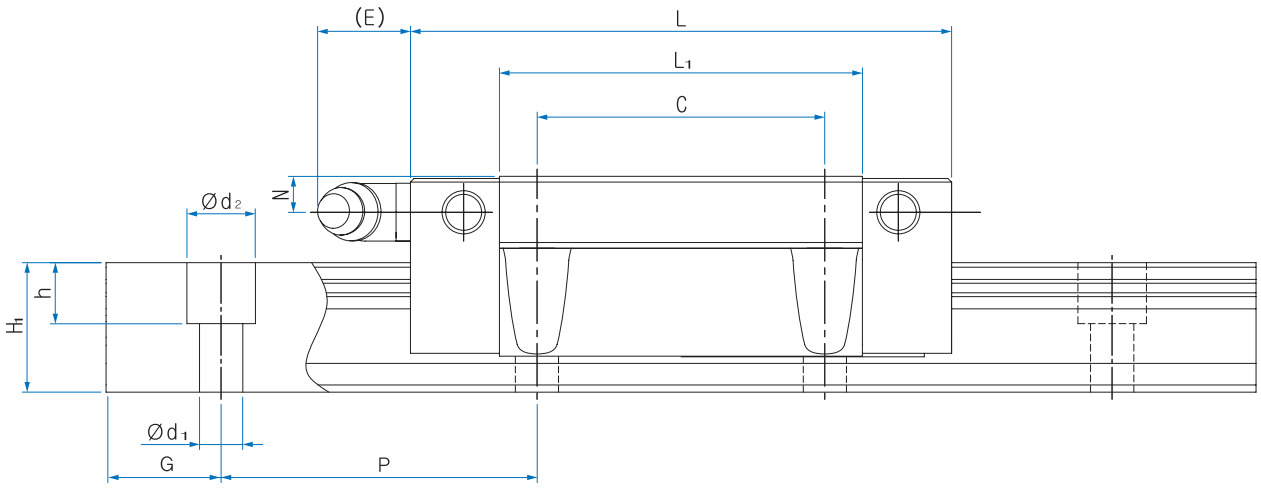
Model No.	External dimensions			Dimensions of block									H_3
	Height H	Width W	Length L	B	C	M	L_1	T	T_1	N	E	Grease nipple	
TWS 15SCF	24	52	40.2	41	-	M5	24	6	7	6	6	A-M4	4.5
TWS 15SF			56.9		26		40.7						
TWS 20SCF	28	59	47.2	49	-	M6	27.6	8	9	5.5	12	B-M6F	6
TWS 20SF			66.3		32		46.7						
TWS 25SCF	33	73	59.1	60	-	M8	34.4	9	10	6	12	B-M6F	7
TWS 25SF			83		35		58.3						

Composition of Model No.

TWS25	M	S	F	SS	2	G_2	I	–	1000L	M	20/40	P	A	T	Z	–	2
1	2	3	4	5	6	7	8		9	10	11	12	13	14	15		16

1. Model No. of Linear Motion Guide
2. Material of block : No symbol – Carbon steel / M – Stainless steel
3. Type of block : No symbol–Full-ball type / S–Spacer Chain type
4. Form of block : C–Rectangular short type / R–Rectangular standard type / CF–Flange short type / F–Flange standard type
5. Type of seal : UU–End seal / SS–End seal+Inside seal / ZZ–End seal+Inside seal+metal scraper
   UULF-End seal+LF seal / SSLF- End seal+Inside seal+LF seal / ZZLF - End seal + Inside seal + metal scraper + LF seal (*1)
6. Number of blocks combined in 1 rail
7. Symbol of clearance : No symbol–Normal preload / G_1–Light preload / G_2–Heavy preload / G_S–Special preload (*2)
8. Material of end plate : No symbol – Synthetic resin / I – Stainless steel / N – Aluminum
9. Length of rail
10. Material of rail : No symbol – Carbon steel / M – Stainless steel
11. Size of G value : standard G value has no symbol
12. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
13. No symbol–Rail counter bore type (A topside assembly) / A– Rail tap hole type (an underside assembly) (*4)
14. Connection symbol
15. Special symbol
16. Number of axis used on the same surface

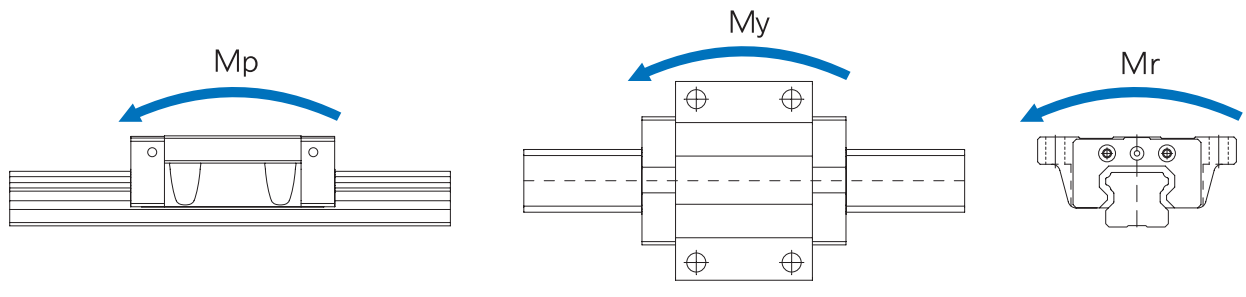
(*1) See P94/95 Symbol List of Optional Parts (*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class (*4) See P69 The reference for standard tap hole type of a rail



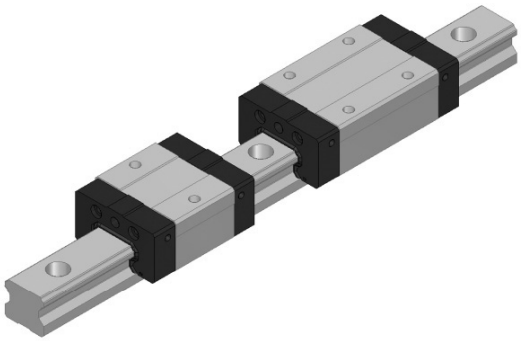
Unit : mm

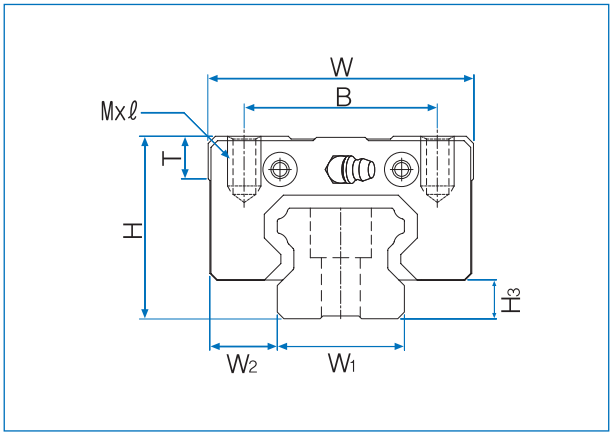
Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W1 ± 0.05	W2	Heigh H1	Value G	Pitch P	d1×d2×h	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
15	18.5	13	20	60	4.5×7.5×5.3	9.0	10.0	0.042	0.224	0.042	0.224	0.079	0.125	1.3
						12.6	16.2	0.115	0.552	0.115	0.552	0.129	0.203	
20	19.5	16.5	20	60	6×9.5×8.5	12.0	13.1	0.063	0.342	0.063	0.342	0.137	0.187	2.2
						16.8	21.2	0.173	0.838	0.173	0.838	0.223	0.301	
23	25	20	20	60	7×11×9	19.2	20.4	0.123	0.670	0.123	0.670	0.246	0.320	3.0
						27.0	33.1	0.337	1.636	0.337	1.636	0.398	0.527	

1N≒0.102kgf



TWS-SC Series, TWS-SR Series





Model No.	External dimensions			Dimensions of block								H3
	Height H	Width W	Length L	B	C	M X ℓ	L1	T	N	E	Grease nipple	
TWS 15SC	24	34	40.2	26	-	M4 x 6	24	6	6	6	A-M4	4.5
TWS 15SR			56.9		26		40.7					
TWS 20SC	28	42	47.2	32	-	M5 x 7	27.6	7.5	5.5	12	B-M6F	6
TWS 20SR			66.3		32		46.7					
TWS 25SC	33	48	59.1	35	-	M6 x 9	34.4	8	6	12	B-M6F	7
TWS 25SR			83		35		58.3					

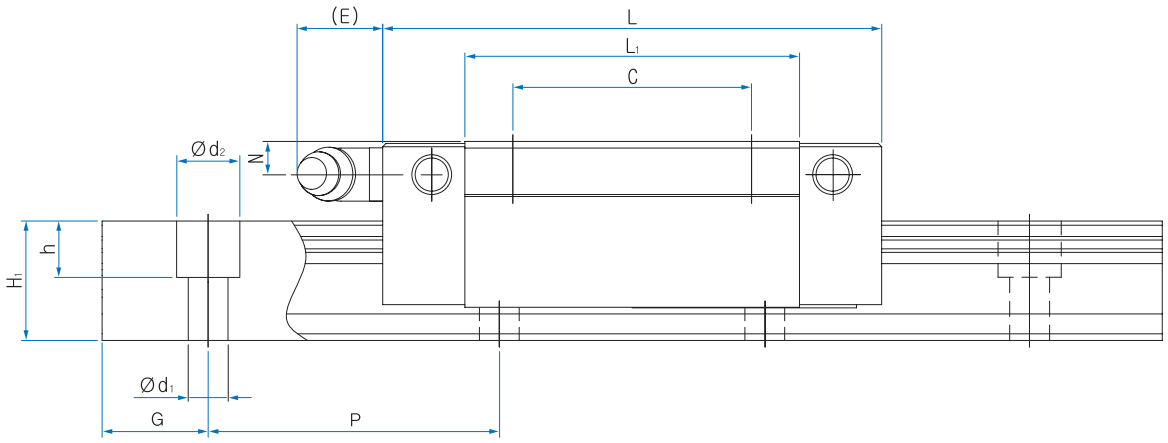
Composition of Model No.

TWS25		S	R	SS	2	G2		–	1000L		20/40	P	A	T	Z	–	2
1	2	3	4	5	6	7	8		9	10	11	12	13	14	15		16

1. Model No. of Linear Motion Guide
2. Material of block : No symbol – Carbon steel / M – Stainless steel
3. Type of block : No symbol–Full-ball type / S–Spacer Chain type
4. Form of block : C–Rectangular short type / R–Rectangular standard type / CF–Flange short type / F–Flange standard type
5. Type of seal : UU–End seal / SS–End seal+Inside seal / ZZ–End seal+Inside seal+metal scraper
   UULF-End seal+LF seal / SSLF- End seal+Inside seal+LF seal / ZZLF - End seal + Inside seal + metal scraper + LF seal (*1)
6. Number of blocks combined in 1 rail
7. Symbol of clearance : No symbol–Normal preload / G1–Light preload / G2–Heavy preload / GS–Special preload (*2)
8. Material of end plate : No symbol – Synthetic resin / I – Stainless steel / N – Aluminum
9. Length of rail
10. Material of rail : No symbol – Carbon steel / M – Stainless steel
11. Size of G value : standard G value has no symbol
12. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
13. No symbol–Rail counter bore type (A topside assembly) / A– Rail tap hole type (an underside assembly) (*4)
14. Connection symbol
15. Special symbol
16. Number of axis used on the same surface

(*1) See P94/95 Symbol List of Optional Parts (*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class (*4) See P69 The reference for standard tap hole type of a rail

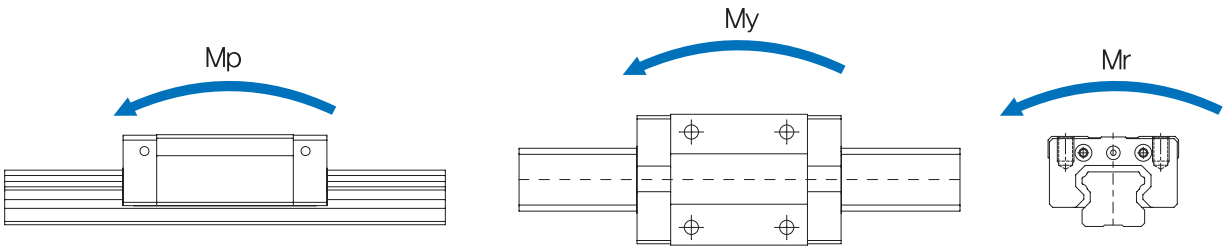
Tretter AG // Schaffhauserstrasse 96 // CH-8222 Beringen // Tel. +41 52 670 06 10 // info@tretter.ch // www.tretter.ch



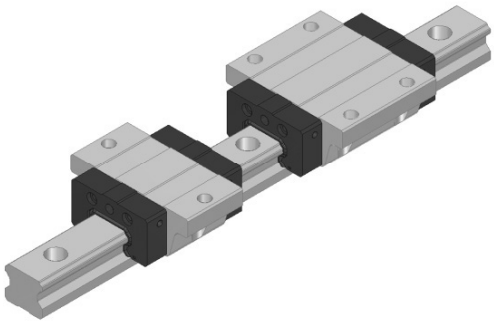
Unit : mm

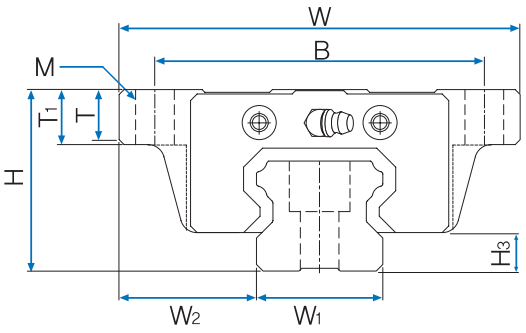
Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
								Mp		My		Mr		
Width W1 ±0.05	W2	Heigh H1	Value G	Pitch P	d1xd2xh	C kN	Co kN	1	2(Contact)	1	2(Contact)	1	Block kg	Rail kg/m
15	9.5	13	20	60	4.5x7.5x5.3	8.3	10	0.042	0.224	0.042	0.224	0.079	0.096	1.3
						12.1	16.2	0.115	0.552	0.115	0.552	0.129	0.156	
20	11	16.5	20	60	6x9.5x8.5	11.1	13.1	0.063	0.342	0.063	0.342	0.137	0.153	2.2
						16.1	21.2	0.173	0.838	0.173	0.838	0.223	0.246	
23	12.5	20	20	60	7x11x9	17.9	20.4	0.123	0.670	0.123	0.670	0.246	0.254	3.0
						25.8	33.1	0.337	1.636	0.337	1.636	0.398	0.413	

1N≒0.102kgf

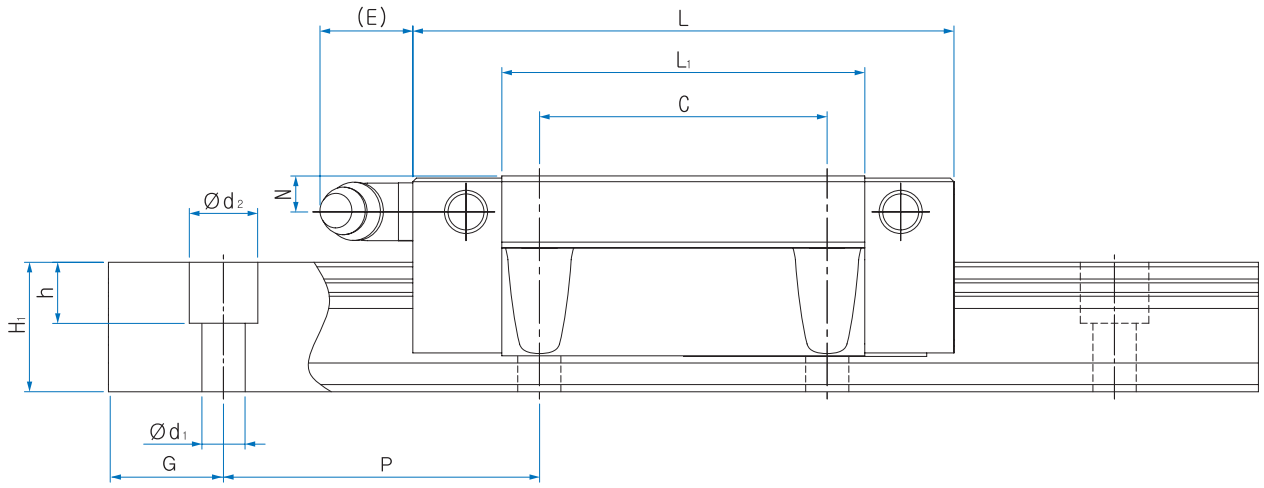


TWS-SCF Series, TWS-SF Series





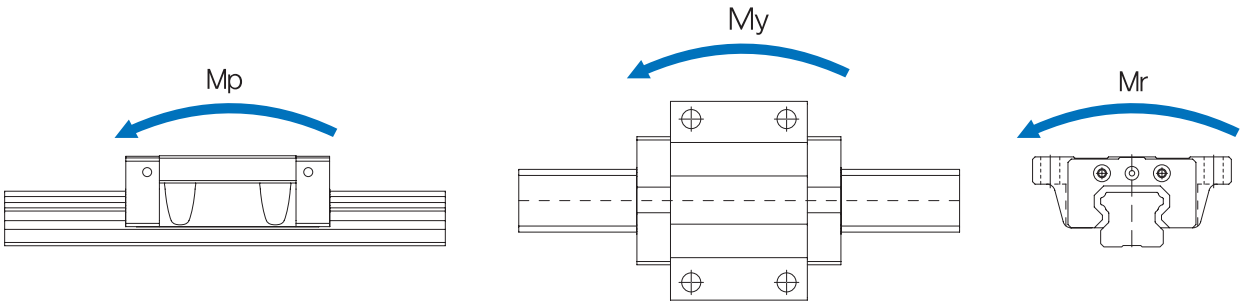
Model No.	External dimensions			Dimensions of block									H_3
	Height H	Width W	Length L	B	C	M	L_1	T	T_1	N	E	Grease nipple	
TWS 15SCF	24	52	40.2	41	-	M5	24	6	7	6	6	A-M4	4.5
TWS 15SF			56.9		26		40.7						
TWS 20SCF	28	59	47.2	49	-	M6	27.6	8	9	5.5	12	B-M6F	6
TWS 20SF			66.3		32		46.7						
TWS 25SCF	33	73	59.1	60	-	M8	34.4	9	10	6	12	B-M6F	7
TWS 25SF			83		35		58.3						



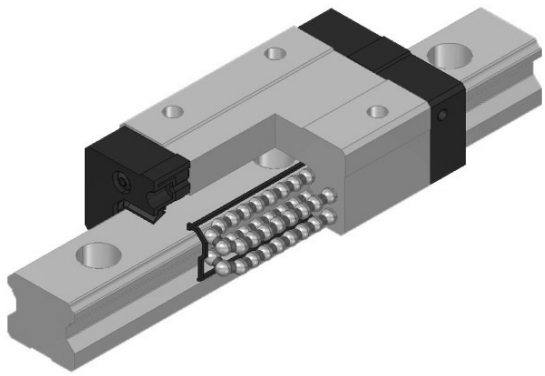
Unit : mm

Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W_1 ±0.05	W_2	Heigh H_1	Value G	Pitch P	$d_1 x d_2 x h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
15	9.5	13	20	60	4.5x7.5x5.3	8.3	10	0.042	0.224	0.042	0.224	0.079	0.125	1.3
						12.1	16.2	0.115	0.552	0.115	0.552	0.129	0.203	
20	11	16.5	20	60	6x9.5x8.5	11.1	13.1	0.063	0.342	0.063	0.342	0.137	0.187	2.2
						16.1	21.2	0.173	0.838	0.173	0.838	0.223	0.301	
23	12.5	20	20	60	7x11x9	17.9	20.4	0.123	0.670	0.123	0.670	0.246	0.320	3.0
						25.8	33.1	0.337	1.636	0.337	1.636	0.398	0.527	

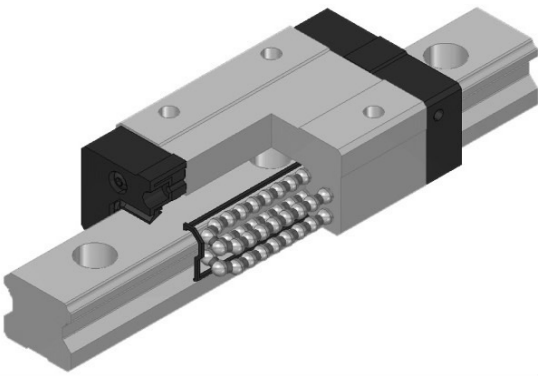
1N≒0.102kgf



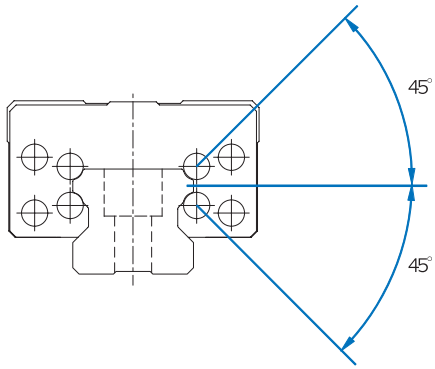
6. Slim Linear Motion Guide TWHS, TWHS-S Series



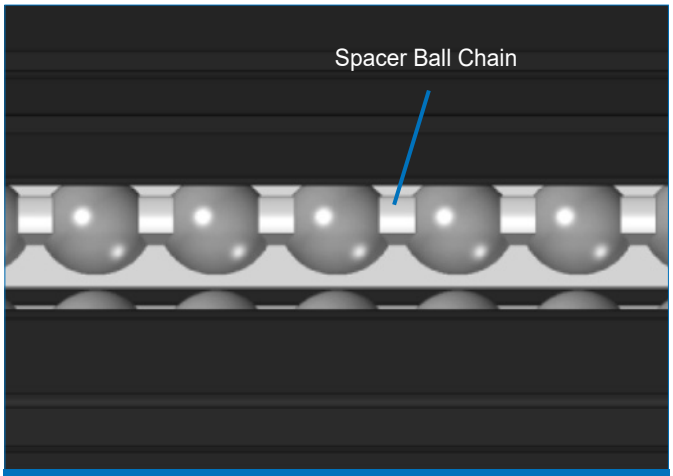
TWHS Series (Full-ball Type)



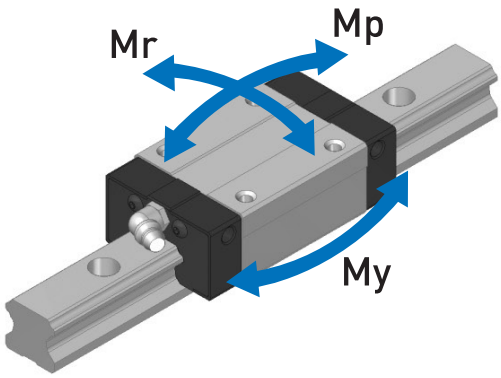
TWHS-S Series (Spacer Chain Type)



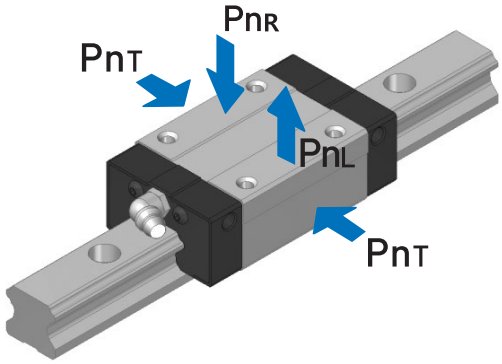
Cross Section



Detail of Raceway of TWHS-S Series

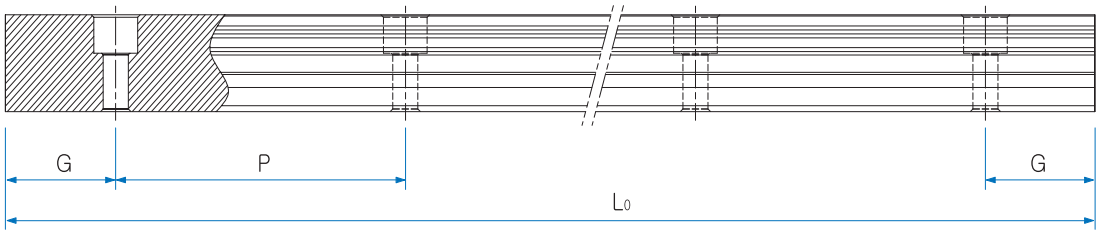


Moment Rigidity



Radial Rigidity

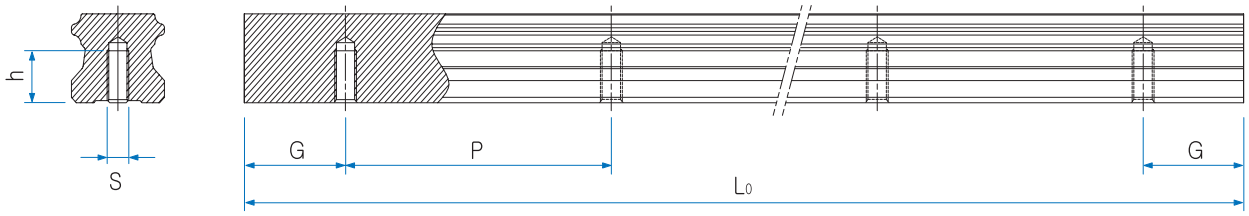
Standard and maximum length of a rail



Unit : mm

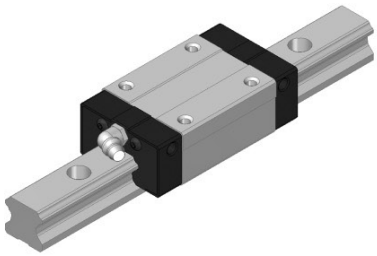
Model No.	TWHS25	TWHS30	TWHS35
Standard length	220	280	440
	340	360	520
	400	440	600
	⋮	520	760
	2200	⋮	840
	2320	2520	⋮
	2440	2680	2840
		2840	2920
			3000
Standard pitch P	60	80	80
G	20	20	20
Max. length	4000		

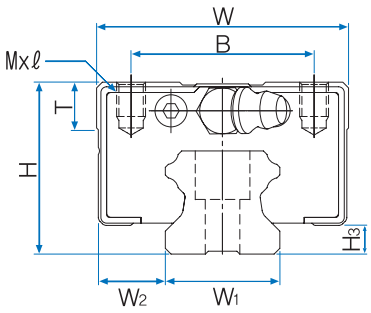
Standard tap hole type of a rail



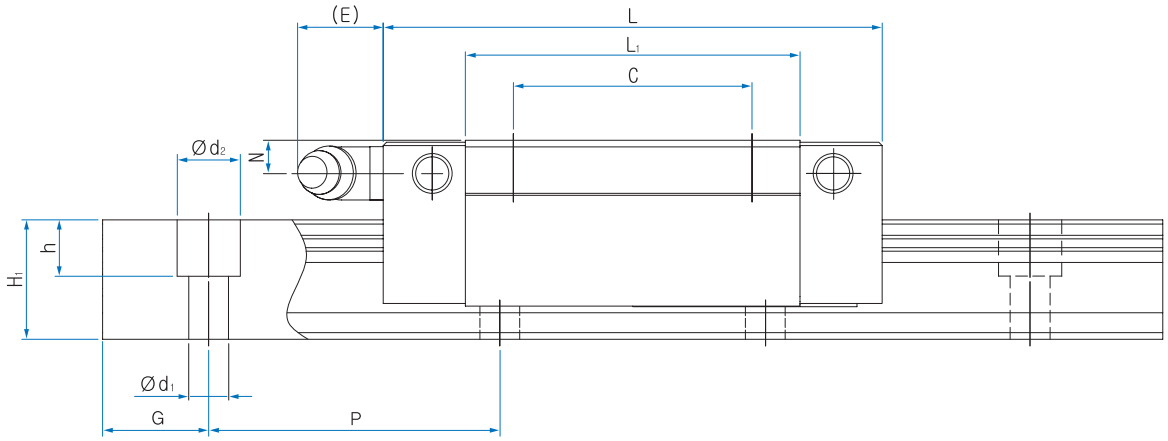
Model No.	S	h(mm)
TWHS25	M6	12
TWHS30	M8	15
TWHS35	M8	17

TWHS-R Series, TWHS-RL Series





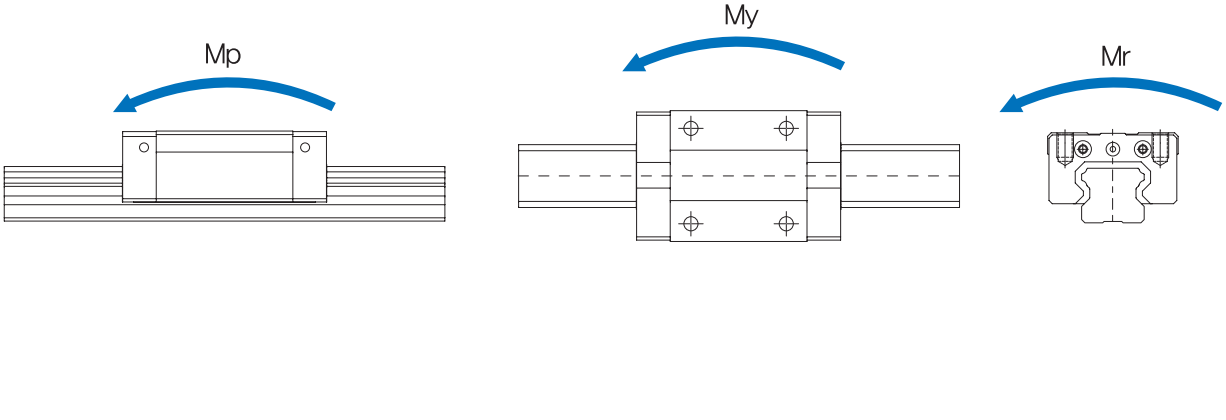
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M X ℓ	L_1	T	N	E	Grease nipple	
TWHS 25R	36	48	83	35	35	M6x6.5	58.3	8	9	12	B-M6F	7
TWHS 25RL			102.9		50		78.2					
TWHS 30R	42	60	97.8	40	40	M8x8	70.8	8	8.2	12	B-M6F	7
TWHS 30RL			120		60		93					
TWHS 35R	48	70	110	50	50	M8x10	80.8	15	10	12	B-M6F	7.5
TWHS 35RL			135.4		72		106.2					



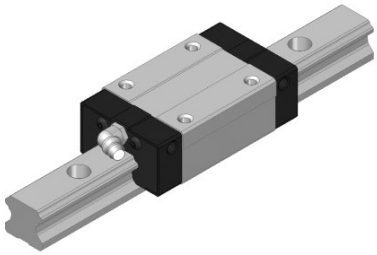
Unit : mm

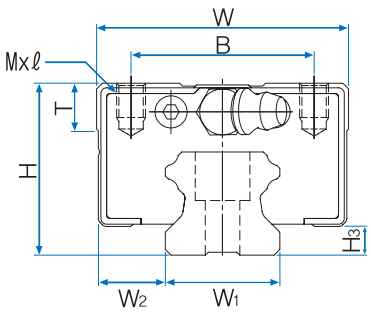
Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W_1 ±0.05	W_2	Heigh H_1	Value G	Pitch P	$d_1 x d_2 x h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
23	12.5	20	20	60	7x11x9	27.0	33.1	0.337	1.636	0.337	1.636	0.398	0.53	3.0
						32.8	43.6	0.596	2.760	0.596	2.760	0.525	0.71	
28	16	25.1	20	80	9x14x14.1	50.4	57.1	0.711	3.384	0.711	3.384	0.828	0.9	4.85
						60.3	73.6	1.203	5.506	1.203	5.506	1.067	1.1	
34	18	27	20	80	9x14x13	67.0	74.6	1.062	5.012	1.062	5.012	1.298	1.5	6.58
						80.2	96.2	1.797	8.172	1.797	8.172	1.674	2.01	

1N≒0.102kgf

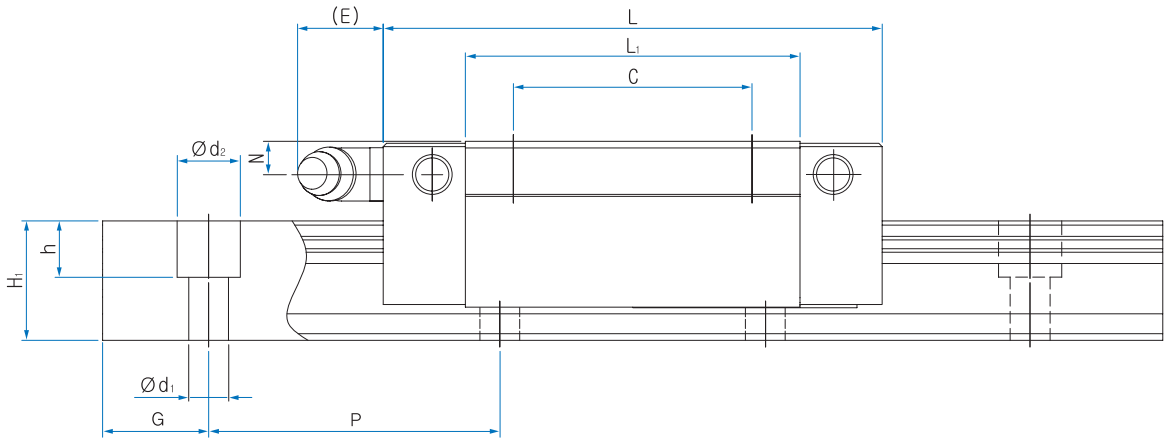


TWHS-SR Series, TWHS-SRL Series





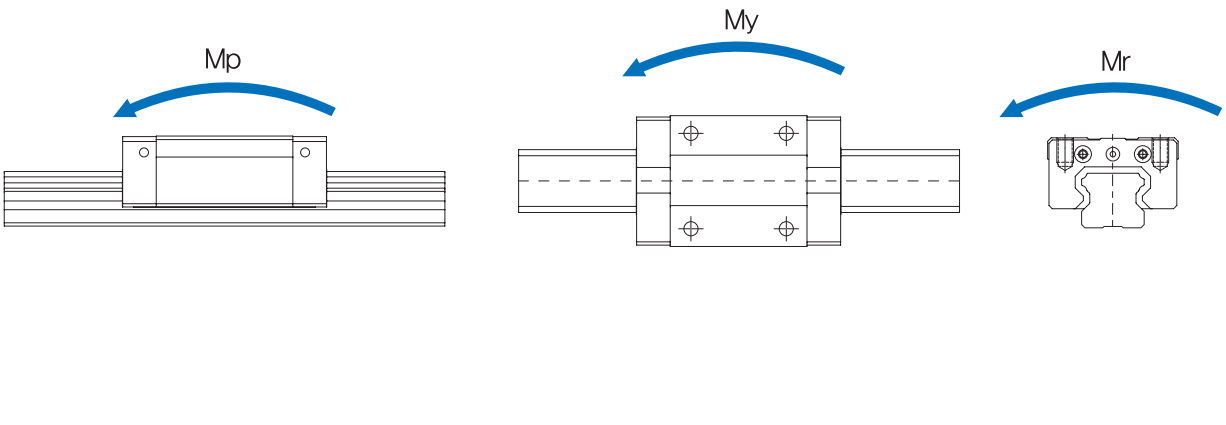
Model No.	External dimensions			Dimensions of block								H_3
	Height H	Width W	Length L	B	C	M X ℓ	L_1	T	N	E	Grease nipple	
TWHS 25SR	36	48	83	35	35	M6x6.5	58.3	8	9	12	B-M6F	7
TWHS 25SRL			102.9		50		78.2					
TWHS 30SR	42	60	97.8	40	40	M8x8	70.8	8	8.2	12	B-M6F	7
TWHS 30SRL			120		60		93					
TWHS 35SR	48	70	110	50	50	M8x10	80.8	15	10	12	B-M6F	7.5
TWHS 35SRL			135.4		72		106.2					
TWHS 45SR	60	86	138.5	60	60	M10x15	106	15	10.5	13	B-PT1/8	10
TWHS 45SRL			170.2		80		137.8					
TWHS 55SR	70	100	171	75	75	M12x15	132.6	20	11	13	B-PT1/8	13
TWHS 55SRL			210.6		95		172.2					



Unit : mm

Dimensions of Rail						Basic load rating		Static allowance morment kN·m					Mass	
Width W_1 ±0.05	W_2	Heigh H_1	Value G	Pitch P	$d_1 x d_2 x h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(Contact)	1	2(Contact)	1		
23	12.5	20	20	60	7x11x9	25.8	33.1	0.337	1.636	0.337	1.636	0.398	0.53	3.0
						31.7	43.6	0.596	2.760	0.596	2.760	0.525	0.71	
28	16	25.1	20	80	9x14x14.1	48.0	57.1	0.711	3.384	0.711	3.384	0.828	0.9	4.85
						58.0	73.6	1.203	5.506	1.203	5.506	1.067	1.1	
34	18	27	20	80	9x14x13	63.7	74.6	1.062	5.012	1.062	5.012	1.298	1.5	6.58
						77.1	96.2	1.797	8.172	1.797	8.172	1.674	2.01	
45	20.5	32	22.5	105	14x20x17	82.9	95.5	1.789	8.251	1.789	8.251	1.992	2.49	9.75
						99.7	122.5	2.984	13.341	2.984	13.341	2.556	3.18	
53	23.5	38	30	120	16x23x20	133.5	149.2	3.495	16.007	3.495	16.007	3.608	4.15	13.75
						160.4	191.4	5.826	25.899	5.826	25.899	4.627	5.29	

1N≒0.102kgf



7. ROLLER LINEAR MOTION GUIDE TWR SERIES

1) Structure of TWR Series

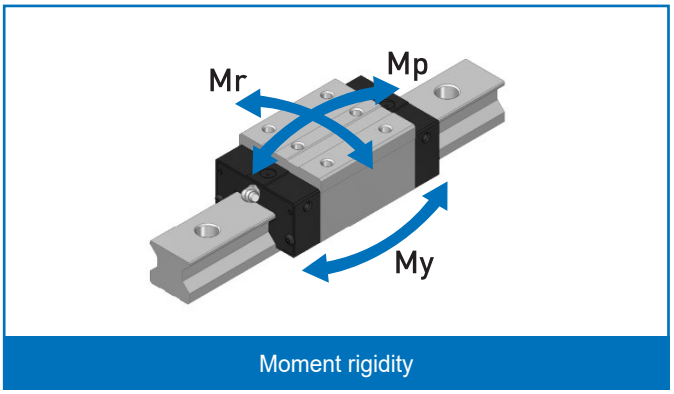
Tretter Linear Motion Guide TWR Series uses rollers as a rolling element between the raceway surface of a rail and a block and its four-row cylindrical roller forms a contact angle of 45° which bears equal load for vertical tensile compression load and horizontal load.

A roller used as a rolling element has less elastic displacement than a ball so it has small displacement for external load. Also the contact area with the roller is wide so that it has advantages such as high rigidity, bearing against big load, long life, impact resistance and wear resistance as well as less friction resistance that supports smooth motion and quite running.

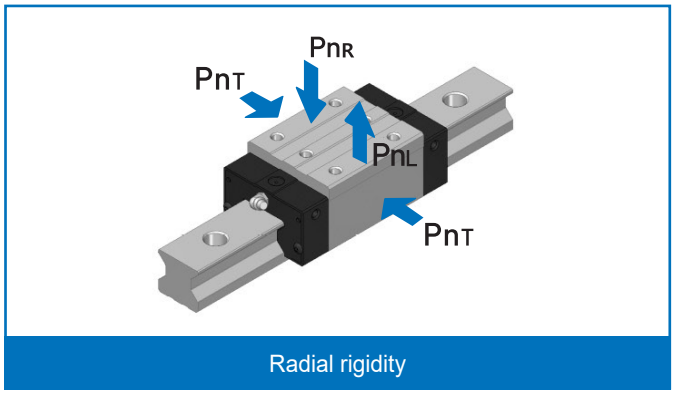
Moreover if the roller is preloaded, it can enhance the rigidity of Linear Motion guide.

2) Features of TWR Series

a. High quality and very effective in realizing high precision and elimination of labor
b. High rigidity and high precision which can realize the stable travel for a long time
c. Great wear resistance and friction resistance which ensures a long life
d. High rigidity and overload capacity compared to ball types of the same model no.
e. Excellent vibration resistance since it has less displacement against impact load or variable load than ball types and vibration decay time is shorter compared to natural frequency.
f. Bigger basic static load rating than ball-type Linear Motion guide with the same specifications allows the compact design using smaller model no. than ball types. If same model no. is used, it achieves longer life due to bigger load rating.
g. Various specification for easy design

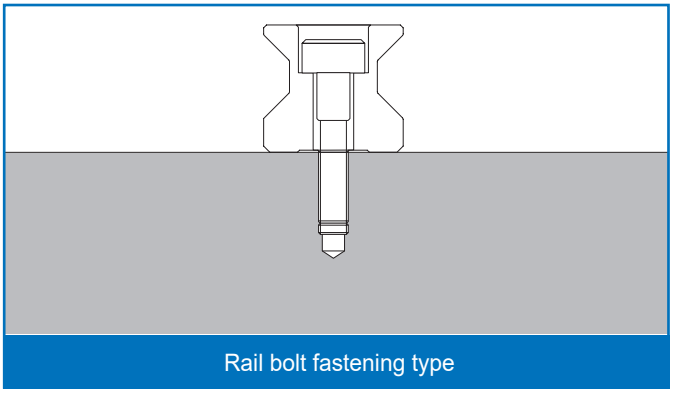


Moment rigidity

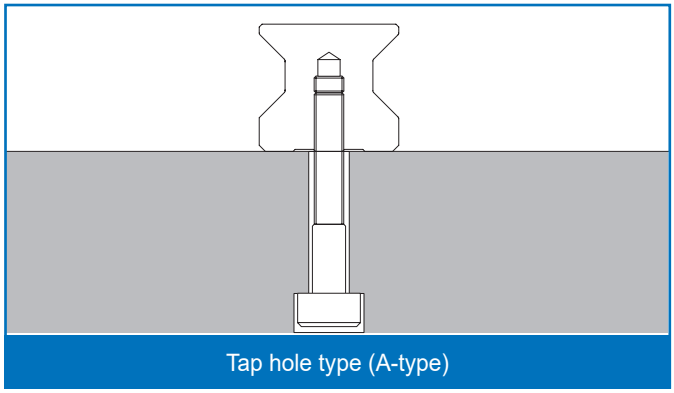


Radial rigidity

Rail bolt fastening type

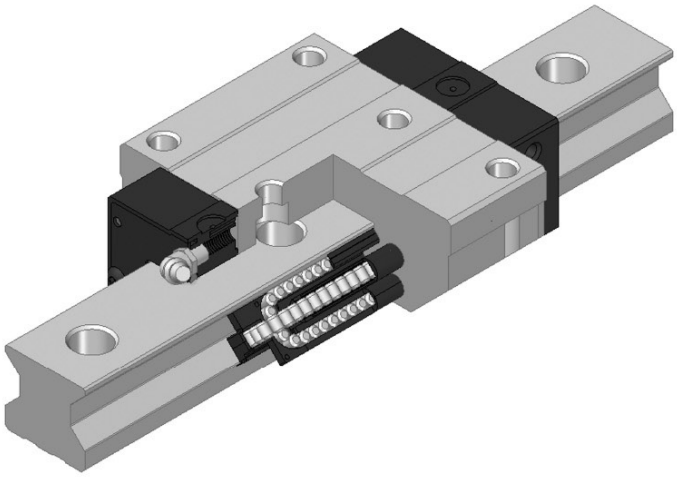


Rail bolt fastening type

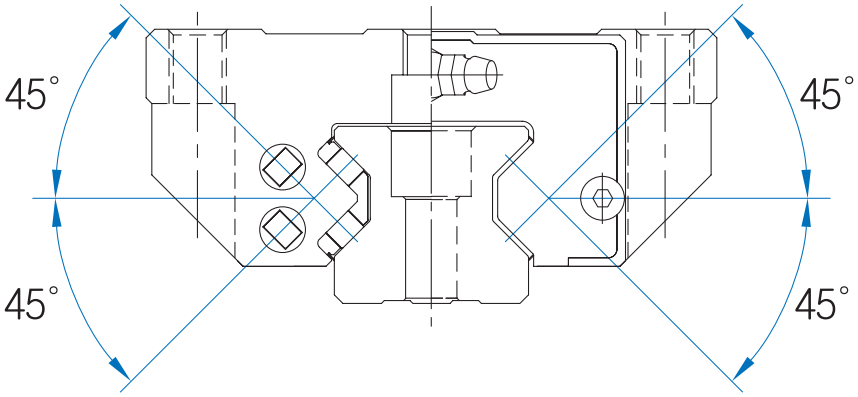


Tap hole type (A-type)

Roller Linear Motion Guide TWR Series

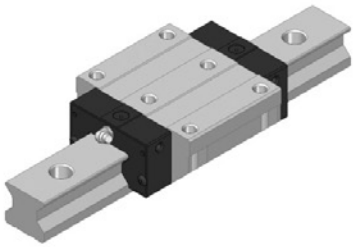
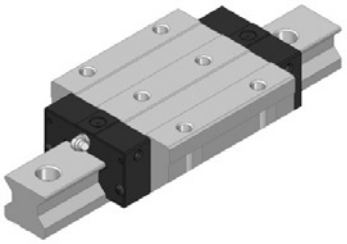
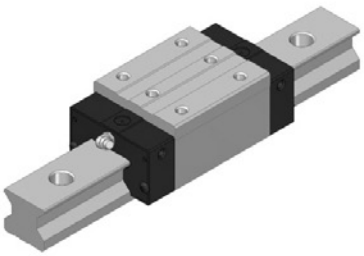
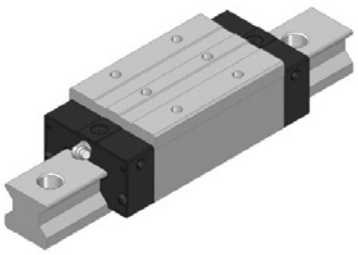


TWR Series

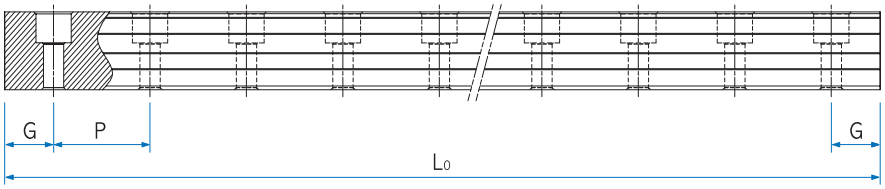


Cross Section

Types and Features

Category	Type	Shape & Features		
Flange type	TWR-F		- With the tapped flange of a lock, it can be assembled both from bottom to top and from top to bottom - A 4-direction equal load type with high rigidity and high load	Machine tool, CNC machining center, CNC tapping center, NC milling machine, boring machine, multiple machining center, planer miller, large injection machine, heavy-duty cutting machine, wire-cut pentahedral processing center, display test equipment
	TWR-FL		- Having the roller contact structure and the cross section identical to those of TWS-F Series, it increased load rating by extending the whole length (L_1) of Linear Motion guide block - A 4-direction equal load type with high rigidity and high load	
Compact type	TWR-R		- With the tapped top side of a block, a compact type that the width of Linear Motion guide block is minimized - A 4-direction equal load type with high rigidity and high load	
	TWR-RL		- Having the cross section identical to that of TWH-R Series, it increased load rating by extending the whole length (L_1) of Linear Motion guide block - A 4-direction equal load type with high rigidity and high load	

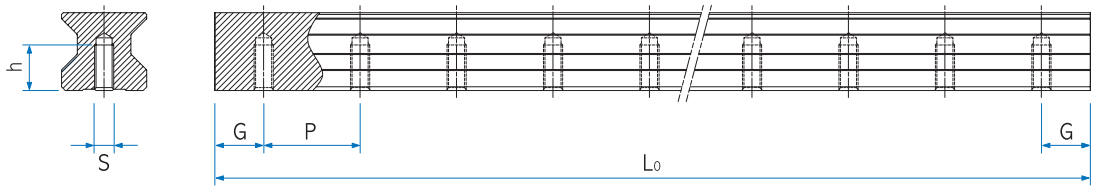
Standard and maximum length of a rail



Unit : mm

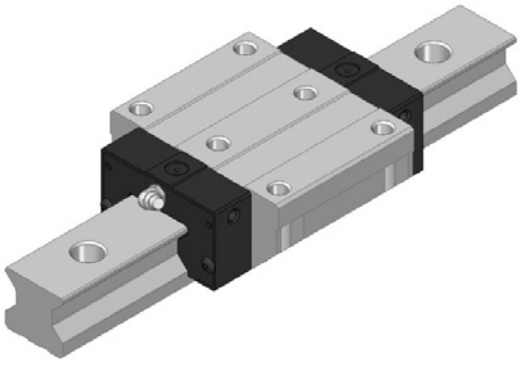
Model No.	TWR25	TWR30	TWR35	TWR45	TWR55	TWR65
Standard length	220	280	280	570	780	1270
	280	360	360	675	900	1570
	340	440	440	780	1020	1870
	400	520	520	885	1140	2170
	460	600	600	990	1260	2470
	⋮	⋮	⋮	⋮	⋮	2770
	3820	3760	3760	3615	3600	3070
	3880	3840	3840	3720	3720	3670
	3940	3920	3920	3825	3840	3970
	4000	4000	4000	3930	3960	
Standard pitch P	30	40	40	52.5	60	75
G	20	20	20	22.5	30	35
Max. length	4000	4000	4000	3930	3960	3970

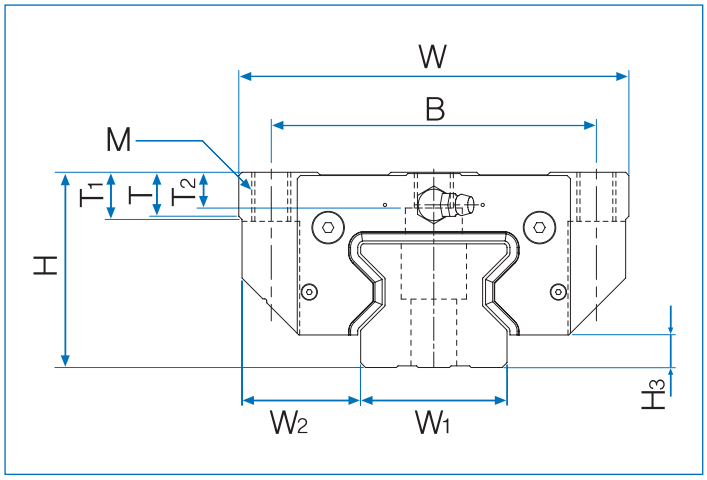
Standard tap hole type of a rail



Model No.	S	h(mm)
TWR25	M6	12
TWR30	M8	15
TWR35	M8	17
TWR45	M12	24
TWR55	M14	24
TWR65	M16	25

TWR-F Series, TWR-FL Series





Model No.	External dimensions			Dimensions of block														H3
	Height H	Width W	Length L	B	C	C2	M	L1	T	T1	T2	N	E	θ1	N1	θ2	Grease nipple	
TWR 25F	36	70	92.2	57	45	40	M8	63.3	7.5	9	6.7	5.5	12	6	5.5	15.2	B-M6F	6.5
TWR 25FL			110.2					81.3								24.2		
TWR 30F	42	90	103.8	72	52	44	M10	71	12	11	8	6.5	12	6	6	16	B-M6F	7
TWR 30FL			126.6					93.8								27.4		
TWR 35F	48	100	118.3	82	62	52	M10	79.5	8	12.5	10.5	7.6	12	12	7.6	16	B-M6F	7
TWR 35FL			142.3					103.5								28		
TWR 45F	60	120	146.3	100	80	60	M12	101.7	10	15	13.5	8	16	12	8	17.9	B-PT1/8	9.5
TWR 45FL			178.8					134.2								34.1		
TWR 55F	70	140	168.6	116	95	70	M14	121.6	12	18	13.4	9	16	13.5	9	21.3	B-PT1/8	10
TWR 55FL			207.7					160.7								40.9		
TWR 65F	90	170	207.2	142	110	82	M16	146.2	15	25	24	13.8	16	18.5	13.8	29.1	B-PT1/8	13
TWR 65FL			255.2					194.2								53.1		

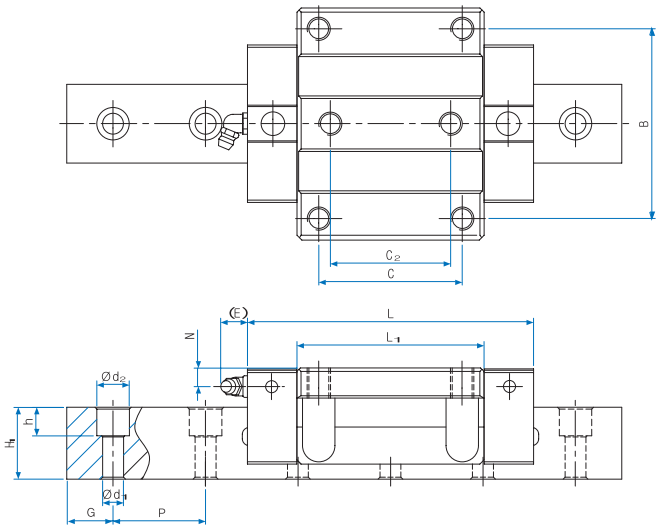
Composition of Model No.

TWR35 [ ] F SS 2 G2 — 1000L 20/40 P A T Z — 2

1 2 3 4 5 6 7 8 9 10 11 12 13

1. Model No. of Linear Motion Guide
2. Type of block : No symbol–Roller type
3. Form of block : R–Rectangular standard type / RL–Rectangular long type / F–Flange standard type / FL–Flange long type
4. Type of seal : UU–End seal / SS–End seal + Inside seal / ZZ–End seal + Inside seal + Metal scraper (*1)
5. Number of blocks combined in 1 rail
6. Symbol of clearance : No symbol–Normal preload / G1–Light preload / G2–Heavy preload / Gs–Special preload (*2)
7. Length of rail
8. Size of G value : standard G value has no symbol.
9. Symbol of precision : No symbol–Moderate precision / H–High precision / P–Precision / SP–Super Precision / UP–Ultra Precision (*3)
10. No symbol–Rail counter bore type (A topside assembly) / A– Rail tap hole type (an underside assembly) (*4)
11. Connection symbol
12. Special symbol
13. Number of axis used on the same surface

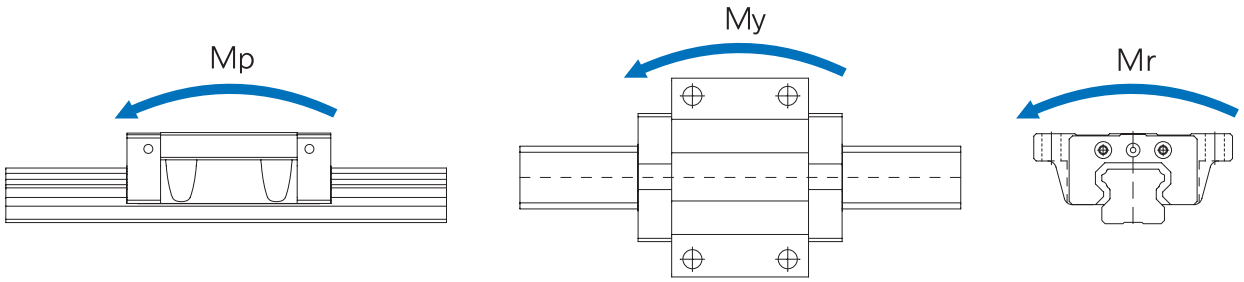
(*1) See P94/95 Symbol List of Optional Parts (*2) See P19 Radial Clearance
(*3) See P26 Selection of Precision Class (*4) See P87 The reference for standard tap hole type of a rail



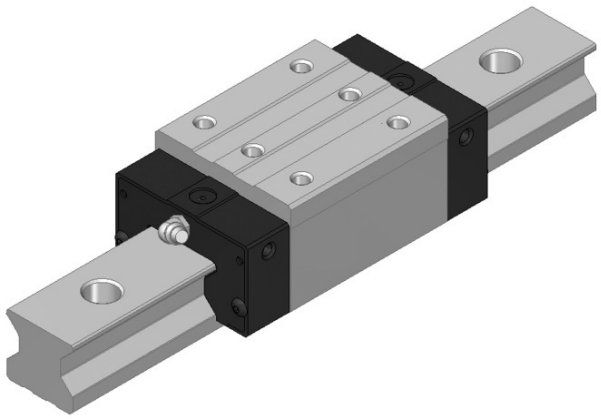
Unit : mm

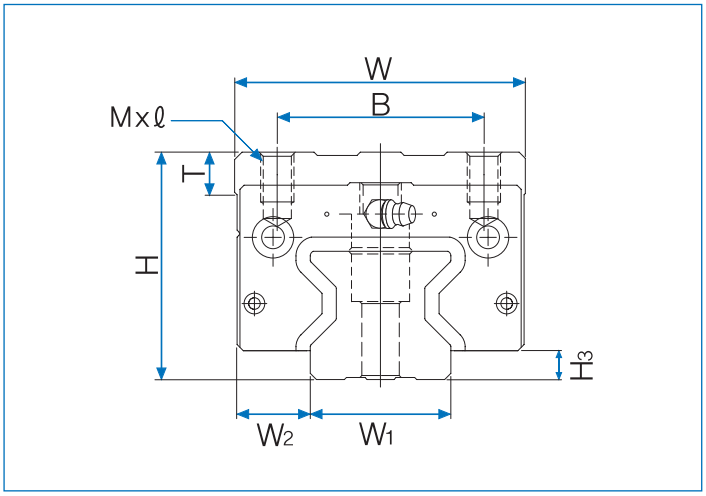
Dimensions of Rail						Basic load rating		Static allowance moment kN·m					Mass	
Width W_1 ±0.05	W_2	Height H_1	Value G	Pitch P	$d_1 \times d_2 \times h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(contact)	1	2(contact)	1		
23	23.5	24	20	30	7x11x9.7	29.1	56.2	0.570	3.090	0.570	3.090	0.820	0.8	3.1
						35.6	73.1	0.925	4.949	0.925	4.949	1.065	1.1	
28	31	28	20	40	9x14x12	44.4	87.3	0.985	5.395	0.985	5.395	1.470	1.4	4.4
						55.0	114.8	1.640	8.946	1.640	8.946	1.935	1.9	
34	33	31	20	40	9x14x12	61.0	114.0	1.460	7.972	1.460	7.972	2.345	2.1	6.2
						75.6	150.0	2.450	13.036	2.450	13.036	3.090	2.8	
45	37.5	38	22.5	52.5	14x20x17	103.8	202.0	3.265	17.712	3.265	17.712	5.430	4.0	10.1
						132.3	276.2	5.840	30.565	5.840	30.565	7.440	5.3	
53	43.5	43.5	30	60	16x23x20	146.9	278.0	5.390	28.523	5.390	28.523	8.880	6.8	13.4
						181.9	380.3	8.960	49.534	8.960	49.534	11.690	8.9	
63	53.5	55	35	75	18x26x22	231.0	450.6	10.600	56.301	10.600	56.301	17.140	13.0	20.1
						303.0	576.0	18.160	91.519	18.160	91.519	21.910	17.2	

1N≒0.102kgf

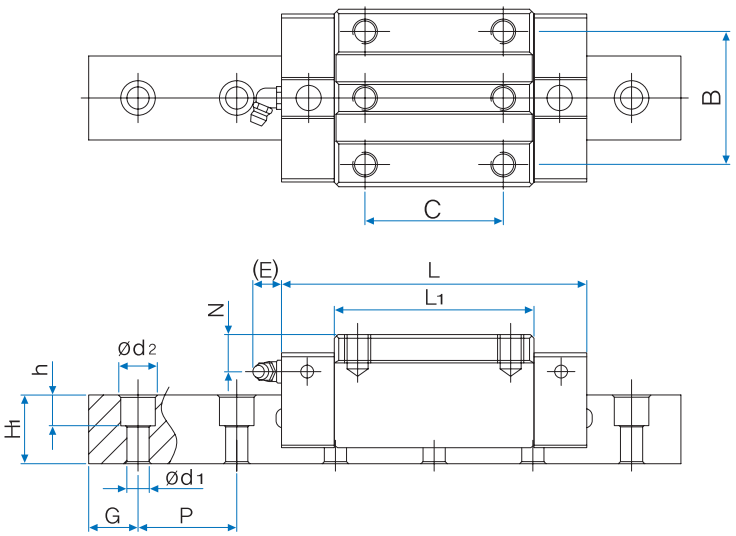


TWR-R Series, TWR-RL Series





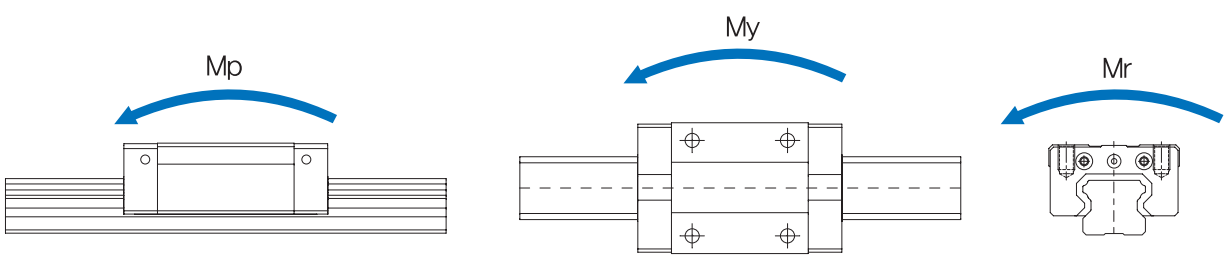
Model No.	External dimensions			Dimensions of block											H3
	Height H	Width W	Length L	B	C	M X ℓ	L1	T	N	E	θ_1	N_1	θ_2	Grease nipple	
TWR 25R	40	48	92.2	35	35	M6 x 9	63.3	7	9.5	12	6	9.5	20.2	B-M6F	6.5
TWR 25RL			110.2		50		81.3						21.7		
TWR 30R	45	60	103.8	40	40	M8 x 11	71	14	9.5	12	6	9	22	B-M6F	7
TWR 30RL			126.6		60		93.8						13.4		
TWR 35R	55	70	118.3	50	50	M8 x 13	79.5	10	14.6	12	12	14.6	22	B-M6F	7
TWR 35RL			142.3		72		103.5						23		
TWR 45R	70	86	146.3	60	60	M10 x 20	101.7	12	18	16	12	18	27.9	B-PT1/8	9.5
TWR 45RL			178.8		80		134.2						34.1		
TWR 55R	80	100	168.6	75	75	M12 x 19	121.6	10	19	16	13.5	19	31.3	B-PT1/8	10
TWR 55RL			207.7		95		160.7						40.9		



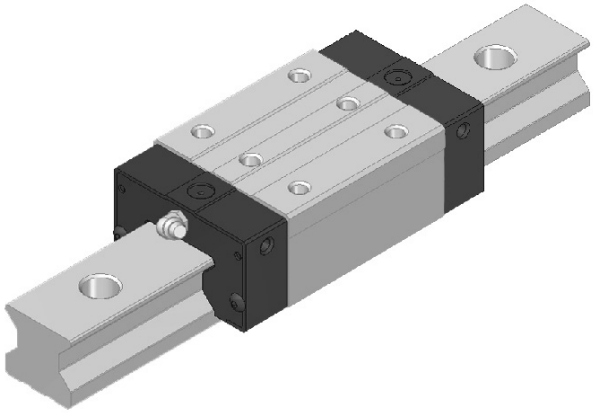
Unit : mm

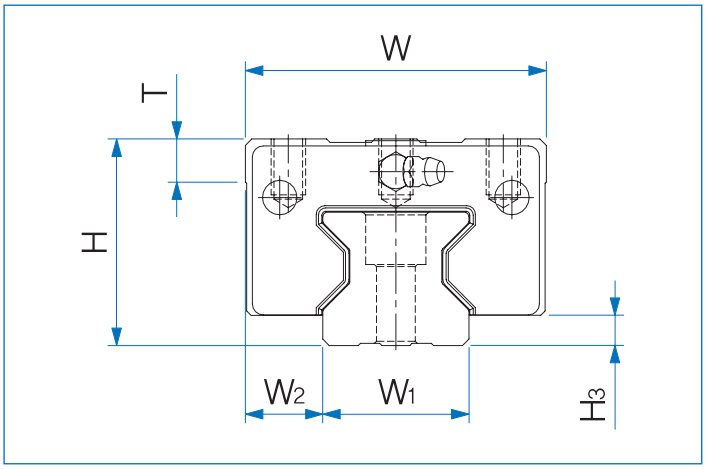
Dimensions of Rail						Basic load rating		Static allowance moment kN·m					Mass	
Width W_1 ±0.05	W_2	Height H_1	Value G	Pitch P	$d_1 \times d_2 \times h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(contact)	1	2(contact)	1		
23	23.5	24	20	30	7x11x9.7	29.1	56.2	0.570	3.090	0.570	3.090	0.820	0.7	3.1
						35.6	73.1	0.925	4.949	0.925	4.949	1.065	0.9	
28	31	28	20	40	9x14x12	44.4	87.3	0.985	5.395	0.985	5.395	1.470	1.2	4.4
						55.0	114.8	1.640	8.946	1.640	8.946	1.935	1.5	
34	33	31	20	40	9x14x12	61.0	114.0	1.460	7.972	1.460	7.972	2.345	2.0	6.2
						75.6	150.0	2.450	13.036	2.450	13.036	3.090	2.5	
45	37.5	38	22.5	52.5	14x20x17	103.8	202.0	3.265	17.712	3.265	17.712	5.430	3.9	10.1
						132.3	276.2	5.840	30.565	5.840	30.565	7.440	5.0	
53	43.5	43.5	30	60	16x23x20	146.9	278.0	5.390	28.523	5.390	28.523	8.880	6.2	13.4
						181.9	380.3	8.960	49.534	8.960	49.534	11.690	8.1	

1N≒0.102kgf

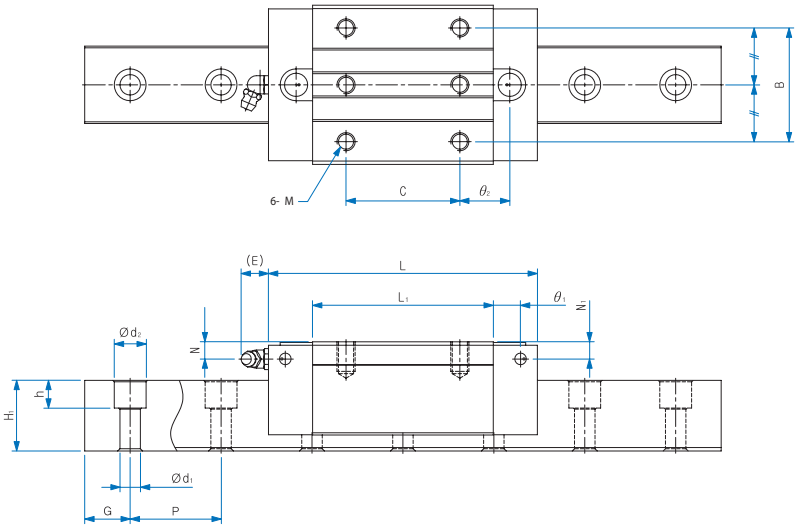


TWRS-R Series, TWRS-RL Series





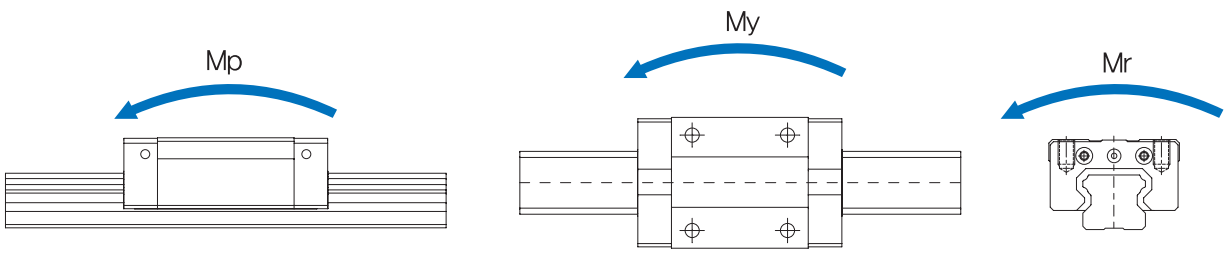
Model No.	External dimensions			Dimensions of block											H_3
	Height H	Width W	Length L	B	C	M X ℓ	L1	T	N	E	θ_1	N_1	θ_2	Grease nipple	
TWRS 25R	36	48	92.2	35	35	M6 x 9	63.3	7	5.5	12	6	5.5	20.2	B-M6F	6.5
TWRS 25RL			110.2		50		81.3						21.7		
TWRS 35R	48	70	118.3	50	50	M8 x 12	79.5	10	7.6	12	12	7.6	22	B-M6F	7
TWRS 35RL			142.3		72		103.5						23		
TWRS 45R	60	86	146.3	60	60	M10 x 18	101.7	12	8	16	12	8	27.9	B-PT1/8	9.5
TWRS 45RL			178.8		80		134.2						34.1		
TWRS 55R	70	100	168.6	75	75	M12 x 19	121.6	10	9	16	13.5	9	31.3	B-PT1/8	10
TWRS 55RL			207.7		95		160.7						40.9		
TWRS 65R	90	126	207.2	76	70	M16 x 21	146.2	15	13.8	16	18.5	13.8	49.1	B-PT1/8	13
TWRS 65RL			255.2		70		194.2						53.1		



Unit : mm

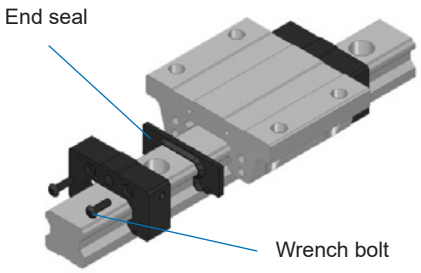
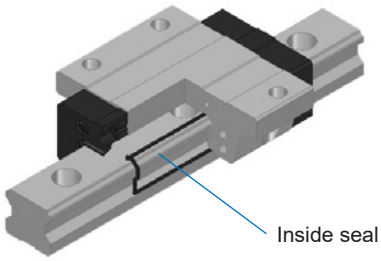
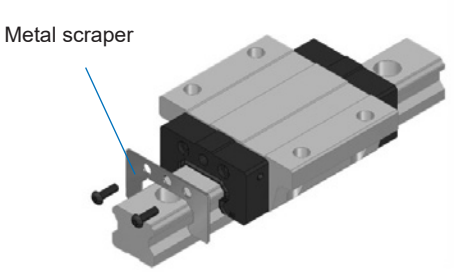
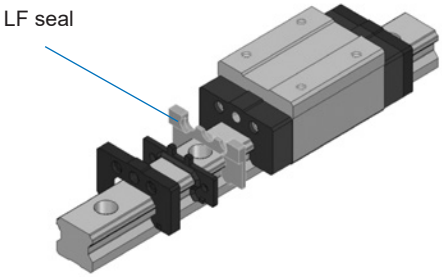
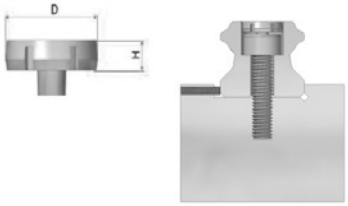
Dimensions of Rail						Basic load rating		Static allowance moment kN·m					Mass	
Width W_1 ±0.05	W_2	Height H_1	Value G	Pitch P	$d_1 \times d_2 \times h$	C kN	Co kN	Mp		My		Mr	Block kg	Rail kg/m
								1	2(contact)	1	2(contact)	1		
23	12.5	24	20	30	7x11x9.7	29.1	56.2	0.570	3.090	0.570	3.090	0.820	0.6	3.1
						35.6	73.1	0.925	4.949	0.925	4.949	1.065	0.8	
34	18	31	20	40	9x14x12	61.0	114.0	1.460	7.972	1.460	7.972	2.345	1.7	6.2
						75.6	150.0	2.450	13.036	2.450	13.036	3.090	2.1	
45	20.5	38	22.5	52.5	14x20x17	103.8	202.0	3.265	17.712	3.265	17.712	5.430	3.2	10.1
						132.3	276.2	5.840	30.565	5.840	30.565	7.440	4.2	
53	23.5	43.5	30	60	16x23x20	146.9	278.0	5.390	28.523	5.390	28.523	8.880	5.3	13.4
						181.9	380.3	8.960	49.534	8.960	49.534	11.690	6.8	
63	31.5	55	35	75	18x26x22	146.9	278.0	5.390	34.735	5.390	34.735	8.880	30.4	20.1
						181.9	380.3	8.960	60.425	8.960	60.425	11.690	33.6	

1N≒0.102kgf

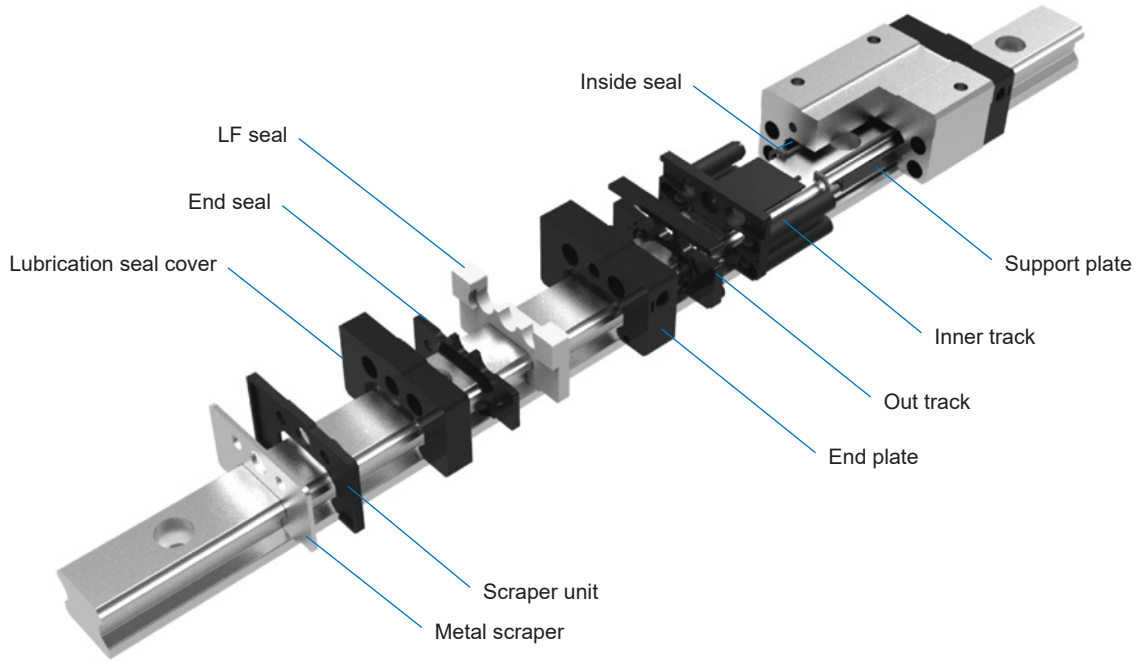


13 OPTIONS

1. Seal and Rail Cap

Item	Place to attach seal	Applications
End seal		- Where dust or particle is frequently generated
Inside seal		- Where foreign substance can be easily accessed from the flank or bottom - Where Linear Motion guide is moving in a vertical, horizontal, and reverse direction - Where a lot of cutting chips or foreign substance present - Where there is a danger in the intrusion of cutting chips or foreign substances into the block
Metal scraper		- Where spatters may arise such as welding slag or metal powers
LF seal		- Use within the maximum operating temperature of 40□. - Avoid contact with organic solvents, such as thinner or milky white oil. - During the initial use of the LF-SEAL, the rolling resistance may increase. - LF-SEAL (1EA) should use both sides of each block.
Rail cap		- If foreign substance enters into the bolt holes in a rail, it may intrude even into the block. A metal or plastic cap is used to prevent it. - C : plastic material railcap - MC : metal material railcap railcap for each part no in the catalog is available.

Symbol List of Optimal Parts



Symbol	Optional parts
UU	End seal
SS	End seal + Inside seal
ZZ	End seal + Inside seal + Metal scraper
UULF	End seal + LF seal
SSLF	End seal + Inside seal + LF seal
ZZLF	End seal + Inside seal + Metal scraper + LF seal

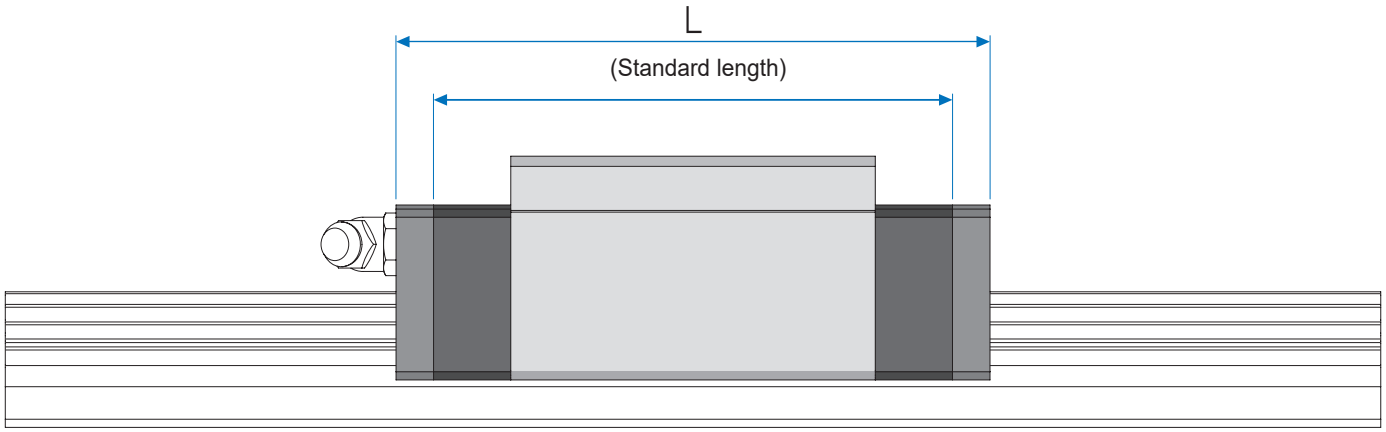
Option Mapping Table by Model No.

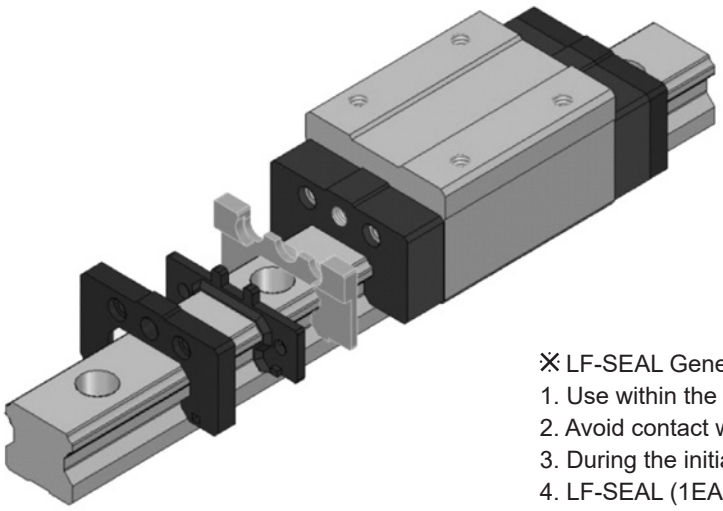
Symbol	Model No.	Ball Linear Motion Guide		Roller Linear Motion Guide
		TWH / TWS / TWHS Series	TWHW Series	TWR Series
Seal	UU	O	O	-
	SS	O	-	-
	ZZ	O	-	O
	UULF	O	O	-
	SSLF	O	-	-
	ZZLF	O	-	-

The installation option table of Linear Motion Guide way

Unit : mm

Symbol		Standard length	L					
			UU	SS	ZZ	UULF	SSLF	ZZLF
TWH	15 F/R/SF/SR	57	57	57	63.7	69	69	75.7
	15 FL/RL/SFL/SRL	65.3	65.3	65.3	72	77.3	77.3	84
	20 F/R/SF/SR	72.7	72.7	72.7	81.4	84.7	84.7	93.4
	20 FL/RL/SFL/SRL	88.6	88.6	88.6	97.3	100.6	100.6	109.3
	25 F/R/SF/SR	83	83	83	91.7	95	95	103.7
	25 FL/RL/SFL/SRL	102.9	102.9	102.9	111.6	114.9	114.9	123.6
	30 F/R/SF/SR	97.8	97.8	97.8	107.7	111.8	111.8	121.7
	30 FL/RL/SFL/SRL	120	120	120	129.9	134	134	143.9
	35 F/R/SF/SR	110	110	110	120	124	124	134
	35 FL/RL/SFL/SRL	135.4	135.4	135.4	145.4	149.4	149.4	159.4
	45 F/R/SF/SR	139	139	139	148.9	154	154	163.9
	45 FL/RL/SFL/SRL	170.8	170.8	170.8	180.7	185.8	185.8	195.7
	55 F/R/SF/SR	163	163	163	172.9	179	179	188.9
	55 FL/RL/SFL/SRL	201.1	201.1	201.1	211	217.1	217.1	227
TWHW	17 F/R	51	51	51	54.6	61.2	61.2	64.8
	21 F/R	59	59	59	63.4	69.2	69.2	73.6
	27 F/R	72.5	72.5	72.5	76.9	85.1	85.1	89.5
	35 F/R	105.3	105.3	105.3	110.9	120.3	120.3	125.9
TWS	15 C/CR/SC/SCF	40.2	40.2	40.2	46.9	52.2	52.2	58.9
	15 R/F/SR/SF	56.9	56.9	56.9	63.6	68.9	68.9	75.6
	20 C/CF/SC/SCF	47.2	47.2	47.2	55.9	59.2	59.2	67.9
	20 R/F/SR/SF	66.3	66.3	66.3	75	78.3	78.3	87
	25 C/CF/SC/SCF	59.1	59.1	59.1	67.8	71.1	71.1	79.8
	25 R/F/SR/SF	83	83	83	91.7	95	95	103.7
TWHS	25 R/SR	83	83	83	91.7	95	95	103.7
	25 RL/SRL	102.9	102.9	102.9	111.3	114.9	114.9	123.6
	30 R/SR	97.8	97.8	97.8	107.7	111.8	111.8	121.7
	30 RL/SRL	120	120	120	129.9	134	134	143.9
	35 R/SR	110	110	110	120	124	124	134
	35 RL/SRL	135.4	135.4	135.4	145.4	149.4	149.4	159.4



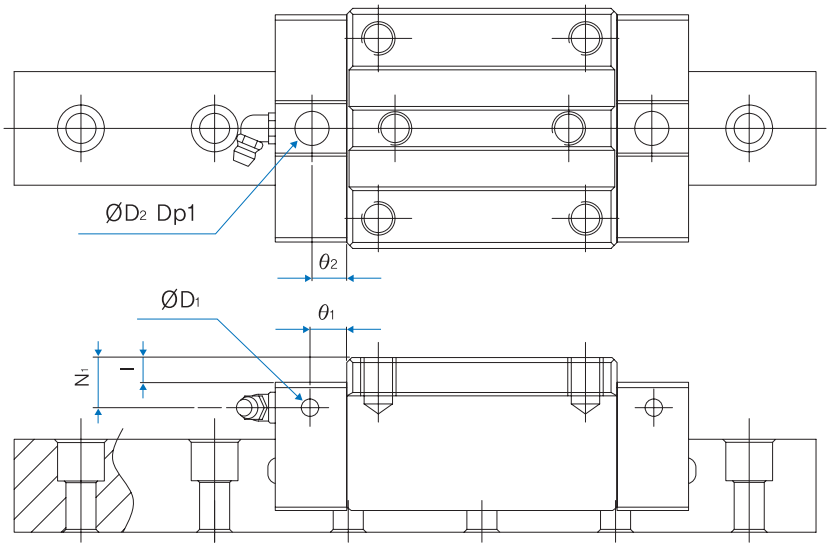


※ LF-SEAL General Precautions

1. Use within the maximum operating temperature of 40°C.
2. Avoid contact with organic solvents, such as thinner or milky white oil.
3. During the initial use of the LF-SEAL, the rolling resistance may increase.
4. LF-SEAL (1EA) should use both sides of each block.

2. Oil Filler

Fuelling on the side and top is available in TWR Series. The standard specification does not include the oil filler that penetrates the block of Linear Motion guide to protect it from foreign substance. Therefore, if you have a request, please contact Tretter.

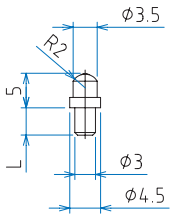
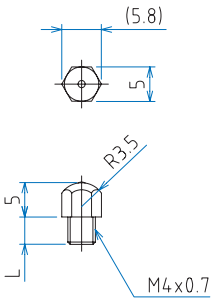
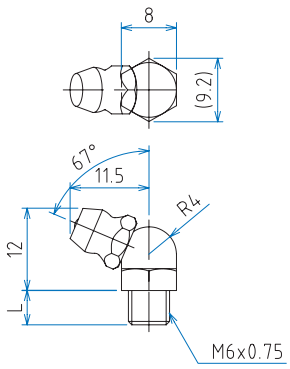
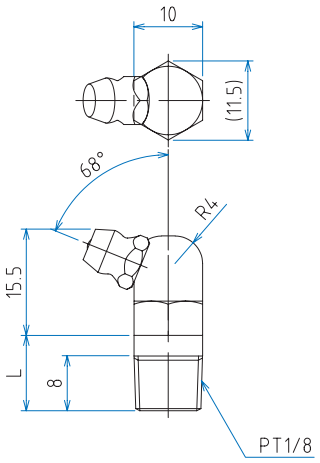


Unit : mm

Model No.		Hole for a side nipple			Top oil filler			
		θ1	N1	D1	D2	(O-ring)	l	θ2
TWR	25F(L)	6	5.5	3.3	10.2	P7	0.4	6
	30F(L)	6	6	5.1	10.2	P7	0.4	6.5
	35F(L)	12	7.6	5.1	10.2	P7	0.4	7.25
	45F(L)	12	8	5.1	10.2	P7	0.4	7
	55F(L)	13.5	9	5.1	10.2	P7	0.4	8
	65F(L)	18.5	13.75	5.4	10.2	P7	0.4	11
	25R(L)	6	9.5	3.3	10.2	P7	4.4	6
	30R(L)	6	9	5.1	10.2	P7	3.4	6.5
	35R(L)	12	14.6	5.1	10.2	P7	7.4	7.25
	45R(L)	12	18	5.1	10.2	P7	10.4	7
	55R(L)	13.5	19	5.1	10.2	P7	10.4	8
TWRS	25R(L)	6	5.5	3.3	10.2	P7	0.4	6
	35R(L)	12	7.6	5.1	10.2	P7	0.4	7.25
	45R(L)	12	8	5.1	10.2	P7	0.4	7
	55R(L)	13.5	9	5.1	10.2	P7	0.4	8
	65R(L)	18.5	13.75	5.4	10.2	P7	0.4	11

3. Grease Nipple

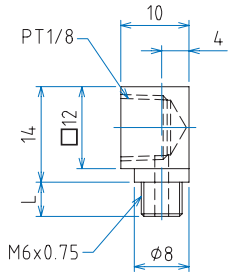
Tretter provides various kinds of grease nipple necessary for lubricating the system of Linear Motion guide.

			
A-Ø3	A-M4	B-M6F	B-PT1/8
TWHW 17, 21	TWH 15 TWS 15	TWH 20, 25, 30, 35 TWHW 27, 35 TWS 20, 25	TWH 45, 55

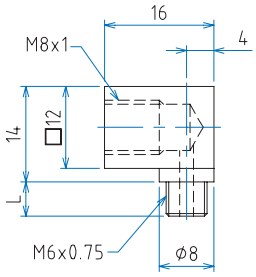
Grease nipple model no.		A - Ø3	A-M4	B-M6F				B-PT1/8	
Application model no.		TWHW 17, 21	TWH 15 TWS 15	TWH 20, 25 TWS 20, 25	TWH 30, 35 TWHW 27	TWHW 35	TWR 25, 30, 35	TWH 45, 55	TWH 45, 55, 65
Thread (L) Length	Standard	4	4	5	5	5	5	8	8
	ZZ	6.5	6	7	7	10	-	11	-
	LF	9	10	10	12	12	-	15.5	-
	LF + ZZ	11	12	12	14.5	17	-	18	-

4. Connection of oil pipes

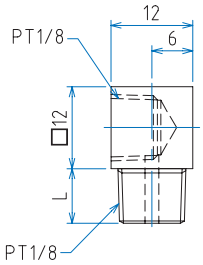
WOL Type



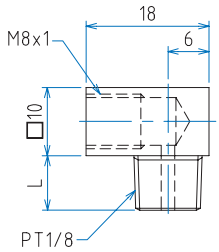
WOL-A



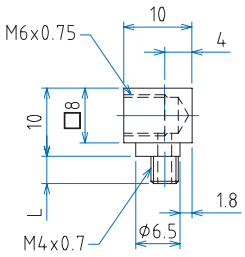
WOL-B



WOL-C

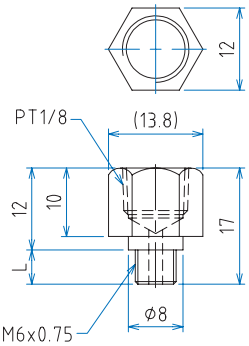


WOL-D

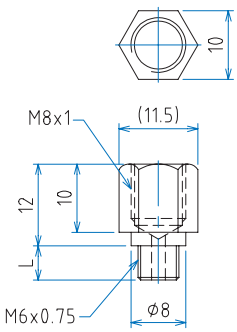


WOL-E

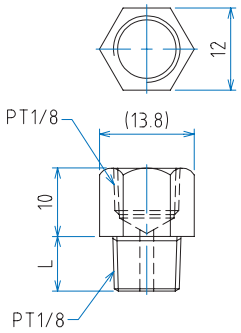
WOS Type



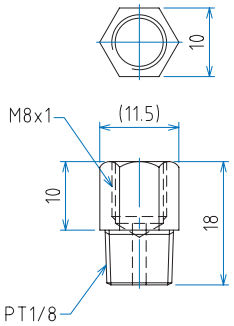
WOS-A



WOS-B



WOS-C



WOS-D

Grease nipple model no.		WOL-E	WOS-B	WOL-A, WOL-B WOS-A, WOS-B				WOL-C, WOL-D WOS-C, WOS-D	
Application model no.		TWH 15 TWS 15	TWH 20 TWS 20	TWH 25 TWS 25	TWH 30, 35 TWHW 27	TWHW 35	TWR 25,30,35	TWH 45,55	TWR 45, 55, 65
Thread (L) Length	Standard	4	5	5	5	5	5	8	8
	ZZ	6	7	7	7	10	-	11	-
	LF	10	10	10	10	12	-	15.5	-
	LF+ZZ	12	12	12	12	17	-	18	-

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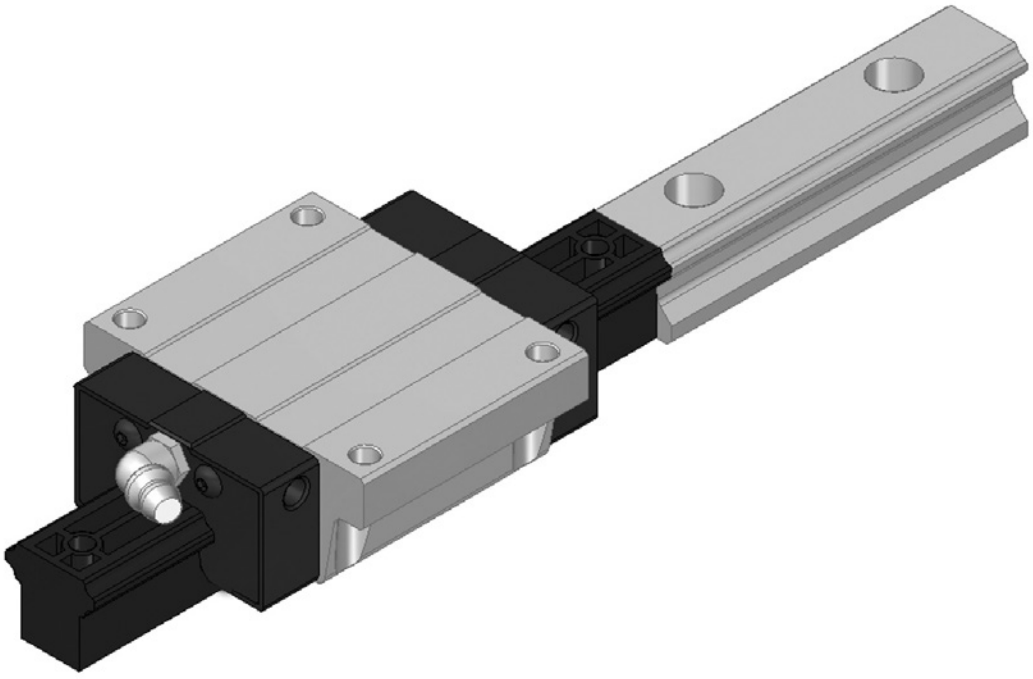
5. HOW TO INSTALL LINEAR MOTION GUIDE USING A SUPPORT RAIL

Linear Motion guide block should be inserted into or removed from the rail using a support rail for safety.
If you install the block in the rail without using the support rail, a rolling element may deviate from the block and damage or destroy the parts inside.
If the block without a rolling element is installed, it may significantly shorten the block's life and lead to load reduction and early breakage.
If you use the support rail, do not lean it. Adhere it to the end of the rail and slowly apply force to assemble it.
If the block is contaminated by dust as the rolling element is deviated from it, please do not use the product and contact Tretter for advice.



14 INSTRUCTIONS FOR HANDLING

1. Handling

1) The packaged Tretter Linear Motion guide is damp-proof after grease removal and cleaning, so please open it just before use.
2) The rail-block compatible product is fitted with a plastic support rail. Please take caution when assembling it with the rail.
3) If you reassemble a block-rail set product or a single block product after dismantling it into pieces, foreign substance may intrude into the block, decreasing performance to make rolling motion unsmooth or damaged. So please do not disassemble it.
4) If either a rail or a block leans to one side, the block or the rail may fall to be damaged. Please take caution and avoid the deviation of the block or the rail.
5) The end plate may be damaged if impact is applied since it is made of plastic material. Please be careful.

2. Lubrication

1) If the product is supplied as it is applied by rust preventive oil, please clean it off thoroughly and fill lubricant prior to use.
2) Do not mix it with other lubricants such as thickener or additive. If so, it may destroy the structure of grease or cause a harmful effect.
3) Viscosity of grease may vary depending on temperature and increase in winter due to low temperature, and the friction resistance of Linear Motion guide may increase.
4) In case of using special lubricant, please contact Tretter in advance.
5) In case of using oil lubricant, it may not reach the hole of raceway depending on the assembly status or direction of a block and a rail, so no lubricating effect may be obtained. Tretter can offer the lubricating method suitable for each assembly environment so please contact Tretter.

3. Caution for Use

1) After opening the product, please put damp-proof agent inside the dry container for storage.
2) Please handle the product after wearing plastic gloves in a clean place.
3) Please be careful to protect it from foreign substance which may inhibit rolling motion or damage function.
4) Please protect it using a holding door or cover to prevent Linear Motion guide exposed directly to poor environment that may cause corrosion or damage.
5) In case of using standard plastic end plate-based Linear Motion guide, use it at under 80°C. To use it at higher temperature than 80°C, please order a metal end plate which will specially customized.
6) If the rail of Linear Motion guide is fixed at the ceiling or in high place and if the block bears load downwards, the end plate may be destroyed or a ball may come off from the rail resulting in the fall of the block and fixtures. So please take a measure to install a safety device.

4. Storage

Depending on storage conditions, a rail may warp. For storage, place it in a horizontal position in the package box provided by Tretter or in a similar box with the flat bottom and avoid the environments where temperature is too high or low and very humid.

Comparison Table of Full-Ball Type Model No. of Other Manufacturers

1. TWH Series (Standard Type)

Tretter	THK	NSK	PMI	HIWIN
TWH 15F TWH 15FL	HSR 15A, B	LH 15EL, EM LH 15GL, GM	MSA 15A	HGW 15CA
TWH 20F TWH 20FL	HSR 20A, B HSR 20LA, LB	LH 20EL, EM LH 20GL, GM	MSA 20A MSA 20LA	HGW 20CA HGW 20HA
TWH 25F TWH 25FL	HSR 25A, B HSR 25LA, LB	LH 25EL, EM LH 25GL, GM	MSA 25A MSA 25LA	HGW 25CA HGW 25HA
TWH 30F TWH 30FL	HSR 30A, B HSR 30LA, LB	LH 30EL, EM LH 30GL, GM	MSA 30A MSA 30LA	HGW 30CA HGW 30HA
TWH 35F TWH 35FL	HSR 35A, B HSR 35LA, LB	LH 35EL, EM LH 35GL, GM	MSA 35A MSA 35LA	HGW 35CA HGW 35HA
TWH 45F TWH 45FL	HSR 45A, B HSR 45LA, LB	LH 45EL, EM LH 45GL, GM	MSA 45A MSA 45LA	HGW 45CA HGW 45HA
TWH 55F TWH 55FL	HSR 55A, B HSR 55LA, LB	LH 55EL, EM LH 55GL, GM	MSA 55A MSA 55LA	HGW 55CA HGW 55HA
TWH 15R TWH 15RL	HSR 15R	LH 15AN, AL LH 15BL, BL	MSA 15S	HGH 15CA
TWH 20R TWH 20RL	HSR 20R HSR 20LR	LH 20AN, AL LH 20BN, BL	MSA 20S MSA 20LS	HGH 20CA HGH 20HA
TWH 25R TWH 25RL	HSR 25R HSR 25LR	LH 25AN, AL LH 25BN, BL	MSA 25S MSA 25LS	HGH 25CA HGH 25HA
TWH 30R TWH 30RL	HSR 30R HSR 30LR	LH 30AN, AL LH 30BN, BL	MSA 30S MSA 30LS	HGH 30CA HGH 30HA
TWH 35R TWH 35RL	HSR 35R HSR 35LR	LH 35AN, AL LH 35BN, BL	MSA 35S MSA 35LS	HGH 35CA HGH 35HA
TWH 45R TWH 45RL	HSR 45R HSR 45LR	LH 45AN, AL LH 45BN, BL	MSA 45S MSA 45LS	HGH 45CA HGH 45HA
TWH 55R TWH 55RL	HSR 55R HSR 55LR	LH 55AN, AL LH 55BN, BL	MSA 55S MSA 55LS	HGH 55CA HGH 55HA

2. TWHW Series(Standard Wide body Type)

Tretter	THK	NSK	PMI	PMI	HIWIN
TWHW 17F	HRW 17CA	LW 17EL	–	WEW 17CC	LWFF 33
TWHW 21F	HRW 21CA	LW 21EL	MSG 21E	WEW 21CC	LWFF 37
TWHW 27F	HRW 27CA	LW 27EL	MSG 27E	WEW 27CC	LWFF 42
TWHW 35F	HRW 35CA	LW 35EL	MSG 35E	WEW 35CC	LWFF 69
TWHW 17R	HRW 17CR	–	–	WEH 17CA	LWFF 33
TWHW 21R	HRW 21CR	–	MSG 21S	WEH 21CA	LWFF 37
TWHW 27R	HRW 27CR	–	MSG 27S	WEH 27CA	LWFF 42
TWHW 35R	HRW 35CR	–	MSG 35S	WEH 35CA	–

3. TWS Series(Slim Type)

Tretter	THK	NSK	PMI	HIWIN
TWS 15C TWS 15R	SR 15V SR 15W	LS 15CL LS 15AL	MSB 15TS MSB 15S	EGH 15SA EGH 15CA
TWS 20C TWS 20R	SR 20V SR 20W	LS 20CL LS 20AL	MSB 20TS MSB 20S	EGH 20SA EGH 20CA
TWS 25C TWS 25R	SR 25V SR 25W	LS 25CL LS 25AL	MSB 25TS MSB 25S	EGH 25SA EGH 25CA
TWS 15CF TWS 15F	SR 15SB SR 15TB	LS 15EM LS 15JM	MSB 15TE MSB 15E	EGW 15CA EGW 15CB
TWS 20CF TWS 20F	SR 20SB SR 20TB	LS 20EM LS 20JM	MSB 20TE MSB 20E	EGW 20CA EGW 20CB
TWS 25CF TWS 25F	SR 25SB SR 25TB	LS 25EM LS 25JM	MSB 25TE MSB 25E	EGW 25CA EGW 25CB

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Comparison Table of Spacer Chain type No. of Other Manufacturers
1. H-S Series (Standard type)

Tretter	THK	NSK	PMI	HIWIN
TWH 15SF TWH 15SFL	SHS 15C SHS 15LC	SH 15FL SH 15HL	SME 15EA SME 15LEA	QHW 15CA -
TWH 20SF TWH 20SFL	SHS 20C SHS 20LC	SH 20FL SH 20HL	SME 20EA SME 20LEA	QHW 20CA QHW 20HA
TWH 25SF TWH 25SFL	SHS 25C SHS 25LC	SH 25FL SH 25HL	SME 25EA SME 25LEA	QHW 25CA QHW 25HA
TWH 30SF TWH 30SFL	SHS 30C SHS 30LC	SH 30FL SH 30HL	SME 30EA SME 30LEA	QHW 30CA QHW 30HA
TWH 35SF TWH 35SFL	SHS 35C SHS 35LC	SH 35FL SH 35HL	SME 35EA SME 35LEA	QHW 35CA QHW 35HA
TWH 45SF TWH 45SFL	SHS 45C SHS 45LC	SH 45FL SH 45HL	SME 45EA SME 45LEA	QHW 45CA QHW 45HA
TWH 55SF TWH 55SFL	SHS 55C SHS 55LC	SH 55FL SH 55HL	– –	– –
TWH 15SR TWH 15SRL	SHS 15R -	SH 15AN SH 15BN	SME 15SA SME 15LSA	QHH 15CA –
TWH 20SR TWH 20SRL	SHS 20V SHS 20LV	SH 20AN SH 20BN	SME 20SA SME 20LSA	QHH 20CA QHH 20HA
TWH 25SR TWH 25SRL	SHS 25R SHS 25LR	SH 25AN SH 25BN	SME 25SA SME 25LSA	QHH 25CA QHH 25HA
TWH 30SR TWH 30SRL	SHS 30R SHS 30LR	SH 30AN SH 30BN	SME 30SA SME 30LSA	QHH 30CA QHH 30HA
TWH 35SR TWH 35SRL	SHS 35R SHS 35LR	SH 35AN SH 35BN	SME 35SA SME 35LSA	QHH 35CA QHH 35HA
TWH 45SR TWH 45SRL	SHS 45R SHS 45LR	SH 45AN SH 45BN	SME 45SA SME 45LSA	QHH 45CA QHH 45HA
TWH 55SR TWH 55SRL	SHS 55R SHS 55LR	SH 55AN SH 55BN	– –	– –

2. S-S Series (Slim type)

Tretter	THK	NSK	PMI	HIWIN
TWS 15SC TWS 15SR	SSR 15XV SSR 15XW	SS 15CL SS 15AL	SME 15EB SME 15LEB	QEH 15SA QEH 15CA
TWS 20SC TWS 20SR	SSR 20XV SSR 20XW	SS 20CL SS 20AL	SME 20EB SME 20LEB	QEH 20SA QEH 20CA
TWS 25SC TWS 25SR	SSR 25XV SSR 25XW	SS 25CL SS 25AL	SME 25EB SME 25LEB	QEH 25SA QEH 25CA
TWS 15SCF TWS 15SF	– SSR 15XTB	SS 15JM SS 15EM	SME 15SB SME 15LSB	QEW 15SA QEW 15CA
TWS 20SCF TWS 20SF	– SSR 20XTB	SS 20JM SS 20EM	SME 20SB SME 20LSB	QEW 20SA QEW 20CA
TWS 25SCF TWS 25SF	– SSR 25XTB	SS 25JM SS 25EM	SME 25SB SME 25LSB	QEW 25SA QEW 25CA

3. HS-S Series (Slim type)

Tretter	THK
TWHS 25SR TWHS 25SRL	SHS 25V SHS 25LV
TWHS 30SR TWHS 30SRL	SHS 30V SHS 30LV
TWHS 35SR TWHS 35SRL	SHS 35V SHS 35LV
TWHS 45SR TWHS 45SRL	SHS 45V SHS 45LV
TWHS 55SR TWHS 55SRL	SHS 55V SHS 55LV

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