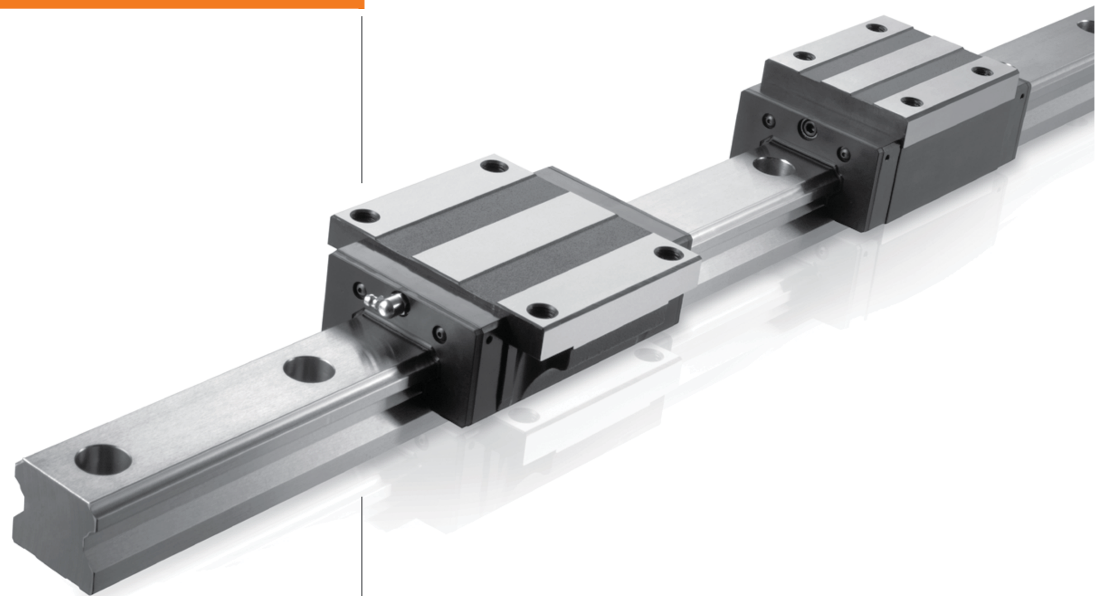
Linear Guideway



1 The Characteristics of *PMI* Linear Guideways

(1) High positioning accuracy, high repeatability

The PMI linear guideway is a design of rolling motion with a low friction coefficient, and the difference between dynamic and static friction is very small. Therefore, the stick-slip will not occur when submicron feeding is making.

(2) Low frictional resistance, high precision maintained for long period

The frictional resistance of a linear guideway is only 1/20th to 1/40th of that in a slide guide. With a linear guideway, a well lubrication can be easily achieved by supplying grease through the grease nipple on carriage or utilizing a centralized oil pumping system, thus the frictional resistance is decreased and the accuracy could be maintained for long period.

(3) High rigidity with four-way load design

The optimum design of geometric mechanics makes the linear guideway to bear the load in all four directions, radial, reversed radial, and two lateral directions. Furthermore, the rigidity of linear guideway could be easily achieved by preloading carriage and by adding the number of carriages.

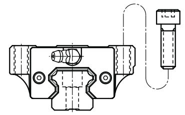
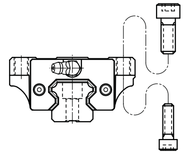
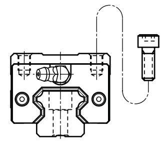
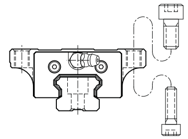
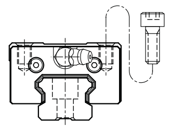
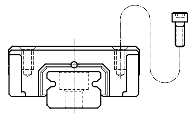
(4) Suitable for high speed operation

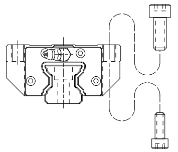
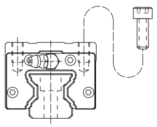
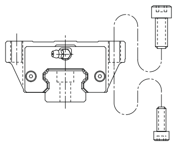
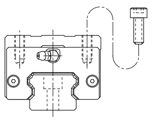
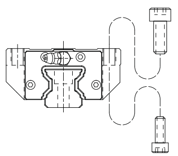
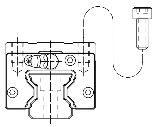
Due to the characteristic of low frictional resistance, the required driving force is much lower than in other systems, thus the power consumption is small. Moreover, the temperature rising effect is small even under high speed operation.

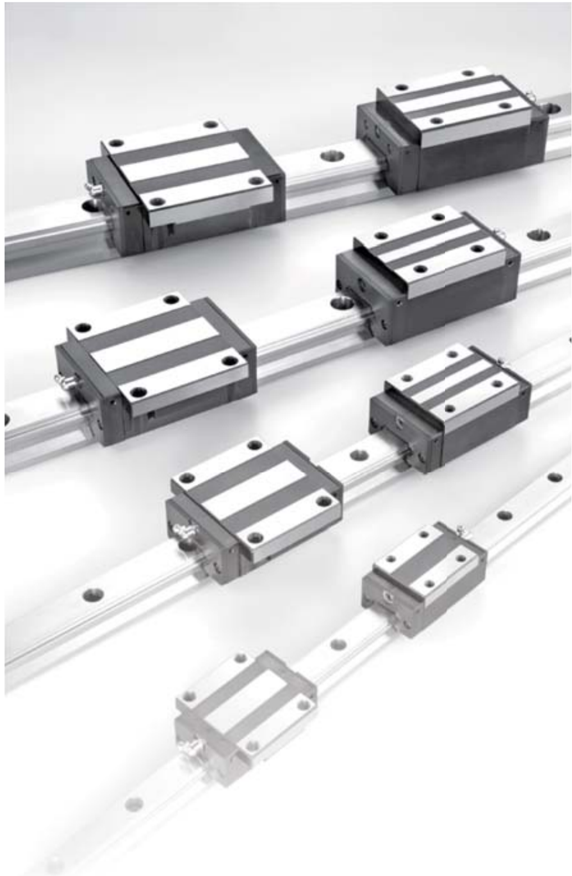
(5) Easy installation with interchangeability

Compared with the high-skill required scrapping process of conventional slide guide, the linear guideway can offer high precision even if the mounting surface is machined by milling or grinding. Moreover the interchangeability of linear guideway gives a convenience for installation and future maintenance.

The Classification Chart of *PMI* Linear Guideways 2

Type	Model		Characteristics	Major Application
Full Ball, Heavy Load Type	MSA-A MSA-LA		• Heavy Load, High Rigidity • Self Alignment Capability • Smooth Movement • Low Noise • Interchangeability	Machine Center, NC lathe, XYZ axes of heavy cutting machine tools, Grinding head feeding axis of grinding machines, Milling machine, Z axis of boring machine and machine tools, EDM, Z axis of industrial machine, Measuring equipment, Precision XY table, Welding machine, Binding machine, Auto packing machine
	MSA-E MSA-LE			
	MSA-S MSA-LS			
Full Ball, Compact Type	MSB-TE MSB-E		• Compact, High Load • Self Alignment Capability • Smooth Movement • Low Noise • Interchangeability	
	MSB-TS MSB-S			
Full Ball, Miniature Type	MSC		• Ultra Compact • Smooth Movement • Low Noise • Ball Retainer • Interchangeability	IC/LSI manufacturing machine, Hard disc drive, Slide unit of OA equipment, Wafer transfer equipment, Printed circuit board assembly table, Medical equipment, Inspection equipment

Type	Model		Characteristics	Major Application
Full Roller, Heavy Load Type	MSR-E MSR-LE		• Ultra Heavy Load • Ultra High Rigidity • Smooth Movement • Low Noise • Good lubricant Effect	Machine Center, NC lathe, Grinding machine, Five axes milling machine, Jig borer, Drilling machine, Horizontal milling machine, Mold processing machine, EDM
	MSR-S MSR-LS			
Ball Chain, Heavy Load Type	SME-E SME-LE		• Heavy Load, High Rigidity • Self Alignment Capability • Ball Chain Design • Smooth Movement • Low Noise, Good Lubricant Effect • Interchangeability	Machine Center, NC lathe, XYZ axes of heavy cutting machine tools, Grinding head feeding axis of grinding machines, milling machine, Z axis of boring machine and machine tools, EDM, Z axis of industrial machine, Measuring equipment, Precision XY table, Welding machine, Binding machine, Auto packing machine
	SME-S SME-LS			
Roller Chain, Heavy Load Type	SMR-E SMR-LE		• Ultra Heavy Load • Ultra High Rigidity • Roller Chain Design • Smooth Movement • Low Noise • Good Lubricant Effect	Machine Center, NC lathe, Grinding machine, Five axes milling machine, Jig borer, Drilling machine, Horizontal milling machine, Mold processing machine, EDM
	SMR-S SMR-LS			



3 The Procedure of Select Linear Guideway

Identify the operating conditions

Parameters for calculating load on the linear guideway
- Space available for installation
- Size (span, No. of carriages, No. of rails)
- Installation position (horizontal, vertical, tilted, or wall-hung, etc.)
- Magnitude, direction, and location of imposed load
- Frequency of use (duty cycle)
- Stroke length
- Moving speed , acceleration
- Required service life, and accuracy
- Operating environment

(span, No. of carriages, No. of rails change → Identify the operating conditions)

Select type

Select proper type and size
(If applied with ballscrew, the size of guideway should be similar to diameter of ballscrew.)

(Type or size changed → Select type)

Calculate the applied load

Calculate the load applied on each carriage

Calculate the equivalent load

Convert the load of block exerts in each direction into equivalent load

Calculate the static safety factor

The safety factor verified by basic static load rating and max equivalent load

Verification of safety factor — NO / YES

Calculate mean load

Averaging the applied loads that fluctuate during operation and convert them into mean load

Calculate nominal life

Using the service-life equation to calculate the running distance or hours

Does the calculated value satisfy the required service life — NO / YES

Identify stiffness
- Select preload
- Determine the fastening methods
- Determine the rigidity of fastened area

Identify accuracy
- Select accuracy grade
- Identify the precision of mounting surface

Lubrication and dust protection
- Types of lubrication (grease, oil, special lubrication)
- Method of lubrication (periodic or forced lubrication)
- Dust prevention design.

Completion

Load Rating and Service Life of Linear Guideway 4

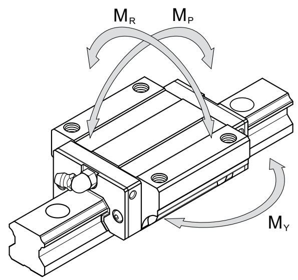
To obtain a model which is most suitable for your service conditions of the linear guideway system, the load capacity and service life of the model must be taken into consideration. To verify the static load capacity, the basic static load rating (C_0) is taken to obtain the static safety factor. The service life can be obtained by calculating the nominal life based on basic dynamic load rating. As the raceways or rolling elements are subjected repeated stresses, the service life of a linear guideway is defined as the total running distance that the linear guideway travel until flaking occurs.

4.1 Basic Static Load Rating (C_0)

A localized permanent deformation will develop between raceways and rolling elements when a linear guideway receives an excessive load or a large impact. If the magnitude of the deformation exceeds a certain limit, it could obstruct the smooth motion of the linear guideway. The basic static load rating (C_0) refers to a static load in a given direction with a specific magnitude applied at the contact area under the most stress where the sum of permanent deformation develops between the raceway and rolling elements is 0.0001 times of the diameter of rolling ball. Therefore, the basic static load rating sets a limit on the static permissible load.

4.2 Static Permissible Moment (M_0)

When a moment is applied to a linear guideway, the rolling balls on both ends will receive the most stress among the stress distribution over the rolling elements in the system. The static permissible moment (M_0) refers to a static moment in a given direction with specific magnitude applied at the contact area under the most stress where the sum of permanent deformation develops between the raceway and rolling elements is 0.0001 times the diameter of rolling elements. Therefore, the static permissible moment sets a limit on the static moment. In linear guideway system, the static permissible moment is defined as M_P, M_Y, M_R three directions. See the figure below.



4.3 Static Safety Factor (f_S)

Due to the impact and vibration while the guideway at rest or moving, or the inertia from start and stop, the linear guideway may encounter with an unexpected external force. Therefore, the safety factor should be taken into consideration for effects of such operating loads. The static safety factor (f_S) is a ratio of the basic static load rating (C_0) to the calculated working load. The static safety factor for different kinds of application is shown as Table.

$$f_s = \frac{C_0}{P} \quad \text{or} \quad f_s = \frac{M_0}{M}$$

- f_s Static safety factor
- C_0 Basic static load rating (N)
- M_0 Static permissible moment ($N \cdot m$)
- P Calculated working load (N)
- M Calculated moment ($N \cdot m$)

Machine Type	Load Condition	f_S (Lower limit)
Regular industrial machine	Normal loading condition	1.0 ~ 1.3
	With impact and vibration	2.0 ~ 3.0
Machine tool	Normal loading condition	1.0 ~ 1.5
	With impact and vibration	2.5 ~ 7.0

Standard value of static safety factor

4.4 Basic Dynamic Load Rating (C)

Even when identical linear guideways in a group are manufactured in the same way or applied under the same condition, the service life may be varied. Thus, the service life is used as an indicator for determining the service life of a linear guideway system. The nominal life (L) is defined as the total running distance that 90% of identical linear guideways in a group, when they are applied under the same conditions, can work without developing flaking. The basic dynamic load rating (C) can be used to calculate the service life when linear guideway system response to a load. The basic dynamic load rating (C) is defined as a load in a given direction and with a given magnitude that when a group of linear guideways operate under the same conditions. As the rolling element is ball, the nominal life of the linear guideway is 50 km. Moreover, as the rolling element is roller, the nominal life is 100 km.

4.5 Calculation of Nominal Life (L)

The nominal life of a linear guideway can be affected by the actual working load. The nominal life can be calculated base on selected basic dynamic load rating and actual working load. The nominal life of linear guideway system could be influenced widely by environmental factors such like hardness of raceway, environmental temperature, motion conditions, thus these factors should be considered for calculation of nominal life.

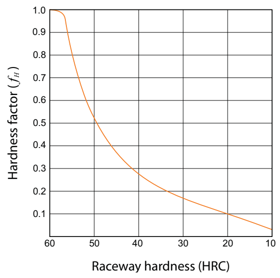
Ball $$L = \left(\frac{f_H \times f_T}{f_W} \times \frac{C}{P} \right)^3 \times 50$$

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

- L Nominal life (km)
- C Basic dynamic load rating (N)
- P Working load (N)
- f_H Hardness factor
- f_T Temperature factor
- f_W Load factor

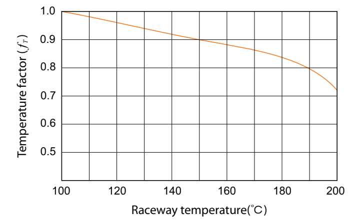
Hardness factor f_H

In order to ensure the optimum load capacity of linear guideway system, the hardness of raceway must be HRC58~64. If the hardness is lower than this range, the permissible load and nominal life will be decreased. For this reason, the basic dynamic load rating and the basic static load rating should be multiplied by hardness factor for rating calculation. See figure below. The hardness requirement of ***PMI*** linear guideway is above HRC58, thus the f_H=1.0.



Temperature factor f_T

When operating temperature higher than 100°C, the nominal life will be degraded. Therefore, the basic dynamic and static load rating should be multiplied by temperature factor for rating calculation. See figure below. The assemble parts of ***PMI*** guideway are made of plastic and rubber, therefore, the operating temperature below 100°C is strongly recommend. For special need, please contact us.



Load factor f_w

Although the working load of liner guideway system can be obtained by calculation, the actual load is mostly higher than calculated value. This is because the vibration and impact, caused by mechanical reciprocal motion, are difficult to be estimated. This is especially true when the vibration from high speed operation and the impact from repeated start and stop. Therefore, for consideration of speed and vibration, the basic dynamic load rating should be divided by the empirical load factor. See the table below.

Motion Condition	Operating Speed	f_W
No impact & vibration	V≦15 m/min	1.0~1.2
Slight impact & vibration	15＜V≦60 m/min	1.2~1.5
Moderate impact & vibration	60＜V≦120 m/min	1.5~2.0
Strong impact & vibration	V≧120 m/min	2.0~3.5

4.6 Calculation of Service Life in Time (L_h)

When the nominal life (L) is obtained, the service life in hours can be calculated by using the following equation when stroke length and reciprocating cycles are constant.

$$L_h = \frac{L \times 10^3}{2 \times l_S \times n_1 \times 60}$$

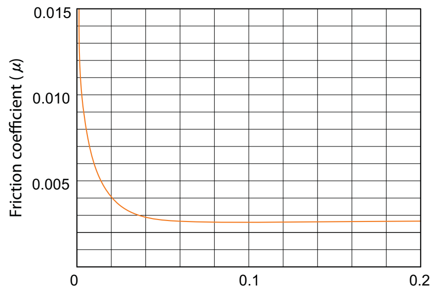
- L_h Service life in hours (hr)
- L Nominal life (km)
- l_S Stroke length (m)
- n_1 No. of reciprocating cycles per minute (min^{-1})

5 Friction Coefficient

A linear guideway manipulates linear motion by rolling elements between the rail and the carriage. In which type of motion, the frictional resistance of linear guideway can be reduced to 1/20th to 1/40th of that in a slide guide. This is especially true in static friction which is much smaller than that in other systems. Moreover, the difference between static and dynamic friction is very little, so that the stick-slip situation does not occur. As such low friction, the submicron feeding can be carried out. The frictional resistance of a linear guideway system can be varied with the magnitude of load and preload, the viscosity resistance of lubricant, and other factors. The frictional resistance can be calculated by the following equation base on working load and seals resistance. Generally, the friction coefficient will be different from series to series, the friction coefficient of ball type is 0.002~0.003 (without considering the seal resistance) and the roller type is 0.001~0.002(without considering the seal resistance)

$$F = \mu \times P + f$$

- F Frictional resistance (kgf)
- μ Dynamic friction coefficient
- P Working load (kgf)
- f Seal resistance (kgf)



Load ratio (P/C)
P: Working load
C: Basic dynamic load rating

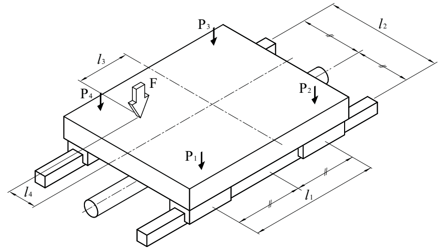
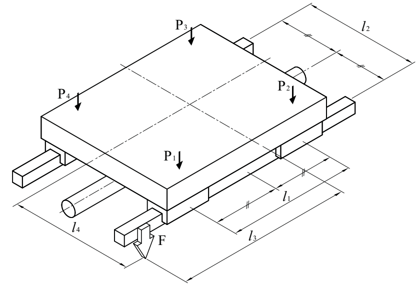
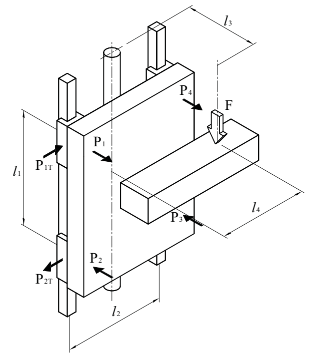
Relationship between working load and friction coefficient

Calculation of Working Load 6

The load applied to a linear guideway system could be varied with several factors such as the location of the center gravity of an object, the location of the thrust, and the inertial forces due to acceleration and deceleration during starting and stopping.

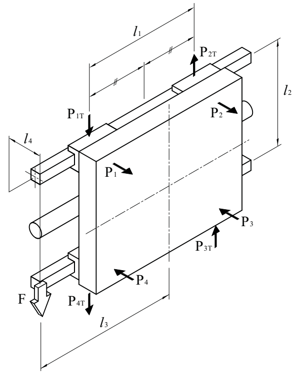
To select a correct linear guideway system, the above conditions must be considered for determining the magnitude of applied load.

Examples for calculating working load

Type	Operation Conditions	Equations
Horizontal application: Uniform motion or at rest		$P_1 = \frac{F}{4} + \frac{F \cdot l_3}{2 \cdot l_1} - \frac{F \cdot l_4}{2 \cdot l_2}$ $P_2 = \frac{F}{4} - \frac{F \cdot l_3}{2 \cdot l_1} - \frac{F \cdot l_4}{2 \cdot l_2}$ $P_3 = \frac{F}{4} - \frac{F \cdot l_3}{2 \cdot l_1} + \frac{F \cdot l_4}{2 \cdot l_2}$ $P_4 = \frac{F}{4} + \frac{F \cdot l_3}{2 \cdot l_1} + \frac{F \cdot l_4}{2 \cdot l_2}$
Overhung horizontal application: Uniform motion or at rest		$P_1 = \frac{F}{4} + \frac{F \cdot l_3}{2 \cdot l_1} + \frac{F \cdot l_4}{2 \cdot l_2}$ $P_2 = \frac{F}{4} - \frac{F \cdot l_3}{2 \cdot l_1} + \frac{F \cdot l_4}{2 \cdot l_2}$ $P_3 = \frac{F}{4} - \frac{F \cdot l_3}{2 \cdot l_1} - \frac{F \cdot l_4}{2 \cdot l_2}$ $P_4 = \frac{F}{4} + \frac{F \cdot l_3}{2 \cdot l_1} - \frac{F \cdot l_4}{2 \cdot l_2}$
Vertical application: Uniform motion or at rest		$P_1 = P_2 = P_3 = P_4 = \frac{F \cdot l_3}{2 \cdot l_1}$ $P_{1T} = P_{2T} = P_{3T} = P_{4T} = \frac{F \cdot l_4}{2 \cdot l_1}$

Type	Operation Conditions	Equations

Wall installation application:
Uniform motion or at rest

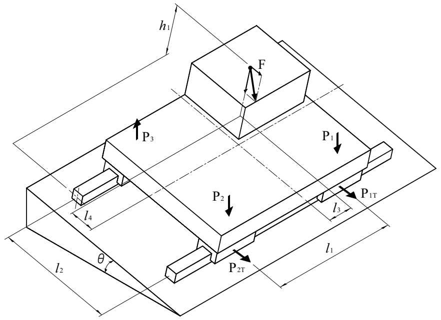


$$P_1=P_2=P_3=P_4=\frac{F\cdot l_4}{2\cdot l_2}$$

$$P_{1T}=P_{4T}=\frac{F}{4}+\frac{F\cdot l_3}{2\cdot l_1}$$

$$P_{2T}=P_{3T}=\frac{F}{4}-\frac{F\cdot l_3}{2\cdot l_1}$$

Laterally tilted application



$$P_1=\frac{F\cdot cos\theta}{4}+\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}-\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}+\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_2}$$

$$P_2=\frac{F\cdot cos\theta}{4}-\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}-\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}+\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_2}$$

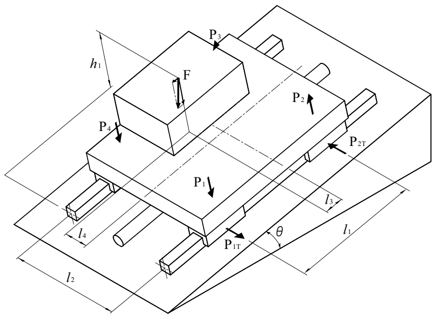
$$P_3=\frac{F\cdot cos\theta}{4}-\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}+\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}-\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_2}$$

$$P_4=\frac{F\cdot cos\theta}{4}+\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}+\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}-\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_2}$$

$$P_{1T}=P_{4T}=\frac{F\cdot sin\theta}{4}+\frac{F\cdot sin\theta\cdot l_3}{2\cdot l_1}$$

$$P_{2T}=P_{3T}=\frac{F\cdot sin\theta}{4}-\frac{F\cdot sin\theta\cdot l_3}{2\cdot l_1}$$

Longitudinally tilted application



$$P_1=\frac{F\cdot cos\theta}{4}+\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}-\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}+\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_1}$$

$$P_2=\frac{F\cdot cos\theta}{4}-\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}-\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}-\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_1}$$

$$P_3=\frac{F\cdot cos\theta}{4}-\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}+\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}-\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_1}$$

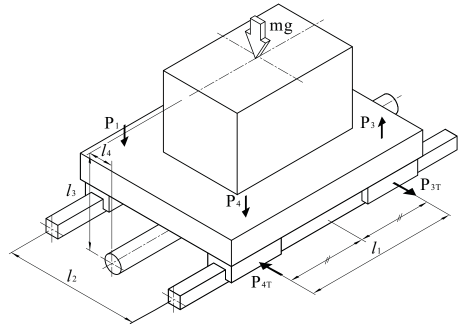
$$P_4=\frac{F\cdot cos\theta}{4}+\frac{F\cdot cos\theta\cdot l_3}{2\cdot l_1}+\frac{F\cdot cos\theta\cdot l_4}{2\cdot l_2}+\frac{F\cdot sin\theta\cdot h_1}{2\cdot l_1}$$

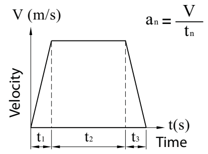
$$P_{1T}=P_{4T}=+\frac{F\cdot sin\theta\cdot l_4}{2\cdot l_1}$$

$$P_{2T}=P_{3T}=-\frac{F\cdot sin\theta\cdot l_4}{2\cdot l_1}$$

Type	Operation Conditions	Equations

Horizontal application: Subjected to inertia





Velocity diagram

During acceleration

$$P_1=P_4=\frac{mg}{4}-\frac{m\cdot a_1\cdot l_3}{2\cdot l_1}$$

$$P_2=P_3=\frac{mg}{4}+\frac{m\cdot a_1\cdot l_3}{2\cdot l_1}$$

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{m\cdot a_1\cdot l_4}{2\cdot l_1}$$

In uniform motion

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{mg}{4}$$

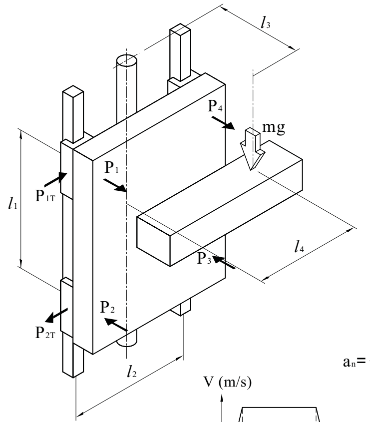
During deceleration

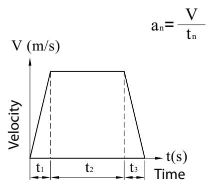
$$P_1=P_4=\frac{mg}{4}+\frac{m\cdot a_3\cdot l_3}{2\cdot l_1}$$

$$P_2=P_3=\frac{mg}{4}-\frac{m\cdot a_3\cdot l_3}{2\cdot l_1}$$

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{m\cdot a_3\cdot l_4}{2\cdot l_1}$$

Vertical application: Subjected to inertia





Velocity diagram

During acceleration

$$P_1=P_2=P_3=P_4=\frac{m\cdot(g+a_1)\cdot l_3}{2\cdot l_1}$$

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{m\cdot(g+a_1)\cdot l_4}{2\cdot l_1}$$

In uniform motion

$$P_1=P_2=P_3=P_4=\frac{m\cdot g\cdot l_3}{2\cdot l_1}$$

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{m\cdot g\cdot l_4}{2\cdot l_1}$$

During deceleration

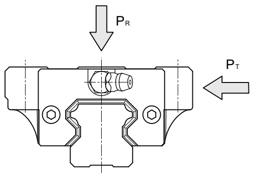
$$P_1=P_2=P_3=P_4=\frac{m\cdot(g-a_3)\cdot l_3}{2\cdot l_1}$$

$$P_{1T}=P_{2T}=P_{3T}=P_{4T}=\frac{m\cdot(g-a_3)\cdot l_4}{2\cdot l_1}$$

7 Calculation of the Equivalent Load

The linear guideway system can take up loads and moments in all four directions those are radial load, reverse-radial load, and lateral load simultaneously. When more than one load is exerted on linear guideway system simultaneously, all loads could be converted into radial or lateral equivalent load for calculating service life and static safety factor. ***PMI*** linear guideway has four-way equal load design. The calculation of equivalent load for the use of two or more linear guideways is shown as below.

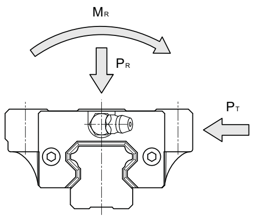
$$P_E = |P_R| + |P_T|$$



P_E Equivalent load (N)
P_R Radial or reverse-radial load (N)
P_T Lateral load (N)

For the case of mono rail, the moment effect should be considered. The equation is:

$$P_E = |P_R| + |P_T| + C_0 \cdot \frac{|M|}{M_R}$$



P_E Equivalent load (N)
P_R Radial or reverse-radial load (N)
P_T Lateral load (N)
C_0 Basic static load rating (N)
M Calculated moment ($N \cdot m$)
M_R Permissible static moment ($N \cdot m$)

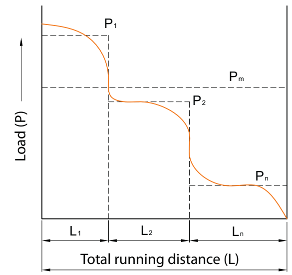
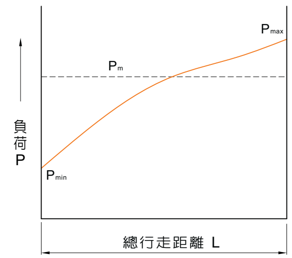
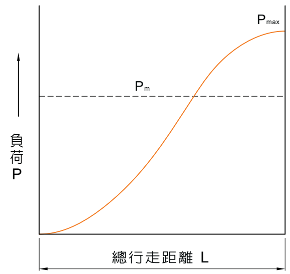
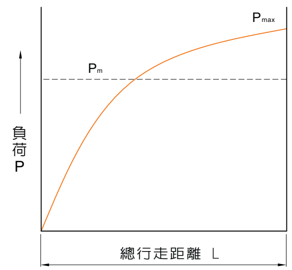
The Calculation of the Mean Load 8

When a linear guideway system receives varying loads, the service life could be calculated in consideration of varying loads of the host-system operation conditions. The mean load (Pm) is the load that the service life is equivalent to the system which under the varying load conditions. The equation of mean load is:

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

P_m Mean load (N)
P_n Varying load (N)
L Total running distance (mm)
L_n Running distance under load P_n (mm)
e Exponent (Ball type:3, Roller type:10/3)

Examples for calculating mean load

Types of Varying Load		Calculation of Mean Load
Loads that change stepwise		$P_m = \sqrt[e]{\frac{1}{L}(P_1^e \cdot L_1 + P_2^e \cdot L_2 \cdots\cdots + P_n^e \cdot L_n)}$ P_m Mean load (N) P_n Varying load (N) L Total running distance (mm) L_n Running distance under load P_n (mm)
Loads that change monotonously		$P_m \cong \frac{1}{3}(P_{min} + 2 \cdot P_{max})$ P_m Mean load (N) P_{min} Minimum load (N) P_{max} Maximum load (N)
Loads that change sinusoidally	 $P_m \cong 0.65 \cdot P_{max}$ P_m Mean load (N) P_{max} Maximum load (N)	 $P_m \cong 0.75 \cdot P_{max}$ P_m Mean load (N) P_{max} Maximum load (N)

9 Calculation Example

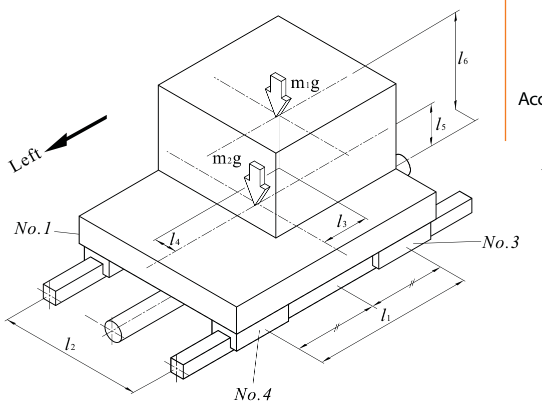
Operation conditions

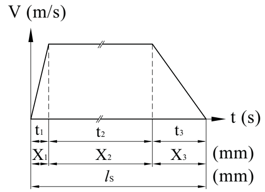
Modle MSA35LA2SSFC + R2520-20/20 P II

Basic dynamic load rating ∶ C = 63.6 kN

Basic static load rating ∶ C₀ = 100.6 kN

Mass	m_1 = 700 kg m_2 = 450 kg	Stroke	l_s = 1500 mm
Velocity	V = 0.75 m/s	Distance	l_1 = 650 mm l_2 = 450 mm l_3 = 135 mm l_4 = 60 mm l_5 = 175 mm l_6 = 400 mm
Time	t_1 = 0.05 s t_2 = 1.9 s t_3 = 0.15 s		
Acceleration	a_1 = 15 m/s² a_3 = 5 m/s²		





Velocity diagram

9.1 Calculate the load that each carriage exerts

9.1.1 Uniform motion, Radial load P_n

$$P_1 = \frac{m_1 g}{4} - \frac{m_1 g \cdot l_3}{2l_1} + \frac{m_1 g \cdot l_4}{2l_2} + \frac{m_2 g}{4}$$

= 2562.4 N

$$P_2 = \frac{m_1 g}{4} + \frac{m_1 g \cdot l_3}{2l_1} + \frac{m_1 g \cdot l_4}{2l_2} + \frac{m_2 g}{4}$$

= 3987.2 N

$$P_3 = \frac{m_1 g}{4} + \frac{m_1 g \cdot l_3}{2l_1} - \frac{m_1 g \cdot l_4}{2l_2} + \frac{m_2 g}{4}$$

= 3072.6 N

$$P_4 = \frac{m_1 g}{4} - \frac{m_1 g \cdot l_3}{2l_1} - \frac{m_1 g \cdot l_4}{2l_2} + \frac{m_2 g}{4}$$

= 1647.8 N

9.1.2 During acceleration to the left, Radial load $P_n la_1$

$$P_1 la_1 = P_1 - \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= -1577 N

$$P_2 la_1 = P_2 + \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= 8126.6 N

$$P_3 la_1 = P_3 + \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= 7212 N

$$P_4 la_1 = P_4 - \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= -2491.6 N

Lateral load $Pt_n la_1$

$$Pt_1 la_1 = -\frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = -484.6 \text{ N}$$

$$Pt_2 la_1 = \frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = 484.6 \text{ N}$$

$$Pt_3 la_1 = \frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = 484.6 \text{ N}$$

$$Pt_4 la_1 = -\frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = -484.6 \text{ N}$$

9.1.3 During deceleration to the left, Radial load $P_n la_3$

$$P_1 la_3 = P_1 + \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_3 \cdot l_5}{2l_1}$$

= 3942.2 N

$$P_2 la_3 = P_2 - \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_3 \cdot l_5}{2l_1}$$

= 2607.4 N

$$P_3 la_3 = P_3 - \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_3 \cdot l_5}{2l_1}$$

= 1692.8 N

$$P_4 la_3 = P_4 + \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_3 \cdot l_5}{2l_1}$$

= 3027.6 N

Lateral load $Pt_n la_3$

$$Pt_1 la_3 = \frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = 161.5 \text{ N}$$

$$Pt_2 la_3 = -\frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = -161.5 \text{ N}$$

$$Pt_3 la_3 = -\frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = 161.5 \text{ N}$$

$$Pt_4 la_3 = \frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = -161.5 \text{ N}$$

9.1.4 During acceleration to the right, Radial load $P_n ra_1$

$$P_1 ra_1 = P_1 + \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= 6701.8 N

$$P_2 ra_1 = P_2 - \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= -152.2 N

$$P_3 ra_1 = P_3 - \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= -1066.8 N

$$P_4 ra_1 = P_4 + \frac{m_1 \cdot a_1 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_1 \cdot l_5}{2l_1}$$

= 5787.2 N

Lateral load $Pt_n ra_1$

$$Pt_1 ra_1 = \frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = 484.6 \text{ N}$$

$$Pt_2 ra_1 = -\frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = -484.6 \text{ N}$$

$$Pt_3 ra_1 = -\frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = -484.6 \text{ N}$$

$$Pt_4 ra_1 = \frac{m_1 \cdot a_1 \cdot l_4}{2l_1} = 484.6 \text{ N}$$

9.1.5 During deceleration to the right, Radial load P_nra_3

$$P_1ra_3 = P_1 - \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_3 \cdot l_5}{2l_1} = 1182.6\ \text{N}$$

$$P_3ra_3 = P_3 + \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_3 \cdot l_5}{2l_1} = 4452.4\ \text{N}$$

$$P_2ra_3 = P_2 + \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} + \frac{m_2 \cdot a_3 \cdot l_5}{2l_1} = 5367\ \text{N}$$

$$P_4ra_3 = P_4 - \frac{m_1 \cdot a_3 \cdot l_6}{2l_1} - \frac{m_2 \cdot a_3 \cdot l_5}{2l_1} = 268\ \text{N}$$

Lateral load Pt_nra_l

$$Pt_1ra_3 = -\frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = \text{-161.5 N}$$

$$Pt_3ra_3 = \frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = 161.5\ \text{N}$$

$$Pt_2ra_3 = \frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = 161.5\ \text{N}$$

$$Pt_4ra_3 = -\frac{m_1 \cdot a_3 \cdot l_4}{2l_1} = \text{-161.5 N}$$

9.2 Calculate equivalent load

9.2.1 In uniform motion

$$P_{E1} = P_1 = 2562.4\ \text{N} \qquad P_{E3} = P_3 = 3072.6\ \text{N}$$

$$P_{E2} = P_2 = 3987.2\ \text{N} \qquad P_{E4} = P_4 = 1647.8\ \text{N}$$

9.2.2 During acceleration to the left

$$P_{E1}la_1 = |P_1la_1| + |Pt_1la_1| = 2061.6\ \text{N} \qquad P_{E3}la_1 = |P_3la_1| + |Pt_3la_1| = 7696.6\ \text{N}$$

$$P_{E2}la_1 = |P_2la_1| + |Pt_2la_1| = 8611.2\ \text{N} \qquad P_{E4}la_1 = |P_4la_1| + |Pt_4la_1| = 2976.2\ \text{N}$$

9.2.3 During deceleration to the left

$$P_{E1}la_3 = |P_1la_3| + |Pt_1la_3| = 4103.7\ \text{N} \qquad P_{E3}la_3 = |P_3la_3| + |Pt_3la_3| = 1854.3\ \text{N}$$

$$P_{E2}la_3 = |P_2la_3| + |Pt_2la_3| = 2768.9\ \text{N} \qquad P_{E4}la_3 = |P_4la_3| + |Pt_4la_3| = 3189.1\ \text{N}$$

9.2.4 During acceleration to the right

$$P_{E1}ra_1 = |P_1la_1| + |Pt_1la_1| = 7186.4\ \text{N} \qquad P_{E3}ra_1 = |P_3la_1| + |Pt_3la_1| = 1551.4\ \text{N}$$

$$P_{E2}ra_1 = |P_2la_1| + |Pt_2la_1| = 636.8\ \text{N} \qquad P_{E4}ra_1 = |P_4la_1| + |Pt_4la_1| = 6271.8\ \text{N}$$

9.2.5 During deceleration to the right

$$P_{E1}ra_3 = |P_1la_3| + |Pt_1la_3| = 1344.1\ \text{N} \qquad P_{E3}ra_3 = |P_3la_3| + |Pt_3la_3| = 4613.9\ \text{N}$$

$$P_{E2}ra_3 = |P_2la_3| + |Pt_2la_3| = 5528.5\ \text{N} \qquad P_{E4}ra_3 = |P_4la_3| + |Pt_4la_3| = 429.5\ \text{N}$$

9.3 Calculation of static factor

From above, the maximum load is exerted on carriage No.2 when during acceleration of the 2nd linear guideway to the left.

$$fs = \frac{C_O}{P_{E2}la_1} = \frac{100.6\times10^3}{8611.2} = 11.7$$

9.4 Calculate the mean load on each carriage Pm_n

$$P_{m1} = \sqrt[3]{\frac{(P_{E1}la_1^3 \cdot X_1 + P_{E1}^3 \cdot X_2 + P_{E1}la_3^3 \cdot X_3 + P_{E1}ra_1^3 \cdot X_1 + P_{E1}^3 \cdot X_2 + P_{E1}ra_3^3 \cdot X_3)}{2l_S}} = 2700.7\ \text{N}$$

$$P_{m2} = \sqrt[3]{\frac{(P_{E2}la_1^3 \cdot X_1 + P_{E2}^3 \cdot X_2 + P_{E2}la_3^3 \cdot X_3 + P_{E2}ra_1^3 \cdot X_1 + P_{E2}^3 \cdot X_2 + P_{E2}ra_3^3 \cdot X_3)}{2l_S}} = 4077.2\ \text{N}$$

$$P_{m3} = \sqrt[3]{\frac{(P_{E3}la_1^3 \cdot X_1 + P_{E3}^3 \cdot X_2 + P_{E3}la_3^3 \cdot X_3 + P_{E3}ra_1^3 \cdot X_1 + P_{E3}^3 \cdot X_2 + P_{E3}ra_3^3 \cdot X_3)}{2l_S}} = 3187.7\ \text{N}$$

$$P_{m4} = \sqrt[3]{\frac{(P_{E4}la_1^3 \cdot X_1 + P_{E4}^3 \cdot X_2 + P_{E4}la_3^3 \cdot X_3 + P_{E4}ra_1^3 \cdot X_1 + P_{E4}^3 \cdot X_2 + P_{E4}ra_3^3 \cdot X_3)}{2l_S}} = 1872.6\ \text{N}$$

9.5 Calculation of nominal life (L_n)

Base on the equation of the nominal life, we assume the f_W=1.5 and the result is as below:

$$L_1 = \left(\frac{C}{f_W \cdot P_{m1}}\right)^3 \times 50 = 193500\ \text{km} \qquad L_3 = \left(\frac{C}{f_W \cdot P_{m3}}\right)^3 \times 50 = 117700\ \text{km}$$

$$L_2 = \left(\frac{C}{f_W \cdot P_{m2}}\right)^3 \times 50 = 56231\ \text{km} \qquad L_4 = \left(\frac{C}{f_W \cdot P_{m4}}\right)^3 \times 50 = 580400\ \text{km}$$

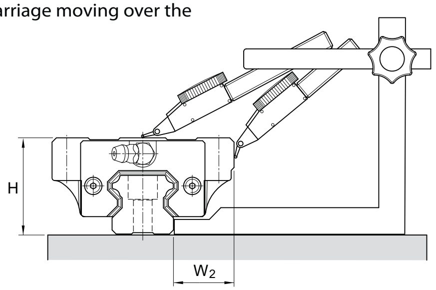
From these calculations and under the operating conditions specified as above, the 56231 km running distance as service life of carriage No.2 is obtained.

10 Accuracy Standard

The accuracy of linear guideway includes the dimensional tolerance of height, width, and the running accuracy of the carriage on the rail. The standard of the dimension difference is built for two or more carriages on a rail or a number of rails are used on the same plane. The accuracy of linear guideway is divided into 5 classes, normal grade (N), high precision (H), precision (P), super precision (SP), and ultra precision (UP).

Running parallelism

The running accuracy is the deviation of parallelism between the reference surface of carriage and reference surface of rail when carriage moving over the entire length of rail.



Height difference (ΔH)

The height difference (ΔH) means the height difference among carriages installed on the same plane.

Width difference (ΔW_2)

The width difference (ΔW_2) means the width difference among carriages installed on a rail.

Additional remarks：

1. When two or more linear guideways are used on the same plane, the tolerance of W_2 and difference of ΔW_2 is applicable to master rail only.

2. The accuracy is measured at the center or central area of carriage.

10.1 The Selection of Accuracy Grade

The accuracy grade for different applications shown as table below.

Sort	Application	Accuracy Grade				
		N	H	P	SP	UP
Machine Tool	Machining center			●	●	
	Lathe			●	●	
	Milling machine			●	●	
	Boring machine			●	●	
	Jig borer				●	●
	Grinding machine				●	●
	Electric discharge machine			●	●	●
	Punching press		●	●		
	Laser-beam machine		●	●	●	
	Woodworking machine	●	●	●		
	NC drilling machine		●	●		
	Tapping center		●	●		
	Pallet changer	●				
	ATC	●				
	Wire cutter			●	●	
	Dresser				●	●

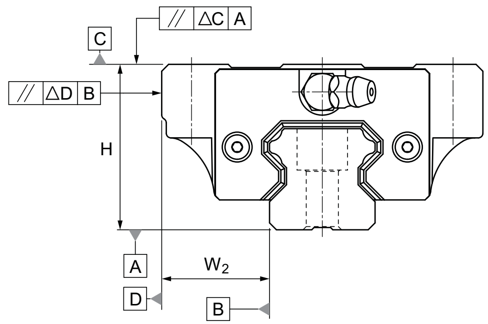
Sort	Application	Accuracy Grade				
		N	H	P	SP	UP
Industrial Robot	Cartesian coordinate robot	●	●	●		
	Cylindrical coordinate robot	●	●			
Semiconductor Manufacturing	Wire bonder			●	●	
	Prober				●	●
	Electronic-component inserter		●	●		
	Printed-circuit-board drilling machine		●	●	●	
Others	Injection-molding machine	●	●			
	3D measuring instrument				●	●
	Office equipment	●	●			
	Transfer equipment	●	●			
	XY table		●	●	●	
	Painting machine	●	●			
	Welding machine	●	●			
	Medical equipment	●	●			
	Digitizer		●	●	●	
	Inspection equipment			●	●	●

10.2 Accuracy Standard of Each Series

Accuracies of series MSA, MSB, MSR, SME and SMR：

Model No.	Item	Accuracy Grade: Normal N	High H	Precision P	Super Precision SP	Ulitra Precision UP
15 20	Tolerance for height H	±0.1	±0.03	0 -0.03	0 -0.015	0 -0.008
	Height difference ΔH	0.02	0.01	0.006	0.004	0.003
	Tolerance for distance W_2	±0.1	±0.03	0 -0.03	0 -0.015	0 -0.008
	Difference in distance $W_2(\Delta W_2)$	0.02	0.01	0.006	0.004	0.003
	Running parallelism of surface C with surface A	ΔC (see the right table)				
	Running parallelism of surface D with surface B	ΔD (see the right table)				
25 30 35	Tolerance for height H	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
	Height difference ΔH	0.02	0.015	0.007	0.005	0.003
	Tolerance for distance W_2	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
	Difference in distance $W_2(\Delta W_2)$	0.03	0.015	0.007	0.005	0.003
	Running parallelism of surface C with surface A	ΔC (see the right table)				
	Running parallelism of surface D with surface B	ΔD (see the right table)				
45 55	Tolerance for height H	±0.1	±0.05	0 -0.05	0 -0.03	0 -0.02
	Height difference ΔH	0.03	0.015	0.007	0.005	0.003
	Tolerance for distance W_2	±0.1	±0.05	0 -0.05	0 -0.03	0 -0.02
	Difference in distance $W_2(\Delta W_2)$	0.03	0.02	0.01	0.007	0.005
	Running parallelism of surface C with surface A	ΔC (see the right table)				
	Running parallelism of surface D with surface B	ΔD (see the right table)				
65	Tolerance for height H	±0.1	±0.07	0 -0.07	0 -0.05	0 -0.03
	Height difference ΔH	0.03	0.02	0.01	0.007	0.005
	Tolerance for distance W_2	±0.1	±0.07	0 -0.07	0 -0.05	0 -0.03
	Difference in distance $W_2(\Delta W_2)$	0.03	0.025	0.015	0.01	0.007
	Running parallelism of surface C with surface A	ΔC (see the right table)				
	Running parallelism of surface D with surface B	ΔD (see the right table)				

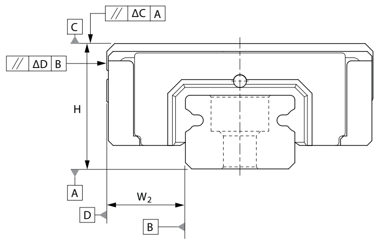
※For MSR and SMR series, only high or higher grades apply.



Rail length (mm)		Running Parallelism Values (μm)				
Above	Or less	N	H	P	SP	UP
0	315	9	6	3	2	1.5
315	400	11	8	4	2	1.5
400	500	13	9	5	2	1.5
500	630	16	11	6	2.5	1.5
630	800	18	12	7	3	2
800	1000	20	14	8	4	2
1000	1250	22	16	10	5	2.5
1250	1600	25	18	11	6	3
1600	2000	28	20	13	7	3.5
2000	2500	30	22	15	8	4
2500	3000	32	24	16	9	4.5
3000	3500	33	25	17	11	5
3500	4000	34	26	18	12	6

Accuracy of MSC series, divided into 3 classes, normal grade (N), high precision (H), precision (P)

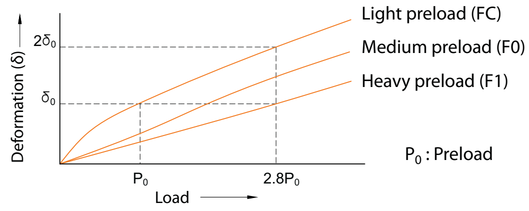
Model No.	Item	Accuracy Grade		
		Normal N	High H	Precision P
7 9 12 15	Tolerance for height H	±0.04	±0.02	±0.01
	Height difference ΔH	0.03	0.015	0.007
	Tolerance for distance W_2	±0.04	±0.025	±0.015
	Difference in distance W_2(ΔW_2)	0.03	0.02	0.01
	Running parallelism of surface C with surface A	ΔC (see Fig)		
	Running parallelism of surface D with surface B	ΔD (see Fig)		



Rail length (mm)		Running Parallelism Values (μm)		
Above	Or less	N	H	P
-	40	8	4	1
40	70	10	4	1
70	100	11	4	2
100	130	12	5	2
130	160	13	6	2
160	190	14	7	2
190	220	15	7	3
220	250	16	8	3
250	280	17	8	3
280	310	17	9	3
310	340	18	9	3
340	370	18	10	3
370	400	19	10	3
400	430	20	11	4
430	460	20	12	4
460	490	21	12	4
490	520	21	12	4

Rail length (mm)		Running Parallelism Values (μm)		
Above	Or less	N	H	P
520	550	22	12	4
550	580	22	13	4
580	610	22	13	4
610	640	22	13	4
640	670	23	13	4
670	700	23	13	5
700	730	23	14	5
730	760	23	14	5
760	790	23	14	5
790	820	23	14	5
820	850	24	14	5
850	880	24	15	5
880	910	24	15	5
910	940	24	15	5
940	970	24	15	5
970	1000	25	16	5

The rigidity of a linear guideway could be enhanced by increasing the preload. As shown as right figure, the load could be raised up to 2.8 times the preload applied. The preload is represented by negative clearance resulting from the increase of rolling element diameter. Therefore, the preload should be considered in calculation service life.



11.1 The Selection of Preload

Selecting proper preload from table below to adapt the specific application and condition.

Preload	Operating Condition	Major Application
Light preload (FC)	• The loading direction is fixed, vibration and impact are light, and two axes are applied in parallel. • High precision is not required, and the low frictional resistance is needed.	Welding machine, binding machine, auto packing machine, XY axis of ordinary industrial machine, material handling equipments.
Medium preload (F0)	• Overhang application with a moment load. • Applied in one-axis configuration • The need of light preload and high precision.	Z axis of industrial machines, EDM, precision XY table, PC board drilling machine, industrial robot, NC lathe, measuring equipment, grinding machine, auto painting machine.
Heavy preload (F1)	• Machine is subjected to vibration and impact, and high rigidity required. • Application of heavy load or heavy cutting.	Machine center, NC lathe, grinding machine, milling machine, Z axis of boring machine and machine tools.
Ultra heavy preload (F2)	• Machine is subjected to vibration and impact, and high rigidity required. • Application of heavy load or heavy cutting.	Machine center, NC lathe, grinding machine, milling machine, Z axis of boring machine and machine tools.

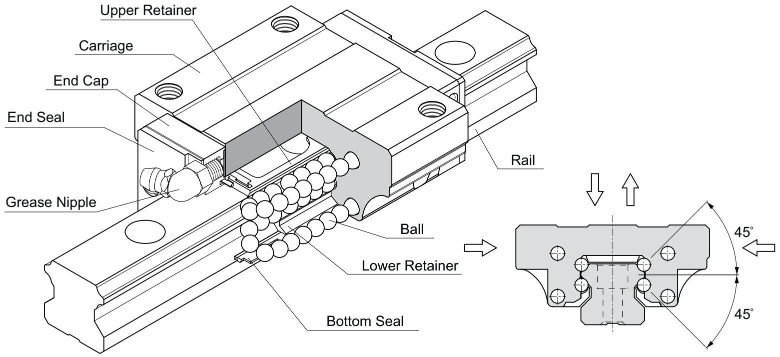
11.2 Preload Grades of Each Series

Preload grades of each series is shown as the table below, the preload is the percentage of basic dynamic load rating (C). The basic dynamic load rating is reference to the dimension tables of each series.

Series / Preload grade and preload(N)		MSA	MSB	MSR	MSC	SME	SMR
Light preload (FC)	0.02 C	●	●		● (Zero)	●	
Medium preload (F0)	0.05 C	●	●	●	● (0.02C)	●	●
Heavy preload (F1)	0.08 C	●	●	●		●	●
Ultra heavy preload (F2)	0.13 C			●			●

12.1 Heavy Load Type, MSA Series

A. Construction



B. Characteristics

The trains of balls are designed to a contact angle of 45° which enables it to bear an equal load in radial, reversed radial and lateral directions. Therefore, it can be applied in any installation direction. Furthermore, MSA series can achieve a well balanced preload for increasing rigidity in four directions while keeping a low frictional resistance. This is especially suit to high precision and high rigidity required motion.

The patent design of lubrication route makes the lubricant evenly distribute in each circulation loop. Therefore, the optimum lubrication can be achieved in any installation direction, and this promotes the performance in running accuracy, service life, and reliability.

High Rigidity, Four-way Equal Load

The four trains of balls are allocated to a circular contact angle at 45°, thus each train of balls can take up an equal rated load in all four directions. Moreover, a sufficient preload can be achieved to increase rigidity, and this makes it suitable for any kind of installation.

Smooth Movement with Low Noise

The simplified design of circulating system with strengthened synthetic resin accessories makes the movement smooth and quiet.

Self Alignment Capability

The self adjustment is performed spontaneously as the design of face-to-face (DF) circular arc groove. Therefore, the installation error could be compensated even under a preload, and which results in precise and smooth linear motion.

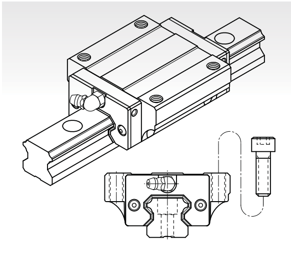
Interchangeability

For interchangeable type of linear guideway, the dimensional tolerances are strictly maintained within a reasonable range, and this has made the random matching of the same size of rails and carriages possible. Therefore, the similar preload and accuracy can be obtained even under the random matching condition. As a result of this advantage, the linear guideway can be stocked as standard parts, the installation and maintenance become more convenient. Moreover, this is also beneficial for shortening the delivery time.

C. Carriage Type

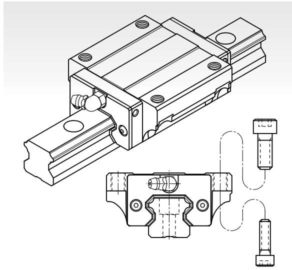
Heavy Load

MSA-A Type



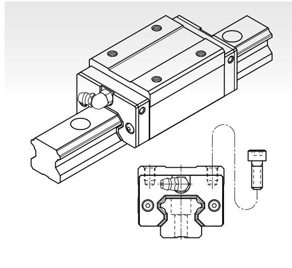
Installed from top side of carriage with the thread length longer than MSA-E type.

MSA-E Type



This type offers the installation either from top or bottom side of carriage.

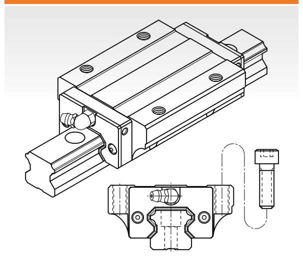
MSA-S Type



Square type with smaller width and can be installed from top side of carriage.

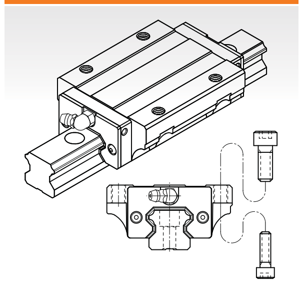
Ultra Heavy Load

MSA-LA Type



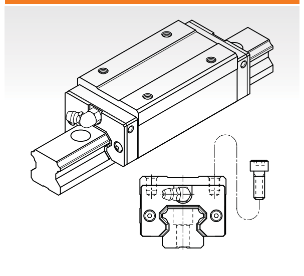
All dimensions are same as MSA-A except the length is longer, which makes it more rigid.

MSA-LE Type



All dimensions are same as MSA-E except the length is longer, which makes it more rigid.

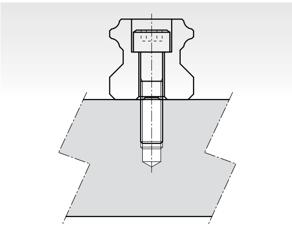
MSA-LS Type



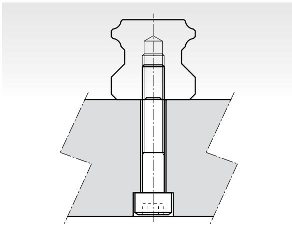
All dimensions are same as MSA-S except the length is longer, which makes it more rigid.

D. Rail Type

Counter bore (R type)



Tapped Hole (T type)



E. Description of Specification

(1) Non-Interchangeable Type

MSA 25 A 2 SS F0 + R 1200 - 20 / 40 P II

- Series : **MSA**
- Size : **15, 20, 25, 30, 35, 45, 55, 65**
- Carriage type : (1) Heavy load
  - **A** : Flange type, mounting from top
  - **E** : Flange type, mounting either from top or bottom
  - **S** : Square type

  (2) Ultra heavy load
  - **LA** : Flange type, mounting from top
  - **LE** : Flange type, mounting either from top or bottom
  - **LS** : Square type
- Number of carriages per rail : **1, 2, 3 ...**
- Dust protection option of carriage : No symbol, **UU, SS, ZZ, DD, KK, LL, RR** (see page B85)
- Preload : **FC** (Light preload) , **F0** (Medium preload) , **F1** (Heavy preload) (see page B27)
- Code of special carriage : **No symbol, A, B ...**
- Rail type : **R** (Counter-bore type), **T** (Tapped hole type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig.12.1)
- Rail hole pitch to the end side (**E2**, see Fig.12.1)
- Accuracy grade : **N, H, P, SP, UP**
- Code of special rail : **No symbol, A, B ...**
- Dust protection option of rail : **No symbol, /CC, /MC** (see page B85)
- Number of rails per axis : **No symbol, II, III, IV ...**

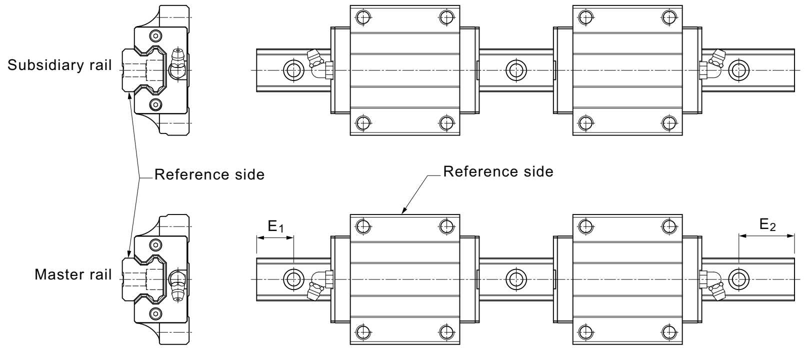


Fig12.1

(2) Interchangeable Type

Code of Carriage **MSA 25 A SS FC N**

- Series : **MSA**
- Size : **15, 20, 25, 30, 35, 45, 55, 65**
- Carriage type : (1) Heavy load
  - **A** : Flange type, mounting from top
  - **E** : Flange type, mounting either from top or bottom
  - **S** : Square type

  (2) Ultra heavy load
  - **LA** : Flange type, mounting from top
  - **LE** : Flange type, mounting either from top or bottom
  - **LS** : Square type
- Dust protection option of carriage : **No symbol, UU, SS, ZZ, DD, KK, LL, RR** (see page B85)
- Preload : **FC** (Light preload) (see page B27)
- Accuracy grade : **N, H**
- Code of special carriage : **No symbol, A, B ...**

Code of Rail **MSA 25 R 1200 - 20 / 40 N**

- Series : **MSA**
- Size : **15, 20, 25, 30, 35, 45, 55, 65**
- Rail type : **R** (Counter-bore type), **T** (Tapped hole type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig.12.1)
- Rail hole pitch to the end side (**E2**, see Fig.12.1)
- Accuracy grade : **N, H**
- Code of special rail : **No symbol, A, B ...**
- Dust protection option of rail : **No symbol, /CC, /MC** (see page B85)

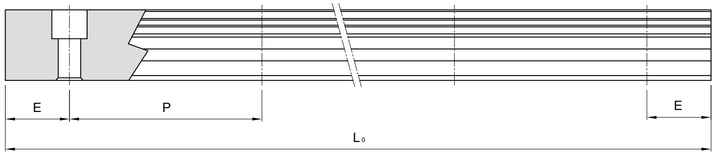
F. Accuracy Grade
For details, see page B24

G. Preload Grade
For details, see page B27

H. The Shoulder Height and Corner Radius for Installation
For details, see page B73

I. Dimensional Tolerance of Mounting Surface
For details, see page B75

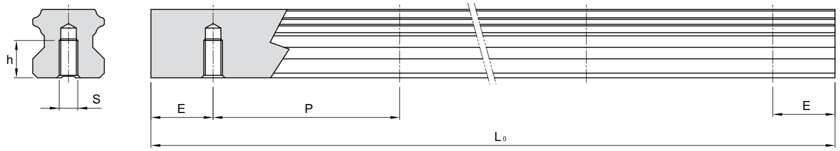
J. Rail Maximum Length and Standrad



Unit: mm

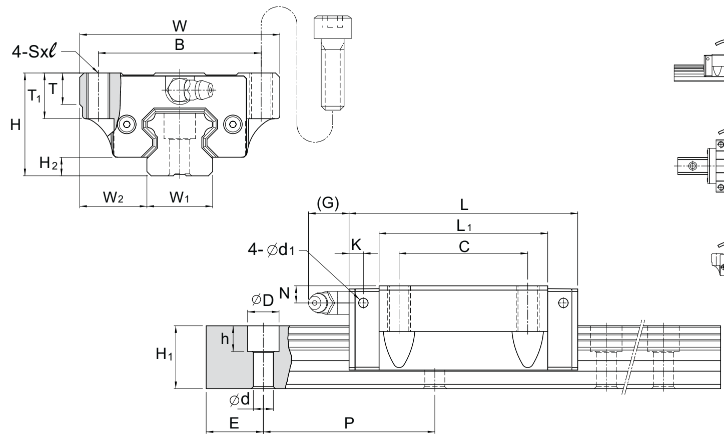
Model No.	MSA 15	MSA 20	MSA 25	MSA 30	MSA 35	MSA 45	MSA 55	MSA 65
Standard Pitch (P)	60	60	60	80	80	105	120	150
Standard ($E_{std.}$)	20	20	20	20	20	22.5	30	35
Minimum ($E_{min.}$)	5	6	7	8	8	11	13	14
Max (L_0 max.)	2000	4000	4000	4000	4000	4000	4000	4000

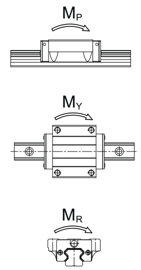
K. Tapped-hole Rail Dimensions



Rail Model	S	h(mm)
MSA 15 T	M5	8
MSA 20 T	M6	10
MSA 25 T	M6	12
MSA 30 T	M8	15
MSA 35 T	M8	17
MSA 45 T	M12	24
MSA 55 T	M14	24
MSA 65 T	M20	30

Dimensions of MSA-A / MSA-LA





Unit: mm

Model No.	External dimension					Carriage dimension											
	Height H	Width W	Length L	W_2	H_2	B	C	$S \times \ell$	L_1	T	T_1	N	G	K	d_1	Grease Nipple
MSA 15 A	24	47	56.3	16	4.2	38	30	M5×11	39.3	7	11	4.3	7	3.2	3.3	G-M4
MSA 20 A MSA 20 LA	30	63	72.9 88.8	21.5	5	53	40	M6×10	51.3 67.2	7	10	5	12	5.8	3.3	G-M6
MSA 25 A MSA 25 LA	36	70	81.6 100.6	23.5	6.5	57	45	M8×16	59 78	11	16	6	12	5.8	3.3	G-M6
MSA 30 A MSA 30 LA	42	90	97 119.2	31	8	72	52	M10×18	71.4 93.6	11	18	7	12	6.5	3.3	G-M6
MSA 35 A MSA 35 LA	48	100	111.2 136.6	33	9.5	82	62	M10×21	81 106.4	13	21	8	11.5	8.6	3.3	G-M6
MSA 45 A MSA 45 LA	60	120	137.7 169.5	37.5	10	100	80	M12×25	102.5 134.3	13	25	10	13.5	10.6	3.3	G-PT1/8

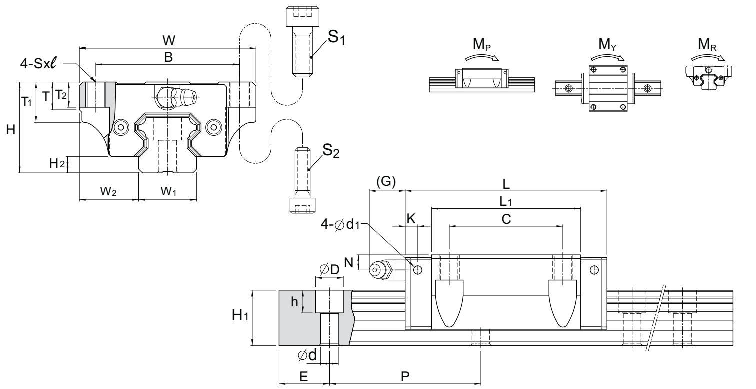
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m		M_Y kN-m		M_R kN-m	Carriage kg	Rail kg/m
								Single*	Double*	Single*	Double*			
MSA 15 A	15	15	60	20	7.5×5.3×4.5	11.8	18.9	0.12	0.68	0.12	0.68	0.14	0.18	1.5
MSA 20 A MSA 20 LA	20	18	60	20	9.5×8.5×6	19.2 23.3	29.5 39.3	0.23 0.39	1.42 2.23	0.23 0.39	1.42 2.23	0.29 0.38	0.4 0.52	2.4
MSA 25 A MSA 25 LA	23	22	60	20	11×9×7	28.1 34.4	42.4 56.6	0.39 0.67	2.20 3.52	0.39 0.67	2.20 3.52	0.48 0.63	0.62 0.82	3.4
MSA 30 A MSA 30 LA	28	26	80	20	14×12×9	39.2 47.9	57.8 77.0	0.62 1.07	3.67 5.81	0.62 1.07	3.67 5.81	0.79 1.05	1.09 1.43	4.8
MSA 35 A MSA 35 LA	34	29	80	20	14×12×9	52.0 63.6	75.5 100.6	0.93 1.60	5.47 8.67	0.93 1.60	5.47 8.67	1.25 1.67	1.61 2.11	6.6
MSA 45 A MSA 45 LA	45	38	105	22.5	20×17×14	83.8 102.4	117.9 157.3	1.81 3.13	10.67 16.95	1.81 3.13	10.67 16.95	2.57 3.43	2.98 3.9	11.5

Note: Request for size 55 and 65 MSA-A / MSA-LA carriage, please refer to MSA-E / MSA-LE carriage type.

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of MSA-E / MSA-LE



Model No.	Bolt Size	
	S_1	S_2
MSA 15	M5	M4
MSA 20	M6	M5
MSA 25	M8	M6
MSA 30	M10	M8
MSA 35	M10	M8
MSA 45	M12	M10
MSA 55	M14	M12
MSA 65	M16	M14

Unit: mm

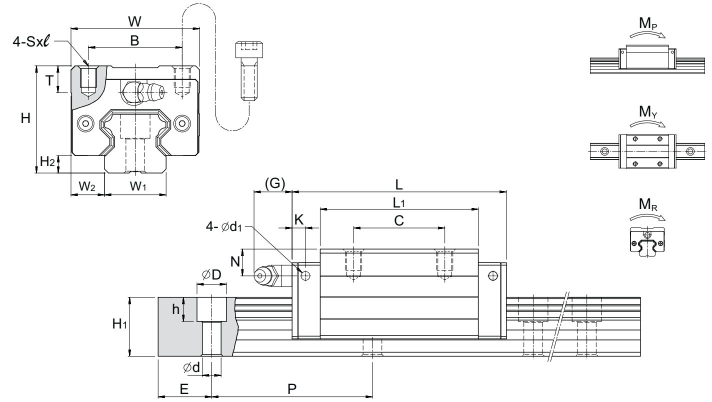
Model No.	External dimension					Carriage dimension												
	Height H	Width W	Length L	W_2	H_2	B	C	S × ℓ	L_1	T	T_1	T_2	N	G	K	d_1	Grease Nipple
MSA 15 E	24	47	56.3	16	4.2	38	30	M5×7	39.3	7	11	7	4.3	7	3.2	3.3	G-M4
MSA 20 E	30	63	72.9	21.5	5	53	40	M6×10	51.3	7	10	10	5	12	5.8	3.3	G-M6
MSA 20 LE			88.8						67.2								
MSA 25 E	36	70	81.6	23.5	6.5	57	45	M8×10	59	11	16	10	6	12	5.8	3.3	G-M6
MSA 25 LE			100.6						78								
MSA 30 E	42	90	97	31	8	72	52	M10×10	71.4	11	18	10	7	12	6.5	3.3	G-M6
MSA 30 LE			119.2						93.6								
MSA 35 E	48	100	111.2	33	9.5	82	62	M10×13	81	13	21	13	8	11.5	8.6	3.3	G-M6
MSA 35 LE			136.6						106.4								
MSA 45 E	60	120	137.7	37.5	10	100	80	M12×15	102.5	13	25	15	10	13.5	10.6	3.3	G-PT 1/8
MSA 45 LE			169.5						134.3								
MSA 55 E	70	140	161.5	43.5	13	116	95	M14×17	119.5	19	32	17	11	13.5	8.6	3.3	G-PT 1/8
MSA 55 LE			199.5						157.5								
MSA 65 E	90	170	199	53.5	15	142	110	M16×23	149	21.5	37	23	19	13.5	8.6	3.3	G-PT 1/8
MSA 65 LE			253						203								

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
MSA 15 E	15	15	60	20	7.5×5.3×4.5	11.8	18.9	0.12	0.68	0.12	0.68	0.14	0.18	1.5
MSA 20 E	20	18	60	20	9.5×8.5×6	19.2	29.5	0.23	1.42	0.23	1.42	0.29	0.4	2.4
MSA 20 LE						23.3	39.3	0.39	2.23	0.39	2.23	0.38	0.52	
MSA 25 E	23	22	60	20	11×9×7	28.1	42.4	0.39	2.20	0.39	2.20	0.48	0.62	3.4
MSA 25 LE						34.4	56.6	0.67	3.52	0.67	3.52	0.63	0.82	
MSA 30 E	28	26	80	20	14×12×9	39.2	57.8	0.62	3.67	0.62	3.67	0.79	1.09	4.8
MSA 30 LE						47.9	77.0	1.07	5.81	1.07	5.81	1.05	1.43	
MSA 35 E	34	29	80	20	14×12×9	52.0	75.5	0.93	5.47	0.93	5.47	1.25	1.61	6.6
MSA 35 LE						63.6	100.6	1.60	8.67	1.60	8.67	1.67	2.11	
MSA 45 E	45	38	105	22.5	20×17×14	83.8	117.9	1.81	10.67	1.81	10.67	2.57	2.98	11.5
MSA 45 LE						102.4	157.3	3.13	16.95	3.13	16.95	3.43	3.9	
MSA 55 E	53	44	120	30	23×20×16	123.6	169.8	3.13	17.57	3.13	17.57	4.50	4.17	15.5
MSA 55 LE						151.1	226.4	5.40	28.11	5.40	28.11	6.00	5.49	
MSA 65 E	63	53	150	35	26×22×18	198.8	265.3	6.11	33.71	6.11	33.71	8.36	8.73	21.9
MSA 65 LE						253.5	375.9	11.84	57.32	11.84	57.32	11.84	11.89	

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of MSA-S / MSA-LS



Unit: mm

Model No.	External dimension					Carriage dimension										
	Height H	Width W	Length L	W_2	H_2	B	C	S × ℓ	L_1	T	N	G	K	d_1	Grease Nipple
MSA 15 S	28	34	56.3	9.5	4.2	26	26	M4×5	39.3	7.2	8.3	7	3.2	3.3	G-M4
MSA 20 S	30	44	72.9	12	5	32	36	M5×6	51.3	8	5	12	5.8	3.3	G-M6
MSA 20 LS			88.8				50		67.2						
MSA 25 S	40	48	81.6	12.5	6.5	35	35	M6×8	59	10	10	12	5.8	3.3	G-M6
MSA 25 LS			100.6				50		78						
MSA 30 S	45	60	97	16	8	40	40	M8×10	71.4	11.7	10	12	6.5	3.3	G-M6
MSA 30 LS			119.2				60		93.6						
MSA 35 S	55	70	111.2	18	9.5	50	50	M8×12	81	12.7	15	11.5	8.6	3.3	G-M6
MSA 35 LS			136.6				72		106.4						
MSA 45 S	70	86	137.7	20.5	10	60	60	M10×17	102.5	16	20	13.5	10.6	3.3	G-PT 1/8
MSA 45 LS			169.5				80		134.3						
MSA 55 S	80	100	161.5	23.5	13	75	75	M12×18	119.5	18	21	13.5	8.6	3.3	G-PT 1/8
MSA 55 LS			199.5				95		157.5						
MSA 65 S	90	126	199	31.5	15	76	70	M16×20	149	23	19	13.5	8.6	3.3	G-PT 1/8
MSA 65 LS			253				120		203						

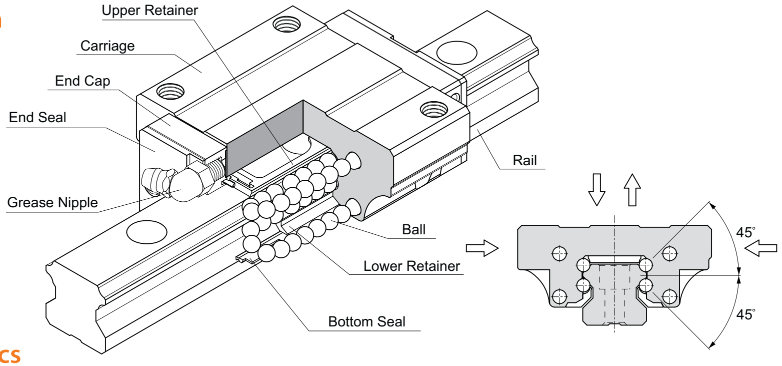
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
MSA 15 S	15	15	60	20	7.5×5.3×4.5	11.8	18.9	0.12	0.68	0.12	0.68	0.14	0.18	1.5
MSA 20 S	20	18	60	20	9.5×8.5×6	19.2	29.5	0.23	1.42	0.23	1.42	0.29	0.3	2.4
MSA 20 LS						23.3	39.3	0.39	2.23	0.39	2.23	0.38	0.39	
MSA 25 S	23	22	60	20	11×9×7	28.1	42.4	0.39	2.20	0.39	2.20	0.48	0.52	3.4
MSA 25 LS						34.4	56.6	0.67	3.52	0.67	3.52	0.63	0.68	
MSA 30 S	28	26	80	20	14×12×9	39.2	57.8	0.62	3.67	0.62	3.67	0.79	0.86	4.8
MSA 30 LS						47.9	77.0	1.07	5.81	1.07	5.81	1.05	1.12	
MSA 35 S	34	29	80	20	14×12×9	52.0	75.5	0.93	5.47	0.93	5.47	1.25	1.45	6.6
MSA 35 LS						63.6	100.6	1.60	8.67	1.60	8.67	1.67	1.9	
MSA 45 S	45	38	105	22.5	20×17×14	83.8	117.9	1.81	10.67	1.81	10.67	2.57	2.83	11.5
MSA 45 LS						102.4	157.3	3.13	16.95	3.13	16.95	3.43	3.7	
MSA 55 S	53	44	120	30	23×20×16	123.6	169.8	3.13	17.57	3.13	17.57	4.50	4.12	15.5
MSA 55 LS						151.1	226.4	5.40	28.11	5.40	28.11	6.00	4.91	
MSA 65 S	63	53	150	35	26×22×18	198.8	265.3	6.11	33.71	6.11	33.71	8.36	6.43	21.9
MSA 65 LS						253.5	375.9	11.84	57.32	11.84	57.32	11.84	8.76	

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

12.2 Compact Type, MSB Series

A. Construction



B. Characteristics

The trains of balls are designed to a contact angle of 45° which enables it to bear an equal load in radial, reversed radial and lateral directions. Therefore, it can be applied in any installation direction. Furthermore, MSB series can achieve a well balanced preload for increasing rigidity in four directions while keeping a low frictional resistance. This is especially suit to high precision and high rigidity required motion.

The patent design of lubrication route makes the lubricant evenly distribute in each circulation loop. Therefore, the optimum lubrication can be achieved in any installation direction, and this promotes the performance in running accuracy, service life, and reliability.

Compact, Four-way Equal Load

Compact design of the carriage with the four trains of balls are allocated to a circular contact angle at 45°, thus each train of balls can take up an equal rated load in all four directions. Moreover, a sufficient preload can be achieved to increase rigidity, and this makes it suitable for any kind of installation.

Smooth Movement with Low Noise

The simplified design of circulating system with strengthened synthetic resin accessories makes the movement smooth and quiet.

Self Alignment Capability

The self adjustment is performed spontaneously as the design of face-to-face (DF) circular arc groove. Therefore, the installation error could be compensated even under a preload, and which results in precise and smooth linear motion.

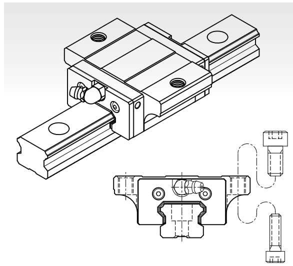
Interchangeability

For interchangeable type of linear guideway, the dimensional tolerances are strictly maintained within a reasonable range, and this has made the random matching of the same size of rails and carriages possible. Therefore, the similar preload and accuracy can be obtained even under the random matching condition. As a result of this advantage, the linear guideway can be stocked as standard parts, the installation and maintenance become more convenient. Moreover, this is also beneficial for shortening the delivery time.

C. Carriage Type

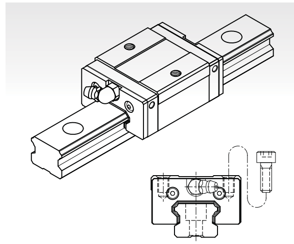
Medium Load

MSB-TE Type



This type offers the installation either from top or bottom side of carriage.

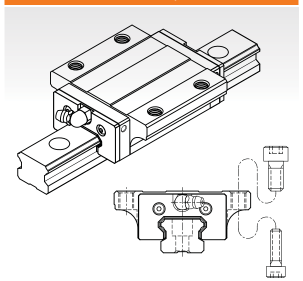
MSB-TS Type



Square type with smaller width and can be installed from top side of carriage.

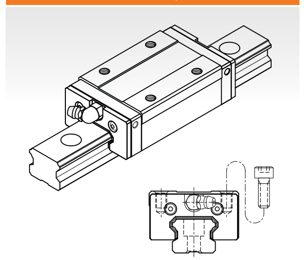
Heavy Load

MSB-E Type



All dimensions are same as MSB-TE except the length is longer, which makes it more rigid.

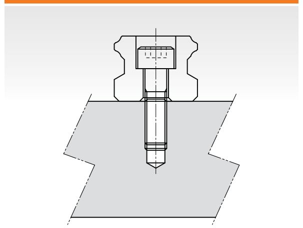
MSB-S Type



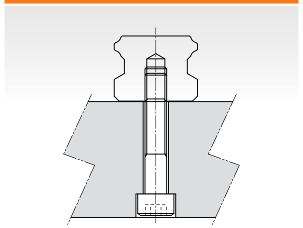
All dimensions are same as MSB-TS except the length is longer, which makes it more rigid.

D. Rail type

Counter bore (R, U type)



Tapped Hole (T type)



E. Description of Specification

(1) Non-Interchangeable Type

MSB 25 E 2 SS F0 +R 1200 -20 /40 P II

Series : **MSB**

Size : **15, 20, 25, 30, 35**

Carriage type : (1) Medium load
TE : Flange type, mounting either from top or bottom
TS : Square type
(2) Ultra heavy load
E : Flange type, mounting either from top or bottom
S : Square type

Number of carriages per rail : **1, 2, 3 ...**

Dust protection option of carriage :
No symbol, **UU, SS, ZZ, DD, KK, LL, RR** (see page B85)

Preload :
FC (Light preload) , **F0** (Medium preload) , **F1** (Heavy preload) (see page B27)

Code of special carriage : **No symbol, A, B ...**

Rail type : **R ,U**[1] (Counter-bore type), **T** (Tapped hole type)

Rail length (mm)

Rail hole pitch from start side (**E1**, see Fig.12.2)

Rail hole pitch to the end side (**E2**, see Fig.12.2)

Accuracy grade : **N, H, P, SP, UP**

Code of special rail : **No symbol, A, B ...**

Dust protection option of rail : **No symbol, /CC, /MC** (see page B85)

Number of rails per axis : **No symbol, II, III, IV ...**

Notr[1] : U type rail is only applicable for MSB15 with M4 mounting hole.

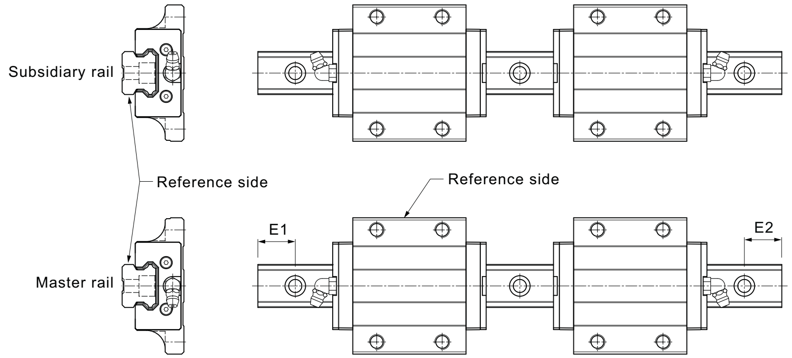


Fig12.2

(2) Interchangeable Type

Code of Carriage **MSB 25 E SS FC N**

Series : **MSB**

Size : **15, 20, 25, 30, 35**

Carriage type : (1) Medium load
TE : Flange type, mounting either from top or bottom
TS : Square type
(2) Ultra heavy load
E : Flange type, mounting either from top or bottom
S : Square type

Dust protection option of carriage :
No symbol, UU, SS, ZZ, DD, KK, LL, RR (see page B85)

Preload : **FC** (Light preload) (see page B27)

Accuracy grade : **N, H**

Code of special carriage : **No symbol, A, B ...**

Code of Rail **MSB 25 R 1200 -20 /40 N**

Series : **MSB**

Size : **15, 20, 25, 30, 35**

Rail type : **R ,U**[1] (Counter-bore type), **T** (Tapped hole type)

Rail length (mm)

Rail hole pitch from start side (**E1**, see Fig.12.2)

Rail hole pitch to the end side (**E2**, see Fig.12.2)

Accuracy grade : **N, H**

Code of special rail : **No symbol, A, B ...**

Dust protection option of rail : **No symbol, /CC, /MC** (see page B85)

Notr[1] : U type rail is only applicable for MSB15 with M4 mounting hole.

Dimensions of MSB-TE / MSB-E

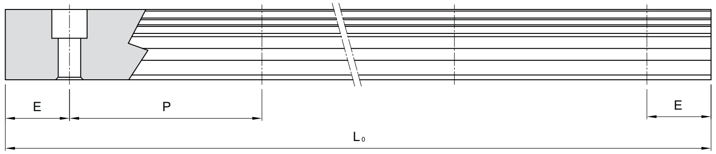
F. Accuracy Grade
For details, see page B24

G. Preload Grade
For details, see page B27

H. The Shoulder Height and Corner Radius for Installation
For details, see page B73

I. Dimensional Tolerance of Mounting Surface
For details, see page B75

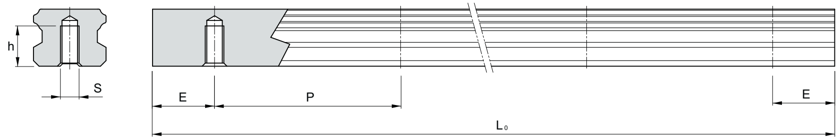
J. Rail Maximum Length and Standrad



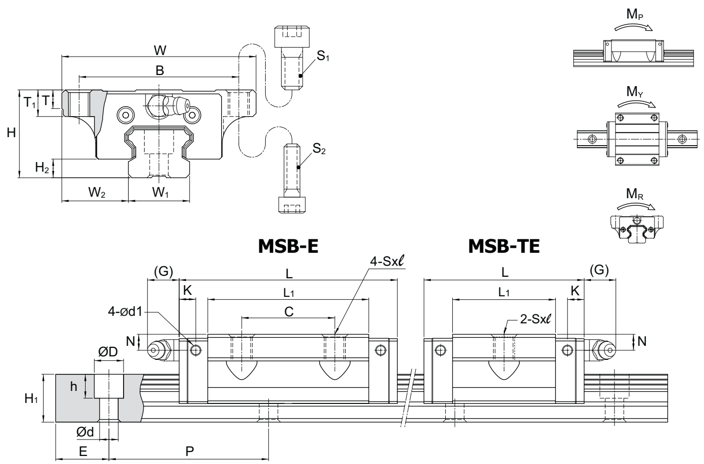
Unit: mm

Model No.	MSB 15	MSB 20	MSB 25	MSB 30	MSB 35
Standard Pitch (P)	60	60	60	80	80
Standard ($E_{std.}$)	20	20	20	20	20
Minimum ($E_{min.}$)	5	6	7	7	8
Max (L_0 max.)	2000	3000	4000	4000	4000

K. Tapped-hole Rail Dimensions



Rail Model	S	h(mm)
MSB 15 T	M5	7
MSB 20 T	M6	9
MSB 25 T	M6	10
MSB 30 T	M8	14
MSB 35 T	M8	16



Model No.	Bolt Size	
	S_1	S_2
MSB 15	M5	M4
MSB 20	M6	M5
MSB 25	M8	M6
MSB 30	M10	M8
MSB 35	M10	M8

Unit: mm

Model No.	External dimension					Carriage dimension											
	Height H	Width W	Length L	W_2	H_2	B	C	S×ℓ	L_1	T	T_1	N	G	K	d_1	Grease Nipple
MSB 15 TE MSB 15 E	24	52	40 57	18.5	4.5	41	- 26	M5×7	23.5 40.5	5	7	5.5	5.5	5.1	3.3	G-M4
MSB 20 TE MSB 20 E	28	59	48 67	19.5	6	49	- 32	M6×9	29 48	5	9	5.5	12	5.9	3.3	G-M6
MSB 25 TE MSB 25 E	33	73	60.2 82	25	7	60	- 35	M8×10	38.7 60.5	7	10	6	12	6.3	3.3	G-M6
MSB 30 TE MSB 30 E	42	90	68 96.7	31	9.5	72	- 40	M10×10	43.3 72	7	10	8	12	6.3	3.3	G-M6
MSB 35 TE MSB 35 E MSB 35 LE	48	100	78 112 137.5	33	9.5	82	- 50 72	M10×13	46 80 105.5	9	13	8.5	12	9.8	3.3	G-M6

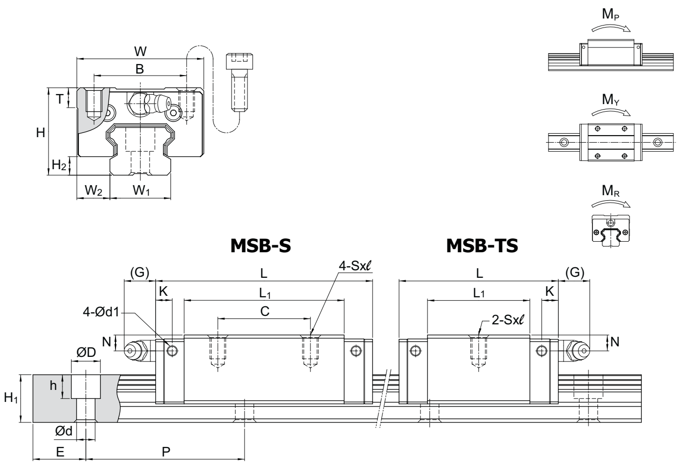
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D×h×d	Dynamic C kN	Static C_o kN	M_P kN-m		M_Y kN-m		M_R kN-m	Carriage kg	Rail kg/m
								Single*	Double*	Single*	Double*			
MSB 15 TE MSB 15 E	15	12.5	60	20	6×4.5×3.5 (7.5×5.3×4.5)	6.7 10.0	9.6 16.9	0.04 0.10	0.26 0.61	0.04 0.10	0.26 0.61	0.07 0.13	0.12 0.21	1.2
MSB 20 TE MSB 20 E	20	15	60	20	9.5×8.5×6	9.7 13.9	14.2 23.6	0.07 0.18	0.44 0.97	0.07 0.18	0.44 0.97	0.14 0.24	0.20 0.34	2
MSB 25 TE MSB 25 E	23	18	60	20	11×9×7	15.6 22.3	22.1 36.9	0.13 0.35	0.91 1.87	0.13 0.35	0.91 1.87	0.26 0.43	0.39 0.60	3
MSB 30 TE MSB 30 E	28	23	80	20	11×9×7	23.1 32.9	31.8 53.1	0.23 0.60	1.39 3.15	0.23 0.60	1.39 3.15	0.45 0.74	0.65 1.08	4.4
MSB 35 TE MSB 35 E MSB 35 LE	34	27.5	80	20	14×12×9	35.7 52.0 63.6	44.0 75.5 100.6	0.34 0.93 1.60	2.81 5.47 8.67	0.34 0.93 1.60	2.81 5.47 8.67	0.75 1.28 1.67	0.91 1.61 1.80	6.2 6.6

Note: Rail mounting holes for M3 (6x4.5x3.5) and M4 (7.5x5.3x4.5) are available for MSB15 rail. The codes of rail type are MSB15R for M3 mounting holes, and MSB15U for M4 mounting holes.

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is C=1.26 x C_{100}.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of MSB-TS / MSB-S



Unit: mm

Model No.	External dimension					Carriage dimension										
	Height H	Width W	Length L	W_2	H_2	B	C	S×ℓ	L_1	T	N	G	K	d_1	Grease Nipple
MSB 15 TS MSB 15 S	24	34	40 57	9.5	4.5	26	- 26	M4×6	23.5 40.5	6	5.5	5.5	5.1	3.3	G-M4
MSB 20 TS MSB 20 S	28	42	48 67	11	6	32	- 32	M5×7	29 48	6	5.5	12	5.9	3.3	G-M6
MSB 25 TS MSB 25 S	33	48	60.2 82	12.5	7	35	- 35	M6×9	38.7 60.5	8	6	12	6.3	3.3	G-M6
MSB 30 TS MSB 30 S	42	60	68 96.7	16	9.5	40	- 40	M8×12	43.3 72	8	8	12	6.3	3.3	G-M6
MSB 35 TS MSB 35 S MSB 35 LS	48	70	78 112 137.5	18	9.5	50	- 50 72	M8×12	46 80 105.5	12.5	8.5	11.5	9.8	3.3	G-M6

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D×h×d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
MSB 15 TS MSB 15 S	15	12.5	60	20	6×4.5×3.5 (7.5×5.3×4.5)	6.7 10.0	9.6 16.9	0.04 0.10	0.26 0.61	0.04 0.10	0.26 0.61	0.07 0.13	0.09 0.16	1.2
MSB 20 TS MSB 20 S	20	15	60	20	9.5×8.5×6	9.7 13.9	14.2 23.6	0.07 0.18	0.44 0.97	0.07 0.18	0.44 0.97	0.14 0.24	0.16 0.26	2
MSB 25 TS MSB 25 S	23	18	60	20	11×9×7	15.6 22.3	22.1 36.9	0.13 0.35	0.91 1.87	0.13 0.35	0.91 1.87	0.26 0.43	0.29 0.45	3
MSB 30 TS MSB 30 S	28	23	80	20	11×9×7	23.1 32.9	31.8 53.1	0.23 0.60	1.39 3.15	0.23 0.60	1.39 3.15	0.45 0.74	0.52 0.82	4.4
MSB 35 TS MSB 35 S MSB 35 LS	34	27.5	80	20	14×12×9	35.7 52.0 63.6	44.0 75.5 100.6	0.34 0.93 1.60	2.81 5.47 8.67	0.34 0.93 1.60	2.81 5.47 8.67	0.75 1.28 1.67	0.81 1.13 1.49	6.2

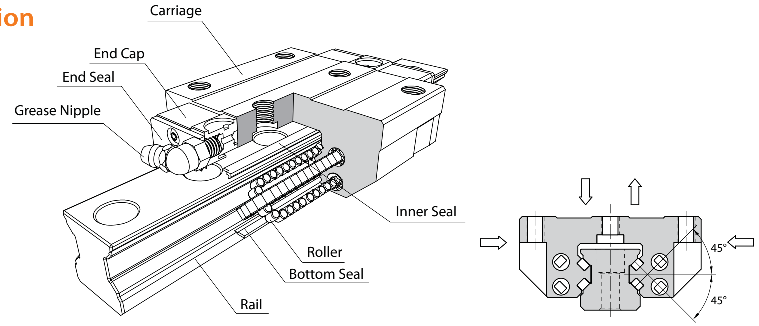
Note: Rail mounting holes for M3 (6x4.5x3.5) and M4 (7.5x5.3x4.5) are available for MSB15 rail. The codes of rail type are MSB15R for M3 mounting holes, and MSB15U for M4 mounting holes.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

12.3 Full Roller Type, MSR Series

A. Construction

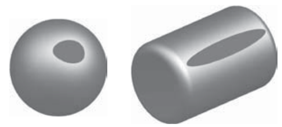


B. Characteristics

The full roller type linear guideway, MSR series, equip with rollers instead of the ball, and therefore the MSR series can provide higher rigidity and loading than the normal type with the same size. Especially suit for the requests of high accuracy, heavy load and high rigidity.

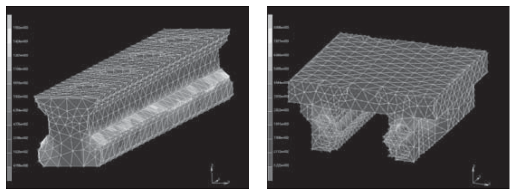
Ultra Heavy Load

MSR linear guideway through rollers have a line contact with carriage and rail. Relative to the general type linear guideway through balls have a point contact; the MSR type linear guideway can offer lower elastic deformation while bearing the same load. Base on the rollers have the same outer diameter with balls, the roller can bear the heavier load. The excellent characteristics of high rigidity and ultra heavy load can suitable for the high accuracy application that heavy load is processed even more.



The Optimization Design of Four Directional Load

Through the structure stress analysis of finite element method, SMR series have four trains of rollers are designed to a contact angle of 45° and the section design for high rigidity. Except for bearing heavier loads in radial, reversed radial and lateral directions, a sufficient preload can be achieved to increase rigidity, and this makes it suitable for any kind of installation.



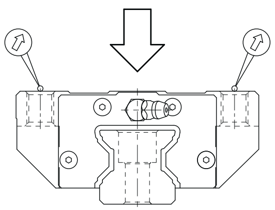
Ultra High Rigidity

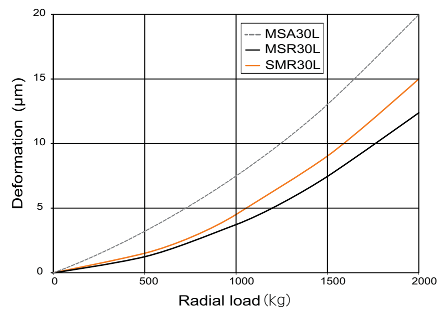
Test data of rigidity

Test samples : Ball type MSA30L with preload F1

Full roller type MSR30L with preload F1

Roller chain type SMR30L with preload F1

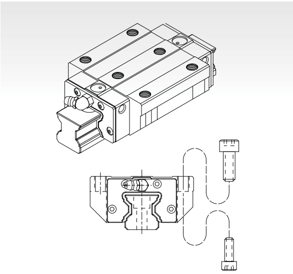




C. Carriage Type

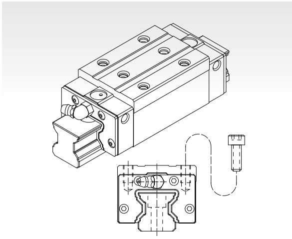
Heavy Load

MSR-E Type



This type offers the installation either from top or bottom side of carriage.

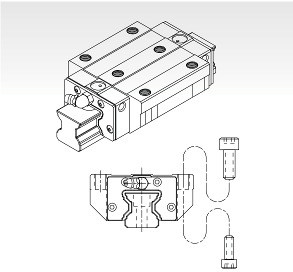
MSR-S Type



Square type with smaller width and can be installed from top side of carriage.

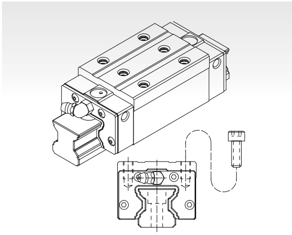
Ultra Heavy Load

MSR-LE Type



All dimensions are same as MSR-E except the length is longer, which makes it more rigid.

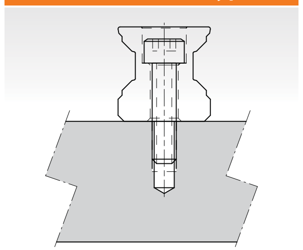
MSR-LS Type



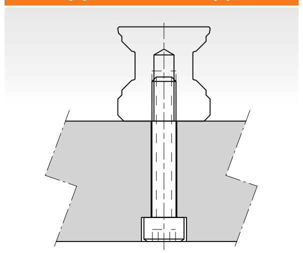
All dimensions are same as MSR-S except the length is longer, which makes it more rigid.

D. Rail Type

Counter bore (R type)



Tapped Hole (T type)



E. Description of Specification

MSR 25 E 2 SS F0 + R 1200 - 20 / 40 P II

Series : MSR

Size : 25, 30, 35, 45, 55, 65

Carriage type : (1) Heavy load
- **E** : Flange type, mounting either from top or bottom
- **S** : Square type

(2) Ultra heavy load
- **LE** : Flange type, mounting either from top or bottom
- **LS** : Square type

Number of carriages per rail : **1, 2, 3 ...**

Dust protection option of carriage :
No symbol, **UU, SS, ZZ, DD, KK** (see page B85)

Preload :
F0 (Medium preload), **F1** (Heavy preload), F2 (Ultra Heavy Preload) (see page B27)

Code of special carriage : No symbol, **A, B ...**

Rail type : **R** (Counter bore type), **T** (Tapped hole type)

Rail length (mm)

Rail hole pitch from start side (**E1** see Fig12.3)

Rail hole pitch to the end side (**E2** see Fig12.3)

Accuracy grade : **H, P, SP, UP**

Code of special rail : No symbol, **A, B ...**

Dust protection option of rail : No symbol, **/CC, /MC ...** (see page B85)

Number of rails per axis : No symbol, **II, III, IV ...**

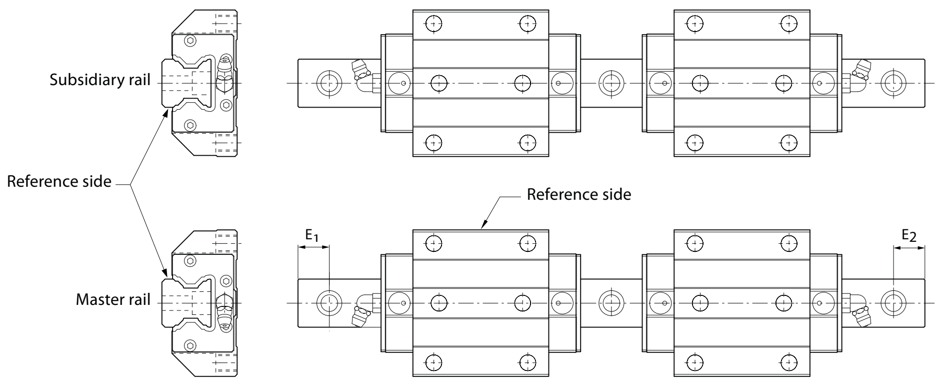


Fig12.3

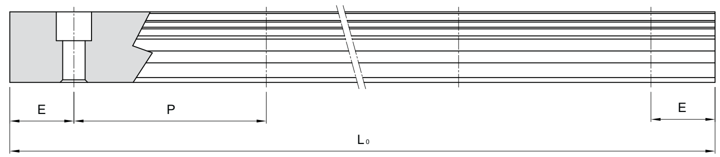
F. Accuracy Grade
For details, see page B24

G. Preload Grade
For details, see page B27

H. The Shoulder Height and Corner Radius for Installation
For details, see page B74

I. Dimensional Tolerance of Mounting Surface
For details, see page B76

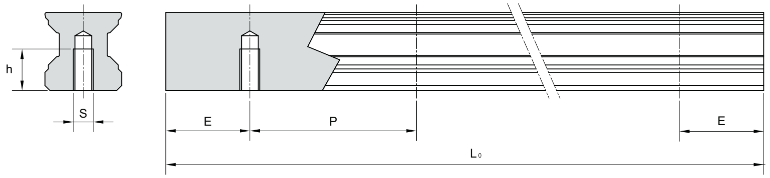
J. Rail Maximum Length and Standrad



Unit: mm

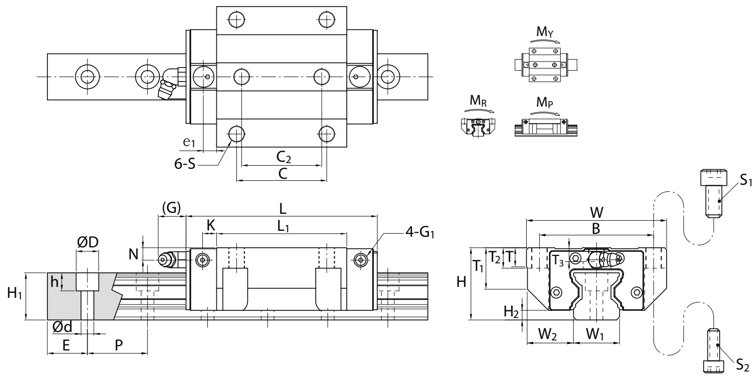
Model No.	MSR 25	MSR 30	MSR 35	MSR 45	MSR 55	MSR 65
Standard Pitch (P)	30	40	40	52.5	60	75
Standard ($E_{std.}$)	20	20	20	22.5	30	35
Minimum ($E_{min.}$)	7	8	8	11	13	14
Max (L_0 max.)	4000	4000	4000	4000	4000	4000

K. Tapped-hole Rail Dimensions



Rail Model	S	h(mm)
MSR 25 T	M6	12
MSR 30 T	M8	15
MSR 35 T	M8	17
MSR 45 T	M12	24
MSR 55 T	M14	24
MSR 65 T	M20	30

Dimensions of MSR-E / MSR-LE



Model No.	Bolt Size	
	S_1	S_2
MSR 25	M8	M6
MSR 30	M10	M8
MSR 35	M10	M8
MSR 45	M12	M10
MSR 55	M14	M12
MSR 65	M16	M14

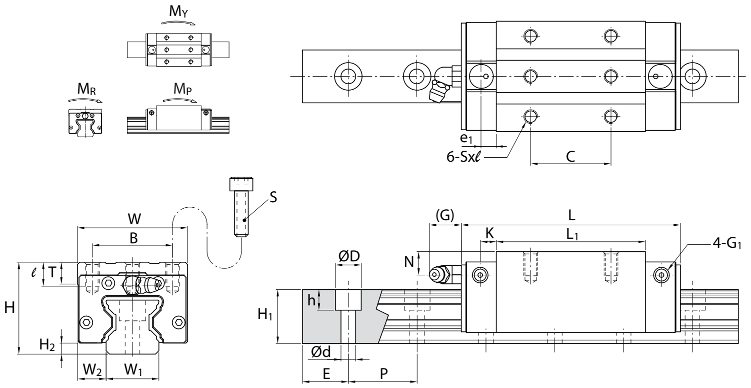
Uni:t mm

Model No.	External dimension					Carriage dimension															
	Height H	Width W	Length L	W_2	H_2	B	C	C_2	S	L_1	T	T_1	T_2	T_3	N	G	K	e_1	G_1	Grease Nipple
MSR 25 E MSR 25 LE	36	70	97.5 115.5	23.5	4.8	57	45	40	M8	65.5 83.5	9.5	20.2	10	5.8	6	12	6.6	6.5	M6	G-M6
MSR 30 E MSR 30 LE	42	90	112.1 136	31	6	72	52	44	M10	75.6 99.5	10	21.6	13	6.7	7	12	8	7	M6	G-M6
MSR 35 E MSR 35 LE	48	100	125.3 154.4	33	6.5	82	62	52	M10	82.3 111.4	12	27.5	15	9.5	8	12	8	7	M6	G-M6
MSR 45 E MSR 45 LE	60	120	154.2 189.7	37.5	8	100	80	60	M12	106.5 142	14.5	35.5	15	12.5	10	13.5	10	10	M6	G-PT 1/8
MSR 55 E MSR 55 LE	70	140	185.4 235.4	43.5	10	116	95	70	M14	129.5 179.5	17.5	41	18	15.5	11	13.5	12	7.95	M6	G-PT 1/8
MSR 65 LE	90	170	302	53.5	12	142	110	82	M16	230	19.5	56	20	26	16.5	13.5	15	15	M6	G-PT 1/8

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
MSR 25 E MSR 25 LE	23	23.5	30	20	11×9×7	29.6 36.3	63.8 82.9	0.65 1.08	3.82 5.94	0.65 1.08	3.82 5.94	0.73 0.95	0.75 0.95	3.5
MSR 30 E MSR 30 LE	28	27.5	40	20	14×12×9	42.8 54.0	91.9 124.0	1.09 1.96	6.38 10.60	1.09 1.96	6.38 10.60	1.27 1.75	1.4 1.72	5
MSR 35 E MSR 35 LE	34	30.5	40	20	14×12×9	57.9 73.9	123.5 169.0	1.59 2.94	9.56 16.18	1.59 2.94	9.56 16.18	2.09 2.85	1.95 2.45	7
MSR 45 E MSR 45 LE	45	37	52.5	22.5	20×17×14	92.8 117.2	193.8 261.6	3.28 5.90	18.76 31.32	3.28 5.90	18.76 31.32	4.40 5.94	3.9 4.5	11.2
MSR 55 E MSR 55 LE	53	43	60	30	23×20×16	132.8 172.5	270.0 378.0	5.49 10.60	31.18 55.58	5.49 10.60	31.18 55.58	7.33 10.28	6 7.9	15.6
MSR 65 LE	63	52	75	35	26×22×18	277.0	624.0	22.50	117.87	22.50	117.87	20.02	17.6	22.4

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of MSR-S / MSR-LS



Unit: mm

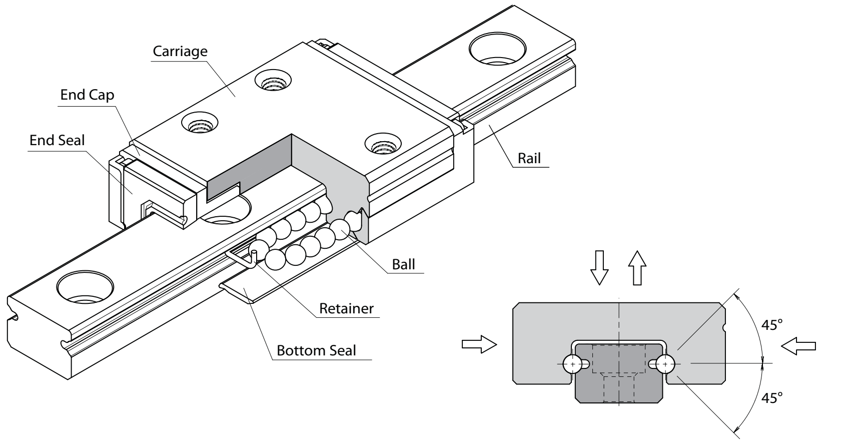
Model No.	Rail dimension Height H	Width W	Length L	External dimension W_2	H_2	B	C	S	ℓ	L_1	T	N	G	K	e_1	G_1	Grease Nipple
MSR 25 S MSR 25 LS	40	48	97.5 115.5	12.5	4.8	35	35 50	M6	10.5	65.5 83.5	9.5	10	12	6.6	6.5	M6	G-M6
MSR 30 S MSR 30 LS	45	60	112.1 136	16	6	40	40 60	M8	12	75.6 99.5	10	10	12	8	7	M6	G-M6
MSR 35 S MSR 35 LS	55	70	125.3 154.4	18	6.5	50	50 72	M8	14	82.3 111.4	12	15	12	8	7	M6	G-M6
MSR 45 S MSR 45 LS	70	86	154.2 189.7	20.5	8	60	60 80	M10	19	106.5 142	17	20	13.5	10	10	M6	G-PT 1/8
MSR 55 S MSR 55 LS	80	100	185.4 235.4	23.5	10	75	75 95	M12	19	129.5 179.5	18	21	13.5	12	7.95	M6	G-PT 1/8
MSR 65 LS	90	126	302	31.5	12	76	120	M16	20	230	19.5	16.5	13.5	15	15	M6	G-PT 1/8

Model No.	Rail dimension Width W_1	Height H_1	Pitch P	E std.	D×h×d	Basic load rating Dynamic C kN	Static C_o kN	Static moment rating M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Weight Carriage kg	Rail kg/m
MSR 25 S MSR 25 LS	23	23.5	30	20	11×9×7	29.6 36.3	63.8 82.9	0.65 1.08	3.82 5.94	0.65 1.08	3.82 5.94	0.73 0.95	0.65 0.85	3.5
MSR 30 S MSR 30 LS	28	27.5	40	20	14×12×9	42.8 54.0	91.9 124.0	1.09 1.96	6.38 10.60	1.09 1.96	6.38 10.60	1.27 1.72	1 1.22	5
MSR 35 S MSR 35 LS	34	30.5	40	20	14×12×9	57.9 73.9	123.5 169.0	1.59 2.94	9.56 16.18	1.59 2.94	9.56 16.18	2.09 2.85	1.65 2.15	7
MSR 45 S MSR 45 LS	45	37	52.5	22.5	20×17×14	92.8 117.2	193.8 261.6	3.28 5.90	18.76 31.32	3.28 5.90	18.76 31.32	4.40 5.94	3.2 4.1	11.2
MSR 55 S MSR 55 LS	53	43	60	30	23×20×16	132.8 172.5	270.0 378.0	5.49 10.60	31.18 55.58	5.49 10.60	31.18 55.58	7.33 10.26	5.1 7	15.6
MSR 65 LS	63	52	75	35	26×22×18	277.0	624.0	22.50	117.87	22.50	117.87	20.02	13.3	22.4

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

12.4 Miniature Type, MSC Stainless Steel Series

A. Construction



B. Characteristics

MSC st ows with Gothic-arch groove and designed to contact angle of 45° which enables it to bear an equal load in radial, reversed radial and lateral directions. Furthermore, ultra compact and low friction resistance design is suit to compact equipment. The lubrication route makes the lubricant evenly distribute in each circulation loop. Therefore,the optimum lubrication can be achieved in any installation direction, and this promotes the performance in running accuracy, service life, and reliability.

Four-way Equal Load

The two trains of balls are allocated to a Gothic-arch groove contact angle at 45°, thus each train of balls can takeup an equal rated load in all four directions.

Ultra Compact

The ultra compact design is suit to the compact application with limited in space.

Ball Retainer

Design with ball retainer can prevent ball form dropping.

Smooth Movement with Low Noise

The simplified design of circulating system with strengthened synthetic resin accessories makes the movement smooth and quiet.

Interchangeability

For interchangeable type of linear guideway, the dimensional tolerances are strictly maintained within a reasonable range, and this has made the random matching of the same size of rails and carriages possible. Therefore, the similar preload and accuracy can be obtained even under the random matching condition. As a result of this advantage, the linear guideway can be stocked as standard parts, the installation and maintenance become more convenient. Moreover, this is also beneficial for shortening the delivery time.

C. Description of Specification

(1) Non-interchangeable Type

MSC 7 M 2 LL F0 + R 600 -7.5 /7.5 P M II

- Series：**MSC**
- Size：**7, 9, 12, 15**
- Carriage type：**M**: Standard type (Stainless)
  LM: Heavy load type (Stainless)
- Number of carriages per rail：**1, 2, 3 ...**
- Dust protection option of carriage：**LL, RR** (see page B85)
- Preload：**FC** (Light preload), **F0** (Medium preload) (see page B27)
- Code of special carriage：No symbol, **A, B ...**
- Rail type：**R** (Counter bore type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig.12.4)
- Rail hole pitch to the end side (**E2**, see Fig.12.4)
- Accuracy grade：**N, H, P**
- Stainless steel
- Code of special rail：No symbol, **A, B ...**
- Number of rails per axis：No symbol , **II, III, IV ...**

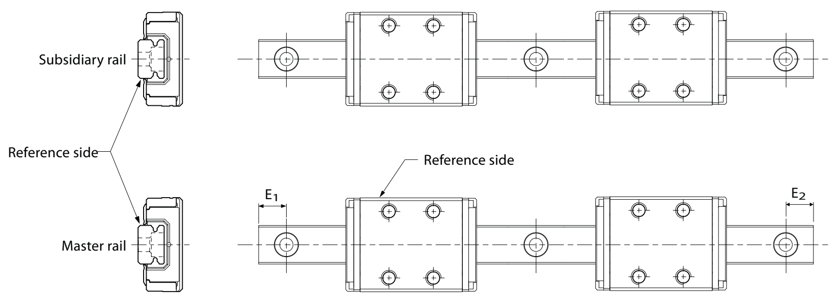


Fig 12.4

(2) Interchangeable Type

Code of Carriage

MSC 7 M LL FC N

- Series：**MSC**
- Size：**7, 9, 12, 15**
- Carriage type：**M**: Standard type (Stainless)
  LM: Heavy load type (Stainless)
- Dust protection option of carriage：**LL, RR** (see page B85)
- Preload：**FC** (Light preload) (see page B27)
- Accuracy grade：**N, H**
- Code of special carriage：No symbol, **A, B ...**

Code of Rail

MSC 7 R 600 -7.5 /7.5 N M

- Series：**MSC**
- Size：**7, 9, 12, 15**
- Rail type：**R** (Counter bore type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig.12.4)
- Rail hole pitch to the end side (**E2**, see Fig.12.4)
- Accuracy grade：**N, H**
- Stainless steel
- Code of special rail：No symbol, **A, B ...**

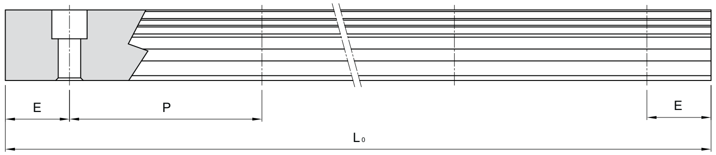
F. Accuracy Grade
For details, see page B26

G. Preload Grade
For details, see page B27

H. The Shoulder Height and Corner Radius for Installation
For details, see page B74

I. Dimensional Tolerance of Mounting Surface
For details, see page B76

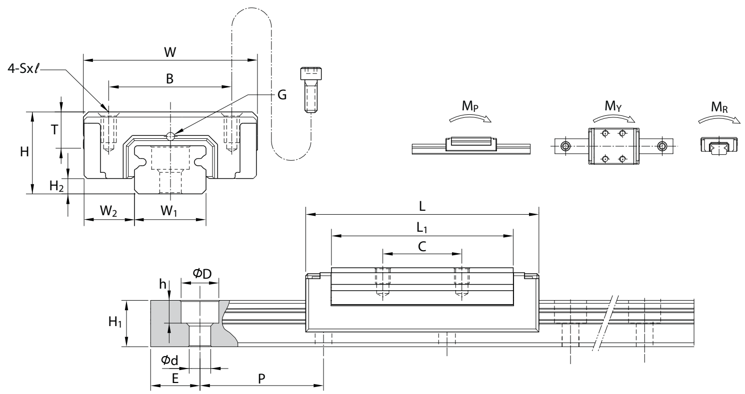
J. Rail Maximum Length and Standrad



Unit: mm

Model No.	MSC 7	MSC 9	MSC 12	MSC 15
Standard Pitch (P)	15	20	25	40
Standard ($E_{std.}$)	5	7.5	10	15
Max (L_0 max.)	600	1000	1000	1000

Dimensions of MSC-M / MSC-LM



Unit: mm

Model No.	External dimension					Carriage dimension					
	Height H	Width W	Length L	W_2	H_2	B	C	S×ℓ	L_1	T	G
MSC 7 M MSC 7 LM	8	17	23.6 33.1	5	1.5	12	8 13	M2×2.5	18.4 27.9	3.5	Ø0.8
MSC 9 M MSC 9 LM	10	20	31.1 41.3	5.5	2.2	15	10 16	M3×3	25.8 36	4.5	Ø1
MSC 12 M MSC 12 LM	13	27	34.6 47.6	7.5	3	20	15 20	M3×3.6	28 41	6	Ø1.5
MSC 15 M MSC 15 LM	16	32	43.5 60.5	8.5	4	25	20 25	M3×4.2	36.1 53.1	7	G-M3

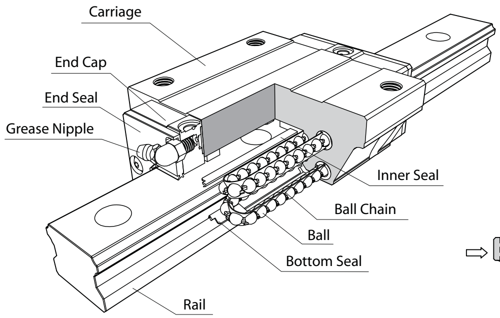
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D×h×d	Dynamic C kN	Static C_0 kN	M_P N-m Single*	M_P N-m Double*	M_Y N-m Single*	M_Y N-m Double*	M_R N-m	Carriage g	Rail kg/m
MSC 7 M MSC 7 LM	7 $^{0}_{-0.05}$	4.7	15	5	4.2×2.3×2.4	0.94 1.36	1.28 2.24	2.6 7.4	15.33 37.92	2.6 7.4	15.33 37.92	4.7 8.3	13 18	0.22
MSC 9 M MSC 9 LM	9 $^{0}_{-0.05}$	5.5	20	7.5	6×3.3×3.5	1.71 2.52	2.24 3.92	6.1 17.4	33.46 84.63	6.1 17.4	33.46 84.63	10.8 18.8	29 39	0.33
MSC 12 M MSC 12 LM	12 $^{0}_{-0.05}$	7.5	25	10	6×4.5×3.5	2.62 3.77	3.52 5.72	11.4 28.3	63.96 141.52	11.4 28.3	63.96 141.52	22.2 36.0	40 60	0.63
MSC 15 M MSC 15 LM	15 $^{0}_{-0.05}$	9.5	40	15	6×4.5×3.5	4.52 6.47	5.70 9.26	24.7 61.0	132.17 295.87	24.7 61.0	132.17 295.87	44.4 72.2	71 100	1.02

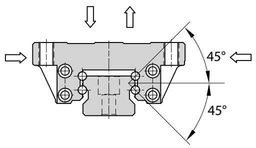
Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is C=1.26 x C_{100}.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

12.5 Ball Chain Type, SME Series

A. Construction





B. Characteristics

The ball chain type linear guideway, SME series, equip with the patent of ball chain design can make the movement smooth and stability, especially suit for the requests of high speed, high accuracy.

The Optimization Design of Four Directional Load

Through the structure stress analysis, SME series have four trains of balls are designed to a circular contact angle of 45° and the section design for high rigidity. Except for bearing heavier loads in radial, reversed radial and lateral directions, a sufficient preload can be achieved to increase rigidity, and this makes it suitable for any kind of installation.

Self Alignment Capability

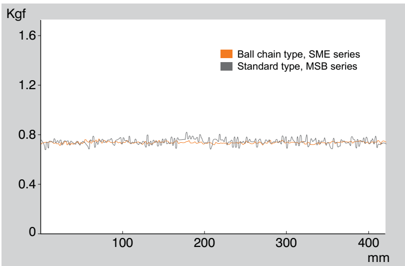
The self adjustment is performed spontaneously as the design of face-face (DF) circular arc groove. Therefore, the installation error could be compensated even under a preload, and which results in precise and smooth linear motion.

Ball Chain Design, Smooth Movement

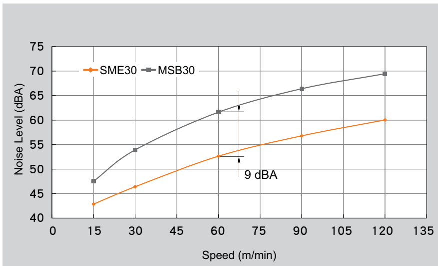
The concise and smooth design of circulating system with strengthened synthetic resin accessories and cooperating with the ball chain, these can avoid interference between balls and make the balls more stability during passing in and out the load district. Besides, the ball chain can keep the ball move in a line and improve the movement most smooth substantially.

Low Noise, Good Lubricant Effect

The ball chain design avoids interference between balls, lowers the operating noise, and can keep the lubricant between the balls and ball chain effectively. Moreover, improve the movement smooth and service life of the whole, can meet high accuracy, high reliability and smooth and stability.



Rolling resistance test

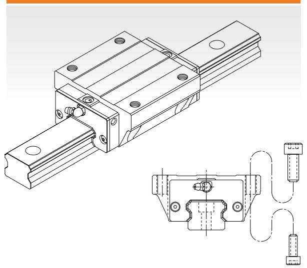


Noise level comparison test

C. Carriage Type

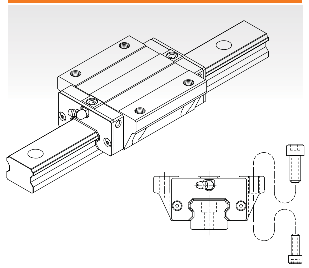
Heavy Load

SME-EA Type



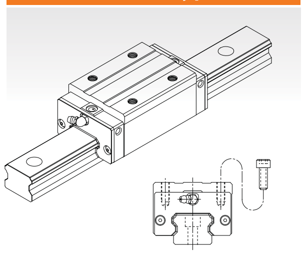
This type offers the installation either from top or bottom side of carriage.

SME-EB Type



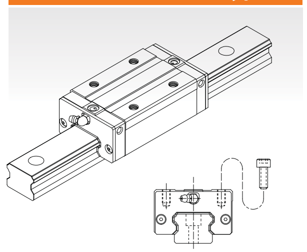
All dimensions are same as SME-EA except the mounting hole dimensions of carriage are different and the height is lower, which do not change the basic loading rating.

SME-SA Type



Square type with smaller width and can be installed from top side of carriage.

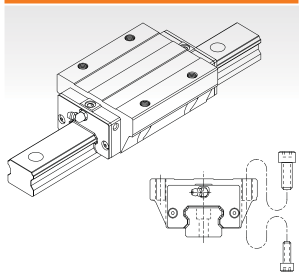
SME-SB / SME-SV Type



All dimensions are same as SME-SA except the mounting hole dimensions of carriage are different and the height is lower, which do not change the basic loading rating.

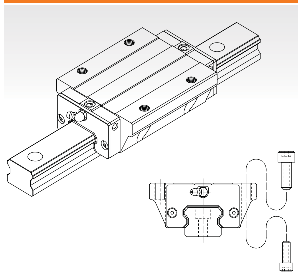
Ultra Heavy Load

SME-LEA Type



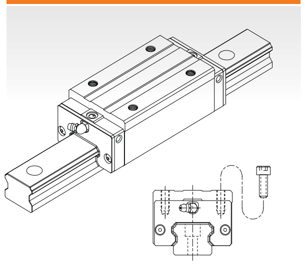
All dimensions are same as SME-EA except the length is longer, which makes it more rigid.

SME-LEB Type



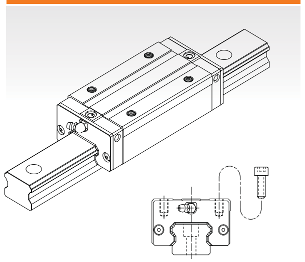
All dimensions are same as SME-EB except the length is longer, which makes it more rigid.

SME-LSA Type



All dimensions are same as SME-SA except the length is longer, which makes it more rigid.

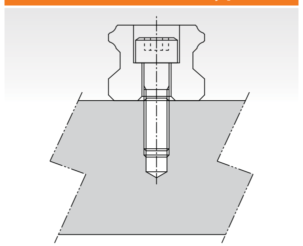
SME-LSB / SME-LSV Type



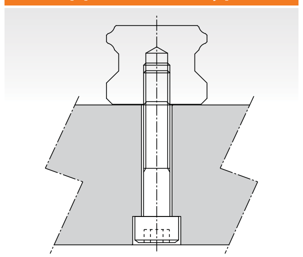
All dimensions are same as SME-SB and SME-SV except the length is longer, which makes it more rigid.

D. Rail Type

Counter bore(R type)



Tapped-Hole(T type)



E. Description of Specification

(1) Non-interchangeable Type

SME 25 EA 2 SS F0 +R 1000 -20 /20 P II

Series : **SME**

Size : **15, 20, 25, 30, 35, 45**

Carriage type : (1) Heavy load

- **EA** : Flange type, mounting either from top or bottom
- **EB** : Compact flange type, mounting either from top or bottom
- **SA** : Square type
- **SB/SV** : Compact square type

(2) Ultra heavy load

- **LEA** : Flange type, mounting either from top or bottom
- **LEB** : Compact flange type, mounting either from top or bottom
- **LSA** : Square type
- **LSB/LSV** : Compact square type

Number of carriages per rail : **1, 2, 3 ...**

Dust protection option of carriage :
No symbol, **UU, SS, ZZ, DD, KK** (see page B85)

Preload :
FC (Light Preload), **F0** (Medium preload), **F1** (Heavy preload) (see page B27)

Code of special carriage : **No symbol, A, B ...**

Rail type : **R** (Counter-bore type), **T** (Tapped hole type)

Rail length (mm)

Rail hole pitch from start side (**E1**, see Fig.12.5)

Rail hole pitch to the end side (**E2**, see Fig.12.5)

Accuracy grade : **N, H, P, SP, UP**

Code of special rail : **No symbol, A, B ...**

Dust protection option of rail : **No symbol, /CC, /MC ...** (see page B85)

Number of rails per axis : **No symbol , II, III, IV ...**

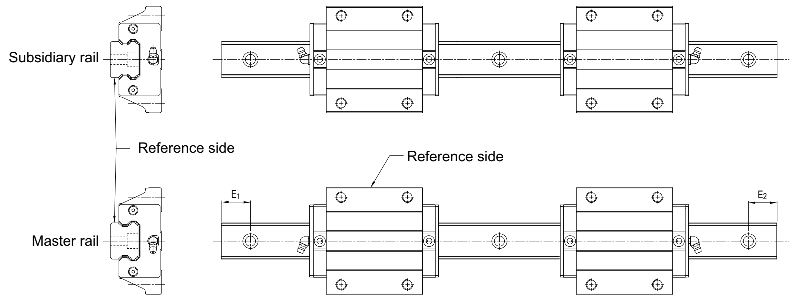


Fig 12.5

(2) Interchangeable Type

Code of Carriage

SME 25 EA SS FC H

- Series : **SME**
- Size : **15, 20, 25, 30, 35, 45**
- Carriage type : (1) Heavy load
  - **EA** : Flange type, mounting either from top or bottom
  - **EB** : Compact flange type, mounting either from top or bottom
  - **SA** : Square type
  - **SB/SV** : Compact square type

  (2) Ultra heavy load
  - **LEA** : Flange type, mounting either from top or bottom
  - **LEB** : Compact flange type, mounting either from top or bottom
  - **LSA** : Square type
  - **LSB/LSV** : Compact square type
- Dust protection option of carriage : No symbol, **UU, SS, ZZ, DD, KK** (see page B85)
- Preload : **FC** (Light Preload) (see page B27)
- Accuracy grade : **N, H**
- Code of special carriage : No symbol, **A, B ...**

Code of Rail

SME 25 R 1000 -20 /20 H

- Series : **SME**
- Size : **15, 20, 25, 30, 35, 45**
- Rail type : **R** (Counter-bore type), **T** (Tapped hole type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig.12.5)
- Rail hole pitch to the end side (**E2**, see Fig.12.5)
- Accuracy grade : **N, H**
- Code of special rail : No symbol, **A, B ...**
- Dust protection option of rail : No symbol, **/CC, /MC ...** (see page B85)

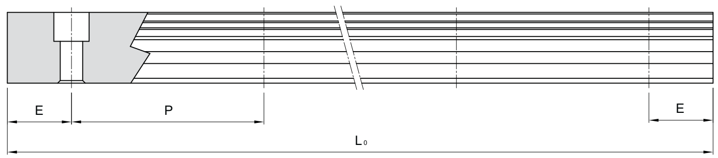
F. Accuracy Grade
For details, see page B24

G. Preload Grade
For details, see page B27

H. The Shoulder Height and Corner Radius for Installation
For details, see page B74

I. Dimensional Tolerance of Mounting Surface
For details, see page B75

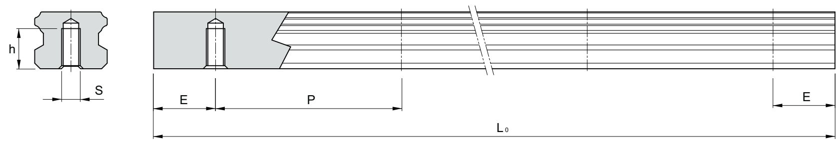
J. Rail Maximum Length and Standrad



Unit: mm

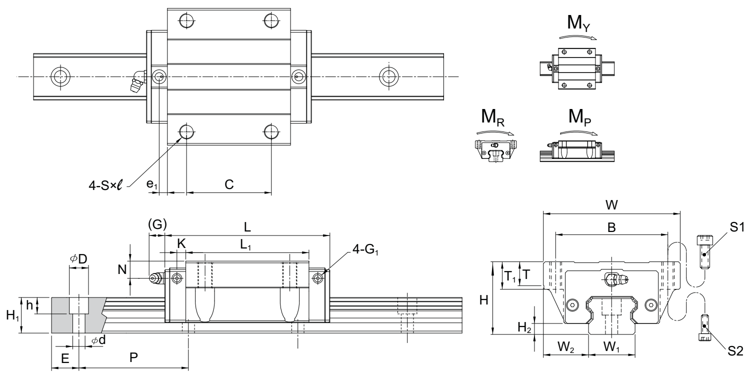
Model No.	SME 15	SME 20	SME 25	SME 30	SME 35	SME 45
Standard Pitch (P)	60	60	60	80	80	105
Standard ($E_{std.}$)	20	20	20	20	20	22.5
Minimum ($E_{min.}$)	5	6	7	8	8	11
Max (L_0 max.)	2000	4000	4000	4000	4000	4000

K. Tapped-hole Rail Dimensions



Rail Model	S	h(mm)
SME 15 T	M5	8
SME 20 T	M6	10
SME 25 T	M6	12
SME 30 T	M8	15
SME 35 T	M8	17
SME 45 T	M12	24

Dimensions of SME-EA / SME-LEA



Model No.	Bolt Size	
	S_1	S_2
SME 15	M5	M4
SME 20	M6	M5
SME 25	M8	M6
SME 30	M10	M8
SME 35	M10	M8
SME 45	M12	M10

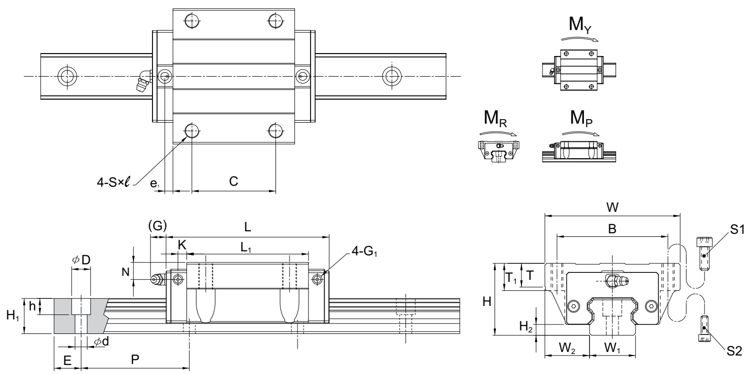
Unit: mm

Model No.	External dimension					Carriage dimension												
	Height H	Width W	Length L	W_2	H_2	B	C	S × ℓ	L_1	T	T_1	N	G	K	e_1	G_1	Grease Nipple
SME 15 EA SME 15 LEA	24	47	64.4 79.4	16	3.5	38	30	M5×8	48 63	5.5	8	5	5.5	2.7	-	M4	G-M4
SME 20 EA SME 20 LEA	30	63	78.5 97.5	21.5	4.7	53	40	M6×10	58.3 77.3	7	10	8	12	3.7	-	M4	G-M6
SME 25 EA SME 25 LEA	36	70	92 109	23.5	5.8	57	45	M8×13	71 88	7	13	10	12	4.7	-	M4	G-M6
SME 30 EA SME 30 LEA	42	90	107.6 132.6	31	7.5	72	52	M10×15	80 105	12	15	8	12	4.5	5.4	M6	G-M6
SME 35 EA SME 35 LEA	48	100	120.6 150.6	33	8	82	62	M10×15	90 120	12	15	8	12	5.4	6	M6	G-M6
SME 45 EA SME 45 LEA	60	120	140 174.5	37.5	10	100	80	M12×18	106 140.5	12	18	10	13.5	8.5	6.1	M6	G-PT 1/8

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m		M_Y kN-m		M_R kN-m	Carriage kg	Rail kg/m
								Single*	Double*	Single*	Double*			
SME 15 EA SME 15 LEA	15	13	60	20	7.5×5.8×4.5	12.5 15.4	20.2 27.5	0.14 0.25	0.69 1.15	0.14 0.25	0.69 1.15	0.16 0.21	0.22 0.29	1.4
SME 20 EA SME 20 LEA	20	15.5	60	20	9.5×8.5×6	20.4 25.3	32.1 43.6	0.27 0.49	1.34 2.24	0.27 0.49	1.34 2.24	0.33 0.44	0.42 0.62	2.3
SME 25 EA SME 25 LEA	23	18	60	20	11×9×7	28.3 33.0	44.3 56.1	0.45 0.71	2.14 3.20	0.45 0.71	2.14 3.20	0.52 0.66	0.67 0.89	3.2
SME 30 EA SME 30 LEA	28	23	80	20	14×12×9	39.4 47.0	59.5 76.5	0.68 1.11	3.37 5.32	0.68 1.11	3.37 5.32	0.83 1.07	1.18 154	4.5
SME 35 EA SME 35 LEA	34	26	80	20	14×12×9	54.7 67.6	81.0 109.9	1.07 1.92	5.25 8.75	1.07 1.92	5.25 8.75	1.41 1.91	1.74 2.28	6.2
SME 45 EA SME 45 LEA	45	32	105	22.5	20×17×14	72.7 90.0	105.8 143.6	1.61 2.88	7.82 13.08	1.61 2.88	7.82 13.08	2.41 3.27	3.22 4.21	10.5

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.
Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of SME-EB / SME-LEB



Model No.	Bolt Size	
	S_1	S_2
SME 15	M5	M4
SME 20	M6	M5
SME 25	M8	M6

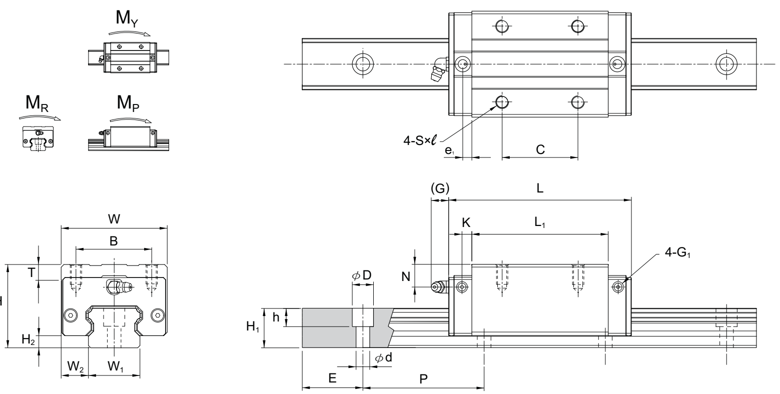
Unit: mm

Model No.	External dimension					Carriage dimension												
	Height H	Width W	Length L	W_2	H_2	B	C	S × ℓ	L_1	T	T_1	N	G	K	e_1	G_1	Grease Nipple
SME 15 EB SME 15 LEB	24	52	64.4 79.4	18.5	3.5	41	26 36	M5×8	48 63	5.5	8	5	5.5	2.7	-	M4	G-M4
SME 20 EB SME 20 LEB	28	59	78.5 97.5	19.5	4.7	49	32 45	M6×8	58.3 77.3	7.0	8	6.0	12	3.7	-	M4	G-M6
SME 25 EB SME 25 LEB	33	73	92 109	25	5.8	60	35 50	M8×10	71 88	7.0	10	7.0	12	4.7	-	M4	G-M6

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m		M_Y kN-m		M_R kN-m	Carriage kg	Rail kg/m
								Single*	Double*	Single*	Double*			
SME 15 EB SME 15 LEB	15	13	60	20	7.5×5.8×4.5	12.5 15.4	20.2 27.5	0.14 0.25	0.69 1.15	0.14 0.25	0.69 1.15	0.16 0.21	0.21 0.27	1.4
SME 20 EB SME 20 LEB	20	15.5	60	20	9.5×8.5×6	20.4 25.3	32.1 43.6	0.27 0.49	1.34 2.24	0.27 0.49	1.34 2.24	0.33 0.44	0.39 0.55	2.3
SME 25 EB SME 25 LEB	23	18	60	20	11×9×7	28.3 33.0	44.3 56.1	0.45 0.71	2.14 3.20	0.45 0.71	2.14 3.20	0.52 0.66	0.42 0.65	3.2

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.
Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of SME-SA / SME-LSA



Unit: mm

Model No.	External dimension					Carriage dimension											
	Height H	Width W	Length L	W_2	H_2	B	C	S×ℓ	L_1	T	N	G	K	e_1	G_1	Grease Nipple
SME 15 SA SME 15 LSA	28	34	64.4 79.4	9.5	3.5	26	26	M4×7.5	48 63	6	9	5.5	2.7	-	M4	G-M4
SME 20 SA SME 20 LSA	30	44	78.5 97.5	12	4.7	32	36 50	M5×7	58.3 77.3	6	8	12	3.7	-	M4	G-M6
SME 25 SA SME 25 LSA	40	48	92 109	12.5	5.8	35	35 50	M6×12	71 88	8	14	12	4.7	-	M4	G-M6
SME 30 SA SME 30 LSA	45	60	107.6 132.6	16	7.5	40	40 60	M8×12	80 105	8	11	12	4.5	5.4	M6	G-M6
SME 35 SA SME 35 LSA	55	70	120.6 150.6	18	8	50	50 72	M8×14	90 120	11	15	12	5.4	6	M6	G-M6
SME 45 SA SME 45 LSA	70	86	140 174.5	20.5	10	60	60 80	M10×20	106 140.5	16	20	13.5	8.5	6.1	M6	G-PT 1/8

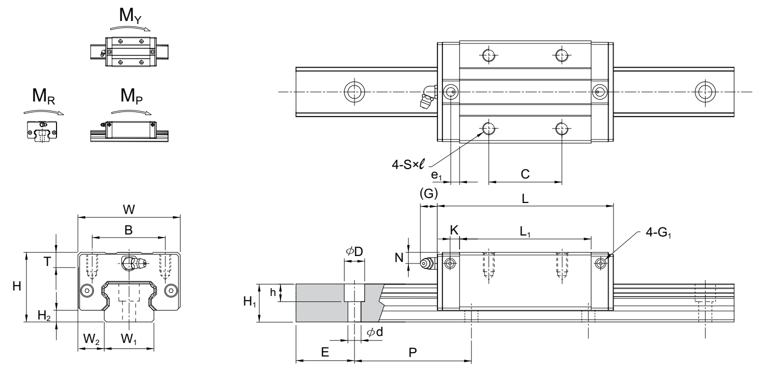
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D×h×d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
SME 15 SA SME 15 LSA	15	13	60	20	7.5×5.8×4.5	12.5 15.4	20.2 27.5	0.14 0.25	0.69 1.15	0.14 0.25	0.69 1.15	0.16 0.21	0.22 0.25	1.4
SME 20 SA SME 20 LSA	20	15.5	60	20	9.5×8.5×6	20.4 25.3	32.1 43.6	0.27 0.49	1.34 2.24	0.27 0.49	1.34 2.24	0.33 0.44	0.30 0.39	2.3
SME 25 SA SME 25 LSA	23	18	60	20	11×9×7	28.3 33.0	44.3 56.1	0.45 0.71	2.14 3.20	0.45 0.71	2.14 3.20	0.52 0.66	0.56 0.73	3.2
SME 30 SA SME 30 LSA	28	23	80	20	14×12×9	39.4 47.0	59.5 76.5	0.68 1.11	3.37 5.32	0.68 1.11	3.37 5.32	0.83 1.07	0.93 1.21	4.5
SME 35 SA SME 35 LSA	34	26	80	20	14×12×9	54.7 67.6	81.0 109.9	1.07 1.92	5.25 8.75	1.07 1.92	5.25 8.75	1.41 1.91	1.57 2.05	6.2
SME 45 SA SME 45 LSA	45	32	105	22.5	20×17×14	72.7 90.0	105.8 143.6	1.61 2.88	7.82 13.08	1.61 2.88	7.82 13.08	2.41 3.27	3.06 4.00	10.5

Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of SME-SB / SME-LSB SME-SV / SME-LSV

Product



Unit: mm

Model No.	External dimension					Carriage dimension											
	Height H	Width W	Length L	W_2	H_2	B	C	S×ℓ	L_1	T	N	G	K	e_1	G_1	Grease Nipple
SME 15 SB SME 15 LSB	24	34	64.4 79.4	9.5	3.5	26	26 34	M4×5	48 63	6	5	5.5	2.7	-	M4	G-M4
SME 20 SB SME 20 LSB	28	42	78.5 97.5	11	4.7	32	32 45	M5×5.5	58.3 77.3	6	6	12	3.7	-	M4	G-M6
SME 25 SB SME 25 LSB	33	48	92 109	12.5	5.8	35	35 50	M6×7	71 88	8	7	12	4.7	-	M4	G-M6
SME 25 SV SME 25 LSV	36	48	92 109	12.5	5.8	35	35 50	M6×9	71 88	8	10	12	4.7	-	M4	G-M6
SME 30 SB SME 30 LSB	42	60	107.6 132.6	16	7.5	40	40 60	M8×10	80 105	8	8	12	4.5	5.4	M6	G-M6
SME 35 SB SME 35 LSB	48	70	120.6 150.6	18	8	50	50 72	M8×11	90 120	11	8	12	5.4	6	M6	G-M6
SME 45 SB SME 45 LSB	60	86	140 174.5	20.5	10	60	60 80	M10×16	106 140.5	16	10	13.5	8.5	6.1	M6	G-PT 1/8

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D×h×d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
SME 15 SB SME 15 LSB	15	13	60	20	7.5×5.8×4.5	12.5 15.4	20.2 27.5	0.14 0.25	0.69 1.15	0.14 0.25	0.69 1.15	0.16 0.21	0.19 0.22	1.4
SME 20 SB SME 20 LSB	20	15.5	60	20	9.5×8.5×6	20.4 25.3	32.1 43.6	0.27 0.49	1.34 2.24	0.27 0.49	1.34 2.24	0.33 0.44	0.26 0.35	2.3
SME 25 SB SME 25 LSB	23	18	60	20	11×9×7	28.3 33.0	44.3 56.1	0.45 0.71	2.14 3.20	0.45 0.71	2.14 3.20	0.52 0.66	0.31 0.49	3.2
SME 25 SV SME 25 LSV	23	18	60	20	11×9×7	28.3 33.0	44.3 56.1	0.45 0.71	2.14 3.20	0.45 0.71	2.14 3.20	0.52 0.66	0.44 0.62	3.2
SME 30 SB SME 30 LSB	28	23	80	20	14×12×9	39.4 47.0	59.5 76.5	0.68 1.11	3.37 5.32	0.68 1.11	3.37 5.32	0.83 1.07	0.85 1.10	4.5
SME 35 SB SME 35 LSB	34	26	80	20	14×12×9	54.7 67.6	81.0 109.9	1.07 1.92	5.25 8.75	1.07 1.92	5.25 8.75	1.41 1.91	1.22 1.61	6.2
SME 45 SB SME 45 LSB	45	32	105	22.5	20×17×14	72.7 90.0	105.8 143.6	1.61 2.88	7.82 13.08	1.61 2.88	7.82 13.08	2.41 3.27	2.86 3.57	10.5

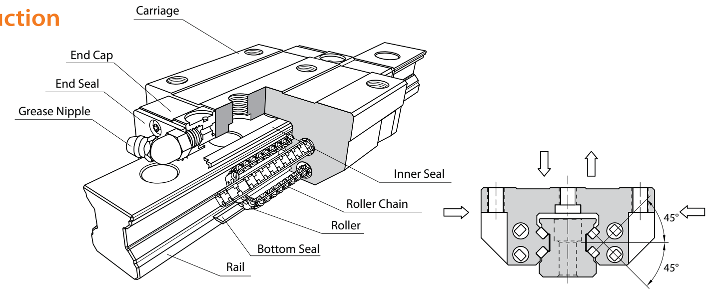
Note: The basic dynamic load rating C of ball type is based on the 50 km for nomonal life. The conversion between C for 50 km and C_{100} for 100 km is $C=1.26 \times C_{100}$.

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Specifications

12.6 Roller Chain Type, SMR Series

A. Construction

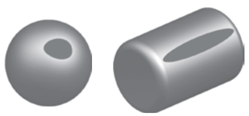


B. Characteristics

The roller chain type linear guideway, SMR series, equip with rollers instead of the ball, and therefore the SMR series can provide higher rigidity and loading than the normal type with the same size. Besides, the patent of roller chain design can make the movement smooth and stability, especially suit for the requests of high accuracy, heavy load and high rigidity.

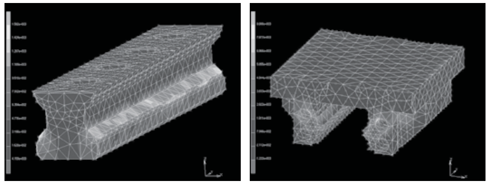
Ultra Heavy Load

SMR linear guideway through rollers have a line contact with carriage and rail. Relative to the general type linear guideway through balls have a point contact; the SMR type linear guideway can offer lower elastic deformation while bearing the same load. Base on the rollers have the same outer diameter with balls, the roller can bear the heavier load. The excellent characteristics of high rigidity and ultra heavy load can suitable for the high accuracy application that heavy load is processed even more.



The Optimization Design of Four Directional Load

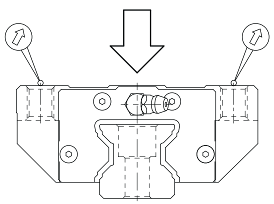
Through the structure stress analysis of finite element method, SMR series have four trains of rollers are designed to a contact angle of 45° and the section design for high rigidity. Except for bearing heavier loads in radial, reversed radial and lateral directions, a sufficient preload can be achieved to increase rigidity, and this makes it suitable for any kind of installation.

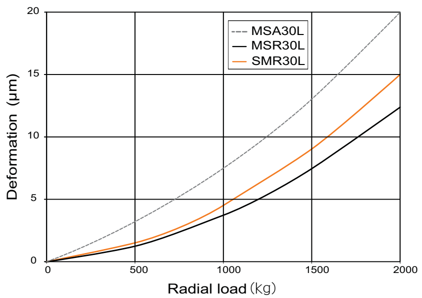


Ultra High Rigidity

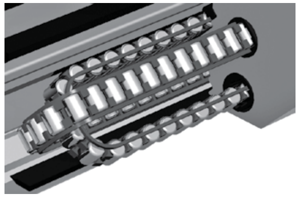
Test data of rigidity

Test samples：Ball type MSA30L with preload F1
Full roller type MSR30L with preload F1
Roller chain type SMR30L with preload F1





Roller Chain Design, Smooth Movement



The concise and smooth design of circulating system with strengthened synthetic resin accessories and cooperating with the roller chain, these can avoid interference between rollers and make the rollers more stability during passing in and out the load district. Besides, the roller chain can keep the roller move in a line and improve the movement most smooth substantially.

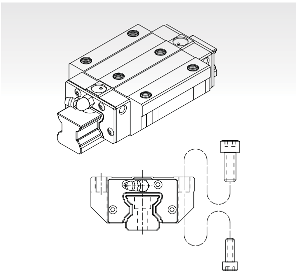
Low Noise, Good Lubricant Effect

The roller chain design avoids interference between rollers, lowers the operating noise, and can keep the lubricant between the rollers and roller chain effectively. Moreover, improve the movement smooth and service life of the whole, can meet high accuracy, high reliability and smooth and stability.

C. Carriage Type

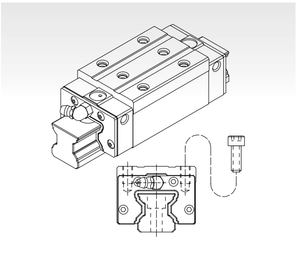
Heavy Load

SMR-E Type



This type offers the installation either from top or bottom side of carriage.

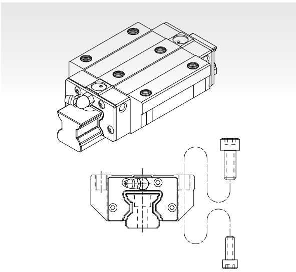
SMR-S Type



Square type with smaller width and can be installed from top side of carriage.

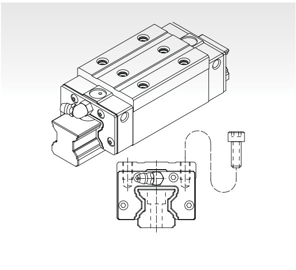
Ultra Heavy Load

SMR-LE Type



All dimensions are same as SMR-E except the length is longer, which makes it more rigid.

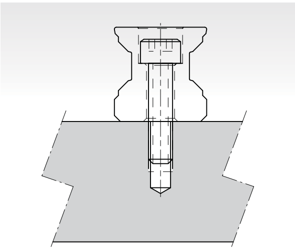
SMR-LS Type



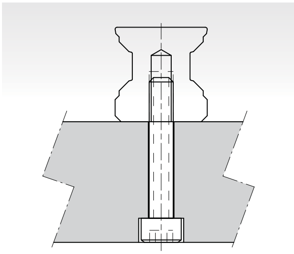
All dimensions are same as SMR-S except the length is longer, which makes it more rigid.

D. Rail Type

Counter bore (R type)



Tapped Hole (T type)



E. Description of Specification

SMR 25 E 2 SS F0 +R 1200 -20 /40 P II

- Series : **SMR**
- Size : **25, 30, 35, 45, 55, 65**
- Carriage type : (1) Heavy load
  - **E** : Flange type, mounting either from top or bottom
  - **S** : Square type

  (2) Ultra heavy load
  - **LE** : Flange type, mounting either from top or bottom
  - **LS** : Square type
- Number of carriages per rail : **1, 2, 3 ...**
- Dust protection option of carriage : No symbol, **UU, SS, ZZ, DD, KK (see page B85)**
- Preload : **F0** (Medium preload), **F1** (Heavy preload), F2(Ultra Heavy Preload) (see page B27)
- Code of special carriage : No symbol, **A, B ...**
- Rail type : **R** (Counter-bore type), **T** (Tapped hole type)
- Rail length (mm)
- Rail hole pitch from start side (**E1**, see Fig12.6)
- Rail hole pitch to the end side (**E2**, see Fig12.6)
- Accuracy grade : **H, P, SP, UP**
- Code of special rail : No symbol, **A, B ...**
- Dust protection option of rail : No symbol, **/CC, /MC ...(see page B85)**
- Number of rails per axis : No symbol , **II, III, IV ...**

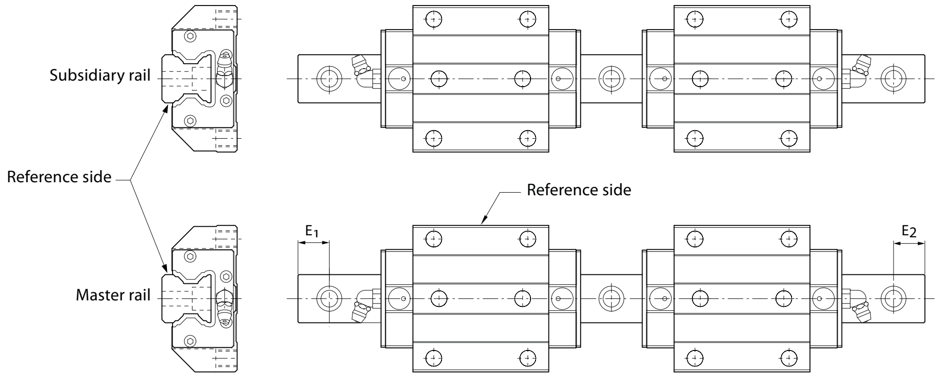


Fig12.6

F. Accuracy Grade

For details, see page B24

G. Preload Grade

For details, see page B27

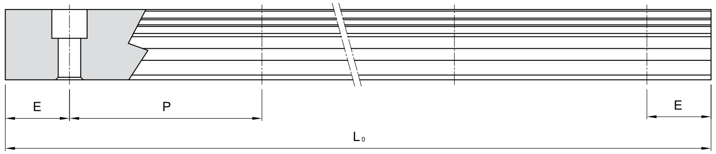
H. The Shoulder Height and Corner Radius for Installation

For details, see page B74

I. Dimensional Tolerance of Mounting Surface

For details, see page B76

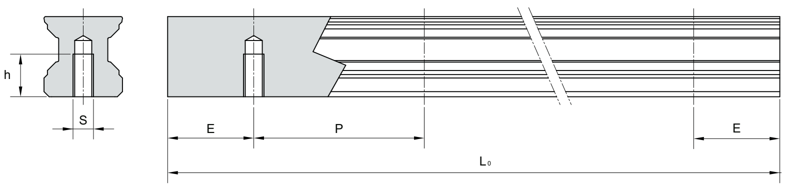
J. Rail Maximum Length and Standrad



Uit: mm

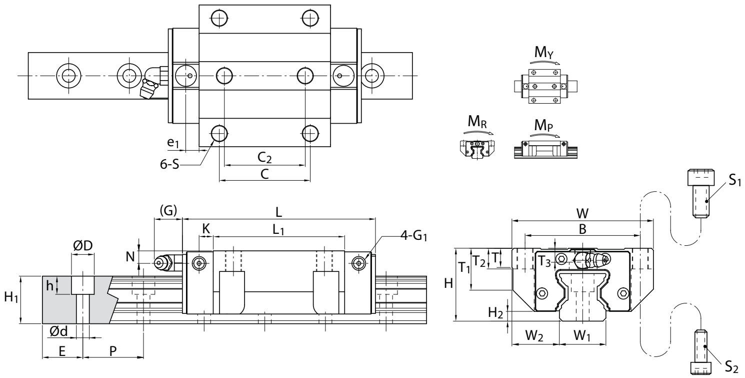
Model No.	SMR 25	SMR 30	SMR 35	SMR 45	SMR 55	SMR 65
Standard Pitch (P)	30	40	40	52.5	60	75
Standard ($E_{std.}$)	20	20	20	22.5	30	35
Minimum ($E_{min.}$)	7	8	8	11	13	14
Max (L_0 max.)	4000	4000	4000	4000	4000	4000

K. Tapped-hole Rail Dimensions



Rail Model	S	h(mm)
SMR 25 T	M6	12
SMR 30 T	M8	15
SMR 35 T	M8	17
SMR 45 T	M12	24
SMR 55 T	M14	24
SMR 65 T	M20	30

Dimensions of SMR-E / SMR-LE



Model No.	Bolt Size	
	S_1	S_2
SMR 25	M8	M6
SMR 30	M10	M8
SMR 35	M10	M8
SMR 45	M12	M10
SMR 55	M14	M12
SMR 65	M16	M14

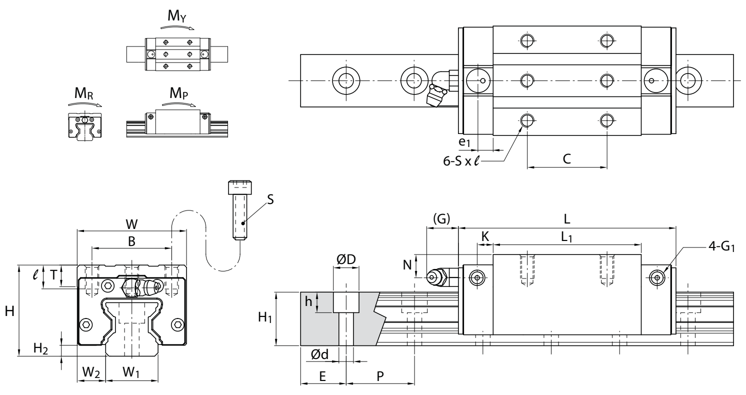
Unit: mm

Model No.	External dimension			Carriage dimension															
	Height H	Width W	Length L	W_2	H_2	B	C	C_2	S	L_1	T	T_1	T_2	T_3	N	G	K	e_1	G_1	Grease Nipple
SMR 25 E SMR 25 LE	36	70	97.5 115.5	23.5	4.8	57	45	40	M8	65.5 83.5	9.5	20.2	10	5.8	6	12	6.6	6.5	M6	G-M6
SMR 30 E SMR 30 LE	42	90	112.1 136	31	6	72	52	44	M10	75.6 99.5	10	21.6	13	6.7	7	12	8	7	M6	G-M6
SMR 35 E SMR 35 LE	48	100	125.3 154.4	33	6.5	82	62	52	M10	82.3 111.4	12	27.5	15	9.5	8	12	8	7	M6	G-M6
SMR 45 E SMR 45 LE	60	120	154.2 189.7	37.5	8	100	80	60	M12	106.5 142	14.5	35.5	15	12.5	10	13.5	10	10	M6	G-PT 1/8
SMR 55 E SMR 55 LE	70	140	185.4 235.4	43.5	10	116	95	70	M14	129.5 179.5	17.5	41	18	15.5	11	13.5	12	7.95	M6	G-PT 1/8
SMR 65 LE	90	170	302	53.5	12	142	110	82	M16	230	19.5	56	20	26	16.5	13.5	15	15	M6	G-PT 1/8

Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m		M_Y kN-m		M_R kN-m	Carriage kg	Rail kg/m
								Single*	Double*	Single*	Double*			
SMR 25 E SMR 25 LE	23	23.5	30	20	11×9×7	27.4 33.1	57.4 73.3	0.63 1.01	3.63 5.49	0.63 1.01	3.63 5.49	0.66 0.84	0.75 0.95	3.5
SMR 30 E SMR 30 LE	28	27.5	40	20	14×12×9	39.5 49.4	82.7 110.3	1.01 1.78	5.90 9.60	1.01 1.78	5.90 9.60	1.15 1.53	1.4 1.72	5
SMR 35 E SMR 35 LE	34	30.5	40	20	14×12×9	55.6 69.6	117.0 156.0	1.63 2.86	9.59 15.57	1.63 2.86	9.59 15.57	1.98 2.63	1.95 2.45	7
SMR 45 E SMR 45 LE	45	37	52.5	22.5	20×17×14	89.3 110.6	184.1 242.2	3.27 5.6	18.48 29.56	3.27 5.6	18.48 29.56	4.18 5.5	3.9 4.5	11.2
SMR 55 E SMR 55 LE	53	43	60	30	20×20×16	127.8 163.2	256.5 351.0	5.51 10.16	30.89 53.02	5.51 10.16	30.89 53.02	6.96 9.52	6 7.9	15.6
SMR 65 LE	63	52	75	35	26×22×18	263.5	583.7	21.49	111.99	21.49	111.99	18.73	17.6	22.4

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

Dimensions of SMR-S / SMR-LS



Unit: mm

Model No.	External dimension					Carriage dimension												
	Height H	Width W	Length L	W_2	H_2	B	C	S	ℓ	L_1	T	N	G	K	e_1	G_1	Grease Nipple
SMR 25 S SMR 25 LS	40	48	97.5 115.5	12.5	4.8	35	35 50	M6	10.5	65.5 83.5	9.5	10	12	6.6	6.5	M6	G-M6
SMR 30 S SMR 30 LS	45	60	112.1 136	16	6	40	40 60	M8	12	75.6 99.5	10	10	12	8	7	M6	G-M6
SMR 35 S SMR 35 LS	55	70	125.3 154.4	18	6.5	50	50 72	M8	14	82.3 111.4	12	15	12	8	7	M6	G-M6
SMR 45 S SMR 45 LS	70	86	154.2 189.7	20.5	8	60	60 80	M10	19	106.5 142	17	20	13.5	10	10	M6	G-PT 1/8
SMR 55 S SMR 55 LS	80	100	185.4 235.4	23.5	10	75	75 95	M12	19	129.5 179.5	18	21	13.5	12	7.95	M6	G-PT 1/8
SMR 65 LS	90	126	302	31.5	12	76	120	M16	20	230	19.5	16.5	13.5	15	15	M6	G-PT 1/8

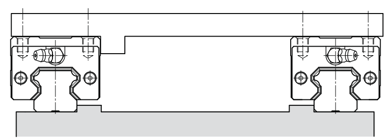
Model No.	Rail dimension					Basic load rating		Static moment rating					Weight	
	Width W_1	Height H_1	Pitch P	E std.	D × h × d	Dynamic C kN	Static C_o kN	M_P kN-m Single*	M_P kN-m Double*	M_Y kN-m Single*	M_Y kN-m Double*	M_R kN-m	Carriage kg	Rail kg/m
SMR 25 S SMR 25 LS	23	23.5	30	20	11×9×7	27.4 33.1	57.4 73.3	0.63 1.01	3.63 5.49	0.63 1.01	3.63 5.49	0.66 0.84	0.65 0.85	3.5
SMR 30 S SMR 30 LS	28	27.5	40	20	14×12×9	39.5 49.4	82.7 110.3	1.01 1.78	5.90 9.60	1.01 1.78	5.90 9.60	1.15 1.53	1 1.22	5
SMR 35 S SMR 35 LS	34	30.5	40	20	14×12×9	55.6 69.6	117.0 156.0	1.63 2.86	9.59 15.57	1.63 2.86	9.59 15.57	1.98 2.63	1.65 2.15	7
SMR 45 S SMR 45 LS	45	37	52.5	22.5	20×17×14	89.3 110.6	184.1 242.2	3.27 5.6	18.48 29.56	3.27 5.6	18.48 29.56	4.18 5.5	3.2 4.1	11.2
SMR 55 S SMR 55 LS	53	43	60	30	23×20×16	127.8 163.2	256.5 351.0	5.51 10.16	30.89 53.02	5.51 10.16	30.89 53.02	6.96 9.52	5.1 7	15.6
SMR 65 LS	63	52	75	35	26×22×18	263.5	583.7	21.43	111.99	21.43	111.99	18.73	13.3	22.4

Note*: Single: Single carriage/ Double: Double carriages closely contacting with each other.

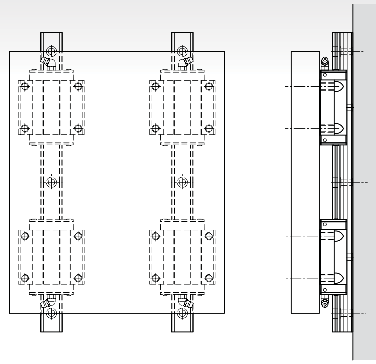
13.1 Installation Direction of Linear Guideway

The installation direction of linear guideway depends on machine structure and load direction. When oil lubrication is applied, the lubricant routing will be varied with different applications. Therefore, please specify the direction of installation when ordering.

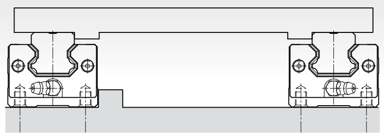
Horizontal (Code：H)



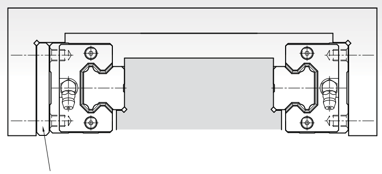
Vertical (Code：V)



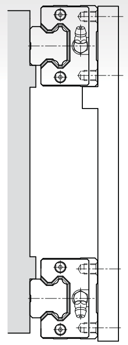
Inverted (Code：R)



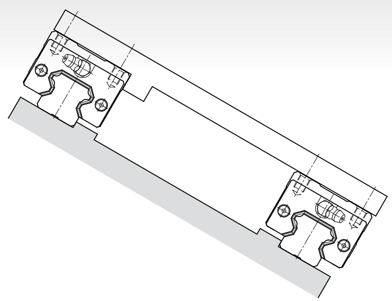
Opposed (Code：F)



Wall mounting (Code：K)

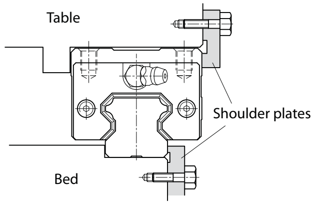


Tilted (Code：T)



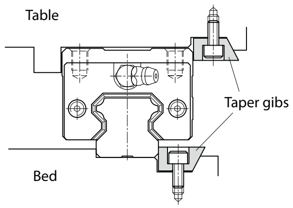
13.2 Fixing Methods of Linear Guideway

The rail and carriage could be displaced when machine receives vibration or impact. Under such situation, the running accuracy and service life will be degraded, so the following fixing methods are recommended for avoiding such situation happens.



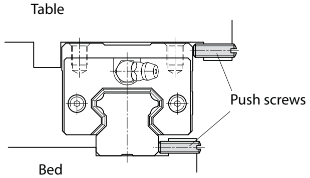
Shoulder plate (Recommended)

For this method, the rail and carriage should stick out slightly from the bed and table. To avoid interference from corner of carriage and rail, the shoulder plate should have a recess.



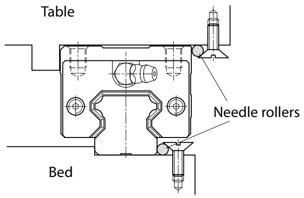
Taper gib

A slight tightening of the taper gib could generate a large pressing force to the linear guideway, and this may cause the rail to deform. Thus, this method should be carried with caution.



Push screw

Due to the limitation of installation space, the size of bolt should be thin.



Needle roller

The needle roller is pressed by the taper section of the head of screw, so the position of screw should be paid attention.

13.3 Design of Installation

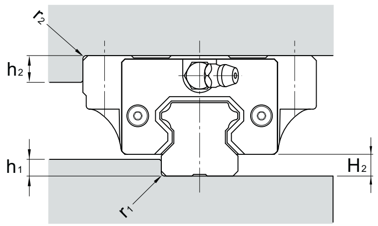
In order to realize the accuracy during installation, please refer to the points below.

A. The Shoulder Height and Corner Radius for Installation

The mounting surface of rails and carriages are machined precisely for aiding in positioning and assemble with high accuracy. The shoulder height and corner radius providing enough mounting space for not to interfere with chamfers made on rails and carriages.

The dimensions of shoulder height and corner radius are shown below.

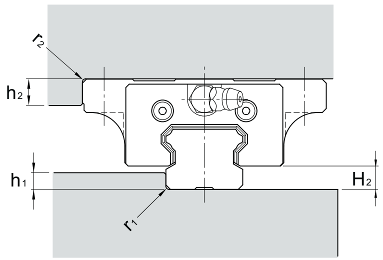
MSA series



Unit: mm

Model No.	r_1 (max.)	r_2 (max.)	h_1	h_2	H_2
15	0.5	0.5	3	4	4.2
20	0.5	0.5	3.5	5	5
25	1	1	5	5	6.5
30	1	1	5	5	8
35	1	1	6	6	9.5
45	1	1	8	8	10
55	1.5	1.5	10	10	13
65	1.5	1.5	10	10	15

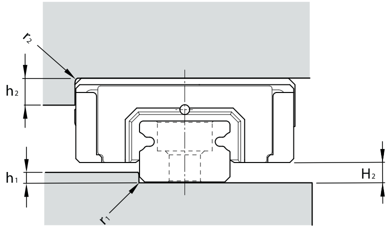
MSB series



Unit: mm

Model No.	r_1 (max.)	r_2 (max.)	h_1	h_2	H_2
15	0.5	0.5	3	4	4.5
20	0.5	0.5	4	5	6
25	1	1	5	5	7
30	1	1	7	5	9.5
35	1	1	8	6	9.5

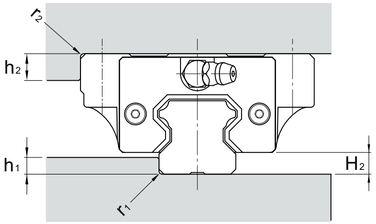
MSC series



Unit: mm

Model No.	r_1 (max.)	r_2 (max.)	h_1	h_2	H_2
7	0.2	0.2	1.0	3	1.5
9	0.2	0.3	1.7	3	2.2
12	0.3	0.4	2.5	4	3.0
15	0.5	0.5	3.5	5	4.0

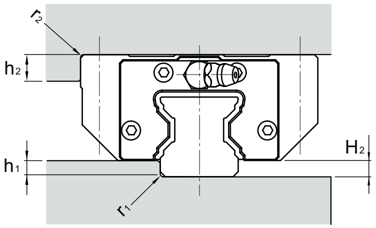
SME series



Unit: mm

Model No.	r_1 (max.)	r_2 (max.)	h_1	h_2	H_2
15	0.5	0.5	2.5	5	3.5
20	0.5	0.5	3.5	5	4.7
25	1	1	5	6	5.8
30	1	1	5	7	7.5
35	1	1	6	8	8
45	1	1	8	8	10

MSR, SMR series



Unit: mm

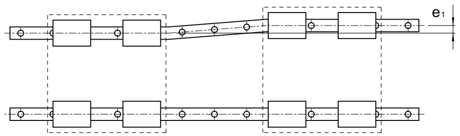
Model No.	r_1 (max.)	r_2 (max.)	h_1	h_2	H_2
25	0.5	0.5	4	8	4.8
30	0.5	0.5	5	8	6
35	1	1	5.5	10	6.5
45	1	1	6	12	8.1
55	1	1	8	15	10
65	1	1	10	15	12

B. Dimensional Tolerance of Mounting Surface

With the self alignment capability, the minor dimensional error in mounting surface could be compensated and achieves smooth linear motion. The tolerances of parallelism between two axes are shown as below.

MSA, MSB, SME series

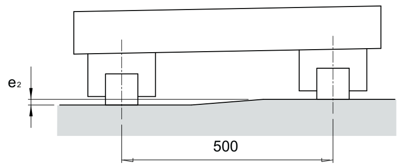
The parallel deviation between two axes (e_1)



Unit: μm

Model No.	Preload Grade		
	FC	F0	F1
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
65	80	60	55

Level difference between two axes (e_2)



Unit: μm

Model No.	Preload Grade		
	FC	F0	F1
15	130	85	-
20	130	85	50
25	130	85	70
30	170	110	90
35	210	150	120
45	250	170	140
55	300	210	170
65	350	250	200

Note: The permissible values in table are applicable when the span is 500mm wide.

MSC Series

The parallel deviation between two axes (e_1)

Unit: μm

Model No.	Preload Grade	
	FC	F0
7	3	3
9	4	3
12	9	5
15	10	6

Level difference between two axes (e_2)

Unit: μm

Model No.	Preload Grade	
	FC	F0
7	25	6
9	35	6
12	50	12
15	60	20

Note: The permissible values in table are applicable when the span is 500mm wide.

MSR, SMR Series

With the high rigidity, the minor dimensional error in mounting surface could be compensated and achieves smooth linear motion. The tolerances of parallelism between two axes are shown as below.

The parallel deviation between two axes (e_1)

Unit: μm

Model No.	Preload Grade		
	F0	F1	F2
25	9	7	5
30	11	8	6
35	14	10	7
45	17	13	9
55	21	14	11
65	27	18	14

Level difference between two axes (e_2)

Unit: μm

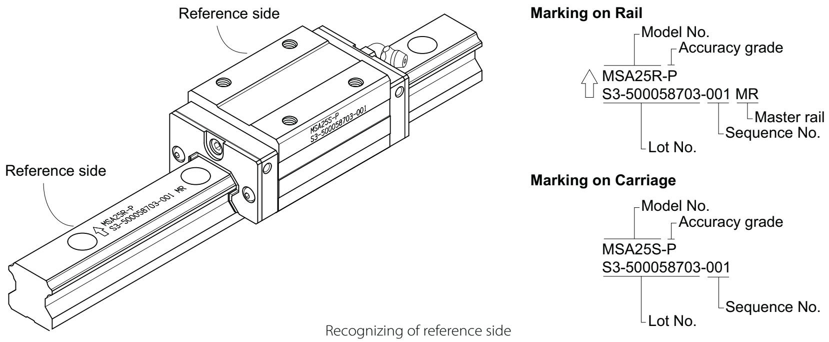
Model No.	Preload Grade		
	F0	F1	F2
25	150	105	55
30			
35			
45			
55			
65			

Note: The permissible values in table are applicable when the span is 500mm wide.

C. Marking on Master Linear Guideway and Combined Case

Recognizing of Reference Side

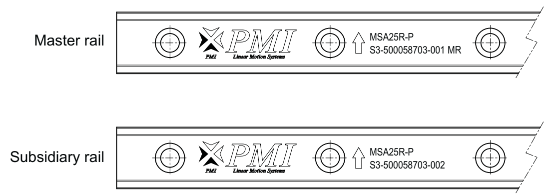
The reference side of rail is assigned by the arrow sign which is marked together with the model code and lot number on top surface of rail while that of carriage is the side which is opposed to the side marked with lot number and model code marked, as shown below.



Recognizing of reference side

Recognizing of Master Rail

Linear rails to be applied on the same plane are all marked with the same serial number, and "MR" is marked at the end of serial number for indicating the master rail, shown as the figure below. The reference side of carriage is the surface where is ground to a specified accuracy. For normal grade (N), it has no mark "MR" on rail which means any one of rails with same serial number could be the master rail.



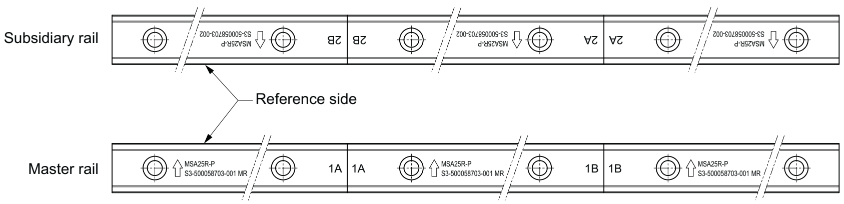
Recognizing of master rail

Combined Use of Rail and Carriage

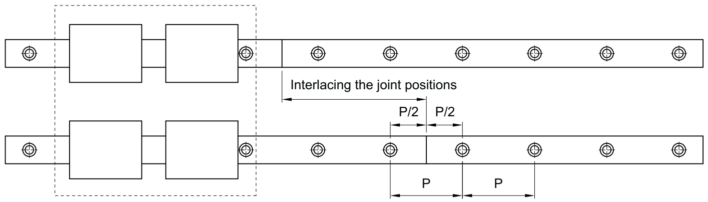
For combined use, the rail and carriage must have the same serial number. When reinstalling the carriage back to the rail, make sure they have the same serial number and the reference side of carriage should be in accordance with that of rail.

For Butt-joint Rail

When applied length of rail longer than specified max. length, the rails can be connected to one another. For this situation, the joint marks indicate the matching position. Accuracy may deviate at joints when carriages pass the joint simultaneously. Therefore, the joints should be interlaced for avoiding such accuracy problem.

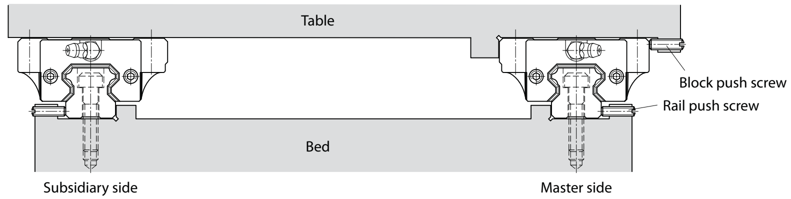


Identification of butt-joint rail



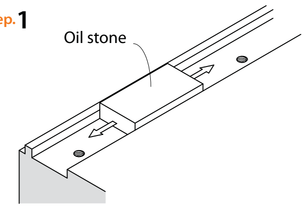
Staggering the joint position

14.1 Installation of Linear Guideway When Machine Subjected to Vibration and Impact



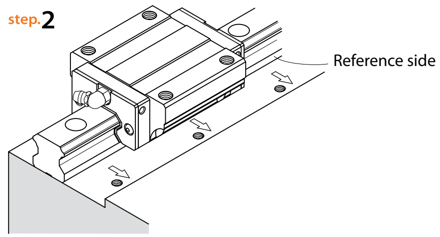
(1) Installation of rail

step.1

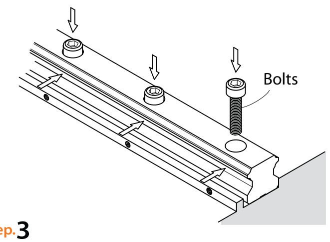


Prior to installation, the burrs, dirt, and rust preventive oil should be removed thoroughly.

step.2

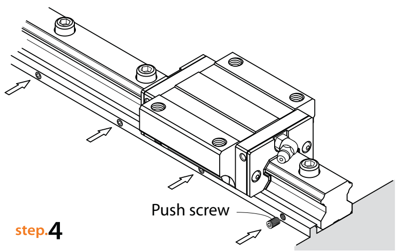


Gently place the linear guideway on the bed, and pushing it against the reference side of bed.



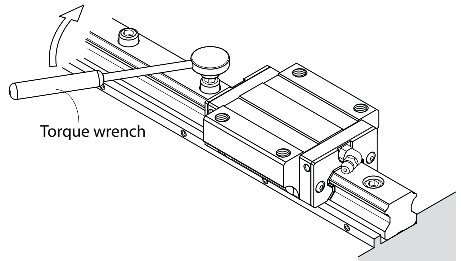
step.3

Check for correct bolt play and temporarily tighten all bolts.



step.4

Tighten the push screw in sequence to ensure the rail close matching the reference side of bed.



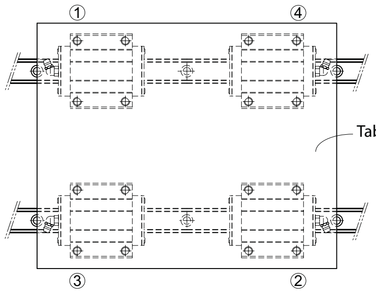
step.5

Tighten all bolts to the specified torque. The tightening sequence should start from the center to both ends. By doing this, the original accuracy could be achieved.

step.6

Follow the same procedure for the installation of remaining rails.

(2) Installation of carriage



step.1

Gently place table onto carriages and temporarily tighten the bolts.

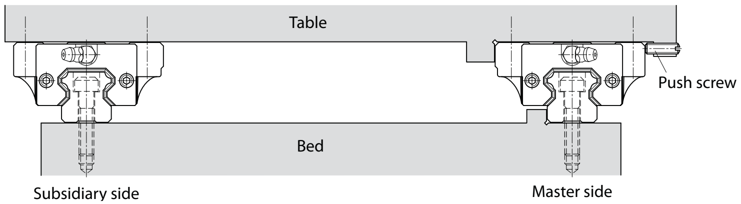
step.2

Tighten the push screw to hold the master rail carriage against the table reference side, and position the table.

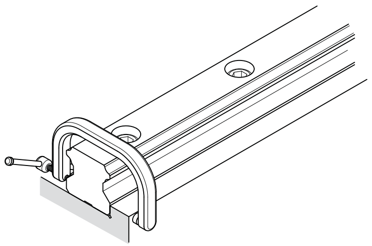
step.3

Fully tighten all bolts on both master and subsidiary sides. The tightening process should be followed by the order of ① to ④.

14.2 Installation of Linear Guideway without Push Screws



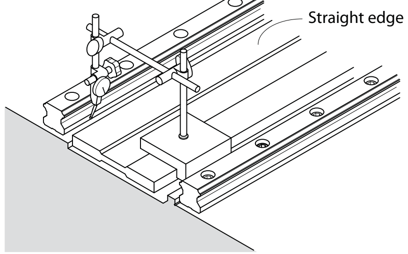
(1) Installation of master rail



Using a vise

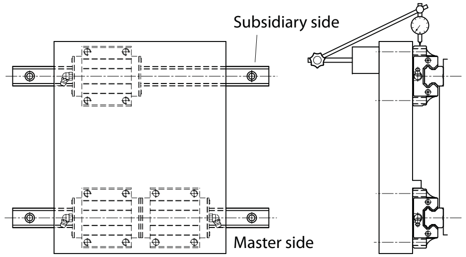
First tighten the mounting bolts temporarily, than use a C vise to press the master rail to reference side. Tighten the mounting bolts in sequence to specified torque.

(2)Installation of subsidiary rail



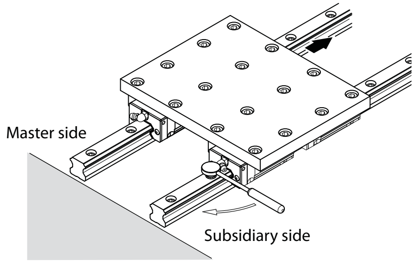
Using a straight edge

Place a straight edge between the two rails and position it parallel to the reference side rail which is temporarily tightened by bolts. Check the parallelism with dial gauge, and align the rail if necessary. Then tighten the bolts in sequence.



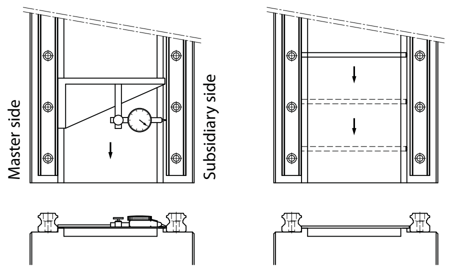
Using a table

Tighten two master side carriages and one subsidiary side carriage onto the table. Then temporarily tighten another subsidiary carriage and rail to the table and bed. Position a dial gauge on the table and have the probe of dial gauge contact the side of the subsidiary carriage. Move the table from the rail end and check the parallelism between the carriage and the subsidiary rail. Then tighten the bolts in sequence.



Compare to master rail side

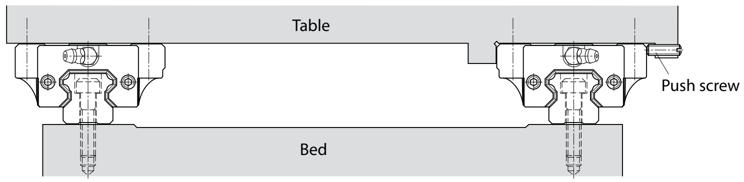
Tighten two master side carriages and one subsidiary side carriage onto the table. Then temporarily tighten another subsidiary carriage and rail to the table and bed. Move the table from one rail, check and align the parallelism of subsidiary rail based on moving resistance. Tighten the bolts in sequence.



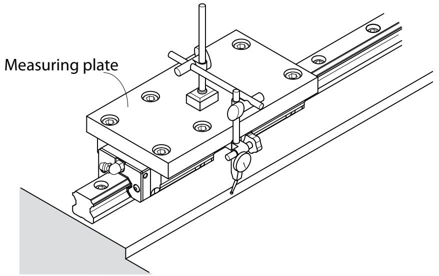
Using a jig

Using the special jig to align the parallelism between the reference side of master rail and that of subsidiary rail from one rail end to another. Tighten the mounting bolts in sequence.

14.3 The Installation of Carriage of Linear Guideway without the Reference Side for Master Rail

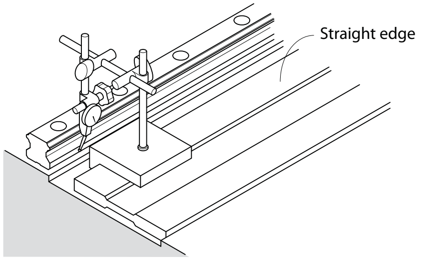


(1) Mounting the master rail



Using a temporary reference side

Two carriages are tightened together onto the measuring plate, and set up a temporary reference surface near the rail mounting surface on the bed. Check and align the parallelism of rails and then tighten bolts sequentially.



Using a straight edge

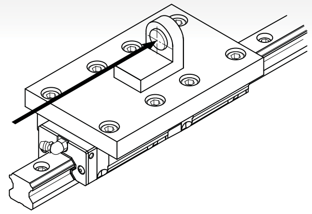
At first temporarily tighten rail onto the bed, then use a dial gauge to align the straightness of rail. Tighten the bolts in sequence.

(2) The installation of subsidiary carriage and rail is same as the prior examples

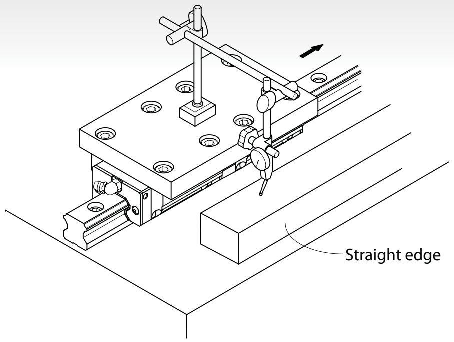
14.4 Accuracy Measurement after Installation

The running accuracy can be obtained by tightening the two carriages onto the measuring plate. A dial gauge or autocollimeter is sued for measuring the accuracy. If a dial gauge is used, the straight edge should be placed as close to carriage as possible for accurate measurement.

Measuring with an Autocollimeter



Measuring with a Dial Gauge



14.5 The Recommended Tightening Torque for Rails

The improper tightening torque could affect the mounting accuracy, so tightening the bolts by torque wrench to specified toque is highly recommended. Different types of mounting surface should have different torque value for applications.

Unit: N-m

Bolt Model	Torque Value		
	Iron	Cast iron	Aluminum
M2	0.6	0.4	0.3
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

* 1 N-m = 0.738 lbf-ft

15.1 Dust Proof

A. Code of contamination protection

Code of contamination protection for Carriage

Code	Contamination Protection
No symbol	Scraper (both ends)
UU	Bidirectional end seal (both ends)
SS	Bidirectional end seal + Bottom seal
ZZ	SS + Scraper
DD	Double bidirectional end seal + Bottom seal

Code	Contamination Protection
KK	DD + Scraper
LL	Low frictional end seal
RR	LL + Bottom seal

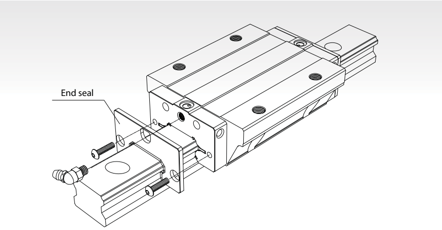
Code of contamination protection for Rail

Code	Contamination Protection
/CC	Cover strip
/MC	Metallic bolt cap

B. Contamination protection

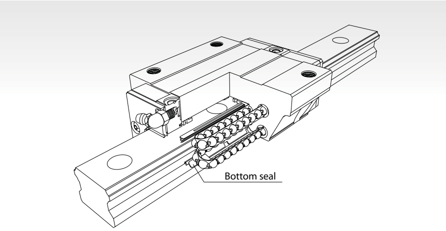
Each series of linear guideway offers various kinds of dust protection accessory to keep the foreign matters from entering into the carriage.

End seal



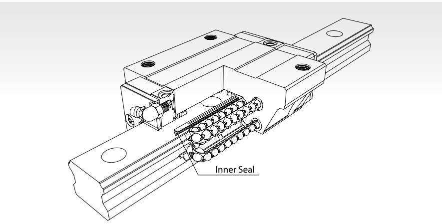
Tow types sealing are available:
1. Bidirectional seal for high dust protection required.
2. Monodirectional seal for low frictional resistance required.

Bottom seal



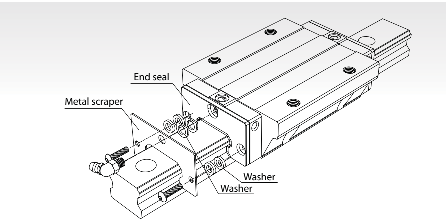
Preventing the inclusion of foreign matters from bottom of carriage.

Inner Seal



Prevent the inclusion of foreign matters form the bolt hole.

Metal scraper



Removing spatters, iron chips , and large foreign matters as well as protecting the end seals.

Types of seal to the increment to the carriage overall length

MSA series

Unit: mm

Model No.	No symbol	UU	SS	LL	RR	ZZ	DD	KK
15	1	-	-	-	-	6	5	11
20	1.4	-	-	-	-	7	5.6	12.6
25	1.4	-	-	-	-	7	5.6	12.6
30	1.4	-	-	-	-	7	5.6	12.6
35	0.6	-	-	-	-	7.8	7.2	15
45	0.6	-	-	-	-	7.8	7.2	15
55	-	-	-	-	-	7.8	7.8	15.6
65	-	-	-	-	-	7.8	7.8	15.6

MSB series

Unit: mm

Model No.	No symbol	UU	SS	LL	RR	ZZ	DD	KK
15	-	-	-	-	-	5	5	10
20	1	-	-	-	-	7	6	13
25	1	-	-	-	-	7	6	13
30	1	-	-	-	-	7	6	13
35	0.6	-	-	-	-	7.8	7.2	15

SME series

Unit: mm

Model No.	No symbol	UU	SS	ZZ	DD	KK
15	0.4	-	-	6	5.6	11.6
20	1	-	-	7	6	13
25	1	-	-	7	6	13
30	1.4	-	-	7	5.6	12.6
35	1	-	-	7.8	6.8	14.6
45	0.6	-	-	7.8	7.2	15

MSR, SMR series

Unit: mm

Model No.	No symbol	UU	SS	ZZ	DD	KK
25	2	-	-	6	6	12
30	2	-	-	7	6	13
35	2	-	-	7	6	13
45	1.6	-	-	7	6.4	13.4
55	0.8	-	-	7.8	7.2	15
65	0.8	-	-	7.8	7.8	15.6

Resistance value of seal

MSA series

The maximum resistance value of MSA series with seals type UU when it is applied with grease is shown below.

Unit: N

Model No.	Resistance
15	2
20	3.5
25	4
30	6
35	10
45	12
55	18
65	30

MSB series

The maximum resistance value of MSB series with seals type UU when it is applied with grease is shown below.

Unit: N

Model No.	Resistance
15	2
20	3
25	4
30	5.5
35	9

MSC series

The maximum resistance value of MSC series with seals type LL when it is applied with grease is shown below.

Unit: N

Model No.	Resistance
7	0.08
9	0.1
12	0.4
15	0.8

SME series

The maximum resistance value of SME series with seals type UU when it is applied with grease is shown below.

Unit: N

Model No.	Resistance
15	2
20	3.5
25	4
30	6
35	10
45	12

MSR, SMR series

The maximum resistance value of MSR and SMR series with seals type UU when it is applied with grease is shown below.

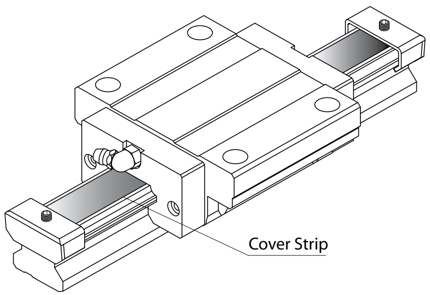
Unit: N

Model No.	Resistance
25	4.5
30	8
35	12
45	18
55	20
65	35

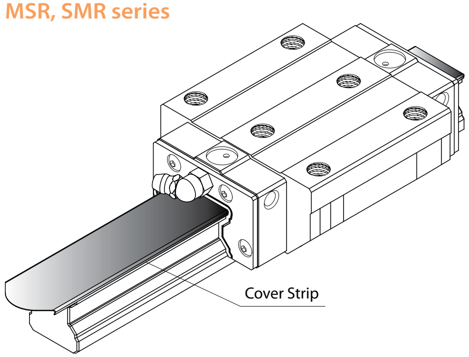
C. Cover Strip

A special designed of cover strip is used to cover the bolt hole to prevent the foreign matters from entering the carriage. Please specify when ordering.

MSA, MSB, SME series



MSR, SMR series



The cover strip of MSR and SMR series will increase the assembly height of rail. The increment refer to the table below.

Model No.	Increment (mm)	Assembly height of rail (mm)
25	0.3	23.8
30	0.3	27.8
35	0.3	30.8
45	0.3	37.3
55	0.3	43.3
65	0.3	52.3

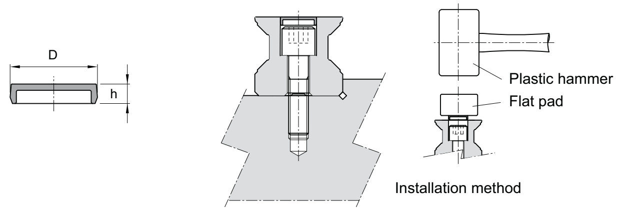
Note: The cover strip of MSA, MSB and SME series will not increase the assembly height of rail.

D. Caps for rail mounting hole

A special designed of cap is used to cover the bolt hole to prevent the foreign matters from entering the carriage. According to difference of application, ***PMI*** provide two kind of caps for selection, made by plastic and metal. The metallic cap is for option, please specify when ordering.
The plastic cap is mounted by using a plastic hammer with a flat pad placed on the top, until the top of cap is flush to the top surface of rail. The dimension of caps for different sizes of rail is shown.

Installation of plastic cap

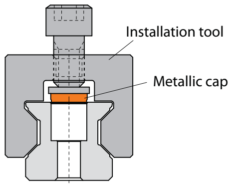
The plastic cap is mounted by using a plastic hammer with a flat pad placed on the top, until the top of cap is flush to the top surface of rail. The dimensions of plastic caps for each series is shown below.



Code of Plastic Cap	Bolt Size	Rail Model					
M3C	M3		MSB15R		MSC12R MSC15R		
M4C	M4	MSA15R	MSB15U			SME15R	
M5C	M5	MSA20R	MSB20R			SME20R	
M6C	M6	MSA25R	MSB25R MSB30R	MSR25R		SME25R	SMR25R
M8C	M8	MSA30R MSA35R	MSB35R	MSR30R MSR35R		SME30R SME35R	SMR30R SMR35R
M12C	M12	MSA45R		MSR45R		SME45R	SMR45R
M14C	M14	MSA55R		MSR55R			SMR55R
M16C	M16	MSA65R		MSR65R			SMR65R

Installation of metallic cap

The metallic cap is mounted by using a installation tool as the figure shown, until the top of cap is flushed to the top surface of rail. The installation tool is optional, please contact *PMI* for the detail.



Code of Metallic Cap	Bolt Size	Rail Model		
M6MC	M6	MSR25R	SME25R	SMR25R
M8MC	M8	MSR30R MSR35R	SME30R SME35R	SMR30R SMR35R
M12MC	M12	MSR45R	SME45R	SMR45R
M14MC	M14	MSR55R		SMR55R
M16MC	M16	MSR65R		SMR65R

E. Table of Supported Options by Series

Code	MSA	MSB	MSC	MSR	SME	SMR
No symbol	●	●	–	●	●	●
UU	●	●	–	●	●	●
SS	○	○	–	●	●	●
ZZ	○	○	–	●	●	●
DD	○	○	–	●	●	●
KK	○	○	–	●	●	●
LL	●	●	●	–	–	–
RR	●	●	●	–	–	–
/CC	●	●	–	●	●	●
/MC	●	●	–	●	●	●

Note: ● : Support, – : Not Support, ○ : Do not provide inner seal for MSA and MSB series.

15.2 Lubrication

A well lubrication is important for maintaining the function of linear guideway. If the lubrication is not sufficient, the frictional resistance at rolling area will increase and the service life will be shortened as a result of wear of rolling parts.

Two primary lubricants are both grease and oil used for linear motion system, and the lubrication methods are categorized into manual and forced oiling. The selection of lubricant and its method should be based on the consideration of operating speed and environment requirement.

Grease lubrication

The grease feeding interval will be varied with different operating conditions and environments. Under normal operating condition, the grease should be replenished every 100km of travel. The standard grease is lithium-based grease No.2. Moving the carriage back and forth with minimum stroke length of length of 3 carriages after the carriages been greased. To assure the grease is evenly distributed inside of carriage, the mentioned process should be repeated twice at least.

Oil lubrication

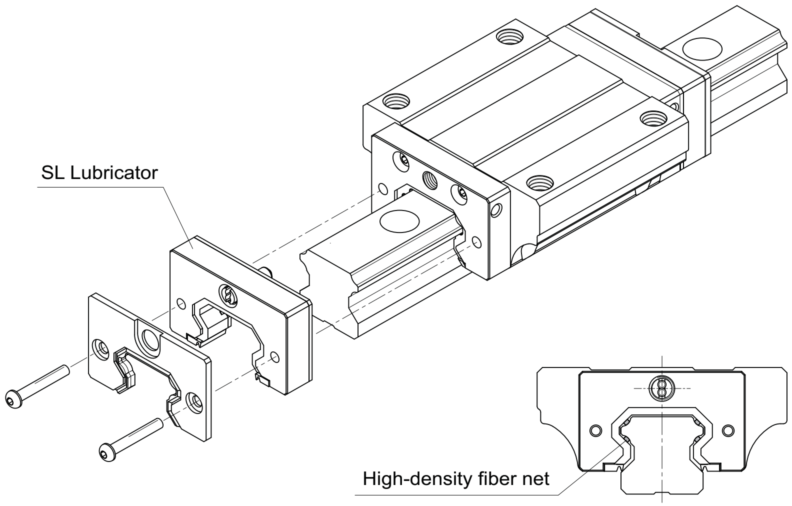
The recommended viscosity of oil is 30~150 cst, and the recommended feeding rate per hour. The installation other than horizontal may caused the oil unable to reach raceway area, so please specify the installed direction your linear guideway applied.

Note:

When the operating stroke length less than the sum of length of two carriages, the lubrication fitting should be applied on both ends of carriage for adequacy. Moreover, if the stroke length less than a half of the length of a carriage, the carriage should be moved back and forth up to the length of two carriages while lubricating.

A. SL Lubricator

1.Construction and Characteristics



Characteristics

PMI SL lubricator unit is designed with an oil reservoir which equipped with a high-density fiber net. Through the fiber net the lubricant can be steadily fed onto the surface of raceway to satisfy the required lubricating function.

1. Lengthening the interval between maintenance works

Contrary to the oil losing problem caused from ordinary lubrication, the SL lubricator effectively and evenly distribute needed amount of oil on to ball raceway during the movement. Therefore, the interval between maintenance works can be greatly extended.

2. To avert the pollution

Through the use of SL lubricator, only the needed amount of oil will be fed for the purpose of lubrication, thereby the oil is almost nothing to lose in application. As a result, the environment will not be contaminated by waste oil.

3. Cost reduction

Saving the expense from oil loss and lubricating device.

4. Enables the most suitable oil for the purpose of use to be selected

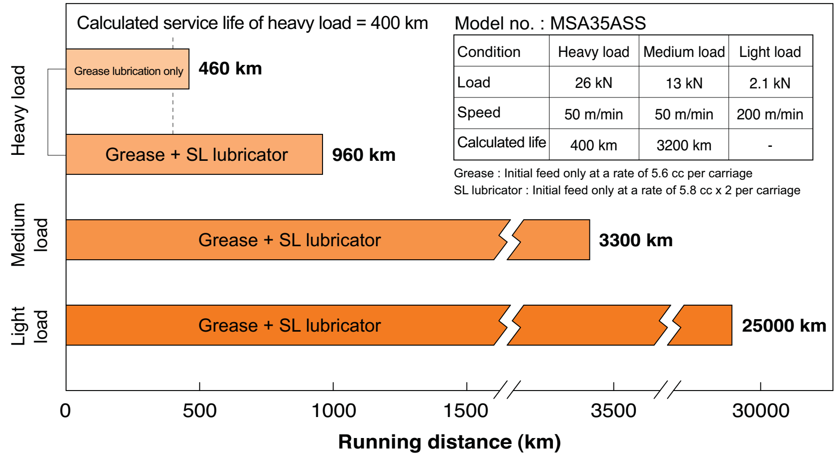
The SL lubricator makes it possible to select the most proper lubricant for your application of linear guideway.

2. Performance

Lengthening the interval between maintenance works

By using the SL lubricator, the interval between maintenance work can be lengthened at all load rating.

Running Test without Replenishment of Lubricant



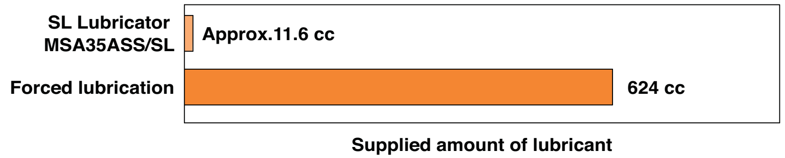
Condition	Heavy load	Medium load	Light load
Load	26 kN	13 kN	2.1 kN
Speed	50 m/min	50 m/min	200 m/min
Calculated life	400 km	3200 km	-

Grease : Initial feed only at a rate of 5.6 cc per carriage
SL lubricator : Initial feed only at a rate of 5.8 cc x 2 per carriage

Effective use of lubricant

Since only the needed amount of lubricant will be applied to needed location, thereby effective use of lubricant can be achieved and the waste of lubricant can also be avoided.

Annual Lubricant Consumption per Carriage



Amount of oil contained in SL Lubricator
5.8 cc x 2 / carriage
= 11.6 cc

Compared

Forced lubrication
0.3 cc/hr x 8 hrs/day x 260 days/year
= 624 cc

3. Description of Specification

(1) Non-Interchangeable Type

MSA25 A 2 SS F0 /SL + R 1200 -20 /40 P II

- Model no.
- Carriage type
- Number of carriages per rail
- Dust protection option
- Preload
- Code of special carriage
- SL lubricator
- Rail type
- rail length (mm)
- Rail hole pitch from start side
- Rail hole pitch to the end side
- Accuracy grade
- Code of special rail
- Number of rails per axis

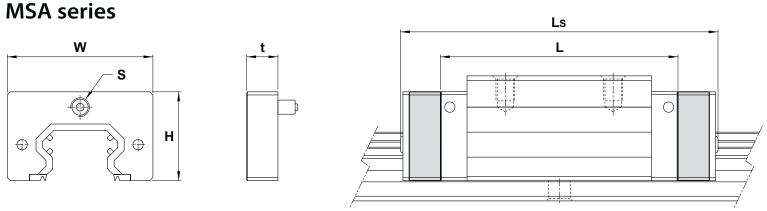
(2) Interchangeable Type Carriage

MSA25 A SS FC N /SL

- Model no.
- Carriage type
- Dust protection option
- Preload
- Accuracy grade
- Code of special carriage
- SL lubricator

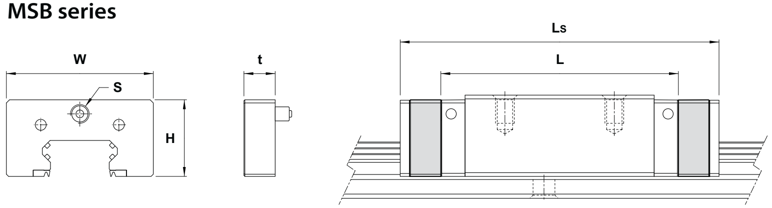
4. Dimensions of the SL Lubricator

MSA series



Model No.		SL Lubricator dimension (mm)				Carriage dimension (mm)	
		Height H	Width W	Thickness t	Tapped hole S	Standard length L	SL Lubricator overall length Ls
MSA 15SL	A/E/S	19	31.2	10	M4	56.3	81.3
MSA 20SL	A/E/S	21.2	42.8	10	M6	72.9	92.9
	LA/LE/LS					88.8	108.8
MSA 25SL	A/E/S	28.5	46.8	10	M6	81.6	101.6
	LA/LE/LS					100.6	120.6
MSA 30SL	A/E/S	32	57	10	M6	97	117
	LA/LE/LS					119.2	139.2
MSA 35SL	A/E/S	36.5	68	10	M6	111.2	131.2
	LA/LE/LS					136.6	156.6
MSA 45SL	A/E/S	49	83.6	15	1/8PT	137.7	167.7
	LA/LE/LS					169.5	199.5

MSB series

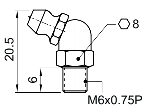


Model No.		SL Lubricator dimension (mm)				Carriage dimension (mm)	
		Height H	Width W	Thickness t	Tapped hole S	Standard length L	SL Lubricator overall length Ls
MSB 15SL	TE/TS	18.5	33	10	M4	40	65
	E/S					57	82
MSB 20SL	TE/TS	21.2	40.8	10	M6	48	68
	E/S					67	87
MSB 25SL	TE/TS	24.5	47	10	M6	60.2	80.2
	E/S					82	102
MSB 30SL	TE/TS	30.8	57	10	M6	68	88
	E/S					96.7	116.7

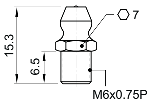
B. Grease nipple and piping joint

Grease nipple

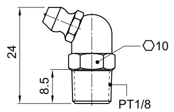
G-M6



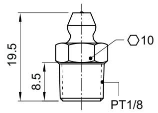
GS-M6



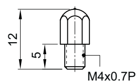
G-PT1/8



GS-PT1/8



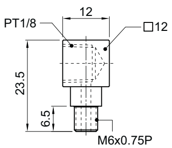
G-M4



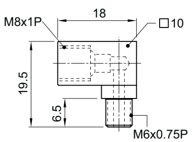
Oil piping joint

OL Type

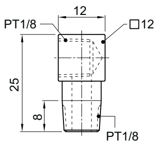
OL-A



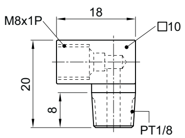
OL-B



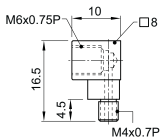
OL-C



OL-D

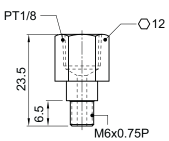


OL-E

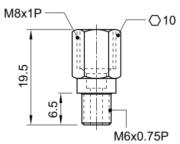


OS Type

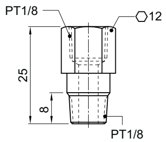
OS-A



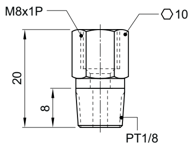
OS-B



OS-C



OS-D



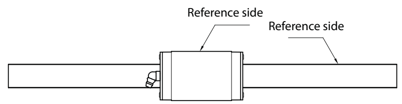
Model No.					Grease Nipple		Piping Joint			
					Standard	Option	Option			
MSA 15	MSB 15		SME 15		G-M4	-	OL-E			
MSA 20	MSB 20		SME 20		G-M6	GS-M6	OL-A	OL-B	OS-A	OS-B
MSA 25	MSB 25	MSR 25	SME 25	SMR 25	G-M6	GS-M6	OL-A	OL-B	OS-A	OS-B
MSA 30	MSB 30	MSR 30	SME 30	SMR 30	G-M6	GS-M6	OL-A	OL-B	OS-A	OS-B
MSA 35	MSB 35	MSR 35	SME 35	SMR 35	G-M6	GS-M6	OL-A	OL-B	OS-A	OS-B
MSA 45		MSR 45	SME 45	SMR 45	G-PT1/8	GS-PT1/8	OL-C	OL-D	OS-C	OS-D
MSA 55		MSR 55		SMR 55	G-PT1/8	GS-PT1/8	OL-C	OL-D	OS-C	OS-D
MSA 65		MSR 65		SMR 65	G-PT1/8	GS-PT1/8	OL-C	OL-D	OS-C	OS-D

C. The Relationship between the Direction of Lubrication and the Reference Side

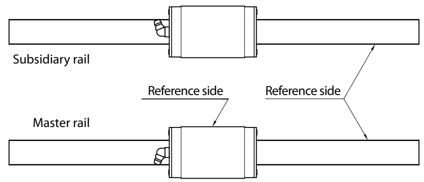
The standard lubrication fitting is grease nipple (G-M6、G-PT1/8、G-M4). The code of different types of application for lubrication fittings are shown below. For cases other than specified, please contact us for confirmation.

The relationship between the direction of lubrication and the reference side

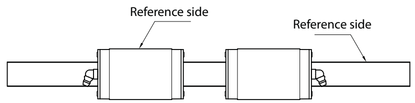
Code: C1R1



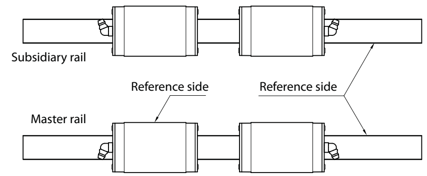
Code: C1R2



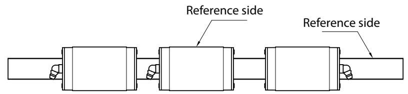
Code: C2R1



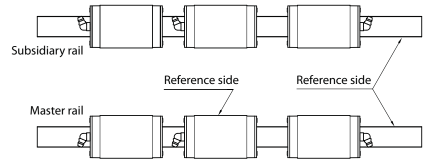
Code: C2R2



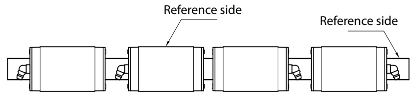
Code: C3R1



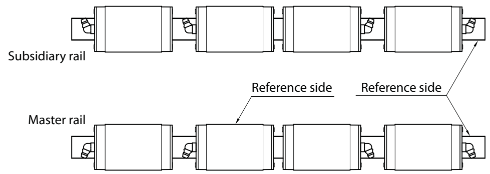
Code: C3R2



Code: C4R1



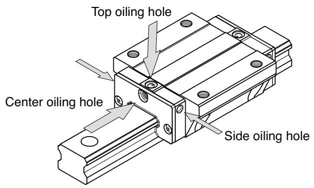
Code: C4R2



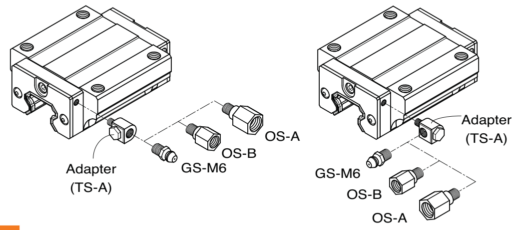
D. Lubrication position

The standard mounting locating of carriage is at the center of both ends. As for lateral and top application, please specify when ordering. As shown as below, the lateral application is achieved by using a adapter to connect the grease/oil fitting to the hole on the carriage.

Lubrication location



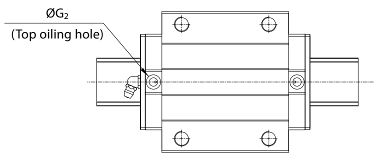
Lateral usage (Adapter only for MSA and MSB series)

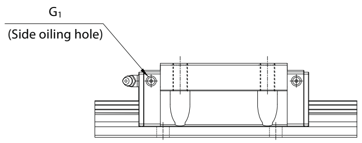


Model No.		Center	Side	
		Nipple	G_1	Nipple
MSA 15	MSB 15	G-M4	M4×0.7P	G-M4
MSA 20	MSB 20	G-M6	M4×0.7P	G-M4
MSA 25	MSB 25	G-M6	M4×0.7P	G-M4
MSA 30	MSB 30	G-M6	M4×0.7P	G-M4
MSA 35	MSB 35	G-M6	M4×0.7P	G-M4
MSA 45		G-PT1/8	M4×0.7P	G-M4
MSA 55		G-PT1/8	M4×0.7P	G-M4
MSA 65		G-PT1/8	M4×0.7P	G-M4

Note: MSA and MSB series have no top oiling hole for option.

Model No.	Center	Side		Top	
	Nipple	G_1	Nipple	G_2	O-ring
SME 15	G-M4	M4×0.7P	G-M4	-	-
SME 20	G-M6	M4×0.7P	G-M4	-	-
SME 25	G-M6	M4×0.7P	G-M4	-	-
SME 30	G-M6	M6×0.75P	G-M6	10.2	P7
SME 35	G-M6	M6×0.75P	G-M6	10.2	P7
SME 45	G-PT1/8	M6×0.75P	G-M6	10.2	P7





Model No.		Center	Side		Top	
		Nipple	G_1	Nipple	G_2	O-ring
SMR 25	MSR 25	G-M6	M6×0.75P	G-M6	10.2	P7
SMR 30	MSR 30	G-M6	M6×0.75P	G-M6	10.2	P7
SMR 35	MSR 35	G-M6	M6×0.75P	G-M6	10.2	P7
SMR 45	MSR 45	G-PT1/8	M6×0.75P	G-M6	10.2	P7
SMR 55	MSR 55	G-PT1/8	M6×0.75P	G-M6	10.2	P7
SMR 65	MSR 65	G-PT1/8	M6×0.75P	G-M6	10.2	P7

Handling

1. Tilting the linear guideway may cause the carriage falling out from the rail by their own weight.
2. Beating or Dropping the linear guideway may cause its function to be damage, even if the product looks intact.
3. Do not disassemble the carriage, this may cause contamination to enter into the carriage or decrease the installation accuracy.

Lubrication

1. Please remove the anti-rust oil in advance and lubricate it before using.
2. Do not mix lubricants with others.
3. If you are using oil as lubricant, the oil may not be distributed evenly to the ball groove that depending on the application of the mounting orientation. Please contact ***PMI*** in such case.

Using

1. The temperature of the place where linear guideways are used should not exceed 80˚C. A higher temperature may damage the plastic end cap.
2. If the carriage must be removed from the rail or remounted onto the rail, be sure to use the dummy rail.
3. Using under special conditions, such as constant vibration, high dust or the temperature exceed our suggested...etc., please contact ***PMI***.

Storage

When storing the linear guideway, enclose it in a package and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.