Brand of OME

OME Technology Co.,Ltd.
www.ome.com.tw
No. 1589, Daying Rd., Daxi Dist., Taoyuan City 335, Taiwan
Tel: +886-3-307-2000 Fax: +886-3-307-2121

Regarding the newest product and certification information, please refer to the official website.

20240910-E03

STAF Linear Guide

A brand of OME

STAF Linear Guide

General Catalog

Website Facebook LinkedIn

OME Technology Co.,Ltd.
www.ome.com.tw

STAF®

Vision of OME :「From Precision Linear Motion Manufacturing to Optical Mechanical and Electronical (OME) Solution.」

Profession Integration:

OME Technology Corporation, whose linear guides services worldwide, dedicates to transmission technology. Our systematic transmission solutions include linear guides, ball screws, and relevant products. OME set up the production line of linear guides in 2007 and started mass production in 2008. The R&D team in the Taiwan headquarter is capable of providing the most comprehensive services for our customers.

Product Innovation:

OME Technology Corporation provides innovative and integrated transmission solutions. Our products are patented in many countries and are both RoHS and ISO 9001 certified. The performance and quality of our products satisfy the market demand and trend. Through continuously improving our technology, OME is one of the crucial partners in the global supply chain of transmission components..

Customer Orientation:

Devoted to providing high-performance and stable transmission products, OME Technology Corporation is the best strategic partner for the customers. Through integration and deep customization, OME provides not only the space for product differentiation but also shortens the time to market. We are together with our customers to improve product quality to a world-class standard.

ISO 9001 Quality Management System

G M P Medical devices – Good Manufacturing Practice

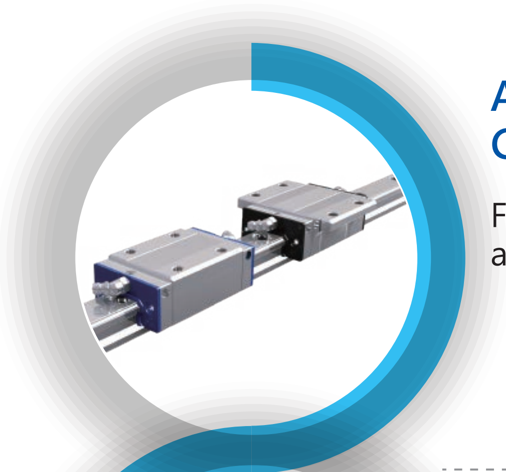
ISO 14064 Greenhouse Gases

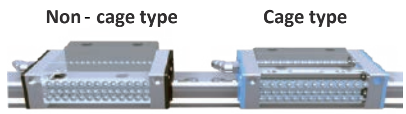
ISO 50001 Energy Management Systems

ISO 13485 Medical devices – Quality Management Systems

PAS 2050 Carbon Footprint Verification

STAF LINEAR GUIDE FEATURES

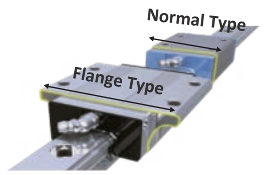




- Common Rail for Cage & Non-cage Type

All Series Available with Cage Type and Common Rail

Flexible product arrangement
allowing less inventory



- Common Rail for Normal & Flange Type

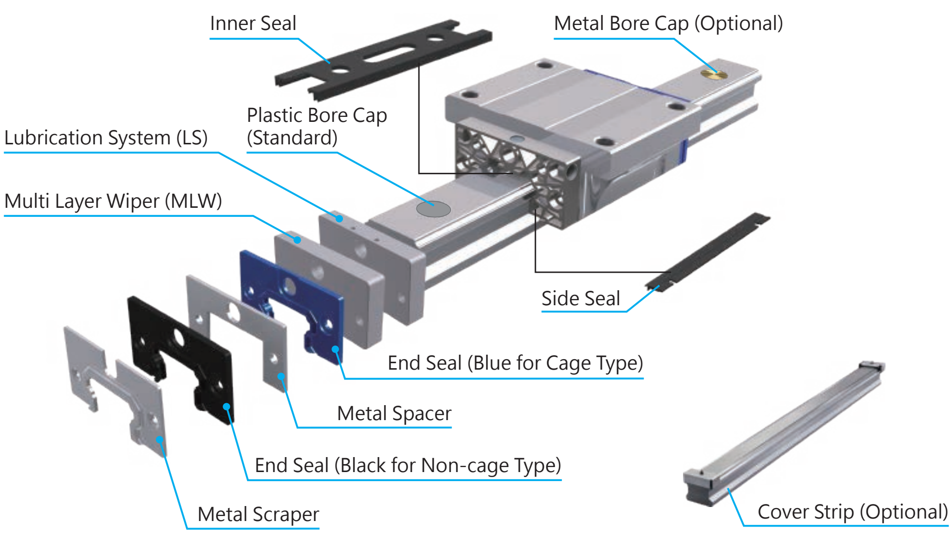
- Common Rail for Various Carriage Height

Special Wrapped Ball-Chain

Provides more stable rolling,
lower noise and extended lifetime

Comprehensive Dust-Proof Concept

Diversified dust-proof components and
packages available to suit various applications



Contents

1. Terms of Linear Guide

1-1 Main Factors

a. Lifetime and Load of Linear Guide (L)

Selection of linear guide has to be made on the static safety factor that is derived by comparing the calculated load of each carriage according to its conditions and forces against the factors such as basic static load rating (C_0) or permissible static moment (Mx, My, Mz) to judge the reliability of the mechanism. To estimate the lifetime in long term, the basic dynamic load rating (C) has to be considered to calculate the distance durability.

b. Basic Static Load Rating (C_0)

When the linear guide receives excessive load, the grooves and the steel balls will be permanently deformed. The linear guide will no longer operate smoothly when the deformation exceeds the limitation. The basic static load rating (C_0) is defined as the static load that will cause the deformation of the grooves and steel ball to 1/10,000 of the steel ball diameter.

c. Permissible Static Moment (Mx , My , Mz)

When the linear guide receives a moment, the grooves and the steel balls will deform. A moment that causes deformation of the grooves and the steel balls to 1/10,000 of the steel ball diameter is called the permissible static moment. The permissible static moment in the X, Y and Z directions are Mx, My and Mz individually.

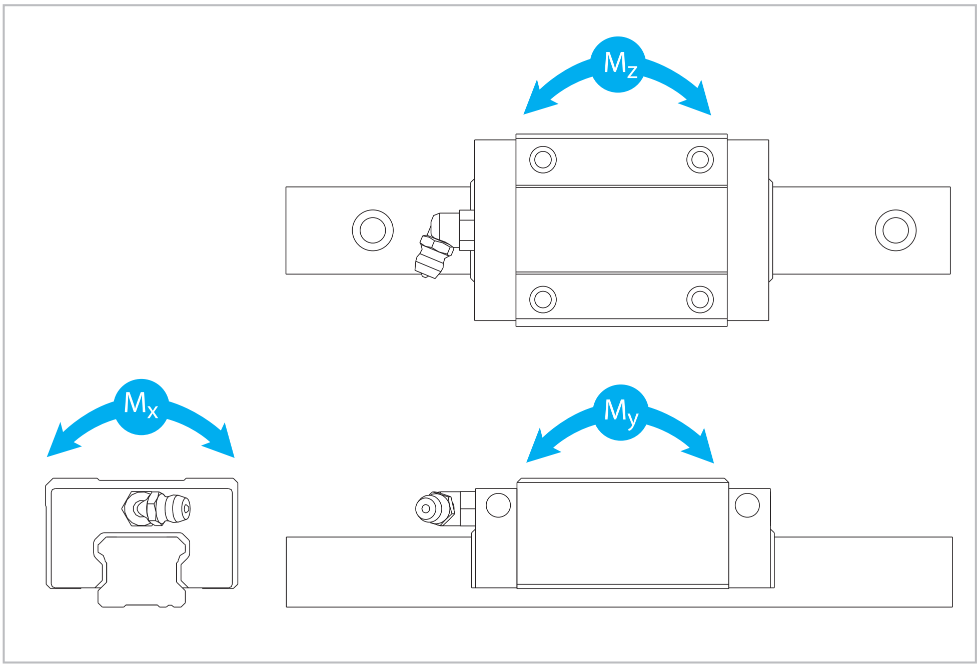


Fig.1-1

d. Static Safety Factor (f_s)

The static safety factor (f_s) is the ratio of the basic static load rating (C_0) against the maximum equivalent load on the linear guide. This factor indicates the reliability of the linear guide. Applied load is the force applied to the groove. To calculate the equivalent load, we have to calculate the load applied to the carriage both vertical and parallel to the contact face of the groove. In the case of 4 symmetric loads at 45° contact, the equivalent load is the sum of the parallel load and the vertical load.

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

f_s	Static safety factor
f_c	Contact factor
C_0	Basic static load rating
M_0	Permissible static moment
P	Equivalent load
M	Equivalent moment

Table 1-1 Static safety factor values:

Operations Conditions	Loading Conditions	Minimum
Standing	Light impact and shift	1.0 ~ 1.3
	Heavy impact and twist	2.0 ~ 3.0
Operation	Light impact and twist	1.0 ~ 1.5
	Heavy impact and twist	2.5 ~ 5.0

e. Nominal Life (L)

Linear guide is a mass production product. Even though the products are manufactured with the same materials via the same processes, durability of individual linear guide is never the same even under the same operation conditions. Nominal life is the distance that 90% linear guides could travel without flaking under the designated conditions.

f. Basic Dynamic Load Rating (C)

If the life distance of certain linear guide is defined as 50 km, and if more than 90 % of the linear guides would last for 50 km under a load of constant direction and magnitude that without flaking owing to fatigue, then the load is defined as the basic dynamic load rating of this type of linear guide.

1-2 Subsidiary Factors

a. Contact Factor (f_C)

When carriages are arranged closely next to another, it is difficult to get even load distribution due to moment and the mounting accuracy. Hence, when multiple linear guide are used as a group, contact factor (f_C) should be brought into consideration.

Table 1-2

Number of Carriages Used	Contact Factor (f_C)
2	0.81
3	0.72
4	0.66
5	0.61
Normal use	1

b. Hardness Factor (f_h)

To maximize the load capacity of the linear guide, the hardness of the raceways is the best in the range of HRC 58 to 62. If the hardness is lower than HRC 58, the hardness factor (f_h) should be brought into consideration when calculating the life distance and the safety factor.

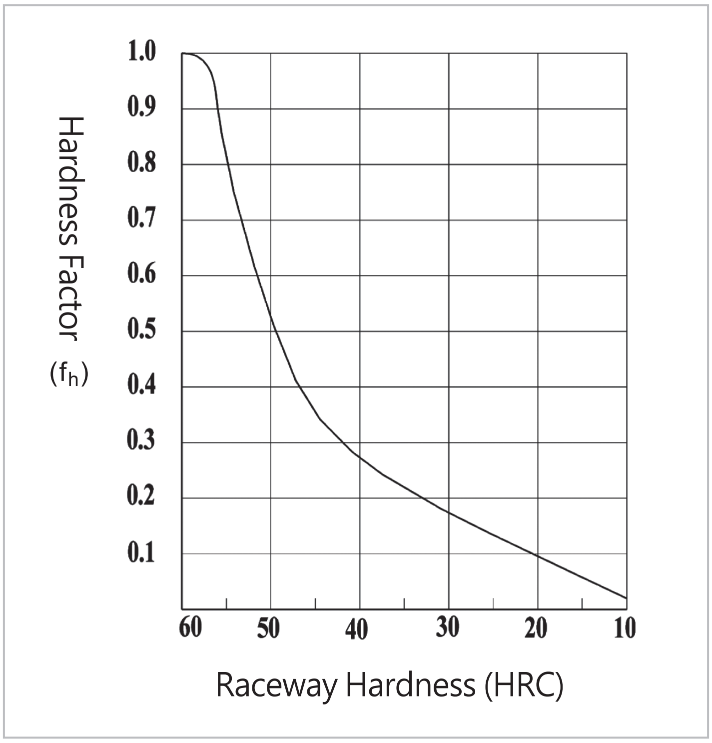
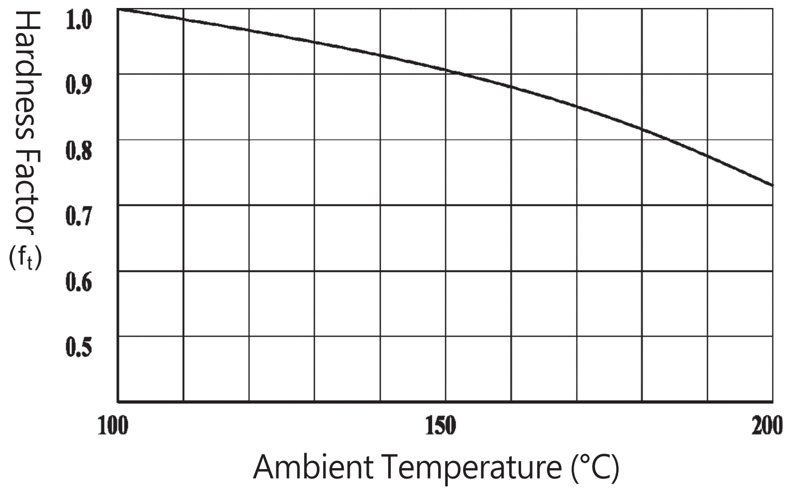


Fig. 1-2

c. Temperature Factor (f_t)

The adverse impact of high temperature must be considered while the ambient temperature exceeds 100°C. At this condition, the temperature factor (f_t) should be brought into calculation.



Note: If the ambient temperature exceeds 80°C, heat-resistant material must be used for the seals and the plastic parts.

Fig. 1-3

d. Load Factor (f_w)

The operation of reciprocating mechanisms is easily inducing vibration or impact. Especially, the vibration caused by high-speed operation or inertial impact generated from the frequent turn on/off. One may refer to the experiential load factors (f_w) in the table below when calculating life distance under high speed or vibration.

Table 1-3

Vibration / Impact	Speed (V)	Vibration (G)	Load Factor (f_w)
Weak	Low speed V <= 15 m/min	G < = 0.5	1 ~ 1.5
Medium	Moderate speed 15 < V <= 60 m/min	0.5 < G < = 1.0	1.5 ~ 2.0
Strong	High speed V > 60 m/min	1.0 < G < = 2.0	2.0 ~ 3.5

1-3 Life Calculation Equation

Life distance (L) of linear guides can be calculated by applying the basic dynamic load rating (C) and the equivalent load (P) to the equation below:

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

Table 1-4

C: Basic dynamic load rating
f_h: Hardness factor
f_c: Contact factor
P: Equivalent load
f_t: Temperature factor
f_w: Load factor
L : Life distance(km)

When the life distance (L) is known, we can calculate the lifetime according to reciprocating stroke and frequency:

$$L_h = \frac{L \cdot 10^6}{2 \cdot L_s \cdot N_1 \cdot 60}$$

Table 1-5

L_h = Lifetime (hr)
N_1 = Reciprocation frequency (cycles/min)
L_s = Stroke (mm)

1-4 Friction

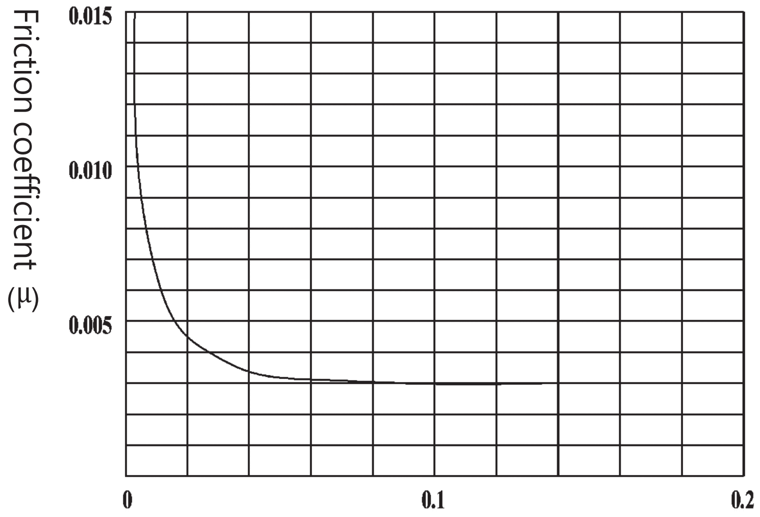
The linear guide is the integration of the carriage, the rail, and the rolling elements such as balls or rollers. Its movement is formed by the rolling elements rolling between the carriage and the rail, and the friction can be as minor as 1/40 of the sliding guide. The static friction of the linear guide is so small that the blank run phenomenon hardly occurs so it can be applied to all sorts of accurate applications. The friction of linear guide varies with the type of linear guide, the preload, the viscosity of lubricants, and the applied load. Friction increases especially when a moment is given or the preload is applied to increase rigidity. The friction characteristic of the STAF linear guide is shown in table 1-7 below.

Friction can be calculated with the equation below,

$F=\mu \cdot W+f$

Table 1-6

F: Friction
W: Load
μ: Friction coefficient
f : Friction of BG carriage



Load ration (P/C)
P: Equivalent load
C: Basic dynamic load rating

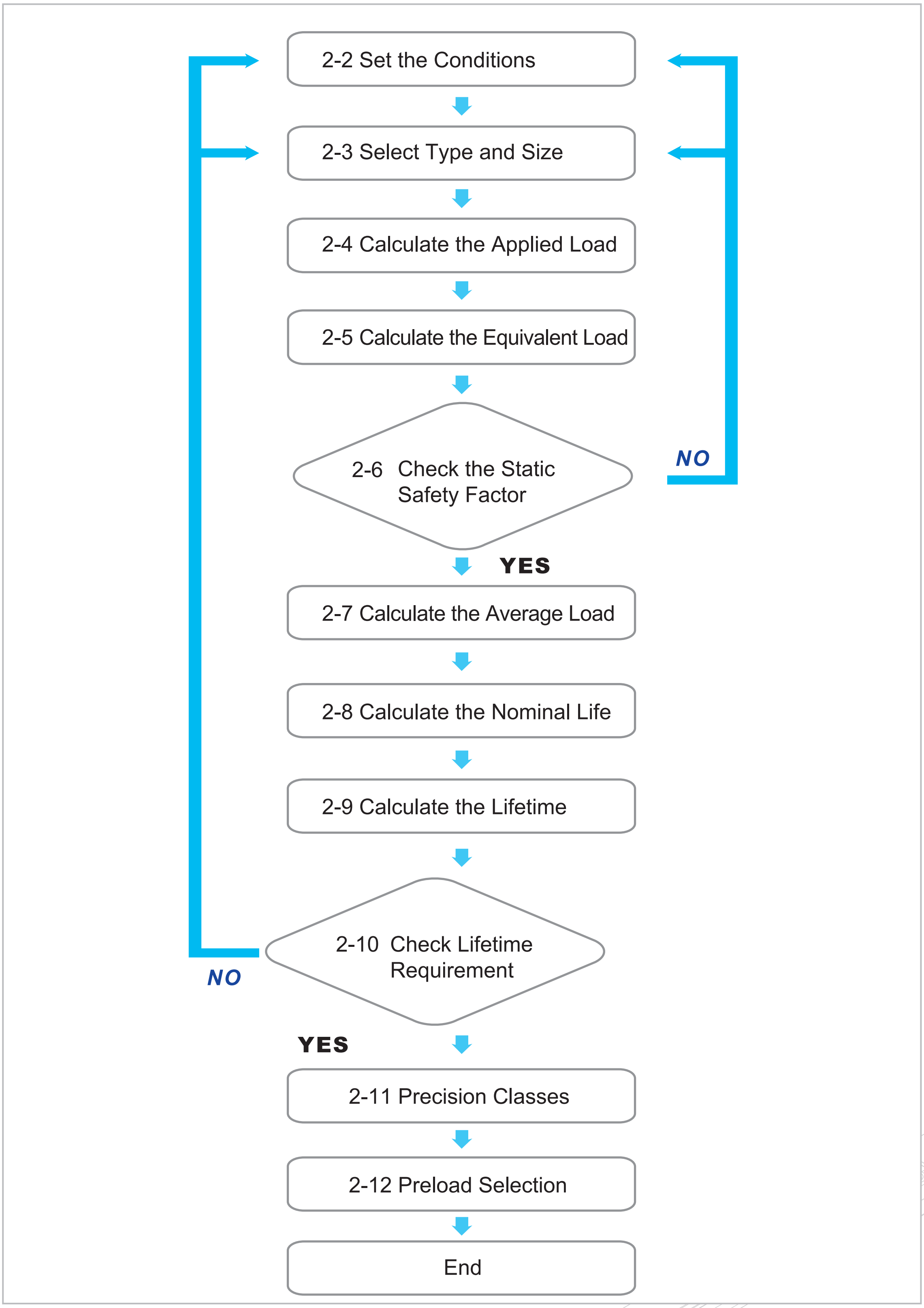
Fig. 1-4

Table 1-7 Friction (μ)

Type	Friction coefficient (μ)
BG series	0.002~0.003
MB series	
MPH series	

2. How to Select Linear Guide

2-1 Linear Guide Selection Steps



2-2 Set the Conditions

Selection of linear guide has to be based on calculation. The information required for such calculation are:

a. Mounting arrangements (span, number of carriages and number of rails)
b. Mounting orientation (horizontal, vertical, slant mount, wall mount or inverted)
c. Work load (magnitude, direction and position of force, and inertia under acceleration)
d. Operation frequency (load cycle)

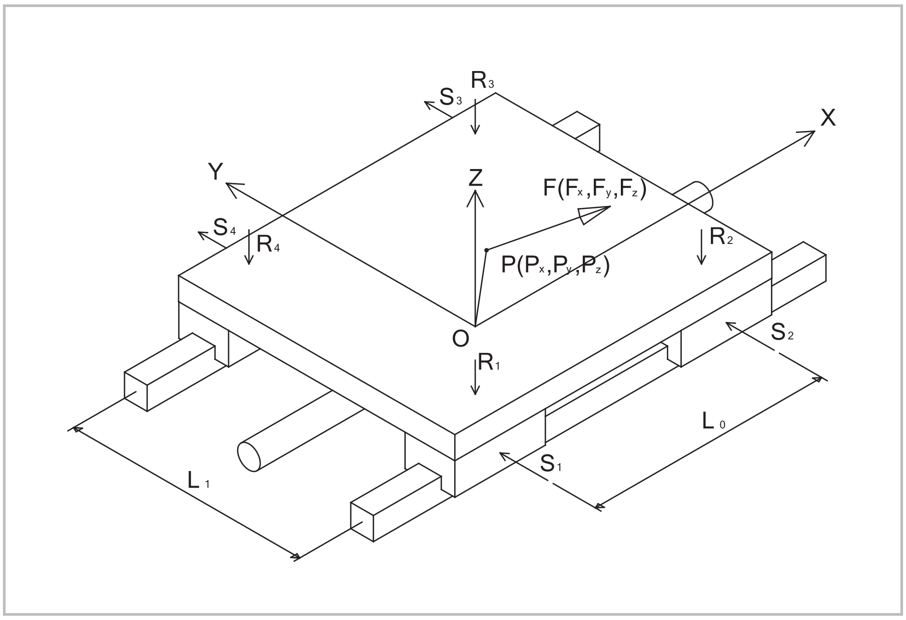


Fig. 2-1

a. Installation Combination

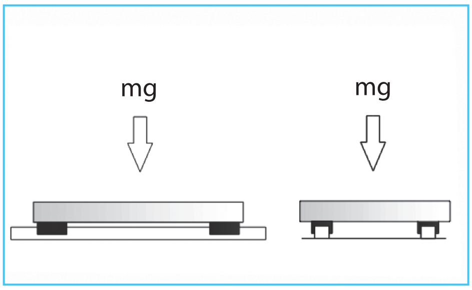
(1) Span: distance between the carriages and the rails such as L_0 and L_1 in the above figure.
L_0: distance between the carriages on single rail.
L_1: distance between two rails.
L_0 and L_1 are crucial to the rigidity and lifetime of the linear motion system.

(2) Number of carriages: how many carriages are mounted on the same rail.
In the above figure, two carriages are mounted on one rail. Normally, loading capacity and rigidity are enhanced as the number of carriages increases, and so is the life. However, the operation space and the stroke must be considered.

(3) Number of rails: how many rails are used in the system.
In the above figure, two rails are used in the system. Normally, in moment capacity is increased as the number of rails increase, and so are rigidity and life.

b. Mounting Orientation:

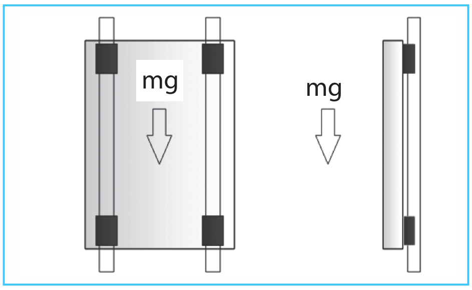
1. Horizontal



◎ Horizontal

This is the most common way of mounting. It is most persistent to vertical load (mg) and is often used in normal positioning and feeding mechanism.

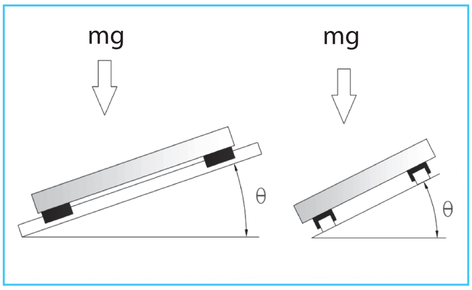
2. Vertical



◎ Vertical

The load (mg) is parallel to the rails, so the span in between the rails and the moment capacity are crucial. This is often seen in the elevator. Attention should be paid to the suspension of the load. The bigger the suspension is, the bigger the moment is.

3. Slant Mount

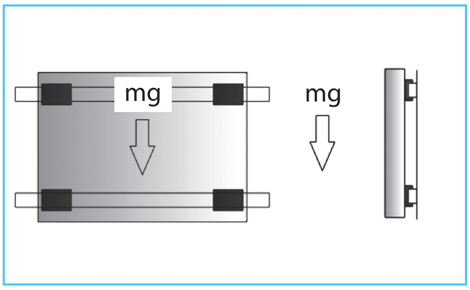


◎ Slant Mount

There are lateral slant mount and longitudinal slant mount.

Lateral slant mount: the load (mg) is vertical to the sliding direction; longitudinal slant mount: the load (mg) is with an angle θ to the sliding direction.

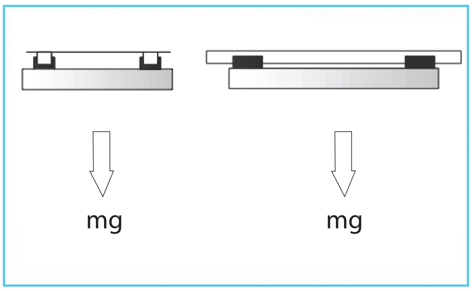
4. Wall Mount



◎ Wall Mount

Moment is crucial for wall mount and the span in between rails affects the load on the carriages and must be taken care of. The load (mg) is parallel to the slide plane and vertical to the sliding direction.

5. Inverted



◎ Inverted

Inverted mount is upside down of horizontal mount. The spans in between the rails, carriages and the moment capacity have to be considered.

c. Work Load

The work load consist 3 elements - magnitude, direction and applied point.

(1) Magnitude of work load:
Mass: The weight of the object gives inertia during movement.
External force: Mechanical forces such as hydraulic, pneumatic or electro-magnetic will not give inertia during the movement.

(2) Direction of work load:
The external force can be divided into 3 components, Fx, Fy and Fz as indicated in the figure 2-2.
F_X is the external force in the X-axis.
F_Y is the external force in the Y-axis.
F_Z is the external force in the Z-axis.

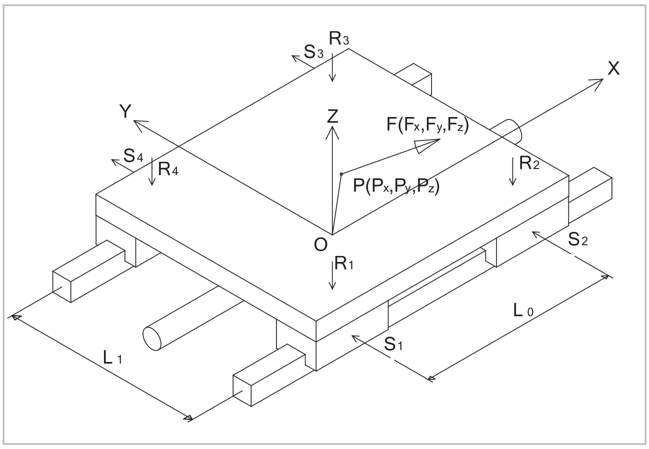


Fig. 2-2

(3) Applied point of work load:
As shown Fig. 2-2, take Point "O" as the origin point of the XYZ coordinate. The source of external force can be a ball screw, a hydraulic cylinder or a linear motor.
The external force "F" applied on the object at point "P", then the applied point of the external force can be defined as:
P_X: Distance of applied point "P" to "O" in X axis.
P_Y: Distance of applied point "P" to "O" in Y axis.
P_Z: Distance of applied point "P" to "O" in Z axis.

(4) Span:
L_0 and L_1 stand for the distances in between the carriages.

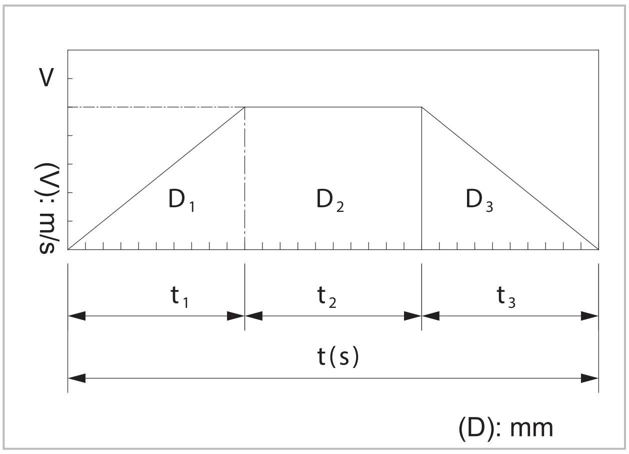


Fig. 2-3 Velocity Diagram

(5) Velocity diagram:
Velocity (V): max operation velocity
Travel distance (D): total travel distance
Acceleration distance (D_1): the distance from start to max velocity
Constant distance (D_2): the distance in constant (max) velocity
Deceleration distance (D_3): the distance from max velocity to stop

(6) Work load on each carriage:
R_1, R_2, R_3 and R_4 are the vertical loads of each carriage.
S_1, S_2, S_3 and S_4 are the horizontal loads of each carriage.

d. Work Frequency:

To determine the lifetime is satisfied or not, the work frequency must be considered.
Ex. 1, if the calculated life is 1,000 km and the daily travel is 1 km, then the duration is 1,000 days.
Ex. 2, if the calculated life is 50,000 km and the daily travel is 500 km, then the duration is only 100 days.

2-3 Select Type and Size

a. Select the appropriate type (BGX or BGC)

Select the appropriate series of linear guides according to the type of machine and the application. Please see our catalogues of BGX and BGC series for relevant information.

b. Select an appropriate size (15, 20, 25, 30, 35, 45 and 55)

Select a size according to the installation space of machine without considering the work load. In the initial stage, it is difficult to judge load capacity and lifetime. Even if the safety factor is sufficient, it does not say that the lifetime is sufficient. Hence, it is recommended to consider the size as the initial selection objective, and then select the bigger type when life or load is insufficient in practice.

2-4 Calculate the Applied Load

The vertical forces on the carriages are:

$$R_1 = \frac{-F_z}{4} + \frac{F_z \cdot P_x - F_x \cdot P_z}{2 \cdot L_0} + \frac{F_z \cdot P_y - F_y \cdot P_z}{2 \cdot L_1}$$

$$R_2 = \frac{-F_z}{4} - \frac{F_z \cdot P_x - F_x \cdot P_z}{2 \cdot L_0} + \frac{F_z \cdot P_y - F_y \cdot P_z}{2 \cdot L_1}$$

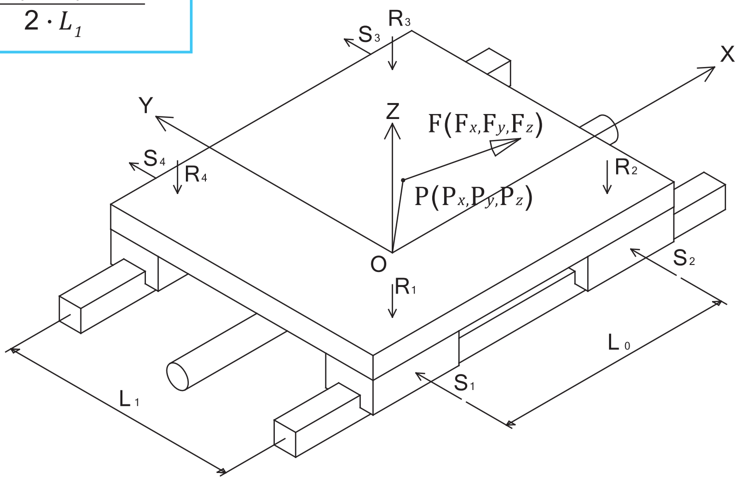
$$R_3 = \frac{-F_z}{4} - \frac{F_z \cdot P_x - F_x \cdot P_z}{2 \cdot L_0} - \frac{F_z \cdot P_y - F_y \cdot P_z}{2 \cdot L_1}$$

$$R_4 = \frac{-F_z}{4} + \frac{F_z \cdot P_x - F_x \cdot P_z}{2 \cdot L_0} - \frac{F_z \cdot P_y - F_y \cdot P_z}{2 \cdot L_1}$$

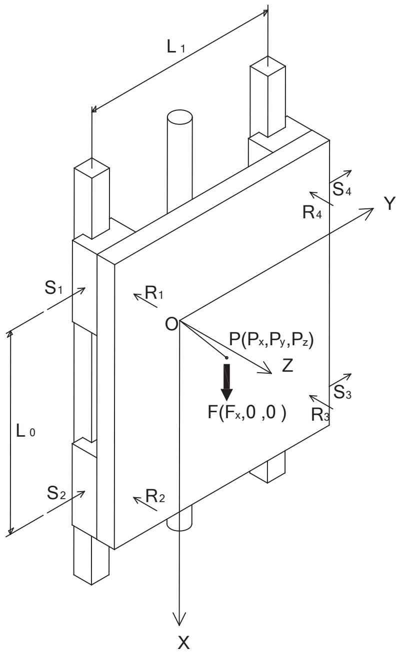
The horizontal forces on the carriages are:

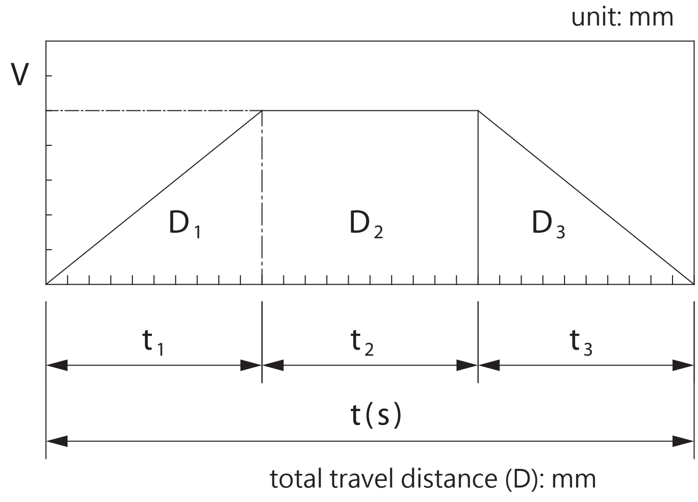
$$S_1 = S_4 = \frac{F_y}{4} + \frac{F_y \cdot P_x - F_x \cdot P_y}{2 \cdot L_0}$$

$$S_2 = S_3 = \frac{F_y}{4} - \frac{F_y \cdot P_x - F_x \cdot P_y}{2 \cdot L_0}$$



Example:

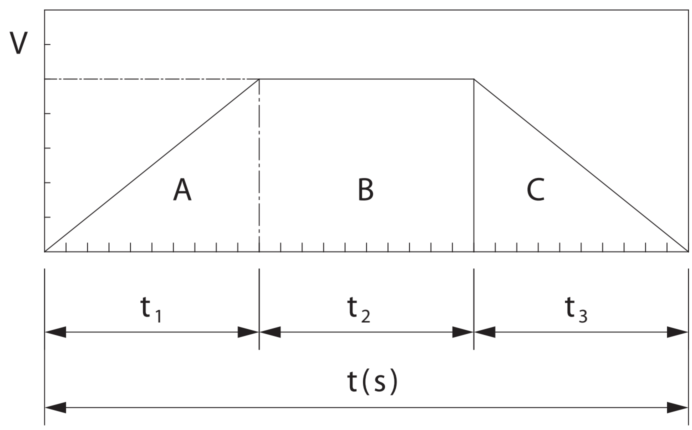




The movement can be divided into 3 phases:
Acceleration phase (A),
Constant phase (B)
And deceleration phase (C)

If we choose to use linear guide BGXH20FN2 L4000 NZO, then

$C = 21.5kN$, $C_0 = 33.6kN$, $V_{max} = 1m/s$
$m = 98kg$, $L_0 = 0.3m$, $L_1 = 0.5m$
$P_x = 0.08m$, $P_y = 0.25m$, $P_z = 0.28m$
$D_1 = 1m$, $t_1 = 2s$, $a_1 = 0.5m/s$
$D_2 = 2m$, $t_2 = 2s$, $a_2 = 0m/s$
$D_3 = 1m$, $t_3 = 2s$, $a_3 = -0.5m/s$
$F_x = m(g+a)$, $F_y = 0$, $F_z = 0$



Load calculation:

$$R_2(A) = R_3(A) = \frac{-m(g+a_1)\cdot P_z}{2\cdot L_0} = \frac{-98(9.81+0.5)\cdot 0.28}{2\cdot 0.3} = 471.5N$$

Phase A

$$F_x(A) = m(g+a_1),\ \ F_y(A) = 0,\ \ F_z(A) = 0$$

$$R_1(A) = R_4(A) = \frac{-m(g+a_1)\cdot P_z}{2\cdot L_0} = \frac{-98(9.81+0.5)\cdot 0.28}{2\cdot 0.3} = -471.5N$$

$$R_2(A) = R_3(A) = \frac{m(g+a_1)\cdot P_z}{2\cdot L_0} = \frac{98(9.81+0.5)\cdot 0.28}{2\cdot 0.3} = 471.5N$$

$$S_1(A) = S_4(A) = \frac{-m(g+a_1)\cdot P_y}{2\cdot L_0} = \frac{-98(9.81+0.5)\cdot 0.25}{2\cdot 0.3} = -421.0N$$

$$S_2(A) = S_3(A) = \frac{m(g+a_1)\cdot P_y}{2\cdot L_0} = \frac{98(9.81+0.5)\cdot 0.25}{2\cdot 0.3} = 421.0N$$

Phase B

$$F_x(B) = m(g+a_2),\ \ F_y(B) = 0,\ \ F_z(B) = 0$$

$$R_1(B) = R_4(B) = \frac{-m(g+a_2)\cdot P_z}{2\cdot L_0} = \frac{-98(9.81+0)\cdot 0.28}{2\cdot 0.3} = -448.6N$$

$$R_2(B) = R_3(B) = \frac{m(g+a_2)\cdot P_z}{2\cdot L_0} = \frac{98(9.81+0)\cdot 0.28}{2\cdot 0.3} = 448.6N$$

$$S_1(B) = S_4(B) = \frac{-m(g+a_2)\cdot P_y}{2\cdot L_0} = \frac{-98(9.81+0)\cdot 0.25}{2\cdot 0.3} = -400.6N$$

$$S_2(B) = S_3(B) = \frac{m(g+a_2)\cdot P_y}{2\cdot L_0} = \frac{98(9.81+0)\cdot 0.25}{2\cdot 0.3} = 400.6N$$

Phase C

$$F_x(C) = m(g+a_1),\ \ F_y(C) = 0,\ \ F_z(C) = 0$$

$$R_1(C) = R_4(C) = \frac{-m(g+a_3)\cdot P_z}{2\cdot L_0} = \frac{-98(9.81-0.5)\cdot 0.28}{2\cdot 0.3} = -425.8N$$

$$R_2(C) = R_3(C) = \frac{m(g+a_3)\cdot P_z}{2\cdot L_0} = \frac{98(9.81-0.5)\cdot 0.28}{2\cdot 0.3} = 425.8N$$

$$S_1(C) = S_4(C) = \frac{-m(g+a_3)\cdot P_y}{2\cdot L_0} = \frac{-98(9.81-0.5)\cdot 0.25}{2\cdot 0.3} = -380.2N$$

$$S_2(C) = S_3(C) = \frac{m(g+a_3)\cdot P_y}{2\cdot L_0} = \frac{98(9.81-0.5)\cdot 0.25}{2\cdot 0.3} = 380.2N$$

2-5 Calculate the Equivalent Load

The vertical and horizontal load capacities of a linear guide depend on the contact angle between the carriage and the rail. The contact angle of the STAF linear guides is designed to be 45° to get equal load in the vertical and the horizontal direction. The equivalent load is the maximum effective load of the carriage against the raceway. Despite counteract, the equivalent load on the rail (Re) can be considered as the sum of vertical load magnitude (Rn) and horizontal load magnitude (Sn).

Vertical load: R_n

Horizontal load: S_n

The equivalent load can be calculated as: $Re = |R_n| + |S_n|$

Individual equivalent work load in phase A:

$P_1(A) = |R_1(A)| + |S_1(A)| = |-471.5| + |-421.0| = 891.5$ N

$P_2(A) = |R_2(A)| + |S_2(A)| = |471.5| + |421.0| = 891.5$ N

$P_3(A) = |R_3(A)| + |S_3(A)| = |471.5| + |421.0| = 891.5$ N

$P_4(A) = |R_4(A)| + |S_4(A)| = |-471.5| + |-421.0| = 891.5$ N

Individual equivalent work load in phase B:

$P_1(B) = |R_1(B)| + |S_1(B)| = |-448.6| + |-400.6| = 849.2$ N

$P_2(B) = |R_2(B)| + |S_2(B)| = |448.6| + |400.6| = 849.2$ N

$P_3(B) = |R_3(B)| + |S_3(B)| = |448.6| + |400.6| = 849.2$ N

$P_4(B) = |R_4(B)| + |S_4(B)| = |-448.6| + |-400.6| = 849.2$ N

Individual equivalent work load in phase C:

$P_1(C) = |R_1(C)| + |S_1(C)| = |-425.8| + |-380.2| = 806$ N

$P_2(C) = |R_2(C)| + |S_2(C)| = |425.8| + |380.2| = 806$ N

$P_3(C) = |R_3(C)| + |S_3(C)| = |425.8| + |380.2| = 806$ N

$P_4(C) = |R_4(C)| + |S_4(C)| = |-425.8| + |-380.2| = 806$ N

2-6 Check the Static Safety Factor

Definition of static safety factor:

Static safety factor calculation by static load rating:

$$f_s = \frac{f_c \cdot C_0}{R_e} = \frac{\text{(contact factor)} \cdot \text{(static load rating)}}{\text{max. individual equivalent load}}$$

Static safety factor calculation by permissible static moment:

$$f_s = \frac{f_c \cdot M_0}{M} = \frac{\text{(contact factor)} \cdot \text{(permissible static moment)}}{\text{calculated moment}}$$

Contact Factor:

When carriages are arranged tightly together, it is difficult to get even load distribution due to moment and assembly accuracy. Hence, when carriages are used tightly together, it is recommended to bring into consideration the contact factor (fc)

Table 2-1

Number of carriages together	Contact factor(f_c)
2	0.81
3	0.72
4	0.66
5	0.61
normal use	1

Following the example:

The max equivalent load (Re) in the above example is 891.51kN. If we select to use linear guide BGXH20FN:

The basic dynamic load, C = 21.5kN

The basic static load, C_0 = 33.6kN

Permissible moment, Mx = 0.285 kN·m

Permissible moment, My = 0.220 kN·m

Permissible moment, Mz = 0.220 kN·m

f_c(normal use) = 1

$$f_s = \frac{f_c \cdot C_0}{R_e} = \frac{33.6 \cdot 10^3}{891.51} = 37.69 \text{ (safety factor)}$$

Table 2-2 Reference static safety factor values

Operation condition	Loading condition	Minimum f_S
Stand still	Light impact and shift	1.0 ~ 1.3
	Heavy impact and twist	2.0 ~ 3.0
Normal operation	Light impact and shift	1.0 ~ 1.5
	Heavy impact and twist	2.5 ~ 5.0

2-7 Calculate the Average Load

Calculation of average load:
There are several methods to calculate average load according to work load variation pattern in movement.

Stepwise load variation:
P_m : Average load (N)
P_n : Varying load(N)
L : Total travel distance (m)
L_n : Travel distance of each step (m)

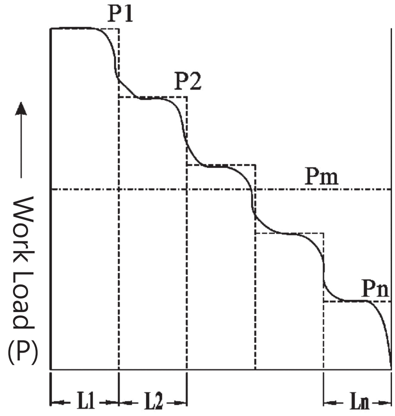


Fig. 2-4

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

Apply the equation to the example:

$$P_{m1} = \left(\frac{P_1(A)^3 \cdot D_1 + P_1(B)^3 \cdot D_2 + P_1(C)^3 \cdot D_3}{D_1 + D_2 + D_3} \right)^{\frac{1}{3}}$$

$$= \left(\frac{891.5^3 \cdot 1 + 849.2^3 \cdot 2 + 806.0^3 \cdot 1}{1+2+1} \right)^{\frac{1}{3}} = 850.0N$$

$$P_{m2} = \left(\frac{P_2(A)^3 \cdot D_1 + P_2(B)^3 \cdot D_2 + P_2(C)^3 \cdot D_3}{D_1 + D_2 + D_3} \right)^{\frac{1}{3}}$$

$$= \left(\frac{891.5^3 \cdot 1 + 849.2^3 \cdot 2 + 806.0^3 \cdot 1}{1+2+1} \right)^{\frac{1}{3}} = 850.0N$$

$$P_{m3} = \left(\frac{P_3(A)^3 \cdot D_1 + P_3(B)^3 \cdot D_2 + P_3(C)^3 \cdot D_3}{D_1 + D_2 + D_3} \right)^{\frac{1}{3}}$$

$$= \left(\frac{891.5^3 \cdot 1 + 849.2^3 \cdot 2 + 806.0^3 \cdot 1}{1+2+1} \right)^{\frac{1}{3}} = 850.0N$$

$$P_{m4} = \left(\frac{P_4(A)^3 \cdot D_1 + P_4(B)^3 \cdot D_2 + P_4(C)^3 \cdot D_3}{D_1 + D_2 + D_3} \right)^{\frac{1}{3}}$$

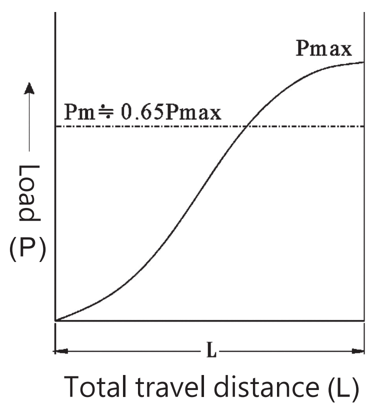
$$= \left(\frac{891.5^3 \cdot 1 + 849.2^3 \cdot 2 + 806.0^3 \cdot 1}{1+2+1} \right)^{\frac{1}{3}} = 850.0N$$

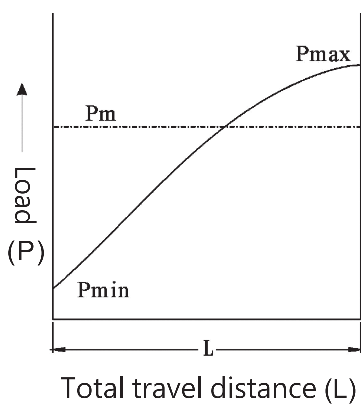
Monotonic load variation:

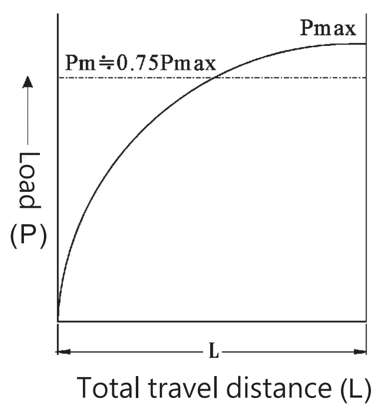
$$P_m \fallingdotseq \left(\frac{P_{min} + 2P_{max}}{3} \right)$$

P_{min} : minimum load (kgf)

P_{max} : maximum load (kgf)







2-8 Calculate the Nominal Life

Equation:

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

Table 2-3

L : Nominal life (km)
C : Basic dynamic load rating (kN)
P : Calculated average load (kN)
f_c : Contact factor
f_h : Hardness factor
f_t : Temperature factor
f_w : Load factor

Example: BGXH20FN
Basic dynamic load rating (C) is 21.5kN.
Hardness is HRC58, hardness factor (f_h) is 1.
At normal temperature, temperature factor (f_t) is 1.
Normal contact, contact factor (f_c) is 1.
Velocity is 15<V<60m/min, load factor (f_w) is 1.5.
Average load (P) is 850N.

$$L = \left(\frac{f_h \cdot f_t \cdot f_c}{f_w} \cdot \frac{C}{P} \right)^3 \cdot 50km = \left(\frac{1 \cdot 1 \cdot 1}{1.5} \cdot \frac{21500}{850} \right)^3 \cdot 50km = 239747.9km$$

Example: BGXH25FN
Basic dynamic load rating (C) is 28.1kN.
Hardness is HRC55, hardness factor (fh) is 0.8.
At normal temperature, temperature factor (ft) is 1.
2 carriages close together, contact factor (cf) is 0.81.
Velocity is 60m/min, load factor (fw) is 2.
Average load (P) is 1530N.

$$L = \left(\frac{f_h \cdot f_t \cdot f_c}{f_w} \cdot \frac{C}{P} \right)^3 \cdot 50km = \left(\frac{0.8 \cdot 1 \cdot 0.81}{2} \cdot \frac{28100}{1530} \right)^3 \cdot 50km = 10535.37km$$

2-9 Calculate the Lifetime

Equation (A): Lifetime by Hours

Table 2-4

L_h: Lifetime by hours
L : Nominal life (km)
L_s: Stroke length (mm)
N_1: Reciprocations per minute (min-1)

$$L_h = \frac{L \cdot 10^6}{2 \cdot L_s \cdot N_1 \cdot 60}$$

Equation (B): Lifetime by Years

Table 2-5

L_y: Lifetime by years
L : Nominal life (km)
L_s: Stroke length (mm)
N_1: Reciprocations per minute (min-1)
M: Work minutes per hour (min/hr)
H: Work hours per day (hr/day)
D: Work days per year (day/year)

$$L_y = \frac{L \cdot 10^6}{2 \cdot L_s \cdot N_1 \cdot M \cdot H \cdot D}$$

Example 1 A machine tool uses linear slides with the estimated nominal life 45,000km with the working conditions as below. What is the lifetime by hours?

1) Ls (the stroke length) is 3,000mm
2) N1 (the reciprocation) is 4 times per minute

$$L_h = \frac{L \cdot 10^6}{2 \cdot L_s \cdot N_1 \cdot 60} = \frac{45000 \cdot 10^6}{2 \cdot 3000 \cdot 4 \cdot 60} = 31250 \text{ (hr)}$$

Example 2 A machine tool uses linear slides with the estimated nominal life 71,231.5km with the working conditions as below. What is the lifetime by years?

1) Ls (the stroke length) is 4,000mm
2) N1 (the reciprocation) is 5 times per minute
3) The machine runs 60 minutes an hour,
4) 24 hours a day, and
5) 360 days a year

$$L_y = \frac{L \cdot 10^6}{2 \cdot L_s \cdot N_1 \cdot M \cdot H \cdot D} = \frac{71231.5 \cdot 10^6}{2 \cdot 4000 \cdot 5 \cdot 60 \cdot 24 \cdot 360} = 3.44 \text{ (year)}$$

2-10 Check Lifetime Requirement

If the calculated lifetime does not meet the lifetime requirement, return and start from the beginning steps:
(1) Set the conditions, or
(2) Select type and size

(1) Check the conditions again:

a. Mounting arrangements (span, number of carriages and number of rails):
Is it necessary to change the span, the number of carriages or the number of rails?
b. Mounting position (horizontal, vertical, slant mount, wall mount or inverted):
Is it necessary to modify current construction?
c. Work load:
Can the load be reduced?
d. Work Frequency:
Is it the estimated frequency too high and lead to underestimation of lifetime?

(2) Select type and size:

If the conditions cannot be changed, then another type of linear guide has to be selected. It is recommended to keep the size of rail, and select a carriage with higher load rating. Selecting a bigger rail may cause some drawbacks below:

a. The weight of the mechanism will be increased:
The weight increases more when selecting a bigger rail than selecting a carriage with higher load rating.
b. More changes in design:
When a bigger rail is selected,
1. The pitch of screw hole increased,
2. The screw size is bigger,
3. Contact area with base is increased,
4. The fastening mechanism has to be changed.

When a carriage with higher load rating is selected,
1. The span of screw holes have to be changed,
2. The length of the carriage may cause interference with mechanism.

c. More space is needed:
When a bigger rail is selected,
1. The total height is increased,
2. The total width is increased,
3. The fastening screw is bigger.
When a carriage with higher load rating is selected, the change of space will be little.
d. Cost will be increased:
The variable cost of the rail is bigger than that of the carriage.

2-11 Precision Classes

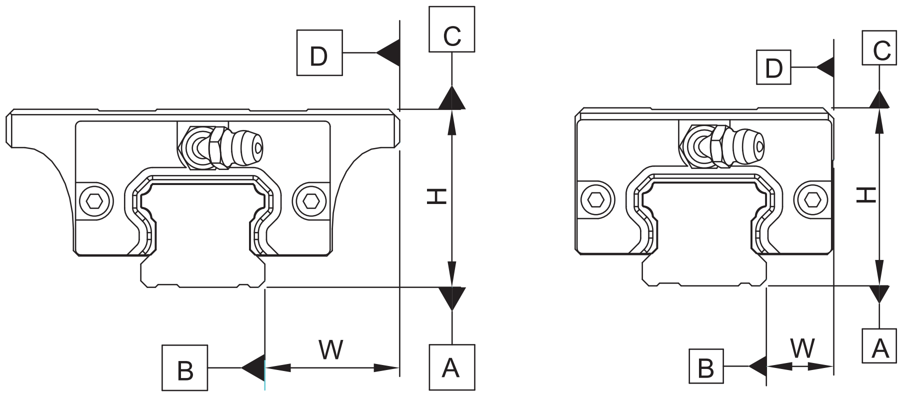


Fig. 2-5 Precision Classes

Table 2-6 Precision classes of non-interchangeable components

unit: mm

Item \ Grade	Normal (N)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Height tolerance (H)	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
Width tolerance (W)	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
Height difference (ΔH) ※	0.03	0.02	0.01	0.005	0.003
Width difference (ΔW) ※	0.03	0.02	0.01	0.005	0.003
Running parallelism between carriage surface [C] and the rail surface [A]	▴C Refer to Fig. 2-6 Running parallelism vs. rail length				
Running parallelism between the carriage reference surface [D] and the rail reference surface [B]	▴D Refer to Fig. 2-6 Running parallelism vs. rail length				

※ Difference between two carriages on the same rail.

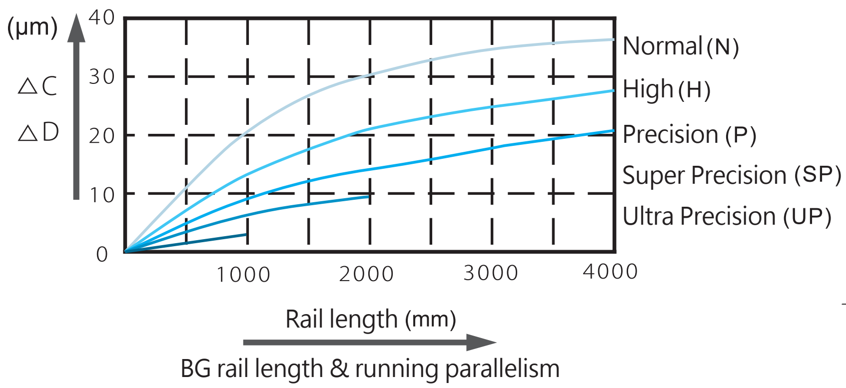
Table 2-7 Precision classes of interchangeable components

unit: mm

Item \ Grade	Normal (N)	High (H)
Height tolerance(H)	± 0.1	± 0.04
Width tolerance(W)	± 0.1	± 0.04

※ Definition of interchangeable: For the carriages on a single rail, not including the carriages on different rails.

Running parallelism of various precision classes



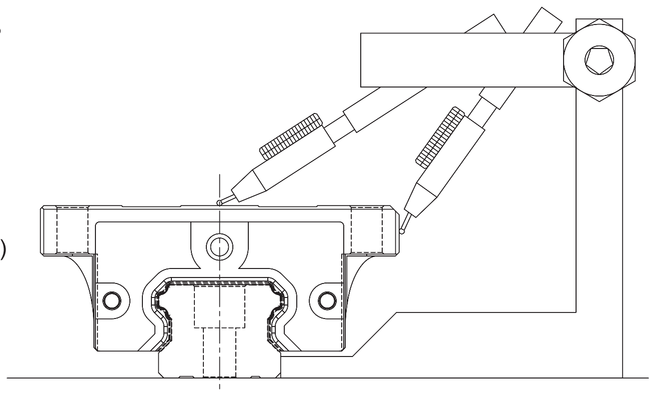


Fig. 2-6 Running parallelism vs. rail length

Notes:

1. Please contact us if SP (super precision) rail over 2000mm or UP (ultra precision) rail over 1000mm is required.
2. To make it easier to gain the required precision when mounting the rails against the datum plane, the rails are made slight curved with a big radius.
3. If the datum plane is non-rigid, machine accuracy is easily effected when mounting rails. Hence, it is necessary to inquire straightness of the rails.

Table 2-8 unit: mm/μm

Standard Type						
Rail Length (mm)		Running Parallelism Values (μm)				
Minimum	Maximum	N	H	P	SP	UP
0	100	12	7	3	2	2
100	200	14	9	4	2	2
200	300	15	10	5	3	2
300	500	17	12	6	3	2
500	700	20	13	7	4	2
700	900	22	15	8	5	3
900	1100	24	16	9	6	
1100	1500	26	18	11	7	
1500	1900	28	20	13	8	
1900	2500	31	22	15		
2500	3100	33	25	18		
3100	3600	36	27	20		
3600	4000	37	28	21		

2-12 Preload Selection

What is preload?

When there is clearance in between the components, the rigidity of linear guide is not enough. It is possible to eliminate the clearance by enlarging the rolling elements to preliminarily apply an internal load to enhance the rigidity.

Table 2-9 Preload grade

Preload grade	Minor clearance / No preload	Light preload	Medium to heavy preload
Conditions	1. low impact 2. two rails in parallel 3. low accuracy 4. small friction 5. light load	1. cantilever 2. single rail 3. light load 4. high accuracy	1. strong impact 2. strong vibration 3. heavy machining
Applications	1. welding machine 2. chopping machine 3. feeding mechanism 4. tool change mechanism 5. ordinary XY table 6. packing machine	1. NC lathe 2. EDM 3. precision XY table 4. ordinary Z-axis 5. industrial robot 6. PCB punching	1. Machining center 2. NC lathe and miler 3. feeding axis of grinder 4. tool feeding axis

Increase the preload will eliminate the vibration and the inertia impact in a reciprocating movement. However, increase of preload will increase the internal load and increase the assembly difficulty. Therefore, selection of linear guide must bring into account the balance between the impact of vibration and the lifetime decrease by preload.

Table 2-10 Radial clearance

unit: μm

Type \ Preload	ZF	Z0	Z1	Z2	Z3
BG 15	4 ~ 8	-3 ~ 3	-8 ~ -4	-13 ~ -9	-18 ~ -14
BG 20	4 ~ 8	-3 ~ 3	-8 ~ -4	-14 ~ -9	-19 ~ -14
BG 25	5 ~ 10	-4 ~ 4	-10 ~ -5	-17 ~ -11	-23 ~ -18
BG 30	5 ~ 11	-4 ~ 4	-11 ~ -5	-18 ~ -12	-25 ~ -19
BG 35	6 ~ 12	-5 ~ 5	-12 ~ -6	-20 ~ -13	-27 ~ -20
BG 45	7 ~ 15	-6 ~ 6	-15 ~ -7	-23 ~ -15	-32 ~ -24
BG 55	8 ~ 19	-7 ~ 7	-19 ~ -8	-29 ~ -20	-38 ~ -30

Table 2-11 Preload values

C: Basic dynamic load rating

Grade	Code	Preload
Clearance Free	ZF	0
No preload	Z0	0
Light preload	Z1	0.02C
Medium preload	Z2	0.05C
Heavy preload	Z3	0.07C

※ If special preload is needed, please contact STAF technical service.

Table 2-12 Comparison of interchangeable and non-interchangeable

Precision class	Non-interchangeable (custom made)					Interchangeable (inventory)	
	UP	SP	P	H	N	H	N
Preload					ZF		
				Z0	Z0	Z0	Z0
	Z1	Z1	Z1	Z1	Z1	Z1	Z1
	Z2	Z2	Z2	Z2	Z2		
	Z3	Z3	Z3				

Permitted installation tolerance:

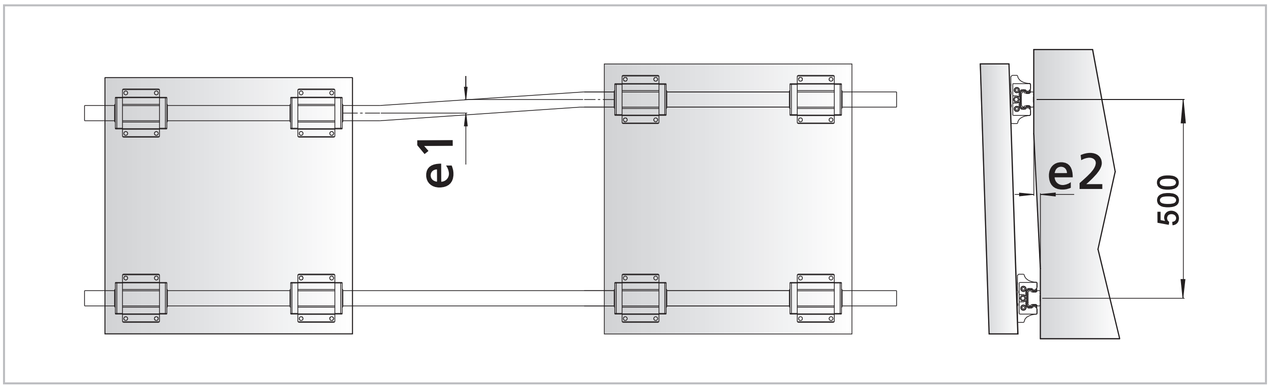


Fig. 2-7

Table 2-13 Allowance of installation deviations unit: μm

Type	Allowance of parallel deviation (e1)					Allowance of level deviation (e2)				
	Z3	Z2	Z1	Z0	ZF	Z3	Z2	Z1	Z0	ZF
BG 15			18	25	35			85	130	190
BG 20		18	20	25	35		50	85	130	190
BG 25	15	20	22	30	42	60	70	85	130	195
BG 30	20	27	30	40	55	80	90	110	170	250
BG 35	22	30	35	50	68	100	120	150	210	290
BG 45	25	35	40	60	85	100	140	170	250	350
BG 55	30	45	50	70	95	125	170	210	300	420

※ The defined values of the allowed parallel deviation and level deviation are shown in table 2-13. The standard is based on the 500 mm wheelbase.

Dust Proof of Rails

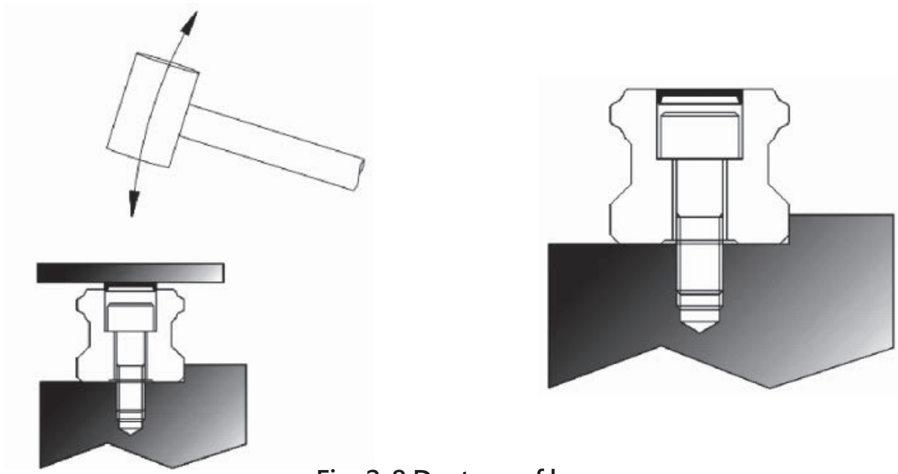


Fig. 2-8 Dust proof bore cap

Rail Contamination:
In the machines built with linear guides, chips and foreign objects pile up easily in the rail bores to get inside the carriages. These chips and particles can block the ball circulation and shorten the life of the linear guides.

Bore Cap:
Most chips and foreign objects that fall on the rails can be wiped away by the end seals. Only few accumulate in the bores. The purpose of the rail caps is to block the objects from falling into the bores. These caps can be easily mounted with plastic mallet or plastic panel aligned with bore after rail is secured.

Counter Bore Rails:
The counter bore rails are fastened differently from the conventional rails. Since there are no exposed countersunk bores on top, dust and chips simply cannot be stocked.

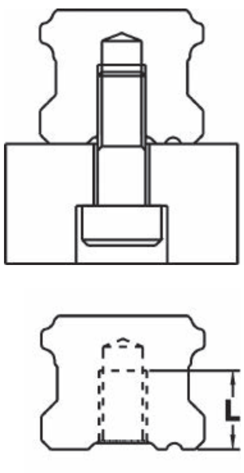


Fig. 2-9

Table 2-14 Specification of bolts unit: mm

Rail type	Thread size	Max thread length (L)
BG 15	M5	8mm
BG 20	M6	10 mm
BG 25	M6	12 mm
BG 30	M8	15 mm
BG 35	M8	17 mm
BG 45	M12	20mm
BG 55	M14	24 mm

3. How to Install Linear Guide

3-1 Installation Design Concept

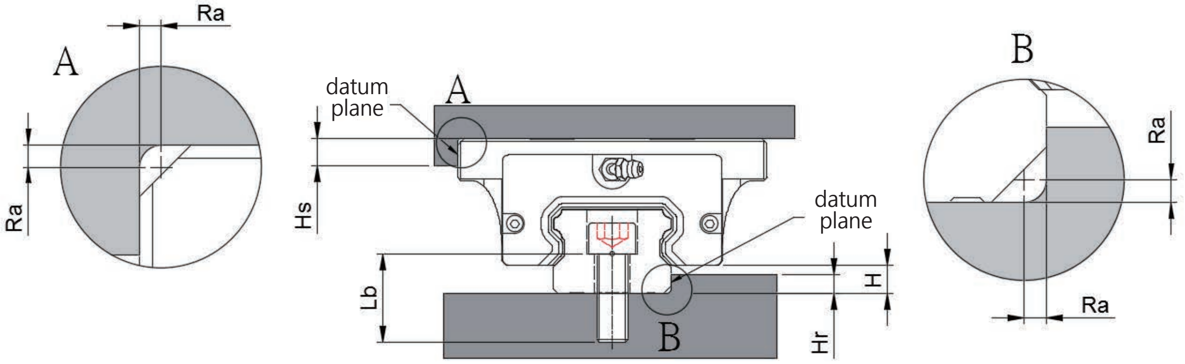


Fig. 3-1

Shoulder height and corner radius of the base

One side of the rail and the carriage is the datum plane for installation and position of linear guide. Datum plane is chamfered both in the rail and in the carriage to avoid interference with the base. It is recommended to design the base shoulder with the dimension in the table below:

Table 3-1 unit: mm

Type	Max. corner radius of align shoulders (Ra)	Height of rail align shoulder (Hr)	Height of carriage align shoulder (Hs)	H
BG 15	0.6	3.1	5	3.3
BG 20	0.9	4.3	6	4.5
BG 25	1.1	5.6	7	5.8
BG 30	1.4	6.8	8	7
BG 35	1.4	7.3	9	7.5
BG 45	1.6	8.7	12	8.9
BG 55	1.6	11.8	17	12.7

Linear guide installation steps

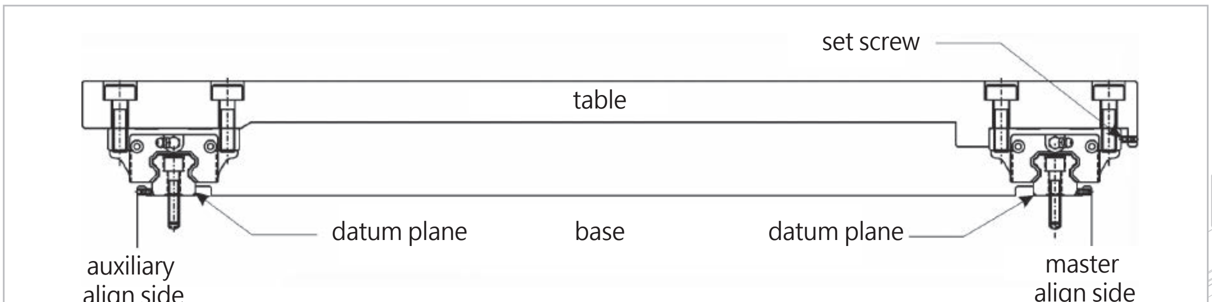


Fig. 3-2

Fig. 3-2 shows a typical example for rail installation with the features below,
1. There are two datum planes for rail installation on the base.
2. There is set screw in the table to position the table laterally.
3. The set screw is at the master align side.

3-2 Installation Steps

Step 1 **All burrs, contaminations and marks must be removed before installation.**

Attention: Datum plane is normally covered with antirust oil. Clean the antirust oil with cleaners before installation. Datum plane will get rusty easily without antirust oil, hence, it is recommended to spray some low viscosity lubricant to protect the datum plane from rusting.

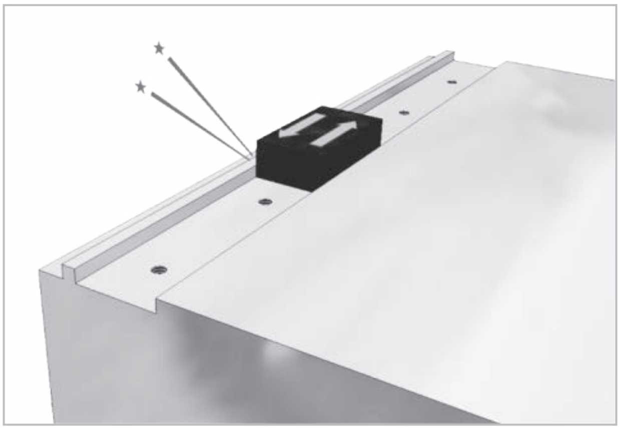


Fig. 3-3

Step 2 **Place the master rail gently on the base and make sure it contacts the datum plane nicely with set screws or other fixtures.**

Attention: Check the alignment of the screw holes before securing. Fastening the rail with unaligned screw holes will affect the accuracy and quality due to offset or deformation.

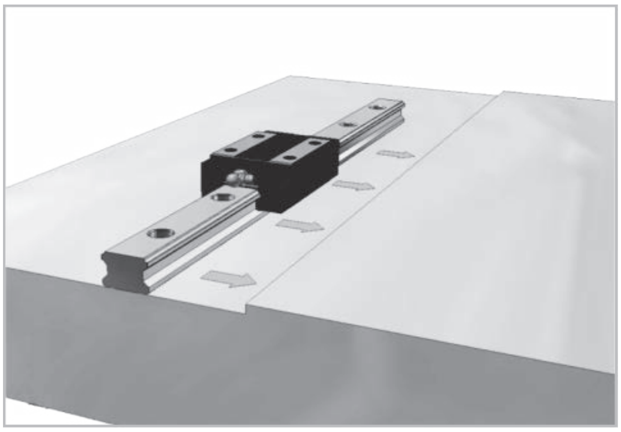


Fig. 3-4

Step 3 **Attach the screws to screw holes in the sequence from center to both ends and push the rail gently against the datum plane.**

Attention: Fasten the screws in the sequence from center to both ends adequately to make the rail more stable. When the rail is stable in place, enhance the lateral force so that the rail adjoins the datum plane properly.

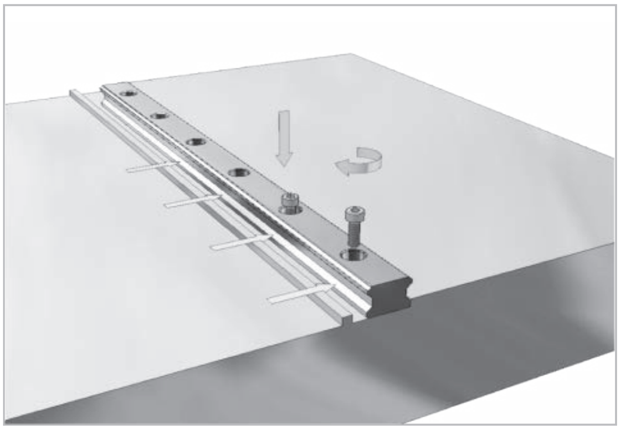


Fig. 3-5

Step 4 **Fasten the screws by a torque wrench with the appropriate torque according to the screw size and base material.**

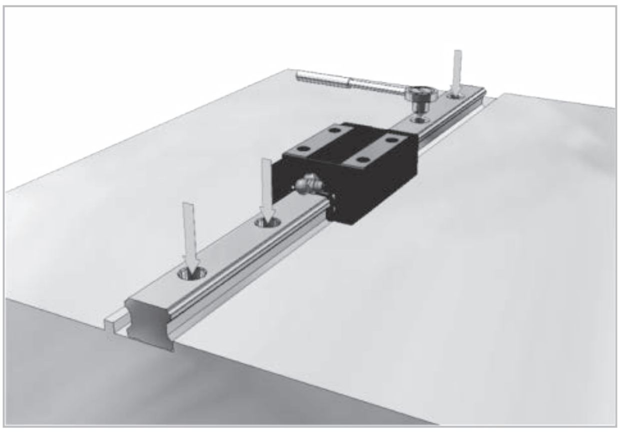


Fig. 3-6

Recommended rail screw fastening torque

Table 3-2 unit: kgf-cm

Screw size	Fastening torque (kgf-cm)		
	Steel	Cast Iron	Aluminum alloy
M 2	6.3	4.2	3.1
M 2.3	8.4	5.7	4.2
M 2.6	12.6	8.4	6.3
M 3	21	13.6	10.5
M 4	44.1	29.3	22
M 5	94.5	63	47.2
M 6	146.7	98.6	73.5
M 8	325.7	215.3	157.5
M 10	724.2	483.2	356.7
M 12	1264.2	840	630
M 14	1682.1	1125	840
M 16	2100	1403.5	1050

※ Please select the appropriate torque according to base material and screw size, and fasten the rail screw gently with the torque wrench.

Step 5 **Install the slave rail with the same steps foresaid, then install the carriages onto the rails individually.**

Attention: Space can be very limited and makes it difficult to assembly the accessories after carriage is installed on the rail. Hence, it is recommended to assembly all accessories, such as grease nipple, oil fitting and seals at this stage.

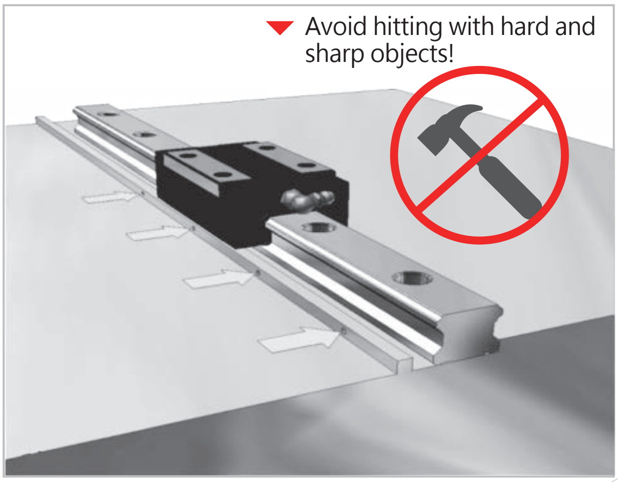


Fig. 3-7

Step 6 Place the table gently on the carriages on both master and slave rails.

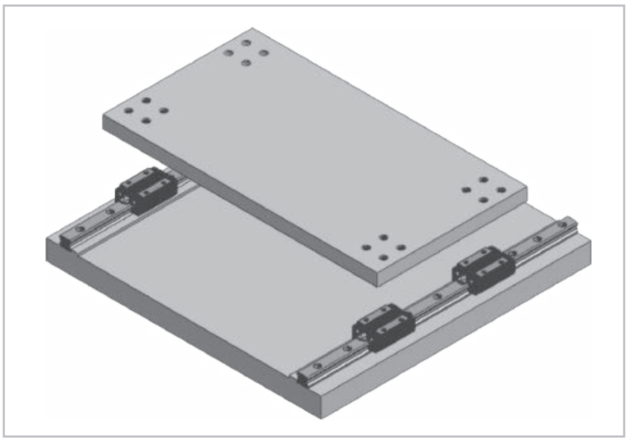


Fig. 3-8

Step 7 Fasten the crosswise set screw to secure the table. Fasten the table screws with the sequence demonstrated in the figure below

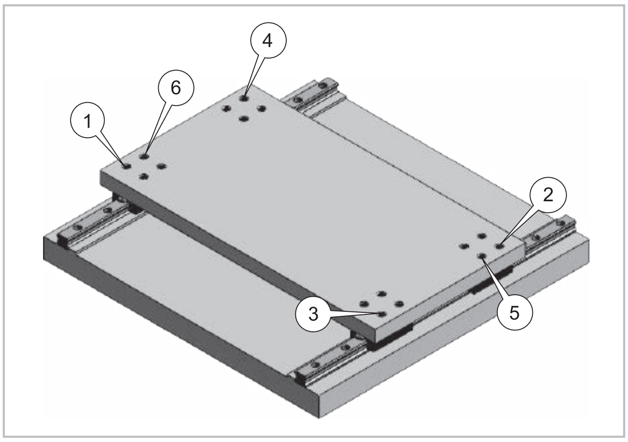


Fig. 3-9

3-3 Common Installation Patterns

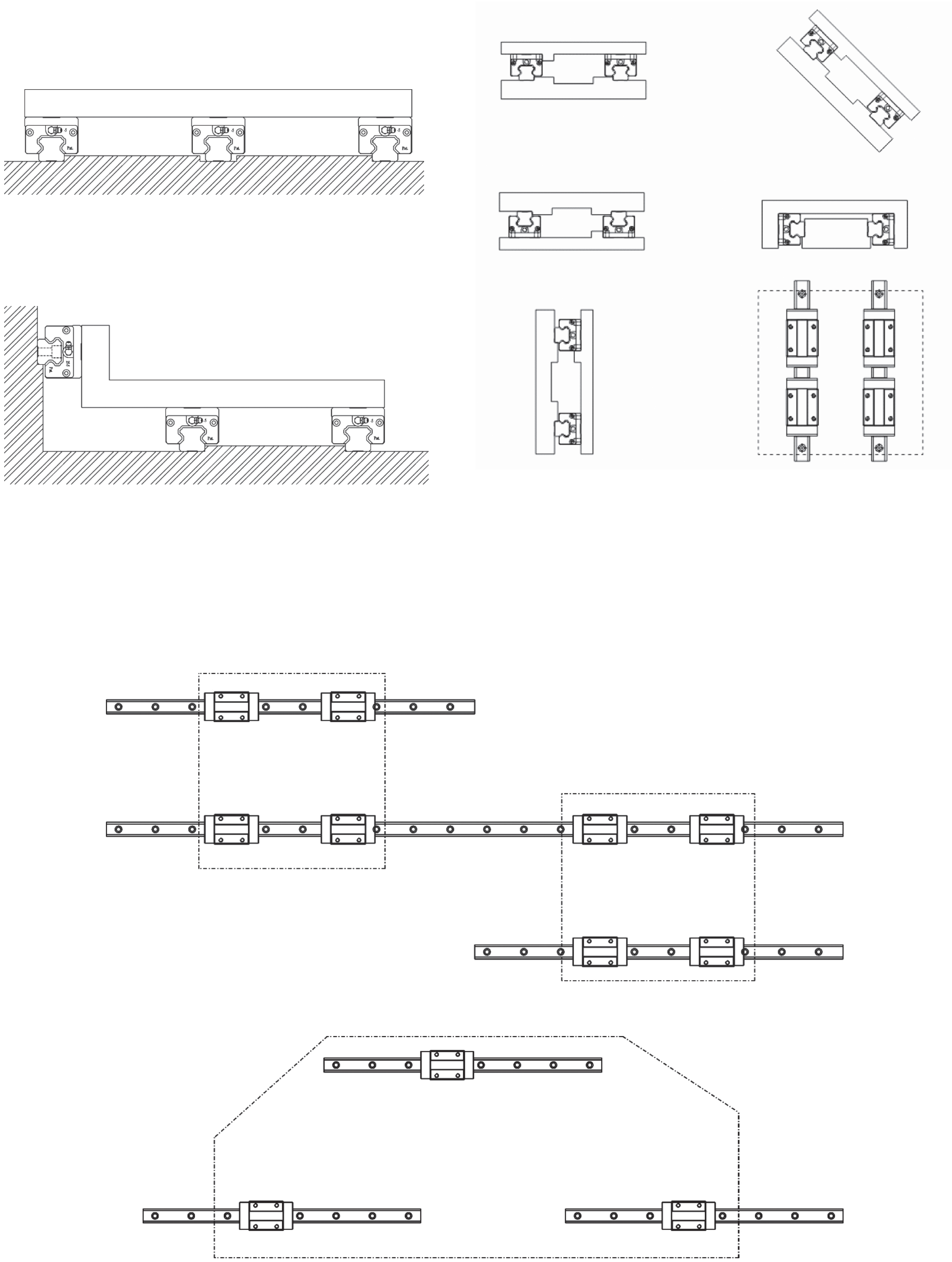


Fig. 3-10

3-4 Common Securing Methods

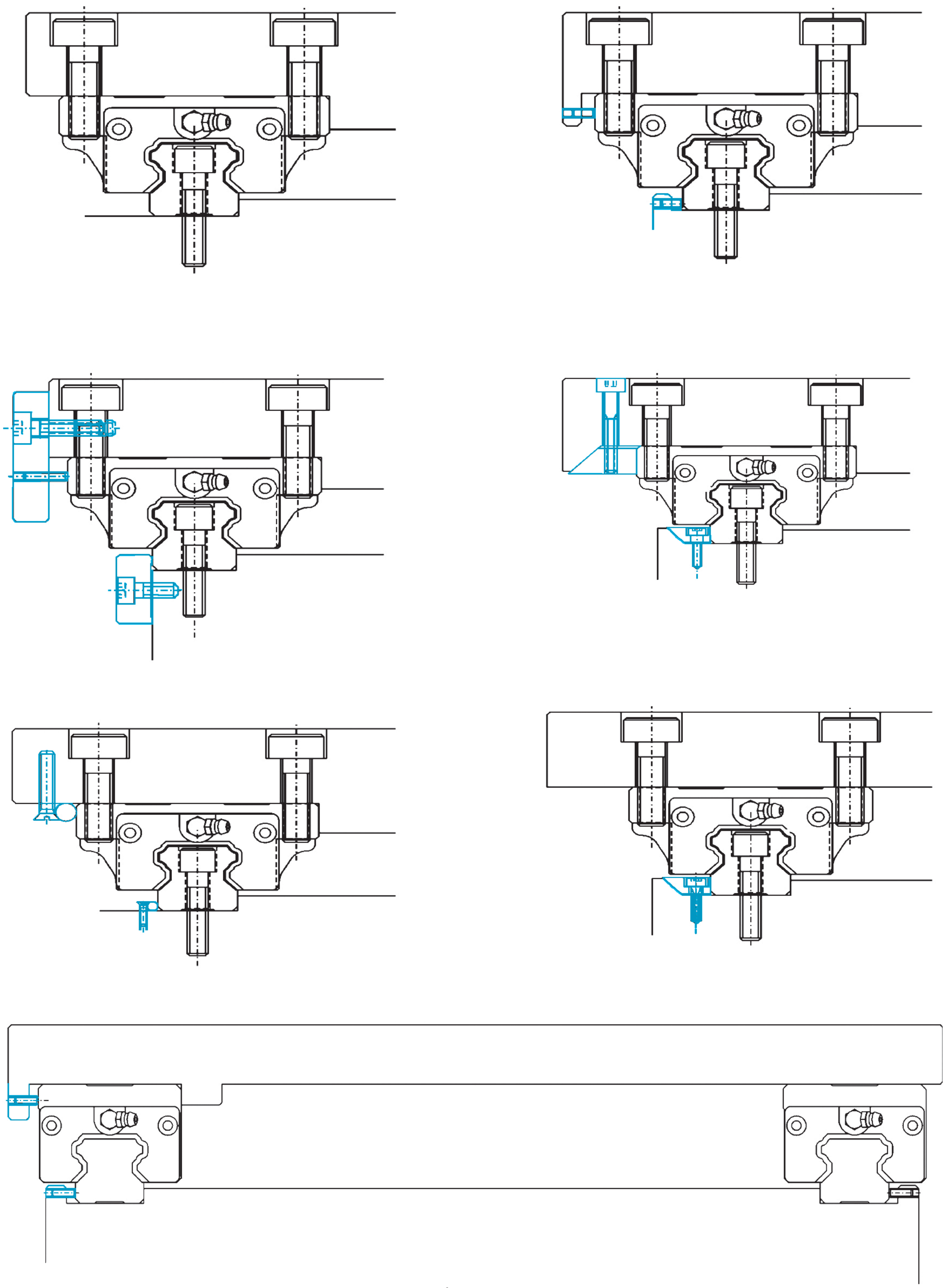


Fig. 3-11

3-5 Use of Jointed Rails

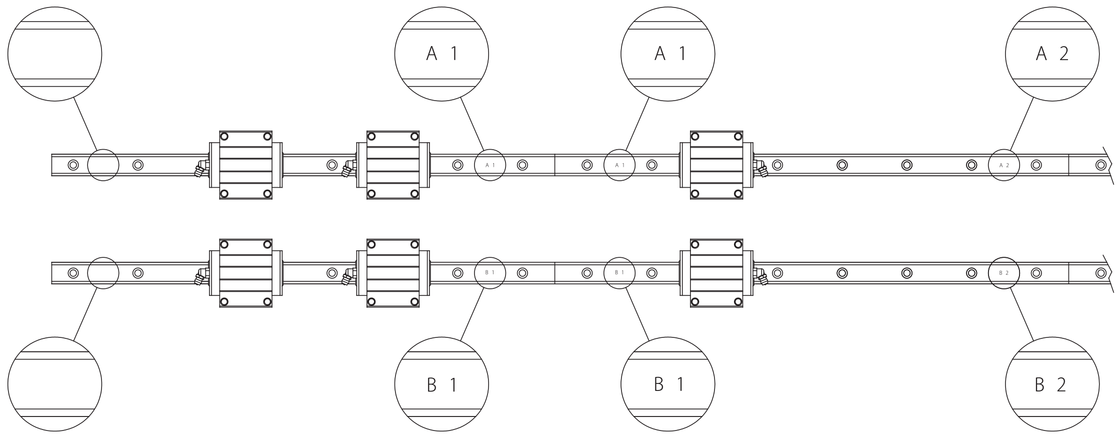


Fig. 3-12

When an over length rail is required, two or more rails can be butt-jointed to the required length. When jointing rails, be sure to match the marked positions correctly as the above figure.

The linear guides will be numbered as the table below:

Table 3-3

	Jointed rail #1		Jointed rail #2		Jointed rail #3		…		Jointed rail #N	
Parallel axis #01	No mark	A1	A1	A2	A2	A3	A3	…	AN	No mark
Parallel axis #02	No mark	B1	B1	B2	B2	B3	B3	…	BN	No mark
…	⋮		⋮		⋮		⋮		⋮	
Parallel axis #26	No mark	Z1	Z1	Z2	Z2	Z3	Z3	…	ZN	No mark

If two jointed rails are used in pair, in order to minimize the deviation, it is recommended to stagger the joint points in these two rails as demonstrated in Fig. 3-13,

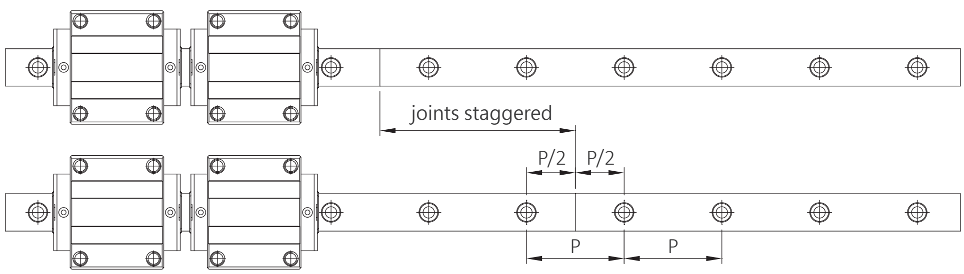


Fig. 3-13

3-6 Lubrication Volume

Table 3-4

Carriage size		Flange & length	Lubrication Grease			Lubrication Oil		
			Initial lubrication (ml)		Lubrication every 100km (ml/100km)	Initial lubrication (ml)		Lubrication every hour (ml/hr)
			Non-cage type	Cage type		Non-cage type	Cage type	
BG15	S	BS,FS	0.3	0.2	0.1	0.2	0.1	0.1
	N	BN,FN	0.4	0.3	0.2	0.2	0.1	0.1
	L	BL,FL	0.5	0.4	0.3	0.2	0.1	0.1
BG20	S	BS,FS	0.4	0.3	0.2	0.3	0.2	0.1
	N	BN,FN	0.6	0.5	0.3	0.4	0.3	0.2
	L	BL,FL	0.8	0.7	0.4	0.4	0.3	0.2
	E	BE,FE	1	0.9	0.5	0.5	0.4	0.2
BG25	S	BS,FS	0.8	0.7	0.4	0.4	0.3	0.1
	N	BN,FN	1	0.9	0.6	0.5	0.4	0.2
	L	BL,FL	2	1.9	1.2	0.6	0.5	0.2
	E	BE,FE	2.5	2.4	1.4	0.7	0.6	0.3
BG30	S	BS,FS	2	1.9	1.2	0.7	0.6	0.2
	N	BN,FN	2.5	2.4	1.4	0.9	0.8	0.2
	L	BL,FL	3	2.9	1.6	1	0.9	0.3
	E	BE,FE	3.5	3.4	1.8	1.2	1.1	0.3
BG35	S	BS,FS	3	2.9	1.6	0.9	0.8	0.2
	N	BN,FN	3.5	3.4	1.8	1.4	1.3	0.3
	L	BL,FL	4	3.9	2	1.5	1.4	0.3
	E	BE,FE	4.5	4.4	2.3	1.8	1.7	0.4
BG45	N	BN,FN	4	3.9	2	2	1.9	0.5
	L	BL,FL	5	4.9	2.5	2.3	2.2	0.5
	E	BE,FE	5.5	5.4	2.8	2.8	2.7	0.6
BG55	N	BN,FN	6	5.8	3	3.5	3.3	0.6
	L	BL,FL	8	7.8	4	4.5	4.3	0.6
	E	BE,FE	10	9.8	5	5.5	5.3	0.7
Remark:			Above volumes are suggested volumes for initial and regular lubrication at every 100KM.			Above volumes are suggested volumes for initial and regular lubrication every hour.		

Cautions

1. To avoid damaging the carriage, do not use lubrication grease containing solid particle like graphite.
2. Do not run the linear guide without lubrication.
3. If travel distance is less than twice the carriage length, both front and rear nipples should be initially and regularly lubricated with the instructed volume.
4. To avoid sever damage, review the grease compatibility when changing the lubrication grease. In addition, it is necessary to review the possibility to shorten lubrication interval in the following conditions: short stroke operation, drop of load capacity, potential chemical reaction between synthetic ingredient, lubricant and antirust. Read the instructions from the lubrication grease supplier carefully.
5. If the greases are incompatible, clean the carriage thoroughly before applying new grease.STAF provide versatile services regarding lubrication grease. Please contact STAF staff for more details.

STAF LINEAR GUIDE

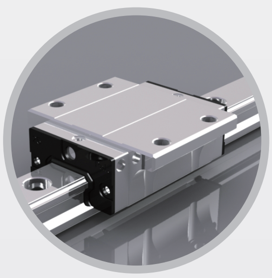
BGX BGC Series

Non-cage type / Cage type

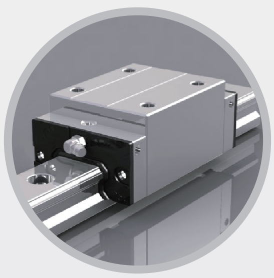
STAF LINEAR GUIDE

BGX Series

Non-cage Type Linear Guides



Non-cage type
with flange



Non-cage type
without flange

4. STAF Linear Guides

4-1 BGX Standard Linear Guides

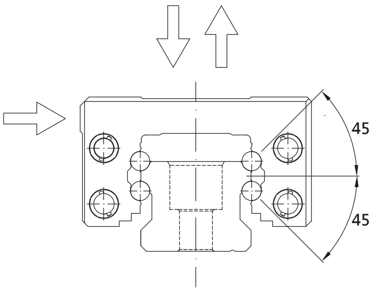


Fig. 4-1

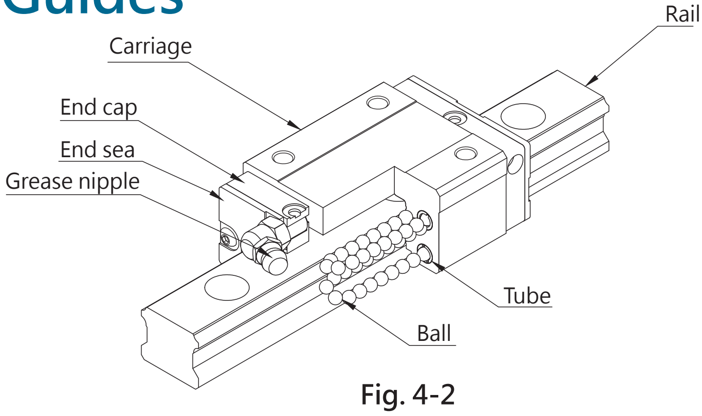


Fig. 4-2

a. BGX Four-Rows Even Load Design

The four rows of steel balls form 45° contact with the grooves at four positions can balance the loads from all directions. This design permits even load capacity in all directions no matter how the rails are mounted is widely adopted in all types of machines. Compared with two rows Gothic design, four rows construction is better in rigidity, accuracy and lifetime. Particularly the auto-adjust capability allows quick accurate linear motions by eliminating the deviation of the base plane and the assembly errors.

Comparison table of 4-row vs. Gothic 2-row

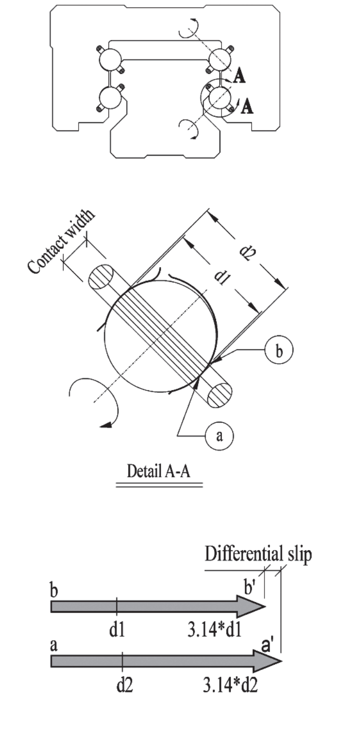
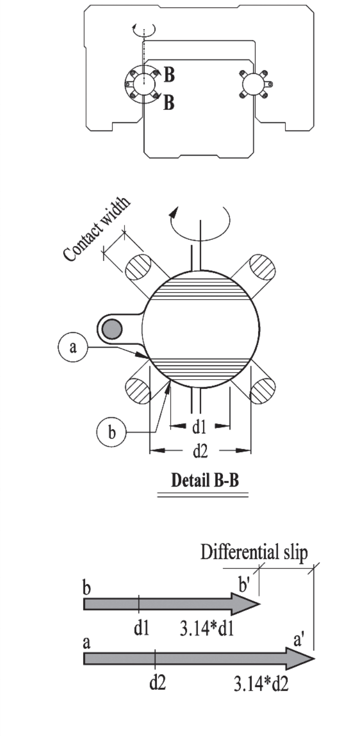
Four rows even load system	Two rows gothic system
	

Fig. 4-3

The advantages of four rows system are:

1. Smooth movement 2. Low friction 3. Higher load rating

b. BGX Tube Muffler System

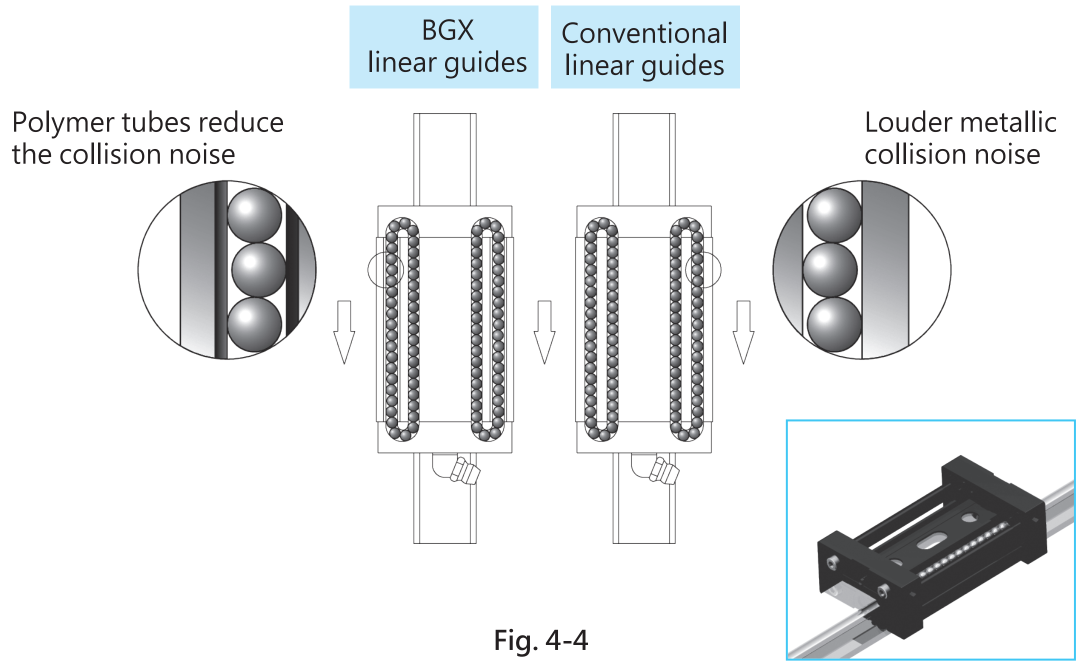


Fig. 4-4

The polymer tubes greatly reduce the collision noises of steel balls in high-speed movement.

Advantages:

1. The carriage moves quieter
   The polymer tubes in BGX linear guide can reduce the collision noise of steel ball and metal body significantly.

2. Better lubrication
   The polymer tubes in BGX linear guide improve the lubrication effect.

3. Steady lifetime
   The BGX tube muffler system also provide steady lifetime owning to the better lubrication and less collision between steel ball and metal body.

c. BGX Lubricant Retaining in Circulation System

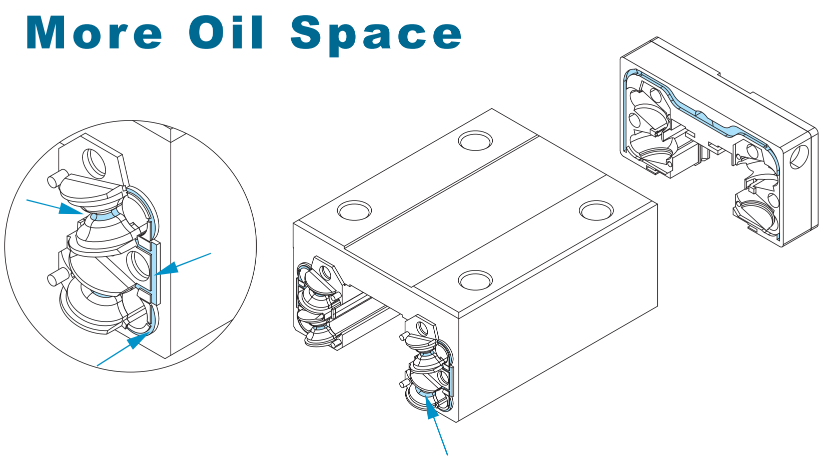
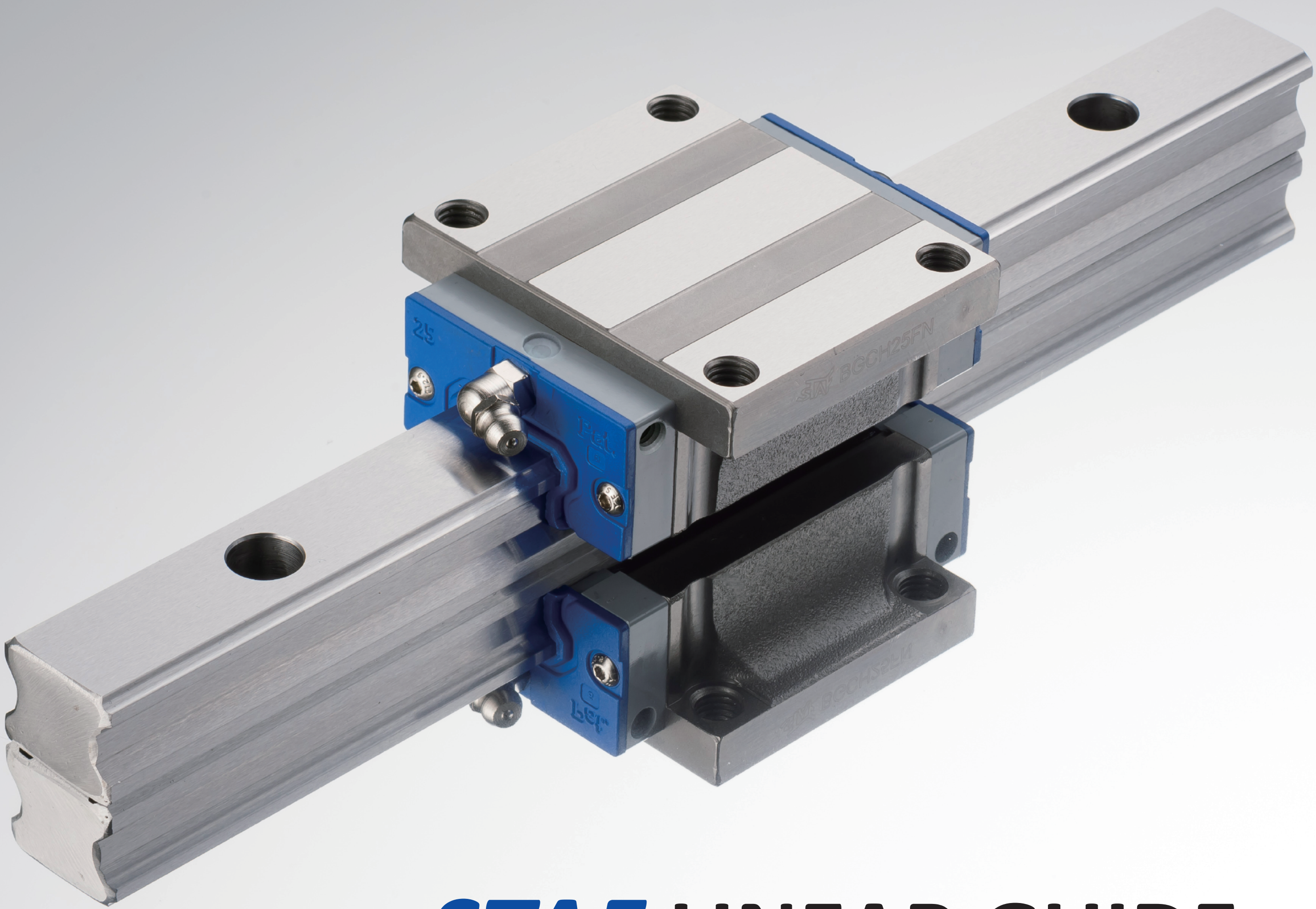


Fig. 4-5

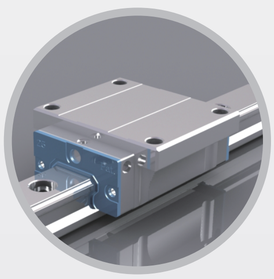
BGX circulation system creates a lot of spaces for reserving lubricant and is able to keep more lubricant inside the carriage. When carriage moves, the lubricant spreads all over the circulation path due to the inertial movement and prolongs the lifetime. When the carriage rests, the lubricant will return to reserving space in the circulation system without escaping.



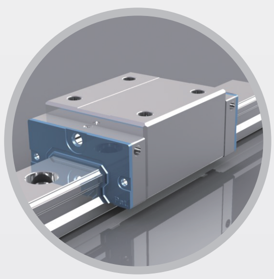
STAF LINEAR GUIDE

BGC Series

Cage Type Linear Guides



Cage type with flange



Cage type without flange

4-2 BGC Cage Type Linear Guides

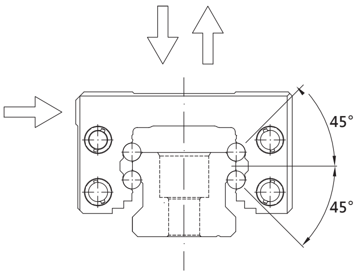


Fig. 4-6

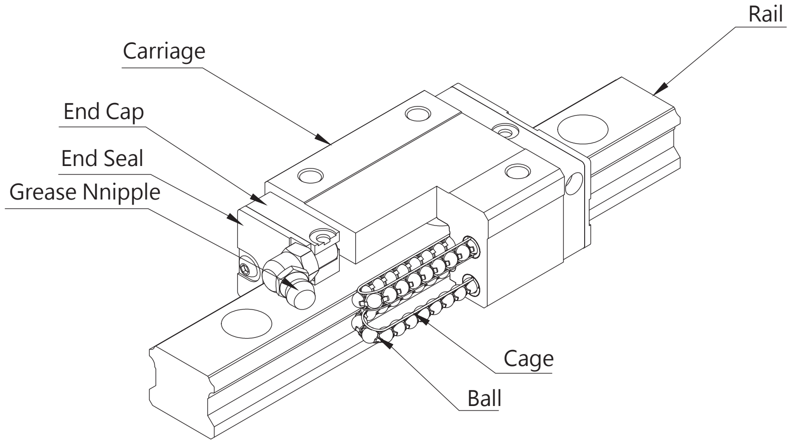
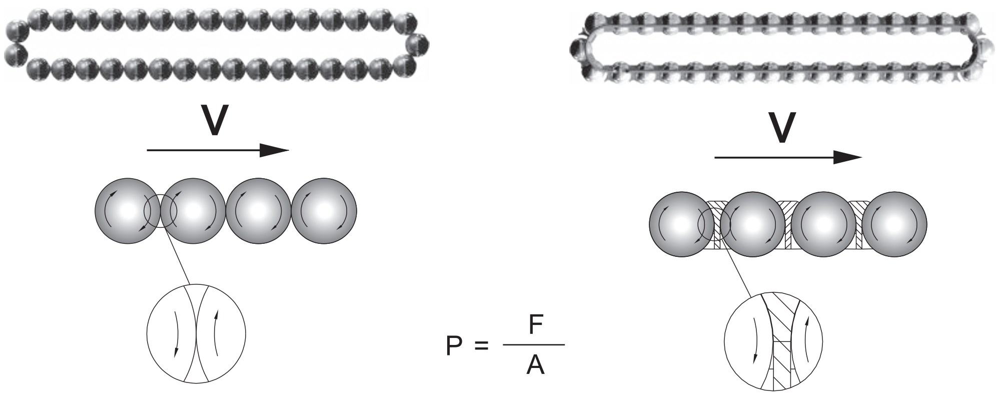


Fig. 4-7

The steel balls in conventional linear guide have point contact between each other. The relative speed at contact point is double that of rotation speed. In addition, the contact area is extremely small that the pressure is almost infinity. This is the major reason of steel ball wearing in conventional linear guides. In BGC linear guide, steel balls are separated by ball cage that significantly reduce the friction and pressure between steel balls. Furthermore, the ball cage provides better lubrication, low noise and longer lifetime.



$$P = \frac{F}{A}$$

Fig. 4-8

P: Contact pressure of steel balls

F: Interaction force of steel balls

A: Contact area of steel balls

Conventional linear guide:	BGC linear guide:
The relative speed is double of rotation speed and the pressure is almost infinity owing to the contact area is extremely small.	Ball cage provide better lubrication and absorbed the friction between steel balls that allows the carriage move in high speed.

a. BGC Lubrication by Circulation

The lubricant can be injected via the nipples and its effect can be enhanced by the ball cage circulation in BGC linear guides. BGC linear guides surely have a longer lifetime than the conventional linear guides and even other cage type linear guides.

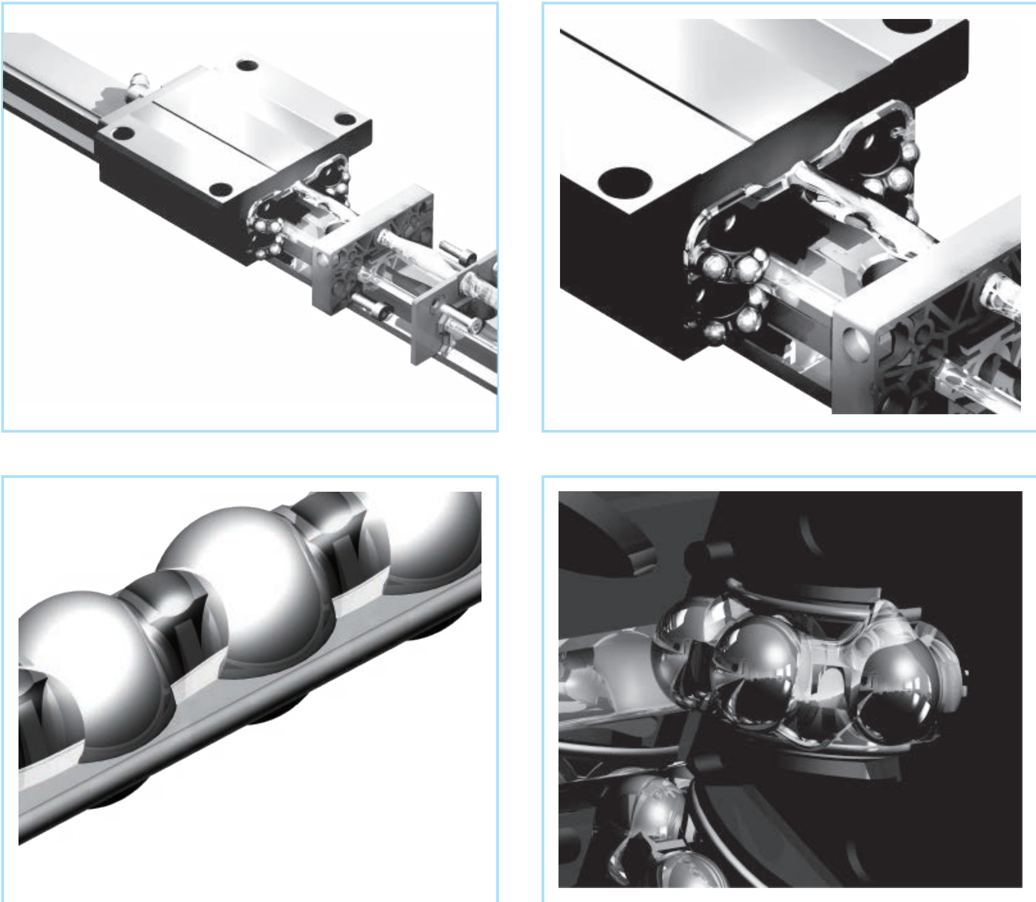


Fig. 4-9

* As shown in Fig. 4-9, the oil film stays in the steel balls and the ball cage. This unique cage design of BGC linear guides provides more space to reserve the lubricant. The ball cage brings the lubricant to every circulation surfaces as it circulates. Even when resting, less lubricant escapes from BGC linear guides than the conventional linear guide

In conventional linear guides, the lubrication oil vanishes easily as they run. Loss of lubrication oil results in wearing, noise and heating. BGC linear guide was design to solve this issue and improves the performance and life effectively.

b. BGC Is Less Noisy

The conventional linear guides are noisier because:
1. Relative speed at steel ball contact is twice than that of motion speed.
2. The contact area is so small that enlarge the contact pressure as well as the the friction.

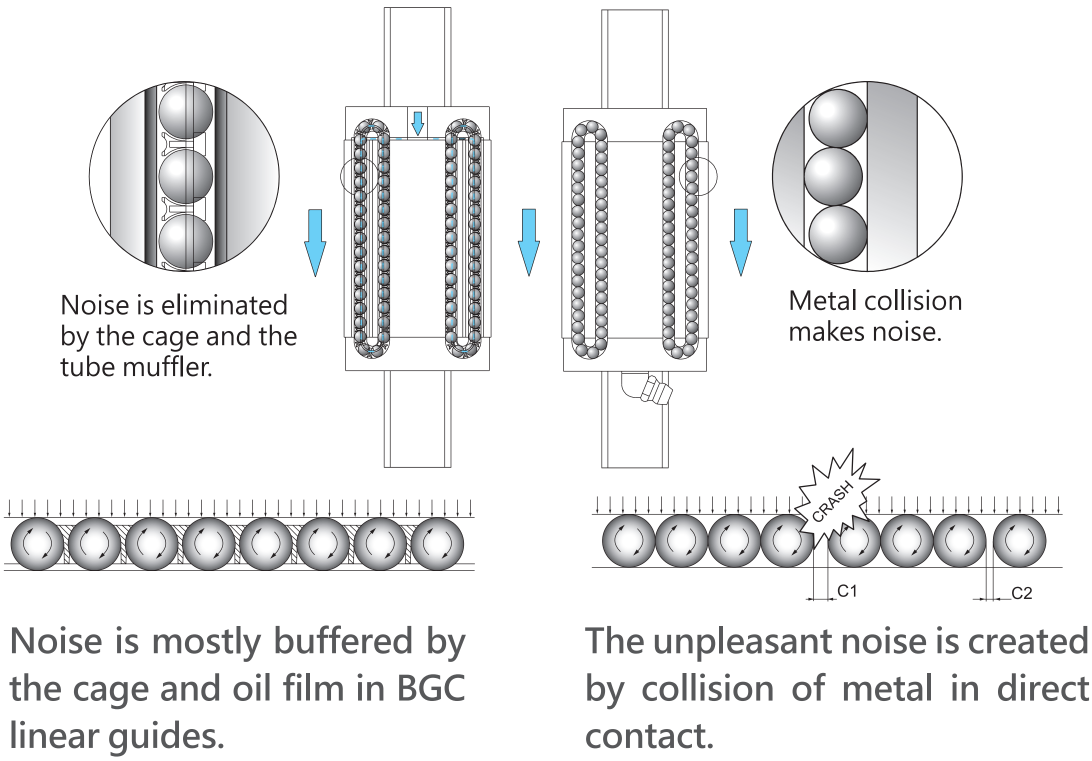
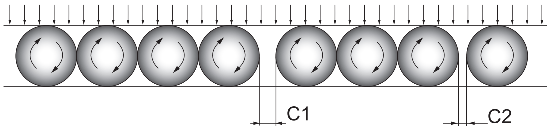


Fig. 4-10

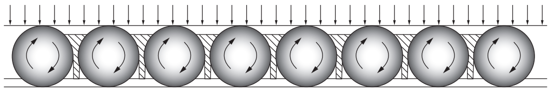
When the steel balls travels in different speeds, circulation will cause chasing in the steel balls. In the conventional linear guides, collisions of steel balls create loud noises. The macromolecular polymer cage of BGC linear guides is designed with rooms to retain lubrication oil. Most collision noises are eliminated by the elasticity of the cage and the oil film buffering.

c. BGC Is Evenly Load Distributed

The steel balls in conventional linear guides cannot be evenly distributed to get even clearances between steel balls, so the load on each steel ball is uneven. This uneven load shortens the lifetime of steel balls in a long time. In BGC linear guides, the steel balls fixed by the cage are evenly distributed in the circulation runway and are evenly loaded so the lifetime is more reliable.



As shown in the figure above:
Steel ball are randomly distributed in the conventional linear guides and unevenly loaded.



As shown in the figure above:
Steel ball are fixed by the cage in BGC linear guides. It minimizes the uneven clearance to guarantee a more reliable lifetime.

Fig. 4-11

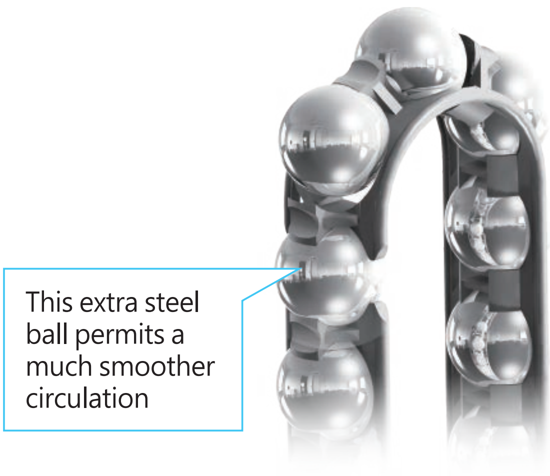


Fig. 4-12

Low Noise

Vibration Amplitude is 1/6 ~ 1/10 in Caged Type Linear

Low Vibration

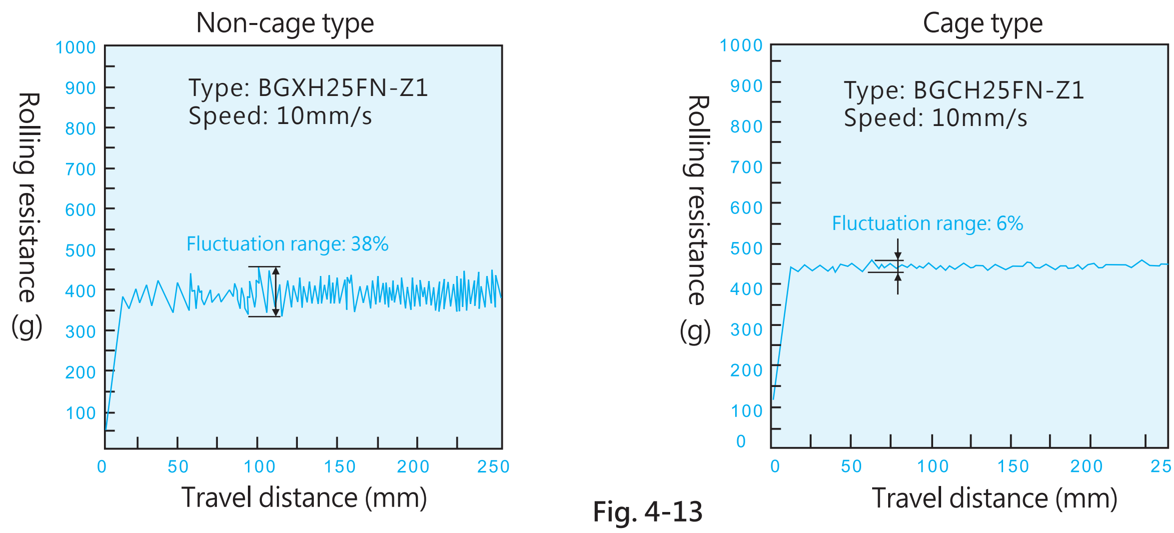


Fig. 4-13

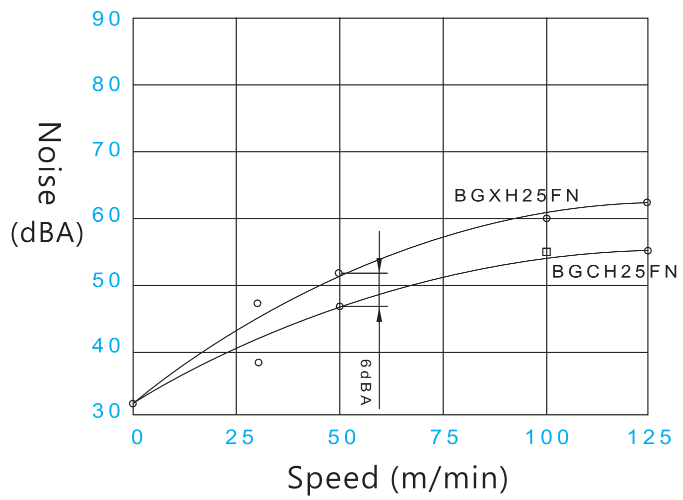


Fig. 4-14

d. BGC vs. Conventional Linear Guides

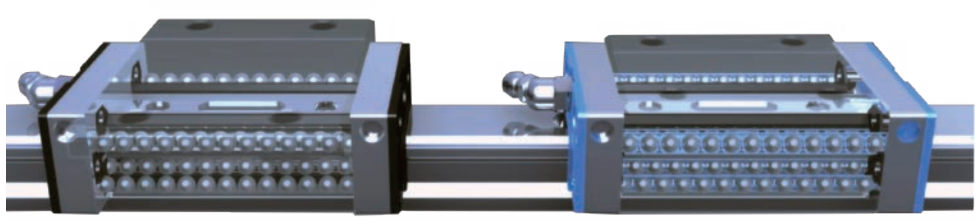


Fig. 4-15

Table 4-1

	Conventional linear guides	BGC linear guides
Maintenance	Oil film not easy to maintain	Oil film easy to maintain
Noise	Noisy	Quiet
Heating	High	Low
Load	Uneven	Even

e. Cage Type vs. Non-Cage Type

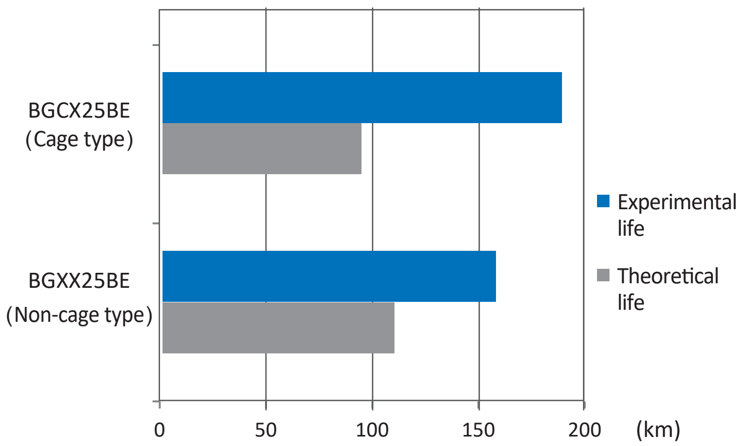
In order to provide the convenience for customers to update the linear guides, OME has design the cage type and non-cage type linear guides to use interchangeable rail and carriage components. To use the interchangeable rail, the cage type linear guide relatively contains fewer steel balls because of the cage and the nominal load rating is less. Theoretically, the lifetime of cage type linear guides would be shorter than the non-cage type. However, with the advantages such as better lubrication, evenly distributed load and steel balls separated by the cage to avoid heat arisen from friction and collision, cage type linear guides appear to be superior to the non-cage type linear guides in the lifetime experiments.

Table 4-2

Lifetime experiment results:

Type	BGXX25BE	BGCX25BE
Max. speed	250mm/s	250mm/s
Preload grade	Z1	Z1
Contact factor f_c	1	1
Hardness factor f_h	1	1
Temperature factor f_t	1	1
Load factor f_w	1.5	1.5
External load	19.21kN	19.21kN
Preload	0.76kN	0.72kN
Basic static load rating	69.6kN	63.3kN
Basic dynamic load rating	38kN	36kN
Theoretical life	101.95km	87.21km
Experimental life	150.67km	180.79km

Type	BGCX25BE	BGXX25BE
Experimental lefe	180.79	150.67
Theoretical life	87.21	101.95



※ Severe conditions are applied to expedite the life experiments of cage type and non-cage type linear guides. In practice, the conditions vary to machine in use.

Experiment Conclusion:

The theoretical life of BGXX25BE non-cage type linear guide is 101.95km. The experimental life is 150.67km which is 1.48 times of the theoretical life. The theoretical life of BGCX25BE cage type linear guide is 87.21km. The experimental life is 180.78km which is 2.07 times of the theoretical life.

From the results above, experimental life of both BGXX25BE non-cage type and BGCX25BE cage type linear guides exceeded the theoretical life. Under the same experimental conditions, BGCX25BE cage type linear guide is superior to BGXX25BE non-cage type in life.

4-3 Product Coding

BGC H 25 B N – 2 – UUAM – L 1500 – P – Z1 – II – R 1

Carriage type :
BGC : Caged
BGX : Non-caged

Assembly height :
H : High assembly
S : Low assembly
X : Special assembly

Size :
15, 20, 25, 30, 35, 45, 55

Carriage design :
B : Block (squared) F : Flange

Carriage length :
S : Short N : Standard L : Long
E : Extra-long

Number of carriages

Seal combination :
– – : End seal + Side seal
UU : End seal
SS : End seal + Side seal + Inner seal
DD : Double end seal + Side seal
EE : Double end seal + Side seal + Inner seal
FF : End seal + Side seal + Inner seal + Metal scraper
GG : Double end seal + Side seal + Inner seal + Metal scraper
ZZ : End seal + Side seal + Metal scraper
KK : Double end seal + Side seal + Metal scraper
A : Self-lubrication
M : Multiple-layer wiper

Rail mounting type :
L : Counterbored holes (standard) C : Bottom tapped holes
J : Jointed rails (counterbored holes)
D : Jointed rails (bottom tapped holes) X : Customized

Rail length (mm)

Precision grades :
N : Normal H : High P : Precision SP : Super precision UP : Ultra precision

Preload grade :
ZF : With clearance Z0 : No preload Z1 : Light preload Z2 : Medium preload
Z3 : Heavy preload

Number of parallel rails

Surface treatment (applicable for precision class N and H) :
– : Without coating D : Trivalent chromium K : Black chromium N : Nickel R : Fluoride chromium

Treated parts :
– : Without coating (1) Rail only (2) Carriage only (3) Rail and carriage (X) By order

4-4 Seal Type Codes

Table 4-3

— —	—	—
Standard	Lubrication	Additional

— —

Standard End Seal Combination			
Code	Content	Code	Content
--	End Seal +Side Seal	FF	End Seal +Side Seal +Inner Seal +Metal Scraper
UU	End Seal		
SS	End Seal +Side Seal +Inner Seal	GG	Double End Seal +Side Seal +Inner Seal +Metal Scraper
DD	Double End Seal +Side Seal	ZZ	End Seal +Side Seal +Metal Scraper
EE	Double End Seal +Side Seal +Inner Seal	KK	Double End Seal +Side Seal +Metal Scraper

—

Lubrication System (LS)	
Code	Content
A	Self-Lubrication

—

Additional	
Code	Content
M	Multiple-Layer Wiper

4-5 Dust-proof Seals

BGX Dust-proof Design

Incursion of foreign particles is the main reason of shorter rail life because accuracy of linear guide relies very much on the precision of rail, carriage and steel balls. Even the tiniest particle in the circulation runway can cause abnormal vibration and bumping of the linear guide and lead to permanent damage. Therefore, dust-proof is the key to quality of linear slide. The dust-proof system of BGX linear guides is divided into 2 systems on top and at bottom and focuses on the rail bores and the gap in between carriage and rail.

Passages for particle incursion:

1. Bores: Dust accumulates easily at the rail bores and get into the circulation runway due to vibration or machine movements.
2. Gap in between carriage and rail: Bigger particles normally incurs from the gap in between carriage and rail that is the closest to the runway.

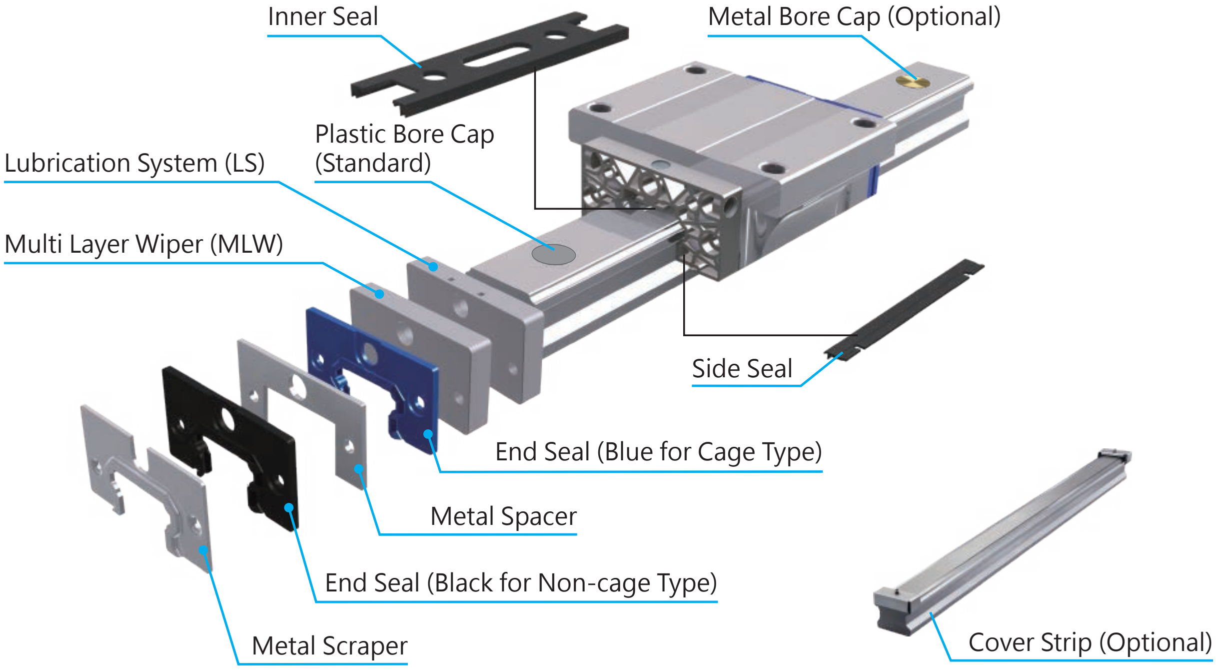


Fig. 4-16

- **End Seals**

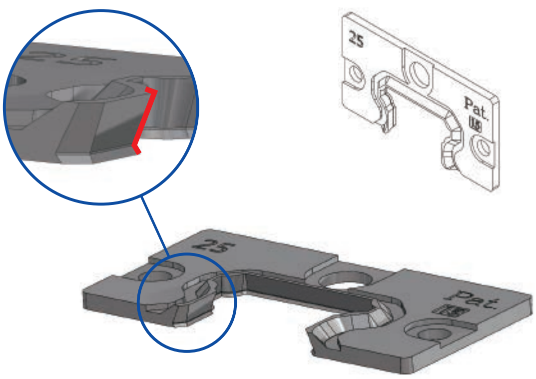


Fig. 4-17

Patented flexible structure design for lighter friction force while possesses good dust-proof performance.

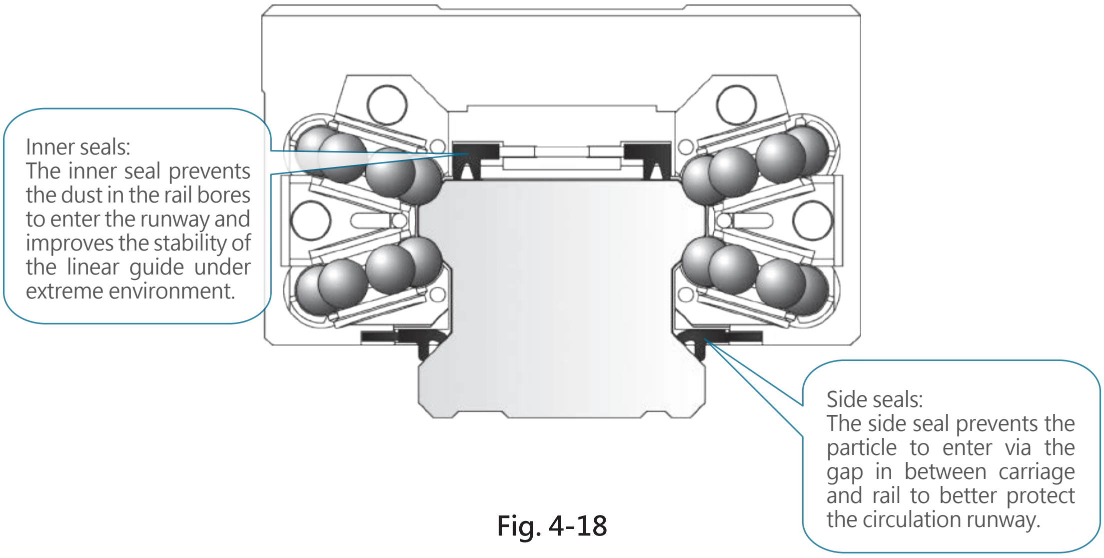


Fig. 4-18

Inner Seals

Inner seal aims at dust accumulated in the rail bores. It stops the dust from entering the circulation runway with the lips to separate the rail bores.

Fig. 4-19

Side Seals

Side seal aims at the gap in between carriage and rail. It closes the gap with the wiper to prevent dust getting into the circulation runway from aside and underneath.

Fig. 4-20

Nylon applied and fit closely with the rail surface, which blocks the dust effectively.

• Metal Scraper

It is applicable for metal cutting machines or flame cutting machines to scrape bigger chips or welding spatters. It protects the end seal from being damaged by sharp chips or burning spatters so that the end seal will its dust-proof function.

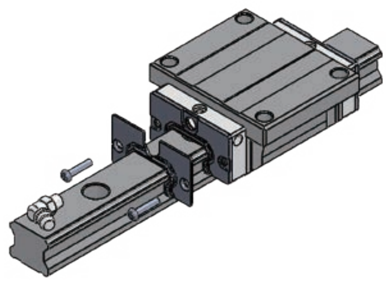


Fig. 4-21

• Multi-layer Wiper (MLW)

For the worst environment, multi-layer wiper is applicable as an option. Stack of 3 wiper layers, multi-layer wiper removes the particles on the rail and blocks them in multi- step.

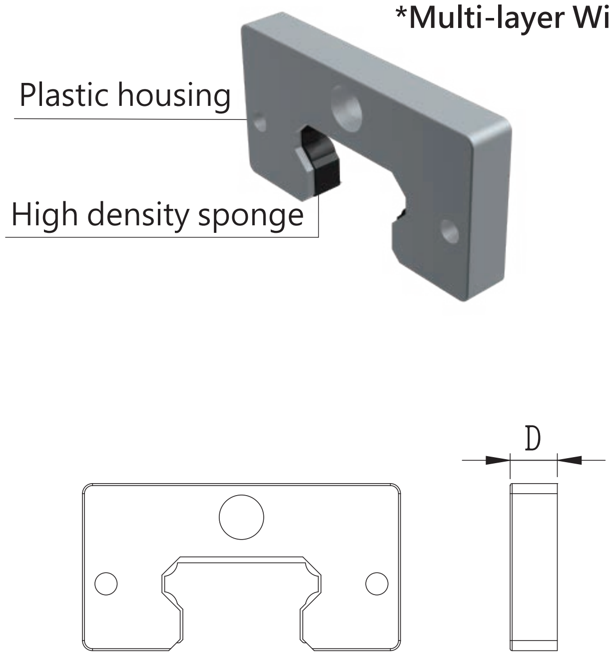


Fig. 4-22

Table 4-4

<table>
<tr><th colspan="2">Dimensions of MLW</th></tr>
<tr><th>Carriage size</th><th>D(mm)</th></tr>
<tr><td>15</td><td rowspan="2">6.5</td></tr>
<tr><td>20</td></tr>
<tr><td>25</td><td>7</td></tr>
<tr><td>30</td><td rowspan="4">9</td></tr>
<tr><td>35</td></tr>
<tr><td>45</td></tr>
<tr><td>55</td></tr>
</table>

4-6 Dust-proof Systems

● Standard System

The double-lip end seal ensures that the dust and particles will be kept of the carriage by the inner lip to secure performance even if the outer lip is worn out. It is recommended for the environment with much powder and chips.

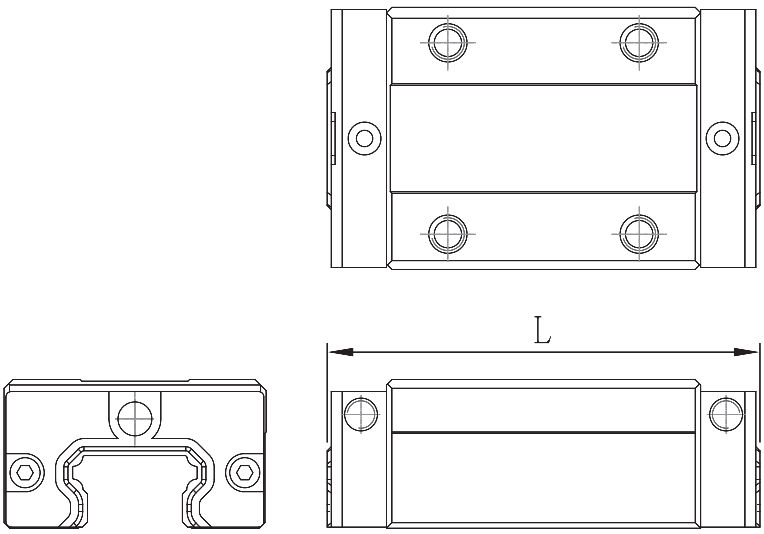


Fig. 4-23

Table 4-5 Sizes of standard system carriages

unit : mm

Overall length of standard system carriages (L)										
Carriage size		--	UU	SS	DD	EE	FF	GG	ZZ	KK
15	S	40.6	40.6	40.6	46.6	46.6	42.4	48.4	42.4	48.4
	N	58.6	58.6	58.6	64.6	64.6	60.4	66.4	60.4	66.4
	L	66.1	66.1	66.1	72.1	72.1	67.9	73.9	67.9	73.9
20	S	49.1	49.1	49.1	56.1	56.1	51.5	58.5	51.5	58.5
	N	70.1	70.1	70.1	77.1	77.1	72.5	79.5	72.5	79.5
	L	82.9	82.9	82.9	89.9	89.9	85.3	92.3	85.3	92.3
	E	98.1	98.1	98.1	105.1	105.1	100.5	107.5	100.5	107.5
25	S	54	54	54	61	61	56.9	63.9	56.9	63.9
	N	79.2	79.2	79.2	86.2	86.2	82.1	89.1	82.1	89.1
	L	93.9	93.9	93.9	100.9	100.9	96.8	103.8	96.8	103.8
	E	108.6	108.6	108.6	115.6	115.6	111.5	118.5	111.5	118.5
30	S	64.2	64.2	64.2	72.2	72.2	66.8	74.8	66.8	74.8
	N	94.8	94.8	94.8	102.8	102.8	97.4	105.4	97.4	105.4
	L	105	105	105	113	113	107.6	115.6	107.6	115.6
	E	130.5	130.5	130.5	138.5	138.5	133.1	141.1	133.1	141.1
35	S	75.5	75.5	75.5	84.5	84.5	78.1	87.1	78.1	87.1
	N	111.5	111.5	111.5	120.5	120.5	114.1	123.1	114.1	123.1
	L	123.5	123.5	123.5	132.5	132.5	126.1	135.1	126.1	135.1
	E	153.5	153.5	153.5	162.5	162.5	156.1	165.1	156.1	165.1
45	N	129	129	129	139	139	132	142	132	142
	L	145	145	145	155	155	148	158	148	158
	E	174	174	174	184	184	177	187	177	187
55	N	155	155	155	165	165	157.6	167.6	157.6	167.6
	L	193	193	193	203	203	195.6	205.6	195.6	205.6
	E	210	210	210	220	220	212.6	222.6	212.6	222.6

4-7 Lubrication System

(1) Lubrication System (LS)

Lubrication system (LS) laminates lubricant on the runway surface. It creates oil film throughout the rolling route to ensure the rollers are properly lubricated. Unlike the previous lubrication loop that just delivers the lubricant to the rollers, the lubrication system together with the pumping system ensures the lubrication reliability.

◎ Pay attention that if the viscosity of the lubrication oil is not within 100 to 400 cSt, the lubrication effect may be not as expected

◎ Lubrication volume can be appropriately adjusted when lubrication system (LS) is integrated.

◎ Grease nipple are not attached when lubrication system (LS) is integrated. Please contact our sales staff if grease nipples are required.

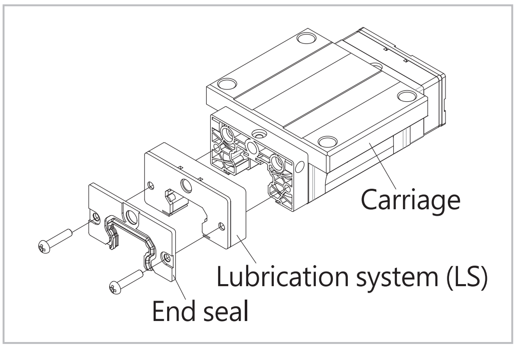


Fig. 4-24

(2) Specifications of Lubrication System (LS)

Table 4-8 Specifications and sizes of LS

Carriage size	D(mm)	V(cm^3)
15	10.3	2.0
20	10.3	2.5
25	10.3	3.0
30	10.3	5.5
35	10.5	8.5
45	13.0	15.0
55	13.0	22.5

D: Lubrication system (LS) V: Oil storage capacity

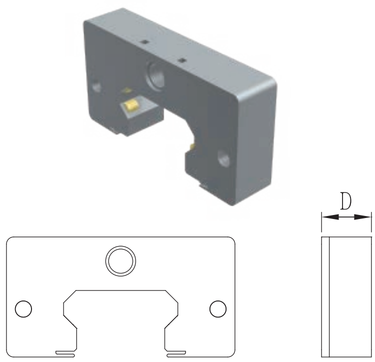


Fig. 4-25

(3) Lubrication System (LS)

Long-lasting lubrication: It has been experimented that there would be residual oil after 1,500km of travel if recommended viscosity oil was applied. Excess oil in the runway will be recycled by the capillary fiber in LS.

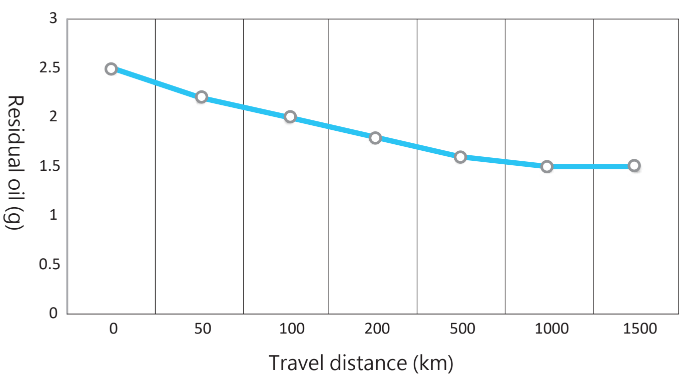


Fig. 4-26

Table 4-9 Durability of LS

Travel distance (km)	0km	50km	100km	200km	500km	1000km	1500km
Residual oil (g)	2.5g	2.2g	2.0g	1.8g	1.6g	1.5g	1.5g

※ Carriage BG15 integrated with LS would still maintain the lubrication performance after 1,500km of travel. If operated in ideal conditions, it would last over 3,000km.

(4) System Compositions

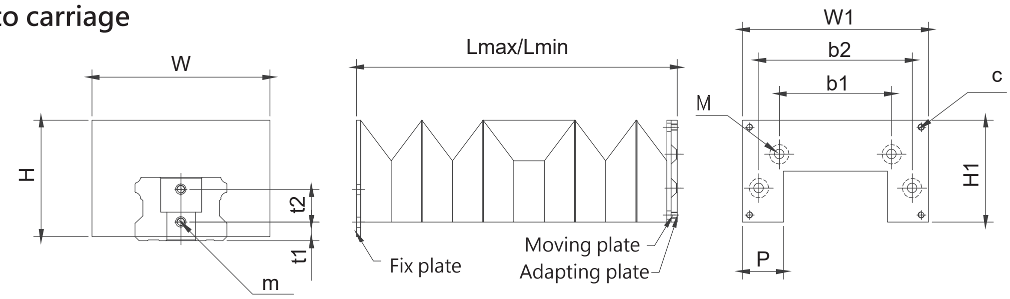
All lubrication systems (LS) consist of 4 kinds of components in table 4-10.

Table 4-10 LS compositions

Composition	Quantity
Lubrication System (LS)	4
Lubrication System (LS) cover	1
Lubrication System (LS) housing	1
Lubrication System (LS) felt	2

4-8 Bellows

Rail to carriage



Carriage to carriage

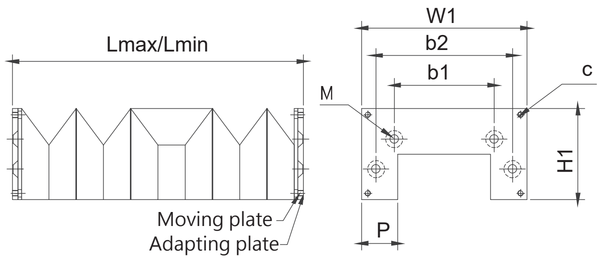


Fig. 4-27

L max: max. extended length

L min: min. retreated length

ST(stroke) = max. extended length(Lmax) - min. retreated length(Lmin)

Table 4-11 Bellows specifications and sizes

unit: mm

Carriage size	Adapting plate dimensions (mm)									Screws and bores		
	W	H	W1	H1	P	b1	b2	t1	t2	M(remark)	m	c
15	36	24	38	20.5	10	18.4	27	3	7.5	M2.5x12L	M3x6L	M3x5L
20	42	27.5	44	23	10	24.6	34.5	3.7	10	M3x12L	M3x6L	M3x5L
25	48	30	48	28	10	28	40.2	6	10	M3x14L	M3x6L	M3x5L
30	70	38	62	34	15	34	50.5	6.8	12	M3x16L	M4x8L	M3x5L
35	70	43	72	40	15	43	60	9	12	M4x18L	M4x8L	M3x5L
45	87	57	91	50	20	55	75	9.1	16	M4x18L	M4x8L	M3x5L
55	100	60	104	55	20	64	88	15	16	M4x25L	M4x8L	M3x5L

remark: countersunk flat heat screws must be used for M

Table 4-12 Bellows strokes

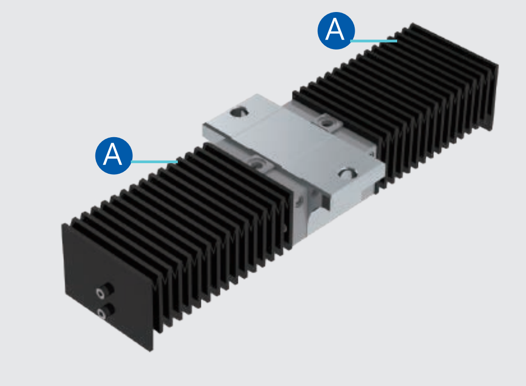
unit: mm

Lmax(mm)	500	800	1000	1200	1500
Lmin(mm)	160	235	285	335	410

For other specifications, please inquire by case.

Photos of bellows

Rail to carriage



Carriage to carriage

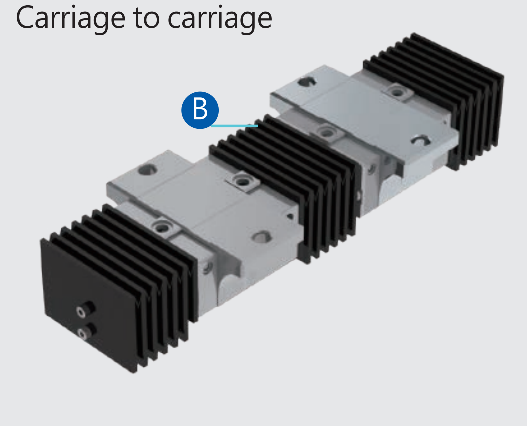


Fig. 4-28

Bellows product codes

BGC — 15 — A — 01000 — 00285

Carriage type
BGC: Cage type
BGX: Non-cage type

Carriage size:
15, 20, 25, 30, 35, 45, 55

Fixing type:
A: Rail to carriage **B:** Carriage to carriage

Max. extended length (Lmax)

Min. retreated length (Lmin)

4-9 Cover Strip

(1) Purpose of Cover Strip

The cover strip covers the bore cap pit and protects the carriage from damages by dust accumulated in the pits. A simple metal strip adhesive to the rail will achieve this purpose. All types of cover strips consist of the components in the figure below

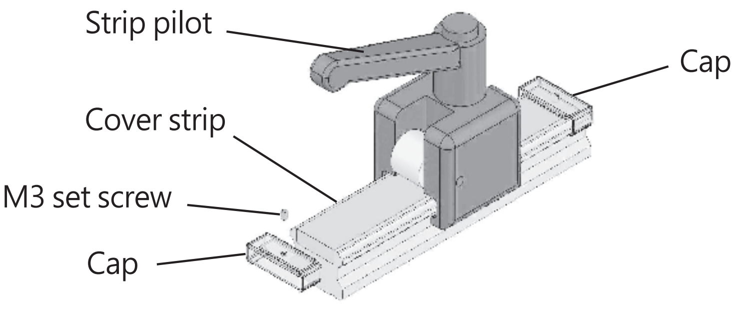
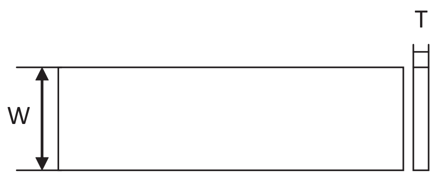


Fig. 4-29

(2) Cover Strip Sizes

Table 4-13 Cover strip sizes

Carriage size	Width (mm)	Thickness (mm)
15	10	0.3 (including adhesive)
20	11	0.3 (including adhesive)
25	13	0.3 (including adhesive)
30	16	0.3 (including adhesive)
35	18	0.3 (including adhesive)
45	27	0.3 (including adhesive)
55	29	0.3 (including adhesive)



(3) Cover Strip Compositions

1. Cover strip box: All cover strips are packed with the same size box. As each type cover strip varies in size, they are then secured by paper stuff in the boxes.
2. Strip pilot: To locate the cover strip accurately in the middle throughout the rail.
3. Cap: To secure the steel bands at rail ends so the strip would not come off.

(4) Cautions

Before attaching the steel band, clean up the rail surface with alcohol. Be sure the bores are capped and the rail is clean and free of oil, and then put the cover strip on.

1. Be sure the rail top is free of oil and stains.
2. Be sure the ambient temperature is within 20~40°C, or the result is not guaranteed.
3. Keep hands off the attaching surface to assure the best attaching result.
4. Shelf life of cover strip is 6 months.

(5) Cover Strip Attaching Steps

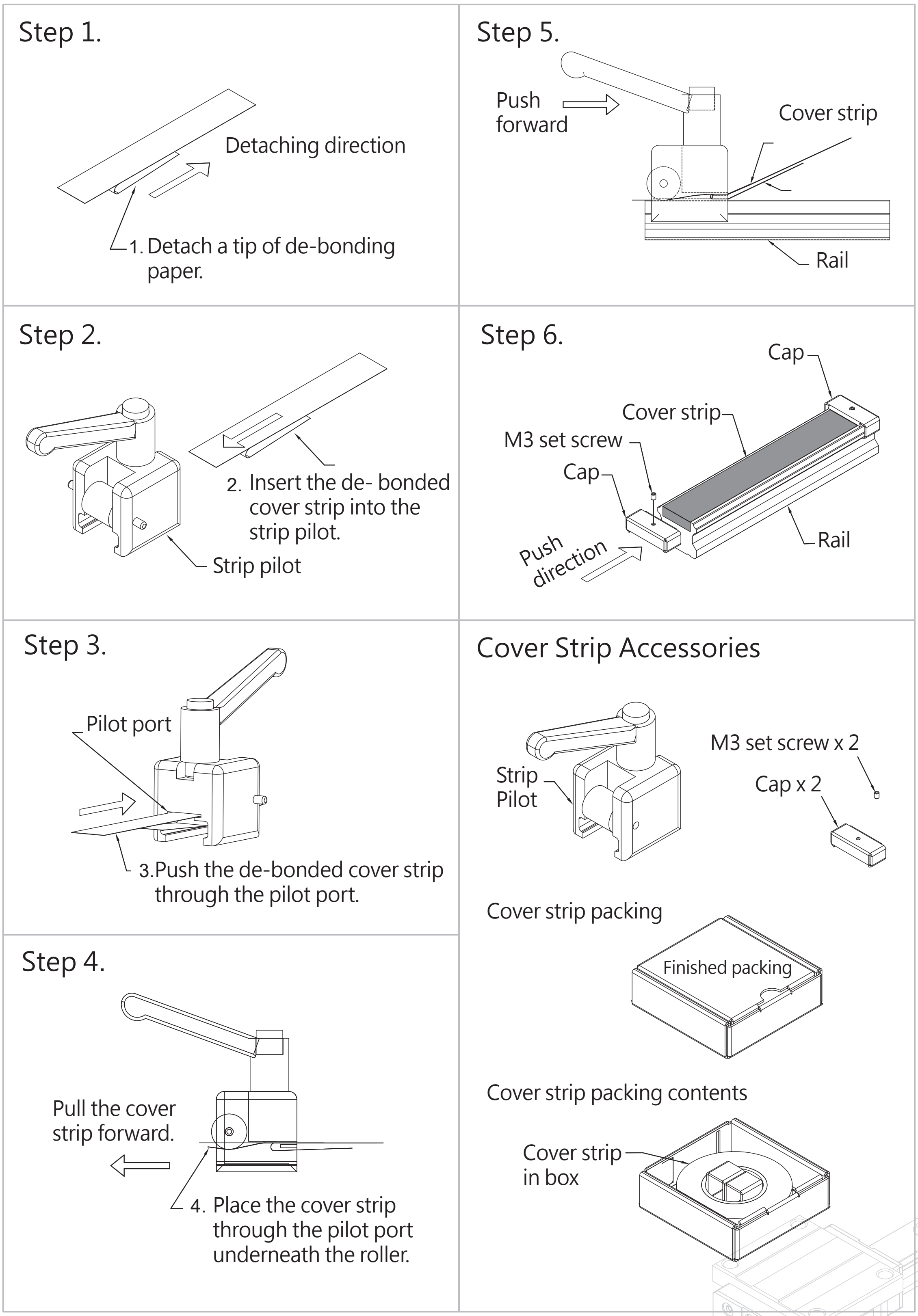


Fig. 4-30

4-10 BGX/BGC Specifications

BGX/BGC Specifications (S-B)

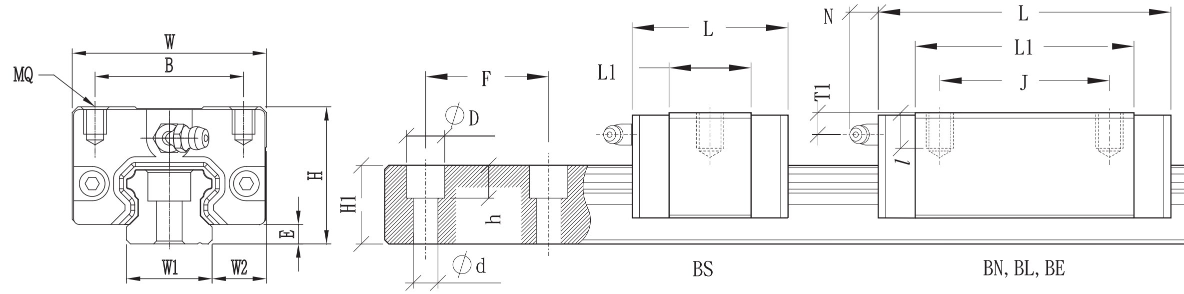


Fig. 4-31

Type	Overall dimensions (mm)				Carriage dimensions (mm)									Rail dimensions (mm)						Basic static load rating (kN)				Basic static moment (kN-m)			Carriage	Rail
	H	W	W2	E	L	B	J	MQ	l	L1	Oil H	T1	N	W1	H1	F	d	D	h	C-BGX	C-BGC	C0-BGX	C0-BGC	M_X	M_Y	M_Z	kg	kg/m
S15BS	24	34	9.5	3.3	40.6	26		M4	4.8	22.2	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	6.9	5.7	10.8	9.8	0.068	0.032	0.032	0.10	1.28
S15BN	24	34	9.5	3.3	58.6	26	26	M4	4.8	40.2	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	13.0	11.5	21.6	19.6	0.136	0.117	0.117	0.17	1.28
S15BL	24	34	9.5	3.3	66.1	26	26	M4	4.8	47.7	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	14.1	13.9	26.1	23.7	0.164	0.169	0.169	0.18	1.28
S20BS	28	42	11.0	4.5	49.1	32		M5	5.5	27.5	M6X1.0	5.1	(12.3)	20	16.3	60	6.0	9.5	8.5	11.1	9.1	17.3	15.7	0.146	0.064	0.064	0.17	2.15
S20BN	28	42	11.0	4.5	70.1	32	32	M5	5.5	48.5	M6X1.0	5.1	(12.3)	20	16.3	60	6.0	9.5	8.5	21.5	17.7	33.6	30.5	0.285	0.220	0.220	0.26	2.15
S25BS	33	48	12.5	5.8	54.0	35		M6	6.8	32.3	M6X1.0	7.2	(12.2)	23	19.2	60	7.0	11.0	9.0	15.5	12.7	23.1	21	0.225	0.101	0.101	0.21	2.88
S25BN	33	48	12.5	5.8	79.2	35	35	M6	6.8	57.5	M6X1.0	7.2	(12.2)	23	19.2	60	7.0	11.0	9.0	28.1	24.8	45.2	41.1	0.440	0.352	0.352	0.38	2.88
X25BN	36	48	12.5	5.8	79.2	35	35	M6	9.0	57.5	M6X1.0	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	28.1	24.8	45.2	41.1	0.440	0.352	0.352	0.40	2.88
X25BL	36	48	12.5	5.8	93.9	35	35	M6	9.0	72.2	M6X1.0	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	33.7	31.9	58.1	52.8	0.566	0.568	0.568	0.54	2.88
X25BE	36	48	12.5	5.8	108.6	35	50	M6	9.0	86.9	M6X1.0	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	38.0	36.0	69.6	63.3	0.679	0.819	0.819	0.67	2.88
S30BS	42	60	16.0	7.0	64.2	40		M8	10.0	37.2	M6X1.0	10	(11.7)	28	22.8	80	9.0	14.0	12.0	22.1	18.2	29.7	27	0.350	0.150	0.150	0.50	4.45
S30BN	42	60	16.0	7.0	94.8	40	40	M8	10.0	67.8	M6X1.0	10	(11.7)	28	22.8	80	9.0	14.0	12.0	41.6	36.7	60.1	54.6	0.706	0.551	0.551	0.80	4.45
S30BL	42	60	16.0	7.0	105.0	40	40	M8	10.0	78.0	M6X1.0	10	(11.7)	28	22.8	80	9.0	14.0	12.0	48.1	47.5	77.8	70.7	0.915	0.821	0.821	0.94	4.45
S30BE	42	60	16.0	7.0	130.5	40	60	M8	10.0	103.5	M6X1.0	10	(11.7)	28	22.8	80	9.0	14.0	12.0	57.9	52.9	95.4	86.7	1.122	1.336	1.336	1.16	4.45
S35BS	48	70	18.0	7.5	75.5	50		M8	10.0	44.5	M6X1.0	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	31.8	26.2	44.8	40.7	0.643	0.269	0.269	0.80	6.25
S35BN	48	70	18.0	7.5	111.5	50	50	M8	10.0	80.5	M6X1.0	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	59.4	52.3	89.2	81.1	1.282	0.972	0.972	1.20	6.25
S35BL	48	70	18.0	7.5	123.5	50	50	M8	10.0	92.5	M6X1.0	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	68.8	65.4	111.5	101.4	1.602	1.396	1.396	1.40	6.25
S35BE	48	70	18.0	7.5	153.5	50	72	M8	10.0	122.5	M6X1.0	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	81.6	71.9	137.8	125.3	1.981	2.286	2.286	1.84	6.25
S45BN	60	86	20.5	8.9	129.0	60	60	M10	15.5	94.0	M8X1.25	14.4	(10.8)	45	31.1	105	14.0	20.0	17.0	81.2	71.6	119.8	108.9	2.300	1.524	1.524	1.64	9.60
S45BL	60	86	20.5	8.9	145.0	60	60	M10	15.5	110.0	M8X1.25	14.4	(10.8)	45	31.1	105	14.0	20.0	17.0	89.7	85.1	142.5	129.5	2.736	2.122	2.122	1.93	9.60
S45BE	60	86	20.5	8.9	174.0	60	80	M10	15.5	139.0	M8X1.25	14.4	(10.8)	45	31.1	105	14.0	20.0	17.0	103.6	98.4	179.6	163.3	3.449	3.379	3.379	2.42	9.60
S55BN	70	100	23.5	12.7	155.0	75	75	M12	18.0	116.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	104.7	86.2	146.7	133.4	3.303	2.304	2.304	2.67	13.80
S55BL	70	100	23.5	12.7	193.0	75	75	M12	18.0	154.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	131.9	116.3	196.8	178.9	4.428	4.101	4.101	3.57	13.80
S55BE	70	100	23.5	12.7	210.0	75	95	M12	18.0	171.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	166.0	157.7	279.0	253.6	6.279	6.458	6.458	3.97	13.80

BGX/BGC Specifications (H-F)(S-F)

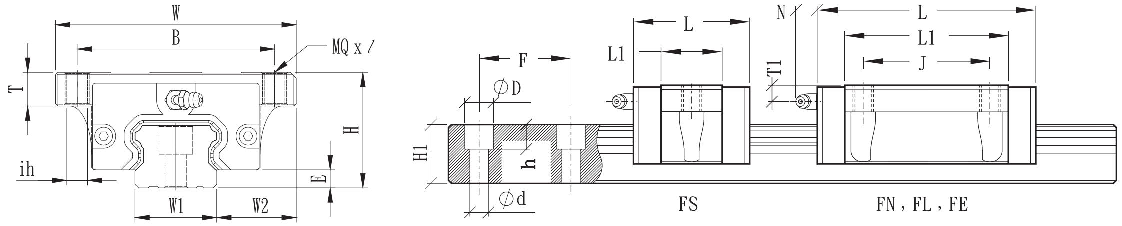


Fig. 4-32

◎: Please contact our sales staff for your inquiry.

Type	Overall dimensions (mm)				Carriage dimensions (mm)											Rail dimensions (mm)						Basic static load rating (kN)				Basic static moment (kN-m)			Carriage	Rail
	H	W	W2	E	L	B	J	MQ	ℓ	ih	T	L1	Oil H	T1	N	W1	H1	F	d	D	h	C-BGX	C-BGC	C0-BGX	C0-BGC	M_X	M_Y	M_Z	kg	kg/m
H15FN	24	47	16.0	3.3	58.6	38	30	M5	7	4.4	7.5	40.2	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	13.0	11.5	21.6	19.6	0.136	0.117	0.117	0.21	1.28
H15FL	24	47	16.0	3.3	66.1	38	30	M5	7	4.4	7.5	47.7	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	14.1	13.9	26.1	23.7	0.164	0.169	0.169	0.23	1.28
◎ S15FS	24	52	18.5	3.3	40.6	41		M5	7	4.4	7.5	22.2	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	6.9	5.7	10.8	9.8	0.068	0.032	0.032	0.12	1.28
S15FN	24	52	18.5	3.3	58.6	41	26	M5	7	4.4	7.5	40.2	M4X0.7	5.5	(5.7)	15	13.0	60	4.5	7.5	5.5	13.0	11.5	21.6	19.6	0.136	0.117	0.117	0.19	1.28
H20FN	30	63	21.5	4.5	70.1	53	40	M6	8.5	5.4	9.0	48.5	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	21.5	17.7	33.6	30.5	0.285	0.220	0.220	0.40	2.15
H20FL	30	63	21.5	4.5	82.9	53	40	M6	8.5	5.4	9.0	61.3	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	26.0	23.0	43.5	39.5	0.369	0.361	0.361	0.46	2.15
H20FE	30	63	21.5	4.5	98.1	53	40	M6	8.5	5.4	9.0	76.5	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	30.9	27.3	53.8	48.9	0.456	0.557	0.557	0.61	2.15
◎ S20FS	28	59	19.5	4.5	49.1	49		M6	6.5	5.4	7.0	27.5	M6X1	5.1	(12.3)	20	16.3	60	6.0	9.5	8.5	11.1	9.1	17.3	15.7	0.225	0.101	0.101	0.18	2.15
S20FN	28	59	19.5	4.5	70.1	49	32	M6	6.5	5.4	7.0	48.5	M6X1	5.1	(12.3)	20	16.3	60	6.0	9.5	8.5	21.5	17.7	33.6	30.5	0.285	0.220	0.220	0.31	2.15
H25FN	36	70	23.5	5.8	79.2	57	45	M8	9.6	6.8	10.1	57.5	M6X1	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	28.1	24.8	45.2	41.1	0.440	0.352	0.352	0.57	2.88
H25FL	36	70	23.5	5.8	93.9	57	45	M8	9.6	6.8	10.1	72.2	M6X1	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	33.7	31.9	58.1	52.8	0.566	0.568	0.568	0.72	2.88
H25FE	36	70	23.5	5.8	108.6	57	45	M8	9.6	6.8	10.1	86.9	M6X1	10.2	(12.2)	23	19.2	60	7.0	11.0	9.0	38.0	36.0	69.6	63.3	0.679	0.819	0.819	0.89	2.88
◎ S25FS	33	73	25.0	5.8	54.0	60		M8	6.6	6.8	7.1	32.3	M6X1	7.2	(12.3)	23	19.2	60	7.0	11.0	9.0	15.5	12.7	23.1	21.0	0.225	0.101	0.101	0.33	2.88
S25FN	33	73	25.0	5.8	79.2	60	35	M8	6.6	6.8	7.1	57.5	M6X1	7.2	(12.3)	23	19.2	60	7.0	11.0	9.0	28.1	24.8	45.2	41.1	0.440	0.352	0.352	0.50	2.88
◎ H30FS	42	90	31.0	7.0	64.2	72		M10	11.5	8.6	12.0	37.2	M6X1	10	(11.7)	28	22.8	80	9.0	14.0	12.0	22.1	18.2	29.7	27.0	0.350	0.150	0.150	0.80	4.45
H30FN	42	90	31.0	7.0	94.8	72	52	M10	11.5	8.6	12.0	67.8	M6X1	10	(11.7)	28	22.8	80	9.0	14.0	12.0	41.6	36.7	60.1	54.6	0.706	0.551	0.551	1.10	4.45
H30FL	42	90	31.0	7.0	105.0	72	52	M10	11.5	8.6	12.0	78.0	M6X1	10	(11.7)	28	22.8	80	9.0	14.0	12.0	48.1	47.5	77.8	70.7	0.915	0.821	0.821	1.34	4.45
H30FE	42	90	31.0	7.0	130.5	72	52	M10	11.5	8.6	12.0	103.5	M6X1	10	(11.7)	28	22.8	80	9.0	14.0	12.0	57.9	52.9	95.4	86.7	1.122	1.336	1.336	1.66	4.45
◎ H35FS	48	100	33.0	7.5	75.5	82		M10	13.5	8.6	14.0	44.5	M6X1	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	31.8	26.2	44.8	40.7	0.643	0.269	0.269	1.00	6.25
H35FN	48	100	33.0	7.5	111.5	82	62	M10	13.5	8.6	14.0	80.5	M6X1	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	59.4	52.3	89.2	81.1	1.282	0.972	0.972	1.50	6.25
H35FL	48	100	33.0	7.5	123.5	82	62	M10	13.5	8.6	14.0	92.5	M6X1	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	68.8	65.4	111.5	101.4	1.602	1.396	1.396	1.90	6.25
H35FE	48	100	33.0	7.5	153.5	82	62	M10	13.5	8.6	14.0	122.5	M6X1	11.5	(11.5)	34	26.0	80	9.0	14.0	12.0	81.6	71.9	137.8	125.3	1.981	2.286	2.286	2.54	6.25
H45FL	60	120	37.5	8.9	145.0	100	80	M12	15.5	10.6	16.0	110.0	M8X1.25	14.4	(10.8)	45	31.1	105	14.0	20.0	17.0	89.7	85.1	142.5	129.5	2.736	2.122	2.122	2.68	9.60
H45FE	60	120	37.5	8.9	174.0	100	80	M12	15.5	10.6	16.0	139.0	M8X1.25	14.4	(10.8)	45	31.1	105	14.0	20.0	17.0	103.6	98.4	179.6	163.3	3.449	3.379	3.379	3.42	9.60
H55FN	70	140	43.5	12.7	155.0	116	95	M14	18.5	12.6	19.0	116.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	104.7	86.2	146.7	133.4	3.303	2.304	2.304	3.44	13.80
H55FL	70	140	43.5	12.7	193.0	116	95	M14	18.5	12.6	19.0	154.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	131.9	116.3	196.8	178.9	4.428	4.101	4.101	4.63	13.80
H55FE	70	140	43.5	12.7	210.0	116	95	M14	18.5	12.6	19.0	171.0	M8X1.25	14.0	(10.8)	53	38.0	120	16.0	23.0	20.0	166.0	157.7	279.0	253.6	6.279	6.458	6.458	5.16	13.80

BGX/BGC Specifications (H-B)

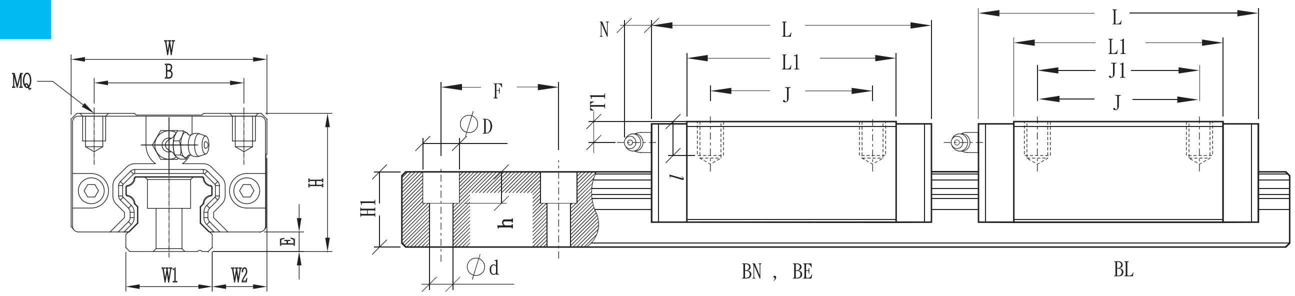


Fig. 4-33

※ BL : BGX → J1 ; BGC → J

Type	Overall dimensions (mm)				Carriage dimensions (mm)										Rail dimensions (mm)						Basic static load rating (kN)				Basic static moment (kN-m)			Carriage	Rail
	H	W	W2	E	L	B	J	J1	MQ	l	L1	Oil H	T1	N	W1	H1	F	d	D	h	C-BGX	C-BGC	C0-BGX	C0-BGC	M_X	M_Y	M_Z	kg	kg/m
H15BN	28	34	9.5	3.3	58.6	26	26		M4	6.0	40.2	M4X0.7	9.5	(5.7)	15	13.0	60	4.5	7.5	5.5	13.0	11.5	21.6	19.6	0.136	0.117	0.117	0.19	1.28
H20BN	30	44	12.0	4.5	70.1	32	36		M5	6.5	48.5	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	21.5	17.7	33.6	30.5	0.285	0.220	0.220	0.31	2.15
※ H20BL	30	44	12.0	4.5	82.9	32	36	50	M5	6.5	61.3	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	26.0	23.0	43.5	39.5	0.369	0.361	0.361	0.36	2.15
H20BE	30	44	12.0	4.5	98.1	32	50		M5	6.5	76.5	M6X1	7.1	(12.3)	20	16.3	60	6.0	9.5	8.5	30.9	27.3	53.8	48.9	0.456	0.557	0.557	0.47	2.15
H25BN	40	48	12.5	5.8	79.2	35	35		M6	9.0	57.5	M6X1	14.2	(12.2)	23	19.2	60	7.0	11.0	9.0	28.1	24.8	45.2	41.1	0.440	0.352	0.352	0.45	2.88
※ H25BL	40	48	12.5	5.8	93.9	35	35	50	M6	9.0	72.2	M6X1	14.2	(12.2)	23	19.2	60	7.0	11.0	9.0	33.7	31.9	58.1	52.8	0.566	0.568	0.568	0.66	2.88
H25BE	40	48	12.5	5.8	108.6	35	50		M6	9.0	86.9	M6X1	14.2	(12.2)	23	19.2	60	7.0	11.0	9.0	38.0	36.0	69.6	63.3	0.679	0.819	0.819	0.80	2.88
H30BN	45	60	16.0	7.0	94.8	40	40		M8	12.0	67.8	M6X1	13	(11.7)	28	22.8	80	9.0	14.0	12.0	41.6	36.7	60.1	54.6	0.706	0.551	0.551	0.91	4.45
※ H30BL	45	60	16.0	7.0	105.0	40	40	60	M8	12.0	78.0	M6X1	13	(11.7)	28	22.8	80	9.0	14.0	12.0	48.1	47.5	77.8	70.7	0.915	0.821	0.821	1.04	4.45
H30BE	45	60	16.0	7.0	130.5	40	60		M8	12.0	103.5	M6X1	13	(11.7)	28	22.8	80	9.0	14.0	12.0	57.9	52.9	95.4	86.7	1.122	1.336	1.336	1.36	4.45
H35BN	55	70	18.0	7.5	111.5	50	50		M8	12.0	80.5	M6X1	18.5	(11.5)	34	26.0	80	9.0	14.0	12.0	59.4	52.3	89.2	81.1	1.282	0.972	0.972	1.50	6.25
※ H35BL	55	70	18.0	7.5	123.5	50	50	72	M8	12.0	92.5	M6X1	18.5	(11.5)	34	26.0	80	9.0	14.0	12.0	68.8	65.4	111.5	101.4	1.602	1.396	1.396	1.80	6.25
H35BE	55	70	18.0	7.5	153.5	50	72		M8	12.0	122.5	M6X1	18.5	(11.5)	34	26.0	80	9.0	14.0	12.0	81.6	71.9	137.8	125.3	1.981	2.286	2.286	2.34	6.25
H45BN	70	86	20.5	8.9	129.0	60	60		M10	18.0	94.0	M8X1.25	24.4	(10.8)	45	31.1	105	14.0	20.0	17.0	81.2	71.6	119.8	108.9	2.300	1.524	1.524	2.28	9.60
※ H45BL	70	86	20.5	8.9	145.0	60	60	80	M10	18.0	110.0	M8X1.25	24.4	(10.8)	45	31.1	105	14.0	20.0	17.0	89.7	85.1	142.5	129.5	2.736	2.122	2.122	2.67	9.60
H45BE	70	86	20.5	8.9	174.0	60	80		M10	18.0	139.0	M8X1.25	24.4	(10.8)	45	31.1	105	14.0	20.0	17.0	103.6	98.4	179.6	163.3	3.449	3.379	3.379	3.35	9.60
H55BN	80	100	23.5	12.7	155.0	75	75		M12	22.0	116.0	M8X1.25	24.0	(10.8)	53	38.0	120	16.0	23.0	20.0	104.7	86.2	146.7	133.4	3.303	2.304	2.304	3.42	13.80
※ H55BL	80	100	23.5	12.7	193.0	75	75	95	M12	22.0	154.0	M8X1.25	24.0	(10.8)	53	38.0	120	16.0	23.0	20.0	131.9	116.3	196.8	178.9	4.428	4.101	4.101	4.57	13.80
H55BE	80	100	23.5	12.7	210.0	75	95		M12	22.0	171.0	M8X1.25	24.0	(10.8)	53	38.0	120	16.0	23.0	20.0	166.0	157.7	279.0	253.6	6.279	6.458	6.458	5.08	13.80

4-11 BGX/BGC Grease Nipple

When ordering the linear guides, please indicate the product type, mounting orientation and the filling direction. OME shall decide the appropriate grease nipple to be fitted on the linear guide.

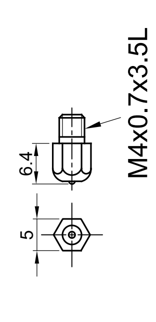
N G S 0 1

G: Grease Fitting
L: Elbow Fitting

S: 0°
X: 67.5°
V: 90°

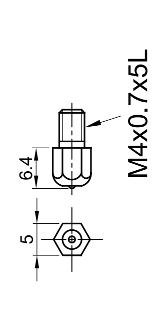
NGS01

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15	V		



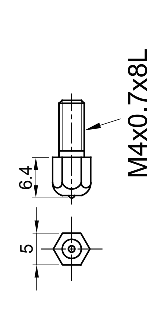
NGS02

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15		V	



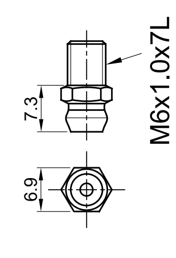
NGS03

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15			V



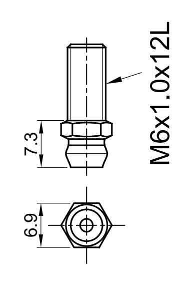
NGS05

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 / 25 / 30 / 35		V	



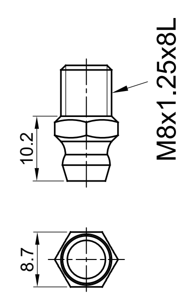
NGS06

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 / 25 / 30 / 35			V



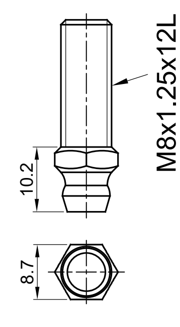
NGS07

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 / 55	V	V	



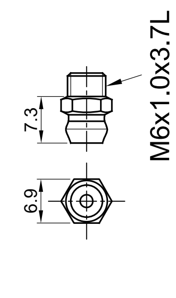
NGS08

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 / 55			V



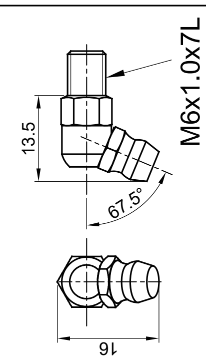
NGS19

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 / 25 / 30 / 35	V		



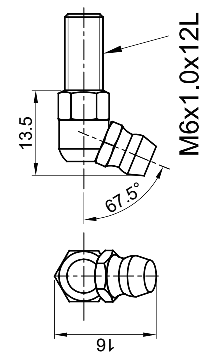
NGX02

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 / 25 / 30 / 35		V	



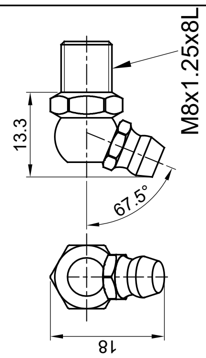
NGX03

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
30 / 35			V



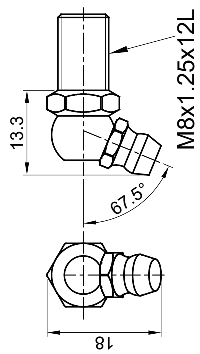
NGX04

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 / 55		V	



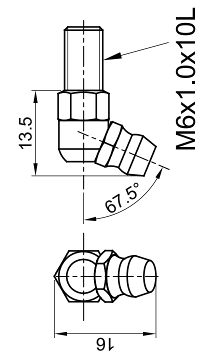
NGX05

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 / 55			V



NGX07

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 / 25			V

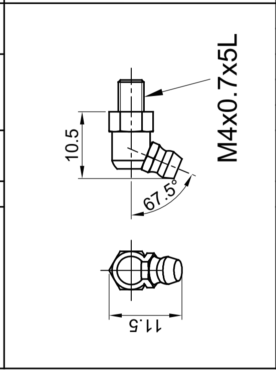


BGX/BGC Grease Nipple

When ordering the linear guides, please indicate the product type, mounting orientation and the filling direction. OME shall decide the appropriate grease nipple to be fitted on the linear guide.

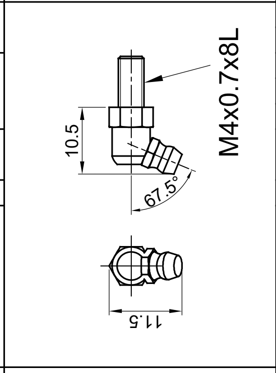
NGX14

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15		V	



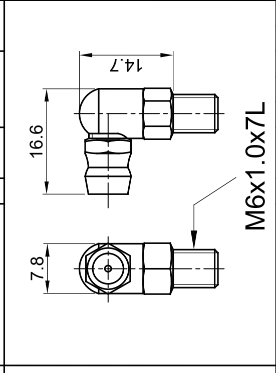
NGX15

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15			V



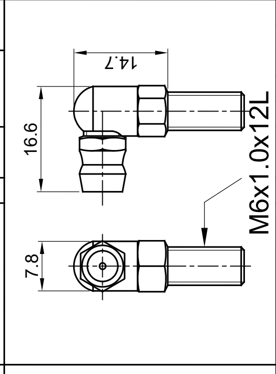
NGV02

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 25 30 35		V	



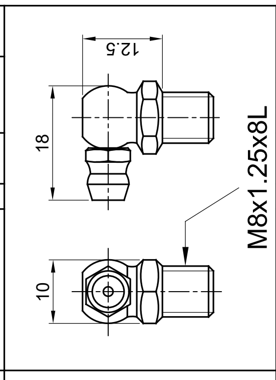
NGV03

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 25 30 35			V



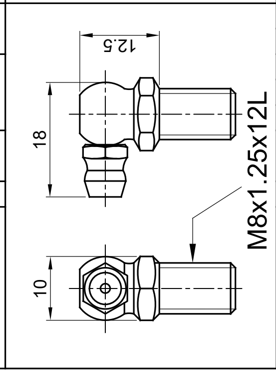
NGV04

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55		V	



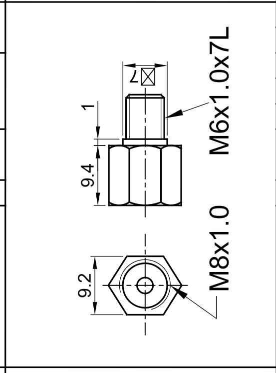
NGV05

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55			V



NLS02

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 25 30 35		V	



NLS03

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
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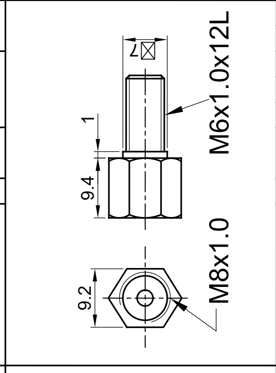
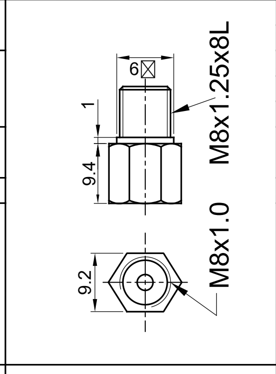


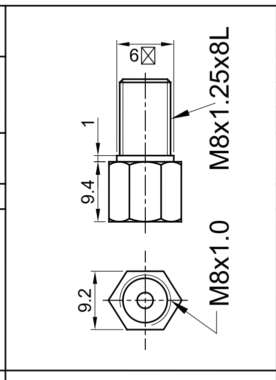
NLS04

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55		V	



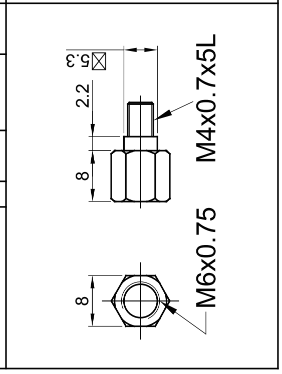
NLS05

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55			V



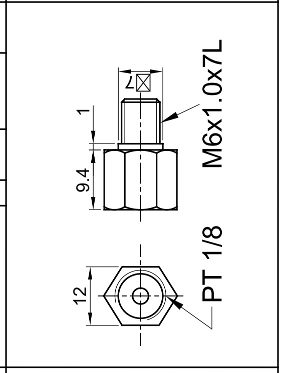
NLS19

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
15		V	



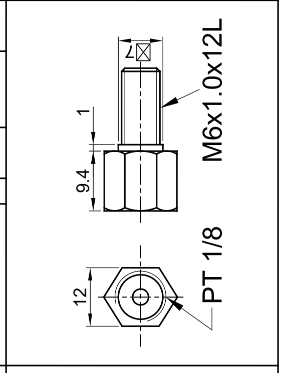
NLS14

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
20 25 30 35		V	



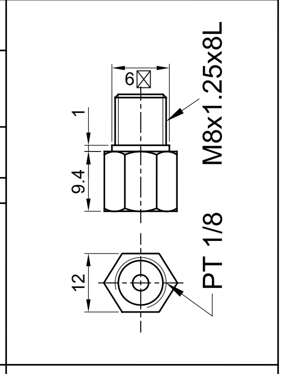
NLS15

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
25 30 35			V



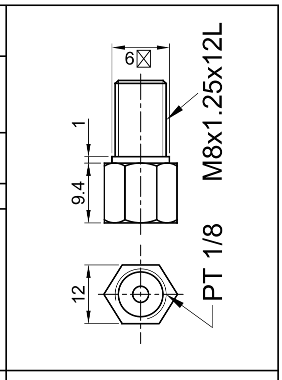
NLS16

Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55		V	



NLS17

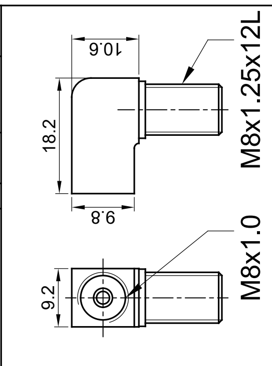
Ty.	SIDE	- - UU FF / SS ZZ	DD GG / EE KK
45 55			V

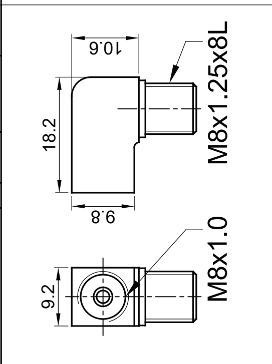


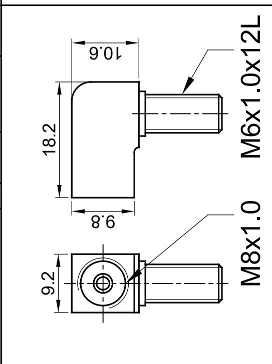
BGX/BGC Grease Nipple

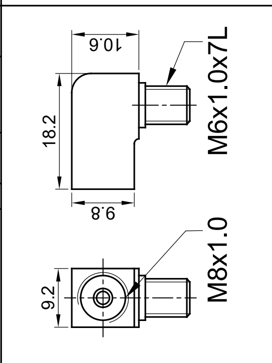
When ordering the linear guides, please indicate the product type, mounting orientation and the filling direction. OME shall decide the appropriate grease nipple to be fitted on the linear guide.

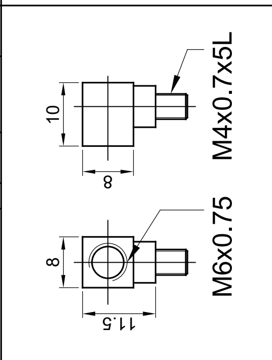
Type	Ty.	SIDE	-- UU FF SS ZZ	DD GG EE KK
NLV05	45, 55			V
NLV04	45, 55		V	
NLV03	20, 25, 30, 35			V
NLV02	20, 25, 30, 35		V	
NLV00	15		V	
NLV07	20, 25		V	
NLV17	45, 55			V
NLV16	45, 55		V	
NLV15	25, 30, 35			V
NLV14	20, 25, 30, 35		V	
NLV19	20, 30, 35		V	V
NLV08	45, 55		V	

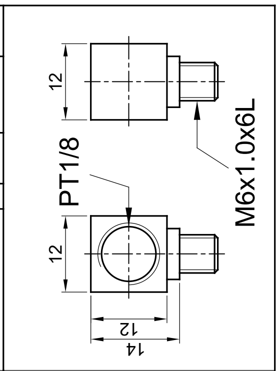
NLV05


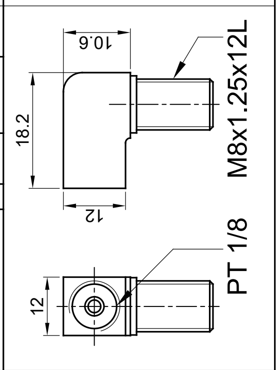
NLV04


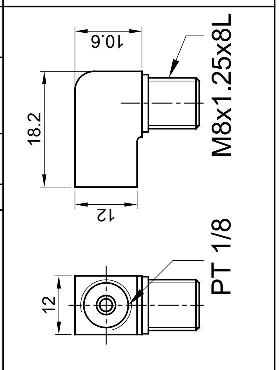
NLV03


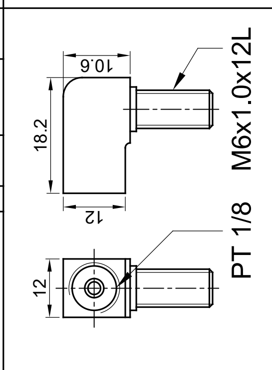
NLV02


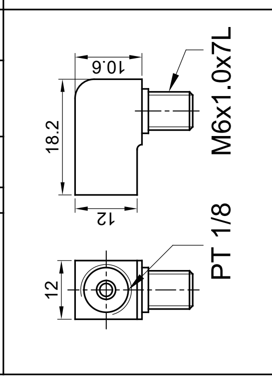
NLV00


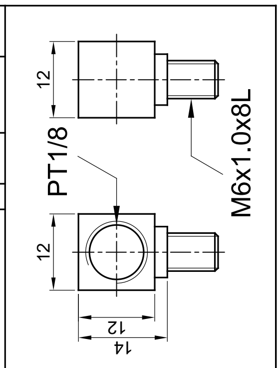
NLV07


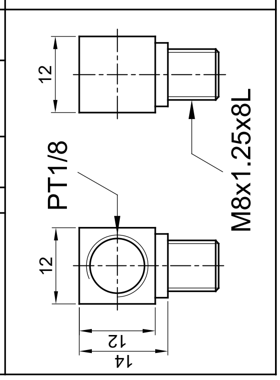
NLV17


NLV16


NLV15


NLV14


NLV19


NLV08


4-12 Lubrication Kit

Lubrication tool

With different size greaser spouts, grease gun is capable to fill lubrication to all types and sizes of linear guides.
Special accessories are available for smaller linear guides. Please select appropriate accessories according to the type and space.

Lubrication accessories

The STAF adaptor tube, with different accessories attached, may be applicable for refill in various ways.

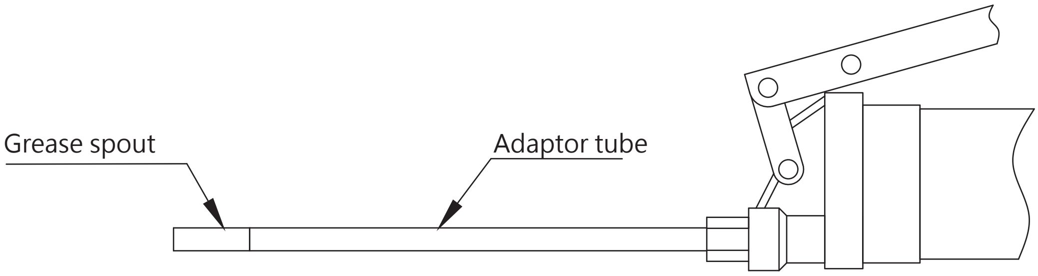


Table 4-14 Applicable lubrication accessories for each linear guide type

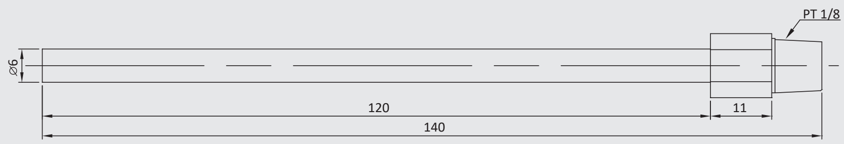
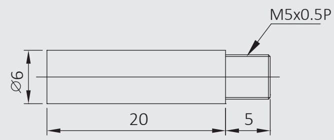
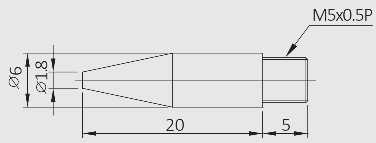
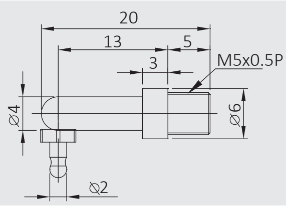
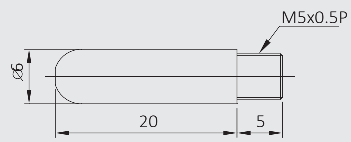
Type	Dimensions
E type (PT1/8-M5)	

Fig. 4-15 Grease spout

Type	Dimensions	Linear guide type
N type		BGX15、BGC15
P type		BGX15、BGC15
L type		MBX15、MBC15、MBX12、MBC12 MPHX12
R type		BGX15、BGC15

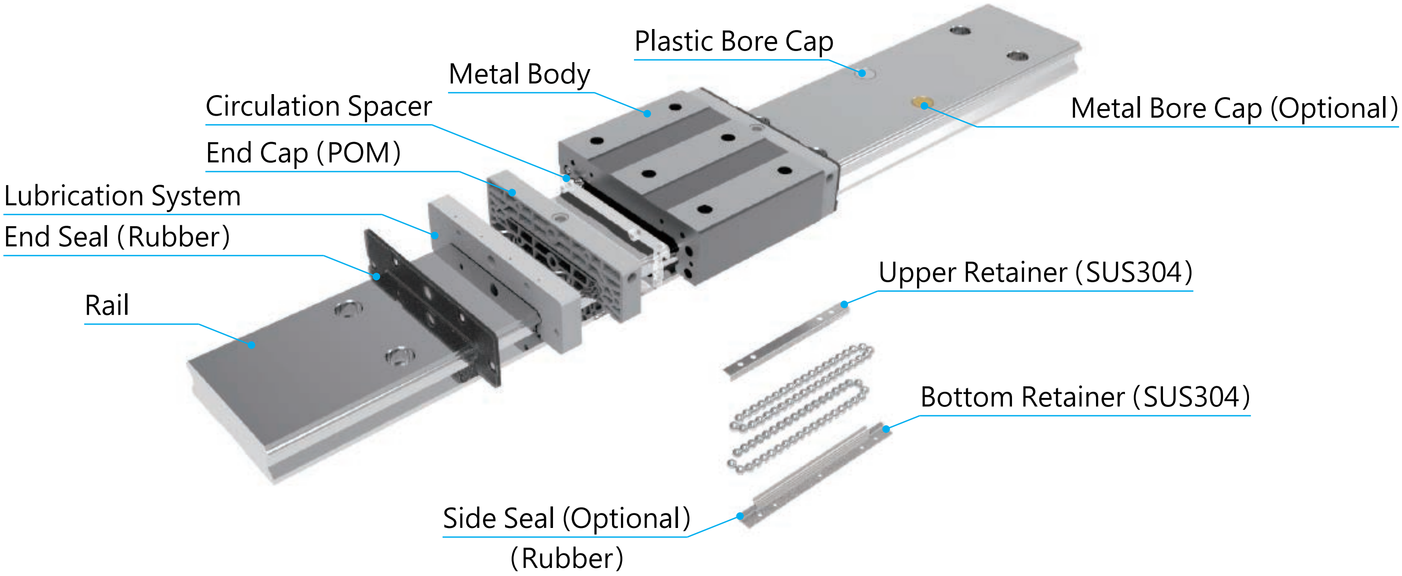
※ Grease guns for various grease are available from STAF, please contact our sales staff for inquiry.
※ Lubrication accessory kit includes adaptor tube and 4 grease spouts, but not the grease gun.

STAF LINEAR GUIDE

BGXW Series

5. STAF Linear Guides

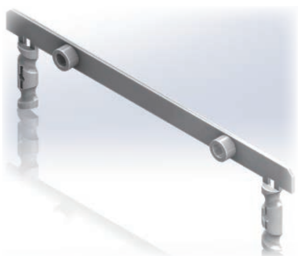
5-1 Product Features



5-2 Lubrication System

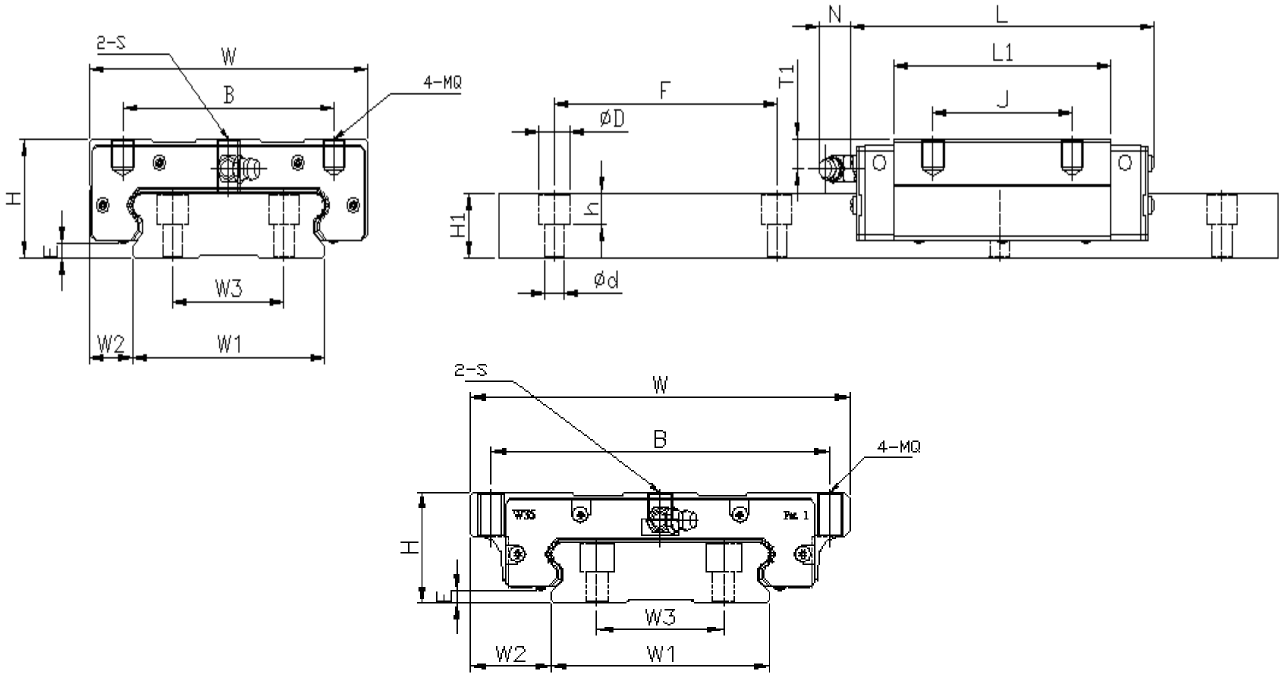
STAF Lubrication System continuously provides lubricant in appropriate amount onto the raceway. The amount of lubricant is controlled by capillary phenomenon, which would significantly extend the maintenance intervals and is Eco-friendly as surplus lubricant can be absorbed back and reused.

5-3 Circulation Spacer



The unique integrated design of circulation spacer provides stable motion performance and greatly enhances the lubrication capability (uniform grease distribution and no leakage).

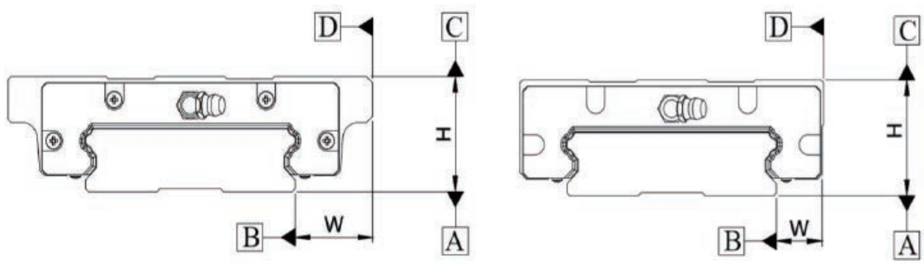
5-4 BGXW Specifications



Unit : mm

Type	Overall dimensions (mm)				Carriage dimensions (mm)								Rail dimensions (mm)							Basic static load rating (kN)		Basic static moment (kN-m)			Car-riage	Rail
	H	W	W2	E	L	B	J	MQ	L1	Oil H	T1	N	W1	W3	H1	F	d	D	h	C-BGXW	C0	Mx	My	Mz	kg	kg/m
BGXW-21BN	21	54	8.5	3	61.1	31	19	M5	40.6	M6×1	5.05	(13)	37	22	11	50	4.5	7.5	5.3	7.2	12.9	0.23	0.07	0.07	0.2	3
BGXW-21FN	21	68	15.5	3	61.1	60	29	M5	40.6	M6×1	5.05	(13)	37	22	11	50	4.5	7.5	5.3	7.2	12.9	0.23	0.07	0.07	0.26	3
BGXW-27BN	27	62	10	3	73.2	46	32	M6	51.8	M6×1	6	(13)	42	24	15	60	4.5	7.5	5.3	12.76	21.58	0.45	0.16	0.16	0.35	4.6
BGXW-27FN	27	80	19	3	73.2	70	40	M6	51.8	M6×1	6	(13)	42	24	15	60	4.5	7.5	5.3	12.76	21.58	0.45	0.16	0.16	0.52	4.6
BGXW-35BN	35	100	15.5	4	103.8	76	50	M8	78	M6×1	8.74	(13)	69	40	19	80	7	11	9	29.41	50.51	1.73	0.57	0.57	1.1	9.5
BGXW-35FN	35	120	25.5	4	103.8	107	60	M8	78	M6×1	8.74	(13)	69	40	19	80	7	11	9	29.41	50.51	1.73	0.57	0.57	1.45	9.5

5-5 Datum Planes



5-6 BGXW Product Coding

BGXW 35 B N − 2 − UU − L 500 − P − Z1 − II − R 1

Carriage type :
BGXW

Size :
21, 27, 35

Carriage design :
B : Block (squared)   F : Flange

Carriage length :
N : Standard

Number of carriages

Seal combination :
− − : End seal + Side seal
UU : End seal
DD : Double end seal + Side seal
ZZ : End seal + Side seal + Metal scraper
KK : Double end seal + Side seal + Metal scraper
A : Self-lubrication

Rail mounting type :
L : Counterbored holes (standard)   C : Bottom tapped holes

Rail length (mm)

Precision grades :
N : Normal   H : High   P : Precision   SP : Super precision   UP : Ultra precision

Preload grade :
Z0 : No preload   Z1 : Light preload   Z2 : Medium preload

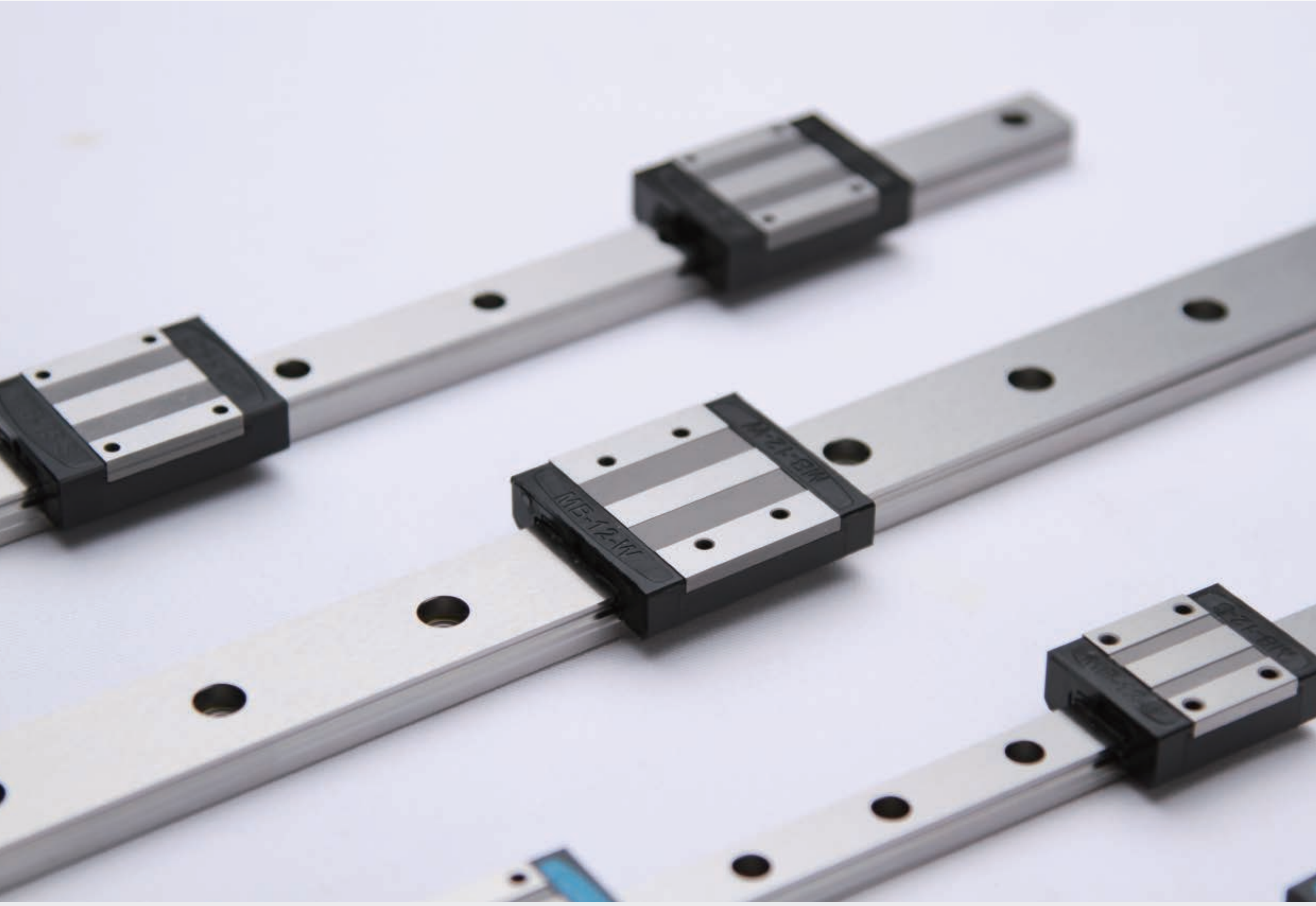
Number of parallel rails

Surface treatment (applicable for precision class N and H) :
− : Without coating   D : Trivalent chromium   K : Black chromium   N : Nickel   R : Fluoride chromium

Treated parts :
− : Without coating   (1) Rail only   (2) Carriage only   (3) Rail and carriage   (X) By order

STAF MINIATURE

MBX MBC Series/ MPH Series



STAF MINIATURE

MB Series

6. MB Series

6-1 MB Series

a. Structure:

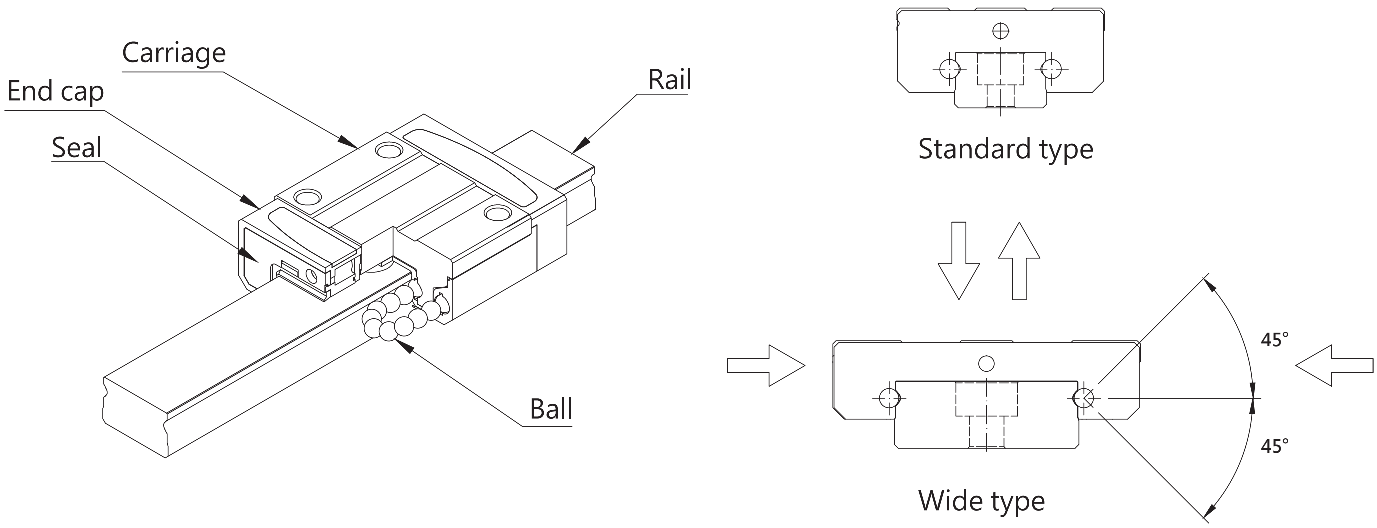


Fig. 5-1

b. Product Features:

MBX standard type and MBC cage type linear guides adopt 2 Gothic arc grooves contacting the steel balls at 45° upward and downward.
The advantages of this structure are more endurable to loads of all directions and moments and space saving. In addition, the friction in between steel balls is eliminated the MBC cage type and the lubrication oil is laminated homogeneously to enhances the lubrication effect. Hence, the MBC linear guides give better precision, smoothness, stability and reliability and so is more durable whatever mounting orientation.

c. Elastic Packing System to Ensure Precision:

Advantages:
a. Requires less room,
b. Injection molding parts requires less machining.

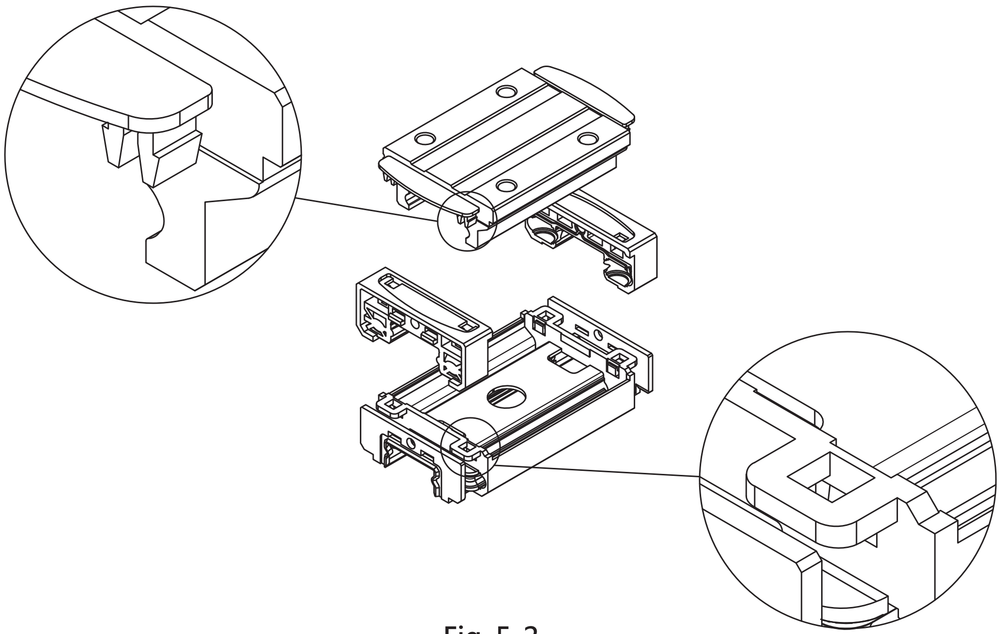


Fig. 5-2

Features:
In the elastic packing system, the plastic parts are assembled by snap-in. It is easier to assemble and is much more compact in size proving more rooms for the users. This structure eliminates the potential issues by screws, such as parts deformed due to screw fastening torque and screws fallen due to vibration. This makes the miniature more applicable, and the more compact size helps promotion of the linear guides.

d. Snap-in Dust-proof Components:

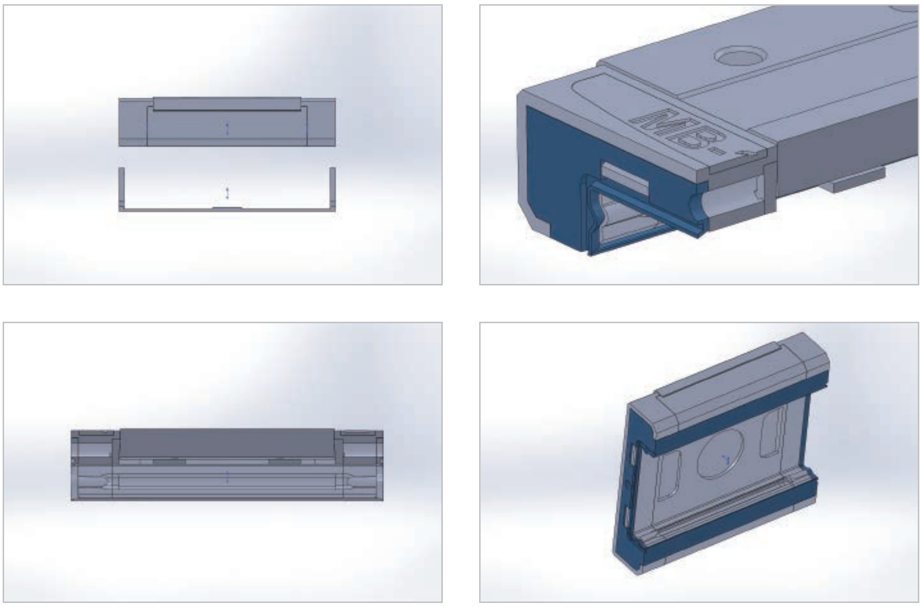


Fig. 5-3

Advantages:

a. Snap-in design makes smaller size possible.

b. Tightly secured end caps improve the rigidity.

c. The seal works as end seal plus side seal shields the foreign particles thoroughly.

Features:

The dust-proof parts are secured with snap-in structure, more room is saved. The screw free structure also gets rid of the problem of deformation due to screw fastening. The one-piece design integrated the end seal and the side seal, so the linear guide is protected at the both end and underneath even in the severe environment. The entire end cap is capsuled to enhance the rigidity.

e. Precision Class

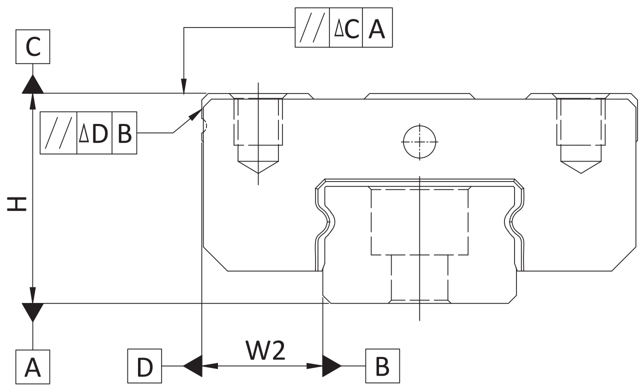


Fig. 5-4

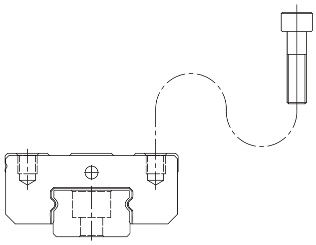
Table 5-1 Deviation of various precision class and rail length

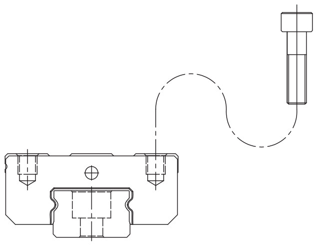
Rail Length (mm)		Running Parallelism Values (μm)		
from	to	N	H	P
-	50	12	6	2
50	80	13	7	3
80	125	14	8	3.5
125	200	15	9	4
200	250	16	10	5
250	315	17	11	5
315	400	18	11	6
400	500	19	12	6
500	630	20	13	7
630	800	22	14	8
800	1000	23	16	9
1000	1200	25	18	11
1200	1300	26	19	12
1300	1400	27	19	12
1400	1500	28	20	13
1500	1600	29	20	14
1600	1700	30	21	14
1700	1800	30	21	15
1800	1900	31	22	15
1900	2000	31	22	16

6-2 MBX Series

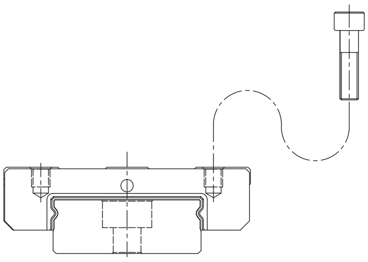
Standard Type

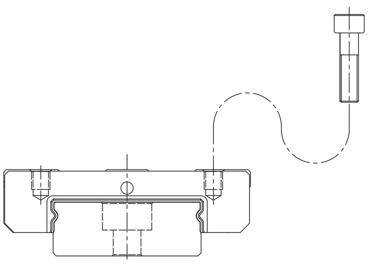
Standard Non-cage Type:

MBX...SN Type	
	Standard non-cage type, the basic dynamic load rating is smaller than that of MBC...SN.

MBX...SL Type	
	Standard non-cage type, the basic dynamic load rating is smaller than that of MBC...SL. Carriage shape is the same as MBX...SN, but is longer。

Wide Non-cage Type:

MBX...WN Type	
	Wide non-cage type, the basic dynamic load rating is smaller than that of MBC...WN.

MBX...WL Type	
	Wide non-cage type, the basic dynamic load rating is smaller than that of MBC...WL. Carriage shape is the same as MBX...WN, but is longer。

6-3 MBC Series Cage Type

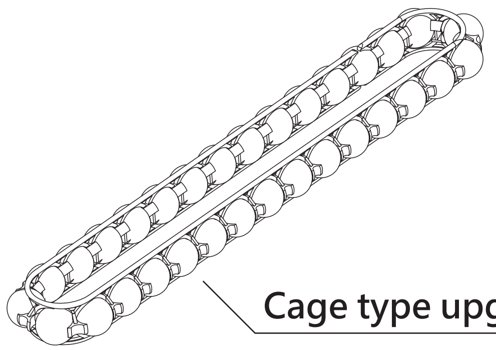
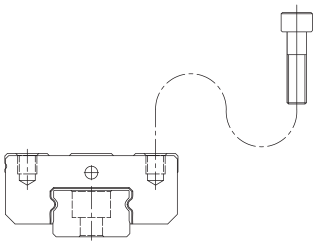


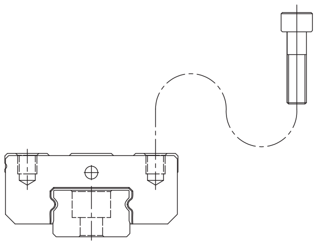
Fig. 5-5

Design Features:
Securing the steel balls with the cage avoids jamming in circulation. The steel balls being hold at 3 equally divided positions are secured in all directions. Even thickness design avoids the shrinkage in injection molding process. Grease distributed to the circulation runway gives the best lubrication result.

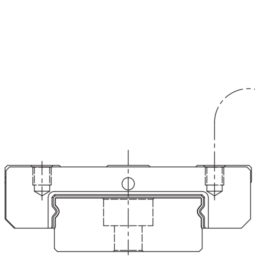
Advantages:
a. The cage secures the steel balls in position to give the muffing and lubrication results.
b. Even thickness design eliminates the chance of deforming in injection molding process,
c. Steel balls are secured with the cage to avoid jammed up in the circulation runway.
d. The retainer gives much better lubrication efficiency than other types of the same specification.
e. Steel balls secured by cage permits automatic assembly and production.
f. The retainer gives room to evenly distribute lubrication oil evenly and smoothly in the runway.

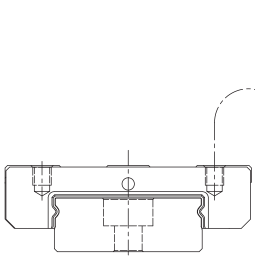
Standard Cage Type:

MBC...SN Type	
	Standard cage type, the basic dynamic load rating is larger than that of MBX...SN.

MBC...SL Type	
	Standard cage type, the basic dynamic load rating is smaller than that of MBX...SL. Carriage shape is the same as MBC...SN, but is longer.

Wide Cage Type:

MBC...WN Type	
	Wide cage type, the basic dynamic load rating is larger than that of MBX...WN.

MBC...WL Type	
	Wide cage type, the basic dynamic load rating is smaller than that of MBX...WL. Carriage shape is the same as MBC...WN, but is longer.

• MB Specifcations & Dimensions

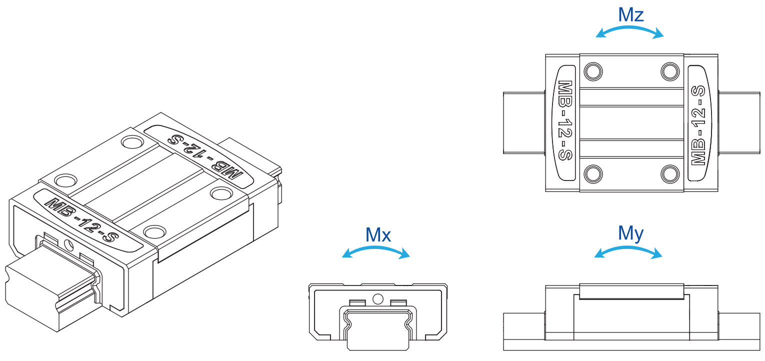


Fig. 5-6

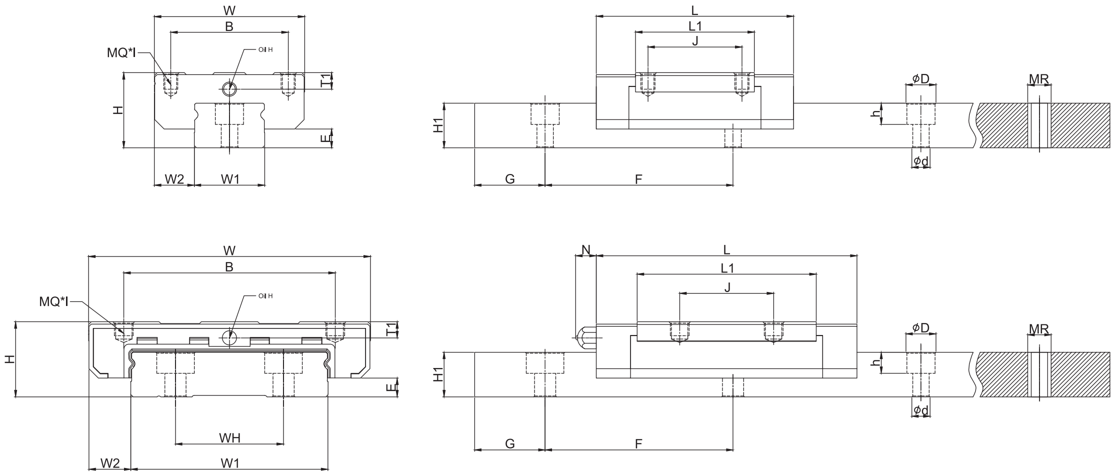


Fig. 5-7

Table 5-2 MBX Standard Type Sepcifcations & Dimensions

Type	Overall dimensions (mm)				Carriage dimensions (mm)									Rail dimensions (mm)										Basic static load rating (kN)		Basic static moment (kN-m)			Weight	
	H	W	W2	E	L	B	J	MQ	I	L1	Oil-H	T1	N	W1	H1	F	d	D	h	WH	G	MR	L max	C	C0	M_X	M_Y	M_Z	Carriage kg	Rail kg/m
MBXX09SN	10	20	5.5	2.2	30.8	15	10	M3	2.5	19.5	Ø1.5	2.4	-	9	6.05	20	3.5	6	3.3	-	7.5	M4	1000	2.01	2.26	10.35	8.34	8.34	0.014	0.39
MBXX09SL	10	20	5.5	2.2	40.5	15	16	M3	2.5	29.2	Ø1.5	2.4	-	9	6.05	20	3.5	6	3.3	-	7.5	M4	1000	2.75	3.24	14.71	16.67	16.67	0.020	0.39
MBXX12SN	13	27	7.5	2	34	20	15	M3	3.2	20.3	Ø2	3	-	12	7.25	25	3.5	6	4.25	-	10	M4	1000	3.29	3.43	22.48	11.67	11.67	0.029	0.63
MBXX12SL	13	27	7.5	2	47	20	20	M3	3.2	33.3	Ø2	3	-	12	7.25	25	3.5	6	4.25	-	10	M4	1000	4.41	5.15	33.34	27.46	27.46	0.047	0.63
MBXX15SN	16	32	8.5	4	42	25	20	M3	3.5	25.3	M3	3.5	5	15	9.5	40	3.5	6	4.5	-	15	M4	1000	5.44	5.59	39.23	25.50	25.50	0.047	1.05
MBXX15SL	16	32	8.5	4	59.8	25	25	M3	3.5	43.1	M3	3.5	5	15	9.5	40	3.5	6	4.5	-	15	M4	1000	7.16	7.85	54.92	53.94	53.94	0.078	1.05
MBXX09WN	12	30	6	3.4	39	21	12	M3	2.5	26.7	Ø1.5	2.3	-	18	7.5	30	3.5	6	4.5	-	10	M4	1000	2.60	3.24	30.60	14.71	14.71	0.030	0.98
MBXX09WL	12	30	6	3.4	51	23	24	M3	2.5	38.7	Ø1.5	2.3	-	18	7.5	30	3.5	6	4.5	-	10	M4	1000	3.33	4.22	40.21	26.97	26.97	0.042	0.98
MBXX12WN	14	40	8	3.8	44.5	28	15	M3	3.5	30.5	Ø2	3	-	24	8.7	40	4.5	8	4.5	-	15	M5	1000	4.32	5.20	64.73	25.69	25.69	0.052	1.53
MBXX12WL	14	40	8	3.8	59.1	28	28	M3	3.5	45.1	Ø2	3	-	24	8.7	40	4.5	8	4.5	-	15	M5	1000	5.59	6.91	86.30	47.56	47.56	0.076	1.53
MBXX15WN	16	60	9	4	55.5	45	20	M4	4.3	38.1	M3	3.5	5	42	9.5	40	4.5	8	4.5	23	15	M5	1000	7.26	8.38	171.62	50.02	50.02	0.111	2.97
MBXX15WL	16	60	9	4	74.7	45	35	M4	4.3	57.3	M3	3.5	5	42	9.5	40	4.5	8	4.5	23	15	M5	1000	8.92	10.79	220.66	95.62	95.62	0.165	2.97

• MB Specifcations & Dimensions

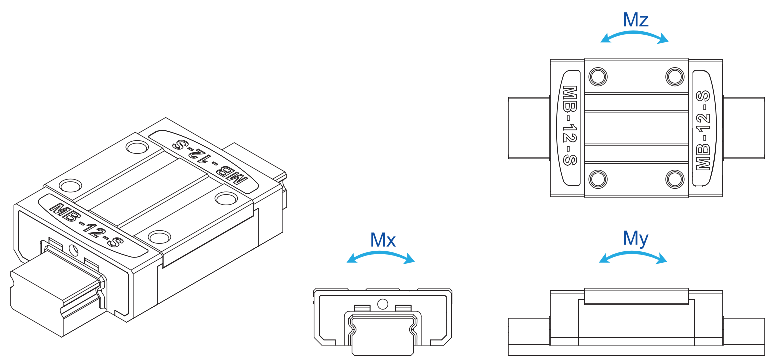


Fig. 5-6

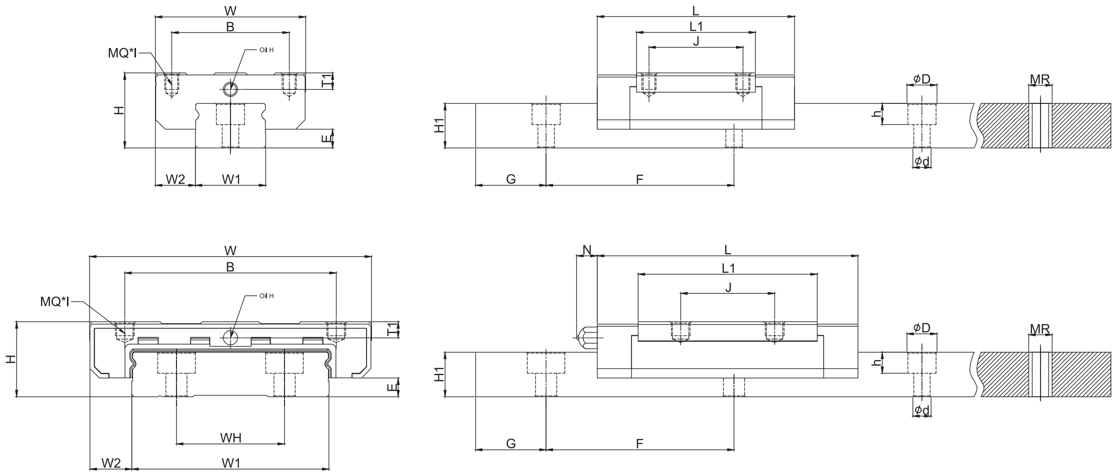
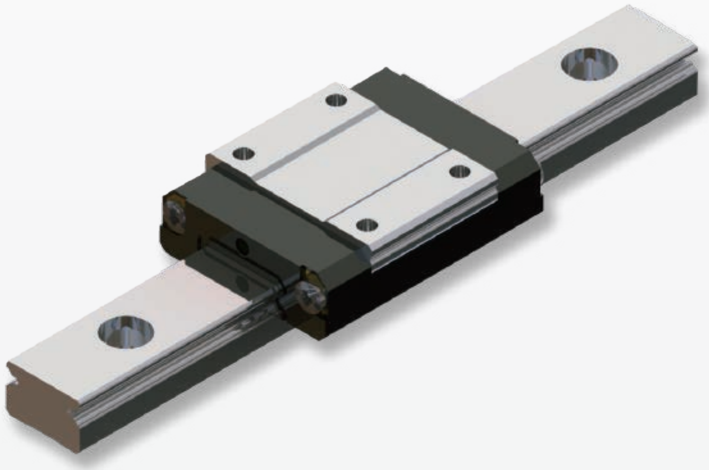


Fig. 5-7

Table 5-3 MBC Cage Type Sepcifcations & Dimensions

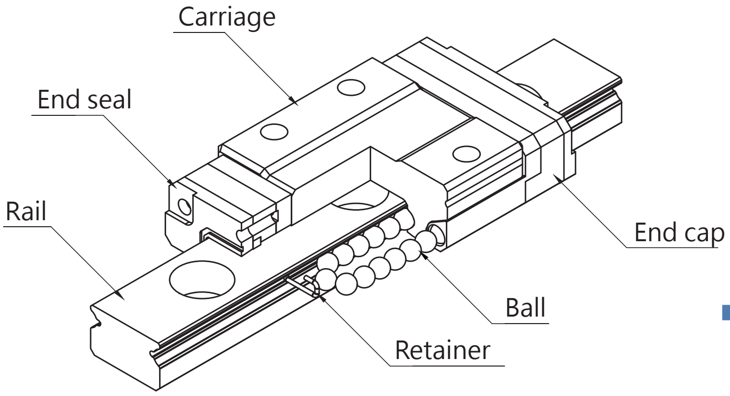
Type	Overall dimensions (mm)			Carriage dimensions (mm)									Rail dimensions (mm)										Basic static load rating (kN)		Basic static moment (kN-m)			Weight	
	H	W	W2	E	L	B	J	MQ	I	L1	Oil-H	T1	N	W1	H1	F	d	D	h	WH	G	MR	L max	C	C0	M_X	M_Y	M_Z	Carriage kg	Rail kg/m
MBCX09SN	10	20	5.5	2.2	30.8	15	10	M3	2.5	19.5	Ø1.5	2.4	-	9	6.05	20	3.5	6	3.3	-	7.5	M4	1000	1.90	2.18	8.19	5.00	5.00	0.014	0.39
MBCX09SL	10	20	5.5	2.2	40.5	15	16	M3	2.5	29.2	Ø1.5	2.4	-	9	6.05	20	3.5	6	3.3	-	7.5	M4	1000	2.60	2.99	11.01	10.00	10.00	0.020	0.39
MBCX12SN	13	27	7.5	2	34	20	15	M3	3.2	20.3	Ø2	3	-	12	7.25	25	3.5	6	4.25	-	10	M4	1000	2.70	3.10	16.07	7.00	7.00	0.029	0.63
MBCX12SL	13	27	7.5	2	47	20	20	M3	3.2	33.3	Ø2	3	-	12	7.25	25	3.5	6	4.25	-	10	M4	1000	3.90	4.48	25.36	14.68	14.68	0.047	0.63
MBCX15SN	16	32	8.5	4	42	25	20	M3	3.5	25.3	M3	3.5	5	15	9.5	40	3.5	6	4.5	-	15	M4	1000	3.60	4.14	28.21	15.30	15.30	0.047	1.05
MBCX15SL	16	32	8.5	4	59.8	25	25	M3	3.5	43.1	M3	3.5	5	15	9.5	40	3.5	6	4.5	-	15	M4	1000	5.40	6.21	40.64	32.36	32.36	0.078	1.05
MBCX09WN	12	30	6	3.4	39	21	12	M3	2.8	26.7	Ø1.5	2.3	-	18	7.5	30	3.5	6	4.5	-	10	M4	1000	2.40	2.76	22.52	8.83	8.83	0.030	0.98
MBCX09WL	12	30	6	3.4	51	23	24	M3	2.8	38.7	Ø1.5	2.3	-	18	7.5	30	3.5	6	4.5	-	10	M4	1000	3.10	3.56	30.94	16.18	16.18	0.042	0.98
MBCX12WN	14	40	8	3.8	44.5	28	15	M3	3.5	30.5	Ø2	3	-	24	8.7	40	4.5	8	4.5	-	15	M5	1000	3.70	4.25	48.00	15.41	15.41	0.052	1.53
MBCX12WL	14	40	8	3.8	59.1	28	28	M3	3.5	45.1	Ø2	3	-	24	8.7	40	4.5	8	4.5	-	15	M5	1000	3.90	4.48	64.93	28.54	28.54	0.076	1.53
MBCX15WN	16	60	9	4	55.5	45	20	M4	4.3	38.1	M3	3.5	5	42	9.5	40	4.5	8	4.5	23	15	M5	1000	4.90	5.63	126.52	30.01	30.01	0.111	2.97
MBCX15WL	16	60	9	4	74.7	45	35	M4	4.3	57.3	M3	3.5	5	42	9.5	40	4.5	8	4.5	23	15	M5	1000	6.60	7.59	165.94	57.37	57.37	0.165	2.97



STAF MINIATURE

MPH Series

6-4 MPH Series Retainer Type



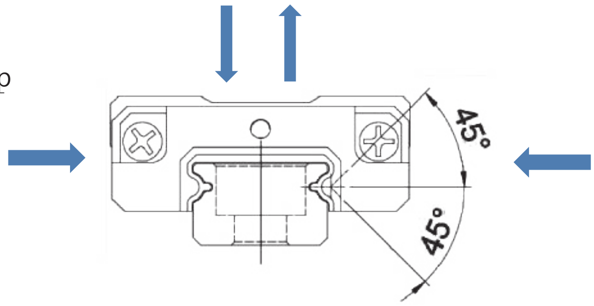


Fig. 5-8

• Features

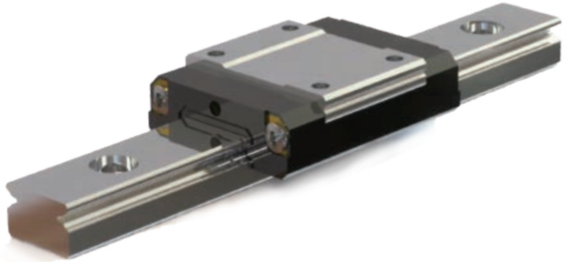
Balanced load in 4 directions:
With 2 Gothic arc grooves contacting the steel balls at 45°, the MPH linear guide is well balanced with load from all directions, and is very stable in many mounting orientations.

Steel Wire Retainer:
The retainer prevents the steel balls from falling off.

Smooth Movement:
The lubrication sponge and the retainer together practice high-precision smooth linear movement.

Compact Size:
MPH linear guide is most applicable to occasions with very limited space due to its compact size.

MPH Specifications & Dimensions



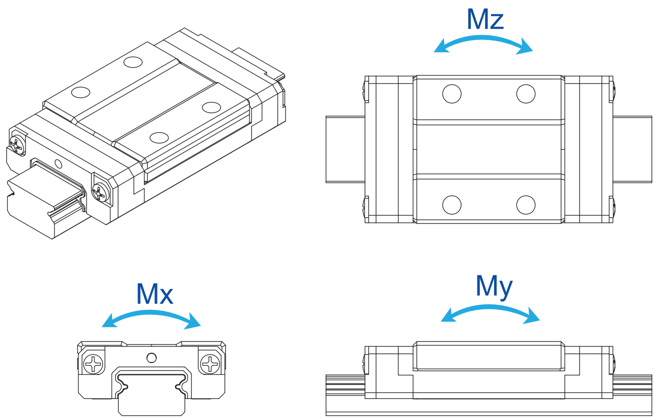


Fig. 5-9

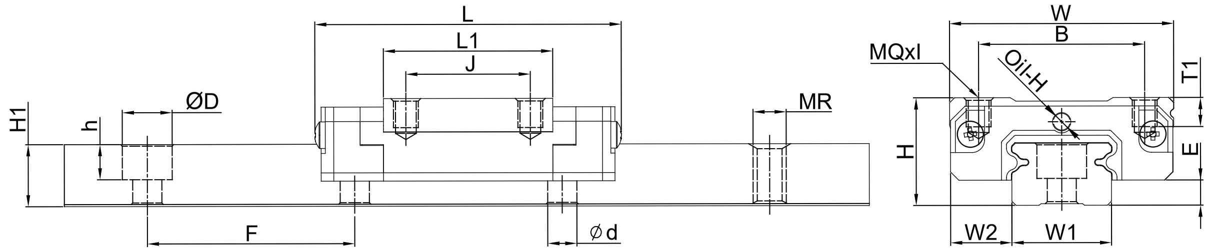


Fig. 5-10

Table 5-4

	Type	Overall dimensions (mm)				Carriage dimensions (mm)								Rail dimensions (mm)									Basic static load rating (kN)		Basic static moment (kN-m)			Weight	
		H	W	W2	E	L	B	J	MQ	I	L1	Oil-H	T1	W1	H1	F	d	D	h	WH	MR	L max	C	C0	Mx	My	Mz	Carriage kg	Rail kg/m
#	MPHX07SN	8	17	5	1.5	24	12	8	M2	2.3	13	Ø1.1	1.7	7	4.7	15	2.4	4.5	2.4	-	M3	500	1.02	1.26	4.97	3.05	3.65	0.009	0.25
	MPHX09SN	10	20	5.5	2.3	33.9	15	10	M3	3	20.4	Ø1.3	2.2	9	5.5	20	3.5	6	3.3	-	M4	1000	1.93	3.42	12.87	7.04	7.04	0.019	0.3
	MPHX09SL	10	20	5.5	2.3	43.9	15	16	M3	3	30.4	Ø1.3	2.2	9	5.5	20	3.5	6	3.3	-	M4	1000	2.67	5.47	20.02	13.64	13.64	0.027	0.3
	MPHX12SN	13	27	7.5	3.05	36.4	20	15	M3	3.5	20.4	Ø2.0	2.9	12	7.5	25	3.5	6	4.3	-	M4	1000	2.87	4.80	22.58	13.55	13.55	0.033	0.60
	MPHX12SL	13	27	7.5	3.05	48.8	20	20	M3	3.5	32.9	Ø2.0	2.9	12	7.5	25	3.5	6	4.3	-	M4	1000	3.92	7.40	38.39	33.20	33.20	0.05	0.60
	MPHX15SN	16	32	8.5	3.9	42.9	25	20	M3	4.5	25.7	Ø2.5	3.35	15	9.5	40	3.5	6	4.5	-	M4	1000	4.74	6.11	47.01	20.37	20.37	0.055	0.99
	MPHX15SL	16	32	8.5	3.9	59.2	25	25	M3	4.5	42	Ø2.5	3.35	15	9.5	40	3.5	6	4.5	-	M4	1000	6.47	9.5	73.13	57.06	57.06	0.087	0.99

Lubrication pad unavailable

Precision Standard

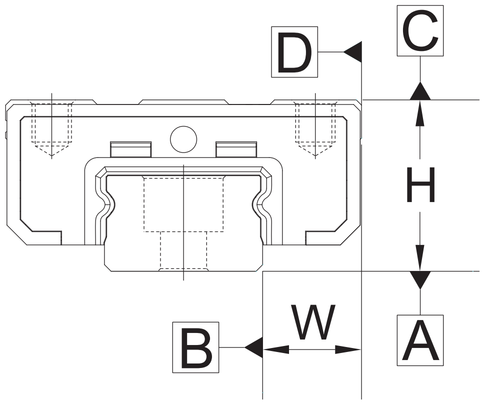


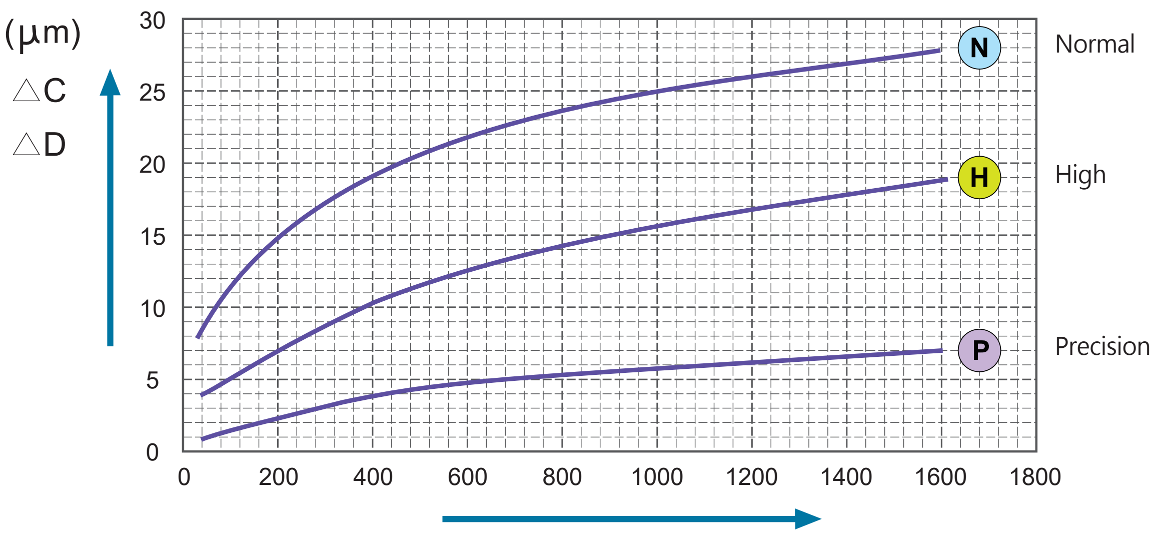
Fig. 5-11

Table 5-5

unit: mm

Item \ Class	N Normal	H High	P Precision
Assembly height tolerance (H)	±0.04	±0.02	±0.01
Assembly width tolerance (W)	±0.04	±0.025	±0.015
Matching height difference (ΔH)	0.03	0.015	0.007
Matching width difference (ΔW)	0.03	0.02	0.01
Tolerance of carriage top C to rail bottom A	Please refer to ΔC in Fig. 5-12		
Tolerance of carriage edge D to rail edge B	Please refer to ΔD in Fig. 5-12		

* P level non-interchangeable. If you have any questions, please kindly contact us.



Deviation VS. Rail Length

Fig. 5-12

6-5 MB/MPH Product Coding

MBC X 12 S N – 2 – UA – L 500 – H – Z0 – II – R 1

Carriage type :
MBC : Caged
MBX : Non-caged
MPH

Material :
X : Stainless steel

Size :
MB : 09, 12, 15
MPH : 07, 09, 12, 15

Rail width :
S : Standard W : Wide

Carriage length :
N : Standard L : Long

Number of carriages

UA :
Lubrication pad (MPH series only)

Rail mounting type :
L : Counterbored holes (standard) C : Bottom tapped holes
J : Jointed rails (counterbored holes)
D : Jointed rails (bottom tapped holes) X : Customized

Rail length (mm)

Precision grades :
N : Normal H : High P : Precision
(P level non-interchangeable.
If you have any questions, please kindly contact us.)

Preload grade :
Z0 : No preload Z1 : Light preload

Number of parallel rails

Surface treatment (precision grade N only) :
– : Without coating D : Trivalent chromium K : Black chromium N : Nickel R : Fluoride chromium

Treated parts :
– : Without coating (1) Rail only (2) Carriage only (3) Rail and carriage (X) By order