

KGT[®]

Zhejiang Jiateng Precision Technology Co.,Ltd



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Technical Information Index

Preface	1
1. General Information	1
1-1 Advantages and Features of Linear Guideways	1
1-2 The Principles of Selecting Linear Guideways	2
1-3 Basic Load Rating of Linear Guideways	3
1-4 The Service Life of Linear Guideways	4
1-5 Acting Loads	5
1-6 Friction	9
1-7 Preload and Stiffness	9
1-8 Lubrication	10
1-9 The Butt-joint Rail	10
1-10 Mounting Configurations	11
1-11 Mounting Procedures	12
2. Product Series	19
2-1 HG Series – Heavy Load Ball Type Linear Guideway	22
2-2 EG Series – Low Profile Ball Type Linear Guideway	44
2-3 MG Series – Miniature Linear Guideway	61
2-4 RG Series – High Rigidity Roller Type Linear Guideway	76
2-5 SFU/DFU/SFY Series - Ball and Steel rod	95
2-6 BK Series - Fixed Side Rectangular Type	133
2-7 BF Series - Floated Side Rectangular Type	134
2-8 EK Series - Miniature Fixed Side Rectangular Type	135
2-9 EF Series - Miniature Floated Side Rectangular Type	136
2-10 FK Series - Fixed Side Round Type	137
2-11 FF Series - Floated Side Round Type	138
2-12 WC/WCS Series - Cylinder Linear Rail	139
2-13 SHF Series - Winding Shape Ball Joint Rod Ends	141
2-14 SK Series - Linear Motion Ball Slide Units	142
2-15 SCS...UU/LUU Series - Linear Motion Ball Slide Units	143
2-16 LM...UU/LUU Series - Linear Bearing	144
2-17 LMF/K/H...UU/LUU Series - Flange Linear Bearing	145

Preface

A linear guideway allows a type of linear motion that utilizes rolling elements such as balls or rollers. By using re-circulating rolling elements between the rail and the block, a linear guideway can achieve high precision linear motion. Compared to a traditional slide, the coefficient of friction for a linear guideway is only 1/50. Because of the restraint effect between the rails and the blocks, linear guideways can take up loads in both the up/down and the left/right directions. With these features, linear guideways can greatly enhance moving accuracy, especially, when accompanied with precise ball screws.

1. General Information

1-1 Advantages and Features of Linear Guideways

(1) High positional accuracy

When a load is driven by a linear motion guideway, the frictional contact between the load and the bed desk is rolling contact. The coefficient of friction is only 1/50 of traditional contact, and the difference between the dynamic and the static coefficient of friction is small. Therefore, there would be no slippage while the load is moving.

(2) Long life with high motion accuracy

With a traditional slide, errors in accuracy are caused by the counter flow of the oil film. Insufficient lubrication causes wear between the contact surfaces, which become increasingly inaccurate. In contrast, rolling contact has little wear; therefore, machines can achieve a long life with highly accurate motion.

(3) High speed motion is possible with a low driving force

Because linear guideways have little friction resistance, only a small driving force is needed to move a load. This results in greater power savings, especially in the moving parts of a system. This is especially true for the reciprocating parts.

(4) Equal loading capacity in all directions

With this special design, these linear guideways can take loads in either the vertical or horizontal directions. Conventional linear slides can only take small loads in the direction parallel to the contact surface. They are also more likely to become inaccurate when they are subjected to these loads.

(5) Easy installation

Installing a linear guideway is fairly easy. Grinding or milling the machine surface, following the recommended installation procedure, and tightening the bolts to their specified torque can achieve highly accurate linear motion.

(6) Easy lubrication

With a traditional sliding system, insufficient lubrication causes wear on the contact surfaces. Also, it can be quite difficult to supply sufficient lubrication to the contact surfaces because finding an appropriate lubrication point is not very easy. With a linear motion guideway, grease can be easily supplied through the grease nipple on the linear guideway block. It is also possible to utilize a centralized oil lubrication system by piping the lubrication oil to the piping joint.

(7) Interchangeability

Compared with traditional boxways or v-groove slides, linear guideways can be easily replaced should any damage occur. For high precision grades consider ordering a matched, non-interchangeable, assembly of a block and rail.

1-2 The Principles of Selecting Linear Guideways

Identify the condition

- Type of equipment
- Space limitations
- Accuracy
- Stiffness
- Travel length
- Magnitude and direction of loads
- Moving speed, acceleration
- Duty cycle
- Service life
- Environment

Selection of series

- HG/CG series - Grinding, milling, and drilling machine, lathe, machine center
- EG series - Automatic equipment, high speed transfer device, semiconductor equipment, wood cutting machine, precision measure equipment
- QE/QH series - precision measure equipment, semiconductor equipment, Automatic equipment, laser marking machine, can be widely applied in high-tech industry required high speed, low noise, low dust generation.
- WE/QW series - Automatic device, transportation device, precision measure equipment, semiconductor equipment, blow moulding machine, single axis robot-robotics.
- MG series - Miniature device, semiconductor equipment, medical equipment
- RG/QR/CRG series - CNC machining centers, heavy duty cutting machines, CNC grinding machines, injection molding machines, electric discharge machines, wire cutting machines, plano millers
- AG Series : Sliding Head Lathe (Swiss lathe), Vibration Test Machine, Automated Robot Dispenser, XY moving platform, Measuring instrument, Vertical Lathe, Slant Bed Lathes

Selection of accuracy

- Classes : C, H, P, SP, UP depends on the accuracy of equipment

Determines the size & the number of blocks

- Dynamic load condition
- If accompanied with a ballscrew, the size should be similar to the diameter of ballscrew. For example, if the diameter of the ballscrew is 35mm, then the model size of linear guideway should be HG35

Calculate the max. load of block

- Make reference to load calculation examples, and calculate the max load.
- Be sure that the static safety factor of selected guideway is larger than the rated static safety factor

Choosing preload

- Depends on the stiffness requirement and accuracy of mounting surface

Identify stiffness

- Calculate the deformation (δ) by using the table of stiffness values, choosing heavier preload and larger size linear guideways to enhance the stiffness

Calculating service life

- Calculate the life time requirement by using the moving speed and frequency.
- Make reference to the life calculation example

Selection of lubrication

- Grease supplied by grease nipple
- Oil supplied by piping joint

Completion of selection

1-3 Basic Load Ratings of Linear Guideways

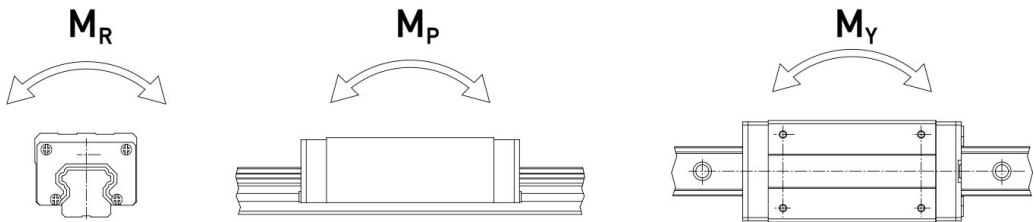
1-3-1 Basic Static Load

(1) Static load rating (C₀)

Localized permanent deformation will be caused between the raceway surface and the rolling elements when a linear guideway is subjected to an excessively large load or an impact load while either at rest or in motion. If the amount of this permanent deformation exceeds a certain limit, it becomes an obstacle to the smooth operation of the linear guideway. Generally, the definition of the basic static load rating is a static load of constant magnitude and direction resulting in a total permanent deformation of 0.0001 times the diameter of the rolling element and the raceway at the contact point subjected to the largest stress. The value is described in the dimension tables for each linear guideway. A designer can select a suitable linear guideway by referring to these tables. The maximum static load applied to a linear guideway must not exceed the basic static load rating.

(2) Static permissible moment (M₀)

The static permissible moment refers to a moment in a given direction and magnitude when the largest stress of the rolling elements in an applied system equals the stress induced by the Static Load Rating. The static permissible moment in linear motion systems is defined for three directions: M_R, M_P and M_Y.



(3) Static safety factor

This condition applies when the guideway system is static or under low speed motion. The static safety factor, which depends on environmental and operating conditions, must be taken into consideration. A larger safety factor is especially important for guideways subject to impact loads (See Table 1-1). The static load can be obtained by using Eq. 1.1

Table 1-1 Static Safety Factor

Load Condition	f _{SL} , f _{SM} (Min.)
Normal Load	1.0~3.0
With impacts/vibrations	3.0~5.0

$$f_{SL} = \frac{C_0}{P} \text{ or } f_{SM} = \frac{M_0}{M}$$

..... Eq.1.1

- f_{SL} : Static safety factor for simple load
- f_{SM} : Static safety factor for moment
- C₀ : Static load rating (kN)
- M₀ : Static permissible moment (kN•mm)
- P : Calculated working load (kN)
- M : Calculated applying moment (kN•mm)

1-3-2 Basic Dynamic Load

(1) Dynamic load rating (C)

The basic dynamic load rating is an important factor used for calculation of service life of linear guideway. It is defined as the maximum load when the load that does not change in direction or magnitude and results in a nominal life of 50km of operation for a ball type linear guideway and 100km for a roller type linear guideway. The values for the basic dynamic load rating of each guideway are shown in dimension tables. They can be used to predict the service life for a selected linear guideway.

1-4 The Service Life of Linear Guideways

1-4-1 Service Life

When the raceway and the rolling elements of a linear guideway are continuously subjected to repeated stresses, the raceway surface shows fatigue. Flaking will eventually occur. This is called fatigue flaking. The life of a linear guideway is defined as the total distance traveled until fatigue flaking appears on the surface of the raceway or rolling elements.

1-4-2 Nominal Life (L)

The service life varies greatly even when the linear motion guideways are manufactured in the same way or operated under the same motion conditions. For this reason, nominal life is used as the criteria for predicting the service life of a linear motion guideway. The nominal life is the total distance that 90% of a group of identical linear motion guideways, operated under identical conditions, can travel without flaking. When the basic dynamic rated load is applied to a linear motion guideway, the nominal life is 50km.

1-4-3 Calculation of Nominal Life

The acting load will affect the nominal life of a linear guideway. Based on the selected basic dynamic rated load and the actual load. The nominal life of ball type and roller type linear guideway can be calculated by Eq.1.2 and Eq. 1.3 respectively.

Ball type: $L = \left(\frac{C}{P}\right)^3 \cdot 50\text{km} = \left(\frac{C}{P}\right)^3 \cdot 31\text{mile}$ Eq.1.2

Roller type: $L = \left(\frac{C}{P}\right)^{\frac{10}{3}} \cdot 100\text{km} = \left(\frac{C}{P}\right)^{\frac{10}{3}} \cdot 62\text{mile}$ Eq.1.3

- L : Nominal life
- C : Basic dynamic load rating
- P : Actual load

If the environmental factors are taken into consideration, the nominal life is influenced greatly by the motion conditions, the hardness of the raceway, and the temperature of the linear guideway. The relationship between these factors is expressed in Eq.1.4 and Eq. 1.5.

Ball type: $L = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P_c}\right)^3 \cdot 50\text{km} = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P_c}\right)^3 \cdot 31\text{mile}$ Eq.1.4

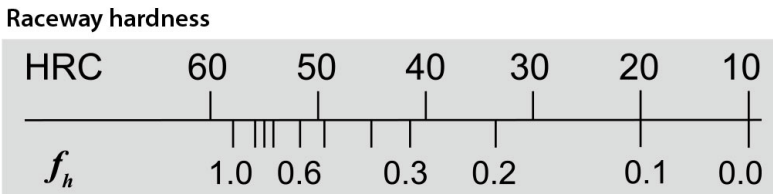
Roller type: $L = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P_c}\right)^{\frac{10}{3}} \cdot 100\text{km} = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P_c}\right)^{\frac{10}{3}} \cdot 62\text{mile}$ Eq.1.5

- L : Nominal life
- f_h : Hardness factor
- C : Basic dynamic load rating
- f_t : Temperature factor
- P_c : Calculated load
- f_w : Load factor

1-4-4 Factors of Normal Life

(1) Hardness factor (f_h)

In general, the raceway surface in contact with the rolling elements must have the hardness of HRC 58~62 to an appropriate depth. When the specified hardness is not obtained, the permissible load is reduced and the nominal life is decreased. In this situation, the basic dynamic load rating and the basic static load rating must be multiplied by the hardness factor for calculation.



[2] Temperature factor (f_t)

Due to the temperature will affect the material of linear guide, therefore the permissible load will be reduced and the nominal service life will be decreased when over 100°C. Therefore, the basic dynamic and static load rating must be multiplied by the temperature factor. As some accessories are plastic which can't resist high temperature, the working environment is recommended to be lower than 100°C.

Temperature



[3] Load factor (f_w)

The loads acting on a linear guideway include the weight of slide, the inertia load at the times of start and stop, and the moment loads caused by overhanging. These load factors are especially difficult to estimate because of mechanical vibrations and impacts. Therefore, the load on a linear guideway should be divided by the empirical factor.

Table 1-2 Load factor

Loading Condition	Service Speed	f_w
No impacts & vibration	$V \leq 15$ m/min	1 ~ 1.2
Small impacts	$15 \text{ m/min} < V \leq 60$ m/min	1.2 ~ 1.5
Normal load	$60 \text{ m/min} < V \leq 120$ m/min	1.5 ~ 2.0
With impacts & vibration	$V > 120$ m/min	2.0 ~ 3.5

1-4-5 Calculation of Service Life (L_h)

Transform the nominal life into the service life time by using speed and frequency.

$$\text{Ball type: } L_h = \frac{L \cdot 10^3}{V_e \cdot 60} = \frac{\left(\frac{C}{P}\right)^3 \cdot 50 \cdot 10^3}{V_e \cdot 60} \text{ hr} \quad \dots \text{Eq.1.6}$$

$$\text{Roller type: } L_h = \frac{L \cdot 10^3}{V_e \cdot 60} = \frac{\left(\frac{C}{P}\right)^{\frac{10}{3}} \cdot 100 \cdot 10^3}{V_e \cdot 60} \text{ hr} \quad \dots \text{Eq.1.7}$$

L_h : Service life (hr)
 L : Nominal life (km)
 V_e : Speed (m/min)
 C/P : Load factor

1-5 Applied Loads

1-5-1 Calculation of Load

Several factors affect the calculation of loads acting on a linear guideway (such as the position of the object's center of gravity, the thrust position, and the inertial forces at the time of start and stop). To obtain the correct load value, each load condition should be carefully considered.

(1) Load on one block

Table 1-3 Calculation example of loads on block

Patterns	Loads layout	Load on one block
		$P_1 = \frac{W}{4} + \frac{F}{4} + \frac{F \cdot a}{2c} + \frac{F \cdot b}{2d}$ $P_2 = \frac{W}{4} + \frac{F}{4} + \frac{F \cdot a}{2c} - \frac{F \cdot b}{2d}$ $P_3 = \frac{W}{4} + \frac{F}{4} - \frac{F \cdot a}{2c} + \frac{F \cdot b}{2d}$ $P_4 = \frac{W}{4} + \frac{F}{4} - \frac{F \cdot a}{2c} - \frac{F \cdot b}{2d}$
		$P_1 = \frac{W}{4} + \frac{F}{4} + \frac{F \cdot a}{2c} + \frac{F \cdot b}{2d}$ $P_2 = \frac{W}{4} + \frac{F}{4} + \frac{F \cdot a}{2c} - \frac{F \cdot b}{2d}$ $P_3 = \frac{W}{4} + \frac{F}{4} - \frac{F \cdot a}{2c} + \frac{F \cdot b}{2d}$ $P_4 = \frac{W}{4} + \frac{F}{4} - \frac{F \cdot a}{2c} - \frac{F \cdot b}{2d}$
		$P_1 = P_3 = \frac{W}{4} - \frac{F \cdot l}{2d}$ $P_2 = P_4 = \frac{W}{4} + \frac{F \cdot l}{2d}$
		$P_1 \sim P_4 = -\frac{W \cdot h}{2d} + \frac{F \cdot l}{2d}$
		$P_1 \sim P_4 = -\frac{W \cdot h}{2c} - \frac{F \cdot l}{2c}$ $P_{t1} = P_{t3} = \frac{W}{4} + \frac{F}{4} + \frac{F \cdot k}{2d}$ $P_{t2} = P_{t4} = \frac{W}{4} + \frac{F}{4} - \frac{F \cdot k}{2d}$

W: Applied weight
l: Distance from external force to driver
c: Rail spacing

P_n: Load (radial, reverse radial), n=1~4
F: External force
d: Block spacing

a,b,k: Distance from external force to geometric center
P_m: Load (lateral), n=1~4
h: Distance from center of gravity to driver

(2) Loads with inertia forces

Table 1-4 Calculation Examples for Loads with Inertia Forces

Considering the acceleration and deceleration	Load on one block
W: Weight of object (N) g: Gravitational acceleration (9.8m/sec²) P_n: Load (radial, reverse radial) (N), n=1~4 V_c: Maximum speed (m/sec) t1(t3): Acceleration (deceleration) time (s) t2: Constant speed time (s) c: Rail spacing (m) d: Block spacing (m) l: Distance from center of gravity to driver (m)	- Constant velocity $P_1 \sim P_4 = \frac{W}{4}$ - Acceleration $P_1 = P_3 = \frac{W}{4} + \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t_1} \cdot \frac{l}{d}$ $P_2 = P_4 = \frac{W}{4} - \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t_1} \cdot \frac{l}{d}$ - Deceleration $P_1 = P_3 = \frac{W}{4} - \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t_3} \cdot \frac{l}{d}$ $P_2 = P_4 = \frac{W}{4} + \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t_3} \cdot \frac{l}{d}$

1-5-2 Calculation of The Mean Load for Variable Loading

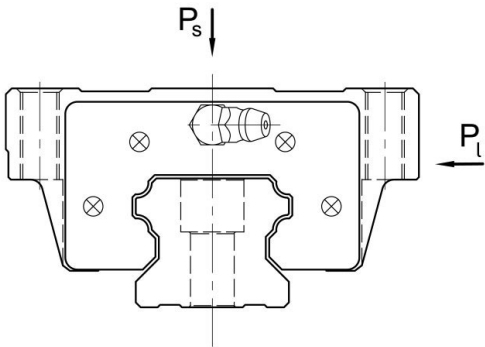
When the load on a linear guideway fluctuates greatly, the variable load condition must be considered in the life calculation. The definition of the mean load is the load equal to the bearing fatigue load under the variable loading conditions. It can be calculated by using table 1-5.

Table 1-5 Calculation Examples for Mean Load (P_m)

Operation Condition	Mean load
Step load	$P_m = \sqrt[3]{1/L(P_1^3 \cdot L_1 + P_2^3 \cdot L_2 + \dots + P_n^3 \cdot L_n)}$ P_m: Mean load P_n: Stepping L : Total running distance L_n: Running distance under load P_n
Linear variation	$P_m = 1/3 (P_{min} + 2 \cdot P_{max})$ P_m : Mean load P_{min} : Min. Load P_{max} : Max. Load
Sinusoidal loading	$P_m = 0.65 \cdot P_{max}$ P_m : Mean load P_{max} : Max. Load

1-5-3 Calculation for Bidirectional Equivalent Loads

KGT linear guideways can accept loads in several directions simultaneously. To calculate the service life of the guideway when the loads appear in multiple directions, calculate the equivalent load (P_e) by using the equations below.



HG/EG/WE/QH/QE/QW/RG/QR/CG/CRG/AG Series

$P_e = P_s + P_l$ Eq.1.8

MG Series

when $P_s > P_l$ $P_e = P_s + 0.5 \cdot P_l$ Eq.1.9

when $P_l > P_s$ $P_e = P_l + 0.5 \cdot P_s$ Eq.1.10

1-5-4 Calculation Example for Service Life

A suitable linear guideway should be selected based on the acting load. The service life is calculated from the ratio of the working load and the basic dynamic load rating.

Table 1-6 Calculation Example for Service Life

Type of Linear Guideway	Dimension of device	Operating condition
Type: HGH 30 CA C : 38.74 kN C ₀ : 52.19 kN Preload: Z0	d : 600 mm c : 400 mm h : 200 mm l : 250 mm	Weight (W) : 15 kN Acting force (F) : 1 kN Temperature: normal temperature Load status: normal load
○ Calculation of acting loads $P_1 \sim P_4 = + \frac{W \times h}{2d} - \frac{F \times l}{2d} = + \frac{15 \times 200}{2 \times 600} - \frac{1 \times 250}{2 \times 600} = 2.29 \text{ (kN)}$$P_{\max} = P_1 \sim P_4 = 2.29 \text{ (kN)}$ ○ Because preload is Z0, $P_c = P_{\max} = 2.29 \text{ (kN)}$ Note: The larger preload (ZA, AB) will increase the rigidity, but decrease the nominal life of guideway. ○ Calculation for life L $L = \left(\frac{f_h \times f_t \times C}{f_w \times P_c} \right)^3 \times 50 = \left(\frac{1 \times 1 \times 38.74}{2 \times 2.29} \right)^3 \times 50 = 30,258 \text{ (km)}$		

1-6 Friction

As mentioned in the preface, a linear guideway allows a type of rolling motion, which is achieved by using balls or rollers. The coefficient of friction for a linear guideway can be as little as 1/50 of a traditional slide. Generally, the coefficient of friction of ball type linear guideway is about 0.004 and roller type is about 0.003 .

When a load is 10% or less than the basic static load rate, the most of the resistance comes from the grease viscosity and frictional resistance between balls. In contrast, if the load is more than the basic static load rating, the resistance will mainly come from the load.

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

Eq.1.11

F : Friction (kN)

μ : Coefficient of friction

S : Friction resistance (kN)

W : Normal loads (kN)

1-7 Preload and Stiffness

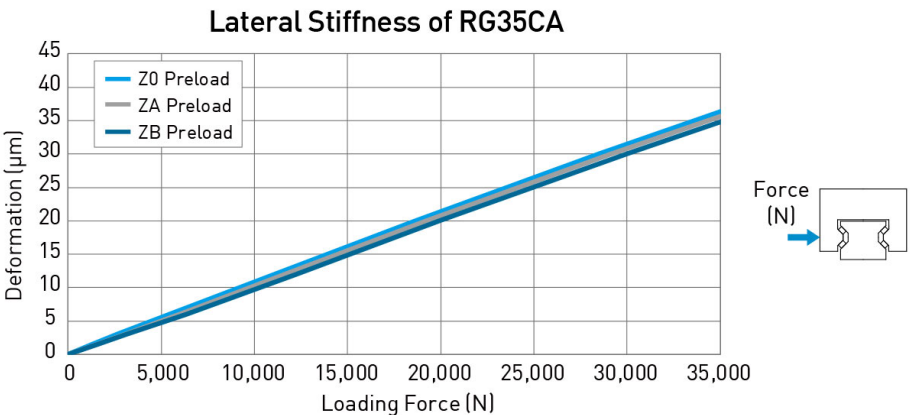
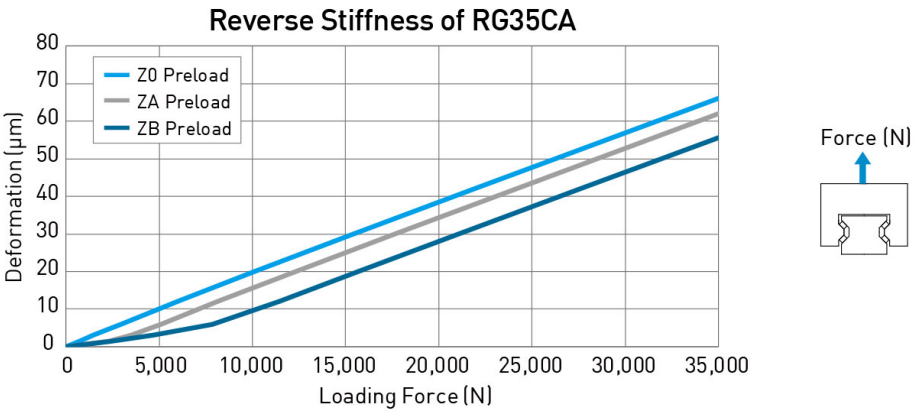
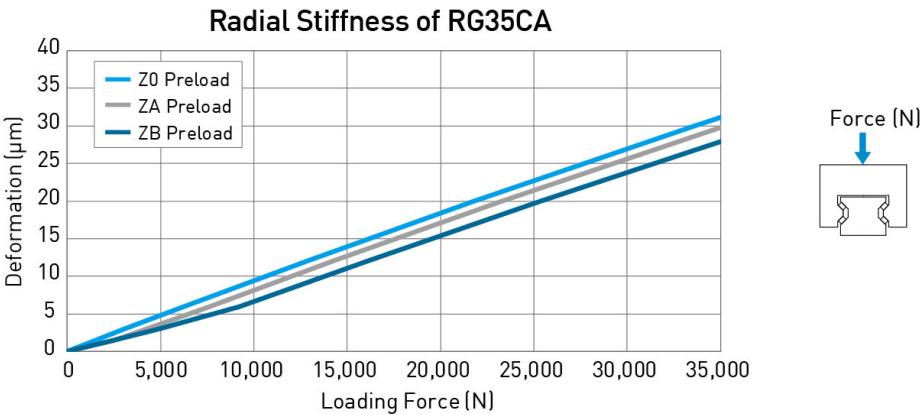
With linear guideways, the block can be preloaded to increase stiffness and the internal preload must be considered in the life calculation. Preload is classified by three classes; Z0, ZA, ZB. Each preload level has a different deformation of the block, higher stiffness presents lower deformation. Stiffness in three axis are used by most applications. The definition of stiffness examples shown below:

$$k = \frac{P}{\delta}$$

δ : Deformation (μm)

P : Applied load (N)

k : Stiffness (N/μm)



1-8 Lubrication

Supplying insufficient lubrication to the guideway will greatly reduce the service life due to an increase in rolling friction. The lubricant provides the following functions;

- Reduces the rolling friction between the contact surfaces to avoid abrasion and surface burning of the guideway.
- Generates a lubricant film between the rolling surfaces and decreases fatigue.
- Anti-corrosion.

1-8-1 Grease

Linear guideway must be lubricated with the lithium soap based grease before installation. After the linear guideway is installed, we recommend that the guideway be re-lubricated every 100 km. It is possible to carry out the lubrication through the grease nipple. Generally, grease is applied for speeds that do not exceed 60 m/min faster speeds will require high-viscosity oil as a lubricant.

$$T = \frac{100 \cdot 1000}{V_e \cdot 60} \text{ hr} \quad \text{Eq.1.12}$$

T : Feeding frequency of oil (hour)

V_e : speed (m/min)

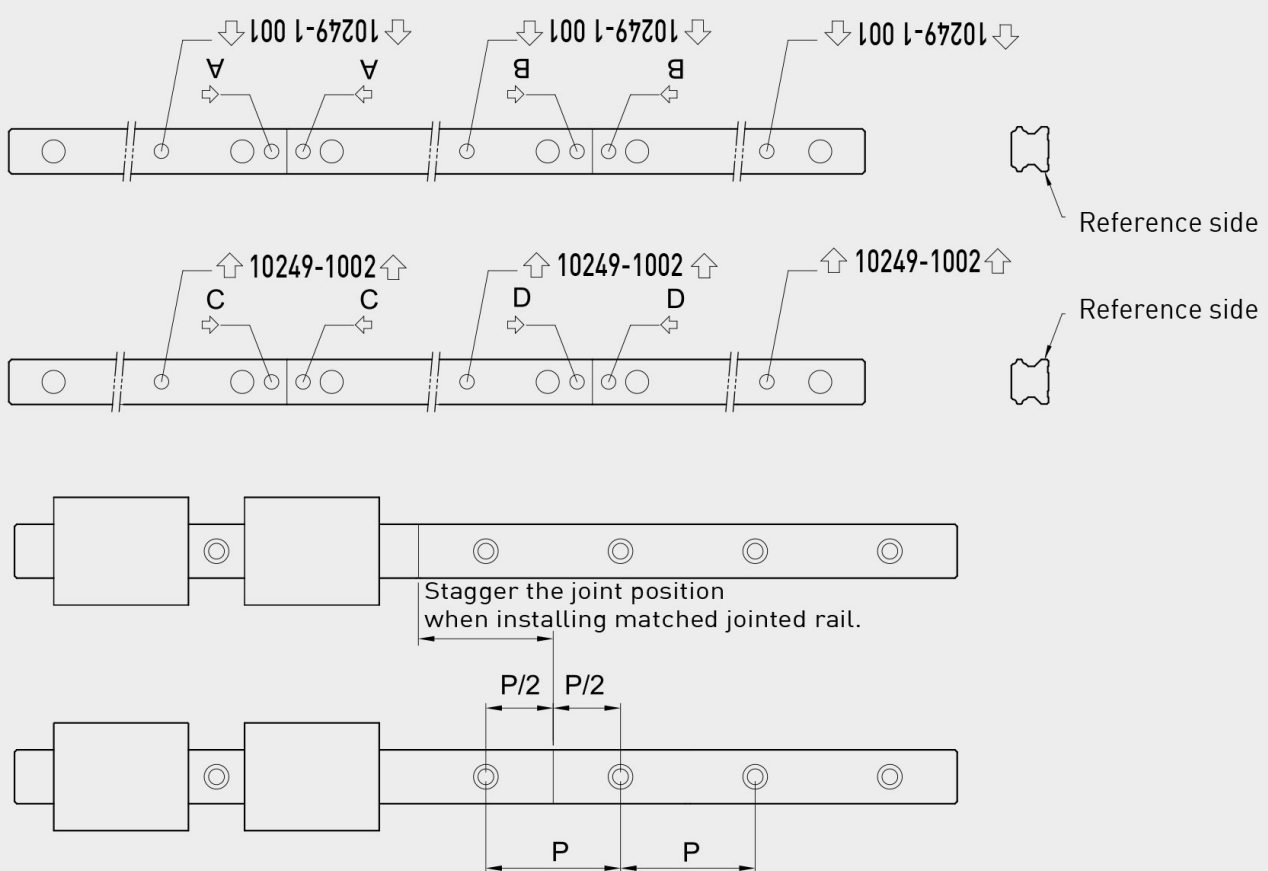
1-8-2 Oil

The recommended viscosity of oil is about 30~150cSt. The standard grease nipple may be replaced by an oil piping joint for oil lubrication. Since oil evaporates quicker than grease, the recommended oil feed rate is approximate 0.3cm³/hr.

1-9 The Butt-joint Rail

Jointed rail should be installed by following the arrow sign and ordinal number which is marked on the surface of each rail.

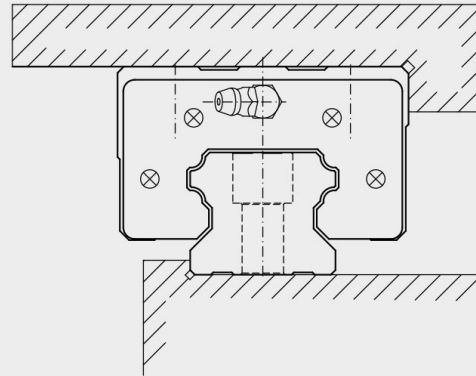
For matched pair, jointed rails, the jointed positions should be staggered. This will avoid accuracy problems due to discrepancies between the 2 rails [see figure].



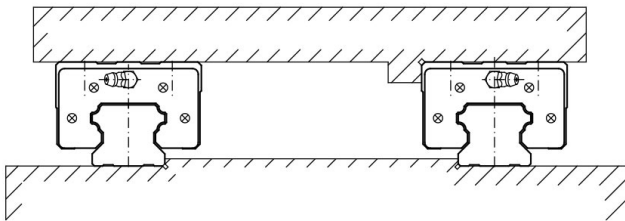
1-10 Mounting Configurations

Linear guideways have equal load ratings in the radial, reverse radial and lateral directions. The application depends on the machine requirements and load directions. Typical layouts for linear guideways are shown below:

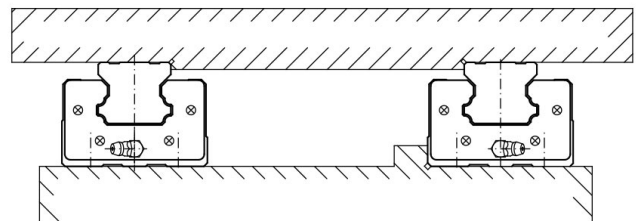
Use of one rail and mounting reference side



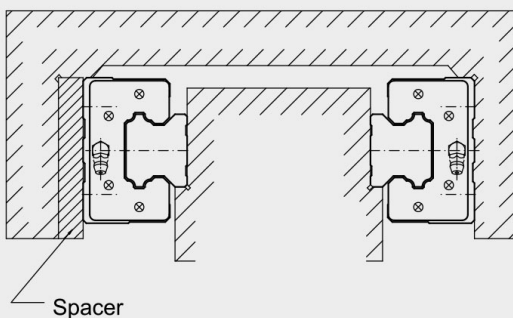
use of two rails(block movement)



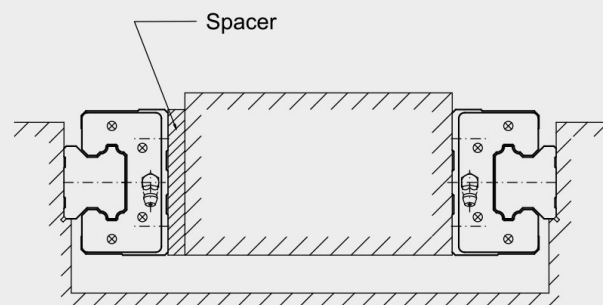
use of two rails(block fixed)



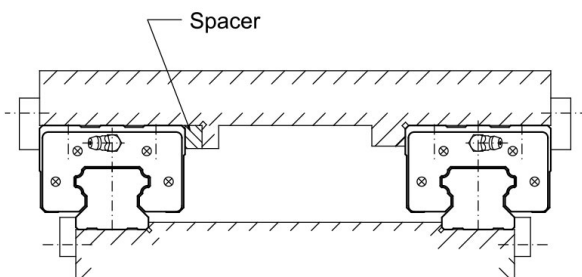
use of two external rails



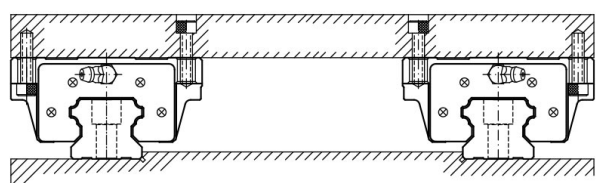
use of two internal rails



total surface fixed installation



HGW type block with mounting holes in different directions.

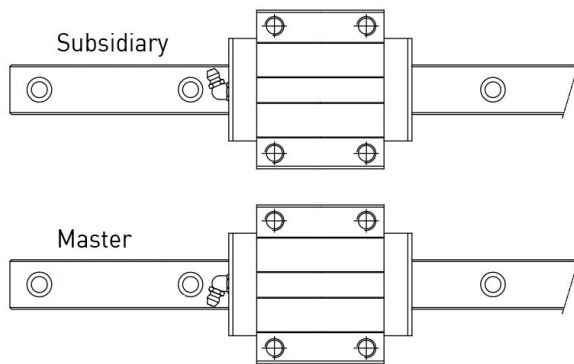


1-11 Mounting Procedures

Three installation methods are recommended based on the required running accuracy and the degree of impacts and vibrations.

1-11-1 Master and Subsidiary Guide

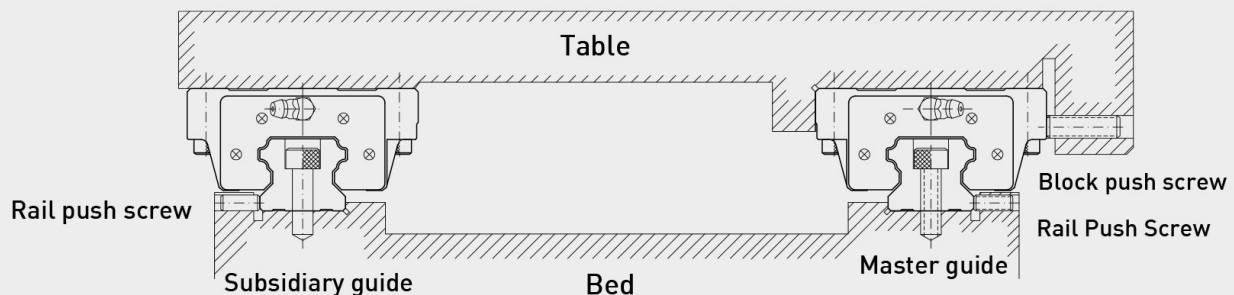
For non-interchangeable type Linear Guideways, there are some differences between the master guide and subsidiary guide. The accuracy of the master guide's datum plane is better than the subsidiary's and it can be a reference side for installation. There is a mark "MA" printed on the rail, as shown in the figure below.



HGH35C 10249-1 001 MA

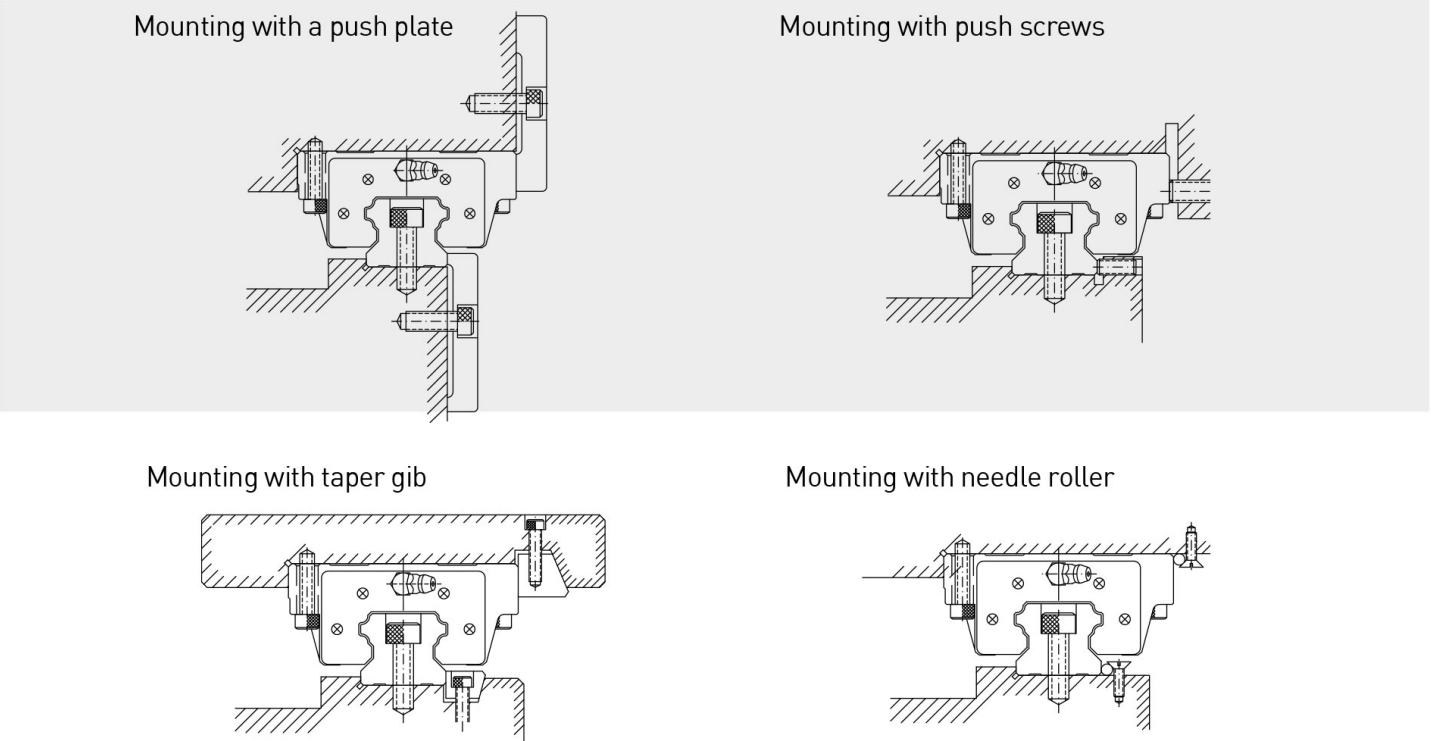
Spec. _____
 Manufacture No _____
 Rail No _____
 Master _____

1-11-2 Installation to Achieve High Accuracy and Rigidity



(1) Mounting methods

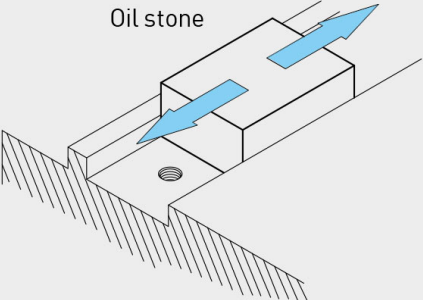
It is possible that the rails and the blocks will be displaced when the machine is subjected to vibrations and impacts. To eliminate these difficulties and achieve high running accuracy, the following four methods are recommended for fixing.



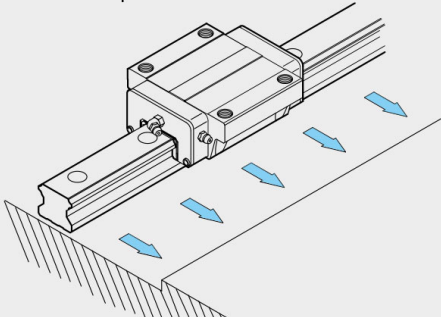
(2) Procedure of rail installation

- 1

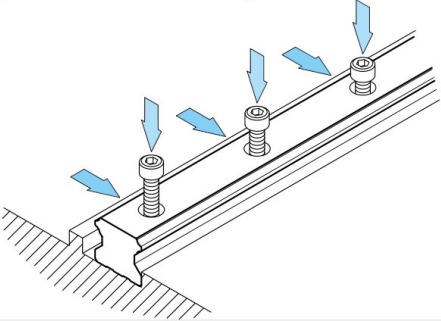
Before starting, remove all dirt from the mounting surface of the machine.


- 2

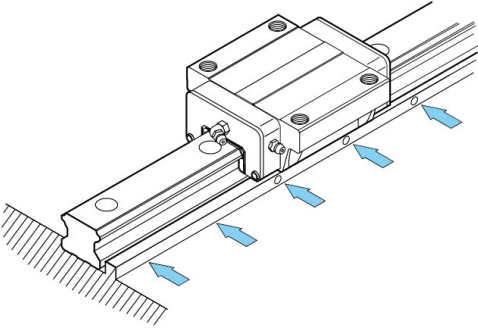
Place the linear guideway gently on the bed. Bring the guideway into close contact with the datum plane of the bed.


- 3

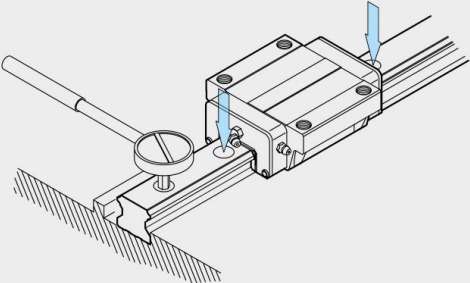
Check for correct thread engagement when inserting a bolt into the mounting hole while the rail is being placed on the mounting surface of the bed.


- 4

Tighten the push screws sequentially to ensure close contact between the rail and the side datum plane.

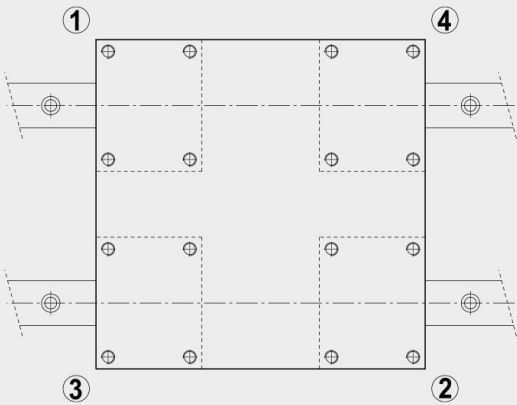

- 5

Tighten the mounting bolts with a torque wrench to the specified torque.


- 6

Install the remaining linear guideway in the same way.

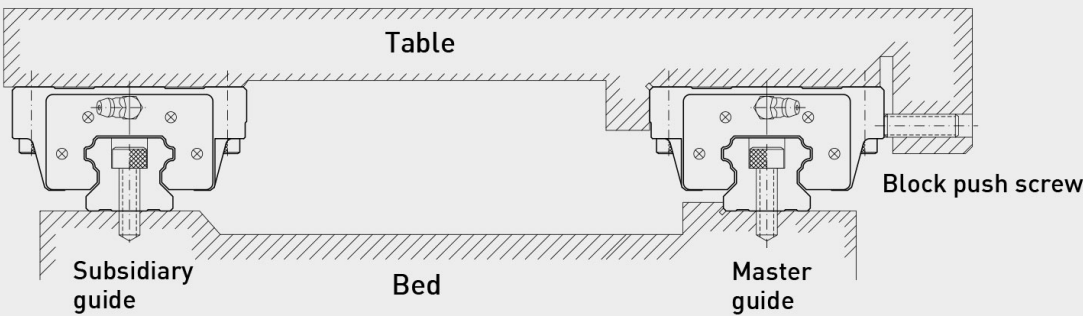
(3) Procedure of block installation



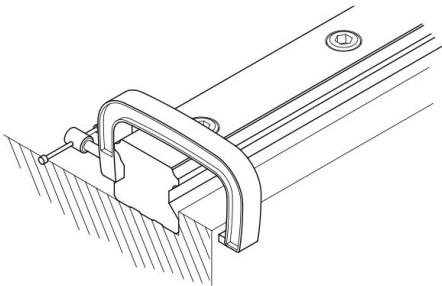
- Place the table gently on the blocks. Next, hand-tighten the block mounting bolts temporarily.
- Push the blocks against the datum plane of the table and position the table by tightening the push screws.
- The table can be fixed uniformly by tightening the mounting bolts on master guide side and subsidiary side in 1 to 4 sequences.

1-11-3 Installation of the Master Guide without Push Screws

To ensure parallelism between the subsidiary guide and the master guide without push screws, the following rail installation methods are recommended. The block installation is the same as mentioned previously.

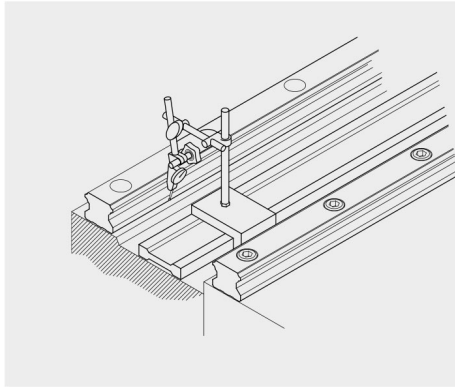


(1) Installation of the rail on the subsidiary guide side



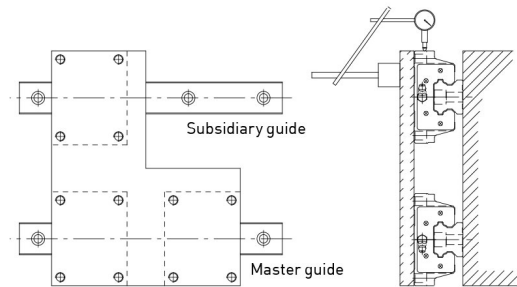
- **Using a vice**
Place the rail into the mounting plane of the bed. Tighten the mounting bolts temporarily; then use a vice to push the rail against the side datum plane of the bed. Tighten the mounting bolts in sequence to the specified torque.

(2) Installation of the rail on the subsidiary guide side



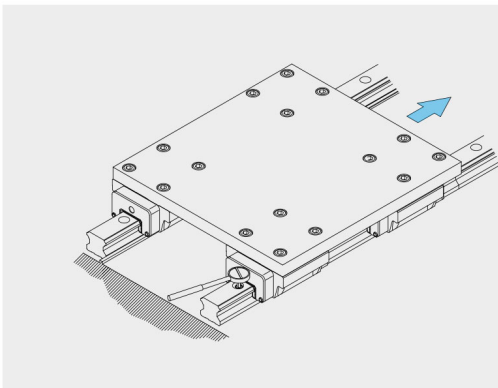
Method with use of a straight edge

Set a straight edge between the rails parallel to the side datum plane of the rail on the master guide side by using a dial gauge. Use the dial gauge to obtain the straight alignment of the rail on the subsidiary guide side. When the rail on the subsidiary guide side is parallel to the master side, tighten the mounting bolts in sequence from one end of the rail to the other.



Method with use of a table

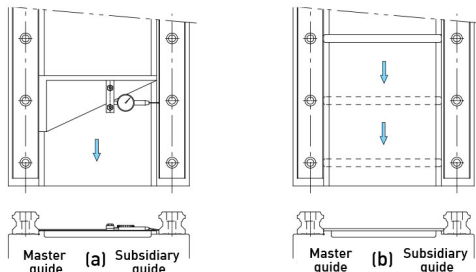
Fix two blocks on the master guide side to the table. Temporarily fix the rail and one block on the subsidiary guide side to the bed and the table. Fix a dial gauge stand on the table surface and bring it into contact with the side of the block on the subsidiary guide side. Move the table from one end of the rail to the other. While aligning the rail on the subsidiary side parallel to the rail on the master guide side, tighten the bolts in sequence.



Method following the master guide side

When a rail on the master guide side is correctly tightened, fix both blocks on the master guide side and one of the two blocks on the subsidiary guide side completely to the table.

When moving the table from one end of the rail, tighten the mounting bolts on the subsidiary guide side completely.

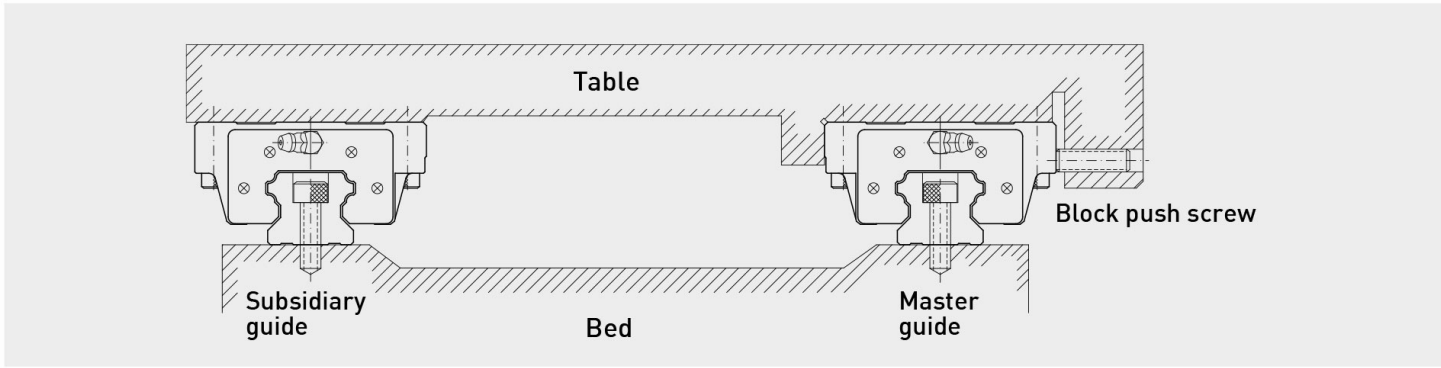


Method with use of a jig

Use a special jig to ensure the rail position on the subsidiary guide side. Tighten the mounting bolts to the specified torque in sequence.

1-11-4 Installation Without Side Surface

To ensure parallelism between the subsidiary guide and the master guide when there is no side surface, the following rail installation method is recommended. The installation of the blocks is the same as mentioned previously.



(1) Installation of the rail on the master guide side

- Using a provisional datum plane
Two blocks are fixed in close contact by the measuring plate. A datum plane provided on the bed is used for straight alignment of the rail from one end to the other. Move the blocks and tighten the mounting bolts to the specified torque in sequence.

- Method with use of a straight edge
Use a dial gauge and a straight edge to confirm the straightness of the side datum plane of the rail from one end to the other. Make sure the mounting bolts are tightened securely in sequence.

(2) Installation of the rail on the subsidiary guide side

The method of installation for the rail on the subsidiary guide side is the same as the case without push screws.

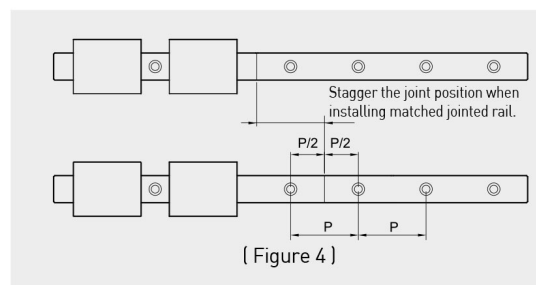
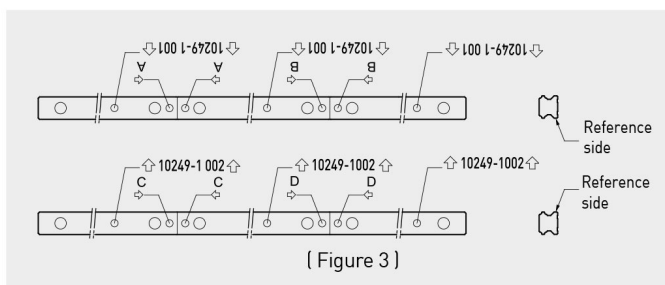
1-11-5 Linear Guideway Mounting Notifications

1. KGT guideways are applied with rust-proof oil before shipping. Please clean the oil before moving or running the blocks.

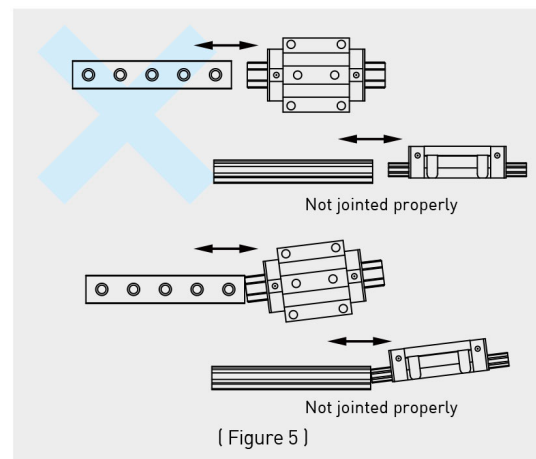
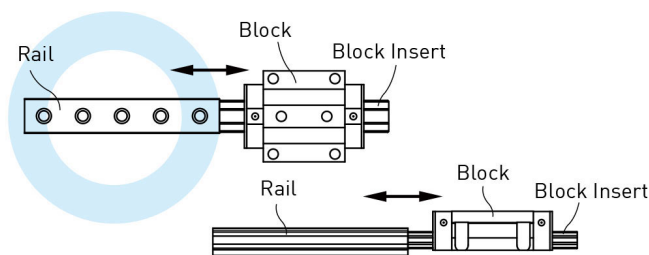
2. Recognition of master and subsidiary rails: For non-interchangeable type linear guideways, there are some differences between the master rail and subsidiary rail. The accuracy of the master rail's datum plane is better than the subsidiary's and it can be a reference side for installation. There is a mark "MA" printed on the rail. Check for the correct order before starting the installation. The rail number of master is an odd number and the rail number of subsidiary is an even number. Please install the rails according to the indication and carry on the installation according to the order for multi-rails installment (e.g.: 001 pairs 002 ; 003 pairs 004 etc.)

3. Recognition of datum plane: The datum plane (B) of rail is the side indicated by the arrow, which is marked on the top surface of the rail. The datum plane of block is smooth ground surface which shows as D in Figure 2.
- [Figure 1]
- [Figure 2]

4. Butt-joint rail: Butt-joint rail should be installed by following the arrow sign and ordinal number which is marked on the surface of each rail as shown in the figure 3. To avoid accuracy problems due to discrepancies between the 2 rails such as for matched pair, butt-joint rails, the jointed positions should be staggered as shown in figure 4.



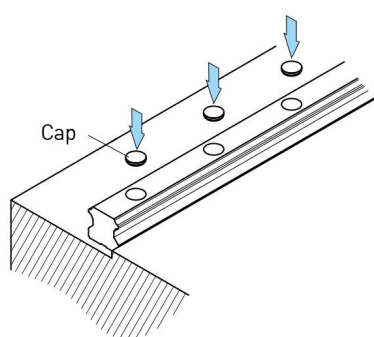
5. Do not remove blocks from rails when assembling the guideways. KGT recommends using block inserts (please see Figure 5) if it is necessary to remove/ mount block from/ onto rail.



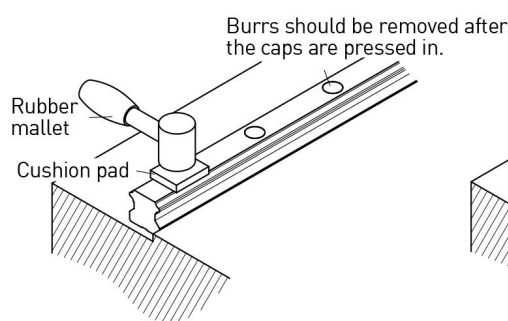
6. KGT recommends not randomly mixing block units and rails for non interchangeable type to avoid any installation problem.
7. To ensure the straightness of rail, please tighten the mounting bolts sequentially with a torque wrench to the specified torque. (Refer to KGT Technical Information).

1-11-6 Linear Guideway Usage Instructions

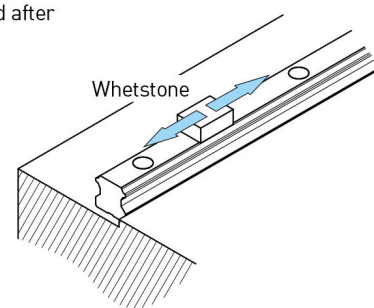
To ensure a long lifetime and running accuracy of the linear guideways after assembly, it is recommended to cover the rail roles with caps.



1. Put the caps into the bolt hole.



2. Use the cushion pad and rubber mallet to flush the caps and make it even with the bolt holes.



3. When the caps are fitted into the bolt holes, please smoothen the top surface of the caps and make sure no burrs remained and not higher than the rail.

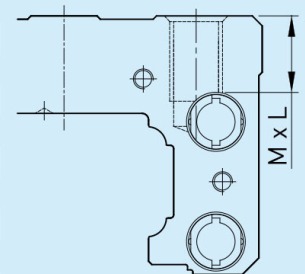
1-11-7 Linear Guideway Usage Instructions

1. Lubricate the blocks after assembling the guideways in machines. Use a lithium soap-base grease or oil.
2. The guideways are packaged with anti-corrosion oil before delivery. If the rails were cleaned before installation, remember to lubricate the rails after assembling the guideways in machine. (Please confirm the compatibility between lubricant & anti rust rail)
3. The blocks are composed of various plastic parts, please avoid prolonged exposure of these parts with any organic solvent when cleaning the blocks to prevent possible damage.
4. Try to avoid any foreign objects from getting into the block as this could result in damage to the product.
5. Please do not disassemble the parts, the incautious actions of disassembly may bring foreign objects into the block and diminish the precision of the guideways or cause possible damage.
6. When handling the guideways please hold them horizontally. Improper handling can cause the blocks to fall off the rail.
7. Please avoid the inappropriate falling or clash on the blocks, which will damage the function of guideways.
8. For special application conditions, please apply the appropriate surface treatment or refer to the Linear Guideway Technical Information catalog for more detailed instructions.
9. The operating temperature range of the E2 type (Self lubricant kit) is $-10^{\circ}\text{C} \sim 50^{\circ}\text{C}$. For Q1 types (Quiet linear guideway), the range is $-10^{\circ}\text{C} \sim 80^{\circ}\text{C}$. The maximum service temperature of the SE type (Metallic end cap) is 150°C and for other standard types it is 100°C .
10. Please refer to the Linear Guideway Technical Information catalog for more detailed instructions. Please do not hesitate to contact KGT if there are further questions related to the application.

Note: For Q1 type guideways (QH & QE), please pay attention to the following instructions:

1. When assembling and disassembling the Q1 blocks, please use the block insert that is provided. (one block insert is equipped per block).
2. Special accessories are used in the Q1 type guideways, any adjustment on the preload is prohibited.
3. For some of our Q1 type Linear Guideways, the boreholes for fixing the slider on the block are connected with recirculation channels. Therefore please pay attention to the length of screws, to avoid the screw with longer length might interfere the recirculation parts and influence the operating performance.

Specification	Max. length of screws M x L (mm)
QHH20	M5 x 6
QHH25	M6 x 8
QHH30	M8 x 10
QHH35	M8 x 12
QEH20	M5 x 7
QEH25	M6 x 9
QEH30	M8 x 10
QWH27	M6 x 6
QWH35	M8 x 8



2.Linear Guideway Product Series

In an effort to meet customer’s requirement and service needs KGT offers several different types of guides. We supply the HG series which is suitable for CNC machineries, the EG series for automation industries, the WE series for single axis equipment, the RG series for high rigidity applications, and the miniature series, MGN/MGW, for medical devices and semiconductor equipment. Also for high technology industries, KGT has developed the QH and QE series with high speed and quiet characteristics.

(1) Types & series

Table 2-1 Types & Series

Series	Assembly Height	Load	Square Tap hole	Flange		
				Tap hole	Drilled hole	Combination
HG	High	Heavy Load	HGH-CA	-	-	-
		Super Heavy Load	HGH-HA	-	-	-
	Low	Heavy Load	HGL -CA	HGW-CA	HGW-CB	HGW-CC
		Super Heavy Load	HGL -HA	HGW-HA	HGW-HB	HGW-HC
EG	Low	Medium Load	EGH -SA	EGW-SA	EGW-SB	-
		Heavy Load	EGH -CA	EGW-CA	EGW-CB	-
WE	Low	Heavy Load	WEH-CA	-	-	WEW-CC
MGN	-	Standard	MGN-C	-	-	-
		Long	MGN-H	-	-	-
MGW	-	Standard	MGW-C	-	-	-
		Long	MGW-H	-	-	-
MGN-O	-	Standard	MGN-C-O	-	-	-
		Long	MGN-H-O	-	-	-
MGW-O	-	Standard	MGW-C-O	-	-	-
		Long	MGW-H-O	-	-	-
QH	High	Heavy Load	QHH-CA	-	-	-
		Super Heavy Load	QHH-HA	-	-	-
	Low	Heavy Load	-	QHW-CA	QHW-CB	QHW-CC
		Super Heavy Load	-	QHW-HA	QHW-HB	QHW-HC
QE	Low	Medium Load	QEH -SA	QEW-SA	QEW-SB	-
		Heavy Load	QEH -CA	QEW-CA	QEW-CB	-
QW	Low	Heavy Load	QWH-CA	-	-	QWW-CC
CG	High	Heavy Load	CGH-CA	-	-	-
		Super Heavy Load	CGH-HA	-	-	-
	Low	Heavy Load	CGL-CA	-	-	CGW-CC CGW-CA ⁽¹⁾
		Super Heavy Load	CGL-HA	-	-	CGW-HC CGW-HA ⁽¹⁾
RG	High	Heavy Load	RGH-CA	-	-	-
		Super Heavy Load	RGH-HA	-	-	-
	Low	Heavy Load	RGL-CA	-	-	RGW-CC
		Super Heavy Load	RGL-HA	-	-	RGW-HC
	Ultra low	Heavy Load	RGS-CA	-	-	RGF-CC
		Super Heavy Load	RGS-HA	-	-	RGF-HC
QR	High	Heavy Load	QRH-CA	-	-	-
		Super Heavy Load	QRH-HA	-	-	-
	Low	Heavy Load	QRL-CA	-	-	QRW-CC
		Super Heavy Load	QRL-HA	-	-	QRW-HC
CRG	High	Heavy Load	CRGH-CA	-	-	-
		Super Heavy Load	CRGH-HA	-	-	-
	Low	Heavy Load	CRGL-CA	-	-	CRGW-CC
		Super Heavy Load	CRGL-HA	-	-	CRGW-HC
AG	-	Heavy Load	AG-C	-	-	-
	-	Super Heavy Load	AG-H	-	-	-

Note : (1) For CGW-CA/HA ,The amount of block mounting holes is four.
For CGW-CC/HC ,The amount of block mounting holes is six.
Both types can be mounting from top or bottom.

[2] Accuracy classes

Table 2-2 Accuracy Classes

Series	Assembly Type					Interchangeable Type		
	Normal	High	Precision	Super Precision	Ultra Precision	Normal	High	Precision
	(C)	(H)	(P)	(SP)	(UP)	(C)	(H)	(P)
HG	●	●	●	●	●	●	●	●
EG	●	●	●	●	●	●	●	●
WE	●	●	●	●	●	●	●	●
MGN	●	●	●	-	-	●	●	●
MGW	●	●	●	-	-	●	●	●
MGN-0	●	●	●	-	-	●	●	●
MGW-0	●	●	●	-	-	●	●	●
QH	●	●	●	●	●	●	●	●
QE	●	●	●	●	●	●	●	●
QW	●	●	●	●	●	●	●	●
CG	●	●	●	●	●	●	●	●
RG	-	●	●	●	●	-	●	●
QR	-	●	●	●	●	-	●	●
CRG	-	●	●	●	●	-	●	●
AG	-	-	●	-	-	-	-	-

[3] Classification of preload

Table 2-3 Preload

Series	Non-interchangeable Type			Interchangeable Type	
	Light preload (Z0)	Medium Preload (ZA)	Heavy Preload (ZB)	Light Preload (Z0)	Medium Preload (ZA)
HG	●	●	●	●	●
EG	●	●	●	●	●
WE	●	●	●	●	●
QH	●	●	●	●	●
QE	●	●	●	●	●
QW	●	●	●	●	●
CG	●	●	●	●	●
AG	●	●	●	-	-

Series	Non-interchangeable Type			Interchangeable Type	
	Very Light Preload (Z0)	Medium Preload (ZA)	Heavy Preload (ZB)	Very Light Preload (Z0)	Light Preload (ZA)
RG	●	●	●	●	●
QR	●	●	●	●	●
CRG	●	●	●	●	●

Series	Non-interchangeable Type			Interchangeable Type		
	Light Clearance (ZF)	Very Ligh Preload (Z0)	Light Preload (Z1)	Light Clearance (ZF)	Very Ligh Preload (Z0)	Light Preload (Z1)
MGN	●	●	●	●	●	●
MGW	●	●	●	●	●	●
MGN-0	●	●	●	●	●	●
MGW-0	●	●	●	●	●	●

(4) Recommended accuracy grade for machine applications

Application Grade		AXIS	Accuracy Grade				
			C	H	P	SP	UP
CNC Machinery Tools	Lathes	X			●	●	●
		Z			●	●	
	Milling Machines Boring Machines	X				●	●
		Y			●	●	
		Z			●	●	
	Machine Center	X			●	●	●
		Y			●	●	●
		Z			●	●	
	Jig Borers	X					●
		Y					●
		Z					●
	Drilling Machines	X			●		
		Y			●		
		Z		●	●		
	Grinders	X				●	●
		Y			●	●	
	EDM	X			●	●	
		Y			●	●	
		Z			●		
	Wire Cut EDM	X				●	
		Y				●	
		U			●	●	
		V			●	●	
	Laser Cutting Machine	X			●		
		Y			●		
		Z			●		
General Machinery	Punching Press	X		●	●		
		Y		●	●		
	Single Purpose Machines			●	●	●	
	Wood Working Machines		●	●			
	Industrial Robot (Precision)				●	●	
	Industrial Robot (General)		●	●	●		
	Coordinate Measuring Machine					●	●
	Non-CNC Machine				●		
	Transport Equipment		●	●	●		
	X-Y Table				●	●	●
	Linear Actuator		●	●	●		
	Aircraft Landing Gear			●	●		
	Airfoil Control			●	●		
	Gate Valve		●	●			
	Power Steering			●			
	Glass Grinder				●	●	
	Surface Grinder				●		
	Induction Hardening Machine		●	●			
	Electromachine				●	●	●
	All-electric Injection Molding Machine		●	●	●		

2-1 HG Series - Heavy Load Ball Type Linear Guideway

HG series linear guideways are designed with load capacity and rigidity higher than other similar products with circular-arc groove and structure optimization. It features equal load ratings in the radial, reverse radial and lateral directions, and self-aligning to absorb installation-error. Thus, KGT HG series linear guideways can achieve a long life with high speed, high accuracy and smooth linear motion.

2-1-1 Features of HG Series

(1) Self-aligning capability

By design, the circular-arc groove has contact points at 45 degrees. HG series can absorb most installation errors due to surface irregularities and provide smooth linear motion through the elastic deformation of rolling elements and the shift of contact points. Self-aligning capability, high accuracy and smooth operation can be obtained with an easy installation.

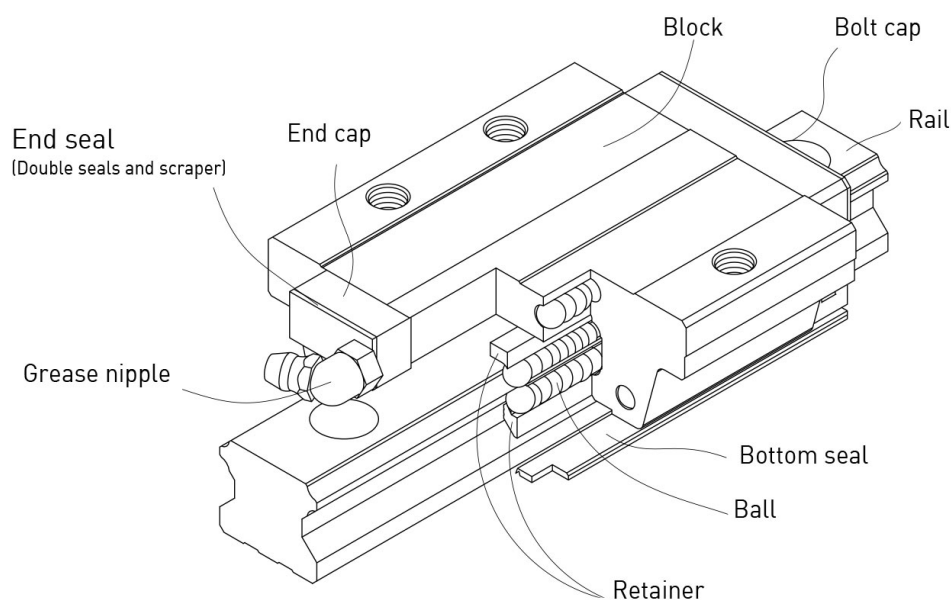
(2) Interchangeability

Because of precision dimensional control, the dimensional tolerance of HG series can be kept in a reasonable range, which means that any blocks and any rails in a specific series can be used together while maintaining dimensional tolerance. And a retainer is added to prevent the balls from falling out when the blocks are removed from the rail.

(3) High rigidity in all four directions

Because of the four-row design, the HG series linear guideway has equal load ratings in the radial, reverse radial and lateral directions. Furthermore, the circular-arc groove provides a wide-contact width between the balls and the groove raceway allowing large permissible loads and high rigidity.

2-1-2 Construction of HG Series

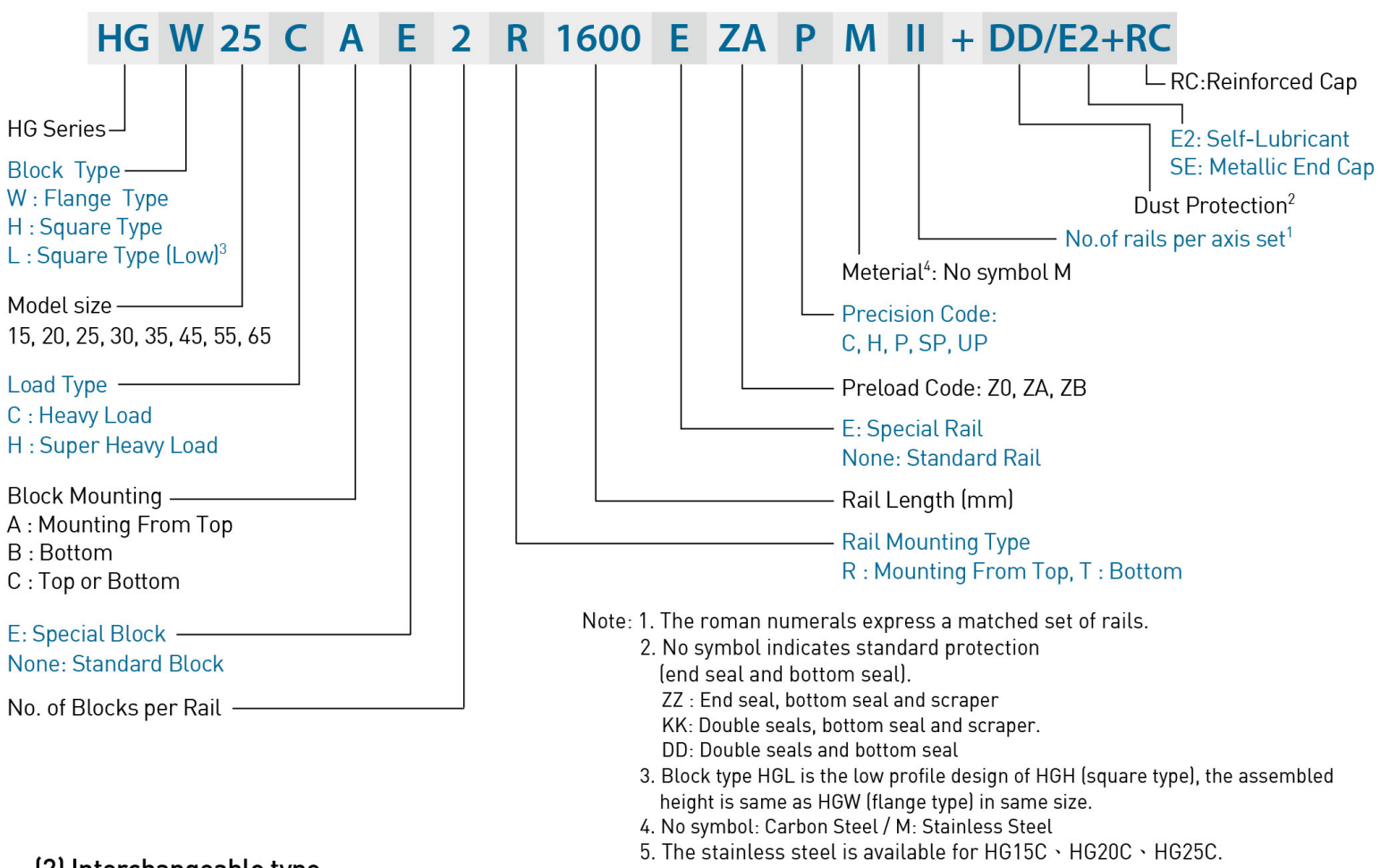


- Rolling circulation system: Block, Rail, End Cap and Retainer
- Lubrication system: Grease Nipple and Piping Joint
- Dust protection system: End seal, Bottom Seal, Bolt Cap, Double Seals and Scraper

2-1-3 Model Number of HG Series

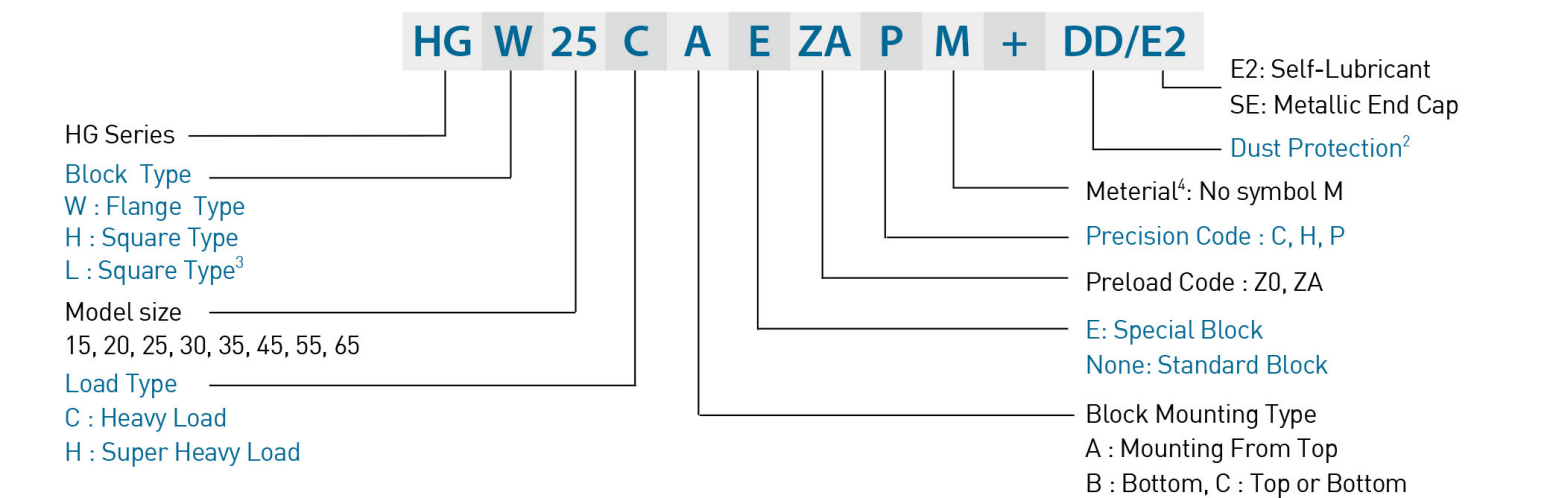
HG series guideways can be classified into non-interchangeable and interchangeable types. The sizes are identical. The only difference between the two types is that the interchangeable type of blocks and rails can be freely exchanged, and their accuracy can reach up to P class. The model number of HG series contains the size, type, accuracy class, preload class, etc..

(1) Non-interchangeable type

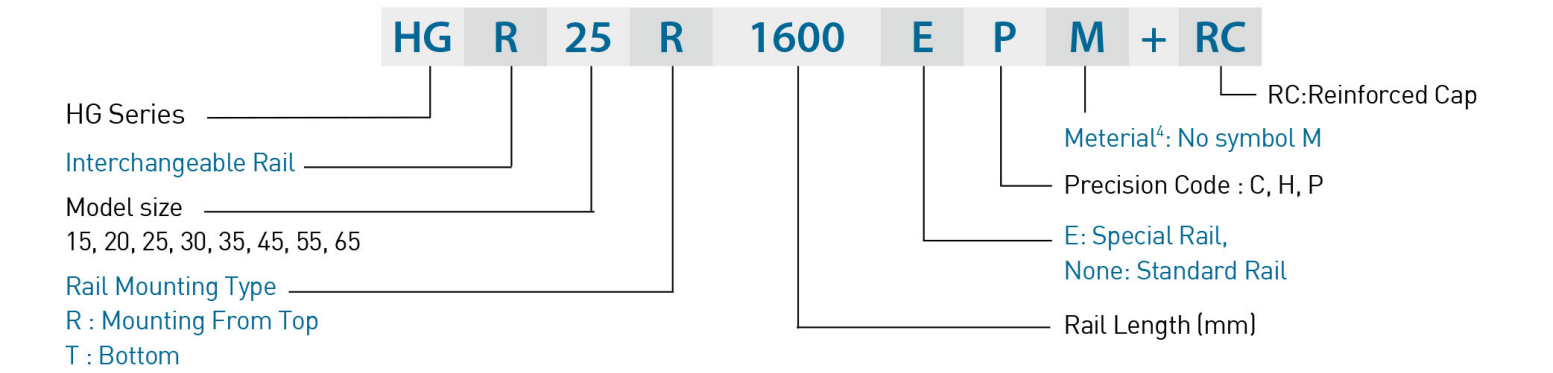


(2) Interchangeable type

○ Model Number of HG Block



○ Model Number of HG Rail



KGT[®] 24

HG Series

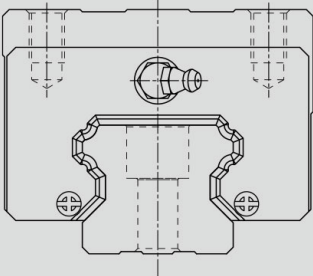
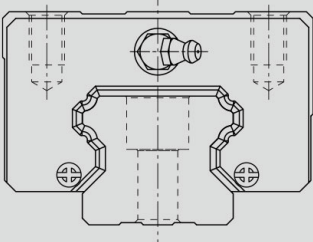
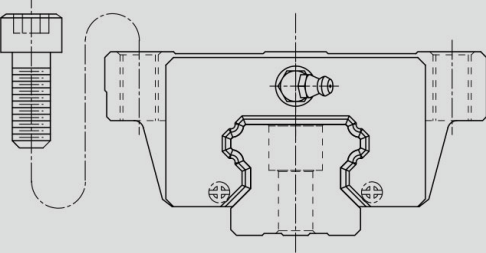
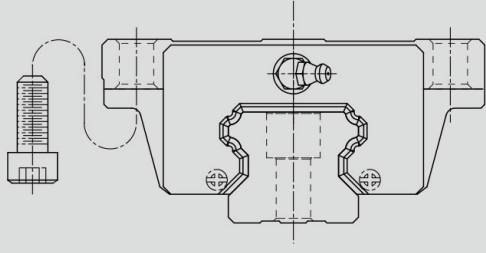
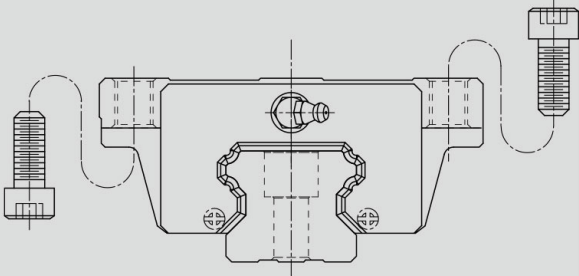
Heavy Load Ball Type

2-1-4 Types

(1) Block types

There're two types of blocks:flange and square. The flange type is suitable for heavy moment load application because of the lower assembly height and wider mounting surface.

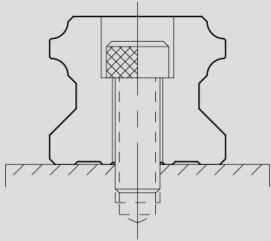
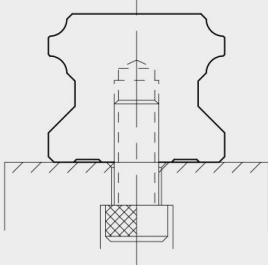
Table 2-1-1 Block Types

Type	Model	Shape	Height (mm)	Rail Length (mm)	Main Application
Square	HGH-CA HGH-HA		28	100	- Machine Centers - NC Lathes - Grinding Machines - Precision Machining Machines - Heavy Cutting Machines - Automation Devices - Transportation Equipment - Measuring Equipment - Devices Requiring High Positional Accuracy
			↓	↓	
			90	4000	
	HGL-CA HGL-HA		24	100	
Flange	HGW-CA HGW-HA		24	100	
			↓	↓	
			90	4000	
	HGW-CB HGW-HB		24	100	
			↓	↓	
			90	4000	
	HGW-CC HGW-HC		24	100	
			↓	↓	
			90	4000	

(2) Rail types

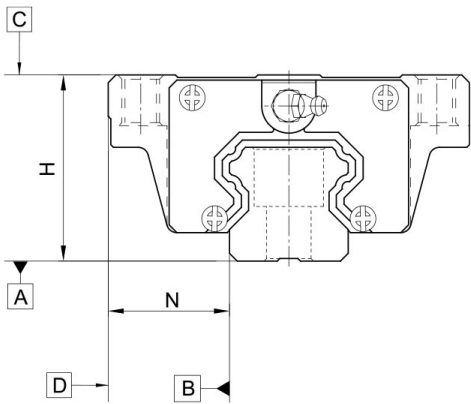
Besides the standard top mounting type, the bottom mounting type is also available.

Table 2-1-2 Rail Types

Mounting from Top	Mounting from bottom
	

2-1-5 Accuracy Classes

The accuracy of HG series can be classified into normal (C), high (H), precision (P), super precision (SP), ultra precision (UP), five classes. Please choose the class by referring the accuracy of applied equipment.



(1) Accuracy of non-interchangeable guideways

Table 2-1-3 Accuracy Standards

Unit: mm

Item	HG - 15, 20				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Dimensional tolerance of width N	± 0.1	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Variation of height H	0.02	0.01	0.006	0.004	0.003
Variation of width N	0.02	0.01	0.006	0.004	0.003
Running parallelism of block surface C to surface A	See Table 2-1-11				
Running parallelism of block surface D to surface B	See Table 2-1-11				

Table 2-1-4 Accuracy Standards

Unit: mm

Item	HG - 25, 30, 35				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Dimensional tolerance of width N	± 0.1	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Variation of height H	0.02	0.015	0.007	0.005	0.003
Variation of width N	0.03	0.015	0.007	0.005	0.003
Running parallelism of block surface C to surface A	See Table 2-1-11				
Running parallelism of block surface D to surface B	See Table 2-1-11				

Heavy Load Ball Type

Table 2-1-5 Accuracy Standards

Unit: mm

Item	HG - 45, 55				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.05	0 - 0.05	0 - 0.03	0 - 0.02
Dimensional tolerance of width N	± 0.1	± 0.05	0 - 0.05	0 - 0.03	0 - 0.02
Variation of height H	0.03	0.015	0.007	0.005	0.003
Variation of width N	0.03	0.02	0.01	0.007	0.005
Running parallelism of block surface C to surface A	See Table 2-1-11				
Running parallelism of block surface D to surface B	See Table 2-1-11				

Table 2-1-6 Accuracy Standards

Unit: mm

Item	HG - 65				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.07	0 - 0.07	0 - 0.05	0 - 0.03
Dimensional tolerance of width N	± 0.1	± 0.07	0 - 0.07	0 - 0.05	0 - 0.03
Variation of height H	0.03	0.02	0.01	0.007	0.005
Variation of width N	0.03	0.025	0.015	0.01	0.007
Running parallelism of block surface C to surface A	See Table 2-1-11				
Running parallelism of block surface D to surface B	See Table 2-1-11				

(2) Accuracy of interchangeable guideways

Table 2-1-7 Accuracy Standards

Unit: mm

Item	HG - 15, 20		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.03	± 0.015
Dimensional tolerance of width N	± 0.1	± 0.03	± 0.015
Variation of height H	0.02	0.01	0.006
Variation of width N	0.02	0.01	0.006
Running parallelism of block surface C to surface A	See Table 2-1-11		
Running parallelism of block surface D to surface B	See Table 2-1-11		

Table 2-1-8 Accuracy Standards

Unit: mm

Item	HG - 25, 30, 35		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.04	± 0.02
Dimensional tolerance of width N	± 0.1	± 0.04	± 0.02
Variation of height H	0.02	0.015	0.007
Variation of width N	0.03	0.015	0.007
Running parallelism of block surface C to surface A	See Table 2-1-11		
Running parallelism of block surface D to surface B	See Table 2-1-11		

Table 2-1-9 Accuracy Standards

Unit: mm

Item	HG - 45, 55		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.05	± 0.025
Dimensional tolerance of width N	± 0.1	± 0.05	± 0.025
Variation of height H	0.03	0.015	0.007
Variation of width N	0.03	0.02	0.01
Running parallelism of block surface C to surface A	See Table 2-1-11		
Running parallelism of block surface D to surface B	See Table 2-1-11		

Table 2-1-10 Accuracy Standards

Unit: mm

Item	HG - 65		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.07	± 0.035
Dimensional tolerance of width N	± 0.1	± 0.07	± 0.035
Variation of height H	0.03	0.02	0.01
Variation of width N	0.03	0.025	0.015
Running parallelism of block surface C to surface A	See Table 2-1-11		
Running parallelism of block surface D to surface B	See Table 2-1-11		

(3) Accuracy of running parallelism

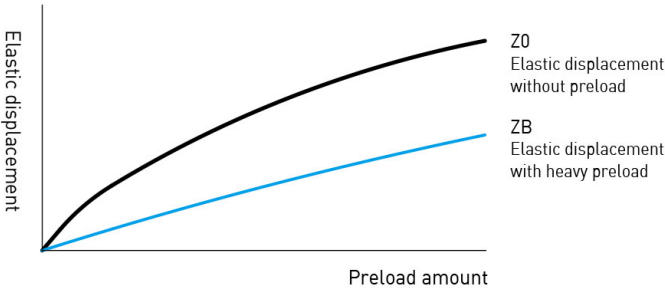
Table 2-1-11 Accuracy of Running Parallelism

Rail Length (mm)	Accuracy (μm)				
	C	H	P	SP	UP
~ 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 ~ 1,100	24	16	9	6	3
1,100 ~ 1,500	26	18	11	7	4
1,500 ~ 1,900	28	20	13	8	4
1,900 ~ 2,500	31	22	15	10	5
2,500 ~ 3,100	33	25	18	11	6
3,100 ~ 3,600	36	27	20	14	7
3,600 ~ 4,000	37	28	21	15	7

2-1-6 Preload

(1) Definition

A preload can be applied to each guideway. Oversized balls are used. Generally, a linear motion guideway has a negative clearance between groove and balls in order to improve stiffness and maintain high precision. The figure shows the load is multiplied by the preload, the rigidity is doubled and the deflection is reduced by one half. The preload no larger than ZA would be recommended for the model size under HG20 to avoid an over-preload affecting the guideway's life.



(2) Preload classes

KGT offers three classes of standard preload for various applications and conditions.

Table 2-1-12 Preload Classes

Class	Code	Preload	Condition	Examples of Application
Light Preload	Z0	0~ 0.02C	Certain load direction,low impact, low precision required	Transportation devices, auto-packing machines, X-Y axis for general industrial machines, welding machines, welders
Medium Preload	ZA	0.05C~0.07C	High precision required	Machining centers, Z axis for general industrial, machines, EDM, NC lathes, Precision X-Y tables, measuring equipment
Heavy Preload	ZB	0.10C~ 0.12C	High rigidity required, with vibration and impact	Machining centers, grinding machines, NC lathes, horizontal and vertical milling machines, Z axis of machine tools, Heavy cutting machines

Class	Interchangeable Guideway	Non-Interchangeable Guideway
Preload classes	Z0, ZA	Z0, ZA, ZB

Note: The “C” in the preload column denotes basic dynamic load rating.

(3) Stiffness performance

Stiffness depends on preload. The following table shows stiffness value of each size.

Table 2-1-13 Radial stiffness for HG Series

Load type	Series / Size	Stiffness (N/μm)		
		Z0	ZA	ZB
Heavy load	HG 15C	196	365	483
	HG 20C	232	460	678
	HG 25C	292	539	705
	HG 30C	354	618	823
	HG 35C	395	642	865
	HG 45C	505	738	980
	HG 55C	609	828	1092
	HG 65C	716	918	1201
Super heavy load	HG 20H	300	611	824
	HG 25H	378	715	935
	HG 30H	453	820	1093
	HG 35H	509	855	1150
	HG 45H	649	970	1298
	HG 55H	789	1085	1445
	HG 65H	946	1221	1599

2-1-7 Lubrication

(1) Grease

Grease nipple

NO.34320001

NO.34320003

NO.34310002

NO. 34310003(OPTION)

NO.3431000B(OPTION)

Mounting location

The standard location of the grease fitting is at either end of the block, but the nipple can be mounted at either side of the block instead. For side installation, contact KGT to pre-drill the block at the desired location.

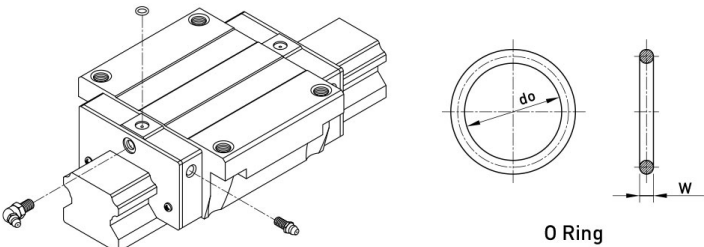
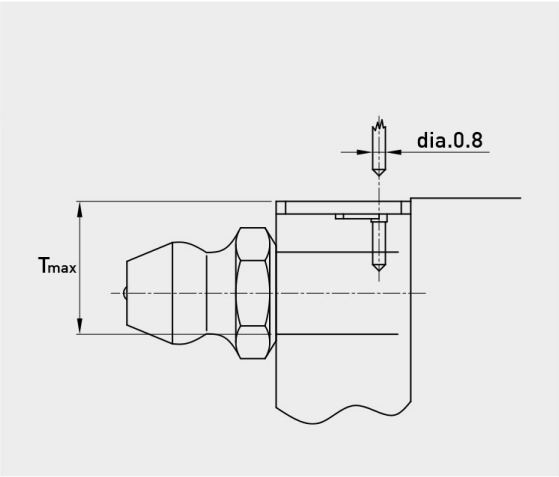


Table 2-1-14 O-Ring size and max. permissible depth for piercing

Size	O-Ring		Lube hole at top: max. permissible depth for piercing
	do (mm)	W (mm)	T _{max} (mm)
HG15	2.5±0.15	1.5±0.15	3.75
HG20	4.5±0.15	1.5±0.15	5.7
HG25	4.5±0.15	1.5±0.15	5.8
HG30	4.5±0.15	1.5±0.15	6.3
HG35	4.5±0.15	1.5±0.15	8.8
HG45	4.5±0.15	1.5±0.15	8.2
HG55	4.5±0.15	1.5±0.15	11.8
HG65	4.5±0.15	1.5±0.15	10.8



The lubricant amount for a block filled with grease

Table 2-1-15 The lubricant Amount for a Block Filled with Grease

Size	Heavy load (cm ³)	Super heavy load (cm ³)	Size	Heavy load (cm ³)	Super heavy load (cm ³)
HG15	1	-	HG35	10	12
HG20	2	3	HG45	17	21
HG25	5	6	HG55	26	33
HG30	7	8	HG65	50	61

Frequency of replenishment

Check the grease every 100 km, or every 3-6 months.

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30

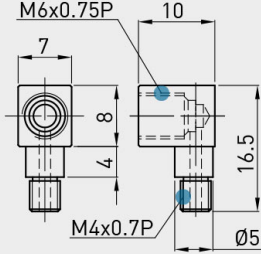
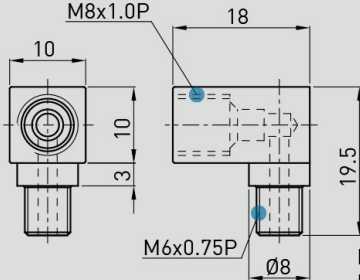
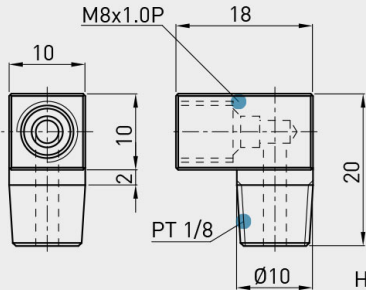
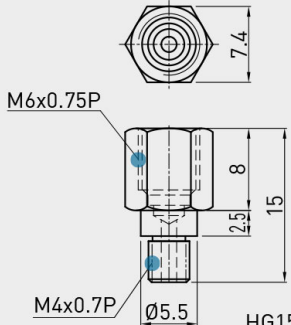
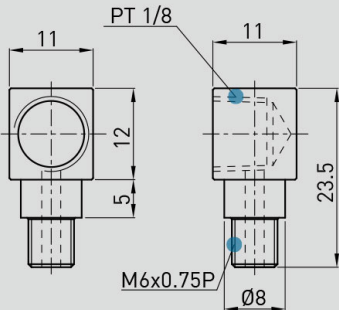
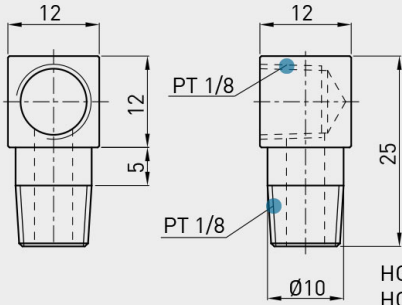
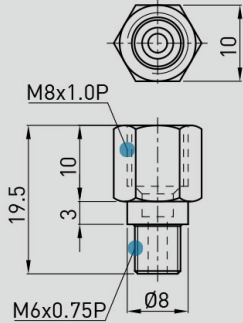
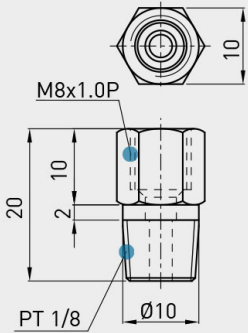
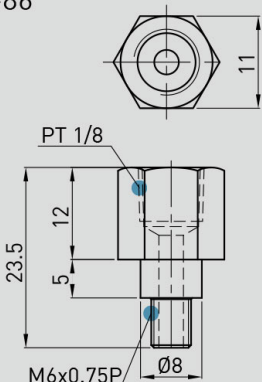
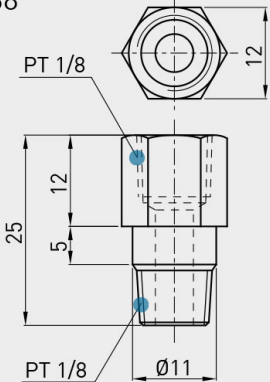
HG Series

Heavy Load Ball Type

(2) Oil

The recommended viscosity of oil is about 30~150cSt. If customers need to use oil-type lubrication, please inform us.

Types of oil piping joint

LF-64  NO.97000EA1 HG15	LF-76  NO.970002A1 HG20 HG25 HG30 HG35	LF-78  NO.970006A1 HG45 HG55 HG65
SF-64  NO.97001TA1 HG15	LF-86  NO.970004A1 HG20 HG25 HG30 HG35	LF-88  NO.970008A1 HG45 HG55 HG65
SF-76  NO.970001A1 HG20 HG25 HG30 HG35	SF-78  NO.970005A1 HG45 HG55 HG65	
SF-86  NO.970003A1 HG20 HG25 HG30 HG35	SF-88  NO.970007A1 HG45 HG55 HG65	

Oil refilling rate

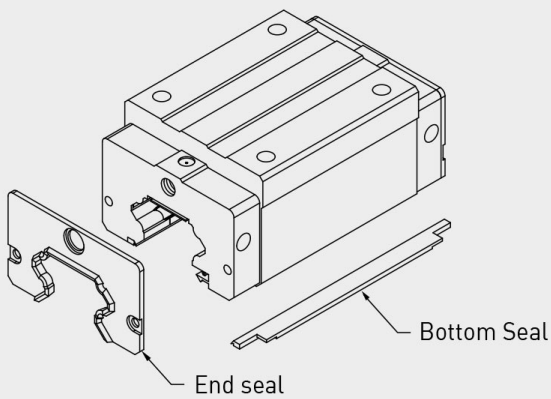
Table 2-1-16

Size	Refilling rate (cm ³ /hr)	Size	Refilling rate (cm ³ /hr)
HG15	0.2	HG35	0.3
HG20	0.2	HG45	0.4
HG25	0.3	HG55	0.5
HG30	0.3	HG65	0.6

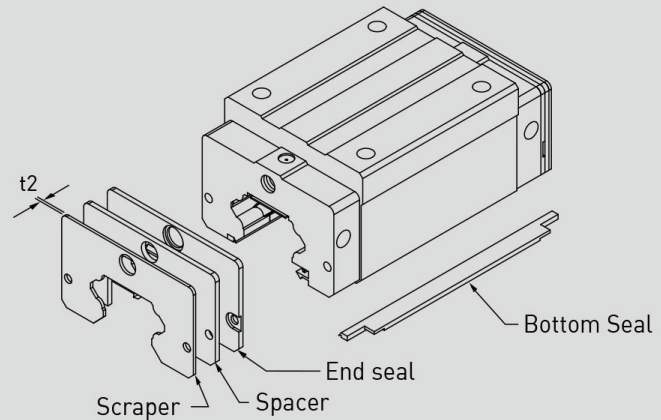
2-1-8 Dust Proof Accessories

(1) Codes of standard dust proof accessories

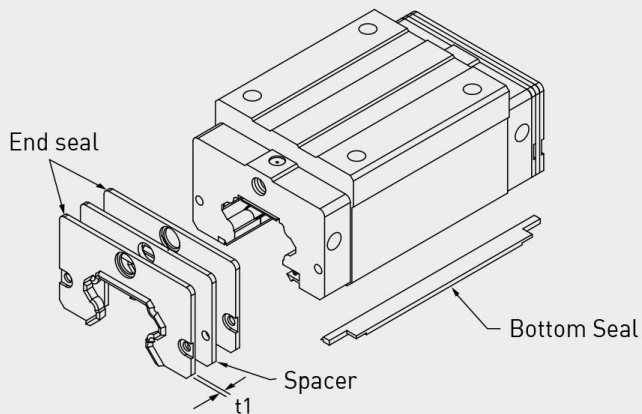
If the following accessories are needed, please add the code followed by the model number.



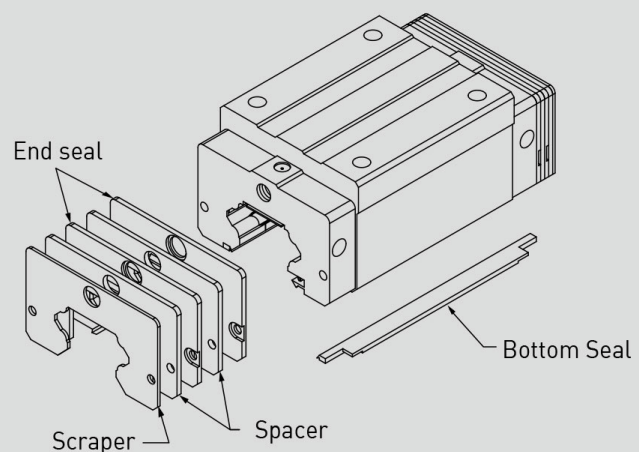
No symbol: Standard Protection (End seal + Bottom Seal)



ZZ (End seal + Bottom Seal + Scraper)



DD (Double seals + Bottom Seal)



KK (Double seals + Bottom Seal + Scraper)

Note: HG20/25/65 are without spacer.

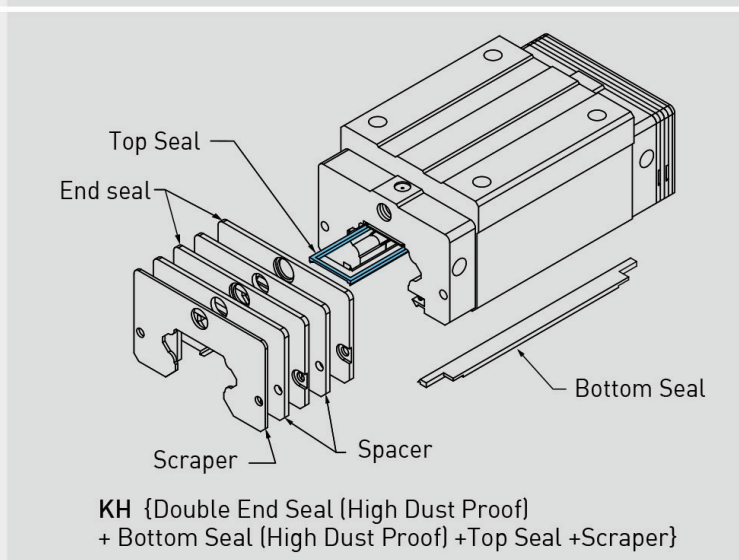
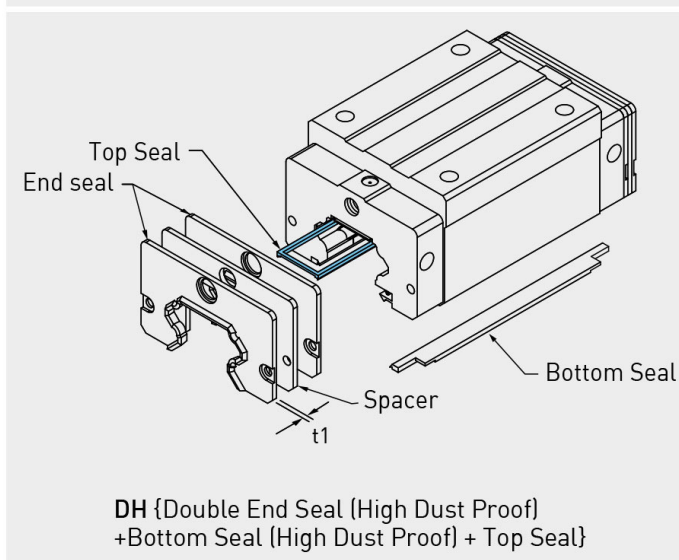
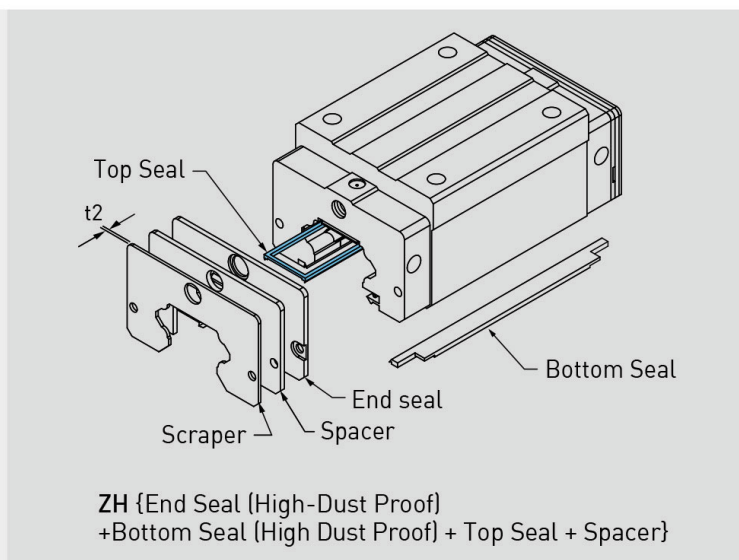
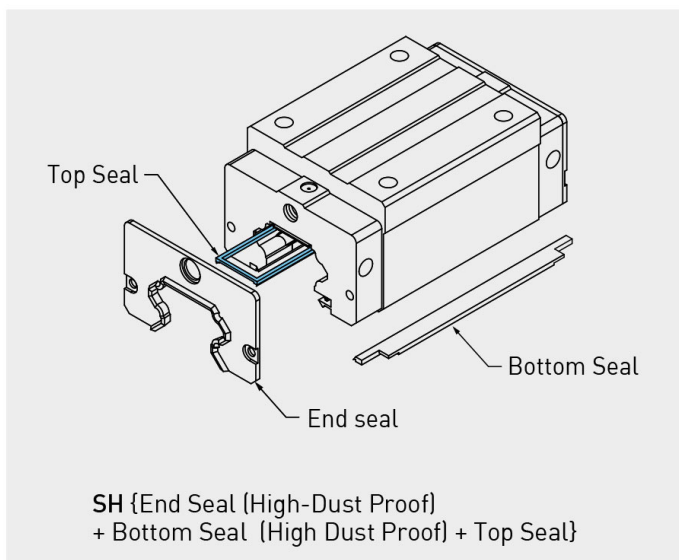
KGT[®] 32

HG Series

Heavy Load Ball Type

[2] Codes of high-dust proof accessories

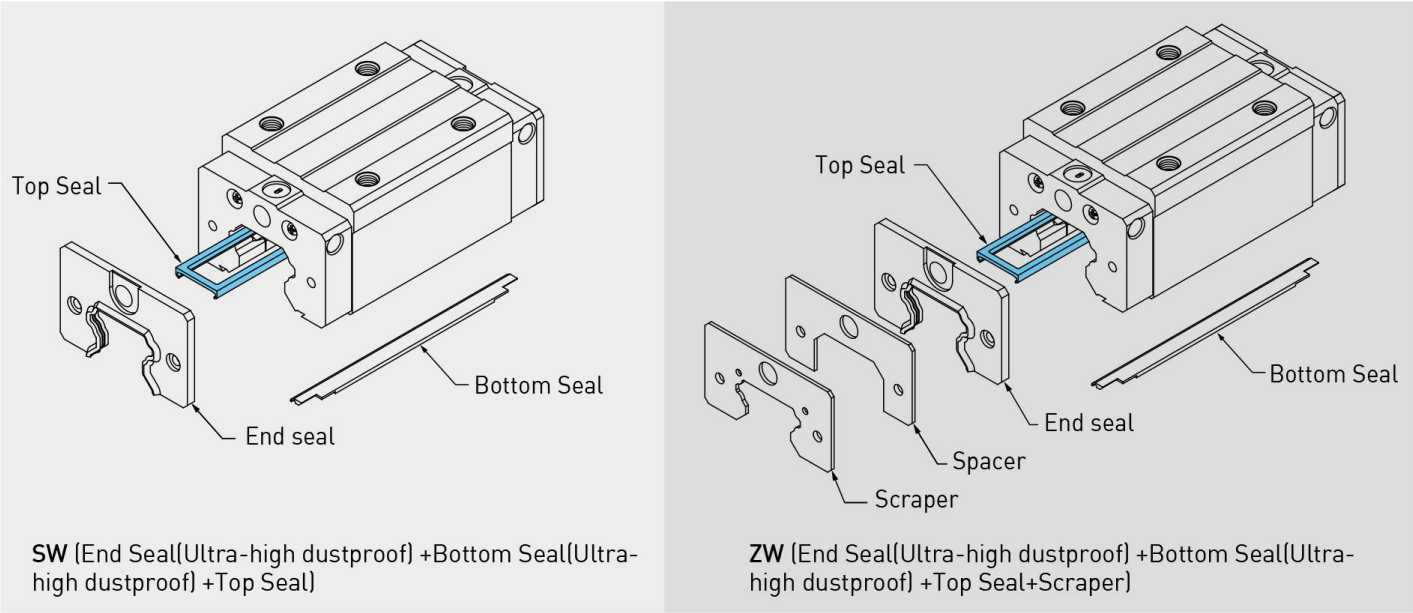
KGT develops many kinds of dust proof accessories for different application and working environment to avoid dust or debris. If the following accessories are needed, please add the code followed by the model number.



- Note:
1. The available size for high dust proof accessories are HG20(C/H), 25(C/H), 30(C/H), 35(C/H) and 45C.
 2. The value of friction force will increase 0.6~1.2 kgf.
 3. HG20/25 are without spacer.
 4. If higher dust proof accessories is needed , please contact KGT

(3) Codes of ultra-high dust proof accessories

KGT has developed high dust proof accessories which is used for environment that is full of dust and particle, such as wood working machinery and glass/stone machining equipment. These accessories show high performance of dust proof. If accessories are needed, please add the code followed by the model number.



- Note :
- 1. The available size for high dust proof accessories are HG15C, HG20(C/H), HG25(C/H), HG30(C/H), HG35(C/H), HG45(C/H).
 - 2. The value of fricton force will increase 1.5~4.0 kgf.
 - 3. MGN5 is only supplied with End Seal (Ultra-high dustproof)

(4) Fuction of dust proof accessories

End seal and bottom seal

To prevent life reduction caused by iron chips or dust entering the block.

Double seals

Enhances the wiping effect, foreign matter can be completely wiped off.

Table 2-1-17 Dimensions of end seal

Size	Thickness (t1) (mm)	Size	Thickness (t1) (mm)
HG15 ES	3	HG35 ES	3.2
HG20 ES	3.5	HG45 ES	4.5
HG25 ES	3.5	HG55 ES	4.5
HG30 ES	3.2	HG65 ES	6

Scraper

The scraper removes high-temperature iron chips and larger foreign objects.

Table 2-1-18 Dimensions of scraper

Size	Thickness (t2) (mm)	Size	Thickness (t2) (mm)
HG15 SC	1.5	HG35 SC	1.5
HG20 SC	1.5	HG45 SC	1.5
HG25 SC	1.5	HG55 SC	1.5
HG30 SC	1.5	HG65 SC	1.5

Top Seal

Top seal can efficiently avoid dust from the surface of rail or tapping hole getting inside the block.

○ Bolt caps for rail mounting holes

Caps are used to cover the mounting holes to prevent chips or other foreign objects from collecting in the holes. The caps will be enclosed in each rail package.

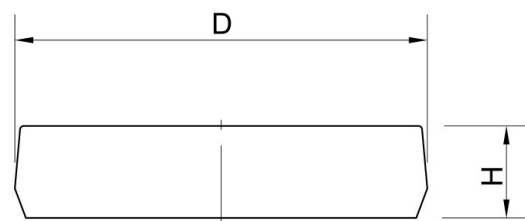


Table 2-1-19 Dimensions of Bolt Caps for Rail Mounting Holes

Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)	Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)
HGR15	M4	7.65	1.1	HGR35	M8	14.20	3.5
HGR20	M5	9.65	2.5	HGR45	M12	20.25	4.5
HGR25	M6	11.15	2.5	HGR55	M14	23.25	5.0
HGR30	M8	14.20	3.5	HGR65	M16	26.35	5.0

(5) Dimensions of block equipped with the parts

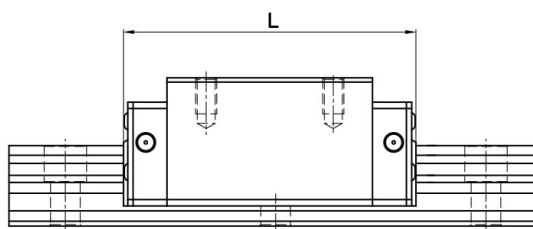


Table 2-1-20 Overall block length

unit: mm

Size	Overall block length (L)					
	SS/SH	ZZ/ZH	DD/DH	KK/KH	SW	ZW
HG15C	61.4 (61.8)	69.0 (69.0)	68.0 (68.4)	75.6 (75.6)	63.2 (63.2)	71.0 (71.0)
*HG20C	77.5 (79.3)	82.5 (84.5)	82.5 (84.3)	87.5 (89.5)	78.5 (78.5)	86.3 (87.7)
*HG20H	92.2 (94.0)	97.2 (99.2)	97.5 (99.0)	102.2 (104.2)	93.2 (93.2)	101.0 (102.4)
*HG25C	84.0 (85.0)	89.0 (91.0)	89.0 (90.0)	94.0 (96.0)	85.0 (85.0)	92.8 (94.8)
*HG25H	104.6 (105.6)	109.6 (111.6)	109.6 (110.6)	114.6 (116.6)	105.6 (105.6)	113.4 (115.4)
*HG30C	97.4 (99.4)	105.4 (107.4)	104.8 (106.8)	112.8 (114.8)	99.0 (100.4)	107.2 (109.2)
*HG30H	120.4 (122.4)	128.4 (130.4)	127.8 (129.8)	135.8 (137.8)	122.0 (123.4)	130.2 (132.2)
*HG35C	112.4 (114.4)	120.4 (122.4)	119.8 (121.8)	127.8 (129.8)	115.2 (116.0)	123.4 (125.4)
*HG35H	138.2 (140.2)	146.2 (148.2)	145.6 (147.6)	153.6 (155.6)	141.0 (141.8)	149.2 (151.2)
*HG45C	139.4 (139.4)	150.0 (150.0)	149.4 (149.4)	160.0 (160.0)	140.0 (140.0)	148.8 (150.2)
HG45H	171.2 (171.2)	181.8 (181.8)	181.2 (181.2)	191.8 (191.8)	171.8 (171.8)	180.6 (182.0)
HG55C	166.7 (166.7)	177.1 (177.1)	177.1 (177.1)	187.5 (187.5)	-	-
HG55H	204.8 (204.8)	215.2 (215.2)	215.2 (215.2)	225.6 (225.6)	-	-
HG65C	200.2 (200.2)	208.2 (208.2)	209.2 (209.2)	217.2 (217.2)	-	-
HG65H	259.6 (259.6)	267.6 (267.6)	268.6 (268.6)	276.6 (276.6)	-	-

Note : 1. For the marking of “*”, it means this specification is available for SH/ZH/DH/KH dust proof accessories.

2. The marking of “[]” denotes the maximum block length with screws, lips of end seals, etc.

2-1-9 Friction

The maximum value of resistance per end seal are as shown in the table.

Table 2-1-21 Seal Resistance

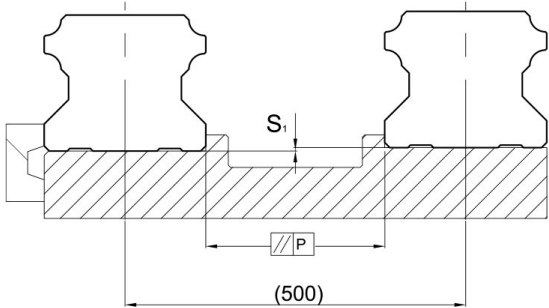
Size	Resistance N (kgf)	Size	Resistance N (kgf)
HG15	2.35 [0.24]	HG35	4.91 [0.5]
HG20	2.75 [0.28]	HG45	3.83 [0.39]
HG25	3.14 [0.32]	HG55	4.61 [0.47]
HG30	3.53 [0.36]	HG65	5.79 [0.59]

- Note: 1. 1kgf=9.81N
2. Please inform KGT if low friction request is required.

2-1-10 The Accuracy Tolerance of Mounting Surface

(1) The accuracy tolerance of rail-mounting surface

Because of the circular-arc contact design, the HG linear guideway can compensate for some surface-error on installation and still maintain smooth linear motion.
As long as the accuracy requirements for the mounting surface are followed, high accuracy and rigidity of linear motion of the guideway can be obtained without any difficulty. For fast installation and smooth movement ability of the deviation in mounting surface accuracy.



(2) The parallelism tolerance of reference surface (P)

Table 2-1-22 Max. Parallelism Tolerance (P)

unit: μm

Size	Preload classes		
	Z0	ZA	ZB
HG15	25	18	13
HG20	25	20	18
HG25	30	22	20
HG30	40	30	27
HG35	50	35	30
HG45	60	40	35
HG55	70	50	45
HG65	80	60	55

(3) The accuracy tolerance of reference surface height

Table 2-1-23 Max. Tolerance of Reference Surface Height (S₁)

unit: μm

Size	Preload classes		
	Z0	ZA	ZB
HG15	130	85	35
HG20	130	85	50
HG25	130	85	70
HG30	170	110	90
HG35	210	150	120
HG45	250	170	140
HG55	300	210	170
HG65	350	250	200

Note : Permissible value is proportional to the axial distance

2-1-11 Cautions for Installation

(1) Shoulder heights and fillets

Improper shoulder heights and fillets of mounting surfaces will cause a deviation in accuracy and the interference with the rail or block. As long as the recommended shoulder heights and fillets are followed, installation inaccuracies should be eliminated.

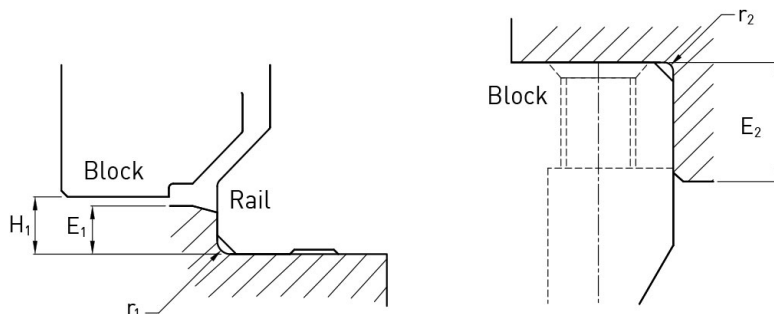


Table 2-1-24 Shoulder Heights and Fillets

Size	Max. radius of fillets r_1 (mm)	Max. radius of fillets r_2 (mm)	Shoulder height beside the rail E_1 (mm)	Shoulder height beside the block E_2 (mm)	Clearance under block H_1 (mm)
HG15	0.5	0.5	3	4	4.3
HG20	0.5	0.5	3.5	5	4.6
HG25	1.0	1	5	5	5.5
HG30	1.0	1	5	5	6
HG35	1.0	1	6	6	7.5
HG45	1.0	1	8	8	9.5
HG55	1.5	1.5	10	10	13
HG65	1.5	1.5	10	10	15

(2) Tightening Torque of Bolts for Installation

Improper tightening of bolts will seriously influence the accuracy of Linear Guideway installation. The following tightening torques for different sizes of bolts are recommended.

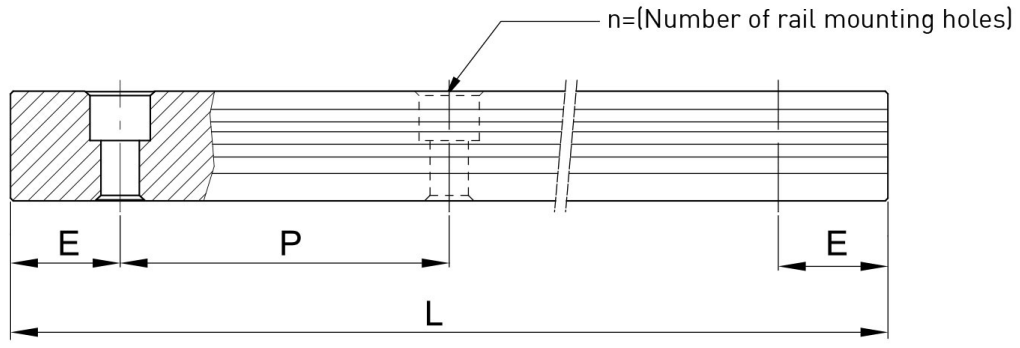
Table 2-1-25 Mounting Torque

Size	Bolt size	Torque N-cm (kgf-cm)		
		Iron	Casting	Aluminum
HG15	M4×0.7P×16L	392 (40)	274 (28)	206 (21)
HG20	M5×0.8P×16L	883 (90)	588 (60)	441 (45)
HG25	M6×1P×20L	1373 (140)	921 (94)	686 (70)
HG30	M8×1.25P×25L	3041 (310)	2010 (205)	1470 (150)
HG35	M8×1.25P×25L	3041 (310)	2010 (205)	1470 (150)
HG45	M12×1.75P×35L	11772 (1200)	7840 (800)	5880 (600)
HG55	M14×2P×45L	15696 (1600)	10500 (1100)	7840 (800)
HG65	M16×2P×50L	19620 (2000)	13100 (1350)	9800 (1000)

Note: 1 kgf=9.81 N

2-1-12 Standard and Maximum Lengths of Rail

KGT offers standard rail lengths for customer needs. For non-standard E-values, the recommended dimension should no greater than 1/2 of the pitch (P) dimension. This will prevent an unstable rail end.



$$L = (n-1) \times P + 2 \times E \quad \text{Eq.2.1}$$

L : Total length of rail (mm)

n : Number of mounting holes

P : Distance between any two holes (mm)

E : Distance from the center of the last hole to the edge (mm)

Table 2-1-26 Rail Standard Length and Max. Length

unit: mm

Item	HG15	HG20	HG25	HG30	HG35	HG45	HG55	HG65
Standard Length L(n)	160 (3)	220 (4)	220 (4)	280 (4)	280 (4)	570 (6)	780 (7)	1,270 (9)
	220 (4)	280 (5)	280 (5)	440 (6)	440 (6)	885 (9)	1,020 (9)	1,570 (11)
	280 (5)	340 (6)	340 (6)	600 (8)	600 (8)	1,200 (12)	1,260 (11)	2,020 (14)
	340 (6)	460 (8)	460 (8)	760 (10)	760 (10)	1,620 (16)	1,500 (13)	2,620 (18)
	460 (8)	640 (11)	640 (11)	1,000 (13)	1,000 (13)	2,040 (20)	1,980 (17)	
	640 (11)	820 (14)	820 (14)	1,640 (21)	1,640 (21)	2,460 (24)	2,580 (22)	
	820 (14)	1,000 (17)	1,000 (17)	2,040 (26)	2,040 (26)	2,985 (29)	2,940 (25)	
		1,240 (21)	1,240 (21)	2,520 (32)	2,520 (32)			
			1,600 (27)	3,000 (38)	3,000 (38)			
Pitch (P)	60	60	60	80	80	105	120	150
Distance to End (E _s)	20	20	20	20	20	22.5	30	35
Max. Standard Length	4,000(67)	4,000 (67)	4,000 (67)	3,960 (50)	3,960 (50)	3,930 (38)	3,900 (33)	3,970 (27)
Max. Length	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000

Note : 1. Tolerance of E value for standard rail is 0.5~0.5 mm. Tolerance of E value for jointed rail is 0~-0.3 mm.

2. Maximum standard length means the max. rail length with standard E value on both sides.

3. If different E value is needed, please contact

4. HGR15/HGR20/HGR25 of stainless steel is supplied with the maximum length of 2000mm.

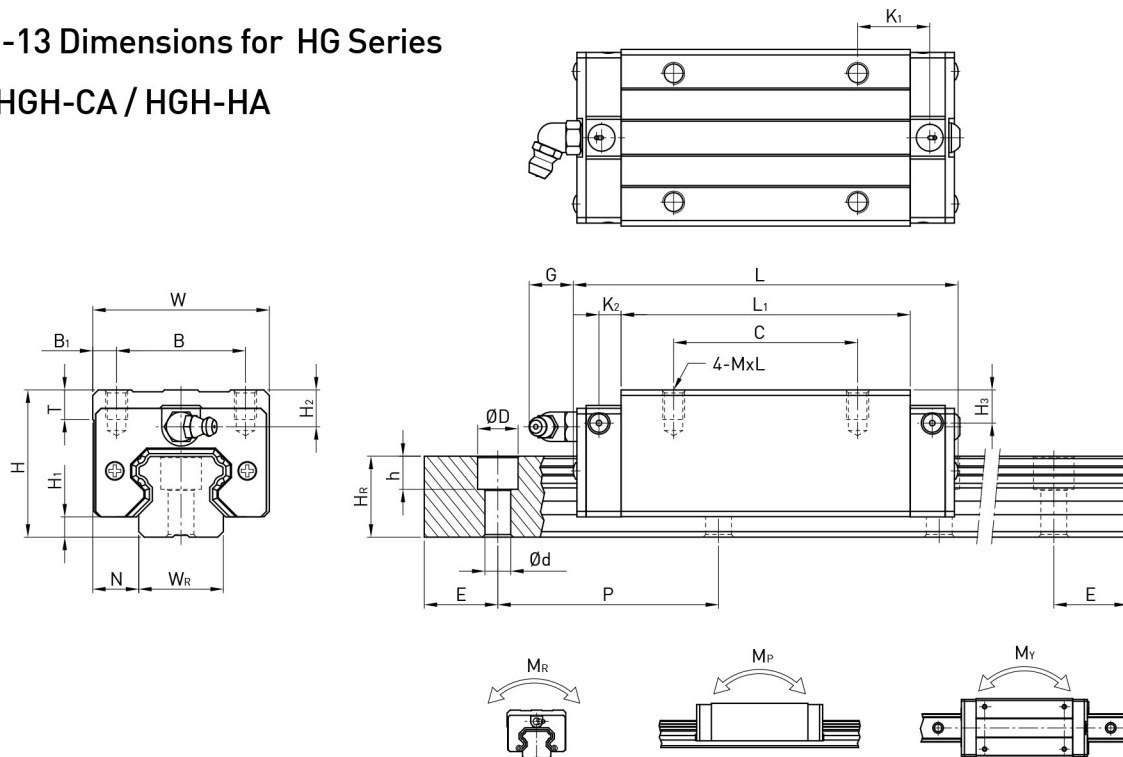
KGT[®] 38

HG Series

Heavy Load Ball Type

2-1-13 Dimensions for HG Series

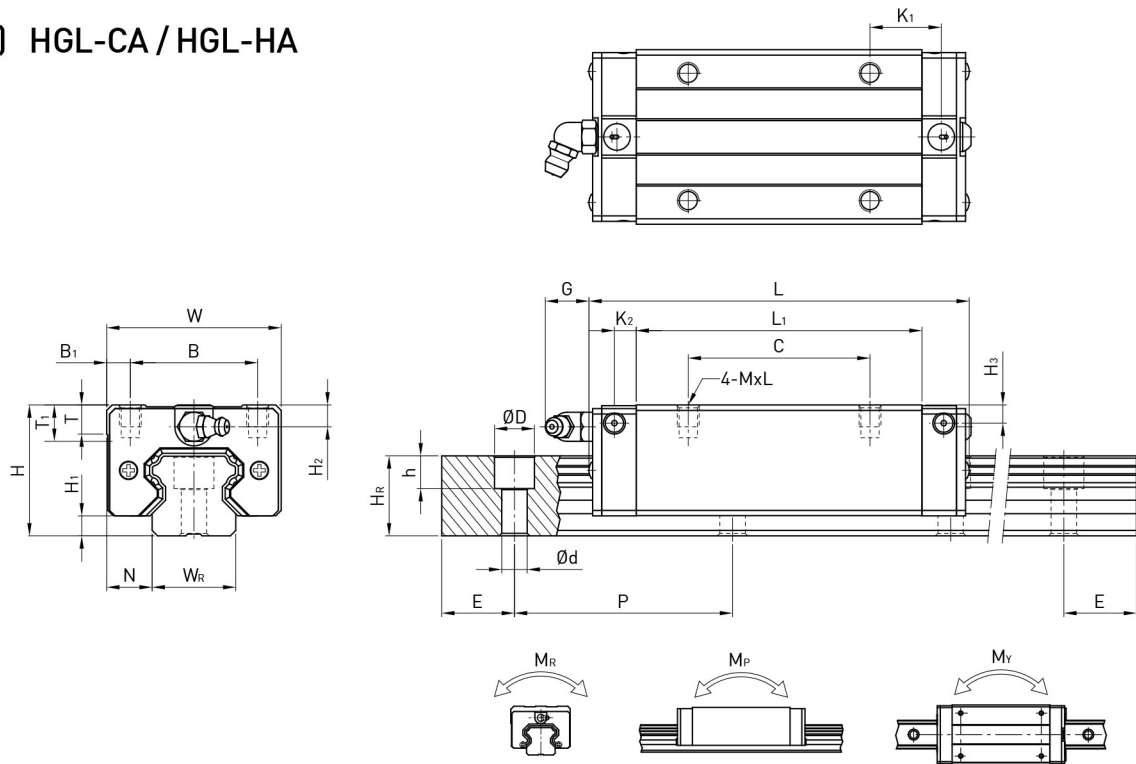
(1) HGH-CA / HGH-HA



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)														Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
				M _R	M _P	M _Y	Block	Rail																									
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	MxL	T	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	kN-m	kN-m	kN-m	kg	kg/m		
HGH15CA	28	4.3	9.5	34	26	4	26	39.4	61.4	10	4.85	5.3	M4x5	6	7.95	7.7	15	15	7.5	5.3	4.5	60	20	M4x16	14.7	23.47	0.12	0.10	0.10	0.18	1.45		
HGH20CA	30	4.6	12	44	32	6	36	50.5	77.5	12.25	6	12	M5x6	8	6	6	20	17.5	9.5	8.5	6	60	20	M5x16	27.1	36.68	0.27	0.20	0.20	0.30	2.21		
HGH20HA							50	65.2	92.2																12.6	32.7	47.96	0.35	0.35	0.35		0.39	
HGH25CA	40	5.5	12.5	48	35	6.5	35	58	84	15.7	6	12	M6x8	8	10	9	23	22	11	9	7	60	20	M6x20	34.9	52.82	0.42	0.33	0.33	0.51	3.21		
HGH25HA							50	78.6	104.6	18.5															42.2	69.07	0.56	0.57	0.57	0.69			
HGH30CA	45	6	16	60	40	10	40	70	97.4	20.25	6	12	M8x10	8.5	9.5	13.8	28	26	14	12	9	80	20	M8x25	48.5	71.87	0.66	0.53	0.53	0.88	4.47		
HGH30HA							60	93	120.4	21.75															58.6	93.99	0.88	0.92	0.92	1.16			
HGH35CA	55	7.5	18	70	50	10	50	80	112.4	20.6	7	12	M8x12	10.2	16	19.6	34	29	14	12	9	80	20	M8x25	64.6	93.88	1.16	0.81	0.81	1.45	6.30		
HGH35HA							72	105.8	138.2	22.5															77.9	122.77	1.54	1.40	1.40	1.92			
HGH45CA	70	9.5	20.5	86	60	13	60	97	139.4	23	10	12.9	M10x17	16	18.5	30.5	45	38	20	17	14	105	22.5	M12x35	103.8	146.71	1.98	1.55	1.55	2.73	10.41		
HGH45HA							80	128.8	171.2	28.9															125.3	191.85	2.63	2.68	2.68	3.61			
HGH55CA	80	13	23.5	100	75	12.5	75	117.7	166.7	27.35	11	12.9	M12x18	17.5	22	29	53	44	23	20	16	120	30	M14x45	153.2	211.23	3.69	2.64	2.64	4.17	15.08		
HGH55HA							95	155.8	204.8	36.4															184.9	276.23	4.88	4.57	4.57	5.49			
HGH65CA	90	15	31.5	126	76	25	70	144.2	200.2	43.1	14	12.9	M16x20	25	15	15	63	53	26	22	18	150	35	M16x50	213.2	287.48	6.65	4.27	4.27	7.00	21.18		
HGH65HA							120	203.6	259.6	47.8															277.8	420.17	9.38	7.38	7.38	9.82			

Note : 1 kgf = 9.81 N

(2) HGL-CA / HGL-HA



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)														Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	MxL	T	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R	M _P	M _Y	Block	Rail		
HGL15CA	24	4.3	9.5	34	26	4	26	39.4	61.4	10	4.85	5.3	M4x4	6	3.95	3.7	15	15	7.5	5.3	4.5	60	20	M4x16	14.7	23.47	0.12	0.10	0.10	0.14	1.45		
HGL25CA	36	5.5	12.5	48	35	6.5	35	58	84	15.7	6	12	M6x6	8	6	5	23	22	11	9	7	60	20	M6x20	34.9	52.82	0.42	0.33	0.33	0.42	3.21		
HGL25HA							50	78.6	104.6	18.5															42.2	69.07	0.56	0.57	0.57	0.57			
HGL30CA	42	6	16	60	40	10	40	70	97.4	20.25	6	12	M8x10	8.5	6.5	10.8	28	26	14	12	9	80	20	M8x25	48.5	71.87	0.66	0.53	0.53	0.78	4.47		
HGL30HA							60	93	120.4	21.75															58.6	93.99	0.88	0.92	0.92	1.03			
HGL35CA	48	7.5	18	70	50	10	50	80	112.4	20.6	7	12	M8x12	10.2	9	12.6	34	29	14	12	9	80	20	M8x25	64.6	93.88	1.16	0.81	0.81	1.14	6.30		
HGL35HA							72	105.8	138.2	22.5															77.9	122.77	1.54	1.40	1.40	1.52			
HGL45CA	60	9.5	20.5	86	60	13	60	97	139.4	23	10	12.9	M10x17	16	8.5	20.5	45	38	20	17	14	105	22.5	M12x35	103.8	146.71	1.98	1.55	1.55	2.08	10.41		
HGL45HA							80	128.8	171.2	28.9															125.3	191.85	2.63	2.68	2.68	2.75			
HGL55CA	70	13	23.5	100	75	12.5	75	117.7	166.7	27.35	11	12.9	M12x18	17.5	12	19	53	44	23	20	16	120	30	M14x45	153.2	211.23	3.69	2.64	2.64	3.25	15.08		
HGL55HA							95	155.8	204.8	36.4															184.9	276.23	4.88	4.57	4.57	4.27			

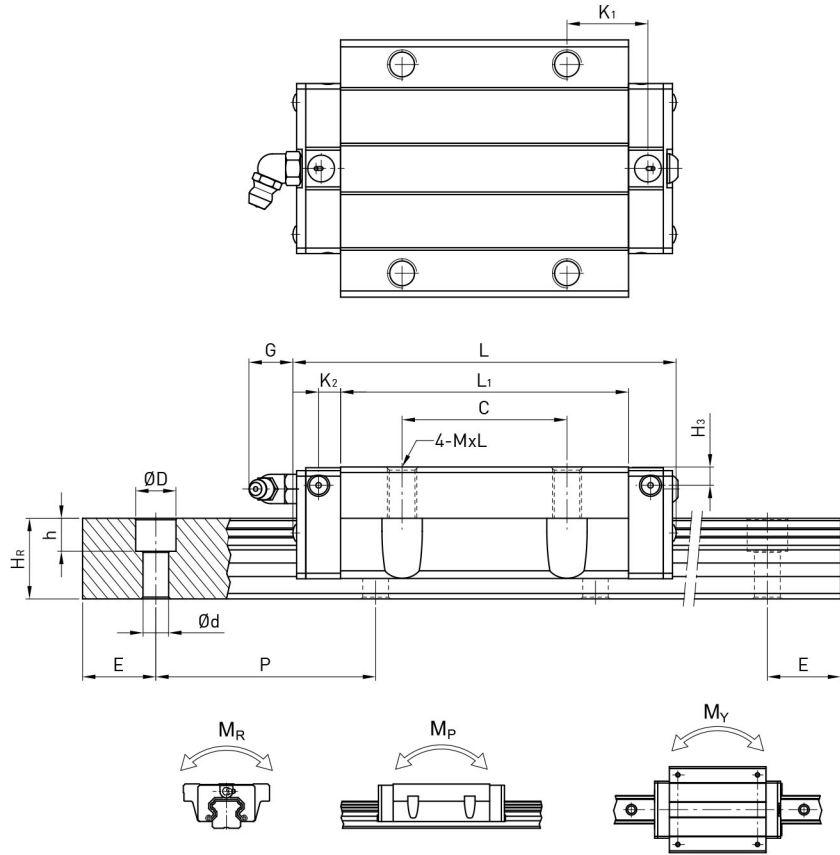
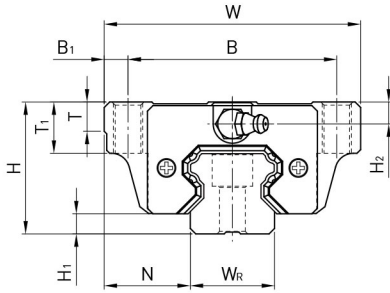
Note : 1 kgf = 9.81 N

KGT[®] 40

HG Series

Heavy Load Ball Type

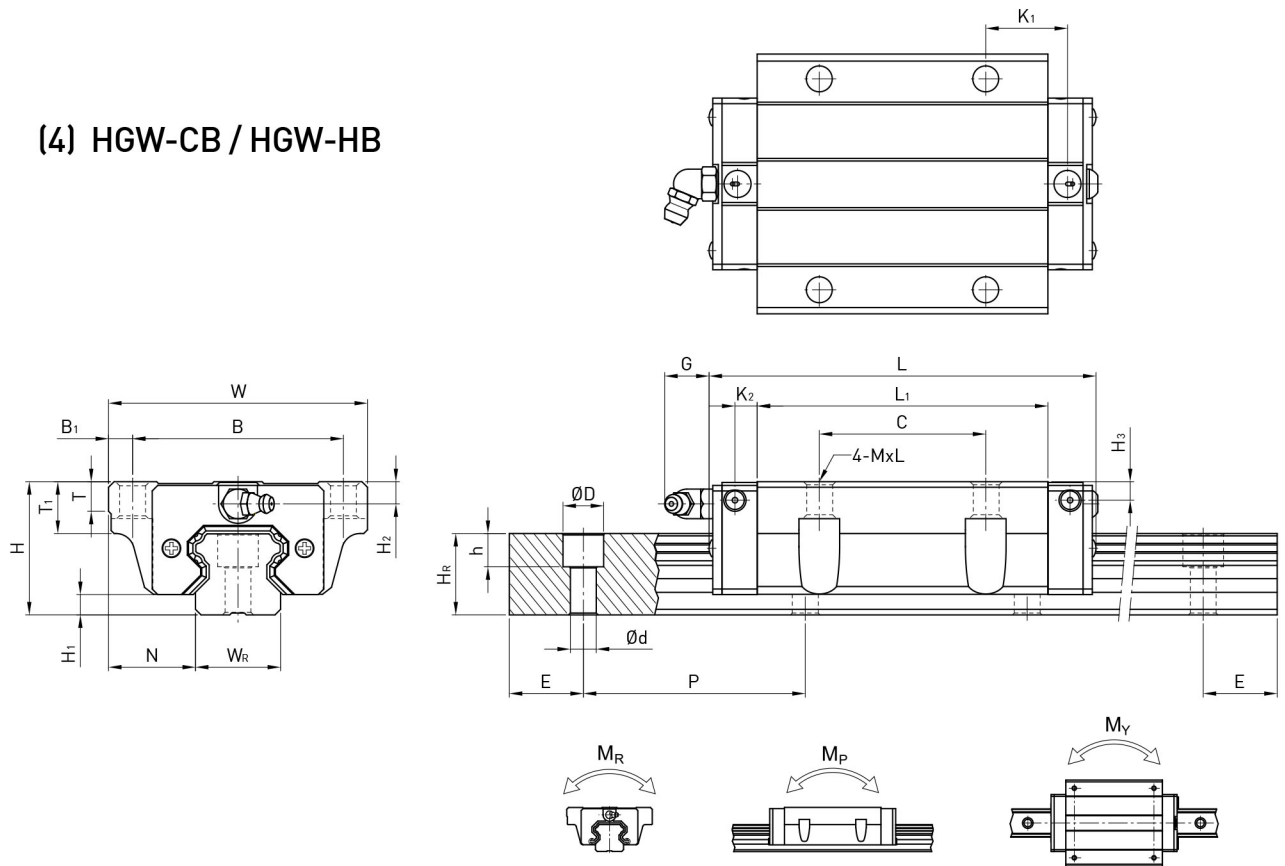
(3) HGW-CA / HGW-HA



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)																Dimensions of Rail (mm)						Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	M	T	T ₁	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R kN-m	M _P kN-m	M _Y kN-m	Block kg	Rail kg/m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
HGW15CA	24	4.3	16	47	38	4.5	30	39.4	61.4	8	4.85	5.3	M5	6	8.9	3.95	3.7	15	15	7.5	5.3	4.5	60	20	M4x16	14.7	23.47	0.12	0.10	0.10	0.17	1.45																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
HGW20CA	30	4.6	21.5	63	53	5	40	50.5	77.5	10.25	6	12	M6	8	10	6	6	20	17.5	9.5	8.5	6	60	20	M5x16	27.1	36.68	0.27	0.20	0.20	0.40	2.21																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
HGW20HA								65.2	92.2	17.6																65.2	92.2	17.6	65.2	92.2	17.6		65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6	65.2	92.2	17.6

Note : 1 kgf = 9.81 N

(4) HGW-CB / HGW-HB



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)																Dimensions of Rail (mm)						Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	M	T	T ₁	T ₂	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R kN-m	M _P kN-m	M _Y kN-m	Block kg	Rail kg/m
HGW15CB	24	4.3	16	47	38	4.5	30	39.4	61.4	8	4.85	5.3	Ø4.5	6	8.9	6.95	3.95	3.7	15	15	7.5	5.3	4.5	60	20	M4x16	14.7	23.47	0.12	0.10	0.10	0.17	1.45
HGW20CB	30	4.6	21.5	63	53	5	40	50.5	77.5	10.25	6	12	Ø6	8	10	9.5	6	6	20	17.5	9.5	8.5	6	60	20	M5x16	27.1	36.68	0.27	0.20	0.20	0.40	2.21
HGW20HB								65.2	92.2	17.6																	32.7	47.96	0.35	0.35	0.35	0.52	
HGW25CB	36	5.5	23.5	70	57	6.5	45	58	84	10.7	6	12	Ø7	8	14	10	6	5	23	22	11	9	7	60	20	M6x20	34.9	52.82	0.42	0.33	0.33	0.59	3.21
HGW25HB								78.6	104.6	21																	42.2	69.07	0.56	0.57	0.57	0.80	
HGW30CB	42	6	31	90	72	9	52	70	97.4	14.25	6	12	Ø9	8.5	16	10	6.5	10.8	28	26	14	12	9	80	20	M8x25	48.5	71.87	0.66	0.53	0.53	1.09	4.47
HGW30HB								93	120.4	25.75																	58.6	93.99	0.88	0.92	0.92	1.44	
HGW35CB	48	7.5	33	100	82	9	62	80	112.4	14.6	7	12	Ø9	10.1	18	13	9	12.6	34	29	14	12	9	80	20	M8x25	64.6	93.88	1.16	0.81	0.81	1.56	6.30
HGW35HB								105.8	138.2	27.5																	77.9	122.77	1.54	1.40	1.40	2.06	
HGW45CB	60	9.5	37.5	120	100	10	80	97	139.4	13	10	12.9	Ø11	15.1	22	15	8.5	20.5	45	38	20	17	14	105	22.5	M12x35	103.8	146.71	1.98	1.55	1.55	2.79	10.41
HGW45HB								128.8	171.2	28.9																	125.3	191.85	2.63	2.68	2.68	3.69	
HGW55CB	70	13	43.5	140	116	12	95	117.7	166.7	17.35	11	12.9	Ø14	17.5	26.5	17	12	19	53	44	23	20	16	120	30	M14x45	153.2	211.23	3.69	2.64	2.64	4.52	15.08
HGW55HB								155.8	204.8	36.4																	184.9	276.23	4.88	4.57	4.57	5.96	
HGW65CB	90	15	53.5	170	142	14	110	144.2	200.2	23.1	14	12.9	Ø16	25	37.5	23	15	15	63	53	26	22	18	150	35	M16x50	213.2	287.48	6.65	4.27	4.27	9.17	21.18
HGW65HB								203.6	259.6	52.8																	277.8	420.17	9.38	7.38	7.38	12.89	

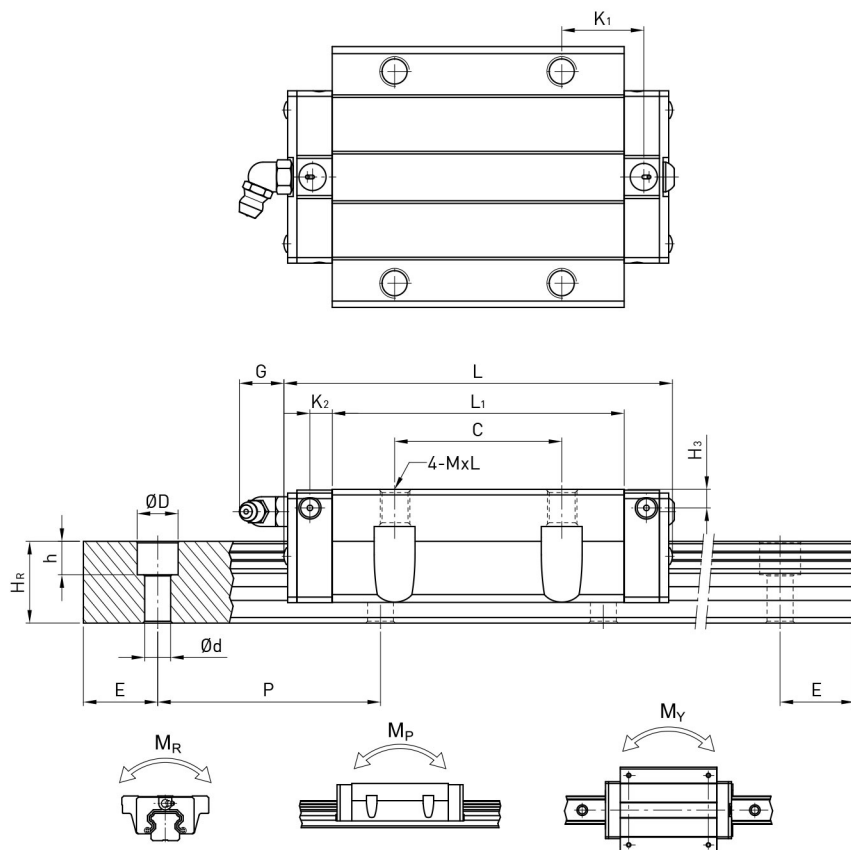
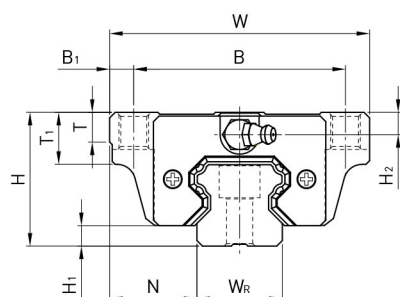
Note : 1 kgf = 9.81 N

KGT[®] 42

HG Series

Heavy Load Ball Type

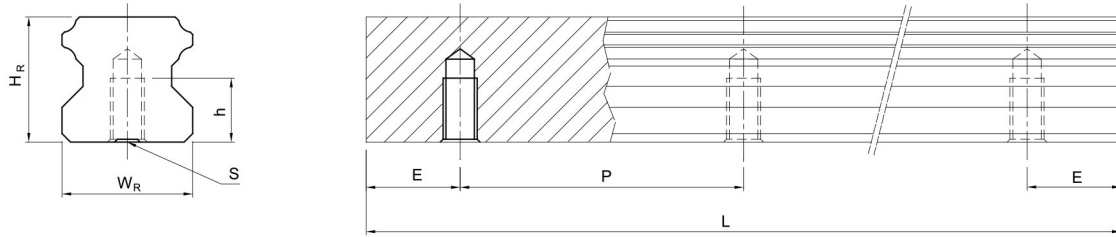
(5) HGW-CC / HGW-HC



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)																Dimensions of Rail (mm)						Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
																													M _R	M _P	M _Y	Block	Rail
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	M	T	T ₁	T ₂	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	kN-m	kN-m	kN-m	kg	kg/m
HGW15CC	24	4.3	16	47	38	4.5	30	39.4	61.4	8	4.85	5.3	M5	6	8.9	6.95	3.95	3.7	15	15	7.5	5.3	4.5	60	20	M4x16	14.7	23.47	0.12	0.10	0.10	0.17	1.45
HGW20CC	30	4.6	21.5	63	53	5	40	50.5	77.5	10.25	6	12	M6	8	10	9.5	6	6	20	17.5	9.5	8.5	6	60	20	M5x16	27.1	36.68	0.27	0.20	0.20	0.40	2.21
HGW20HC								65.2	92.2	17.6																	32.7	47.96	0.35	0.35	0.35	0.52	
HGW25CC	36	5.5	23.5	70	57	6.5	45	58	84	10.7	6	12	M8	8	14	10	6	5	23	22	11	9	7	60	20	M6x20	34.9	52.82	0.42	0.33	0.33	0.59	3.21
HGW25HC								78.6	104.6	21																	42.2	69.07	0.56	0.57	0.57	0.80	
HGW30CC	42	6	31	90	72	9	52	70	97.4	14.25	6	12	M10	8.5	16	10	6.5	10.8	28	26	14	12	9	80	20	M8x25	48.5	71.87	0.66	0.53	0.53	1.09	4.47
HGW30HC								93	120.4	25.75																	58.6	93.99	0.88	0.92	0.92	1.44	
HGW35CC	48	7.5	33	100	82	9	62	80	112.4	14.6	7	12	M10	10.1	18	13	9	12.6	34	29	14	12	9	80	20	M8x25	64.6	93.88	1.16	0.81	0.81	1.56	6.30
HGW35HC								105.8	138.2	27.5																	77.9	122.77	1.54	1.40	1.40	2.06	
HGW45CC	60	9.5	37.5	120	100	10	80	97	139.4	13	10	12.9	M12	15.1	22	15	8.5	20.5	45	38	20	17	14	105	22.5	M12x35	103.8	146.71	1.98	1.55	1.55	2.79	10.41
HGW45HC								128.8	171.2	28.9																	125.3	191.85	2.63	2.68	2.68	3.69	
HGW55CC	70	13	43.5	140	116	12	95	117.7	166.7	17.35	11	12.9	M14	17.5	26.5	17	12	19	53	44	23	20	16	120	30	M14x45	153.2	211.23	3.69	2.64	2.64	4.52	15.08
HGW55HC								155.8	204.8	36.4																	184.9	276.23	4.88	4.57	4.57	5.96	
HGW65CC	90	15	53.5	170	142	14	110	144.2	200.2	23.1	14	12.9	M16	25	37.5	23	15	15	63	53	26	22	18	150	35	M16x50	213.2	287.48	6.65	4.27	4.27	9.17	21.18
HGW65HC								203.6	259.6	52.8																	277.8	420.17	9.38	7.38	7.38	12.89	

Note : 1 kgf = 9.81 N

(6) Dimesions for HGR-T (Rail Mounting from Bottom)



Model No.	Dimensions of Rail (mm)						Weight
	W_R	H_R	S	h	P	E	(kg/m)
HGR15T	15	15	M5 x 0.8P	8	60	20	1.48
HGR20T	20	17.5	M6 x 1P	10	60	20	2.29
HGR25T	23	22	M6 x 1P	12	60	20	3.35
HGR30T	28	26	M8 x 1.25P	15	80	20	4.67
HGR35T	34	29	M8x1.25P	17	80	20	6.51
HGR45T	45	38	M12 x 1.75P	24	105	22.5	10.87
HGR55T	53	44	M14 x 2P	24	120	30	15.67
HGR65T	63	53	M20 x 2.5P	30	150	35	21.73

KGT[®] 44

EG Series

Low Profile Ball Type

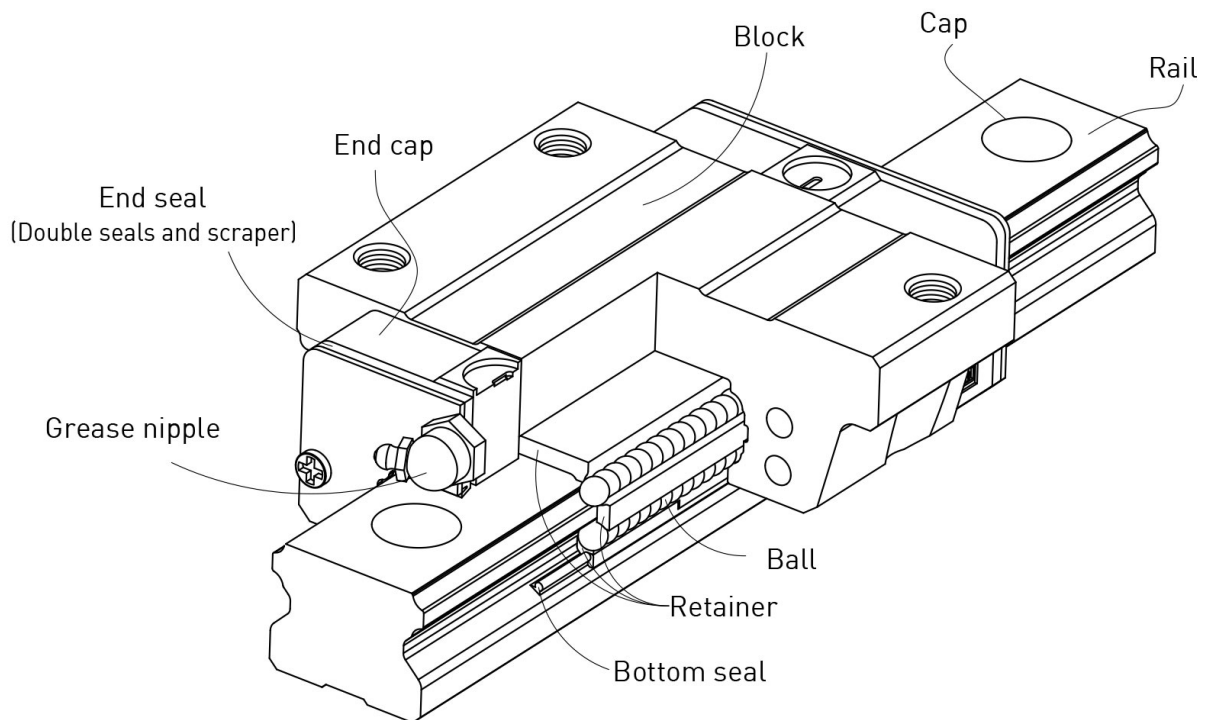
2-2 EG Series - Low Profile Ball Type Linear Guideway

2-2-1 Features of the EG Series Linear Guideway

The design of the EG series offers a low profile, high load capacity, and high rigidity. It also features an equal load rating in all four directions and self-aligning capability to absorb installation-error, allowing for higher accuracies. Additionally, the lower assembly height and the shorter length make the EG series more suitable for high-speed, automation machines and applications where space is limited.

The retainer is designed to hold the balls in the block even when it is removed from the rail.

2-2-2 Construction of EG Series

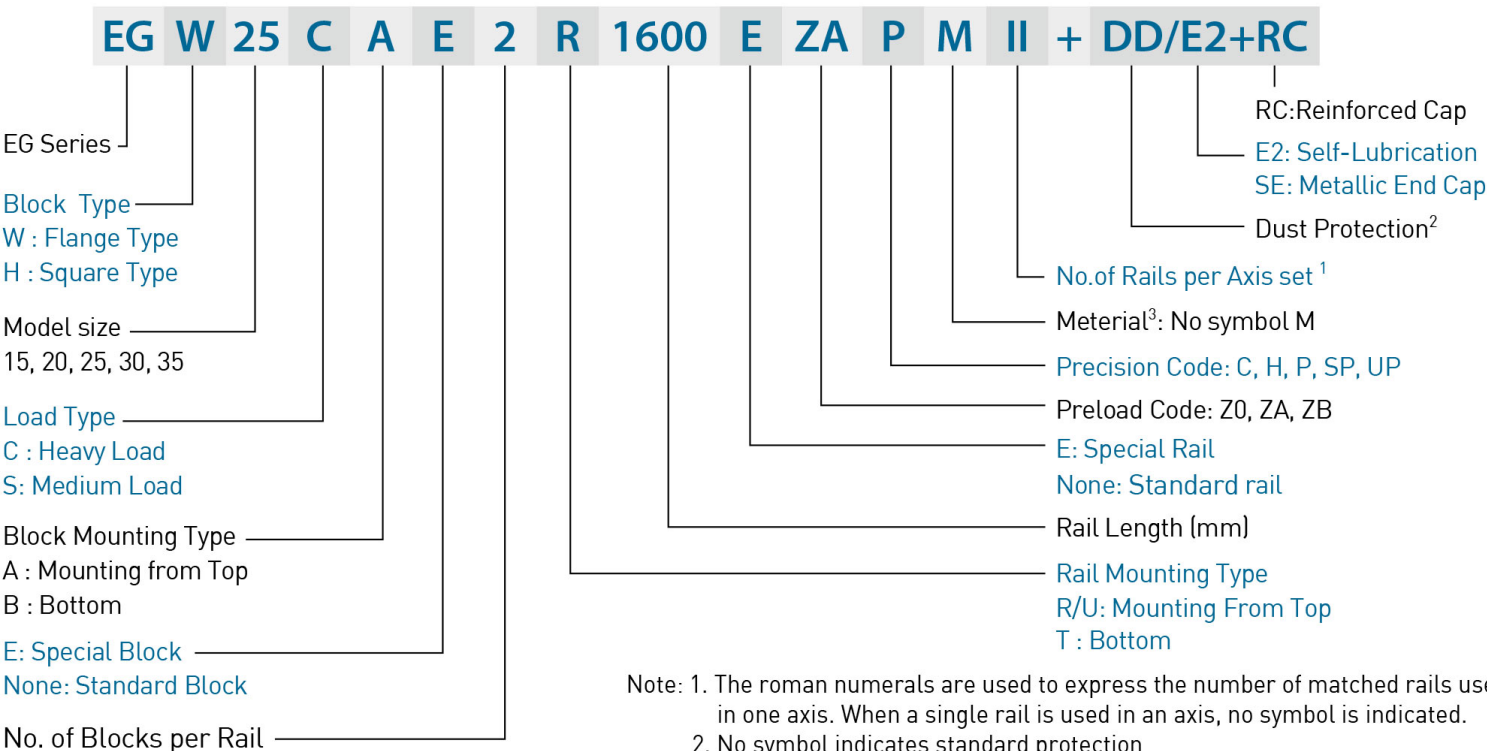


- Rolling circulation system: Block, rail, end cap and retainer
- Lubrication system: Grease nipple and piping Joint
- Dust protection system: End seal, bottom seal, cap and scraper

2-2-3 Model Number of EG Series

EG series linear guideways are classified into non-interchangeable and interchangeable types. The sizes of these two types are the same as one another. The main difference is that the interchangeable type of blocks and rails can be freely exchanged and they can maintain P-class accuracy. Because of strict dimensional control, the interchangeable type linear guideways are a wise choice for customers when rails do not need to be matched for an axis. The model number of the EG series identifies the size, type, accuracy class, preload class, etc.

(1) Non-interchangeable type



Note: 1. The roman numerals are used to express the number of matched rails used in one axis. When a single rail is used in an axis, no symbol is indicated.

2. No symbol indicates standard protection (end seal and bottom seal).

ZZ : End seal, bottom seal and scraper

KK: Double seals, bottom seal and scraper.

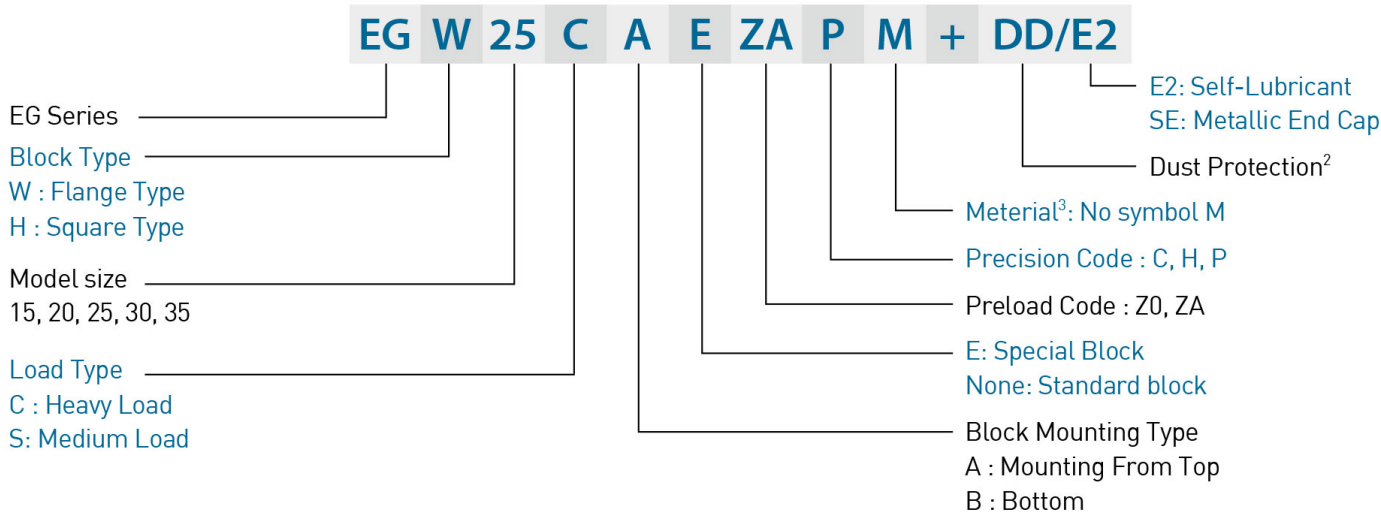
DD: Double seals and bottom seal

3. No symbol: Carbon Steel, M: Stainless Steel

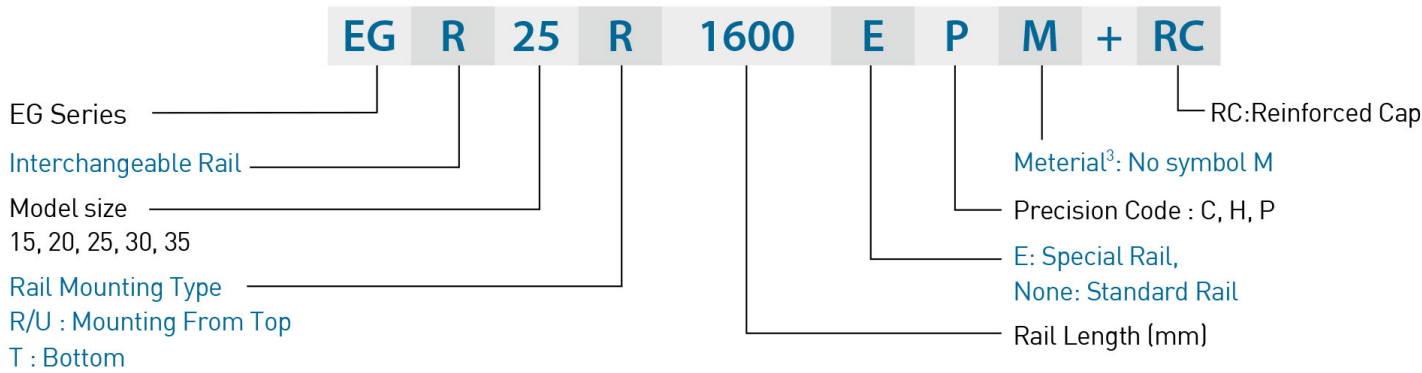
4. The stainless steel is available for EG15C.

(2) Interchangeable type

Model Number of EG Block



Model Number of EG Rail



KGT[®] 46

EG Series

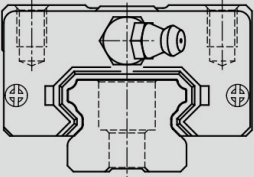
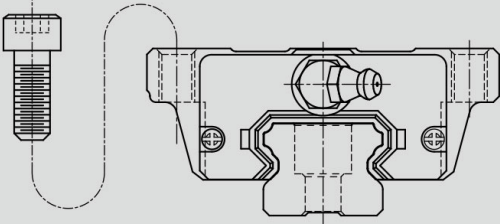
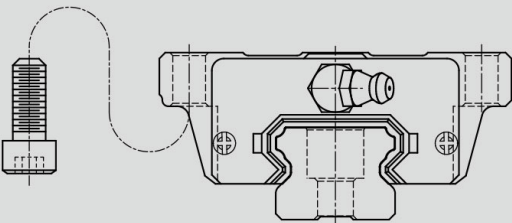
Low Profile Ball Type

2-2-4 Types

(1) Block types

KGT offers two types of linear guideways, flange and square types.

Table 2-2-1 Block Types

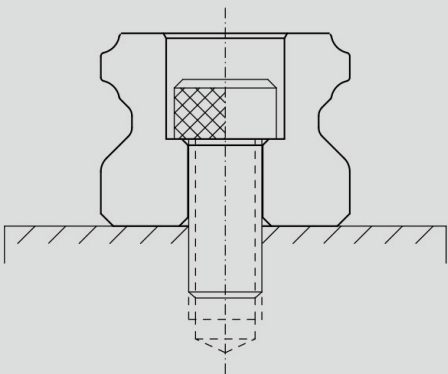
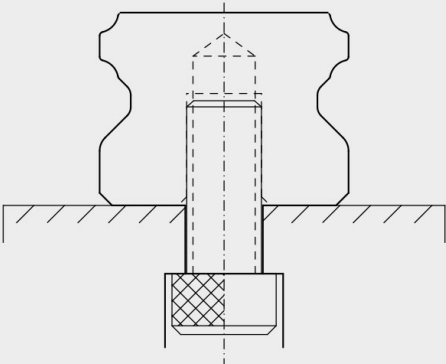
Type	Model	Shape	Height (mm)	Rail Length (mm)	Main Applications
Square	EGH-SA EGH-CA		24	100	- Automation devices - High-speed transportation equipment - Precision measuring equipment - Semiconductor manufacturing equipment
			↓	↓	
Flange	EGW-SA EGW-CA		24	100	
			↓	↓	
	EGW-SB EGW-CB		24	100	
			↓	↓	
			48	4000	
			48	4000	

*Please refer to the chapter 2-2-13 for the dimensional detail.

(2) Rail types

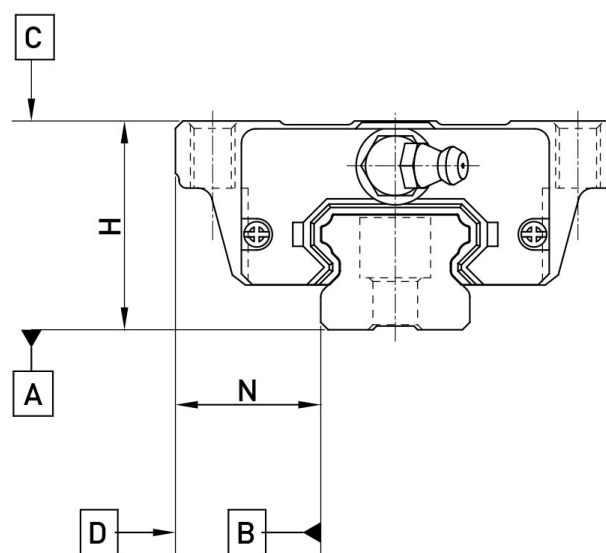
Besides the standard top mounting type,KGT also offers bottom mounting type rails.

Table 2-2-2 Rail Types

Mounting from Top	Mounting from Bottom
	

2-2-5 Accuracy

The accuracy of the EG series can be classified into 5 classes: normal(C), high(H), precision(P), super precision(SP), and ultra precision(UP). Choose the class by referencing the accuracy of selected equipment.



(1) Accuracy of non-interchangeable guideways

Table 2-2-3 Accuracy Standards

Unit: mm

Item	EG - 15, 20				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Dimensional tolerance of width N	± 0.1	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Variation of height H	0.02	0.01	0.006	0.004	0.003
Variation of width N	0.02	0.01	0.006	0.004	0.003
Running parallelism of block surface C to surface A	See Table 2-2-7				
Running parallelism of block surface D to surface B	See Table 2-2-7				

Table 2-2-4 Accuracy Standards

Unit: mm

Item	EG - 25, 30, 35				
Accuracy Classes	Normal (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.1	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Dimensional tolerance of width N	± 0.1	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Variation of height H	0.02	0.015	0.007	0.005	0.003
Variation of width N	0.03	0.015	0.007	0.005	0.003
Running parallelism of block surface C to surface A	See Table 2-2-7				
Running parallelism of block surface D to surface B	See Table 2-2-7				

KGT[®] 48

EG Series

Low Profile Ball Type

(2) Accuracy of interchangeable guideways

Table 2-2-5 Accuracy Standards

Unit: mm

Item	EG - 15, 20		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.03	± 0.015
Dimensional tolerance of width N	± 0.1	± 0.03	± 0.015
Variation of height H	0.02	0.01	0.006
Variation of width N	0.02	0.01	0.006
Running parallelism of block surface C to surface A	See Table 2-2-7		
Running parallelism of block surface D to surface B	See Table 2-2-7		

Table 2-2-6 Accuracy Standards

Unit: mm

Item	EG - 25, 30, 35		
Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.1	± 0.04	± 0.02
Dimensional tolerance of width N	± 0.1	± 0.04	± 0.02
Variation of height H	0.02	0.015	0.007
Variation of width N	0.03	0.015	0.007
Running parallelism of block surface C to surface A	See Table 2-2-7		
Running parallelism of block surface D to surface B	See Table 2-2-7		

(3) Accuracy of running parallelism

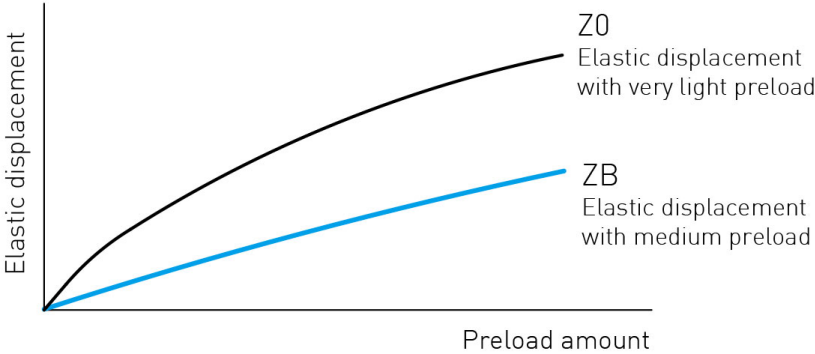
Table 2-2-7 Accuracy of Running Parallelism

Rail Length (mm)	Accuracy (μm)				
	C	H	P	SP	UP
~ 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 ~ 1,100	24	16	9	6	3
1,100 ~ 1,500	26	18	11	7	4
1,500 ~ 1,900	28	20	13	8	4
1,900 ~ 2,500	31	22	15	10	5
2,500 ~ 3,100	33	25	18	11	6
3,100 ~ 3,600	36	27	20	14	7
3,600 ~ 4,000	37	28	21	15	7

2-2-6 Preload

(1) Definition

A preload can be applied to each guideway. Generally, a linear motion guideway has a negative clearance between the groove and balls in order to improve stiffness and maintain high precision. The figure shows that adding a preload can improve stiffness of the linear guideway. A preload no greater than ZA would be recommended for model sizes smaller than EG20. This will avoid an over-loaded condition that would affect guideway life.



(2) Preload classes

KGT offers three standard preloads for various applications and conditions.

Table 2-2-8 Preload Classes

Class	Code	Preload	Condition
Very Light Preload	Z0	0~ 0.02C	Certain load direction,low impact, low precision required
Light Preload	ZA	0.03C~0.05C	low load and high precision required
Medium Preload	ZB	0.06C~ 0.08C	High rigidity required, with vibration and impact

Class	Interchangeable Guideway	Non-Interchangeable Guideway
Preload classes	Z0, ZA	Z0, ZA, ZB

Note: The “C” in the preload column denotes basic dynamic load rating.

(3) Stiffness performance

Stiffness depends on preload. The following table shows stiffness value of each size.

Table 2-2-9 Radial stiffness for EG Series

Load type	Series / Size	Stiffness (N/μm)		
		Z0	ZA	ZB
Medium load	EG 15S	87	186	246
	EG 20S	114	267	369
	EG 25S	138	307	415
	EG 30S	166	335	447
	EG 35S	189	369	492
Heavy load	EG 15C	141	323	429
	EG 20C	181	444	615
	EG 25C	219	510	668
	EG 30C	265	555	745
	EG 35C	307	615	816

KGT[®] 50

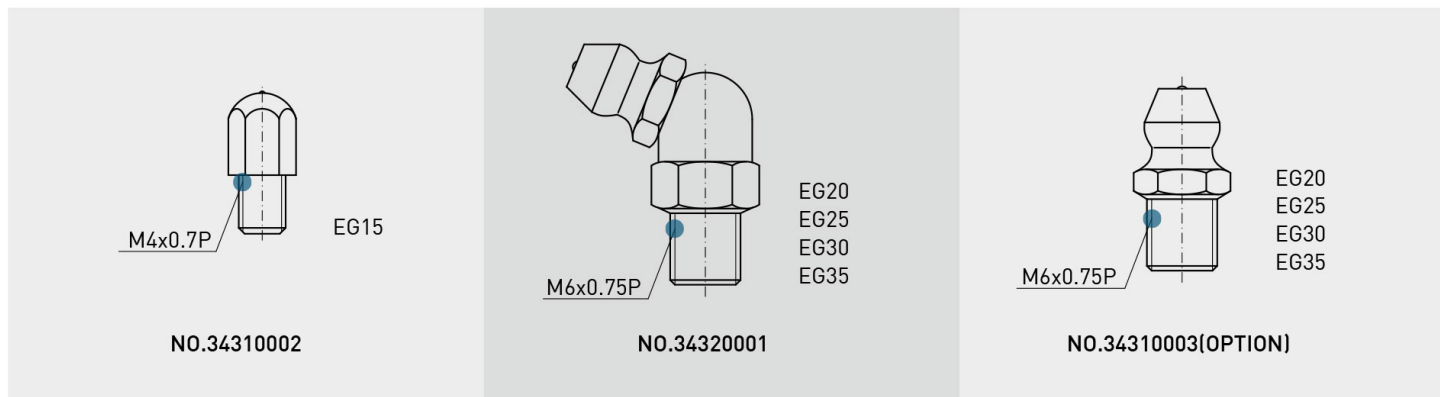
EG Series

Low Profile Ball Type

2-2-7 Lubrication

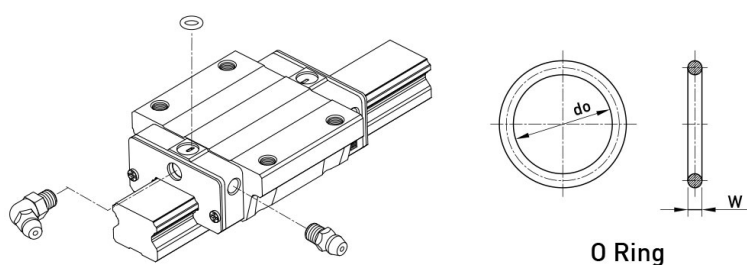
(1) Grease

○ Grease nipple



○ Mounting location

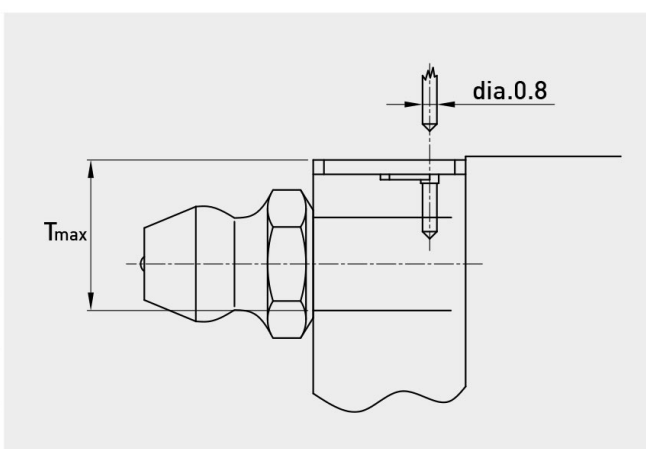
The standard location of the grease fitting is at both ends of the block, the nipple may be mounted in the side or top of the block. For lateral installation, we recommend that the nipple be mounted to the non-reference side, otherwise please contact us. When lubricating from above, in the recess for the O-ring, a smaller, preformed recess can be found. Preheat the 0.8 mm diameter metal tip. Carefully open the small recess with the metal tip and pierce through it. Insert a round sealing ring into the recess. (The round sealing ring is not supplied with the block) Do not open the small recess with a drill bit this may introduce the danger of contamination. It is possible to carry out the lubrication by using the oil-piping joint.



O Ring

Table 2-2-10 O-Ring size and max. permissible depth for piercing

Size	O-Ring		Lube hole at top: max. permissible depth for piercing
	do(mm)	W (mm)	T _{max} (mm)
EG15	2.5 ± 0.15	1.5 ± 0.15	6.9
EG20	4.5 ± 0.15	1.5 ± 0.15	8.4
EG25	4.5 ± 0.15	1.5 ± 0.15	10.4
EG30	4.5 ± 0.15	1.5 ± 0.15	10.4
EG35	4.5 ± 0.15	1.5 ± 0.15	10.8



○ The oil amount for a block filled with grease

Table 2-2-11 The oil amount for a block filled with grease

Size	Medium Load [cm³]	Heavy Load [cm³]
EG15	0.8	1.4
EG20	1.5	2.4
EG25	2.8	4.6
EG30	3.7	6.3
EG35	5.6	6.6

○ Frequency of replenishment

Check the grease every 100 km, or every 3-6 months.

(2) Oil

The recommended viscosity of oil is about 32~150cSt. If you need to use oil-type lubrication, please inform us.

○ Types of oil piping joint

LF-64

NO.97000EA1

EG15

LF-76

NO.970002A1

EG20
EG25
EG30
EG35

LF-86

NO.970004A1

EG20
EG25
EG30
EG35

SF-64

NO.97001TA1

EG15

SF-76

NO.970001A1

EG20
EG25
EG30
EG35

SF-86

NO.970003A1

EG20
EG25
EG30
EG35

○ Oil feeding rate

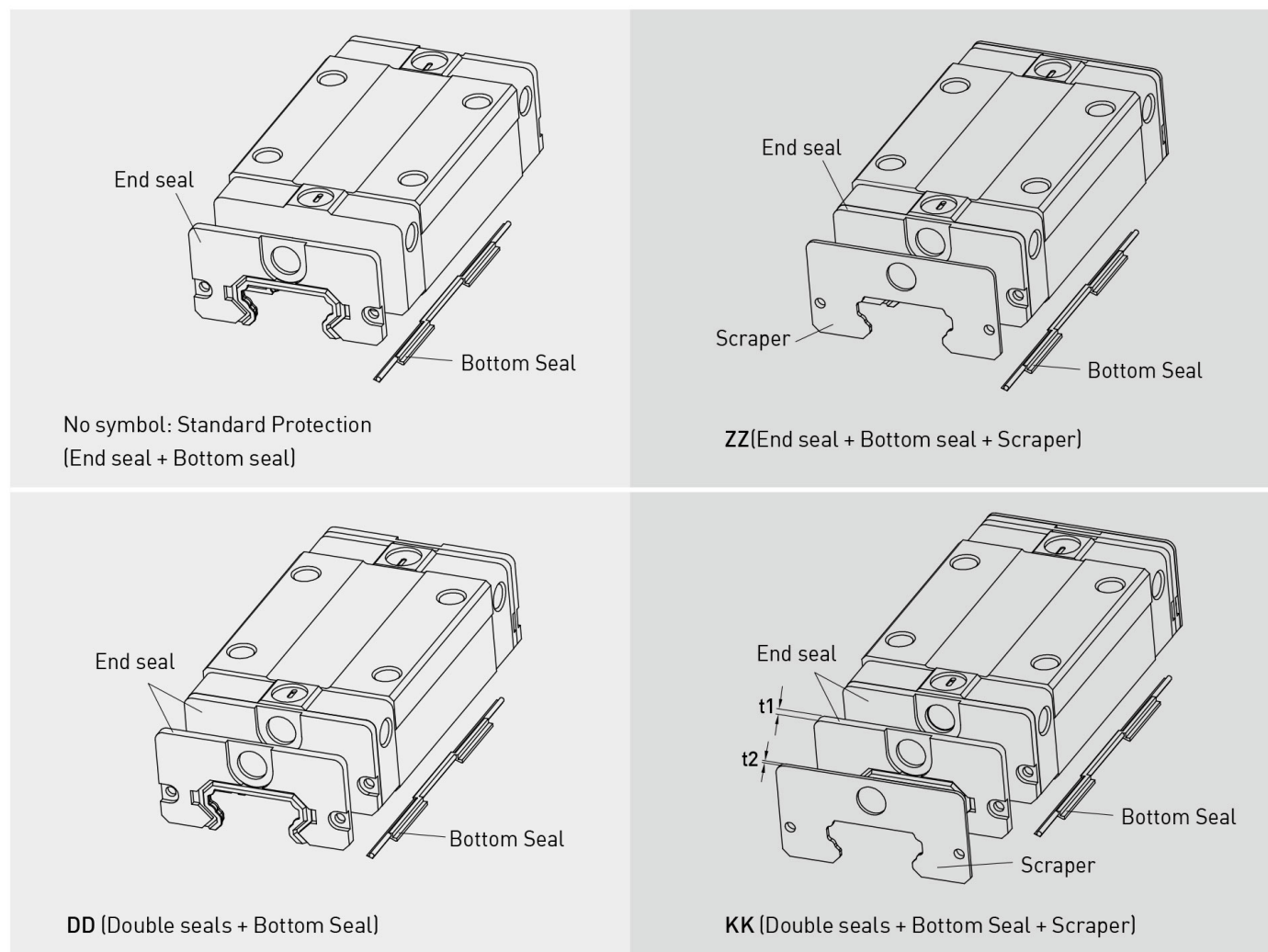
Table 2-2-12 oil feed rate

Size	feed rate [cm³/hr]	Size	feed rate [cm³/hr]
EG15	0.1	EG30	0.2
EG20	0.133	EG35	0.233
EG25	0.167		

2-2-8 Dust Protection Equipment

(1) Codes of equipment

If the following equipment is needed, please indicate the code followed by the model number.



(2) End seal and bottom seal

Protects against contaminants entering the block. Reduces potential for groove damage resulting in a reduction of life ratings.

(3) Double seals

Removing foreign matters from the rail to prevent contaminants from entering the block.

Table 2-2-13 Dimensions of end seal

Size	Thickness (t1) (mm)	Size	Thickness (t1) (mm)
EG15 ES	2	EG30 ES	2
EG20 ES	2	EG35 ES	2
EG25 ES	2		

(4) Scraper

Clears larger contaminants, such as weld spatter and metal cuttings, from the rail. Metal scraper protects end seals from excessive damage.

Table 2-2-14 Dimensions of Scraper

Size	Thickness (t2) (mm)	Size	Thickness (t2) (mm)
EG15 SC	0.8	EG30 SC	1
EG20 SC	0.8	EG35 SC	1.5
EG25 SC	1		

(5) Bolt caps for rail mounting holes

Rail mounting hole caps prevent foreign matter from accumulating in the mounting holes. Caps are included with the rail package.

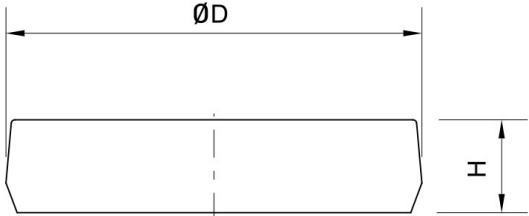


Table 2-2-15 Dimensions of Bolt Caps for Rail Mounting Holes

Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)
EGR15R	M3	6.15	1.2
EGR20R	M5	9.65	2.5
EGR25R	M6	11.15	2.5
EGR30R	M6	11.15	2.5
EGR35R	M8	14.20	3.5
EGR15U	M4	7.65	1.1
EGR30U	M8	14.20	3.5

(6) Dimensions of block equipped with the dustproof parts

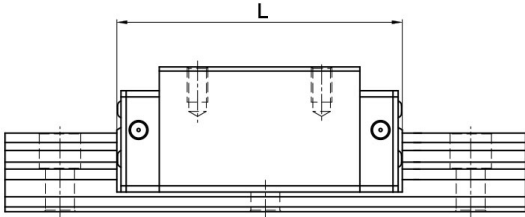


Table 2-2-16 Overall block length

unit: mm

Size	Overall block length (L)			
	SS	ZZ	DD	KK
EG15S	40.1 [42.5]	41.7 [46.1]	44.1 [46.5]	45.7 [50.1]
EG15C	56.8 [59.2]	58.4 [62.8]	60.8 [63.2]	62.4 [66.8]
EG20S	50.0 [54.0]	51.6 [57.6]	54.0 [58.0]	55.6 [61.6]
EG20C	69.1 [73.1]	70.7 [76.7]	73.1 [77.1]	74.7 [80.7]
EG25S	59.1 [63.1]	61.1 [67.1]	63.1 [67.1]	65.1 [71.1]
EG25C	82.6 [86.6]	84.6 [90.6]	86.6 [90.6]	88.6 [94.6]
EG30S	69.5 [73.5]	71.5 [77.5]	73.5 [77.5]	75.5 [81.5]
EG30C	98.1 [102.1]	100.1 [106.1]	102.1 [106.1]	104.1 [110.1]
EG35S	75.0 [79.0]	78.0 [84.0]	79.0 [83.0]	82.0 [88.0]
EG35C	108.0 [112.0]	111.0 [117.0]	112.0 [116.0]	115.0 [121.0]

Note : The marking of “[]” denotes the maximum block length with screws, lips of end seals, etc.

2-2-9 Friction

The maximum value of resistance per end seal are as shown in the table.

Table 2-2-17 Seal Resistance

Size	Resistance N (kgf)
EG15	1.47 (0.15)
EG20	1.96 (0.2)
EG25	1.96 (0.2)
EG30	2.45 (0.25)
EG35	1.96 (0.2)

- Note: 1. 1kgf=9.81N
2. Please inform KGT if low friction request is required.

2-2-10 Mounting Surface Accuracy Tolerance

Because of the circular-arc contact design, the EG linear guideway can withstand surface-error installation and deliver smooth linear motion. When the mounting surface meets the accuracy requirements of the installation, the high accuracy and rigidity of the guideway will be obtained without any difficulty. For faster installation and smoother movement, KGT offers a preload with normal clearance because of its ability to absorb higher deviations in mounting surface inaccuracies.

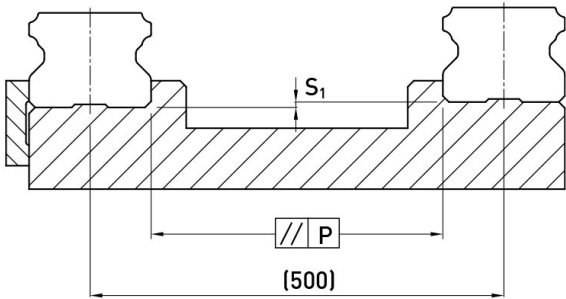


Table 2-2-18 Max. Parallelism Tolerance (P)

unit: μm

Size	Preload classes		
	Z0	ZA	ZB
EG15	25	18	-
EG20	25	20	18
EG25	30	22	20
EG30	40	30	27
EG35	50	35	30

Table 2-2-19 Max. Tolerance of Reference Surface Height (S₁)

unit: μm

Size	Preload classes		
	Z0	ZA	ZB
EG15	130	85	-
EG20	130	85	50
EG25	130	85	70
EG30	170	110	90
EG35	210	150	120

Note : Permissible value is proportional to the axial distance

2-2-11 Cautions for Installation

(1) Shoulder heights and chamfers

Improper shoulder heights and fillets of mounting surfaces will cause a deviation in accuracy and the interference with the rail or block. As long as the recommended shoulder heights and fillets are followed, installation inaccuracies should be eliminated.

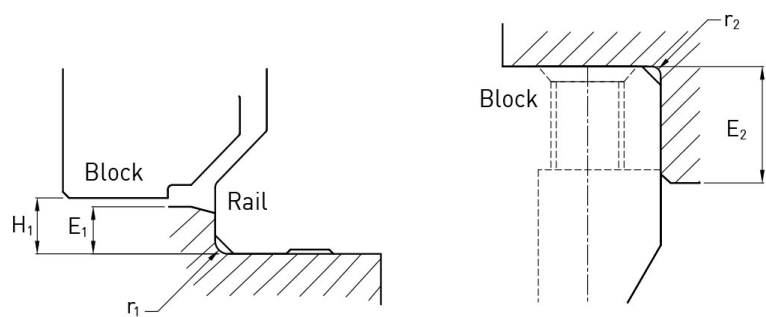


Table 2-2-20 Shoulder Heights and Chamfers

unit: mm

Size	Max. radius of fillets r_1 (mm)	Max. radius of fillets r_2 (mm)	Shoulder height beside the rail E_1 (mm)	Shoulder height beside the block E_2 (mm)	Clearance under block H_1 (mm)
EG15	0.5	0.5	2.7	5.0	4.5
EG20	0.5	0.5	5.0	7.0	6.0
EG25	1.0	1.0	5.0	7.5	7.0
EG30	1.0	1.0	7.0	7.0	10.0
EG35	1.0	1.0	7.5	9.5	11.0

(2) Tightening Torque of Bolts for Installation

Improperly tightened mounting bolts will seriously affect the accuracy of linear guide installations. The following tightening torques for different sizes of bolts are recommended.

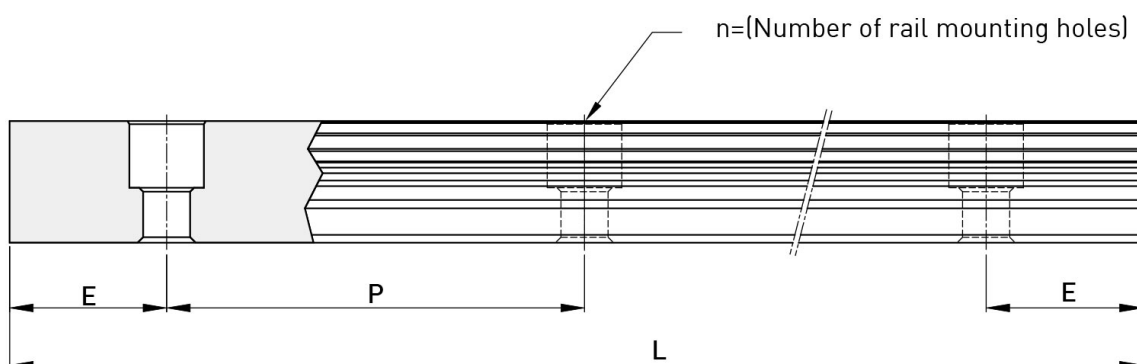
Table 2-2-21 Tightening Torque

Size	Bolt size	Torque N-cm(kgf-cm)		
		Iron	Casting	Aluminum
EG 15	M3×0.5P×16L	186 (19)	127 (13)	98 (10)
EG 20	M5×0.8P×16L	883 (90)	588 (60)	441 (45)
EG 25	M6×1P×20L	1373 (140)	921 (94)	686 (70)
EG 30	M6×1P×25L	1373 (140)	921 (94)	686 (70)
EG 35	M8×1.25P×25L	3041 (310)	2010 (205)	1470 (150)

Note: 1 kgf = 9.81 N

2-2-12 Standard and Maximum Lengths of Rail

KGT offers a number of standard rail lengths. Standard rail lengths feature end mounting hole placements set to predetermined values (E). For non-standard rail lengths, be sure to specify the E-value to be no greater than 1/2 the pitch (P) dimension. An E-value greater than this will result in unstable rail ends.



$$L = (n-1) \times P + 2 \times E \quad \text{Eq.2.2}$$

L : Total length of rail (mm)

n : Number of mounting holes

P : Distance between any two holes (mm)

E : Distance from the center of the last hole to the edge (mm)

Table 2-2-22 Rail Standard Length and Max. Length

unit: mm

Item	EGR15	EGR20	EGR25	EGR30	EGR35
Standard Length L(n)	160 (3)	220 (4)	220 (4)	280 (4)	280 (4)
	220 (4)	280 (5)	280 (5)	440 (6)	440 (6)
	280 (5)	340 (6)	340 (6)	600 (8)	600 (8)
	340 (6)	460 (8)	460 (8)	760 (10)	760 (10)
	460 (8)	640 (11)	640 (11)	1,000 (13)	1,000 (13)
	640 (11)	820 (14)	820 (14)	1,640 (21)	1,640 (21)
	820 (14)	1,000 (17)	1,000 (17)	2,040 (26)	2,040 (26)
		1,240 (21)	1,240 (21)	2,520 (32)	2,520 (32)
		1,600 (27)	1,600 (27)	3,000 (38)	3,000 (38)
Pitch (P)	60	60	60	80	80
Distance to End (E _s)	20	20	20	20	20
Max. Standard Length	4,000(67)	4,000 (67)	4,000 (67)	3,960 (50)	3,960 (50)
Max. Length	4,000	4,000	4,000	4,000	4,000

Note : 1. Tolerance of E value for standard rail is 0.5~0.5 mm. Tolerance of E value for jointed rail is 0~0.3 mm.

2. Maximum standard length means the max. rail length with standard E value on both sides.

3. If different E value is needed, please contact KGT

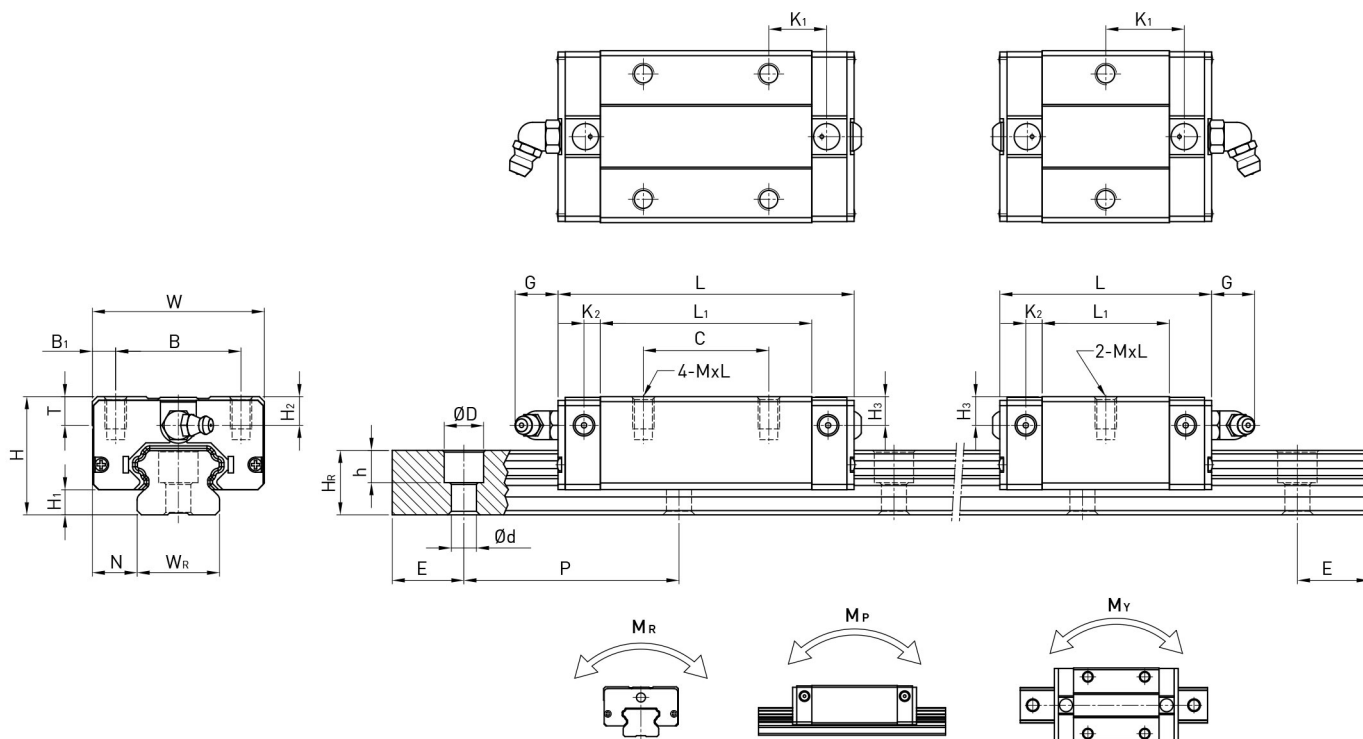
4. EGR15 of stainless steel is supplied with the maximum length of 2000mm.

2-2-13 Dimensions for EG Series

(1) EGH-SA / EGH-CA

EGH-CA

EGH-SA



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)														Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	MxL	T	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R kN-m	M _P kN-m	M _V kN-m	Block kg	Rail kg/m		
EGH15SA	24	4.5	9.5	34	26	4	-	23.1	40.1	14.8	3.5	5.7	M4x6	6	5.5	6	15	12.5	6	4.5	3.5	60	20	M3x16	5.35	9.40	0.08	0.04	0.04	0.09	1.25		
EGH15CA							26	39.8	56.8	10.15															7.83	16.19	0.13	0.10	0.10	0.15			
EGH20SA	28	6	11	42	32	5	-	29	50	18.75	4.15	12	M5x7	7.5	6	6	20	15.5	9.5	8.5	6	60	20	M5x16	7.23	12.74	0.13	0.06	0.06	0.15	2.08		
EGH20CA							32	48.1	69.1	12.3															10.31	21.13	0.22	0.16	0.16	0.24			
EGH25SA	33	7	12.5	48	35	6.5	-	35.5	59.1	21.9	4.55	12	M6x9	8	8	8	23	18	11	9	7	60	20	M6x20	11.40	19.50	0.23	0.12	0.12	0.25	2.67		
EGH25CA							35	59	82.6	16.15															16.27	32.40	0.38	0.32	0.32	0.41			
EGH30SA	42	10	16	60	40	10	-	41.5	69.5	26.75	6	12	M8x12	9	8	9	28	23	11	9	7	80	20	M6x25	16.42	28.10	0.40	0.21	0.21	0.45	4.35		
EGH30CA							40	70.1	98.1	21.05															23.70	47.46	0.68	0.55	0.55	0.76			
EGH35SA	48	11	18	70	50	10	-	45	75	28.5	7	12	M8x12	10	8.5	8.5	34	27.5	14	12	9	80	20	M8x25	22.66	37.38	0.56	0.31	0.31	0.74	6.14		
EGH35CA							50	78	108	20															33.35	64.84	0.98	0.69	0.69	1.10			

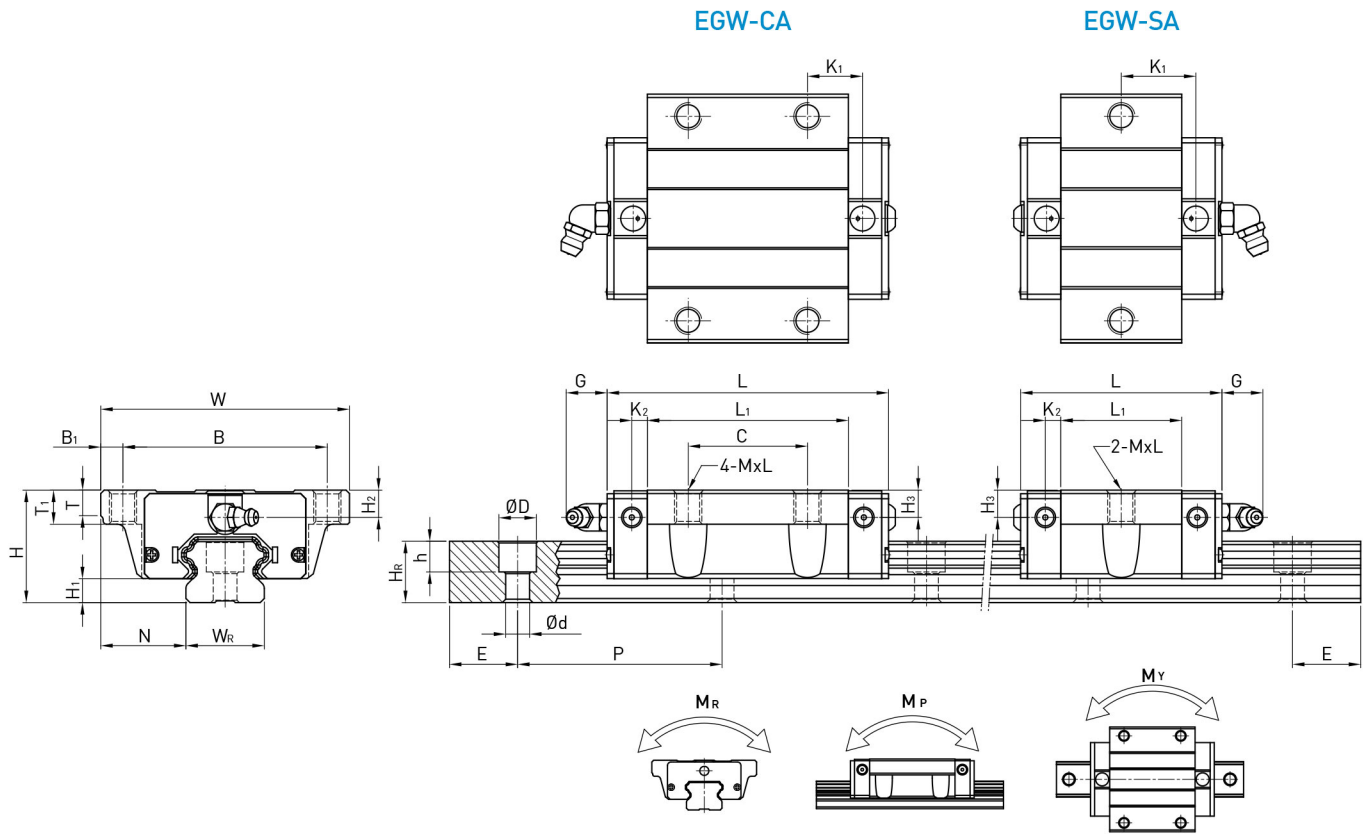
Note : 1 kgf = 9.81 N

KGT[®] 58

EG Series

Low Profile Ball Type

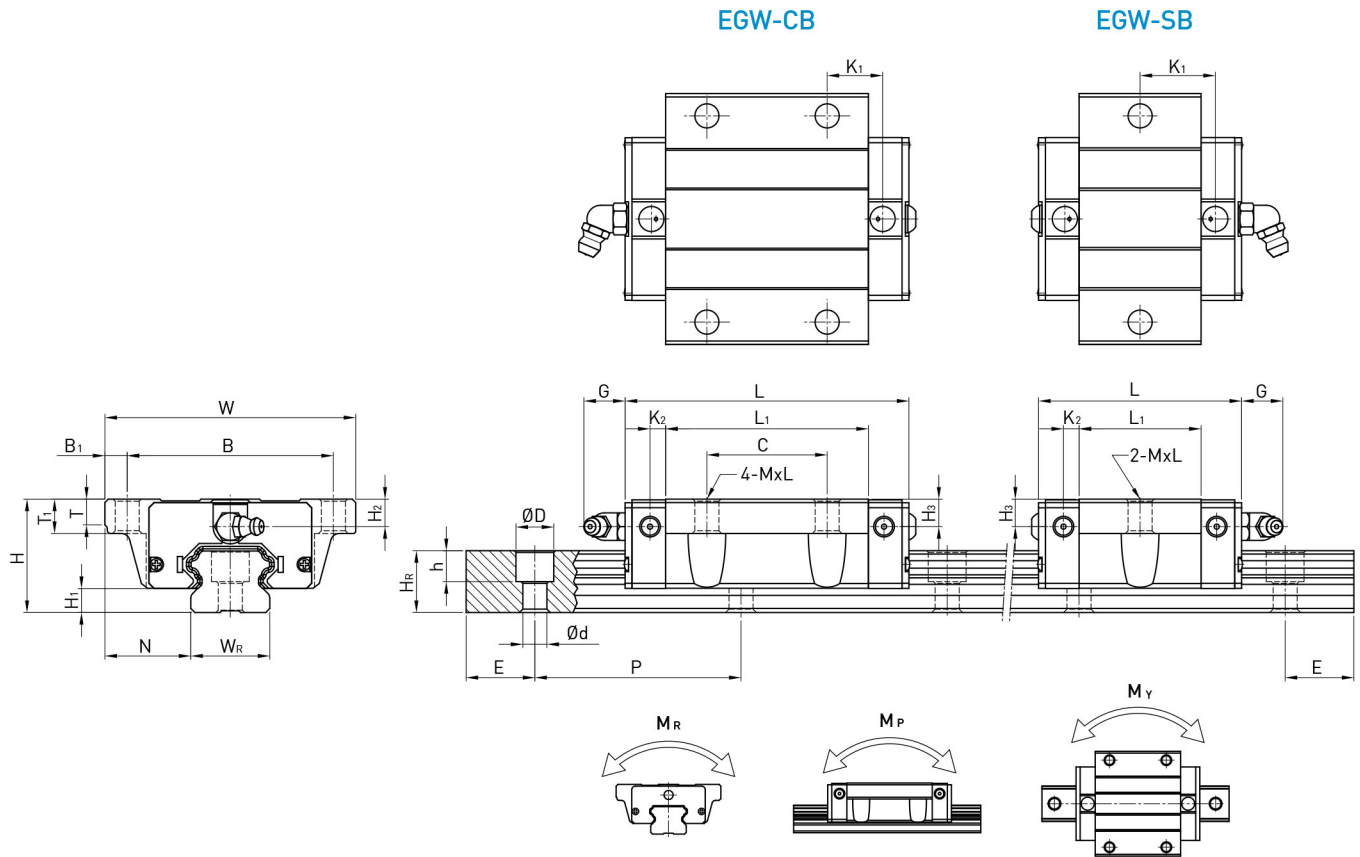
(2) EGW-SA / EGW-CA



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)															Dimensions of Rail (mm)										Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	M	T	T ₁	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R	M _p	M _y	Block	Rail				
EGW15SA	24	4.5	18.5	52	41	5.5	-	23.1	40.1	14.8	3.5	5.7	M5	5	7	5.5	6	15	12.5	6	4.5	3.5	60	20	M3x16	5.35	9.40	0.08	0.04	0.04	0.12	1.25				
EGW15CA							26	39.8	56.8	10.15																										
EGW20SA	28	6	19.5	59	49	5	-	29	50	18.75	4.15	12	M6	7	9	6	6	20	15.5	9.5	8.5	6	60	20	M5x16	7.23	12.74	0.13	0.06	0.06	0.19	2.08				
EGW20CA																												32	48.1	69.1	12.3					
EGW25SA	33	7	25	73	60	6.5	-	35.5	59.1	21.9	4.55	12	M8	7.5	10	8	8	23	18	11	9	7	60	20	M6x20	11.40	19.50	0.23	0.12	0.12	0.35	2.67				
EGW25CA																												35	59	82.6	16.15					
EGW30SA	42	10	31	90	72	9	-	41.5	69.5	26.75	6	12	M10	7	10	8	9	28	23	11	9	7	80	20	M6x25	16.42	28.10	0.40	0.21	0.21	0.62	4.35				
EGW30CA																												40	70.1	98.1	21.05					
EGW35SA	48	11	33	100	82	9	-	45	75	28.5	7	12	M10	10	13	8.5	8.5	34	27.5	14	12	9	80	20	M8x25	22.66	37.38	0.56	0.31	0.31	0.84	6.14				
EGW35CA																												50	78	108	20					

Note : 1 kgf = 9.81 N

(3) EGW-SB / EGW-CB



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)																Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	M	T	T ₁	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R	M _P	M _Y	Block	Rail			
EGW15SB	24	4.5	18.5	52	41	5.5	-	23.1	40.1	14.8	3.5	5.7	Ø4.5	5	7	5.5	6	15	12.5	6	4.5	3.5	60	20	M3x16	5.35	9.40	0.08	0.04	0.04	0.12	1.25			
EGW15CB							26	39.8	56.8	10.15																7.83	16.19	0.13	0.10	0.10	0.21				
EGW20SB	28	6	19.5	59	49	5	-	29	50	18.75	4.15	12	Ø5.5	7	9	6	6	20	15.5	9.5	8.5	6	60	20	M5x16	7.23	12.74	0.13	0.06	0.06	0.19	2.08			
EGW20CB							32	48.1	69.1	12.3																10.31	21.13	0.22	0.16	0.16	0.32				
EGW25SB	33	7	25	73	60	6.5	-	35.5	59.1	21.9	4.55	12	Ø7	7.5	10	8	8	23	18	11	9	7	60	20	M6x20	11.40	19.50	0.23	0.12	0.12	0.35	2.67			
EGW25CB							35	59	82.6	16.15																16.27	32.40	0.38	0.32	0.32	0.59				
EGW30SB	42	10	31	90	72	9	-	41.5	69.5	26.75	6	12	Ø9	7	10	8	9	28	23	11	9	7	80	20	M6x25	16.42	28.10	0.40	0.21	0.21	0.62	4.35			
EGW30CB							40	70.1	98.1	21.05																23.70	47.46	0.68	0.55	0.55	1.04				
EGW35SB	48	11	33	100	82	9	-	45	75	28.5	7	12	Ø9	10	13	8.5	8.5	34	27.5	14	12	9	80	20	M8x25	22.66	37.38	0.56	0.31	0.31	0.84	6.14			
EGW 35CB							50	78	108	20																33.35	64.84	0.98	0.69	0.69	1.45				

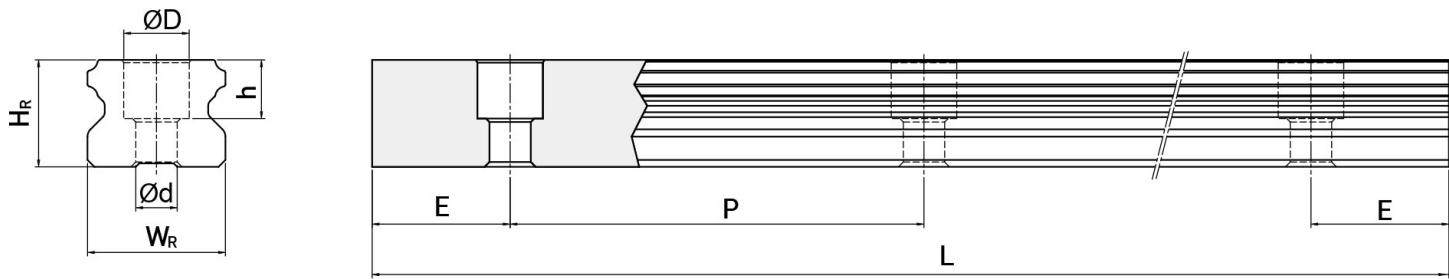
Note : 1 kgf = 9.81 N

KGT[®] 60

EG Series

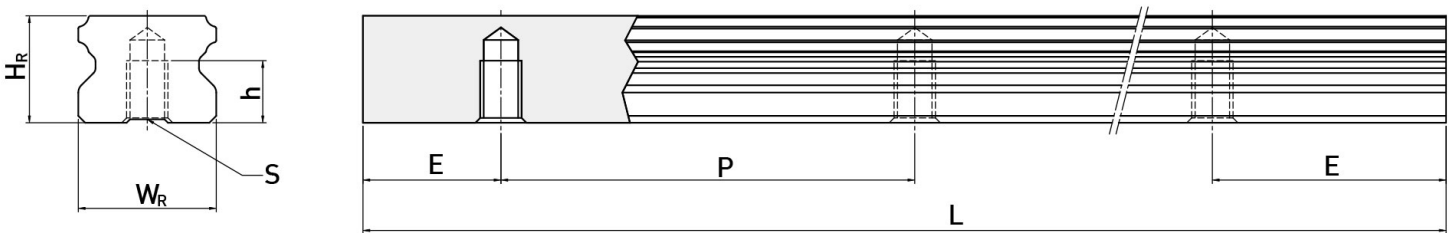
Low Profile Ball Type

(4) Dimensions for EGR-U (large mounting hole, rail mounting from top)



Model No.	Mounting Bolt for Rail(mm)	Dimensions of Rail (mm)							Weight
		W_R	H_R	D	h	d	P	E	(kg/m)
EGR15U	M4x16	15	12.5	7.5	5.3	4.5	60	20	1.23
EGR30U	M8x25	28	23	14	12	9	80	20	4.23

(5) Dimensions for EGR-T (rail mounting from bottom)



Model No.	Dimensions of Rail (mm)						Weight
	W_R	H_R	S	h	P	E	(kg/m)
EGR15T	15	12.5	M5 x 0.8P	7	60	20	1.26
EGR20T	20	15.5	M6 x 1P	9	60	20	2.15
EGR25T	23	18	M6 x 1P	10	60	20	2.79
EGR30T	28	23	M8 x 1.25P	14	80	20	4.42
EGR35T	34	27.5	M8 x 1.25P	17	80	20	6.34

KGT[®] 61

MG Series

Miniature Type

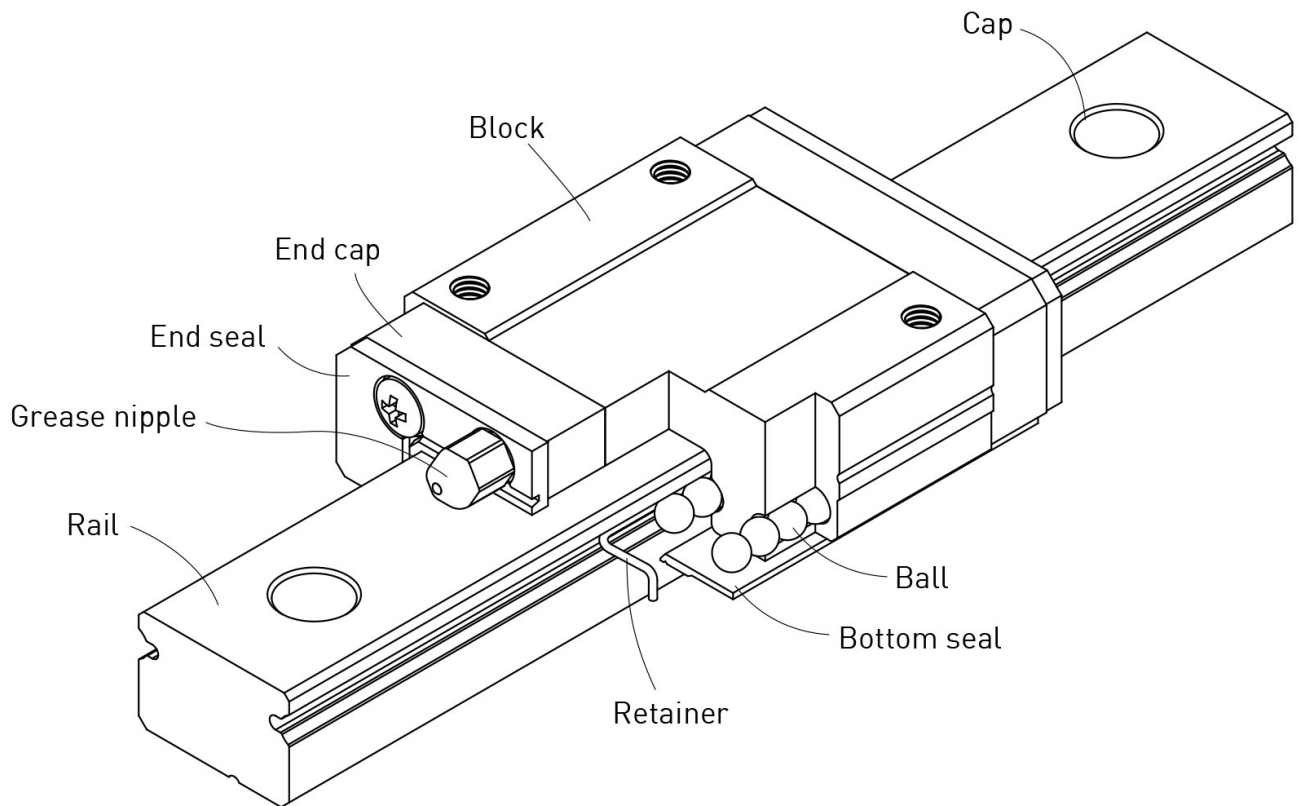
2-4 MG Series - Miniature Linear Guideway

2-4-1 Features of MGN Series

Design features of narrow type miniature guideways- MGN:

1. Tiny and light weight, suitable for miniature equipment.
2. Gothic arch contact design can sustain loads from all directions and offer high rigidity and high accuracy.
3. Specification with ball retainers would avoid ball falling when the blocks are removed from rails.
4. Interchangeable types are available in certain sizes and precision grades.

2-4-2 Construction of MGN Series



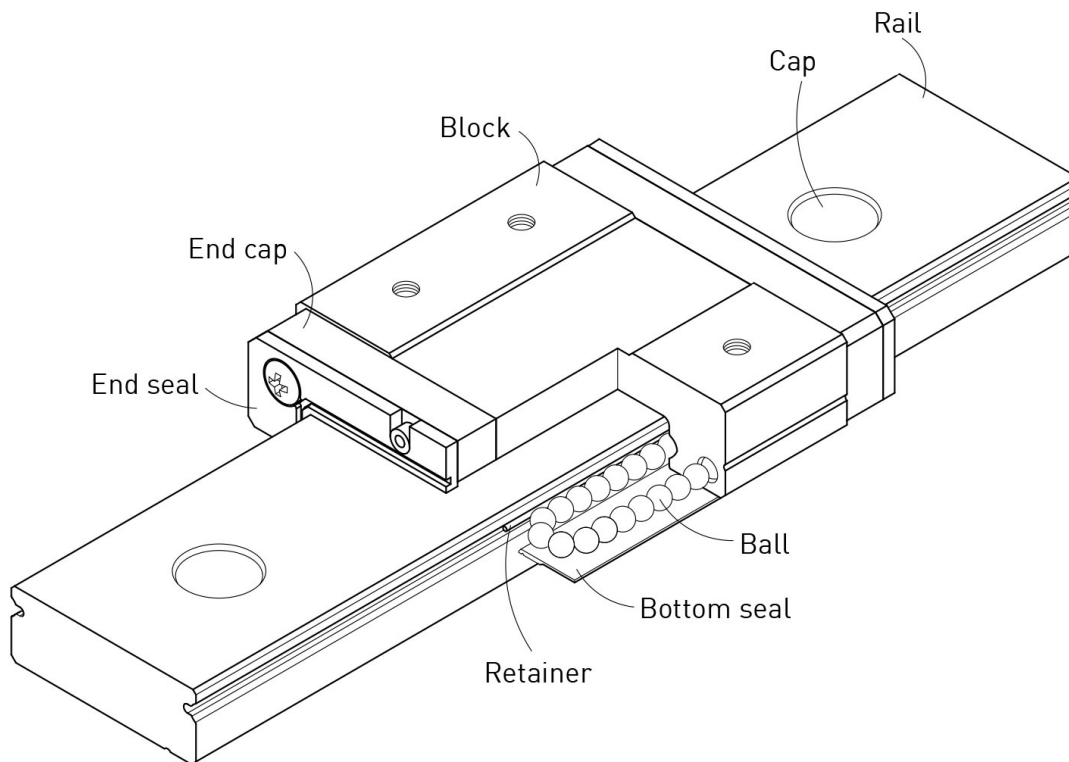
- Rolling circulation system: Block, rail, ball, end cap and retainer (except size 2, 3)
- Lubrication system: Grease nipple is available for MGN15, lubricated by grease gun. MGN7, 9, 12 are lubricated by the hole at the side of the end cap.
- Dust protection system: End seal (except size 2), bottom seal (optional size 9,12,15), cap (size12,15)

2-4-3 Features of MGW Series

Design features of wide type miniature guideways- MGW:

1. The enlarged width design increases the capacity of moment loading.
2. Gothic arch contact design has high rigidity characteristic in all directions.
3. Specification with ball retainers would avoid ball falling when the blocks are removed from rails.
4. Interchangeable types are available in certain sizes and precision grades.

2-4-4 Construction of MGW Series



- Rolling circulation system: Block, rail, ball, end cap and retainer (except size 2)
- Lubrication system: Grease nipple is available for MGW14, 15, lubricated by grease gun. MGW3, 7, 9, 12 are lubricated by the hole at the side of the end cap.
- Dust protection system: End seal (except size 2), bottom seal (optional size 9,12,14,15), cap (size12,14,15)

KGT[®] 63

MG Series

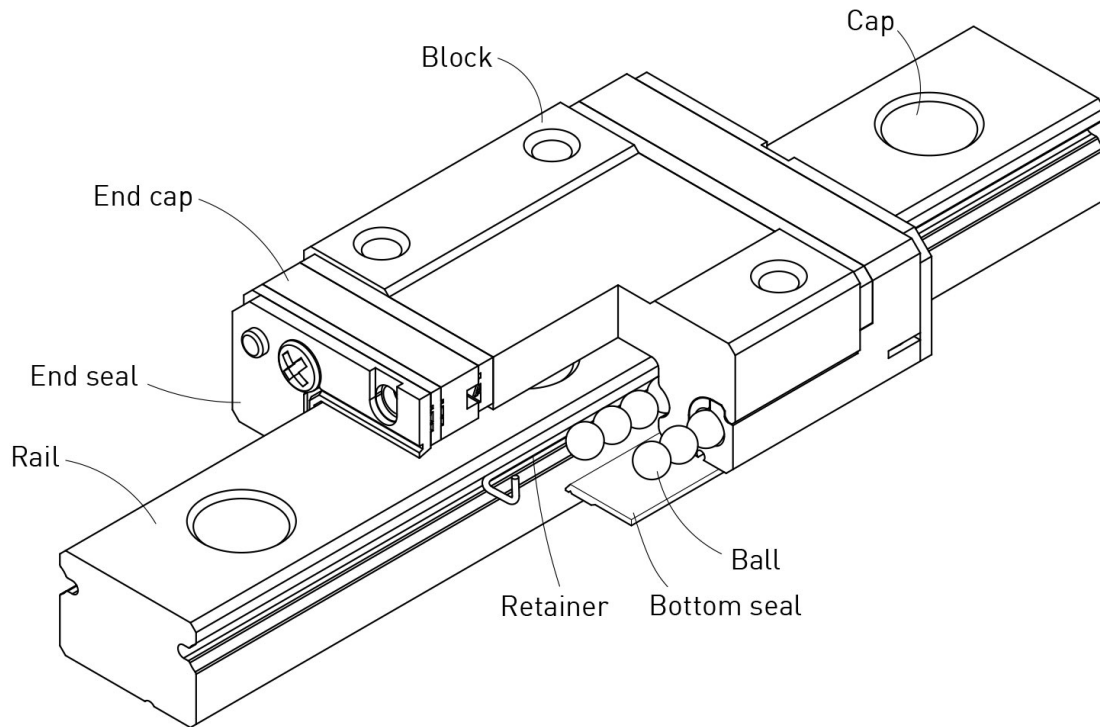
Miniature Type

2-4-5 Features of MGN-O Series

Design features of narrow type miniature guideways- MGN-O:

1. Reduce 20% weight of block by using resin in the recirculation unit. The compact size and light weight is suitable for miniaturized machinery.
2. Gothic arch contact design can sustain loads from all directions and offer high rigidity and high accuracy.
3. Interchangeable types are available in certain precision grades.
4. The design of resin recirculation unit which is able to eliminate the collision with the metal block.
5. Integrated design for recirculation system.

2-4-6 Construction of MGN-O Series



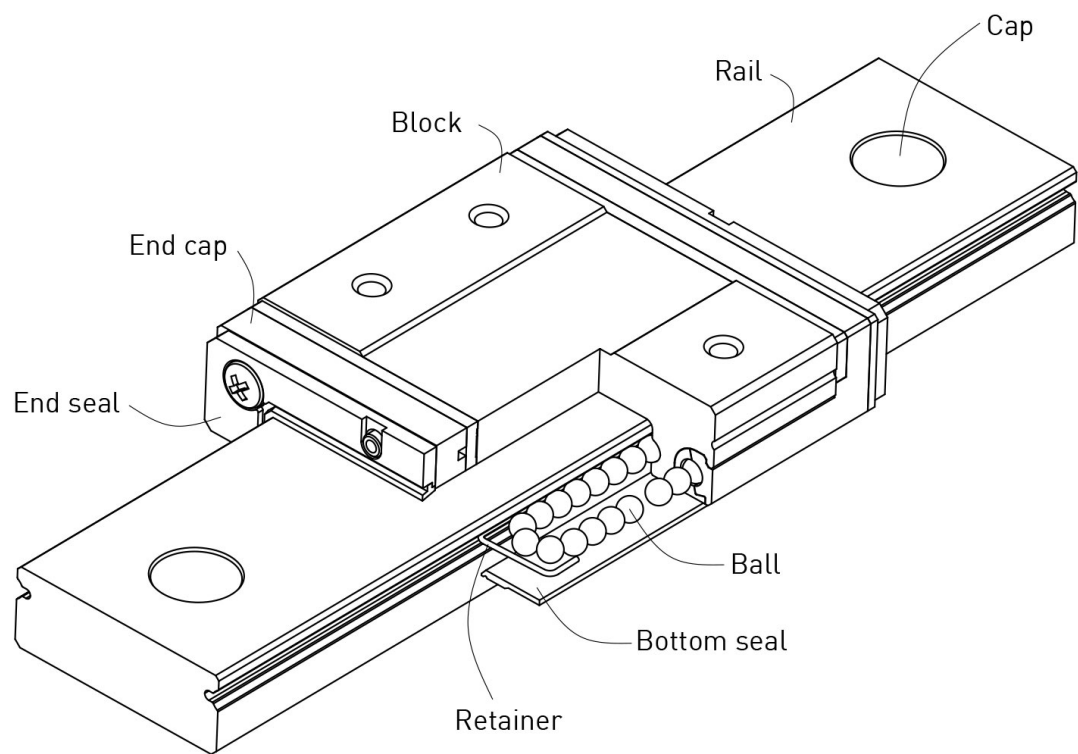
- Rolling circulation system: Block, rail, ball, end cap and retainer
- Lubrication system: Grease nipple is available for MGN15-O, lubricated by grease gun. MGN5-O, MGN7-O, MGN9-O, MGN12-O are lubricated by the hole at the side of the end cap.
- Dust protection system: End seal, bottom seal (optional size 9,12,15), cap (size12,15)

2-4-7 Features of MGW-O Series

Design features of wide type miniature guideways- MGW-O:

1. The enlarged width design increases the capacity of moment loading.
2. Gothic arch contact design has high rigidity characteristic in all directions.
3. Steel balls are held by a miniature retainer to keep balls from falling out, even when the blocks are removed from the rail.
4. Integrated design for recirculation system, which reduce 20% weight of block by using resin in the recirculation unit.

2-4-8 Construction of MGW-O Series



- Rolling circulation system: Block, rail, ball, end cap and retainer
- Lubrication system: Grease nipple is available for MGW15-O, lubricated by grease gun. MGW5-O, MGW7-O, MGW9-O, MGW12-O are lubricated by the hole at the side of the end cap.
- Dust protection system: End seal, bottom seal (optional size 9, 12, 15), cap (size12, 15)

2-4-9 Application

MGN/MGW series can be used in various applications, such as semiconductor equipment, PCB /IC equipment, medical, robotics, measuring equipment, automation equipment, and other miniature sliding machinery.

2-4-10 Model Number of MG Series

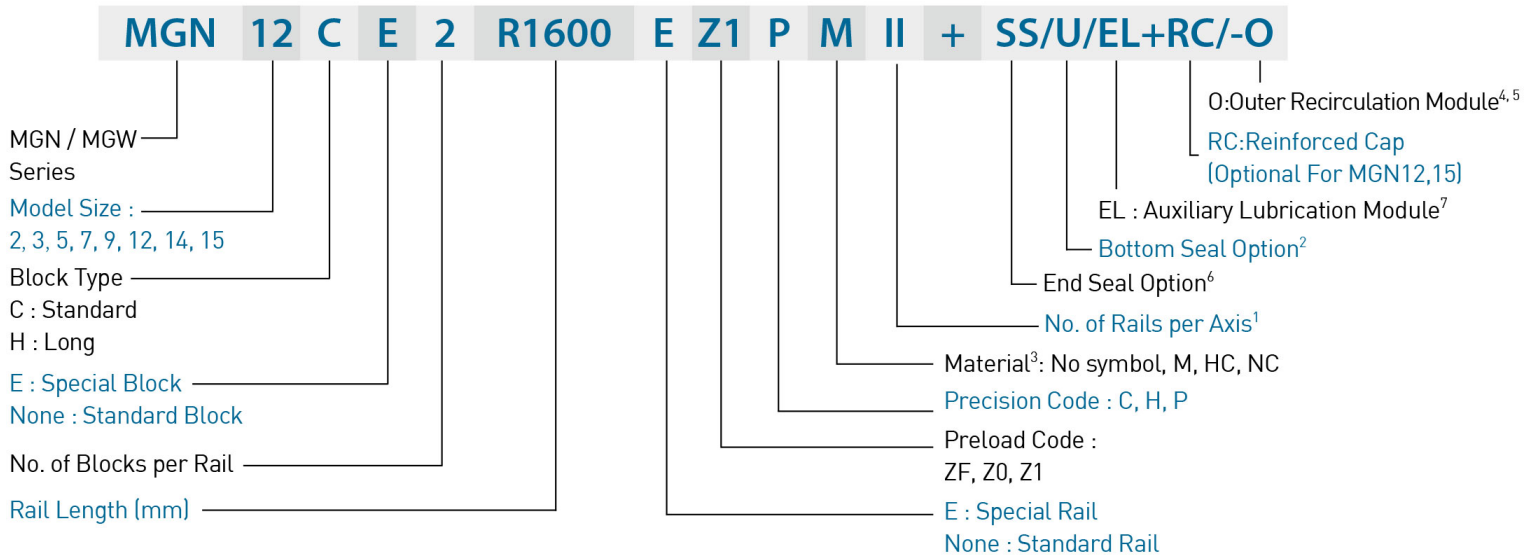
MG Series linear guideway can be classified into non-interchangeable and interchangeable types, which are the same size. The interchangeable type is more convenient due to replaceable rails; however, the precision is less than non-interchangeable type. With strict dimension and quality control, the interchangeable type linear guideways are a suitable choice for customers when rails don't need to be paired. The model number contains information for the size, type, accuracy, preload, and so on.

KGT[®] 65

MG Series

Miniature Type

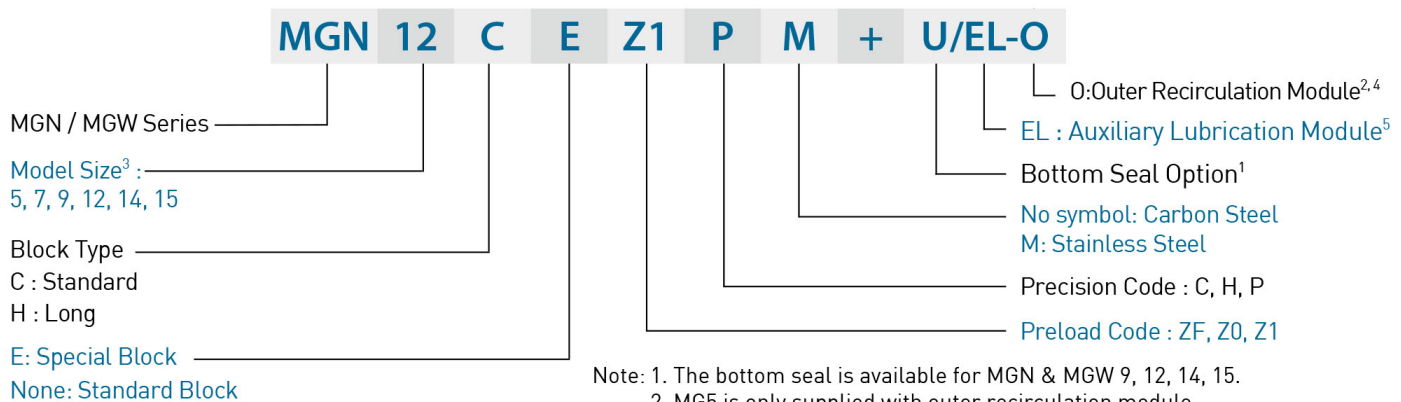
(1) Non-interchangeable type



- Note: 1. Symbol for No. of rails used on the same plane.
No symbol indicates single rail in a axis.
2. The bottom seal is available for MGN & MGW 9, 12, 14, 15.
3. No symbol: Carbon Steel
M: Stainless Steel
HC: Carbon Steel+Hard Chrome Treatment
NC: Carbon Steel+hicoating Treatment
4. MG5 is only supplied with outer recirculation module.
5. MG2, MG3 and MGW14 are only supplied without outer recirculation module.
6. The end seal is optional for MGN3, and it's available for SS symbol.
7. The available size for EL auxiliary lubrication module are , MGN7,9,12 & MGW9,12.

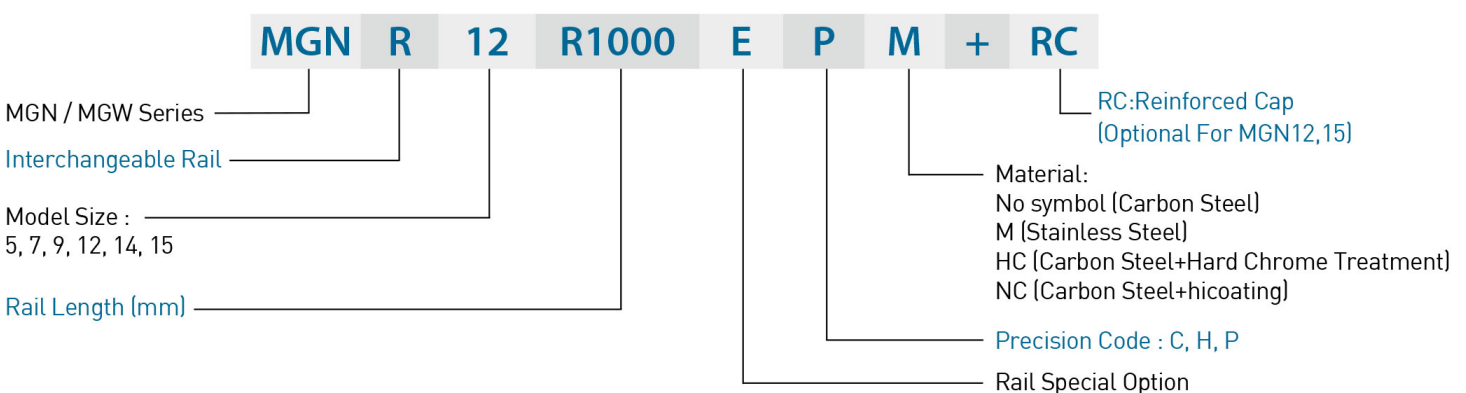
(2) Interchangeable type

Interchangeable Block



- Note: 1. The bottom seal is available for MGN & MGW 9, 12, 14, 15.
2. MG5 is only supplied with outer recirculation module.
3. No interchangeable offer of MG2 and MG3.
4. MGW14 is only supplied without outer recirculation module.
5. The available size for EL auxiliary lubrication module are , MGN7,9,12 & MGW9,12.

Interchangeable Rail

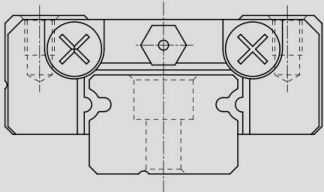
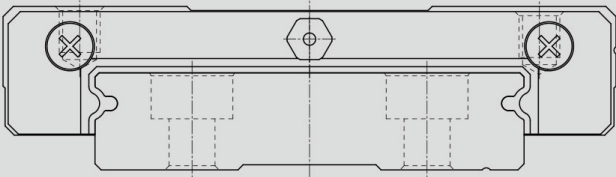


2-4-11 Types

(1) Block types

KGT offers two types of linear guideways, flange and square types.

Table 2-4-1 Block Types

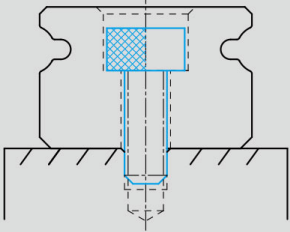
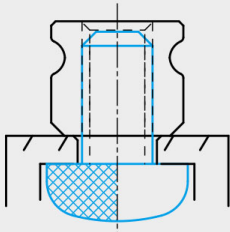
Type	Model	Shape	Height (mm)	Rail Length (mm)	Main Applications
Square	MGN-C MGN-H		3.2	30	- Printer - Robotics - Precision measure equipment - Semiconductor equipment
			↓	↓	
			16	2000	
Flange	MGW-C MGW-H		4	40	
			↓	↓	
			16	2000	

*Please refer to the chapter 2-4-14 for the dimensional detail.

(2) Rail types

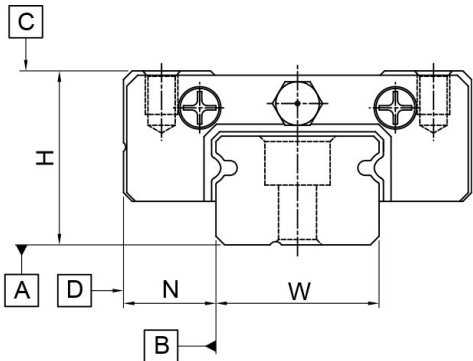
KGT offers standard top mounting and bottom mounting type.

Table 2-4-2 Rail Types

Mounting from Top	Mounting from bottom (MGN2, MGN3)
	

2-4-12 Accuracy Classes

The accuracy of MGN/MGW series can be classified into three classes: normal (C), high (H), precision (P). Choices for different accuracy classes are available according to various requirements.



Unit: mm

(1) Accuracy of non-interchangeable guideways

Table 2-4-3 Accuracy Standard of Non-interchangeable Type

Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.04	± 0.02	± 0.01
Dimensional tolerance of width N	± 0.04	± 0.025	± 0.015
Pair Variation of height H	0.03	0.015	0.007
Pair Variation of width N (Master Rail)	0.03	0.02	0.01
Running parallelism of block surface C to surface A	See Table 2-4-5		
Running parallelism of block surface D to surface B	See Table 2-4-5		

(2) Accuracy of interchangeable guideways

Table 2-4-4 Accuracy Standard of Interchangeable Type

Unit: mm

Accuracy Classes	Normal (C)	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.04	± 0.02	± 0.01
Dimensional tolerance of width N	± 0.04	± 0.025	± 0.015
One Set	Pair Variation of height H	0.03	0.015
	Pair Variation of width N	0.03	0.02
Pair Variation of width N (Master Rail)	0.07	0.04	0.02
Running parallelism of block surface C to surface A	See Table 2-4-5		
Running parallelism of block surface D to surface B	See Table 2-4-5		

(3) Accuracy of running parallelism

The running parallelism C to A and D to B are related to the rail length.

Table 2-4-5 Accuracy of Running Parallelism

Rail Length (mm)	Accuracy (μm)			Rail Length (mm)	Accuracy (μm)		
	(C)	(H)	(P)		(C)	(H)	(P)
~ 50	12	6	2	1,000 ~ 1,200	25	18	11
50 ~ 80	13	7	3	1,200 ~ 1,300	25	18	11
80 ~ 125	14	8	3.5	1,300 ~ 1,400	26	19	12
125 ~ 200	15	9	4	1,400 ~ 1,500	27	19	12
200 ~ 250	16	10	5	1,500 ~ 1,600	28	20	13
250 ~ 315	17	11	5	1,600 ~ 1,700	29	20	14
315 ~ 400	18	11	6	1,700 ~ 1,800	30	21	14
400 ~ 500	19	12	6	1,800 ~ 1,900	30	21	15
500 ~ 630	20	13	7	1,900 ~ 2,000	31	22	15
630 ~ 800	22	14	8	2,000 ~	31	22	16
800 ~ 1,000	23	16	9				

2-4-13 Preload

MGN/MGW series provides three different preload levels for various applications.

Table 2-4-6 Preload Classes

Class	Code	Preload	Accuracy
Light Clearance	ZF	Clearance 4~10μm	C
Very Light Preload	Z0	Clearance 0~3μm	C~P
Light Preload	Z1	0.02C	C~P

Note: “C” in column preload means basic dynamic load rating.

○ Stiffness performance

Stiffness depends on preload. The following table shows stiffness value of each size.

Table 2-4-7 Radial stiffness for MG Series

Load type	Series / Size	Stiffness (N/μm)		Series / Size	Stiffness (N/μm)	
		Z0	Z1		Z0	Z1
Standard	MGN5C-0	20	61	MGW5C-0	32	85
	MGN7C	26	73	MGW7C	44	112
	MGN9C	38	102	MGW9C	62	140
	MGN12C	44	105	MGW12C	72	148
	MGN15C	58	126	MGW15C	85	154
Long	MGN5H-0	26	79	-	-	-
	MGN7H	42	122	MGW7H	64	168
	MGN9H	56	153	MGW9H	81	190
	MGN12H	70	175	MGW12H	102	217
	MGN15H	89	202	MGW15H	122	235

2-4-14 Dust Proof Accessories

End seals on both sides of the block can prevent dust from entering the block and maintain the accuracy and service life of a linear guideway. End seals for MGN3 are optional, customers can order it by adding the mark “+SS” followed by the model number. For other size of MG series, end seals are standard accessories. Bottom seals are fixed under the skirt portion of the block to prevent dust from entering. Customers can order bottom seals by adding the mark “+U” followed by the model number. Sizes 9, 12, 14 and 15 provide bottom seals as an option, but size 2, 3, 5, 7 do not offer the option due to the space limit of H₁. Note that “H₁” would reduced if bottom seals are attached, be aware of possible interference between block and mounting surface.

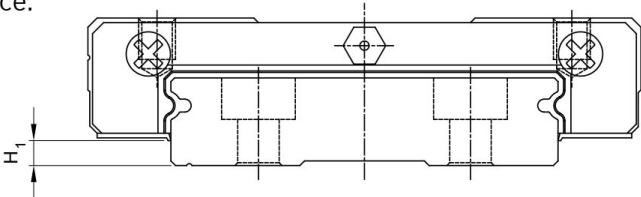


Table 2-4-8

Size	Bottom seal	H ₁ mm	Size	Bottom seal	H ₁ mm
MGN2	-	-	MGW2	-	-
MGN3	-	-	MGW3	-	-
MGN7	-	-	MGW7	-	-
MGN9	●	1	MGW9	●	1.9
MGN12	●	2	MGW12	●	2.4
-	-	-	MGW14	●	2.4
MGN15	●	3	MGW15	●	2.4
MGN5-0	-	-	MGW5-0	-	-
MGN7-0	-	-	MGW7-0	-	-
MGN9-0	●	1.2	MGW9-0	●	1.95
MGN12-0	●	2	MGW12-0	●	2.45
MGN15-0	●	3	MGW15-0	●	2.45

KGT[®] 69

MG Series

Miniature Type

● Bolt caps for rail mounting holes

Rail mounting hole caps prevent foreign matter from accumulating in the mounting holes. Caps are included with the rail package.



Table 2-4-9 Dimensions of Bolt Caps for Rail Mounting Holes

Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)
MGN12	M3	6.15	1.2
MGN15	M3	6.15	1.2
MGW12	M4	8.15	2.2
MGW14	M4	8.15	2.2
MGW15	M4	8.15	2.2

2-4-15 Mounting Surface Accuracy Tolerance

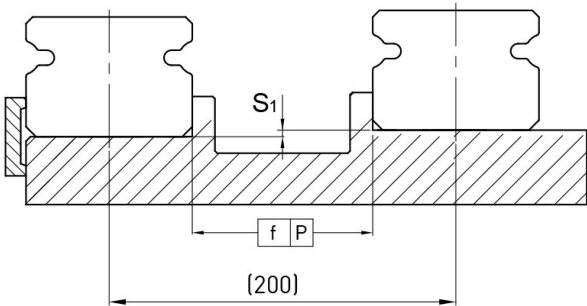


Table 2-4-10 Max. Parallelism Tolerance (P) unit: μm

Size	Preload classes			Size	Preload classes		
	ZF	Z0	Z1		ZF	Z0	Z1
MG2	2	2	2	MG9	4	4	3
MG3	2	2	2	MG12	9	9	5
MG5	2	2	2	MG14	10	10	6
MG7	3	3	3	MG15	10	10	6

Table 2-4-11 Max. Tolerance of Reference Surface Height (S₁) unit: μm

Size	Preload classes			Size	Preload classes		
	ZF	Z0	Z1		ZF	Z0	Z1
MG2	15	15	2	MG9	35	35	6
MG3	15	15	2	MG12	50	50	12
MG5	20	20	2	MG14	60	60	20
MG7	25	25	3	MG15	60	60	20

Table 2-4-12 Permissible Error of Mounting Surface unit: mm

Size	Flatness of the Mounting Surface	Size	Flatness of the Mounting Surface
MG2	0.012/200	MG9	0.035/200
MG3	0.012/200	MG12	0.050/200
MG5	0.015/200	MG14	0.060/200
MG7	0.025/200	MG15	0.060/200

Note: The values above are suitable for preload of ZF/Z0. For preload of Z1 or using two(or more) rails on the same plane, 50% or less of the values above are recommended.

2-4-16 Cautions for Installation

(1) Shoulder heights and fillets

Improper shoulder heights and fillets of mounting surfaces will cause a deviation in accuracy and the interference with the rail or block. As long as the recommended shoulder heights and fillets are followed, installation inaccuracies should be eliminated.

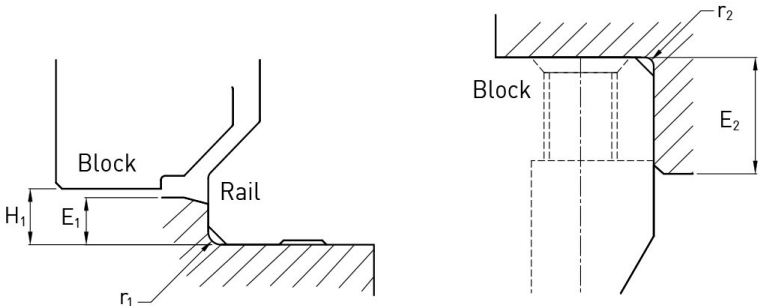


Table 2-4-13 Shoulder Heights and Fillets

Size	Max. radius of fillets r_1 (mm)	Max. radius of fillets r_2 (mm)	Shoulder height beside the rail E_1 (mm)	Shoulder height beside the block E_2 (mm)	Clearance under block H_1 (mm)
MGN2	0.1	0.2	0.5	1.5	0.7
MGN3	0.1	0.2	0.6	1.5	1
MGN5	0.1	0.2	1.2	2	1.5
MGN7	0.2	0.2	1.2	3	1.5
MGN9	0.2	0.3	1.7	3	2
MGN12	0.3	0.4	1.7	4	3
MGN15	0.5	0.5	2.5	5	4
MGW2	0.1	0.2	0.6	1.5	1
MGW3	0.1	0.2	0.6	2	1
MGW5	0.1	0.2	1.2	2	1.5
MGW7	0.2	0.2	1.7	3	1.9
MGW9	0.3	0.3	2.5	3	2.9
MGW12	0.4	0.4	3	4	3.4
MGW14	0.4	0.4	3	5	3.5
MGW15	0.4	0.8	3	5	3.4

(2) Tightening torque of bolts for installation

Improper tightening of rail mounting bolts will seriously affect the accuracy of the linear guideway. The following table lists the recommended tightening torque for the specific bolt sizes.

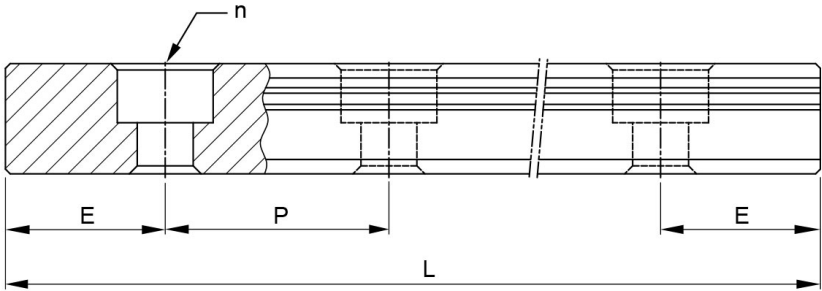
Table 2-4-14 Tightening Torque

Size	Bolt size	Torque, N-cm (kgf-cm)		
		Iron	Casting	Aluminum
MGN5	M2×0.4P×6L	57(5.9)	39.2(4)	29.4(3)
MGN7	M2×0.4P×6L	57(5.9)	39.2(4)	29.4(3)
MGN9	M3×0.5P×8L	186(19)	127(13)	98(10)
MGN12	M3×0.5P×8L	186(19)	127(13)	98(10)
MGN15	M3×0.5P×10L	186(19)	127(13)	98(10)
MGW2	M1.6×0.35P×4.4L	27.6(2.8)	19(1.94)	14.2(1.45)
MGW3	M2×0.4P×6L	57(5.9)	39.2(4)	29.4(3)
MGW5	M2.5×0.45P×7L	118(12)	78.4(8)	58.8(6)
MGW7	M3×0.5P×6L	186(19)	127(13)	98(10)
MGW9	M3×0.5P×8L	186(19)	127(13)	98(10)
MGW12	M4×0.7P×8L	392(40)	274(28)	206(21)
MGW14	M4×0.7P×10L	392(40)	274(28)	206(21)
MGW15	M4×0.7P×10L	392(40)	274(28)	206(21)

Note : 1 kgf = 9.81 N

2-4-17 Standard and Maximum Lengths of Rail

KGT offers standard lengths of rail for fast shipping. For non-standard rail lengths, it's recommended that the E value is no greater than 1/2 of the pitch(P) to prevent instability at the end of the rail, and the E value should be no less than E-min to avoid a broken mounting hole.



$$L = (n - 1) \times P + 2 \times E$$

Eq.2.4

- L : Total length of rail (mm)
- n : Number of mounting holes
- P : Distance between any two holes (mm)
- E : Distance from the center of the last hole to the edge (mm)

Table 2-4-15

unit: mm

Item	MGNR2	MGNR3	MGNR5	MGNR7	MGNR9	MGNR12	MGNR15	MGWR2	MGWR3	MGWR5	MGWR7	MGWR9	MGWR12	MGWR14	MGWR15
Standard Length L (n)	32(4)	30(3)	40(3)	40(3)	55(3)	70(3)	70(2)	40(4)	40(3)	50(3)	50(2)	80(3)	110(3)	110(3)	110(3)
	40(5)	40(4)	55(4)	55(4)	75(4)	95(4)	110(3)	60(6)	55(4)	70(4)	80(3)	110(4)	150(4)	150(4)	150(4)
	56(7)	50(5)	70(5)	70(5)	95(5)	120(5)	150(4)	70(7)	70(5)	90(5)	110(4)	140(5)	190(5)	190(5)	190(5)
	80(10)	60(6)	100(7)	85(6)	115(6)	145(6)	190(5)	80(8)	100(7)	110(6)	140(5)	170(6)	230(6)	230(6)	230(6)
	104(13)	80(8)	130(9)	100(7)	135(7)	170(7)	230(6)	100(10)	130(9)	130(7)	170(6)	200(7)	270(7)	270(7)	270(7)
		100(10)	160(11)	130(9)	155(8)	195(8)	270(7)		160(11)	150(8)	200(7)	230(8)	310(8)	310(8)	310(8)
					175(9)	220(9)	310(8)			170(9)	260(9)	260(9)	350(9)	350(9)	350(9)
					195(10)	245(10)	350(9)				290(10)	290(10)	390(10)	390(10)	390(10)
					275(14)	270(11)	390(10)					350(14)	430(11)	430(11)	430(11)
					375(19)	320(13)	430(11)					500(19)	510(13)	510(13)	510(13)
						370(15)	470(12)					710(24)	590(15)	590(15)	590(15)
						470(19)	550(14)					860(29)	750(19)	750(19)	750(19)
Pitch (P)	8	10	15	15	20	25	40	10	15	20	30	30	40	40	40
	4	5	5	5	7.5	10	15	5	5	5	10	10	15	15	15
	248(31)	250(25)	250(17)	595(40)	1195(60)	1995(80)	1990(50)	250(25)	250(17)	250(13)	590(20)	1970(66)	1990(50)	1790(45)	1990(50)
	250 ⁶	250 ⁶	250 ⁶	600	1200 ⁷	2000	2000	250 ⁶	250 ⁶	250 ⁶	600 ⁸	2000	2000	1800 ⁵	2000

Note:

1. Tolerance of E value for standard rail is 0.5~0.5 mm. Tolerance of E value for jointed rail is 0~0.3 mm.

2. Maximum standard length indicates the max. rail length with standard E value on both sides.

3. Fixing screws for MGN5's mounting holes are appended.

4. If smaller E value is needed, please contact KGT

5. MGWR14 is only supplied with carbon steel.

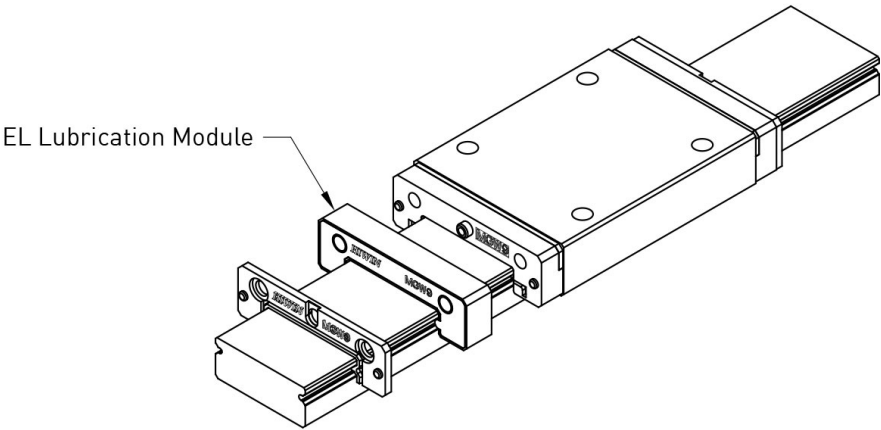
6. MGNR2, MGWR2, MGNR3, MGWR3, MGNR5, MGWR5 are only supplied with stainless steel.

7. MGNR9 of stainless steel is supplied with the maximum length of 1200mm; MGNR9 of carbon steel is supplied with the maximum length of 1000mm.

8. MGWR7 of stainless steel is supplied with the maximum length of 600mm; MGWR7 of carbon steel is supplied with the maximum length of 2000mm .

2-4-18 EL Auxiliary Lubrication Module

The EL Auxiliary Lubrication Module is an environment friendly lubrication system that can extend the maintenance life of KGT and guideways up to 10,000 km. The module is installed on either end of a guideway block and provides extended lubrication through a no-drip encapsulated material for a cleaner environmental solution.



(1) Feature

- 1. Extend maintenance period up to 10,000km
- 2. Contained lubrication fluid prevents spills
- 3. Direct lubrication in ball rolling raceway.
- 4. Compatible with most KGT guideways.
- 5. Conform to cleanroom class 1000 regulation.

Notes :

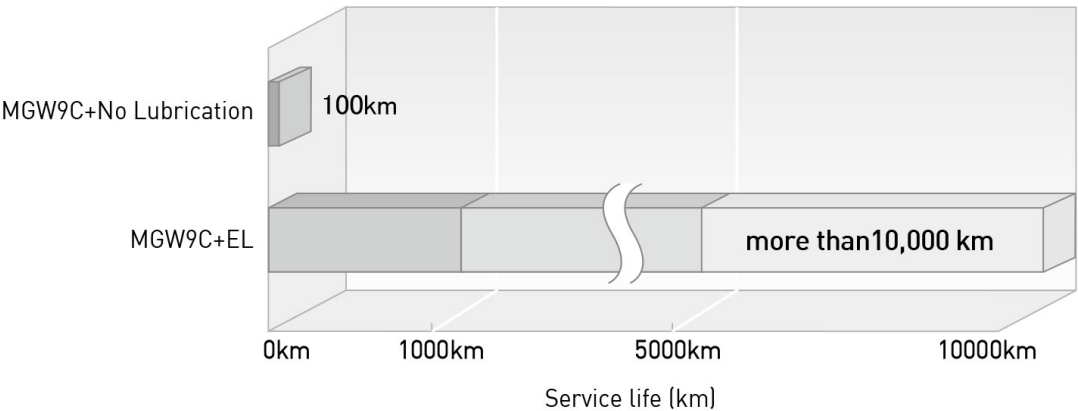
- 1. Service life will vary from application environment, lubrication conditions, and assembly accuracy.
- 2. Not for use in high heat conditions greater than 50°C ,and if lower than 25° Ç please contact KGT
- 3. Standard parts must be pregreased with KGT G05. If there is no pregreasing, the maintenance mileage will be shortened.

(2) Applications

Broadly applicable in automation, conveying equipment, Industrial machine, Semi-conductor, and inspection machine.

(3) Lubrication Capability

- High speed life testing with light load



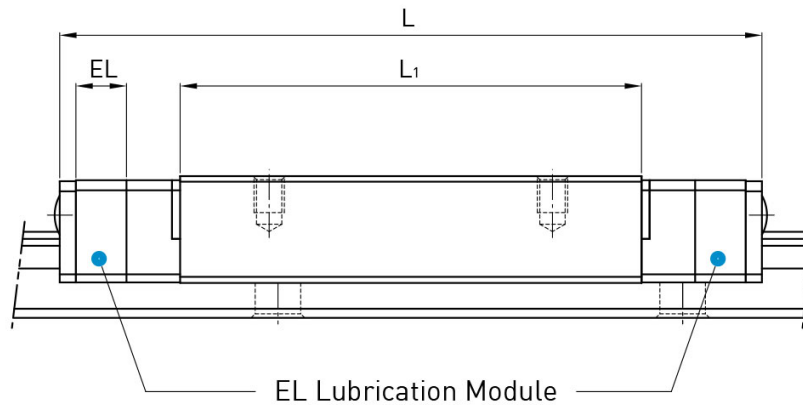
Test Specification	MGW9C1R1000Z0CM+EL
Velocity	5 m/s
Acceleration	50 m/s ²
Applied Load	0.2 kgf
Stroke	850 mm
Lubrication	Lithium Soap Grease+EL
Distance travel	10,000 km

KGT[®] 73

MG Series

Miniature Type

(4) Dimension Table for EL Type



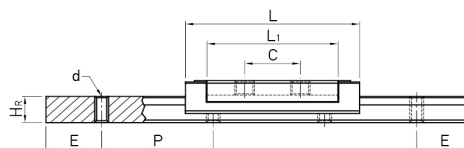
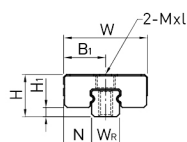
unit : mm

Model No.	Lubrication device (R ₁)	Block length (L ₁)	Total length (L)
MGN7C	3.5	13.5	29.5
MGN7H		21.8	37.8
MGN9C	5	18.9	38.9
MGN9H		29.9	49.9
MGN12C	5	21.7	44.7
MGN12H		32.4	55.4
MGW9C	5	27.5	49.3
MGW9H		38.5	60.7
MGW12C	5	31.3	56.1
MGW12H		45.6	70.4

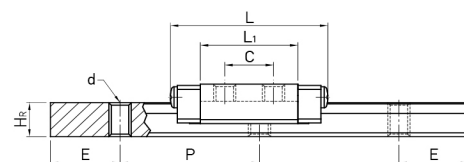
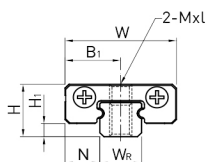
Dimensions for MGN/MGW Series

MGN-C / MGN-H

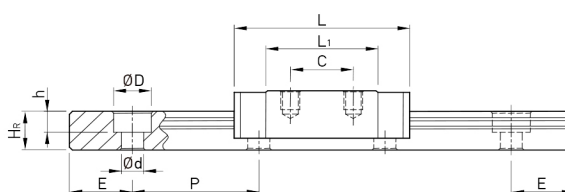
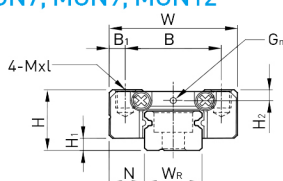
MGN2



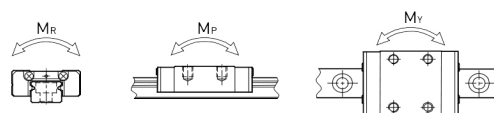
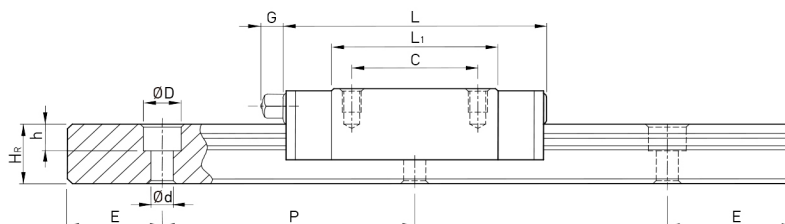
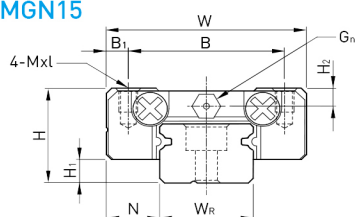
MGN3



MGN7, MGN9, MGN12



MGN15



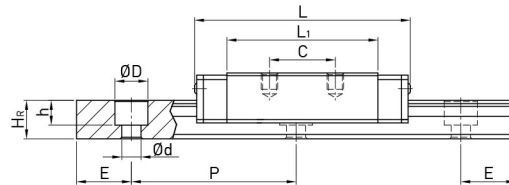
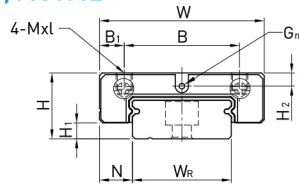
Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)												Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
H	H ₁	N	W	B	B ₁	C	L ₁	L	L _{max} (Note3)	G	G _n	MxL	H ₂	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R N-m	M _P N-m	M _V N-m	Block kg	Rail kg/m			
MGN 2C	3.2	0.7	2	6	-	3	4	9.4	12.5	12.5	-	-	M1.4 THRU	-	2	2	M1 THRU	8	4		M1	0.22	0.4	0.42	0.63	0.63	0.001	0.03			
MGN 3C	4	1	2.5	8	-	4	3.5	6.7	11.5	11.5	-	-	M1.6x1.3	-	3	2.6	M1.6 THRU	10	5	M1.6	0.29	0.44	0.7	0.5	0.5	0.001	0.05				
MGN 3H							5.5	10.7	15.5	15.5			M2x1.3								0.39	0.68	1.0	1.3	1.3	0.002					
MGN 5C	6	1.5	3.5	12	8	2	-	9.6	16	16.4	-	0.8	M2x1.5	1	5	3.6	3.6	0.8	2.4	15	5	M2x6	0.54	1.08	2.6	2.3	2.3	0.004	0.15		
MGN 5H							-	12.6	19	19.4													0.67	1.08	2.6	2.3	2.3	0.004			
MGN 7C	8	1.5	5	17	12	2.5	8	13.5	22.5	23.1	-	Ø1.2	M2x2.5	1.5	7	4.8	4.2	2.3	2.4	15	5	M2x6	0.98	1.24	4.70	2.84	2.84	0.010	0.22		
MGN 7H							13	21.8	30.8	31.4													1.37	1.96	7.64	4.80	4.80	0.015			
MGN 9C	10	2	5.5	20	15	2.5	10	18.9	28.9	29.9	-	Ø1.4	M3x3	1.8	9	6.5	6	3.5	3.5	20	7.5	M3x8	1.86	2.55	11.76	7.35	7.35	0.016	0.38		
MGN 9H							16	29.9	39.9	40.9													2.55	4.02	19.60	18.62	18.62	0.026			
MGN 12C	13	3	7.5	27	20	3.5	15	21.7	34.7	35.1	-	Ø2	M3x3.5	2.5	12	8	6	4.5	3.5	25	10	M3x8	2.84	3.92	25.48	13.72	13.72	0.034	0.65		
MGN 12H							20	32.4	45.4	45.8													3.72	5.88	38.22	36.26	36.26	0.054			
MGN 15C	16	4	8.5	32	25	3.5	20	26.7	42.1	42.7	4.5	M3	M3x4	3	15	10	6	4.5	3.5	40	15	M3x10	4.61	5.59	45.08	21.56	21.56	0.059	1.06		
MGN 15H							25	43.4	58.8	59.4													6.37	9.11	73.50	57.82	57.82	0.092			

Note : 1. 1 kgf = 9.81N

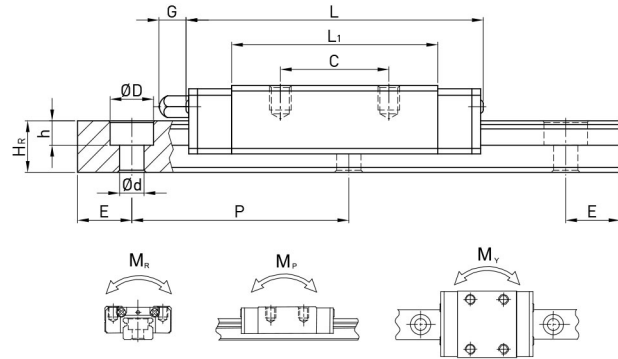
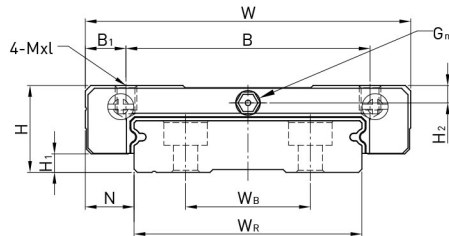
2. MG2, MG3 blocks should not be removed from the rail. If removing the blocks is necessary, the blocks should be kept on the block inserts.

3. The marking of "L Max." denotes the maximum block length with screws, lips of end seals, etc.

MGW7, MGW9, MGW12



MGW15



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)										Dimensions of Rail (mm)										Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	G	G _n	MxL	H ₂	W _R	W _B	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R N-m	M _P N-m	M _Y N-m	Block kg	Rail kg/m		
MGW 7C	9	1.9	5.5	25	19	3	10	21	31.2	-	Ø1.2	M3x3	1.85	14	-	5.2	6	3.2	3.5	30	10	M3x6	1.37	2.06	15.70	7.14	7.14	0.020	0.51		
MGW 7H							19	30.8	41														1.77	3.14	23.45	15.53	15.53	0.029			
MGW 9C	12	2.9	6	30	21	4.5	12	27.5	39.3	-	Ø1.2	M3x3	2.4	18	-	7	6	4.5	3.5	30	10	M3x8	2.75	4.12	40.12	18.96	18.96	0.040	0.91		
MGW 9H							23	3.5	24														38.5	50.7	3.43	5.89	54.54	34.00		34.00	0.057
MGW 12C	14	3.4	8	40	28	6	15	31.3	46.1	-	Ø1.2	M3x3.6	2.8	24	-	8.5	8	4.5	4.5	40	15	M4x8	3.92	5.59	70.34	27.80	27.80	0.071	1.49		
MGW 12H							28	45.6	60.4														5.10	8.24	102.70	57.37	57.37	0.103			
MGW 15C	16	3.4	9	60	45	7.5	20	38	54.8	5.2	M3	M4x4.2	3.2	42	23	9.5	8	4.5	4.5	40	15	M4x10	6.77	9.22	199.34	56.66	56.66	0.143	2.86		
MGW 15H							35	57	73.8														8.93	13.38	299.01	122.60	122.60	0.215			

Note : 1. 1 kgf = 9.81N

2. MG2 and MG3 blocks should not be removed from the rail. If removing the blocks is necessary, the blocks should be kept on the block inserts.

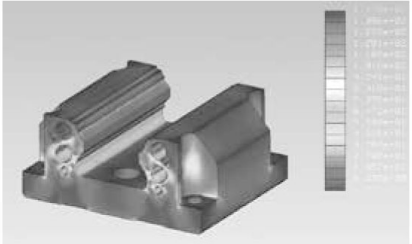
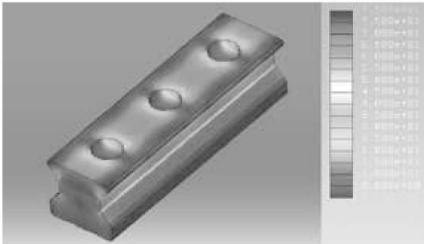
2-3 RG Series – High Rigidity Roller Type Linear Guideway

2-3-1 Advantages and features

The new RG series from KGT features a roller as the rolling element instead of steel balls. The roller series offers super high rigidity and very high load capacities. The RG series is designed with a 45-degree angle of contact. Elastic deformation of the linear contact surface, during load, is greatly reduced thereby offering greater rigidity and higher load capacities in all 4 load directions. The RG series linear guideway offers high performance for high-precision manufacturing and achieving longer service life.

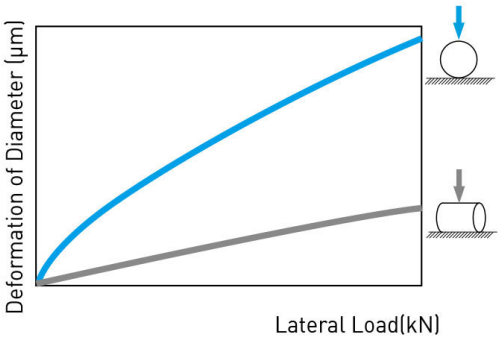
(1) Optimal design

FEM analysis was performed to determine the optimal structure of the block and the rail. The unique design of the circulation path allows the RG series linear guideway to offer smoother linear motion.



(2) Super high rigidity

The RG series is a type of linear guideway that uses rollers as the rolling elements. Rollers have a greater contact area than balls so that the roller guideway features higher load capacity and greater rigidity. The figure shows the rigidity of a roller and a ball with equal volume.

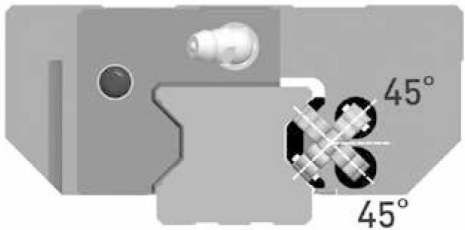


(3) Super high load capacity

With the four rows of rollers arranged at a contact angle of 45-degrees, the RG series linear guideway has equal load ratings in the radial, reverse radial and lateral directions. The RG series has a higher load capacity in a smaller size than conventional, ball-type linear guideways.

(4) Operating life increased

Compare with the ball element, the contact pressure of rolling element is distributed on the line region. Therefore, stress concentration was reduced significantly and the RG series offers longer running life. The nominal life of RG series can be calculated by using Eq.



The acting load will affect the nominal life of a linear guideway. Based on the selected basic dynamic rated load and the actual load. The nominal life of ball type and roller type linear guideway can be calculated by Eq.2.5 respectively.

$$L = \left(\frac{C}{P} \right)^{\frac{10}{3}} \cdot 100\text{km} = \left(\frac{C}{P} \right)^{\frac{10}{3}} \cdot 62\text{mile}$$

Eq. 2.5

If the environmental factors are taken into consideration, the nominal life is influenced greatly by the motion conditions, the hardness of the raceway, and the temperature of the linear guideway. The relationship between these factors is expressed in Eq.2.6.

$$L = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P} \right)^{\frac{10}{3}} \cdot 100\text{km} = \left(\frac{f_h \cdot f_t \cdot C}{f_w \cdot P} \right)^{\frac{10}{3}} \cdot 62\text{mile}$$

Eq. 2.6

L : Nominal life	f_h : Hardness factor
C : Basic dynamic load rating	f_t : Temperature factor
P : Actual load	f_w : Load factor

KGT[®] 77

RG Series

High Rigidity Roller Type

(5) Test Data

1. Nominal life test

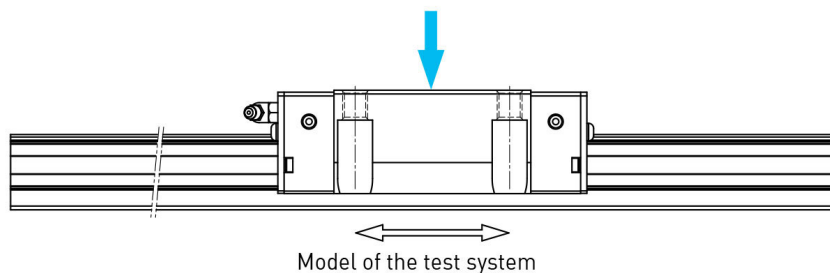


Table 2-9-1

Tested model 1: RGH35CA

Preload: ZA class
Max. Speed: 60m/min
Acceleration: 1G
Stroke: 0.55m
Lubrication: grease held every 100km
External load: 15kN
Traveling distance: 1135km

Test results:

The nominal life of RGH35CA is 1000km.
After traveling 1135km, fatigue flaking did not appear on the surface of the raceway or rollers.



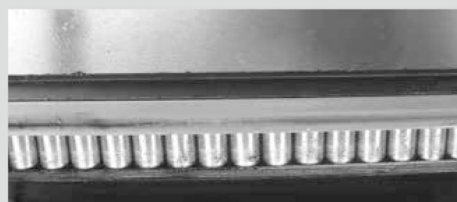
2. Durability Test

Tested model 2: RGW35CC

Preload: ZA class
Max. Speed: 120m/min
Acceleration: 1G
Stroke: 2m
Lubrication: oil feed rate: 0.3cm³/hr
External load: 0kN
Traveling distance: 15000km

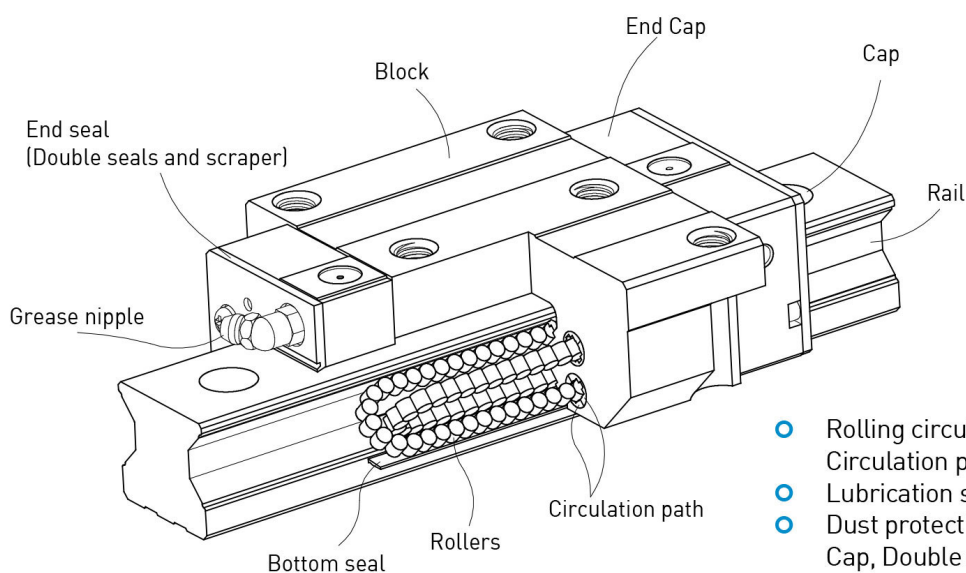
Test results:

Fatigue flaking did not appear on the surface of the raceway or rollers after traveling 15000km.



Note: The data listed are from samples.

2-3-2 Construction of RG Series

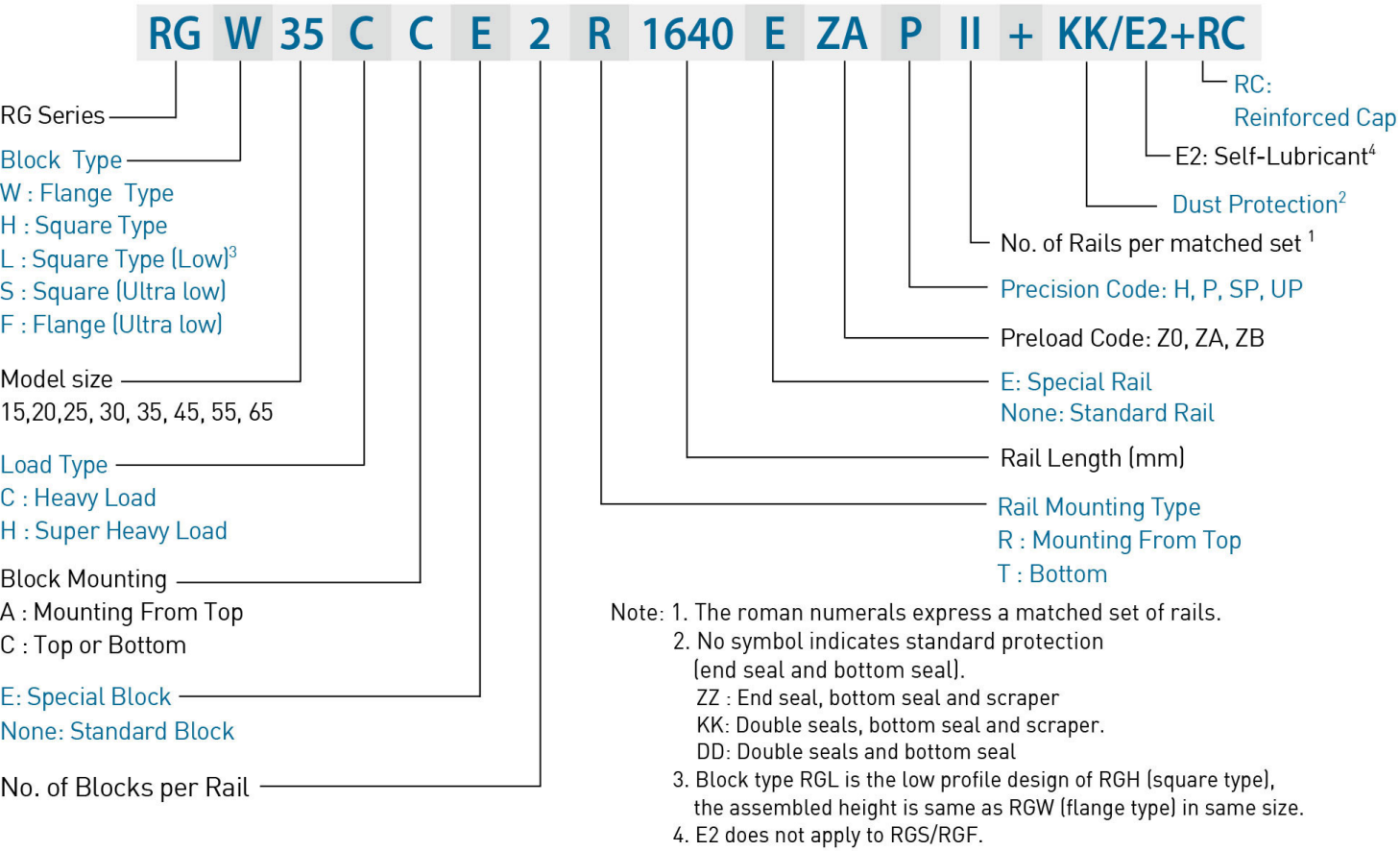


- Rolling circulation system: Block, Rail, End cap, Circulation path, rollers
- Lubrication system: Grease nipple and piping joint
- Dust protection system: End seal, Bottom seal, Cap, Double seals and Scraper

2-3-3 Model Number of RG series

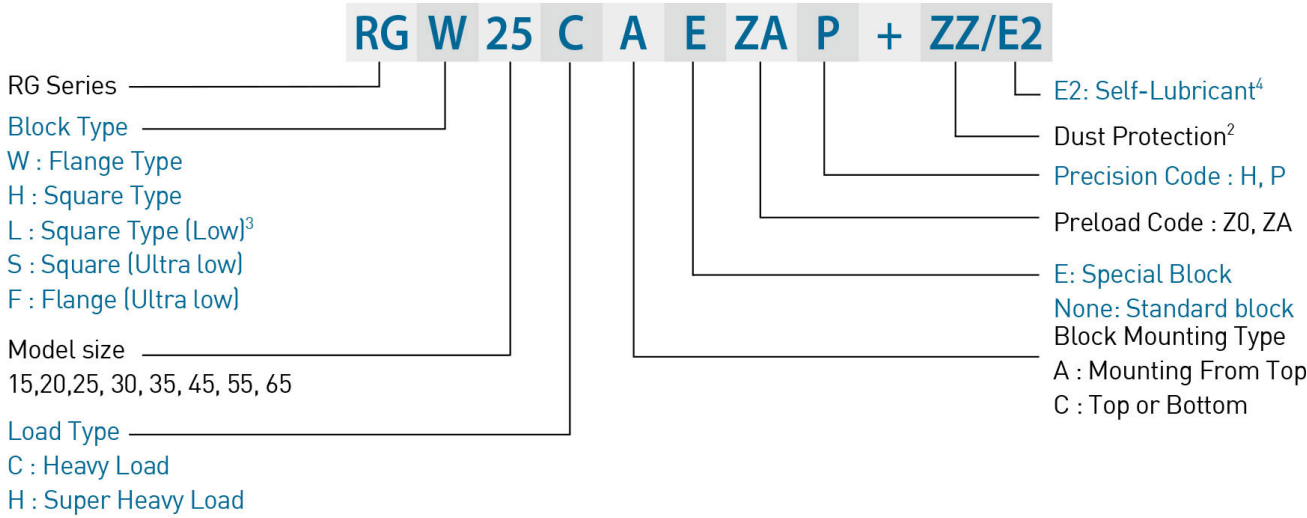
RG series linear guideways are classified into non-interchangeable and interchangeable types. The sizes of these two types are the same as one another. The main difference is that the interchangeable type of blocks and rails can be freely exchanged and they can maintain P-class accuracy. Because of strict dimensional control, the interchangeable type linear guideways are a wise choice for customers when rails do not need to be matched for an axis. The model number of the RG series identifies the size, type, accuracy class, preload class, etc.

(1) Non-interchangeable type

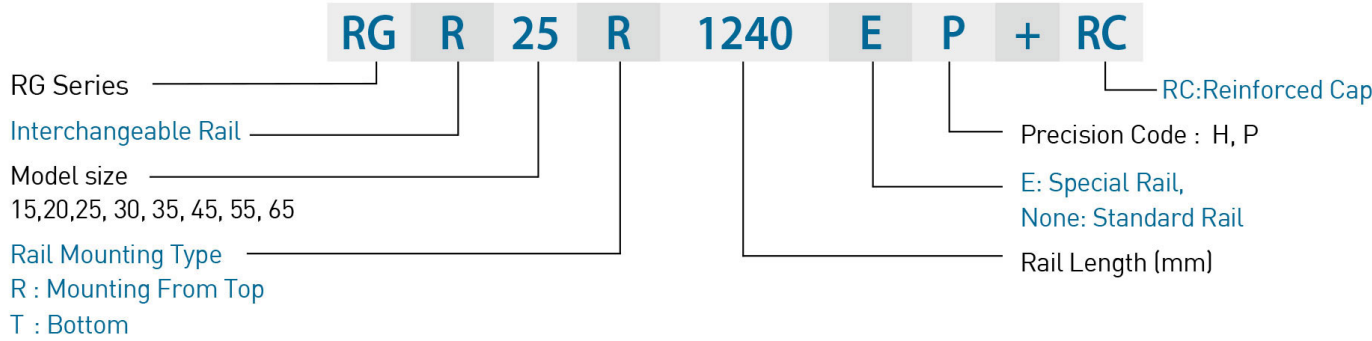


(2) Interchangeable type

Model Number of RG Block



Model Number of RG Rail



KG[®]T

79

RG Series

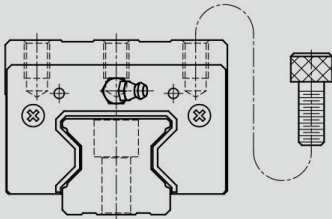
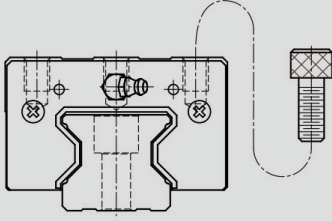
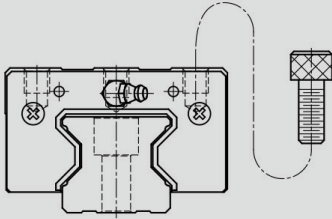
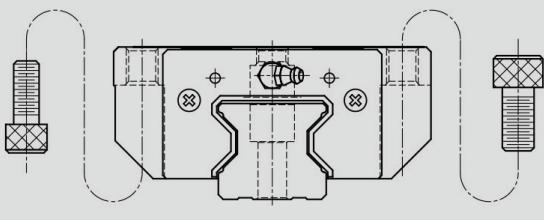
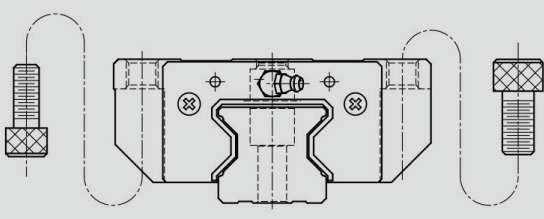
High Rigidity Roller Type

2-3-4 Types

(1) Block types

KGT offers two types of guide blocks, flange and square type. Because of the low assembly height and large mounting surface, the flange type is excellent for heavy moment load applications.

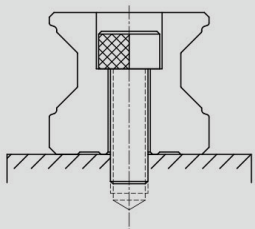
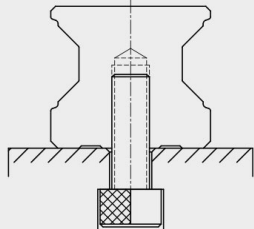
Table 2-9-2 Block Types

Type	Model	Shape	Height (mm)	Rail Length (mm)	Main Applications
Square	RGH-CA RGH-HA		28	100	- Automation Systems - Transportation equipment - CNC machining centers - Heavy duty cutting machines - CNC grinding machines - Injection molding machines - Plano millers - Devices requiring high rigidity - Devices requiring high load capacity - Electric discharge machines
			↓	↓	
			90	4000	
Square (low)	RGL-CA RGL-HA		24	100	
			↓	↓	
			70	4000	
Square (Ultra low)	RGS-CA RGS-HA		44	100	
			↓	↓	
			52	4000	
Flange	RGW-CC RGW-HC		24	100	
			↓	↓	
			90	4000	
Flange (Ultra low)	RGF-CC RGF-HC		44	100	
			↓	↓	
			52	4000	

(2) Rail types

In addition to the standard top mounting type, KGT also offers the bottom mounting type of rails.

Table 2-9-3 Rail Types

Mounting from Top	Mounting from Bottom
	

2-3-5 Accuracy Classes

The accuracy of the RG series can be classified into four classes: high (H), precision (P), super precision (SP) and ultra precision (UP). Customers may choose the class by referencing the accuracy requirements of the applied equipment.

(1) Accuracy of non-interchangeable

Table 2-9-4 Accuracy Standards

Item	RG - 15, 20			
Accuracy Classes	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Dimensional tolerance of width N	± 0.03	0 - 0.03	0 - 0.015	0 - 0.008
Variation of height H	0.01	0.006	0.004	0.003
Variation of width N	0.01	0.006	0.004	0.003
Running parallelism of block surface C to surface A	See Table 2-9-12			
Running parallelism of block surface D to surface B	See Table 2-9-12			

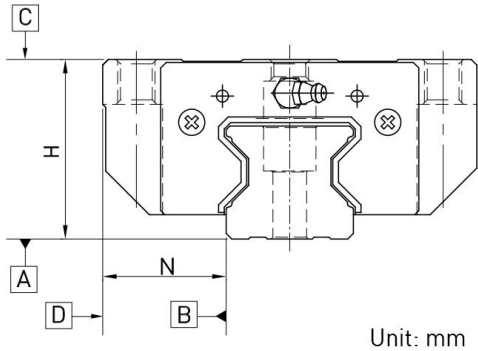


Table 2-9-5 Accuracy Standards

Item	RG - 25, 30, 35			
Accuracy Classes	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Dimensional tolerance of width N	± 0.04	0 - 0.04	0 - 0.02	0 - 0.01
Variation of height H	0.015	0.007	0.005	0.003
Variation of width N	0.015	0.007	0.005	0.003
Running parallelism of block surface C to surface A	See Table 2-9-12			
Running parallelism of block surface D to surface B	See Table 2-9-12			

Unit: mm

KGT[®]

81

RG Series

High Rigidity Roller Type

Table 2-9-6 Accuracy Standards

Unit: mm

Item	RG - 45, 55			
Accuracy Classes	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.05	0 - 0.05	0 - 0.03	0 - 0.02
Dimensional tolerance of width N	± 0.05	0 - 0.05	0 - 0.03	0 - 0.02
Variation of height H	0.015	0.007	0.005	0.003
Variation of width N	0.02	0.01	0.007	0.005
Running parallelism of block surface C to surface A	See Table 2-9-12			
Running parallelism of block surface D to surface B	See Table 2-9-12			

Table 2-9-7 Accuracy Standards

Unit: mm

Item	RG - 65			
Accuracy Classes	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dimensional tolerance of height H	± 0.07	0 - 0.07	0 - 0.05	0 - 0.03
Dimensional tolerance of width N	± 0.07	0 - 0.07	0 - 0.05	0 - 0.03
Variation of height H	0.02	0.01	0.007	0.005
Variation of width N	0.025	0.015	0.01	0.007
Running parallelism of block surface C to surface A	See Table 2-9-12			
Running parallelism of block surface D to surface B	See Table 2-9-12			

(2) Accuracy of interchangeable

Table 2-9-8 Accuracy Standards

Unit: mm

Item	RG - 15, 20	
Accuracy Classes	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.03	± 0.015
Dimensional tolerance of width N	± 0.03	± 0.015
Variation of height H	0.01	0.006
Variation of width N	0.01	0.006
Running parallelism of block surface C to surface A	See Table 2-9-12	
Running parallelism of block surface D to surface B	See Table 2-9-12	

Table 2-9-9 Accuracy Standards

Unit: mm

Item	RG - 25, 30, 35	
Accuracy Classes	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.04	± 0.02
Dimensional tolerance of width N	± 0.04	± 0.02
Variation of height H	0.015	0.007
Variation of width N	0.015	0.007
Running parallelism of block surface C to surface A	See Table 2-9-12	
Running parallelism of block surface D to surface B	See Table 2-9-12	

Table 2-9-10 Accuracy StandardsUnit: mm

Item	RG - 45, 55	
Accuracy Classes	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.05	± 0.025
Dimensional tolerance of width N	± 0.05	± 0.025
Variation of height H	0.015	0.007
Variation of width N	0.02	0.01
Running parallelism of block surface C to surface A	See Table 2-9-12	
Running parallelism of block surface D to surface B	See Table 2-9-12	

Table 2-9-11 Accuracy StandardsUnit: mm

Item	RG - 65	
Accuracy Classes	High (H)	Precision (P)
Dimensional tolerance of height H	± 0.07	± 0.035
Dimensional tolerance of width N	± 0.07	± 0.035
Variation of height H	0.02	0.01
Variation of width N	0.025	0.015
Running parallelism of block surface C to surface A	See Table 2-9-12	
Running parallelism of block surface D to surface B	See Table 2-9-12	

(3) Accuracy of running parallelism

Table 2-9-12 Accuracy of Running Parallelism

Rail Length (mm)	Accuracy (μm)			
	H	P	SP	UP
~ 100	7	3	2	2
100 ~ 200	9	4	2	2
200 ~ 300	10	5	3	2
300 ~ 500	12	6	3	2
500 ~ 700	13	7	4	2
700 ~ 900	15	8	5	3
900 ~ 1,100	16	9	6	3
1,100 ~ 1,500	18	11	7	4
1,500 ~ 1,900	20	13	8	4
1,900 ~ 2,500	22	15	10	5
2,500 ~ 3,100	25	18	11	6
3,100 ~ 3,600	27	20	14	7
3,600 ~ 4,000	28	21	15	7

KGT[®] 83

RG Series

High Rigidity Roller Type

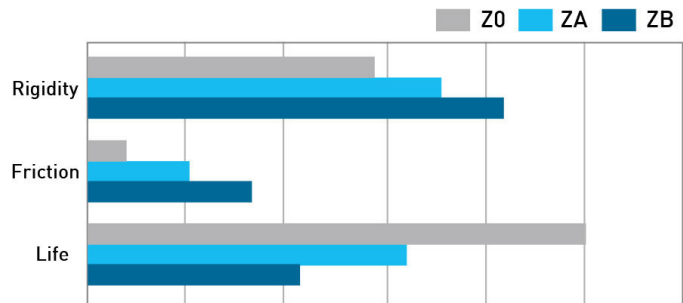
2-3-6 Preload

A preload can be applied to each guideway using oversized rollers. Generally, a linear motion guideway has negative clearance between the raceway and rollers to improve stiffness and maintain high precision. The RG series linear guideway offers three standard preloads for various applications and conditions.

Table 2-9-13

Class	Code	Preload	Condition
Light Preload	Z0	0.02C~0.04C	Certain load direction, low impact, low precision required
Medium Preload	ZA	0.07C~0.09C	High rigidity required, high precision required
Heavy Preload	ZB	0.12C~0.14C	Super high rigidity required, with vibration and impact

The figure shows the relationship between the rigidity, friction and nominal life. A preload no larger than ZA would be recommended for smaller model sizes to avoid over-preload affecting the life of the guideway.



○ Stiffness performance

Stiffness depends on preload. The following table shows stiffness value of each size.

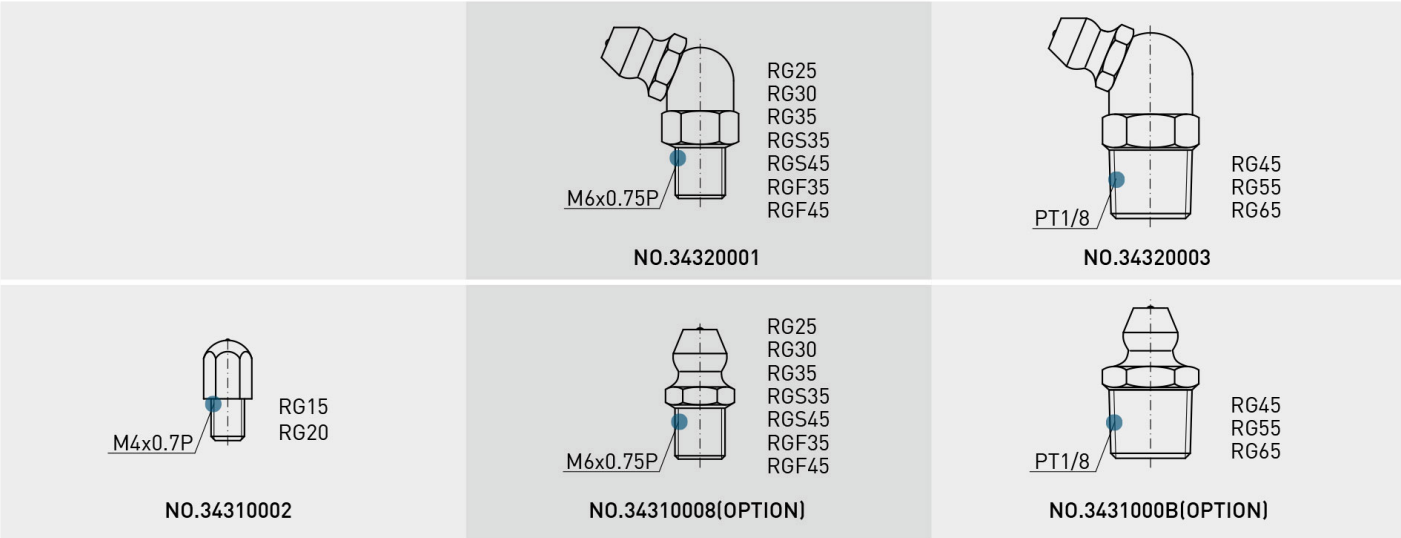
Table 2-9-14 Radial stiffness for RG Series

Load type	Series / Size	Stiffness (N/μm)		
		Z0	ZA	ZB
Heavy load	RG 15C	508	727	788
	RG 20C	625	853	950
	RG 25C	692	954	1196
	RG 30C	882	1082	1333
	RG 35C	1059	1247	1547
	RG 45C	1642	1851	2332
	RG 55C	1784	2053	2506
	RG 65C	2564	2900	3482
Super heavy load	RG 20H	840	1160	1279
	RG 25H	887	1242	1549
	RG 30H	1125	1391	1711
	RG 35H	1412	1757	2144
	RG 45H	2207	2511	3172
	RG 55H	2459	2858	3538
	RG 65H	3560	4064	4937

2-3-7 Lubrication

(1) Grease

Grease nipple



Mounting location

The standard location of the grease fitting is at both ends of the block, but the nipple can be mounted in the side or the top of block. For lateral installation, we recommend that the nipple be mounted at the non-reference side, otherwise please contact us. It is possible to carry out the lubrication by using an oil-piping joint. The figure shows the locations of the grease fitting.

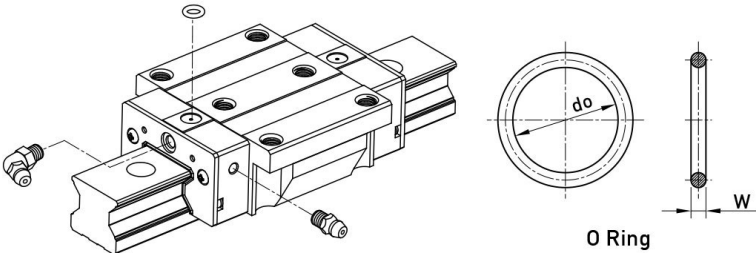
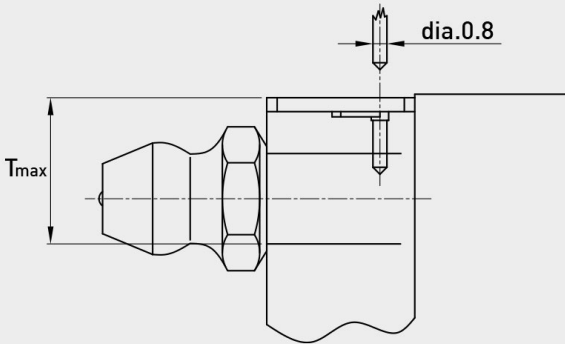


Table 2-9-15 O-Ring size and max. permissible depth for piercing

Size	O-Ring		Lube hole at top: max. permissible depth for piercing
	do (mm)	W (mm)	T _{max} (mm)
RG15	2.5±0.15	1.5±0.15	3.45
RG20	2.5±0.15	1.5±0.15	4
RG25	7.5±0.15	1.5±0.15	5.8
RG30	7.5±0.15	1.5±0.15	6.2
RG35	7.5±0.15	1.5±0.15	8.65
RG45	7.5±0.15	1.5±0.15	9.5
RG55	7.5±0.15	1.5±0.15	11.6
RG65	7.5±0.15	1.5±0.15	14.5



The oil amount for a block filled with grease

Table 2-9-16 The oil amount for a block filled with grease

Size	Heavy Load(cm ³)	Super Heavy Load(cm ³)	Size	Heavy Load(cm ³)	Super Heavy Load(cm ³)
RG15	3	-	RG35	12	14
RG20	5	6	RG45	19	23
RG25	7	8	RG55	28	35
RG30	9	10	RG65	52	63

Frequency of replenishment

Check the grease every 100 km, or every 3-6 months.

KGT[®] 85

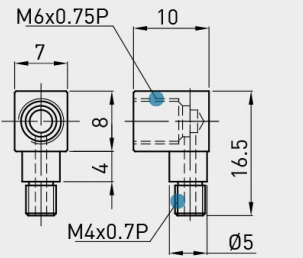
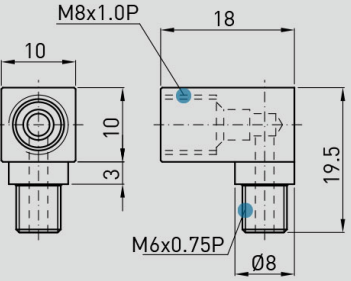
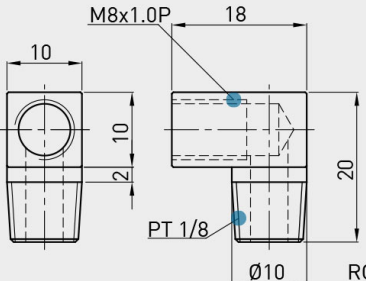
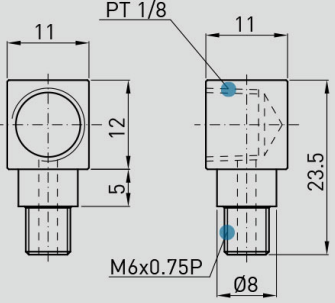
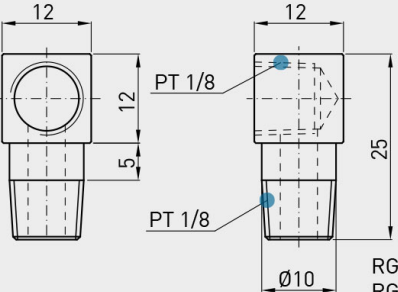
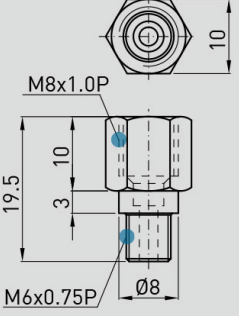
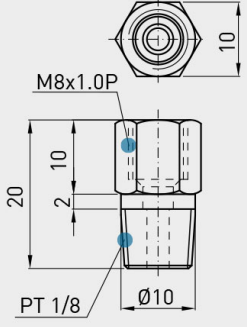
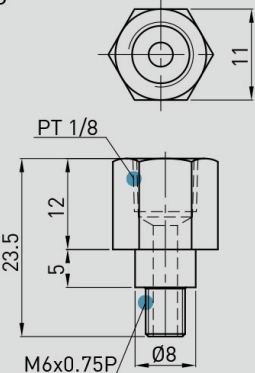
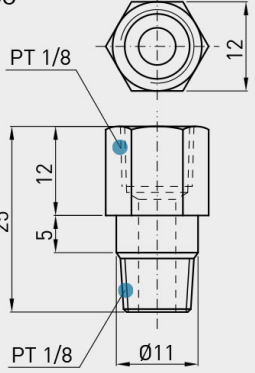
RG Series

High Rigidity Roller Type

(2) Oil

The recommended viscosity of oil is about 32~150cSt. If you need to use oil-type lubrication, please inform us.

○ Types of oil piping joint

LF-64  NO.97000EA1 RG15 RG20	LF-76  NO.970002A1 RG25 RG30 RG35 RGS35 RGS45 RGF35 RGF45	LF-78  NO.970006A1 RG45 RG55 RG65
	LF-86  NO.970004A1 RG25 RG30 RG35 RGS35 RGS45 RGF35 RGF45	LF-88  NO.970008A1 RG45 RG55 RG65
	SF-76  NO.970001A1 RG25 RG30 RG35 RGS35 RGS45 RGF35 RGF45	SF-78  NO.970005A1 RG45 RG55 RG65
	SF-86  NO.970003A1 RG25 RG30 RG35 RGS35 RGS45 RGF35 RGF45	SF-88  NO.970007A1 RG45 RG55 RG65

Oil feeding rate

Table 2-9-17 oil feed rate

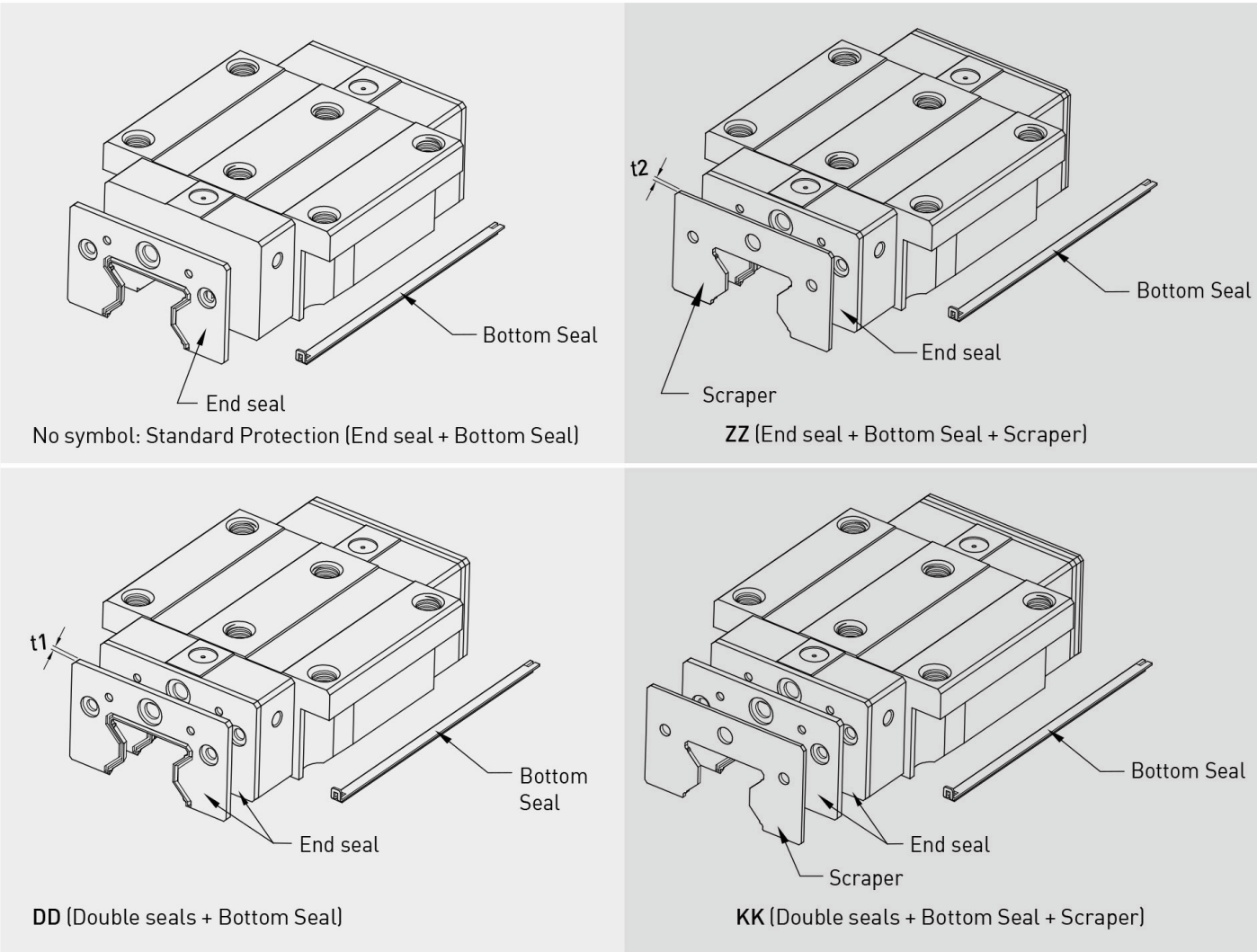
Size	Feed rate (cm³/hr)	Size	Feed rate (cm³/hr)
RG15	0.14	RG35	0.23
RG20	0.14	RG45	0.3
RG25	0.167	RG55	0.367
RG30	0.2	RG65	0.433

2-3-8 Dust Proof Accessories

(1) Codes of accessories

If the following accessories are needed, please add the code followed by the model number.

Table 2-9-18



(2) End seal and bottom seal

To prevent life reduction caused by iron chips or dust entering the block.

(3) Double seals

Enhances the wiping effect, foreign matter can be completely wiped off.

Table 2-9-19 Dimensions of end seal

Size	Thickness (t1) (mm)	Size	Thickness (t1) (mm)
RG15 ES	2.2	RG35 ES	2.5
RG20 ES	2.2	RG45 ES	3.6
RG25 ES	2.2	RG55 ES	3.6
RG30 ES	2.4	RG65 ES	4.4

KGT[®] 87

RG Series

High Rigidity Roller Type

(4) Scraper

The scraper removes high-temperature iron chips and larger foreign objects.

Table 2-9-20 Dimensions of scraper

Size	Thickness (t2) (mm)	Size	Thickness (t2) (mm)
RG15 SC	1.0	RG35 SC	1.5
RG20 SC	1.0	RG45 SC	1.5
RG25 SC	1.0	RG55 SC	1.5
RG30 SC	1.5	RG65 SC	1.5

(5) Bolt caps for rail mounting holes

Caps are used to cover the mounting holes to prevent chips or other foreign objects from collecting in the holes. The caps will be enclosed in each rail package.



Table 2-9-21 Dimensions of Bolt Caps for Rail Mounting Holes

Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)	Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)
RGR15	M4	7.65	1.1	RGR35	M8	14.20	3.5
RGR20	M5	9.65	2.5	RGR45	M12	20.25	4.5
RGR25	M6	11.15	2.5	RGR55	M14	23.25	5
RGR30	M8	14.2	3.5	RGR65	M16	26.35	5

(6) Dimensions of block equipped with the dustproof parts

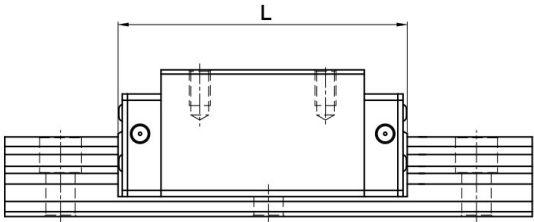


Table 2-9-22 Overall block length

Size	Overall block length (L)			
	SS	ZZ	DD	KK
RG15C	68.0 [70.4]	70.0 [74.4]	72.4 [74.8]	74.4 [78.8]
RG20C	86.0 [88.4]	88.0 [92.4]	90.4 [92.8]	92.4 [96.8]
RG20H	106.0 [108.4]	108.0 [112.4]	110.4 [112.8]	112.4 [116.8]
RG25C	97.9 [101.5]	99.9 [105.9]	102.3 [105.9]	104.3 [110.3]
RG25H	114.4 [118]	116.4 [122.4]	118.8 [122.4]	120.8 [126.8]
RG30C	109.8 [113.4]	112.8 [118.8]	114.6 [118.2]	117.6 [123.6]
RG30H	131.8 [135.4]	134.8 [140.8]	136.6 [140.2]	139.6 [145.6]
RG35C	124.0 [129.4]	127.0 [135.0]	129.0 [134.4]	132.0 [140.0]
RG35H	151.5 [156.9]	154.5 [162.5]	156.5 [161.9]	159.5 [167.5]
RG45C	153.2 [156.4]	156.2 [164.2]	160.4 [163.6]	163.4 [171.4]
RG45H	187.0 [190.2]	190.0 [198.0]	194.2 [197.4]	197.2 [205.2]
RG55C	183.7 [186.9]	186.7 [194.7]	190.9 [194.1]	193.9 [201.9]
RG55H	232.0 [235.2]	235.0 [243.0]	239.2 [242.4]	242.2 [250.2]
RG65C	232.0 [236.0]	235.0 [245.0]	240.8 [244.8]	243.8 [253.8]
RG65H	295.0 [299.0]	298.0 [308.0]	303.8 [307.8]	306.8 [316.8]

unit: mm

Note : The marking of “[]” denotes the maximum block length with screws, lips of end seals, etc.

2-3-9 Friction

The maximum value of resistance per end seal are as shown in the table.

Table 2-9-23 Seal Resistance

Size	Resistance N (kgf)	Size	Resistance N (kgf)
RG15	2.45 [0.25]	RG35	4.61 [0.47]
RG20	2.9 [0.3]	RG45	4.91 [0.5]
RG25	3.43 [0.35]	RG55	5.89 [0.6]
RG30	4.22 [0.43]	RG65	7.36 [0.75]

Note: 1. 1kgf=9.81N

2. Please inform HIWIN if low friction request is required.

2-3-10 The Accuracy Tolerance of Mounting Surface

(1) The accuracy tolerance of rail-mounting surface

As long as the accuracy requirements of the mounting surfaces shown in the following tables are met, the high accuracy, high rigidity and long life of the RG series linear guideway will be maintained without any difficulty.

○ The parallelism tolerance of reference surface (P)

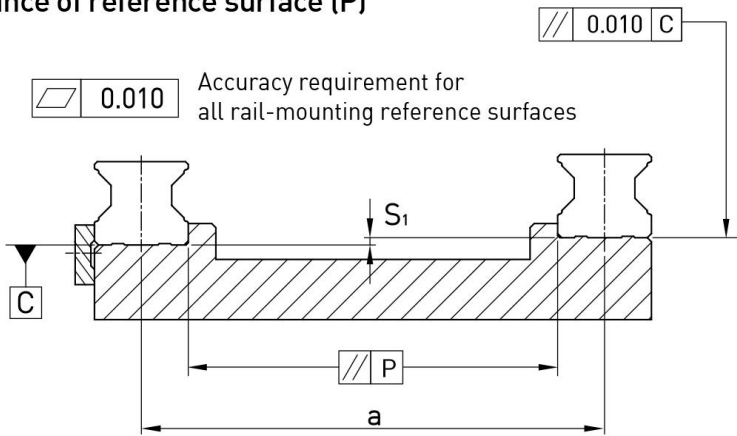


Table 2-9-24 Max. Parallelism Tolerance (P)

unit: μm

Size	Preload classes		
	Light Preload (Z0)	Medium Preload (ZA)	Heavy Preload (ZB)
RG15	5	3	3
RG20	8	6	4
RG25	9	7	5
RG30	11	8	6
RG35	14	10	7
RG45	17	13	9
RG55	21	14	11
RG65	27	18	14

○ The accuracy tolerance of reference surface height (S₁)

$S_1 = a \times K - T_H$

S₁ : Max. tolerance of height

a : Distance between paired rails

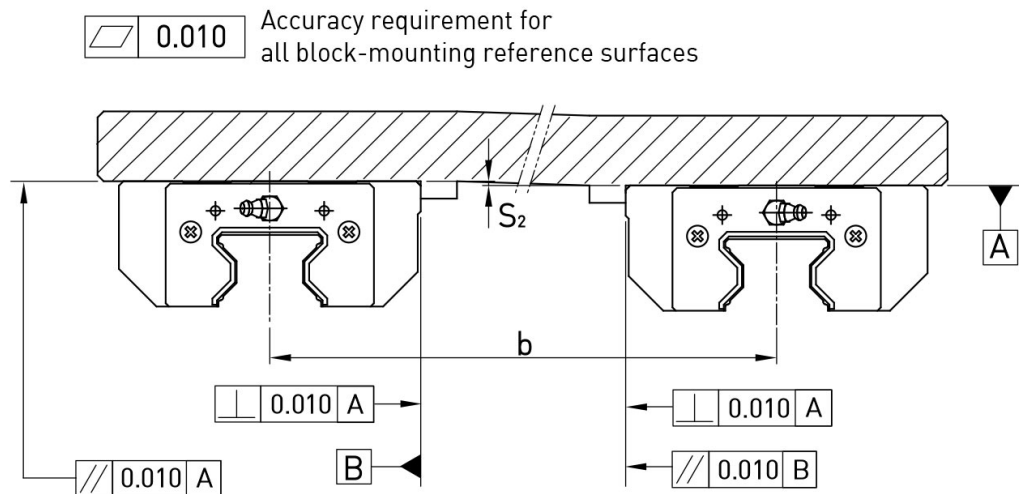
K : Coefficient of tolerance of height

Table 2-9-25 Coefficient of tolerance of height

Size	Preload classes		
	Light Preload (Z0)	Medium Preload (ZA)	Heavy Preload (ZB)
K	2.2×10 ⁻⁴	1.7×10 ⁻⁴	1.2×10 ⁻⁴

(2) The accuracy tolerance of block-mounting surface

- The tolerance of the height of reference surface when two or more pieces are used in parallel (S_2)

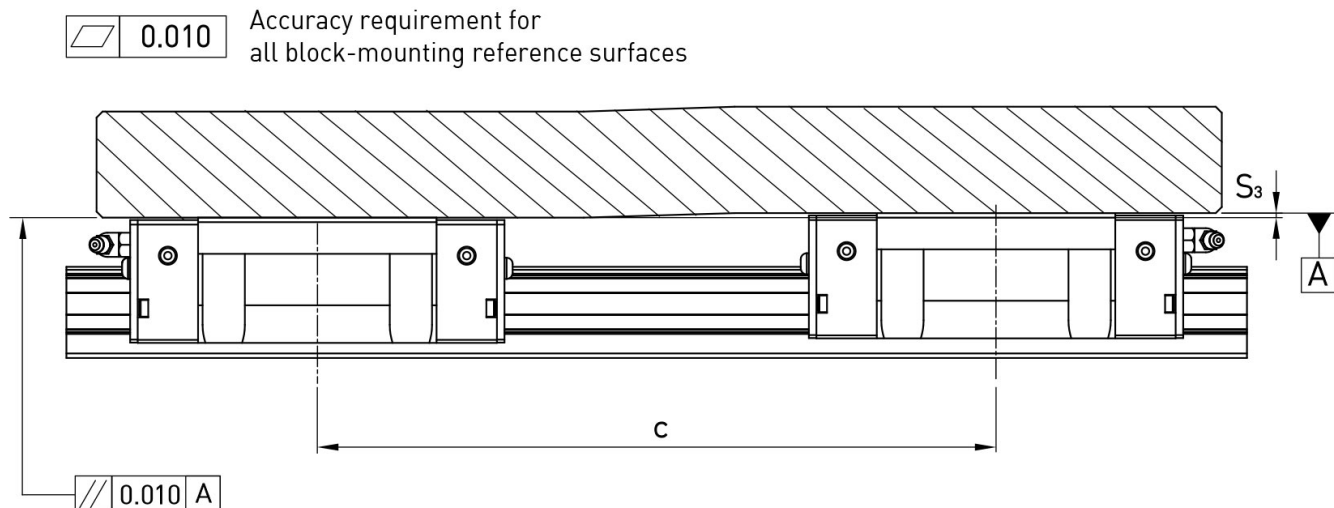


$$S_2 = b \times 4.2 \times 10^{-5}$$

S_2 : Max. tolerance of height

b : Distance between paired blocks

- The tolerance of the height of reference surface when two or more pieces are used in parallel (S_3)



$$S_3 = c \times 4.2 \times 10^{-5}$$

S_3 : Max. tolerance of height

c : Distance between paired blocks

2-3-11 Cautions for Installation

(1) Shoulder heights and fillets

Improper shoulder heights and fillets of mounting surfaces will cause a deviation in accuracy and the interference with the rail or block. As long as the recommended shoulder heights and fillets are followed, installation inaccuracies should be eliminated.

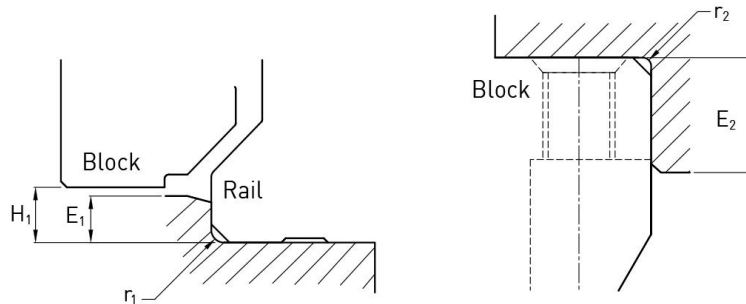


Table 2-9-26

Size	Max. radius of fillets r_1 (mm)	Max. radius of fillets r_2 (mm)	Shoulder height beside the rail E_1 (mm)	Shoulder height beside the block E_2 (mm)	Clearance under block H_1 (mm)
RG15	0.5	0.5	3	4	4
RG20	0.5	0.5	3.5	5	5
RG25	1.0	1.0	5	5	5.5
RG30	1.0	1.0	5	5	6
RG35	1.0	1.0	6	6	6.5
RG45	1.0	1.0	7	8	8
RG55	1.5	1.5	9	10	10
RG65	1.5	1.5	10	10	12

(2) Tightening Torque of Mounting Bolts

Improper tightening of mounting bolts will seriously influence the accuracy of a linear guideway. The following tightening torque for the different sizes of bolt is recommended.

Table 2-9-27

Size	Bolt size	Torque N-cm(kgf-cm)		
		Iron	Casting	Aluminum
RG15	M4×0.7P×16L	392 [40]	274 [28]	206 [21]
RG20	M5×0.8P×20L	883 [90]	588 [60]	441 [45]
RG25	M6×1P×20L	1373 [140]	921 [94]	686 [70]
RG30	M8×1.25P×25L	3041 [310]	2010 [205]	1470 [150]
RG35	M8×1.25P×25L	3041 [310]	2010 [205]	1470 [150]
RG45	M12×1.75P×35L	11772 [1200]	7840 [800]	5880 [600]
RG55	M14×2P×45L	15696 [1600]	10500 [1100]	7840 [800]
RG65	M16×2P×50L	19620 [2000]	13100 [1350]	9800 [1000]

®

KGT

91

RG Series

High Rigidity Roller Type

2-3-12 Standard and Maximum Lengths of Rail

KGT offers a number of standard rail lengths. Standard rail lengths feature end mounting hole placements set to predetermined values (E). For non-standard rail lengths, be sure to specify the E-value to be no greater than 1/2 the pitch (P) dimension. An E-value greater than this will result in unstable rail ends.

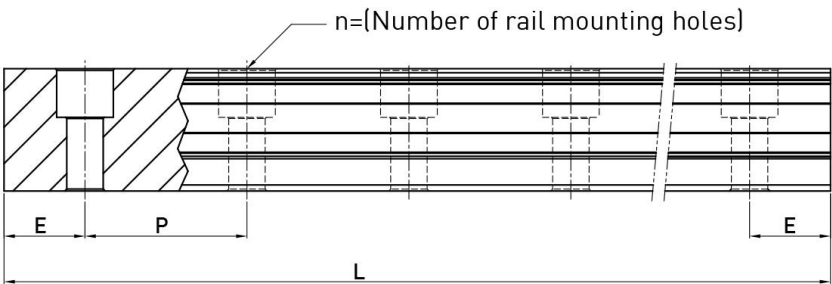


Table 2-9-28

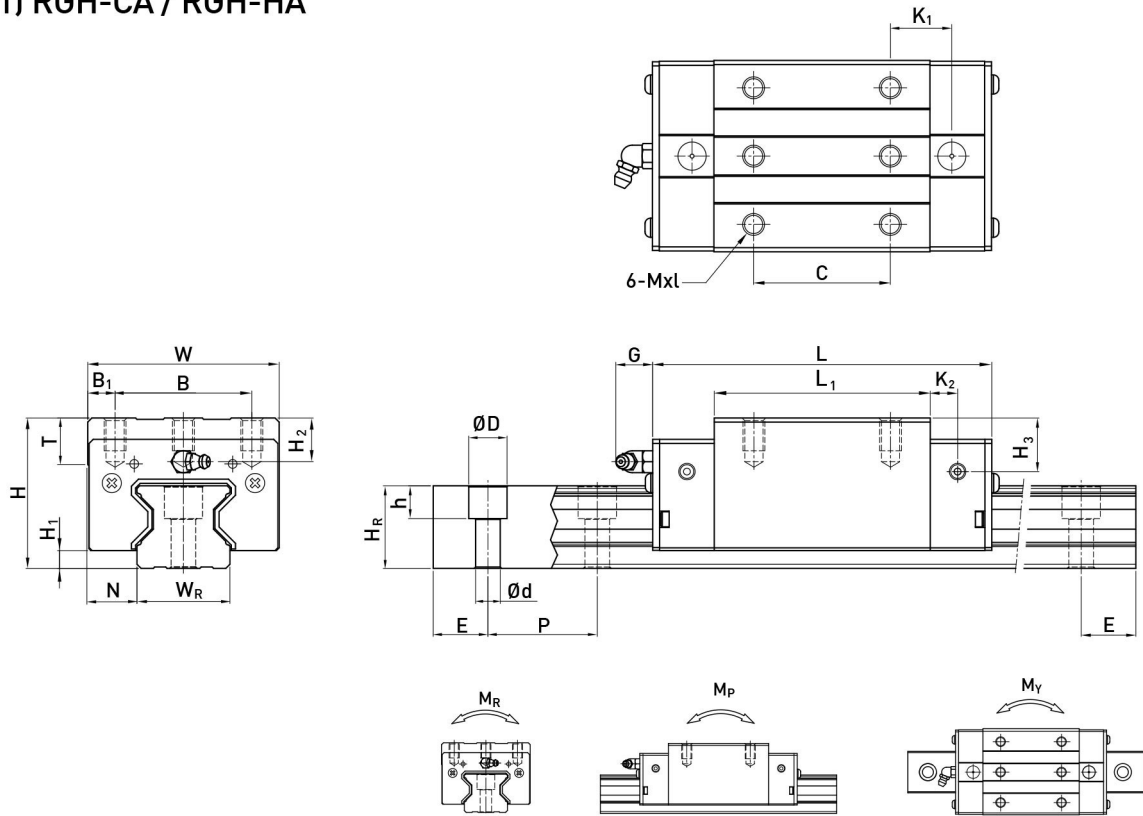
unit: mm

Item	RGR15	RGR20	RGR25	RGR30	RGR35	RGR45	RGR55	RGR65
Standard Length L(n)	160 (5)	220 (7)	220 (7)	280 (7)	280 (7)	570 (11)	780 (13)	1,270 (17)
	220 (7)	280 (9)	280 (9)	440 (11)	440 (11)	885 (17)	1020 (17)	1,570 (21)
	340 (11)	340 (11)	340 (11)	600 (15)	600 (15)	1,200 (23)	1,260 (21)	2,020 (27)
	460 (15)	460 (15)	460 (15)	760 (19)	760 (19)	1,620 (31)	1,500 (25)	2,620 (35)
	580 (19)	640 (21)	640 (21)	1,000 (25)	1,000 (25)	2,040 (39)	1,980 (33)	-
	700 (23)	820 (27)	820 (27)	1,640 (41)	1,640 (41)	2,460 (47)	2,580 (43)	-
	940 (31)	1000 (33)	1,000 (33)	2,040 (51)	2,040 (51)	2,985 (57)	2,940 (49)	
	1120 (37)	1180 (39)	1,240 (41)	2,520 (63)	2,520 (63)	3,090 (59)	3,060 (51)	-
	1360 (45)	1360 (45)	1,600 (53)	3,000 (75)	3,000 (75)	-	-	-
Pitch (P)	30	30	30	40	40	52.5	60	75
Distance to End (E _s)	20	20	20	20	20	22.5	30	35
Max. Standard Length	4,000 (133)	4,000 (133)	4,000 (133)	4,000 (100)	4,000 (100)	3,982.5 (76)	3,960 (66)	3,970 (53)
Max. Length	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000

Note : 1. Tolerance of E value for standard rail is 0.5~0.5 mm. Tolerance of E value for jointed rail is 0~-0.3 mm.
2. Maximum standard length means the max. rail length with standard E value on both sides.
3. If different E value is needed, please contact KGT

2-3-13 Dimensions for RG series

(1) RGH-CA / RGH-HA

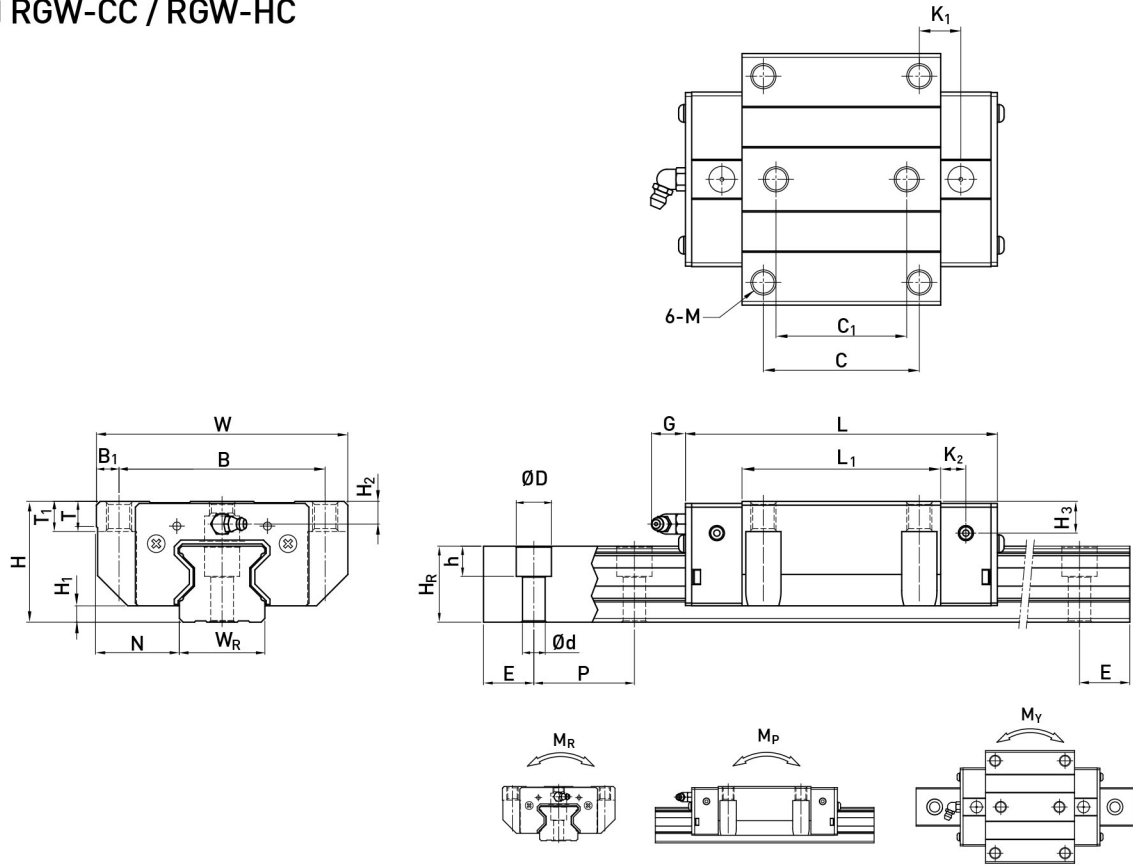


Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)														Dimensions of Rail (mm)								Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H ₁	N	W	B	B ₁	C	L ₁	L	K ₁	K ₂	G	MxL	T	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R kN-m	M _p kN-m	M _y kN-m	Block kg	Rail kg/m		
RGH15CA	28	4	9.5	34	26	4	26	45	68	13.4	4.7	5.3	M4 x 8	6	7.6	10.1	15	16.5	7.5	5.7	4.5	30	20	M4 x16	11.3	24	0.311	0.173	0.173	0.20	1.8		
RGH20CA	34	5	12	44	32	6	36	57.5	86	15.8	6	5.3	M5 x 8	8	8.3	8.3	20	21	9.5	8.5	6	30	20	M5 x20	21.3	46.7	0.647	0.46	0.46	0.40	2.76		
RGH20HA							50	77.5	106	18.8			M6 x 8	9.5	10.2	10	23	23.6	11	9	7	30	20	M6 x20	26.9	63	0.872	0.837	0.837	0.53			
RGH25CA	40	5.5	12.5	48	35	6.5	35	64.5	97.9	20.75	7.25	12	M6 x 8	9.5	10.2	10	23	23.6	11	9	7	30	20	M6 x20	27.7	57.1	0.758	0.605	0.605	0.61	3.08		
RGH25HA							50	81	114.4	21.5			M8 x10	9.5	9.5	10.3	28	28	14	12	9	40	20	M8 x25	33.9	73.4	0.975	0.991	0.991	0.75			
RGH30CA	45	6	16	60	40	10	40	71	109.8	23.5	8	12	M8 x10	9.5	9.5	10.3	28	28	14	12	9	40	20	M8 x25	39.1	82.1	1.445	1.06	1.06	0.90	4.41		
RGH30HA							60	93	131.8	24.5			M8 x12	12	16	19.6	34	30.2	14	12	9	40	20	M8 x25	48.1	105	1.846	1.712	1.712	1.16			
RGH35CA	55	6.5	18	70	50	10	50	79	124	22.5	10	12	M8 x12	12	16	19.6	34	30.2	14	12	9	40	20	M8 x25	57.9	105.2	2.17	1.44	1.44	1.57	6.06		
RGH35HA							72	106.5	151.5	25.25			M10x17	16	20	24	45	38	20	17	14	52.5	22.5	M12 x35	73.1	142	2.93	2.6	2.6	2.06			
RGH45CA	70	8	20.5	86	60	13	60	106	153.2	31	10	12.9	M10x17	16	20	24	45	38	20	17	14	52.5	22.5	M12 x35	92.6	178.8	4.52	3.05	3.05	3.18	9.97		
RGH45HA							80	139.8	187	37.9			M12x18	17.5	22	27.5	53	44	23	20	16	60	30	M14 x45	116	230.9	6.33	5.47	5.47	4.13			
RGH55CA	80	10	23.5	100	75	12.5	75	125.5	183.7	37.75	12.5	12.9	M12x18	17.5	22	27.5	53	44	23	20	16	60	30	M14 x45	130.5	252	8.01	5.4	5.4	4.89	13.98		
RGH55HA							95	173.8	232	51.9			M16 x20	25	15	15	63	53	26	22	18	75	35	M16x50	167.8	348	11.15	10.25	10.25	6.68			
RGH65CA	90	12	31.5	126	76	25	70	160	232	60.8	15.8	12.9	M16 x20	25	15	15	63	53	26	22	18	75	35	M16x50	213	411.6	16.20	11.59	11.59	8.89	20.22		
RGH65HA							120	223	295	67.3			M16 x20	25	15	15	63	53	26	22	18	75	35	M16x50	275.3	572.7	22.55	22.17	22.17	12.13			

Note : 1. 1 kgf = 9.81 N

2. The theoretical dynamic rated load is C_{100R}, if necessary C_{50R} conversion formula is as follows : C_{50R} = 1.23 x C_{100R}

(3) RGW-CC / RGW-HC



Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)														Dimensions of Rail (mm)						Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight			
	H	H ₁	N	W	B	B ₁	C	C ₁	L ₁	L	K ₁	K ₂	G	M	T	T ₁	H ₂	H ₃	W _R	H _R	D	h	d	P	E	(mm)	C(kN)	C ₀ (kN)	M _R kN-m	M _p kN-m	M _y kN-m	Block kg	Rail kg/m
RGW15CC	24	4	16	47	38	4.5	30	26	45	68	11.4	4.7	5.3	M5	6	6.95	3.6	6.1	15	16.5	7.5	5.7	4.5	30	20	M4x16	11.3	24	0.311	0.173	0.173	0.22	1.8
RGW20CC	30	5	21.5	63	53	5	40	35	57.5	86	13.8	6	5.3	M6	8	10	4.3	4.3	20	21	9.5	8.5	6	30	20	M5x20	21.3	46.7	0.647	0.46	0.46	0.47	2.76
RGW20HC									77.5	106	23.8																26.9	63	0.872	0.837	0.837	0.63	
RGW25CC	36	5.5	23.5	70	57	6.5	45	40	64.5	97.9	15.75	7.25	12	M8	9.5	10	6.2	6	23	23.6	11	9	7	30	20	M6x20	27.7	57.1	0.758	0.605	0.605	0.72	3.08
RGW25HC									81	114.4	24																33.9	73.4	0.975	0.991	0.991	0.91	
RGW30CC	42	6	31	90	72	9	52	44	71	109.8	17.5	8	12	M10	9.5	10	6.5	7.3	28	28	14	12	9	40	20	M8x25	39.1	82.1	1.445	1.06	1.06	1.16	4.41
RGW30HC									93	131.8	28.5																48.1	105	1.846	1.712	1.712	1.52	
RGW35CC	48	6.5	33	100	82	9	62	52	79	124	16.5	10	12	M10	12	13	9	12.6	34	30.2	14	12	9	40	20	M8x25	57.9	105.2	2.17	1.44	1.44	1.75	6.06
RGW35HC									106.5	151.5	30.25																73.1	142	2.93	2.6	2.6	2.40	
RGW45CC	60	8	37.5	120	100	10	80	60	106	153.2	21	10	12.9	M12	14	15	10	14	45	38	20	17	14	52.5	22.5	M12x35	92.6	178.8	4.52	3.05	3.05	3.43	9.97
RGW45HC									139.8	187	37.9																116	230.9	6.33	5.47	5.47	4.57	
RGW55CC	70	10	43.5	140	116	12	95	70	125.5	183.7	27.75	12.5	12.9	M14	16	17	12	17.5	53	44	23	20	16	60	30	M14x45	130.5	252	8.01	5.4	5.4	5.43	13.98
RGW55HC									173.8	232	51.9																167.8	348	11.15	10.25	10.25	7.61	
RGW 65CC	90	12	53.5	170	142	14	110	82	160	232	40.8	15.8	12.9	M16	22	23	15	15	63	53	26	22	18	75	35	M16x50	213	411.6	16.20	11.59	11.59	11.63	20.22
RGW 65HC									223	295	72.3																275.3	572.7	22.55	22.17	22.17	16.58	

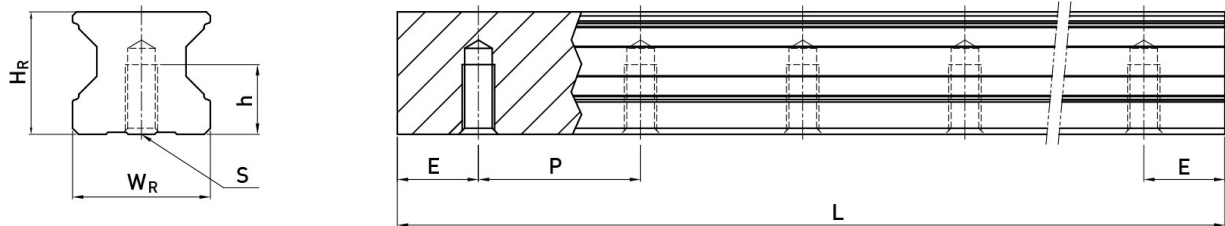
Note : 1. 1 kgf = 9.81 N

2. The theoretical dynamic rated load is C_{100R}, if necessary C_{50R} conversion formula is as follows : C_{50R} = 1.23 x C_{100R}

RG Series

High Rigidity Roller Type

(6) Dimensions for RGR-T (Rail Mounting from Bottom)



Model No.	Dimensions of Rail (mm)						Weight
	W_R	H_R	S	h	P	E	(kg/m)
RGR15T	15	16.5	M5×0.8P	8	30	20	1.86
RGR20T	20	21	M6×1P	10	30	20	2.76
RGR25T	23	23.6	M6×1P	12	30	20	3.36
RGR30T	28	28	M8×1.25P	15	40	20	4.82
RGR35T	34	30.2	M8×1.25P	17	40	20	6.48
RGR45T	45	38	M12×1.75P	24	52.5	22.5	10.83
RGR55T	53	44	M14×2P	24	60	30	15.15
RGR65T	63	53	M20×2.5P	30	75	35	21.24

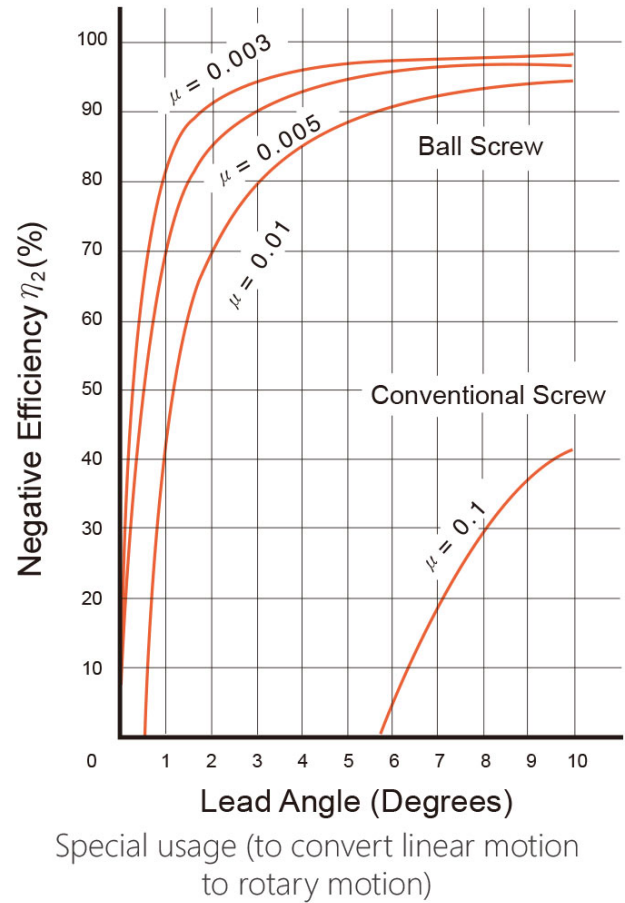
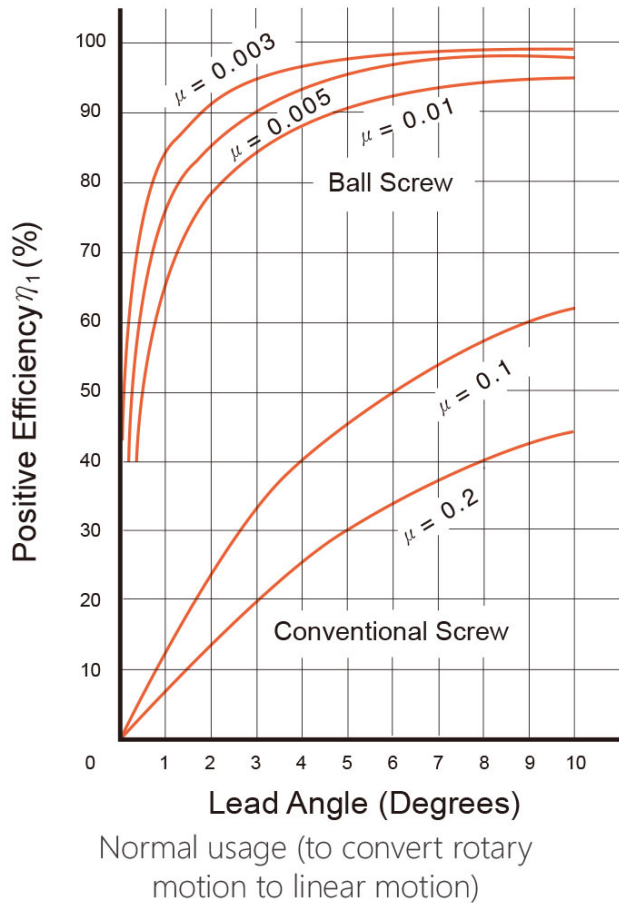
2-5-1 Features of KGT Ball Screw

(1) High Reliability

KGT applies stringent quality control standards on every production process. With proper lubrication and use, trouble-free operation for an extended period of time is possible.

(2) Smooth Operation

The high efficiency of ball screw is vastly superior than conventional screws as shown in Fig 1.1.1. It takes less than 30% torque to make the linear motion into rotary motion.



μ : friction coefficient

$$P = \frac{2\pi\eta_1 \times T}{\ell}$$

T = Torque kgf · cm
 P = Force kgf
 ℓ = Lead cm
 η_1 = Efficiency

$$T = \frac{\ell \times \eta_2 \times P}{2\pi}$$

T = Torque kgf · cm
 P = Force kgf
 ℓ = Lead cm
 η_2 = Efficiency

Fig 1.1.1 Mechanical Efficiency of Ball Screws

(3) High Rigidity and Preload

As figure 1.1.2 shown in below, the ball screw of KGT is designed with Gothic arch groove, which makes the screw easy to rotate even using minimum axial play. To make the rigidity more appropriate to using condition, you can change the preload between one or two screw nuts to reduce axial play.

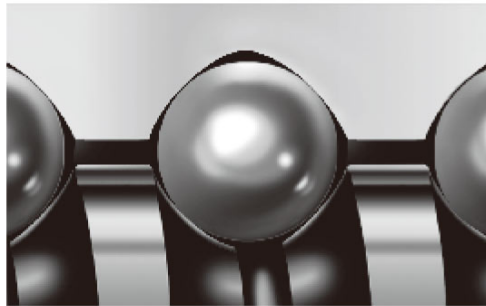


Fig 1.1.2 Groove Shape of Precision Ball Screw

(4) Circulation Method

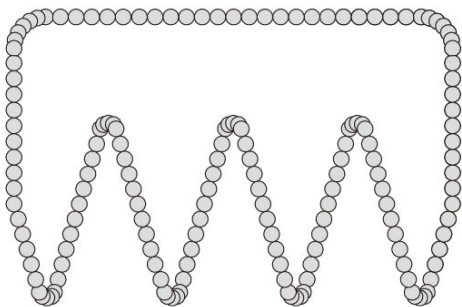


Fig 1.1.3 External Ball Circulation Nuts

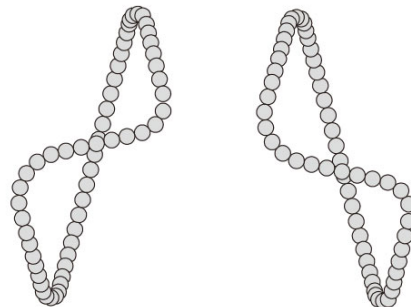


Fig 1.1.4 Internal Ball Circulation Nuts

(5) High Durability

As figure 1.1.2 shown in below, the ball screw of KGT is designed with Gothic arch groove, which makes the screw easy to rotate even using minimum axial play. To make the rigidity more appropriate to using condition, you can change the preload between one or two screw nuts to reduce axial play.

Table 1.1.1 Material and Heat Treatment

Item	Material	Hardness
Screw	SCM450 S55C	HRC 58°~62°
Nut	SCM415H SCM420H	HRC 58°~62°
Steel Ball	SUJ2	HRC 60°UP

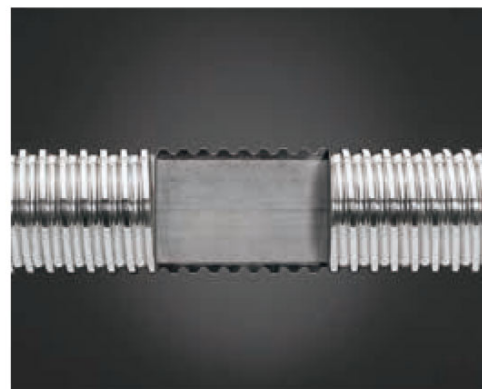


Fig 1.1.5 Heat Treatment

2-5-2 Accuracy

Lead/Travel Accuracy

According to the standard of JIS, we classified our lead accuracy through E, e, e300 and e2 π , four main regulations. As figure 1.3.1 ~ 1.3.3 shown in below, all the definition and tolerance are specified. To test the accumulated travel deviations for grade C7 and C10, the tolerance will be chosen in random 300mm of useful length and evaluated if it is qualified with the e300 table of 1.3.3.

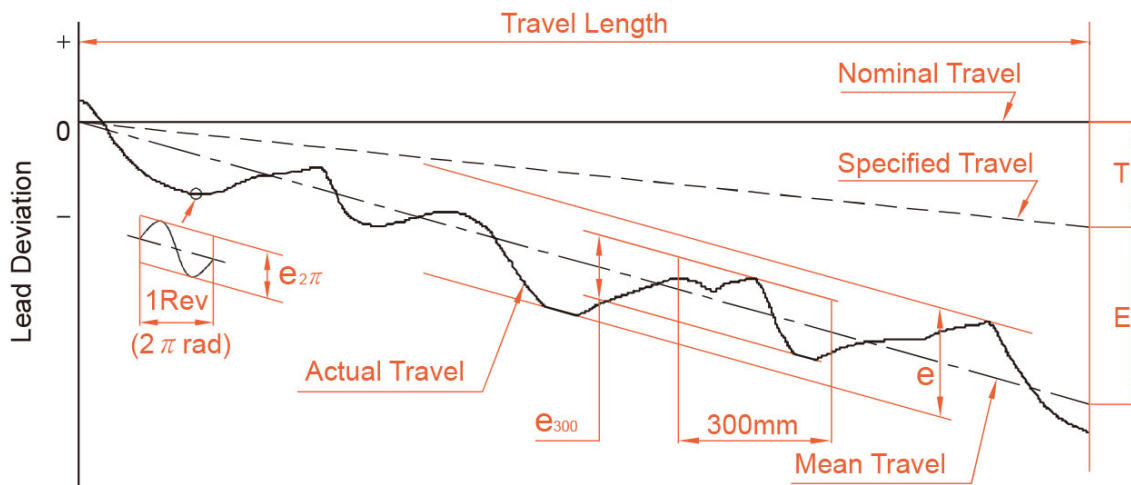


Fig 1.3.1 Diagram of Lead Accuracy

Terms	Reference	Definition	Allowable
Travel Compensation	T	Travel compensation is the deduction between specified and nominal travel in the useful travel. A slightly smaller value compared with nominal travel is often selected by customer, to compensate for an expected elongation caused by temperature rise or external load. Therefore " T " is usually a negative value. <i>Note : if no compensation is needed, specified travel is the same as nominal travel.</i>	
Actual Travel		Actual travel is the axial displacement of the nut relative to the screw shaft.	
Mean Travel		Mean travel is the linear best fit line of actual. This could be obtained by the least squares method. This line represents the tendency of actual travel.	
Mean Travel Deviation	E	Mean travel deviation is the deduction between mean travel and specified travel within travel length.	Table 1.3.2
Travel Variations	e	Travel variations is the coverage of 2 lines drawn parallel to the mean travel.	Table 1.3.2
	e300	Maximum width of variation within the travel length.	Table 1.3.3
	e2 π	Actual width of variation for the length of 300mm taken anywhere within the travel length. Wobble error, actual width of variation for one revolution (2 π radian)	Table 1.3.3

Table 1.3.2 Mean Travel Deviation ($\pm E$) and Travel Variation (e) (JIS B 1192)

Unit : μm

Grade		C0		C1		C2		C3		C5		C7	C10
Over	Incl.	$\pm E$	e	$\pm E$	e	$\pm E$	e	$\pm E$	e	$\pm E$	e	e	e
	100	3	3	3.5	5	5	7	8	8	18	18	$\pm 50/300\text{mm}$	$\pm 210/300\text{mm}$
100	200	3.5	3	4.5	5	7	7	10	8	20	18		
200	315	4	3.5	6	5	8	7	12	8	23	18		
315	400	5	3.5	7	5	9	7	13	10	25	20		
400	500	6	4	8	5	10	7	15	10	27	20		
500	630	6	4	9	6	11	8	16	12	30	23		
630	800	7	5	10	7	13	9	18	13	35	25		
800	1000	8	6	11	8	15	10	21	15	40	27		
1000	1250	9	6	13	9	18	11	24	16	46	30		
1250	1600	11	7	15	10	21	13	29	18	54	35		
1600	2000			18	11	25	15	35	21	65	40		
2000	2500			22	13	30	18	41	24	77	46		
2500	3150			26	15	36	21	50	29	93	54		
3150	4000			30	18	44	25	60	35	115	65		
4000	5000					52	30	72	41	140	77		
5000	6300					65	36	90	50	170	93		
6300	8000							110	60	210	115		
8000	10000									260	140		
10000	12500									320	170		

Table 1.3.3 Variation per 300mm (e_{300}) and Wobble Error ($e_{2\pi}$) (JIS B 1192)

Unit : μm

Grade	C0	C1	C2	C3	C5	C7	C10
e_{300}	3.5	5	7	8	18	50	210
$e_{2\pi}$	2.5	4	5	6	8		

■ 1-3-2 Axial Play

Axial play of KGT's precision ball screw is shown in

Table 1.3.4 Classification of Axial Play

Grade	P0	P1	P2	P3	P4
Axial Play	Yes	No	No	No	No
Preload	No	No	Light	Medium	Heavy

Excessive preload increases the friction torque and generates heat which will reduce the life expectancy. However, insufficient preload will reduce stiffness and increase the possibility of lost motion. KGT recommends that the preload applied on CNC machine tools should not heavier than 8% of the dynamic load; 5% for industrial automation X-Y table.

Table 1.3.5 The reference spring force of (P2)

Model No.	Spring Force (Kg) Single Nut	Spring Force(Kg) Double Nut
1605	0.1~0.3	0.3~0.6
2005	0.1~0.3	0.3~0.6
2505	0.2~0.5	0.3~0.6
3205	0.2~0.5	0.5~0.8
4005	0.2~0.5	0.5~0.8
2510	0.2~0.5	0.5~0.8
3210	0.3~0.6	0.5~0.8
4010	0.3~0.6	0.5~0.8
5010	0.3~0.6	0.8~1.2
6310	0.6~1.0	0.8~1.2
8010	0.6~1.0	0.8~1.2

Table 1.3.6 Axial Play (P0) Clearance in the Axial Direction of Rolled and Ground Ball Screw

Unit : mm

Nominal Diameter	Rolled Ball Screw Clearance in the Axial Direction (max.)	Ground Ball Screw Clearance in the Axial Direction (max.)
Ø04~Ø14 miniature ball screw	0.05	0.015
Ø15~Ø40 middle size of ball screw	0.08	0.025
Ø50~Ø100 big size of ball screw	0.12	0.05

Definition of Mounting Accuracy and Tolerance on Ball Screw

The main items of the mounting accuracy of ball screw are listed in below.

- (1) Periphery run-out of the supporting part of the screw shaft to the screw groove.
- (2) Concentricity of a mounting portion of the shaft to the adjacent ground portion of the screw shaft.
- (3) Perpendicularity of the shoulders to the adjacent ground portion of the screw shaft.
- (4) Perpendicularity of the nut flange to the axis of the screw shaft.
- (5) Concentricity of the ball nut diameter to the screw groove.
- (6) Parallelism of the mounting surface of a ball nut to the screw groove.
- (7) Total run-out of the screw shaft to the axis of the screw shaft.

All ball screws are manufactured, inspected and guaranteed to be within specifications.

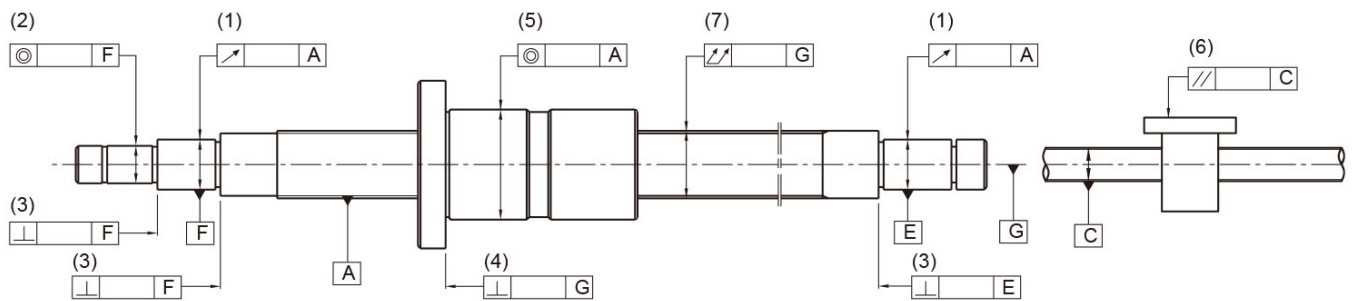


Fig 1.3.2 Mounting Accuracy and Tolerance

Preload Torque

As figure 1.3.3 shown in below, it specified all the type of preload torque generated by rotating a preloaded ball screw.

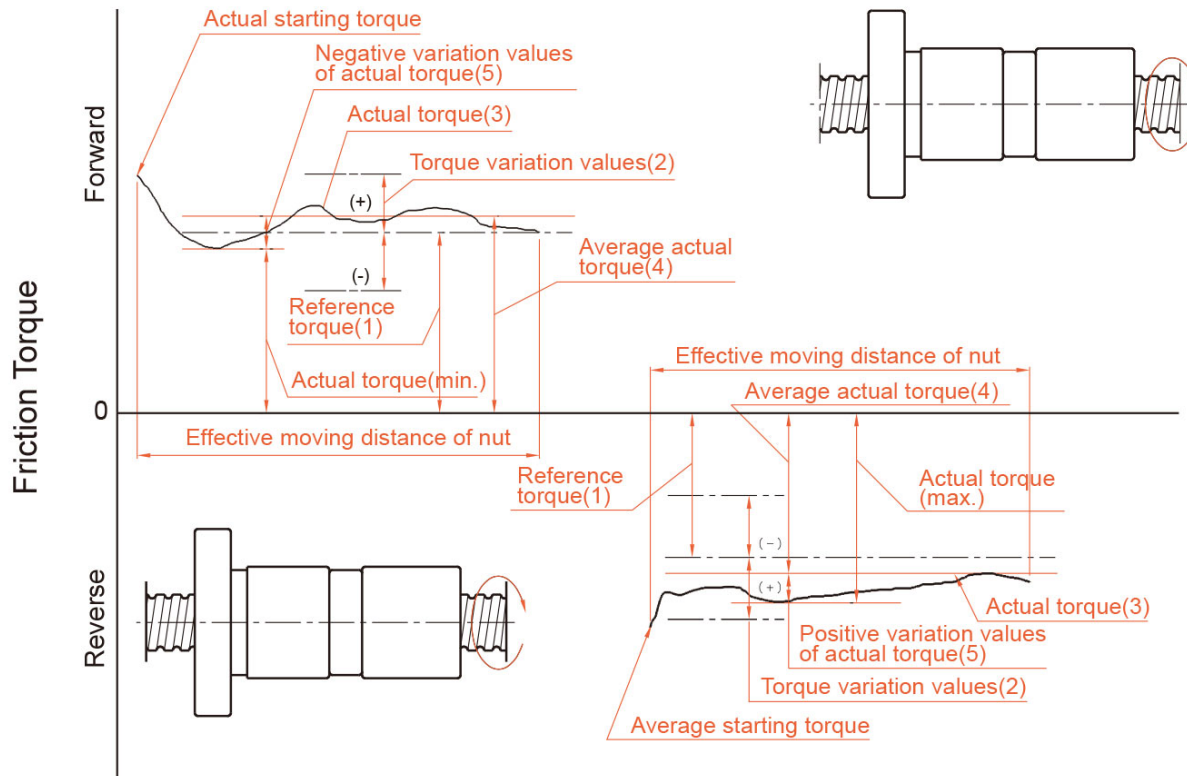


Fig 1.3.3 Descriptions of preload torque

Glossary

(1) Preload

To generate the inner force inside the ball screw to decrease the clearance and increase the rigidity, a set of one gage (approximately 2μ) larger steel balls is filled inside the nut or two nuts which are executing mutual displacement in axial direction.

(2) Preload dynamic torque

The dynamic torque required for continuously rotating the screws shaft or the nuts under unload condition and the preload has applied to the ball screws.

(3) Reference torque

The targeted preload dynamic torque Fig 1.3.3-(1)

(4) Torque variation values

The variation values of the targeted preload torque variation rates are specified generally based on JIS standards as indicated in Fig 1.3.3.

(5) Torque variation rate

The variation ratio of reference torque.

(6) Actual torque

The actual measured preload dynamic torque of the ball screws.

(7) Average actual torque

The arithmetic average of the maximal and minimal actual torque values measured when the nuts are doing reciprocating movements.

(8) Actual torque variation values

After the nut doing reciprocating movements on the effective length of the thread, the biggest variation tested will be the actual torque variation value, which is covered between the positive and negative minimum value relative to the actual torque.

(9) Actual torque variation rate

The rate of actual torque variation values in relation of the average actual torque.

Table 1.3.7 Permissible ranges of torque variation rates

Reference torque kgf•cm		Effective threading length mm										
		Below 4000								4000~10000		
		Slenderness 1: below 40				Slenderness 1: 40~1:60				-		
		Grade				Grade				Grade		
Over	Incl	C0	C1	C2, C3	C5	C0	C1	C2, C3	C5	C1	C2, C3	C5
2	4	±35%	±40%	±45%	±55%	±45%	±45%	±55%	±65%	-	-	-
4	6	±25%	±30%	±35%	±45%	±38%	±38%	±45%	±50%	-	-	-
6	10	±20%	±25%	±30%	±35%	±30%	±30%	±35%	±40%	-	±40%	±45%
10	25	±15%	±20%	±25%	±30%	±25%	±25%	±30%	±35%	-	±35%	±40%
25	63	±10%	±15%	±20%	±25%	±20%	±20%	±25%	±30%	-	±30%	±35%
63	100	-	-	±15%	±20%	-	-	±20%	±25%	-	±25%	±30%

Remarks : 1. Slenderness is the value of dividing the screws shaft outside diameter with the screws shaft threading length.
2. For reference torque less than 2 kgf • cm, specifications will apply.

Calculation of Reference Torque Tp

The equation for computing reference torque of the ball screws is given in following :

$$TP = 0.05 (\tan\beta)^{-0.5} \cdot \frac{F_{ao} \cdot \ell}{2\pi}$$

Where, F_{ao} = Preload (kgf)

β = Lead angle

ℓ = Lead (cm)

Measurement Conditions

The measure condition as indicated in Fig 1.3.4, the preload dynamic torque will be the multiplication of F (The force to make the nut stay still during rotating the screw) and L (The arm of force).

$$Tp = F \cdot L$$

Measure conditions

- (1) Measurement is executed under the condition of unattached with scraper.
- (2) The rotating speed during measurement maintains at 100 rpm.
- (3) According to JSK2001(industrial lubrication oil viscosity standard), the lubrication oil used should be in compliance with ISO VG68.

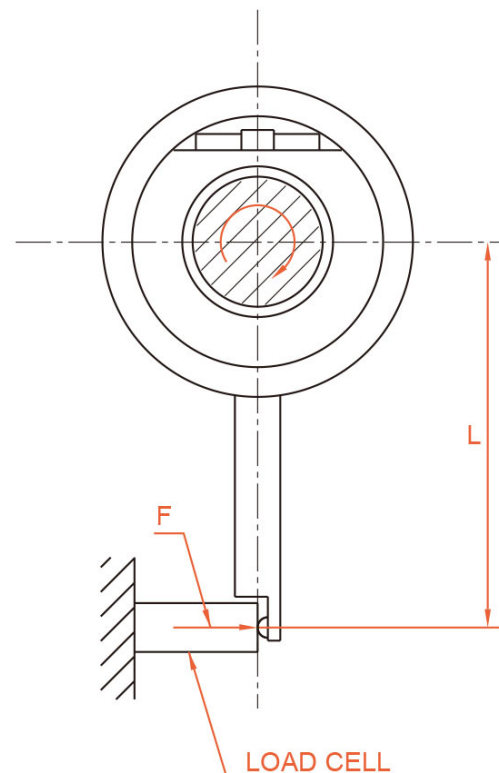


Fig 1.3.4 Preload dynamic torque measuring method

2-5-3 Screw Shaft Design

Mounting Methods

It's important to consider mounting method (Fig 1.4.1~1.4.8) during your selection of ball screw specification. If you have special requirement related with mounting method, please consult KGT

(Mounting Screw and Nut)

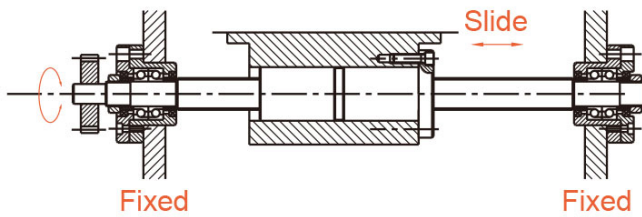


Fig 1.4.1

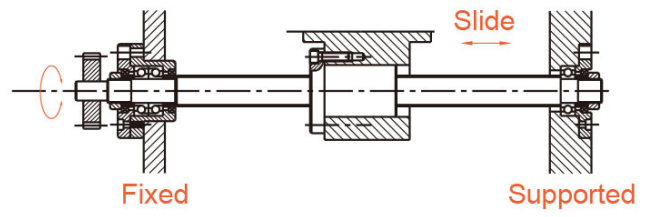


Fig 1.4.5

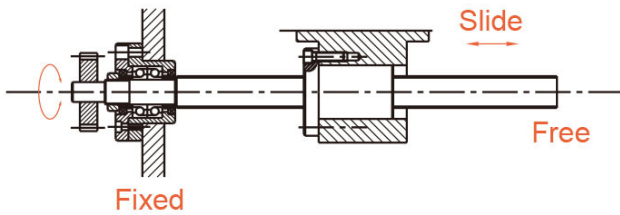


Fig 1.4.2

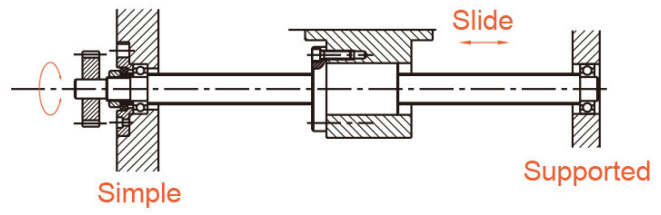


Fig 1.4.6

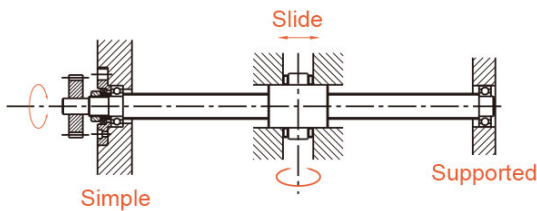


Fig 1.4.3

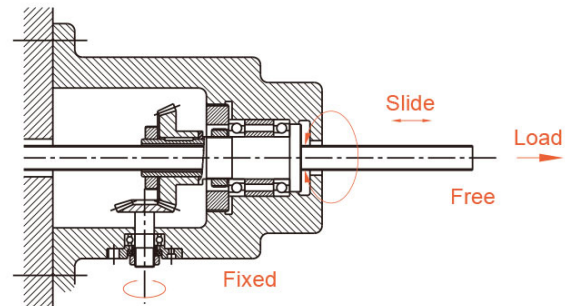


Fig 1.4.7

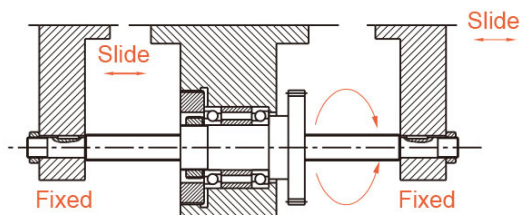


Fig 1.4.4

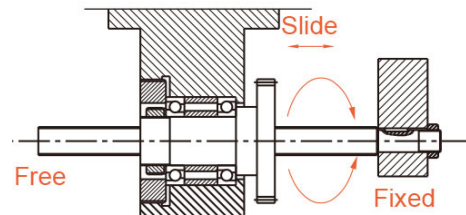


Fig 1.4.8

(The mounting method for common types of machinery.)

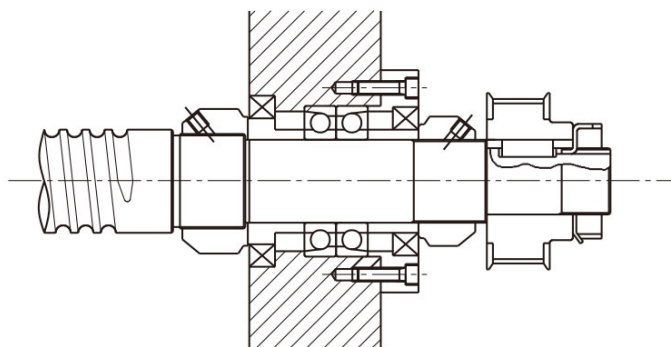


Fig 1.4.9

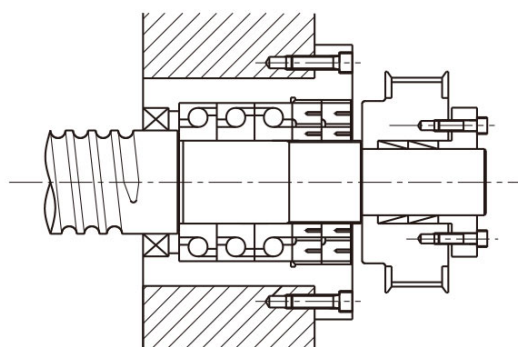


Fig 1.4.11

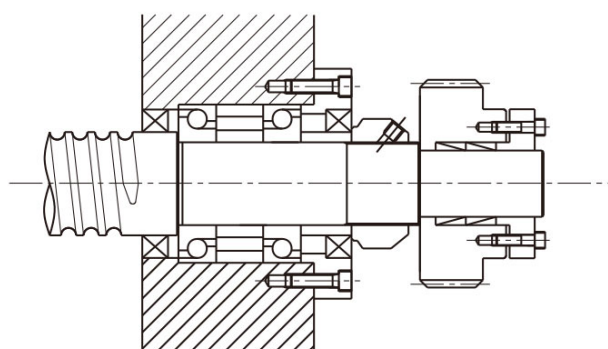


Fig 1.4.10

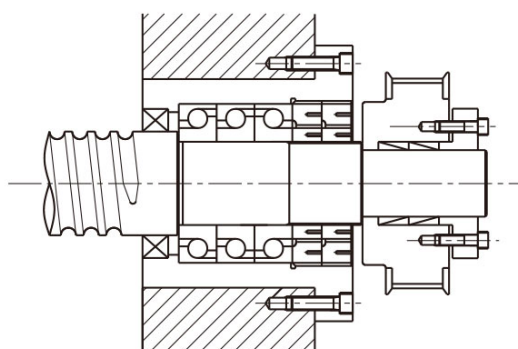


Fig 1.4.12

(The mounting method for bearing in a given pretension.)

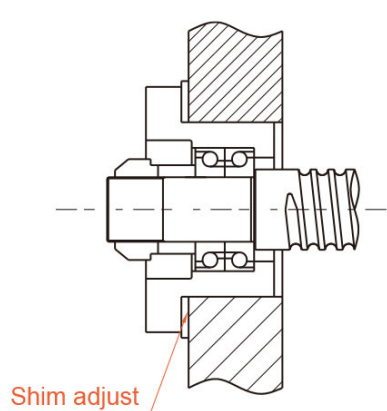


Fig 1.4.13

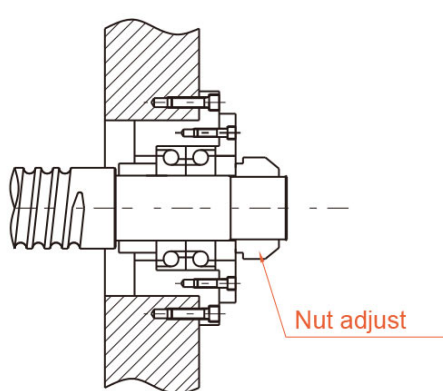


Fig 1.4.14

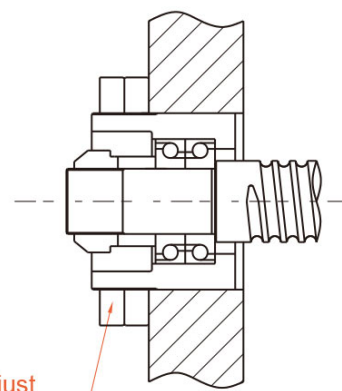


Fig 1.4.15

Allowable Load of Axial Direction

(1) Buckling Load

The safety of the screw shaft against buckling needs to be checked when the shaft is expected to receive buckling loads. Fig 1.4.16 shows a diagram which summarizes the allowable compressive load for buckling for each nominal outside diameter of screw shaft. (Calculate with the equation shown in below when the nominal outside diameter of the screw shaft exceeds 125mm.)

Select the graduation of allowable axial load according to the method of ball screw support method.

$$P = \alpha \cdot \frac{I \cdot N \cdot \pi^2 \cdot E}{L^2} = m \frac{dr^4}{L^2} \cdot 10^3$$

Where

α = Safety Factor ($\alpha = 0.5$)

E : Vertical elastic modules ($E = 2.1 \cdot 10^4 \text{ kgf/mm}^2$)

I : Min. secondary moment of screw shaft sectional area

$$I = \frac{\pi}{64} dr^4 (\text{mm}^4)$$

dr : Screw shaft root diameter (mm)

L : Mounting distance (mm)

m · N : Coefficient determined from mounting method of ball screw

Floated-Floated m = 5.1 (N = 1)

Fixed-Floated m = 10.2 (N = 2)

Fixed-Fixed m = 20.3 (N = 4)

Fixed-Free m = 1.3 (N = 1/4)

(2) Allowable Tensile/Buckling Load

With shorter mounting distance, please calculate the two items describe in below.

1. The allowable tensile / buckling load which equals to the derating stress.
2. Allowable load of the screw's groove.

$$P = \sigma A = 11.8 dr^2 (\text{kgf})$$

Where,

P : Buckling load (kgf)

σ : Allowable tensile compressive stress (kgf/mm^2)

A:Sectional area of screw shaft root bottom diameter (mm^2)

dr : Screw shaft root diameter (mm)

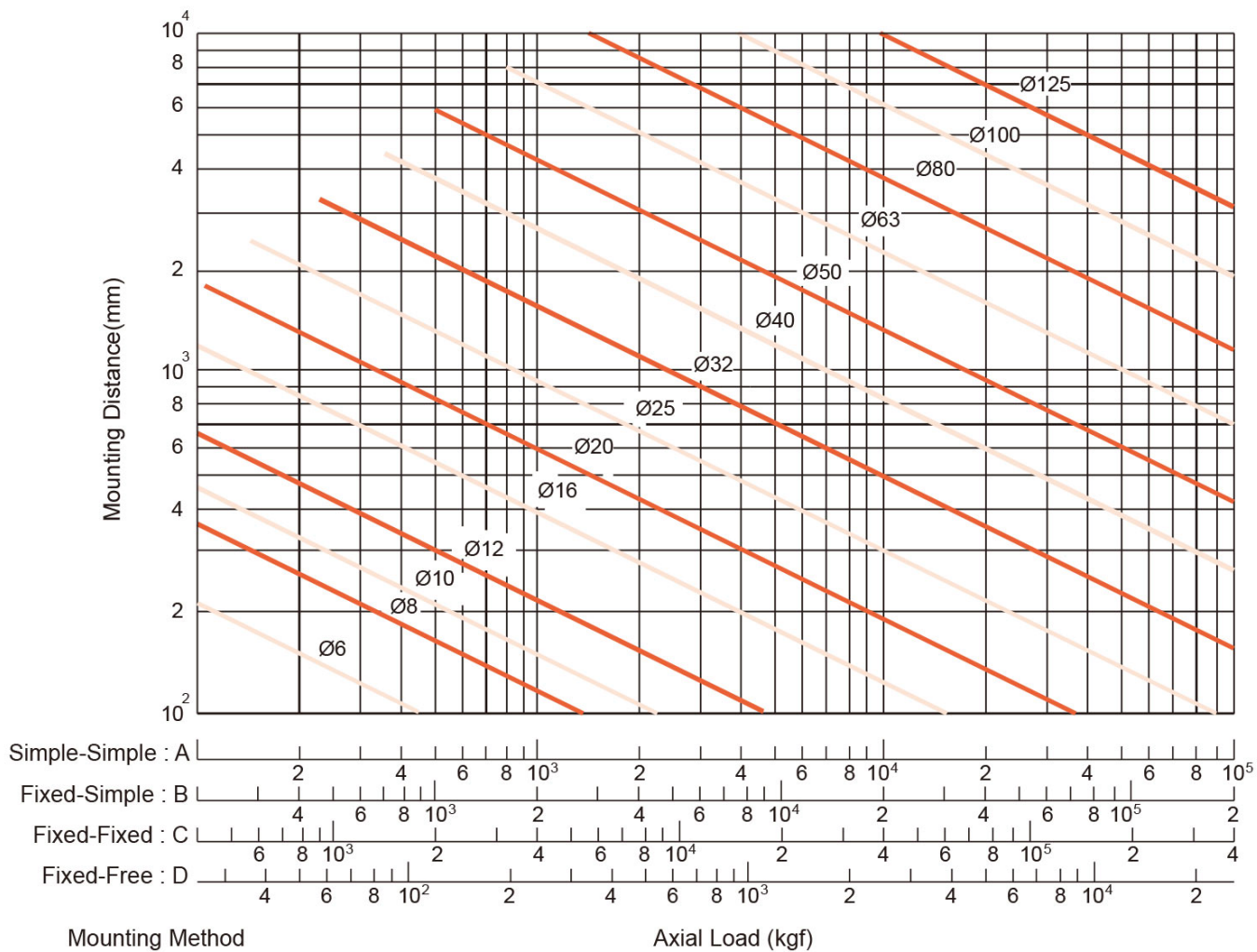


Fig 1.4.16 Buckling Load vs. Nominal Diameter and Length

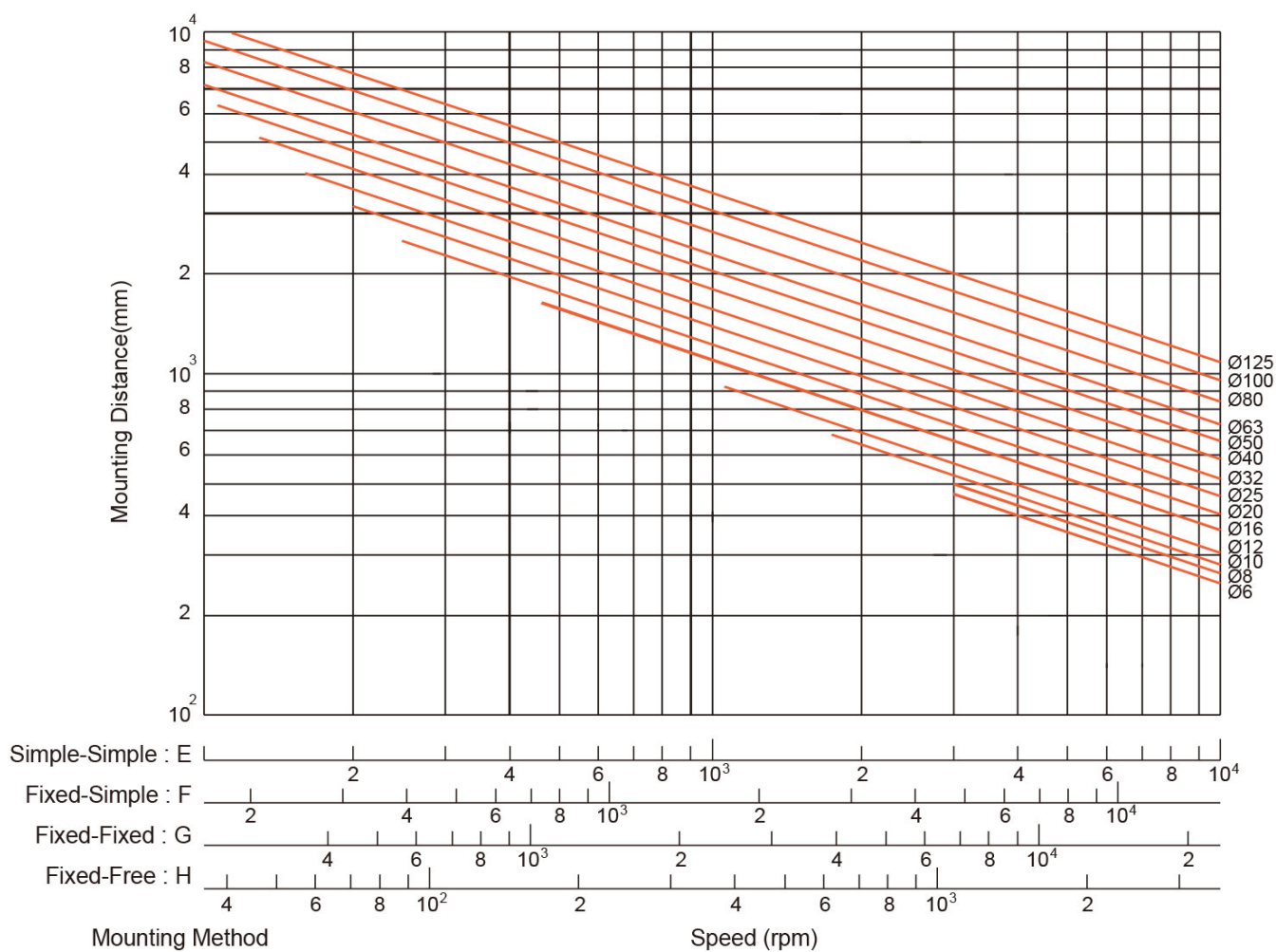


Fig 1.4.16 Buckling Load vs. Nominal Diameter and Length

Critical Speed

(1) Dangerous speed

To prevent the screw's natural frequency attain resonance which will occur critical speed, it's necessary to look into the ball screw allowable rotation speed (Below 80% of the Critical Speed). More detail of allowable rotation speed classified though screw diameter please refer to Fig 1.4.17.

(2) $d_m \cdot n$ value

The allowable rotation speed is regulated also by the $D_m \times N$ value (D_m : diameter of central circle of steel ball, N : Revolution speed, rpm) which expresses the peripheral speed.

Generally,

For precision

(accuracy grade C7 to C0)
 $D_m \times N \leq 70,000$

For general industry (C10)
 $D_m \times N \leq 50,000$

If your requirement about the product will exceed the limitation, please contact with KGT to discuss the detailed solution for the ideal product.

※ When ϵ , the ratio of screw length and shaft diameter has exceeded 70, please contact with KGT to arrange the special arrangement for production.

$$n = \alpha \cdot \frac{60\lambda^2}{2\pi L^2} \sqrt{\frac{Eg}{\gamma A}} = f \frac{dr}{L^2} \cdot 10^7 (\text{rpm})$$

Where

α : Safty factor ($\alpha = 0.8$)

E : Verticle elastic modules ($E = 2.1 \cdot 10^4 \text{kgf/mm}^2$)

I : Minimum secondary torque of axial section plane

$$I = \frac{\pi}{64} dr^4 (\text{mm}^4)$$

dr : Screw shaft root diameter (mm)

g : Acceleration of gravity ($g = 9.8 \cdot 10^3 \text{mm/s}^2$)

γ : Density ($\gamma = 7.8 \cdot 10^{-6} \text{kgf/mm}^3$)

A : Screw shaft sectional area ($A = \pi dr^2/4 \text{mm}^2$)

L : Mounting distance (mm)

f, λ : Coefficient determined from the ball screw mounting method

Floated-Floated $f = 9.7$ ($\lambda = \pi$)

Fixed-Floated $f = 15.1$ ($\lambda = 3.927$)

Fixed-Fixed $f = 21.9$ ($\lambda = 4.730$)

Fixed-Free $f = 3.4$ ($\lambda = 1.875$)

Driving Torque

Driving torque T_S of the transmission shaft

$$T_S = T_P + T_D + T_F \text{ (in fixed speed)}$$

$$T_S = T_G + T_P + T_D + T_F \text{ (when accelerating)}$$

T_G : Acceleration torque (1) T_P : Load torque (2)

T_D : Preload torque (3) T_F : Friction torque (4)

(1) Acceleration T_G

$$T_G = J\alpha \text{ (kgf} \cdot \text{cm)}$$

$$\alpha = \frac{2\pi n}{60\Delta t} \text{ (rad/s}^2\text{)}$$

J : Moment of inertia (kgf · cm · s²)

α : Angular acceleration (rad/s²)

n : Revolutions (min⁻¹)

Δt : Starting time (sec)

(3) Preload torque T_D

$$T_D = \frac{K \cdot P_{PL} \cdot \ell}{\sqrt{\tan \alpha} \cdot 2\pi} \text{ (kgf} \cdot \text{cm)}$$

K : Internal coefficient

(0.05 is usually adopted)

P_{PL} : Preload (kgf)

ℓ : Lead (cm)

α : Lead angle

(4) Friction torque T_F

$$T_F = T_B + T_O + T_J \text{ (kgf} \cdot \text{cm)}$$

T_B : Friction torque of bracing shaft

T_O : Friction torque of free shaft

T_J : Friction torque motor shaft

(2) Load torque T_P

$$T_P = \frac{P \cdot \ell}{2\pi\eta_1} \text{ (kgf} \cdot \text{cm)}$$

$$P = F + \mu Mg$$

P : Axial load (kgf)

ℓ : Lead (cm)

η_1 : Positive efficiency

The efficiency when rotating motion is altered to linear motion

F : Cutting force (kgf)

μ : Friction

M : Mass of moving object (kg)

g : Acceleration of gravity (9.8 m/s²)

$$T_P = \frac{P \cdot \ell \cdot \eta_2}{2\pi} \text{ (kgf} \cdot \text{cm)}$$

η_2 : Reverse efficiency

The efficiency when linear motion returns to rotating motion

The friction torque of the bracing shaft would be affected by the volume of lubrication oil. Besides, be careful with the excessive tight end seal may lead to unexpected over friction torque or temperature rise.

【For reference】 Moment of inertia of load (refer to Table 1.5.1)

$$J = J_{BS} + J_{CU} + J_W + J_M$$

J_{BS} : Moment of inertia Ball screws shaft

J_{CU} : Moment of inertia Coupler

J_W : Moment of inertia Linear motion part

J_M : Moment of inertia Roller shaft part of motor shaft

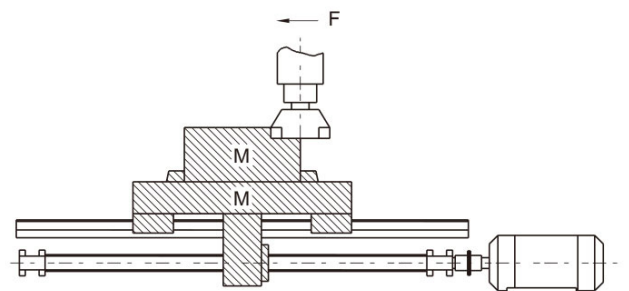


Fig 1.5.1 Moment of inertia of load

Table 1.6.1 Circulation type

Circulation type	Model		Characteristic
	Single Nut	Double Nuts	
Internal circulation type	SFM SFK BSH SFNI SFNU	DFM	• Delicated diameter of screw takes only little space. • Applicable to those with smaller lead / the outside diameter of the screw
External circulation type	SFV XSV BSH	DFV	• Economy • Applicable to larger lead and diameter. • Applicable for high loading purpose. (KGT patent nut)
End-caps circulation type	SFY SFH	DFS	• Suitable for high speed positioning

1-6-2 Nut Types

U, I, M - Type Nut

In these types of nuts, by using the internal circulator which makes the ball pass over the crest diagonally, the ball will return to the starting point. Normally, one roll of balls will fit with one circulation. As figure 1.6.1 specified, these types of nuts need at least one side which is completely tooth passing, which is applicable for smaller shaft diameter.

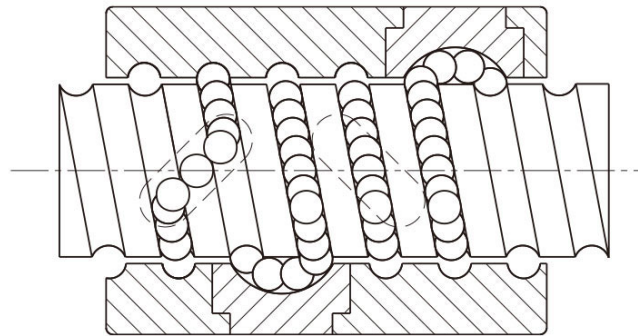


Fig 1.6.1 U, I, M - Type Nut

K - Type Nut

It applies the similar circulation as that of I-type, but circulation takes place in key slots of identical angle for different circulation. (see Fig 1.6.2)

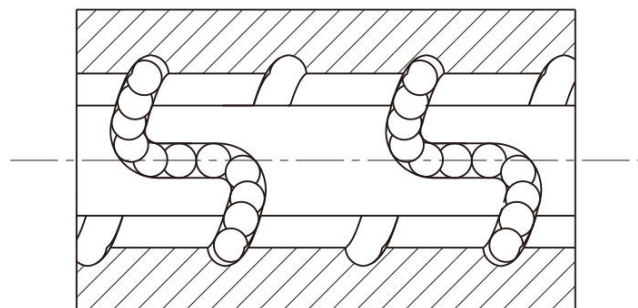


Fig 1.6.2 K - Type Nut

Rigidity

Excessively weak rigidity of the screw's peripheral structure is one of the primary causes that result in lost motion. Therefore, in order to achieve excellent position accuracy for the precision machines such as NC working machines and etc, axial rigidity balance as well as torsional rigidity for the parts at various portions of the transmission screw have to be taken into consideration at time of designing.

Static Rigidity K

The axial elastic deformation and rigidity of the transmission screw system can be determined by the formula below.

$$K = \frac{P}{e} \text{ (kgf/mm)}$$

P : Axial load (kgf) borne by the transmission screw system

e : Axial flexural displacement (mm)

$$\frac{1}{K} = \frac{1}{K_S} + \frac{1}{K_N} + \frac{1}{K_B} + \frac{1}{K_H} \text{ (mm/kgf)}$$

K_S : Axial rigidity of screw shaft (1)

K_B : Axial rigidity of support shaft (3)

K_N : Axial rigidity of nut (2)

K_H : Axial rigidity of installation (4)

(1) Axial rigidity K_S and displacement δ_S

$$K_S = \frac{P}{\delta_S} \text{ (kgf/mm)}$$

P : Axial load (kgf)

For places of Fixed - Fixed installation

For places other than Fixed - Fixed installation

$$\delta_{SF} = \frac{PL}{4AE} \text{ (mm)}$$

$$\delta_{SS} = \frac{PL_0}{AE} \text{ (mm)}$$

$$\delta_{SS} = 4\delta_{SF}$$

δ_{SF} : Directional displacement at places of fixed-fixed

δ_{SS} : Directional displacement at places excluding fixed-fixed installation

A : Cross-sectional area of the screw shaft tooth root diameter (mm²)

E : Longitudinal elastic modulus (2.1 · 10⁴kgf/mm²)

L : Distance between installations (mm)

L₀ : Distance between load applying points (mm)

(2) Axial rigidity K_N and displacement δ_N of nuts

$$K_N = \frac{P}{\delta_s} \text{ (kgf/mm)}$$

(a) In case of single nut

$$\delta_{NS} = \frac{K}{\sin \beta} \left[\frac{Q^2}{d} \right]^{\frac{1}{3}} \cdot \frac{1}{\zeta} \text{ (mm)}$$

$$Q = \frac{P}{n \cdot \sin \beta} \text{ (kgf)}$$

$$n = \frac{D_0 \pi m}{d} \text{ (each)}$$

Q : Load of one steel ball (kgf)

n : Amount of steel ball

k : Constant determined based on material, shape, dimensions

$$k \approx 5.7 \cdot 10^{-4}$$

β : Angle of contact (45°)

P : Axial load (kgf)

d : Steel ball diameter (mm)

ζ : Accuracy, internal structure coefficient

m : Effective amount of balls

D_0 : Steel ball center diameter (mm)

$$D_0 = \frac{\ell}{\tan \alpha \cdot \pi} \text{ (kgf/mm)}$$

ℓ : Lead (mm)

α : Lead angle

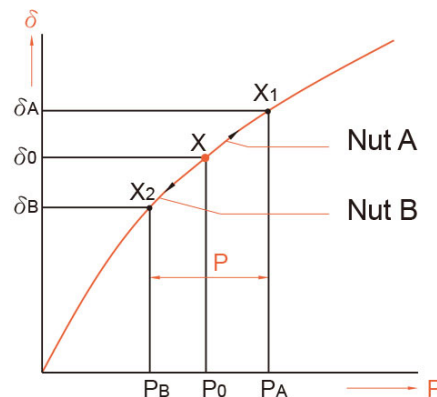


Fig 1.7.1

(b) In case of double nuts

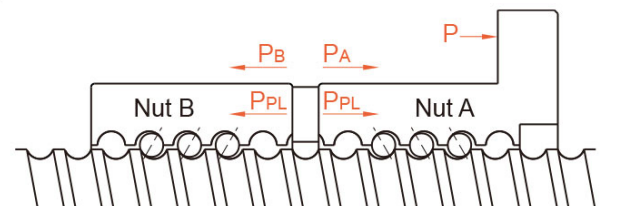


Fig 1.7.2 Preloaded for the double nuts

As bearing weight of preload (P_{PL}) exert, there will be approximately three times of axial loading (P). To eliminate the preload of nut b, please set the bearing weight of preload (P_{PL}) under $1/3$ of the maximum axial load weight. Take $0.25 C_a$ as maximum load weight of preload. When the displacement under the preload which equals to three times of the bearing load of the axial direction, the value will be $1/2$ of single nut's displacement.

$$K_N = \frac{P}{\delta_{NW}} = \frac{3P_{PL}}{\delta_{NS/2}} = \frac{6P_{PL}}{\delta_{NS}} \text{ (kgf/mm)}$$

δ_{NS} : Displacement of single nut (mm)

δ_{NW} : Displacement of double nuts (mm)

(Explanation of the rigidity of double nuts)

As shown in Fig 1.7.1 and 1.7.2, when a preload PPL is applied on the nut A and B both nuts A, B would produce flexural deformations that will reach point X. If an external force P is exerted from here, nut A moves from point X to point X1, while nut B moves from X to X2.

Then, based on the computing formula for displacement δ_{NS} of the single nut, we can obtain :

$$\delta_0 = aP_{PL}^{\frac{2}{3}}$$

Since nut A and B have the displacement of $\delta_a = aP_{PL}^{\frac{2}{3}}$ while external force (P) gave the same displacement on nut A and B, we can obtain that $\delta_A - \delta_0 = \delta_0 - \delta_B$.

In other cases, if external force applied on nut A and B is P only, and cause the increase of P_A , we will get the formula of $P_A - P_B = P$ $\delta_B = 0$

$$P_A - P_B = P$$

$$\delta_B = 0$$

For preventing the external force applied on nut B being absorbed by nut A thus decreasing, so when $\delta_B = 0$

$$aP_A^{\frac{2}{3}} - aP_{PL}^{\frac{2}{3}} = aP_{PL}^{\frac{2}{3}}$$

$$P_A^{\frac{2}{3}} = 2P_{PL}^{\frac{2}{3}}$$

$$P_A = \sqrt[3]{8} P_{PL} \approx 3P_{PL}$$

As Fig 1.7.3 shown in below, if the axial direction loading weight equals to three times of preload, the single nut's displacement will be cut into half and gain two times stronger of rigidity.

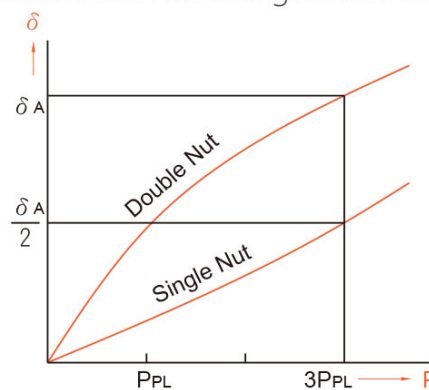


Fig 1.7.3

(3) Axial rigidity K_B and displacement δ_B of support shaft

$$K_B = \frac{P}{\delta_B} \text{ (kgf/mm)}$$

Being the support bearing of ball screw and meanwhile applying on precision machines, we can calculate the rigidity of bevel ball bearing through the formula below.

$$\delta_B = \frac{2}{\sin\beta} \left[\frac{Q^2}{d} \right]^{\frac{1}{3}} \text{ (mm)} \quad Q = \frac{P}{n \cdot \sin\beta} \text{ (kgf)}$$

Q : Load of one steel ball (kgf)

n : Amount of steel balls

β : Angle of contact (45°)

P : Axial load (kgf)

d : Steel ball diameter (mm)

a : Effective stroke

(4) Look into the nut and bearing mounting part's axial direction, the rigidity K_H and displacement δ_H should aware of the requirement of high rigidity on mounting portion during the initial machine development.

$$K_H = \frac{P}{\delta_H} \text{ (kgf/mm)}$$

Positioning Accuracy

Among the factors that cause feed accuracy errors, lead accuracy and feed system rigidity are the key points for review, while other factors such as heat deformation due to temperature rise as well as assembly accuracy for the guiding surface, etc. should also be considered.

Accuracy Selection

Table 1.8.1 shows the recommended application ranges for various ball screws accuracy classes based on different.

Table 1.8.1 Examples of ball screws accuracy classes for different uses

Application				Accuracy Grade					
				C0	C1	C2	C3	C5	C7
NC Machine Tools	Lathe	X	○	○	○	○	○	○	
		Y				○	○	○	
	Milling Machine Boring Machine	XY		○	○	○	○	○	
		Z			○	○	○	○	
	Machine Center	XY		○	○	○	○		
		Z			○	○	○		
	Jig Borer	Y	○	○					
		Z	○	○					
	Drilling Machine	XY				○	○	○	
		Z					○	○	
	Grinding Machine	X	○	○	○	○	○	○	
		Z		○	○	○	○	○	
	Electro-discharge Machine (EDM)	XY		○	○	○	○	○	
		(Z)			○	○	○	○	
	Wire Cut (EDM)	Y		○	○	○			
		UV		○	○	○	○	○	
	Punching Press	XY				○	○	○	
	Laser Cutting Mathine	XY				○	○		
		Z				○	○		
	Wood Working Machine						○	○	○
Machines of General use and special Use					○	○	○	○	○
Semiconductor Machines	Explosure Equipments		○	○					
	Chemical Treatment					○	○	○	○
	Wire Bonder			○	○	○			
	Prober		○	○	○	○			
	Inserter				○	○	○	○	
	PCB Driller			○	○	○	○	○	
Industrial Robots	Orthogonal Type	As'sy		○	○	○	○	○	
		Others					○	○	○
	Muliti-joints Type	As'sy			○	○	○		
		Others				○	○	○	
	SCARA Type				○	○	○	○	
Machines for Steel molding							○	○	○
Injection Molding Machines							○	○	○
Three-Dimensional Measuring Machines			○	○	○				
Business Machines							○	○	○
Pattern Image Machines			○	○					
Nuclear	Rod Control					○	○	○	
	Mechnaical Snubber							○	○
Aircrafts						○	○		

Countermeasure Against Thermal Displacement

Thermal displacement of the screw shaft results in deterioration of the position accuracy. The magnitude of the thermal displacement is calculated as follows :

$$\Delta \ell = \alpha \cdot \Delta t \cdot L$$

$\Delta \ell$: Thermal displacement

α : Coefficient of thermal expansion

Δt : Temperature rise (deg) at screw shaft

L : Effective length of screw thread

Namely, the screw shaft develops elongation of 12μm per 1m when the temperature rises by 1°C. The ball screw, which lead has been machined to high accuracy, may fail to meet high level requirements because of the thermal displacement due to temperature rise. As high speed is applied during ball screw usage, the heat will rise as well and cause more influence.

The thermal displacement countermeasures for ball screws include the following :

(1) Control of heat generation

- Optimization of preload
- Correct selection and supply of lubricant
- Increase in ball screw lead, with reduced rotation speed

(2) Forced cooling

- Hollow screw shaft to allow cooling fluid to flow through
- Cooling of screw shaft exterior with cooling oil or air

(3) Avoid influence of temperature rise

Warming up the machine through high speed to attain the stable temperature :

- Operates after the temperature become stable
- Pre-tension on screw shaft
- Preset a negative value on target value of the cumulative lead.
- Use the closed loop for positioning

Service Life Design

Service Life of Ball Screws

Even the ball screw is used under correct conditions, it would still fail after a period time of usage. From the beginning to the unusable condition of ball screw, this period of time is called service life of ball screw, which is generally classified into the fatigue life when delamination phenomenon occurs and the accuracy deterioration life caused by wear-out, etc.

Basic Static Load Rating Coa

The basic load rating is an axial static load which will produce a permanent deformation at contact points of the steel balls to ball grooves equal to 0.01% of ball diameter.

Basic Dynamic Load Rating Ca

The basic dynamic load rating is an axial load which allow 90% of a group of identical ball screws (rotated under the same condition) to rotate without flaking for 10^6 revolutions. This basic dynamic load rating is shown in the table of dimensions.

Relation between load and service life $L \propto \left(\frac{1}{P}\right)^3$ L : Service life P : Load

Fatigue Life

Average load P_e

(1) When axial load keeps changing, please calculate in order the average load for the equivalent fatigue life under different load condition changes. (see Table 1.9.1)

$$(P_e = \frac{P_1^3 n_1 t_1 + P_2^3 n_2 t_2 + \dots + P_n^3 n_n t_n}{n_1 t_1 + n_2 t_2 + \dots + n_n t_n})^{\frac{1}{3}} \text{ (kgf)})$$

Axial Load (kgf)	Rotating Speed (min^{-1})	Time(%)
P_1	n_1	t_1
P_2	n_2	t_2
.	.	.
.	.	.
.	.	.
P_n	n_n	t_n

But, $t_1 + t_2 + t_3 + \dots + t_n = 100$

Table 1.9.1 Service Life in Different Application.

Usage	Life in hours (h)
Working machines	20000
General industrial machines	10000
Automatic control machines	15000
Measurement machines	15000

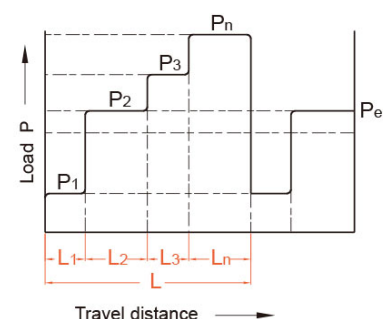


Fig 1.9.1

$$P_e = \frac{2P_{\max} + P_{\min}}{3} \text{ (kgf)}$$

$P_{\max}$: Maximal axial load (kgf)

$P_{\min}$: Minimal axial load (kgf)

(2) When load changes according to sine curve
(see Fig 1.9.2)

$P_e \approx 0.65 P_{\max}$ (Fig A)

$P_e \approx 0.75 P_{\max}$ (Fig B)

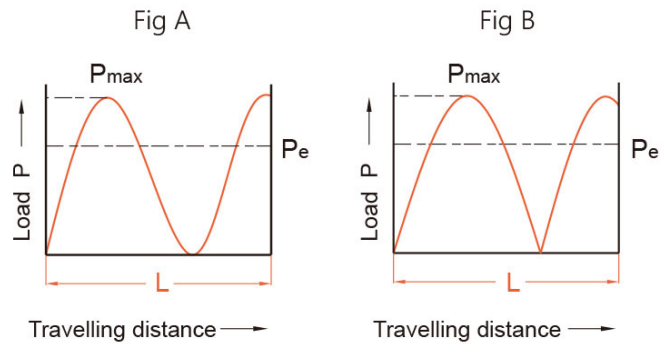


Fig 1.9.2

Calculation of Service Life

The fatigue life is generally expressed by the total number of revolutions. The total rotation hours or total travel distance may also be used to express service life. The fatigue life is calculated as follow :

$$L = \left[\frac{C_a}{P_a \cdot f_w} \right]^3 \cdot 10^6$$

$$L_t = \frac{L}{60n}$$

$$L_s = \frac{L \cdot \ell}{10^6}$$

Where

L : Rated fatigue life (rev)

L_s : Life in travel distance (km)

P_a : Axial load (kgf)

f_w : Load Coefficient (Required coefficient to operate)

L_t : Life in hours (h)

C_a : Basic dynamic load rating (kgf)

n : Rotating speed (rpm)

ℓ : Lead (mm)

Table 1.9.2 Load Factor (f_w)

Vibration and impact	Velocity (V)	f_w
Minor	$V \leq 0.25$ m/s Very Low	1~1.2
Little	$0.25 < V \leq 1$ m/s Low	1.2~1.5
Moderate	$1 < V \leq 2$ m/s Medium	1.5~2
Heavy	$V > 2$ m/s High	2~3.5

Table 1.9.3 Factor of Safety (f_s)

Usage	Operation	f_s
Machine tool	Normal operation	1.0 ~ 1.3
	Operation with impact and vibration	2.0 ~ 3.0
Industrial machine	Normal operation	1.0 ~ 1.5
	Operation with impact and vibration	2.5 ~ 7.0

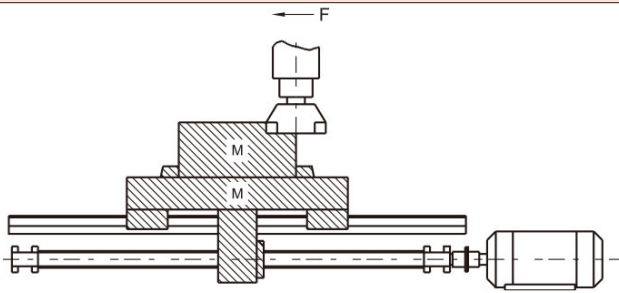
Basic Dynamic Load Rating C_a

$$C_a = P_e \cdot f_s$$

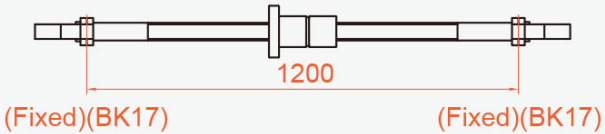
Basic Static Load Rating C_o

$$C_o = P_{\max} \cdot f_s$$

Life Design

Key Points for Ball Screws Selection	Calculation for Ball Screws Selection																																																		
To choose a perfect fit ball screw, users need to understand operating requirement, which is the fundamental principal of deciding the design. Besides, the main factors of selection include load weight, stroke, torque, positioning accuracy in a single time and repeatedly, rigidity, lead and nut's inner diameter. Among all the factors, any single factor's change will cause the change of other factors. Therefore, the balance between all factors is a must to pay attention to.	 Design conditions 1. Working table weight 2. Working object weight 3. Max Stroke 4. Feeding speed 5. Minimal disassembly ability 6. Driving motor DC motor 7. Guiding surface friction coefficient 8. Running rate 9. Accuracy review items 10. Inertia generated during acceleration/deceleration can be neglected because the time periods involved are comparatively small. 300 Kg 400 Kg 700 mm 10 m/min 10μm/stroke (MAX 1000 min) (μ= 0.05~0.1) 60 %																																																		
1. Setting of operation conditions (a) Machine service life time reckoning of H (hr) H= · · · hours/day days/year life years running rate (b) Mechanical conditions <table><tr><th>Calculation Items Different Operations</th><th>Speed/ rotations</th><th>Cutting resistance</th><th>Sliding resistance</th><th>Time used</th></tr><tr><td>Fast feed</td><td>m/min/-1 min</td><td>kgf</td><td>kgf</td><td>%</td></tr><tr><td>Light cutting</td><td>/</td><td></td><td></td><td></td></tr><tr><td>Medium cutting</td><td>/</td><td></td><td></td><td></td></tr><tr><td>Heavy cutting</td><td>/</td><td></td><td></td><td></td></tr></table> (c) Position determination accuracy Feed accuracy error factor includes load accuracy and system rigidity. Other factors which caused by temperature rise such as heat deformation and mounting accuracy of surface are needed to be considered.	Calculation Items Different Operations	Speed/ rotations	Cutting resistance	Sliding resistance	Time used	Fast feed	m/min/-1 min	kgf	kgf	%	Light cutting	/				Medium cutting	/				Heavy cutting	/				1. Setting of operation conditions (a) Machine service life time reckoning of H (hr) H = 12 hr · 250 days · 10 years · 0.6 Running rate = 18000 hr (b) Mechanical conditions <table><tr><th>Calculation Items Different Operations</th><th>Speed/ rotations</th><th>Cutting resistance</th><th>Sliding resistance</th><th>Time used</th></tr><tr><td>Fast feed</td><td>10m/ min/1000min⁻¹</td><td>0 kgf</td><td>70 kgf</td><td>10 %</td></tr><tr><td>Light cutting</td><td>6/600</td><td>100</td><td>70</td><td>50</td></tr><tr><td>Medium cutting</td><td>2/200</td><td>200</td><td>70</td><td>30</td></tr><tr><td>Heavy cutting</td><td>1/100</td><td>300</td><td>70</td><td>10</td></tr></table> Sliding resistance = (300 + 400) · 0.1 = 70 kgf	Calculation Items Different Operations	Speed/ rotations	Cutting resistance	Sliding resistance	Time used	Fast feed	10m/ min/1000min ⁻¹	0 kgf	70 kgf	10 %	Light cutting	6/600	100	70	50	Medium cutting	2/200	200	70	30	Heavy cutting	1/100	300	70	10
Calculation Items Different Operations	Speed/ rotations	Cutting resistance	Sliding resistance	Time used																																															
Fast feed	m/min/-1 min	kgf	kgf	%																																															
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Medium cutting	/																																																		
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Medium cutting	2/200	200	70	30																																															
Heavy cutting	1/100	300	70	10																																															

Key Points for Ball Screws Selection	Calculation for Ball Screws Selection
2. Ball screw lead ℓ (mm) $\ell = \frac{\text{Feeding speed (m/min)} \cdot 1000}{\text{Max. Rotating speed (min}^{-1}\text{) of motor}} \text{ (mm)}$	2. Ball screw lead ℓ (mm) $\ell = \frac{10000}{1000} = 10 \text{ (mm)}$ Minimal disassembly = $\frac{10 \text{ mm}}{1000 \text{ stroke}}$ = 0.01 mm/stroke
3. Computation of average load P_e (kgf) $P_e = \left[\frac{P_1^3 n_1 t_1 + P_2^3 n_2 t_2 + \dots + P_n^3 n_n t_n}{n_1 t_1 + n_2 t_2 + \dots + n_n t_n} \right]^{\frac{1}{3}}$ $P_e = \frac{2P_{\max} + P_{\min}}{3}$ $P_e \approx 0.65 P_{\max}$ $P_e \approx 0.75 P_{\max}$	3. Computation of average load P_e (kgf) $P_e = \left[\frac{70^3 \cdot 1000 \cdot 10 + 170^3 \cdot 600 \cdot 50 + 270^3 \cdot 200 \cdot 30 + 370^3 \cdot 100 \cdot 10}{1000 \cdot 10 + 600 \cdot 50 + 200 \cdot 30 + 100 \cdot 10} \right]^{\frac{1}{3}}$ $= \left[\frac{31.7 \cdot 10^{10}}{4.7 \cdot 10^4} \right]^{\frac{1}{3}}$ $\approx 189 \text{ kgf}$
4. Average number of rotations n_m $n_m = \frac{n_1 t_1 + n_2 t_2 + \dots + n_n t_n}{100}$	4. Average number of rotations n_m $n_m = \frac{1000 \cdot 10 + 600 \cdot 50 + 200 \cdot 30 + 100 \cdot 10}{100}$ $= \frac{4.7 \cdot 10^4}{100} = 470 \text{ min}^{-1}$
5. Calculation of required dynamic rated load C_a $C_a = P_e \cdot f_s$	5. Calculation of required dynamic rated load C_a $C_a = 189 \cdot 5 = 945 \text{ (kgf)}$
6. Calculation of required static rated load C_{oa} $C_{oa} = P_{\max} \cdot f_s$	6. Calculation of required static rated load C_{oa} $C_{oa} = 369 \cdot 5 = 1845 \text{ (kgf)}$
7. Selection of nut type $C_a > 945$ $C_{oa} > 1845$ Select the nut types with basic dynamic rated load and and basic static rated load as specified above.	7. Selection of nut type Choose SFNI 2510 on the catalogue $C_a = 2954 \text{ (kgf)}$ $C_{oa} = 7295 \text{ (kgf)}$

Key Points for Ball Screws Selection	Calculation for Ball Screws Selection
8. Calculation of service life L_t (h) $L_t = \frac{L}{60n} = \left(\frac{C_a}{P_e \cdot f_w} \right)^3 \cdot 10^6 \cdot \frac{1}{60n}$	8. Calculation of service life L_t (h) $L_t = \left(\frac{2954}{189 \cdot 2} \right)^3 \cdot 10^6 \cdot \frac{1}{60 \cdot 470} = 42544(h)$
9. Mounting distance between supporting bearings	9. Mounting distance between supporting bearings  (Fixed)(BK17) 1200 (Fixed)(BK17)
10. Determination of screw length Screw length = Maximal stroke + Nut length + Two reserved length at shaft end	10. Determination of screw length Screw length = 700 + 85 + 76 + 76 = 937 mm 937 mm < 1200 mm
11. Permissible axial load	11. Permissible axial load Omitted because of F-F support
12. Permissible revolution speed n and DN $n = \alpha \cdot \frac{60\lambda^2}{2\pi L^2} \sqrt{\frac{E\lambda}{\gamma A}} = f \cdot \frac{dr}{L^2} \cdot 10^7 (rpm)$ DN = Shaft dia · Maximal speed	12. Permissible revolution speed n and DN $n = \frac{21.9 \cdot 21.86 \cdot 10^7}{1200^2} = 3324 \text{ min}^{-1} < n_{\max}$ DN = 25 · 1000 = 25000 < 50000
13. Countermeasure against thermal displacement $\Delta \ell = \alpha \cdot \Delta t \cdot L$ $\Delta \ell$: Thermal displacement α: Coefficient of thermal expansion Δt: Temperature rise (deg) at screw shaft L: Effective length of screw thread	13. Countermeasure against thermal displacement It is estimated there would be a temperature rise 2~5°C with the ball screws of the general machinery, take temperature rise of 2°C to compute the extension of ball screw. $\Delta \ell = \alpha \cdot \Delta t \cdot L = 11.7 \cdot 10 \cdot 2 \cdot 700 \text{ mm}$ $\approx 0.016 \text{ mm}$ $F_p = \frac{EA \Delta \ell}{L}$ $= \frac{2.06 \cdot 10^4 \cdot \frac{\pi \cdot 21.86^2}{4} \cdot 0.016}{700}$ $\approx 177 (\text{kgf})$

Key Points for Ball Screws Selection	Calculation for Ball Screws Selection
14. Rigidity (1) Axial rigidity K_s and displacement δ_s of screw shaft $K_s = \frac{P}{\delta_s} \text{ (kgf/mm)}$ P : Axial load (kgf) $\delta_{SF} = \frac{PL}{4AE} \text{ (mm).....(with reference to page C20)}$ (2) Axial rigidity K_N and displacement δ_s of nut $\delta_{NS} = \frac{K}{\sin\beta} \left[\frac{Q^2}{d} \right]^{\frac{1}{3}} \cdot \frac{1}{\xi} \text{ (mm)}$ $Q = \frac{P}{n \cdot \sin\beta} \text{ (kgf)}$ $n = \frac{D_0 \pi m}{d} \text{ (each).....(with reference to page C21)}$ (3) Axial rigidity K_B and displacement δ_B of bracing shaft $K_B = \frac{P}{\delta_B} \text{ (kgf/mm).....(with reference to page C22)}$	14. Rigidity Deviation can be corrected by estimating the temperature rise per extension of 0.016 mm, and taking into consideration of the pre-tension of 177 kgf. (1) Directional rigidity $\delta_{SF} = \frac{PL}{4AE} = \frac{27 \cdot 1200}{4 \cdot \frac{\pi \cdot 21.86^2}{4} \cdot 2.06 \cdot 10^4}$ $= 0.00105 \text{ (mm)}$ $K_s = \frac{370}{0.00105} = 3.5 \cdot 10^5 \text{ kgf/mm}$ (2) Rigidity of steel ball and nut groove $n = \frac{26.62 \cdot \pi \cdot 4}{4.762} = 70$ $Q = \frac{370}{70 \sin 45^\circ} = 10$ $\delta_{NS} = \frac{0.00057}{\sin 45^\circ} \left(\frac{10^2}{4.762} \right)^{\frac{1}{3}} \cdot \frac{1}{0.7}$ $= 3.2 \cdot 10 \text{ mm}$ $K_N = \frac{370}{3.2 \cdot 10^{-3}} = 1.27 \cdot 10^5 \text{ kgf/mm}$ (3) Rigidity of support bearings Where, nut rigidity 50 kgf/μm $\delta_B = \frac{370}{51 \cdot 2} = 3.6 \mu\text{m}$ $K_B = \frac{370}{0.0036} = 1 \cdot 10^5 \text{ kgf/mm}$ ● $\delta_{TOTAL} = 1.05 + 3.2 + 3.6 = 7.85 \mu\text{m}$
15. Confirmation of the ball screw life	15. Confirmation of the ball screw life $L = 42544 \text{ (h)} > 18000 \text{ (h)}$

Nominal Model Code of Ball Screw

SFU R 025 05 T4 D G C5 - 600 - P1 - B2 + N3 N3

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

①	②	⑤	⑦	
Nominal Model	Threading Direction	Number of Turns (Turn·Row)	Product Code	
S	S:Single nut	R:Right	Turn: T:1	G:Ground
	D:Double nut	L :Left	A:1.5 (or 1.7/1.8)	F:Rolled
	O:OFF set double nut		B:2.5/2.8	
F	F : With flange	③	C:3.5	⑧
	C: Without flange	Nominal Diameter	D:4.8	Accuracy Grade
U	NI :NI type nut	Unit:mm	ex:(2.5:2 = B2)	C0, C1, C2, C3, C5, C7, C10
	NU : NU type nut			
	H : H type nut	④	⑥	⑨
	Y : Y type nut	Lead	Flange Type	Overall Length of Shaft
	V:V type nut	Unit:mm	N:Not cutting	Unit:mm
	U:DIN nut		S:Single cutting	
	M:M type nut		D:Double cutting	
K:K type nut				
⑩		⑪		
Axial Clearance and Preload Value		Number of Nut		
P0, P1, P2, P3, P4		(Leave blank if only one nut is required) Ex : Install two nuts on a shaft B2		
⑫		⑬		
Nut Surface Treatment		Shaft Surface Treatment		
S:Standard		S:Standard		
B1:Black Oxidation		B1:Black Oxidation		
N1:Hard Chrome Plating		N1:Hard Chrome Plating		
P:Phosphating		P:Phosphating		
N3:Nickel Plating		N3:Nickel Plating		
N4:Raydent		N4:Raydent		
N5:Chrome Plating		N5:Chrome Plating		

※ No symbol required when plating is not needed.

※ An inspection report is provided for ground ball screws with an accuracy higher than C5.

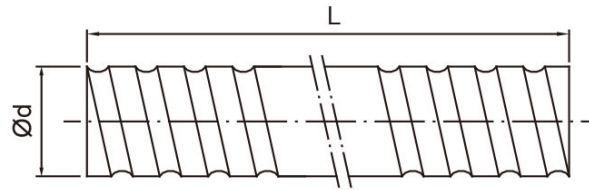


Fig 2.1.1 Screw Shaft Nominal Diameter

Table 2.1.1 Ground Ball Screw Specifications Ø4~32

Model No.			Accuracy Grade	Threading Direction	Number of Grooves	Standard Code of Shaft	Type of Nut
Ød	I	Da		R : Right L : Left			
4	1	0.8	C7, C5, C3	R	1	SCR00401	K
6	1	0.8	C7, C5, C3	R	1	SCR00601	K
8	1	0.8	C7, C5, C3	R/L	1	SCR00801	K
	2	1.2	C7, C5, C3	R/L	1	SCR00802	K
	2.5	1.2	C7, C5, C3	R	1	SCR0082.5	K, BSH
10	2	1.2	C7, C5, C3	R/L	1	SCR01002	K, BSH
	4	2	C7, C5, C3	R	1	SCR01004	K, BSH
12	2	1.2	C7, C5, C3	R/L	1	SCR01202	K
	4	2.5	C7, C5, C3	R	1	SCR01204	U, BSH
	5	2.5	C7, C5, C3	R	1	SCR01205-A	V, U, BSH, H
	5	2.5	C7, C5, C3	R	1	SCR01205-B	K
	10	2.5	C7, C5, C3	R	2	SCR01210-B	V
14	2	1.2	C7, C5, C3	R/L	1	SCR01402	K
	4	2.5	C7, C5, C3	R	1	SCR01404	BSH
16	2	1.2	C7, C5, C3	R/L	1	SCR01602	K
	4	2.381	C7, C5, C3	R	1	SCR01604(N)	V, I, U, BSH
	5	3.175	C7, C5, C3	R/L	1	SCR01605	V, I, U, BSH
	10	3.175	C7, C5, C3	R/L	2	SCR01610	V, I, U, BSH
	16	2.778	C7, C5, C3	R	2	SCR01616	Y
20	32	2.778	C7, C5, C3	R	2	SCR01632	Y
	4	2.381	C7, C5, C3	R	1	SCR02004(N)	V, I, U
	5	3.175	C7, C5, C3	R/L	1	SCR02005	V, I, U, BSH, H
	10	3.969	C7, C5, C3	R	1	SCR02010	V
	20	3.175	C7, C5, C3	R	2	SCR02020	V, Y, H
25	40	3.175	C7, C5, C3	R	2	SCR02040	Y
	4	2.381	C7, C5, C3	R	1	SCR02504(N)	I, U
	5	3.175	C7, C5, C3	R/L	1	SCR02505	V, I, U, BSH, H
	6	3.969	C7, C5, C3	R	1	SCR02506	V, U
	8	4.762	C7, C5, C3	R	1	SCR02508	V, U
	10	4.762	C7, C5, C3	R	1	SCR02510-A	I, U, BSH
	10	6.35	C7, C5, C3	R	1	SCR02510-B	V
	25	3.969	C7, C5, C3	R	2	SCR02525	Y
32	50	3.969	C7, C5, C3	R	2	SCR02550	Y
	4	2.381	C7, C5, C3	R	1	SCR03204(N)	V, I, U
	5	3.175	C7, C5, C3	R/L	1	SCR03205	V, NI, NU, M, H
	6	3.969	C7, C5, C3	R	1	SCR03206	V, U
	8	4.762	C7, C5, C3	R	1	SCR03208	V, U
	10	6.35	C7, C5, C3	R/L	1	SCR03210	V, I, U
	20	6.35	C7, C5, C3	R	1	SCR03220	V
	32	4.762	C7, C5, C3	R	2	SCR03232	Y
64	64	4.762	C7, C5, C3	R	2	SCR03264	Y

Table 2.1.2 Standard Specifications Ø40~80

Unit : mm

Model No.			Accuracy Grade	Threading Direction	Number of Grooves	Standard Code of Shaft	Type of Nut
Ød	I	Da		R : Right L : Left			
40	5	3.175	C7, C5, C3	R / L	1	SCR04005	V, NI, NU, H
	6	3.969	C7, C5, C3	R	1	SCR04006	V, NU
	8	4.762	C7, C5, C3	R	1	SCR04008	V, NU
	10	6.35	C7, C5, C3	R / L	1	SCR04010	V, NI, NU
	20	6.35	C7, C5, C3	R	2	SCR04020	V
	40	6.35	C7, C5, C3	R	2	SCR04040	Y
	80	6.35	C7, C5, C3	R	2	SCR04080	Y
50	5	3.175	C7, C5, C3	R	1	SCR05005	V, H
	10	6.35	C7, C5, C3	R / L	1	SCR05010	V, NI, NU
	20	9.525	C7, C5, C3	R	1	SCR05020	V
	50	7.938	C7, C5, C3	R	2	SCR05050	Y
	100	7.938	C7, C5, C3	R	2	SCR050100	Y
63	10	6.35	C7, C5, C3	R	1	SCR06310	V, NI, NU
	20	9.525	C7, C5, C3	R	1	SCR06320	V, NU
80	10	6.35	C7, C5, C3	R	1	SCR08010	V, NI, NU
	20	9.525	C7, C5, C3	R	1	SCR08020	V, NU

Table 2.1.3 H-type Specifications Ø16~50

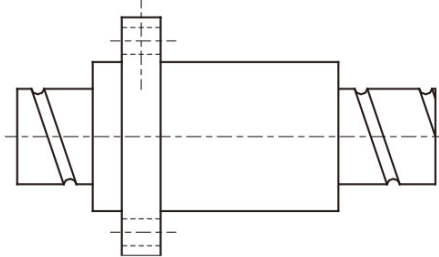
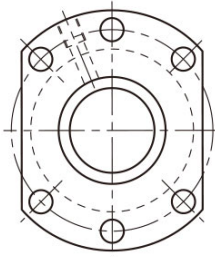
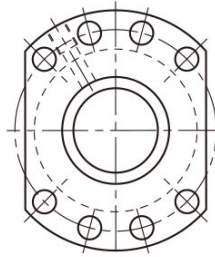
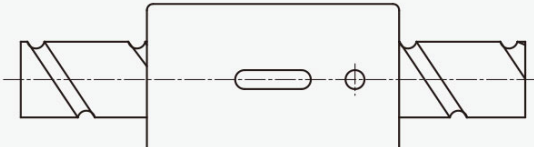
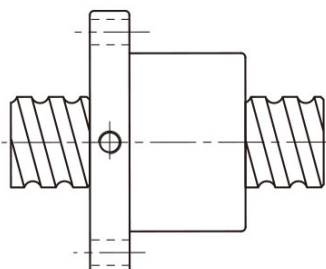
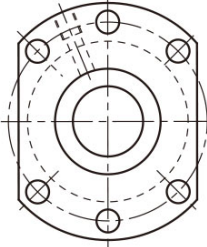
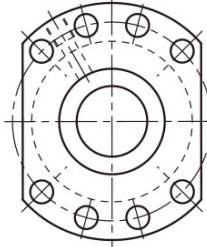
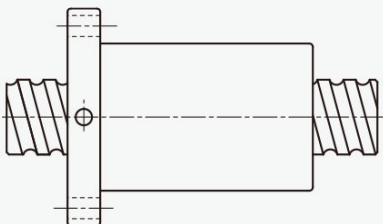
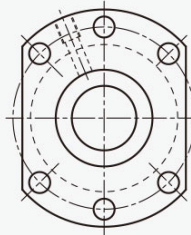
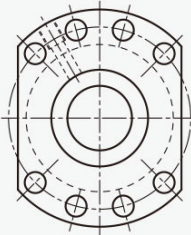
Unit : mm

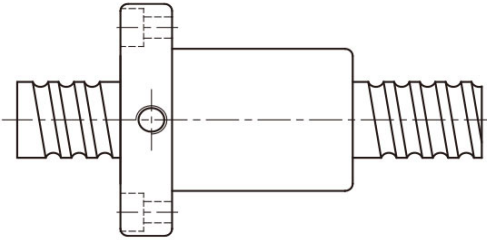
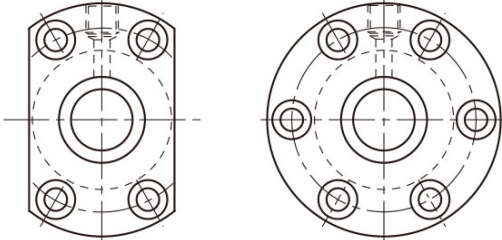
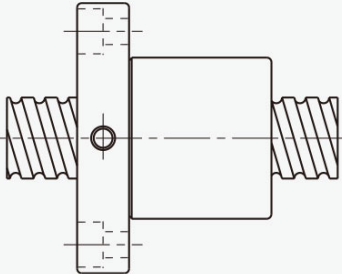
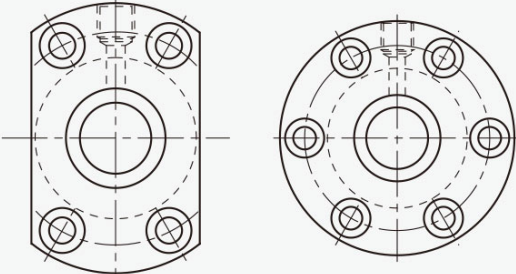
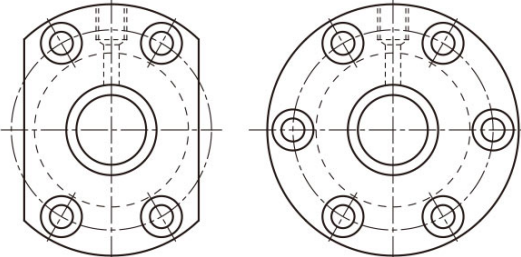
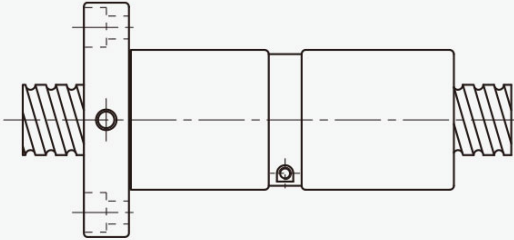
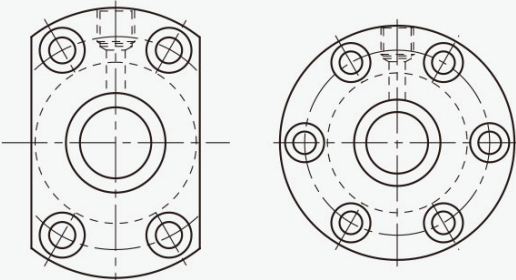
Model No.			Accuracy Grade	Threading Direction	Number of Grooves	Type-H Code of Shaft	Type of Nut
Ød	I	Da		R : Right L : Left			
12	10	2.5	C7, C5, C3	R	1	SSR01210	H
16	5	2.778	C7, C5, C3	R	1	SSR01605	H
	10	2.778	C7, C5, C3	R	1	SSR01610	H
	16	2.778	C7, C5, C3	R	1	SSR01616	H
	20	2.778	C7, C5, C3	R	1	SSR01620	H
20	10	3.175	C7, C5, C3	R	1	SSR02010	H
25	10	3.175	C7, C5, C3	R	1	SSR02510	H
	25	3.175	C7, C5, C3	R	1	SSR02525	H
32	10	3.969	C7, C5, C3	R	1	SSR03210	H
	20	3.969	C7, C5, C3	R	1	SSR03220	H
	32	6.35	C7, C5, C3	R	1	SSR03232	H
40	10	6.35	C7, C5, C3	R	1	SSR04010	H
	20	6.35	C7, C5, C3	R	1	SSR04020	H
	40	6.35	C7, C5, C3	R	1	SSR04040	H
50	10	6.35	C7, C5, C3	R	1	SSR05010	H
	20	6.35	C7, C5, C3	R	1	SSR05020	H
	50	6.35	C7, C5, C3	R	1	SSR05050	H

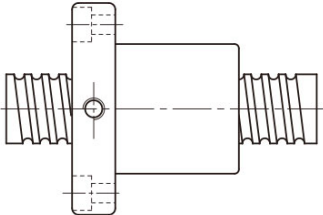
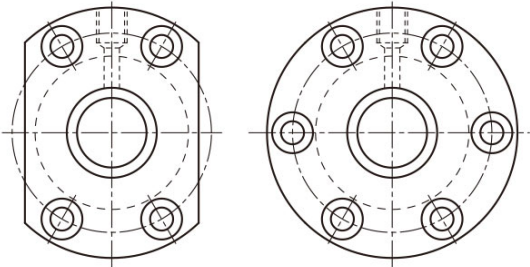
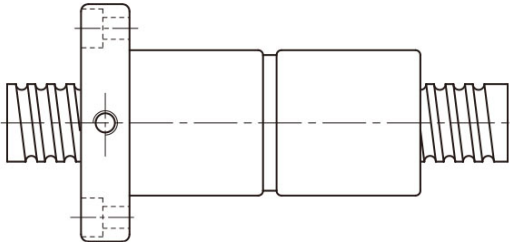
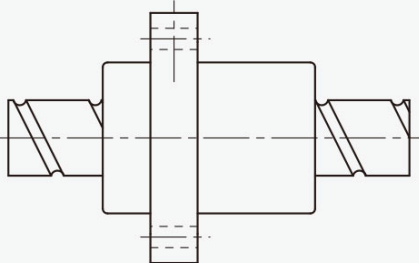
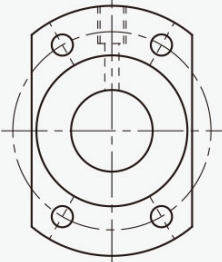
※ The information is for specifications, if customized products are needed please contact **TBI MOTION**.

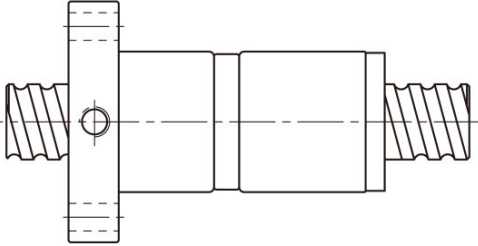
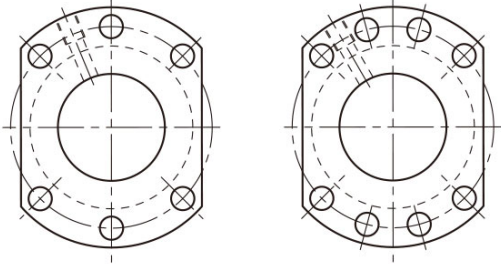
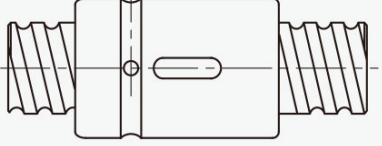
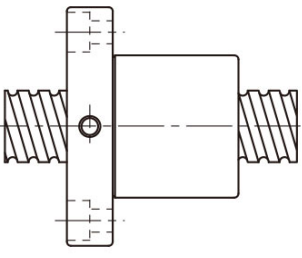
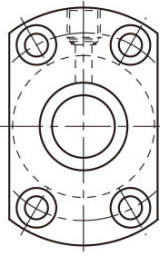
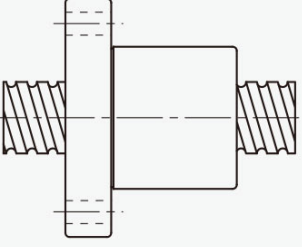
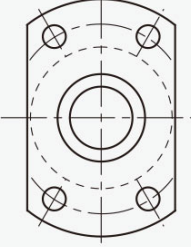
Precision Ground Ball Screw Series

Nut of Precision Ground Ball Screw Type

Nut Type		Flange Type	
NH/H (High Speed/Strong dust-proof type)	SFNH/SFH (DIN)  C44	 d≤32  d≥40	
CNH (Actuator type)	SCNH  C45	No-Flange	
NU/U (Strong dust-proof type)	SFNU/SFU (DIN)  C46	 d≤32  d≥40	
OFU/U (OFF set double nut)	OFU/DFU (DIN)  C47	 	

	Nut Type	Flange Type
NI/I (Strong dust-proof type)	SFNI/SFI  C48	
Σ (Design for Milling)	SFM  C48	
OFI/I (OFF set double nut)	OFI/DFI  C49	
Σ (Design for Milling)	DFM  C49	

Nut Type		Flange Type	
> (High Load External Circulation type)	SFV  C50		
OFV (OFF set double nut)	OFV  C51		
> (High Load External Circulation type)	DFV  C51		
> (High DM-N Rating)	SFY  C52		

	Nut Type	Flange Type
∞ (High Speed / Low Noise type)	DFS (DIN)  C53	 Model No. ≤3232 Model No. ≥4005
CNI/I (Standard)	SCNI/SCI  C54	No-Flange
≪ (Miniature type)	SFK  C55	 (SFK 01004) (SFK 02002) (SFK 02502)
	SFK  C55	

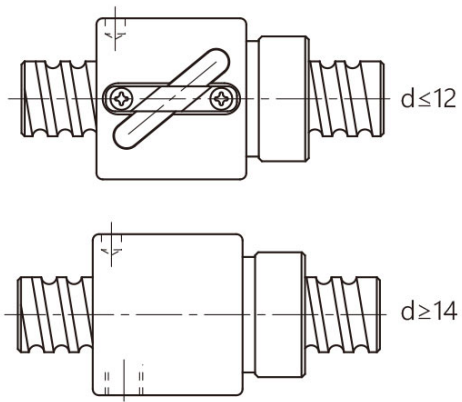
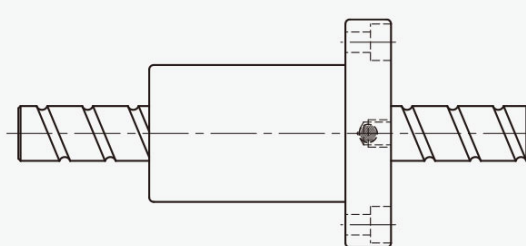
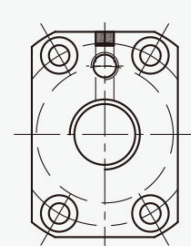
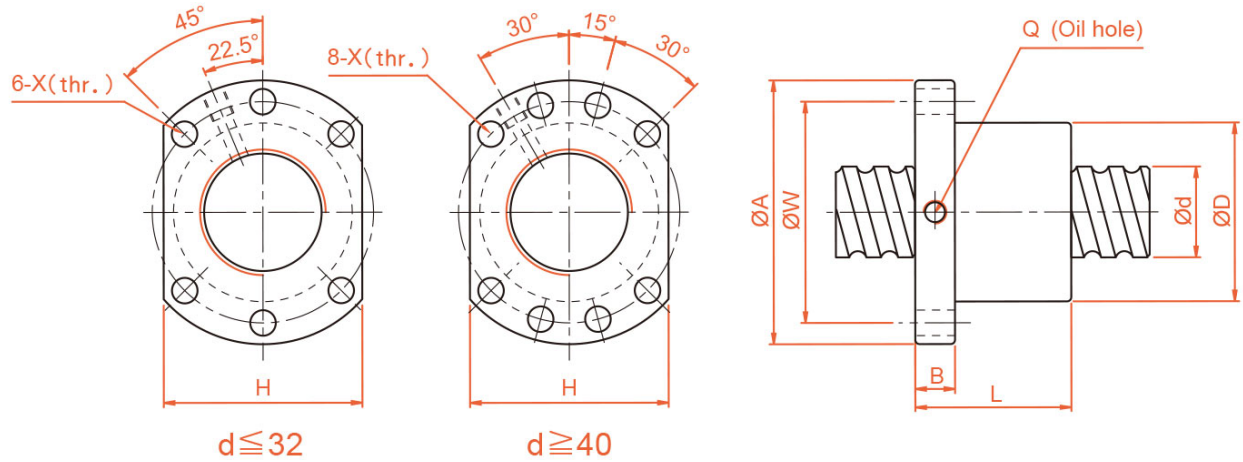
Nut Type		Flange Type
BSH	BSH  C56	No-Flange
XSV (Design for factory automation)	XSV  C57~61	

Table 2.2.1 Preload Chart

Preload	I, U, M-type	H-type	Y-type	V-type	BSH-type	K-type
P0						
P1	√	√	√	√	√	√
P2	√	√	√	√	√	
P3	√	√	√	√	√	
P4				√		

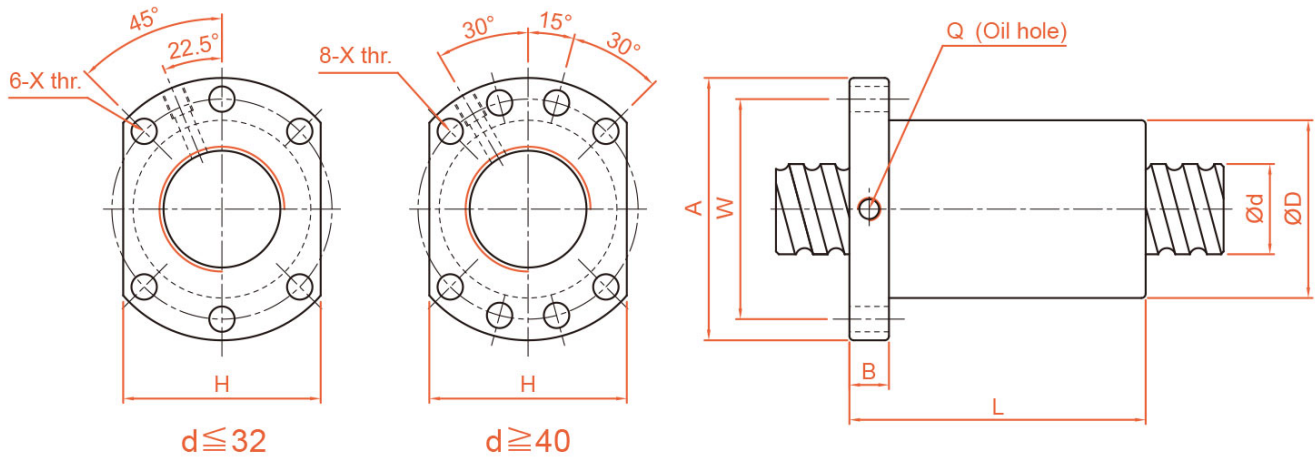
SFNU/SFU (DIN 69051 FORM B) Series Specifications



Unit : mm

Model No.	d	I	Da	Dimension									Load Rating		K kgf/ μ m
				D	A	B	L	W	H	X	Q	n	Ca (kgf)	Coa (kgf)	
SFNU01605-4	16	5	3.175	28	48	10	45	38	40	5.5	M6	1x4	1380	3052	32
SFNU01610-3		10	3.175	28	48	10	57	38	40	5.5	M6	1x3	1103	2401	26
SFNU02005-4	20	5	3.175	36	58	10	51	47	44	6.6	M6	1x4	1551	3875	39
SFNU02505-4	25	5	3.175	40	62	10	51	51	48	6.6	M6	1x4	1724	4904	45
SFNU02510-4		10	4.762	40	62	12	80	51	48	6.6	M6	1x4	2954	7295	50
SFNU03205-4	32	5	3.175	50	80	12	52	65	62	9	M6	1x4	1922	6343	54
SFNU03210-4		10	6.35	50	80	12	85	65	62	9	M6	1x4	4805	12208	61
SFNU04005-4	40	5	3.175	63	93	14	55	78	70	9	M8	1x4	2110	7988	63
SFNU04010-4		10	6.35	63	93	14	88	78	70	9	M8	1x4	5399	15500	73
SFNU05010-4	50	10	6.35	75	110	16	88	93	85	11	M8	1x4	6004	19614	85
SFNU06310-4	63	10	6.35	90	125	18	93	108	95	11	M8	1x4	6719	25358	99
SFNU08010-4	80	10	6.35	105	145	20	93	125	110	13.5	M8	1x4	7346	31953	109
SFU01204-4	12	4	2.5	24	40	10	40	32	30	4.5		1x4	902	1884	26
SFU01604-4	16	4	2.381	28	48	10	40	38	40	5.5	M6	1x4	973	2406	32
SFU02004-4	20	4	2.381	36	58	10	42	47	44	6.6	M6	1x4	1066	2987	38
SFU02504-4	25	4	2.381	40	62	10	42	51	48	6.6	M6	1x4	1180	3795	43
SFU02506-4		6	3.969	40	62	10	54	51	48	6.6	M6	1x4	2318	6057	47
SFU02508-4		8	4.762	40	62	10	63	51	48	6.6	M6	1x4	2963	7313	49
SFU03204-4	32	4	2.381	50	80	12	44	65	62	9	M6	1x4	1296	4838	51
SFU03206-4		6	3.969	50	80	12	57	65	62	9	M6	1x4	2632	7979	57
SFU03208-4		8	4.762	50	80	12	65	65	62	9	M6	1x4	3387	9622	60
SFU04006-4	40	6	3.969	63	93	14	60	78	70	9	M6	1x4	2873	9913	66
SFU04008-4		8	4.762	63	93	14	67	78	70	9	M6	1x4	3712	11947	70
SFU05020-4	50	20	7.144	75	110	16	138	93	85	11	M8	1x4	7142	22588	94
SFU06320-4	63	20	9.525	95	135	20	149	115	100	13.5	M8	1x4	11444	36653	112
SFU08020-4	80	20	9.525	125	165	25	154	145	130	13.5	M8	1x4	12911	47747	138
SFU10020-4	100	20	9.525	150	202	30	180	170	155	17.5	M8	1x4	14303	60698	162

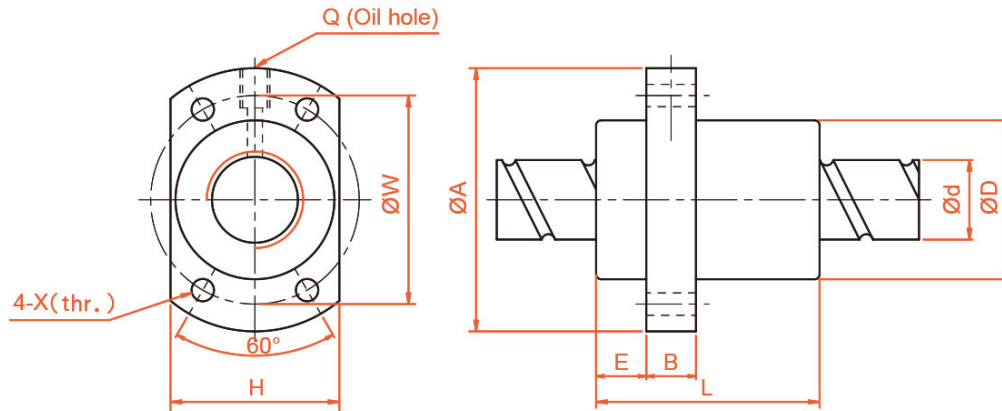
DFU (DIN 69051 FORM B) Series Specifications



Unit : mm

Model No.	d	I	Da	Dimension									Load Rating		K kgf/μm
				D	A	B	L	W	H	X	Q	n	Ca (kgf)	Coa (kgf)	
DFU01604-4	16	4	2.381	28	48	10	80	38	40	5.5	M6	1x4	973	2406	43
DFU02004-4	20	4	2.381	36	58	10	80	47	44	6.6	M6	1x4	1066	2987	51
DFU02504-4	25	4	2.381	40	62	10	80	51	48	6.6	M6	1x4	1180	3795	60
DFU02506-4		6	3.969	40	62	10	105	51	48	6.6	M6	1x4	2318	6057	64
DFU02508-4		8	4.762	40	62	10	120	51	48	6.6	M6	1x4	2963	7313	67
DFU03204-4	32	4	2.381	50	80	12	80	65	62	9	M6	1x4	1296	4838	71
DFU03206-4		6	3.969	50	80	12	105	65	62	9	M6	1x4	2632	7979	78
DFU03208-4		8	4.762	50	80	12	122	65	62	9	M6	1x4	3387	9622	82
DFU04006-4	40	6	3.969	63	93	14	108	78	70	9	M6	1x4	2873	9913	91
DFU04008-4		8	4.762	63	93	14	132	78	70	9	M6	1x4	3712	11947	96
DFU05020-4	50	20	7.144	75	110	16	280	93	85	11	M8	1x4	7142	22588	126
DFU06320-4	63	20	9.525	95	135	20	290	115	100	13.5	M8	1x4	11444	36653	152
DFU08020-4	80	20	9.525	125	165	25	295	145	130	13.5	M8	1x4	12911	47747	187
DFU10020-4	100	20	9.525	150	202	30	340	170	155	17.5	M8	1x4	14303	60698	222

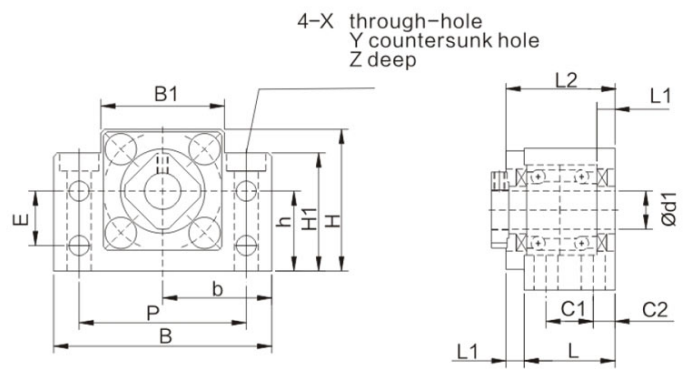
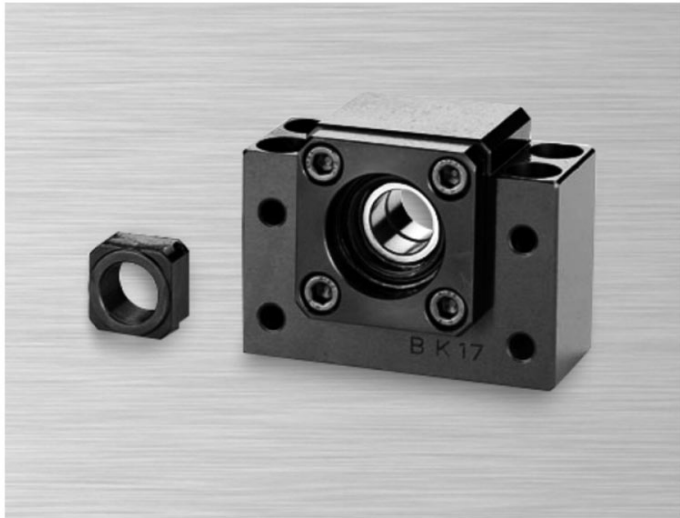
SFY Series Specifications



Unit : mm

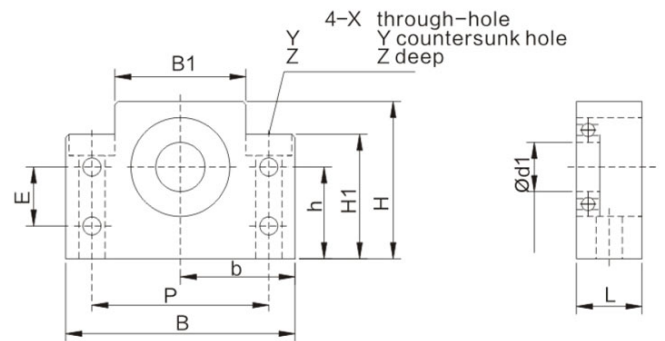
Large Lead Model No.	d	I	Da	Dimension										Load Rating		K kgf/μm
				D	A	E	B	L	W	H	X	Q	n	Ca (kgf)	Coa (kgf)	
SFY01616-3.6	16	16	2.778	32	53	10.1	10	45	42	34	4.5	M6	1.8x2	1073	2551	31
SFY01616-5.6		16	2.778	32	53	10.1	10	61	42	34	4.5	M6	2.8x2	1568	3968	47
SFY02020-3.6	20	20	3.175	39	62	13	10	52	50	41	5.5	M6	1.8x2	1387	3515	37
SFY02020-5.6		20	3.175	39	62	13	10	72	50	41	5.5	M6	2.8x2	2029	5468	56
SFY02525-3.6	25	25	3.969	47	74	15	12	64	60	49	6.6	M6	1.8x2	2074	5494	45
SFY02525-5.6		25	3.969	47	74	15	12	89	60	49	6.6	M6	2.8x2	3032	8546	69
SFY03232-3.6	32	32	4.762	58	92	17	12	78	74	60	9	M6	1.8x2	3021	8690	58
SFY03232-5.6		32	4.762	58	92	17	12	110	74	60	9	M6	2.8x2	4417	13517	88
SFY04040-3.6	40	40	6.35	73	114	19.5	15	99	93	75	11	M6	1.8x2	4831	14062	70
SFY04040-5.6		40	6.35	73	114	19.5	15	139	93	75	11	M6	2.8x2	7065	21874	106
SFY05050-3.6	50	50	7.938	90	135	21.5	20	117	112	92	14	M6	1.8x2	7220	21974	86
SFY05050-5.6		50	7.938	90	135	21.5	20	167	112	92	14	M6	2.8x2	10558	34182	131
Twin Lead Model No.	d	I	Da	Dimension										Ca (kgf)	Coa (kgf)	K kgf/μm
				D	A	E	B	L	W	H	X	Q	n			
SFY01632-1.6	16	32	2.778	32	53	10.1	10	42.5	42	34	4.5	M6	0.8x2	493	1116	11
SFY01632-3.6		32	2.778	32	53	10.1	10	74.5	42	34	4.5	M6	1.8x2	989	2511	23
SFY02040-1.6	20	40	3.175	39	62	13	10	48	50	41	5.5	M6	0.8x2	653	1597	15
SFY02040-3.6		40	3.175	39	62	13	10	88	50	41	5.5	M6	1.8x2	1311	3592	30
SFY02550-1.6	25	50	3.969	47	74	15	12	58	60	49	6.6	M6	0.8x2	976	2495	19
SFY02550-3.6		50	3.969	47	74	15	12	108	60	49	6.6	M6	1.8x2	1960	5614	32
SFY03264-1.6	32	64	4.762	58	92	17	12	71	74	60	9	M6	0.8x2	1374	3571	22
SFY03264-3.6		64	4.762	58	92	17	12	135	74	60	9	M6	1.8x2	2759	8441	46
SFY04080-1.6	40	80	6.35	73	114	19.5	15	90	93	75	11	M6	0.8x2	2273	6387	29
SFY04080-3.6		80	6.35	73	114	19.5	15	170	93	75	11	M6	1.8x2	4566	14370	50
SFY050100-1.6	50	100	7.938	90	135	21.5	20	111	112	92	14	M6	0.8x2	3398	9980	35
SFY050100-3.6		100	7.938	90	135	21.5	20	211	112	92	14	M6	1.8x2	6824	22455	72

BK Series - Fixed Side Rectangular Type



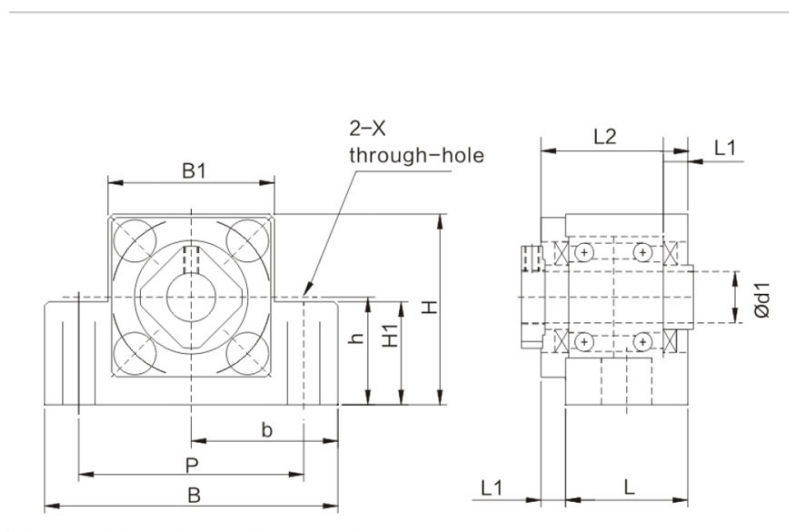
Model	d1	L	L1	L2	L3	C1	C2	B	H	b±0.02	h±0.02	B1	H1	E	P	d2	X	Y	Z
BK 10	10	25	5	29	5	13	6	60	39	30	22	34	32.5	15	46	5.5	6.6	10.8	5
BK 12	12	25	5	29	5	13	6	60	43	30	25	34	32.5	18	46	5.5	6.6	10.8	5
BK 15	15	27	6	32	6	15	6	70	48	35	28	40	38	18	54	5.5	6.6	11	6.5
BK 17	17	35	9	44	7	19	8	86	64	43	39	50	55	28	68	6.6	9	14	8.5
BK 20	20	35	8	43	8	19	8	88	60	44	34	52	50	22	70	6.6	9	14	8.5
BK 25	25	42	12	54	9	22	10	108	80	53	48	64	70	33	85	9	11	17.5	11
BK 30	30	45	14	61	9	23	11	128	89	64	51	76	78	33	102	11	14	20	13
BK 35	35	50	14	67	12	26	12	140	96	70	52	88	79	35	114	11	14	20	13
BK 40	40	61	18	76	15	33	14	160	110	80	60	100	90	37	130	14	18	26	17.5

BF Series - Floated Side Rectangular Type



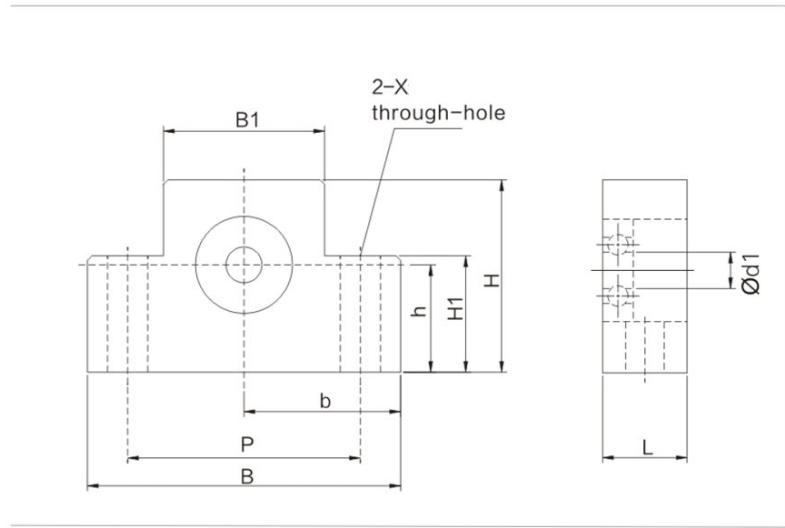
Model	d1	L	B	H	b±0.02	h±0.02	B1	H1	E	P	d2	X	Y	Z
BF 10	8	20	60	39	30	22	34	32.5	15	46	5.5	6.6	10.8	5
BF 12	10	20	60	43	30	25	34	32.5	18	46	5.5	6.6	10.8	5
BF 15	15	20	70	48	35	28	40	38	18	54	5.5	6.6	11	6.5
BF 17	17	23	86	64	43	39	50	55	28	68	6.6	9	14	8.5
BF 20	20	26	88	60	44	34	52	50	22	70	6.6	9	14	8.5
BF 25	25	30	106	80	53	48	64	70	33	85	9	11	17.5	11
BF 30	30	32	128	89	64	51	76	78	33	102	11	14	20	13
BF 35	35	32	140	96	70	52	88	79	35	114	11	14	20	13
BF 40	40	37	160	110	80	60	100	90	37	130	14	18	26	17.5

EK Series - Miniature Fixed Side Rectangular Type



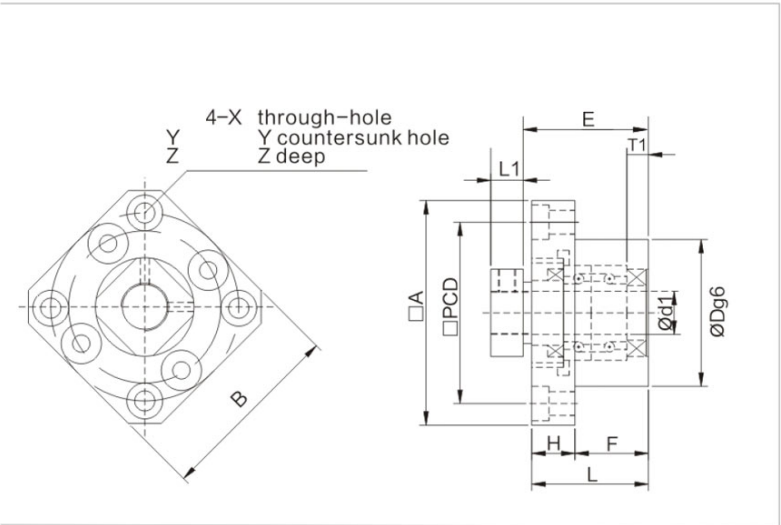
Model	d1	L	L1	L2	L3	B	H	b±0.02	h±0.02	B1	H1	P	X
EK 10	10	24	6	29.5	6	70	43	35	25	36	24	52	9
EK 12	12	24	6	29.5	6	70	43	35	25	36	24	52	9
EK 15	15	25	6	35	5	80	49	40	30	41	25	60	11
EK 20	20	42	10	50	10	95	58	47.5	30	56	25	75	11

EF Series - Miniature Floated Side Rectangular Type



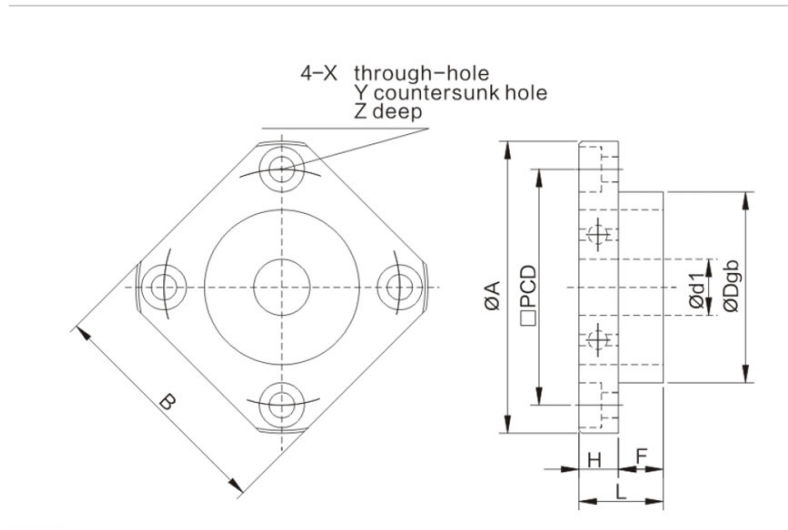
Model	d1	L	B	H	b±0.02	h±0.02	B1	H1	P	X	Y	Z
EF 10	8	20	70	43	35	25	36	24	52	9	—	—
EF 12	10	20	70	43	35	25	36	24	52	9	—	—
EF 15	15	20	80	49	40	30	41	25	60	9	—	—
EF 20	20	26	95	58	47.5	30	56	25	75	11	—	—

FK Series - Fixed Side Round Type



Model	d1	L	H	F	E	Dg6	A	PCD	B	L1	T1	X	Y	Z
FK 10	10	27	10	17	29.5	34	52	42	42	7.5	5	4.5	8	4
FK 12	12	27	10	17	29.5	36	54	44	44	7.5	5	4.5	8	4
FK 15	15	32	15	17	36	40	63	50	52	10	6	5.5	9.5	6
FK 20	20	52	22	30	50	57	85	70	68	8	10	6.6	11	10
FK 25	25	57	27	30	60	63	98	80	79	13	10	9	15	13
FK 30	30	62	30	32	61	75	117	95	93	11	12	11	17.5	15

FF Series - Floated Side Round Type



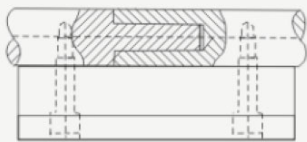
Model	d1	L	H	F	Dg6	A	PCD	B	X	Y	Z
FF 10	8	12	7	5	28	43	35	35	3.4	6.5	4
FF 12	10	15	7	8	34	52	42	42	4.5	8	4
FF 15	15	17	9	8	40	63	50	52	5.5	9.5	5.5
FF 20	20	20	11	9	57	85	70	68	6.6	11	6.5
FF 25	25	24	14	10	63	98	80	79	9	14	8.5
FF 30	30	27	18	9	75	117	95	93	11	17.5	11

WC/WCS Series - Cylinder Linear Rail

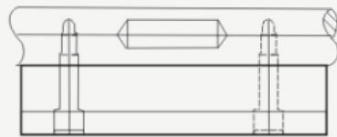
Special Machining for Shaft

We can offer linear shaft with diameter $\phi 5\text{ mm} \sim \phi 150\text{ mm}$, maximum length up to 6000mm.

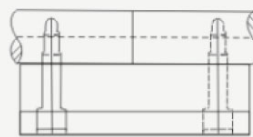
1. When you are special requirements on length, we can meet your machining requirements with different length; when you request above 6000mm, we can anti-connect for you. (shown in Fig a)



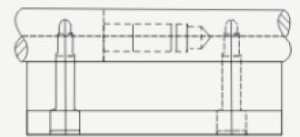
Dowel joint



Dowel joint

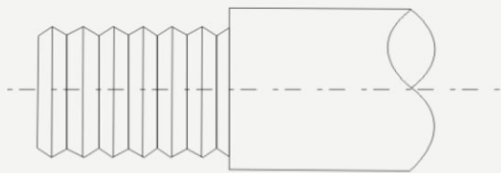


Butted joint

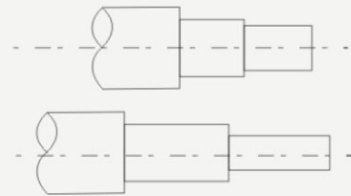


Threaded and ground joint

2. When you are special requirements on machining, such as threading, coaxial holes drilled and tapped, radial holes drilled and tapped, reduced shaft diameter etc, we can machine for you, and these special machines are finished after heat treatment and hard chromic so that ensure the precision of product. send us your detailed sketch or blue print for prompt quotation and action. your should be satisfied with our service.



THREADING



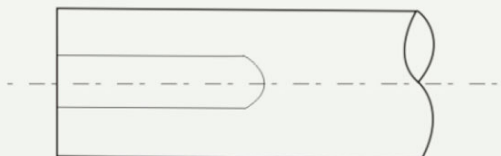
REDUCED SHAFT DIAMETER



COAXIAL HOLES DRILLED AND TAPPED



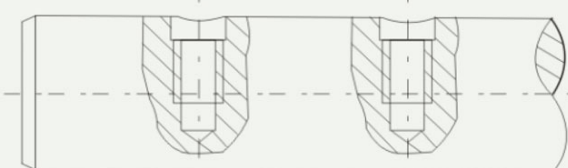
FLATS-SINGLE OR MULTIPLE



KEY WAY



SNAP RING GROOVES

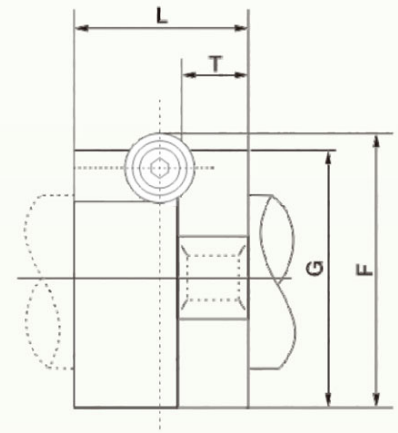
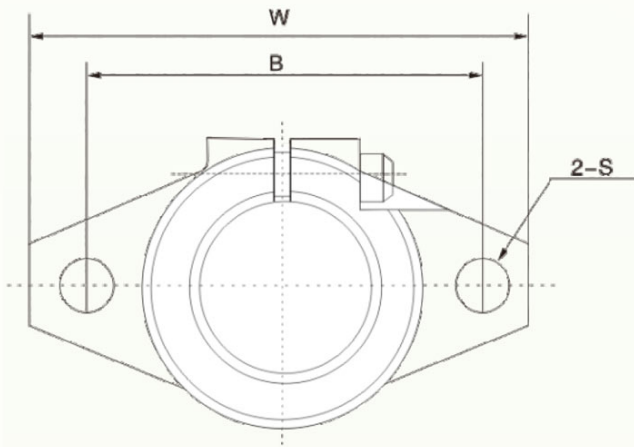


RADIAL HOLES DRILLED AND TAPPED



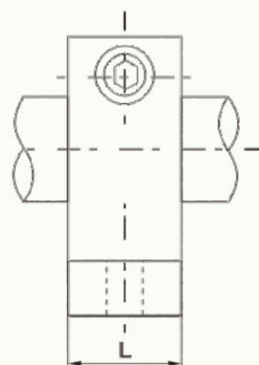
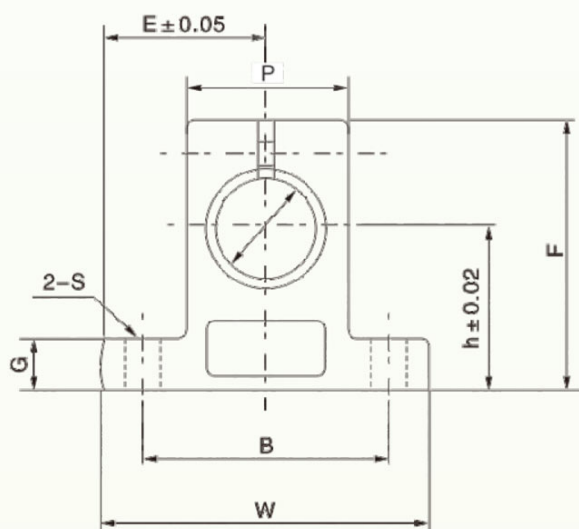
CHAMFERING

SHF Series - Winding Shape Ball Joint Rod Ends



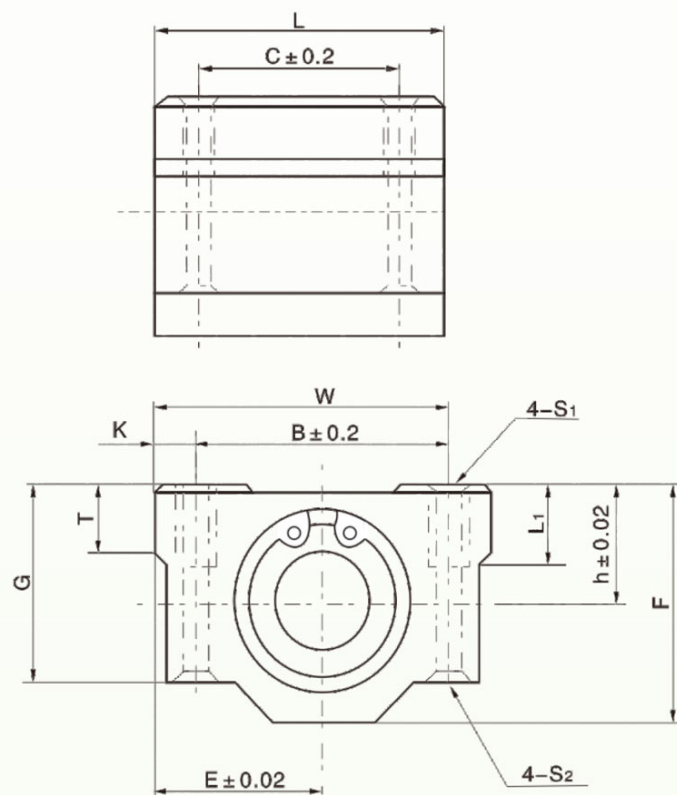
Model No.	Shaft Diameter	Dimensions (mm)							Locking Bolt	Clamping Bolt	weight (kg)
		W	L	T	F	G	B	S			
SHF 3	3	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 4	4	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 5	5	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 6	6	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 8	8	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 10	10	43	10	5	24	20	32	5.5	M4	M5	0.013
SHF 12	12	47	13	7	28	25	36	5.5	M4	M5	0.020
SHF 13	13	47	13	7	28	25	36	5.5	M4	M5	0.020
SHF 16	16	50	16	8	31	28	40	5.5	M4	M5	0.027
SHF 20	20	60	20	8	37	34	48	7	M5	M6	0.040
SHF 25	25	70	25	10	42	40	56	7	M5	M6	0.060
SHF 30	30	80	30	12	50	46	64	9	M6	M8	0.110
SHF 35	35	92	35	14	58	50	72	12	M8	M10	0.380
SHF 40	40	102	40	16	67	56	80	12	M10	M10	0.510
SHF 50	50	122	50	19	83	70	96	14	M12	M12	0.890
SHF 60	60	140	60	23	95	82	112	14	M12	M12	1.500

SK Series - Linear Motion Ball Slide Units



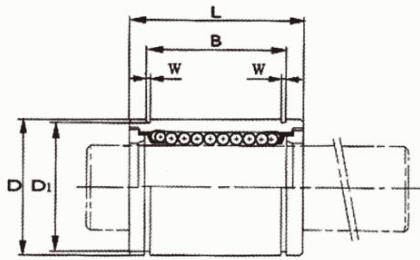
Support Designation	Shaft Dimensions	Dimensions (mm)									Locking Bolt	Clamping Bolt	weight (g)
		h	E	W	L	F	G	P	B	S			
SK 8	8	20	21	42	14	32.8	6	18	32	5.5	M4	M5	24
SK 10	10	20	21	42	14	32.8	6	18	32	5.5	M4	M5	24
SK 12	12	23	21	42	14	37.5	6	20	32	5.5	M4	M5	30
SK 13	13	23	21	42	14	37.5	6	20	32	5.5	M4	M5	30
SK 16	16	27	24	48	16	44	8	25	38	5.5	M4	M5	40
SK 20	20	31	30	60	20	51	10	30	45	6.6	M5	M6	70
SK 25	25	35	35	70	24	60	12	38	56	6.6	M6	M6	130
SK 30	30	42	42	84	28	70	12	44	64	9	M6	M8	180
SK 35	35	50	49	98	32	82	15	50	74	11	M8	M10	270
SK 40	40	60	57	114	36	96	15	60	90	11	M8	M10	420
SK 50	50	70	63	126	40	120	18	74	100	14	M12	M12	750
SK 60	60	80	74	148	45	136	18	90	120	14	M12	M12	1100

SCS...UU/LUU Series - Linear Motion Ball Slide Units

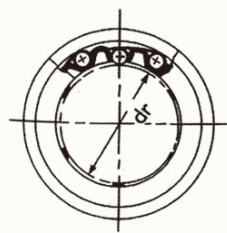


Unit Designation	Dimensions (mm)													Slide bush			weight (g)
	T	h	E	W	L	F	G	B	C	K	S ₁	S ₂	L ₁	Designation	Basic load rating		
															dynamic CN	static CoN	
SCS 6UU	6	9	15	30	25	18	15	20	15	5	M4	3.4	8	LM 6UU	206	265	34
SCS 8UU	6	11	17	34	30	22	18	24	18	5	M4	3.4	8	LM 8UU	274	392	52
SCS 10UU	8	13	20	40	35	26	21	28	21	6	M5	4.3	12	LM 10UU	372	549	92
SCS 12UU	8	15	21	42	36	28	24	30.5	26	5.75	M5	4.3	12	LM 12UU	510	784	102
SCS 13UU	8	15	22	44	39	30	24.5	33	26	5.5	M5	4.3	12	LM13UU	510	784	120
SCS 16UU	9	19	25	50	44	38.5	32.5	36	34	7	M5	4.3	12	LM 16UU	774	1180	200
SCS 20UU	11	21	27	54	50	41	35	40	40	7	M6	5.2	12	LM 20UU	882	1370	255
SCS 25UU	12	26	38	76	67	51.5	42	54	50	11	M8	7	18	LM 25UU	980	1570	600
SCS 30UU	15	30	39	78	72	59.5	49	58	58	10	M8	7	18	LM 30UU	1570	2740	735
SCS 35UU	18	34	45	90	80	68	54	70	60	10	M8	7	18	LM 35UU	1670	3140	1100
SCS 40UU	20	40	51	102	90	78	62	80	60	11	M10	8.7	25	LM 40UU	2160	4020	1590
SCS 50UU	25	52	61	122	110	102	80	100	80	11	M10	8.7	25	LM 50UU	3820	7940	3340
SCS 60UU	30	58	66	132	122	114	94	108	90	12	M10	10.7	25	LM 60UU	4700	10000	4270
SCS 8LUU	6	11	17	34	58	22	18	24	42	5	M4	3.4	8	LM 8LUU	274	392	100
SCS 10LUU	8	13	20	40	68	26	21	28	45	6	M5	4.3	12	LM 10LUU	372	549	180
SCS 12LUU	8	15	21	42	70	28	24	30.5	50	5.75	M5	4.3	12	LM 12LUU	510	784	200
SCS 13LUU	8	15	22	44	75	30	24.5	33	50	5.5	M5	4.3	12	Lm13LUU	510	784	230
SCS 16LUU	9	19	25	50	85	38.5	32.5	36	60	7	M5	4.3	12	LM 16LUU	774	1180	390
SCS 20LUU	11	21	27	54	96	41	35	40	70	7	M6	5.2	12	LM 20LUU	882	1370	490
SCS 25LUU	12	26	38	76	130	51.5	42	54	100	11	M8	7	18	LM 25LUU	980	1570	1165
SCS 30LUU	15	30	39	78	140	59.5	49	58	110	10	M8	7	18	LM 30LUU	1570	2740	1430
SCS 35LUU	18	34	45	90	155	68	54	70	120	10	M8	7	18	LM 35LUU	1670	3140	2130
SCS 40LUU	20	40	51	102	175	78	62	80	140	11	M10	8.7	25	LM 40LUU	2160	4020	3090
SCS 50LUU	25	52	61	122	215	102	80	100	160	11	M10	8.7	25	LM 50LUU	3820	7940	6530
SCS 60LUU	30	58	66	132	240	114	94	108	180	12	M12	10.7	25	LM 60LUU	4700	10000	9290

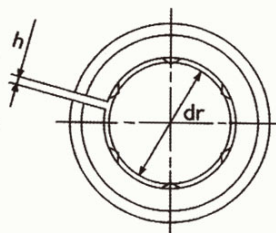
LM...UU/LUU Series - Linear Bearing



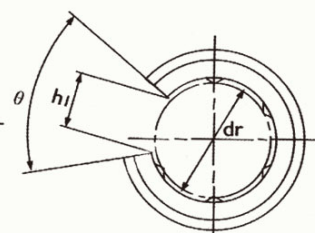
Nominal Part No.							Nominal Shaft Diameter(mm)
Standard	Type	Seal Type	Ball Circuit	Weight g	Adjustable Type	Open Type	dr
LM	5	LM 5UU	4	4	—	—	5
LM	6	LM 6UU	4	8	LM 6-AJ	—	6
LM	8S	LM 8SUU	4	11	LM 8S-AJ	—	8
LM	8	LM 8UU	4	16	LM 8-AJ	—	8
LM	10	LM 10UU	4	30	LM 10-AJ	—	10
LM	12	LM 12UU	4	31.5	LM 12-AJ	LM 12-OP	12
LM	13	LM 13UU	4	43	LM 13-AJ	LM 13-OP	13
LM	16	LM 16UU	5	69	LM 16-AJ	LM 16-OP	16
LM	20	LM 20UU	5	87	LM 20-AJ	LM 20-OP	20
LM	25	LM 25UU	6	220	LM 25-AJ	LM 25-OP	25
LM	30	LM 30UU	6	250	LM 30-AJ	LM 30-OP	30
LM	35	LM 35UU	6	390	LM 35-AJ	LM 35-OP	35
							38
LM	40	LM 40UU	6	585	LM 40-AJ	LM 40-OP	40
LM	50	LM 50UU	6	1580	LM 50-AJ	LM 50-OP	50
LM	60	LM 60UU	6	2000	LM 60-AJ	LM 60-OP	60



LM



LM...AJ



LM...OP

Major Dimensions and Tolerance (mm)								Eccentricity (max)	Radial Clearance (max)	Basic Load Ratings		Nominal Part No.
D	L	B	W	D ₁	h	h ₁	Temp			C kgf	Cor kgf	
10	15	10.2	1.1	9.6	—	—	—	8	-3	17	21	LM 5
12	19	13.5	1.1	11.5	1	—	—	12	-5	21	27	LM 6
15	17	11.5	1.1	14.3	1	—	—	12	-5	18	23	LM 8S
15	24	17.5	1.1	14.3	1	—	—	12	-5	27	41	LM 8
19	29	22	1.3	18	1	—	—	12	-5	38	56	LM 10
21	30	23	1.3	20	1.5	8	80°	12	-5	42	61	LM 12
23	32	23	1.3	22	1.5	9	80°	12	-7	52	79	LM 13
28	37	26.5	1.6	27	1.5	11	60°	12	-7	79	120	LM 16
32	42	30.5	1.6	30.5	1.5	11	60°	15	-9	88	140	LM 20
40	59	41	1.85	38	2	12	50°	15	-9	100	160	LM 25
45	64	44.5	1.85	43	2.5	15	50°	15	-9	160	280	LM 30
52	70	49.5	2.1	49	2.5	17	50°	20	-13	170	320	LM 35
60	80	60.5	2.1	57	3	20	50°	20	-13	220	410	LM 40
80	100	74	2.6	76.5	3	25	50°	20	-13	390	810	LM 50
90	110	85	3.15	86.5	3	30	50°	25	-16	480		LM 60

LMF/K/H...UU/LUU Series - Flange Linear Bearing



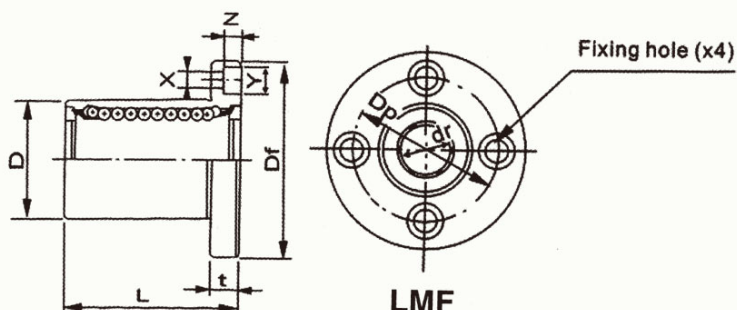
LMF



LMK

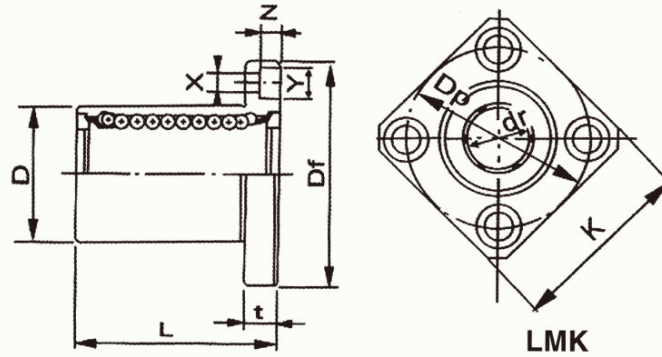


LMH



Nominal Part No.					Major Dimensions and Tolerance (mm)									Eccentricity Squareness μm μm		Basic Load Ratings		Nominal Part No.
Standard	Type	Seal Type	Ball Circuit	Weight g	dr	D	L	Flange										
								Df	t	dP	X	Y	Z			Dynamic CN	Static C ₀ N	
LMF	6	LMF 6UU	4	24	6	12	19	28	5	20	3.5	6	3.1	12	12	206	265	LMF 6
LMF	8S	LMF 6UU	4	32	8	15	17	32	5	24	3.5	6	3.1	12	12	176	216	LMF 8S
LMF	8	LMF 8SUU	4	37	8	15	24	32	5	24	3.5	6	3.1	12	12	274	392	LMF 8
LMF	10	LMF 10UU	4	72	10	19	29	40	6	29	4.5	7.5	4.1	12	12	372	549	LMF 10
LMF	12	LMF 12UU	4	76	12	21	30	42	6	32	4.5	7.5	4.1	12	12	510	784	LMF 12
LMF	13	LMF 13UU	4	88	13	23	32	43	6	33	4.5	7.5	4.1	12	12	510	784	LMF 13
LMF	16	LMF 16UU	4	120	16	28	37	48	6	38	4.5	7.5	4.1	12	12	774	1,180	LMF 16
LMF	20	LMF 20UU	5	180	20	32	42	54	8	43	5.5	9	5.1	15	15	882	1,370	LMF 20
LMF	25	LMF 25UU	5	340	25	40	59	62	8	51	5.5	9	5.1	15	15	980	1,570	LMF 25
LMF	30	LMF 30UU	6	470	30	45	64	74	10	60	6.6	11	6.1	15	15	1,570	2,740	LMF 30
LMF	35	LMF 35UU	6	650	35	52	70	82	10	67	6.6	11	6.1	20	20	1,670	3,140	LMF 35
LMF	40	LMF 40UU	6	1,060	40	60	80	96	13	78	9	14	8.1	20	20	2,160	4,020	LMF 40
LMF	50	LMF 50UU	6	2,200	50	80	100	116	13	98	9	14	8.1	20	20	3,820	7,900	LMF 50
LMF	60	LMF 60UU	6	3,000	60	90	110	134	18	112	11	17	11.1	25	25	4,700	10,000	LMF 60

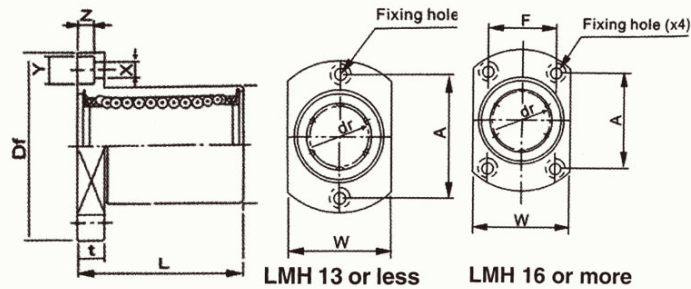
SI Unit 1N=0.102kgf



LMK

Nominal Part No.					Major Dimensions and Tolerance										Eccentricity Squareness		Basic Load Ratings		Nominal Part No.
Standard	Type	Seal Type	Ball Circuit	Weight g	dr	D	L	Flange									μm	μm	
								Df	K	t	DP	X	Y	Z					
LMK	6	LMK 6UU	4	24	6	12	19	28	22	5	20	3.5	6	3.1	12	12	206	265	LMK 6
LMK	8S	LMK 6UU	4	32	8	15	17	32	25	5	24	3.5	6	3.1	12	12	176	216	LMK 8S
LMK	8	LMK 8SUU	4	37	8	15	24	32	25	5	24	3.5	6	3.1	12	12	274	392	LMK 8
LMK	10	LMK 10UU	4	72	10	19	29	40	30	6	29	4.5	7.5	4.1	12	12	372	549	LMK 10
LMK	12	LMK 12UU	4	76	12	21	30	42	32	6	32	4.5	7.5	4.1	12	12	510	784	LMK 12
LMK	13	LMK 13UU	4	88	13	23	32	43	34	6	33	4.5	7.5	4.1	12	12	510	784	LMK 13
LMK	16	LMK 16UU	5	120	16	28	37	48	37	6	38	4.5	7.5	4.1	12	12	774	1,180	LMK 16
LMK	20	LMK 20UU	5	180	20	32	42	54	42	8	43	5.5	9	5.1	15	15	882	1,370	LMK 20
LMK	25	LMK 25UU	5	340	25	40	59	62	50	8	51	5.5	9	5.1	15	15	980	1,570	LMK 25
LMK	30	LMK 30UU	6	470	30	45	64	74	58	10	60	6.6	11	6.1	15	15	1,570	2,740	LMK 30
LMK	35	LMK 35UU	6	650	35	52	70	82	64	10	67	6.6	11	6.1	20	20	1,670	3,140	LMK 35
LMK	40	LMK 40UU	6	1,060	40	60	80	96	75	13	78	9	14	8.1	20	20	2,160	4,020	LMK 40
LMK	50	LMK 50UU	6	2,200	50	80	100	116	92	13	98	9	14	8.1	20	20	3,820	7,900	LMK 50
LMK	60	LMK 60UU	6	3,000	60	90	110	134	106		112	11	17	11.1	25	25	4,700	10,000	LMK 60

SI Unit 1N=0.102kgf



LMH 13 or less

LMH 16 or more

Nominal Part No.					Major Dimensions and Tolerance										Eccentricity Squareness		Basic Load Ratings		Nominal Part No.	
Standard	Type	Seal Type	Ball Circuit	Weight g	dr	D	L	Flange									Dynamic CN	Static C ₀ N		
								Df	W	t	A	F	X	Y						Z
LMH	6	LMH 6UU	4	21	6	12	19	28	18	5	20	3.5	6	3.1	12	12	206	265	LMH 6	
LMH	8	LMH 8UU	4	33	8	15	24	32	21	5	24	3.5	6	3.1	12	12	274	392	LMH 8	
LMH	10	LMH 10UU	4	64	10	19	29	40	25	6	29	4.5	7.5	4.1	12	12	372	549	LMH 10	
LMH	12	LMH 12UU	4	68	12	21	30	42	27	6	32	4.5	7.5	4.1	12	12	510	784	LMH 12	
LMH	13	LMH 13UU	4	88	13	23	32	43	29	6	33	4.5	7.5	4.1	12	12	510	784	LMH 13	
LMH	16	LMH 16UU	5	112	16	28	37	48	34	6	31	4.5	7.5	4.1	12	12	774	1,180	LMH 16	
LMH	20	LMH 20UU	5	167	20	32	42	54	38	8	36	5.5	9	5.1	15	15	882	1,370	LMH 20	
LMH	25	LMH 25UU	6	325	25	40	59	62	46	8	40	5.5	9	5.1	15	15	980	1,570	LMH 25	
LMH	30	LMH 30UU	6	388	30	45	64	74	51	10	49	6.6	11	6.1	15	15	1,570	2,740	LMH 30	

SI Unit 1N=0.102kgf

KGT[®]

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Whatsapp



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