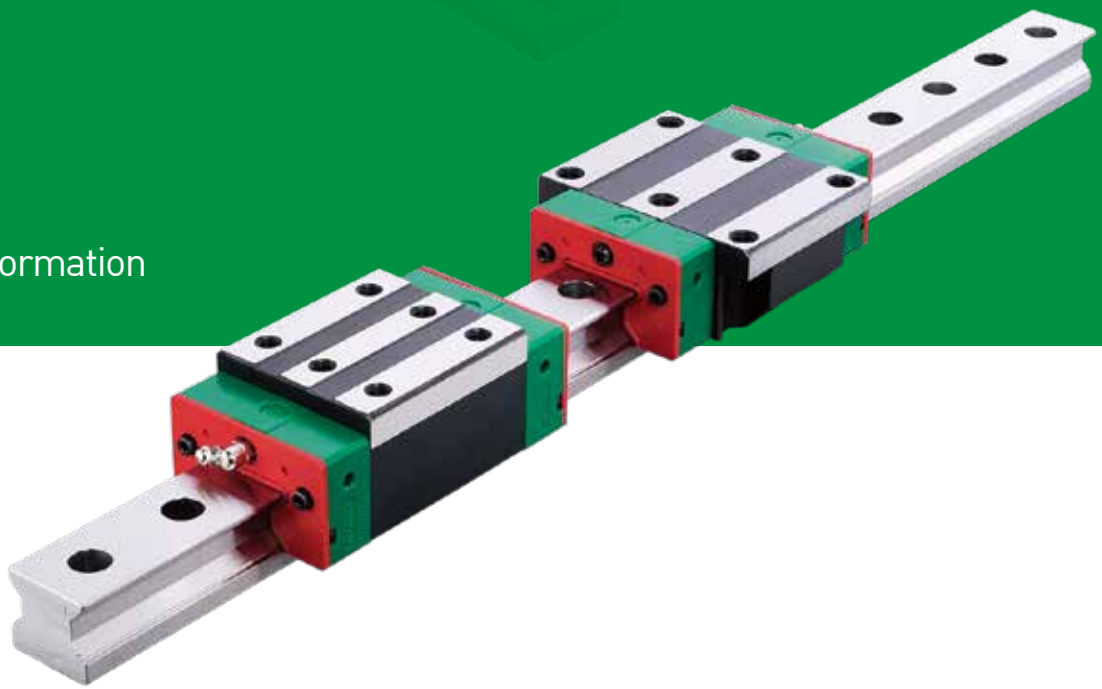
HIWIN®
Motion Control and System Technology

Linear Guideway

Technical Information



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HIWIN®
Motion Control and System Technology

INDUSTRIE 4.0 Best Partner

Multi Axis Robot

Pick-and-place / Assembly /
Array and packaging / Semiconductor /
Electro-Optical industry /
Automotive industry / Food industry

- Articulated Robot
- Delta Robot
- SCARA Robot
- Wafer Robot
- Electric Gripper
- Integrated Electric Gripper
- Rotary Joint

Single Axis Robot

Precision / Semiconductor /
Medical / FPD

- KK, SK
- KS, KA
- KU, KE, KC

Direct Drive Rotary Table

Aerospace / Medical / Automotive industry /
Machine tools / Machinery industry

- RAB Series
- RAS Series
- RCV Series
- RCH Series

Ballscrew

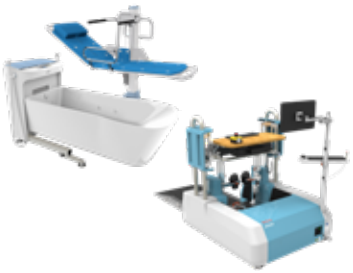
Precision Ground / Rolled

- Super S series
- Super T series
- Mini Roller
- Ecological & Economical lubrication Module E2
- Rotating Nut (R1)
- Energy-Saving & Thermal-Controlling (C1)
- Heavy Load Series (RD)
- Ball Spline

Linear Guideway

Automation / Semiconductor / Medical

- Ball Type--HG, EG, WE, MG, CG
- Quiet Type--QH, QE, QW, QR
- Other--RG, E2, PG, SE, RC



Medical Equipment

Hospital / Rehabilitation centers /
Nursing homes

- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Bearing

Machine tools / Robot

- Crossed Roller Bearings
- Ball Screw Bearings
- Linear Bearing
- Support Unit

AC Servo Motor & Drive

Semiconductor / Packaging machine
/SMT / Food industry / LCD

- Drives-D1, D1-N, D2T
- Motors-50W~2000W

Driven Tool Holders

All kinds of turret

- VDI Systems
  Radial Series, Axial Series, MT
- BMT Systems
  DS, NM, GW, FO, MT, OM, MS

Linear Motor

Automated transport / AOI application
/ Precision / Semiconductor

- Iron-core Linear Motor
- Coreless Linear Motor
- Linear Turbo Motor LMT
- Planar Servo Motor
- Air Bearing Platform
- X-Y Stage
- Gantry Systems

Torque Motor (Direct Drive Motor)

Inspection / Testing equipment /
Machine tools / Robot

- Rotary Tables-TMS,TMY,TMN
- TMRW Series
- TMRI Series

HIWIN®

Linear Guideways

Technical Information Index

(The specifications in this catalogue are subject to change without notification.)

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 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 series - CNC machining centers, heavy duty cutting machines, CNC grinding machines, injection molding machines, electric discharge machines, wire cutting machines, plano millers

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

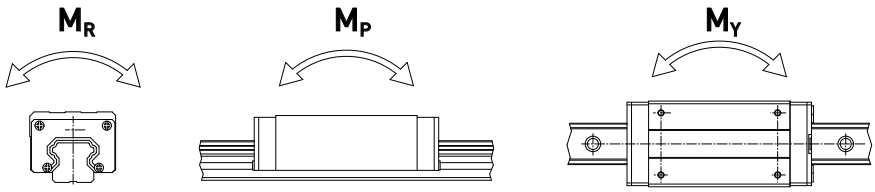
1-3-1 Basic Static Load

(1) Static load rating (C_0)

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 (M_0)

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 applys 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

$$f_{SL}=\frac{C_0}{P} \text{ or } f_{SM}=\frac{M_0}{M} \qquad \text{Eq.1.1}$$

f_{SL} : Static safety factor for simple load
f_{SM} : Static safety factor for moment
C_0 : Static load rating (kN)
M_0 : Static permissible moment (kN•mm)
P : Calculated working load (kN)
M : Calculated appling 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 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: $$L=\left(\frac{C}{P}\right)^{3}\cdot 50km=\left(\frac{C}{P}\right)^{3}\cdot 31mile \quad \text{Eq.1.2}$$

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

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

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

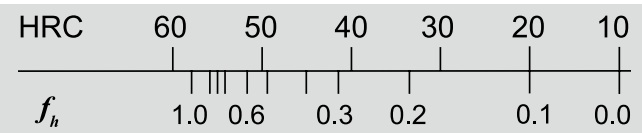
L : Nominal life
f_h : Hardness factor
C : Basic dynamic load rating
f_t : Temperature factor
P_C : Calculated load
f_W : Load factor

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.

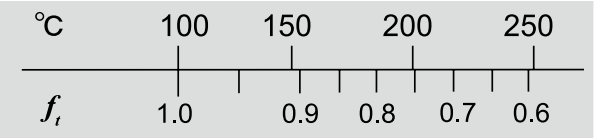
Raceway hardness



(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 enviornment 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 empircal factor.

Table 1-2 **Load factor**

Loading Condition	Service Speed	f_w
No impacts & vibration	V ≦ 15 m/min	1 ~ 1.2
Small impacts	15 m/min <V ≦ 60 m/min	1.2 ~ 1.5
Normal load	60m/min < V ≦ 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.

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

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

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

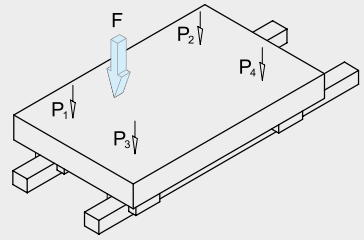
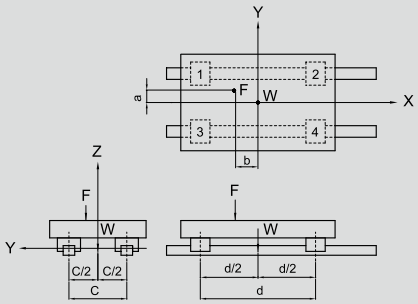
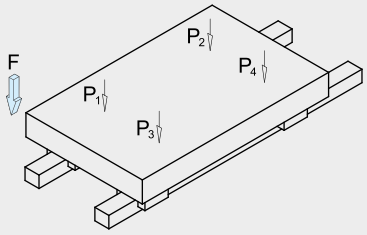
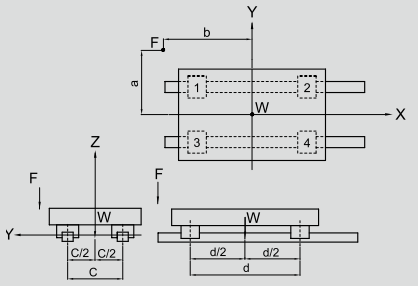
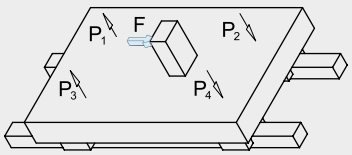
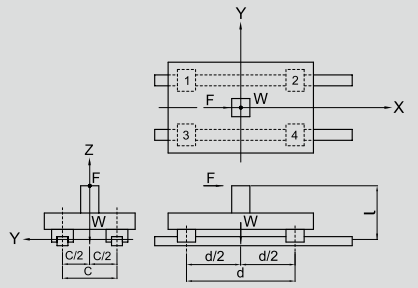
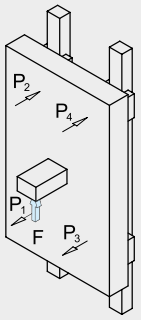
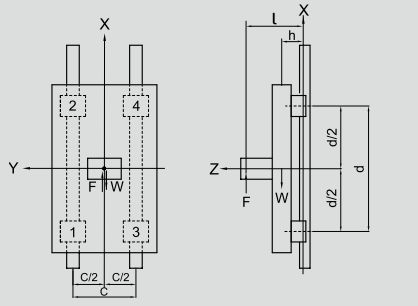
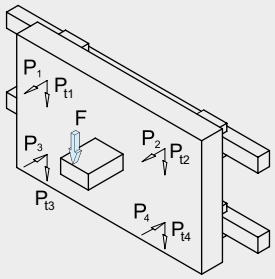
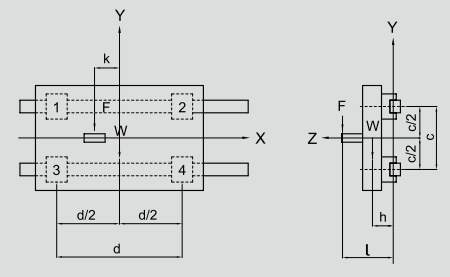
1-5 Applied Loads

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

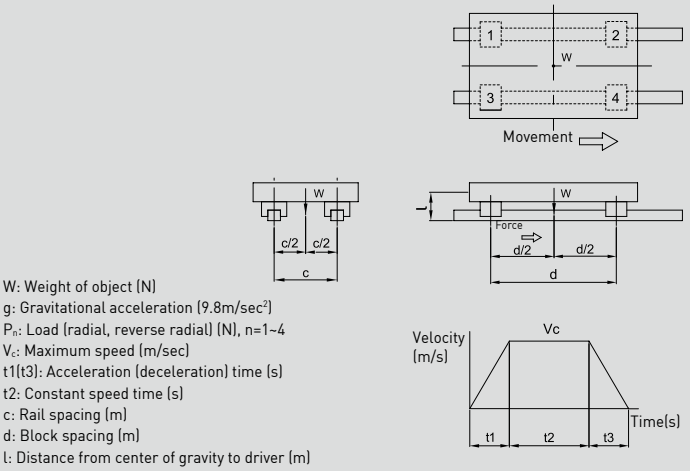
W: Applied weight
l: Distance from external force to driver
c: Rail spacing

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_{tn}: Load (lateral), n=1~4
h: Distance from center of gravity to driver

(2) Loads with inertia forces

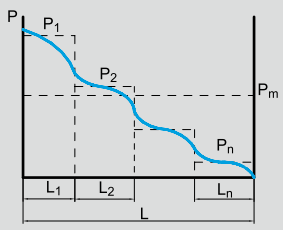
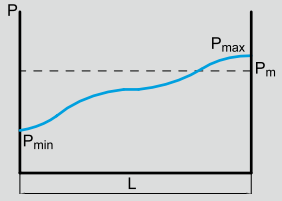
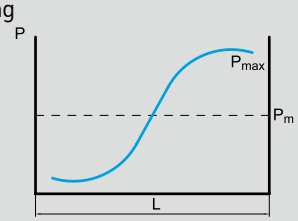
Table 1-4 **Calculation Examples for Loads with Inertia Forces**

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 $P_1 = P_3 = \frac{W}{4} + \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t1} \cdot \frac{l}{d}$ $P_2 = P_4 = \frac{W}{4} - \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t1} \cdot \frac{l}{d}$ ○ Deceleration $P_1 = P_3 = \frac{W}{4} - \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t3} \cdot \frac{l}{d}$ $P_2 = P_4 = \frac{W}{4} + \frac{1}{2} \cdot \frac{W}{g} \cdot \frac{V_c}{t3} \cdot \frac{l}{d}$

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

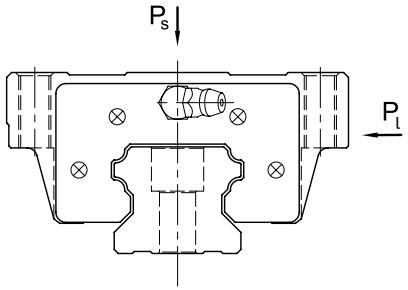
When the load on a linear guideway fluctuates greatly, the variable load condition must be considered in the life calculation. The definition of the mean load is the load equal to the bearing fatigue load under the variable loading conditions. It can be calculated by using table 1-5.

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

Operation Condition	Mean load
Step load 	$P_m = \sqrt[3]{1/L(P_1^3 \cdot L_1 + P_2^3 \cdot L_2 + \ldots + P_n^3 \cdot L_n)}$ 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

HIWIN 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 Series

$$P_e = P_s + P_l \quad \text{Eq.1.8}$$

MG Series

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

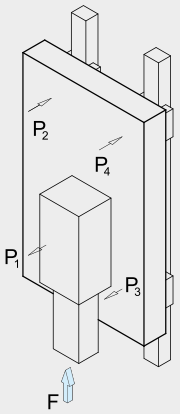
when $P_l > P_s$ $P_e = P_l + 0.5 \cdot P_s$ Eq.1.10

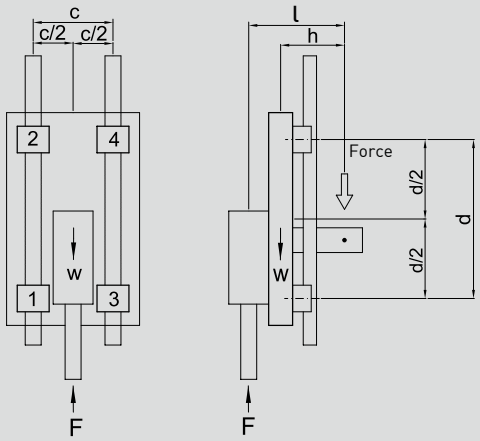
1-5-4 Calculation Example for Service Life

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	d : 600 mm	Weight (W) : 15 kN
C : 38.74 kN	c : 400 mm	Acting force (F) : 1 kN
C_0 : 52.19 kN	h : 200 mm	Temperature: normal temperature
Preload: Z0	l : 250 mm	Load status: normal load





- Calculation of acting loads

$$P_1 \sim P_4 = + \frac{W \times h}{2d} - \frac{F \times l}{2d} = + \frac{15 \times 200}{2 \times 600} - \frac{1 \times 250}{2 \times 600} = 2.29\,(kN)$$

$$P_{max} = |P_1 \sim P_4| = 2.29\,(kN)$$

- Because preload is Z0, $P_c = P_{max} = 2.29\,(kN)$

Note: The larger preload (ZA, AB) will increase the rigidity, but decrease the nominal life of guideway.

- Calculation for life L

$$L = \left(\frac{f_h \times f_t \times C}{f_w \times P_c}\right)^3 \times 50 = \left(\frac{1 \times 1 \times 38.74}{2 \times 2.29}\right)^3 \times 50 = 30{,}258\ (km)$$

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.

$$F = \mu \cdot W + S \quad \text{Eq.1.11}$$

F : Friction (kN)
S : Friction resistance (kN)
μ : Coefficient of friction
W : Normal loads (kN)

1-7 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 .

1-7-1 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.

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

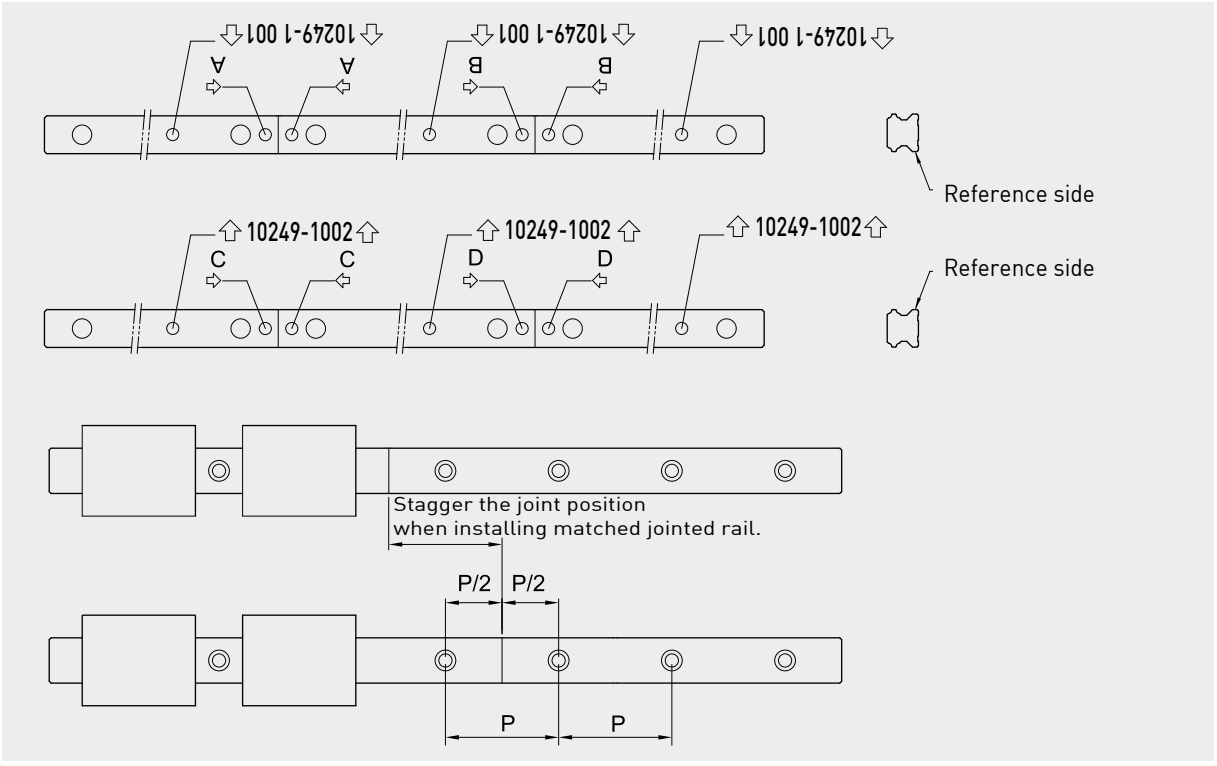
T : Feeding frequency of oil (hour)
V_e : speed (m/min)

1-7-2 Oil

The recommended viscosity of oil is about 32~150cSt. 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 0.3cm^3/hr.

1-8 The Butt-joint Rail

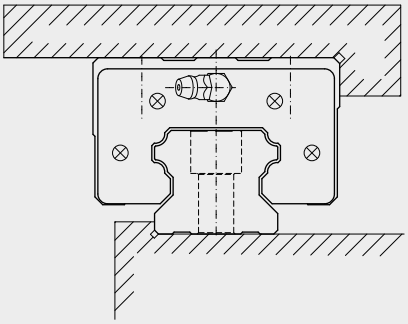
Jointed rail should be installed by following the arrow sign and ordinal number which is marked on the surface of each rail.
For matched pair, jointed rails, the jointed positions should be staggered. This will avoid accuracy problems due to discrepancies between the 2 rails (see figure).



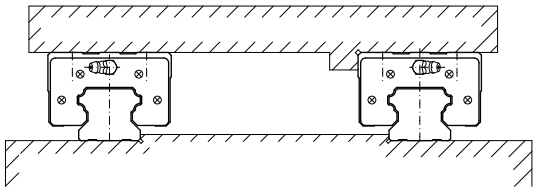
1-9 Mounting Configurations

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:

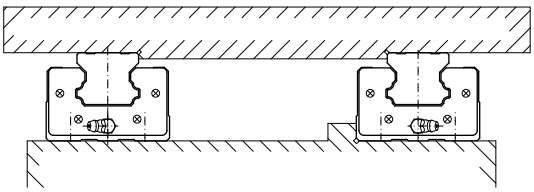
Use of one rail and mounting reference side



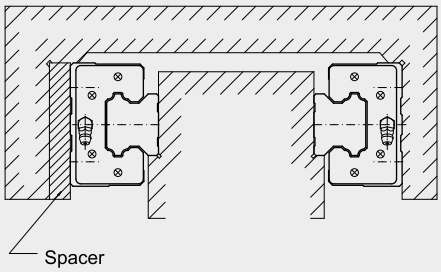
use of two rails(block movement)



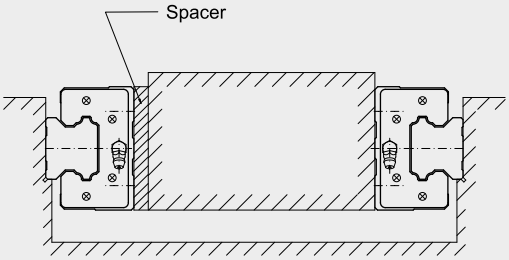
use of two rails(block fixed)



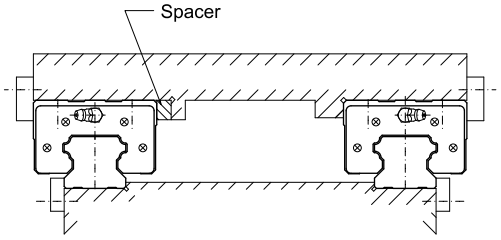
use of two external rails



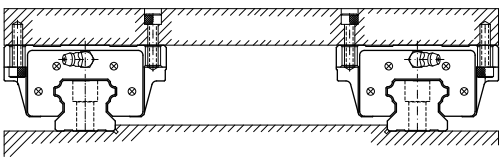
use of two internal rails



total surface fixed installation



HGW type block with mounting holes in different directions.

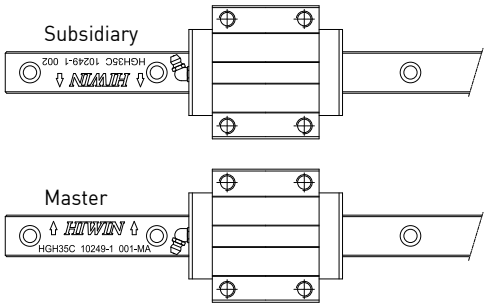


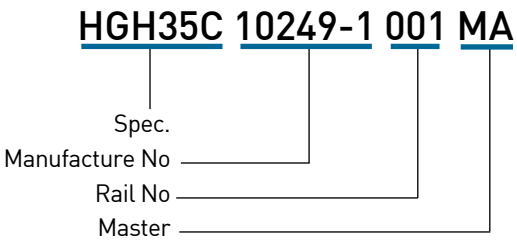
1-10 Mounting Procedures

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

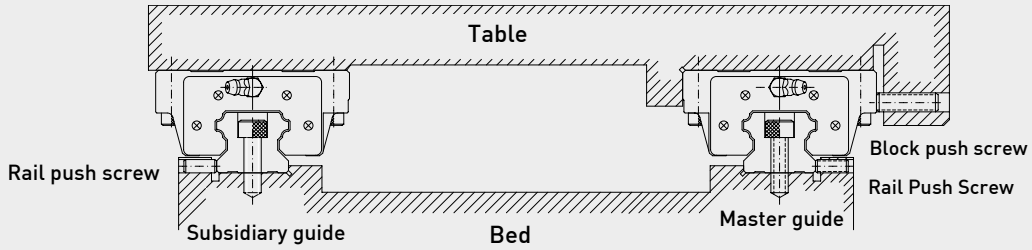
1-10-1 Master and Subsidiary Guide

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.





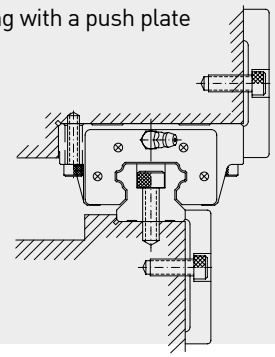
1-10-2 Installation to Achieve High Accuracy and Rigidity



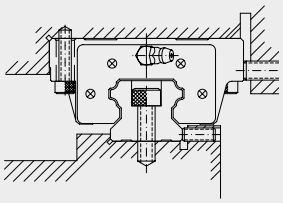
(1) Mounting methods

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.

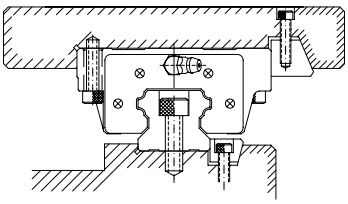
Mounting with a push plate



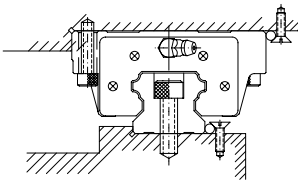
Mounting with push screws



Mounting with taper gib

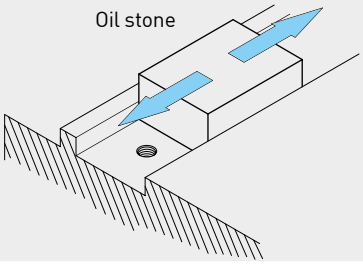


Mounting with needle roller

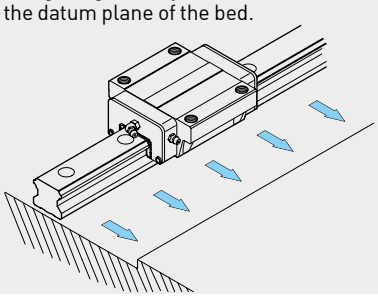


(2) Procedure of rail installation

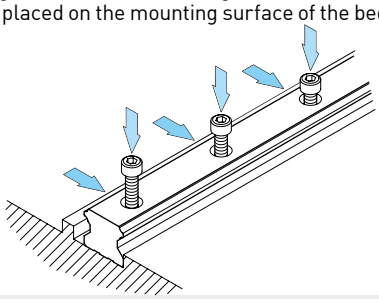
1 Before starting, remove all dirt from the mounting surface of the machine.



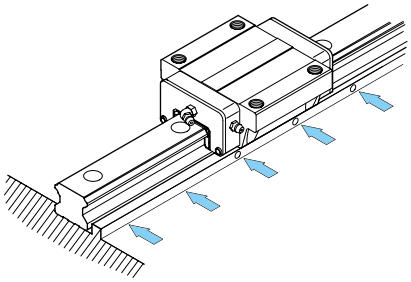
2 Place the linear guideway gently on the bed. Bring the guideway into close contact with the datum plane of the bed.



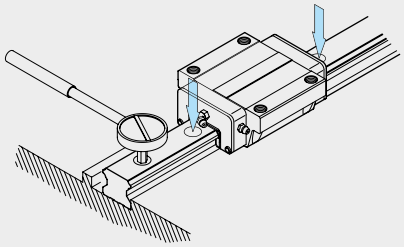
3 Check for correct thread engagement when inserting a bolt into the mounting hole while the rail is being placed on the mounting surface of the bed.



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

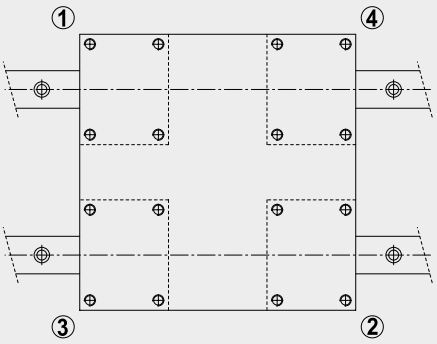


5 Tighten the mounting bolts with a torque wrench to the specified torque.



6 Install the remaining linear guideway in the same way.

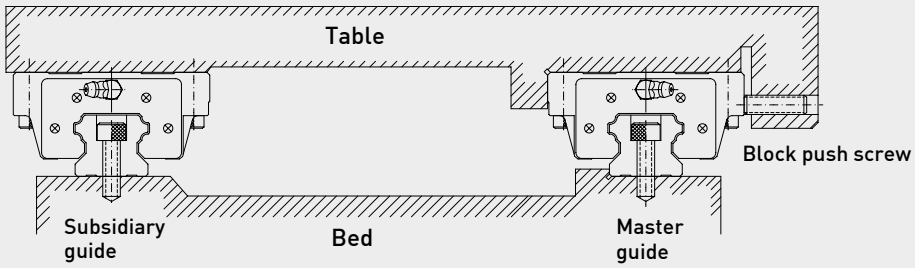
(3) Procedure of block installation



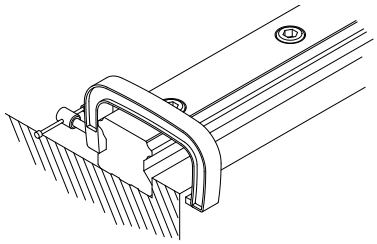
- Place the table gently on the blocks. Next, tighten the block mounting bolts temporarily.
- Push the blocks against the datum plane of the table and position the table by tightening the push screws.
- The table can be fixed uniformly by tightening the mounting bolts on master guide side and subsidiary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

1-10-3 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.

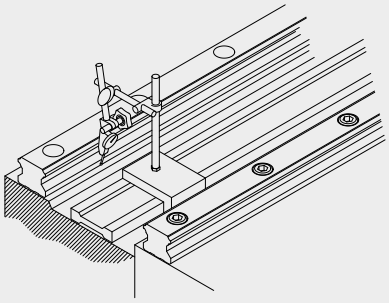


(1) Installation of the rail on the subsidiary guide side

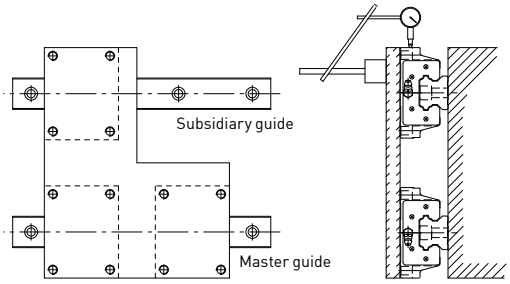


- **Using a vice**
  Place the rail into the mounting plane of the bed. Tighten the mounting bolts temporarily; then use a vice to push the rail against the side datum plane of the bed. Tighten the mounting bolts in sequence to the specified torque.

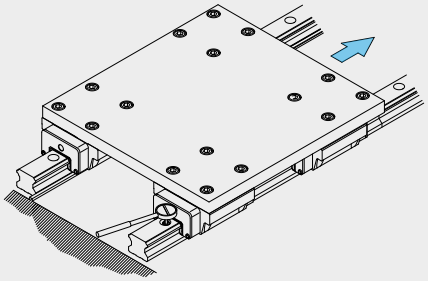
(2) Installation of the rail on the subsidiary guide side



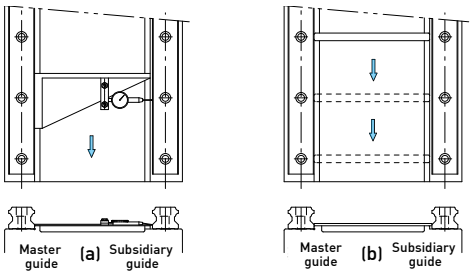
- **Method with use of a straight edge**
  Set a straight edge between the rails parallel to the side datum plane of the rail on the master guide side by using a dial gauge. Use the dial gauge to obtain the straight alignment of the rail on the subsidiary guide side. When the rail on the subsidiary guide 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.



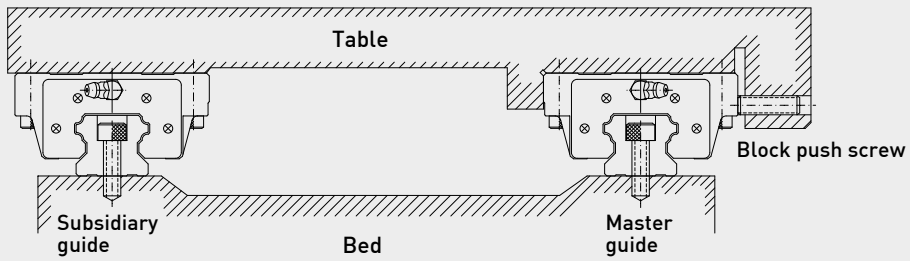
- **Method following the master guide side**
  When a rail on the master guide side is correctly tightened, fix both blocks on the master guide side and one of the two blocks on the subsidiary guide side completely to the table.
  When moving the table from one end of the rail, tighten the mounting bolts on the subsidiary guide side completely.



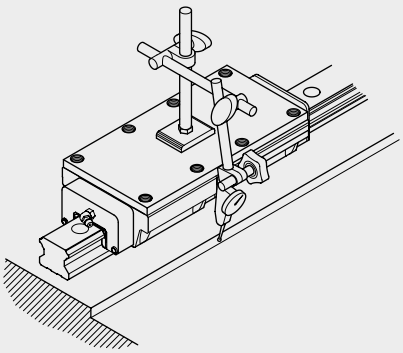
- **Method with use of a jig**
  Use a special jig to ensure the rail position on the subsidiary guide side. Tighten the mounting bolts to the specified torque in sequence.

1-10-4 When There Is No Side Surface of The Bed On The Master Guide Side

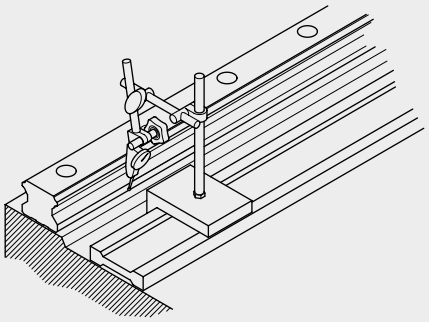
To ensure parallelism between the subsidiary guide and the master guide when there is no side surface, the following rail installation method is recommended. The installation of the blocks is the same as mentioned previously.



(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.

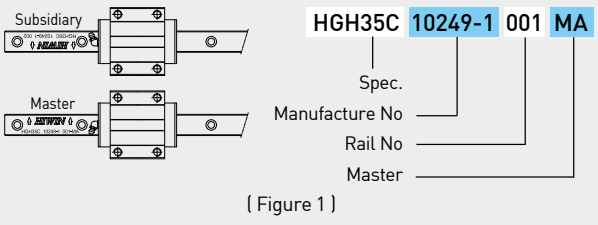
(2) Installation of the rail on the subsidiary guide side

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

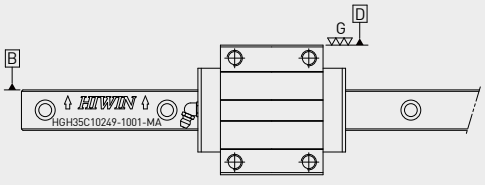
1-10-5 Linear Guideway Mounting Instructions

1. HIWIN guideways are supplied with a coating of anti-corrosion oil before being shipped. 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.

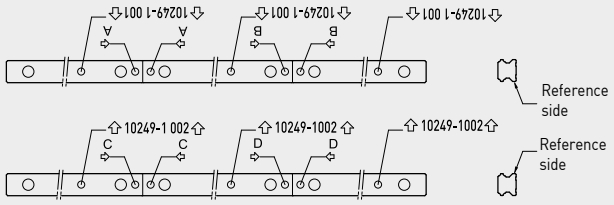


(Figure 1)

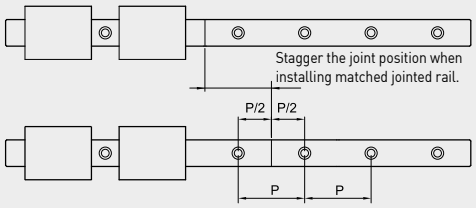


(Figure 2)

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.

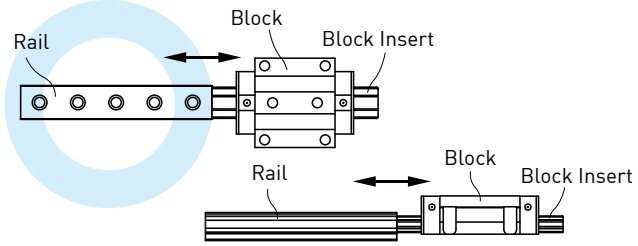


(Figure 3)

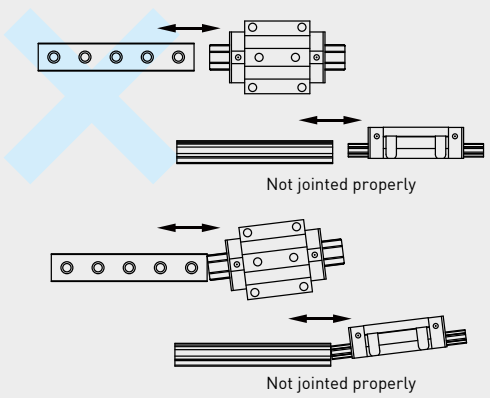


(Figure 4)

5. Do not remove blocks from rails when assembling the guideways in machines as far as possible. Please use block inserts (please see Figure 5) if it is necessary to remove/ mount block from/ onto rail.



6. Please do not randomly mix 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 HIWIN Technical Information).



(Figure 5)

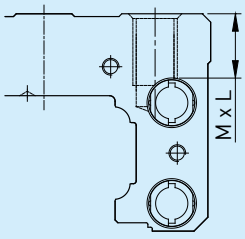
1-10-6 Linear Guideway Usage Instructions

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˚C~ 50˚C. For Q1 types (Quiet linear guideway), the range is -10˚C~80˚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 HIWIN 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. HIWIN Linear Guideway Product Series

In an effort to meet customer's requirement and service needs HIWIN 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, HIWIN 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	Flange		
			Tap hole	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	-	-	-	CGW-CC CGW-CA(1)
		Super Heavy Load	-	-	-	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
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

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 (C)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)	Normal (C)	High (H)	Precision (P)
HG	●	●	●	●	●	●	●	●
EG	●	●	●	●	●	●	●	●
WE	●	●	●	●	●	●	●	●
MGN	●	●	●	-	_	●	●	●
MGW	●	●	●	-	-	●	●	●
MGN-O	●	●	●	-	-	●	●	●
MGW-O	●	●	●	-	-	●	●	●
QH	●	●	●	●	●	●	●	●
QE	●	●	●	●	●	●	●	●
QW	●	●	●	●	●	●	●	●
CG	●	●	●	●	●	●	●	●
RG	-	●	●	●	●	-	●	●
QR	-	●	●	●	●	-	●	●

(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	●	●	●	●	●

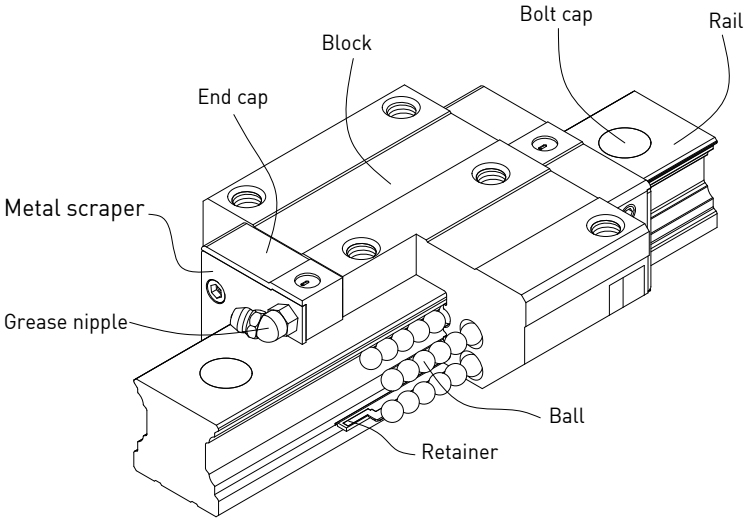
Series	Non-interchangeable Type			Interchangeable Type	
	Very Light Preload (Z0)	Medium Preload (ZA)	Heavy Preloa (ZB)	Very Light Preload (Z0)	Light Preload (ZA)
RG	●	●	●	●	●
QR	●	●	●	●	●

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-O	●	●	●	●	●	●
MGW-O	●	●	●	●	●	●

CG Series

Superior Rolling Moment Capacity with Cover Strip

2-8-2 Construction of CG Series

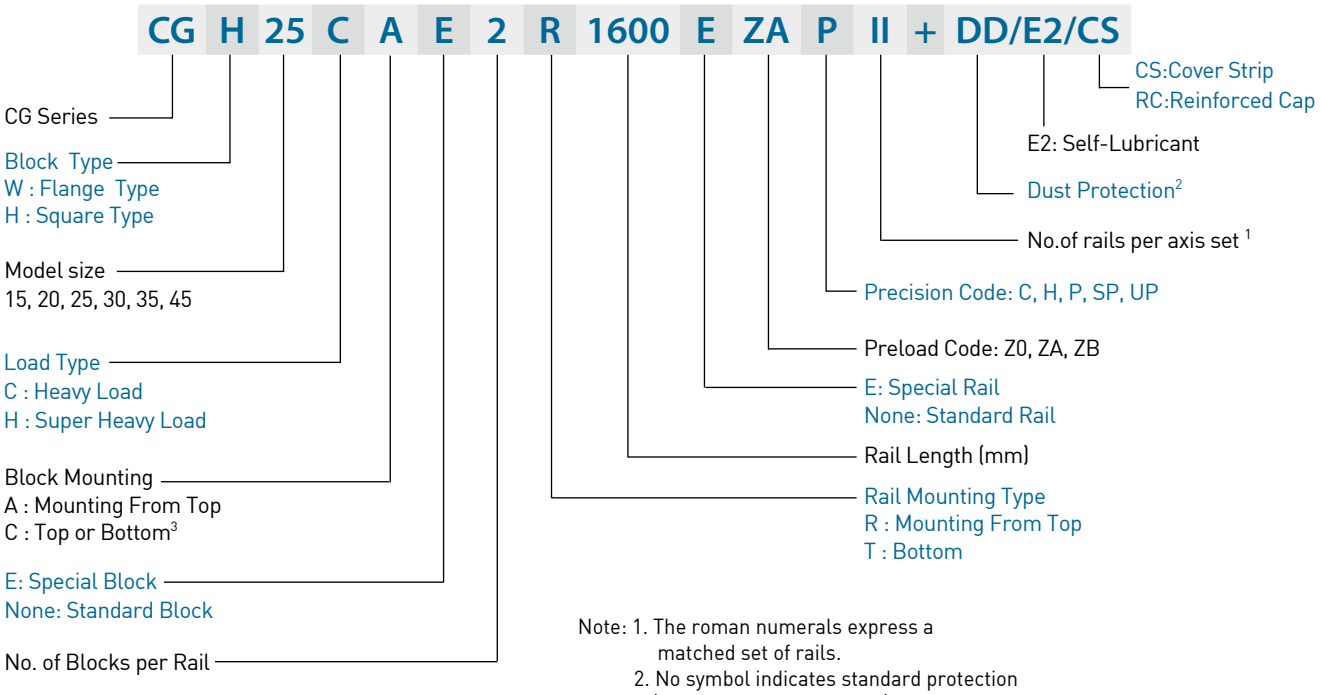


- Rolling circulation system: Block, Rail, End Cap and Retainer
- Lubrication system: Grease Nipple and Piping Joint
- Dust protection system: End seal, Bottom Seal, Bolt Cap, Metal scraper

2-8-3 Model Number of CG Series

CG 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 CG series contains the size, type, accuracy class, preload class, etc..

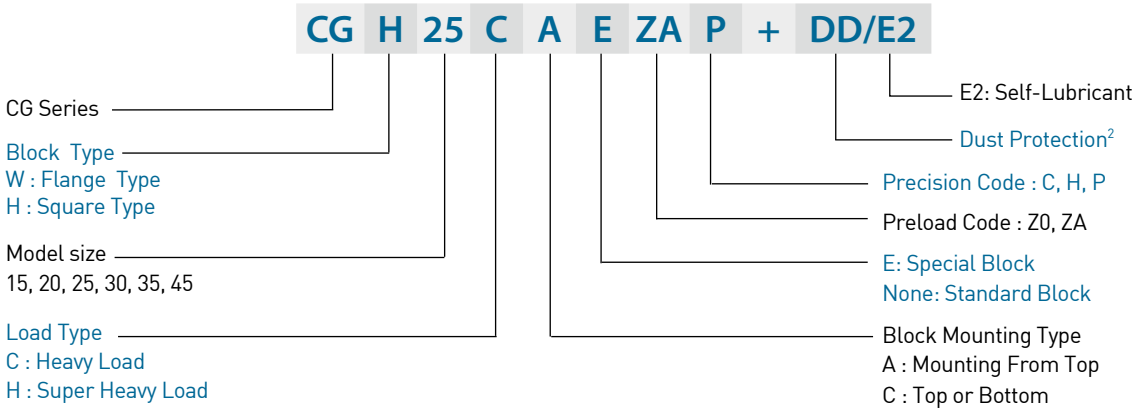
(1) Non-interchangeable type



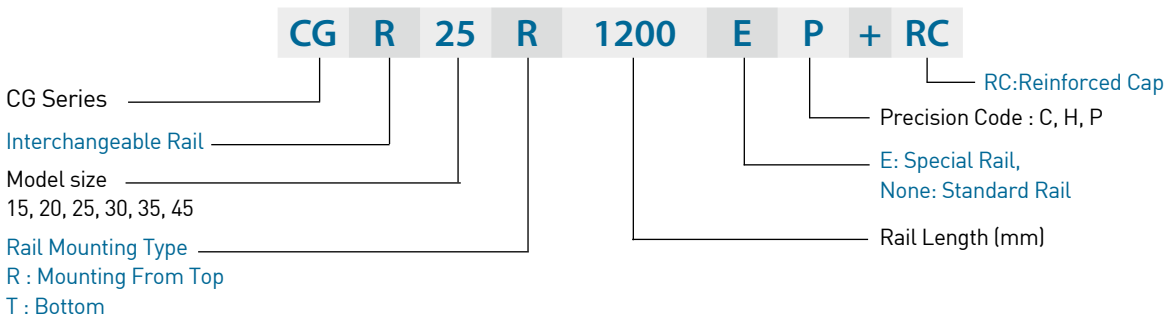
Note: 1. The roman numerals express a matched set of rails.
2. No symbol indicates standard protection (end seal and bottom seal).
DD: Double seals, bottom seal and metal scraper
3. For mounting type A ,The amount of block mounting holes is four.
For mounting type C ,The amount of block mounting holes is six.
Both types can be mounting from top or bottom.

(2) Interchangeable type

- **Model Number of CG Block**



- **Model Number of CG Rail**



CG Series

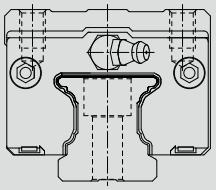
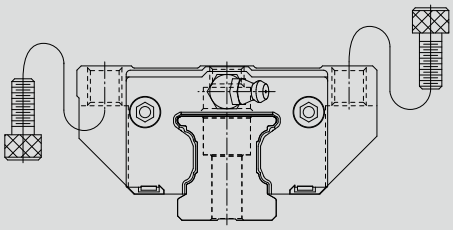
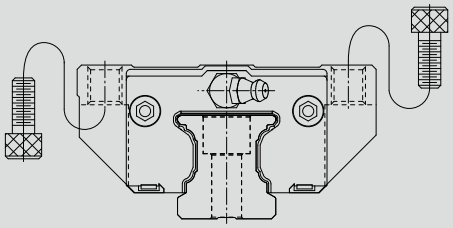
Superior Rolling Moment Capacity with Cover Strip

2-8-4 Types

(1) Block types

There are two types of blocks: flange and square.

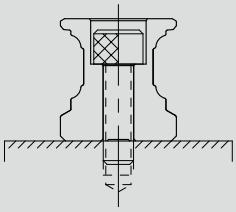
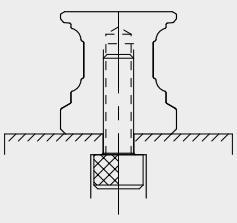
Table 2-8-1 **Block Types**

Type	Model	Shape	Height (mm)	Rail Length (mm)	Main Application
Square	CGH-CA CGH-HA		28 ↓ 90	100 ↓ 4000	○ Machine Centers ○ NC Lathes ○ Grinding Machines ○ Precision Machining Machines ○ Heavy Cutting Machines ○ Automation Devices ○ Transportation Equipment ○ Measuring Equipment ○ Devices Requiring High Positional Accuracy
Flange	CGW-CC CGW-HC		24 ↓ 60	100 ↓ 4000	
Flange	CGW-CA CGW-HA		24 ↓ 60	100 ↓ 4000	

(2) Rail types

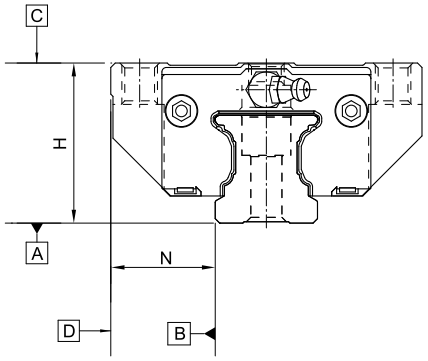
Besides the standard top mounting type, the bottom mounting type is also available.

Table 2-8-2 **Rail Types**

Mounting from Top	Mounting from bottom
	

2-8-5 Accuracy Classes

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



(1) Accuracy of non-interchangeable guideways

Table 2-8-3 **Accuracy Standards** Unit: mm

Item	CG - 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 2-8-9				
Running parallelism of block surface D to surface B	See Table 2-8-9				

Table 2-8-4 **Accuracy Standards** Unit: mm

Item	CG - 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 2-8-9				
Running parallelism of block surface D to surface B	See Table 2-8-9				

Table 2-8-5 **Accuracy Standards** Unit: mm

Item	CG - 45				
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 2-8-9				
Running parallelism of block surface D to surface B	See Table 2-8-9				

CG Series

Superior Rolling Moment Capacity with Cover Strip

(2) Accuracy of interchangeable guideways

Table 2-8-6 **Accuracy Standards**

Unit: mm

Item	CG - 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 2-8-9		
Running parallelism of block surface D to surface B	See Table 2-8-9		

Table 2-8-7 **Accuracy Standards**

Unit: mm

Item	CG - 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 2-8-9		
Running parallelism of block surface D to surface B	See Table 2-8-9		

Table 2-8-8 **Accuracy Standards**

Unit: mm

Item	CG - 45		
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 2-8-9		
Running parallelism of block surface D to surface B	See Table 2-8-9		

(3) Accuracy of running parallelism

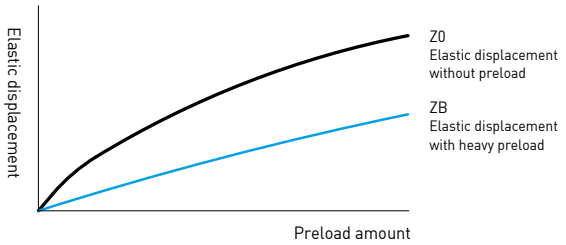
Table 2-8-9 **Accuracy of Running Parallelism**

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

2-8-6 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

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

Table 2-8-10 **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.

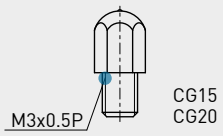
CG Series

Superior Rolling Moment Capacity with Cover Strip

2-8-7 Lubrication

(1) Grease

Grease nipple



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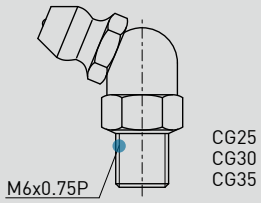

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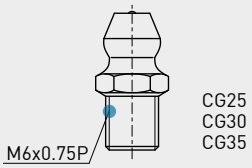
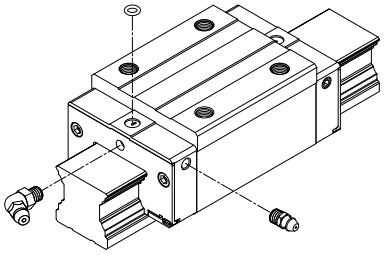
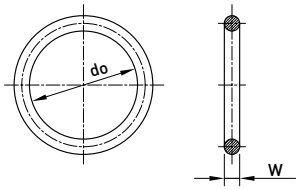


NO.34310003(OPTION)

Mounting location

The standard location of the grease fitting is at both ends of the block, but the nipple can be mounted at each side of block. For lateral installation, we recommend that the nipple can be mounted at the non-reference side, otherwise please contact us. It is possible to perform lubrication by using the oil-piping joint.

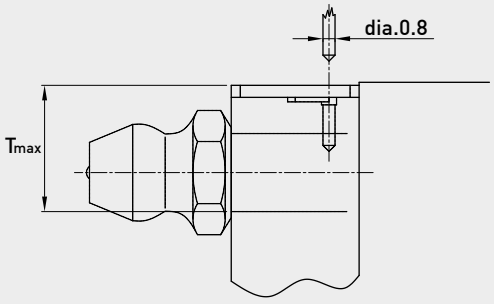




O Ring

Table 2-8-11 **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)
CG15	2.5±0.15	1.5±0.15	3.75
CG20	4.5±0.15	1.5±0.15	5.7
CG25	4.5±0.15	1.5±0.15	5.8
CG30	4.5±0.15	1.5±0.15	6.3
CG35	4.5±0.15	1.5±0.15	8.8
CG45	4.5±0.15	1.5±0.15	8.2



The lubricant amount for a block filled with grease

Table 2-8-12 **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)
CG15	1	-	CG30	3.5	5
CG20	2	3	CG35	7	9
CG25	2.5	4	CG45	8.5	-

Note：If other size is needed, please contact HIWIN.

Frequency of replenishment

Table 2-8-13 **Frequency of replenishment for one block**

Recommended lubrication interval [km]					
Size	P/C < 0,1	0,1 < P/C < 0,3	Size	P/C < 0,1	0,1 < P/C < 0,3
CG15	3000	(C/P)*100	CG30	3000	(C/P)*100
CG20	3000	(C/P)*100	CG35	3000	(C/P)*100
CG25	3000	(C/P)*100	CG45	3000	(C/P)*100

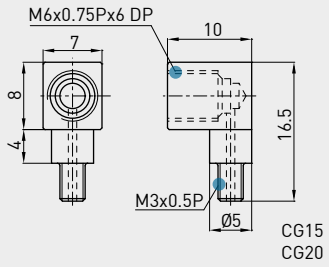
C : Dynamic rating P : Loading

(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

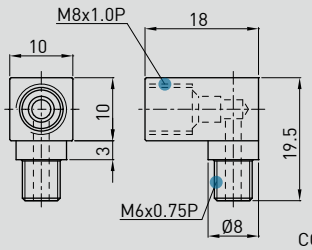
LF-63



CG15
CG20

NO.97002PA1

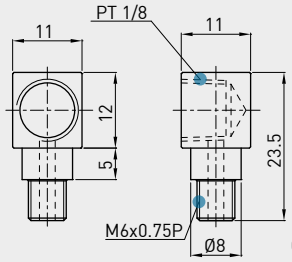
LF-76



CG25
CG30
CG35

NO.970002A1

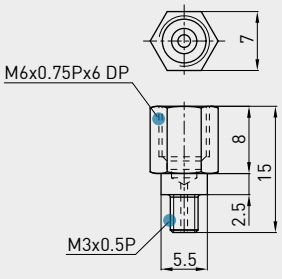
LF-86



CG25
CG30
CG35

NO.970004A1

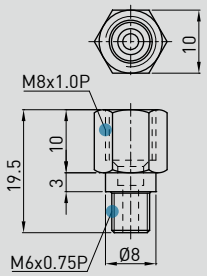
SF-63



CG15
CG20

NO.97002QA2

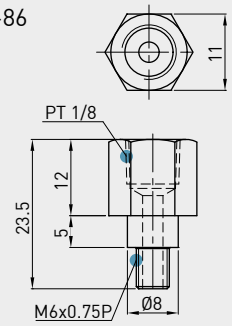
SF-76



CG25
CG30
CG35

NO.970001A1

SF-86



CG25
CG30
CG35

NO.970003A1

Oil refilling rate

Table 2-8-14

Size	Refilling rate (cm³/hr)	Size	Refilling rate (cm³/hr)
CG 15	0.2	CG 30	0.3
CG 20	0.2	CG 35	0.3
CG 25	0.3	CG 45	0.4

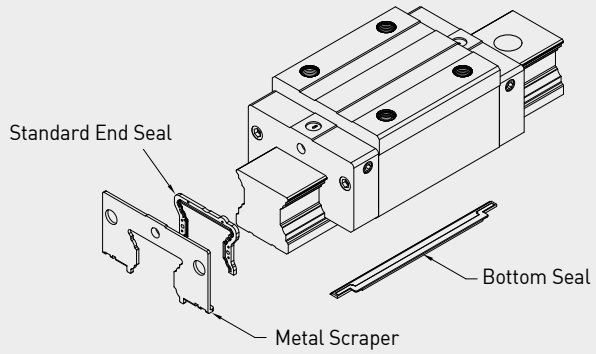
CG Series

Superior Rolling Moment Capacity with Cover Strip

2-8-8 Dust Proof Accessories

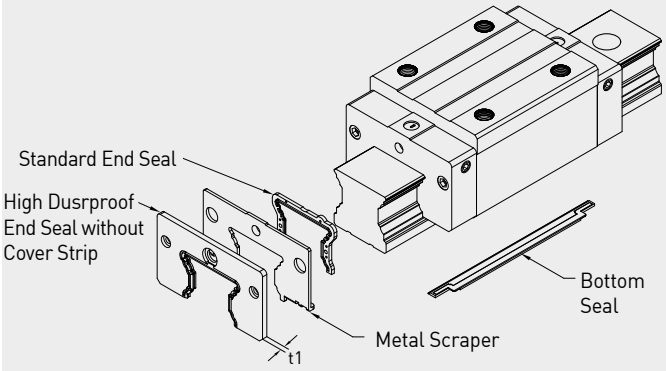
(1) Codes of standard dust proof accessories

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

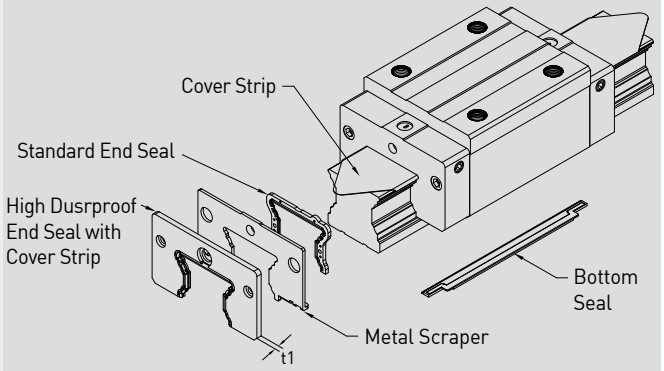


SS (Standard End Seal +Metal Scraper+Bottom Seal)

(2) Codes of high-dust proof accessories



DD (Standard End Seal+High Dusrproof End Seal without Cover Strip +Metal Scraper+Bottom Seal)



DD+CS(Standard End Seal+High Dusrproof End Seal with Cover Strip +Metal Scraper+Bottom Seal+Cover Strip)

(3) 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

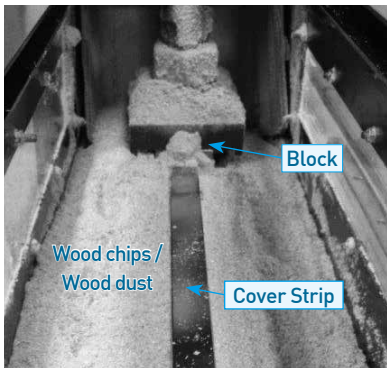
Enhances the wiping effect, foreign matter can be completely wiped off.

Table 2-8-15 **Dimensions of end seal**

Size	Thickness (t1) (mm)	Size	Thickness (t1) (mm)
CG15	2.8	CG30	2.8
CG20	2.8	CG35	2.8
CG25	2.5	CG45	2.7

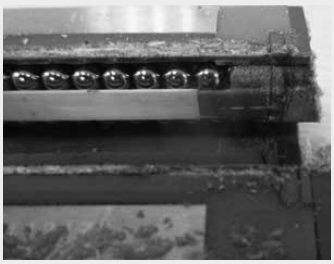
Cover Strip

The cover strip offers better dust proof protection than rail bolt caps and is easier to install. The strip is held in place by a plastic retainer at each end. For high temperature environments a metal retainer is available.



Spec.	CGH25CA1R700Z0C+DD/CS
Max.velocity/ acceleration	1m/s,1G
Loading	Fixture weight
Distance	1500km
Dust type	Wood chips / Wood dust
Diameter	100~500μm

Test result



No dust get into ball tracks

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.

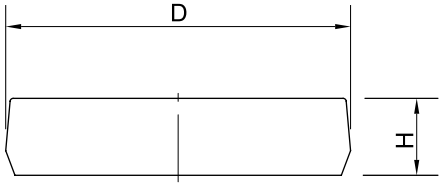


Table 2-8-16 **Dimensions of Bolt Caps for Rail Mounting Holes**

Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)	Rail size	Bolt size	Diameter(D) (mm)	Thickness(H) (mm)
CGR15	M4	7.65	1.1	CGR30	M8	14.20	3.5
CGR20	M5	9.65	2.5	CGR35	M8	14.20	3.5
CGR25	M6	11.15	2.5	CGR45	M12	20.25	4.5

(4) Dimensions of block equipped with the parts

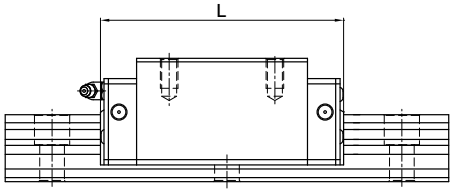


Table 2-8-17 **Overall block length**

unit: mm

Size	Overall block length (L)			Size	Overall block length (L)		
	SS	DD	DD+CS		SS	DD	DD+CS
CG15C	58.2	63.8	63.8	-	-	-	-
CG20C	74.9	80.5	80.5	CG20H	90.9	96.5	96.5
CG25C	84	89	89	CG25H	101.4	106.4	106.4
CG30C	97.4	103.8	103	CG30H	119.9	126.3	125.5
CG35C	111.4	117.8	117	CG35H	135.8	142.2	141.4
CG45C	137.6	145.6	145.6	CG45H	174	182	182

CG Series

Superior Rolling Moment Capacity with Cover Strip

2-8-9 Friction

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

Table 2-8-18 **Seal Resistance**

Size	Resistance N (kgf)	Size	Resistance N (kgf)
CG15	0.98 (0.1)	CG30	3.43 (0.35)
CG20	1.96 (0.2)	CG35	3.92 (0.4)
CG25	3.43 (0.35)	CG45	4.9 (0.5)

Note : 1 kgf = 9.81N
Other specifications please contact HIWIN

2-8-10 The Accuracy Tolerance of Mounting Surface

CG rail designed with DB type (also known as o arrangemnt) which has better moment load capacity. Moreover, The CG series can compensate for some suface-error on installation and still maintain smooth linear motion due to circular-arc contact design.

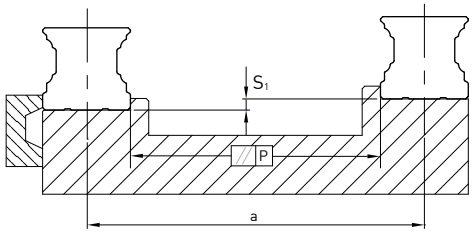


Table 2-8-19 **Max. Parallelism Tolerance (P)** unit: μm

Size	Preload classes		
	Z0	ZA	ZB
CG15	9	5	4
CG20	11	7	5
CG25	12	8	6
CG30	14	9	7
CG35	15	11	8
CG45	19	12	10

- The accuracy tolerance of reference surface height (S_1)

$$S_1 = K \cdot 10^{(-4)} \cdot a - T_H$$

S_1 : Max. tolerance of height
a : Distance between paired rails
K : Coefficient of tolerance of height
T_H : dimensional tolerance of height,please refer to accuracy class

Table 2-8-20 **Coefficient of tolerance of height**

Size	Preload classes		
	Light Preload (Z0)	Medium Preload (ZA)	Heavy Preload (ZB)
K [μm/mm]	2.8	1.7	1.2

2-8-11 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 chamfered part of the rail or block. As long as the recommended shoulder heights and fillets are followed, installation inaccuracies should be eliminated.

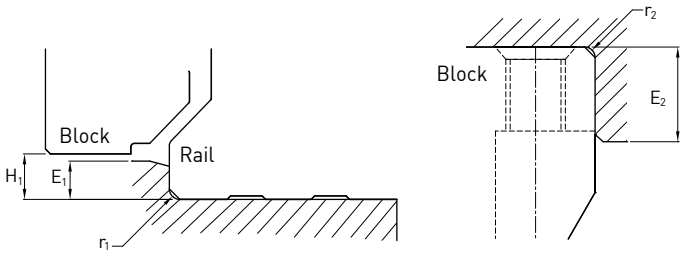


Table 2-8-21 **Shoulder Heights and Fillets**

Size	Max. radius of fillets r_1 (mm)	Max. radius of fillets r_2 (mm)	Shoulder height of the rail E_1 (mm)	Shoulder height of the block E_2 (mm)	Clearance under block H_1 (mm)
CG 15	0.5	0.5	3.0	4.0	4.3
CG 20	0.5	0.5	3.5	5.0	4.6
CG 25	1.0	1.0	5.0	5.0	5.5
CG 30	1.0	1.0	5.0	5.0	6.0
CG 35	1.0	1.0	6.0	6.0	7.5
CG 45	1.0	1.0	8.0	8.0	9.5

(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 2-8-22 **Mounting Torque**

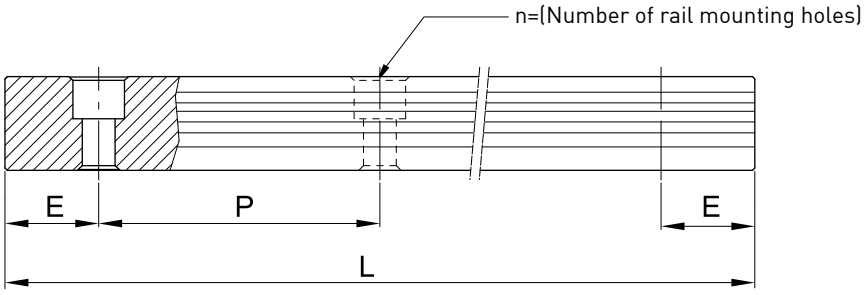
Size	Bolt size	Torque N-cm (kgf-cm)		
		Iron	Casting	Aluminum
CG 15	M4×0.7P×16L	392(40)	274(28)	206(21)
CG 20	M5×0.8P×16L	883(90)	588(60)	441(45)
CG 25	M6×1P×20L	1373(140)	921(94)	686(70)
CG 30	M8×1.25P×25L	3041(310)	2010(205)	1470(150)
CG 35	M8×1.25P×25L	3041(310)	2010(205)	1470(150)
CG 45	M12×1.75P×35L	11772(1200)	7840(800)	5880(600)

CG Series

Superior Rolling Moment Capacity with Cover Strip

2-8-12 Standard and Maximum Lengths of Rail

HIWIN offers standard rail lengths for customer needs. For non-standard E-values, the recommended dimension should not be 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 2-8-23 **Rail Standard Length and Max. Length**

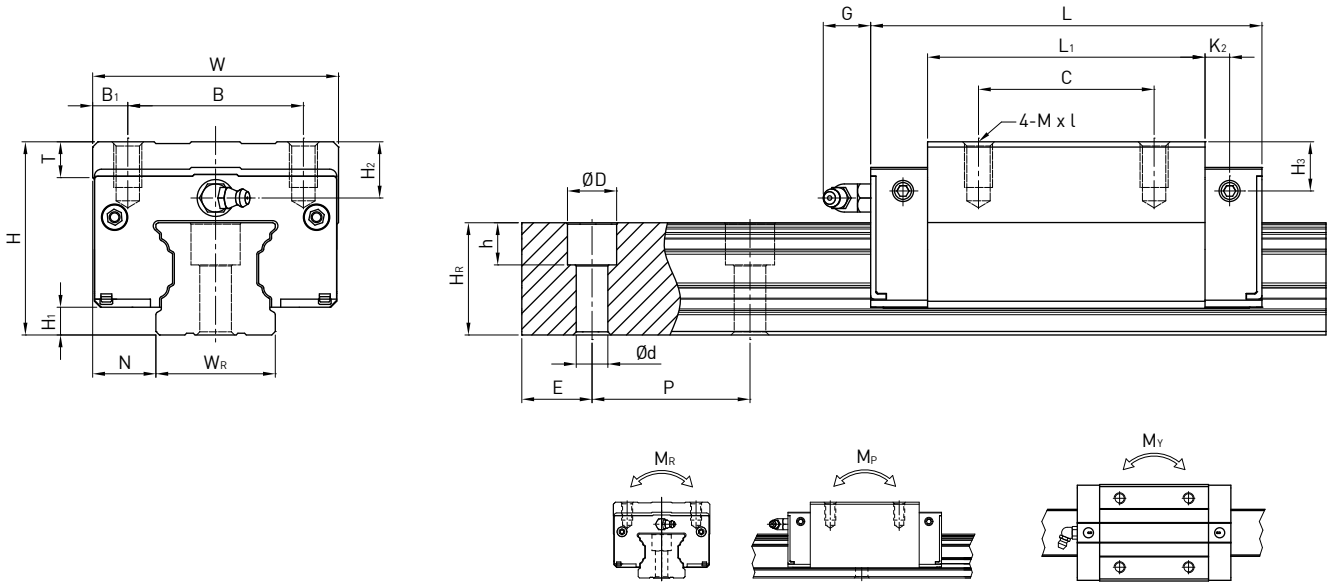
unit: mm

Item	CG15	CG20	CG25	CG30	CG35	CG45
Standard Length L(n)	160(3)	220(4)	220(4)	280(4)	280(4)	570(6)
	220(4)	280(5)	280(5)	440(6)	440(6)	885(9)
	280(5)	340(6)	340(6)	600(8)	600(8)	1,200(12)
	340(6)	460(8)	460(8)	760(10)	760(10)	1,620(16)
	460(8)	640(11)	640(11)	1,000(13)	1,000(13)	2,040(20)
	640(11)	820(14)	820(14)	1,640(21)	1,640(21)	2,460(24)
	820(14)	1,000(17)	1,000(17)	2,040(26)	2,040(26)	2,985(29)
		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
Distance to End (E_s)	20	20	20	20	20	22.5
Max. Standard Length	4,000(67)	4,000(67)	4,000(67)	3,960(50)	3,960(50)	3,930(38)
Max. Length	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 HIWIN.

2-8-13 Dimensions for HIWIN CG Series

(1) CGH-CA / CGH-HA



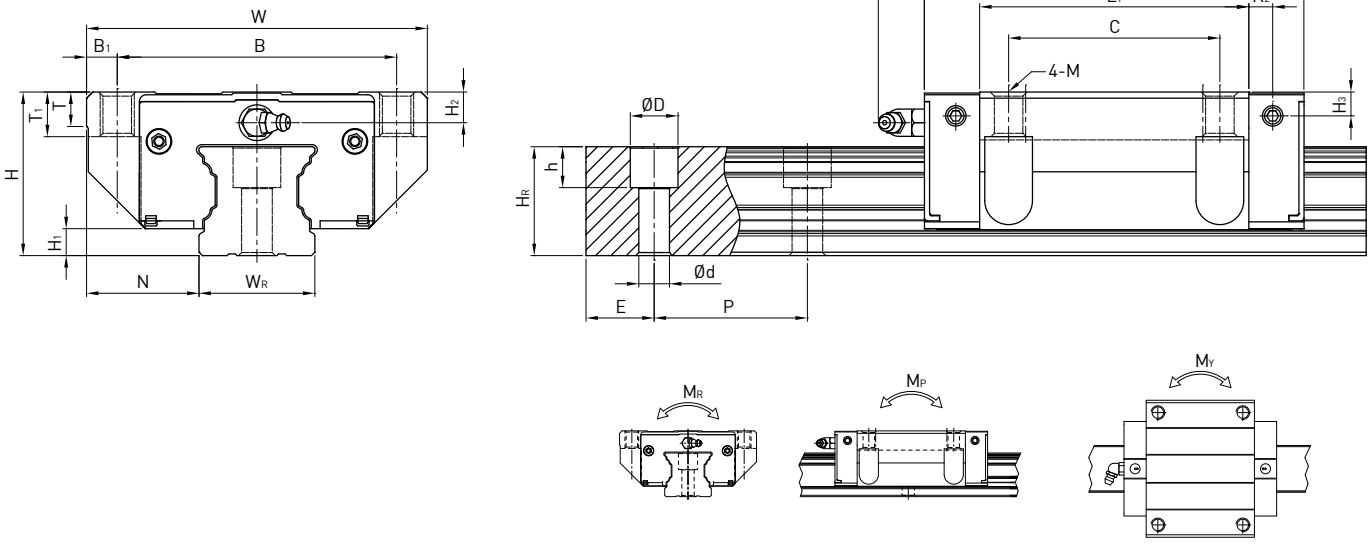
Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)												Dimensions of Rail (mm)							Mounting Bolt for Rail	Basic Dynamic Load Rating	Basic Static Load Rating	Static Rated Moment			Weight	
	H	H1	N	W	B	B1	C	L1	L	G	K2	T	H2	H3	M x l	WR	HR	D	h	d	P	E	(mm)	C (kN)	C0 (kN)	MR kN-m	MP kN-m	MY kN-m	Block kg	Rail kg/m
CGH15CA	28	4.1	9.5	34	26	4	26	39.6	58.2	6	4.25	5	7.8	7.8	M4 x 6	15	16.2	7.5	5.9	4.5	60	20	M4x17	14.7	19.52	0.19	0.14	0.14	0.15	1.58
CGH20CA	30	4.65	12	44	32	6	36	52.5	74.9	6	5.5	8	3.7	3.5	M5 x 6	20	20.55	9.5	8.5	6	60	20	M5x19	23.7	30.51	0.37	0.28	0.28	0.25	2.48
CGH20HA	30	4.65	12	44	32	6	50	68.5	90.9	6	5.5	8	3.7	3.5	M5 x 6	20	20.55	9.5	8.5	6	60	20		28.6	39.9	0.48	0.48	0.48	0.33	2.48
CGH25CA	40	6.1	12.5	48	35	6.5	35	61	84	13	5	8	10	9.5	M6 x 8	23	24.25	11	9	7	60	20	M6x22	34.96	43.94	0.6	0.49	0.49	0.46	3.38
CGH25HA	40	6.1	12.5	48	35	6.5	50	78.4	101.4	13	5	8	10	9.5	M6 x 8	23	24.25	11	9	7	60	20		40.5	54.08	0.74	0.73	0.73	0.59	3.38
CGH30CA	45	7	16	60	40	10	40	69	97.4	13	8.7	9.5	9.7	10	M8 x 10	28	28.35	14	12	9	80	20	M8x25	46	55.19	0.95	0.7	0.7	0.71	5.1
CGH30HA	45	7	16	60	40	10	60	91.5	119.9	13	8.7	9.5	9.7	10	M8 x 10	28	28.35	14	12	9	80	20		58.59	78.18	1.35	1.23	1.23	0.94	5.1
CGH35CA	55	7.6	18	70	50	10	50	79	111.4	13	7	10.2	16	14	M8 x 13	34	31.85	14	12	9	80	20	M8x28	61.17	79.3	1.73	1.09	1.09	1.24	7.14
CGH35HA	55	7.6	18	70	50	10	72	103.4	135.8	13	7	10.2	16	14	M8 x 13	34	31.85	14	12	9	80	20		77.9	112.34	2.46	2.02	2.02	1.62	7.14
CGH45CA	70	9.7	20.5	86	60	13	60	97.2	137.6	13	8.7	16	18.5	18.2	M10 x 17	45	39.85	20	17	14	105	22.5	M12x37	98.43	112.66	3.56	2.35	2.35	2.38	11.51
CGH45HA	70	9.7	20.5	86	60	13	80	133.6	174	13	8.7	16	18.5	18.2	M10 x 17	45	39.85	20	17	14	105	22.5		125.58	159.6	5.05	4.45	4.45	3.01	11.51

Note : 1 kgf = 9.81 N

CG Series

Superior Rolling Moment Capacity with Cover Strip

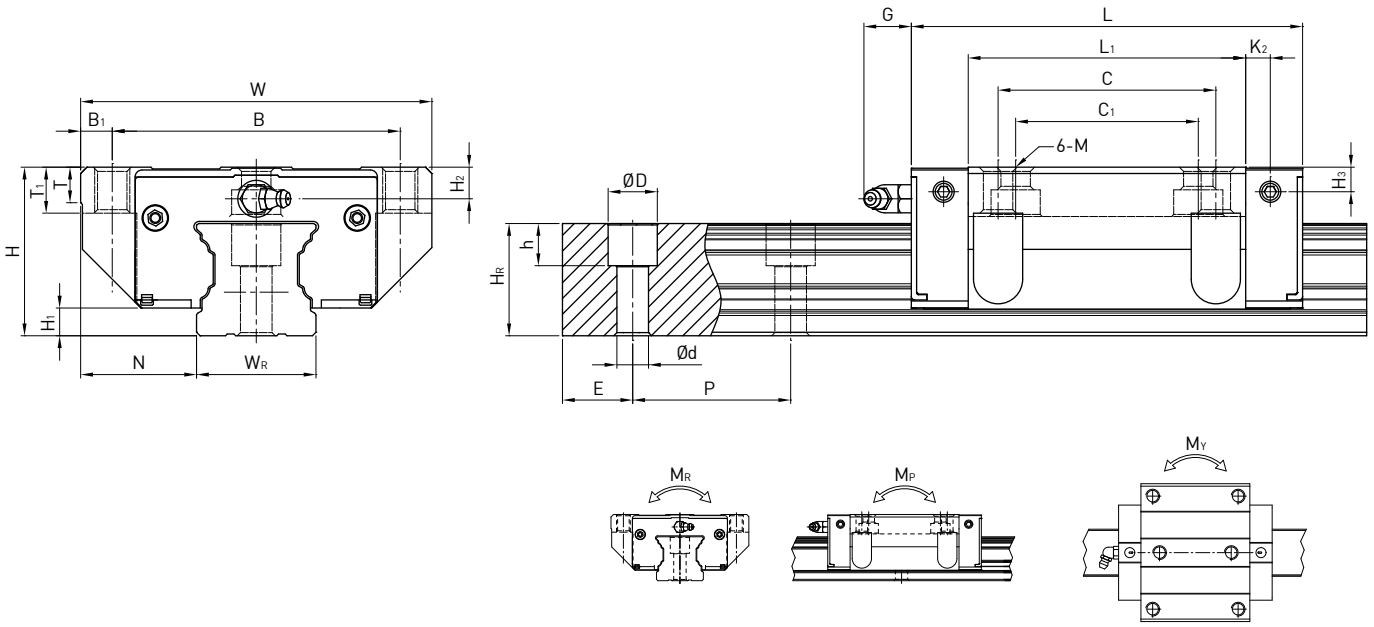
(2) CGW-CA / CGW-HA



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	G	K_2	T	T_1	H_2	H_3	M	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
CGW15CA	24	4.1	16	47	38	4.5	30	39.6	58.2	6	4.25	5	6.5	3.8	3.8	M5	15	16.2	7.5	5.9	4.5	60	20	M4x17	14.7	19.52	0.19	0.14	0.14	0.14	1.58
CGW20CA	30	4.65	21.5	63	53	5	40	52.5	74.9	6	5.5	6.5	7.7	3.7	3.5	M6	20	20.55	9.5	8.5	6	60	20	M5x19	23.7	30.51	0.37	0.28	0.28	0.36	2.48
CGW20HA	30	4.65	21.5	63	53	5	40	68.5	90.9	6	5.5	6.5	7.7	3.7	3.5	M6	20	20.55	9.5	8.5	6	60	20		28.6	39.9	0.48	0.48	0.48	0.47	2.48
CGW25CA	36	6.1	23.5	70	57	6.5	45	61	84	13	5	7	9.3	6	5.5	M8	23	24.25	11	9	7	60	20	M6x22	34.96	43.94	0.6	0.49	0.49	0.53	3.38
CGW25HA	36	6.1	23.5	70	57	6.5	45	78.4	101.4	13	5	7	9.3	6	5.5	M8	23	24.25	11	9	7	60	20		40.5	54.08	0.74	0.73	0.73	0.68	3.38
CGW30CA	42	7	31	90	72	9	52	69	97.4	13	8.7	10.5	12	6.7	7	M10	28	28.35	14	12	9	80	20	M8x25	46	55.19	0.95	0.7	0.7	0.9	5.1
CGW30HA	42	7	31	90	72	9	52	91.5	119.9	13	8.7	10.5	12	6.7	7	M10	28	28.35	14	12	9	80	20		58.59	78.18	1.35	1.23	1.23	1.19	5.1
CGW35CA	48	7.6	33	100	82	9	62	79	111.4	13	7	10.1	13.1	9	7	M10	34	31.85	14	12	9	80	20	M8x28	61.17	79.3	1.73	1.09	1.09	1.37	7.14
CGW35HA	48	7.6	33	100	82	9	62	103.4	135.8	13	7	10.1	13.1	9	7	M10	34	31.85	14	12	9	80	20		77.9	112.34	2.46	2.02	2.02	1.79	7.14
CGW45CA	60	9.7	37.5	120	100	10	80	97.2	137.6	13	8.7	13.5	15	8.5	8.1	M12	45	39.85	20	17	14	105	22.5	M12x37	98.43	112.66	3.56	2.35	2.35	2.45	11.51
CGW45HA	60	9.7	37.5	120	100	10	80	133.6	174	13	8.7	13.5	15	8.5	8.1	M12	45	39.85	20	17	14	105	22.5		125.58	159.6	5.05	4.45	4.45	3	11.51

Note : 1 kgf = 9.81 N

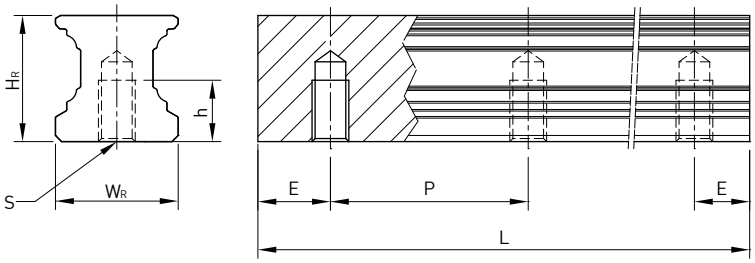
(2) CGW-CC / CGW-HC



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	G	K_2	T	T_1	H_2	H_3	M	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
CGW15CC	24	4.1	16	47	38	4.5	30	26	39.6	58.2	6	4.25	5	6.5	3.8	3.8	M5	15	16.2	7.5	5.9	4.5	60	20	M4x17	14.7	19.52	0.19	0.14	0.14	0.14	1.58
CGW20CC	30	4.65	21.5	63	53	5	40	35	52.5	74.9	6	5.5	6.5	7.7	3.7	3.5	M6	20	20.55	9.5	8.5	6	60	20	M5x19	23.7	30.51	0.37	0.28	0.28	0.36	2.48
CGW20HC	30	4.65	21.5	63	53	5	40	35	68.5	90.9	6	5.5	6.5	7.7	3.7	3.5	M6	20	20.55	9.5	8.5	6	60	20		28.6	39.9	0.48	0.48	0.48	0.47	2.48
CGW25CC	36	6.1	23.5	70	57	6.5	45	40	61	84	13	5	7	9.3	6	5.5	M8	23	24.25	11	9	7	60	20	M6x22	34.96	43.94	0.6	0.49	0.49	0.53	3.38
CGW25HC	36	6.1	23.5	70	57	6.5	45	40	78.4	101.4	13	5	7	9.3	6	5.5	M8	23	24.25	11	9	7	60	20		40.5	54.08	0.74	0.73	0.73	0.68	3.38
CGW30CC	42	7	31	90	72	9	52	44	69	97.4	13	8.7	10.5	12	6.7	7	M10	28	28.35	14	12	9	80	20	M8x25	46	55.19	0.95	0.7	0.7	0.9	5.1
CGW30HC	42	7	31	90	72	9	52	44	91.5	119.9	13	8.7	10.5	12	6.7	7	M10	28	28.35	14	12	9	80	20		58.59	78.18	1.35	1.23	1.23	1.19	5.1
CGW35CC	48	7.6	33	100	82	9	62	52	79	111.4	13	7	10.1	13.1	9	7	M10	34	31.85	14	12	9	80	20	M8x28	61.17	79.3	1.73	1.09	1.09	1.37	7.14
CGW35HC	48	7.6	33	100	82	9	62	52	103.4	135.8	13	7	10.1	13.1	9	7	M10	34	31.85	14	12	9	80	20		77.9	112.34	2.46	2.02	2.02	1.79	7.14
CGW45CC	60	9.7	37.5	120	100	10	80	60	97.2	137.6	13	8.7	13.5	15	8.5	8.1	M12	45	39.85	20	17	14	105	22.5	M12x37	98.43	112.66	3.56	2.35	2.35	2.45	11.51
CGW45HC	60	9.7	37.5	120	100	10	80	60	133.6	174	13	8.7	13.5	15	8.5	8.1	M12	45	39.85	20	17	14	105	22.5		125.58	159.6	5.05	4.45	4.45	3	11.51

Note : 1 kgf = 9.81 N

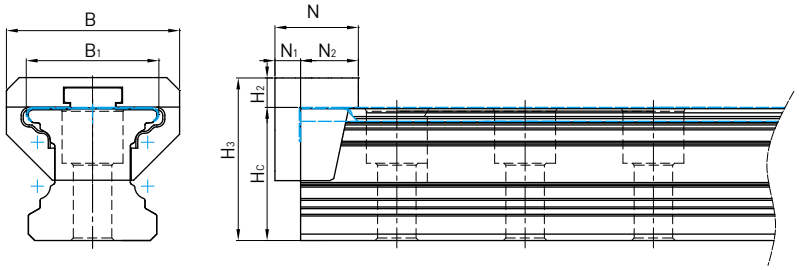
(3) Dimesions for CGR-T (Rail Mounting from Bottom)



Size	Dimensions of Rail (mm)					
	W_R	H_R	S	h	P	E
CGR15T	15	16.2	M5X0.8P	8	60	20
CGR20T	20	20.55	M6X1P	10	60	20
CGR25T	23	24.25	M6X1P	12	60	20
CGR30T	28	28.35	M8X1.25P	15	80	20
CGR35T	34	31.85	M8X1.25P	17	80	20
CGR45T	45	39.85	M12X1.75P	24	105	22.5

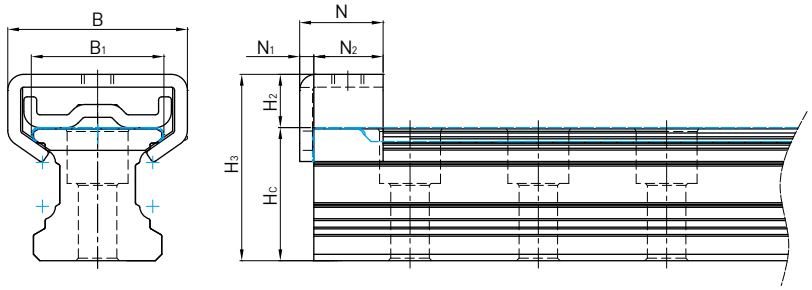
(4) Dimension of cover strip and plastic end jig

- plastic end jig (standard)



Size	H_3	H_c	H_2	N	N_1	N_2	B	B_1
CG 15	20.8	16.4	4.4	13.0	3.7	9.3	20.0	15.8
CG 20	25.65	20.75	4.9	13.0	4.0	9.0	27.0	20.7
CG 25	29.55	24.45	5.1	15.0	4.2	10.8	31.5	23.9
CG 30	35.45	28.55	6.9	21.0	6.0	15.0	40.0	28.9
CG 35	40.75	32.05	8.7	21.5	6.2	15.3	46.0	34.8
CG 45	48.0	40.05	7.95	22.0	6.2	15.8	51.6	45.6

- Metal end jig (optional)



Size	H_3	H_c	H_2	N	N_1	N_2	B	B_1
CG 15	20.09	16.70	3.9	15.0	2.2	12.8	21.0	15.8
CG 20	29.05	20.75	8.3	13.0	2.2	10.8	28.0	20.7
CG 25	34.42	24.45	10.0	15.0	2.2	12.8	30.6	23.9
CG 30	37.80	28.55	9.3	12.0	2.2	9.8	34.0	28.9
CG 35	43.2	30.40	13.0	18.0	2.2	15.8	35.4	34.8
CG 45	52.66	39.85	13.7	18.0	2.2	15.8	53.6	45.6