



Linear Guideway

Technical Information

ALMOTION

HIWIN®

Linear Guideways

Technical Information Index

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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.

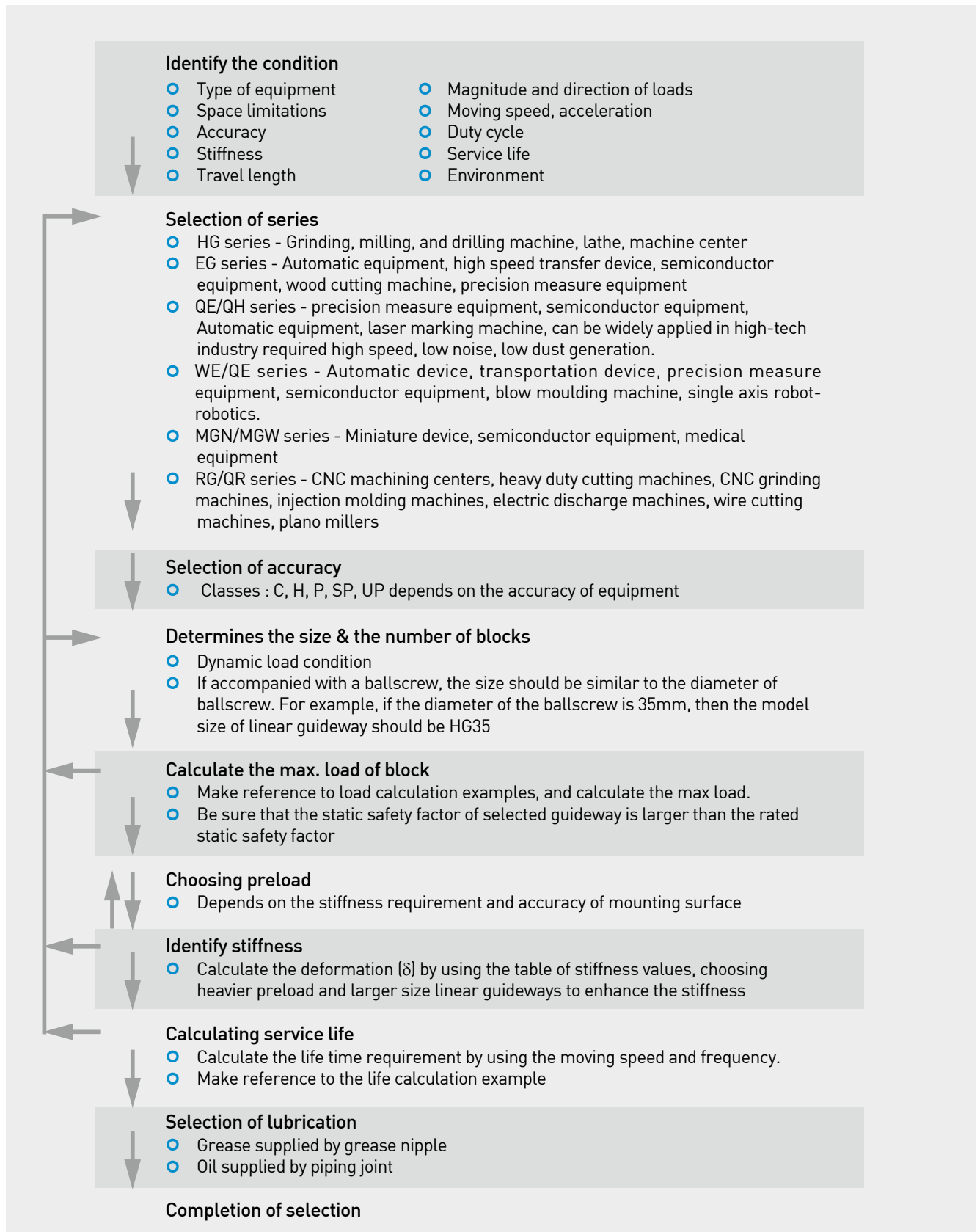
(7) Interchangeability

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.

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1-2 Selecting Linear Guideways



1-3 Basic Load Ratings of Linear Guideways

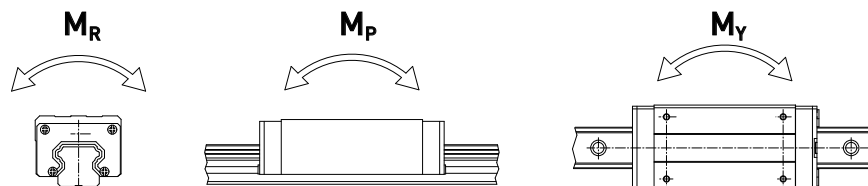
1-3-1 Basic Static Load

(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 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

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

- 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 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.

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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.

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

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

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.

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

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

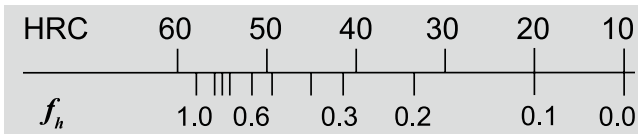
L : Nominal life
 f_h : Hardness factor
C : Basic dynamic load rating
 f_t : Temperature factor
 P_c : Calculated load
 f_w : Load factor

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.

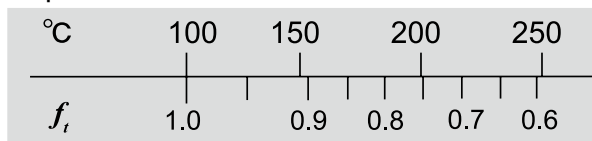
Raceway hardness



(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 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	$15 \text{ m/min} < V \leq 60 \text{ m/min}$	1.2 ~ 1.5
Normal load	$60 \text{ m/min} < V \leq 120 \text{ m/min}$	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.

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

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

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.

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(1) Load on one block

Table 1-3 Calculation example of loads on block

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

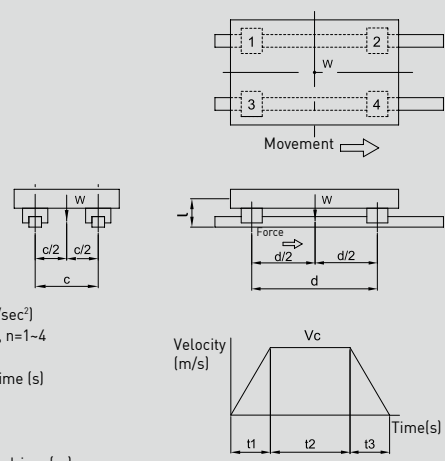
W: Applied weight
l: Distance from external force to driver
c: Rail spacing

P_n : Load (radial, reverse radial), $n=1\sim4$
F: External force
d: Block spacing

a, b, k: Distance from external force to geometric center
 P_{tn} : Load (lateral), $n=1\sim4$
h: Distance from center of gravity to driver

(2) Loads with inertia forces

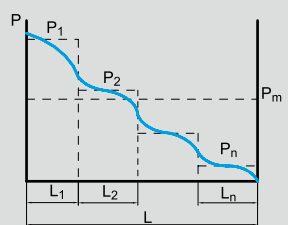
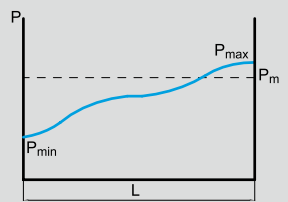
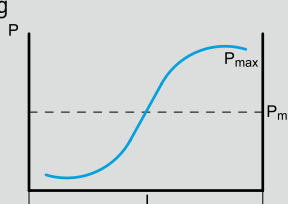
Table 1-4 Calculation Examples for Loads with Inertia Forces

Considering the acceleration and deceleration	Load on one block
 <p>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)</p>	<ul style="list-style-type: none"> 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)

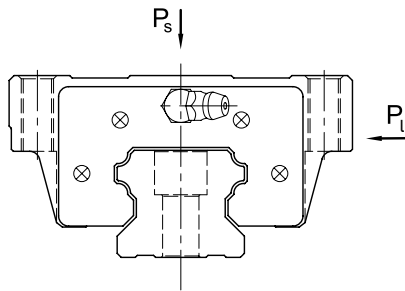
Operation Condition	Mean load
<p>Step load</p> 	$P_m = \sqrt[3]{1/L(P_1^3 \cdot L_1 + P_2^3 \cdot L_2 + \dots + P_n^3 \cdot L_n)}$ <p>P_m: Mean load P_n: Stepping L: Total running distance L_n: Running distance under load P_n</p>
<p>Linear variation</p> 	$P_m = 1/3 (P_{min} + 2 \cdot P_{max})$ <p>P_m: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

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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

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

MG Series

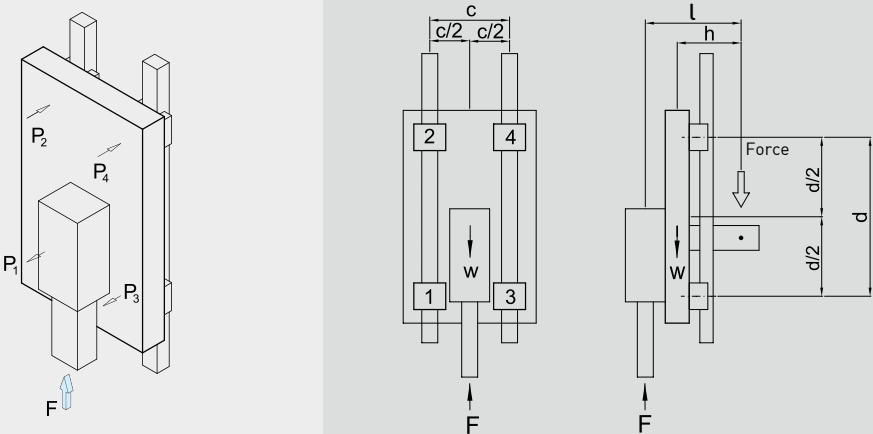
$$\text{when } P_s > P_l \quad P_e = P_s + 0.5 \cdot P_l \quad \dots \quad \text{Eq.1.9}$$

$$\text{when } P_l > P_s \quad P_e = P_l + 0.5 \cdot P_s \quad \dots \quad \text{Eq.1.10}$$

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
		
<ul style="list-style-type: none"> 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.

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

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

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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.

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

T : Feeding frequency of oil (hour)

V_e : speed (m/min)

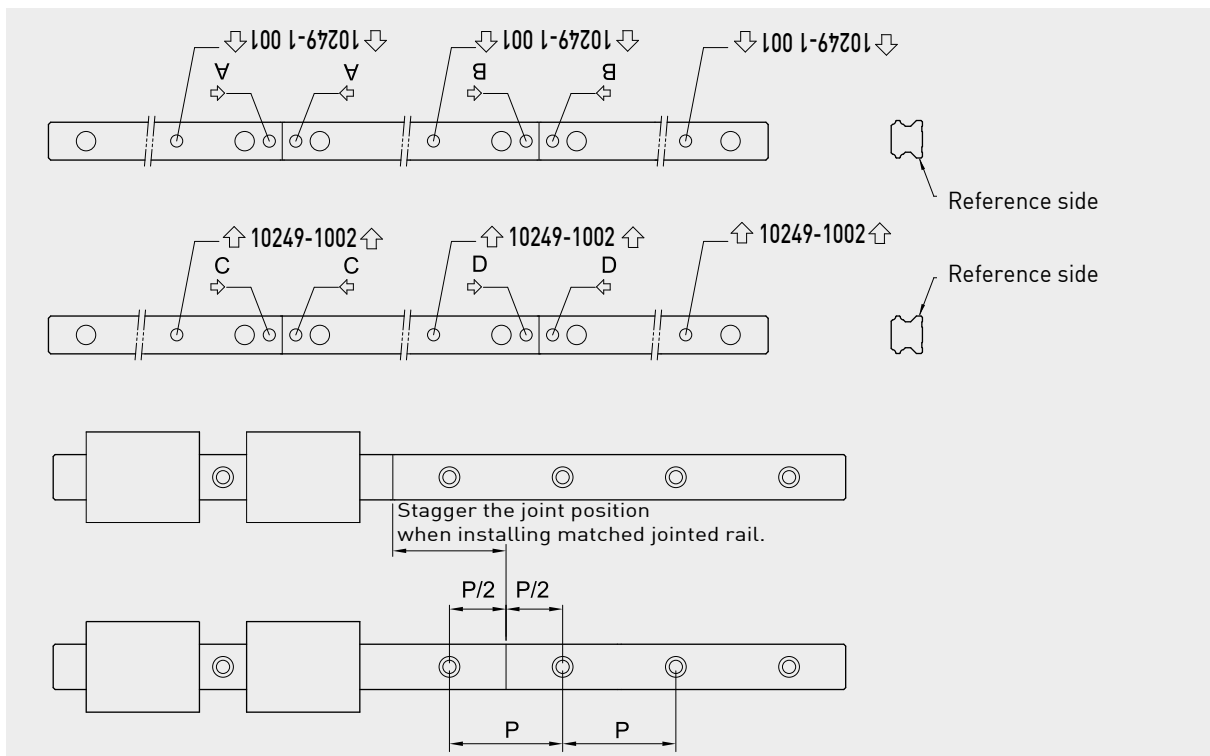
1-7-2 Oil

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 0.3cm³/hr.

1-8 Jointed Rail

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

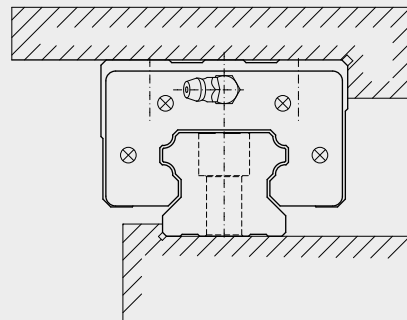
For matched pair, jointed rails, the jointed positions should be staggered. This will avoid accuracy problems due to discrepancies between the 2 rails (see figure).



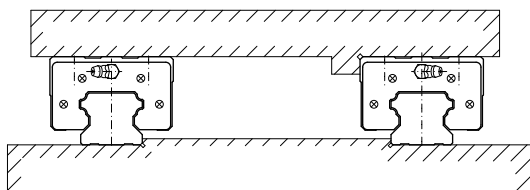
1-9 Mounting Configurations

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:

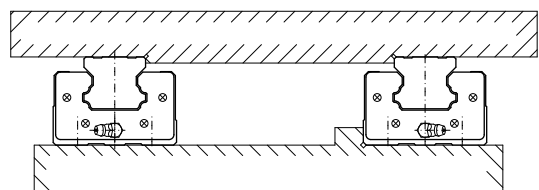
Use of one rail and mounting reference side



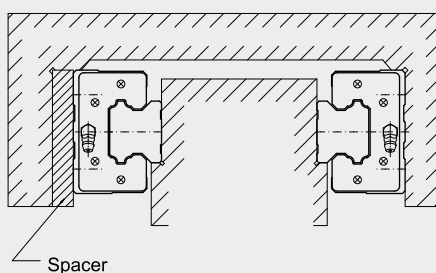
use of two rails(block movement)



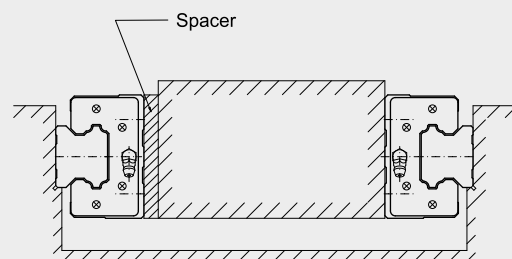
use of two rails(block fixed)



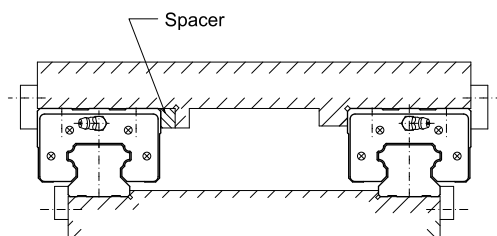
use of two external rails



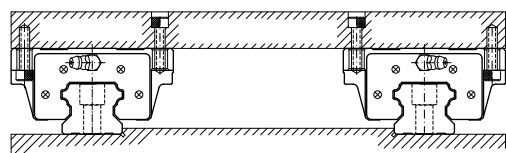
use of two internal rails



total surface fixed installation



HGW type block with mounting holes in different directions.



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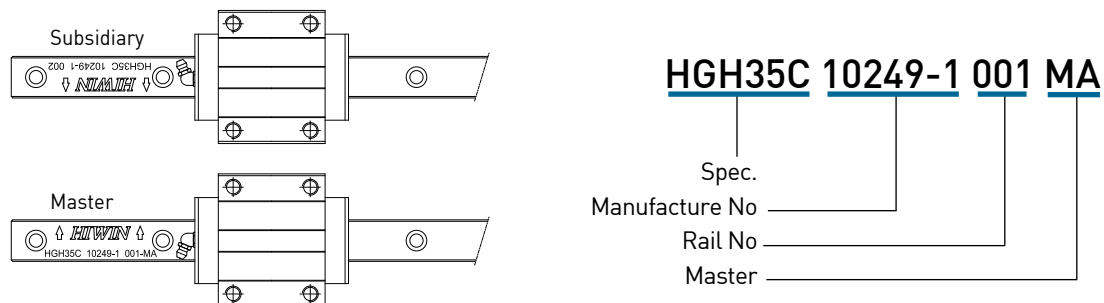
General Information

1-10 Mounting Procedures

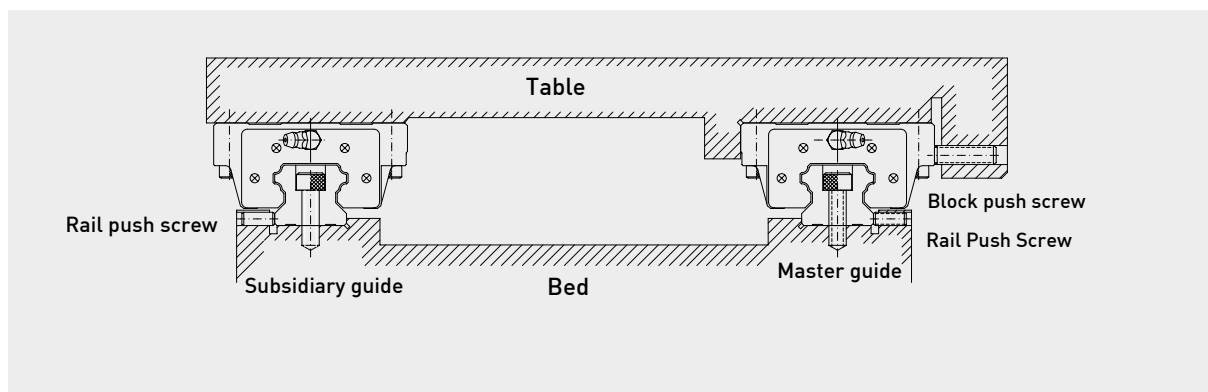
Three installation methods are recommended based on the required running accuracy and the degree of impacts and vibrations.

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.



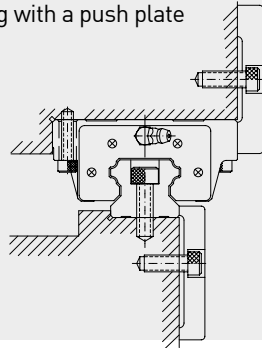
1-10-2 Installation to Achieve High Accuracy and Rigidity



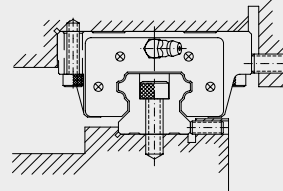
(1) Mounting methods

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.

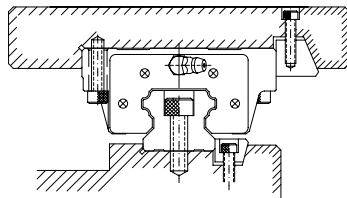
Mounting with a push plate



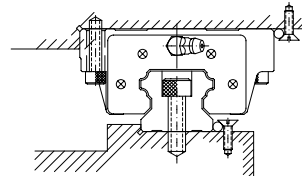
Mounting with push screws



Mounting with taper gib

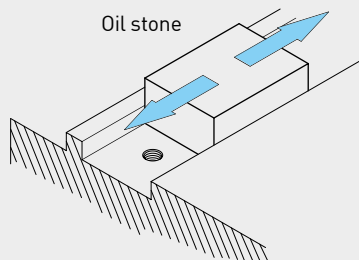


Mounting with needle roller

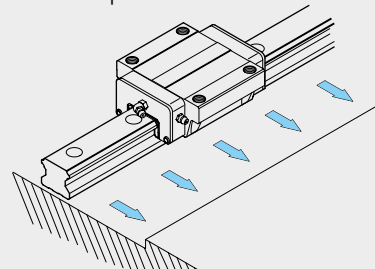


(2) Procedure of rail installation

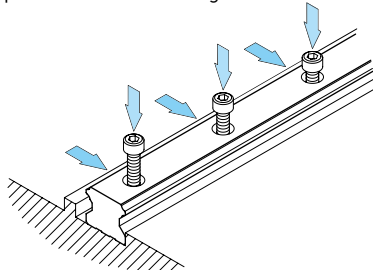
- 1 Before starting, remove all dirt from the mounting surface of the machine.



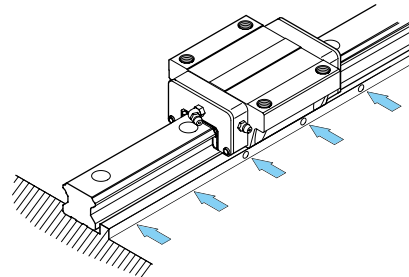
- 2 Place the linear guideway gently on the bed. Bring the guideway into close contact with the datum plane of the bed.



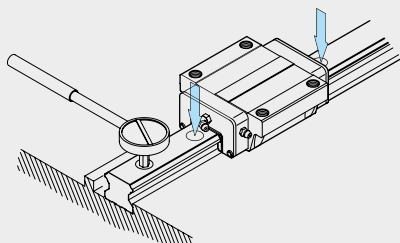
- 3 Check for correct thread engagement when inserting a bolt into the mounting hole while the rail is being placed on the mounting surface of the bed.



- 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.

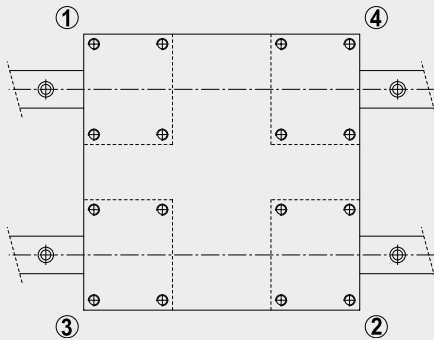


- 6 Install the remaining linear guideway in the same way.

Linear Guideways

General Information

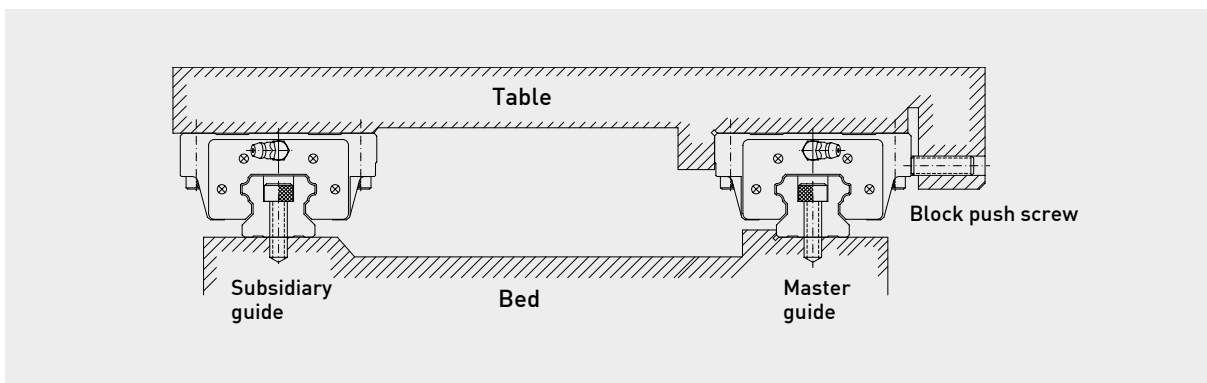
(3) Procedure of block installation



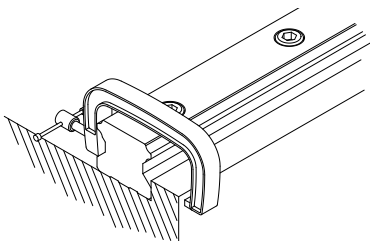
- Place the table gently on the blocks. Next, tighten the block mounting bolts temporarily.
- Push the blocks against the datum plane of the table and position the table by tightening the push screws.
- The table can be fixed uniformly by tightening the mounting bolts on master guide side and subsidiary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

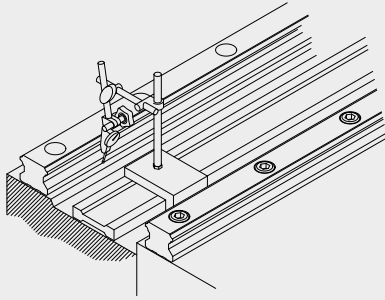


(1) Installation of the rail on the subsidiary guide side



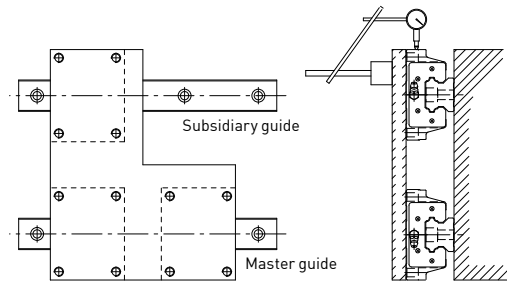
- **Using a vice**
Place the rail into the mounting plane of the bed. Tighten the mounting bolts temporarily; then use a vice to push the rail against the side datum plane of the bed. Tighten the mounting bolts in sequence to the specified torque.

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



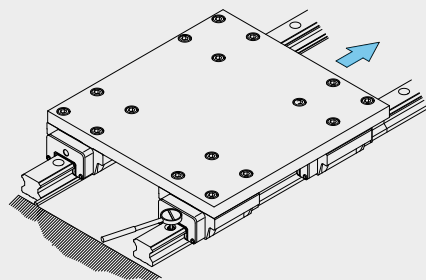
Method with use of a straight edge

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.



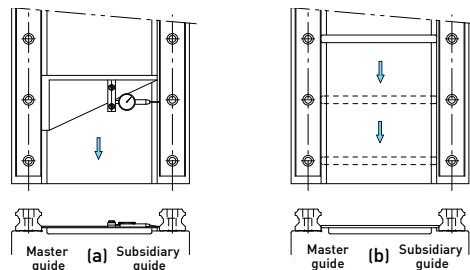
Method with use of a table

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

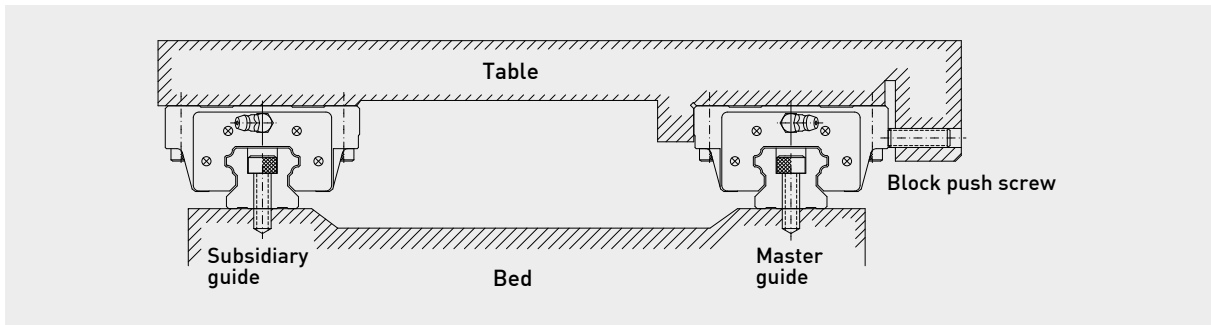
Use a special jig to ensure the rail position on the subsidiary guide side. Tighten the mounting bolts to the specified torque in sequence.

Linear Guideways

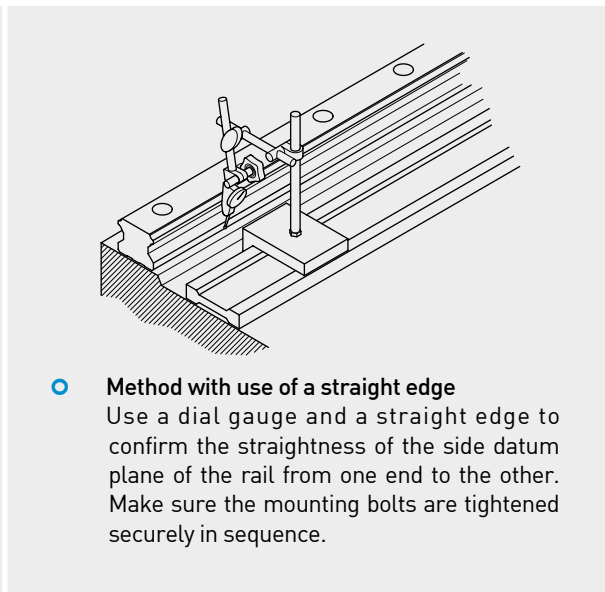
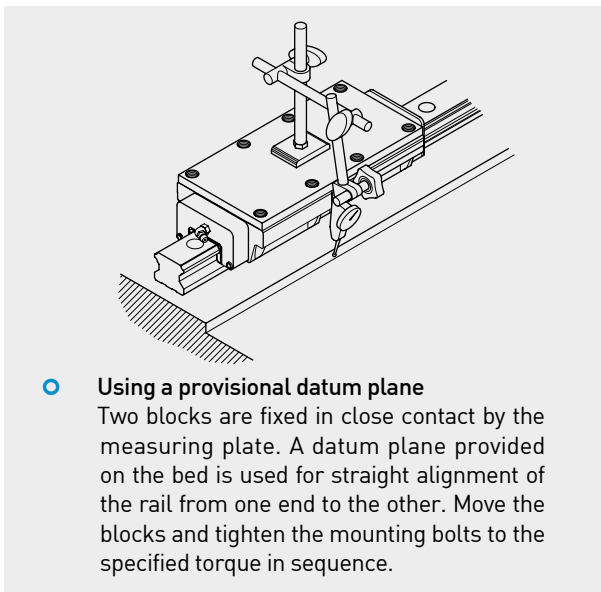
General Information

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

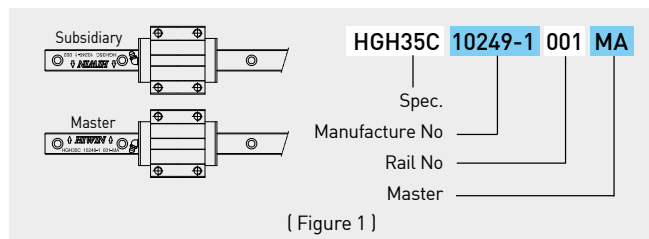


(2) Installation of the rail on the subsidiary guide side

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

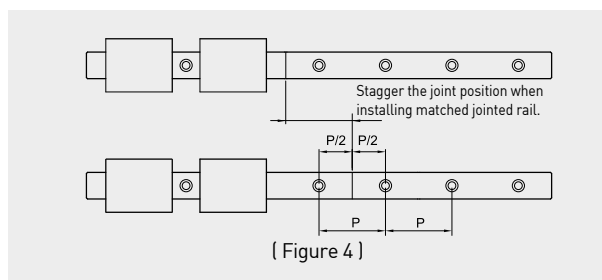
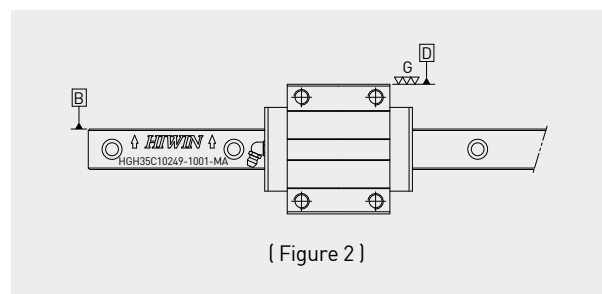
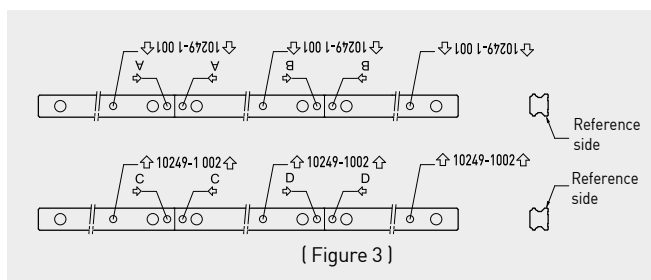
1-10-5 Linear Guideway Mounting Instructions

- HIWIN guideways are supplied with a coating of anti-corrosion oil before being shipped. Please clean the oil before moving or running the blocks.
- 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.)

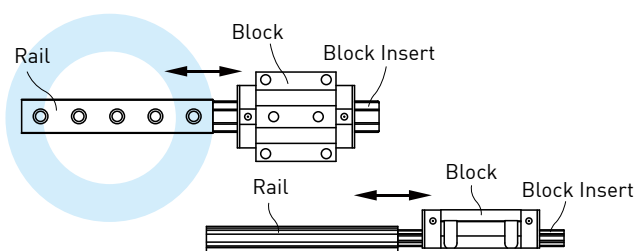


3. Recognition of datum plane: The datum plane (B) of rail is the side indicated by the arrow, which is marked on the top surface of the rail. The datum plane of block is smooth ground surface which shows as D in Figure 2.

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.

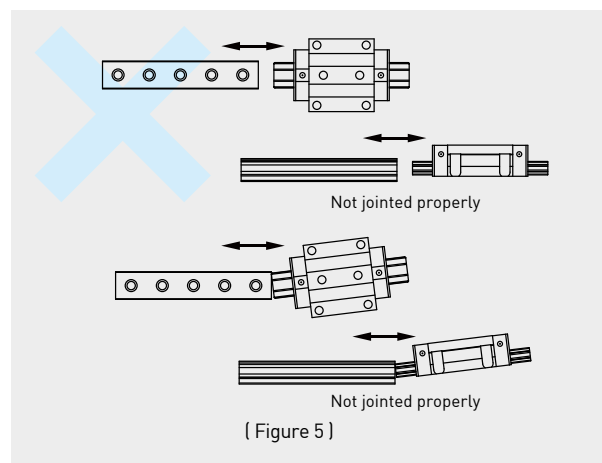


5. Do not remove blocks from rails when assembling the guideways in machines as far as possible. Please use block inserts (please see Figure 5) if it is necessary to remove/ mount block from/ onto rail.



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).



1-10-6 Linear Guideway Usage Instructions

1. Standard guideways are enclosed with high-quality lubricants (lubricant oil or lithium-soap-base grease). Please re-lubricate the blocks after assembling the guideways in machines. The same soap-base lubricants should be used.
2. The blocks are composed of various plastic parts; please avoid prolonged exposure of the plastic parts with any organic solvent when cleaning the blocks so that the product damage can be prevented.
3. Please avoid any foreign object getting into the block since this could be one of the causes for breakdown or damage.
4. Please do not disassemble the parts arbitrarily, the incautious actions of disassembly may bring the foreign objects into the block and diminish the precision of guideways.
5. When handling the guideways please hold it horizontally. The improper oblique posture of guideways will cause the blocks falling from the rail.
6. Please avoid the inappropriate falling or clash on the blocks, which will damage the function of guideways.
7. The maximum tolerant temperature of E2 type (Self lubricant kit) is in the range of -10°C ~ 60°C . and for Quiet type guideways (QH, QE, QW and QR) are in the range of -10°C ~ 80°C . The maximum service temperature of SE type (Metallic end cap) is 150°C and for other standard types is 100°C .
8. Please refer to HIWIN technical information for more detailed instructions. Please do not hesitate to contact HIWIN if there are further questions related to the application.

Note: For Quiet type guideways (QH, QE, QW and QR), please pay attention for the following instructions:

1. When assemble and disassemble the Quiet type blocks, please use the block insert as enclosed and do not take it off the block. (one block insert is equipped per block).
2. Special accessories are used in the Quiet type guideways, any impermissible adjustment on the preload is prohibited.

Linear Guideways

General Information

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 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	-	-	-
TMN	-	Standard	TMN-C	-	-	-
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
RG	High	Heavy Load	RGH-CA	-	-	-
		Super Heavy Load	RGH-HA	-	-	-
	Low	Heavy Load	-	-	-	RGW-CC
		Super Heavy Load	-	-	-	RGW-HC
QR	High	Heavy Load	QRH-CA	-	-	-
		Super Heavy Load	QRH-HA	-	-	-
	Low	Heavy Load	-	-	-	QRW-CC
		Super Heavy Load	-	-	-	QRW-HC

(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	●	●	●	-	-	●	●	●
TMN	●	●	●	-	-	●	●	●
QH	●	●	●	●	●	●	●	●
QE	●	●	●	●	●	●	●	●
QW	●	●	●	●	●	●	●	●
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	●	●	●	●	●

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	●	●	●	●	●

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