LINEAR GUIDEWAY

As a kind of rolling linear guide component, the rolling linear guide pair makes infinite rolling cycle between the slider and the guide rail, so that the workbench can easily move linearly with high precision along the guide rail. With excellent characteristics such as heavy load-bearing, high precision, high speed, wear rsistance and high reliability, it has become an indispensable and important functional component in various machine tools and precision electronic machinery.

This catalog focuses on the structure, characteristics, product series, accuracy level, numbering specifications, installation combination form and installation method, selection design calculation, and usage precautions of HTPM's specialized production of rolling linear guide pairs, providing users with reference when selecting.

● Characteristic

1、Guide accuracy

Guiding accuracy is the most basic performance index of linear guideway. When the moving parts move along the guide rail, whether bearing load or not, the linearity of the moving trajectory and the accuracy of positioning should be ensured, which is the key to ensure the good operation of the machine tool. All kinds of equipments have regulations or standards on the flatness, verticality and equal height and length requirements of the guide rail pair.

2、Wear resistance

Wear of guide rail is the main failure form of rolling linear guide rail pair, which will affect the stable geometric accuracy and service lifespan of machine tool, so wear resistance is one of the main performance indexes to measure rolling linear guide rail pair.

3、Rigidity and load capacity

It is required that the linear guideway can ensure that the deformation does not exceed a certain limit under the rated load. Especially when it is applied to heavy cutting machine tools, it requires high bearing capacity.

4、Frictional characteristic

For precision equipment with high positioning accuracy, it is required that the difference of static and dynamic friction force is small and the crawling phenomenon is eliminated while feeding.

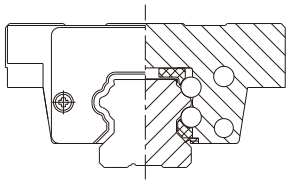
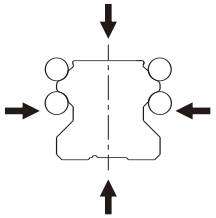
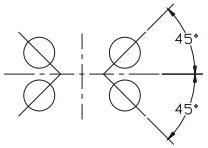
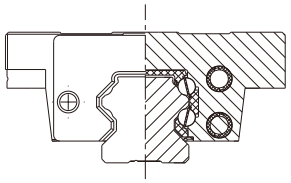
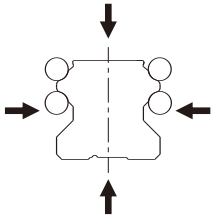
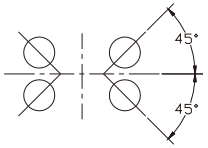
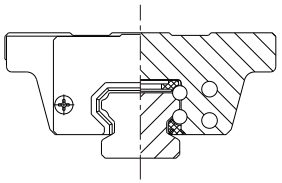
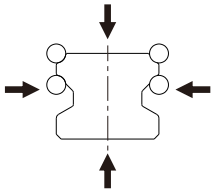
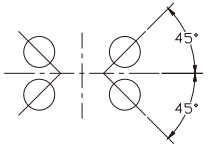
5、Manufacturability

Linear guideway should be easy to assemble, adjust, dust-control, lubricate and maintain.

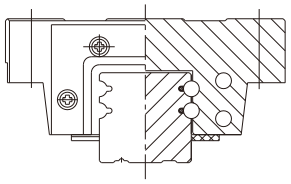
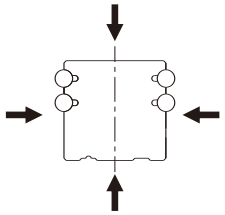
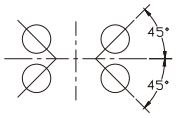
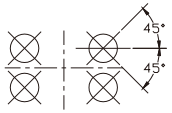
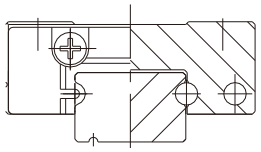
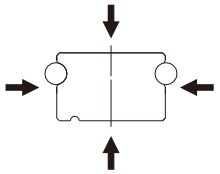
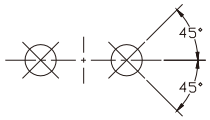
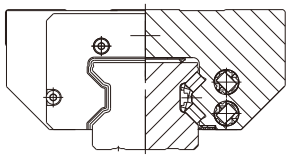
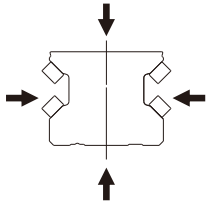
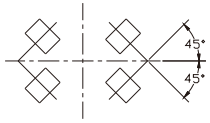
There are three main types of guide rails used at home and abroad at present, its basic performance comparison is as follows:

	sliding guide	linear rolling guide	hydrostatic guideway
coefficient of friction	F=0. 04～0. 06	F=0. 0015～0. 01	F=0. 0005～0. 001
speed	low	low ~ high	medium ~high
rigidity	high	relatively high	relatively low
positional accuracy	2μm	0. 5μm	poor
lifespan	Similar to each other		
reliability	high	relatively high	relatively poor

HTPM Series and classification of linear guideway

Series	Classification	Appearance	Load direction/ load capacity	Contact form	Characteristics	Main Application
LGS	Single circular arc type				● DF structure is adopted, which can absorb installation errors greatly. ● Set the contact angle between the ball and the groove to 45°, so it has equal rigidity and load capacity in four directions.	woodworker Material supply device Electrical discharge machine Laser processing machinery Machining center CNC lathe Industrial robot Packing machinery
LSQ	Single circular arc mute type				● With the characteristics of LGS single arc type. ● Low noise and smooth motion. ● self-lubricating effect. ● Can be interchange with LGS.	Material supply device Electrical discharge machine Optical mechanical measuring table CNC lathe Industrial robot Semiconductor manufacturing device Packing machinery
LGE	Single arc low assembly type				● DF structure is adopted, which can absorb installation errors greatly. ● Set the contact angle between the ball and the groove to 45 °, so it has equal rigidity and load energy in four directions. ● Reduce the combined height of guide rail pair.	Fine measuring instrument Material supply device Semiconductor manufacturing equipment Electrical discharge machine Packing machinery

HTPM Series and classification of linear guideway

Series	Classification	Appearance	Load direction/ load capacity	Contact form	Characteristics	Main Application
LG	Similar double circular arc type			 small preload  large preload	● The groove adopts a unique double-arc structure, which has good static stiffness, friction characteristics, preload, error equalization ability and other performance indicators. ● Set the contact angle between the ball and the groove to 45°, so that the load bearing capacity and rigidity in the up, down, left and right directions are uniform. ● When subjected to impact load and heavy load, the bearing contact area increases, which improves the stiffness of the system.	Machining center Digital control milling machine CNC lathe Surface-grinding machine Coordinate grinder Industrial robot Electrical discharge machine Welding machine Material supply device Packing machinery
LM/ LMW	Miniature				● The exquisite design of one row of raceways on the left and right is adopted, which is small and lightweight. ● The groove is designed as a Gothic structure, and its contact angle is 45 °, so it has equal rigidity and load energy in four directions. ● LMW series has high rigidity in lateral torque due to wide guide rail amplitude.	Semiconductor manufacturing equipment Printed circuit board IC assembly equipment Medical equipment Mechanical arm Fine measuring instrument Optical table Pneumatic components
LGR	Roller type				● Cylindrical rollers are used instead of steel balls, and the rollers are in line contact with the guide rail and the slider, which greatly improves the rigidity of the guide rail. ● Using DB 45 ° combination, it has equal rigidity and load capacity in four directions.	Machining center CNC milling machine CNC grinder Vertical or horizontal boring machine Large gantry machine tool Heavy handling device Electrical discharge machine

Rated dynamic load, rated static load and life

The working principle of linear guideway is similar to that of rolling bearing. All steel balls are on the circular raceway and make continuous rolling motion under a certain load. Therefore, the linear guideway also has many damage forms similar to the rolling bearing, such as contact fatigue wear, corrosion, overheating, precision reduction, vibration, etc., many of which belong to improper selection, application or maintenance. Some forms of damage, such as contact fatigue, cannot be completely avoided. It is generally believed that if the installation is correct, the lubrication is good, and the load is moderate without the influence of harmful media and high temperature, the failure form of the rolling linear guide pair is mainly the fatigue peeling of the raceway surface layer caused by repeated compressive stress, that is, contact fatigue.

1、Rated dynamic load C

A batch of guide rail assemblies with the same structure and size operate under the same conditions. The load the guide rails born when their service life of 90% can reach or exceed a specific travel distance.

2、Rated static load Co

The static load the guide rails born when the total plastic deformation at the maximum contact stress between the roller and the raceway is equal to one ten thousandth of the diameter of the roller.

3、Static Safety Factor So

When the linear guideway is at rest or running, it may be affected by external forces such as inertia force or torque caused by vibration, impact or violent start and stop. For such usage scenarios, it is necessary to consider its static load safety factor to confirm whether the selected guide pair model is suitable. Different safety factors must be considered according to different use occasions, and the reference values are shown in the following table.

$$S_0 = \frac{C_0}{P} \quad \text{or} \quad S_0 = \frac{M_0}{M}$$

S_0 :Static Safety Factor

C_0 :Rated static load (N)

M_0 :Rated torque (N.m)

P :External applied load (N)

M :External load torque(N.m)

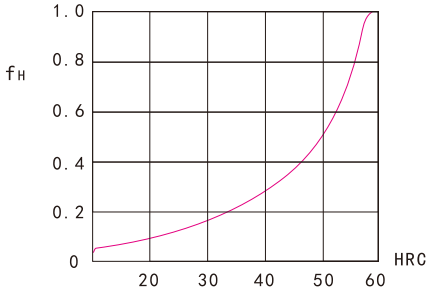
Application	Load condition	Lower bound of S_0
General industrial machine	General load	2.0～2.3
	vibration or impact	3.0～4.0
Machine tool	General load	2.0～2.5
	vibration or impact	3.0～7.0

4、life L

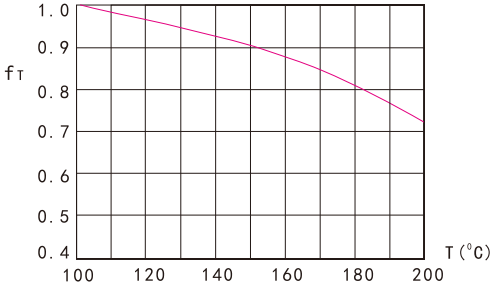
Under the same working conditions, a batch of guide rail assemblies with the same structure and size are operated separately, and before 90% of the guide rail assemblies have fatigue, the sum of the moving distances of the slider relative to the guide rail or the working hours at a certain moving speed.

In the actual guide rail system, in order to give full play to the performance of rolling linear guide rail pair, the hardness of raceway surface in contact with steel ball should be between HRC 58 and 64. If the surface hardness of raceway surface is low, the rated dynamic load will be reduced and the rated life of guide rail will be reduced. Therefore, the rated dynamic load and static load of the guide rail should be multiplied by the hardness coefficient f_H to be the hardness coefficient fH corresponding to different raceway surface hardness. As shown in the left picture below.

When the temperature of the guide rail system exceeds 100℃, the rated dynamic load is reduced and the life is shortened compared with that in normal temperature, so the rated dynamic load and static load of the guide rail should be multiplied by the temperature coefficient f_T. The right figure below shows the temperature coefficient f_T at different temperatures.



The hardness coefficient of raceway surface f_H



Temperature coefficient f_T

When calculating the rated life, we should also consider the influence of external load and application situation, the change of inertia force caused by the weight and travel speed of the object, and introduce the load coefficient fw for this purpose. See the left table below for the values of fw under different use conditions.

The rolling linear guide rail is used by two or more sliders in most working occasions, so the influence of the uniformity of its load distribution on its life must be considered, and the contact coefficient fc should be introduced in the calculation. See the right table below for the relationship between contact coefficient and the number of sliders on the same guide shaft.

coefficient of load fw

Conditions of use	fw
Without external impact load and vibration. (<15m/min)	1.0～1.5
Without significant impact load and vibration. (<60m/min)	1.5～2.0
With external impact load and vibration (<60m/min)	2.0～3.5

Contact coefficient fc

Number of sliders installed on the same guide rail	Contact coefficient fc
1	1.0
2	0.81
3	0.72
4	0.66
5	0.61

Therefore, considering the hardness, temperature, contact condition and service conditions of the guide rail surface, the rated life of the guide rail pair is calculated according to the following formula:

Where the ball-type guideway is used:

$$L=50\times\left[\frac{f_H\times f_T\times f_C}{f_W}\cdot\frac{C}{P_C}\right]^3$$

Where roller guideway is used:

$$L=100\times\left[\frac{f_H\times f_T\times f_C}{f_W}\cdot\frac{C}{P_C}\right]^{\frac{10}{3}}$$

life(time) calculate: $In=\frac{L\times10^3}{2\times L_S\times n\times60}$ (hour)

In which, Pc is the actual load L is the rated life (km) Ls is the travel distance(m)
N is the number of cycles per minute(opm)

● Lubrication and dust-control design

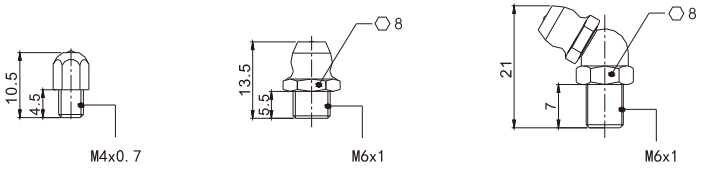
1、Lubrication method

Compared with the sliding guide, the linear guideway needs less oil and has a long lubrication period. However, if it is used without lubrication, the wear of rolling contact parts will increase and the life of guideway will be shortened, so appropriate lubrication methods must be adopted.

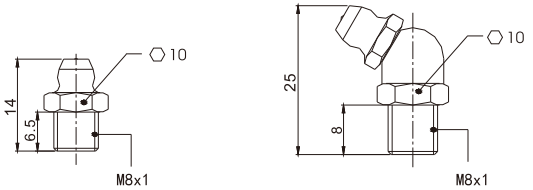
■ 1) Grease lubrication

The slider of the HTPM rolling linear guide pair is usually pre filled with lithium soap based No. 2 lubricating grease under normal circumstances. The lubricating grease is usually replenished every 100km of operation or the lubrication frequency is adjusted according to specific circumstances. In case of external influences such as pollution, vibration, and collision, the lubrication cycle is correspondingly shortened.

The nozzle type for using lubricating grease is shown in the following figur:



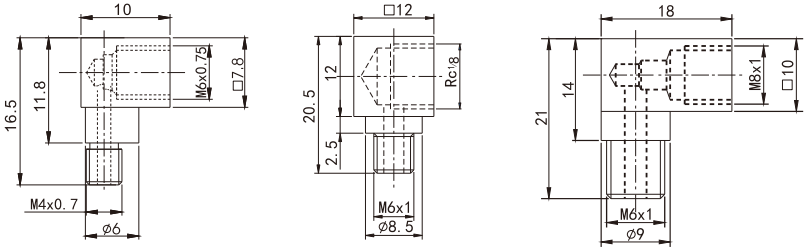
number:M4ZH number:M6ZH number:M6WH



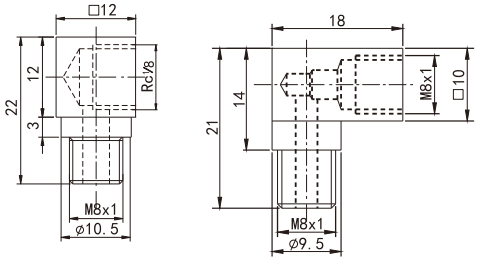
number:M8ZH number:M8WH

■ 2)Oil lubrication

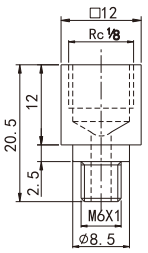
When the customer uses a centralized lubrication oil supply system to lubricate the guide rail pair, please contact our company and explain the requirements for using oil lubrication and the installation status of the guide rail pair (such as horizontal, inclined, vertical, etc.). Before leaving the factory, our company does not lubricate grease on the slide block, and also makes appropriate treatment according to different installation statuses to ensure that the grooves of the slide block are fully lubricated. We recommend that the customer use lubricating oil with a viscosity of ISO VG32-150. The type of pipe joint using lubricating oil is shown in the following figure:



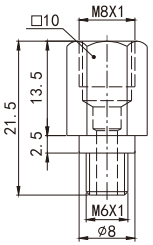
number:M4WM number:M6WT number:M6WM



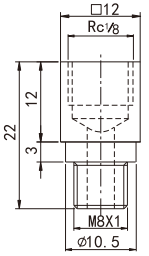
number:M8WT number:M8WM



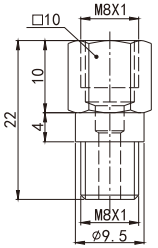
number:M6ZT



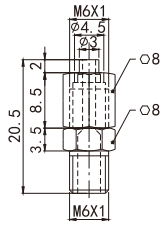
number:M6ZM



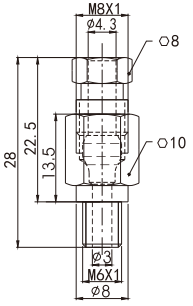
number:M8ZT



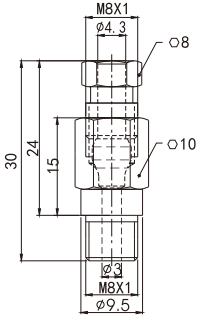
number:M8ZM



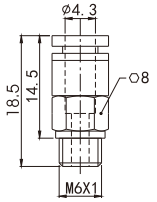
number: Ø 4-M6
Flared straight joint



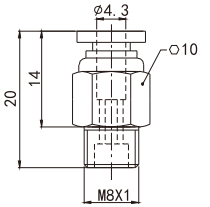
number: Ø 4-M6
Copper pipe straight joint



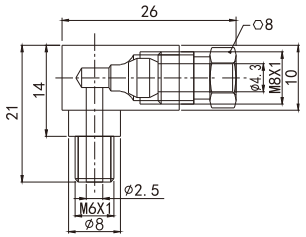
number: Ø 4-M8
Copper pipe straight joint



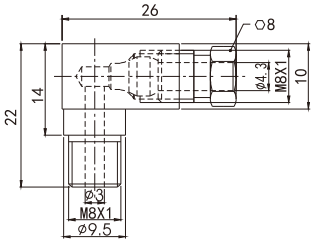
number : PCO4-M6
Quick insertion air pipe joint



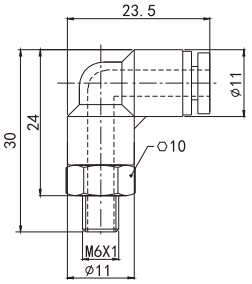
number: PCO4-M8
Quick insertion air pipe joint



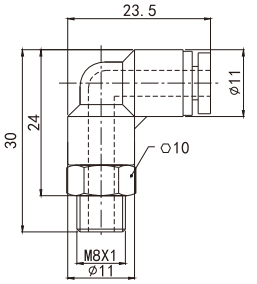
number: Ø 4-M6
Copper pipe bending joint



number: Ø 4-M8
Copper pipe bending joint



number: PL04-M6
Quick insertion air pipe joint



number: PL04-M8
Quick insertion air pipe joint

Oil supply rate of various types of sliders

Model	Lubricant supply rate cm³/hr	Model	Lubricant supply rate cm³/hr	Model	Lubricant supply rate cm³/hr
LGS15	0.2	LGE15	0.1	LGR12	0.12
LGS20N/LSQ20	0.2	LGE20	0.14	LGR15	0.2
LGS25/LSQ25	0.3	LGE25	0.17	LGR20	0.2
LGS30/LSQ30	0.3	LGE30	0.2	LGR25N	0.3
LGS35/LSQ35	0.3	LGW25	0.4	LGR30	0.3
LGS45	0.4	LG45	0.4	LGR35	0.4
LGS55	0.5	LG55	0.5	LGR45	0.5
LGS65	0.6	LG65	0.6	LGR55	0.64
LGSW20	0.2			LGR65	0.8
LGSW25	0.3			LGR85	1.6
				LGR100	2.7

Model of oil nozzles and pipe joints installed on various type of guide rail

Model					Oil nozzle type		Special pipe joint type			
					standard	optional	optional			
				LGR12	ф3glib					
LGS15		LGE15		LGR15	M4ZH		M4WM			
				LGR20						
LGS20N/ LGSW20	LSQ20	LGE20			M6WH	M6ZH	M6WM	M6ZM	Ø4-M6 Copper pipe bending joint PL04-M6 Quick insertion air pipe joint	Ø4-M6 Copper pipe straight joint PC04-M6 Quick insertion air pipe joint Ø 4-M6 Flared straight joint
LGS25/ LGSW25	LSQ25	LGE25	LGW25	LGR25N			M6WT	M6ZT		
LGS30	LSQ30	LGE30		LGR30			M6WM	M6ZM		
LGS35	LSQ35			LGR35						
LGS45			LG45	LGR45	M8WH	M8ZH	M8WT	M8ZT	Ø4-M8 Copper pipe bending joint PL04-M8 Quick insertion air pipe joint	Ø4-M8 Copper pipe straight joint PC04-M8 Quick insertion air pipe joint
LGS55			LG55	LGR55						
LGS65			LG65	LGR65			M8WM	M8ZM		
				LGR85						
				LGR100						

2、Sealing measures

When the slider moves at speed V, a negative pressure area will be formed behind the direction of slider movement, which will suck in dust. The dust sucked in accumulates inside the fixed screws and on the surface of the guide rail, causing a sharp decrease in the life of the linear guideway.

In order to ensure its service life, appropriate dust prevention measures must be taken。

- 1) Using sealed end caps and bottom seal plate to prevent dust and debris from entering the interior of the slider, as shown in Figure 1.

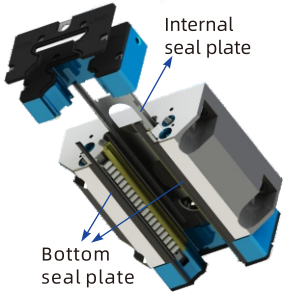


Figure 1

- 2)Internal sealing: Internal sealing is to prevent foreign objects from entering the raceway and affecting the service life of the guide rail pair when the sealing end caps at both ends of the slider cannot fully block foreign objects, resulting in a small amount of them entering the interior of the slider. As shown in Figure 1。
  A、The LGR45-100 types adopt an internal sealing plate form.
  B、The LGS30 to LGS35, LSQ30, and LSQ35 types adopt an internal sealing strip form.

- 3) Use a cap to plug the installation hole of the guide rail, so that the installation hole surface is on the same plane as the top surface of the guide rail, which can prevent debris from entering into the slider. The installation method of the hole cap is shown in Figure 2. Using a metal flat plate, use a hammer to gradually tap the hole cap into the installation hole until it forms a plane with the top surface of the guide rail.
  A、The material of the special hole cap is made of oil and wear resistant plastic to ensure full life。
  B、 Special copper hole caps and steel hole caps are used in conjunction with guide rails with non chamfered installation holes. The hole caps do not sink during long-term use and are suitable for various harsh environments.

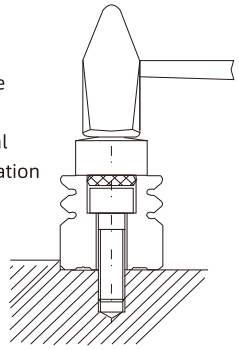


Figure 2

- 4) Protective belt plate: The protective belt plate is mainly used to seal the installation holes of the guide rail, making the top surface of the guide rail smooth and flat, without the accumulation of foreign objects, not only improving the sealing effect, but also beautiful and practical. As shown in Figure 3.
  Please consult HTPM for the installation method of the protective belt plate.

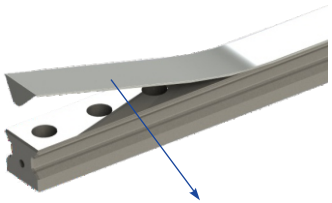


Figure 3

- 5) By adopting protective cover measures, HTPM will recommend the use of two types of protective covers: foldable protective covers and retractable plate protective covers.
  A、 Folding protective covers has a large expansion and contraction rate, good dust prevention effect, and is widely used. It is generally made of oil resistant, moisture resistant, and cold resistant chloroprene rubber or synthetic leather or plastic. For special purposes such as acid and alkali resistance, special materials are used for manufacturing.
  B、 The telescopic plate type protective cover is made of steel plates with a thickness of 0.5-0.6mm, and the surface is treated with oxidation. It consists of several sections, with a certain gap left between the two sections to ensure smooth expansion and contraction. The gap between each section is 0.05mm. This type of protective cover has a compact structure and good dust prevention effect, but the cost is relatively high.

After lubricating grease is injected into the slider, due to the influence of the sealing device, there is still a certain friction resistance during the operation of the slider. The friction resistance of the sealing device is shown in Table 1。

Table1 Reference value for friction resistance of sealing device unit: N

Product type	Friction	Product type	Friction	Product type	Friction
LM12	1	LSQ20	7	LGR12	1
LM15	1.5	LSQ25	8	LGR15	3
LMW15	3	LSQ30	9	LGR20	4
LGW25	9	LSQ35	9	LGR25N	8
LG45	10	LGS15	3	LGR30	9
LG55	11	LGS20N	7	LGR35	9
LG65	13	LGS25	8	LGR45	11
LGE15	2	LGS30	9	LGR55	13
LGE20	2.5	LGS35	9	LGR65	15
LGE25	3	LGS45	10	LGR85	20
LGE30	4	LGS55	13	LGR100	24
		LGS65	15		
		LGSW20	4		
		LGSW25	7		

● Installation of guide rail pairs

1、combination form

The commonly used combination form of guide rail pairs is shown in Figure 4, and the slider can also be used as a base (as shown in Figure 5) to place the guide rail under the workbench. In addition, the guide rail pair can also be installed in several other forms, as shown in Figure 6.

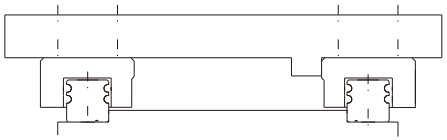


Figure 4: Double root formal installation

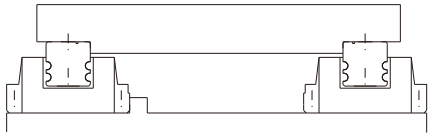
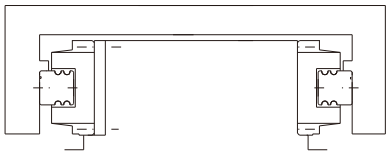
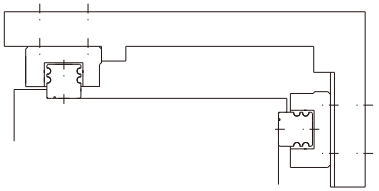


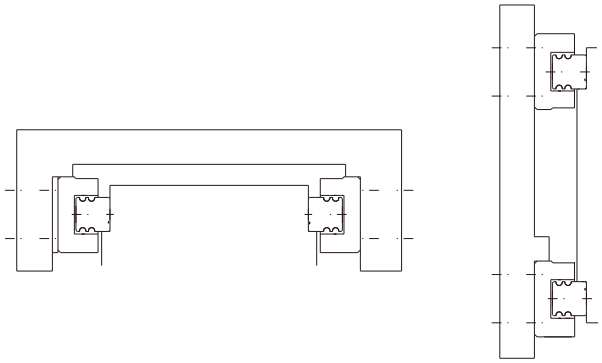
Figure 5: Double Root Reverse Installation



Double sided installation with movable guide rails



Double sided installation with movable guide rails



Double root hybrid installationDouble sided installation with sliding block movement

Figure 6

2、Accuracy requirements for installation base

The linear guide way has a homogenizing effect on errors due to the large number of steel balls. The elastic deformation of the guide rail can also reduce the error of the installation surface, and multiple sliders have a homogenizing effect on the error. The motion error of the moving parts installed on the guide rail will be reduced to 1/2 to 1/5 of the installation base surface error. Therefore, in general, the installation surface does not need to be ground and can be processed by precision planning or milling. (If it is required that the installation of the guide rail pair can achieve high accuracy, the installation surface must also have high accuracy).

Installation errors have a certain impact on friction resistance and the lifespan of guide rail pairs (see Figure 7 and Figure 8). When the installation error is large, it will cause an increase in dynamic friction and a decrease in service life. Under normal circumstances, if the installation error is controlled within the allowable error range given in the table below, it can ensure small and stable friction and long service life.

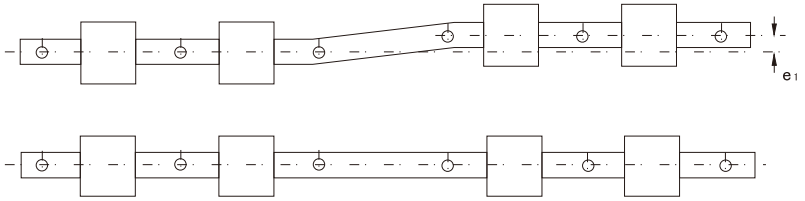


Figure 7 The parallelism error of two rails

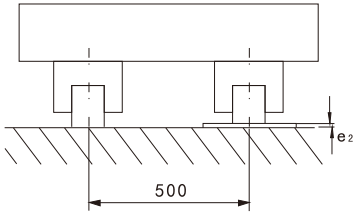


Figure 8 Installation base height error

LGS、LSQ、LGE 、LG、 LM 、LMW 、LGSW Series reference table below：：

Permissible tolerance for parallelism error of installation base unit:μm

Item	Preload	Guide rail specifications												
		3	5	7	9	12	15	20	25	30	35	45	55	65
Permissible value of parallelism of two rails e_1	Micro-clearance PN	7	10	15	18	20	25	28	40	45	50	60	70	80
	Micro-preload P0	2	2	4	6	9	10	13	25	30	35	45	55	65
	Light-preload P1	--	--	3	4	5	10	13	25	30	35	45	55	65
	Medium-preload P2	--	--	--	--	--	6	8	20	25	30	40	45	55
	Heavy preload P3	--	--	--	--	--	--	--	20	20	25	30	40	50
Permissible value of parallelism of two rails e_2		35μm/200mm				60μm/200mm			160μm/500mm					

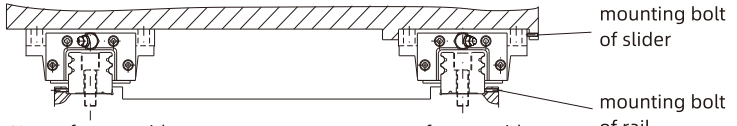
The contact state of the groove in the LGR type roller linear guideway is O-shaped, and the change in angular displacement of the slider when subjected to swinging torque is small, with high stiffness. The roller linear guideway requires higher installation surface accuracy from customers.
LGR Series reference table below:

Permissible tolerance for parallelism error of installation base unit: μm

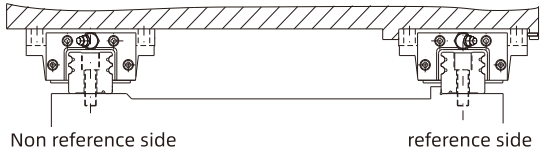
Item	Preload	Guide rail specifications										
		12	15	20	25N	30	35	45	55	65	85	100
Permissible value of parallelism of two rails e_1	Medium P2	4	5	6	7	8	10	13	15	20	29	33
	Heavy P3	2	3	4	5	6	7	9	11	16	23	26
Permissible value of parallelism of two rails e_2	Medium P2	85μm/500mm										
	Heavy P3	60μm/500mm										

3、 installation

When installing two pairs of guide rails in parallel in the same plane, if there is significant vibration and impact, and the accuracy requirement is high, then both guide rails should be positioned on their sides and have lateral clamping devices, as shown in the following figure. Otherwise, only one guide rail needs to be positioned on the side, and the other does not need to be positioned.

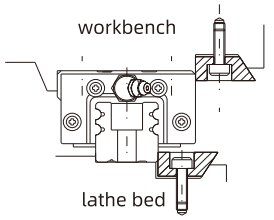


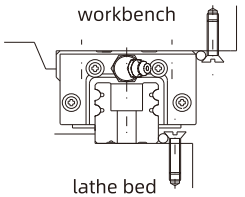
Double guide rail positioning

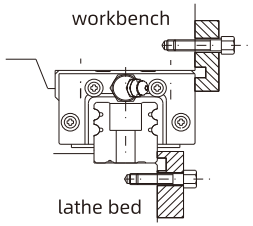


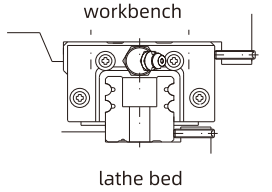
Single rail positioning

When the machine tool is subjected to vibration and impact, and the guide rail or slider may deviate from its original position, it is recommended to use various fixing methods as shown in the following figures.



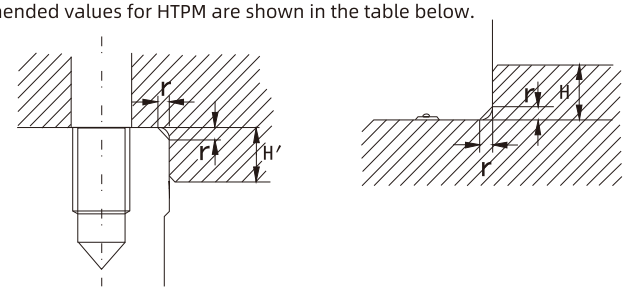






■ 1) The shoulder height and chamfer size of the installation base

As shown in the figure on the right, the height dimensions H, H ', and chamfer r of the installation base should be determined based on the corresponding dimensions of the guide rail and slider. The recommended values for HTPM are shown in the table below.



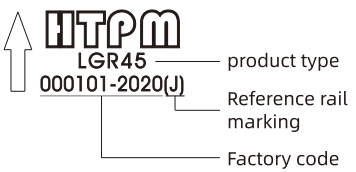
Type of guide rail	Chamfer radius r (maximum)	Shoulder height of guide rail H	Shoulder height of slider H
LM3	0.1	0.8	2
LM5	0.1	0.8	2
LM7	0.2	1.2	2.5
LM9	0.3	1.5	3
LM12	0.3	2.5	4
LM15	0.3	2.5	5
LMW15	0.3	2.5	5
LGW25	0.5	4	5
LG45	0.7	8	8
LG55	0.7	10	10
LG65	1.0	10	10
LGE15	0.5	3	4
LGE20	0.5	4	5
LGE25	0.5	5.5	5
LGE30	0.5	6	6
LSQ20	0.5	4	5
LSQ25	0.5	5.5	5
LSQ30	0.5	6	6
LSQ35	0.5	6	6

Type of guide rail	Chamfer radius r (maximum)	Shoulder height of guide rail H	Shoulder height of slider H
LGS15	0.5	3	4
LGS20N	0.5	4	5
LGSW20	0.5	4	5
LGS25	0.5	5.5	5
LGSW25	0.5	5.5	5
LGS30	0.5	6	6
LGS35	0.5	6	6
LGS45	0.7	8	8
LGS55	0.7	10	10
LGS65	1.0	10	10
LGR12	0.3	2.5	4
LGR15	0.5	3	4
LGR20	0.5	4	5
LGR25N	0.5	5	5
LGR30	0.5	5	6
LGR35	0.5	5.5	6
LGR45	0.7	7	8
LGR55	0.7	9	10
LGR65	1.0	10	10
LGR85	1.0	12	14
LGR100	1.0	12	16

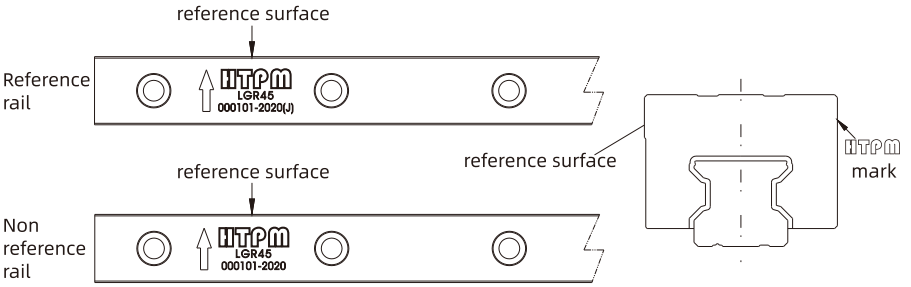
■ 2) Identification of Guideway and Slider Datum

The top of the guide rail is marked with the model and Factory serial number mark. When two guide rails are paired for use, the reference guide rail is marked with a "J" after the factory mark for identification.

The reference surface of the guide rail is the side plane indicated by the arrow next to the word HTPM; The reference surface of the slider is a smooth surface that has been ground with side cutting grooves, while the non-reference surface is marked with HTPM.



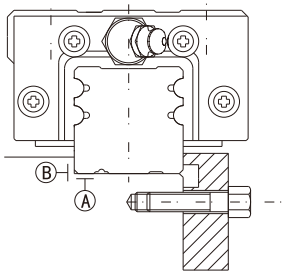
Note: During installation, please identify the reference plane and install according to regulations.



■ 3) Installation of guide rails

Firstly, use an oilstone to wipe off burrs and small protrusions on the reference surface of the machine tool, straighten them, and clean them with a cloth. Then wipe it clean with a volatile liquid. The rust proof oil on the guide rail should also be cleaned firstly.

After the side reference plane of the guide rail (the reference rail must use the side reference plane) is placed against the positioning step side reference plane B, it is pre fixed on the bed reference plane A with screws. The tightening force should not be too large, so that the bottom surface of the guide rail is tightly connected to the reference plane. The pressing method between the side of the guide rail and the reference B surface is shown in the right figure. Use a pressure plate to press the guide rail tightly, so that the side of the guide rail is tightly connected to the installation reference B surface.09



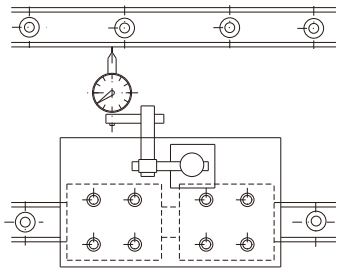
After the above work is completed, use a torque wrench to tighten the installation screws of the guide rails one by one according to the reference values in the table, starting from the middle and tightening in a cross sequence towards both ends.

Bolt tightening torque value

unit: Nm

Screw number	Iron	Casting	Aluminum
M2	0.6	0.4	0.3
M3	2	1.3	1
M4	4	2.7	2
M5	8.8	5.8	4.5
M6	14	9.2	6.8
M8	30	20	15
M10	68	45	33
M12	120	78	58
M14	157	105	78
M16	196	131	98
M18	265	178	133
M20	382	255	191
M22	519	348	260
M24	657	441	328
M30	1300	872	652

When positioning with dual guide rails, both guide rails should be installed according to the above method; When using a single guide rail positioning method, the side of one of the guide rails will not be positioned, and calibration should be carried out according to the method shown in the right figure. Firstly, connect the two sliders with a fixture, and place a dial gauge above the fixture. The measuring end of the dial gauge contacts the side of the non-reference guide rail, move the dial gauge, adjust the non-reference guide rail according to the reading, and then tighten the installation screw with a torque wrench.



However, the above method is only applicable to situations where the span of the two guide rails is small. When the span is large, the measurement accuracy may be affected due to insufficient rigidity of the gauge frame. Therefore, for situations with large spans, HTPM suggests that users firstly install and fix the workbench on the slider of the reference guide rail. For the two sliders of the non-reference guide rail, gently connect them to the workbench with installation screws, place a dial gauge holder on the workbench, contact the measuring head with the side base surface of the non-reference side guide rail, adjust the non-reference side guide rail according to the reading during the movement of the dial gauge, and then use a torque wrench to tighten the installation screws of the guide rail one by one.

■ 4) Installation and fixation of sliders and workbenches

After the above work is completed, position the slider at the predetermined intervals. Gently place the workbench on the slider, align the installation holes of the workbench with the installation screw holes on the top surface of the slider, pre fix the slider with installation screws, and press the device so that the reference side of the reference slider is close to the reference side of the workbench. Tighten the installation screws on the slider one by one in diagonal order.

After installation, check whether the operation within the stroke is light, flexible, and free of any obstruction, and whether the friction force changes significantly throughout the entire stroke.

4、Joint marking and combination of splicing guide rails

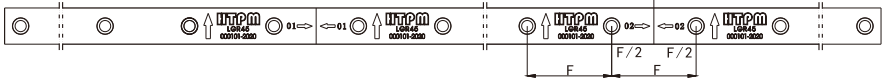
If the required guide rail length exceeds the maximum length that HTPM can produce for a single rail, the method of splicing two or more guide rails together can be used. When installing, the user must follow the joint markings marked on the top surface of the guide rail for installation.

The distance between the installation holes of the guide rail at the joint is shown as F in the following figure. To avoid accuracy changes when the slider passes through the joint, it is recommended to stagger the joints of the two guide rails. Please consult HTPM for specific information on the installation of splicing guide rails.

Reference rail

stagger

Non reference rail



Attention:

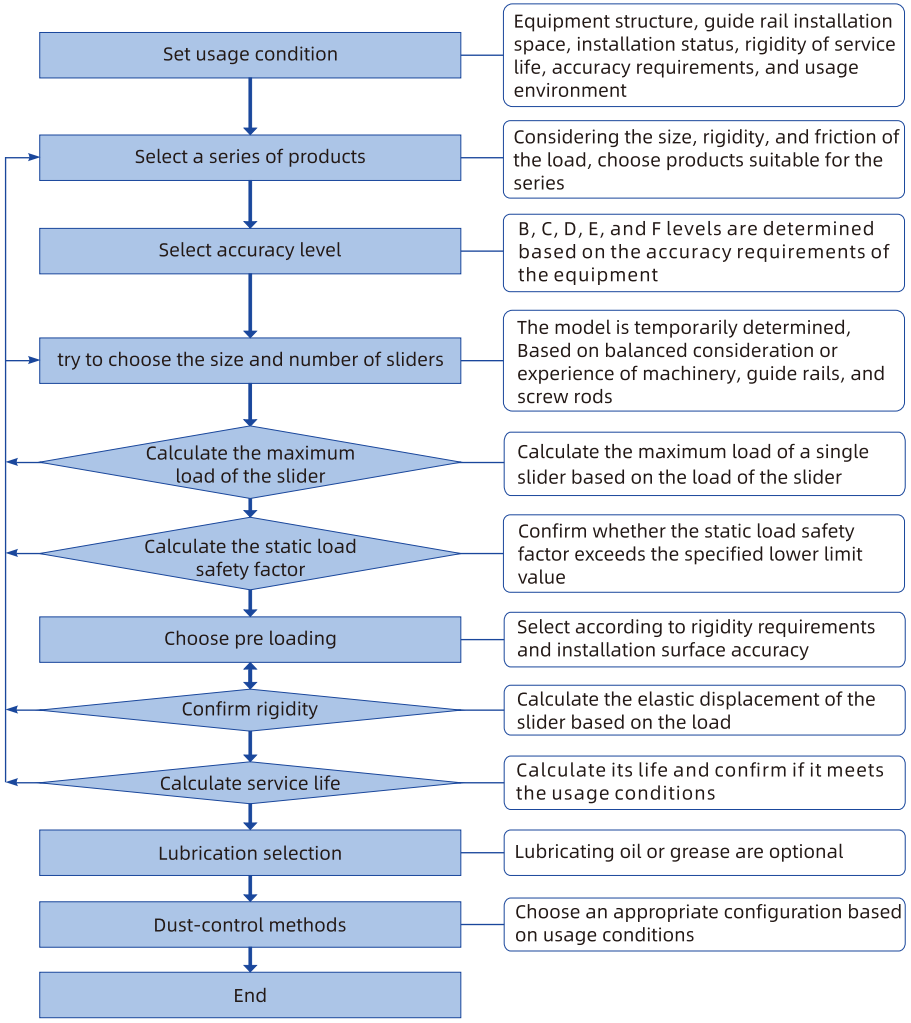
*If it is not necessary to install the guide rail, do not remove the slider from the guide rail. If you need to remove or install the slider from the guide rail, please use a plastic guide rail. Align the plastic guide rail with the axis direction of the guide rail, with the end of the plastic guide rail tightly against the end face of the guide rail. First, insert the return part of the slider, and then push the entire slider into the guide rail or push it out to the plastic guide rail.

*The slider contains a lot of plastic accessories, so avoid using organic solvents to contact or soak the slider during cleaning.

*When the guide rail is tilted, it may cause the slider to slide out of the guide rail due to its own weight, so please be careful when moving the guide rail.

● User guidance of linear guideway selection

1、Selection flow chart



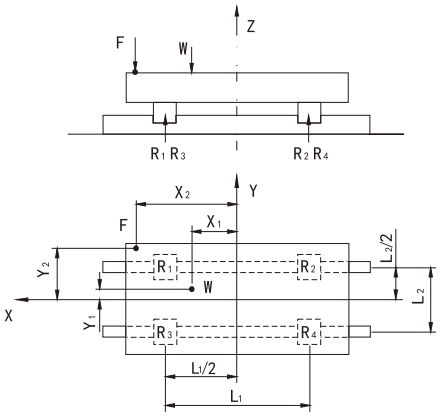
2、Calculation of load on linear guideway

The load on each slider of the linear guideway is influenced by various factors such as the installation status of the guide pair (horizontal, vertical, etc.), the center of gravity and force point position of the workbench, the effect of cutting resistance, and the acceleration during motion.

The following table shows the calculation of the load acting on each slider of the rolling linear guide pair in several situations.

Users can calculate the load carried by each slider of the rolling linear guide pair based on the configuration form of the selected guide pair, and then calculate the life of the guide pair according to the life calculation method provided later.

Four-sliders worktable



W:weight of workbench F:external load

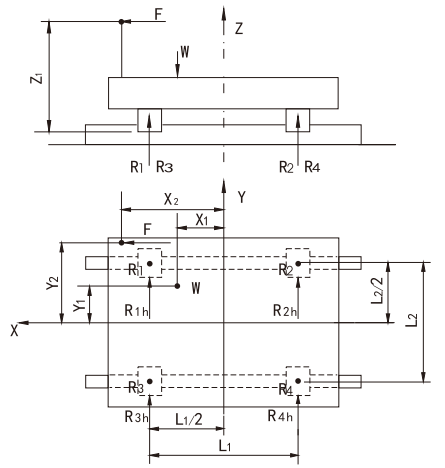
Ri: Reaction Force of slider

$$R_1=\frac{F+W}{4}+\frac{WY_1+FY_2}{2L_2}+\frac{WX_1+FX_2}{2L_1}$$

$$R_2=\frac{F+W}{4}+\frac{WY_1+FY_2}{2L_2}-\frac{WX_1+FX_2}{2L_1}$$

$$R_3=\frac{F+W}{4}-\frac{WY_1+FY_2}{2L_2}+\frac{WX_1+FX_2}{2L_1}$$

$$R_4=\frac{F+W}{4}-\frac{WY_1+FY_2}{2L_2}-\frac{WX_1+FX_2}{2L_1}$$



$$R_1=\frac{W}{4}+\frac{WY_1}{2L_2}+\frac{WX_1+FZ_1}{2L_1}$$

$$R_2=\frac{W}{4}+\frac{WY_1}{2L_2}-\frac{WX_1+FZ_1}{2L_1}$$

$$R_3=\frac{W}{4}-\frac{WY_1}{2L_2}+\frac{WX_1+FZ_1}{2L_1}$$

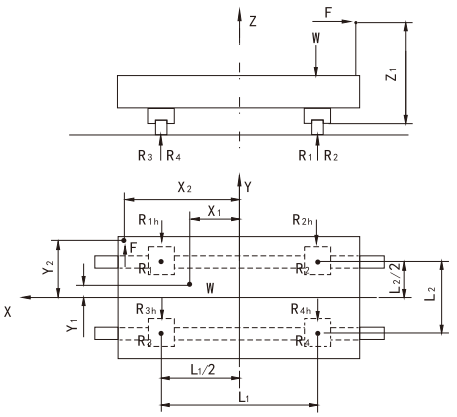
$$R_4=\frac{W}{4}-\frac{WY_1}{2L_2}-\frac{WX_1+FZ_1}{2L_1}$$

$$R_{1h}=\frac{FY_2}{2L_1}$$

$$R_{2h}=-\frac{FY_2}{2L_1}$$

$$R_{3h}=\frac{FY_2}{2L_1}$$

$$R_{4h}=-\frac{FY_2}{2L_1}$$



$$R_1=\frac{W}{4}+\frac{WX_1}{2L_1}+\frac{WY_1+FZ_1}{2L_2}$$

$$R_2=\frac{W}{4}-\frac{WX_1}{2L_1}+\frac{WY_1+FZ_1}{2L_2}$$

$$R_3=\frac{W}{4}+\frac{WX_1}{2L_1}-\frac{WY_1+FZ_1}{2L_2}$$

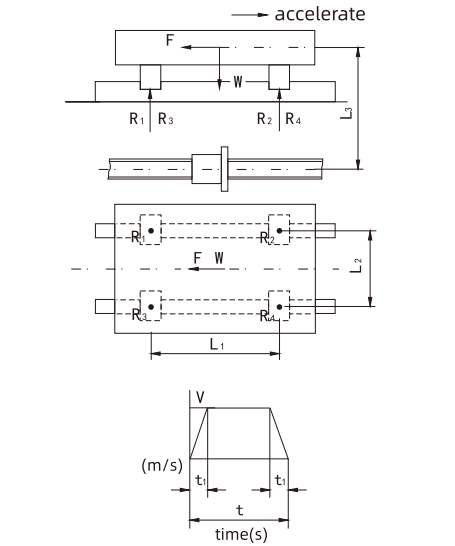
$$R_4=\frac{W}{4}-\frac{WX_1}{2L_1}-\frac{WY_1+FZ_1}{2L_2}$$

$$R_{1h}=\frac{F}{4}+\frac{FX_2}{2L_1}$$

$$R_{2h}=\frac{F}{4}-\frac{FX_2}{2L_1}$$

$$R_{3h}=\frac{F}{4}+\frac{FX_2}{2L_1}$$

$$R_{4h}=\frac{F}{4}-\frac{FX_2}{2L_1}$$



$$R_2=R_4=\frac{W}{4}-\frac{L_3}{2L_1}\frac{V}{gt_1}W$$

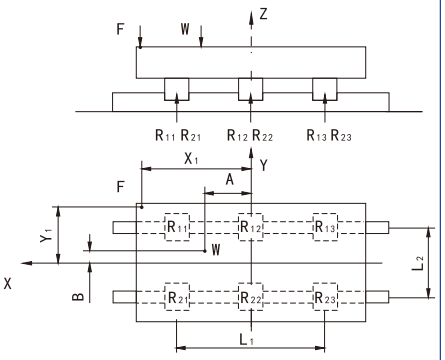
$$R_1=R_3=\frac{W}{4}+\frac{L_3}{2L_1}\frac{V}{gt_1}W$$

g: Gravitational acceleration

V: velocity

L3: The distance between the axis of the ball screw and F When moving at a constant speed

$$R_1=R_2=R_3=R_4=\frac{W}{4}$$



When subjected to vertical loads

$$R_{11}=\frac{F+W}{6}+\frac{WB+FY_1}{3L_2}+\frac{WA+FX_1}{2L_1}$$

$$R_{12}=\frac{F+W}{6}+\frac{WB+FY_1}{3L_2}$$

$$R_{13}=\frac{F+W}{6}+\frac{WB+FY_1}{3L_2}-\frac{WA+FX_1}{2L_1}$$

$$R_{21}=\frac{F+W}{6}-\frac{WB+FY_1}{3L_2}+\frac{WA+FX_1}{2L_1}$$

$$R_{22}=\frac{F+W}{6}-\frac{WB+FY_1}{3L_2}$$

$$R_{23}=\frac{F+W}{6}-\frac{WB+FY_1}{3L_2}-\frac{WA+FX_1}{2L_1}$$

For the load that varies throughout the entire stroke, the calculated load should be calculated:

1) Calculated load when load changes in sections:

$$P_c=\sqrt[3]{(P_1^3L_1+P_2^3L_2+\cdots+P_n^3L_n)/L}$$

Pn- load within the corresponding stroke Ln (KN)

Ln-segmented travel (km)

L-full stroke, equal to Ln (km)

2) Calculated load when load changes with linear variation: $P_c=(P_{min}+2P_{max})/3$

3) Calculated load when load changes with full wave sine curve variation: $P_c=0.65P_{max}$

4) Calculated load when load changes with half wave sine curve variation: $P_c=0.75P_{max}$

5) Calculated load when bearing both vertical load Pv and horizontal load PH: $P_c=P_v+P_H$ (KN)

6) Calculated load when bearing torque M: $P_c=P_0+C_0\cdot\frac{M}{M_t}$ (KN)

Po - external load ; Co - rated static load; M-external torque; Mt - Rated torque

3、Calculation of frictional force

The frictional resistance varies depending on the structural form of the guide rail pair, the viscosity of the lubricant, the load received, and the speed of motion. After preloading, the frictional resistance will increase.

The friction force F can be calculated using the following formula: F=μp+f

LG、LM series: μ= 0.005 ~ 0.01

LGS、LSQ、LGE series: μ= 0.003 ~ 0.004

LGR series: μ= 0.001 ~ 0.002

P- normal load (N)

f- Seal resistance (N) Refer to Table 1 on page 6

4、Example of Life Calculation

■ 1)A certain wire cutting machine worktable is known to use LGS30AA type guide rail pairs, and there are two sliders on one guide rail. Each slider is subjected to a load of P_C=1.8KN, a stroke of L_S=1m, and a reciprocating motion of n=10 per minute. The machine is turned on for 16 hours a day, and calculated based on 300 working days per year, the annual working time is 16 hours × 300=4800 hours.

f_U=1,f_T=1,f_C=0.81,f_W=1.5

so: $L=\left[\frac{1\times1\times0.81}{1.5}\cdot\frac{34.8}{1.8}\right]^3\times50=56894km$

Lifespan:

$$I_n=\frac{L\times10^3}{2\times L_S\times n\times60}=\frac{56894\times10^3}{2\times1\times10\times60}=47411(hour)$$

$\frac{47411}{4800}$=9.8(year) Therefore, it can work for 9.8 years under normal conditions

■ 2) LG type rolling linear guide rail auxiliary support system installed horizontally. Two sliders are used on a guide rail, with given parameters: the weight of the workbench W=2KN, the load-bearing capacity P=14KN (acting on the center of the sliders), the effective stroke L_m=0.8 meters, and the number of reciprocations per minute n=8. The operating conditions are: no obvious impact or vibration, and the target lifespan is 11 years. Try to choose the specifications of this rolling linear guide rail pair. (Calculated based on 16 hours of operation per day and 300 working days per year.)

f_H=1,f_T=1,f_C=0.81,f_W=1.5

The target lifespan is: $L=11\times300\times16\times60\times0.8\times8\times2\times10^{-3}=40550.4(km)$

The load of the four sliders is: P1=P2=P3=P4= (14+2) /4=4KN

$$L=50\times\left[\frac{f_H\times f_T\times f_c}{f_w}\cdot\frac{C}{P_c}\right]^3$$

It can be calculated that: $C\geqslant\left(\frac{40550.4}{50}\right)^{1/3}\times\frac{4\times1.5}{0.81}=69.07(KN)$

Users can choose the LG45 standard linear guideway.

Its rated dynamic load value is 73KN, and its rated static load value is 102.9KN.

■ 3) A certain CNC special machine requires the installation of LGR type rolling linear guide rail pairs on the horizontal axis. Two guide rails are used in pairs. Two sliders are used on each guide rail. The weight of the workbench is W=3KN. The load is P=20KN (acting on the center of the sliders). The effective stroke is Lm=1 meter, and the number of reciprocating times per minute is n=10. The operating conditions are no obvious impact and vibration. The target lifespan is 15 years. The specification of the rolling linear guide rail pair is selected for trial use. (Calculated as 300 working days per year based on a daily start-up time of 16 hours.)

f_H=1, f_T=1, f_C=0.81, f_W=1.5

The target lifespan is:

$L=15\times300\times16\times60\times1\times10\times2\times10^{-3}$=86400km

The load of the four sliders is: P1=P2=P3=P4= (20+3) /4=5.75KN

$$L=100\times\left[\frac{f_H\times f_T\times f_C}{f_W}\cdot\frac{C}{P_C}\right]^{10/3}$$

It can be calculated that: $C\geq\left(\frac{86400}{100}\right)^{3/10}\times\frac{5.75\times1.5}{0.81}=80.95KN$ $C_{50}=1.23\times C=99.57KN$

Users can choose the LGR55 standard linear guideway.

Its rated dynamic load value is 157.3KN, and its rated static load value is 275.3KN.

Precautions for using the rolling linear guide pair

1、Storing

1) When storing the guide rail pair, please keep it in the original packaging state, store it horizontally indoors, and avoid high temperature, low temperature and highly environment.

2)Due to long-term storage (over 2 years), the lubricating grease inside the guide rail may gradually deteriorate. Please add it regularly before use.

2、Installation

1) When handling the product, please use protective gloves, safety shoes and other protective equipment as needed to ensure safety.

2)When lifting or installing the guide rail assembly, improper tilting may cause the slide to slide out of the guide rail due to its own weight.

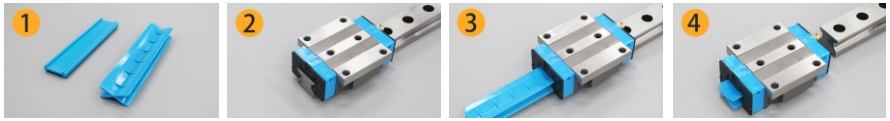
3) For rail assemblies that are too heavy, more than 2 people are needed or use lifting tools to assist in lifting or installation to avoid personal injury or damage to workpieces.

4) When knocking on the guide rail assembly or when the guide rail assembly falls, even if there is no visible damage, it may cause functional damage or affect the accuracy.

5) If you put your hand into the guide rail mounting hole, it may get caught between the mounting hole and the slide, causing injury. Please be careful.

6) The slide is precisely adjusted and assembled at the factory. Disassembling any part of the slide by yourself may lead to the entry of foreign objects or adversely affect on the assembly effect.

7) Generally, it is not allowed to move the slide out of the guide rail. If it is necessary to move the slide out of guide rail for installation, it is necessary to use the factory-installed fake guide rail and ensure that the fake guide rail is fully inserted into the slide to avoid the elements falling off.



8) During the installation of the guide rail assembly, since it is easy for foreign objects to enter the slide after the slide is moved out of guide rail, resulting in jamming or abnormal operation, please pay attention.

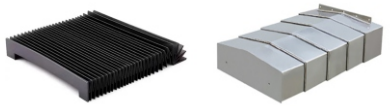
9) To avoid rust on the guide rail assembly affecting the use, please clean the its surface and apply lubricating oil in time after the guide rail assembly is installed.

10）The guide rail contains more plastic parts, avoid using organic solvents to contact the guide rail when cleaning.

3、Using

1) When used in environments with chips, coolant, corrosive solvents, or high humidity, it is suggested to use telescopic covers or protective shields to prevent them from entering the product to cause damage or reduce the rust prevention effect.

Organ shield　　Steel plate protective cover



2) Except for the high-temperature rail pair with a metal return end cap, which can be used in high-temperature of 80 to 150℃,other guide rail need to be used within the temperature of -10 to 80℃.

3) The guide rail pair can only ensure accuracy and service life under good lubrication conditions, but please do not mix different types of lubricating oil (ase), to avoid adverse effects on each other.

4) After the guide rail pair is initially filled with lubricating oil (grease), move the slide block back and forth at least 3 times the length of the slide block first and observe whether there is a uniform oil film on the guide rail surface. It can ensure that the lubricating oil (grease) can be normally supplied for the use of the guide rail pair.

5) After adding lubricating grease, the slide block may exert a certain resistance on the rolling elements, resulting in increased running resistance of the slide block. make sure to perform the break-in of the guide pair.

6) When using oil lubrication, due to the influence of the installation method, the lubricating oil may not reach all parts inside the slide block. For details, please consult HTPM in advance.

7) When the travel is small (i.e., the travel is less than twice the total length of the slide), it is difficult to form an oil between the rolling surface and the rolling element, which may cause fretting wear. Please use a grease with excellent anti-fretting wear performance. In addition, it recommended to regularly perform a stroke movement equivalent to the full length of the slide to form an oil film between the rolling surface and the rolling element.

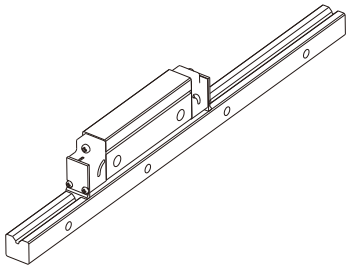
8）For equipment that needs to be stopped for use due to holidays or other reasons, it is necessary to properly clean the foreign objects around the guide rail pair in advance and add rust prevention oil on the surface of the guide rail pair. At the same time, before stopping the machine, it is necessary to add lubricating oil (grease) to the guide rail pair once. Before reusing the equipment, it is necessary to re-add lubricating oil (grease) to the guide rail pair and ensure the lubrication system is normal before it can be used.

9) Dust, chips, wood shavings, etc., will deposit and scale on the guide, especially when the guide is not enclosed and protected without a. In order to ensure the function of the seal, these impurities must be removed regularly, and it is recommended to perform at least one full-stroke "clean stroke" every 8 hours.

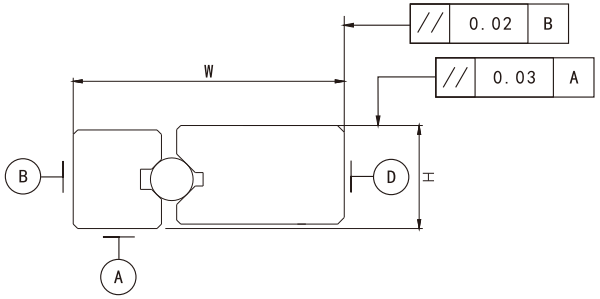
BALL V-TYPE LINEAR GUIDEWAY

Structure

A set of guide rails consists of 2 guide rails with V-shaped grooves and 4 sliding blocks. The reversers at both ends of the slider achieve infinite circulation of steel balls. The slider is equipped with sealed end caps at both ends to scrape away dust and other debris that falls on the guide rail. There are dust discharge slots installed on the slider body and backflow device, which can effectively prevent dust or wood chips from blocking and ensure the normal operation of the slider. The V-shaped ball guide pair is suitable for the woodworking machinery industry with extremely harsh working environments.



Precision specification



Unit:mm

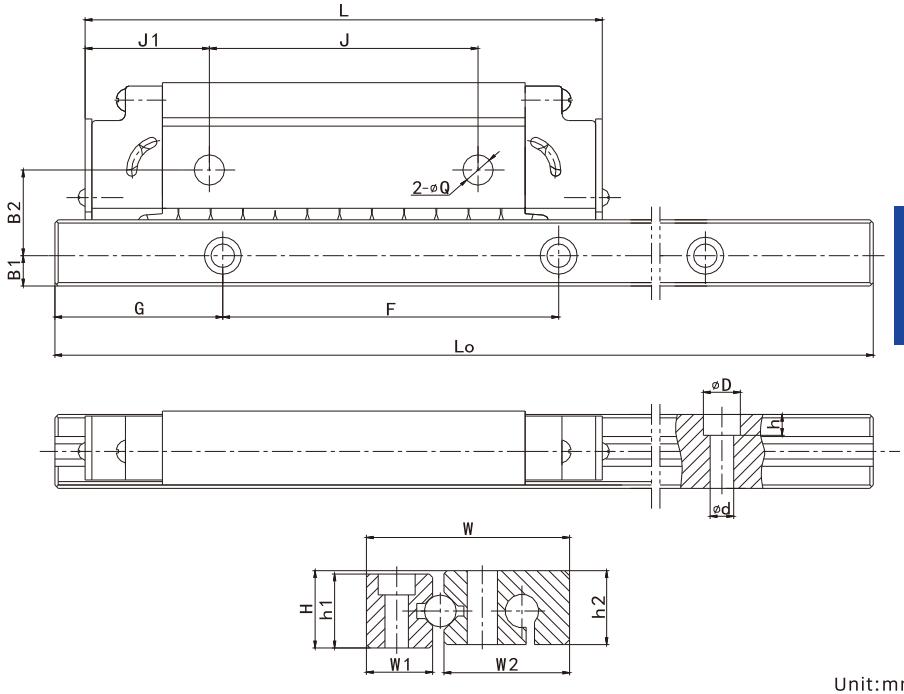
Project	Symbol	Accuracy
Dimensional tolerance of height H	δH	±0.1
The dimensional variation of multiple sliders H on the same plane	ΔH	0.02
Dimensional tolerance from base plane "D" to side base plane "B"	δW	0~-0.2
The dimensional variation of multiple sliders W on the same guide rail	ΔW	0.05

Order number

FVG 10 — 1000
- 1000 — Rail length
- 10 — Size specifications
- FVG — Ball V-shaped guide rail code

FVS 10
- 10 — Size specifications
- FVS — Ball V-shaped Slide code

Dimension list



Unit:mm

Specification Code	Combined dimensions after assembly			Slider dimensions						Rail size							Weight of slider	Rail weight	Basic rated Load	
	H	W	B2	L	J	J1	Q	W2	h2	B1	h1	F	d×D×h	W1	Reference G	Lomax	Kgf	Kgf/m	Dynamic load C(kgf)	Static load Co(kgf)
VL10	23	60.5	25.5	155	80	37.5	9	37	22	9	22	100	7×11×6.2	19.7	50	3000	0.9	3.08	102	800