SFT

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Standard Type
Linear Guideway

SFT Standard Type Linear Guideway

Contents

Introduction

Linear guideway is the motion product by rolling elements. By using recirculated rolling elements such as balls or rollers between the rail and the carriages can achieve much lower friction. Which compared with the traditional slide and provide much smoother operation. Furthermore, depending to our outstanding process capability, we can offer the interchange of high accuracy to customers for easy maintenance and replacing.
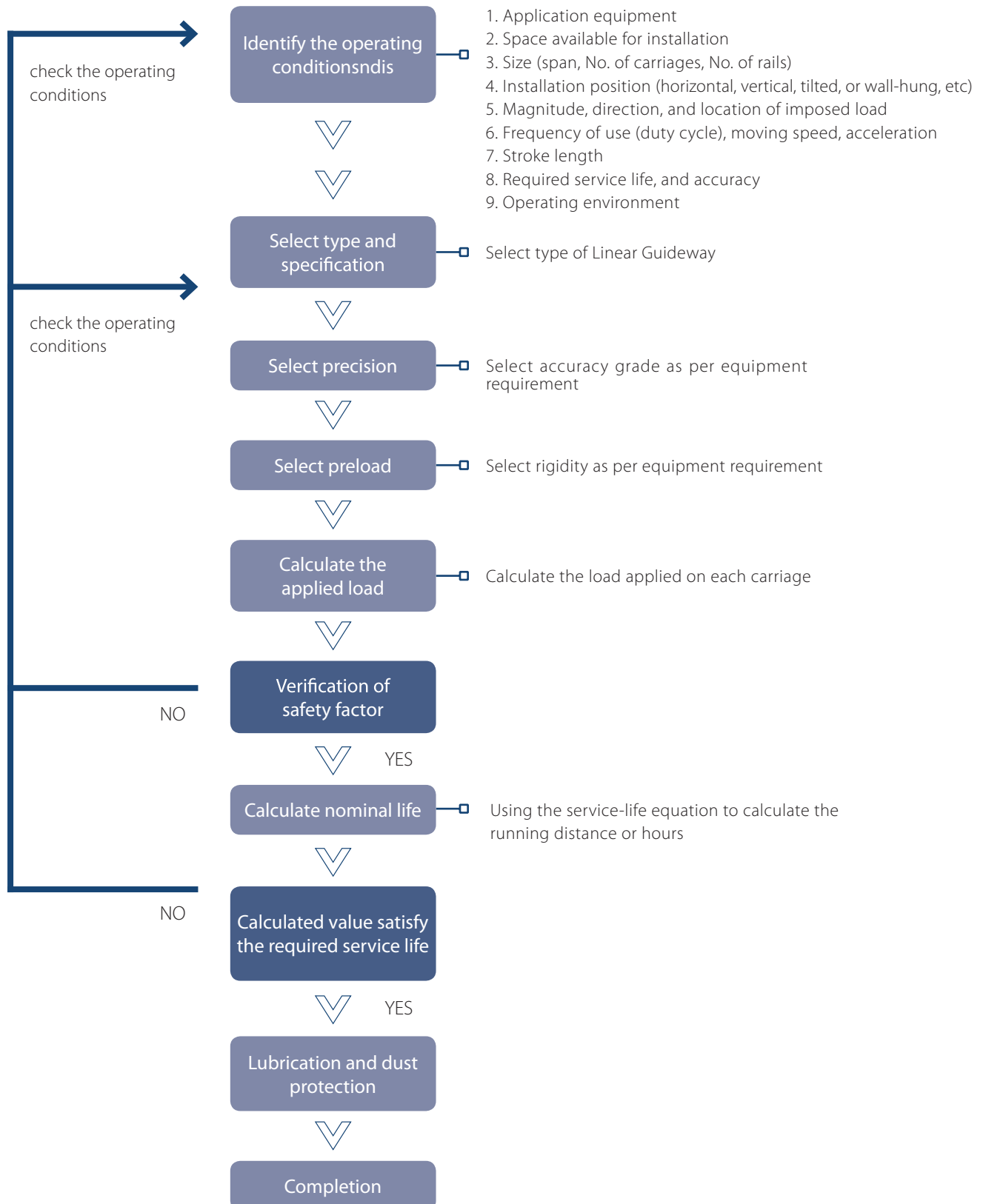
Features

1. Low frictional resistance-With using the rolling contact to replace of the traditional sliding one, the friction coefficient is only 1/50 of tradition contact.

2. High positioning accuracy-The rolling motion with a low friction coefficient, and the difference between dynamic and static friction is very small. Therefore, there would be no slippage while the load is moving.

3. Low power consumption-Due to the characteristic of low frictional resistance, the required driving force is much lower than in other systems, thus the power consumption is small. Moreover, the emperature rising effect is small even under high speed operation.

4. Four-way equal load-The optimum design of geometric mechanics makes the linear guideway to bear the load in all four directions, radial, reversed radial, and two lateral directions.

5. Interchangeability-Superior processing ability can offer the linear guideway high precision and make the customers use and maintain easily, and also achieve original highly accurate linear motion.

6. Easy lubrication-With a special lubricating design linear guideway, it is possible to equip various grease nipples and piping joints, and then to effectively inject grease or lubrication oil into the interior of the carriages.

Selection Process

check the operating
conditions

Identify the operating conditionsndis

1. Application equipment
2. Space available for installation
3. Size (span, No. of carriages, No. of rails)
4. Installation position (horizontal, vertical, tilted, or wall-hung, etc)
5. Magnitude, direction, and location of imposed load
6. Frequency of use (duty cycle), moving speed, acceleration
7. Stroke length
8. Required service life, and accuracy
9. Operating environment

check the operating
conditions

Select type and specification

Select type of Linear Guideway

Select precision

Select accuracy grade as per equipment requirement

Select preload

Select rigidity as per equipment requirement

Calculate the applied load

Calculate the load applied on each carriage

NO

Verification of safety factor

YES

Calculate nominal life

Using the service-life equation to calculate the running distance or hours

NO

Calculated value satisfy the required service life

YES

Lubrication and dust protection

Completion

Rated Load and Life

1. Basic Static Load Rating (C_0)

The basic static load rating (C_0) refers to a static load in a given direction with a specific magnitude applied at the contact area under the most stress where the sum of permanent deformation develops between the raceway and rolling elements is 0.0001 times of the diameter of rolling ball. Therefore, the basic static load rating sets a limit on the static permissible load.

2. Static Permissible Moment (M_0)

When a moment is applied to a linear guideway, the rolling balls on both ends will receive the most stress among the stress distribution over the rolling elements in the system. The static permissible moment (M_0) refers to a static moment in a given direction with specific magnitude applied at the contact area under the most stress where the sum of permanent deformation develops between the raceway and rolling elements is 0.0001 times the diameter of rolling elements. Therefore, the static permissible moment sets a limit on the static moment. In linear guideway system, the static permissible moment is dened as M_P, M_Y, M_R three directions. See the gure below.
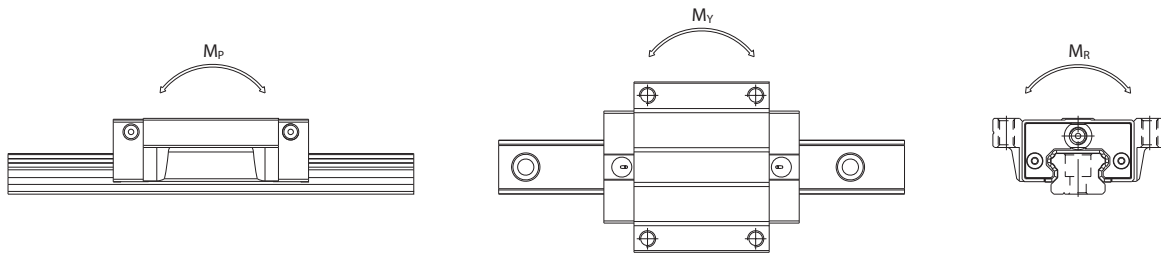
3. Static Safety Factor (f_s)

Due to the impact and vibration while the guideway at rest or moving, or the inertia from start and stop, the linear guideway may encounter with an unexpected external force. Therefore, the safety factor should be taken into consideration for effects of such operating loads. The static safety factor (f_s) is a ratio of the basic static load rating (C_0) to the calculated working load. The static safety factor for different kinds of application is shown as Table.

$$f_s = \frac{C_o}{P} \quad \text{or} \quad f_s = \frac{M_o}{M}$$

f_s	Static safety factor
C_0	Basic static loadrating(N)
M_0	Static permissible momemt(N-m)
P	Calculated working load(N)
M	Calculated moment(N-m)

Load Condition	f_s
Normal loading condition	1~3
With impact and vibration	3~7

4. Basic Dynamic Load Rating

The basic dynamic load rating (C) is dened as a load in a given direction and with a given magnitude that when a group of linear guideways operate under the same conditions. As the rolling element is ball, the nominal life of the linear guideway is 50 km.

5. Calculation of Nominal Life

The life of linear guideway is defined as the total distance traveled until fatigue flaking appears on the surface of the raceway or rolling elements. Even when the linear 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 prediction the service of a linear guideway. The nominal life is the total distance that 90% of a group of identical linear guideways, operated under the identical conditions, can travel without flaking. Based on the selected basic dynamic rated load (C) and actual load (P), the nominal life of linear guideway can be calculated.

$$L = (\frac{f_h \times f_t \times C}{f_w \times P})^3 \times 50 \ (km)$$

L	Nominal life (km)	f_h	Hardness factor
C	Basic dynamic load rating (N)	f_t	Temperature factor
P	Working load (N)	f_w	Loading factor

6. Factors of normal life

As the above mentioned about the calculation of nominal life of the linear guideway, which the factors about the hardness, temperature and load will affect the nominal life of the linear guideway, the related coefficient is as the following explanation.

6.1 Hardness factor

In order to ensure the optimum load capacity of linear guideway system, the hardness of raceway must be HRC58~64. If the hardness is lower than this range, the permissible load and nominal life will be decreased. For this reason, the basic dynamic load rating and the basic static load rating should be multiplied by hardness factor for rating calculation. See figure below. The hardness requirement of SFT linear guideway is above HRC58~64, thus the f_h=1.0.

6.2 Temperature factor

When operating temperature higher than 100℃, the nominal life will be degraded. Therefore, the basic dynamic and static load rating should be multiplied by temperature factor for rating calculation. See figure below. The assemble parts of SFT guideway are made of plastic and rubber, therefore, the operating temperature below 100℃ is strongly recommend. For special need, please contact us.

6.3 Load factor

Although the working load of linear guideway system can be obtained by calculation, the actual load is mostly higher than calculated value. This is because the vibration and impact, caused by mechanical reciprocal motion, are difficult to be estimated. This is especially true when the vibration from high speed operation and the impact from repeated start and stop. Therefore, for consideration of speed and vibration, the basic dynamic load rating should be divided by the empirical load factor. See the table below.

Motion Condition	Operating Speed (m/min)	f_w
No impact & smooth operation	V ≦ 15	1.0~1.2
Slight impact & vibration	15 < V ≦ 60	1.2~1.5
Moderate impact	60 < V ≦ 120	1.5~2.0
Strong impact & vibration	120 < V	2.0~3.5

Preloading and Rigidity

The rigidity of a linear guideway could be enhanced by increasing the preload. The preload is represented by negative clearance resulting from the increase of rolling element diameter. Therefore, the preload should be considered in calculation service life. Selecting proper preload from table below to adapt the specific application and condition.

Preload Grade	Preload	Operating Condition	Application
Light preload Z0	0~0.02C	The loading direction is fixed, vibration and impact are light, and two axes are applied in parallel. High precision is not required, and the low frictional resistance is needed.	Semiconductor Manufacturing, Medical equipment, Punching press, Welding machine, Industrial Robot, Auto packing machine, XY axis of ordinary industrial machine, Pallet changer, material handling equipments, and other small sliding systems.
Medium preload Z1	0.03C~0.05C	Applied in one-axis configuration. The need of light preload and high precision.	Z axis of industrial machines, precision XY table, Industrial Robot, NC Lathe, measuring equipment, grinding machine, auto painting machine、Precision XY table.
Heavy preload Z2	0.06C~0.08C	Machine is subjected to vibration and impact, and high rigidity required. Application of heavy load or heavy cutting.	Machining center, NC Lathe, Milling machine, Boring machine, Z axis of industrial machines.

Accuracy Standard

The accuracy of linear guideway includes the dimensional tolerance of height, width, and the running accuracy of the carriage on the rail. The standard of the dimension difference is built for two or more carriages on a rail or a number of rails are used on the same plane. The accuracy of linear guideway is divided into 5 classes, normal grade (N), high precision (H), precision (P), super precision (SP), and ultra precision (UP). When two or more linear guideways are used on the same plane, the tolerance of N and difference of △W is applicable to master rail only. The accuracy is measured at the center or central area of carriage. The accuracy grade for different applications shown as table below.

	Normal C	High H	Precision P	Super Precision SP	Ultra Precision UP
G Series	◎	◎	◎	◎	◎

Lubrication

Supplying the sufficient lubrication to the linear guideway will greatly reduce the rolling friction and increase the service life. Otherwise, the lubrication also prevent from corrosion. Generally, the linear guideway usually use lubrication grease and lubrication oil. It will be chosen by customers' options.

1. Grease

After the linear guideway installed, we recommend 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 speed that do not exceed 60 m/min faster speed will require high-viscosity oil with a lubricant. The standard grease is lithium-based grease No.2.
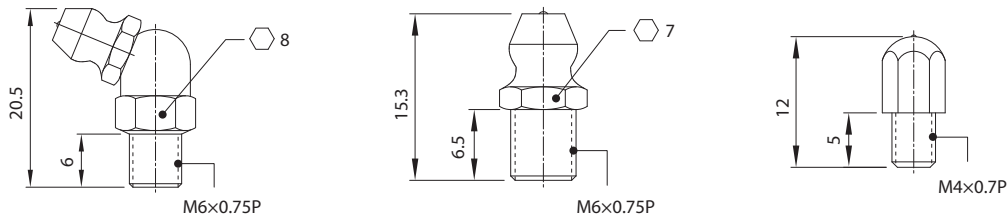
2. Oil

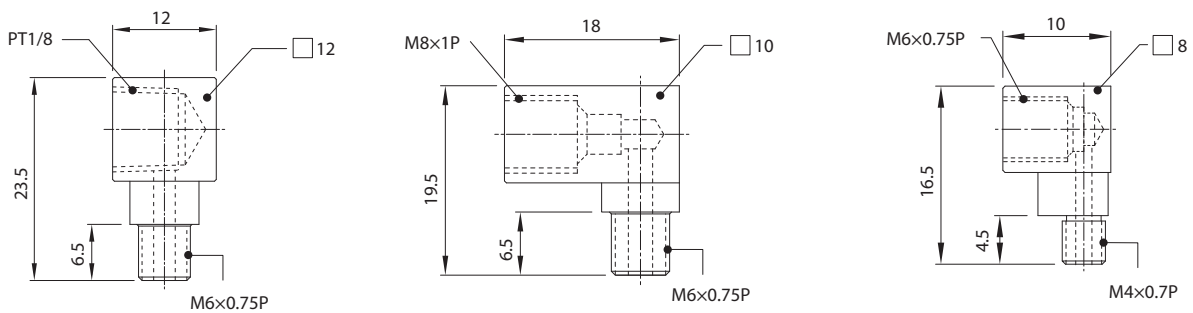The recommend viscosity of oil is about 30~150 cST, and the recommend oil.

3. Grease nipples and piping

SFT offers the following various grease nipples and piping joints to customers' options.

Grease Type

Piping Type

Dustproof Accessories

SFT offers various contamination protection against different environments for linear guideway.

Code	Contamination protection	Applied condition
No symbol	Metallic scraper (both ends)	Low resistance and cleaner enviroments
UU	Bidirectional end seal(both ends)	Low resistance
SS	Bidirectional end seal+Bottom seal	Normal environments
ZZ	SS + Inner seal+ Metallic scraper	Prevent large steel chips
DD	Double bidirectional end seal + Bottom seal + Inner seal	Highly dust-proof requirement
KK	DD + Metallic scraper	Prevent large steel chips and highly dust-proof requirement

End Seal

Inner Seal

Bottom Seal

SS Layout

Metallic Scraper
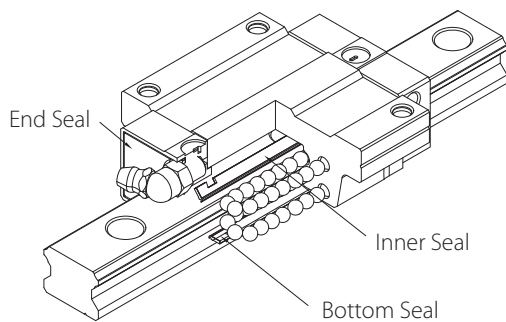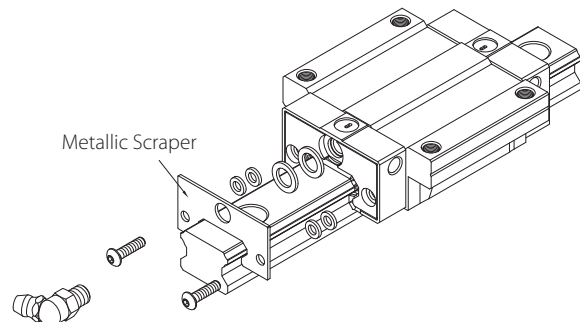
ZZ Layout

Standard Linear Guideway

Standard linear guideway are designed with load capacity and rigidity higher than other similar product with circular-arc groover and structure optimization. It features equal load rating, reverse radial and lateral direction, self-aligning to absorb the installation-error, and use and install easily.
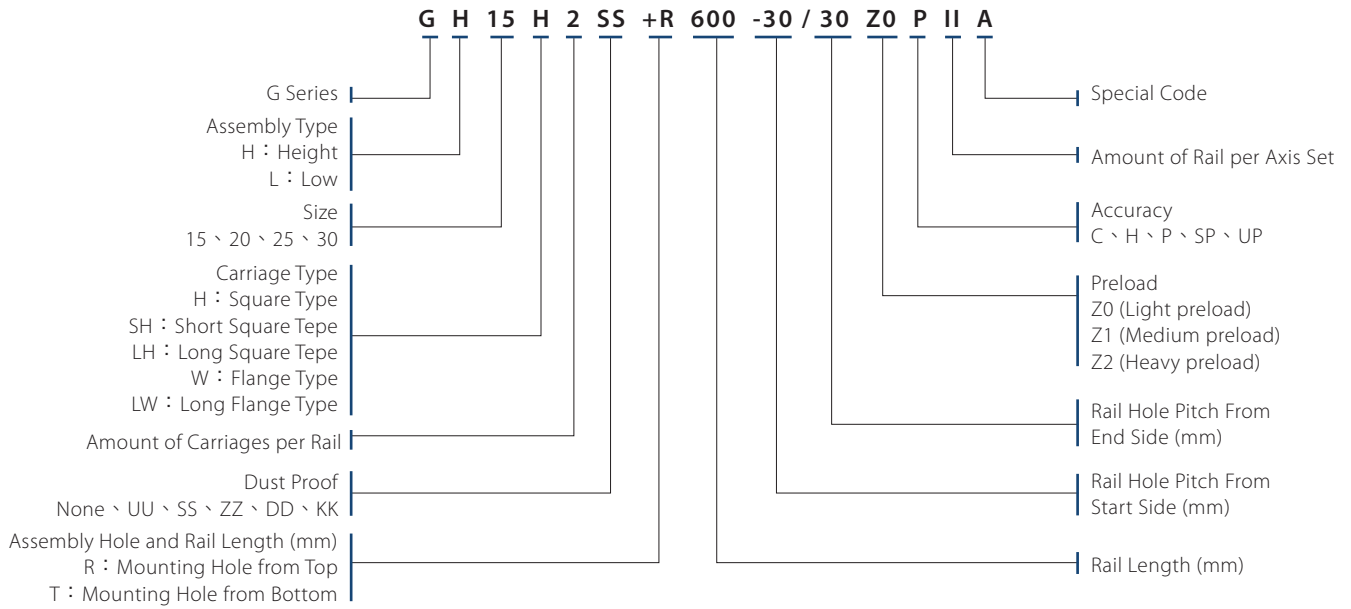
1. Characteristics of G Series

(1) With the design of DF circular-arc groove, G Series can absorb most installation errors due to surface irregularities and provide the smooth linear motion through the shift of contact points and the elastic deformation of rolling elements.

(2) Four-way Equal Load the G Series linear guideway has equal load rating in the radial and lateral direction.

(3) Optimal Design compact type linear guide have heavy load and anti-torque ability could extend life.

(4) High precision interchangeability linear guideway made by sophisticated production process and quality control.

(5) Common rail suit for heavy load type and compact type could reduce Inventory costs.

(6) Excellent smooth reflux design could reduce the running vibration.
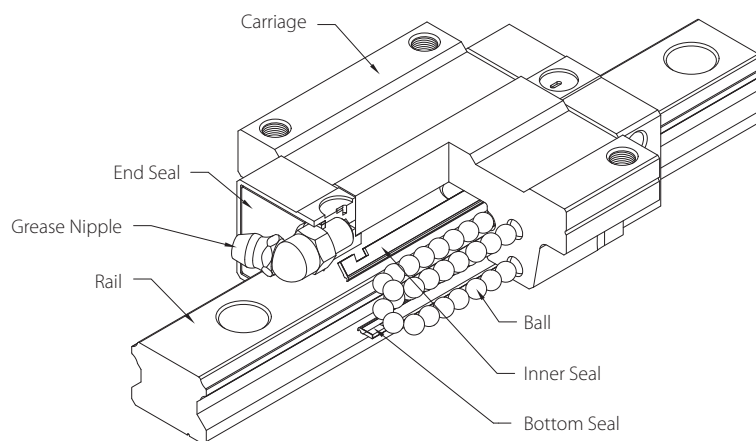
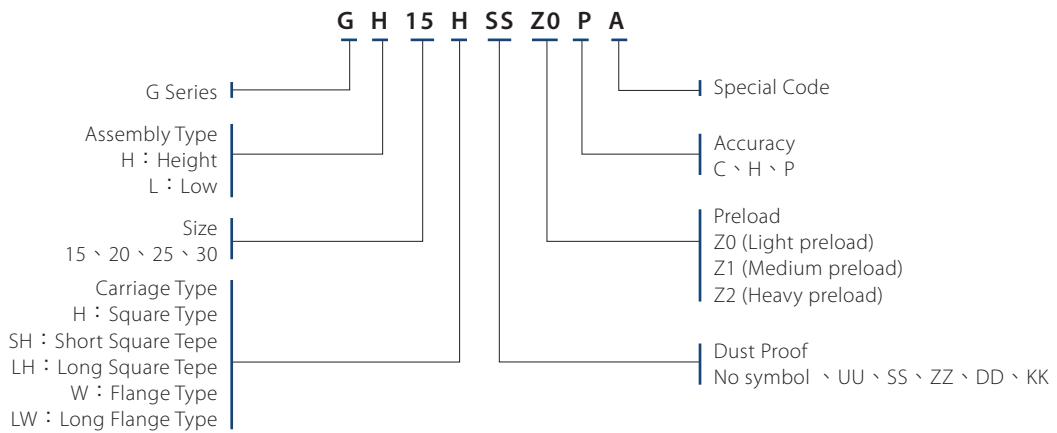## 2. Description of Specification

SFT guideway can be classified into non-interchangeable and interchangeable types. The size is identical. The only difference between the two types is that the interchangeable type of blocks and rails can be freely exchanged, and their accuracy reach up to P class. The model number of GA Series contains the size, type, accuracy, class, preload class, and so on.
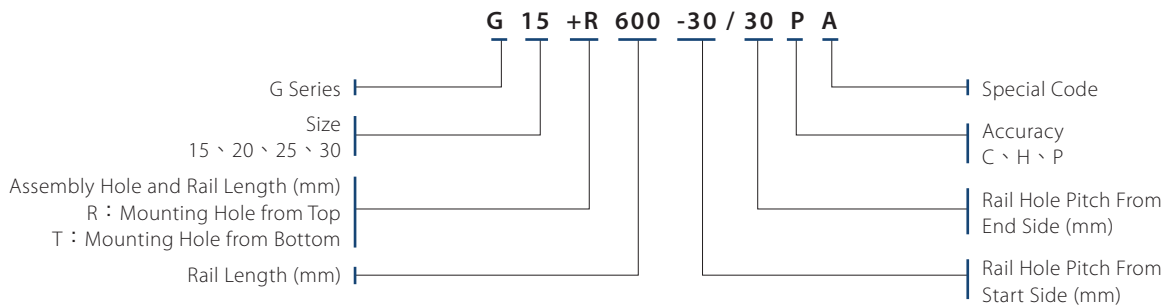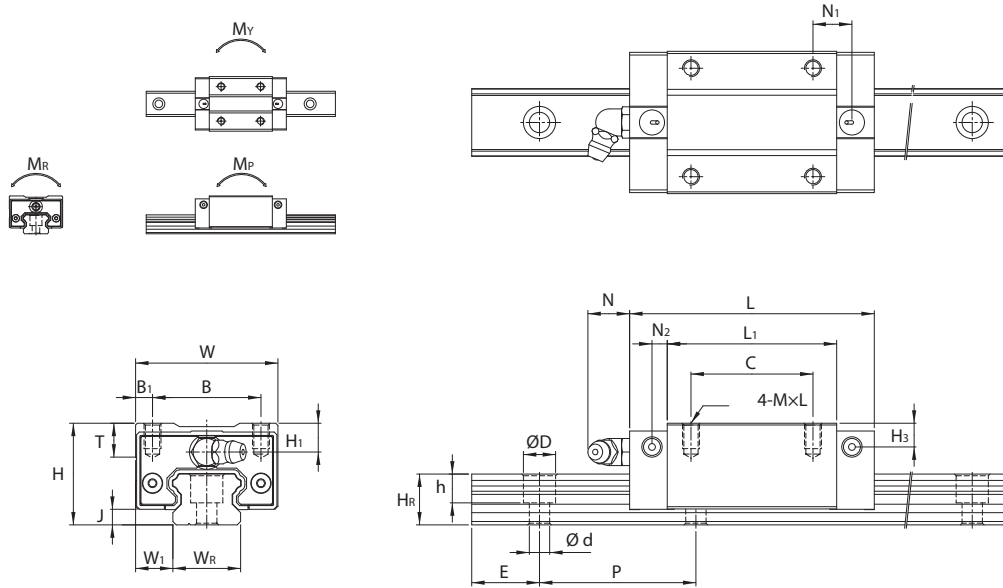
(1) Non-Interchangeable Type of Guideway

G H 15 H 2 SS +R 600 -30 / 30 Z0 P II A

G Series

Assembly Type
H：Height
L：Low

Size
15、20、25、30

Carriage Type
H：Square Type
SH：Short Square Tepe
LH：Long Square Tepe
W：Flange Type
LW：Long Flange Type

Amount of Carriages per Rail

Dust Proof
None、UU、SS、ZZ、DD、KK

Assembly Hole and Rail Length (mm)
R：Mounting Hole from Top
T：Mounting Hole from Bottom

Special Code

Amount of Rail per Axis Set

Accuracy
C、H、P、SP、UP

Preload
Z0 (Light preload)
Z1 (Medium preload)
Z2 (Heavy preload)

Rail Hole Pitch From End Side (mm)

Rail Hole Pitch From Start Side (mm)

Rail Length (mm)

(2) Interchangeable Type of Carriage

G H 15 H SS Z0 P A

G Series

Assembly Type
H：Height
L：Low

Size
15、20、25、30

Carriage Type
H：Square Type
SH：Short Square Tepe
LH：Long Square Tepe
W：Flange Type
LW：Long Flange Type

Special Code

Accuracy
C、H、P

Preload
Z0 (Light preload)
Z1 (Medium preload)
Z2 (Heavy preload)

Dust Proof
No symbol 、UU、SS、ZZ、DD、KK

(3) Interchangeable Type of Rail

G 15 +R 600 -30 / 30 P A

G Series

Size
15、20、25、30

Assembly Hole and Rail Length (mm)
R：Mounting Hole from Top
T：Mounting Hole from Bottom

Rail Length (mm)

Special Code

Accuracy
C、H、P

Rail Hole Pitch From End Side (mm)

Rail Hole Pitch From Start Side (mm)

Dimension of GH-H

Unit: mm

Model	Assembly dimension					Basic load rating		Static moment rating						Weight	
								M_P (KN-m)		M_Y (KN-m)					
	Hight H	Width W	Length L	W_1	J	Dynamic C KN	Static C_0 KN	1*	2*	1*	2*	M_R (KN-m)	Carriage Kg	Rail Kg/m
GH15H	28	34	58.5	9.5	4.5	11.8	18.9	0.13	0.78	0.13	0.78	0.16	0.18	1.28
GH20H	30	44	72.2	12	4.5	19.8	31.9	0.28	1.64	0.28	1.64	0.32	0.32	1.90
GH20LH	30	44	86.2	12	4.5	22.5	38.6	0.43	2.33	0.43	2.33	0.39	0.39	1.90
GH25H	40	48	83.5	12.5	6.5	27.1	41.9	0.42	2.43	0.42	2.43	0.50	0.52	2.64
GH25LH	40	48	102.5	12.5	6.5	33.3	55.8	0.74	3.95	0.74	3.95	0.65	0.70	2.64
GH30H	45	60	98.4	16	7	38.9	57.8	0.69	3.87	0.69	3.87	0.79	0.92	4.29
GH30LH	45	60	121	16	7	47.5	77.1	1.21	6.27	1.21	6.27	1.05	1.15	4.29

Model	Rail dimension					Carriage dimension										
	Width W_R	Hight H_R	Pitch P	E std. E	Hole dimension D×h×d	B	C	M×L	L_1	T	H_2	H_3	N	N_1	N_2	Grease Nipple Size
GH15H	15	13	60	20	7.5x5.3x4.5	26	26	M4x7	39	7.5	9	8	5	10	3.5	M4x0.7P
GH20H	20	15	60	20	9.5x8.5x6	32	36	M5x7	50	10	8.5	7	12	11.5	4.5	M6x0.75P
GH20LH	20	15	60	20	9.5x8.5x6	32	50	M5x7	64	10	8.5	7	12	11.5	4.5	M6x0.75P
GH25H	23	18	60	20	11x9x7	35	35	M6x9	58.5	10	14.5	12.5	12	13.5	4.5	M6x0.75P
GH25LH	23	18	60	20	11x9x7	35	50	M6x9	77.5	10	14.5	12.5	12	13.5	4.5	M6x0.75P
GH30H	28	23.5	80	20	14x12x9	40	40	M8x10	70.4	10	10	12.5	12	22	4.5	M6x0.75P
GH30LH	28	23.5	80	20	14x12x9	40	60	M8x10	93	10	10	12.5	12	32	4.5	M6x0.75P

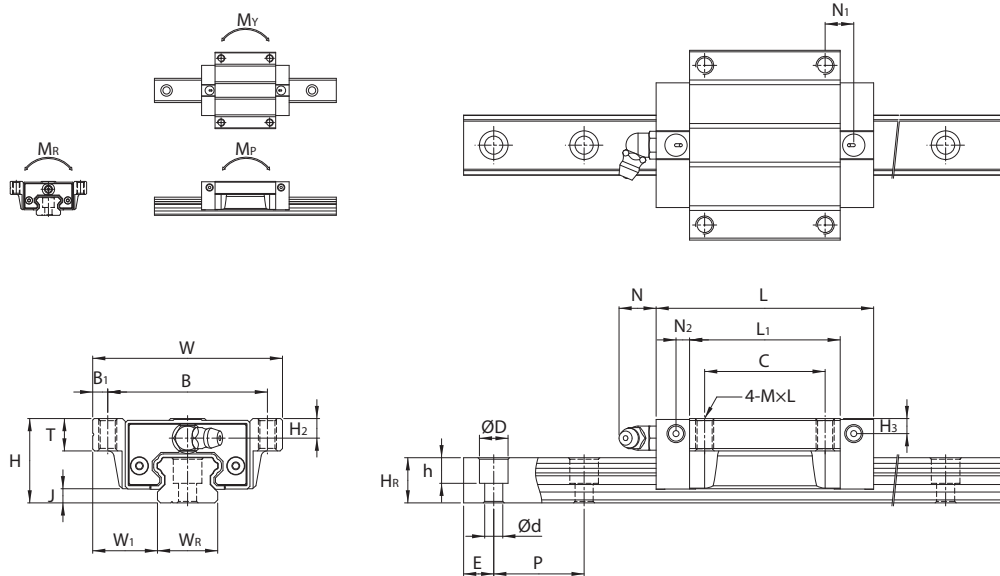*1 is for one carriage, and 2 is for two carriages closely contacting.

Dimension of GL-H

Unit: mm

Model	Assembly dimension					Basic load rating		Static moment rating					Weight	
	Hight H	Width W	Length L	W_1	J	Dynamic C KN	Static C_0 KN	M_P (KN-m)		M_Y (KN-m)		M_R (KN-m)	Carriage Kg	Rail Kg/m
								1*	2*	1*	2*			
GL15SH	24	34	41	9.5	4.5	7.8	9.4	0.04	0.28	0.04	0.28	0.08	0.09	1.28
GL15H	24	34	58.5	9.5	4.5	11.8	18.9	0.13	0.78	0.13	0.78	0.16	0.15	1.28
GL20SH	28	42	47	11	4.5	11.4	14.5	0.07	0.5	0.07	0.5	0.13	0.14	1.90
GL20H	28	42	72.2	11	4.5	19.8	31.9	0.28	1.64	0.28	1.64	0.32	0.28	1.90
GL25SH	33	48	55	12.5	6.5	18.6	24.4	0.15	1.06	0.15	1.06	0.28	0.24	2.64
GL25H	33	48	83.5	12.5	6.5	27.1	41.9	0.42	2.43	0.42	2.43	0.5	0.39	2.64
GL30H	42	60	98.4	16	7	38.9	57.8	0.69	3.87	0.69	3.87	0.79	0.92	4.29

Model	Rail dimension					Carriage dimension										
	Width W_R	Hight H_R	Pitch P	E std. E	Hole Dimension D×h×d	B	C	M×L	L_1	T	H_2	H_3	N	N_1	N_2	Grease Nipple Size
GL15SH	15	13	60	20	7.5x5.3x4.5	26	-	M4x5	21.5	7	5	4	5	10	3.5	M4x0.7P
GL15H	15	13	60	20	7.5x5.3x4.5	26	26	M4x5	39	7	5	4	5	10	3.5	M4x0.7P
GL20SH	20	15	60	20	9.5x8.5x6	32	-	M5x7	24	8	6.5	5	12	11.5	4.5	M6x0.75P
GL20H	20	15	60	20	9.5x8.5x6	32	32	M5x7	50	8	6.5	5	12	11.5	4.5	M6x0.75P
GL25SH	23	18	60	20	11x9x7	35	-	M6x8	29.4	9	7.5	5.5	12	13.5	4.5	M6x0.75P
GL25H	23	18	60	20	11x9x7	35	35	M6x8	58.5	9	7.5	5.5	12	13.5	4.5	M6x0.75P
GL30H	28	23.5	80	20	14x12x9	40	40	M8x10	70.4	10	7	9.5	12	22	4.5	M6x0.75P

*1 is for one carriage, and 2 is for two carriages closely contacting.

Dimension of GH-W

Unit: mm

Model	Assembly dimension					Basic load rating		Static moment rating					Weight	
	Hight H	Width W	Length L	W_1	J	Dynamic C KN	Static C_0 KN	M_P (KN-m)		M_Y (KN-m)		M_R (KN-m)	Carriage Kg	Rail Kg/m
								1*	2*	1*	2*			
GH15W	24	47	58.5	16	4.5	11.8	18.9	0.13	0.78	0.13	0.78	0.16	0.18	1.28
GH20W	30	63	72.2	21.5	4.5	19.8	31.9	0.28	1.64	0.28	1.64	0.32	0.39	1.90
GH20LW	30	63	86.2	21.5	4.5	22.5	38.6	0.43	2.33	0.43	2.33	0.39	0.48	1.90
GH25W	36	70	83.5	23.5	6.5	27.1	41.9	0.42	2.43	0.42	2.43	0.50	0.58	2.64
GH25LW	36	70	102.5	23.5	6.5	33.3	55.8	0.74	3.95	0.74	3.95	0.65	0.76	2.64
GH30W	42	90	98.4	31	7	38.9	57.8	0.69	3.87	0.69	3.87	0.79	0.92	4.29
GH30LW	42	90	121	31	7	47.5	77.1	1.21	6.27	1.21	6.27	1.05	1.15	4.29

Model	Rail dimension					Carriage dimension										
	Width W_R	Hight H_R	Pitch P	E std. E	Hole dimension $D \times h \times d$	B	C	$M \times L$	L_1	T	H_2	H_3	N	N_1	N_2	Grease Nipple Size
GH15W	15	13	60	20	7.5x5.3x4.5	38	30	M5x7	39	7.5	9	8	5	8	3.5	M4x0.7P
GH20W	20	15	60	20	9.5x8.5x6	53	40	M6x10	50	10	8.5	7	12	9.5	4.5	M6x0.75P
GH20LW	20	15	60	20	9.5x8.5x6	53	40	M6x10	64	10	8.5	7	12	16.5	4.5	M6x0.75P
GH25W	23	18	60	20	11x9x7	57	45	M8x10	58.5	10	14.5	12.5	12	13	4.5	M6x0.75P
GH25LW	23	18	60	20	11x9x7	57	45	M8x10	77.5	10	14.5	12.5	12	22.5	4.5	M6x0.75P
GH30W	28	23.5	80	20	14x12x9	72	52	M10x10	70.4	10	7	9.5	12	16.2	4.5	M6x0.75P
GH30LW	28	23.5	80	20	14x12x9	72	52	M10x10	93	10	7	9.5	12	27.5	4.5	M6x0.75P

*1 is for one carriage, and 2 is for two carriages closely contacting.

3. Accuracy Grade

The accuracy of G Series can be classified into three classes: normal (C), high (H), precision (P), Super precision (SP), Ultra precision (SP). Choices for different classes are available according to various requirements.

Non-Interchangeable Type

Unit: mm

Model	Item	Accuracy Grade				
		Norm C	High H	Precision P	Super Precision SP	Ultra Precision UP
15 20	Tolerance for height H	±0.1	±0.03	0 -0.03	0 -0.015	0 -0.008
	Height difference (△H)	0.02	0.01	0.006	0.004	0.003
	Tolerance for width W_1	±0.1	±0.03	0 -0.03	0 -0.015	0 -0.008
	Width difference (△W_1)	0.02	0.01	0.006	0.004	0.003
	Running parallelism of surface C with Surface A	△C(Show bellow Table)				
	Running parallelism of surface D with Surface B	△D(Show bellow Table)				
25 30	Tolerance for height H	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
	Height difference (△H)	0.02	0.015	0.007	0.005	0.003
	Tolerance for width W_1	±0.1	±0.04	0 -0.04	0 -0.02	0 -0.01
	Width difference (△W_1)	0.03	0.015	0.007	0.005	0.003
	Running parallelism of surface C with Surface A	△C(Show bellow Table)				
	Running parallelism of surface D with Surface B	△D(Show bellow Table)				

Interchangeable Type

Unit: mm

Model	Item	Accuracy Grade		
		Norm C	High H	Precision P
15 20	Tolerance for height H	±0.1	±0.03	0 -0.03
	Height difference (△H)	0.02	0.01	0.006
	Tolerance for width W_1	±0.1	±0.03	0 -0.03
	Width difference (△W_1)	0.02	0.01	0.006
	Running parallelism of surface C with Surface A	△C(Show bellow Table)		
	Running parallelism of surface D with Surface B	△D(Show bellow Table)		
25 30	Tolerance for height H	±0.1	±0.04	0 -0.04
	Height difference (△H)	0.02	0.015	0.007
	Tolerance for width W_1	±0.1	±0.04	0 -0.04
	Width difference (△W_1)	0.03	0.015	0.007
	Running parallelism of surface C with Surface A	△C(Show bellow Table)		
	Running parallelism of surface D with Surface B	△D(Show bellow Table)		
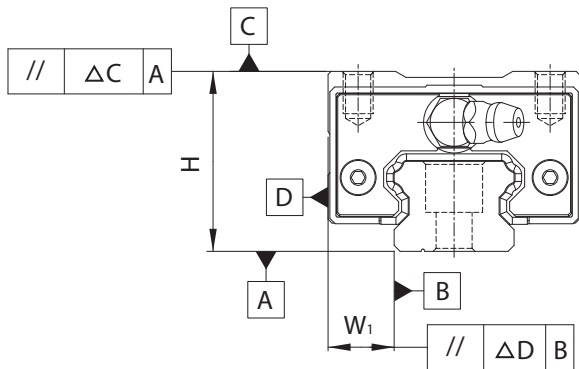
Rail Length (mm)		Running Parallelism (μm)				
Above	Below	C	H	P	SP	UP
0	100	12	7	3	2	2
100	200	14	9	4	2	2
200	300	15	10	5	3	2
300	500	17	12	6	3	2
500	700	20	13	7	4	2
700	900	22	15	8	5	3
900	1100	24	16	9	6	3
1100	1500	26	18	11	7	4
1500	1900	28	20	13	8	4
1900	2500	31	22	15	10	5
2500	3000	33	25	18	11	6
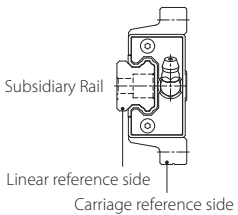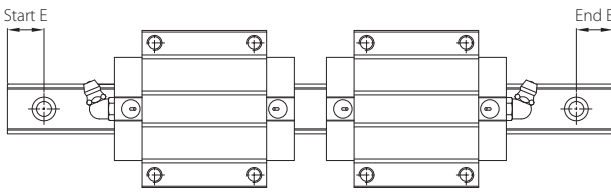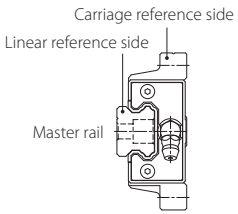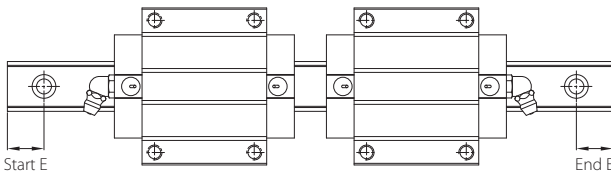
4. The Recommended Tightening Torque for Rails

The improper tightening torque could affect the mounting accuracy, so tightening the bolts by torque wrench to specified torque is highly recommended.

Model	Bolt Spec.	Torque N-m (kg-cm)		
		Iron	Cast Iron	Aluminum
G15	M4×0.7P×16L	4 (41)	2.7 (28)	2 (20)
G20	M5×0.8P×16L	8.8 (89)	5.9 (60)	4.4 (45)
G25	M6×1P×20L	13.7 (140)	9.2 (94)	6.8 (69)
G30	M8×1.25P×25L	30 (306)	20 (204)	15 (153)

Linear Guideway Request Form

Customer		Contact	
Tel		Fax	
Add			

Machine Type		Drawing No.		Name of axis	

Carriage Type	
Size	□15　　□20　　□25　　□30
Carriage Amount	□1　　□2　　□3　　□4　　□Other:
Dust Proof for Carriage	□None　　□UU　　□SS　　□ZZ　　□DD　　□KK
Preload Grade	□Z0　　□Z1　　□Z2
Rail Type	□R　　□T
Rail Length	
Rail Pitch	Start E　　　　　　　　End E
Accuracy Grade	□C　　□H　　□P　　□SP　　□UP
Rail per Axis	□I　　□II　　□III　　□IV　　□Other:

Standard reference side and lubrication position

Subsidiary Rail

Linear reference side
Carriage reference side

Start E

End E

Carriage reference side
Linear reference side

Master rail

Start E

End E

Above drawing is the layout for standard design . Please contact us for customized design.

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