General Description

Basic Dynamic Load Rating and Life

Life of Linear Motion Rolling Guides

When linear motion rolling guides are operated over a certain period, they will eventually wear out even under normal operating conditions. This is because the raceways and rolling elements of linear motion rolling guides are subjected to repeated loads and will be damaged by rolling contact fatigue of material characterized by the formation of scale-like wear fragments (fatigue flaking). These damaged rolling guides can no longer be used. The life of linear motion rolling guide is defined as the total traveling distance accomplished before the first evidence of fatigue flaking appears on one of the raceways or rolling elements.
There is a variation in life because material fatigue is a statistical phenomenon. The basic rating life is therefore calculated statistically.

Rating life

The basic rating life of linear motion rolling guide is defined as the total traveling distance that 90% of a group of identical rolling guides can be operated individually under the same conditions free from any material damage caused by rolling fatigue.
However, the basic rating life of Stroke Rotary Bushing is represented by the total number of revolutions.

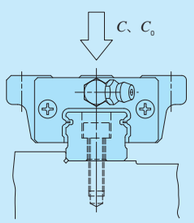


Fig. 1 Direction of load rating

Basic dynamic load rating C

(Complying with ISO 14728-1)

The basic dynamic load rating of linear motion rolling guide is the constant load both in direction and magnitude that gives the basic rating life as shown in Table 1, when a group of identical rolling guides are individually operated.
The basic dynamic load rating may be corrected for the direction of applied load. For details, see the description of each series.

Basic static load rating C_0

(Complying with ISO 14728-2)

The basic static load rating of linear motion rolling guide is defined as the static load which gives the contact stress as shown in Table 1 at the center of the contact area between the rolling element and the raceway receiving the maximum load.
If a large load or a heavy shock is applied to a rolling guide when it is stationary or running at a relatively low speed, a local permanent deformation may be made on the rolling elements and/or the raceway surfaces of the slide unit, track rail, external cylinder, shaft, etc. When this permanent deformation becomes larger than a certain size, it will prevent smooth rolling motion and cause the guide to generate noise or vibrate, resulting in degradation in traveling performance and eventually early-stage damage.
The basic static load rating is used in combination with the static safety factor to give the load that may cause the permanent deformation exceeding this limit.
The basic static load rating may be corrected for the applied load direction. For details, see the description of each series.

Table 1 Maximum contact stress

Series	Maximum contact stress
Linear Way	4 200 MPa
Linear Roller Way	4 000 MPa

Static moment rating T_0, T_X, T_Y

The static moment rating is defined as the static moment which gives the contact stress as shown in Table 1 at the center of the contact area between the rolling element and the raceway receiving the maximum load when the moment shown in the examples of Fig. 2 is applied.
Generally, like the basic static load rating, the static moment rating is used in combination with the static safety factor to give the limiting load for normal rolling motion.

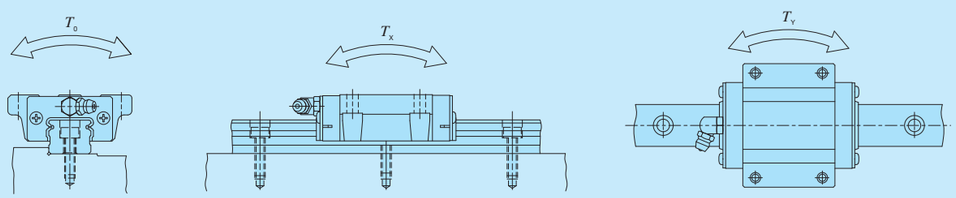


Fig. 2 Examples of static moment rating direction

Life calculation formula

The life calculation formulae are shown below.

Linear Way

$$L=50\left(\frac{C}{P}\right)^3 \cdots\cdots(1)$$

Linear Roller Way

$$L=50\left(\frac{C}{P}\right)^{10/3} \cdots\cdots(2)$$

where, L : Basic rating life, 10^3m
C : Basic dynamic load rating, N
P : Dynamic equivalent load, N

Operating time is given by stroke length and number of strokes per minute.

$$L_h=\frac{10^6 L}{2Sn_1\times 60} \cdots\cdots(3)$$

where, L_h : Basic rating life in hours, h
S : Stroke length, mm
n_1 : Number of strokes per minute, cpm

Load factor

Due to vibration and/or shocks during machine operation, the actual load on each rolling guide becomes greater in many cases than the theoretically calculated load. The applied load is generally calculated by multiplying the theoretically calculated load by the load factor indicated in Table 2.

Table 2 Load factor

Operating conditions	f_W
Smooth operation free from vibration and/or shocks	1 ～ 1.2
Normal operation	1.2 ～ 1.5
Operation with vibration and/or shocks	1.5 ～ 3

Static safety factor

The basic static load rating and the static moment rating (or static torque rating) are considered as the theoretical allowable limit of load for normal rolling motion. In practice, this limit must be corrected by the static safety factor considering the operating conditions and performance required of linear motion rolling guides. The static safety factor is obtained by the formulas below, and Tables 3.1 to 3.2 give standard values of this factor. For moment or torque load, the formula (5) is a representative formula. The static safety factor is calculated in each direction by applying the static moment rating and the maximum moment in that direction.

$$f_S=\frac{C_0}{P_0} \cdots\cdots(4)$$

$$f_S=\frac{T_0}{M_0} \cdots\cdots(5)$$

where, f_S : Static safety factor
C_0 : Basic static load rating, N
P_0 : Static equivalent load, N
(or applied static load (maximum load))
T_0 : Static moment rating, N·m
(or static torque rating)
M_0 : Moment or torque, N·m
(maximum moment or maximum torque)

Table 3.1 Static safety factor

Operating conditions	f_s
Operation with vibration and/or shocks	3 ～ 5
High operating performance	2 ～ 4
Normal operation	1 ～ 3

Table 3.2 Static safety factor of Linear Roller Way

Operating conditions	f_s
Operation with vibration and/or shocks	4 ～ 6
High operating performance	3 ～ 5
Normal operation	2.5 ～ 3

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Dynamic equivalent load

When a load is applied in a direction other than that of the basic dynamic load rating of Linear Way or Linear Roller Way or a complex load is applied, the dynamic equivalent load must be calculated to obtain the basic rating life.

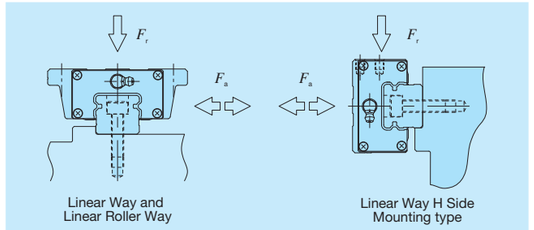
Obtain the downward and lateral conversion loads from the loads and moments in various directions.

$$F_{re}=k_r|F_r|+\frac{C_0}{T_0}|M_0|+\frac{C_0}{T_X}|M_X| \cdots\cdots(6)$$

$$F_{ae}=k_a|F_a|+\frac{C_0}{T_Y}|M_Y| \cdots\cdots(7)$$

where, F_{re} : Downward conversion load, N
F_{ae} : Lateral conversion load, N
F_r : Downward load, N
F_a : Lateral load, N
M_0 : Moment in the T_0 direction, N · m
M_X : Moment in the T_X direction, N · m
M_Y : Moment in the T_Y direction, N · m
k_r、k_a : Conversion factors for load direction (See Table 4.)
C_0 : Basic static load rating, N
T_0 : Static moment rating in the T_0 direction, N · m
T_X : Static moment rating in the T_X direction, N · m
T_Y : Static moment rating in the T_Y direction, N · m

Table 4 Conversion factor for load direction



Linear Way and Linear Roller Way　　Linear Way H Side Mounting type

Series and size		Conversion factor k_r $F_r \geqq 0$	Conversion factor k_r $F_r < 0$	Conversion factor k_a
C-Lube Linear Way L Linear Way L	Ball retained type	1	1	1.19
	Ball non-retained type	1	1	0.84
C-Lube Linear Way E Linear Way E	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way H Linear Way H	8～12	1	1	1.19
	15～30	1	1	1
	35～65	1	1.19	1.28
	85	1	1.43	1.34
Linear Way H Side Mounting type	15～30	1	1	1
	35～65(1)	1	1	0.84 0.95
C-Lube Linear Way UL Linear Way U	25，30	1	1	1.19
	40～130	1	1	1
Linear Way F	33～42	1	1	1
	69	1	1	1.19
	LWFH	1	1.19	1.28
C-Lube Linear Roller Way Super X Linear Roller Way Super X		1	1	1

Note(1) : The upper value in the k_a column is the value when the load is applied to the right and the lower value is the value when the load is applied to the left in the above sketch.

Obtain the dynamic equivalent load from the downward and lateral conversion loads.

$$P=XF_{re}+YF_{ae} \cdots\cdots(8)$$

where, P : Dynamic equivalent load, N
X、Y : Dynamic equivalent load factor (See Table 5.)
F_{re} : Downward conversion load, N
F_{ae} : Lateral conversion load, N

Table 5 Dynamic equivalent load factor

Condition	X	Y
$\|F_{re}\| \geqq \|F_{ae}\|$	1	0.6
$\|F_{re}\| < \|F_{ae}\|$	0.6	1

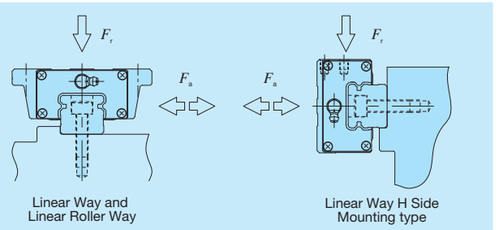
Static equivalent load

When a load is applied in a direction other than that of the basic static load rating of Linear Way or Linear Roller Way or a complex load is applied, the static equivalent load must be calculated to obtain the static safety factor.

$$P_0=k_{0r}|F_r|+k_{0a}|F_a|+\frac{C_0}{T_0}|M_0|+\frac{C_0}{T_X}|M_X|+\frac{C_0}{T_Y}|M_Y| \cdots\cdots(9)$$

where, P_0 : Static equivalent load, N
F_r : Downward load, N
F_a : Lateral load, N
M_0 : Moment in the T_0 direction, N · m
M_X : Moment in the T_X direction, N · m
M_Y : Moment in the T_Y direction, N · mT_Y
k_{0r}、k_{0a} : Conversion factors for load direction (See Table 6.)
C_0 : Basic static load rating, N
T_0 : Static moment rating in the T_0 direction, N · m
T_X : Static moment rating in the T_X direction, N · m
T_Y : Static moment rating in the T_Y direction, N · m

Table 6 Conversion factor for load direction



Linear Way and Linear Roller Way　　Linear Way H Side Mounting type

Series and size		Conversion factor k_{0r} $F_r \geqq 0$	Conversion factor k_{0r} $F_r < 0$	Conversion factor k_{0a}
C-Lube Linear Way L Linear Way L	Ball retained type	1	1	1.19
	Ball non-retained type	1	1	0.84
C-Lube Linear Way E Linear Way E	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way H Linear Way H	8～12	1	1	1.19
	15～30	1	1	1
	35～65	1	1.19	1.28
	85	1	1.43	1.34
Linear Way H Side Mounting type	15～30	1	1	1
	35～65(1)	1	1	0.78 0.93
C-Lube Linear Way UL Linear Way U	25，30	1	1	1.19
	40～130	1	1	1
Linear Way F	33～42	1	1	1
	69	1	1	1.19
	LWFH	1	1.19	1.28
C-Lube Linear Roller Way Super X Linear Roller Way Super X		1	1	1

Note(1) : The upper value in the k_{0a} column is the value when the load is applied to the right and the lower value is the value when the load is applied to the left in the above sketch.

Accuracy

Five classes of accuracy, Ordinary, High, Precision, Super Precision, and Ultra Precision are specified for IKO Linear Way and Linear Roller Way.

Table 7 Accuracy classes

Series \ Classification (symbol)	Ordinary (No symbol)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
C-Lube Linear Way L Linear Way L	–	○	○	–	–
C-Lube Linear Way E Linear Way E	○	○	○	○	–
C-Lube Linear Way H Linear Way H	–	○	○	○	–
C-Lube Linear Way UL Linear Way U	○	○	–	–	–
Linear Way F	–	○	○	○	–
C-Lube Linear Roller Way Super X Linear Roller Way Super X	–	○	○	○	○

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Preload

Purpose of preload

A clearance may be given to linear motion rolling guides, when the load is small and very smooth motion is required. However, in many cases, preload is preferred, because it eliminates play in the guide mechanism and increases the rigidity of rolling guide.
Preload is given by applying an internal stress, in advance, to the contact area between raceways and rolling elements. When a load is applied on the preloaded rolling guide, elastic deformation due to the load is smaller compared to that without preload by the effect of this internal stress, and the rigidity of rolling guide is increased. (See Fig. 3)

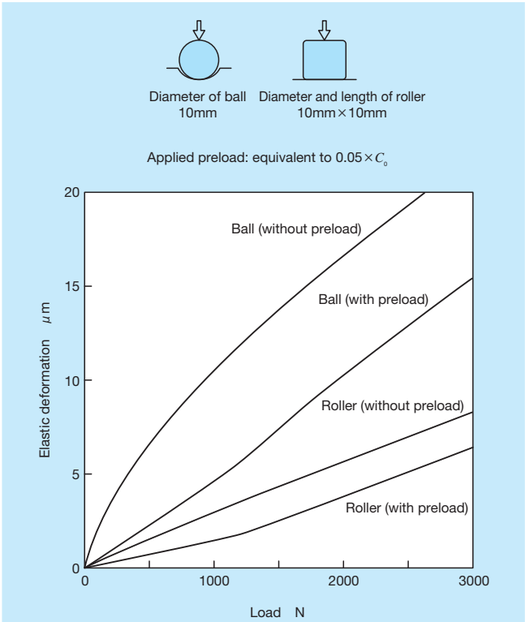


Fig. 3 Effect of preload on elastic deformation due to load

Setting preload

The preload amount is determined by considering the characteristics of the machines and equipment on which the rolling guide is mounted and the nature of load acting on the rolling guide. The standard amount of preload for linear motion rolling guides is, in general, approx. 1/3 of load when the rolling elements are balls (steel balls) and approx. 1/2 of load when they are rollers (cylindrical rollers). If the rolling guides are required to have very high rigidity to withstand vibration or fluctuating load, a larger preload may be applied.
Specify this item for an assembled set or a single slide unit.
For applicable preload amount, see Table 8.

Cautions on Preload Selection

Even when high rigidity must be obtained, excessive preload should be avoided, because it will produce an excessive stress between rolling elements and raceways, and eventually result in short life of rolling guides. It is important to apply a proper amount of preload, considering the operating conditions. When linear motion rolling guides must be used with a large preload, consult **IKO** for further information.
Linear Bushing and Stroke Rotary Bushing should never be given a large amount of preload.

Table 8 Preload amount

Series \ Classification (symbol)	Clearance (T_C)	Clearance (T_0)	Standard (No symbol)	Light preload (T_1)	Medium preload (T_2)	Heavy preload (T_3)
C-Lube Linear Way L Linear Way L	–	○	○	○	–	–
C-Lube Linear Way E Linear Way E	○	–	○	○	○	–
C-Lube Linear Way H Linear Way H	–	○	○	○	○	○
C-Lube Linear Way UL Linear Way U	–	–	○	○	–	–
Linear Way F	–	–	○	○	○	–
C-Lube Linear Roller Way Super X Linear Roller Way Super X	–	–	○	○	○	○

Friction

Friction of Linear Motion Rolling Guides

The static friction (start-up friction) of linear motion rolling guides is much lower than that of conventional plain guides. Also, the difference between static friction and dynamic friction is small, and friction varies little when velocity changes. These are excellent features of linear motion rolling guides, and account for their ability to reduce power consumption, suppress operating temperature rise, and increase traveling speed.
Since frictional resistance and variation are small, high speed response to motion commands and high accuracy positioning can be achieved.

Friction coefficient

The frictional resistance of rolling guides varies with their type, load, traveling speed and lubricant used. Generally speaking, lubricants or seals are major factors in determining the frictional resistance in light load and high speed applications, while the magnitude of load is the major factor in heavy load and low speed applications. The frictional resistance of rolling guides actually depends on various factors, but the following formula is used for practical purposes.

$$F=\mu P \cdots\cdots (10)$$

where, F : Frictional resistance, N
μ : Dynamic friction coefficient
P : Load, N

For sealed guides, seal resistance is added to the above value, but this resistance varies greatly with the interference amount of seal lip and lubrication conditions.
Where the methods of lubrication and mounting are correct and the load is moderate, the friction coefficients of linear motion rolling guide in operation are within the range shown in Table 9. Generally, friction coefficient is large under small load. Table 9 gives typical examples of this relationship.

Table 9 Friction coefficient

Series	Dynamic friction coefficient μ (1)
Linear Way	0.0040～0.0060
Linear Roller Way	0.0020～0.0040

Note(1) : These friction coefficients do not include the seal friction.

Lubrication

Purpose of lubrication

The purpose of lubrication for linear motion rolling guides is to keep raceways, rolling elements, etc. from direct metal-to-metal contact, and thereby reduce friction and wear and prevent heat generation and seizure. When an adequate oil film is formed between the raceways and rolling elements at the rolling contact area, the contact stress due to load can be moderated. Lubrication is important for ensuring the reliability of linear motion rolling guides.

Selection of lubricant

To obtain the full performance of linear motion rolling guides, it is necessary to select an appropriate lubricant and lubrication method by considering the type, load and speed of each linear motion rolling guide. However, as compared with plain guides, lubrication of linear motion rolling guides is much simpler. Only a small amount of lubricant is needed and the replenishment interval is longer, so maintenance can be greatly reduced. Oil and grease are the two most commonly used lubricants for linear motion rolling guides.

Grease lubrication

For grease lubrication of linear motion rolling guides, lithium-soap base grease (Consistency No.2 of JIS) is commonly used. For rolling guides operating under heavy load conditions, grease containing extreme pressure additives is recommended.
In clean and high-vacuum environments, where low dust generation performance and low vaporization characteristics are required, greases containing a synthetic base oil or a soap other than the lithium-soap base are used. For applications in these environments, due consideration is necessary to select a grease type that is suitable for the special operating conditions and achieves satisfactory lubrication performance at the same time.

Table 10 Pre-packed grease list

Series	Pre-packed grease
C-Lube Linear Way L Linear Way L	MULTEMP PS No.2 (KYODO YUSHI)
C-Lube Linear Way E Linear Way E	ALVANIA EP GREASE 2 (SHELL)
C-Lube Linear Way H(1) Linear Way H(1)	
C-Lube Linear Way UL Linear Way U(2)	MULTEMP PS No.2 (KYODO YUSHI)
Linear Way F	ALVANIA EP GREASE 2 (SHELL)
C-Lube Linear Roller Way Super X Linear Roller Way Super X	

Note(1) : For size 8 to 12 models, MULTEMP PS No.2 is pre-packed.
(2) : For size 40 and 130 models, MULTEMP PS No.2 is pre-packed.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Grease Replenishment Interval

The quality of any grease will gradually deteriorate as operating time passes. Therefore, periodic relubrication is necessary. The relubrication interval varies depending on the operating conditions of the rolling guides. A six month interval is generally recommended and, if the machine operation consists of reciprocating motions with many cycles and long strokes, relubrication every three months is recommended.

Grease Replenishment Method

New grease must be supplied through a grease feed device such as a grease nipple until old grease is discharged. After grease is replenished, running in is performed and excess grease will be discharged from the inside of rolling guide. Discharged grease must then be removed before starting the operation.

The amount of grease required for standard replenishment is about 1/3 to 1/2 of the free space inside the linear motion rolling guide. When grease is supplied from a grease nipple for the first time, there will be grease lost in the replenishment path. The amount lost should be taken into consideration.

Generally, immediately after grease is replenished, frictional resistance tends to increase. If running-in is performed for10 to 20 reciprocating cycles after excess grease is discharged, frictional resistance becomes small and stable.

For applications where low frictional resistance is required, the replenishment amount of grease may be reduced, but it must be kept to an appropriate level so as not to give a bad influence on the lubrication performance.

Mixing of Different Grease Types

Mixing different types of greases may result in changing the properties of base oil, soap base, or additives used, and, in some cases, severely deteriorate the lubrication performance or cause a trouble due to chemical changes of additives. Old grease should therefore be removed thoroughly before filling with new grease.

Oil lubrication

For oil lubrication, heavy loads require a higher oil viscosity and higher operating speeds require a lower viscosity. Generally, for linear motion rolling guides operating under heavy loads, lubrication oil with a viscosity of about 68 mm^2/s is used. For linear motion rolling guides under light loads at high speeds, lubrication oil with a viscosity of about 13 mm^2/s is used.

Maintenance-Free system “C-Lube”

C-Lube system **IKO** has been developed is for new type lubrication. It is a porous resin sleeve or plate with steel backing formed by sintering fine resin powder and impregnating a large amount of lubrication oil in its open pores. C-Lube system always supplies proper amount of lubrication oil to the balls and lubrication condition of the raceway can be kept well for long period of time.

Table 11 Grease Brands for Linear Motion Rolling Guides

Name		Base oil	Thickener	Service range(2) ℃	Remarks
ALVANIA GREASE EP2	SHELL	Mineral oil	Lithium	−20～110	General applications, contains extreme pressure additives
ALVANIA GREASE S2	SHELL	Mineral oil	Lithium	−25～120	General applications
MULTEMP PS No.2	KYODO OIL	Synthetic oil, mineral oil	Lithium	−50～130	General applications
IKO CLEAN ENVIRONMENT GREASE CG2	NIPPON THOMPSON	Synthetic oil	Urea	−40～200	For clean environment, long life
IKO CLEAN ENVIRONMENT GREASE CGL	NIPPON THOMPSON	Synthetic oil, mineral oil	Lithium/Calcium	−30～120	For clean environment, Low friction
DEMNUM GREASE L-200(1)	DAIKIN	Synthetic oil	Ethylene tetra-fluoride	−60～300	For clean environment
FOMBLIN YVAC3(1)	AUSIMONT	Synthetic oil	Ethylene tetra-fluoride	−20～250	For vacuum environment
IKO ANTI-FRETTING CORROSION GREASE AF2	NIPPON THOMPSON	Synthetic oil	Urea	−50～170	Fretting-proof
6459 GREASE N	SHELL	Mineral oil	Poly-urea	−	Fretting-proof

Note(1) : Set a little shorter replenishment interval.
(2) : Figures in parentheses show the maximum allowable temperature in very short time operation, and they are not applicable for continuous operation.
Remark : When using a grease type, check the selected type according to the manufacturer's catalog of grease.
For applications other than those described above, consult **IKO** for further information.

Miniature grease

The miniature greaser is specially prepared for grease replenishment for Linear Way with an oil hole. Table 12 shows the types of grease and specifications of the miniature greaser.

Table 12 Specifications

Identification number	Grease name	Content	Outside diameter of injector needle
MG10/MT2	MULTEMP PS No.2 (KYODO YUSHI)	10ml	φ1mm
MG10/CG2	**IKO** Low Dust Generation Grease for Clean Environment CG2		
MG2.5/EP2	Alvania EP Grease 2 [Shell]	2.5ml	
MG2.5/CG2	**IKO** Low Dust Generation Grease for Clean Environment CG2		
MG2.5/CGL	**IKO** Low Dust Generation Grease for Clean Environment CGL		
MG2.5/AF2	**IKO** Anti-Fretting Corrosion Grease AF2		

Grease nipple and supply nozzle

Tables 13.1 and 13.2 show the specifications of grease nipples and applicable types of supply nozzles. Table 14 shows the specifications of supply nozzles.

Table 13.1 Grease nipples and applicable supply nozzles

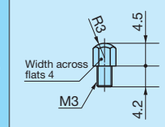
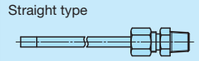
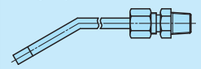
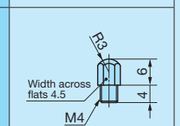
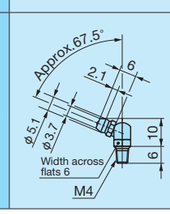
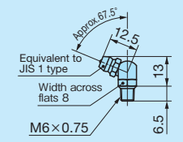
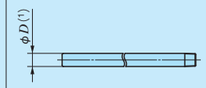
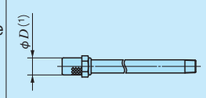
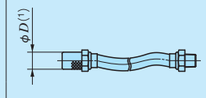
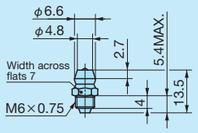
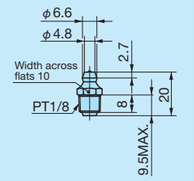
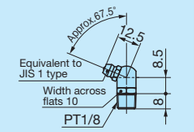
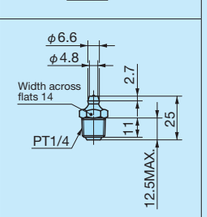
Grease nipple		Applicable supply nozzle	
Type	Shape and dimension	Type	Shape
A-M3		A-5120V A-5240V B-5120V B-5240V	Straight type  Straight type with angle 
A-M4			
B-M4		A-8120V B-8120V	

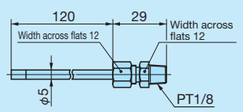
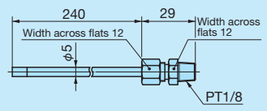
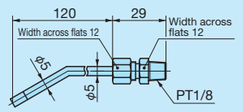
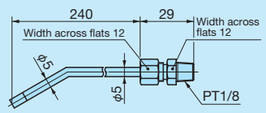
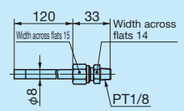
Table 13.2 Grease nipples and applicable supply nozzles

Grease nipple		Applicable supply nozzle	
Type	Shape and dimension	Type	Shape
B-M6		Product available on the market	Straight type  Chuck type  Hose type 
JIS 1 type			
JIS 2 type			
JIS 4 type			
A-PT 1/4			

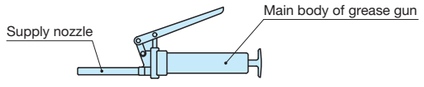
Note(1) : For straight type, chuck type and hose type supply nozzles available on the market, it is recommended to use one with an outside diameter (*D*) of 13 mm or less.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Table 14 Applicable supply nozzles

Type	Shape and dimension
A-5120V	
A-5240V	
B-5120V	
B-5240V	
A-8120V	
B-8120V	

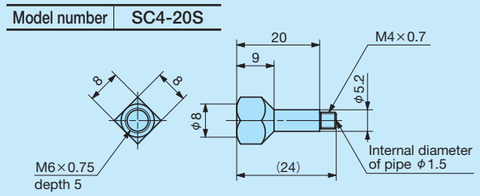
Remark : The supply nozzles shown in the table can be mounted on the main body of a common grease gun available on the market (shown below). If these supply nozzles are required, consult **IKO** by specifying the supply nozzle type.



Pipe joints

When applying centralized grease or oil lubrication, detach the grease nipple or stop cock from the slide unit, and replace them with pipe joints, which are prepared for various piping female thread sizes. Use them after comparing the dimension of the pipe joints and the dimension H_3 in the dimension table of each series, because the top face of some pipe joints is at the same or higher level with the top face of slide unit. Fig. 4.1 and 4.2, Tables 15.1, 15.2, 15.3, 15.4 show model numbers and dimensions of pipe joints. Note that some of them are not applicable for the slide units of special specifications. Pipe joints can be mounted on Linear Way and Linear Roller Way prior to delivery upon request. Consult **IKO** for further information.

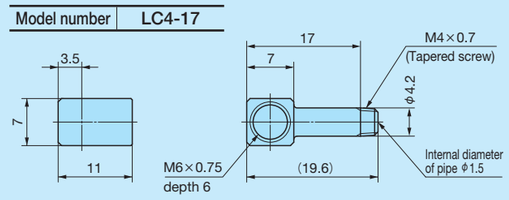
Model number	SC4-20S



Remark : Not applicable to MX, LRX.

Fig. 4.1 Pipe joint for M4×0.7 (Straight type)

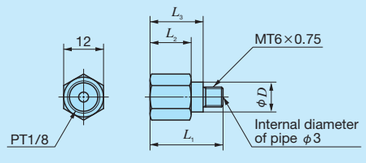
Model number	LC4-17



Remark : The straight type pipe joint shown in Table 15.1 is recommended for female threads (M6×0.75).

Fig. 4.2 Pipe joint for M4×0.7 (L type)

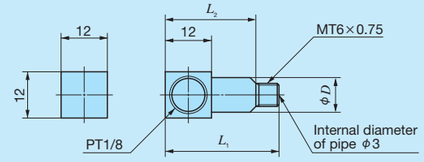
Table 15.1 Pipe joint for M6×0.75 (Straight type)



unit : mm

Model number	L_1	L_2	L_3	L_4
SC6-16	22	12.4	16	9
SC6-22S	28	12	22	6
SC6-25S	31	12	25	6

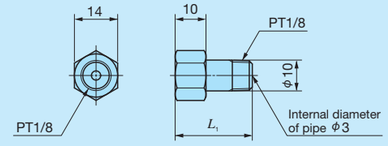
Table 15.2 Pipe joint for M6×0.75 (L type)



unit : mm

Model number	L_1	L_2	D
LC6-18	25	18	9
LC6-22S	28	–	6
LC6-24	30.5	23.5	9
LC6-25S	31	–	6

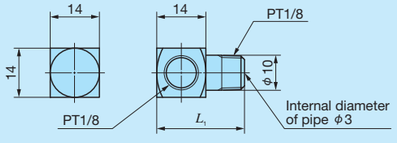
Table 15.3 Pipe joint for PT1/8 (Straight type)



unit : mm

Model number	L_1
SC1/8-19S	25
SC1/8-34S	40

Table 15.4 Pipe joint for PT1/8 (L type)



unit : mm

Model number	L_1
LC1/8-19S	25
LC1/8-34S	40

Dust protection

Purpose of dust protection

To obtain the full performance of linear motion rolling guides, it is important to protect them from the intrusion of dust and other harmful foreign matter. Select an effective sealing or dust-protection device to withstand any operating conditions that might be imposed.

Method of dust protection

Sealed types are available in some linear motion rolling guide series.
Linear Way and Linear Roller Way have end seals as a standard specification. In addition, double seals or scrapers are provided as special specifications for improvement in dust protection performance. Caps for covering the track rail mounting holes and a rail cover plate for covering the top surface of the track rail will further increase the reliability for dust protection.
However, when a large amount of dust or foreign particles are floating in air, or when large foreign substances such as chips or sand fall onto raceways, dust protection becomes difficult. In this case, it is recommended to cover the entire guide mechanism with bellows (Fig. 7), telescopic shields, etc.
Rail cover sheet and track rail for mouniting form bottom are alos available, consult **IKO** if required.

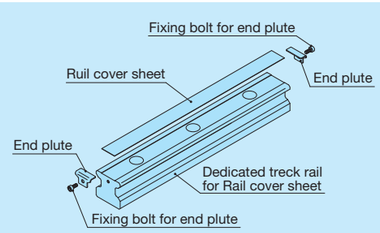


Fig. 5 Rail cover sheet

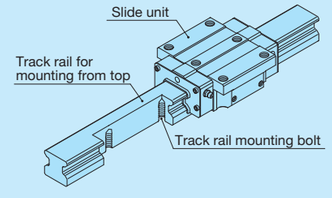


Fig. 6 Track rail for mounting from top

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

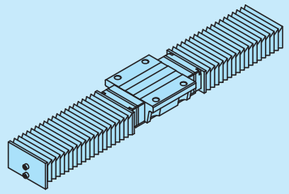


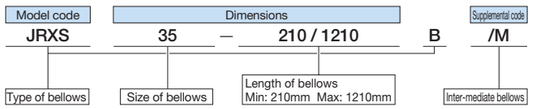
Fig. 7 Bellows

Bellows

Dimensions of bellows specially prepared for IKO Linear Way and Linear Roller Way are shown in Tables 17.1 and 17.2. These bellows are manufactured to match the dimensions of each series for easy mounting and effective dust protection.
For special bellows to be used in an upside-down position or those made of heat-resistant material, consult IKO for further information.

Identification number of bellows

The identification number of bellows consists of a model code, dimensions, and any supplemental codes. Its standard arrangement is shown below.



Calculation of minimum length of bellows

The minimum necessary length of bellows is determined, by first calculating the necessary number of accordion pleats as follows.

$$ns=\frac{S}{\ell s_{max}-\ell s_{min}}$$

where, ns : Number of pleats (Raise decimal fractions.)
S : Length of stroke, mm
ℓs_{max} : Maximum length of one pleat (See Tables 17.1 and 17.2.)
ℓs_{min} : Minimum length of one pleat (See Tables 17.1 and 17.2.)

$$L_{min}=ns\times\ell s_{min}+m\times5+10$$
$$L_{max}=S+L_{min}$$

where, L_{min} : Minimum length of bellows, mm
L_{max} : Maximum length of bellows, mm
m : Number of internal guide plates (See Table 16.)

Table 16 Number of internal guide plates

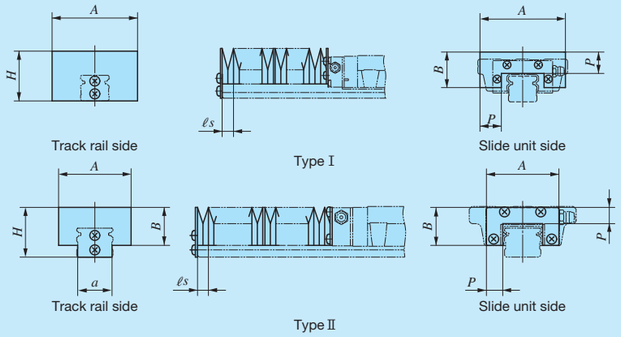
Type of bellows	Dimension P of bellows(1) mm over	incl.	Number of internal guide plates, m
JEF JRES	—	35	$m=\frac{ns}{7}-1$
JES JHS JFS JRXS···B JFFS	—	22	$m=\frac{ns}{16}$ but m=0, when $ns\leqq20$
	22	25	$m=\frac{ns}{12}$ but m=0, when $ns\leqq18$
	25	35	$m=\frac{ns}{8}$

Note(1) : For dimension P, see Tables 17.1 and 17.2.
Remark : In calculating the number of internal guide plates m, raise the decimal fractions for JEF and JRES and omit the decimal fractions for others.

Intermediate bellows

Another type of mounting plate is used for mounting bellows between slide units. Add the supplemental code "/M" onto the identification number when ordering.
Reinforced bellows are also available, which are specially designed for use on long track rails or for lateral mounting. The width A of reinforced bellows is greater than that of standard type bellows. For these reinforced bellows, consult IKO.

Table 17.1 Dimensions of bellows and applicable models



unit : mm

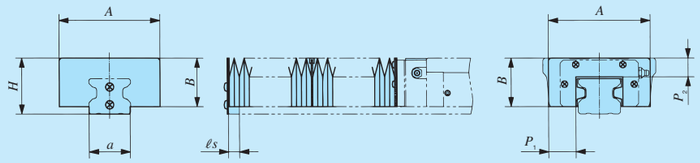
Series	Size	Bellows model code	Type	H	A	a	B	P	ℓs_{min}	ℓs_{max}
C-Lube Linear Way E Linear Way E	15	JEF 15	Ⅱ	23.5	34	14	17	8	2	9
	20	JEF 20		27.5	40	19	21	9	2	10
	25	JEF 25		32	46	22	24	10	2	11
	30	JES 30		42	70	27	35	15	2	14
	35	JES 35		48	85	33	40	18	2	18.5
	45	JES 45		60	105	44	50	22	2	23.5
C-Lube Linear Way H Linear Way H(1)	15	JHS 15	Ⅰ	31(2)	55	–	19.5	15	2	14
	20	JHS 20		35(2)	60	–	25	15	2	14
	25	JHS 25		39(2)	64	–	29.5	15	2	14
	30	JHS 30		42	70	–	35	15	2	14
	35	JHS 35		48	85	–	40	18	2	18.5
	45	JHS 45		60	105	–	50	22	2	23.5
	55	JHS 55		70	120	–	57	25	2	28
	65	JHS 65		90	158	–	76	35	2	42
Linear Way F	33	JFFS 33	Ⅱ	26(2)	66(3)	–	23	15	2	15
	37	JFFS 37	Ⅱ	27.5(2)	70(3)	–	24	15	2	15
	40	JFS 40	Ⅰ	32(2)	80	–	27	15	2	14
	42	JFFS 42	Ⅱ	30.5(2)	76(3)	–	27.5	15	2	15
	60	JFS 60	Ⅰ	36(2)	100	–	30	15	2	14
	69	JFFS 69	Ⅱ	36(2)	106	–	31.5	15	2	15
	90	JFS 90	Ⅰ	50	150	–	43	22	2	23.5

Note(1) : Not applicable for LWHY series.
(2) : The height of bellows may become higher than the height H of Linear Way. Check H dimension of Linear Way shown in the table of dimensions of each series.
(3) : The width of bellows may become larger than the width W_2 of Linear Way. Check W_2 dimension of Linear Way shown in the table of dimensions of each series. : The width of bellows may become larger than the width W2 of Linear Way. Check W2 dimension of Linear Way shown in the table of dimensions of each series.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Dust protection

Table 17.2 Dimensions of bellows and applicable models



unit : mm

Series	Size	Bellows model code	H	A	a	B	P_1	P_2	ℓs_{min}	ℓs_{max}
C-Lube Linear Roller Way Super X Linear Roller Way Super X	15	JRES 15	34(1)	55(2)	14	30	17.5	15	2	15
	20	JRES 20	39(1)	60(2)	19	34	15	15	2	15
	25	JRES 25	42(1)	65(2)	22	36	16.5	15	2	15
	30	JRES 30	46(1)	70(2)	27	39.5	15	15	2	15
	35	JRES 35	48	88(2)	33	41.5	24	15	2	15
	45	JRES 45	60	108(2)	44	52	29	20	2	21
	55	JRES 55	70	122(2)	52	61	31	22	2	23.5
	65	JRES 65	88	140(2)	61	76	25	25	2	30
	85	JRES 85	107	180	82	89	30	30	2	36

Note(1) : The height of bellows may become higher than the height H of Linear Roller Way. Check H dimension of Linear Roller Way shown in the table of dimensions of each series.
(2) : The height of bellows may become higher than the height W_2 of Linear Way. Check H dimension of Linear Roller Way shown in the table of dimensions of each series.

For Ordering

When ordering assembled sets of Linear Way or Linear Roller Way, indicate the number of sets which is always represented by the number of track rails. For ordering the slide units and track rails of interchangeable specification separately, indicate the number of slide units and track rails, respectively. Examples of ordering are shown below.

Interchangeable specification

Slide unit

(for two units)

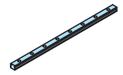
Ordering example

LWESG 25 C1 SL T1 P S1 /U

Only "C1" meaning one slide unit can be indicated.

Order quantity
2pieces

Track rail



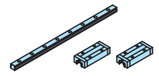
(for one rail)

Ordering example

LWE 25 R640 SL P S1 /F

Order quantity
1piece

Assembled set



(for one set)

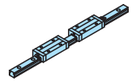
Ordering example

LWESG 25 C2 R640 SL T1 P S1 /FU

Order quantity
1piece

Non-interchangeable specification

Assembled set



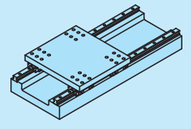
(for one set)

Ordering example

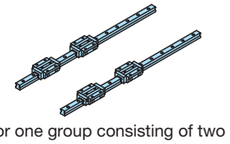
LWESG 25 C2 R640 SL T1 P /FU

Order quantity
1piece

Matched sets to be used as an assembled group (supplemental code /W)



Linear Way and Linear Roller Way



(for one group consisting of two sets)

Ordering example

LRX 45 C2 R1260 T3 SP /W2

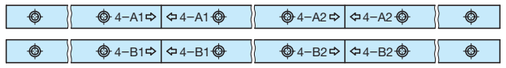
Order quantity
2pieces

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Special Specifications

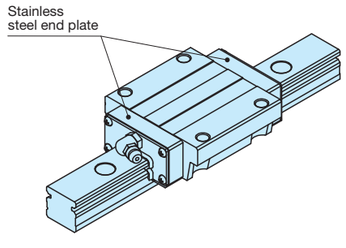
IKO Linear Way and Linear Roller Way of the special specifications shown on page Ⅲ-17 to Ⅲ-23 are available. In some cases, however, special specifications may not be applicable. For details, see the description of each series.
When a special specification is required, add the applicable supplemental code to the end of the identification number. When a combination of several special specifications is required, arrange their supplemental codes in alphabetical order.

Butt-jointing track rails /A



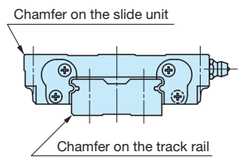
When the required length of non-interchangeable specification track rail exceeds the maximum length indicated in the description of each series, two or more track rails can be used by butt-jointing them in the direction of linear motion. For the length and the number of butt-jointing track rails, consult IKO for further information.

With stainless steel end plates /BS



The standard synthetic resin end plates are replaced with stainless steel end plates, keeping the total length of slide unit unchanged.
When superior heat resistance is required, it is recommended to apply this specification in combination with the "with no end seal (/N)" specification.

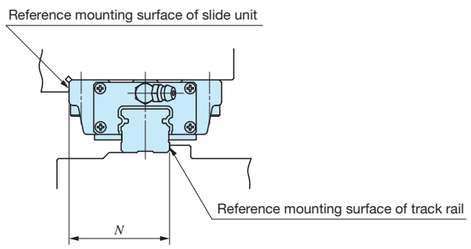
Chamfered reference surface /C /CC



Chamfering is additionally made at the edges of reference mounting surfaces of slide unit and track rail.

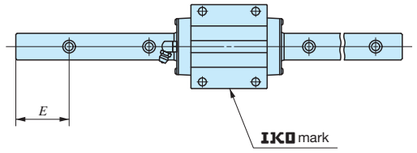
① /C Chamfering is additionally made at the edge of reference mounting surface of track rail.
② /CC Chamfering is additionally made at the edges of reference mounting surfaces of slide unit and track rail.

Opposite reference surfaces arrangement /D



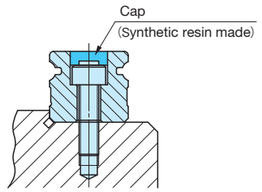
The reference mounting surface of track rail is made opposite to the standard side. The accuracy of dimension N including parallelism in operation is the same with that of standard specification.

Specified rail mounting hole positions /E



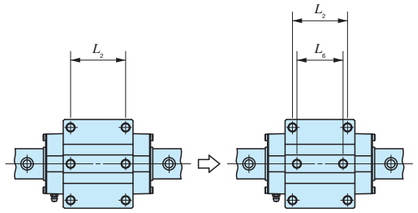
The mounting hole positions of track rail can be specified by specifying dimension E at the left end, which is the distance from the mounting hole nearest to the left end of the track rail to the left end face of the track rail in sight of IKO mark on the slide unit.
When ordering, add the dimension (in mm) after "/E".
Dimension E can be specified in a limited range. Consult IKO for further information.

With caps for rail mounting holes /F



Specially prepared caps for track rail mounting holes are appended. These caps cover the track rail mounting holes to improve the sealing performance in the linear motion direction. Aluminum caps are also available. Consult IKO for further information.

Changed pitch of slide unit middle mounting holes /GE

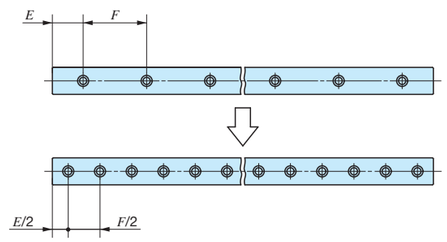


The pitch length between the two middle mounting holes of slide unit of Linear Roller Way Super X is changed. For this dimension, see the description of each series.

Ceramic ball specification /HB

Silicon nitride ceramics balls are incorporated in the slide unit to realize high-speed operation and low running noise.
In addition, the rigidity has been improved because of the minimal elastic deformation of ceramic characteristic.

Half pitch of track rail mounting holes /HP



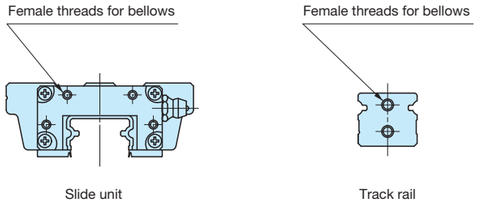
The pitch of the track rail mounting holes is changed to 1/2 of the dimension F of standard type. Track rail mounting bolts are appended in the same number as that of mounting holes.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Inspection sheet /I

The inspection sheet recording dimensions H and N, dimensional variations of H and N, and parallelism in operation of the slide unit (or slide member) is attached for each set.

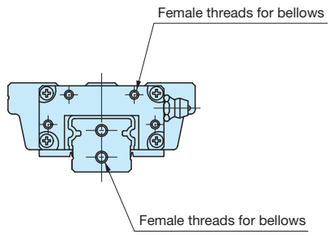
With female threads for bellows (for single slide unit or track rail) /J /JR /JL



Female threads for mounting bellows are provided on the interchangeable slide unit or the interchangeable track rail. For details of related dimensions, see the description of each series.

① /J Female threads are provided at both ends of the slide unit or the track rail.
② /JR Female threads are provided at the right end of the slide unit in sight of IKO mark.
③ /JL Female threads are provided at the left end of the slide unit in sight of IKO mark.

With female threads for bellows (for assembled set) /J /JJ /JR /JS /JJS



For an assembled set of interchangeable or non-interchangeable specification, female threads for mounting bellows are provided on the slide unit and the track rail. For details of related dimensions, see the description of each series.

① /J Female threads are provided at both ends of the track rail, and at the slide unit ends which are the closest to the track rail ends. (In case only one slide unit is assembled, female threads are provided at both ends.)
② /JJ Female threads are provided at both ends of the track rail, and at all ends of all slide units. (Applicable, when the number of slide units is two or more. In case only one slide unit is assembled, indicate "/J".)
③ /JR Female threads are provided at both ends of the track rail.
④ /JS Female threads are provided at the slide unit ends which are the closest to the track rail ends. (In case only one slide unit is assembled, female threads are provided at both ends.)
⑤ /JJS Female threads are provided at all ends of all slide units. (Applicable, when the number of slide units is two or more. In case only one slide unit is assembled, indicate "/JS".)

Black chrome surface treatment /LC /LR /LCR

After forming a black permeable chrome film, the surface is coated with acrylic resin for improvement in corrosion resistance.

① /LC Treatment is applied to the casing.
② /LR Treatment is applied to the track rail.
③ /LCR Treatment is applied to the casing and the track rail.

Fluorine black chrome surface treatment /LFC /LFR /LFCR

After forming a black permeable chrome film, the surface is coated with fluorine resin for further improvement in corrosion resistance. This treatment is also effective in preventing the adhesion of foreign substances on the surface.

① /LFC Treatment is applied to the casing.
② /LFR Treatment is applied to the track rail.
③ /LFCR Treatment is applied to the casing and the track rail.

With track rail mounting bolts /MA

Track rail mounting bolts are appended according to the number of mounting holes. For the size of bolt, see dimension tables.

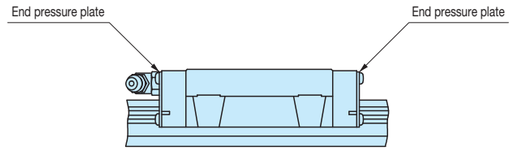
Without track rail mounting bolts /MN

Track rail mounting bolts are not appended.

Change of mounting hole size and female thread size /M4

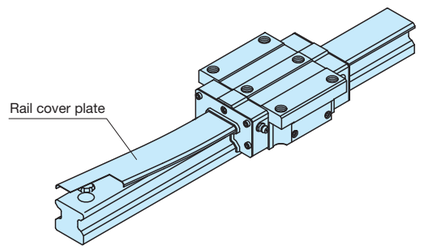
The track rail mounting holes for M3 of LWE15 are changed to holes for M4. Indicate "/MA4" if "/MA" is also required.

No end seal /N



End seals at both ends of slide unit are replaced by end pressure plates (not in contact with the track rail) to reduce frictional resistance. The under seals are not assembled.
This specification is not effective for dust protection.

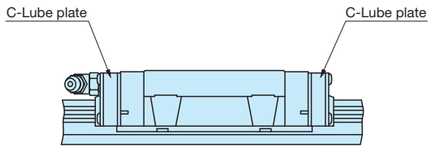
Rail cover plate /PS



After mounting the track rail, the top surface of track rail is covered with a U-shaped thin stainless steel plate for further improvement in sealing performance. The rail cover plate is delivered as assembled on the track rail. Standard end seals must be replaced with the special end seals.
When mounting the cover plate, refer to the attached instruction manual for rail cover plate.

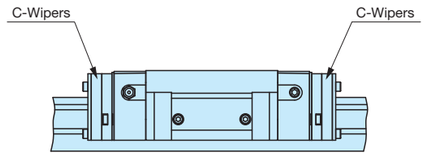
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

C-Lube plate /Q



The C-Lube plate is assembled inside the end seal of the slide unit. It is impregnated with lubricant so that re-lubrication interval can be made longer.

C-Wipers /RC /RCC



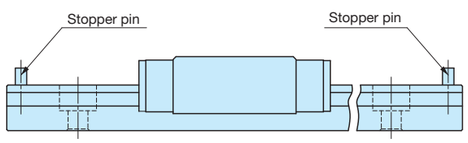
C-Wipers are attached on the slide unit for additional dust protection.
The slide unit with C-Wipers has also Inner Seal (/UR) and Scraper (/Z).

① /RC C-Wipers are provided at the ends of slide units which are closest to the end of the track rail. In case only one slide unit is assembled, C-Wipers are provided at the both ends of side unit.
② /RCC C-Wipers are provided at both ends of all slide units. Applicable when the number of slide units to be two or more. In case one slide unit, indeicate "/RC".

Seal for special environment /RE

The standard end seals and under seals are changed to seals for special environment that can be used at high temperature.

Track rail with stopper pins /S

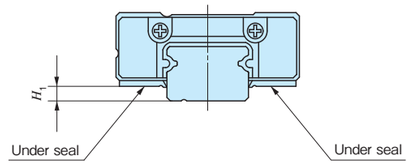


To prevent the slide unit of Linear Way L from slipping off, a stopper pin is provided at both ends of the track rail. For related dimensions, see the description of Linear Way L.

Butt-jointing interchangeable track rail (for interchangeable specification) /T

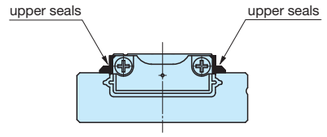
A special interchangeable track rail of which both ends are finished for butt-jointing is provided.
Use the track rails having the same interchangeable code for butt-jointing. For the non-interchangeable specification, indicate "butt-jointing track rail (/A)". In case /T, the maximum length of track rail is shorter for one pitch of mounting hole. (Dimension "F" in dimension table)

With under seals(1) /U

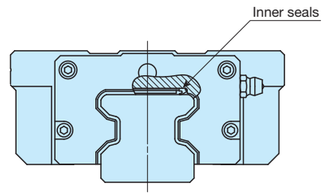


To prevent foreign substances intruding from the lower side of Linear Way, seals are provided on the bottom faces of slide unit. For size H_1, see the description of each series.

Note(1) For C-Lube Linear Way UL and Linear Way U, rubber seals are attached to upper side face of the slide unit to prevent foreign materials from entering from the upper side.
For dimensions with upper seals, please see the description of each series.



Inner seals /UR



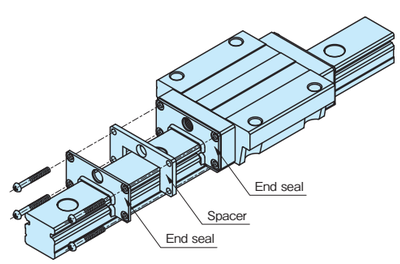
Inner seals are provided inside of slide unit, where recirculation area is effectively protected from dust collected on upper surface of track rail.

With double end seals (for single slide unit) /V /VR /VL

Double end seals are provided on the interchangeable slide unit for more effective dust protection. For the total length of the slide unit with double end seals, see the description of each series.

① /V Double end seals are provided at both ends of the slide unit.
② /VR Double end seals are provided at the right end of the slide unit in sight of IKO mark.
③ /VL Double end seals are provided at the left end of the slide unit in sight of IKO mark.

With double end seals (for assembled set) /V /VV



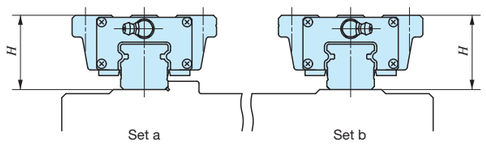
Double end seals are provided on the slide unit of assembled set of interchangeable specification or non-interchangeable specification for more effective dust protection. For the total length of the slide unit with double end seals, see the description of each series.

① /V Double end seals are provided at the ends of slide units which are the closest to the ends of the track rail. (In case only one slide unit is assembled, double end seals are provided at both ends.)
② /VV Double end seals are provided at all ends of all slide units. (Applicable when the number of slide units is two or more. In case only one slide unit is assembled, indicate "/V".)

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Special Specifications

Matched sets to be used as an assembled group /W



For two or more sets of Linear Way or Linear Roller Way used on the same plane, the dimensional variation of H of Linear Way or Linear Roller Way is kept within the specified range.
The dimensional variation of dimension H in matched sets is the same as that of a single set. Indicate the number of sets after "/W".
Order the number of sets in a grorp.
Please refer Page 80 for ordering.

Specified grease /YCG /YCL /YAF /YBR /YNG

The type of pre-packed grease in the slide unit can be changed by a supplemental code. Rust preventive oil is applied.

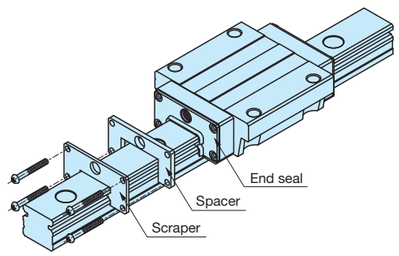
① /YCG IKO Low Dust Generation Grease for Clean Environment CG2 is pre-packed.
② /YCL IKO Low Dust Generation Grease for Clean environment CGL is pre-packed.
③ /YAF IKO Anti-Fretting Corrosion Grease AF2 is pre-packed.
④ /YBR MOLYCOTE BR2 Plus Grease (Dow Corning) is pre-packed.
⑤ /YNG No grease is pre-packed.

With scrapers (for single slide unit) /Z /ZR /ZL

Metal scrapers are provided on the slide unit of interchangeable specification. The scraper (non-contact type) is used to effectively remove large particles of dust or foreign matter adhering to the track rail. For the total length of the slide unit with scrapers, see the description of each series.

① /Z Scrapers are provided at both ends of the slide unit.
② /ZR A scraper is provided at the right end of the slide unit in sight of IKO mark.
③ /ZL A scraper is provided at the left end of the slide unit in sight of IKO mark.

With scrapers (for assembled set) /Z /ZZ



Metal scrapers are provided on the slide unit of assembled set of interchangeable specification or non-interchangeable specification.
The scraper (non-contact type) is used to effectively remove large particles of dust or foreign matter adhering to the track rail. For the total length of the slide unit with scrapers, see the description of each series.

① /Z Scrapers are provided at the ends of slide units which are the closest to the ends of the track rail. (In case only one slide unit is assembled, scrapers are provided at both ends.)
② /ZZ Scrapers are provided at all ends of all slide units. (Applicable when the number of slide units is two or more. In case only one slide unit is assembled, indicate "/Z".)

Precautions for Use

Operating temperature

The maximum operating temperature is 120℃ and a continuous operation is possible at temperatures up to 100℃. When the temperature exceeds 100℃, consult IKO.
In the case of C-Lube Linear Way and the models "with Capillary plates" of special specification, operate below 80℃.
In "with C-Lube plates" (/Q), the maximum temperature is limited as 80℃.

Multiple slide units mounted in close distance

When multiple slide units are used in close distance to each other, the actual load may be greater than the calculated load depending on the accuracy of the mounting surfaces and the reference mounting surfaces of the machine. It is suggested in such cases to assume a greater load than the calculated load.

For lateral or upside-down mounting

When mounting Linear Way E or Linear Way F slide units in lateral or reverse (upside-down) position, specify slide units with under seals (supplemental code "/U"), if necessary, to prevent foreign particles from intruding into the slide units.

Operating speed

The limiting values for operating speed of Linear Way or Linear Roller Way depend on various operating conditions such as the type of motion, magnitude of applied load, lubrication conditions, mounting accuracy, and ambient temperature.
Based on the experiences and actual practice, standard values of maximum speed under general operating conditions are given in Table 18 for reference.

Table 18 Standard maximum speed

Model size	Maximum speed m/min
35	180
45	120
55	100
65	75

Cleaning

Do not wash C-Lube Linear Way with organic solvent and/or white kerosene, which have the ability of removing fat, nor leave them in contact with the above agents.

Oil supply point for lubrication

When lubrication oil is fed by gravity, sufficient amounts of oil may not reach to the raceways which are located higher than the supply point. In such cases, it is necessary to examine the lubrication route and supply point. Consult IKO for further information.

Precautions for Mounting

When mounting multiple sets at the same time

●Interchangeable specification product
In the case of an interchangeable specification product, assemble a slide unit and a track rail with the same interchangeable code ("S1" or "S2")
●Non-interchangeable specification product
Use an assembly of slide unit and track rail as delivered without changing the combination.
●Matched sets to be used as an assembled group
Special specification products of matched sets (supplemental code "/W") are delivered as a group in which dimensional variations are specially controlled. Mount them without mixing with the sets of another group.

Assembling a slide unit and a track rail

When assembling C-Lube Linear Way ML or Linear Way L, correctly fit the grooves of the slide unit mounted on a dummy rail (steel ball holder) to the grooves of the track rail, and then move the slide unit gently from the dummy rail to the track rail in parallel direction.
Steel balls are retained in C-Lube Linear Way ML and Linear Way L Ball Retained type, so the slide unit can be separated freely from the track rail. However, the slide unit can be assembled on the track rail much easier by using the dummy rail.
The Linear Way L slide unit of interchangeable specification is delivered as assembled on a dummy rail.
In Linear Way L Ball Non-Retained type, steel balls are not retained. When separating the slide unit from the track rail, a dummy rail (steel ball holder) should be used.
The dummy rail (steel ball holder) is appended as an accessory to models shown in Table 20.1 and 20.2. The steel ball holder for other models are also available. If required, consult IKO for further information.

Mounting accuracy

Inadequate mounting accuracy of Linear Way and Linear Roller Way will affect the operating accuracy and life adversely, so mounting must be carried out with care. When multiple sets are mounted, the parallelism between the two mounting surfaces of machines must be prepared, in general, as shown in Table 19. In the case of Linear Way, if mounting parallelism is poor, frictional resistance will steeply increase giving a warning signal, which can be used to perform high accuracy mounting. For details, see "Mounting Examples" on page Ⅲ-28.

Table 19 Parallelism between two mounting surfaces unit : μm

Class	Ordinary (No symbol)	High (H)	Precision (P)	Super precision (SP)	Ultra Precision (UP)
Parallelism	30		20	10	6

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Corner radius and shoulder height of reference mounting surfaces

It is recommended to make a relieved fillet at the corner of the mating reference mounting surfaces as shown in Fig. 8. For details, see each series explanation.

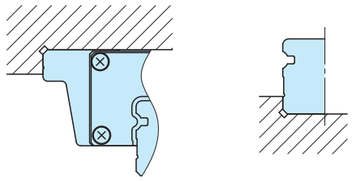


Fig. 8 Relieved fillet at the corner of the mating reference mounting surfaces

Table 20.1 Dummy rail

○ : Products append dummy rail

Series		Interchangeable specification		Non-interchangeable set
		Slidc unit	Assembled set	
C-Lube Linear Way L Linear Way L		○	See Table 20.2	See Table 20.2
C-Lube Linear Way E Linear Way E		○	–	–
C-Lube Linear Way H Linear Way H	8~12	○	○	○
	15~65	○	–	–
	Extra high, rigidity long	○	○	○
	85	–	–	–
Linear Way F		○	–	–
C-Lube Linear Way UL Linear Way U	25、30	–	–	○
	40~130	–	–	–
C-Lube Linear Roller Way Super X Linear Roller Way Super X	10~30	○	○	○
	35~65	○	–	–
	Extra high, rigidity long	○	○	○
	85、100	–	–	–

Table 20.2 Models to which a steel ball holder is appended

C-Lube Linear Way L		Linear Way L	
Standard type	Wide Rail type	Standard type	Wide Rail type
–	–	LWL 2	LWLF 4
–	–	LWLC 3	LWLFC 6
–	–	LWL 3	LWLF 6
MLC 5	MLFC 10	LWLC 5···B	LWLFC 10···B
ML 5	MLF 10	LWL 5···B	LWLF 10···B
MLC 7	MLFC 14	LWLC 7···B	LWLFC 14···B
ML 7	MLF 14	LWL 7···B	LWLF 14···B
MLG 7	MLFG 14	LWLG 7···B	LWLFG 14···B
MLC 9	MLFC 18	LWLC 9···B	LWLFC 18···B
ML 9	MLF 18	LWL 9···B	LWLF 18···B
MLG 9	MLFG 18	LWLG 9···B	LWLFG 18···B
MLG 12	MLFG 24	LWLG 12···B	LWLFG 24···B
MLG 15	MLFG 30	LWLG 15···B	LWLFG 30···B
MLG 20	MLFG 42	LWLG 20···B	LWLFG 42···B
MLG 25	–	LWLG 25···B	–

Cleaning of mounting surfaces

Remove burrs and blemishes from the reference mounting surfaces and mounting surfaces of the machine or equipment, on which Linear Way or Linear Roller Way will be mounted, using an oil-stone, etc., and then wipe the surfaces with clean cloth.

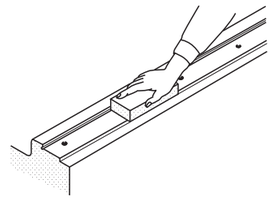


Fig. 9 Cleaning of mounting surfaces

Plugging-in of caps for rail mounting holes

When plugging the caps of special specification (“with caps for rail mounting holes, supplemental code /F”) into the mounting holes of track rail, tap in the cap gently by applying a flat plate on the top face of the cap until the top face of the cap becomes level with the top face of the track rail.

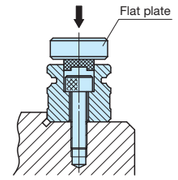


Fig. 10 Plugging-in of caps for rail mounting holes

Tightening torque of mounting bolts

The standard torque values for Linear Way and Linear Roller Way mounting bolts are shown in Tables 21. When machines or equipment are subjected to severe vibration, shock, large fluctuating load, or moment load, the bolts should be tightened with a torque 1.2 to 1.5 times higher than the standard torque values shown.
When the mating member material is cast iron or aluminum, tightening torque should be lowered in accordance with the strength characteristics of the material.

Table 21 Tightening torque of mounting bolts of Linear Way and Linear Roller Way

Bolt size	Tightening torque N · m		
	Carbon steel bolt (Strength division 8.8)	Stainless steel bolt (In case strength division 12.9)	Stainless steel bolt (Property division A2-70)
M 1 ×0.25	–	–	0.04
M 1.4×0.3	–	–	0.10
M 1.6×0.35	–	–	0.15
M 2 ×0.4	–	–	0.31
M 2.3×0.4	–	–	0.48
M 2.5×0.45	–	–	0.62
M 2.6×0.45	–	–	0.70
M 3 ×0.5	1.2	1.7	1.1
M 4 ×0.7	2.8	4.0	2.5
M 5 ×0.8	5.6	7.9	5.0
M 6 ×1	–	13.3	8.5
M 8 ×1.25	–	32.0	20.4
M10 ×1.5	–	62.7	–
M12 ×1.75	–	108	–
M14 ×2	–	172	–
M16 ×2	–	263	–
M20 ×2.5	–	512	–
M24 ×3	–	882	–
M30 ×3.5	–	1 750	–

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Mounting surface, reference mounting surface, and general mounting structure

To mount Linear Way or Linear Roller Way, correctly fit the reference mounting surfaces B and D of the slide unit and the track rail to the reference mounting surfaces of the table and the bed, and then fix them tightly. (See Fig. 11.)
The reference mounting surfaces B and D and mounting surfaces A and C of Linear Way or Linear Roller Way are accurately finished by grinding. Stable and high accuracy linear motion can be obtained by finishing the mating mounting surfaces of machines or equipment with high accuracy and correctly mounting the guide on these surfaces.

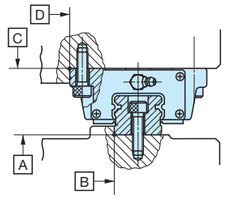


Fig. 11 Reference mounting surfaces and general mounting structure of Linear Way and Linear Roller Way

The slide unit reference mounting surface is always the side surface opposite to the IKO mark. The track rail reference mounting surface is identified by locating the IKO mark on the top surface of the track rail. The track rail reference mounting surface is the side surface above the IKO mark (in the direction of the arrow). (See Fig. 12.)

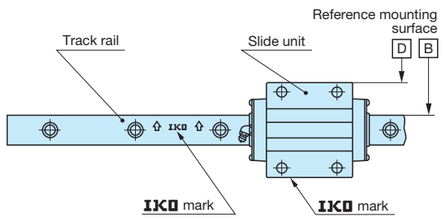


Fig. 12 Reference mounting surfaces of Linear Way and Linear Roller Way

Load direction and mounting structure

When a lateral load, alternate load, or fluctuating load is applied to Linear Way or Linear Roller Way, firmly fix the side faces of the slide unit and track rail as shown in Fig. 13 and Fig. 14.
When the applied load is small or the operating conditions are not too severe, mounting methods shown in Fig. 15 and Fig. 16 are also used.

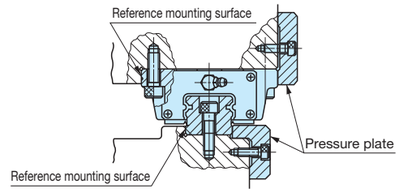


Fig. 13 Mounting example with pressure plate

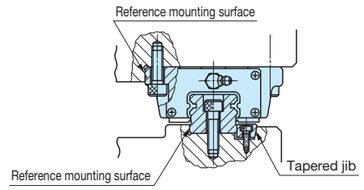


Fig. 14 Mounting example with tapered jib

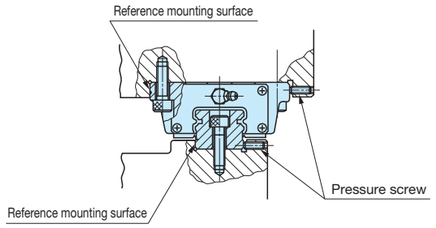


Fig. 15 Mounting example with pressure screw

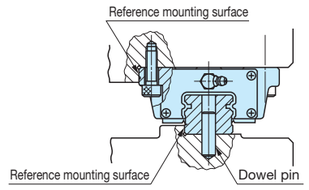


Fig. 16 Mounting example with dowel pin

Mounting Examples

The general mounting procedure for Linear Way and Linear Roller Way is shown in Examples 1 to 3 using a Linear Way as an example.

Example 1 For general operation

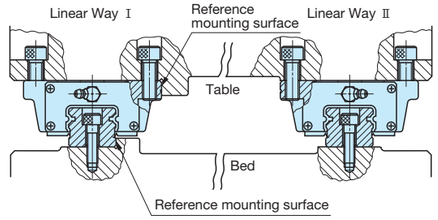


Fig. 17 Example 1

For operations under normal conditions without shocks, prepare one mating reference mounting surface on the table and the bed respectively, and proceed as follows. (See Fig. 17.)

❶Cleaning of mounting surfaces

- Remove burrs and blemishes from the reference mounting surfaces and mounting surfaces of the machine using an oil-stone, etc. and then wipe the surfaces with clean cloth. (See Fig. 18.)
- Remove rust preventive oil and dirt from the reference mounting surfaces and mounting surfaces of Linear Way with clean cloth.

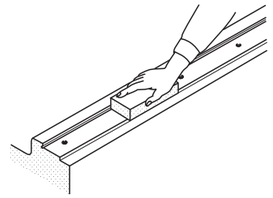


Fig. 18 Cleaning of mounting surfaces

❷Temporary fixing of Linear Way Ⅰ and Ⅱ track rails

- Correctly fit the reference mounting surface of Linear Way Ⅰ track rail onto the mating reference mounting surface of the bed, and temporarily fix the track rail with mounting bolts. (See Fig. 19.)
  During installation, ensure that track rail mounting bolts do not interfere with the mounting holes.
- emporarily fix Linear Way Ⅱ track rail onto the bed.

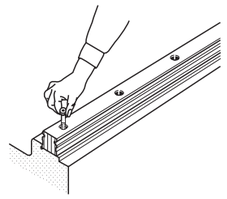


Fig. 19 Temporary fixing of track rail

❸Final fixing of Linear Way Ⅰ track rail

- Firmly push the reference mounting surface of Linear Way Ⅰ track rail to the mating reference mounting surface of the bed using a small vise or clamp. Tighten the track rail mounting bolt at the position where the vise or clamp is applied. Fix the track rail by progressively moving the position of the vise or clamp from one rail end to the other. (See Fig. 20.)
- At this stage, leave Linear Way Ⅱ track rail temporarily fixed.

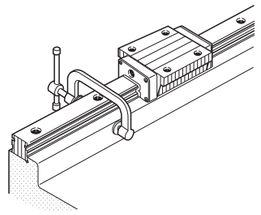


Fig. 20 Fixing of datum side track rail to the bed

❹Temporary fixing of Linear Way Ⅰ and Ⅱ slide units

- After locating all slide units to their respective table mounting positions, gently place the table on them.
- Temporarily fix Linear Way Ⅰ and Ⅱ slide units to the table.

❺Final fixing of Linear Way Ⅰ slide units

- Fix the Linear Way Ⅰ slide units to the table while correctly fitting the reference mounting surfaces of slide units to the mating reference mounting surface of the table.

❻Fixing of Linear Way Ⅱ slide units

- Correctly fix one of the slide units of Linear Way Ⅱ in relation to the linear motion direction and leave other slide units temporarily tightened with mounting bolts. (See Fig. 21.)

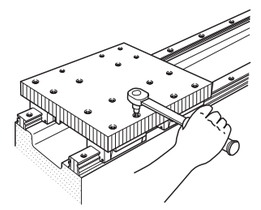


Fig. 21 Fixing of the slide units to the table

❼Final fixing of Linear Way Ⅱ track rail

- While moving the table by hand and ensuring its smooth movement, fix the Linear Way Ⅱ track rail to the bed with the mounting bolts. During this procedure, tighten the mounting bolt immediately behind the fixed slide unit of Linear Way , while progressively moving the table from one rail end to the other. (See Fig. 22.)

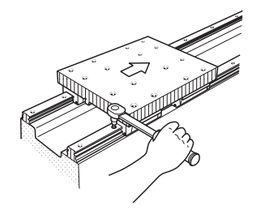


Fig. 22 Fixing of attendant side track rail

❽Final fixing of other Linear Way Ⅱ slide units

- Fix all Linear Way Ⅱ slide units that have been left temporarily fixed to the table.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Example 2 Operation requiring accurate movement and rigidity

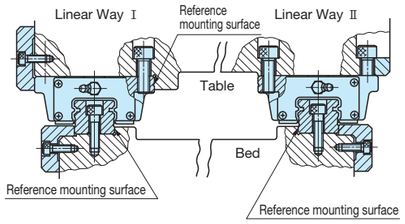


Fig. 23 Example 2

When machines using Linear Way require high running accuracy and rigidity, prepare two mating reference mounting surfaces on the bed and one mating reference mounting surface on the table, then perform the following procedure. (See Fig. 23.)

❶Cleaning of mounting surfaces and reference mounting surfaces

- Remove burrs and blemishes from mounting surfaces and reference mounting surfaces of the machine using an oil-stone, etc., and then wipe the surfaces with clean cloth. (See Fig. 24.)
- Remove rust preventive oil and dirt from Linear Way reference mounting surfaces and mounting surfaces with clean cloth.

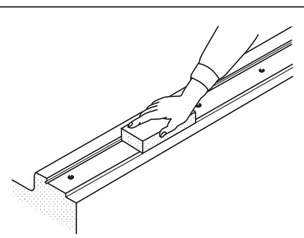


Fig. 24 Cleaning of mounting surfaces

❷Temporary fixing of Linear Way Ⅰ and Ⅱ track rails

- Correctly fit the reference mounting surfaces of Linear Way Ⅰ and Ⅱ track rails onto the mating reference mounting surfaces of the bed, and temporarily fix the track rails with mounting bolts. (See Fig. 25.)
  During installation, ensure that the track rail mounting bolts do not interfere with the mounting holes.

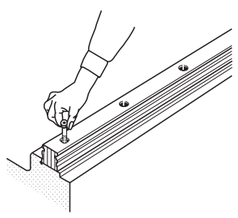


Fig. 25 Temporary fixing of track rail

❸Final fixing of Linear Way Ⅰ and Ⅱ track rails

- Firmly press the reference mounting surface of Linear Way Ⅰ track rail to the mating reference surface of the bed with pressure plates or pressure screws. Tighten the mounting bolt of the track rail at the pressure plate or screw position from one end of the track rail to the other in succession. (See Fig. 26.)

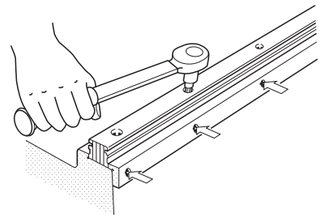


Fig. 26 Fixing of track rail using pressure plate

❹Temporary fixing of Linear Way Ⅰ and Ⅱ slide units

- After locating all slide units to their respective table mounting positions, gently place the table on them. Temporarily fix Linear Way Ⅰ and Ⅱ slide units to the table.

❺Final fixing of Linear Way Ⅰ slide units

- Fix the Linear Way Ⅰ slide units to the table while correctly fitting the reference mounting surfaces of the slide units to the mating reference mounting surface of the table using pressure plates or pressure screws.

❻Final fixing of Linear Way Ⅱ slide units

- Move the table by hand to ensure smooth movement, then fix the Linear Way Ⅱ slide units to the table with mounting bolts. (See Fig. 27.)

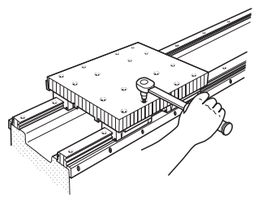


Fig.27 Fixing of slide units to the table

Example 3 Separate mounting of slide units from track rails

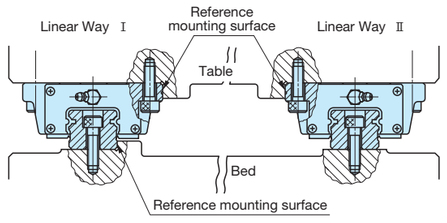


Fig. 28 Example 3

When the slide units assembled on the track rail cannot be securely fixed to the table due to table construction, prepare one reference mounting surface on the bed and two reference mounting surfaces on the table, then proceed as follows. (See Fig. 28.)

❶Cleaning of mounting surfaces

- Remove burrs and blemishes from reference mounting surfaces and mounting surfaces of the machine using an oil-stone, etc., and then wipe the surfaces with clean cloth. (See Fig. 29.)
- Remove rust preventive oil and dirt from Linear Way reference mounting surfaces and mounting surfaces with clean cloth.

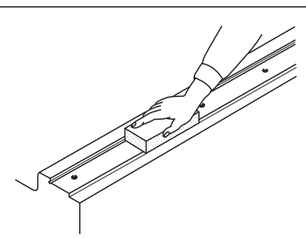


Fig. 29 Cleaning of mounting surfaces

❷Temporary fixing of Linear Way Ⅰ and Ⅱ track rails

- Correctly fit the reference mounting surface of Linear Way Ⅰ and Ⅱ track rail onto the mating reference mounting surface of the bed, and temporarily fix the track rail with mounting bolts. (See Fig. 30.)
  During installation, ensure that the track rail mounting bolts do not interfere with the mounting holes.

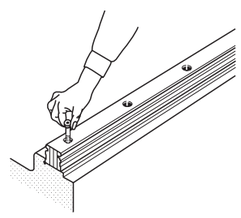


Fig. 30 Temporary fixing of track rail

❸Final fixing of Linear Way Ⅰ track rail

- Firmly push the reference mounting surface of Linear Way Ⅰ track rail to the mating reference mounting surface of the bed using a small vise or clamp. Tighten the track rail mounting bolt at the position of the vise or clamp. Fix the track rail by progressively moving the vise or clamp from one rail end to the other. (See Fig. 31.)
- At this stage, leave Linear Way Ⅱ track rail temporarily fixed.

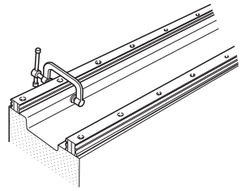


Fig. 31 Fixing of track rail

❹Separation of slide units from track rails

- After noting the respective markings which identify correct assembly positions of slide units on Linear Way Ⅰ and Ⅱ track rails, separate slide units from track rails.

❺Fixing of Linear Way Ⅰ and Ⅱ slide units

- Correctly fit the reference mounting surfaces of Linear Way Ⅰ and Ⅱ slide units to the mating reference mounting surfaces of the table and fix the slide units as shown in the figure. (See Fig. 32.)

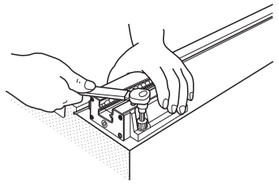


Fig. 32 Fixing of slide unit

❻Installing slide units on track rails

- Gently and gradually install the slide units which are fixed on the table onto the track rails which are fixed or temporarily tightened on the bed. Take care to maintain parallelism of the table to the track rails as the table is slid onto the rails.

❼Fixing of Linear Way Ⅱ track rail

- Fix the track rail of Linear Way Ⅱ while checking the smooth motion by moving the table. At this time, tighten the mounting bolt right behind the fixed slide unit of Linear Way Ⅱ just passed. Fix the track rail by repeating this procedure from one rail end to the other.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Mounting methods of datum track rail

The following methods may be used to mount the datum track rails of IKO Linear Way and Linear Roller Way. Select the method most suited to the specifications of the machine or equipment.

❶Use of mating reference mounting surface of bed

・Firmly push the reference mounting surface of the track rail against the mating reference mounting surface of the bed using a small vise or clamp. Tighten the mounting bolt at the position of the vise. Fix the track rail by repeating this procedure from one end of the rail to the other in succession.

❷Use of a temporary reference surface

・Prepare a temporary reference surface near the mounting surface of the bed and temporarily fix the track rail. Next, fix an indicator stand on the top face of the slide unit as shown in Fig. 33. Apply the indicator probe to the temporary reference surface and fix the track rail by tightening the mounting bolts in succession from one end of the track rail to the other while checking the straightness of the slide unit movement.

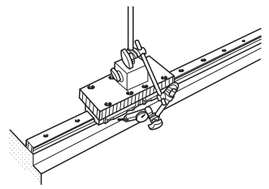


Fig. 33 Mounting by using a temporary reference surface

❸Use of straight-edge

・After temporarily fixing the track rail, apply an indicator probe to the reference mounting surface of the track rail as shown in Fig. 34. Tighten the mounting bolts one by one, while progressively checking the straightness of the track rail in reference to the straight-edge from one end of the track rail to the other.

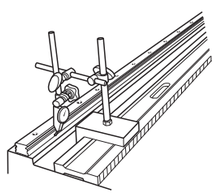


Fig. 34 Mounting by using a straight-edge

Mounting methods of attendant track rail

The following methods may be used to mount the attendant track rail. Select the method most suited to the specifications of the machine or equipment.

❶Use of reference mounting surface

・Firmly push the reference mounting surface of the track rail against the reference mounting surface of the bed using a pressure plate or small vise. Fix the track rail by tightening the mounting bolt at the position of the pressure plate or vise. Tighten the mounting bolts one by one starting from one end of the track rail to the other.

❷Use of mounted datum track rail as the reference

・Fix the datum track rail correctly, fix one attendant slide unit correctly in the direction of motion, and temporarily fix the other slide units and the attendant track rail. Then, fix the attendant track rail by tightening the mounting bolts one by one from one end of the track rail to the other while checking the smooth movement.

❸Use of straight-edge

・After fixing the track rail temporarily, apply the indicator probe to the reference mounting surface of the track rail (as shown in Fig. 34). While checking the straightness in reference to the straight-edge, fix the attendant track rail by tightening the mounting bolts one by one from one end of the track rail to the other.

❹Use of datum side Linear Way

・As shown in Fig. 35, set an indicator stand on the top face of the datum slide unit and apply the indicator probe to the reference mounting surface of the attendant track rail. While checking parallelism of the two rails, fix the attendant rail by tightening mounting bolts one by one from one end of the track rail to the other.

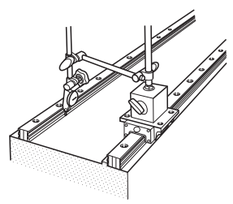


Fig. 35 Mounting by using Linear Way of datum side

Mounting method for butt-jointing track rails

When using butt-jointing track rails, indicate whether a butt-jointing track rail of special specification (non-interchangeable specification, supplemental code "/A") or a butt-jointing interchangeable track rail (interchangeable specification, supplemental code "/T") is to be mounted.
For butt-jointing track rails of non-interchangeable specification, a match mark as shown in Fig. 36 is indicated on the top face of track rail end. Procedures for mounting jointing track rails are generally as follows.

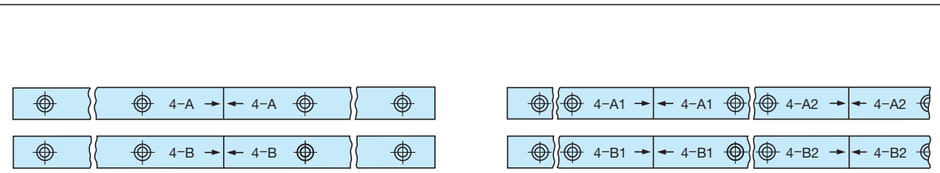


Fig. 36 Butt-jointing match marks

❶Joint the track rails end-to-end in accordance with the match marks, and temporarily fix the rails onto the bed. The butt-jointing interchangeable track rail of interchangeable specification does not require matching butt-jointing rail ends, because the rail is prepared for free combination.

❷Fit the reference mounting surfaces of the track rails onto the reference mounting surface of the bed, then fix all track rails one by one. While performing this procedure, tightly press the reference mounting surface of each track rail with a small vise, etc. against the reference mounting surface of the bed at the butt-jointing position so that the track rails at the butt-jointing position are connected without a step. (See Fig. 37.)

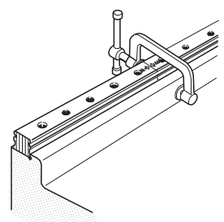


Fig. 37 Fixing of butt-jointing track rails

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch