IKO

Innovation, Know-how & Originality

IKO *Clean Lubrication*

C-Lube

Friendly to Maintenance

Gentle to the Earth

Printed in Japan Ⓒ 2009.03 (OKU)

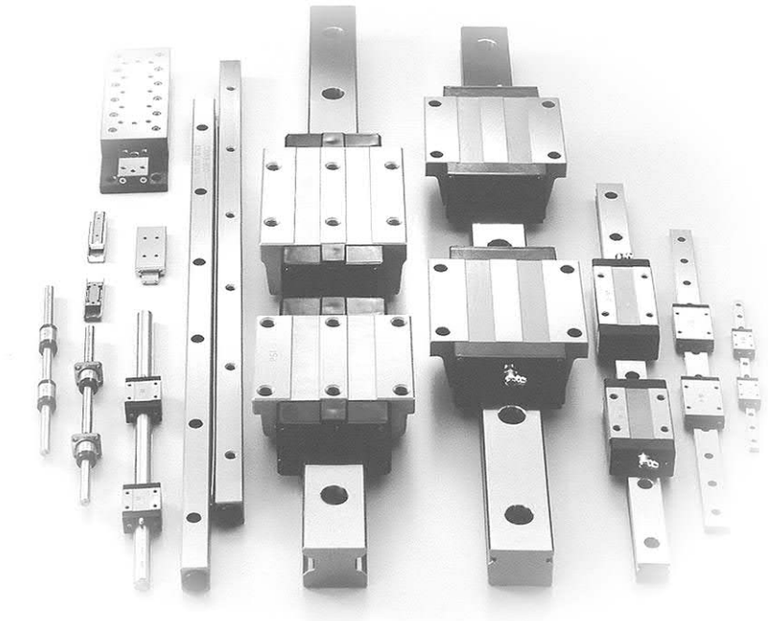
INDEX OF DEMENSION TABLES

A

C-Lube Maintenance Free Series

B

Linear Way Series



C

Linear Roller Way Series

D

Linear Ball Spline Series

E

Crossed Roller Way

Precision Linear Slide

Linear Bushing

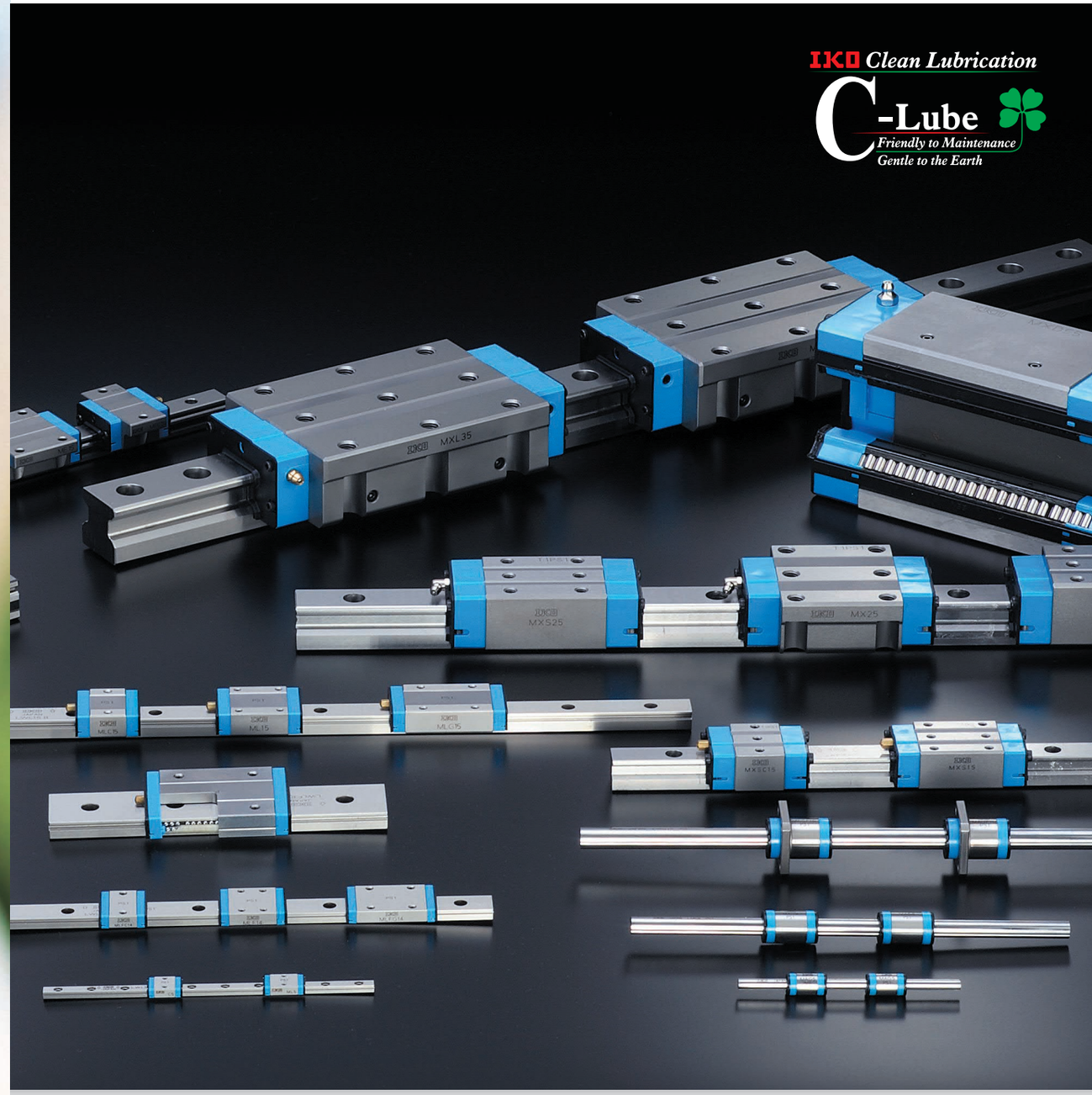
Stroke Rotary Bushing

Flat Roller Cage

We recognize that the conservation of the global environment as the top-priority challenge to all human being and will help fostering a rich global environment through its activities with the considerations to the environment and reducing negative impacts on the environment as its corporate social responsibility.

IKO Clean Lubrication
C-Lube
Friendly to Maintenance
Gentle to the Earth

Friendly to Maintenance
Gentle to the Earth



LINEAR MOTION ROLLING GUIDES

CAT-5507.1

IKO Linear Motion Rolling Guides are produced at a quality level approved by **ISO-14001** and **ISO-9001** using a production system that reduces negative impact on the global environment.

This catalog adopts the **SI** system (system of international units) in conformance with **ISO** (International Organization for Standardization) Standard 1000.
The specifications and dimensions of products in this catalog are subject to change without prior notice.

In the table of dimensions, standard products are referred to using identification numbers marked with ▭ . The identification numbers marked with ▭ refer to our semi-standard products.

INDEX

GENERAL DESCRIPTON

LINEAR WAY and LINEAR ROLLER WAY

LINEAR BALL SPLINE

OTHER LINEAR MOTION ROLLING GUIDES

General Description

IKO Linear Motion Rolling Guides are used with satisfactory results for various applications requiring precision positioning such as semi-conductor manufacturing equipment and large-sized machine tools.

In contrast to conventional rolling bearings used in rotating parts, Linear Motion Rolling Guides are the products applicable to plane sliding surfaces, and meet the increasing needs for linear motion and precision positioning in machines and equipment.

Linear Way and Linear Roller Way of rail guide type, Linear Ball Spline of shaft guide type, and other products, recognized for their high quality and excellent features, are available.

Advantages of Linear Motion Rolling Guides

Advantages of Linear Motion Rolling Guides compared with conventional plain guides are as follows.

1 High positioning accuracy

Superior response characteristics to micro-feeding and accurate positioning performance can be achieved owing to the stable frictional characteristics of rolling friction with small differences between dynamic and static (start-up) friction and small variations in friction due to velocity changes.

2 Reductions in machine size and power consumption

The low frictional resistance allows the use of smaller drive units, which makes it possible to design more compact and lighter machines with less power consumption. So the machine cost and power cost can be saved. In addition, machines can be operated at higher speeds, achieving higher machine efficiency.

3 Highly reliable accuracy in long run operations

Owing to very little wear of raceways and rolling elements, high accuracy and reliability of machines and equipment are maintained in long run operations. In addition, the thinner oil films needed to lubricate Linear Motion Rolling Guides in comparison with conventional plain guides reduce errors caused by variations in oil film thickness.

4 Improvement of product reliability from first design

Reliability of the machines and equipment is improved from the first stage of the design, because the life of Linear Motion Rolling Guides can be estimated by using the established life calculation formulas based on rolling contact fatigue.

5 Simple design for lubrication

In most cases, grease lubrication is sufficient, which requires only a simple design for lubrication and simple maintenance.

6 Guide mechanism free from play

By giving a preload, the rigidity of Linear Motion Rolling Guides can be increased and a guide mechanism free from play can be designed. A preloaded rolling guide also achieves smooth motion even without any clearance.

Features of IKO Linear Motion Rolling Guides

IKO Linear Motion Rolling Guides have the following features.

1 A choice between ball types and roller types assures the best selection for any application

IKO offers two basic design concepts: steel ball types and cylindrical roller types. Steel ball types are most suited for general purpose applications requiring a light to medium load capacity and low frictional resistance. Cylindrical roller types, in comparison, are most often selected for machines needing a high load capacity and very high rigidity.

2 A wide selection of various types for all kinds of industrial uses

Suitable designs in rail guide types and shaft guide types as well as limited motion types and endless motion types are all parts of IKO's standard product lines.

3 A functional simplicity in structure yields high reliability

IKO Linear Motion Rolling Guides feature functional and simple designs. Compared to more complicated designs needing extra steps in manufacturing, the simplicity of IKO designs reduce the potential processing errors that might occur during the various stages of production. Mounting errors can also be eliminated.

4 Process reductions in designing and assembling

Typical IKO Linear Motion Rolling Guides are made into one complete unit of linear motion rolling guide mechanism, and their sizes and accuracy are standardized. Design, assembly and maintenance time of machines and equipment can be reduced greatly by adopting these products.

5 Superior performance and high quality through advanced manufacturing techniques

IKO's precision manufacturing technology and quality control have been developed to achieve and maintain an internationally recognized reputation as a manufacturer of top quality needle roller bearings and other precision machine components. This firm commitment to manufacturing excellence is reflected in the superior performance and high quality of IKO Linear Motion Rolling Guides.

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

Features of IKO interchangeable specification products

Interchangeable specification products are available in Linear Way, Linear Roller Way, and Linear Ball Spline series of IKO Linear Motion Rolling Guides. As slide units/external cylinders and track rails/spline shafts of these products are interchangeable, product selection can be made more freely and easily meeting the customer's needs.

1 Easy addition and replacement of parts

Slide units/external cylinders can be added or replaced on a track rail/spline shaft as required, and even slide units/external cylinders of different types can be assembled on a same track rail/spline shaft. When replacement of parts must be made urgently, for example, due to a design change, it can be made without delay.

2 Short delivery term

As slide units/external cylinders and track rails/spline shafts are stocked separately, these parts can be delivered promptly.

3 High accuracy and high preload

Interchangeability is achieved by rigorous accuracy control of individual parts. As a result, one-step higher accuracy and preload can be offered.

4 Improved efficiency at assembly work

Interchangeable specification products can be assembled without specially selecting slide units/external cylinders and track rails/spline shafts for assembly. So efficiency at assembly work can be improved.

5 A wide range of variations

A wide range of variations in types, sizes, materials, etc. are available, so an optimum product can be selected by the customer for each application.

6 Special specifications

Standard products are available with abundant optional special specifications to meet the diversified needs. These special specification products can be ordered by simply adding the supplemental code to the end of the identification number.

IKO proposes interchangeable specification Linear Motion Rolling Guides for free and easy product selection by the user.

Line-up of interchangeable specification products

	Rolling element	Series name	Material	Variation	Reference page
C-Lube Maintenance Free series	Ball	C-Lube Linear Way ML	Stainless steel	6 types, 37 sizes	A-2 〜
		C-Lube Linear Way ME	Carbon steel	9 types, 45 sizes	A-18 〜
		C-Lube Linear Way MH	Carbon steel	8 types, 40 sizes	A-34 〜
			Stainless steel	4 types, 12 sizes	
	Roller	C-Lube Linear Roller Way Super MX	High Carbon steel	13 types, 75 sizes	A-70 〜
	Ball	C-Lube Linear Ball Spline MAG	High Carbon steel	4 types, 20 sizes	A-100 〜
Linear Way series	Ball	Linear Way L	High carbon steel	2 types, 8 sizes	B-2 〜
			Stainless steel	6 types, 38 sizes	
		Linear Way E	High carbon steel	9 types, 45 sizes	B-30 〜
			Stainless steel	9 types, 36 sizes	
		Linear Way H	High carbon steel	8 types, 52 sizes	B-74 〜
			Stainless steel	6 types, 24 sizes	
		Linear Way F	High carbon steel	3 types, 9 sizes	B-110 〜
			Stainless steel	1 type, 3 sizes	
Linear Roller Way series	Roller	Linear Roller Way Super X	High carbon steel	9 types, 69 sizes	C-2 〜
			Stainless steel	3 types, 15 sizes	
Linear Ball Spline series	Ball	Linear Ball Spline G	High carbon steel	8 types, 56 sizes	D-28 〜
		Block type Linear Ball Spline	High carbon steel	2 types, 14 sizes	D-46 〜
			Stainless steel	1 type, 3 sizes	

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

Types of IKO Linear Motion Rolling Guides

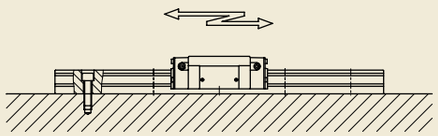
IKO Linear Motion Rolling Guides are classified according to the guide type, motion type and rolling element type. Three guide types, namely, rail guide type, shaft guide type and flat guide type are available. Each of them is divided into the endless motion type in which rolling elements are re-circulated to achieve endless linear motion and the limited motion type without rolling element re-circulation. These types are divided again into ball types and roller types. Each of these guides has its own features.

Ball type

Roller type

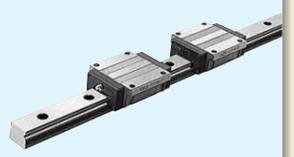
Rail guide type

The rail guide type achieves linear motion along a rail. This product can receive a complex load and features high performance, excellent total balance and easy handling.

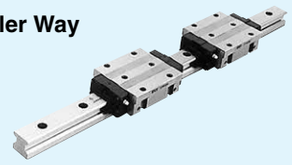


Endless linear motion

Linear Way

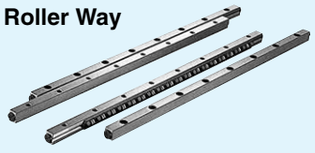


Linear Roller Way



Limited linear motion

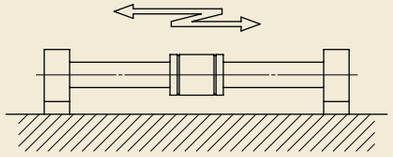
Crossed Roller Way



Precision Linear Slide

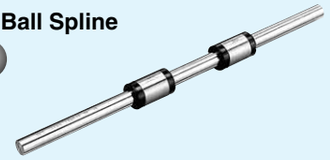
Shaft guide type

The shaft guide type achieves linear motion along a shaft. This product is easy to handle and suitable for relatively low load conditions. Some shaft guide products can achieve both rotation and reciprocating linear motion.



Endless linear motion

Linear Ball Spline



Linear Bushing

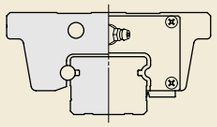
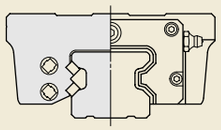
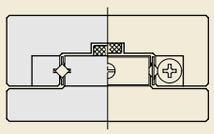
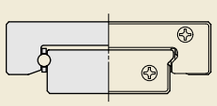
Limited linear motion and rotation

Stroke Rotary Bushing

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

Rail guide type

Rail guide type linear motion rolling guides are easy to mount and can receive complex loads. Man-hours for mounting them on machines and equipment and for designing the guide mechanism can be saved, and consequently the overall machine cost can be reduced greatly. Linear Roller Way can be used for applications subjected to a large load and Linear Way for general-purpose applications.
For applications with a relatively small load requiring smooth and precise motion, use Crossed Roller Way or Precision Linear Slide.

		Type of rolling element	Type of motion	Load direction and load carrying capacity	Rigidity	Frictional characteristic	Ease of mounting	General applications	
Endless linear motion	Linear Way 	 Ball	Endless linear motion	 Complex load, medium to heavy load	◯	◯	◎	・NC machine tool ・Precision working machine ・Robot ・Material transfer machine	Page A-2~ Page B-2~
	Linear Roller Way 	 Roller	Endless linear motion	 Complex load, heavy to extra-heavy load	◎	◯	◎	・Heavy duty machine tool ・Large working machine ・High-rigidity robot	Page C-2~
Limited linear motion	Crossed Roller Way 	 Roller	Limited linear motion	 Complex load, medium load	◯	◎	◎	・Precision working machine ・Electronic parts assembling machine ・Precision measuring instrument	Page E-2~
	Precision Linear Slide 	 Ball	Limited linear motion	 Complex load, light to medium load	△	◎	◎	・Electronic parts assembling machine	Page E-92~

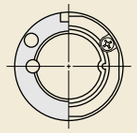
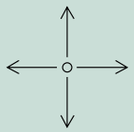
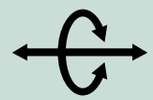
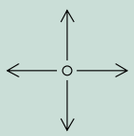
Remarks: ◎ Excellent, ◯ Good, △ Fair

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

Shaft Guide Type

Shaft guide type linear motion rolling guides feature easy mounting. These guides can be used to reduce man-hours for mounting them on machines and equipment, and consequently to save greatly the overall system cost. Stroke Rotary Bushings make both linear reciprocating motion and rotation and can be used on rotary shafts. Linear Ball Splines can be used as rotary shafts to transmit torque when combined with shaft support bearings.

Shaft Guide Type

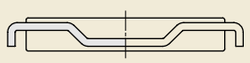
		Type of rolling element	Type of motion	Load direction and load carrying capacity	Rigidity	Frictional characteristic	Ease of mounting	General applications	
Endless linear motion	**Linear Ball Spline** 	 Ball	 Endless linear motion	 Complex load, medium to heavy load	◯	◯	◯	・Robot ・Testing and inspection equipment ・Material transfer machine	Page D-28~
	Linear Bushing 	 Ball	 Endless linear motion	 Radial load, light load	△	◯	◯	・Packaging machine ・Measuring instrument ・Medical equipment	Page E-120~
Limited linear motion + rotation	**Stroke Rotary Bushing** 	 Ball	 Limited linear motion + rotation	 Radial load, light load	△	◎	◯	・Printing press ・Press die set ・Precision measuring instrument	Page E-188~

Remarks: ◎ Excellent, ◯ Good, △ Fair

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

Flat Guide Type

Flat guide type linear motion rolling guides can receive only a uni-directional load but feature high rigidity in the load direction. A guide surface must be prepared for these rolling guides by surface hardening such as heat treatment and precision surface finishing.

		Type of rolling element	Type of motion	Load direction and load carrying capacity	Rigidity	Frictional characteristic	Ease of mounting	General applications	
Limited linear motion	Flat Roller Cage 	 Roller	 Limited linear motion	One-directional load, extra-heavy load	◎	◎	○	· Precision working machine · Optical measuring instrument	Page E-230~

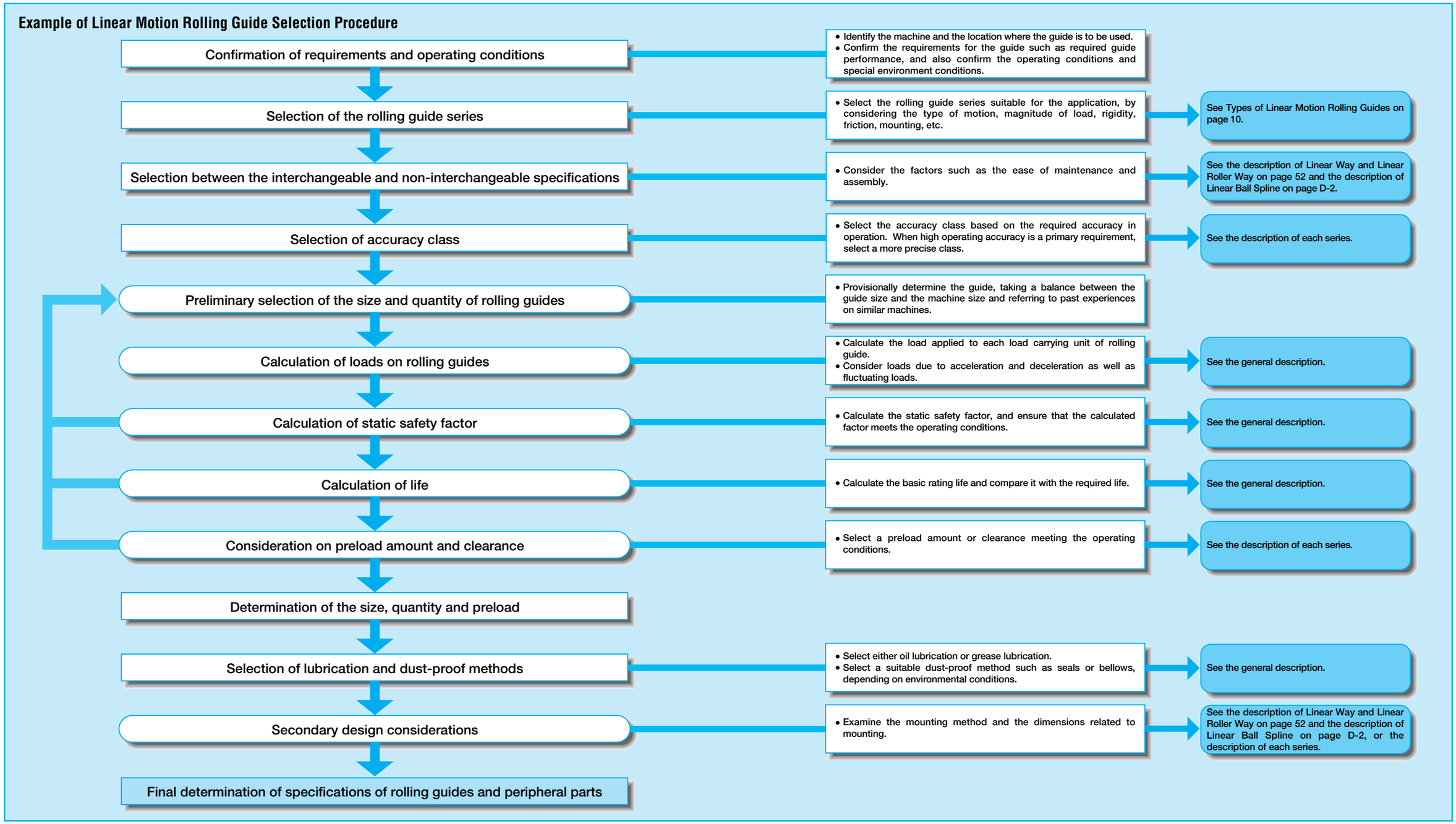
Remarks: ◎ Excellent, ○ Good, △ Fair

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

Outline of Linear Motion Rolling Guide Selection Procedure

Selection of an optimum linear motion rolling guide is made with careful consideration on various factors from the basic items to the details.
An example of standard procedure for selection is shown below.

Example of Linear Motion Rolling Guide Selection Procedure



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

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.

Basic dynamic load rating *C* (Complying with ISO 14728-1)(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.

Note(1) : This standard is not applicable on some series.

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.

Table 1 Basic rating life for basic dynamic load rating

Series	Basic rating life for basic dynamic load rating
Linear Way Linear Roller Way Linear Ball Spline Precision Linear Slide Linear Bushing	50×10^3 m
Crossed Roller Way Flat Roller Cage	100×10^3 m
Stroke Rotary Bushing	10^6 rev.

Life calculation

Life calculation formula

Table 2 shows the relationship between the basic rating life, basic dynamic load rating and applied load of the linear motion rolling guides.
In the life calculation for practical applications, load factor, temperature factor, hardness factor, etc. are taken into consideration. See Table 3 for Stroke Rotary Bushing.

Table 2 Applicable life calculation formula

Series	Basic rating life calculation formula unit : 10^3m	Basic rating life calculation formula unit : hours	Symbols
Linear Way Precision Linear Slide Linear Bushing	$L=50\left(\frac{C}{P}\right)^3$	$L_h=\frac{10^6 L}{2S n_1\times60}$	L : Basic rating life, 10^3m C : Basic dynamic load rating, N T : Dynamic torque rating, N·m P : Dynamic equivalent load (or applied load), N M : Applied torque, N·m L_h : Basic rating life in hours, h S : Stroke length, mm n_1 : Number of strokes per minute, cpm
Linear Ball Spline	$L=50\left(\frac{C}{P}\right)^3$ $L=50\left(\frac{T}{M}\right)^3$		
Linear Roller Way	$L=50\left(\frac{C}{P}\right)^{10/3}$		
Crossed Roller Way Flat Roller Cage	$L=100\left(\frac{C}{P}\right)^{10/3}$		

Table 3 Life calculation formula of Stroke Rotary Bushing

Type of motion	Basic rating life calculation formula unit : 10^6rev.	Basic rating life calculation formula unit : hours	Symbols
Rotation	$L=\left(\frac{C}{P}\right)^3$	$L_h=\frac{10^6 L}{60\sqrt{(D_{pw}n)^2+(10S n_1)^2}/D_{pw}}$	L : Basic rating life, 10^6rev. C : Basic dynamic load rating, N P : Applied load, N L_h : Basic rating life in hours, h n : Rotation speed, rpm n_1 : Number of strokes per minute, cpm S : Stroke length, mm D_{pw} : Pitch diameter of ball set, mm ($D_{pw}\fallingdotseq1.15F_w$) F_w : Diameter of inscribed circle, mm
Combined motion of rotation and reciprocating linear motion			
Reciprocating linear motion		$L_h=\frac{10^6 L}{600S n_1/\pi D_{pw}}$	

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

Temperature factor

Since the allowable contact stress of rolling guides will gradually decrease when the operating temperature of the rolling guide rises over 150℃, the basic dynamic load rating must be corrected for temperature.

$$C_t = f_t C \quad \cdots\cdots (1.1)$$

where, C_t : Basic dynamic load rating considering a temperature rise, N
f_t : Temperature factor (See Fig. 1.)
C : Basic dynamic load rating, N

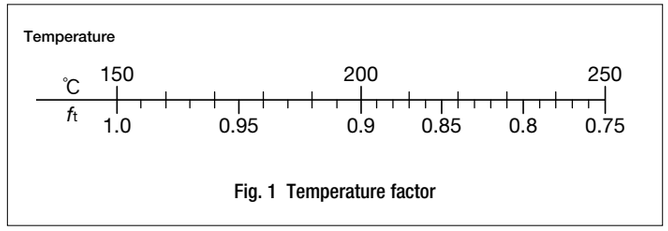


Fig. 1 Temperature factor

Hardness factor

The raceway surface hardness must be 58 to 64HRC. When the hardness is lower than 58HRC, the basic dynamic load rating must be corrected by the following formula.

$$C_H = f_H C \quad \cdots\cdots (1.2)$$

where, C_H : Basic dynamic load rating considering hardness, N
f_H : Hardness factor (See Fig. 2.)
C : Basic dynamic load rating, N

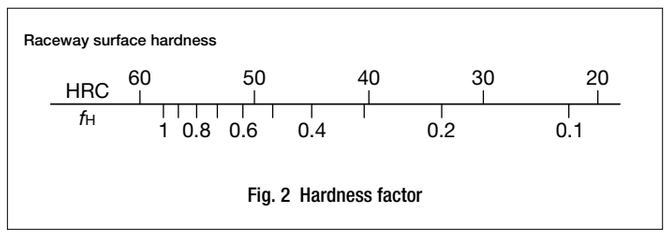


Fig. 2 Hardness factor

Basic Static Load Rating and Static Safety Factor

Basic static load rating C_0 (Complying with ISO 14728-2)(1)

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 4 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.

Note(1) : This standard is not applicable on some series.

Table 4 Maximum contact stress

Series	Maximum contact stress
Linear Way Linear Ball Spline	4 200 MPa
Linear Roller Way Crossed Roller Way Roller Way Flat Roller Cage	4 000 MPa

Static moment rating

The static moment rating is defined as the static moment which gives the contact stress as shown in Table 4 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. 3 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.

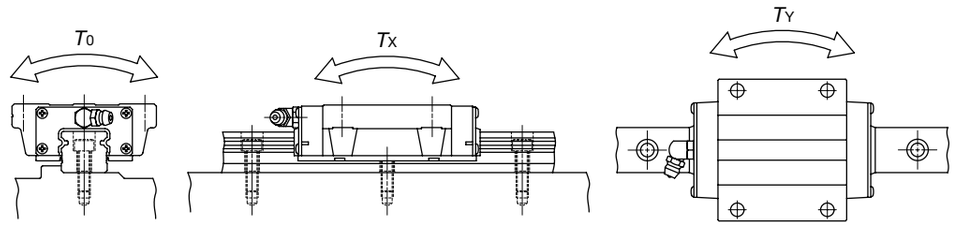


Fig. 3 Examples of static moment rating direction

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

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 5.1 to 5.4 give standard values of this factor. For moment or torque load, the formula (1.4) 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.

$$f_s = \frac{C_0}{P_0} \quad \cdots\cdots (1.3)$$

$$f_s = \frac{T_0}{M_0} \quad \cdots\cdots (1.4)$$

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

Table 5.1 Static safety factor

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

Remark : This table does not apply to Linear Roller Way, Linear Ball Spline, Linear Bushing and Stroke Rotary Bushing.

Table 5.2 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

Table 5.3 Static safety factor of Linear Ball Spline

Operating conditions	f_s
Operation with vibration and/or shocks	5～7
High operating performance	4～6
Normal operation	3～5

Remark : It is recommended to adopt a static safety factor of 5 or more for Angular type Linear Ball Spline.

Table 5.4 Static safety factor of Linear Bushing and Stroke Rotary Bushing

Operating conditions	f_s
Operation with vibration and/or shocks	2.5
Quiet operation	2
Normal operation	1.5

Equivalent Load

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.

$$F_{re} = k_r |F_r| + \frac{C_0}{T_0}|M_0| + \frac{C_0}{T_X}|M_X| \quad \cdots\cdots (1.5)$$

$$F_{ae} = k_a |F_a| + \frac{C_0}{T_Y}|M_Y| \quad \cdots\cdots (1.6)$$

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 7.)
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

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

$$P = X F_{re} + Y F_{ae} \quad \cdots\cdots (1.7)$$

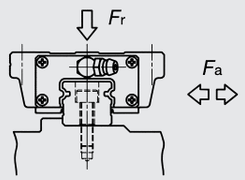
where, P : Dynamic equivalent load, N
X、Y : Dynamic equivalent load factor (See Table 6.)
F_{re} : Downward conversion load, N
F_{ae} : Lateral conversion load, N

Table 6 Dynamic equivalent load factor

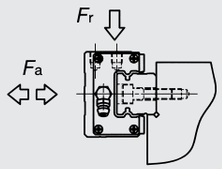
Condition	X	Y
$\lvert F_{re}\rvert \geqq \lvert F_{ae}\rvert$	1	0.6
$\lvert F_{re}\rvert < \lvert F_{ae}\rvert$	0.6	1

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

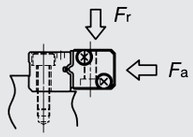
Table 7 Conversion factor for load direction



Linear Way and Linear Roller Way



Linear Way H Side Mounting type



Linear Way LM
Linear Way M
Linear Roller Way M

Series and size		Conversion factor		
		k_r		k_a
		$F_r \geqq 0$	$F_r < 0$	
C-Lube Linear Way ML		1	1	1.19
C-Lube Linear Way ME	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way MH	8～12	1	1	1.19
	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way MUL		1	1	1.19
Linear Way L	Ball retained type	1	1	1.13
	Ball non-retained type	1	1	0.88
Linear Way E	15～30	1	1	1
	35～45	1	1.13	1.19
Low Decibel Linear Way E		1	1	1
Linear Way H	8～12	1	1	1.13
	15～30	1	1	1
	35～65	1	1.13	1.19
	85	1	1.28	1.23
Linear Way H Side Mounting type	15～30	1	1	1
	35～65 (1)	1	1	0.84 0.95
Linear Way F	33～42	1	1	1
	69	1	1	1.13
Linear Way FH		1	1.13	1.19
Linear Way U	25，30	1	1	1.13
	40～130	1	1	1
C-Lube Linear Roller Way Super MX		1	1	1
Linear Roller Way Super X		1	1	1
Linear Way Module LM		1	1	0.70
Linear Way Module M	1～ 5	1	1.13	0.73
	6	1	1.28	0.76

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.
Remark : F_r is the downward load. (When its value is smaller than zero, it is an upward load.)

Static equivalent load P_0

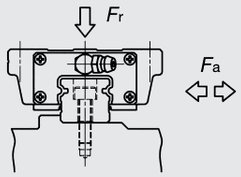
When a load is applied in a direction other than that of the basic static load rating of Linear Way or Linear Roller Way or a complex load is applied, the static equivalent load must be calculated to obtain the static safety factor.

$$P_0 = k_{0r}|F_r| + k_{0a}|F_a| + \frac{C_0}{T_0}|M_0| + \frac{C_0}{T_X}|M_X| + \frac{C_0}{T_Y}|M_Y| \cdots\cdots\cdots (1.8)$$

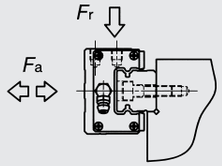
where, P_0 : Static equivalent load, N
F_r : Downward load, N
F_a : Lateral load, N
M_0 : Moment in the T_0 direction, N・m
M_X : Moment in the T_X direction, N・m
M_Y : Moment in the T_Y direction, N・m
k_{0r}, k_{0a} : Conversion factors for load direction (See Table 8.)
C_0 : Basic static load rating, 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

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

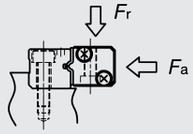
Table 8 Conversion factor for load direction



Linear Way and Linear Roller Way



Linear Way H Side Mounting type



Linear Way LM
Linear Way M
Linear Roller Way M

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 ML		1	1	1.19
C-Lube Linear Way ME	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way MH	8～12	1	1	1.19
	15～30	1	1	1
	35～45	1	1.19	1.28
C-Lube Linear Way MUL		1	1	1.19
Linear Way L	Ball retained type	1	1	1.19
	Ball non-retained type	1	1	0.84
Linear Way E	15～30	1	1	1
	35～45	1	1.19	1.28
Low Decibel Linear Way E		1	1	1
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
Linear Way F	33～42	1	1	1
	69	1	1	1.19
Linear Way FH		1	1.19	1.28
Linear Way U	25，30	1	1	1.19
	40～130	1	1	1
C-Lube Linear Roller Way Super MX		1	1	1
Linear Roller Way Super X		1	1	1
Linear Way Module LM		1	1	0.60
Linear Way Module M	1～ 5	1	1.19	0.64
	6	1	1.43	0.67

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.
Remark : F_r is the downward load. (When its value is smaller than zero, it is an upward load.)

Applied Load

In some series of Linear Motion Rolling Guides excluding Linear Way and Linear Roller Way, the dynamic load rating and static load rating corrected for the direction of the theoretical applied load are used for calculating the basic rating life and static safety factor. For details, see the description of each series.

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 9.

Table 9 Load factor

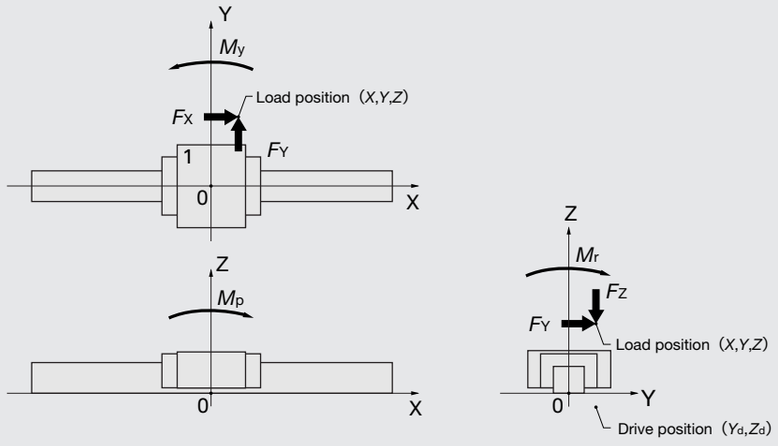
Operating conditions	f_W
Smooth operation free from vibration and/or shocks	1 ～1.2
Normal operation	1.2～1.5
Operation with vibration and/or shocks	1.5～3

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

Calculation of load

Table 10.1 to Table 10.6 show calculation examples of the loads applied on Linear Motion Rolling Guides incorporated in machines or equipment.

Table 10.1 One track rail and one slide unit

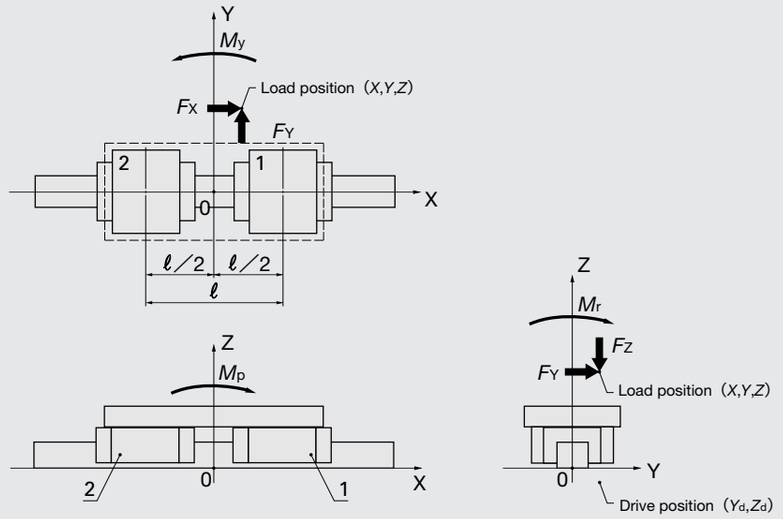


Slide unit No.	Load applied on the slide unit				
	Downward load F_r	Lateral load F_a	Moment in the T_0 direction M_0	Moment in the T_X direction M_X	Moment in the T_Y direction M_Y
1	F_z	F_y	M_r	M_p	M_y

Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

$$M_r = F_Y Z + F_Z Y$$
$$M_p = F_X (Z - Z_d) + F_Z X$$
$$M_y = -F_X (Y - Y_d) + F_Y X$$

Table 10.2 One track rail and two slide units



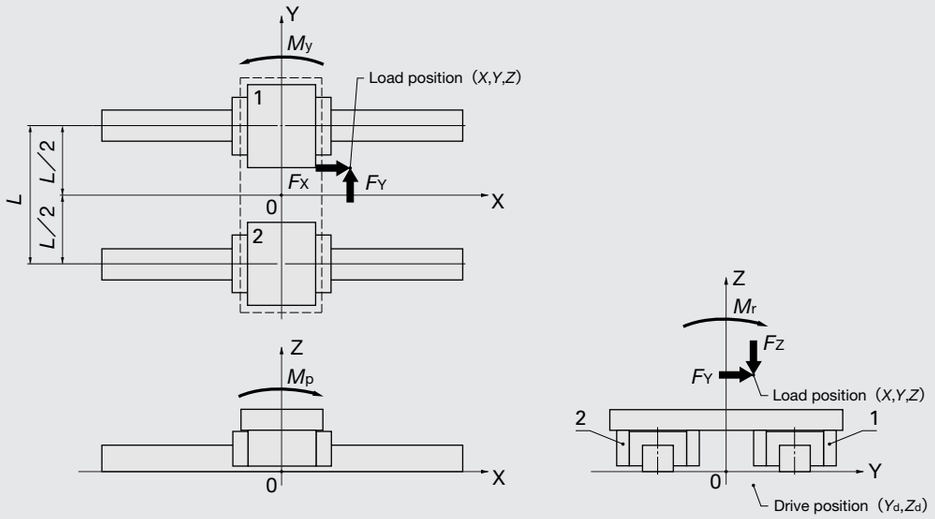
Slide unit No.	Load applied on the slide unit		
	Downward load F_r	Lateral load F_a	Moment in the T_0 direction M_0
1	$\frac{F_z}{2} + \frac{M_p}{\ell}$	$\frac{F_Y}{2} + \frac{M_y}{\ell}$	$\frac{M_r}{2}$
2	$\frac{F_z}{2} - \frac{M_p}{\ell}$	$\frac{F_Y}{2} - \frac{M_y}{\ell}$	$\frac{M_r}{2}$

Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

$$M_r = F_Y Z + F_Z Y$$
$$M_p = F_X (Z - Z_d) + F_Z X$$
$$M_y = -F_X (Y - Y_d) + F_Y X$$

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

Table 10.3 Two track rails and one slide unit on each track rail



Slide unit No.	Load applied on the slide unit			
	Downward load F_r	Lateral load F_a	Moment in the T_X direction M_X	Moment in the T_Y direction M_Y
1	$\frac{F_Z}{2}+\frac{M_r}{L}$	$\frac{F_Y}{2}$	$\frac{M_p}{2}$	$\frac{M_y}{2}$
2	$\frac{F_Z}{2}-\frac{M_r}{L}$	$\frac{F_Y}{2}$	$\frac{M_p}{2}$	$\frac{M_y}{2}$

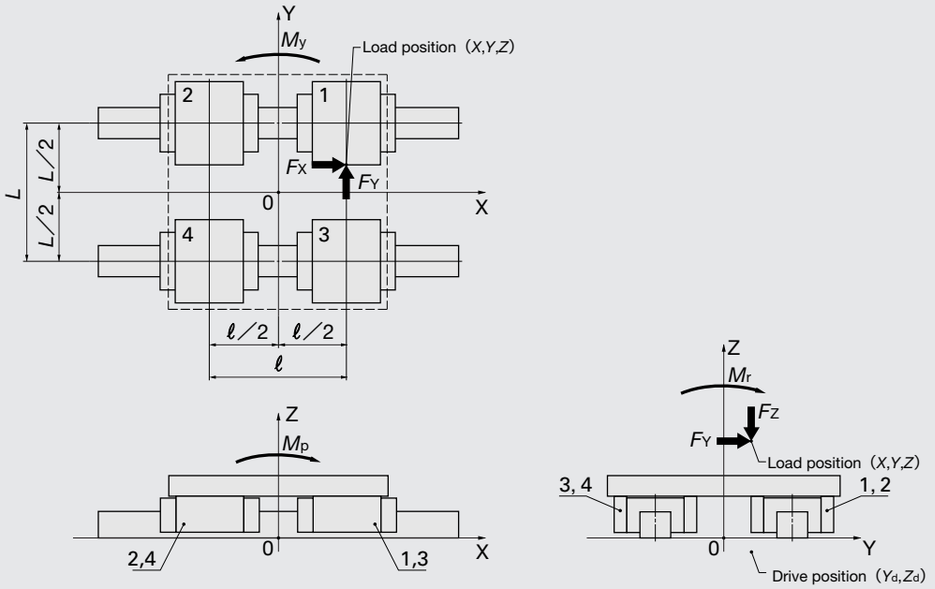
Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

$M_r = F_Y Z + F_Z Y$

$M_p = F_X (Z - Z_d) + F_Z X$

$M_y = -F_X (Y - Y_d) + F_Y X$

Table 10.4 Two track rails and two slide units on each track rail



Slide unit No.	Load applied on the slide unit	
	Downward load F_r	Lateral load F_a
1	$\frac{F_Z}{4}+\frac{M_r}{2L}+\frac{M_p}{2\ell}$	$\frac{F_Y}{4}+\frac{M_y}{2\ell}$
2	$\frac{F_Z}{4}+\frac{M_r}{2L}-\frac{M_p}{2\ell}$	$\frac{F_Y}{4}-\frac{M_y}{2\ell}$
3	$\frac{F_Z}{4}-\frac{M_r}{2L}+\frac{M_p}{2\ell}$	$\frac{F_Y}{4}+\frac{M_y}{2\ell}$
4	$\frac{F_Z}{4}-\frac{M_r}{2L}-\frac{M_p}{2\ell}$	$\frac{F_Y}{4}-\frac{M_y}{2\ell}$

Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

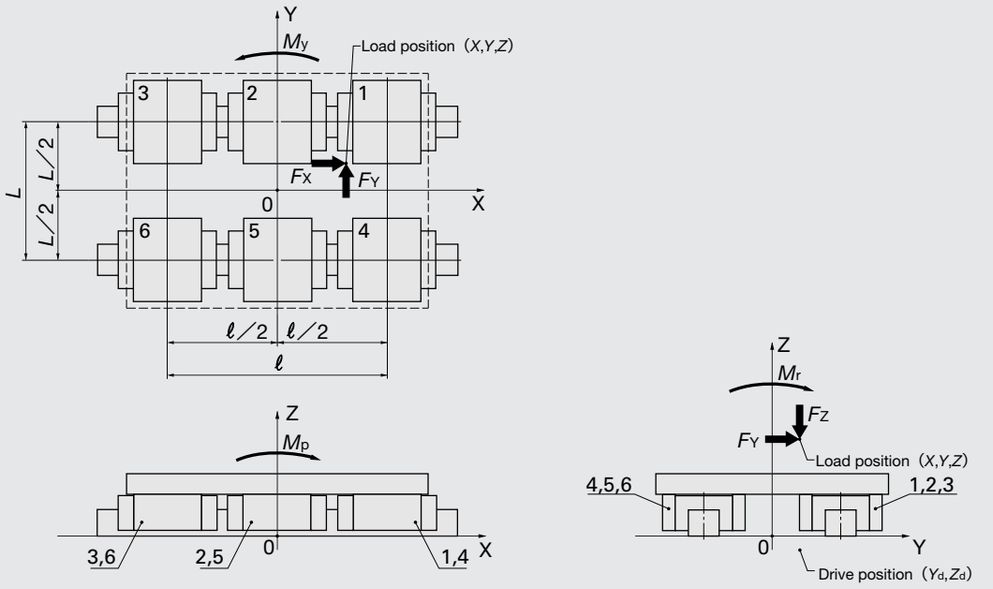
$M_r = F_Y Z + F_Z Y$

$M_p = F_X (Z - Z_d) + F_Z X$

$M_y = -F_X (Y - Y_d) + F_Y X$

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

Table 10.5 Two track rails and three slide units on each track rail



Slide unit No.	Load applied on the slide unit	
	Downward load F_r	Lateral load F_a
1	$\frac{F_Z}{6}+\frac{M_r}{3L}+\frac{M_p}{2\ell}$	$\frac{F_Y}{6}+\frac{M_y}{2\ell}$
2	$\frac{F_Z}{6}+\frac{M_r}{3L}$	$\frac{F_Y}{6}$
3	$\frac{F_Z}{6}+\frac{M_r}{3L}-\frac{M_p}{2\ell}$	$\frac{F_Y}{6}-\frac{M_y}{2\ell}$
4	$\frac{F_Z}{6}-\frac{M_r}{3L}+\frac{M_p}{2\ell}$	$\frac{F_Y}{6}+\frac{M_y}{2\ell}$
5	$\frac{F_Z}{6}-\frac{M_r}{3\ell}$	$\frac{F_Y}{6}$
6	$\frac{F_Z}{6}-\frac{M_r}{3L}-\frac{M_p}{2\ell}$	$\frac{F_Y}{6}-\frac{M_y}{2\ell}$

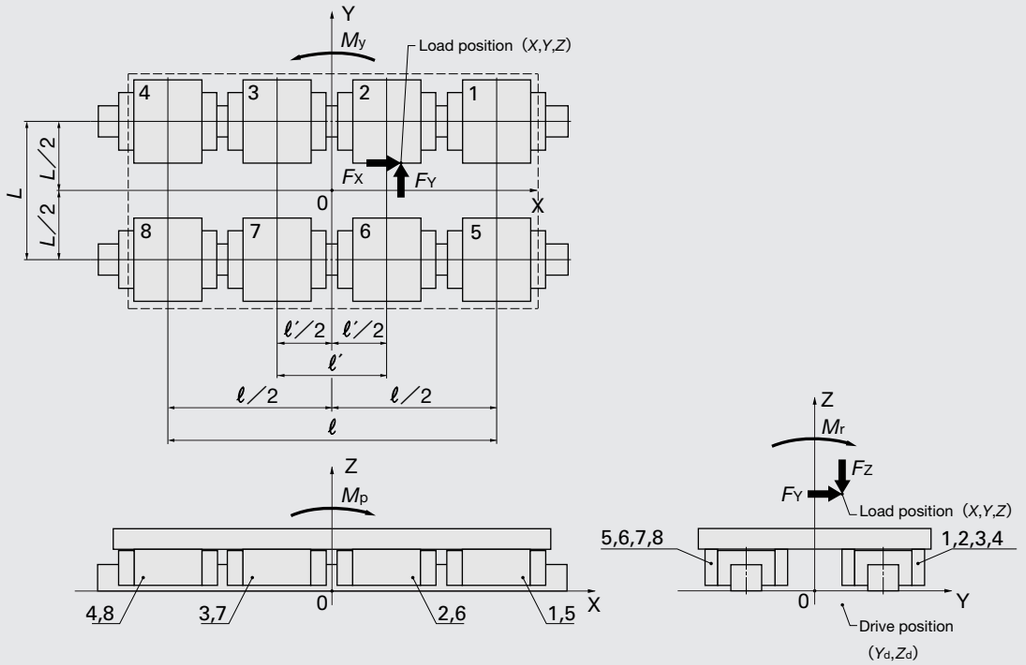
Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

$M_r = F_Y Z + F_Z Y$

$M_p = F_X (Z - Z_d) + F_Z X$

$M_y = -F_X (Y - Y_d) + F_Y X$

Table 10.6 Two track rails and four slide units on each track rail



Slide unit No.	Load applied on the slide unit	
	Downward load F_r	Lateral load F_a
1	$\frac{F_Z}{8}+\frac{M_r}{4L}+\frac{M_p}{2}\frac{\ell}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}+\frac{M_y}{2}\frac{\ell}{\ell^2+\ell'^2}$
2	$\frac{F_Z}{8}+\frac{M_r}{4L}+\frac{M_p}{2}\frac{\ell'}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}+\frac{M_y}{2}\frac{\ell'}{\ell^2+\ell'^2}$
3	$\frac{F_Z}{8}+\frac{M_r}{4L}-\frac{M_p}{2}\frac{\ell'}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}-\frac{M_y}{2}\frac{\ell'}{\ell^2+\ell'^2}$
4	$\frac{F_Z}{8}+\frac{M_r}{4L}-\frac{M_p}{2}\frac{\ell}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}-\frac{M_y}{2}\frac{\ell}{\ell^2+\ell'^2}$
5	$\frac{F_Z}{8}-\frac{M_r}{4L}+\frac{M_p}{2}\frac{\ell}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}+\frac{M_y}{2}\frac{\ell}{\ell^2+\ell'^2}$
6	$\frac{F_Z}{8}-\frac{M_r}{4L}+\frac{M_p}{2}\frac{\ell'}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}+\frac{M_y}{2}\frac{\ell'}{\ell^2+\ell'^2}$
7	$\frac{F_Z}{8}-\frac{M_r}{4L}-\frac{M_p}{2}\frac{\ell'}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}-\frac{M_y}{2}\frac{\ell'}{\ell^2+\ell'^2}$
8	$\frac{F_Z}{8}-\frac{M_r}{4L}-\frac{M_p}{2}\frac{\ell}{\ell^2+\ell'^2}$	$\frac{F_Y}{8}-\frac{M_y}{2}\frac{\ell}{\ell^2+\ell'^2}$

Remark：The moment loads in each direction M_r, M_p, and M_y can be obtained by the following formulae.

$M_r = F_Y Z + F_Z Y$

$M_p = F_X (Z - Z_d) + F_Z X$

$M_y = -F_X (Y - Y_d) + F_Y X$

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

Mean equivalent load for fluctuating load

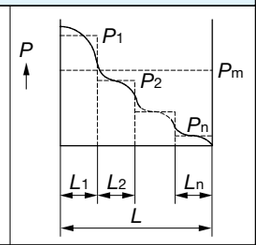
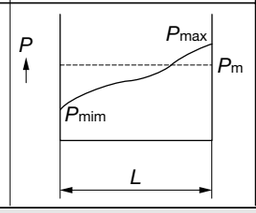
When the load on the rolling guide fluctuates, the mean equivalent load P_m is used in place of the load P in the life calculation formula.
The mean equivalent load is a constant load which gives the basic rating life equal to that for the fluctuating load. It is obtained by the following formula.

$$P_m = \sqrt[p]{\frac{1}{L}\int_0^L P_n^p \, dL} \quad \cdots\cdots (1.9)$$

where, P_m : Mean equivalent load, N
L : Total traveling distance, m
P_n : Fluctuating load, N
p : Exponent (Ball guide: 3, roller guide: 10/3)

Table 11 gives calculation examples of the mean equivalent load for typical fluctuating loads.

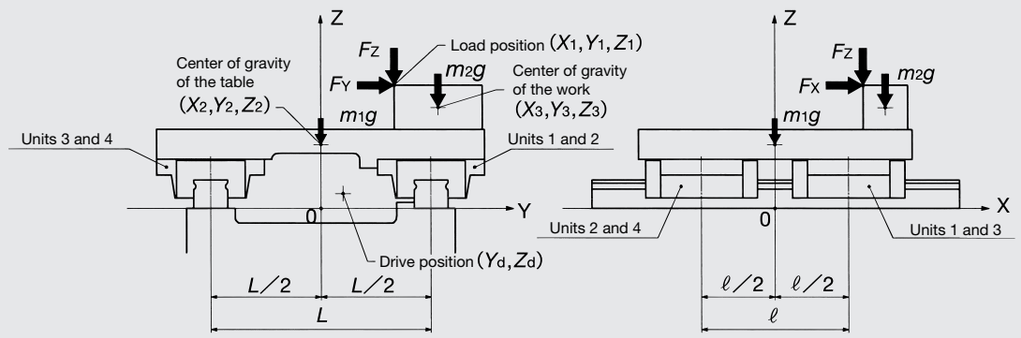
Table 11 Mean equivalent load for fluctuating load

Example	Calculation formula
① Step load 	$P_m = \sqrt[p]{\frac{1}{L}(P_1^p L_1 + P_2^p L_2 + \cdots + P_n^p L_n)}$ where, L_1 : Total traveling distance under load P_1, m L_2 : Total traveling distance under load P_2, m L_n : Total traveling distance under load P_n, m
② Monotonously changing load 	$P_m \fallingdotseq \frac{1}{3}(2P_{max} + P_{min})$ where, P_{max} : Maximum value of fluctuating load, N P_{min} : Minimum value of fluctuating load, N

Examples of Load and Life Calculation

Example 1

Model No.		LWE 25 C2 R640 H	
Basic dynamic load rating	C	= 18100 N	
Basic static load rating	C_0	= 21100 N	
Applied load	F_{X1}	= 1000 N	
	F_{Y1}	= 2000 N	
	F_{Z1}	= 1000 N	
Load position	X_1	= 60 mm	
	Y_1	= 50 mm	
	Z_1	= 83 mm	
Table mass	m_1	= 10 kg	
Position of the center of gravity of table	X_2	= 0 mm	
	Y_2	= 0 mm	
	Z_2	= 43 mm	
Work mass	m_2	= 10 kg	
Position of the center of gravity of work	X_3	= 75 mm	
	Y_3	= 80 mm	
	Z_3	= 68 mm	
Number of strokes per minute	n_1	= 5 cpm	
Stroke length	S	= 100 mm	
Distance between the slide units	ℓ	= 100 mm	
Distance between the track rails	L	= 150 mm	
Drive position	Y_d	= 150 mm	
	Z_d	= 10 mm	



The life and static safety factor under the above conditions are calculated as follows. Load factor f_w is assumed to be 1.5.

❶Load on the slide unit

Moments that occur due to the applied load and the table weight act around each coordinate axis of the Linear Motion Rolling Guide as shown below.

$$M_r = \Sigma (F_Y Z) + \Sigma (F_Z Y) = F_{Y1} Z_1 + F_{Z1} Y_1 + m_1 g Y_2 + m_2 g Y_3$$
$$= 2000 \times 83 + 1000 \times 50 + 10 \times 9.8 \times 0 + 10 \times 9.8 \times 80 \fallingdotseq 224000$$
$$M_p = \Sigma \{F_X (Z - Z_d)\} + \Sigma (F_Z X) = F_{X1} (Z_1 - Z_d) + F_{Z1} X_1 + m_1 g X_2 + m_2 g X_3$$
$$= 1000 \times (83 - 10) + 1000 \times 60 + 10 \times 9.8 \times 0 + 10 \times 9.8 \times 75 \fallingdotseq 140000$$
$$M_y = -\Sigma \{F_X (Y - Y_d)\} + \Sigma (F_Y X) = -F_{X1} (Y_1 - Y_d) + F_{Y1} X_1$$
$$= -1000 \times (50 - 150) + 2000 \times 60 = 220000$$

where, M_r : Moment in the rolling direction, N・mm
M_p : Moment in the pitching direction, N・mm
M_y : Moment in the yawing direction, N・mm

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

The loads applied on each slide unit are calculated according to Table 10.4 on page 33.

$$F_{r1}=\frac{\Sigma F_Z}{4}+\frac{M_r}{2L}+\frac{M_p}{2\ell}=\frac{F_{Z1}+m_1g+m_2g}{4}+\frac{M_r}{2L}+\frac{M_p}{2\ell}$$

$$=\frac{1000+10\times9.8+10\times9.8}{4}+\frac{224000}{2\times150}+\frac{140000}{2\times100}\fallingdotseq1750$$

$$F_{r2}=\frac{\Sigma F_Z}{4}+\frac{M_r}{2L}-\frac{M_p}{2\ell}=\frac{F_{Z1}+m_1g+m_2g}{4}+\frac{M_r}{2L}-\frac{M_p}{2\ell}\fallingdotseq346$$

$$F_{r3}=\frac{\Sigma F_Z}{4}-\frac{M_r}{2L}+\frac{M_p}{2\ell}=\frac{F_{Z1}+m_1g+m_2g}{4}-\frac{M_r}{2L}+\frac{M_p}{2\ell}\fallingdotseq252$$

$$F_{r4}=\frac{\Sigma F_Z}{4}-\frac{M_r}{2L}-\frac{M_p}{2\ell}=\frac{F_{Z1}+m_1g+m_2g}{4}-\frac{M_r}{2L}-\frac{M_p}{2\ell}\fallingdotseq-1150$$

$$F_{a1}=F_{a3}=\frac{\Sigma F_Y}{4}+\frac{M_y}{2\ell}=\frac{F_{Y1}}{4}+\frac{M_y}{2\ell}$$

$$=\frac{2000}{4}+\frac{220000}{2\times100}=1600$$

$$F_{a2}=F_{a4}=\frac{\Sigma F_Y}{4}-\frac{M_y}{2\ell}=\frac{F_{Y1}}{4}-\frac{M_y}{2\ell}=-600$$

❷Basic rating life

The upward/downward load and lateral load are converted into the conversion loads by formulas (1.5) and (1.6) on page 25.

$$F_{re1}=k_r|F_{r1}|=1\times1750=1750$$
$$F_{re2}=k_r|F_{r2}|=1\times346=346$$
$$F_{re3}=k_r|F_{r3}|=1\times252=252$$
$$F_{re4}=k_r|F_{r4}|=1\times1150=1150$$
$$F_{ae1}=k_a|F_{a1}|=1\times1600=1600$$
$$F_{ae2}=k_a|F_{a2}|=1\times600=600$$
$$F_{ae3}=k_a|F_{a3}|=1\times1600=1600$$
$$F_{ae4}=k_a|F_{a4}|=1\times600=600$$

where, k_r, k_a : Conversion factors for load direction (See Table 7 on page 26.)

The dynamic equivalent load is calculated by formula (1.7) on page 25.

$$P_1=X|F_{re1}|+Y|F_{ae1}|=1\times1750+0.6\times1600=2710$$
$$P_2=X|F_{re2}|+Y|F_{ae2}|=0.6\times346+1\times600\fallingdotseq808$$
$$P_3=X|F_{re3}|+Y|F_{ae3}|=0.6\times252+1\times1600\fallingdotseq1750$$
$$P_4=X|F_{re4}|+Y|F_{ae4}|=1\times1150+0.6\times600=1510$$

The basic rating life of slide unit 1 receiving the largest dynamic equivalent load is calculated. The basic rating life is obtained by the formula given in Table 2 on page 21 while considering the load factor f_w.

$$L_1=50\left(\frac{C}{f_w\,P_1}\right)^3=50\times\left(\frac{18100}{1.5\times2710}\right)^3\fallingdotseq4410$$

$$L_{h1}=\frac{10^6\,L_1}{2S\,n_1\times60}=\frac{10^6\times4410}{2\times100\times5\times60}\fallingdotseq73500$$

As the result of the above calculation, the basic rating life is about 73500 hours.

❸Static safety factor

The static equivalent load is calculated from the upward/downward load and lateral load by formula (1.8) on page 27.

$$P_{01}=k_{0r}|F_{r1}|+k_{0a}|F_{a1}|=1\times1750+1\times1600=3350$$
$$P_{02}=k_{0r}|F_{r2}|+k_{0a}|F_{a2}|=1\times346+1\times600=946$$
$$P_{03}=k_{0r}|F_{r3}|+k_{0a}|F_{a3}|=1\times252+1\times1600=1852$$
$$P_{04}=k_{0r}|F_{r4}|+k_{0a}|F_{a4}|=1\times1150+1\times600=1750$$

where, k_{0r}, k_{0a} : Conversion factors for load direction (See Table 8 on page 28.)

The static safety factor of slide unit 1 receiving the largest static equivalent load is obtained. The static safety factor is calculated by formula (1.3) on page 24.

$$f_{s1}=\frac{C_0}{P_{01}}=\frac{21100}{3350}\fallingdotseq6.3$$

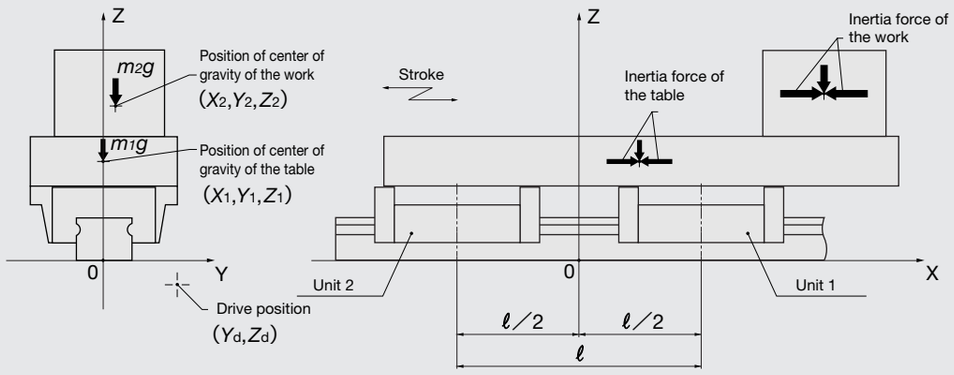
As the result of the above calculation, the static safety factor is about 6.3.

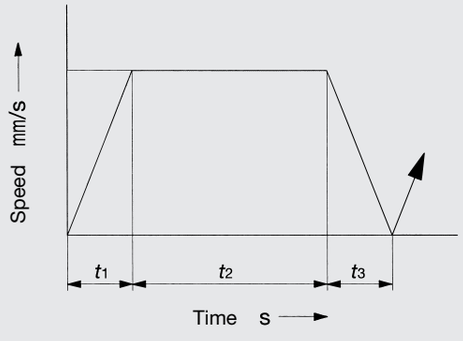
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Example 2

Model No. ·····LWH 45 C2 R1050 B H

Basic dynamic load rating	C	= 74600	N
Basic static load rating	C_0	= 80200	N
Static moment rating in the T_0 direction	T_0	= 1610	N·m
Table mass	m_1	= 100	kg
Position of the center of gravity of table	X_1	= 50	mm
	Y_1	= 0	mm
	Z_1	= 80	mm
Work mass	m_2	= 1000	kg
Position of the center of gravity of work	X_2	= 200	mm
	Y_2	= 10	mm
	Z_2	= 130	mm
Distance between the slide units	ℓ	= 200	mm
Stroke length	S	= 500	mm
Number of strokes per minute	n_1	= 6	cpm
Maximum travel speed	V	= 100	mm/s
Time spent for acceleration	t_1	= 0.1	s
Time spent during constant speed motion	t_2	= 4.9	s
Time spent for deceleration	t_3	= 0.1	s
Drive position	Y_d	= 60	mm
	Z_d	= −20	mm





The life and static safety factor under the above conditions are calculated as follows. Load factor f_w is assumed to be 1.5.

❶Load on the slide unit

Moments that occur due to the applied load, the table weight and the inertia force act around each coordinate axis of the Linear Motion Rolling Guide as shown below.

·During acceleration at the start of motion

$$M_r = \Sigma (F_Y Z) + \Sigma (F_Z Y) = m_1 g Y_1 + m_2 g Y_2 = 100 \times 9.8 \times 0 + 1000 \times 9.8 \times 10 \fallingdotseq 98000$$

$$M_p = \Sigma \{F_X (Z - Z_d)\} + \Sigma (F_Z X)$$

$$= m_1 \frac{V}{1000 \times t_1} (Z_1 - Z_d) + m_2 \frac{V}{1000 \times t_1} (Z_2 - Z_d) + m_1 g X_1 + m_2 g X_2$$

$$= 100 \times \frac{100}{1000 \times 0.1} \times (80 + 20) + 1000 \times \frac{100}{1000 \times 0.1} \times (130 + 20)$$

$$+ 100 \times 9.8 \times 50 + 1000 \times 9.8 \times 200 \fallingdotseq 2169000$$

$$M_y = -\Sigma \{F_X (Y - Y_d)\} + \Sigma (F_Y X)$$

$$= -m_1 \frac{V_{max}}{1000 \times t_1} (Y_1 - Y_d) - m_2 \frac{V_{max}}{1000 \times t_2} (Y_2 - Y_d)$$

$$= -100 \times \frac{100}{1000 \times 0.1} \times (0 - 60) - 1000 \times \frac{100}{1000 \times 0.1} \times (10 - 60) \fallingdotseq 56000$$

·During constant speed motion

$$M_r = m_1 g Y_1 + m_2 g Y_2 \fallingdotseq 98000$$

$$M_p = m_1 g X_1 + m_2 g X_2 \fallingdotseq 2010000$$

$$M_y = 0$$

·During deceleration at the end of motion

$$M_r = m_1 g Y_1 + m_2 g Y_2 \fallingdotseq 98000$$

$$M_p = -m_1 \frac{V_{max}}{t_1} (Z_1 - Z_d) - m_2 \frac{V_{max}}{t_1} (Z_2 - Z_d) + m_1 g X_1 + m_2 g X_2 \fallingdotseq 1850000$$

$$M_y = m_1 \frac{V_{max}}{t_1} (Y_1 - Y_d) + m_2 \frac{V_{max}}{t_2} (Y_2 - Y_d) \fallingdotseq -56000$$

where, M_r : Moment in the rolling direction, N·mm
M_p : Moment in the pitching direction, N·mm
M_y : Moment in the yawing direction, N·mm

The loads applied on each slide unit are calculated according to Table 10.2 on page 31.

·During acceleration at the start of motion

$$F_{r1} = \frac{\Sigma F_z}{2} + \frac{M_p}{\ell} = \frac{m_1 g + m_2 g}{2} + \frac{M_p}{\ell} = \frac{100 \times 9.8 + 1000 \times 9.8}{2} + \frac{2169000}{200} \fallingdotseq 16200$$

$$F_{r2} = \frac{\Sigma F_z}{2} - \frac{M_p}{\ell} = \frac{m_1 g + m_2 g}{2} - \frac{M_p}{\ell} \fallingdotseq -5460$$

$$F_{a1} = \frac{\Sigma F_Y}{2} + \frac{M_y}{\ell} = 280$$

$$F_{a2} = \frac{\Sigma F_Y}{2} - \frac{M_y}{\ell} = -280$$

$$M_{01} = M_{02} = \frac{M_r}{2} = 49000$$

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

・During constant speed motion

$$F_{r1} = \frac{100\times9.8+1000\times9.8}{2}+\frac{2010000}{200} \fallingdotseq 15400$$

$$F_{r2} \fallingdotseq -4660$$

$$F_{a1} = F_{a2} = 0$$

$$M_{01} = M_{02} = 49000$$

・During deceleration at the end of motion

$$F_{r1} = \frac{100\times9.8+1000\times9.8}{2}+\frac{1850000}{200} \fallingdotseq 14600$$

$$F_{r2} \fallingdotseq -3860$$

$$F_{a1} \fallingdotseq -280$$

$$F_{a2} \fallingdotseq 280$$

$$M_{01} = M_{02} = 49000$$

❷Basic rating life

The upward/downward load, lateral load, and moment in the T_0 direction are converted into the conversion loads by formulas (1.5) and (1.6) on page 25, and the dynamic equivalent load is calculated by formula (1.7).

・During acceleration at the start of motion

$$F_{re1} = k_r|F_{r1}|+\frac{C_0}{T_0}|M_{01}| = 1\times16200+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 18600$$

$$F_{re2} = 1\times5460+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 7900$$

$$F_{ae1} = k_a|F_{a1}| = 1.28\times280 \fallingdotseq 358$$

$$F_{ae2} = 1.28\times280 \fallingdotseq 358$$

$$P_1 = X F_{re1}+Y F_{ae1} = 1\times18600+0.6\times358 \fallingdotseq 18800$$

$$P_2 = X F_{re2}+Y F_{ae2} = 1\times7900+0.6\times358 \fallingdotseq 8110$$

・During constant speed motion

$$F_{re1} = 1\times15400+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 17800$$

$$F_{re2} = 1\times4660+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 7100$$

$$F_{ae1} = 0$$

$$F_{ae2} = 0$$

$$P_1 = 17800$$

$$P_2 = 7100$$

・During deceleration at the end of motion

$$F_{re1} = 1\times14600+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 17000$$

$$F_{re2} = 1\times3860+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 6300$$

$$F_{ae1} = 1.28\times280 \fallingdotseq 358$$

$$F_{ae2} = 1.28\times280 \fallingdotseq 358$$

$$P_1 = 1\times17000+0.6\times358 \fallingdotseq 17200$$

$$P_2 = 1\times6300+0.6\times358 \fallingdotseq 6510$$

Because the dynamic equivalent load changes stepwise along the traveling distance, the average load is calculated from ① in Table 11 on page 36.

$$P_{m1} = \sqrt[3]{\frac{1}{S}\left(P_1^3\frac{V_{max}t_1}{2}+P_2^3 V_{max}t_2+P_3^3\frac{V_{max}t_3}{2}\right)}$$

$$= \left\{\frac{1}{500}\times\left(18800^3\times\frac{100\times0.1}{2}+17800^3\times100\times4.9+17200^3\times\frac{100\times0.1}{2}\right)\right\}^{1/3} \fallingdotseq 17800$$

$$P_{m2} = \left\{\frac{1}{500}\times\left(8110^3\times\frac{100\times0.1}{2}+7100^3\times100\times4.9+6510^3\times\frac{100\times0.1}{2}\right)\right\}^{1/3} \fallingdotseq 7110$$

The basic rating life of slide unit 1 receiving the largest dynamic equivalent load is calculated. The basic rating life is obtained by the formula given in Table 2 on page 21 while considering the load factor f_w.

$$L_1 = 50\left(\frac{C}{f_w P_{m1}}\right)^3 = 50\left(\frac{74600}{1.5\times17800}\right)^3 \fallingdotseq 1090$$

$$L_{h1} = \frac{10^6 L_1}{2S\ n_1\times60} = \frac{10^6\times1090}{2\times500\times6\times60} \fallingdotseq 3030$$

As the result of the above calculation, the basic rating life is about 3030 hours.

❸Static safety factor

The static equivalent load is calculated from the upward/downward load and lateral load by formula (1.8) on page 27.

・During acceleration at the start of motion

$$P_{01} = k_{0r}|F_{r1}|+k_{0a}|F_{a1}|+\frac{C_0}{T_0}|M_{01}| = 1\times16200+1.28\times280+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 19000$$

$$P_{02} = k_{0r}|F_{r2}|+k_{0a}|F_{a2}|+\frac{C_0}{T_0}|M_{02}| = 1.19\times5460+1.28\times280+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 9300$$

・During constant speed motion

$$P_{01} = 1\times15400+1.28\times0+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 19000$$

$$P_{02} = 1.19\times4660+1.28\times0+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 7990$$

・During deceleration at the end of motion

$$P_{01} = 1\times14600+1.28\times280+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 17400$$

$$P_{02} = 1.19\times3860+1.28\times280+\frac{80200}{1610}\times\frac{49000}{1000} \fallingdotseq 7390$$

The static safety factor of slide unit 1 during acceleration at the start receiving the largest static equivalent load is calculated. The static safety factor is obtained by formula (1.3) on page 24.

$$f_s = \frac{C_0}{P_{01}} = \frac{80200}{19000} \fallingdotseq 4.2$$

As the result of the above calculation, the static safety factor is about 4.2.

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. 4.)

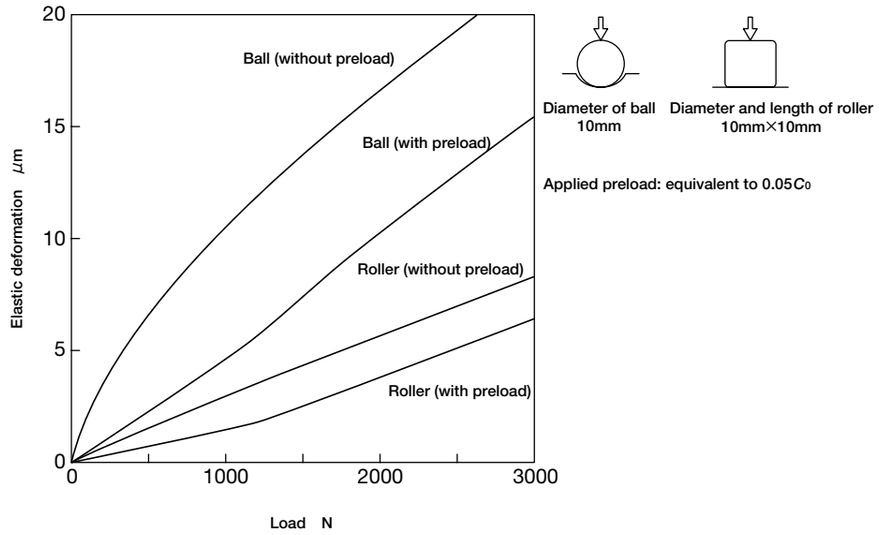


Fig. 4 Effect of preload on elastic deformation due to load

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.

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.

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.

$$F = \mu P \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (1.10)$$

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 12. Generally, friction coefficient is large under small load. Fig. 5 gives typical examples of this relationship.

Table 12 Friction coefficient

Series	Dynamic friction coefficient μ(1)
Linear Way	0.0040～0.0060
Linear Roller Way	0.0020～0.0040
Linear Ball Spline	0.0020～0.0040
Crossed Roller Way	0.0010～0.0030
Precision Linear Slide	0.0010～0.0020
Linear Bushing	0.0020～0.0030
Stroke Rotary Bushing	0.0006～0.0012
Flat Roller Cage	0.0010～0.0030

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

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

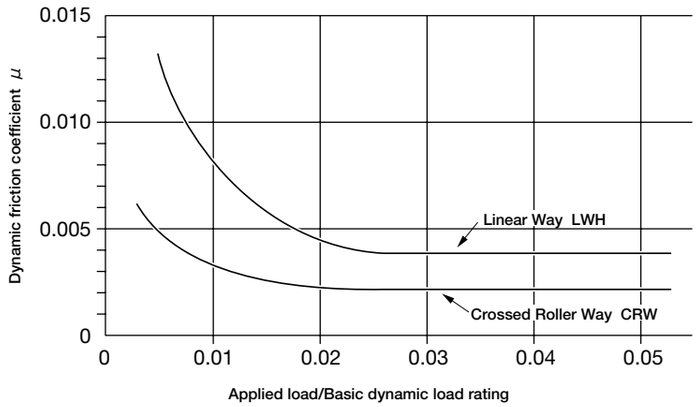


Fig. 5 Relationship between load and friction coefficient

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.

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.

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

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.

Grease Brands for Linear Motion Rolling Guides

Name		Base oil	Thickener	Service range ℃	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～+200	For vacuum environment
IKO ANTI-FRETTING CORROSION GREASE	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.
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.

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.

Operating Environment

Operating temperature

When linear motion rolling guides are operated at a temperature exceeding 150℃, the basic dynamic load rating must be corrected by using the temperature factor.
Some linear motion rolling guides comprise synthetic resin components. When they are used at high temperature, these components may not endure the high temperature. The maximum operating temperature for these linear motion rolling guides is 120℃. For continuous operation, they can be operated at temperatures not exceeding 100℃. C-Lube Linear Way must be used under 80℃ (maximum). If the operating temperature exceeds 100℃, consult IKO for further information.

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 (Fig. 6) 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.

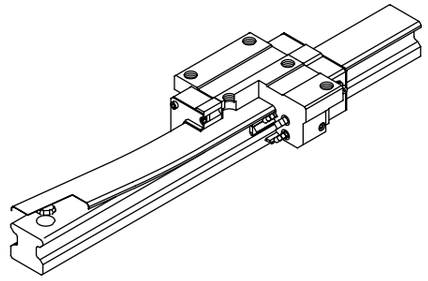


Fig. 6 Rail cover plate

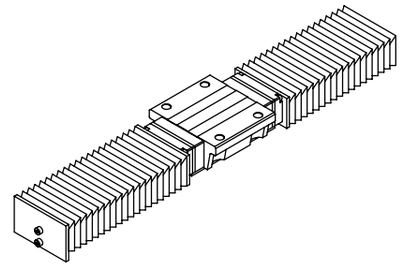


Fig. 7 Bellows

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

Linear Way
Linear Roller Way

LINEAR WAY
LINEAR ROLLER WAY

Features of Linear Way and Linear Roller Way

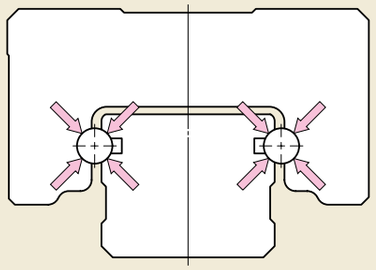
IKO Linear Way and Linear Roller Way are linear motion rolling guides which achieve endless linear motion of a slide unit along a track rail by re-circulating rolling elements inside the slide unit. Slide units and track rails are fixed on machines and equipment with mounting bolts, and a highly accurate linear motion can readily be obtained.
As compared with other types of linear motion rolling guides, Linear Way and Linear Roller Way have the following features.

1 Lower manufacturing cost

It is not necessary to prepare a guide plane on machines and equipment by heat treatment and surface finishing. A large reduction in man-hour and cost can be achieved in the design and manufacturing of linear motion guide mechanism.

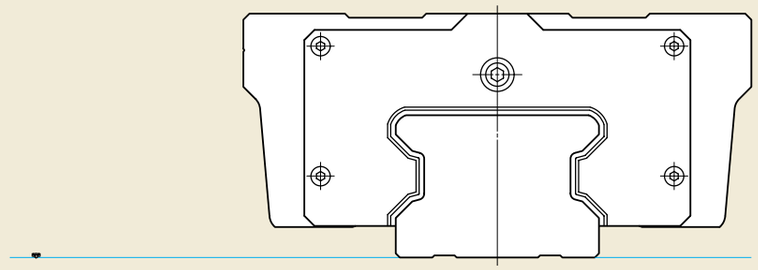
2 Large load capacity in any directions

Loads in any directions can be received without making a complicated guide structure. A linear motion rolling guide mechanism can readily be obtained that can withstand moment load and complex load.



3 Wide range of selections for high degree of design freedom

A wide range of variations in types and sizes makes it possible to select a model most suitable for the operating conditions. Size variations range from track rail width 1 mm to 100 mm.



LWL1

C	66.8	N
C_0	113	N

LRXG100

C	498 000	N
C_0	821 000	N

4 High rigidity for achieving compact design of machines and equipment

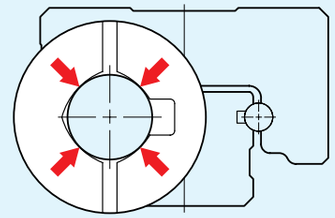
Because the track rail is firmly fixed on the mating mounting surface over its total length, high rigidity can be obtained in comparison with shaft type guides which may be affected by shaft bending.

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

Features of Linear Way

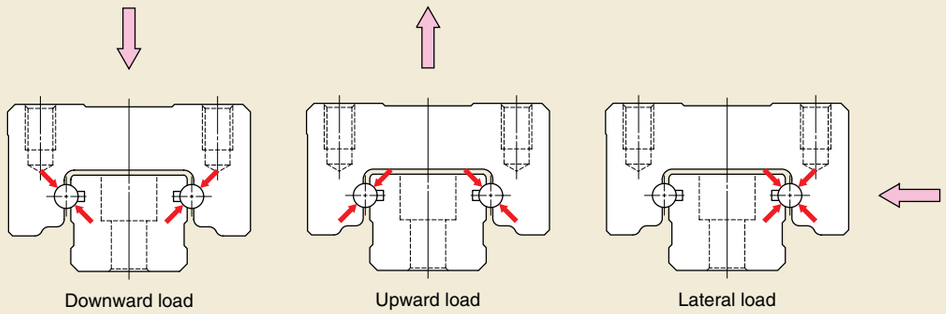
IKO Linear Way features the design in which large diameter steel balls are arranged in two rows with each ball making four-point contact with the raceways, and has following advantages over other types.

Four-points contact structure



1 Large load capacity in any directions

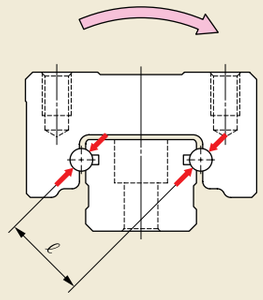
The simple two-row raceway design makes it possible to incorporate large diameter steel balls for high load ratings. Loads in any directions can almost uniformly be received.



Load acting on rolling elements in each loading direction

2 Excellent strength against moment load and complex load

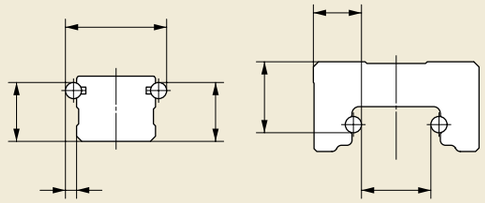
A large moment load capacity can be obtained, since the moment arm distance ℓ is long as shown in the figure. Load capacity under complex load is also large.



When T_0 moment is applied

3 High accuracy with simple structure

The simple two-row raceway design minimizes the number of potential errors in manufacturing and measurement, and high dimensional accuracy of raceways can be obtained.
Interchangeable specification products can be manufactured benefiting from this feature by rigorous control of the dimensional accuracy of individual slide units and track rails.



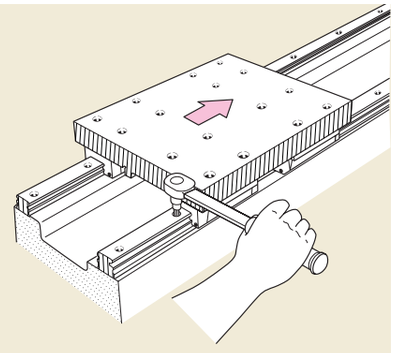
Measurement of raceway accuracy

4 Smooth operation and low noise

Smooth and quiet operation is achieved, because all raceway contours are precisely ground and the ball re-circulating routes are designed based on the analysis of optimal functional characteristics.

5 Accurate and simple installation

Accurate parallel mounting of two track rails can be made by aligning the attendant rail to the datum rail. Because the rigidity in the lateral direction is high, frictional resistance of poorly aligned two rails will steeply increase giving a warning so that misalignment can be easily detected and corrected. Potential troubles due to misalignment during actual operation such as short life, degradation in guide accuracy can therefore be eliminated in advance.
It is easy to butt-joint track rails to form longer lengths.

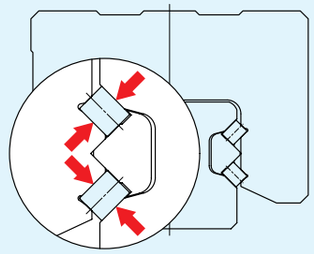


1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Features of Linear Roller Way

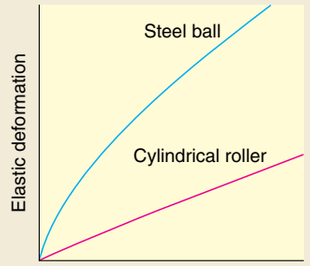
IKO Linear Roller Way features the design in which four rows of cylindrical rollers are arranged in a highly rigid casing in a well balanced form. The rollers in each row are arranged in parallel to each other and not crossed alternately. These linear motion rolling guides achieve smooth motion with high rigidity, high accuracy and high reliability.

Parallel arrangement



1 Super high rigidity

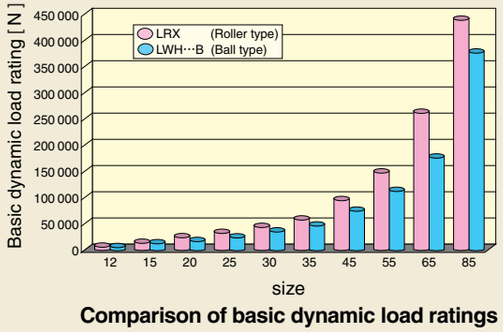
Very high rigidity is achieved owing to the excellent elastic deformation characteristics of cylindrical rollers which give smaller elastic deformation under load as compared with steel balls, and, in addition, to a large number of cylindrical rollers incorporated in the slide unit.



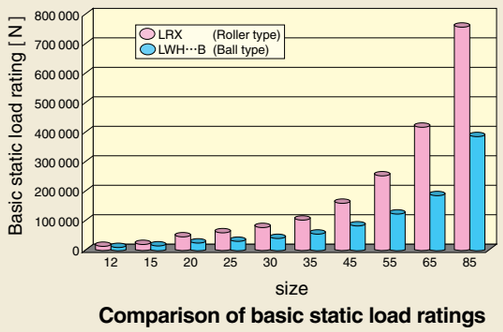
Comparison of rigidity between cylindrical roller and steel ball

2 Super high load capacity

Cylindrical rollers give a larger contact area compared to steel balls, so higher load capacity is attainable when cylindrical rollers are used. Incorporating a large number of cylindrical rollers, Linear Roller Way has a very high load rating.



Comparison of basic dynamic load ratings

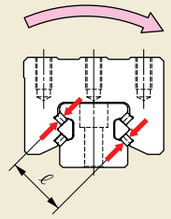


Comparison of basic static load ratings

Remark : The calculation formulas of rating life are different for roller type and ball type. Generally, if the values of basic dynamic load rating are the same, the life of the roller type is longer.

3 Excellent load balance and moment load capacity

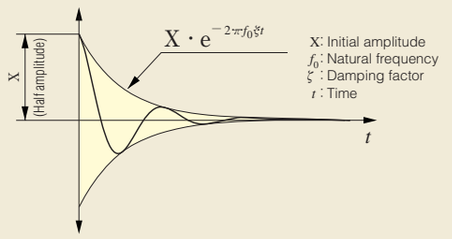
Cylindrical rollers are arranged in a well-balanced form so that they can uniformly withstand loads in all directions. In addition, rows are arranged in such a way that the moment arm distance ℓ between the loading points is large under T_0 moment. A high moment load capacity can be obtained.

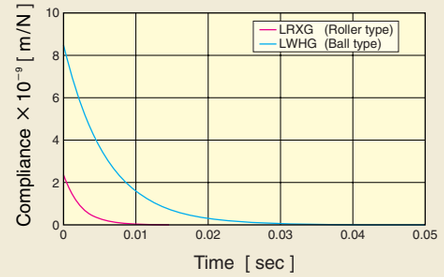


When T_0 moment is applied

4 Excellent vibration characteristics

As compared with ball types of the same size, these guides have higher rigidity and give smaller deformation under repeated fluctuating load. The natural frequency is high, and the vibration damping time is short.





Vibration damping curve

5 High running performance

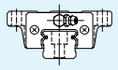
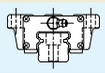
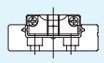
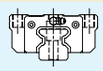
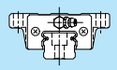
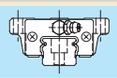
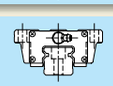
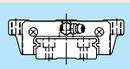
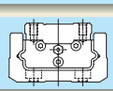
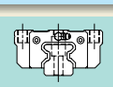
The optimum design based on the analysis of roller re-circulation behavior achieves smooth and quiet motion.

Remark : Features mentioned above are those of C-Sleeve Linear Roller Way Super MX and Linear Roller Way Super X which are the typical roller guides.

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

Series of Linear Motion Rolling Guides

Linear Motion Rolling Guides

	Series			Reference page
Maintenance Free Series (C-Lube Linear Way / C-Lube Linear Roller Way / C-Lube Linear Ball Spline)	*Miniature Maintenance Free Linear Way* **C-Lube Linear Way ML**		C-Lube Linear Way ML is a linear motion rolling guide, incorporating the C-Lube as a components part for lubrication in the slide unit of miniature type Linear Way L series to achieve maintenance free operations for a long period of time.	A-2 〜
	Compact Maintenance Free Linear Way **C-Lube Linear Way ME**		C-Lube Linear Way ME is a linear motion rolling guide, incorporating the C-Lube as a components part for lubrication in the slide unit of compact type Linear Way LWE series to achieve maintenance free operations for a long period of time.	A-18 〜
	High Rigidity Maintenance Free Linear Way **C-Lube Linear Way MH**		C-Lube Linear Way MH is a linear motion rolling guide, incorporating the C-Lube as a components part for lubrication in the slide unit of high rigidity type Linear Way LWH series to achieve maintenance free operations for a long period of time.	A-40 〜
	U-shaped Maintenance Free Linear Way **C-Lube Linear Way MUL**		C-Lube Linear Way MUL is a linear motion rolling guide, incorporating the C-Lube as a components part for lubrication in the slide unit of U shaped track rail type Linear Way LWUL series to achieve maintenance free operations for a long period of time.	A-62 〜
	Maintenance Free Linear Roller Way **C-Lube Linear Roller Way Super MX**		C-Lube Linear Roller Way Super MX is a high performance roller type linear motion rolling guide,featuring high reliability,high rigidity,high accuracy and smooth motion which is required from machine tool, semiconductor manufacturing and liquid crystal manufacturing equipments.	A-70 〜
	Maintenance Free Linear ball Spline **C-Lube Linear Ball Spline MAG**		A maintenance free type has been released for IKO Ball Spline MAG having an overwhelmingly high market share in the field of semiconductor and liquid crystal manufacturing systems that are forced to be operated in severe operating conditions of high acceleration/deceleration motion.	A-100 〜
Linear Way	*Miniature Type Linear Way* **Linear Way L**		This is the smallest of the Linear Ways. Sizes with track rail width as small as 1mm and upward are made available owing to the simple and compact design of IKO Linear Way.	B-2 〜
	Compact Type Linear Way **Linear Way E**		Lower, narrower and shorter. Compactness has been pursued in every dimension.	B-30 〜
	Low Decibel Linear Way **Low Decibel Linear Way E**		Plastic separators are incorporated to eliminate direct contact between balls and thus achieve smooth and quiet motion.	B-56 〜
	High Rigidity Type Linear Way **Linear Way H**		Incorporating large diameter steel balls as rolling elements, the product of this series has large load ratings.	B-74 〜
	Wide Rail Type Linear Way **Linear Way F**		As a wide track rail is used, a large moment load as well as a complex load can be received. This series is best suited to a single row rail arrangement, which provides a simple guide structure.	B-110 〜
	U-shaped Track Rail Linear Way **Linear Way U**		By adopting a U-shaped track rail, rigidity against moment and torsion is greatly improved.	B-130 〜
Linear Way Module	**Linear Way Module LM / Linear Way Module M**		The product of this series requires the smallest mounting space. A track rail and a slide member are designed as a set, and two sets are arranged in parallel for standard applications.	B-142 〜
Linear Roller Way	**Linear Roller Way Super X**		Cylindrical rollers are used as rolling elements, and arranged in four rows with the rollers in each row being aligned in parallel to each other. Excellent load carrying performance is obtained in all directions. The mounting dimensions of this series are interchangeable with those of Linear Way H, so these two series can be exchanged readily.	C-2 〜

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

Maintenance Free Linear Motion Rolling Guide Series

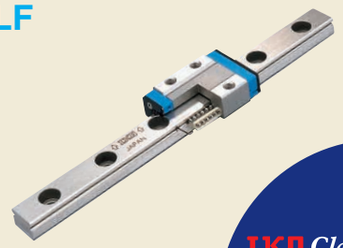
This Maintenance Free series can reduce the man-hours for troublesome lubrication control and achieve long-term maintenance free operations. In Maintenance Free series, Miniature type C-Lube Linear Way ML, Compact type C-Lube Linear Way ME, High Rigidity type C-Lube Linear Way MH, U-shaped track rail type C-Lube Linear Way MUL, C-Lube Linear Roller Way Super MX, C-Lube Linear Ball Spline MAG and Linear (Roller) Ways with self lubrication Capillary plate are available.

Wide variation of C-Lube Linear Way

Miniature type

C-Lube Linear Way ML

ML・MLF



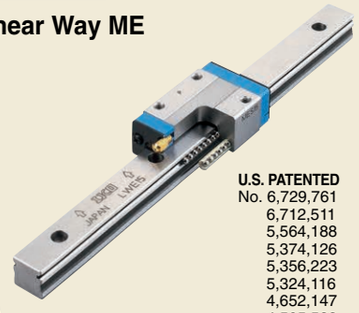
U.S. PATENTED
No. 6,729,761
6,712,511
5,435,649
5,289,779
5,250,126
4,652,147
4,505,522

IKO Clean Lubrication
C-Lube
Friendly to Maintenance
Gentle to the Earth

Compact type

C-Lube Linear Way ME

ME

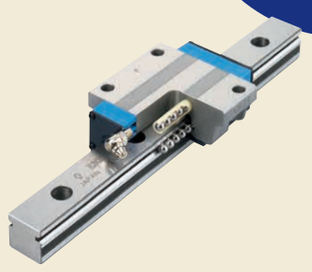


U.S. PATENTED
No. 6,729,761
6,712,511
5,564,188
5,374,126
5,356,223
5,324,116
4,652,147
4,505,522

High Rigidity type

C-Lube Linear Way MH

MH

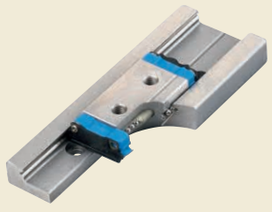


U.S. PATENTED
No. 6,729,761
6,712,511
5,622,433
5,564,188
5,374,126
4,652,147
4,610,488
4,505,522

U-shaped track rail type

C-Lube Linear Way MUL

MUL

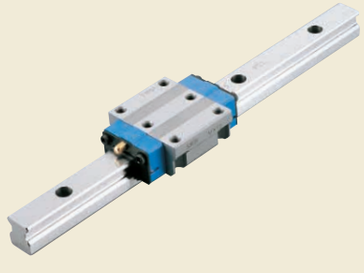


U.S. PATENTED
No. 6,729,761
6,712,511
6,309,107
5,435,649
5,289,779
5,250,126
4,652,147
4,505,522

Roller type

C-Lube Linear Roller Way Super MX

MX

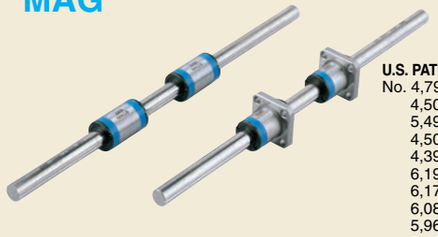


U.S. PATENTED
No. 5,800,064
5,193,914
5,564,188
5,374,126
5,622,433
6,176,617
5,967,667
5,464,288

Ball Spline type

C-Lube Linear Ball Spline MAG

MAG



U.S. PATENTED
No. 4,799,803
4,505,522
5,490,729
4,505,522
4,390,215
6,190,046
6,176,617
6,082,899
5,967,667
5,464,288
5,356,223

Feature of C-Lube Linear Way

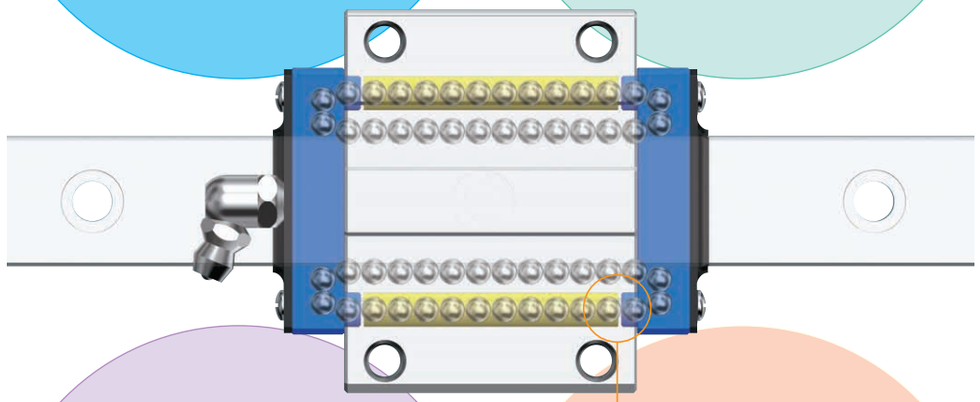
Maintenance free for 20,000km or 5 years
Interchangeable is newly available.

Maintenance Free

Ability of lubrication is maintained for long term, the cost of lubrication management and system can be reduced.

Ecology

C-Lube contributes to global environment protection because the amount of lubricant can be minimized.



Compactness

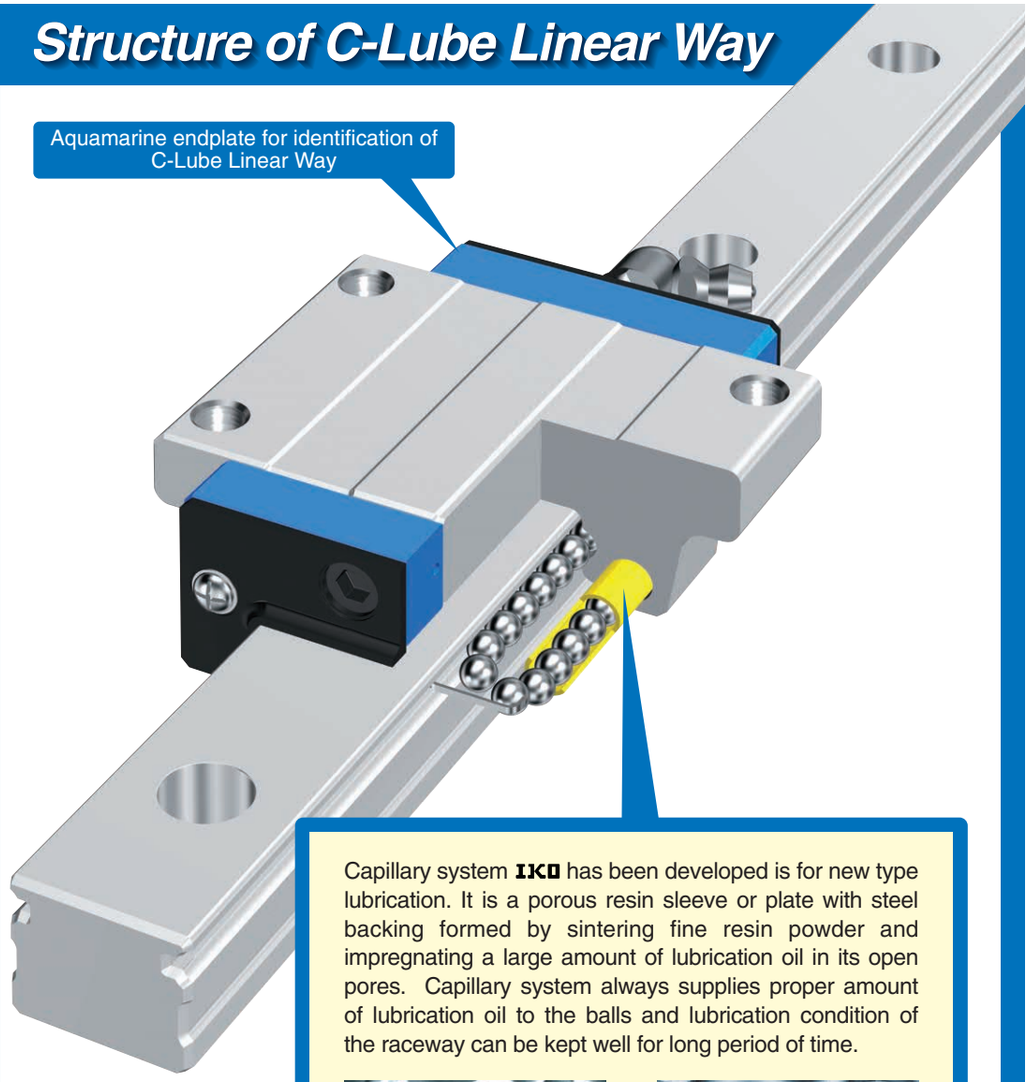
No increase in carriage length unlike a bolt-on external lubrication parts. No loss of available stroke length when replacing standard unit.

Smoothness

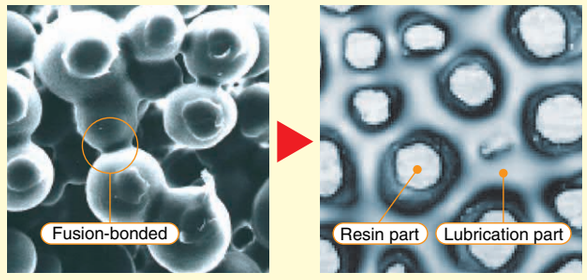
Light and smooth running is achieved by the improvement of design. It is designed not to have contact to track rail and this has brought a very smooth friction.

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

Structure of C-Lube Linear Way



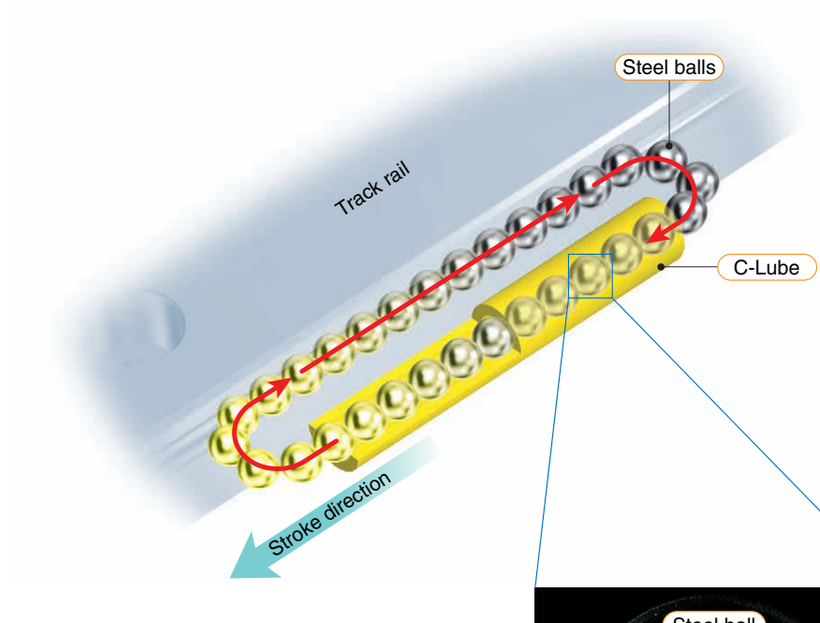
Capillary system **IKO** has been developed is for new type lubrication. It is a porous resin sleeve or plate with steel backing formed by sintering fine resin powder and impregnating a large amount of lubrication oil in its open pores. Capillary system always supplies proper amount of lubrication oil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



Before impregnating oil
Resin particles are strongly fusion-bonded.

After impregnating oil
(Capillary lubrication structure)
Lubricant is retained in cavities amongst resin particles.

C-Lube lubrication mechanism

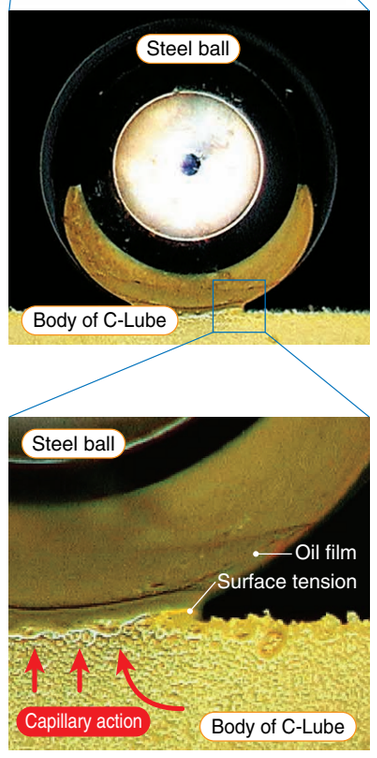


Lubricant is distributed by the circulation of the steel balls.

Lubricant is supplied directly to the steel balls. As the steel circulate, the lubricant is distributed to the loading area along the track rail. This results in adequate lubrication being properly maintained in the loading area for a long time.

Lubricant is deposited directly to the surface of the steel balls.

The surface of C-Lube is always covered with the lubricant. Lubricant is continuously supplied to the surface of steel ball by surface tension in the contact of C-Lube surface and steel balls. New oil permeates automatically from the core of C-Lube to the internal surface that comes in contact with steel balls.



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

Interchangeable Specification

IKO Linear Way and Linear Roller Way include interchangeable specification products. The track rails and the slide units of this specification can be handled separately and can be assembled to make a set as required.
The interchangeable specification guides are produced with the original precision manufacturing technology, making the most of the IKO guide designs: namely, the simple two-row raceway and four-point contact ball design of ball types, and the unique four-row raceway and parallel re-circulating roller design of roller types. The dimensional accuracy of both slide units and track rails is strictly controlled to achieve the interchangeability of higher standard.

Wide range of variations

The models for which the interchangeable specification is applicable are indicated by a star-mark (☆) in the table of dimensions of each series.

C-Lube Linear Way ML
(page **A-2** to page **A-17**)
6 types and 37 models

C-Lube Linear Way ME
(page **A-18** to page **A-39**)
18 types and 81 models

C-Lube Linear Way MH
(page **A-40** to page **A-61**)
12 types and 52 models

C-Lube Linear Roller Way Super MX
(page **A-70** to page **A-99**)
13 types and 75 models

C-Lube Linear Ball Spline MAG
(page **A-100** to page **A-109**)
4 types and 20 models

Linear Way L
(page **B-2** to page **B-29**)
8 types and 46 models

Linear Way E
(page **B-30** to page **B-55**)
18 types and 81 models

Linear Way H
(page **B-74** to page **B-109**)
14 types and 76 models

Linear Way F
(page **B-110** to page **B-129**)
4 types and 12 models

Linear Roller Way Super X
(page **C-2** to page **C-33**)
12 types and 84 models

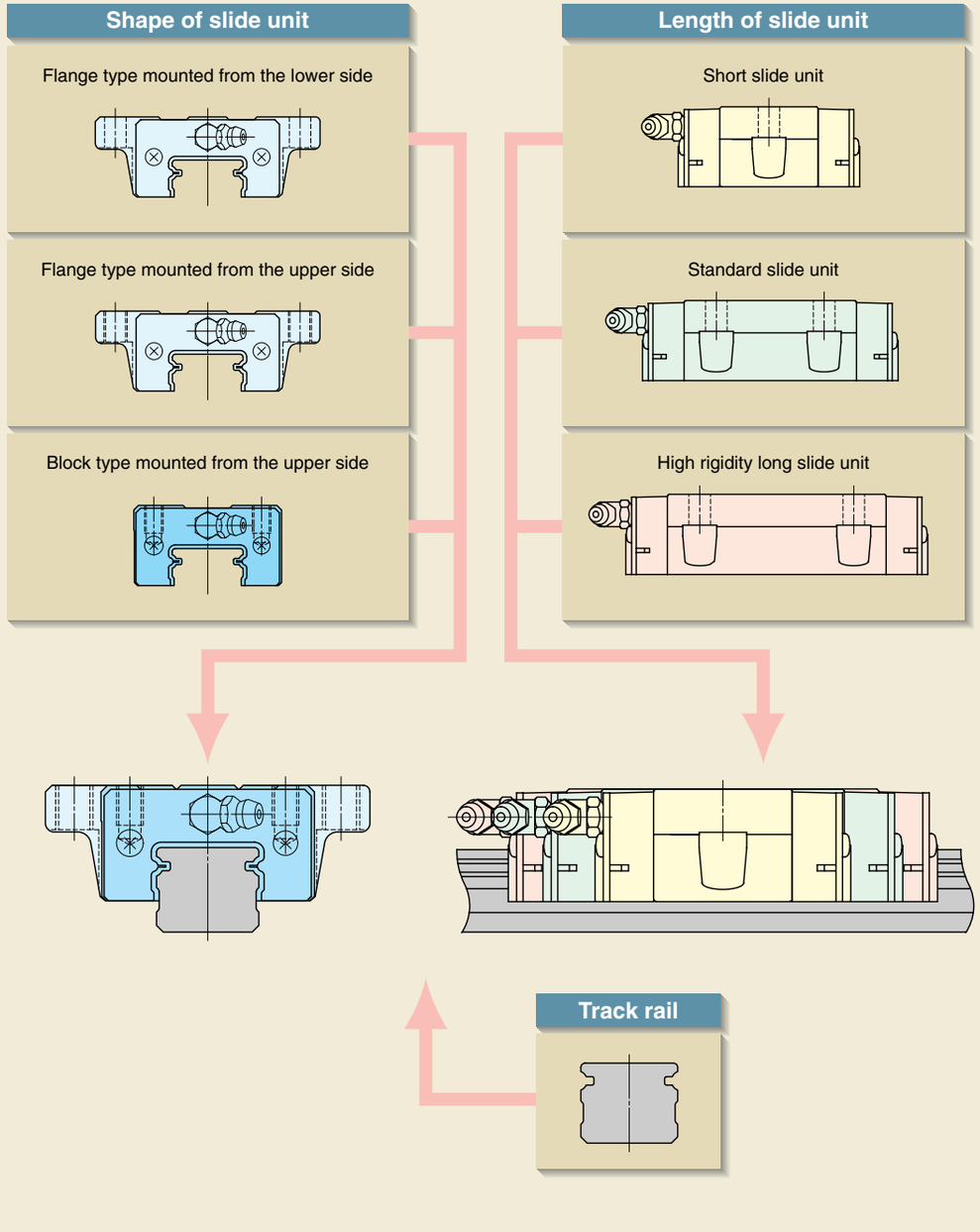
Linear Ball Spline G
(page **D-28** to page **D-45**)
8 types and 56 models

Block type Linear ball Spline
(page **D-46** to page **D-53**)
3 types and 17 models

Features of interchangeable specification products [1]

Interchangeable slide unit

Various types of slide units with different sectional shapes and lengths are prepared. All of these slide units can be freely mounted on the same track rail.
Track rails can be butt-jointed for use.(1)



Note(1) : When butt-jointing track rails are required, place an order specifying "butt-jointing interchangeable track rail" of special specification.

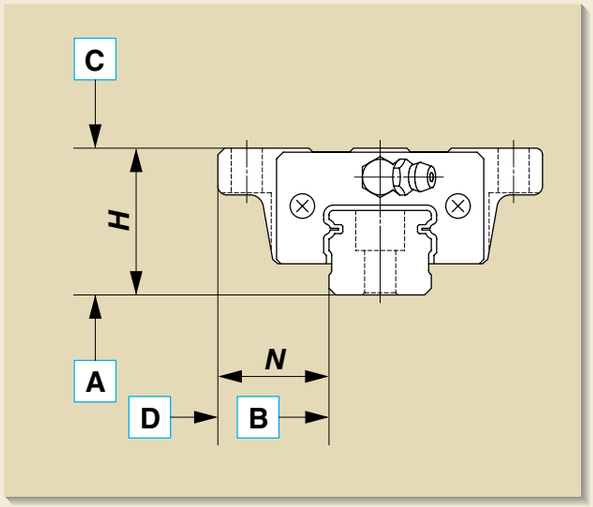
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Interchangeable with high accuracy

Three accuracy classes, Ordinary, High and Precision are prepared for the interchangeable specification products so that these products can be used for applications requiring high running accuracy.
Height variation among multiple sets is also controlled at a high accuracy level, ensuring that these products can be used for parallel track rail arrangement.

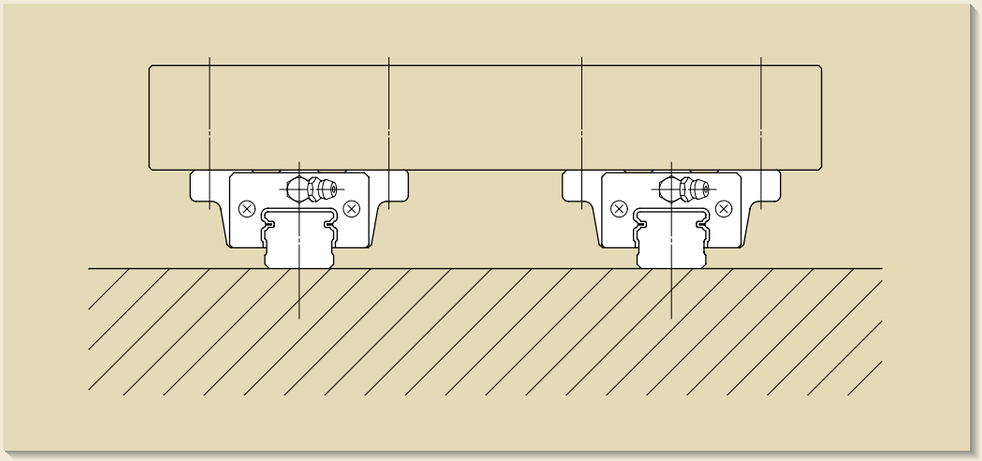
Standard accuracy specifications : up to Precision class

Tolerances of Dimensions H and N
Tolerances of Dimensions H and N in one set
Parallelism in operation of plane C to plane A
Parallelism in operation of plane D to plane B



Parallel arrangement of multiple sets using standard specification products

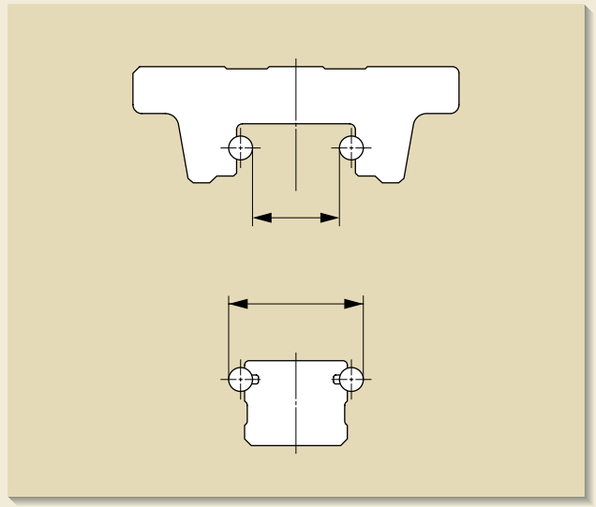
The dimensional variation of H among multiple sets is specified.



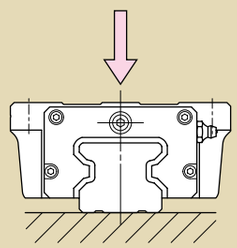
Interchangeable with preload

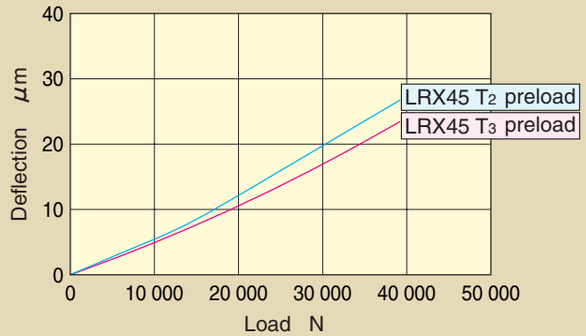
High accuracy dimensional control owing to a simple structure has made it possible to realize the interchangeability among preloaded slide units.
In the interchangeable specification products, several preload types are prepared so that these products can be used for applications requiring one step higher rigidity.

High accuracy dimensional control realizing heavy preload



Slide units with the same preload symbol are interchangeable for achieving high rigidity

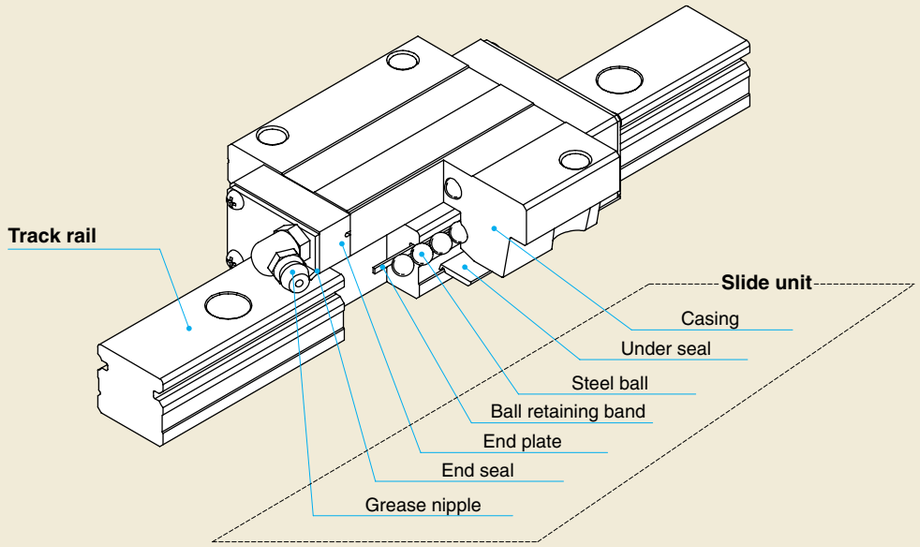




1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Stainless Series

IKO Linear Way and Linear Roller Way include products in which stainless steel is used for product components. Stainless steel components are more resistant to corrosion than high carbon steel components, so these products are most suitable for applications where the use of oil or grease (including rust preventive oil) should be avoided or kept to a minimum.
The stainless series is suitable for use in clean rooms and can be used with IKO Clean Grease to minimize dust generation.



Material

Part	Material
Track rail	Martensitic stainless steel
Casing	Martensitic stainless steel
Steel ball	Martensitic stainless steel
Ball retaining band	Austenitic stainless steel
End plate	Functional synthetic resin
End seal	Austenitic stainless steel + Synthetic rubber
Grease nipple	Brass

	Series		Reference page
C-Lube Linear Way	*Miniature Maintenance Free Linear Way* **C-Lube Linear Way ML**	This Linear Way incorporates the C-Lube as a component part for lubrication in Linear Way L. The lubricant contained in the C-Lube achieves long-term maintenance free operations, so the man-hours for troublesome lubrication control can be reduced.	A-2 〜
	Compact type Maintenance Free Linear Way **C-Lube Linear Way ME**	This Linear Way incorporates the C-Lube as a component part for lubrication in Linear Way E.	A-18 〜
	High rigidity Maintenance Free Linear Way **C-Lube Linear Way MH**	This Linear Way incorporates the C-Lube as a component part for lubrication in Linear Way H.	A-40 〜
	U-shaped Maintenance Free Linear Way **C-Lube Linear Way MUL**	This Linear Way incorporates the C-Lube as a component part for lubrication in Linear Way UL.	A-62 〜
Linear Way	*Miniature Type Linear Way* **Linear Way L**	This is the smallest in the IKO Linear Ways. This product is suitable for use in machines or equipment in clean rooms. Models with various track rail widths from as small as 2 mm are lined up.	B-2 〜
	Compact Type Linear Way **Linear Way E**	This is a compact type in comparison with Linear Way H and can be used for general purpose applications.	B-30 〜
	High Rigidity Type Linear Way **Linear Way H**	This type features large load ratings and high rigidity.	B-56 〜
	Wide Rail Type Linear Way **Linear Way F**	Being a wide rail type, it can support a large moment load acting around the axial direction, and it is also suitable for single row rail arrangement.	B-110 〜
	U-shaped Track Rail Linear Way **Linear Way U**	By adopting a U-shaped track rail, rigidity against moment and torsion is greatly improved.	B-130 〜
Linear Roller Way	**Linear Roller Way Super X**	For its rolling elements, this product employs cylindrical rollers, which provide very high rigidity and high accuracy.	C-2 〜

When combined with the following special specifications, IKO Stainless series Linear Way and Linear Roller Way will provide a specification more suitable for each

IKO Low Dust Generation Grease for Clean Environment CG2 /YCG

IKO CG2 grease is a low dust generation grease consists of synthetic base oil and urea type thickener. This grease has superior performance for wide range of temperature, lubrication performance, rust prevention and oxidation stability.

IKO Low Dust Generation Grease for Clean Environment CGL /YCL

IKO CGL grease has blended soaps for thickener and synthetic oil and petrolatum with low fluid point for base oil. In addition to its superior low dust generating, feature, it provides minimal level of rolling resistance as well as high lubricating and rust preventing performance.

IKO Anti-Fretting Corrosion Grease AF2 /YAF

IKO AF2 grease is an Anti-Fretting Corrosion Grease consists of synthetic base oil and urea type thickener. It is suitable to very short stroke application that general grease cannot be used because of fretting corrosion or false brinelling.

Stainless Steel End Plate /BS

A steel end plate (austenitic stainless steel) is used in place of the synthetic resin end plate of the standard specification. Linear Way and Linear Roller Way of this specification can be used in high vacuum and its heat resistance is improved as well. When placing an order for this item, specify it together with the special specification "With no end seal" (/N). A change in grease type to vacuum or heat-resistant grease should also be considered.

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

Linear Way and Linear Roller Way for Special Environment

To meet requirements in various environmental conditions, IKO Linear Way and Linear Roller Way must be modified in terms of their material, lubricating grease, surface treatment, dust protection methods, etc.
General fields of application and principal methods in special environments are shown below.

Clean Environment

When Linear Way and Linear Roller Way are used in clean environments such as a clean room, the environment must not be polluted by the dust generated from them, and also superior corrosion resistance is required for them, since rust preventive oil cannot be used.
Dust generation from Linear Way and Linear Roller Way is mainly caused by lubricant spattering, which can be avoided by using low dust generation grease for clean environment.
As a corrosion prevention measure, Stainless Linear Way and Linear Roller Way can be used or black chrome surface treatment can be performed to improve corrosion resistance.

Corrosion prevention

Stainless Linear Way and Linear Roller Way

Black chrome surface treatment

Fluorine black chrome surface treatment

Lubricant spatter protection

Low dust generation grease for clean environment

Vacuum Environment

When Linear Way and Linear Roller Way are used in vacuum environments, the environment must not be polluted and the degree of vacuum must not be lowered by the gas emitted from them, and also superior corrosion resistance is required for them, since rust preventive oil cannot be used.
Gases emitted from synthetic resin components and lubricant spatters are the main causes of pollution. Components and lubricant must be properly selected as a preventive measure.
Corrosion resistance will be improved by using Stainless Linear Way and Linear Roller Way.

Corrosion and gas emission prevention

Stainless Linear Way and Linear Roller Way

Stainless steel end plate

Lubricant

Vacuum grease

High Temperature

When Linear Way is used at high temperature, heat resistance of synthetic resin components and steel components must be examined, and special measures must be taken, if necessary.
Stainless Linear Way with stainless steel end plates of special specification can be used together with high temperature grease.

Material

Stainless Linear Way

Stainless steel end plate

Seal for special environment

Lubricant

High temperature grease

Dust Protection

If foreign matter such as metal or wooden chips fall onto the raceways of Linear Way and Linear Roller Way, the life or accuracy of these guides may be affected adversely. Therefore, measures must be taken to prevent intrusion of foreign matter.
Bellows covering the entire linear motion mechanism is effective for dust protection. Also, double end seals are often used to protect the guides from intrusion of foreign matter. As dust accumulated in mounting holes may intrude into the slide unit and attach to the raceways, mounting holes can be covered using caps or rail cover plates.

High sealing performance

Linear Roller Way Super X

Linear Way H Ultra Sealed Type

Sealing

Double end seals

Scrapers

Track rail mounting hole

Caps

Rail cover plate

Bellows

Specially prepared bellows

Female threads for bellows

Spatter Protection

Hot welding spatters adhering firmly on track rails cannot be removed by ordinary dust protection measures. Special measures for preventing adhesion and removing adhered spatters are necessary.
Welding spatters and similar foreign substances can be removed easily by applying fluorine black chrome surface treatment and providing a scraper at the same time.

Spatter adhesion protection

Fluorine black chrome surface treatment

Sealing

Scrapers

Dust protection

Caps (aluminum caps)

Rail cover plate

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

Linear Way and Linear Roller Way for Special Environment

For applications in special environments requiring high corrosion resistance and high sealing performance, IKO provides Linear Way and Linear Roller Way for special environment as follows.

Linear Way and Linear Roller Way for Special Environment

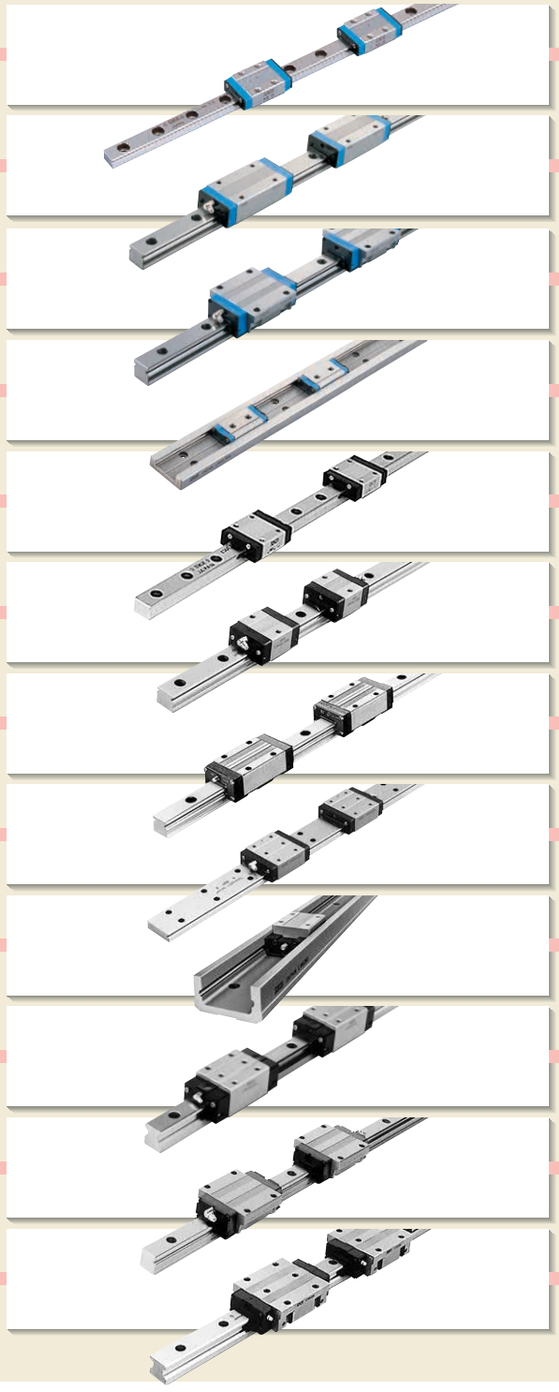
Rust prevention

Stainless steel components are used in place of common steel components for improving corrosion resistance.

High sealing specification

Precision grinding is applied to the entire contour surfaces of the track rail for improving the sealing performance.

Series		Reference page
Miniature Maintenance Free Linear Way	**C-Lube Linear Way ML** Stainless standard product	A-2 〜
Compact Type Maintenance Free Linear Way	**C-Lube Linear Way ME** Stainless standard product	A-18 〜
High rigidity Maintenance Free Linear Way	**C-Lube Linear Way MH** Stainless standard product	A-40 〜
U-shaped Maintenance Free Linear Way	**C-Lube Linear Way MUL** Stainless standard product	A-62 〜
Miniature Type Linear Way	**Linear Way L** Stainless standard product	B-2 〜
Compact Type Linear Way	**Linear Way E** Stainless specification product	B-30 〜
High Rigidity Type Linear Way	**Linear Way H** Stainless specification product	B-74 〜
Wide Rail Type Linear Way	**Linear Way F** Stainless specification product	B-110 〜
U-shaped Track Rail Linear Way	**Linear Way U** Stainless specification product	B-130 〜
	Linear Roller Way Super X Stainless specification product	C-2 〜
	Linear Way H Ultra sealed specification product	B-74 〜
	Linear Roller Way Super X Standard product, size 25 and upward	C-2 〜



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

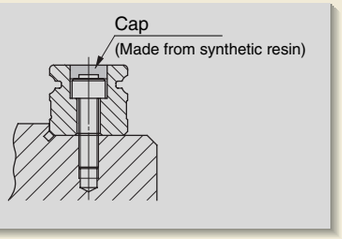
Optional Special Specifications for Special Environment

IKO Linear Way and Linear Roller Way with the following special specifications are available for various special environment applications. For details of supplemental codes, see pages 88 and 89.

Dust protection

With caps for rail mounting holes /F

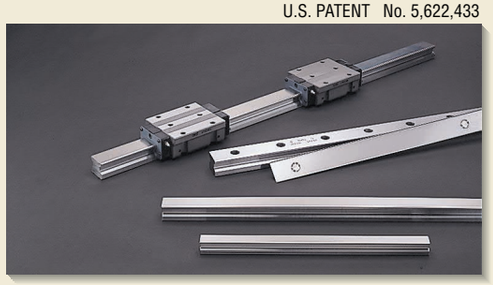
The caps prevent dust and other harmful foreign matter from accumulating in rail mounting holes and intruding into the slide unit.
Aluminum caps are also available. Consult IKO for further information.



Rail cover plate /PS

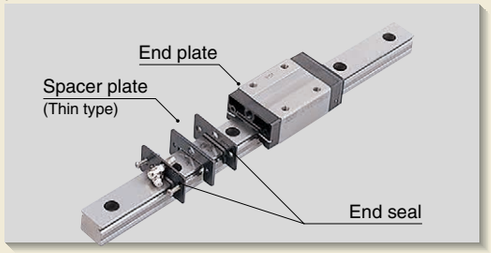
The top surface of the track rail is completely covered with a rail cover plate to prevent intrusion of foreign matter into the slide unit from track rail mounting holes.

U.S. PATENT No. 5,622,433



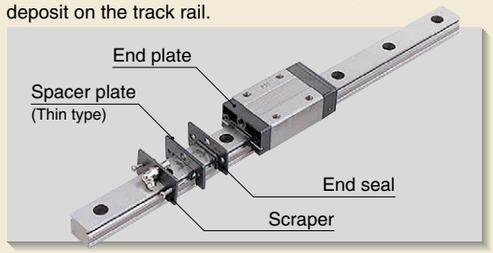
With double end seals /V

The double end seals improve the dust protection performance.



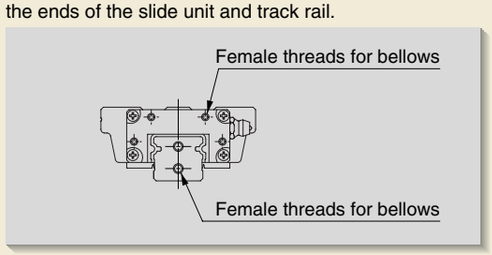
With scrapers /Z

Scrapers are mounted on the outside of end seals to remove large particles of dust or foreign matter that deposit on the track rail.



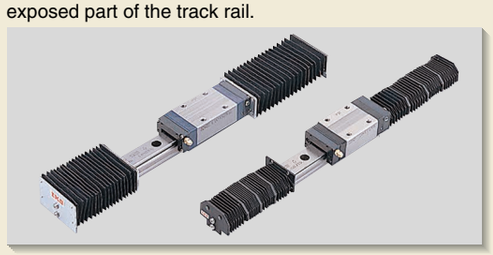
With female threads for bellows /J

Female threads for attaching bellows are provided at the ends of the slide unit and track rail.



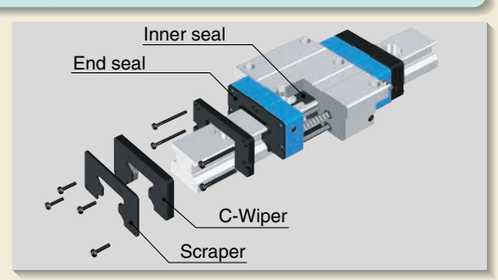
Bellows (available product)

This is a covering for dust protection to cover the exposed part of the track rail.



C-Wiper /RC

C-Wiper is the superior dust protective component against cutting chips and/or coolant of machine tool, lath and grinding machine. C-Wiper is always contacting to the top surface of track rail by its all wiping surface. Continuous dust protection performance provides better machine reliability under severe working condition.

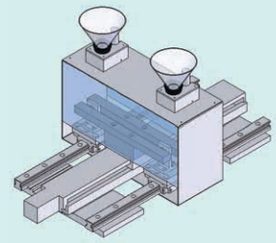


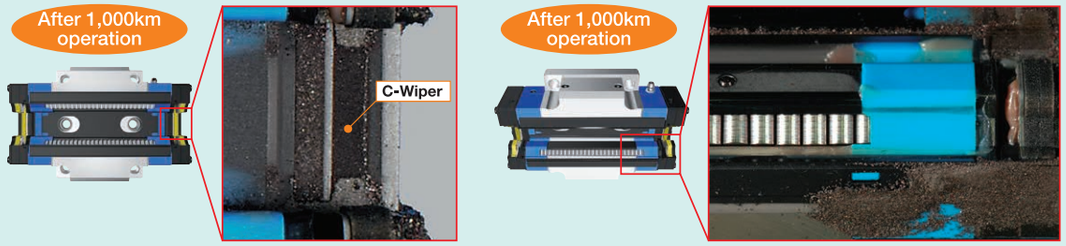
Durability test results

Durability test result under fine particles

Test condition

Product	MX 35 T_3 preload/FRC : **C-Wiper specification**
Operating speed	18 m/min
Travel length	500 mm
Dust condition	Fine matal particles Diameter of particle : 125μm or less Hardness of particle : HRC40 to 50 Application amount : 1 g/hr (Total volume : 1 kg)



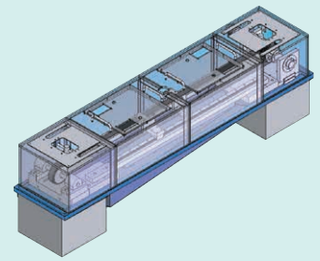


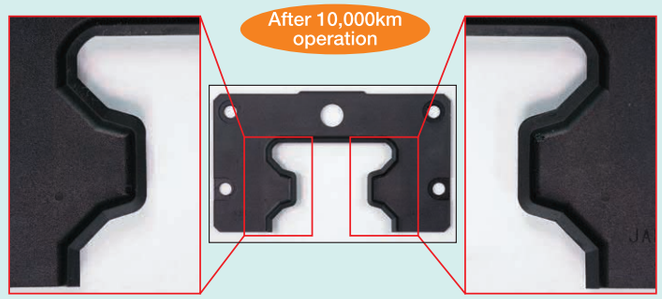
Steel particles inside of slide unit could be minimized.

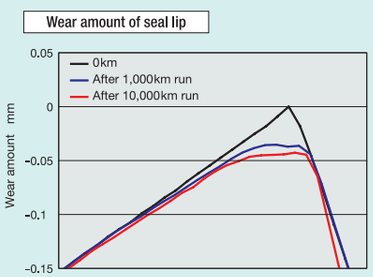
Durability test result under coolant mist

Test condition

Product	MX 35 T_3 preload/FRC : **C-Wiper specification**
Operating speed	115.2 m/min
Travel length	300 mm
Coolant	Soluble type Diluting rate : ×20 Spraying amount : 5cc







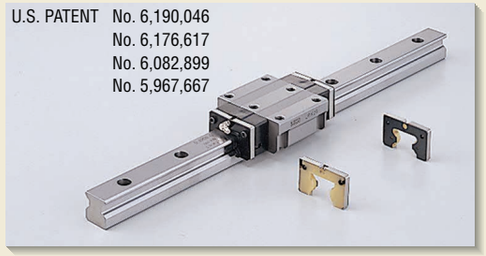
No damage of end seal was found.

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

Lubrication

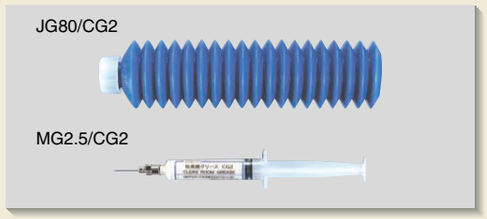
Capillary plate /Q

Re-lubrication interval can be made longer and maintenance time and cost can be saved by incorporating this lubrication part.



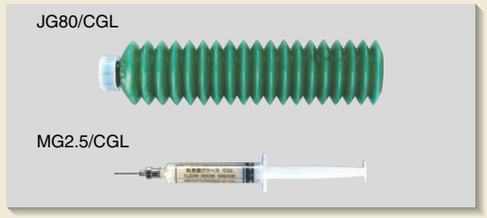
IKO Low Dust Generation Grease for Clean Environment CG2

This grease is used for low dust generation in clean rooms. Bellow type container JG80/CG2 (80g), miniature grease injector type MG10/CG2 (10ml) and MG2.5/CG2 (2.5ml) are available.



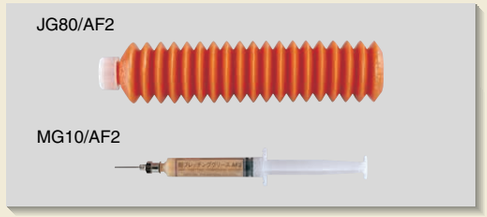
IKO Low Dust Generation Grease for Clean Environment CGL

This grease is used for low dust generation in clean rooms. Bellow type container JG80/CGL (80g) and miniature grease injector type MG2.5/CGL (2.5ml) are available.



IKO Anti-Fretting Corrosion Grease AF2

IKO AF2 grease is suitable to very short stroke application that general grease cannot be used because of fretting corrosion or false brinelling. Bellow type container JG80/AF2 (80g) and miniature grease injector type MG10/AF2 (10ml) are available.



Others

Miniature grease injector type for Alvania EP grease 2 (MG2.5/EP2) is available. When special grease is required for vacuum or high temperature, consult IKO for information.

Corrosion prevention

Black chrome surface treatment /L

A black chrome permeable film is formed on the track rail or slide unit surface to improve corrosion resistance.

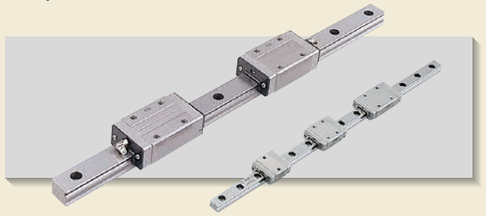
Fluorine black chrome surface treatment /LF

Fluorine resin coating is performed on top of the black chrome permeable film for further improvement in corrosion resistance. This treatment also effectively prevents foreign matter from adhering to the surface.

Others

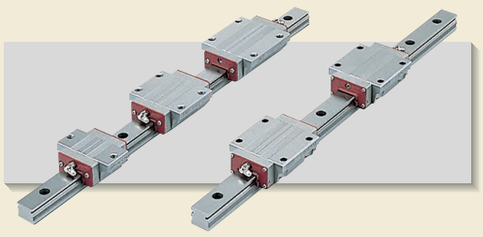
With stainless steel end plates /BS

The end plates are replaced with stainless steel end plates.



With seals for special environment /RE

The end seals and under seals are changed to seals for special environment that can be used at high temperatures. For use at high temperatures, this specification is combined with the specification "with stainless steel end plates" (/BS) and/or "specified grease" (/YCG).



The photo shows a combined specification of "with seals for special environment" (/RE) and "with stainless steel end plates" (/BS).

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

Identification Number

Identification numbers of IKO Linear Way and Linear Roller Way consist of a model code, a size, a part code, a material symbol, a preload symbol, a classification symbol, an interchangeable code, and any supplemental codes. Examples of identification numbers are shown below. For details of specifications, see the description of each series.

Interchangeable specification

Slide unit	LWESG	25	C1		SL	T1	P	S2	/U
Track rail	LWE	25		R640	SL		P	S2	/F
Assembled set	LWESG	25	C2	R640	SL	T1	P	S2	/FU

Non-interchangeable specification

Assembled set	LWESG	25	C2	R640	SL	T1	P		/FU

Model code

MLC MLFC	ML MLF	MLG MLFG
MEC METC MESC	ME MET MES	MEG METG MESG
	MH MHT MHD MHS	MHG MHTG MHDG MHSG
	MUL	
	MX MXD MXS MXN MXNS	MXG MXDG MXSG
LWLC ···B LWLC ···N LWLFC···B LWLFC···N LWLC LWLFC	LWL ···B LWL ···N LWLF···B LWLF···N LWL LWLF	LWLG ···B LWLG ···N LWLFG···B LWLFG···N
LWEC LWETC LWESC	LWE LWET LWES	LWEG LWETG LWESG
	LWE ···Q LWET···Q LWES···Q	
LWHDC	LWH (···B) LWHT(···B) LWHD(···B) LWHS(···B) LWHY	LWHG LWHTG LWHDG LWHSG
	LWFH LWFF LWFS	
	LWUL···B LWU ···B LWU	
	LWLM LWM LRWM	
LRXC LRXDC	LRX LRXD LRXS	LRXG LRXDG

Size
Size

Part code
- Number of slide units
- Length of track rail

Material symbol
No symbol, CS, SL

Preload symbol
T_C, T_0, No symbol, T_1, T_2, T_3

Classification symbol
No symbol, H, P, SP, UP

Interchangeable code
No symbol, S1, S2

Supplemental code
/A /BS /C /D /E /F /GE /HP /I /J /L /LF /MA /MN /M /N /PS /Q /RE /S /T /U /V /W /Y /Z

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 S2 /U
(Only "C1" meaning one slide unit can be indicated.)

Order quantity: 2 pieces

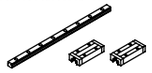
Track rail

(for one rail)

Ordering example: LWE 25 R640 SL P S2 /F

Order quantity: 1 piece

Assembled set



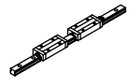
(for one set)

Ordering example: LWESG 25 C2 R640 SL T1 P S2 /FU

Order quantity: 1 piece

Non-interchangeable specification

Assembled set

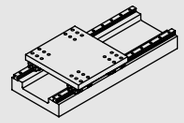


(for one set)

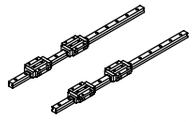
Ordering example: LWESG 25 C2 R640 SL T1 P /FU

Order quantity: 1 piece

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



Linear Way and Linear Roller Way

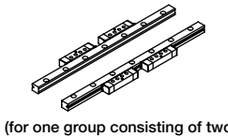


(for one group consisting of two sets)

Ordering example: LRX 45 C2 R1260 T3 SP /W2

Order quantity: 2 pieces

Linear Way Module



(for one group consisting of two sets)

Ordering example: LWM 2 M2 R480 P /W2

Order quantity: 2 pieces

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

Load Rating

The load ratings of IKO Linear Way and Linear Roller Way are defined for downward load. Summarized descriptions of load ratings are given below. For details of load rating definitions and load calculations, see "General description".

Basic dynamic load rating *C*

The basic dynamic load rating is defined as the constant load both in direction and magnitude under which a group of identical Linear Ways or Linear Roller Ways are individually operated and 90% of the units in the group can travel 50×10^3 meters free from material damage due to rolling contact fatigue.

Basic static load rating C_0

The basic static load rating is defined as the static load that gives a prescribed constant contact stress at the center of the contact area between the rolling element and raceway receiving the maximum load.

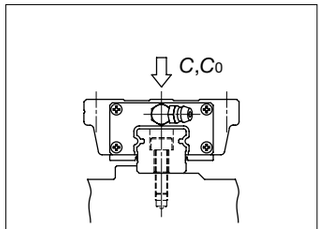


Fig. 1 Direction of load rating

Static moment rating T_0,T_X,T_Y

The static moment rating is defined as the static moment load that gives a prescribed constant contact stress at the center of the contact area between the rolling element and raceway receiving the maximum load when a moment is loaded.

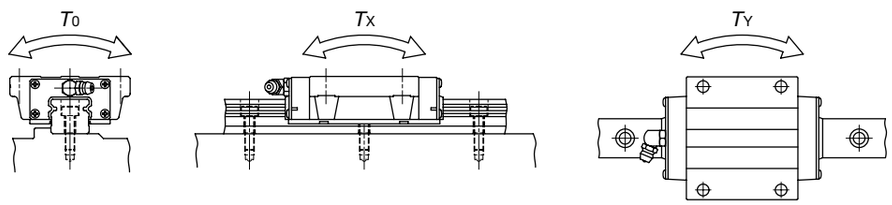


Fig. 2 Static moment rating direction

Accuracy

Five classes of accuracy, Ordinary, High, Precision, Super Precision, and Ultra Precision are specified for IKO Linear Way and Linear Roller Way. Table 1 summarizes applicable accuracy classes for each series, and Tables 2.1 to 2.4 show accuracy of each series. For details of applicable classes, see the description of each series.
For the accuracy of series other than those shown in Table 2, consult IKO for further information.

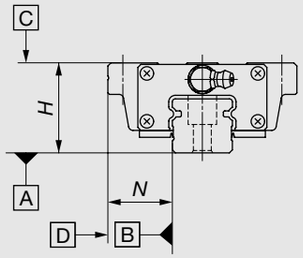
Table 1 Accuracy classes

Classification (symbol) / Series	Ordinary (No symbol)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
C-Lube Linear Way ML	–	☆	☆	–	–
C-Lube Linear Way ME	☆	☆	☆	○	–
C-Lube Linear Way MH	–	☆	☆	○	–
C-Lube Linear Way MUL	○	○	–	–	–
C-Lube Linear Roller Way Super MX	–	☆	☆	○	○
Linear Way L	–	☆	☆	–	–
Linear Way E	☆	☆	☆	○	–
Low Decibel Linear Way E	○	○	○	–	–
Linear Way H(1)	–	☆	☆	○	–
Linear Way F	–	☆	☆	○	–
Linear Way U	○	○	–	–	–
Linear Roller Way Super X	–	☆	☆	○	○
Linear Way Module	–	○	○	○	–

Note(1) : For the size 8 to 12 models, the classification for Linear Way L is applicable.
Remark : In the table, the mark ☆ indicates that it is also applicable to interchangeable specification products.

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

Table 2.1 Accuracy of Linear Way and Linear Roller Way



unit : mm

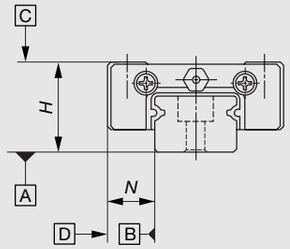
Item \ Classification (symbol)	Ordinary (No symbol)	High (H)	Precision (P)	Super Precision (SP)	Ultra Precision (UP)
Dim. *H* tolerance	±0.080	±0.040	±0.020	±0.010	±0.008
Dim. *N* tolerance	±0.100	±0.050	±0.025	±0.015	±0.010
Dim. variation of *H* (1)	0.025	0.015	0.007	0.005	0.003
Dim. variation of *N* (1)	0.030	0.020	0.010	0.007	0.003
Dim. variation of *H* for multiple assembled sets (2)	0.045	0.035	0.025	—	—
Parallelism in operation of C to A	See Fig. 3.1.				
Parallelism in operation of D to B	See Fig. 3.1.				

Note(1) : It means the size variation between slide units mounted on the same track rail.
(2) : It applies to the interchangeable specification products.
Remark 1 : The accuracy of C-Lube Linear Way ML, Linear Way L and the size 8 to 12 models of Linear Way H is shown in Table 2.2.
2 : The accuracy of Linear Way U and C-Lube Linear Way MUL is shown in Table 2.3.
3 : The accuracy of Linear Way Module is shown in Table 2.4.

(a) **Linear Way** (b) **Linear Roller Way**

Fig. 3.1 Parallelism in operation of Linear Way and Linear Roller Way

Table 2.2 Accuracy of Linear Way L (size 2 or larger) and C-Lube Linear Way ML

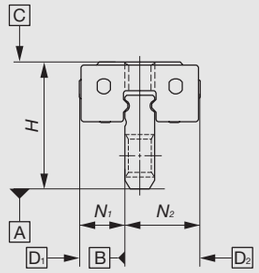


unit : mm

Item \ Classification (Symbol)	High (H)	Precision (P)
Dim. *H* tolerance	±0.020	±0.010
Dim. *N* tolerance	±0.025	±0.015
Dim. variation of *H* (1)	0.015	0.007
Dim. variation of *N* (1)	0.020	0.010
Dim. variation of *H* for multiple assembled sets (2)	0.030	0.020
Parallelism in operation of C to A	See Fig. 3.2.	
Parallelism in operation of D to B	See Fig. 3.2.	

Note(1) : It means the size variation between slide units mounted on the same track rail.
(2) : It applies to the interchangeable specification products.
Remark : The accuracy given in this table also applies to C-Lube Linear Way L and the size 8 to 12 models of Linear Way H.

Table 2.3 Accuracy of Linear Way L for LWL 1-Y



unit : mm

Item	Tolerance
Dim. *H* tolerance	±0.020
Dim. N_1 and N_2 tolerance	±0.025

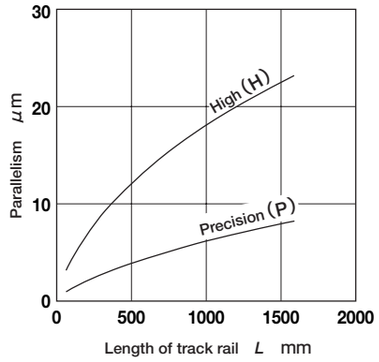
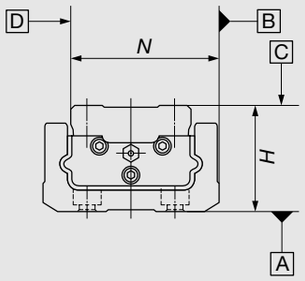


Fig. 3.2 Parallelism in operation of Linear Way L (Size 2 or larger) and C-Lube Linear Way ML

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

Table 2.4 Accuracy of Linear Way U



unit : mm

Item \ Classification (Symbol)	Ordinary (No symbol)	High (H)
Dim. *H* tolerance	±0.100	±0.050
Dim. *N* tolerance	±0.100	±0.050
Dim. variation of *H*(1)	0.050	0.040
Dim. variation of *N*(1)	0.050	0.040
Parallelism in operation of C to A	See Fig. 3.3.	
Parallelism in operation of D to B	See Fig. 3.3.	

Note(1) : It means the size variation between slide units mounted on the same track rail.
Remark : Also applicable to C-Lube Linear Way MUL.

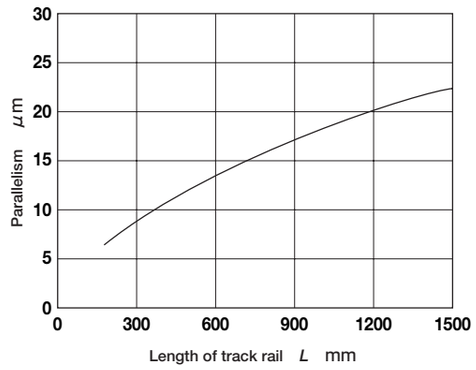
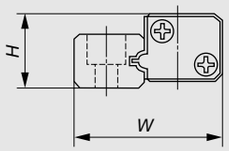
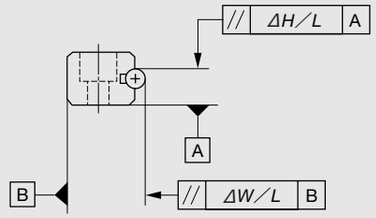


Fig. 3.3 Parallelism in operation of Linear Way U

Table 2.5 Accuracy of Linear Way Module





unit : mm

Item \ Classification (symbol)	High (H)	Precision (P)	Super Precision (SP)
Dim. *H* tolerance	±0.040	±0.020	±0.010
Dim. *W* tolerance	±0.050	±0.025	±0.015
Dim. variation of *H*(1)	0.015	0.007	0.005
Dim. variation of *W*(1)	0.020	0.010	0.007
Parallelism of track rail ⊿*H*	See Figs. 3.4 and 3.5.		
Parallelism of track rail ⊿*W*	See Figs. 3.4 and 3.5.		

Note(1) : It means the size variation between slide members mounted on the same track rail.

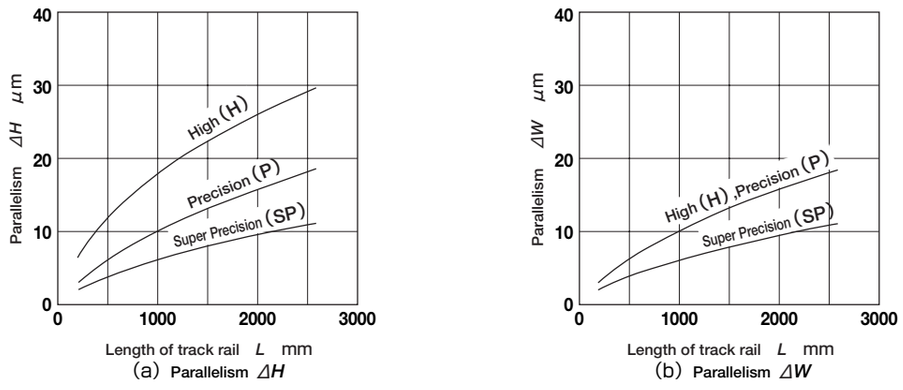


Fig. 3.4 Parallelism of Linear Way Module M

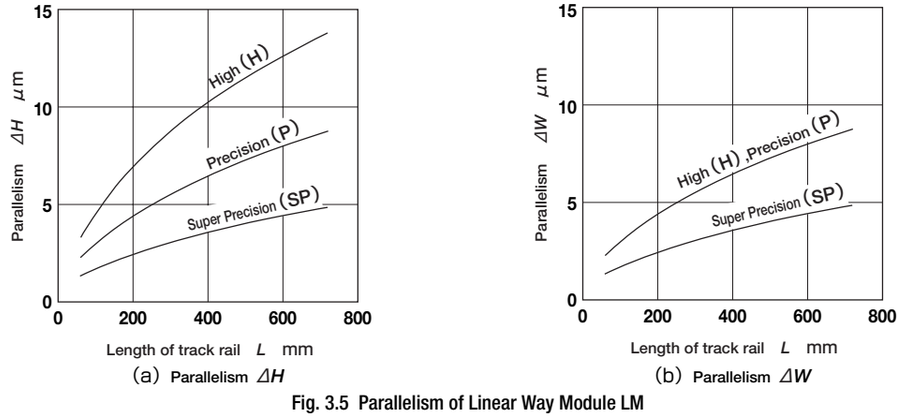


Fig. 3.5 Parallelism of Linear Way Module LM

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

Preload

The average amount of preload for IKO Linear Way and Linear Roller Way is shown in Table 3. When both rigidity and vibration characteristics are important, the standard preload amount is 1/3 of the applied load for Linear Way and 1/2 for Linear Roller Way.
A summary of applicable preload types is shown in Table 4. For details, see the description of each series.

Table 3 Preload amount

Item / Preload type	Symbol	Preload amount N	Application
Clearance	T_C	0 (1)	• Very smooth motion • To absorb slight misalignment
	T_0	0 (2)	• Very smooth motion
Standard	(No symbol)	0 (3)	• Smooth and precise motion
Light preload	T_1	$0.02C_0$	• Minimum vibration • Load is evenly balanced. • Smooth and precise motion
Medium preload	T_2	$0.05C_0$	• Medium vibration • Medium overhung load
Heavy preload	T_3	$0.08C_0$	• Vibration and/or shocks • Large overhung load • Heavy cutting

Note(1) : Clearance of about 10μm
(2) : Zero or minimal amount of clearance
(3) : Zero or minimal amount of preload
Remark : C_0 means the basic static load rating.

Table 4 Preload type

Series / Preload type (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 ML	–	☆	☆	☆	–	–
C-Lube Linear Way ME	☆	–	☆	☆	○	–
C-Lube Linear Way MH	–	–	☆	☆	○	○
C-Lube Linear Way MUL	–	–	○	○	–	–
C-Lube Linear Roller Way Super MX	–	–	☆	☆	☆	☆
Linear Way L	–	☆	☆	☆	–	–
Linear Way E	☆	–	☆	☆	○	–
Low Decibel Linear Way E	–	–	○	○	–	–
Linear Way H	–	○ (1)	☆	☆	☆	☆
Linear Way F	–	–	☆	☆	○	–
Linear Way U	–	–	○	○	–	–
Linear Roller Way Super X	–	–	☆	☆	☆	☆

Note(1) : It applies to size 8 to 12 models.
Remark : In the table, the mark ☆ indicates that it is also applicable to interchangeable specification products.

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

Special Specifications

IKO Linear Way and Linear Roller Way of the special specifications shown in Table 5 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.

Table 5.1 Special specifications for Linear Way and Linear Roller Way

Special specification	Supplemental code	C-Lube Linear Way ML	C-Lube Linear Way ME	C-Lube Linear Way MH	C-Lube Linear Way MUL	C-Lube Linear Roller Way Super MX	Linear Way L	Linear Way E	Low Decibel Linear Way E
Butt-jointing track rails (Non-interchangeable specification)	A	○	○	○	–	○	○	○	–
Stainless steel end plates	BS	–	–	–	–	–	○	☆	–
Chamfered reference surface	C	–	–	–	–	–	–	–	–
Opposite reference surfaces arrangement	D	☆	☆	☆	–	☆	☆	☆	○
Specified rail mounting hole positions	E	☆	☆	☆	○	☆	☆	☆	–
Caps for rail mounting holes	F	–	☆	☆	–	☆	–	☆	○
Changed pitch of slide unit middle mounting holes	GE	–	–	–	–	☆	–	–	–
Half pitch of track rail mounting holes	HP	–	–	–	–	☆	–	–	–
Inspection sheet (Non-interchangeable specification)	I	○	○	○	–	○	○	○	–
Female threads for bellows	J	–	☆	☆	–	☆	–	☆	–
Black chrome surface treatment	L	○	☆	☆	○	☆	○	☆	○
Fluorine black chrome surface treatment	LF	–	☆	☆	–	☆	○	☆	○
With track rail mounting bolt	MA	–	☆	☆	○	–	–	☆	○
Without track rail mounting bolt	MN	☆	–	☆	–	☆	☆	–	–
Change of mounting hole and female thread sizes	M	–	☆	–	–	–	○	☆	○
No end seal	N	☆	☆	☆	–	☆	☆	☆	–
Rail cover plate (Non-interchangeable specification)	PS	–	–	○	–	–	–	–	–
Capillary plate (Non-interchangeable specification)	Q	–	–	–	–	–	☆	☆	○
Seal for special environment	RE	–	–	–	–	–	○	☆	–
Track rail with stopper pins (Non-interchangeable specification)	S	○	–	–	–	–	○	–	–
Butt-jointing interchangeable track rail (Interchangeable specification)	T	–	☆	☆	–	☆	–	☆	–
Under seals	U	☆	☆	–	○	–	☆	☆	–
Double end seals	V	–	☆	☆	–	☆	–	☆	○
Matched sets to be used as an assembled group	W	○	○	○	○	○	○	○	○
Specified grease	Y	–	–	–	–	–	○	☆	○
Scrapers	Z	–	☆	☆	–	☆	–	☆	○

Note(1) : Including Linear Way LM and Linear Roller Way M.
Remark 1 : The mark ☆ indicates that interchangeable specification products are available.
2 : For the details of special specifications applicable to each series and combinations of special specifications, see the description of each series.

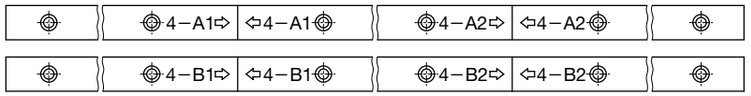
Table 5.2 Special specifications for Linear Way and Linear Roller Way

Special specification	Supplemental code	Linear Way H	Linear Way F	Linear Way U	Linear Roller Way Super X	Linear Way Module M(1)
Butt-jointing track rails (Non-interchangeable specification)	A	○	○	–	○	○
Stainless steel end plates	BS	☆	–	–	–	–
Chamfered reference surface	C	–	☆	–	–	–
Opposite reference surfaces arrangement	D	☆	☆	–	☆	–
Specified rail mounting hole positions	E	☆	☆	○	☆	○
Caps for rail mounting holes	F	☆	☆	–	☆	○
Changed pitch of slide unit middle mounting holes	GE	–	–	–	☆	–
Half pitch of track rail mounting holes	HP	–	–	–	☆	–
Inspection sheet (Non-interchangeable specification)	I	○	○	–	○	○
Female threads for bellows	J	☆	☆	–	☆	–
Black chrome surface treatment	L	☆	☆	○	☆	○
Fluorine black chrome surface treatment	LF	☆	☆	–	☆	○
With track rail mounting bolt	MA	–	–	○	–	–
Without track rail mounting bolt	MN	☆	☆	○	☆	○
Change of mounting hole and female thread sizes	M	–	–	–	–	–
No end seal	N	☆	☆	–	☆	–
Rail cover plate (Non-interchangeable specification)	PS	○	–	–	○	–
Capillary plate (Non-interchangeable specification)	Q	☆	☆	○	☆	–
C-Wiper	RC	–	–	–	○	–
Seal for special environment	RE	☆	–	–	–	–
Track rail with stopper pins (Non-interchangeable specification)	S	–	–	–	–	–
Butt-jointing interchangeable track rail (Interchangeable specification)	T	☆	–	–	☆	–
Under seals	U	☆	☆	○	–	–
Inner seal	UR	–	–	–	○	–
Double end seals	V	☆	☆	–	☆	–
Matched sets to be used as an assembled group	W	○	○	○	○	○
Specified grease	Y	☆	☆	–	☆	○
Scrapers	Z	☆	☆	–	☆	–

Note(1) : Including Linear Way LM.
Remark 1 : The mark ☆ indicates that interchangeable specification products are available.
2 : For the details of special specifications applicable to each series and combinations of special specifications, see the description of each series.

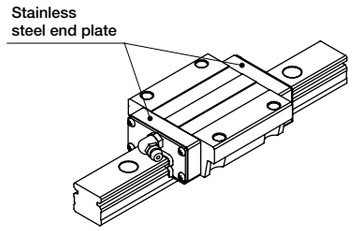
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Butt-jointing track rails /A



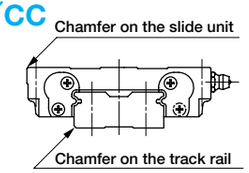
When the required length of non-interchangeable specification track rail exceeds the maximum length indicated in the description of each series, two or more track rails can be used by butt-jointing them in the direction of linear motion. For the length and the number of butt-jointing track rails, consult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

With stainless steel end plates /BS



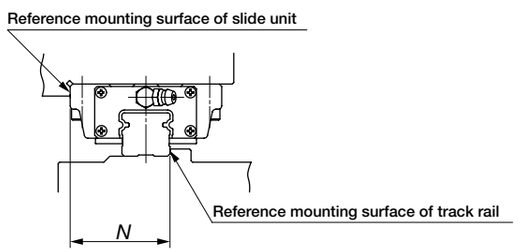
The standard synthetic resin end plates are replaced with stainless steel end plates, keeping the total length of slide unit unchanged.
When superior heat resistance is required, it is recommended to apply this specification in combination with the "with no end seal (/N)" specification.

Chamfered reference surface /C /CC



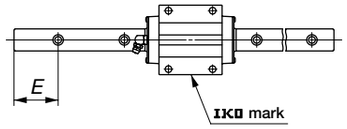
Chamfering is additionally made at the edges of reference mounting surfaces of slide unit and track rail.
For the corner radius of mating mounting parts, see Table 23.2 on page 120.
① /C
Chamfering is additionally made at the edge of reference mounting surface of track rail.
② /CC
Chamfering is additionally made at the edges of reference mounting surfaces of slide unit and track rail.

Opposite reference surfaces arrangement /D



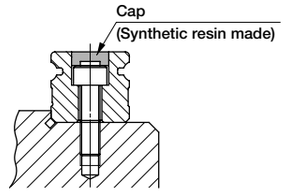
The reference mounting surface of track rail is made opposite to the standard side. The accuracy of dimension *N* including parallelism in operation is the same with that of standard specification.

Specified rail mounting hole positions /E



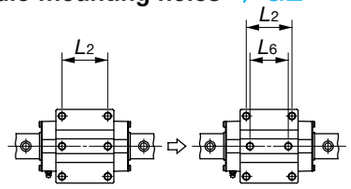
The mounting hole positions of track rail can be specified by specifying dimension *E* at the left end, which is the distance from the mounting hole nearest to the left end of the track rail to the left end face of the track rail in sight of IKO mark on the slide unit.
When ordering, add the dimension (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



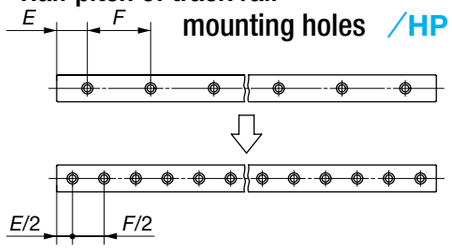
Specially prepared caps for track rail mounting holes are appended. These caps cover the track rail mounting holes to improve the sealing performance in the linear motion direction. Aluminum caps are also available. Consult IKO for further information.

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.

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.

Inspection sheet /I

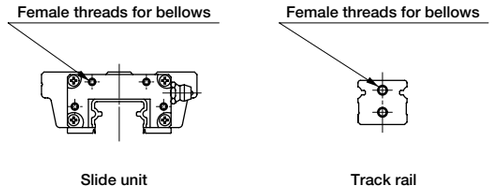
The inspection sheet recording dimensions *H* and *N*, dimensional variations of *H* and *N*, and parallelism in operation of the slide unit (or slide member) is attached for each set.

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.

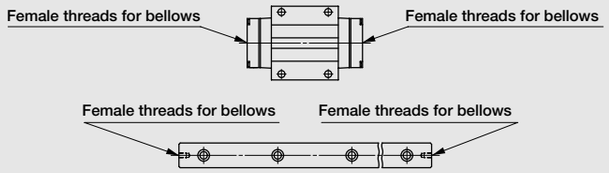
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

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



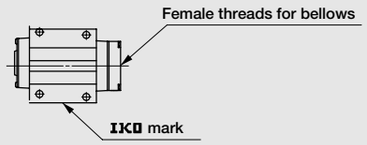
Female threads for mounting bellows are provided on the interchangeable slide unit or the interchangeable track rail. For details of related dimensions, see the description of each series.

① /J



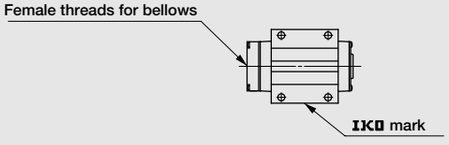
Female threads are provided at both ends of the slide unit or the track rail.

② /JR



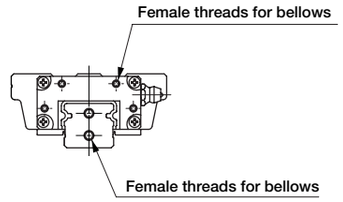
Female threads are provided at the right end of the slide unit in sight of IKO mark.

③ /JL



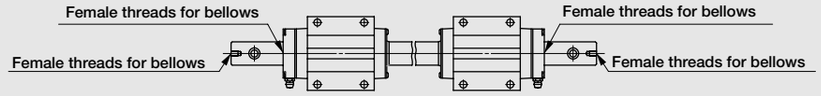
Female threads are provided at the left end of the slide unit in sight of IKO mark.

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



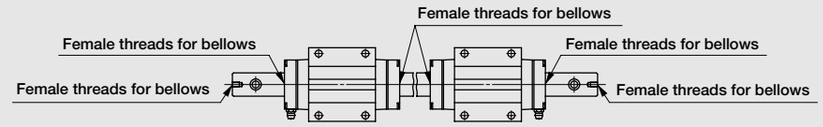
For an assembled set of interchangeable or non-interchangeable specification, female threads for mounting bellows are provided on the slide unit and the track rail. For details of related dimensions, see the description of each series.

① /J



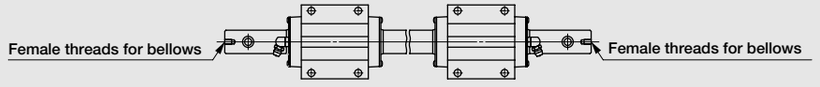
Female threads are provided at both ends of the track rail, and at the slide unit ends which are the closest to the track rail ends. (In case only one slide unit is assembled, female threads are provided at both ends.)

② /JJ



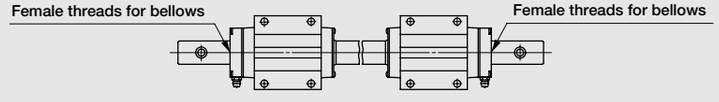
Female threads are provided at both ends of the track rail, and at all ends of all slide units. (Applicable, when the number of slide units is two or more. In case only one slide unit is assembled, indicate "/J".)

③ /JR



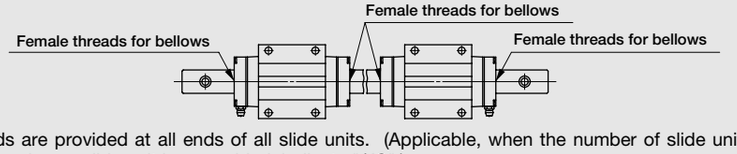
Female threads are provided at both ends of the track rail.

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".)

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

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

U.S. PATENT NO. 5,564,188
NO. 5,374,126

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.

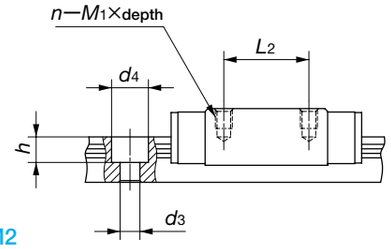
With track rail mounting bolts
／MA(1)

Track rail mounting bolts are appended according to the number of mounting holes.

Without track rail mounting bolts
／MN(1)

Track rail mounting bolts are not appended.

Change of mounting hole size and female thread size　／M2(1)　／M3(1)　／M4(1)



The size of the female threads for mounting the slide unit or the size of the track rail mounting hole is changed. For dimensions, see the description of each series.

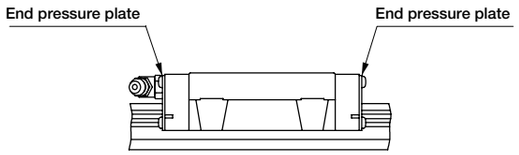
① ／M2
The female threads for mounting the LWL5 slide unit are changed to M2.

② ／M3
The female threads for mounting LWL9 and LWL12 slide units are changed to M3, and the track rail mounting holes are changed to holes for M3.
The female threads for mounting LWLF14 and LWLF18 slide units are changed to M3.

③ ／M4
The track rail mounting holes for M3 of LWE15 are changed to holes for M4.

Note(1) : For assembling /MA, /MN, /M2, /M3, /M4, please indicate as shown below.
Combination of /MA and /M4: /MA4
Combination of /MN and /M2: /MN2
Combination of /MN and /M3: /MN3

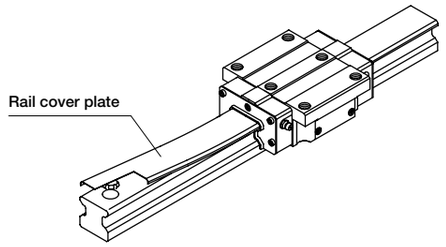
No end seal　／N



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

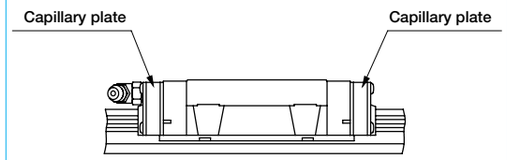
U.S. PATENT NO. 5,622,433



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.

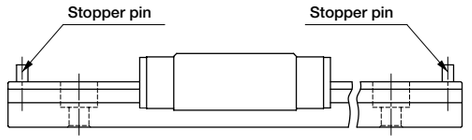
Capillary plate　／Q

U.S. PATENT NO. 6,190,046
NO. 6,176,617
NO. 6,082,899
NO. 5,967,667



The capillary 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. For the total length of the slide unit with capillary plate, see the description of each series.

Track rail with stopper pins　／S

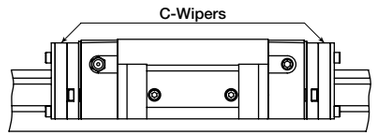


To prevent the slide unit of Linear Way L from slipping off, a stopper pin is provided at both ends of the track rail. For related dimensions, see the description of Linear Way L.

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.

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. Total lengths of slide unit with C-Wipers are shown in Table 9.

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".

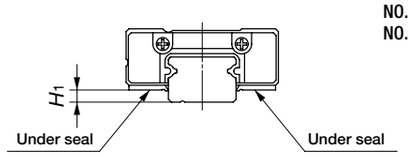
Butt-jointing interchangeable track rail (for interchangeable specification)　／T

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)".

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

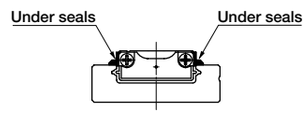
With under seals /U

U.S. PATENT NO. 5,464,288
NO. 5,356,223
NO. 5,324,116
NO. 5,306,089
NO. 5,209,575



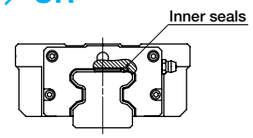
To prevent foreign substances intruding from the lower side of Linear Way, seals are provided on the bottom faces of slide unit. For size H_1, see the description of each series.

With upper seals /U



For C-Sleeve Linear Way MUL and Linear Way LWUL, 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

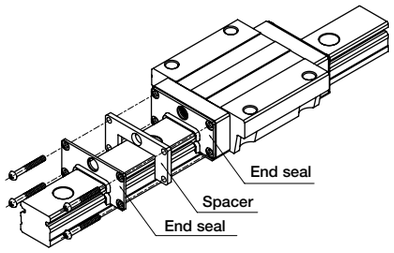
Double end seals are provided on the interchangeable slide unit for more effective dust protection. For the total length of the slide unit with double end seals, see the description of each series.

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

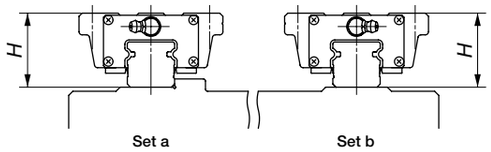


Double end seals are provided on the slide unit of assembled set of interchangeable specification or non-interchangeable specification for more effective dust protection. For the total length of the slide unit with double end seals, see the description of each series.

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".)

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

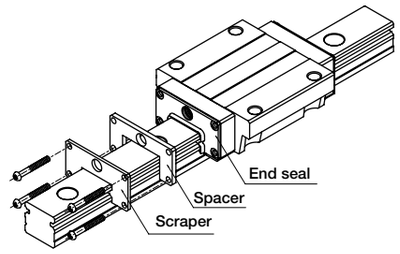
Metal scrapers are provided on the slide unit of interchangeable specification. The scraper (non-contact type) is used to effectively remove large particles of dust or foreign matter adhering to the track rail. For the total length of the slide unit with scrapers, see the description of each series.

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".)

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

Lubrication and Dust Protection

IKO Linear Way and Linear Roller Way are most generally lubricated with grease, which allows for easy lubrication control. A grease nipple for grease replenishment is provided on each slide unit of Linear Way and Linear Roller Way of standard specification (except some models). Parts such as piping joints are also available, and can be delivered if required.
IKO Linear Way and Linear Roller Way are provided with special rubber seals for dust protection. But, if a large amount of fine contaminants are present, or if large particles of foreign matter may fall on the track rail, it is recommended to provide bellows and other protective covers.
The size 2, 3, 4, and 6 models of Linear Way L are not provided with seals.

Pre-packed grease

A high quality lithium-soap base grease shown in Table 6 is pre-packed in IKO Linear Way and Linear Roller Way. A special grease can be pre-packed by specifying "Specified grease" of the special specification on page 97. For the interval and amount of grease replenishment, see "General description".

Table 6 Pre-packed grease list

Series	Pre-packed grease
C-Lube Linear Way ML	MULTEMP PS No.2 (KYODO YUSHI)
C-Lube Linear Way ME	ALVANIA EP GREASE 2 (SHELL)
C-Lube Linear Way MH	
C-Lube Linear Way MUL	MULTEMP PS No.2(KYODO YUSHI)
C-Lube Linear Roller Way Super MX	ALVANIA EP GREASE 2(SHELL)
Linear Way L	MULTEMP PS No.2(KYODO YUSHI)
Linear Way E	ALVANIA EP GREASE 2 (SHELL)
Low Decibel Linear Way E	
Linear Way H(1)	
Linear Way F	
Linear Way U(2)	
Linear Roller Way Super X	
Linear Way Module	

Note(1) : For size 8 to 12 models, MULTEMP PS No.2 is pre-packed.
(2) : For size 25 and 30 models, MULTEMP PS No.2 is pre-packed.

Parts for lubrication

IKO Linear Way and Linear Roller Way are provided with a grease nipple or oil hole for grease replenishment. Table 7 shows parts for lubrication applicable to each series. However, Linear Way L Ball Non-retained type is not provided a grease nipple and oil hole. For re-lubrication of this type, apply grease directly to the raceways of the track rail.

Table 7.1 Parts for lubrication

Series	Model code	Size	Grease nipple		Nominal size of female threads for piping
			Type	Applicable supply nozzle type	
C-Lube Linear Way ML	ML	5 7 9 12	Oil hole	Mini-grease injector	–
		15 20	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		25	B–M4	A–8120V B–8120V	M4
	MLF	10 14 18 24	Oil hole	Mini-grease injector	–
		30 42	A–M3	A–5120V A–5240V B–5120V B–5240V	–
C-Lube Linear Way ME	ME	15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25 30	B–M6	Grease gun available on the market	M6
		35 45	JIS 4 type		PT1/8
C-Lube Linear Way MH	MH	8 10	Oil hole	Mini-grease injector	–
		12	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		15	A–M4	A–5120V A–5240V B–5120V B–5240V	–
		20 25 30	B–M6	Grease gun available on the market	M6
		35 45			PT1/8
C-Lube Linear Way MUL	MUL	25 30	Oil hole	Mini-grease injector	–
C-Lube Linear Roller Way Super MX	MX	15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25	B–M4	A–8120V B–8120V	M4
		30	B–M6	Grease gun available on the market	M6
		35	JIS 1 type		
		45 55 65	JIS 2 type		PT1/8
Linear Way L Ball Retained type	LWL ···B	5 7 9 12	Oil hole	Mini-grease injector	–
		15 20	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		25	B–M4	A–8120V B–8120V	M4
	LWLF···B	10 14 18 24	Oil hole	Mini-grease injector	–
		30 42	A–M3	A–5120V A–5240V B–5120V B–5240V	–
Linear Way E	LWE	15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25 30	B–M6	Grease gun available on the market	M6
		35 45	JIS 4 type		PT1/8
Low Decibel Linear Way E	LWE···Q	15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25 30	B–M6	Grease gun available on the market	M6
		35	JIS 4 type		PT1/8

Remark : The above table shows representative model codes, but is applicable to all other models.
When "Oil hole" is described in the grease nipple column, an oil hole is provided in place of a grease nipple.

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

Table 7.2 Parts for lubrication

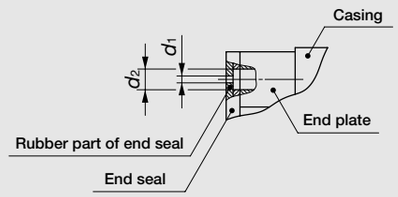
Series	Model code	Size	Grease nipple		Nominal size of female threads for piping
			Type	Applicable supply nozzle type	
Linear Way H	LWH···B	8 10	Oil hole	Mini-grease injector	–
		12	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25 30	B–M6	Grease gun available on the market	M6
		35 45 55 65 85	JIS B type		PT1/8
Linear Way F	LWFH	40 60 90	JIS A–M6F		M6
	LWFF LWFS	33	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		37	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		42 69	B–M6	Grease gun available on the market	M6
Linear Way U	LWUL···B	25 30	Oil hole	Mini-grease injector	–
	LWU···B LWU	40 50	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		60 86 100 130	JIS A–M6F	Grease gun available on the market	M6
Linear Roller Way Super X	LRX	12	A–M3	A–5120V A–5240V B–5120V B–5240V	–
		15	A–M4	A–5120V A–5240V B–5120V B–5240V	M4
		20 25	B–M4	A–8120V B–8120V	M4
		30	B–M6	Grease gun available on the market	M6
		35	JIS A–M6F		M6
		45 55 65 85	JIS A–PT1/8		PT1/8
		100	JIS A–PT1/4		PT1/4

Remark : The above table shows representative model codes, but is applicable to all other models.
When "Oil hole" is described in the grease nipple column, an oil hole is provided in place of a grease nipple.

Oil hole

Some models of C-Lube Linear Way ML, C-Lube Linear Way MUL, Linear Way L Ball Retained type and Linear Way H are provided with an oil hole as shown in Table 8. (See also Table 7.) For grease replenishment, use a syringe type dispenser. The specially prepared miniature greaser is also available.

Table 8 Oil hole



unit : mm

Series	Size	Oil hole size d_1	Oil hole size d_2
C-Lube Linear Way ML	5 10	0.5	1.1
	7 14		1.2
	9 18		1.5
	12 24		2
C-Lube Linear Way MUL	25	0.5	1.2
	30		1.5
Linear Way L Ball Retained type	5 10	0.5	1.1
	7 14		1.2
	9 18		1.5
	12 24		2
Linear Way H	8 10	0.5	1.5
Linear Way U	25	0.5	1.2
	30		1.5

Miniature greaser

The miniature greaser is specially prepared for grease replenishment for Linear Way with an oil hole shown in Table 8. Table 9 shows the types of grease and specifications of the miniature greaser.

Table 9 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(1)	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		

Note(1) : Applicable to size 10 of LRX.

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

Grease nipple and supply nozzle

Tables 10.1 and 10.2 show the specifications of grease nipples and applicable types of supply nozzles. Table 11 shows the specifications of supply nozzles.

Table 10.1 Grease nipples and applicable supply nozzles

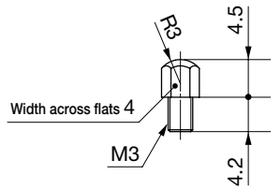
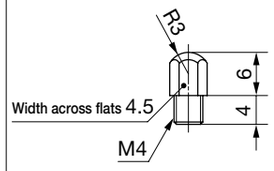
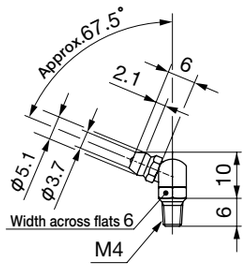
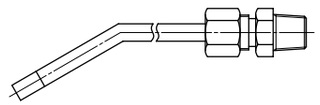
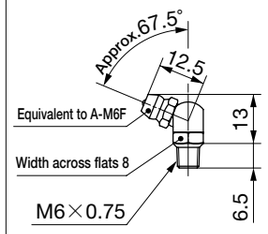
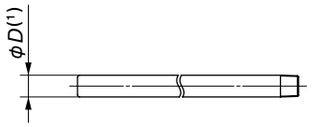
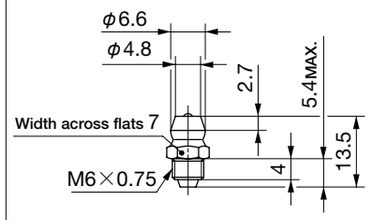
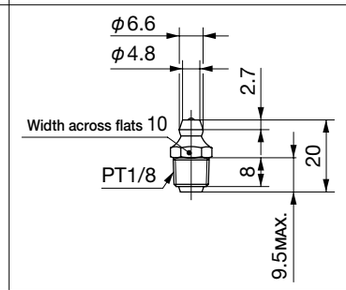
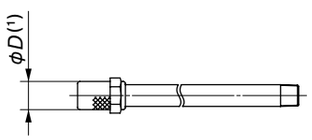
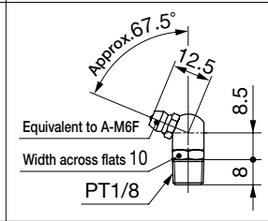
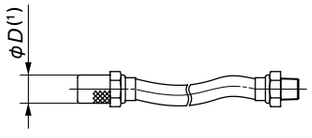
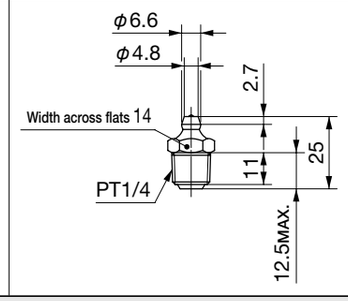
Grease nipple		Applicable supply nozzle	
Type	Shape and dimension	Type	Shape
A–M3		A–5120V A–5240V B–5120V B–5240V	Straight type 
A–M4			
B–M4		A–8120V B–8120V	Straight type with angle 

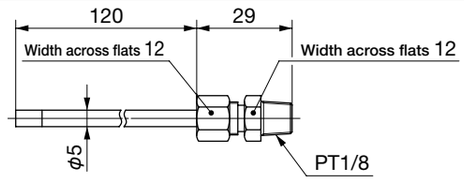
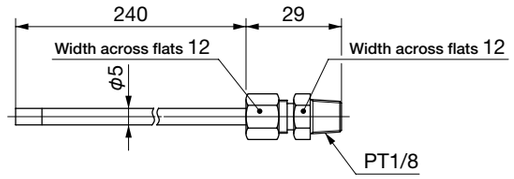
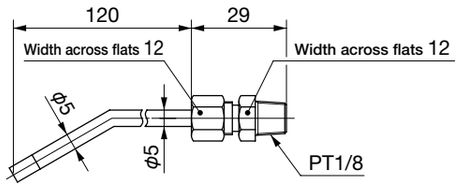
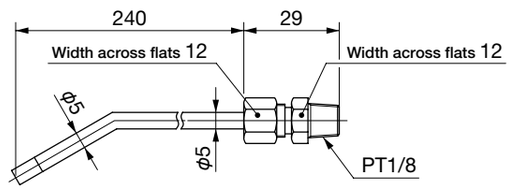
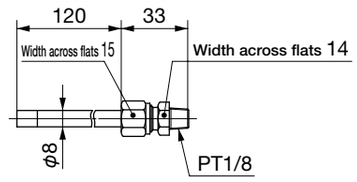
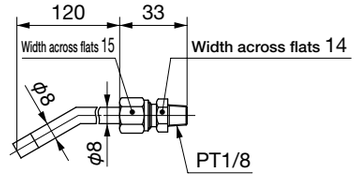
Table 10.2 Grease nipples and applicable supply nozzles

Grease nipple		Applicable supply nozzle	
Type	Shape and dimension	Type	Shape
B–M6		Product available on the market	Straight type 
JIS 1 type			
JIS 2 type			Chuck type 
JIS 4 type			Hose type 
JIS A–PT1/4			

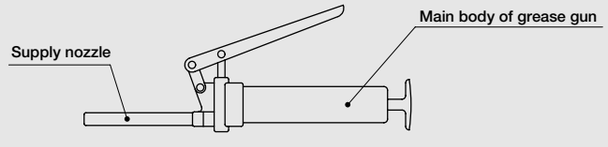
Note(1) : For straight type, chuck type and hose type supply nozzles available on the market, it is recommended to use one with an outside diameter (*D*) of 13 mm or less.

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

Table 11 Applicable supply nozzles

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

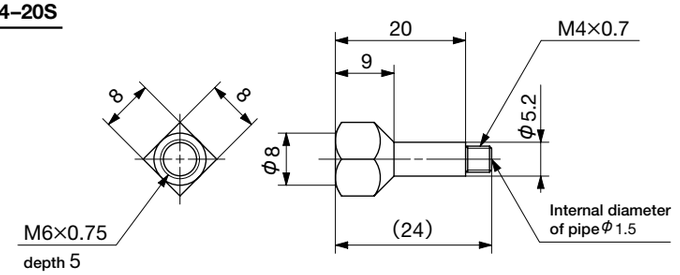
Remark : The supply nozzles shown in the table can be mounted on the main body of a common grease gun available on the market (shown below). If these supply nozzles are required, consult IKO by specifying the supply nozzle type.



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 12.1, 12.2, 13.1 and13.2 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.

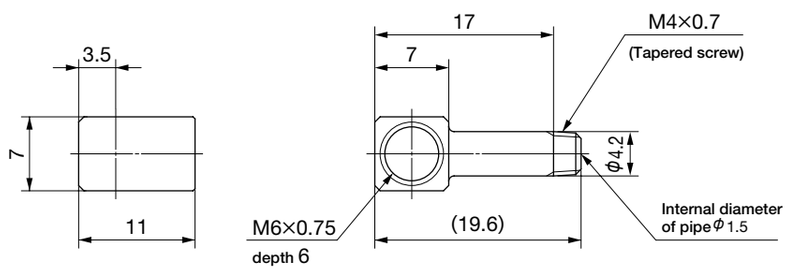
Model number **SC4–20S**



Remark : Not applicable to LRX.

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

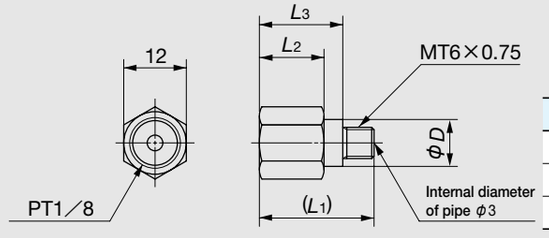
Model number **LC4–17**



Remark : The straight type pipe joint shown in Table 12.1 is recommended for female threads (M6 × 0.75).

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

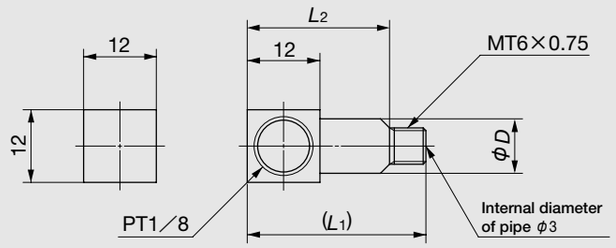
Table 12.1 Pipe joint for M6 × 0.75 (Straight type)



unit : mm

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

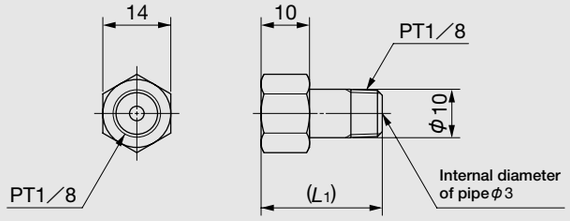
Table 12.2 Pipe joint for M6 × 0.75 (L type)



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

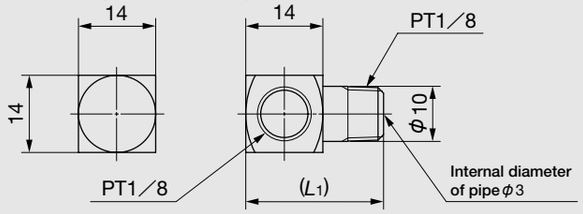
Table 13.1 Pipe joint for PT1/8 (Straight type)



unit : mm

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

Table 13.2 Pipe joint for PT1/8 (L type)



unit : mm

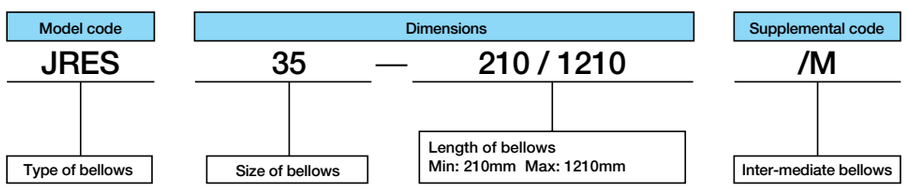
Model number	L_1
LC1/8–19S	25
LC1/8–34S	40

Bellows

Dimensions of bellows specially prepared for IKO Linear Way and Linear Roller Way are shown in Tables 15.1 and 15.2. 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
$\ell s\max$: Maximum length of one pleat (See Tables 15.1 and 15.2.)
$\ell s\min$: Minimum length of one pleat (See Tables 15.1 and 15.2.)

$$L\min = ns \times \ell s\min + m \times 5 + 10$$
$$L\max = S + L\min$$

where, $L\min$: Minimum length of bellows, mm
$L\max$: Maximum length of bellows, mm
m: Number of internal guide plates (See Table 14.)

Table 14 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 JFFS	—	22	$m = \frac{ns}{16}$ but $m=0$, when $ns \leqq 20$
	22	25	$m = \frac{ns}{12}$ but $m=0$, when $ns \leqq 18$
	25	35	$m = \frac{ns}{8}$

Note(1) : For dimension P, see Tables 15.1 and 15.2.
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.

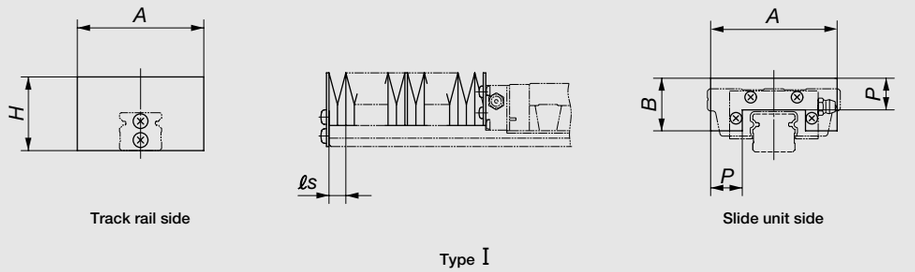
Intermediate bellows

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.

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

Table 15.1 Dimensions of bellows and applicable models



unit : mm

Series	Size	Bellows model code	Type	*H*	*A*	*a*	*B*	*P*	ℓsmin	ℓsmax
C-Lube Linear Way ME	15	JEF15	Ⅱ	23.5	34	14	17	8	2	9
	20	JEF20		27.5	40	19	21	9	2	10
	25	JEF25		32	46	22	24	10	2	11
	30	JES30		42	70	27	35	15	2	14
	35	JES35		48	85	33	40	18	2	18.5
	45	JES45		60	105	44	50	22	2	23.5
C-Lube Linear Way MH	15	JHS15	Ⅰ	31(2)	55	–	19.5	15	2	14
	20	JHS20		35(2)	60	–	25	15	2	14
	25	JHS25		39(2)	64	–	29.5	15	2	14
	30	JHS30		42	70	–	35	15	2	14
	35	JHS35		48	85	–	40	18	2	18.5
	45	JHS45		60	105	–	50	22	2	23.5
Linear Way E	15	JEF15	Ⅱ	23.5	34	14	17	8	2	9
	20	JEF20		27.5	40	19	21	9	2	10
	25	JEF25		32	46	22	24	10	2	11
	30	JES30		42	70	27	35	15	2	14
	35	JES35		48	85	33	40	18	2	18.5
	45	JES45		60	105	44	50	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.

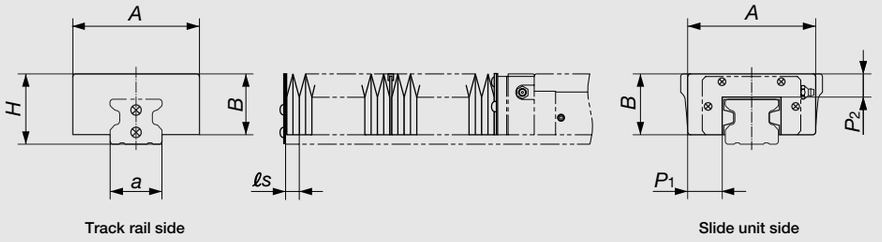
Table 15.2 Dimensions of bellows and applicable models

unit : mm

Series	Size	Bellows model code	Type	*H*	*A*	*a*	*B*	*P*	ℓsmin	ℓsmax
Linear Way H(1)	15	JHS15	Ⅰ	31(2)	55	–	19.5	15	2	14
	20	JHS20		35(2)	60	–	25	15	2	14
	25	JHS25		39(2)	64	–	29.5	15	2	14
	30	JHS30		42	70	–	35	15	2	14
	35	JHS35		48	85	–	40	18	2	18.5
	45	JHS45		60	105	–	50	22	2	23.5
	55	JHS55		70	120	–	57	25	2	28
	65	JHS65		90	158	–	76	35	2	42
Linear Way F	33	JFFS33	Ⅱ	26(2)	66(3)	–	23	15	2	15
	37	JFFS37	Ⅱ	27.5(2)	70(3)	–	24	15	2	15
	40	JFS40	Ⅰ	32(2)	80	–	27	15	2	14
	42	JFFS42	Ⅱ	30.5(2)	76(3)	–	27.5	15	2	15
	60	JFS60	Ⅰ	36(2)	100	–	30	15	2	14
	69	JFFS69	Ⅱ	36(2)	106	–	31.5	15	2	15
	90	JFS90	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.

Table 15.3 Dimensions of bellows and applicable models



unit : mm

Series	Size	Bellows model code	*H*	*A*	*a*	*B*	P_1	P_2	ℓsmin	ℓsmax
C-Lube Linear Roller Way Super MX	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
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
	100	JRES100	115	214	96	100	35	35	2	45

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 *H* of Linear Way. Check *H* dimension of Linear Roller Way shown in the table of dimensions of each series.

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

Mounting structure

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 Figs. 5 and 6.)
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.

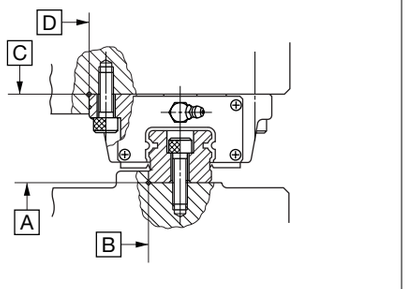


Fig. 5 Reference mounting surfaces and general mounting structure of Linear Way and Linear Roller Way

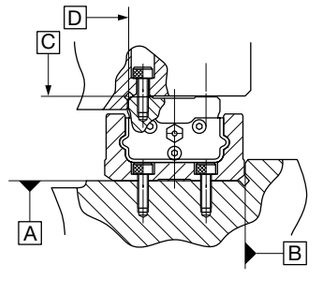


Fig. 6 Reference mounting surfaces and general mounting structure of Linear Way U

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 Figs. 7 and 8.)

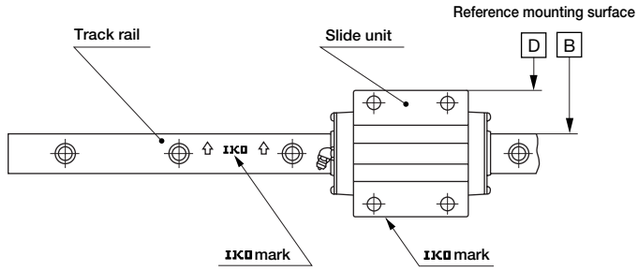


Fig. 7 Reference mounting surfaces of Linear Way and Linear Roller Way

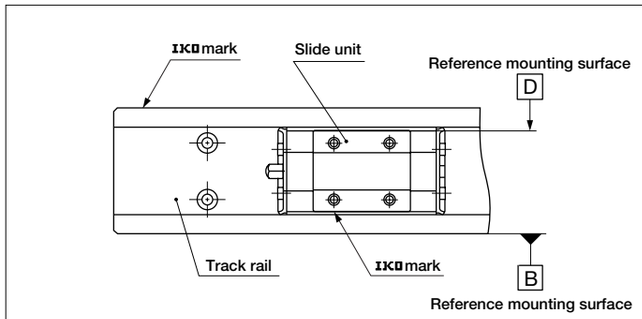


Fig. 8 Reference mounting surfaces of Linear Way U

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. 9 and Fig. 10.
When the applied load is small or the operating conditions are not too severe, mounting methods shown in Fig. 11 and Fig. 12 are also used.

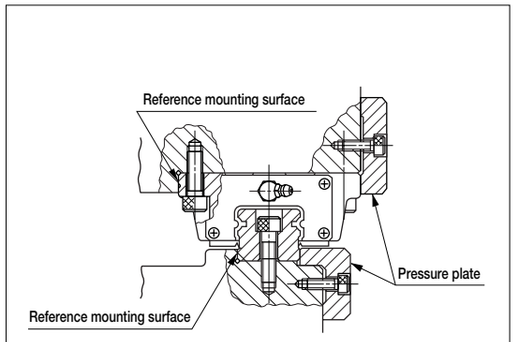


Fig. 9 Mounting example with pressure plate

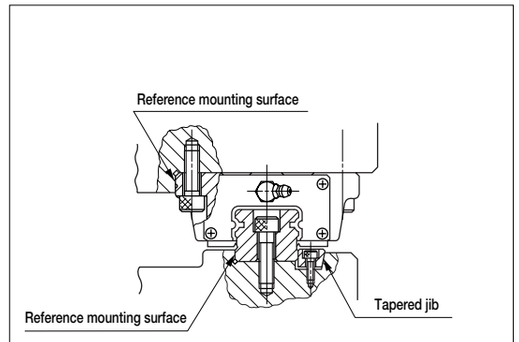


Fig. 10 Mounting example with tapered jib

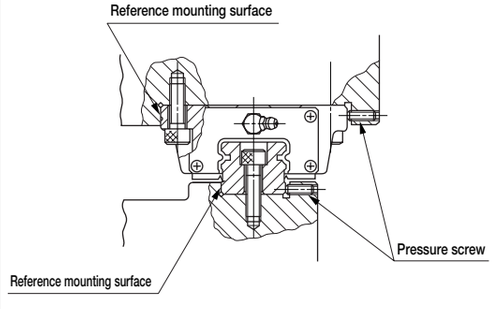


Fig. 11 Mounting example with pressure screw

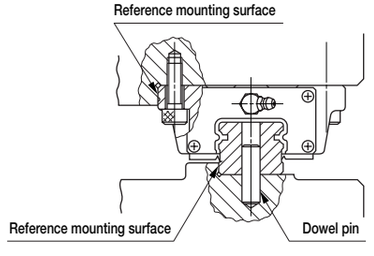


Fig. 12 Mounting example with dowel pin

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

Mounting of Linear Way L (For the size 2, 3, 4 and 6)

The general mounting structure of Linear Way L is similar to that shown in Fig. 5. The slide unit of this series is mounted by tightening bolts in the female threads of the slide unit.
For the size 2, 3, 4 and 6 models, the female threads for mounting the slide unit and the track rail are through holes. (See Fig. 13.) If the fixing depth of the mounting bolts is too long, the bolts will interfere with the slide unit or track rail, resulting in poor traveling accuracy and short life. The fixing depth of the mounting bolts should be kept within the values shown in the table of dimensions.
The mounting bolts for the track rail are not appended to the tapped rail specification products. Prepare bolts with a fixing depth not exceeding H_4 shown in the dimension table.

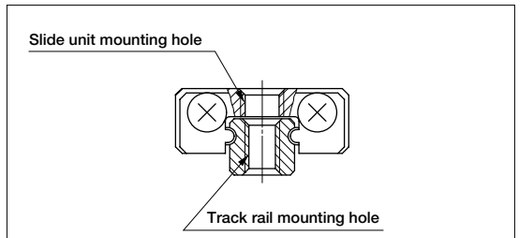


Fig. 13 Slide unit and track rail mounting holes of Linear Way L (Size 2, 3, 4 and 6 models)

Mounting of C-Lube Linear Roller Way Super MX and Linear Roller Way Super X

The general mounting structure of C-Lube Linear Roller Way Super MX and Linear Roller Way Super X is similar to that shown in Fig. 5. Some slide units are provided with one or two mounting thread holes in the middle of width (See Fig. 14.) so that an applied load can be received with good load balance. When designing machines or equipment, ensure that these middle mounting holes of the slide unit can be securely tightened to obtain maximum performance of the guide.

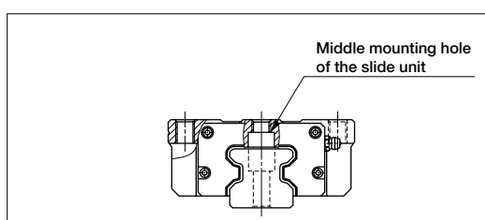


Fig. 14 Middle mounting hole of the slide unit

Mounting of Linear Way Module

Fig. 15 shows the standard mounting structure of Linear Way Module. As a convenient means to eliminate play or give preload, preload adjusting screws are often used in linear motion rolling guides.
Set the preload adjusting screws at the positions of fixing bolts of slide member and in the middle of the height of slide member, and then press the slide member by tightening the screw.
For mounting the slide member of Linear Way Module LM, it is recommended to fix the slide member from the table side, because the allowance for preload adjustment in the bolt hole of slide member is small. In this case, the bolt hole and the counter bore in the table should be made larger to give the adjustment allowance.
The preload amount differs depending on the operating conditions of machines or equipment. An excessive preload will result in short bearing life and raceway damage. The preload amount for general application should be adjusted to a zero or slight minus clearance in the ideal case.

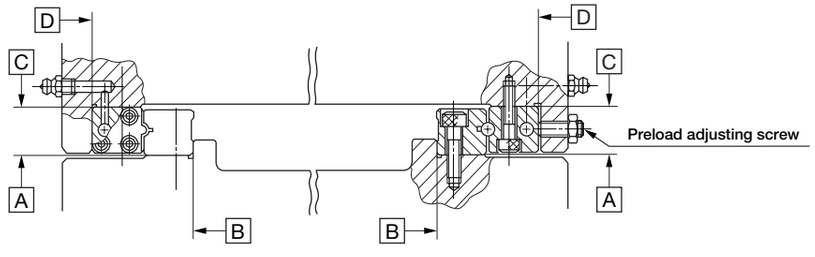


Fig. 15 Mounting of Linear Way Module

Specifications of mounting parts

Accuracy of mounting surfaces

The life and other performances of Linear Way and Linear Roller Way are greatly affected by the accuracy of the mounting surfaces of machines and equipment and the mounting accuracy. Poor accuracy may result in producing a larger load than the calculated load, and eventually lead to short life, etc.
Reliable operation of linear motion rolling guide is ensured by providing high manufacturing and mounting accuracy of mounting parts and designing a mounting structure so as to keep the accuracy and performance, while considering the required linear motion accuracy, rigidity and other related operating conditions.
As an example, the standard values of parallelism between two track rail mounting surfaces when multiple sets are used, are shown in Table 30 on page 126.

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. 16. However, in some series, corner radii R_1 and R_2 shown in Fig. 17 can also be used. Tables 16.1 to 27.3 show recommended shoulder heights and corner radii of the mating reference mounting surfaces.

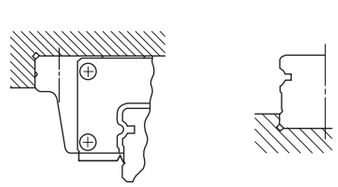


Fig. 16 Relieved fillet at the corner of the mating reference mounting surfaces

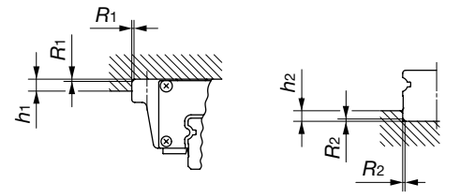
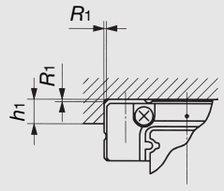
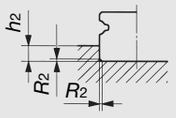


Fig. 17 Corner radii and shoulder heights of the mating reference mounting surfaces

Table 16.1 Shoulder heights and corner of the mating reference mounting of C-Lube Linear Way ML standard type



Slide unit



Track rail

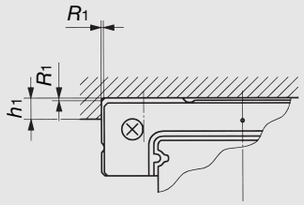
unit : mm

Model number	Slide unit		Track rail	
	Shoulder height h_1	Comer radius R_1 (max.)	Shoulder height(1) h_2	Comer radius R_2 (max.)
ML 5	2	0.3	0.8	0.2
ML 7	2.5	0.2	1.2	0.2
ML 9	3	0.2	1.5	0.2
ML 12	4	0.2	2.5	0.2
ML 15	4.5	0.2	3	0.2
ML 20	5	0.2	4	0.2
ML 25	6.5	0.7	4	0.7

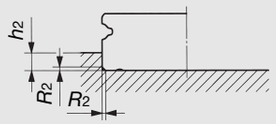
Note(1) : For models with under seals (/U), it is use h_2 values 1mm smaller than the values in the table. However, for "with under seals" of the size 9 models, 0.8mm is recommended.
Remark : The above table shows representative model numbers but is applicable to all models.

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

Table 16.2 Shoulder heights and corner of the mating reference mounting of C-Lube Linear Way ML wide rail type



Slide unit



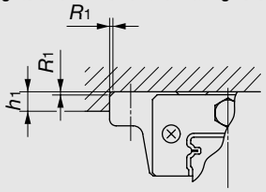
Track rail

unit : mm

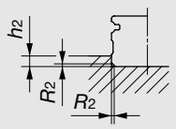
Model number	Slide unit		Track rail	
	Shoulder height h_1	Comer radius R_1 (max.)	Shoulder height(1) h_2	Comer radius R_2 (max.)
MLF 10	2	0.3	1.2	0.2
MLF 14	2.5	0.2	1.2	0.2
MLF 18	3	0.2	2.5	0.2
MLF 24	4	0.2	2.5	0.2
MLF 30	4.5	0.2	2.5	0.2
MLF 42	5	0.2	3	0.2

Note(1) : For models with under seals (/U), it is use h_2 values 1mm smaller than the values in the table.
Remark : The above table shows representative model numbers but is applicable to all models.

Table 17 Shoulder heights and corner of the mating reference mounting of C-Lube Linear Way ME



Slide unit



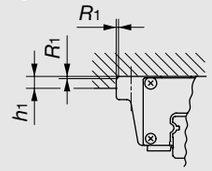
Track rail

unit : mm

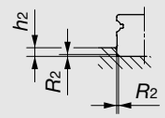
Model number	Slide unit		Track rail	
	Shoulder height h_1	Comer radius R_1 (max.)	Shoulder height h_2	Comer radius R_2 (max.)
ME(T) 15	4	1	3	0.5
MES 15		0.5		
ME(T) 20	5	1	3	0.5
MES 20		0.5		
ME(T) 25	6	1	4	1
MES 25				
ME(T) 30	8	1	5	1
MES 30				
ME(T) 35	8	1	6	1
MES 35				
ME(T) 45	8	1.5	7	1.5
MES 45				

Remark : The above table shows representative model numbers but is applicable to all models.

Table 18 Shoulder heights and corner of the mating reference mounting of C-Lube Linear Way MH



Slide unit



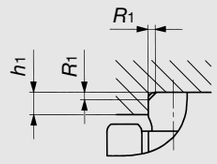
Track rail

unit : mm

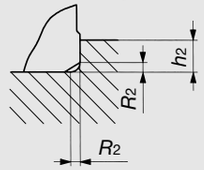
Model number	Slide unit		Track rail	
	Shoulder height h_1	Comer radius R_1 (max.)	Shoulder height h_2	Comer radius R_2 (max.)
MHT 8···SL	3.5	0.5	1.6(1)	0.2
MHD 8···SL	4	0.5	1.6(1)	0.2
MHT 10···SL	4.5	0.5	1.9(1)	0.2
MHD 10···SL	5	0.5	1.9(1)	0.2
MHT 12	6	0.5	2.7(1)	0.7
MHD 12	6	0.5	2.7(1)	0.7
MH 15	4	0.5	3	0.5
MH 20	5	0.5	3	0.5
MH 25	6	1	4	1
MH 30	8	1	5	1
MH 35	8	1	6	1
MH 45	8	1.5	7	1.5

Note(1) : For models with under seals (/U),it is recommended to use h_2 values 0.6mm smaller than the values in the table.
Remark : The above table shows representative model numbers but is applicable to all models.

Table 19 Shoulder heights and corner of the mating reference mounting of C-Lube Linear Way MUL



Slide unit



Track rail

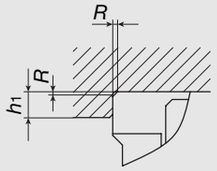
unit : mm

Model number	Slide unit		Track rail	
	Shoulder height h_1	Comer radius R_1 (max.)	Shoulder height h_2	Comer radius R_2 (max.) (1)
MUL 25	1.5	0.2	2.5	—
MUL 30	2.5	0.2	3	—

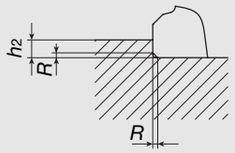
Note(1) : Please provide a relieved fillet as shown on Fig.16.

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

Table 20 Shoulder height and radius of the reference mounting of C-Lube Linear Roller Way Super MX



Slide unit



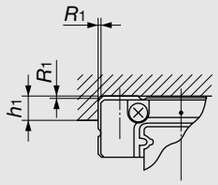
Track rail

unit : mm

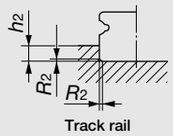
Model number	Slide unit Shoulder height h_1	Track rail Shoulder height h_2	Relieved radius R (max.)
MX 15	4	3	0.5
MX 20	5	4	0.5
MX 25	6	5	1
MX 30	8	5.5	1
MX 35	8	5.5	1
MX 45	8	7	1.5
MX 55	10	8	1.5
MX 65	10	10	1.5

Remark : The table shows representative model numbers but is applicable to all models of the same size.

Table 21.1 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way L standard type



Slide unit



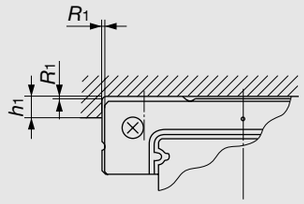
Track rail

unit : mm

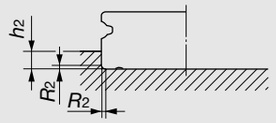
Model number	Slide unit Shoulder height h_1	Slide unit Corner radius R_1 (max.)	Track rail Shoulder height(1) h_2	Track rail Corner radius R_2 (max.)
LWL 1	1.3	—	—	—
LWL 1…Y			2	
LWL 2	1	0.1	0.5	0.05
LWL 3	1.2	0.15	0.8	0.1
LWL 5…B	2	0.3	0.8	0.2
LWL 5				
LWL 7…B	2.5	0.2	1.2	0.2
LWL 7				
LWL 9…B	3	0.2	1.5	0.2
LWL 9…BCS		0.4		
LWL 9		0.2		
LWL 12…B	4	0.2	2.5	0.2
LWL 12…BCS		0.4		
LWL 12		0.2		
LWL 12…CS		0.4		
LWL 15…B	4.5	0.2	3	0.2
LWL 15…BCS		0.4		
LWL 15	4	0.2		
LWL 15…CS		0.4		
LWL 20…B	5	0.2	4	0.2
LWL 20…BCS		0.4		
LWL 25…B	6.5	0.7	4	0.7

Note(1) : For models with under seals (/U), it is recommended to use h_2 values 1mm smaller than the values in the table. However, for "with under seals" of the size 9 models, 0.8mm is recommended.
Remark : The above table shows representative model numbers but is applicable to all models.

Table 21.2 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way L wide rail type



Slide unit



Track rail

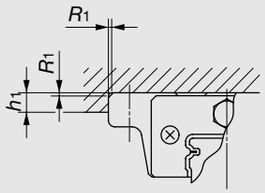
unit : mm

Model number	Slide unit Shoulder height h_1	Slide unit Corner radius R_1 (max.)	Track rail Shoulder height(1) h_2	Track rail Corner radius R_2 (max.)
LWLF 4	1.5	0.1	0.8	0.1
LWLF 6	2	0.1	0.8	0.1
LWLF 10…B	2	0.3	1.2	0.2
LWLF 14…B	2.5	0.2	1.2	0.2
LWLF 14				
LWLF 18…B	3	0.2	2.5	0.2
LWLF 18…BCS		0.4		
LWLF 18		0.2	1.5	
LWLF 18…CS		0.4		
LWLF 24…B	4	0.2	2.5	0.2
LWLF 24…BCS		0.4		
LWLF 24	3	0.2		
LWLF 24…CS		0.4		
LWLF 30…B	4.5	0.2	2.5	0.2
LWLF 30…BCS		0.4		
LWLF 42…B	5	0.2	3	0.2
LWLF 42…BCS		0.4		
LWLF 42	4	0.2	2.5	
LWLF 42…CS		0.4		

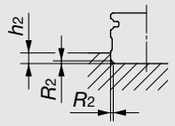
Note(1) : For models with under seals (/U), it is recommended to use h_2 values 1mm smaller than the values in the table.
Remark : The above table shows representative model numbers but is applicable to models.

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

Table 22 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way E



Slide unit



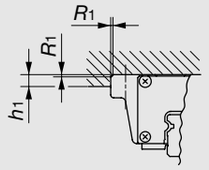
Track rail

unit : mm

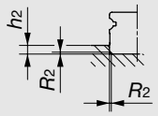
Model number	Slide unit		Track rail	
	Shoulder height h_1	Corner radius R_1(max.)	Shoulder height h_2	Corner radius R_2(max.)
LWE(T) 15	4	1	3	0.5
LWES 15		0.5		
LWE(T) 20	5	1	3	0.5
LWES 20		0.5		
LWE(T) 25	6	1	4	1
LWES 25				
LWE(T) 30	8	1	5	1
LWES 30				
LWE(T) 35	8	1	6	1
LWES 35				
LWE(T) 45	8	1.5	7	1.5
LWES 45				

Remark : The above table shows representative model numbers but is applicable to all models.

Table 23 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way H



Slide unit



Track rail

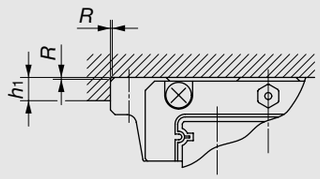
unit : mm

Model number	Slide unit		Track rail	
	Shoulder height h_1	Corner radius R_1(max.)	Shoulder height h_2	Corner radius R_2(max.)
LWHT 8···SL	3.5	0.5	1.6(1)	0.2
LWHD 8···SL	4	0.5	1.6(1)	0.2
LWHT 10···SL	4.5	0.5	1.9(1)	0.2
LWHD 10···SL	5	0.5	1.9(1)	0.2
LWHT 12	6	0.5	2.7(1)	0.7
LWHD 12	6	0.5	2.7(1)	0.7
LWH 15···B	4	0.5	3	0.5
LWH 20···B	5	0.5	3	0.5
LWH 25···B	6	1	4	1
LWH 30···B	8	1	5	1
LWH 35···B	8	1	6	1
LWH 45···B	8	1.5	7	1.5
LWH 55···B	10	1.5	8	1.5
LWH 65···B	10	1.5	10	1.5

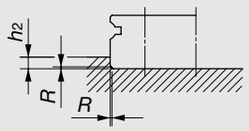
Note(1) : For models with under seals (/U), it is recommended to use h_2 values 0.6mm smaller than the values in the table.
Remark : The above table shows representative model numbers but is applicable to all models.

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

Table 24.1 Shoulder heights and corner radius of the mating reference mounting surfaces of Linear Way F



Slide unit

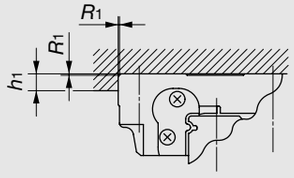


Track rail

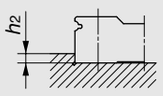
unit : mm

Model number	Slide unit Shoulder height h_1	Track rail Shoulder height h_2	Corner radius R(max.)
LWFF 33 **LWFS 33**	4	2	0.4
LWFF 37 **LWFS 37**	5	2.5	0.4
LWFF 42	5	2.5	0.4
LWFF 69	5	3.5	0.8

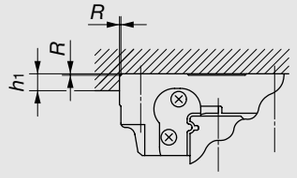
Table 24.2 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way F



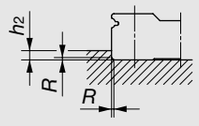
Slide unit



Track rail



Slide unit



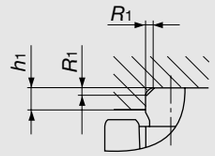
Track rail

When supplemental code "/CC" is specified

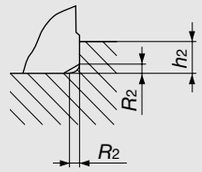
unit : mm

Model number	Slide unit Shoulder height h_1	Slide unit Corner radius R_1(max.)	Track rail Shoulder height h_2	Corner radius for "/CC" specification R(max.)
LWFH 40	4	0.3	3	1
LWFH 60	6	0.5	4	1
LWFH 90	8	0.5	6	1

Table 25 Shoulder heights and corner radii of the mating reference mounting surfaces of Linear Way U



Slide unit



Track rail

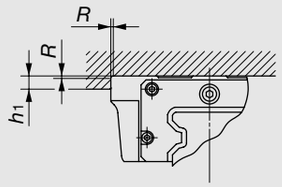
unit : mm

Model number	Slide unit Shoulder height h_1	Slide unit Corner radius R_1 (max.)	Track rail Shoulder height h_2	Track rail Corner radius R_2 (max.) (1)
LWUL 25···B	1.5	0.2	2.5	—
LWUL 30···B	2.5	0.2	3	—
LWU 40···B	3	0.5	5	1
LWU 50···B	3	0.5	7	2
LWU 60···B	3	0.5	9	2
LWU 86···B	4	0.5	11	2
LWU 100	4	0.5	13	1
LWU 130	5	1	14	2

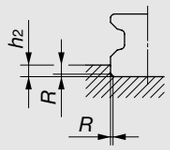
Note(1) : For the size 25 and 30 models, provide a relieved fillet as shown on Fig. 16.

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

Table 26 Shoulder heights and corner radius of the mating reference mounting surfaces of Linear Roller Way Super X



Slide unit



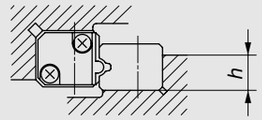
Track rail

unit : mm

Model number	Slide unit Shoulder height h_1	Track rail Shoulder height h_2	Corner radius R(max.)
LRXD 10···SL	4	1	0.3
LRX 12	4	2	0.5
LRX 15	4	3	0.5
LRX 20	5	4	0.5
LRX 25	6	5	1
LRX 30	8	5.5	1
LRX 35	8	5.5	1
LRX 45	8	7	1.5
LRX 55	10	8	1.5
LRX 65	10	10	1.5
LRX 85	14	14	2.5
LRX 100	14	13	2.5

Remark : The above table shows representative model numbers but is applicable to all models.

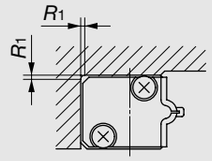
Table 27.1 Shoulder height of the mating reference mounting surface of Linear Way Module LM



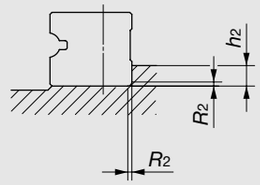
unit : mm

Model number	h
LWLM 7	4
LWLM 9	5
LWLM 11	6

Table 27.2 Shoulder height and corner radius of the mating reference mounting surfaces of Linear Way Module M



Slide member



Track rail

unit : mm

Model number	Slide member Corner radius R_1(max.)	Track rail Shoulder height h_2	Track rail Corner radius R_2(max.)
LWM 1	0.8	4	0.8
LWM 2	1	5	1
LWM 3	1	5	1
LWM 4	1.5	6	1
LWM 5	1.5	6	1
LWM 6	1.5	8	1.5

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

Operating conditions

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 28 for reference.

Table 28 Standard maximum speed

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

Operating temperature

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

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.

Lubrication of Linear Way Module

A grease nipple is not provided on the slide member of Linear Way Module, but a lubrication hole is provided on it to supply lubricant directly to the steel ball re-circulation route. By preparing a lubricant supply route in the mating machine parts as shown in Fig.18, lubrication can be carried out readily .

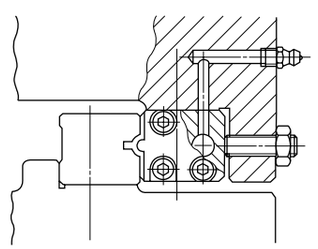


Fig.18 Example of lubrication method for Linear Way Module

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

- Assembling of C-Lube Linear Way ML and Linear Way L
  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 29. The steel ball holder for other models are also available. If required, consult **IKO** for further information.

Table 29 Models to which a steel ball holder is appended

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

Remark : For Linear Way L series, also applicable to high carbon steel products.

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

• Assembling of types other than C-Lube Linear Way ML and Linear Way L
When assembling the slide unit on the track rail, correctly fit the grooves of the slide unit to the grooves of the track rail and move the slide unit gently in parallel direction. Rough handling will result in seal damage or dropping of steel balls.
The interchangeable specification slide unit is provided with a dummy rail. And, the size 12, 15, 20, 25 and 30 models of Linear Roller Way Super X are appended with a dummy rail. This dummy rail should be used for assembly.

Handling of C-Lube Linear Way ML, Linear Way L and Linear Way Module LM

In C-Lube Linear Way ML, Linear Way L Ball Retained type and Linear Way Module LM, steel balls are retained with a steel ball retaining band. However, these products must be handled with care to prevent the steel balls from falling out.

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 30. 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" on page 128.

Table 30 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

Cleaning of mounting surfaces

When mounting Linear Way or Linear Roller Way, first clean all mounting and reference mounting surfaces. (See Fig. 19.)

- 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.
- Remove rust preventive oil and dirt from the reference mounting surfaces and mounting surfaces of Linear Way or Linear Roller Way with clean cloth.

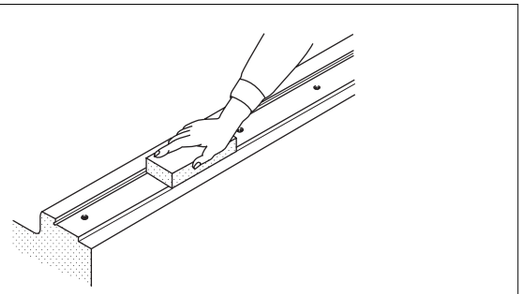


Fig. 19 Cleaning of mounting surfaces

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.

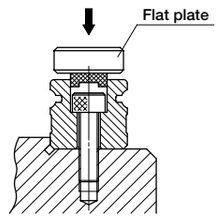


Fig. 20 Plugging-in of caps for rail mounting holes

Tightening torque of mounting bolts

The standard torque values for Linear Way and Linear Roller Way mounting bolts are shown in Tables 31.1 and 31.2. 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 31.1 Tightening torque of mounting bolts of Linear Way and Linear Roller Way

Bolt size	Tightening torque N·m: Carbon steel bolt (In case strength division 12.9)	Tightening torque N·m: Stainless steel bolt (Property division A2-70)
M 3 × 0.5	1.7	1.1
M 4 × 0.7	4.0	2.5
M 5 × 0.8	7.9	5.0
M 6 × 1	13.3	8.5
M 8 × 1.25	32.0	20.4
M 10 × 1.5	62.7	—
M 12 × 1.75	108	—
M 14 × 2	172	—
M 16 × 2	263	—
M 20 × 2.5	512	—
M 24 × 3	882 (746)(1)	—
M 30 × 3.5	1 750 (1 480)(1)	—

Note(1) : The values in ( ) show recommended tightening torque for strength division 10.9.
Remark 1 : For C-Lube Linear Way ML, Linear Way L, Linear Way LM and the size 8, 10 and 12 models of Linear Way H, see Table 31.2.
2 : Tightening torque for the slide unit middle mounting holes of the size 15, 20, 25, 30 and 35 models of Linear Roller Way Super X flange type is recommended to be 70 to 80 % of the values in the table.

Table 31.2 Tightening torque of mounting bolts of C-Lube Linear Way ML, Linear Way L, Linear Way LM and the size 8, 10 and 12 models of Linear Way H

Bolt size	Tightening torque N·m: Carbon steel bolt (Strength division 8.8)	Tightening torque N·m: 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	1.1
M 4 × 0.7	2.8	2.5
M 5 × 0.8	5.6	5.0
M 6 × 1	—	8.5

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

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. The mounting procedure for Linear Way Module is shown in Example 4.

Example 1 For general operation

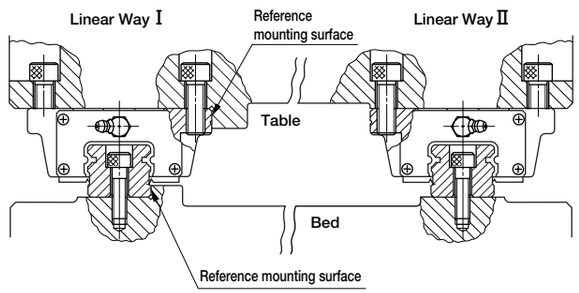


Fig. 21 Example 1

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. 21.)

❶ Cleaning 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. 22.)
- Remove rust preventive oil and dirt from the reference mounting surfaces and mounting surfaces of Linear Way with clean cloth.

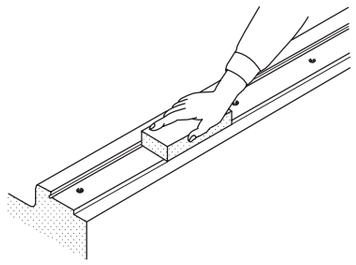


Fig. 22 Cleaning of mounting surfaces

❷ Temporary 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. 23.)
  During installation, ensure that track rail mounting bolts do not interfere with the mounting holes.
- Temporarily fix Linear Way Ⅱ track rail onto the bed.

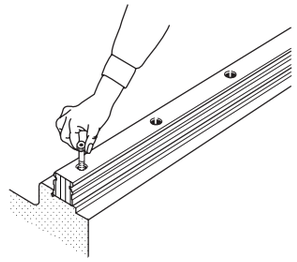


Fig. 23 Temporary fixing of track rail

❸ Final 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. 24.)
- At this stage, leave Linear Way Ⅱ track rail temporarily fixed.

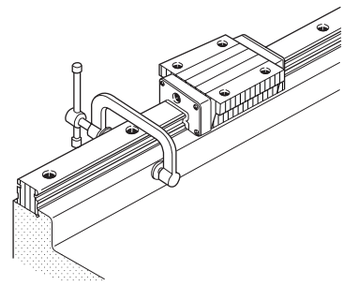


Fig. 24 Fixing of datum side track rail to the bed

❹ Temporary 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.

❺ Final 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.

❻ Fixing 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. 25.)

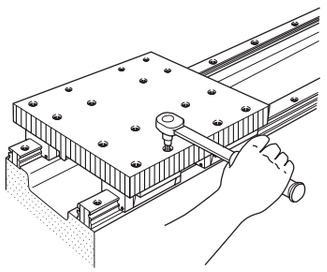


Fig. 25 Fixing of the slide units to the table

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

❼ Final 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 Ⅱ, while progressively moving the table from one rail end to the other. (See Fig. 26.)

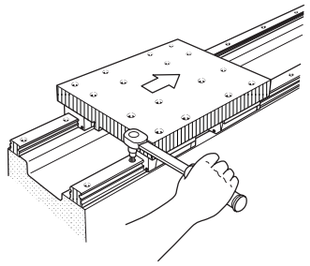


Fig. 26 Fixing of attendant side track rail

❽ Final fixing of other Linear Way Ⅱ slide units

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

Example 2 Mounting example of Micro Linear Way

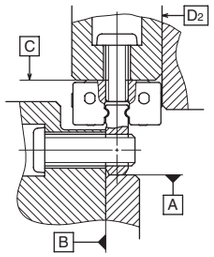


Fig. 27 Reference mounting surface and general mounting structure Ⅰ of LWL1⋯ Y

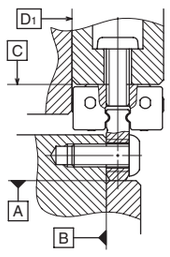


Fig. 28 Reference mounting surface and general mounting structure Ⅱ of LWL1⋯ Y

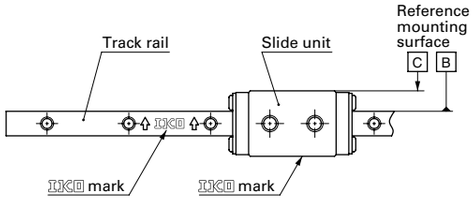


Fig. 29 Reference mounting surface and general mounting structure of LWL2 or larger

Example 3 Operation requiring accurate movement and rigidity

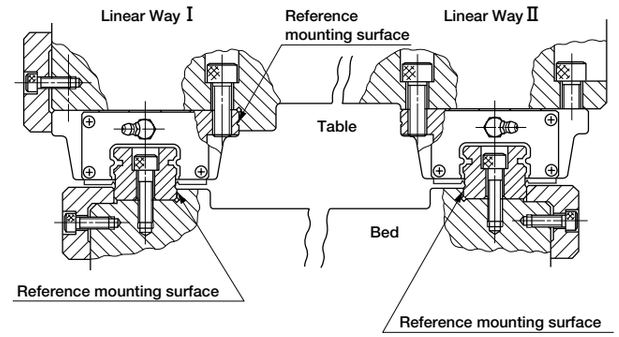


Fig. 30 Example 2

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. 30.)

❶ Cleaning 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. 31.)

- Remove rust preventive oil and dirt from Linear Way reference mounting surfaces and mounting surfaces with clean cloth.

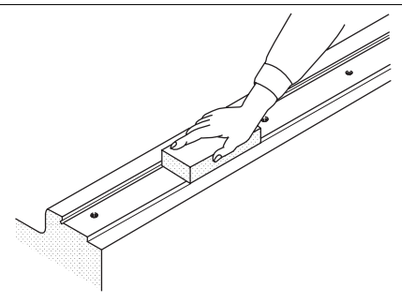


Fig. 31 Cleaning of mounting surfaces

❷ Temporary 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. 32.)

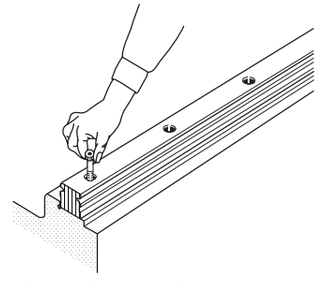


Fig. 32 Temporary fixing of track rail

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

❸ Final 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. 33.)

- Fix Linear Way Ⅱ track rail in the same way.

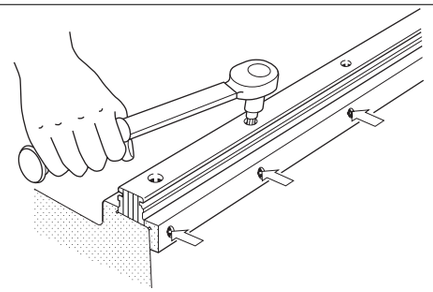


Fig. 33 Fixing of track rail using pressure plate

❹ Temporary 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.

❺ Final 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.

❻ Final 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. 34.)

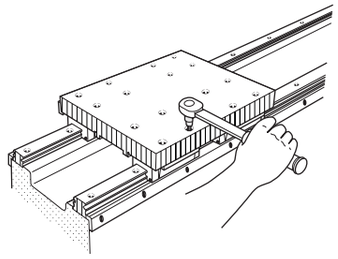


Fig.34 Fixing of slide units to the table

Example 4 Separate mounting of slide units from track rails

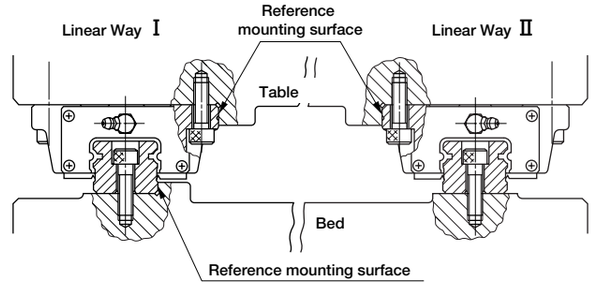


Fig. 35 Example 3

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. 35.)

❶ Cleaning 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. 36.)

- Remove rust preventive oil and dirt from Linear Way reference mounting surfaces and mounting surfaces with clean cloth.

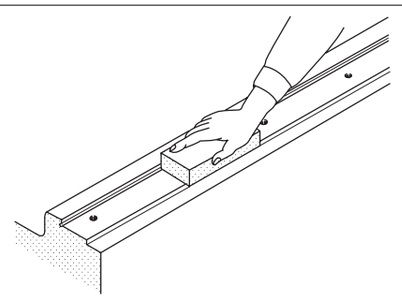


Fig. 36 Cleaning of mounting surfaces

❷ Temporary 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. 37.)
  During installation, ensure that the track rail mounting bolts do not interfere with the mounting holes.

- Temporarily fix Linear Way Ⅱ track rail onto the bed.

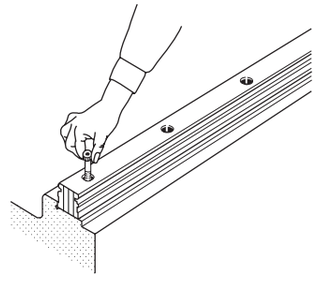


Fig. 37 Temporary fixing of track rail

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

❸ Final 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. 38.)

- At this stage, leave Linear Way Ⅱ track rail temporarily fixed.

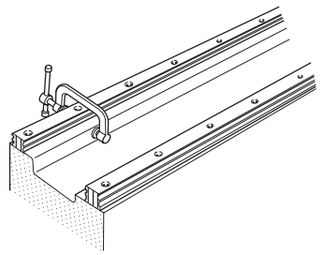


Fig. 38 Fixing of track rail

❹ Separation 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.

❺ Fixing 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. 39.)

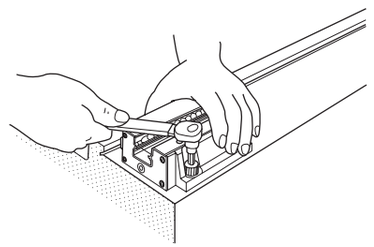


Fig. 39 Fixing of slide unit

❻ Installing 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.

❼ Fixing 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.

Example 5 Assembly of Linear Way Module

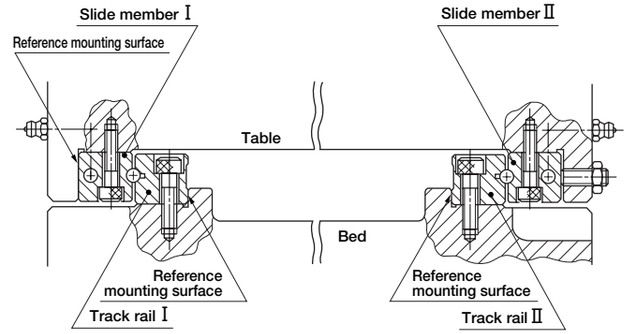


Fig. 40 Example 4

Generally, two sets of Linear Way Modules are used in parallel as shown in Fig. 36. They are usually mounted according to the following procedure. (See Fig. 40.)

❶ Cleaning 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. 41.)

- Remove rust preventive oil and dirt from Linear Way Module reference mounting surfaces and mounting surfaces with clean cloth.

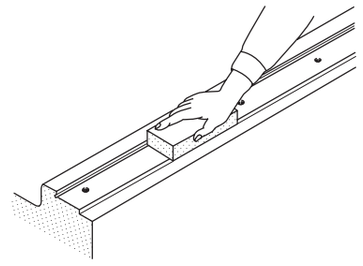


Fig. 41 Cleaning of mounting surfaces

❷ Fixing of track rails

- Correctly fit the reference mounting surfaces of Track Rails Ⅰ and Ⅱ to the reference mounting surfaces of the bed and bring them in close contact using a small vise, etc. Tighten the mounting bolt at the position of the vise. (See Fig. 42.)

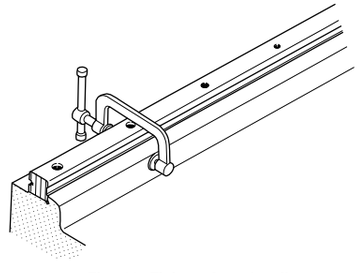


Fig. 42 Fixing of track rail

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

❸ Fixing of slide members

• Tighten the mounting bolts and fix the slide member Ⅰ to the table while correctly fitting the reference mounting surface of the slide member to the mating reference mounting surface of the table. Temporarily fix the slide member Ⅱ. (See Fig. 43.)

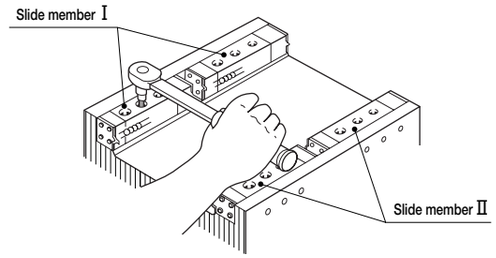


Fig. 43 Fixing of slide members

❹ Installing slide members on track rails

• Gently and gradually install the slide members fixed to the table onto the track rails fixed to the bed, taking care to maintain parallelism between the table and the track rails.

❺ Final fixing of slide member Ⅱ

• While measuring the clearance with a dial gauge as shown in Fig. 44, tighten all preload adjusting screws starting from the screw in the center.

• When the dial gauge indicates no deflection while the table is pushed to right and left in the direction perpendicular to the rails, the preload is zero or very light.

• After adjusting preload, fix slide members Ⅱ by tightening the mounting bolts.

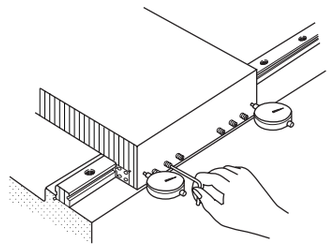


Fig. 44 Preload adjustment

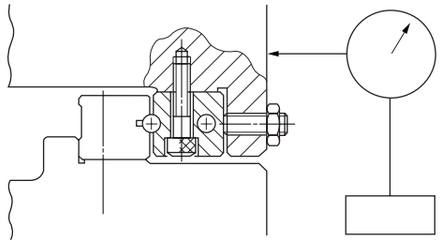


Fig. 45 Example of preload adjustment checking method

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.

❶ Use 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.

❷ Use 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. 46. 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.

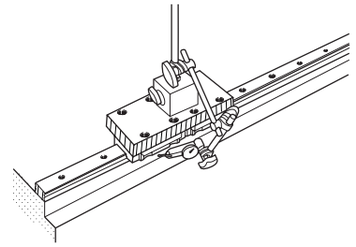


Fig. 46 Mounting by using a temporary reference surface

❸ Use 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. 47. 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.

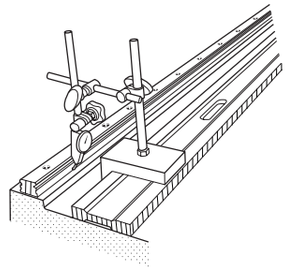


Fig. 47 Mounting by using a straight-edge

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

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.

❶ Use 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.

❷ Use 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.

❸ Use 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. 44). 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.

❹ Use of datum side Linear Way

As shown in Fig. 48, 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.

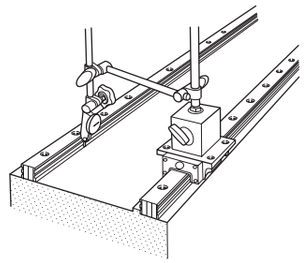


Fig. 48 Mounting by using Linear Way of datum side

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. 49 is indicated on the top face of track rail end. Procedures for mounting jointing track rails are generally as follows.

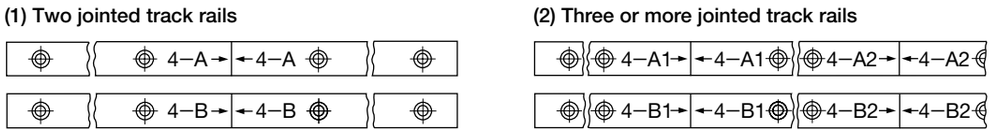


Fig. 49 Butt-jointing match marks

❶ Joint 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.

❷ Fit 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. 50.)

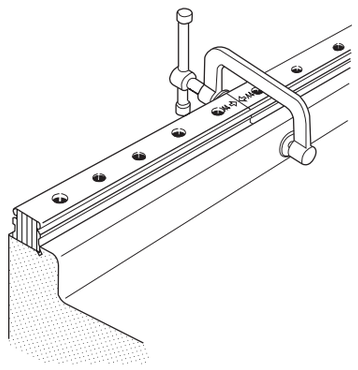


Fig. 50 Fixing of butt-jointing track rails

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