IKO

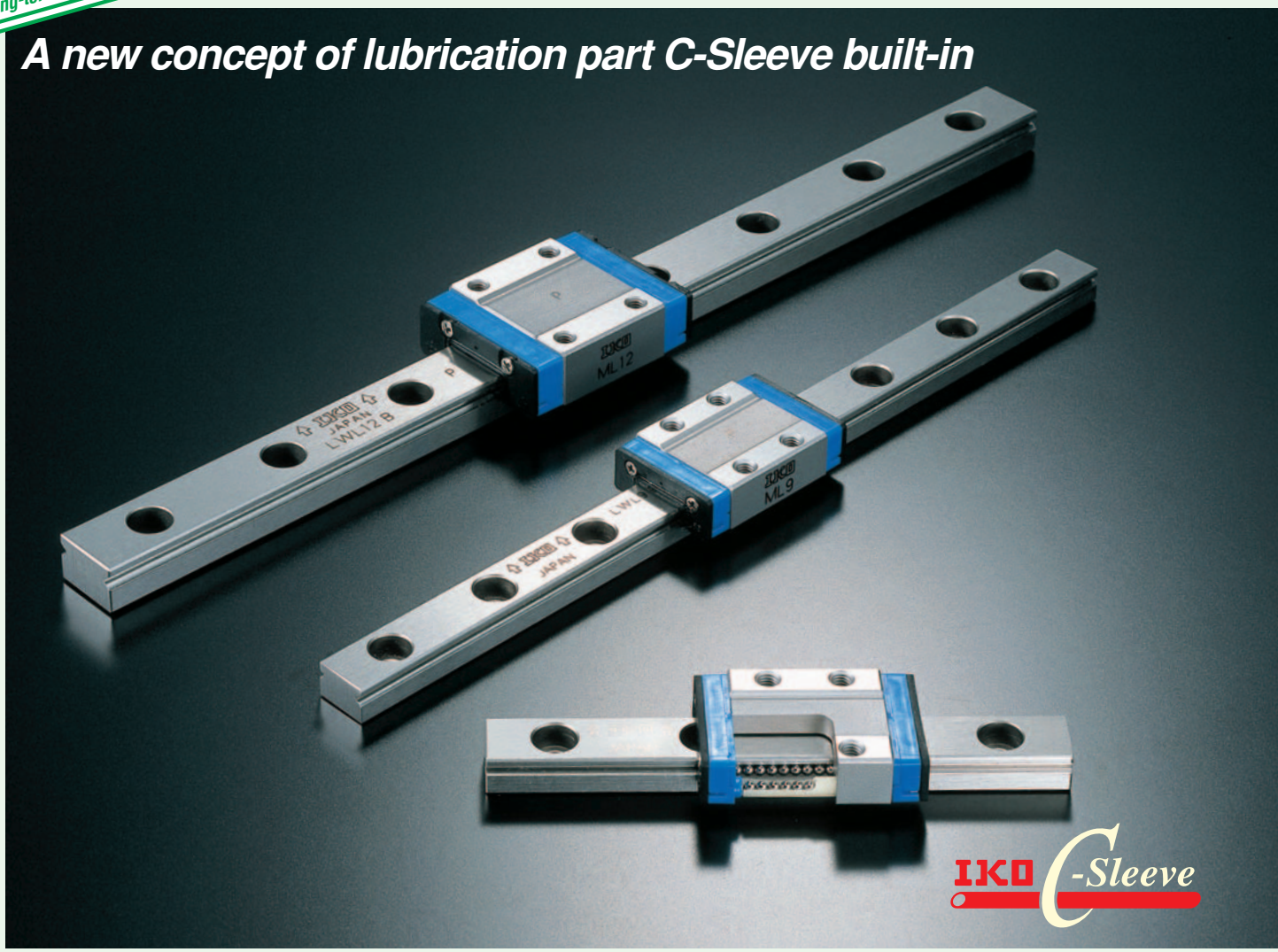
C-Sleeve Linear Way L

ML

Long-term maintenance free series

Patent pending

A new concept of lubrication part C-Sleeve built-in



ISO 9002 Certified

ISO 14001 Certified

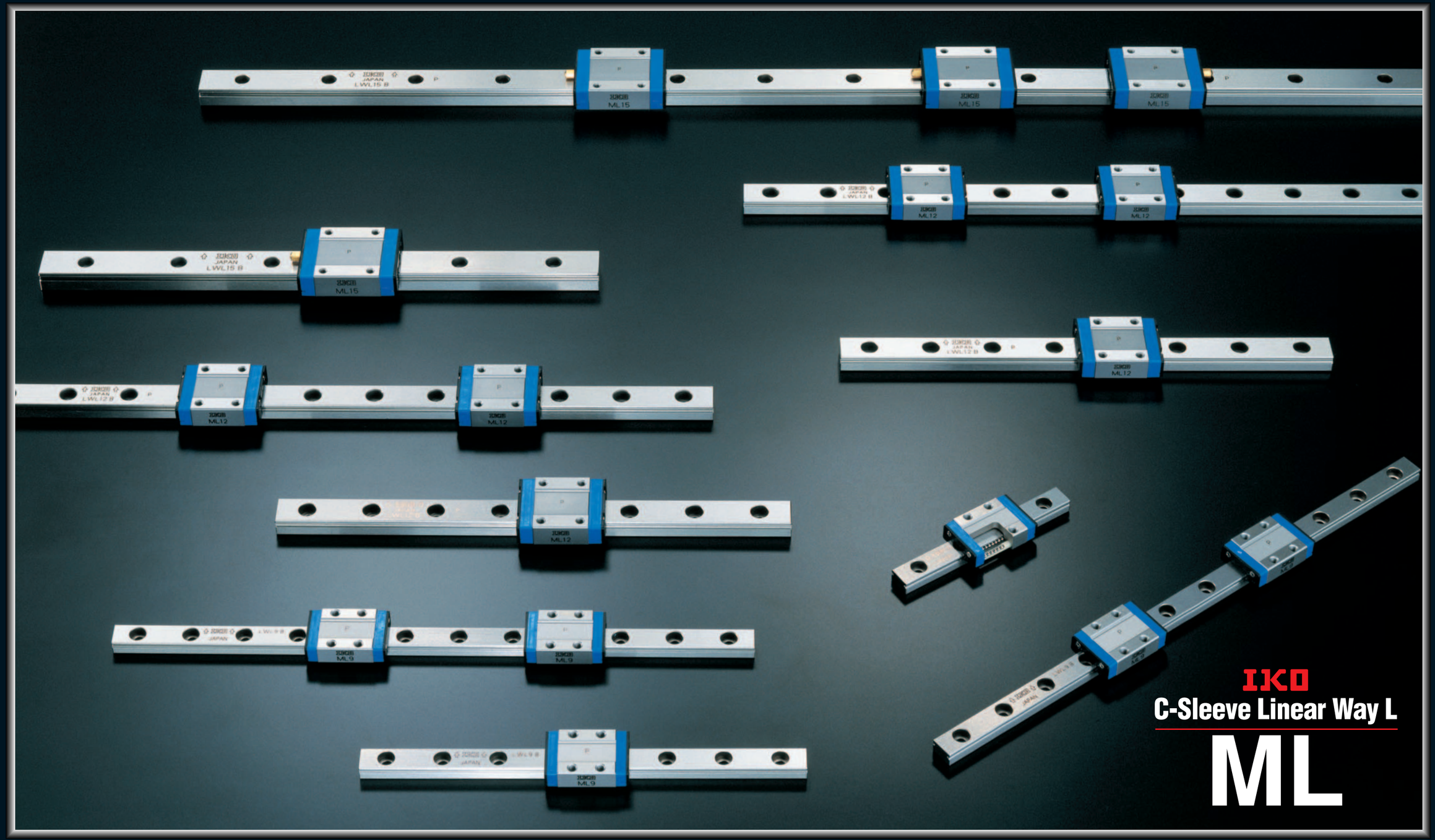
CAT-57126

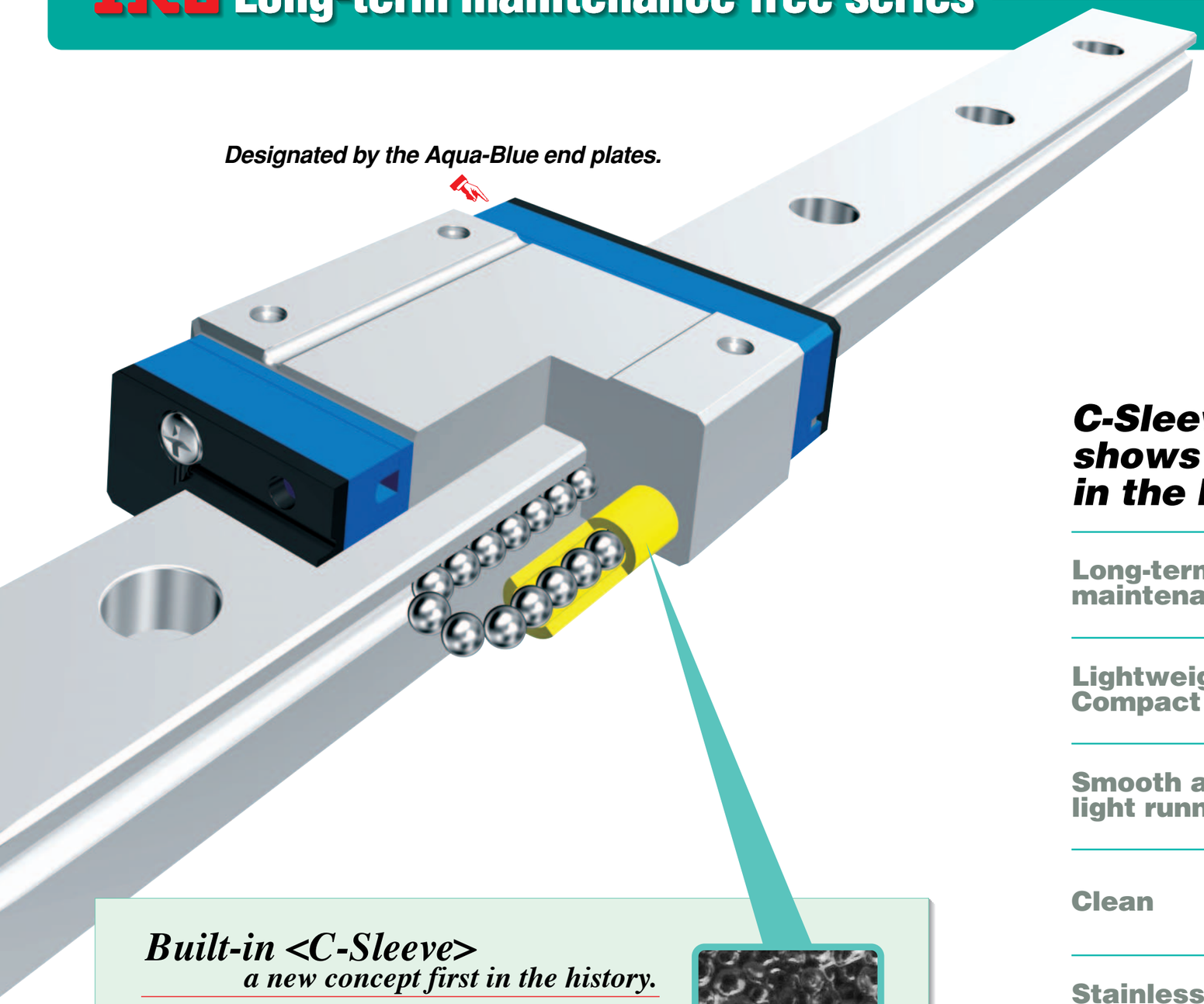
Long-term maintenance free series

Built-in component part for lubrication <C-Sleeve> from a new concept in the miniature type Linear Way series introduced first in the history.

IKO C-Sleeve

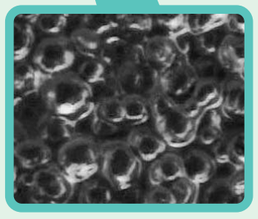
Extended relubrication interval
Perfect for hard-to-relubricate area
Suitable for free-from-oil application





Built-in <C-Sleeve>
a new concept first in the history.

C-Sleeve (Capillary Sleeve) is a component part for lubrication originally developed by IKO. This is a porous sintered resin made in the form of a sleeve by sintering fine resin powder and impregnating a large amount of lubricant into its continuous open pores.



Texture of C-Sleeve (x 200)

IKO C-Sleeve

C-Sleeve, built into the slide unit, shows significant savings in the both the lubricant and its control.

Long-term maintenance free

The lubricant in the C-Sleeve keeps the lubrication performance for a long period of time, so that the man-hours for troublesome lubrication control can be reduced and achieves long-term maintenance free operations (5 years or 20,000 km).

Lightweight and Compact

Incorporating C-Sleeve in the Linear Way L of the miniature series provides a lightweight compact slide unit without changing the external dimensions. (Dimensionally equal to LWL series)

Smooth and light running

C-Sleeve is not in contact with the track rail. This permits smooth and light slide motion without increasing the rolling resistance.

Clean

C-Sleeve will not contaminate machines with excessive lubricant, and is suitable for applications in food processing and in a clean environment. For clean room applications, a low dust lubricant specification is available to achieve the required operating performance. Contact IKO for further information.

Stainless steel made

The metal components of the C-Sleeve Linear Way L are manufactured in corrosion resistant stainless steel. This makes the units most suitable for applications in special environments and where lubricants and corrosion protection oils are prohibited.

Safety-assured structure

For the ease of mounting on machines or equipments, the slide units have steel ball-retaining bands incorporated within its structure to prevent the loss of the rolling elements (balls) when the slide unit is removed from the track rail.

Durability test results with IKO C-Sleeve

To confirm the endurance performance of C-Sleeve, running tests under different conditions were conducted as shown below.
C-Sleeve Linear Way L has traveled 80,000 km at a high-speed test at the maximum speed of 240 m/min with no load and has also traveled 30,000 km at a high-acceleration test with an acceleration of 26G and still keep running.
C-Sleeve Linear Way L has satisfied the service life rating at a high-load test with an applied load of 0.4*C*. C-Sleeve Linear Way has been proved its sufficient lubrication performance from those tests.

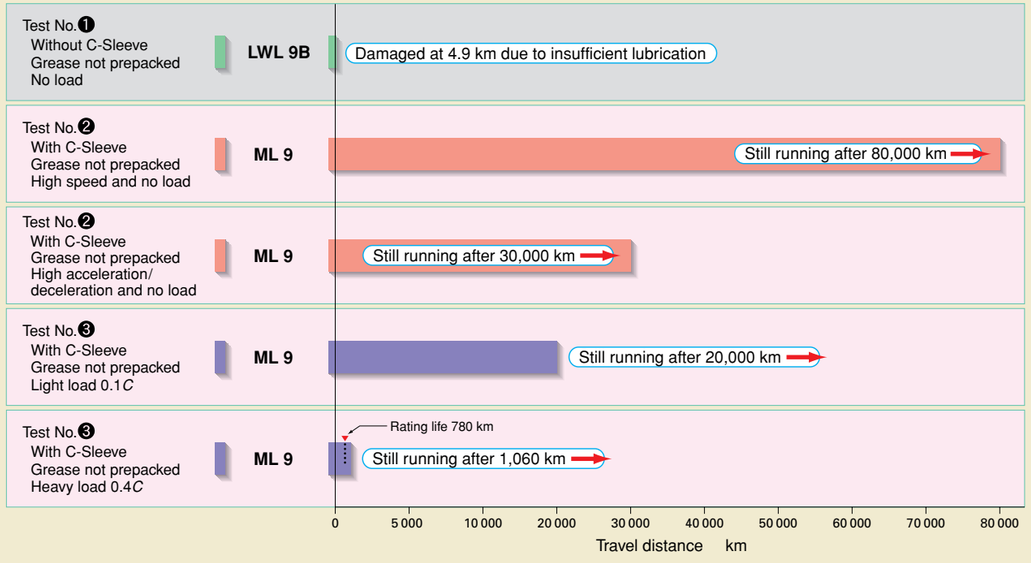
Test conditions and results

Durability test results of C-Sleeve Linear Way L

Test No.	Test condition			Test piece	Applied load (1) N	Test speed m/min	Acceleration/ Deceleration G	Calculated service life *L* km	Test results (conditions of test piece)
	C-Sleeve	Grease	Applied load						
❶	Not used	Not prepacked	No load	LWL 9B	—	64	0.5	—	Damaged at 4.9 km due to insufficient lubrication
❷	Used	Not prepacked	No load	ML 9	—	240	3.4	—	Still running after 80,000 km
						240	26	—	Still running after 30,000 km
❸	Used	Not prepacked	Loaded	ML 9	0.1 *C*	120	1.7	50,000	Still running after 20,000 km
					0.4 *C*	64	0.5	780	Still running after 1,060 km

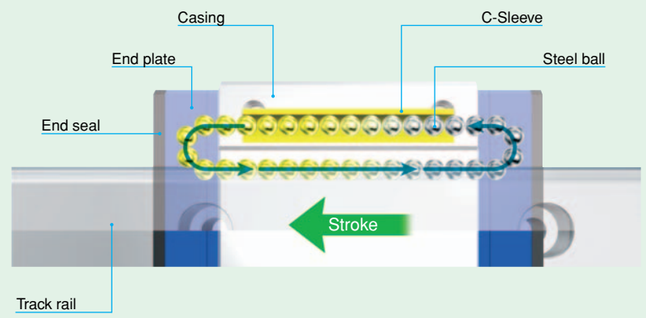
Note (1) : The applied load does not include the fixture weight.
Remark : IKO standard is provided with grease prepacked.

Durability test results



Long-term maintenance free

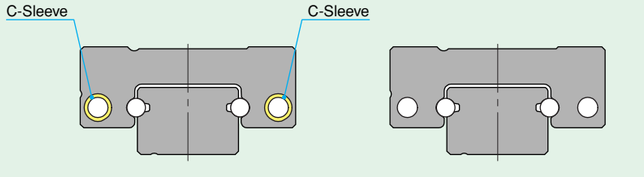
As the steel balls circulate, they make contact with the oil impregnated C-Sleeve, which evenly deposits proper amount of lubrication onto the rolling elements. This action provides lubrication to both the rolling elements and the raceways resulting in long-term maintenance free periods.



Lubrication mechanism of C-Sleeve

Lightweight and Compact
Smooth and light sliding

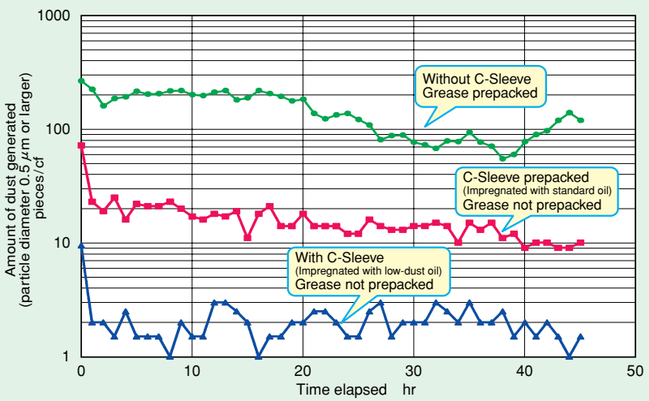
Incorporating C-Sleeve in the Linear Way L of the miniature series provides a light-weight and compactness with the same external and mounting dimensions as those of the standard type.
C-Sleeve is not in contact with the track rail. This permits smooth and light slide motion in the same way as the standard type.
C-Sleeve Linear Way having no external parts does not sacrifice the allowable stroke length.



C-Sleeve Linear Way L **Linear Way L**

Clean

For applications in clean rooms, low-dust specification that assures low level of dust generation is also available. Contact IKO for further information.



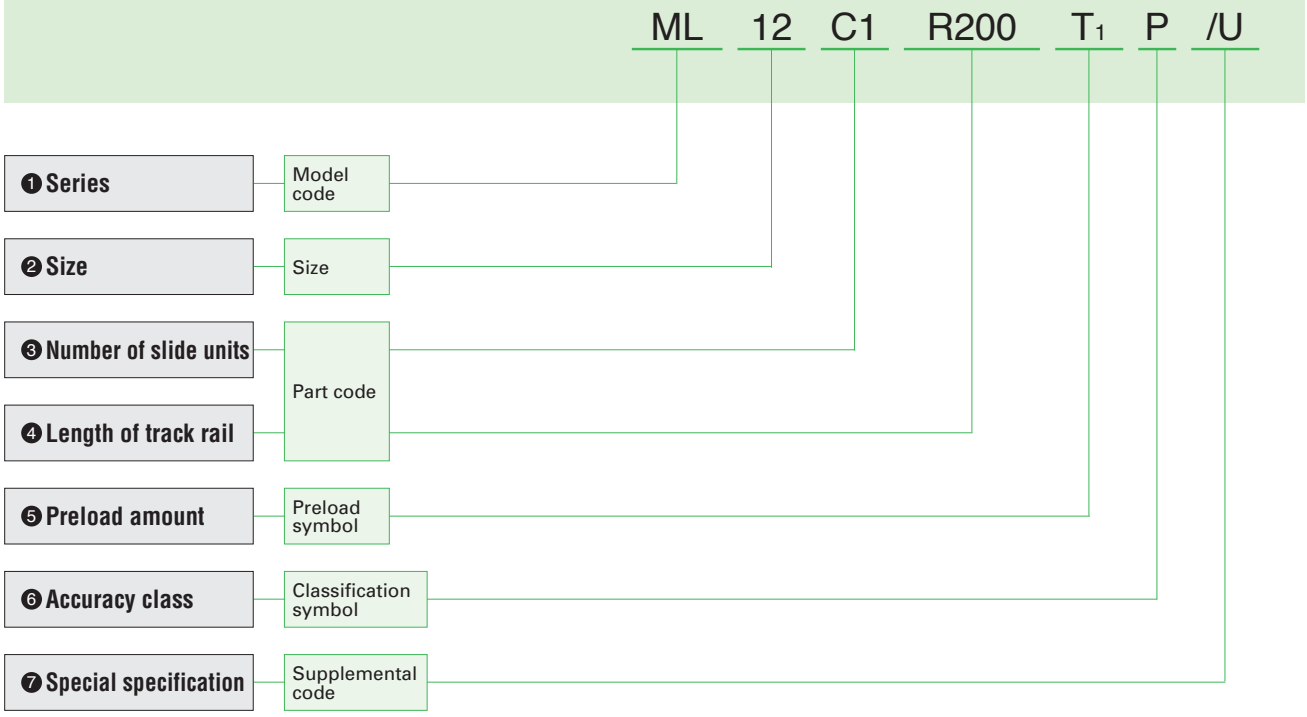
Dust generation characteristics of the low-dust specification of C-Sleeve Linear Way L*1

*1 Consult IKO for this specification.

Identification Number

The specification of C-Sleeve Linear Way L is indicated by the identification number, which consists of a model code, a size, a part code, a material symbol, a preload symbol, a classification symbol, and any supplemental codes.

Example of identification number



❶Series	ML	
❷Size	9, 12, 15	
❸Number of slide units	C○	For an assembled set, the number of slide units assembled on one track rail is indicated.
❹Length of track rail	R○	The length of track rail is indicated in millimeter (mm). For standard and maximum rail lengths, see Table 16 on page 16.
❺Preload amount	Clearance : T_0 Standard preload : No symbol Light preload : T_1	For details of preload amount, see Table 7 on page 11.
❻Accuracy class	High class : H Precision class : P	For details of accuracy classes, see Table 6 on page 10.
❼Special specification	/A, /D, /E, /I, /LR, /N, /S, /U, /W○	For applicable special specifications, see Table 8 on page 11.

Load Rating and Life

Basic dynamic load rating C

The basic dynamic load rating is defined as the constant load in both direction and magnitude under which a group of identical Linear Ways are individually operated and 90% of those in the group can travel 50 x 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. It is the allowable limit load that permits normal rolling motion. Generally, the basic static load rating is used in combination with the static safety factor.

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 (See Fig. 3.) is loaded. It is the allowable limit moment that permits normal rolling motion. Generally, the static moment rating is used in combination with the static safety factor.

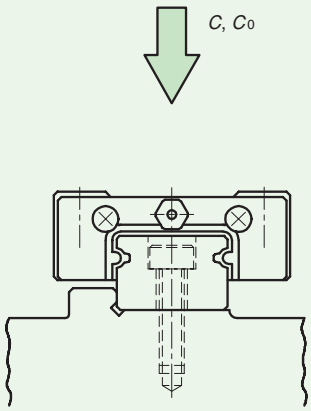


Fig. 1 Load direction

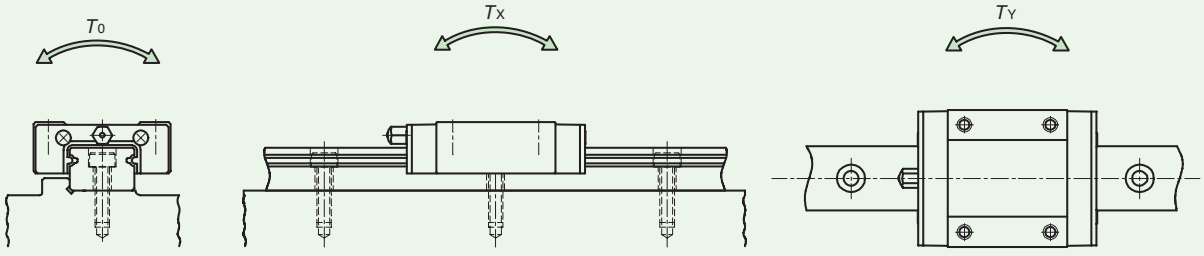


Fig. 2 Directions of static moment rating

Life

The rating life of C-Sleeve Linear Way L can be calculated by the following formula.

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

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

Accordingly, when the stroke length and the number of strokes per minute are given, the life in hours can be calculated from the following formula.

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

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

Static safety factor

The static safety factor of C-Sleeve Linear Way L can be calculated by the following formula.

$$f_s = \frac{C_0}{P_0} \quad \cdots\cdots(3)$$

where, f_s : Static safety factor
C_0 : Basic static load rating, N
P_0 : Applied load (maximum load), N

Table 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

Load factor

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

Table 2 Load factor

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

Dynamic equivalent load

When a load is applied in a different direction from the direction of the basic dynamic load rating of C-Sleeve Linear Way L or a complex load is applied, obtain the dynamic equivalent load to calculate the service life rating.
Obtain the downward and lateral conversion loads from the load of each direction.

$$F_{re} = k_r|F_r| + \frac{C_0}{T_0}|M_0| + \frac{C_0}{T_X}|M_X| \quad \cdots\cdots(4)$$

$$F_{ae} = k_a|F_a| + \frac{C_0}{T_Y}|M_Y| \quad \cdots\cdots(5)$$

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 T_0 direction, N-m
M_X : Moment in T_X direction, N-m
M_Y : Moment in T_Y direction, N-m
k_r, k_a : Conversion factor in the load direction (see Table 4.)
C_0 : Basic static load rating, N
T_0 : Static moment rating in T_0 direction, N-m
T_X : Static moment rating in T_X direction, N-m
T_Y : Static moment rating in T_Y direction, N-m

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

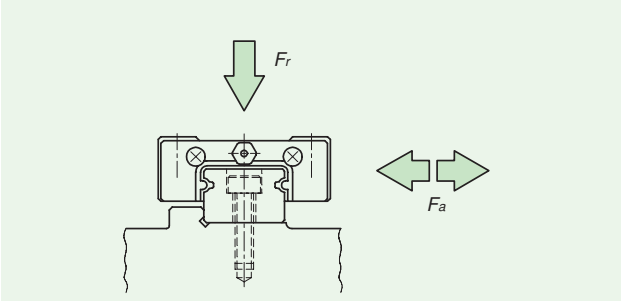
$$P = XF_{re} + YF_{ae} \quad \cdots\cdots(6)$$

where, P : Dynamic equivalent load, N
X, Y : Dynamic equivalent load factor (see Table 3.)
F_{re} : Downward conversion load, N
F_{ae} : Lateral conversion load, N

Table 3 Dynamic equivalent load factor

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

Table 4 Conversion factor by load direction



Size	Conversion factor		
	k_r		k_a
	$F_r \geqq 0$	$F_r < 0$	
9, 12, 15	1	1	1.13

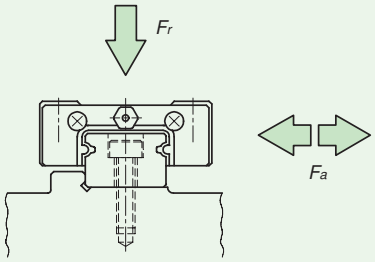
Static equivalent load

When a load is applied in a different direction from the direction of the basic static load rating of C-Sleeve Linear Way L or a complex load is applied, obtain the static equivalent load to calculate the static safety factor.

$$P_0 = k_{0r}|F_r| + k_{0a}|F_a| + \frac{C_0}{T_0}|M_0| + \frac{C_0}{T_X}|M_X| + \frac{C_0}{T_Y}|M_Y| \quad \cdots(7)$$

where, P_0 : Static equivalent load, N-m
F_r : Downward load, N
F_a : Lateral load, N
M_0 : Moment in T_0 direction, N-m
M_X : Moment in T_X direction, N-m
M_Y : Moment in T_Y direction, N-m
k_{0r}, k_{0a} : Conversion factor in the load direction (See Table 5.)
C_0 : Basic static load rating, N
T_0 : Static moment rating in T_0 direction, N-m
T_X : Static moment rating in T_X direction, N-m
T_Y : Static moment rating in T_Y direction, N-m

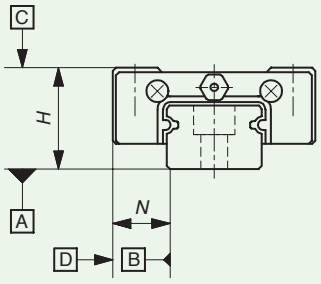
Table 5 Conversion factor by load direction



Size	Conversion factor		
	k_{0r}		k_{0a}
	$F_r \geqq 0$	$F_r < 0$	
9, 12, 15	1	1	1.19

The accuracy of C-Sleeve Linear Way L is shown in Table 6.

Table 6 Accuracy Table



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
Parallelism in operation of C to A	See Fig. 3	
Parallelism in operation of D to B	See Fig. 3	

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

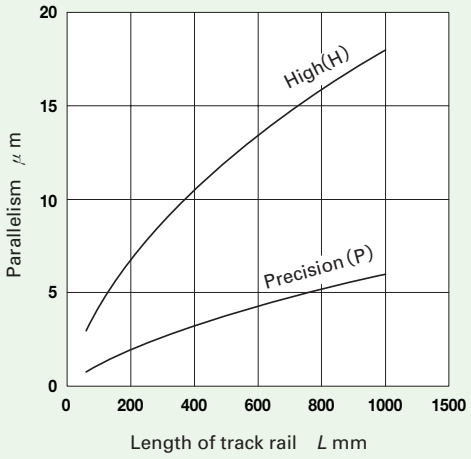


Fig.3 Parallelism in operation

Preload

The average amount of preload for C-Sleeve Linear Way L is shown in Table 7.

Table 7 Preload amount

Item / Preload type	Symbol	Preload amount (N)	Application
Clearance	T_0	0 (1)	· Very smooth motion
Standard	(No symbol)	0 (2)	· Smooth and precise motion
Light preload	T_1	$0.02C_0$	· Minimum vibration · Load is equally balanced. · Smooth and precise motion

Note(1): Zero or minimal amount of clearance
(2): Zero or minimal amount of preload
Remark: C_0 denotes the basic static load rating.

Special specifications

C-Sleeve Linear Way L of the special specifications shown in Table 8 are available.
When a special specification is required, add the applicable supplemental code to the end of the identification number. If a combination of several special specifications is required (see Table 9.), arrange their supplemental codes in alphabetical order.

Table 8 Special specifications

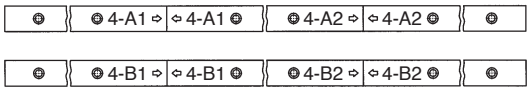
Special specification	Supplemental code
Butt-jointing track rail	/A
Opposite reference surfaces arrangement	/D
Specified track rail mounting hole positions	/E
With Inspection sheet	/ I
Black chrome surface treatment (track rail)	/LR
No end seal	/N
Track rail with stopper pins	/S
Under seals	/U
Matched sets to be used as an assembled group	/W○

Table 9 Combination of special specifications

	A	D	E	I	LR	N	S	U
D	○							
E	–	–						
I	○	○	○					
LR	–	○	○	○				
N	○	○	○	○	○			
S	○	○	○	○	○	○		
U	○	○	○	○	○	–	○	
W	○	○	–	○	○	○	○	○

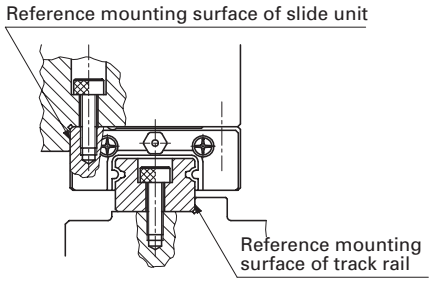
Remark: The specifications marked ○ in this table can be combined.

Butt-jointing track rails /A



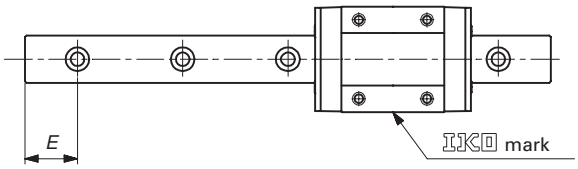
When the required length of track rail exceeds the maximum length shown in Table 16, two or more track rails can be used by butt-jointing them in the direction of linear motion. For the length and the number of butt-jointing track rails, consult IKO for further information.

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 track 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.

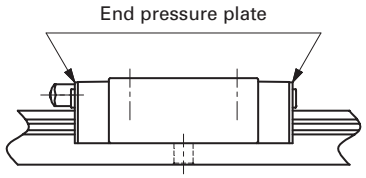
With Inspection sheet /I

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

Black chrome surface treatment /LR

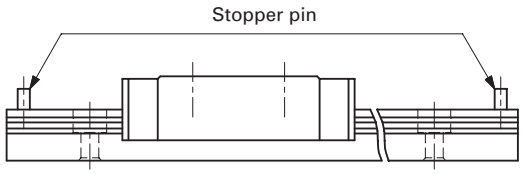
After a black permeable chrome film is formed on the track rail by treatment, acrylic resin is coated to improve the corrosion resistance.

No end seal /N



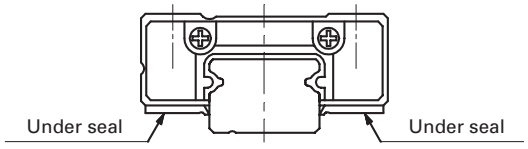
End seals at both ends of slide unit are replaced with end pressure plates that are not in contact with the track rail to reduce frictional resistance. The under seals are not assembled.
This specification is not effective for dust protection.

Track rail with stopper pins /S



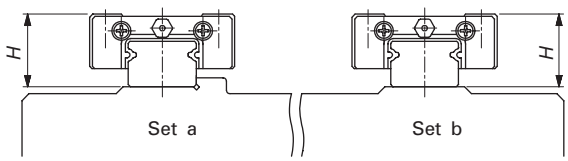
To prevent the slide unit of Linear Way L from slipping off, stopper pins are provided at both ends of the track rail. For dimensions of the track rail with stopper pins, see Table 10.

With under seals /U



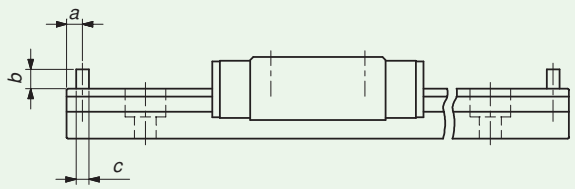
To prevent foreign substances from intruding from the lower side of Linear Way, seals are provided on the bottom faces of slide unit. For size H_1, see Table 11.

Matched sets to be used as an assembled group /W



For two or more sets of C-Sleeve Linear Way L used on the same plane, the dimensional variation of *H* of Linear Way L is kept within the specified range.
The dimensional variation of dimension H in matched sets is the same as that in a single set.
When ordering, indicate the number of sets, which is always represented by the number of track rails, after "/W".

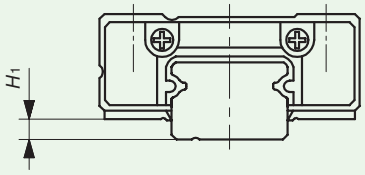
Table 10 Dimensions of track rail with stopper pins (Supplemental code /S)



unit: mm

Model number	*a*	*b*	*c*
ML 9	2.5	3	2
ML 12			
ML 15		4	

Table 11 Dimension H_1 of slide unit with under seals (Supplemental code /U)



unit: mm

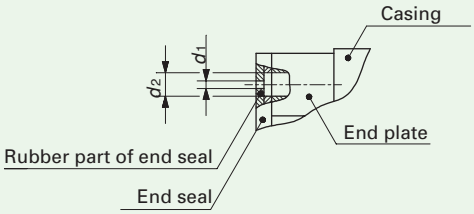
Model number	H_1
ML 9	1
ML 12	2
ML 15	3

Lithium-soap base grease (MULTEMP PS No.2 (KYODO YUSHI)) is pre-packed in C-Sleeve Linear Way L. Additionally, C-Sleeve (Capillary sleeve) a component part is placed in the ball re-circulation path, thereby extending the re-lubrication (greasing) interval time and reducing the maintenance work for a long period.

C-Sleeve Linear Way L is provided with an oil hole shown in Table 12 or a grease nipple shown in Table 13.

Supply nozzles matching the size of grease nipples and special grease injectors (miniature greaser) matching the size of oil holes are available. For these parts for lubrication, consult IKO for further information.

Table 12 Oil hole

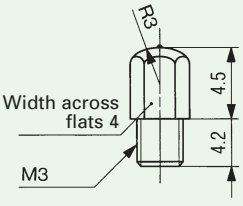


unit: mm

Identification number	Oil hole size	
	d_1	d_2
ML 9	0.5	1.5
ML 12		2

Table 13 Grease nipple

unit: mm

Identification number	Grease nipple	
	Type	Dimensions and shape
ML 15	A-M3	

Precautions for Use

❶ Mounting surface, reference mounting surface, and general mounting structure

To mount C-Sleeve Linear Way L, correctly fit the reference mounting surfaces B and D of the slide unit and the track rail to the reference mounting surfaces of the table and the bed, and then fix them tightly. (See Fig. 4.)

The reference mounting surfaces B and D and mounting surfaces A and C of C-Sleeve Linear Way L 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.

The slide unit reference mounting surface is always the side surface opposite to the IKO mark. The track rail reference mounting surface is identified by locating the IKO mark on the top surface of the track rail. The track rail reference mounting surface is the side surface above the IKO mark (in the direction of the arrow). (See Fig. 5.)

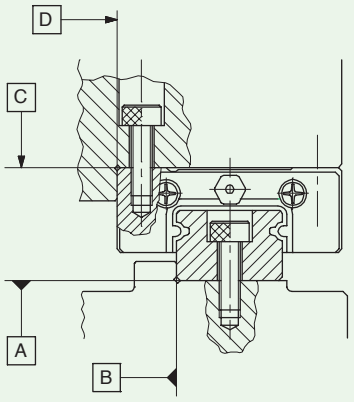


Fig. 4 Reference mounting surfaces and general mounting structure

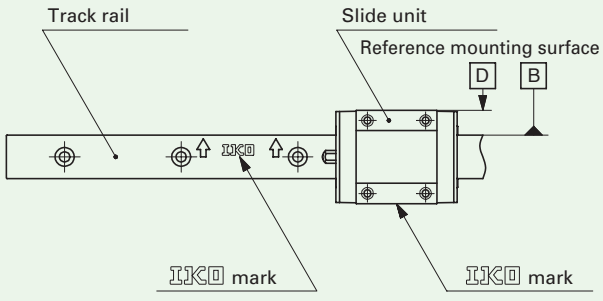
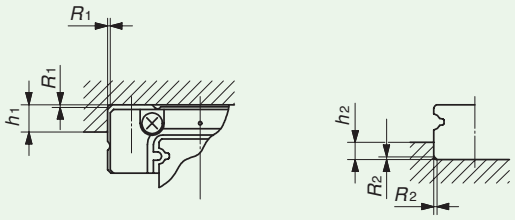


Fig. 5 Reference mounting surfaces

❷ 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 4. Otherwise, corner radius R_1 and R_2 are recommended shown in Table 14. Table 14 shows recommended shoulder heights and radius of the reference mounting surfaces.

Table 14 Shoulder heights and radius of the reference mounting surfaces



unit: mm

Model number	Slide unit		Track rail	
	Shoulder height h_1	Relieved radius R_1(max.)	Shoulder height(1) h_2	Relieved radius R_2(max.)
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

Note(1): For "with under seals" (supplemental code "/U"), it is recommended to use a value obtained by subtracting 1 mm from the value h_2 shown in the table. However, for "with under seals" of the size 9 models, 0.8 mm is recommended.

❸ Multiple slide units mounted in close distance

When using multiple slide units in close distance to each other, actual load may be greater than the calculated load depending on the mounting accuracy of the slide units on 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.

❹ Operating temperature

The maximum operating temperature is 80°C.

❺ Cleaning

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

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

Mounting

❶ When mounting multiple sets at the same time

In case of C-Sleeve Linear Way L, use an assembly of slide unit and track rail as delivered without changing the combination.

In the case of 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.

❷ Assembling a slide unit and a track rail

Steel balls are retained in C-Sleeve Linear Way L, 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 (steel ball holder).

Dummy rail is attached on model 9. The dummy rails for other models are also available. If required, consult IKO for further information.

❸ Cleaning of mounting surfaces

When mounting C-Sleeve Linear Way L, remove burrs and blemishes from the mounting surfaces and reference mounting surfaces of machines and equipment and wipe off the rust preventive oil and foreign substances with clean cloth.

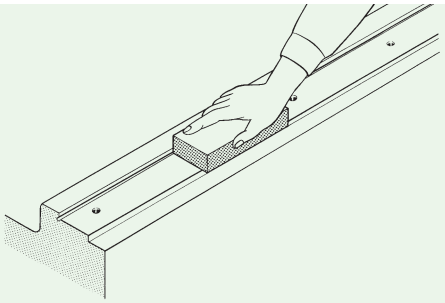


Fig. 6 Cleaning of mounting surfaces

❹ Tightening torque of mounting bolts

The standard torque values for mounting C-Sleeve Linear Way L on the mating steel made member are shown in Table 15. 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 15 Tightening torque of mounting bolts

Bolt size	Tightening torque N-m Stainless steel bolt (Property division A2-70)
M3 × 0.5	1.1

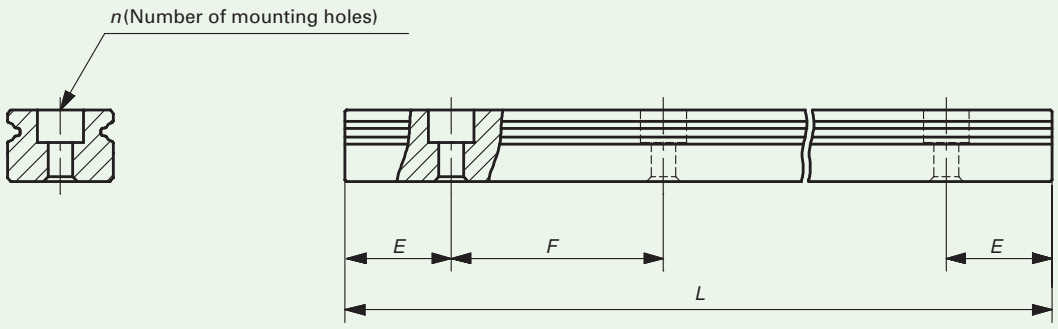
Track Rail Length

Standard and maximum lengths of track rails are shown in Table 16. Track rails in any length are also available. Simplyindicate the necessary length of track rail in millimeter (mm) in the identification number.

For track rail longer than the maximum length shown in Table 16, butt-jointing track rails are available upon request. In this case, indicate "/A" in the identification number.

E dimensions at both ends are the same unless otherwise specified. To change these dimensions, specify the specified rail mounting hole positions (supplemental code "/E") of special specification.

Table 16 Standard and maximum lengths of stainless steel track rails

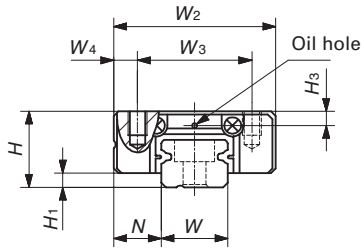


unit: mm

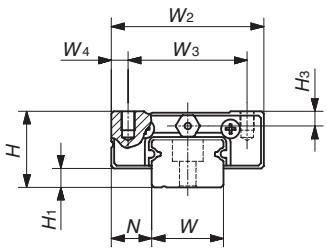
Item \ Model number	ML 9	ML 12	ML 15
Standard length $L(n)$	60(3) 80(4) 120(6) 160(8) 220(11) 280(14)	100(4) 150(6) 200(8) 275(11) 350(14) 475(19)	80(2) 160(4) 240(6) 320(8) 440(11) 560(14) 680(17)
Pitch of mounting holes F	20	25	40
E	10	12.5	20
Maximum length(1)	860 (960)	1 000 (1 200)	1 000 (1 200)
Maximum number of track rails for butt-jointing	2	2	2
Maximum length of butt-jointing track rails	1 660	1 925	1 880

Note(1): The track rails can be manufactured up to the maximum lengths shown in parentheses. If required, consult IKO for further information.

ML



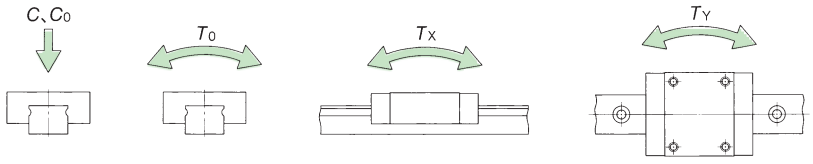
ML 9
ML 12

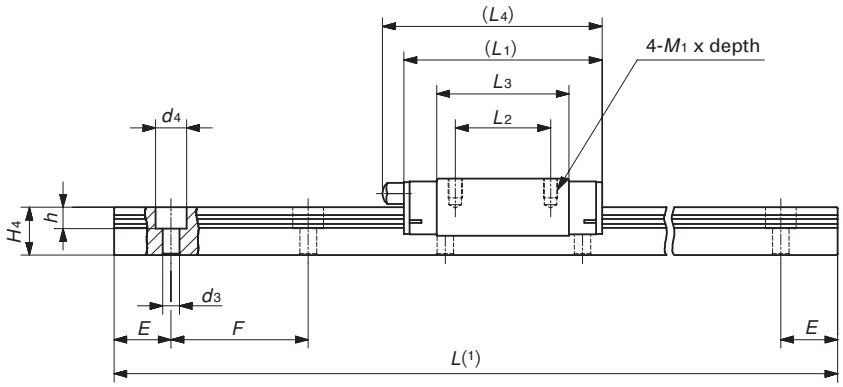


ML 15

Model number	Mass (Ref.) g		Dimensions of assembly mm			Dimensions of slide unit mm								
	Slide unit	Track rail (per 100mm)	H	H_1	N	W_2	W_3	W_4	L_1	L_2	L_3	L_4	$M_1 \times$ depth	H_3
ML 9	18	35	10	2	5.5	20	15	2.5	30	10	20.8	—	M3 × 3	2.2
ML 12	34	65	13	3	7.5	27	20	3.5	34	15	21.6	—	M3 × 3.5	2.7
ML 15	63	107	16	4	8.5	32	25	3.5	42	20	27.9	47	M3 × 4	3.1

Note(1): Track rail lengths L are shown in Table 16.
(2): The directions of basic dynamic load rating (C), basic static load rating (C_0), and static moment rating (T_0, T_X, and T_Y) are shown in the sketches below.
The upper values in the T_X and T_Y columns apply to one slide unit, and the lower values apply to two slide units in close contact.
Remarks: The appended bolts for mounting track rails are hexagon socket head bolts of JIS B 1176 or equivalent, or cross recessed head screws for precision equipment.





Dimensions of track rail mm							Appended mounting bolt for track rail mm	Basic dynamic load rating(2)	Basic static load rating(2)	Static moment rating(2)			Model number
W	H_4	d_3	d_4	h	E	F	Bolt size × ℓ	C N	C_0 N	T_0 N-m	T_X N-m	T_Y N-m	
9	6	3.5	6	3.5	10	20	M3 × 8	1 610	2 860	13.3	9.4 53.0	7.9 44.5	**ML 9**
12	8	3.5	6.5	4.5	12.5	25	M3 × 8	2 960	4 450	27.6	16.0 96.6	13.4 81.1	**ML 12**
15	10	3.5	6.5	4.5	20	40	M3 × 10	4 390	6 730	51.8	30.8 178	25.9 149	**ML 15**

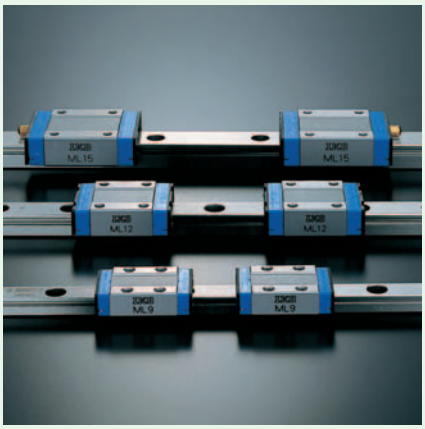
Example of identification number of assembled set

ML 12 C2 R275 T_1 P /U

- ML — Model code: ML
- 12 — Size
- C2 — Number of slide units (two slide units)
- R275 — Length of track rail (275mm)
- T_1 — Preload amount: Clearance : T_0; Standard : No symbol; Light preload : T_1
- P — Accuracy class: High : H; Precision : P
- /U — Special specification: With under seals

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

ML



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