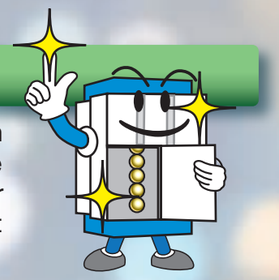
IKO's unique ideas and experiences are utilized to explore new world for special environment applications.

IKO Linear Way and Linear Roller Way are available for various special environment by using different materials and grease, surface treatment and dust protection measures, etc. Typical application fields and major countermeasures are described below.

Clean Environment



When the Linear Way or Linear Roller Way is used in clean environment such as a clean room, it is required that the environment is not polluted by dust-generation by the Linear Way or Linear Roller Way and it must have excellent rust prevention property as rust prevention oil cannot be used.

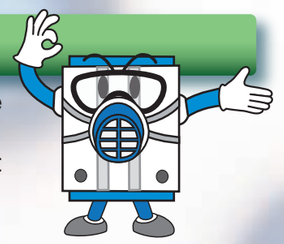
Vacuum Environment

When the Linear Way or Linear Roller Way is used in vacuum environment, it is required that the gas discharged from the Linear Way or Linear Roller Way does not pollute the environment or reduce the degree of vacuum, and it must have excellent rust prevention property as rust prevention oil cannot be used.

Heat Resistance Measures

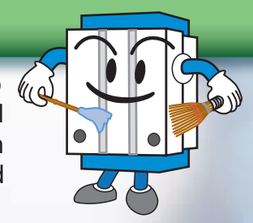
When the Linear Way is used in an environment where temperature is higher than usual, heat resistance of synthetic resin components and metal parts will be an issue.

Dust Protection



If dust such as metal or wooden chips get into the way of the Linear Way or Linear Roller Way, reduction of life and accuracy may be caused. Therefore, measures to prevent foreign substances from entering into the way are necessary.

Spatter Protection



Spatter of welding, etc. is so hot that it adheres to components. Foreign substances adhering to the track rail firmly cannot be fully removed by normal dust protection measures, so measures to avoid adherence and enhanced foreign substances removal measures are necessary.

Clean

- ○ Hybrid Lubrication Linear Way L
- ○ Stainless Linear Way and Linear Roller Way
- ● Black chrome surface treatment
- ● Specified grease (CG2 or CGL grease)
- ◇ Fluorine grease

Corrosion resistance

- ○ Non-Magnetic Hard Alloy Linear Way L
- ○ Stainless Linear Way and Linear Roller Way
- ● Black chrome surface treatment

Vacuum

- ○ Vacuum Environment Linear Roller Way Super X
- ○ Hybrid Lubrication Linear Way L
- ● No end seal
- ● Stainless steel end plate
- ◇ Fluorine grease

Heat resistance

- ● Stainless steel end plate
- ● Special environment seal
- ● Specified grease (CG2 grease)
- ◇ High temperature grease

Foreign substances (wood chips and metal powder, etc.)

- ○ Linear Way H Ultra seal specification
- ○ Track rail mounting from bottom
- ● Double end seals
- ● Scrapers
- ● C-Wiper
- ● Caps for rail mounting holes
- ● Rail cover plate for track rail
- ● Rail cover sheet
- ● Female threads for bellows
- ● Specific bellows

Spatter

- ● Scrapers
- ● Caps for rail mounting holes (aluminum alloy)
- ● Rail cover sheet
- ● Fluorine black chrome surface treatment
- ● Stainless steel end plate

○ **Linear motion rolling guide series for special environment :**
Collective name of linear motion rolling guide series models corresponding to special environment.

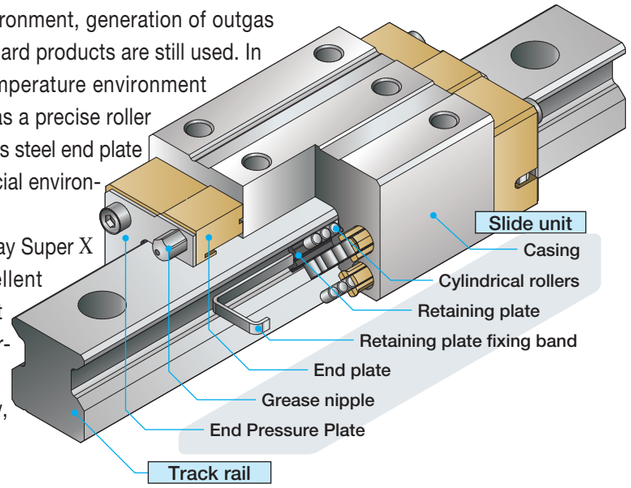
● **Special specification for special environment :**
Special specification corresponding to special environment by combination of linear motion rolling guide series.

◇ **Lubricant :**
Lubricant suitable for each special environment can be selected.

Vacuum Environment
Linear Roller Way Super X

When a linear motion rolling guide is used in vacuum environment, generation of outgas from resin parts such as end plates will be an issue if standard products are still used. In addition, the specification must be applicable to high temperature environment during baking. As roller type linear motion rolling guide has a precise roller circulation structure, it has not been compatible with stainless steel end plate widely used in ball type linear motion rolling guides for special environment applications.

The newly developed Vacuum Environment Linear Roller Way Super X is a roller type linear motion rolling guide realizing excellent outgas reduction property by combining corrosion-resistant stainless steel casing and resin parts such as super engineering plastic (PEEK resin) end plate to resolve these issues. Excellent properties of roller type such as high load capacity, high rigidity and smooth sliding characteristic with low frictional resistance can be ensured even under vacuum environment.



Features

Newly developed!
Roller type linear motion guide available under vacuum environment!

1 Corresponding to low to high vacuum area (degree of vacuum 10^{-3} [Pa])!

2 Excellent outgas reduction property!

3 Baking temperature can be up to 200°C!

- Temperature in still condition.
- If baking temperature exceeds 150°C, multiply the basic load rating by the temperature factor.

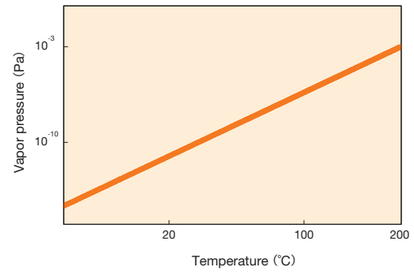
4 Excellent corrosion resistance!

- Corrosion-resistant stainless steel is used in all steel made parts.

Selection of lubricant

Though fluorine grease is recommended for lubricant, carefully select grease since vapor pressure and temperature of base oil are correlated as vapor pressure goes up along with increase of the temperature.
For details, see chosen grease manufacturer's catalog.

Relationship example between fluorine grease vapor pressure and temperature



■ Representative brands of fluorine grease

Brand	Manufacturer
BARRIERTA SUPER IS/V	NOK KLUVER
DEMNUM™ GREASE L-200	DAIKIN INDUSTRIES, LTD.
FOMBLIN® VAC3	SOLVAY SOLEXIS
FULLTRIBO VAC	KYODO YUSHI CO., LTD.
KRYTOX® LVP	DU PONT

Remarks 1. KRYTOX® is a registered trademark of DU PONT.
2. FOMBLIN® is a registered trademark of SOLVAY SOLEXIS.

Specifications

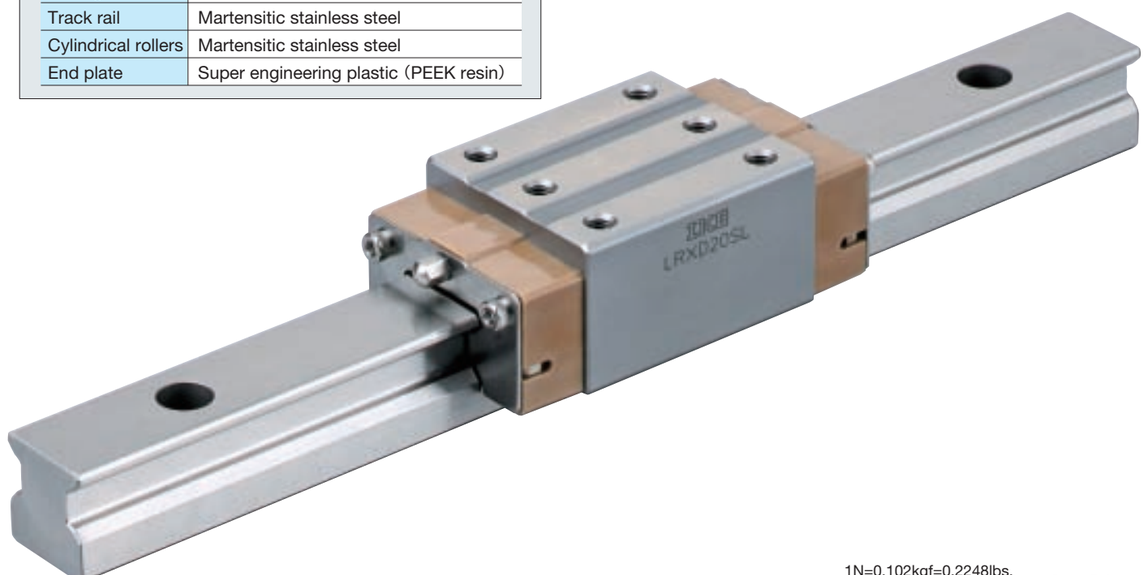
We can offer optimal specification for your use conditions. If needed, please contact IKO.

● Applicable products

Series	Linear Roller Way Super X
Applicable model	LRXD20···SL

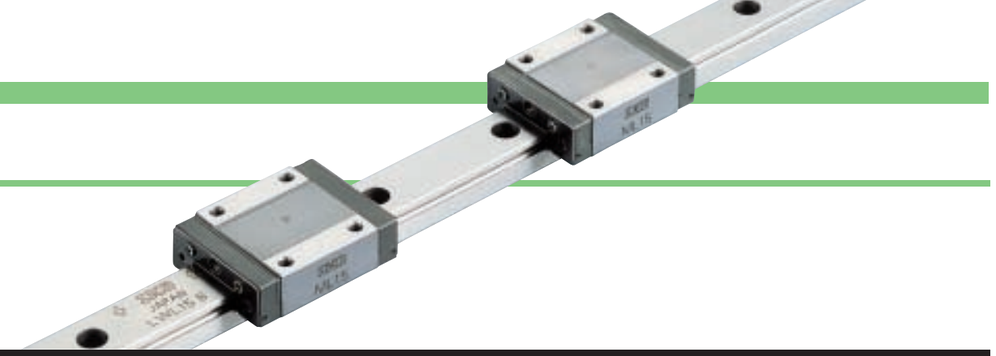
■ Main component materials

Casing	Martensitic stainless steel
Track rail	Martensitic stainless steel
Cylindrical rollers	Martensitic stainless steel
End plate	Super engineering plastic (PEEK resin)

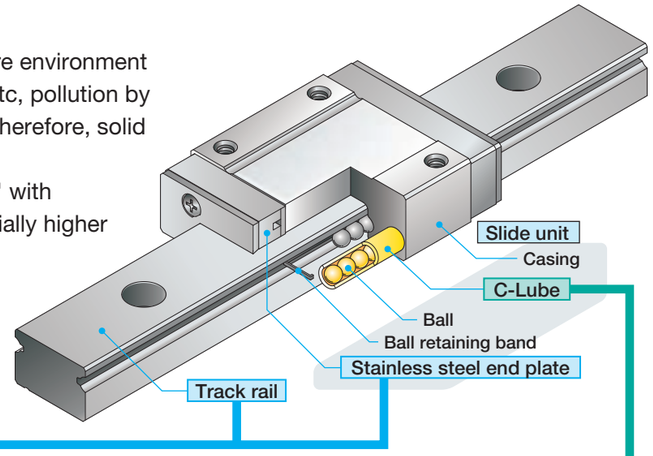


1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Hybrid Lubrication Linear Way L



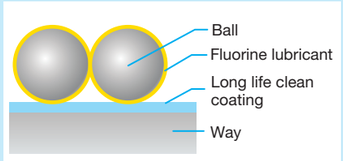
In clean environment, vacuum or high temperature environment of semiconductor producer and LCD producer, etc, pollution by outgas and particles is extremely not welcome. Therefore, solid lubrication film has been used as lubricant.
IKO developed "Hybrid Lubrication Linear Way" with dust-generation life and load resistance substantially higher than conventional solid lubrication film.
Optimal for applications where general grease or oil cannot be used, such as vacuum environment.



What is hybrid lubrication

IKO Hybrid system of IKO's landmark lubrication system "C-Lube" and newly developed "Low dust-generation coating" achieves low dust generating performance, outgas reduction property, long life and excellent load resistance of Linear Way.

Low dust-generation coating

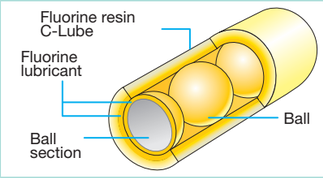


"Low dust-generation coating" consists of special high molecule fluorine lubricant of thinned submicron order, forming a gel lubricant film firmly adhering to metal surface with special jointing.

Hybrid lubrication

Lubricant supplied from C-Lube to ball surface and low dust-generation coating ensure excellent adherence and super low dust-generation performance.

Fluorine lubricant + Fluorine resin C-Lube



Poromeric fluorine resin lube is adopted for newly developed "C-Lube" incorporated in ball circulation path and impregnated fluorine lubricant is constantly supplied by minute amount to the ball surface by capillary from micro air holes to form stable lubrication film.

Features

Clean
(Low dust-generation)
JIS cleanliness class 4 compliant
(Up to 352 particles of diameter 0.5 $\mu m/m^3$)

Vacuum
Corresponding to low to high vacuum environment

High temperature property
~200℃※ (fluorine lubricant and fluorine resin C-Lube are adopted) compliant

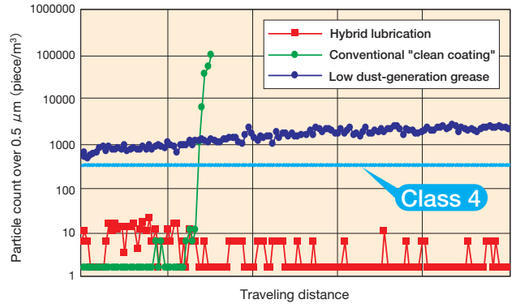
Load resistance
Load resistance more than double of general clean coating

※ For continuous operation, up to 150℃.

Performance

Class 4 low dust generating performance

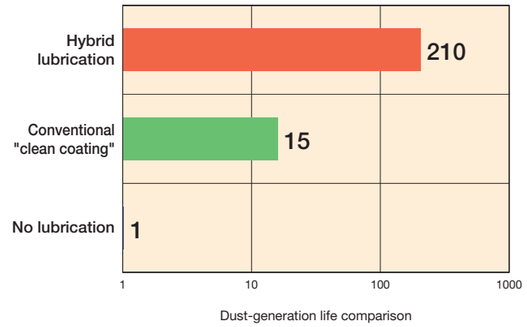
Dust-generation property



Test conditions Model : ML9 equivalent load: 80N stroke: 500 mm

Life 10 times longer than general clean coating is achieved

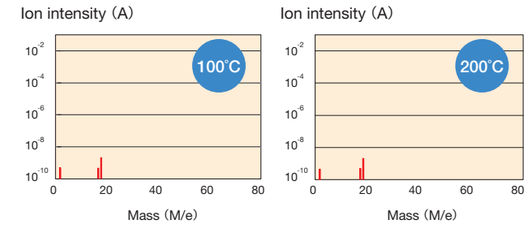
Dust-generation life comparison



Dust-generation life comparison

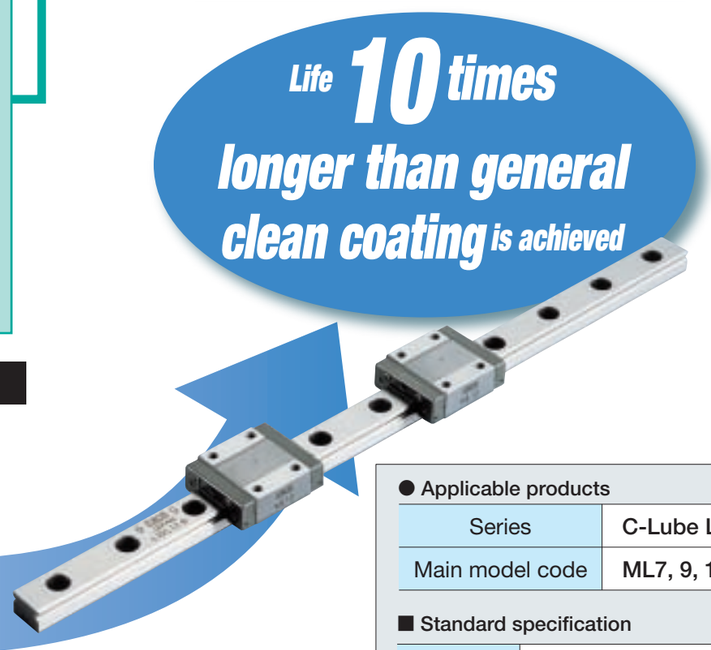
Excellent outgas reduction property

Outgas reduction property



Outgassing property of Hybrid Lubrication Linear Way

Measuring condition Model : ML9 Degree of vacuum: 10^{-5} Pa Temperature: 100℃, 200℃



● Applicable products

Series	C-Lube Linear Way ML
Main model code	ML7, 9, 12, 15

■ Standard specification

Casing	Martensitic stainless steel
Track rail	Martensitic stainless steel
Ball	Martensitic stainless steel
End plate	Stainless steel
C-Lube	Poromeric fluorinated resin

This is made-to-order. If needed, please contact IKO. In addition, we also offer non-magnetic stainless steel specification. Please ask us for your request.

● Precaution for Use

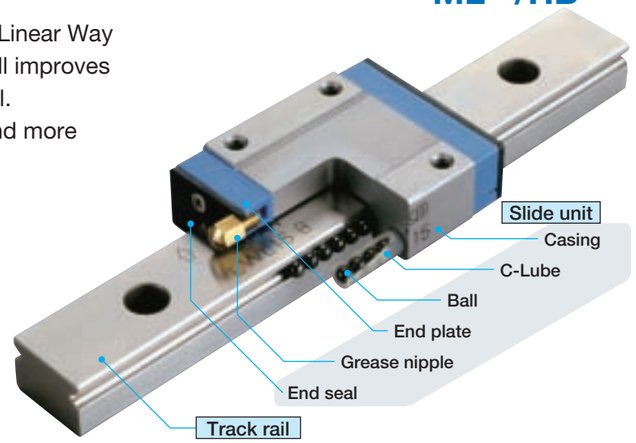
1. Although heat resistant fluorinated lubricant and parts are used, operating temperature shall be 200℃ at the maximum or up to 150℃ for continuous operation.
2. The unit must be stored in a dry and clean place and unpacked in the same environment right before use. In addition, do not touch the product directly by bare hand.
3. Hybrid Lubrication Linear Way is packed in clean condition and therefore cleaning is not necessary. In addition, do not wipe off the coating film on the raceway as it may affect lubrication and dust-generation properties.

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

Hybrid C-Lube Linear Way ML

ML…/HB

While maintenance free performance of C-Lube Linear Way ML is maintained, the silicon nitride ceramics ball improves high-speed performance and reduces noise level. Ceramics has more resistance to deformation and more rigidity than bearing steel and stainless steel.



■ Standard specification

Casing	Martensitic stainless steel
Track rail	Martensitic stainless steel
Ball	Silicon nitride ceramics
C-Lube	Capillary lubricating element (Porous resin)

Features

1 Superior high-speed performance ••• More than three times durability

2 Noise reduction •••••••••• Noise reduction by about 4.5 dB

3 High rigidity •••••••••• Displacement volume reduced by about 10%

4 Superior abrasion resistance ••• Preload reduction volume is about one fourth

※ All of the above based on comparison with our C-Lube Linear Way ML

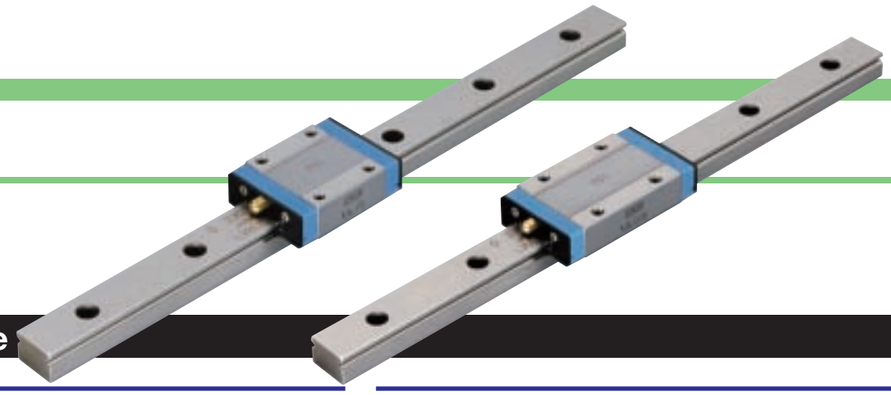
+

Maintenance free
Achieved long term maintenance free

Eco-friendly
Minimized lubrication oil consumption

Compact
Integral lubrication parts

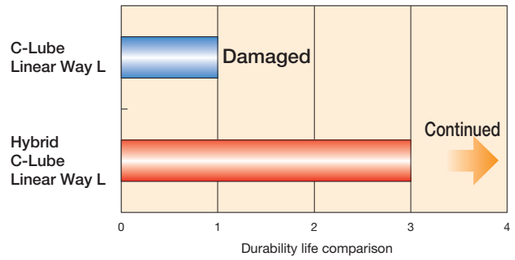
Smooth
Excellent sliding characteristic



Performance

More than three times durability

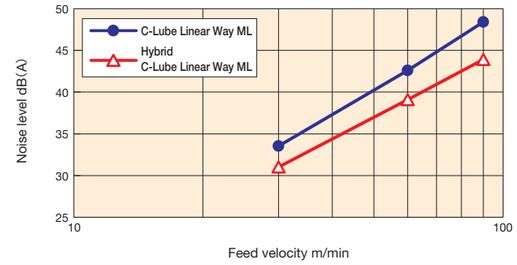
High-speed performance



Test conditions Model : ML12 Velocity: 300 m/min Acceleration: 40 G

Noise reduction by about 4.5 dB

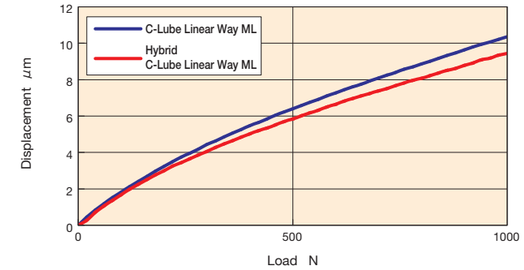
Low decibel



Test conditions Model : ML12 Measurement velocity: 30, 60, 90 m/min

Small deformation of rolling elements and excellent rigidity

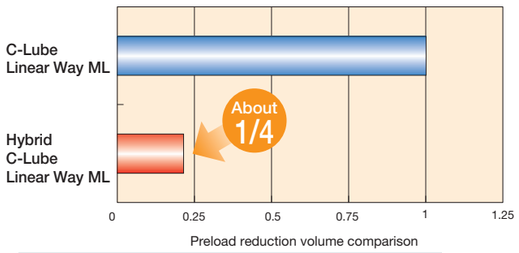
High rigidity



Test conditions Model : ML12 Preload: Standard Preload Load direction: Downward

Low preload reduction volume and accuracy maintained after operation

Abrasion resistance

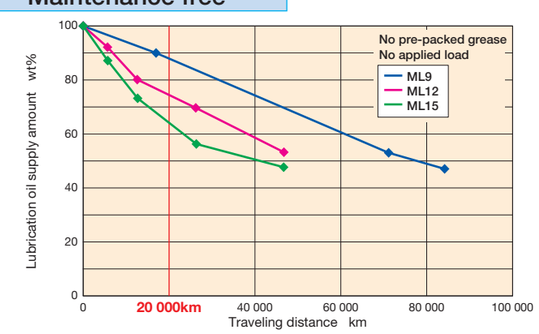


Test conditions Model : ML12 Velocity: 300 m/min Acceleration: 40 G Traveling distance: 13,000 km

Basic performance of C-Lube Linear Way

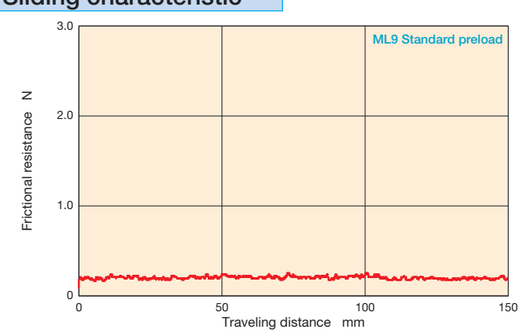
Achieved long term maintenance free

Maintenance free



Achieved light and smooth sliding

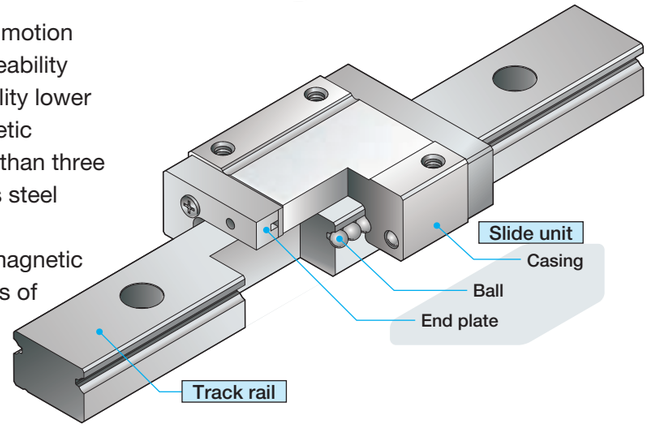
Sliding characteristic



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

Non-Magnetic Hard Alloy Linear Way L

Non-magnetic hard alloy Linear Way L is a linear motion rolling guide that realizes relative magnetic permeability lower than 1.001 and relative magnetic permeability lower than one tenth of that of conventional non-magnetic stainless steel products. Further, durability more than three times as higher as that of non-magnetic stainless steel products is realized.
Non-magnetic hard alloy Linear Way L is a non-magnetic linear motion rolling guide optimal to avoid effects of magnetic force in magnetic field environment.



Features

Relative magnetic permeability lower than 1.001

Relative magnetic permeability lower than one tenth of that of non-magnetic stainless steel products

More than three times durability

More than three times durability with hardness 1.5 times as much as that of non-magnetic stainless steel products

High corrosion resistance

Optimal for use in clean environment thanks to corrosion-resistant alloy

Easy handling

Casing and track rail have excellent ductility and coefficient of linear expansion similar to general metals as they are made of metal

Non-magnetic hard alloy characteristics

Characteristics \ Material name	Non-magnetic hard alloy	Silicon nitride ceramics	Non-magnetic stainless steel
Relative magnetic(1) permeability	1.001 or less	1 (0.999991)	1.01 or less (1.005)
Electric conductivity	○	×	○
Hardness (HV)	610 ～ 700	1400 ～ 1600	380 ～ 450
Linear expansion coefficient (×10-6/°C)	11.5 (30 ～ 200°C)	3.2 (20 ～ 400°C)	19.0 (20 ～ 400°C)
Specific gravity (g/cm)	7.7	3.2	7.9
Main component	Ni, Cr	Si_3N_4	Fe, Mn, Cr
Cost	○	△	○
Remark	Good corrosion resistance	Good corrosion resistance	—

Note (1) ( ) is only an example of the measurement value.

Selection of lubricant

By selecting appropriate lubricant such as vacuum grease and low dust-generating grease, this may be corresponding to any operating environment.

● Applicable products

Series	Linear Way L
Main model	LWL5···B ～ LWL15···B

Remark: No ball retaining band is included.

■ Main component materials

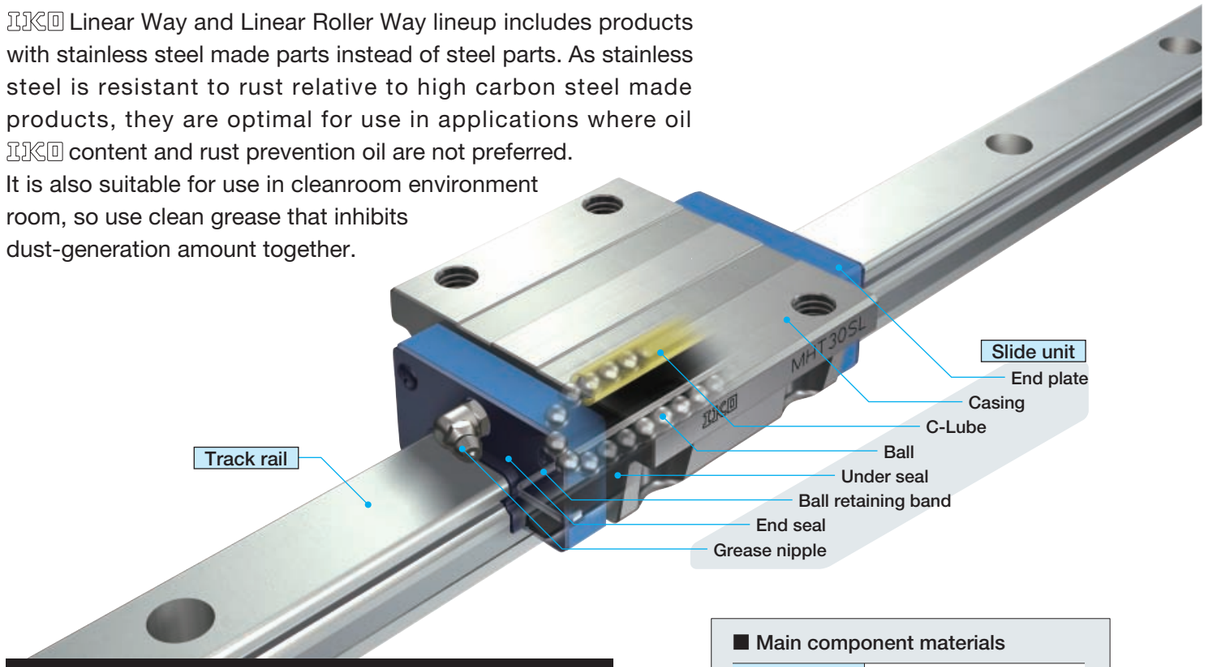
Casing	Non-magnetic hard alloy
Track rail	Non-magnetic hard alloy
Ball	Silicon nitride ceramics
End plate	Non-magnetic alloy steel

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

Stainless Linear Way and Linear Roller Way

A variety of stainless steel series

IKO Linear Way and Linear Roller Way lineup includes products with stainless steel made parts instead of steel parts. As stainless steel is resistant to rust relative to high carbon steel made products, they are optimal for use in applications where oil IKO content and rust prevention oil are not preferred.
It is also suitable for use in cleanroom environment room, so use clean grease that inhibits dust-generation amount together.



■ Main component materials

Casing	Martensitic stainless steel
Track rail	Martensitic stainless steel
Ball	Martensitic stainless steel
Ball retaining band	Stainless steel
End plate	Engineering plastic
End seal	Stainless steel + Synthetic rubber
Grease nipple	Brass

Series name

Linear Way

Ball Type Miniature Series

- C-Lube Linear Way ML
- Linear Way L
- Micro Linear Way L

Ball Type Compact Series

- C-Lube Linear Way ME
- Linear Way E

Ball Type High Rigidity Series

- C-Lube Linear Way MH
- Linear Way H

Ball Type Wide Type Series

- Linear Way F

Ball Type U-Shaped Track Rail Series

- C-Lube Linear Way MUL
- Linear Way U

Linear Roller Way

Roller Type

- C-Lube Linear Roller Way Super MX
- Linear Roller Way Super X

Combination with special specification corresponds to use in special environment!

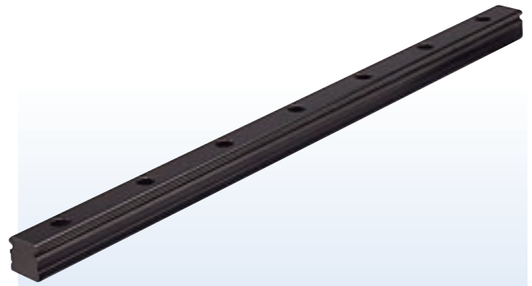
Rust prevention

Black chrome surface treatment /L

Black chrome surface treatment on the track rail and slide unit improves rust prevention capacity.

Fluorine black chrome surface treatment /LF

Coating of fluorinated resin is applied over the black chrome surface treatment to prevent foreign substances from sticking and improve the rust prevention capacity.

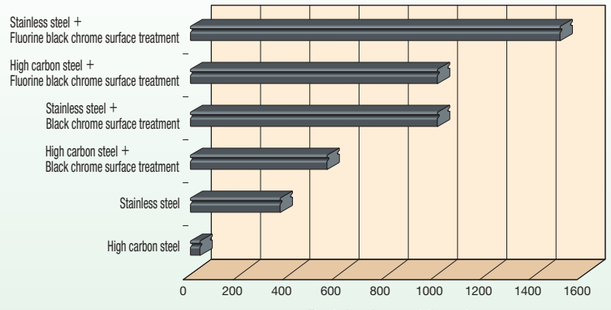


Black chrome surface treatment

Features

1. Thin film
2. Uniform film
3. Strong adhesion
4. Excellent rust prevention capacity
5. Low temperature processing to prevent distortion
6. No peeling and no effects on life and cleanroom environment

Corrosion resistance comparison based on humidity cabinet test



Test conditions Temperature 50℃, Relative humidity 95%RH

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

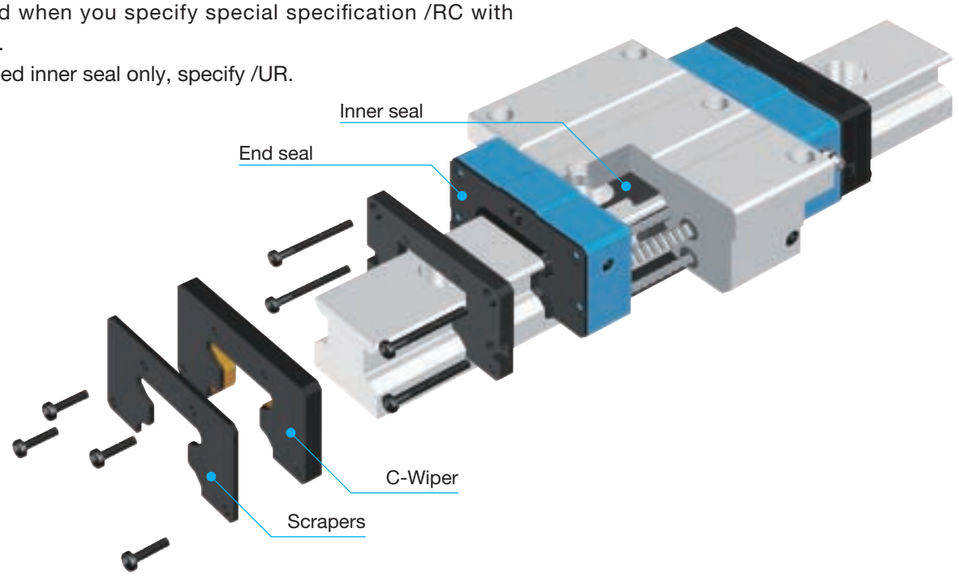
Special specification for special environment

IKO Linear Way and Linear Roller Way lineup includes following special specifications to correspond to various special environments.

Dust protection

C-Wiper /RC

Mounted to the outside of end seal, it may be used for long time even under environment where metal chips are spattering. End seal, inner seal (/UR) and scraper (/Z) may be equipped as standard when you specify special specification /RC with C-Wiper.
If you need inner seal only, specify /UR.



Applicable C-Wiper size

Model	Length of slide unit	Model code	Size								
			12	15	20	25	30	35	45	55	65
Flange type mounting from top / bottom	Short	MXC	–	–	○(1)	○	○	○	○	○	○
	Standard	MX	–	–	○(1)	○	○	○	○	○	○
	Long	MXG	–	–	○(1)	○	○	○	○	○	○
	Extra long	MXL	–	–	○(1)	○	○	○	○	○	○
Block type mounting from top	Short	MXDC	–	–	○	○	○	○	○	○	○
	Standard	MXD	–	–	○	○	○	○	○	○	○
	Long	MXDG	–	–	○	○	○	○	○	○	○
	Extra long	MXDL	–	–	○	○	○	○	○	○	○
Compact block type mounting from top	Short	MXSC	–	–	○	○	○	–	–	–	–
	Standard	MXS	–	–	○	○	○	○	○	○	–
	Long	MXSG	–	–	○	○	○	○	○	○	–
	Extra long	MXSL	–	–	○	○	○	–	–	–	–
Low section flange type mounting from top	Standard	MXN	–	–	–	–	○	○	○	○	–
	Long	MXNG	–	–	–	–	○	○	○	○	–
	Extra long	MXNL	–	–	–	–	○	○	○	○	–
Low section block type mounting from top	Standard	MXNS	–	–	–	–	○	○	○	○	–
	Long	MXNSG	–	–	–	–	○	○	○	○	–
	Extra long	MXNSL	–	–	–	–	○	○	○	○	–

Note (1) Applicable to models mounting from top (MXHC20, MXH20, MXHG20, MXHL20).

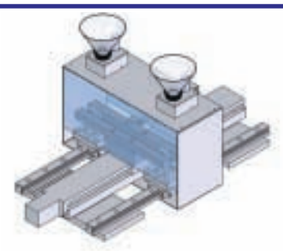
Dust protection

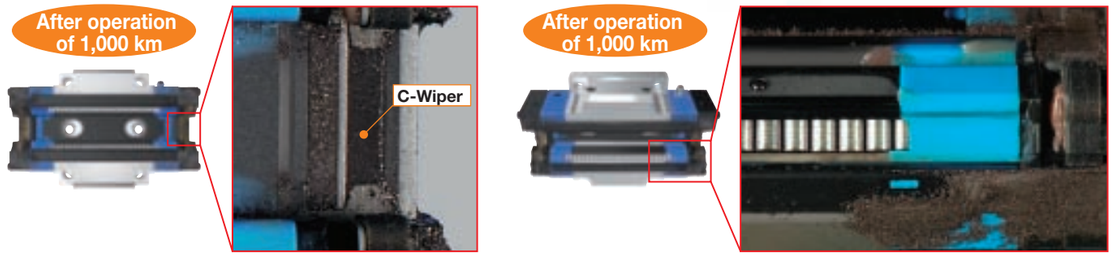
Durability test result backing excellent dust protection effect of [C-Wiper]!

Durability test in environment with foreign substances

Test conditions

Test portion	**MX35** T3 preload / caps for rail mounting holes and C-Wiper included
Maximum velocity	18 m/min
Stroke length	500 mm
Foreign substances	Fine metal chips Particle diameter lower than 125 μm Hardness HRC40 ~ 50 Application dose 1 g/hr (total dose: 1 kg)





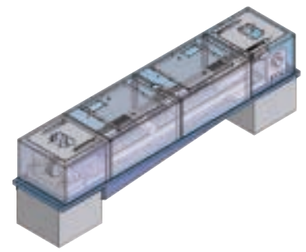
Only few foreign substances may get into the slide unit.

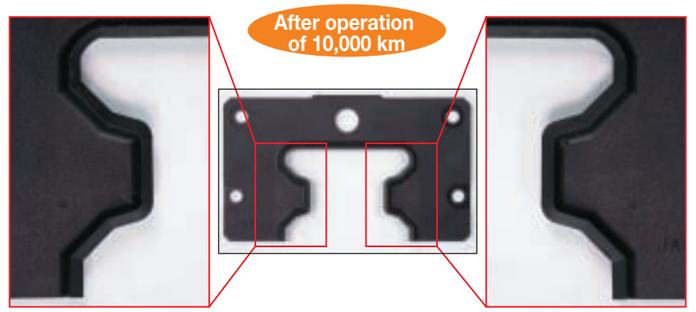
Only few foreign substances get into the way!

Durability test in coolant mist environment

Test conditions

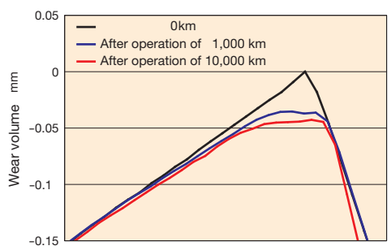
Test portion	**MX35** T3 preload / caps for rail mounting holes and C-Wiper included
Maximum velocity	115.2 m/min
Stroke length	300 mm
Coolant	Soluble type Dilute strength 20 times Spray amount 5 cc/hr





End seal is not damaged.

Wear condition of end seal lip tip



Wear on the end seal is negligible!

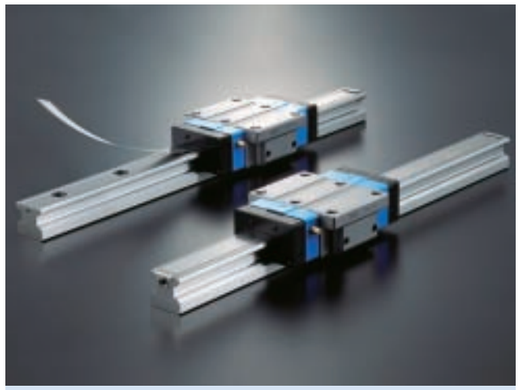
1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Special specification for special environment

Dust protection

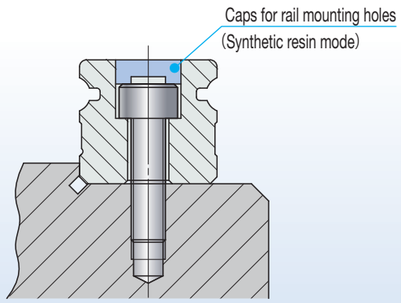
Rail cover sheet

Rail cover sheet that consists of steel plate and adhesive tape and fastened to the dedicated track rail with groove on the track rail prevents foreign substances from entering into the slide unit.



Caps for rail mounting holes /F

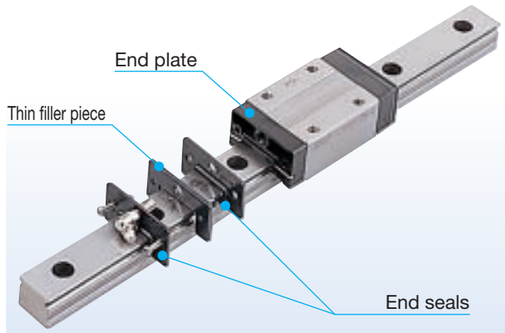
Caps for rail mounting holes close the track rail mounting holes to prevent foreign substances from entering into the slide unit.
Aluminum caps for rail mounting holes are also available. Ask IKO for your request.



Dust protection

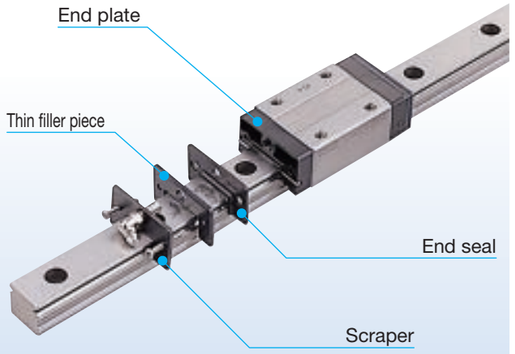
Double end seals /V

Double end seals improve the dust protection property further.



Scraper /Z

Mounted to the outside of end seal, it may remove large foreign substances adhering to the track rail.

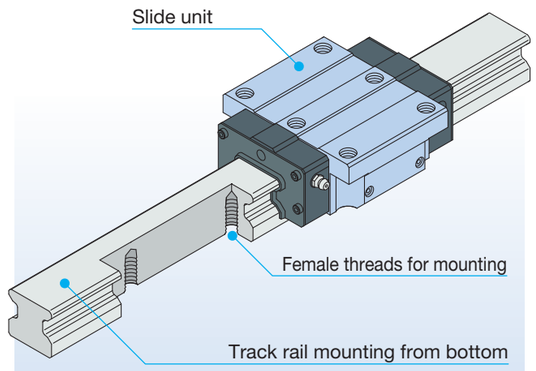


Rail cover plate /PS

Rail cover plate totally covers the upper surface of the track rail to prevent foreign substances from entering into the track rail.

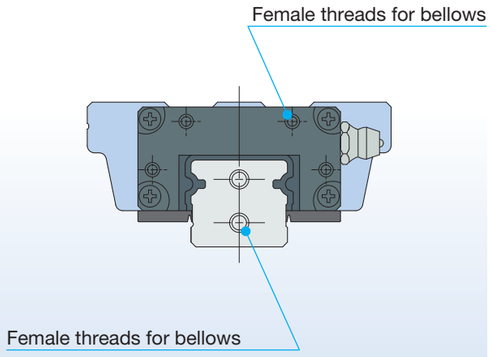
Track rail mounting from bottom

This is the specification that track rail is fixed from the mounting surface side. As there are no mounting holes on the track rail upper surface, adherence with the seal is superior and better dust protection effect is achieved.



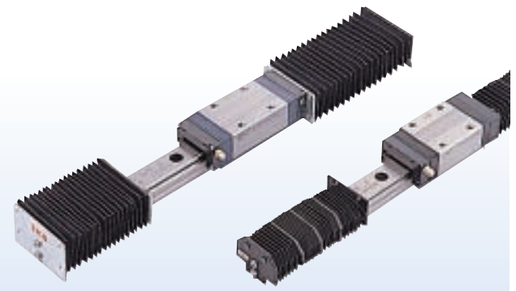
Female threads for bellows /J

Female threads for bellows are prepared on the slide unit and track rail ends.



Specific bellows

Dust protection cover over the exposed part of the track rail.



Special specification for special environment

Lubrication

With C-Lube plate /Q

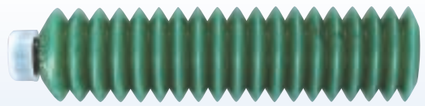
Lubrication parts to substantially reduce the need for lubrication management, i.e. grease job.

Low Dust-Generation Grease for Clean Environment CGL /YCL

For this grease, mixed soap is used as thickener and synthetic oil and low pour point mineral oil are mixed with base oil, so it has excellent low dust generating performance, rolling resistance, lubrication, and rust prevention property.

Bellows cartridge (80 g)

JG80 /CGL



With miniature greaser (2.5 ml)

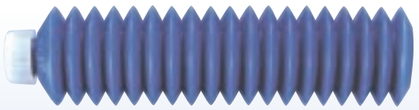
MG2.5 /CGL

Low Dust-Generation Grease for Clean Environment CG2 /YCG

For this grease, urea is used as thickener and synthetic oil is used as base oil, so it has excellent low dust generating performance, operating temperature range, lubrication property, rust prevention property and oxidation stability.

Bellows cartridge (80 g)

JG80 /CG2



With miniature greaser (2.5 ml)

MG2.5 /CG2

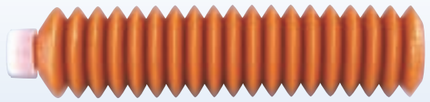
MG10 /CG2 with 10 ml are also available.

Anti-Fretting Corrosion Grease AF2 /YAF

Grease with excellent fretting-proof corrosion property.

Bellows cartridge (80 g)

JG80 /AF2



With miniature greaser (2.5 ml)

MG2.5 /AF2

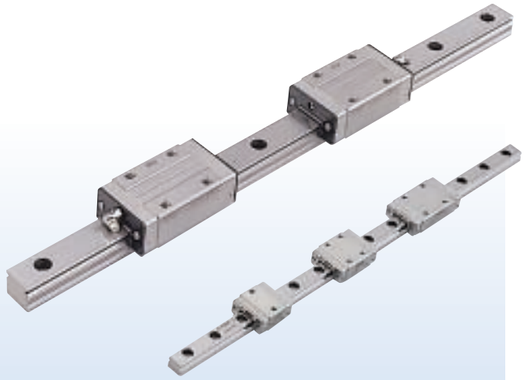
Other special grease

If you need any special grease for vacuum or high temperature, ask IKO your request.

Others

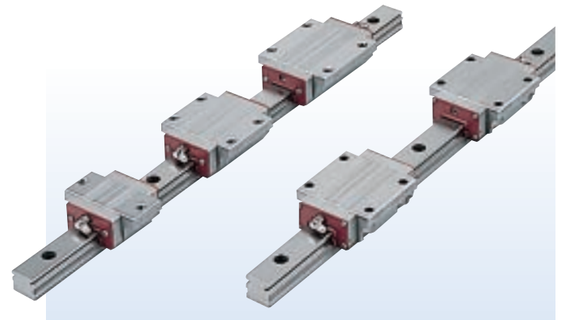
Stainless steel end plate /BS

End plate is changed to stainless steel.



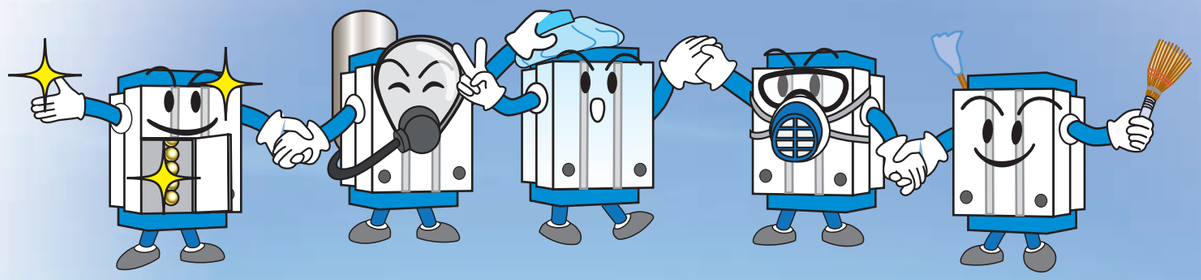
Special environment seal /RE

The end and under seals are replaced with end seals for special environment that can be used at high temperatures. When it is used in high temperature environment, stainless steel end plate (/BS) and high temperature grease should be combined.



The photo shoes a combination of special environment seal (/RE) and stainless steel end plate (/BS).

IKO can offer products for special environment!



If needed, ask IKO for your request.