**Features of Special Environment Linear Way and Linear Roller Way**

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

IKO's 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

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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

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!
4. Excellent corrosion resistance!

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.

Specifications

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

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARRIERTA SUPER IS/V</td>
<td>NOK KLLUVER</td>
</tr>
<tr>
<td>DEMNUM® GREASE L-200</td>
<td>DAIKIN INDUSTRIES, LTD.</td>
</tr>
<tr>
<td>FOMBLIN® VAC3</td>
<td>SOLVAY SOLEXIS</td>
</tr>
<tr>
<td>FULLTRIBO VAC</td>
<td>KYODO YUSHI CO., LTD.</td>
</tr>
<tr>
<td>KRYTOX® LVP</td>
<td>DU PONT</td>
</tr>
</tbody>
</table>

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

Relationship example between fluorine grease vapor pressure and temperature

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

<table>
<thead>
<tr>
<th>Temperature [˚C]</th>
<th>Vapor pressure [Pa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>20</td>
</tr>
</tbody>
</table>

Features of Special Environment Linear Way and Linear Roller Way

- Casing
- Slide unit
- Cylindrical rollers
- Retaining plate
- Retaining plate fixing band
- End plate
- Grease nipple
- End Pressure Plate
- Track rail

Specifications

- Applicable products
  - Series: Linear Roller Way Super X
  - Applicable model: LRXD200~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)
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**

“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.

**Features**

- **Clean (Low dust-generation)**: JIS cleanliness class 4 compliant (Up to 320 particles of diameter 0.5 μm/m²)
- **Vacuum**: Corresponding to low to high vacuum environment
- **Load resistance**: Load resistance more than double of general clean coating
- **High temperature property**: ~ 200°C (Fluorine lubricant and fluorine resin C-Lube are adopted compliant)

**Features of Special Environment Linear Way and Linear Roller Way**

**Hybrid Lubrication Linear Way L**

**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 ensures 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.

**Exciting outgas reduction property**

**Outgas reduction property**

- **Outgassing property of Hybrid Lubrication Linear Way**

**Performance**

- **Class 4 low dust generating performance**
- **Life 10 times longer than general clean coating is achieved**

**Precaution for Use**

1. Although heat resistant fluorinated lubricant and parts are used, operating temperature shall be 200°C at the maximum or up to 150°C 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.

**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

For continuous operation, up to 150°C.
Hybrid C-Lube Linear Way ML

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 have more resistance to deformation and more rigidity than bearing steel and stainless steel.

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.

Performance

More than three times durability

High-speed performance

C-Lube Linear Way L
Hybrid C-Lube Linear Way L

Noise reduction by about 4.5 dB

Low decibel

Small deformation of rolling elements and excellent rigidity

Low preload reduction volume and accuracy maintained after operation

Basic performance of C-Lube Linear Way

Achieved long term maintenance free

Maintenance free

Maintenance free

Achieved light and smooth sliding

Sliding characteristic

Eco-friendly

Minimized lubrication of consumption

Compact

Integral lubrication parts

Smooth

Excellent sliding characteristic
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

<table>
<thead>
<tr>
<th>Material name</th>
<th>Characteristic</th>
<th>Non-magnetic hard alloy</th>
<th>Silicon nitride ceramics</th>
<th>Non-magnetic stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative magnetic permeability</td>
<td>1.001 or less</td>
<td>1 (0.999991)</td>
<td>1.01 or less (1.005)</td>
<td></td>
</tr>
<tr>
<td>Electric conductivity</td>
<td>○</td>
<td>×</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Hardness (HV)</td>
<td>610 ~ 700</td>
<td>1400 ~ 1600</td>
<td>380 ~ 450</td>
<td></td>
</tr>
<tr>
<td>Linear expansion coefficient (×10-6/°C)</td>
<td>11.5 (30 ~ 200°C)</td>
<td>3.2 (20 ~ 400°C)</td>
<td>19.0 (20 ~ 400°C)</td>
<td></td>
</tr>
<tr>
<td>Specific gravity (g/cm³)</td>
<td>7.7</td>
<td>3.2</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Main component</td>
<td>Ni, Cr</td>
<td>Si₃N₄</td>
<td>Fe, Mn, Cr</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>○</td>
<td>△</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Remark</td>
<td>Good corrosion resistance</td>
<td>Good corrosion resistance</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

Note (*) 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

<table>
<thead>
<tr>
<th>Series</th>
<th>Linear Way L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main model</td>
<td>LWL5-B ~ LWL15-B</td>
</tr>
</tbody>
</table>

Remark: No ball retaining band is included.

Main component materials

<table>
<thead>
<tr>
<th>Casing</th>
<th>Track rail</th>
<th>Ball</th>
<th>End plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-magnetic hard alloy</td>
<td>Non-magnetic hard alloy</td>
<td>Silicon nitride ceramics</td>
<td>Non-magnetic alloy steel</td>
</tr>
</tbody>
</table>
Stainless Linear Way and Linear Roller Way

A variety of stainless steel series

Linear Way and 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 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.

**Features of Special Environment Linear Way and Linear Roller Way**

**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.

**Series name**

<table>
<thead>
<tr>
<th>Linear Way</th>
<th>C-Lube Linear Way ML</th>
<th>Linear Way L</th>
<th>Micro Linear Way L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Type Miniature Series</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-Lube Linear Way ME</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear Way E</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linear Roller Way</th>
<th>C-Lube Linear Roller Way Super MX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roller Type</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main component materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casing</td>
</tr>
<tr>
<td>Track rail</td>
</tr>
<tr>
<td>Ball</td>
</tr>
<tr>
<td>Ball retaining band</td>
</tr>
<tr>
<td>End plate</td>
</tr>
<tr>
<td>End seal</td>
</tr>
<tr>
<td>Grease nipple</td>
</tr>
</tbody>
</table>

**Features**

- Thin film
- Uniform film
- Strong adhesion
- Excellent rust prevention capacity
- Low temperature processing to prevent distortion
- No peeling and no effects on life and cleanroom environment

**Corrosion resistance comparison based on humidity cabinet test**

**Test conditions** Temperature 50˚C, Relative humidity 95% RH

- 1N=0.102kgf=0.2248lbs.
- 1mm=0.03937inch
Special specification for special environment

**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.

<table>
<thead>
<tr>
<th>Applicable C-Wiper size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Flange type mounting from top / bottom</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Extra long</td>
</tr>
<tr>
<td>Block type mounting from top</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Extra long</td>
</tr>
<tr>
<td>Compact block type mounting from top</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Extra long</td>
</tr>
<tr>
<td>Low section flange type mounting from top</td>
</tr>
<tr>
<td>Extra long</td>
</tr>
<tr>
<td>Low section block type mounting from top</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note (*) 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**

<table>
<thead>
<tr>
<th>Test conditions</th>
<th>Test portion</th>
<th>MX35 T3 preload / caps for rail mounting holes and C-Wiper included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum velocity</td>
<td>18 m/min</td>
<td></td>
</tr>
<tr>
<td>Stroke length</td>
<td>500 mm</td>
<td></td>
</tr>
<tr>
<td>Foreign substances</td>
<td>Fine metal chips</td>
<td>Particle diameter lower than 125 µm</td>
</tr>
<tr>
<td>Hardness HRC40</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Application dose</td>
<td>1 g/hr</td>
<td>Total dose: 1 kg</td>
</tr>
</tbody>
</table>

**After operation of 1,000 km**

Only few foreign substances may get into the slide unit.

**After operation of 10,000 km**

End seal is not damaged. Wear on the end seal is negligible!

**Durability test in coolant mist environment**

<table>
<thead>
<tr>
<th>Test conditions</th>
<th>Test portion</th>
<th>MX35 T3 preload / caps for rail mounting holes and C-Wiper included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum velocity</td>
<td>115.2 m/min</td>
<td></td>
</tr>
<tr>
<td>Stroke length</td>
<td>300 mm</td>
<td></td>
</tr>
<tr>
<td>Foreign substances</td>
<td>Oil droplets, 20 times</td>
<td></td>
</tr>
<tr>
<td>Concentration spray amount</td>
<td>5 cc/hr</td>
<td></td>
</tr>
</tbody>
</table>

**Wear condition of end seal lip tip**

<table>
<thead>
<tr>
<th>Wear volume</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>After operation of 1,000 km</td>
<td>--</td>
</tr>
<tr>
<td>After operation of 10,000 km</td>
<td>--</td>
</tr>
</tbody>
</table>

**Wear on the end seal is negligible!**
**Dust protection**

### Rail cover sheet
Rail cover sheet that consists of steel plate and adhesive tape and fastened to the dedicated 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 for your request.

### 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.
**IKO can offer products for special environment!**

If needed, ask **IKO** for your request.

**Features of Special Environment Linear Way and Linear Roller Way**

**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

#### 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

### 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 shows a combination of special environment seal (/RE) and stainless steel end plate (/BS).

**Other special grease**

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