IKO

Micro Linear Way

LWL

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June 2008 Overseas Dept.
Micro Linear Way L for downsizing your machines

Micro Linear Way is the smallest linear motion rolling guide having precise and smooth motion developed by 456’s original miniature technology.

Track rail width can be chosen from 1mm to 6mm and that suites to precise positioning in your micro machine.

Structure of Micro Linear Way L

LWL2

Track Rail

Slide Unit

Casing

Steel Balls

End Plate

LWL1···Y (The smallest size)

Tapped mounting hole type track rail

LWL1···Y

Non-mounting hole type track rail

LWL1

The track rail can be fixed correctly by using prepared female threads.

Also Low profile holeless track rail is available.

Simple structure for controlling accuracy and micro-sizing

All 456 Linear Way features unique design in which large diameter steel balls contacting raceways at four points each are arranged in two rows. High level of accuracy, even in Micro Linear Way, is realized by 456’s all of accumulated linear motion technology and this simple structure.

Simple two-row and four-points contact is necessary for micro sizing.

Four points contact

Casing

Track rail

End Plate

Slide unit

Non-mounting hole type track rail

Simple two-row and four-points contact design minimizes the number of potential errors in manufacturing. High level of accuracy control is possible.

For special specification

Stainless Steel made

All products are made by stainless steel which is highly corrosion resistance. This is suitable for the use in clean rooms and places where rust preventive oil should be avoided or kept to a minimum.

Stainless made End Plate /BS

The standard end plate made by resin can be replaced with stainless steel made end plate. It is suitable for vacuum and high temperature application. Applicable to size 2 and 3.

Special Grease /Y

Several greases for clean room application are available. For size 3 and 6, specify a grease by supplemental code if necessary.

Micro Linear Way LWL is suitable for optical fiber communication device, medical equipments, semiconductor manufacturing system, liquid crystal display manufacturing process, etc.
**Micro Linear Way LWL**

**Wide variation**

There is a great variation in sizes and shapes. The best specification can be selected to suit each machine and equipment.

- Track rail width; 1mm to 6mm are available.
- Standard type and wide type are available. Wide type is suitable for single row rail arrangement.
- Standard length slide unit and short type slide unit are available in the same sectional dimension.
- Two kinds of track rails, through mounting holes type and female thread mounting holes type, are available.

<table>
<thead>
<tr>
<th>Cross section (Full-scale)</th>
<th>LWL1</th>
<th>LWL2</th>
<th>LWL3</th>
<th>LWLF4</th>
<th>LWLF6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Standard</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length of slide unit (Full-scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
</tr>
<tr>
<td>Standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shape of track rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard track rail</td>
</tr>
<tr>
<td>Tapped track rail</td>
</tr>
<tr>
<td>Tapped track rail (screw)</td>
</tr>
<tr>
<td>Holeless track rail</td>
</tr>
</tbody>
</table>

**The ultimate IKO miniature technology for super micro machine**

Other micro series are also available. Please consult IKO for future information.

- Linear Ball Spline G
  - LSAG 2, LSAGF 2
- Miniature Stroke Rotary Bushing
  - STSI 2
- Miniature Cam Follower
  - CFS 1.4

**Linear Ball Spline G**

- Spline shaft diameter: 2mm
- Shaft diameter: 2mm
- Stud diameter: 1.4mm

**Accuracy is as high as larger size Linear Ways.**

All dimensional tolerances are strictly controlled with the original precision manufacturing technology. This is the smallest linear motion rolling guide for the places where compactness and high accuracy are required.

**Two female threads are prepared on the top surface of slide unit.**

Two fixing bolts help proper alignment. Both side surfaces of slide unit can be used as reference surfaces, thus universal mounting is possible.

**Mounting method (for tapped track rail specification LWL1--Y)**

For track rail width 1mm, female threads are prepared for lateral mounting and track rail can be fixed easily and correctly.

**Super micro 1mm width will take you onto a “Fantastic Voyage”**

- Tapped track rail specification
- Using female thread (Required bolt size is M1.4)
- Using as through hole (Required bolt size is M1.0)
Identification Number

The specification of Micro Linear Way LWL is specified by the identification number, which consists of a model code, a size, a part code, a preload symbol, a classification symbol, interchangeable code and special supplemental codes.

### Example of identification number

| Size 1 | LWL | 1  | C1 | R42 | Y | T0 |
| Size 2 or over | LWLF | C | 6 | C2 | R120 | T0 | P | /D |

### Table 1: Type and size of Micro Linear Way LWL

<table>
<thead>
<tr>
<th>Series</th>
<th>Material</th>
<th>Structure</th>
<th>Length of the slide unit</th>
<th>Model code</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard type</td>
<td>Stainless steel</td>
<td>Tapped track rail specification</td>
<td>Short</td>
<td>LWLC</td>
<td>–</td>
</tr>
<tr>
<td>Standard type</td>
<td>Stainless steel</td>
<td>Non-mounting hole type track rail specification</td>
<td>Standard</td>
<td>LWL</td>
<td>–</td>
</tr>
<tr>
<td>Standard type</td>
<td>Stainless steel</td>
<td>Non-mounting hole type track rail specification</td>
<td>Non symbol; Y</td>
<td>LWL-Y</td>
<td>–</td>
</tr>
<tr>
<td>Wide type</td>
<td>Stainless steel</td>
<td>Tapped track rail specification</td>
<td>Short</td>
<td>LWLF</td>
<td>–</td>
</tr>
<tr>
<td>Wide type</td>
<td>Stainless steel</td>
<td>Tapped track rail specification</td>
<td>Standard</td>
<td>LWLF</td>
<td>–</td>
</tr>
<tr>
<td>Wide type</td>
<td>Stainless steel</td>
<td>Tapped track rail specification</td>
<td>Non symbol; N</td>
<td>LWLF-N</td>
<td>–</td>
</tr>
</tbody>
</table>

### Usage
- **Series**
  - **Standard type**
  - **Wide type**
- **Length of slide unit**
  - **Short**
  - **Standard**
- **Structure**
  - **Tapped track rail specification**
  - **Non-mounting hole type track rail specification**
- **Size**
  - 1, 2, 3, 4 and 6

### Conversion Factors
- 1N = 0.102kgf = 0.2248lbs.
- 1mm = 0.03937inch
Accuracy of Micro Linear Way LWL is shown in Table 2 and 3.

### Table 2 Accuracy of Micro Linear Way LWL (for LWL1-Y)

<table>
<thead>
<tr>
<th>Item</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dim. H tolerance</td>
<td>± 0.020</td>
</tr>
<tr>
<td>Dim. H tolerance</td>
<td>± 0.025</td>
</tr>
<tr>
<td>Dim. Variation of H(1)</td>
<td>0.015</td>
</tr>
<tr>
<td>Dim. Variation of N(1)</td>
<td>0.020</td>
</tr>
<tr>
<td>Parallism in operation of C to A</td>
<td>See Fig. 1</td>
</tr>
<tr>
<td>Parallism in operation of D to B</td>
<td>See Fig. 1</td>
</tr>
</tbody>
</table>

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

### Table 3 Accuracy of Micro Linear Way LWL (for LWL2 and larger sizes)

![Diagram](https://via.placeholder.com/150)

<table>
<thead>
<tr>
<th>Classification (Symbol)</th>
<th>High (H)</th>
<th>Precision (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dim. H tolerance</td>
<td>± 0.020</td>
<td>± 0.010</td>
</tr>
<tr>
<td>Dim. H tolerance</td>
<td>± 0.025</td>
<td>± 0.015</td>
</tr>
<tr>
<td>Dim. Variation of H(1)</td>
<td>0.015</td>
<td>0.007</td>
</tr>
<tr>
<td>Dim. Variation of N(1)</td>
<td>0.020</td>
<td>0.010</td>
</tr>
<tr>
<td>Parallism in operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of C to A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of D to B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Special Specifications

Micro Linear Way LWL series with the special specifications shown in Table 2 are optionally available for various applications. When ordering, add any supplemental codes onto the identification number. If a combination of special specifications is required (See Table 5), indicate the supplemental codes in alphabetical order. These optional items can be combined to achieve further improvements in performance. These special specifications are not available to size 1.

#### Table 4 Applicable specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Supplemental code</th>
</tr>
</thead>
<tbody>
<tr>
<td>With stainless steel end plate(1)</td>
<td>/BS</td>
</tr>
<tr>
<td>Opposite reference surface arrangement</td>
<td>/D</td>
</tr>
<tr>
<td>Specified rail mounting hole positions</td>
<td>/E</td>
</tr>
<tr>
<td>Appendixing inspection sheet</td>
<td>/I</td>
</tr>
<tr>
<td>Without track rail mounting bolts(1)</td>
<td>/MN</td>
</tr>
<tr>
<td>-Matched sets to be used as an assembled group</td>
<td>/W</td>
</tr>
<tr>
<td>Specified grease</td>
<td>/Y</td>
</tr>
</tbody>
</table>

Notes: (1) Applicable to size 2 and 3.

- (2) Applicable to size 4 and 6.

- (3) In size 2 and 4, only /YNG can be chosen.

#### Table 5 Combination of special specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Supplemental code</th>
</tr>
</thead>
<tbody>
<tr>
<td>With stainless steel end plates /BS</td>
<td></td>
</tr>
<tr>
<td>Opposite reference surfaces arrangement /D</td>
<td></td>
</tr>
<tr>
<td>Specified track rail mounting hole positions /E</td>
<td></td>
</tr>
<tr>
<td>Without track rail mounting bolts /MN</td>
<td></td>
</tr>
<tr>
<td>Matched sets to be used as an assembled group /W</td>
<td></td>
</tr>
</tbody>
</table>

Remark: In the table, the mark ☑ indicates that this combination can be made.

#### With stainless steel end plates /BS

The standard synthetic resin end plates are replaced with stainless material, keeping the total length of slide unit unchanged. This specification (for size 2 and 3) is recommended for high temperature and vacuum conditions.

#### 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 /E mark on the slide unit. When ordering, add the dimension (in mm) after “E”. Dimension E can be specified in a limited range. Consult /I for further information.

#### With inspection sheet /I

The inspection sheet recording dimensions H and N (See “Accuracy”), dimensional variations of H and N, and parallelism in operation of the slide unit is attached to each set.

#### Without track rail mounting bolts /MN

Track rail mounting bolts are not appended. (Applicable to sizes 4 and 6)

#### Matched sets to be used as an assembled group /W

For two or more sets of Micro Linear Way LWL used on the same plane, the dimensional variation of dimension H of Micro Linear Way LWL is kept within the specified range. The dimensional variation of dimension H in matched sets is the same as that of single set. Indicate the number of sets after “/W”.

#### Specified grease /YCG /YCL /YBR /YNG

The type of pre-packaged grease in the slide unit can be changed by a supplemental code.

- /YCG Low Dust Generation Grease for Clean Environment
- /YCL Low Dust Generation Grease for Clean Environment
- /YBR MOLYKOTE BR-2 PLUS Grease (Dow Corning) is pre-packed.
- /YNG No grease is pre-packed.

Note: For sizes 2 and 4, only /YNG is applicable.
Load Rating and Life

Basic dynamic load rating \( C \)

The basic dynamic load rating is defined as a constant load both in direction and magnitude under which a group of identical Micro Linear Way LWL series are individually operated and 90% of those in the group can travel 50 \( \times 10^6 \) m free from material damage due to rolling contact fatigue.

Basic static load rating \( C_0 \)

The basic static load rating is defined as a static load that gives a prescribed constant contact stress at the center of the contact area between rolling elements and raceways 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 a static moment load (See Fig.3) that gives a prescribed constant contact stress at the center of the contact area between rolling elements and raceways receiving the maximum load. It is the allowable limit load for normal rolling motion.

Life

The rating life of Micro Linear Way LWL series is obtained from the following calculation formula.

\[
L = \left( \frac{10^6}{P_i} \right) 
\]

where,
\( L \) : Rating life, \( 10^6 \) m
\( C \) : Basic dynamic load rating, N
\( P_i \) : Dynamic equivalent load, N

If the stroke length and the number or strokes per minute are known, the life in hours must be calculated by the following formula.

\[
L_i = \frac{T_0}{3.5X \times 60} \]

where,
\( L_i \) : Rating life in hours, hours
\( T_0 \) : Stroke length mm
\( X \) : Number of strokes per minute cpm

Static safety factor

The static safety factor \( f_s \) of Micro Linear Way LWL series is obtained from the following formula, and general values of this factor are shown in Table 6.

\[
f_s = \frac{C_0}{T_0} \]

where,
\( f_s \) : Static safety factor
\( C_0 \) : Basic static load rating, N
\( T_0 \) : Static equivalent load, N

Table 6 Static safety factor

<table>
<thead>
<tr>
<th>Operating conditions</th>
<th>( f_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation with vibration and/or shocks</td>
<td>3 – 5</td>
</tr>
<tr>
<td>High operating performance</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Normal operation</td>
<td>1 – 3</td>
</tr>
</tbody>
</table>

Dynamic equivalent load for rating life

When a load is applied in a direction other than that of the basic dynamic load rating of Linear 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.

\[
F_{ae} = k_r \left( F_0 + \frac{1}{2} \cdot M_0 \right) \left( \frac{F_0 + 1}{F_0} \right) \]

where,
\( F_{ae} \) : Downward load, N
\( M_{ae} \) : Lateral load, N
\( F_0 \) : Downward load, N
\( M_0 \) : Lateral load, N
\( k_r \) : Conversion factor by load direction

Table 7 Load factor

<table>
<thead>
<tr>
<th>Conditions</th>
<th>( f_w )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth operation free from vibration and/or shocks</td>
<td>1 – 1.2</td>
</tr>
<tr>
<td>Normal operation</td>
<td>1.2 – 1.5</td>
</tr>
<tr>
<td>Operation with shock loads</td>
<td>1.5 – 3</td>
</tr>
</tbody>
</table>

Table 8 Conversion factor by load direction

<table>
<thead>
<tr>
<th>Condition</th>
<th>Conversion factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_s )</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Table 9 Mean equivalent dynamic load factor

<table>
<thead>
<tr>
<th>Condition</th>
<th>( \bar{x} )</th>
<th>( \bar{y} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_{ae} ) &amp; ( P_{ae} )</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>( f_s P_{ae} ) &lt; ( P_{ae} )</td>
<td>0.6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch.
Static equivalent load for static safety factor

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

From each directional load, converted load equal to downward or lateral is given by the following formula.

\[ P_0 = k_0 F_r + k_0 F_a \]

\[ = k_0 \left( \frac{C_0}{T_0} \right) T_0 + k_0 \left( \frac{C_0}{T_0} \right) T_0 \]

\[ = \frac{C_0}{T_0} \left( \frac{F_r}{F_a} \right) + \frac{C_0}{T_0} \left( \frac{F_a}{F_r} \right) \]

where,

- \( P_0 \): Static equivalent load, N
- \( F_r \): Downward load, N
- \( F_a \): Lateral load, N
- \( M_0 \): Moment, Nm
- \( k_0 \): Conversion factor by load direction (See Table 10)

Table 10 Conversion factor by load direction

<table>
<thead>
<tr>
<th>Condition</th>
<th>Conversion factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_r \geq 0 )</td>
<td>1</td>
</tr>
<tr>
<td>( F_r &lt; 0 )</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Lubrication and Dust Protection

Quality lithium-soap base grease (MULTITEMP PS No.2: KYODO YUSHI) is pre-packed in Micro Linear Way LWL. The quality of any grease will gradually deteriorate as operating time passes. Therefore, periodic re-lubrication is necessary. The re-lubrication interval varies depending on the operating conditions of the rolling guides. A six months interval of generally recommended and, if the machine operation consists of reciprocating motions with many cycles and long strokes, re-lubrication every three months is recommended.

Micro Linear Way LWL does not have oil hole, thus, grease must be directly applied on the raceways of track rail. Miniature Grease Injector is available and please consult if necessary.

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. Low and stable friction can be obtained after ten to twenty times of manual strokes. It is possible to reduce the amount of grease to make frictional resistance lower. But careful attention is necessary to keep minimum amount of lubricant strictly for the product safety.

Micro Linear Way LWL does not have end seals. When it is used in places except clean environment, preparing dust protection cover is recommended to avoid intruding harmful dust and particles from outside.

Precautions for Use

To mount Micro Linear Way LWL, correctly fit the reference mounting surfaces B and D (D1 or D2) of the slide unit and track rail to the reference mounting surfaces of the table and the bed, and then fix them tightly. (See Fig.4.3)

In size 1, reference surfaces are available to both side of slide unit. (D and D1)

Track rail of LWL1-Y can be mounted in lateral direction. Two kinds of mounting methods can be chosen. (See Fig.4.1 and 4.2)

The reference mounting surfaces of B and D (D1 and D2) and the mounting surfaces A and C of Micro Linear Way LWL 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.

Reference mounting surfaces of slide unit and track rail are shown in Table 11.

Table 11 Reference mounting surface of slide unit and track rail

<table>
<thead>
<tr>
<th>Model number</th>
<th>Slide unit</th>
<th>Track rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWL1</td>
<td>Either side is possible. (See Fig.4.1)</td>
<td>--</td>
</tr>
<tr>
<td>LWL1-Y</td>
<td>Opposite to the ( \bar{\sigma} ) mark. (See Fig.5.1)</td>
<td>--</td>
</tr>
<tr>
<td>LWL2 or larger</td>
<td>Opposite to the ( \bar{\sigma} ) mark. (See Fig.5.2)</td>
<td>Side surface above the ( \bar{\sigma} ) mark in the direction of the arrow. (See Fig.5.2)</td>
</tr>
</tbody>
</table>

Fig. 4.1 Reference mounting surface and general mounting structure of LWL1-Y

Fig. 4.2 Reference mounting surface and general mounting structure \( \bar{\sigma} \) of LWL1-Y

Fig. 4.3 Reference mounting surface and general mounting structure of LWL2 or larger

Fig. 5.1 Reference mounting surface of LWL1

Fig. 5.2 Reference mounting surface of LWL2 or larger

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch
Female threads for mounting the slide unit and track rail are through holes. 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. Also, small head (less than 1.8mm) screw for precision equipment is recommended for mounting of size 1.

The mounting bolts for track rail are not appended. For sizes 2 and 3, prepare bolts with a fixing depth not exceeding H4 shown in the dimension table.

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 surface as shown in Fig.4.1 and Fig.4.2. Table 12 and Table 13 show recommended shoulder height and radius of the reference mounting surfaces.

Table 12 Shoulder height for the reference mounting surface of slide unit

<table>
<thead>
<tr>
<th>Model number</th>
<th>Shoulder height for slide unit  h₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWL 1</td>
<td>1.3</td>
</tr>
<tr>
<td>LWL 2</td>
<td>1</td>
</tr>
<tr>
<td>LWLC 3, LWL 3</td>
<td>1.2</td>
</tr>
<tr>
<td>LWLF 4</td>
<td>1.5</td>
</tr>
<tr>
<td>LWLF 6, LWLF 6</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Remark: For LWL1, prepare the reference mounting surface not to interfere with slide unit.

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 machines. It is suggested in such cases to assume a greater load than the calculated load.

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 [JOGC].

Cleaning the mounting surfaces

When mounting Micro Linear Way LWL, first clean all mounting and reference mounting surfaces. (See Fig.7) 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.

Tightening torque of mounting bolts

The standard torque values for Micro Linear Way mounting bolts are shown in Table 14. When machines or equipment are subjected to serve 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 strength characteristics of the material.

When assembling two or more sets

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 (by supplemental code”W”) are delivered as a group in which dimensional variations are specially controlled. Mount them without mixing with the sets of another group.

Assembling a slide unit and a track rail

When assembling Micro Linear Way LWL, correctly fit the groove of the slide unit mounted on a steel ball holder to the groove of the track rail, and then move the slide unit gently from the steel ball holder to the track rail in parallel direction. Steel balls are not retained in Micro Linear Way, so using steel ball holder is necessary when re-assemble the slide unit from the track rail. For sizes 2 or larger, a steel ball holder is appended as an accessory.

Cleaning the mounting surfaces

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Table 12 Shoulder height for the reference mounting surface of slide unit

<table>
<thead>
<tr>
<th>Model number</th>
<th>Shoulder height for slide unit  h₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWL 1</td>
<td>1.3</td>
</tr>
<tr>
<td>LWL 2</td>
<td>1</td>
</tr>
<tr>
<td>LWLC 3, LWL 3</td>
<td>1.2</td>
</tr>
<tr>
<td>LWLF 4</td>
<td>1.5</td>
</tr>
<tr>
<td>LWLF 6, LWLF 6</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Remark: For LWL1, prepare the reference mounting surface not to interfere with slide unit.

Table 13 Shoulder height for the reference mounting surface of track rail

<table>
<thead>
<tr>
<th>Model number</th>
<th>Shoulder height for track rail  h₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWL 1 - Y</td>
<td>2</td>
</tr>
<tr>
<td>LWL 2</td>
<td>0.5</td>
</tr>
<tr>
<td>LWLC 3, LWL 3</td>
<td>0.8</td>
</tr>
<tr>
<td>LWLF 4</td>
<td>0.8</td>
</tr>
<tr>
<td>LWLF 6, LWLF 6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Remark: For LWL1, prepare the reference mounting surface not to interfere with slide unit.

Table 14 Tightening torque of mounting bolts

<table>
<thead>
<tr>
<th>Bolt size</th>
<th>Torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>0.04</td>
</tr>
<tr>
<td>M1.4 × 0.3</td>
<td>0.10</td>
</tr>
<tr>
<td>M1.6 × 0.35</td>
<td>0.15</td>
</tr>
<tr>
<td>M2</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Remark: Tightening torque for LWL1 is recommended to be 70 to 80% of the values in the table.
Track Rail Lengths

Standard and maximum lengths of track rails of Micro Linear Way LWL are shown in Table 15. Track rail in any length are also available. Simply indicate the necessary length of track rail in millimeter (mm) 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 15  Standard and maximum lengths of track rail

<table>
<thead>
<tr>
<th>Model number</th>
<th>Item</th>
<th>LWL 1</th>
<th>LWL 2</th>
<th>LWL 3</th>
<th>LWL 4</th>
<th>LWL 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard length (L)</td>
<td>18 (3)</td>
<td>30 (5)</td>
<td>42 (7)</td>
<td>32 (4)</td>
<td>40 (5)</td>
<td>40 (7)</td>
</tr>
<tr>
<td>Over (incl.)</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>3.5</td>
<td>4.5</td>
<td>6</td>
</tr>
<tr>
<td>Under</td>
<td>5.5</td>
<td>6.5</td>
<td>8</td>
<td>8.5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Maximum length(1)</td>
<td>102</td>
<td>102</td>
<td>150</td>
<td>150</td>
<td>290</td>
<td></td>
</tr>
</tbody>
</table>

Note(1): The track rails can be manufactured up to the maximum length shown in parentheses. If required, please consult .

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

Mounting Bolts

For Micro Linear Way LWL, fixing bolts for slide unit and tapped track rail are available as shown in Table 16.1 and Table 16.2. Consult .

Table 16.1  Cross-recessed head cap screw for precision equipment

<table>
<thead>
<tr>
<th>Nominal size (<em>d</em>)</th>
<th>Pitch of screw (<em>P</em>)</th>
<th><em>A</em></th>
<th><em>s</em></th>
<th><em>l</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>0.25</td>
<td>1.6</td>
<td>0.45</td>
<td>3, 4, 5</td>
</tr>
<tr>
<td>M1.4</td>
<td>0.3</td>
<td>2.5</td>
<td>0.8</td>
<td>2.5, 3, 4</td>
</tr>
<tr>
<td>M1.6</td>
<td>0.35</td>
<td>2.8</td>
<td>0.85</td>
<td>4, 5, 6</td>
</tr>
<tr>
<td>M2</td>
<td>0.4</td>
<td>3.5</td>
<td>1</td>
<td>3, 4, 5</td>
</tr>
</tbody>
</table>

Remark: They differ from appended track rail mounting bolt.

Table 16.2  Hexagon socket head bolt

<table>
<thead>
<tr>
<th>Nominal size (<em>d</em>)</th>
<th>Pitch of screw (<em>P</em>)</th>
<th><em>A</em></th>
<th><em>s</em></th>
<th><em>l</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>M1.4</td>
<td>0.3</td>
<td>2.6</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>M1.6(1)</td>
<td>0.35</td>
<td>3</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>M2(1)</td>
<td>0.4</td>
<td>3.8</td>
<td>2</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Note(1): They conform to JIS 1176. (Japanese Industrial Standard)
**Micro Linear Way LWL**

**LWLC • LWL • LWLFC • LWLF**

### Dimension of Track Rail

<table>
<thead>
<tr>
<th>Model number</th>
<th>Slide unit</th>
<th>Track rail length (mm)</th>
<th>Dimension of assembly (mm)</th>
<th>Dimension of slide unit (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWL 1 Y</td>
<td>1</td>
<td>1.6</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>LWL 2</td>
<td>2</td>
<td>0.9</td>
<td>2.4</td>
<td>4.0</td>
</tr>
<tr>
<td>LWLC 3</td>
<td>3</td>
<td>1.0</td>
<td>2.3</td>
<td>4.4</td>
</tr>
<tr>
<td>LWL 3</td>
<td>4</td>
<td>1.6</td>
<td>2.4</td>
<td>4.8</td>
</tr>
<tr>
<td>LWLF 4</td>
<td>5</td>
<td>2.1</td>
<td>2.4</td>
<td>5.0</td>
</tr>
<tr>
<td>LWLFC 6</td>
<td>6</td>
<td>2.4</td>
<td>2.6</td>
<td>6.0</td>
</tr>
<tr>
<td>LWLF 6 N</td>
<td>7</td>
<td>2.4</td>
<td>2.6</td>
<td>6.0</td>
</tr>
</tbody>
</table>

### Note

1. Track rail length c is shown in Table 15.
2. Bolt is reamed out to mounting structure.
3. Prepare track rail mounting bolts with a fixing depth less than H0.

### Example of Identification number for assembled set

**LWL FC 6 C2 R120 N T0 P D**

- **Model code:** LWL, LWL, LWL, LWLFC, LWLF
- **Size:**
  - C2: 2.0 mm
  - R120: 120 mm
- **Preload amount:**
  - T0: 0.0 mm
- **Special specification:**
  - D: 0.0 mm

### Accuracy class

- None (for LWL, LWLFC, LWLF)
- Other: Precision

### Preload amount

- T0: 0.0 mm
- T1: 0.1 mm

### Preload amount

- P: 0.0 mm
- D: 0.0 mm

### Accuracy class

- None (for LWL, LWLFC, LWLF)
- Other: Precision

**Number of slide unit**

- Two slide units

**Length of track rail (122mm)**

**Dimensions**

- LWL 2
- LWL 3
- LWL 4
- LWLFC 6
- LWLF 6
- LWLF 6 N
Unprecedented smoothness and compactness for Saving energy and Compact designing

IKO Stroke Ball Spline

CAT-57155

This is our new output for the manufacturing process of semiconductor and liquid crystal display requires high speed and high acceleration. As a regular leader of this industrial field..........

Unprecedented smoothness

Precise ball retainer is incorporated and non-circulation structure provide superior low friction even in the vertical operation.

Compact design with high rigidity

Large diameter steel balls are arranged in two rows and in four point contact with the raceways, achieving compact design with high rigidity under any direction of load and moment.

Superior positioning accuracy

By applying suitable preload, clearance in the rotational direction is eliminated. So high positioning accuracy in the rotational direction has been obtained.

Unprecedented smoothness

Four Point Contact

Stroke Ball Spline LS

(Limited Stroke Length)

Linear Ball Spline G LSAG

( Unlimited Stroke Length)

Travel length of cage x 2 = Effective stroke

Allowable stroke length

Available shaft diameter: 4mm to 6mm

Available shaft diameter: 2mm to 50mm
World Network of

IKO

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ISO 9001 & 14001 Quality system registration certificate

Recognizing that conservation of the global environment is the top-priority challenge for the world's population, IKO will conduct its activities with consideration of the environment as a corporate social responsibility, reduce its negative impact on the environment, and help foster a rich global environment.


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