Instruction Manual for the LM Guide

THK CO., LTD.
1. Introduction

Thank you for purchasing the THK products. This document will explain any precautions involved with using the LM guide as well as mounting and lubricating procedures.

The LM guide is sealed in a plastic bag with anti-rust oil and then packaged in a cardboard box. When storing the LM guide, please keep it in the THK packaging and store it horizontally without subjecting it to high temperatures and/or humidity.

The Certificate of Inspection, which guarantees the quality of the product, is enclosed in the package. If there are any concerns regarding the quality, please contact THK.

Fig.1–1 Example of Packing

Fig.1–2 Certificate of Inspection
2. Precautions on Using the LM Guide

Handling

(1) Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.
(2) Tilting an LM block or LM rail may cause them to fall by their own weight.
(3) Dropping or hitting the LM Guide may damage it. Giving an impact to the LM Guide could also cause damage to its function even if the guide looks intact.

Lubrication

(1) Thoroughly remove anti-corrosion oil and feed lubricant before using the product.
(2) Do not mix lubricants of different physical properties.
(3) In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
(4) When planning to use a special lubricant, contact THK before using it.
(5) When adopting oil lubrication, the lubricant may not be distributed throughout the LM system depending on the mounting orientation of the system. Contact THK for details.
(6) Lubrication interval varies according to the service conditions. Contact THK for details.

Precautions on Use

(1) Entrance of foreign matter may cause damage to the ball (roller) circulating path or functional loss. Prevent foreign matter, such as dust or cutting chips, from entering the system.
(2) When planning to use the LM system in an environment where the coolant penetrates the LM block, it may cause trouble to product functions depending on the type of the coolant. Contact THK for details.
(3) Do not use the LM system at a temperature of 80°C or higher. When desiring to use the system at temperatures of 80°C or higher, contact THK in advance.
(4) If foreign matter adheres to the LM system, replenish the lubricant after cleaning the product. For available types of detergent, contact THK.
(5) When using the LM Guide with inverted mount, breakage of the endplate due to an accident or the like may cause balls (rollers) to fall and the LM block to come off from the LM rail and fall. In these cases, take preventive measures such as adding a safety mechanism for preventing such falls.
(6) When using the LM system in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
(7) When removing the LM block from the LM rail and then replacing the block, an LM block mounting/removing jig that facilitates such installation is available. Contact THK for details.

Storage

When storing the LM Guide, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.
3. Marking on the Master LM Guides and Combined Use

3.1. Marking on Master LM Guides
All LM rails mounted on the same plane are marked with the same serial number. Of those LM rails, the one marked with "KB" after the serial number is the master LM rail. The LM block on the master LM rail has its datum plane finished to a designated accuracy, allowing it to serve as the positioning reference for the table (see Fig3-1). LM Guides of the normal grade are not marked "KB". Therefore, any one of the LM rails having the same serial number can be used as the master LM rail.

3.2. Markings on the Datum Plane
In the LM Guide, the datum plane of the LM block is opposite the surface marked with the "THK" logo, and that of the LM rail is on the surface marked with a line (see Fig.3-2). If it is necessary to reverse the datum plane of the LM rail and block, or if the grease nipple must be oriented in the opposite direction, specify it.

3.3. Combined Use of an LM Rail and LM Block
An LM rail and LM block(s) used in combination must have the same serial number. When removing an LM block from the LM rail and reinstalling the LM block, make sure that they have the same serial number and the numbers are oriented in the same direction (Fig.3-3).

3.4. Use of Connected LM Rails
When a long LM rail is ordered, two or more rails will be connected together to the desired length. When connecting rails, make sure that the joint match marks shown in Fig.3-4 are correctly positioned. When two LM Guides with connected rails are to be arranged in parallel to each other, the two LM Guides will be manufactured so that the two LM Guides are axisymmetrically aligned.
4. Mounting the LM Guide

4.1. Mounting Procedures

4.1.1. Example of Mounting the LM Guide When an Impact Load is Applied to the Machine and therefore Rigidity and High Accuracy are Required

Mounting the LM Rail(s)

① Be sure to remove burr, indentations and dust from the mounting surface of the machine to which the LM Guide is to be mounted before installing the LM Guide (Fig. 4-2).

Note: Since the LM Guide is coated with anti-corrosion oil, remove it from the datum plane by wiping the surface with wash oil before using the guide. Once the anti-corrosion oil has been removed, the datum plane is prone to getting rusted. We recommend applying low-viscosity spindle oil.

② Gently place the LM rail onto the base, and temporarily secure the bolts to the extent that the LM rail lightly contacts the mounting surface (align the line-marked side of the LM rail with the side datum plane of the base) (Fig. 4-3).

Note: The bolts for securing the LM Guide must be clean. When placing the bolts into the mounting holes of the LM rail, check if the bolt holes are displaced (Fig. 4). Forcibly tightening the bolt into a displaced hole may deteriorate the accuracy.

③ Secure the setscrews for the LM rail in order with a tightening force just enough to have the rail closely contact the side mounting surface (Fig. 4-5).

④ Tighten the mounting bolts at the designated torque using a torque wrench (see Fig. 4-6, and tables 1 and 2).

Note: To achieve stable accuracy when tightening the LM rail mounting bolts, tighten them in order from the center to the rail ends.

⑤ Mount the other rail in the same manner to complete the installation of the LM rails.

⑥ Hammer in caps into the bolt holes on the top face of each LM rail until the top of the cap is on the same level as the top face of the rail.

Mounting the LM blocks

① Gently place the table on the LM blocks and temporarily secure the mounting bolts.

② Press the master side LM blocks to the side datum plane of the table using setscrews and position the table (Fig. 4-1).

③ Fully tighten the mounting bolts on the master side and the subsidiary side to complete the installation.

Note: To evenly secure the table, tighten the mounting bolts in diagonal order as shown in Fig. 4-7.

This method saves time in establishing straightness of the LM rail and eliminates the need to machine securing knock pins, thus to Drastically shorten the installation man-hours.
4.1.2. Example of Mounting the LM Guide When the Master LM Rail is not Provided with Setscrews

Mounting the master LM rail

After temporarily tightening the mounting bolts, firmly press the LM rail to the side Datum plane at the position of each mounting bolt using a small vice and fully tighten the bolt. Perform this in order from either rail end to the other (Fig. 4-9).

Mounting the subsidiary LM rail

To mount the subsidiary LM rail in parallel with the master LM rail, which has been correctly installed, we recommend adopting the methods below.

● Use a straight edge

Place straight edges between the two rails, and arrange the straight edges in parallel. With the side datum plane of the master LM rail using a dial gauge. Then, secure the mounting bolts in order while achieving straightness of the subsidiary rail with the Straight edge as the reference by using the Dial gauge (Fig. 4-10).

● Use Parallelism of the Table

Secure the two LM blocks on the master LM rail with the table (or a temporary for measurement), and temporarily fasten the LM rail and the LM block on the subsidiary LM rail with the table. Place a dial gauge to the side face of the LM block on the subsidiary rail from the dial stand fixed on the table top, then fasten the bolts in order while achieving Parallelism of the subsidiary LM rail by moving the table from the rail end (Fig. 4-11).

● Having the Subsidiary LM Rail Follow the Master LM Rail.

Place the table on the blocks of the correctly mounted master LM rail and the temporarily fastened subsidiary LM rail, and fully tighten the two LM blocks on the master rail and one of the two LM blocks on the subsidiary rail with the bolt. Fully tighten the mounting bolts on the subsidiary LM rail in order while temporarily fastening the remaining LM block on the subsidiary LM rail (Fig. 4-12).

● Use a jig

Use a jig like the one shown in Fig. 4-13 to achieve parallelism of the datum plane on the subsidiary side against the side datum plane of the master side from one end of the rail by the mounting pitch, and at the same time, fully tighten the mounting bolts in order (Fig. 4-13).
4.1.3. Example of Mounting the LM Guide When the Master LM Rail Does not Have a Side Datum Plane

You can temporarily set a datum plane near the LM rail mounting position on the base to achieve straightness of the LM rail from the rail end. In this method, two LM blocks must be joined together and attached to a measurement plane, as shown in Fig. 4-15.

- Use a temporary datum plane

After temporarily tightening the mounting bolts, use a dial gauge to check the straightness of the side datum plane of the LM rail from the rail end, and at the same time, fully tighten the mounting bolts.

To mount the subsidiary LM rail, follow the procedures described on the previous page 6.

4.2. Methods for Measuring Accuracy after Installation

When Measuring Running Accuracy for Single Rail Application

When measuring running accuracy of the LM block, stable accuracy can be obtained by securing two LM blocks on an inspection plate, as shown in Fig. 4-17. When using a dial gauge, we recommend placing the straight edge as close as possible to the LM block in order to perform accurate measurement.

1) Measurement method using an auto-collimeter
2) Measurement method using a dial gauge

4.3. Recommended Tightening torque for LM Rails

With high-precision LM rails for the LM Guide, their raceways are ground and accuracy is inspected with the rails tightened with bolts. When mounting a high-precision LM rail on a machine, we recommend using the corresponding tightening torque indicated in Table 1 or 2.

<table>
<thead>
<tr>
<th>Screw model No.</th>
<th>Tightening torque (Unit: N-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not hardened</td>
</tr>
<tr>
<td>M 2</td>
<td>17.6</td>
</tr>
<tr>
<td>M 2.3</td>
<td>29.4</td>
</tr>
<tr>
<td>M 2.6</td>
<td>44.1</td>
</tr>
<tr>
<td>M 3</td>
<td>63.0</td>
</tr>
<tr>
<td>M 4</td>
<td>94.0</td>
</tr>
<tr>
<td>M 5</td>
<td>127.0</td>
</tr>
<tr>
<td>M 6</td>
<td>160.0</td>
</tr>
<tr>
<td>M 8</td>
<td>304.0</td>
</tr>
<tr>
<td>M 10</td>
<td>676.0</td>
</tr>
<tr>
<td>M 12</td>
<td>1180.0</td>
</tr>
<tr>
<td>M 14</td>
<td>1700.0</td>
</tr>
<tr>
<td>M 16</td>
<td>1960.0</td>
</tr>
<tr>
<td>M 20</td>
<td>38200.0</td>
</tr>
<tr>
<td>M 22</td>
<td>51900.0</td>
</tr>
<tr>
<td>M 24</td>
<td>65700.0</td>
</tr>
<tr>
<td>M 30</td>
<td>130000.0</td>
</tr>
</tbody>
</table>

Table 4-2 Tightening Torques when Hexagon Socket Screws are Used

<table>
<thead>
<tr>
<th>Screw model No.</th>
<th>Tightening torque (Unit: N-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iron</td>
</tr>
<tr>
<td>M 2</td>
<td>58.8</td>
</tr>
<tr>
<td>M 2.3</td>
<td>78.4</td>
</tr>
<tr>
<td>M 2.6</td>
<td>118.0</td>
</tr>
<tr>
<td>M 3</td>
<td>196.0</td>
</tr>
<tr>
<td>M 4</td>
<td>412.0</td>
</tr>
<tr>
<td>M 5</td>
<td>682.0</td>
</tr>
<tr>
<td>M 6</td>
<td>912.0</td>
</tr>
<tr>
<td>M 8</td>
<td>3040.0</td>
</tr>
<tr>
<td>M 10</td>
<td>6760.0</td>
</tr>
<tr>
<td>M 12</td>
<td>11800.0</td>
</tr>
<tr>
<td>M 14</td>
<td>17000.0</td>
</tr>
<tr>
<td>M 16</td>
<td>19600.0</td>
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<td>M 20</td>
<td>38200.0</td>
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<td>M 22</td>
<td>51900.0</td>
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<tr>
<td>M 24</td>
<td>65700.0</td>
</tr>
<tr>
<td>M 30</td>
<td>130000.0</td>
</tr>
</tbody>
</table>
5. Permissible Error of the Mounting Surface

The LM Guide allows smooth linear motion through its self adjustment capability even when there is a slight distortion or error on the mounting surface.

Please refer to THK general catalog since Permissible error of the mounting surface of each LM block type, that will not affect the service life in normal operation is indicated.

**Error Allowance in the Parallelism between Two Rails**

![Fig.5-1 Error Allowance in Parallelism (P) between Two Rails](image)

**Error Allowance in Vertical Level between Two Rails**

![Fig.5-2 Error Allowance in Vertical Level (S) between Two Rails](image)

6. Lubrication

For long-term use of a linear motion system under normal conditions, good lubrication is a must. If lubricant is not used, rolling parts wear quickly, and the service life of the system is shortened considerably.

To tap the full functionality of a linear motion system, it is essential to provide lubrication that best meets the system service conditions.

Note that linear motion systems, even if sealed, cannot completely eliminate leakage of lubricants no matter how negligible the amount of leakage is at any given time. It is therefore necessary to replenish the lubricant periodically according to the operating conditions for the lubricant in question.

### 6.1. Greasing Interval

**Grease lubrication**

Although the grease feeding interval depends on the service conditions and environment, as a rule, feeding should be performed every 100 km of travel under normal usage condition.

Normally you can feed grease through a grease nipple or a greasing pot provided on your linear motion system. Use a grease of the same type as is in use grease can increase the consistency of the resulting grease, thus degrading system performance.

**Oil lubrication**

- The amount of oil to be fed varies with the stroke length. For a long stroke, increase the oiling frequency or the amount of feed so that the oil film reaches the stroke end on the raceway.
- In environments where a liquid coolant is spattered, the lubricant will mix with the coolant, and this can result in the lubricant being emulsified or washed lubrication performance. In such locations, apply a lubricant with high viscosity (kinematic viscosity: approx. 68cst) and high emulsification resistance, and adjust the lubrication frequency or the amount of feed.
- Please make certain that lubrication oil normally discharges from the ends of your lubrication piping, i.e., the oiling ports that connect to your linear motion system.
Methods for lubrication linear motion systems are divided into: 1) manual greasing with the aid of a grease gun, manual pump, and the like; 2) forced oiling with the aid of an automatic pump; and 3) lubrication with the aid of an oil bath.

**Manual greasing**

Normally grease is replenished periodically, fed through the grease nipple provided on a linear motion system, with the aid of a grease gun (Fig. 6-1). For systems that have many locations to be greased, integrated piping is used so that grease can be fed at one location with a manual pump at a certain time interval (Fig. 6-2).

![Fig.6-1 Greasing with a Grease Gun](image1)

![Fig.6-2 Greasing with Integrated Piping](image2)

Note: When integrated greasing is used, some types of grease cannot reach the ends of the piping because of the viscous resistance on the piping interior. Select the right type of grease for your system, considering the consistency of the grease and the pipe diameters.

**Forced oiling**

In this method, a given amount of lubricant is forcibly fed to certain locations with the aid of an automatic pump at a given time interval. Normally the lubricant is not collected after use. Although a special design for the piping is required, this method reduces the likelihood that lubricant will not be replenished in time. While forced oiling is used chiefly for lubrication with oil, it can be applied also to lubrication with grease. When using grease, it is necessary to consider the piping diameter and grease consistency.

![Fig.6-3 Forced Oiling](image3)