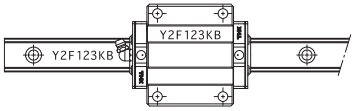
Mounting the LM Guide

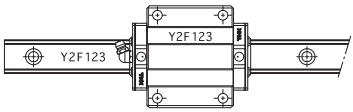
Master LM Guide Indicators and Combined Use

Master LM Guide Indicators

All LM rails mounted on the same plane are marked with the same serial number. The LM rail marked with “KB” after the serial number is the master LM rail. The LM block on the master LM rail has its reference surface finished to a designated precision, allowing it to serve as the positioning reference for tables (see Fig. 1).
Normal grade LM Guides are not marked with “KB.” Therefore, any one of the LM rails having the same serial number can be used as the master LM rail.



Master LM Guide



Subsidiary LM Guide

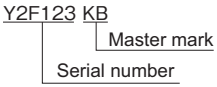
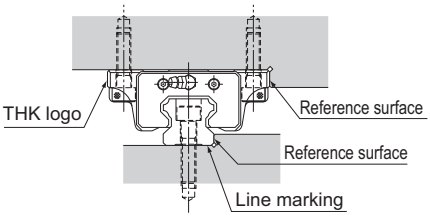


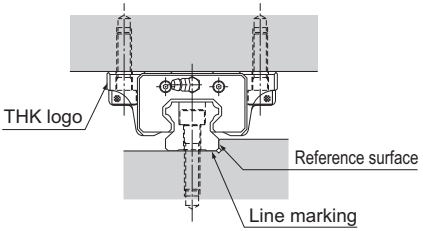
Fig. 1: Master and Subsidiary LM Guide Units (e.g. Model HSR-C)

Reference Surface Indicators

In the LM Guide, the reference surface 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. 2). Please specify if it is necessary to reverse the reference surface of the LM rail and block or if the grease nipple must be oriented in the opposite direction.



Master LM Guide



Subsidiary LM Guide

Fig. 2: Reference Surface Indicators

Serial Number Marking and Combined Use of an LM Rail and LM Blocks

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)

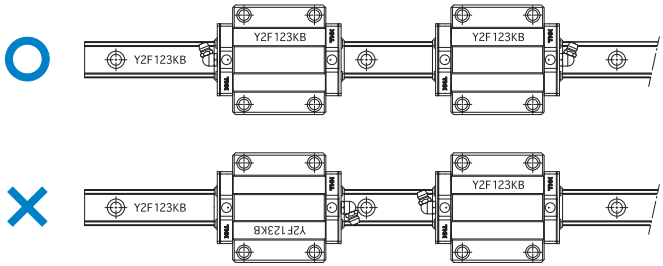


Fig. 3: Serial Number Marking and Combined Use of an LM Rail and LM Blocks (E.g. Model HSR-C)

Use of Jointed Rails

When a long LM rail is ordered, two or more rails will be jointed together to the desired length. When jointing rails, make sure that the joint match marks shown in Fig. 4 are correctly positioned.

When two LM Guide units with jointed rails are to be arranged parallel to each other, they will be manufactured so that they have axial symmetry (are mirror images of each other) as a set.

If a large load is applied near the LM rail joint, the LM rail may deflect and cause misalignment. Therefore, we recommend securely fastening the joint section by pressing the LM rail against the datum plane using a set screw or the like and keeping the L dimension as short as possible. (Fig. 4)

For details, contact THK.

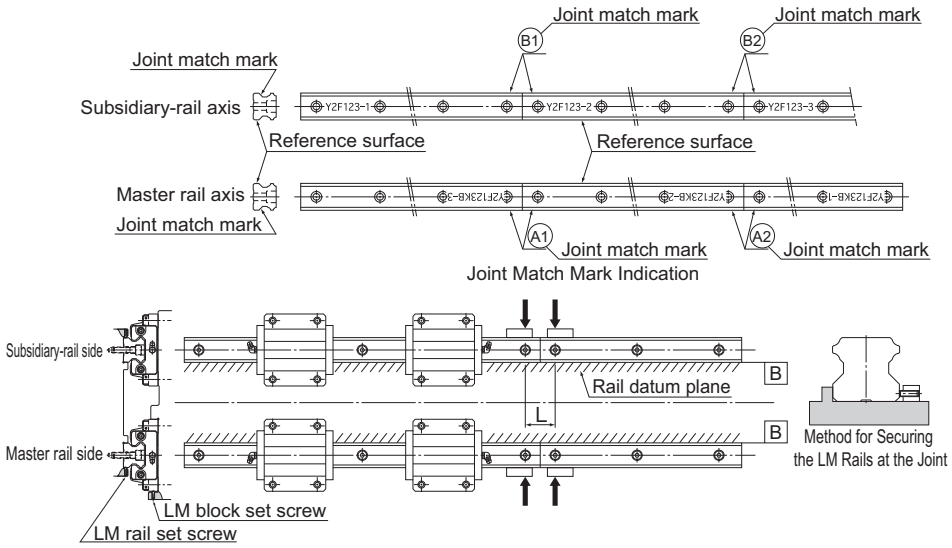


Fig. 4: Use of Jointed Rails

Mounting Procedure

LM Guide Mounting Example Requiring Rigidity and Accuracy Because of Impact Loads Applied to the Machine

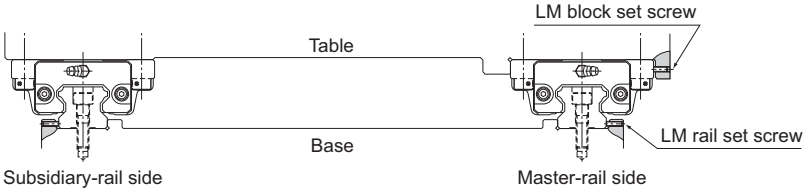


Fig. 5: When an Impact Load is Applied to the Machine

● Mounting the LM Rail(s)

(1) Be sure to remove burrs, dents, and dust from the mounting surface of the machine to which the LM Guide is to be mounted before installing the LM Guide. (Fig. 6)

Note) Since the LM Guide is coated with anti-rust oil, remove the oil from the reference surface by wiping it with washing oil before using the guide. Once the anti-rust oil has been removed, the reference surface is prone to rusting. We recommend applying low-viscosity spindle oil.

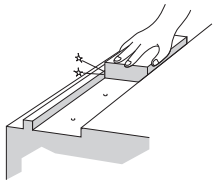


Fig. 6: Checking the Mounting Surface

(2) Gently place the LM rail onto the base, and temporarily secure the bolts so that the LM rail lightly contacts the mounting surface (align the line-marked side of the LM rail with the side reference-surface of the base). (Fig. 7)

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. 8) Forcibly tightening the bolt into a displaced hole may lower the accuracy.

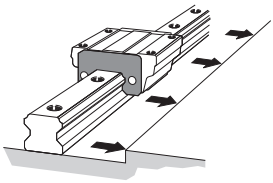


Fig. 7: Aligning the LM Rail with the Reference Surface

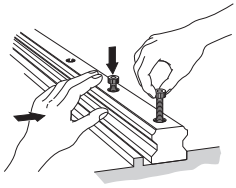


Fig. 8: Checking Slack in the Bolt

(3) Secure the LM rail set screws in order with a tightening force just enough to have the rail closely contact the side mounting surface. (Fig. 9)

(4) Tighten the mounting bolts at the designated torque using a torque wrench. (See Fig. 10, and Table 1 and Table 2 on B**1-101**.)

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 caps into the bolt holes on the top face of each LM rail until the top of the cap is flush with the top face of the rail.

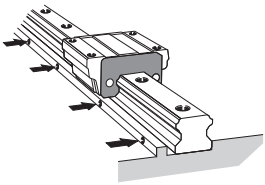


Fig. 9: Tightening the Set Screws

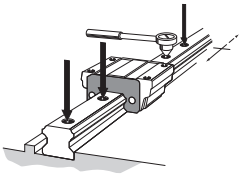


Fig. 10: Fully Fastening the Mounting Bolts

● Mounting the LM Blocks

(1) Gently place the table on the LM blocks and temporarily fasten the mounting bolts.

(2) Press the master side LM blocks to the side reference surface of the table using set screws and position the table. (See Fig. 5 on B**1-91**.)

(3) Fully fasten 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. 11.

This method saves time in establishing straightness of the LM rail and eliminates the need to machine securing dowel pins, thus drastically reducing the labor required for installation.

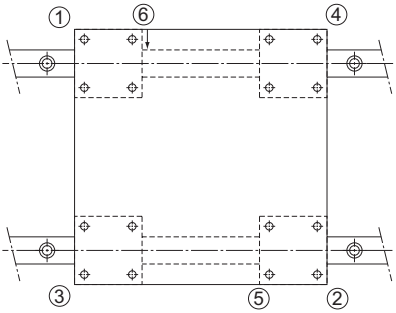


Fig. 11: Sequence for Tightening the LM Blocks

Example of Mounting the LM Guide When the Master LM Rail is not Provided with Set Screws

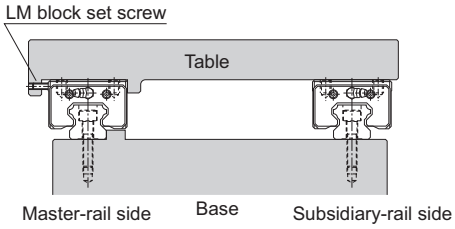


Fig. 12: When the Master LM Rail is not Provided with Set Screws

● Mounting the Master LM Rail

After temporarily fastening the mounting bolts, firmly press the LM rail to the side reference surface at the position of each mounting bolt using a small vice and fully fasten the bolt. Perform this in order from either rail end to the other. (Fig. 13)

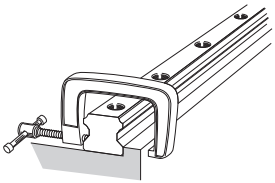


Fig. 13

● 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.

■Using a Straightedge

Place a straightedge between the two rails, and arrange it in parallel with the side reference surface 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 straightedge as the reference by using the dial gauge. (Fig. 14)

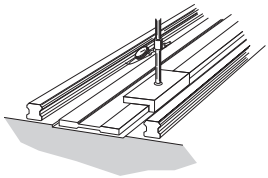


Fig. 14

■Using the Parallelism of the Table

Secure the two LM blocks on the master LM rail to the table (or a temporary table for measurement), and temporarily fasten the LM rail and the LM block on the subsidiary side to the base and the table. From a dial gauge stand fixed to the upper surface of the table, position the gauge so that it contacts the side face of the LM block on the subsidiary rail. Then beginning at one end of the rail, confirm the parallelism of the subsidiary rail by moving the table and fasten the bolts in order as you go. (Fig. 15)

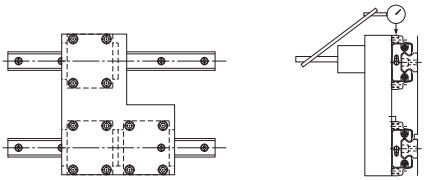


Fig. 15

■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 fasten the two LM blocks on the master rail and one of the two LM blocks on the subsidiary rail with bolts. 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. 16)

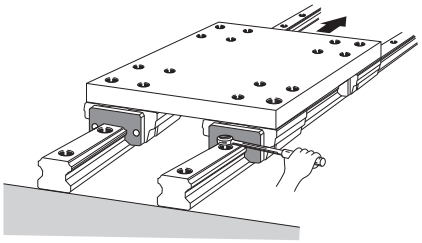


Fig. 16

■Using a Jig

Use a jig like the one shown in Fig. 17 to achieve parallelism between the reference surface on the subsidiary side and the side reference surface of the master side. Beginning at one end of the rail, confirm the parallelism at each mounting hole, and fully fasten the mounting bolts in order. (Fig. 17)

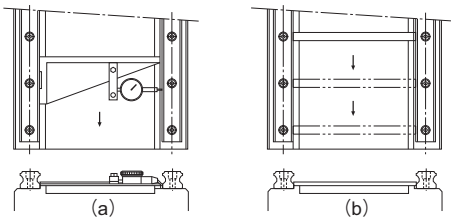


Fig. 17

Example of Mounting the LM Guide When the Master LM Rail Does not Have a Reference Surface

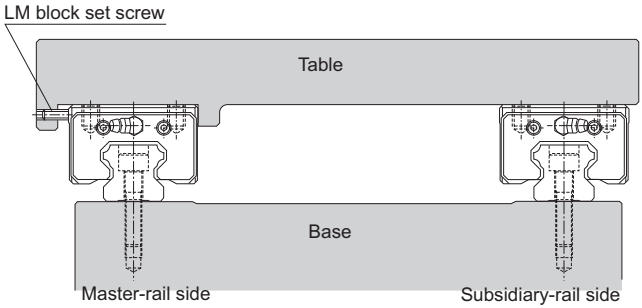


Fig. 18

● Mounting the Master LM Rail

■Using a Temporary Reference Surface

It is possible to achieve straightness of the LM rail by starting from one end and using a reference surface built into the base near the LM rail mounting position. In this method, two LM blocks must be joined together and attached to a measurement plate, as shown in Fig. 19.

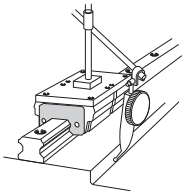


Fig. 19

■Using a Straightedge

After temporarily fastening the mounting bolts, use a dial gauge to check the straightness of the side reference surface of the LM rail from the rail end, and at the same time, fully fasten the mounting bolts. (Fig. 20)

To mount the subsidiary LM rail, follow the procedure described on B1-93.

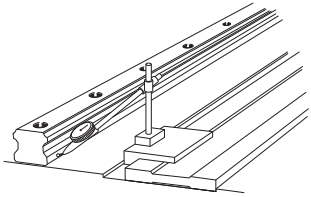


Fig. 20

Procedure for Assembling Model HR

The following procedure is recommended for assembling model HR.

(1) Use an oilstone to remove burrs or knots from the LM rail mounting surface on the base. (Fig. 21)

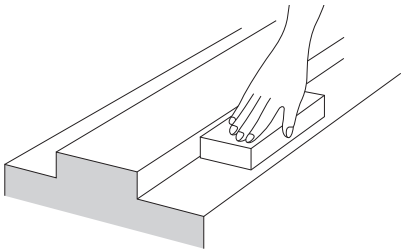


Fig. 21

(2) Use a small vice to press the two LM rails to the base so that they closely contact the reference surface, then tighten the mounting bolts to the recommended torque (see B**1-101**). (Fig. 22)
   a. Check if any of the bolts protrude.
   b. Use a torque wrench to tighten the bolts in order from the center to both ends.

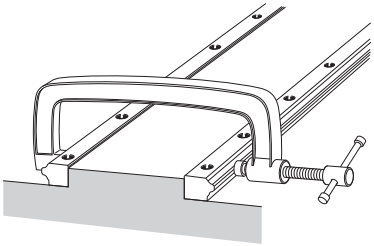


Fig. 22

(3) Mount the LM blocks on the table, then install them onto the LM rails. Be sure the mounting bolts for the LM blocks are temporarily fastened.

(4) Alternate between adjustment bolts to tighten them gradually and adjust the clearance. If a relatively large preload is applied in order to achieve high rigidity, control the tightening torque or the rolling resistance.
   a. It is preferable to use three clearance adjustment bolts for each LM block as shown in Fig. 23.
   b. For optimal clearance adjustment results, set the tightening torque of the two outside screws to approximately 90% of that of the center screw.

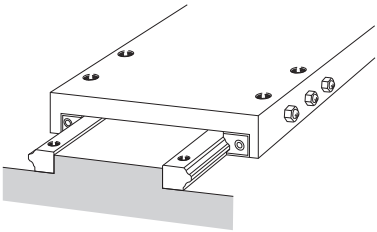


Fig. 23

(5) Secure each LM block by gradually tightening the two temporarily fastened LM block mounting bolts while sliding the table. (Fig. 24)

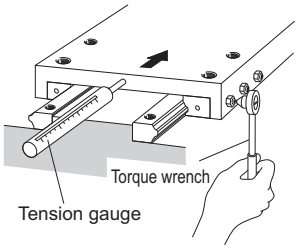
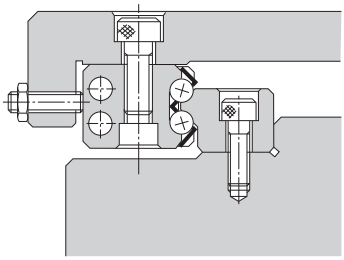


Fig. 24

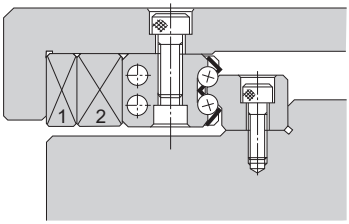
● **Example of Clearance Adjustment**

Design the clearance adjustment bolt so that it presses the center of the side face of the LM block.

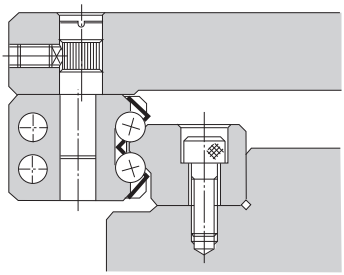
a. Using an adjustment screw
Normally, an adjustment screw is used to press the LM block.



b. Using tapered gibs
When high accuracy and high rigidity are required, use tapered gibs 1) and 2).



c. Using an eccentric pin
A type using an eccentric pin to adjust the clearance is also available.



Procedure for Assembling Model GSR

The procedure for assembling model GSR is as follows:

(1) Align the table with the reference surface of each LM block and fully fasten the mounting bolts to secure the blocks.
Both ends of the table must have a datum surface. (Fig. 25)

(2) Place LM rail A onto the base and align the rail with a straightedge.
Fully fasten the mounting bolts using a torque wrench. (Fig. 26)

(3) Temporarily secure LM rail B onto the base, then mount the blocks on the rail.
Temporarily fasten LM rail B while pressing it toward the LM blocks. (Fig. 27)

(4) Move the table a few strokes to warm up the LM blocks, then fully fasten LM rail B using a torque wrench. (Fig. 28)

If there are more GSR units to be assembled, we recommend producing a jig like the one shown in Fig. 29 first. You can easily mount LM rails while achieving parallelism of the LM rails using the jig.

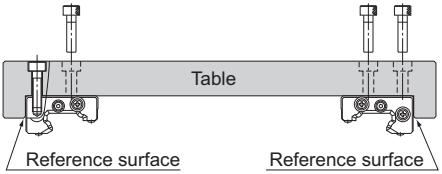


Fig. 25

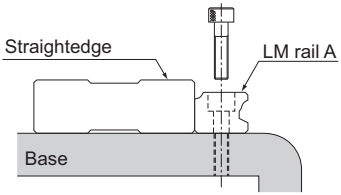


Fig. 26

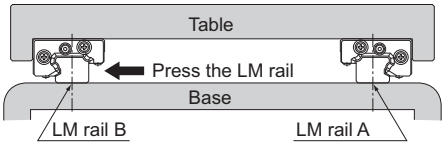


Fig. 27

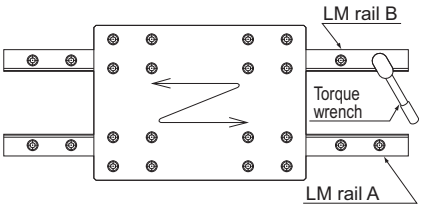


Fig. 28

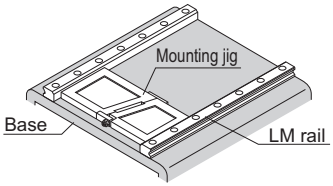


Fig. 29

Procedure for Assembling Model JR

● Mounting the LM Rails

When two LM rails are to be used in parallel as shown in Fig. 30, first secure one LM rail on the base, and place a dial gauge on the LM block. Then, place the pointer of the dial gauge on the side face and top face of the other LM rail to simultaneously adjust the parallelism and the level while mounting the rail.

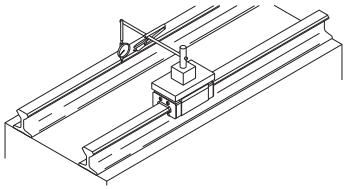


Fig. 30

● Jointing LM Rails

When two or more LM rails are to be jointed, a special metal fitting as shown in Fig. 31 is available. For such applications, specify this fitting when ordering the LM Guide (the rail will be tapped for attaching a joint fitting).

Installation Procedure

(1) Temporarily fasten the rail presser bolt.
(2) Secure rail A and the joint fitting with bolts C and D.
(3) Apply a dial gauge to side G of the joint between rails A and B. Adjust the left and right level differences using bolt E and set screw F on rail B.
If bolt E is tightened, rail B will move to the b side.
If set screw F is tightened, rail B will move to the a side.
(4) When the adjustment using set screw F is finished, secure set screw F with the nut.
(5) Adjust and secure the vertical direction using the rail presser.

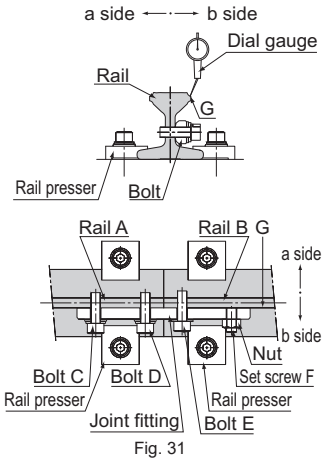


Fig. 31

● **Welding the LM Rail**

When welding the LM rail, it is best to weld the LM rail while clamping it at the welding point with a small vice or the like as shown in Fig. 32. For effective welding, we recommend the following welding conditions. (When welding the LM rail, take care to prevent spatter from contacting the LM rail raceway.)

Welding conditions
Preheating temperature: 200℃
Postheating temperature: 350℃
Note) If the temperature exceeds 750℃, the LM rail may be hardened again.

For shielded metal arc welding
Welding rod: LB-52 (Kobelco)

For carbon dioxide arc welding
Wire: YGW12
Electric current: 200 A

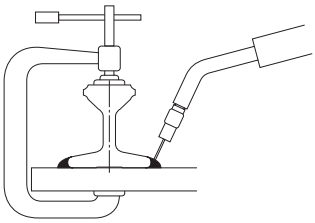


Fig. 32

Procedure for Assembling Model HCR

To install the LM rails of Curved Guide Model HCR, we recommend having some form of datum point (such as a pin) on the reference side (inside) of the LM rail, then pressing the LM rail to the datum point and securing it from the counter-reference surface with a presser plate or brace.

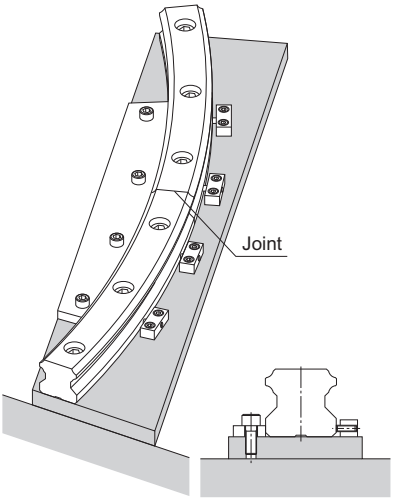


Fig. 33: Method for Securing the LM Rails at the Joint

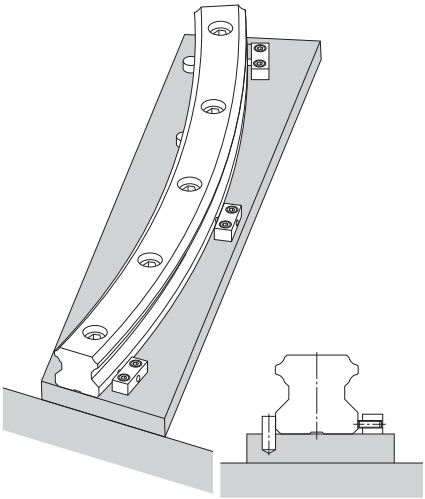
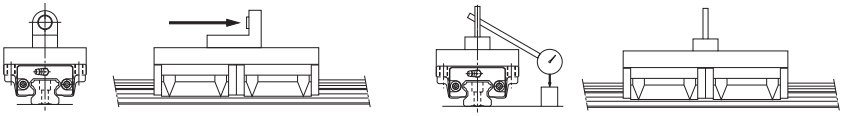


Fig. 34: Method for Securing the LM Rail Using a Pin as a Datum Point

Methods for Measuring Accuracy after Installation

When Measuring Running Accuracy for a 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. 35. When using a dial gauge, we recommend placing the straightedge as close as possible to the LM block in order to perform accurate measurement.



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

Fig. 35: Methods for Measuring Accuracy after Installation

Recommended Tightening Torque for LM Rails

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

Table 1: Tightening Torques when Pan Head Screws are Used
Unit: N·cm

Screw model No.	Tightening torque	
	Not hardened	Hardened
M 2	17.6	21.6
M 2.3	29.4	35.3
M 2.6	44.1	52.9

Table 2: Tightening Torques when Hexagonal-Socket-Head Type Bolts are Used
Unit: N·cm

Screw model No.	Tightening torque		
	Steel	Cast iron	Aluminum
M 2	58.8	39.2	29.4
M 2.3	78.4	53.9	39.2
M 2.6	118	78.4	58.8
M 3	196	127	98
M 4	412	274	206
M 5	882	588	441
M 6	1370	921	686
M 8	3040	2010	1470
M 10	6760	4510	3330
M 12	11800	7840	5880
M 14	15700	10500	7840
M 16	19600	13100	9800
M 20	38200	25500	19100
M 22	51900	34800	26000
M 24	65700	44100	32800
M 30	130000	87200	65200