



THK Linear Motion System

Linear Bushing

Instruction Manual

No. 1030-T34670

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1. Introduction

1. Introduction

1-1 Foreword

Thank you for purchasing this THK product. This manual describes the precautions on use, assembly method, and lubrication method that apply to a Linear Bushing.

1-2 About This Manual

1-2-1 Intended Audience

Persons in charge of product mounting design, installation, wiring, and maintenance, and persons actually using the product.

1-2-2 Using This Manual

This manual describes the correct handling of this product and precautions on its use. For maximum product performance and long-term use, read this manual carefully and understand its contents so that you use this product safely and properly. When printing this manual for reading, store it in a place where the intended audience can read it when necessary.

1-2-3 Notice and Attention

- Do not handle or use this product in any way other than as described in this manual.
- No part of this manual may be duplicated, reproduced, or loaned without permission.
- Due to a continuing process of product improvement, information contained herein is subject to change without notice.
- Efforts have been made to ensure the accuracy of the information contained herein. If, however, you notice an error or have a concern, notify THK.
- The diagrams contained herein are representative examples and may vary from the actual product.
- THK will not be liable for the effects resulting from the use of this manual for any reason whatsoever.
- This manual also applies to special products, but content specified on the Delivery Specification Diagram takes priority.

*Special products are products that differ from standard products listed in the catalog, in material and/or specifications.

1-3 Applying This Product

- Do not use this product for equipment or systems used in life-threatening situations.
- Consult THK beforehand when considering using this product for special applications such as in passenger vehicles or in medical, aviation and space, nuclear power, or electrical power equipment or systems.
- This product was manufactured under strict quality control, but this does not completely rule out product failure. When using this product in equipment where failure of this product could cause a severe accident or damage, install a safety device or backup device to prevent the occurrence of severe accidents or damage.

1-4 Product Support

Efforts have been made to ensure the accuracy of the information contained herein. If, however, you have a concern, notify THK.

1-5 Product Information and THK Information

For the latest product information and company information, we recommend that you regularly access and view the THK website.

- Website URL: <https://www.thk.com/eng/>
- Technical support site URL: <https://tech.thk.com/>

2. Precautions on Use

2. Precautions

2-1 Safety Related Warning Displays

This manual uses the following safety related warning displays. Descriptions containing safety related warning displays are serious and must be followed. The Linear Bushing is a precision part, to be handled with care based on the following information.



Warning

"A matter which, if mishandled, could result in death or serious injury."



Caution

"A matter which, if mishandled, could result in physical injury or material damage."



"Prohibited (never do this)"



"Required (always do this)"

2-2 Handling



CAUTION



Do not disassemble

- Disassembling components may cause dust to enter the system or degrade mounting accuracy of parts. Do not disassemble the product.



Falling objects

- Take care not to drop or strike the Linear Bushing. This could cause injury and damage the product. If the product receives an impact, it could impair the product's functions, even if the product looks intact.



Handle with care

- When handling the product, wear safety gloves and safety boots, etc., as appropriate to ensure safety.

2. Precautions on Use

2-3

Precautions on Use

CAUTION



Prevent dust

- Prevent foreign materials, such as cutting chips or coolant, from entering the product. Failure to do so could damage the product.
- Prevent foreign materials, such as cutting chips, coolant, corrosive solvents or water from getting in the product by using a bellows or cover when the product is used in an environment where such a thing is likely.
- If foreign materials such as cutting chips adhere to the product, clean the product and then replenish the lubricant.
- Small strokes can inhibit the formation of an oil film between the raceway and the area of contact for rolling elements, resulting in fretting. Therefore, be sure to use a type of grease with high fretting resistance properties. We recommend periodically adding stroke movement for approximately the outer cylinder length to help ensure that an oil film forms between the raceway and the rolling elements.



Maximum temperature

- Do not use this product if the external temperature exceeds 80 °C. If used in excess of this temperature, there is a risk that the resin and rubber parts may deform or become damaged (except the heat-resistant type).



Handle with care

- Do not forcibly drive a pin, key, or other positioning device into the product. This could create indentations on the raceway and impair the product's functions.
- Inserting the shaft while tilted risks foreign material entering, internal parts being damaged, and rolling elements dropping off.
- Using while the rolling elements are removed may cause early damage.
- A lack of rigidity and accuracy of mounting components may cause the bearing load to localize, reducing the performance of the bearing significantly. Therefore, consider carefully the rigidity and accuracy of the housing and base, and the strength of the securing bolts.



Falling objects

- If any of the rolling elements fall, discontinue use and contact THK.

2. Precautions on Use

2-4

Lubrication

CAUTION



Check lubricant

- Thoroughly remove anti-rust oil and feed lubricant before using the product.
- Do not mix different lubricants. Even grease containing the same type of thickening agent may, if mixed, interact in an adverse manner due to disparate additives or other ingredients.
- When using the product in locations subject to constant vibrations or in special environments such as in clean rooms, vacuums, and under low or high temperatures, be sure to use a lubricant suitable for the specifications and environment.
- When lubricating products, directly coat the raceway surface with lubricant and perform several warm-up strokes to ensure that the grease permeates the interior.
- Grease consistency can vary depending on the temperature. Keep in mind that the Linear Bushing sliding resistance will be affected by changes in consistency.
- Following greasing, the stirring resistance of the grease can cause the Linear Bushing to exhibit increased sliding resistance. Before commencing operations, be sure to run the unit through several warm-up cycles to ensure that the grease is adequately integrated and dispersed.
- Excess grease may spatter immediately after lubrication. Wipe off spattered grease as necessary.
- The properties of the grease deteriorate over time, thereby degrading the lubricity. It is necessary to inspect and apply the grease in accordance with the usage frequency.
- How often grease should be replenished varies depending on the usage conditions and environment. Final greasing interval/amount should be set at an actual machine.

2-5

Storage

Linear Bushings should be stored in their original packaging in an indoor location where they are not exposed to abnormally high or low temperatures or high humidity.

2-6

Disposal

The product should be disposed of appropriately as industrial waste.

3. Assembly

3. Assembly

Housing Inner Diameter

Table 3-1 shows recommended housing inner-diameter tolerance for the Linear Bushing. When fitting the Linear Bushing on the housing, a loose fit is normally recommended. If the clearance needs to be smaller, make a transition fit.

Table 3-1 Housing Inner-diameter Tolerance

Model No.	Type	Housing	
	Accuracy	Loose fit	Transition fit
LM	High accuracy grade (no symbol)	H7	J7
	Precision grade (P)	H6	J6
LME	—	H7	K6, J6
LMF	High accuracy grade (no symbol)	H7	J7
LMK			
LMH			
LM-L			
LMF-L			
LMK-L			
LMH-L			
LMIF			
LMIK			
LMIH			
LMIF-L			
LMIK-L			
LMIH-L			
LMCF-L			
LMCK-L			
LMCH-L			

Clearance between the Outer Cylinder and LM Shaft

When using the Linear Bushing in combination with an LM shaft, use normal clearance in ordinary use and a small gap if the clearance is to be minimized.

Note 1: If the clearance after installation is to be negative, it is preferable not to exceed the radial clearance tolerance indicated in the specification table.

Note 2: The shaft tolerance for case unit models SC, SL, SH, and SH-L falls under the high accuracy grade (no symbol).

3. Assembly

3. Assembly

Table 3-2 Shaft Outer-Diameter Tolerance

Type		LM Shaft	
Model No.	Accuracy	Normal clearance	Small gap
LM	High accuracy grade (no symbol)	f6, g6	h6
	Precision grade (P)	f5, g5	h5
LME	—	h7	k6
LMF	High accuracy grade (no symbol)	f6, g6	h6
LMK			
LMH			
LM-L			
LMF-L			
LMK-L			
LMH-L			
LMIF			
LMIK			
LMIH			
LMIF-L			
LMIK-L			
LMIH-L			
LMCF-L			
LMCK-L			
LMCH-L			

3-1

Mounting the Outer Cylinder

Although the Linear Bushing does not require a large amount of strength for securing it in the LM shaft direction, do not rely only on a press fit to support the nut. For the housing inner-diameter tolerance, see Table 3-1.

● Mounting a Standard Linear Bushing

Figure 3-1 and Figure 3-2 show mounting examples.

Use snap rings or stopper plates when securing Linear Bushings.

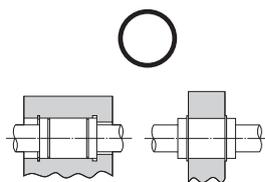


Figure 3-1 Secured by a Snap Ring

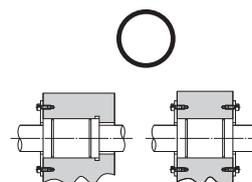


Figure 3-2 Secured by a Stopper Plate

3. Assembly

3. Assembly

Snap Ring for Mounting

See Table 3-3 for the models of snap rings to use for securing the Linear Bushing model LM.

Note 1: For models indicated in parentheses, use C-shape concentric snap rings.

Note 2: Table 3-3 commonly applies to models LM, LM-GA, LM-MG, and LM-L.

Table 3-3 Types of Snap Rings

Model No.	Snap ring			
	For outer diameter		For inner diameter	
	Needle snap ring	C-shape snap ring	Needle snap ring	C-shape snap ring
LM 3	—	—	AR 7	—
LM 4	—	—	8	—
LM 5	WR 10	10	10	10
LM 6	12	12	12	12
LM 8	—	15	15	15
LM 8S	—	15	15	15
LM 10	19	19	19	19
LM 12	21	21	21	21
LM 13	23	22	23	—
LM 16	28	—	28	28
LM 20	32	—	32	32
LM 25	40	40	40	40
LM 30	45	45	45	45
LM 35	52	52	52	52
LM 38	—	56•58	57	—
LM 40	—	60	60	60
LM 50	—	80	80	80
LM 60	—	90	90	90
LM 80A	—	120	120	120
LM 100A	—	(150)	150	—
LM 120A	—	(180)	180	—

Set Screws Not Allowed

As shown in 3-3, avoid securing the nut by using one set screw to press against the outer surface of the outer cylinder, because this will cause deformation to the outer cylinder.

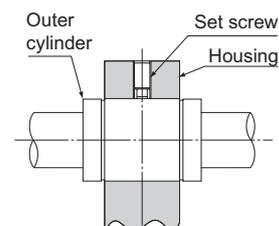


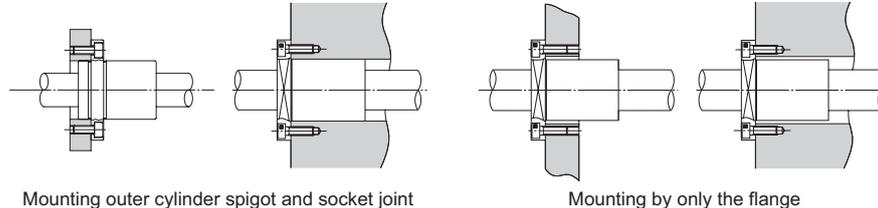
Figure 3-3 Set Screws Not Allowed

3. Assembly

3. Assembly

● Mounting a Flanged Type

With models LMF, LMK, LMH, LMIF, LMCF, LMIK, LMCK, LMIH, and LMCH, the flange is integrated with the outer cylinder. Therefore, the Linear Bushing can be secured via only the flange.



● Mounting a Clearance-Adjustable Type

To adjust the clearance of a Clearance-Adjustable type (-AJ), use a housing that allows adjustment of the outer diameter to facilitate adjustment of the clearance between the Linear Bushing and the LM shaft. Positioning the Linear Bushing slit at a 90° angle to the housing slit will apply uniform deformation in the circumferential direction. (Figure 3-4)

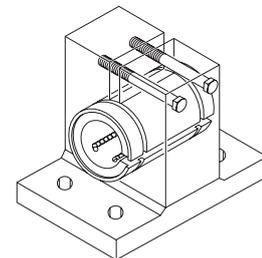


Figure 3-4 Mounting a Clearance-Adjustable Type

● Mounting an Open Type

For an Open type (-OP), also use a housing that allows clearance adjustment, as shown in Figure 3-5. Open types are normally used with a light preload. Be sure not to provide an excessive preload.

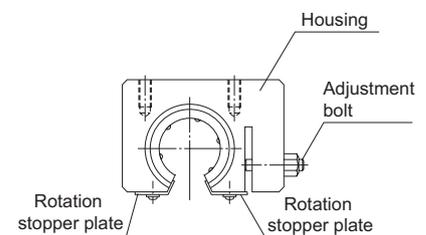


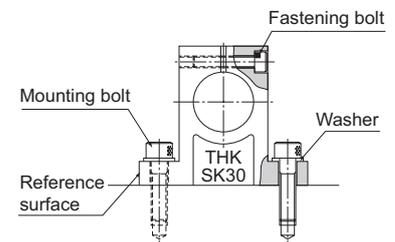
Figure 3-5 Mounting an Open Type

3. Assembly

3. Assembly

3-2 Mounting the Shaft Support

Shaft Support model SK can easily be secured to the table using mounting bolts and the LM shaft can be firmly secured using clamping bolts.



3-3 Mounting the Linear Bushing

● Mounting Model SC (SL)

Since models SC and SL can be attached from the top or bottom by simply tightening the bolts, the installation time can be shortened. (Figure 3-6)

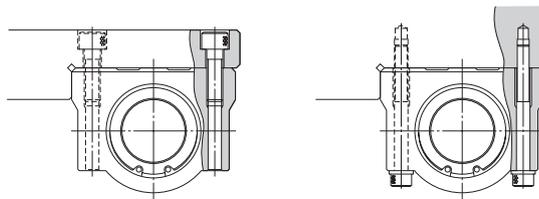


Figure 3-6 Mounting Model SC (SL)

● Mounting Model SH (SH-L)

Since models SH and SH-L can be attached from the top or bottom by simply tightening the bolts, the installation time can be shortened. (Figure 3-7)

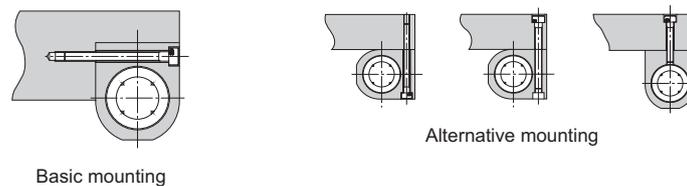


Figure 3-7 Mounting Model SH (SH-L)

3. Assembly

3. Assembly

Installing the Outer Cylinder

When incorporating the standard Linear Bushing into a housing, do not directly hit the seal or side plate. Use a jig and drive in the nut, or place a flatter piece of metal on the nut and gently hit that. (Figure 3-8)

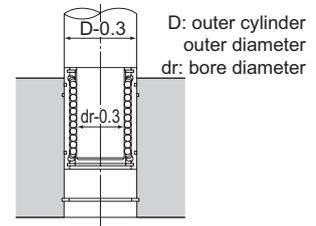


Figure 3-8 Installing the Outer Cylinder

Inserting the LM Shaft

When inserting the LM shaft into the Linear Bushing, align the center of the shaft and gently insert the shaft straight into the nut. If the shaft is slanted while it is inserted, balls may fall out or the retainer may be deformed. (Figure 3-9)

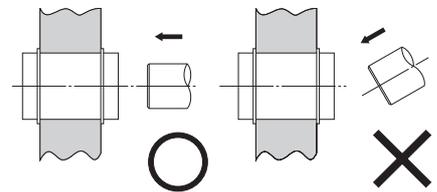


Figure 3-9 Inserting the LM Shaft

Under Moment Load

When using the Linear Bushing, make sure the load is evenly distributed across the entire ball raceway. In particular, if a moment load is to be applied, use two or more Linear Bushing units on the same LM shaft and secure an adequately large distance between the Linear Bushings. Also, when using with a moment load, calculate the equivalent radial load and check the model number.

Rotational Use Not Allowed

The Linear Bushing is structurally not suited for rotational operation. (Figure 3-10)
Forcibly rotating it may cause an unexpected accident.

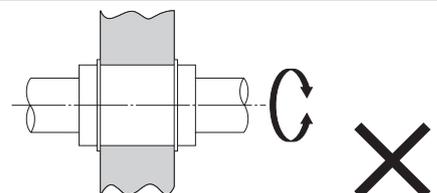


Figure 3-10 Rotational Use Not Allowed

3. Assembly

3. Assembly

Precautions on Installing an Open Three-Ball-Row Type Linear Bushing

When mounting an Open Three-Ball-Row type Linear Bushing, mount it as shown in Figure 3-11, while taking into account the load distribution.

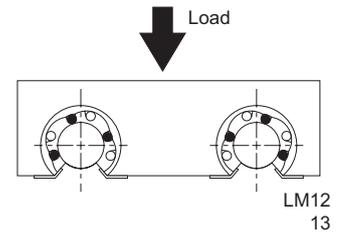


Figure 3-11 Precautions on Installing an Open Three-Ball-Row Type Linear Bushing

3-4 Attaching FLM Felt Seal

The felt seal can be press-fit into a housing finished to H7, but cannot be used as a stopper for preventing the Linear Bushing from detaching. Be sure to attach the felt seal as shown in Figure 3-12.

Also make sure to impregnate the felt with sufficient lubricant before attaching it.

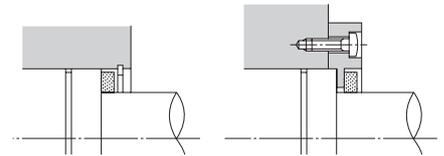


Figure 3-12 Attaching FLM Felt Seal

4. Lubrication

It is necessary to use a good quality lubricant when using Linear Bushings. Usage with no lubrication may increase wear on the rolling elements and shorten the service life.

A lubricant has the following effects.

- (1) Minimizes friction in moving elements to prevent seizure and reduce wear.
- (2) Forms an oil film on the raceway to decrease stress acting on the surface and extend rolling fatigue life.
- (3) Covers the metal surface in an oil film to prevent rust formation.

To optimize Linear Bushing functions, provide lubrication appropriate to the usage conditions.

Grease Lubrication

When installing onto an LM shaft, apply grease to the rows of balls in the Linear Bushing.

Then, depending on the usage state, either apply as described above when appropriate, provide a housing as shown in Figure 4-1, or apply grease to the LM shaft.

We recommend using high-quality lithium-soap group grease No. 2.

Oil Lubrication

Either drip oil onto the LM shaft when appropriate, or provide a housing as shown in Figure 4-1 like for grease lubrication.

Turbine oil, machine oil and spindle oil are commonly used as a lubricant.

In addition to the above, an oil hole or a grease nipple could be used. Contact THK for details.

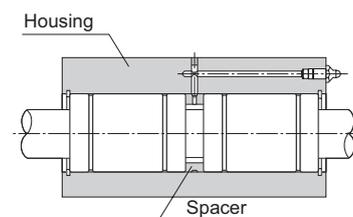


Figure 4-1

4-1

Lubrication Interval

4-1-1

Grease Lubrication

How often grease should be replenished varies depending on the usage conditions and environment. We recommend greasing the system approximately every 100 km traveled (three to six months). Final greasing interval/amount should be set at an actual machine.

4. Lubrication

Normally, relubricate using the same grease type and through the lubrication hole or grease nipple provided on the Linear Bushing. Mixing different types of grease may deteriorate the system's performance due to increased consistency or other such factor.

Lubricant	Type	Brand name
Grease	Lithium-Based Grease Urea-Based Grease Calcium-Based Grease	AFA Grease (THK)
		AFB-LF Grease (THK)
		AFC Grease (THK)
		AFE-CA Grease (THK)
		AFF Grease (THK)
		AFG Grease (THK)
		AFJ Grease (THK)
		L100 Grease (THK)
		L450 Grease (THK)
		L500 Grease (THK)
		L700 Grease (THK)
		Alvania Grease S No.2 (Showa Shell Sekiyu)
		Eponex Grease No.2 (Idemitsu Kosan)
		or equivalent

*The recommended grease will vary according to the usage conditions and environment.

4-1-2

Oil Lubrication

LM systems that require oil lubrication are shipped with only anti-rust oil applied. When placing an order, specify the required lubricant oil.

- The amount of oil to be applied varies depending on the stroke length. For a long stroke, increase the lubrication frequency or the amount of oil applied so that an oil film is able to form in the stroke end of the raceway.
- In environments where coolant may spatter, the lubricant may become mixed with the coolant. This could result in the lubricant being emulsified or washed away, causing significantly degraded lubrication performance. In such locations, apply a lubricant with high viscosity (kinematic viscosity: approx. 68 cst) and high emulsification resistance, and adjust the lubrication frequency or the amount of the applied lubricant accordingly.
- For machine tools and similar devices that are subject to heavy loads, require high rigidity, and operate at high speed, oil lubrication is recommended.
- Make sure that lubrication oil discharges normally from the ends of the lubrication piping; that is, the oiling ports that connect to your linear motion system.

Lubricant	Type	Brand name
Oil	Raceway Oil or Turbine Oil ISOVG32 to 68	Daphne Super Multi Oil (Idemitsu Kosan)
		Mobil DTE Oil Series (Exxon Mobil)
		Shell Tonna S3 M (Showa Shell Sekiyu)
		Mobil Vactra Numbered Series (Exxon Mobil)
		Mobil Vactra No. 2 SLC (Exxon Mobil)
		or equivalent

Appendix

Revision History

The instruction manual number is on the back cover.

Publication Date	Instruction Manual No.	Revisions
December 2017	No. 1030-T34670	First edition

THK CO., LTD.

Inquiries

Website URL: <https://www.thk.com/eng/>

Technical support site URL: <https://tech.thk.com/>