Linear Bushing G
LMG

IKO Linear Bushing G is a high load capacity type linear motion rolling guide which achieves endless linear motion of an external cylinder along a shaft with grooved raceways. It is a very simple and compact linear bushing with a large load capacity.

Interchangeable

The dimensional accuracy of the external cylinder and that of the shaft with grooved raceways are controlled individually to ensure interchangeability, so that they can be combined, added or exchanged freely.

High load capacity

Two rows of steel balls are incorporated in the external cylinder and make contact with grooved raceways of the shaft to obtain high rigidity and high load capacity.

Solid shaft and hollow shaft

The shaft with grooved raceways can be selected from two types: the solid shaft type LMG and the hollow shaft type LMGT. The hollow shaft type is suitable for applications in which piping, wiring or ventilation is needed.
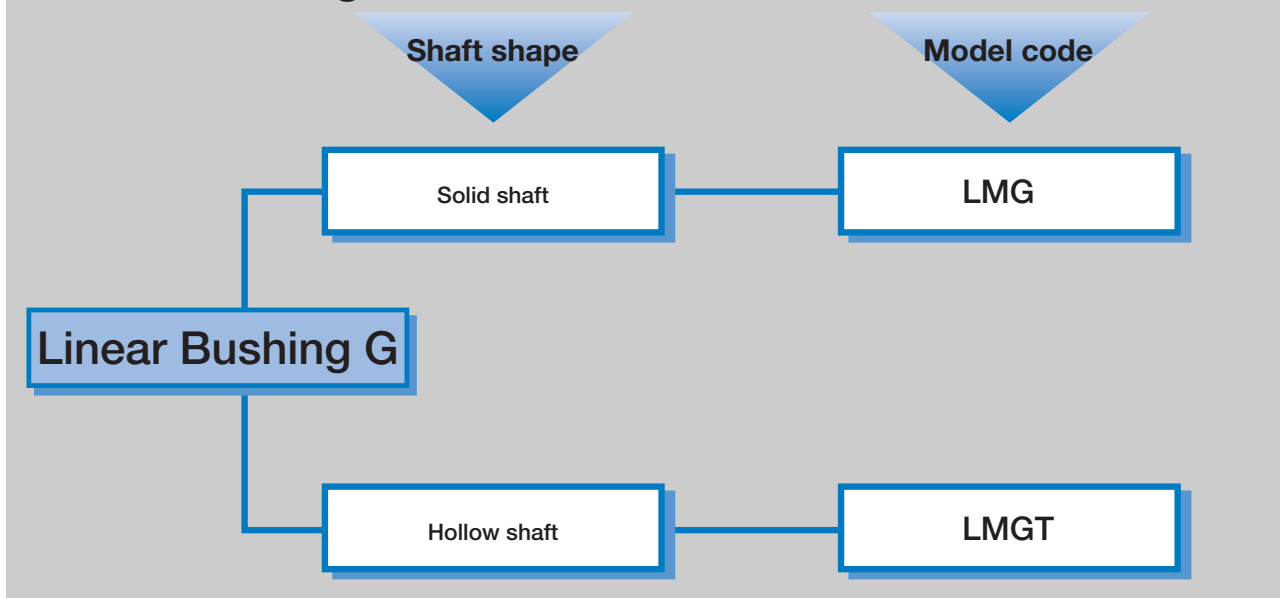
Dimensionally interchangeable with Linear Bushing LM

Linear Bushing G is dimensionally interchangeable with Linear Bushing LM and it is easy to change from one to another.
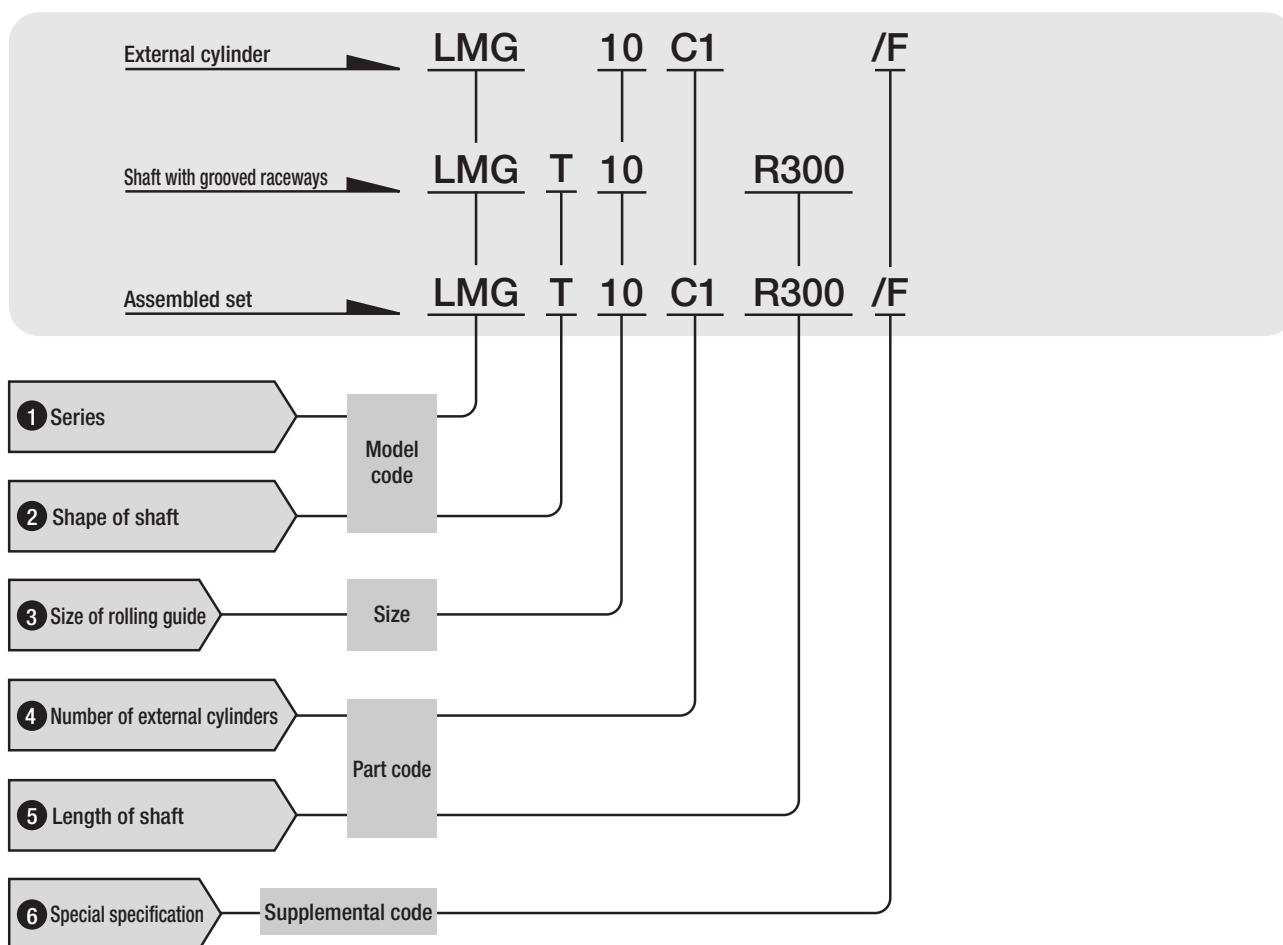
U.S. PATENT No.5,893,646

Shaft with grooved raceways

External cylinder
External cylinder body
Steel ball
Ring
Retainer
End plate
Stop ring
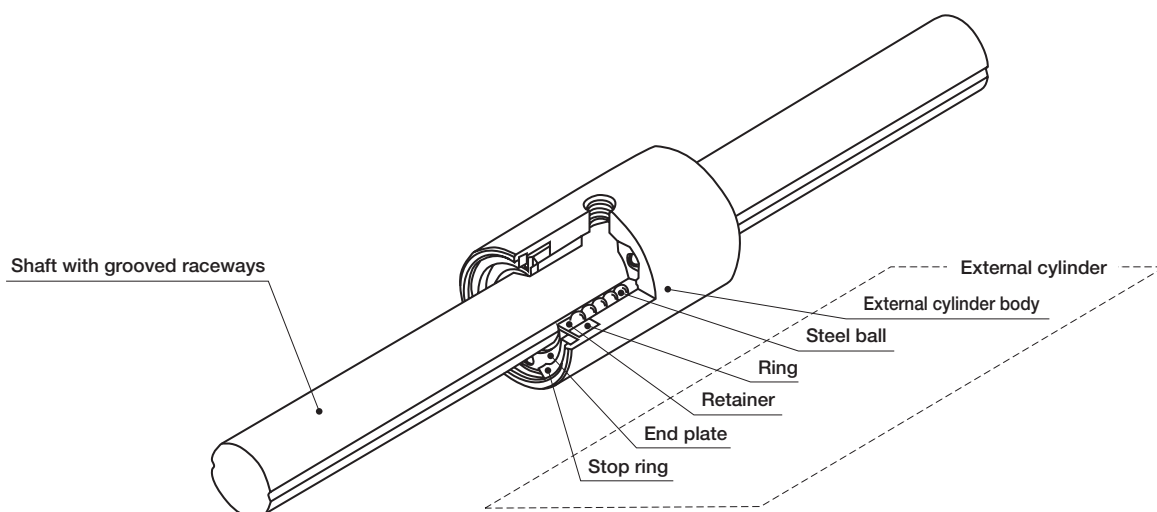
Structure of Linear Bushing G

Linear Bushing G series

Shaft shape		Model code
	Solid shaft	LMG
Linear Bushing G		
	Hollow shaft	LMGT

● Identification number and specification

The specification of Linear Bushing G is indicated by the identification number, consisting of a model code, a size, a part code and any supplemental codes.

External cylinder ▶	LMG		10 C1		/F
Shaft with grooved raceways ▶	LMG	T 10		R300	
Assembled set ▶	LMG	T 10	C1	R300	/F

❶ Series
❷ Shape of shaft
— Model code

❸ Size of rolling guide
— Size

❹ Number of external cylinders
❺ Length of shaft
— Part code

❻ Special specification
— Supplemental code

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1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

| 1 | Series | LMG |
| | | |

Shape of shaft

| 2 | Shape of shaft | Solid shaft | : No symbol |
| | | Hollow shaft | : T |

Size of rolling guide

| 3 | Size of rolling guide | Indicate the shaft diameter in mm. |

Number of external cylinders

| 4 | Number of external cylinders | Assembled set | : C○ | For an assembled set, indicate the number of external cylinders assembled on one shaft with grooved raceways. For an external cylinder, only "C1" can be indicated. |
| | | External cylinder only | : C1 | |

Length of shaft

| 5 | Length of shaft | Assembled set | : R○ | Indicate the length of shaft with grooved raceways in mm. For standard and maximum lengths, see the table of dimensions. |
| | | Shaft only | : R○ | |

External cylinder with shell type flange : **F**

With end seals : **U**

Special specification is applicable to all models and sizes. When a combination of several special specifications is required, arrange their supplemental codes in alphabetical order.

External cylinder with shell type flange ╱**F**

When a flanged external cylinder is required, this type can be used. A shell type flange is formed by precision drawing of thin steel plate.

Table 1 Dimensions of the external cylinder with shell type flange
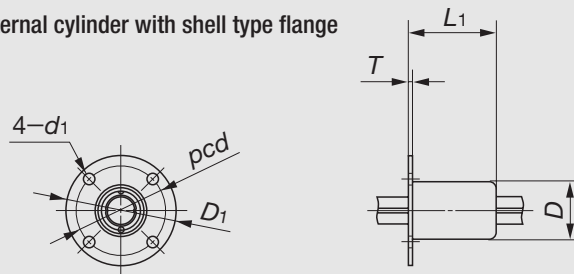
unit : mm

Model number		D	L_1	T	D_1	d_1	pcd
LMG 6	LMGT 6	14	20.5	1.1	28	3.4	22
LMG 8	LMGT 8	17	25.5	1.1	32	3.4	26
LMG 10	LMGT 10	21	30.5	1.1	39	4.5	31
LMG 13	LMGT 13	25	33.5	1.1	43	4.5	35
LMG 16	LMGT 16	30	38.5	1.1	48	4.5	40
LMG 20	LMGT 20	34	43.5	1.1	55	5.5	45

With end seals ╱**U**

To prevent intrusion of foreign matter, end seals are mounted at both ends of the external cylinder.

End seal   End seal

LMG

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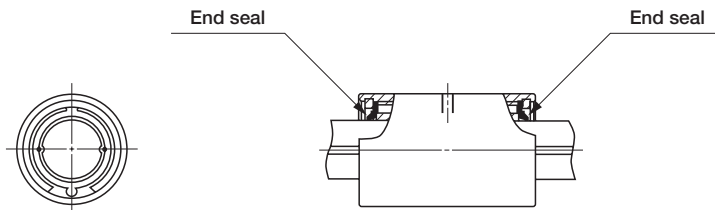
Load Rating

The load ratings of Linear Bushing G are defined for downward load. Summarized descriptions of load ratings are given below. For details of load rating definitions and load calculations, see "General description".

● Basic dynamic load rating C

The basic dynamic load rating is defined as the constant load both in direction and magnitude under which a group of identical Linear Bushings G are individually operated and 90% of the units in the group can travel 50×10^3 meters free from material damage due to rolling contact fatigue.

● Basic static load rating C_0

The basic static load rating is defined as the static load that gives a prescribed constant contact stress at the center of the contact area between the rolling element and raceway receiving the maximum load.

● Dynamic torque rating T

The dynamic torque rating is defined as the constant torque both in direction and magnitude under which a group of identical Linear Bushings G are individually operated and 90% of the units in the group can travel 50×10^3 meters free from material damage due to rolling contact fatigue.

● Static torque rating T_0

The static torque rating is defined as the static torque that gives a prescribed constant contact stress at the center of the contact area between the rolling element and raceway receiving the maximum load.

Fig. 1 Directions of load rating and torque rating

● Load direction and load rating

Since the load ratings of Linear Bushing G given in the table of dimensions are for downward load, they must be corrected for the load direction for upward or lateral load. The corrected basic dynamic load ratings and basic static load ratings are shown in Table 2.
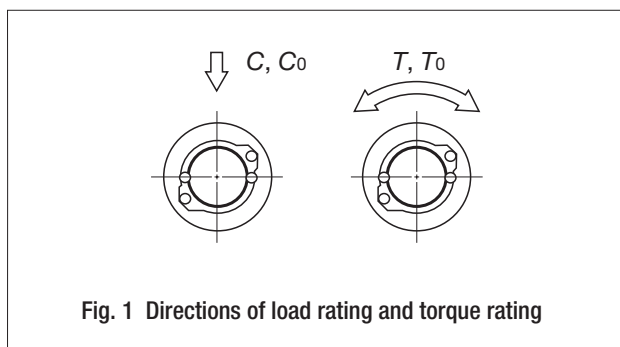
Table 2 Load direction and load rating

Load rating Load direction	Dynamic load rating	Static load rating
Downward	C	C_0
Upward	C	C_0
Lateral	$1.43C$	$1.73C_0$

Accuracy

The accuracy of Linear Bushing G is shown in the dimension table. The allowable value for the total radial runout of axial line of the shaft with grooved raceways is shown in Table 3.
The allowable value for the twist of grooves with respect to effective length of shaft with grooved raceways is 33 μm for any length of 100 mm over the entire effective length of raceway. Measuring methods of accuracy are shown in Table 4.

Table 3 Total radial runout of axial line of shaft with grooved raceways
unit : μm

Overall length of shaft mm		LMG 6 LMGT 6	LMG 8 LMGT 8	LMG 10 LMGT 10	LMG 13 LMGT 13	LMG 16 LMGT 16	LMG 20 LMGT 20
over	incl.						
–	200	142	142	129	129	126	
200	315	203	203	153	153	141	
315	400	–	255	173	173	153	
400	500	–	306	193	193	165	
500	630	–	–	221	221	182	
630	800	–	–	–	260	207	
800	1 000	–	–	–	–	240	

Remark : These values are applicable when the radial internal clearance is 0 μm.

Table 4 Measuring methods of accuracy

Item	Measuring method	Illustrations of measuring method
Twist of grooves with respect to effective length of the shaft with grooved raceways	Fix and support the shaft. Then apply a uni-directional torsional moment on the external cylinder before placing a dial gage probe at right angles to the shaft against the side face of the measuring block attached on the external cylinder. Measure runout when the external cylinder and the gage have traveled together 100 millimeters on any effective part of the raceway grooves. In the measurement, the probe should be applied as near as possible to the outer surface of the external cylinder.	Measuring block 100 Datum block for traveling of gage
Total radial runout of axial line of shaft with grooved raceways (See Table 3.)	While supporting the shaft at its supporting parts or at both center holes, place a dial gage probe to the outer surface of external cylinder, and measure runout at several positions in the axial direction while turning the shaft one rotation. Use the maximum value.	

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Radial Internal Clearance

The radial internal clearance of Linear Bushing G is approx. 10μm. In the shell flange type, radial internal clearance is slightly smaller than that of standard type.

Moment of Inertia of Sectional Area and Section Modulus of Shaft with Grooved Raceways

Moment of inertia of sectional area and section modulus of the shaft with grooved raceways are shown in Table 5.

Table 5 Moment of inertia of sectional area and section modulus

Model number		Moment of inertia of sectional area mm^4		Section modulus mm^3	
		Solid shaft	Hollow shaft	Solid shaft	Hollow shaft
LMG 6	LMGT 6	60	59	20	20
LMG 8	LMGT 8	190	190	49	48
LMG 10	LMGT 10	470	460	95	93
LMG 13	LMGT 13	1 360	1 300	210	200
LMG 16	LMGT 16	3 130	2 930	390	360
LMG 20	LMGT 20	7 720	7 230	770	720

Precautions for Use

❶ Lubrication

Both grease and oil lubrication are applicable. In case of grease lubrication, use of quality lithium-soap base grease is recommended for general applications.

❷ Fixing depth of mounting bolt of external cylinder

The fixing depth of mounting bolt of external cylinder should be less than the maximum depth shown in the dimension table. The fixing female thread hole in the external cylinder is a through hole. Therefore, if the fixing depth of mounting bolt is too large, the mounting bolt will contact and push the shaft, and accuracy and life will be affected adversely.

❸ Multiple external cylinders in close distance

When two or more external cylinders (standard or with shell type flange) are used in close distance in the same housing, the distance between the centers of external cylinders should be over three times of the length of external cylinders. If the external cylinders are used in close distance, consult **IKO**.

❹ Operation with rotational torque

In case a bi-directional and/or repeated rotational torque is applied, select **IKO** Linear Ball Spline G.

● Fit

The normal fit between the external cylinder of Linear Bushing G and the housing is recommended to be a clearance fit (H7). But, in special cases, a transition fit (J7) may be used.
In case of the external cylinder with shell type flange, a clearance of over 0.2 mm based on the nominal outside diameter is required.

● Mounting

To mount Linear Bushing G, the external cylinder should be press fitted carefully with proper tools using, for example, a press machine. Mounting examples are shown in Fig. 2.
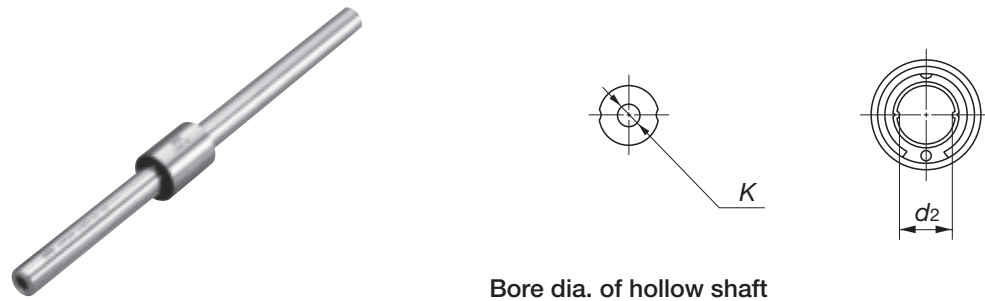
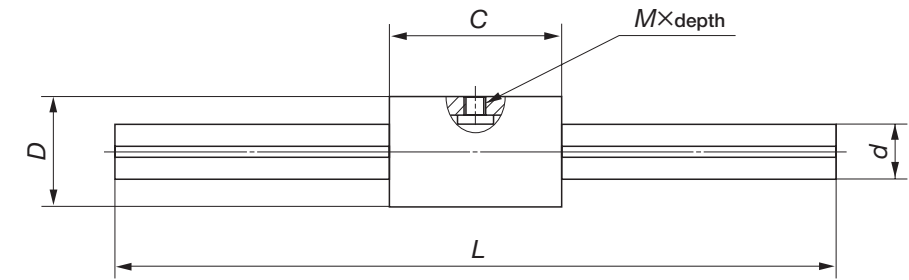Fig. 2 Mounting examples of external cylinder
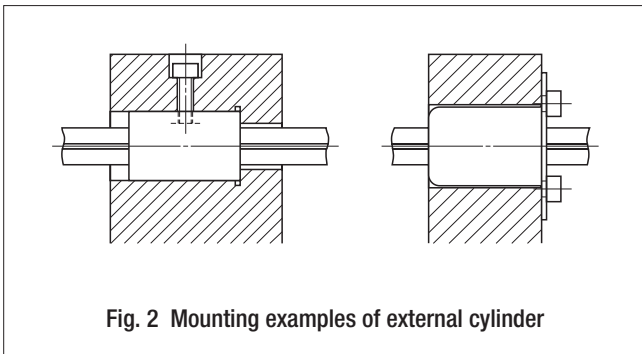
Accessories

● Shaft Support Block

Support blocks are prepared for supporting the ends of "shaft with grooved raceways" of Linear Bushing G. For details, consult **IKO**.

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| Solid shaft : **LMG** |
| Hollow shaft : **LMGT** |

Bore dia. of hollow shaft

Model number	Interchangeable	Mass (Ref.) g		Nominal dimensions and tolerances mm							
		External cylinder	Shaft[1]	D	Tolerance	C	Tolerance	M×depth[2]	d	Tolerance
LMG 6	☆	9.4	22.0	12	0 −0.011	19	0 −0.200	M2.5×1.9 (2.5)	6	0 −0.012
LMGT 6	☆		19.5							
LMG 8	☆	15.7	39.3	15	0 −0.011	24	0 −0.200	M3 ×2.4 (3)	8	0 −0.015
LMGT 8	☆		33.7							
LMG 10	☆	31.5	61.2	19	0 −0.013	29	0 −0.200	M3 ×3.1 (4)	10	0 −0.015
LMGT 10	☆		51.4							
LMG 13	☆	45.4	104	23	0 −0.013	32	0 −0.200	M3 ×3.4 (4.5)	13	0 −0.018
LMGT 13	☆		81.4							
LMG 16	☆	78.2	157	28	0 −0.013	37	0 −0.200	M4 ×4.1 (5.5)	16	0 −0.018
LMGT 16	☆		118							
LMG 20	☆	110	246	32	0 −0.016	42	0 −0.200	M4 ×4.1 (5.5)	20	0 −0.021
LMGT 20	☆		185							

Note([1]) : Figures shown in this column are the mass per 100 mm of shaft.
([2]) : The values in parentheses indicate the max. fixing depth of mounting bolt.
([3]) : Dimension d_2 indicates the maximum diameter when machining is done at the shaft ends.
([4]) : Figures shown in T and T_0 columns are applicable when a uni-directional torque is applied.
    In case a bi-directional and/or repeated rotational torque is applied, select **IK0** Linear Ball Spline G.
Remark : All Linear Bushing G series are interchangeable specification products.

d_2([3])	K	L	Maximum length	Basic dynamic load rating	Basic static load rating	Dynamic torque rating([4])	Static torque rating([4])
				C	C_0	T	T_0
				N	N	N·m	N·m
5.2	–	150 200	300	587	641	2.1	2.2
	2						
7	–	150 200 250	500	769	962	3.5	4.3
	3		400				
8.9	–	200 300	600	1 410	1 710	8.0	9.7
	4						
11.9	–	200 300 400	800	1 880	2 150	13.7	15.7
	6						
14	–	200 300 400	1 000	2 590	2 930	23.1	26.1
	8						
17.5	–	300 400 500 600	1 000	3 010	3 660	32.8	39.9
	10						

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