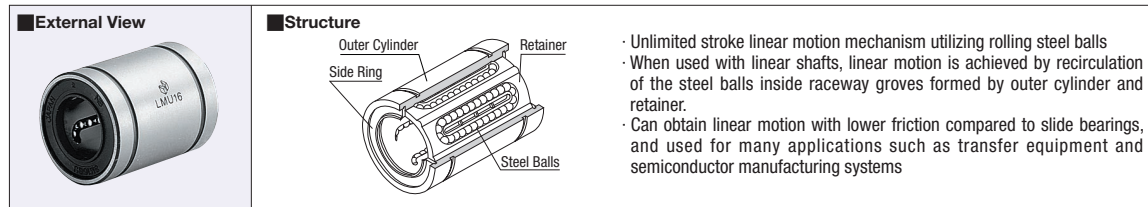


# Linear Bushings

## Technical Information / Various Greases

### Basic Technical Information

#### Characteristics of Linear Bushings



- Unlimited stroke linear motion mechanism utilizing rolling steel balls
- When used with linear shafts, linear motion is achieved by recirculation of the steel balls inside raceway grooves formed by outer cylinder and retainer.
- Can obtain linear motion with lower friction compared to slide bearings, and used for many applications such as transfer equipment and semiconductor manufacturing systems

#### Allowable Load

##### Basic Static Load Rating (Co)

Basic Static Load Rating is static load exerted on contacting parts under maximum stress, at which the sum of the permanent deformation in the rolling element and rolling contact surface equals 0.0001 times of the diameter of the rolling element.

##### Basic Dynamic Load Rating (C)

Basic Dynamic Load Rating is the static load applied in a constant direction that enables each linear system of the same series to travel 50km under the same condition, without 90% of the material suffering damage from rolling contact fatigue.

##### Allowable Static Moment (Mo)

Static Allowable Limit Load when a moment load is applied. Determined by permanent deformation same as Basic Static Load Rating.

#### Life

When the linear systems are in motion with loads, rolling surfaces and races are subject to repeated stress and will show stress induced flaking that seems scaly. The total run distance of a linear system until this flaking will first appear is the Life

Rated life can be obtained from the Basic Dynamic Load Rating and the actual load applied on the linear bushings, as shown below.

$$L = \left( \frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P} \right)^3 \cdot 50$$

L : Rated Life (km) f<sub>w</sub>: Load Factor (Refer to Table-4)  
 f<sub>H</sub>: Hardness Factor (Refer to Fig-1) C : Basic Dynamic Load Rating (N)  
 f<sub>T</sub>: Temperature Factor (Refer to Fig-2) P : Applied Load (N)  
 f<sub>C</sub>: Contact Factor (Refer to Table-3)

##### Hardness Factor (f<sub>H</sub>)

For linear systems, ample hardness of the shafts that ball contact is needed. If the ample hardness of the shafts are not obtained, the allowable loads are reduced and the life will be shortened.

##### Temperature Factor (f<sub>T</sub>)

If linear systems are exposed to temperature higher than 100°C, hardness will be reduced and allowable loads and life will be reduced.

Fig-1. Hardness Factor

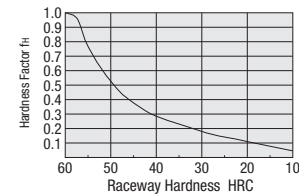
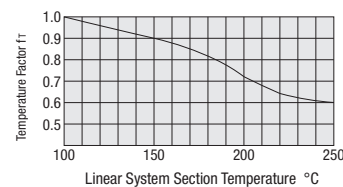


Fig-2. Temperature Factor



##### Contact Factor (f<sub>C</sub>)

More than 2 linear systems are used for 1 shaft, in general. In this case, the load on each linear system will vary depending on machining accuracies and will not be equally distributed loads. As the result, allowable load per linear system will vary depending on the number of linear systems used on one shaft.

##### Load Factor (f<sub>w</sub>)

To calculate load applied to the linear system, in addition to object weight, it requires inertia force attributed to motion velocity or moment loads. Further, it is necessary to accurately determine the temporal change of each. However, for reciprocating motion applications, it is difficult to obtain accurate calculations due to the effects of vibrations and shocks. Therefore, use the Table below in order to simplify the Life Calculations.

Table-3 Contact Factor

Number of bushings on one shaft	Contact Factor f <sub>C</sub>
1	1.00
2	0.81
3	0.72
4	0.66
5	0.61

Table-4 Load Factor

Condition	f <sub>w</sub>
No external shocks or vibrations Low Speed 15m / min. or Less	1.0~1.5
No excessive external shocks or vibrations Medium Speed 60m / min. or Less	1.5~2.0
External shocks and vibrations present High speed over 60m / min.	2.0~3.5

Life in hours can be obtained by calculating travel distance per hour. When stroke length and stroke cycles are fixed, see the equation below.

$$L_h = \frac{L \cdot 10^3}{2 \cdot \ell_s \cdot n_1 \cdot 60}$$

L<sub>h</sub>: Life Hours (hr)  
 L : Rated Life (km)  
 ℓ<sub>s</sub>: Stroke Length (m)  
 n<sub>1</sub>: Reciprocating Cycles per Minute (cpm)

### Cautions on Selection and Usage

#### Fitting Design

For MISUMI linear bushings, use in combination with MISUMI shafts (hardened with g6 tolerance) is recommended.

Reference: Tolerance range of linear bushings and shafts made by MISUMI

Dimension (mm)	Linear Bushings Single Type (LMU) I.D. Tolerance	Shaft (SFJ) O.D. Tolerance (g6)
0		
-0.001		
-0.002		
-0.003		
-0.004		
-0.005		
-0.006		
-0.007		
-0.008		
-0.009		
-0.010		
-0.011		
-0.012		
-0.013		
-0.014		
-0.015		
-0.016		
-0.017		
-0.018		
-0.019		
-0.020		
-0.021		
-0.022		
-0.023		
-0.024		
-0.025		

#### Lubrication

##### At the time of delivery

Other than the MX Lubrication Units, MISUMI Linear Bushings are applied with Anti-rust Oil harmless to the bearing lubrication greases. After de-greasing the Antirust Oil, application of grease is recommended. The MX Lubrication Units are filled with lithium soap-based grease. L, G, and H Grease filled types are also available.

##### Maintenance

Before usage, apply grease to the ball rows within the Linear bushings, then periodically apply grease during the use. The grease has an effect of reducing friction by forming a layer between the balls and shaft rolling surfaces, preventing seizures. Grease loss and deterioration will cause shorter life of linear guides.

Recommended Grease: Lithium soap based grease (Alvania Grease S2 by Showa Shell Sekiyu). Recommended Greasing Interval: Normally 6 months Every 3 month when travel distance is extensive, or every 1000km.

#### Grease Service

Service to apply greases shown below at the time of shipping

Type	Product Name	Main Feature
<span style="color: green;">●</span> L Type	ET-100K(Made by Kyodo Yushi)	Superior heat resistance and oxidation stability. Also high adhesion and cohesion with limited splash or leakage.
<span style="color: red;">●</span> G Type	LG2(Made by NSK Ltd.)	Suitable for clean environment due to low particle generation grease. Also good anti-rusting characteristics.
<span style="color: blue;">●</span> H Type	FGL(Lubriplate™)	Suitable for food, beverage and pharmaceutical industries. (NSF H-1 Reg. NO.043534)

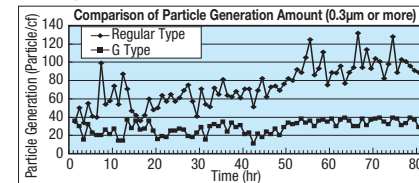
#### Products with Filled Grease Options

Applicable Products	Shaft Dia. dr	Unit Price (Price for Grease Filling Service)
P272-P299 Linear Bushing Related	3~50	
*Products below are excluded. - Linear bushings without seals - Linear Ball Bushings		
	P300	

#### Grease Performance

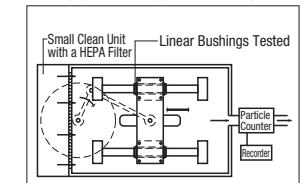
Item	Conditions	Unit	Measurement Method	L Type	G Type	H Type
Thickener	-	-	-	Aromatic Diurea	Lithium Type	Aluminum Complex Soap
	-	-	-	Ether Synthetic Oil	(Mineral Oil - Synthetic Hydrocarbon Oil)	USP White Oil
Base Oil	40°C	mm <sup>2</sup> /s	JIS K2220 5.19	103	30	105
	100°C	-	-	12.8	-	11.5
Base Oil Kinetic Viscosity	40°C	mm <sup>2</sup> /s	JIS K2220 5.3	280	207	310
	100°C	-	-	<260	200	238
Dropping Point	-	°C	JIS K2220 5.4	-	-	-
Evaporation Amount	99°Cx22hr	wt%	-	0.15%	1.40%	0.27%(ASTMD-972)
Oil Separation	100°Cx22hr	wt%	JIS K2220 5.14	1.2%	0.8%	2.1%(ASTMD-1742)
Operating Temp.	In Air	°C	-	-40~200	-10~80	-12~170

#### Comparison of Particle Generation



\*The data above are for reference only, and not guaranteed by the manufacturer.

#### <Test Equipment for G Type Grease Comparison>

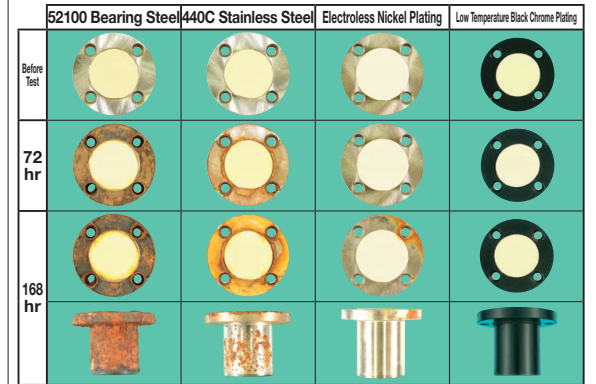


<Testing Condition>  
 Linear Bushing  
 Liner Motion Speed  
 Stroke  
 Environment  
 Temperature  
 Humidity  
 Particle Counter

LHFS16 (Regular Type)  
 LHFS16G (G Type)  
 20m/min  
 100mm  
 Inside Clean Booth (Class100)  
 22.5°C±2°C  
 50wt%  
 Made by Rion Co. Ltd.  
 KC03A1

#### (Ref. Data) Antirust Performance Comparison Test

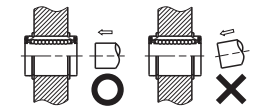
Salt water spray testing method conforms to JIS H8502. Testing Sample: Flanged Linear Bushing Single Type



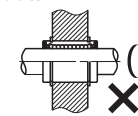
Low temperature black chrome plating on linear bushings is fluoropolymer layer chemically deposited, and it has a rust prevention effect.

#### Assembly

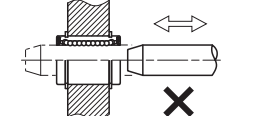
①When assembling with linear shafts, forcing the shaft into the bushing with angular misalignment may cause the ball retainers to deform and balls to fall out. Be sure to align the centers and insert the shaft gently.



②Linear Bushings are not suitable for rotating motion due to its construction. Forcing to rotate may cause failures.



③Linear Bushings are not suitable for uses that need repetitive insertion and extraction from shafts.



Ⓜ Except Linear Ball Bushings



Ordering Example

#### Part Number

- LMU12L (L Type Greased)
- LMU12G (G Type Greased)
- LMU12H (H Type Greased)

Ⓜ To place an order, add L, G, or H after Part Number of Regular Type.



Days to Ship

[Configure Online](#)



Price

[Configure Online](#)