

1.4. Large Permissible Load and High Rigidity

● Large Permissible Load

The LM Guide has raceway grooves with a radius almost equal to the ball radius, which is significantly different from the linear bush. As shown in Fig. 5, which compares size between the LM Guide and the linear bush with similar basic dynamic load ratings, the LM Guide is much smaller than the linear bush, indicating that the LM Guide allows a significantly compact design.

The reason for this space saving is the greater difference in permissible load between the R-groove contact structure and the surface contact structure. The R-groove contact structure (radius: 52% of the ball radius) can bear a load per ball 13 times greater than the surface contact structure. Since service life is proportional to the cube of the permissible load, this increased ball-bearing load translates into a service life that is approximately 2,200 longer than the linear bush.

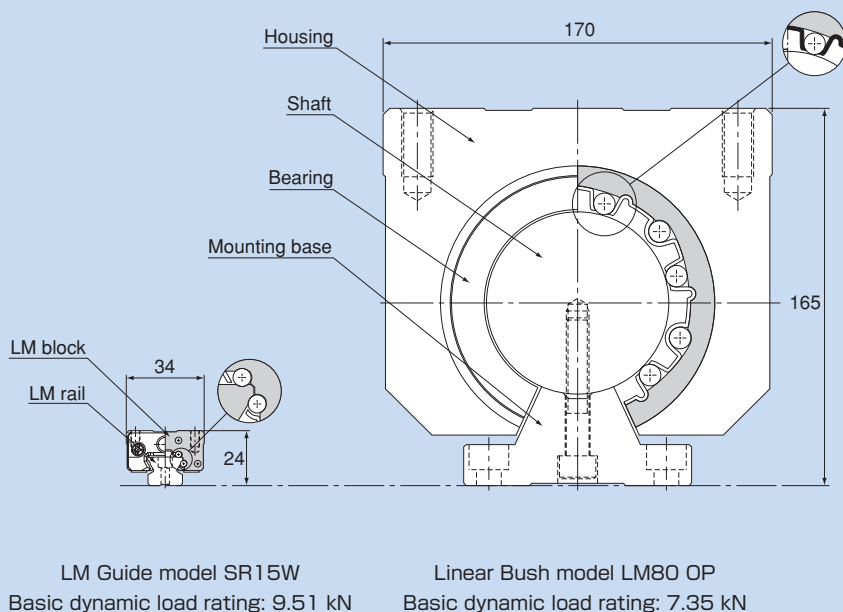


Fig. 5 Comparison between the LM Guide and the Linear Bush

Table 3 Load Capacity per Ball (P and P_1)
Permissible contact surface pressure: 4,200 MPa

	R-groove (P)	Flat surface (P_1)	P/P_1
ϕ 3.175 (1 / 8")	0.9 kN	0.07 kN	13
ϕ 4.763 (3 / 16")	2.03 kN	0.16 kN	13
ϕ 6.350 (1 / 4")	3.61 kN	0.28 kN	13
ϕ 7.938 (5 / 16")	5.64 kN	0.44 kN	13
ϕ 11.906 (15 / 32")	12.68 kN	0.98 kN	13

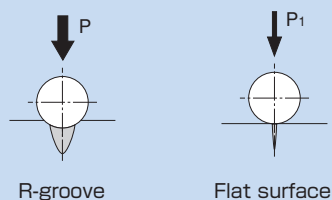


Fig. 6 Load Capacity per Ball

●High rigidity

The LM Guide is capable of bearing vertical and horizontal loads. Additionally, due to the circular-arc groove design, it is capable of carrying a preload as necessary to increase its rigidity. When compared with a feed screw shaft system and a spindle in rigidity, the guide surface using an LM Guide has higher rigidity.

Example of comparing static rigidity between the LM Guide, a feed screw shaft system and a spindle

(vertical machining center with the main shaft motor of 7.5 kW)

Table 4 Comparison of Static Rigidity
Unit: N/ μ m

Components

LM Guide: HSR45LB...CO

(CO clearance: preload = 6.43 kN)

Ball Screw: BNFN4010-5...GO

(CO clearance: preload = 2.64 kN)

Spindle: general-purpose cutting spindle

Components	X-axis direction	Y-axis direction	Z-axis direction
LM Guide	—	2800	6,600 (radial) 4,300 (reverse radial)
Ball Screw	330	—	—
Spindle	250	250	280

Note: The rigidity of the feed screw shaft system includes rigidity of the shaft end support bearing.

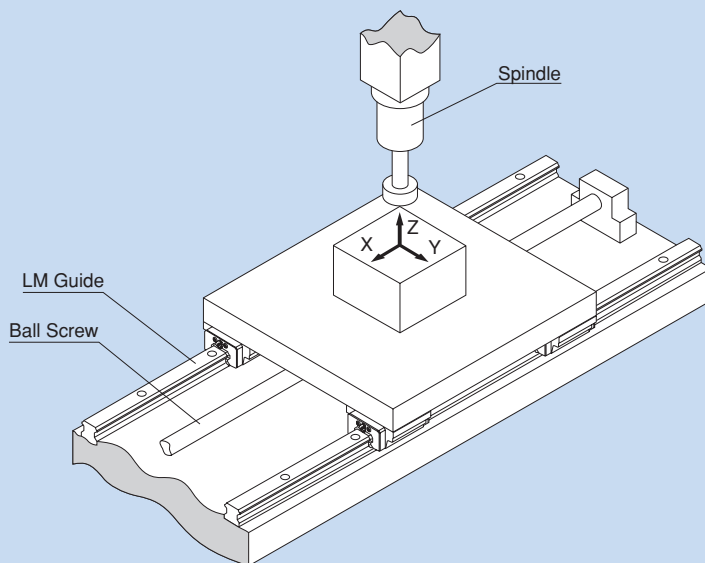


Fig. 7