2. Design, Functions, Features

2.1 Design and functions

MarMotion high-precision rotary stroke bearings consist of the cylindrical shaft and bush, which act as guiding elements, and the steel balls, which act as the rolling bearing elements. The balls are held in a brass or plastic smooth-moving tube where they roll easily.

The guide shaft, balls and guide bush are specially hardened and micro-finished. The structure is stabilized through careful application of heat treatment.

The balls roll non-positively between the bush and shaft under a preloading tension. Linear, rotary and combined movements are possible. The frictional connection of the balls means the cage moves in accordance with the laws of kinematics.

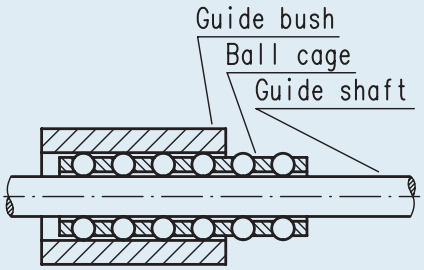


Fig. 1

2.2 Preloading

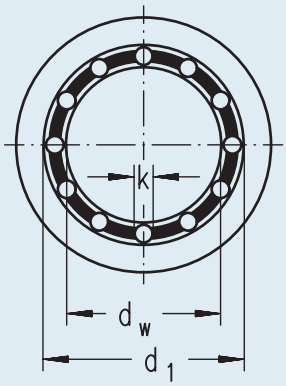
Preloading must be set with great precision to ensure problem-free operation. This is achieved and defined using the manufacturing tolerances. Preloading value v is the difference between the size of the inside diameter of the guide bush d_1 and the distance between two balls lying opposite each other and touching the shaft.

Recommended preloading

The preloading values given in the following table are recommended for most applications. These values are based on theoretical knowledge and practical experience.

Preloading values

d_w [mm]	v [µm]	d_w [mm]	v [µm]
2.5/ 3	0.5 - 2	14/ 25	4 - 7
4/ 5	1 - 3	30/ 42	4 - 8
6/ 8	2 - 4	50/ 63	6 - 10
10/12	3 - 5	80/100	8 - 12



$v = d_w + 2 \cdot k - d_1$ [mm]
$d_1 = d_w + 2 \cdot k - v$ [mm]

Fig. 2

These preloading values ensure that the rotary stroke bearing has both excellent rigidity and smooth running. In the case of orders for complete rotary stroke bearings consisting of a guide shaft, ball cage and guide bush, the components are paired in the factory. This ensures optimum and uniform preloading.

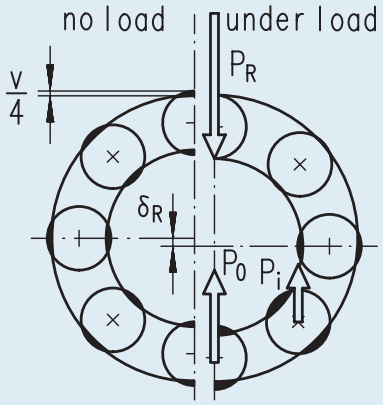
Due to the range of scatter of the manufacturing tolerances (IT 3), indiscriminate pairing of shafts, ball cages and bushes can result in unfavorable preloading values which deviate from those listed in the table. The rotary stroke bearings of the Mini Range should always be ordered in pairs.

The significance of preloading

Preloading guarantees that the MarMotion high-precision rotary stroke bearing has absolutely no backlash. In the case of applications where special conditions have to be satisfied, the required preloading value can be specified at the time of ordering.

A very low preloading value means that the rotary stroke bearing runs smoothly but rigidity is limited. A higher preloading value increases loading capacity and rigidity. A very high preloading value leads to the rotary stroke bearing running less smoothly.

If the preloading value is too high, the run will be rough and stiff. The rotary stroke bearing can also be overloaded by excessive surface pressure. This is prevented by the narrow manufacturing tolerances of the rotary stroke bearing. It must therefore be ensured that the guide bush is not deformed when being installed. The guide bush should thus not be pressed into the location bore or secured with pressure screws.



Stationary guide bush
P_R = radial force acting on the shaft
P_0 = force acting on the ball at the load apex
P_i = force on a ball outside the load apex
δ_R = radial offset of the bush and shaft axes
v = preloading

Fig. 3