2. Design, Functions, Features

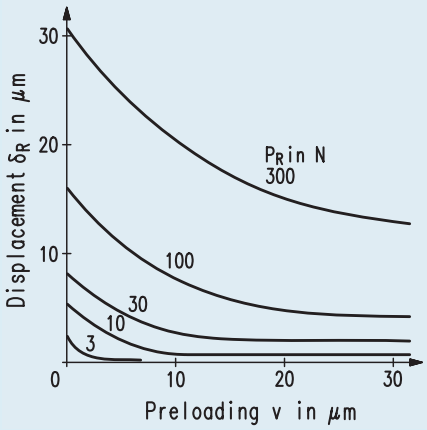

Fig. 4

Optimum preloading

If the rotary stroke bearing is loaded radially with a force P_R, the guide bush axis and shaft axis are displaced by an amount δ_R. The permissible amount of displacement δ_R depends on preloading value v. The calculation of the optimum preloading value should take into account factors of service life, running behavior and guiding stability.

The diagram shows the radial offset of a rotary stroke bearing as a function of the preloading value and the radial load. For a given radial force, the offset with a small preloading value is relatively large (the guide is soft). With high preloading values, however, the offset is significantly smaller for the same radial force (the guide is rigid).

Taking into account the Hertzian stress, manufacturing tolerances and deformation of components during installation and operation of the rotary stroke bearing, and also taking into account the most favorable resilience conditions for the rotary stroke bearing, a value of

$\delta_R = 0{,}5 \cdot v$

has been taken as the basis for the computations. This satisfies the call for "high-precision". This condition is met for the indicated "specific rated loads" C_{10}.

2.3 Matching of the shaft and ball diameters

From the rules of rolling friction, it is known that ball diameter k affects the degree of friction, i.e. a larger ball rolls more smoothly than a smaller one.

On the other hand, a large number of smaller balls results in better vibration dampening than a small number of large balls.

For this reason, and in order to save space, the smaller sized ball is often preferred. Moreover, with a low degree of roughness and greater geometrical accuracy of form for the rolling element, the ball diameter becomes relatively unimportant for the running characteristics.

The shaft and ball diameters of the MarMotion high-precision rotary stroke bearings have been matched to optimum effect and the optimum number of balls defined on the basis of thorough testing.

2.4 Coefficient of friction µ

The coefficients of friction µ apply for the start-up run and movement alike.

Influencing variables:

- Surface condition of the rolling elements
- Degree of preloading and load
- Number of balls
- Friction of cage

The MarMotion high-precision rotary stroke bearings run free of stick-slip. The following coefficients of friction apply to radial load:

high $\mu = 0.001–0.002$
medium $\mu = 0.003–0.004$
low $\mu = 0.005–0.008$

The rolling resistance of a rotary stroke bearing derives from the inner load caused by preloading and from the influence of outside radial forces. With a low radial load, the preloading and cage friction components predominate. The coefficient of friction µ thus increases as the radial load decreases. Consequently, when there is a small radial load and extremely smooth motion is required, a low preloading value must be used.