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5. Computation of the Rotary Stroke Bearing

After P_{10} has been calculated, a comparison with the specific rated load C_{10} (tables in Fig. 27 and 28) reveals whether the rotary stroke bearing is correctly dimensioned.

Requirement: $P_{10} \leq C_{10}$

The deflection A is calculated as described in section 5.2.2.

Computation example:

To be determined: Load of the most heavily loaded ball zone

Given: Radial force acting on one side
$P_R = 1000$ N
$l = 300$ mm
Contact length $e = 200$ mm
Distance between the ball zones $l_i = 100$ mm

Solution:
$\mathbf{P_{10} = g \cdot M + h \cdot P_R}$
$\mathbf{M = P_R \cdot l}$
$= 1000 \text{ N} \cdot 0.3 \text{ m} = 300 \text{ Nm}$
$g = 2 \text{ m}^{-1}$ (from diagram Fig. 25)
$h = 0.11$ (from diagram Fig 26)
$P_{10} = 2 \text{ m}^{-1} \cdot 300 \text{ Nm} + 0.11 \cdot 1000 \text{ N}$
$\mathbf{P_{10} = 710 \text{ N}}$

5.3 Specific rated load C_{10}

Definition

The specific rated load C_{10} is the radial loading capacity of ball operating zone 10 mm long **of a MarMotion high-precision rotary stroke bearing**, taking into account the nominal diameter d_w, preloading value v and cage type N 500, N 501, N 511 or N 502.

In section 5.2, the specific radial force P_{10} was calculated from the load of the rotary stroke bearing.
The following must always apply:

$\mathbf{P_{10} \leq C_{10}}$

C_{10} depends on:
Nominal diameter d_w, ball diameter, number of balls, preloading value v and the following criteria: The surface pressure at the contact points between the rolling elements and the rolling faces of the shaft and the bush (Hertzian stress); and the elastic deflection of the shaft axis from the "0" position, which is determined by the rigidity R_{10} of a 10 mm ball zone.

The specific rated loads C_{10} of Mahr ball cages N 500 and N 501 set out in the tables (Fig. 27 and 28) were defined to justify our claim of manufacturing "high-precision rotary stroke bearings".

The elastic deviation under a load $P_{10} = C_{10}$ should not be more than half the preloading value v.

$\delta_{R,max} = \mathbf{0{,}5\ v}$ [µm]

The quoted values for C_{10} and R_{10} are given as a function of the preloading value v in such a way as to ensure that this condition is met.

The **rigidity R_{10}** [µm/N] is the axial deflection of a 10 mm ball zone under a radial load of 1 N.
The deflection of a 10 mm ball zone is computed from:

$\mathbf{A_{10} = P_{10} \cdot R_{10}}$ [µm]

Method I

The first step is to determine the specific radial force P_{10}. The required nominal diameter d_w and value for C_{10}, which must be greater than or equal to the value of P_{10}, are then read off from one of the tables.

Method II

From the known nominal diameter d_w, C_{10} is read off from one of the tables and then used in further computations as the **permissible** specific radial force P_{10}.

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