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# ESZ pyramid bearing

Unreinforced profiled elastomer bearing  
with general supervisory approval

## CALCULATION EXAMPLE

### PROOF OF PERMISSIBLE COMPRESSION:

The ESZ pyramid bearing is certified for bearing classes 1 and 2 according to DIN 4141-3. The permissible characteristic bearing compression  $\text{perm } s_m$  is determined depending on the form factor  $S$  and is limited to  $10 \text{ N/mm}^2$ . Due to the profiling, the nominal thickness of  $t = 10 \text{ mm}$  is not applied, but rather the thickness of the bearing in the loaded condition,  $t_b = 7 \text{ mm}$ .

$$S = \frac{a \times b}{2 \times t_b \times (a + b)}$$

$$\sigma_m = \frac{F}{a \times b} \leq \text{perm } \sigma_m = 2 \frac{N}{\text{mm}^2} \times S \leq 10 \frac{N}{\text{mm}^2}$$

### Example of a calculatory stress verification:

Bearing side  $a = 100 \text{ mm}$

Bearing side  $b = 200 \text{ mm}$

$G_k = 100 \text{ kN}$  &  $Q_k = 50 \text{ kN} \Rightarrow$  bearing class 1

$F_{z,\text{max}} = 150 \text{ kN}$

$$S = \frac{100 \times 200}{2 \times 7 \times (100 + 200)} = 4,76$$

$$\sigma_m = \frac{150000}{100 \times 200} \leq \text{perm } \sigma_m = 2 \times 4,76$$

$$\sigma_m = 7,5 \frac{N}{\text{mm}^2} \leq \text{perm } \sigma_m = 9,52 \frac{N}{\text{mm}^2}$$

The pyramid bearing of the size of  $100 \times 200 \text{ mm}$  can thus be loaded up to  $9.52 \text{ N/mm}^2$ .

## CALCULATION OF THE PERMISSIBLE SUPPORT TORSION

The support torsion is to be verified by the empirical formula from the approval. For the torsion, only half the time-dependent deformations (creep, shrinkage) need be applied, plus the support imperfections (F1). A separate verification is to be made for each side in case of torsion across both bearing sides positioned at a right angle to one another. The following boundary condition is to be adhered to:

$$\alpha \leq \text{perm } \alpha = \frac{2,5}{c} + \frac{210}{c^2} - \frac{1900}{c^3} \times \text{perm } \sigma_m$$

$c$  is the length [mm] of the respectively stressed bearing side

### Example of calculatory bearing torsion:

A torsion of  $2.2 \text{ ‰}$  acts on bearing side  $b = 200 \text{ mm}$  on the pyramid bearing calculated above. The total angle of rotation is  $15.325 \text{ ‰}$  plus the imperfections.

$$\alpha_b = \left( \frac{0,625}{200} + 0,01 \right) + 0,0022 = 0,15325$$

With the bearing side  $b = 200 \text{ mm}$  and the permissible stress  $\text{perm } s_m = 9.52 \text{ N/mm}^2$  we go into the boundary condition of the torsion:

$$\alpha_b \leq \text{perm } \alpha_b = \frac{2,5}{200} + \frac{210}{200^2} - \frac{1900}{200^3} \times 9,52$$

$$0,015325 \leq \text{perm } \alpha_b = 0,01548$$

The permissible torsion for this bearing is  $15.48 \text{ ‰}$ . Therefore the verification of the bearing torsion is provided.

$$\left( \frac{0,625}{c} + 0,01 \right) = \alpha_{\text{Im perfection}} \quad s \quad (F 1)$$