WILFRIED BECKER GMBH
Elastomer Service Zentrale

Weilerhöfe 1
41564 Kaarst-Büttgen

Telefon (0 21 31) 75 81 00
Telefax (0 21 31) 75 81 11

E-Mail: info@esz-becker.de
Internet: www.esz-becker.de

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 perm s_m is determined depending on the form factor S and is limited to 10 N/mm². Due to the profiling, the nominal thickness of t= 10 mm is not applied, but rather the thickness of the bearing in the loaded condition, t_b= 7 mm.

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

$$\sigma_m = \frac{F}{a \; x \; b} \leq perm\,\sigma_m = 2\,\frac{N}{mm^2}\,x\,S \leq 10\,\frac{N}{mm^2}$$

Example of a calculatory stress verification:

Bearing side a= 100 mm

Bearing side b= 200 mm

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

$F_{z,max}$= 150 kN

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

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

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

The pyramid bearing of the size of 100 x 200 mm can thus be loaded up to 9.52 N/mm².

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:

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

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

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

Example of calculatory bearing torsion:

A torsion of 2.2 ‰ acts on bearing side b=200 mm on the pyramid bearing calculated above. The total anglSe of rotation is 15.325 ‰ plus the imperfections.

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

With the bearing side b= 200 mm and the permissible stress perms$_m$ = 9.52 N/mm² we go into the boundary condition of the torsion:

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

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

The permissible torsion for this bearing is 15.48 ‰. Therefore the verification of the bearing torsion is provided.