ESZ type 100 | with national technical approval

General information and calculation basis

Conditions > Dimensions of the bearings and permissible bores (according to abZ section 2.1.1)

Thickness of the bearing t = 10 to 30 mm

$t \leq a/5$ with $t_{max} = 30$ mm
$t \geq a/30$ with $t_{min} = 10$ mm

The following applies to rectangular, point bearings:

a ≥ 70 mm, b ≥ 70 mm
The following applies to strip-shaped bearings:
a ≥ 50 mm, b ≥ 100 mm
The following applies to round bearings:
r ≥ 40 mm

with
t thickness of the unloaded bearing
a shorter side of the bearing
b longer side of the bearing

In Table 1 of the general technical approval, the load-bearing capacities are assigned to different shape factor ranges as a design function.

The **shape factor S** for rectangular bearings is calculated as follows:

$$S = \frac{a \cdot b}{2 \cdot t \cdot (a + b)}$$

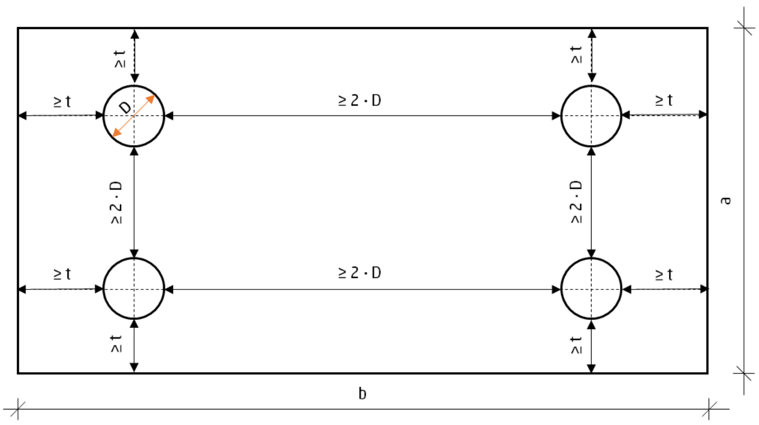
The **shape factor S** for round bearings is calculated as follows:

$$S_{mod} = \frac{r}{\sqrt{8} \cdot t}$$

Boreholes (base area and lateral surfaces) must still be taken into account (=deducted) in the calculation!

Up to four boreholes are permitted per bearing, whereby the area of the boreholes may not exceed 10 % of the total area of the bearing.

The distance between the holes must be at least 2 x D. A minimum edge distance of the bearing thickness t must be maintained for the holes. The maximum diameter of the hole is D = 50 mm.



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General information and calculation basis

Calculation of the load-bearing capacity and consideration of the angle of rotation incl. surcharges

The load-bearing capacity of the **ESZ type 100** is limited by the manufacturer to **14 N/mm²**, although significantly higher load-bearing capacities are specified according to the design function in Table 1 of the approval, depending on the shape factor.

The vertical load on an elastomeric bearing leads to a **centric** load concentration and, in conjunction with a support torsion, to an **eccentric** load concentration.
The simultaneous occurrence of compressive stress and rotation must be taken into account when dimensioning an elastomeric bearing and its suitability for use must be verified accordingly.
The resulting effects on the neighbouring components must also be considered.
For the bearing design, the shear stresses from the vertical compression and the torsion are superimposed.
Elastomeric bearings allow shear deformation, but they must not be used to **absorb constant external shear forces.**

The angle of rotation of the adjacent components must be determined by adding the following influences:

- obliqueness with 10 ‰
- unevenness with 625/a ‰

In the case of torsion across both sides of the bearing, the allowances for angular torsion are added proportionally to the respective design data (torsion due to component deformations) from the structural analysis.

In addition to the regulations listed in the approval, the following formula are used for the design of the **ESZ type 100** to calculate the load-bearing capacity, taking into account support torsion (if the entire support situation is known, modifications are possible after consultation with ESZ):

Rectangular bearing

$$\sigma_{z,Rd} = \left[f_{tRd} - \alpha_{bd} \cdot \frac{G}{2} \cdot \left(\frac{a}{t}\right)^2 - \alpha_{ad} \cdot \frac{G}{2} \cdot \left(\frac{b}{t}\right)^2 \right] \cdot \frac{c}{t} \cdot \eta_2$$

Round bearing

$$\sigma_{z,Rd} = \left[f_{tRd} - \alpha_{d} \cdot \frac{3 \cdot G}{8} \mathrm{N/mm^2} \cdot \left(\frac{d}{t}\right)^2 \right] \cdot \frac{d}{t} \cdot \eta_2$$

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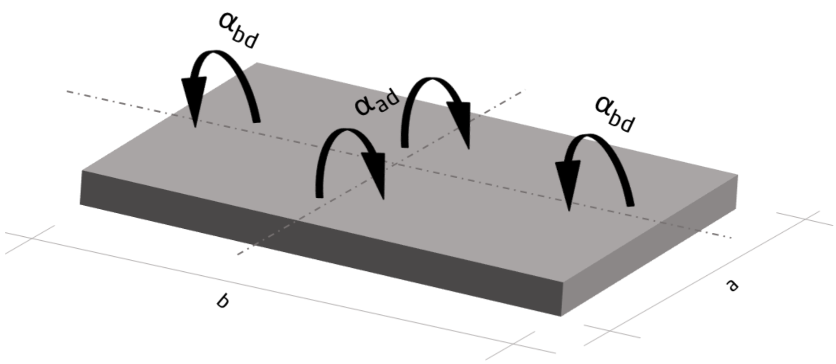
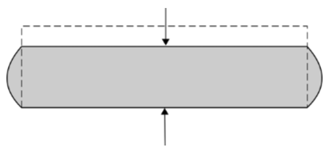


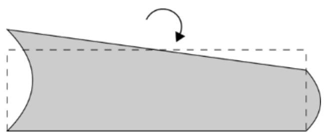
$$\alpha_{b,max} = \frac{450 \cdot t}{a} \leq 48\ ‰ \qquad \alpha_{a,max} = \frac{450 \cdot t}{b} \leq 48\ ‰$$

$$\alpha_{Resultierende} = \sqrt{\alpha_{a,max}{}^2 + \alpha_{b,max}{}^2} \leq 48\ ‰$$



The interaction of load action and angular torsion leads to a reduction in the load-bearing capacity, which must be verified by a mathematical analysis.

Deviations from the plane parallelism and unevenness of the contact surfaces of the adjacent components are treated mathematically as planned rotations. Geometric imperfections and deviations from the plane parallelism of the contact surfaces must be recognised with at least 0.01 rad [= 10 ‰] and added to the calculated value of the bearing torsion.



If no more precise verification is provided, unevenness of the contact surfaces must be taken into account with 625/a [‰] and considered mathematically in the same way as planned rotations. Bearing side a is always the shorter bearing side.
If a cast-in-place concrete component is concreted onto the bearing or the contact surface is steel, this value can be halved.

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