

## Perforated™ Bearing Type Z

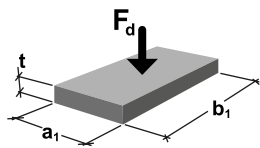
Structural bearing for static structural members

### Design values

The bearings are dimensioned according to the general building authority approval up to a compressive stress  $\sigma_{R,d} = 35 \text{ N/mm}^2$ . Holes, cut-outs and the required edge distances must be taken into account according to DIN EN 1992.

#### TYPE OF LOAD ACTING

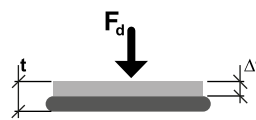
Design value of bearing resistance  
(max. compressive stress)



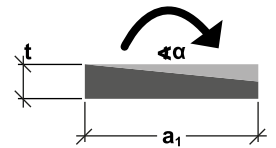
max. shear deformation



Deflection



max. rotation



#### FORMULA

$$\sigma_{R,d} = 35 \text{ N/mm}^2$$

$$t = 15 \text{ mm: } u_{\max} = 0.4 \times t$$

$$t > 15 \text{ mm: } u_{\max} = 0.35 \times t$$

Horizontal force

$$H = c_{s(t)} \times u \times A_E / 10,000 \text{ mm}^2$$

A minimum compressive stress of  $5 \text{ N/mm}^2$  is required to prevent the bearing from slipping.  
 $c_{s(t)}$ -values and boundary conditions  
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$$t = 15 \text{ mm: } \alpha_{\max} = 200 \text{ ‰} \times t/a_1 \leq 40 \text{ ‰}$$

$$t > 15 \text{ mm: } \alpha_{\max} = 350 \text{ ‰} \times t/a_1 \leq 43 \text{ ‰}$$

Acc. to technical approval:  
10 ‰ from obliquity  
625 ‰ x mm/a from unevenness  
see also booklet 600, DAFStb

#### LEGEND FORMULA SYMBOLS

$F_d$	Vertical force	$\alpha$	Bearing rotation
$H$	Horizontal force	$c_{s(t)}$	Shear stiffness
$A_E$	Bearing area	$u$	Shear deformation of the bearing
$a_1$	Short side of bearing	$\gamma$	Push angle
$b_1$	Long side of bearing	$t$	Thickness of bearing
$\sigma_{R,d}$	Design value of the load capacity	$\Delta t$	Bearing deflection
		$\varnothing$	Bore diameter

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Structural bearing for static structural members

Thicknesses: 15, 24, 33, 42 and 51 mm

The table below depicts the design values of the load capacity and the allowable angle of distortion, depending on the bearing dimensions. Interim values can be inpolated.

RECTANGULAR BEARINGS										
BEARING WIDTH a [mm]	Bearing Thickness									
	t = 15 mm		t = 24 mm		t = 33 mm		t = 42 mm		t = 51 mm	
	Shear Deformation									
	u = 6 mm		u = 8.4 mm		u = 11.6 mm		u = 14.7 mm		u = 17.9 mm	
	$\sigma_{R,d}$	$\alpha_{max}$	$\sigma_{R,d}$	$\alpha_{max}$	$\sigma_{R,d}$	$\alpha_{max}$	$\sigma_{R,d}$	$\alpha_{max}$	$\sigma_{R,d}$	$\alpha_{max}$
	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]
120	35.0	25.0	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
130	35.0	23.1	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
140	35.0	21.4	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
150	35.0	20.0	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
200	35.0	15.0	35.0	42.0	35.0	43.0	35.0	43.0	35.0	43.0
250	35.0	12.0	35.0	33.6	35.0	43.0	35.0	43.0	35.0	43.0
300	35.0	10.0	35.0	28.0	35.0	38.5	35.0	43.0	35.0	43.0
350	35.0	8.6	35.0	24.0	35.0	33.0	35.0	42.0	35.0	43.0
400	35.0	7.5	35.0	21.0	35.0	28.9	35.0	36.8	35.0	43.0
450	35.0	6.7	35.0	18.7	35.0	25.7	35.0	32.7	35.0	39.7
500	35.0	6.0	35.0	16.8	35.0	23.1	35.0	29.4	35.0	35.7
550	35.0	5.5	35.0	15.3	35.0	21.0	35.0	26.7	35.0	32.5
600	35.0	5.0	35.0	14.0	35.0	19.3	35.0	24.5	35.0	29.8

Number of boreholes  $\leq 4$

Percentage of boreholes in the bearing area  $\leq 10\%$

Minimum dimensions of the bearing  $a \geq 120$  mm,  $b \geq 120$  mm without holes,  $a \geq 140$  mm,  $b \geq 140$  mm with holes

Bore diameter  $\leq 60$  mm

Edge distance  $\geq 20$  mm

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Thicknesses: 15, 24, 33, 42 and 51 mm

The table below depicts the design values of the load capacity and the allowable angle of distortion, depending on the bearing dimensions. Interim values can be inpolated.

ROUND BEARINGS										
DIAMETER D [mm]	Bearing Thickness									
	t = 15 mm		t = 24 mm		t = 33 mm		t = 42 mm		t = 51 mm	
	Shear Deformation									
	u = 6 mm		u = 8,4 mm		u = 11,6 mm		u = 14,7 mm		u = 17,9 mm	
	$\sigma_{R,d}$	$\alpha_{\max}$	$\sigma_{R,d}$	$\alpha_{\max}$	$\sigma_{R,d}$	$\alpha_{\max}$	$\sigma_{R,d}$	$\alpha_{\max}$	$\sigma_{R,d}$	$\alpha_{\max}$
	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]	[N/mm <sup>2</sup> ]	[‰]
120	35.0	25.0	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
130	35.0	23.1	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
140	35.0	21.4	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
150	35.0	20.0	35.0	43.0	35.0	43.0	35.0	43.0	35.0	43.0
200	35.0	15.0	35.0	42.0	35.0	43.0	35.0	43.0	35.0	43.0
250	35.0	12.0	35.0	33.6	35.0	43.0	35.0	43.0	35.0	43.0
300	35.0	10.0	35.0	28.0	35.0	38.5	35.0	43.0	35.0	43.0
350	35.0	8.6	35.0	24.0	35.0	33.0	35.0	42.0	35.0	43.0
400	35.0	7.5	35.0	21.0	35.0	28.9	35.0	36.8	35.0	43.0
450	35.0	6.7	35.0	18.7	35.0	25.7	35.0	32.7	35.0	39.7
500	35.0	6.0	35.0	16.8	35.0	23.1	35.0	29.4	35.0	25.7
550	35.0	5.5	35.0	15.3	35.0	21.0	35.0	26.7	35.0	32.5
600	35.0	5.0	35.0	14.0	35.0	19.3	35.0	24.5	35.0	29.8

Number of boreholes  $\leq 4$

Percentage of boreholes in the bearing area  $\leq 10\%$

Minimum dimensions of the bearing  $d \geq 120$  mm without holes,  $d \geq 140$  mm with holes

Bore diameter  $\leq 60$  mm

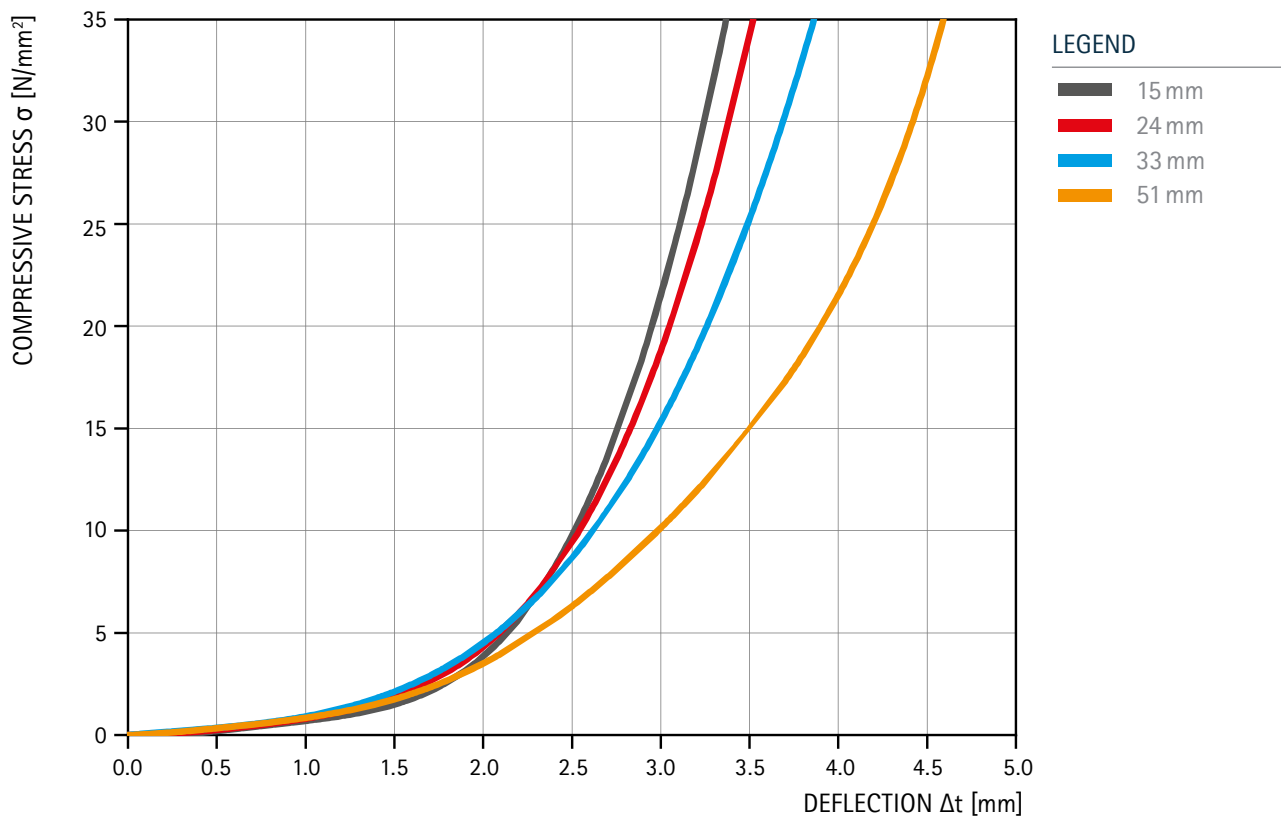
Edge distance  $\geq 20$  mm

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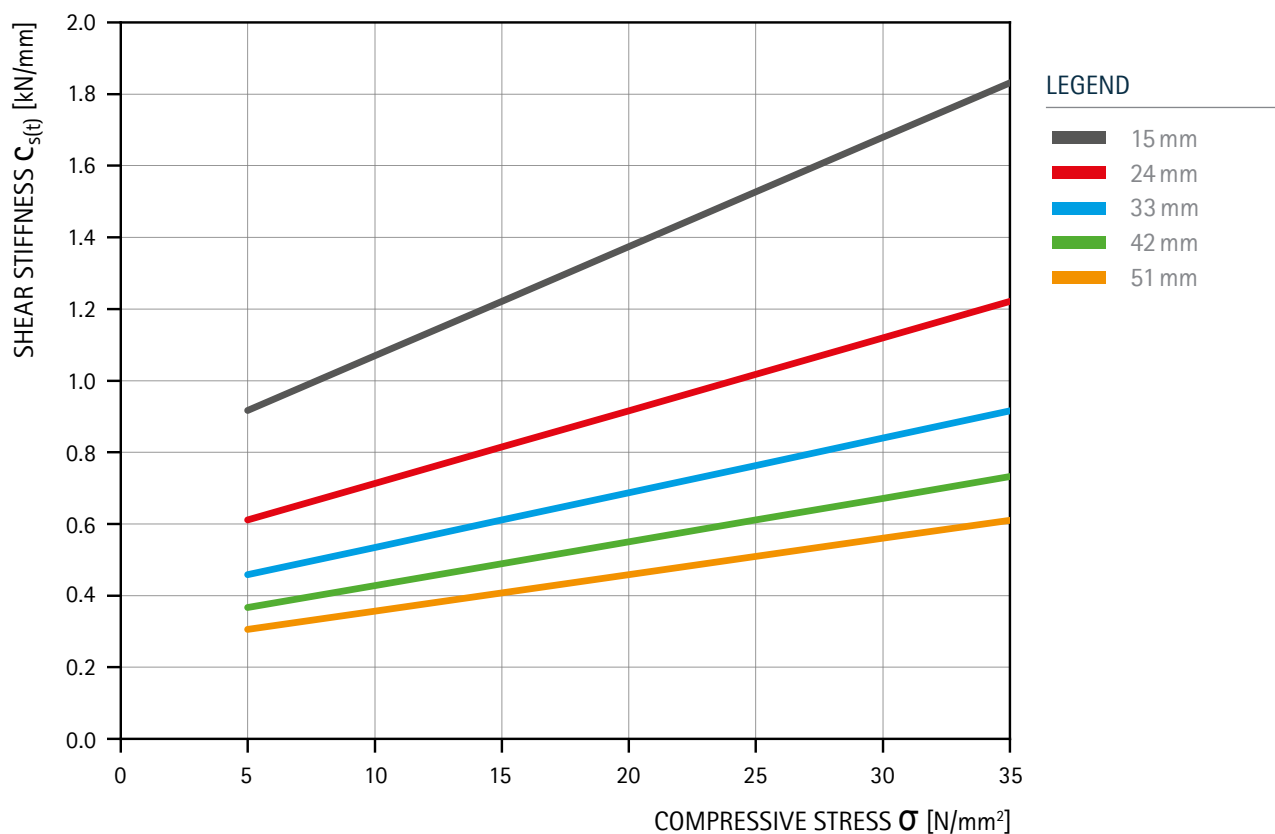
Structural bearing for static structural members

### Load deflection curve

The following diagram shows the compression behaviour for different formats when used between concrete surfaces (precast elements).



### Shear stiffness



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Structural bearing for static structural members

### Design example

Given:  $F_{E,d} = 1410 \text{ kN}^*$  corresponding to  $F_{E,k} = \text{approx. } F_{E,d}/1.4 = 1007 \text{ kN}^*$ , bearing rotation  $\alpha = 19\text{‰}$ , horizontal deformation  $u = 8 \text{ mm}$

Selected dimensions:  $a_1 = 150 \text{ mm}$ ,  $b_1 = 300 \text{ mm}$ ,  $t = 24 \text{ mm}$

Load capacity:  $\sigma_{R,d} = 35.0 \text{ N/mm}^2$   
 $F_{R,d} = \sigma_{R,d} \times A_E = 35.0 \text{ N/mm}^2 \times 150 \text{ mm} \times 300 \text{ mm} = 1570 \text{ kN}$   
 $F_{R,d} \geq F_{E,d} \rightarrow \text{Load capacity of the bearing is sufficient}$

Bearing distortion from component deflection:  $\alpha = 19\text{‰}$

Additional rotation from obliqueness:  $10\text{‰}$

Additional rotation from unevenness:  $625 \text{ (mm*‰)} / a = 625 / 150 \text{ ‰} = 4.2\text{‰}$

Total rotation to be measured:  $\alpha = 19\text{‰} + 10\text{‰} + 4.2\text{‰} = 33.2\text{‰}$

$\text{max. } \alpha = 350 \text{ ‰} \times t/a = 350 \text{ ‰} \times 24 \text{ mm} / 150 \text{ mm} =$

$56\text{‰} > 43\text{‰} \rightarrow \text{max. } \alpha = 43\text{‰}$

$\text{max. } \alpha \geq \alpha \rightarrow \text{Angle of twist for rotation is sufficient}$

Horizontal deflection of structural members:  $u = 8.0 \text{ mm}$

$\text{max. } u = 0.35 \times t = 8.4 \text{ mm}$

$\text{max. } u \geq u \rightarrow \text{Shear deformability of the bearing is sufficient}$

\* Note on partial safety factor: The partial safety factor of a compressive load depends on its type. In case of permanent loads it is e.g. 1.35, in case of variable loads 1.5. Since structural bearings in building construction should only be used under predominantly permanent loads, a factor of approximately 1.4 can be used for the ratio between the total characteristic load and the total design rated load.

The contents of this publication are the result of many years of research and experience gained in the application of this technology. All information is given in good faith; it does not represent a guarantee with respect to characteristics and does not exempt the user from testing the suitability of products and from ascertaining that the industrial property rights of third parties are not violated. No liability whatsoever will be accepted for damage – regardless of its nature and its legal basis – arising from advice given in this publication. We reserve the right to make technical modifications in the course of product development.

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