Perforated™ Bearing Type Z

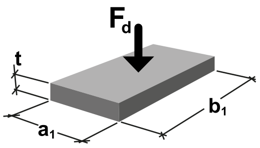
Structural bearing for static structural members

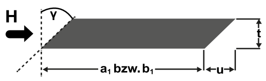
Design values

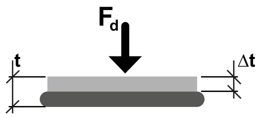
The bearings are dimensioned according to the general building authority approval up to a compressive stress $\sigma_{R,d} = 35\,N/mm^2$. Holes, cut-outs and the required edge distances must be taken into account according to DIN EN 1992.

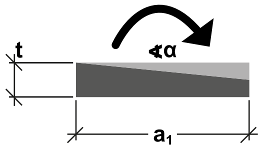
TYPE OF LOAD ACTING

Design value of bearing resistance (max. compressive stress)	max. shear deformation	Deflection	max. rotation









FORMULA

Design value of bearing resistance (max. compressive stress)	max. shear deformation	Deflection	max. rotation
$\sigma_{R,d} = 35\,N/mm^2$	t = 15 mm: $u_{max} = 0.4 \times t$ t > 15 mm: $u_{max} = 0.35 \times t$ Horizontal force $H = c_{s(t)} \times u \times A_E / 10{,}000\ mm^2$ A minimum compressive stress of $5\ N/mm^2$ is required to prevent the bearing from slipping. $c_{s(t)}$-values and boundary conditions s. page 4	s. page 4	t = 15 mm: $\alpha_{max} = 200\,‰ \times t/a_1 \leq 40\,‰$ t > 15 mm: $\alpha_{max} = 350\,‰ \times t/a_1 \leq 43\,‰$ 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
H	Horizontal force
A_E	Bearing area
a_1	Short side of bearing
b_1	Long side of bearing
$\sigma_{R,d}$	Design value of the load capacity
α	Bearing rotation
$c_{s(t)}$	Shear stiffness
u	Shear deformation of the bearing
γ	Push angle
t	Thickness of bearing
Δt	Bearing deflection
D	Bore diameter

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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.

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	
	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}
	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]
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 ≤ 4
Percentage of boreholes in the bearing area ≤ 10 %
Minimum dimensions of the bearing a ≥ 120 mm, b ≥ 120 mm without holes, a ≥ 140 mm, b ≥ 140 mm with holes
Bore diameter ≤ 60 mm
Edge distance ≥ 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	
	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}
	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]
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 ≤ 4
Percentage of boreholes in the bearing area ≤ 10 %
Minimum dimensions of the bearing d ≥ 120 mm without holes, d ≥ 140 mm with holes
Bore diameter ≤ 60 mm
Edge distance ≥ 20 mm

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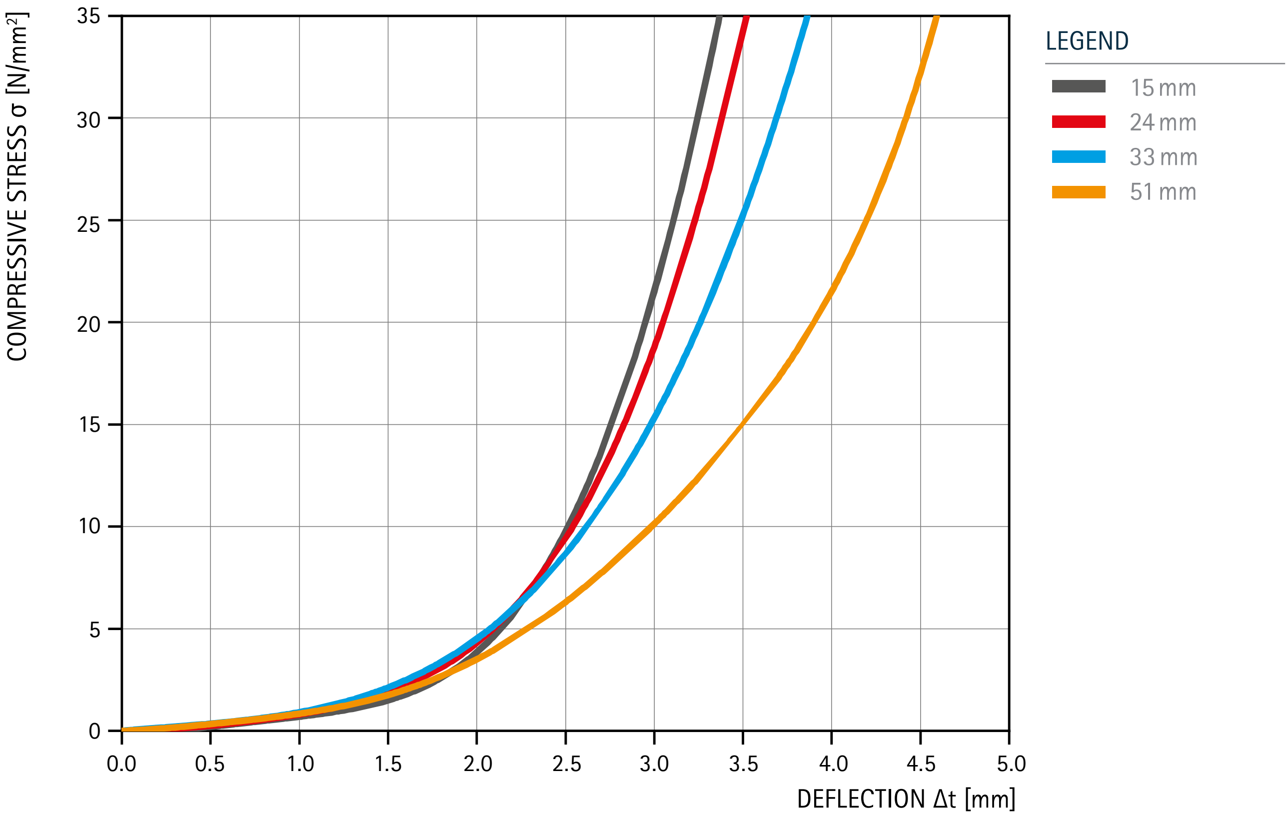
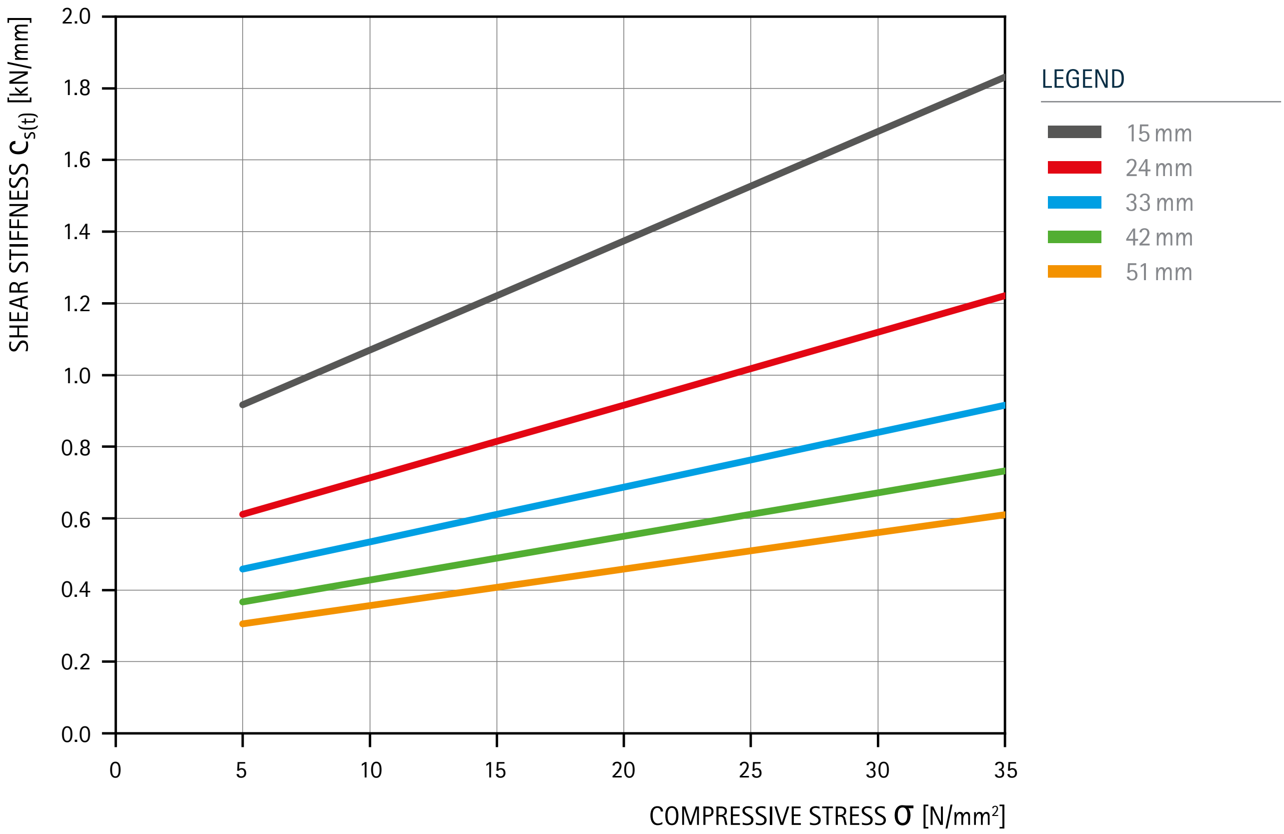
Load deflection curve

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



Shear stiffness



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Design example

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

Selected dimensions: $a_1 = 150$ mm, $b_1 = 300$ mm, $t = 24$ mm

Load capacity: $\sigma_{R,d} = 35.0$ N/mm²

$F_{R,d} = \sigma_{R,d} \times A_E = 35.0$ N/mm² x 150 mm x 300 mm = 1570 kN

$F_{R,d} \geq F_{E,d}$ ⟶ Load capacity of the bearing is sufficient

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

Additional rotation from obliqness: 10 ‰

Additional rotation from unevenness: 625 (mm*‰) / a = 625 / 160 ‰ = 3.9 ‰

Total rotation to be measured: $\alpha = 19$ ‰ + 10 ‰ + 3.9 ‰ = 32.9 ‰

max. α = 350 ‰ x t / a = 350 ‰ x 24 mm / 150 mm =

56 ‰ > 43 ‰ ⟶ max. α = 43 ‰

max. $\alpha \geq \alpha$ ⟶ Angle of twist for rotation is sufficient

Horizontal deflection of structural members: u = 8.0 mm

max. u = 0.35 x t = 8.4 mm

max. u ≥ u ⟶ 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.

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