

bi-Trapez Bearing®

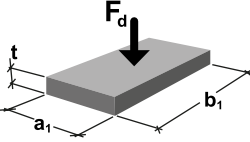
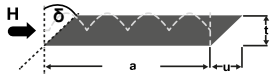
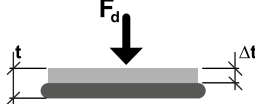
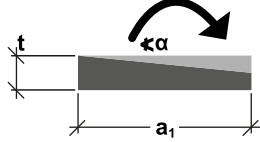
Structural bearing for static structural members and impact sound insulation

Design values

The bearings are dimensioned according to the national technical approval up to a compressive stress $\sigma_{R,d} = 17,4 \text{ N/mm}^2$.

The design concept is based on the shape factor. 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	All. shear deformation	Deflection	Allowable rotation
			

FORMULA

$\sigma_{R,d} = 1,095 \times S^{1,543} \leq 17,4 \text{ [N/mm}^2\text{]}$	Thickness t t = 10 mm: all. u = 4 mm t = 15 mm: all. u = 5,5 mm t = 20 mm: all. u = 8 mm Horizontal force $H_d = c_{s(t)} \cdot u \cdot A_E / 20000 \text{ [kN]}$	see page 4	Thickness t t = 10 mm: all. $\alpha = 3000/a_1 \text{ [‰]}$ t = 15 mm: all. $\alpha = 5000/a_1 \text{ [‰]}$ t = 20 mm: all. $\alpha = 6500/a_1 \text{ [‰]}$ (Rectangular bearing) Additional rotation acc. to technical approval: <ul style="list-style-type: none"> • 10‰ from obliquity • $\frac{625}{a_1}$ from unevenness see also booklet 600, DAfStb
Shape factor S see page 2	$c_{s(t)}$ values and boundary conditions, see page 5		

LEGEND FORMULA SYMBOLS

F_d	Vertical force	$\sigma_{R,d}$	Design value of the load capacity
H_d	Horizontal force	$\sigma_{E,d}$	Design compressive stress from load
A_E	Bearing area	α	Bearing rotation
S	Shape factor, Ratio of pressed bearing surface A_E to unloaded lateral surface	$c_{s(t)}$	Shear stiffness
a_1	Short side of bearing	u	Shear deformation of the bearing
b_1	Long side of bearing	t	Thickness of bearing
a	Component width	Δt	Bearing deflection
b	Component length		

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Design of the shape factor

For the design of unreinforced elastomeric bearings, the shape factor S is defined as the ratio of the compressed to the freely deformable surface. The shape factor S is used to calculate the permissible compressive stress as a function of the bearing dimensions.

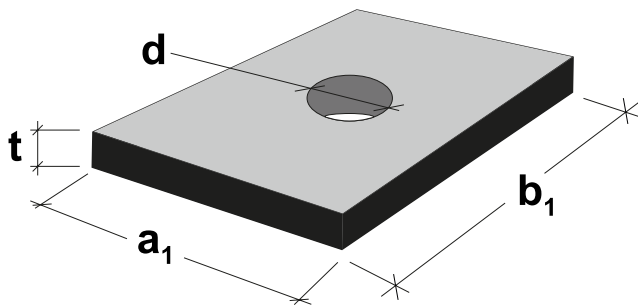
SHAPE FACTOR FOR RECTANGULAR BEARING

Without drilled holes

$$S = \frac{b_1 \cdot a_1}{2 \cdot t \cdot (b_1 + a_1)}$$

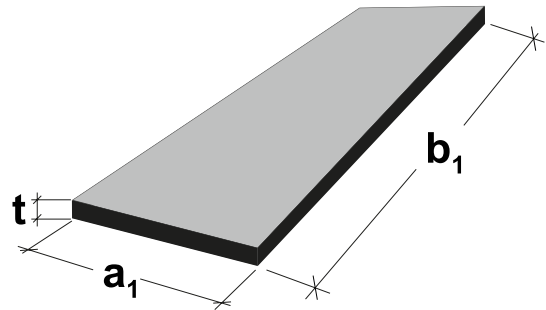
With drilled holes, $n \leq 2$

$$S = \frac{a \cdot b - \frac{\pi}{4} n \cdot d^2}{2 \cdot t \cdot (a + b) + t \cdot \pi \cdot n \cdot d}$$



SHAPE FACTOR FOR BEARING STRIP

$$S = \frac{a_1}{2 \cdot t} \quad b_1 \gg a_1$$



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Thickness: 10 mm

The following tables show the design value of the load capacity and the allowable angle of distortion as a function of the bearing dimensions. Intermediate values may be interpolated.

BEARING			DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm ²]																		
[mm]	α [‰]	[mm]	BEARING LENGTH [mm]																		
Thick-ness	all. rotation	Width	70	80	90	100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500
			10	40	50	-	-	-	2,4	2,5	2,6	2,7	2,8	2,9	3,1	3,2	3,3	3,4	3,5	3,5	3,7
30	100	3,3		3,8	4,1	4,5	4,8	5,1	5,4	5,7	6,0	6,5	7,0	7,4	7,8	8,1	8,4	8,9	9,3	9,6	9,9
20	150	4,2		4,8	5,4	6,0	6,5	7,0	7,5	8,0	8,4	9,4	10,3	11,2	11,9	12,5	13,1	14,1	15,0	15,7	16,4
15	200	4,8		5,5	6,3	7,0	7,7	8,4	9,1	9,7	10,3	11,8	13,1	14,3	15,4	16,5	17,4	17,4	17,4	17,4	17,4

Thickness: 15 mm

BEARING			DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm ²]																		
[mm]	α [‰]	[mm]	LBEARING LENGTH [mm]																		
Thick-ness	all. rotation	Width	70	80	90	100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500
			15	40	50	-	-	-	1,3	1,4	1,4	1,5	1,5	1,5	1,6	1,7	1,8	1,8	1,9	1,9	2,0
40	100	1,9		2,0	2,2	2,4	2,6	2,8	2,9	3,1	3,2	3,5	3,8	4,0	4,2	4,3	4,5	4,8	5,0	5,1	5,3
33,3	150	2,4		2,6	2,9	3,2	3,5	3,8	4,0	4,3	4,5	5,0	5,5	6,0	6,4	6,7	7,0	7,6	8,0	8,4	8,8
25	200	2,8		3,0	3,4	3,8	4,1	4,5	4,9	5,2	5,5	6,3	7,0	7,7	8,3	8,8	9,3	10,2	10,9	11,6	12,2

Thickness: 20 mm

BEARING			DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm ²]																
[mm]	α [‰]	[mm]	BEARING LENGTH [mm]																
Thick-ness	all. rotation	Width	100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500	
			20	40	100	1,5	1,7	1,8	1,9	2,0	2,0	2,2	2,4	2,6	2,7	2,8	2,9	3,1	3,2
32,5	200	2,4		2,7	2,9	3,1	3,3	3,5	4,0	4,5	4,9	5,3	5,6	6,0	6,5	7,0	7,4	7,8	

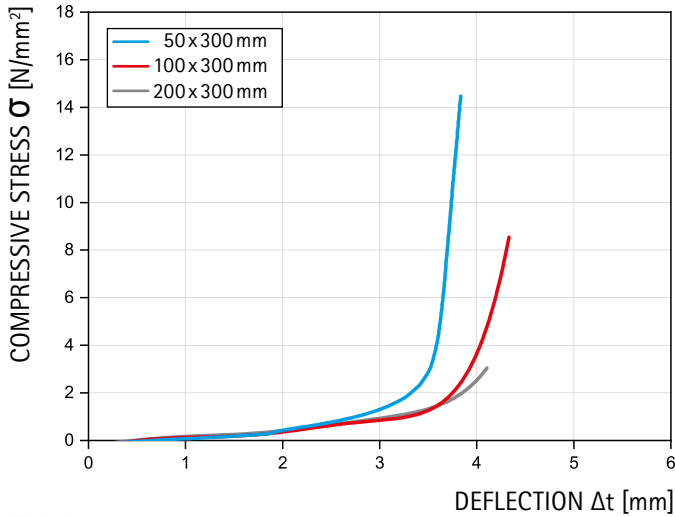
STRIP BEARINGS						
BI-TRAPEZ BEARING®						
BEARING WIDTH a_1	BEARING THICKNESSES					
	10 mm		15 mm		20 mm	
	$F_{R,d}$	α	$F_{R,d}$	α	$F_{R,d}$	α
[mm]	[kN/m]	[‰]	[kN/m]	[‰]	[kN/m]	[‰]
50	225	40	120	40	-	-
100	1312	30	702	40	450	40
150	2610	20	1968	33,3	-	-
200	3480	15	3480	25	2624	32,5

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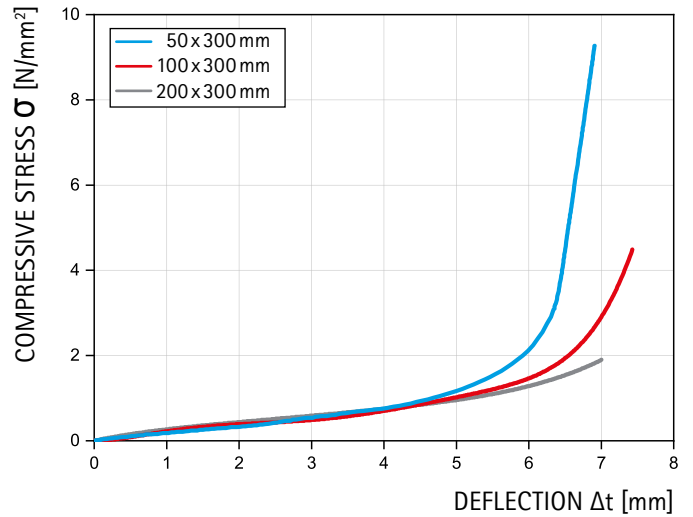
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Load deflection curves

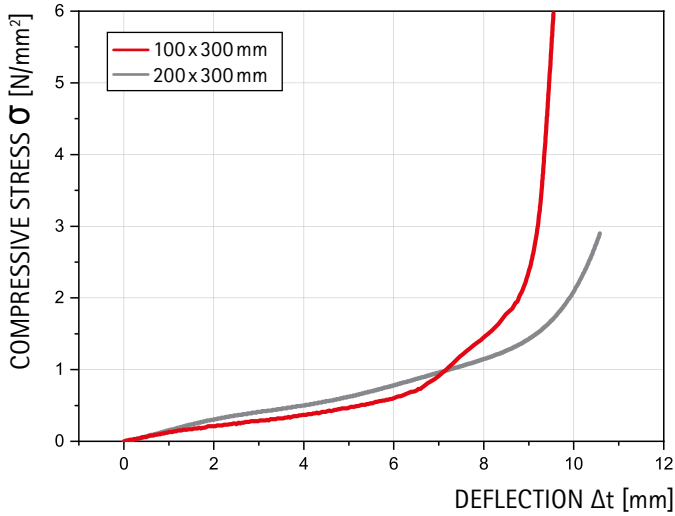
Thickness 10 mm



Thickness 15 mm

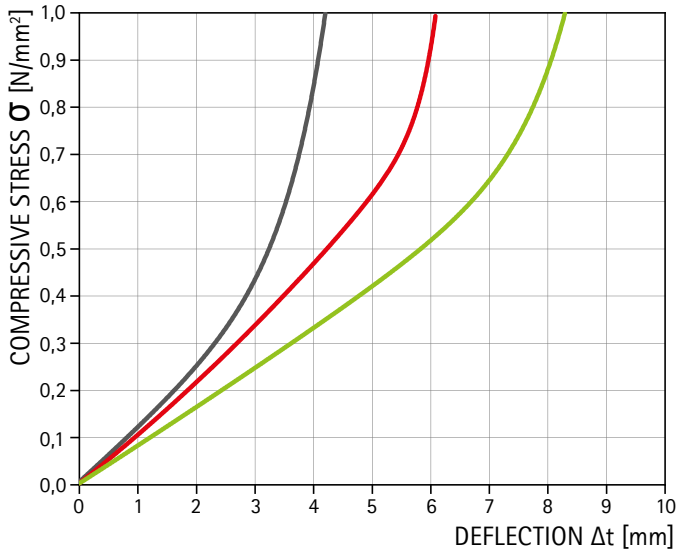


Thickness 20 mm

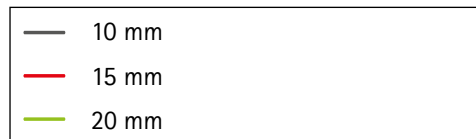


Load deflection curve up to the design value of load capacity acc. to the approval for a bearing of this type with high shape factor.

Load deflection curve for different bearing thicknesses



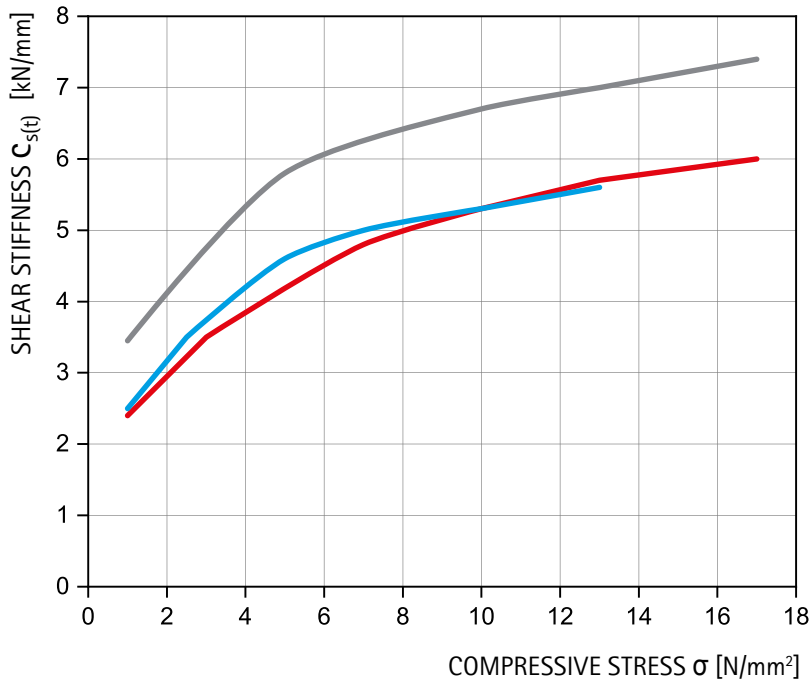
Bearing deflection in the lower, acoustically relevant compressive stress range, orientation diagram



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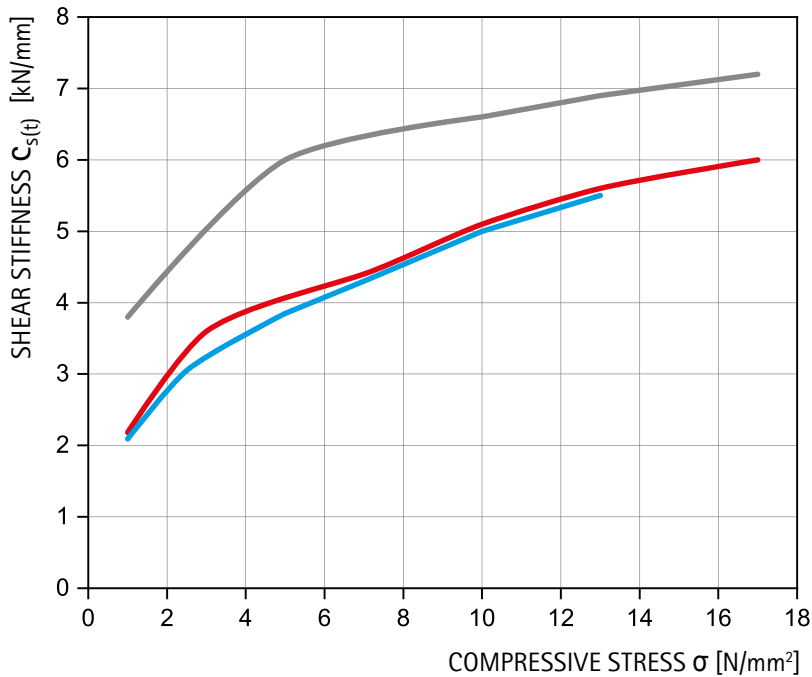
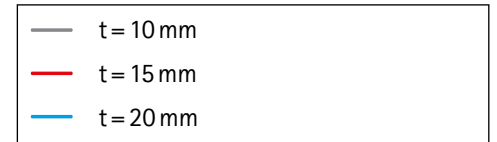
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Shear stiffness

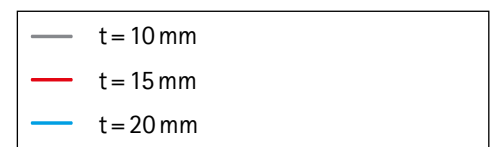


SHEAR STIFFNESS CURVE

Perpendicular to profile.



Parallel to profile.



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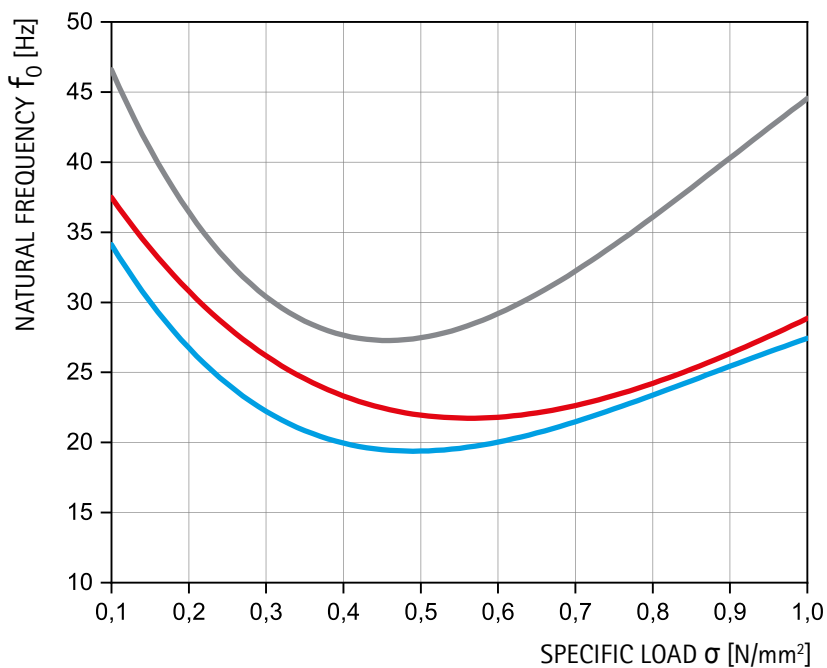
Structural bearing for static structural members and impact sound insulation

BI-TRAPEZ BEARING® IMPACT SOUND STOP FOR USE IN STAIRWAY CONSTRUCTION

Bearing thickness [mm]	Bearing width [mm]	Eff. vertical load (charact. values) [kN/m]	Impact sound mitigation (as per DIN 52210-4) in the compressive stress range between 0.3 and 0.7 N/mm ² (charact. values) [dB]	Insulation effect [%]	Deflection [mm]
10	50	15-35	23	87	2,3 - 2,8
	100	30-70	23	87	2,3 - 2,8
15	50	15-35	27	91	2,8 - 5,5
	100	30-70	27	91	2,8 - 5,5
20	100	30-70	28	93	3,8 - 7,4

bi-Trapez Bearing® can be used as strip or rectangular bearing for impact sound insulation in stairs. The table shows the compressive stress range for the application as well as the impact sound improvement factor according to DIN 52210-4.

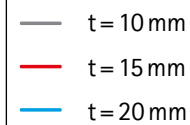
Natural Frequency



NATURAL FREQUENCY CURVE

The figure shows the natural frequency of a single-degree-oscillator with bi-Trapez Bearing® as an elastic bearing for an excitation with a velocity amplitude between 0,1 and 1,0 N/mm².

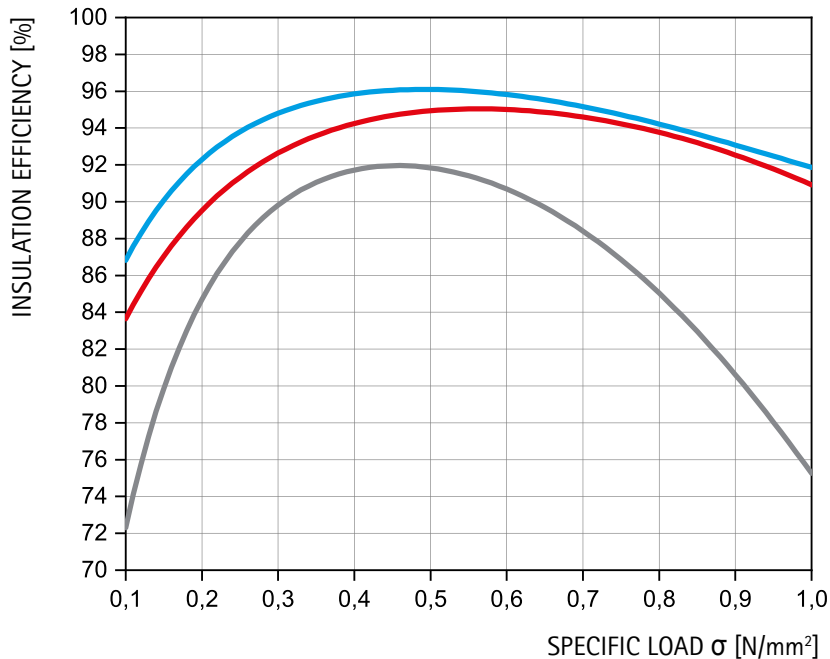
In this range, bi-Trapezlager® is suitable for the impact sound and structure-borne noise insulation due to its soft spring characteristics.



bi-Trapez Bearing®

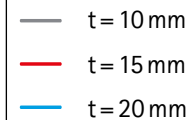
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Insulation efficiency

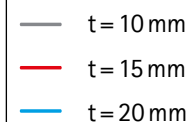
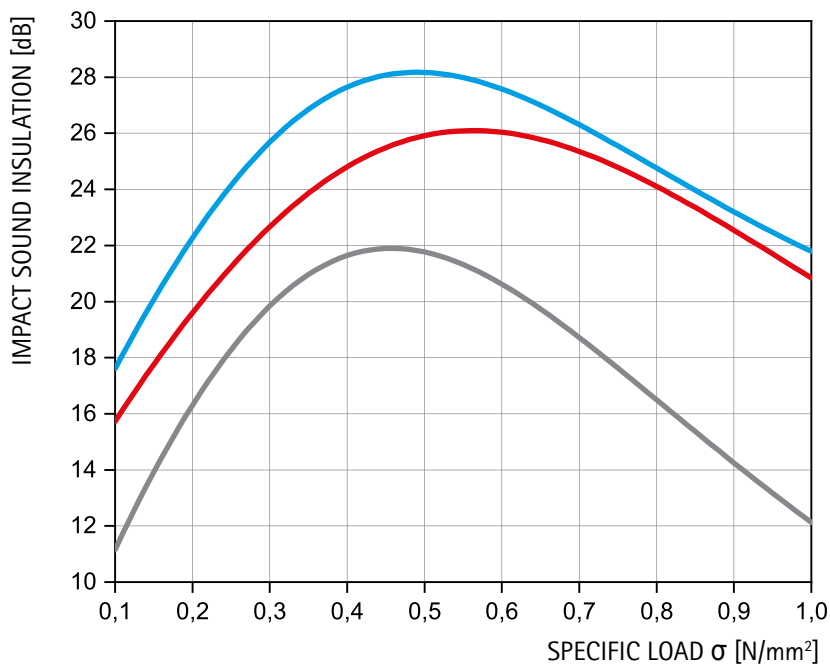


DIAGRAM

The two diagrams show the possible effect of bi-Trapez Bearing® when used for the insulation of structure-borne noise. Decisive for the structure-borne sound insulation is the ratio of the occurring excitation frequency to the natural frequency shown above. The larger this is, the better the insulation. As can be seen in the diagrams, an insulation effect of over 90 % is possible even with an excitation frequency of 100 Hz. This corresponds to an impact sound insulation of 20 dB. Excitation frequencies above 100 Hz are shielded to an even higher degree.



Impact sound insulation



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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