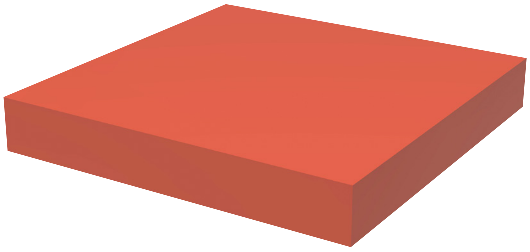


COMPACT CORE BEARING

Static elastomeric bearing for high loads and thermal separation

Load capacity up to 63 N/mm²

A LISEGA Group Company

SECURELY AND PERMANENTLY SUPPORTED

INCREASE LIVING COMFORT WITH CALENBERG

High-value rubber material and the high quality standard of our elastomer bearings ensure freedom from maintenance, a long service life and thus absolute freedom of the structure from damage.

KNOW HOW

Effective façade protection

Avoid thermal bridges and lower energy costs

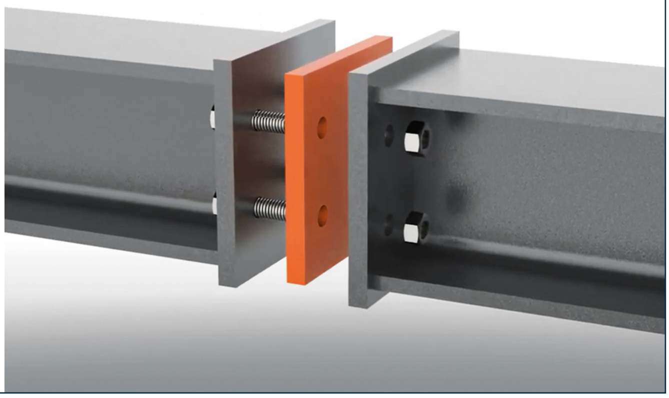
The compact core bearing has been used for 50 years for the transmission of very high loads between components. The hard elastomer material can bear loads of up to 63 N/mm^2 depending on the format.

The use of steel components is a popular stylistic device in modern architecture for building complexes and industrial halls. These include, for example, balconies, façade elements or porches. With this construction method, care must be taken in the interests of saving energy to avoid thermal bridges. Continuous steel girders from the exterior into the interior are a weak point in relation to energy losses, formation of condensation, mould growth and corrosion.

The compact core bearings are very well suited for use as thermal separation for façade constructions and cantilever components. The use of the bearing enables the user to meet increasing requirements for the minimisation of energy consumption and the associated, not inconsiderable cost savings.

PRODUCT ADVANTAGES

- Verified and validated design software (PCAE)
- Maintenance-free
- Resistant to weathering and ozone
- Extremely durable
- Very low creepage
- High-quality material
- High load capacity
- Building authority approved elastomer bearing
- Moments are transmitted according to plan



The compact core bearing

Product description

The Calenberg compact core bearing is an unreinforced elastomer bearing with smooth pressure contact surfaces. The main constituent is an aging-resistant NBR elastomer material. The purpose of the reddish-brown dyeing is for product-specific identification. The material is resistant to weathering, oil, grease, fuels and ozone, as well as abrasion and wear.

Application and areas of use

Compact core bearings are suitable for use as supports where very high loads are transmitted perpendicularly to the bearing plane. In order to avoid energy losses due to thermal bridges, the bearings are used in all areas of construction for thermal separation, e.g. in façade construction, for the installation of solar systems and heat pumps, or when connecting balconies and porches to the support structure.

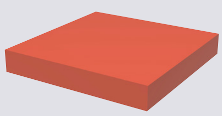
Building authority approval

Usability in building construction is regulated by the general building authority approval no. Z-16.32-515, issued by the German Institute of Building Technology.

Fire behaviour

The fire protection assessment no. 3799/7357-AR issued by the Technical University of Braunschweig is to be observed in case of fire protection requirements. This assessment contains specifications for the minimum dimensions and other measures that meet the requirements of the DIN 4102-2 standard.

EXTRACT FROM TECHNICAL DATA

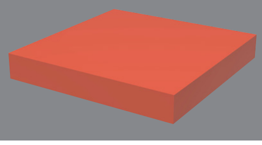
Compact Core Bearing	Bearing type	Bearing thickness [mm]	Compressive stress	Approval
	Unreinforced, high-strength bearing for thermal separation	5*	max. $\sigma_{R,d} = 42$ N/mm²	Approval no. Z-16.32-515, issued by the DIBt Berlin
		10		
		15		
		20	max. $\sigma_{R,d} = 63$ N/mm²	

* No building authority approval

Delivery forms

Calenberg core compact bearing are delivered in virtually every desired size to suit the structure.
The bearings can be provided with holes, cut-outs, slots, etc.

STANDARD CUT-OUTS



- Hole
- Slot
- Slot cut-out
- Angled cut
- Corner cut-out
- Rectangular cut-out
- Rectangular hole

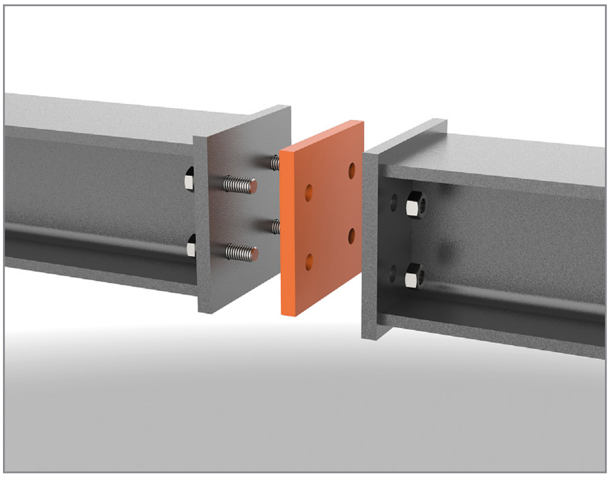
DIMENSIONS

Bearing thicknesses	Maximum cut blank size	Minimum cut blank size
5*, 10, 15, 20 mm	1200 mm x 1200 mm	100 mm x 100 mm

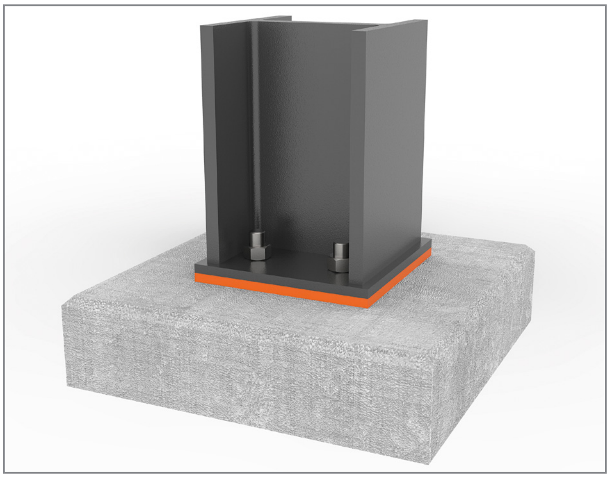
* No building authority approval

Installation instructions

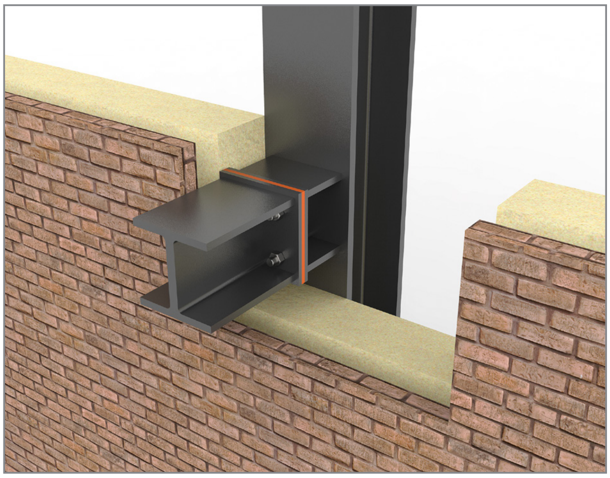
Prior to installation, ensure that the elastomer bearings and support surfaces are free from dirt, burrs, blow-holes, ice, snow, greases, solvents, oils and release agents.



Vertical use in the area of front slab and cantilever slab connections

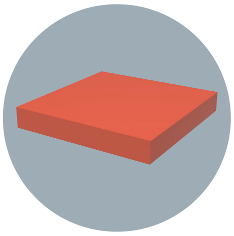


Horizontal use between columns and various substrates



Thermal separation using compact core bearing in the façade area

Extract from our customer references



COMPACT CORE BEARING

- German State Opera, Berlin, Germany
- Berlin Philharmonic Hall, Berlin, Germany
- Wesertower, Bremen, Germany
- Leipzig Zoo – Giant Tropical Hall, Leipzig, Germany
- German Maritime Museum, Wilhelmshaven, Germany
- Minimundus, Klagenfurt, Austria
- Cleveland Clinic Abu Dhabi, Abu Dhabi, UAE
- Cultural Centre of the Embassy of Azerbaijan, Berlin, Germany
- Hotel Fährhaus, Norddeich North Sea resort, Germany
- Federal Ministry of Employment and Social Affairs, Bonn, Germany
- Schiphol Airport, Schiphol, The Netherlands
- Skyline Plaza, Frankfurt am Main, Germany
- Mega-Casino Ufo, Oberhausen, Germany
- RWE, Essen, Germany
- Central Bus Station (ZOB), Munich, Germany
- Gläserne Manufaktur (Transparent Factory), Dresden, Germany
- Ulmer Schokoladen, Wilhelmshaven, Germany
- Neurath Blöcke F/G Power Station, Grevenbroich, Germany

German State Opera, Berlin, Germany

Berlin Philharmonic Hall, Berlin, Germany

Cleveland Clinic Abu Dhabi, Abu Dhabi, UAE

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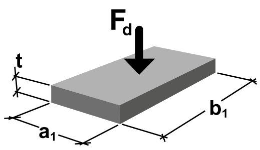
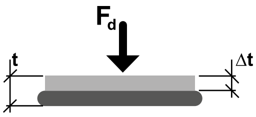
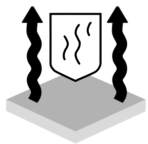
Compact core bearing

Transmission of high loads and thermal separation in the construction industry

Dimensioning with design values

The bearing is dimensioned in accordance with the general building authority approval up to a compressive stress $\sigma_{R,d}$ of 63 N/mm² (thickness 20 mm) and $\sigma_{R,d}$ of 42 N/mm² (thicknesses 5, 10 and 15 mm). The dimensioning concept is based on the form factor.

LOAD TYPE		
Design value of the load capacity	Elastic deformation	Material properties
		
EQUATION		
For t ≤ 15 mm $\sigma_{perm} = 16.2 \cdot S^{0.75} \leq 42$ [N/mm²] For t = 20 mm $\sigma_{perm} = 34.2 \cdot S^{0.7} \leq 63$ [N/mm²] Form factor S, see page 2	see page 4	Coefficient of thermal conductivity λ: 0.2 [W/(m*K)] Surface resistivity according to EN 20284: $7.5 \cdot 10^{10}$ Ω Volume resistivity according to IEC 93: $2.1 \cdot 10^{12}$ Ω cm

KEY TO EQUATION SYMBOLS

F_d	Vertical force
A_E	Bearing area
S	Form factor, ratio of compressed bearing area A_E to unloaded body area
a_1	Shorter bearing side
b_1	Longer bearing side
a	Component width
b	Component length
$\sigma_{R,d}$	Design value of the load capacity
t	Bearing thickness
Δt	Elastic deformation
λ	Thermal conductivity

Compact core bearing

Transmission of high loads and thermal separation in the construction industry

Calculation of the form factor

The form factor S, as the ratio of the compressed area to the freely formable area, is taken for the dimensioning of unreinforced elastomeric bearings. The permissible compressive stress in relation to the bearing dimensions is calculated with the form factor S.

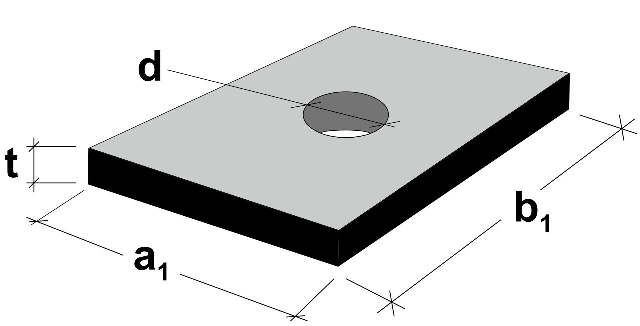
FORM FACTOR FOR RECTANGULAR BEARINGS

Without hole

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

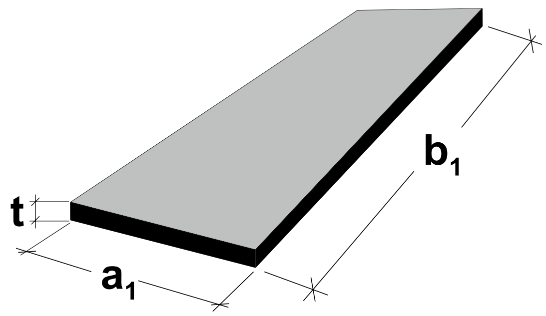
With hole(s), $n \leq 12$

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



FORM FACTOR FOR STRIP-SHAPED BEARINGS

$$S = \frac{a_1}{2 \cdot t} \qquad b_1 >> a_1$$



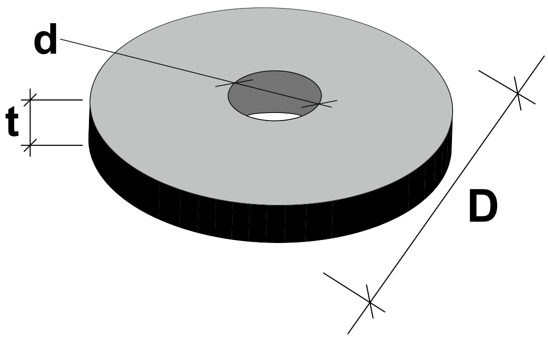
FORM FACTOR FOR ROUND BEARINGS

Without hole

$$S = \frac{D}{4 \cdot \sqrt{2}\, t}$$

With hole

$$S = \frac{D - d}{4 \cdot \sqrt{2}\, t}$$



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Compact core bearing

Transmission of high loads and thermal separation in the construction industry

Thicknesses: 5, 10 and 15 mm

Note: For t = 5 mm, $\sigma_{R,d}$ = 42 mm². This tabular overview is not shown here.

The table below shows the design value of the load capacity and the permissible angle of rotation in relation to the bearing dimensions. Intermediate values may be interpolated.

BEARING		DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm²]															
Thickness [mm]	Width [mm]	BEARING LENGTH [mm]															
		100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500
10	100	32.2	33.4	34.4	35.3	36.2	36.9	38.6	40.0	41.1							
	110	33.4	34.6	35.7	36.7	37.7	38.5	40.4	41.9								
	120	34.4	35.7	36.9	38.0	39.0	40.0										
	130	35.3	36.7	38.0	39.2	40.3	41.3										
	140	36.2	37.7	39.0	40.3	41.5											
	150	36.9	38.5	40.0	41.3												
	160	37.6	39.3	40.8													
	175	38.6	40.4														
	200	40.0	41.9														
	250																
	300																42.0

BEARING		DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm²]															
Thickness [mm]	Width [mm]	BEARING LENGTH [mm]															
		100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500
15	100	23.8	24.6	25.4	26.1	26.7	27.2	28.5	29.5	30.3	31.1	31.7	32.2	33.1	33.8	34.4	34.9
	110	24.6	25.5	26.4	27.1	27.8	28.4	29.8	30.9	31.8	32.7	33.4	34.0	35.0	35.8	36.4	37.0
	120	25.4	26.4	27.2	28.1	28.8	29.5	31.0	32.2	33.3	34.1	34.9	35.6	36.7	37.6	38.4	39.0
	130	26.1	27.1	28.1	28.9	29.7	30.5	32.1	33.4	34.6	35.5	36.4	37.1	38.4	39.4	40.2	40.9
	140	26.7	27.8	28.8	29.7	30.6	31.4	33.1	34.5	35.8	36.8	37.8	38.6	40.0	41.1		
	150	27.2	28.4	29.5	30.5	31.4	32.2	34.0	35.6	36.9	38.1	39.1	40.0	41.5			
	160	27.8	29.0	30.1	31.1	32.1	33.0	34.9	36.6	38.0	39.2	40.3	41.3				
	175	28.5	29.8	31.0	32.1	33.1	34.0	36.2	37.9	39.5	40.8						
	200	29.5	30.9	32.2	33.4	34.5	35.6	37.9	40.0	41.7							
	250	31.1	32.7	34.1	35.5	36.8	38.1	40.8									
	300	32.2	34.0	35.6	37.1	38.6	40.0										
	350	33.1	35.0	36.7	38.4	40.0	41.5										
	400	33.8	35.8	37.6	39.4	41.1											
	450	34.4	36.4	38.4	40.2												42.0

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Compact core bearing

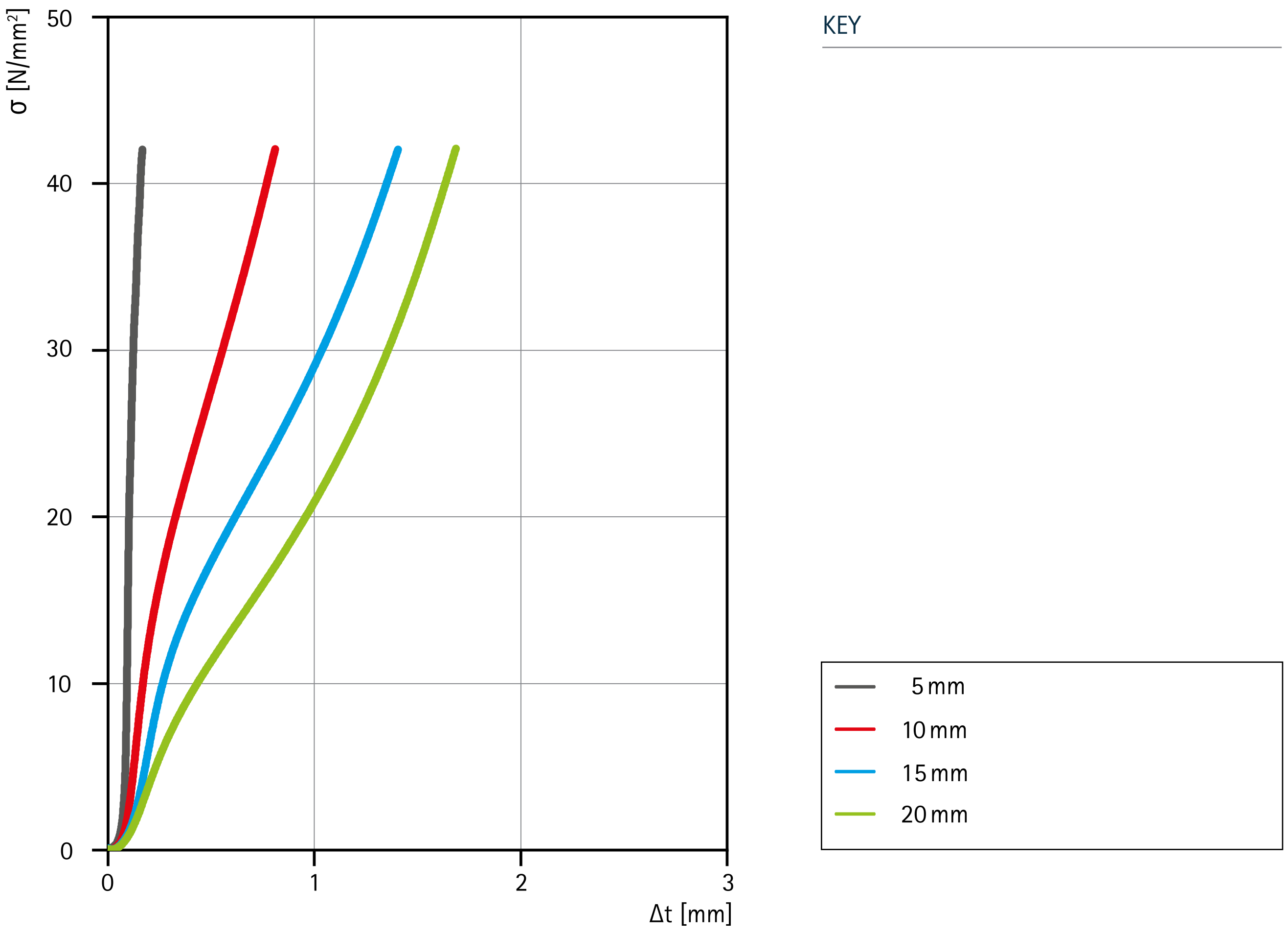
Transmission of high loads and thermal separation in the construction industry

Thickness: 20 mm

BEARING		DESIGN VALUE OF THE LOAD CAPACITY, $\sigma_{R,d}$ [N/mm²]															
Thickness [mm]	Width [mm]	BEARING LENGTH [mm]															
		100	110	120	130	140	150	175	200	225	250	275	300	350	400	450	500
20	100	40.0	41.3	42.5	43.6	44.5	45.4	47.3	48.9	50.2	51.3	52.3	53.1	54.5	55.6	56.4	57.2
	110	41.3	42.7	44.0	45.2	46.3	47.2	49.4	51.1	52.5	53.8	54.9	55.8	57.3	58.6	59.6	60.4
	120	42.5	44.0	45.4	46.7	47.8	48.9	51.2	53.1	54.7	56.1	57.3	58.3	60.0	61.4	62.5	
	130	43.6	45.2	46.7	48.0	49.3	50.4	52.9	55.0	56.7	58.2	59.5	60.7	62.6			
	140	44.5	46.3	47.8	49.3	50.6	51.8	54.5	56.7	58.6	60.2	61.6	62.9				
	150	45.4	47.2	48.9	50.4	51.8	53.1	55.9	58.3	60.3	62.1						
	160	46.2	48.1	49.9	51.5	52.9	54.3	57.3	59.8								
	175	47.3	49.4	51.2	52.9	54.5	55.9	59.2	61.9								
	200	48.9	51.1	53.1	55.0	56.7	58.3	61.9									
	250	51.3	53.8	56.1	58.2	60.2	62.1										
	300	53.1	55.8	58.3	60.7	62.9											
	350	54.5	57.3	60.0	62.6												
	400	55.6	58.6	61.4													
	450	56.4	59.6	62.5													
	500	57.2	60.4														
	550	57.8	61.1														
	600	58.3	61.7														

63.0

Spring characteristic



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Compact core bearing

Transmission of high loads and thermal separation in the construction industry

Dimensioning

Static dimensioning of a thermal separation layer of the type core compact bearing using the method according to the article in Bauingenieur 11/2005 "Dimensioning of front slab connections with elastomer intermediate layers", Prof. Dr. L. Nasdala, B. Hohn, R. Rühl

GEOMETRY

Dimensions of front slab

- Height of the front slab h_p
- Width of the front slab b_p
- Number of holes n
- Diameter of the holes d
- Vertical distance between the holes e_2

Selected edge distance* d_r

This produces the

- Height of the thermal separation layer h_e
  $h_e = h_p - 2\,d_r$
- Width of the thermal separation layer b_e
  $b_e = b_p - 2\,d_r$

Thickness of the thermal separation layer t_e

*) Calenberg Ingenieure recommends an edge distance between the thermal separation layer and the edge of the front slab that corresponds to the thickness of the thermal separation layer. This is done for visual reasons rather than structural ones and is intended to avoid the bulging of the core compact bearing out of the bearing joint.

LOADS

Design moment (positive value means pressure on the lower half of the component) $M_{y,d}$
Design normal force (negative value means compressive force) N_d
Prestress force per bolt F_S

Characteristic level is applied on account of the bolt prestress force

This produces
- the characteristic moment $M_y = M_{y,d} / 1.4$
- the characteristic normal force $N = N_d / 1.4$

CALCULATION OF THE EXISTING STRESS σ_{exist}

Zero stress line z_0:

$$z_0 = \frac{n * F_s - N}{12\,M_y}\,h^2_e$$

Case a):

$|z_0| > h_e/2$ ⟶ Zero stress line outside the cross-section ⟶ Only compressive stress in the cross-section

Effective height h_m:

$$h_m = h_e + \frac{2\,M_y}{N - n * F_s}$$

Existing characteristic compressive stress σ_{exist}:

$$\sigma_{exist} = \frac{(N - n * F_s)^2}{b_e\,[h_e\,(N - n * F_s) + 2\,M_y]}$$

Existing design compressive stress $\sigma_{exist,d}$:

$$\sigma_{exist,d} = 1.4 * \sigma_{exist}$$

Compact core bearing

Transmission of high loads and thermal separation in the construction industry

Dimensioning

Case b):

$|z_0| \leq h_e/2$ ⟶ Zero stress line inside the cross-section ⟶ Tensile and compressive stresses in the cross-section

Bolt tensile stress F:

$$F = \frac{N - n * F_s}{h_e} \left(\frac{h_e}{2} - Z_0\right) + \frac{6 M_y}{h^3_e} \left(\frac{h_e^2}{4} - Z_0^2\right)$$

$$h_m = h_e + \frac{2 M_y - F * e_2}{N - n * F_s - F}$$

Existing characteristic compressive stress σ_{exist}:

$$\sigma_{exist} = \frac{(N - n * F_{s,d} - F)^2}{b_e [h_e (N - n * F_s - F) + 2 M_y - F * e_2]}$$

Existing design compressive stress $\sigma_{exist,d}$:

$$\sigma_{exist,d} = 1.4 * \sigma_{exist}$$

CALCULATION OF THE PERMISSIBLE STRESS $\sigma_{perm,d}$

Form factor S (ratio of the compressed area to the body area)

Is $h_m \leq 2/3\, h_e$? ⟶ yes ⟶ no

If yes:
Assumption: only one bolt row in pressure area

$$S = \frac{h_m * b_e - \pi \frac{d^2}{2}}{2t_e (h_m + b_e + \pi d)}$$

$\sigma_{perm,d} = 16.2 * S^{0,75} \leq 42$ N/mm² for t < 20 mm

$\sigma_{perm,d} = 34.2 * S^{0.7} \leq 63$ N/mm² for t = 20 mm

Comparison of existing stress and permissible stress: If $\sigma_{perm,d} \geq \sigma_{exist,d}$ proof is provided!

If no:
Assumption: all bolts in pressure area

$$S = \frac{h_m * b_e - n\pi \frac{d^2}{4}}{t_e (2h_m + 2b_e + n\pi d)}$$

$\sigma_{perm,d} = 16.2 * S^{0.75} \leq 42$ N/mm² for t < 20 mm

$\sigma_{perm,d} = 34.2 * S^{0.7} \leq 63$ N/mm² for t = 20 mm

Comparison of existing stress and permissible stress: If $\sigma_{perm,d} \geq \sigma_{exist,d}$ proof is provided!

QR-CODES FOR THE MANUALS FOR THE DIMENSIONING SOFTWARE PCAE

Bending joint with thermal separation layer
Program 4h-ec3tt

Rigid girder connection
Program 4h-ec3bt