The following standards have been used:

ASME B18.2.1	Release 2012-01	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)s
ASME B18.3	Release 2012-01	Socket Cap, Shoulder, Set Screws, and Hex Keys (Inch Series)
DIN 13-1	Release 1999-11	ISO general purpose metric screw threads - Part 1: Nominal sizes for coarse pitch threads; nominal diameter from 1 mm to 68 mm
DIN 13-10	Release 1999-11	ISO general purpose metric screw threads - Part 10: Nominal sizes for 6 mm fine pitch threads; nominal diameter from 70 mm to 500 mm
DIN 13-2	Release 1999-11	ISO general purpose metric screw threads - Part 2: Nominal sizes for 0,2 mm, 0,25 mm and 0,35 mm fine pitch threads; nominal diameter from 1 mm to 50 mm
DIN 13-3	Release 1999-11	ISO general purpose metric screw threads - Part 3: Nominal sizes for 0,5 mm fine pitch threads; nominal diameter from 3,5 mm to 90 mm
DIN 13-4	Release 1999-11	ISO general purpose metric screw threads - Part 4: Nominal sizes for 0,75 mm fine pitch threads; nominal diameter from 5 mm to 110 mm
DIN 13-5	Release 1999-11	ISO general purpose metric screw threads - Part 5: Nominal sizes for 1 mm and 1,25 mm fine pitch threads; nominal diameter from 7,5 mm to 200 mm
DIN 13-6	Release 1999-11	ISO general purpose metric screw threads - Part 6: Nominal sizes for 1,5 mm fine pitch threads; nominal diameter from 12 mm to 300 mm
DIN 13-7	Release 1999-11	ISO general purpose metric screw threads - Part 7: Nominal sizes for 2 mm fine pitch threads; nominal diameter from 17 mm to 300 mm
DIN 13-8	Release 1999-11	ISO general purpose metric screw threads - Part 8: Nominal sizes for 3 mm fine pitch threads; nominal diameter from 28 mm to 300 mm
DIN 13-9	Release 1999-11	ISO general purpose metric screw threads - Part 9: Nominal sizes for 4 mm fine pitch threads; nominal diameter from 40 mm to 300 mm
DIN 267-13	Release 2007-05	Fasteners - Technical specifications - Part 13: Parts for bolted connections with specific mechanical properties for use at temperatures ranging from -200 ÁC to +700 ÁC
DIN 6796	Release 2009-08	Conical spring washers for bolted connections
DIN EN 10269	Release 2014-02	Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties
DIN EN 20273	Release 1992-02	Fasteners; clearance holes for bolts and screws
DIN EN ISO 3506-1	Release 2018-02	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified property classes - Coarse pitch thread and fine pitch thread
DIN EN ISO 4014	Release 2011-06	Hexagon head bolts - Product grades A and B
DIN EN ISO 4032	Release 2012-05	Hexagon nuts, style 1 - Product grades A and B
DIN EN ISO 4762	Release 2004-06	Hexagon socket head cap screws
DIN EN ISO 7089	Release 2000-11	Plain washers - Normal series, Product grade A
DIN EN ISO 8673	Release 2023-12	Fasteners - Hexagon regular nuts (style 1), with fine pitch thread
DIN EN ISO 8676	Release 2011-07	Hexagon head screws with metric fine pitch thread - Product grades A and B
DIN EN ISO 8765	Release 2011-06	Hexagon head bolts with metric fine pitch thread - Product grades A and B

DIN EN ISO 898-1	Release 2013-05	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread
VDI 2230 Blatt 1	Release 2015-11	Systematic calculation of highly stressed bolted joints - Joints with one cylindrical bolt
VDI 2230 Blatt 2	Release 2014-12	Systematic calculation of highly stressed bolted joints - Multi bolted joints

Input data:

Determining of the load distribution of multi bolted joint

Geometry Assembly

Assembly

Nr.	Part	Flange plate	Attached geometry	Material	Source	Number	Youngs Modulus N/mm²	Poisson	a_P 1/K	Rmin N/mm²	Dx mm	Dy mm	Da Á	H_{Blatt} mm	H_{AK} mm
1	Blind flange	Circular	None	E295	MDESIGN database	1.0050	205 000	0,3	1,25 e-05	470	0	0	0	18	0
2	Flange, bolts outside	Circular	Circular	E295	MDESIGN database	1.0050	205 000	0,3	1,25 e-05	470	0	0	0	18	20

Geometry of Part 1

Outside diameter of flange plate	D_1 = 100	mm
Recess in flange plate	None	
Stiffening on flange sheet	none	

Geometry of Part 2

Outer diameter of flange plate	D_2 = 100	mm
Diameter of attached geometry	d_2 = 60	mm
Wall thickness of attached geometry	s_2 = 3	mm
Recess in flange plate	Yes	
Stiffening on flange sheet	none	

Bolt

Mounting condition

Orientation of bolts	Head on part 1
Type of bolting	Bolted joint

Type of thread: Standard thread

Overview of the bolts used

Nr.	Source screw	Type	Size	Source strength	Strength grade	deep sunk mm	Å sunk mm
1	MDESIGN database	Hexagon head bolt with shank	M8 x 50	MDESIGN database	8.8 (d <= M16)	0	0

Bolt Pattern

	linear	rectangular	polar	single screws
Type of bolt pattern	No	No	Yes	No

Polar pattern

Nr.	n	d mm	x_c mm	y_c mm	a_{start} Á	a_{end} Á	
1	10	83	0	0	0	360	M8 x 50

List of bolts for polar pattern

Nr.	Number of bolt pattern	Bolt number	Bolt	Á	x mm	y mm
1	1	1	M8 x 50	0	41,5	0
2	1	2	M8 x 50	36	33,574	24,393
3	1	3	M8 x 50	72	12,824	39,469
4	1	4	M8 x 50	108	-12,824	39,469
5	1	5	M8 x 50	144	-33,574	24,393
6	1	6	M8 x 50	180	-41,5	0
7	1	7	M8 x 50	216	-33,574	-24,393
8	1	8	M8 x 50	252	-12,824	-39,469
9	1	9	M8 x 50	288	12,824	-39,469
10	1	10	M8 x 50	324	33,574	-24,393

Boundary Conditions

Fixed Part	Part 2	
Position of fixed boundary	On attached geometry	
Prevent the deformation of the cross section	Yes	
Axial load	F_A = 0	N
Bending moment	MB = 0	N*m
Angle between axis of bending moment and y-axis	a_{MB} = 0	Á
Torque around z-axis	T_z = 0	N*m
Radial force	F_R = 0	N
Angle of radial force	a = 0	Á
Internal pressure	P_i = 5	N/mmĮ
Operating temperature of bolt	T_s = 20	ÁC

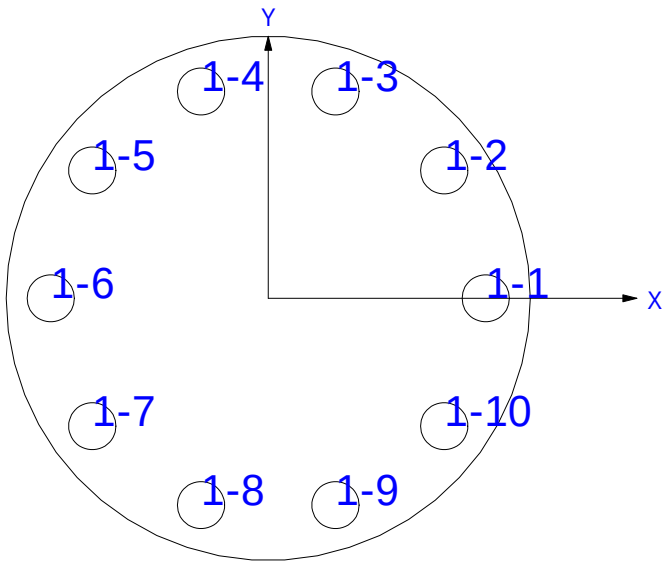
Operating temperature of bolted parts	T_p = 20	ÁC
Assembly preload/define required tightening torque	No	
Tightening technique	Free input	
Tightening factor	a_A = 1,7	

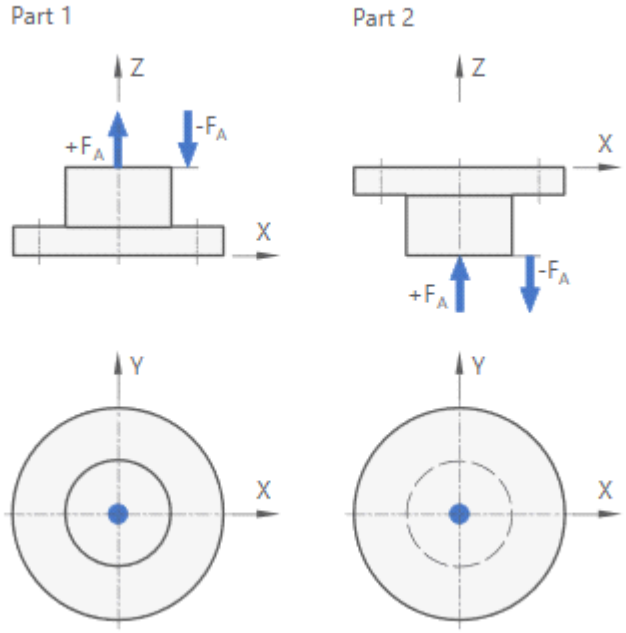
Screw	Type 1	Type 2	
Utilisation of yield point	n = 90	0	%
Assembly preload	F_{Mzul} = 11236,29	0	N
Minimum coefficient of friction in the head bearing area	m_{Kmin} = 0,1		
Minimum coefficient of friction at the interface	m_{Tmin} = 0,1		
Minimum coefficient in the thread	m_{Gmin} = 0,1		
Mesh quality	Quick approximation		
Calculation method	FEM calculation		
Single proof execute for all screws?	no		

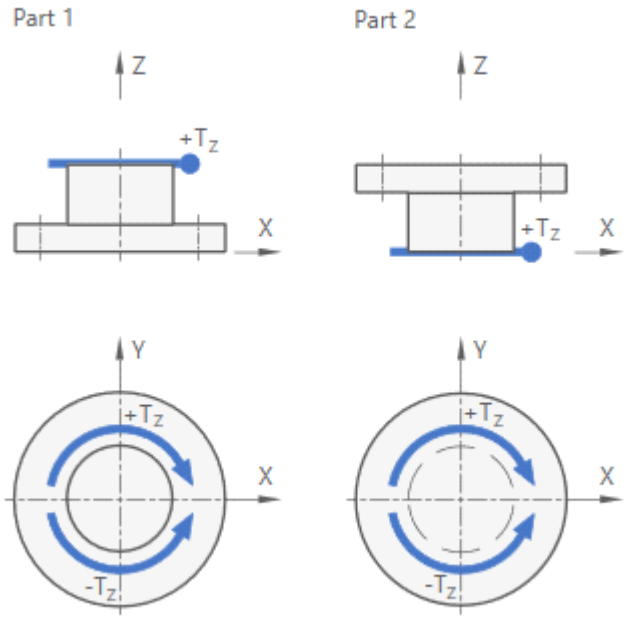
Computer utilization for FE calculation

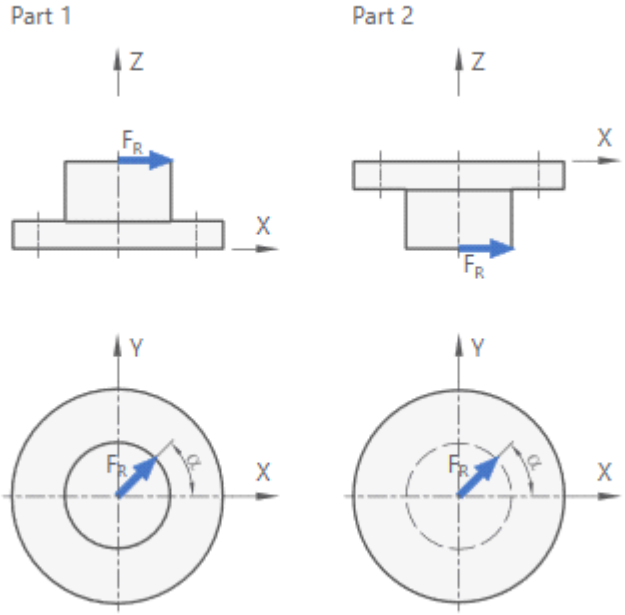
Individual Specification of Computer utylization by FE-Calculation	no

Geometrie Bauteil 1




Part 1
Part 2
Z
X
Y
+F_A
-F_A


Part 1
Part 2
Z
X
Y
+T_Z
-T_Z



Results:

Summary of bolt connection parameters

Nr.	Bolt	Additional bolt force F_{SA} N	Additional bolt moment M_{SA} N mm	Additional plate force F_{PA} N	Transverse load F_Q N	Substitutional outside diameter at the interface D_A mm
1	1-1	-8,4	53,3	1144,1	358,2	17
2	1-2	-8,3	62,9	1134,5	358,9	17
3	1-3	-8,2	55,6	1134,9	359,3	17
4	1-4	-8,3	62,3	1139	359,4	17
5	1-5	-8,4	65,5	1138,1	359,6	17
6	1-6	-8,4	56,9	1143,4	359,7	17
7	1-7	-8,5	74	1137,4	359	17
8	1-8	-8,3	56,2	1138,8	358,4	17
9	1-9	-8,3	79,3	1147,3	357,7	17
10	1-10	-8,3	74,3	1140,2	359	17

Hint:

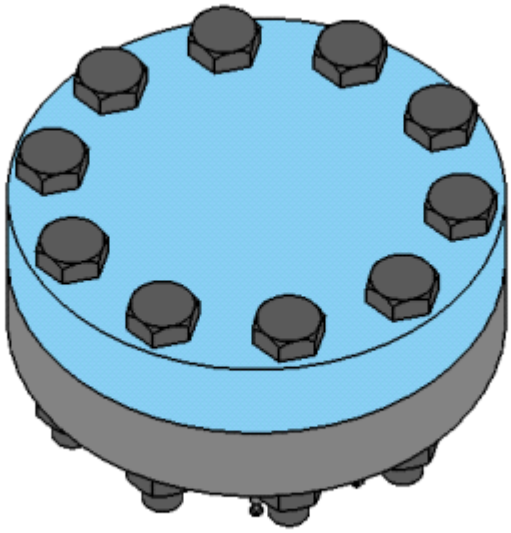
Resilience and preload

Resilience of plate	d_P	=	0,213	E-6 mm/N	
Assembly preload	F_{Mzul}	=	1,124e+04	-	N

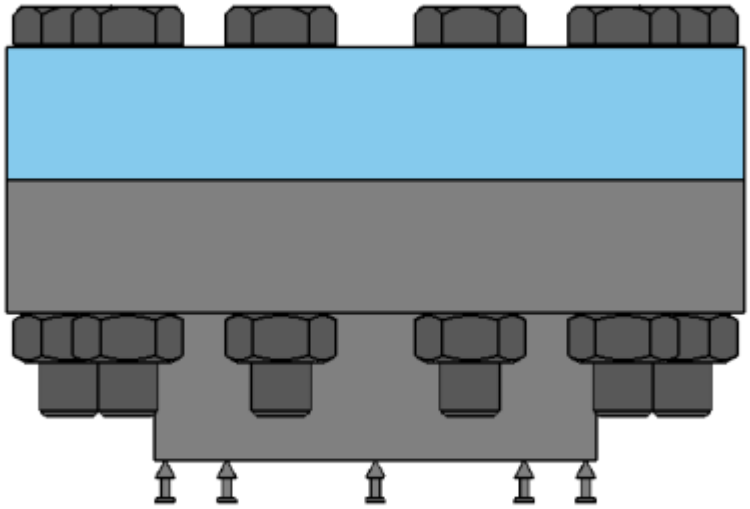
Number of most loaded bolt

Bending	=	9	
Tensile load	=	3	
Calculation time	=	-	

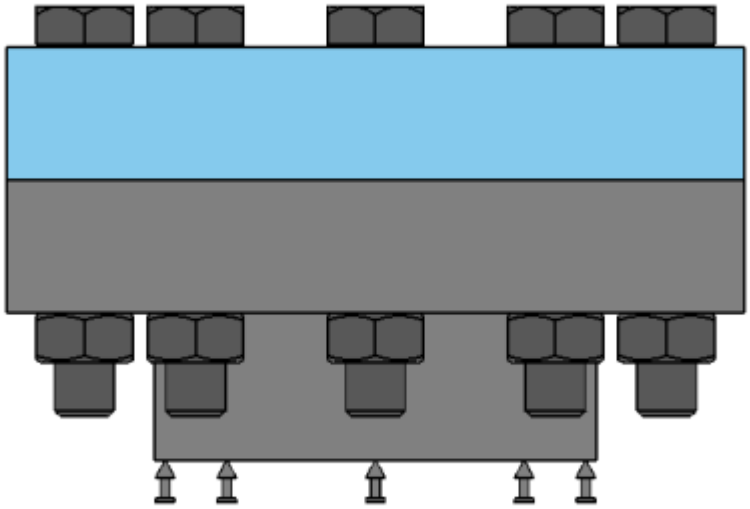
Ansicht Isometrisch



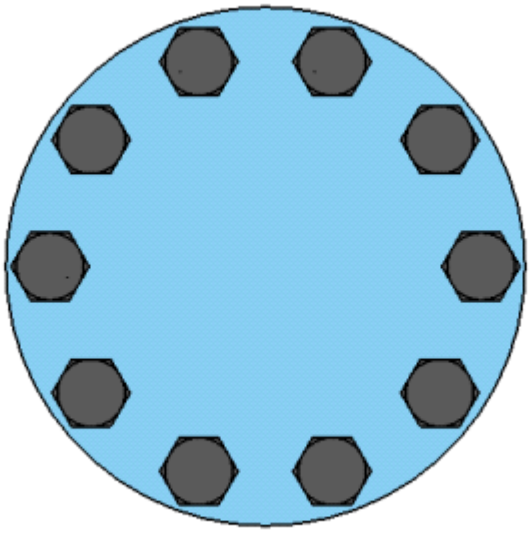
Ansicht Vorne



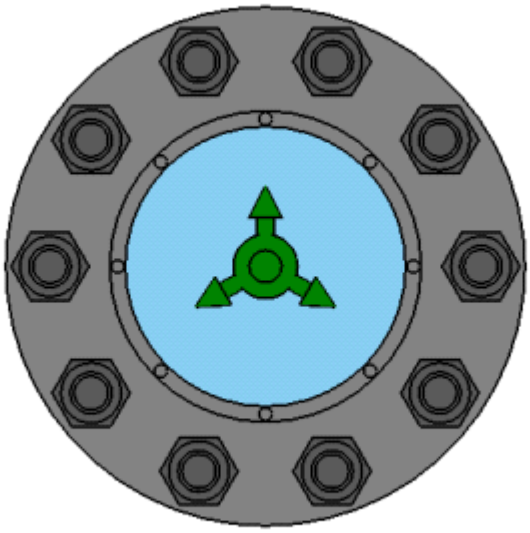
Ansicht Links



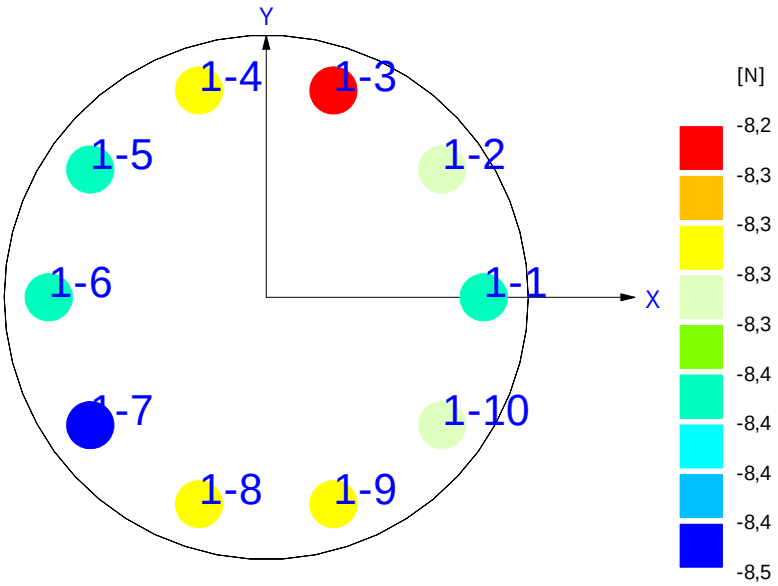
Ansicht Oben



Ansicht Unten



Lastverteilung (Zug)



Lastverteilung (Biegemoment)