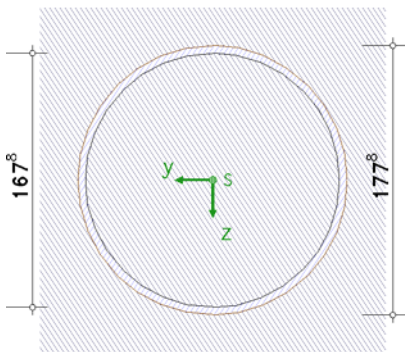


POS. 10: KREISROHR

Welded connection EC 3-1-8 (04.25), NA: Deutschland

1. input report

scale 1:5.0



material

steel grade S235

material safety factors

resistance of cross-sections $\gamma_{M0} = 1.00$

resistance of bolts, welds, plates in bearing $\gamma_{M2} = 1.25$

geometry

section R 177.8 x 5.0(w)

plate: thickness $t_p = 35.0$ mm

full penetrated butt weld

resistance

plastic verification of cross-section

2. table of results

internal forces and moments and utilizations

Lc	N _{Ed} kN	M _{y,Ed} kNm	V _{z,Ed} kN	M _{z,Ed} kNm	V _{y,Ed} kN	M _{x,Ed} kNm	U _σ	U _{c/t}	U _w	My,Ed	Vy,Ed	NEd	Vz,Ed
--													
1	-18.11	-6.39	-13.47	-2.11	0.70	3.64	0.193	0.508	0.261	import			
2	-3.11	-0.19	-0.06	5.39	-8.60	14.62	0.459	0.508	0.435	import			
3	-3.11	-0.19	-0.06	3.18	-12.41	18.43	0.579	0.508	0.556	import			
4	-3.11	-0.19	-0.06	---	---	---	0.005	0.508	0.010	import			
5	-13.94	-4.55	-9.46	1.70	-11.92	20.98	0.659*	0.508	0.645	import			
6	-12.85	-4.49	-9.43	-7.01	-9.05	12.08	0.380	0.508	0.475	import			
7	-4.20	-0.25	-0.08	10.89	-3.59	11.12	0.349	0.508	0.456	import			
8	-18.11	-6.39	-13.47	6.60	-2.18	12.53	0.394	0.508	0.458	import			
9	-3.11	-0.19	-0.06	-5.53	-9.54	9.54	0.300	0.508	0.313	import			
10	-18.11	-6.39	-13.47	-5.43	-5.03	9.36	0.294	0.508	0.423	import			
11	-3.11	-0.19	-0.06	10.89	-3.59	11.12	0.349	0.508	0.455	import			

N_{Ed}, M_{y,Ed}, V_{z,Ed}, M_{z,Ed}, V_{y,Ed}, M_{x,Ed}: internal forces and moments

U_σ: stress utilization of cross-section; U_{c/t}: c/t-utilization of cross-section; U_w: stress utilization of welds

*) maximum utilization

3. final result

maximum utilization [Lc 5]: resistance max U = 0.659 < 1 ok
c/t-ratio max U = 0.508 < 1 ok

verification succeeded

4. Regulations

EN 1990, Eurocode 0: Grundlagen der Tragwerksplanung;

Deutsche Fassung EN 1990:2002 + A1:2005 + A1:2005/AC:2010, Ausgabe Dezember 2010

EN 1990/NA, Nationaler Anhang zur EN 1990, Ausgabe Dezember 2010

EN 1993-1-1, Eurocode 3: Bemessung und Konstruktion von Stahlbauten -

Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau;

Deutsche Fassung EN 1993-1-1:2022, Ausgabe April 2025

EN 1993-1-1/NA, Nationaler Anhang zur EN 1993-1-1, Ausgabe April 2026

EN 1993-1-8, Eurocode 3: Bemessung und Konstruktion von Stahlbauten -

5. Lc 5 (decisive)

5.1. verification of cross-section

section class 1, utilization $U_{c/t} = 0.508$

circular hollow section: $V = (V_y^2 + V_z^2)^{1/2} = 15.22 \text{ kN}$, $M = (M_y^2 + M_z^2)^{1/2} = 4.86 \text{ kNm}$

plastic verification for $N_{Ed} = -13.94 \text{ kN}$, $M_{Ed} = 4.86 \text{ kNm}$, $V_{Ed} = 15.22 \text{ kN}$, $T_{t,Ed} = 20.98 \text{ kNm}$

plastic values: $N_{pl,Rd} = A \cdot f_y / \gamma_{M0} = 637.87 \text{ kN}$, $M_{pl,Rd} = W_{pl} \cdot f_y / \gamma_{M0} = 34.92 \text{ kNm}$

$V_{pl,Rd} = A_v \cdot f_y / (3^{1/2} \cdot \gamma_{M0}) = 234.45 \text{ kN}$

torsion

$\tau_{t,Ed} = I T_{t,Ed} / W_t = 89.46 \text{ N/mm}^2$

verification: $\tau_{t,Ed} / \tau_{Rd} = 0.659 < 1$ **ok**

shear force and torsion

deduction: $V_{pl,T,Rd} = V_{pl,Rd} \cdot f_T = 79.86 \text{ kNm}$

shear force

verification: $V_{Ed} / V_{pl,T,Rd} = 0.191 < 1$ **ok**

reduction factor for $0.5 \cdot V_{pl,T,Rd} = 39.93 \text{ kN} > V_{Ed} = 15.22 \text{ kN}$: $\rho = 0$ (no deduction)

axial force

verification: $|N_{Ed}| / N_{pl,Rd} = 0.022 < 1$ **ok**

bending and axial force

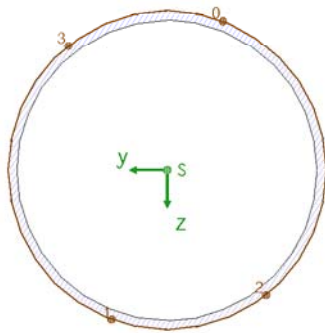
deduction M_y : $M_{pl,N,y,Rd} = M_{pl,y,Rd} \cdot f_{N,y} = 34.87 \text{ kNm}$, $f_{N,y} = 0.998$

bending

verification: $|M_{y,Ed}| / M_{pl,N,y,Rd} = 0.139 < 1$ **ok**

5.2. verification of welds

calculation section:



weld 1: $a_w = 5.0 \text{ mm}$ $l_w = 558.6 \text{ mm}$

design values referring to centroid of the section:

$N_{Ed} = -13.94 \text{ kN}$, $M_{y,Ed} = -4.55 \text{ kNm}$, $V_{z,Ed} = -9.46 \text{ kN}$, $M_{z,Ed} = 1.70 \text{ kNm}$, $V_{y,Ed} = -11.92 \text{ kN}$, $M_{x,Ed} = 20.98 \text{ kNm}$

cross-sectional properties referring to centroid of the line cross-section:

$\Sigma A_w = 27.93 \text{ cm}^2$, $A_{w,y} = 13.96 \text{ cm}^2$, $A_{w,z} = 13.96 \text{ cm}^2$, $\Sigma l_w = 55.9 \text{ cm}$

$I_{w,y} = 1103.63 \text{ cm}^4$, $I_{w,z} = 1103.63 \text{ cm}^4$, $W_{w,t} = 248.29 \text{ cm}^3$, $\Delta y_w = 0.0 \text{ mm}$, $\Delta z_w = 0.0 \text{ mm}$

verification of line section:

due to torsion: $\tau_{w,T} = 84.50 \text{ N/mm}^2$

pt. 0: $\sigma_{w,x} = 34.16 \text{ N/mm}^2$ $\tau_{w,t} = 78.88 \text{ N/mm}^2 \Rightarrow U_w = 0.543 < 1$ **ok**

pt. 1: $\sigma_{w,x} = -44.14 \text{ N/mm}^2$ $\tau_{w,t} = 90.12 \text{ N/mm}^2 \Rightarrow U_w = 0.626 < 1$ **ok**

pt. 2: $\sigma_{w,x} = -25.19 \text{ N/mm}^2$ $\tau_{w,t} = 95.40 \text{ N/mm}^2 \Rightarrow U_w = 0.645 < 1$ **ok**

pt. 3: $\sigma_{w,x} = 15.21 \text{ N/mm}^2$ $\tau_{w,t} = 73.60 \text{ N/mm}^2 \Rightarrow U_w = 0.495 < 1$ **ok**

Result:

pt. 2: $\sigma_{w,x} = -25.19 \text{ N/mm}^2$ $\tau_{w,t} = 95.40 \text{ N/mm}^2$

Max: $F_{w,Ed} = 835.71 \text{ kN/m} < F_{w,Rd} = 1296.00 \text{ kN/m} \Rightarrow U_w = 0.645 < 1$ **ok**