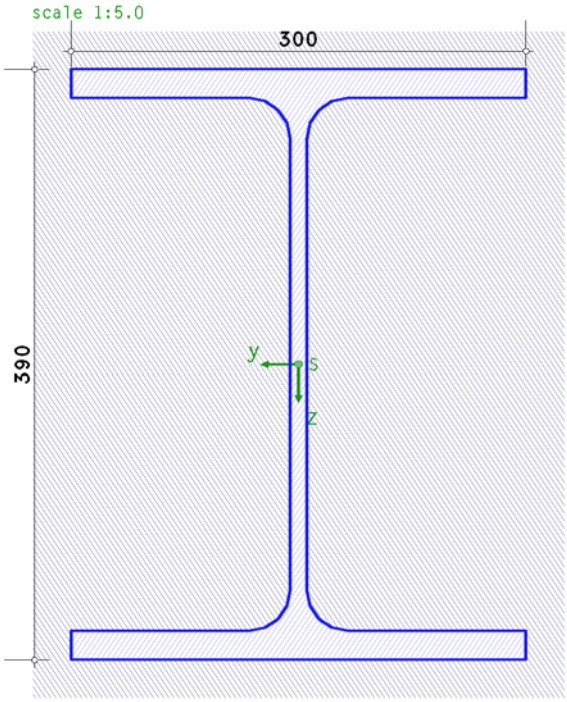
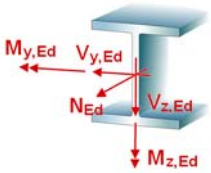
POS. 2: WAGENKNECHT 2.5.2

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

1. input report



material
steel grade S235
material safety factors
resistance of cross-sections γ_{M0} = 1.00
resistance of bolts, welds, plates in bearing γ_{M2} = 1.25
geometry
section HE400A
plate: thickness t_p = 24.0 mm
surrounding fillet weld: $a_{w,2}$ = 9.0 mm, $a_{w,fu}$ = 9.0 mm, $a_{w,1}$ = 5.0 mm
resistance
elastic cross-sectional check
weld verification with the directional method
resolution of shear force is conventional by taking over V_y with the horizontal welds, V_z with the vertical welds.
internal forces and moments refering to local axes of cross-section
Lc 1: N_{Ed} = -1190.00 kN, $M_{y,Ed}$ = 225.00 kNm, $V_{z,Ed}$ = 370.00 kN
$M_{z,Ed}$ = -26.00 kNm, $V_{y,Ed}$ = -180.00 kN



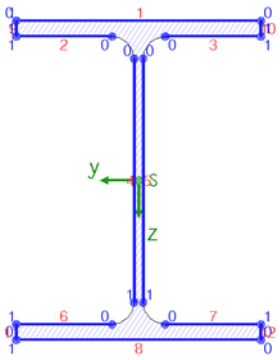
2. Lc 1

2.1. verification of cross-section

elastic verification for N = -1190.00 kN, M_y = 225.00 kNm, V_z = 370.00 kN, M_z = -26.00 kNm
V_y = -180.00 kN
verification: σ_v = 218.45 N/mm² < $\sigma_{v,Rd}$ = 235.00 N/mm² ⇒ U_σ = 0.930 < 1 ok
c/t-ratio (reg. section class 3):
outstand flange: utilization $U_{c/t}$ = 0.421 < 1 ok
internal compression parts: utilization $U_{c/t}$ = 0.346 < 1 ok

2.2. verification of welds

calculation section:



weld 1:	a_w = 9.0 mm	l_w = 300.0 mm
weld 2:	a_w = 9.0 mm	l_w = 117.5 mm
weld 3:	a_w = 9.0 mm	l_w = 117.5 mm
weld 4:	a_w = 5.0 mm	l_w = 298.0 mm
weld 5:	a_w = 5.0 mm	l_w = 298.0 mm
weld 6:	a_w = 9.0 mm	l_w = 117.5 mm
weld 7:	a_w = 9.0 mm	l_w = 117.5 mm
weld 8:	a_w = 9.0 mm	l_w = 300.0 mm
weld 9:	a_w = 9.0 mm	l_w = 19.0 mm
weld 10:	a_w = 9.0 mm	l_w = 19.0 mm
weld 11:	a_w = 9.0 mm	l_w = 19.0 mm
weld 12:	a_w = 9.0 mm	l_w = 19.0 mm

design values refering to centroid of the section:
N_{Ed} = -1190.00 kN, $M_{y,Ed}$ = 225.00 kNm, $V_{z,Ed}$ = 370.00 kN, $M_{z,Ed}$ = -26.00 kNm, $V_{y,Ed}$ = -180.00 kN
cross-sectional properties refering to centroid of the line cross-section:
roots are not considered at surrounding welds.
ΣA_w = 132.94 cm², $A_{w,y}$ = 96.30 cm², $A_{w,z}$ = 29.80 cm², Σl_w = 174.2 cm
$I_{w,y}$ = 38197.37 cm⁴, $I_{w,z}$ = 9606.82 cm⁴, Δy_w = 0.0 mm, Δz_w = 0.0 mm
verifications in weld edges:

weld 1,	pt. 0:	$\sigma_{w,x}$ = -244.97 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.967 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -163.78 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.650 < 1	ok
weld 2,	pt. 0:	$\sigma_{w,x}$ = -184.39 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.730 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -152.59 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.606 < 1	ok
weld 3,	pt. 0:	$\sigma_{w,x}$ = -201.98 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.799 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -233.78 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.923 < 1	ok
weld 4,	pt. 0:	$\sigma_{w,x}$ = -175.79 N/mm²		$\tau_{w,z}$ = 124.16 N/mm²	⇒ U_w = 0.913 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -0.26 N/mm²		$\tau_{w,z}$ = 124.16 N/mm²	⇒ U_w = 0.597 < 1	ok
weld 5,	pt. 0:	$\sigma_{w,x}$ = -178.77 N/mm²		$\tau_{w,z}$ = 124.16 N/mm²	⇒ U_w = 0.922 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -3.23 N/mm²		$\tau_{w,z}$ = 124.16 N/mm²	⇒ U_w = 0.598 < 1	ok
weld 6,	pt. 0:	$\sigma_{w,x}$ = 22.95 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.127 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = 54.75 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.233 < 1	ok
weld 7,	pt. 0:	$\sigma_{w,x}$ = 5.36 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.092 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -26.44 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.137 < 1	ok
weld 8,	pt. 0:	$\sigma_{w,x}$ = -15.25 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.108 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = 65.95 N/mm²	$\tau_{w,y}$ = -18.69 N/mm²		⇒ U_w = 0.274 < 1	ok
weld 9,	pt. 0:	$\sigma_{w,x}$ = -163.78 N/mm²			⇒ U_w = 0.643 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -152.59 N/mm²			⇒ U_w = 0.599 < 1	ok
weld 10,	pt. 0:	$\sigma_{w,x}$ = -244.97 N/mm²			⇒ U_w = 0.962 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -233.78 N/mm²			⇒ U_w = 0.918 < 1	ok
weld 11,	pt. 0:	$\sigma_{w,x}$ = 65.95 N/mm²			⇒ U_w = 0.259 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = 54.75 N/mm²			⇒ U_w = 0.215 < 1	ok
weld 12,	pt. 0:	$\sigma_{w,x}$ = -15.25 N/mm²			⇒ U_w = 0.060 < 1	ok
	pt. 1:	$\sigma_{w,x}$ = -26.44 N/mm²			⇒ U_w = 0.104 < 1	ok

Result:
weld 1, pt. 0: $\sigma_{w,x}$ = -244.97 N/mm² $\tau_{w,y}$ = -18.69 N/mm²
Max: $\sigma_{1,w,Ed}$ = 347.96 N/mm² < $f_{1w,d}$ = 360.00 N/mm²,
$\sigma_{2,w,Ed}$ = 173.22 N/mm² < $f_{2w,d}$ = 259.20 N/mm² ⇒ U_w = 0.967 < 1 ok

3. final result

maximum utilization:	resistance	max U = 0.967 < 1 ok
	c/t-ratio	max U = 0.421 < 1 ok

verification succeeded