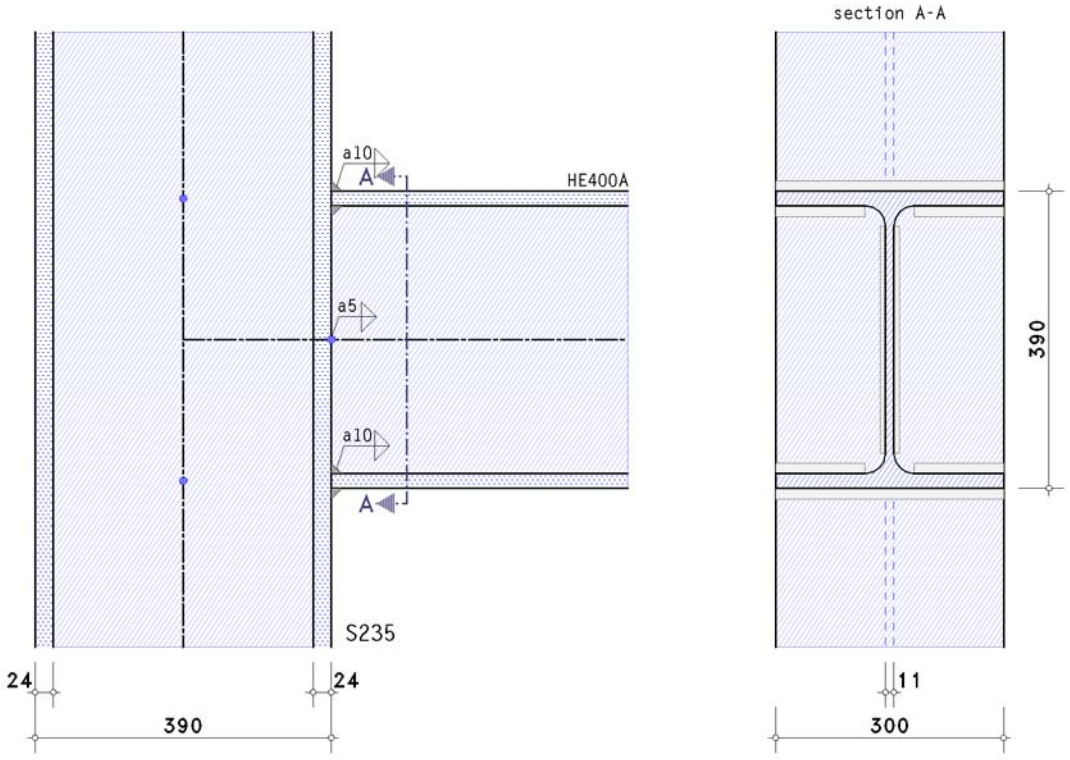
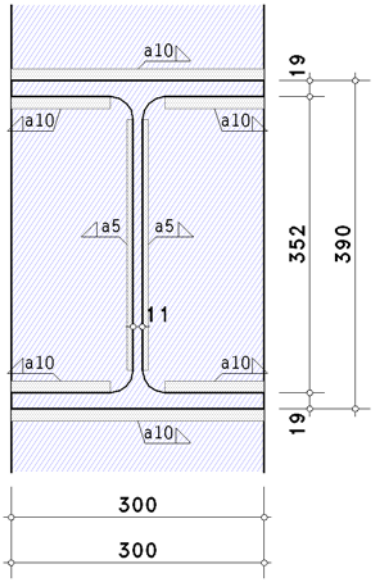
4H-ec3BT version: 4/2013-5l

Rigid beam connection EC 3-1-8 (12.10), NA: Deutschland

1. input report



details (section A - A)

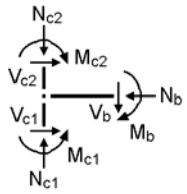


steel grade
steel grade S235
column parameters
parameter (I-section):
overall depth h = 390.0 mm, web thickness t_w = 11.0 mm
flange width b_f = 300.0 mm, flange thickness t_f = 24.0 mm
rolled section, root radius r = 27.0 mm
beam parameters
section HE400A
verification parameters
welds at the connection point:
beam flange top: fillet weld, weld thickness a = 10.0 mm
beam web: fillet weld, weld thickness a = 5.0 mm

beam flange bottom: fillet weld, weld thickness a = 10.0 mm

internal forces and moments at the joint periphery refering to the system axes

Lk 1: $N_{b,Ed}$ = -1190.00 kN $M_{b,Ed}$ = 225.00 kNm $V_{b,Ed}$ = 370.00 kN



partial safety factors for material

resistance of cross-sections γ_{M0} = 1.00

resistance of members in stability failure γ_{M1} = 1.10

resistance of bolts, welds, plates in bearing γ_{M2} = 1.25

check of data

ok

notes

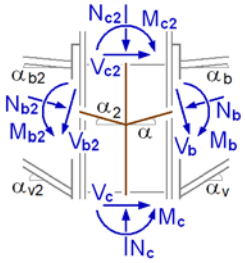
no verification for cross-sections.

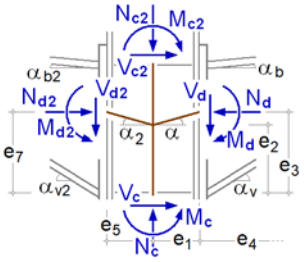
no verification for column web area.

2. Lk 1

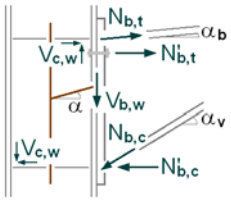
2.1. design values

periphery connection ⊥ zur connection plane





partial internal forces and moments



slope angle: $\alpha_b = \alpha_v = \alpha = 0°$

distance: e_1 = 195.0 mm, e_3 = 185.5 mm, e_2 = 185.5 mm

internal forces and moments perpendicular to the connection planes

periphery beam

N_d = -1190.00 kN, M_d = 225.00 kNm, V_d = 370.00 kN

calculation of internal forces and moments at periphery column (top)

$N_{c2} = N_c - V_d$ = -370.00 kN

$V_{c2} = N_d - V_c$ = -1190.00 kN

$M_{c2} = M_c + V_c \cdot e_6 - M_d - V_d \cdot e_1 - N_d \cdot (e_6 - e_3)$ = -76.41 kNm

partial internal forces and moments

$N_{b,t} = -N_d \cdot z_{bu}/z_b + M_d/z_b$ = 1201.47 kN, z_b = 371.0 mm, z_{bu} = 185.5 mm

$N_{b,c} = N_d \cdot z_{bo}/z_b + M_d/z_b$ = 11.47 kN, z_b = 371.0 mm, z_{bo} = 185.5 mm

2.2. resistance of cross-section

elastic cross-sectional check for N = 1190.00 kN, M_y = -225.00 kNm, V_z = 370.00 kN

max σ_v bei y = 0.0 mm, z = -185.5 mm: σ_x = 16.74 kN/cm², τ = 8.10 kN/cm², σ_v = 21.85 kN/cm²

verification: σ_v = 21.85 kN/cm² < zul σ_v = 23.50 kN/cm² ⇒ U = 0.930 < 1 ok

utilizations: resistance U_σ = 0.930 < 1 ok, c/t-ratio $U_{c/t}$ = 0.123 < 1 ok

2.3. verifications

2.3.1. verification of welds at beam section

weld 1: beam flange in tension outer

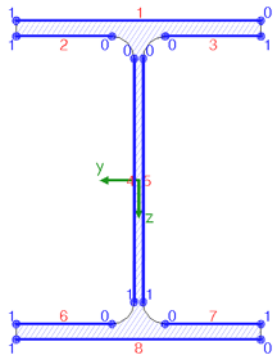
weld 8: beam flange in compression outer

welds 2,3: beam flange in tension inner

welds 4,5: beam web double-sided

welds 6,7: beam flange in compression inner

calculation section:



weld 1:	a_w = 10.0 mm	l_w = 300.0 mm
weld 2:	a_w = 10.0 mm	l_w = 117.5 mm
weld 3:	siehe weld 2	
weld 4:	a_w = 5.0 mm	l_w = 298.0 mm
weld 5:	siehe weld 4	
weld 6:	a_w = 10.0 mm	l_w = 117.5 mm
weld 7:	siehe weld 6	
weld 8:	a_w = 10.0 mm	l_w = 300.0 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

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

ΣA_w = 136.80 cm², $A_{w,z}$ = 29.80 cm², Σl_w = 166.6 cm
$I_{w,y}$ = 39579.02 cm⁴, $I_{w,z}$ = 8963.24 cm⁴, $W_{w,t}$ = 158.98 cm³, Δz_w = 0.0 mm
distribution of internal forces and moments:
weld 1: N_w = 593.53 kN
weld 2: N_w = 219.77 kN
weld 3: siehe weld 2
weld 4: N_w = 129.61 kN $M_{y,w}$ = -6.27 kNm
weld 5: siehe weld 4
weld 6: N_w = -15.35 kN
weld 7: siehe weld 6
weld 8: N_w = -71.60 kN
from conventionel distribution of shear force: $V_{z,w}$ = 370.00 kN
verifications in weld edges:

weld 1,	pt. 0:	$\sigma_{w,x}$ = 197.84 N/mm²		$\Rightarrow$ U_w = 0.777 < 1 ok
weld 2,	pt. 0:	$\sigma_{w,x}$ = 187.04 N/mm²		$\Rightarrow$ U_w = 0.735 < 1 ok
weld 4,	pt. 0:	$\sigma_{w,x}$ = 171.69 N/mm²	$\tau_{w,z}$ = 124.16 N/mm²	$\Rightarrow$ U_w = 0.901 < 1 ok
	pt. 1:	$\sigma_{w,x}$ = 2.28 N/mm²	$\tau_{w,z}$ = 124.16 N/mm²	$\Rightarrow$ U_w = 0.597 < 1 ok
weld 6,	pt. 0:	$\sigma_{w,x}$ = -13.06 N/mm²		$\Rightarrow$ U_w = 0.051 < 1 ok
weld 8,	pt. 0:	$\sigma_{w,x}$ = -23.87 N/mm²		$\Rightarrow$ U_w = 0.094 < 1 ok

Result:
weld 4, pt. 0: $\sigma_{w,x}$ = 171.69 N/mm² $\tau_{w,z}$ = 124.16 N/mm²
Max: $\sigma_{1,w,Ed}$ = 32.44 kN/cm² < $f_{1w,d}$ = 36.00 kN/cm²,
$\sigma_{2,w,Ed}$ = 12.14 kN/cm² < $f_{2w,d}$ = 25.92 kN/cm² $\Rightarrow$ U_w = 0.901 < 1 ok

2.3.2. verification result

maximum utilization: max U = 0.930 < 1 ok

3. final result

maximum utilization: max U = 0.930 < 1 ok

verification succeeded