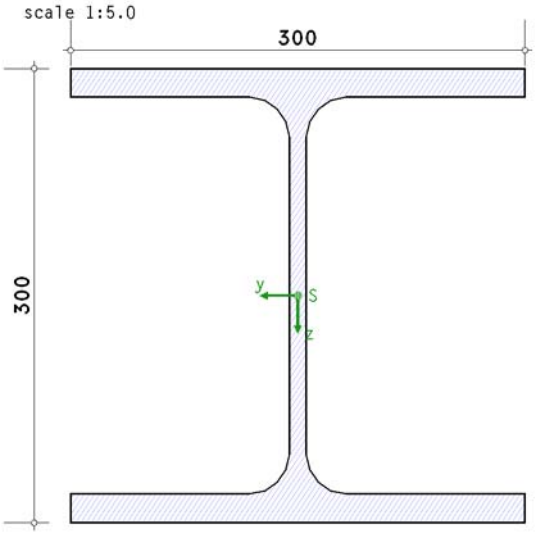
POS. 3: HE300B, S235, EC3

verification of cross-section EC 3-1-8 (12.10), NA: Deutschland

1. input report



steel
steel grade S235
material safety factor
resistance of cross-sections γ_{M0} = 1.00
geometry
section HE300B
resistance
plastic verification acc. to EC 3-1-1, 6.2

notes
buckling is not investigated.

2. table of results

internal forces and moments and utilizations

Lk	$M_{y,Ed}$	$V_{z,Ed}$	$M_{z,Ed}$	$V_{y,Ed}$	$T_{t,Ed}$	$U_{c/t}$	U
--	kNm	kN	kNm	kN	kNm		
1	134.40	60.40	-14.90	10.00	8.59	0.228	0.408
2	181.44	81.54	-20.11	13.50	11.60	0.228	0.519*
3	181.44	81.54	-14.90	10.00	11.25	0.228	0.494
4	134.40	60.40	-20.11	13.50	8.95	0.228	0.438

$M_{y,Ed}, V_{z,Ed}, M_{z,Ed}, V_{y,Ed}, T_{t,Ed}$: internal forces and moments by sign definition of statics; $U_{c/t}$: c/t-utilization
U: total utilization
*) maximum utilization

3. final result

maximum utilization [Lk 2]:	stress	max U_σ = 0.519 < 1 ok
	c/t-ratio	max $U_{c/t}$ = 0.228 < 1 ok
	resistance	max U = 0.519 < 1 ok

verification succeeded

4. Lk 2 (decisive)

4.1. verification of cross-section

4.1.1. plastic verification

web: section class 1, utilization $U_{c/t} = 0.228$
plastic verification for $M_y = 181.44$ kNm, $V_z = 81.54$ kN, $M_z = -20.11$ kNm, $V_y = 13.50$ kN
$T_t = 11.60$ kNm
plate buckling: section class of the section $1 \le 2$ ok
shear buckling: $h_p/t_p = 23.82 \le 72 \cdot \varepsilon/\eta = 60.00$ ok
plastic values: $M_{pl,y,Rd} = W_{pl,y} \cdot f_y/\gamma_{M0} = 439.10$ kNm, $V_{pl,z,Rd} = A_{vz} \cdot f_y/(3^{1/2} \cdot \gamma_{M0}) = 643.49$ kN
$M_{pl,z,Rd} = W_{pl,z} \cdot f_y/\gamma_{M0} = 204.39$ kNm, $V_{pl,y,Rd} = A_{vy} \cdot f_y/(3^{1/2} \cdot \gamma_{M0}) = 1379.16$ kN
torsion
$\tau_{t,Ed} = |T_{t,Ed}|/\min W_t = 113.29$ N/mm²
shear force and torsion
deduction V_z: $f_{T,z} = (1 - \tau_{t,z,Ed}/(1.25 \cdot \tau_{Rd}))^{1/2} = 0.783 \Rightarrow V_{pl,T,z,Rd} = V_{pl,z,Rd} \cdot f_{T,z} = 503.92$ kNm
deduction V_y: $f_{T,y} = (1 - \tau_{t,y,Ed}/\tau_{Rd})^{1/2} = 0.406 \Rightarrow V_{pl,T,y,Rd} = V_{pl,y,Rd} \cdot f_{T,y} = 560.20$ kNm
shear force
reduction factors:
web: $0.5 \cdot V_{pl,T,z,Rd} = 251.96$ kN $>$ $|V_{z,Ed}| = 81.54$ kN: $\rho_z = 0$ (no deduction)
flanges: $0.5 \cdot V_{pl,T,y,Rd} = 280.10$ kN $>$ $|V_{y,Ed}| = 13.50$ kN: $\rho_y = 0$ (no deduction)
bending
verification: $(|M_{y,Ed}|/M_{pl,y,Rd})^{\alpha} + (|M_{z,Ed}|/M_{pl,z,Rd})^{\beta} = 0.171 + 0.098 = 0.269 < 1$ ok
with $\alpha = 2.00$, $\beta = 1.00 = 5 \cdot n \ge 1$
utilization: $U = 0.269^{1/2} = 0.519$