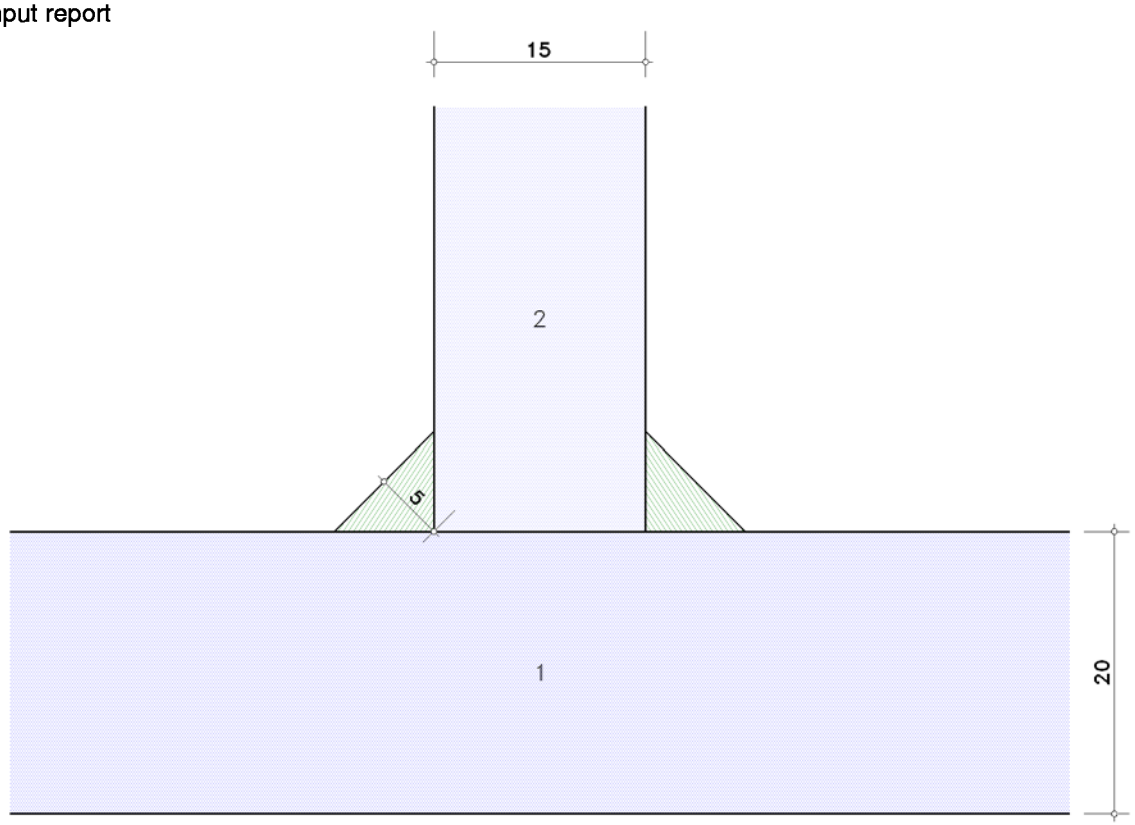
1. Welded Connection

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

1.1. input report



connection device

fillet weld, double-sided, weld thickness a = 5.0 mm, weld length l_w = 200.0 mm (full-size)

connection plates

plate 1 with thickness t_1 = 20.0 mm
plate 2 with thickness t_2 = 15.0 mm
steel grade S235

verifications

directional method
design member forces in the connection plate 2
axial force N_{Ed} = 200.00 kN
internal moment perpendicular to weld axis $M_{s,Ed}$ = 10.00 kNm
shear force perpendicular to weld axis $V_{s,Ed}$ = 150.00 kN

partial safety factors for material

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

1.2. resistance

plate thickness t_1 = 20.0 mm > 3.0 mm ok
plate thickness t_2 = 15.0 mm > 3.0 mm ok
NA-DE: plate thickness $t_{max} \geq 3$ mm: weld thickness a = 5.0 mm > $a_{min} = t_{max}^{1/2} - 0.5$ = 3.97 mm ok
weld thickness a = 5.0 mm < $a_{max} = 0.7 \cdot t_{min}$ = 10.5 mm (Schweißtechnik, s. DIN 18800) ok
weld thickness a = 5.0 mm > a_{min} = 3 mm ok
effective weld length $l_{eff} = l_w$ = 200.0 mm
effective weld length l_{eff} = 200.0 mm > 30 mm ok
effective weld length l_{eff} = 200.0 mm > 6·a = 30.0 mm ok

resistance of a fillet weld

weld: $N_{Ed} = N_{Ed}/2$ = 100.00 kN, $M_{s,Ed} = M_{s,Ed}/2$ = 5.00 kNm, $V_{s,Ed} = V_{s,Ed}/2$ = 75.00 kN
design values of maximum root forces:
$F_{N,Ed} = (N_{Ed} + M_{s,Ed} \cdot 6/l_{eff}) / l_{eff}$ = 1250.00 kN/m
$F_{Vs,Ed} = V_{s,Ed} / l_{eff}$ = 375.00 kN/m
design values of loads, acting on the effective weld area (α = 45.00°):
$F_{Ed}(\sigma_s) = F_{N,Ed} \cdot \sin(\alpha) + F_{Vs,Ed} \cdot \cos(\alpha)$ = 1149.05 kN/m
$F_{Ed}(\tau_s) = F_{N,Ed} \cdot \cos(\alpha) - F_{Vs,Ed} \cdot \sin(\alpha)$ = 618.72 kN/m
$F_{Ed}(\tau_p)$ = 0
design values of stress on the design area of the weld:
$\sigma_s = F_{Ed}(\sigma_s)/a$ = 229.81 N/mm², $\tau_s = F_{Ed}(\tau_s)/a$ = 123.74 N/mm², τ_p = 0

requirement 1:
$\sigma_{1,w,Ed} = (\sigma_s^2 + 3\cdot(\tau_s^2 + \tau_p^2))^{1/2} = 314.25$ N/mm²
resistance of a fillet weld (req.1): $f_{1w,d} = f_u / (\beta_w \cdot \gamma_{M2}) = 360.00$ N/mm², $f_u = 360.0$ N/mm², $\beta_w = 0.80$ (plate 1)
$\sigma_{1,w,Ed} = 314.25$ N/mm² < $f_{1w,d} = 360.00$ N/mm² ⇒ U = 0.873 < 1 ok
requirement 2:
$\sigma_{2,w,Ed} = |\sigma_s| = 229.81$ N/mm²
resistance of a fillet weld (req.2): $f_{2w,d} = 0.9\cdot f_u / \gamma_{M2} = 259.20$ N/mm², $f_u = 360.0$ N/mm² (plate 1)
$\sigma_{2,w,Ed} = 229.81$ N/mm² < $f_{2w,d} = 259.20$ N/mm² ⇒ U = 0.887 < 1 ok

maximum utilization $U_{max} = 0.887$ < 1 ok

verification succeeded

2. 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/A1, Ergänzungen zur EN 1993-1-1, Ausgabe Juli 2014
EN 1993-1-1/NA, Nationaler Anhang zur EN 1993-1-1, Ausgabe Oktober 2022

EN 1993-1-8, Eurocode 3: Bemessung und Konstruktion von Stahlbauten -
Teil 1-8: Bemessung von Anschlüssen;
Deutsche Fassung EN 1993-1-8:2024, Ausgabe April 2025
EN 1993-1-8/NA, Nationaler Anhang zur EN 1993-1-8, Ausgabe November 2020