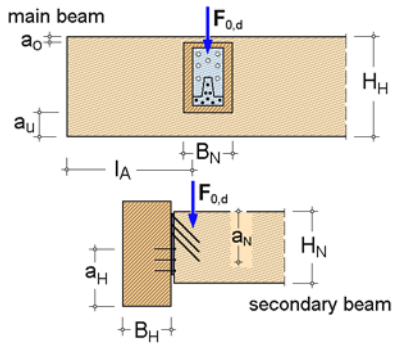
POSITION 21: CONCEALED BEAM HANGER

4H-HOLZ concealed beam hanger-connection

(4H-HLZ72 Version: 1/2012-1a) (principle sketch)



calculation bases:
DIN EN 1995-1-1:2010-12 (EC5) /NA:2010-12,
BAZ Z-9.1-550 und ETA-04/0013
sizes of main and secondary beam (single-sided)
H_H = 320 mm B_H = 240 mm a_O = 50 mm
H_N = 220 mm B_N = 120 mm a_U = 50 mm
l_A = 35 mm a = 50 mm
service class 2
species/timber grade
main beam: coniferous timber, timber grade C24
secondary beam: coniferous timber, timber grade C24
internal forces and factors
$F_{0,d}$ force in insertion direction of the connector

combinations of internal forces (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	7.00 kN	---	---	0.60

connection method concealed beam hanger
make, size ET Simpson-concealed beam hanger 120
conc.beam h. size width b = 46.0 mm height h = 120.0 mm st.pl. th. to = 10.0 mm tu = 6.0 mm
nails CNA ribbed nails 4,0x35
d_n = 4.0 mm l_n = 35.0 mm d_k = 8.0 mm l_g = 25.0 mm M_{yk} = 6.6 Nm
screws Spax-S full thread 5,0x70

verifications

combination of internal forces 1 (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	7.00 kN	---	---	0.60

nail anchorage capacities (withdrawal)
main beam $f_{1,k}$ = 6.125 N/mm² $R_{ax,k}$ = 0.613 kN $R_{ax,d}$ = 0.306 kN
nail anchorage capacity (shear)
main beam $f_{h,k}$ = 18.935 N/mm² $R_{la,k}$ = 1.332 kN $R_{la,d}$ = 0.666 kN
screw anchorage capacity (withdrawal)
secondary beam $f_{1,k}$ = 6.125 N/mm² $R_{ax,k}$ = 2.562 kN $R_{ax,d}$ = 1.537 kN
load-carrying capacities concealed beam hanger
material safety factors $\gamma_{M,timber}$ = 1.30 $\gamma_{M,steel}$ = 1.10 $\gamma_{M,calc}$ = 1.00
load-carrying capacity connector part main beam (1)
number of nails n_H = 9
$F_{1,d}$ = 7.00 kN $R_{1,d}$ = 11.99 kN $F_{1,d}/R_{1,d}$ = 0.58 ≤ 1.00 verification successful
load-carrying capacity connector part at secondary beam (2)
number of SPAX-screws n_N = 6
$F_{1,d}$ = 7.00 kN $R_{1,d}$ = 6.52 kN $F_{1,d}/R_{1,d}$ = 1.07 > 1.00 verification not successful <======
verification of splitting capacity
at a/H ≤ 0.7 verification of splitting capacity required. Acc. to DIN 1052:2008-12, par. 11.1.5
the following requirement should be satisfied: $F_{90,d} / R_{90,d} \leq 1.0$
$F_{90,d}$ design value of the force component perpendicular to grain
$R_{90,d}$ design splitting capacity of the beams
$R_{90,d} = k_s * k_r * (6.5 + 18.*a^2/H_H^2) * (t_{ef} * H_H)^{0.8} * f_{t,90,d}$
verification of splitting capacity am main beam (3)
a_H = 227.5 mm H_H = 320.0 mm a_H/H_H = 0.711 a_r = 40.0 mm t_{ef} = 34.0 mm
h_1 = 92.5 mm k_s = 1.000 k_r = 1.918 l_{Ag} = 35.0 mm k_g = 1.000
$f_{t,90,k}$ = 0.400 N/mm² $f_{t,90,d}$ = 0.240 N/mm² $F_{90,d}$ = 7.00 kN $R_{90,d}$ = 12.18 kN
$F_{90,d} / R_{90,d}$ = 7.00 / 12.18 = 0.57 ≤ 1.0 verification successful
verification of splitting capacity am secondary beam (4)
a_N = 130.0 mm H_N = 220.0 mm a_N/H_N = 0.591 a_r = 39.1 mm t_{ef} = 70.0 mm
h_1 = 90.0 mm k_s = 1.000 k_r = 1.635 l_H = 55.9 mm k_g = 1.000
$f_{t,90,k}$ = 0.400 N/mm² $f_{t,90,d}$ = 0.240 N/mm² $F_{90,d}$ = 7.00 kN $R_{90,d}$ = 5.62 kN
$F_{90,d} / R_{90,d}$ = 7.00 / 12.18 = 1.25 > 1.0 ⇒ verification not successful, reinforcement of

verifications

the connection necessary for hang force $F_{t,90,d}$ = 0.00 kN! <====

LK1: Attention, 2 verifications could not be executed!

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summary

maximum utilization max U = 1.25
decisive load combination 1, verification 4