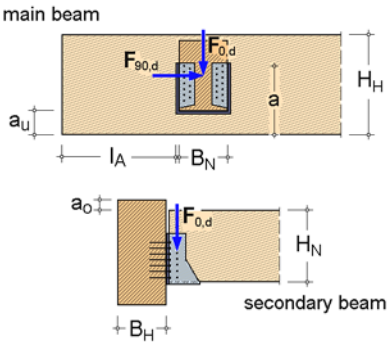
POSITION 10: SIMPSON BSI

4H-HOLZ joist 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-9.1-468 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
w = 119 mm a = 190 mm $l_A \geq H_H$

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 perpendicular to the base plate
$F_{90,d}$	force parallel to the base plate
$N_{,d}$	normal force in secondary beam

combinations of internal forces (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	1.50 kN	---	---	0.60

connection method joist hangers with inner plates
make Simpson BSI 120x157.5, basic form 440
joist hanger size width b = 120.0 mm height h = 157.5 mm steel plate thickness t = 2.0 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

verifications

combination of internal forces 1 (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	1.50 kN	---	---	0.60

nail anchorage capacities (withdrawal)
main beam $f_{1,k}$ = 6.125 N/mm² $R_{ax,k}$ = 0.613 kN $R_{ax,d}$ = 0.283 kN
secondary beam $f_{1,k}$ = 6.125 N/mm² $R_{ax,k}$ = 0.613 kN $R_{ax,d}$ = 0.283 kN
nail anchorage capacities (shear)
main beam $f_{h,k}$ = 18.935 N/mm² $R_{1a,k}$ = 1.309 kN $R_{1a,d}$ = 0.714 kN $d_{R,k}$ = 0.153 kN
secondary beam $f_{h,k}$ = 18.935 N/mm² $R_{1a,k}$ = 1.309 kN $R_{1a,d}$ = 0.714 kN $d_{R,k}$ = 0.153 kN
joist hanger load-carrying capacities (full nailing)
number of nails n_H = 26 n_N = 14
form factors k_{H1} = 40.40 k_{H2} = 36.70
material safety factors $\gamma_{M,timber}$ = 1.30 $\gamma_{M,steel}$ = 1.10 $\gamma_{M,calc}$ = 1.00
load-carrying capacity for load towards base plate ($R_{1,d}$) (2)
$F_{1,d}$ = 9.00 kN $R_{1,d}$ = 9.73 kN $F_{1,d}/R_{1,d}$ = 0.93 ≤ 1.00 verification successful
load-carrying capacity for load away from base plate ($R_{1a,d}$) (3)
$F_{1a,d}$ = 0.00 kN $R_{1a,d}$ = 9.06 kN $F_{1a,d}/R_{1a,d}$ = 0.00 ≤ 1.00 verification successful

verification of splitting capacity (6)
For a/H_H = 0.594 ≤ 0.7 verif. of splitting capacity is 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
$R_{90,d} = k_s * k_r * (6.5 + 18. * a^2/H_H^2) * (t_{ef} * H_H)^{0.8} * f_{t,90,d}$
a = 190.0 mm H_H = 320.0 mm a/H_H = 0.594 a_r = 119.0 mm t_{ef} = 33.0 mm
h_1 = 130.0 mm k_s = 1.221 k_r = 1.893 l_{Ag} = 119.0 mm k_g = 1.000
$f_{t,90,k}$ = 0.400 N/mm² $f_{t,90,d}$ = 0.240 N/mm² $F_{90,d}$ = 9.00 kN $R_{90,d}$ = 9.07 kN
$F_{90,d} / R_{90,d}$ = 9.00 / 9.07 = 0.99 ≤ 1.0 verification successful

LK1: all verifications successful.

summary

maximum utilization max U = 0.99
decisive load combination 1, verification 6