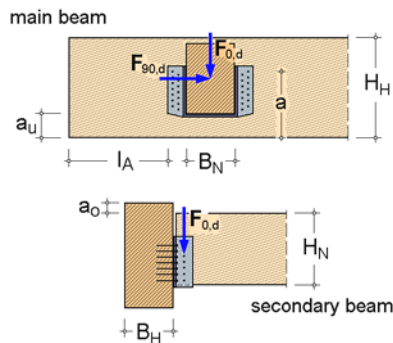


## POSITION 14: SIMPSON BSA

### 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-9.1-225 und ETA-04/0013

#### sizes of main and secondary beam (single-sided)

$H_H = 320 \text{ mm}$     $B_H = 240 \text{ mm}$     $a_0 = 50 \text{ mm}$   
 $H_N = 220 \text{ mm}$     $B_N = 120 \text{ mm}$     $a_u = 50 \text{ mm}$   
 $w = 119 \text{ mm}$     $a = 40 \text{ mm}$     $l_A \geq H_H$

#### 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	0.50 kN	---	0.60

connection method joist hanger (strap shape, outer plates)

make SIMPSON-BSA 120X0

joist hanger size width  $b = 120.0 \text{ mm}$  height  $h = 0.0 \text{ mm}$  steel plate thickness  $t = 2.0 \text{ mm}$

nails CNA ribbed nails 4,0x35

$d_n = 4.0 \text{ mm}$     $l_n = 35.0 \text{ mm}$     $d_k = 8.0 \text{ mm}$     $l_g = 25.0 \text{ mm}$     $M_{yk} = 6.6 \text{ Nm}$

#### 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	0.50 kN	---	0.60

#### nail anchorage capacities (withdrawal)

main beam  $f_{1,k} = 6.125 \text{ N/mm}^2$     $R_{ax,k} = 0.613 \text{ kN}$     $R_{ax,d} = 0.283 \text{ kN}$

secondary beam  $f_{1,k} = 6.125 \text{ N/mm}^2$     $R_{ax,k} = 0.613 \text{ kN}$     $R_{ax,d} = 0.283 \text{ kN}$

#### nail anchorage capacities (shear)

main beam  $f_{h,k} = 18.935 \text{ N/mm}^2$     $R_{1a,k} = 1.309 \text{ kN}$     $R_{1a,d} = 0.714 \text{ kN}$     $d_{R,k} = 0.153 \text{ kN}$

secondary beam  $f_{h,k} = 18.935 \text{ N/mm}^2$     $R_{1a,k} = 1.309 \text{ kN}$     $R_{1a,d} = 0.714 \text{ kN}$     $d_{R,k} = 0.153 \text{ kN}$

#### joist hanger load-carrying capacities (full nailing)

number of nails  $n_H = 56$     $n_N = 28$

form factors  $k_{H1} = 138.50$     $k_{H2} = 131.50$

material safety factors  $\gamma_{M,timber} = 1.30$     $\gamma_{M,steel} = 1.10$     $\gamma_{M,calc} = 1.00$

#### transversely load-carrying capacity ( $R_{2,d}$ ) (1)

$e_N = 340.00 \text{ mm}$     $R = 140.00 \text{ mm}$

$F_{2,d} = 0.45 \text{ kN}$     $R_{2,d} = 3.22 \text{ kN}$     $F_{2,d}/R_{2,d} = 0.14 \leq 1.00$  verification successful

#### load-carrying capacity for load towards base plate ( $R_{1,d}$ ) (2)

$F_{1,d} = 9.00 \text{ kN}$     $R_{1,d} = 21.43 \text{ kN}$     $F_{1,d}/R_{1,d} = 0.42 \leq 1.00$  verification successful

#### load-carrying capacity for load away from base plate ( $R_{1a,d}$ ) (3)

$F_{1a,d} = 0.00 \text{ kN}$     $R_{1a,d} = 20.00 \text{ kN}$     $F_{1a,d}/R_{1a,d} = 0.00 \leq 1.00$  verification successful

#### verification of interaction (4 + 5)

$(F_{1,d}/R_{1,d})^2 + (F_{2,d}/R_{2,d})^2 = 0.20 \leq 1.00$  verification successful

$(F_{1a,d}/R_{1a,d})^2 + (F_{2,d}/R_{2,d})^2$  verification not required

#### verification of splitting capacity (6)

For  $a/H_H = 0.125 \leq 0.7$  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

$R_{90,d} = k_s \cdot k_r \cdot (6.5 + 18 \cdot a^2/H_H^2) \cdot (t_{ef} \cdot H_H)^{0.8} \cdot f_{t,90,d}$

$a = 40.0 \text{ mm}$     $H_H = 320.0 \text{ mm}$     $a/H_H = 0.125$     $a_r = 185.0 \text{ mm}$     $t_{ef} = 33.0 \text{ mm}$

$h_1 = 280.0 \text{ mm}$     $k_s = 1.509$     $k_r = 1.947$     $l_{Ag} = 119.0 \text{ mm}$     $k_g = 1.000$

$f_{t,90,k} = 0.400 \text{ N/mm}^2$     $f_{t,90,d} = 0.240 \text{ N/mm}^2$     $F_{90,d} = 9.00 \text{ kN}$     $R_{90,d} = 6.09 \text{ kN}$

$F_{90,d}/R_{90,d} = 9.00/6.09 = 1.48 > 1.0 \Rightarrow$  verification not successful, reinforcement of



## verifications

the connection necessary for hang force  $F_{t,90,d} = 8.61 \text{ kN!}$  <====

**LK1: Attention, 1 verification could not be executed!**

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## references and comments

Attention, connections with  $a/H_H < 0.2$  are only allowed for short-term duration of load!

## summary

maximum utilization  $\max U = 1.48$   
decisive load combination 1, verification 6