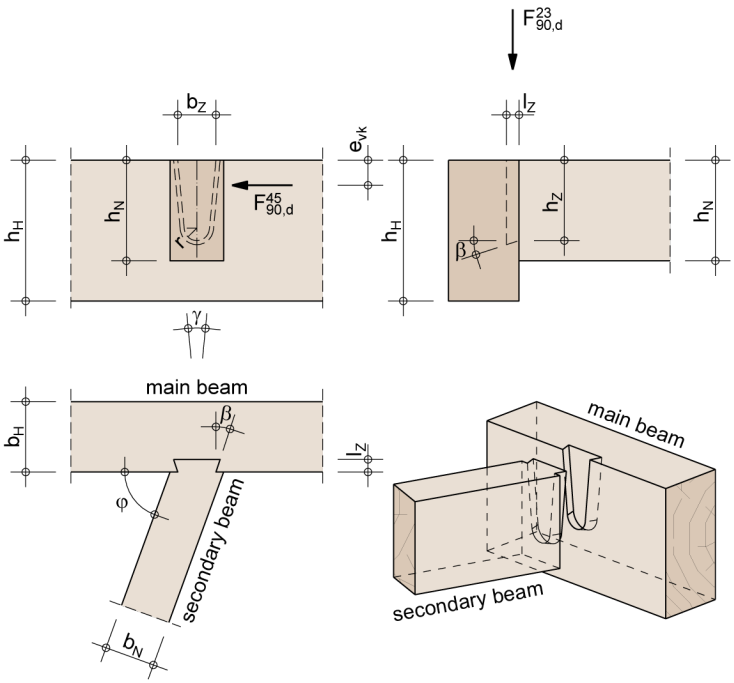
Verification Dovetail-Connection

according to building approval Z-9.1-649 (validity 18 June 2018 - 5 October 2022)

Connection & Geometry

one-sided connection

material:	laminated timber
solidity:	GL24c according to DIN EN 14080:2013-09
width secondary beam b_N:	100 mm
height secondary beam h_N:	240 mm
width main beam b_H:	160 mm
height main beam h_H:	280 mm
connection angle φ:	80 °
milling angle β:	10 °
pin cone angle γ:	4 °
length pin l_Z:	28 mm
width pin b_Z:	81 mm
height pin h_Z:	193 mm
pin hole radius r:	33.4 mm
dimensional tolerances:	+/- 0.2 mm



Loads

Load $F_{23,90,d}$:	13.00 kN
Load $F_{45,90,d}$:	0.00 kN
e_{vk}:	0 mm
Service class:	NKL1 - heated interiors
KLED:	short
modification factor k_{mod}:	0.9

Verification:	$0.88 \leq 1.00$	**Verification fulfilled**
Moment $M_{H,tor,d}$ from one-sided connection 0.858 kNm must be observed with the main beam!		

Construction tip

Building approval Z-9.1-649 must be observed.

Stress resistance in insertion direction

k_n: 6.50

$$\alpha = \cos(\delta) * \frac{h_Z - r}{h_N} = \cos(0) * \frac{193 - 33.4}{240} = 0.66$$

$$k_v = min \begin{Bmatrix} 1 \\ \frac{k_n}{\sqrt{h_N} * \left(\sqrt{\alpha * (1-\alpha)} + 0.4 * \frac{l_Z}{h_N} * \sqrt{\frac{1}{\alpha} - \alpha^2}\right)} \end{Bmatrix}$$

$$= min \begin{Bmatrix} 1 \\ \frac{6.50}{\sqrt{240} * \left(\sqrt{0.66 * (1-0.66)} + 0.4 * \frac{28}{240} * \sqrt{\frac{1}{0.66} - 0.66^2}\right)} \end{Bmatrix}$$

$$= min \begin{Bmatrix} 1 \\ 0.8 \end{Bmatrix}$$

k_{ab}: 1.00

$f_{t,90,d}$: 0.346 N/mm² (with $f_{t,90,k}$ = 0.5 N/mm² according to approval)

$f_{v,d}$: 1.731 N/mm² (with $f_{v,k}$ = 2.5 N/mm² according to approval)

$$F_{90,Rd}^{23} = min \begin{Bmatrix} k_{ab} * \frac{h_Z}{h_Z - r} * \left(6.5 + \frac{18 * (h_H - h_Z + r)^2}{h_H^2}\right) * (t_{ef} * h_H)^{0.8} * f_{t,90,d} \\ \frac{k_v * b_N * (h_Z - r)}{1.5} * f_{v,d} \end{Bmatrix}$$

$$= min \begin{Bmatrix} 1.00 * \frac{193}{193 - 33.4} * \left(6.5 + \frac{18 * (280 - 193 + 33.4)^2}{280^2}\right) * (100 * 280)^{0.8} * 0.346 \\ \frac{0.8 * 100 * (193 - 33.4)}{1.5} * 1.731 \end{Bmatrix}$$

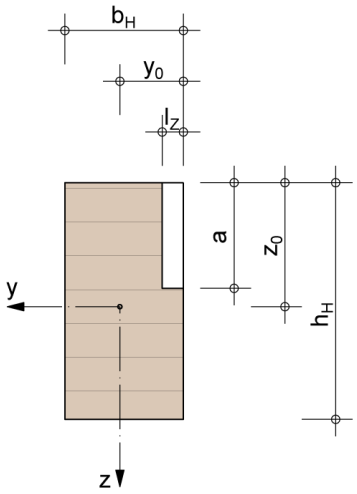
$$= min \begin{Bmatrix} 14.86 \\ 14.80 \end{Bmatrix}$$

stress resistance $F_{90,Rd}^{23}$: 14.80 kN

Verification in insertion direction:	$\frac{F_{90,d}^{23}}{F_{90,Rd}^{23}} = \frac{13.00}{14.80} =$	$0.88 \leq 1.00$

Cross-sectional weakening

width main beam b_H:	160 mm
height main beam h_H:	280 mm
height a:	197.9 mm
length pin l_Z:	28 mm
position of centre y_0:	89.3 mm
position of centre z_0:	145.8 mm
moment of interia I_y:	26395 cm^4



moment of inertia of the unattenuated main beam:

$$I_{y,H} = \frac{b_H * h_H^3}{12} = \frac{160 * 280^3}{12} * 10^{-4} = 29269 \text{ cm}^4$$

required cross-sectional height with the same moment of interia I_y related to the unattenuated cross-sectional of the main beam:

width beam b_H:	160 mm
height beam h_{erf}:	290 mm
height a:	197.9 mm
length pin l_Z:	28 mm
position of centre y_0:	89.0 mm
position of centre z_0:	151.2 mm
moment of interia I_y:	29376 cm^4