Basic principles
GH joist hangers to ETA-08/0264.

Use
GH joist hangers can be used to fix secondary members onto main members. The secondary members can be made of solid timber, glulam or laminated veneer lumber. In addition to solid timber, glulam and laminated veneer lumber, the main members made of steel, masonry or concrete can also be used as the keying surface.

In the case of main members made of solid timber, glulam or laminated veneer lumber, interlayers made of wood-based panels (see ETA-13/0523) can be positioned between the joist hanger and main member. If the interlayer is sufficiently rigidly bonded with the substrate and the fasteners are anchored in the main member with adequate depth (see timber-to-timber joint), the resistances (load-carrying capacities) shown can be used without reduction.

Steel quality
Hot-dip galvanised steel sheet 1.5mm, 2.0mm or 2.5mm thick. The material from with the joist hangers are made corresponds to grade S 250 GD or S 280 GD + Z (min Z275) in accordance with EN 10326:2004 or stainless steel 1.4301, 1.4401, 1.4541 or 1.4571 in accordance with EN 10088:1997 (see also ETA-08/0264).

Anti-corrosion protection
275 g/m² on both sides (corresponds to a zinc coating approx. 20 µm thick) or 1.4571 (stainless steel).

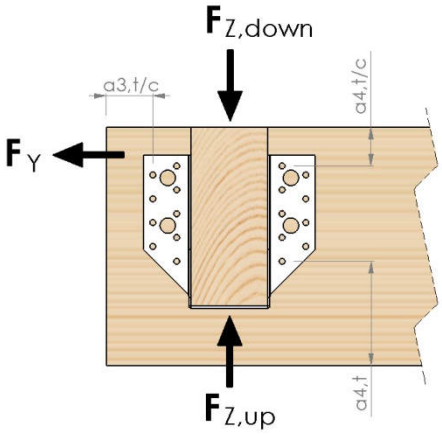
Actions
The joist hangers can absorb vertical and horizontal actions. The vertical loads can not only act in the direction of the bearing plate (down) but also away from the bearing plate (up).

In the listed table values for the resistance of the load component F_Y, it is assumed that the position of the line of action is 20mm below the top of the joist hanger. The resistance reduces with increasing distance of the load line of action from the centre of gravity of the fastener on the main member.

Joint variations
The joist hangers can be fully nailed or fixed with partial nailing. The joist hangers have additional holes for installation with bolts, dowels or concrete anchors for fixing on steel, masonry or concrete.

Fasteners
The following fasteners can be used for installation on timber:
(1) Profiled GH threaded anchor nails: Ø 4mm, L ≥ 40mm to 100mm
(2) GH timber connector screw: Ø 5mm, L ≥ 25mm to 70mm
(3) Bolts, dowels or concrete anchors M8, M10, M12 – plain washers to EN ISO 7094 must be mounted under the 2 top bolt heads or nuts at least.

Timber-to-timber joint



- Timber-to-timber fastener

GH joist hangers are mounted with GH connector nails Ø 4mm, L ≥ 40mm or GH timber connector screws Ø 5mm, L ≥ 25mm. For load-bearing capacities (resistances), see website www.holzverbinder.de.

- Joint across interlayers

If an interlayer is positioned between the joist hanger and the main member, the fastener must be selected so that the fastener is anchored in the main member with the above-named lengths.

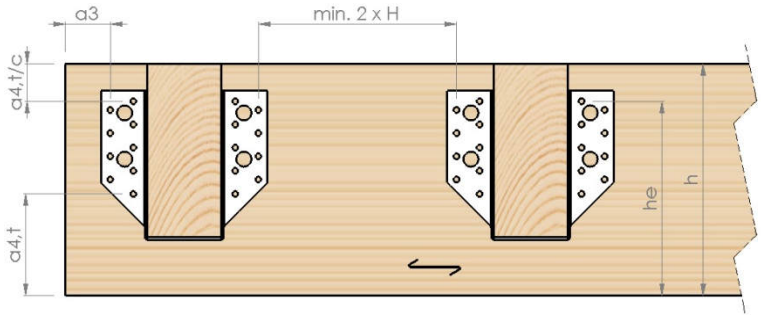
- Partial and full nailing or screwing/bolting

Nailing or screwing pattern for partial or full nailing in accordance with ETA 08/0264.

- Minimum edge distances

The rules to EN1995-1-1 apply to the edge distances parallel and perpendicular to the grain.

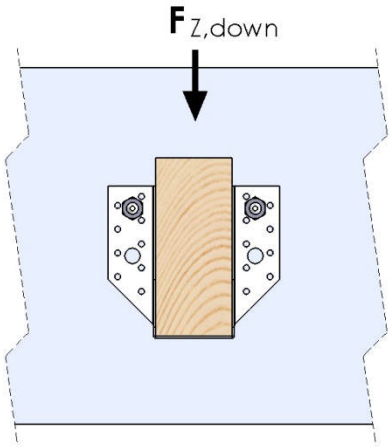
Based on DIN 1052:2008-12, it is recommended that the clear distance between the outer fastener groups of two adjacent joist hangers is at least equal to 2 times the main member height. If the actual distance is less than this recommended minimum clear distance, the resistance (load-carrying capacity) should be reduced.

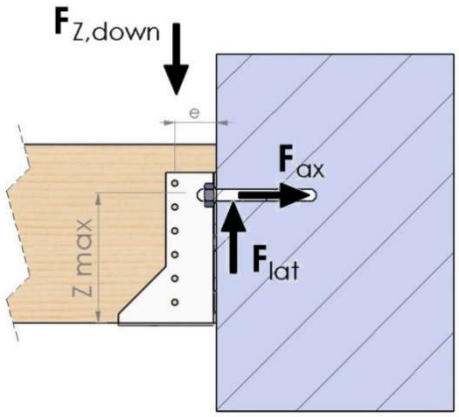


Minimum spacings to EN 1995-1-1, without predrilling, $p_k \leq 420$ kg/m³

		GH connector nail Ø 4mm	GH screw Ø 5mm
$a_{3,t}$	loaded end	60 mm	75 mm
$a_{3,c}$	unloaded end	40 mm	50 mm
$a_{4,t}$	loaded edge	28 mm	50 mm
$a_{4,c}$	unloaded edge	20 mm	25 mm

Joint on masonry, concrete or steel





The resistances shown result for the fixing with a pair of dowels, bolts or concrete anchors.
If the fixing is made with several dowel, bolt or concrete anchor pairs, the resistance of the joist hanger and the loading of each dowel, bolt or concrete anchor can be converted as follows:

Example:
Resistance: $F_{Z,down,Ed}$ = 30 kN min. , k_{mod} = 0.8 (LDC medium-term)
Joist hanger: Combination 05 160x200x2.5, full nailing, 4 dowels / bolts Threaded nails (connector nails): 4x60 to ETA-13/0523 $F_{v,Rd}$ = 1.45 kN (for resistances, see website www.holzverbinder.de)

The following verifications must be provided for the design of the joint (ETA-08/0264):

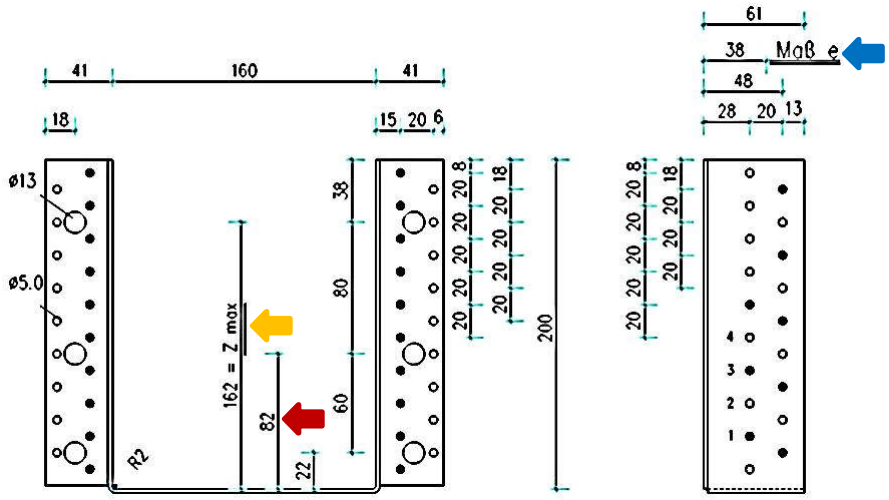
Fastener resistance in the secondary member: $F_{Z,Rd} = (n_J + 2) \cdot F_{v,J,Rd}$
$F_{Z,Rd}$ = (22 + 2) · 1.45 = 34.8 kN >OK

Lateral loading that acts on a dowel, bolt or concrete anchor: $F_{lat,bolt} = F / n_{bolt}$
$F_{lat,bolt}$ = 30 kN / 4 = 7.5 kN >OK
Check: max. dowel load $F_{lat,bolt}$ = 8.6 kN

Axial loading, which acts on the top dowel, bolt or concrete anchor: $F_{ax,bolt} = \frac{F \cdot e}{2 \cdot z_{max}}$
$F_{ax,bolt}$ = 30 kN · 38 / (2 · 162) = 3.52 kN (formula for distribution of the axial load to all dowels, Bolts or concrete anchors – see next page)

For design table key, see last page

			Full nailing							
			Timber-to-timber				Timber-to concrete/steel			
Dimensions	n_{HT}	n_{NT}	4x40	4x60	5x40	5x60	4x40		4x60	
W x H x D	Ø5	Ø5	$F_{z,down}$							
mm	mm	mm	kN							
160x200x2.5	38 (20)	22 (12)	40,1	56,7	48,1	54,4	21,5	10,7	21,5	10,7
								2,9		2,9
			39,2 | 15,3	52,0 | 22,4	44,1 | 22,0	49,8 | 26,6				
			24,7	34,9	29,6	33,5	14,8	8,6	17,2	8,6
								2,4		2,4
			24,1 | 9,4	32,0 | 13,8	27,1 | 13,5	30,7 | 16,4				



- Partial nailing

If the fixing is made with several dowel, bolt or concrete anchor pairs, the axial load on each dowel, bolt or concrete anchor can be converted as follows:

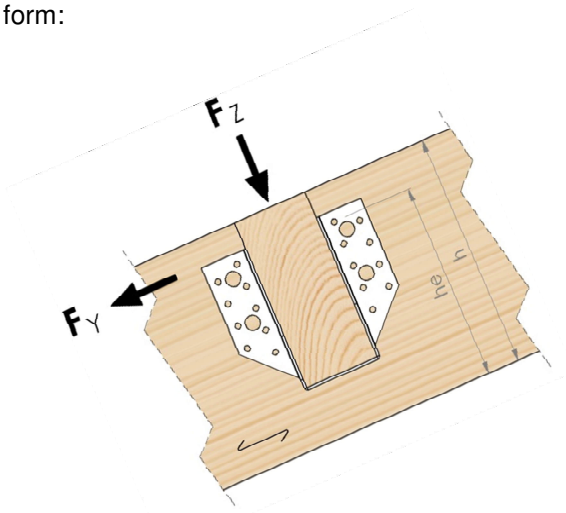
$$F_{ax,n,Bo,Ed} = \frac{z_{max}^2}{\sum_{i=1}^{n} z_i^2} \cdot F_{ax,n=1,Bo,Ed} = \frac{z_{max}^2}{\sum z_1^2 + z_2^2} \cdot F_{ax,1,Bo,Ed} = \frac{152^2}{\sum 152_1^2 + 72_2^2} \cdot 3{,}52 = \underline{2.87\ \text{kN}}$$

$F_{ax,n,Bo,Ed}$	Design value of the load acting on a dowel, bolt or concrete anchor, if the joist hanger is fixed with n dowel, bolt or concrete anchor pairs.
$F_{ax,n=1,Bo,Ed}$	Design value of the load that acts on one dowel, bolt or concrete anchor, if the joist hanger is fixed by a dowel, bolt or concrete anchor pair (table value).
z_{max}	Distance of the top dowel, bolt or concrete anchor pair from the bottom of the joist hanger, less 10 mm.
z_i	Distance of the ith dowel, bolt or concrete anchor pair from the bottom of the joist hanger, less 10 mm.
n	Number of dowel. bolt or concrete anchor pairs with which the joist hanger is fixed.
E_d	Load design value
R_d	Resistance design value

Biaxial loading

In case of simultaneous action of load components, F_Z and F_Y, the interaction must be additionally demonstrated in the following form:

$$\left(\frac{F_{Z,Ed}}{F_{Z,Rd}}\right)^2 + \left(\frac{F_{Y,Ed}}{F_{Y,Rd}}\right)^2 \leq 1$$



General design notes

The main member must be supported torsionally stiff. In case of a one-sided joist hanger joint or a difference between opposite support reaction forces of more than 20%, a torsion analysis is required (including for joints on concrete or masonry).
These support reaction forces produce an offseting moment (torsion) each of :

$$M_{ec} = F_{Z,E} \cdot \left(\frac{b_{header}}{2} + e_{J,0}\right)$$

b_{header}	Width of the main member
$e_{J,0}$	Distance of the centre of gravity of the nailing pattern in the secondary member from the shear surface

Analysis of failure in tension in the main and/or secondary member must be carried out separately.
An analysis is not required for transverse joints with h_e/h > 0.7.

Design tables – figures in kN

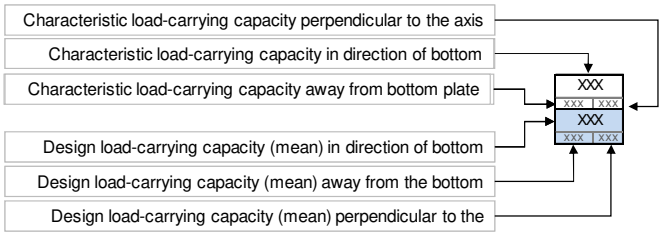
The resistances(load-carrying capacities) listed in the tables were determined assuming service class 1 and 2. The shear and axial load-carrying capacities of the nails and screws were determined assuming material grade C24 and GL24c. The strength parameters of OSB/3 were used in the calculations for the fixing on wood-based materials.
The tables contain not only the characteristics load-carrying capacities (resistances) but also the design values of the load-carrying capacity (resistance) for the "medium-term" load duration class (e.g. living rooms and occupied rooms, offices and work spaces, corridors, etc.).

The following applies: $Bemessungswert \quad F_d = F_k \cdot k_{mod} / y_M$ $\qquad k_{mod,mittel} = 0{,}8$
$y_{M,Holz} = 1{,}3$

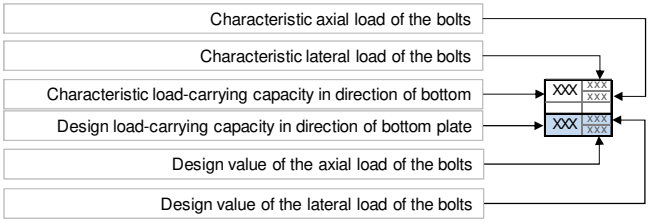
The resistances for service class 3 can be determined separately, taking into consideration the material-specific parameters.

Design tables key

Timber-to-timber joint



Timber-to-masonry, concrete, steel



1/ Arrange GH connector nails Ø 4.0x40 in secondary member offset only with partial nailing (up to joist hanger width ≤ 54 mm)
2/ Arrange GH connector nail Ø 4.0x60 in secondary member offset only with partial nailing (up to joist hanger width ≤ 74 mm)
3/ Arrange the GH timber connector screw Ø5.0x40 in the secondary member offset only with partial screwing (up to JH width ≤ 58 mm)
4/ Arrange GH timber connector screw Ø5.0x60 in the secondary member offset only with partial screwing (up to JH width ≤ 78 mm)
5/ Arrange GH timber connector screw Ø 4.0x60 in secondary member offset only with partial nailing (up to joist hanger width ≤ 44 mm)