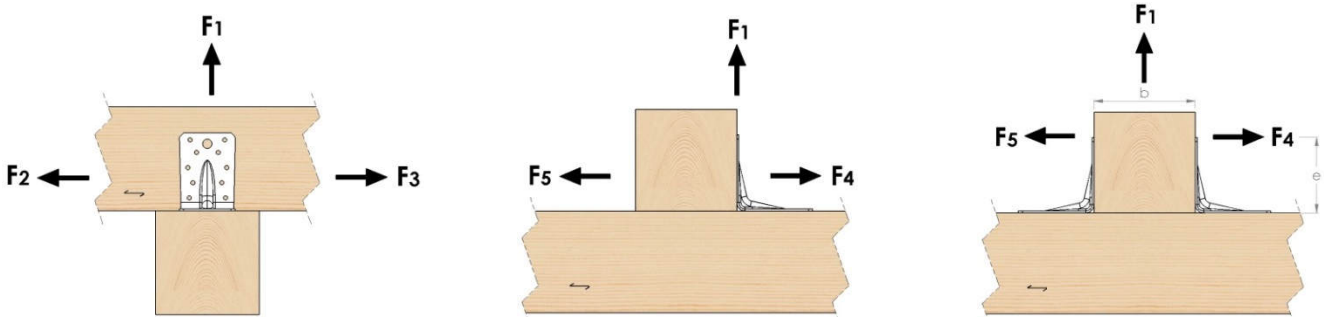
Basic principles
Angle brackets to ETA-13/0900, ETA-09/0322, ETA-09/0323, ETA-09/0324.

Use
Angle brackets can be used for joints between two timber members, e.g. column-purlin connection and for timber member joints on concrete, masonry or steel members.
The timber members can be made of solid wood, glulam, glulam solid timber, cross-laminated timber, laminated veneer lumber, plywood, parallel strand lumber (PSL) and laminated strand lumber (LSL).
The fasteners that can be used for joints on timber members are anchor nails ∅ 4.0 mm, GH screws ∅ 5.0 mm and bolts.
Suitable dowels or bolts are to be used for fixing onto concrete, masonry and steel.

Joint variations
Joints can be made with one or several angle brackets. For connections with an angle bracket, the members must be secured against twisting (torsion).
Depending on the grain orientation, the angle brackets can be fully nailed or fixed with partial nailing. All end-grain end joints (column-to-purlin) are only allowed with partial nailing!
The angle brackets have additional holes for bolts, dowels or concrete anchors for fixing on timber, masonry or concrete.

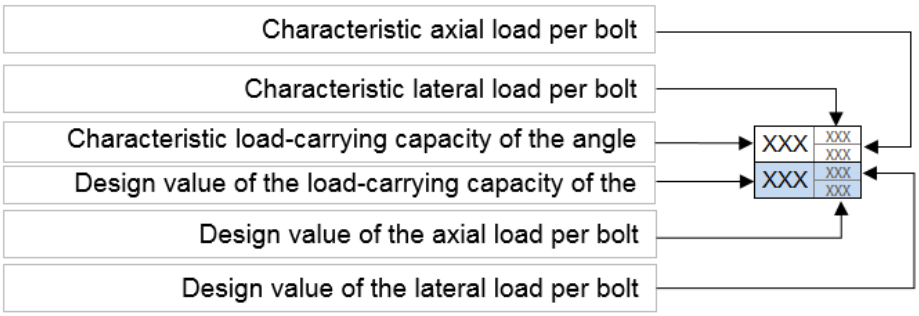
Installation / fasteners
The following fasteners to ETA-13/0523 are used for joints on timber and wood-based panels:
Threaded/anchor nails: d ≥ 4mm, ℓ ≥ 40mm
GH timber connector screw: d ≥ 5mm, ℓ ≥ 25mm
The nailing or screwing pattern for partial and full nailing must satisfy the data of the ETA for the connector.
The following fasteners can be used for fixing onto timber, concrete, masonry or steel:
Bolts, dowels or concrete anchors M8 to M12 (maximum 2 mm smaller than the hole in the angle bracket)
For the edge distances parallel and perpendicular to the grain, unless stated otherwise, the rules to EN1995-1-1, Clause .8.3.1.2, Table 8.2. apply; see also last page.
The minimum spacings can be reduced by predrilling

Actions
Three types of loads are defined for angle brackets: F_1, $F_{2,3}$ and $F_{4,5}$ direction. In the design, a differentiation is made between whether one or two brackets interact in a joint. Connections with several angle bracket must be designed (dimensioned) accordingly. In case of a joint with only one angle bracket, in case of loading in the $F_{4,5}$ direction, an additional differentiation between the loads F_4 and F_5 must also be made. The loading always acts in the plane of an angle bracket leg (flange). If the loading is in the $F_{4,5}$ direction, the force can also be applied with an eccentricity e. This must be demonstrated as combined loading in the verification.



Design tables
The tables contain characteristic resistances (load-carrying capacities) and the load-carrying capacity design values for the "short-term" load duration class (e.g. for wind and snow loads) in kN.
The resistance / load-carrying capacity design values given in the table have been determined assuming service class 1 and 2 and apply to timber with a characteristic density of 350 kg/m³ or higher.
The numbers of the holes to be nailed and the numbers of the holes in which bolts are to be inserted are given in the tables for each angle bracket and the different action cases.

Key for design tables



Loading in several directions

In case of simultaneous action of load components F_1, $F_{2/3}$ and $F_{4/5}$, the interaction must be demonstrated in the following form:

$$\left(\frac{F_{1,d}}{R_{1,d}}\right)^2 + \left(\frac{F_{2/3,d}}{R_{2/3,d}}\right)^2 + \left(\frac{F_{4/5,d}}{R_{4/5,d}}\right)^2 \leq 1$$

Eccentric loading

If the load $F_{4/5}$ is applied to joints with two angle brackets opposite each other with eccentricity e, the verification must be provided for combined loading. In this case, a force ΔF_1 must be used in addition to the existing force F_1.

$$\Delta F_1 = F_{4/5} \cdot \frac{e}{b}$$

Minimum spacings to EN 1995-1-1 for nails Ø 4 mm, without predrilling, in nailing plates, $\rho_k \leq 420$ kg/m³

		Force parallel to the grain	Force perpendicular to the grain
a_1	in grain direction	28 mm	14 mm
a_2	perpendicular to the grain direction	14 mm	14 mm
$a_{3,t}$	loaded end	60 mm	40 mm
$a_{3,c}$	unloaded end	40 mm	40 mm
$a_{4,t}$	loaded edge	20 mm	28 mm
$a_{4,c}$	unloaded edge	20 mm	20 mm
For angles other than those given between the force and grain, see EN 1995-1-1 Tab.8.2			

Table: Edge distances in mm, without predrilled holes, $\rho_k \leq 420$ kg/m³

		GH nail Ø4mm	GH screws Ø5mm
Distance from loaded edge, parallel to the grain (end grain)	$a_{3,t}$	(40 + 20 · cos α)	(50 + 25 · cos α)
Distance from unloaded edge, parallel to the grain (end grain)	$a_{3,c}$	40	50
Distance from loaded edge, perpendicular to the grain (side timber)	$a_{4,t}$	(20 + 8 · sin α)	(25 + 25 · sin α)
Distance from unloaded edge, perpendicular to the grain (side timber)	$a_{4,c}$	20	25