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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-25/0702 of 2025/08/27

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	Knapp EVO GRIP connectors
Product family to which the above construction product belongs:	Three-dimensional nailing plate (Joist bearings)
Manufacturer:	Knapp GmbH Wassergasse 31 A-3324 Euratsfeld Tel. +43 (0) 7474 / 799 10 Fax +43 (0) 7474 / 799 10 99 Internet www.knapp-verbinder.com
Manufacturing plant:	Knapp GmbH Manufacturing Plants:
This European Technical Assessment contains:	30 pages including 3 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 130186-00-0603 for Three-dimensional nailing plates
This version replaces:	

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

Technical description of the product
Knapp EVO GRIP connectors are two-piece, face-fixed joist bearings to be used in timber to timber or timber to concrete or steel connections.

EVO GRIP connectors are made from aluminium alloy EN AW-6082 T6 according to EN 573-3:2009. Dimensions, hole positions and typical installations are shown in Annexes A and C.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

EVO GRIP connectors are intended for use in making end-grain to side-grain connections in load bearing timber structures, as a connection between a wood based joist and a solid timber or wood based header or column as well as connections between a timber joist and a concrete structure or a steel member, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled.

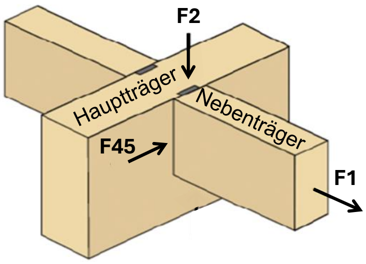
EVO GRIP connectors can be installed as connections between wood-based members such as:

- Structural solid timber according to EN 14081,
- Glued solid timber according to EN 14080
- Glulam according to EN 14080 or ETA,
- Cross-laminated timber according to ETA,
- LVL according to EN 14374 or ETA,
- FST according to ETA-14/0354,
- Engineered wood products with certified mechanical resistances for connections with dowel-type fasteners.

However, the calculation methods are only allowed for a characteristic wood density of up to 460 kg/m³ for softwood and up to 730 kg/m³ for LVL or hardwood. Even though the wood-based material may have a larger density, this must not be used in the formulas for the load-carrying capacities of the fasteners.

Annex B states the formulas for the characteristic load-carrying capacities of the connections with EVO GRIP connectors. The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code.

It is assumed that the forces acting on the EVO GRIP connector are F_1 or F_2 perpendicular to the header axis and F_{45} perpendicular to the joist axis. The forces F_1 and F_2 shall act in the symmetry plane of the joist bearing. It is assumed that the forces F_2 or F_{45} are acting with an eccentricity e with regard to the side grain surface of the header.



F_1	axial
F_2	downward
F_{45}	lateral

It is assumed that the header beam is prevented from rotating. If the header beam only has installed a joist bearing on one side the eccentricity moment $M_v = F_d \cdot (B_H / 2 + e)$ shall be considered. The same applies when the header has joist bearing connections on both sides, but with vertical forces which differ more than 20%.

EVO GRIP connectors are intended for use for connections subject to static or quasi static loading.

The EVO GRIP connectors are for use in timber structures subject to the dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1:2004, (Eurocode 5).

The scope of the angle brackets regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions and in conjunction with the admissible service conditions according to EN 1995-1-1 and the admissible corrosivity category as described and defined in EN ISO 12944-2.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the joist bearings of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*) (BWR1)	
Joint Strength - Characteristic load-carrying capacity	See Annex B
Joint Stiffness	No performance assessed
Joint ductility	No performance assessed
Resistance to seismic actions	No performance assessed
Resistance to corrosion and deterioration	See section 3.6
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The connectors are made from aluminium classified as **Euroclass A1** in accordance with Commission Delegated Regulation 2016/364 and EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 General aspects related to the performance of the product	The connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service classes 1 and 2

*) See additional information in section 3.4 – 3.7.

3.4 Methods of verification

Safety principles and partial factors

The characteristic load-carrying capacities are based on the characteristic values of the fasteners and the aluminium plates. To obtain design values the capacities must be divided by different partial factors for the material properties, in case of timber failure in addition multiplied with the coefficient k_{mod}.

According to EN 1990 (Eurocode – Basis of design) paragraph 6.3.5 the design value of load-carrying capacity may be determined by reducing the characteristic values of the load-carrying capacity with different partial factors.

Thus, the characteristic values of the load–carrying capacity are determined also for timber failure $F_{Rk,H}$ (obtaining the embedment strength of fasteners subjected to shear or the withdrawal capacity of the most loaded fastener, respectively) as well as for aluminium plate failure $F_{Rk,alu}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

$$F_{Rd} = \min\left\{\frac{k_{mod} \cdot F_{Rk,H}}{\gamma_{M,H}}; \frac{F_{Rk,alu}}{\gamma_{M,alu}}\right\}$$

Therefore, for timber failure the load duration class and the service class are included. The different partial factors γ_M for aluminium or timber, respectively, are also correctly considered.

3.5 Mechanical resistance and stability

See annex B for characteristic load-carrying capacities of the joist bearings.

The characteristic capacities of the joist bearings are determined by calculation assisted by testing as described in the EAD 130186-00-0603 clause 2.2.1. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

The design models allow the use of fasteners described in the table on page 17 in Annex A:

- *Self-tapping screws in accordance with EN 14592 or ETA-11/00190 or ETA-12/0373*
- *Bolts in accordance with EN 14592*
- *Metal anchors in accordance with an ETA*

In the formulas in Annex B the capacities for screws calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral fastener load-carrying-capacity.

No performance has been determined in relation to ductility of a joint under cyclic testing. The contribution to the performance of structures in seismic zones, therefore, has not been assessed.

3.5 Aspects related to the performance of the product

3.6.1 Corrosion protection in service class 1, 2 and 3.
In accordance with EAD 130186-00-0603 the EVO GRIP connectors are made from aluminium alloy EN AW-6082 T6 according to EN 573-3:2009 and could be either anodized or coated with an organic coating.

3.7 General aspects related to the use of the product

Knapp EVO GRIP connectors are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

EVO GRIP connections

An EVO GRIP connection is deemed fit for its intended use provided:

Header – support conditions

- The header shall be restrained against rotation and be free from wane under the connector.

  If the header carries joists only on one side the eccentricity moment from the joists $M_{ec} = R_{joist}$ ($B_H/2+e_{45}$) shall be considered for EVO GRIP connectors at the strength verification of the header.

  R_{joist} Reaction force from the joists
  B_H Width of header

- For a header with joists from both sides but with different reaction forces a similar consideration applies.

Wood to wood connections

- Joist bearings are fastened to wood-based headers or joists by screws.
- There shall be screws in all holes (full fastener pattern) or in a part of the holes (partial fastener pattern).
- The characteristic capacity of the EVO GRIP connection is calculated according to the manufacturer's technical documentation, dated 2025-05-02.

- The EVO GRIP connection is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the end of the joist and the surface, where contact stresses can occur during loading shall be limited. This means that for EVO GRIP connectors the gap between the surface of the plate and the end of the joist shall be maximum 1 mm.
- The groove in the joist and the surface of the header shall have a plane surface against the whole EVO GRIP connector.
- Screws to be used shall have a diameter and head shape, which fits the holes of the EVO GRIP connector.

Wood to concrete or steel

The above-mentioned rules for wood-to-wood connections are applicable also for the connection between the joist and the EVO GRIP connector.

- The EVO GRIP connection is designed in accordance with Eurocodes 2, 3, 5 or 9 or an appropriate national code.
- The EVO GRIP connector shall be in close contact with the concrete or steel over the whole face. There shall be no intermediate layers in between.
- The gap between the connector plate and the surface, where contact stresses can occur during loading shall be limited. This means that the gap between the connector plate and that of the concrete or steel shall be maximum 1 mm.
- The bolt or metal anchor shall have a diameter not less than the hole diameter minus 2 mm.
- The bolts or metal anchors shall be placed symmetrically about the vertical symmetry line. There shall always be bolts in the uppermost holes.
- The upper bolts shall have washers according to EN ISO 7094.

4 Assessment and verification of constancy of performance (AVCP) (hereinafter AVCP) system applied, with reference to its legal base

4.1 AVCP system

According to the decision 97/638/EC of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

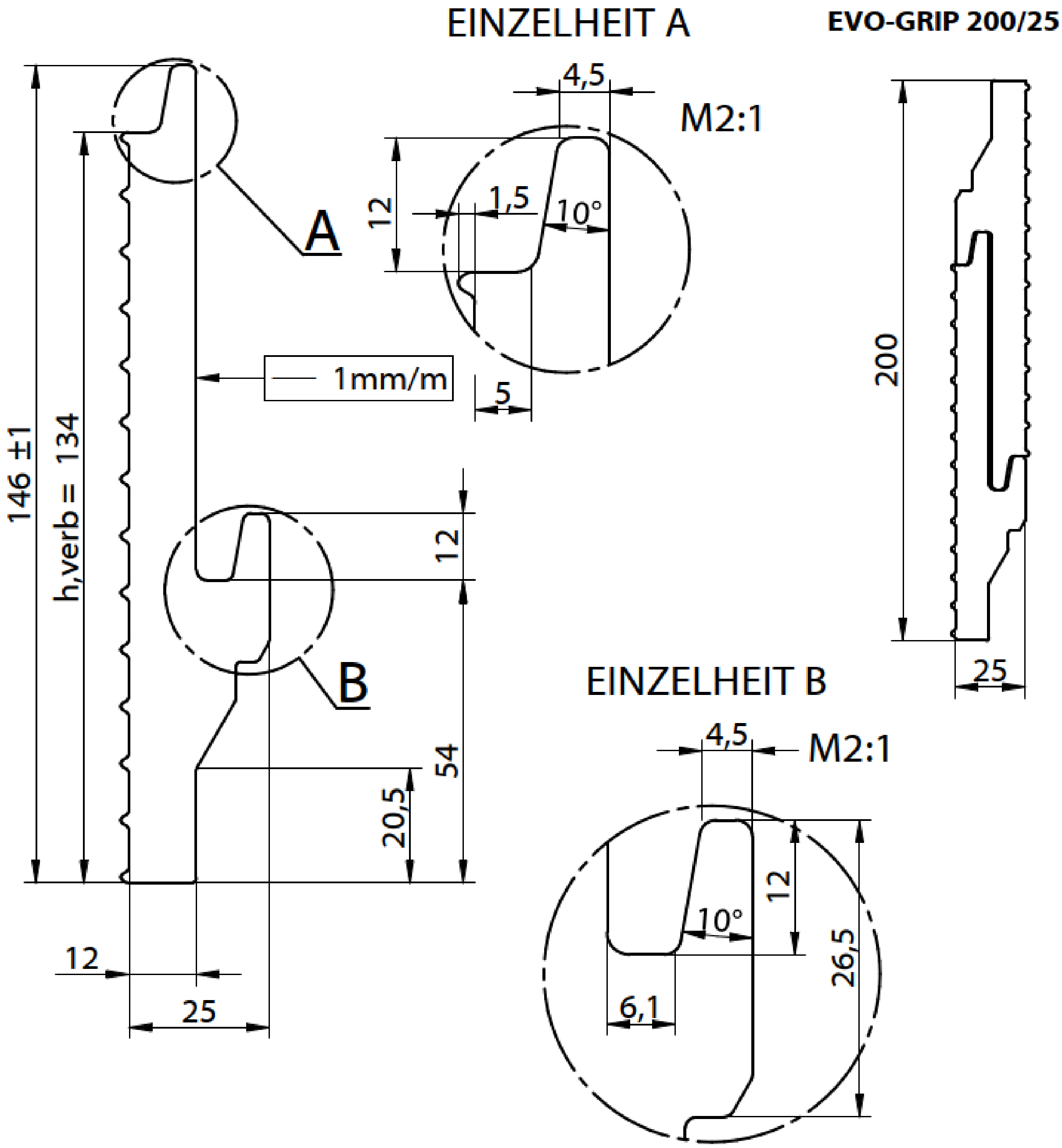
Issued in Copenhagen on 2025-08-27 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions

KNAPP® Clip Connector EVO-GRIP-profile 200 series - material and geometry

Connecting profile 146x25 mm for timber/ steel/ concrete connection
25.0 mm thick aluminum profile, grade EN-AW 6082 T6 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 310 MPa; minimum 0,2 yield strength $R_{p0.2}$ of 260 MPa;
minimum ultimate strain A_{50} of 8%

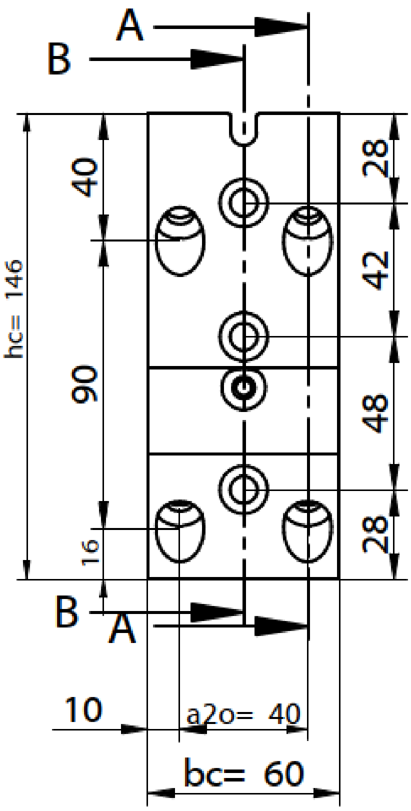


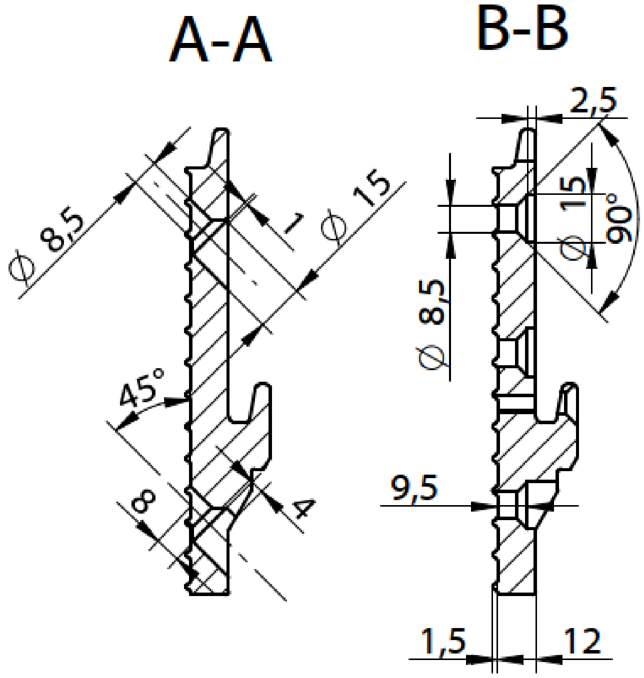
dimensions in mm

KNAPP® Clip Connector EVO-GRIP-profile 200 series - hole pattern wood connection

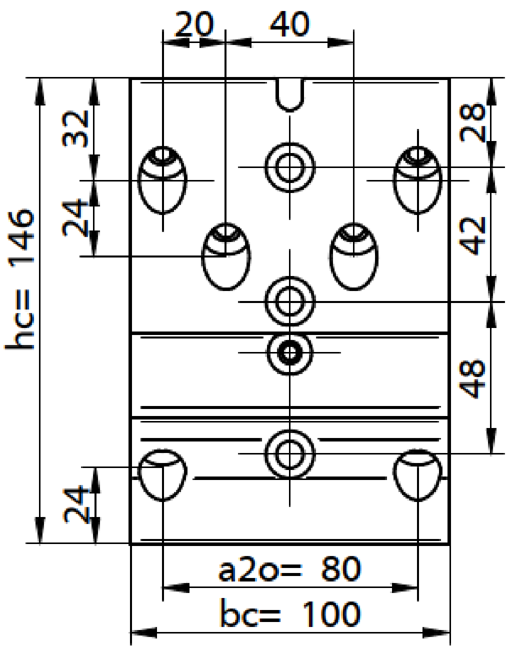
The connector is fixed by horizontal 0° and inclined 45° screws D=8mm with a torque of 20Nm. The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to the following views:

EVO GRIP 200x60x25H

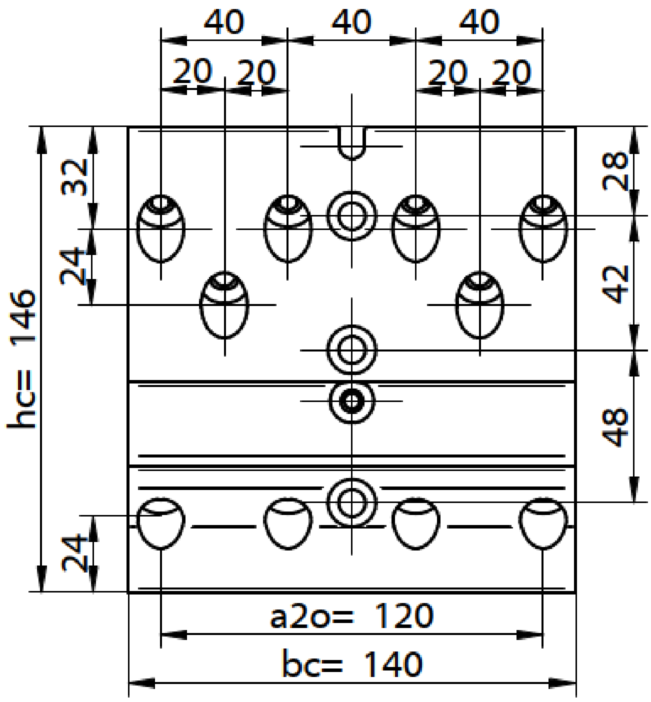




EVO GRIP 200x100x25H



EVO GRIP 200x140x25H



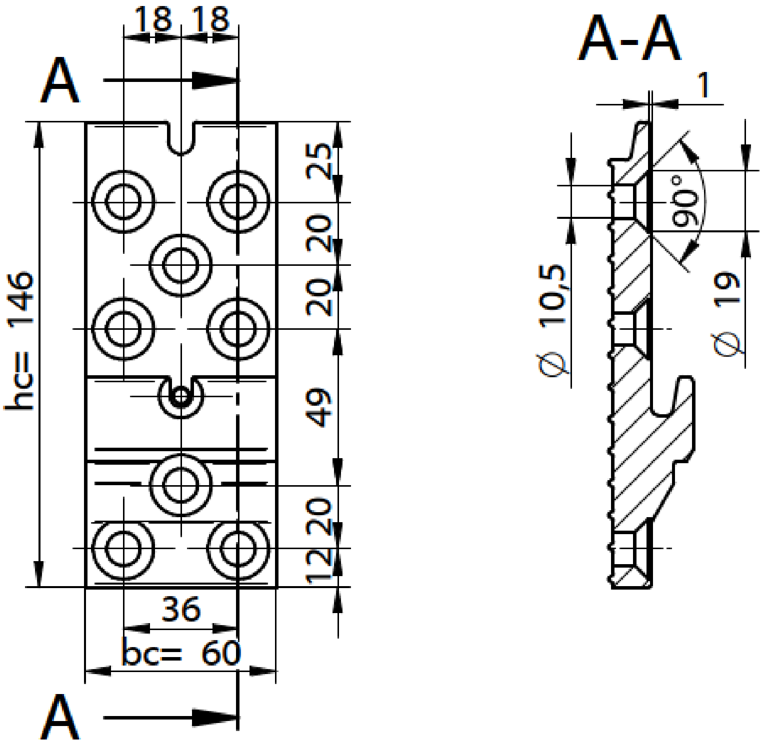
dimensions in mm

Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

KNAPP® Clip Connector EVO-GRIP-profile 200 series - hole pattern steel/conrete connection

The connector is fixed by horizontal 0° countersunk screws 8.8 size M10. The connector have to be fixed to a steelplate or concrete according to EN 1993-1-8 3.6.1.
The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to the EN 1991-1-1:2007 8.5.

EVO GRIP 200x60x25S



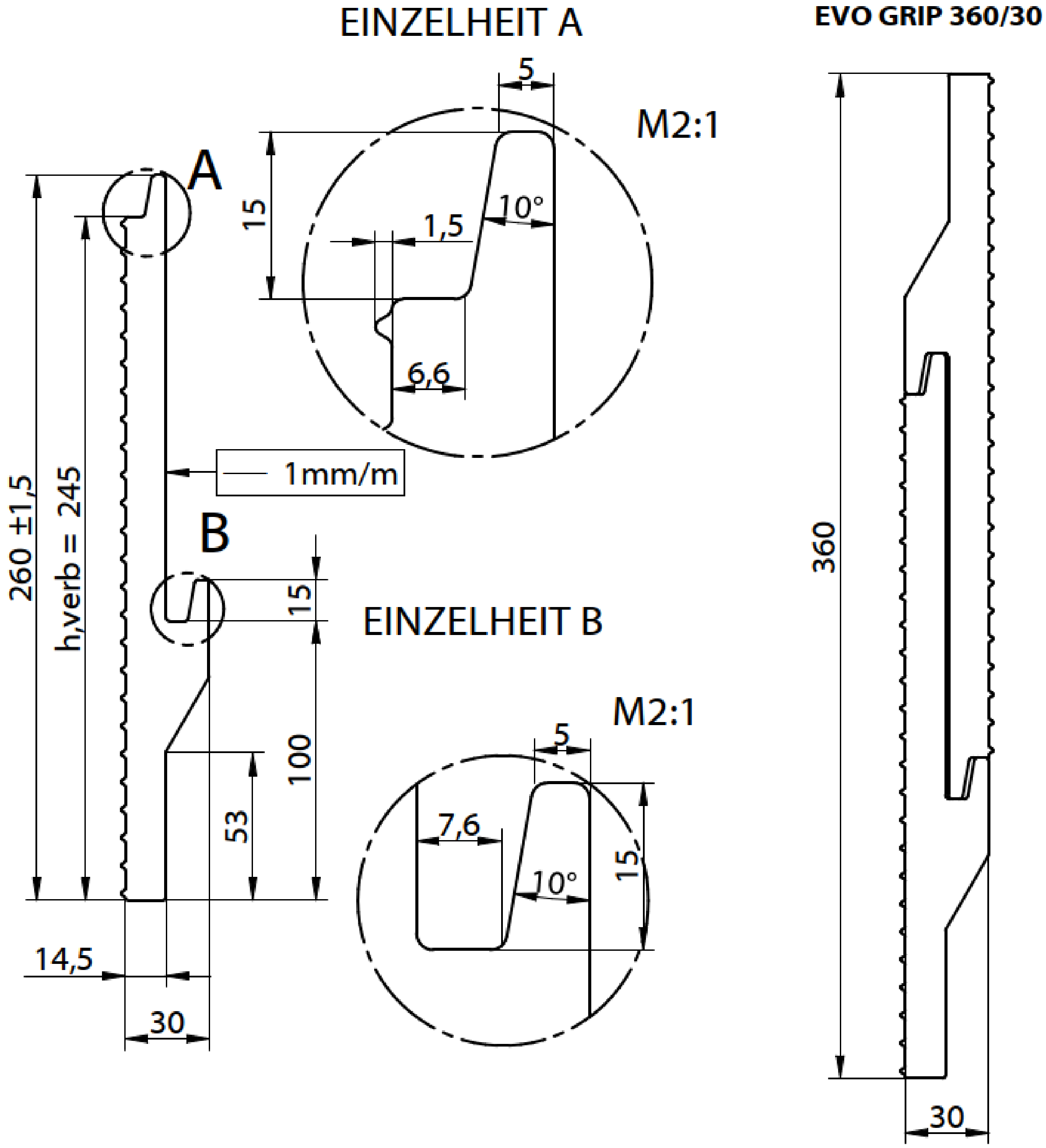
Hole geometry for M10
Countersunk screw 8.8

dimensions in mm

Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

KNAPP® Clip Connector EVO-GRIP-profile 360 series - material and geometry

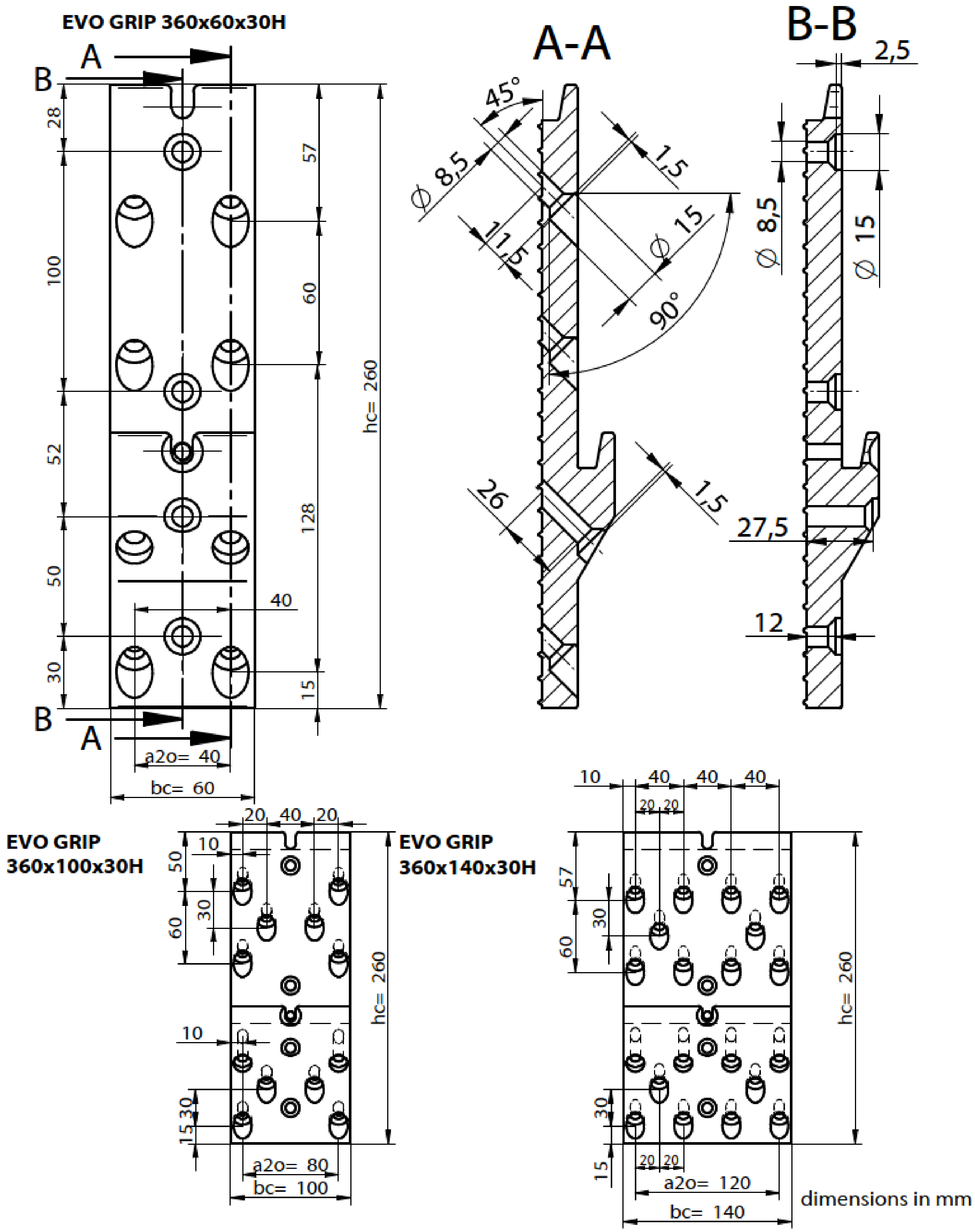
Connecting profile 260x30 mm for timber/ steel/ concrete connection
30.0 mm thick aluminum profile, grade EN-AW 6082 T6 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 310 MPa; minimum 0,2 yield strength $R_{p0.2}$ of 260 MPa; minimum ultimate strain A_{50} of 8%



dimensions in mm

KNAPP® Clip Connector EVO-GRIP-profile 360 series - hole pattern wood connection

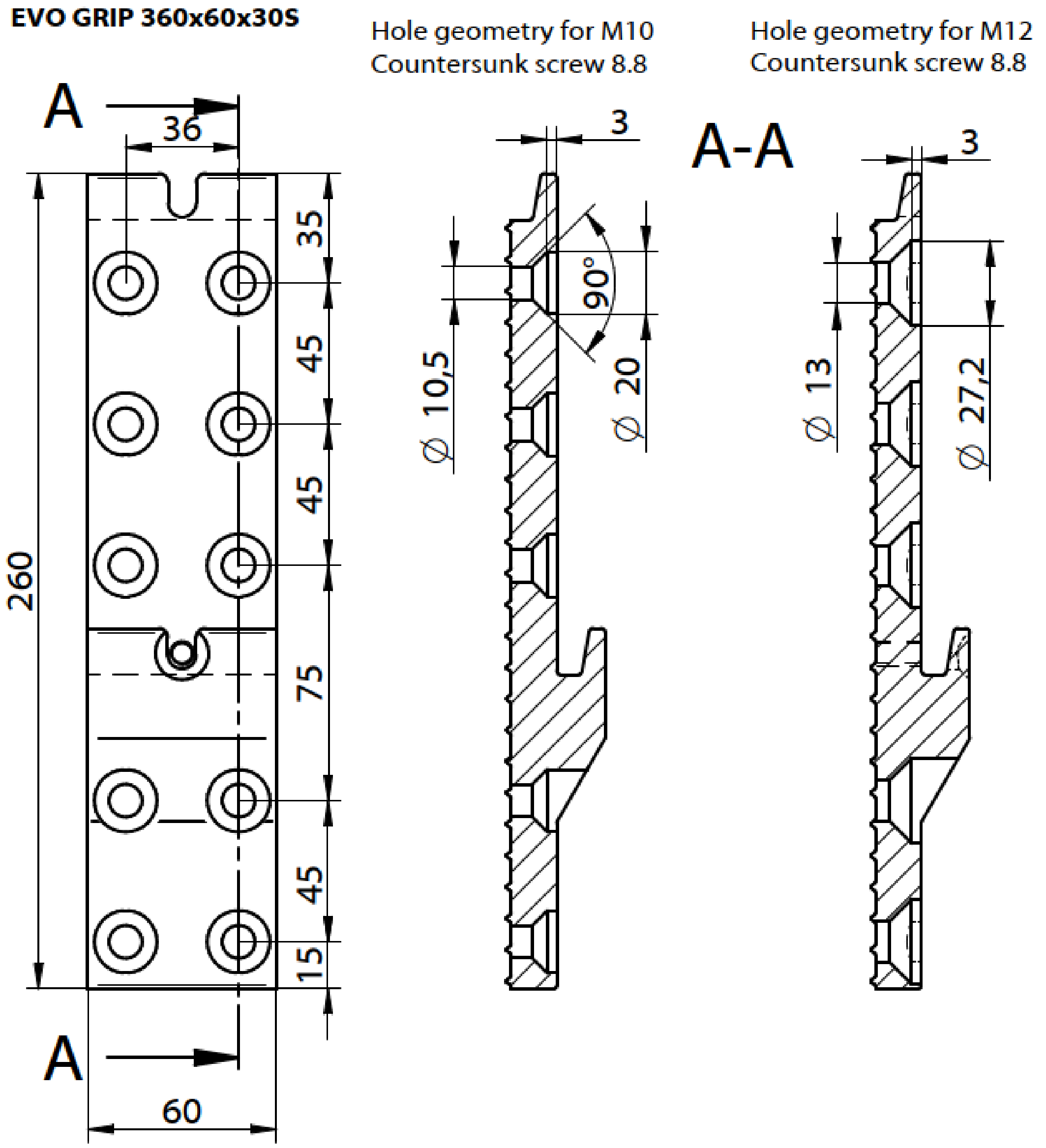
The connector is fixed by horizontal 0° and inclined 45° screws D=8mm with a torque of 20Nm. The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to the following views:



Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

KNAPP® Clip Connector EVO-GRIP-profile 360 series - hole pattern steel/conrete connection

The connector is fixed by horizontal 0° countersunk screws 8.8 size M10 or M12. The connector have to be fixed to a steelplate or concrete according to EN 1993-1-8 3.6.1.
The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to EN 1991-1-1:2007 8.5.



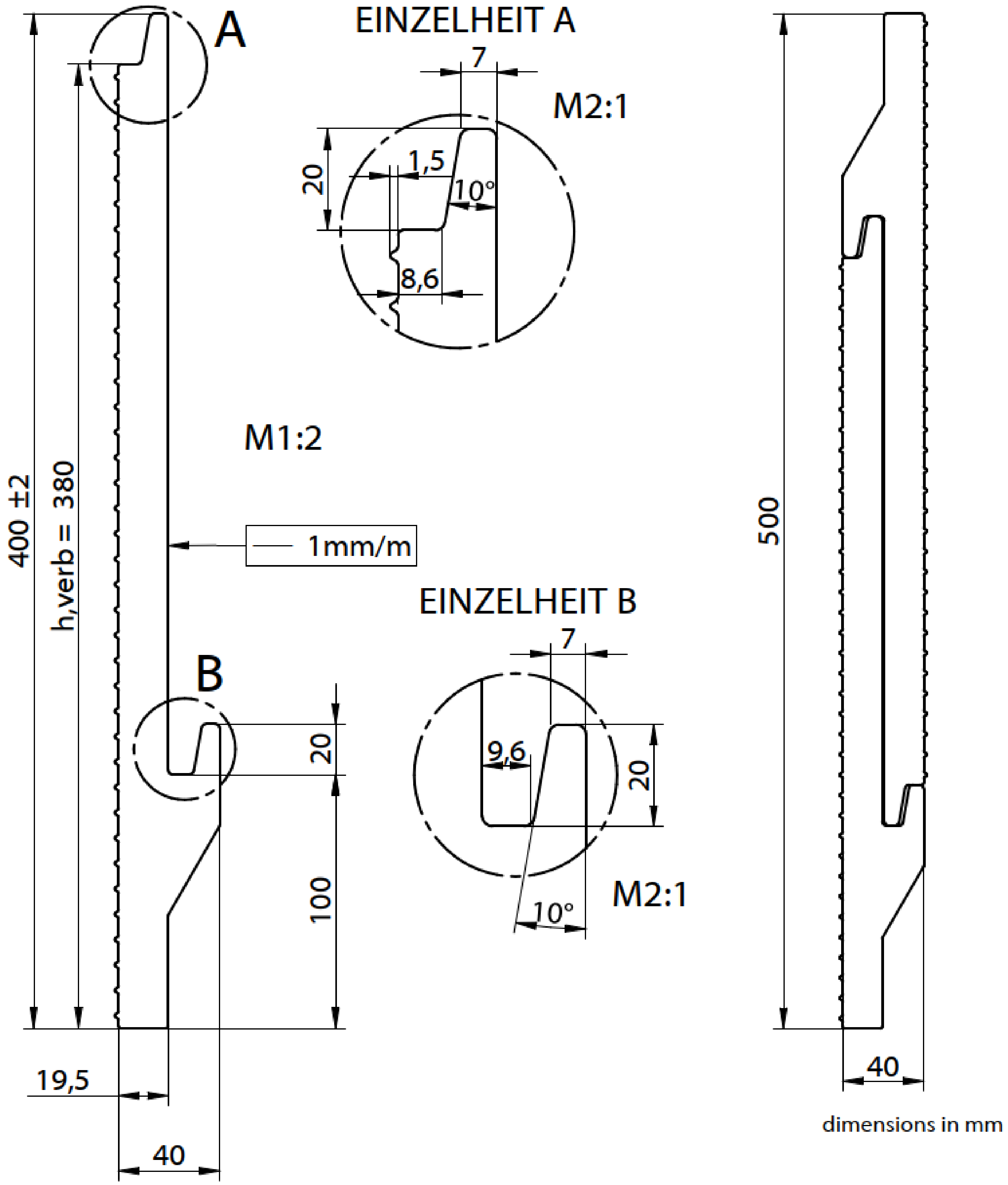
dimensions in mm

Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

KNAPP® Clip Connector EVO-GRIP-profile 500series - material and geometry

Connecting profile 400x40 mm for timber/ steel/ concrete connection
40.0 mm thick aluminum profile, grade EN-AW 6082 T6 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 310 MPa; minimum 0,2 yield strength $R_{p0,2}$ of 260 MPa;
minimum ultimate strain A_{50} of 8%

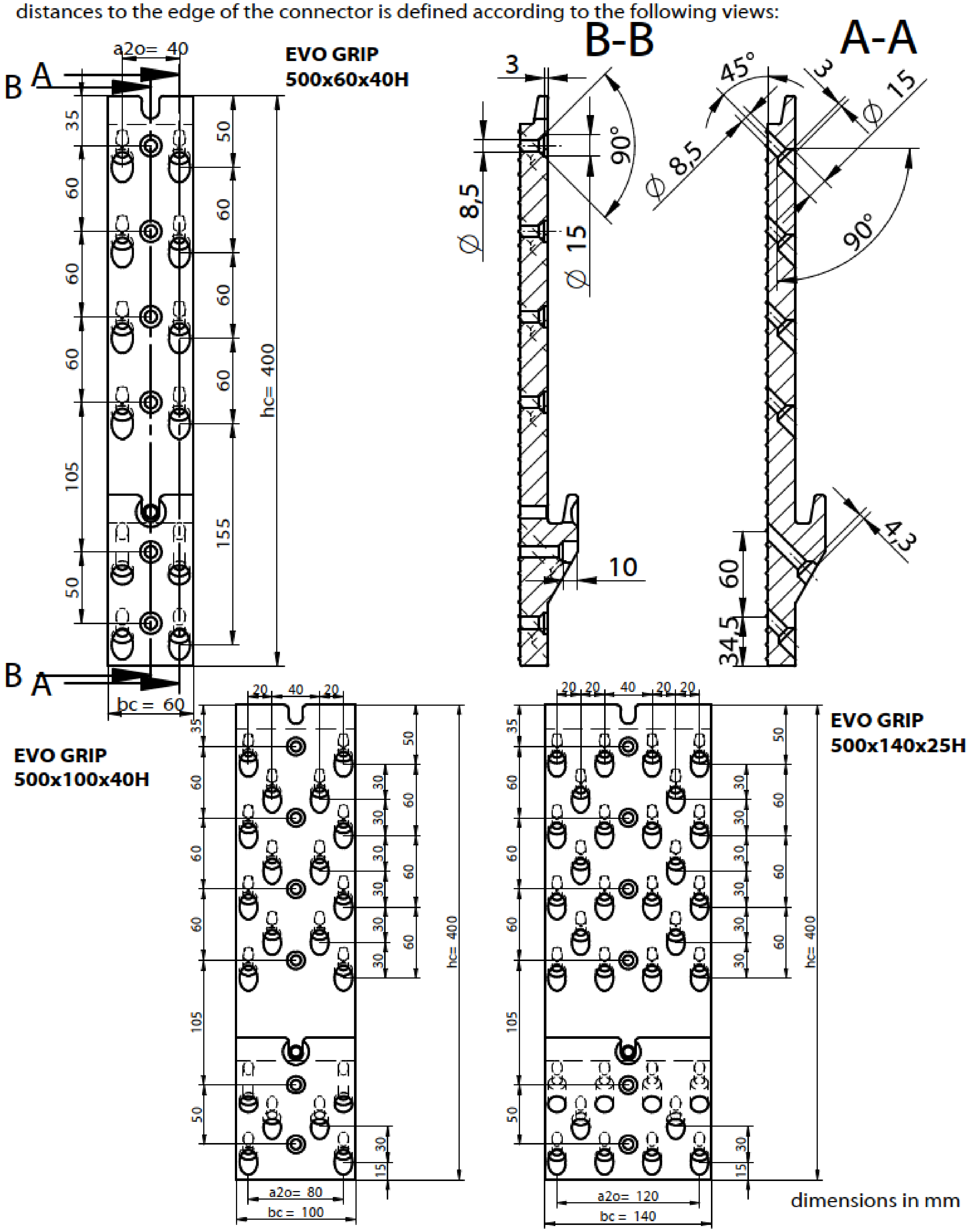
EVO-GRIP 500/40



dimensions in mm

KNAPP® Clip Connector EVO-GRIP-profile 500 series - hole pattern wood connection

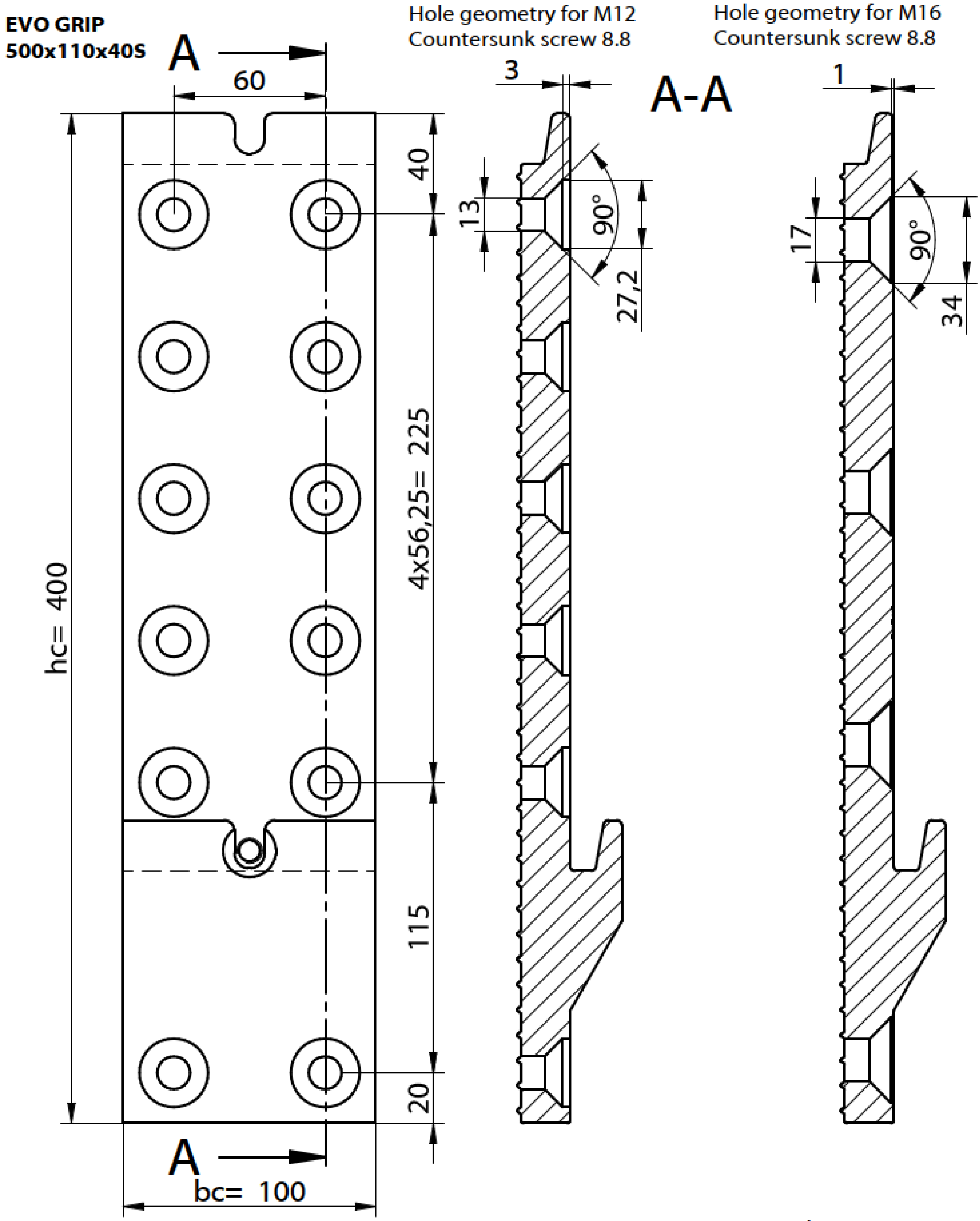
The connector is fixed by horizontal 0° and inclined 45° screws D=8mm with a torque of 20N. The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to the following views:



Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

KNAPP® Clip Connector EVO-GRIP-profile 500series - hole pattern steel/conrete connection

The connector is fixed by horizontal 0° countersunk screws 8.8 size M12 or M16. The connector have to be fixed to a steelplate or concrete according to EN 1993-1-8 3.6.1.
The width of the connector is flexible, while the min. distances between the screws and the min. distances to the edge of the connector is defined according to EN 1991-1-1:2007 8.5.



dimensions in mm

Note: The hole patterns on this page are examples showing the minimum distances between the screws and the connector edges. The connector widths and the number of screws may be adjusted depending on the application.

Fastener types and sizes

Screw diameter	Length	Screw type
8.0	80 – 240	Screw according to EN 14592, ETA-11/0190, or ETA-12/0373 pre-drilled or non-pre-drilled

In the formulas in Annex B the capacities for self-tapping screws calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral load-carrying-capacity. The characteristic axial capacity of the screws is determined by calculation:

$$F_{ax,\alpha,Rk} = \min\left\{ f_{tens,k};\ \frac{n_{ef} \cdot k_{ax} \cdot f_{ax,k} \cdot d \cdot \ell_{ef}}{k_\beta} \left(\frac{\rho_k}{\rho_a}\right)^{0,8} \right\}$$

Where:

$f_{ax,k}$ Characteristic value of the withdrawal parameter in N/mm^2

d Screw diameter in mm, d = 8 mm

ℓ_{ef} Penetration depth of the thread in mm,

$\ell_{ef} = \ell$ - 10 mm for screws perp. to connector plate in EVO GRIP 200,
$\ell_{ef} = \ell$ - 13 mm for screws perp. to connector plate in EVO GRIP 360,
$\ell_{ef} = \ell$ - 17 mm for screws perp. to connector plate in EVO GRIP 500,
$\ell_{ef} = \ell$ - 13 mm for inclined screws in EVO GRIP 200,
$\ell_{ef} = \ell$ - 16 mm for inclined screws in EVO GRIP 360,
$\ell_{ef} = \ell$ - 20 mm for inclined screws in EVO GRIP 500,

$f_{ax,k}$, $f_{tens,k}$, ρ_a, k_{ax} and k_β see DoP of the screw, ETA-11/0190 or ETA-12/0373.

BOLTS or METAL ANCHORS diameter	**Corresponding hole diameter in aluminium plate**	**Fastener type**
Bolt M10 Bolt M12 Bolt M16	10,5 mm 13,0 mm 17,0 mm	Bolts with metric thread min. 8.8 according to EN ISO 4762, EN ISO 10642, EN ISO 898, EN ISO 4014, EN ISO 4016, EN ISO 4017, EN ISO 4018, EN 15048 or ETA
Metal anchor 10 mm Metal anchor 12 mm Metal anchor 16 mm	10,5 mm 13,0 mm 17,0 mm	Metal anchors according to manufacturer's specification

Annex B
Characteristic values of load-carrying-capacities

Two-piece EVO GRIP connectors consist of a header/column connector and a joist connector. Header/column section and joist connector are joined with one (solo) or two (standard) aluminium hooks. The gap between the hooks in both connector parts provide a hinge between header/column and joist connector and an installation tolerance. The rotational capacity of the connection in solo arrangement is significantly larger than in standard arrangement.

Header/column and joist connectors for timber members are used with inclined screws according to ETA-11/0190, ETA-12/073 or EN 14592. Header/column connectors for steel or concrete members are used with bolts or metal anchors.

The downward directed forces and the axial joist forces are assumed to act in the middle of the joist.

Full or partial fastener patterns are foreseen. For header connections with bolts or metal anchors, there must always be at least bolts or metal anchors in the two upper two holes for loading down.

B.1 Timber-to-timber connections

Tensile loading parallel to the joist axis

$$F_{1,Rk} = \min\left\{2{,}3 \cdot F_{ax,Rk} + \frac{F_{2,Ed}}{1{,}8}; F_{1,alu,Rk}; 5{,}7 \cdot \left(F_{2,Ed} + F_{2,dir,Rk}\right)\right\} \qquad \text{(B.1)}$$

Where:

$F_{ax,Rk}$ Characteristic withdrawal capacity of an axially loaded header, column or joist screw perpendicular to the connector plate according to EN 1995-1-1 and ETA-11/0190 or ETA-12/0373, $F_{ax,Rd} = k_{mod} \cdot F_{ax,Rk} / \gamma_M$

$F_{2,Ed}$ Characteristic action of permanent downward force F_2. The design value of the permanent action is determined by multiplying the characteristic value $F_{2,Ed}$ with $\gamma_{G,inf}$.

$F_{1,alu,Rk}$ Characteristic load-carrying capacity of the hook connection between the two connector plates, see Table B.1. $F_{1,alu,Rd} = F_{1,alu,Rk} / \gamma_{M2}$

$F_{2,dir,Rk}$ Characteristic load-carrying capacity of a direct connection between the two timber members in load direction F_2. $F_{2,dir,Rd} = k_{mod} \cdot F_{2,dir,Rk} / \gamma_M$

Table B.1: Knapp EVO GRIP connectors: Load-carrying capacity $F_{1,alu,Rk}$, $F_{2,alu,Rk}$, and $F_{45,alu,Rk}$ and eccentricity e_{45}

EVO GRIP	$F_{1,alu,Rk}$ [kN]		$F_{2,alu,Rk}$ [kN]		$F_{45,alu,Rk}$ [kN]		e_{45} [mm]	
	Solo	Standard	Solo	Standard	Solo	Standard	Solo	Standard
200	$0{,}4 \cdot b_c$	$0{,}8 \cdot b_c$	$2{,}0 \cdot b_c$	$4{,}0 \cdot b_c$	14,0	28,0	18,8	12,5
360	$0{,}5 \cdot b_c$	$1{,}0 \cdot b_c$	$2{,}5 \cdot b_c$	$5{,}0 \cdot b_c$	18,0	36,0	22,5	15,0
500	$0{,}6 \cdot b_c$	$1{,}2 \cdot b_c$	$4{,}0 \cdot b_c$	$8{,}0 \cdot b_c$	27,0	54,0	30,0	20,0
b_c is the connector width in mm								

Loading down:

$$F_{2,Rk} = \min \begin{cases} 1{,}15 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ F_{2,alu,Rk} \\ \dfrac{k_{cr} \cdot B_J \cdot h_{ef} \cdot k_v \cdot f_{v,k}}{1{,}5} \\ 1{,}6 \cdot h_c^2 \cdot f_{r,k} + \min \begin{cases} 1{,}6 \cdot h_c \cdot h_o \cdot f_{r,k} \\ 0{,}8 \cdot h_c \cdot b_c \cdot f_{c,90,k} \end{cases} \end{cases} \quad \text{for joists} \qquad \text{(B.2)}$$

$$F_{2,Rk} = \min \begin{cases} \min \begin{cases} 0{,}64 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ A_{ef} \cdot f_{c,90,k} \cdot k_{c,90} + n_{c,90} \cdot F_{ax,Rk} \end{cases} + \min \begin{cases} 0{,}51 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ 0{,}8 \cdot A_{ef} \cdot f_{c,90,k} \cdot k_{c,90} \end{cases} \\ F_{2,alu,Rk} \\ \left(1{,}6 \cdot h_c + b_c\right) \cdot \left(h_c \cdot f_{rk} + \min \begin{cases} h_u \cdot f_{rk} \\ \ell_{ef} / \sqrt{2} \cdot f_{c,90,k} \end{cases} \right) \end{cases} \quad \text{for headers} \qquad \text{(B.3)}$$

$$F_{2,Rk} = \min \begin{cases} \min \begin{cases} 0{,}64 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ A_{ef} \cdot f_{c,90,k} \cdot k_{c,90} + n_{c,90} \cdot F_{ax,Rk} \end{cases} + \min \begin{cases} 0{,}51 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ 0{,}8 \cdot A_{ef} \cdot f_{c,90,k} \cdot k_{c,90} \end{cases} \\ F_{2,alu,Rk} \\ \max \begin{cases} 1{,}3 \cdot A_{net,c} \cdot f_{c,0,k} \\ 0{,}75 \cdot A_{net,v} \cdot f_{v,k} \end{cases} \end{cases} \quad \text{for columns} \qquad \text{(B.4)}$$

Where:

n_{45} Number of inclined screws in the header or column or the joist

$F_{ax,\alpha,Rk}$ Characteristic withdrawal capacity of an inclined header, column or joist screw according to EN 1995-1-1 and ETA-11/0190 or ETA-12/0373, $F_{ax,\alpha,Rd} = k_{mod} \cdot F_{ax,\alpha,Rk} / \gamma_M$

$F_{2,alu,Rk}$ Characteristic load-carrying capacity of the hook connection between the two connector plates, see Table B.1. $F_{2,alu,Rd} = F_{2,alu,Rk} / \gamma_{M2}$

$F_{ax,Rk}$ Characteristic compressive capacity of reinforcement screws according to ETA-11/0190 or ETA-12/0373 in N, $F_{ax,Rd} = k_{mod} \cdot F_{ax,Rk} / \gamma_M$

k_{cr} Factor according to EN 1995-1-1, 6.1.7(2)

$$k_v = \min \begin{cases} 1 \\ k_n \cdot \left(\sqrt{H_J} \cdot \left(\left(\sqrt{\alpha \cdot (1-\alpha)} \right) + \dfrac{0{,}8 \cdot x}{H_J} \cdot \sqrt{\dfrac{1}{\alpha} - \alpha^2} \right) \right)^{-1} \end{cases}$$

B_J Joist width in mm

$f_{v,k}$ Characteristic shear strength of joist or column in N/mm², $f_{v,d} = k_{mod} \cdot f_{v,k} / \gamma_M$

H_J Joist depth in mm

k_n Parameter according to EN 1995-1-1 equation (6.63), $k_n = 6{,}5$ for glulam

α $= h_{ef}/H_J$

$$x = \frac{\ell_{ef}}{1{,}8 \cdot \sqrt{2}}$$

ℓ_{ef} Threaded penetration length of an inclined screw in mm

h_c Connector depth,
$h_c = 146$ mm for EVO GRIP 200, $h_c = 260$ mm for EVO GRIP 360, $h_c = 400$ mm for EVO GRIP 500

b_c Connector width in mm

h_o Timber joist depth above the joist EVO GRIP connector in mm

h_u Timber header depth below the header EVO GRIP connector in mm

$f_{r,k}$ Characteristic rolling shear strength in N/mm², $f_{r,d} = k_{mod} \cdot f_{r,k} / \gamma_M$

$f_{c,90,k}$ Characteristic compressive strength perp. to grain in N/mm², $f_{c,90,d} = k_{mod} \cdot f_{c,90,k} / \gamma_M$

$f_{c,0,k}$ Characteristic compressive strength parallel to grain in N/mm², $f_{c,0,d} = k_{mod} \cdot f_{c,0,k} / \gamma_M$

$F_{90,Rk}$ Characteristic load-carrying capacity according to EN 1995-1-1, 8.1.4. $F_{90,Rd} = k_{mod} \cdot F_{90,Rk} / \gamma_M$

$A_{net,c}$ Timber cross section loaded in compression parallel to grain between the two outer vertical screw rows and between the screw tips and the shear plane in mm²

$$A_{net,c} = (a_{2o} - n_R \cdot d) \cdot \ell_{ef} / \sqrt{2}$$

$A_{net,v}$ Sum of the timber shear planes defined by the two outer vertical screw rows and the plane along the screw tips in mm²

$$A_{net,v} = (\ell_{EGC} - n_S \cdot d \cdot \sqrt{2}) \cdot \sqrt{2} \cdot \ell_{ef} + \ell_{EGC} \cdot a_{2o}$$

A_{ef} Effective contact area perp. to grain (effective connector width x effective connector depth) according to EN 1995-5-1, 6.1.5 in mm²

$k_{c,90}$ Factor according to EN 1995-5-1, 6.1.5

n_S Number of screws in the outer vertical screw row parallel to grain direction

n_R Number of vertical screw rows in the connector width

$n_{c,90}$ Number of compressive reinforcement screws (optional)

a_{2o} Distance perpendicular to the grain in mm between the two outer vertical screw rows

ℓ_{EGC} Length of EVO GRIP connector pair, 200 mm or 360 mm or 500 mm

d Screw diameter, d = 8 mm

Loading perpendicular to the symmetry plane:

$$F_{45,Rk} = \min \left\{ \frac{1}{\sqrt{\left(\frac{1}{(n_{45}+n_{90}) \cdot F_{v,Rk}}\right)^2 + \left(\frac{e_{45}}{(0,5 \cdot b_c - 10\text{ mm}) \cdot F_{ax,Rk}}\right)^2}}; F_{45,alu,Rk} \right\} \text{for joists} \qquad \text{(B.5)}$$

$$F_{45,Rk} = \min \begin{cases} \frac{1}{\sqrt{\left(\frac{1}{(n_{45}+n_{90}) \cdot F_{v,Rk}}\right)^2 + \left(\frac{e_{45}}{(0,5 \cdot b_c - 10\text{ mm}) \cdot F_{ax,Rk}}\right)^2}} \\ F_{45,alu,Rk} \\ \frac{f_{c,90,k} \cdot (0,5 \cdot b_c - 10\text{ mm}) \cdot h_c \cdot 20\text{ mm}}{e_{45}} \end{cases} \text{for headers or columns} \qquad \text{(B.6)}$$

Where:

n_{45} Number of inclined screws in the joist, header or column

n_{90} Number of screws perpendicular to the connector plate in the joist, header or column

$F_{v,Rk}$ Characteristic lateral load-carrying capacity of an 8 mm inclined screw in single shear in the joist, header or column according to EN 1995-1-1 and ETA-11/0190 or ETA-12/0373 assuming a thick plate, $F_{v,Rd} = k_{mod} \cdot F_{v,Rk} / \gamma_M$

$F_{ax,Rk}$ Characteristic withdrawal capacity of an axially loaded header, column or joist screw perpendicular to the connector plate according to EN 1995-1-1 and ETA-11/0190 or ETA-12/0373, $F_{ax,Rd} = k_{mod} \cdot F_{ax,Rk} / \gamma_M$

$F_{45,alu,Rk}$ Characteristic load-carrying capacity of the hook connection between the two connector plates, see Table B.1. $F_{45,alu,Rd} = F_{45,alu,Rk} / \gamma_{M2}$

b_c Connector width in mm

h_c Connector depth,
h_c = 146 mm for EVO GRIP 200, h_c = 260 mm for EVO GRIP 360, h_c = 400 mm for EVO GRIP 500

e_{45} Eccentricity in mm, see Table B.1

$f_{c,90,k}$ Characteristic compressive strength perp. to grain in N/mm², $f_{c,90,d} = k_{mod} \cdot f_{c,90,k} / \gamma_M$

B.2 EVO GRIP connectors fastened with bolts or metal anchors in concrete or steel

Tensile loading parallel to the joist axis

$$F_{1,Rk} = n_H \cdot F_{ax,H,Rk} \tag{B.7}$$

Loading down:

$$F_{2,Rk} = \min\left\{ \frac{1}{\sqrt{\left(\frac{1}{n_H \cdot F_{v,H,Rk}}\right)^2 + \left(\frac{e_{45} \cdot z_{max}}{I_{p,H,ax} \cdot F_{ax,H,Rk}}\right)^2}} ; F_{2,alu,Rk} \right\} \tag{B.8}$$

Where:

n_H Number of bolts or metal anchors in the header connection; there must always be at least bolts or metal anchors in the two upper holes for loading down

e_{45} Distance between the load $F_{2,Ed}$ and the header surface, see Table B.1

z_{max} Distance between the uppermost bolt or metal anchor and the lower end of the joist bearing

$I_{p,H,ax}$ Polar moment of inertia of the header fasteners where the centre of rotation may be assumed at the lower end of the EVO GRIP connector

$F_{v,H,Rk}$ Characteristic value of the lateral load-carrying-capacity per bolt or metal anchor in the header connection

$F_{ax,H,Rk}$ Characteristic value of the axial load-carrying-capacity per bolt or metal anchor in the header connection

For load direction F_{45}, equation (B.5) applies.

B.3 Combined loading

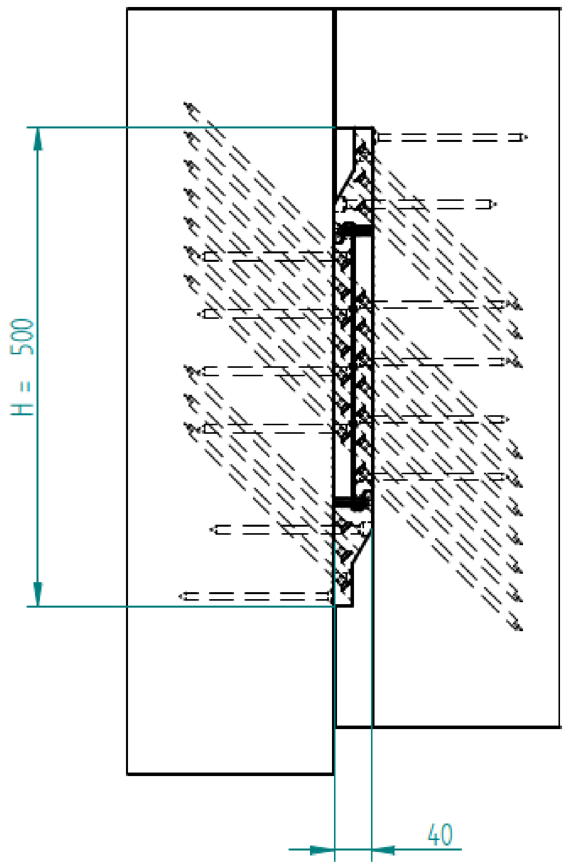
If $F_{1,Ed}$ or $F_{2,Ed}$ or $F_{45,Ed}$ act simultaneously, the following interaction equation shall be fulfilled:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2,Ed}}{F_{2,Rd}}\right)^2 + \left(\frac{F_{45,Ed}}{F_{45,Rd}}\right)^2 \leq 1{,}0 \tag{B.9}$$

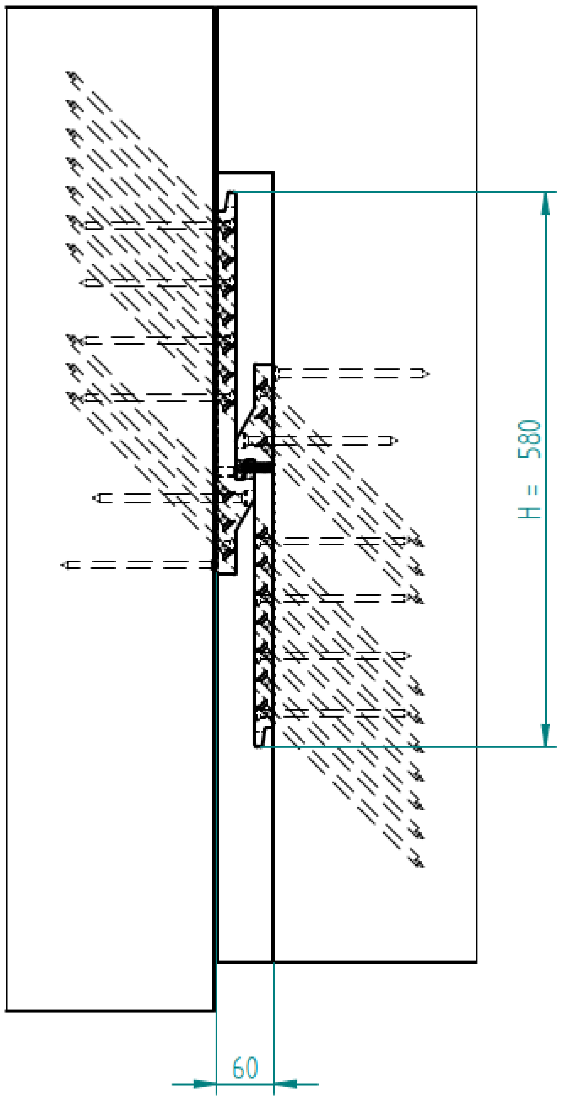
Annex C
Installation of EVO GRIP connectors

KNAPP® Connector EVO GRIP 500 series - Connection types

standard type

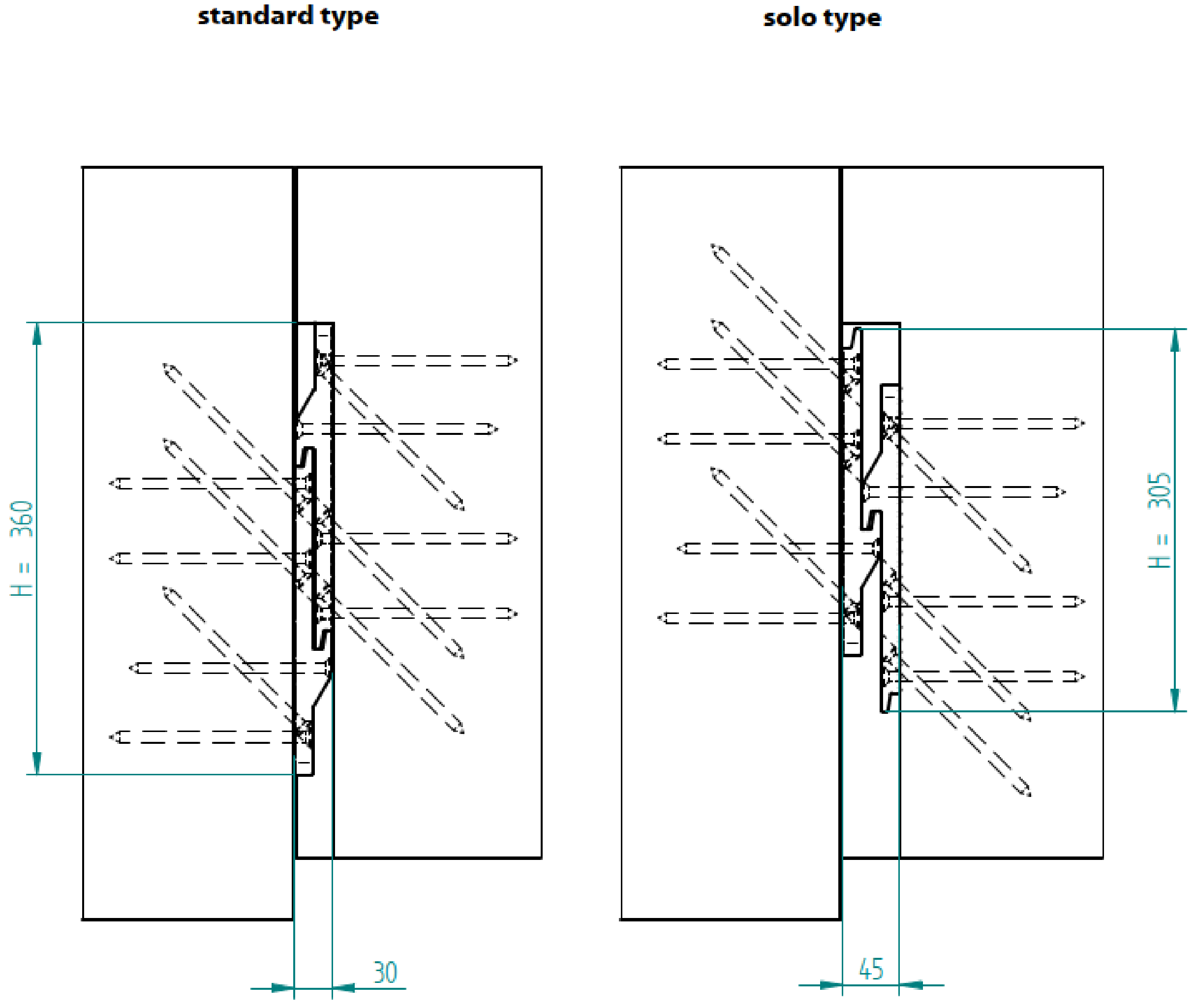


solo type



dimensions in mm

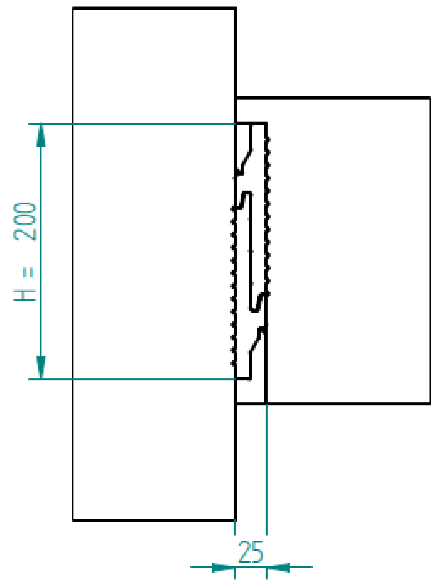
KNAPP® Connector EVO GRIP 360 series - Connection types



dimensions in mm

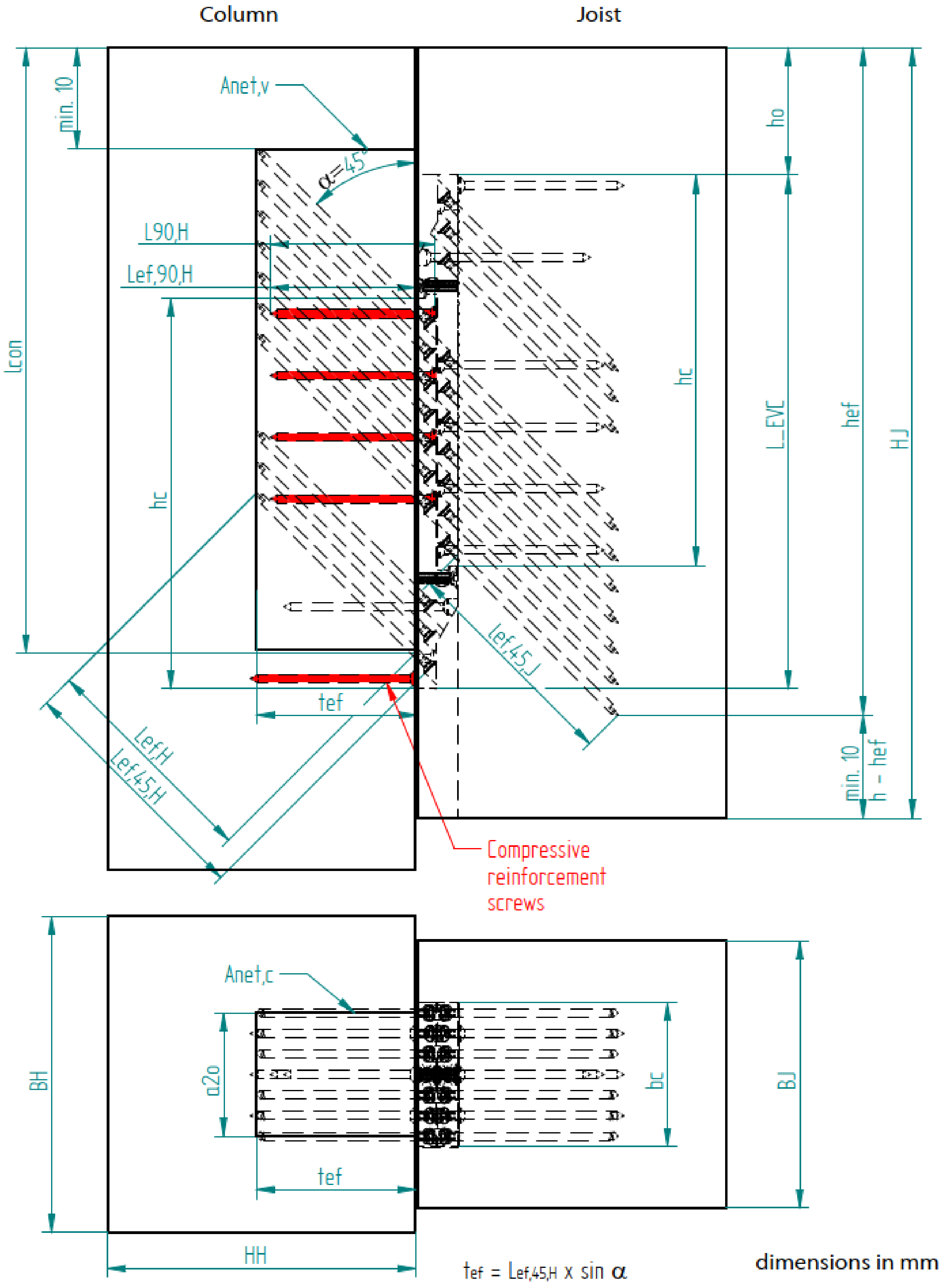
KNAPP® Connector EVO GRIP 200series - Connection types

stand rd type

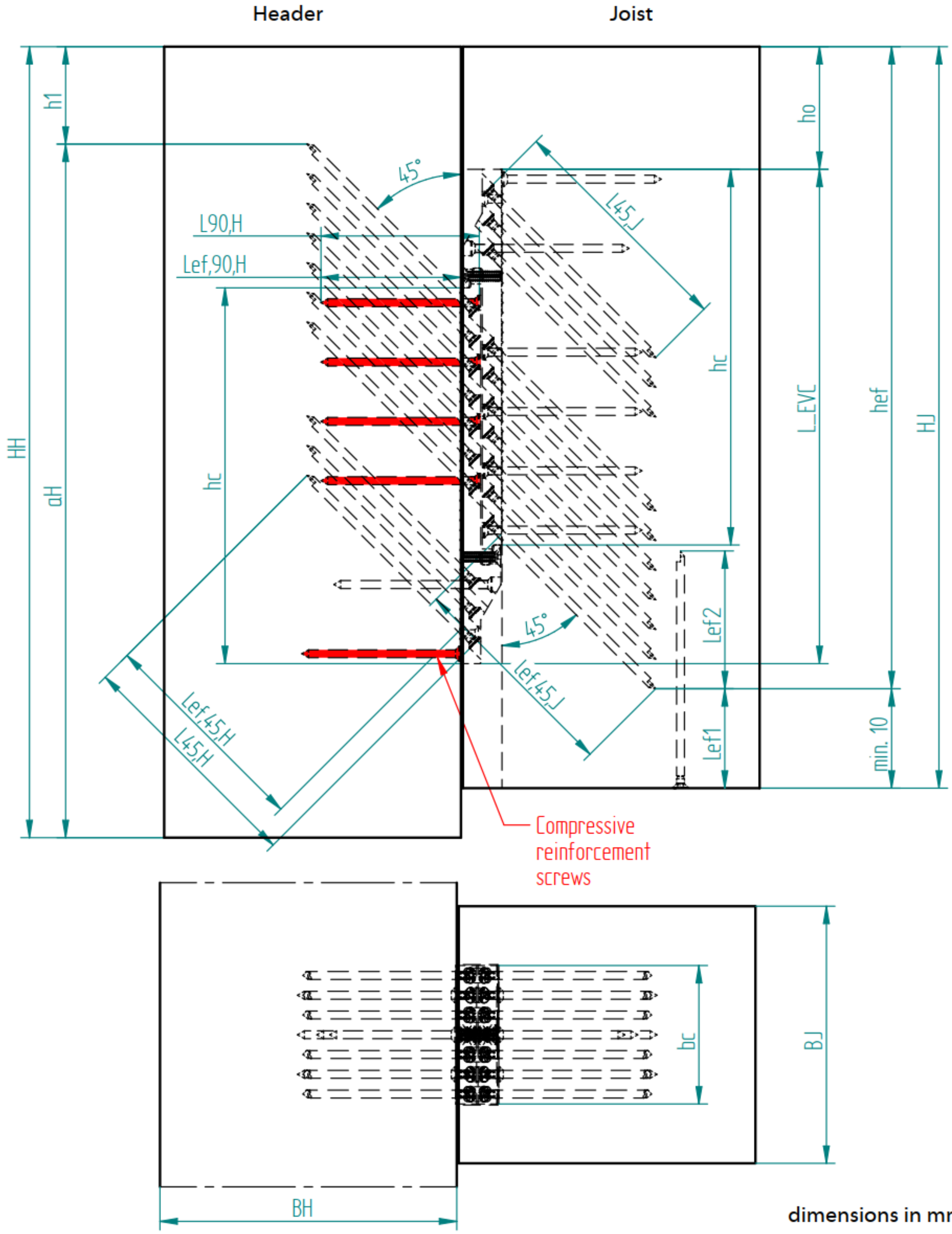


dimensions in mm

KNAPP® Connector EVO GRIP - Column/Joist Connection



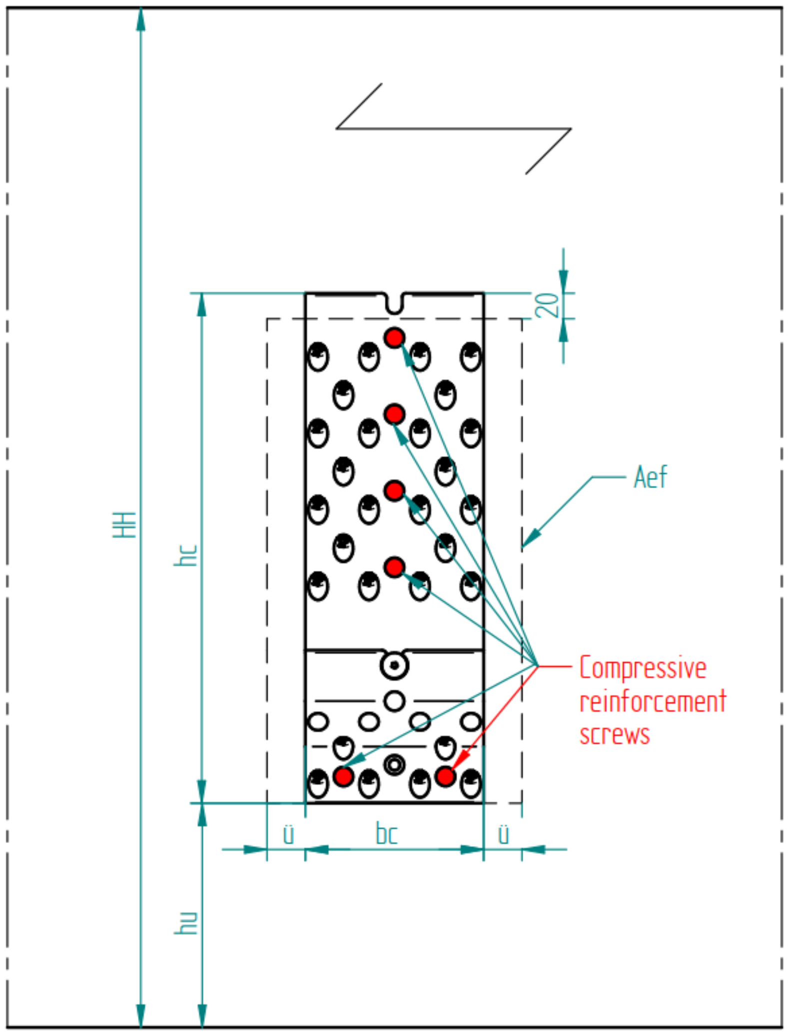
KNAPP® Connector EVO GRIP - Header/Joist Connection



dimensions in mm

KNAPP® Connector EVO GRIP - Header Connection

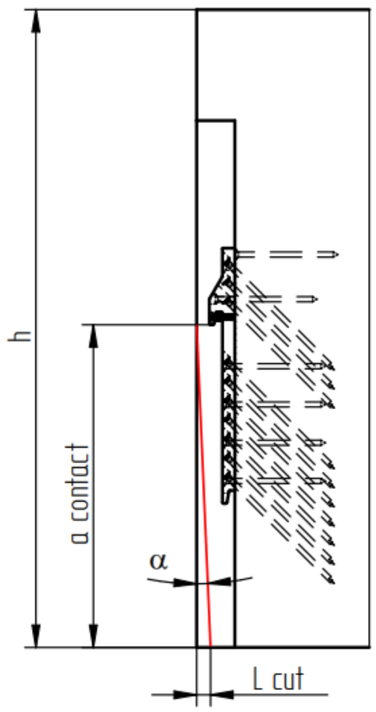
Header connection:
Aef: Effective contact area perp. to grain



dimensions in mm

KNAPP® Connector EVO GRIP - Rotation of the secondary member's cross section

To ensure constraint-free rotations of the end cross sections of secondary members, triangular cut-outs are required. The cut-out line starts at the position of the contact between the two EVO GRIP connector plates.



Triangular cut-out at the lower part of the secondary member end cross-section, see red line

The length of the cut-out at the bottom of the secondary beam parallel to grain is:

$$\ell_{cut} = \alpha \cdot a_{contact}$$

Where:

α maximum rotation of secondary beam end cross section in ultimate limit state
$a_{contact}$ distance of the contact between the two EVO GRIP connector plates from the lower end of cross-section

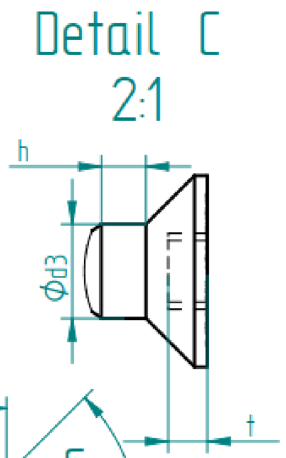
If the final deformation of the secondary beam is determined in ultimate limit state, the angle for simply supported beams under constant line load may be assumed as:

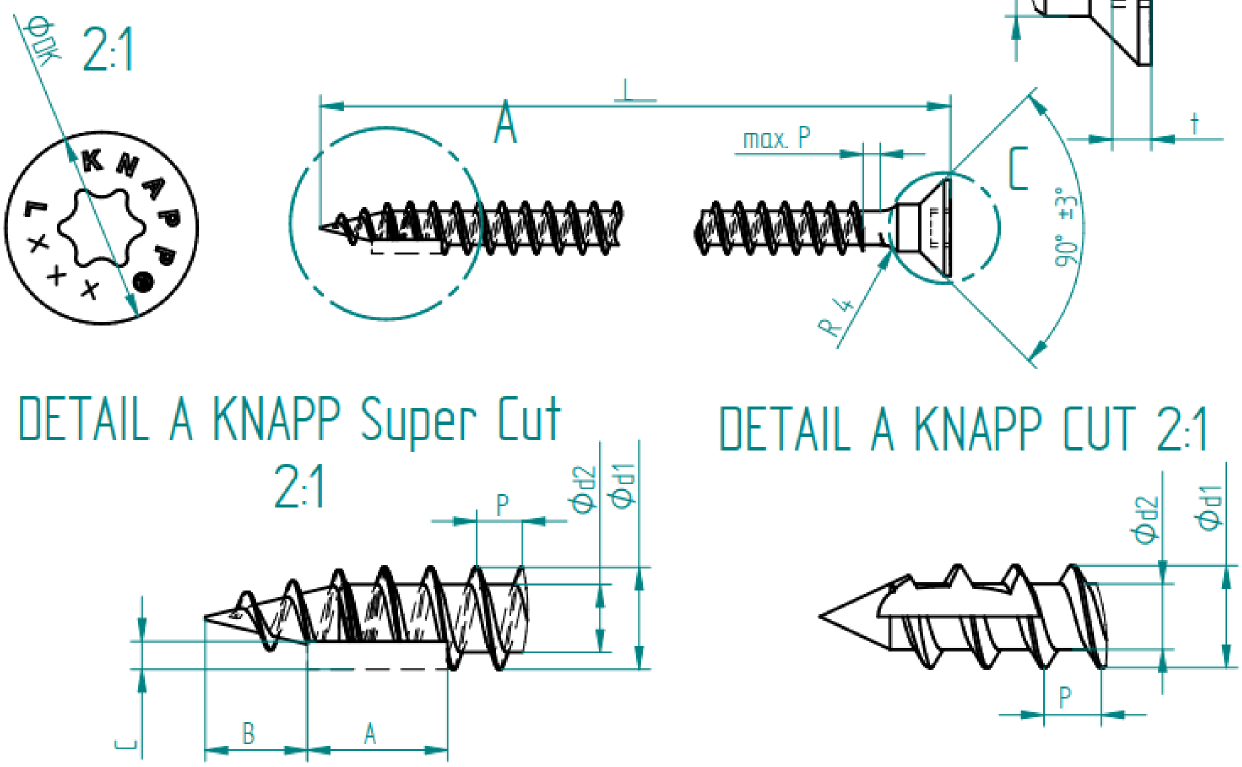
$$\alpha = \frac{16 \cdot w_{ULS}}{5 \cdot \ell}$$

Where:
w_{ULS} Final vertical deformation of simply supported beam under ultimate limit state loads
ℓ Secondary beam span

dimensions in mm

Wood screws for KNAPP® Connector EVO GRIP Connector



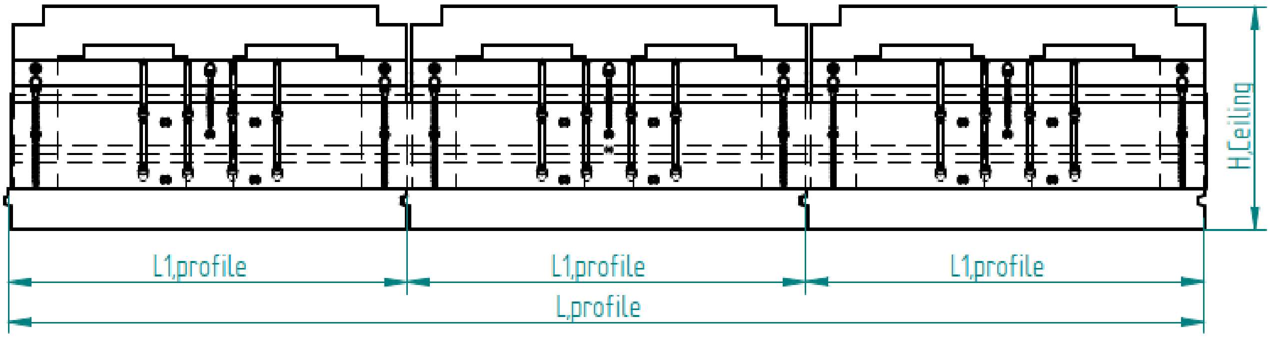


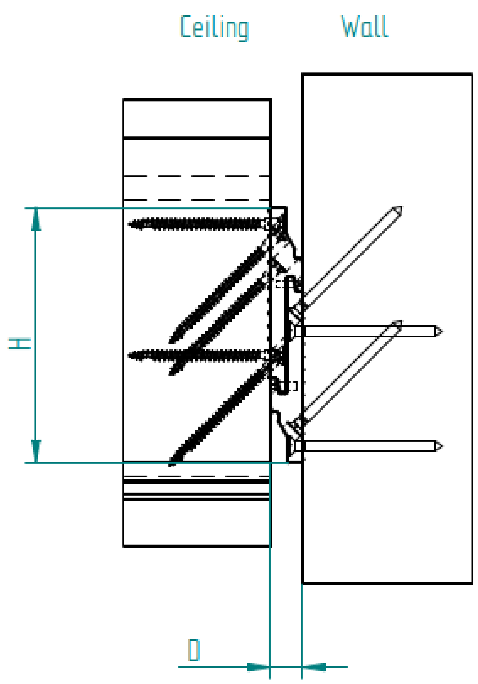
	KNAPP® Super Cut	KNAPP® Cut	ASSY PLUS	SCHMID RAPID
Modulus of elasticity	210 000 N/mm²	210 000 N/mm²	ASSY PLUS VG 8 x L mm acc. to ETA-11/0190	SCHMID RAPID VG 8 x L mm acc. to ETA-12/0373
Char. tensile strength $f_{tens,k}$	24 kN	20 kN		
Char. yield moment $M_{y,k}$	24 Nm	20 Nm		
Char. torque resistance $f_{tor,k}$	30 Nm	30 Nm		
Char. withdrawal strength $f_{ax,90°,k}$	13 N/mm²	11,6 N/mm²		
Head outer diameter D_K	15 mm	15 mm		
Thread outer diameter d_1	8 mm	8 mm		
Thread inner diameter d_2	5,3 mm	5,1 mm		
Head collar diameter d_3	7,4 mm	7,4 mm		
Head collar height h	3,5 mm	3,5 mm		
Torx height t	3 mm	3 mm		
Length L	80 - 240 mm	80 - 240 mm		
Screw tip dimension A	11 mm	-		
Screw tip dimension B	8 mm	-		
Screw tip dimension C	2 mm	-		

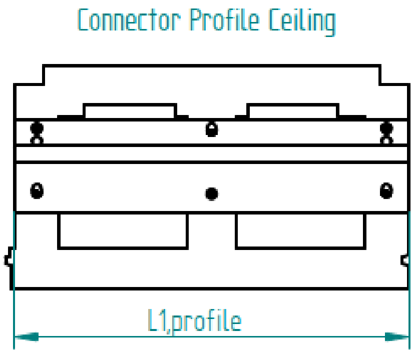
dimensions in mm

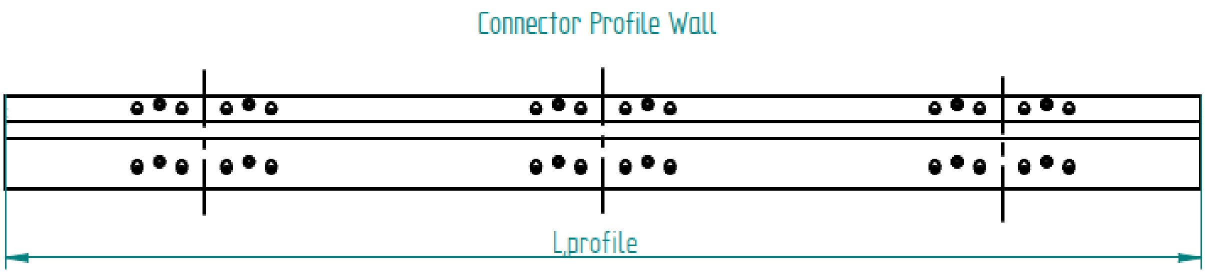
KNAPP® Clip Connector Profile EVO-GRIP 200, 360, 500

Connecting profile for Ceiling/Wood connection
Aluminum profile EVO GRIP 200, 360 and 500 series with a length L = 60 - 4000mm









dimensions in mm