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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-23/0302 of 2023/05/17

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 Solo MEGANT Connectors
Product family to which the above construction product belongs:	Three-dimensional nailing plate (face-fixed beam hangers to be used in timber to timber, timber to concrete or timber to steel connections)
Manufacturer:	Knapp GmbH Wassergasse 31 A-3324 Euratsfeld Tel. +43 7474 / 799 10 Internet www.knapp-verbinder.com
Manufacturing plant:	
This European Technical Assessment contains:	23 pages including 4 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

Knapp Solo MEGANT connectors are two-piece, face-fixed beam hangers to be used in timber-to-timber, timber-to-concrete or timber-to-steel connections. They are connected to construction members made of timber or wood-based products with screws according to EN 14592 or ETA-11/0190.

The connectors are made of aluminium grade EN-AW 6082 T651 to EN 573-3 and EN 755-2. Dimensions, hole positions and typical installations are shown in Annex A.

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

Knapp Solo MEGANT connectors are intended for use in making connections in load bearing timber structures, as a connection between a wood-based joist and a solid timber, wood-based, concrete or steel header, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Work Requirements 1 and 4 of the Regulation 305/2011 (EU) shall be fulfilled.

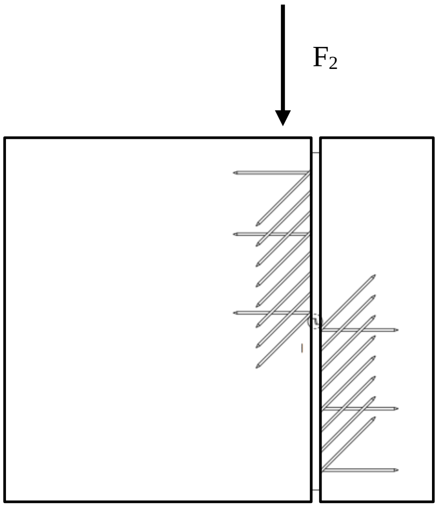
The Knapp Solo MEGANT connectors can be installed as connections between wood-based members such as:

- Structural solid timber according EN 14081,
- Glued laminated and glued solid timber according to EN 14080 or ETA,
- LVL according to EN 14374,
- Beam BauBuche GL75 according to ETA-14/0354,
- Cross laminated timber.

However, the calculation methods are only allowed for a characteristic wood density of up to 730 kg/m^3. 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 Knapp connectors. The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code.

It is assumed that the force acting on the connection is F_2. The force F_2 shall act in the middle of the connector in the direction of insertion. It is assumed that the force F_2 is acting right at the end of the joist.



Force direction for Solo MEGANT connectors

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

The Knapp connectors are intended for use for connections subject to static or quasi static loading.

The Knapp connectors are for use in timber structures subject to the dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1:2010, (Eurocode 5).

The scope of the connectors 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

Assumed working life

The assumed intended working life of the connectors for the intended use is 50 years, provided that they are subject to appropriate use and maintenance.

The information on the working life should not be regarded as a guarantee provided by the manufacturer or ETA Danmark. An “assumed intended working life” means that it is expected that, when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

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	See Annex B
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
Identification	See Annex A

*) 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 connections with metal fasteners, the steel plates, and the timber members.

In the case of timber failure or failure of the metal fasteners, the design values shall be calculated according to EN 1995-1-1 by dividing the characteristic values of the load-carrying capacities by different partial factors for the strength properties, and in addition multiplied with the coefficient k_{mod}.

Thus, the characteristic values of the load–carrying capacity are determined also for timber failure $F_{Rk,H}$ (obtaining the withdrawal capacity of the screws) as well as for screw tensile failure $F_{Rk,S}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

In the case of aluminium failure, the design value shall be calculated according to EN 1993-1-1 by reducing the characteristic values of the load-carrying capacity with different partial factors.

The design value of the load-carrying capacity is the smaller value of all load-carrying capacities:

$$F_{Rd} = \min\left\{\frac{k_{mod} \cdot F_{Rk,T}}{\gamma_{M,T}}; \frac{F_{Rk,S}}{\gamma_{Mi,S}}\right\}$$

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

3.5 Mechanical resistance and stability

See annex B for characteristic load-carrying capacities of the Knapp connectors.

The characteristic capacities of the Knapp connectors are determined by calculation as described in 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 Annex A:

Screws in accordance with ETA-11/0190 based on the relevant approval conditions

In the formulas in Annex B the capacities for screws calculated from the formulas in ETA-11/0190 are used when calculating the axial fastener load-carrying-capacity, $F_{ax,Rk}$.

No performance has been assessed 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.

See annex B for the joint's stiffness properties - to be used for the analysis of the ultimate or serviceability limit state.

3.6 Aspects related to the performance of the product

In accordance with EAD 130186-00-0603 the aluminium Knapp connectors are produced from aluminium alloy EN AW-6082 T651 according to EN 573-3 and EN 755-2.

3.7 General aspects related to the use of the product

Knapp 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.

The following provisions concerning product performance apply:

Knapp Solo MEGANT connector joints

A Knapp connector joint is assessed for its intended use provided:

Header – support conditions

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

  If the header or column carries joists only on one side the eccentricity moment from the joists M_{ec} = R_{joist} (b_{header}/2) shall be considered for Knapp Solo MEGANT connectors at the strength verification of the header.
  R_{joist} Reaction force from the joists
  b_{header} Width of header

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

- Knapp Solo MEGANT connectors are fastened to wood-based joists, headers, or columns by screws.
- There shall be screws in all holes.
- The characteristic capacity of the Knapp connector joint is calculated according to the manufacturer's technical documentation dated 2022-10-09.

- The Knapp connector joint 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 Knapp Solo MEGANT connectors the gap between the surface of the connector plates and the timber surface shall be maximum 1 mm.
- The end grain of the joist and the surface of the header or column shall have a plane surface against the whole Knapp connector.
- The depth of the joist shall be so large that the bottom of the joist is at least 10 mm below the lower screw tip in the joist.
- Only screws in accordance with ETA-11/0190 shall be used and shall have a diameter and head shape which fits the holes of the Knapp Solo MEGANT connectors.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/638/EC of the European Commission1, 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 foreseen in the applicable EAD

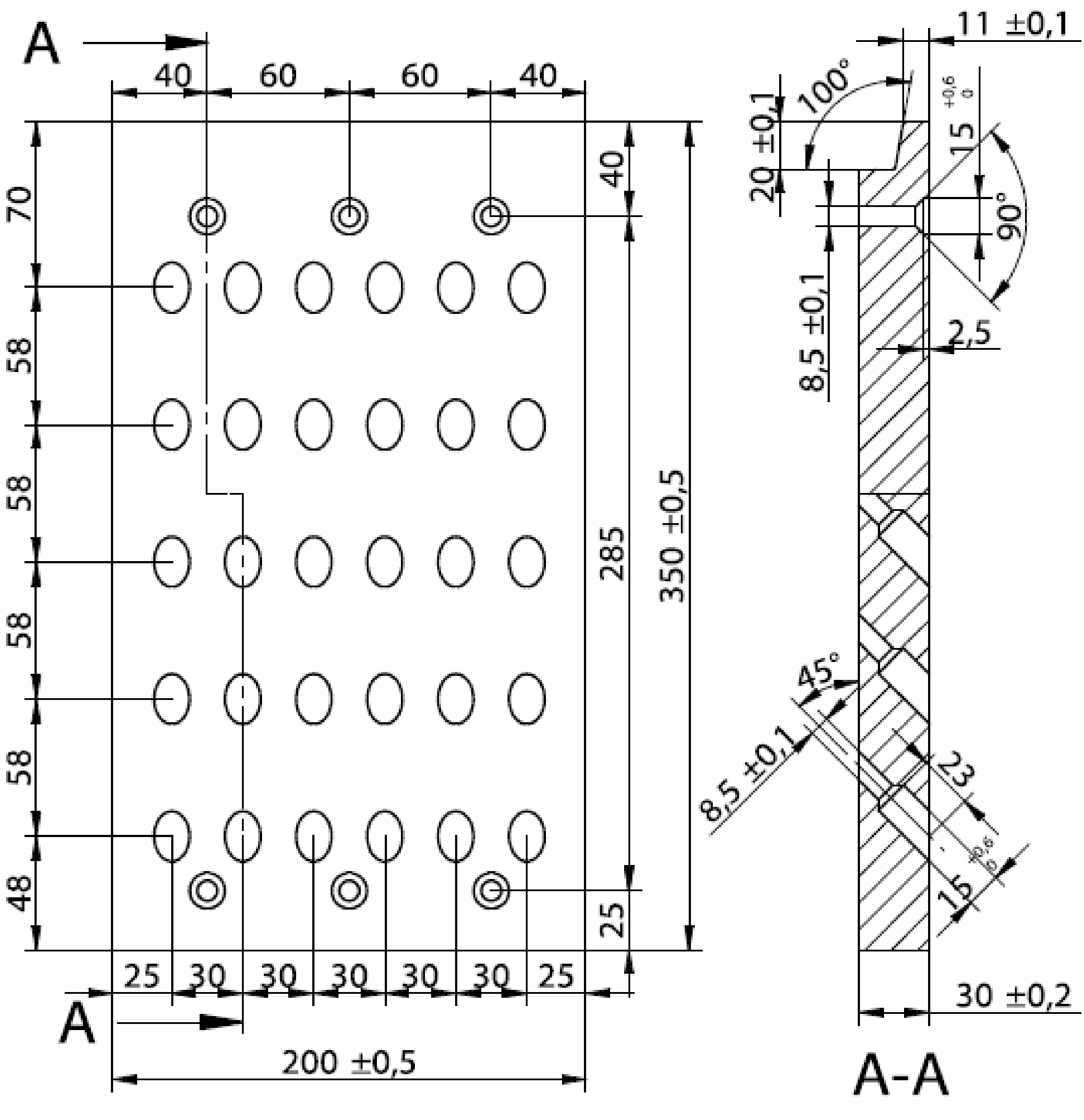
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2023-05-17 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions

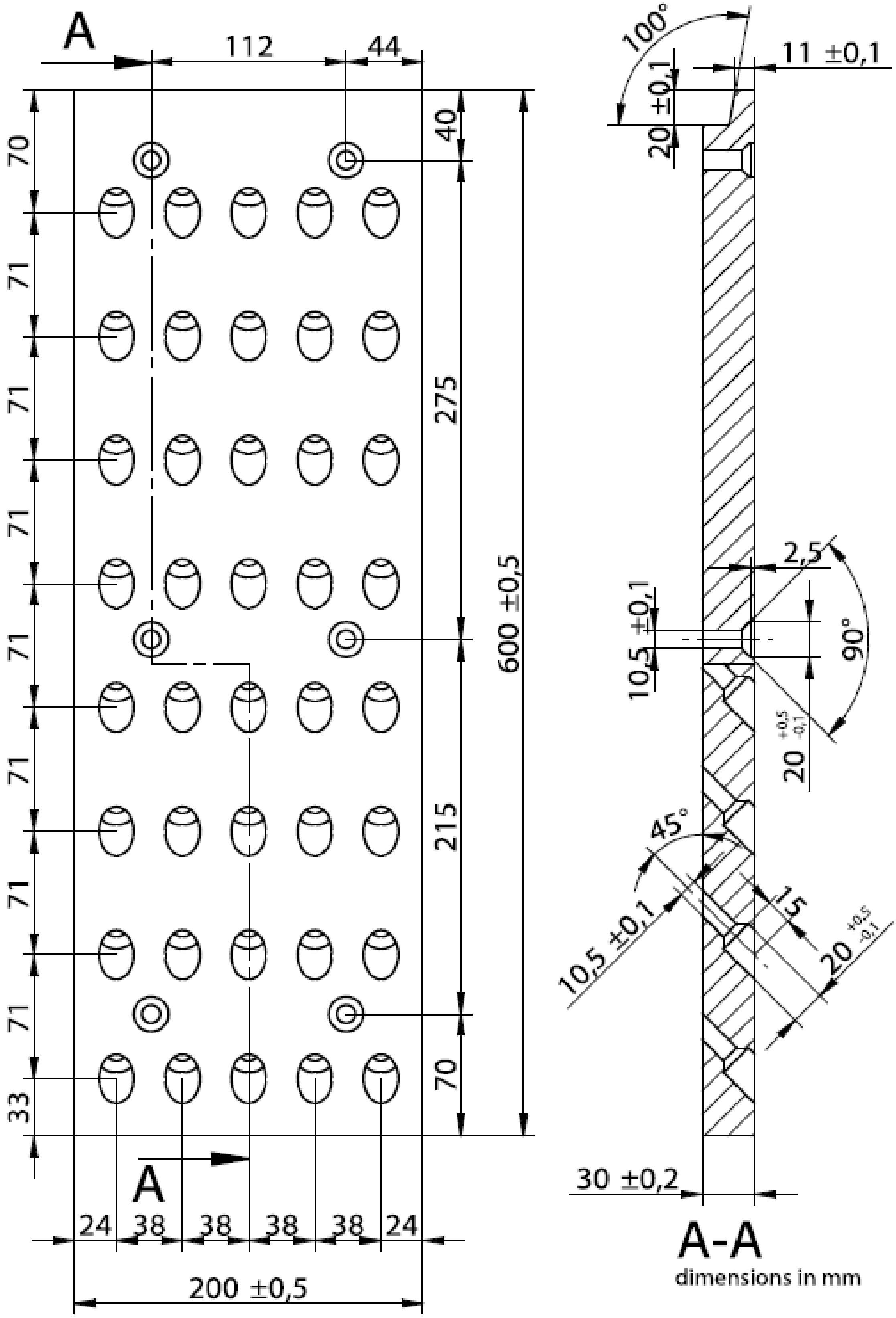
KNAPP® Clip Connector Solo MEGANT
Connecting plate 200x350x30 mm for timber connection
30.0 mm thick aluminum plate, grade EN-AW 6082 T651 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 295 MPa; minimum 0,2 yield strength R_e of 240 MPa;
minimum ultimate strain A_{50} of 7%



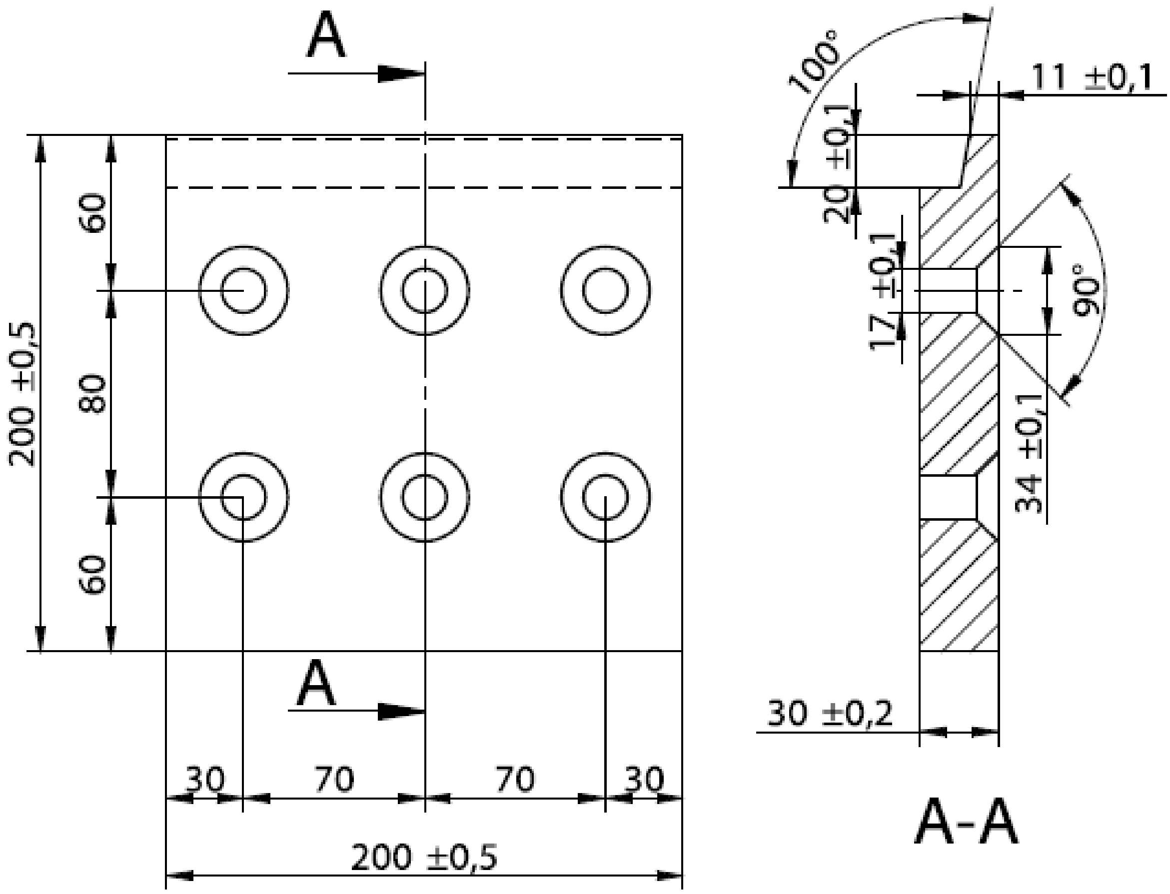
dimensions in mm

KNAPP® Clip Connector Solo MEGANT
Connecting plate 200x600x30 mm for timber connection

30.0 mm thick aluminum plate, grade EN-AW 6082 T651 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 295 MPa; minimum 0,2 yield strength R_e of 240 MPa;
minimum ultimate strain A_{50} of 7%

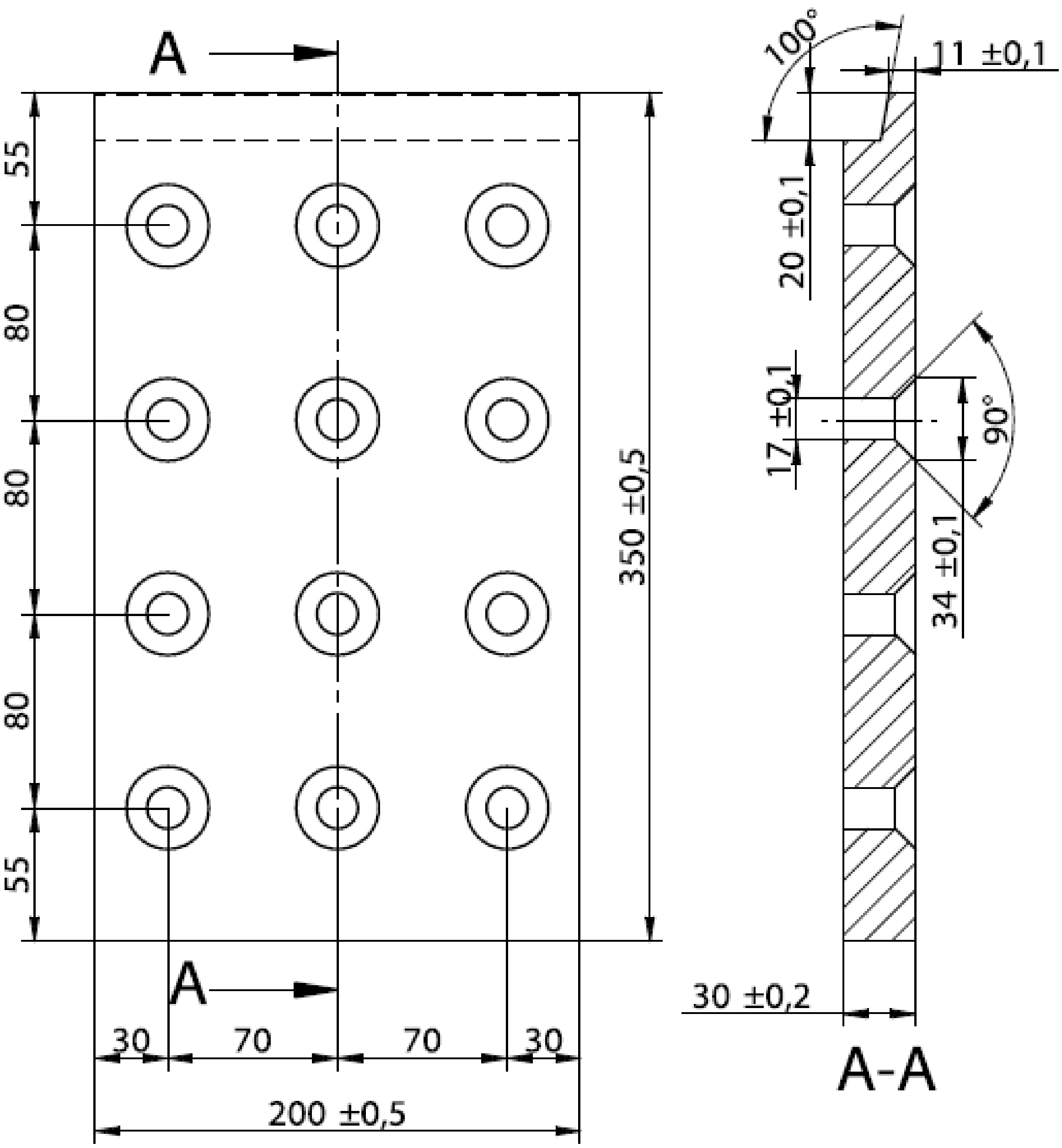


KNAPP® Clip Connector Solo MEGANT
Connecting plate 200x200x30 mm for steel connection
30.0 mm thick aluminum plate, grade EN-AW 6082 T651 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 295 MPa; minimum 0,2 yield strength R_e of 240 MPa;
minimum ultimate strain A_{50} of 7%



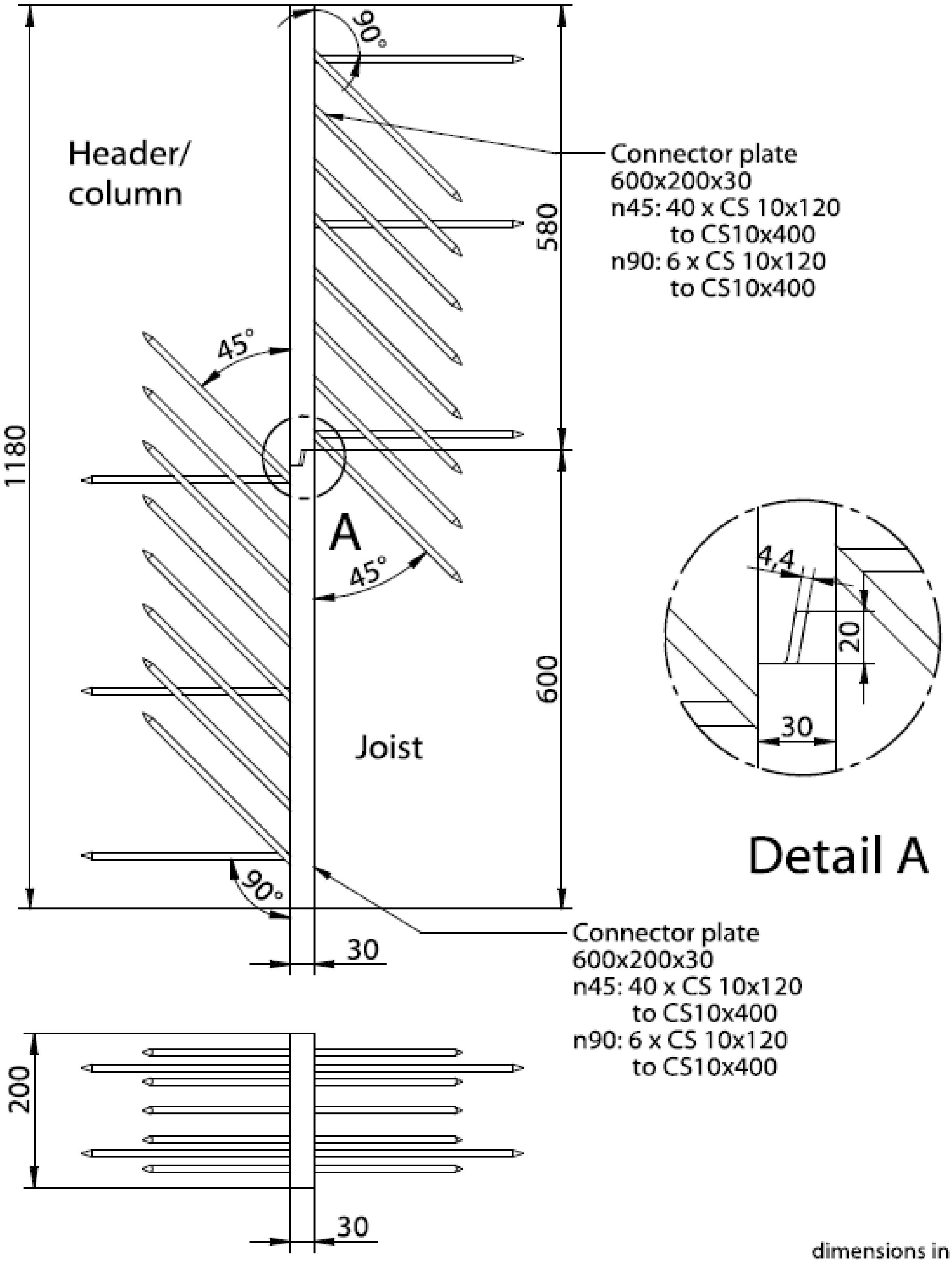
dimensions in mm

KNAPP® Clip Connector Solo MEGANT
Connecting plate 200x350x30 mm for steel connection
30.0 mm thick aluminum plate, grade EN-AW 6082 T651 to EN 573-3 and EN 755-2
minimum tensile strength f_u of 295 MPa; minimum 0,2 yield strength R_e of 240 MPa;
minimum ultimate strain A_{50} of 7%



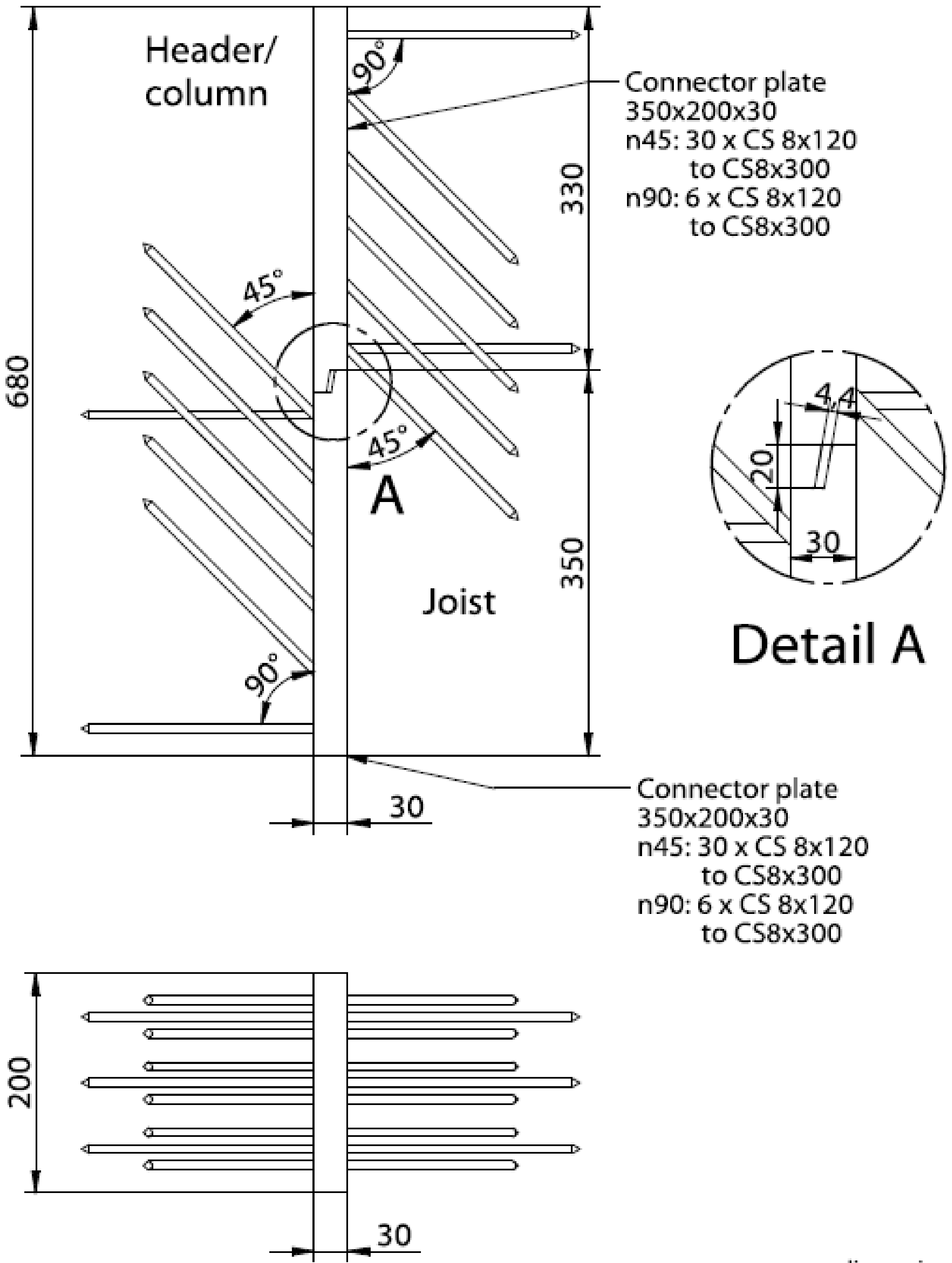
dimensions in mm

Solo MEGANT 1180x200x30
Timber-timber connection



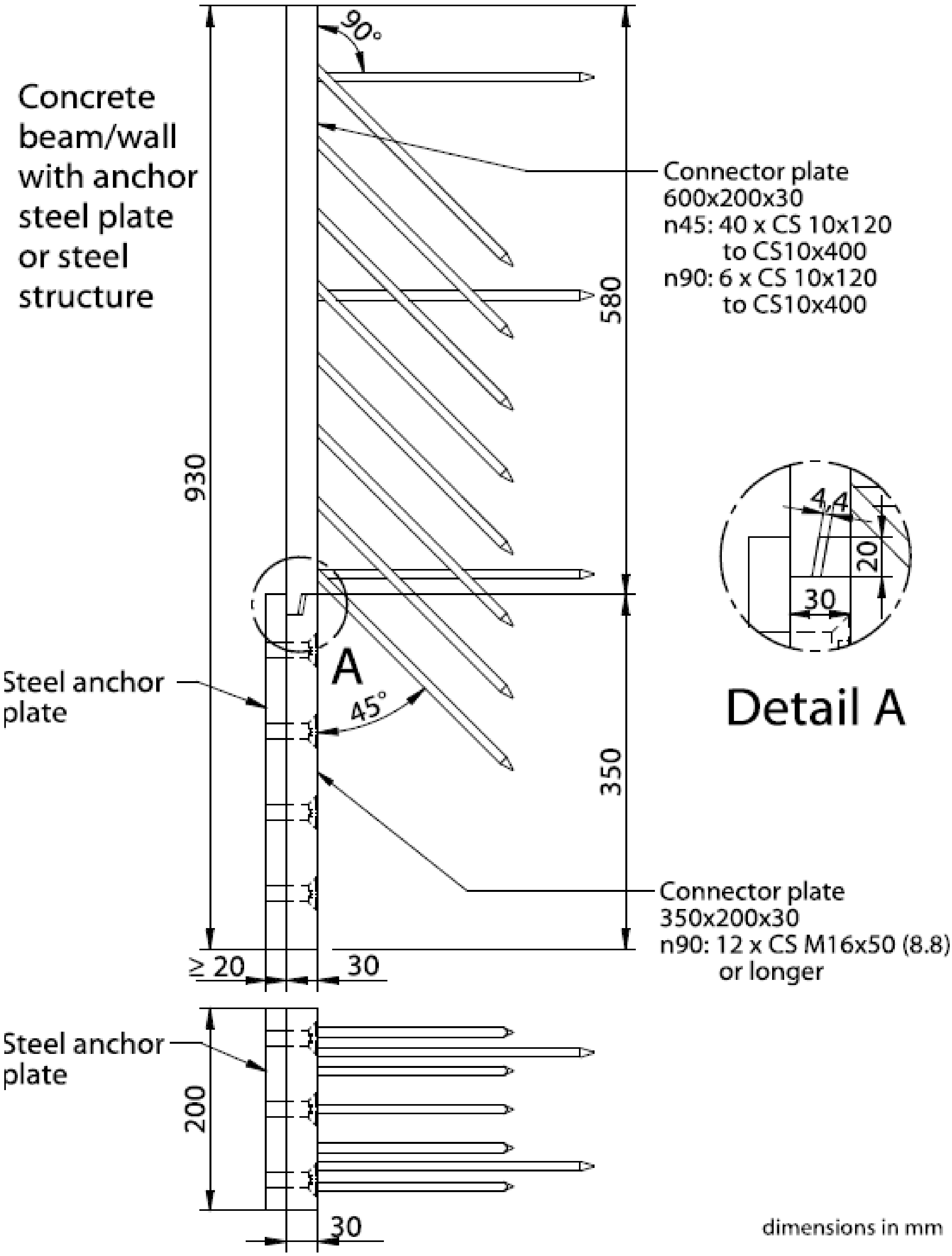
dimensions in mm

Solo MEGANT 680x200x30
Timber-timber connection

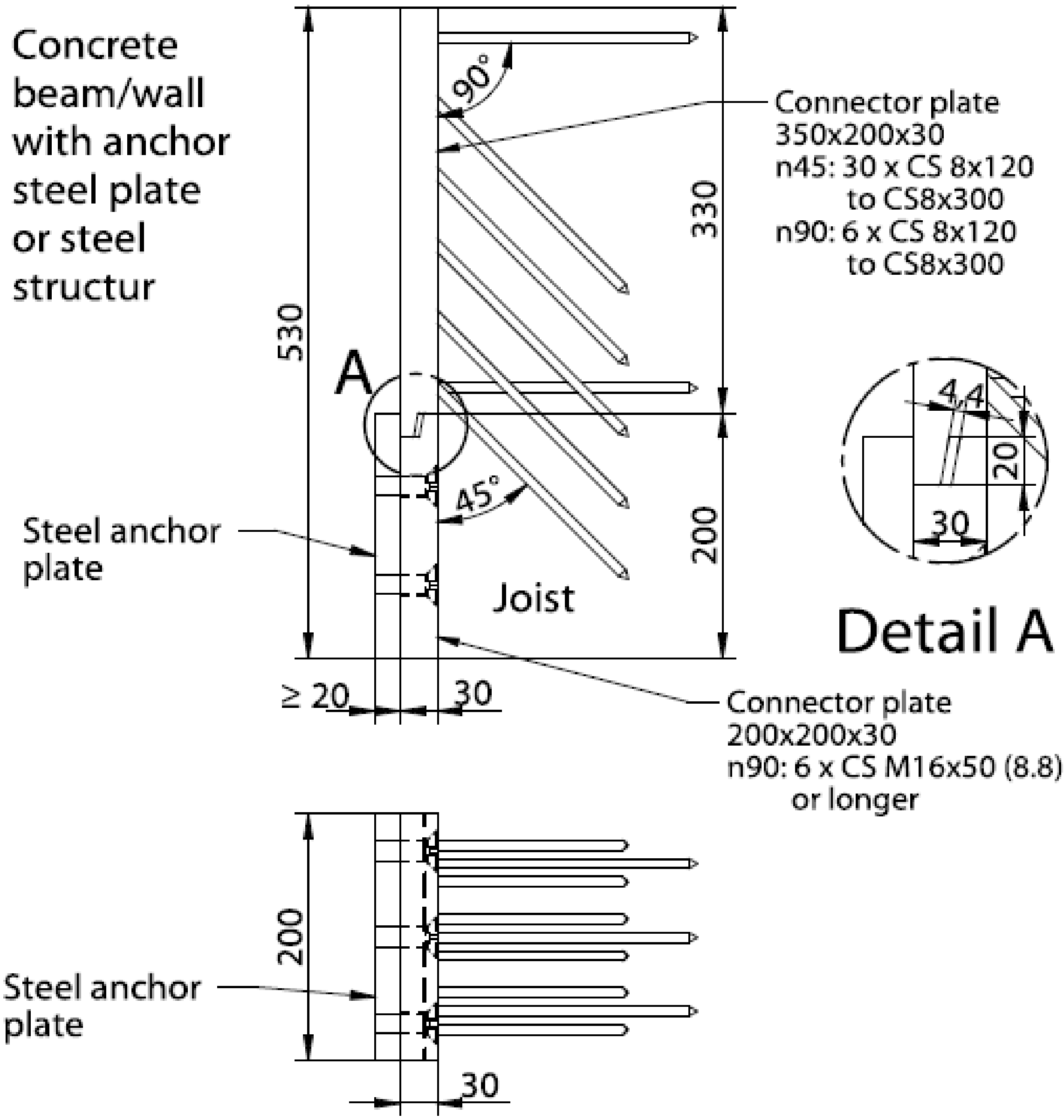


dimensions in mm

Solo MEGANT 930x200x30
Timber-steel or concrete connection

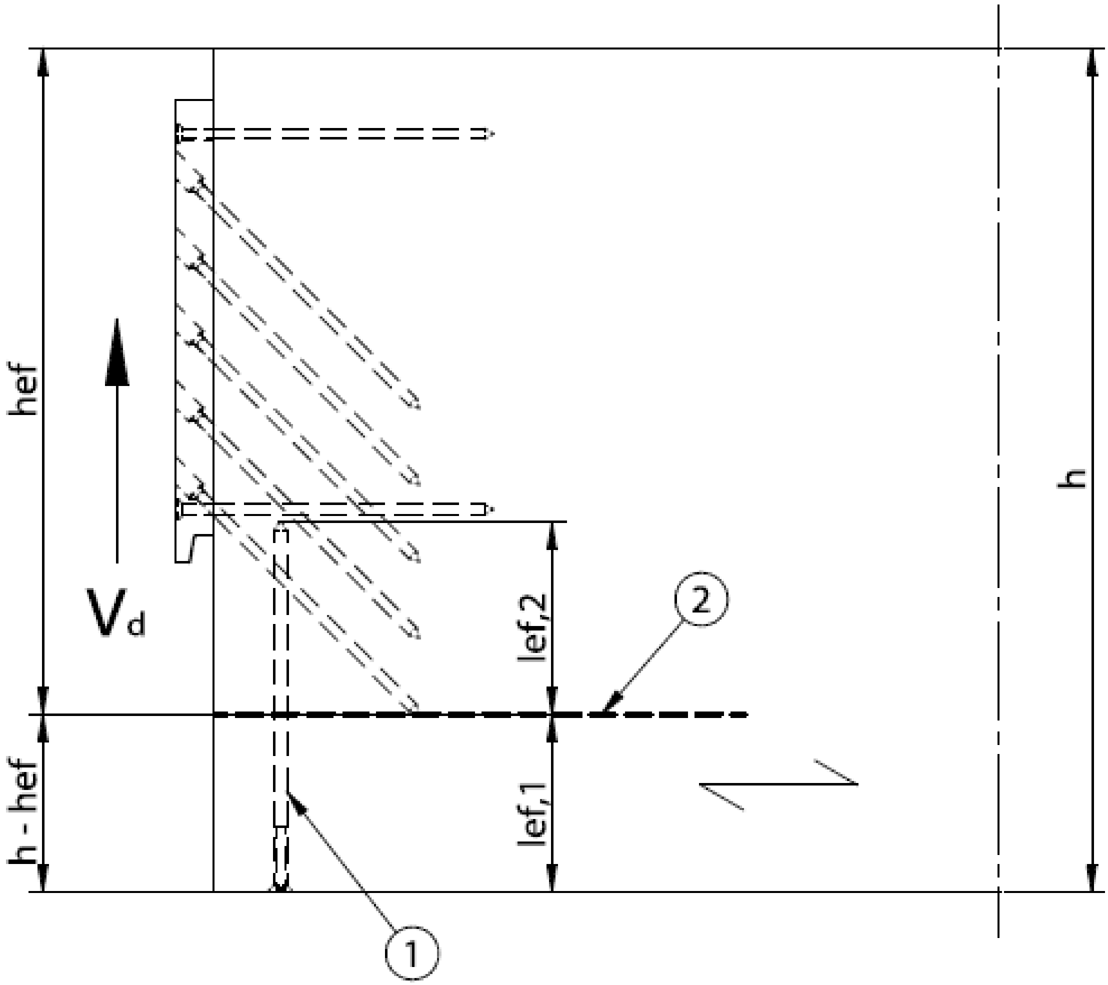


Solo MEGANT 530x200x30
Timber-steel or concrete connection



dimensions in mm

Tension perp. to grain in secondary beam

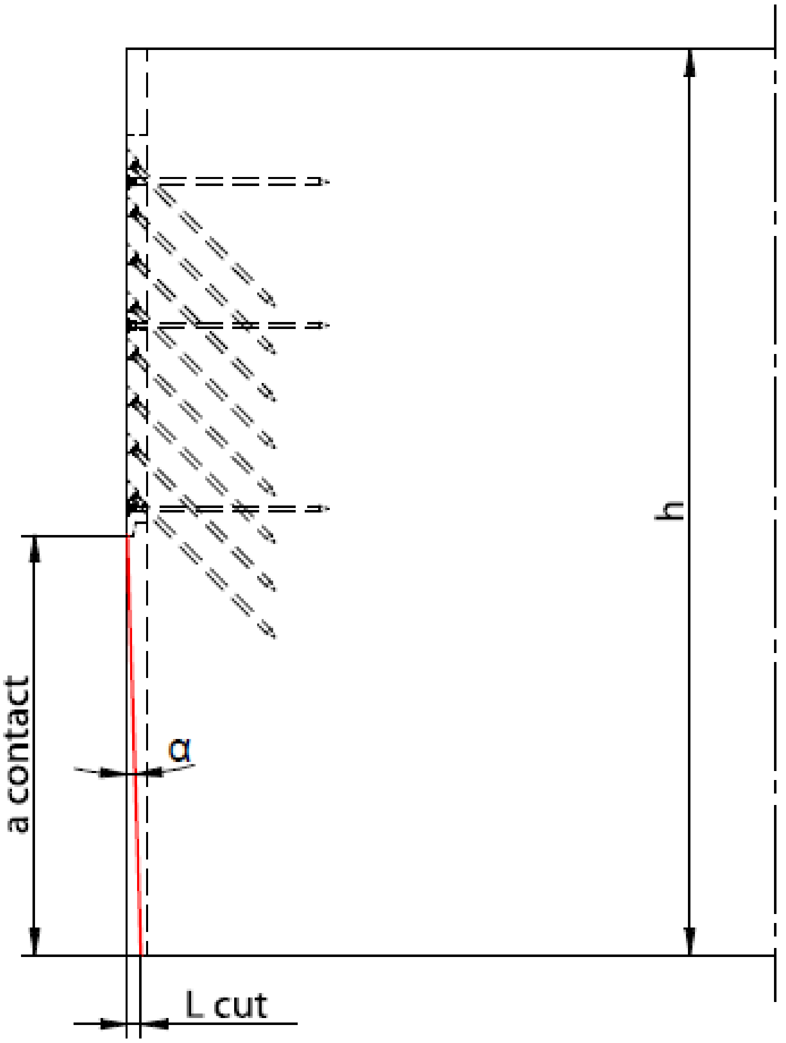


① Reinforcing screw

② Expected crack plane

dimensions in mm

Rotation of the secondary member´s end cross section



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

dimensions in mm

Annex B
Characteristic values of load-carrying-capacities and stiffness – Solo MEGANT Connector

The forces are assumed to act in the middle of the joist.

Only a full fastener pattern is specified, where there are screws in all the holes of the joist and header connection.

B.1 Timber-to-timber connections with screws - torsionally restrained header beam

Loading in the direction of insertion

Solo MEGANT connector plate fixed to a timber main beam or column:

$$F_{2,Rk} = \min \begin{cases} 0,8 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ F_{2,alu,Rk} \\ 1,25 \cdot A_{c,90,ef} \cdot f_{c,90,k} \cdot k_{c,90} \end{cases} \quad (B.1)$$

$$K_{2,ser} = n_{45} \cdot 25 \cdot d \cdot \ell_{ef} \text{ for softwood members} \quad (B.2)$$

$$K_{2,ser} = n_{45} \cdot 30 \cdot d \cdot \ell_{ef} \text{ for hardwood members} \quad (B.3)$$

Solo MEGANT connector plate fixed to a timber joist:

$$F_{2,Rk} = \min \begin{cases} 0,8 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ F_{2,alu,Rk} \end{cases} \quad (B.4)$$

$$K_{2,ser} = n_{45} \cdot 25 \cdot d \cdot \ell_{ef} \text{ for softwood members} \quad (B.5)$$

$$K_{2,ser} = n_{45} \cdot 30 \cdot d \cdot \ell_{ef} \text{ for hardwood members} \quad (B.6)$$

Where:

n_{45} Number of screws arranged under 45°

$F_{ax,\alpha,Rk}$ Characteristic withdrawal or tensile capacity of an inclined Würth ASSY VG 4 CS screw according to ETA-11/0190, $f_{tens,k}$ = 22 kN for a 8 mm screw, $f_{tens,k}$ = 33 kN for a 10 mm screw

$F_{2,alu,Rk}$ Characteristic compressive capacity of the connector plate in the net cross-section, see Table B.1

$A_{c,90,ef}$ Effective compressive area perp. to grain for main beams or columns, see Table B.1

$f_{c,90,k}$ Characteristic compressive strength perp. to grain of main beam or column, for solid or glulam softwood $f_{c,90,k} = 0,007 \cdot \rho_k$

ρ_k Characteristic density in kg/m³

$k_{c,90}$ Coefficient according to EN 1995-1-1, 6.1.5 (4)

$\ell_{ef,J}$ Penetration length of the threaded part of a joist screw

$\ell_{ef,H}$ Penetration length of the threaded part of a header or column screw

d Outer thread diameter of a screw

Table B.1: Knapp Solo MEGANT connectors; dimensions and numbers of screws

Knapp Solo MEGANT connector	Width b [mm]	Depth h [mm]	Screw diameter [mm]	Number of screws				$F_{2,alu,Rk}$ [kN]	$A_{c,90,ef}$ [mm²]	
				Header		Joist			Connection to	
				n_{90}	n_{45}	n_{90}	n_{45}		Header	Column
200x350x30	200	350	8.0	6	30	6	30	870	85800	78000
200x600x30	200	600	10.0	6	40	6	40	950	150800	128000

Table B.2: Characteristic load-carrying capacity $F_{2,Rk}$ in kN of Solo MEGANT connector plates fixed to the end grain of timber joists. ℓ is the length and ℓ_{ef} is the threaded penetration length of the ASSY PLUS VG 4 CS screws according to ETA-11/0190.

Material			Softwood		Softwood Glulam								LVL		hardwood		Beech LVL
ρ_k [kg/m³]			350	380	365	385	390	400	405	425	430	440	480	500	530	550	730
ℓ	ℓ_{ef}																
120	97	200x350x30	205	219	212	221	223	228	230	239	242	246	264	273	286	294	528
140	117		247	264	256	267	269	275	278	289	291	297	318	329	344	355	528
160	137		289	309	299	312	316	322	325	338	341	347	373	385	403	415	528
180	157		332	354	343	358	362	369	373	387	391	398	427	441	462	476	528
200	177		374	399	387	403	408	416	420	437	441	449	481	497	521	528	528
220	197		416	444	430	449	454	463	468	486	491	500	528	528	528	528	528
240	217		458	489	474	495	500	510	515	528	528	528	528	528	528	528	528
260	237		501	528	518	528	528	528	528	528	528	528	528	528	528	528	528
280	257		528	528	528	528	528	528	528	528	528	528	528	528	528	528	528
300	272		528	528	528	528	528	528	528	528	528	528	528	528	528	528	528
120	93	200x600x30	327	350	339	353	357	364	368	382	386	393	421	435	456	470	950
140	113		398	425	411	429	434	443	447	465	469	478	512	529	554	571	950
160	133		468	500	484	505	510	521	526	547	552	562	603	623	652	672	950
180	153		539	575	557	581	587	599	605	629	635	647	693	716	751	773	950
200	173		609	650	630	657	664	678	684	711	718	731	784	810	849	874	950
220	193		679	726	703	733	741	756	764	794	801	816	875	904	947	950	950
240	213		750	801	775	809	818	834	843	876	884	900	950	950	950	950	950
260	233		820	876	848	885	894	913	922	950	950	950	950	950	950	950	950
280	253		891	950	921	950	950	950	950	950	950	950	950	950	950	950	950
300	272		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950
320	292		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950
340	312		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950
360	332		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950
380	352		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950
400	372		950	950	950	950	950	950	950	950	950	950	950	950	950	950	950

Table B.3: Characteristic load-carrying capacity $F_{2,Rk}$ in kN of Solo MEGANT connector plates fixed to the side grain of timber headers. ℓ is the length and ℓ_{ef} is the threaded penetration length of the ASSY PLUS VG 4 CS screws according to ETA-11/0190.

Material			Softwood		Softwood glulam								LVL		Hardwood		BauBuche
ρ_k [kg/m³]			350	380	365	385	390	400	405	425	430	440	480	500	530	550	730
$f_{c,90,k}$ [N/mm²]			2,45	2,66	2,56	2,7	2,73	2,8	2,84	2,98	3,01	3,08	7,9	7,9	5,3	5,5	12,3
ℓ	ℓ_{ef}	$k_{c,90}$	1,5	1,5	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,0	1,0	1,0	1,0	1,0
120	97	Plate 200x350x30	205	219	212	221	223	228	230	239	242	246	264	273	286	294	528
140	117		247	264	256	267	269	275	278	289	291	297	318	329	344	355	528
160	137		289	309	299	312	316	322	325	338	341	347	373	385	403	415	528
180	157		332	354	343	358	362	369	373	387	391	398	427	441	462	476	528
200	177		374	399	387	403	408	416	420	437	441	449	481	497	521	528	528
220	197		394	428	430	449	454	463	468	486	491	500	528	528	528	528	528
240	217		394	428	474	495	500	510	515	528	528	528	528	528	528	528	528
260	237		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
280	257		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
300	272		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
120	93	Plate 200x600x30	327	350	339	353	357	364	368	382	386	393	421	435	456	470	950
140	113		398	425	411	429	434	443	447	465	469	478	512	529	554	571	950
160	133		468	500	484	505	510	521	526	547	552	562	603	623	652	672	950
180	153		539	575	557	581	587	599	605	629	635	647	693	716	751	773	950
200	173		609	650	630	657	664	678	684	711	718	731	784	810	849	874	950
220	193		679	726	703	733	741	756	764	794	801	816	875	904	947	950	950
240	213		693	752	775	809	818	834	843	876	884	900	950	950	950	950	950
260	233		693	752	843	885	894	913	922	950	950	950	950	950	950	950	950
280	253		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
300	272		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
320	292		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
340	312		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
360	332		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
380	352		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
400	372		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950

Table B.4: Characteristic load-carrying capacity $F_{2,Rk}$ in kN of Solo MEGANT connector plates fixed to the side grain of timber columns. ℓ is the length and ℓ_{ef} is the threaded penetration length of the ASSY PLUS VG 4 CS screws according to ETA-11/0190.

Material			Softwood		Softwood glulam								LVL		Hardwood		BauBuche
ρ_k [kg/m³]			350	380	365	385	390	400	405	425	430	440	480	500	530	550	730
$f_{c,90,k}$ [N/mm²]			2,45	2,66	2,56	2,7	2,73	2,8	2,84	2,98	3,01	3,08	7,9	7,9	5,3	5,5	12,3
ℓ	ℓ_{ef}	$k_{c,90}$	1,5	1,5	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,0	1,0	1,0	1,0	1,0
120	97	Plate 200x350x30	205	219	212	221	223	228	230	239	242	246	264	273	286	294	528
140	117		247	264	256	267	269	275	278	289	291	297	318	329	344	355	528
160	137		289	309	299	312	316	322	325	338	341	347	373	385	403	415	528
180	157		332	354	343	358	362	369	373	387	391	398	427	441	462	476	528
200	177		374	399	387	403	408	416	420	437	441	449	481	497	521	528	528
220	197		394	428	430	449	454	463	468	486	491	500	528	528	528	528	528
240	217		394	428	474	495	500	510	515	528	528	528	528	528	528	528	528
260	237		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
280	257		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
300	272		394	428	480	506	512	526	528	528	528	528	528	528	528	528	528
120	93	Plate 200x600x30	327	350	339	353	357	364	368	382	386	393	421	435	456	470	950
140	113		398	425	411	429	434	443	447	465	469	478	512	529	554	571	950
160	133		468	500	484	505	510	521	526	547	552	562	603	623	652	672	950
180	153		539	575	557	581	587	599	605	629	635	647	693	716	751	773	950
200	173		609	650	630	657	664	678	684	711	718	731	784	810	849	874	950
220	193		679	726	703	733	741	756	764	794	801	816	875	904	947	950	950
240	213		693	752	775	809	818	834	843	876	884	900	950	950	950	950	950
260	233		693	752	843	885	894	913	922	950	950	950	950	950	950	950	950
280	253		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
300	272		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
320	292		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
340	312		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
360	332		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
380	352		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950
400	372		693	752	843	889	901	924	935	950	950	950	950	950	950	950	950

B.2 Timber-to-concrete or timber-to-steel connections with screws and bolts or metal anchors - torsionally restrained header beam

Loading in the direction of insertion

$$F_{2,Rk} = \min\begin{cases} F_{2,J,Rk} \\ F_{2,H,Rk} \end{cases} \qquad \text{(B.7)}$$

$$F_{2,J,Rk} = \min\begin{cases} 0,8 \cdot n_{45} \cdot F_{ax,\alpha,Rk} \\ F_{2,alu,Rk} \end{cases} \qquad \text{(B.8)}$$

$$F_{2,H,Rk} = n_{90,H} \cdot F_{la,H,Rk} \qquad \text{(B.9)}$$

Where:

n_{45} Number of joist screws arranged under 45°

$F_{ax,\alpha,Rk}$ Characteristic withdrawal or tensile capacity of an inclined Würth ASSY VG 4 CS screw according to ETA-11/0190

$F_{2,alu,Rk}$ Characteristic compressive capacity of the connector plate in the net cross-section, see Table B.1

$n_{90,H}$ Number of bolts or metal anchors perpendicular to the Solo MEGANT header plate, $n_{90,H} \geq 2$

$F_{la,H,Rk}$ Characteristic lateral capacity of a header bolt or metal anchor

Annex C

Tension perp. to grain in secondary members

Solo MEGANT connector plate at the end grain of a secondary member may cause perpendicular to grain tensile stresses like in a notched beam support, see Figure D.1. The secondary beam connection should therefore be designed as unreinforced or reinforced notched beam support.

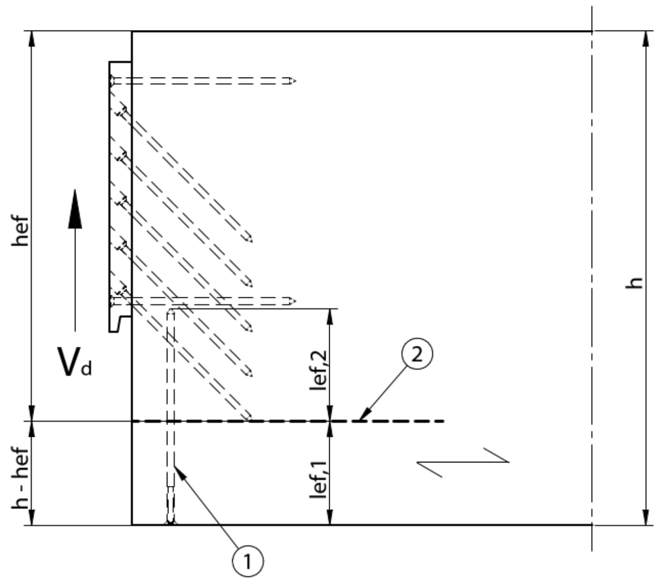


Figure D.1 Solo MEGANT connector plate at the end grain of a secondary member. (1) Reinforcing screw, (2) Expected crack plane

The axial capacity of a reinforcement of a notched beam support shall fulfil the following condition:

$$\frac{1{,}3 \cdot V_d \cdot \left[3 \cdot (1-\alpha)^2 - 2 \cdot (1-\alpha)^3\right]}{F_{ax,Rd}} \leq 1 \qquad \text{(D.1)}$$

Where:

V_d design value of the shear force

α $= h_e/h$

h = member depth

$F_{ax,Rd}$ $= \min\left\{f_{ax,d} \cdot d \cdot \ell_{ef}; F_{t,Rd}\right\}$

$f_{ax,d}$ design value of the axial withdrawal capacity of the threaded part of the screw

d outer thread diameter of the screw

ℓ_{ef} smaller value of the penetration depth below or above the potential crack, the total minimum penetration depth of the screw shall be $2 \cdot l_{ef}$

$F_{t,Rd}$ design value of the tensile resistance of the screws $= f_{tens,d}$

Only one screw in longitudinal direction of the secondary beam shall be considered.

Annex D

Rotation of the secondary member's end cross section

To ensure constraint-free rotations of the end cross sections of secondary members, triangular cut-outs are required, see Figure E.1. The cut-out line starts at the position of the contact between the two Solo MEGANT connector plates.

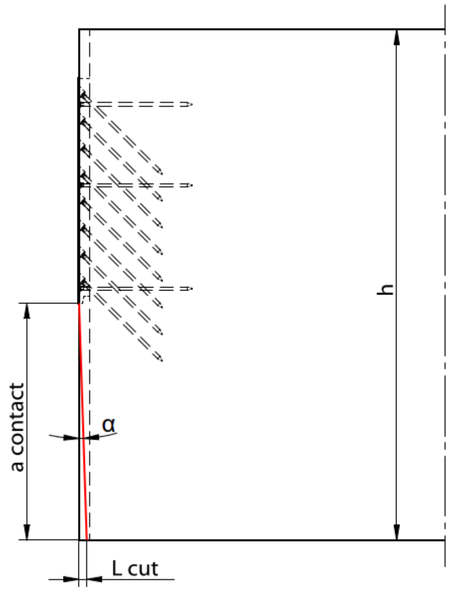


Figure 4: Triangular cut-out at the lower part of the secondary member end cross-section, see red line

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

$$\ell_{cut} = \alpha \cdot a_{contact} \tag{E.1}$$

Where:

α maximum rotation of secondary beam end cross section in ultimate limit state

$a_{contact}$ distance of the contact between the two Solo MEGANT 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 α for simply supported beams under constant line load may be assumed as:

$$\alpha = \frac{16 \cdot w_{ULS}}{5 \cdot \ell} \tag{E.2}$$

Where:

w_{ULS} Final vertical deformation of simply supported beam under ultimate limit state loads

ℓ Secondary beam span