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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-15/0761 of 17/05/2016

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:	E.u.r.o.Tec Magnus 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 connections)
Manufacturer:	E.u.r.o.Tec GmbH Unter dem Hofe 5 D-58099 Hagen Tel. +49 2331 / 6245 - 0 Fax +49 2331 / 6245 - 200 Internet www.e-u-r-o-tec.de
Manufacturing plant:	HSW 19, HSW 20, HSW 21
This European Technical Assessment contains:	21 pages including 2 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:	Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD).
This version replaces:	-

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product

E.u.r.o.Tec Magnus connectors are two-piece, face-fixed beam hangers to be used in timber to timber connections.

E.u.r.o.Tec Magnus connectors are made from aluminium alloy EN AW-5083 according to EN 754. Dimensions, hole positions and typical installations are shown in Annexes A and C.

2 Specification of the intended use in accordance with the applicable EAD

E.u.r.o.Tec Magnus 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 or wood based 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 E.u.r.o.Tec Magnus 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,
- LVL according to EN 14374,
- Cross laminated timber,

However, the calculation methods are only allowed for a characteristic wood density of up to 460 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 EUROTEC 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 joist hanger connection are the following F_1, F_2, F_3 and F_4. The force F_1 acts perpendicular to the connector plate, F_2 shall act in and F_3 against the direction of insertion. The force F_4 is assumed to act with an eccentricity e_{45} with regard to the centre of gravity of the connector plates. With the exception of F_2 it is assumed that the forces are acting in the centre plane of the connector.
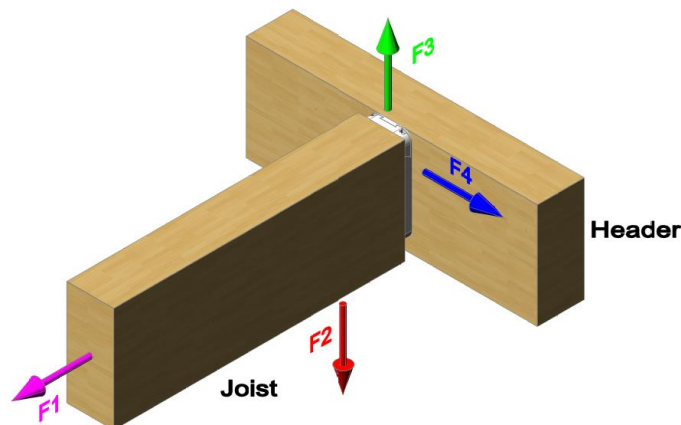
It is assumed that the header beam is prevented from rotating. If the header beam only has installed a E.u.r.o.Tec connector on one side the eccentricity moment $M_v = F_d \cdot (B_H / 2)$ shall be considered. The same applies when the header has E.u.r.o.Tec connectors on both sides, but with vertical forces which differ more than 20%.

The E.u.r.o.Tec Magnus connectors are intended for use for connections subject to static or quasi static loading.

The E.u.r.o.Tec Magnus 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 (BWR 1)*)	
Characteristic load-carrying capacity	See Annex B
Stiffness	See Annex B
Ductility in cyclic testing	No performance Assessed
3.2 Safety in case of fire (BWR 2)	
Reaction to fire	The connectors are made from aluminium classified as **Euroclass A1** in accordance with EN 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 Hygiene, health and the environment (BWR 3)	
Influence on air quality	The product does not contain/release dangerous substances specified in TR 034, dated March 2012 *)
3.7 Sustainable use of natural resources (BWR 7)	No Performance Assessed
3.8 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, B and C

*) See additional information in section 3.9 – 3.12.

In addition to the specific clauses relating to dangerous substances contained in this European technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.9 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 post.

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}.

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 steel or timber failure, respectively, are also correctly taken into account.

3.10 Mechanical resistance and stability
See annex B for characteristic load-carrying capacities of the E.u.r.o.Tec Magnus connectors.

The characteristic capacities of the E.u.r.o.Tec Magnus connectors are determined by calculation assisted by tests as described in the EOTA Guideline 015 clause 5.1.1. 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 41 in Annex A:

Screws in accordance with ETA-11/0024 based on the relevant approval conditions

In the formulas in Annex B the capacities for screws calculated from the formulas of Eurocode 5 are used assuming a thick steel plate without the rope effect 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.

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

3.11 Aspects related to the performance of the product
In accordance with ETAG 015 the aluminium E.u.r.o.Tec Magnus connectors are produced from aluminium alloys EN AW-5083 according to DIN EN 754.

3.12 General aspects related to the use of the product
E.u.r.o.Tec Magnus 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:

EUROTEC connector joints

A E.u.r.o.Tec connector joint is assessed for its intended use provided:

Header – support conditions
- The header beam shall be restrained against rotation and be free from wane under the E.u.r.o.Tec connector.

  If the header carries joists only on one side the eccentricity moment from the joists $M_{ec} = R_{joist}$ ($b_{header}/2$) shall be considered for E.u.r.o.Tec Magnus connectors at the strength verification of the header.
  R_{joist} Reaction force from the joists
  b_{header} Width of header

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

- E.u.r.o.Tec Magnus connectors are fastened to wood-based joists or headers by screws.

- There shall be screws in all holes.

- The characteristic capacity of the E.u.r.o.Tec connector joint is calculated according to the manufacturer's technical documentation dated 2015-06-29.

- The E.u.r.o.Tec 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 E.u.r.o.Tec Magnus 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 shall have a plane surface against the whole E.u.r.o.Tec 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 E.u.r.o.Tec screws in accordance with ETA-11/0024 shall be used and shall have a diameter and head shape which fits the holes of the E.u.r.o.Tec Magnus connectors.
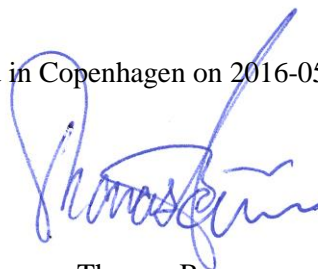
4 Assessment and verification of constancy of performance (AVCP)

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

Issued in Copenhagen on 2016-05-17 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions
Magnus XS 30x30
All specifications in mm
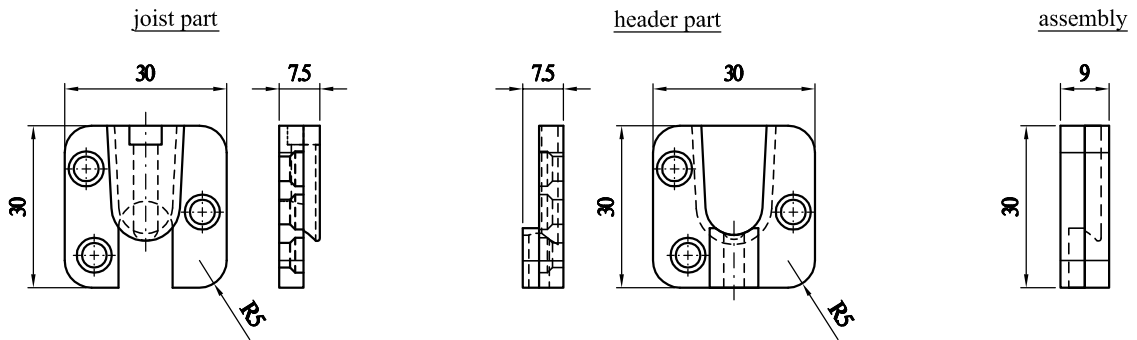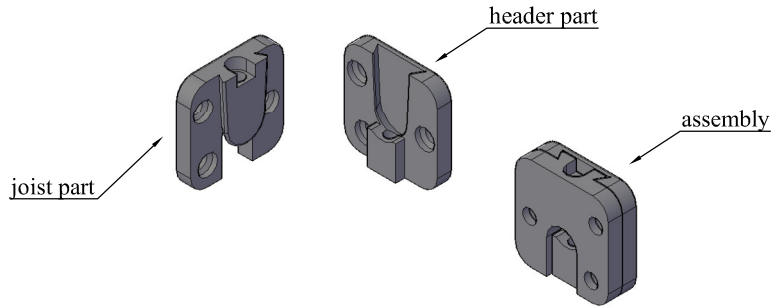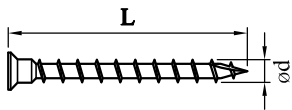
header part

joist part

assembly

joist part

header part

assembly

30	7.5

30

R5

7.5	30

30

R5

9

30

Fastener types and sizes

L

ø d

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

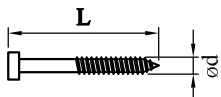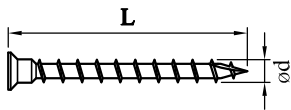| d	L	total number per connector
4,0	30	6

L

ø d

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,2	26	1

Magnus S 50x60
All specifications in mm
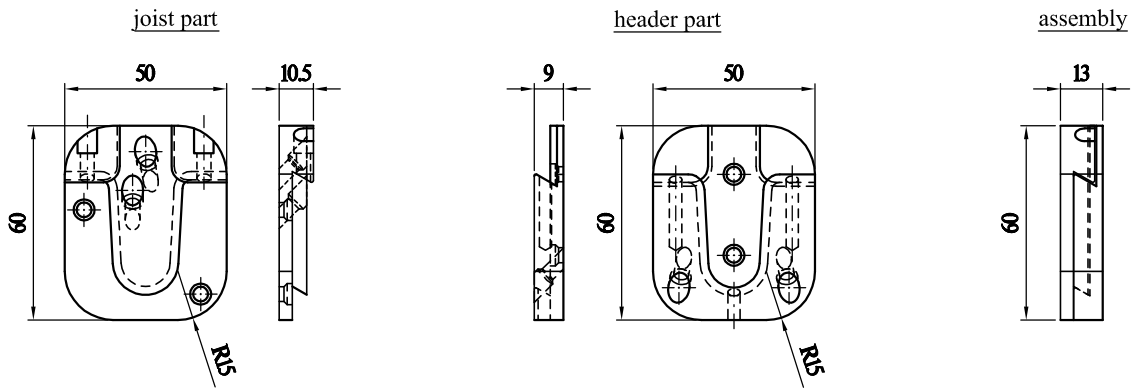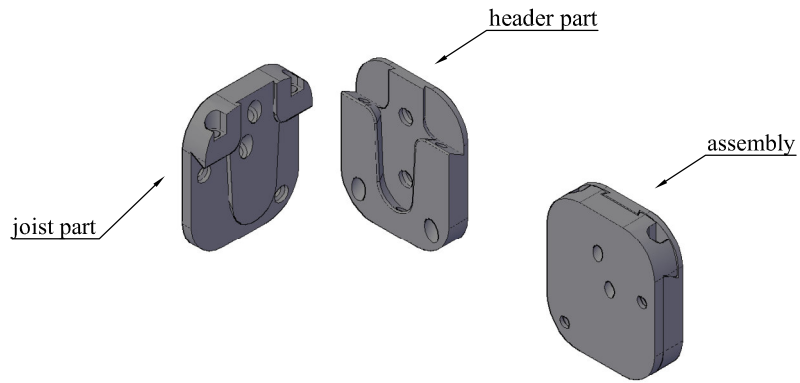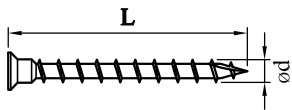
header part

joist part

assembly

joist part

header part

assembly

50   10.5

9   50

13

60

R15

60

R15

60

Fastener types and sizes

L

ø d

Self-tapping screw according to ETA-11/0024
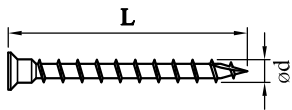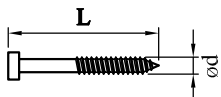for fixing the connector to wood

d	L	total number per connector
4,0	60	8

L

ø d
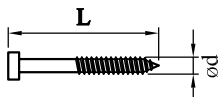
Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus S 50x80
All specifications in mm
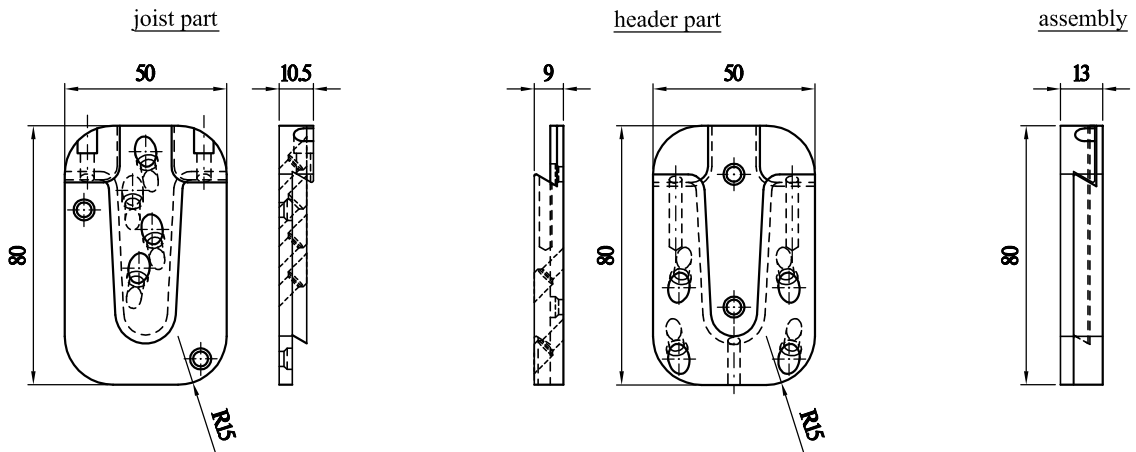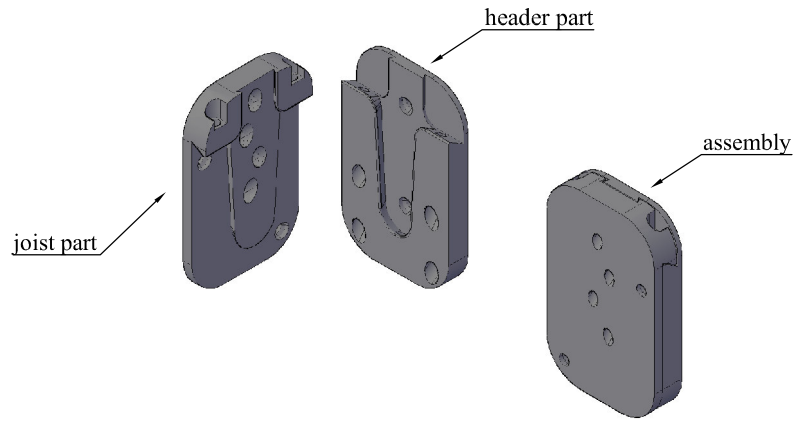
header part

joist part

assembly

joist part

header part

assembly

50 10.5

9 50

13

80

80

80

R15

R15

Fastener types and sizes

L

ø d

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

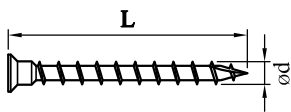| d	L	total number per connector
4,0	60	12

L

ø d

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus S 50x100
All specifications in mm
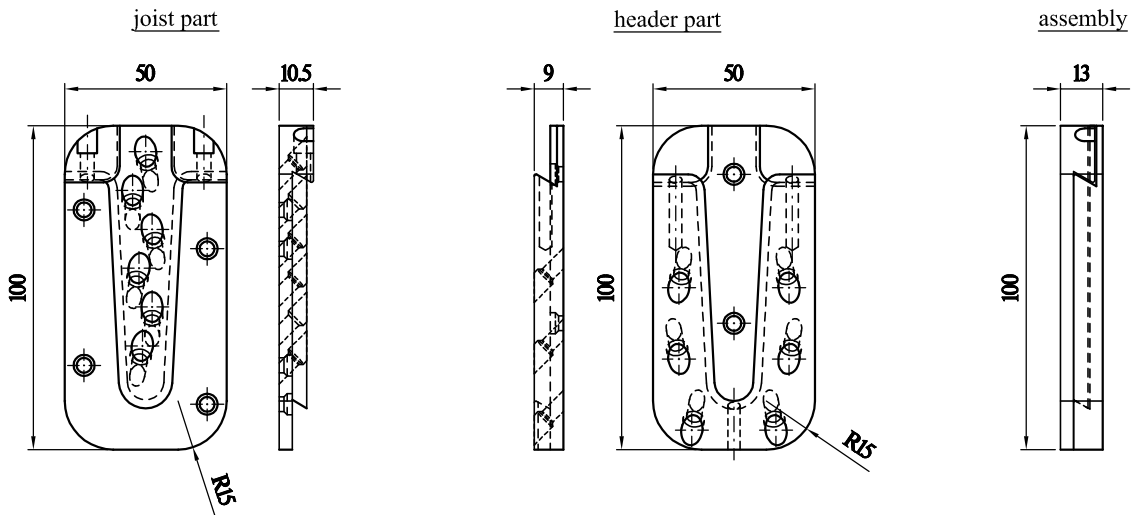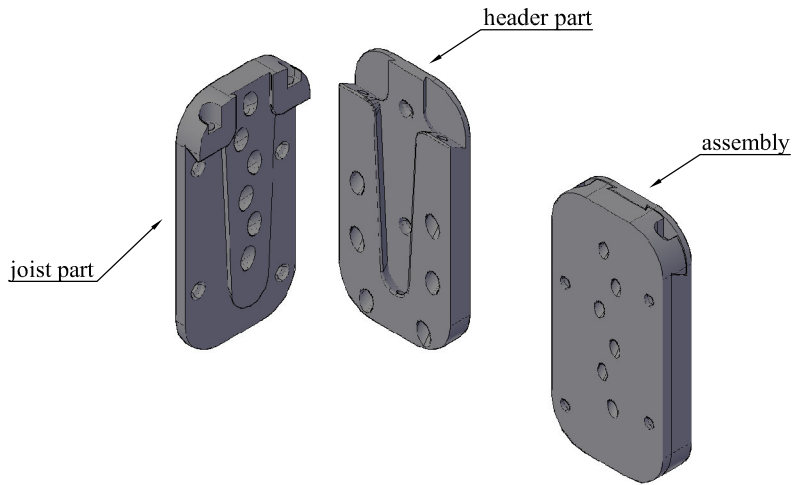
header part

joist part

assembly

joist part

header part

assembly

50   10.5

9   50

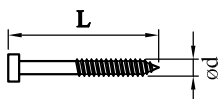13

100

R15

100

R15

100

Fastener types and sizes

L

ø d

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

d	L	total number per connector
4,0	60	18

L

ø d

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus M 70x120
All specifications in mm
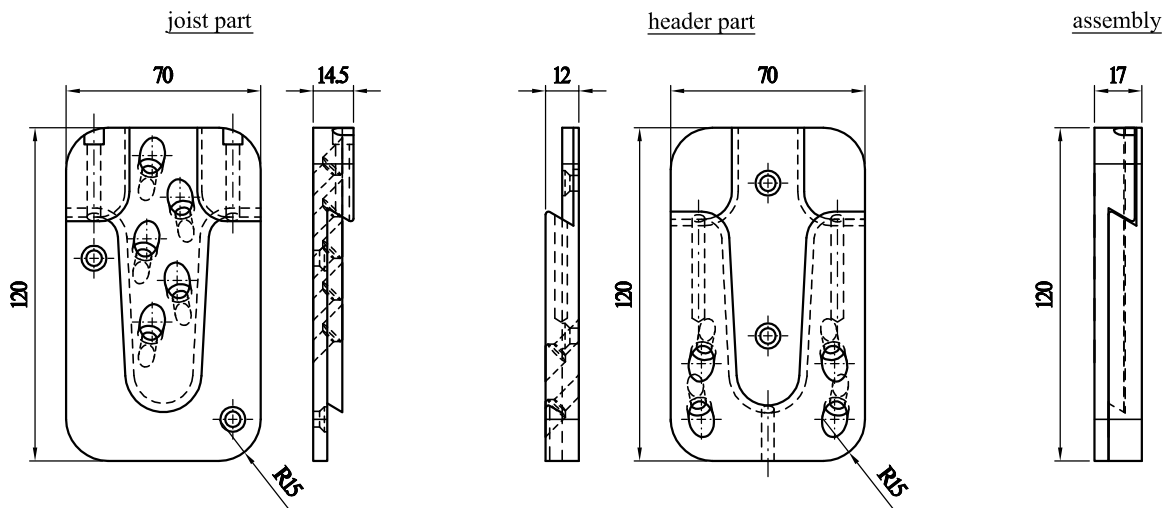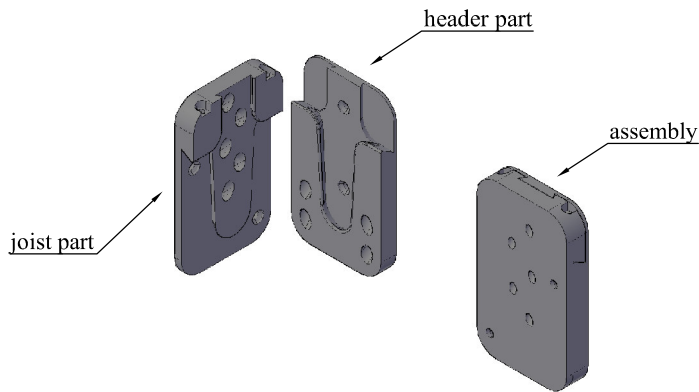
header part

joist part

assembly

joist part

header part

assembly

70   14.5

12   70

17

120

120

120

R15

R15

Fastener types and sizes

L

Ød

Self-tapping screw according to ETA-11/0024
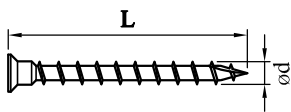for fixing the connector to wood

d	L	total number per connector
5,0	80	13

L

Ød

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x140
All specifications in mm
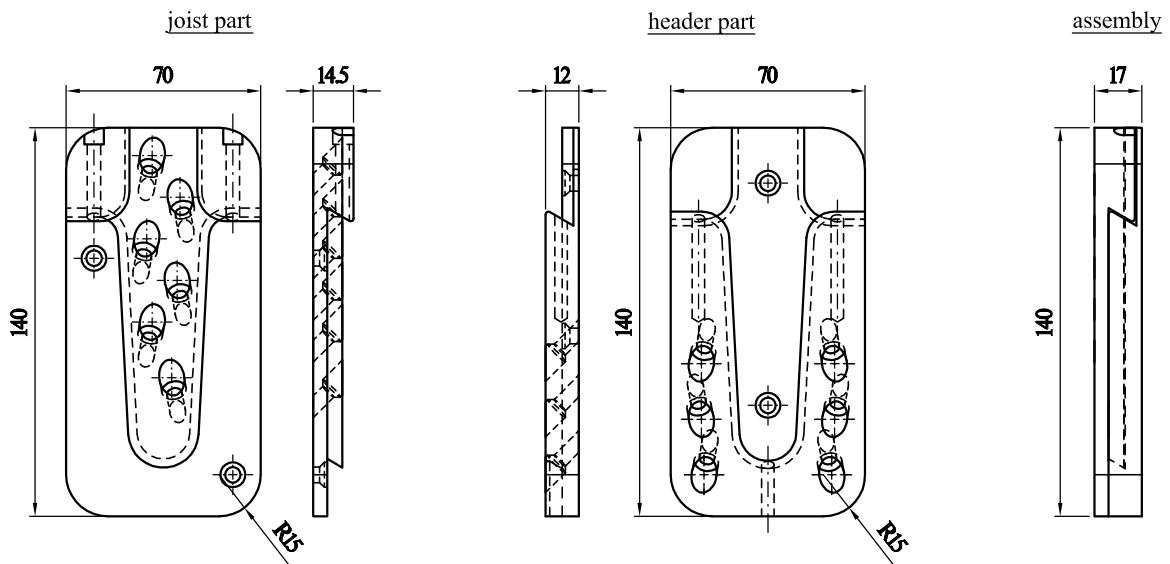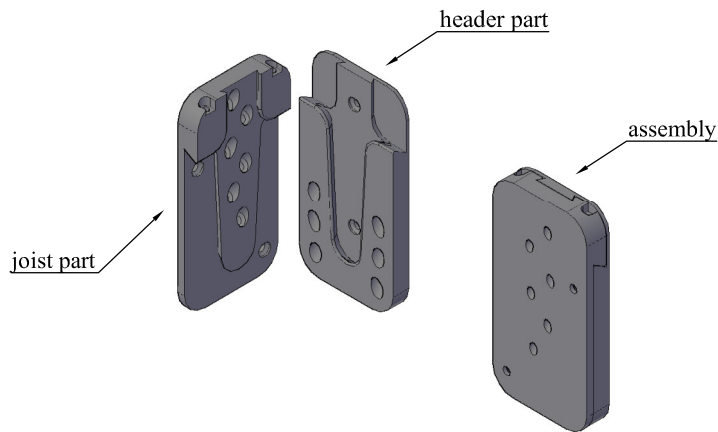
header part

joist part

assembly

joist part

header part

assembly

70   14.5   12   70   17

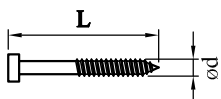140   140   140

R15   R15

Fastener types and sizes

L

ød

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

d	L	total number per connector
5,0	80	16

L

ød

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x160
All specifications in mm
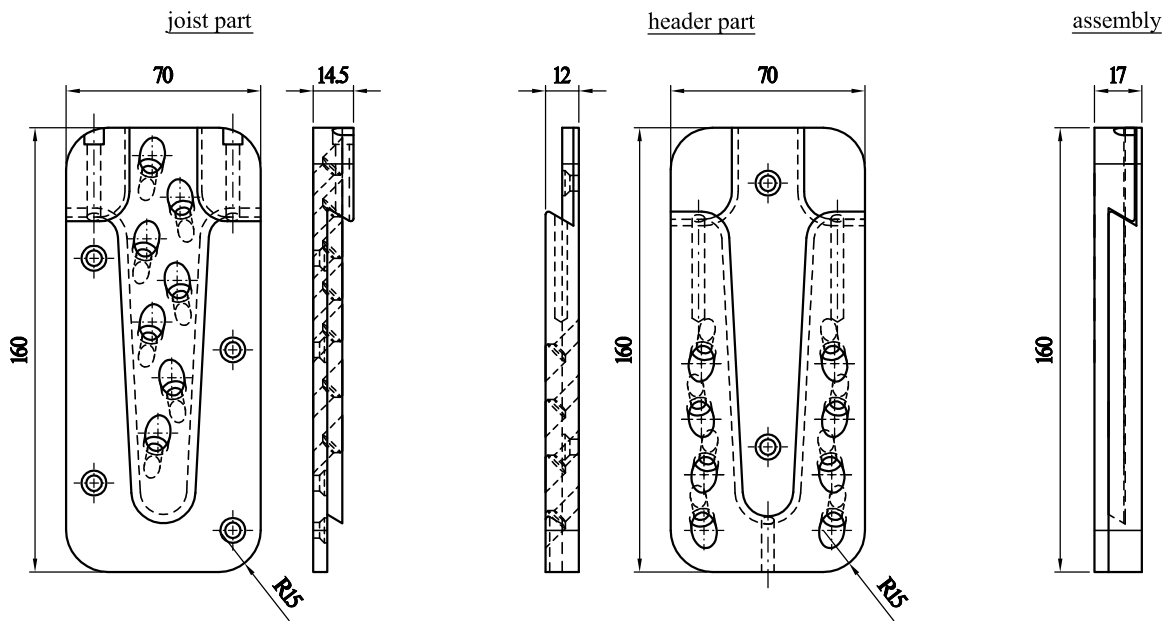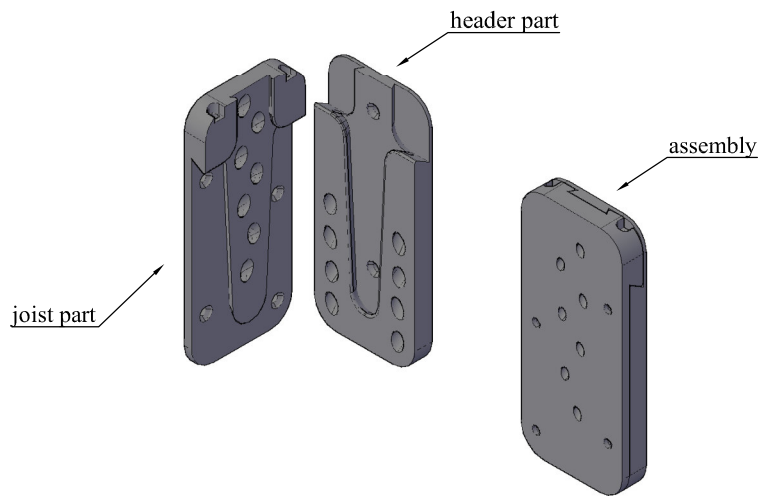
header part

assembly

joist part

joist part

header part

assembly

70   14.5

12   70

17

160

160

160

R15

R15

Fastener types and sizes

L

ø d

Self-tapping screw according to ETA-11/0024
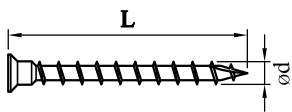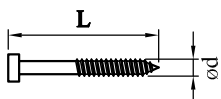for fixing the connector to wood

d	L	total number per connector
5,0	80	21

L

ø d

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x180
All specifications in mm
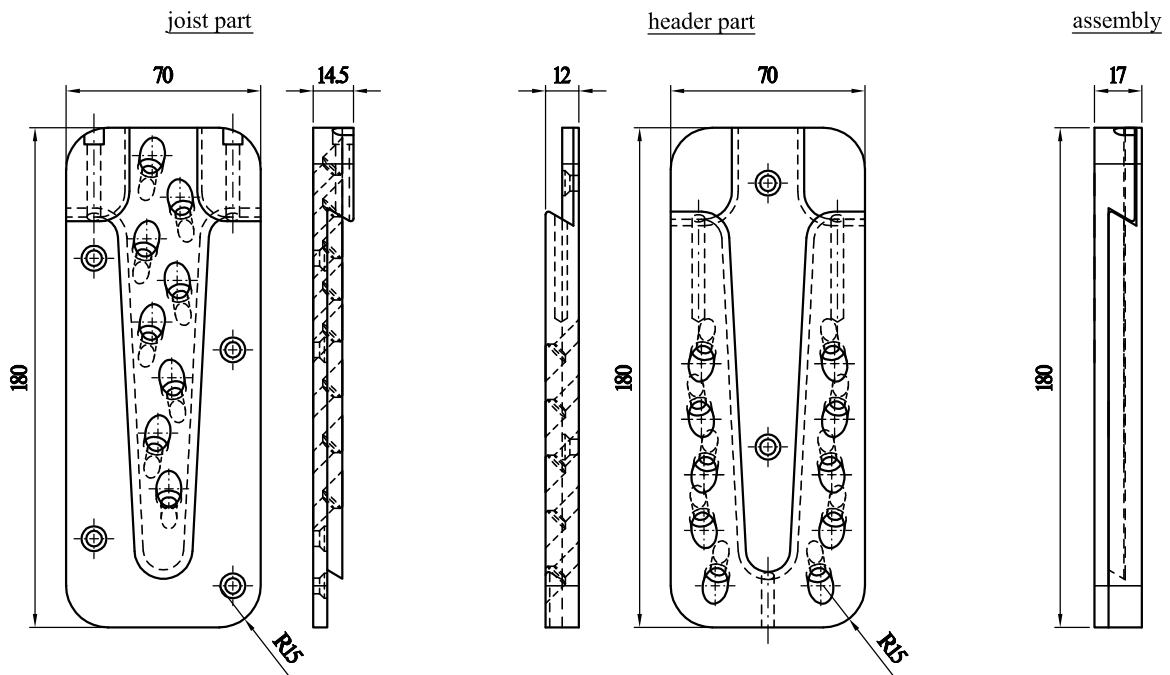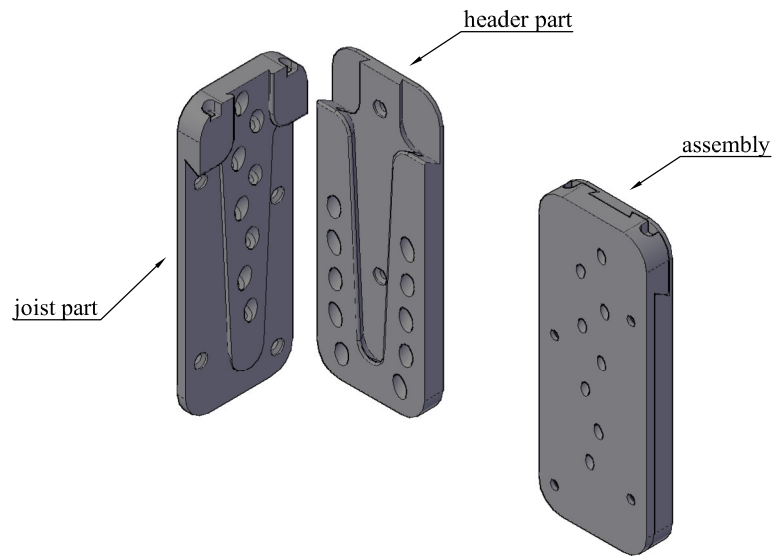
header part

joist part

assembly

joist part

header part

assembly

70   14.5   12   70   17

180   180   180

R15   R15

Fastener types and sizes

L

Ø

Self-tapping screw according to ETA-11/0024
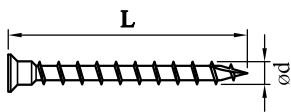for fixing the connector to wood

d	L	total number per connector
5,0	80	24

L

Ø

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x220
All specifications in mm
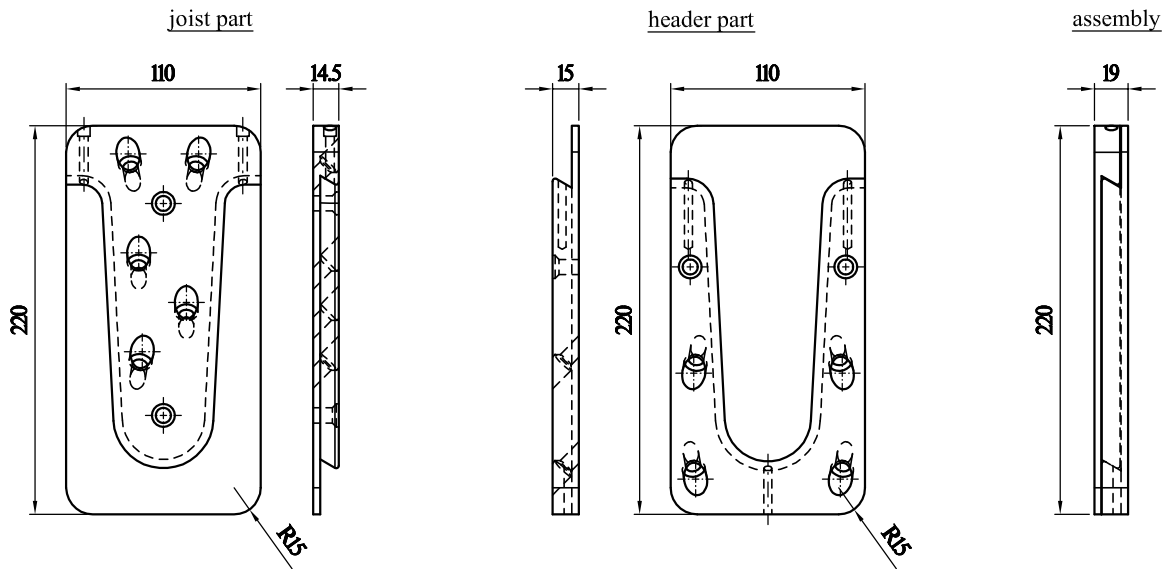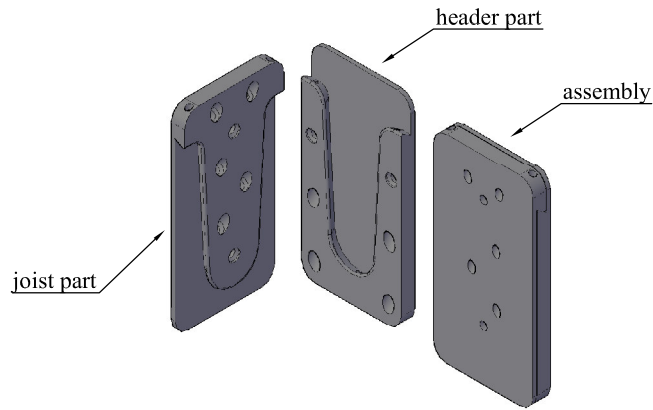
header part

assembly

joist part

joist part

header part

assembly
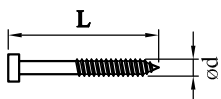
110   14.5

15   110

19

220

R15

220

R15

220

Fastener types and sizes

L

⌀d

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

d	L	total number per connector
8,0	120	13

L

⌀d

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x260
All specifications in mm
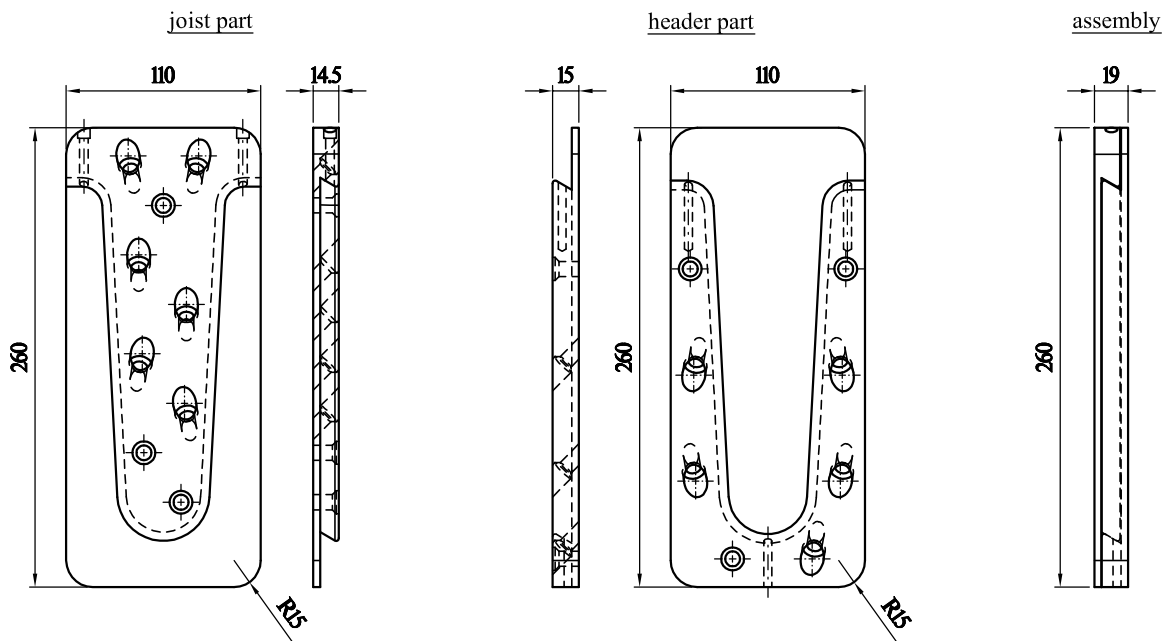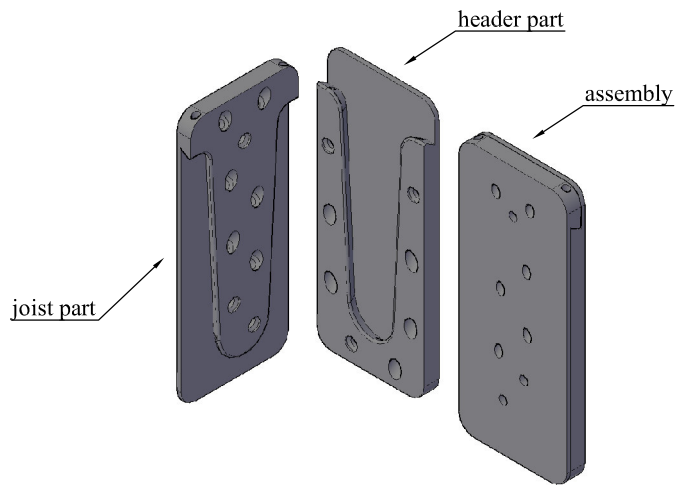
header part

assembly

joist part

joist part	header part	assembly

110   14.5

15   110

19

260

260

260

R15

R15

Fastener types and sizes

L

ød

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

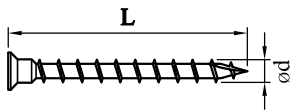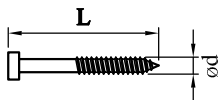| d	L	total number per connector
8,0	120	17

L

ød

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x300
All specifications in mm
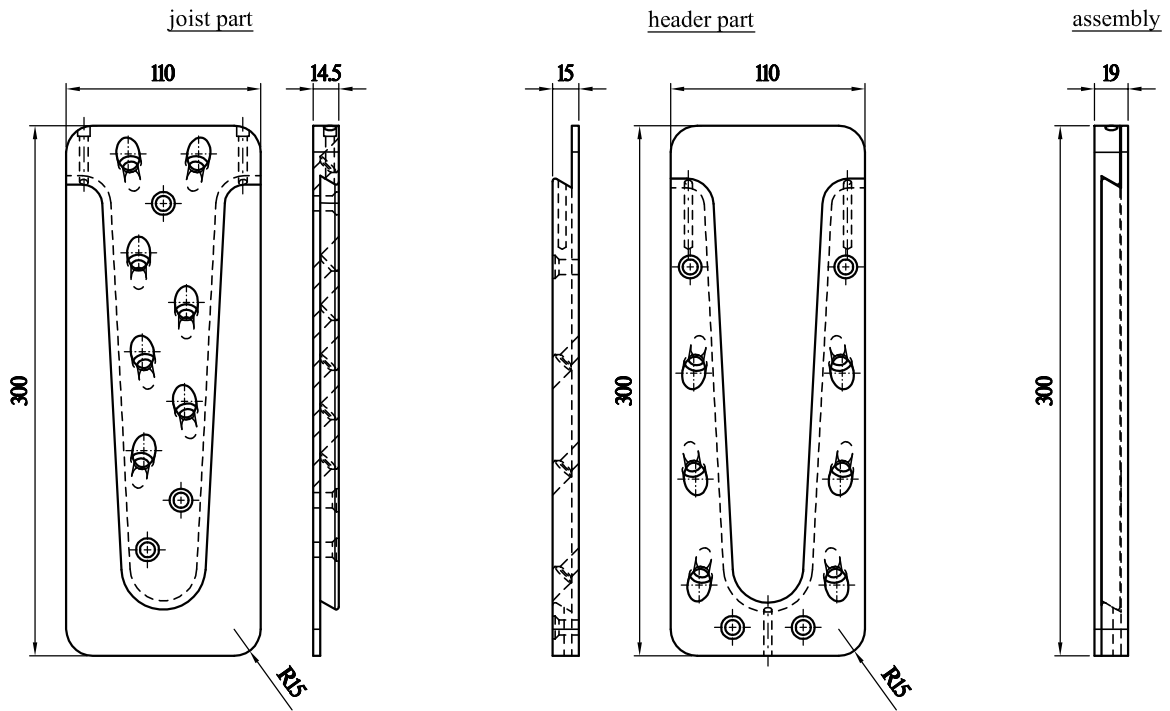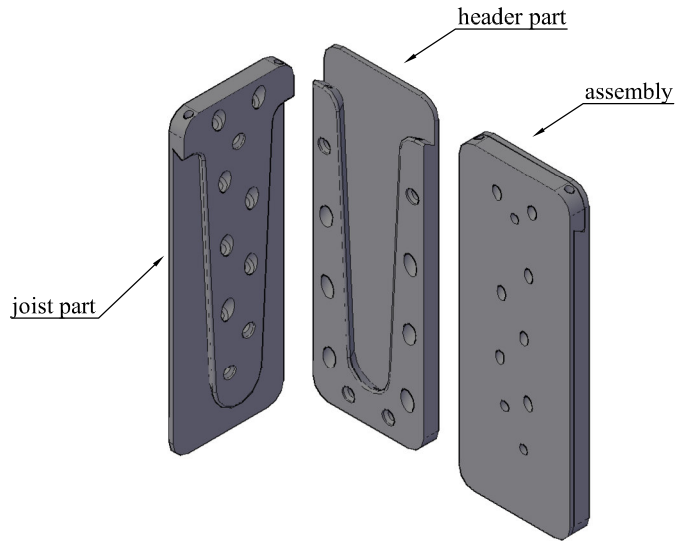
header part

assembly

joist part

joist part

header part

assembly

110   14.5

15   110

19

300

300

300

R15

R15

Fastener types and sizes

L

ød

Self-tapping screw according to ETA-11/0024
for fixing the connector to wood

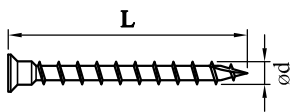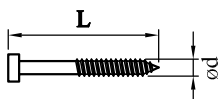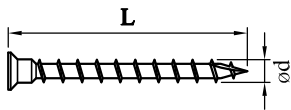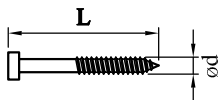| d	L	total number per connector
8,0	120	20

L

ød

Self-tapping screw according to this ETA
for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Annex B
Characteristic values of load-carrying-capacities and stiffness

The forces perpendicular to the connector plate 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 perpendicular to the connector plane

$$F_{1,Rk} = n_{ef} \cdot 0,43 \cdot \sqrt{d} \cdot \ell_{ef}^{0,9} \cdot \rho_k^{0,8} \text{ in N} \tag{B.1}$$

Loading in the direction of insertion for $e_2 \leq e_{lim}$

EUROTEC connectors XS:

$$F_{2,Rk} = n_{90,J} \cdot F_{la,J,Rk} \tag{B.2}$$

$$K_{ser} = \frac{n_{90} \cdot \rho_m^{1,5} \cdot d^{0,8}}{30} \tag{B.3}$$

EUROTEC connectors S, M and L:

$$F_{2,Rk} = \frac{1,25 \cdot n_{45} \cdot F_{ax,\alpha,Rk}}{\sqrt{2}} \tag{B.4}$$

$$K_{2,ser} = \frac{F_{2,Rk}}{2 \text{ mm}} \tag{B.5}$$

Loading in the direction of insertion for $e_2 > e_{lim}$

EUROTEC connectors S, M and L:

$$F'_{2,Rk} = \frac{F_{2,Rk}}{\left(1 + \left(\dfrac{e_2 - e_{lim}}{e_M}\right)^3\right)^{1/3}} \tag{B.6}$$

Loading against the direction of insertion

EUROTEC connectors XS:	$F_{3,Rk} = 1,7 \text{ kN}$	(B.7)
EUROTEC connectors S:	$F_{3,Rk} = 5,0 \text{ kN}$	(B.8)
EUROTEC connectors M:	$F_{3,Rk} = 13 \text{ kN}$	(B.9)
EUROTEC connectors L:	$F_{3,Rk} = 23 \text{ kN}$	(B.10)

Loading perpendicular to the direction of insertion

$$F_{4,Rk} = \min \begin{cases} \dfrac{F_{la,J,Rk}}{\sqrt{\left(\dfrac{1}{(n_{90}+n_{45})} + \dfrac{e_{45}}{e_{1,J}}\right)^2 + \left(\dfrac{e_{45}}{e_{2,J}}\right)^2}} \\ \dfrac{F_{la,H,Rk}}{\sqrt{\left(\dfrac{1}{(n_{90}+n_{45})} + \dfrac{e_{45}}{e_{1,H}}\right)^2 + \left(\dfrac{e_{45}}{e_{2,H}}\right)^2}} \end{cases} \tag{B.11}$$

Where:

α Angle between screw axis and grain direction

n_{ef} = 0,6 for EUROTEC connector XS

n_{ef} = $0,5 \cdot n_{90,J}$ for EUROTEC connectors S, M and L

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

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

$\rho_{k,J}$ Characteristic density of the joist

$\rho_{k,H}$ Characteristic density of the header

n_{45} Number of inclined screws in the joist or header plate of the EUROTEC connector

n_{90} Number of screws perpendicular to the joist or header plate of the EUROTEC connector

$F_{la,J,Rk}$ Lateral capacity of a joist screw,

$$F_{la,J,Rk} = \min\left(2,3 \cdot \sqrt{0,4 \cdot M_{y,k} \cdot f_{h,k} \cdot d} ; 0,4 \cdot f_{h,k} \cdot d \cdot \ell_{ef}\left[\sqrt{2 + \frac{4 \cdot M_{y,k}}{0,4 \cdot f_{h,k} \cdot d \cdot \ell_{ef}^2}} - 1 \right] \right)$$

$F_{la,H,Rk}$ Lateral capacity of a header screw, $F_{la,H,Rk} = \min\left(2,3 \cdot \sqrt{M_{y,k} \cdot f_{h,k} \cdot d} ; f_{h,k} \cdot d \cdot \ell_{ef}\left[\sqrt{2 + \frac{4 \cdot M_{y,k}}{f_{h,k} \cdot d \cdot \ell_{ef}^2}} - 1 \right] \right)$

$M_{y,k}$ Characteristic yield moment of a screw

$f_{h,k}$ Characteristic embedding strength according to equation (8.15) of Eurocode 5

d Outer thread diameter of a screw

$F_{ax,\alpha,J,Rk}$ Withdrawal capacity of an inclined joist screw, $\quad F_{ax,\alpha,J,Rk} = \dfrac{0,52 \cdot \sqrt{d} \cdot \ell_{ef,J}^{0,9} \cdot \rho_{k,J}^{0,8}}{1,2 \cdot \cos^2 \alpha + \sin^2 \alpha}$,

$F_{ax,\alpha,H,Rk}$ Withdrawal capacity of an inclined header screw, $\quad F_{ax,\alpha,H,Rk} = \dfrac{0,52 \cdot \sqrt{d} \cdot \ell_{ef,H}^{0,9} \cdot \rho_{k,H}^{0,8}}{1,2 \cdot \cos^2 \alpha + \sin^2 \alpha}$

e_2 Eccentricity of the force $F_{2,Ed}$ with regard to the joist end grain surface

e_{45} Eccentricity of the force $F_{4,Ed}$ with regard to the centre of the EUROTEC connector

e_{lim} EUROTEC connector dimension (see Table B.1)

e_M $M_{2,Rk}/F_{2,Rk}$

$M_{2,Rk}$ The lower characteristic moment capacity of the joist or header connection

   $M_{2,Rk} = F_{ax,Rk} \cdot e_Z + F_{2,Ed} \cdot e_{lim}$

$F_{ax,Rk}$ Withdrawal capacity of a moment screw arranged perpendicular to the connector plate

e_Z EUROTEC connector dimension (see Table B.1)

$e_{1,J}, e_{2,J}, e_{1,H}, e_{2,H}$ EUROTEC connector dimensions (see Table B.1);

Table B.1:   EUROTEC connectors; dimensions and numbers of screws

| EUROTEC connector No.	Width b [mm]	Depth h [mm]	Screw diameter [mm]	Number of screws				e_{lim} [mm]	e_Z [mm]	$e_{1,J}$ [mm]	$e_{2,J}$ [mm]	$e_{1,H}$ [mm]	$e_{2,H}$ [mm]
				Header		Joist							
				n_{90}	n_{45}	n_{90}	n_{45}						
30x30	30	30	4,0	3	-	3	-	-	16	52	52	38	39
50x60	50	60	4,0	2	2	2	2	0,0	25	80	80	82	93
50x80	50	80	4,0	2	4	2	4	9,1	41	117	101	197	170
50x100	50	100	4,0	2	6	4	6	14	46	158	185	366	380
70x120	70	120	5,0	2	4	2	5	10	55	170	151	301	286
70x140	70	140	5,0	2	6	2	6	17	78	213	189	467	436
70x160	70	160	5,0	2	8	4	7	23	95	265	310	689	837
70x180	70	180	5,0	2	10	4	8	30	95	320	378	965	1173
110x220	110	220	8,0	2	4	2	5	33	0	419	278	572	1027
110x260	110	260	8,0	3	5	3	6	50	129	517	440	964	2157
110x300	110	300	8,0	4	6	3	7	66	146	700	536	1623	3004
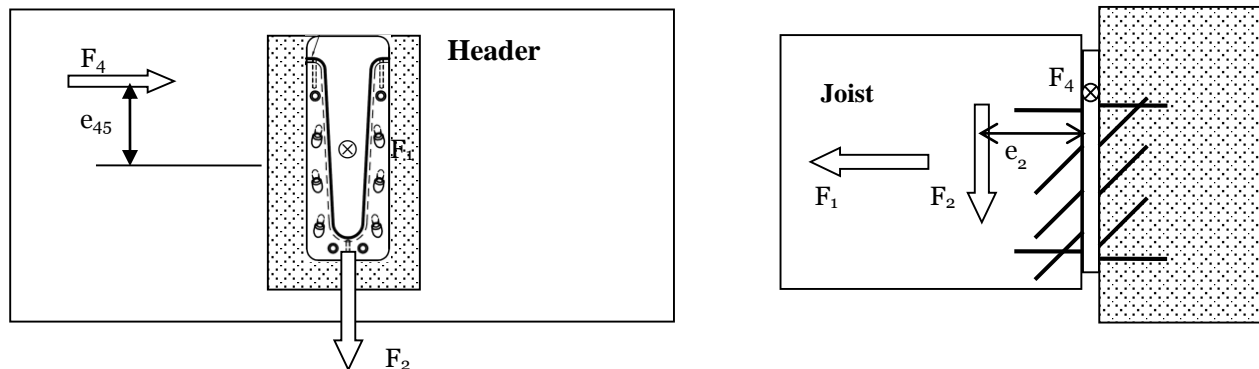
Figure B1: Definition of e_2 and e_{45}

For combined loading of the EUROTEC connector, the following condition should be fulfilled:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{2,Ed}}{F_{2,Rd}}\right)^2 + \left(\frac{F_{3,Ed}}{F_{3,Rd}}\right)^2 + \left(\frac{F_{4,Ed}}{F_{4,Rd}}\right)^2 \leq 1 \qquad (B.14)$$

Here, $F_{1,Ed}$, $F_{2,Ed}$, $F_{3,Ed}$ and $F_{4,Ed}$ are the design loads perpendicular to the connector plate and parallel and perpendicular to the direction of insertion, respectively.