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Authorized 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 2020/03/05

### 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 and Timberframe PRV  
connector

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](http://www.e-u-r-o-tec.de)

Manufacturing plant:

HSW 19, HSW 20, HSW 21

This European Technical  
Assessment contains:

37 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:

The ETA with the same number issued on 2016-05-17

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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 connectors are two-piece, face-fixed beam hangers to be used in timber to timber connections. They are connected to construction members made of timber or wood-based products with screws according to EN 14592 or ETA-11/0024.

The connectors are made of aluminium grade EN-AW 5083 H111 to EN 573-3 and EN 755-2. Dimensions, hole positions and typical installations are shown in Annex A and Annex 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<sup>3</sup>. 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.

The E.u.r.o.Tec Timberframe PRV connector 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 wood based header, 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.

The E.u.r.o.Tec Timberframe PRV connector can be installed between wood based members such as:

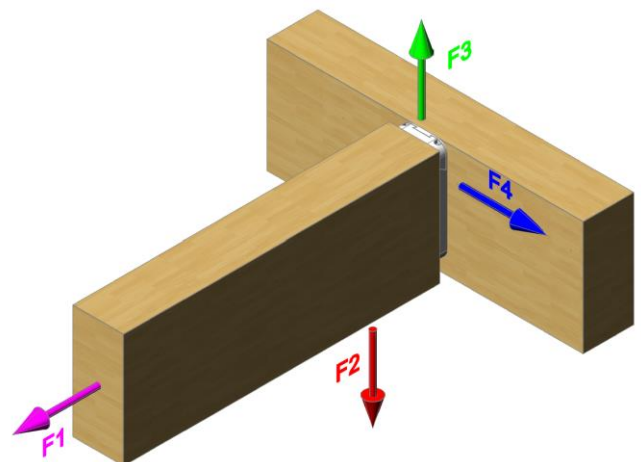
- Structural solid timber according to EN 14081,
- Glulam or glued solid timber according to EN 14080,

- LVL according to EN 14374 or European Technical Assessment.

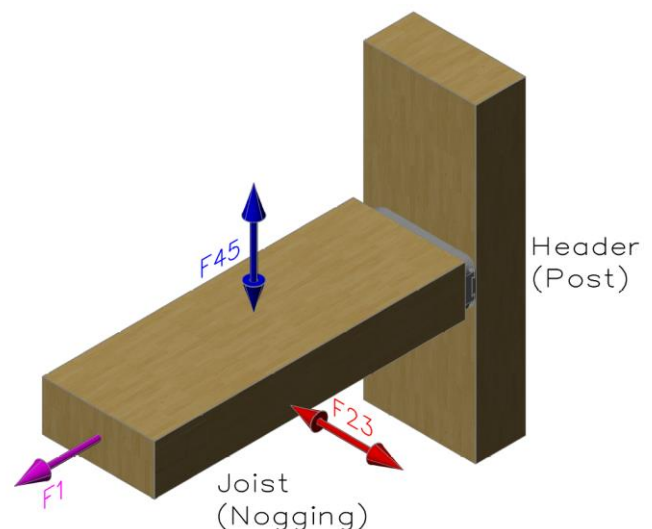
However, the calculation methods are only allowed for a characteristic wood density of up to 550 kg/m<sup>3</sup>. Even though the wood based material may have a larger density, this must not be used in the formulas for the load-carrying capacities of the fasteners.

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 connection are the following  $F_1$ ,  $F_2$ ,  $F_3$  and  $F_{45}$ . The force  $F_1$  acts perpendicular to the connector plate with an eccentricity  $e_1$  with regard to the centre of gravity of the screws in the joist connector part,  $F_2$  and  $F_3$  shall act in the middle of the connector in or against the direction of insertion. The force  $F_{45}$  acts with an eccentricity  $e_{45}$  with regard to the centre of gravity of the screws in the joist connector part. It is assumed that the forces are acting right at the end of the joist.



Force directions for Magnus connectors



Force directions for Timberframe PRV 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 connectors are intended for use for connections subject to static or quasi static loading.

The E.u.r.o.Tec 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
<b>3.1 Mechanical resistance and stability (BWR 1)*</b>	
Characteristic load-carrying capacity	See Annex B
Stiffness	See Annex B
Ductility in cyclic testing	No performance assessed
<b>3.2 Safety in case of fire (BWR 2)</b>	
Reaction to fire	The connectors are made from aluminium classified as <b>Euroclass A1</b> 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
<b>3.3 Hygiene, health and the environment (BWR 3)</b>	
	No performance assessed
<b>3.7 Sustainable use of natural resources (BWR 7)</b>	
	No Performance assessed
<b>3.8 General aspects related to the performance of the product</b>	
	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.

### 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  $k_{mod}$ .

Thus, the characteristic values of the load-carrying capacity are determined also for timber failure  $F_{Rk,H}$  (obtaining the embedment strength of screws subjected to shear or the withdrawal capacity of the screws, respectively) 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:

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

Therefore, for timber failure or failure of the metal fasteners the load duration class and the service class are included. The different partial factors  $\gamma_M$  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 connectors.

The characteristic capacities of the E.u.r.o.Tec 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,  $F_{Rk}$ .

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 connectors are produced from aluminium alloy EN AW-5083 H111 and according to EN 573-3 and EN 755-2.

#### 3.12 General aspects related to the use of the product

E.u.r.o.Tec 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:

#### E.u.r.o.Tec Magnus 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.
- Screws shall have a diameter of 4 mm or 5 mm and a head shape, which fits the holes of the connector plates.

#### **E.u.r.o.Tec Timberframe PRV connector joints**

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

#### **Header – support conditions**

- Connectors are fastened to wood-based members by screws.
- There shall be screws in all marked holes as prescribed in Annex A.
- The characteristic capacity of the connector joint is calculated according to the manufacturer's technical documentation, dated 2019-01-09.
- The connector joint is designed in accordance with Eurocode 5 or an appropriate national code.
- There is no gap between the end of the joist and the connector part or between the header surface and the connector part.
- For EUROTEC connectors the width of the joist and header shall be at least 60 mm as prescribed in Annex A or C.
- The cross section of the joist at the connector joint shall have sharp edges e, i.e. it shall be without wane.
- The cross section of the header shall have a plane surface against the whole connector part.
- The depth of the joist or header shall be so large that the minimum fastener end and edge distances are observed.

## **4 Assessment and verification of constancy of performance (AVCP)**

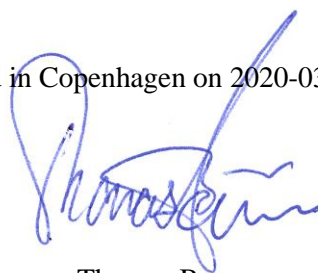
### **4.1 AVCP system**

According to the decision 97/638/EC of the European Commission<sup>1</sup>, 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

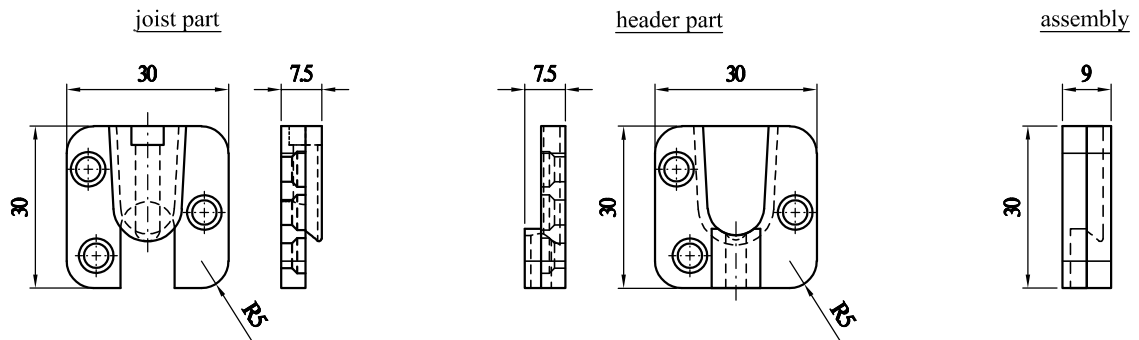
Issued in Copenhagen on 2020-03-05 by



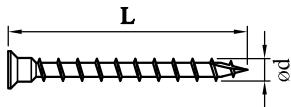
Thomas Bruun  
Managing Director, ETA-Danmark



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

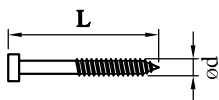


Fastener types and sizes



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

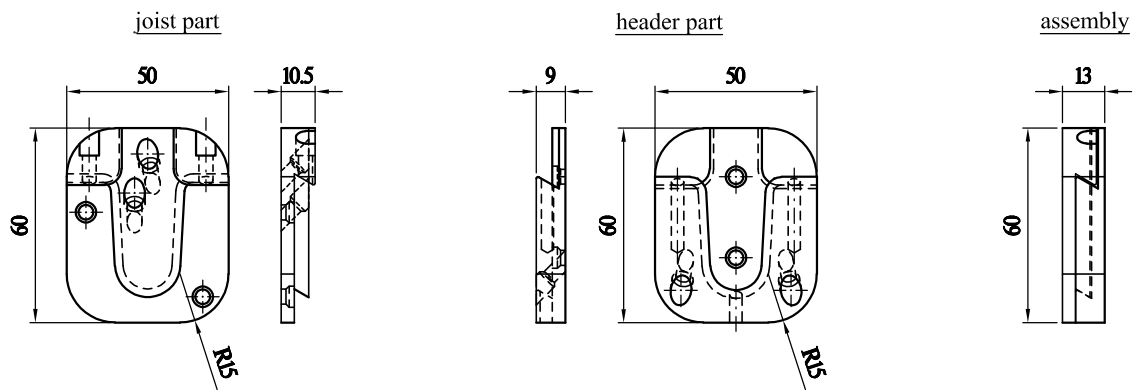
d	L	total number per connector
4,0	30	6



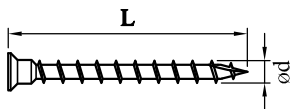
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,2	26	1

Magnus S 50x60  
All specifications in mm

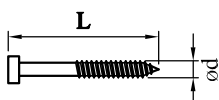


Fastener types and sizes



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

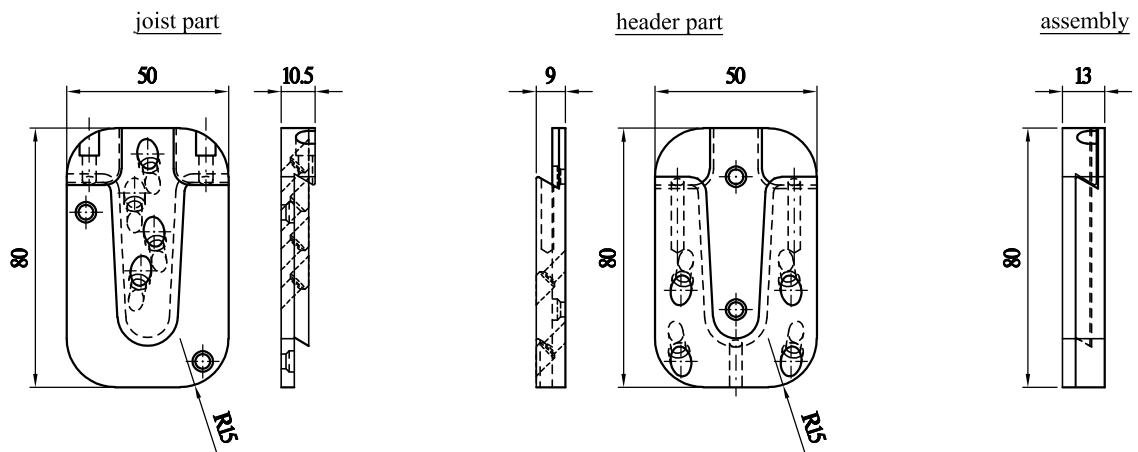
d	L	total number per connector
4,0	60	8



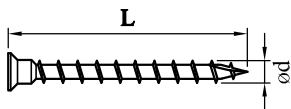
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus S 50x80  
All specifications in mm

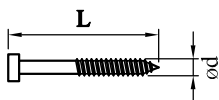


Fastener types and sizes



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

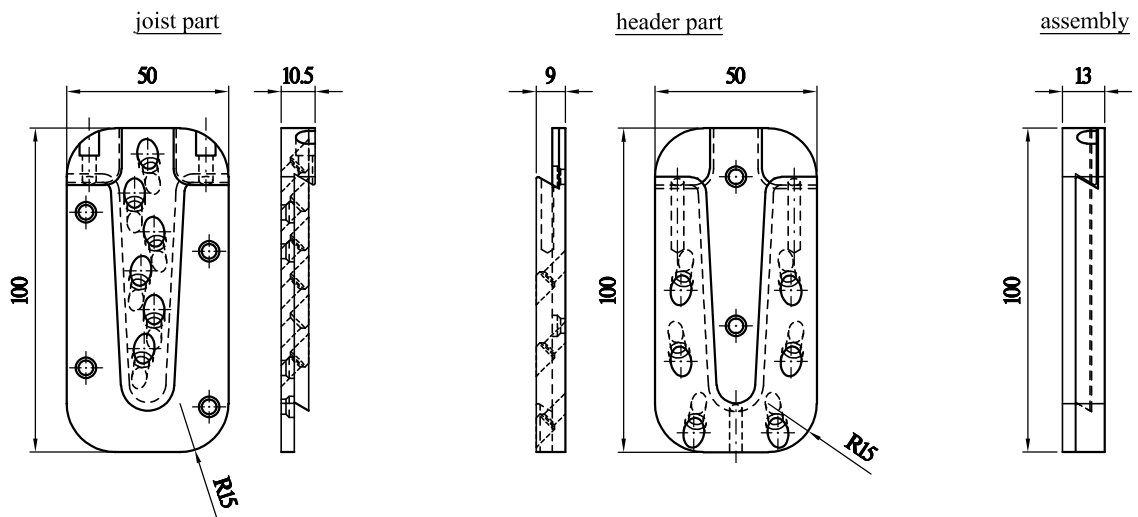
d	L	total number per connector
4,0	60	12



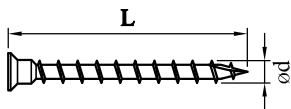
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus S 50x100  
All specifications in mm

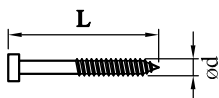


Fastener types and sizes



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

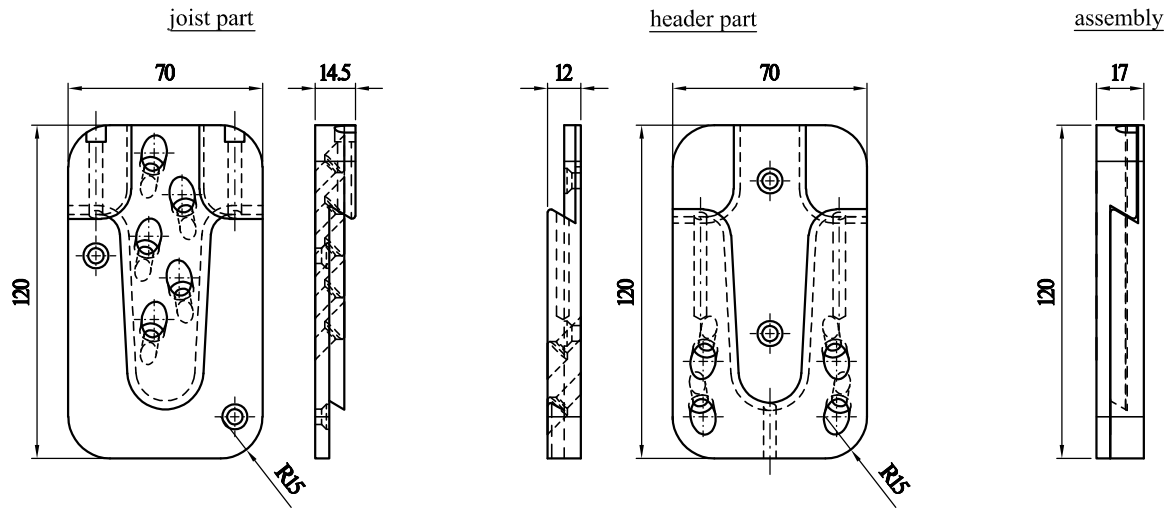
d	L	total number per connector
4,0	60	18



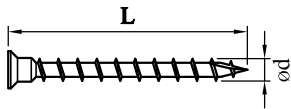
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,2	26	2

Magnus M 70x120  
All specifications in mm

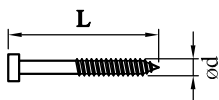


Fastener types and sizes



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

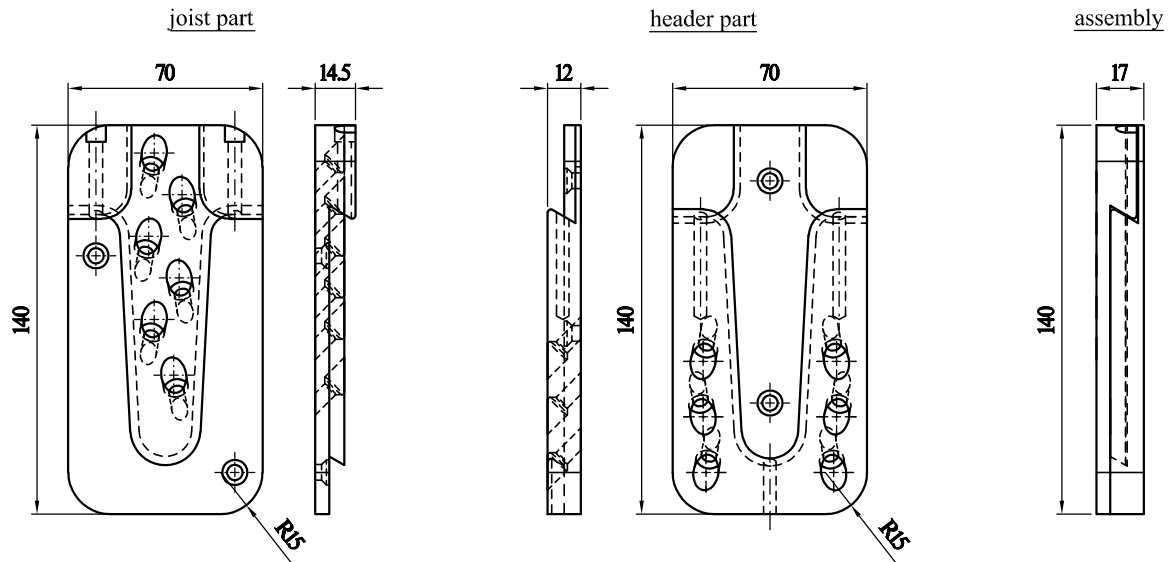
d	L	total number per connector
5,0	80	13



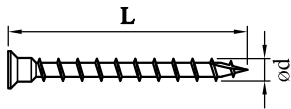
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x140  
All specifications in mm

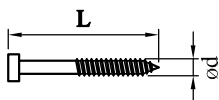


Fastener types and sizes



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

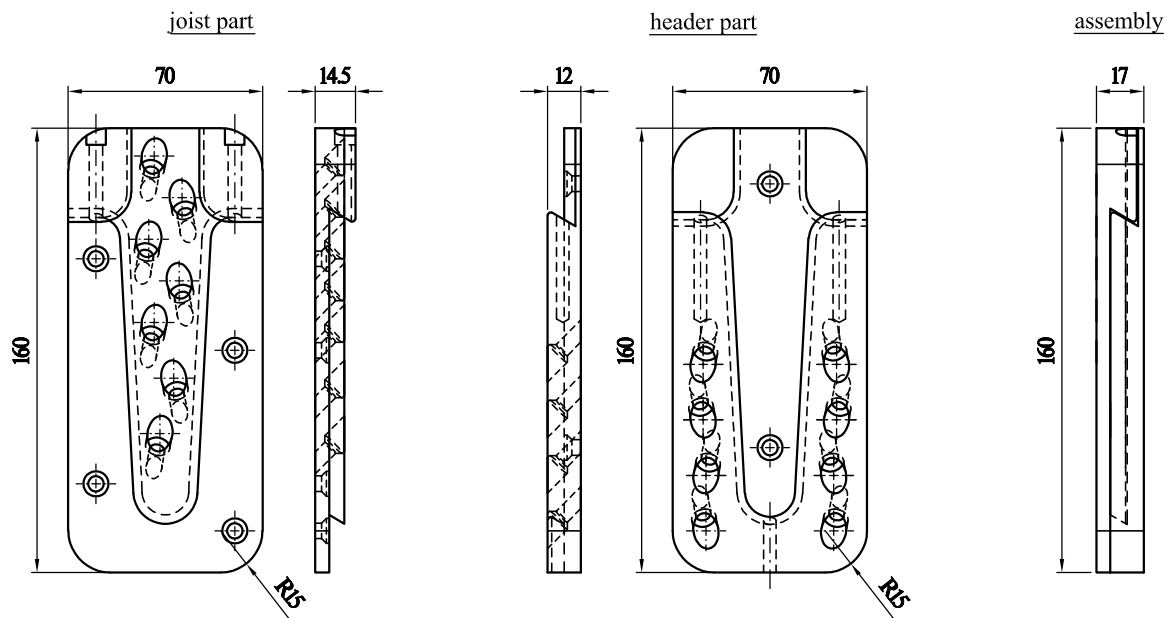
d	L	total number per connector
5,0	80	16



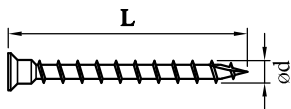
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x160  
All specifications in mm

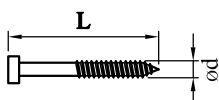


Fastener types and sizes



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

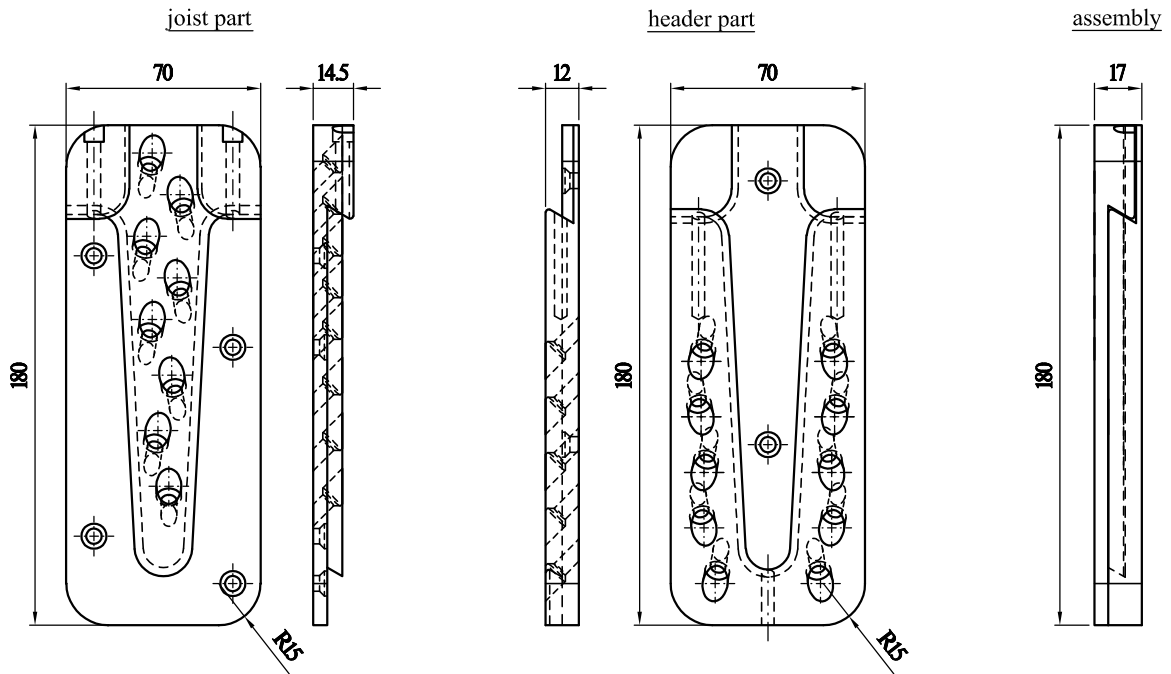
d	L	total number per connector
5,0	80	21



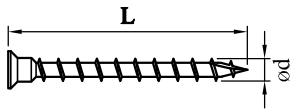
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus M 70x180  
All specifications in mm

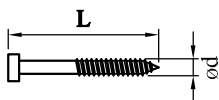


Fastener types and sizes



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

d	L	total number per connector
5,0	80	24

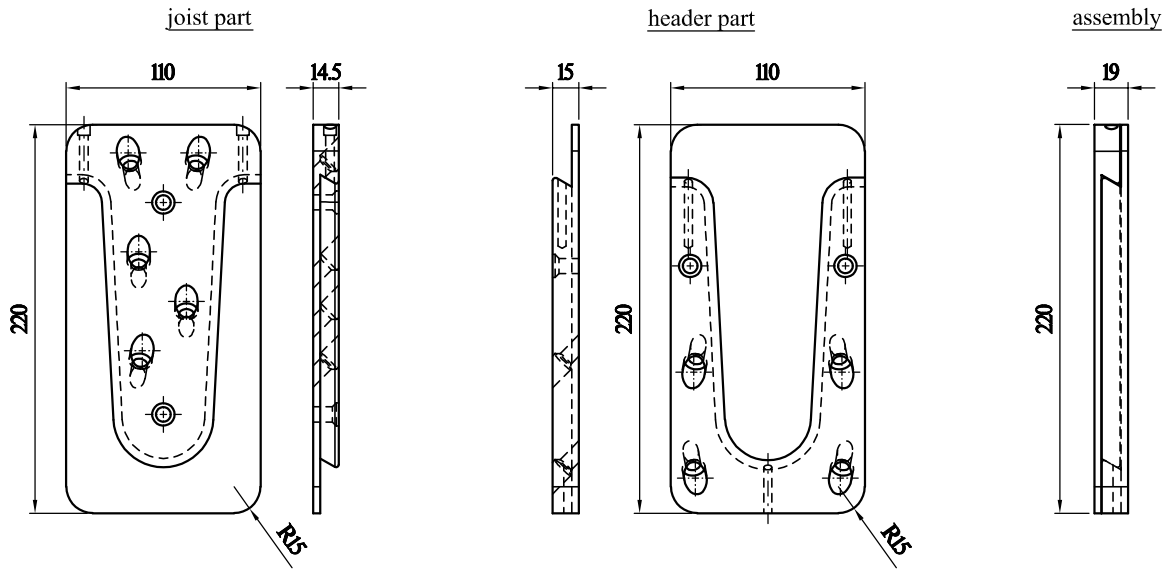


Self-tapping screw according to this ETA for connecting the two connector parts

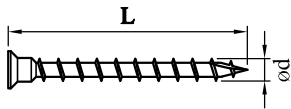
d	L	total number per connector
4,8	60	2



Magnus L 110x220  
All specifications in mm



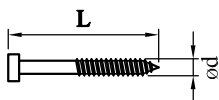
Fastener types and sizes



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

d	L	total number per connector
8,0	120	13

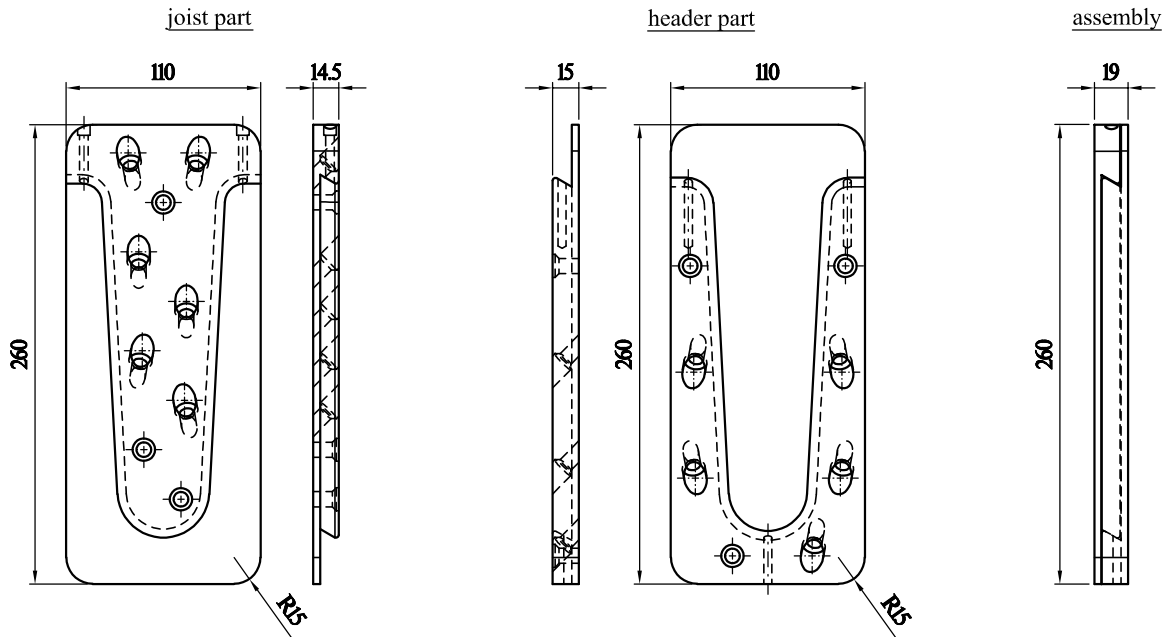
optionally 8,0x160 with the same number



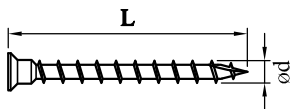
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x260  
All specifications in mm



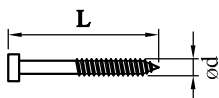
Fastener types and sizes



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

d	L	total number per connector
8,0	120	17

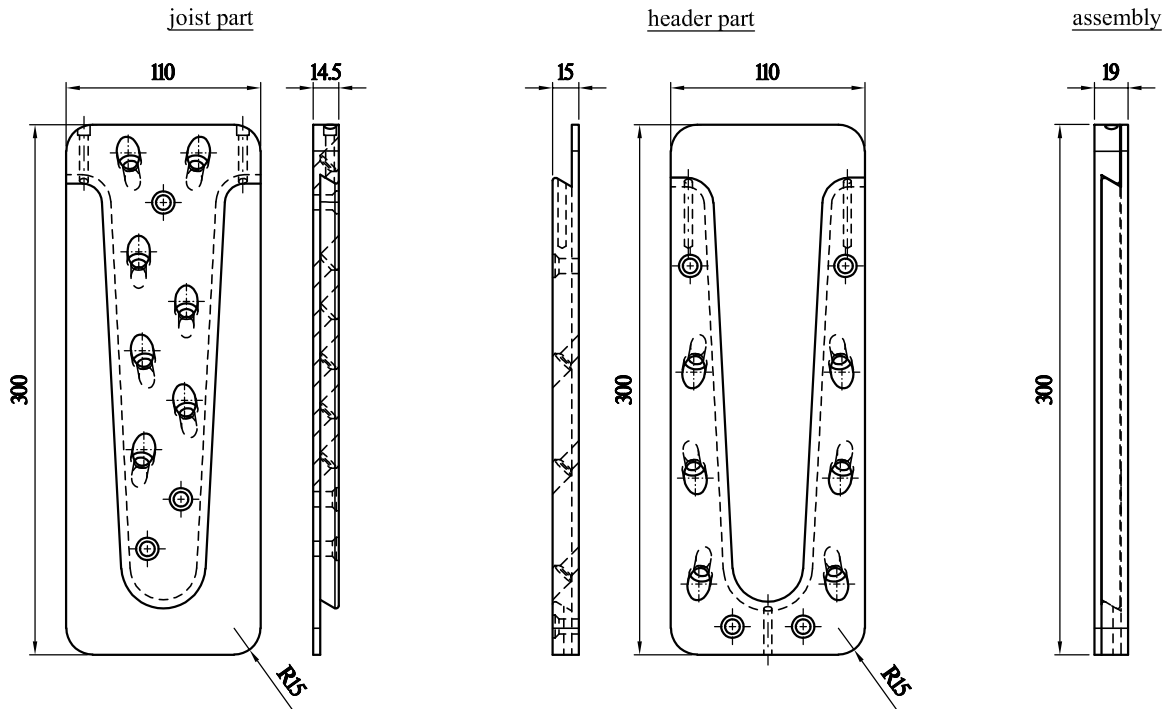
optionally 8,0x160 with the same number



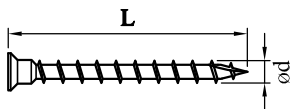
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x300  
All specifications in mm



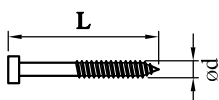
Fastener types and sizes



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

d	L	total number per connector
8,0	120	20

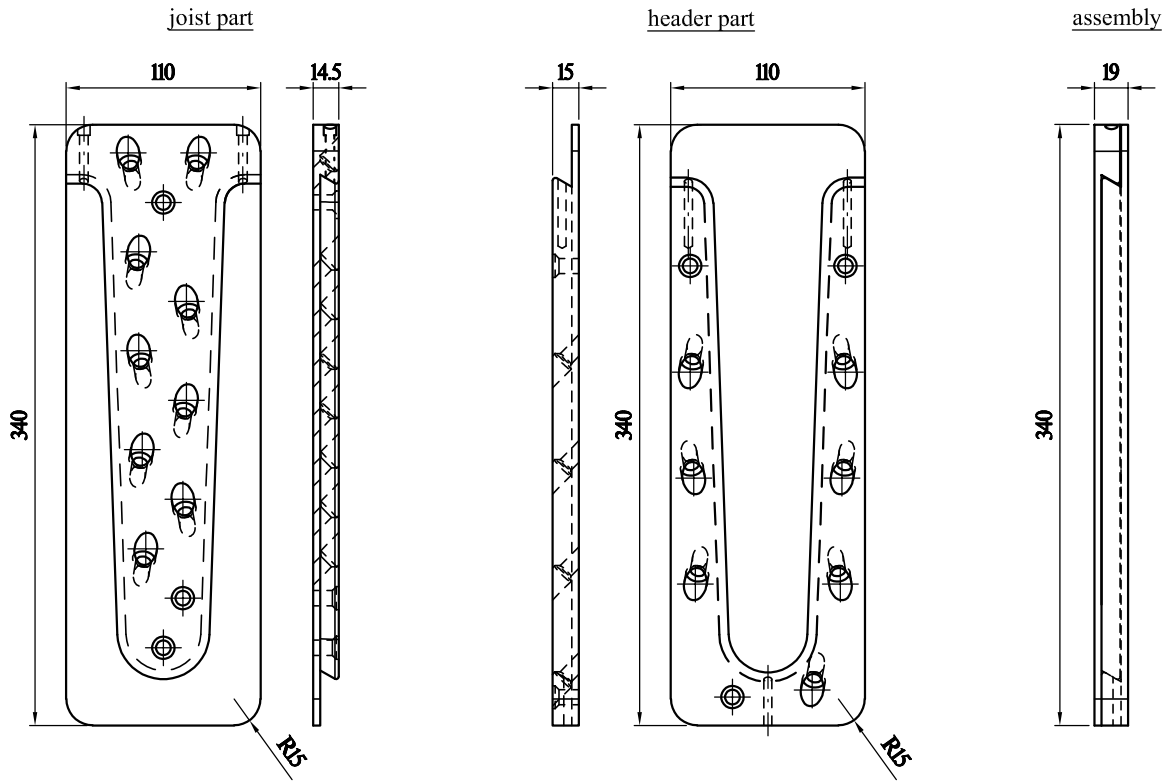
optionally 8,0x160 with the same number



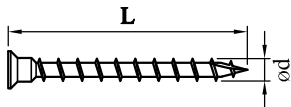
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x340  
All specifications in mm



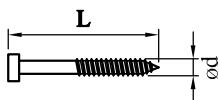
Fastener types and sizes



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

d	L	total number per connector
8,0	120	22

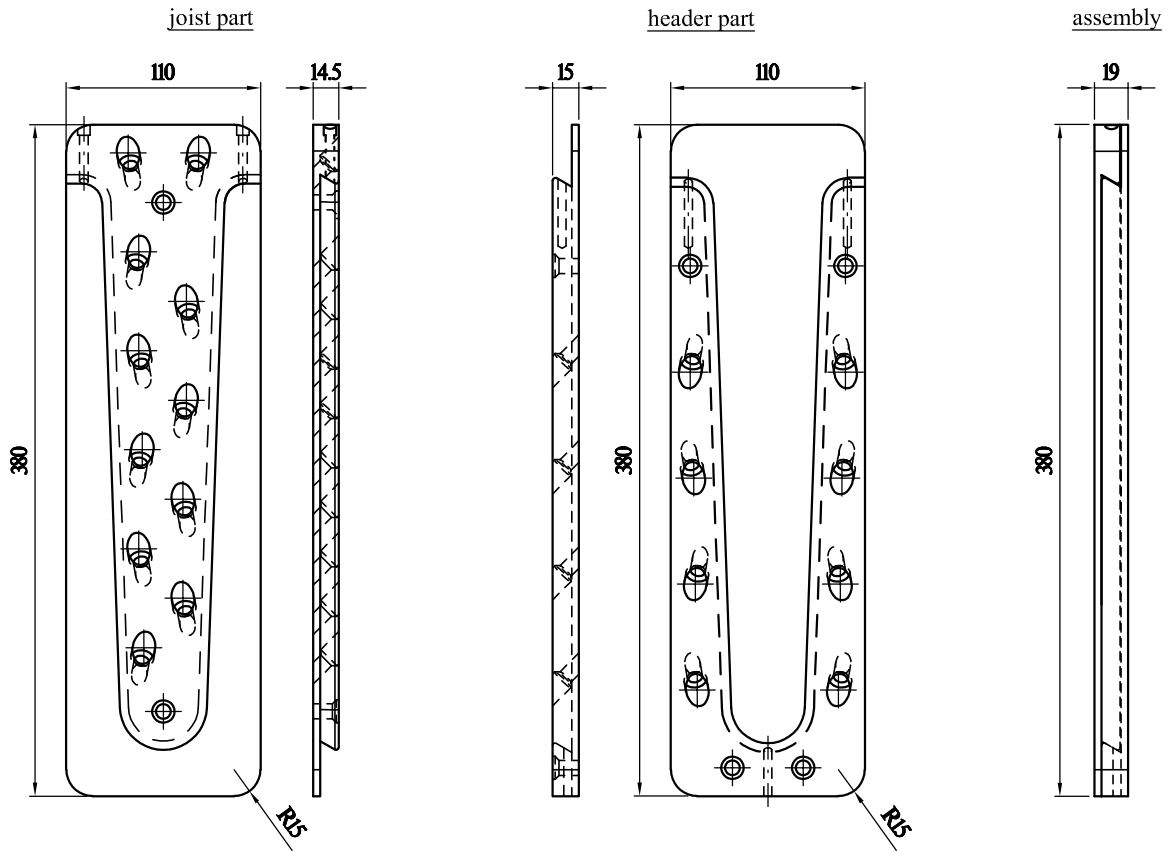
optionally 8,0x160 with the same number



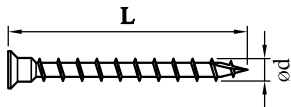
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x380  
All specifications in mm



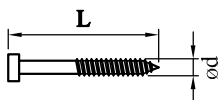
Fastener types and sizes



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

d	L	total number per connector
8,0	120	25

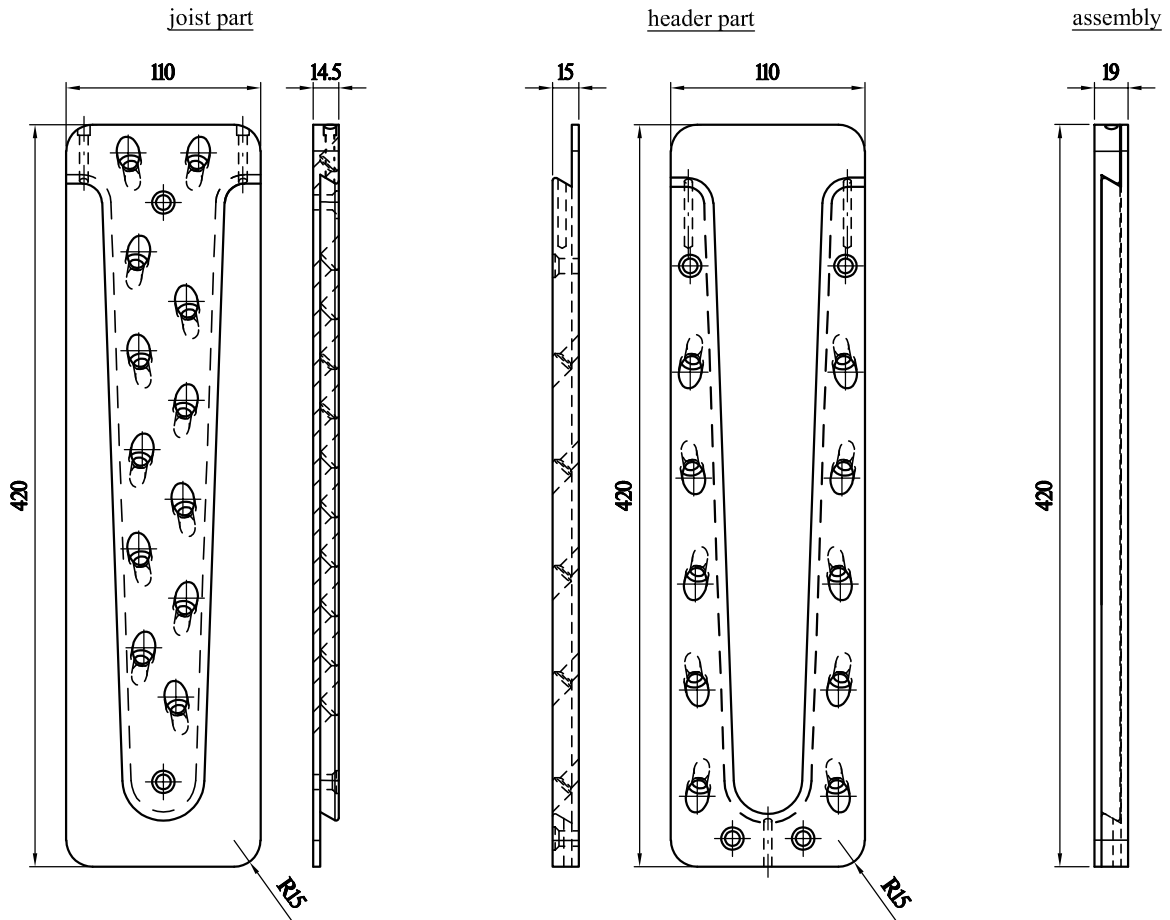
optionally 8,0x160 with the same number



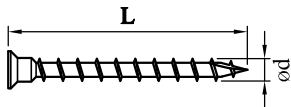
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x420  
All specifications in mm



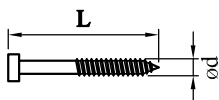
Fastener types and sizes



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

d	L	total number per connector
8,0	120	28

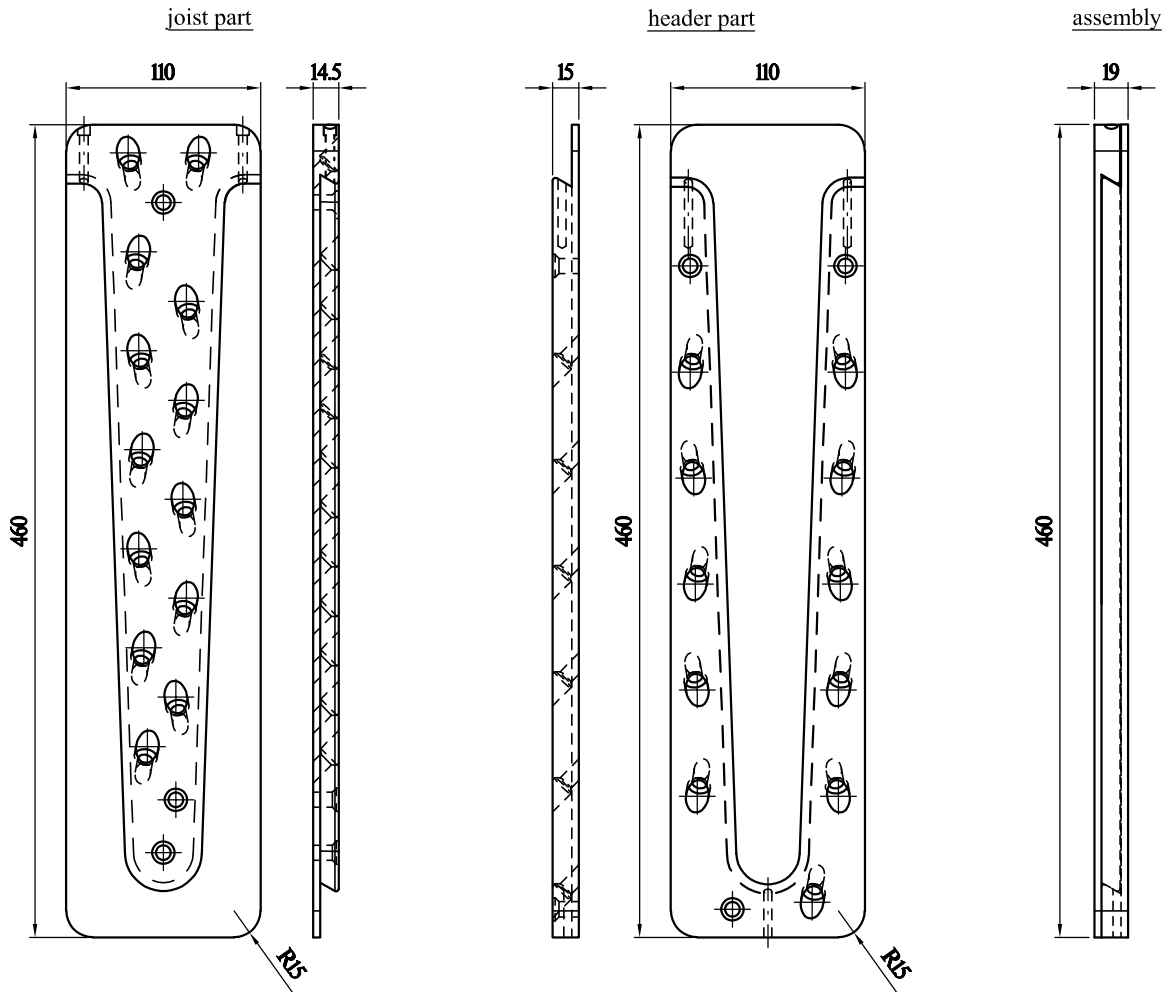
optionally 8,0x160 with the same number



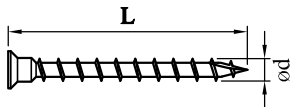
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x460  
All specifications in mm



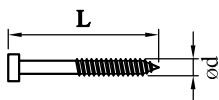
Fastener types and sizes



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

d	L	total number per connector
8,0	120	30

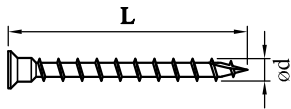
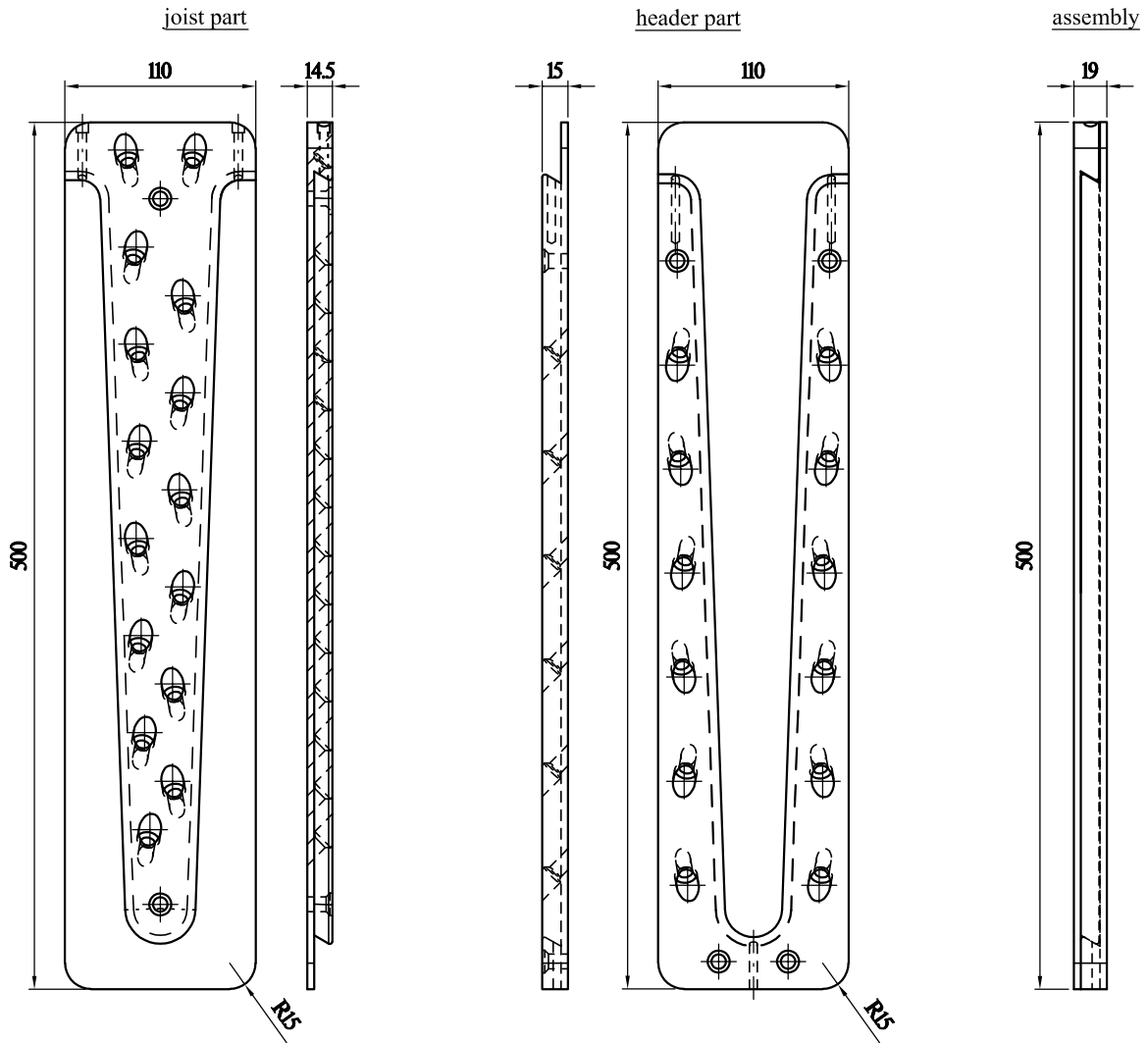
optionally 8,0x160 with the same number



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

d	L	total number per connector
4,8	60	2

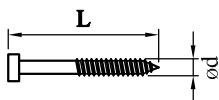
Magnus L 110x500  
All specifications in mm



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

d	L	total number per connector
8,0	120	33

optionally 8,0x160 with the same number

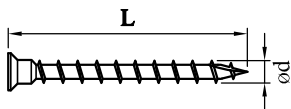
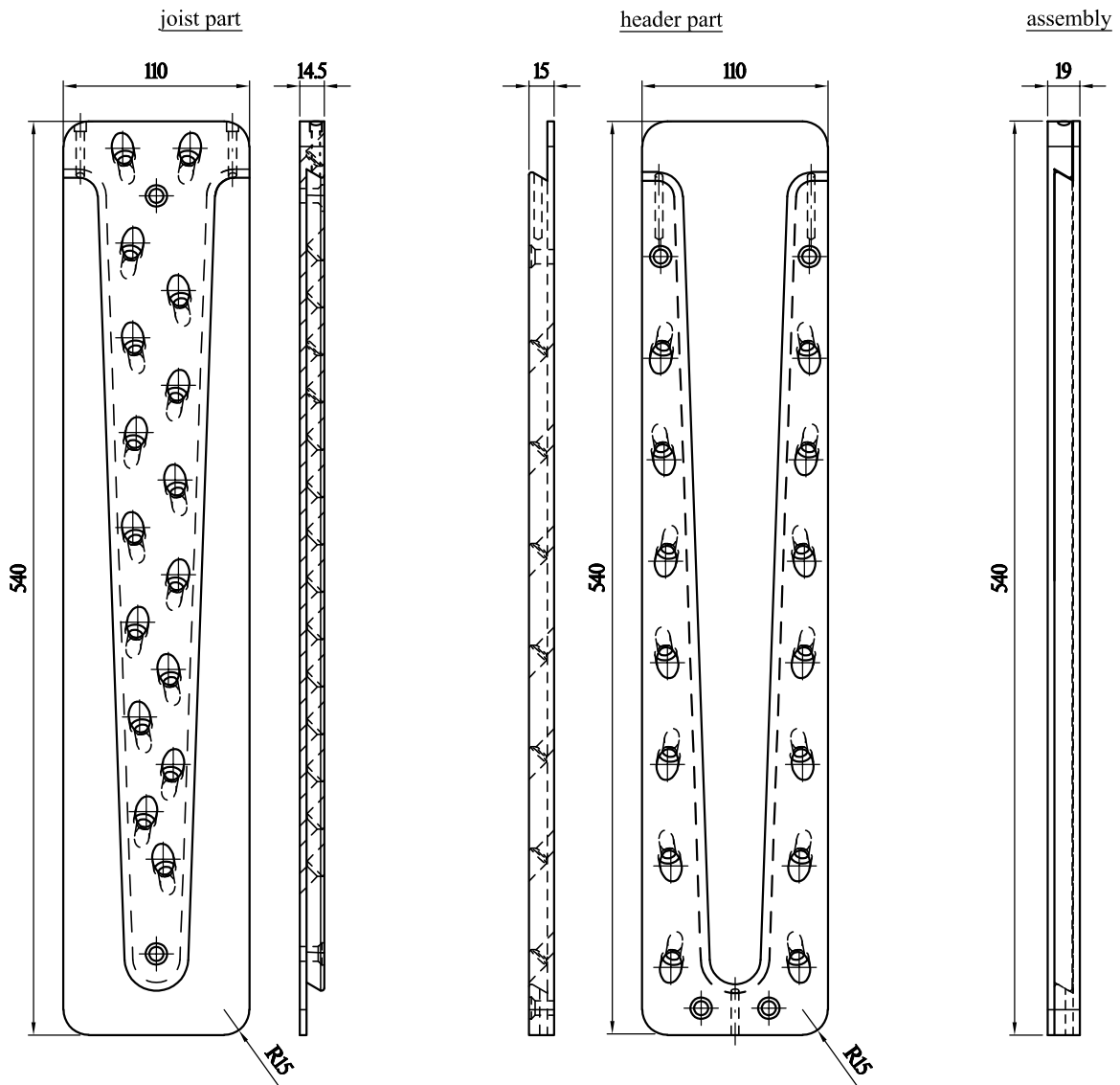


Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2



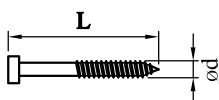
Magnus L 110x540  
All specifications in mm



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

d	L	total number per connector
8,0	120	36

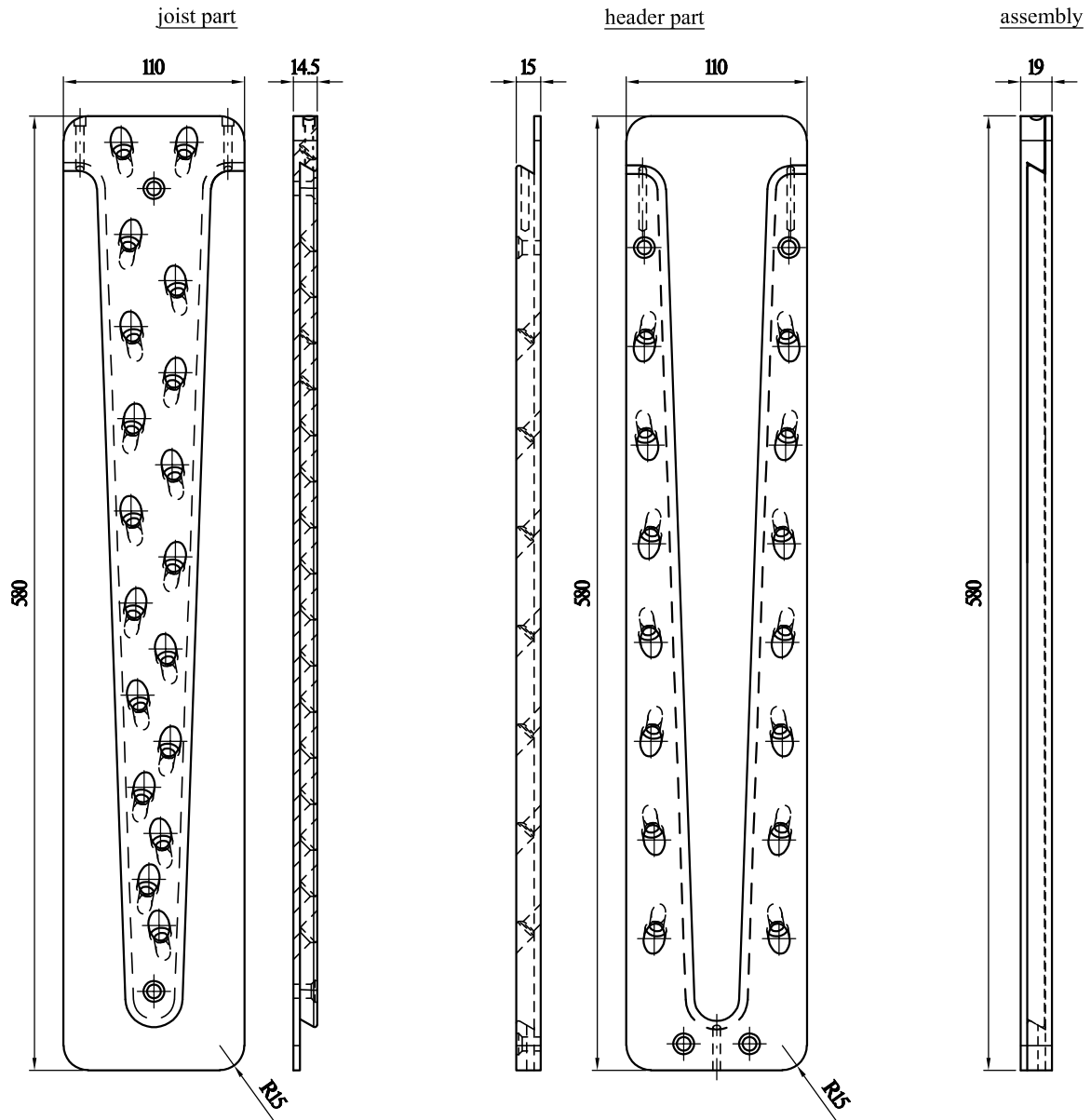
optionally 8,0x160 with the same number



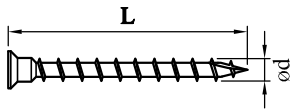
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Magnus L 110x580  
All specifications in mm



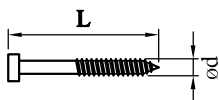
Fastener types and sizes



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

d	L	total number per connector
8,0	120	38

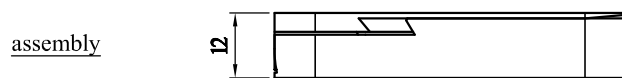
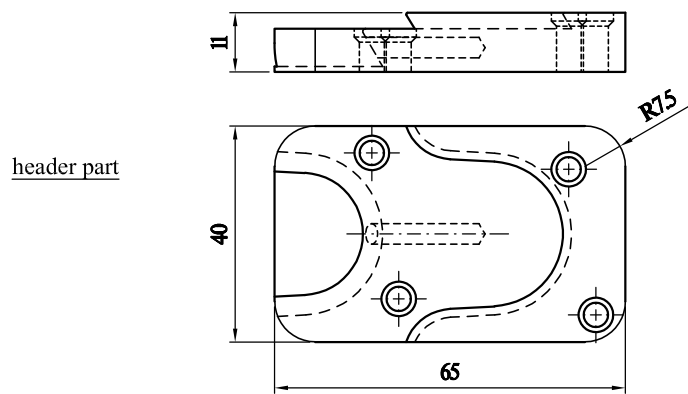
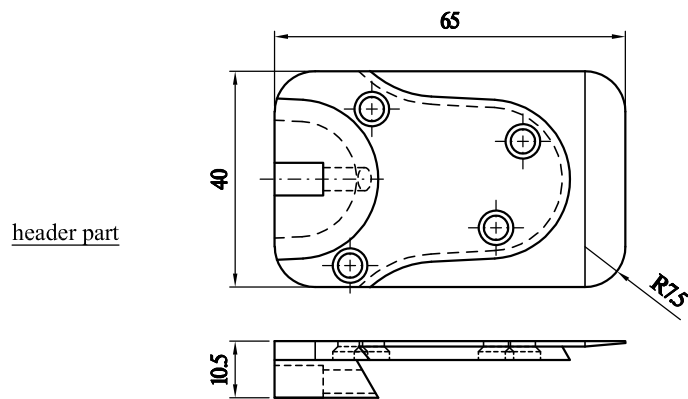
optionally 8,0x160 with the same number



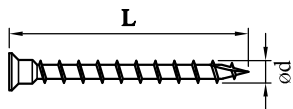
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	2

Timberframe Connector PRV 40x65  
All specifications in mm

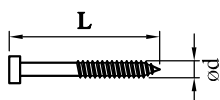


Fastener types and sizes



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

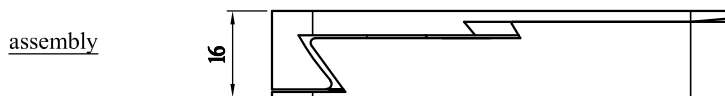
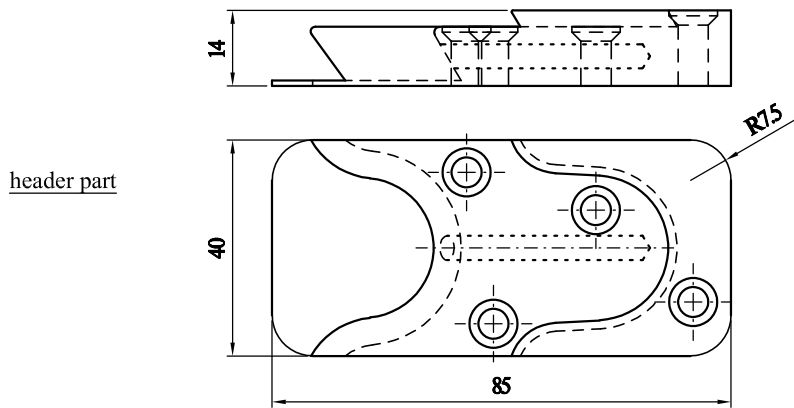
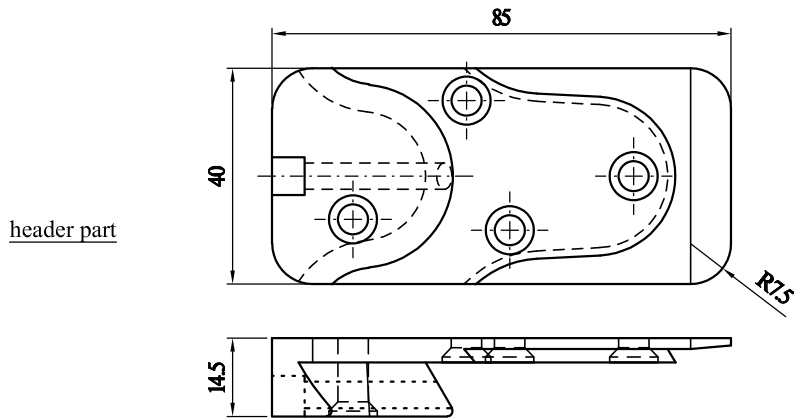
d	L	total number per connector
4,0	60	8



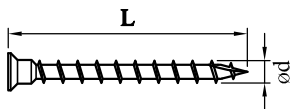
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,2	26	1

Timberframe Connector PRV 40x85  
All specifications in mm

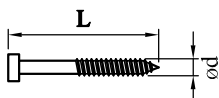


Fastener types and sizes



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

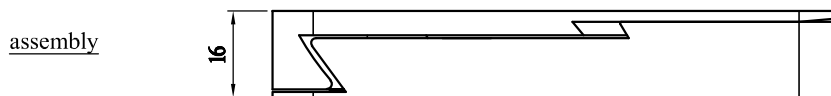
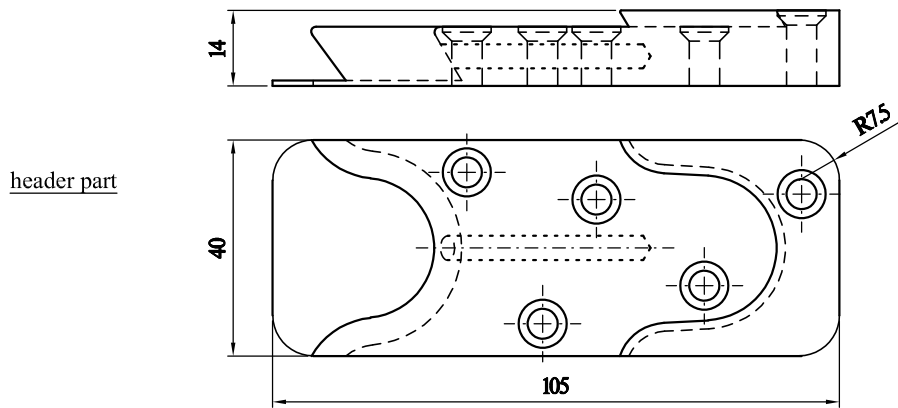
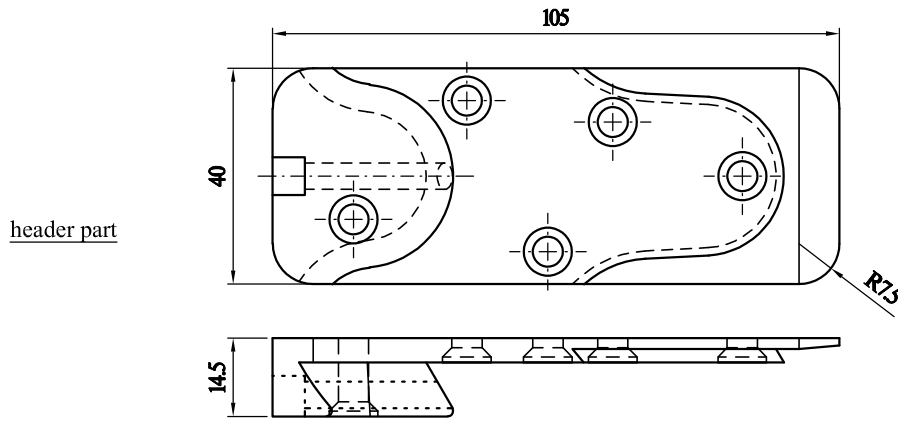
d	L	total number per connector
5,0	60	8



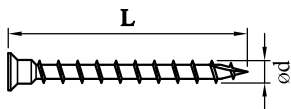
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	1

Timberframe Connector PRV 40x105  
All specifications in mm

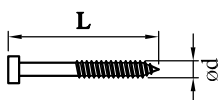


Fastener types and sizes



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

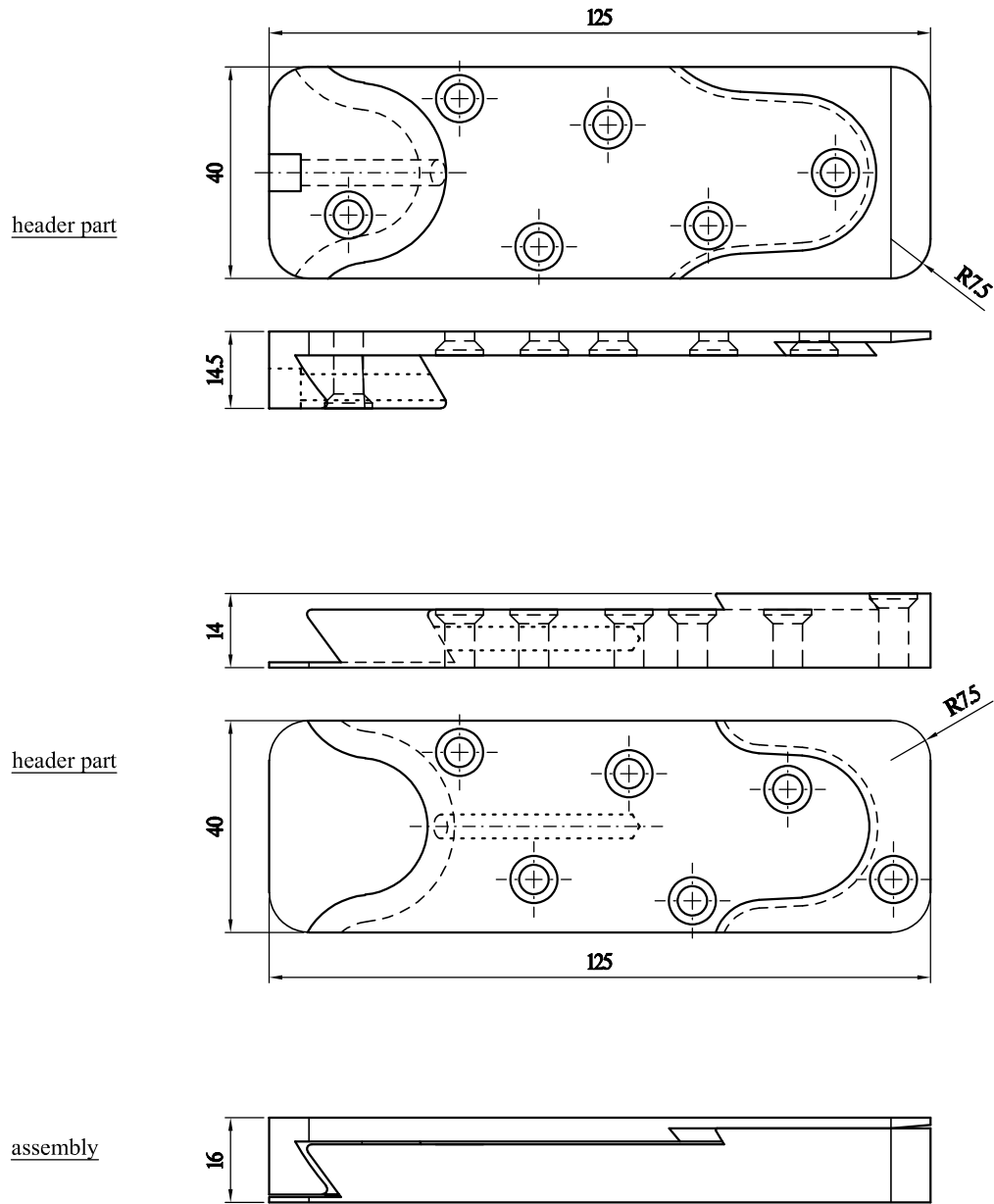
d	L	total number per connector
5,0	60	10



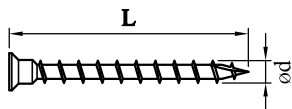
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	1

Timberframe Connector PRV 40x125  
All specifications in mm

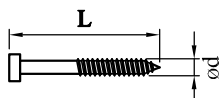


Fastener types and sizes



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

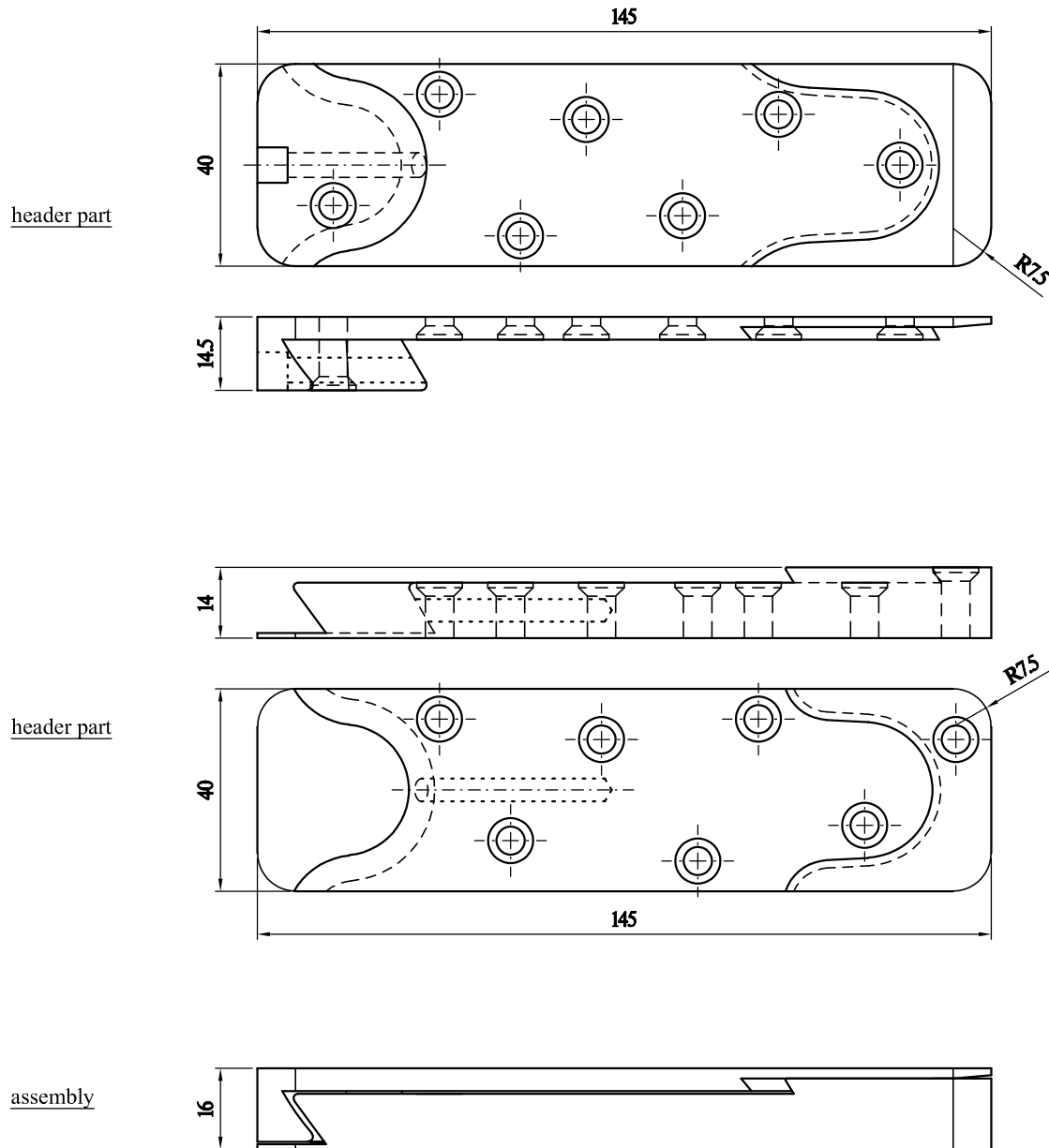
d	L	total number per connector
5,0	60	12



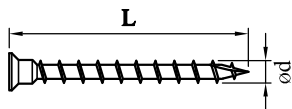
Self-tapping screw according to this ETA for connecting the two connector parts

d	L	total number per connector
4,8	60	1

Timberframe Connector PRV 40x145  
All specifications in mm

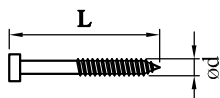


Fastener types and sizes



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

d	L	total number per connector
5,0	60	14



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

d	L	total number per connector
4,8	60	1

**Annex B**  
**Characteristic values of load-carrying-capacities and stiffness – MAGNUS Connector**

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**

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

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

**EUROTEC connectors XS:**

$$F_{2,Rk} = n_{90,J} \cdot F_{la,J,Rk} \quad (\text{B.2})$$

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

**EUROTEC connectors S, M and L:**

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

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

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

**EUROTEC connectors S, M and L:**

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

**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**

$$F_{4,Rk} = \min \left\{ \begin{array}{l} \frac{F_{la,J,Rk}}{\sqrt{\left(\frac{1}{(n_{90} + n_{45})} + \frac{e_{45}}{e_{1,J}}\right)^2 + \left(\frac{e_{45}}{e_{2,J}}\right)^2}} \\ \frac{F_{la,H,Rk}}{\sqrt{\left(\frac{1}{(n_{90} + n_{45})} + \frac{e_{45}}{e_{1,H}}\right)^2 + \left(\frac{e_{45}}{e_{2,H}}\right)^2}} \end{array} \right. \quad (\text{B.11})$$

Where:

$\alpha$  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,  $F_{ax,\alpha,J,Rk} = \frac{0,52 \cdot \sqrt{d} \cdot \ell_{ef,J}^{0,9} \cdot \rho_{k,J}^{0,8}}{1,2 \cdot \cos^2 \alpha + \sin^2 \alpha}$ ,

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

$e_2$  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	39	52	38
50x60	50	60	4,0	2	2	2	2	0,0	25	80	93	80	82
50x80	50	80	4,0	2	4	2	4	9,1	41	101	170	117	197
50x100	50	100	4,0	2	6	4	6	14	46	185	380	158	366
70x120	70	120	5,0	2	4	2	5	10	55	151	286	170	301
70x140	70	140	5,0	2	6	2	6	17	78	189	436	213	467
70x160	70	160	5,0	2	8	4	7	23	95	310	837	265	689
70x180	70	180	5,0	2	10	4	8	30	95	378	1173	320	965
110x220	110	220	8,0	2	4	2	5	33	0	278	1027	419	572
110x260	110	260	8,0	3	5	3	6	50	129	440	2157	517	964
110x300	110	300	8,0	4	6	3	7	66	146	7536	3004	700	1623
110x340	110	240	8,0	3	7	3	9	84	240	759	5311	726	2014
110x380	110	380	8,0	4	8	2	11	101	288	879	6946	954	3079
110x420	110	420	8,0	4	10	2	12	107	338	999	9140	1237	4555
110x460	110	460	8,0	3	11	3	13	123	364	1315	13020	1237	5116
110x500	110	500	8,0	4	12	2	15	141	407	1459	15870	1555	7139
110x540	110	540	8,0	4	14	2	16	147	448	1612	19190	1925	9713
110x580	110	580	8,0	4	14	2	18	175	488	2001	25810	1915	10530

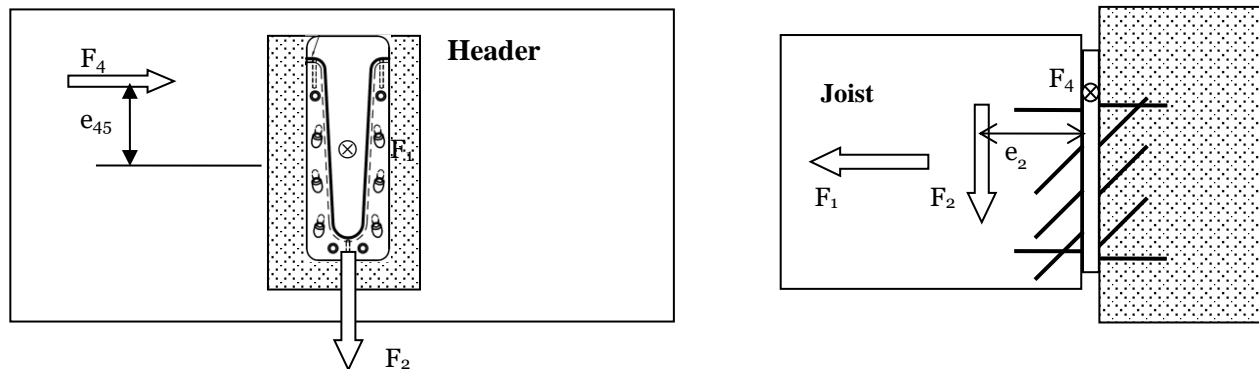


Figure B1: Definition of  $e_2$  and  $e_{45}$

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

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

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.

**Annex B - continued**  
**Design values of load-carrying-capacities and stiffness - Timberframe PRV**

**B.1 Design load-carrying capacities of EUROTEC connector joints**

The force  $F_{23}$  is assumed to act in the middle of the joist. The forces  $F_1$  and  $F_{45}$  are assumed to act at a distance  $e_1$  or  $e_{45}$  from the centre of gravity of the joist connection.

**Force  $F_1$  for EUROTEC Timberframe PRV connectors:**

$$F_{1,Rd} = \frac{F_{ax,Rd}}{\frac{1}{n_J} + \frac{e_1 \cdot x_{max}}{I_{p,ax}}} \quad (B.1.1)$$

**Force  $F_2$  or  $F_3$  for EUROTEC Timberframe PRV connectors:**

$$F_{23,Rd} = \min \left\{ \begin{array}{l} n_J \cdot F_{v,Rd} \\ \frac{f_{tens,FS,k}}{\gamma_{M2}} \quad [N] \end{array} \right. \quad (B.1.2)$$

**Force  $F_{45}$  for EUROTEC Timberframe PRV connectors:**

$$F_{45,Rd} = \frac{F_{v,Rd}}{\sqrt{\left( \frac{1}{n_J} + \frac{e_{45} \cdot x_{max}}{I_p} \right)^2 + \left( \frac{e_{45} \cdot y_{max}}{I_p} \right)^2}} \quad (B.1.3)$$

Where:

$F_{ax,Rd}$  Axial design load-carrying capacity per joist screw in N;

$$F_{ax,Rk} = 0,3 \cdot f_{ax,k} \cdot d \cdot \ell_{ef} \cdot \left( \frac{\rho_k}{350} \right)^{0,8}$$

$f_{ax,k}$  Joist screw withdrawal parameter for an angle of  $90^\circ$  between screw axis and grain direction;

$d$  Joist screw diameter,  $d = 4$  mm or  $d = 5$  mm;

$\ell_{ef}$  Thread penetration length of the joist screws in mm;

$\rho_k$  Characteristic joist density in  $kg/m^3$ ;

$F_{v,Rd}$  Lateral design load-carrying-capacity of a joist screw oriented parallel to grain in N;

$$F_{v,Rk} = 2,3 \cdot \sqrt{M_{y,k} \cdot f_{h,k} \cdot d} + 0,25 \cdot F_{ax,Rk}$$

$M_{y,k}$  Characteristic yield moment of a joist screw in Nmm;

$f_{h,k}$  Characteristic joist embedding strength in  $N/mm^2$ ;

$$f_{h,k} = 0,033 \cdot \rho_k \cdot d^{-0,3}$$

$n_J$  Number of screws per joist connection, see table B.1;

$e_1$  Distance between the force  $F_{1,Ed}$  and the centre of gravity of the joist connection in mm;

$e_{45}$  Distance between the force  $F_{45,Ed}$  and the centre of gravity of the joist connection in mm;

$f_{tens,FS,k}$  Characteristic tensile capacity of a fixing screw in N, see Table B.1;

$\gamma_{M2}$  Partial material safety factor for steel tensile members;

$I_{p,ax}/x_{max}$  Connector dimension, see table B.1;

$I_p/x_{max}$  Connector dimension, see table B.1;

$I_p/y_{max}$  Connector dimension, see table B.1;

**Combined forces**

In case of combined forces the following inequality shall be fulfilled:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{23,Ed}}{F_{23,Rd}}\right)^2 + \left(\frac{F_{45,Ed}}{F_{45,Rd}}\right)^2 \leq 1 \quad (\text{B.1.4})$$

**Table B.1: Numbers  $n_J$  and connector dimensions**

Connector		40x65	40x85	40x125	40x145
d	[mm]	4	5	5	5
$n_J$		4	4	6	7
$f_{tens,FS,k}$	[N]	7000	8000	8000	8000
$I_{p,ax}/X_{max}$	[mm]	49	54	123	168
$I_p/X_{max}$	[mm]	84	66	137	182
$I_p/y_{max}$	[mm]	90	125	391	692

## B.2 Slip moduli of EUROTEC Timberframe PRV joints

The following slip moduli  $K_{ser}$  related to joist edge are to be used for EUROTEC connector joints:

EUROTEC connector joint for load direction  $F_1$ : 
$$K_{ser,1} = \frac{F_{1,Rk}}{0,6 \text{ mm}}$$

EUROTEC connector joint for load direction  $F_{23}$ : 
$$K_{ser,23} = \frac{F_{23,Rk}}{1,5 \text{ mm}}$$

EUROTEC connector joint for load direction  $F_{45}$ : 
$$K_{ser,45} = \frac{F_{45,Rk}}{2 \text{ mm}}$$