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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

European Technical Assessment ETA-21/0710 of 2021/09/01

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 T-Tec 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, timber to steel and timber to concrete 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 47
This European Technical Assessment contains:	12 pages including 3 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 130186-00-0603 for Three-dimensional nailing plates.
This version replaces:	

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

Technical description of the product
E.u.r.o. Tec T-Tec connectors are one-piece, face-fixed connectors to be used in timber to timber or timber to concrete or steel connections.

The connectors are made from aluminium alloy EN AW-6005A T6 to EN 573-3:2009. Dimensions, hole positions, aluminium alloy and typical installa-tions are shown in Annexes A and C.

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

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

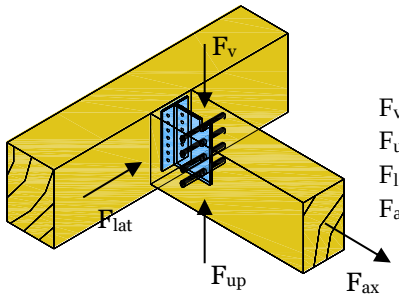
The connectors can be installed as connections between wood based members such as:

- Structural solid timber according to EN 14081,
- Glued solid timber according to EN 14080
- Glulam according to EN 14080,
- Cross-laminated timber according to ETA,
- Solid wood panels according to EN 13353 and EN 13986,
- LVL according to EN 14374 or ETA,
- FST according to ETA-14/0354,
- Plywood according to EN 636 or ETA,
- Engineered wood products with certified mechanical resistances for connections with dowel-type fasteners.

However, the calculation methods are only allowed for a characteristic wood density of up to 460 kg/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 T-Tec 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 connector connection are F_{up} or F_{down} or F_{ax} perpendicular to the header axis and F_{lat} perpendicular to the connector axis. The forces F_{up} and F_{down} shall act in the symmetry plane of the connector. It is assumed that the forces F_{up}, F_{down} or F_{lat} are acting with an eccentricity e with regard to the side grain surface of the header.



$F_v = F_{down}$	downward
F_{up}	uplift
F_{lat}	lateral
F_{ax}	axial

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

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

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

The scope of the 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 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, B and C

*) See additional information in section 3.4 – 3.7.

3.9 Methods of verification

Safety principles and partial factors

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

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

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

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

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

3.10 Mechanical resistance and stability

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

The characteristic capacities of the E.u.r.o.Tec connectors are determined by calculation assisted by tests as described in the EAD 130186-00-0603. 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 7 in Annex A:

- *Screws, bolts, dowels or self-drilling dowels in accordance with EN 14592 or according to ETA*
- *Self-tapping screws in accordance with ETA-11/0024*
- *Metal anchors in accordance with an ETA*

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

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

No performance has been determined in relation to the joint's stiffness properties - to be used for the analysis of the serviceability limit state.

3.11 Aspects related to the performance of the product

In accordance with EAD 130186-00-0603 the aluminium E.u.r.o.Tec connectors are produced from aluminium alloy EN AW 6005A T6 according to EN 573-3.

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:

T-Tec connector joints

A connector joint is deemed fit for its intended use provided:

Header – support conditions

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

  If the header carries joists only on one side the eccentricity moment from the joists $M_{ec} = R_{joist}$ (b_{header}/2+96mm) shall be considered 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.

Wood to wood connections

- Connectors are fastened to wood-based headers by screws and to wood-based joists by dowels.
- There shall be screws in all holes.
- The characteristic capacity of the connector joint is calculated according to the manufacturer's technical documentation, dated 2020-01-03.

- The 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 connectors the gap between the surface of the header plate and the end of the joist shall be maximum 10 mm.
- The groove in the joist and the surface of the header shall have a plane surface against the whole connector.
- The depth of the joist shall be so large that the top (bottom) of the joist is at least $a_{4,t}$ above (below) the upper (lower) dowel in the joist.
- Screws to be used shall have a diameter and head shape, which fits the holes of the connectors.

Wood to concrete or steel

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

- The connector connection is designed in accordance with Eurocodes 2, 3, 5 or 9 or an appropriate national code.
- The connector shall be in close contact with the concrete or steel over the whole face. There shall be no intermediate layers in between.
- The gap between the end of the joist and the surface, where contact stresses can occur during loading shall be limited. This means that the gap between the end grain surface of the joist and that of the concrete or steel shall be maximum 20 mm.
- The bolt or metal anchor shall have a diameter not less than the hole diameter minus 2 mm.
- The bolts or metal anchors shall be placed symmetrically about the vertical symmetry line. There shall always be bolts in the 2 upper holes considering the minimum edge distance.
- The upper bolts shall have washers according to EN ISO 7094.

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

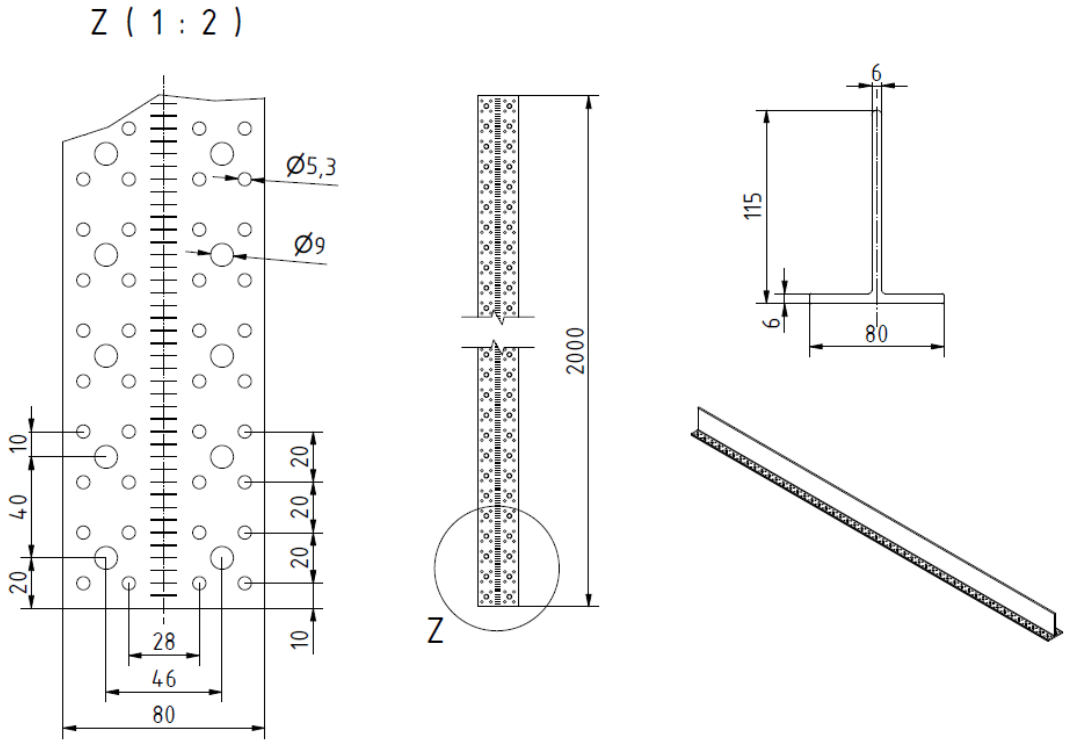
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking

Issued in Copenhagen on 2021-09-01 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions

T-Tec Connector
Face mount hanger with flanges without pre-punched holes for the joist connection. 6.0 mm thick aluminium alloy EN AW 6005A T6 according to EN 573-3:2009.



T-Tec Connector	Effective N° of screw holes		Max. N° of dowels	Effective N° of anchor holes	
	N°	d	N°	N°	d
100	4	5	3	2	9
120	8	5	3	2	9
140	12	5	4	2	9
160	16	5	5	2	9
180	20	5	6	4	9
200	24	5	7	4	9
220	28	5	8	4	9
240	32	5	9	4	9
260	36	5	10	4	9
280	40	5	10	4	9
300	44	5	11	6	9
320	48	5	12	6	9
340	52	5	13	6	9
360	56	5	14	6	9
380	60	5	15	6	9
400	64	5	16	6	9
420	68	5	16	8	9
440	72	5	17	8	9
460	76	5	18	8	9
480	80	5	19	8	9

The distance of the dowels of the joist connection from the header surface is 96 mm.
The T-Tec connectors are supplied in lengths of 2000 mm, which are cut to fit the lengths in the above table and to intermediate sizes within the range of 100 mm - 480 mm. For the load-carrying capacity of a T-Tec connector with intermediate size, refer to the next smaller tabulated size.

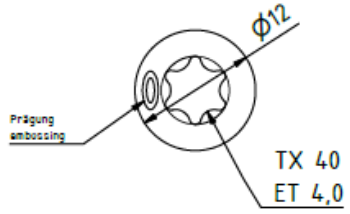
Fastener types and sizes

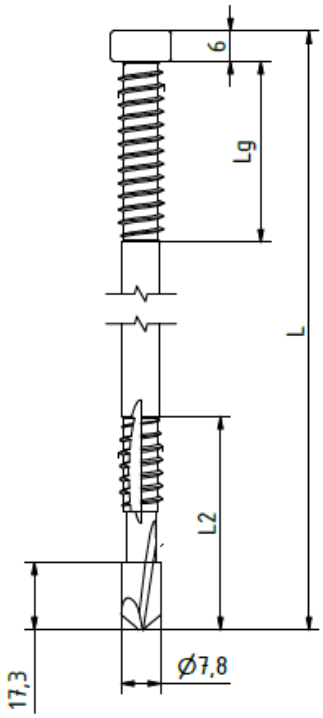
Screw diameter	Length	Screw type
5.0	35 – 70	Self-tapping screw according to EN 14592 or ETA-11/0024
The part of the screw directly under the head shall have a diameter which fits the hole diameter (see Annex A of ETA-11/0024).		

BOLTS, METAL ANCHORS or DOWELS diameter	Corresponding hole diameter in aluminium plate	Fastener type
7.5	-	EST self-drilling dowels
7.5	9.0	Metal anchors according to manufacturer's specification
8.0	9.0	Bolts or dowels according to EN 14592, metal anchors according to manufacturer's specification

EST self-drilling dowels:

L	Lg	L2
73	27	0
93	27	32
113	36	36
133	36	36
153	36	36
173	36	36
193	36	36
213	36	36
233	36	36





Annex B
Characteristic values of load-carrying-capacities

The downward and the upward directed forces are assumed to act in the joist axis.

Only a full screw pattern is specified, where there are screws in all the holes of the header connection. For header connections with bolts or metal anchors, there must always be at least bolts or metal anchors in the two upper two holes for loading down or in the two lower holes for loading up.

B.1 T-Tec Connectors fastened with screws and dowels or with screws and bolts or metal anchors

Loading down or up:

$$F_{v,Rk} = F_{Z,Rk} = \min \begin{cases} n_J \cdot F_{v,J,Rk} \\ \dfrac{1}{\sqrt{\left(\dfrac{1}{n_{H,ef} \cdot F_{v,H,Rk}}\right)^2 + \left(\dfrac{1}{k_{H,Z} \cdot F_{ax,H,Rk}}\right)^2}} \end{cases} \qquad \text{(B.1)}$$

n_J Number of dowels in the joist, see Table B.1

$n_{H,ef}$ Effective total number of fasteners in the header plate

$F_{v,J,Rk}$ Characteristic lateral load-carrying capacity of a dowel with two shear planes in the joist

$F_{v,H,Rk}$ Characteristic lateral load-carrying capacity of a fastener in single shear in the header assuming a thick plate

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

$k_{H,Z}$ form factor, see Table B.1

The load-carrying capacity $F_{v,J,Rk}$ of the connection with EST self-drilling dowels may be calculated according to Eurocode 5 using the characteristic yield moment $M_{y,k}$ = 49 Nm for d = 7.5 mm.

Table B.1: E.u.r.o. Tec T-Tec connectors: Form factors $k_{H,Z}$ and effective number of dowels $n_{H,ef}$

T-Tec Connector	n_J	$n_{H,ef}$	$k_{H,Z}$	$n_{H,ef}$	$k_{H,Z}$
		Timber-to-timber		Timber-to-concrete or steel	
100	3	4	5,02	2	0,63
120	3	8	9,51	2	1,04
140	4	12	14,1	2	1,46
160	5	16	19,1	2	1,88
180	6	20	24,4	4	3,24
200	7	24	30,3	4	4,28
220	8	28	36,7	4	5,38
240	9	32	43,5	4	6,51
260	10	36	51,0	4	7,66
280	10	40	58,9	4	8,84
300	11	44	67,4	6	10,5
320	12	48	76,4	6	12,0
340	13	52	86,0	6	13,7
360	14	56	96,1	6	15,4
380	15	60	107	6	17,1
400	16	64	118	6	18,9
420	16	68	130	8	21,0
440	17	72	142	8	23,1
460	18	76	155	8	25,3
480	19	80	168	8	27,6

The values in Table B.1 are based on the assumption that the depth of the joist equals the depth of the T-Tec connector. For timber headers, the four uppermost header screws are placed 25 mm below the upper end of the connector and hence fulfil the unloaded edge distance requirements of Eurocode 5. At the lower end of the connector,

the screws outside the minimum loaded edge distance are not considered load-bearing.
For concrete headers, the two uppermost header screws are placed 50 mm below the upper end of the connector. The subsequent header screws below are spaced at 120 mm.

Loading perpendicular to the joist plate:

$$F_{lat,Rk} = F_{Y,Rk} = \min \begin{cases} 42,9 \cdot H \\ \dfrac{k_n \cdot h \cdot b \cdot f_{v,k}}{\sqrt{b} \cdot \left(1,5 + \dfrac{231}{b}\right)} \end{cases} \quad \text{(B.2)}$$

Where

$F_{Y,Rk}$ Characteristic load-carrying capacity of a T-Tec connector for loads perpendicular to the joist plate in N;

H Depth of the connector in mm;

k_n Parameter according to Eurocode 5 equation (6.63);

b Joist width in mm;

h Joist depth in mm;

$f_{v,k}$ Characteristic joist shear strength [N/mm²]

Note: For calculating design values, the partial factor for aluminium has to be applied to the first expression in equation (B.2), and k_{mod} and the partial factor for timber to the second expression in equation (B.2).

Loading perpendicular to the header plate
(only if minimum end distance $a_{3,t}$ = 80 mm for joist fasteners are met):

$$F_{ax,Rk} = F_{X,Rk} = \min \begin{cases} 0,4 \cdot n_{H,ef} \cdot F_{ax,Rk} \\ n_J \cdot F_{v,Rk} \end{cases} \quad \text{(B.3)}$$

Where

$F_{ax,Rk}$ Characteristic load-carrying capacity of an axially loaded header fastener;

$n_{H,ef}$ Effective number of header fasteners, see Table B.1;

n_J Number of joist fasteners;

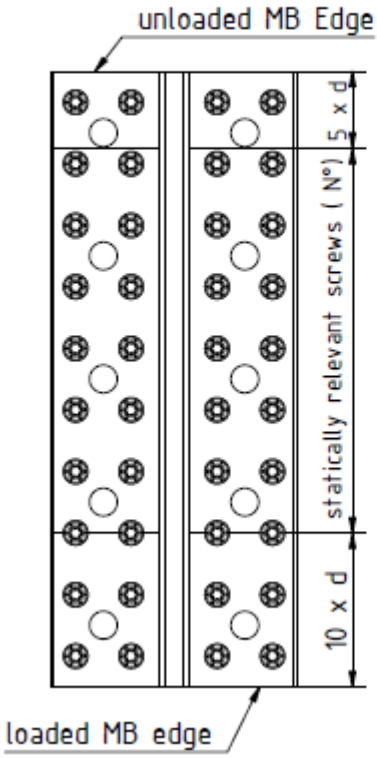
$F_{v,Rk}$ Characteristic load-carrying capacity of a dowel with two shear planes in the joist;

If $F_{X,Ed}$ or $F_{Y,Ed}$ or $F_{Z,Ed}$ load the connection simultaneously, the following interaction equation shall be fulfilled:

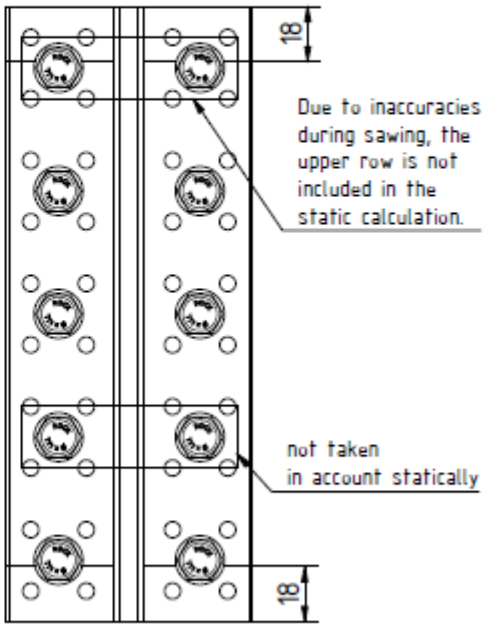
$$\left(\frac{F_{X,Ed}}{F_{X,Rd}}\right)^2 + \left(\frac{F_{Y,Ed}}{F_{Y,Rd}}\right)^2 + \left(\frac{F_{Z,Ed}}{F_{Z,Rd}}\right)^2 \leq 1,0 \quad \text{(B.4)}$$

Annex C
Installation of connectors

wood-wood joint - main beam



wood-concrete joint - main beam



Example length 200 mm

Main beam:

There shall be screws in all holes.

However, not all screws are included in the static calculation.

The drawings show the edge distances and the resulting relevant screws.

Secondary beam:

The drawing shows the specified number of self-drilling dowels, based on the edge distances and centre distances that have to be used.

wood-wood / wood-concrete joint - secondary beam