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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-13/0348 of 2018-05-28

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S	
Trade name of the construction product:	FraP concealed beam hangers
Product family to which the above construction product belongs:	Three-dimensional nailing plate (concealed beam hangers to be used in timber to timber connections)
Manufacturer:	FraP Metall GmbH Triftstrasse 21B D-16348 Wandlitz Tel. +49 33 397 64 313 Fax +49 33 397 64 314 Internet www.frap-metall.de
Manufacturing plant:	UAB Toga FMG Obeniu k. Kietaviskiu sen. LT-21413 Elektrénu sav.
This European Technical Assessment contains:	10 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:	Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD).
This version replaces:	The previous ETA with the same number issued on 2013-05-28 and expiry on 2018-05-28

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

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
FraP concealed beam hangers are one-piece, face-fixed concealed beam hangers to be used in timber to timber connections.

The concealed beam hangers are made from pre-galvanized steel Grade DX51D + Z (min Z275) according to EN 10346:2009 with minimum R_{eH} of 250 MPa, minimum tensile strength R_m of 330 MPa and minimum ultimate strain A_{80} of 19 % with tolerances according to EN 10143:1993 or from stainless steel (1.4301, 1.4401, 1.4541, 1.4571 or 1.4016 according to EN 10088) with equivalent characteristics. Dimensions, hole positions, steel type and typical installations are shown in Annex A.

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

The concealed beam hangers are intended for use in making end-grain to side-grain connections in load bearing timber structures, as a connection between a wood based joist and a solid timber or wood based header or column, 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 concealed beam hangers can be installed as connections between wood based members such as:

- Structural solid timber classified to C14-C40 according to EN 338 / EN 14081,
- Glulam classified to GL24-GL36 according to EN 1194 / EN 14080,
- LVL according to EN 14374,
- Parallam PSL,
- Intrallam LSL,
- Duo- and Triobalken,
- Cross laminated timber,
- I-beams with backer blocks on both sides of the web in the header and web stiffeners in the joist,
- Plywood according to EN 636.

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 concealed beam hangers. 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 concealed beam hanger connection are F_{up} or F_{down} perpendicular to the header axis. The forces F_{up} and F_{down} shall act in the symmetry plane of the concealed beam hanger. It is assumed that the forces are acting with an eccentricity e with regard to side grain surface of the header.

It is assumed that the header beam is prevented from rotating. If the header beam only has installed a concealed beam hanger on one side the eccentricity moment $M_v = F_d \cdot (B_H / 2 + 40\text{mm})$ shall be considered. The same applies when the header has concealed beam hanger connections on both sides, but with vertical forces which differ more than 20%.

The concealed beam hangers are intended for use for connections subject to static or quasi static loading.

The zinc-coated 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). Beam hangers made from stainless steel are for use in service classes 1, 2 and 3 of EN 1995-1-1:2004, (Eurocode 5).

The scope of the hangers regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions.

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

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

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

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*) (BWR1)	
Characteristic load-carrying capacity	See Annex B
Stiffness	No performance assessed
Ductility in cyclic testing	No performance assessed
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The hangers are made from steel classified as **Euroclass A1** in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364
3.3 Hygiene, health and the environment (BWR3)	
Influence on air quality	The product does not contain/release dangerous substances specified in TR 034, dated March 2012 0**)
3.7 Sustainable use of natural resources (BWR7)	No performance assessed
3.8 General aspects related to the performance of the product	The hangers 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 class 1, 2 and 3
Identification	See Annex A

*) See additional information in section 3.9 – 3.11.

**) 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.

Safety principles and partial factors
See annex B for characteristic load-carrying capacities of the concealed beam hangers.

The characteristic capacities of the concealed beam hangers are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. 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 9 in Annex A:

- *Threaded nails (ringed shank nails) in accordance with EN 14592*
- *Dowels in accordance with EN 14592*

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

3.9 Mechanical resistance and stability

See annex B for the characteristic load-carrying capacity in the different directions F_{23} to F_{45}.

The characteristic capacities of the cantilever brackets are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

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

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

3.10 Aspects related to the performance of the product

3.10.1 Corrosion protection in service class 1, 2 and 3.
In accordance with ETAG 015 the concealed beam hangers have a zinc coating weight of min Z275. The steel employed is pre-galvanized steel Grade DX51D + Z275 according to EN 10346:2009 with $R_e \geq 250$ N/mm², $R_m \geq 330$ N/mm² and $A_{80} \geq 19\%$ or from stainless steel (1.4301, 1.4401, 1.4541, 1.4571 or 1.4016 according to EN 10088) with equivalent characteristics.

3.11 General aspects related to the fitness for use of the product

Concealed beam hanger connections

A concealed beam hanger connection is deemed fit for its intended use provided:

Header – support conditions

- The header beam shall be restrained against rotation and be free from wane under the concealed beam hanger.

  If the header carries joists only on one side the eccentricity moment from the joists $M_{ec} = R_{joist}$ (b_{header}/2+40mm) 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

- Concealed beam hangers are fastened to wood-based members by nails (header) and dowels (joist).
- There shall be nails in all holes or a partial nailing pattern for type 90 as a column connection may be used. There shall be dowels in all holes.
- The characteristic capacity of the concealed beam hanger connection is calculated according to the manufacturer's technical documentation, dated 2013-01-29.
- The concealed beam hanger connection is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the end of the joist and the surface, where contact stresses can occur during loading shall be limited. This means that for concealed beam hangers the gap between the surface of the nail heads in the flaps and the end of the joist shall be maximum 8 mm.
- The cross section of the header shall have a plane surface against the whole concealed beam hanger.
- 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.
- Nails and dowels to be used shall have a diameter, which fits the holes of the concealed beam hangers.

4 Attestation 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.

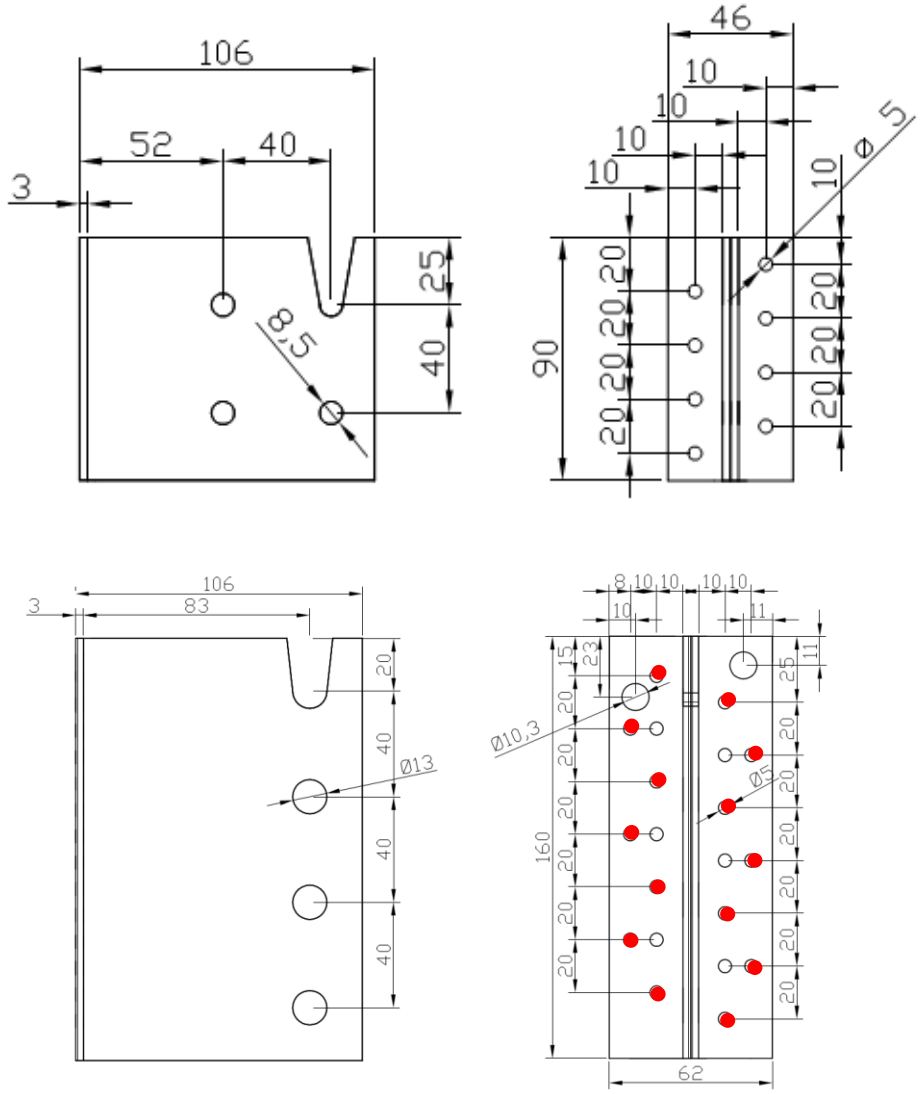
Issued in Copenhagen on 2018-05-28 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions

Concealed beam hanger

Face mount hanger with flanges. 3.0 mm thick pre-galvanized steel DX51D + Z (min Z275) according to EN 10346:2009 with minimum R_{eH} of 250 MPa, minimum tensile strength R_m of 330 MPa and minimum ultimate strain A_{80} of 19 % with tolerances according to EN 10143:1993 or stainless steel (1.4301, 1.4401, 1.4541, 1.4571 or 1.4016 according to EN 10088) with equivalent characteristics.



Drawing: beam hanger 90 (top), beam hanger 160 (bottom)

Beam hanger	N° of nail holes		N° of Dowel holes	
	N°	d	N°	d
90 to header	8	5	4	8,5
90 to column	4	5	4	8,5
120	10	5	3	13
160	14	5	4	13
200	18	5	5	13
240	22	5	6	13

Fastener types and sizes

NAIL diameter	Length	Nail type
4.0	50	Ringed shank nails according to EN 14592

In the formulas in Annex B the capacities for threaded nails calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral nail load-carrying-capacity. The load bearing capacities of the concealed beam hangers has been determined based on the use of connector nails 4,0 x L mm in accordance with the German national approval for the nails. The characteristic withdrawal capacity of the nails has to be determined by calculation in accordance with EN 1995-1-1, paragraph 8.3.2 (head pull-through is not relevant):

$F_{ax,Rk} = f_{1,k} \times d \times t_{pen}$

Where:

$f_{1,k}$ Characteristic value of the withdrawal parameter in N/mm^2

d Nail diameter in mm

t_{pen} Penetration depth of the profiled shank in mm, $t_{pen} \geq 40$ mm

Based on tests by Versuchsanstalt für Stahl, Holz und Steine, University of Karlsruhe, the characteristic value of the withdrawal resistance for the threaded nails used can be calculated as:

$f_{1,k} = 50 \times 10^{-6} \times \rho_k^2$

Where:

ρ_k Characteristic density of the timber in kg/m^3

The shape of the nail directly under the head shall be in the form of a truncated cone with a diameter under the nail head which exceeds the hole diameter.

DOWELS diameter	Correspondence hole diameter in steel plate	Dowels type
8.0	Max. 0.5 mm. larger than the dowel diameter	dowels according to EN 14592
12.0	Max. 1 mm. larger than the dowel diameter	dowels according to EN 14592

Annex B
Characteristic values of load-carrying-capacities

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

Only a full nailing pattern is specified for beam hangers 120 to 240, where there are nails in all marked holes of the header connection. Also dowels are placed in all the dowel holes in the joist.
For beam hanger 90, a full and a partial nailing pattern is specified. The first corresponds to nails in all nail holes, the latter to nails in every second nail hole.

B.1 Concealed beam hangers fastened with nails and dowels

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

$n_{J,ef}$ effective number of dowels in the joist, see Table B.1
n_H total number of nails in the side of the header or column
$F_{v,J,Rk}$ 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 nail in single shear in the header assuming a thick steel plate
$F_{ax,H,Rk}$ Characteristic axial load-carrying capacity of a nail in the header
k_H form factor, see Table B.1

Table B.1: FraP concealed beam hangers: Form factors k_H and effective number of dowels $n_{J,ef}$

Beam hanger	n_J	n_H	k_H	$n_{J,ef}$	k_H	$n_{J,ef}$
			Loading DOWN		Loading UP	
90 to header	4	8	5,71	0,78	8,00	1,05
90 to column	4	4	5,36	0,65	9,18	0,91
120	3	10	35	0,97	14,0	0,61
160	4	14	68	1,57	27,1	1,18
200	5	18	111	2,28	44,4	1,88
240	6	22	165	3,07	66,0	2,68

Annex C
Installation of concealed beam hangers