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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-09/0105 of 2014-05-23

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:	Gutzeit concealed beam hangers 90, 120 160, 200 and 240
Product family to which the above construction product belongs:	Three-dimensional nailing plate (concealed beam hangers)
Manufacturer:	Gutzeit Verbindungssysteme GmbH & Co. Rudolf-Diesel-Strasse 1 D-58730 Fröndenberg, Industriegebiet Tel. +49 2373 - 979261 Fax +49 2373 - 979266 Internet www.gutzeit-holzverbinder.de
Manufacturing plant:	Gutzeit Verbindungssysteme GmbH & Co. Rudolf-Diesel-Strasse 1 D-58730 Fröndenberg, Industriegebiet
This European Technical Assessment contains:	11 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 2010-05-04 and expiry on 2014-05-29

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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
Gutzeit 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 a minimum R_e of 295 MPa, a maximum tensile strength R_m of 360 MPa and a minimum ultimate strain A_{80} of 22 % with tolerances according to EN 10143:1993. 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, 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,
- Layered wood plates,
- Kreuzbalken,
- 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).

The scope of the brackets 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 hangers 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 determined
Ductility in cyclic testing	No performance determined
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 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 Hygiene, health and the environment (BWR3)	
Influence on air quality	No dangerous materials**)
3.7 Sustainable use of natural resources (BWR7)	No Performance Determined
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 and 2
Identification	See Annex A

*) See additional information in section 3.8 – 3.9.

**) 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

3.10 Mechanical resistance and stability

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 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 brackets has been determined based on the use of connector nails 4,0 x 40 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: 2004, paragraph 8.3.2 (head pull-through is not relevant):

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

Where:

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

d Nail diameter in mm

t_{pen} Penetration depth of the profiles in mm

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

$$f_{ax,k} = 50 \times 10^{-6} \times \sigma_k^2$$

Where:

σ_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.

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

3.11.1 Corrosion protection in service class 1 and 2.

The hangers are made from pre-galvanized steel DX 51 D / Z 275 according to EN 10346:2009 with $R_e \geq 295$ N/mm², $R_m \leq 360$ N/mm² and $A_{80} \geq 22\%$

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

Gutzeit concealed hangers 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 installation apply:

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.
- There shall be nails in all holes or a partial nailing pattern as prescribed in Annex A-C may be used.
- The characteristic capacity of the concealed beam hanger connection is calculated according to the manufacturer's technical documentation, dated 2008-12-15.
- 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 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

Issued in Charlottenlund on 2014-05-23 by

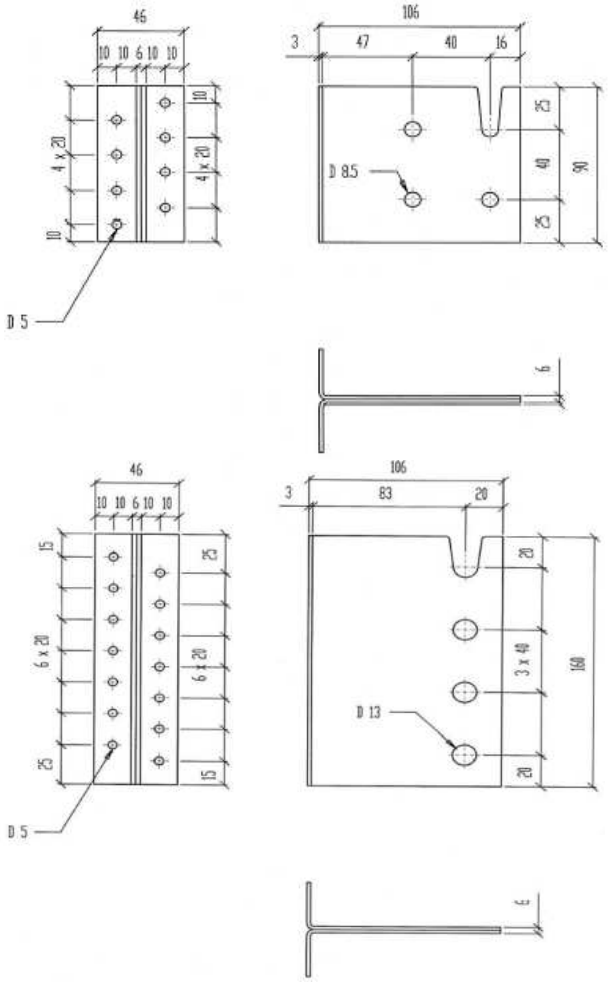
Thomas Bruun
Managing Director, ETA-Danmark

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 a minimum R_e of 295 MPa, a maximum tensile strength R_m of 360 MPa and a minimum ultimate strain A_{80} of 22 % with tolerances according to EN 10143:1993.



Drawing: beam hanger 90 (left), beam hanger 160 (right)

Beam hanger	N° of nail holes		N° of Bolt holes	
	N°	d	N°	d
90	8	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	40	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: 2004, 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

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, where there are nails in all the holes of the header connection. Also dowels are placed in all the dowel holes in the joist.

B.1 Concealed beam hangers fastened with nails and dowels

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

$n_{J,ef}$ effective number of dowels in the joist, see Table B.1

n_H total number of nails in the side of the header

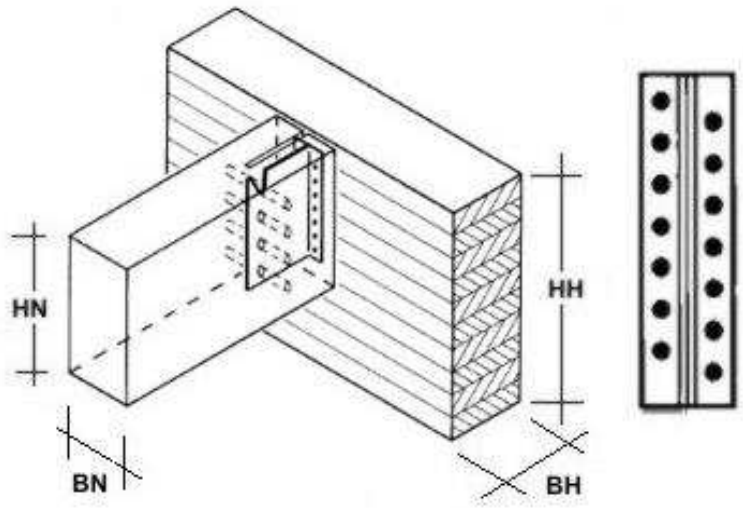
$F_{v,J,Rd}$ Characteristic lateral load-carrying capacity of a dowel with two shear planes in the joist

$F_{v,J,Rd}$ Characteristic lateral load-carrying capacity of a nail in single shear in the header assuming a thick steel plate

$F_{ax,H,Rd}$ Characteristic axial load-carrying capacity of a nail in the header

k_H form factor, see Table B.1

Table B.1: Gutzeit 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	4	8	5,00	0,85	6,67	1,12
120	3	10	23,3	1,03	11,7	0,66
160	4	14	45,1	1,66	22,6	1,26
200	5	18	74,0	2,40	37,0	2,00
240	6	22	110	3,22	55,0	2,84

Annex C
Installation of concealed beam hangers