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MEMBER OF EOTA

Authorised and notified according to Article 10 of the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products

European Technical Approval ETA-12/0500

Trade name:

Würth ZD Connector

Holder of approval:

Adolf Würth GmbH & Co. KG
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Generic type and use of construction product:

Three-dimensional nailing plate (Connector for timber-to-steel connections)

Valid from:
to:

2012-12-21
2016-12-05

Manufacturing plant:

Werk 1	Werk 2	Werk 3	Werk 4	Werk 5
Werk 6	Werk 7	Werk 8	Werk 9	Werk 10

This European Technical Approval contains:

11 pages including 2 annexes which form an integral part of the document



European Organisation for Technical Approvals

Europæisk Organisation for Tekniske Godkendelser

I LEGAL BASIS AND GENERAL CONDITIONS

1 This European Technical Approval is issued by ETA-Danmark A/S in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹⁾, as amended by Council Directive 93/68/EEC of 22 July 1993²⁾.

- Bekendtgørelse 559 af 27-06-1994 (afløser bekendtgørelse 480 af 25-06-1991) om ikrafttræden af EF direktiv af 21. december 1988 om indbyrdes tilnærmelse af medlemsstaternes love og administrative bestemmelser om byggevarer.

- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC³⁾.

- EOTA Guideline ETAG 015 *Three-dimensional nailing plates*, September 2002 edition.

2 ETA-Danmark A/S is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4 This European Technical Approval may be withdrawn by ETA-Danmark A/S pursuant to Article 5(1) of Council Directive 89/106/EEC.

1) Official Journal of the European Communities N° L40, 11 Feb 1989, p 12.

2) Official Journal of the European Communities N° L220, 30 Aug 1993, p 1.

3) Official Journal of the European Communities N° L 17, 20 Jan 1994, p 34.

5 Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of ETA-Danmark A/S. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 This European Technical Approval is issued by ETA-Danmark A/S in English. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

II SPECIAL CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

Definition of the product

WÜRTH ZD connectors are two-piece, face-fixed connectors to be used in steel-to-timber connections.

The WÜRTH ZD connectors are made from steel grade S355 according to EN 10025-2 or steel casting for structural use according to EN 10340 (grade G24Mn6 or G10MnMoV6-3). Dimensions, hole positions and typical installations are shown in Annexes A and B.

Intended use

WÜRTH ZD connectors are intended for use in making connections in load bearing timber structures, as a connection between a steel plate and a solid timber or wood based member, where requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled.

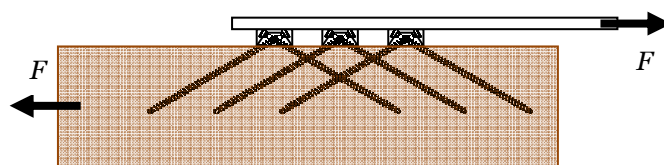
The WÜRTH ZD connectors can be installed as connections between wood based members such as:

- 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.

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 and slip moduli of the connections with WÜRTH ZD 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 F . The force F acts perpendicular to the longitudinal axis of the connector and parallel to the timber member surface.



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

The WÜRTH ZD 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 (Eurocode 5).

Assumed working life

The assumed intended working life of the angle brackets 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.

2 Characteristics of product and assessment

ETAG paragraph	Characteristic	Assessment of characteristic
2.1 Mechanical resistance and stability*)		
6.1.1	Characteristic load-carrying capacity	See Annex B
6.1.2	Stiffness	See Annex B
6.1.3	Ductility in cyclic testing	No performance determined
2.2 Safety in case of fire		
6.2.1	Reaction to fire	The ZD connectors 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
2.3 Hygiene, health and the environment		
6.3.1	Influence on air quality	No dangerous materials **)
2.4 Safety in use		
Not relevant		
2.5 Protection against noise		
Not relevant		
2.6 Energy economy and heat retention		
Not relevant		
2.7 Related aspects of serviceability		
6.7.1	Durability	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 class 1 and 2
6.7.2	Serviceability	
6.7.3	Identification	

*) See page 5 of this ETA

**) In accordance with <http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm> In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, 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 EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

Safety principles and partial factors

2.1 Mechanical resistance and stability

See annex B for characteristic load-carrying capacities and stiffness of the WÜRTH ZD connections.

The characteristic capacities of the WÜRTH ZD 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 9 in Annex A:

- Screws in accordance with EN 14592 or an ETA based on CUAP 06-03/08
- Bolts in accordance with EN ISO 4017

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.

2.7 Related aspects of serviceability

2.7.1 Corrosion protection in service class 1 and 2.

In accordance with ETAG 015 the WÜRTH ZD connectors are produced from steel grade S355 according to EN 10025-2 or steel casting for structural use according to EN 10340 (grade G24Mn6 or G10MnMoV6-3).

3 Attestation of Conformity and CE marking

3.1 Attestation of Conformity system

The system of attestation of conformity is 2+ described in Council Directive 89/106/EEC (Construction Products Directive) Annex III.

- a) Tasks for the manufacturer:
- (1) Factory production control,
 - (2) Initial type testing of the product,
- b) Tasks for the notified body:
- (1) Initial inspection of the factory and the factory production control,
 - (2) Continuous surveillance

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan⁴. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as sheet metal, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and zinc coating thickness.

The manufactured components are checked visually and for dimensions.

The control plan, which is part of the technical documentation of this European Technical Approval,

⁴ The control plan has been deposited at ETA-Danmark and is only made available to the approved bodies involved in the conformity attestation procedure.

includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control and has been agreed between the approval holder and ETA Danmark.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- Designation of the product, basic material and components;
- Type of control or testing;
- Date of manufacture of the product and date of testing of the product or basic material and components;
- Result of control and testing and, if appropriate, comparison with requirements;
- Signature of person responsible for factory production control.

The records shall be presented to ETA Danmark on request.

3.2.1.1 Initial type testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type testing has to be agreed between ETA Danmark and the notified body.

3.2.2. Tasks of notified bodies

3.2.2.1 Initial inspection of the factory and the factory production control

The approved body should ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the connectors with the specifications given in part 2.

3.2.2.2 Continuous surveillance

The approved body shall visit the factory at least twice a year for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the control plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body to ETA Danmark. Where the provisions of the European Technical Approval and the control plan are no longer fulfilled, the certificate

of conformity shall be withdrawn by the approved body.

3.3 CE marking

The CE marking shall be affixed on each packaging of connectors. The initials "CE" shall be followed by the identification number of the notified body and shall be accompanied by the following information:

- Name or identifying mark of the manufacturer
- The last two digits of the year in which the marking was affixed
- Number of the European Technical Approval
- Name and size of product
- Number of the ETA Guideline (ETAG no. 015)
- Number of the EC Certificate of Conformity

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

WÜRTH ZD connectors are manufactured in accordance with the provisions of this European Technical Approval using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation

4.2 Installation

WÜRTH ZD connector joints

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

Timber member

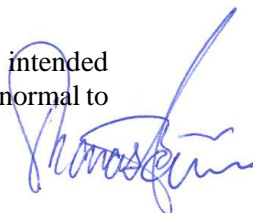
- The timber member shall be free from wane under the WÜRTH ZD connector.

Steel to timber connections

- WÜRTH ZD connectors are fastened to wood-based members by screws with a full thread.
- There shall be screws of equal length in all holes.
- The characteristic capacity of the WÜRTH ZD connector joint is calculated according to the manufacturer's technical documentation dated 2011-06-21.
- The WÜRTH ZD connector joint is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the timber member and the surface, where contact stresses can occur during loading shall be limited. This means that for WÜRTH ZD connectors the gap between the surface of the connector plates and the timber surface shall be maximum 1 mm.
- The side grain of the timber member and the surface of the header shall have a plane surface against the whole WÜRTH ZD connector.
- The depth of the timber member shall be so large that the bottom of the timber member is at least 10 mm below the lower screw tip in the joist.
- Screws to be used shall have a diameter of 10 mm and head shape which fits the holes of the WÜRTH ZD connectors.

4.3 Maintenance and repair

Maintenance is not required during the assumed intended working life. Should repair prove necessary, it is normal to replace the WÜRTH ZD connector.

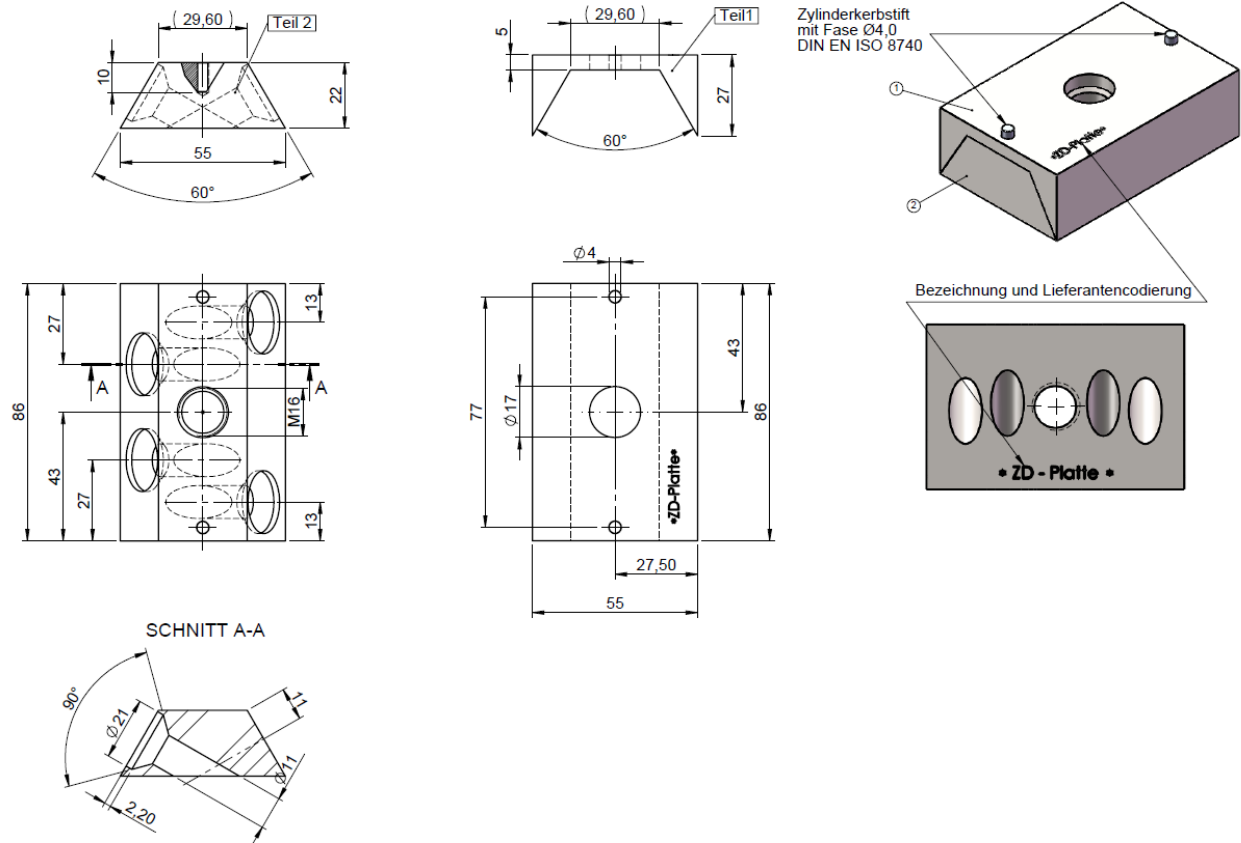


Thomas Bruun
Manager, ETA-Danmark

Annex A
Product details and definitions

WÜRTH ZD connector

Face mount two-piece connector. Steel grade S355 according to EN 10025-2 or steel casting for structural use according to EN 10340 (grade G24Mn6 or G10MnMoV6-3). Steel-to-timber connections with screws. The metric bolts M16 10.9 should be tightened to a torque of 230 Nm.



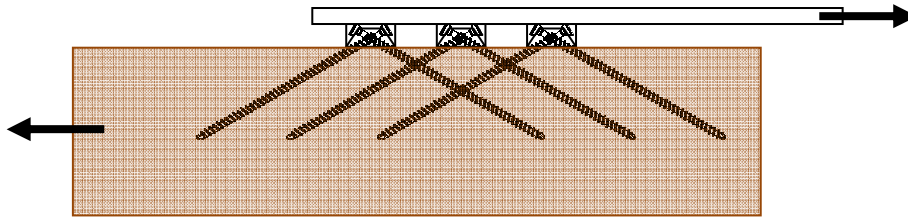
Fastener types and sizes

SCREW diameter [mm]	Length [mm]	Screw type
10.0	240 - 600	Self-tapping screws according to EN 14592 or ETA
BOLTS diameter [mm]	Length [mm]	Bolt type
16.0	30 – 60	Bolts 10.9 according to EN ISO 4017

Annex B
Characteristic values of load-carrying-capacities

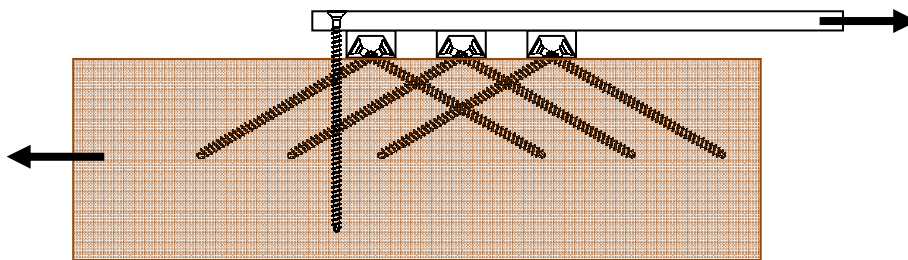
The forces are assumed to act perpendicular to the longitudinal axis of the connector and parallel to the timber member surface. Only a full fastener pattern is specified, where there are screws of equal length in all the four holes of the connector.

Steel-to-timber connections with screws – no additional screws perpendicular to the shear plane



$$F_{ZD,Rk} = F_{ax,Rk} \cdot \frac{3 \cdot n_{ZD} - 1,3}{1 + \frac{16 + 0,3 \cdot t}{a_1 \cdot (n_{ZD} - 1)}} \quad (B.1)$$

Steel-to-timber connections with screws – additional screws perpendicular to the shear plane



$$F_{ZD,Rk} = F_{ax,Rk} \cdot 3 \cdot n_{ZD} \quad (B.2)$$

The additional tensile screws perpendicular to the shear plane should be designed for a tensile force:

$$F_{t,k} = F_{ax,Rk} \cdot \frac{3 \cdot n_{ZD}}{\frac{a_1 \cdot (n_{ZD} - 1)}{27 + t/2} - \frac{1}{4}} \quad (B.3)$$

Where:

$F_{ax,Rk}$ Withdrawal or tensile capacity of a screw,

$$F_{ax,\alpha,Rk} = \min \left\{ \frac{f_{ax,k} \cdot d \cdot l_{ef}}{1,2 \cdot \cos^2 \alpha + \sin^2 \alpha} \cdot \left(\frac{\rho_k}{\rho_a} \right)^{0,8}, f_{tens,k} \right\}$$

With $f_{ax,k} = 0,52 \cdot d^{-0,5} \cdot l_{ef}^{-0,1} \cdot \rho_a^{0,8}$ for screws in accordance with EN 14592

$f_{ax,k}$ according to the ETA for screws in accordance with an ETA based on CUAP 06-03/08

ρ_a reference density for $f_{ax,k}$ in accordance with EN 14592 an ETA based on CUAP 06-03/08

and

- d Outer thread diameter of a screw, d = 10 mm
- l_{ef} Penetration length of the threaded part of a screw, $l_{ef} = l - 24$ mm
- ρ_k Characteristic density of the timber member
- α Angle between screw axis and grain direction
- n_{ZD} Number WÜRTH ZD connectors, $n_{ZD} \geq 2$
- t steel plate thickness
- a_1 spacing of the WÜRTH ZD connectors
- $f_{tens,k}$ Tensile capacity of a screw

The slip modulus per WÜRTH ZD connector may be assumed as:

$K_{ser} = 20$ kN/mm for WÜRTH ZD connections without additional screws perpendicular to the shear plane

$K_{ser} = 100$ kN/mm for WÜRTH ZD connections with additional screws perpendicular to the shear plane