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European Technical Assessment ETA-21/0154 of 2021/02/23

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:

fischer CSC 45 connector

Product family to which the
above construction product
belongs:

Self-tapping screws for use in wood-concrete slab kits

Manufacturer:

fischerwerke GmbH & Co. KG
Klaus-Fischer-Straße 1
D-72178 Waldachtal
Germany

Manufacturing plant:

fischerwerke

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:

European Assessment Document (EAD) no. EAD
130090-00-0303 "Wood-concrete composite slab with
dowel-type fasteners"

This version replaces:

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

This ETA is an assessment of the fischer CSC 45 connectors for wood-concrete composite slab kits. The connector is composed of a socket made of polyamide and two galvanised steel screws. The nominal diameter of the screws is 8 mm. Shape and tolerances of the connectors are given in Annex C. The use of screws with a different nominal diameter is not covered by this ETA.

The kits are individually designed to meet the requirements put on the works.

fischerwerke GmbH delivers the fischer CSC 45 connectors for the composite action to be used as kit components. The composite members may be prefabricated at factory, or they may be composed at the building site. The proper function of the wood-concrete composite slabs provides for the following components to be added in the factory or at the building site:

Base Material:

- Timber members, e.g., glued laminated timber according to EN 14080:2013, or glued solid timber, sawn softwood timber according to EN 14081-1:2016/A1:2019, Laminated Veneer Lumber according to EN 14374:2004 or to ETA, cross laminated timber according to ETA or light composite wood-based beams according to ETA. Hardwood sawn timber according to EN 14081-1:2016/A1:2019 is allowed only with fischer Power-Fast screws. The screws shall be screwed into softwood without predrilling or after pre-drilling with a diameter not larger than the inner thread diameter for the length of the threaded part and with a maximum of the smooth shank diameter for the length of the smooth shank. The screws shall be driven into hardwood after pre-drilling with a suitable diameter. For details refer to the relevant ETA.

Moulding:

- In the case of concrete cast at the building site: optional intermediate layer between the concrete and the timber as formwork, e.g., timber boards or wood-based panel. Lateral moulding along the edges of the slab. This moulding has no function in the final product
- In the case of prefabricated concrete slab: no intermediate layer between timber and concrete is needed.
- No essential characteristics are assessed for the moulding.

Finalisation of wood-concrete composite slab kit:

- Concrete slab, according to EN 206:2013/A1:2016, and reinforcement according to EN 10080:2005 and national regulations either prefabricated or cast at the building site. The minimum concrete strength class is C20/25 and LC 20/22.
- The concrete slab is not part of the kit. No characteristics are assessed for the concrete slab.

Finished floor or ceiling covering as well as possible sound reducing courses are not part of the kit.

The concrete slab is generally stressed at combined compression and bending while the timber beam is stressed at combined tension and bending

This ETA covers screws for composite members with minimum concrete flange depths which comply with the regulations on the minimum slab depths in the place of use (national regulations). Recommended values are not less than 50 mm and not more than one third of the timber member's height.

Typical spans for the construction are up to 8 m with sawn softwood timber members, 10 m with LVL members and with glulam members.

A typical composite member is shown in figure A.1 of Annex A. A fischer CSC 45 connector is shown in figures A.2 and A.3 of Annex A.

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

fischer CSC 45 connectors are intended to be used in structural composite members such as floor, roof, or wall constructions in service classes 1 and 2 as defined in EN 1995-1-1:2004/A2:2014 subject to static or quasi static loading. In addition, use class 3.1 as defined in EN 335:2013 (exterior, above ground, protected) is possible, as balconies, depending on national provisions.

The provisions made in this European Technical Assessment are based on an assumed working life of fischer CSC 45 connectors for wood-concrete composite floors of 50 years, provided that the conditions laid down in this ETA for the installation, use and maintenance are met.

The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, 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 (BWR 1*)	
Structural performance	<p>Wood-concrete composite slabs including fischer CSC 45 connectors are used and manufactured according to an individual design made by a structural engineer responsible for the design of works on a case-by-case basis. Wood-concrete composite floors may function as directly load bearing and structural bracing members. The structural performance of them shall be considered in accordance with the limit state design principles specified in Eurocodes.</p> <p>The calculation method of the mechanical resistance of the slab kit shall be based on EN 1995-1-1:2004/A2:2014 and EN 1992-1-1:2004/A1:2014 considering the resistance of the dowel-type fasteners.</p> <p>The screws included in the fischer CSC 45 connector are made of case-hardened steel as specified in the control plan and corrosion protected with a zinc coating.</p> <p>Mechanical properties of CSC 45 connectors and applicable creep and duration of load factors for composite members are given in Annex B.</p> <p>Geometry of the connector is defined in Annex C.</p>
3.2 Safety in case of fire (BWR 2)	
Reaction to fire	<p>Screws for fischer CSC 45 connectors are made from steel classified as Euroclass A1 in accordance with EN 13501-1:2018 and Commission Delegated Regulation 2016/364.</p>
*) See additional information in section 3.9 – 3.10.	
No other BRW's are relevant for this ETA	
3.9 General aspects	
<p>fischerwerke GmbH delivers fischer CSC 45 connectors intended to be used as components in wood-concrete composite slabs in accordance with the provisions of this European Technical Assessment. The fischer CSC 45 connectors are manufactured in the factory in accordance with the provisions of this European Technical Assessment as identified during inspection of the plant.</p>	<p>installation. Load bearing capacities and stiffness to be used in the design are given in Annex B.</p> <p>The design also shall take into account any aspects regarding installation of the kit components, as any temporary bracing and supporting. Wood-concrete composite slabs shall be installed by appropriately qualified personnel, following the installation plan. Details on the installation of the connectors are given in Annex C. Only screws without any defects are allowed to be used. Before concrete is poured, the person responsible for the design of the works shall check the set of the CSC 45 connectors to be in accordance with the design. The manufacturer shall ensure that the</p>
<p>fischer CSC 45 connectors shall be installed on the basis of a specific structural design for each composite slab</p>	

information of these provisions is given to those concerned. For details of installation of fischer screws refer to relevant ETA.

3.10 Aspects related to the performance of the product

3.10.1 Corrosion protection in service class 1 and 2.

Durability of the finished composite slab is not covered by this ETA.

Durability of the fischer CSC 45 connectors is provided by the protective zinc coating of the screws for a minimum thickness of 5 μm .

The material specification of the steel screws is deposited with ETA-Danmark.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 2000/447/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 1.

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 2021-02-23 by



Thomas Bruun
Managing Director, ETA-Danmark

**ANNEX A:
WOOD-CONCRETE COMPOSITE SLAB COMPOSED WITH FISCHER CSC 45 CONNECTORS**

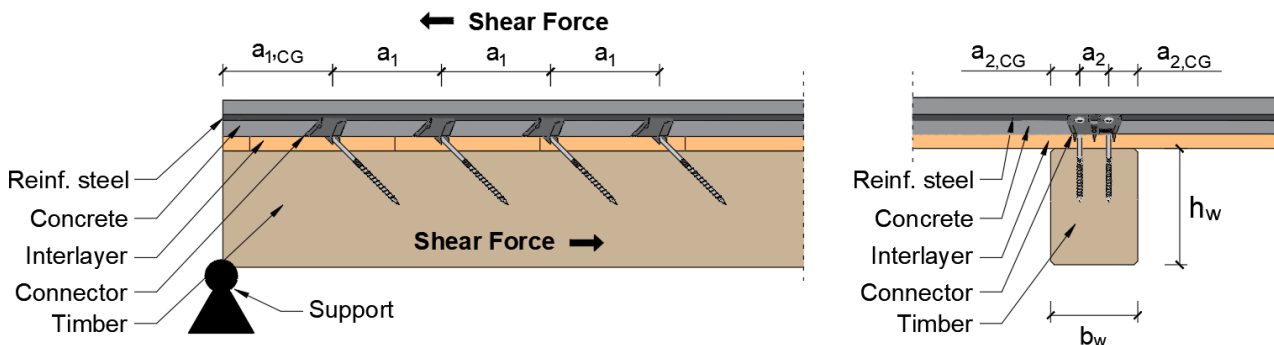


Figure A.1 Elevation on (left) and cross-section through (right) a composite member with fischer CSC 45 connectors

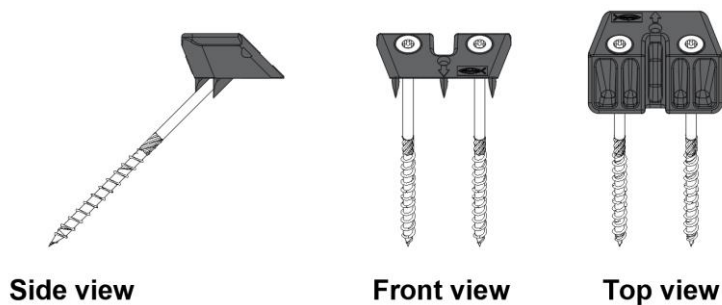


Figure A.2 fischer CSC 45 connectors with fischer Power-Fast screws

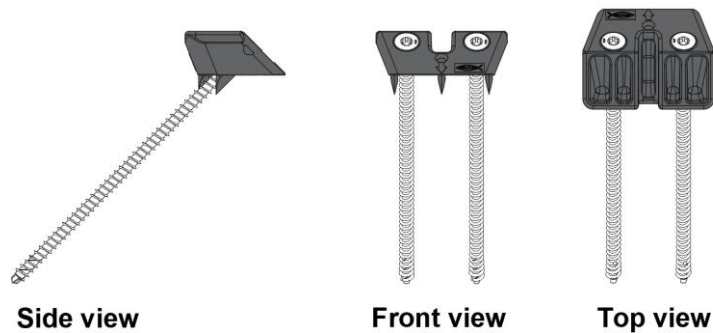


Figure A.3 fischer CSC 45 connectors with fischer Power-Full screws

Table A.1 – Minimum spacing, end and edge distances for fischer CSC 45 connectors in mm

Nominal diameter of the screws d	8 mm
Minimum spacing parallel to grain a_1	100 mm
Minimum end distance $a_{1,CG}$	80 mm
Spacing between the two screws a_2	40 mm
Minimum edge distance $a_{2,CG}$	32 mm
Minimum width of the timber beam b_w	104 mm
Minimum height of the timber beam h_w	100 mm

The geometry of the connector is given in Annex C.

(Fig. not to scale)

fischer CSC 45	Annex A.1 of European Technical Assessment ETA- 21/0154
Product description Installed conditions, system components and installation parameters	

ANNEX B MECHANICAL PROPERTIES

Structural model

Composite members with fischer CSC 45 connectors are to be designed considering the influence of the slip occurring in the joints. The calculation method for the load bearing capacity and the deformation of mechanically jointed beams shall be based on EN 1995-1-1:2004/A2:2014 and EN 1992-1-1:2004/A1:2014 taking into account the resistance of the dowel-type fasteners. Alternative methods for the calculation based on numerical models are also applicable.

Friction between timber and concrete may be taken into account, if no acoustic interlayer is placed between timber and concrete. The friction coefficient may in this case be assumed as $\mu = 0,25$.

Apart from the design of the composite member, the load-carrying-capacity of the concrete layer spanning between the timber beams and the shear capacity of the timber member in the perimeter area around the screws should be checked. A proposed effective width of the concrete slab b_{eff} according to EN 1992-1-1:2004/A1:2014 is reported in Table B.1.

Table B.1 – Evaluation of b_{eff} for timber-concrete-joints with fischer CSC 45 connectors

$b_{eff} = b_w + 0,2 l_0 \leq s$	
where:	
b_{eff}	is the effective width of the concrete slab
b_w	is the width of the timber beam
l_0	is the span of the timber beam
s	is the spacing between two consecutive timber beams

Alternative methods for the calculation are also applicable.

Design of the wood-concrete composite slab

The design of the wood-concrete composite slab in the ultimate and the serviceability limit states shall take into account the influence of creep, concrete shrinkage and moisture changes. The verification of the limit states is to be performed both for the initial state ($t = 0$) and the final state ($t = \infty$). The influence of creep and moisture changes shall be taken into account by reducing the modulus of elasticity of the timber and concrete and the slip modulus to be used in calculations analogous with EN 1995-1-1:2004/A2:2014 and EN 1992-1-1:2004/A1:2014.

The values of the deformation factors k_{def} for timber and fischer CSC 45 connectors should be taken from EN 1995-1-1:2004/A2:2014. The values of the deformation factor φ for concrete should be taken from EN 1992-1-1:2004/A1:2014. For composite beams in service class = 1, φ for concrete may be taken = 2.5. For prefabricated concrete slabs, the concrete shrinkage may be disregarded.

fischer CSC 45	Annex B.1 of European Technical Assessment ETA- 21/0154
Intended use Structural model. Design of the wood-concrete composite slab	

For timber-concrete composite joints made with fischer CSC 45 connectors the design load bearing capacity per connector $F_{v,Rd}$ parallel to the shear plane should be taken from Table B.2 adopting the mechanical parameters from Table B.3.

Table B.2 – Evaluation of $F_{v,Rd}$ for timber-concrete-joints with fischer CSC 45 connectors

$$F_{v,Rd} = \min \left\{ \begin{array}{l} n_{ef} \cdot F_{ax,k} (\cos \alpha + \mu \cdot \sin \alpha) \cdot k_{mod} / \gamma_{M,EC5} \\ F_{c,k} / \gamma_{M,EC2} \end{array} \right.$$

where:

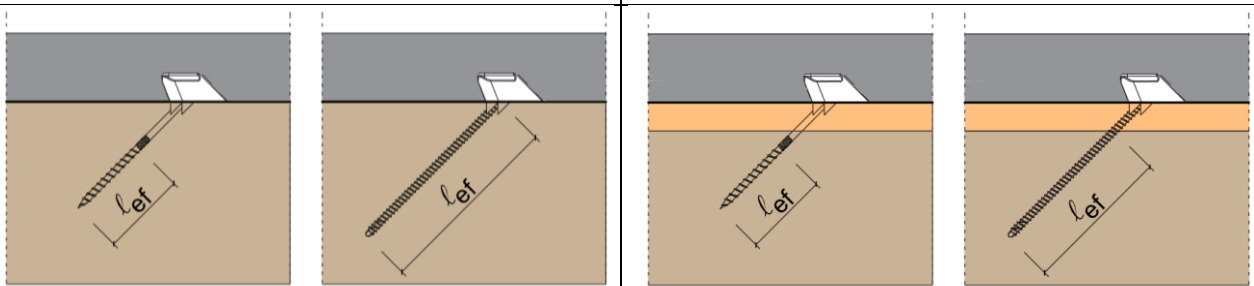
- $F_{v,Rd}$ is the design shear load-carrying capacity per connector in N;
- n_{ef} $n_{ef} = 2$; is the effective number of screws according to EN 1995-1-1:2004/A2:2014;
- $\gamma_{M,EC5}$ is the partial factor for material according to EN 1995-1-1:2004/A2:2014;
- $\gamma_{M,EC2}$ is the partial factor for material according to EN 1992-1-1:2004/A1:2014;
- k_{mod} is the modification factor according to EN 1995-1-1:2004/A2:2014
- α $\alpha = 45^\circ$; is the angle between screw axis and direction of grain;
- μ is the friction coefficient;
- $F_{ax,k}$ is the axial load bearing capacity of a single screw in N;

$$F_{ax,k} = \min \left\{ \begin{array}{l} k_{ax} \cdot f_{ax,k} \cdot d \cdot l_{ef} \cdot \left(\frac{\rho_k}{350} \right)^{0,8} \\ f_{tens,k} \end{array} \right.$$
- k_{ax} $k_{ax} = 1,0$; is the factor accounting the angle between screw axis and grain direction;
- $f_{ax,k}$ is the characteristic withdrawal parameter of the screws;
- $f_{tens,k}$ is the characteristic tensile strength of the screws;
- d is the nominal diameter of the screws in mm;
- ρ_k is the characteristic timber member density in kg/m³;
- $F_{c,k}$ is the characteristic shear load-carrying capacity due to concrete failure in N;

$$F_{c,k} = 6,0 \cdot \sqrt{f_{ck}}$$
- l_{ef} is the effective length of the screw in the timber member in mm; if an intermediate layer is present and fully threaded screws are used, the effective length must be taken by the effective length penetrating the timber member only;

Direct contact between timber and concrete

With intermediate layer



(Fig. not to scale)

fischer CSC 45

Annex B.2
of European
Technical
Assessment ETA-
21/0154

Intended use

Specifications for design: Part 1

Table B.3 – Properties of screws employed in CSC 45 connector.

Screw tradename	fischer Power-Fast	fischer Power-Full
Thread length	Partial thread	Full thread
Nominal diameter [mm]	8,0	8,0
Inner core diameter [mm]	5,4	5,2
Characteristic tensile strength (capacity) $f_{tens,k}$ [kN]	19,1	25,0
Characteristic yield moment $M_{y,k}$ [Nmm]	20.057	25.000
Characteristic torsional strength $f_{tor,k}$ [Nmm]	25.000	28.000
Mean insertion moment $R_{tor,mean}$ [Nmm]	≥ 37.500	≥ 42.000
Characteristic withdrawal strength $f_{ax,k}$ [N/mm ²]	10,0	11,1

Other fischer screws with equal or greater mechanical performances may be used.

For timber-concrete composite joints made with fischer CSC 45 connectors the slip modulus K_{ser} per connector under service load parallel to the shear plane should be taken from Table B.4.

Table B.4 – Evaluation of K_{ser} for timber-concrete-joints with fischer CSC 45 connectors

$K_{ser} = (1 + \mu) \cdot K_{\parallel} + (1 - \mu) \cdot K_{\perp}$	
where:	
K_{\parallel}	is the axial slip modulus per screw in N according to ETA; $K_{\parallel} = 780 \cdot d^{0.2} \cdot \ell_{ef}^{0.4}$
K_{\perp}	is the lateral slip modulus per screw in N according to EN 1995-1-1:2004/A2:2014; $K_{\perp} = \rho_m^{1.5} \cdot d/23$
μ	is the friction coefficient;
d	is the nominal diameter of the screws in mm;
ρ_m	is the mean timber member density in kg/m ³ ;
ℓ_{ef}	is the effective length of the screw in the timber member in mm; if an intermediate layer is present and fully threaded screws are used, the effective length must be taken by the effective length penetrating the timber member only;

Resistance to fire

Simplified rules in EN 1995-1-2:2004 for calculation of resistance to fire in case of screws are applicable for constructions made with fischer CSC 45 connectors.

Thus, in design of works, fire resistance of the timber members may be determined according to EN 1995-1-2:2004 and the fire resistance of the concrete flange according to EN 1992-1-2:2004/A1:2019, if the national rules allow for calculation.

fischer CSC 45	Annex B.3 of European Technical Assessment ETA- 21/0154
Intended use Specifications for design: Part 2. Resistance to fire	

ANNEX C CSC 45 CONNECTOR

Geometry of connector

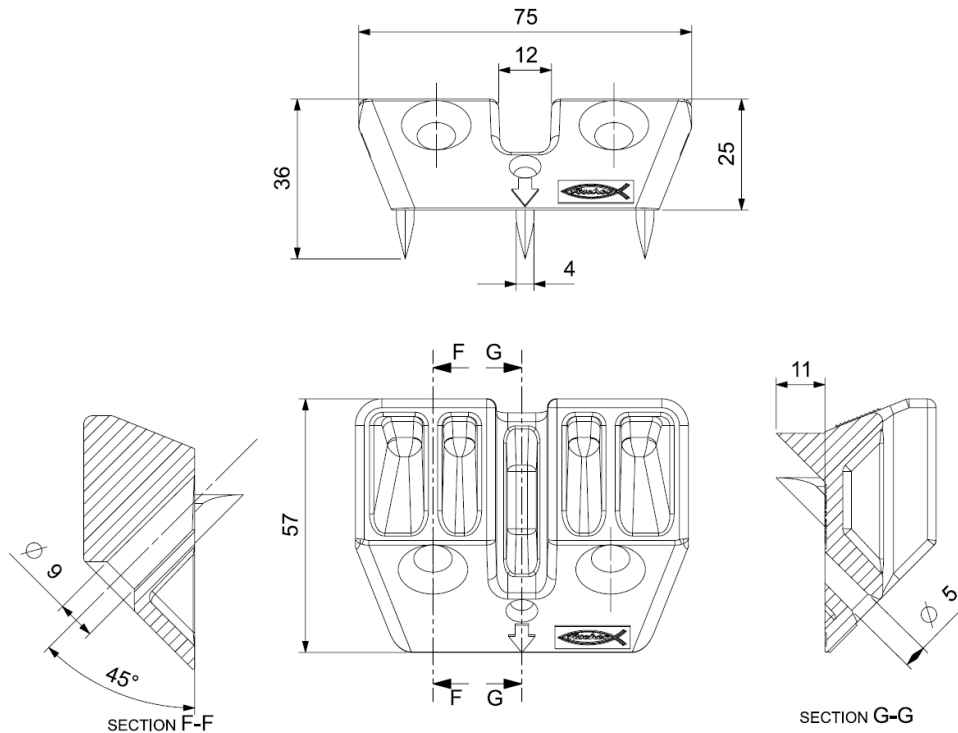


Figure C.1 fischer CSC 45 connectors (dimensions in mm, production tolerance $\pm 2\%$).

For details on the geometry of fischer Power-Fast and Power-Full screws refer to the relevant ETA.

Installation of connector

Place CSC 45 connector on top of the timber beam or on top of the intermediate layer (if present, e.g., timber planking) and let the teeth at the bottom grasp the surface by hitting the connector with a hammer. If teeth do not provide enough anchoring (e.g., timber elements with very high density) use a nail or screw with diameter ≤ 5 mm in the central hole (see section G-G in Figure C.1). Place the screws in the two side holes and screw them until a flush installation is reached. The tip of the screws must point to the midspan of the beam (see Figure C.2). For details of installation of fischer screws refer to relevant ETA.

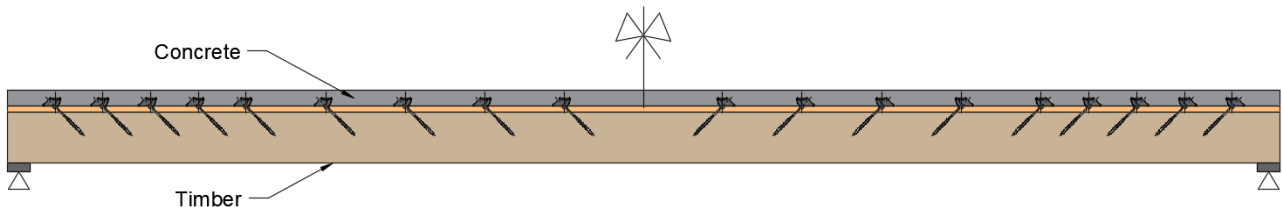


Figure C.2 typical layout of CSC 45 connectors in a wood-concrete composite beam.

(Fig. not to scale)

fischer CSC 45	Annex C.1 of European Technical Assessment ETA- 21/0154
Intended use Geometry of connector. Installation of connector	