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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

MEMBER OF EOTA

## European Technical Approval ETA-11/0027

*This ETA replaces the previous ETA with the same number and validity from 2012-05-08 to 2016-03-22*

Trade name:	fischer Power-Fast screws and fischer construction screws FCS
Holder of approval:	fischerwerke GmbH & Co. KG Weinhalde 14 – 18 D-72178 Waldachtal Tel. +49 7443 12-4608 Fax + +49 7443 12-8983 Internet <a href="http://www.fischer.de">www.fischer.de</a>
Generic type and use of construction product:	Self-tapping screws for use in timber structures
Valid from: to:	2013-06-26 2018-06-26
Manufacturing plant:	fischerwerke

This European Technical Approval contains:	34 pages including 3 annexes which form an integral part of the document
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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 products<sup>1)</sup>, as amended by Council Directive 93/68/EEC of 22 July 1993<sup>2)</sup>.
- 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/EC<sup>3)</sup>.

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

“fischer Power-Fast” and “fischer Holzbauschrauben FCS” are self-tapping screws to be used in timber structures. “fischer Power-Fast” screws shall be threaded over a part or over the full length. “fischer Holzbauschrauben FCS” shall be threaded over a part of the length. The screws shall be produced from carbon steel wire for nominal diameters of 3,0 mm to 12,0 mm and from stainless steel wire for nominal diameters of 3,0 mm to 8,0 mm. The material specification of the stainless steel screws is deposited with ETA-Danmark. Where corrosion protection is required, the material or coating shall be declared in accordance with the relevant specification given in Annex A of EN 14592.

### Geometry and Material

The nominal diameter (outer thread diameter),  $d$ , shall not be less than 3,0 mm and shall not be greater than 12,0 mm. The overall length,  $L$ , of screws shall not be less than 20 mm and shall not be greater than 600 mm. Other dimensions are given in Annex A1 to Annex A14.

The ratio of inner thread diameter to outer thread diameter  $d_i/d$  ranges from 0,59 to 0,69.

The screws are threaded over a minimum length  $\ell_g$  of  $4,0 \cdot d$  (i.e.  $\ell_g \geq 4,0 \cdot d$ ).

The lead  $p$  (distance between two adjacent thread flanks) ranges from  $0,50 \cdot d$  to  $0,67 \cdot d$ .

No breaking of screws shall be observed at a bend angle,  $\alpha$ , of less than  $(45/d^{0,7} + 20)$  degrees.

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

### Intended use

The screws are used for connections in load bearing timber structures between members of solid timber (softwood), glued laminated timber, cross-laminated timber, laminated veneer lumber, similar glued members, wood-based panels or steel.

Furthermore “fischer Power-Fast” screws with diameter of 6 mm, 8 mm, 10 mm and 12 mm may also be used for the fixing of heat insulation on rafters and on vertical facades.

Steel plates and wood-based panels except solid wood panels and cross laminated timber shall only be located on the side of the screw head. The following wood-based panels may be used:

- Plywood according to EN 636 or European Technical Approval

- Particleboard according to EN 312 or European Technical Approval
- Oriented Strand Board, Type OSB/3 and OSB/4 according to EN 300 or European Technical Approval
- Fibreboard according to EN 622-2 and 622-3 or European Technical Approval (minimum density 650 kg/m<sup>3</sup>)
- Cement bonded particleboard according to European Technical Approval
- Solid wood panels according to EN 13353 and EN 13986, and cross laminated timber according to European Technical Approval
- Laminated Veneer Lumber according to EN 14374 or European Technical Approval
- Engineered wood products according to European Technical Approval if the ETA of the product includes provisions for the use of self-tapping screws, the provisions of the ETA of the engineered wood product apply

The screws shall be screwed into the wood without pre-drilling 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 are intended to be used in timber connections for which 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.

Form and dimensions of washers are given in Annex A14. Washers must be made of steel.

The design of the connections shall be based on the characteristic load-carrying capacities of the screws. The design capacities shall be derived from the characteristic capacities in accordance with Eurocode 5 or an appropriate national code (e.g. DIN 1052:2008-12). Regarding environmental conditions, national provisions at the building site shall apply.

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

The zinc-coated screws are for use in timber structures subject to the dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1:2008 (Eurocode 5).

The screws made of stainless steel meet the requirements of Eurocode 5 (EN 1995-1-1:2008), for use in structures subject to the wet conditions defined as service class 3.

### Assumed working life

The assumed intended working life of the screws 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 the approval body issuing the ETA. 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

Characteristic		Assessment of characteristic
<b>2.1 Mechanical resistance and stability*)</b>		
2.1.1	Tensile strength	<p>Characteristic value <math>f_{\text{tens},k}</math>:</p> <p>Screw d = 3,0 mm: 2,7 kN  Screw d = 3,5 mm: 3,7 kN  Screw d = 4,0 mm: 4,8 kN  Screw d = 4,5 mm: 6,0 kN  Screw d = 5,0 mm: 7,5 kN  Screw d = 6,0 mm: 10,7 kN  Screw d = 8,0 mm: 19,1 kN  Screw d = 10,0 mm: 29,8 kN  Screw d = 12,0 mm: 32,7 kN</p> <p>Screws from stainless steel:  Screw d = 3,0 mm: 1,6 kN  Screw d = 3,5 mm: 2,1 kN  Screw d = 4,0 mm: 2,8 kN  Screw d = 4,5 mm: 3,5 kN  Screw d = 5,0 mm: 4,3 kN  Screw d = 6,0 mm: 6,2 kN  Screw d = 8,0 mm: 13,0 kN</p>
2.1.2	Insertion moment	<p>Ratio of the characteristic torsional strength to the mean insertion moment:</p> <p><math>f_{\text{tor},k} / R_{\text{tor,mean}} \geq 1,5</math></p>
2.1.3	Torsional strength	<p>Characteristic value <math>f_{\text{tor},k}</math>:</p> <p>Screws from carbon steel:  Screw d = 3,0 mm: 1,3 Nm  Screw d = 3,5 mm: 2,0 Nm  Screw d = 4,0 mm: 3,5 Nm  Screw d = 4,5 mm: 5,0 Nm  Screw d = 5,0 mm: 6,5 Nm  Screw d = 6,0 mm: 9,5 Nm  Screw d = 8,0 mm: 25,0 Nm  Screw d = 10,0 mm: 40,0 Nm  Screw d = 12,0 mm: 55,0 kN</p> <p>Screws from stainless steel:  Screw d = 3,0 mm: 0,9 Nm  Screw d = 3,5 mm: 1,3 Nm  Screw d = 4,0 mm: 1,9 Nm  Screw d = 4,5 mm: 2,6 Nm  Screw d = 5,0 mm: 3,7 Nm  Screw d = 6,0 mm: 6,5 Nm  Screw d = 8,0 mm: 20,0 kN</p>
<b>2.2 Safety in case of fire</b>		
2.2.1	Reaction to fire	<p>The screws are made from steel classified as <b>Euroclass A1</b> in accordance with EN 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC</p>

Characteristic		Assessment of characteristic
<b>2.3 Hygiene, health and the environment</b>		
2.3.1	Influence on air quality	No dangerous materials **)
<b>2.4 Safety in use</b>		Not relevant
<b>2.5 Protection against noise</b>		Not relevant
<b>2.6 Energy economy and heat retention</b>		Not relevant
<b>2.7 Related aspects of serviceability</b>		
2.7.1	Durability	The screws 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
2.7.2	Serviceability	
2.7.3	Identification	See Annex A

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\*) See page 6 of the 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.

## 2.1 Mechanical resistance and stability

The load-carrying capacities for “fischer Power-Fast” and “fischer Holzbauschrauben FCS” screws are applicable to the wood-based materials mentioned in paragraph 1 even though the term timber has been used in the following.

The characteristic lateral load-carrying capacities and the characteristic axial withdrawal capacities of “fischer Power-Fast” and “fischer Holzbauschrauben FCS” screws should be used for designs in accordance with Eurocode 5 or an appropriate national code.

Pointside penetration length of the threaded part must be  $\ell_{ef} \geq 4 \cdot d$ , where  $d$  is the outer thread diameter of the screw. For the fixing of rafters, point side penetration must be at least 40 mm,  $\ell_{ef} \geq 40$  mm.

European Technical Approvals for structural members may be considered if applicable.

For wood-based panels the relevant European Technical Approvals must be considered where applicable.

### Lateral load-carrying capacity

The characteristic lateral load-carrying capacity of “fischer Power-Fast” and “fischer Holzbauschrauben FCS” screws shall be calculated according to EN 1995-1-1:2008 (Eurocode 5) using the outer thread diameter  $d$  as the nominal diameter of the screw. The contribution from the rope effect may be considered.

The characteristic yield moment shall be calculated from:

Screws from carbon steel for  $3,0 \text{ mm} \leq d \leq 3,5 \text{ mm}$  and  $12,0 \text{ mm}$ :

$$M_{y,k} = 0,15 \cdot 500 \text{ (N/mm}^2\text{)} \cdot d^{2,6} \quad [\text{Nmm}]$$

Screws from carbon steel for  $4,0 \text{ mm} \leq d \leq 10,0 \text{ mm}$ :

$$M_{y,k} = 0,15 \cdot 600 \text{ (N/mm}^2\text{)} \cdot d^{2,6} \quad [\text{Nmm}]$$

Screws from stainless steel for  $3,0 \text{ mm} < d < 6,0 \text{ mm}$ :

$$M_{y,k} = 0,15 \cdot 350 \text{ (N/mm}^2\text{)} \cdot d^{2,6} \quad [\text{Nmm}]$$

Screws from stainless steel for  $d = 8,0 \text{ mm}$ :

$$M_{y,k} = 0,15 \cdot 500 \text{ (N/mm}^2\text{)} \cdot d^{2,6} \quad [\text{Nmm}]$$

where

$d$  outer thread diameter [mm]

### Axial withdrawal capacity

The characteristic axial withdrawal capacity of “fischer Power-Fast” and “fischer Holzbauschrauben FCS” screws in solid timber (softwood), glued laminated timber or cross-laminated timber members at an angle of  $0^\circ \leq \alpha \leq 90^\circ$  to the grain shall be calculated from:

$$F_{ax,\alpha,Rk} = n_{ef} \cdot k_{ax} \cdot f_{ax,k} \cdot d \cdot \ell_{ef} \cdot \left( \frac{\rho_k}{350} \right)^{0,8} \quad [\text{N}]$$

Where

$F_{ax,\alpha,Rk}$	Characteristic withdrawal capacity of the connection at an angle $\alpha$ to the grain [N]
$n_{ef}$	Effective number of screws according to EN 1995-1-1:2008
$k_{ax}$	Factor, taking into account the angle $\alpha$ between screw axis and grain direction $k_{ax} = 1,0$ for $45^\circ \leq \alpha < 90^\circ$ $k_{ax} = 0,3 + \frac{0,7 \cdot \alpha}{45}$ for $0^\circ \leq \alpha < 45^\circ$
$f_{ax,k}$	Characteristic withdrawal parameter [N/mm <sup>2</sup> ] screw $d = 3,0 \text{ mm}$ : $f_{ax,k} = 13,8 \text{ N/mm}^2$ screw $d = 3,5 \text{ mm}$ : $f_{ax,k} = 13,4 \text{ N/mm}^2$ screw $d = 4,0 \text{ mm}$ : $f_{ax,k} = 13,0 \text{ N/mm}^2$ screw $d = 4,5 \text{ mm}$ : $f_{ax,k} = 12,6 \text{ N/mm}^2$ screw $d = 5,0 \text{ mm}$ : $f_{ax,k} = 12,2 \text{ N/mm}^2$ screw $d = 6,0 \text{ mm}$ : $f_{ax,k} = 11,6 \text{ N/mm}^2$ screw $d \geq 8,0 \text{ mm}$ : $f_{ax,k} = 10,0 \text{ N/mm}^2$
$d$	Outer thread diameter [mm]
$\ell_{ef}$	Point side penetration length of the threaded part according to EN 1995-1-1:2008 [mm]
$\alpha$	Angle between grain and screw axis [°]
$\rho_k$	Characteristic density [kg/m <sup>3</sup> ]

The axial withdrawal capacity is limited by the head pull-through capacity and the tensile strength of the screw.

### Head pull-through capacity

The characteristic head pull-through capacity of “fischer Power-Fast” and “fischer Holzbauschrauben FCS” shall be calculated according to EN 1995-1-1:2008 from:

$$F_{ax,\alpha,Rk} = n_{ef} \cdot f_{head,k} \cdot d_h^2 \cdot \left( \frac{\rho_k}{350} \right)^{0,8} \quad [\text{N}]$$

where:

$F_{ax,\alpha,Rk}$	characteristic head pull-through capacity of the connection at an angle $\alpha \geq 30^\circ$ to the grain [N]
$n_{ef}$	effective number of screws according to EN 1995-1-1:2008
$f_{head,k}$	characteristic head pull-through parameter [N/mm <sup>2</sup> ]
$d_h$	diameter of the screw head [mm]
$\rho_k$	characteristic density [kg/m <sup>3</sup> ], for wood-based panels $\rho_k = 380 \text{ kg/m}^3$

Characteristic head pull-through parameter for screws with head diameter  $\leq 21 \text{ mm}$  in connections with timber and with wood-based panels with thicknesses above 20 mm:  
 $f_{head,k} = 12 \text{ N/mm}^2$

Characteristic head pull-through parameter for screws with head diameter  $21 \text{ mm} < d_h \leq 35 \text{ mm}$  in connections with

timber and with wood-based panels with thicknesses above 20 mm:

$$f_{\text{head,k}} = 10 \text{ N/mm}^2$$

Characteristic head pull-through parameter for screws in connections with wood-based panels with thicknesses between 12 mm and 20 mm:

$$f_{\text{head,k}} = 8 \text{ N/mm}^2$$

Screws in connections with wood-based panels with a thickness below 12 mm (minimum thickness of the wood based panels of  $1,2 \cdot d$  with  $d$  as outer thread diameter):

$$f_{\text{head,k}} = 8 \text{ N/mm}^2$$

limited to  $F_{\text{ax,Rk}} = 400 \text{ N}$

The head diameter  $d_h$  shall be greater than  $1,8 \cdot d_s$ , where  $d_s$  is the smooth shank or the wire diameter. Otherwise the characteristic head pull-through capacity  $F_{\text{ax},\alpha,\text{Rk}} = 0$ .

Outer diameter of washers  $d_h > 35 \text{ mm}$  shall not be considered.

The minimum thickness of wood-based panels according to the clause 2.1 must be observed.

In steel-to-timber connections the head pull-through capacity is not decisive.

### Tensile capacity

The characteristic tensile strength  $f_{\text{tens,k}}$  of “fischer Power-Fast” and “fischer Holzbauschrauben FCS” is:

Screws from carbon steel:

Screw $d = 3,0 \text{ mm}$ :	2,7 kN
Screw $d = 3,5 \text{ mm}$ :	3,7 kN
Screw $d = 4,0 \text{ mm}$ :	4,8 kN
Screw $d = 4,5 \text{ mm}$ :	6,0 kN
Screw $d = 5,0 \text{ mm}$ :	7,5 kN
Screw $d = 6,0 \text{ mm}$ :	10,7 kN
Screw $d = 8,0 \text{ mm}$ :	19,1 kN
Screw $d = 10,0 \text{ mm}$ :	29,8 kN
Screw $d = 12,0 \text{ mm}$ :	32,7 kN

Screws from stainless steel:

Screw $d = 3,0 \text{ mm}$ :	1,6 kN
Screw $d = 3,5 \text{ mm}$ :	2,1 kN
Screw $d = 4,0 \text{ mm}$ :	2,8 kN
Screw $d = 4,5 \text{ mm}$ :	3,5 kN
Screw $d = 5,0 \text{ mm}$ :	4,3 kN
Screw $d = 6,0 \text{ mm}$ :	6,2 kN
Screw $d = 8,0 \text{ mm}$ :	13,0 kN

For screws used in combination with steel plates, the tear-off capacity of the screw head should be greater than the tensile strength of the screw.

### Combined laterally and axially loaded screws

For screwed connections subjected to a combination of axial load and lateral load, the following expression should be satisfied:

$$\left( \frac{F_{\text{ax,Ed}}}{F_{\text{ax,Rd}}} \right)^2 + \left( \frac{F_{\text{la,Ed}}}{F_{\text{la,Rd}}} \right)^2 \leq 1$$

where

$F_{\text{ax,Ed}}$	axial design load of the screw
$F_{\text{la,Ed}}$	lateral design load of the screw
$F_{\text{ax,Rd}}$	design load-carrying capacity of an axially loaded screw
$F_{\text{la,Rd}}$	design load-carrying capacity of a laterally loaded screw

### Slip modulus

The axial slip modulus  $K_{\text{ser}}$  of a screw for the serviceability limit state should be taken independent of angle  $\alpha$  to the grain as:

$$C = K_{\text{ser}} = 780 \cdot d^{0,2} \cdot \ell_{\text{ef}}^{0,4} \quad [\text{N/mm}]$$

Where

$d$  outer thread diameter [mm]

$\ell_{\text{ef}}$  penetration length in the structural member [mm]

### Thermal insulation material on top of rafters

“fischer Power-Fast” screws with an outer thread diameter of  $d = 6 \text{ mm}$ ,  $8 \text{ mm}$ ,  $10 \text{ mm}$  and  $12 \text{ mm}$  may be used for the fixing of thermal insulation material on top of rafters.

The thickness of the insulation ranges up to 300 mm. The rafter insulation must be placed on top of solid timber or glued laminated timber rafters or cross-laminated timber members and be fixed by battens placed parallel to the rafters or by wood-based panels on top of the insulation layer. The insulation of vertical facades is also covered by the rules given here.

Screws must be screwed in the rafter through the battens or panels and the insulation without pre-drilling in one sequence.

The angle  $\alpha$  between the screw axis and the grain direction of the rafter should be between  $30^\circ$  and  $90^\circ$ .

The battens must be from solid timber (softwood) according to EN 338:2003-04. The minimum thickness of the battens is 80 mm and the minimum width 100 mm for screws with outer thread diameter  $d = 12 \text{ mm}$ . The minimum thickness of the battens is 40 mm and the minimum width 60 mm for screws with outer thread diameter  $d = 10 \text{ mm}$ . For screws with outer thread diameter  $d = 6 \text{ mm}$  and  $8 \text{ mm}$  the minimum thickness of the battens is 30 mm and the minimum width 50 mm.

Alternatively to the battens, boards with a minimum thickness of 20 mm from plywood according to EN 636,



particle board according to EN 312, oriented strand board OSB/3 and OSB/4 according to EN 300 or European Technical Approval and solid wood panels according to EN 13353 may be used.

The rafter consists of solid timber (softwood) according to EN 338, glued laminated timber according to EN 14081, cross-laminated timber, laminated veneer lumber according to EN 14374 or to European Technical Approval or similar glued members according to European Technical Approval and has a minimum width of 60 mm.

The insulation must comply with a European Technical Approval.

The insulation must have a minimum compressive stress of  $\sigma_{10\%} = 0,05 \text{ N/mm}^2$  at 10 % deformation according to EN 826:1996-05.

The analysis of the fixing of the insulation and battens or boards, respectively, may be carried out using the static model in Annex B. The battens or boards, respectively, must have sufficient strength and stiffness. The maximum pressure between the battens or boards, respectively, and the insulation shall not exceed  $1,1 \cdot \sigma_{10\%}$ .

The characteristic axial withdrawal capacity of the screws for rafter or facade insulation shall be calculated from:

$$F_{ax,\alpha,Rk} = \min \left\{ \begin{array}{l} k_{ax} \cdot f_{ax,k} \cdot d \cdot \ell_{ef} \cdot k_1 \cdot k_2 \cdot \left( \frac{\rho_k}{350} \right)^{0,8} \\ f_{head,k} \cdot d_h^2 \cdot \left( \frac{\rho_k}{350} \right)^{0,8} \end{array} \right. \quad [N]$$

where

$F_{ax,\alpha,Rk}$	Characteristic withdrawal capacity of the connection at an angle $\alpha$ to the grain [N]
$k_{ax}$	Factor, taking into account the angle $\alpha$ between screw axis and grain direction $k_{ax} = 1,0$ for $45^\circ \leq \alpha < 90^\circ$ $k_{ax} = 0,3 + \frac{0,7 \cdot \alpha}{45}$ for $0^\circ \leq \alpha < 45^\circ$
$f_{ax,k}$	Characteristic withdrawal parameter [N/mm <sup>2</sup> ]
$D$	Outer thread diameter [mm]
$\ell_{ef}$	Point side penetration length of the threaded part according to EN 1995-1-1:2008 [mm]
$\alpha$	Angle between grain and screw axis ( $\alpha \geq 30^\circ$ )
$k_1$	$\min \{ 1; 220/t_{HI} \}$
$k_2$	$\min \{ 1; \sigma_{10\%}/0,12 \}$
$t_{HI}$	Thickness of the thermal insulation [mm]
$\sigma_{10\%}$	Compressive stress of the thermal insulation under 10 % deformation [N/mm <sup>2</sup> ] $\sigma_{10\%} \geq 0,05 \text{ N/mm}^2$
$f_{head,k}$	Characteristic head pull-through parameter [N/mm <sup>2</sup> ]
$d_h$	Outer diameter of the screw head [mm]
$\rho_k$	Characteristic density [kg/m <sup>3</sup> ]

Friction forces shall not be considered for the design of the characteristic axial withdrawal capacity of the screws.

The axial withdrawal capacity is limited by the head pull-through capacity (see 2.1).

The anchorage of wind suction forces as well as the bending stresses of the battens or the boards, respectively, shall be considered in design. Additional screws perpendicular to the grain of the rafter (angle  $\alpha = 90^\circ$ ) may be arranged if necessary.

Screws for the anchorage of rafter insulation shall be arranged according to Annex B.

The maximum screw spacing is  $e_s = 1,75 \text{ m}$ .

## 2.7 Related aspects of serviceability

### 2.7.1 Corrosion protection in service class 1, 2 and 3.

The fischer Power-Fast and fischer Holzbauschrauben FCS screws are produced from carbon wire. Screws made from carbon steel are electrogalvanised and yellow or blue chromate. The mean thickness of the zinc coating is 5µm. The material specification of the stainless steel screws is deposited with ETA-Danmark.

### 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 plan<sup>4</sup>. 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

The manufactured components shall be subject to the following checks:

- Raw material specification;
- Dimension of the screws;
- Characteristic tensile strength  $f_{tens,k}$ ;
- Characteristic torsional strength  $f_{tor,k}$ ;

- Characteristic insertion moment  $R_{tor,k}$ ;
- Durability;
- Marking.

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

The initial type testing shall be subject to the following checks:

- Raw material specification;
- Dimension of the screws;
- Characteristic yield moment  $M_{y,k}$ ;
- Characteristic withdrawal parameter  $f_{ax,k}$ ;
- Characteristic head pull-through parameter  $f_{head,k}$ ;
- Characteristic tensile strength  $f_{tens,k}$ ;
- Characteristic yield strength if relevant;
- Characteristic torsional strength  $f_{tor,k}$ ;
- Characteristic insertion moment  $R_{tor,k}$ ;
- Durability.

##### 3.2.2. Tasks of notified bodies

##### 3.2.2.1 Initial inspection of the factory and the factory production control

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

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 screws 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 screws. 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 of product
- Outer thread diameter and length of the self-tapping screws
- Type and mean thickness of the corrosion protection
- Reaction to fire
- 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

fischer Power-Fast and fischer Holzbauschrauben FCS screws 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

4.2.1 The installation shall be carried out in accordance with Eurocode 5 or an appropriate national code unless otherwise is defined in the following. Instructions from fischerwerke GmbH Co. KG should be considered for installation.

4.2.2 The screws are used for connections in load bearing timber structures between members of solid timber (softwood), glued laminated timber, cross-laminated timber (minimum diameter  $d = 6,0$  mm), laminated veneer lumber, similar glued members, wood-based panels or steel members.

The screws may be used for connections in load bearing timber structures with structural members according to an associated European Technical Approval, if according to the associated European Technical Approval of the structural member a connection in load bearing timber structures with screws according to a European Technical Approval is allowed.

Furthermore the screws with diameters between 6 mm and 12 mm may also be used for the fixing of insulation on top of rafters or at vertical facades.

A minimum of two screws should be used for connections in load bearing timber structures.

The minimum penetration depth in structural members made of solid, glued or cross-laminated timber is  $4 \cdot d$ .

Wood-based panels and steel plates should only be arranged on the side of the screw head. The minimum thickness of wood-based panels should be  $1,2 \cdot d$ . Furthermore the minimum thickness for following wood-based panels should be:

- Plywood, Fibreboards: 6 mm
- Particleboards, OSB, Cement Particleboards: 8 mm
- Solid wood panels: 12 mm

For structural members according to European Technical Approvals the terms of the European Technical Approvals must be considered.

If screws with an outer thread diameter  $d \geq 8$  mm are used in load bearing timber structures, the structural solid or glued laminated timber, laminated veneer lumber and similar glued members must be from spruce, pine or fir. This does not apply for screws in pre-drilled holes.

The minimum angle between the screw axis and the grain direction is  $\alpha = 0^\circ$ .

4.2.3 The screws shall be screwed into the wood with or without pre-drilling. The maximum pre-drilling diameter is the inner thread diameter for the length of the threaded part and the smooth shank diameter for the depth of the smooth shank. The hole diameter in steel members must be predrilled with a suitable diameter.

Only the equipment prescribed by fischerwerke GmbH Co. KG shall be used for driving the screws.

In connections with screws with countersunk head according to Annex A1 to A4, A7 and A12 the head must be flush with the surface of the connected structural member. A deeper countersink is not allowed. This applies also to screws with pan head and flange head except of the height of the head  $k$ .

Screws from carbon steel with countersunk head according to Annex A2 to A5, A7, A8 and A12 may be used together with washers according to Annex A. Washers should have a full bearing area.

4.2.4 For structural timber members, minimum spacing and distances for screws in predrilled holes are given in EN 1995-1-1:2008 (Eurocode 5) clause 8.3.1.2 and table 8.2 as for nails in predrilled holes. Here, the outer thread diameter  $d$  must be considered.

For screws in non-predrilled holes, minimum spacing and distances are given in EN 1995-1-1:2008 (Eurocode 5) clause 8.3.1.2 and table 8.2 as for nails in non-predrilled holes.

Alternatively, minimum distances and spacing for exclusively axially loaded “fischer Power-Fast” screws in non-predrilled holes in members of solid timber, glued laminated timber or similar glued products with a minimum thickness  $t = 12 \cdot d$  and a minimum width of  $8 \cdot d$  or 60 mm, whichever is the greater, may be taken as:

Spacing $a_1$ parallel to the grain	$a_1 = 5 \cdot d$
Spacing $a_2$ perpendicular to the grain	$a_2 = 5 \cdot d$
Distance $a_{3,c}$ from centre of the screw-part in timber to the end grain	$a_{3,c} = 9 \cdot d$
Distance $a_{4,c}$ from centre of the screw-part in timber to the edge	$a_{4,c} = 4 \cdot d$

Spacing  $a_2$  perpendicular to the grain may be reduced from  $5 \cdot d$  to  $2,5 \cdot d$ , if the condition  $a_1 \cdot a_2 \geq 25 \cdot d^2$  is fulfilled.

For Douglas fir members minimum spacing and distances parallel to the grain shall be increased by 50%.

Minimum distances from loaded or unloaded ends must be  $15 \cdot d$  for screws in non-predrilled holes with outer thread diameter  $d \geq 8$  mm and timber thickness  $t < 5 \cdot d$ .

Minimum distances from the unloaded edge perpendicular to the grain may be reduced to  $3 \cdot d$  also for timber thickness  $t < 5 \cdot d$ , if the spacing parallel to the grain and the end distance is at least  $25 \cdot d$ .

Unless specified otherwise in the technical specification (ETA or hEN) of cross laminated timber, minimum distances and spacing for screws in the wide face of cross laminated timber members with a minimum thickness  $t = 10 \cdot d$  may be taken as (see Annex C):

Spacing $a_1$ parallel to the grain	$a_1 = 4 \cdot d$
Spacing $a_2$ perpendicular to the grain	$a_2 = 2,5 \cdot d$
Distance $a_{3,c}$ from centre of the screw-part in timber to the unloaded end grain	$a_{3,c} = 6 \cdot d$
Distance $a_{3,t}$ from centre of the screw-part in timber to the loaded end grain	$a_{3,t} = 6 \cdot d$
Distance $a_{4,c}$ from centre of the screw-part in timber to the unloaded edge	$a_{4,c} = 2,5 \cdot d$
Distance $a_{4,t}$ from centre of the screw-part in timber to the loaded edge	$a_{4,t} = 6 \cdot d$

Unless specified otherwise in the technical specification (ETA or hEN) of cross laminated timber, minimum distances and spacing for screws in the edge surface of cross laminated timber members with a minimum thickness  $t = 10 \cdot d$  and a minimum penetration depth perpendicular to the edge surface of  $10 \cdot d$  may be taken as (see Annex C):

Spacing $a_1$ parallel to the CLT plane	$a_1 = 10 \cdot d$
Spacing $a_2$ perpendicular to the CLT plane	$a_2 = 4 \cdot d$
Distance $a_{3,c}$ from centre of the screw-part in timber to the unloaded end	$a_{3,c} = 7 \cdot d$
Distance $a_{3,t}$ from centre of the screw-part in timber to the loaded end	$a_{3,t} = 12 \cdot d$
Distance $a_{4,c}$ from centre of the screw-part in timber to the unloaded edge	$a_{4,c} = 3 \cdot d$
Distance $a_{4,t}$ from centre of the screw-part in timber to the loaded edge	$a_{4,t} = 6 \cdot d$

For a crossed screw couple the minimum spacing between the crossing screws is  $1,5 \cdot d$ .

Minimum thickness for structural members is  $t = 24$  mm for screws with outer thread diameter  $d < 8$  mm,  $t = 30$  mm for screws with outer thread diameter  $d = 8$  mm,  $t = 40$  mm for screws with outer thread diameter  $d = 10$  mm and  $t = 80$  mm for screws with outer thread diameter  $d = 12$  mm.

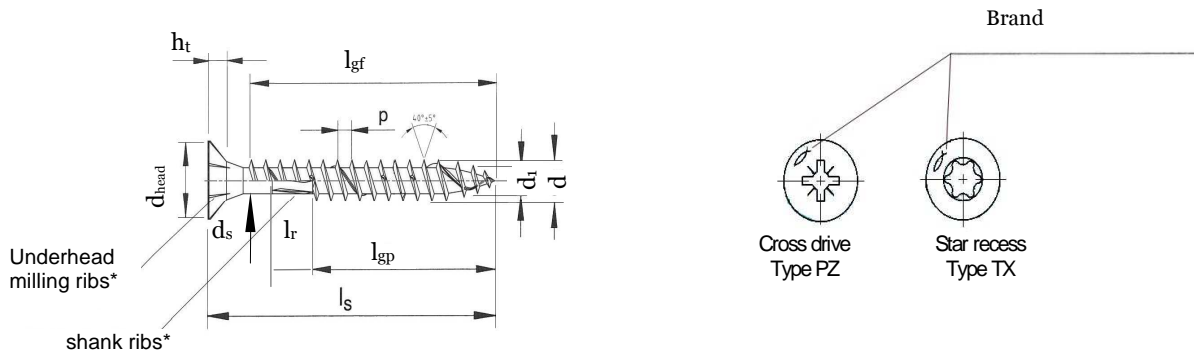
Maintenance is not required during the assumed intended working life. Should repair prove necessary, it is normal to replace the screw.



Thomas Bruun  
Manager, ETA-Danmark

### 4.3 Maintenance and repair





\* optional

Power-Fast self-drilling screw (countersunk head) with full thread or with partial thread																				
Thread Ø			3,0	3,5	4,0	4,5	5,0	6,0												
d	Nominal thread diameter		3,15	3,65	4,15	4,65	5,15	6,15												
	Allow. deviation		-0,40																	
d1	Core diameter		2,00	2,20	2,50	2,70	3,10	3,80												
	Allow. deviation		-0,30 / +0,10																	
d <sub>head</sub>	Head diameter		6,00	7,00	8,00	8,80	9,70	11,90												
	Allow. deviation		-0,50 / +0,10																	
d <sub>s</sub>	Shank diameter		2,25	2,55	2,90	3,25	3,55	4,20												
	Allow. deviation		-0,30 / +0,10																	
h <sub>t</sub>	Length of head		1,90	2,10	2,50	2,70	3,00	3,40												
p	Thread pitch		1,50	1,80	2,00	2,20	2,50	3,00-4,50												
	Allow. deviation		±10%																	
l <sub>r</sub> *	Length of shank ribs		3,75	4,25	4,75	5,5	6,0	7,0												
	Allow. deviation		±0,75					±1,0												
Star recess Type TX			10				20				30									
Cross drive type PZ			1	2						3										
l <sub>s</sub>			Standard thread length												l <sub>gr</sub> = Full thread		l <sub>gp</sub> =Partial thread		Tolerance: ± 2,0	
Nominal size	min	max	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>						
20	18,95	21,05			16															
25	23,75	26,25	21		21	18	20	18	20											
30	28,75	31,25	26	18	26	18	25	18	25	18	24									
35	33,50	36,50	31	24	31	24	30	24	30	24	29	24	28							
40	38,50	41,50	36	24	36	24	35	24	35	24	34	24	33	24						
45	43,50	46,50	41	30	41	30	40	30	40	30	39	30	38	30						
50	48,50	51,50			46	30	45	30	45	30	44	30	43	30						
55	53,50	56,50					50	36	50	36	49	36	48							
60	58,50	61,50						36		36		36	53	36						
70	68,50	71,50						42		42		42	63	42						
80	78,50	81,50						50		50		50	73	50						
90	88,25	91,75										60		60						
100	98,25	101,75										60		60						
110	108,25	111,75										70		70						
120	118,25	121,75										70		70						
130	128,00	132,00												70						
140	138,00	142,00												70						
150	148,00	152,00												70						
160	158,00	162,00												70						
180	178,00	182,00												70						
up to																				
300	298,00	302,00												70						

Intermediate length at l<sub>s</sub> are possible

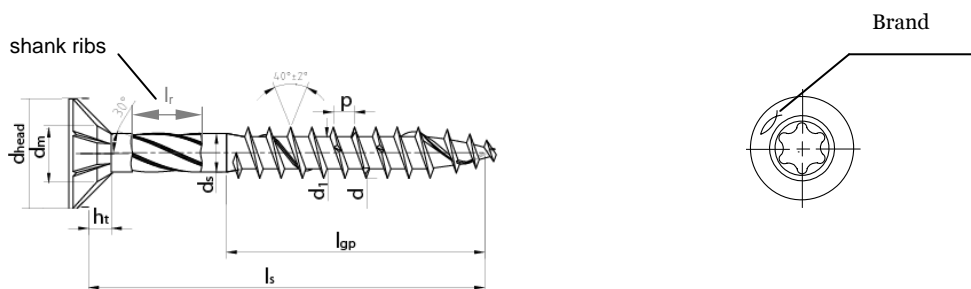
All sizes in mm

Allowable surface treatments: yellow zinc plated, blue zinc plated, bonus-zincd, burnished, nickel-plated, brass plated

\*Screws with partial thread &gt; 50 mm length with shank ribs

Material: Carbon steel

fischer Power-Fast and Construction Screws	Annex A2
	of European Technical Approval ETA-11/0027
Sizes and Material	



Power-Fast wood construction screw (countersunk head) with partial thread							
Thread Ø		6,0	8,0	10,0	12,0		
d	Nominal thread diameter	6,15	8,15	10,15	12,15		
	Allow. deviation	-0,4	-0,4	-0,5	-0,6		
d <sub>1</sub>	Core diameter	4,00	5,40	6,40	7,60		
	Allow. deviation			-0,2			
d <sub>head</sub>	Head diameter	12,10	14,80	18,60	22,60		
	Allow. deviation			-0,6			
d <sub>s</sub>	Shank diameter	4,30	5,90	7,10	8,30		
	Allow. deviation			-0,15			
h <sub>t</sub>	Length of head	3,40	6,50	8,00	10,80		
	Thread pitch	3,00-4,50	6,00	7,50	7,50		
p	Allow. deviation			-0,1			
	Length of shank ribs		13,00				
l <sub>r</sub> *	Allow. deviation		-2,0				
Star recess Type TX		30	30	40	50		
Nomi nal size	l <sub>s</sub>		l <sub>gp</sub> = Partial thread Tolerance: ± 2,0				
	min	max	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gp</sub>	l <sub>gp</sub>	
60	58,50	61,50	36				
80	78,50	81,50	50	50	52		
90	88,25	91,75	60	50			
100	98,25	101,75	60	50	52	60	
120	118,25	121,75	70	75	80	80	
140	138	142	70	75	80	80	
160	158	162	70	75	80	80	
180	178	182	70	75	100	100	
200	198	202	70	100	100	100	
220	218	222	70	100	100	100	
240	238	262	70	100	100	120	
260	258	262	70	100	100	120	
280	278	282	70	100	115	120	
300	398	302	70	100	115	120	
320	317	323		100	115		
330	327	333			115		
340	337	343		100	115		
350	347	353				145	
360	357	363		100	115		
380	377	383		100	115		
400	397	403		100	115	145	
450	447	453		100	115	145	
500	497	503		100	115	145	
550	547	553				145	
600	597	603				145	

Intermediate length at l<sub>s</sub> are possible

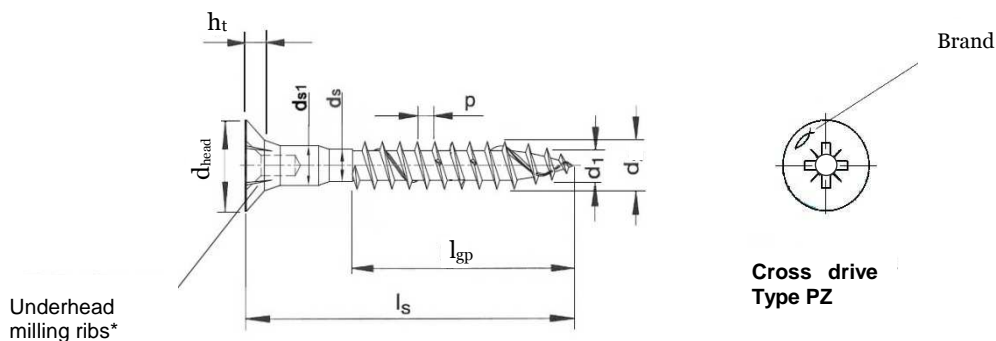
All sizes in mm

Allowable surface treatments: yellow zinc plated, blue zinc plated, Bonus-zincd

Material: Carbon steel

fischer Power-Fast and Construction Screws	Annex A3
	of European Technical Approval ETA-11/0027
Sizes and Material	





\* optional

[illegible]

Intermediate length at  $l_s$  are possible  
Allowable surface treatments: blue zinc plated  
Material: Carbon steel

All sizes in mm

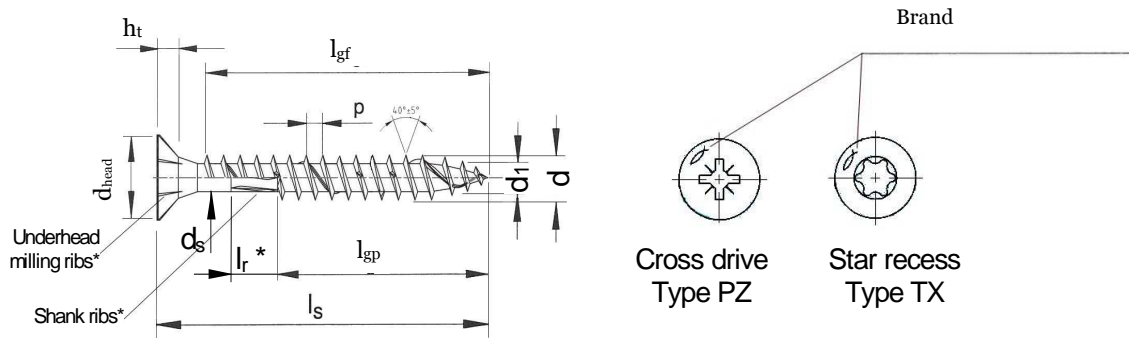
<b>fischer Power-Fast and Construction Screws</b> Sizes and Material	<b>Annex A4</b> of European Technical Approval ETA-11/0027

Intermediate length at  $l_s$  are possible All sizes in mm  
Possible surface treatments: yellow zinc-plated, blue zinc-plated, additional zinc layer,  
burnished, nickel-plated, brass plated  
Material: Carbon steel

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex A5</b> of European Technical Approval ETA-11/0027
Sizes and Material	

Intermediate length at  $l_s$  are possible All sizes in mm  
Possible surface treatments: yellow zinc-plated, blue zinc-plated, additional zinc layer,  
burnished, nickel-plated, brass plated  
Material: Carbon steel

<b>fischer Power-Fast and Construction Screws</b> Sizes and Material	<b>Annex A6</b> of European Technical Approval ETA-11/0027



\* optional

Power-Fast self-drilling screw (countersunk head) with full thread or with partial thread																					
Thread Ø			3,0	3,5	4,0	4,5	5,0	6,0	8,0												
d	Nominal thread diameter		3,15	3,65	4,15	4,65	5,15	6,15	8,15												
	Allow. deviation		-0,40																		
d <sub>1</sub>	Core diameter		2,00	2,20	2,50	2,70	3,10	3,80	5,40												
	Allow. deviation		-0,25 / +0,10						-0,30 / +0,10		-0,2										
d <sub>head</sub>	Head diameter		6,00	7,00	8,00	8,80	9,70	11,60	14,80												
	Allow. deviation		-0,50 / +0,10												-0,8						
d <sub>s</sub>	Shank diameter		2,25	2,55	2,90	3,25	3,55	4,30	5,90												
	Allow. deviation		-0,30 / +0,10								-0,15										
h <sub>t</sub>	Length of head		1,90	2,10	2,50	2,70	3,00	3,40	6,50												
p	Thread pitch		1,50	1,80	2,00	2,20	2,50	3,00-4,50	6,00												
	Allow. deviation		±10%																		
l <sub>r</sub> *	Length of shank rips		3,75	4,25	4,75	5,5	6,0	7,0	13,00												
	Allow. deviation		±0,75					±1,0			-2,0										
Star recess Type TX			10				20				30		40								
Cross drive type PZ			1	2						3			-								
Nominal Size	l <sub>s</sub>		Standard thread length l <sub>gf</sub> = Full thread l <sub>gp</sub> =Partial thread Tolerance: ± 2,0																		
	min	max	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>	l <sub>gf</sub>	l <sub>gp</sub>					
20	18,95	21,05	16		16																
25	23,75	26,25	21		21	18	20	18	20												
30	28,75	31,25	26	18	26	18	25	18	25	18	24										
35	33,50	36,50	31	24	31	24	30	24	30	24	29	24	28								
40	38,50	41,50	36	24	36	24	35	24	35	24	34	24	33	24							
45	43,50	46,50	41	30	41	30	40	30	40	30	39	30	38								
50	48,50	51,50			46	30	45	30	45	30	44	30	43	30							
55	53,50	56,50					50	36	50	36	49	36	48								
60	58,50	61,50						36		36		36	53	36							
70	68,50	71,50						42		42		42	63	42							
80	78,50	81,50						50		50		50	73	50		50					
90	88,25	91,75										60		60		50					
100	98,25	101,75										60		60		50					
110	108,25	111,75										70		70							
120	118,25	121,75										70		70		75					
130	128,00	132,00												70							
140	138,00	142,00												70		75					
150	148,00	152,00												70							
160	158,00	162,00												70		75					
180	178,00	182,00												70		75					
Up to																					
300	298,00	302,00												70		100					
320	318,00	322,00														100					
340	338,00	342,00														100					
360	358,00	362,00														100					
380	378,00	382,00														100					
400	398,00	402,00														100					
450	448,00	452,00														100					
500	498,00	502,00														100					

Intermediate length at l<sub>s</sub> are possible

All sizes in mm

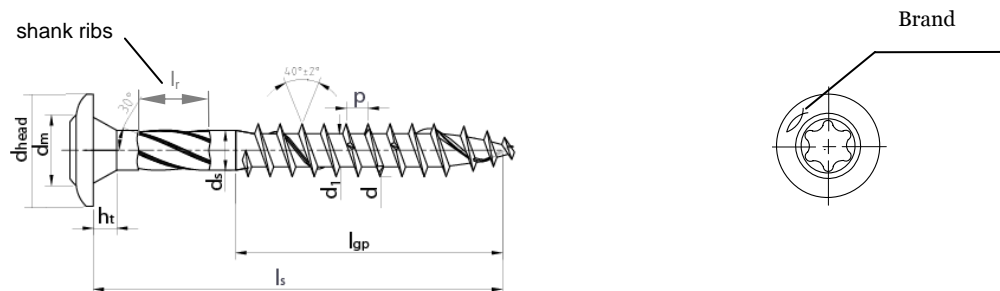
Material: stainless steel

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex A7</b> of European Technical Approval ETA-11/0027
Sizes and Material	

<p><b>fischer Power-Fast and Construction Screws</b></p>	<p><b>Annex A8</b> of European Technical Approval ETA-11/0027</p>
<p>Sizes and Material</p>	

Intermediate length at  $l_s$  are possible  
Material: Stainless steel

<b>fischer Power-Fast Screws</b>	<b>Annex A9</b> of European Technical Approval ETA-11/0027
Sizes and Material	



Power-Fast wood construction screw (flange head) with partial thread											
Thread Ø		6,0	8,0	10,0	12,00						
d	Nominal thread diameter	6,15	8,15	10,15	12,15						
	Allow. deviation	-0,4									
d <sub>1</sub>	Core diameter	4,00	5,40	6,40	7,60						
	Allow. deviation	-0,2									
d <sub>head</sub>	Head diameter	14,50	21,00	27,00	30,00						
	Allow. deviation	-2,0	-1,00	-3,00	-3,00						
d <sub>s</sub>	Shank diameter	4,30	5,90	7,10	8,30						
	Allow. deviation	-0,15									
h <sub>t</sub>	Length of head	2,50	2,60	3,40	4,40						
	Allow. deviation	-0,2									
p	Thread pitch	3,00-4,50	6,00	7,50	7,50						
	Allow. deviation	-0,1									
l <sub>r</sub>	Length of shank ribs	13,00									
	Allow. deviation	-2,0									
Star recess Type TX		30	40	40	50						
Is		Standard thread length l <sub>gr</sub> = Full thread l <sub>gp</sub> = Partial thread Tolerance: ± 2,0									
Nominal size	min max	l <sub>gp</sub>	l <sub>gp</sub>	l <sub>gp</sub>	l <sub>gp</sub>						
60	58,50 61,50	36									
80	78,50 81,50	50	50	52							
90	88,25 91,75	60	50								
100	98,25 101,75	60	50	52	60						
120	118,25 121,75	70	75	80	80						
140	138 142	70	75	80	80						
160	158 162	70	75	80	80						
180	178 182	70	75	100	100						
200	198 202	70	100	100	100						
220	218 222	70	100	100	100						
240	238 262	70	100	100	120						
260	258 262	70	100	100	120						
280	278 282	70	100	115	120						
300	398 302	70	100	115	120						
320	317 323		100	115							
330	327 333			115							
340	337 343		100	115							
350	347 353				145						
360	357 363		100	115							
380	377 383		100	115							
400	397 403		100	115	145						
450	447 453		100	115	145						
500	497 503		100	115	145						
550	547 553				145						
600	597 603				145						

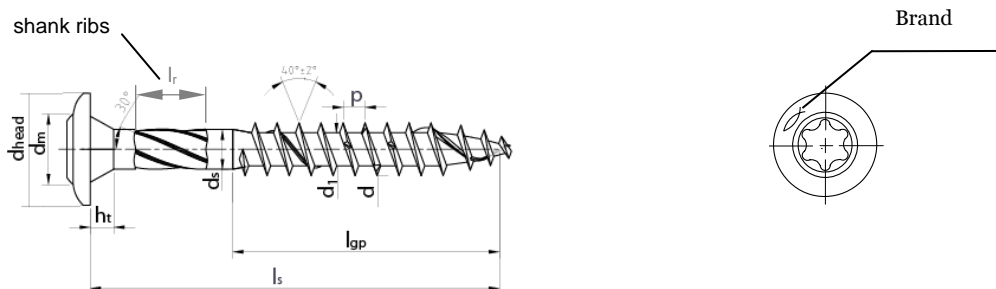
Intermediate length at l<sub>s</sub> are possible

All sizes in mm

Possible surface treatments: yellow zinc-plated, blue zinc-plated, Bonus-zincd

Material: Carbon steel

fischer Power-Fast and Construction Screws	Annex A10
	of European Technical Approval ETA-11/0027
Sizes and Material	



Power-Fast wood construction screw (flange head) with partial thread													
Thread Ø			6,0	8,0									
d	Nominal thread diameter		6,00	8,00									
	Allow. deviation		-0,50 / +0,15										
d <sub>1</sub>	Core diameter		4,00	5,40									
	Allow. deviation		-0,35 / +0,15										
d <sub>head</sub>	Head diameter		13,75	21,00									
	Allow. deviation		+/-0,75	+/-1,00									
d <sub>s</sub>	Shank diameter		4,30	5,90									
	Allow. deviation		-0,30 / +0,10										
h <sub>t</sub>	Length of head		2,3-2,5	2,5-4,5									
	Thread pitch		4,50	6,00									
p	Allow. deviation		±10%										
	Length of shank ribs		12,0										
l <sub>r</sub>	Allow. deviation		±1,0										
Star recess Type TX			30	40									
Nominal size	l <sub>s</sub>		Standard thread length		l <sub>gr</sub> = Full thread		l <sub>gp</sub> = Partial thread		Tolerance: ± 2,0				
	min	max	l <sub>gp</sub>	l <sub>gp</sub>									
60	58,50	61,50	36										
80	78,50	81,50	50	50									
90	88,25	91,75	60	50									
100	98,25	101,75	60	50									
120	118,25	121,75	70	75									
140	138	142	70	75									
160	158	162	70	75									
180	178	182	70	75									
200	198	202	70	100									
220	218	222	70	100									
240	238	262	70	100									
260	258	262	70	100									
280	278	282	70	100									
300	398	302	70	100									
320	317	323		100									
330	327	333											
340	337	343		100									
350	347	353											
360	357	363		100									
380	377	383		100									
400	397	403		100									
450	447	453		100									
500	497	503		100									
550	547	553											
600	597	603											

Intermediate length at l<sub>s</sub> are possible

All sizes in mm

Material: Stainless steel

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex A11</b> of European Technical Approval ETA-11/0027
Sizes and Material	



[illegible]

All sizes in mm

Material: Carbon steel

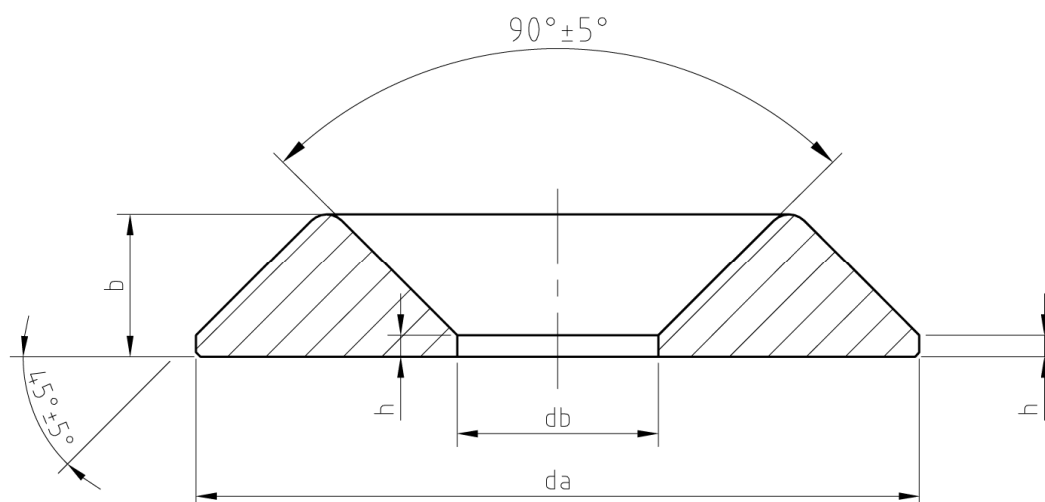
<b>fischer Power-Fast and Construction Screws</b>	<b>Annex A12</b> of European Technical Approval ETA-11/0027
Sizes and Material	

[illegible]

All sizes in mm

Material: Carbon steel

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex A13</b> of European Technical Approval ETA-11/0027
Sizes and Material	



### Washer for Power-Fast and for FCS screws

		Type 1				Type 2					
Size		6	8	10	12	6	8	10			
d <sub>b</sub>	Inner diameter	6,7	8,7	11,2	13,2	6,7	8,7	11,2			
	Allowed deviation	-0,4	-0,4	-0,4	-0,4	-0,4	-0,4	-0,4			
d <sub>a</sub>	Outer diameter	21	30	35	43	21	25,5	30,5			
	Allowed deviation	±2,0									
b	Height	4,7	5,2	6,2	8,3	4,7	5,2	6,2			
	Allowed deviation	-0,4	-0,4	-0,4	-0,4	-0,4	-0,4	-0,4			
h	Height	1,5	1,8	2,0	2,2	1,5	1,8	2,0			
	Allowed deviation	-0,15	-0,15	-0,15	-0,15	-0,15	-0,15	-0,15			

All sizes in mm

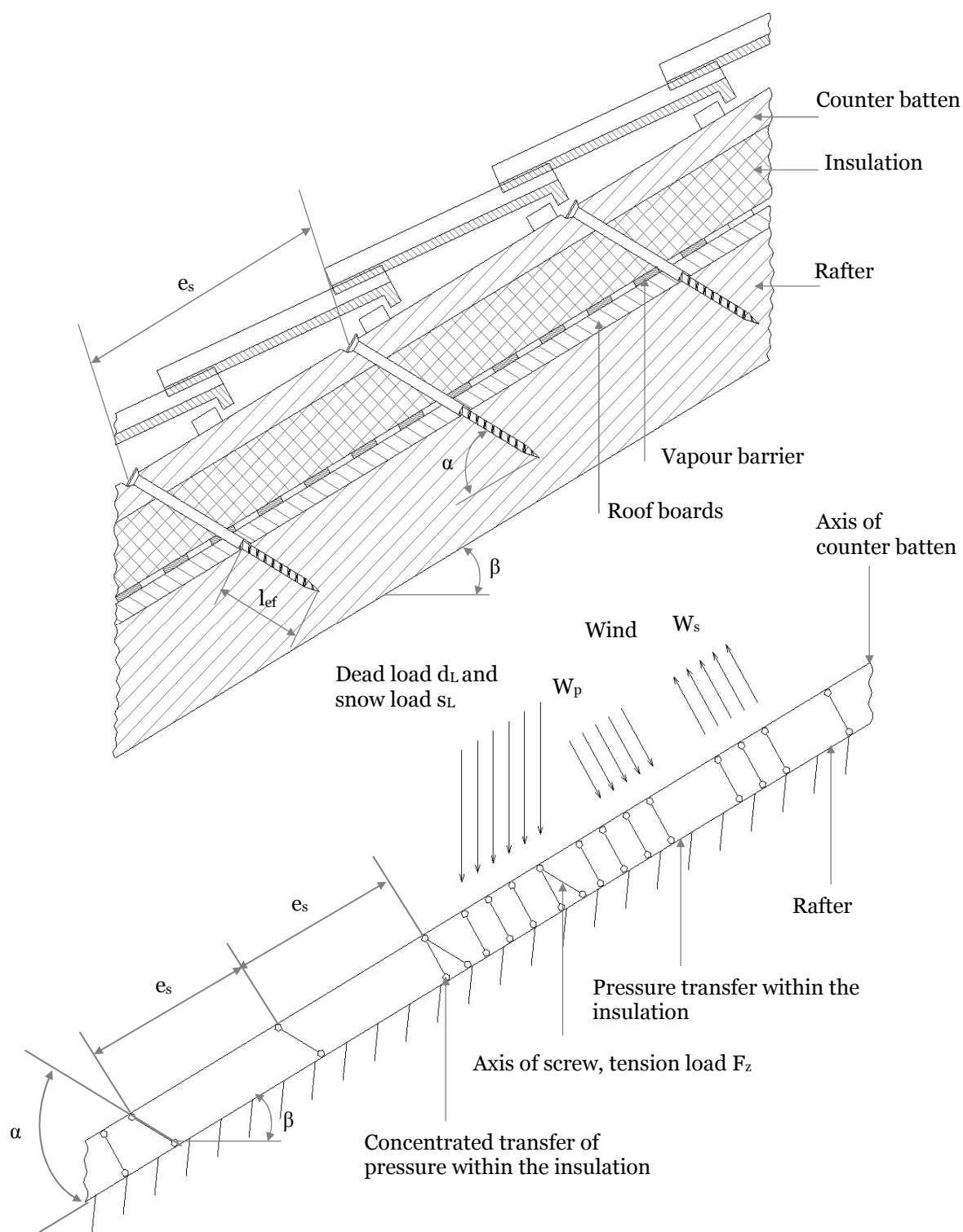
Possible surface treatments: yellow zinc-plated, blue zinc-plated, Bonus-zincd

Material: Carbon steel

fischer Power-Fast and Construction Screws	Annex A14
	of European Technical Approval ETA-11/0027
Assecories	

## Annex B1

### Fixing of on-roof insulation system



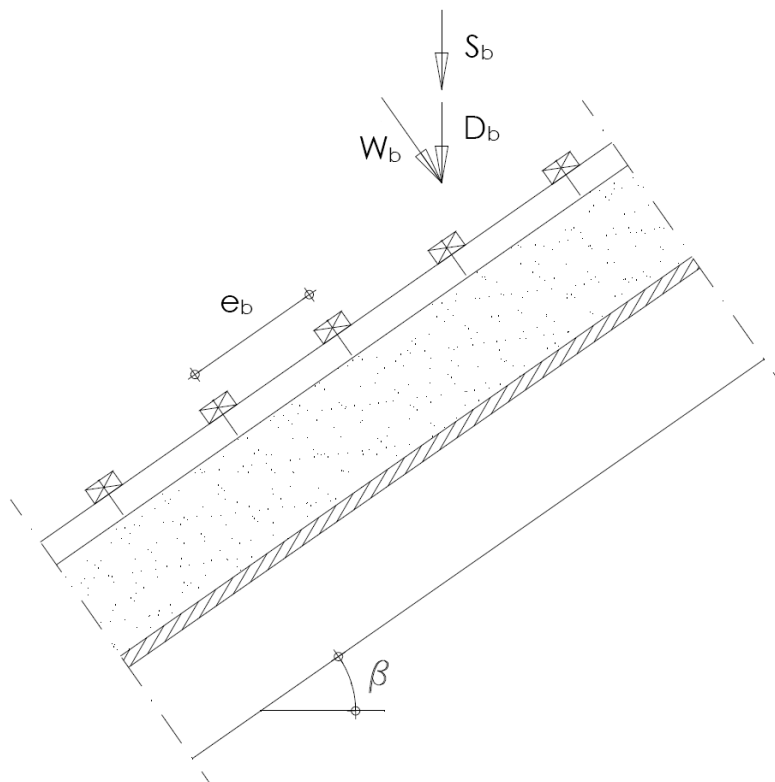
$W_s$	=	Wind suction	$W_p$	=	Wind pressure
$e_s$	=	Spacing of screws	$l_{ef}$	=	Thread part part of screw in rafter
$\beta$	=	Roof inclination	$\alpha$	=	Angle between axis of screw and axis of batten

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex B1</b> of European Technical Approval ETA-11/0027
Assecories	

## Annex B2

### Fixing of on-roof insulation system

#### Point loads $F_b$ perpendicular to the battens



$$D_b = d \cdot e_b \cdot e_r$$

$$S_b = s \cdot e_b \cdot e_r \cdot \cos \beta$$

$$W_b = w_p \cdot e_b \cdot e_r$$

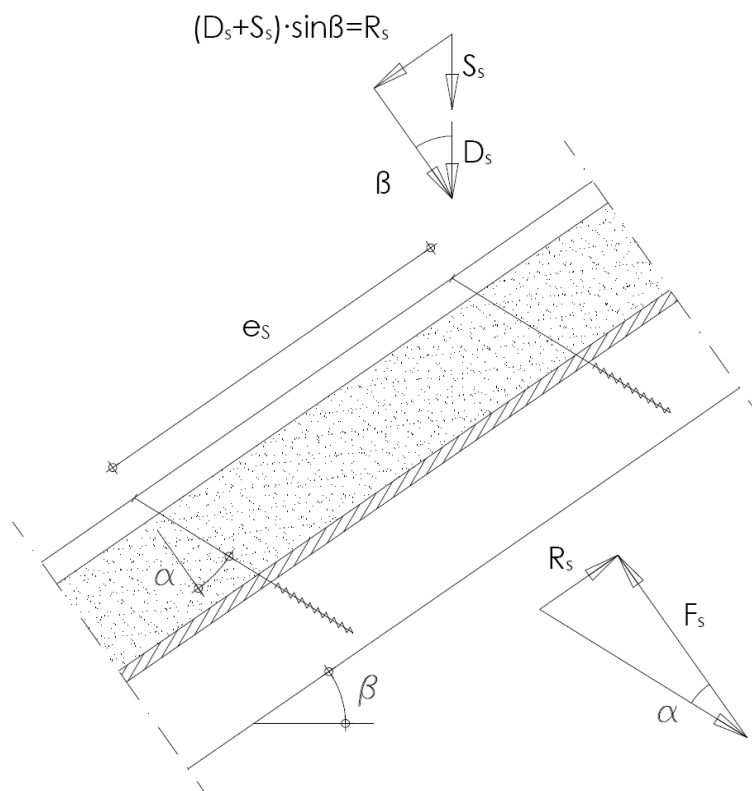
$$F_b = W_b + (D_b + S_b) \cdot \cos \beta$$

where

$D_b$  = point load by dead load  
 $S_b$  = point load by snow load  
 $W_b$  = point load perpendicular to the batten by wind load (pressure)  
 $e_b$  = distance of the battens  
 $e_r$  = distance of the rafters  
 $s$  = snow load per  $m^2$  ground area  
 $w_p$  = wind pressure on the roof area  
 $d$  = dead load per  $m^2$  roof area  
 $\beta$  = roof angle

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex B2</b> of European Technical Approval ETA-11/0027
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### Point loads $F_s$ perpendicular to the battens by screws



$$D_s = d \cdot e_s \cdot e_r$$

$$S_s = s \cdot e_s \cdot e_r \cdot \cos \beta$$

$$R_s = (D_s + S_s) \cdot \sin \beta$$

$$F_s = R_s / \tan \alpha$$

where

$D_s$  = point load by dead load

$S_s$  = point load by snow load

$R_s$  = shear load of the roof by dead load and snow load

$e_s$  = distance of the screws

$e_r$  = distance of the rafters

$\alpha$  = angle between screw axis and perpendicular to rafter axis

## Design of the battens

The bending stresses are calculated as:

$$M = \frac{(F_b + F_s) \cdot \ell_{\text{char}}}{4}$$

Where

$$\ell_{\text{char}} = \text{characteristic length } \ell_{\text{char}} = \sqrt[4]{\frac{4 \cdot EI}{w_{\text{ef}} \cdot K}}$$

EI = bending stiffness of the batten

K = coefficient of subgrade

$w_{\text{ef}}$  = effective width of the heat insulation

$F_b$  = Point loads perpendicular to the battens

$F_s$  = Point loads perpendicular to the battens, load application in the area of the screw heads

The coefficient of subgrade K may be calculated from the modulus of elasticity  $E_{\text{HI}}$  and the thickness  $t_{\text{HI}}$  of the heat insulation if the effective width  $w_{\text{ef}}$  of the heat insulation under compression is known. Due to the load extension in the heat insulation the effective width  $w_{\text{ef}}$  is greater than the width of the batten or rafter, respectively. For further calculations, the effective width  $w_{\text{ef}}$  of the heat insulation may be determined according to:

$$w_{\text{ef}} = w + t_{\text{HI}} / 2$$

where

w = minimum width of the batten or rafter, respectively

$t_{\text{HI}}$  = thickness of the heat insulation

$$K = \frac{E_{\text{HI}}}{t_{\text{HI}}}$$

The following condition shall be satisfied:

$$\frac{\sigma_{\text{m,d}}}{f_{\text{m,d}}} = \frac{M_{\text{d}}}{W \cdot f_{\text{m,d}}} \leq 1$$

For the calculation of the section modulus W the net cross section has to be considered.

The shear stresses shall be calculated according to:

$$V = \frac{(F_b + F_s)}{2}$$

The following condition shall be satisfied:

$$\frac{\tau_{\text{d}}}{f_{\text{v,d}}} = \frac{1,5 \cdot V_{\text{d}}}{A \cdot f_{\text{v,d}}} \leq 1$$

For the calculation of the cross section area the net cross section has to be considered.

## Design of the heat insulation

The compressive stresses in the heat insulation shall be calculated according to:

$$\sigma = \frac{1,5 \cdot F_b + F_s}{2 \cdot \ell_{\text{char}} \cdot w}$$

The design value of the compressive stress shall not be greater than 110 % of the compressive stress at 10 % deformation calculated according to EN 826.

fischer Power-Fast and Construction Screws	Annex B of European Technical Approval ETA-11/0027
Assecories	

## Design of the screws

The screws are loaded predominantly axially. The axial tension force in the screw may be calculated from the shear loads of the roof  $R_s$ :

$$T_s = \frac{R_s}{\cos \alpha}$$

The load-carrying capacity of axially loaded screws is the minimum design value of the axial withdrawal capacity of the threaded part of the screw, the head pull-through capacity of the screw and the tensile capacity of the screw.

In order to limit the deformation of the screw head for heat insulation thicknesses over 220 mm or with compressive strength below 0,12 N/mm<sup>2</sup>, respectively, the axial withdrawal capacity of the screws shall be reduced by the factors  $k_1$  and  $k_2$ :

$$F_{ax,\alpha,Rd} = \min \left\{ \begin{array}{l} k_{ax} \cdot f_{ax,d} \cdot d \cdot \ell_{ef} \cdot k_1 \cdot k_2 \left( \frac{\rho_k}{350} \right)^{0,8} \\ f_{head,d} \cdot d_h^2 \cdot \left( \frac{\rho_k}{350} \right)^{0,8} \end{array} \right.$$

where:

$f_{ax,d}$	design value of the axial withdrawal parameter of the threaded part of the screw
$d$	outer thread diameter of the screw
$\ell_{ef}$	Point side penetration length of the threaded part of the screw in the rafter, $\ell_{ef} \geq 40$ mm
$\alpha$	Angle between grain and screw axis ( $\alpha \geq 30^\circ$ )
$\rho_k$	characteristic density of the wood-based member [kg/m <sup>3</sup> ]
$f_{head,d}$	design value of the head pull-through capacity of the screw
$d_h$	head diameter
$k_1$	$\min \{1; 220/t_{HI}\}$
$k_2$	$\min \{1; \sigma_{10\%}/0,12\}$
$t_{HI}$	thickness of the heat insulation [mm]
$\sigma_{10\%}$	compressive stress of the heat insulation under 10 % deformation [N/mm <sup>2</sup> ]

If equation  $k_1$  and  $k_2$  are considered, the deflection of the battens does not need to be considered. Alternatively to the battens, panels with a minimum thickness of 20 mm from plywood according to EN 636 or an ETA or national provisions that apply at the installation site, particle board according to EN 312 or an ETA or national provisions that apply at the installation site, oriented strand board according to EN 300 or an ETA or national provisions that apply at the installation site and solid wood panels according to EN 13353 or an ETA or national provisions that apply at the installation site or cross laminated timber according to an ETA may be used.

<b>fischer Power-Fast and Construction Screws</b>	<b>Annex B</b> of European Technical Approval ETA-11/0027
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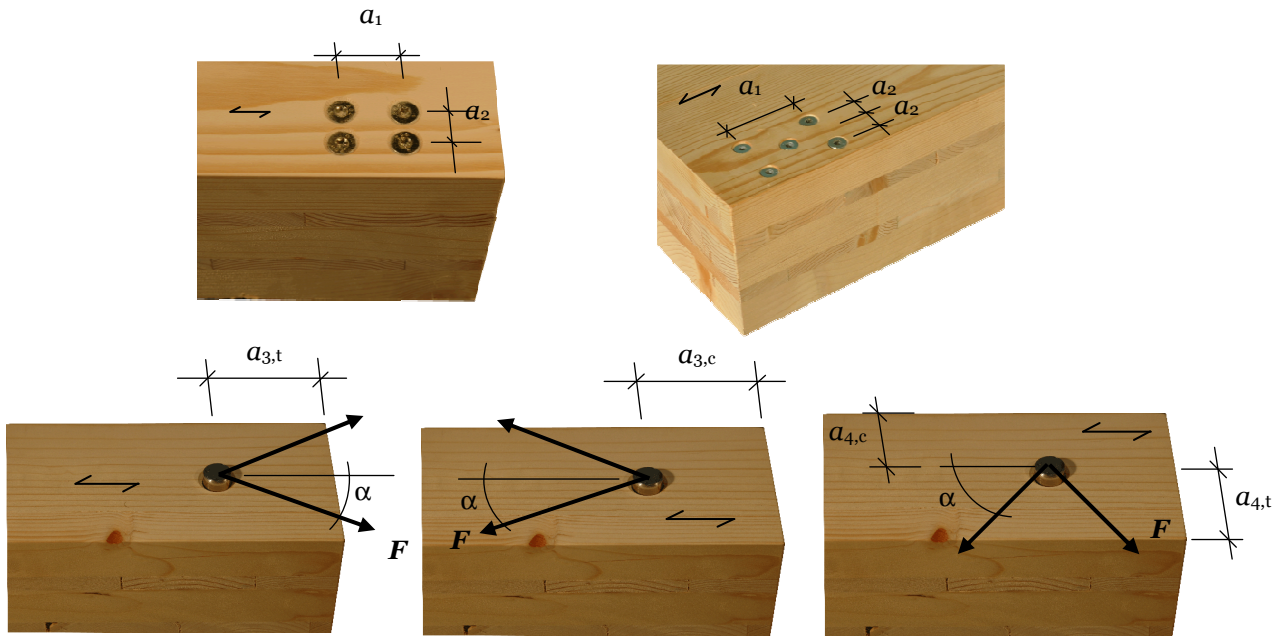


## Annex C

### Minimum distances and spacing

#### Axially or laterally loaded screws in the plane or edge surface of cross laminated timber

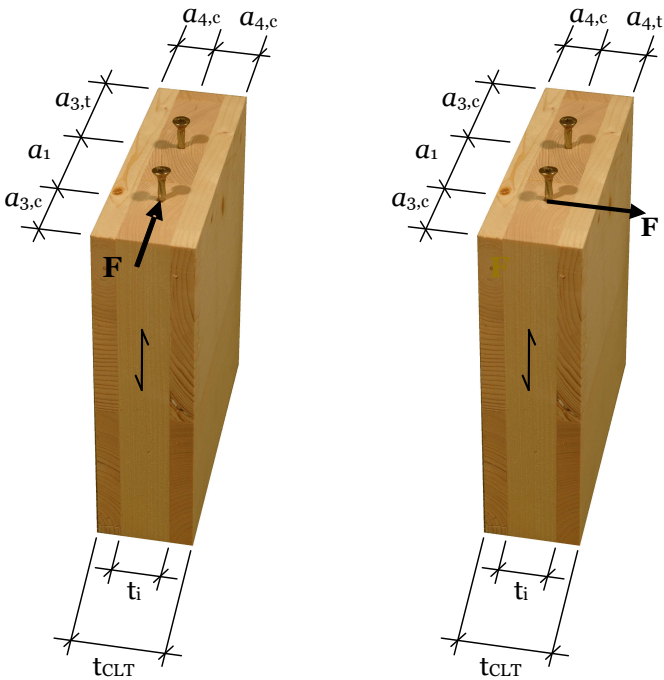
Definition of spacing, end and edge distances in the plane surface unless otherwise specified in the technical specification (ETA or hEN) for the cross laminated timber:



Definition of spacing, end and edge distances in the edge surface unless otherwise specified in the technical specification (ETA or hEN) for the cross laminated timber

<p style="text-align: center;"><b>fischer Power-Fast and Construction Screws</b></p>	<p style="text-align: center;"><b>Annex C1</b> of European Technical Approval ETA-11/0027</p>
<p style="text-align: center;">Assecories</p>	

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fischer Power-Fast and Construction Screws	Annex C2 of European Technical Approval ETA-11/0027
Assecories	