HOBSONTECHNICAL

HOBSON MTFOKS

304 ANGLE BRACKET

ETA 14/0392 (04/12/2014)

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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-14/0392 of 04/12/2014

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	Tecfi angle brackets type KS and KZ
Product family to which the above construction product belongs:	Three-dimensional nailing plate (Angle Bracket for timber-to-timber connections)
Manufacturer:	Tecfi SpA Strada Statale Appia, Km. 193 IT-81050 Pastorano (CE) Tel. +39 0823 88 33 38 Fax +39 0823 88 32 60 Internet www.tecfi.it
Manufacturing plant:	Tecfi SpA Strada Statale Appia, Km. 193 IT-81050 Pastorano (CE)
This European Technical Assessment contains:	18 pages including 3 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD).
This version replaces:	

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
Tecfi KS and KZ angle brackets are one-piece non-welded, face-fixed angle brackets to be used in timber to timber connections. They are connected to construction members made of timber or wood-based products with screws according to EN 14592.

The angle brackets are made from pre-galvanized steel class DX51D+Z275 or S250GD+Z275 according to EN 10346:2009 with a yield strength in the range of 250 MPa – 320 MPa; or from stainless steel grade 1.4306, 1.4307, 1.4301, 1.4948 according to EN 10088-2 with a yield strength in the range of 250 – 320 MPa.

Dimensions, hole positions and typical installations are shown in Annex B.

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

The angle brackets are intended for use in making connections in load bearing timber structures, as a connection between a beam and a purlin, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled.

The connection may be with an angle bracket on each side of the fastened timber member.

The static and kinematical behaviour of the timber members or the supports shall be as described in Annex A and B.

The wood members may be of solid timber, glued laminated timber and similar glued members, or wood-based structural members with a characteristic density from 290 kg/m^3 to 420 kg/m^3. This requirement to the material of the wood members can be fulfilled by using the following materials:

- 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,
- Plywood according to EN 636.

Annex B states the load-carrying capacities of the angle bracket connections for a characteristic density of 350 kg/m^3. For timber or wood based material with a lower characteristic density than 350 kg/m^3 the load-carrying capacities shall be reduced by the factor k_{dens}:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^2$$

where ρ_k is the characteristic density of the timber in kg/m^3.

The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code. The wood members shall have a thickness which is larger than the penetration depth of the nails into the members. The angle brackets are primarily for use in timber structures subject to the dry, internal conditions defined by service classes 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading.

The angle brackets can also be used in outdoor timber structures, service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield strength and ultimate strength is employed.

The scope of the angle brackets regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions and in conjunction with the admissible service conditions according to EN 1995-1-1 and the admissible corrosivity category as described and defined in EN ISO 12944-2

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

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

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

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*) (BWR1)	
Characteristic load-carrying capacity	See Annex C
Stiffness	No performance determined
Ductility in cyclic testing	No performance determined
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The angle brackets are made from steel classified as Euroclass A1 in accordance with EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 Hygiene, health and the environment (BWR3)	
Influence on air quality	No dangerous materials
3.7 Sustainable use of natural resources (BWR7)	No performance determined
3.8 General aspects related to the performance of the product	The angle brackets have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3
Identification	See Annex A

*) See additional information in section 3.9 – 3.12.

In addition to the specific clauses relating to dangerous substances contained in this European technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.9 Methods of verification

Safety principles and partial factors

The characteristic load-carrying capacities are based on the characteristic values of the nail connections and the steel plates. To obtain design values the capacities have to be divided by different partial factors for the material properties, the screw connection in addition multiplied with the coefficient k_{mod}.

According to EN 1990 (Eurocode – Basis of design) paragraph 6.3.5 the design value of load-carrying capacity may be determined by reducing the characteristic values of the load-carrying capacity with different partial factors.

Thus, the characteristic values of the load–carrying capacity are determined also for timber failure $F_{Rk,H}$ (obtaining the embedment strength of screws subjected to shear or the withdrawal capacity of the most loaded nail, respectively) as well as for steel plate failure $F_{Rk,S}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

$$F_{Rd} = \min\left\{\frac{k_{mod} \cdot F_{Rk,H}}{\gamma_{M,H}}; \frac{F_{Rk,S}}{\gamma_{M,S}}\right\}$$

Therefore, for timber failure the load duration class and the service class are included. The different partial factors γ_M for steel or timber, respectively, are also correctly taken into account.

3.10 Mechanical resistance and stability

See annex C for the characteristic load-carrying capacity in the different directions F_1 to F_5

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

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

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

3.11 Aspects related to the performance of the product

3.11.1 Corrosion protection in service class 1, 2 and 3.
In accordance with ETAG 015 the angle brackets are produced from pre-galvanized steel class DX51D+Z275 or S250GD+Z275 according to EN 10346:2009 with a yield strength in the range of 250 MPa – 320 MPa; or from stainless steel grade 1.4306, 1.4307, 1.4301, 1.4948 according to EN 10088-2 with a yield strength in the range of 250 – 320 MPa.

3.12 General aspects related to the use of the product

The angle brackets are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation

The nailing pattern used shall be either the maximum or the minimum pattern as defined in Annex B.

The following provisions apply:

- The structural members to which the brackets are fixed shall be:
  - Restrained against rotation. At a load F_4/F_5, the component 2 – see figure on page 14 – is allowed to be restrained against rotation by the angle brackets.
  - Strength class C14 or better, see section II.2 of this ETA
  - Free from wane under the bracket.
- The actual end bearing capacity of the timber member to be used in conjunction with the bracket is checked by the designer of the structure to ensure it is not less than the bracket capacity and, if necessary, the bracket capacity reduced accordingly.
- The gap between the timber members does not exceed 3 mm.
- There are no specific requirements relating to preparation of the timber members.

The execution of the connection shall be in accordance with the assessment holder's technical literature.

4 Attestation and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/638/EC of the European Commission1, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark

Issued in Copenhagen on 2014-12-04 by

Thomas Bruun
Manager, ETA-Danmark

Annex A
Product details definitions

Table A.1 Materials specification and ranges of sizes.

Code	Dimensions (mm)				Material	Note	Picture
	h. flap	v. flap	base	thickness			
KS0205020	50	50	40	2,0	galvanized steel	with rib	
KS0205025	50	50	40	2,5	galvanized steel	with rib	
KS0207020	70	70	55	2,0	galvanized steel	with rib	
KS0207025	70	70	55	2,5	galvanized steel	with rib	
KS0209020	90	90	65	2,0	galvanized steel	with rib	
KS0209025	90	90	65	2,5	galvanized steel	with rib	
KS0210520	105	105	90	2,0	galvanized steel	with rib	
KS0210525	105	105	90	2,5	galvanized steel	with rib	
KS0210530	105	105	90	3,0	galvanized steel	with rib	
KZ0205020	50	50	40	2,0	galvanized steel	no rib	
KS0205025	50	50	40	2,5	galvanized steel	no rib	
KZ0207020	70	70	55	2,0	galvanized steel	no rib	
KZ0207025	70	70	55	2,5	galvanized steel	no rib	
KZ0209020	90	90	65	2,0	galvanized steel	no rib	
KZ0209025	90	90	65	2,5	galvanized steel	no rib	
KZ0210520	105	105	90	2,0	galvanized steel	no rib	
KZ0210525	105	105	90	2,5	galvanized steel	no rib	
KZ0210530	105	105	90	3,0	galvanized steel	no rib	

Table A.2 Fastener specification

Fastener	**Length**	**Profiled Length**	**Fastener type**
Tecfi TM 5.0 x 40 mm	40 mm	40 mm	Self-tapping screws according to EN 14592

In the load-carrying-capacities of the nailed or with 5.0 mm screwed connection in Annex B the capacities calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral fastener load-carrying-capacity.

The screws shall have a minimum characteristic withdrawal strength of 12,5 N/mm^2 and minimum yield moment of the shank of 5500 Nmm. For stainless steel screws the minimum requirements are a minimum characteristic withdrawal strength of 12,5 N/mm^2 and minimum yield moment of the shank of 2600 Nmm

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

Annex B
Nailing patterns

The dimensions and the position of the holes for all the nailing plates are given in Figures B1.1 to B1.8

Table B1.1 additionally gives the nailing patterns for all the nailing plates with reference to the hole number as marked on the technical drawings.

Legend

● Partial nailing (P)

● + X Full nailing (F)

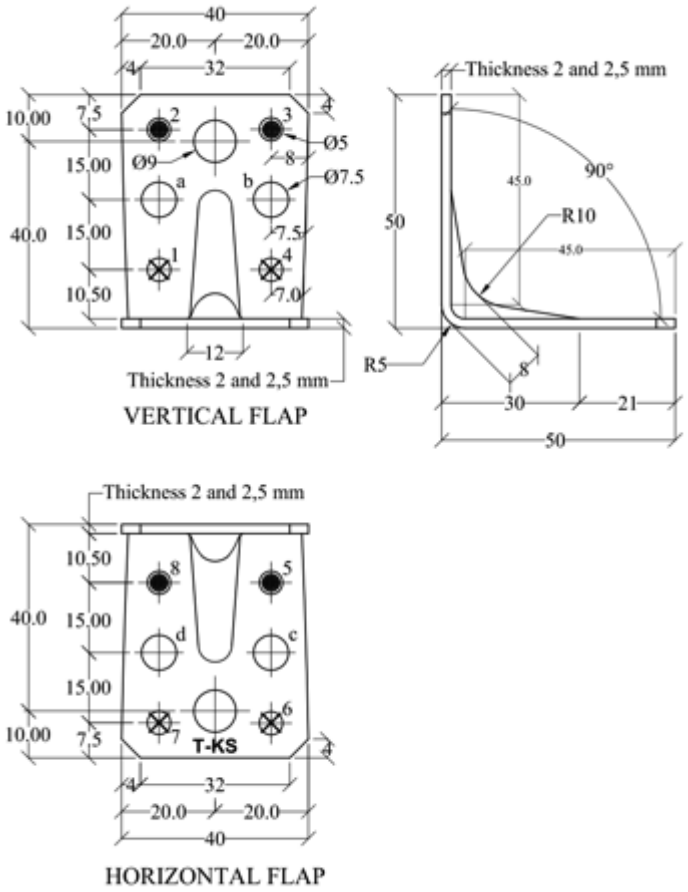


Figure B1.1 – KS0205020, KS0205025

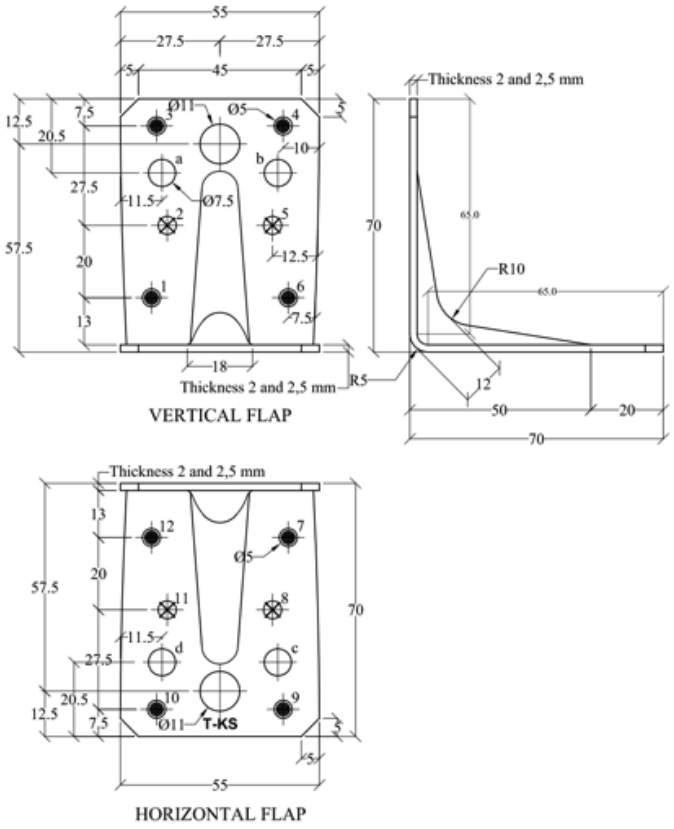


Figure B1.2 – KS0207020, KS0705025

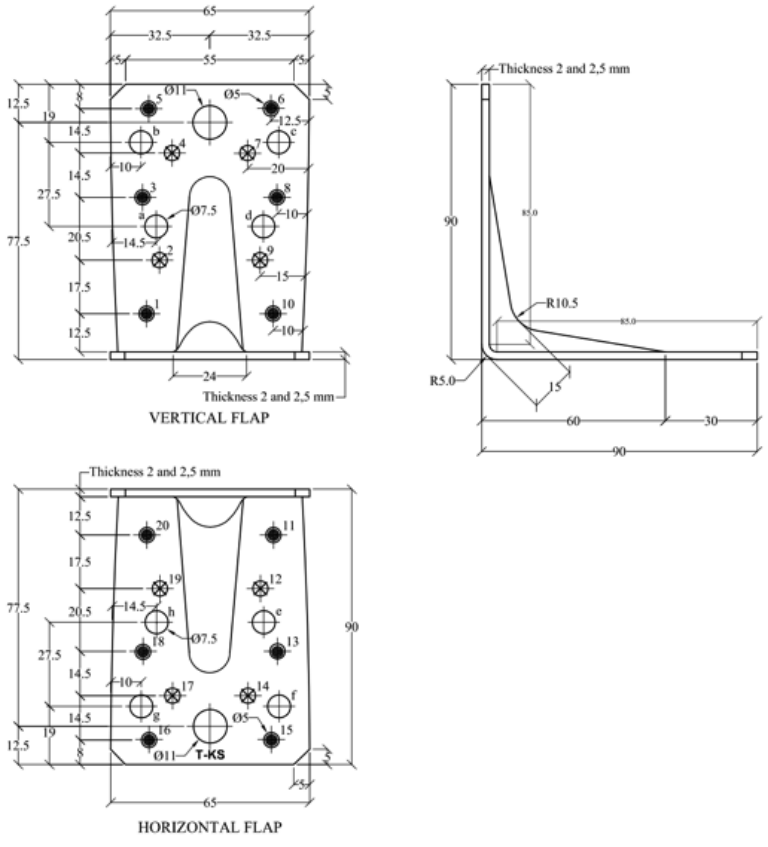


Figure B1.3 – KS0209020, KS0209025

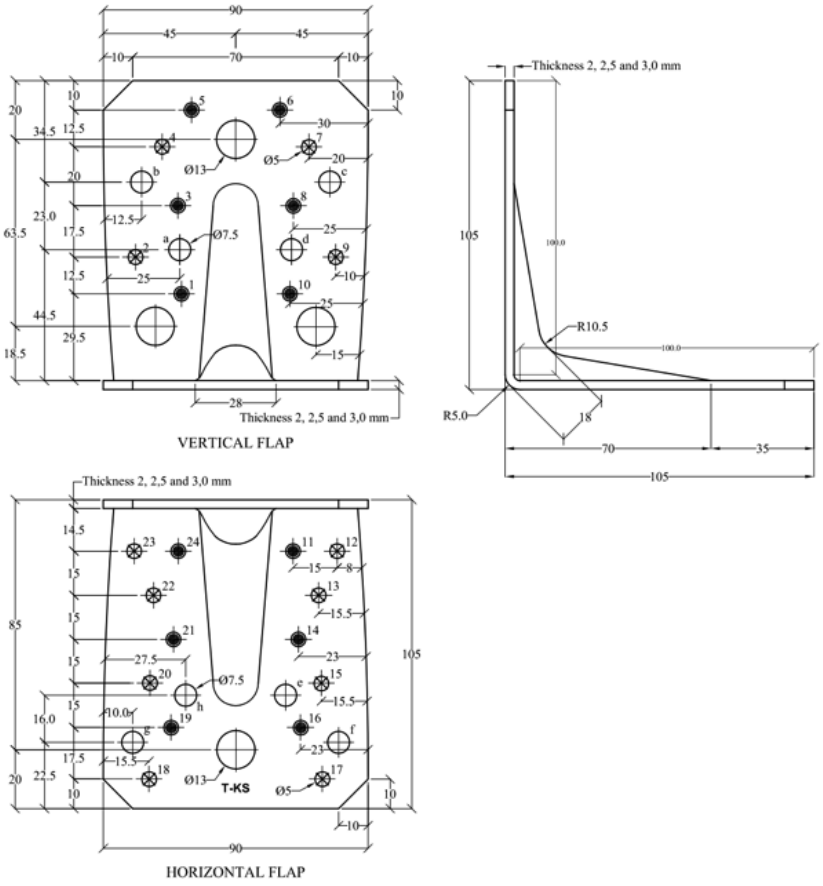


Figure B1.4 – KS0210520, KS0210525, KS0210530

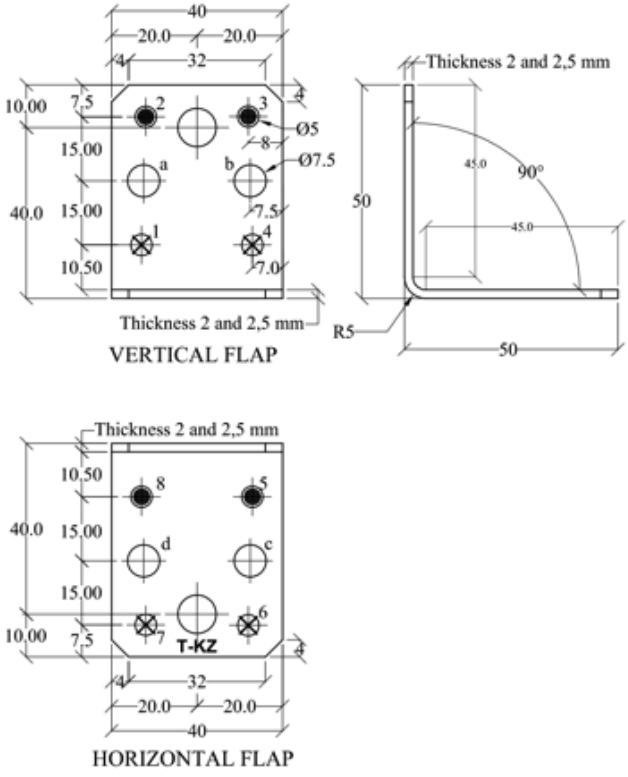


Figure B1.5 – KZ0205020, KZ0205025

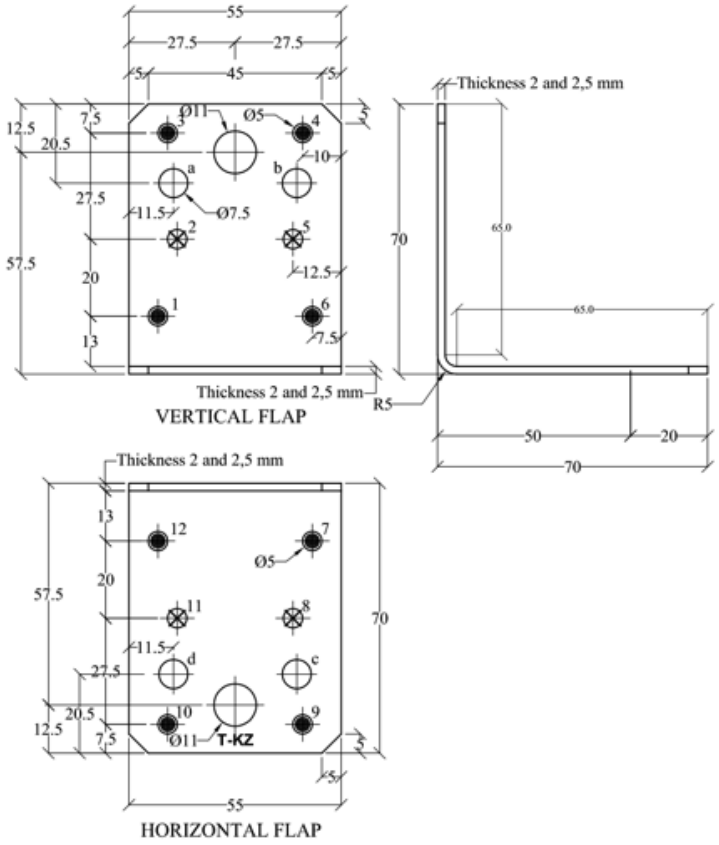


Figure B1.6 – KZ0207020, KZ0705025

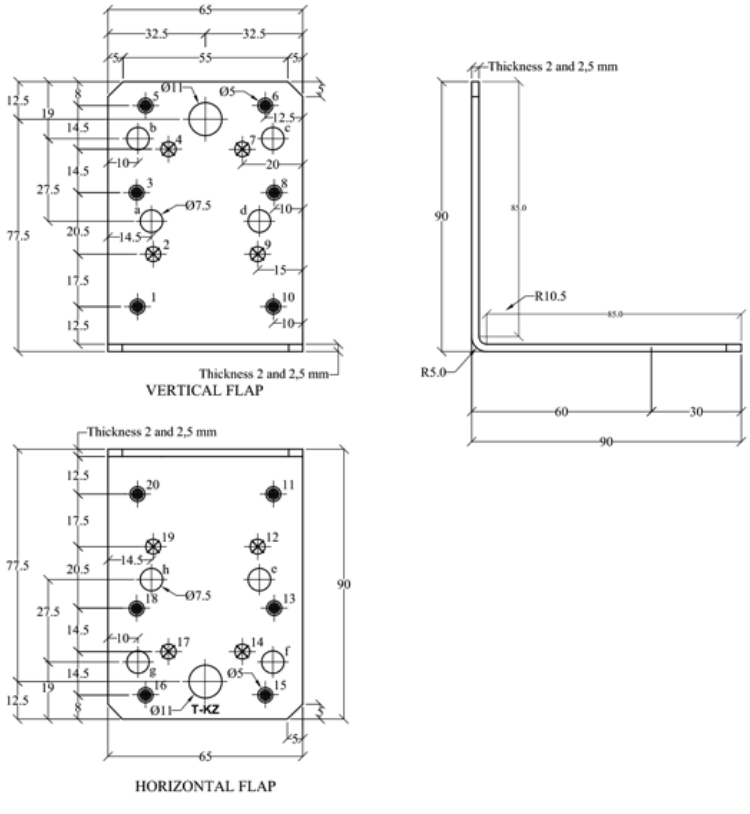


Figure B1.7 – KZ0209020, KZ0209025

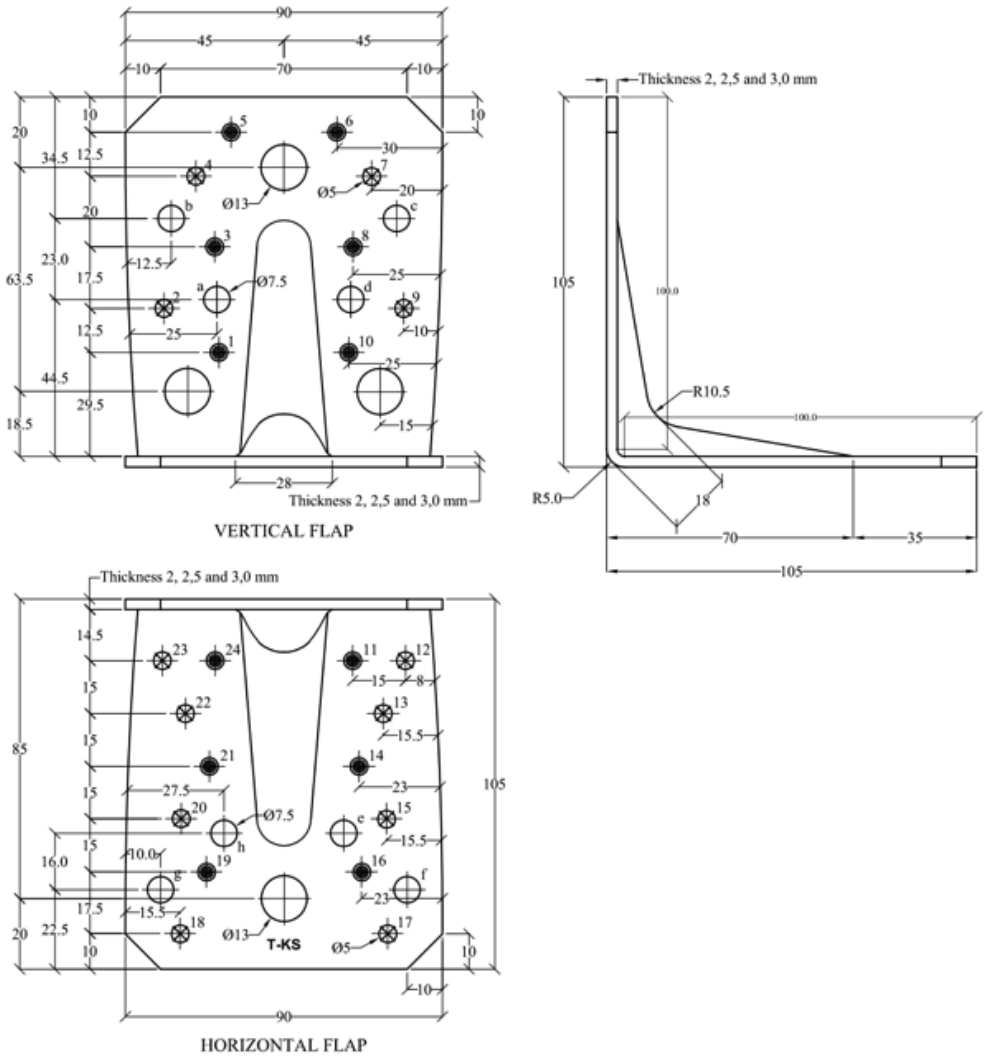


Figure B1.8 – KZ0210520, KZ0210525, KZ0210530

Table B1.1 – KS and KZ, nailing patterns

Model	Nailing patterns (*)	
	Partial	Full
KS0205020 KS0205025 KZ0205020 KZ0205025	2, 3, 5, 8	1, 2, 3, 4, 5, 6, 7, 8
KS0207020 KS0207025 KZ0207020 KZ0207025	1, 3, 4, 6, 7, 9, 10, 12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
KS0209020 KS0209025 KZ0209020 KZ0209025	1, 3, 5, 6, 8, 10, 11, 13, 15, 16, 18, 20	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
KS0210520 KS0210525 KS0210530 KZ0210520 KZ0210525 KZ0210530	1, 3, 4, 5, 6, 8, 10, 11, 14, 16, 19, 21, 24	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 22, 23, 24
(*) Numbers indicate holes that have to be nailed.		

Annex C
Characteristic load-carrying capacities

Tables C1.1 to C1.4 report the load-bearing capacities of Tecfi KS and KZ angle brackets. The same load-bearing capacities apply to stainless steel versions.

Fastener specification
The holes to be nailed are marked in Annex B pictures.

Double angle brackets per connection
The angle brackets must be placed at each side opposite to each other, symmetrically to the component axis.

Acting forces

F_1	Lifting force acting along the central axis of the joint.
F_2 and F_3	Lateral force acting in the joint between the component 2 and component 1 in the component 2 direction
F_4 and F_5	Lateral force acting in the component 1 direction along the central axis of the joint.

Wane
Wane is not allowed, the timber has to be sharp-edged in the area of the angle brackets.

Timber splitting
For the lifting force F_1 it must be checked in accordance with Eurocode 5 or a similar national Timber Code that splitting will not occur.

Combined forces
If the forces F_1 and F_2/F_3 or F_4/F_5 act at the same time, the following inequality shall be fulfilled:

$$\left(\frac{F_{1,d}}{F_{Rd,1}}\right)^2+\left(\frac{F_{2,d}}{F_{Rd,2}}\right)^2+\left(\frac{F_{3,d}}{F_{Rd,3}}\right)^2+\left(\frac{F_{4,d}}{F_{Rd,4}}\right)^2+\left(\frac{F_{5,d}}{F_{Rd,5}}\right)^2 \le 1$$

The forces F_2 and F_3 or F_4 and F_5 are forces with opposite direction. Therefore only one force F_2 or F_3, and F_4 or F_5, respectively, is able to act simultaneously with F_1, while the other shall be set to zero.

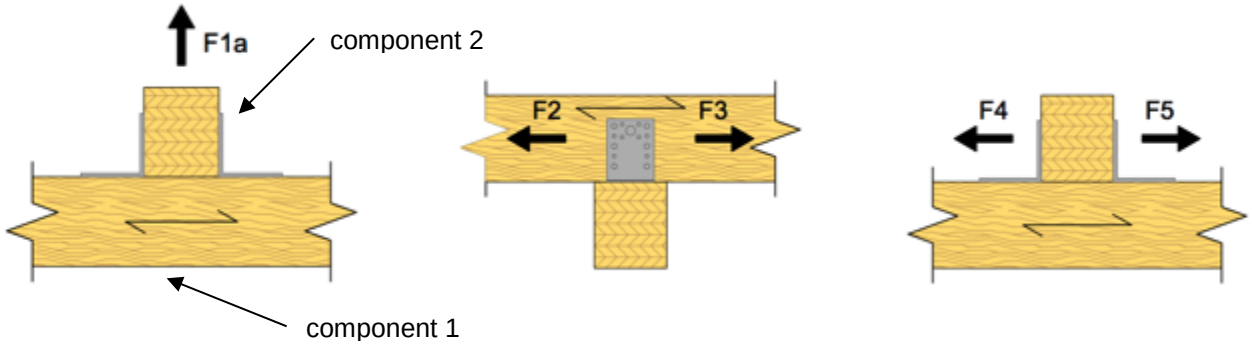


Figure C1 – Acting forces

Table C1.1 – KS02050XX and KS02070XX

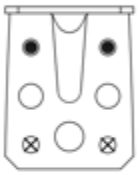
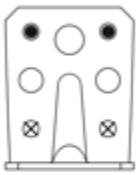
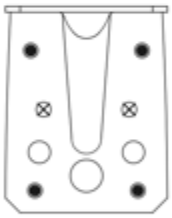
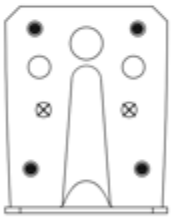
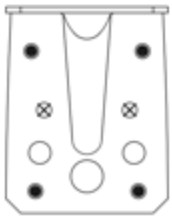
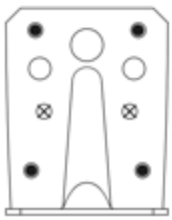
Model	Force direction - Nailing pattern	e/b (-)	F_{Rk} (kN)	Partial nailing pattern (●) / Full nailing pattern (● + ×)	
				Horizontal flap	Vertical Flap
KS0205020	F1a - P	-	3,36		
	F1a - F	-	4,84		
	F23 - P	-	1,72		
	F23 - F	-	2,16		
	F45 - P	0,5	1,51		
	F45 - F	0,5	3,63		
	F45 - P	1,0	1,19		
	F45 - F	1,0	2,21		
	F45 - P	2,0	0,75		
	F45 - F	2,0	1,18		
KS0205025	F1a - P	-	3,34		
	F1a - F	-	4,82		
	F23 - P	-	1,68		
	F23 - F	-	2,18		
	F45 - P	0,5	1,51		
	F45 - F	0,5	3,62		
	F45 - P	1,0	1,19		
	F45 - F	1,0	2,20		
	F45 - P	2,0	0,74		
	F45 - F	2,0	1,17		
KS0207020	F1a - P	-	6,62		
	F1a - F	-	9,14		
	F23 - P	-	2,78		
	F23 - F	-	3,48		
	F45 - P	0,5	4,74		
	F45 - F	0,5	5,45		
	F45 - P	1,0	2,97		
	F45 - F	1,0	3,79		
	F45 - P	2,0	1,60		
	F45 - F	2,0	2,16		
KS0207025	F1a - P	-	6,62		
	F1a - F	-	8,20		
	F23 - P	-	2,76		
	F23 - F	-	3,46		
	F45 - P	0,5	4,74		
	F45 - F	0,5	6,39		
	F45 - P	1,0	2,97		
	F45 - F	1,0	3,80		
	F45 - P	2,0	1,60		
	F45 - F	2,0	2,00		

Table C1.2 – KS02090XX and KS02150XX

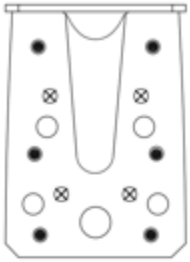
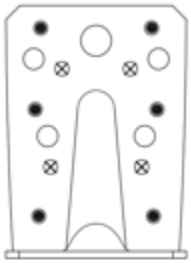
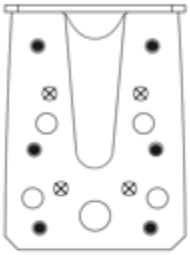
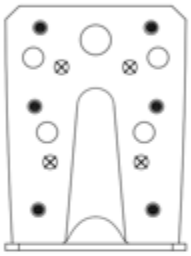
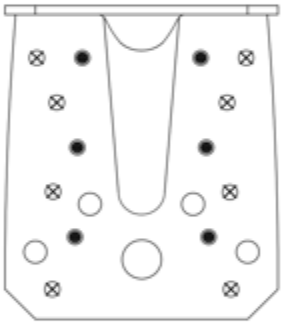
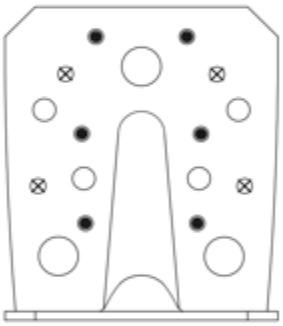
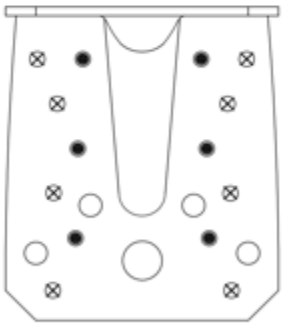
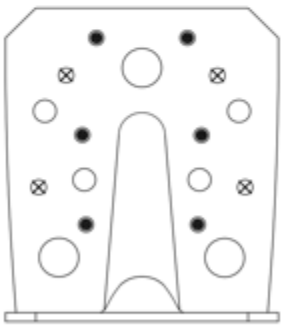
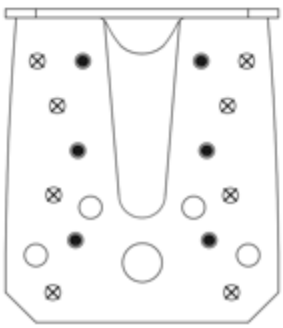
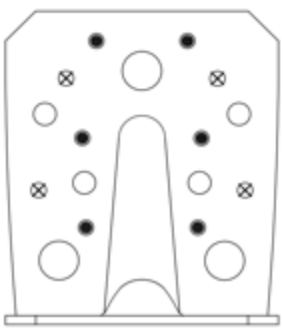
Model	Force direction - Nailing pattern	e/b (-)	F_{Rk} (kN)	Partial nailing pattern (●) / Full nailing pattern (● + ×)	
				Horizontal flap	Vertical Flap
KS0209020	F1a - P	-	7,52		
	F1a - F	-	11,70		
	F23 - P	-	3,20		
	F23 - F	-	4,50		
	F45 - P	0,5	4,44		
	F45 - F	0,5	7,43		
	F45 - P	1,0	3,10		
	F45 - F	1,0	5,00		
	F45 - P	2,0	1,77		
	F45 - F	2,0	2,79		
KS0209025	F1a - P	-	7,30		
	F1a - F	-	11,70		
	F23 - P	-	3,18		
	F23 - F	-	4,48		
	F45 - P	0,5	5,47		
	F45 - F	0,5	7,43		
	F45 - P	1,0	3,33		
	F45 - F	1,0	5,00		
	F45 - P	2,0	1,78		
	F45 - F	2,0	2,79		
KS0210520	F1a - P	-	7,62		
	F1a - F	-	15,56		
	F23 - P	-	3,06		
	F23 - F	-	6,42		
	F45 - P	0,5	4,11		
	F45 - F	0,5	7,50		
	F45 - P	1,0	3,00		
	F45 - F	1,0	5,75		
	F45 - P	2,0	1,77		
	F45 - F	2,0	3,54		
KS0210525	F1a - P	-	7,94		
	F1a - F	-	15,16		
	F23 - P	-	3,04		
	F23 - F	-	6,38		
	F45 - P	0,5	5,39		
	F45 - F	0,5	7,45		
	F45 - P	1,0	3,49		
	F45 - F	1,0	5,67		
	F45 - P	2,0	1,91		
	F45 - F	2,0	3,46		
KS0210530	F1a - P	-	7,94		
	F1a - F	-	15,16		
	F23 - P	-	3,02		
	F23 - F	-	6,34		
	F45 - P	0,5	5,39		
	F45 - F	0,5	10,54		
	F45 - P	1,0	3,49		
	F45 - F	1,0	6,73		
	F45 - P	2,0	1,91		
	F45 - F	2,0	3,66		

Table C1.3 – KZ02050XX and KZ02070XX

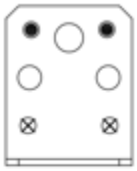
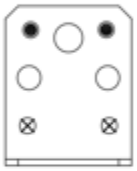
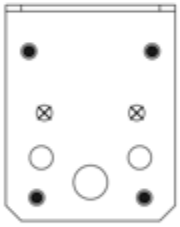
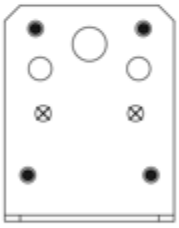
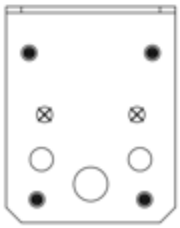
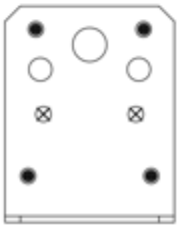
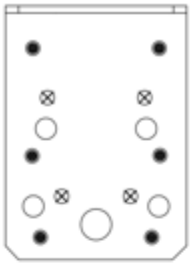
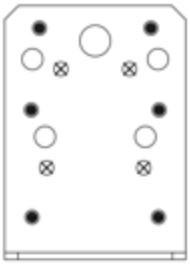
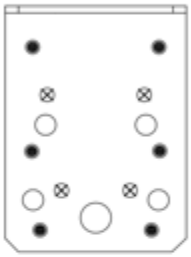
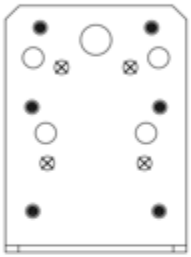
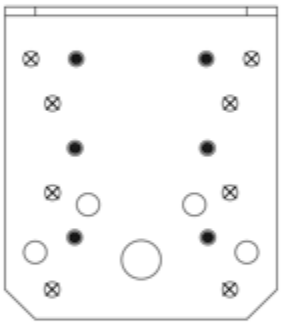
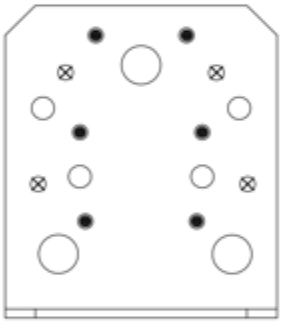
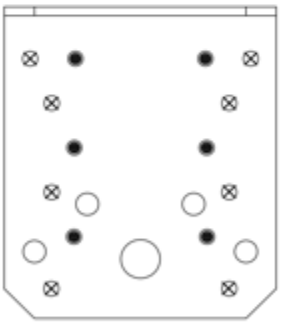
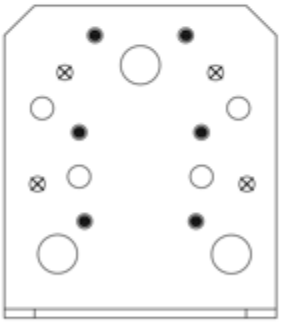
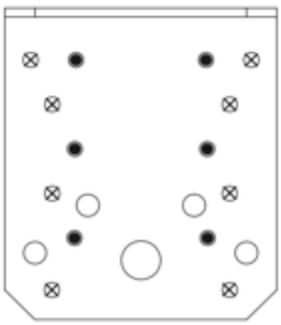
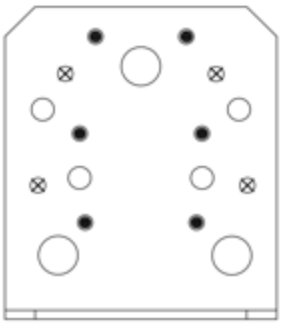
Model	Force direction - Nailing pattern	e/b (-)	F_{Rk} (kN)	Partial nailing pattern (●) / Full nailing pattern (● + ×)	
				Horizontal flap	Vertical Flap
KZ0205020	F1a - P	-	1,60		
	F1a - F	-	4,84		
	F23 - P	-	1,72		
	F23 - F	-	2,16		
	F45 - P	0,5	1,44		
	F45 - F	0,5	3,14		
	F45 - P	1,0	0,77		
	F45 - F	1,0	2,08		
	F45 - P	2,0	0,39		
	F45 - F	2,0	1,16		
KZ0205025	F1a - P	-	2,40		
	F1a - F	-	5,34		
	F23 - P	-	1,68		
	F23 - F	-	2,18		
	F45 - P	0,5	1,38		
	F45 - F	0,5	3,26		
	F45 - P	1,0	0,98		
	F45 - F	1,0	2,24		
	F45 - P	2,0	0,56		
	F45 - F	2,0	1,27		
KZ0207020	F1a - P	-	6,62		
	F1a - F	-	9,14		
	F23 - P	-	2,78		
	F23 - F	-	3,48		
	F45 - P	0,5	4,04		
	F45 - F	0,5	5,45		
	F45 - P	1,0	2,77		
	F45 - F	1,0	3,79		
	F45 - P	2,0	1,57		
	F45 - F	2,0	2,16		
KZ0207025	F1a - P	-	6,62		
	F1a - F	-	9,12		
	F23 - P	-	2,76		
	F23 - F	-	3,46		
	F45 - P	0,5	4,04		
	F45 - F	0,5	5,45		
	F45 - P	1,0	2,77		
	F45 - F	1,0	3,78		
	F45 - P	2,0	1,57		
	F45 - F	2,0	2,16		

Table C1.4 – KZ02090XX and KZ02150XX

Model	Force direction - Nailing pattern	e/b (-)	F_{Rk} (kN)	Partial nailing pattern (●) / Full nailing pattern (● + ×)	
				Horizontal flap	Vertical Flap
KZ0209020	F1a - P	-	7,24		
	F1a - F	-	10,04		
	F23 - P	-	3,20		
	F23 - F	-	4,50		
	F45 - P	0,5	4,98		
	F45 - F	0,5	7,42		
	F45 - P	1,0	3,20		
	F45 - F	1,0	4,56		
	F45 - P	2,0	1,75		
	F45 - F	2,0	2,44		
KZ0209025	F1a - P	-	7,80		
	F1a - F	-	10,56		
	F23 - P	-	3,18		
	F23 - F	-	4,48		
	F45 - P	0,5	5,16		
	F45 - F	0,5	7,62		
	F45 - P	1,0	3,39		
	F45 - F	1,0	4,76		
	F45 - P	2,0	1,87		
	F45 - F	2,0	2,56		
KZ0210520	F1a - P	-	7,94		
	F1a - F	-	10,30		
	F23 - P	-	3,06		
	F23 - F	-	6,42		
	F45 - P	0,5	4,16		
	F45 - F	0,5	7,88		
	F45 - P	1,0	3,08		
	F45 - F	1,0	4,74		
	F45 - P	2,0	1,83		
	F45 - F	2,0	2,51		
KZ0210525	F1a - P	-	7,94		
	F1a - F	-	11,98		
	F23 - P	-	3,04		
	F23 - F	-	6,38		
	F45 - P	0,5	4,16		
	F45 - F	0,5	8,56		
	F45 - P	1,0	3,08		
	F45 - F	1,0	5,38		
	F45 - P	2,0	1,83		
	F45 - F	2,0	2,90		
KZ0210530	F1a - P	-	7,94		
	F1a - F	-	13,06		
	F23 - P	-	3,02		
	F23 - F	-	6,34		
	F45 - P	0,5	4,16		
	F45 - F	0,5	8,93		
	F45 - P	1,0	3,08		
	F45 - F	1,0	5,76		
	F45 - P	2,0	1,83		
	F45 - F	2,0	3,15		