ETA-Danmark A/S
Göteborg Plads 1 6
DK-2150 Nordhavn
Tel. +45 72 24 59 00
Internet
www.etadanmark.dk

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-15/0603 of 2026/08/17

I General Part

Technical Assessment Body issuing the European Technical Assessment:
ETA-Danmark A/S

Trade name of the construction product:	Hector and Trilift connectors
Product family to which the above construction product belongs:	Three-dimensional nailing plate (timber to timber connectors)
Manufacturer:	E.u.r.o. Tec GmbH Unter dem Hofe 5 D-58099 Hagen Tel. +49 2331 / 6245 - 0 Fax +49 2331 / 6245 - 200 Internet: www.eurotec.team
Manufacturing plant:	HSW 19, HSW 20, HSW 21
This European Technical Assessment contains:	28 pages including 3 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Article 95(4) of Regulation (EU) 2024/3110, on the basis of	EAD 130186-00-0603 for Three-dimensional nailing plates.
This version replaces:	The ETA with the same number issued on 2018-06-01

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.

.

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of the product

Hector connectors are two-piece, face-fixed connectors to be used in timber-to-timber and in steel-to-timber connections.
Trilift connectors are used in steel-to-timber connections exclusively.

Hector and Trilift connectors are made from steel grade S235 JR according to EN 10025-2. Dimensions, hole positions, structural capacities and typical installations are shown in Annexes A, B and C.

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

Hector connectors are intended for use in making end grain to side grain connections in load bearing timber structures, as a connection between a main and secondary solid timber or wood-based member as well as steel-to timber connections.

Trilift connectors are used in steel-to-timber connections with a metric bolt. For Trilift connectors assessed values concern only the joint of Trilift to timber part.

Requirements for mechanical resistance and stability and safety in use in the sense of the Basic Work Requirements 1 and 4 of the Regulation 305/2011 (EU) shall be fulfilled.

The Hector and Trilift connectors can be installed as connections between members such as:

- Structural solid timber according to EN 14081,
- Glued laminated or glued solid timber according to EN 14080,
- LVL according to EN 14374 or ETA,
- Cross-laminated timber according to ETA

The Hector connector is additionally applicable for steel to timber connections.

However, the calculation methods are only allowed for a characteristic wood density of up to 460 kg/m^3. Even though the wood-based material may have a larger density, this must not be used in the formulas for the load-carrying capacities of the fasteners.

Annex B states the formulas for the characteristic load-carrying capacities and slip moduli of the connections with Hector and Trilift connectors. The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code.

It is assumed that the forces acting on the connection are the axial force F_1 parallel to the symmetry axis of the connector or the shear force F_2 perpendicular to the symmetry axis of the connector, as shown in annex B.

The Hector and Trilift connectors are intended for use for connections subjected to static or quasi static loading.

The scope of the connectors 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.

Assumed working life
The assumed intended working life of the connectors for the intended use is 50 years, provided that they are subject to appropriate use and maintenance.

The information on the working life should not be regarded as a guarantee provided by the manufacturer or ETA Danmark. An “assumed intended working life” means that it is expected that, when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

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)*)	
Characteristic load-carrying capacity	See Annex B
Stiffness	See Annex B
Ductility in cyclic testing	No performance Assessed
Resistance to seismic actions	No performance Assessed
Resistance to corrosion and deterioration	See section 3.6
3.2 Safety in case of fire (BWR 2)	
Reaction to fire	The connectors are made from steel classified as **Euroclass A1** in accordance with EN 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
Resistance to fire	No performance Assessed

*) See additional information in section 3.4 – 3.7

3.4 Methods of verification

Safety principles and partial factors

The characteristic load-carrying capacities are based on the characteristic values of the connections with metal fasteners, the steel plates and the timber member.

In the case of timber failure or failure of the metal fasteners, the design values shall be calculated according to EN 1995-1-1 by dividing the characteristic values of the load-carrying capacities by different partial factors for the strength properties, and in addition multiplied by the coefficient k_{mod}.

In the case of steel failure, the design value shall be calculated according to EN 1993-1-1 by reducing the characteristic values of the load-carrying capacity with different partial factors.

The design value of the load-carrying capacity is the smaller value of all load-carrying capacities:

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

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

3.5 Mechanical resistance and stability

See Annex B for characteristic load-carrying capacities of the Hector and Trilift connectors.

The characteristic capacities of the Hector connectors are determined by calculation assisted by testing as described in EAD 130186-00-0603. The characteristic capacities of the Trilift connector are determined by calculation as described in EAD 130186-00-0603, depending on load bearing capacities of self-tapping screws according to ETA-11/0024. The characteristic capacities should be used for designs in accordance with Eurocode 5 or a similar national Timber Code. The load-bearing capacity of the metric bolt used in connection with Trilift connectors is not assessed within this ETA but is verified according to EC 3-1-8 or a similar national code.

The design models allow the use of fasteners described in the tables in Annex A:

- *Screws in accordance with this ETA*
- *Bolts in accordance with EN ISO 898-1*

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.

3.6 Aspects related to the performance of the product

Corrosion protection in service class 1 and 2.
The use of Trilift or Hector connectors assembled with screws made of carbon steel according to ETA-11/0024 is limited to service class 1 and 2.

Hector and Trilift connectors are produced from steel grade S235 JR according to EN 10025-2. The Hector and Trilift connectors are for use in timber structures subject to dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1 (Eurocode 5).

3.7 General aspects related to the use of the product

Hector and Trilift connectors are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation. The following provisions concerning product performance apply:

Hector and Trilift Connector joints

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

- The timber member shall be free from wane under the Hector and Trilift connector.
- The main member, i.e. header shall be restraint against rotation. If the header beam supports the joist beam only on one side, the verification of main member has to take account of moments due to eccentricity of the forces.
  $M_{ec} = R_{joist} * (b_H/2)$
  R_{joist}: Reaction force from the joist
  b_H: width of the header beam
- Hector and Trilift connectors are fastened to wood-based members by screws with a full thread according to ETA-11/0024.
- The characteristic capacity of the Hector and Trilift connector joint is calculated according to the models presented in Annex B.
- The Hector or Trilift connector joint is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the timber member and the surface, where contact stresses can occur during loading shall be limited. This means that for Hector connectors the gap between the timber members shall be maximum 1 mm.
- The depth of the timber member shall be sufficient that the edge is at least 10 mm outside the screw tips in the secondary member.
- Screws to be used are defined in annex B.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

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 provided for 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 2026-08-17 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A

Product details and definitions

Hector connector

Face mount two-piece connector. Steel grade S235 JR according to EN 10025-2. Timber-to-timber or steel-to-timber connections with screws and metric bolts.

Table A.1: Connectors dimension and applicable fasteners

Hector's ⌀ d_c	Hector's depth t	VSS ⌀ ETA-11/0024	Number of VSS	Metric bolt d_M ⌀
⌀25	28 mm	4 mm	6	M10
⌀30	28 mm	5 mm	8	M12
⌀40	28 mm, 30 mm	6 mm	8 6	M16
⌀50	30 mm	8 mm	8	M20

Geometry of metric bolts according to the referenced codes in EN 14592

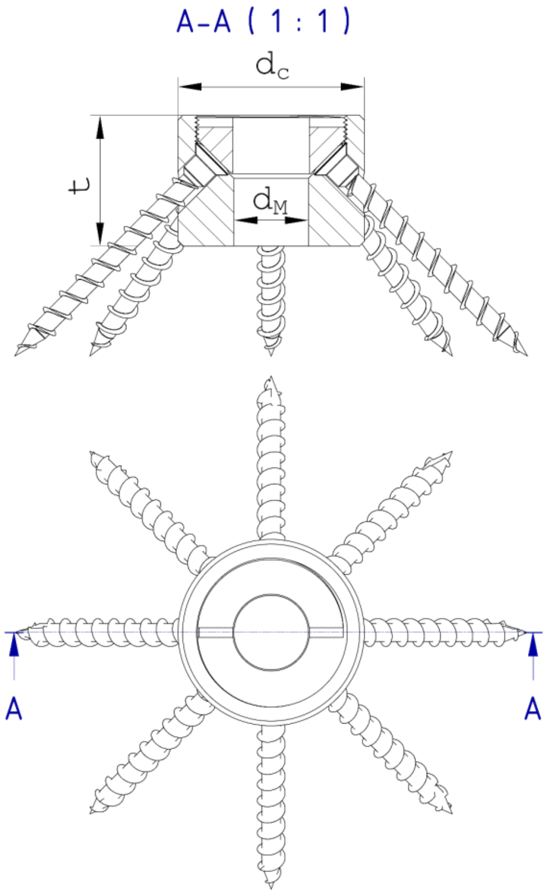
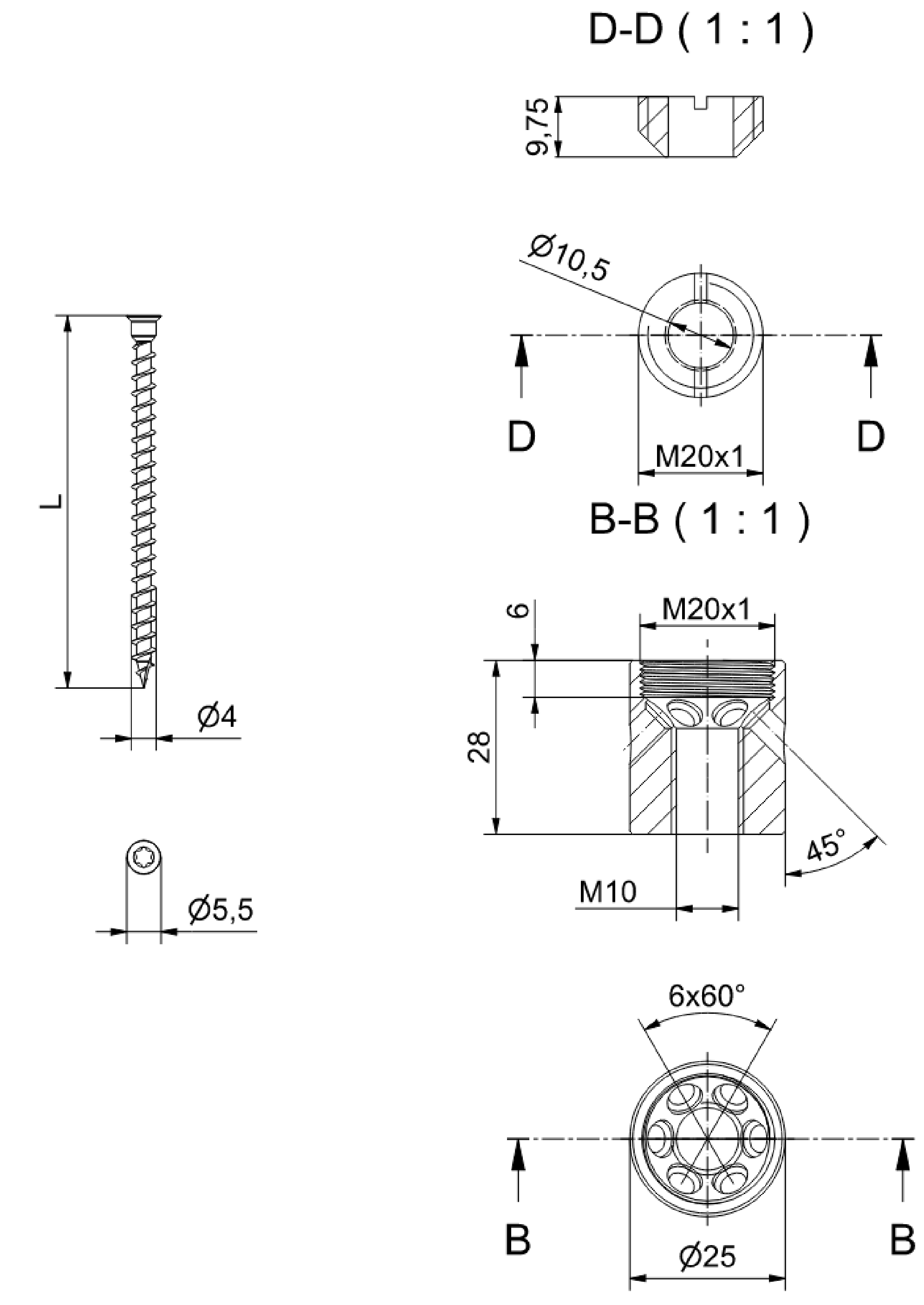
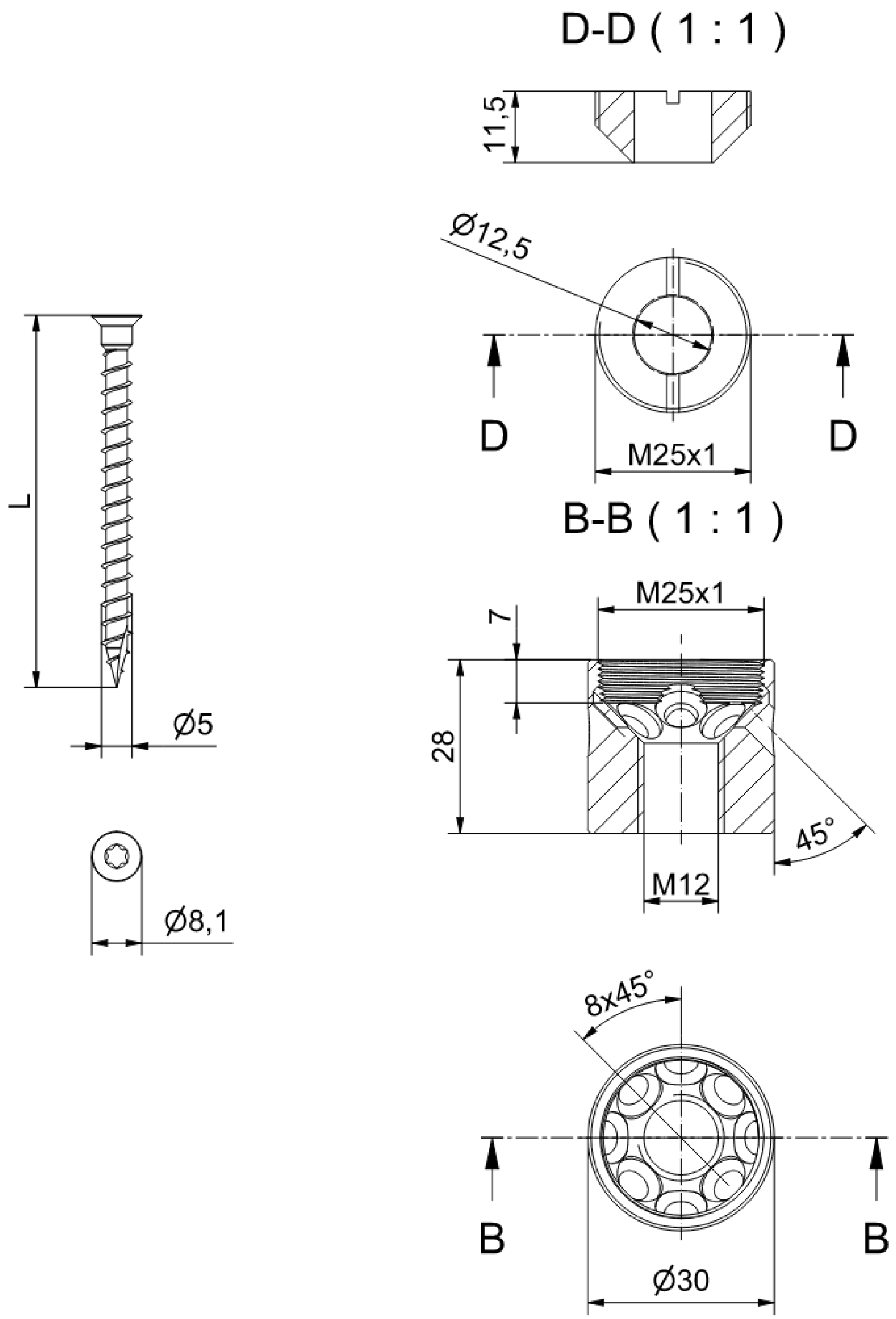


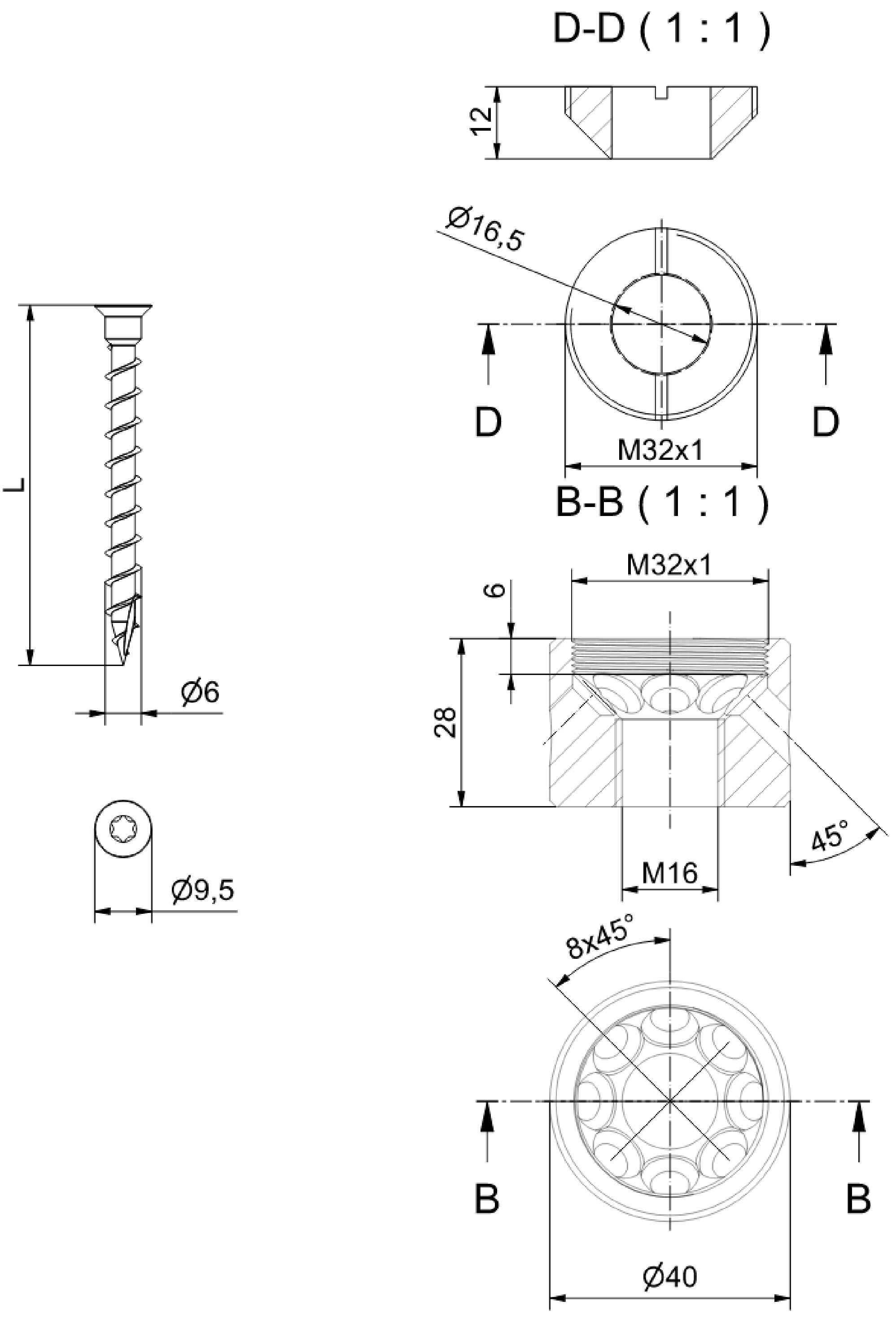
Figure A.1: Hector's dimension



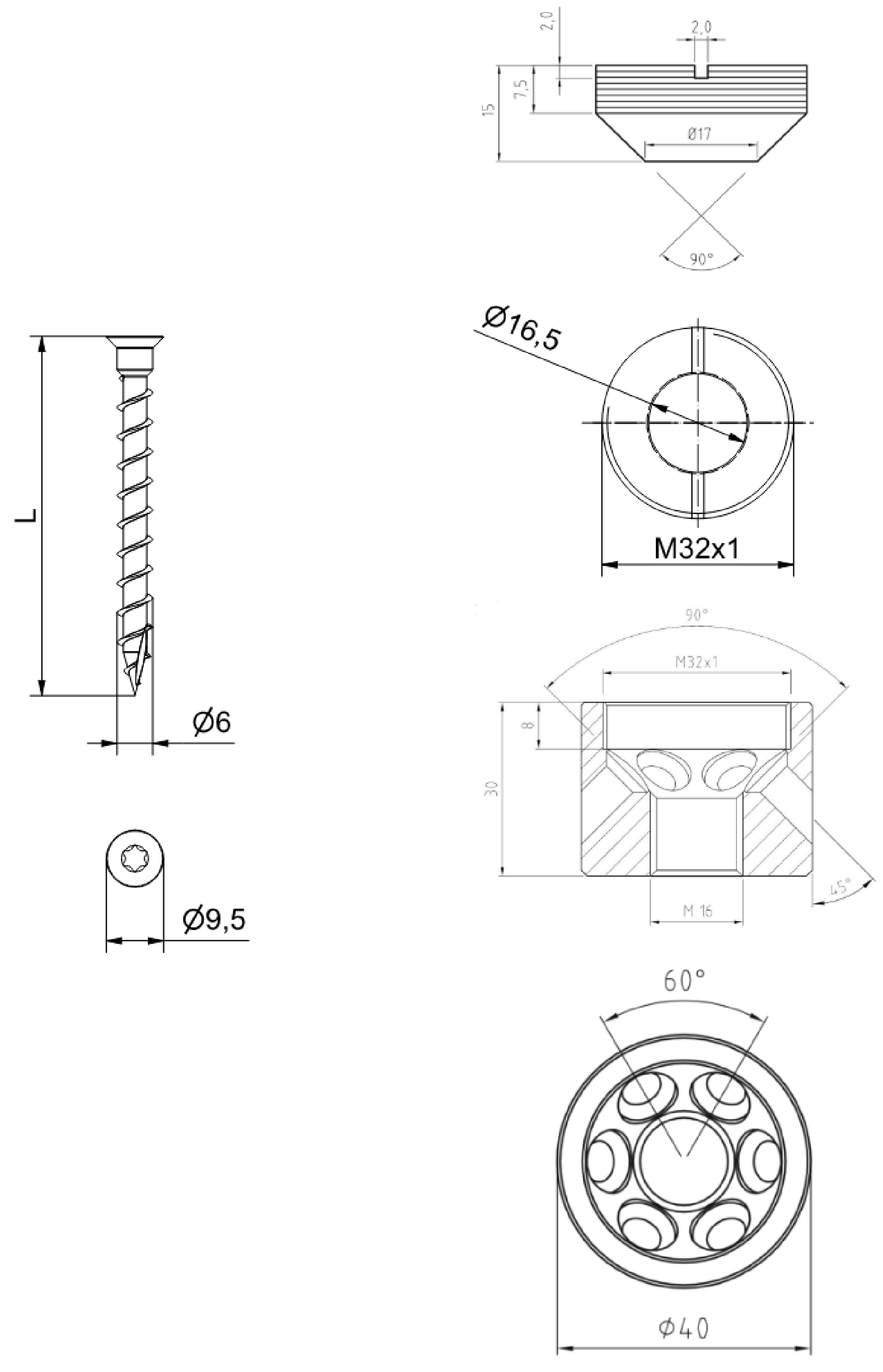
Eurotec®	Oberfläche: Surface:	Allgemein-toleranzen: DIN ISO 2768-m	Maßstab / Scale: 1 : 1	Gewicht / Weight: –		
			Material / Material :			
		Datum	Name	Benennung / Designation:		
	Erstellt	08.01.2025	Brüggemann	Hector-Verbinder Ø25x28		
	Bearb.					
	Gepr.					
Nr / Änderung / Datum / Name	Eurotec GmbH Unter dem Hofe 5 58099 Hagen www.eurotec.team info@eurotec.team			Zeichnung / Drawing: 02407	Blatt: 1/1	
				Status: InBearbeitung		



Eurotec®	Oberfläche: Surface:		Allgemein-toleranzen: DIN ISO 2768-m		Maßstab / Scale: 1 : 1	Gewicht / Weight: –
					Material / Material :	
		Datum	Name		Benennung / Designation:	
	Erstellt	19.12.2024	Brüggemann		Hector-Verbinder Ø30x28	
	Bearb.					
	Gepr.					
Nr / Änderung / Datum / Name	Eurotec GmbH Unter dem Hofe 5 58099 Hagen www.eurotec.team info@eurotec.team				Zeichnung / Drawing: 02408	Blatt: 1/1
					Status: InBearbeitung	



Eurotec®	Oberfläche: Surface:	Allgemein-toleranzen: DIN ISO 2768-m	Maßstab / Scale: 1 : 1	Gewicht / Weight: –	
			Material / Material :		
		Datum	Name	Benennung / Designation:	
	Erstellt	11.07.2014	MKA	Hector-Verbinder Ø40x28	
	Bearb.				
	Gepr.				
	Eurotec GmbH Unter dem Hofe 5 58099 Hagen www.eurotec.team info@eurotec.team			Zeichnung / Drawing: 00810-r01	Blatt: 1/1
Nr / Änderung / Datum / Name				Status: InBearbeitung	



Eurotec®

Oberfläche: Surface:	
Allgemein-toleranzen:	DIN ISO 2768-m
Maßstab / Scale:	1 : 1
Gewicht / Weight:	–
Material / Material :	

	Datum	Name
Erstellt	11.07.2014	MKA
Bearb.		
Gepr.		

Benennung / Designation:

Hector-Verbinder Ø40x30

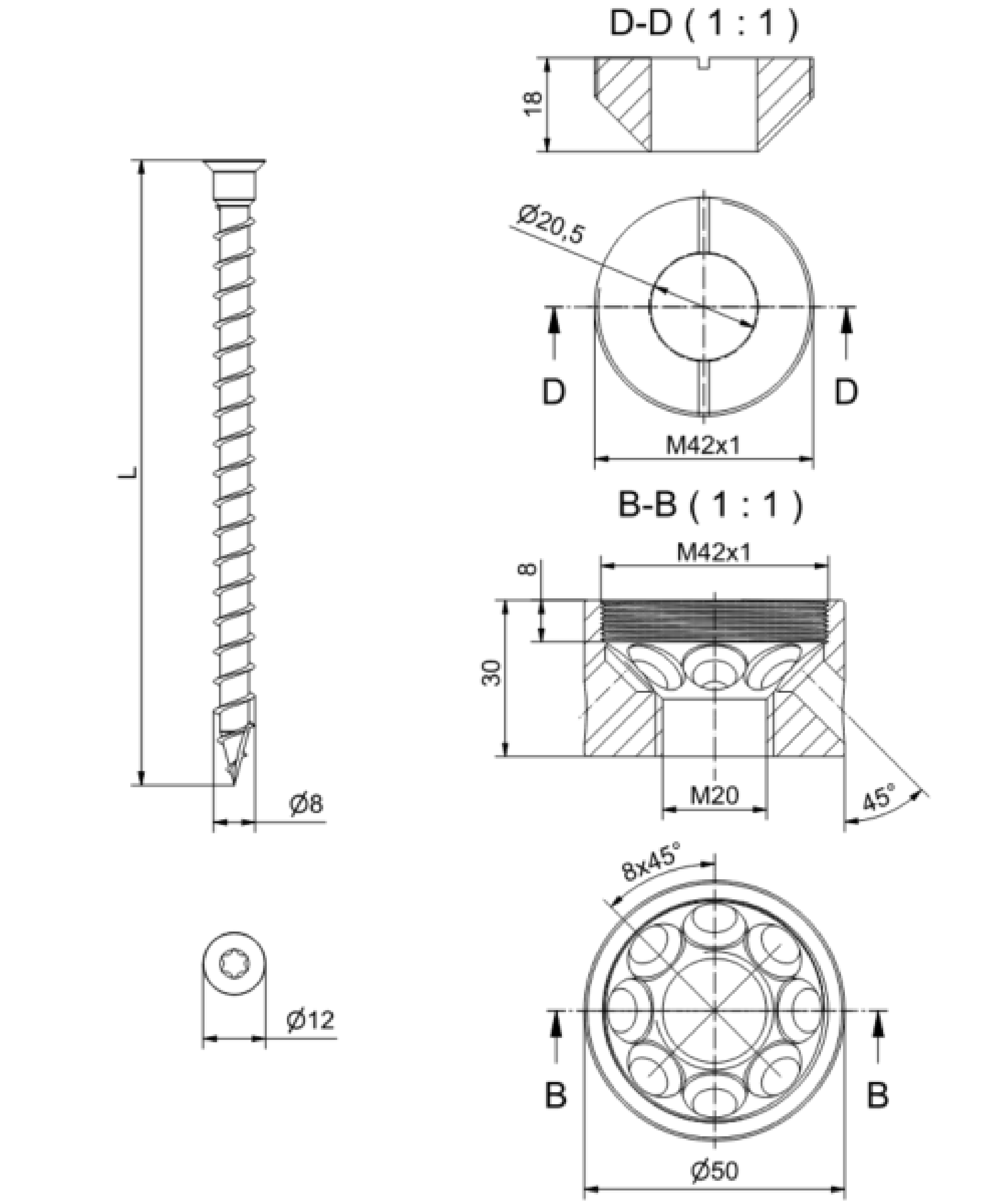
Nr | Änderung | Datum | Name

Eurotec GmbH
Unter dem Hofe 5
58099 Hagen
www.eurotec.team
info@eurotec.team

Zeichnung / Drawing: 00810

Blatt: 1/1

Status: InBearbeitung



Eurotec®

Oberfläche: / Surface:

Allgemein-toleranzen: DIN ISO 2768-m

Maßstab / Scale: 1 : 1

Gewicht / Weight: -

Material / Material:

	Datum	Name
Erstellt	08.01.2025	Brüggemann
Bearb.		
Gepr.		

Benennung / Designation:

Hector-Verbinder Ø50x30

Eurotec GmbH
Unter dem Hofe 5
58099 Hagen
www.eurotec.team
info@eurotec.team

Zeichnung / Drawing: 02409

Blatt: 1/1

Status: InBearbeitung

Nr	Änderung	Datum	Name

Annex A continued

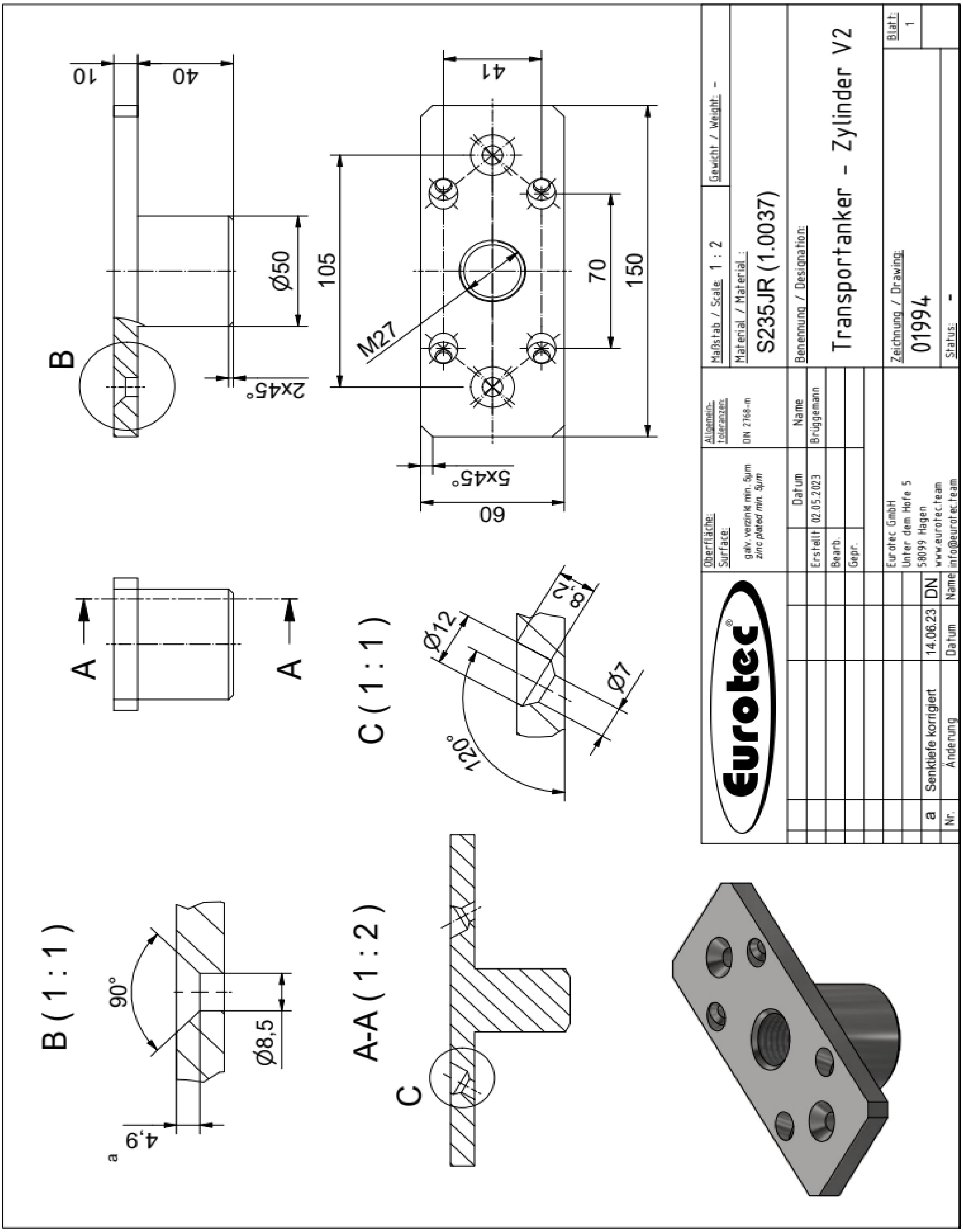
Trilift connector

Face mount two-piece connector. Steel grade S235 JR according to EN 10025-2. Steel-to-timber connections with screws and metric bolt M27.

Table A.2: Fastener used with Trilift connectors

SCREW diameter [mm]	Length [mm]	Screw type
6,5	140	Self-tapping fully threaded screws according to ETA-11/0024 KonstruX ST SK
8,0	200	

BOLTS diameter [mm]	Length [mm]	Bolt type
27,0	Length in threaded part of Trilift $l \geq 30\ mm$	Bolts M27 grade 4.6 or higher


B (1 : 1)
90°
Ø8,5
4,9
a
A-A (1 : 2)
C
C (1 : 1)
Ø12
Ø7
8,2
120°
A
A
B
10
40
Ø50
105
2x45°
M27
41
70
150
5x45°
60
Eurotec
Oberfläche: / Surface:
galv. verzinkt min. 5µm
zinc plated min. 5µm
Allgemein-toleranzen:
DIN 2768-m
Datum
Name
Erstellt 02.05.2023 Brüggemann
Bearb.
Gepr.
Eurotec GmbH
Unter dem Hofe 5
58099 Hagen
www.eurotec.team
info@eurotec.team
a Senktiefe korrigiert 14.06.23 DN
Nr. Änderung Datum Name
Maßstab / Scale: 1 : 2
Gewicht / Weight: -
Material / Material:
S235JR (1.0037)
Benennung / Designation:
Transportanker - Zylinder V2
Zeichnung / Drawing:
01994
Status: -
Blatt: 1

Annex B

Characteristic values of load-carrying-capacities and slip moduli

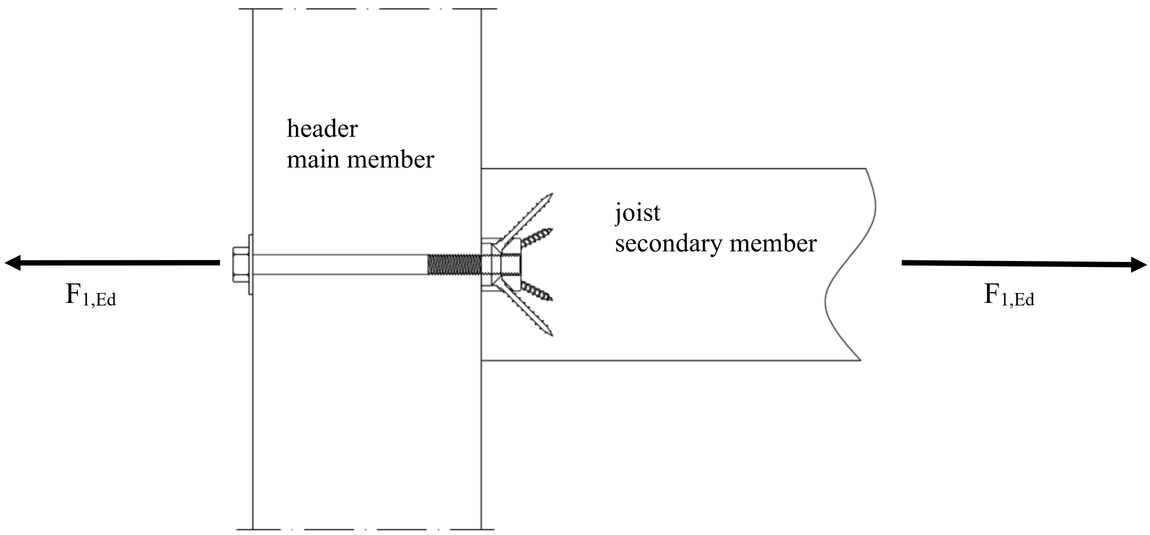
Hector connector

The forces are assumed to act parallel F_1 or perpendicular F_2 to the longitudinal axis of the connector.

B.1 Timber-to-timber or steel-to-timber connections with screws and bolt loaded in tension or compression, F_1

The load bearing capacity of the Hector connector subjected to tension or compression forces are determined by the formulas given in B.1.1 and B.1.2. The screws of equal length are arranged in all holes of the connector.

Figure B.1: Hector loaded in tension



B 1.1 Tensile capacity of Hector

For the calculation of the tensile capacity of Hector, $F_{la,VSS,Rk}$ is the load carrying capacity according to ETA-11/0024 and EC5-1-1 of a screw by taking into account the rod effect, an angle $\epsilon = 45°$ between screw axis and grain direction and the assumption of a joint with a thick steel plate according to Johansen's model in EC5-1-1. For timber-to-timber joints the pressure perpendicular to the grain under the bolt's head or washer respectively might be decisive and must be verified according to EC5-1-1.

$$F_{1,t,Rk} = n_{Id} \cdot \left(n^{0,9} \cdot F_{ax,\epsilon,Rk} + n \cdot F_{la,Rk}\right) \cdot cos(45°) \quad \text{(B.1.1)}$$

Where

$F_{1,t,Rk}$	: Characteristic tensile capacity
n_{Id}	: Number of Hector
n	: Number of fasteners
$F_{ax,\varepsilon,Rk}$	: Withdrawal capacity of the screw
$F_{la,Rk}$	: Lateral capacity of the screw

B 1.2 Compression capacity of Hector

The compression capacity of the Hector joint is given in the formula below. For timber-to-timber joints, metric bolt capacity shall be checked separately.

$$F_{1,\mathrm{c,Rk}} = n_{Id} \cdot min\{A_{net} \cdot f_{c,\alpha,k} + 0{,}82 \cdot n \cdot l_{ef}^{0,9} \cdot \rho_{SM,k}^{0,8}; \kappa \cdot N_{pl,k}\} \qquad \text{(B.1.2)}$$

Where

$F_{1,c,Rk}$	: Characteristic compression capacity
n_{Id}	: Number of Hector connectors
n	: Number of screws
$f_{c,\alpha,k}$	: Characteristic compression capacity of the screw
$N_{pl,k}$	: Characteristic value of plastic compressive capacity of metric bolt in N
ℓ_{ef}	: Effective embedment depth of the threaded part of a screw, $\ell_{ef} = \ell - 12$ mm
κ	: Factor according to European buckling curve c (determined from ETA-11/0024)
$\rho_{SM,k}$	: Characteristic density of the joist

B.2 Timber-to-timber connections with screws and bolt loaded in shear, F_2

The load bearing capacity of the Hector connector in timber-to-timber connections is determined by the minimum of the capacity of the connector in the secondary beam or in the main beam, column respectively. A full fastener pattern is specified, where there are screws of equal length in all holes of the connector.

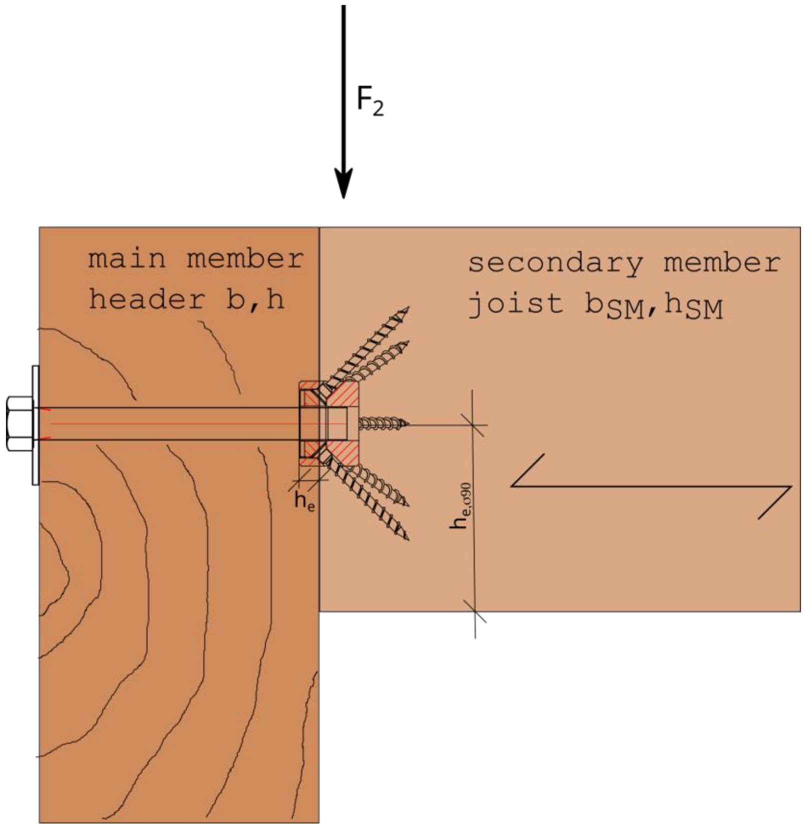


Figure B.2: Hector connector loaded by shear force

B.2.1 Load bearing capacity of the connector in joist

The load bearing capacity of one Hector in the joist can be determined by the capacity of a split ring in the end grain plus a portion of the lateral load bearing capacity of screws according to ETA-11/0024 as shown in the following equation:

$$F_{2,SM,Rk} = F_{splitring,SM,Rk} + F_{2,VSS,Rk} \qquad \text{(B.2.1)}$$

Where

$$F_{splitring,SM,Rk} = \frac{0{,}65 \cdot 35 \cdot d_c^{1,5}}{(1{,}3+0{,}001 \cdot d_c)} \cdot \frac{\rho_k}{350\,kg/m^3}$$

$F_{2,VSS,Rk} = 5{,}16 \cdot F_{la,VSS;Rk}$ for Hector connectors with 6 VSS screws
$F_{2,VSS,Rk} = 6{,}88 \cdot F_{la,VSS;Rk}$ for Hector connectors with 8 VSS screws

$F_{la,VSS,Rk}$ the load carrying capacity according to ETA-11/0024 and EC5-1-1 of a screw without taking into account the rod effect, an angle $\epsilon = 45°$ between screw axis and grain direction and the assumption of a joint with a thick steel plate according to Johansen's model in EC5-1-1. Additionally, the resistance for loading perpendicular to grain has to be verified based on EC5-1-1.

For joints with multiple Hector connectors (see Figure B.3), the effective number (n_{ef}) of connectors shall be used. n_{ef}: Effective number of Hector connectors $n_{ef} = n^{0,9}$.

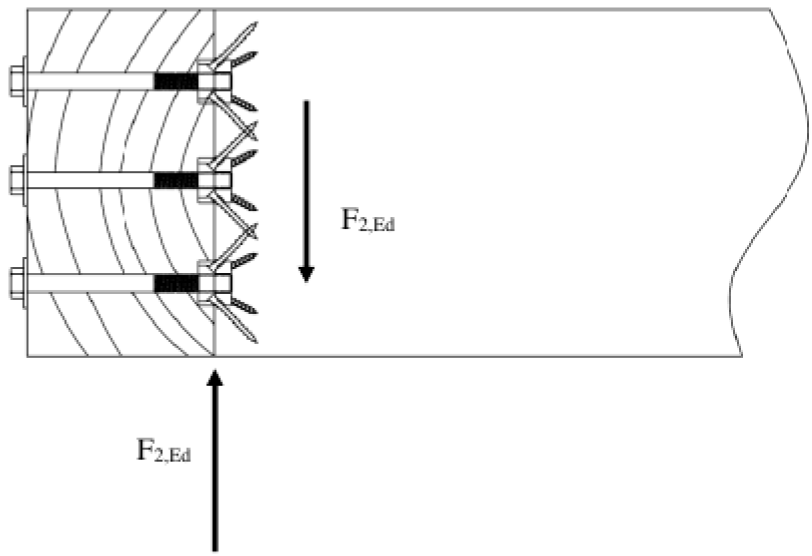


Figure B.3: Multiple Hector connectors loaded by shear force

Additionally, the resistance of the joist for loading perpendicular to grain has to be verified based on EC5-1-1.

B.2.2 Load bearing capacity of the connector in main member

The load bearing capacity of the Hector in the main beam is the sum of the capacity of a split ring and the resistance of the bolt treated as joint with thick steel plate, both according to EC 5-1-1. Here, the rod effect might be applied as the minimum of the capacity of the washer and the withdrawal capacity of the screws in the hector.

$$\mathrm{F_{2,MM,Rk}} = \mathrm{F_{splitting,MM,Rk}} + \mathrm{F_{Bolt,Rk}} \tag{B.2.2}$$

Where

$$F_{splitring,MM,\alpha,Rk} = \frac{F_{v,0,Rk}}{k_{90} \cdot \sin(\alpha)^2 + \cos(\alpha)^2}$$

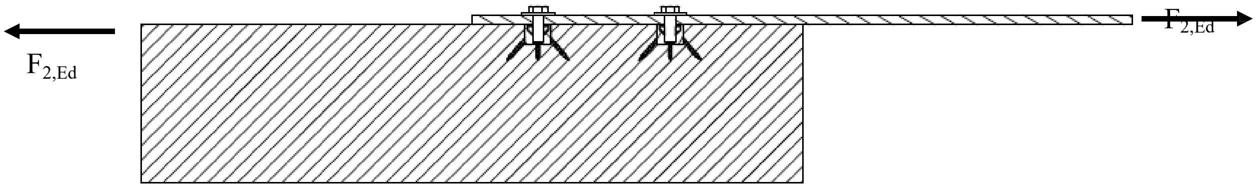
$$F_{v,0,Rk} = 35 \cdot d_c^{1,5} \cdot \frac{\rho_k}{350\,kg/m^3}, \quad k_{90} = 1{,}3+0{,}001 \cdot d_c,$$

and α angle load-direction to grain e.g., for header α=90°, while for a column as main member α=0°.

If the Hector connectors are not embedded or are embedded less than 10 mm ($he < 10\ mm$) into the main member, the main beam joint's strength with the locknut must be calculated solely based on the bolt's resistance.

$$\mathrm{F_{2,MM,Rk}} = \mathrm{F_{Bolt,Rk}} \tag{B.2.3}$$

B.3 Steel-to-timber or timber-to-timber connections with screws and bolt loaded in shear
The load bearing capacity of the Hector in steel to timber connections can be determined by the capacity of the split-ring plus the portion of the lateral capacity of the screws. A full fastener pattern is specified, where there are screws of equal length in all holes of the connector and a locknut of Hector shall always be used.



The load bearing capacity of a single Hector connector is

$$F_{2,Rk} = n_{ef} \cdot \left(F_{splitring,Rk} + F_{2,VSS,Rk}\right) \qquad \text{(B.3.1)}$$

Where
$F_{splitring,Rk}$ according to B.2.2
$F_{2,VSS,Rk}$ according to B.2.1

B.4 Timber-to-timber connections loaded in shear, F_2 without bolt
The load bearing capacity of the Hector without bolt in timber-to-timber connections can be determined by the formula shown in B.4.1 where a full fastener pattern is specified in the secondary member. Minimum timber member sections shall be based on screws according to ETA-11/0024.

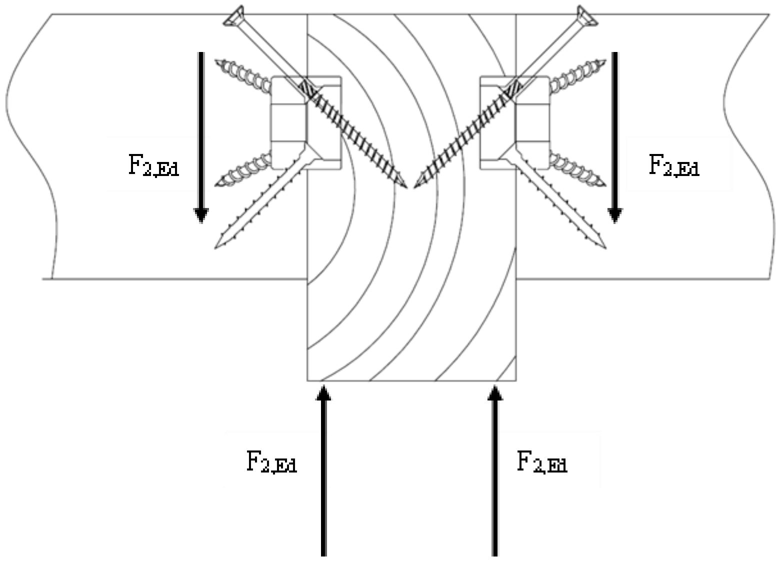


Figure B.4: Hector connector without bolt

$$F_{2,Rk} = \min\begin{cases} \sqrt{2}\cdot F_{ax,Rk} + \min\left(k_{ln}\cdot\sqrt{2}\cdot F_{ax,Rk}; 12,3\cdot\rho_{SM,k}\right) \\ \dfrac{25,3\cdot\rho_{MM,k}}{1,35\cdot\sin^2\alpha+\cos^2\alpha} \end{cases} \qquad \text{(B.4.1)}$$

Where

$F_{ax,Rk}$ Characteristic withdrawal capacity of a self-tapping screw VSS in the secondary member

n Number of screws per Hector connector loaded in tension or compression

n_{Id} Number of Hector connectors

n_{ef} Effective number of Hector connectors in steel-to-timber connections

$n_{ef} = \max (n_{Id}^{0,9}; 0,9\ n_{Id})$

ℓ_{ef} Penetration length of the threaded part of a screw, $\ell_{ef} = \ell - 12$ mm

A_{net} Contact area between Hector connector and the end grain of secondary member

$f_{c,\alpha,k}$ Compression strength of end grain contact area in N/mm²

$N_{pl,k}$ Characteristic value of plastic compressive capacity of metric bolt in N

κ Factor according to European buckling curve c

α Angle between load and grain direction

k_{ln} Factor taking into account the presence of an inserted lock nut
$k_{ln} = 1$ for Hector connectors with inserted lock nut
$k_{ln} = 0$ for Hector connectors without lock nut

$\rho_{MM,k}$ Characteristic main member density in kg/m³, ρ_k is taken into account with a maximum of 460 kg/m³

$\rho_{SM,k}$ Characteristic secondary member density in kg/m³, ρ_k is taken into account with a maximum of 460 kg/m³

ρ_k Characteristic timber density in kg/m³, ρk is taken into account with a maximum of 460 kg/m³

$f_{h,k}$ Characteristic main member bolt embedding strength in N/mm²

$M_{y,k}$ Characteristic bolt yield moment in Nmm

B.5 Slip moduli of connections with Hector

The slip modulus per Hector connector may be assumed as:

$K_{1,ser} = n \cdot 10\, kN/mm$ for Hector connections loaded axially in tension or compression

$K_{2,ser} = 15\, kN/mm$ for Hector connections with bolt loaded laterally

$K_{2,ser} = 7\, kN/mm$ for Hector connections without bolt loaded laterally

The rotational stiffness for a laterally loaded joint with Hector connectors may be assumed as:

$K_{r,ser} = 0,5 \cdot n_{Id} \cdot K_{1,ser} \cdot e^2$

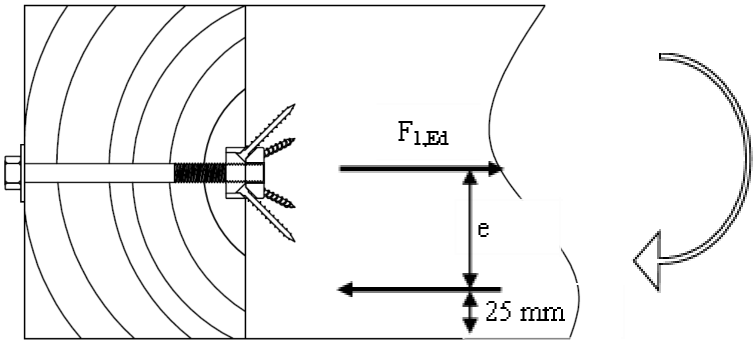


Figure B.5: Hector connectors loaded by a moment with one (row) of connectors over the member depth

$K_{r,ser} = K_{1,ser} \cdot \sum_{i=1}^{n_{Id}} e_i^2$ for Hector connections loaded by a moment with more than one (row) of connectors over the member depth

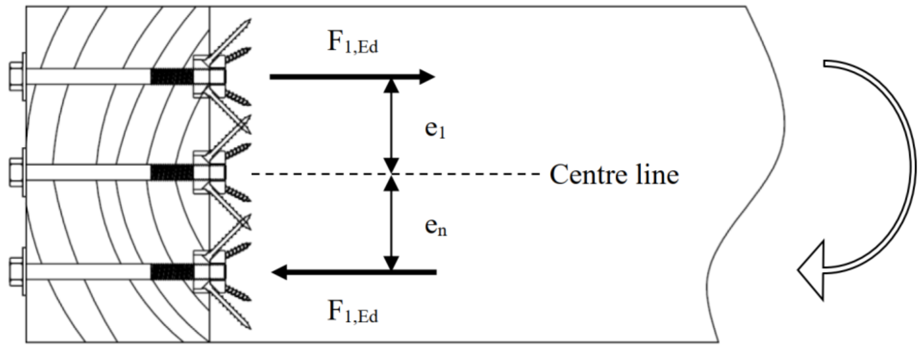


Figure B.6: Hector connectors loaded by a moment with more than one (row) of connectors

Annex B – Continued

Trilift connector

Only a full fastener pattern is specified: Four KonstruX ST screws Ø 6,5 inclined under 60° to the plate of Trilift and two KonstruX ST Ø 8 are arranged perpendicular to the plate and the timber member's side. Minimum timber member sections shall be based on screws according to ETA-11/0024.

B.6 Tensile loading of Trilift on the face of a timber member, F_1

To determine the characteristic tension capacity of Trilift connectors, the following three verifications must be fulfilled:

1. The pull-out resistance of screws $F_{1,Rk} = 1{,}87 \cdot F_{ax,Rk,8x245} + sin(60°) \cdot 3{,}73 \cdot F_{ax,Rk,6,5x140}$
2. The bending in section II-II yielding $F_{1,Rk,steel} = 42{,}1kN$ with $\gamma_{M0} = 1{,}0$
3. Tensile stresses perpendicular to the grain must be verified in section III-III according EC5-1-1, 8.1.4 or national provisions applying codes

Table B.1: Fastener used with Trilift connectors

KonstruX ST SK	ε	l_{ef}	$F_{ax,Rk}$	n_{ef}
Ø 6,5 x 140	60°	129 mm	According to ETA-11/0024	$2 \cdot 2^{0,9} = 3{,}73$
Ø 8 x 245	90°	232 mm		$2^{0,9} = 1{,}87$

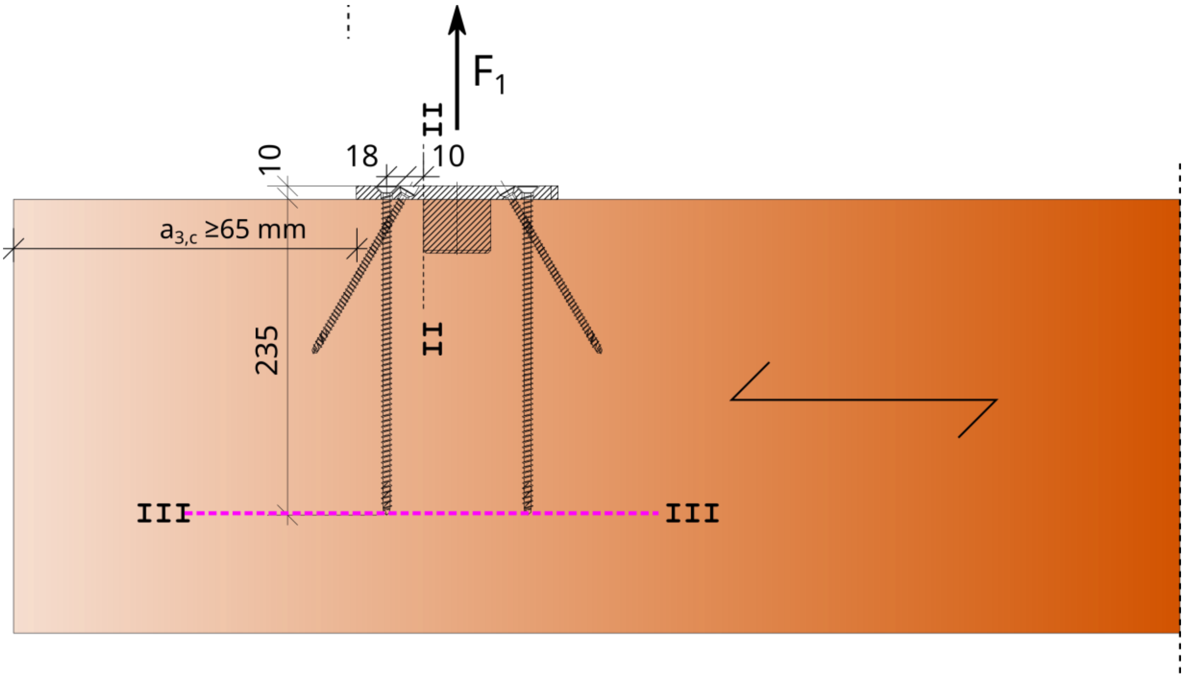


Figure B.7: Tensile loading of Trilift on a timber member

B.7 Shear loading of Trilift on the face of a timber member, F_2

To determine the characteristic shear capacity of Trilift connectors, the following two verifications must be fulfilled:

1. Shear capacity shall be calculated by using the embedding strength and screws as formula below
   $F_{2,Rk} = F_{h,Rk} + 2^{0,9} \cdot F_{ax,6,5x140} \cdot cos(60°)$

   Where the embedding strength of the cylinder by applying the approach for dowels of EC5-1-1, $d = 50mm$

   $F_{h,Rk} = f_{h,0,k} \cdot d \cdot t$ with $f_{h,0,k} = 0{,}082 \cdot (1 - 0{,}01 \cdot d) \cdot \rho_k$

2. The verification of stresses perpendicular to grain due to the eccentricity e:

$$\sigma_{c,90,d} = \frac{F_{2,Rk,Trilift} \cdot e}{127\,mm \cdot A_{ef}} \cdot 2 \leq k_{c,90} \cdot f_{c,90,d}$$

Where $A_{eff} = 60mm \cdot (50 + 30)mm$

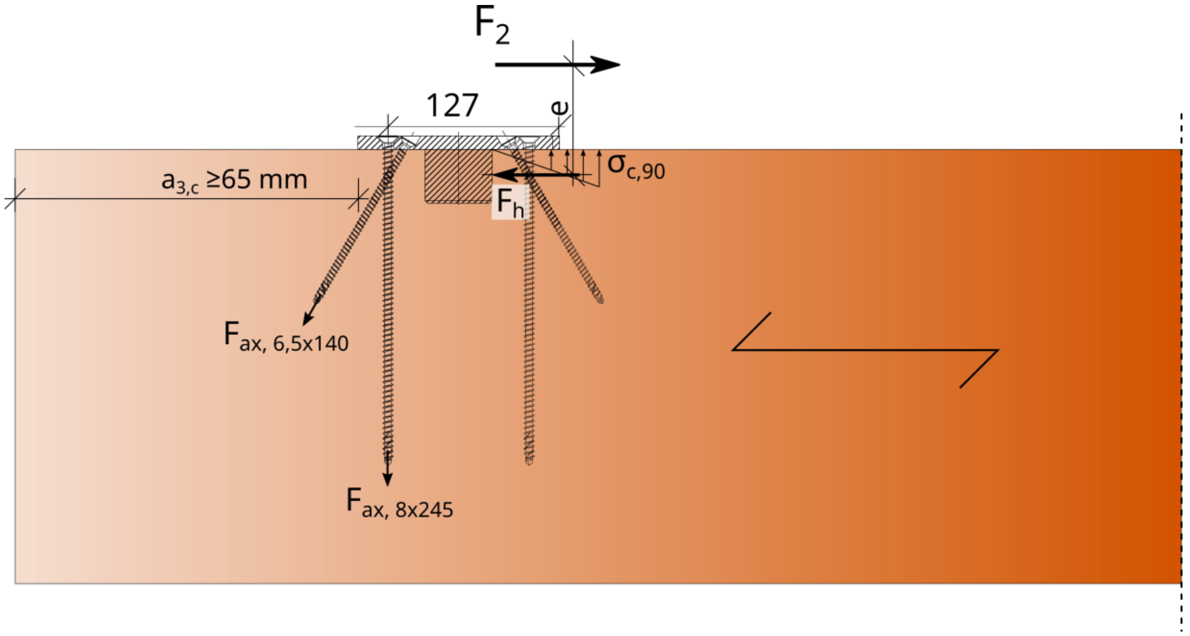


Figure B.8: Shear loading of Trilift on a timber member

B.8 Tensile loading of Trilift in the narrow edge of CLT panels, F_1

Applying the anchor at the face of CLT panel different angles ε, between the screw axis and the grain direction are possible. The models used for connections to softwood or glulam loaded by tensile forces F_1 are applicable to connections with CLT panels, by taking care of the reduced withdrawal resistances for angles ε between screw axis and grain direction capacities according to ETA-11/0024.

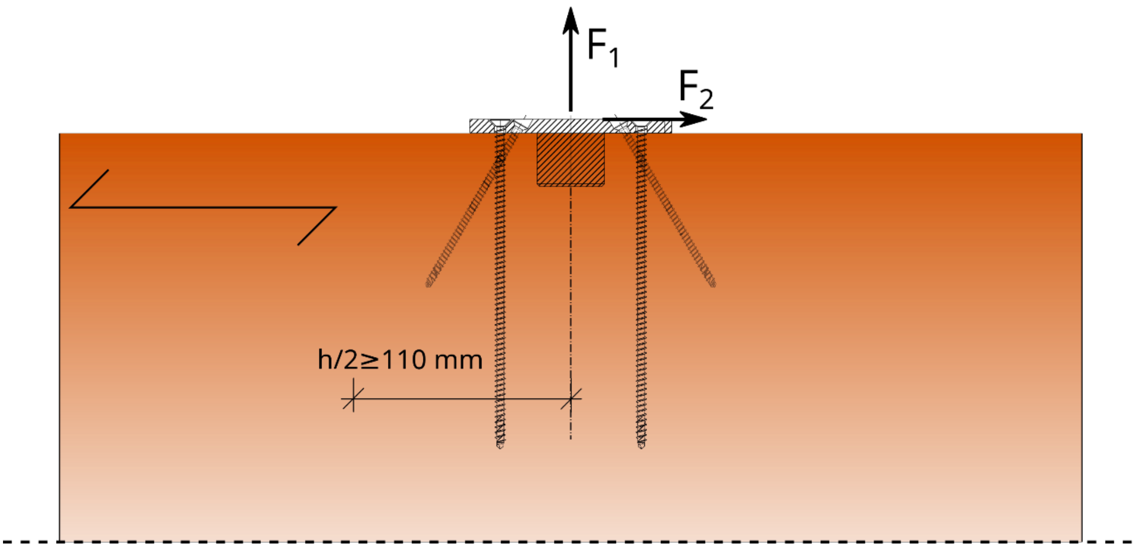


Figure B.9: Actions on Trilift in the narrow edge of CLT panels

B.9 Shear loading of Trilift on the narrow edge of a CLT panel, F_2
For shear loading, F_2, the formulations used for connections in softwood or glulam rest unchanged as long as the cylinder, $d = 50\ mm$ of the Trilift connector acts parallel to grain direction, as shown in Figure B.10.

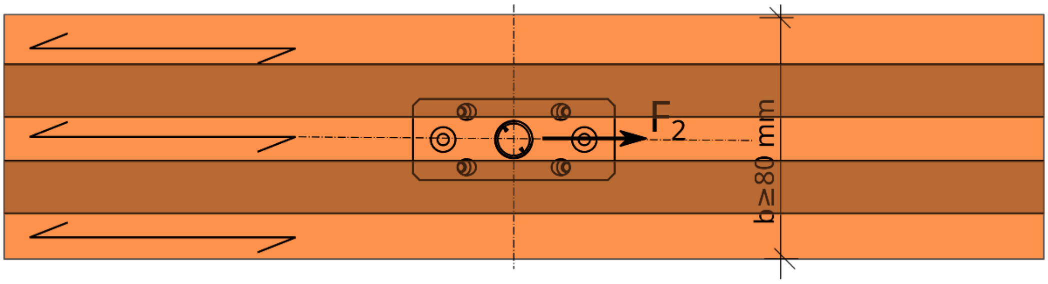


Figure B.10: Shear loading of Trilift on the narrow edge of CLT, cylinder parallel to grain

The load bearing capacity is reduced if the cylinder $d = 50mm$ of Trilift acts perpendicular to grain, as shown in Figure B.11:

$$F_{2,Rk} = f_{h,\|,k} \cdot 50\ mm \cdot 40\ mm$$

Where

$$f_{h,\|,k} = \frac{0{,}65}{1{,}3+0{,}001 \cdot 50} \cdot f_{h,0,k}$$

and the effect of the eccentricity moment $F_{2,Ed} \cdot e$ is verified by

$$F_{2,Ed} \cdot e = \left(F_{ax,8,Rd} + 2^{0,9} \cdot F_{ax,6,5,Rd} \cdot sin(60°)\right) \cdot 110mm$$

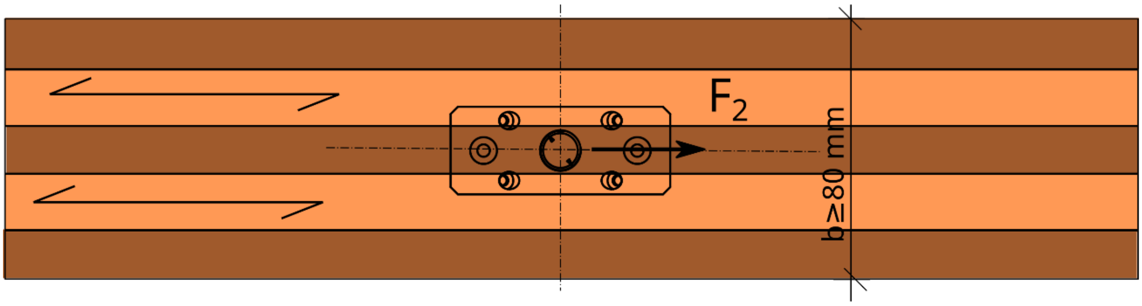


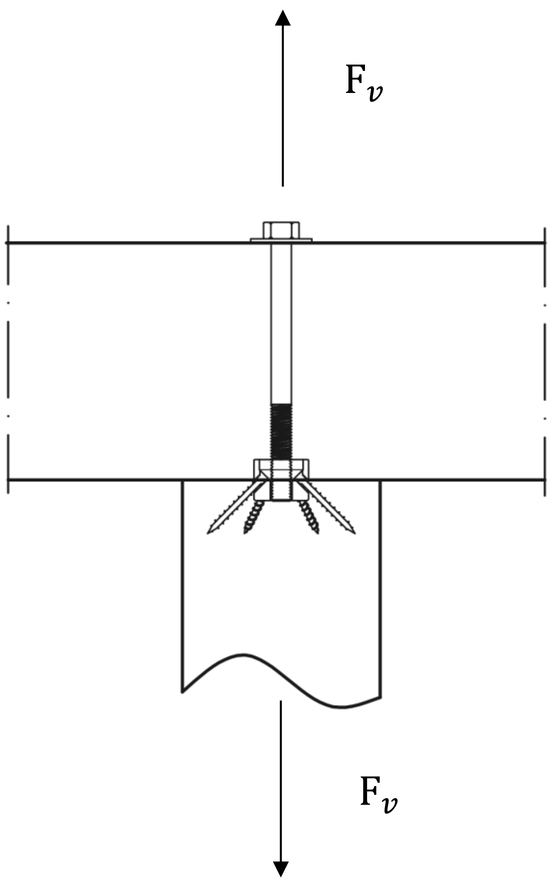
Figure B.11: Shear loading of Trilift on the narrow edge of CLT, cylinder perpendicular to grain

B.10 Combined loading
For all connectors subjected to a combination of axial F_1 and lateral F_2 loads, the following expression should be satisfied:

$$\frac{F_{1,Ed}}{F_{1,Rd}} + \frac{F_{2,Ed}}{F_{2,Rd}} \leq 1$$

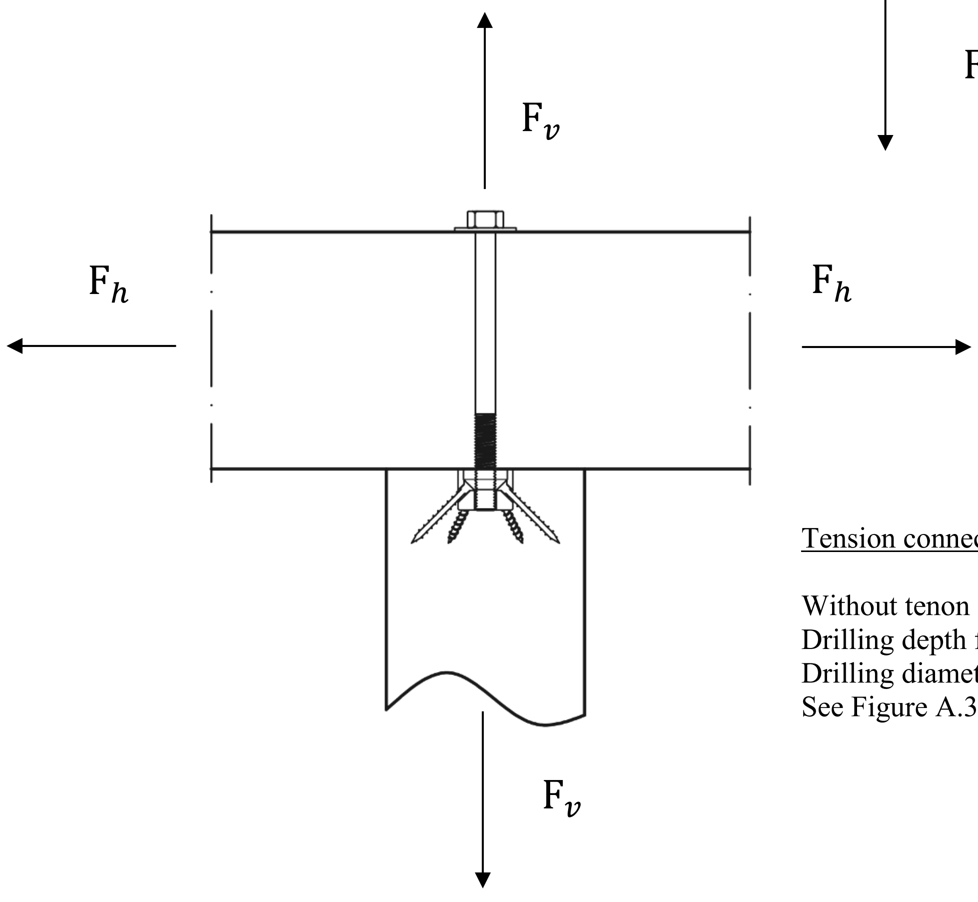
Annex C
Installation details

Tenon Joint Connection



<u>Mortise connection</u>

Drilling depth for cross beam: ≥10 mm
Drilling diameter for cross beam: d_M [mm]
See Figure A.2



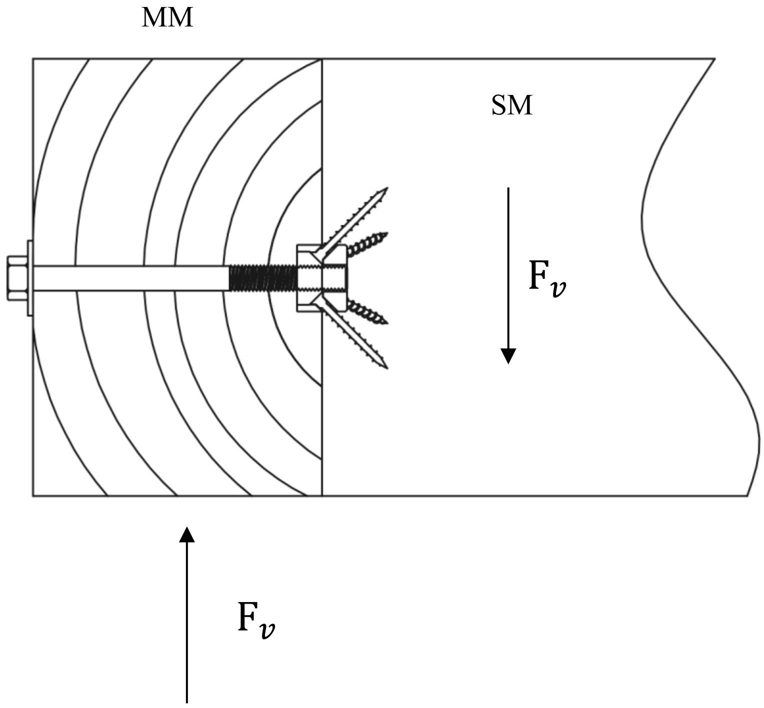
<u>Tension connection</u>

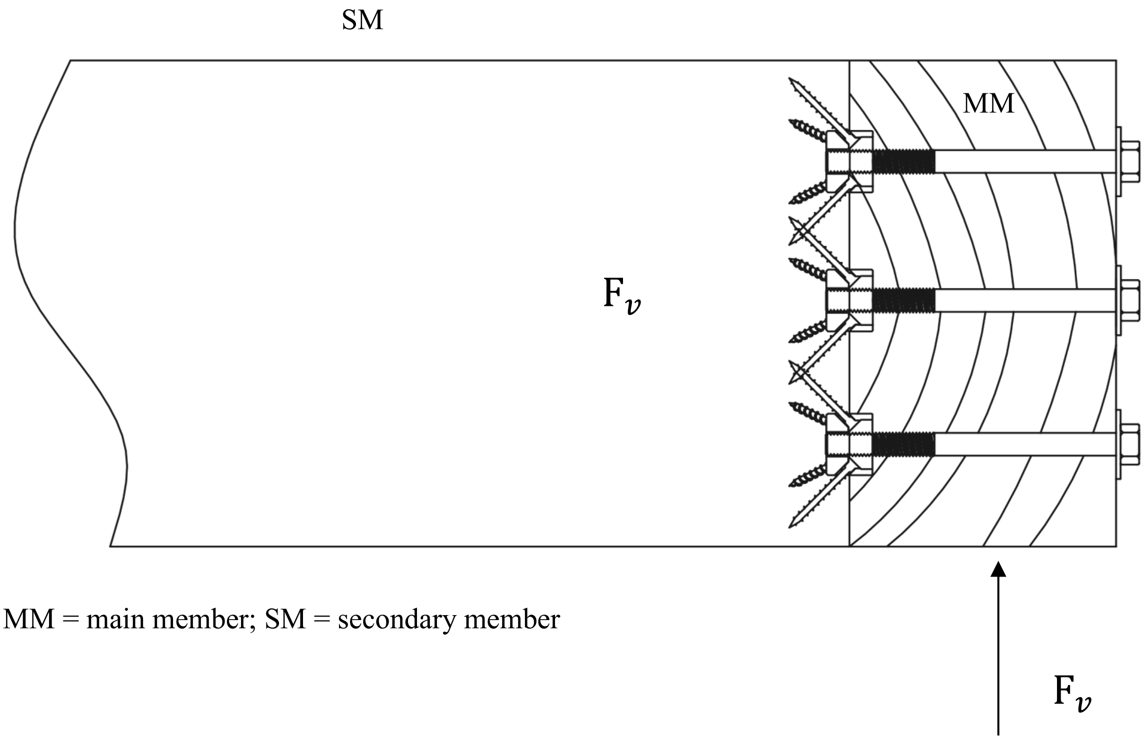
Without tenon and mortise
Drilling depth for post: t
Drilling diameter for cross beam: d_M [mm]
See Figure A.3

Main-Secondary Member Connection

Drilling diameter for MM: d_M [mm]
See Figure A.1

Execution with mortise: Drilling depth for MM ≥10 mm
Alternative execution without mortise in MM is possible





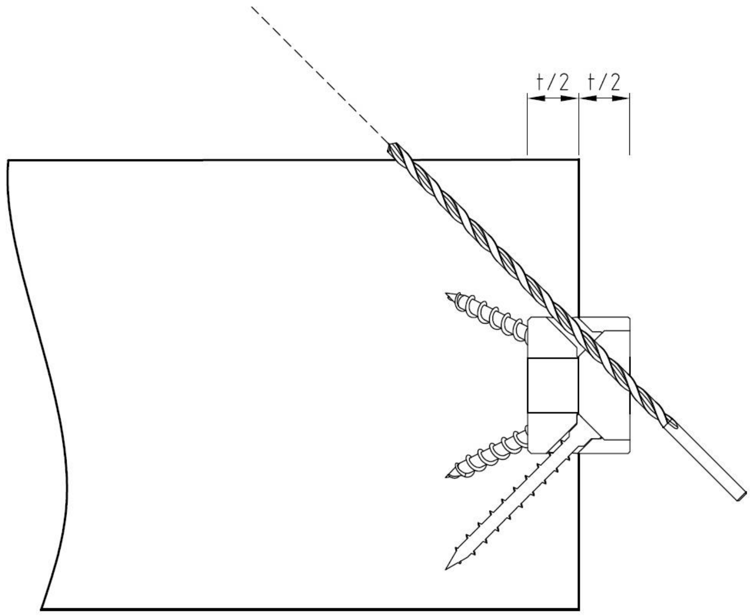
MM = main member; SM = secondary member

Bending moments
Axial tensile or compressive load per Hector connectors $K_{1,ser} = n \cdot 10$ kN/mm
where “n” is the number of screws per connector.

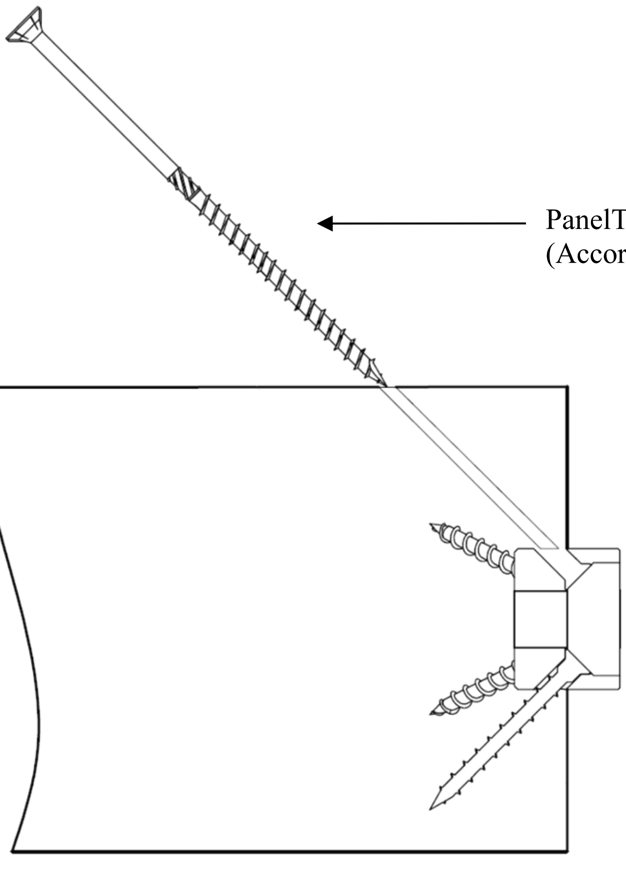
Connection loaded by a moment with one (row) of connector over the member depth:
$K_{r,ser} = 0{,}5 \cdot K_{1,ser} \cdot x^2$ where “x” is the distance between the connector axis and the contact area between end and side grain. The depth of the contact area is assumed as 50 mm.

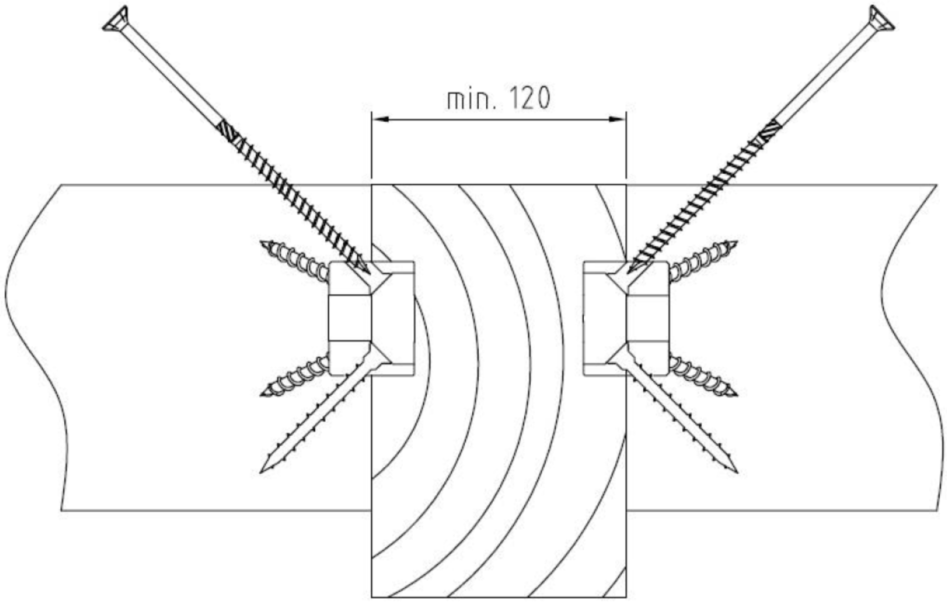
Timber-to-Timber connections with screws and without bolt loaded in shear:

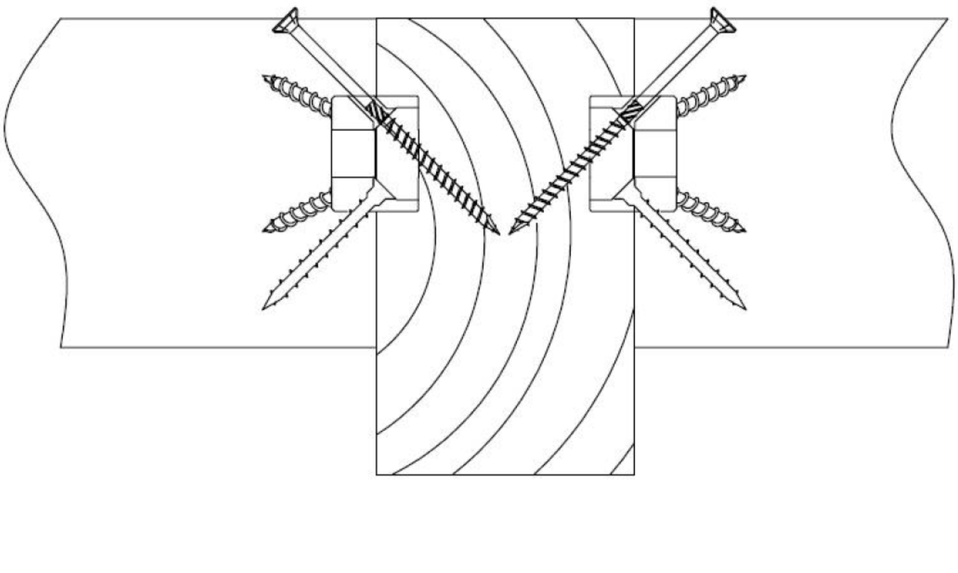
Preparing secondary member
Ø 4,0 mm pre-drill



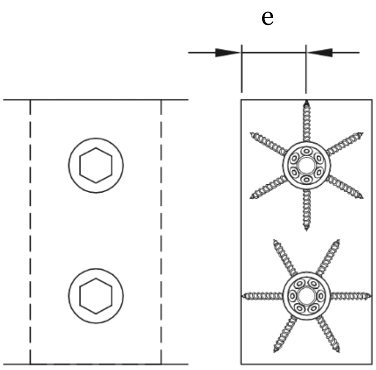
PanelTwistec countersunk head, Ø 6,0 x L mm
(According to ETA-11/0024)



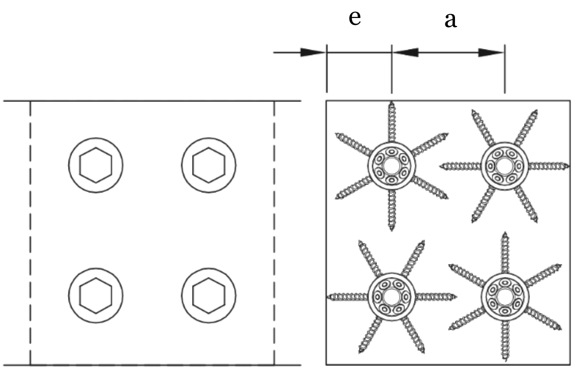

min. 120



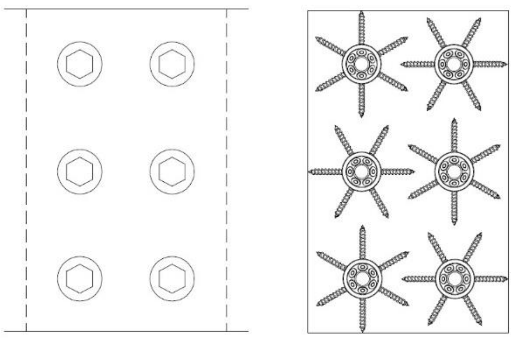
Multiple port connection main-secondary member
(Example with Ø 6,0 x 60 mm self-tapping screw)



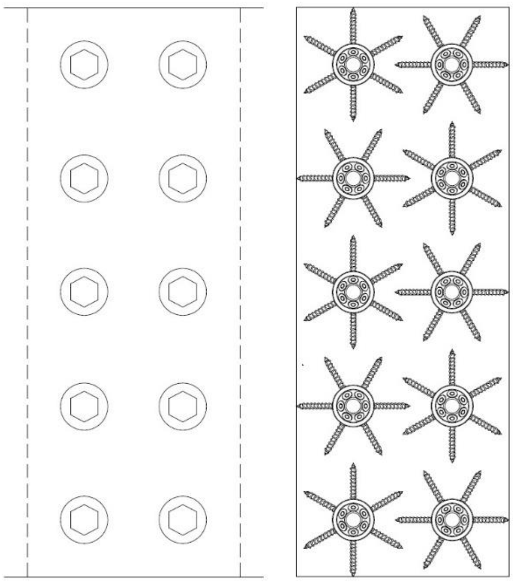
120 x 180 single row



180 x 180 double row (2x2)



180 x 240 double row (2x3)



180 x 360 double row (2x5)

Table C.1 Hector connector minimum edge distance and spacing requirements

Hector	Screw	Edge distance [e]	Axial spacing [a]
ød_c	ø×L	[mm]	[mm]
25	4,0x50	50	50
	4,0x60	60	60
30	5,0x40	50	50
	5,0x60	60	60
	5,0x80	70	70
40	6,0x60	60	60
	6,0x80	80	80
	6,0x100	90	90
50	8,0x90	90	90
	8,0x100	100	100