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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-25/0316 of 2025/05/31

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:	Rotho Blaas RING connectors
Product family to which the above construction product belongs:	Three-dimensional nailing plate
Manufacturer:	ROTHO BLAAS SRL Via dell'Adige 2/1 IT-39040 Cortaccia (BZ) Tel. + 39 0471 818400 Fax + 39 0471 818484 Internet www.rothoblaas.com
Manufacturing plant:	ROTHO BLAAS SRL Manufacturing Plants: ROTHO BLAAS s.r.l. Held on file by ETA-Danmark AS
This European Technical Assessment contains:	25 pages including 4 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:	EAD 130186-00-0603 for Three-dimensional nailing plates
This version replaces:	

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

Rotho Blaas RING connectors are one-piece, face-fixed connectors to be used in timber to timber or timber to concrete or steel connections.

RING connectors are made of steel S355 according to EN 10025-2 or an equivalent or better carbon steel or an equivalent or better stainless steel. Dimensions, hole positions and typical installations are shown in Annexes A and C.

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

RING connectors are intended for use in making end-grain to end-grain or end-grain to side-grain connections in load bearing timber structures, as a connection between wood based members as well as connections between a timber member and a concrete structure or a steel member, 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.

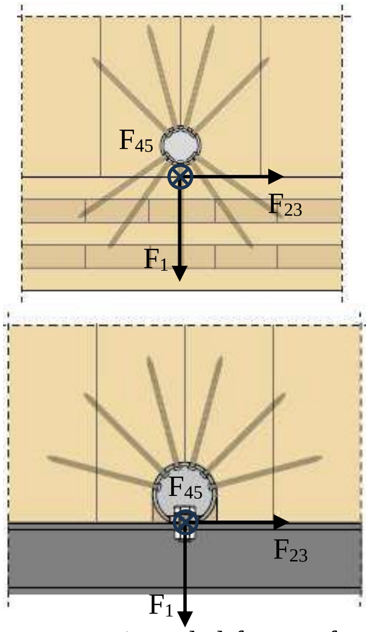
RING connectors can be installed as connections between wood-based members such as:

- Structural solid timber according to EN 14081,
- Glued solid timber according to EN 14080,
- Glulam according to EN 14080 or ETA,
- Cross-laminated timber according to ETA,
- LVL according to EN 14374 or ETA,
- Engineered wood products with certified mechanical resistances for connections with dowel-type fasteners.

However, the calculation methods are only allowed for a characteristic wood density of up to 420 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. If a RING60T connector transfers a load F_{23} between two members with different densities, the lower density governs.

Annex B states the formulas for the characteristic load-carrying capacities of the connections with RING 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 RING connector are F_1 or F_{23} perpendicular to the pipe's axis and F_{45} parallel to the pipe's axis. The forces shall act in the shear plane between a timber member and a timber or concrete or steel member.



RING connectors are intended for use for connections subject to static or quasi static loading. This includes seismic actions.

The RING connectors are for use in timber structures subject to service classes 1, 2 and 3 of Eurocode 5 and for connections subject to static or quasi-static loading. In service class 1 and 2 the corrosion protection is given according to EN1995-1-1, or by equivalent measures.

In service class 3 the corrosion protection is given according to EN1995-1-1 or by stainless steel or zinc coating with minimum thickness of 55 µm according to EN ISO 1461, or by equivalent measures.

The metal fasteners shall also be of stainless steel or have a coating for the intended use in service class 3 of EN 1995-1-1.

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.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the connectors 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)	
Joint Strength - Characteristic load-carrying capacity	See Annex B
Joint Stiffness	See Annex B
Joint ductility	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 (BWR2)	
Reaction to fire	RING connectors are made from steel grade S355 classified as Euroclass A1 in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364
Resistance to fire	No performance assessed
3.3 General aspects related to the performance of the product	RING connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3

*) 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 fasteners and the steel connectors. To obtain design values the capacities must be divided by different partial factors for the material properties, in case of timber failure in addition multiplied with the coefficient k_{mod}.

According to EN 1990:2002+A1:2005 (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 fasteners subjected to shear or the withdrawal capacity of the most loaded fastener, respectively) as well as for steel failure $F_{Rk,steel}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

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

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 considered.

3.5 Mechanical resistance and stability

See annex B for characteristic load-carrying capacities of the connectors.

The characteristic capacities of the connectors are determined by calculation assisted by testing as described in the EAD 130186-00-0603 clause 2.2.1. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

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

- Self-tapping screws in accordance with ETA-11/0030
- Bolts in accordance with ISO 4017 or ISO 4762
- Threaded rods in accordance with ISO 965-1 or equivalent

In the formulas in Annex B the capacities for screws calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral fastener load-carrying-capacity.

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

3.6.1 Corrosion protection in service class 1 and 2.
In accordance with EAD 130186-00-0603 the RING connectors are made from steel grade S355 according to EN 10025-2 or an equivalent or better carbon steel or an equivalent or better stainless steel and may be not coated for t ≥ 6 mm, zinc electro plated or hot dip galvanised.

3.6.2. Corrosion protection in service class 3
In service class 3 the corrosion protection is given according to EN1995-1-1, or by equivalent measure. The requirement is fulfilled by connectors with a corrosion protection stainless steel according to EN 10088-3 or hot-dip galvanized of approximately 55 µm according to EN ISO 1461, or by equivalent measures.

3.7 General aspects related to the use of the product

Rotho Blaas RING 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.

RING connections

A RING connection is deemed fit for its intended use provided:

Wood to wood connections

- Connectors are fastened to wood-based members by screws.
- There shall be a bolt in the lower hole of RING90C.
- The characteristic capacity of the RING connection is calculated according to the manufacturer’s technical documentation, dated 2025-01-16.
- The RING connection is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the hole in the timber member and the surface, where contact stresses can occur during loading shall be limited. This means that for RING connectors the gap between the surface of the pipe and the timber member hole surface shall be maximum 1 mm.

- The width of the timber member shall allow the tip of any screw being at least 10 mm from the member surface. The edge distance, if not indicated by this document follows the requirements in ETA-11/0030.
- Screws to be used shall have a diameter and head shape, which fits the holes of the RING connector.

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 Commission, 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.

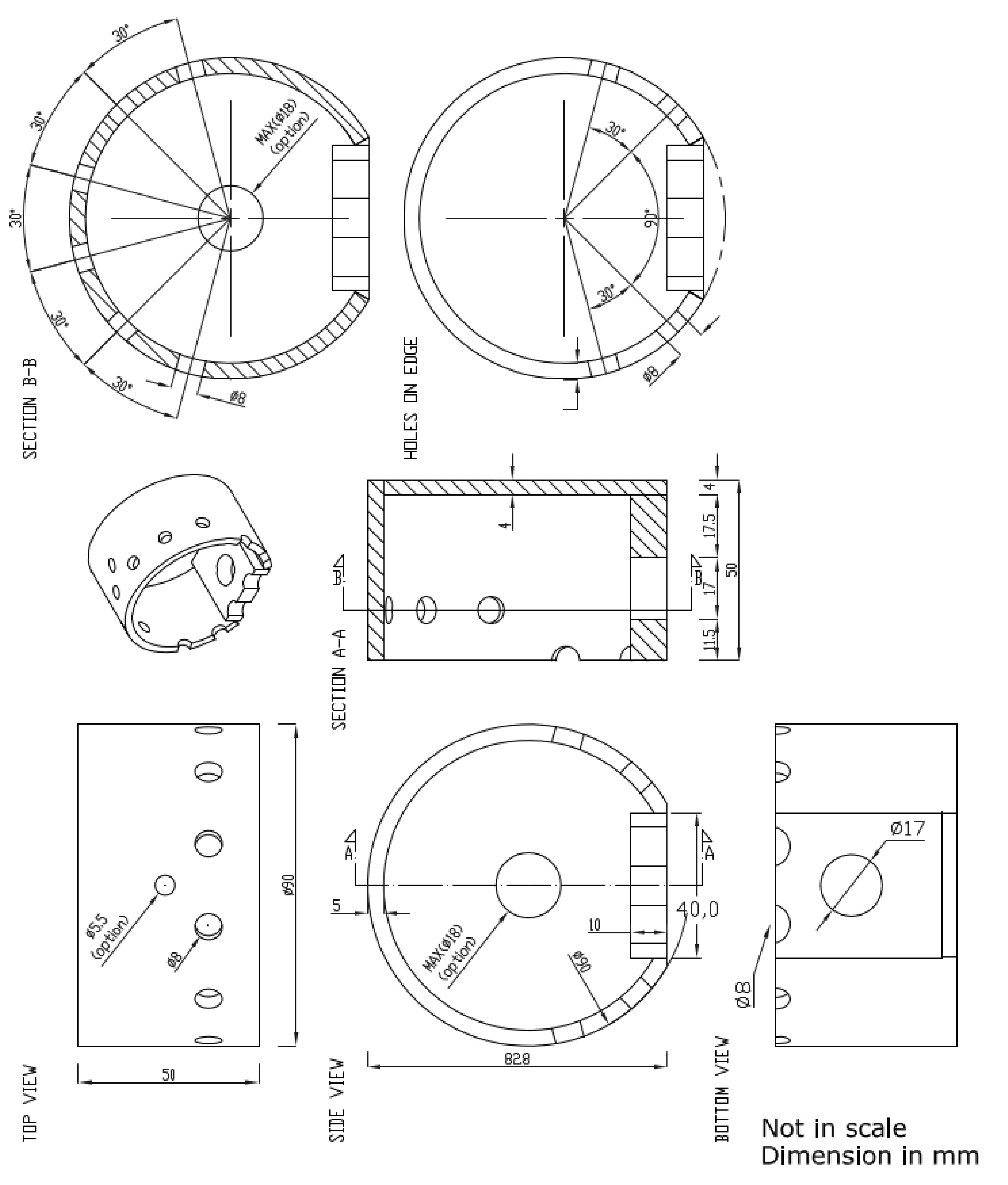
Issued in Copenhagen on 2025-05-31 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details and definitions

RING90C

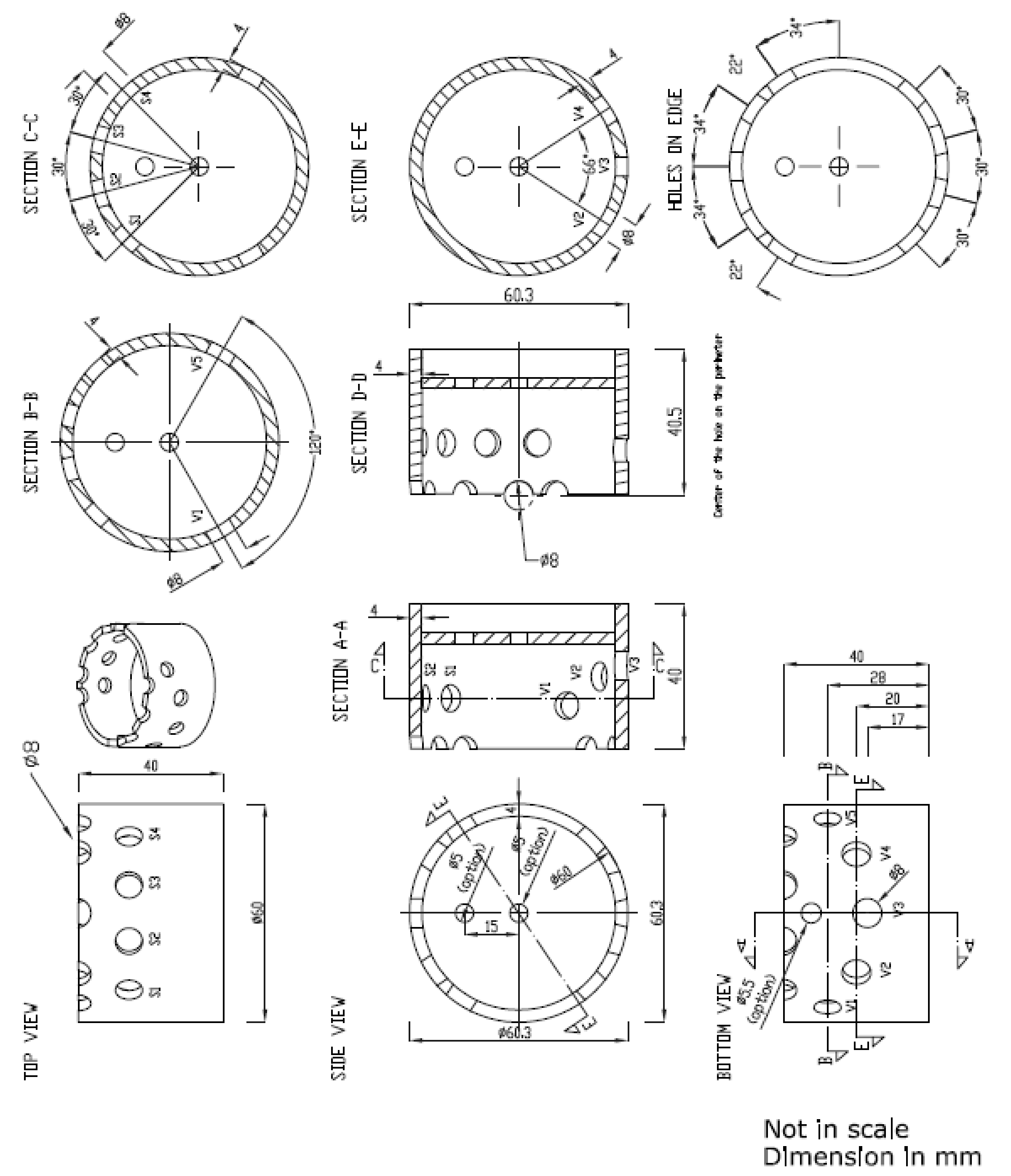
Face mount connector. 5.0 mm thick steel S355 according to EN 10025-2 or an equivalent or better carbon steel or an equivalent or better stainless steel.



RING Connectors	Annex A of European Technical Assessment ETA-25/0316
Product details: RING90C	

RING60T

Face mount connector. 4.0 mm thick steel S355 according to EN 10025-2 or an equivalent or better carbon steel or an equivalent or better stainless steel.



RING Connectors	Annex A of European Technical Assessment ETA-25/0316
Product details: RING60T	

Fastener types and sizes

Screw diameter	Minimum Length (L)	Screw type
7.0	100	LBSH or LBSH EVO screw according to ETA-11/0030

In the formulas in Annex B the capacities for self-tapping screws calculated from the formulas of Eurocode 5 (2010-12) are used assuming a thick steel plate when calculating the lateral load-carrying-capacity. The embedding strength is determined according to ETA-11/0030 for fasteners in the narrow side of CLT:

$$f_{h,k} = 20 \cdot d^{-0,5}$$

The characteristic axial capacity of the screws is determined by calculation:

$$F_{ax,\alpha,Rk} = \min\left\{f_{tens,k}; 0,35 \cdot d^{0,8} \cdot \ell_{ef}^{0,9} \cdot \rho_k^{0,75}\right\}$$

Where:

d Screw diameter in mm
ℓ_{ef} Penetration depth of the thread in mm
ρ_k Characteristic density of timber member
$f_{tens,k}$ see ETA-11/0030.

BOLTS diameter	Corresponding hole diameter in steel plate	Fastener type
Bolt M16	M16	Bolts or threaded rods according to EN ISO 4016, EN ISO 4017, EN ISO 4018, EN ISO 898, EN ISO 4014, EN 15048 or ETA, EN ISO 4762, EN ISO 10642

Annex B
Characteristic values of load-carrying-capacities and stiffness

One-piece RING connectors consist of a steel pipe and one (RING60T) or two (RING90C) welded steel plates. The pipe is connected to the timber member with fully threaded LBSH EVO screws. The RING90C connector steel plate is joined to a second RING90C connector or to steel parts with 8.8 or greater metric steel bolts or threaded rods M16.

The forces are assumed to act in the shear plane between a timber member and a timber or concrete or steel member.

Two fastener patterns are foreseen for RING90C. Fastener pattern for RING90C has 4 or 6 symmetrically arranged fully threaded screws. Fastener pattern for RING60T has 4 + 5 symmetrically arranged fully threaded screws.

For RING connectors arranged side-by-side, the load-carrying capacity of the connection is the sum of the load-carrying capacities of the RING connectors.

B.1 Characteristic load-carrying capacity

Tensile loading in load direction 1

$$F_{1,t,Rk} = \sum_{i=1}^{n_s} F^1_{ax,i,Rk} \cdot \cos\alpha^1_i \cdot \left(\cos\beta_i + \mu_1 \cdot \sin\beta_i\right) \tag{B.1}$$

Where:

n_s Number of symmetrically arranged screws in the RING90C connector or 5 in the RING60T connector

$F^1_{ax,i,Rk}$ Characteristic axial load-carrying capacity of screw i [N]

$$F^1_{ax,i,Rk} = \min\left\{0{,}35 \cdot d^{0,8} \cdot \ell_{ef}^{0,9} \cdot \rho_k^{0,75} ; f_{tens,k}\right\}$$

$f_{tens,k}$ see ETA-11/0030.

d screw diameter, d = 7 mm

ℓ_{ef} Screw penetration length in the timber member [mm]

ρ_k Characteristic timber density, $\rho_k \leq 420$ kg/m³

α^1_i Angle between the direction of $F^1_{rad,i,Ed}$ and the direction of load $F_{1,Ed}$

β_i Angle between screw axis and the plane of the connector's rear plate

μ_1 Friction coefficient between timber member and connector rear plate,
$\mu_1 = 0{,}25$ for RING90C with contact between timber member and connector rear plate
$\mu_1 = 0$ for RING60T and for RING 90C without contact between timber member and connector rear plate

Compressive loading in load direction 1

$$F_{1,c,Rk} = \frac{200 \cdot \rho_k}{2 \cdot \sin^2\varepsilon + \cos^2\varepsilon} \text{ for RING90C} \tag{B.2}$$

Where:

$F_{1,c,Rk}$ Characteristic compressive load-carrying capacity of RING90C connectors [N],

ρ_k Characteristic timber density, $\rho_k \leq 420$ kg/m³

ε Angle between the grain direction at the timber member surface and the direction of load $F_{1,Ed}$

Shear loading in load direction 2/3

$$F_{23,Rk} = 0,5 \cdot \frac{F^1_{ax,i,RK}}{\sqrt{k_2^2 + 1/k_1}} + \sum_{i=4}^{6} \frac{78 \cdot \rho_k}{2 \cdot \sin^2\varepsilon_i^{23} + \cos^2\varepsilon_i^{23}} \cdot \cos\alpha_i^{23} \text{ for RING90C} \qquad \text{(B.3)}$$

$$F_{23,Rk} = \sum_{i=1}^{2} F^1_{ax,i,Rk} \cdot \left(\cos\alpha_i^{23} + \mu_{23} \cdot \sin\alpha_i^{23}\right) + \sum_{i=4}^{5} F^1_{ax,i,Rk} \cdot \cos\alpha_i^{23} \text{ for RING60T} \qquad \text{(B.4)}$$

Where:

k_1 $= \left[\left(\cos\beta + \mu_1 \cdot \sin\beta\right) \cdot \sum_{i=1}^{n_S} \cos\alpha_i^{23}\right]^2$

k_2 $= \dfrac{0,9 \cdot F^1_{ax,Rk}}{n_S \cdot F_{v,Rk}}$

α_i^{23} Angle between the direction of $F^{23}_{rad,i,Ed}$ and the direction of load $F_{23,Ed}$

ε_i^{23} Angle between the direction of $F^{23}_{rad,i,Ed}$ and the grain direction at the timber member surface

β Angle between screw axis and the plane of the RING90C connector's rear plate

n_S Number of screws, n_S = 4 or 6

$F^1_{ax,Rk}$ Characteristic axial load-carrying capacity of a screw according to ETA-11/0030, see B.1 [N]

$F_{v,Rk}$ Characteristic lateral load-carrying capacity of a screw with thick steel plate according to EN 1995-1-1 [N]

μ_{23} Friction coefficient between timber members,

μ_{23} = 0,5 for CLT edge face to timber or to CLT edge face and for CLT edge face to CLT wide face,
μ_{23} = 0,25 for Xylofone to timber or CLT,
μ_{23} = 0 for compressive screws

Shear loading in load direction 4/5

$$F_{45,Rk} = 12\,\text{kN} \cdot \frac{\rho_k}{350} \quad \text{for RING90C with six 200 mm long LBSH screws} \qquad \text{(B.5)}$$

$$F_{45,Rk} = 3\,\text{kN} \cdot \frac{\rho_k}{350} \quad \text{for RING60T} \qquad \text{(B.6)}$$

Where:

ρ_k Characteristic timber density, $\rho_k \leq 420$ kg/m³

Combined loading

If $F_{1,Ed}$ or $F_{23,Ed}$ or $F_{45,Ed}$ act simultaneously, the following interaction equation shall be fulfilled:

$$\left(\frac{F_{1,Ed}}{F_{1,Rd}}\right)^2 + \left(\frac{F_{23,Ed}}{F_{23,Rd}}\right)^2 + \left(\frac{F_{45,Ed}}{F_{45,Rd}}\right)^2 \leq 1,0 \qquad \text{(B.7)}$$

B.2 Slip moduli of RING connectors

The slip moduli do not consider the initial slip due to oversized connector holes for bolts.

$$K_{1,t,ser} = \frac{F_{Rk}^{1}}{3\ \mathrm{mm}} \text{ for RING90C} \tag{B.8}$$

$$K_{1,t,ser} = \frac{F_{Rk}^{1}}{10\ \mathrm{mm}} \text{ for RING60T} \tag{B.9}$$

$$K_{1,c,ser} = \frac{F_{Rk}^{1}}{1{,}5\ \mathrm{mm}} \text{ for RING90C parallel to grain in glulam or CLT} \tag{B.10}$$

$$K_{1,c,ser} = \frac{F_{Rk}^{1}}{2{,}4\ \mathrm{mm}} \text{ for RING90C perpendicular to grain in glulam} \tag{B.11}$$

$$K_{1,c,ser} = \frac{F_{Rk}^{1}}{0{,}8\ \mathrm{mm}} \text{ for RING90C perpendicular to grain in CLT} \tag{B.12}$$

$$K_{23,ser} = \frac{F_{Rk}^{23}}{7\ \mathrm{mm}} \text{ for RING90C} \tag{B.13}$$

$$K_{23,ser} = \frac{F_{Rk}^{23}}{0{,}6\ \mathrm{mm}} \text{ for RING60T} \tag{B.14}$$

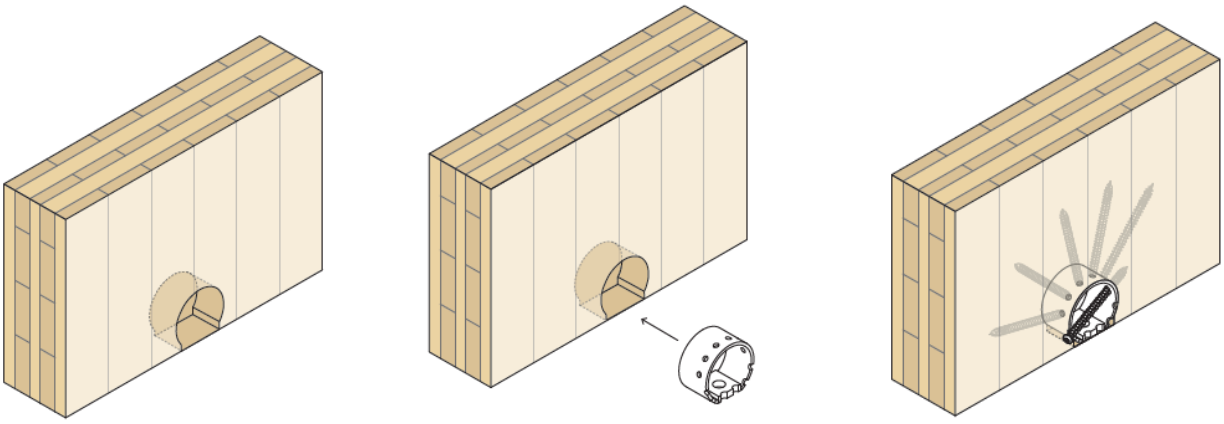
$$K_{23,ser} = \frac{F_{Rk}^{23}}{1{,}2\ \mathrm{mm}} \text{ for RING60T and Xylofone Interlayer} \tag{B.15}$$

$$K_{45,ser} = \frac{F_{Rk}^{45}}{7\ \mathrm{mm}} \text{ for RING90C} \tag{B.16}$$

$$K_{45,ser} = \frac{F_{Rk}^{45}}{0{,}3\ \mathrm{mm}} \text{ for RING60T} \tag{B.17}$$

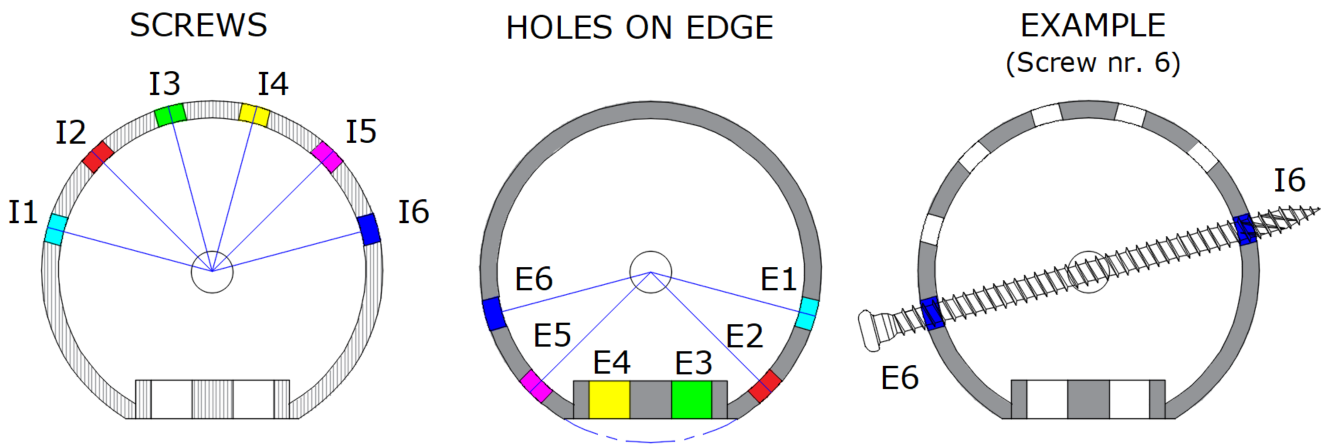
Annex C
Installation of RING connectors

Installation of RING90C connectors



Note: drawing is copyright Rotho Blaas

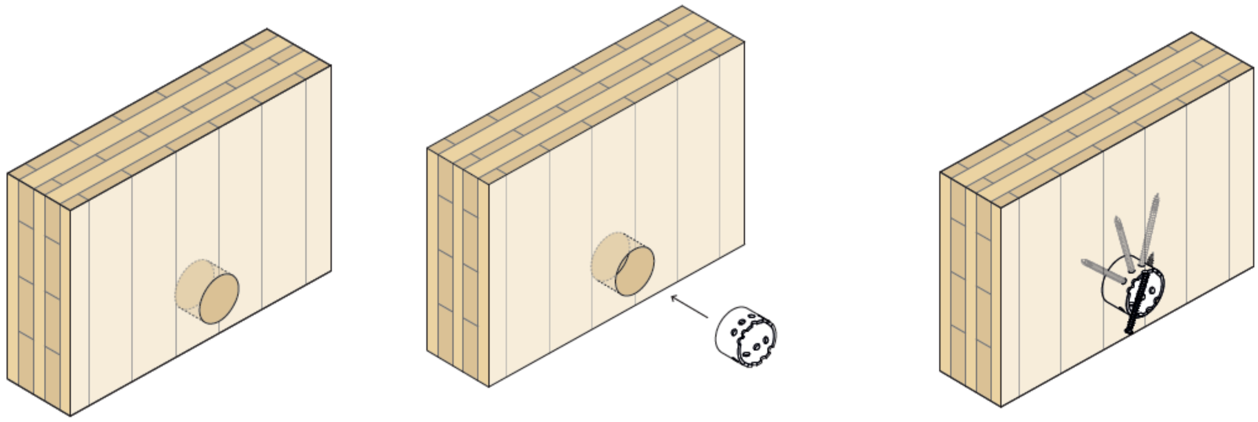
Installation of RING90C - screws layout



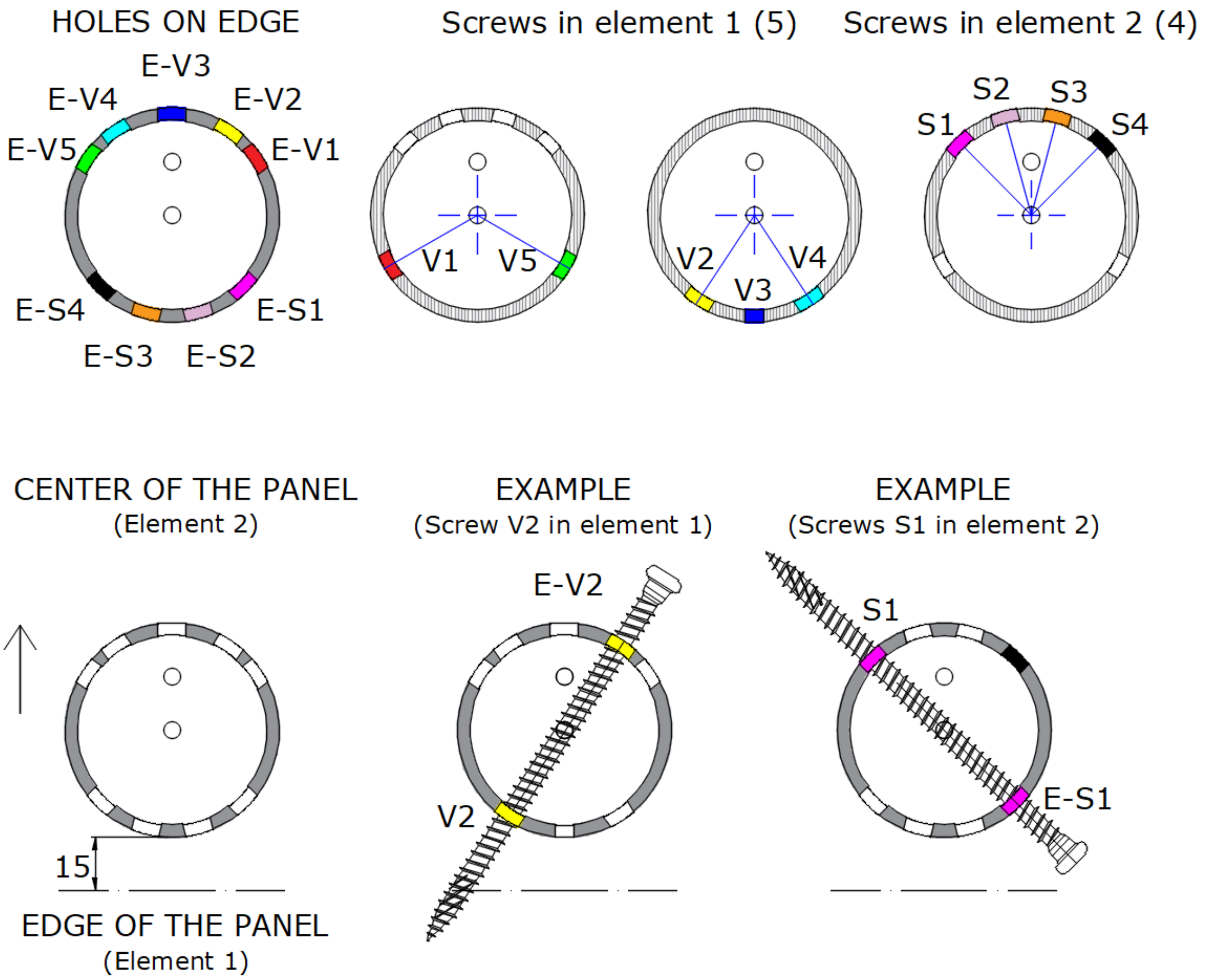
Pattern	Nr of screws	Position
Full	6	I1; I2; I3; I4; I5; I6
Partial	4	I2; I3; I4; I5

Note: drawing is copyright Rotho Blaas

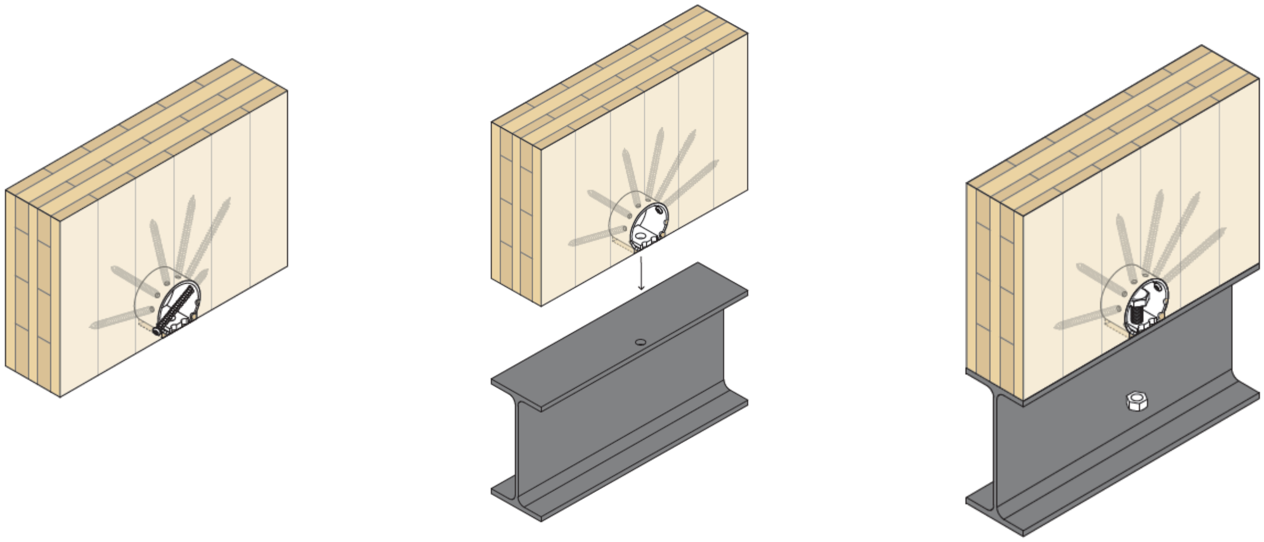
Installation of RING60T connectors



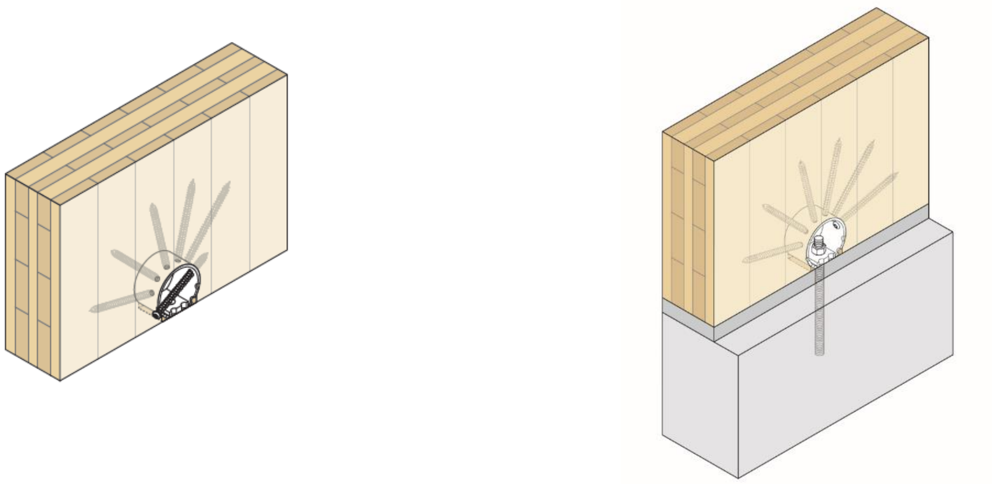
Installation of RING60T -screws layout



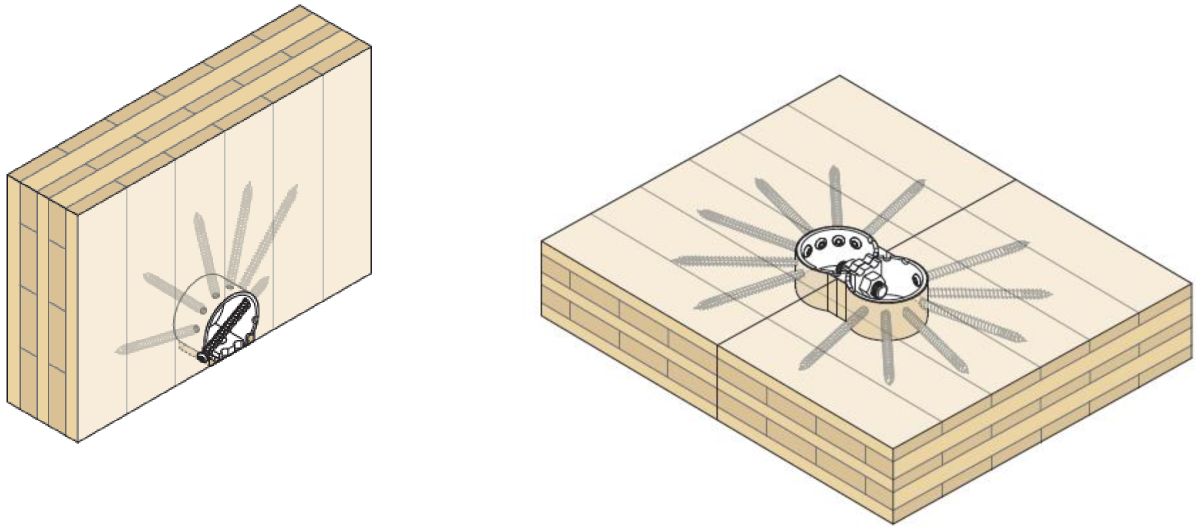
Direct connection (RING90C): Timber-to- steel direct connection



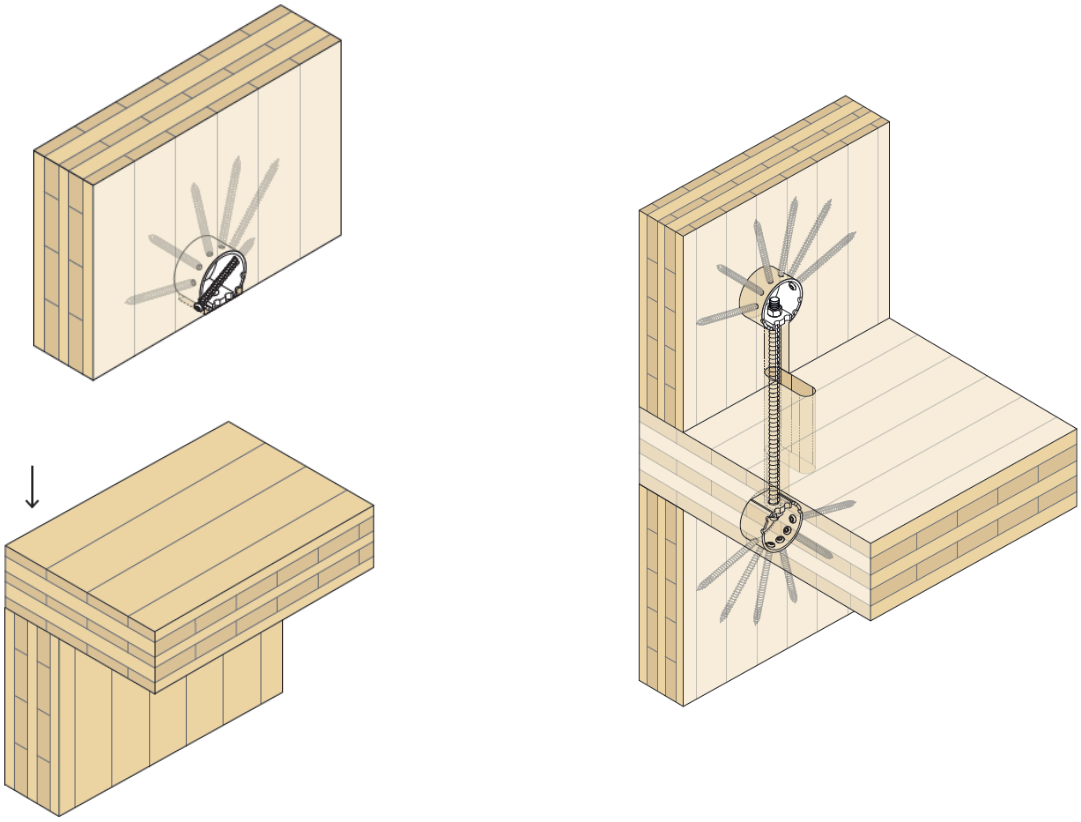
Direct connection (RING90C): Timber-to-concrete or steel direct connection



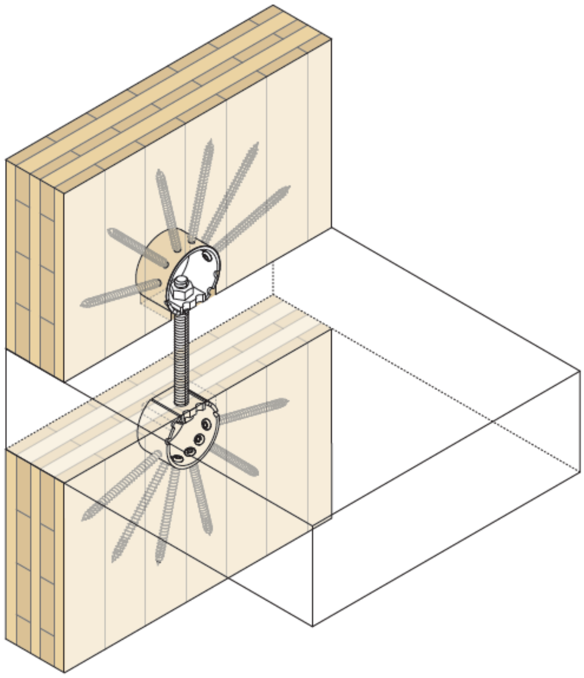
Direct connection (RING90C): CLT narrow (edge) face-CLT narrow (edge) face



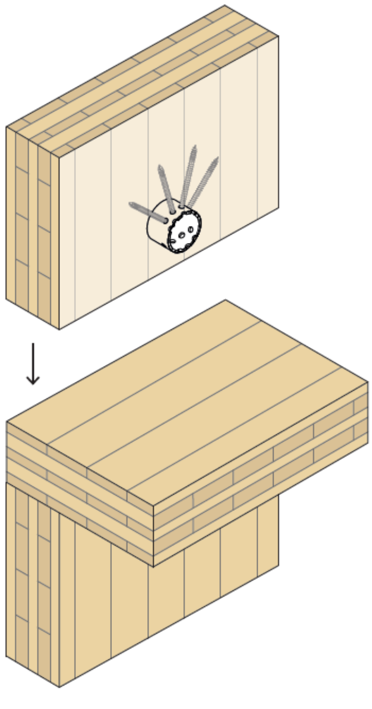
Spaced connection (RING90C): CLT narrow (edge) face-CLT side face

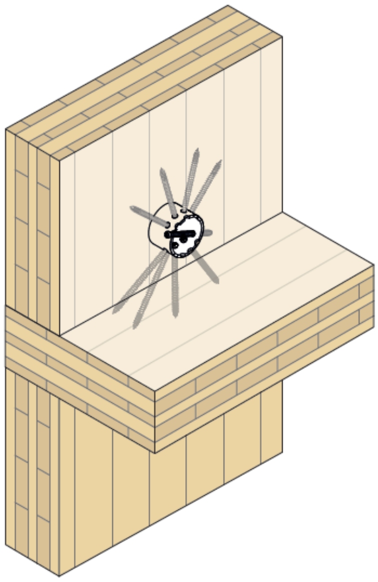


Spaced connection with interlayer (RING90C+RING90C):

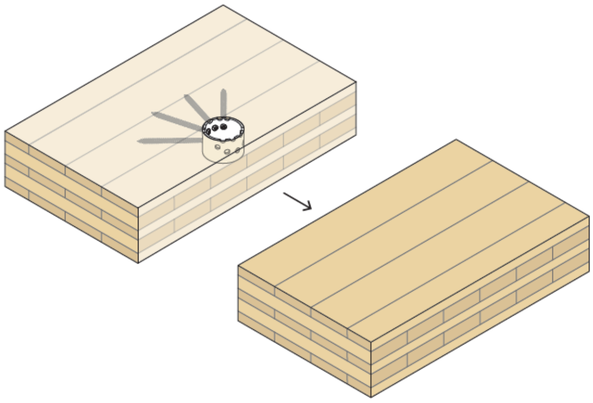


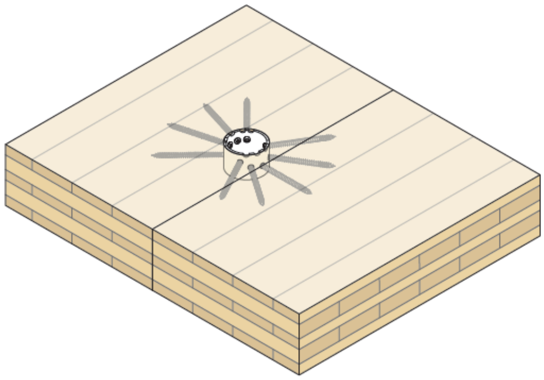
Timber to timber connection (RING60T): CLT narrow (edge) face-CLT side face



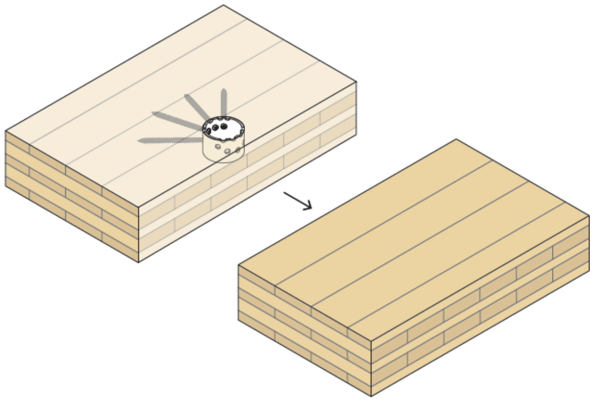


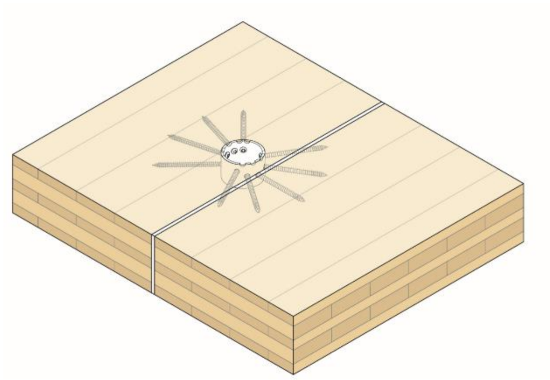
Timber to timber connection (RING60T): CLT narrow (edge) face-CLT narrow (edge) face





Timber to timber connection (RING60T): CLT-CLT - interlayer





Note: Drawings are copyright Rotho Blaas

Annex D
Characteristic capacities for Rotho Blaas RING connectors

RING90C: Axial capacity – tension ($F_{1,t,Rk}$)

l	l_{eff}	Contact web/ timber Full pattern (6 screws)	Contact web/ timber Partial pattern (4 screws)	No contact web/ timber Full pattern (6 screws)	No contact web/ timber Partial pattern (4 screws)
[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
120	115	38,2	33,1	36,6	31,7
160	155	50,0	43,3	47,8	41,4
200	195	61,4	53,2	58,8	50,9

RING90C: Axial capacity – compression ($F_{1,c,Rk}$)

l	l_{eff}	0	90
[mm]	[mm]	[kN]	[kN]
-	-	70,0	35,0

RING90C: In-plane shear capacity ($F_{23,t,Rk}$)

l	l_{eff}	Contact web/timber Full pattern (6 screws) 90	 0	Contact web/timber Partial pattern (4 screws) 90	 0	No contact web/timber Full pattern (6 screws) 90	 0	No contact web/timber Partial pattern (4 screws) 90	 0
[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
120	115	53,6	45,5	48,4	40,3	53,4	45,3	48,2	40,2
160	155	54,9	46,8	49,5	41,3	54,7	46,6	49,4	41,2
200	195	55,7	47,6	50,1	42,0	55,5	47,4	50,0	41,9

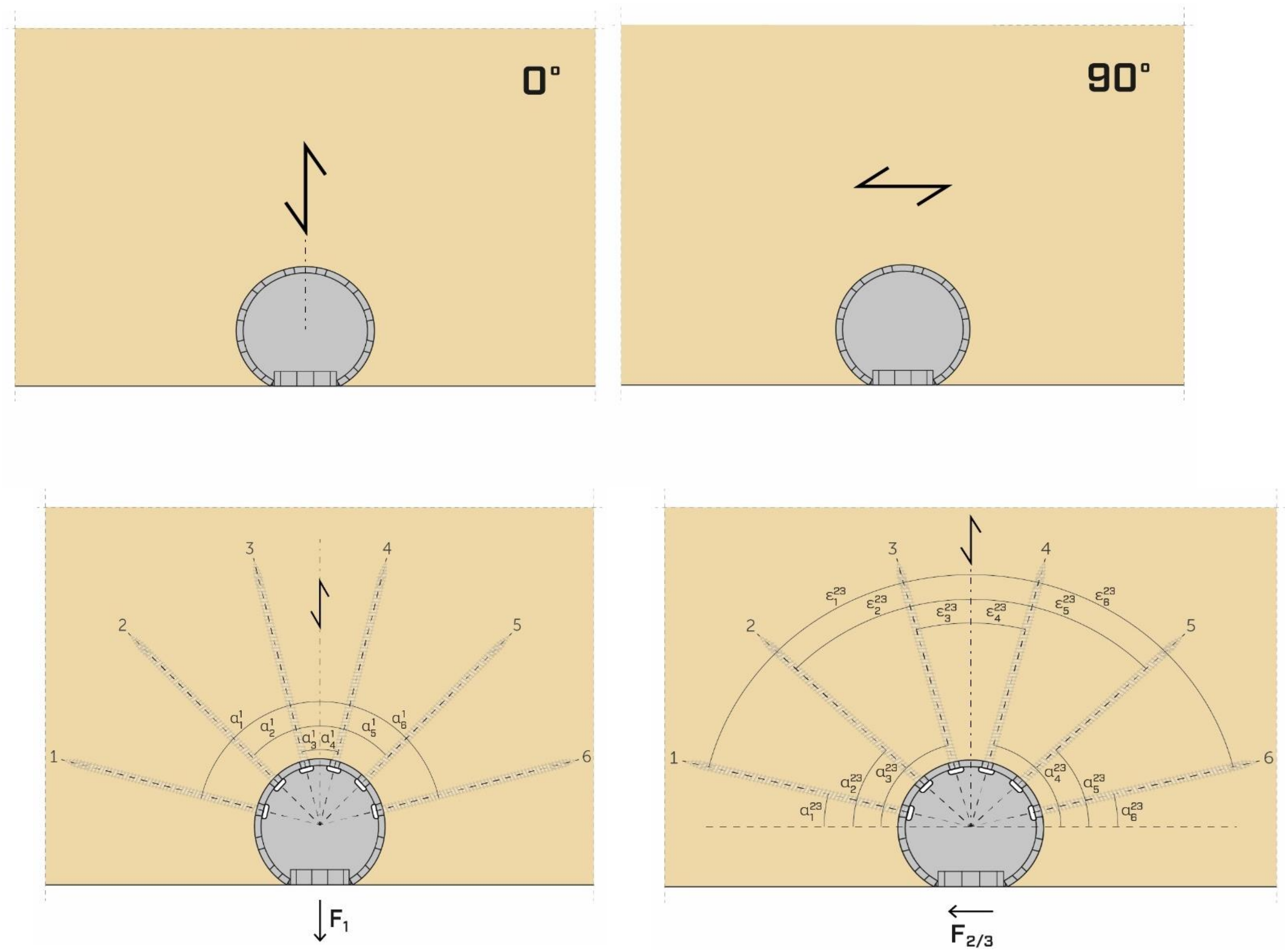
RING90C: Out of plane shear capacity ($F_{45,t,Rk}$)

l	l_{eff}	
[mm]	[mm]	[kN]
200	195	12,0

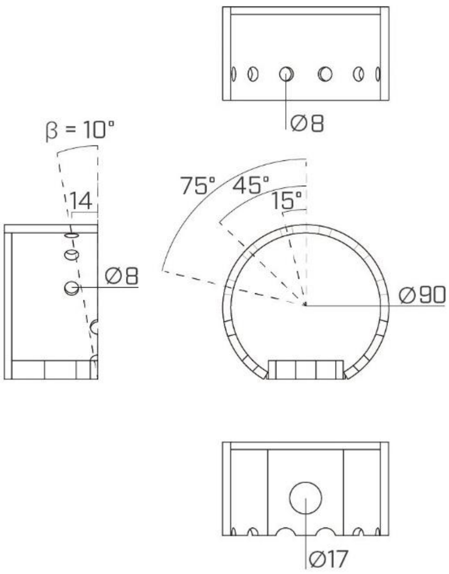
Input data:

ρ_k	= 350	[kg/m^3]	α	{15,45,75}	[°]
μ_1	= 0	[-] No-contact	β	{10;10;10}	[°]
μ_1	= 0,25	[-] Contact			

RING90C: Definition of the angles ($F_{1,t,Rk}$ – $F_{23,t,Rk}$)



Note:
In case of cross laminated timber (CLT) the angles refer to the grain direction of external layer.



RING60T: Axial capacity – tension ($F_{1,t,Rk}$)

l [mm]	**no - Interlayer** [kN]	**6 mm - Interlayer** [kN]
120	25,7	23,4
160	36,6	34,4
200	47,2	45,0

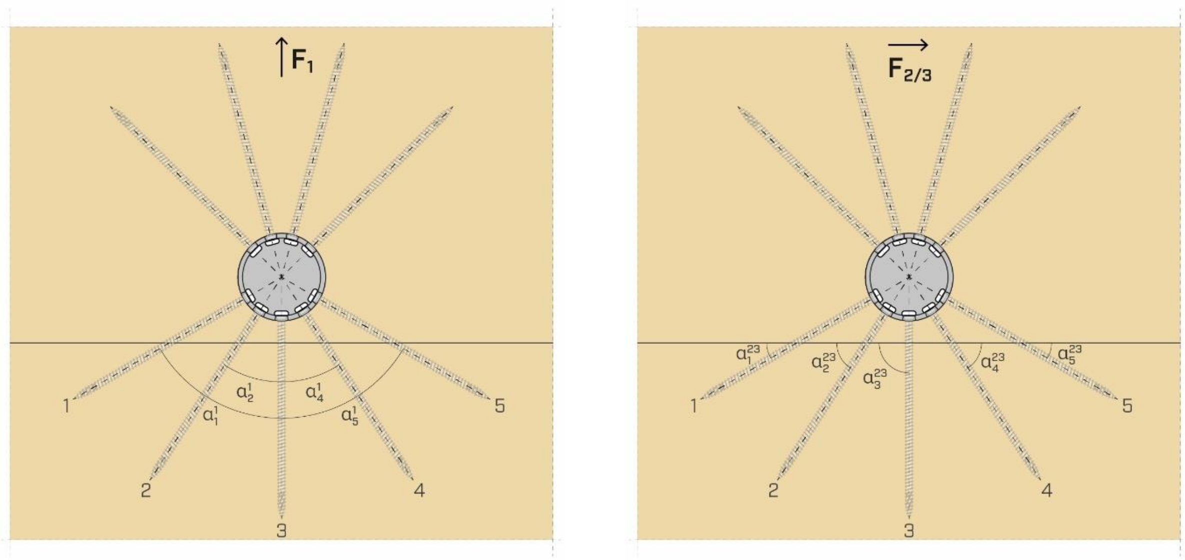
RING60T: In-plane shear capacity ($F_{23,Rk}$)

	no - Interlayer		**6 mm - Interlayer**
l [mm]	μ_{23}**=0,25** [kN]	μ_{23}**=0,5** [kN]	μ_{23}**=0,25** [kN]
120	16,6	18,9	15.3
160	21,9	25,3	20.7
200	27,1	31,5	25.8

RING60T: Out of plane shear capacity ($F_{45,t,Rk}$)

l [mm]	 [kN]
200	3,0

RING60T: Definition of the angles ($F_{1,t,Rk} – F_{23,t,Rk}$)



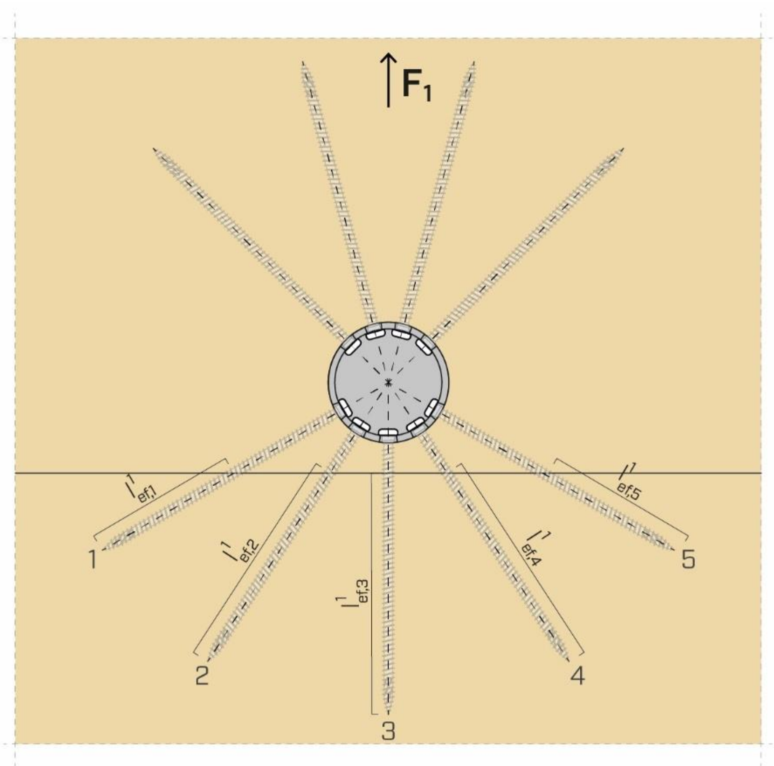
Input data:

ρ_k = 350 [kg/m³] α {56; 34; 0; 34; 56} [°] β {12; 20; 22; 20; 12} [°]

RING60T: Effective length of the screws - TENSION ($F_{1,t,Rk}$)

$l_{eff,i}$	No interlayer			6mm-Interlayer		
	∅7x120 [mm]	∅7x160 [mm]	∅7x200 [mm]	∅7x120 [mm]	∅7x160 [mm]	∅7x200 [mm]
l_{eff1}	63	103	143	52	92	132
l_{eff2}	89	129	169	81	121	161
l_{eff3}	98	138	178	92	132	171
l_{eff4}	89	129	169	81	121	161
l_{eff5}	63	103	143	52	92	132

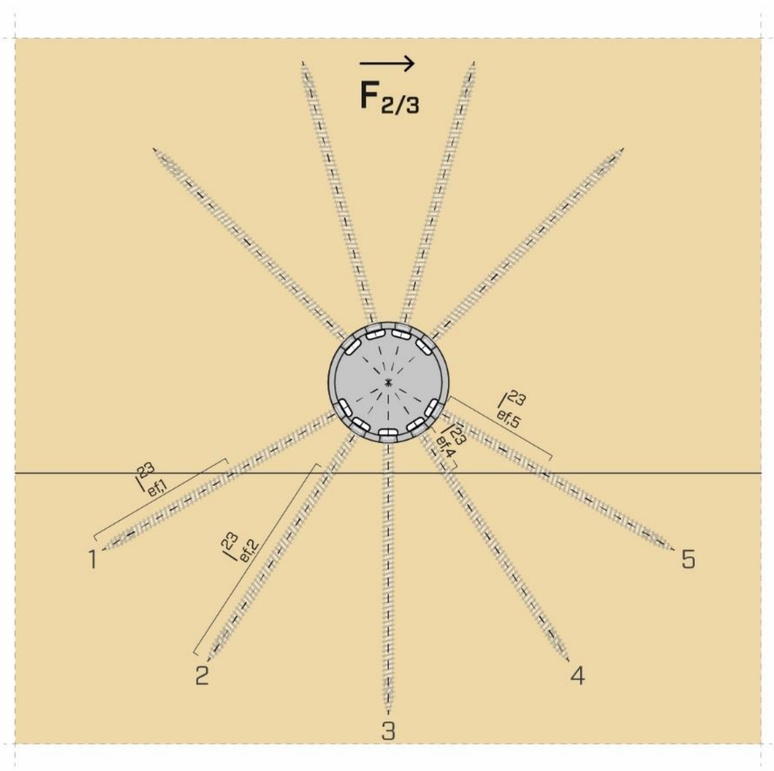
RING60T: Definition of screws effective length ($F_{1,t,Rk}$)

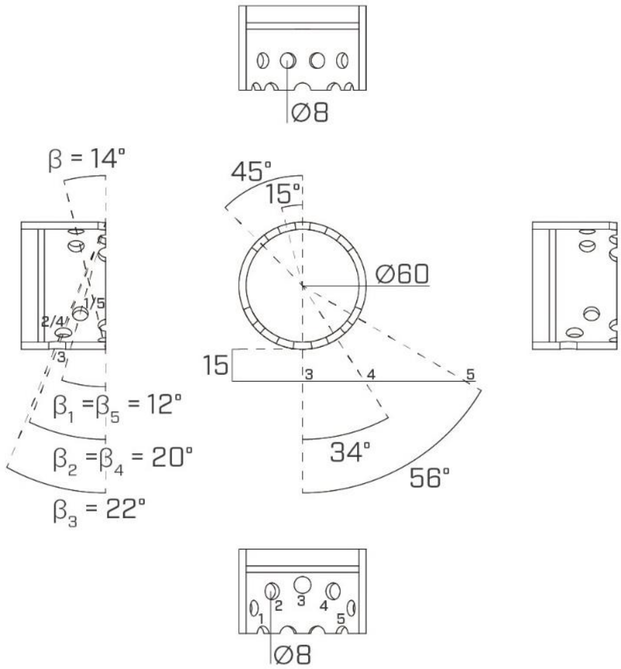


RING60T: Effective length of the screws - IN-PLANE SHEAR ($F_{23,Rk}$)

$l_{eff,i}$	No-Interlayer ∅7x120 [mm]	No-Interlayer ∅7x160 [mm]	No-Interlayer ∅7x200 [mm]	6mm-Interlayer ∅7x120 [mm]	6mm-Interlayer ∅7x160 [mm]	6mm-Interlayer ∅7x200 [mm]
l_{eff1}	63	103	143	52	92	132
l_{eff2}	89	129	169	81	121	161
l_{eff3}	98	138	178	92	132	171
l_{eff4}	26	26	26	26	26	26
l_{eff5}	52	52	52	52	52	52

RING60T: Definition of screws effective length ($F_{23,t,Rk}$)





RING90C-RING60T: Coefficient for different timber characteristic density

The previous table refer to a timber density of ρ_k = 350 kg/m^3. For different ρ_k values, the capacity can be multiplied by k_{dens} coefficient:

ρ_k [kg/m^3]	k_{dens} Tension / In-plane shear [-]	k_{dens} Compression/Out of plane shear [-]
290	0,87	0.83
350	1,00	1.00
385	1,07	1.10
>=420	1,15	1.20

The calculation methods are only allowed for a characteristic wood density of up to 420 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.