

CROSS-LAMINATED TIMBER CONNECTIONS

L and T connectors

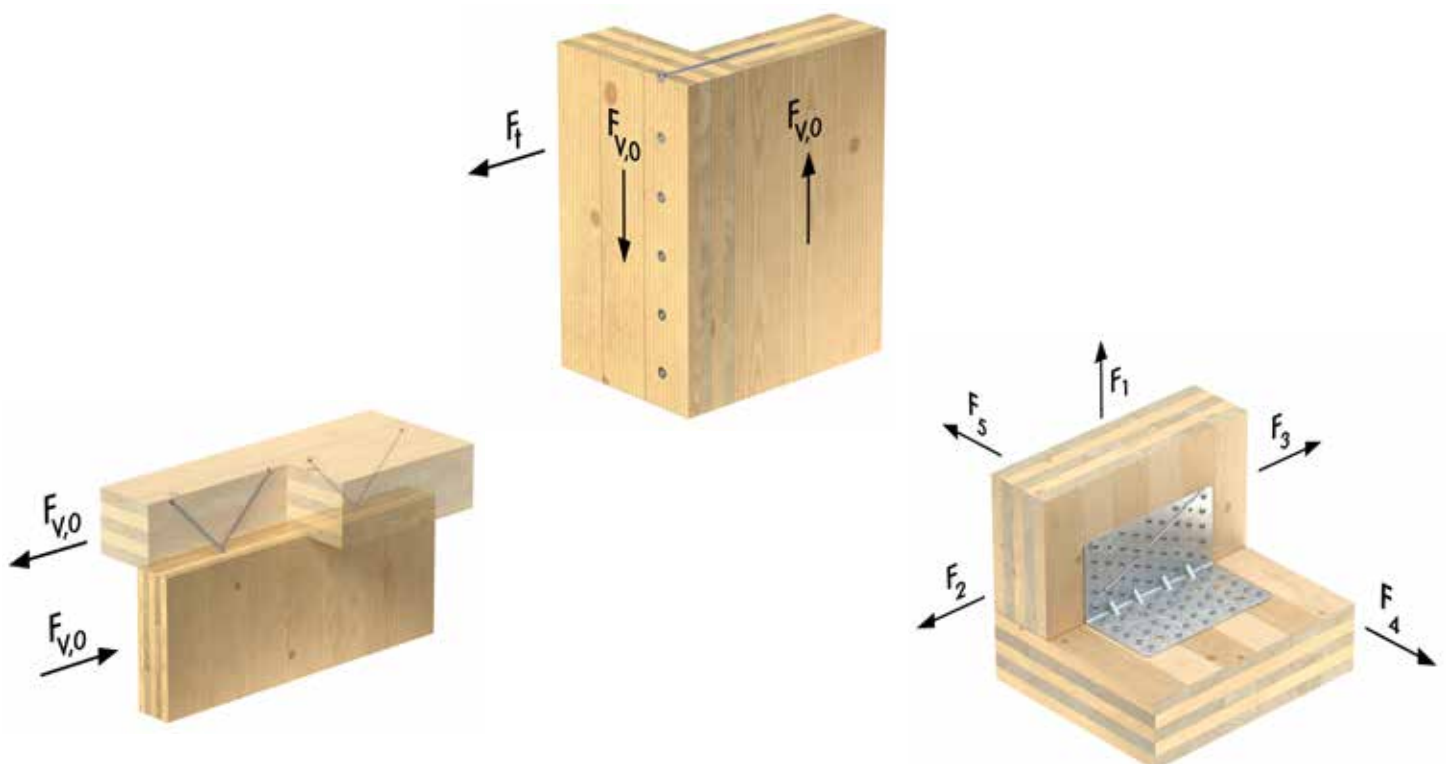


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Please note:

Relevant parameters of ETA and/or other standards may be quoted in part and summarized in this brochure. Please observe the full text of the respective regulations and standards. Plausibility and conformity with currently applicable standards shall be checked and approved by the responsible structural engineer.

ASSY screws have approval in accordance with ETA-11/0190, are subject to voluntary third-party inspection according to the 2+ system and are CE marked in accordance with the Construction Products Regulation. For specific instructions for use please refer to ETA-11/0190.

1. Application

CLT-to-CLT connections

Timber-to-timber connections with self-drilling wood construction screws are among the most commonly used joining techniques on CLT elements and adopt a wide variety of forms.

The connections presented in this brochure are therefore treated according to the fasteners used:

- ASSY 4 WH washer head screw steel zinc-plated partial thread washer head
- ASSY 4 CSMP universal screw steel zinc-plated partial thread countersunk head with milling pockets
- ASSY plus VG 4 CH construction screw steel zinc-plated full thread cylinder head
- Deneb angle bracket

L and T connectors are used primarily to join wall elements and to secure floor and wall elements.

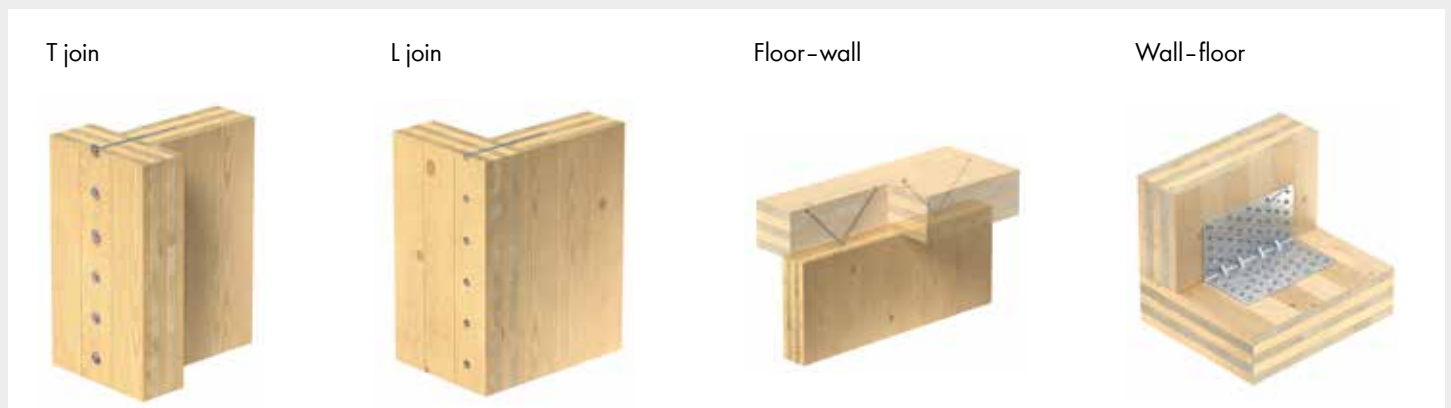
Connections between two wall or two floor elements are described in our brochure "CLT CONNECTIONS Wall and floor panel assemblies".

The following pages show the systems most widely used for L and T connections on CLT elements. The tables list the characteristic load-bearing values of the selected fastener subject to the required edge distance if spacing distances vary.

You can also refer to the tables for the minimum lengths of each fastener and so confirm the thread length needed in the connected component.

The selection of suitable connection systems taking into account a variation of fasteners allows for the greatest possible flexibility when pre-designing wall and floor connections for your CLT project. The sealing tapes used (e.g. compression tapes) may take proper effect only when the walls are pressed against each other, for instance with partial-thread screws.

The connection geometries treated in this brochure:



2. Characteristic load-bearing values for L and T connectors on CLT elements

2.1 ASSY 4 WH

2.1.1 Load direction $f_{v,0}$ with screw connection $< 90^\circ$

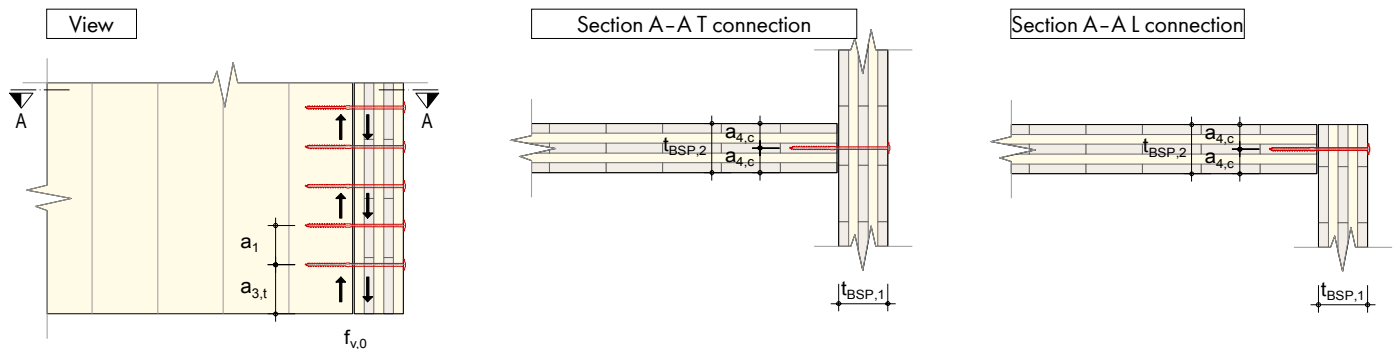
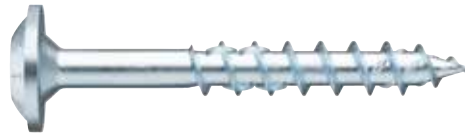
Dimensions

CLT elements

$t_{BSP} \geq 100$ mm

Fasteners

ASSY 4 WH washer head screw steel zinc-plated
partial thread washer head



No.	$F_{v,0,Rk}$ [kN] per fastener	$f_{v,0,Rk}$ [kN/m] for single row										Screw lengths L [mm] needed for screw-head-side CLT element thicknesses										Fasteners	
		a_1 [mm]										$t_{CLT,1}$ [mm]											
		100	125	150	175	200	225	250	300	350	400	100	120	140	160	180	200	220	240	260	280		300
2.1.1.1	1.96	19.6	15.7	13.1	11.2	9.8	8.7	7.8	6.5	5.6	4.9	180	200	220	240	260	280	300	-	-	-	-	ASSY 4 WH 6.0 x L
2.1.1.2	3.38	-	27.0	22.5	19.3	16.9	15.0	13.5	11.3	9.7	8.5	200	220	240	260	280	300	320	340	360	380	400	ASSY 4 WH 8.0 x L
2.1.1.3	4.45	-	-	29.7	25.4	22.3	19.8	17.8	14.8	12.7	11.1	200	220	240	260	280	300	340	360	380	400	420	ASSY 4 WH 10.0 x L

Remarks

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

Combined loads on screws (lateral and axial) should be subject to the requirements in DIN EN 1995-1-1 Section 8.3.3 (8.28) – “quadratic interaction”.

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

Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
a_1	$a_{3,t}$	a_2	$a_{4,c}$	a_1	$a_{3,t}$	a_2	$a_{4,c}$	
60	72	24	18	10 d	12 d	4 d	3 d	ASSY 4 WH 6.0 x L
80	96	32	24	10 d	12 d	4 d	3 d	ASSY 4 WH 8.0 x L
100	120	40	30	10 d	12 d	4 d	3 d	ASSY 4 WH 10.0 x L

* VM = Fastener

2.1.2 Load direction f_t with screw connection $< 90^\circ$

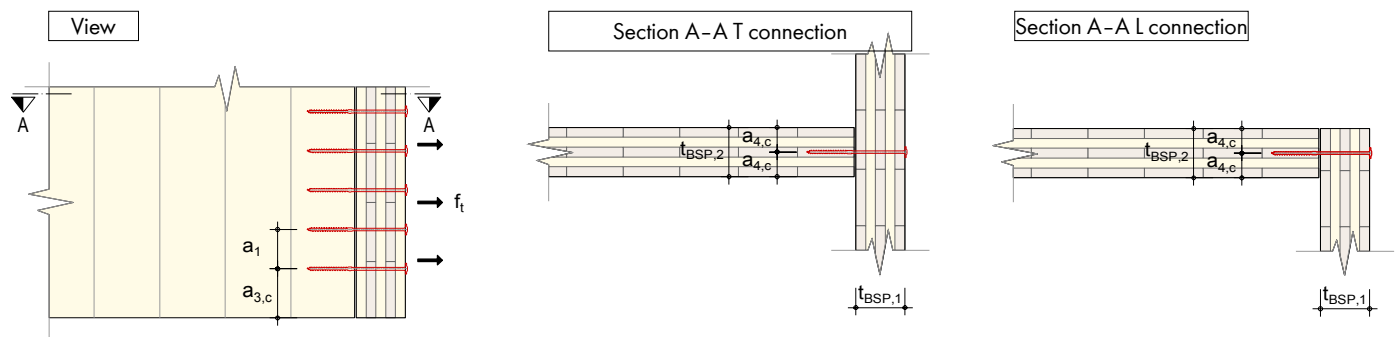
Dimensions

CLT elements

$t_{BSP} \geq 100$ mm

Fasteners

ASSY 4 WH washer head screw steel zinc-plated
partial thread washer head



No.	$F_{t,Rk}$ [kN] per fastener	$f_{t,Rk}$ [kN/m] for single row										Screw lengths L [mm] needed for screw-head-side CLT element thicknesses										Fasteners	
		a_1 [mm]										$t_{CLT,1}$ [mm]											
		100	125	150	175	200	225	250	300	350	400	100	120	140	160	180	200	220	240	260	280		300
2.1.2.1	2.55	25.5	20.4	17.0	14.6	12.8	11.3	10.2	8.5	7.3	6.4	180	200	220	240	260	280	300	-	-	-	-	ASSY 4 WH 6.0 x L
2.1.2.2	4.84	-	38.7	32.3	27.7	24.2	21.5	19.4	16.1	13.8	12.1	200	220	240	260	280	300	320	340	360	380	400	ASSY 4 WH 8.0 x L
2.1.2.3	6.25	-	-	41.7	35.7	31.3	27.8	25.0	20.8	17.9	15.6	200	220	240	260	280	300	340	360	380	400	420	ASSY 4 WH 10.0 x L

Comments

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.

The effective number of fasteners $n_{ef} = n^{0.9}$ shall be used to calculate the design value of the load-bearing capacity.

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

Combined loads on screws (lateral and axial) should be subject to the requirements in DIN EN 1995-1-1 Section 8.3.3 (8.28) - "quadratic interaction": $\left(\frac{F_{ax,Ed}}{F_{ax,Rd}}\right)^2 + \left(\frac{F_{y,Ed}}{F_{y,Rd}}\right)^2 \leq 1$

Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
a_1	$a_{3,c}$	a_2	$a_{4,c}$	a_1	$a_{3,c}$	a_2	$a_{4,c}$	
60	42	24	18	10 d	7 d	4 d	3 d	ASSY 4 WH 6.0 x L
80	56	32	24	10 d	7 d	4 d	3 d	ASSY 4 WH 8.0 x L
100	70	40	30	10 d	7 d	4 d	3 d	ASSY 4 WH 10.0 x L

* VM = Fastener

2.2 ASSY 4 CSMP

2.2.1 Load direction $f_{v,0}$ with screw connection $< 90^\circ$

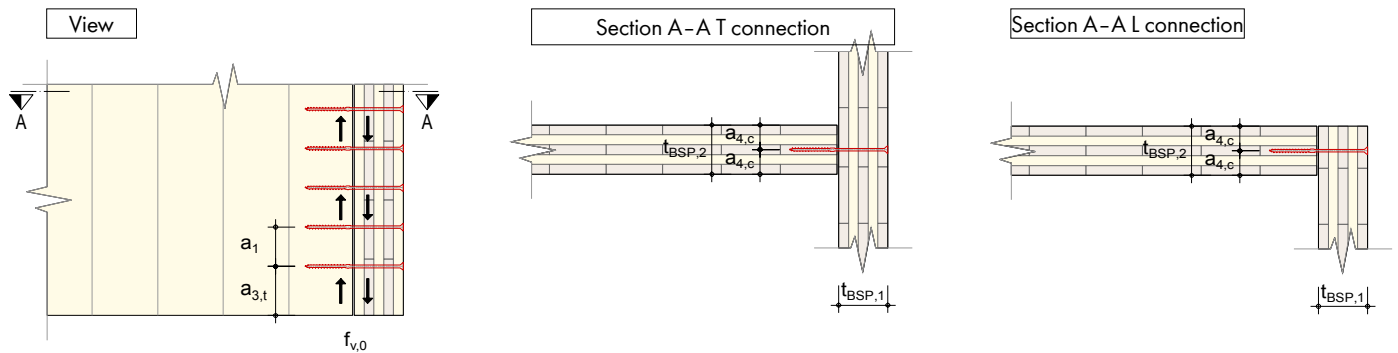
Dimensions

CLT elements

$t_{BSP} \geq 100$ mm

Fasteners

ASSY 4 CSMP universal screw steel zinc-plated partial thread countersunk head with milling pockets



No.	$F_{v,0,Rk}$ [kN] per fastener	$f_{v,0,Rk}$ [kN/m] for single row										Screw lengths L [mm] needed for screw-head-side CLT element thicknesses										Fasteners	
		a_1 [mm]										$t_{CLT,1}$ [mm]											
		100	125	150	175	200	225	250	300	350	400	100	120	140	160	180	200	220	240	260	280		300
2.2.1.1	1.79	17.9	14.3	11.9	10.2	9.0	8.0	7.2	6.0	5.1	4.5	180	200	220	240	260	280	300	-	-	-	-	ASSY 4 CSMP 6.0 x L
2.2.1.2	2.89	-	23.1	19.3	16.5	14.5	12.8	11.6	9.6	8.3	7.2	200	220	240	260	280	300	320	340	360	380	400	ASSY 4 CSMP 8.0 x L
2.2.1.3	4.45	-	-	29.7	25.4	22.3	19.8	17.8	14.8	12.7	11.1	200	220	240	260	280	300	340	360	380	400	420	ASSY 4 CSMP 10.0 x L

Remarks

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

Combined loads on screws (lateral and axial) should be subject to the requirements in DIN EN 1995-1-1 Section 8.3.3 (8.28) - "quadratic interaction".

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

Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
a_1	$a_{3,t}$	a_2	$a_{4,c}$	a_1	$a_{3,t}$	a_2	$a_{4,c}$	
60	72	24	18	10 d	12 d	4 d	3 d	ASSY 4 CSMP 6.0 x L
80	96	32	24	10 d	12 d	4 d	3 d	ASSY 4 CSMP 8.0 x L
100	120	40	30	10 d	12 d	4 d	3 d	ASSY 4 CSMP 10.0 x L

* VM = Fastener

2.2.2 Load direction f_t with screw connection $< 90^\circ$

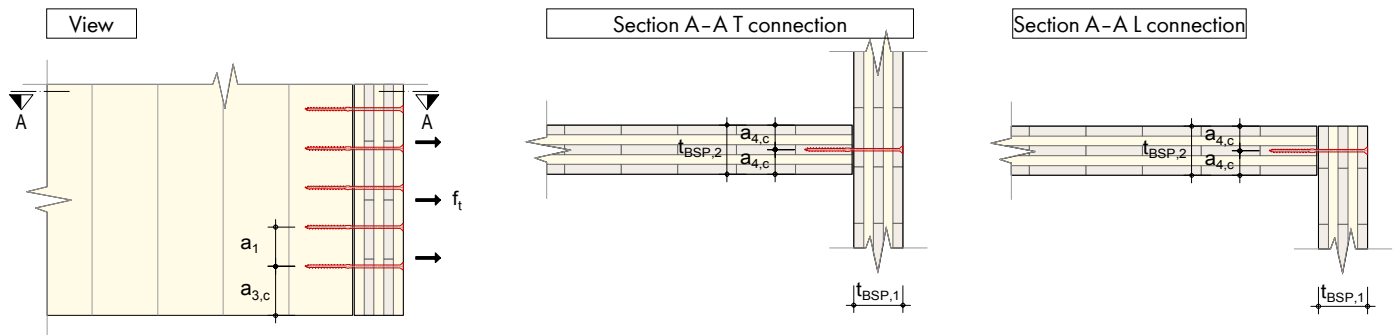
Dimensions

CLT elements

$t_{BSP} \geq 100$ mm

Fasteners

ASSY 4 CSMP universal screw steel zinc-plated partial thread countersunk head with milling pockets



No.	$F_{t,Rk}$ [kN] per fastener	$f_{t,Rk}$ [kN/m] for single row										Screw lengths L [mm] needed for screw-head-side CLT element thicknesses										Fasteners	
		a_1 [mm]										$t_{CLT,1}$ [mm]											
		100	125	150	175	200	225	250	300	350	400	100	120	140	160	180	200	220	240	260	280		300
2.2.2.1	1.87	18.7	15.0	12.5	10.7	9.4	8.3	7.5	6.2	5.3	4.7	180	200	220	240	260	280	300	-	-	-	-	ASSY 4 CSMP 6.0 x L
2.2.2.2	2.87	-	23.0	19.1	16.4	14.4	12.8	11.5	9.6	8.2	7.2	200	220	240	260	280	300	320	340	360	380	400	ASSY 4 CSMP 8.0 x L
2.2.2.3	4.31	-	-	28.7	24.6	21.6	19.2	17.2	14.4	12.3	10.8	200	220	240	260	280	300	340	360	380	400	420	ASSY 4 CSMP 10.0 x L

Remarks

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.

The effective number of fasteners $n_{ef} = n^{0.9}$ shall be used to calculate the design value of the load-bearing capacity.

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

Combined loads on screws (lateral and axial) should be subject to the requirements in DIN EN 1995-1-1 Section 8.3.3 (8.28) - "quadratic interaction".

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

Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
a_1	$a_{3,c}$	a_2	$a_{4,c}$	a_1	$a_{3,c}$	a_2	$a_{4,c}$	
60	42	24	18	10 d	7 d	4 d	3 d	ASSY 4 CSMP 6.0 x L
80	56	32	24	10 d	7 d	4 d	3 d	ASSY 4 CSMP 8.0 x L
100	70	40	30	10 d	7 d	4 d	3 d	ASSY 4 CSMP 10.0 x L

* VM = Fastener

2.3 ASSYplus VG

2.3.1 Load direction $f_{v,0}$ with screw connection $< 45^\circ$

Dimensions

CLT elements

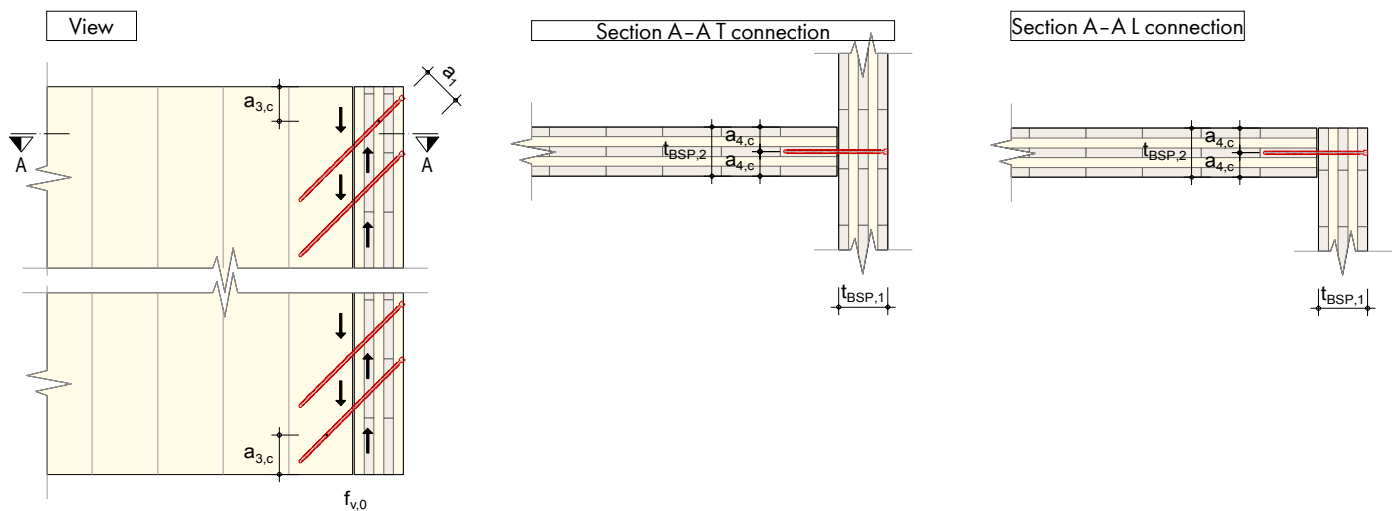
$t_{BSP} \geq 100$ mm

Fasteners

ASSY plus VG 4 CH construction screw steel zinc-plated

Full thread cylinder head

Tables shall apply to all ASSYplus VG screws



No.	$F_{v,0,Rk}$ [kN] per fastener	$t_{CLT,1}$ [mm]	$l_{req,screw}$ [mm]	$f_{v,0,Rk}$ [kN/m] for single row										Fasteners
				a_1 [mm] ($n_{ef} = 0.9 \cdot n$)										
				100	125	150	175	200	225	250	300	350	400	
2.3.1.1	5.79	100	260	52.1	41.7	34.7	29.8	26.1	23.2	20.8	17.4	14.9	13.0	ASSYplus VG 4 6.0 x L
	4.41	120	260	39.7	31.8	26.5	22.7	19.8	17.6	15.9	13.2	11.3	9.9	
	3.03	140	260	27.3	21.8	18.2	15.6	13.6	12.1	10.9	9.1	7.8	6.8	
2.3.1.2	8.80	100	300	-	63.4	52.8	45.3	39.6	35.2	31.7	26.4	22.6	19.8	ASSYplus VG 4 8.0 x L
	10.6	120	340	-	76.3	63.6	54.5	47.7	42.4	38.2	31.8	27.3	23.9	
	12.3	140	400	-	88.6	73.8	63.3	55.4	49.2	44.3	36.9	31.6	27.7	
	14.1	160	480	-	101.5	84.6	72.5	63.5	56.4	50.8	42.3	36.3	31.7	
	15.6	180	530	-	112.3	93.6	80.2	70.2	62.4	56.2	46.8	40.1	35.1	
	15.6	200	580	-	112.3	93.6	80.2	70.2	62.4	56.2	46.8	40.1	35.1	
	15.6	220	580	-	112.3	93.6	80.2	70.2	62.4	56.2	46.8	40.1	35.1	
	15.0	240	580	-	108.0	90.0	77.1	67.5	60.0	54.0	45.0	38.6	33.8	
	13.2	260	580	-	95.0	79.2	67.9	59.4	52.8	47.5	39.6	33.9	29.7	
	11.5	280	580	-	82.8	69.0	59.1	51.8	46.0	41.4	34.5	29.6	25.9	
9.69	300	580	-	69.8	58.1	49.8	43.6	38.8	34.9	29.1	24.9	21.8		

No.	$F_{v,0,Rk}$ [kN] per fastener	$f_{CLT,1}$ [mm]	$l_{req,screw}$ [mm]	$f_{v,0,Rk}$ [kN/m] for single row										Fasteners
				a_1 [mm] ($n_{ef} = 0.9 \cdot n$)										
				100	125	150	175	200	225	250	300	350	400	
2.3.1.3	11.0	100	300	-	-	66.0	56.6	49.5	44.0	39.6	33.0	28.3	24.8	ASSYplus VG 4 10.0 x L
	13.2	120	340	-	-	79.2	67.9	59.4	52.8	47.5	39.6	33.9	29.7	
	15.4	140	400	-	-	92.4	79.2	69.3	61.6	55.4	46.2	39.6	34.7	
	17.6	160	480	-	-	105.6	90.5	79.2	70.4	63.4	52.8	45.3	39.6	
	19.8	180	530	-	-	118.8	101.8	89.1	79.2	71.3	59.4	50.9	44.6	
	22.0	200	580	-	-	132.0	113.1	99.0	88.0	79.2	66.0	56.6	49.5	
	23.3	220	650	-	-	139.8	119.8	104.9	93.2	83.9	69.9	59.9	52.4	
	23.3	240	650	-	-	139.8	119.8	104.9	93.2	83.9	69.9	59.9	52.4	
	23.3	260	700	-	-	139.8	119.8	104.9	93.2	83.9	69.9	59.9	52.4	
	23.3	280	700	-	-	139.8	119.8	104.9	93.2	83.9	69.9	59.9	52.4	
	23.3	300	750	-	-	139.8	119.8	104.9	93.2	83.9	69.9	59.9	52.4	

Remarks

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.

The characteristic load-bearing capacity was calculated with the effective number of fasteners $n_{ef} = n \cdot 0,9$.

Each of the load-bearing values can be multiplied by 1.25 when the friction between the components is to be considered.

In case of alternating loads, additional screws inclined in the opposite direction shall be applied. Please refer to 2.3.2.

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

No.	Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
	a_1	$a_{3,c}$	a_2	$a_{4,c}$	a_1	$a_{3,c}$	a_2	$a_{4,c}$	
2.3.1.1	60	42	24	18	10 d	7 d	4 d	3 d	ASSYplus VG 4 6.0 x L
2.3.1.2	80	56	32	24	10 d	7 d	4 d	3 d	ASSYplus VG 4 8.0 x L
2.3.1.3	100	70	40	30	10 d	7 d	4 d	3 d	ASSYplus VG 4 10.0 x L

* VM = Fastener

2.3.2 Load direction $f_{v,0}$ with crossed screw pair (tension-compression screw connection $< 45^\circ$ – alternately inclined)

Dimensions

CLT elements

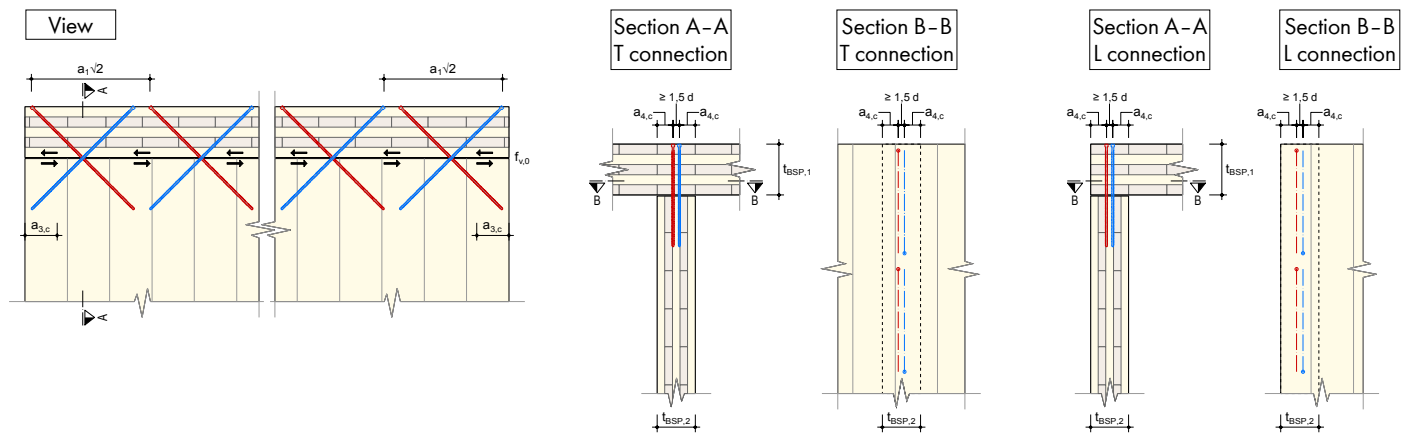
$t_{BSP} \geq 100$ mm

Fasteners

ASSYplus VG 4 CH construction screw steel zinc-plated

Full thread cylinder head

Tables shall apply to all ASSYplus VG screws



No.	$F_{ax,Rk}$ [kN]	$F_{ki,Rk}$ [kN]	$t_{CLT,1}$ [mm]	$l_{req,screw}$ [mm]	$f_{ax,v,0,Rk}$ and/or $f_{ki,v,0,Rk}$ [kN/m] for single row										Fasteners
					a_1 [mm] ($n_{ef} = 0.9 \cdot n$)										
					100	125	150	175	200	225	250	300	350	400	
2.3.2.1	11.6	-	100	260	104	83.4	69.5	59.6	52.1	46.3	41.7	34.7	29.8	26.1	ASSYplus VG 4 6.0 x L
	8.82	-	120	260	79.4	63.5	52.9	45.4	39.7	35.3	31.8	26.5	22.7	19.8	
	6.06	-	140	260	54.5	43.6	36.4	31.2	27.3	24.2	21.8	18.2	15.6	13.6	
	9.63	100-140	260	86.7	69.3	57.8	49.5	43.3	38.5	34.7	28.9	24.8	21.7		
2.3.2.2	17.6	-	100	300	-	127	106	90.5	79.2	70.4	63.4	52.8	45.3	39.6	ASSYplus VG 4 8.0 x L
	21.2	-	120	340	-	153	127	109	95.4	84.8	76.3	63.6	54.5	47.7	
	24.6	-	140	400	-	177	148	127	111	98.4	88.6	73.8	63.3	55.4	
	28.2	-	160	480	-	203	169	145	127	113	102	84.6	72.5	63.5	
	31.2	-	180	530	-	225	187	160	140	125	112	93.6	80.2	70.2	
	31.2	-	200	580	-	225	187	160	140	125	112	93.6	80.2	70.2	
	31.2	-	220	580	-	225	187	160	140	125	112	93.6	80.2	70.2	
	30.0	-	240	580	-	216	180	154	135	120	108	90.0	77.1	67.5	
	26.4	-	260	580	-	190	158	136	119	106	95.0	79.2	67.9	59.4	
	23.0	-	280	580	-	166	138	118	104	92.0	82.8	69.0	59.1	51.8	
	19.4	-	300	580	-	140	116	99.7	87.2	77.5	69.8	58.1	49.8	43.6	
-	15.9	100-300	300-580	-	114	95.4	81.7	71.5	63.6	57.2	47.7	40.9	35.8		

"ax": Characteristic load-bearing capacity against pull-out or push-through for 1 crossed screw pair or per running meter

"ki": Characteristic load-bearing capacity against bending for 1 crossed screw pair or per running meter

No.	F _{ax,Rk} [kN]	F _{ki,Rk} [kN]	t _{CLT,1} [mm]	l _{req,screw} [mm]	f _{ax,v,0,Rk} and/or f _{ki,v,0,Rk} [kN/m] for single row										Fasteners
					a ₁ [mm] (n _{ef} = 0.9 · n)										
					per crossed screw pair										
2.3.2.3	22.0	-	100	300	-	-	132	113	99.0	88.0	79.2	66.0	56.6	49.5	ASSYplus VG 4 10.0 x L
	26.4	-	120	340	-	-	158	136	119	106	95.0	79.2	67.9	59.4	
	30.8	-	140	400	-	-	185	158	139	123	111	92.4	79.2	69.3	
	35.2	-	160	480	-	-	211	181	158	141	127	106	90.5	79.2	
	39.6	-	180	530	-	-	238	204	178	158	143	119	102	89.1	
	44.0	-	200	580	-	-	264	226	198	176	158	132	113	99.0	
	46.6	-	220	650	-	-	280	240	210	186	168	140	120	105	
	46.6	-	240	650	-	-	280	240	210	186	168	140	120	105	
	46.6	-	260	700	-	-	280	240	210	186	168	140	120	105	
	46.6	-	280	700	-	-	280	240	210	186	168	140	120	105	
	46.6	-	300	750	-	-	280	240	210	186	168	140	120	105	
-	24.9	100-300	300-750			150	128	112	99.7	89.8	74.8	64.1	56.1		

"ax": Characteristic load-bearing capacity against pull-out or push-through for 1 crossed screw pair or per running meter
"ki": Characteristic load-bearing capacity against bending for 1 crossed screw pair or per running meter

Remarks

The fasteners applied to the narrow side must be arranged so that they engage in one of the inner, and not in the top layers.
The characteristic load-bearing capacity was calculated with the effective number of fasteners (here the effective number of crossed screw pairs) $n_{ef} = n \cdot 0,9$.

The decisive design value with γ_M for timber and γ_{M1} for steel is subject to the following:

$$f_{v,0,Rd} = \min \left\{ \begin{array}{l} k_{mod} \cdot \frac{f_{ax,v,0,Rk}}{\gamma_M} \\ \frac{f_{ki,v,0,Rk}}{\gamma_{M1}} \end{array} \right.$$

Design (e.g. shear load) and any block shear calculations must be made for each building component.

The minimum requirement should be three screws applied per meter, or $e \leq 33$ cm.

A connection consists of at least two screws.

Load-bearing capacities apply to a characteristic bulk density of boards $\rho_k \geq 350$ kg/m³ or the strength class for boards C24.

No.	Min fastener spacing per connection [mm]*				Min fastener spacing per connection*				Fasteners
	a ₁	a _{3,c}	a ₂	a _{4,c}	a ₁	a _{3,c}	a ₂	a _{4,c}	
2.3.2.1	60	42	24	18	10 d	7 d	4 d	3 d	ASSYplus VG 4 6.0 x L
2.3.2.2	80	56	32	24	10 d	7 d	4 d	3 d	ASSYplus VG 4 8.0 x L
2.3.2.3	100	70	40	30	10 d	7 d	4 d	3 d	ASSYplus VG 4 10.0 x L

* VM = Fastener

2.4 Corner connection with Deneb bracket

2.4.1 Characteristic load-bearing values for load directions F_1 , $F_{2/3}$, F_4 , F_5 and $F_{4/5}$

Dimensions

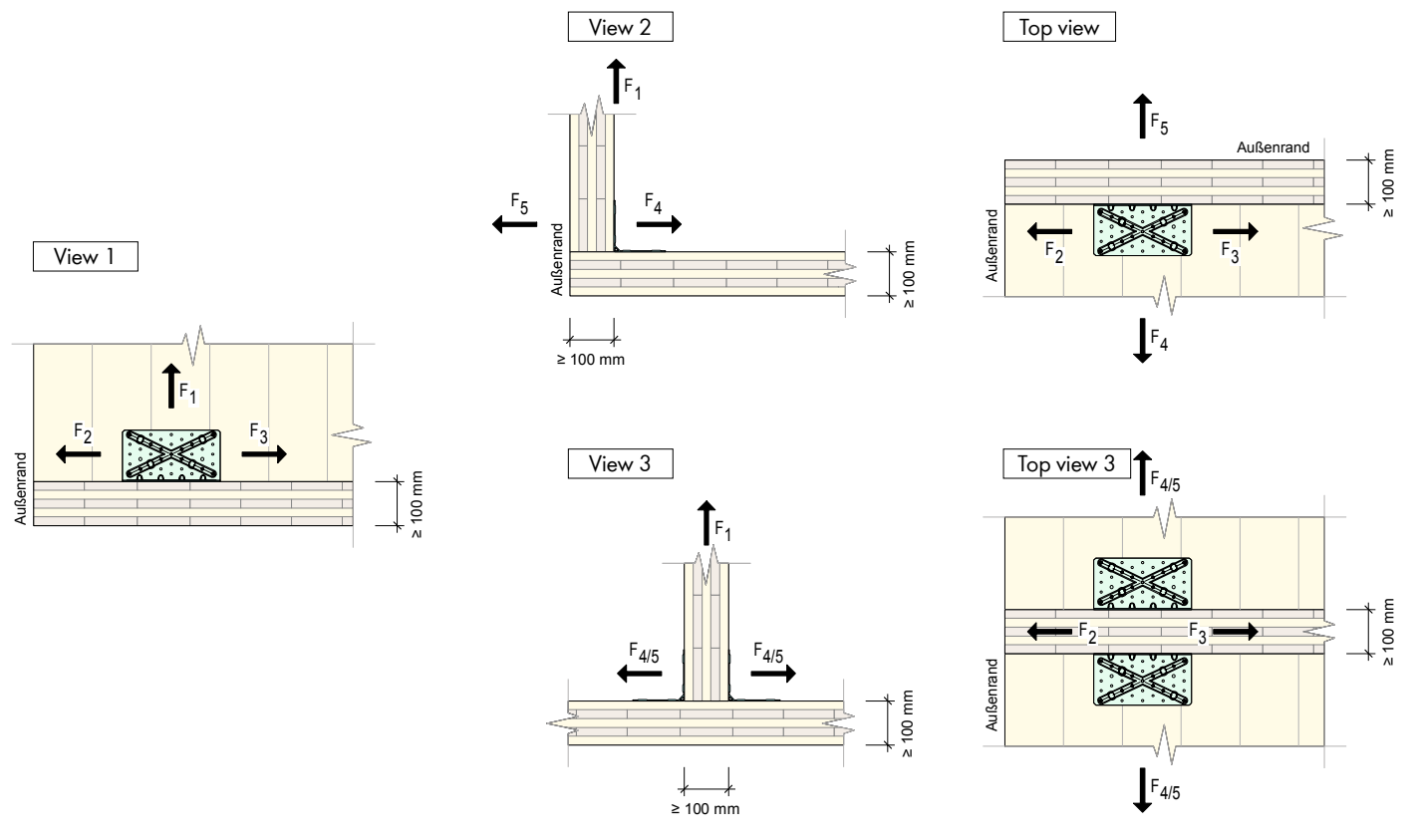
CLT elements $t_{CLT} \geq 100$ mm

Wood connectors

Deneb brackets

Fasteners

See overview "Fastener patterns according to ETA-20/0773"



Fastener patterns according to ETA-20/0773

Timber (specifications per leg)

	Dimensions [mm]	Fastener pattern in timber						
		1	2	3	4	5	6	7
ASSYplus VG 4 COMBI	12 x length	4 pcs				4 pcs		
ASSYplus VG 4 CSMP	6 x 200		4 pcs					
45° angled washer, round hole	6.5 x 2		4 pcs					
ASSY 4 JH	5 x 50			35 pcs		9 pcs		
	5 x 70				35 pcs			
Ring-shank nail	4 x 60						35 pcs	
Stepped nail	4 x 50							35 pcs

	Dimensions [mm]	Number of fasteners for partial mounting in timber*					
		a	b	c	d	e	f
ASSY 4 JH	5x50	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
	5x70	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
Ring-shank nail	4x60	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
Stepped nail	4x50	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs

* Partial mounting refers to the leg seated on the component that is joined with the other component.

When partially mounting the bracket, any row of holes can be used as long as all holes of the selected horizontal row are filled with nails (or screws). See the examples on page 14.

The bracket may not be fastened with less than the minimum number of screws/nails in the selected pattern.

Characteristic load-bearing values for CLT bulk density 350 kg/m³

$\rho_k = 350 \text{ kg/m}^3$		Fastener pattern	$\uparrow F_{1,Rk}$	$\leftrightarrow F_{2/3,Rk}$	$\rightarrow F_{4,Rk}$	$\leftarrow F_{5,Rk}$	$\leftrightarrow F_{4/5,Rk}$
			[kN]				
Fastener pattern	1	Length = 120/140/160	7.0/9.0/10.0	17.0/20.0/24.0	31.0	7.0/9.0/10.0	38.0/40.0/41.0
	2		10.0	15.0	10.0	10.0	20.0
	3	a/b/c d/e/f	24.0/21.0/18.0 16.0/14.0/11.0	40.0/37.9/36.3 34.5/33.8/30.4	31.0	24.0/9.8/7.4 4.9/5.1/4.3	55.0/41.0/38.0 36.0/36.0/35.0
	4	a/b/c d/e/f	37.0/32.0/27.0 24.0/22.0/17.0	65.0/43.4/42.1 40.6/40.0/36.9	38.0	37.0/11.1/8.0 6.2/5.1/4.3	75.0/49.0/46.0 44.0/43.0/42.0
	5	Length = 120/140/160	20.0/24.0/28.0	34.0/41.0/48.0	33.0	20.0/25.0/28.0	53.0/57.0/61.0
	6	a/b/c d/e/f	13.0/11.0/10.0 9.0/8.0/6.0	44.0/31.3/29.0 26.6/25.9/22.2	39.0	13.0/5.0/3.8 2.5/5.1/4.3	52.0/44.0/43.0 42.0/44.0/43.0
	7	a/b/c d/e/f	12.0/10.0/9.0 8.0/7.0/5.0	40.0/28.3/26.0 23.7/23.0/19.4	38.0	12.0/4.0/3.0 2.0/5.0/4.0	50.0/42.0/41.0 40.0/43.0/42.0

Characteristic load-bearing values for CLT bulk density 400 kg/m³

$\rho_k = 400 \text{ kg/m}^3$		Fastener pattern	$\uparrow F_{1,Rk}$	$\leftrightarrow F_{2/3,Rk}$	$\rightarrow F_{4,Rk}$	$\leftarrow F_{5,Rk}$	$\leftrightarrow F_{4/5,Rk}$
			[kN]				
Fastener pattern	1	Length = 120/140/160	8.0/10.0/12.0	19.0/23.0/27.0	35.0	8.0/10.0/12.0	43.0/45.0/47.0
	2		10.0	17.0	10.0	10.0	20.0
	3	a/b/c d/e/f	28.0/24.0/21.0 18.0/17.0/13.0	44.0/41.1/39.3 37.4/36.7/33.1	35.0	28.0/11.0/8.0 5.5/5.1/4.3	63.0/46.0/43.0 40.0/40.0/39.0
	4	a/b/c d/e/f	42.0/36.0/31.0 28.0/25.0/19.0	72.0/47.1/45.7 44.2/43.5/40.2	42.0	42.0/11.1/8.0 6.2/5.1/4.3	84.0/53.0/50.0 48.0/47.0/46.0
	5	Length = 120/140/160	23.0/28.0/33.0	38.0/45.0/54.0	35.0	23.0/28.0/33.0	58.0/63.0/68.0
	6	a/b/c d/e/f	15.0/13.0/11.0 10.0/9.0/7.0	49.0/33.8/31.3 28.9/28.1/24.1	42.0	15.0/5.6/4.2 2.8/5.1/4.3	57.0/48.0/46.0 45.0/47.0/46.0
	7	a/b/c d/e/f	14.0/12.0/10.0 9.0/8.0/6.0	44.0/30.5/28.1 25.6/24.9/21.3	42.0	14.0/4.5/3.1 2.2/5.1/4.3	56.0/46.0/45.0 44.0/47.0/46.0

• for **one** DENEK bracket – load directions F_1 , $F_{2/3}$, $F_{4'}$ and F_5

• for **two** DENEK brackets – load directions $F_{4/5}$ and for the load directions F_1 and $F_{2/3}$, the corresponding value in the table must be doubled

In case of connections with several possible fastener patterns on one leg, the smaller load-bearing value of the two selected fastener patterns shall apply

Illustration (examples) of possible patterns for the partial mounting in timber

	Dimensions [mm]	Number of fasteners for partial mounting in timber*					
		a	b	c	d	e	f
ASSY 4 JH	5x50	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
	5x70	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
Ring-shank nail	4x60	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs
Stepped nail	4x50	35 pcs	30 pcs	26 pcs	23 pcs	21 pcs	16 pcs

* Partial mounting refers to the leg seated on the component that is joined with the other component.

When partially mounting the bracket, any row of holes can be used as long as all holes of the selected horizontal row are filled with nails (or screws).

The bracket may not be fastened with less than the minimum number of screws/nails in the selected pattern.



Pattern a



Pattern b



Pattern c



Pattern d

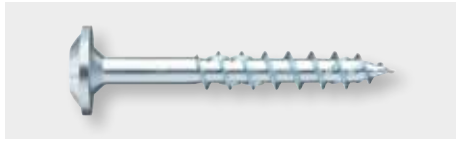


Pattern e



Pattern f

3. Products



ASSY® 4 WH washer head screw steel zinc-plated partial thread washer head

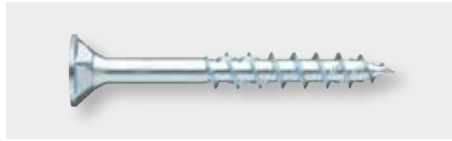
Partial-thread screw with large washer head for timber-to-timber connections in timber construction that must be pulled together in indoor dry or wet areas

ASSY 4 WH (PT)

Art. no. 0177 306 ...

Art. no. 0177 308 ...

Art. no. 0177 310 ...



ASSY® 4 CSMP universal screw steel zinc-plated partial thread countersunk head with milling pockets

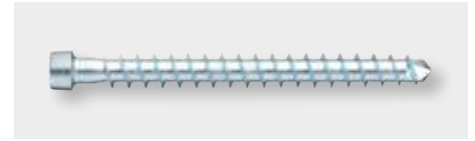
Universal partial-thread screw for fast, gap-free timber-to-timber connections in furniture, interior applications, or timber construction in indoor dry or wet areas

ASSY 4 CSMP (PT)

Art. no. 0190 160 ...

Art. no. 0190 180 ...

Art. no. 0190 110 ...



ASSY® plus VG 4 CH construction screw steel zinc-plated full thread cylinder head

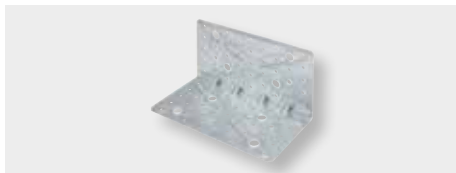
Special full-thread screw with small cylinder head for high-load-bearing timber-to-timber connections or structural timber reinforcements which also require small edge and screw clearances, in indoor dry or wet areas

ASSYplus VG 4

Art. no. 0150 006 ...

Art. no. 0150 008 ...

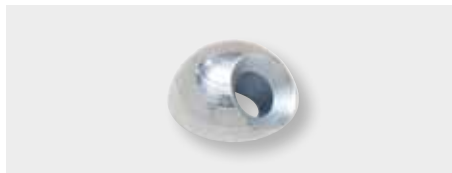
Art. no. 0150 010 ...



Angle bracket Deneb

The Deneb bracket for shear and tensile loads is ideal for connecting timber structures to concrete or timber substructures

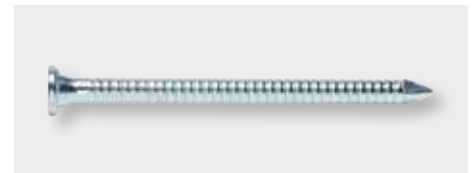
Art. no. 5390 000 300



45° angled washer, round hole

Custom-fit washer with 45° drilling channel for optimum transfer of tensile loads for metal-to-timber connections

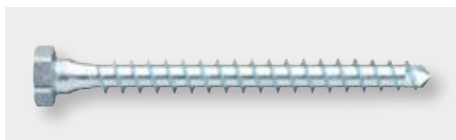
Art. no. 0457 700 ...



Ring-shank nail

Steel, zinc-plated, blue passivated (A2K)

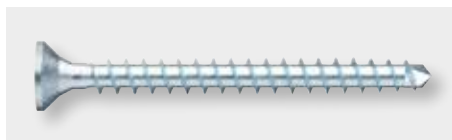
Art. no. 0681 94 ...



ASSY®plus VG 4 combi

Special full-thread screw with hexagon head and underside shank reinforcement for high-load-bearing metal-to-timber connections in timber construction, which also require small edge and screw clearances, in indoor dry or wet areas

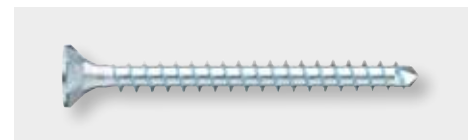
Art. no. 0150 2 ...



ASSY®plus VG 4 CS

Special full-thread screw with countersunk head for universal use for high-load-bearing timber-to-timber or timber-to-metal connections or structural timber reinforcements, which also require small edge and screw clearances, in indoor dry or wet areas

Art. no. 0150 1 ...



ASSY®plus VG CSMP

Special full-thread screw with countersunk head with milling pockets for universal use for high-load-bearing timber-to-timber or timber-to-metal connections or structural timber reinforcements, which also require small edge and screw clearances, in indoor dry or wet areas

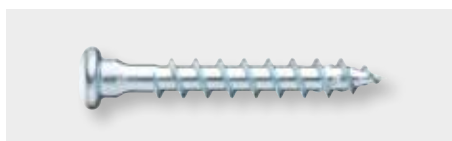
Art. no. 0150 1 ...



Stepped nail

Optimized nail for fastening wood connectors in BauBuche, hardwood and softwood

Art. no. 0681 945 040



ASSY® 4 JH

Full-thread screw with visually appealing pan head with underhead shank reinforcement for fastening sheet metal parts and metal connectors in timber in indoor dry or wet areas without play

Art. no. 0153 3 ...

4. Accessories



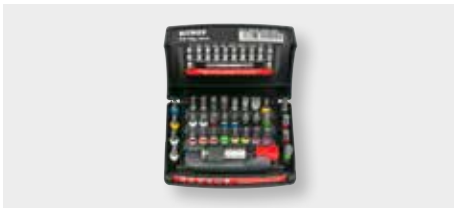
M-CUBE® ABS 18 POWER
cordless drill/driver
Art. no. 5701 404 ...



Mechanic's glove
Art. no. 0899 400 528



Electra safety goggles
Art. no. 0899 102 340



Bit box
Art. no. 0614 400 301



Longlife auger drill bit assortment
Art. no. 0650 776 165



Roofing hammer
Art. no. 0714 733 030



Corded ear plugs
Art. no. 0899 300 338



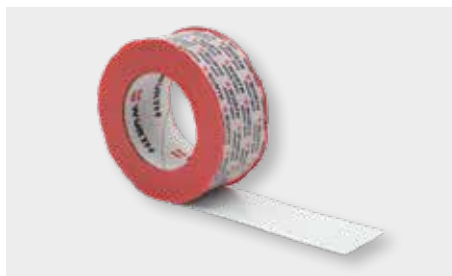
Stretch X S3 SRC safety shoes, grey
M418 099 ...



VKP® Plus sealing tape
High-quality, waterproofed, pre-compressed BG1 sealing tape for secure and permanent joint sealing up to over 600 Pa

- Chemical basis: fine, open-cell polyurethane foam
- Sustainability: low-emission

Art. no. 0875 0...



EURASOL® Quick adhesive sealing tape
Very strong adhesive tape without release paper for fast application, for airtight and windproof bonding indoors and outdoors

- Specially coated adhesive tape without separating paper
 - Saves time, as the separating paper does not need to be pulled off
 - Avoids waste on the construction site
- Extremely high resistance to UV and weathering
- Particularly strong and high-quality adhesive
- Solvent-free

Art. no. 0992 710 660

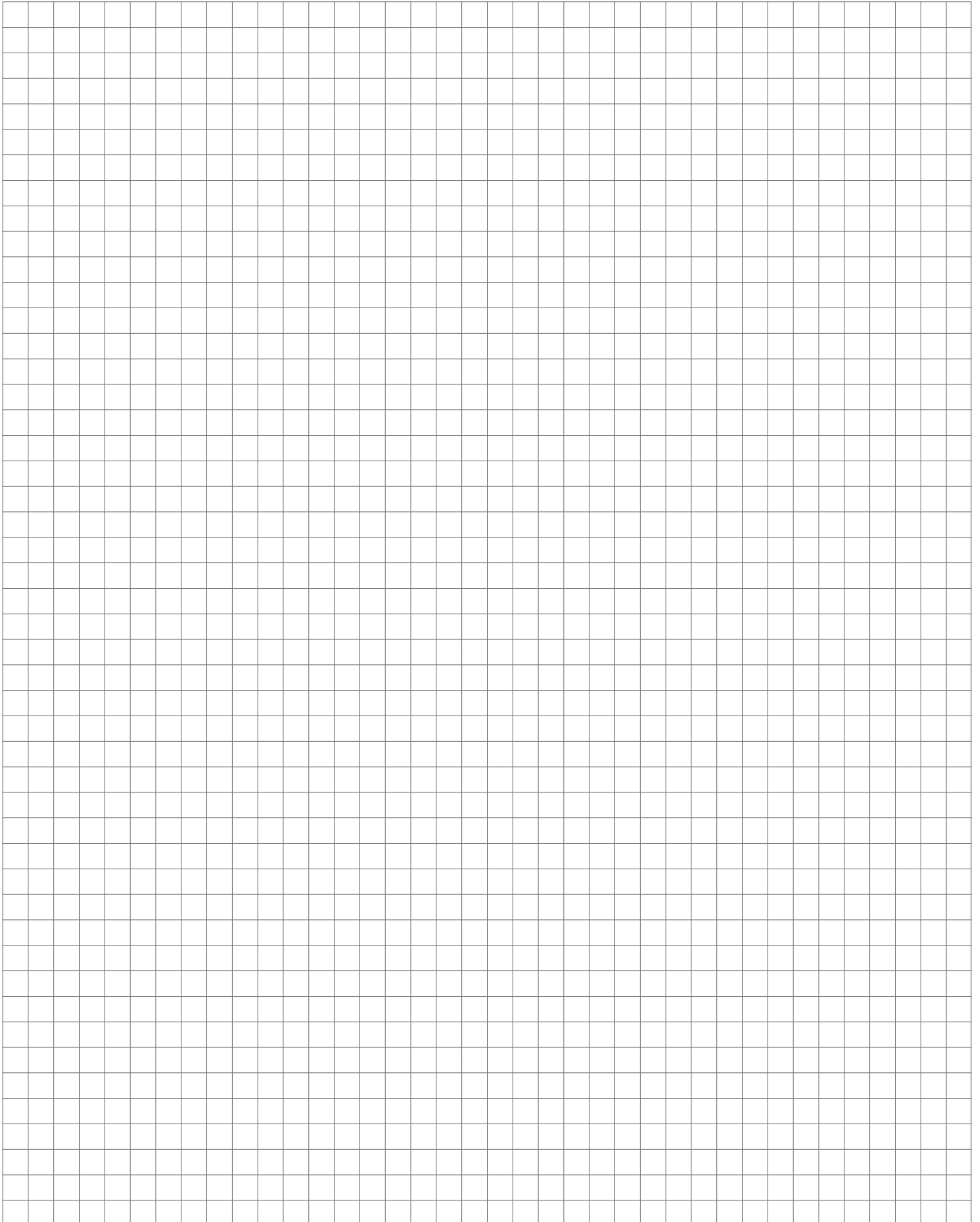


5. General conditions

Design basis

DIN EN 1995-1-1:2010-12	Design of timber structures – Common rules and rules for buildings
DIN EN 1995-1-1/NA:2013-08	National Annex - Nationally determined parameters
DIN 20000-6	Application of construction products in structures - Part 6: Dowel-type fasteners and connectors
ETA-11/0190	Self-tapping screws for use in timber constructions
ETA-20/0773	DENEb angle bracket
ETA CLT	The latest ETA provided by the manufacturer of the CLT components Additional requirements of the respective CLT approval (ETA) must be observed

Notes

A large, empty grid of small squares, intended for taking notes. The grid consists of approximately 25 columns and 40 rows.

CROSS-LAMINATED TIMBER CONNECTIONS

L and T connectors

Adolf Würth GmbH & Co. KG
74650 Künzelsau
T +49 7940 15-0
Fax +49 (0)7940 15-1000
info@wuerth.com
www.wuerth.de

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