SPIDER

CONNECTION AND REINFORCEMENT SYSTEM FOR COLUMNS AND FLOORS

VIDEO

PATENTED

ETA-19/0700

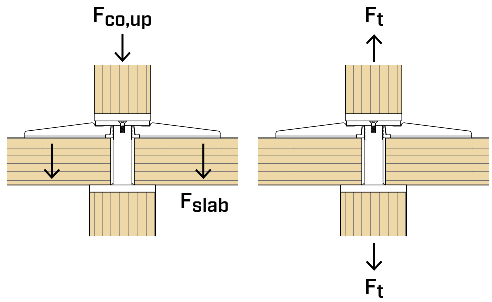
SERVICE CLASS SC1 SC2

MATERIAL

S355 Fe/Zn12c — S355 + Fe/Zn12c carbon steel

S690 Fe/Zn12c — S690 + Fe/Zn12c carbon steel

EXTERNAL LOADS



MULTI-STOREY BUILDINGS

It allows the construction of multi-storey buildings with a column-to-floor structure. Certified, calculated and optimised for glulam, LVL, steel and reinforced concrete columns. New architectural and structural horizons.

COLUMN-TO-COLUMN

The steel core of the system prevents the CLT panels from being crushed and allows more than 5000 kN of vertical load to be transferred between the columns.

REINFORCEMENT SYSTEM FOR CLT

The arms of the system ensure the punching shear reinforcement of the CLT panels, allowing exceptional shear strength values. Column spacing greater than 7,0 x 7,0 m structural grid.

VIDEO

Scan the QR Code and watch the video on our YouTube channel

FIELDS OF USE

Multi-storey buildings with column-to-floor system. Solid timber, glulam, high density timber, CLT, LVL, steel and concrete columns.

WOODEN SKYSCRAPERS

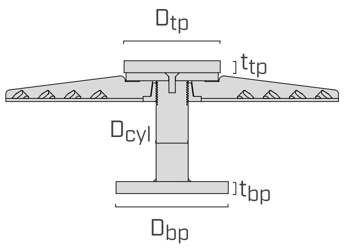
Standard connection and reinforcement system to build wooden skyscrapers with post-and-slab system. New architectural possibilities in construction.

CROSS CLT PANELS

Exceptional strength and stiffness of the structure with crossed arrangement of the CLT floors. It is possible to create free spans greater than 6,0 x 6,0 m even without the use of moment joints.

CODES AND DIMENSIONS

SPIDER CONNECTOR

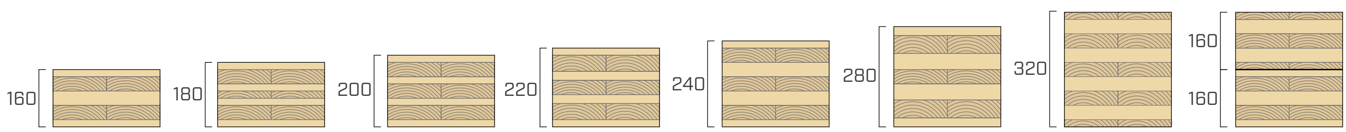


The code consists of the respective CLT panel thickness in mm (XXX = t_{CLT}).
SPI80MXXX for CLT panels with XXX = t_{CLT} = 200 mm : code **SPI80M200**.

CODE	cylinder D_{cyl} [mm]	bottom plate D_{bp} x t_{bp} [mm]	top plate D_{tp} x t_{tp} [mm]	weight [kg]	pcs
SPI60SXXX[1]	60	200 x 30	200 x 20[1]	52,2	1
SPI80SXXX	80	240 x 30	200 x 20	63,6	1
SPI80MXXX	80	280 x 30	240 x 30	73,1	1
SPI80LXXX	80	280 x 40	280 x 30	87,0	1
SPI100SXXX	100	240 x 30	240 x 20	74,9	1
SPI100MXXX	100	280 x 30	280 x 30	86,1	1
SPI120SXXX	120	280 x 30	280 x 30	91,6	1
SPI120MXXX	120	280 x 40	280 x 40	111.6	1
SPI100LXXX	100	240 x 20	not provided	64,6	1
SPI120LXXX	120	240 x 20	not provided	70.1	1

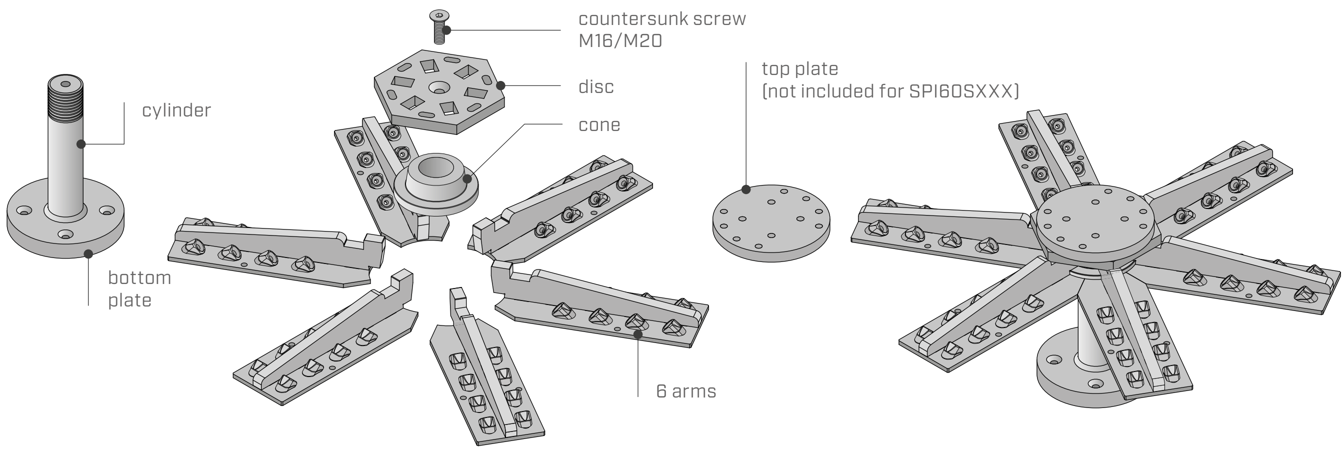
[1] SPI60S is supplied without top plate. This can be ordered separately with the code STP20020C.

XXX = t_{CLT} [mm]							
160	180	200	220	240	280	320	320



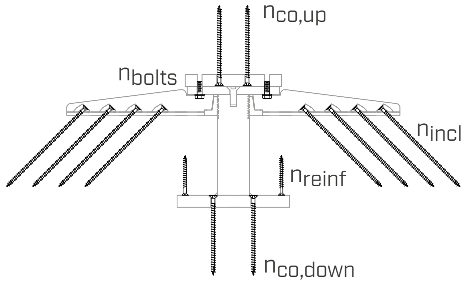
Also available for intermediate t_{CLT} thickness values not shown in the table.

Each code includes the following components:



CODES AND DIMENSIONS

NUMBER OF SCREWS FOR EACH CONNECTOR

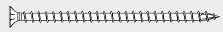


	SPI60S - SPI80S - SPI100S-SPI100L - SPI120L	SPI80M - SPI80L - SPI100M - SPI120S - SPI120M	
n_{incl}	48	48	VGS Ø9
$n_{co,up}$	4	4	VGS Ø11
$n_{co,down}$	4	4	VGS Ø11
n_{bolts}	4	4	SPBOLT1235 - SPROD1270
n_{reinf}	14	16	VGS Ø9

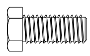
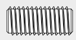
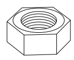
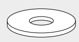
Screws and bolts not included in the package.
The n_{reinf} reinforcement screws are optional.

ADDITIONAL PRODUCTS - FASTENING

SCREWS

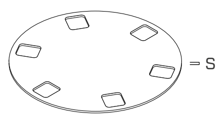
type	description		d [mm]	support
HBS PLATE	pan head screw		8	
VGS	fully threaded countersunk screw		9-11	

BOLTS - METRIC

CODE	description		d [mm]	L [mm]	SW [mm]
SPBOLT1235	hexagonal head bolt 8.8 DIN 933 EN 15048		M12	35	19
SPROD1270	threaded rod 8.8 DIN 976-1		M12	70	-
MUT93412	hexagonal nut class 8 DIN 934-M12		M12	-	19
ULS13242	DIN 125 washer				

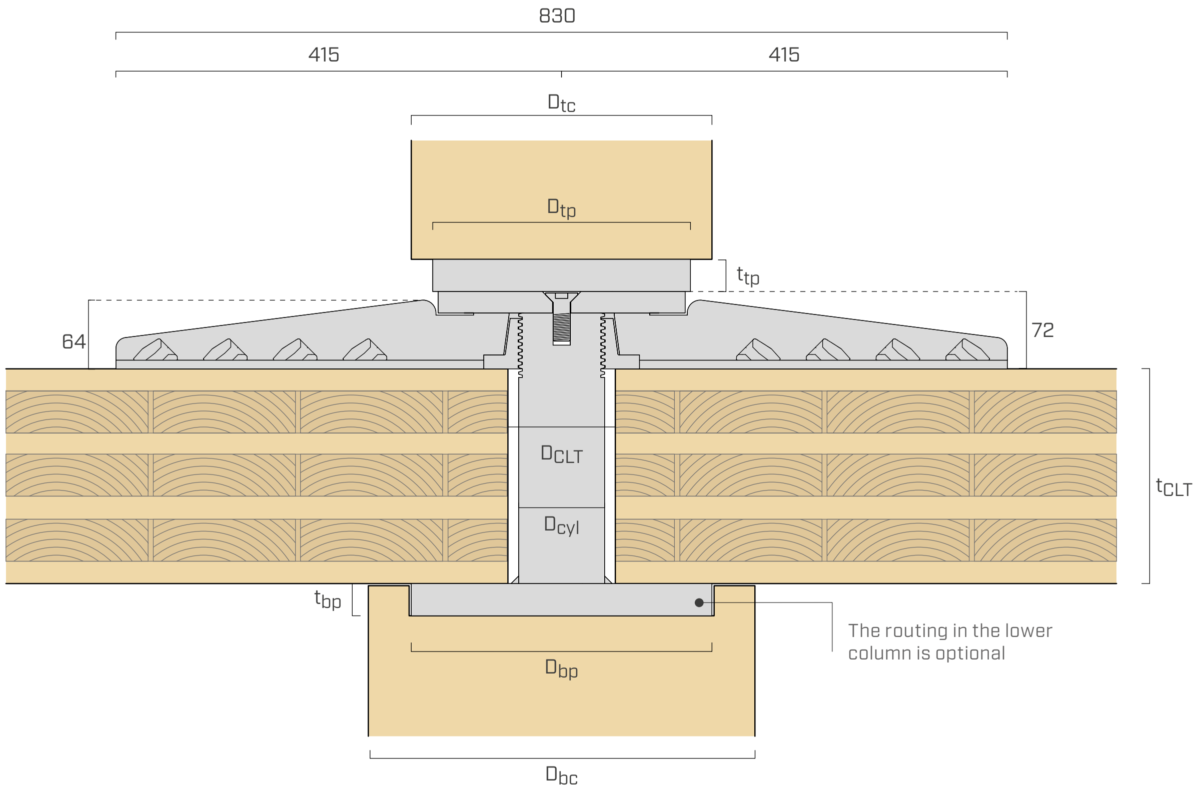
ASSEMBLY ACCESSORIES

CODE	description	s [mm]	pcs
SPISHIM10	levelling shim	1	20
SPISHIM20	levelling shim	2	10



The **data sheet** complete with **structural values** is available at www.rothoblaas.com

GEOMETRY AND MATERIALS



CONNECTOR

MODEL	bottom plate D_{bp} x t_{bp} [mm]			bottom plate shape	bottom plate material	cylinder D_{cyl} [mm]	cylinder material	disc material	top plate D_{tp} x t_{tp} [mm]			top plate shape	top plate material
SPI60S	200	x	30	○	S355	60	S355	S355	200	x	20	○[1]	S355
SPI80S	240	x	30	○	S355	80	S355	S355	200	x	20	○	S355
SPI80M	280	x	30	○	S690	80	S355	S355	240	x	30	○	S355
SPI80L	280	x	40	□	S690	80	S355	S355	280	x	30	○	S690
SPI100S	240	x	30	○	S690	100	S355	S355	240	x	20	○	S690
SPI100M	280	x	30	○	S690	100	S355	S355	280	x	30	○	S690
SPI120S	280	x	30	○	S690	120	S355	S355	280	x	30	○	S690
SPI120M	280	x	40	□	S690	120	S355	S355	280	x	40	□	S690
SPI100L	240	x	20	○	S690	100	1,7225	S690				-[2]	
SPI120L	240	x	20	○	S690	120	1,7225	S690				-[2]	

[1]SPI60S includes optional top plate.
[2]SPI100L and SPI120L provide for fastening on steel columns without using the top plate.

COLUMNS AND CLT PANELS

MODEL	upper column $D_{tc,min}$ [mm]	lower column $D_{bc,min}$ [mm]	CLT panel D_{CLT} [mm]	reinforcement (optional) D_{reinf} [mm]	reinforcement (optional) n_{reinf}
SPI60S	200	200	80	170	14
SPI80S	200	240	100	210	14
SPI80M	240	280	100	240	16
SPI80L	280	280	100	240	16
SPI100S	240	240	120	210	14
SPI100M	280	280	120	240	16
SPI120S	280	280	140	240	16
SPI120M	280	280	140	240	16
SPI100L	240	240	120	210	14
SPI120L	240	240	140	220	14

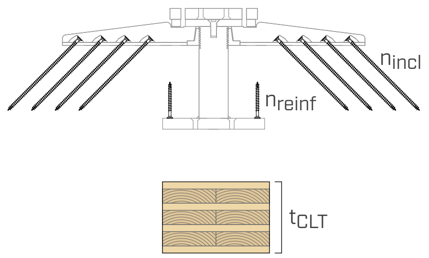
GEOMETRY AND MATERIALS

CHARACTERISTICS OF CLT PANELS

Parameter	160 mm ≤ t_{CLT} < 200 mm	t_{CLT} ≥ 200 mm
EI_x/EI_y	0.68 - 1.46	0.84 - 1.19
$GA_{z,x}/GA_{z,y}$	0,71 - 1,40	0.76 - 1.31
Min (EI_x, EI_y)	1525 kNm^2/m	3344 kNm^2/m
Min ($GA_{z,x}$, $GA_{z,y}$)	11945 kNm/m	17708 kNm/m
Lamellas thickness	≤ 40 mm	≤ 40 mm
B/t lamellas width - thickness ratio	≥ 3,5	≥ 3,5
Minimum strength class according to EN 338	C24/T14	C24/T14
Dimensional tolerance on CLT panel thickness	± 2 mm	± 2 mm
EI_x, EI_y	Flexural stiffness for x and y directions for the 1 m wide CLT panel	
$GA_{z,x}$, $GA_{z,y}$	Shear stiffness for x and y directions for the 1 m wide CLT panel	
x	Direction parallel to the upper lamellas grain	
y	Direction perpendicular to the upper lamellas grain	

CLT PANEL SCREWS

t_{CLT} [mm]	inclined screws n_{incl} [pcs - ØxL]	optional reinforcement screws n_{reinf} [pcs - ØxL]
160	48 VGS Ø9x200	VGS Ø9x100
180	48 VGS Ø9x240	VGS Ø9x100
200	48 VGS Ø9x280	VGS Ø9x100
220	48 VGS Ø9x280	VGS Ø9x120
240	48 VGS Ø9x320	VGS Ø9x120
280	48 VGS Ø9x360	VGS Ø9x140
320	48 VGS 9x400	VGS 9x160
320 (160 + 160)	48 VGS Ø9x400	VGS Ø9x160

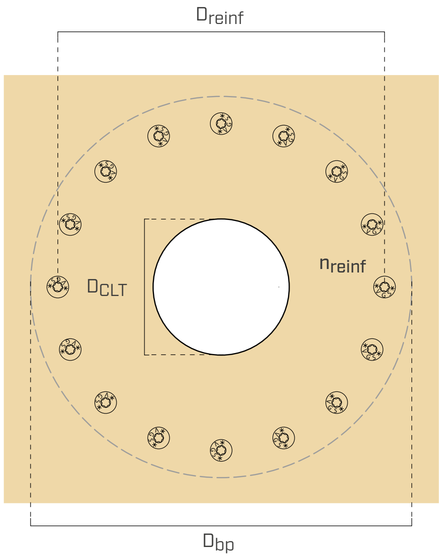


Rules for panel thickness values not included in the table:
- for inclined screws use the length provided for the panel with lower thickness;
- for the reinforcement screws use the length provided for the panel with greater thickness.

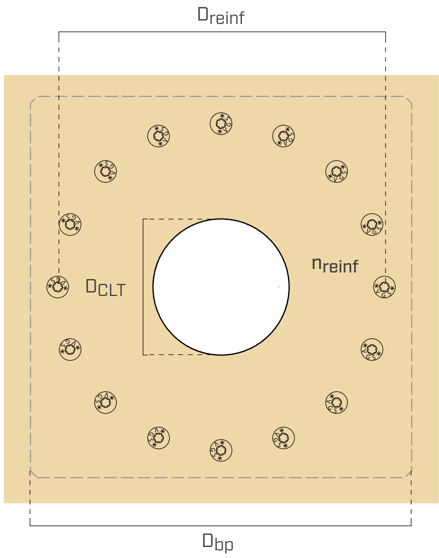
Example: for CLT panels with thickness of 250 mm we will use VGS Ø9x320 inclined screws and VGS Ø9x140 reinforcement screws.

REINFORCEMENT SCREWS (OPTIONAL)

circular bottom plate



rectangular bottom plate

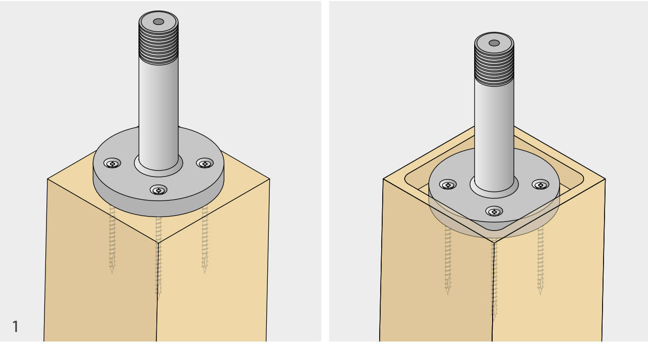


INTELLECTUAL PROPERTY

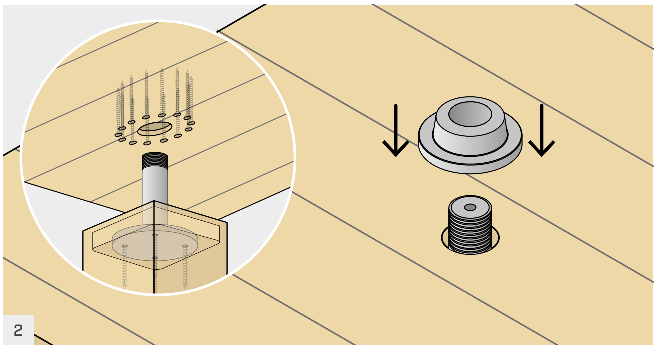
- SPIDER is protected by patent EP3.384.097B1.

MOUNTING

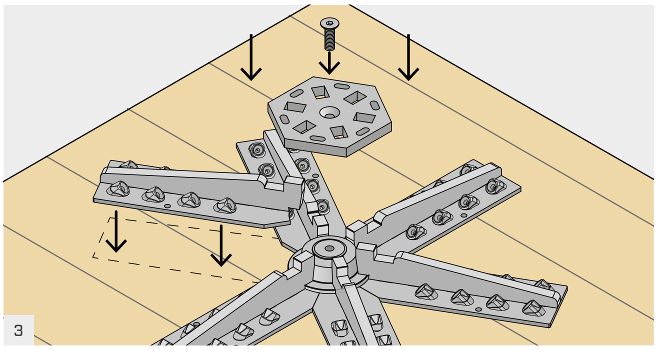
VIDEO



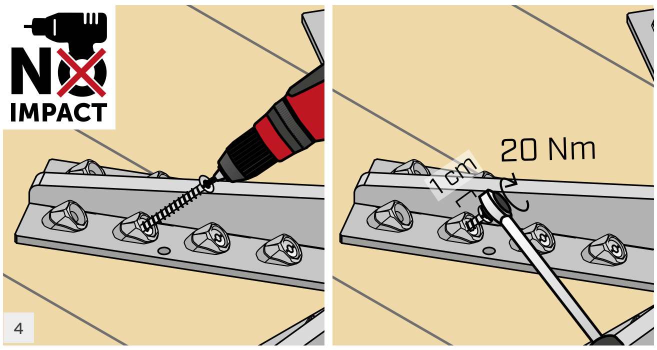
Fasten the bottom plate to the upper face of the column using the VGS Ø11 screws in accordance with the relevant installation instructions. It is possible to conceal the bottom plate in a routing prepared in the column. For installation on steel columns it is possible to use M12 countersunk head bolts. Use suitable countersunk head connectors in case of installation on reinforced concrete columns. To avoid eccentricity of the column axis line, it is essential to centre the base plate in relation to the column.



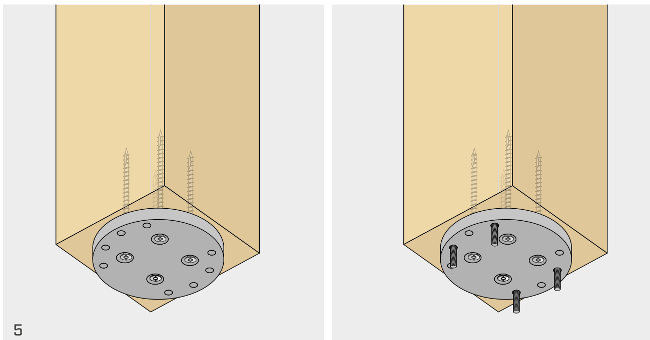
Fit the pre-drilled CLT panel with a circular hole of D_{CLT} diameter onto the cylinder. A compression reinforcement can be fitted to the bottom of the panel to increase strength. Screw the cone to the cylinder until it makes contact with the surface of the CLT panel.



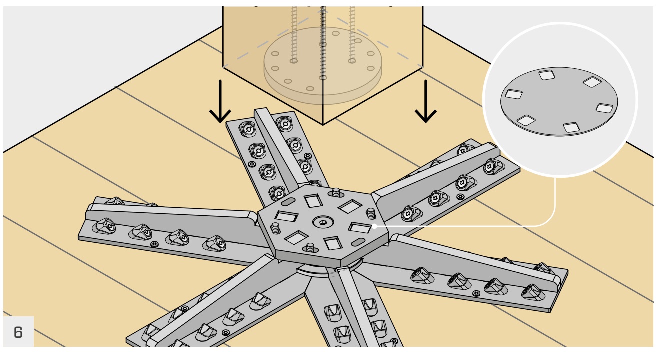
Place the 6 arms on the top surface of the CLT panel and cone. Insert the hexagonal disc in order to fit the 6 arms and fasten the countersunk head screw with a 10 or 12 mm male hexagonal wrench.



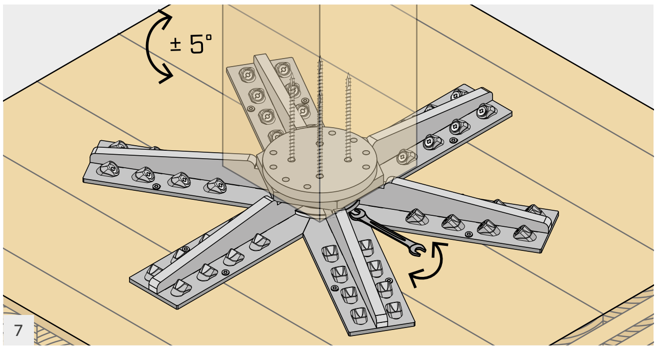
With a NON-PULSE screwdriver, insert the 48 VGS Ø9 screws inside the inclined washers, respecting the 45° insertion angle (use the JIGVGU945 pre-drilling template). Tighten by stopping about 1 cm from the washer and complete the screwing using a torque wrench by applying an insertion torque of 20 Nm.



Fasten the upper plate to the lower face of the column using the VGS Ø11 screws, in accordance with the relevant installation instructions. The top plate is equipped with suitable threaded holes for fastening to the hexagonal disc. If SPRODS are used, after positioning the plate on the upper column, they must be screwed in, taking care to mark the minimum pull-through length in the upper plate.



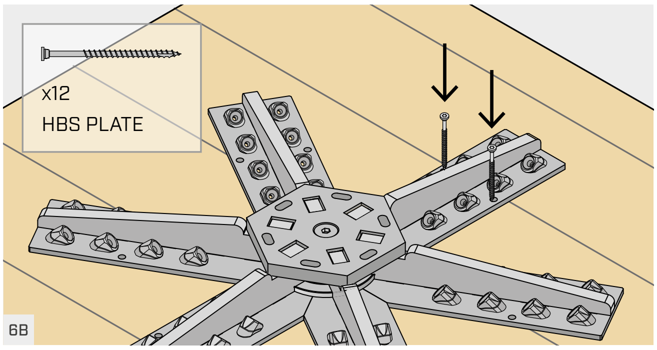
Place the upper column on the hexagonal disc and fasten it using 4 SPBOLT1235 bolts with ULS125 washer. If the option with SPRODS was chosen, the fastening is completed using a washer and a hexagonal nut. In the case of an upper steel column, the upper plate must not be used and the column must be equipped with a suitable steel plate with holes for fastening the 4 SPBOLT1235 or 4 SPROD bolts.
In the event of a misalignment of the column set-up dimension, e.g. due to cutting tolerances, it is possible to compensate for this by means of the SPISHIM10 (1mm) or SPISHIM20 (2mm) shims, or a combination of these two.



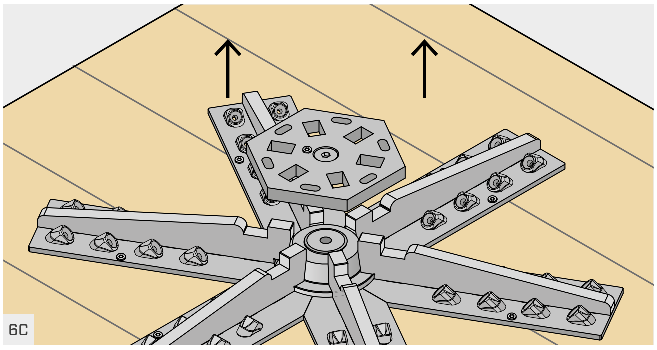
The slotted holes in the hexagonal disc allow the column to be rotated ±5°. Turn the column to the correct position and tighten the 4 SPBOLT1235 bolts or MUT hex nuts of the SPRODS using a side wrench.

SPECIAL INSTRUCTIONS FOR SPI100S - SPI100M - SPI100L - SPI120S - SPI120M - SPI120L

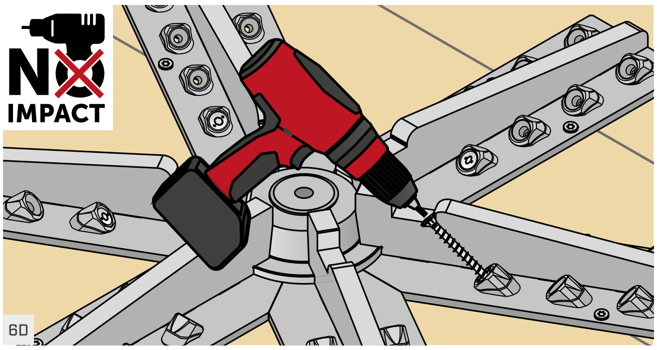
For SPIDER connectors with cylinder diameter D_{cyl} = 100 or 120 mm, the hexagonal disc dimension is increased.
In this case, the phase 6A must be replaced with phases 6B - 6F.



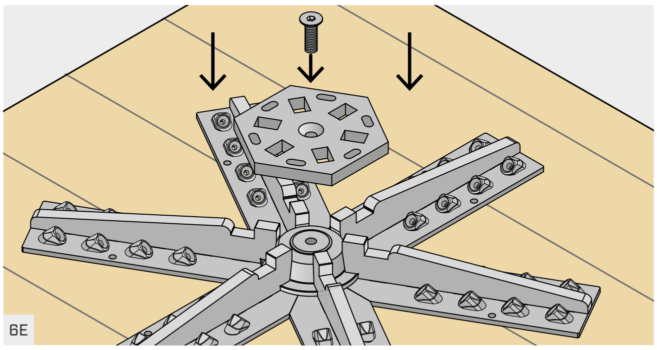
After inserting the hexagonal disc and countersunk head screw, insert 12 HBSP8120 screws into the 12 vertical holes provided in the 6 arms. These screws will hold the arms in place in the following phases.



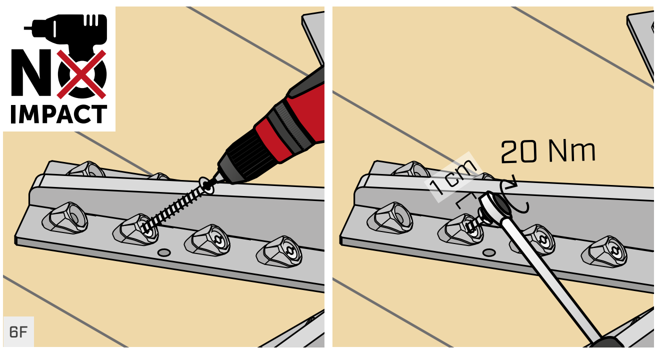
Unscrew the countersunk head screw and remove the hexagonal disc.



With a NON-PULSE screwdriver, insert the 12 VGS Ø9 screws inside the inclined washers closest to the cylinder, respecting the 45° insertion angle (use the JIGVGU945 pre-drilling template). Screw it in stopping about 1 cm from the washer.



Insert the hexagonal disc and secure the countersunk head screw with a 10 or 12 mm male hexagonal wrench.



With a NON-PULSE screwdriver, insert the remaining 36 VGS Ø9 screws inside the inclined washers, respecting the 45° insertion angle (use the JIGVGU945 pre-drilling template). Tighten by stopping about 1 cm from the washer and complete the screwing using a torque wrench by applying an insertion torque of 20 Nm.

CLT PANEL PRODUCTION AND INSTALLATION TOLERANCES

The connector is designed to adapt to CLT panel production and installation tolerances.

1. PRODUCTION TOLERANCE ON CLT PANEL THICKNESS of ±2 mm

   The cone must be screwed until it touches the surface of the CLT panel (surface C), while the disc must be installed in way to ensure contact with the cylinder (surface A).

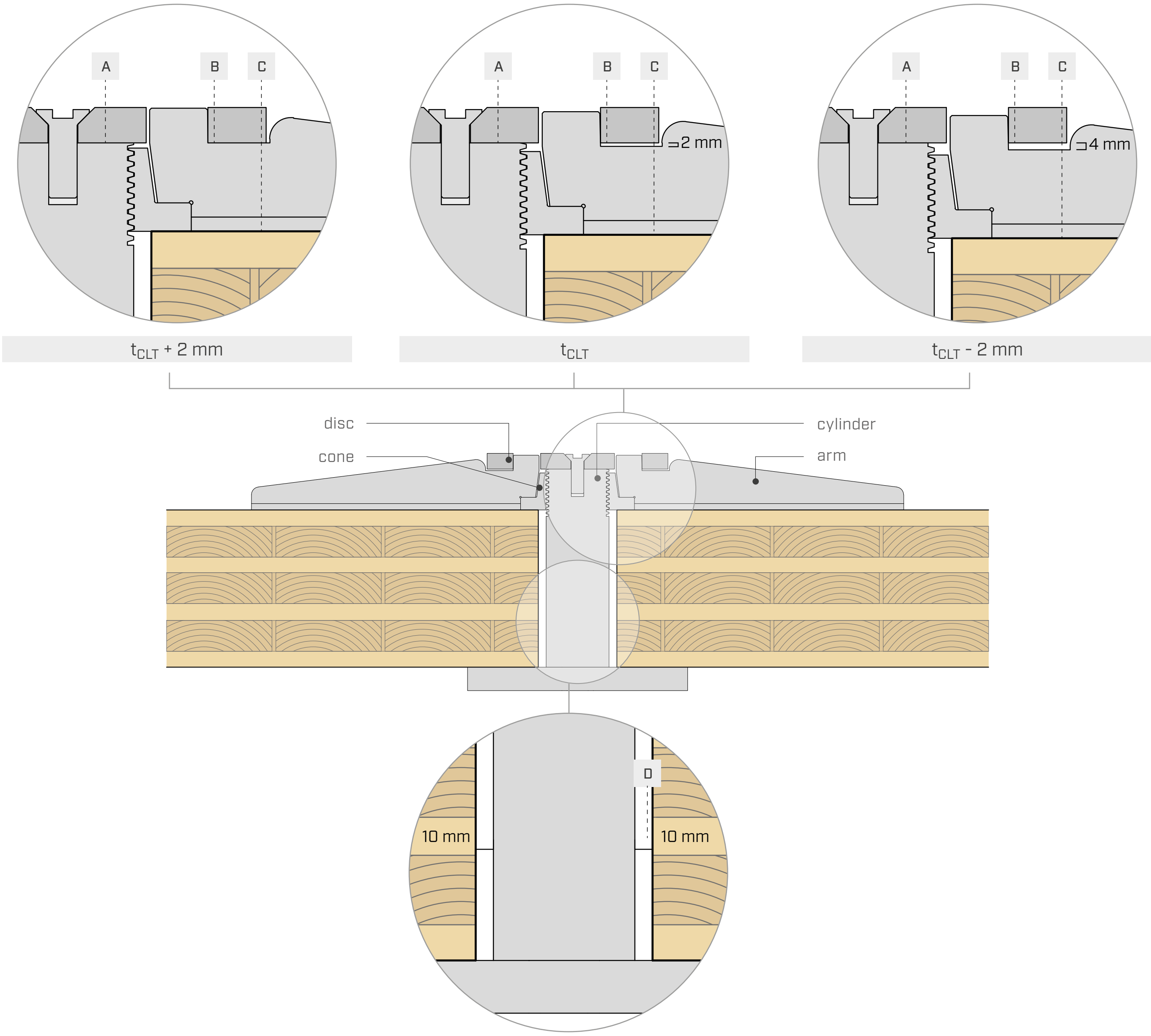
   The tolerance of ±2 mm is absorbed in the area B:

   - CLT thickness tolerance +2 mm ⟶ contact between disc and arm in the area B;
   - CLT tolerance thickness 0 mm ⟶ joint of 2 mm in the area B;
   - CLT tolerance thickness -2 mm ⟶ joint of 4 mm in the area B.

   The total height of the SPIDER remains constant regardless of the CLT panel production tolerance.
   In this way, the length of the columns is not affected by the CLT panels production tolerance.

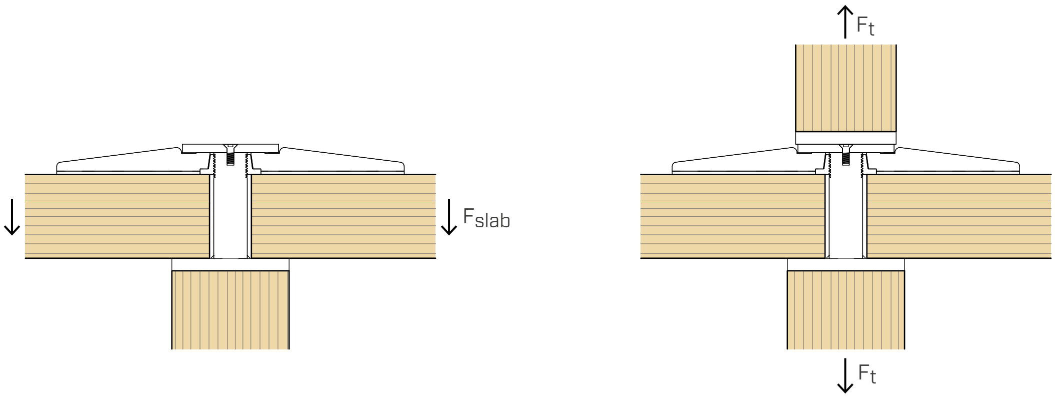
2. TOLERANCE OF ±10 mm ON THE FLOOR POSITIONING (area D)

   The hole in the CLT panel is increased by 20 mm to allow a slight offset between SPIDER and hole.



STRUCTURAL VALUES | PUNCHING SHEAR AND TENSION

STRESSES ON THE CONNECTOR



PUNCHING SHEAR STRENGTH - VALUES VALID FOR ALL SPIDER MODELS

t_{CLT} [mm]	with reinforcement $R_{slab,k}$ [kN]	with reinforcement k_{sus} (2)	without reinforcement $R_{slab,k}$ [kN]	without reinforcement k_{sus} (2)
160	463	0,60	419	0,70
180	545	0,60	494	0,70
200	627	0,60	568	0,70
220	709	0,60	642	0,70
240	791	0,60	717	0,70
280	791	0,60	717	0,70
320	791	0,60	717	0,70
160 + 160 (1)	616	0,36	558	0,46

TENSILE STRENGTH - VALUES VALID FOR ALL SPIDER MODELS

Upper/lower column screws [pcs - ØxL]	$F_{t,k}$ [kN] C24 (3)	GL24h (4)	GL28h (5)	GL32h (6)
4 VGS Ø11x250	34,60	37,32	40.38	41.54
4 VGS Ø11x400	56,20	60,65	65.64	67.49

NOTES:

(1) The 160 + 160 configuration refers to installation with crossed CLT panels.

(2) The k_{sus} coefficient expresses the ratio between the load applied by the inclined screws by tension and the load discharged on the bottom plate by compression.

(3) Values calculated according to ETA-11/0030. A C24 solid timber column with ρ_k = 350 kg/m^3 has been considered in the calculation.

(4) Values calculated according to ETA-11/0030. A GL24h glulam column with ρ_k = 385 kg/m^3 has been considered in the calculation.

(5) Values calculated according to ETA-11/0030. A GL28h glulam column with ρ_k = 425kg/m^3 has been considered in the calculation.

(6) Values calculated according to ETA-11/0030. A GL32h glulam column with ρ_k = 440kg/m^3 has been considered in the calculation.

GENERAL PRINCIPLES:

- For t_{CLT} panel thickness intermediate to those listed in the table, it is recommended to use the strength values provided for the lower thickness.
- The design values are obtained from the characteristic values as follows: The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation. The γ_M coefficient is the relevant safety coefficient on connections side.

$$R_{slab,d} = \frac{R_{slab,k} \cdot k_{mod}}{\gamma_M}$$

$$R_{t,d} = \frac{R_{t,k} \cdot k_{mod}}{\gamma_M}$$

- The following expressions must be fulfilled for the verifications:

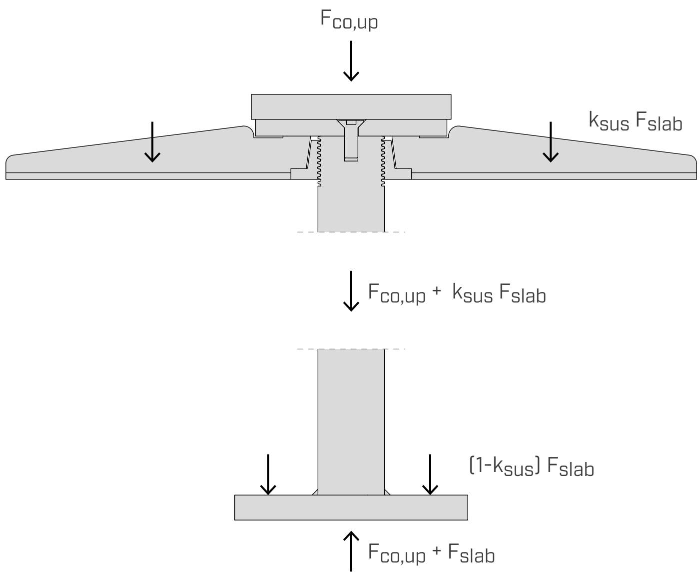
$$\frac{F_{slab,d}}{R_{slab,d}} \leq 1{,}0$$

$$\frac{F_{t,d}}{R_{t,d}} \leq 1{,}0$$

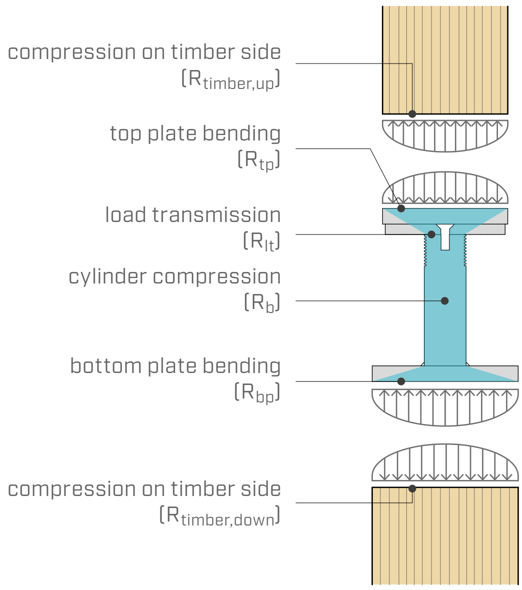
- The punching shear strength of the floor ($F_{slab,d}$) includes the verification of all the SPIDER reinforcement components (reinforcement arms and screws) as well as the shear and rolling shear strength of the CLT panel in the area affected by the presence of the support. The Ultimate Limit State and the Service Limit State on the floor panels must be checked by the designer.

STRUCTURAL VALUES | LOAD TRANSMISSION

STRESSES ON THE CONNECTOR



FAILURE MECHANISMS AND VERIFICATIONS



SPIDER SPI60S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(5)	450	γ_{M0}(1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	663	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	907	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$(5)	706	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
C24	595	660
GL24h	680	754
GL28h	794	880
GL32h(3)	907	1005

SPIDER SPI80S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(6)	655	γ_{M0}(1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	1626	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$
Bottom plate	$R_{bp,k}$(6)	939	γ_{M0}(1)	$F_{co,up,d} + k_{sus}\ F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	754	1086
GL28h	880	1267
GL32h(3)	1005	1448

SPIDER SPI80M

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(6)	939	γ_{M0}(1)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	1626	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$(6)	1761	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	1086	1426
GL28h	1267	1663
GL32h(3)	1448	1901

SPIDER SPI80L

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(6)	1761	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	1286	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	1626	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$(6)	2350	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL24h	1426	1802
GL28h	1663	2102
GL32h(3)	1901	2402

SPIDER SPI100S

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(7)	1689	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2031	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	2474	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$(7)	2519	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1163	1267
GL32h	1330	1448
LVL GL75(4)	2280	2977

SPIDER SPI100M

STRENGTH ON STEEL SIDE

Controls		strength $R_{steel,k}$ [kN]	γ_{steel}	stress
Top plate	$R_{tp,k}$(7)	2394	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2031	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$(8)	2474	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$(7)	2394	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$ [kN]	$R_{timber,down,k}$ [kN]
GL28h	1724	1724
GL32h	1970	1970
LVL GL75(4)	3748	3748

SPIDER SPI120S

STRENGTH ON STEEL SIDE

Controls		strength		stress
		$R_{steel,k}$		
		[kN]	γ_{steel}	
Top plate	$R_{tp,k}$ (7)	3034	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2856	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	3034	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL28h	1724	1724
GL32h	1970	1970
LVL GL75(4)	4184	4184

SPIDER SPI120M

STRENGTH ON STEEL SIDE

Controls		strength		stress
		$R_{steel,k}$		
		[kN]	γ_{steel}	
Top plate	$R_{tp,k}$ (7)	3976	γ_{M0}*(2)	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	2856	γ_{M0}(1)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	3336	γ_{M0}(1)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate	$R_{bp,k}$ (7)	3976	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$

STRENGTH ON TIMBER SIDE

Strength class	$R_{timber,up,k}$	$R_{timber,down,k}$
	[kN]	[kN]
GL28h	2188	2188
GL32h	2501	2501
LVL GL75(4)	5101	5101

SPI100L and SPI120L are optimised for use with steel columns. In this case the top plate is not present.

SPIDER SPI100L

STRENGTH ON STEEL SIDE

Controls		strength		stress
		$R_{steel,k}$		
		[kN]	γ_{steel}	
Top plate(9)	$R_{tp,k}$	-	-	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	4190	γ_{M0}*(2)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	5010	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate(10)	$R_{bp,k}$	-	-	$F_{co,up,d} + k_{sus} F_{slab,d}$

SPIDER SPI120L

STRENGTH ON STEEL SIDE

Controls		strength		stress
		$R_{steel,k}$		
		[kN]	γ_{steel}	
Top plate(9)	$R_{tp,k}$	-	-	$F_{co,up,d}$
Load transmission	$R_{lt,k}$	5325	γ_{M0}*(2)	$F_{co,up,d}$
Cylinder compression	$R_{b,k}$ (8)	6220	γ_{M0}*(2)	$F_{co,up,d} + k_{sus} F_{slab,d}$
Bottom plate(10)	$R_{bp,k}$	-	-	$F_{co,up,d} + k_{sus} F_{slab,d}$

NOTES:

(1) The coefficient γ_{M0} corresponds to the partial coefficient for steel S355 sections strength and it should be taken according to the current regulations used for the calculation. For example, according to EN 1995-1-1 it is to be considered as 1,00.

(2) The coefficient γ_{M0}* corresponds to the partial coefficient for steels section strength not covered by EN 1993-1-1. This should be taken according to the current regulations used for the calculation. In the absence of normative indications, it is recommended to use a value γ_{M0}*=1,10.

(3) The SPIDER connector model in question is optimized for use with GL32h glulam columns. Materials of inferior characteristics may be used; in this case, the metal components of the connector will be oversized.

(4) The SPIDER connector model in question is optimized for use with LVL GL75 timber columns in accordance with ETA-14/0354. Materials of inferior characteristics may be used; in this case, the metal components of the connector will be oversized.

(5) For safety reasons, the strength is calculated using a k_{steel} coefficient valid for timber columns C24. The same value can be used for GL24h, GL28h and GL32h columns.

(6) The strength is calculated using a k_{steel} coefficient valid for GL32h timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(7) The strength is calculated using a k_{steel} coefficient valid for GL75 timber columns. If other materials are used for columns, the strength must be calculated with reference to ETA-19/0700.

(8) The compressive strength of the cylinder has been calculated for a panel height of 320 mm. In all other cases, the same value can be used for safety purposes.

(9) The connector is supplied without top plate. The steel column can be connected directly to the SPIDER connector through 4 M12 bolts. The top column must be equipped with a plate, dimensioned by the designer, suitable to transfer the load to the SPIDER connector.

(10) The bottom plate of the SPIDER connector is not dimensioned to spread the load on the lower steel column. This must be equipped with a plate, dimensioned by the designer, suitable to receive the load from the SPIDER connector.

GENERAL PRINCIPLES:

- The design values on timber side can be obtained from the characteristic values as follows. The coefficients γ_{MT} and k_{mod} should be taken according to the current regulations used for the calculation. The coefficient γ_{MT} is the relevant safety coefficient of timber.

$$R_{timber,up,d} = \frac{R_{timber,up,k} \cdot k_{mod}}{\gamma_{MT}}$$

$$R_{timber,down,d} = \frac{R_{timber,down,k} \cdot k_{mod}}{\gamma_{MT}}$$

- The design values on steel side can be obtained from the characteristic values as follows. The coefficients γ_{steel} should be taken according to the current regulations used for the calculation (see notes 1 and 2).

$$R_{tp,d} = \frac{R_{tp,k}}{\gamma_{steel}} \qquad R_{lt,d} = \frac{R_{lt,k}}{\gamma_{steel}}$$

$$R_{b,d} = \frac{R_{b,k}}{\gamma_{steel}} \qquad R_{bp,d} = \frac{R_{bp,k}}{\gamma_{steel}}$$

- The following expressions must be fulfilled for the verifications:

$$\frac{F_{co,up,d}}{min\,\{R_{timber,up,d}\,;R_{tp,d}\,;R_{lt,d}\}} \leq 1{,}0$$

$$\frac{F_{co,up,d} + k_{sus} \cdot F_{slab,d}}{min\,\{R_{b,d}\,;R_{bp,d}\}} \leq 1{,}0$$

$$\frac{F_{co,up,d} + F_{slab,d}}{R_{timber,down,d}} \leq 1{,}0$$

- The checks on the column side refer to the compressive strength parallel to the fiber, at the SPIDER connector. Column instability must be verified separately.