HBS HARDWOOD

COUNTERSUNK SCREW FOR HARDWOODS

UKCA UKTA-0836 22/6195

CE ETA-11/0030

HARDWOOD CERTIFICATION

Special tip with diamond geometry and notched, serrated thread. ETA-11/0030 certification for use with high density timber without any pre-drill. Approved for structural applications subject to stresses in any direction vs the grain (α = 0° - 90°).

INCREASED DIAMETER

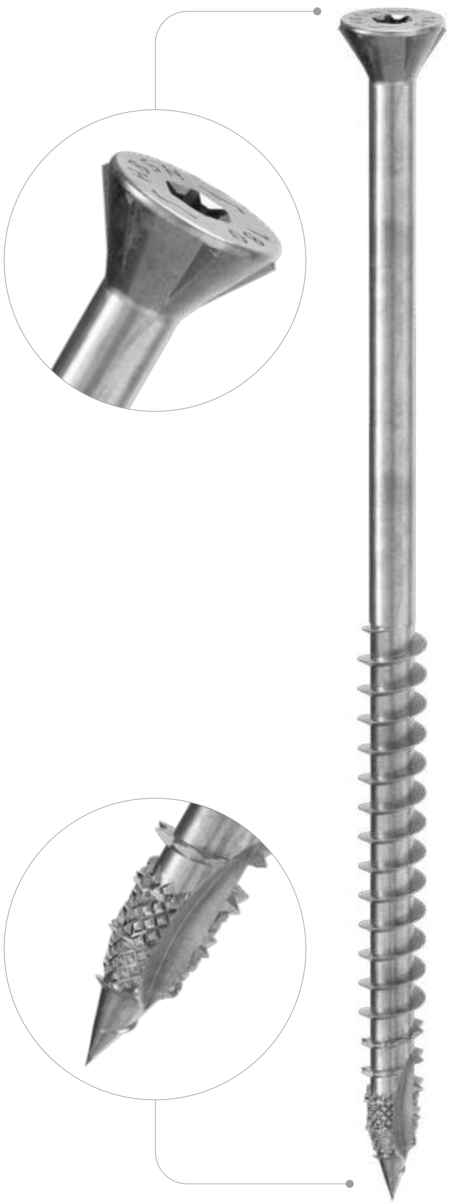
Internal thread diameter increased to ensure tightening in the highest density woods. Excellent twisting moment values. HBS H Ø6 mm, comparable to a diameter of 7 mm; HBS H Ø8 mm, comparable to a diameter of 9 mm.

60° COUNTERSUNK HEAD

Concealed head, 60°, for effective, minimally invasive insertion, even in high density woods.

HYBRID SOFTWOOD-HARDWOOD

Approved for different types of applications without the need for pre-drill hole with softwood and hardwood used simultaneously. For example: composite beam (softwood and hardwood) and hybrid engineered timbers (softwood and hardwood).

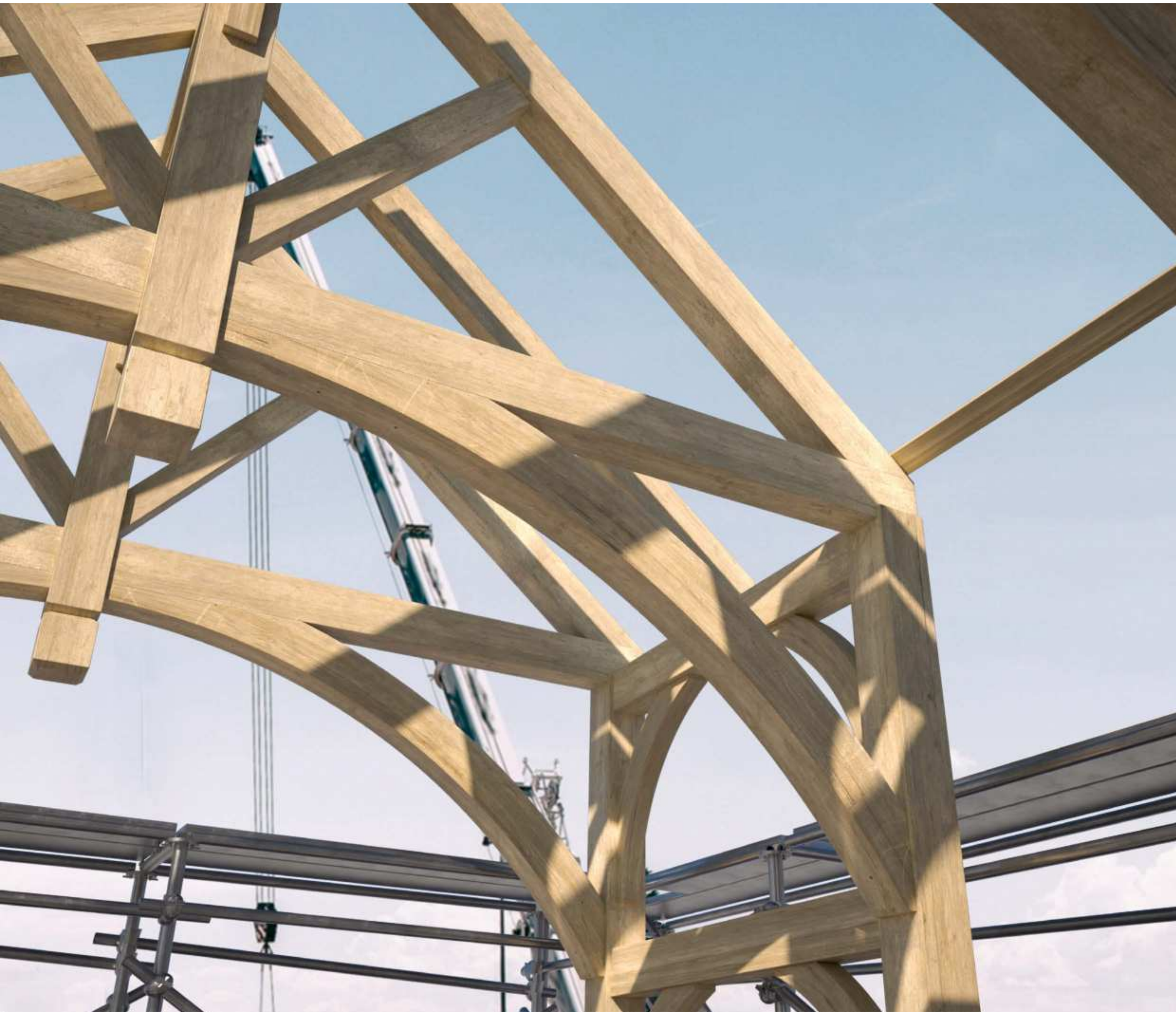


BIT INCLUDED

DIAMETER [mm]	3 — 6 – 8 — 12
LENGTH [mm]	12 — 80 – 480 — 1000
SERVICE CLASS	SC1 SC2
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED electrogalvanized carbon steel

FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- beech, oak, cypress, ash, eucalyptus, bamboo



HARDWOOD PERFORMANCE

Geometry developed for high performance and use without pre-drilling on structural woods such as beech, oak, cypress, ash, eucalyptus, bamboo.

BEECH LVL

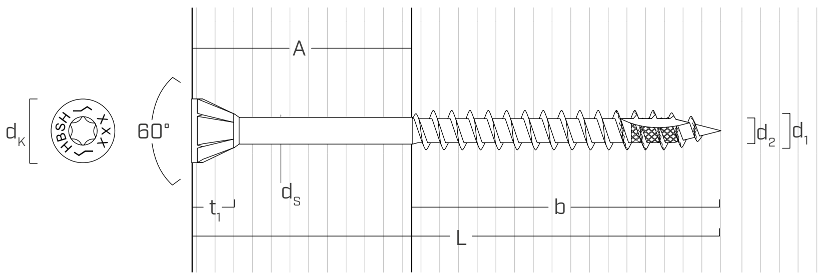
Values also tested, certified and calculated for high density woods such as beechwood Microllam® LVL. Certified for use without pre-drilling, for densities of up to 800 kg/m^3.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
6 TX 30	**HBSH680**	80	50	30	100
	HBSH6100	100	60	40	100
	HBSH6120	120	70	50	100
	HBSH6140	140	80	60	100
	HBSH6160	160	90	70	100

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
8 TX 40	**HBSH8120**	120	70	50	100
	HBSH8140	140	80	60	100
	HBSH8160	160	90	70	100
	HBSH8180	180	100	80	100
	HBSH8200	200	100	100	100
	HBSH8220	220	100	120	100
	HBSH8240	240	100	140	100
	HBSH8280	280	100	180	100
	HBSH8320	320	100	220	100
	HBSH8360	360	100	260	100
	HBSH8400	400	100	300	100
	HBSH8440	440	100	340	100
	HBSH8480	480	100	380	100

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	**[mm]**	**6**	**8**
Head diameter	d_K	[mm]	12,00	14,50
Thread diameter	d_2	[mm]	4,50	5,90
Shank diameter	d_S	[mm]	4,80	6,30
Head thickness	t_1	[mm]	7,50	8,40
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	4,0	5,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	6,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

CHARACTERISTIC MECHANICAL PARAMETERS

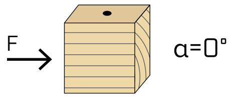
Nominal diameter	d_1	**[mm]**	**6**	**8**
Tensile strength	$f_{tens,k}$	[kN]	18,0	32,0
Yield moment	$M_{y,k}$	[Nm]	15,8	33,4

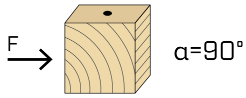
			softwood *(softwood)*	**oak, beech** *(hardwood)*	**ash** *(hardwood)*	**beech LVL** *(Beech LVL)*
Withdrawal resistance parameter	$f_{ax,k}$	[N/mm²]	11,7	22,0	30,0	42,0
Head-pull-through parameter	$f_{head,k}$	[N/mm²]	10,5	28,0 (d_1 = 6 mm) 24,0 (d_1 = 8 mm)	28,0 (d_1 = 6 mm) 24,0 (d_1 = 8 mm)	50,0
Associated density	ρ_a	[kg/m³]	350	530	530	730
Calculation density	ρ_k	*[kg/m³]*	*≤ 440*	*≤ 590*	*≤ 590*	*590 ÷ 750*

For applications with different materials please see ETA-11/0030.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

screws inserted **WITHOUT pre-drilled hole** $\rho_k > 420\ kg/m^3$



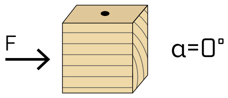


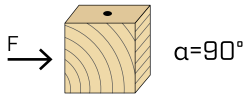
d_1	[mm]		6	8
a_1	[mm]	15·d	90	120
a_2	[mm]	7·d	42	56
$a_{3,t}$	[mm]	20·d	120	120
$a_{3,c}$	[mm]	15·d	90	80
$a_{4,t}$	[mm]	7·d	42	40
$a_{4,c}$	[mm]	7·d	42	40

d_1	[mm]		6	8
a_1	[mm]	7·d	42	56
a_2	[mm]	7·d	42	56
$a_{3,t}$	[mm]	15·d	90	120
$a_{3,c}$	[mm]	15·d	90	120
$a_{4,t}$	[mm]	12·d	72	96
$a_{4,c}$	[mm]	7·d	42	56

α = load-to-grain angle
d = d_1 = nominal screw diameter

screws inserted **WITH pre-drilled hole**



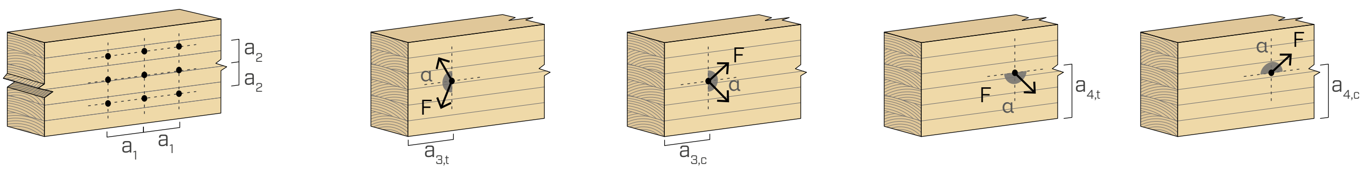


d_1	[mm]		6	8
a_1	[mm]	5·d	30	40
a_2	[mm]	3·d	18	24
$a_{3,t}$	[mm]	12·d	72	96
$a_{3,c}$	[mm]	7·d	42	56
$a_{4,t}$	[mm]	3·d	18	24
$a_{4,c}$	[mm]	3·d	18	24

d_1	[mm]		6	8
a_1	[mm]	4·d	24	32
a_2	[mm]	4·d	24	32
$a_{3,t}$	[mm]	7·d	42	56
$a_{3,c}$	[mm]	7·d	42	56
$a_{4,t}$	[mm]	7·d	42	56
$a_{4,c}$	[mm]	3·d	18	24

α = load-to-grain angle
d = d_1 = nominal screw diameter

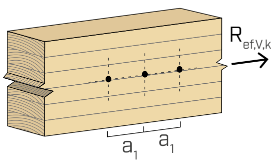
stressed end -90° < α < 90° | unloaded end 90° < α < 270° | stressed edge 0° < α < 180° | unload edge 180° < α < 360°



NOTE on page 66.

EFFECTIVE NUMBER FOR SHEAR LOADS

The load-bearing capacity of a connection made with several screws, all of the same type and size, may be lower than the sum of the load-bearing capacities of the individual connection system.
For a row of n screws arranged parallel to the direction of the grain at a distance a_1, the characteristic effective load-bearing capacity is equal to:



$$R_{ef,V,k} = n_{ef} \cdot R_{V,k}$$

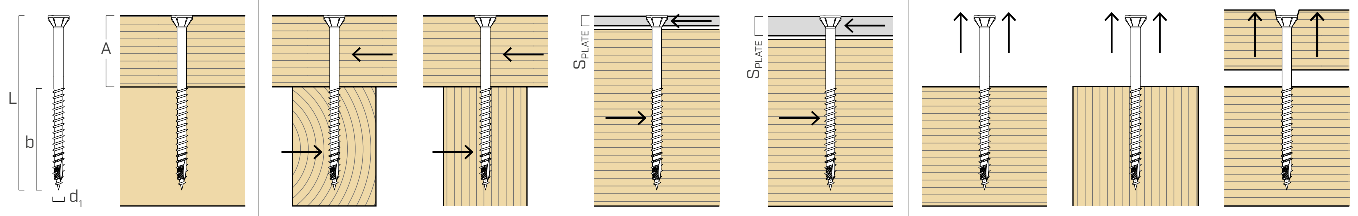
The n_{ef} value is given in the table below as a function of n and a_1.

		a_1(*)										
		4·d	5·d	6·d	7·d	8·d	9·d	10·d	11·d	12·d	13·d	≥ 14·d
n	2	1,41	1,48	1,55	1,62	1,68	1,74	1,80	1,85	1,90	1,95	2,00
	3	1,73	1,86	2,01	2,16	2,28	2,41	2,54	2,65	2,76	2,88	3,00
	4	2,00	2,19	2,41	2,64	2,83	3,03	3,25	3,42	3,61	3,80	4,00
	5	2,24	2,49	2,77	3,09	3,34	3,62	3,93	4,17	4,43	4,71	5,00

(*)For intermediate a_1 values a linear interpolation is possible.

STRUCTURAL VALUES | TIMBER(SOFTWOOD)

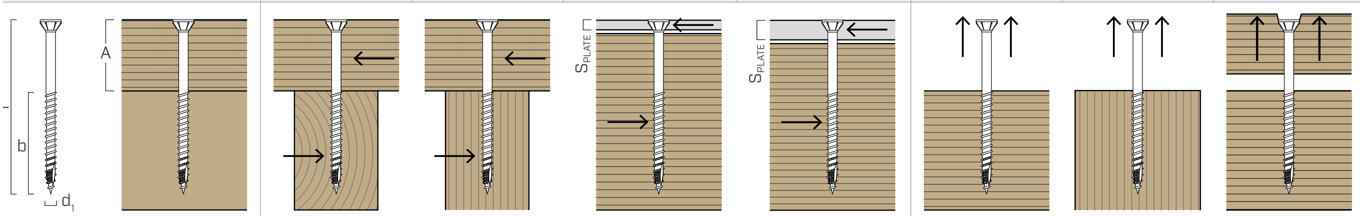
CHARACTERISTIC VALUES
EN 1995:2014



geometry				SHEAR timber-to-timber ε=90°	SHEAR timber-to-timber ε=0°	SHEAR steel-to-timber thin plate		SHEAR steel-to-timber thick plate		TENSION thread withdrawal ε=90°	TENSION thread withdrawal ε=0°	TENSION head pull-through
d_1 [mm]	L [mm]	b [mm]	A [mm]	$R_{V,90,k}$ [kN]	$R_{V,0,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{head,k}$ [kN]
	80	50	30	2,07	1,37		3,10		3,99	3,79	1,14	1,63
	100	60	40	2,35	1,70		3,29		4,18	4,55	1,36	1,63
6	120	70	50	2,56	1,89	3	3,48	6	4,37	5,30	1,59	1,63
	140	80	60	2,56	2,03		3,67		4,56	6,06	1,82	1,63
	160	90	70	2,56	2,03		3,86		4,75	6,82	2,05	1,63
	120	70	50	3,62	2,58		5,23		6,66	7,07	2,12	2,38
	140	80	60	4,00	2,79		5,48		6,91	8,08	2,42	2,38
	160	90	70	4,05	2,95		5,73		7,16	9,09	2,73	2,38
	180	100	80	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	200	100	100	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	220	100	120	4,05	3,13		5,98		7,42	10,10	3,03	2,38
8	240	100	140	4,05	3,13	4	5,98	8	7,42	10,10	3,03	2,38
	280	100	180	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	320	100	220	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	360	100	260	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	400	100	300	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	440	100	340	4,05	3,13		5,98		7,42	10,10	3,03	2,38
	480	100	380	4,05	3,13		5,98		7,42	10,10	3,03	2,38

ε = screw-to-grain angle

STRUCTURAL VALUES | HARDWOOD



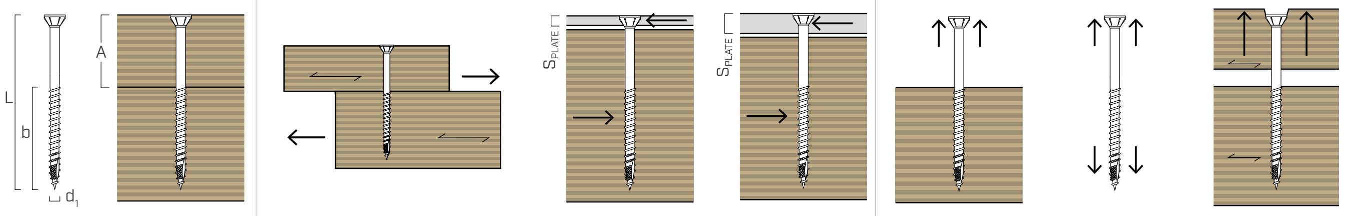
geometry				SHEAR hardwood-hardwood ε=90°	SHEAR hardwood-hardwood ε=0°	SHEAR steel-hardwood thin plate		SHEAR steel-hardwood thick plate		TENSION thread withdrawal ε=90°	TENSION thread withdrawal ε=0°	TENSION head pull-through
d_1 [mm]	L [mm]	b [mm]	A [mm]	$R_{V,90,k}$ [kN]	$R_{V,0,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	S_{PLATE} [mm]	$R_{V,k}$ [kN]	$R_{ax,90,k}$ [kN]	$R_{ax,0,k}$ [kN]	$R_{head,k}$ [kN]
	80	50	30	3,21	2,06		4,27		5,33	6,80	2,04	4,15
	100	60	40	3,61	2,42		4,61		5,67	8,16	2,45	4,15
6	120	70	50	3,61	2,66	3	4,95	6	6,01	9,52	2,86	4,15
	140	80	60	3,61	2,76		5,14		6,35	10,88	3,26	4,15
	160	90	70	3,61	2,86		5,14		6,69	12,24	3,67	4,15
	120	70	50	5,35	3,65		7,31		9,02	12,69	3,81	5,20
	140	80	60	5,43	4,02		7,76		9,47	14,50	4,35	5,20
	160	90	70	5,43	4,35		8,21		9,92	16,32	4,89	5,20
8	180	100	80	5,43	4,42	4	8,27	8	10,38	18,13	5,44	5,20
	200	100	100	5,43	4,42		8,27		10,38	18,13	5,44	5,20
	220	100	120	5,43	4,42		8,27		10,38	18,13	5,44	5,20
	240	100	140	5,43	4,42		8,27		10,38	18,13	5,44	5,20

ε = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 66.

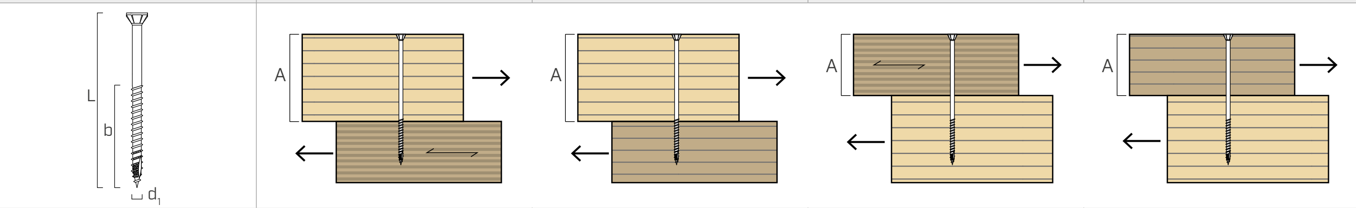
STRUCTURAL VALUES | BEECH LVL

CHARACTERISTIC VALUES
EN 1995:2014



				SHEAR					TENSION		
geometry				beech LVL-beech LVL	steel-beech LVL thin plate		steel-beech LVL thick plate		thread withdrawal	steel tension	head pull-through
d_1	L	b	A	$R_{V,90,k}$	S_{PLATE}	$R_{V,k}$	S_{PLATE}	$R_{V,k}$	$R_{ax,90,k}$	$R_{tens,k}$	$R_{head,k}$
[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]	[kN]	[kN]	[kN]
6	80	50	30	5,19	3	6,54	6	7,94	12,60	18,00	7,20
	100	60	40	5,19		6,77		8,57	15,12		7,20
	120	70	50	5,19		6,77		9,20	17,64		7,20
	140	80	60	5,19		6,77		9,29	20,16		7,20
	160	90	70	5,19		6,77		9,29	22,68		7,20
8	120	70	50	8,19	4	11,13	8	13,75	23,52	32,00	10,51
	140	80	60	8,19		11,13		14,59	26,88		10,51
	160	90	70	8,19		11,13		15,43	30,24		10,51
	180	100	80	8,19		11,13		15,74	33,60		10,51
	200	100	100	8,19		11,13		15,74	33,60		10,51
	220	100	120	8,19		11,13		15,74	33,60		10,51
	240	100	140	8,19		11,13		15,74	33,60		10,51

STRUCTURAL VALUES | HYBRID CONNECTIONS



			SHEAR							
geometry			timber-beech LVL		timber-hardwood		beech LVL-timber		hardwood-timber	
d_1	L	b	A	$R_{V,k}$	A	$R_{V,k}$	A	$R_{V,k}$	A	$R_{V,k}$
[mm]	[mm]	[mm]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
6	80	50	30	2,31	30	2,18	30	3,50	30	2,97
	100	60	40	2,61	40	2,61	40	3,70	40	3,37
	120	70	50	2,96	50	2,74	50	3,89	50	3,37
	140	80	60	2,98	60	2,74	60	4,08	60	3,37
	160	90	70	2,98	70	2,74	70	4,27	70	3,37
8	120	70	50	4,06	50	4,06	50	5,92	50	5,05
	140	80	60	4,47	60	4,35	60	6,17	60	5,05
	160	90	70	4,75	70	4,35	70	6,43	70	5,05
	180	100	80	4,75	80	4,35	80	6,68	80	5,05
	200	100	100	4,75	100	4,35	100	6,68	100	5,05
	220	100	120	4,75	120	4,35	120	6,68	120	5,05
	240	100	140	4,75	140	4,35	120	6,68	120	5,05
	280	100	180	4,75	180	4,35	120	6,68	120	5,05
	320	100	220	4,75	220	4,35	120	6,68	120	5,05
	360	100	260	4,75	260	4,35	120	6,68	120	5,05
	400	100	300	4,75	300	4,35	120	6,68	120	5,05
	440	100	340	4,75	340	4,35	120	6,68	120	5,05
	480	100	380	4,75	380	4,35	120	6,68	120	5,05

NOTES and GENERAL PRINCIPLES on page 66.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- Design values can be obtained from characteristic values as follows:

$$R_d = \frac{R_k \cdot k_{mod}}{\gamma_M}$$

  The coefficients γ_M and k_{mod} should be taken according to the current regulations used for the calculation.
- The tensile design strength of the connector is the lower between the timber-side design strength ($R_{ax,d}$) and the steel-side design strength ($R_{tens,d}$).

$$R_{ax,d} = min \begin{cases} \frac{R_{ax,k} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{tens,k}}{\gamma_{M2}} \end{cases}$$

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- Sizing and verification of the timber elements and metal plates must be done separately.
- The screws must be positioned in accordance with the minimum distances.
- Shear strengths were calculated considering the threaded part fully inserted in the second element.
- The characteristic plate shear strengths are evaluated considering the case of thin plate (S_{PLATE} = 0.5 d_1) and thick plate (S_{PLATE} = d_1) .
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to b.
- The head pull-through characteristic strength was calculated using timber elements.
  In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or pull-through.
- A suitable pilot hole may be required for the insertion of some connectors. For further details please see ETA-11/0030.

NOTES | TIMBER (SOFTWOOD)

- The characteristic timber-to-timber shear strengths were evaluated considering both an ε angle of 90° ($R_{V,90,k}$) and 0° ($R_{V,0,k}$) between the grains of the second element and the connector.
- The characteristic steel-timber shear strengths were evaluated considering an angle ε of 90° between the grains of the timber element and the connector.
- The characteristic shear resistances are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- The characteristic thread withdrawal resistances were evaluated considering both an ε angle of 90° ($R_{ax,90,k}$) and of 0° ($R_{ax,0,k}$) between the grains of the timber element and the connector.
- For the calculation process a timber characteristic density ρ_k = 385 kg/m^3 has been considered.
  For different values of ρ_k, the strength values in the table (timber-to-timber shear, steel-to-timber shear and tensile) can be converted by means of the coefficient k_{dens}.

$$R'_{V,k} = k_{dens,v} \cdot R_{V,k}$$
$$R'_{ax,k} = k_{dens,ax} \cdot R_{ax,k}$$
$$R'_{head,k} = k_{dens,ax} \cdot R_{head,k}$$

ρ_k [kg/m^3]	350	380	**385**	405	425	430	440
C-GL	*C24*	*C30*	*GL24h*	*GL26h*	*GL28h*	*GL30h*	*GL32h*
$k_{dens,v}$	0,90	0,98	1,00	1,02	1,05	1,05	1,07
$k_{dens,ax}$	0,92	0,98	1,00	1,04	1,08	1,09	1,11

Strength values thus determined may differ, for higher safety standards, from those resulting from an exact calculation.

NOTES | HARDWOOD

- For the calculation process a mass density equal to ρ_k = 550 kg/m^3 has been considered for hardwood (oak) elements.
- The characteristic timber-to-timber shear strengths were evaluated considering both an ε angle of 90° ($R_{V,90,k}$) and 0° ($R_{V,0,k}$) between the grains of the second element and the connector.
- The characteristic steel-timber shear strengths were evaluated considering an angle ε of 90° between the grains of the timber element and the connector.
- The characteristic thread withdrawal resistances were evaluated considering both an ε angle of 90° ($R_{ax,90,k}$) and of 0° ($R_{ax,0,k}$) between the grains of the timber element and the connector.
- The characteristic strength are calculated for screws inserted without pre-drilling hole.

NOTES | BEECH LVL

- For the calculation process a mass density equal to ρ_k = 730 kg/m^3 has been considered for LVL beech elements.
- A 90° angle between the connector and the fiber, a 90° angle between the connector and the side face of the LVL element, and a 0° angle between the force and the fiber were considered for individual timber elements in the calculation.
- The characteristic strength are calculated for screws inserted without pre-drilling hole.

NOTES | HYBRID CONNECTIONS

- In the calculation, a density ρ_k = 385 kg/m^3 was assumed for softwood elements, a density ρ_k = 550 kg/m^3 for hardwood (oak) elements and a density ρ_k = 730 kg/m^3 for beech LVL elements.
- For softwood and hardwood elements, an angle ε = 90° between the connector and the grain was considered in the calculation.
- A 90° angle between the connector and the fiber, a 90° angle between the connector and the side face of the LVL element, and a 0° angle between the force and the fiber were considered in the calculation.
- The characteristic strength are calculated for screws inserted without pre-drilling hole.

MINIMUM DISTANCES

NOTES | TIMBER

- The minimum distances comply with EN 1995:2014, according to ETA-11/0030, considering a timber element mass density of 420 kg/m^3 < ρ_k ≤ 500 kg/m^3.
- The minimum spacing for all steel-to-timber connections (a_1, a_2) can be multiplied by a coefficient of 0,7.
- In the case of joints with elements in Douglas fir (Pseudotsuga menziesii), the minimum spacing and distances parallel to the grain must be multiplied by a coefficient of 1.5.

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