LBS HARDWOOD

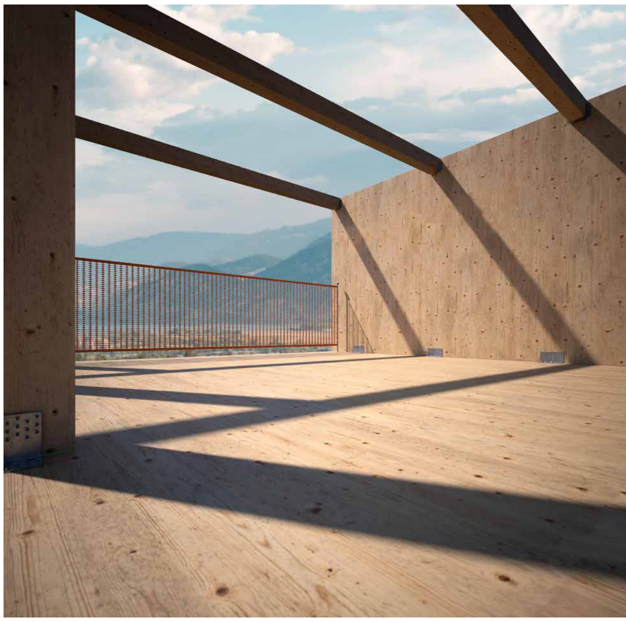
UKCA UKTA-0836 22/6195 | CE ETA-11/0030

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

HARDWOOD CERTIFICATION
Special tip with embossed slit elements. ETA-11/0030 certification allows for use with high density timber without any pre-drill. Approved for structural applications subject to stresses in any direction vs the grain.

LARGER DIAMETER
Internal thread diameter increased compared to the LBS version to ensure tightening in the highest density woods. In steel-timber connections, an increase in strength of more than 15 % can be achieved.

SCREW FOR PERFORATED PLATES
Cylindrical shoulder designed for fastening metal elements. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.



MY PROJECT SOFTWARE

BIT INCLUDED

DIAMETER [mm]

3,5 — 5 — 12

LENGTH [mm]

25 — 40 – 70 — 200

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

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5 TX 20	**LBSH540**	40	36	500
	LBSH550	50	46	200
	LBSH560	60	56	200
	LBSH570	70	66	200

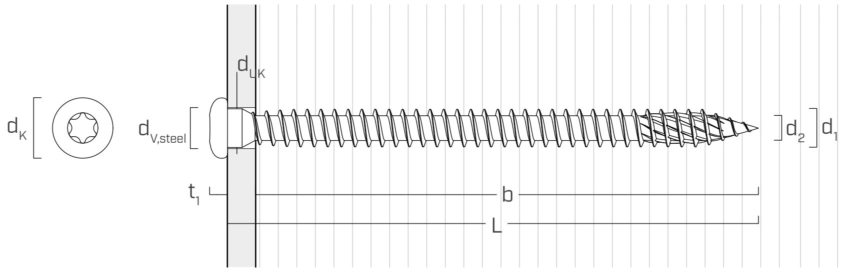
LBS HARDWOOD EVO

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

DIAMETER [mm]	3	5	7	12
LENGTH [mm]	25	60	200	200

Also available in the LBS HARDWOOD EVO version, L from 80 to 200 mm, diameter Ø5 and Ø7 mm, see page 244.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	**[mm]**	**5**
Head diameter	d_K	[mm]	7,80
Thread diameter	d_2	[mm]	3,48
Underhead diameter	d_{UK}	[mm]	4,90
Head thickness	t_1	[mm]	2,45
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0÷5,5
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5
Characteristic tensile strength	$f_{tens,k}$	[kN]	11,5
Characteristic yield moment	$M_{y,k}$	[Nm]	9,0

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

			softwood *(softwood)*	**oak, beech** *(hardwood)*	**ash** *(hardwood)*	**beech LVL** *(Beech LVL)*
Characteristic withdrawal-resistance parameter	$f_{ax,k}$	[N/mm²]	11,7	22,0	30,0	42,0
Characteristic head-pull-through parameter	$f_{head,k}$	[N/mm²]	10,5	-	-	-
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.

HARDWOOD PERFORMANCE

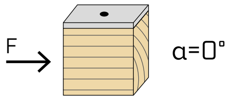
Geometry developed for high performance and use without pre-drill hole on structural woods such as beech, oak, cypress, ash, eucalyptus, bamboo.

BEECH LVL

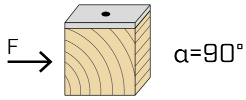
Values also tested, certified and calculated for high density woods such as beechwood Microllam® LVL. Certified for use without pre-drilling, for densities of up to 800 kg/m³.

MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER

screws inserted **WITHOUT pre-drilled hole** $\rho_k > 420$ kg/m³

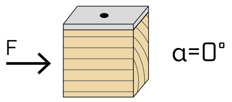


d_1	[mm]		5
a_1	[mm]	15·d·0,7	53
a_2	[mm]	7·d·0,7	25
$a_{3,t}$	[mm]	20·d	100
$a_{3,c}$	[mm]	15·d	75
$a_{4,t}$	[mm]	7·d	35
$a_{4,c}$	[mm]	7·d	35

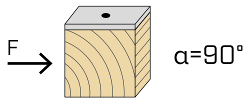


d_1	[mm]		5
a_1	[mm]	7·d·0,7	25
a_2	[mm]	7·d·0,7	25
$a_{3,t}$	[mm]	15·d	75
$a_{3,c}$	[mm]	15·d	75
$a_{4,t}$	[mm]	12·d	60
$a_{4,c}$	[mm]	7·d	35

screws inserted **WITH pre-drilled hole**

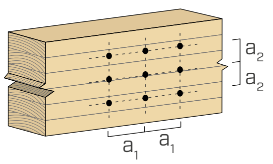


d_1	[mm]		5
a_1	[mm]	5·d·0,7	18
a_2	[mm]	3·d·0,7	11
$a_{3,t}$	[mm]	12·d	60
$a_{3,c}$	[mm]	7·d	35
$a_{4,t}$	[mm]	3·d	15
$a_{4,c}$	[mm]	3·d	15

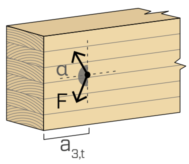


d_1	[mm]		5
a_1	[mm]	4·d·0,7	14
a_2	[mm]	4·d·0,7	14
$a_{3,t}$	[mm]	7·d	35
$a_{3,c}$	[mm]	7·d	35
$a_{4,t}$	[mm]	7·d	35
$a_{4,c}$	[mm]	3·d	15

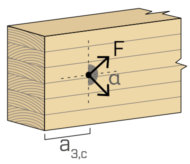
α = load-to-grain angle
d = d_1 = nominal screw diameter



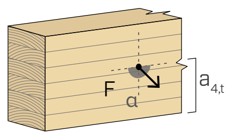
stressed end
-90° < α < 90°



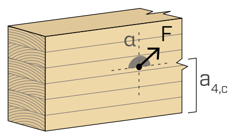
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°

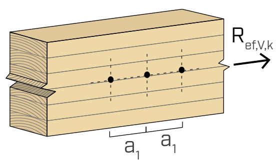


NOTE on page 243.

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:

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

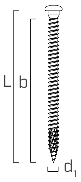
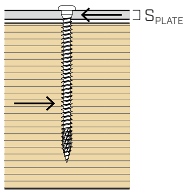
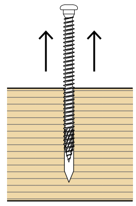
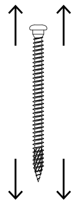


The n_{ef} value is given in the table below as a function of n and a_1.

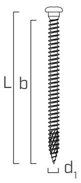
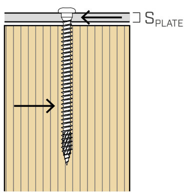
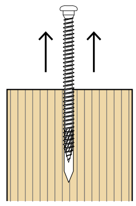
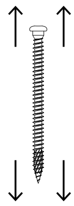
		a_1(*)										
		4·d	5·d	6·d	7·d	8·d	9·d	10·d	11·d	12·d	13·d	≥ 14·d
n	2	1,41	1,48	1,55	1,62	1,68	1,74	1,80	1,85	1,90	1,95	2,00
	3	1,73	1,86	2,01	2,16	2,28	2,41	2,54	2,65	2,76	2,88	3,00
	4	2,00	2,19	2,41	2,64	2,83	3,03	3,25	3,42	3,61	3,80	4,00
	5	2,24	2,49	2,77	3,09	3,34	3,62	3,93	4,17	4,43	4,71	5,00

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

STRUCTURAL VALUES | TIMBER(SOFTWOOD)

			SHEAR							TENSION	
geometry			steel-to-timber ε=90°							thread withdrawal ε=90°	steel tension
											
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-	-
5	40	36	2,44	2,43	2,41	2,39	2,36	2,32	2,27	2,27	11,50
	50	46	2,88	2,88	2,88	2,88	2,85	2,80	2,75	2,90	
	60	56	3,04	3,04	3,04	3,04	3,04	3,02	3,01	3,54	
	70	66	3,20	3,20	3,20	3,20	3,20	3,18	3,16	4,17	

ε = screw-to-grain angle

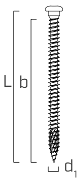
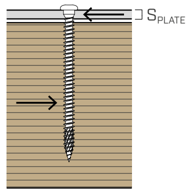
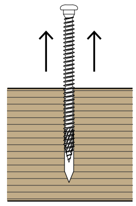
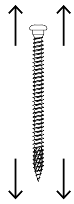
			SHEAR							TENSION	
geometry			steel-to-timber ε=0°							thread withdrawal ε=0°	steel tension
											
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]							$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-	-
5	40	36	1,10	1,10	1,09	1,09	1,08	1,07	1,05	0,68	11,50
	50	46	1,25	1,25	1,24	1,23	1,22	1,21	1,19	0,87	
	60	56	1,42	1,41	1,41	1,40	1,39	1,37	1,35	1,06	
	70	66	1,60	1,59	1,59	1,58	1,57	1,55	1,53	1,25	

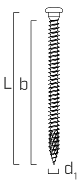
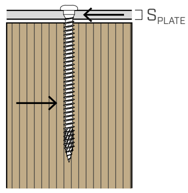
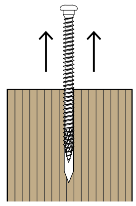
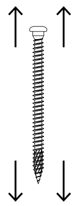
ε = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 243.

STRUCTURAL VALUES | HARDWOOD

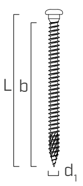
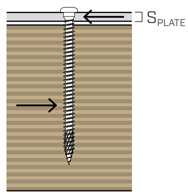
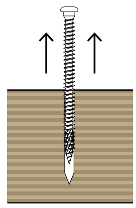
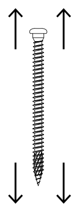
CHARACTERISTIC VALUES
EN 1995:2014

			SHEAR							TENSION	
geometry			steel-hardwood ε=90°							thread withdrawal ε=90°	steel tension
											
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-	-
5	40	36	3,56	3,54	3,51	3,49	3,44	3,36	3,29	4,08	11,50
	50	46	3,88	3,88	3,88	3,88	3,88	3,85	3,82	5,21	
	60	56	4,16	4,16	4,16	4,16	4,16	4,13	4,10	6,35	
	70	66	4,44	4,44	4,44	4,44	4,44	4,42	4,39	7,48	

			SHEAR							TENSION	
geometry			steel-hardwood ε=0°							thread withdrawal ε=0°	steel tension
											
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]							$R_{ax,0,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-	-
5	40	36	1,51	1,50	1,49	1,48	1,47	1,45	1,42	1,22	11,50
	50	46	1,76	1,75	1,74	1,74	1,72	1,69	1,67	1,56	
	60	56	2,04	2,03	2,02	2,01	1,99	1,96	1,93	1,90	
	70	66	2,19	2,19	2,19	2,19	2,19	2,18	2,17	2,24	

ε = screw-to-grain angle

STRUCTURAL VALUES | BEECH LVL

			SHEAR							TENSION	
geometry			steel-beech LVL							thread withdrawal flat	steel tension
											
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [kN]	$R_{tens,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-	-
5	40	36	5,24	5,24	5,24	5,24	5,24	5,18	5,13	7,56	11,50
	50	46	5,76	5,76	5,76	5,76	5,76	5,71	5,66	9,66	
	60	56	6,22	6,22	6,22	6,22	6,22	6,22	6,18	11,76	
	70	66	6,22	6,22	6,22	6,22	6,22	6,22	6,22	13,86	

NOTES and GENERAL PRINCIPLES on page 243.

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 characteristic shear strength are calculated for screws inserted without pre-drilling hole.
- The screws must be positioned in accordance with the minimum distances.
- The thread withdrawal characteristic strength has been evaluated considering a fixing length equal to b.
- The characteristic shear-strength value for LBSH Ø5 nails has been evaluated assuming a plate thickness = S_{PLATE}, always considering the case of thick plate according to ETA-11/0030 ($S_{PLATE} \geq 1{,}5$ mm).
- In the case of combined shear and tensile stress, the following verification must be satisfied:

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

- In the case of steel-to-timber connections with a thick plate, it is necessary to assess the effects of timber deformation and install the connectors according to the assembly instructions.

NOTES | HARDWOOD

- The characteristic steel-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.
- In the case of screws inserted with pre-drilling hole, higher strength values can be achieved.
- 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 and the connector.
- For the calculation process a mass density equal to ρ_k = 550 kg/m^3 has been considered for hardwood (oak) elements.

NOTES | TIMBER (SOFTWOOD)

- The characteristic steel-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 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 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}.

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

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 | 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.

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 < $\rho_k \leq$ 500 kg/m^3.
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) can be multiplied by a coefficient of 1,5.
- 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.