LBS

UKCA UKTA-0836 22/6195 | ICC ES AC233 ESR-4645 | CE ETA-11/0030

ROUND HEAD SCREW FOR PLATES

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.

STATICS
These can be calculated according to Eurocode 5 under thick steel-timber plate connections, even with thin metal elements.
Excellent shear strength values.

NEW-GENERATION WOODS
Tested and certified for use on a wide variety of engineered timbers such as CLT, GL, LVL, OSB and Beech LVL.
The LBS5 version up to a length of 40 mm is approved completely without pre-drilling hole on Beech LVL.

DUCTILITY
Excellent ductility behaviour as evidenced by SEISMIC-REV cyclic tests according to EN 12512.

MY PROJECT SOFTWARE

BIT INCLUDED

DIAMETER [mm]

3,5 — 5 – 7 — 12

LENGTH [mm]

25 — 25 – 100 — 200

SERVICE CLASS

SC1 SC2

ATMOSPHERIC CORROSIVITY

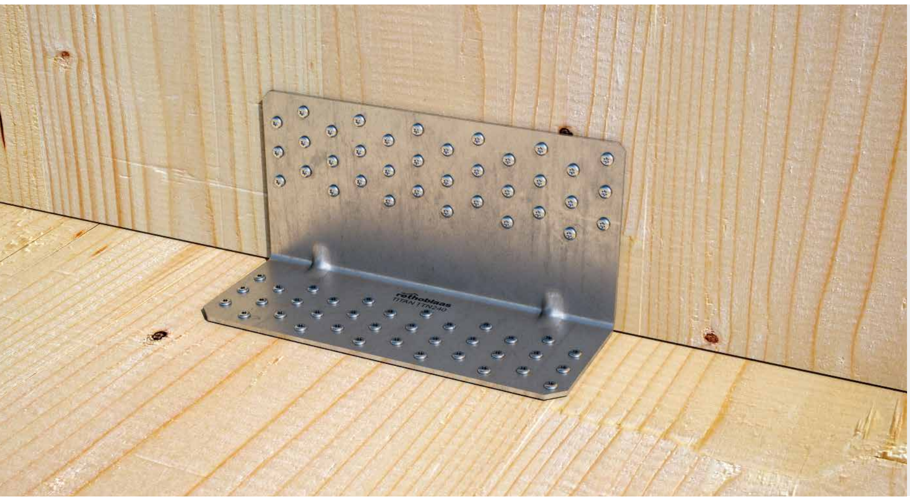
C1 C2

WOOD CORROSIVITY

T1 T2

MATERIAL

Zn ELECTRO PLATED — electrogalvanized carbon steel



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5 TX 20	LBS525	25	21	500
	LBS540	40	36	500
	LBS550	50	46	200
	LBS560	60	56	200
	LBS570	70	66	200
7 TX 30	LBS760	60	55	100
	LBS780	80	75	100
	LBS7100	100	95	100

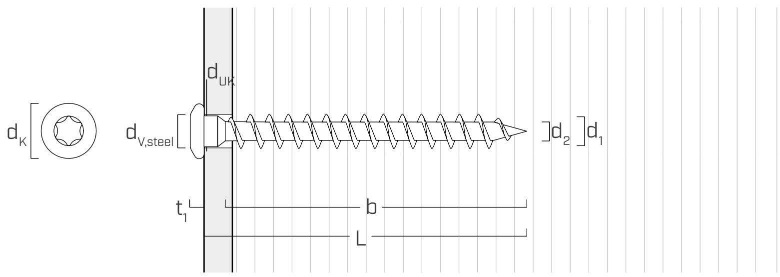
LBS HARDWOOD EVO

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



GEOMETRY

Nominal diameter	d_1	[mm]	5	7
Head diameter	d_K	[mm]	7,80	11,00
Thread diameter	d_2	[mm]	3,00	4,40
Underhead diameter	d_{UK}	[mm]	4,90	7,00
Head thickness	t_1	[mm]	2,40	3,50
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0÷5,5	7,5÷8,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0	4,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5	5,0

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

CHARACTERISTIC MECHANICAL PARAMETERS

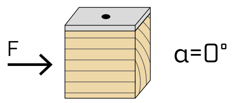
Nominal diameter	d_1	[mm]	5	7
Tensile strength	$f_{tens,k}$	[kN]	7,9	15,4
Yield moment	$M_{y,k}$	[Nm]	5,4	14,2

			softwood *(softwood)*	**LVL softwood** *(LVL softwood)*	**pre-drilled beech LVL** *(beech LVL predrilled)*	**LVL beech** (3) *(beech LVL)*
Characteristic withdrawal-resistance parameter	$f_{ax,k}$	[N/mm^2]	11,7	15,0	29,0	42,0
Characteristic head-pull-through parameter	$f_{head,k}$	[N/mm^2]	10,5	20,0	-	-
Associated density	ρ_a	[kg/m^3]	350	500	730	730
Calculation density	ρ_k	*[kg/m^3]*	*≤ 440*	*410 ÷ 550*	*590 ÷ 750*	590 ÷ 750

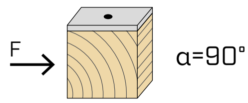
(3)Valid for d_1 = 5 mm and $l_{ef} \leq$ 34 mm
For applications with different materials please see ETA-11/0030.

MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER

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

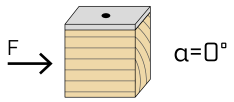


d_1	[mm]		5	7
a_1	[mm]	12·d·0,7	42	59
a_2	[mm]	5·d·0,7	18	25
$a_{3,t}$	[mm]	15·d	75	105
$a_{3,c}$	[mm]	10·d	50	70
$a_{4,t}$	[mm]	5·d	25	35
$a_{4,c}$	[mm]	5·d	25	35

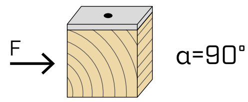


d_1	[mm]		5	7
a_1	[mm]	5·d·0,7	18	25
a_2	[mm]	5·d·0,7	18	25
$a_{3,t}$	[mm]	10·d	50	70
$a_{3,c}$	[mm]	10·d	50	70
$a_{4,t}$	[mm]	10·d	50	70
$a_{4,c}$	[mm]	5·d	25	35

screws inserted **WITH pre-drilled hole**



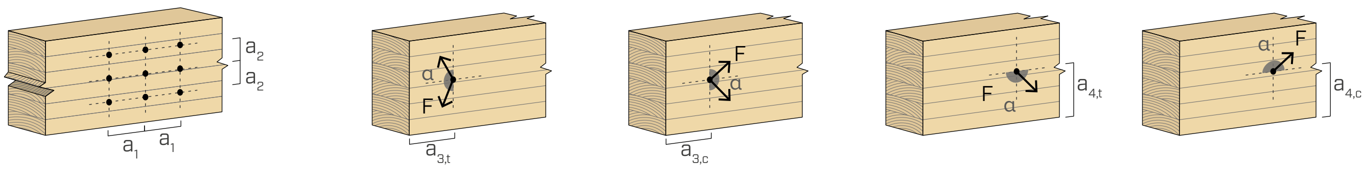
d_1	[mm]		5	7
a_1	[mm]	5·d·0,7	18	25
a_2	[mm]	3·d·0,7	11	15
$a_{3,t}$	[mm]	12·d	60	84
$a_{3,c}$	[mm]	7·d	35	49
$a_{4,t}$	[mm]	3·d	15	21
$a_{4,c}$	[mm]	3·d	15	21



d_1	[mm]		5	7
a_1	[mm]	4·d·0,7	14	20
a_2	[mm]	4·d·0,7	14	20
$a_{3,t}$	[mm]	7·d	35	49
$a_{3,c}$	[mm]	7·d	35	49
$a_{4,t}$	[mm]	7·d	35	49
$a_{4,c}$	[mm]	3·d	15	21

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°

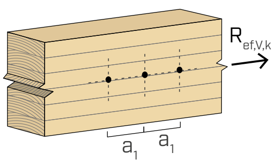


NOTES

- The minimum distances comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- 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.

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:

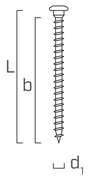


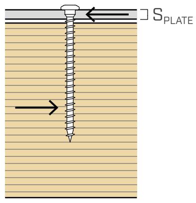
$$R_{ef,V,k} = n_{ef} \cdot R_{V,k}$$

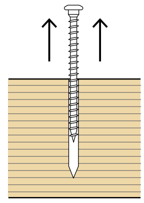
The n_{ef} value is given in the table below as a function of n and a_1.

		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.

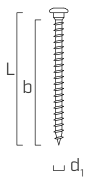


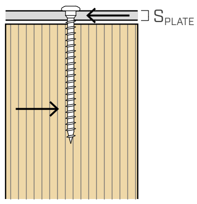


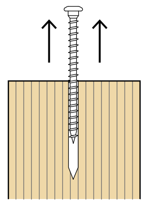


			SHEAR							TENSION
geometry			steel-to-timber ε=90°							thread withdrawal ε=90°
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-
5	25	21	1,59	1,58	1,56	-	-	-	-	1,33
	40	36	2,24	2,24	2,24	2,24	2,23	2,18	2,13	2,27
	50	46	2,39	2,39	2,39	2,39	2,39	2,38	2,36	2,90
	60	56	2,55	2,55	2,55	2,55	2,55	2,54	2,52	3,54
	70	66	2,71	2,71	2,71	2,71	2,71	2,69	2,68	4,17
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	-
7	60	55	2,81	2,98	3,37	3,80	4,18	4,05	3,92	4,86
	80	75	3,80	3,88	4,13	4,40	4,63	4,59	4,55	6,63
	100	95	4,25	4,38	4,63	4,87	5,08	5,03	4,99	8,40

ε = screw-to-grain angle







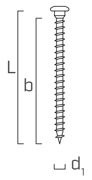
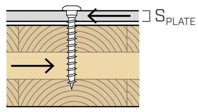
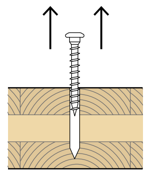
			SHEAR							TENSION
geometry			steel-to-timber ε=0°							thread withdrawal ε=0°
d_1 [mm]	L [mm]	b [mm]	$R_{V,0,k}$ [kN]							$R_{ax,0,k}$ [kN]
	S_{PLATE}		1,5 mm	2,0 mm	2,5 mm	3,0 mm	4,0 mm	5,0 mm	6,0 mm	-
5	25	21	0,77	0,77	0,77	0,76	0,76	0,75	0,74	0,40
	40	36	0,98	0,98	0,97	0,96	0,95	0,94	0,92	0,68
	50	46	1,15	1,15	1,14	1,13	1,12	1,10	1,09	0,87
	60	56	1,32	1,32	1,32	1,32	1,30	1,28	1,27	1,06
	70	66	1,37	1,37	1,37	1,37	1,37	1,36	1,36	1,25
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	-
7	60	55	1,12	1,21	1,41	1,60	1,77	1,73	1,69	1,46
	80	75	1,52	1,61	1,83	2,04	2,22	2,17	2,13	1,99
	100	95	1,91	1,99	2,17	2,35	2,53	2,52	2,51	2,52

ε = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 233.

STRUCTURAL VALUES | CLT

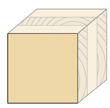
CHARACTERISTIC VALUES
EN 1995:2014

			SHEAR							TENSION
geometry			steel-to-CLT lateral face							thread withdrawal lateral face
										
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [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	25	21	1,48	1,47	1,45	1,44	1,42	1,38	1,35	1,23
	40	36	2,12	2,12	2,10	2,09	2,05	2,01	1,96	2,11
	50	46	2,26	2,26	2,26	2,26	2,26	2,25	2,23	2,69
	60	56	2,41	2,41	2,41	2,41	2,41	2,39	2,38	3,28
	70	66	2,56	2,56	2,56	2,56	2,56	2,54	2,53	3,86
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	-
7	60	55	2,55	2,77	3,13	3,53	3,86	3,74	3,62	4,50
	80	75	3,45	3,59	3,82	4,10	4,38	4,33	4,29	6,14
	100	95	4,00	4,12	4,36	4,58	4,79	4,74	4,70	7,78

NOTES and GENERAL PRINCIPLES on page 233.

MINIMUM DISTANCES FOR SHEAR AND AXIAL LOADS | CLT

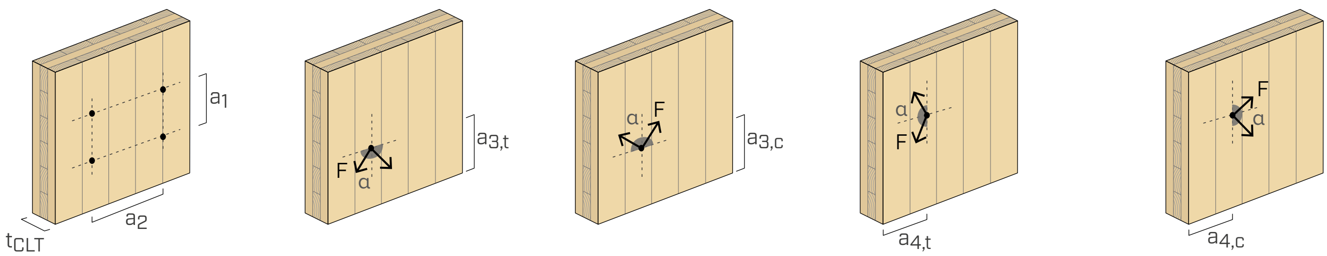
screws inserted **WITHOUT pre-drilled hole**



lateral face

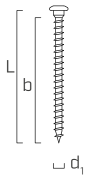
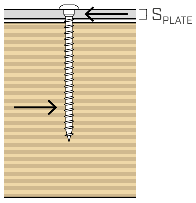
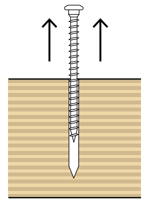
d_1	[mm]		5	7
a_1	[mm]	4·d	20	28
a_2	[mm]	2,5·d	13	18
$a_{3,t}$	[mm]	6·d	30	42
$a_{3,c}$	[mm]	6·d	30	42
$a_{4,t}$	[mm]	6·d	30	42
$a_{4,c}$	[mm]	2,5·d	13	18

d = d_1 = nominal screw diameter



NOTES

- The minimum distances are compliant with ETA-11/0030 and are to be considered valid unless otherwise specified in the technical documents for the CLT panels.
- Minimum distances are valid for minimum CLT thickness $t_{CLT,min}$ =10·d_1.

			SHEAR							TENSION
geometry			steel-LVL							thread withdrawal flat
										
d_1 [mm]	L [mm]	b [mm]	$R_{V,90,k}$ [kN]							$R_{ax,90,k}$ [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	25	21	1,59	1,58	1,56	-	-	-	-	1,33
	40	36	2,24	2,24	2,24	2,24	2,23	2,18	2,13	2,27
	50	46	2,39	2,39	2,39	2,39	2,39	2,38	2,36	2,90
	60	56	2,55	2,55	2,55	2,55	2,55	2,54	2,52	3,54
	70	66	2,71	2,71	2,71	2,71	2,71	2,69	2,68	4,17
	S_{PLATE}		3,0 mm	4,0 mm	5,0 mm	6,0 mm	8,0 mm	10,0 mm	12,0 mm	-
7	60	55	2,81	2,98	3,37	3,80	4,18	4,05	3,92	4,86
	80	75	3,80	3,88	4,13	4,40	4,63	4,59	4,55	6,63
	100	95	4,25	4,38	4,63	4,87	5,08	5,03	4,99	8,40

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.
- 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 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 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 LBS 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).
- The characteristic shear-strength value for LBS Ø7 screws has been evaluated assuming a plate thickness = S_{PLATE}, and considering the thin ($S_{PLATE} \leq 3{,}5$ mm) intermediate (3,5 mm < S_{PLATE} < 7,0 mm) or thick ($S_{PLATE} \geq 7$ mm) plate case.
- 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 | TIMBER

- 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 timber element and the connector.
- Characteristic timber-to-timber shear strengths can be found on page 237.
- 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 | CLT

- The characteristic values are according to the national specifications ÖNORM EN 1995 - Annex K.
- For the calculation process a mass density ρ_k = 350 kg/m^3 has been considered for CLT elements.
- The characteristics shear resistance are calculated considering a minimum fixing length of 4 d_1.
- The characteristic shear strength is independent from the direction of the grain of the CLT panels outer layer.
- The axial thread withdrawal strength is valid for minimum CLT thickness $t_{CLT,min} = 10 \cdot d_1$.

NOTES | LVL

- For the calculation process a mass density equal to ρ_k = 480 kg/m^3 has been considered for softwood LVL elements.
- The axial thread-withdrawal resistance was calculated considering a 90° angle between the grains and the connector.
- The characteristic shear strengths are evaluated for connectors inserted on the side face (wide face) considering, for individual timber elements, a 90° angle between the connector and the grain, a 90° angle between the connector and the side face of the LVL element and a 0° angle between the force and the grain.