LBS

ROUND HEAD SCREW FOR PLATES

ELC-4645 | ESR-4645 | UKTA-0836 22/6195 | ETA-11/0030

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 LBS diameter 0.2 inch version up to a length of 1 9/16 inch 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 [in]

0.14 | 0.20 0.28 | 0.48

LENGTH [in]

1 | 1 4 | 8

EXPOSURE CONDITION

EC1 DRY

ATMOSPHERIC CORROSIVITY

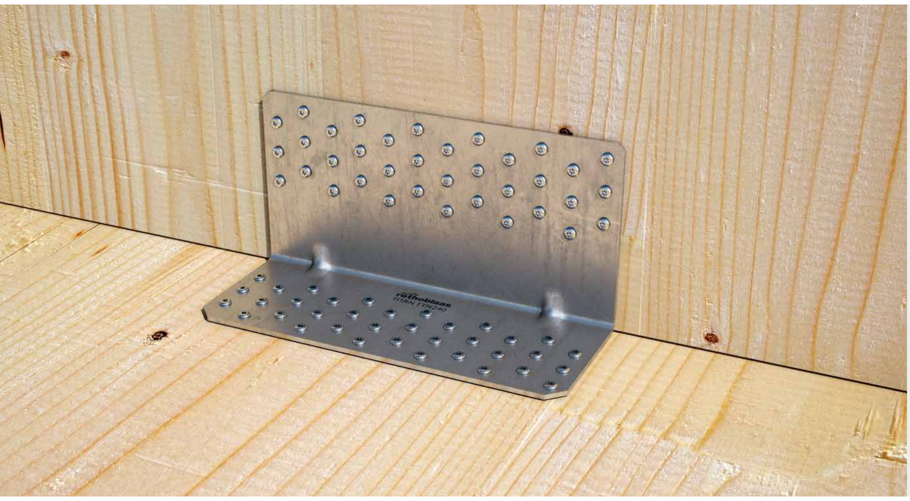
C1 C2

WOOD CORROSIVITY

T1 T2

MATERIAL

Zn ELECTRO PLATED — electrogalvanized carbon steel



FIELDS OF USE

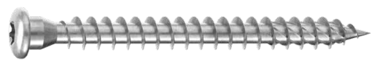
- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5 **0.20** **#11** **TX 20**	**LBS525**	25	1	21	13/16	500
	LBS540	40	1 9/16	36	1 7/16	500
	LBS550	50	1 15/16	46	1 13/16	200
	LBS560	60	2 3/8	56	2 3/16	200
	LBS570	70	2 3/4	66	2 5/8	200
7 **0.28** **#16** **TX 30**	**LBS760**	60	2 3/8	55	2 3/16	100
	LBS780	80	3 1/8	75	2 15/16	100
	LBS7100	100	4	95	3 3/4	100

LBS HARDWOO

ROUND HEAD SCREW FOR PLATES ON HARDWOODS



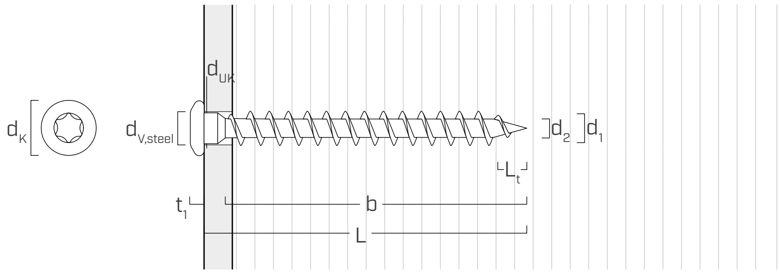
For more information see page 284.

LBS HARDWOOD EVO

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

For more information see page 286.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	[in][(1)]	**0.20**	**0.28**
Outer thread diameter	d_1	[mm]	5	7
		[in]	**0.197**	**0.276**
Head diameter	d_K	[in]	0.307	0.433
Root diameter	d_2	[in]	0.118	0.173
Underhead diameter	d_{UK}	[in]	0.193	0.276
Head thickness	t_1	[in]	0.094	0.138
Tip Lenght	L_t	[in]	0.197	0.276
Recommended hole diameter on steel plate	$d_{V,steel}$	[in]	3/16 - 7/32	5/16
Pre-drilling hole diameter[(2)]	$d_{V,G\leq0.55}$	[in]	1/8	5/32
Pre-drilling hole diameter[(3)]	$d_{V,G>0.55}$	[in]	9/64	13/64

(1) The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.
(2) Pre-drilling applies to timber with $G\leq0.55$ (optional).
(3) Pre-drilling applies to timber with $G>0.55$ (required).

CHARACTERISTIC MECHANICAL PARAMETERS

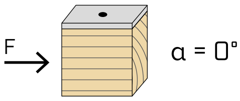
Nominal diameter	d_1	[in]	**0.20**	**0.28**
Tensile strength (allowable)	f_{tens}	[lbf]	740	1600
Bending yield strength (specified)	$F_{y,b}$	[psi]	180000	192000

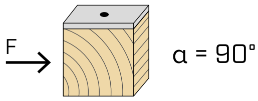
Nominal diameter	d_1	[in]		**0.20**	**0.28**
Withdrawal	W_{90}	[lbf/in]	G = 0.35	99	115
			G = 0.42	114	132
			G = 0.49	128	149
			G = 0.55	140	162
minimum embedded length		[in]		1 3/16	1 5/8

NOTES and GENERAL PRINCIPLES on page 277.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

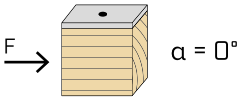
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.50**

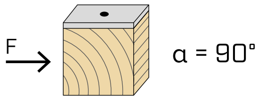




d_1	[in]		α = 0°: 0.20	α = 0°: 0.28		α = 90°: 0.20	α = 90°: 0.28
	[mm]		5	7		5	7
a_1	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
a_2	[in]	**5·d**	1	1 3/8	**5·d**	1	1 3/8
$a_{3,t}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{3,c}$	[in]	**10·d**	1 15/16	2 3/4	**10·d**	1 15/16	2 3/4
$a_{4,t}$	[in]	**10·d**	1 15/16	2 3/4	**10·d**	1 15/16	2 3/4
$a_{4,c}$	[in]	**5·d**	1 5/16	1 3/8	**5·d**	1	1 3/8

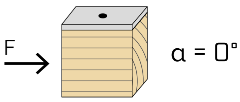
screws inserted **WITHOUT pre-drilled hole** — **G > 0.50**

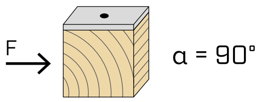




d_1	[in]		α = 0°: 0.20	α = 0°: 0.28		α = 90°: 0.20	α = 90°: 0.28
	[mm]		5	7		5	7
a_1	[in]	**15·d**	2 15/16	4 1/8	**10·d**	1 15/16	2 3/4
a_2	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{3,t}$	[in]	**20·d**	4	5 1/2	**20·d**	4	5 1/2
$a_{3,c}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{4,t}$	[in]	**12·d**	2 3/8	3 5/16	**12·d**	2 3/8	3 5/16
$a_{4,c}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16

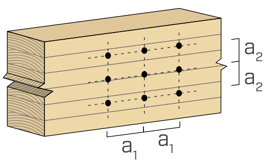
screws inserted **WITH pre-drilled hole**



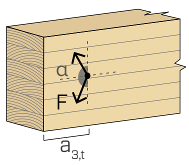


d_1	[in]		α = 0°: 0.20	α = 0°: 0.28		α = 90°: 0.20	α = 90°: 0.28
	[mm]		5	7		5	7
a_1	[in]	**10·d**	1 15/16	2 3/4	**5·d**	1	1 3/8
a_2	[in]	**4·d**	13/16	1 1/8	**4·d**	13/16	1 1/8
$a_{3,t}$	[in]	**12·d**	2 3/8	3 5/16	**12·d**	2 3/8	3 5/16
$a_{3,c}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{4,t}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{4,c}$	[in]	**3·d**	9/16	13/16	**3·d**	9/16	13/16

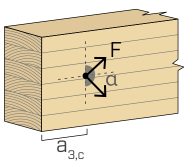
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



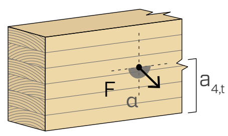
stressed end
-90° < α < 90°



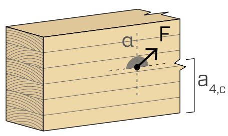
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



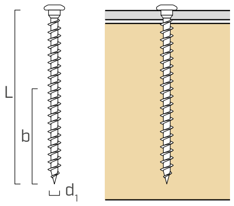
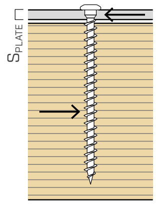
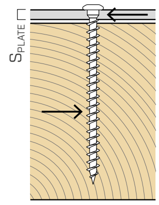
unload edge
180° < α < 360°



NOTES

- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

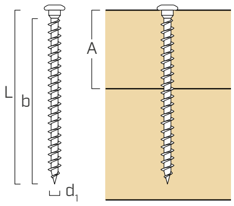
REFERENCE LATERAL DESIGN VALUES (Z) | STEEL-TO-WOOD

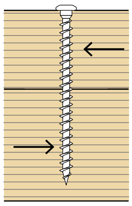
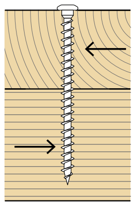
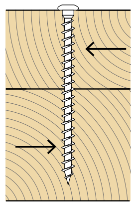
geometry				$Z_{\parallel}$ (1)					$Z_{\perp}$ (2)				
													
d_1	L		b	S_{PLATE}	G 0.35	G 0.42	G 0.49	G 0.55	S_{PLATE}	G 0.35	G 0.42	G 0.49	G 0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20	25	1	13/16	1/16	49	65	84	103	1/16	49	65	84	103
	40	1 9/16	1 7/16		77	92	105	116		77	92	105	116
	50	1 15/16	1 13/16		79	92	105	116		79	92	105	116
	60	2 3/8	2 3/16		79	92	105	116		79	92	105	116
	70	2 3/4	2 5/8		79	92	105	116		79	92	105	116
7 0.28	60	2 3/8	2 3/16	1/16	167	196	224	247	1/16	134	157	179	198
	80	3 1/8	2 15/16		167	196	224	247		134	157	179	198
	100	4	3 3/4		167	196	224	247		134	157	179	198
5 0.20	25	1	13/16	1/8	65	80	97	113	1/8	65	80	97	113
	40	1 9/16	1 7/16		85	110	124	136		85	110	124	136
	50	1 15/16	1 13/16		94	110	124	136		94	110	124	136
	60	2 3/8	2 3/16		94	110	124	136		94	110	124	136
	70	2 3/4	2 5/8		94	110	124	136		94	110	124	136
7 0.28	60	2 3/8	2 3/16	1/8	172	212	241	265	1/8	138	170	193	212
	80	3 1/8	2 15/16		182	212	241	265		145	170	193	212
	100	4	3 3/4		182	212	241	265		145	170	193	212
5 0.20	25	1	13/16	1/4	75	90	106	121	1/4	75	90	106	121
	40	1 9/16	1 7/16		89	115	143	158		89	115	143	158
	50	1 15/16	1 13/16		105	125	143	158		105	125	143	158
	60	2 3/8	2 3/16		106	125	143	158		106	125	143	158
	70	2 3/4	2 5/8		106	125	143	158		106	125	143	158
7 0.28	60	2 3/8	2 3/16	1/4	202	262	309	338	1/4	161	209	247	271
	80	3 1/8	2 15/16		233	273	309	338		186	219	247	271
	100	4	3 3/4		233	273	309	338		186	219	247	271
5 0.20	50	1 15/16	1 13/16	3/8	100	125	143	158	3/8	100	125	143	158
	60	2 3/8	2 3/16		106	125	143	158		106	125	143	158
	70	2 3/4	2 5/8		106	125	143	158		106	125	143	158
7 0.28	60	2 3/8	2 3/16	3/8	195	251	314	347	3/8	156	201	251	277
	80	3 1/8	2 15/16		233	274	314	347		186	219	251	277
	100	4	3 3/4		233	274	314	347		186	219	251	277
5 0.20	50	1 15/16	1 13/16	1/2	95	123	143	158	1/2	95	123	143	158
	60	2 3/8	2 3/16		106	125	143	158		106	125	143	158
	70	2 3/4	2 5/8		106	125	143	158		106	125	143	158
7 0.28	60	2 3/8	2 3/16	1/2	189	242	302	347	1/2	151	193	241	277
	80	3 1/8	2 15/16		233	274	314	347		186	219	251	277
	100	4	3 3/4		233	274	314	347		186	219	251	277
5 0.20	50	1 15/16	1 13/16	5/8	90	116	143	158	5/8	90	116	143	158
	60	2 3/8	2 3/16		105	125	143	158		105	125	143	158
	70	2 3/4	2 5/8		106	125	143	158		106	125	143	158
7 0.28	60	2 3/8	2 3/16	5/8	183	232	288	341	5/8	147	186	230	273
	80	3 1/8	2 15/16		225	274	314	347		180	219	251	277
	100	4	3 3/4		233	274	314	347		186	219	251	277
5 0.20	50	1 15/16	1 13/16	3/4	86	109	136	158	3/4	86	109	136	158
	60	2 3/8	2 3/16		100	125	143	158		100	125	143	158
	70	2 3/4	2 5/8		106	125	143	158		106	125	143	158
7 0.28	60	2 3/8	2 3/16	3/4	178	224	275	324	3/4	142	179	220	259
	80	3 1/8	2 15/16		218	274	314	347		174	219	251	277
	100	4	3 3/4		233	274	314	347		186	219	251	277

(1) Main member loaded parallel to the grain.
(2) Main member loaded perpendicular to the grain.

NOTES and GENERAL PRINCIPLES on page 277.

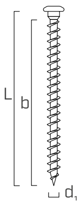
REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

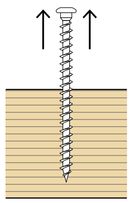
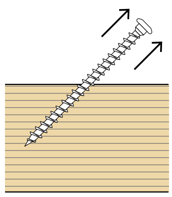
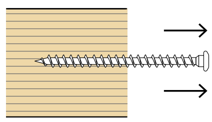


geometry					$Z_{\parallel}$				$Z_{\perp/\parallel}$				$Z_{\perp}$			
d_1	L		b	A	G				G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20	25	1	13/16	1/2	24	34	45	55	24	34	45	55	24	34	45	55
	40	1 9/16	1 7/16	13/16	40	56	74	91	40	56	74	91	40	56	74	91
	50	1 15/16	1 13/16	1	50	70	93	110	50	70	93	110	50	70	93	110
	60	2 3/8	2 3/16	1 3/16	61	84	104	115	61	84	104	115	61	84	104	115
	70	2 3/4	2 5/8	1 3/8	71	90	104	115	71	90	104	115	71	90	104	115
7 0.28	60	2 3/8	2 3/16	1 3/16	86	121	160	198	69	97	128	159	69	97	128	159
	80	3 1/8	2 15/16	1 9/16	117	163	215	253	93	130	172	202	93	130	172	202
	100	4	3 3/4	1 15/16	147	197	227	253	118	158	182	202	118	158	182	202

THREAD WITHDRAWAL (W) | WOOD



geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°			
d_1	L		b	G				G				G			
				0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20	25	1 (1)	13/16	62	72	81	88	57	65	73	80	19	22	24	26
	40	1 9/16 (2)	1 7/16	121	139	156	171	110	127	142	155	36	42	47	51
	50	1 15/16	1 13/16	160	184	207	226	145	167	188	206	48	55	62	68
	60	2 3/8	2 3/16	199	229	257	281	181	208	234	256	60	69	77	84
	70	2 3/4	2 5/8	238	274	307	336	216	249	280	306	71	82	92	101
7 0.28	60	2 3/8 (2)	2 3/16	217	249	282	306	198	227	256	279	65	75	84	92
	80	3 1/8	2 15/16	308	353	399	434	280	322	363	395	92	106	120	130
	100	4	3 3/4	398	457	516	561	363	416	470	511	120	137	155	168

(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle 0°≤ α <90° to the grain).
(2) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle 0°≤ α <90° to the grain).

NOTES and GENERAL PRINCIPLES on page 277.

GENERAL PRINCIPLES

- Tabulated values comply with NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION in accordance with ESR-4645.
- To determine allowable loads for use with ASD, design loads for use with LRFD or both, tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners.
- As part of the connection design, the structural wood members, the steel plates must be sized and verified in accordance with the corresponding Section of the NDS and must be done separately by the designer.
- Connections with multiple screws must be designed in accordance with the corresponding Sections of the NDS and ESR-4645.
- LBS screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection CM is 1.0).
- LBS screws must be positioned in accordance with the minimum distances.

REFERENCE LATERAL DESIGN VALUES

- Tabulated values are determined from the yield model equations in the corresponding Section of the NDS.
- Unless otherwise noted, the threaded part of the screw is fully inserted in the main member.
- The screw penetration into the main member is minimum 6 times the outer thread diameter unless otherwise noted.
- The reference lateral design values may be determined for other connection configurations in accordance with the corresponding Section of NDS and ESR-4645.
- The reference lateral design values 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.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length minus the thickness of the wood side member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- The fixable thickness (A) is considered as half the length of the screw (L/2).

STEEL-TO-WOOD

- The steel side member must have a minimum tensile strength equal to 58 ksi (400 MPa) and comply with the minimum requirements of ASTM A36.
- The wood main member thickness must be greater than the screw length minus the thickness of the steel side member.
- In case of steel-to-wood connection with a thick plate, it is necessary to assess the effects of wood deformations and install the connectors according to the assembly instructions.

REFERENCE WITHDRAWAL DESIGN VALUES

- The reference withdrawal design values (W_{ref}) expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain can be found in the ESR-4645.
- The values for screws installed at an angle α to the grain are determined by multiplying the reference withdrawal design values with the effective thread penetration L_{eff} of the screw in the wood member and with the factor k_α:

  $W_\alpha = W_{ref} \cdot k_\alpha \cdot L_{eff}$

  Where:

  - W_{ref} is the reference withdrawal design value for screws installed at an angle of 90° to the grain, as shown in the table on the left;
  - k_α factor is calculated as:

$$k_\alpha = \begin{cases} 35^\circ < \alpha \leq 90^\circ & \dfrac{1}{1.2 \cdot \cos^2(\alpha) + \sin^2(\alpha)} \\ 0^\circ \leq \alpha \leq 35^\circ & 0.3 + 0.7 \cdot \dfrac{\alpha}{45} \end{cases}$$

  - α is the angle between the grain direction and screw axis.

  Tabulated values at page 276 are valid for L_{eff} equal to the screw thread length b minus the tip length L_t and k_α = 1 for α=90°, k_α = 0.91 for α= 45°, k_α = 0.3 for α = 0°.
- The minimum embedded thread length is 6 times the outer thread diameter for screws installed at 90° to the grain, unless otherwise noted.
- The minimum embedded thread length for screws installed at an angle 0° ≤ α < 90° to the grain is 8 times the outer thread diameter, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis α < 15°.
- The reference withdrawal design values must be inferior to f_{tens} of the screw.

CONNECTIONS

GENERAL NOTES

- Designed connections must respect all requirements on general principles and minimum distances.
- Calculations comply with the NDS in accordance with ESR 4645.
- Tabulated values, that are referred to a single fastener, are valid for Allowable Stress Design (ASD) considering a standard loading (C_D = 1.0).
- Timber element specific gravity is considered as G = 0.42, unless otherwise noted.
- $Z_{\parallel}$: Force-to-grain angle in the shear plane is considered as 0°.
- $Z_{\perp}$: Force-to-grain angle in the shear plane is considered as 90°.
- $Z_{m\perp}$: Force-to-grain angle in the shear plane is considered as 0° for side member and as 90° for main member.
- $Z_{s\perp}$: Force-to-grain angle in the shear plane is considered as 90° for side member and as 0° for main member.
- For the connectors inserted in the panel's face, it has been considered the same grain direction as the layer in the shear plane. For the connectors inserted in the panel's narrow edge, it has been considered the same grain direction as the layer in which the connector is installed.
- For lateral design values the force-to-fastener angle is always considered 90°.

STEEL-TO-WOOD | CLT FLOOR-TO-STEEL BEAM

- Steel side member must be pre-drilled in accordance with the indications provided in this technical data sheet and installation instructions.
- A dowel bearing strength of F_e = 87,000 psi is used in the yield limit equations for the steel side member, in accordance with the NDS.
- The main grain direction of the CLT floor panel is considered both parallel and perpendicular to the beam direction.
- The withdrawal capacity has been considered as the minimum between thread withdrawal and tensile strength of the screw.

STEEL-TO-WOOD | STEEL SIDE PLATE CLT CONNECTION

- Steel side member must be pre-drilled according to the information reported in these tecnical datasheet and installation instructions.
- Beam element can be considered both solid wood or glulam.
- The proposed screw length does not exceed the total thickness of the connection. In the case of steel plates on both sides of the beam, the geometry of the connection must be designed to avoid collisions between screws inserted from opposite sides.
- A dowel bearing strength of F_e = 87,000 psi is used in the yield limit equations for the steel side member, in accordance with the NDS.

STEEL-TO-WOOD | STEEL SIDE PLATE CLT CONNECTION

- Steel side member must be pre-drilled according to the information reported in these tecnical datasheet and installation instructions.
- A dowel bearing strength of Fe = 87,000 psi is used in the yield limit equations for the steel side member, in accordance with the NDS.
- The main grain direction of the CLT floor panel is considered both parallel and perpendicular to the beam direction.
- The withdrawal capacity has been considered as the minimum between thread withdrawal and tensile strength of the screw.