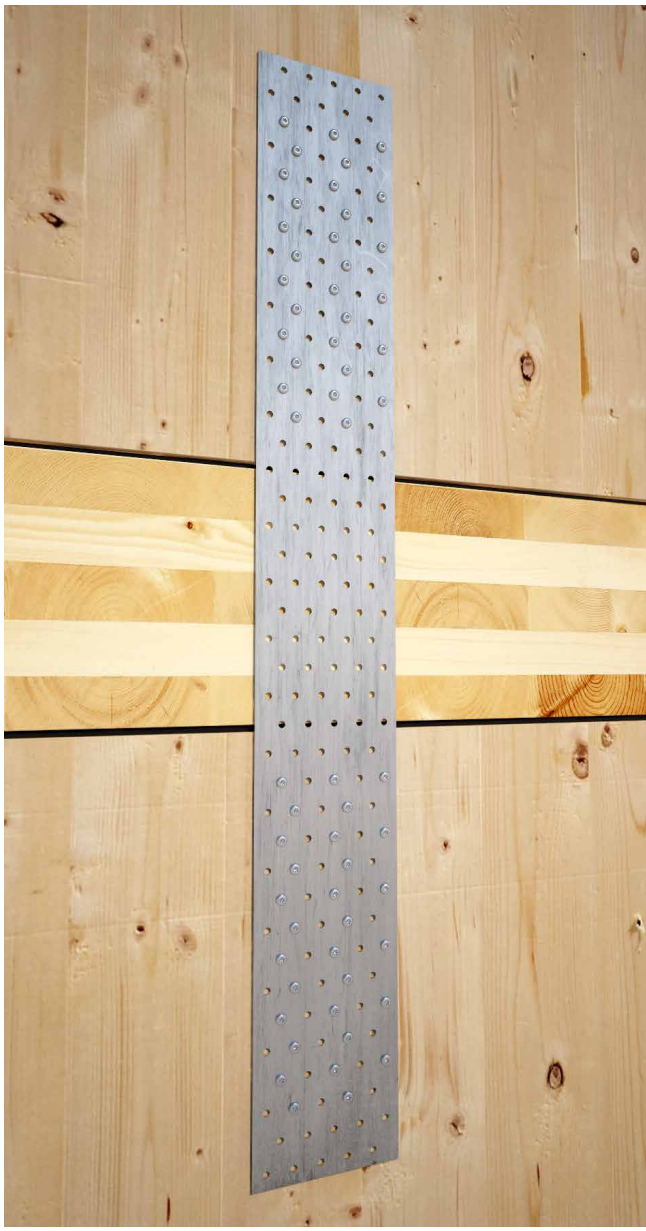
LBS

ROUND HEAD SCREW FOR PLATES

AC233 ESR-4645 | BIT INCLUDED | MY PROJECT SOFTWARE | ETA-11/0030



SCREW FOR PERFORATED PLATES

Cylindrical shoulder designed for fastening perforated metal plates with 5,0 mm | **0.20 inches** and 7,0 mm | **0.28 inches** holes. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.

SUPERIOR STRENGTH

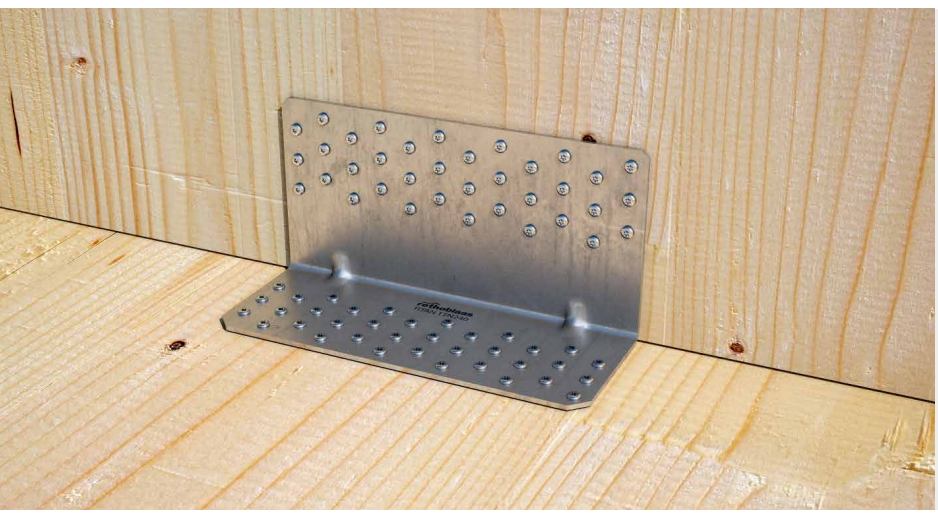
Steel with superb bending yield strength (minimum of F_{yb} = 1240 N/mm² | **180,000 psi** according to ESR-4645). Very high torsional strength $f_{tor,k}$ for safer screwing.

STRUCTURAL APPLICATIONS

Evaluated by ICC-ES according to Acceptance Criteria AC 233. Withdrawal values for any angle between the screw axis and the grain (including end-grain).

CHARACTERISTICS

FOCUS	screw for perforated plates	
HEAD	round with cylindrical underhead	
DIAMETER	5,0 | 7,0 mm	0.20 | 0.28 inches
LENGTH	from 25 to 100 mm	1 to 4 inches



MATERIAL

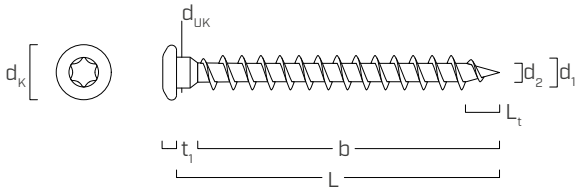
Bright zinc plated carbon steel.

FIELDS OF USE

- sawn lumber and timber
- Glued Laminated Timber
- CLT and other mass timber products
- high density woods

Dry in-service conditions.

GEOMETRY AND MECHANICAL CHARACTERISTICS



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 length	L_t	[in]	0.197	0.276
Pre-drilling hole diameter(2)	d_V	[in]	0.12	0.16
Bending yield strength(3)	$F_{y,b}$	[psi]	180,000	192,000
Tensile strength	f_{tens}	[lbf]	740	1600

(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 softwood timber.
(3) Bending yield strengths are determined in accordance with ASTM F1575 using the root diameter d_2.

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5 **0.20 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

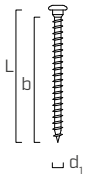
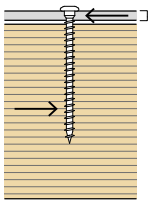
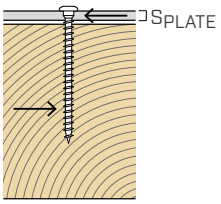
d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
7 **0.28 TX 30**	**LBS760**	60	2 3/8	55	2 3/16	100
	LBS780	80	3 1/8	75	2 15/16	100
	LBS7100	100	4	95	3 3/4	100

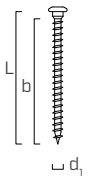
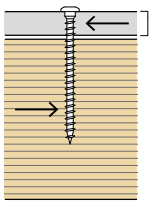
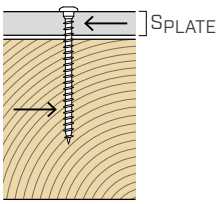
ALUMAXI

The 7 mm | **0.28 inch** diameter version is ideal for joining the ALUMAXI concealed beam hanger.

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

LBS Ø5 | 0.20 inch - LBS Ø7 | 0.28 inch

geometry				$Z_{\parallel}$ (1)				$Z_{\perp}$ (2)				
												
d_1	L		b	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55	steel plate thickness	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 (3)	1	13/16	S_{PLATE} = 1/8"	65	80	97	113	S_{PLATE} = 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	S_{PLATE} = 1/8"	172	212	241	265	S_{PLATE} = 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

geometry				$Z_{\parallel}$ (1)				$Z_{\perp}$ (2)				
												
d_1	L		b	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55	steel plate thickness	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 (3)	1	13/16	S_{PLATE} = 1/4"	75	90	106	121	S_{PLATE} = 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	S_{PLATE} = 1/4"	202	262	309	338	S_{PLATE} = 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

NOTES:

Tabulated reference lateral design values are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

(1) $Z_{\parallel}$ main member loaded parallel to the grain.

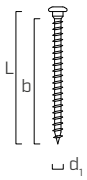
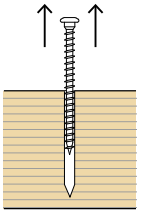
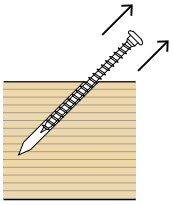
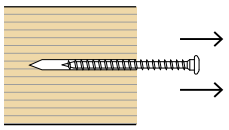
(2) $Z_{\perp}$ main member loaded perpendicular to the grain.

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645.

Refer to page 7 for the general calculation principles.

STRUCTURAL VALUES | THREAD WITHDRAWAL (W)

LBS Ø5 | 0.20 inch - LBS Ø7 | 0.28 inch

geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°(3)			
															
d_1	L		b	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=0.55	G=0.35	G=0.42	G=0.49	G=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(2)	1 9/16	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)	2 3/8	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

NOTES:

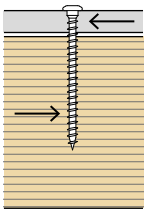
(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

(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 $0° \leq \alpha < 90°$ to the grain).

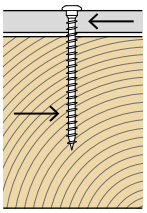
(3) At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis $\alpha \leq 15°$.

Refer to page 7 for the general calculation principles.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°

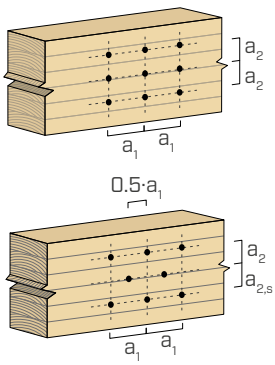


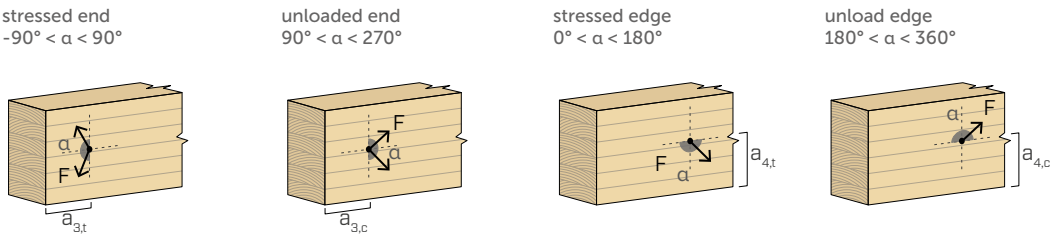
Load-to-grain angle α = 90°

		Screws inserted without pre-drilling hole **G < 0.50**			Screws inserted without pre-drilling hole **G < 0.50**		
d_1	*[mm]*		*5*	*7*		*5*	*7*
	[in]		**0.20**	**0.28**		**0.20**	**0.28**
a_1	[in]	**15·d**	2 15/16	4 1/8	**10·d**	1 15/16	2 3/4
a_2	[in]	**5·d**	1	1 3/8	**5·d**	1	1 3/8
$a_{2,s}$	[in]	**2.5·d**	1/2	11/16	**2.5·d**	1/2	11/16
$a_{3,t}$	[in]	**15·d**	2 15/16	4 1/8	**10·d**	1 15/16	2 3/4
$a_{3,c}$	[in]	**10·d**	1 15/16	2 3/4	**10·d**	1 15/16	2 3/4
$a_{4,t}$	[in]	**5·d**	1	1 3/8	**10·d**	1 15/16	2 3/4
$a_{4,c}$	[in]	**5·d**	1	1 3/8	**5·d**	1	1 3/8

		Screws inserted without pre-drilling hole **G ≥ 0.50**			Screws inserted without pre-drilling hole **G ≥ 0.50**		
d_1	*[mm]*		*5*	*7*		*5*	*7*
	[in]		**0.20**	**0.28**		**0.20**	**0.28**
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
$a_{2,s}$	[in]	**3·d**	9/16	13/16	**3·d**	9/16	13/16
$a_{3,t}$	[in]	**20·d**	4	5 1/2	**15·d**	2 15/16	4 1/8
$a_{3,c}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{4,t}$	[in]	**7·d**	1 3/8	1 15/16	**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

d = nominal screw diameter

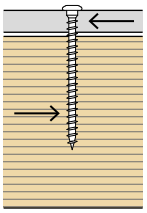




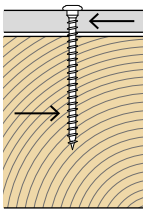
NOTES:

- The minimum spacing and distances comply with Table 9 of ESR-4645, where d refers to the nominal diameter of the screw.
- Values for spacing between staggered rows $a_{2,s}$ apply where fasteners in adjacent rows are offset by half of the spacing between fasteners in a row ($0.5 \cdot a_1$).
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

MINIMUM DISTANCES FOR SHEAR LOADS | STEEL-TO-TIMBER



Load-to-grain angle α = 0°



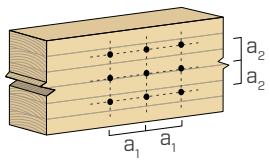
Load-to-grain angle α = 90°

			Screws inserted without pre-drilling hole **G ≤ 0.47**			Screws inserted without pre-drilling hole **G ≤ 0.47**	
d_1	*[mm]*		*5*	*7*		*5*	*7*
	[in]		**0.20**	**0.28**		**0.20**	**0.28**
a_1	[in]	**12·d·0,7**	1 5/8	2 5/16	**5·d·0,7**	11/16	1
a_2	[in]	**5·d·0,7**	11/16	1	**5·d·0,7**	11/16	1
$a_{3,t}$	[in]	**15·d**	2 15/16	4 1/8	**10·d**	1 15/16	2 3/4
$a_{3,c}$	[in]	**10·d**	1 15/16	2 3/4	**10·d**	1 15/16	2 3/4
$a_{4,t}$	[in]	**5·d**	1	1 3/8	**10·d**	1 15/16	2 3/4
$a_{4,c}$	[in]	**5·d**	1	1 3/8	**5·d**	1	1 3/8

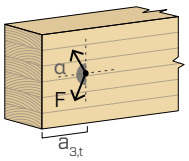
			Screws inserted without pre-drilling hole **G > 0.47**			Screws inserted without pre-drilling hole **G > 0.47**	
d_1	*[mm]*		*5*	*7*		*5*	*7*
	[in]		**0.20**	**0.28**		**0.20**	**0.28**
a_1	[in]	**15·d·0,7**	2 1/16	2 15/16	**7·d·0,7**	1	1 3/8
a_2	[in]	**7·d·0,7**	1	1 3/8	**7·d·0,7**	1	1 3/8
$a_{3,t}$	[in]	**20·d**	4	5 1/2	**15·d**	2 15/16	4 1/8
$a_{3,c}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{4,t}$	[in]	**7·d**	1 3/8	1 15/16	**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-drilling hole			Screws inserted **with** pre-drilling hole	
d_1	*[mm]*		*5*	*7*		*5*	*7*
	[in]		**0.20**	**0.28**		**0.20**	**0.28**
a_1	[in]	**5·d·0,7**	11/16	1	**4·d·0,7**	9/16	13/16
a_2	[in]	**3·d·0,7**	7/16	9/16	**4·d·0,7**	9/16	13/16
$a_{3,t}$	[in]	**12·d**	2 3/8	3 5/16	**7·d**	1 3/8	1 15/16
$a_{3,c}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{4,t}$	[in]	**3·d**	9/16	13/16	**7·d**	1 3/8	1 15/16
$a_{4,c}$	[in]	**3·d**	9/16	13/16	**3·d**	9/16	13/16

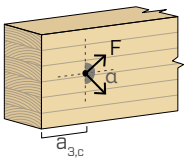
d = nominal screw diameter



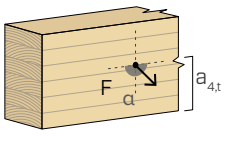
stressed end
-90° < α < 90°



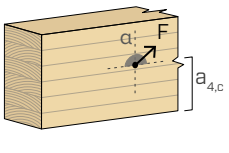
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES:

- The tabulated values for the minimum spacing and distances are according to the European Technical Assessment ETA-11/0030. The values from ETA-11/0030 are based on extensive research studies carried out in Europe and are according to the well-established provisions from EN 1995:2014 (Eurocode 5). Designers may adopt, under their responsibility, the minimum spacing and distances from ETA-11/0030.
- Specific gravity of G = 0.47 is equivalent to a characteristic density of ρ_k = 420 kg/m^3.
- In the case of timber-to-timber joints, the minimum spacing (a_1, a_2) should be multiplied by a coefficent of 1.5.

GENERAL PRINCIPLES:

- Tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners to determine allowable loads for use with ASD, design loads for use with LRFD or both.
- As part of the connection design, the structural wood members must be checked for load-carrying capacity in accordance with Section 11.1.2 of the NDS and local stresses within multiple-fastener connections must be checked against Appendix E of the NDS to ensure the capacity of the connection and fastener group.
- Connections with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS and the requirements in Section 4.1.7.3.1 of 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).
- Sizing and verification of the timber elements and steel plates must be done separately by the designer.

REFERENCE LATERAL DESIGN VALUES:

- Tabulated values are determined from the yield model equations in Section 12.3 and Table 12.3.1A of the NDS.
- 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 NDS and Section 4.1.6.2 of ESR-4645.

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 less the thickness of the steel side member.

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 Table 7 of ESR-4645 and are reported below.

d_1	Reference withdrawal design values W_{ref}			
	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[lbf/in]	[lbf/in]	[lbf/in]	[lbf/in]
5 **0.20**	99	114	128	140
7 **0.28**	115	132	149	162

- 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:

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

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

Tabulated values at page 4 are valid for L_{eff} equal to the screw thread length b minus the tip length L_t and $k_\alpha = 1$ for α=90°, $k_\alpha = 0.91$ for α = 45°, $k_\alpha = 0.3$ for α = 0°.

- The minimum embedded thread length for screws installed at an angle $0° \leq \alpha < 90°$ to the grain is 8 times the outer thread diameter according to ESR-4645, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between screw axis and grain direction $\alpha \leq 15°$.
- The reference withdrawal design values must be less than f_{tens} of the screw.