LBS HARDWOOD EVO

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

ELC-4645 ESR-4645 ETA-11/0030

C4 EVO COATING

The atmospheric corrosion resistance class (C4) of the C4 EVO coating was tested by the Research Institutes of Sweden - RISE. Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch and pine (see the "TIMBER SCREWS AND DECK FASTENING - US EDITION" catalogue at www.rothoblaas.com)

HARDWOOD CERTIFICATION

Special tip with embossed slit elements. Designed for use with high density timber without any pre-drill.
Approved for structural applications subject to stresses in any direction of the grain.

ROBUSTNESS

The inner core diameter of the screw has been enlarged compared to the LBS version to ensure safe installation in higher density woods. The cylindrical under head is designed for fastening mechanical elements and producing an interlocking effect with the plate hole that provides excellent static perfornances.

MY PROJECT SOFTWARE

BIT INCLUDED

DIAMETER [in]

0.14 | 0.20 0.28 | 0.48

LENGTH [in]

1 | 2 3/8 8 | 8

EXPOSURE CONDITION

EC1 EC3

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3

MATERIAL

C4 EVO COATING — carbon steel with C4 EVO coating

FIELDS OF USE

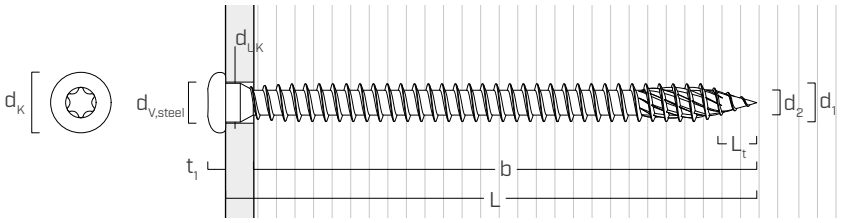
- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
5 **0.20** **#11** **TX 20**	**LBSHEVO580**	80	3 1/8	76	3	200
	LBSHEVO5100	100	4	96	3 3/4	200
	LBSHEVO5120	120	4 3/4	116	4 9/16	200

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	pcs
7 **0.28** **#11** **TX 30**	**LBSHEVO760**	60	2 3/8	55	2 3/16	100
	LBSHEVO780	80	3 1/8	75	2 15/16	100
	LBSHEVO7100	100	4	95	3 3/4	100
	LBSHEVO7120	120	4 3/4	115	4 1/2	100
	LBSHEVO7160	160	6 1/4	155	6 1/8	100
	LBSHEVO7200	200	8	195	7 11/16	100

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

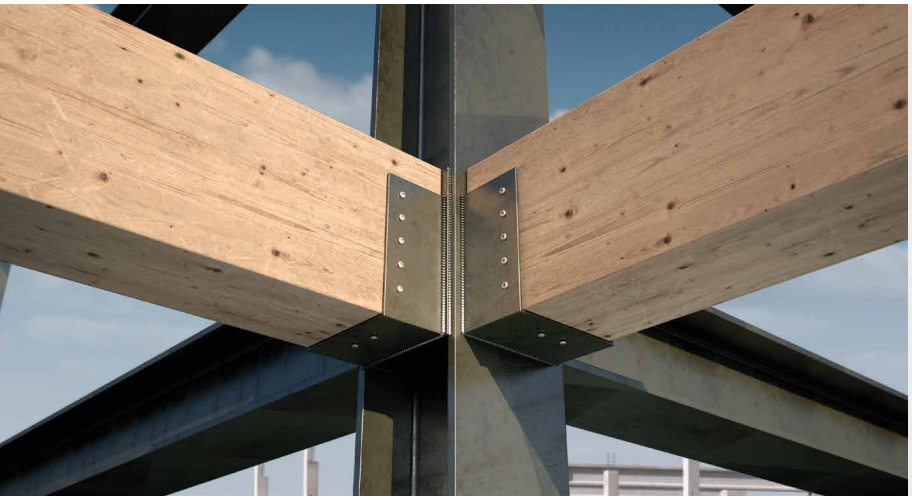
Nominal diameter	**d_1**	**[in]**(1)	**0.20**	**0.28**
Outer thread diameter	**d_1**	[mm]	5	7
		[in]	**0.197**	**0.276**
Head diameter	d_K	[in]	0.307	0.433
Root diameter	d_2	[in]	0.137	0.191
Underhead diameter	d_{UK}	[in]	0.193	0.276
Head thickness	t_1	[in]	0.096	0.138
Tip Lenght	L_t	[in]	0.197	0.276
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≤0.55 (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]**	980	2050
Bending yield strength (specified)	$F_{y,b}$	**[psi]**	185000	195000

Nominal diameter	**d_1**	[in]		**0.20**	**0.28**
Withdrawal	W_{90}	**[lbf/in]**	G = 0.35	113	144
			G = 0.42	129	166
			G = 0.49	146	187
			G = 0.55	159	204
minimum embedded length		**[in]**		1 5/8	2 3/4



HYBRID STEEL-TIMBER STRUCTURES

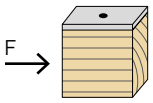
The LBSHEVO Ø7 mm (0.28 inch) screws are suitable for custom-designed connections, which are characteristic of steel structures. Maximum performance in hardwoods combined with the strengths of steel plates.

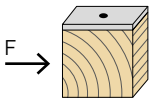
T3 TIMBER CORROSIVITY

Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch, pine, ash and birch.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

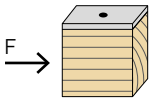
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.50**

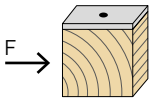




d_1	[in]		0.20	0.28		0.20	0.28
	[mm]		5	7		5	7
a_1	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
a_2	[in]	**5·d**	1	1 3/8	**5·d**	1	1 3/8
$a_{3,t}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{3,c}$	[in]	**10·d**	1 15/16	2 3/4	**10·d**	1 15/16	2 3/4
$a_{4,t}$	[in]	**10·d**	1 15/16	2 3/4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

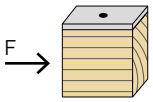
screws inserted **WITHOUT pre-drilled hole** — **G > 0.50**

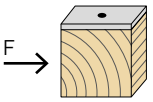




d_1	[in]		0.20	0.28		0.20	0.28
	[mm]		5	7		5	7
a_1	[in]	**15·d**	2 15/16	4 1/8	**10·d**	1 15/16	2 3/4
a_2	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{3,t}$	[in]	**20·d**	4	5 1/2	**20·d**	4	5 1/2
$a_{3,c}$	[in]	**15·d**	2 15/16	4 1/8	**15·d**	2 15/16	4 1/8
$a_{4,t}$	[in]	**12·d**	2 3/8	3 5/16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

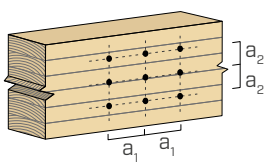
screws inserted **WITH pre-drilled hole**



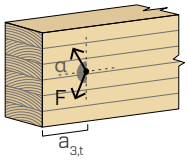


d_1	[in]		0.20	0.28		0.20	0.28
	[mm]		5	7		5	7
a_1	[in]	**10·d**	1 15/16	2 3/4	**5·d**	1	1 3/8
a_2	[in]	**4·d**	13/16	1 1/8	**4·d**	13/16	1 1/8
$a_{3,t}$	[in]	**12·d**	2 3/8	3 5/16	**12·d**	2 3/8	3 5/16
$a_{3,c}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**	1 3/8	1 15/16
$a_{4,t}$	[in]	**7·d**	1 3/8	1 15/16	**7·d**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

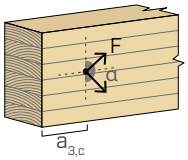
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



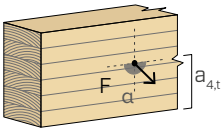
stressed end
-90° < α < 90°



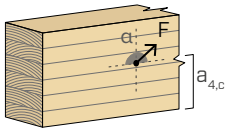
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



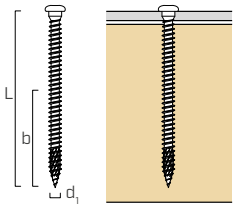
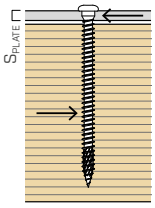
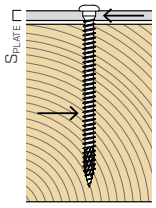
unload edge
180° < α < 360°



NOTES

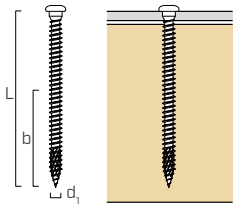
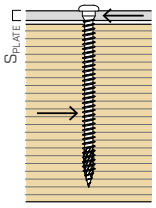
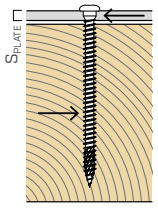
- The minimum spacing and distances comply with Table 8 of ESR-4645, where d refers to the nominal diameter of the screw;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

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

geometry				Z_{II} (1)					$Z_{\perp}$ (2)				
													
d_1	L		b	S_{PLATE}	G				S_{PLATE}	G			
					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]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 **0.20**	80	3 1/8	3	1/16	106	124	142	156	1/16	106	124	142	156
	100	4	3 3/4		106	124	142	156		106	124	142	156
	120	4 3/4	4 9/16		106	124	142	156		106	124	142	156
7 **0.28**	60	2 3/8	2 3/16	1/16	171	221	253	279	1/16	137	177	202	223
	80	3 1/8	2 15/16		189	221	253	279		151	177	202	223
	100	4	3 3/4		189	221	253	279		151	177	202	223
	120	4 3/4	4 1/2		189	221	253	279		151	177	202	223
	160	6 1/4	6 1/8		189	221	253	279		151	177	202	223
	200	8	7 11/16		189	221	253	279		151	177	202	223
5 **0.20**	80	3 1/8	3	5/64	109	127	145	159	5/64	109	127	145	159
	100	4	3 3/4		109	127	145	159		109	127	145	159
	120	4 3/4	4 9/16		109	127	145	159		109	127	145	159
7 **0.28**	60	2 3/8	2 3/16	5/64	171	224	255	282	5/64	137	179	204	225
	80	3 1/8	2 15/16		191	224	255	282		153	179	204	225
	100	4	3 3/4		191	224	255	282		153	179	204	225
	120	4 3/4	4 1/2		191	224	255	282		153	179	204	225
	160	6 1/4	6 1/8		191	224	255	282		153	179	204	225
	200	8	7 11/16		191	224	255	282		153	179	204	225
5 **0.20**	80	3 1/8	3	7/64	116	136	154	169	7/64	116	136	154	169
	100	4	3 3/4		116	136	154	169		116	136	154	169
	120	4 3/4	4 9/16		116	136	154	169		116	136	154	169
7 **0.28**	60	2 3/8	2 3/16	7/64	174	231	263	289	7/64	139	185	210	232
	80	3 1/8	2 15/16		197	231	263	289		158	185	210	232
	100	4	3 3/4		197	231	263	289		158	185	210	232
	120	4 3/4	4 1/2		197	231	263	289		158	185	210	232
	160	6 1/4	6 1/8		197	231	263	289		158	185	210	232
	200	8	7 11/16		197	231	263	289		158	185	210	232
5 **0.20**	80	3 1/8	3	1/8	121	141	160	176	1/8	121	141	160	176
	100	4	3 3/4		121	141	160	176		121	141	160	176
	120	4 3/4	4 9/16		121	141	160	176		121	141	160	176
7 **0.28**	60	2 3/8	2 3/16	1/8	176	236	268	295	1/8	141	188	214	236
	80	3 1/8	2 15/16		202	236	268	295		161	188	214	236
	100	4	3 3/4		202	236	268	295		161	188	214	236
	120	4 3/4	4 1/2		202	236	268	295		161	188	214	236
	160	6 1/4	6 1/8		202	236	268	295		161	188	214	236
	200	8	7 11/16		202	236	268	295		161	188	214	236
5 **0.20**	80	3 1/8	3	9/64	126	147	167	183	9/64	126	147	167	183
	100	4	3 3/4		126	147	167	183		126	147	167	183
	120	4 3/4	4 9/16		126	147	167	183		126	147	167	183
7 **0.28**	60	2 3/8	2 3/16	9/64	178	240	274	301	9/64	143	192	219	241
	80	3 1/8	2 15/16		207	241	274	301		165	193	219	241
	100	4	3 3/4		207	241	274	301		165	193	219	241
	120	4 3/4	4 1/2		207	241	274	301		165	193	219	241
	160	6 1/4	6 1/8		207	241	274	301		165	193	219	241

NOTES and GENERAL PRINCIPLES on page 7.

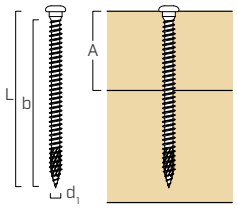
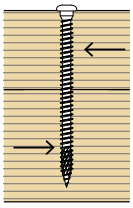
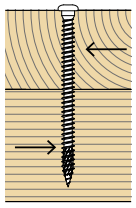
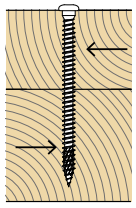
REFERENCE LATERAL DESIGN VALUES (Z) | STEEL-TO-WOOD

geometry				Z_{II} [1]					$Z_{\perp}$ [2]				
													
d_1	L		b	S_{PLATE}	G				S_{PLATE}	G			
					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]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 **0.20**	80	3 1/8	3	1/4	145	171	195	216	1/4	145	171	195	216
	100	4	3 3/4		145	171	195	216		145	171	195	216
	120	4 3/4	4 9/16		145	171	195	216		145	171	195	216
7 **0.28**	60	2 3/8	2 3/16	1/4	210	268	332	364	1/4	168	214	266	291
	80	3 1/8	2 15/16		253	294	332	364		202	235	266	291
	100	4	3 3/4		253	294	332	364		202	235	266	291
	120	4 3/4	4 1/2		253	294	332	364		202	235	266	291
	160	6 1/4	6 1/8		253	294	332	364		202	235	266	291
	200	8	7 11/16		253	294	332	364		202	235	266	291
5 **0.20**	80	3 1/8	3	3/8	145	171	195	216	3/8	145	171	195	216
	100	4	3 3/4		145	171	195	216		145	171	195	216
	120	4 3/4	4 9/16		145	171	195	216		145	171	195	216
7 **0.28**	60	2 3/8	2 3/16	3/8	211	269	335	393	3/8	169	215	268	315
	80	3 1/8	2 15/16		255	311	356	393		204	248	285	315
	100	4	3 3/4		264	311	356	393		211	248	285	315
	120	4 3/4	4 1/2		264	311	356	393		211	248	285	315
	160	6 1/4	6 1/8		264	311	356	393		211	248	285	315
	200	8	7 11/16		264	311	356	393		211	248	285	315
5 **0.20**	80	3 1/8	3	1/2	145	171	195	216	1/2	145	171	195	216
	100	4	3 3/4		145	171	195	216		145	171	195	216
	120	4 3/4	4 9/16		145	171	195	216		145	171	195	216
7 **0.28**	60	2 3/8	2 3/16	1/2	205	260	321	379	1/2	164	208	257	303
	80	3 1/8	2 15/16		247	311	356	393		198	248	285	315
	100	4	3 3/4		264	311	356	393		211	248	285	315
	120	4 3/4	4 1/2		264	311	356	393		211	248	285	315
	160	6 1/4	6 1/8		264	311	356	393		211	248	285	315
	200	8	7 11/16		264	311	356	393		211	248	285	315
5 **0.20**	80	3 1/8	3	5/8	145	171	195	216	5/8	145	171	195	216
	100	4	3 3/4		145	171	195	216		145	171	195	216
	120	4 3/4	4 9/16		145	171	195	216		145	171	195	216
7 **0.28**	60	2 3/8	2 3/16	5/8	200	251	308	362	5/8	160	201	246	290
	80	3 1/8	2 15/16		240	311	356	393		192	248	285	315
	100	4	3 3/4		264	311	356	393		211	248	285	315
	120	4 3/4	4 1/2		264	311	356	393		211	248	285	315
	160	6 1/4	6 1/8		264	311	356	393		211	248	285	315
	200	8	7 11/16		264	311	356	393		211	248	285	315
5 **0.20**	80	3 1/8	3	3/4	145	171	195	216	3/4	145	171	195	216
	100	4	3 3/4		145	171	195	216		145	171	195	216
	120	4 3/4	4 9/16		145	171	195	216		145	171	195	216
7 **0.28**	60	2 3/8	2 3/16	3/4	196	243	296	346	3/4	157	194	237	277
	80	3 1/8	2 15/16		232	303	356	393		186	242	285	315
	100	4	3 3/4		264	311	356	393		211	248	285	315
	120	4 3/4	4 1/2		264	311	356	393		211	248	285	315
	160	6 1/4	6 1/8		264	311	356	393		211	248	285	315
	200	8	7 11/16		264	311	356	393		211	248	285	315

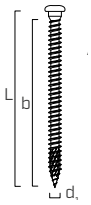
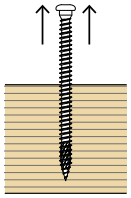
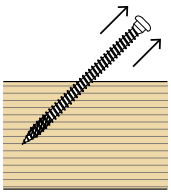
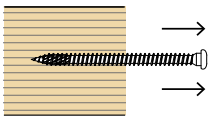
[1] Main member loaded parallel to the grain.
[2] Main member loaded perpendicular to the grain.

NOTES and **GENERAL PRINCIPLES** on page 7.

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**	80	3 1/8	3	1 9/16	95	123	142	158	95	123	142	158	95	123	142	158
	100	4	3 3/4	1 15/16	104	123	142	158	104	123	142	158	104	123	142	158
	120	4 3/4	4 9/16	2 3/8	104	123	142	158	104	123	142	158	104	123	142	158
7 **0.28**	60	2 3/8	2 3/16	1 3/16	88	123	164	203	71	99	131	162	71	99	131	162
	80	3 1/8	2 15/16	1 9/16	119	167	221	272	95	133	177	218	95	133	177	218
	100	4	3 3/4	1 15/16	150	210	258	287	120	168	206	229	120	168	206	229
	120	4 3/4	4 1/2	2 3/8	180	224	258	287	144	179	206	229	144	179	206	229
	160	6 1/4	6 1/8	3 1/8	189	224	258	287	151	179	206	229	151	179	206	229
	200	8	7 11/16	4	189	224	258	287	151	179	206	229	151	179	206	229

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**	80	3 1/8	3	316	361	408	444	287	328	371	404	95	108	122	133
	100	4	3 3/4	405	462	523	570	368	421	476	518	121	139	157	171
	120	4 3/4	4 9/16	494	564	638	695	449	513	581	632	148	169	191	208
7 **0.28**	60[(1)]	2 3/8	2 3/16	272	314	353	386	248	285	322	351	82	94	106	116
	80	3 1/8	2 15/16	386	444	501	546	351	404	456	497	116	133	150	164
	100	4	3 3/4	499	575	648	707	454	523	590	643	150	173	194	212
	120	4 3/4	4 1/2	612	706	795	867	557	642	724	789	184	212	239	260
	160	6 1/4	6 1/8	839	967	1090	1189	764	880	992	1082	252	290	327	357
	200	8	7 11/16	1066	1229	1384	1510	970	1118	1260	1374	320	369	415	453

[(1)] 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 7.

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.

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 7 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 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 $0° \leq \alpha < 90°$ 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 $\alpha < 15°$.
- The reference withdrawal design values must be inferior to f_{tens} of the screw.