

TBS EVO

LARGE WASHER HEAD SCREW

ICC
ES
AC233 | AC257
ESR-4645

BIT INCLUDED

MY
PROJECT
SOFTWARE

C4
EVO
COATING

CE
ETA-11/0030

C4 EVO COATING

C4 EVO 20 µm multilayer coating with a surface treatment of epoxy resin and aluminum flakes. No rust after 1440 hours of salt spray exposure, as per ISO 9227. Tested for use in outdoor applications under C4 atmospheric corrosion class conditions (ISO 12944-2).

PRESSURE - TREATED LUMBER

Ideal for applications with timber containing tannin or treatment agents. EVO Coating has been evaluated by ICC-ES according to Acceptance Criteria AC 257 for use with ACQ treated lumber for durable structures in challenging conditions.

INTEGRATED WASHER

The large head serves as washer and ensures high tensile strength. Ideal in the presence of wind or variations in timber dimensions.

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). Asymmetric "umbrella" shape thread for improved penetration capacity into the wood member.

CHARACTERISTICS

FOCUS	corrosiveness class C4	
HEAD	large washer head	
DIAMETER	from 6 to 8 mm	0.24 to 0.32 inches
LENGTH	from 60 to 240 mm	2 3/8 to 9 1/2 inches



MATERIAL

Carbon steel, with a 20 µm coating, highly resistant to corrosion.

FIELDS OF USE

- sawn lumber and timber
 - Glued Laminated Timber
 - CLT
 - high density woods
 - Pressure - treated lumber (ACQ)
- Dry in-service conditions.

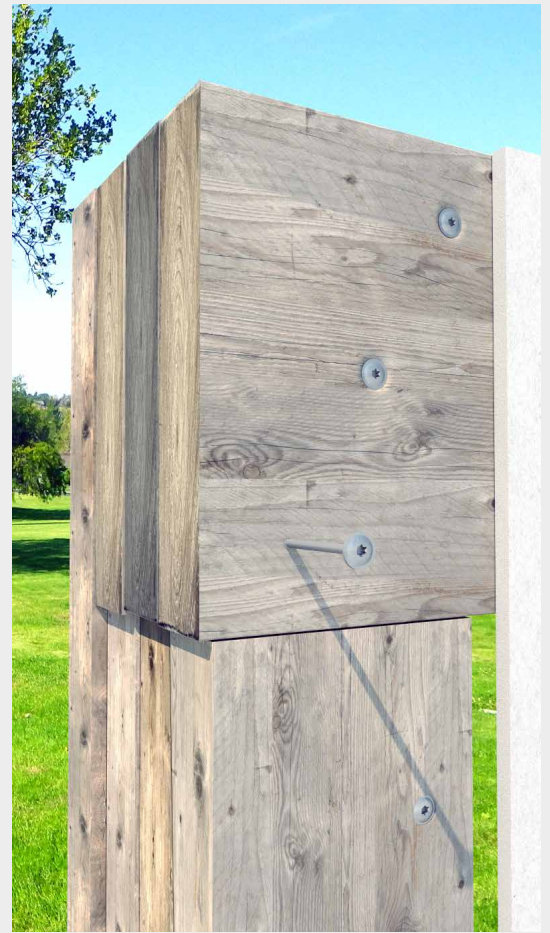


OUTDOOR WALKWAYS

Ideal for the construction of outdoor structures such as walkways and arcades. Values were also tested, certified, and calculated for screw insertion parallel to the grain.

SIP PANELS

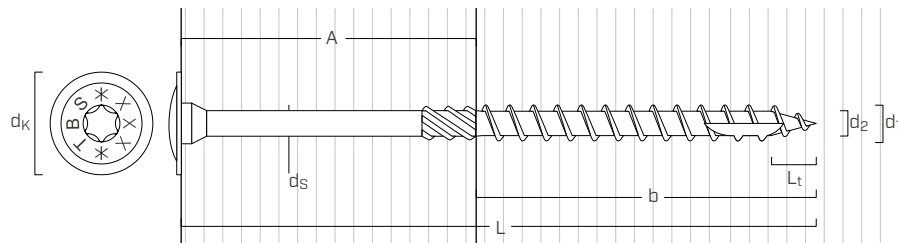
Values also tested, certified and calculated for CLT and high density woods such as Microllam® LVL. Suitable for fastening SIP and sandwich panels.



^
Fastening Wood Trusses outdoors.

Fastening of 3-layer, multi-ply beams
with plasterboard coating. >

■ GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d₁	[in] ⁽¹⁾	0.24	0.32
		[mm]	6	8
Outer thread diameter	d₁	[in]	0.236	0.315
Head diameter	d _K	[in]	0.61	0.75
Root diameter	d ₂	[in]	0.156	0.213
Shank diameter	d _s	[in]	0.169	0.228
Tip length	L _t	[in]	0.236	0.315
Pre-drilling hole diameter ⁽²⁾	d _v	[in]	0.16	0.20
Bending yield strength ⁽³⁾	F _{y,b}	[psi]	200,000	180,000
Tensile strength	f _{tens}	[lbf]	1180	2040

⁽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.

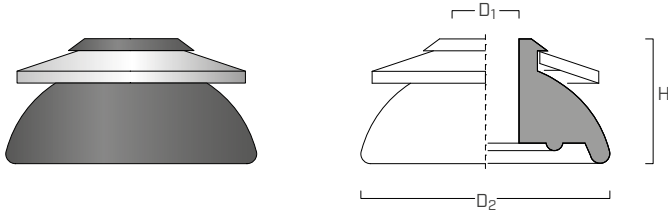
⁽³⁾ Bending yield strengths are determined in accordance with ASTM F1575 using the root diameter d₂.

CODES AND DIMENSIONS

d ₁ [mm] [in]	d _k [mm] [in]	CODE	L		b	A		pcs
6 0.24 TX 30	15,5 0.61	TBSEVO660	60	2 3/8	19/16	13	1/2	100
		TBSEVO680	80	3 1/8	1 15/16	25	1	100
		TBSEVO6100	100	4	2 3/8	32	1 1/4	100
		TBSEVO6120	120	4 3/4	2 15/16	38	1 1/2	100
		TBSEVO6140	140	5 1/2	2 15/16	57	2 1/4	100
		TBSEVO6160	160	6 1/4	2 15/16	83	3 1/4	100
		TBSEVO6180	180	7 1/8	2 15/16	102	4	100
		TBSEVO6200	200	8	2 15/16	121	4 3/4	100

d ₁ [mm] [in]	d _k [mm] [in]	CODE	L		b	A		pcs
8 0.32 TX 40	19 0.75	TBSEVO8100	100	4	2 1/16	44	1 3/4	50
		TBSEVO8120	120	4 3/4	3 1/8	32	1 1/4	50
		TBSEVO8140	140	5 1/2	3 1/8	57	2 1/4	50
		TBSEVO8160	160	6 1/4	4	57	2 1/4	50
		TBSEVO8180	180	7 1/8	4	76	3	50
		TBSEVO8200	200	8	4	95	3 3/4	50
		TBSEVO8220	220	8 5/8	4	114	4 1/2	50
		TBSEVO8240	240	9 1/2	4	133	5 1/4	50

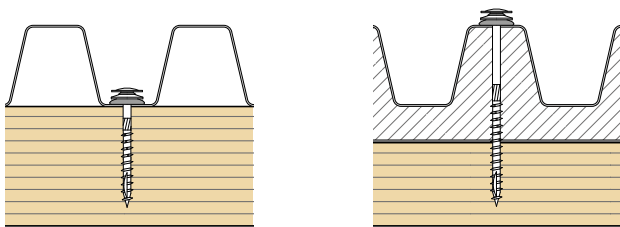
WBAZ WASHER^(*)



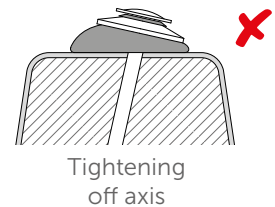
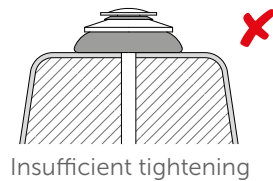
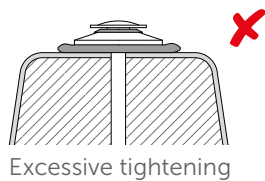
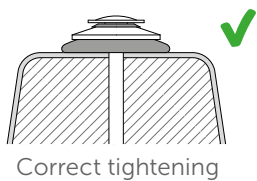
CODE	screw		D ₂	H	D ₁	pcs
	[mm]	[in]	[in]	[in]	[in]	
WBAZ25A2	6,0 - 6,5	0.24 - 0.25	1	9/16	1/4	100

(*) Not evaluated in ESR-4645.

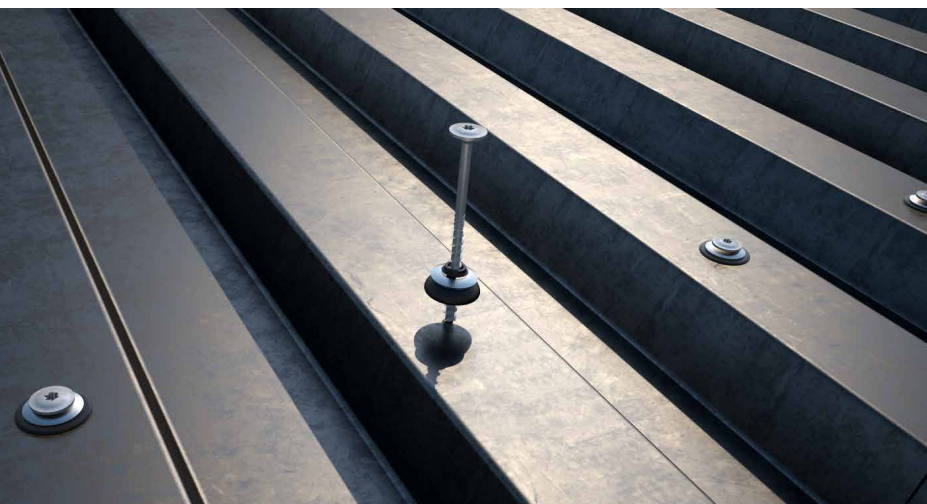
INSTALLATION



TBS EVO + WBAZ	fastening package	
	[mm]	[in]
TBSEVO660	min. 0 - max. 40	min. 0 - max. 1 9/16
TBSEVO680	min. 10 - max. 60	min. 3/8 - max. 2 3/8
TBSEVO6100	min. 30 - max. 80	min. 1 3/16 - max. 3 1/8
TBSEVO6120	min. 50 - max. 100	min. 1 15/16 - max. 4
TBSEVO6140	min. 70 - max. 120	min. 2 3/4 - max. 4 3/4
TBSEVO6160	min. 90 - max. 140	min. 3 1/2 - max. 5 1/2
TBSEVO6180	min. 110 - max. 160	min. 4 3/8 - max. 6 1/4
TBSEVO6200	min. 130 - max. 180	min. 5 1/8 - max. 7 1/8



NOTES: The thickness of the washer after installation is approximately 8 - 9 mm | 0.32 - 0.36 inches.

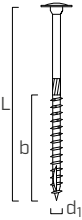
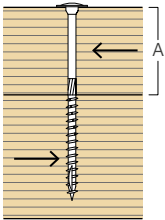
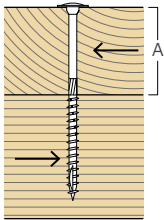
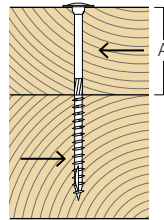


FASTENING METAL SHEET

Can be installed on sheets up to 0,7 mm | 0.03 inch thick without pre-drilling. TBS EVO 6 mm | 0.24 inch, ideal when used in combination with washer WBAZ.
For outdoor use.

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

TBS EVO Ø6 | 0.24 inch - TBS EVO Ø8 | 0.32 inch

geometry					$Z_{ }^{(1)}$				$Z_{\perp/\perp}^{(2)}$				$Z_{\perp}^{(3)}$			
																
d_1	L	b	A		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]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
6 0.24	60	2 3/8	1 9/16	1/2	85	116	135	151	85	116	135	151	85	116	135	151
	80	3 1/8	1 15/16	1	104	129	156	182	104	129	156	182	104	129	156	182
	100	4	2 3/8	1 1/4	111	140	174	206	111	140	174	206	111	140	174	206
	120	4 3/4	2 15/16	1 1/2	120	154	190	211	120	154	190	211	120	154	190	211
	140	5 1/2	2 15/16	2 1/4	139	165	190	211	139	165	190	211	139	165	190	211
	160	6 1/4	2 15/16	3 1/4	139	165	190	211	139	165	190	211	139	165	190	211
	180	7 1/8	2 15/16	4	139	165	190	211	139	165	190	211	139	165	190	211
	200	8	2 15/16	4 3/4	139	165	190	211	139	165	190	211	139	165	190	211
8 0.32	100	4	2 1/16	1 3/4	155	216	270	313	124	173	216	251	124	173	216	251
	120	4 3/4	3 1/8	1 1/4	153	189	228	266	122	151	183	213	122	151	183	213
	140	5 1/2	3 1/8	2 1/4	191	245	282	313	153	196	225	251	153	196	225	251
	160	6 1/4	4	2 1/4	191	245	282	313	153	196	225	251	153	196	225	251
	180	7 1/8	4	3	207	245	282	313	165	196	225	251	165	196	225	251
	200	8	4	3 3/4	207	245	282	313	165	196	225	251	165	196	225	251
	220	8 5/8	4	4 1/2	207	245	282	313	165	196	225	251	165	196	225	251
	240	9 1/2	4	5 1/4	207	245	282	313	165	196	225	251	165	196	225	251

NOTES:

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

(1) $Z_{||}$ both side and main members loaded parallel to the grain.

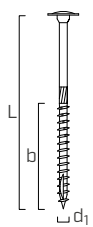
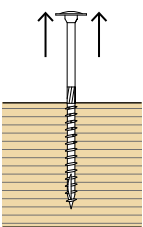
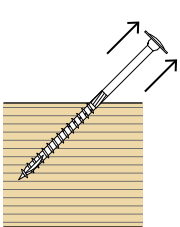
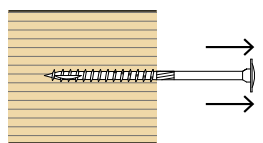
(2) $Z_{\perp/\perp}$ side member loaded perpendicular to the grain; main member loaded parallel to the grain.

(3) $Z_{\perp}$ both side and main members loaded perpendicular to the grain.

Refer to page 10 for the general calculation principles.

STRUCTURAL VALUES | THREAD WITHDRAWAL [W]

TBS EVO Ø6 | 0.24 inch - TBS EVO Ø8 | 0.32 inch

geometry				thread withdrawal $\alpha = 90^\circ$				thread withdrawal $\alpha = 45^\circ$				thread withdrawal $\alpha = 0^\circ$			
															
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]
6 0.24	60 ⁽¹⁾	2 3/8	1 9/16	103	119	175	191	94	108	160	174	31	36	53	57
	80 ⁽²⁾	3 1/8	1 15/16	133	154	227	248	121	140	207	225	40	46	68	74
	100	4	2 3/8	164	189	279	304	149	172	253	277	49	57	84	91
	120	4 3/4	2 15/16	209	242	356	388	190	220	324	354	63	73	107	117
	140	5 1/2	2 15/16	209	242	356	388	190	220	324	354	63	73	107	117
	160	6 1/4	2 15/16	209	242	356	388	190	220	324	354	63	73	107	117
	180	7 1/8	2 15/16	209	242	356	388	190	220	324	354	63	73	107	117
	200	8	2 15/16	209	242	356	388	190	220	324	354	63	73	107	117
8 0.32	100 ⁽¹⁾	4	2 1/16	189	217	239	301	172	197	218	274	57	65	72	90
	120	4 3/4	3 1/8	309	354	391	493	281	322	356	449	93	106	117	148
	140	5 1/2	3 1/8	309	354	391	493	281	322	356	449	93	106	117	148
	160	6 1/4	4	395	453	500	630	359	412	455	574	118	136	150	189
	180	7 1/8	4	395	453	500	630	359	412	455	574	118	136	150	189
	200	8	4	395	453	500	630	359	412	455	574	118	136	150	189
	220	8 5/8	4	395	453	500	630	359	412	455	574	118	136	150	189
	240	9 1/2	4	395	453	500	630	359	412	455	574	118	136	150	189

NOTES:

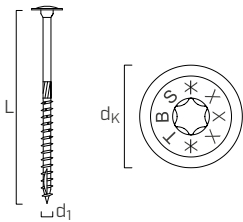
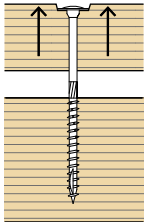
- (1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle $0^\circ \leq \alpha < 90^\circ$ to the grain).
- (2) The embedded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

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 $\alpha \leq 15^\circ$.

Refer to page 10 for the general calculation principles.

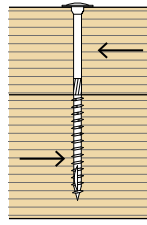
STRUCTURAL VALUES | HEAD PULL-THROUGH (W_H)

TBS EVO Ø6 | 0.24 inch - TBS EVO Ø8 | 0.32 inch

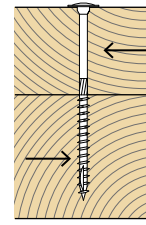
geometry				head pull-through			
							
d ₁ [mm] [in]	d _K [mm] [in]	L [mm] [in]	minimum side member thickness [in]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]
6 0.24	15,5 0.61	from 60 to 200 from 2 3/8 to 8	1 1/2	125	144	162	177
8 0.32	19,0 0.75	from 100 to 240 from 4 to 9 1/2	1 1/2	166	216	243	265

NOTES:

Refer to page 10 for the general calculation principles.



Load-to-grain angle $\alpha = 0^\circ$

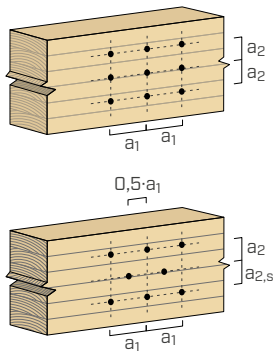


Load-to-grain angle $\alpha = 90^\circ$

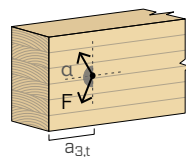
		Screws inserted without pre-drilling hole $G < 0.50$			Screws inserted without pre-drilling hole $G < 0.50$		
d_1	[mm]	6			6		
	[in]	0.24			0.24		
a_1	[in]	15·d	3 1/2	4 3/4	12·d	2 13/16	3 3/4
a_2	[in]	5·d	1 3/16	1 9/16	5·d	1 3/16	1 9/16
$a_{2,s}$	[in]	2.5·d	9/16	13/16	2.5·d	9/16	13/16
$a_{3,t}$	[in]	15·d	3 1/2	4 3/4	10·d	2 3/8	3 1/8
$a_{3,c}$	[in]	10·d	2 3/8	3 1/8	10·d	2 3/8	3 1/8
$a_{4,t}$	[in]	5·d	1 3/16	1 9/16	10·d	2 3/8	3 1/8
$a_{4,c}$	[in]	5·d	1 3/16	1 9/16	5·d	1 3/16	1 9/16

		Screws inserted without pre-drilling hole $G \geq 0.50$			Screws inserted without pre-drilling hole $G \geq 0.50$		
d_1	[mm]	6			6		
	[in]	0.24			0.24		
a_1	[in]	15·d	3 1/2	4 3/4	15·d	3 1/2	4 3/4
a_2	[in]	7·d	1 5/8	2 3/16	7·d	1 5/8	2 3/16
$a_{2,s}$	[in]	3·d	11/16	15/16	3·d	11/16	15/16
$a_{3,t}$	[in]	20·d	4 3/4	6 1/4	15·d	3 1/2	4 3/4
$a_{3,c}$	[in]	15·d	3 1/2	4 3/4	15·d	3 1/2	4 3/4
$a_{4,t}$	[in]	7·d	1 5/8	2 3/16	12·d	2 13/16	3 3/4
$a_{4,c}$	[in]	7·d	1 5/8	2 3/16	7·d	1 5/8	2 3/16

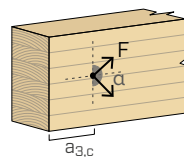
d = nominal screw diameter



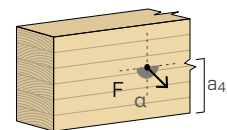
stressed end
 $-90^\circ < \alpha < 90^\circ$



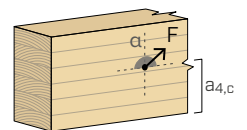
unloaded end
 $90^\circ < \alpha < 270^\circ$



stressed edge
 $0^\circ < \alpha < 180^\circ$

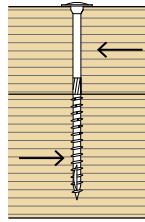


unload edge
 $180^\circ < \alpha < 360^\circ$

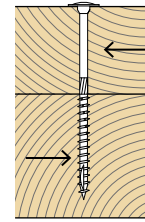


NOTES:

- 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.



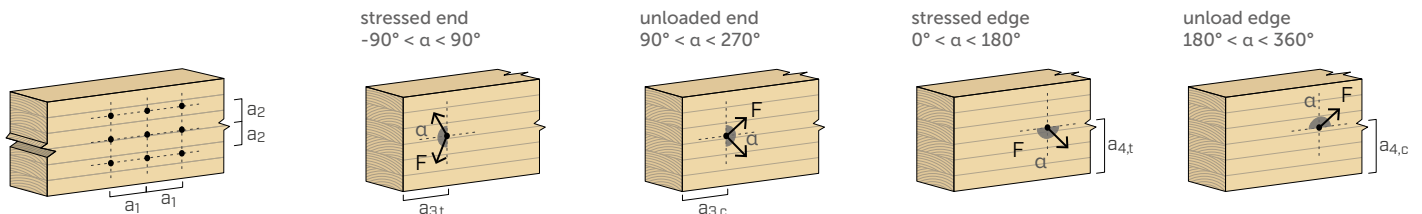
Load-to-grain angle $\alpha = 0^\circ$



Load-to-grain angle $\alpha = 90^\circ$

		Screws inserted without pre-drilling hole $G \leq 0.47$			Screws inserted without pre-drilling hole $G \leq 0.47$		
d_1	$[mm]$	6		8	6		8
	[in]	0.24		0.32	0.24		0.32
a_1	[in]	12·d	2 13/16	3 3/4	5·d	1 3/16	1 9/16
a_2	[in]	5·d	1 3/16	1 9/16	5·d	1 3/16	1 9/16
$a_{3,t}$	[in]	15·d	3 1/2	4 3/4	10·d	2 3/8	3 1/8
$a_{3,c}$	[in]	10·d	2 3/8	3 1/8	10·d	2 3/8	3 1/8
$a_{4,t}$	[in]	5·d	1 3/16	1 9/16	10·d	2 3/8	3 1/8
$a_{4,c}$	[in]	5·d	1 3/16	1 9/16	5·d	1 3/16	1 9/16
		Screws inserted without pre-drilling hole $G > 0.47$			Screws inserted without pre-drilling hole $G > 0.47$		
d_1	$[mm]$	6		8	6		8
	[in]	0.24		0.32	0.24		0.32
a_1	[in]	15·d	3 1/2	4 3/4	7·d	1 5/8	2 3/16
a_2	[in]	7·d	1 5/8	2 3/16	7·d	1 5/8	2 3/16
$a_{3,t}$	[in]	20·d	4 3/4	6 1/4	15·d	3 1/2	4 3/4
$a_{3,c}$	[in]	15·d	3 1/2	4 3/4	15·d	3 1/2	4 3/4
$a_{4,t}$	[in]	7·d	1 5/8	2 3/16	12·d	2 13/16	3 3/4
$a_{4,c}$	[in]	7·d	1 5/8	2 3/16	7·d	1 5/8	2 3/16
		Screws inserted with pre-drilling hole			Screws inserted with pre-drilling hole		
d_1	$[mm]$	6		8	6		8
	[in]	0.24		0.32	0.24		0.32
a_1	[in]	5·d	1 3/16	1 9/16	4·d	15/16	1 1/4
a_2	[in]	3·d	11/16	15/16	4·d	15/16	1 1/4
$a_{3,t}$	[in]	12·d	2 13/16	3 3/4	7·d	1 5/8	2 3/16
$a_{3,c}$	[in]	7·d	1 5/8	2 3/16	7·d	1 5/8	2 3/16
$a_{4,t}$	[in]	3·d	11/16	15/16	7·d	1 5/8	2 3/16
$a_{4,c}$	[in]	3·d	11/16	15/16	3·d	11/16	15/16

d = nominal screw diameter



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 $\rho_k = 420 \text{ kg/m}^3$.

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.
- TBS EVO screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection C_M 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.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length less the thickness of the wood side member.
- Values are calculated considering the threaded part as being completely inserted in the main member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G .

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 [mm] [in]	Reference withdrawal design values W_{ref}			
	$G=0.35$ [lbf/in]	$G=0.42$ [lbf/in]	$G=0.49$ [lbf/in]	$G=0.55$ [lbf/in]
6 0.24	77	89	131	143
8 0.32	109	125	138	174

- 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_a :

$$W_a = W_{ref} \cdot k_a \cdot L_{eff}$$

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_a factor is calculated as:

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

- 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 $k_a = 1$ for $\alpha = 90^\circ$, $k_a = 0.91$ for $\alpha = 45^\circ$, $k_a = 0.3$ for $\alpha = 0^\circ$.

- 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 $0^\circ \leq \alpha < 90^\circ$ 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 $\alpha \leq 15^\circ$.
- The reference withdrawal design values must be less than f_{tens} of the screw.

REFERENCE HEAD-PULL THROUGH DESIGN VALUES:

- Tabulated values are valid for TBS EVO screws installed perpendicular to the faces of the wood members.
- The reference head pull-through values must be less than the allowable tensile strength of the screw.