

HBS PLATE EVO

PAN HEAD SCREW FOR PLATES

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.

PLATE FASTENING

Designed for steel-to-timber joints: the head has a shoulder and the thickness is increased for completely safe, reliable fastening plates to the timber. Evaluated by ICC-ES according to Acceptance Criteria AC233. Increased thread length for excellent shear and tensile strength.



5,0 | 6,0 mm - 0.20 | 0.24 inches



8,0 | 10,0 mm - 0.32 | 0.40 inches

CHARACTERISTICS

FOCUS	steel-to-timber joints	
HEAD	shoulder for plate	
DIAMETER	from 5,0 to 10,0 mm	0.20 to 0.40 inches
LENGTH	from 50 to 180 mm	1 15/16 to 7 1/8 inches



5,0 | 6,0 mm -
0.20 | 0.24 inches



8,0 | 10,0 mm -
0.32 | 0.40 inches

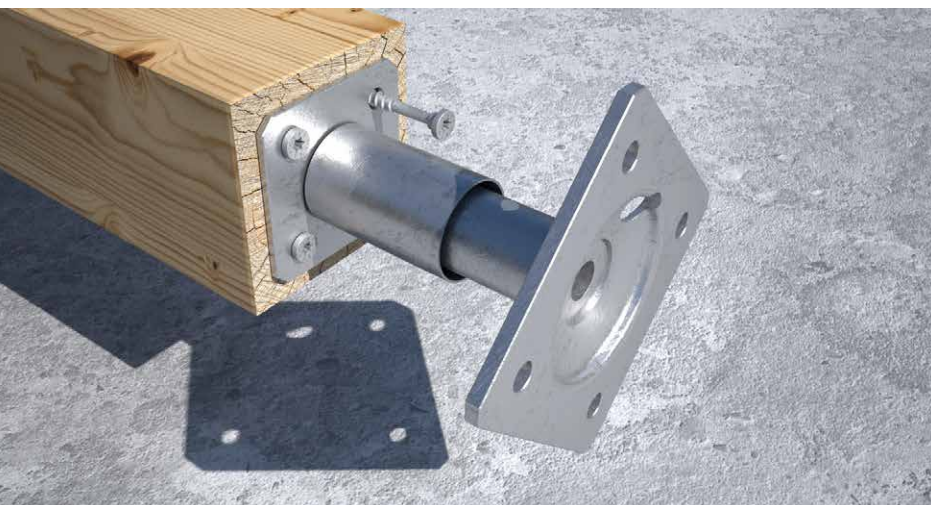


MATERIAL

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.



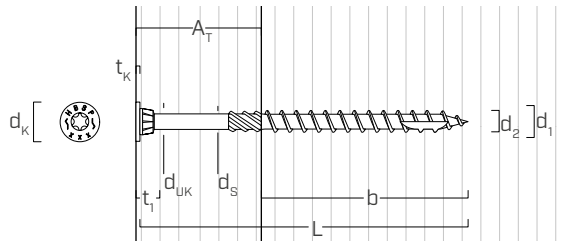
OUTDOOR PLATES

Ideal for fastening standard Rothoblaas plates, like TYP R post bases and LOCK EVO connectors, in outdoor environments. The 5 mm diameter version is ideal for fastening patio deck planks.

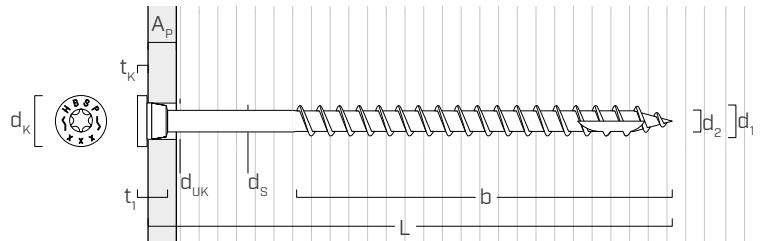
EXPOSURE CONDITIONS 3

Approved for use in exposure condition 3 outdoor applications according to Acceptance Criteria AC 257, and tested for use under class C4 atmospheric corrosion conditions.

■ GEOMETRY AND MECHANICAL CHARACTERISTICS



HBS P EVO - 5,0 | 6,0 mm



HBS P EVO - 8,0 | 10,0 mm

Nominal diameter	d ₁	[in] ⁽¹⁾	0.20(*)	0.24	0.32	0.40
		[mm]	5	6	8	10
Outer thread diameter	d ₁	[in]	0.197	0.236	0.315	0.394
Head diameter	d _K	[in]	0.380	0.472	0.571	0.719
Root diameter	d ₂	[in]	0.134	0.156	0.213	0.252
Shank diameter	d _S	[in]	0.144	0.169	0.228	0.276
Head thickness	t ₁	[in]	0.039	0.059	0.134	0.171
Underhead diameter	d _{UK}	[in]	0.236	0.315	0.394	0.472
Tip length	L _t	[in]	0.197	0.236	0.315	0.394
Pre-drilling hole diameter ⁽²⁾	d _V	[in]	0.12	0.16	0.20	0.24
Bending yield strength	F _{y,b}	[psi]	145,000	200,000	180,000	185,000
Tensile strength	f _{tens}	[lbf]	680	1180	2040	2700

(*) Not evaluated in ESR-4645.

(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.

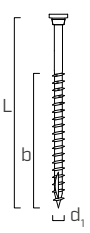
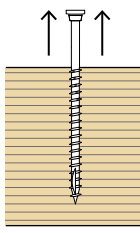
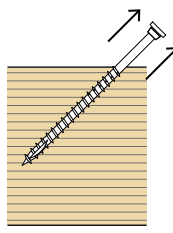
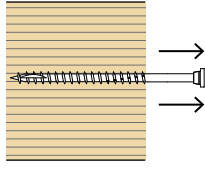
■ CODES AND DIMENSIONS

d ₁	CODE	L		b		A		pcs
[mm] [in]		[mm]	[in]	[mm]	[in]	[mm]	[in]	
5 0.20(*) TX 25	HBSPEVO550	50	1 15/16	30	1 3/16	1,0 ÷ 10,0	0.04 ÷ 0.40	200
	HBSPEVO560	60	2 3/8	35	1 3/8	1,0 ÷ 10,0	0.04 ÷ 0.40	200
	HBSPEVO570	70	2 3/4	40	1 9/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
	HBSPEVO580	80	3 1/8	50	1 15/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
6 0.24 TX 30	HBSPEVO680	80	3 1/8	50	1 15/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
	HBSPEVO690	90	3 1/2	55	2 3/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
8 0.32 TX 40	HBSPEVO840	40	1 9/16	32	1 1/4	1,0 ÷ 10,0	0.04 ÷ 0.40	100
	HBSPEVO860	60	2 3/8	52	2 1/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
	HBSPEVO880	80	3 1/8	55	2 3/16	1,0 ÷ 15,0	0.04 ÷ 0.60	100
	HBSPEVO8100	100	4	75	2 15/16	1,0 ÷ 15,0	0.04 ÷ 0.60	100
	HBSPEVO8120	120	4 3/4	95	3 3/4	1,0 ÷ 20,0	0.04 ÷ 0.79	100
	HBSPEVO8140	140	5 1/2	110	4 3/8	1,0 ÷ 20,0	0.04 ÷ 0.79	100
	HBSPEVO8160	160	6 1/4	130	5 1/8	1,0 ÷ 20,0	0.04 ÷ 0.79	100
	HBSPEVO1080	80	3 1/8	60	2 3/8	1,0 ÷ 10,0	0.04 ÷ 0.40	50
10 0.40 TX 40	HBSPEVO10100	100	4	75	2 15/16	1,0 ÷ 15,0	0.04 ÷ 0.60	50
	HBSPEVO10120	120	4 3/4	95	3 3/4	1,0 ÷ 15,0	0.04 ÷ 0.60	50
	HBSPEVO10140	140	5 1/2	110	4 3/8	1,0 ÷ 20,0	0.04 ÷ 0.79	50
	HBSPEVO10160	160	6 1/4	130	5 1/8	1,0 ÷ 20,0	0.04 ÷ 0.79	50
	HBSPEVO10180	180	7 1/8	150	6	1,0 ÷ 20,0	0.04 ÷ 0.79	50

(*) Not evaluated in ESR-4645.

STRUCTURAL VALUES | THREAD WITHDRAWAL [W]

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 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]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20(*)	50 ⁽²⁾	1 15/16	1 3/16	63	73	107	117	57	66	98	107	19	22	32	35
	60 ⁽¹⁾	2 3/8	1 3/8	76	87	129	141	69	80	117	128	23	26	39	42
	70 ⁽¹⁾	2 3/4	1 9/16	88	102	150	164	80	93	137	149	26	31	45	49
	80	3 1/8	1 15/16	113	131	193	211	103	119	176	192	34	39	58	63
6 0.24	80 ⁽¹⁾	3 1/8	1 15/16	133	154	227	248	121	140	207	225	40	46	68	74
	90	3 1/2	2 3/16	149	172	253	276	135	156	230	251	45	52	76	83
8 0.32	40 ⁽²⁾	1 9/16	1 1/4	103	118	130	164	94	107	119	150	31	35	39	49
	60 ⁽²⁾	2 3/8	2 1/16	189	217	239	301	172	197	218	274	57	65	72	90
	80 ⁽²⁾	3 1/8	2 3/16	202	231	255	322	184	210	232	293	61	69	77	97
	100	4	2 15/16	288	330	364	459	262	300	331	418	86	99	109	138
	120	4 3/4	3 3/4	373	428	473	596	340	390	430	542	112	128	142	179
	140	5 1/2	4 3/8	438	502	554	699	398	457	504	636	131	151	166	210
10 0.40	160	6 1/4	5 1/8	524	600	663	836	476	546	603	761	157	180	199	251
	80 ⁽²⁾	3 1/8	2 3/8	276	317	370	404	251	288	337	367	83	95	111	121
	100 ⁽¹⁾	4	2 15/16	358	412	481	525	326	375	438	477	107	124	144	157
	120	4 3/4	3 3/4	469	539	629	686	426	490	573	624	141	162	189	206
	140	5 1/2	4 3/8	551	634	740	807	502	577	674	734	165	190	222	242
	160	6 1/4	5 1/8	661	761	888	969	602	692	808	881	198	228	266	291
	180	7 1/8	6	772	887	1036	1130	702	808	943	1028	231	266	311	339

(*) Not evaluated in ESR-4645.

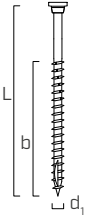
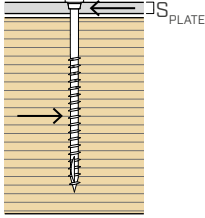
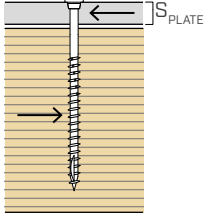
NOTES:

- (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 $0^\circ \leq \alpha < 90^\circ$ to the grain).
- (2) 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).

Refer to page 13 for the general calculation principles and for the calculation of the reference withdrawal design values for screws installed at an angle α to the grain.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\parallel}^{(1)}$					$Z_{\perp}^{(1)}$				
													
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
<i>[mm]</i> [in]	<i>[mm]</i> [in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20^(*)	50	1 15/16	1 3/16	$S_{\text{PLATE}} = 5/32"$	119	139	157	172	$S_{\text{PLATE}} = 5/16"$	116	144	165	183
	60	2 3/8	1 3/8		119	139	157	172		123	144	165	183
	70	2 3/4	1 9/16		119	139	157	172		123	144	165	183
	80	3 1/8	1 15/16		119	139	157	172		123	144	165	183
6 0.24	80	3 1/8	1 15/16		165	193	218	240		194	228	262	289
	90	3 1/2	2 3/16		165	193	218	240		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		136	173	216	256		136	173	216	256
	60 ⁽³⁾	2 3/8	2 1/16		184	246	302	332		227	287	356	421
	80	3 1/8	2 3/16		228	266	302	332		269	339	389	430
	100	4	2 15/16		228	266	302	332		288	339	389	430
	120	4 3/4	3 3/4		228	266	302	332		288	339	389	430
	140	5 1/2	4 3/8		228	266	302	332		288	339	389	430
	160	6 1/4	5 1/8		228	266	302	332		288	339	389	430
10 0.40	80	3 1/8	2 3/8		321	349	374	393		347	402	456	480
	100	4	2 15/16		321	349	374	393		396	428	458	480
	120	4 3/4	3 3/4		321	349	374	393		396	428	458	480
	140	5 1/2	4 3/8		321	349	374	393		396	428	458	480
	160	6 1/4	5 1/8		321	349	374	393		396	428	458	480
	180	7 1/8	6		321	349	374	393		396	428	458	480

(*) Not evaluated in ESR-4645.

NOTES:

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

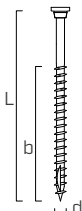
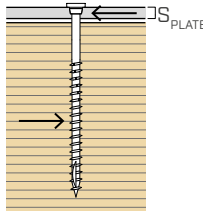
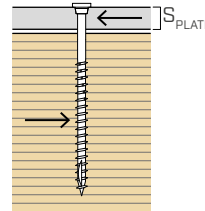
(1) $Z_{\parallel}$ main member loaded parallel to the grain.

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

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 5/16" plate thickness. Refer to page 13 for the general calculation principles.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\perp}^{(1)}$					$Z_{\parallel}^{(1)}$				
													
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
<i>[mm]</i> [in]	<i>[mm]</i> [in]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20 ^(*)	50	1 15/16	1 3/16	$S_{\text{PLATE}} = 3/16''$	122	144	165	183	$S_{\text{PLATE}} = 3/8''$	114	144	165	183
	60	2 3/8	1 3/8		123	144	165	183		123	144	165	183
	70	2 3/4	1 9/16		123	144	165	183		123	144	165	183
	80	3 1/8	1 15/16		123	144	165	183		123	144	165	183
6 0.24	80	3 1/8	1 15/16		178	207	234	257		194	228	262	289
	90	3 1/2	2 3/16		178	207	234	257		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		150	186	227	266		136	173	216	256
	60 ⁽³⁾	2 3/8	2 3/8		192	252	316	347		224	283	349	412
	80	3 1/8	2 3/16		239	279	316	347		266	339	389	430
	100	4	2 15/16		239	279	316	347		288	339	389	430
	120	4 3/4	3 3/4		239	279	316	347		288	339	389	430
	140	5 1/2	4 3/8		239	279	316	347		288	339	389	430
	160	6 1/4	5 1/8		239	279	316	347		288	339	389	430
10 0.40	80	3 1/8	2 3/8		324	361	386	406		367	420	473	517
	100	4	2 15/16		333	361	386	406		427	465	501	527
	120	4 3/4	3 3/4		333	361	386	406		427	465	501	527
	140	5 1/2	4 3/8		333	361	386	406		427	465	501	527
	160	6 1/4	5 1/8		333	361	386	406		427	465	501	527
	180	7 1/8	6		333	361	386	406		427	465	501	527

(*) Not evaluated in ESR-4645.

NOTES:

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

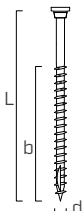
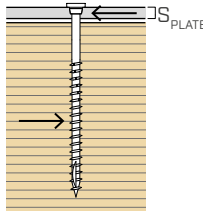
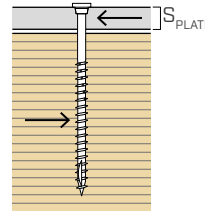
(1) $Z_{\parallel}$ main member loaded parallel to the grain.

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

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 3/8" plate thickness. Refer to page 13 for the general calculation principles.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\perp}^{(1)}$					$Z_{\parallel}^{(1)}$				
													
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
$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$
5 0.20^(*)	50	1 15/16	1 3/16	$S_{PLATE} = 1/4"$	119	144	165	183	$S_{PLATE} = 15/32"$	109	143	165	183
	60	2 3/8	1 3/8		123	144	165	183		123	144	165	183
	70	2 3/4	1 9/16		123	144	165	183		123	144	165	183
	80	3 1/8	1 15/16		123	144	165	183		123	144	165	183
6 0.24	80	3 1/8	1 15/16		194	228	262	289		194	228	262	289
	90	3 1/2	2 3/16		194	228	262	289		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		185	221	260	297		185	240	278	313
	60 ⁽³⁾	2 3/8	2 3/8		214	272	338	386		220	276	339	399
	80	3 1/8	2 3/16		259	311	352	386		260	339	389	430
	100	4	2 15/16		268	311	352	386		288	339	389	430
	120	4 3/4	3 3/4		268	311	352	386		288	339	389	430
	140	5 1/2	4 3/8		268	311	352	386		288	339	389	430
	160	6 1/4	5 1/8		268	311	352	386		288	339	389	430
10 0.40	80	3 1/8	2 3/8		333	389	418	440		396	457	501	528
	100	4	2 15/16		361	391	418	440		427	465	501	528
	120	4 3/4	3 3/4		361	391	418	440		427	465	501	528
	140	5 1/2	4 3/8		361	391	418	440		427	465	501	528
	160	6 1/4	5 1/8		361	391	418	440		427	465	501	528
	180	7 1/8	6		361	391	418	440		427	465	501	528

(*) Not evaluated in ESR-4645.

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.

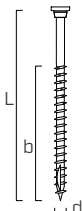
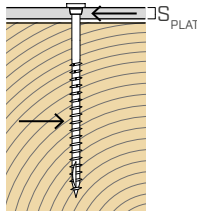
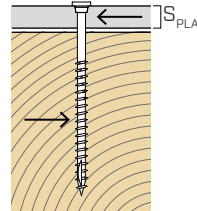
(2) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645.

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 15/32" plate thickness.

Refer to page 13 for the general calculation principles.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\perp}^{(1)}$					$Z_{\perp}^{(1)}$				
													
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
$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$	$\begin{matrix} [lbf] \\ [lbf] \end{matrix}$
5 0.20(*)	50	1 15/16	1 3/16	$S_{PLATE} = 5/32"$	119	139	157	172	$S_{PLATE} = 5/16"$	116	144	165	183
	60	2 3/8	1 3/8		119	139	157	172		123	144	165	183
	70	2 3/4	1 9/16		119	139	157	172		123	144	165	183
	80	3 1/8	1 15/16		119	139	157	172		123	144	165	183
6 0.24	80	3 1/8	1 15/16		165	193	218	240		194	228	262	289
	90	3 1/2	2 3/16		165	193	218	240		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		109	139	173	205		163	195	229	260
	60 ⁽³⁾	2 3/8	2 3/8		147	197	241	265		181	230	285	337
	80	3 1/8	2 3/16		182	212	241	265		216	271	311	344
	100	4	2 15/16		182	212	241	265		231	271	311	344
	120	4 3/4	3 3/4		182	212	241	265		231	271	311	344
	140	5 1/2	4 3/8		182	212	241	265		231	271	311	344
	160	6 1/4	5 1/8		182	212	241	265		231	271	311	344
10 0.40	80	3 1/8	2 3/8		179	229	269	290		206	251	300	344
	100	4	2 15/16		215	243	269	290		242	300	330	355
	120	4 3/4	3 3/4		215	243	269	290		266	300	330	355
	140	5 1/2	4 3/8		215	243	269	290		266	300	330	355
	160	6 1/4	5 1/8		215	243	269	290		266	300	330	355
	180	7 1/8	6		215	243	269	290		266	300	330	355

(*) Not evaluated in ESR-4645.

NOTES:

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

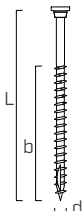
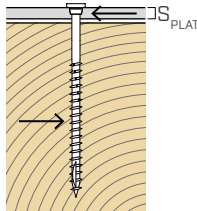
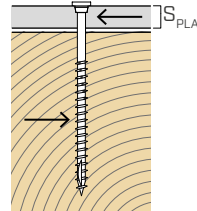
(1) $Z_{\perp}$ main member loaded perpendicular to the grain.

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

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 5/16" plate thickness. Refer to page 13 for the general calculation principles.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\perp}^{(1)}$					$Z_{\perp}^{(1)}$				
													
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
$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [mm] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [in] \\ [in] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$	$\begin{matrix} [lb f] \\ [lb f] \end{matrix}$
5 0.20(*)	50	1 15/16	1 3/16	$S_{PLATE} = 3/16''$	122	144	165	183	$S_{PLATE} = 3/8''$	114	144	165	183
	60	2 3/8	1 3/8		123	144	165	183		123	144	165	183
	70	2 3/4	1 9/16		123	144	165	183		123	144	165	183
	80	3 1/8	1 15/16		123	144	165	183		123	144	165	183
6 0.24	80	3 1/8	1 15/16		178	207	234	257		194	228	262	289
	90	3 1/2	2 3/16		178	207	234	257		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		120	149	182	213		162	193	226	256
	60 ⁽³⁾	2 3/8	2 3/8		153	202	253	278		179	226	279	330
	80	3 1/8	2 3/16		192	223	253	278		213	271	311	344
	100	4	2 15/16		192	223	253	278		231	271	311	344
	120	4 3/4	3 3/4		192	223	253	278		231	271	311	344
	140	5 1/2	4 3/8		192	223	253	278		231	271	311	344
	160	6 1/4	5 1/8		192	223	253	278		231	271	311	344
	80	3 1/8	2 3/8		182	231	278	299		224	268	315	358
10 0.40	100	4	2 15/16		223	251	278	299		256	314	302	324
	120	4 3/4	3 3/4		223	251	278	299		283	321	302	324
	140	5 1/2	4 3/8		223	251	278	299		283	321	302	324
	160	6 1/4	5 1/8		223	251	278	299		283	321	302	324
	180	7 1/8	6		223	251	278	299		283	321	302	324

(*) Not evaluated in ESR-4645.

NOTES:

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

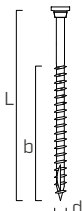
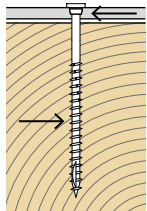
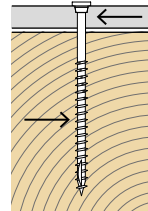
(1) $Z_{\perp}$ main member loaded perpendicular to the grain.

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

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 3/8" plate thickness. Refer to page 13 for the general calculation principles.

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

HBS PLATE EVO Ø5 | 0.20 inch - Ø6 | 0.24 inch - Ø8 | 0.32 inch - Ø10 | 0.40 inch

geometry				$Z_{\perp}^{(1)}$					$Z_{\perp}^{(1)}$				
													
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
$\begin{smallmatrix} [mm] \\ [in] \end{smallmatrix}$	$\begin{smallmatrix} [mm] \\ [in] \end{smallmatrix}$	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
5 0.20(*)	50	1 15/16	1 3/16	$S_{PLATE} = 1/4"$	119	144	165	183	$S_{PLATE} = 15/32"$	109	143	165	183
	60	2 3/8	1 3/8		123	144	165	183		123	144	165	183
	70	2 3/4	1 9/16		123	144	165	183		123	144	165	183
	80	3 1/8	1 15/16		123	144	165	183		123	144	165	183
6 0.24	80	3 1/8	1 15/16		194	228	262	289		194	228	262	289
	90	3 1/2	2 3/16		194	228	262	289		194	228	262	289
8 0.32	40 ⁽²⁾	1 9/16	1 1/4		148	177	208	237		148	192	223	251
	60 ⁽³⁾	2 3/8	2 3/8		171	218	270	309		176	221	271	319
	80	3 1/8	2 3/16		207	249	282	309		208	271	311	344
	100	4	2 15/16		214	249	282	309		231	271	311	344
	120	4 3/4	3 3/4		214	249	282	309		231	271	311	344
	140	5 1/2	4 3/8		214	249	282	309		231	271	311	344
	160	6 1/4	5 1/8		214	249	282	309		231	271	311	344
10 0.40	80	3 1/8	2 3/8		192	239	289	324		236	287	342	386
	100	4	2 15/16		232	273	302	324		275	321	358	387
	120	4 3/4	3 3/4		242	273	302	324		283	321	358	387
	140	5 1/2	4 3/8		242	273	302	324		283	321	358	387
	160	6 1/4	5 1/8		242	273	302	324		283	321	358	387
	180	7 1/8	6		242	273	302	324		283	321	358	387

(*) Not evaluated in ESR-4645.

NOTES:

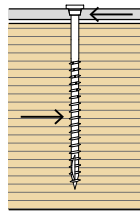
Tabulated reference lateral design values are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

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

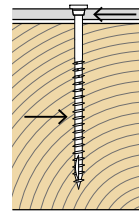
(2) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645.

(3) The screw penetration in the main member is lower than 6 times the outer thread diameter as specified in ESR-4645 for 15/32" plate thickness.

Refer to page 13 for the general calculation principles.



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

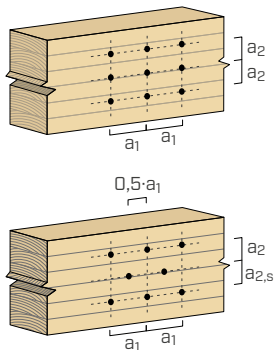


Load-to-grain angle $\alpha = 90^\circ$

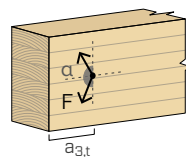
Screws inserted without pre-drilling hole $G < 0.50$						Screws inserted without pre-drilling hole $G < 0.50$					
d_1 [mm]	5 ^(*)	6	8	10		d_1 [mm]	5 ^(*)	6	8	10	
[in]	0.20	0.24	0.32	0.40		[in]	0.20	0.24	0.32	0.40	
a_1 [in]	15·d	2 15/16	3 1/2	4 3/4	15·d	6	10·d	1 15/16	2 3/8	3 1/8	10·d
a_2 [in]	5·d	1	1 3/16	1 9/16	5·d	1 15/16	5·d	1	1 3/16	1 9/16	5·d
$a_{2,s}$ [in]	2.5·d	1/2	9/16	13/16	5·d	1 15/16	2.5·d	1/2	9/16	13/16	5·d
$a_{3,t}$ [in]	15·d	2 15/16	3 1/2	4 3/4	15·d	6	10·d	1 15/16	2 3/8	3 1/8	10·d
$a_{3,c}$ [in]	10·d	1 15/16	2 3/8	3 1/8	10·d	4	10·d	1 15/16	2 3/8	3 1/8	10·d
$a_{4,t}$ [in]	5·d	1	1 3/16	1 9/16	5·d	1 15/16	10·d	1 15/16	2 3/8	3 1/8	10·d
$a_{4,c}$ [in]	5·d	1	1 3/16	1 9/16	5·d	1 15/16	5·d	1	1 3/16	1 9/16	5·d

Screws inserted without pre-drilling hole $G \geq 0.50$						Screws inserted without pre-drilling hole $G \geq 0.50$					
d_1 [mm]	5 ^(*)	6	8	10		d_1 [mm]	5 ^(*)	6	8	10	
[in]	0.20	0.24	0.32	0.40		[in]	0.20	0.24	0.32	0.40	
a_1 [in]	15·d	2 15/16	3 1/2	4 3/4	15·d	6	10·d	1 15/16	2 3/8	3 1/8	10·d
a_2 [in]	7·d	1 3/8	1 5/8	2 3/16	7·d	2 3/4	7·d	1 3/8	1 5/8	2 3/16	7·d
$a_{2,s}$ [in]	3·d	9/16	11/16	15/16	5·d	1 15/16	3·d	9/16	11/16	15/16	5·d
$a_{3,t}$ [in]	20·d	4	4 3/4	6 1/4	20·d	8	15·d	2 15/16	3 1/2	4 3/4	15·d
$a_{3,c}$ [in]	15·d	2 15/16	3 1/2	4 3/4	15·d	6	15·d	2 15/16	3 1/2	4 3/4	15·d
$a_{4,t}$ [in]	7·d	1 3/8	1 5/8	2 3/16	7·d	2 3/4	12·d	2 3/8	2 13/16	3 3/4	12·d
$a_{4,c}$ [in]	7·d	1 3/8	1 5/8	2 3/16	7·d	2 3/4	7·d	1 3/8	1 5/8	2 3/16	7·d

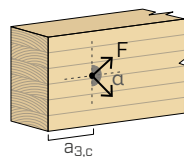
d = nominal screw diameter



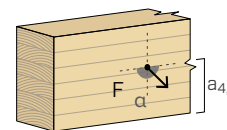
stressed end
 $-90^\circ < \alpha < 90^\circ$



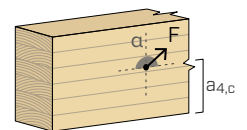
unloaded end
 $90^\circ < \alpha < 270^\circ$



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



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

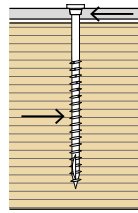


NOTES:

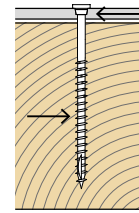
(*) Not evaluated in ESR-4645.

- 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.



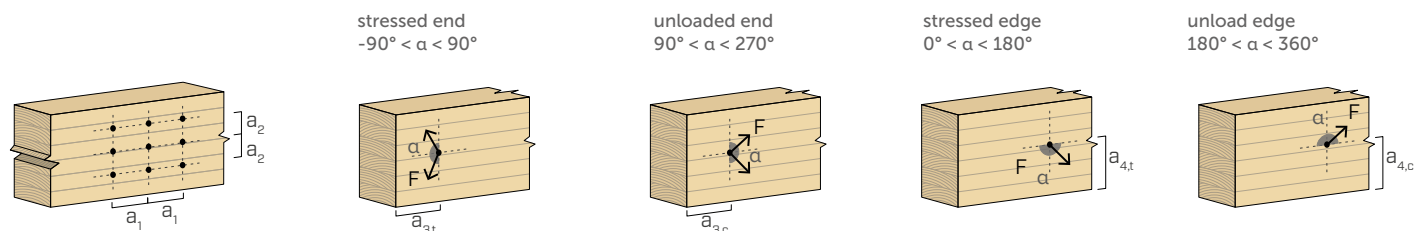
Load-to-grain angle $\alpha = 0^\circ$



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	$[mm]$	5	6	8	10	5	6	8	10		
	[in]	0.20	0.24	0.32	0.40	0.20	0.24	0.32	0.40		
a_1	[in]	12·d·0.7	1 5/8	2	2 11/16	3 5/16	5·d·0.7	11/16	13/16	1 1/8	1 3/8
a_2	[in]	5·d·0.7	11/16	13/16	1 1/8	1 3/8	5·d·0.7	11/16	13/16	1 1/8	1 3/8
$a_{3,t}$	[in]	15·d	2 15/16	3 1/2	4 3/4	6	10·d	1 15/16	2 3/8	3 1/8	4
$a_{3,c}$	[in]	10·d	1 15/16	2 3/8	3 1/8	4	10·d	1 15/16	2 3/8	3 1/8	4
$a_{4,t}$	[in]	5·d	1	1 3/16	1 9/16	1 15/16	10·d	1 15/16	2 3/8	3 1/8	4
$a_{4,c}$	[in]	5·d	1	1 3/16	1 9/16	1 15/16	5·d	1	1 3/16	1 9/16	1 15/16
		Screws inserted without pre-drilling hole $G > 0.47$				Screws inserted without pre-drilling hole $G > 0.47$					
d_1	$[mm]$	5	6	8	10	5	6	8	10		
	[in]	0.20	0.24	0.32	0.40	0.20	0.24	0.32	0.40		
a_1	[in]	15·d·0.7	2 1/16	2 1/2	3 5/16	4 1/8	7·d·0.7	1	1 3/16	1 9/16	1 15/16
a_2	[in]	7·d·0.7	1	1 3/16	1 9/16	1 15/16	7·d·0.7	1	1 3/16	1 9/16	1 15/16
$a_{3,t}$	[in]	20·d	4	4 3/4	6 1/4	8	15·d	2 15/16	3 1/2	4 3/4	6
$a_{3,c}$	[in]	15·d	2 15/16	3 1/2	4 3/4	6	15·d	2 15/16	3 1/2	4 3/4	6
$a_{4,t}$	[in]	7·d	1 3/8	1 5/8	2 3/16	2 3/4	12·d	2 3/8	2 13/16	3 3/4	4 3/4
$a_{4,c}$	[in]	7·d	1 3/8	1 5/8	2 3/16	2 3/4	7·d	1 3/8	1 5/8	2 3/16	2 3/4
		Screws inserted with pre-drilling hole				Screws inserted with pre-drilling hole					
d_1	$[mm]$	5	6	8	10	5	6	8	10		
	[in]	0.20	0.24	0.32	0.40	0.20	0.24	0.32	0.40		
a_1	[in]	5·d·0.7	11/16	13/16	1 1/8	1 3/8	4·d·0.7	9/16	11/16	7/8	1 1/8
a_2	[in]	3·d·0.7	7/16	1/2	11/16	13/16	4·d·0.7	9/16	11/16	7/8	1 1/8
$a_{3,t}$	[in]	12·d	2 3/8	2 13/16	3 3/4	4 3/4	7·d	1 3/8	1 5/8	2 3/16	2 3/4
$a_{3,c}$	[in]	7·d	1 3/8	1 5/8	2 3/16	2 3/4	7·d	1 3/8	1 5/8	2 3/16	2 3/4
$a_{4,t}$	[in]	3·d	9/16	11/16	15/16	1 3/16	7·d	1 3/8	1 5/8	2 3/16	2 3/4
$a_{4,c}$	[in]	3·d	9/16	11/16	15/16	1 3/16	3·d	9/16	11/16	15/16	1 3/16

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.
- The design of connection with steel side plate must comply with Section 11.2.3 of the NDS.
- Connections with multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of the NDS.
- HBS PLATE 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, panels 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.
- 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.

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 expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain are reported below.

d ₁ [mm] [in]	Reference withdrawal design values [lbf/in]			
	G=0.35 [lbf/in]	G=0.42 [lbf/in]	G=0.49 [lbf/in]	G=0.55 [lbf/in]
5 0.20 ^(*)	64	74	109	119
6 0.24	77	89	131	143
8 0.32	109	125	138	174
10 0.40	140	161	188	205

(*) Not evaluated in 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_a :

$$W_a = W \cdot k_a \cdot L_{eff}$$

Where:

- W 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:

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

- α is the angle between the grain direction and screw axis.
Tabulated values are valid for L_{eff} equal to the screw thread length b and $k_a = 1$ for $\alpha = 90^\circ$, $k_a = 0.91$ for $\alpha = 45^\circ$, $k_a = 0.3$ for $\alpha = 0^\circ$.

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