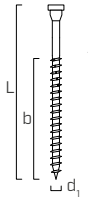
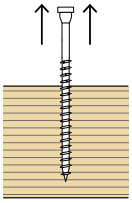
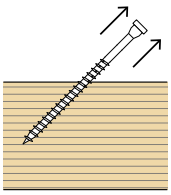
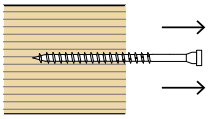
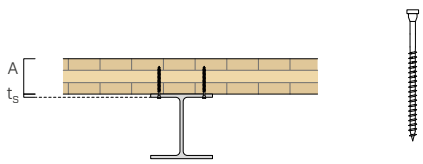
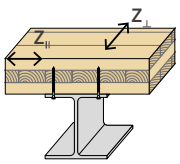
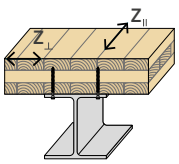
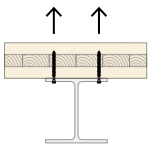
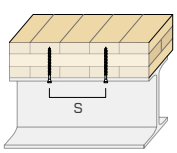
THREAD WITHDRAWAL (W) | WOOD

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]
8 **0.32**	60	2 3/8(1)	2 1/16	244	281	317	346	222	255	288	315	73	84	95	104
	80	3 1/8(1)	2 3/16	261	300	339	370	237	273	308	337	78	90	102	111
	100	4	2 15/16	372	427	483	528	338	389	439	480	112	128	145	158
	120	4 3/4	3 3/4	483	555	627	685	439	505	570	623	145	166	188	206
	140	5 1/2	4 3/8	566	651	735	803	515	592	669	731	170	195	220	241
	160	6 1/4	5 1/8	677	778	879	961	616	708	800	874	203	233	264	288
10 **0.40**	80	3 1/8(1)	2 3/8	366	421	474	518	333	383	432	471	110	126	142	155
	100	4(2)	2 15/16	476	548	617	673	433	498	561	612	143	164	185	202
	120	4 3/4	3 3/4	622	716	806	880	566	652	734	801	187	215	242	264
	140	5 1/2	4 3/8	732	843	949	1035	666	767	863	942	220	253	285	311
	160	6 1/4	5 1/8	879	1011	1139	1243	800	920	1036	1131	264	303	342	373
	180	7 1/8	6	1025	1180	1328	1450	933	1073	1209	1319	308	354	399	435
12 **0.48**	100	4(1)	2 15/16	551	635	714	779	501	578	650	709	165	190	214	234
	120	4 3/4(2)	3 1/2	682	786	884	964	620	715	805	877	205	236	265	289
	140	5 1/2	4 3/8	857	988	1111	1211	779	899	1011	1102	257	296	333	363
	160	6 1/4	4 3/4	944	1089	1225	1335	859	991	1114	1215	283	327	367	401
	180	7 1/8	5 1/2	1119	1290	1451	1582	1018	1174	1321	1440	336	387	435	475
	200	8	6 1/4	1294	1492	1678	1830	1177	1357	1527	1665	388	447	503	549

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

NOTES and **GENERAL PRINCIPLES** on page 255.

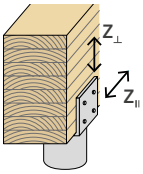
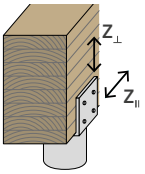
STEEL-TO-WOOD | CLT FLOOR-TO-STEEL BEAM

					SHEAR				TENSION	SPACING	
				geometry	floor-to-beam orientation 1		floor-to-beam orientation 2		withdrawal / tensile	fastener in a row	
											
	main member thickness (wall/floor) = A		steel beam flange thickness = t_s	suggested screw	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	W(*)	minimum	typical
	[mm]	[in]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[in]
3 PLY	79	3 1/8	3/16	HBSPL860	257	205	257	205	281	3 1/8	6
			3/16	HBSPL1080	367	235	367	235	421	4	8
	105	4 1/8	1/4	HBSPL880	328	262	328	262	300	3 1/8	6
			1/4	HBSPL1080	399	243	399	243	421	4	8
			1/4	HBSPL12100	482	313	482	313	635	4 3/4	10
	120	4 3/4	5/16	HBSPL8100	365	292	365	292	427	3 1/8	6
			5/16	HBSPL10100	438	304	438	304	548	4	8
			5/16	HBSPL12100	521	323	521	323	635	4 3/4	10
5 PLY	100	3 15/16	3/16	HBSPL880	297	238	297	238	300	3 1/8	6
			3/16	HBSPL1080	367	235	367	235	421	4	8
	140	5 1/2	1/4	HBSPL8120	328	262	328	262	555	3 1/8	6
			1/4	HBSPL10120	399	277	399	277	716	4	8
			1/4	HBSPL12120	482	326	482	326	786	4 3/4	10
	175	6 7/8	5/16	HBSPL8140	365	292	365	292	651	3 1/8	6
			5/16	HBSPL10140	438	304	438	304	843	4	8
			5/16	HBSPL12140	521	353	521	353	988	4 3/4	10
	200	7 7/8	3/8	HBSPL8160	368	295	368	295	778	3 1/8	6
			3/8	HBSPL10160	472	323	472	323	1011	4	8
			3/8	HBSPL12160	566	384	566	384	1089	4 3/4	10
7 PLY	140	5 1/2	3/16	HBSPL8120	297	238	297	238	555	3 1/8	6
			3/16	HBSPL10120	367	254	367	254	716	4	8
			3/16	HBSPL12120	450	304	450	304	786	4 3/4	10
	191	7 1/2	1/4	HBSPL8140	328	262	328	262	651	3 1/8	6
			1/4	HBSPL10140	399	277	399	277	843	4	8
			1/4	HBSPL12140	482	326	482	326	988	4 3/4	10
	244	9 5/8	3/8	HBSPL8160	368	295	368	295	778	3 1/8	6
			3/8	HBSPL10160	472	323	472	323	1011	4	8
			3/8	HBSPL12160	566	384	566	384	1089	4 3/4	10
	280	11	1/2	HBSPL8160	368	295	368	295	778	3 1/8	6
			1/2	HBSPL10180	472	323	472	323	1180	4	8
			1/2	HBSPL12180	594	397	594	397	1290	4 3/4	10
9 PLY	180	7 1/16	5/16	HBSPL8140	365	292	365	292	651	3 1/8	6
			5/16	HBSPL10140	438	304	438	304	843	4	8
			5/16	HBSPL12140	521	353	521	353	988	4 3/4	10
	267	10 1/2	7/16	HBSPL8160	368	295	368	295	778	3 1/8	6
			7/16	HBSPL10160	472	323	472	323	1011	4	8
			7/16	HBSPL12160	594	397	594	397	1089	4 3/4	10
	314	12 3/8	9/16	HBSPL8160	368	295	368	295	778	3 1/8	6
			9/16	HBSPL10180	472	323	472	323	1180	4	8
			9/16	HBSPL12180	594	397	594	397	1290	4 3/4	10
	360	14 3/16	5/8	HBSPL8160	368	295	368	295	778	3 1/8	6
			5/8	HBSPL10180	472	323	472	323	1180	4	8
			5/8	HBSPL12200	594	397	594	397	1492	4 3/4	10

(*) Minimum between head pull-through and withdrawal resistance.

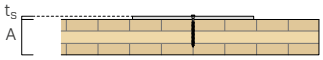
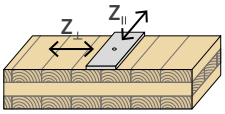
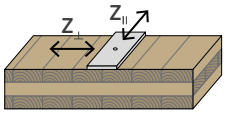
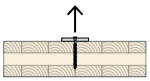
NOTES and GENERAL PRINCIPLES on page 255.

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

geometry				SHEAR			
				wood beam (SPF) - steel side plate		wood beam (D.Fir) - steel side plate	
							
main member thickness (beam width) = A		steel beam flange thickness = t_s	suggested screw	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$
[mm]	[in]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]
79	3 1/8	1/8	HBSPL860	246	196	312	250
		1/8	HBSPL1080	345	231	369	263
		1/4	HBSPL880	328	262	372	297
		1/4	HBSPL1080	399	243	427	294
130	5 1/8	1/4	HBSPL8100	328	262	372	297
		1/4	HBSPL10100	399	277	427	305
		1/4	HBSPL12100	482	313	515	360
		3/8	HBSPL8120	368	295	422	338
		3/8	HBSPL10120	472	323	507	360
		3/8	HBSPL12120	566	384	604	424
171	6 3/4	3/8	HBSPL8100	368	295	422	338
		3/8	HBSPL10100	472	320	507	360
		3/8	HBSPL12100	566	337	604	403
		3/8	HBSPL8120	368	295	422	338
		1/2	HBSPL10120	472	323	507	360
		1/2	HBSPL12120	594	397	639	442
222	8 3/4	1/2	HBSPL8120	368	295	422	338
		1/2	HBSPL10140	472	323	507	360
		1/2	HBSPL12140	594	397	639	442
		5/8	HBSPL8140	368	295	422	338
		5/8	HBSPL10160	472	323	507	360
		5/8	HBSPL12160	594	397	639	442
		3/4	HBSPL8160	368	295	422	338
		3/4	HBSPL10180	472	323	507	360
		3/4	HBSPL12180	594	397	639	442
273	10 3/4	5/8	HBSPL8120	368	295	422	338
		5/8	HBSPL10140	472	323	507	360
		5/8	HBSPL12160	594	397	639	442
		3/4	HBSPL8140	368	295	422	338
		3/4	HBSPL10160	472	323	507	360
		3/4	HBSPL12180	594	397	639	442
		7/8	HBSPL8160	368	295	422	338
		7/8	HBSPL10180	472	323	507	360
		7/8	HBSPL12200	594	397	639	442

NOTES and GENERAL PRINCIPLES on page 255.

STEEL-TO-WOOD | STEEL SIDE PLATE CLT CONNECTION

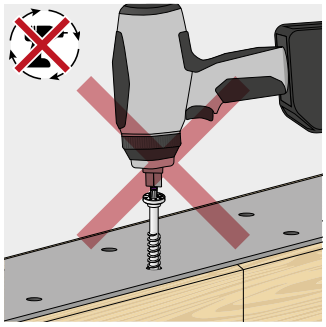
					SHEAR				TENSION
	geometry				CLT (SPF) - steel side plate		CLT (D.Fir) - steel side plate		withdrawal / tensile
									
	main member thickness (wall/floor) = A		steel beam flange thickness = t_s	suggested screw	Z_{II}	$Z_{\perp}$	Z_{II}	$Z_{\perp}$	$W^{(*)}$
	[mm]	[in]	[in]	CODE	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
3 PLY	79	3 1/8	3/16	HBSPL860	257	205	327	262	281
			3/16	HBSPL1080	367	235	393	281	421
	105	4 1/8	1/4	HBSPL880	328	262	372	297	300
			1/4	HBSPL1080	399	243	427	294	421
			1/4	HBSPL12100	482	313	515	360	635
	120	4 3/4	5/16	HBSPL8100	365	292	413	330	427
			5/16	HBSPL10100	438	304	467	335	548
			5/16	HBSPL12100	521	323	556	390	635
5 PLY	100	3 15/16	3/16	HBSPL880	297	238	337	270	300
			3/16	HBSPL1080	367	235	393	281	421
	140	5 1/2	1/4	HBSPL8120	328	262	372	297	555
			1/4	HBSPL10120	399	277	427	305	716
			1/4	HBSPL12120	482	326	515	360	786
	175	6 7/8	5/16	HBSPL8140	365	292	413	330	651
			5/16	HBSPL10140	438	304	467	335	843
			5/16	HBSPL12140	521	353	556	390	988
	200	7 7/8	3/8	HBSPL8160	368	295	422	338	778
			3/8	HBSPL10160	472	323	507	360	1011
			3/8	HBSPL12160	566	384	604	424	1089
7 PLY	140	5 1/2	3/16	HBSPL8120	297	238	337	270	555
			3/16	HBSPL10120	367	254	393	281	716
			3/16	HBSPL12120	450	304	482	337	786
	191	7 1/2	1/4	HBSPL8140	328	262	372	297	651
			1/4	HBSPL10140	399	277	427	305	843
			1/4	HBSPL12140	482	326	515	360	988
	244	9 5/8	3/8	HBSPL8160	368	295	422	338	778
			3/8	HBSPL10160	472	323	507	360	1011
			3/8	HBSPL12160	566	384	604	424	1089
	280	11	1/2	HBSPL8160	368	295	422	338	778
			1/2	HBSPL10180	472	323	507	360	1180
			1/2	HBSPL12180	594	397	639	442	1290
9 PLY	180	7 1/16	5/16	HBSPL8140	365	292	413	330	651
			5/16	HBSPL10140	438	304	467	335	843
			5/16	HBSPL12140	521	353	556	390	988
	267	10 1/2	7/16	HBSPL8160	368	295	422	338	778
			7/16	HBSPL10160	472	323	507	360	1011
			7/16	HBSPL12160	594	397	639	442	1089
	314	12 3/8	9/16	HBSPL8160	368	295	422	338	778
			9/16	HBSPL10180	472	323	507	360	1180
			9/16	HBSPL12180	594	397	639	442	1290
	360	14 3/16	5/8	HBSPL8160	368	295	422	338	778
			5/8	HBSPL10180	472	323	507	360	1180
			5/8	HBSPL12200	594	397	639	442	1492

(*) Minimum between head pull-through and withdrawal resistance

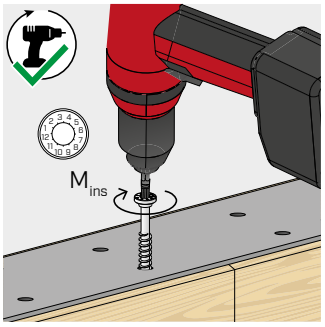
NOTES and GENERAL PRINCIPLES on page 255.

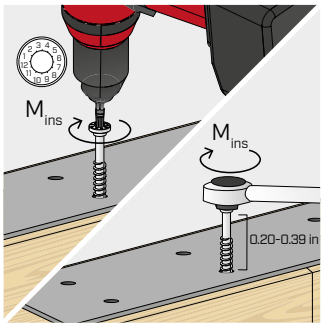
INSTALLATION

MANUALS



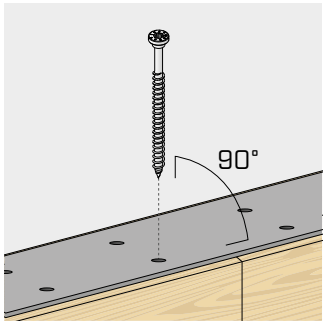
The use of pulse screw guns/impact wrenches is not permitted.



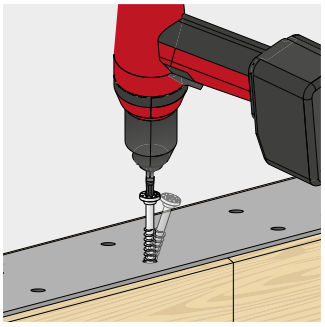


HBSPL	d_1 [in]	$M_{ins,max}$ [ft·lbs]
Ø0.32	0.32	13
Ø0.40	0.40	19
Ø0.48	0.48	29

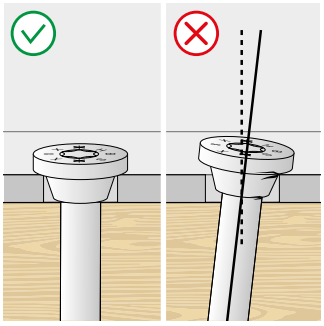
Ensure tightening torque is less than or equal to the maximum recommended tightening torque ($M_{ins,max}$). We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.



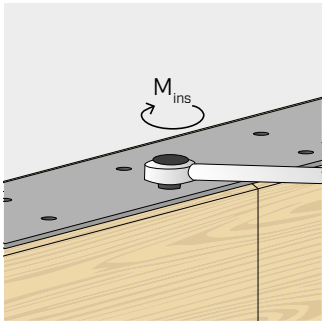
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



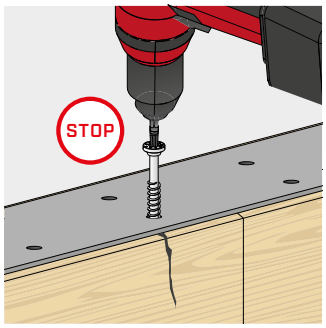
Avoid bending.



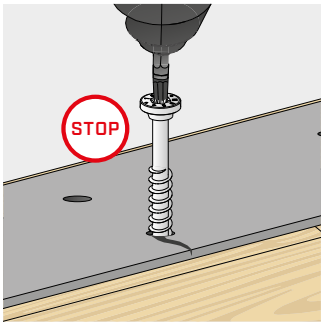
Ensure full contact between the entire surface of the screw head and the metal element



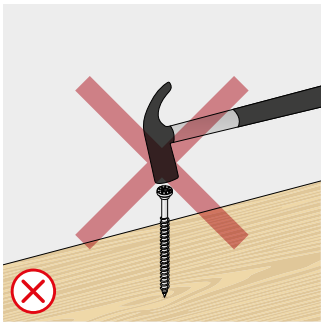
After installation, the fasteners can be inspected using a torque wrench.



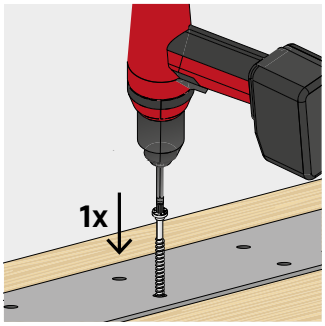
Stop installation if damage to the fastener or timber is noticed.



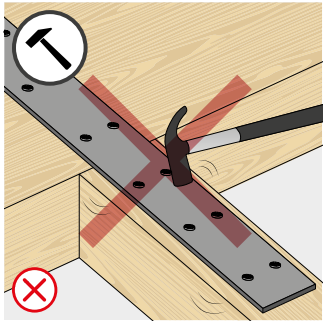
Stop installation if damage to the fastener or metal plates is noticed.



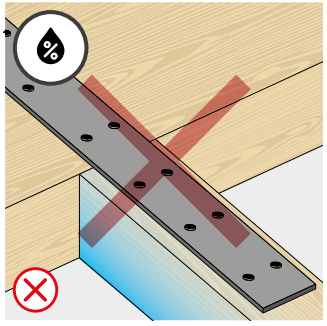
Do not hammer the screw tips into the timber.



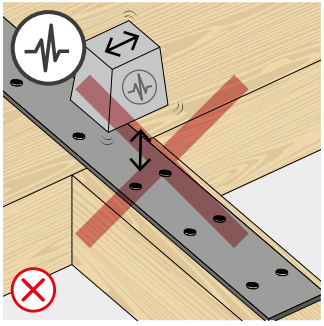
Install screws in one continuous stroke and stop when the screw head makes contact with the metal element.



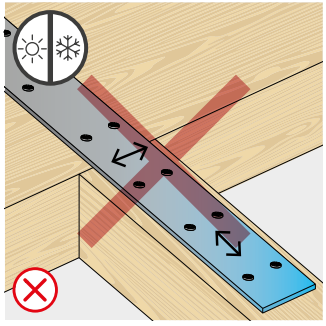
Avoid accidental stress during installation.



Protect the connection and avoid moisture changes and shrinkage and swelling of the timber.



Use not permitted for dynamic loads.



Avoid dimensional changes to the metal.

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.
- HBS PLATE 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).
- HBS PLATE 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 250 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 $\alpha \leq 15°$.
- The reference withdrawal design values must be inferior to f_{tens} of the screw.

CONNECTIONS

GENERAL NOTES

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

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

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

STEEL-TO-WOOD | STEEL SIDE PLATE CLT CONNECTION

- Steel side member must be pre-drilled according to the information reported in these tecnical datasheet and installation instructions.
- Beam element can be considered both solid wood or glulam.
- The proposed screw length does not exceed the total thickness of the connection. In the case of steel plates on both sides of the beam, the geometry of the connection must be designed to avoid collisions between screws inserted from opposite sides.
- A dowel bearing strength of F_e = 87,000 psi is used in the yield limit equations for the steel side member, in accordance with the NDS.
- The density considered is G = 0.42 for SPF, G = 0.49 for D-fir.

STEEL-TO-WOOD | STEEL SIDE PLATE CLT CONNECTION

- Steel side member must be pre-drilled according to the information reported in these tecnical datasheet and installation instructions.
- A dowel bearing strength of F_e = 87,000 psi is used in the yield limit equations for the steel side member, in accordance with the NDS.
- The main grain direction of the CLT floor panel is considered both parallel and perpendicular to the beam direction.
- The withdrawal capacity has been considered as the minimum between thread withdrawal and tensile strength of the screw.
- The density considered is G = 0.42 for SPF, G = 0.49 for D-fir.

HBS PLATE EVO

PAN HEAD SCREW

ESR-4645 ETA-11/0030

C4 EVO COATING

HBS PLATE EVO version designed for steel-timber joints outdoors. Atmospheric corrosion resistance class (C4) 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 page 354).

NEW GEOMETRY

The inner core diameter of the Ø0.32, Ø0.40 and Ø0.48 inch screws has been increased to ensure higher performance in thick plate applications. In steel-timber connections, the new geometry achieves a strength increase of more than 15%.

PLATE FASTENING

The under-head shoulder achieves an interlocking effect with the circular hole in the plate, thus guaranteeing excellent static performance. The edgeless geometry of the head reduces stress concentration points and gives the screw strength.

HBS P EVO
0.20 | 0.24 inch

HBS PLATE EVO
0.32 | 0.40 | 0.48 inch

MY PROJECT SOFTWARE

MANUALS

BIT INCLUDED

DIAMETER [in]

0.14 | **0.20** — **0.48** | 0.48

LENGTH [in]

1 | **1 15/16** — **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

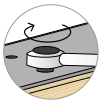
HBS P EVO

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	A [in]	pcs
5 **0.20** #11 TX 25	**HBSPEVO550**	50	1 15/16	30	1 3/16	1/32 - 3/8	200
	HBSPEVO560	60	2 3/8	35	1 3/8	1/32 - 3/8	200
	HBSPEVO570	70	2 3/4	40	1 9/16	1/32 - 3/8	100
	HBSPEVO580	80	3 1/8	50	1 15/16	1/32 - 3/8	100
6 **0.24** #14 TX 30	**HBSPEVO680**	80	3 1/8	50	1 15/16	1/32 - 3/8	100
	HBSPEVO690	90	3 1/2	55	2 3/16	1/32 - 3/8	100

RAPTOR
TRANSPORT PLATE FOR TIMBER ELEMENTS

page 441

METAL-to-TIMBER recommended use:

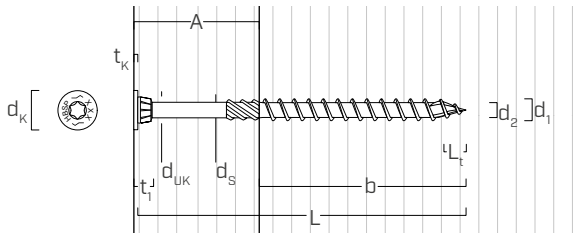


HBS PLATE EVO

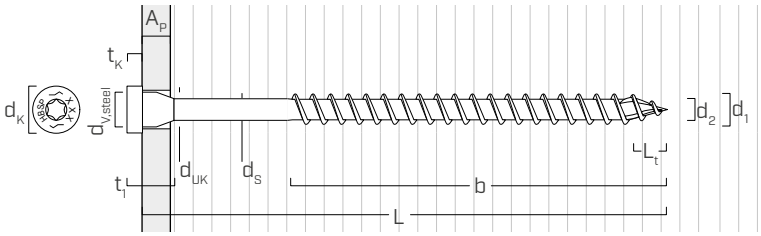
d_1 [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	A_P [in]	pcs
8 **0.32** TX 40	**HBSPLEVO840**	40	1 9/16	32	1 1/4	1/32 - 3/8	100
	HBSPLEVO860	60	2 3/8	52	2 1/16	1/32 - 3/8	100
	HBSPLEVO880	80	3 1/8	55	2 3/16	1/32 - 9/16	100
	HBSPLEVO8100	100	4	75	2 15/16	1/32 - 9/16	100
	HBSPLEVO8120	120	4 3/4	95	3 3/4	1/32 - 9/16	100
	HBSPLEVO8140	140	5 1/2	110	4 3/8	1/32 - 13/16	100
	HBSPLEVO8160	160	6 1/4	130	5 1/8	1/32 - 13/16	100
10 **0.40** TX 40	**HBSPLEVO1060**	60	2 3/8	52	2 1/16	1/3 2- 3/8	50
	HBSPLEVO1080	80	3 1/8	60	2 3/8	1/32 - 3/8	50
	HBSPLEVO10100	100	4	75	2 15/16	1/32 - 9/16	50
	HBSPLEVO10120	120	4 3/4	95	3 3/4	1/32 - 9/16	50
	HBSPLEVO10140	140	5 1/2	110	4 3/8	1/32 - 13/16	50
	HBSPLEVO10160	160	6 1/4	130	5 1/8	1/32 - 13/16	50
	HBSPLEVO10180	180	7 1/8	150	6	1/32 - 13/16	50
12 **0.48** TX 50	**HBSPLEVO12120**	120	4 3/4	90	3 1/2	1/32 - 13/16	25
	HBSPLEVO12140	140	5 1/2	110	4 3/8	1/32 - 13/16	25
	HBSPLEVO12160	160	6 1/4	120	4 3/4	1/32 -1 3/16	25
	HBSPLEVO12180	180	7 1/8	140	5 1/2	1/32 -1 3/16	25
	HBSPLEVO12200	200	8	160	6 1/4	1/32 -1 3/16	25

GEOMETRY AND MECHANICAL CHARACTERISTICS

HBS P EVO - 0.20 | 0.24 inch



HBS PLATE EVO - 0.32 | 0.40 | 0.48 inch



A = side memeber thickness

Nominal diameter	**d_1**	**[in]**(1)	**0.20**	**0.24**	**0.32**	**0.40**	**0.48**
Outer thread diameter	**d_1**	[mm]	5	6	8	10	12
		[in]	**0.197**	**0.236**	**0.315**	**0.394**	**0.472**
Head diameter	d_K	[in]	0.380	0.472	0.531	0.650	0.728
Root diameter	d_2	[in]	0.134	0.156	0.232	0.260	0.287
Shank diameter	d_S	[in]	0.144	0.169	0.248	0.283	0.337
Head thickness	t_1	[in]	0.217	0.256	0.531	0.650	0.768
Washer thickness	t_k	[in]	0.039	0.059	0.177	0.197	0.217
Underhead diameter	d_{UK}	[in]	0.236	0.315	0.394	0.472	0.512
Tip Lenght	L_t	[in]	0.197	0.236	0.315	0.394	0.472
Recommended hole diameter on steel plate	$d_{V,steel}$	[in]	1/4	3/8	7/16	1/2	9/16
Pre-drilling hole diameter(2)	$d_{V,G\leq0.55}$	[in]	1/8	5/32	13/64	15/64	9/32
Pre-drilling hole diameter(3)	$d_{V,G>0.55}$	[in]	9/64	5/32	15/64	9/32	5/16

(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).

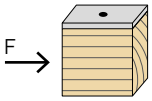
CHARACTERISTIC MECHANICAL PARAMETERS

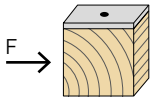
Nominal diameter	**d_1**	**[in]**	**0.20**	**0.24**	**0.32**	**0.40**	**0.48**
Tensile strength (allowable)	$F_{y,b}$	[psi]	220000	200000	172000	168000	178000
Bending yield strength (specified)	f_{tens}	[lbf]	690	1180	2660	3350	4310

Nominal diameter	**d_1**	[in]		**0.20**	**0.24**	**0.32**	**0.40**	**0.48**
Withdrawal	W_{90}	[lbf/in]	G = 0.35	103	131	141	186	222
			G = 0.42	119	151	162	214	256
			G = 0.49	133	171	183	241	288
			G = 0.55	146	188	200	263	314
minimum embedded length		[in]		1 7/8	1 7/8	1 7/8	2 3/8	2 13/16

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

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

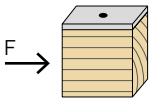


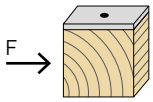


d_1	[in]		0.20	0.24	0.32	0.40	0.48
	[mm]		5	6	8	10	12
a_1	[in]	**15·d**	2 15/16	3 1/2	4 3/4	6	7 1/8
a_2	[in]	**5·d**	1	1 3/16	1 9/16	1 15/16	2 3/8
$a_{3,t}$	[in]	**15·d**	2 15/16	3 1/2	4 3/4	6	7 1/8
$a_{3,c}$	[in]	**10·d**	1 15/16	2 3/8	3 1/8	4	4 3/4
$a_{4,t}$	[in]	**10·d**	1 15/16	2 3/8	3 1/8	4	4 3/4
$a_{4,c}$	[in]	**5·d**	1	1 3/16	1 9/16	1 15/16	2 3/8

	0.20	0.24	0.32	0.40	0.48
	5	6	8	10	12
10·d	1 15/16	2 3/8	3 1/8	4	4 3/4
5·d	1	1 3/16	1 9/16	1 15/16	2 3/8
15·d	2 15/16	3 1/2	4 3/4	6	7 1/8
10·d	1 15/16	2 3/8	3 1/8	4	4 3/4
10·d	1 15/16	2 3/8	3 1/8	4	4 3/4
5·d	1	1 3/16	1 9/16	1 15/16	2 3/8

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

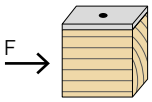


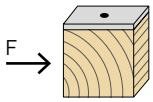


d_1	[in]		0.20	0.24	0.32	0.40	0.48
	[mm]		5	6	8	10	12
a_1	[in]	**15·d**	2 15/16	3 1/2	4 3/4	6	7 1/8
a_2	[in]	**7·d**	1 3/8	1 5/8	2 3/16	2 3/4	3 5/16
$a_{3,t}$	[in]	**20·d**	4	4 3/4	6 1/4	8	9 1/2
$a_{3,c}$	[in]	**15·d**	2 15/16	3 1/2	4 3/4	6	7 1/8
$a_{4,t}$	[in]	**12·d**	2 3/8	2 13/16	3 3/4	4 3/4	5 11/16
$a_{4,c}$	[in]	**7·d**	1 3/8	1 5/8	2 3/16	2 3/4	3 5/16

	0.20	0.24	0.32	0.40	0.48
	5	6	8	10	12
10·d	1 15/16	2 3/8	3 1/8	4	4 3/4
7·d	1 3/8	1 5/8	2 3/16	2 3/4	3 5/16
20·d	4	4 3/4	6 1/4	8	9 1/2
15·d	2 15/16	3 1/2	4 3/4	6	7 1/8
12·d	2 3/8	2 13/16	3 3/4	4 3/4	5 11/16
7·d	1 3/8	1 5/8	2 3/16	2 3/4	3 5/16

screws inserted **WITH pre-drilled hole**

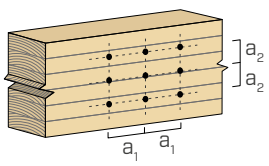




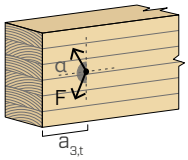
d_1	[in]		0.20	0.24	0.32		0.40	0.48
	[mm]		5	6	8		10	12
a_1	[in]	**10·d**	1 15/16	2 3/8	3 1/8	**5·d**	1 15/16	2 3/8
a_2	[in]	**4·d**	13/16	15/16	1 1/4	**5·d**	1 15/16	2 3/8
$a_{3,t}$	[in]	**12·d**	2 3/8	2 13/16	3 3/4	**7·d**	2 3/4	3 5/16
$a_{3,c}$	[in]	**7·d**	1 3/8	1 5/8	2 3/16	**4·d**	1 9/16	1 7/8
$a_{4,t}$	[in]	**7·d**	1 3/8	1 5/8	2 3/16	**4·d**	1 9/16	1 7/8
$a_{4,c}$	[in]	**3·d**	9/16	11/16	15/16	**3·d**	1 3/16	1 7/16

	0.20	0.24	0.32		0.40	0.48
	5	6	8		10	12
5·d	1 15/16	2 3/8	3 1/8	**5·d**	1 15/16	2 3/8
4·d	13/16	15/16	1 1/4	**5·d**	1 15/16	2 3/8
12·d	2 3/8	2 13/16	3 3/4	**7·d**	2 3/4	3 5/16
7·d	1 3/8	1 5/8	2 3/16	**4·d**	1 9/16	1 7/8
7·d	1 3/8	1 5/8	2 3/16	**4·d**	1 9/16	1 7/8
3·d	9/16	11/16	15/16	**3·d**	1 3/16	1 7/16

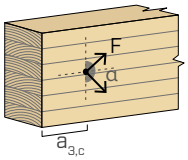
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



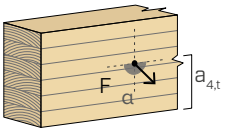
stressed end
-90° < α < 90°



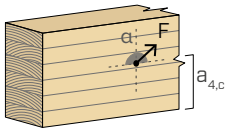
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES

- The minimum spacing and distances comply with ESR-4645, where d refers to the nominal diameter of the screw, and are valid for screw installed into sawn lumber, structural glued laminated timber and cross laminated timber;
- 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.