HBS PLATE

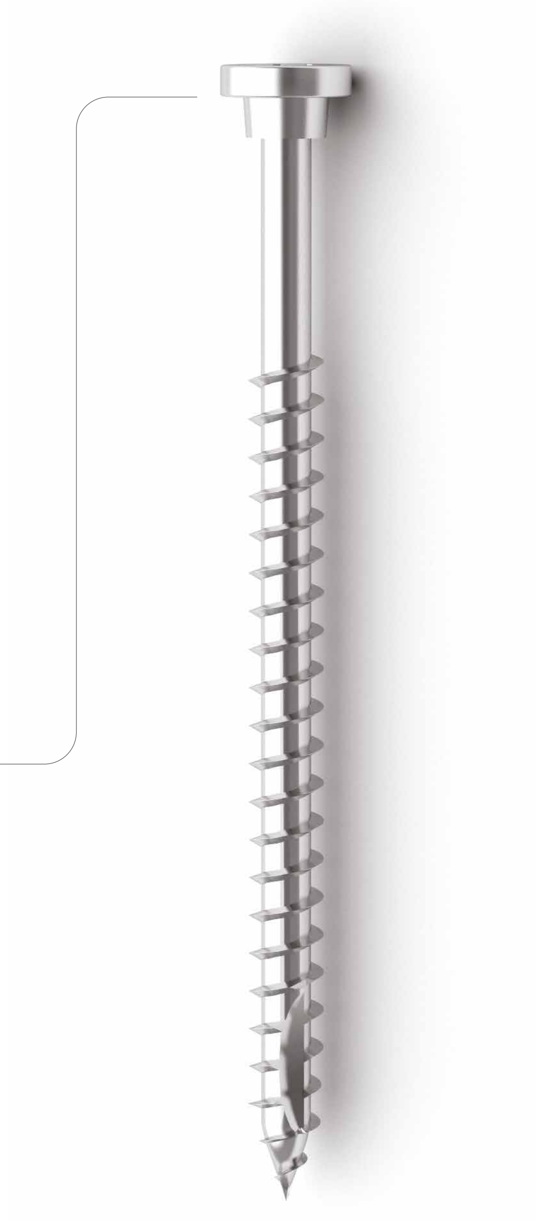
PAN HEAD SCREW FOR PLATES

AC233 | AC257
ESR-4645

BIT INCLUDED

MY PROJECT SOFTWARE

ETA-11/0030



HBS P

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.

PLATE FASTENING

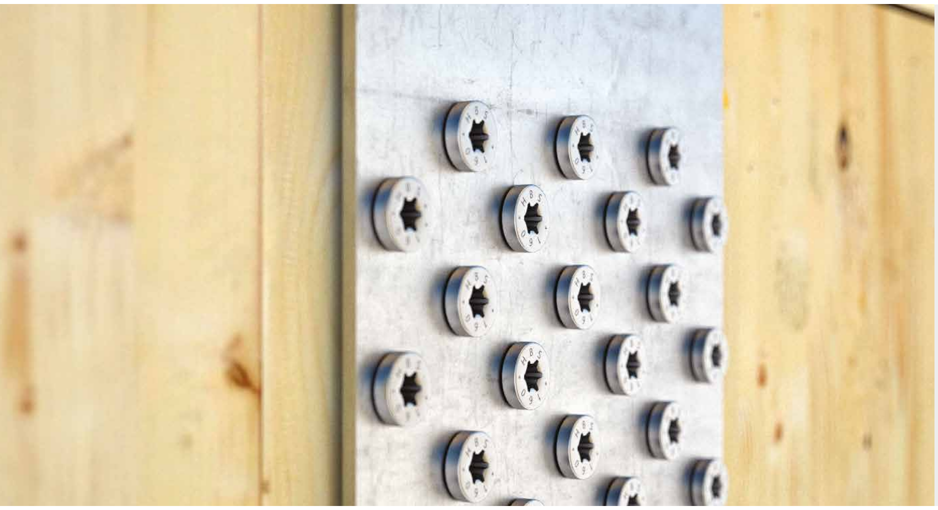
The under-head shoulder achieves an interlocking effect with the circular hole in the plate, thus guaranteeing excellent static performance.

LONGER THREAD

Increased thread length for excellent shear strength and tensile strength in steel-to-timber joints. Values higher than normal.

CHARACTERISTICS

FOCUS	steel-to-timber joints	
HEAD	shoulder for plate	
DIAMETER	from 8,0 to 12,0 mm	**0.32 to 0.48 inches**
LENGTH	from 80 to 200 mm	**3 1/8 to 8 inches**



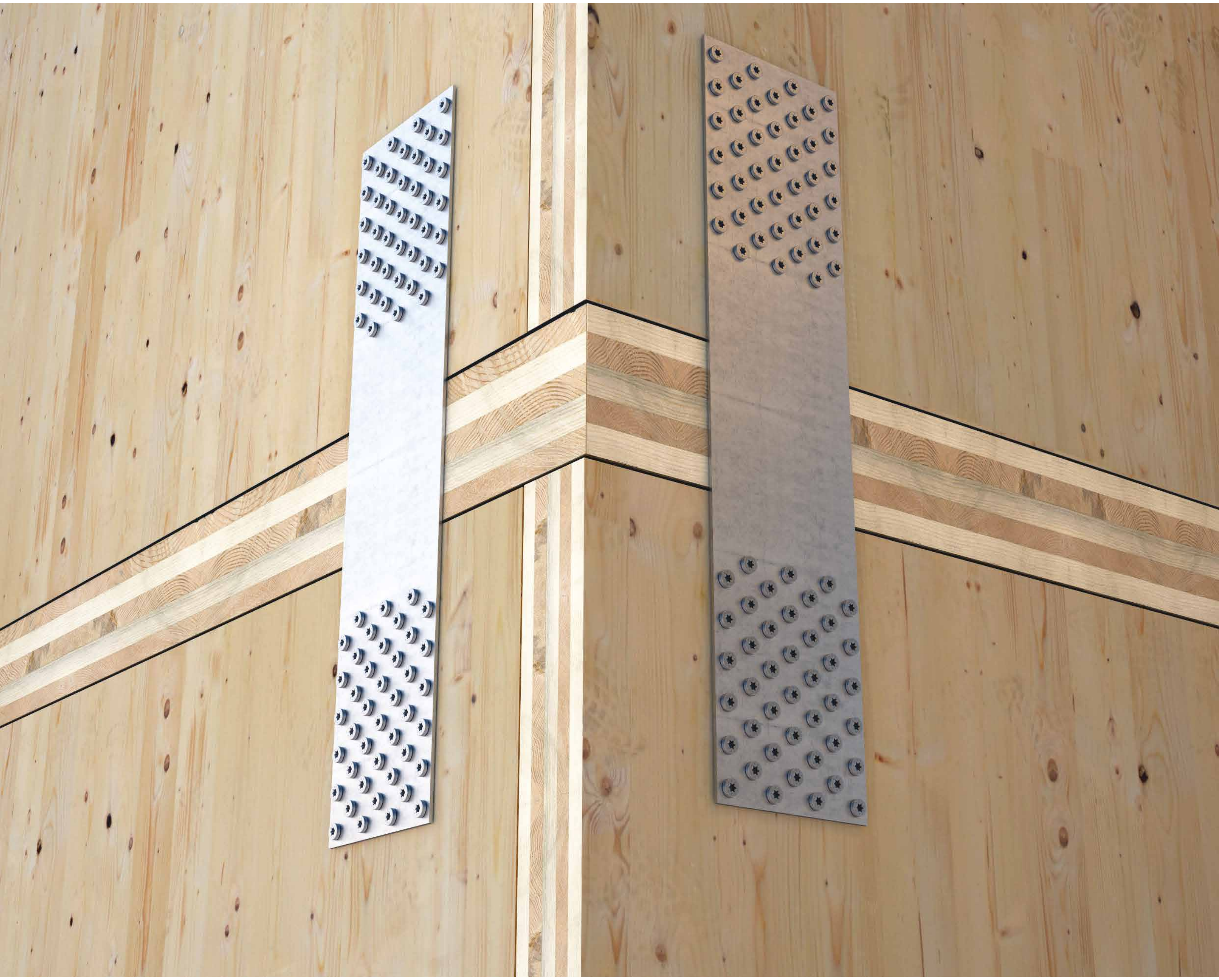
MATERIAL

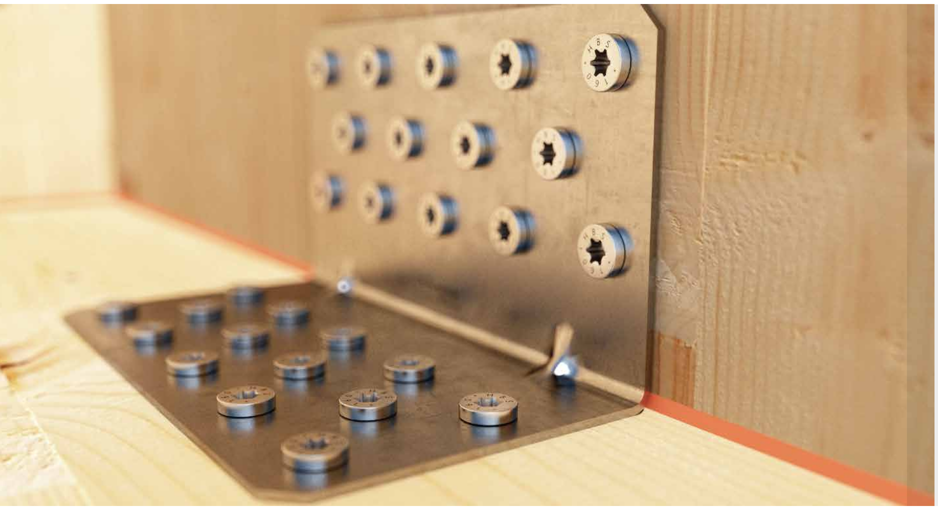
Bright zinc plated carbon steel.

FIELDS OF USE

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

Dry in-service conditions.



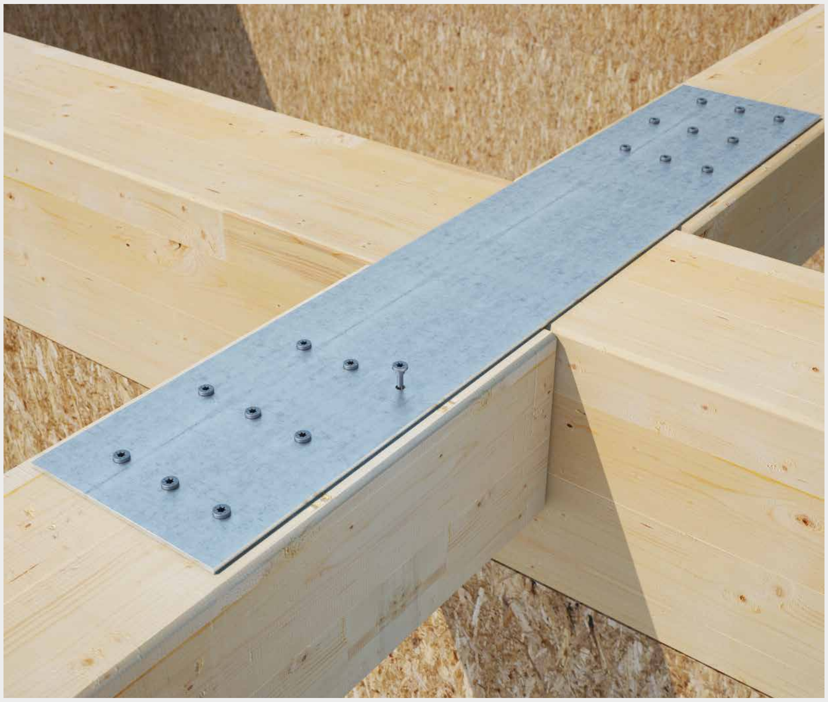


MULTISTOREY

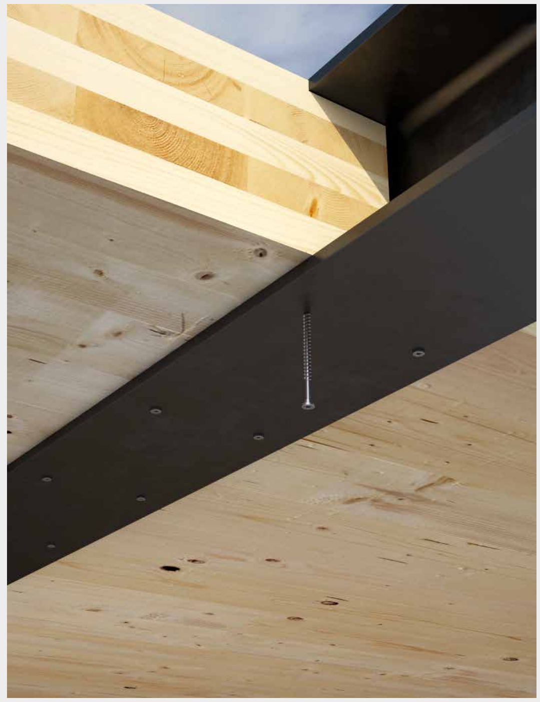
Ideal for steel-to-timber joints with large customized plates, designed for multi-story timber buildings.

TITAN

Values also tested, certified and calculated for fastening standard Rothoblaas plates.

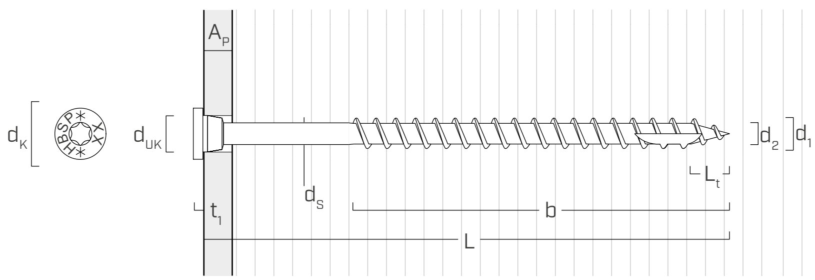


Steel-to-timber shear joint



Mixed steel-to-timber structural joint

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[in](1)	0.32	0.40	0.48
Outer thread diameter	d_1	[mm]	8	10	12
		[in]	0.315	0.394	0.472
Head diameter	d_K	[in]	0.571	0.719	0.817
Root diameter	d_2	[in]	0.213	0.252	0.268
Shank diameter	d_S	[in]	0.228	0.276	0.315
Head thickness	t_1	[in]	0.134	0.171	0.197
Underhead diameter	d_{UK}	[in]	0.394	0.472	0.551
Tip length	L_t	[in]	0.315	0.394	0.472
Pre-drilling hole diameter(2)	d_V	[in]	0.20	0.24	0.27
Recommended hole diameter on steel plate(2)	$d_{V,steel}$	[in]	0.430	0.510	0.590
Bending yield strength	$F_{y,b}$	[psi]	180,000	185,000	190,000
Tensile strength	f_{tens}	[lbf]	2040	2700	3060

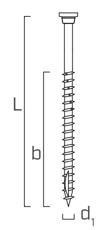
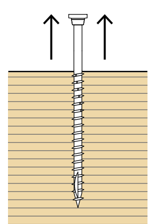
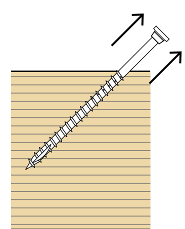
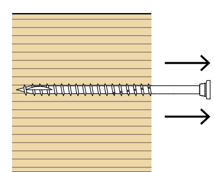
(1) The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.
(2) Pre-drilling applies to softwood timber.

CODES AND DIMENSIONS

d₁ [mm] [in]	CODE	L [mm]	L [in]	b [mm]	b [in]	A_P [mm]	A_P [in]	pcs
8 0.32 TX 40	**HBSP860**	60	2 3/8	52	2 1/16	1,0 ÷ 10,0	0.04 ÷ 0.40	100
	HBSP880	80	3 1/8	55	2 3/16	1,0 ÷ 15,0	0.04 ÷ 0.60	100
	HBSP8100	100	4	75	2 15/16	1,0 ÷ 15,0	0.04 ÷ 0.60	100
	HBSP8120	120	4 3/4	95	3 3/4	1,0 ÷ 20,0	0.04 ÷ 0.79	100
	HBSP8140	140	5 1/2	110	4 3/8	1,0 ÷ 20,0	0.04 ÷ 0.79	100
	HBSP8160	160	6 1/4	130	5 1/8	1,0 ÷ 20,0	0.04 ÷ 0.79	100
10 0.40 TX 40	**HBSP1080**	80	3 1/8	60	2 3/8	1,0 ÷ 10,0	0.04 ÷ 0.40	50
	HBSP10100	100	4	75	2 15/16	1,0 ÷ 15,0	0.04 ÷ 0.60	50
	HBSP10120	120	4 3/4	95	3 3/4	1,0 ÷ 15,0	0.04 ÷ 0.60	50
	HBSP10140	140	5 1/2	110	4 3/8	1,0 ÷ 20,0	0.04 ÷ 0.79	50
	HBSP10160	160	6 1/4	130	5 1/8	1,0 ÷ 20,0	0.04 ÷ 0.79	50
	HBSP10180	180	7 1/8	150	6	1,0 ÷ 20,0	0.04 ÷ 0.79	50
12 0.48 TX 50	**HBSP12100**	100	4	75	2 15/16	1,0 ÷ 15,0	0.04 ÷ 0.60	25
	HBSP12120	120	4 3/4	90	3 1/2	1,0 ÷ 20,0	0.04 ÷ 0.79	25
	HBSP12140	140	5 1/2	110	4 3/8	1,0 ÷ 20,0	0.04 ÷ 0.79	25
	HBSP12160	160	6 1/4	120	4 3/4	1,0 ÷ 30,0	0.04 ÷ 1.19	25
	HBSP12180	180	7 1/8	140	5 1/2	1,0 ÷ 30,0	0.04 ÷ 1.19	25
	HBSP12200	200	8	160	6 1/4	1,0 ÷ 30,0	0.04 ÷ 1.19	25

STRUCTURAL VALUES | THREAD WITHDRAWAL (W)

HBS PLATE Ø8 | 0.32 inch - Ø10 | 0.40 inch - Ø12 | 0.48 inch

geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°			
															
d₁ *[mm]* [in]	L *[mm]*	L [in]	b [in]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]	G=0.35 [lbf]	G=0.42 [lbf]	G=0.49 [lbf]	G=0.55 [lbf]
8 0.32	*60*(1)	2 3/8	2 1/16	223	256	283	356	203	233	257	324	67	77	85	107
	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
	160	6 1/4	5 1/8	524	600	663	836	476	546	603	761	157	180	199	251
10 0.40	*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
12 0.48	*100*(2)	4	2 15/16	511	585	660	719	465	533	600	655	153	176	198	216
	120(1)	4 3/4	3 1/2	633	725	817	891	576	659	743	810	190	217	245	267
	160	6 1/4	4 3/8	795	911	1026	1119	723	829	934	1018	238	273	308	336
	200	8	4 3/4	876	1003	1131	1233	797	913	1029	1122	263	301	339	370
	240	9 1/2	5 1/2	1038	1189	1340	1461	945	1082	1220	1330	311	357	402	438
	280	11	6 1/4	1200	1375	1550	1690	1092	1251	1410	1538	360	413	465	507

NOTES:

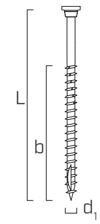
(1) The embedded thread length is lower than 8 times the outer thread diameter.

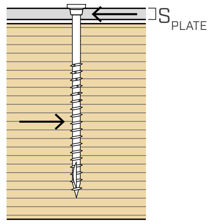
(2) The embedded thread length is lower than 6 times the outer thread diameter.

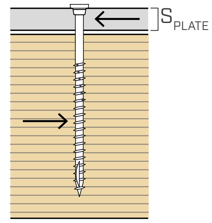
Refer to page 10 for the general calculation principles and for the calculation of the reference withdrawal design values for screws installed at an angle α to the grain.

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

HBS PLATE Ø8 | 0.32 inch - Ø10 | 0.40 inch - Ø12 | 0.48 inch



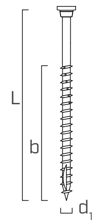
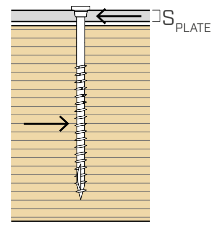
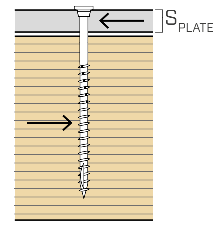




geometry				$Z_{\perp}$ (1)					$Z_{\perp}$ (1)				
d_1	L		b	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	*[mm]*	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
8 **0.32**	*60*	2 3/8	2 1/16	S_{PLATE} = 5/32"	184	246	302	332	S_{PLATE} = 5/16"	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
12 **0.48**	*100*	4	2 15/16		363	395	423	446		438	474	507	532
	120	4 3/4	3 1/2		363	395	423	446		438	474	507	532
	140	6 1/4	4 3/8		363	395	423	446		438	474	507	532
	160	8	4 3/4		363	395	423	446		438	474	507	532
	180	9 1/2	5 1/2		363	395	423	446		438	474	507	532
	200	11	6 1/4		363	395	423	446		438	474	507	532
8 **0.32**	*60*	2 3/8	2 1/16	S_{PLATE} = 3/16"	192	252	316	347	S_{PLATE} = 3/8"	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
12 **0.48**	*100*	4	2 15/16		375	407	435	458		457	517	552	579
	120	4 3/4	3 1/2		375	407	435	458		478	517	552	579
	140	6 1/4	4 3/8		375	407	435	458		478	517	552	579
	160	8	4 3/4		375	407	435	458		478	517	552	579
	180	9 1/2	5 1/2		375	407	435	458		478	517	552	579
	200	11	6 1/4		375	407	435	458		478	517	552	579

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

HBS PLATE Ø8 | 0.32 inch - Ø10 | 0.40 inch - Ø12 | 0.48 inch

geometry				$Z_{\parallel}$ (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
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
8 0.32	60	2 3/8	2 1/16	S_{PLATE} = 1/4"	214	272	338	386	S_{PLATE} = 15/32"	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
12 0.48	100	4	2 15/16		403	437	467	491		488	533	573	605
	120	4 3/4	3 1/2		403	437	467	491		488	533	573	605
	140	6 1/4	4 3/8		403	437	467	491		488	533	573	605
	160	8	4 3/4		403	437	467	491		488	533	573	605
	180	9 1/2	5 1/2		403	437	467	491		488	533	573	605
	200	11	6 1/4		403	437	467	491		488	533	573	605

NOTES:

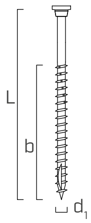
Tabulated reference lateral design values are applicable to screws installed perpendicular to the faces of the wood members and loaded as follows:

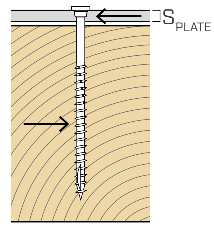
(1) $Z_{\parallel}$ main member loaded parallel to the grain.

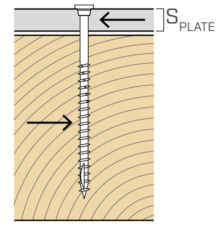
Refer to page 10 for the general calculation principles.

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

HBS PLATE Ø8 | 0.32 inch - Ø10 | 0.40 inch - Ø12 | 0.48 inch



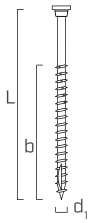
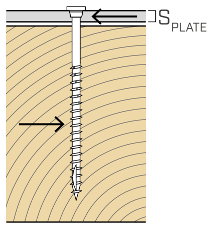
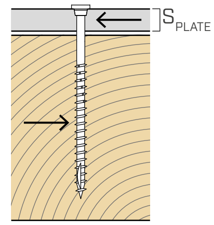




geometry				$Z_{\perp}$ (1)					$Z_{\perp}$ (1)			
d_1	L		b	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55	steel plate thickness	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[mm]	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
8 0.32	60	2 3/8	2 1/16	S_{PLATE} = 5/32"	147	197	241	265	S_{PLATE} = 5/16"	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
12 0.48	100	4	2 15/16		229	271	300	323		249	310	361	388
	120	4 3/4	3 1/2		239	271	300	323		290	327	361	388
	140	6 1/4	4 3/8		239	271	300	323		290	327	361	388
	160	8	4 3/4		239	271	300	323		290	327	361	388
	180	9 1/2	5 1/2		239	271	300	323		290	327	361	388
	200	11	6 1/4		239	271	300	323		290	327	361	388
8 0.32	60	2 3/8	2 1/16	S_{PLATE} = 3/16"	153	202	253	278	S_{PLATE} = 3/8"	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
10 0.40	80	3 1/8	2 3/8		182	231	278	299		224	268	315	358
	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
12 0.48	100	4	2 15/16		231	279	309	333		264	323	386	423
	120	4 3/4	3 1/2		247	279	309	333		301	357	394	423
	140	6 1/4	4 3/8		247	279	309	333		318	357	394	423
	160	8	4 3/4		247	279	309	333		318	357	394	423
	180	9 1/2	5 1/2		247	279	309	333		318	357	394	423
	200	11	6 1/4		247	279	309	333		318	357	394	423

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

HBS PLATE Ø8 | 0.32 inch - Ø10 | 0.40 inch - Ø12 | 0.48 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
[mm] [in]	*[mm]*	[in]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[in]	[lbf]	[lbf]	[lbf]	[lbf]
8 0.32	*60*	2 3/8	2 1/16	S_{PLATE} = 1/4"	171	218	270	309	S_{PLATE} = 15/32"	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
12 0.48	*100*	4	2 15/16		238	301	332	358		291	349	403	437
	120	4 3/4	3 1/2		267	301	332	358		319	362	403	437
	140	6 1/4	4 3/8		267	301	332	358		319	362	403	437
	160	8	4 3/4		267	301	332	358		319	362	403	437
	180	9 1/2	5 1/2		267	301	332	358		319	362	403	437
	200	11	6 1/4		267	301	332	358		319	362	403	437

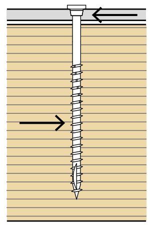
NOTES:

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

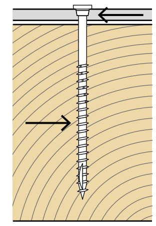
(1) $Z_{\perp}$ main member loaded perpendicular to the grain.

Refer to page 10 for the general calculation principles.

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°

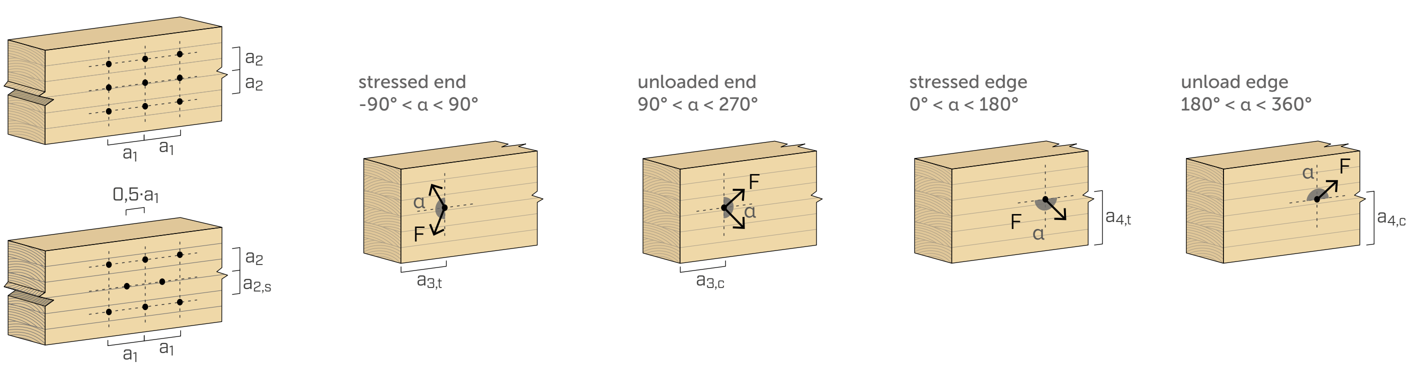


Load-to-grain angle α = 90°

d_1		Screws inserted without pre-drilling hole **G < 0.50**					Screws inserted without pre-drilling hole **G < 0.50**				
	[mm]		*8*		*10*	*12*		*8*		*10*	*12*
	[in]		**0.32**		**0.40**	**0.48**		**0.32**		**0.40**	**0.48**
a_1	[in]	**15·d**	4 3/4	**15·d**	6	7 1/8	**10·d**	3 1/8	**10·d**	4	4 3/4
a_2	[in]	**5·d**	1 9/16	**5·d**	1 15/16	2 3/8	**5·d**	1 9/16	**5·d**	1 15/16	2 3/8
$a_{2,s}$	[in]	**2.5·d**	13/16	**5·d**	1 15/16	2 3/8	**2.5·d**	13/16	**5·d**	1 15/16	2 3/8
$a_{3,t}$	[in]	**15·d**	4 3/4	**15·d**	6	7 1/8	**10·d**	3 1/8	**10·d**	4	4 3/4
$a_{3,c}$	[in]	**10·d**	3 1/8	**10·d**	4	4 3/4	**10·d**	3 1/8	**10·d**	4	4 3/4
$a_{4,t}$	[in]	**5·d**	1 9/16	**5·d**	1 15/16	2 3/8	**10·d**	3 1/8	**10·d**	4	4 3/4
$a_{4,c}$	[in]	**5·d**	1 9/16	**5·d**	1 15/16	2 3/8	**5·d**	1 9/16	**5·d**	1 15/16	2 3/8

d_1		Screws inserted without pre-drilling hole **G ≥ 0.50**					Screws inserted without pre-drilling hole **G ≥ 0.50**				
	[mm]		*8*		*10*	*12*		*8*		*10*	*12*
	[in]		**0.32**		**0.40**	**0.48**		**0.32**		**0.40**	**0.48**
a_1	[in]	**15·d**	4 3/4	**15·d**	6	7 1/8	**10·d**	3 1/8	**10·d**	4	4 3/4
a_2	[in]	**7·d**	2 3/16	**7·d**	2 3/4	3 5/16	**7·d**	2 3/16	**7·d**	2 3/4	3 5/16
$a_{2,s}$	[in]	**3·d**	15/16	**5·d**	1 15/16	2 3/8	**3·d**	15/16	**5·d**	1 15/16	2 3/8
$a_{3,t}$	[in]	**20·d**	6 1/4	**20·d**	8	9 1/2	**15·d**	4 3/4	**15·d**	6	7 1/8
$a_{3,c}$	[in]	**15·d**	4 3/4	**15·d**	6	7 1/8	**15·d**	4 3/4	**15·d**	6	7 1/8
$a_{4,t}$	[in]	**7·d**	2 3/16	**7·d**	2 3/4	3 5/16	**12·d**	3 3/4	**12·d**	4 3/4	5 11/16
$a_{4,c}$	[in]	**7·d**	2 3/16	**7·d**	2 3/4	3 5/16	**7·d**	2 3/16	**7·d**	2 3/4	3 5/16

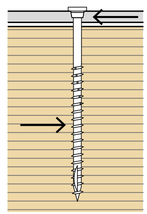
d = nominal screw diameter



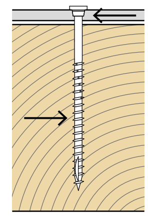
NOTES:

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

MINIMUM DISTANCES FOR LATERAL LOADING



Load-to-grain angle α = 0°



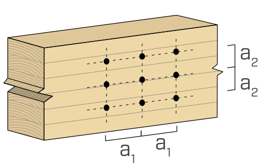
Load-to-grain angle α = 90°

		Screws inserted without pre-drilling hole **G ≤ 0.47**				Screws inserted without pre-drilling hole **G ≤ 0.47**			
d_1	*[mm]*		*8*	*10*	*12*		*8*	*10*	*12*
	[in]		**0.32**	**0.40**	**0.48**		**0.32**	**0.40**	**0.48**
a_1	[in]	**12·d·0.7**	2 11/16	3 5/16	4	**5·d·0.7**	1 1/8	1 3/8	1 5/8
a_2	[in]	**5·d·0.7**	1 1/8	1 3/8	1 5/8	**5·d·0.7**	1 1/8	1 3/8	1 5/8
$a_{3,t}$	[in]	**15·d**	4 3/4	6	7 1/8	**10·d**	3 1/8	4	4 3/4
$a_{3,c}$	[in]	**10·d**	3 1/8	4	4 3/4	**10·d**	3 1/8	4	4 3/4
$a_{4,t}$	[in]	**5·d**	1 9/16	1 15/16	2 3/8	**10·d**	3 1/8	4	4 3/4
$a_{4,c}$	[in]	**5·d**	1 9/16	1 15/16	2 3/8	**5·d**	1 9/16	1 15/16	2 3/8

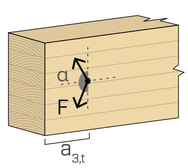
		Screws inserted without pre-drilling hole **G > 0.47**				Screws inserted without pre-drilling hole **G > 0.47**			
d_1	*[mm]*		*8*	*10*	*12*		*8*	*10*	*12*
	[in]		**0.32**	**0.40**	**0.48**		**0.32**	**0.40**	**0.48**
a_1	[in]	**15·d·0.7**	3 5/16	4 1/8	4 15/16	**7·d·0.7**	1 9/16	1 15/16	2 5/16
a_2	[in]	**7·d·0.7**	1 9/16	1 15/16	2 5/16	**7·d·0.7**	1 9/16	1 15/16	2 5/16
$a_{3,t}$	[in]	**20·d**	6 1/4	8	9 1/2	**15·d**	4 3/4	6	7 1/8
$a_{3,c}$	[in]	**15·d**	4 3/4	6	7 1/8	**15·d**	4 3/4	6	7 1/8
$a_{4,t}$	[in]	**7·d**	2 3/16	2 3/4	3 5/16	**12·d**	3 3/4	4 3/4	5 11/16
$a_{4,c}$	[in]	**7·d**	2 3/16	2 3/4	3 5/16	**7·d**	2 3/16	2 3/4	3 5/16

		Screws inserted **with** pre-drilling hole				Screws inserted **with** pre-drilling hole			
d_1	*[mm]*		*8*	*10*	*12*		*8*	*10*	*12*
	[in]		**0.32**	**0.40**	**0.48**		**0.32**	**0.40**	**0.48**
a_1	[in]	**5·d·0.7**	1 1/8	1 3/8	1 5/8	**4·d·0.7**	7/8	1 1/8	1 5/16
a_2	[in]	**3·d·0.7**	11/16	13/16	1 1/32	**4·d·0.7**	7/8	1 1/8	1 5/16
$a_{3,t}$	[in]	**12·d**	3 3/4	4 3/4	5 11/16	**7·d**	2 3/16	2 3/4	3 5/16
$a_{3,c}$	[in]	**7·d**	2 3/16	2 3/4	3 5/16	**7·d**	2 3/16	2 3/4	3 5/16
$a_{4,t}$	[in]	**3·d**	15/16	1 3/16	1 7/16	**7·d**	2 3/16	2 3/4	3 5/16
$a_{4,c}$	[in]	**3·d**	15/16	1 3/16	1 7/16	**3·d**	15/16	1 3/16	1 7/16

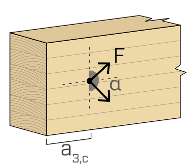
d = nominal screw diameter



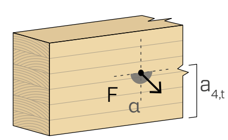
stressed end
-90° < α < 90°



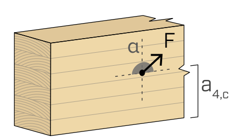
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES:

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

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 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	Reference withdrawal design values [lbf/in]			
	G=0.35	G=0.42	G=0.49	G=0.55
[mm] [in]	[lbf/in]	[lbf/in]	[lbf/in]	[lbf/in]
8 **0.32**	109	125	138	174
10 **0.40**	140	161	188	205
12 **0.48**	206	236	266	290

- 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 Leff of the screw in the wood member and with the factor k_α:

$$W_\alpha = W \cdot k_\alpha \cdot L_{eff}$$

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_α factor is calculated as:

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

- 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_α = 1 for α = 90°, k_α = 0.91 for α = 45°, k_α = 0.3 for α = 0°.

- 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 α ≤ 15°.
- The reference withdrawal design values must be less than f_{tens} of the screw.