

COUNTERSUNK SCREW

SUPERIOR STRENGTH

Steel with superb yield and failure strength ($f_{y,k} = 1000 \text{ N/mm}^2$ | *145,038 psi*). Very high torsional strength $f_{tor,k}$ for safer screwing.

STRUCTURAL APPLICATIONS

Approved for structural applications subject to stresses in any direction vs. the grain ($\alpha = 0^\circ - 90^\circ$). Asymmetric "umbrella" threading for better wood pull-through.

DUCTILITY

Bending angle 20° greater than standard, certified according to ETA-11/0030, Cyclical SEISMIC-REV tests according to EN 12512. Seismic performance tested according to EN 14592.

CHROMIUM (VI) FREE

Total absence of hexavalent chromium. Compliance with the strictest regulations governing chemical substances (SVHC). REACH information available.

CHARACTERISTICS

FOCUS	extremely complete range	
HEAD	countersunk with under-head ribs	
DIAMETER	from 6 mm to 12 mm	<i>0.24 to 0.48 inch</i>
LENGTH	from 40 mm to 600 mm	<i>1 9/16 to 23 5/8 inch</i>



MATERIAL

Carbon steel with bright zinc plated.

FIELDS OF USE

- wood based panels
 - solid timber
 - glulam (Glued Laminated Timber)
 - CLT, LVL
 - high density woods
- Service classes 1 and 2.



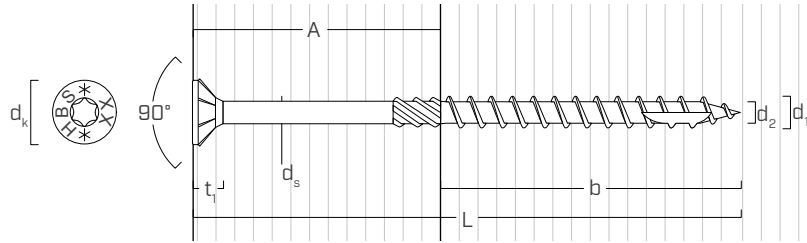
CLT

Values also tested, certified and calculated for CLT. Calculation tables and dimensioning software (MyProject) for CLT available in the catalogue and online.

LVL

Values also tested, certified and calculated for CLT and high density woods such as Microllam® LVL.

■ GEOMETRY AND MECHANICAL CHARACTERISTICS



		[mm]	6	8	10	12
Nominal diameter	d_1	[in]	0.24	0.32	0.40	0.48
		[in] ⁽¹⁾	1/4	5/16	3/8	1/2
Head diameter	d_k	[mm]	12.00	14.50	18.25	20.75
		[in]	0.472	0.571	0.719	0.817
Tip diameter	d_2	[mm]	3.95	5.40	6.40	6.80
		[in]	0.156	0.213	0.252	0.268
Shank diameter	d_s	[mm]	4.30	5.80	7.00	8.00
		[in]	0.169	0.228	0.276	0.315
Head thickness	t_1	[mm]	4.50	4.50	5.80	7.20
		[in]	0.177	0.177	0.228	0.283
Pre-drilling diameter	d_v	[mm]	4.00	5.00	6.00	7.00
		[in]	0.157	0.197	0.236	0.276
Characteristic yield moment	$M_{y,k}$	[Nm]	9.5	20.1	35.8	48.0
		[lbf.in]	84.1	177.9	316.9	424.8
Characteristic withdrawal-resistance parameter ⁽²⁾	$f_{ax,k}$	[N/mm ²]	11.7	11.7	11.7	11.7
		[psi]	1,697	1,697	1,697	1,697
Associated density	ρ_a	[kg/m ³]	350	350	350	350
Characteristic head-pull-through parameter ⁽²⁾	$f_{head,k}$	[N/mm ²]	10.5	10.5	10.5	10.5
		[psi]	1,523	1,523	1,523	1,523
Associated density	ρ_a	[kg/m ³]	350	350	350	350
Characteristic tensile strength	$f_{tens,k}$	[kN]	11.3	20.1	31.4	33.9
		[lbf]	2,540	4,519	7,059	7,621
Associated density	ρ_a	[kg/m ³]	350	350	350	350

⁽¹⁾The value in fractional inches is rounded to the closest fraction for simplicity of use. For the precise value of the nominal diameter d_1 , see the value in decimal inches.

⁽²⁾Valid for softwood - maximum density 440 kg/m³.

For applications on different timber types (e.g. LVL) or with a high density please check on the ETA-11/0030.

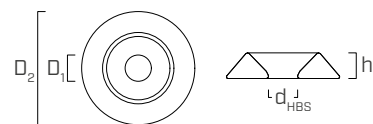
CODES AND DIMENSIONS

d ₁	CODE	L		b		A		pcs
[mm][in]		[mm]	[in]	[mm]	[in]	[mm]	[in]	
6 0.24 TX 30	HBS640	40	1 9/16	35	1 3/8	8	5/16	100
	HBS650	50	1 15/16	45	1 3/4	15	9/16	100
	HBS660	60	2 3/8	30	1 3/16	30	1 3/16	100
	HBS670	70	2 3/4	40	1 9/16	30	1 3/16	100
	HBS680	80	3 1/8	40	1 9/16	40	1 9/16	100
	HBS690	90	3 1/2	50	1 15/16	40	1 9/16	100
	HBS6100	100	4	50	1 15/16	50	1 15/16	100
	HBS6110	110	4 3/8	60	2 3/8	50	1 15/16	100
	HBS6120	120	4 3/4	60	2 3/8	60	2 3/8	100
	HBS6130	130	5 1/8	60	2 3/8	70	2 3/4	100
	HBS6140	140	5 1/2	75	2 15/16	65	2 9/16	100
	HBS6150	150	6	75	2 15/16	75	2 15/16	100
	HBS6160	160	6 1/4	75	2 15/16	85	3 3/8	100
	HBS6180	180	7 1/8	75	2 15/16	105	4 1/8	100
	HBS6200	200	8	75	2 15/16	125	4 15/16	100
	HBS6220	220	8 5/8	75	2 15/16	145	5 11/16	100
	HBS6240	240	9 1/2	75	2 15/16	165	6 1/2	100
	HBS6260	260	10 1/4	75	2 15/16	185	7 1/4	100
	HBS6280	280	11	75	2 15/16	205	8 1/16	100
	HBS6300	300	11 3/4	75	2 15/16	225	8 7/8	100
8 0.32 TX 40	HBS880	80	3 1/8	52	2 1/16	28	1 1/8	100
	HBS8100	100	4	52	2 1/16	48	1 7/8	100
	HBS8120	120	4 3/4	60	2 3/8	60	2 3/8	100
	HBS8140	140	5 1/2	60	2 3/8	80	3 1/8	100
	HBS8160	160	6 1/4	80	3 1/8	80	3 1/8	100
	HBS8180	180	7 1/8	80	3 1/8	100	4	100
	HBS8200	200	8	80	3 1/8	120	4 3/4	100
	HBS8220	220	8 5/8	80	3 1/8	140	5 1/2	100
	HBS8240	240	9 1/2	80	3 1/8	160	6 1/4	100
	HBS8260	260	10 1/4	80	3 1/8	180	7 1/8	100
	HBS8280	280	11	80	3 1/8	200	8	100
	HBS8300	300	11 3/4	100	4	200	8	100
	HBS8320	320	12 5/8	100	4	220	8 5/8	100
	HBS8340	340	13 3/8	100	4	240	9 1/2	100
	HBS8360	360	14 1/4	100	4	260	10 1/4	100
	HBS8380	380	15	100	4	280	11	100
	HBS8400	400	15 3/4	100	4	300	11 3/4	100
	HBS8440	440	17 1/4	100	4	340	13 3/8	100
	HBS8480	480	19	100	4	380	15	100
	HBS8520	520	20 1/2	100	4	420	16 9/16	100

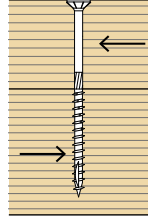
d ₁	CODE	L		b		A		pcs
[mm][in]		[mm]	[in]	[mm]	[in]	[mm]	[in]	
10 0.40 TX 40	HBS1080	80	3 1/8	52	2 1/16	28	1 1/8	50
	HBS10100	100	4	52	2 1/16	48	1 7/8	50
	HBS10120	120	4 3/4	60	2 3/8	60	2 3/8	50
	HBS10140	140	5 1/2	60	2 3/8	80	3 1/8	50
	HBS10160	160	6 1/4	80	3 1/8	80	3 1/8	50
	HBS10180	180	7 1/8	80	3 1/8	100	4	50
	HBS10200	200	8	80	3 1/8	120	4 3/4	50
	HBS10220	220	8 5/8	80	3 1/8	140	5 1/2	50
	HBS10240	240	9 1/2	80	3 1/8	160	6 1/4	50
	HBS10260	260	10 1/4	80	3 1/8	180	7 1/8	50
	HBS10280	280	11	80	3 1/8	200	8	50
	HBS10300	300	11 3/4	100	4	200	8	50
	HBS10320	320	12 5/8	100	4	220	8 5/8	50
	HBS10340	340	13 3/8	100	4	240	9 1/2	50
	HBS10360	360	14 1/4	100	4	260	10 1/4	50
	HBS10380	380	15	100	4	280	11	50
	HBS10400	400	15 3/4	100	4	300	11 3/4	50
	HBS12120	120	4 3/4	80	3 1/8	60	2 3/8	25
	HBS12160	160	6 1/4	80	3 1/8	80	3 1/8	25
12 0.48 TX 50	HBS12200	200	8	80	3 1/8	120	4 3/4	25
	HBS12240	240	9 1/2	80	3 1/8	160	6 1/4	25
	HBS12280	280	11	80	3 1/8	200	8	25
	HBS12320	320	12 5/8	120	4 3/4	200	8	25
	HBS12360	360	14 1/4	120	4 3/4	240	9 1/2	25
	HBS12400	400	15 3/4	120	4 3/4	280	11	25
	HBS12440	440	17 1/4	120	4 3/4	320	12 5/8	25
	HBS12480	480	19	120	4 3/4	360	14 1/4	25
	HBS12520	520	20 1/2	120	4 3/4	400	15 3/4	25
	HBS12560	560	22	120	4 3/4	440	17 1/4	25
	HBS12600	600	23 5/8	120	4 3/4	480	19	25

HUS COUNTERSUNK WASHER

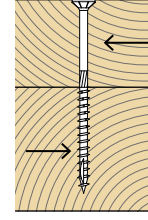
d _{HBS}	CODE	D ₁		D ₂		h		pcs
[mm]		[mm]	[in]	[mm]	[in]	[mm]	[in]	
6	HUS6	7.5	0.295	20	0.787	4	0.157	100
8	HUS8	8.5	0.335	25	0.984	5	0.197	50
10	HUS10	11	0.433	32	1.260	6	0.236	50
12	HUS12	14	0.551	37	1.457	7	0.295	25



MINIMUM DISTANCES FOR SHEAR LOADS | WOOD ELEMENTS



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

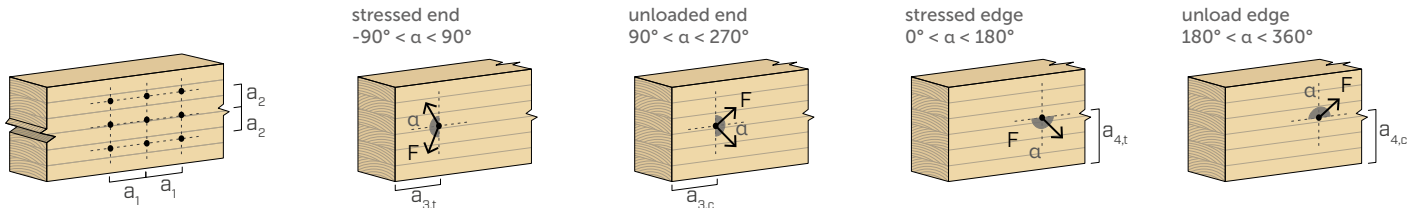


Load-to-grain angle $\alpha = 90^\circ$

SCREWS INSERTED WITH PREDRILL									
$\alpha = 0^\circ$					$\alpha = 90^\circ$				
d_1	[mm] [in]	6	8	10	12	6	8	10	12
a_1	[mm] [in]	30 1.181	40 1.575	50 1.969	60 2.362	24 0.945	32 1.260	40 1.575	48 1.890
a_2	[mm] [in]	18 0.709	24 0.945	30 1.181	36 1.417	24 0.945	32 1.260	40 1.575	48 1.890
$a_{3,t}$	[mm] [in]	72 2.835	96 3.780	120 4.724	144 5.669	42 1.654	56 2.205	70 2.756	84 3.307
$a_{3,c}$	[mm] [in]	42 1.654	56 2.205	70 2.756	84 3.307	42 1.654	56 2.205	70 2.756	84 3.307
$a_{4,t}$	[mm] [in]	18 0.709	24 0.945	30 1.181	36 1.417	42 1.654	56 2.205	70 2.756	84 3.307
$a_{4,c}$	[mm] [in]	18 0.709	24 0.945	30 1.181	36 1.417	18 0.709	24 0.945	30 1.181	36 1.417

SCREWS INSERTED WITHOUT PREDRILL									
$\alpha = 0^\circ$					$\alpha = 90^\circ$				
d_1	[mm] [in]	6	8	10	12	6	8	10	12
a_1	[mm] [in]	72 2.835	96 3.780	120 4.724	144 5.669	30 1.181	40 1.575	50 1.969	60 2.362
a_2	[mm] [in]	30 1.181	40 1.575	50 1.969	60 2.362	30 1.181	40 1.575	50 1.969	60 2.362
$a_{3,t}$	[mm] [in]	90 3.543	120 4.724	150 5.906	180 7.087	60 2.362	80 3.150	100 3.937	120 4.724
$a_{3,c}$	[mm] [in]	60 2.362	80 3.150	100 3.937	120 4.724	60 2.362	80 3.150	100 3.937	120 4.724
$a_{4,t}$	[mm] [in]	30 1.181	40 1.575	50 1.969	60 2.362	60 2.362	80 3.150	100 3.937	120 4.724
$a_{4,c}$	[mm] [in]	30 1.181	40 1.575	50 1.969	60 2.362	30 1.181	40 1.575	50 1.969	60 2.362

d = nominal screw diameter



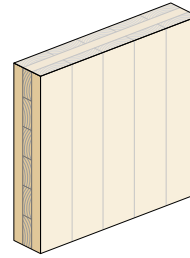
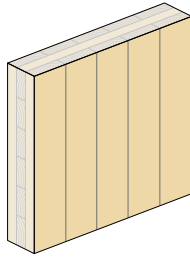
NOTES:

- The minimum distances are in accordance with the EN 1995:2014 standard, according to ETA-11/0030, considering a density of the wood elements $\rho_K \leq 420 \text{ kg/m}^3$.
- For wood densities conversion (mean oven-dry relative density to 5th-percentile density 12% MC wt & vol) see "Background document" available at Rothoblaas.
- In the case of OSB-wood joints, the minimum spacings (a_1 , a_2) can be multiplied by a coefficient of 0.85.

- In the case of steel-wood joints, the minimum spacings (a_1 , a_2) can be multiplied by a coefficient of 0.7.

(1) For Douglas fir members minimum spacing and distances parallel to the grain shall be increased by 50%.

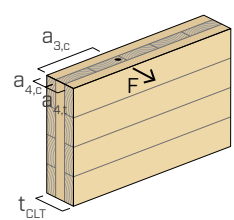
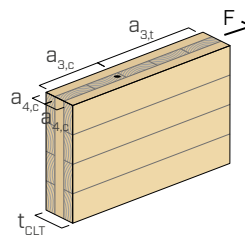
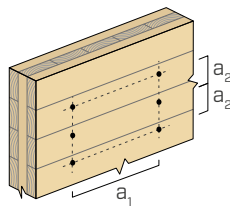
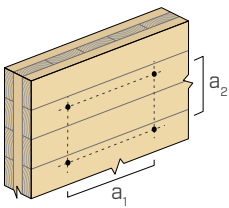
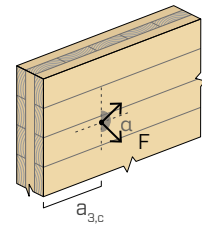
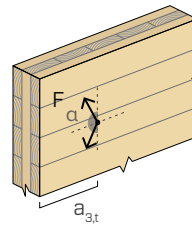
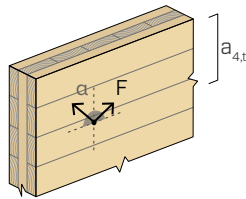
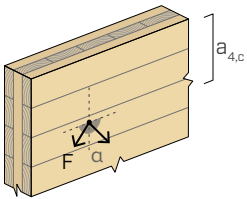
■ MINIMUM DISTANCES FOR SHEAR LOADS | CLT



SCREWS INSERTED WITHOUT PREDRILL

		lateral face ⁽²⁾				narrow face ⁽³⁾					
d ₁	[mm] [in]		6	8	10	12		6	8	10	12
			0.24	0.32	0.40	0.48		0.24	0.32	0.40	0.48
a ₁	[mm] [in]	4·d	24 0.945	32 1.260	40 1.575	48 1.890	10·d	60 2.362	80 3.150	100 3.937	120 4.724
a ₂	[mm] [in]	2,5·d	15 0.591	20 0.787	25 0.984	30 1.181	4·d	24 0.945	32 1.260	40 1.575	48 1.890
a _{3,t}	[mm] [in]	6·d	36 1.417	48 1.890	60 2.362	72 2.835	12·d	72 2.835	96 3.780	120 4.724	144 5.669
a _{3,c}	[mm] [in]	6·d	36 1.417	48 1.890	60 2.362	72 2.835	7·d	42 1.654	56 2.205	70 2.756	84 3.307
a _{4,t}	[mm] [in]	6·d	36 1.417	48 1.890	60 2.362	72 2.835	6·d	36 1.417	48 1.890	60 2.362	72 2.835
a _{4,c}	[mm] [in]	2,5·d	15 0.591	20 0.787	25 0.984	30 1.181	3·d	18 0.709	24 0.945	30 1.181	36 1.417

d = nominal screw diameter



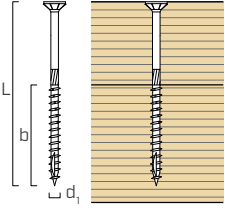
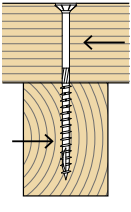
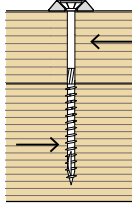
NOTES:

- The minimum distances are according to ETA-11/0030, unless otherwise specified in the technical specification (ETA or hEN) for the cross laminated timber.

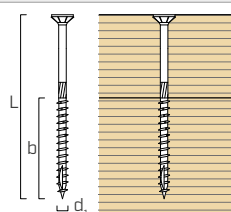
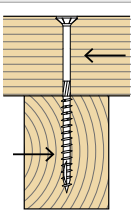
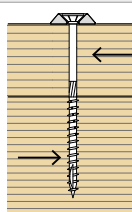
(2) Minimum thickness of CLT members $t_{CLT,min} = 10 d$.

(3) Minimum thickness of CLT members $t_{CLT,min} = 10 d$ and minimum screw penetration depth perpendicular to the edge surface of $10 d$.

■ STATIC VALUES | SHEAR TIMBER-TO-TIMBER

geometry						timber-to-timber						timber-to-timber with washer					
																	
d ₁	L		b			characteristic values		design values (factored resistance)				characteristic values		design values (factored resistance)			
						R _{V,k}		R _{V,d}		R _{V,d}		R _{V,d}		R _{V,k}		R _{V,d}	
[mm] [in]	[mm]	[in]	[mm]	[in]		[kN]	[lbf]	Load Case 1		Load Case 2&3		Load Case 4&5		[kN]	[lbf]	Load Case 1	
6																	
8																	

■ STATIC VALUES | SHEAR TIMBER-TO-TIMBER

geometry						timber-to-timber								timber-to-timber with washer							
																					
d ₁		L		b		characteristic values		design values (factored resistance)						characteristic values		design values (factored resistance)					
						R _{V,k}		R _{V,d} Load Case 1		R _{V,d} Load Case 2&3		R _{V,d} Load Case 4&5		R _{V,k}		R _{V,d} Load Case 1		R _{V,d} Load Case 2&3		R _{V,d} Load Case 4&5	
[mm]	[in]	[mm]	[in]	[mm]	[in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
10 0.40		80	3 1/8	52	2 1/16	3.53	794	1.63	367	2.17	489	2.45	550	4.21	946	1.94	437	2.59	582	2.91	655
		100	4	52	2 1/16	4.07	914	1.88	422	2.50	563	2.82	633	4.74	1,066	2.19	492	2.92	656	3.28	738
		120	4 3/4	60	2 3/8	4.69	1,055	2.17	487	2.89	649	3.25	730	5.61	1,262	2.59	582	3.45	777	3.89	874
		140	5 1/2	60	2 3/8	4.71	1,058	2.17	488	2.90	651	3.26	732	5.63	1,265	2.60	584	3.46	778	3.90	876
		160	6 1/4	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		180	7 1/8	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		200	8	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		220	8 5/8	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		240	9 1/2	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		260	10 1/4	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		280	11	80	3 1/8	4.71	1,059	2.17	489	2.90	651	3.26	733	6.24	1,403	2.88	648	3.84	863	4.32	971
		300	11 3/4	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
		320	12 5/8	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
		340	13 3/8	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
		360	14 1/4	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
		380	15	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
		400	15 3/4	100	4	4.71	1,059	2.17	489	2.90	651	3.26	733	6.60	1,485	3.05	685	4.06	914	4.57	1,028
12 0.48		120	4 3/4	80	3 1/8	4.73	1,063	2.18	491	2.91	654	3.27	736	6.48	1,457	2.99	673	3.99	897	4.49	1,009
		160	6 1/4	80	3 1/8	5.86	1,318	2.71	609	3.61	811	4.06	913	7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
		200	8	80	3 1/8	5.86	1,318	2.71	609	3.61	811	4.06	913	7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
		240	9 1/2	80	3 1/8	5.86	1,318	2.71	609	3.61	811	4.06	913	7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
		280	11	80	3 1/8	5.86	1,318	2.71	609	3.61	811	4.06	913	7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
		320	12 5/8	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		360	14 1/4	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		400	15 3/4	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		440	17 1/4	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		480	19	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		520	20 1/2	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		560	22	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314
		600	23 5/8	120	4 3/4	5.86	1,318	2.71	609	3.61	811	4.06	913	8.44	1,897	3.90	876	5.19	1,168	5.84	1,314

GENERAL PRINCIPLES:

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-11/0030.
- According to EN 1995:2014 for shear characteristic values the contribution from the rope effect ($F_{ax,Rk} / 4$) is considered. This is resulting in higher shear resistances compared to shear resistances calculated in accordance with CSA O86-14.
- Design values for wood-side are obtained from the following characteristic values:

$$R_d = R_k \cdot DMF$$

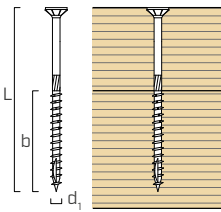
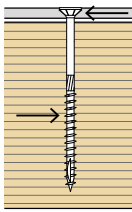
DMF: design modification factor based on k_{mod} as per Table 10 and for γ_M as per Table 11 ($\gamma_M = 1.3$). See "Background document" available at Rothoblaas.

Load case	Load Combination		Design Modification Factor DMF
	Principal Load	Companion Load	
1	1.4D	-	0.46
2	(1.25D or 0.9D) + 1.5L	1.0S or 0.4W	0.62 ⁽¹⁾
3	(1.25D or 0.9D) + 1.5S	1.0L or 0.4W	0.62
4	(1.25D or 0.9D) + 1.4W	0.5L or 0.5S	0.69
5	1.0D + 1.0E	0.5L or 0.25S	0.69

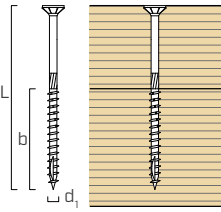
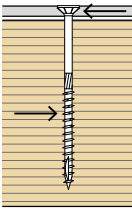
⁽¹⁾ If Live Load L is associated with long term loads such as storage, equipment areas etc., use 0.54.

- For the mechanical resistance values and the geometry of the screws, reference was made to ETA-11/0030.
- In the calculations, the density of the wood elements was considered equal to $\rho_k = 370 \text{ kg/m}^3$ (S-P-F sawn lumber). For wood densities conversion (mean oven-dry relative density to 5th-percentile density 12% MC wt & vol) see "Background document" available at Rothoblaas. Characteristic resistances can also be considered as valid for higher densities, for the purposes of safety.
- Values were calculated considering the threaded part as being completely inserted into the wood.
- Sizing and verification of the wooden elements and steel plates must be done separately.
- The shear characteristic resistances are calculated for screws inserted without pre-bored holes. In the case of screws inserted with pre-bored holes, greater resistance values can be obtained.
- For different calculation methods, the MyProject software is available free of charge (www.rothoblaas.com).
- The characteristic resistances were calculated using solid wood or glulam. In the case of joints with CLT elements, the resistance values may be different and should be calculated on the basis of the characteristics of the panel and the connection configuration.

■ STATIC VALUES | SHEAR STEEL-TO-TIMBER

geometry						steel-to-timber thin plate ⁽¹⁾									
															
d ₁	L		b			characteristic values		design values (factored resistance)							
						R _{V,k}		R _{V,d}	R _{V,d}		R _{V,d}				
								Load Case 1		Load Case 2&3		Load Case 4&5			
[mm]	[in]	[mm]	[in]	[mm]	[in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]		
6 0.24	40	1 9/16	35	1 3/8	S PLATE ≤ 3 mm 0.118 in	1.57	354	0.73	163	0.97	218	1.09	245		
	50	1 15/16	45	1 3/4		2.00	449	0.92	207	1.23	277	1.38	311		
	60	2 3/8	30	1 3/16		2.19	491	1.01	227	1.34	302	1.51	340		
	70	2 3/4	40	1 9/16		2.37	532	1.09	246	1.46	328	1.64	369		
	80	3 1/8	40	1 9/16		2.37	532	1.09	246	1.46	328	1.64	369		
	90	3 1/2	50	1 15/16		2.55	574	1.18	265	1.57	353	1.77	397		
	100	4	50	1 15/16		2.55	574	1.18	265	1.57	353	1.77	397		
	110	4 3/8	60	2 3/8		2.74	615	1.26	284	1.68	378	1.89	426		
	120	4 3/4	60	2 3/8		2.74	615	1.26	284	1.68	378	1.89	426		
	130	5 1/8	60	2 3/8		2.74	615	1.26	284	1.68	378	1.89	426		
	140	5 1/2	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	150	6	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	160	6 1/4	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	180	7 1/8	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	200	8	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	220	8 5/8	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	240	9 1/2	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	260	10 1/4	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	280	11	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
	300	11 3/4	75	2 15/16		3.01	677	1.39	312	1.85	417	2.08	469		
8 0.32	80	3 1/8	52	2 1/16	S PLATE ≤ 4 mm 0.157 in	3.90	877	1.80	405	2.40	540	2.70	607		
	100	4	52	2 1/16		3.90	877	1.80	405	2.40	540	2.70	607		
	120	4 3/4	60	2 3/8		4.10	921	1.89	425	2.52	567	2.84	638		
	140	5 1/2	60	2 3/8		4.10	921	1.89	425	2.52	567	2.84	638		
	160	6 1/4	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	180	7 1/8	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	200	8	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	220	8 5/8	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	240	9 1/2	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	260	10 1/4	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	280	11	80	3 1/8		4.59	1,031	2.12	476	2.82	635	3.18	714		
	300	11 3/4	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	320	12 5/8	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	340	13 3/8	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	360	14 1/4	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	380	15	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	400	15 3/4	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	440	17 1/4	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	480	19	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		
	520	20 1/2	100	4		5.08	1,141	2.34	527	3.12	702	3.51	790		

■ STATIC VALUES | SHEAR STEEL-TO-TIMBER

geometry						steel-to-timber thin plate ⁽¹⁾							
													
d ₁	L		b			characteristic values		design values (factored resistance)					
						R _{V,k}		R _{V,d} Load Case 1		R _{V,d} Load Case 2&3		R _{V,d} Load Case 4&5	
[mm] [in]	[mm]	[in]	[mm]	[in]		[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
10 0.40	80	3 1/8	52	2 1/16	S _{PLATE} ≤ 5 mm 0.197 in	4.56	1,026	2.11	473	2.81	631	3.16	710
	100	4	52	2 1/16		5.38	1,211	2.49	559	3.31	745	3.73	838
	120	4 3/4	60	2 3/8		5.63	1,266	2.60	584	3.46	779	3.90	876
	140	5 1/2	60	2 3/8		5.63	1,266	2.60	584	3.46	779	3.90	876
	160	6 1/4	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	180	7 1/8	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	200	8	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	220	8 5/8	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	240	9 1/2	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	260	10 1/4	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	280	11	80	3 1/8		6.24	1,403	2.88	648	3.84	863	4.32	971
	300	11 3/4	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
	320	12 5/8	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
	340	13 3/8	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
	360	14 1/4	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
	380	15	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
	400	15 3/4	100	4		6.85	1,541	3.16	711	4.22	948	4.74	1,067
12 0.48	120	4 3/4	80	3 1/8	S _{PLATE} ≤ 6 mm 0.236 in	7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
	160	6 1/4	80	3 1/8		7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
	200	8	80	3 1/8		7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
	240	9 1/2	80	3 1/8		7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
	280	11	80	3 1/8		7.62	1,713	3.52	791	4.69	1,054	5.27	1,186
	320	12 5/8	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	360	14 1/4	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	400	15 3/4	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	440	17 1/4	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	480	19	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	520	20 1/2	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	560	22	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414
	600	23 5/8	120	4 3/4		9.09	2,043	4.19	943	5.59	1,257	6.29	1,414

NOTES:

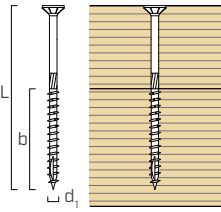
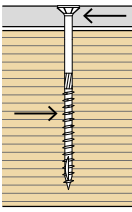
- (1) The shear characteristics resistances are calculated considering the case of a thin plate ($S_{\text{PLATE}} \leq 0.5 d_1$).
- (2) The shear characteristic resistances are calculated considering the case of a thick plate ($S_{\text{PLATE}} \geq d_1$).
- (3) The axial thread-extraction resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.

- (4) The axial resistance to head penetration, with and without a washer, was calculated using wood elements.
In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or penetration.

■ STATIC VALUES | SHEAR STEEL-TO-TIMBER

geometry						steel-to-timber thick plate ⁽²⁾							
d ₁	L		b			characteristic values		design values (factored resistance)					
						R _{V,k}		R _{V,d} Load Case 1		R _{V,d} Load Case 2&3		R _{V,d} Load Case 4&5	
[mm] [in]	[mm]	[in]	[mm]	[in]		[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
6 0.24	40	1 9/16	35	1 3/8	S PLATE ≤ 6 mm 0.236 in	2.52	567	1.16	262	1.55	349	1.75	392
	50	1 15/16	45	1 3/4		3.06	688	1.41	318	1.88	424	2.12	477
	60	2 3/8	30	1 3/16		2.86	643	1.32	297	1.76	396	1.98	445
	70	2 3/4	40	1 9/16		3.05	685	1.41	316	1.87	421	2.11	474
	80	3 1/8	40	1 9/16		3.05	685	1.41	316	1.87	421	2.11	474
	90	3 1/2	50	1 15/16		3.23	726	1.49	335	1.99	447	2.24	503
	100	4	50	1 15/16		3.23	726	1.49	335	1.99	447	2.24	503
	110	4 3/8	60	2 3/8		3.41	767	1.58	354	2.10	472	2.36	531
	120	4 3/4	60	2 3/8		3.41	767	1.58	354	2.10	472	2.36	531
	130	5 1/8	60	2 3/8		3.41	767	1.58	354	2.10	472	2.36	531
	140	5 1/2	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	150	6	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	160	6 1/4	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	180	7 1/8	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	200	8	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	220	8 5/8	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	240	9 1/2	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
	260	10 1/4	75	2 15/16		3.69	829	1.70	383	2.27	510	2.55	574
280	11	75	2 15/16	3.69	829	1.70	383	2.27	510	2.55	574		
300	11 3/4	75	2 15/16	3.69	829	1.70	383	2.27	510	2.55	574		
8 0.32	80	3 1/8	52	2 1/16	S PLATE ≤ 8 mm 0.315 in	4.99	1,122	2.30	518	3.07	690	3.46	777
	100	4	52	2 1/16		4.99	1,122	2.30	518	3.07	690	3.46	777
	120	4 3/4	60	2 3/8		5.19	1,166	2.39	538	3.19	718	3.59	807
	140	5 1/2	60	2 3/8		5.19	1,166	2.39	538	3.19	718	3.59	807
	160	6 1/4	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	180	7 1/8	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	200	8	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	220	8 5/8	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	240	9 1/2	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	260	10 1/4	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	280	11	80	3 1/8		5.68	1,276	2.62	589	3.49	785	3.93	883
	300	11 3/4	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	320	12 5/8	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	340	13 3/8	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	360	14 1/4	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	380	15	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	400	15 3/4	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	440	17 1/4	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	480	19	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960
	520	20 1/2	100	4		6.17	1,386	2.85	640	3.79	853	4.27	960

■ STATIC VALUES | SHEAR STEEL-TO-TIMBER

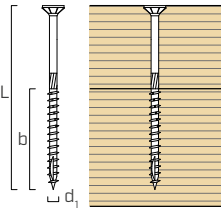
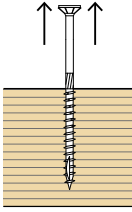
geometry						steel-to-timber thick plate ⁽²⁾							
													
d ₁	L		b			characteristic values		design values (factored resistance)					
						R _{V,k}		R _{V,d} Load Case 1		R _{V,d} Load Case 2&3		R _{V,d} Load Case 4&5	
[mm] [in]	[mm]	[in]	[mm]	[in]		[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
10 0.40	80	3 1/8	52	2 1/16	S _{PLATE} ≤ 10 mm 0.394 in	6.71	1,508	3.09	696	4.13	928	4.64	1,044
	100	4	52	2 1/16		6.96	1,564	3.21	722	4.28	962	4.82	1,083
	120	4 3/4	60	2 3/8		7.20	1,619	3.32	747	4.43	996	4.99	1,121
	140	5 1/2	60	2 3/8		7.20	1,619	3.32	747	4.43	996	4.99	1,121
	160	6 1/4	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	180	7 1/8	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	200	8	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	220	8 5/8	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	240	9 1/2	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	260	10 1/4	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	280	11	80	3 1/8		7.81	1,756	3.61	811	4.81	1,081	5.41	1,216
	300	11 3/4	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
	320	12 5/8	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
	340	13 3/8	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
	360	14 1/4	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
	380	15	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
	400	15 3/4	100	4		8.42	1,894	3.89	874	5.18	1,165	5.83	1,311
12 0.48	120	4 3/4	80	3 1/8	S _{PLATE} ≤ 12 mm 0.472 in	9.56	2,149	4.41	992	5.88	1,322	6.62	1,488
	160	6 1/4	80	3 1/8		9.56	2,149	4.41	992	5.88	1,322	6.62	1,488
	200	8	80	3 1/8		9.56	2,149	4.41	992	5.88	1,322	6.62	1,488
	240	9 1/2	80	3 1/8		9.56	2,149	4.41	992	5.88	1,322	6.62	1,488
	280	11	80	3 1/8		9.56	2,149	4.41	992	5.88	1,322	6.62	1,488
	320	12 5/8	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	360	14 1/4	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	400	15 3/4	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	440	17 1/4	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	480	19	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	520	20 1/2	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	560	22	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716
	600	23 5/8	120	4 3/4		11.03	2,479	5.09	1,144	6.79	1,525	7.63	1,716

NOTES:

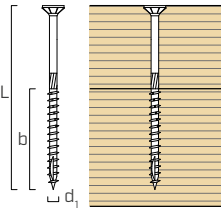
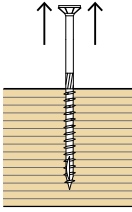
- (1) The shear characteristic resistances are calculated considering the case of a thin plate ($S_{\text{PLATE}} \leq 0.5 d_1$).
- (2) The shear characteristic resistances are calculated considering the case of a thick plate ($S_{\text{PLATE}} \geq d_1$).
- (3) The axial thread-extraction resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.

- (4) The axial resistance to head penetration, with and without a washer, was calculated using wood elements.
In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or penetration.

■ STATIC VALUES | TRACTION THREAD WITHDRAWAL

geometry						thread withdrawal ⁽³⁾							
													
d ₁	L		b		characteristic values		design values (factored resistance)						
					R _{ax,k}		R _{ax,d} Load Case 1		R _{ax,d} Load Case 2&3		R _{ax,d} Load Case 4&5		
	[mm] [in]	[mm] [in]	[mm] [in]	[mm] [in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[lbf]
6	40	1 9/16	35	1 3/8	2.57	577	1.19	267	1.58	355	1.58	400	
	50	1 15/16	45	1 3/4	3.30	742	1.52	343	2.03	457	2.03	514	
	60	2 3/8	30	1 3/16	2.20	495	1.02	228	1.35	305	1.35	343	
	70	2 3/4	40	1 9/16	2.94	660	1.35	305	1.81	406	1.81	457	
	80	3 1/8	40	1 9/16	2.94	660	1.35	305	1.81	406	1.81	457	
	90	3 1/2	50	1 15/16	3.67	825	1.69	381	2.26	508	2.26	571	
	100	4	50	1 15/16	3.67	825	1.69	381	2.26	508	2.26	571	
	110	4 3/8	60	2 3/8	4.40	990	2.03	457	2.71	609	2.71	685	
	120	4 3/4	60	2 3/8	4.40	990	2.03	457	2.71	609	2.71	685	
	130	5 1/8	60	2 3/8	4.40	990	2.03	457	2.71	609	2.71	685	
	140	5 1/2	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	150	6	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	160	6 1/4	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	180	7 1/8	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	200	8	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	220	8 5/8	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	240	9 1/2	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	260	10 1/4	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	280	11	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
	300	11 3/4	75	2 15/16	5.50	1,237	2.54	571	3.39	761	3.39	857	
8	80	3 1/8	52	2 1/16	5.09	1,144	2.35	528	3.13	704	3.13	792	
	100	4	52	2 1/16	5.09	1,144	2.35	528	3.13	704	3.13	792	
	120	4 3/4	60	2 3/8	5.87	1,320	2.71	609	3.61	812	3.61	914	
	140	5 1/2	60	2 3/8	5.87	1,320	2.71	609	3.61	812	3.61	914	
	160	6 1/4	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	180	7 1/8	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	200	8	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	220	8 5/8	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	240	9 1/2	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	260	10 1/4	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	280	11	80	3 1/8	7.83	1,760	3.61	812	4.82	1,083	4.82	1,218	
	300	11 3/4	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	320	12 5/8	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	340	13 3/8	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	360	14 1/4	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	380	15	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	400	15 3/4	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	440	17 1/4	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	480	19	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	520	20 1/2	100	4	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	

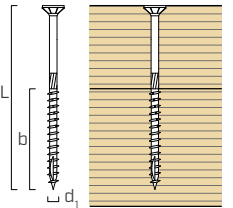
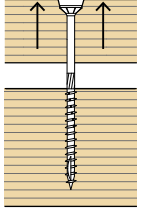
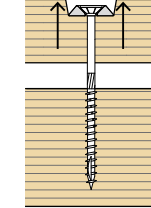
■ STATIC VALUES | TRACTION THREAD WITHDRAWAL

geometry						thread withdrawal ⁽³⁾							
													
d ₁	L		b		characteristic values		design values (factored resistance)						
					R _{ax,k}		R _{ax,d}		R _{ax,d}		R _{ax,d}		
							Load Case 1		Load Case 2&3		Load Case 4&5		
[mm] [in]	[mm]	[in]	[mm]	[in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[lbf]
10 0.40	80	3 1/8	52	2 1/16	6.36	1,430	2.94	660	3.91	880	3.91	990	
	100	4	52	2 1/16	6.36	1,430	2.94	660	3.91	880	3.91	990	
	120	4 3/4	60	2 3/8	7.34	1,650	3.39	761	4.52	1,015	4.52	1,142	
	140	5 1/2	60	2 3/8	7.34	1,650	3.39	761	4.52	1,015	4.52	1,142	
	160	6 1/4	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	180	7 1/8	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	200	8	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	220	8 5/8	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	240	9 1/2	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	260	10 1/4	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	280	11	80	3 1/8	9.79	2,200	4.52	1,015	6.02	1,354	6.02	1,523	
	300	11 3/4	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
	320	12 5/8	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
	340	13 3/8	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
	360	14 1/4	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
	380	15	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
	400	15 3/4	100	4	12.23	2,750	5.65	1,269	7.53	1,692	7.53	1,904	
12 0.48	120	4 3/4	80	3 1/8	11.74	2,640	5.42	1,218	7.23	1,625	7.23	1,828	
	160	6 1/4	80	3 1/8	11.74	2,640	5.42	1,218	7.23	1,625	7.23	1,828	
	200	8	80	3 1/8	11.74	2,640	5.42	1,218	7.23	1,625	7.23	1,828	
	240	9 1/2	80	3 1/8	11.74	2,640	5.42	1,218	7.23	1,625	7.23	1,828	
	280	11	80	3 1/8	11.74	2,640	5.42	1,218	7.23	1,625	7.23	1,828	
	320	12 5/8	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	360	14 1/4	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	400	15 3/4	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	440	17 1/4	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	480	19	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	520	20 1/2	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	560	22	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	
	600	23 5/8	120	4 3/4	17.61	3,960	8.13	1,828	10.84	2,437	10.84	2,741	

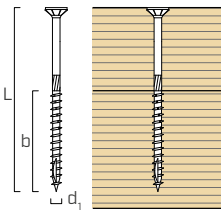
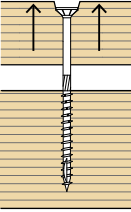
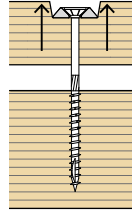
NOTES:

- (1) The shear characteristics resistances are calculated considering the case of a thin plate ($S_{PLATE} \leq 0.5 d_1$).
- (2) The shear characteristic resistances are calculated considering the case of a thick plate ($S_{PLATE} \geq d_1$).
- (3) The axial thread-extraction resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.

- (4) The axial resistance to head penetration, with and without a washer, was calculated using wood elements.
In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or penetration.

geometry						head penetration ⁽⁴⁾								head penetration with washer ⁽⁴⁾							
																					
d₁ L b						characteristic values		design values (factored resistance)						characteristic values		design values (factored resistance)					
						R _{head,k}		R _{head,d} Load Case 1		R _{head,d} Load Case 2&3		R _{head,d} Load Case 4&5		R _{head,k}		R _{head,d} Load Case 1		R _{head,d} Load Case 2&3		R _{head,d} Load Case 4&5	
[mm]	[in]	[mm]	[in]	[mm]	[in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
6 0.24	40	1 9/16	35	1 3/8		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	50	1 15/16	45	1 3/4		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	60	2 3/8	30	1 3/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	70	2 3/4	40	1 9/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	80	3 1/8	40	1 9/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	90	3 1/2	50	1 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	100	4	50	1 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	110	4 3/8	60	2 3/8		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	120	4 3/4	60	2 3/8		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	130	5 1/8	60	2 3/8		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	140	5 1/2	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	150	6	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	160	6 1/4	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	180	7 1/8	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	200	8	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
	220	8 5/8	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683
240	9 1/2	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683	
260	10 1/4	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683	
280	11	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683	
300	11 3/4	75	2 15/16		1.58	355	0.73	164	0.97	219	1.09	246	4.39	987	2.03	456	2.70	607	3.04	683	
8 0.32	80	3 1/8	52	2 1/16		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	100	4	52	2 1/16		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	120	4 3/4	60	2 3/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	140	5 1/2	60	2 3/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	160	6 1/4	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	180	7 1/8	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	200	8	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	220	8 5/8	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	240	9 1/2	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	260	10 1/4	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	280	11	80	3 1/8		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	300	11 3/4	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	320	12 5/8	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	340	13 3/8	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	360	14 1/4	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
	380	15	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068
400	15 3/4	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068	
440	17 1/4	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068	
480	19	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068	
520	20 1/2	100	4		2.31	519	1.07	239	1.42	319	1.60	359	6.86	1,542	3.17	712	4.22	949	4.75	1,068	

■ STATIC VALUES | TRACTION HEAD PENETRATION

geometry						head penetration ⁽⁴⁾						head penetration with washer ⁽⁴⁾													
																									
d ₁	L		b		characteristic values		design values (factored resistance)						characteristic values		design values (factored resistance)										
							R _{head,k}		R _{head,d} Load Case 1		R _{head,d} Load Case 2&3				R _{head,d} Load Case 4&5		R _{head,k}		R _{head,d} Load Case 1		R _{head,d} Load Case 2&3		R _{head,d} Load Case 4&5		
[mm]	[in]	[mm]	[in]	[mm]	[in]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]
10 0.40	80	3 1/8	52	2 1/16		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	100	4	52	2 1/16		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	120	4 3/4	60	2 3/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	140	5 1/2	60	2 3/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	160	6 1/4	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	180	7 1/8	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	200	8	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	220	8 5/8	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	240	9 1/2	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	260	10 1/4	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	280	11	80	3 1/8		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	300	11 3/4	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	320	12 5/8	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	340	13 3/8	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	360	14 1/4	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	380	15	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
	400	15 3/4	100	4		3.66	822	1.69	379	2.25	506	2.53	569	11.24	2,527	5.19	1,166	6.92	1,555	7.78	1,749				
12 0.48	120	4 3/4	80	3 1/8		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	160	6 1/4	80	3 1/8		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	200	8	80	3 1/8		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	240	9 1/2	80	3 1/8		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	280	11	80	3 1/8		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	320	12 5/8	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	360	14 1/4	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	400	15 3/4	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	440	17 1/4	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	480	19	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	520	20 1/2	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	560	22	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				
	600	23 5/8	120	4 3/4		4.73	1,063	2.18	490	2.91	654	3.27	736	15.03	3,378	6.94	1,559	9.25	2,079	10.40	2,339				

NOTES:

- (1) The shear characteristics resistances are calculated considering the case of a thin plate ($S_{PLATE} \leq 0.5 d_1$).
- (2) The shear characteristic resistances are calculated considering the case of a thick plate ($S_{PLATE} \geq d_1$).
- (3) The axial thread-extraction resistance was calculated considering a 90° angle between the grain and the connector and for a fixing length of b.
- (4) The axial resistance to head penetration, with and without a washer, was calculated using wood elements.

In the case of steel-to-timber connections, generally the steel tensile strength is binding with respect to head separation or penetration.

Packaged quantities may vary.
Original text: Italian.
Reference unit of measurement: metric.