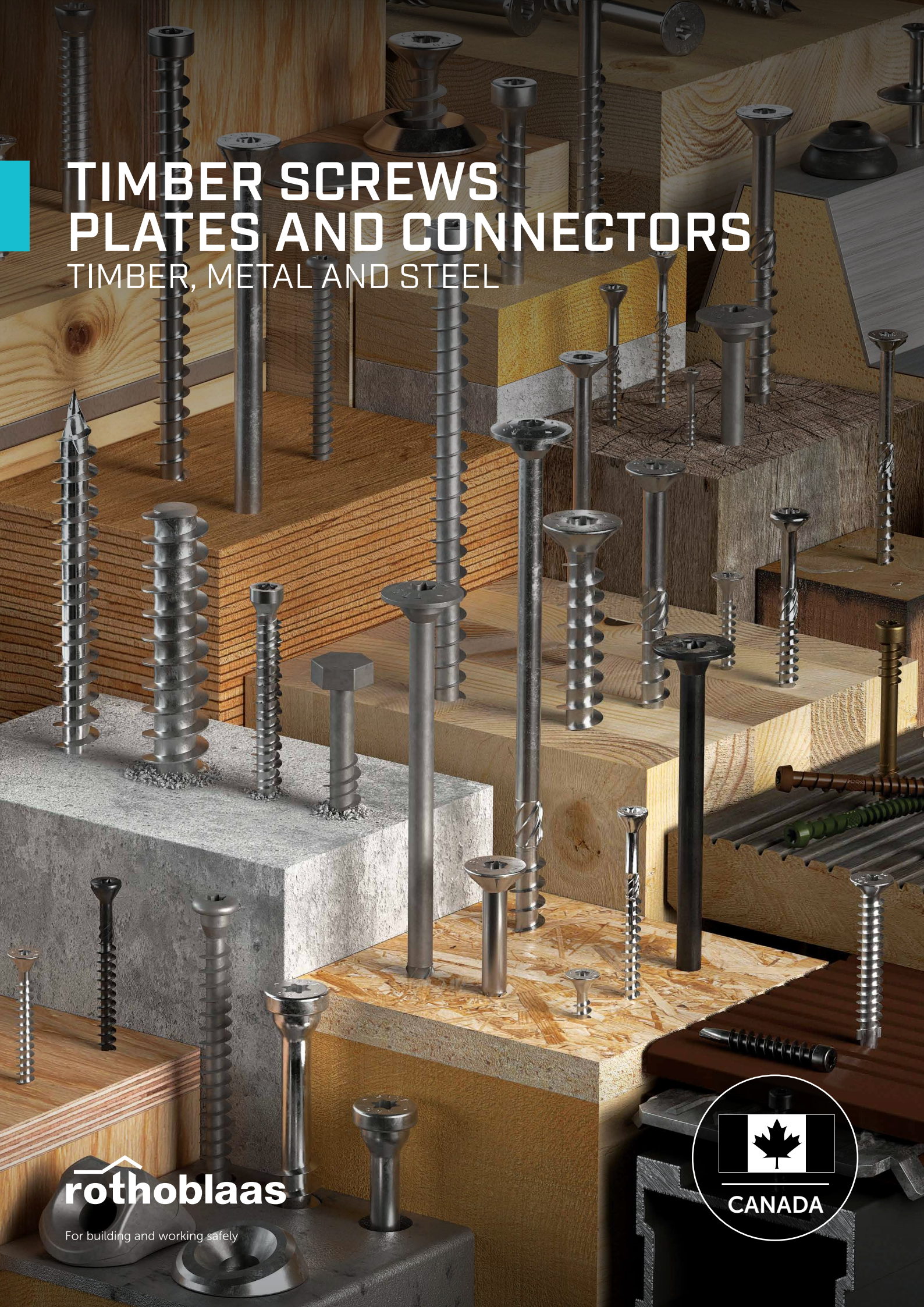
TIMBER SCREWS PLATES AND CONNECTORS

TIMBER, METAL AND STEEL



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ICC ES ELC-4645

ICC ES ESR-4645

CSA GROUP

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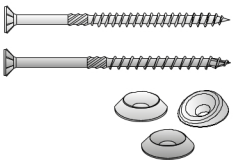
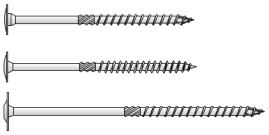
FASTENERS 12

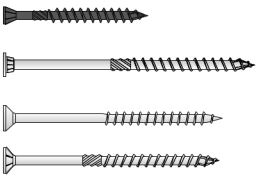
PARTIALLY THREADED



HBS 14
HBS EVO 34
HUS 44



TBS 54
TBS EVO 68
TBS MAX 78

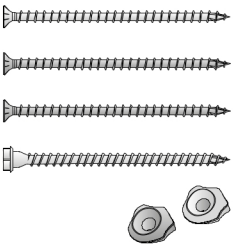


SHS AISI410 84
KKF AISI410 94
SCI A2 | AISI304 100
SCI A4 | AISI316 108

FULLY THREADED

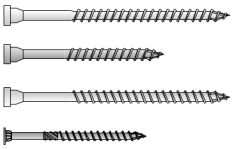


VGZ 114
VGZ EVO 140

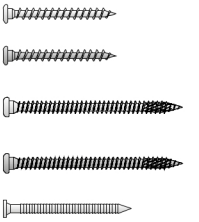


VGS 166
VGS EVO 184
VGS A4 194
VGS PLATE 204
VGU 216

PLATE FASTENING

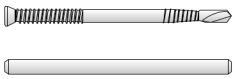


HBS PLATE 224
HBS PLATE EVO 236
HBS PLATE A4 246



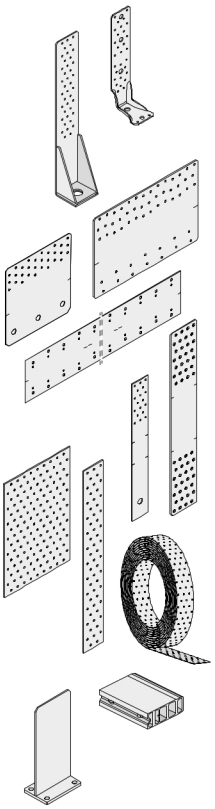
LBS 256
LBS EVO 264
LBS HARDWOOD 272
LBS HARDWOOD EVO 278
LBA 284

DOWELS 294



SBD 296
STA 306

BRACKETS AND PLATES 316



WKR 318
WHT 330

TITAN PLATE T 340
TITAN PLATE C 348

WHT PLATE T 356
WHT PLATE C 360

LBB 367
LBV 372

SLOT 376

F70 384

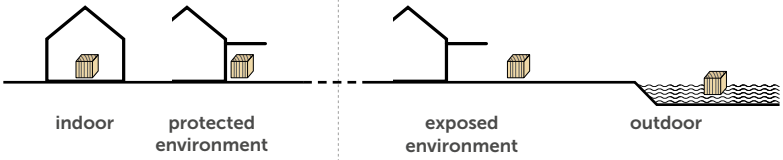
CONTENTS

MOISTURE AND EXPOSURE CONDITIONS

To ensure optimal performance in various environmental conditions across the North America , we have chosen to adopt the classifications of National Design Specification for Wood Construction (NDS) and the AC257 acceptance criteria by ICC-ES.

The dry classification includes environments where humidity is limited and corrosion risk is minimal (e.g. indoor or protected spaces). The wet classification covers environments with high humidity exposure, such as outdoor areas or locations with direct water contact. AC257 also introduces specific criteria for corrosion resistance in chemically treated environments or in coastal areas exposed to salt. The summary table considers AC257 Exposure Conditions 1 through 4, ensuring that selected screws provide optimal performance and durability in diverse usage conditions.

The moisture content of wood significantly affects the mechanical properties, strength, and stiffness of structural members. In the design of wood connections, standards like the NDS (National Design Specification for Wood Construction) and CSA-086 (Canadian Standards Association) provide guidance on service condition factors. These factors account for moisture content at the time of fabrication and during service.Proper evaluation of the combined service class, wood corrosivity class, and atmospheric class is essential to ensure the structural performance and durability of connections. These classifications affect decisions such as material choice and protective measures, particularly in environments with varying humidity or exposure.

	DRY SERVICE	WET SERVICE
MOISTURE CONDITION According to NDS and CSA-O86	DRY	WET
MAXIMUM MOISTURE CONTENT OF THE WOOD	≤ 19% moisture	> 19% moisture
DEFINITION	Table 11.3.3 in the NDS and Table 12.1 in CSA-086 outline the interaction of moisture content at fabrication (whether the wood is green or dried) with the in-service moisture levels. The factors vary based on the type of connection and loading conditions. Notably: • A moisture content (MC) of ≤ 19% is the threshold for "dry service conditions."	Wet service conditions apply to wood connections when: 1. The connection is exposed to direct wetting (e.g., rain, snow, condensation) such that drying is not effective. 2. The wood member is classified as "green" upon installation and retains a moisture content above 19% until dries. 3. The equilibrium moisture content exceeds 15% averaged annually or exceeds 19% at any given time. In wet conditions, the need for moisture management is critical, as prolonged exposure above 19% MC can compromise the mechanical properties of wood and the long-term performance of connections.
DESCRIPTION	 wood remains with low moisture levels	wood reaches high continuous moisture levels
NOTE	If MC > 19% at fabrication or in service, adjustments using the service condition factors are applied to ensure the integrity of the structural design. For detailed application, designers should consult **NDS Table 11.3.3** and **CSA-086 Table 12.1**, which provide the necessary correlations between moisture content, connection type, and loading conditions.	

	EC1	EC2	EC3	EC4
EXPOSURE CONDITION According to AC257				
DESCRIPTION	**treated wood in dry use applications** treated wood where equilibrium moisture content meets dry conditions with occasional high humidity	**aboveground with coastal salt exposure** clean untreated wood, exposed to saltwater spray	**general construction** treated wood and exposure in environments without saltwater	**coastal construction** continuous exposure to high humidity and saltwater on treated and untreated wood

ESR-4645 certification for Rothoblaas screws permits their design and use in wet service conditions from a structural standpoint according to AC233. However, this certification does not cover corrosion resistance requirements, which must be evaluated separately.

ATMOSPHERIC CORROSIVITY
CLASSES

Corrosion caused by the atmosphere depends on relative humidity, air pollution, chloride content, and whether the connection is internal, external protected, or external. Exposure is described by the C category as following ISO 9223:2012. Atmospheric corrosivity only affects the exposed part of the connector. While the Exposure Conditions partially account for atmospheric corrosivity, it is possible to consider it separately for a more accurate evaluation, using ISO 9223 as a reference.

	C1	C2	C3	C4	C5
MOISTURE	rare condensation	rare condensation	occasional condensation	frequent condensation	permanent condensation
DISTANCE FROM THE SEA		> 10 km from the coast	from 10 to 3 km from the coast	from 3 to 0,25 km from the coast	< 0,25 km from the coast
POLLUTION	very low	low	average	high	very high
	deserts, central arctic/antarctic	rural areas with little pollution, small towns	urban and industrial areas with medium pollution	highly polluted urban and industrial area	environment with very high industrial pollution

WOOD CORROSIVITY
CLASSES

Corrosion caused by wood depends on the wood species, wood treatment, and moisture content (see page 10). Exposure is defined by the T category as indicated. The corrosivity of wood only affects the connector part inserted in the wooden element. Although the Exposure Conditions consider wood corrosivity to some extent, it is possible to assess it separately for a more accurate evaluation according to EN 14592:2022.

	T1	T2	T3	T4	T5
TIMBER pH AND TREATMENT	any	any	pH > 4 "standard" wood species with low acidity and **not treated**	pH ≤ 4 "aggressive" wood species with high acidity and/or **treated**	any
MOISTURE CONTENT OF THE WOOD	≤ 10%	10% < ≤ 16%	16% < ≤ 20%	> 20%	
MOISTURE CONDITION According to NDS and CSA-O86	DRY		WET		

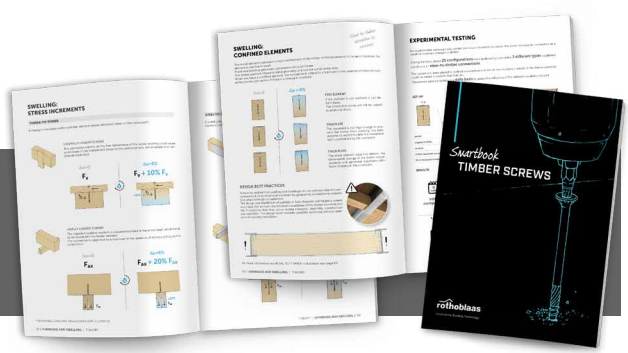
LEGEND:

use according to regulations

Rothoblaas experience

assessed in ESR-4645

Theory, practice and experimental campaigns: our experience is in your hands.
Download the SMARTBOOK TIMBER SCREWS.

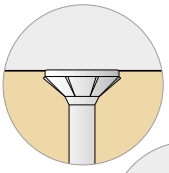


COMPLETE RANGE

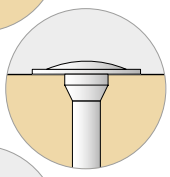
HEADS AND TIPS



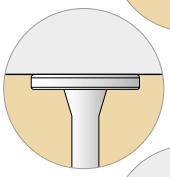
HEAD TYPE



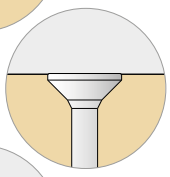
COUNTERSUNK WITH RIBS
HBS, HBS COIL, HBS EVO C4/C5, VGS, VGS EVO C4/C5, VGS A4, SCI A2/A4, SBS, SPP, MBS



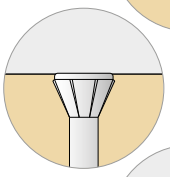
FLANGE
TBS , TBS MAX, TBS EVO C4/C5, FAS A4



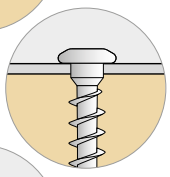
FLAT FLANGE
TBS FRAME



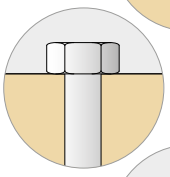
COUNTERSUNK SMOOTH
HTS, DRS, DRT, SKS EVO, SBS A2, SBN, SBN A2



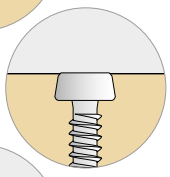
COUNTERSUNK 60°
SHS, SHS AISI410, HBS H



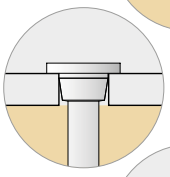
ROUND
LBS, LBS EVO, LBS H, LBS H EVO



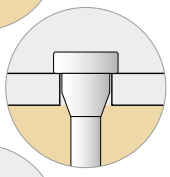
HEXAGONAL
KOP, SKR EVO, VGS, VGS EVO, MTS A2, SAR



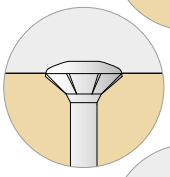
CONE-SHAPED
KKT A4 COLOR, KKT A4, KKT COLOR



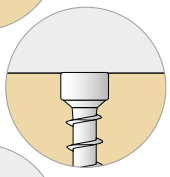
PAN HEAD
HBS P, HBS P EVO, KKF AISI410



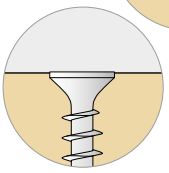
REINFORCED PAN HEAD
HBS PLATE, HBS PLATE EVO, HBS PLATE A4



CONVEX
EWS A2, EWS AISI410,

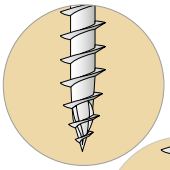


CYLINDRICAL
VGZ, VGZ EVO C4/C5, VGZ H, DGZ, CTC, MBZ, SBD, KKZ A2, KKZ EVO C5, KKA AISI410, KKA COLOR

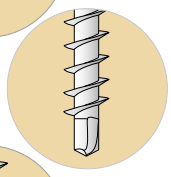


BUGLE
DWS, DWS COIL

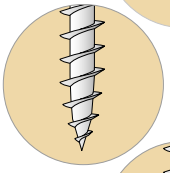
TIP TYPE



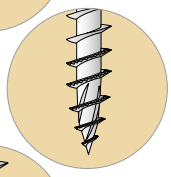
3 THORNS
HBS, HTS, HBS COIL, HBS EVO C4/C5, HBS PLATE, HBS PLATE EVO, TBS, TBS MAX, TBS EVO C4/C5, TBS FRAME, VGZ, VGZ EVO C4/C5, VGS, VGS EVO C4/C5, DGZ, CTC, SHS, SHS AISI410, KKF AISI410, SCI A2



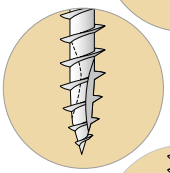
SELF-DRILLING
VGZ , VGS, VGS A4



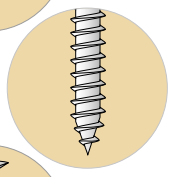
SHARP
LBS, LBS EVO, DRS, DRT, DWS, DWS COIL, MCS A2, KKT COLOR A4, KKT A4, EWS A2, EWS AISI410, SCI HCR, SCI A4, FAS



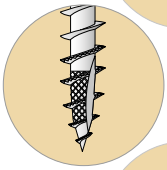
SHARP SAW NIBS (RBSN)
VGS



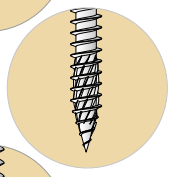
SHARP 2 CUT
KKT COLOR



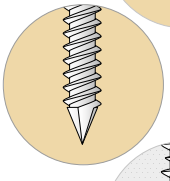
STANDARD FOR WOOD
MBS, MBZ, KOP, MTS A2



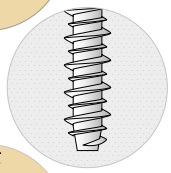
HARD WOOD TIMBER
HBS H, VGZ H



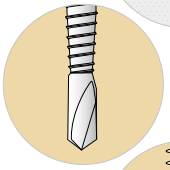
HARD WOOD (STEEL - to - TIMBER)
LBS H, LBS H EVO



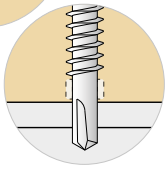
HARD WOOD (DECKING)
KKZ A2, KKZ EVO C5



CONCRETE
SKR EVO, SKS EVO



METAL (TAPERED TIP)
SBD



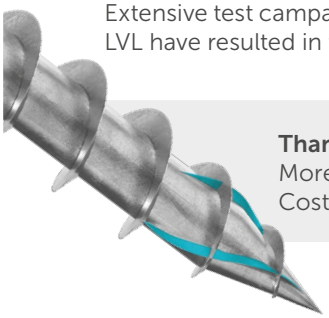
METAL (WITH FINS)
SBS, SBS A2, SPP

METAL (WITHOUT FINS)
SBD, SBN, SBN A2, KKA AISI 410, KKA COLOR

RESEARCH & DEVELOPMENT

3 THORNS TIP

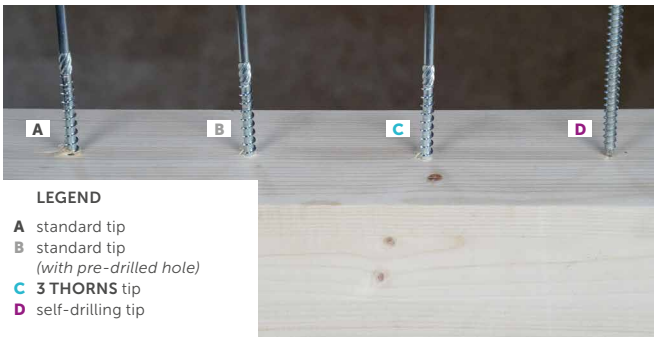
Extensive test campaigns carried out in Rothoblaas' own laboratories and at external institutions on softwood, hardwood and LVL have resulted in the development of a performing product in every respect.



Thanks to the 3 THORNS tip, minimum installation distances are reduced.
More screws can be used in less space and larger screws in smaller elements.
Costs and time for project implementation are reduced.

EASY AND FAST INSTALLATION

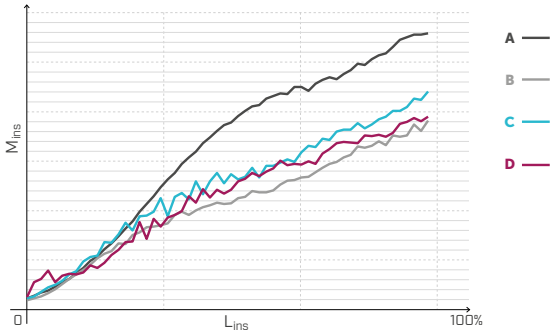
Featuring raised slitting elements and an umbrella thread reaching the end, the **3 THORNS** tip ensures a quick initial grip and easy installation, reduces torsional stress on the screw and minimises timber damage. The aesthetic finish is optimal.



LEGEND
A standard tip
B standard tip *(with pre-drilled hole)*
C **3 THORNS** tip
D self-drilling tip

The picture shows the insertion of screws with different tips and shows the change in pull-through depth after 1.0 second of tightening.

To be inserted, the screw must overcome the strength force of the wood. The screwing force, measured through the insertion moment (M_{ins}), is only minimised if the tip is performing.

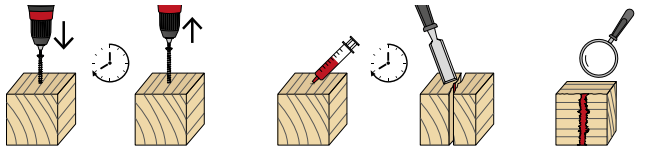


The graph shows the development of the insertion moment for screws with different geometric characteristics of the drill bit and the same boundary conditions (screw diameter, thread length and type, timber substrate material, applied force) as a function of the penetration length (L_{ins}).

The accumulated torsional stress on the screw with a **3 THORNS** tip (C) during its insertion is significantly lower than in the case of screws with standard tips (A) and is close to the screwing with pre-drilling hole (B).

REDUCTION OF MINIMUM DISTANCES

Thanks to its counter-threaded slitting elements, the **3 THORNS** tip facilitates insertion of the screw into the grains without damaging them.
It acts as a guide hole, allowing the reduction of edge distances and screw spacing. At the same time, it prevents wooden element's cracking and mechanisms of brittle failure of the connection.



The sequence represents the test procedure for the evaluation of minimum distances for axially stressed screws according to EAD 130118-01-0603.

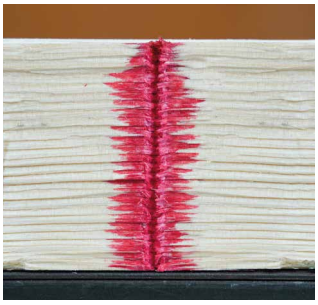
The test is performed by tightening the screw, unscrewing it after 24 hours and filling the hole with dye to check its diffusion inside the wooden element. The portion of wood affected by the insertion of the screw is proportional to the red area.



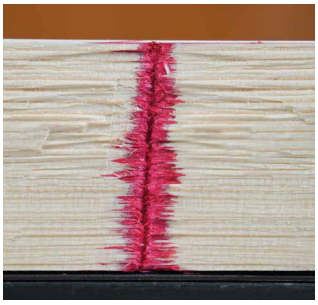
A standard tip



B standard tip *(with pre-drilled hole)*



C 3 THORNS tip



D self-drilling tip

The **3 THORNS** tip (C) exhibits similar behaviour to that of the standard screw inserted with pre-drilling hole (B), tending towards the case of the self-drilling tip screw (D).

COMPLETE RANGE

MATERIALS AND COATINGS

CARBON STEEL WITH COATING

C5 EVO ANTI-CORROSION COATING

Multi-layer coating capable of withstanding outdoor environments classified C5 according to ISO 9223. Salt spray exposure time (SST) according to ISO 9227 greater than 3000h (test carried out on screws previously screwed and unscrewed in Douglas fir).

C4 EVO ANTI-CORROSION COATING

Inorganic-based multilayer coating with a functional outer layer of epoxy matrix with aluminium flakes. Suitability for atmospheric corrosivity class C4 proven by RISE.

ORGANIC **ANTI-CORROSION COATING**

Colored organic-based coating that provides excellent resistance to atmospheric and wood corrosive agents in outdoor applications.

ELECTROLYTIC GALVANIZING

Coating consisting of a layer of electrolytic galvanizing with Cr passivation; standard for most connectors.

STAINLESS STEEL

STAINLESS STEEL **A4 | AISI316** - CRC III

Austenitic stainless steel. The presence of molybdenum provides high resistance to generalised and crevice corrosion.

STAINLESS STEEL **- A2 | AISI304 - CRC II**

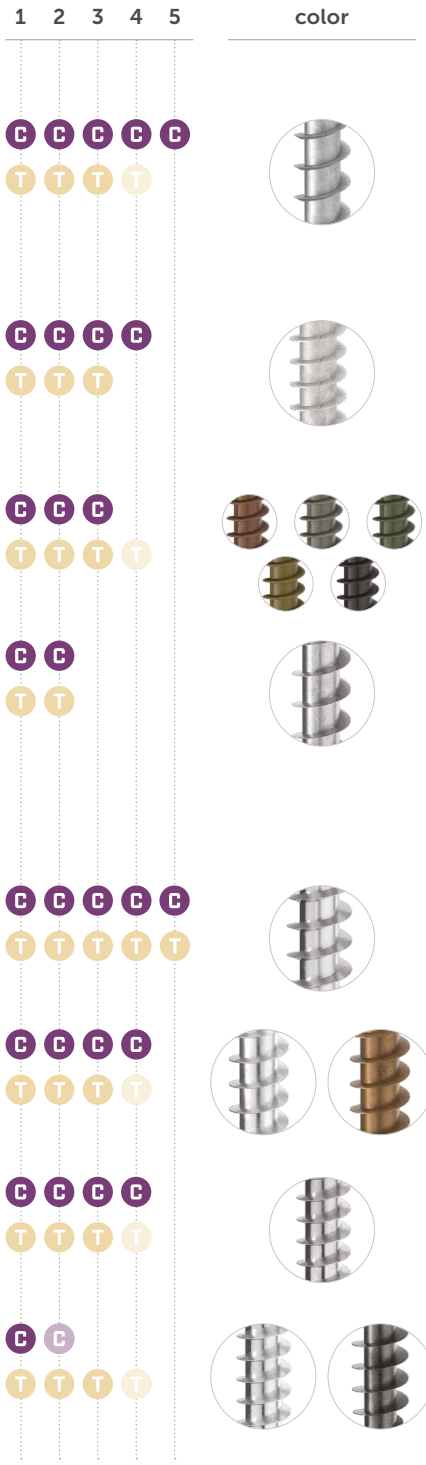
Austenitic stainless steel. It is the most common of the austenitic steels. It offers an excellent level of protection against generalised corrosion.

STAINLESS STEEL **- A2 | AISI305 - CRC II**

Austenitic stainless steel similar to A2 | AISI304. This alloy contains slightly more carbon than A2 | AISI304, making it more workable in production.

AISI410 STAINLESS STEEL

Martensitic stainless steel, characterised by its high carbon content. Suitable for outdoor applications (SC3). This stainless steels offers the highest mechanical performance compared to the other available stainless steels.



LEGEND:

- **atmospheric corrosivity classes**
- **wood corrosivity classes**
- Rothoblaas experience
- Rothoblaas experience

Atmospheric corrosivity classes defined according to EN 14592:2022 based on EN ISO 9223 and EN 1993-1-4:2014 (for stainless steel, an equivalent atmospheric corrosivity class was determined considering only the influence of chlorides and without a cleaning maintenance).
Wood corrosivity classes according to EN 14592:2022.

For further information, see **SMARTBOOK TIMBER SCREWS** at www.rothoblaas.com.

RESEARCH & DEVELOPMENT

EVO COATINGS

Rothoblaas research projects result in coatings that meet the most complex market requirements. Our goal is to offer state-of-the-art fastening solutions that guarantee uncompromising mechanical strength and corrosion resistance.

C4 EVO



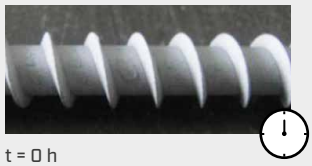
Atmospheric corrosivity class C4: areas with a high concentration of pollutants, salts or chlorides. For example, heavily polluted urban and industrial areas and coastal zones.

C4 EVO COATING — Inorganic-based multilayer coating with a functional outer layer of epoxy matrix with aluminium flakes.



1440 h

Hours of exposure in **salt spray test** according to EN ISO 9227:2012 in the absence of red rust.



t = 0 h



t = 1440 h

C5 EVO



Atmospheric corrosivity class C5: areas with a very high concentration of salts, chlorides or corrosive agents from production processes. For example, places by the sea or areas of high industrial pollution.

C5 EVO COATING — Organic-based multilayer coating with a functional layer. The top-coat has a sealing function, which delays the start of the corrosion reaction.



> 3000 h

Hours of exposure in **salt spray test** according to EN ISO 9227:2012 in the absence of red rust carried out on previously screwed and unscrewed Douglas fir screws.



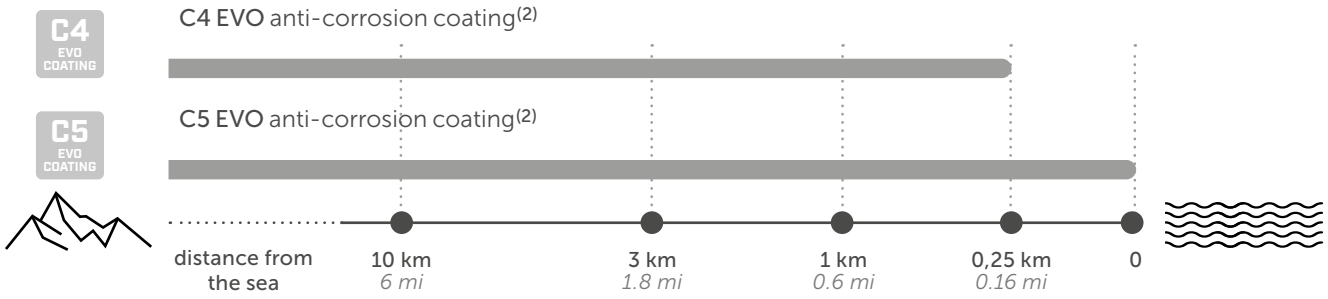
t = 0 h



t = > 3000 h

DISTANCE FROM THE SEA

RESISTANCE TO CHLORIDE EXPOSURE[1]

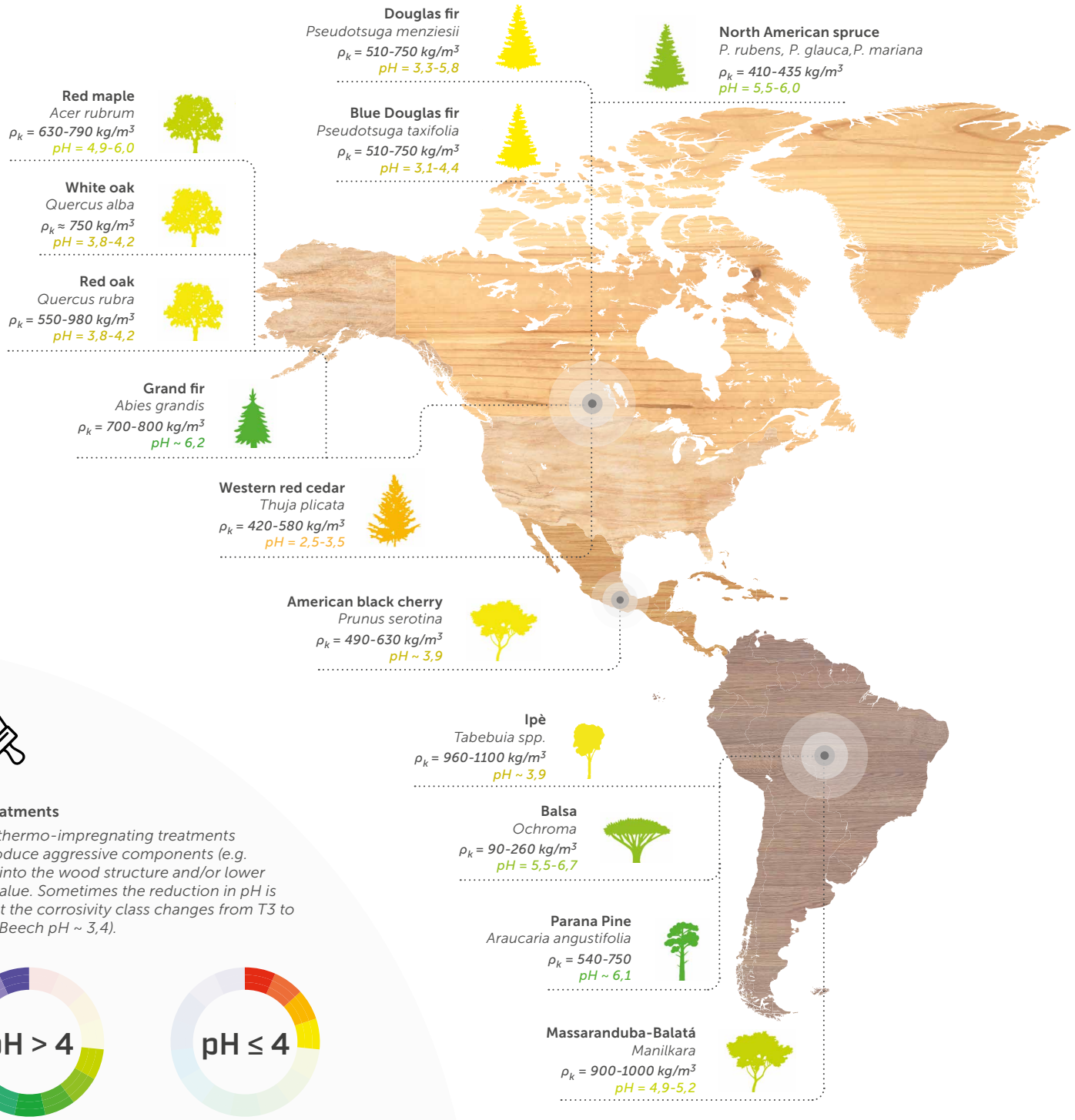


(1)C4 and C5 are defined according to EN 14592:2022 based on EN ISO 9223.
(2)EN 14592:2022 currently limits the service life of alternative coatings to 15 years.

WOOD SPECIES | pH and density

Each wood species has unique characteristics that influence its stability and strength to weathering, mould, fungus and pests. Where the density of the material is such that the functionality of the connector is compromised (ρ_k > 500 kg/m^3), pre-drilling is required prior to screwing. The limiting density depends on the type of connector chosen.

The pH of each wood is an indication of the presence of acetic acid, a corrosive agent for various types of metal in contact with wood, especially when the latter is in service class S3. The classification of wood for average moisture contents between 16 and 20 per cent (classes T3/T4) and consequently the type of connectors to be used depends on the pH value.

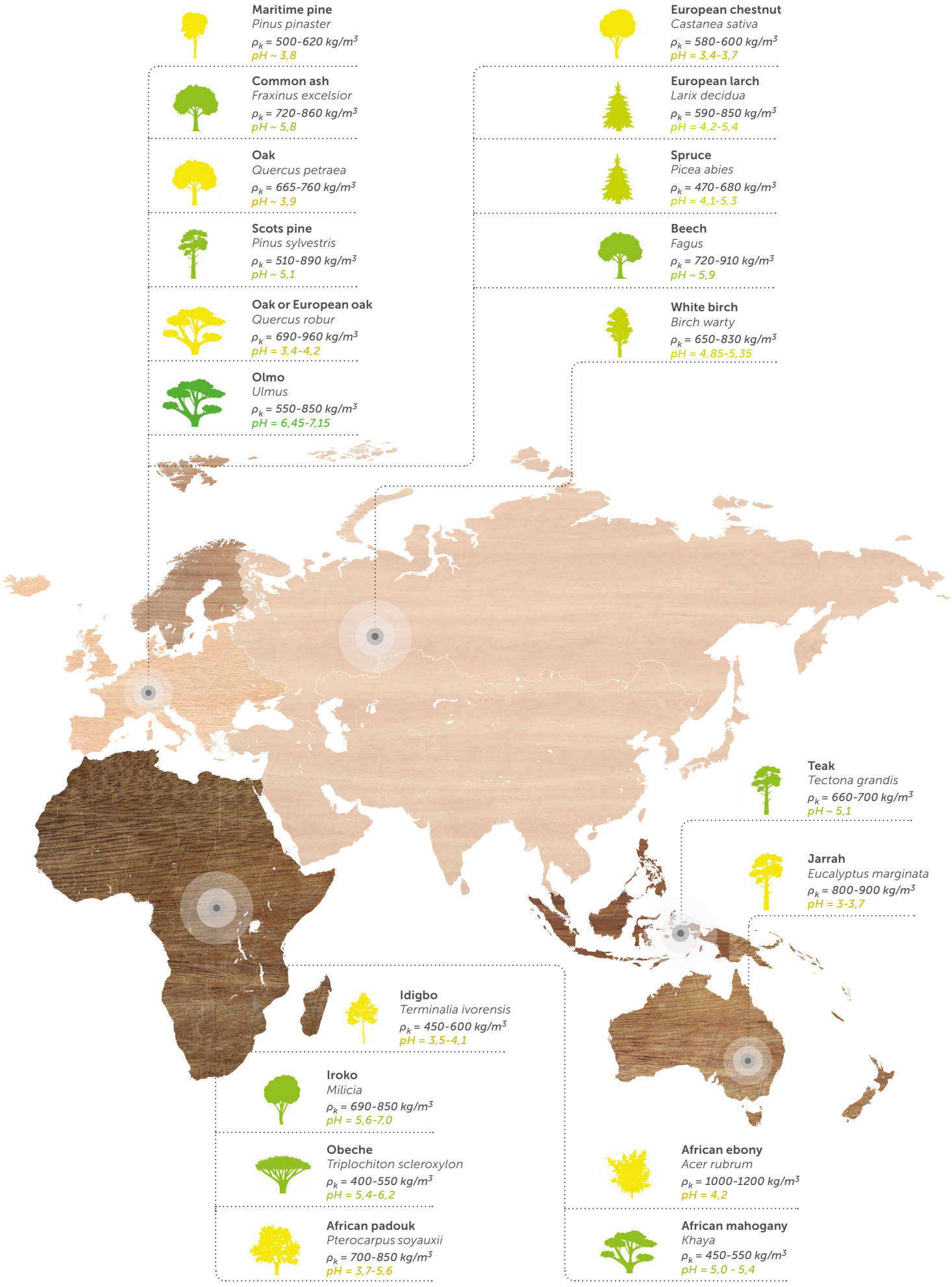


Heat treatments

Heat or thermo-impregnating treatments can introduce aggressive components (e.g. copper) into the wood structure and/or lower the pH value. Sometimes the reduction in pH is such that the corrosivity class changes from T3 to T4. (e.g. Beech pH ~ 3,4).

"standard" timbers
low acidity

"aggressive" woods
high acidity



Density and pH taken from: "Wagenführ R; Wagenführ A. Holzatlas (2022)" and from "Canadian Conservation Institute Jean Tétreault, Coatings for Display and Storage in Museums (January 1999)".

FASTENERS

FASTENERS

HBS
COUNTERSUNK SCREW 14

HBS EVO
COUNTERSUNK SCREW 34

HUS
TURNED WASHER 44

TBS
FLANGE HEAD SCREW 54

TBS EVO
FLANGE HEAD SCREW 68

TBS MAX
XL FLANGE HEAD SCREW 78

SHS AISI410
60° COUNTERSUNK SCREW 84

KKF AISI410
PAN HEAD SCREW 94

SCI A2 | AISI304
COUNTERSUNK SCREW 100

SCI A4 | AISI316
COUNTERSUNK SCREW 108

VGZ
FULL THREADED SCREW WITH CYLINDRICAL HEAD 114

VGZ EVO
FULLY THREADED SCREW WITH CYLINDRICAL HEAD 140

VGS
FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD 166

VGS EVO
FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD 184

VGS A4
FULL THREAD CONNECTOR WITH COUNTERSUNK HEAD 194

VGS PLATE
PAN HEAD HEX SCREW FOR LIFTING 204

VGU
45° WASHER FOR VGS 216

HBS PLATE
PAN HEAD SCREW FOR PLATES 224

HBS PLATE EVO
PAN HEAD SCREW 236

HBS PLATE A4
PAN HEAD SCREW FOR PLATES 246

LBS
ROUND HEAD SCREW FOR PLATES 256

LBS EVO
ROUND HEAD SCREW FOR PLATES 264

LBS HARDWOOD
ROUND HEAD SCREW FOR PLATES ON HARDWOODS 272

LBS HARDWOOD EVO
ROUND HEAD SCREW FOR PLATES ON HARDWOODS 278

LBA
HIGH BOND NAIL 284

HBS

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

COUNTERSUNK SCREW

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

FAST

With the 3 THORNS tip, screw grip becomes more reliable and faster, while maintaining the usual mechanical performance. More speed, less effort.

JOINTS WITH SOUNDPROOFING PROFILES

The screw has been tested and characterised in applications with sound-proofing layers (XYLOFON) interposed on the shear plane. The impact of acoustic profiles on the mechanical performance of the HBS screw. For more information see the "TIMBER SCREWS AND DECK FASTENING" catalogue at www.rothoblaas.com.

NEW-GENERATION WOODS

Tested and certified for use on a wide variety of engineered timbers such as CLT, and Glulam. Structural connector approved according to ICC ELC-4645 listing report in Canada. Extremely versatile, the HBS screw guarantees the use of new-generation woods for the creation of in-creasingly innovative and sustainable structures.



BIT INCLUDED

DIAMETER [mm]	3 — 3,5 — 12 — 12
LENGTH [mm]	12 — 30 — 1000 — 1000
SERVICE CONDITION	EC1 DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED — electrogalvanized carbon steel
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- fibreboard, MDF, HDF and LDF
- plated and melamine faced panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.





CLT, LVL AND HARDWOOD

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

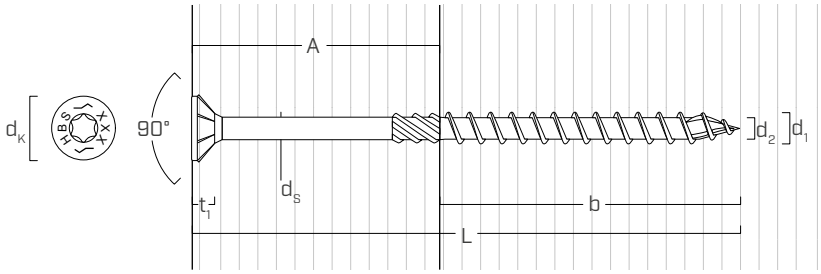


Wall insulation boards fastening with THERMOWASHER and HBS 8 mm diameter.



Fastening CLT walls with 6 mm diameter HBS screws.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**3,5**	**4**	**4,5**	**5**	**6**	**8**	**10**	**12**
Head diameter	d_K	[mm]	7,00	8,00	9,00	10,00	12,00	14,50	18,25	20,75
Root diameter	d_2	[mm]	2,25	2,55	2,80	3,40	3,95	5,40	6,40	6,80
Shank diameter	d_S	[mm]	2,45	2,75	3,15	3,65	4,30	5,80	7,00	8,00
Head thickness	t_1	[mm]	2,20	2,80	2,80	3,10	4,50	4,50	5,80	7,20
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	2,0	2,5	2,5	3,0	4,0	5,0	6,0	7,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	-	-	-	3,5	4,0	6,0	7,0	8,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**3,5**	**4**	**4,5**	**5**	**6**	**8**	**10**	**12**
Factored tensile strength	Φf_u	[kN]		2,36	3,11	3,91	4,97	8,56	14,7	19,51	22,11
Bending yield strength	F_{yb}	[MPa]		1537	1482	1515	1315	1188	1047	1080	1114
Factored shear strength of the screw	Φv_s	[kN]		1,53	1,96	2,36	3,49	4,71	8,79	12,35	13,95
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	36,60	41,83	47,06	52,29	52,38	69,83	87,29	104,75
			G=0.42	42,35	48,40	54,45	60,50	60,60	80,80	101,00	121,20
			G=0.49	47,91	54,75	61,60	68,44	68,55	91,40	114,26	137,11
			G=0.55	52,55	60,05	67,56	75,07	75,19	100,25	125,32	150,38
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,35	0,44	0,55	0,66	0,92	1,28	1,88	2,31
			G=0.42	0,42	0,53	0,66	0,80	1,10	1,53	2,25	2,77
			G=0.49	0,48	0,62	0,77	0,93	1,29	1,79	2,63	3,23
			G=0.55	0,54	0,70	0,86	1,04	1,45	2,01	2,95	3,63

CODES AND DIMENSIONS

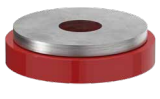
d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
3,5 TX 15	HBS3540	40	18	22	500
	HBS3545	45	24	21	400
	HBS3550	50	24	26	400
4 TX 20	HBS430	30	18	12	500
	HBS435	35	18	17	500
	HBS440	40	24	16	500
	HBS445	45	30	15	400
	HBS450	50	30	20	400
	HBS460	60	35	25	200
	HBS470	70	40	30	200
	HBS480	80	40	40	200
4,5 TX 20	HBS4540	40	24	16	400
	HBS4545	45	30	15	400
	HBS4550	50	30	20	200
	HBS4560	60	35	25	200
	HBS4570	70	40	30	200
	HBS4580	80	40	40	200
5 TX 25	HBS540	40	24	16	200
	HBS545	45	24	21	200
	HBS550	50	24	26	200
	HBS560	60	30	30	200
	HBS570	70	35	35	100
	HBS580	80	40	40	100
	HBS590	90	45	45	100
	HBS5100	100	50	50	100
	HBS5120	120	60	60	100
6 TX 30	HBS640	40	35	8	100
	HBS650	50	35	15	100
	HBS660	60	30	30	100
	HBS670	70	40	30	100
	HBS680	80	40	40	100
	HBS690	90	50	40	100
	HBS6100	100	50	50	100
	HBS6110	110	60	50	100
	HBS6120	120	60	60	100
	HBS6130	130	60	70	100
	HBS6140	140	75	65	100
	HBS6150	150	75	75	100
	HBS6160	160	75	85	100
	HBS6180	180	75	105	100
	HBS6200	200	75	125	100
	HBS6220	220	75	145	100
	HBS6240	240	75	165	100
	HBS6260	260	75	185	100
	HBS6280	280	75	205	100
	HBS6300	300	75	225	100
	HBS6320	320	75	245	100
	HBS6340	340	75	265	100
	HBS6360	360	75	285	100
	HBS6380	380	75	305	100
	HBS6400	400	75	325	100

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
8 TX 40	HBS880	80	52	28	100
	HBS8100	100	52	48	100
	HBS8120	120	60	60	100
	HBS8140	140	60	80	100
	HBS8160	160	80	80	100
	HBS8180	180	80	100	100
	HBS8200	200	80	120	100
	HBS8220	220	80	140	100
	HBS8240	240	80	160	100
	HBS8260	260	80	180	100
	HBS8280	280	80	200	100
	HBS8300	300	100	200	100
	HBS8320	320	100	220	100
	HBS8340	340	100	240	100
	HBS8360	360	100	260	100
	HBS8380	380	100	280	100
	HBS8400	400	100	300	100
	HBS8440	440	100	340	100
	HBS8480	480	100	380	100
	HBS8520	520	100	420	100
	HBS8560	560	100	460	100
	HBS8580	580	100	480	100
	HBS8600	600	100	500	100
10 TX 40	HBS1080	80	52	28	50
	HBS10100	100	52	48	50
	HBS10120	120	60	60	50
	HBS10140	140	60	80	50
	HBS10160	160	80	80	50
	HBS10180	180	80	100	50
	HBS10200	200	80	120	50
	HBS10220	220	80	140	50
	HBS10240	240	80	160	50
	HBS10260	260	80	180	50
	HBS10280	280	80	200	50
	HBS10300	300	100	200	50
	HBS10320	320	100	220	50
	HBS10340	340	100	240	50
	HBS10360	360	100	260	50
	HBS10380	380	100	280	50
	HBS10400	400	100	300	50
	HBS10440	440	100	340	50
	HBS10480	480	100	380	50
	HBS10520	520	100	420	50
	HBS10560	560	100	460	50
	HBS10600	600	100	500	50
12 TX 50	HBS12120	120	80	40	25
	HBS12160	160	80	80	25
	HBS12200	200	80	120	25
	HBS12240	240	80	160	25
	HBS12280	280	80	200	25
	HBS12320	320	120	200	25
	HBS12360	360	120	240	25
	HBS12400	400	120	280	25
	HBS12440	440	120	320	25
	HBS12480	480	120	360	25
	HBS12520	520	120	400	25
	HBS12560	560	120	440	25
	HBS12600	600	120	480	25
	HBS12700	700	120	580	25
	HBS12800	800	120	680	25
	HBS12900	900	120	780	25
	HBS121000	1000	120	880	25

RELATED PRODUCTS



HUS



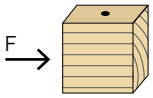
XYLOFON WASHER



THERMOWASHER

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

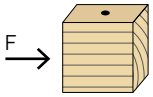
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**12·d‡**	42	*1 5/8*	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
S_Q	**5·d**	18	*11/16*	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
a_L	**15·d‡**	53	*2 1/16*	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
a	**10·d‡**	35	*1 3/8*	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_Q	**10·d**	35	*1 3/8*	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_P	**5·d**	18	*11/16*	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*

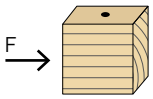
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



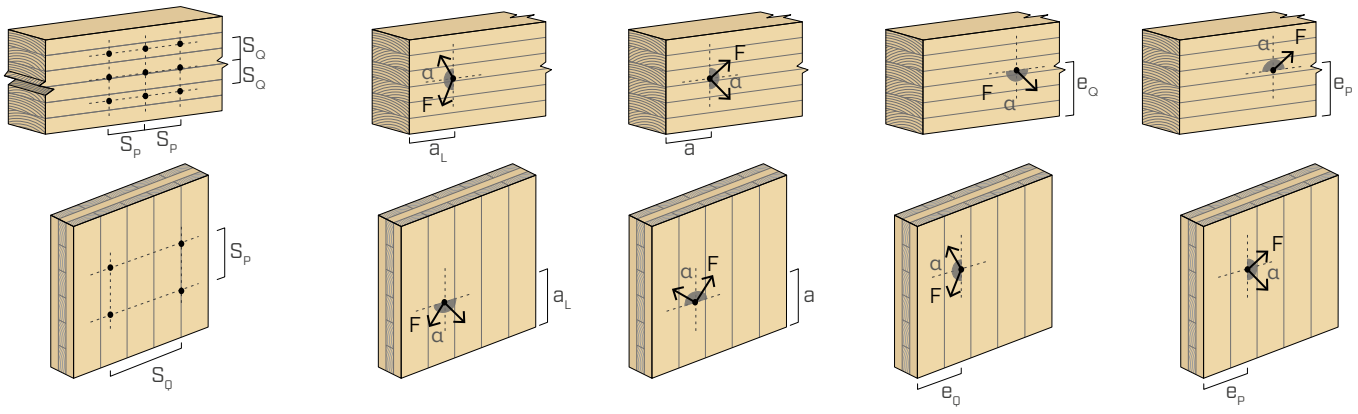
d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**18·d**	63	*2 1/2*	72	*2 13/16*	81	*3 3/16*	90	*3 1/2*	108	*4 1/4*	144	*5 11/16*	180	*7 1/8*	216	*8 1/2*
S_Q	**7·d**	25	*15/16*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
a_L	**22·d**	77	*3 1/16*	88	*3 7/16*	99	*3 7/8*	110	*4 3/8*	132	*5 3/16*	176	*6 15/16*	220	*8 5/8*	264	*10 3/8*
a	**15·d**	53	*2 1/16*	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
e_Q	**12·d**	42	*1 5/8*	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	*144*	*5 11/16*
e_P	**7·d**	25	*15/16*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*

screws inserted **WITH pre-drilled hole**



d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**5·d†**	18	*11/16*	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
S_Q	**4·d**	14	*9/16*	16	*5/8*	18	*11/16*	20	*13/16*	24	*15/16*	32	*1 1/4*	40	*1 9/16*	48	*1 7/8*
a_L	**12·d†**	42	*1 5/8*	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
a	**7·d†**	25	*15/16*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_Q	**7·d**	25	*15/16*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_P	**3·d**	11	*7/16*	12	*1/2*	14	*9/16*	15	*9/16*	18	*11/16*	24	*15/16*	30	*1 3/16*	36	*1 7/16*

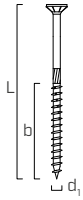
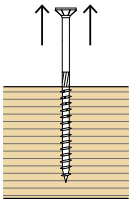
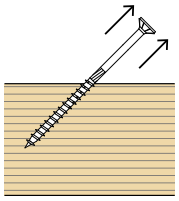
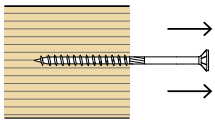
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

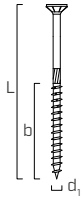
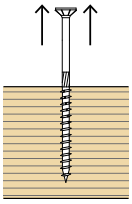
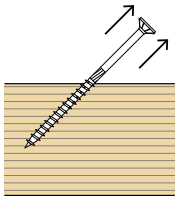
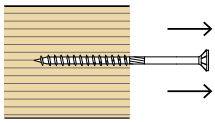
STRUCTURAL VALUES | AXIAL TENSION

geometry				TENSION[1]												steel tension
				thread withdrawal												
				α = 90°				α = 45°				end grain α = 0°				
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw} (2)(3)				factored tension resistance T_{rs}
				G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3.5 *0.14*	40	*1 9/16*	18	0,37	0,43	0,49	0,53	0,34	0,39	0,44	0,48	0,19	0,21	0,24	0,27	2,36
	45	*1 3/4*	24	0,53	0,61	0,69	0,75	0,48	0,55	0,63	0,69	0,26	0,30	0,34	0,38	
	50	*1 15/16*	24	0,53	0,61	0,69	0,75	0,48	0,55	0,63	0,69	0,26	0,30	0,34	0,38	
4 *0.16*	30	*1 3/16*	18	0,41	0,47	0,54	0,59	0,37	0,43	0,49	0,53	0,20	0,24	0,27	0,29	3,11
	35	*1 3/8*	18	0,41	0,47	0,54	0,59	0,37	0,43	0,49	0,53	0,20	0,24	0,27	0,29	
	40	*1 9/16*	24	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42	
	45	*1 3/4*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	50	*1 15/16*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	60	*2 3/8*	35	0,91	1,05	1,19	1,30	0,83	0,95	1,08	1,18	0,45	0,53	0,59	0,65	
	70	*2 3/4*	40	1,05	1,22	1,38	1,51	0,96	1,11	1,25	1,38	0,53	0,61	0,69	0,76	
	80	*3 1/8*	40	1,05	1,22	1,38	1,51	0,96	1,11	1,25	1,38	0,53	0,61	0,69	0,76	
4.5 *0.18*	40	*1 9/16*	24	0,64	0,74	0,84	0,92	0,58	0,68	0,76	0,84	0,32	0,37	0,42	0,46	3,91
	45	*1 3/4*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	50	*1 15/16*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	60	*2 3/8*	35	1,00	1,16	1,32	1,44	0,91	1,06	1,20	1,31	0,50	0,58	0,66	0,72	
	70	*2 3/4*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
	80	*3 1/8*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
5 *0.20*	40	*1 9/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	4,97
	45	*1 3/4*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	
	50	*1 15/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	
	60	*2 3/8*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	70	*2 3/4*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	80	*3 1/8*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	90	*3 1/2*	45	1,46	1,69	1,92	2,10	1,33	1,54	1,74	1,91	0,73	0,85	0,96	1,05	
	100	*4*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
	120	*4 3/4*	60	2,01	2,33	2,63	2,89	1,83	2,12	2,40	2,63	1,01	1,16	1,32	1,45	

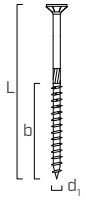
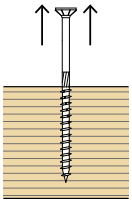
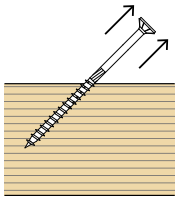
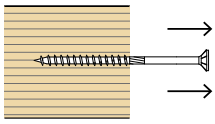
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 31.

TENSION[1]

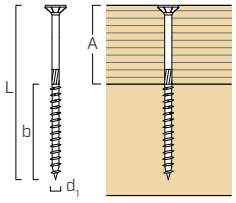
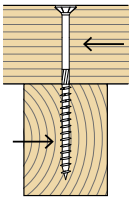
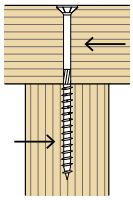
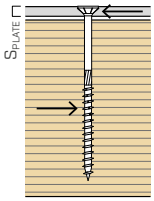
geometry			thread withdrawal α = 90°				thread withdrawal α = 45°				end grain α = 0°				steel tension
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
			G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	40	*1 9/16*	35	1,06	1,23	1,39	1,53	0,97	1,12	1,27	1,39	0,53	0,62	0,70	0,76	8,56
	50	*1 15/16*	35	1,06	1,23	1,39	1,53	0,97	1,12	1,27	1,39	0,53	0,62	0,70	0,76	
	60	*2 3/8*	30	0,88	1,02	1,15	1,26	0,80	0,93	1,05	1,15	0,44	0,51	0,58	0,63	
	70	*2 3/4*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	80	*3 1/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	90	*3 1/2*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	100	*4*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	110	*4 3/8*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	120	*4 3/4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	130	*5 1/8*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	150	*6*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	180	*7 1/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	200	*8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	220	*8 5/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	240	*9 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	260	*10 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	280	*11*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	300	*11 3/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	320	*12 5/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	340	*13 3/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	360	*14 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	380	*15*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	400	*15 3/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
8 *0.32*	80	*3 1/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	14,7
	100	*4*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	120	*4 3/4*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,83	
	140	*5 1/2*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,83	
	160	*6 1/4*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	180	*7 1/8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	200	*8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	220	*8 5/8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	240	*9 1/2*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	260	*10 1/4*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	280	*11*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	300	*11 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	320	*12 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	340	*13 3/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	360	*14 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	380	*15*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	400	*15 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	440	*17 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	480	*19*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	520	*20 1/2*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	560	*22*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	580	*22 13/16*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	600	*23 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	

STRUCTURAL VALUES | AXIAL TENSION

geometry			TENSION[1]												steel tension
			thread withdrawal								end grain α = 0°				
			α = 90°				α = 45°								
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw} (2)(3)				factored tension resistance T_{rs}
			G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
10 *0.40*	80	*3 1/8*	52	2,57	2,97	3,36	3,68	2,33	2,70	3,05	3,35	1,28	1,48	1,68	1,84	19,51
	100	*4*	52	2,57	2,97	3,36	3,68	2,33	2,70	3,05	3,35	1,28	1,48	1,68	1,84	
	120	*4 3/4*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	140	*5 1/2*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	160	*6 1/4*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	180	*7 1/8*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	200	*8*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	220	*8 5/8*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	240	*9 1/2*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	260	*10 1/4*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	280	*11*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	300	*11 3/4*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	320	*12 5/8*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	340	*13 3/8*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	360	*14 1/4*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	380	*15*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	400	*15 3/4*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	440	*17 1/4*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	480	*19*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	520	*20 1/2*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	560	*22*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	600	*23 5/8*	100	5,50	6,36	7,20	7,89	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
12 *0.48*	120	*4 3/4*	80	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	22,11
	160	*6 1/4*	80	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	200	*8*	80	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	240	*9 1/2*	80	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	280	*11*	80	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	320	*12 5/8*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	360	*14 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	400	*15 3/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	440	*17 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	480	*19*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	520	*20 1/2*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	560	*22*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	600	*23 5/8*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	700	*27 1/2*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	800	*31 1/2*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	900	*35 1/2*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	1000	*39 3/8*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	

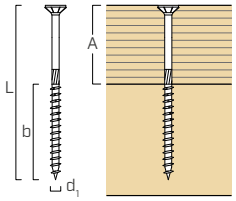
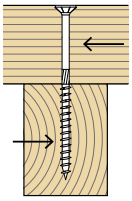
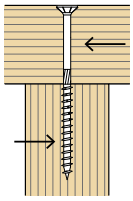
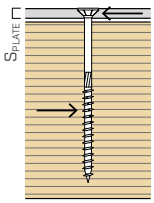
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 31.

geometry					SHEAR[4] timber-to-timber α = 90°				timber-to-timber α = 0°				steel-to-timber				
																	
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]					factored lateral resistance N_r			
d_1	L		b	A[5]	G				G				S_{PLATE}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
3.5 *0.14*	40	*1 9/16*	18	22	0,33	0,40	0,46	0,52	0,24	0,28	0,31	0,33	1,6 *1/16*	0,63	0,72	0,78	0,83
	45	*1 3/4*	24	21	0,36	0,44	0,51	0,57	0,27	0,31	0,35	0,38		0,69	0,76	0,83	0,89
	50	*1 15/16*	24	26	0,40	0,48	0,55	0,59	0,27	0,31	0,35	0,38		0,69	0,76	0,83	0,89
4 *0.16*	30	*1 3/16*	18	12	0,30	0,36	0,42	0,47	0,19	0,23	0,27	0,30	1,6 *1/16*	0,66	0,75	0,84	0,91
	35	*1 3/8*	18	17	0,34	0,40	0,47	0,53	0,23	0,27	0,32	0,35		0,70	0,79	0,89	0,97
	40	*1 9/16*	24	16	0,37	0,45	0,52	0,59	0,26	0,31	0,36	0,40		0,78	0,89	1,00	1,08
	45	*1 3/4*	30	15	0,41	0,49	0,55	0,60	0,28	0,33	0,39	0,44		0,86	0,98	1,07	1,14
	50	*1 15/16*	30	20	0,45	0,54	0,61	0,66	0,31	0,38	0,44	0,49		0,88	0,98	1,07	1,14
	60	*2 3/8*	35	25	0,51	0,58	0,66	0,72	0,37	0,42	0,47	0,52		0,92	1,02	1,11	1,19
	70	*2 3/4*	40	30	0,55	0,63	0,69	0,74	0,38	0,44	0,49	0,54		0,96	1,06	1,16	1,24
	80	*3 1/8*	40	40	0,57	0,63	0,69	0,74	0,38	0,44	0,49	0,54		0,96	1,06	1,16	1,24
4.5 *0.18*	40	*1 9/16*	24	16	0,42	0,50	0,58	0,66	0,29	0,34	0,39	0,44	1,6 *1/16*	0,89	1,02	1,14	1,24
	45	*1 3/4*	30	15	0,46	0,55	0,64	0,71	0,31	0,38	0,44	0,49		0,98	1,12	1,26	1,35
	50	*1 15/16*	30	20	0,50	0,60	0,70	0,78	0,35	0,42	0,49	0,55		1,02	1,16	1,27	1,35
	60	*2 3/8*	35	25	0,58	0,68	0,77	0,84	0,41	0,49	0,56	0,61		1,09	1,21	1,32	1,41
	70	*2 3/4*	40	30	0,64	0,73	0,82	0,90	0,45	0,52	0,58	0,64		1,13	1,26	1,37	1,47
	80	*3 1/8*	40	40	0,69	0,77	0,84	0,90	0,45	0,52	0,58	0,64		1,13	1,26	1,37	1,47
5 *0.20*	40	*1 9/16*	24	16	0,46	0,55	0,65	0,73	0,31	0,37	0,42	0,47	1,6 *1/16*	1,05	1,19	1,33	1,45
	45	*1 3/4*	24	21	0,51	0,61	0,71	0,79	0,35	0,42	0,48	0,54		1,09	1,25	1,39	1,52
	50	*1 15/16*	24	26	0,55	0,66	0,77	0,86	0,39	0,47	0,54	0,61		1,14	1,30	1,45	1,59
	60	*2 3/8*	30	30	0,63	0,76	0,89	1,00	0,48	0,57	0,64	0,69		1,28	1,45	1,58	1,69
	70	*2 3/4*	35	35	0,72	0,87	1,01	1,13	0,53	0,60	0,68	0,74		1,36	1,51	1,64	1,75
	80	*3 1/8*	40	40	0,81	0,97	1,08	1,15	0,55	0,62	0,70	0,77		1,41	1,56	1,70	1,82
	90	*3 1/2*	45	45	0,89	0,98	1,08	1,15	0,56	0,65	0,73	0,79		1,45	1,61	1,76	1,88
	100	*4*	50	50	0,89	0,98	1,08	1,15	0,58	0,67	0,75	0,82		1,50	1,67	1,82	1,95
	120	*4 3/4*	60	60	0,89	0,98	1,08	1,15	0,62	0,71	0,80	0,87		1,59	1,77	1,94	2,08

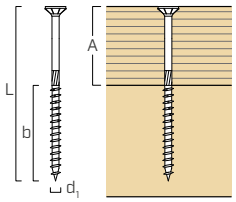
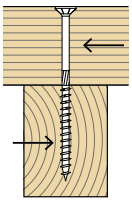
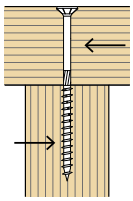
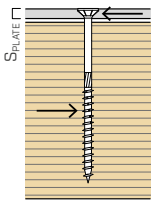
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 31.

geometry					SHEAR[4] timber-to-timber α = 90°				timber-to-timber α = 0°				steel-to-timber					
																		
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]					factored lateral resistance N_r				
					G				G					G				
d_1	L		b	A[5]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	S_{PLATE}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	
6 *0.24*	40	*1 9/16*	35	10	0,55	0,66	0,77	0,87	0,33	0,39	0,45	0,50	3,2 *1/8*	1,32	1,50	1,67	1,81	
	50	*1 15/16*	35	15	0,65	0,78	0,91	1,02	0,42	0,50	0,57	0,64		1,41	1,61	1,81	1,97	
	60	*2 3/8*	30	30	0,75	0,90	1,05	1,18	0,52	0,62	0,72	0,81		1,47	1,68	1,88	2,04	
	70	*2 3/4*	40	30	0,85	1,02	1,19	1,33	0,61	0,72	0,84	0,93		1,66	1,87	2,04	2,17	
	80	*3 1/8*	40	40	0,95	1,14	1,32	1,48	0,68	0,77	0,86	0,93		1,69	1,87	2,04	2,17	
	90	*3 1/2*	50	40	1,04	1,20	1,35	1,48	0,73	0,83	0,94	1,03		1,78	1,98	2,16	2,30	
	100	*4*	50	50	1,14	1,27	1,38	1,48	0,73	0,83	0,94	1,03		1,78	1,98	2,16	2,30	
	110	*4 3/8*	60	50	1,14	1,27	1,38	1,48	0,77	0,88	0,99	1,09		1,87	2,08	2,28	2,43	
	120	*4 3/4*	60	60	1,14	1,27	1,38	1,48	0,77	0,88	0,99	1,09		1,87	2,08	2,28	2,43	
	130	*5 1/8*	60	70	1,14	1,27	1,38	1,48	0,77	0,88	0,99	1,09		1,87	2,08	2,28	2,43	
	140	*5 1/2*	75	65	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	150	*6*	75	75	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	160	*6 1/4*	75	85	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	180	*7 1/8*	75	105	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	200	*8*	75	125	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	220	*8 5/8*	75	145	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	240	*9 1/2*	75	165	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	260	*10 1/4*	75	185	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	280	*11*	75	205	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	300	*11 3/4*	75	225	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	320	*12 5/8*	75	245	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	340	*13 3/8*	75	265	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	360	*14 1/4*	75	285	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	380	*15*	75	305	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	400	*15 3/4*	75	325	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
8 *0.32*	80	*3 1/8*	52	28	1,18	1,42	1,66	1,86	0,81	0,97	1,13	1,27	3,2 *1/8*	2,60	2,98	3,35	3,63	
	100	*4*	52	48	1,42	1,71	1,99	2,24	1,05	1,24	1,39	1,51		2,83	3,13	3,41	3,63	
	120	*4 3/4*	60	60	1,66	2,00	2,23	2,39	1,13	1,29	1,44	1,57		2,92	3,24	3,54	3,77	
	140	*5 1/2*	60	80	1,76	2,02	2,23	2,39	1,13	1,29	1,44	1,57		2,92	3,24	3,54	3,77	
	160	*6 1/4*	80	80	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	180	*7 1/8*	80	100	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	200	*8*	80	120	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	220	*8 5/8*	80	140	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	240	*9 1/2*	80	160	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	260	*10 1/4*	80	180	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	280	*11*	80	200	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	300	*11 3/4*	100	200	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	320	*12 5/8*	100	220	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	340	*13 3/8*	100	240	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	360	*14 1/4*	100	260	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	380	*15*	100	280	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	400	*15 3/4*	100	300	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	440	*17 1/4*	100	340	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	480	*19*	100	380	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	520	*20 1/2*	100	420	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	560	*22*	100	460	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	580	*22 13/16*	100	480	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	600	*23 5/8*	100	500	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	

α = screw-to-grain angle

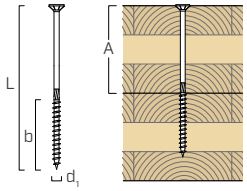
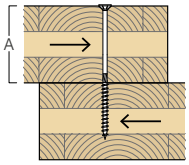
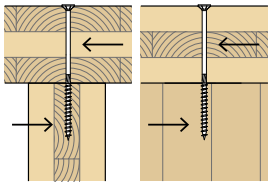
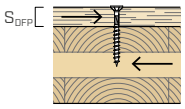
SHEAR[4]

geometry					timber-to-timber α = 90°				timber-to-timber α = 0°				steel-to-timber				
																	
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]					factored lateral resistance N_r			
					G				G					G			
d_1	L		b	A[5]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	S_{PLATE}	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	80	*3 1/8*	52	28	1,45	1,74	2,03	2,28	1,01	1,19	1,38	1,54		3,30	3,76	4,20	4,57
	100	*4*	52	48	1,73	2,08	2,42	2,72	1,29	1,53	1,77	1,98		3,58	4,09	4,60	4,98
	120	*4 3/4*	60	60	2,01	2,42	2,82	3,16	1,51	1,75	1,96	2,14		3,98	4,43	4,83	5,15
	140	*5 1/2*	60	80	2,29	2,67	3,00	3,28	1,54	1,75	1,96	2,14		4,01	4,43	4,83	5,15
	160	*6 1/4*	80	80	2,57	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
	180	*7 1/8*	80	100	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
	200	*8*	80	120	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
	220	*8 5/8*	80	140	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
	240	*9 1/2*	80	160	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
	260	*10 1/4*	80	180	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31		4,31	4,79	5,23	5,59
10	280	*11*	80	200	2,60	2,92	3,18	3,40	1,65	1,89	2,12	2,31	6,4	4,31	4,79	5,23	5,59
0.40	300	*11 3/4*	100	200	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49	*1/4*	4,62	5,14	5,63	6,03
	320	*12 5/8*	100	220	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	340	*13 3/8*	100	240	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	360	*14 1/4*	100	260	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	380	*15*	100	280	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	400	*15 3/4*	100	300	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	440	*17 1/4*	100	340	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	480	*19*	100	380	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	520	*20 1/2*	100	420	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	560	*22*	100	460	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	600	*23 5/8*	100	500	2,63	2,92	3,18	3,40	1,76	2,02	2,28	2,49		4,62	5,14	5,63	6,03
	120	*4 3/4*	80	40	2,32	2,74	3,07	3,35	1,55	1,86	2,17	2,44		4,98	5,65	6,18	6,60
	160	*6 1/4*	80	80	2,95	3,47	3,79	4,06	1,95	2,23	2,50	2,73		5,09	5,65	6,18	6,60
	200	*8*	80	120	3,04	3,47	3,79	4,06	1,95	2,23	2,50	2,73		5,09	5,65	6,18	6,60
	240	*9 1/2*	80	160	3,04	3,47	3,79	4,06	1,95	2,23	2,50	2,73		5,09	5,65	6,18	6,60
	280	*11*	80	200	3,04	3,47	3,79	4,06	1,95	2,23	2,50	2,73		5,09	5,65	6,18	6,60
	320	*12 5/8*	120	200	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	360	*14 1/4*	120	240	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	400	*15 3/4*	120	280	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
12	440	*17 1/4*	120	320	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13	6,4	5,83	6,50	7,14	7,65
0.48	480	*19*	120	360	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13	*1/4*	5,83	6,50	7,14	7,65
	520	*20 1/2*	120	400	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	560	*22*	120	440	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	600	*23 5/8*	120	480	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	700	*27 1/2*	120	580	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	800	*31 1/2*	120	680	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	900	*35 1/2*	120	780	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65
	1000	*39 3/8*	120	880	3,13	3,47	3,79	4,06	2,20	2,53	2,86	3,13		5,83	6,50	7,14	7,65

α = screw-to-grain angle

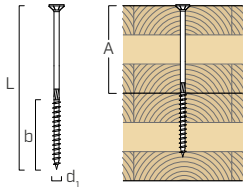
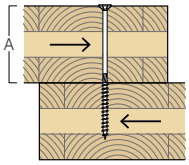
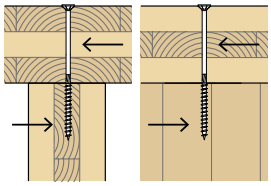
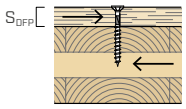
NOTES and **GENERAL PRINCIPLES** on page 31.

SHEAR[4]

geometry				CLT-CLT lateral face α = 90°				CLT-CLT α = 0°				spline joint lateral face α = 90°				
																
d_1	L		b	A	factored lateral resistance N_r [6] G				factored lateral resistance N_r [2][3] G				S_{DFP}	factored lateral resistance N_r 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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
6 *0.24*	60	*2 3/8*	30	30	0,69	0,83	0,97	1,09	0,48	0,57	0,66	0,74	12,7 *1/2*	0,91	1,00	1,08	1,14
	70	*2 3/4*	40	40	0,78	0,94	1,09	1,22	0,57	0,64	0,71	0,76		1,00	1,09	1,12	1,14
	80	*3 1/8*	40	40	0,87	1,04	1,21	1,36	0,65	0,73	0,82	0,89		1,05	1,09	1,12	1,14
	90	*3 1/2*	50	50	0,96	1,13	1,27	1,39	0,65	0,73	0,82	0,89		1,05	1,09	1,12	1,14
	100	*4*	50	50	1,04	1,21	1,32	1,42	0,69	0,79	0,89	0,97		1,05	1,09	1,12	1,14
	110	*4 3/8*	60	60	1,07	1,21	1,32	1,42	0,69	0,79	0,89	0,97		1,05	1,09	1,12	1,14
	120	*4 3/4*	60	60	1,09	1,21	1,32	1,42	0,72	0,83	0,94	1,03		1,05	1,09	1,12	1,14
	130	*5 1/8*	60	70	1,09	1,21	1,32	1,42	0,72	0,83	0,94	1,03		1,05	1,09	1,12	1,14
	140	*5 1/2*	75	75	1,09	1,21	1,32	1,42	0,74	0,85	0,96	1,05		1,05	1,09	1,12	1,14
	150	*6*	75	75	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	160	*6 1/4*	75	85	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	180	*7 1/8*	75	105	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	200	*8*	75	125	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	220	*8 5/8*	75	145	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	240	*9 1/2*	75	165	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	260	*10 1/4*	75	185	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	280	*11*	75	205	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	300	*11 3/4*	75	225	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	320	*12 5/8*	75	245	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	340	*13 3/8*	75	265	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	360	*14 1/4*	75	285	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	380	*15*	75	305	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	400	*15 3/4*	75	325	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
8 *0.32*	80	*3 1/8*	52	45	1,09	1,31	1,52	1,71	0,80	0,96	1,11	1,20	19,1 *3/4*	1,47	1,60	1,73	1,85
	100	*4*	52	55	1,30	1,56	1,83	2,05	1,00	1,13	1,26	1,36		1,69	1,79	1,84	1,88
	120	*4 3/4*	60	60	1,52	1,82	2,13	2,28	1,07	1,22	1,37	1,49		1,73	1,79	1,84	1,88
	140	*5 1/2*	60	80	1,64	1,89	2,13	2,28	1,07	1,22	1,37	1,49		1,73	1,79	1,84	1,88
	160	*6 1/4*	80	80	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	180	*7 1/8*	80	100	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	200	*8*	80	120	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	220	*8 5/8*	80	140	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	240	*9 1/2*	80	160	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	260	*10 1/4*	80	180	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	280	*11*	80	200	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	300	*11 3/4*	100	200	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	320	*12 5/8*	100	220	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	340	*13 3/8*	100	240	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	360	*14 1/4*	100	260	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	380	*15*	100	280	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	400	*15 3/4*	100	300	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	440	*17 1/4*	100	340	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	480	*19*	100	380	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	520	*20 1/2*	100	420	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	560	*22*	100	460	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	580	*22 13/16*	100	480	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	600	*23 5/8*	100	500	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88

α = screw-to-grain angle

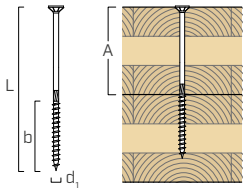
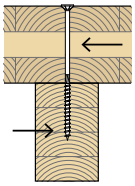
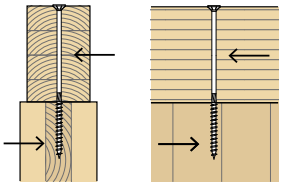
SHEAR[4]

geometry					CLT-CLT lateral face α = 90°				CLT-CLT α = 0°				spline joint lateral face α = 90°				
																	
d_1	L		b	A	factored lateral resistance N_r [6]				factored lateral resistance N_r [2][3]				S_{DFP}	factored lateral resistance N_r			
					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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	80	*3 1/8*	52	45	1,34	1,61	1,87	2,10	0,94	1,12	1,29	1,45		1,93	2,07	2,20	2,32
	100	*4*	52	55	1,59	1,91	2,23	2,50	1,19	1,42	1,64	1,78		2,18	2,37	2,56	2,72
	120	*4 3/4*	60	60	1,84	2,21	2,58	2,90	1,39	1,66	1,86	2,03		2,43	2,62	2,69	2,75
	140	*5 1/2*	60	80	2,10	2,50	2,81	3,08	1,46	1,66	1,86	2,03		2,54	2,62	2,69	2,75
	160	*6 1/4*	80	80	2,35	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
	180	*7 1/8*	80	100	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
	200	*8*	80	120	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
	220	*8 5/8*	80	140	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
	240	*9 1/2*	80	160	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
	260	*10 1/4*	80	180	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19		2,54	2,62	2,69	2,75
10	280	*11*	80	200	2,43	2,79	3,04	3,25	1,56	1,78	2,00	2,19	25,4	2,54	2,62	2,69	2,75
0.40	300	*11 3/4*	100	200	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34	*1*	2,54	2,62	2,69	2,75
	320	*12 5/8*	100	220	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	340	*13 3/8*	100	240	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	360	*14 1/4*	100	260	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	380	*15*	100	280	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	400	*15 3/4*	100	300	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	440	*17 1/4*	100	340	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	480	*19*	100	380	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	520	*20 1/2*	100	420	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	560	*22*	100	460	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	600	*23 5/8*	100	500	2,51	2,79	3,04	3,25	1,66	1,90	2,14	2,34		2,54	2,62	2,69	2,75
	120	*4 3/4*	80	65	2,18	2,60	3,01	3,36	1,64	1,91	2,12	2,29		2,81	3,08	3,17	3,24
	160	*6 1/4*	80	80	2,70	3,24	3,63	3,88	1,84	2,11	2,37	2,58		2,99	3,09	3,17	3,24
	200	*8*	80	120	2,85	3,28	3,63	3,88	1,84	2,11	2,37	2,58		2,99	3,09	3,17	3,24
	240	*9 1/2*	80	160	2,85	3,28	3,63	3,88	1,84	2,11	2,37	2,58		2,99	3,09	3,17	3,24
	280	*11*	80	200	2,85	3,28	3,63	3,88	1,84	2,11	2,37	2,58		2,99	3,09	3,17	3,24
	320	*12 5/8*	120	200	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	360	*14 1/4*	120	240	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	400	*15 3/4*	120	280	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
12	440	*17 1/4*	120	320	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94	25,4	2,99	3,09	3,17	3,24
0.48	480	*19*	120	360	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94	*1*	2,99	3,09	3,17	3,24
	520	*20 1/2*	120	400	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	560	*22*	120	440	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	600	*23 5/8*	120	480	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	700	*27 1/2*	120	580	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	800	*31 1/2*	120	680	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	900	*35 1/2*	120	780	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24
	1000	*39 3/8*	120	880	2,99	3,32	3,63	3,88	2,07	2,38	2,69	2,94		2,99	3,09	3,17	3,24

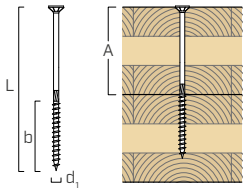
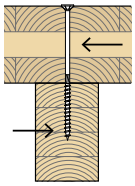
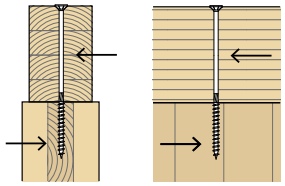
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 31.

SHEAR[4]

geometry				CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
				G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	60	*2 3/8*	30	30	0,72	0,86	1,01	1,13	0,51	0,61	0,70	0,77
	70	*2 3/4*	40	40	0,82	0,98	1,15	1,27	0,59	0,70	0,81	0,89
	80	*3 1/8*	40	40	0,91	1,09	1,27	1,41	0,65	0,74	0,82	0,89
	90	*3 1/2*	50	50	0,99	1,14	1,28	1,41	0,69	0,80	0,89	0,98
	100	*4*	50	50	1,08	1,24	1,35	1,45	0,69	0,80	0,89	0,98
	110	*4 3/8*	60	60	1,08	1,24	1,35	1,45	0,73	0,84	0,94	1,03
	120	*4 3/4*	60	60	1,11	1,24	1,35	1,45	0,73	0,84	0,94	1,03
	130	*5 1/8*	60	70	1,11	1,24	1,35	1,45	0,73	0,84	0,94	1,03
	140	*5 1/2*	75	75	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	150	*6*	75	75	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	160	*6 1/4*	75	85	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	180	*7 1/8*	75	105	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	200	*8*	75	125	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	220	*8 5/8*	75	145	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	240	*9 1/2*	75	165	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	260	*10 1/4*	75	185	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	280	*11*	75	205	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	300	*11 3/4*	75	225	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	320	*12 5/8*	75	245	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	340	*13 3/8*	75	265	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	360	*14 1/4*	75	285	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	380	*15*	75	305	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	400	*15 3/4*	75	325	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
8 *0.32*	80	*3 1/8*	52	45	1,15	1,38	1,61	1,81	0,78	0,94	1,10	1,23
	100	*4*	52	55	1,37	1,64	1,91	2,15	1,02	1,19	1,33	1,45
	120	*4 3/4*	60	60	1,59	1,91	2,16	2,33	1,07	1,23	1,38	1,50
	140	*5 1/2*	60	80	1,73	2,00	2,18	2,33	1,07	1,23	1,38	1,50
	160	*6 1/4*	80	80	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	180	*7 1/8*	80	100	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	200	*8*	80	120	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	220	*8 5/8*	80	140	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	240	*9 1/2*	80	160	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	260	*10 1/4*	80	180	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	280	*11*	80	200	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	300	*11 3/4*	100	200	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	320	*12 5/8*	100	220	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	340	*13 3/8*	100	240	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	360	*14 1/4*	100	260	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	380	*15*	100	280	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	400	*15 3/4*	100	300	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	440	*17 1/4*	100	340	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	480	*19*	100	380	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	520	*20 1/2*	100	420	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	560	*22*	100	460	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	580	*22 13/16*	100	480	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	600	*23 5/8*	100	500	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77

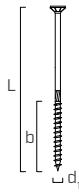
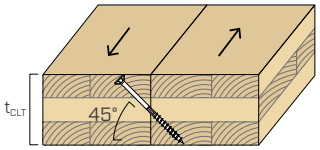
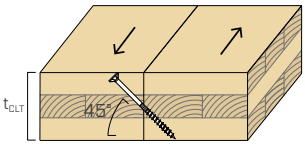
α = screw-to-grain angle

geometry					SHEAR[4]							
					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	80	*3 1/8*	52	45	1,41	1,69	1,98	2,22	0,98	1,16	1,34	1,49
	100	*4*	52	55	1,66	2,00	2,33	2,62	1,26	1,49	1,73	1,92
	120	*4 3/4*	60	60	1,93	2,31	2,70	3,03	1,47	1,68	1,88	2,04
	140	*5 1/2*	60	80	2,18	2,62	2,96	3,24	1,47	1,68	1,88	2,04
	160	*6 1/4*	80	80	2,46	2,83	3,11	3,32	1,57	1,80	2,02	2,20
	180	*7 1/8*	80	100	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
	200	*8*	80	120	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
	220	*8 5/8*	80	140	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
	240	*9 1/2*	80	160	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
	260	*10 1/4*	80	180	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
10	280	*11*	80	200	2,57	2,85	3,11	3,32	1,57	1,80	2,02	2,20
0.40	300	*11 3/4*	100	200	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	320	*12 5/8*	100	220	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	340	*13 3/8*	100	240	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	360	*14 1/4*	100	260	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	380	*15*	100	280	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	400	*15 3/4*	100	300	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	440	*17 1/4*	100	340	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	480	*19*	100	380	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	520	*20 1/2*	100	420	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	560	*22*	100	460	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	600	*23 5/8*	100	500	2,57	2,85	3,11	3,32	1,67	1,92	2,16	2,36
	120	*4 3/4*	80	65	2,25	2,63	2,94	3,20	1,50	1,80	2,10	2,36
	160	*6 1/4*	80	80	2,83	3,32	3,71	3,96	1,86	2,12	2,38	2,60
	200	*8*	80	120	3,01	3,39	3,71	3,96	1,86	2,12	2,38	2,60
	240	*9 1/2*	80	160	3,01	3,39	3,71	3,96	1,86	2,12	2,38	2,60
	280	*11*	80	200	3,01	3,39	3,71	3,96	1,86	2,12	2,38	2,60
	320	*12 5/8*	120	200	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	360	*14 1/4*	120	240	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	400	*15 3/4*	120	280	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
12	440	*17 1/4*	120	320	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
0.48	480	*19*	120	360	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	520	*20 1/2*	120	400	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	560	*22*	120	440	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	600	*23 5/8*	120	480	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	700	*27 1/2*	120	580	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	800	*31 1/2*	120	680	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	900	*35 1/2*	120	780	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96
	1000	*39 3/8*	120	880	3,06	3,39	3,71	3,96	2,09	2,40	2,70	2,96

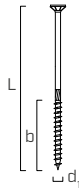
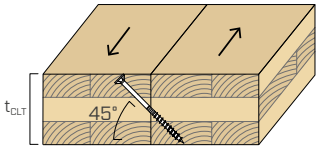
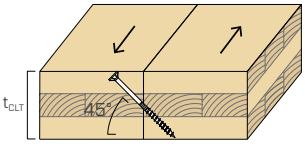
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 31.

SHEAR[4][7]

geometry				butt-joint α = 90°				butt-joint α = 45°			
											
				factored lateral resistance N_r				factored lateral resistance N_r			
				G				G			
d_1	L		b	t_{CLT}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	90	*3 1/2*	50	65	0,79	0,93	1,04	1,14	0,45	0,55	0,64	0,71
	100	*4*	50	70	0,88	1,02	1,10	1,16	0,50	0,61	0,71	0,79
	110	*4 3/8*	60	80	0,91	1,02	1,10	1,16	0,56	0,67	0,77	0,84
	120	*4 3/4*	60	85	0,93	1,02	1,10	1,16	0,61	0,73	0,83	0,88
	130	*5 1/8*	60	90	0,93	1,02	1,10	1,16	0,65	0,75	0,83	0,88
	140	*5 1/2*	75	100	0,93	1,02	1,10	1,16	0,68	0,77	0,83	0,88
	150	*6*	75	105	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	160	*6 1/4*	75	115	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	180	*7 1/8*	75	125	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
6	200	*8*	75	140	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
0.24	220	*8 5/8*	75	155	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	240	*9 1/2*	75	170	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	260	*10 1/4*	75	185	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	280	*11*	75	200	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	300	*11 3/4*	75	210	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	320	*12 5/8*	75	225	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	340	*13 3/8*	75	240	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	360	*14 1/4*	75	255	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	380	*15*	75	270	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	400	*15 3/4*	75	285	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	80	*3 1/8*	52	55	0,86	1,04	1,21	1,36	0,49	0,59	0,69	0,78
	100	*4*	52	70	1,08	1,30	1,51	1,70	0,62	0,74	0,86	0,97
	120	*4 3/4*	60	85	1,30	1,56	1,81	1,93	0,74	0,89	1,04	1,16
	140	*5 1/2*	60	100	1,42	1,62	1,82	1,93	0,86	1,04	1,21	1,31
	160	*6 1/4*	80	115	1,54	1,69	1,82	1,93	0,99	1,19	1,38	1,46
	180	*7 1/8*	80	125	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	200	*8*	80	140	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	220	*8 5/8*	80	155	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	240	*9 1/2*	80	170	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	260	*10 1/4*	80	185	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	280	*11*	80	200	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
8	300	*11 3/4*	100	210	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
0.32	320	*12 5/8*	100	225	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	340	*13 3/8*	100	240	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	360	*14 1/4*	100	255	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	380	*15*	100	270	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	400	*15 3/4*	100	285	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	440	*17 1/4*	100	310	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	480	*19*	100	340	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	520	*20 1/2*	100	370	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	560	*22*	100	395	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	580	*22 13/16*	100	410	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	600	*23 5/8*	100	425	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46

α = screw-to-grain angle

geometry				SHEAR[4][7]							
				butt-joint α = 90°				butt-joint α = 45°			
											
				factored lateral resistance N_r				factored lateral resistance N_r			
				G				G			
d_1	L		b	t_{CLT}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	80	*3 1/8*	52	55	1,01	1,21	1,41	1,59	0,58	0,69	0,81	0,91
	100	*4*	52	70	1,26	1,52	1,77	1,98	0,72	0,87	1,01	1,13
	120	*4 3/4*	60	85	1,52	1,82	2,12	2,38	0,87	1,04	1,21	1,36
	140	*5 1/2*	60	100	1,77	2,11	2,35	2,56	1,01	1,21	1,41	1,59
	160	*6 1/4*	80	115	2,02	2,39	2,58	2,74	1,15	1,39	1,62	1,81
	180	*7 1/8*	80	125	2,10	2,39	2,58	2,74	1,30	1,56	1,78	1,94
	200	*8*	80	140	2,10	2,39	2,58	2,74	1,40	1,60	1,78	1,94
	220	*8 5/8*	80	155	2,10	2,39	2,58	2,74	1,40	1,60	1,78	1,94
	240	*9 1/2*	80	170	2,10	2,39	2,58	2,74	1,40	1,60	1,78	1,94
	260	*10 1/4*	80	185	2,10	2,39	2,58	2,74	1,40	1,60	1,78	1,94
10	280	*11*	80	200	2,10	2,39	2,58	2,74	1,40	1,60	1,78	1,94
0.40	300	*11 3/4*	100	210	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	320	*12 5/8*	100	225	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	340	*13 3/8*	100	240	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	360	*14 1/4*	100	255	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	380	*15*	100	270	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	400	*15 3/4*	100	285	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	440	*17 1/4*	100	310	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	480	*19*	100	340	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	520	*20 1/2*	100	370	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	560	*22*	100	395	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	600	*23 5/8*	100	425	2,18	2,39	2,58	2,74	1,55	1,77	1,95	2,07
	120	*4 3/4*	80	85	1,72	2,07	2,34	2,52	0,98	1,18	1,38	1,55
	160	*6 1/4*	80	115	2,30	2,76	3,06	3,25	1,31	1,57	1,84	2,06
	200	*8*	80	140	2,44	2,80	3,06	3,25	1,63	1,86	2,08	2,26
	240	*9 1/2*	80	170	2,44	2,80	3,06	3,25	1,63	1,86	2,08	2,26
	280	*11*	80	200	2,44	2,80	3,06	3,25	1,63	1,86	2,08	2,26
	320	*12 5/8*	120	225	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	360	*14 1/4*	120	255	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	400	*15 3/4*	120	285	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
12	440	*17 1/4*	120	310	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
0.48	480	*19*	120	340	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	520	*20 1/2*	120	370	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	560	*22*	120	395	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	600	*23 5/8*	120	425	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	700	*27 1/2*	120	495	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	800	*31 1/2*	120	565	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	900	*35 1/2*	120	635	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45
	1000	*39 3/8*	120	705	2,59	2,84	3,06	3,25	1,96	2,14	2,32	2,45

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 31.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The specified head pull-through design values are taken from report ELC-4645. The withdrawal and head pull-through values provided in this datasheet are also applicable to CLT connections.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- HBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) HBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

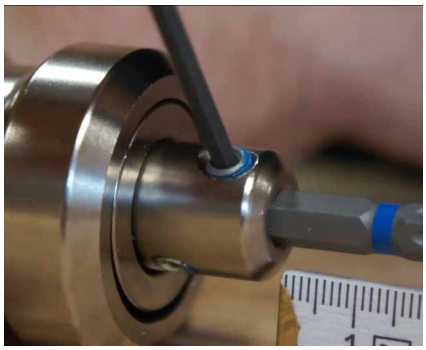
(5) The side-member thickness, A, for HBS 6 x 40 mm was set to 10 mm to ensure the connection is not governed by failure mode (a).

(6) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

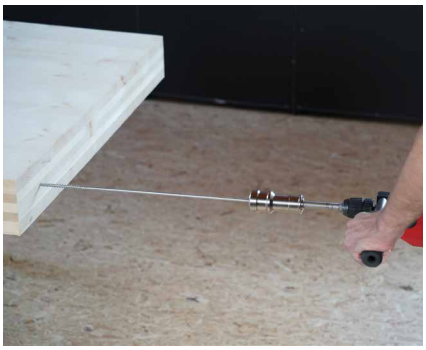
(7) The lateral resistance calculation for butt joints assumes the screws are installed on the CLT member's narrow face.

INSTALLATION SUGGESTIONS

SCREWING USING CATCH



Place the bit inside the CATCH screwing device and fasten it to the correct depth depending on the chosen connector.

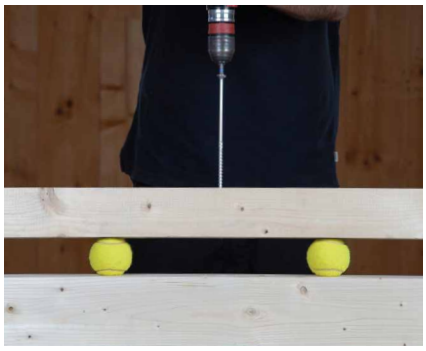


CATCH is suitable with long connectors where the insert would otherwise tend to come out of the screw head space.



Useful in case of screwing in corners, which usually do not allow exerting a great screwing force.

PARTIALLY THREADED SCREWS vs FULLY THREADED SCREW



Compressible elements are interposed between two timber beams and a screw is screwed centrally to evaluate its effect on the connection.



The partial thread screw (e.g. HBS) allows the joint to be closed. The threaded portion, inserted all the way inside the second element, allows the first element to slide on the smooth shank.



The fully threaded screw (e.g. VGZ) transfers the force by exploiting its axial strength and penetrates inside the timber elements without moving.

APPLICATION ON HARDWOODS



Pre-drill a hole of the required diameter ($d_{V,H}$) and length equal to the chosen connector size using the SNAIL tip.



Install the screw (e.g. HBS).



Alternatively, specific screws for hardwood applications (e.g. HBSH) can be used, which can be inserted without the aid of pre-drill hole.

RELATED PRODUCTS



CATCH



LEWIS



SNAIL



A 18 | ASB 18



HBS EVO

COUNTERSUNK SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

C4 EVO COATING

Multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. It can be used for service class 3 outdoor applications and under class C4 atmospheric corrosion conditions tested by the Research Institutes of Sweden - RISE.

3 THORNS TIP

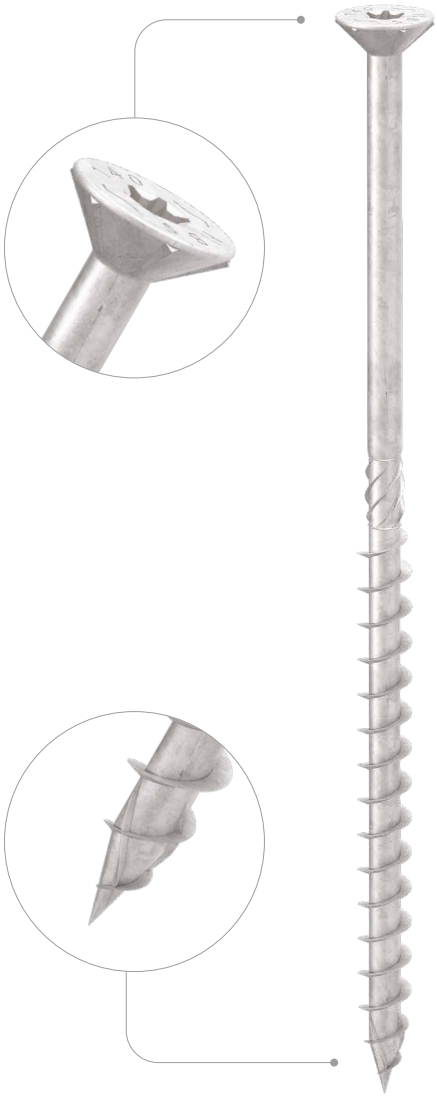
Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

PRESSURE TREATED LUMBER

The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

T3 TIMBER CORROSIVITY

Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch and pine. For more information see the "TIMBER SCREWS AND DECK FASTENING" catalogue at www.rothoblaas.com



MANUALS

BIT INCLUDED

DIAMETER [mm]	3	4 – 8	12
LENGTH [mm]	12	40 – 320	1000
SERVICE CONDITION	EC1 EC3	
ATMOSPHERIC CORROSIVITY	C1 C2 C3 C4	
WOOD CORROSIVITY	T1 T2 T3	
MATERIAL	C4 EVO COATING	carbon steel with C4 EVO coating
CORE HARDNESS	<390 HV	as required in CSA O86:24[1]

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

[1] Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.





EXPOSURE CONDITION 3

Certified for use in exposure condition 3 outdoor applications and under class C4 atmospheric corrosion conditions. Ideal for fastening timber framed panels and trusses (Rafter, Truss).

PERGOLAS AND DECKS

The smaller sizes are ideal for securing boards and battens of decks set up outdoors.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4 TX 20	HBSEVO440	40	24	16	500
	HBSEVO450	50	30	20	500
	HBSEVO460	60	35	25	500
4,5 TX 20	HBSEVO4545	45	30	15	400
	HBSEVO4550	50	30	20	200
	HBSEVO4560	60	35	25	200
	HBSEVO4570	70	40	30	200
5 TX 25	HBSEVO550	50	24	26	200
	HBSEVO560	60	30	30	200
	HBSEVO570	70	35	35	100
	HBSEVO580	80	40	40	100
	HBSEVO590	90	45	45	100
	HBSEVO5100	100	50	50	100
6 TX 30	HBSEVO660	60	30	30	100
	HBSEVO670	70	40	30	100
	HBSEVO680	80	40	40	100
	HBSEVO6100	100	50	50	100
	HBSEVO6120	120	60	60	100
	HBSEVO6140	140	75	65	100
	HBSEVO6160	160	75	85	100
	HBSEVO6180	180	75	105	100
	HBSEVO6200	200	75	125	100

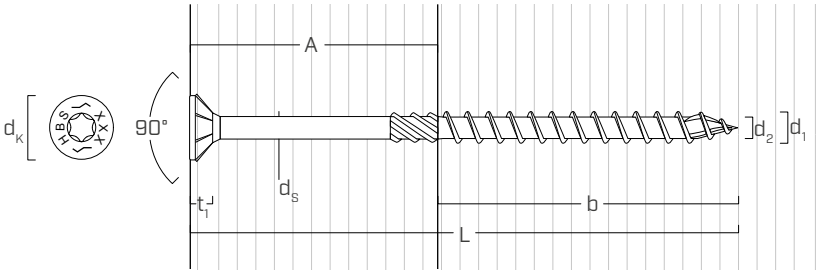
d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
8 TX 40	HBSEVO8100	100	52	48	100
	HBSEVO8120	120	60	60	100
	HBSEVO8140	140	60	80	100
	HBSEVO8160	160	80	80	100
	HBSEVO8180	180	80	100	100
	HBSEVO8200	200	80	120	100
	HBSEVO8220	220	80	140	100
	HBSEVO8240	240	80	160	100
	HBSEVO8260	260	80	180	100
	HBSEVO8280	280	80	200	100
	HBSEVO8300	300	100	200	100
	HBSEVO8320	320	100	220	100

RELATED PRODUCTS



HUS EVO
TURNED WASHER

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	[mm]	4	4,5	5	6	8
Head diameter	d_K	[mm]	8,00	9,00	10,00	12,00	14,50
Root diameter	d_2	[mm]	2,55	2,80	3,40	3,95	5,40
Shank diameter	d_S	[mm]	2,75	3,15	3,65	4,30	5,80
Head thickness	t_1	[mm]	2,80	2,80	3,10	4,50	4,50
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	2,5	2,5	3,0	4,0	5,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	-	-	3,5	4,0	6,0

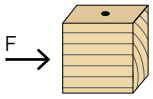
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		4	4,5	5	6	8
Factored tensile strength	Φf_u	[kN]		3,11	3,91	4,97	8,56	14,7
Bending yield strength	F_{yb}	[MPa]		1482	1515	1315	1188	1047
Factored shear strength of the screw	Φv_s	[kN]		1,96	2,36	3,49	4,71	8,79
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	41,83	47,06	52,29	52,38	69,83
			G=0.42	48,40	54,45	60,50	60,60	80,80
			G=0.49	54,75	61,60	68,44	68,55	91,40
			G=0.55	60,05	67,56	75,07	75,19	100,25
Specified head pull-through resistance per screw	f_{pt}	[kN]	G=0.35	0,44	0,55	0,66	0,92	1,28
			G=0.42	0,53	0,66	0,80	1,10	1,53
			G=0.49	0,62	0,77	0,93	1,29	1,79
			G=0.55	0,70	0,86	1,04	1,45	2,01

MINIMUM DISTANCES FOR SHEAR LOADS

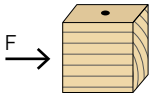
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**12·d‡**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
S_Q	**5·d**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
a_L	**15·d‡**	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
a	**10·d‡**	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_Q	**10·d**	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_P	**5·d**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*

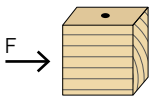
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



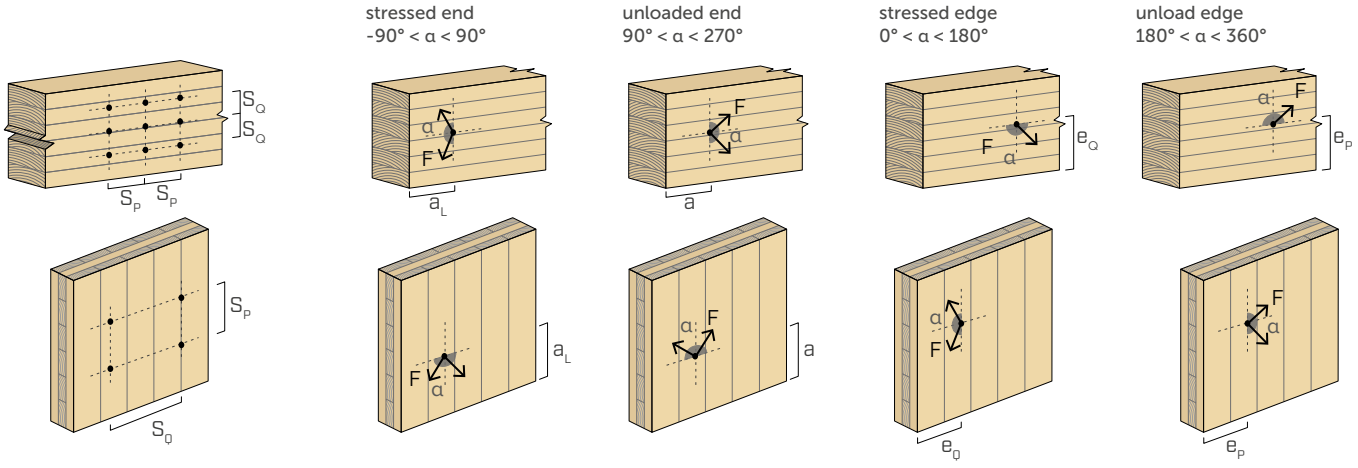
d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**18·d**	72	*2 13/16*	81	*3 3/16*	90	*3 1/2*	108	*4 1/4*	144	*5 11/16*
S_Q	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
a_L	**22·d**	88	*3 7/16*	99	*3 7/8*	110	*4 3/8*	132	*5 3/16*	176	*6 15/16*
a	**15·d**	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
e_Q	**12·d**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
e_P	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*

screws inserted **WITH pre-drilled hole**



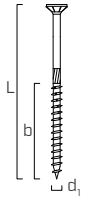
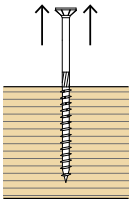
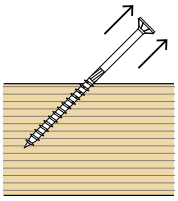
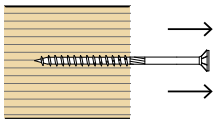
d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**5·d†**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
S_Q	**4·d**	16	*5/8*	18	*11/16*	20	*13/16*	24	*15/16*	32	*1 1/4*
a_L	**12·d†**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
a	**7·d†**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_Q	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_P	**3·d**	12	*1/2*	14	*9/16*	15	*9/16*	18	*11/16*	24	*15/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

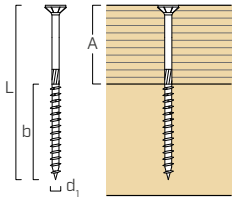
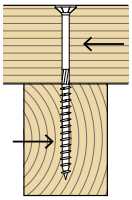
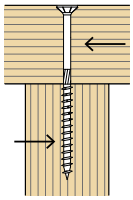
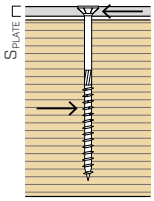
geometry			TENSION[1]												steel tension
			thread withdrawal								end grain				
			α = 90°				α = 45°				α = 0°				
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	40	*1 9/16*	24	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42	3,11
	50	*1 15/16*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	60	*2 3/8*	35	0,91	1,05	1,19	1,30	0,83	0,95	1,08	1,18	0,45	0,53	0,59	0,65	
4.5 *0.18*	45	*1 3/4*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	3,91
	50	*1 15/16*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	60	*2 3/8*	35	1,00	1,16	1,32	1,44	0,91	1,06	1,20	1,31	0,50	0,58	0,66	0,72	
	70	*2 3/4*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
5 *0.2*	50	*1 15/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	4,97
	60	*2 3/8*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	70	*2 3/4*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	80	*3 1/8*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	90	*3 1/2*	45	1,46	1,69	1,92	2,10	1,33	1,54	1,74	1,91	0,73	0,85	0,96	1,05	
	100	*4*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
6 *0.24*	60	*2 3/8*	30	0,88	1,02	1,15	1,26	0,80	0,93	1,05	1,15	0,44	0,51	0,58	0,63	8,56
	70	*2 3/4*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	80	*3 1/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	100	*4*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	120	*4 3/4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	180	*7 1/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	200	*8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
8 *0.32*	100	*4*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	14,7
	120	*4 3/4*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,82	
	140	*5 1/2*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,82	
	160	*6 1/4*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	180	*7 1/8*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	200	*8*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	220	*8 5/8*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	240	*9 1/2*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	260	*10 1/4*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	280	*11*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	300	*11 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	320	*12 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 43.

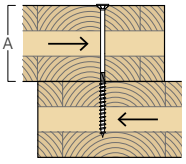
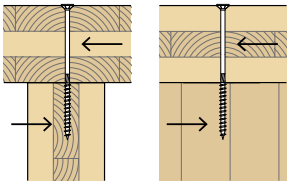
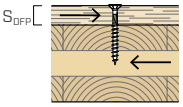
STRUCTURAL VALUES | LATERAL RESISTANCE

SHEAR[4]

geometry					timber-to-timber α = 90°				timber-to-timber α = 0°				steel-to-timber					
																		
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]					factored lateral resistance N_r				
					G				G					G				
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	S_{PLATE}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	
4 *0.16*	40	*1 9/16*	24	16	0,37	0,45	0,52	0,59	0,26	0,31	0,36	0,40	1,6 *1/16*	0,78	0,89	1,00	1,08	
	50	*1 15/16*	30	20	0,45	0,54	0,61	0,66	0,31	0,38	0,44	0,49		0,88	0,98	1,07	1,14	
	60	*2 3/8*	35	25	0,51	0,58	0,66	0,72	0,37	0,42	0,47	0,52		0,92	1,02	1,11	1,19	
4.5 *0.18*	45	*1 3/4*	30	15	0,46	0,55	0,64	0,71	0,31	0,38	0,44	0,49	1,6 *1/16*	0,98	1,12	1,26	1,35	
	50	*1 15/16*	30	20	0,50	0,60	0,70	0,78	0,35	0,42	0,49	0,55		1,02	1,16	1,27	1,35	
	60	*2 3/8*	35	25	0,58	0,68	0,77	0,84	0,41	0,49	0,56	0,61		1,09	1,21	1,32	1,41	
	70	*2 3/4*	40	30	0,64	0,73	0,82	0,90	0,45	0,52	0,58	0,64		1,13	1,26	1,37	1,47	
5 *0.2*	50	*1 15/16*	24	26	0,55	0,66	0,77	0,86	0,39	0,47	0,54	0,61	1,6 *1/16*	1,14	1,30	1,45	1,59	
	60	*2 3/8*	30	30	0,63	0,76	0,89	1,00	0,48	0,57	0,64	0,69		1,28	1,45	1,58	1,69	
	70	*2 3/4*	35	35	0,72	0,87	1,01	1,13	0,53	0,60	0,68	0,74		1,36	1,51	1,64	1,75	
	80	*3 1/8*	40	40	0,81	0,97	1,08	1,15	0,55	0,62	0,70	0,77		1,41	1,56	1,70	1,82	
	90	*3 1/2*	45	45	0,89	0,98	1,08	1,15	0,56	0,65	0,73	0,79		1,45	1,61	1,76	1,88	
	100	*4*	50	50	0,89	0,98	1,08	1,15	0,58	0,67	0,75	0,82		1,50	1,67	1,82	1,95	
6 *0.24*	60	*2 3/8*	30	30	0,75	0,90	1,05	1,18	0,52	0,62	0,72	0,81	3,2 *1/8*	1,47	1,68	1,88	2,04	
	70	*2 3/4*	40	30	0,85	1,02	1,19	1,33	0,61	0,72	0,84	0,93		1,66	1,87	2,04	2,17	
	80	*3 1/8*	40	40	0,95	1,14	1,32	1,48	0,68	0,77	0,86	0,93		1,69	1,87	2,04	2,17	
	100	*4*	50	50	1,14	1,27	1,38	1,48	0,73	0,83	0,94	1,03		1,78	1,98	2,16	2,30	
	120	*4 3/4*	60	60	1,14	1,27	1,38	1,48	0,77	0,88	0,99	1,09		1,87	2,08	2,28	2,43	
	140	*5 1/2*	75	65	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	160	*6 1/4*	75	85	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	180	*7 1/8*	75	105	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
	200	*8*	75	125	1,14	1,27	1,38	1,48	0,83	0,95	1,08	1,18		2,01	2,24	2,46	2,63	
8 *0.32*	100	*4*	52	48	1,42	1,71	1,99	2,24	1,05	1,24	1,39	1,51	3,2 *1/8*	2,83	3,13	3,41	3,63	
	120	*4 3/4*	60	60	1,66	2,00	2,23	2,39	1,13	1,29	1,44	1,57		2,92	3,24	3,54	3,77	
	140	*5 1/2*	60	80	1,76	2,02	2,23	2,39	1,13	1,29	1,44	1,57		2,92	3,24	3,54	3,77	
	160	*6 1/4*	80	80	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	180	*7 1/8*	80	100	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	200	*8*	80	120	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	220	*8 5/8*	80	140	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	240	*9 1/2*	80	160	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	260	*10 1/4*	80	180	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	280	*11*	80	200	1,85	2,05	2,23	2,39	1,22	1,40	1,58	1,72		3,17	3,52	3,86	4,13	
	300	*11 3/4*	100	200	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	
	320	*12 5/8*	100	220	1,85	2,05	2,23	2,39	1,32	1,52	1,71	1,88		3,41	3,81	4,17	4,48	

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 43.

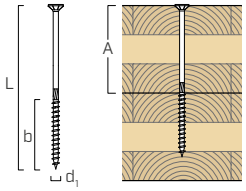
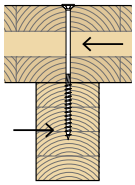
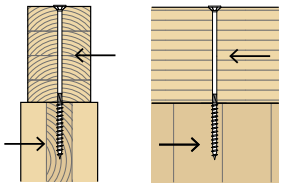
geometry					SHEAR[4] CLT-CLT lateral face α = 90°				SHEAR[4] CLT-CLT α = 0°				SHEAR[4] spline joint lateral face α = 90°				
																	
					factored lateral resistance N_r [5]				factored lateral resistance N_r [2][3]				S_{DFP}	factored lateral resistance N_r			
d_1	L		b	A	G				G					G			
					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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	30	30	0,69	0,83	0,97	1,09	0,48	0,57	0,66	0,74		0,91	1,00	1,08	1,14
	70	*2 3/4*	40	40	0,78	0,94	1,09	1,22	0,57	0,64	0,71	0,76		1,00	1,09	1,12	1,14
	80	*3 1/8*	40	40	0,87	1,04	1,21	1,36	0,65	0,73	0,82	0,89		1,05	1,09	1,12	1,14
	100	*4*	50	50	1,04	1,21	1,32	1,42	0,69	0,79	0,89	0,97		1,05	1,09	1,12	1,14
6 *0.24*	120	*4 3/4*	60	60	1,09	1,21	1,32	1,42	0,72	0,83	0,94	1,03	12,7 *1/2*	1,05	1,09	1,12	1,14
	140	*5 1/2*	75	75	1,09	1,21	1,32	1,42	0,74	0,85	0,96	1,05		1,05	1,09	1,12	1,14
	160	*6 1/4*	75	85	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	180	*7 1/8*	75	105	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	200	*8*	75	125	1,09	1,21	1,32	1,42	0,78	0,90	1,01	1,11		1,05	1,09	1,12	1,14
	100	*4*	52	55	1,30	1,56	1,83	2,05	1,00	1,13	1,26	1,36		1,69	1,79	1,84	1,88
	120	*4 3/4*	60	60	1,52	1,82	2,13	2,28	1,07	1,22	1,37	1,49		1,73	1,79	1,84	1,88
	140	*5 1/2*	60	80	1,64	1,89	2,13	2,28	1,07	1,22	1,37	1,49		1,73	1,79	1,84	1,88
	160	*6 1/4*	80	80	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	180	*7 1/8*	80	100	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
8 *0.32*	200	*8*	80	120	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	220	*8 5/8*	80	140	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62	19,1 *3/4*	1,73	1,79	1,84	1,88
	240	*9 1/2*	80	160	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	260	*10 1/4*	80	180	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	280	*11*	80	200	1,76	1,96	2,14	2,28	1,15	1,32	1,49	1,62		1,73	1,79	1,84	1,88
	300	*11 3/4*	100	200	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88
	320	*12 5/8*	100	220	1,76	1,96	2,14	2,28	1,24	1,42	1,61	1,76		1,73	1,79	1,84	1,88

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 43.

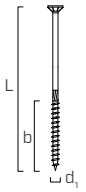
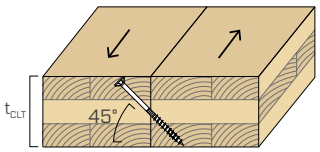
STRUCTURAL VALUES | LATERAL RESISTANCE

SHEAR [4]

geometry					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	60	*2 3/8*	30	30	0,72	0,86	1,01	1,13	0,51	0,61	0,70	0,77
	70	*2 3/4*	40	40	0,82	0,98	1,15	1,27	0,59	0,70	0,81	0,89
	80	*3 1/8*	40	40	0,91	1,09	1,27	1,41	0,65	0,74	0,82	0,89
	100	*4*	50	50	1,08	1,24	1,35	1,45	0,69	0,80	0,89	0,98
	120	*4 3/4*	60	60	1,11	1,24	1,35	1,45	0,73	0,84	0,94	1,03
	140	*5 1/2*	75	75	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	160	*6 1/4*	75	85	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	180	*7 1/8*	75	105	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
	200	*8*	75	125	1,11	1,24	1,35	1,45	0,78	0,90	1,02	1,12
8 *0.32*	100	*4*	52	55	1,37	1,64	1,91	2,15	1,02	1,19	1,33	1,45
	120	*4 3/4*	60	60	1,59	1,91	2,16	2,33	1,07	1,23	1,38	1,50
	140	*5 1/2*	60	80	1,73	2,00	2,18	2,33	1,07	1,23	1,38	1,50
	160	*6 1/4*	80	80	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	180	*7 1/8*	80	100	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	200	*8*	80	120	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	220	*8 5/8*	80	140	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	240	*9 1/2*	80	160	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	260	*10 1/4*	80	180	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	280	*11*	80	200	1,80	2,00	2,18	2,33	1,16	1,33	1,50	1,64
	300	*11 3/4*	100	200	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77
	320	*12 5/8*	100	220	1,80	2,00	2,18	2,33	1,25	1,43	1,62	1,77

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 43.

geometry					SHEAR [4][6]							
					butt-joint α = 90°				butt-joint α = 45°			
												
					factored lateral resistance N_r				factored lateral resistance N_r			
d_1	L		b	t_{CLT}	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	100	*4*	50	70	0,88	1,02	1,10	1,16	0,50	0,61	0,71	0,79
	120	*4 3/4*	60	85	0,93	1,02	1,10	1,16	0,61	0,73	0,83	0,88
	140	*5 1/2*	75	100	0,93	1,02	1,10	1,16	0,68	0,77	0,83	0,88
	160	*6 1/4*	75	115	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	180	*7 1/8*	75	125	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
	200	*8*	75	140	0,93	1,02	1,10	1,16	0,70	0,77	0,83	0,88
8 *0.32*	100	*4*	52	70	1,08	1,30	1,51	1,70	0,62	0,74	0,86	0,97
	120	*4 3/4*	60	85	1,30	1,56	1,81	1,93	0,74	0,89	1,04	1,16
	140	*5 1/2*	60	100	1,42	1,62	1,82	1,93	0,86	1,04	1,21	1,31
	160	*6 1/4*	80	115	1,54	1,69	1,82	1,93	0,99	1,19	1,38	1,46
	180	*7 1/8*	80	125	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	200	*8*	80	140	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	220	*8 5/8*	80	155	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	240	*9 1/2*	80	170	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	260	*10 1/4*	80	185	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	280	*11*	80	200	1,54	1,69	1,82	1,93	1,08	1,23	1,38	1,46
	300	*11 3/4*	100	210	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46
	320	*12 5/8*	100	225	1,54	1,69	1,82	1,93	1,16	1,28	1,38	1,46

α = screw-to-grain angle

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- The specified head pull-through design values are taken from report ELC-4645. The withdrawal and head pull-through values provided in this datasheet are also applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- HBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) HBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

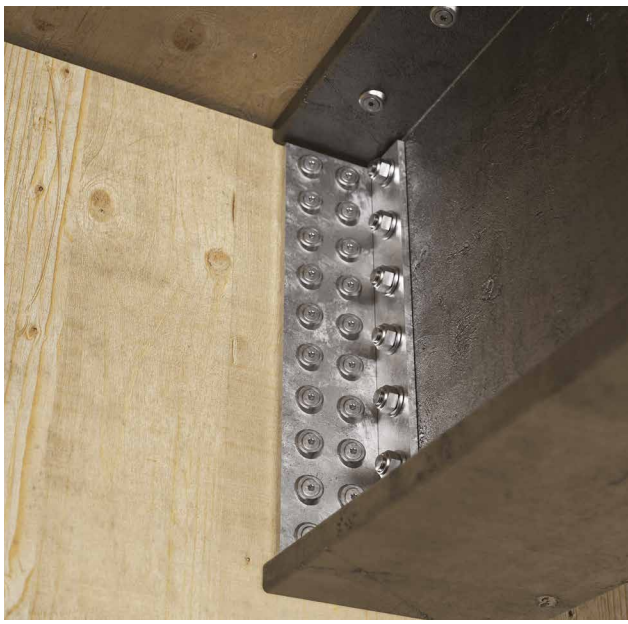
(5) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

(6) The lateral resistance calculation for butt joints assumes the screws are installed on the CLT member's narrow face.

HUS

TURNED WASHER

ICC ES ELC-4645 | ICC ES ESR-4645 | UKCA UKTA-0836 22/6195 | CE ETA-11/0030



COMPATIBILITY
It is the ideal coupling for countersunk screws (HBS, VGS, SBS-SPP, SCI, etc.) when the axial strength of the connection is to be increased.

TIMBER-TO-METAL
It is the optimal choice for connections on metal plates with cylindrical holes.

HUS EVO
The HUS EVO version increases the washer's corrosion resistance due to the special surface treatment. This allows it to be used in exposure condition 3 and atmospheric corrosion class C4.

HUS 15°
The 15° angled washer is specifically designed for particular timber-to-metal applications where just a small angle is needed for screw insertion. The HUS BAND double-sided adhesive tape holds the washer in place during overhead applications.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



HUS



HUS 15°



HUS EVO



HUS A4

MATERIAL

HUS 15°
EC1 or WET, C2, T3
alu — aluminium alloy EN AW 6082-T6

HUS
EC1, DRY, C2, T2
Zn ELECTRO PLATED — electrogalvanized carbon steel

HUS EVO
EC1, EC3, C4, T3
C4 EVO COATING — carbon steel with C4 EVO coating

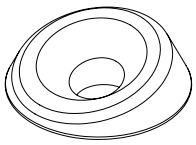
HUS A4
EC1, EC2, EC3, EC4, WET, C5, T5
A4 AISI 316 — A4 | AISI316 austenitic stainless steel



FIELDS OF USE

- thin, thick metal plates with cylindrical holes
- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods

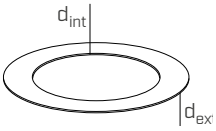
CODES AND DIMENSIONS



alu

HUS 15° - 15° angled washer

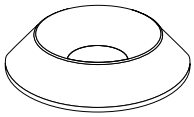
CODE	d_{HBS} [mm]	d_{VGS} [mm]	pcs
HUS815	8	9	50



HUS BAND - double-sided adhesive for HUS washers

CODE	d_{int} [mm]	d_{ext} [mm]	pcs
HUSBAND	22	30	50

Compatible with HUS815, HUS10, HUS12, HUS10A4.



Zn ELECTRO PLATED

HUS - turned washer

CODE	d_{HBS} [mm]	d_{VGS} [mm]	pcs
HUS6	6	-	100
HUS8	8	9	50
HUS10	10	11	50
HUS12	12	13	25

C4 EVO COATING

HUS EVO - turned washer

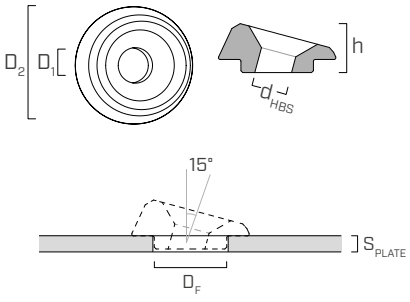
CODE	$d_{HBS\ EVO}$ [mm]	$d_{VGS\ EVO}$ [mm]	pcs
HUSEVO6	6	-	100
HUSEVO8	8	9	50

A4 AISI 316

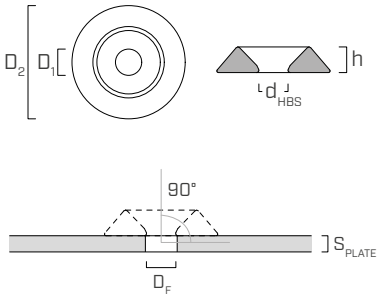
HUS A4 - turned washer

CODE	d_{SCI} [mm]	$d_{VGS\ A4}$ [mm]	pcs
HUS6A4	6	-	100
HUS8A4	8	9	100
HUS10A4	-	11	50

GEOMETRY AND MECHANICAL CHARACTERISTICS



HUS 15°



HUS - HUS EVO - HUS A4

GEOMETRY

Washer			HUS815	HUS6 HUSEVO6 HUS6A4	HUS8 HUSEVO8 HUS8A4	HUS10 HUS10A4	HUS12
Internal diameter	D_1	[mm]	9,50	7,50	8,50	10,80	14,00
External diameter	D_2	[mm]	31,40	20,00	25,00	30,00	37,00
Height	h	[mm]	13,60	4,50	5,50	6,50	8,50
Plate hole diameter (1)	D_F	[mm]	20 - 22	6,5 - 8,0	8,5 - 10,0	10,5 - 12,0	12,5 - 14,0
Steel plate thickness	S_{PLATE}	[mm]	4 - 18	-	-	-	-

(1) The choice of diameter is also linked to the diameter of the screw used.

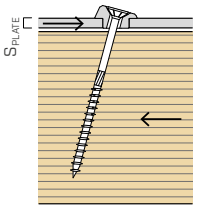
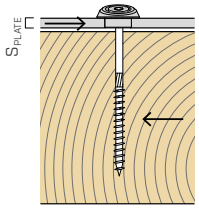
MECHANICAL PROPERTIES

Nominal diameter	$d_{1,HBS}$ [mm]		6	8	10	12
Specified head pull-through resistance per screw with HUS washer(*)	F_{pt}	[kN]	G=0.35	2,72	3,85	5,01	6,63
			G=0.42	3,27	4,62	6,02	7,96
			G=0.49	3,81	5,39	7,02	9,28
			G=0.55	4,28	6,05	7,88	10,42

(*)Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3, and are likewise applicable to CLT connections. These values do not apply to HUS 15° washers.

STRUCTURAL VALUES | LATERAL RESISTANCE

HUS 15°

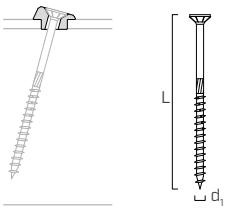
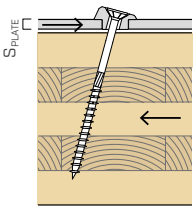
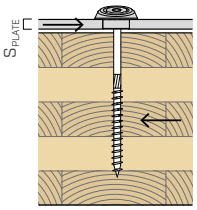
geometry				SHEAR[1] [2]							
				steel-to-timber α=75°				steel-to-timber α=75°			
											
				factored lateral resistance N_r [3]				factored lateral resistance N_r [4]			
				G				G			
	$d_{1,HBS}$	L	S_{PLATE}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
	[mm] *[in]*	[mm]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
HUS 15°	8 0.32	80 *3 1/8*	6,4 *1/4*	2,32	2,65	2,96	3,23	2,35	2,68	3,00	3,27
		100 *4*		2,53	2,90	3,26	3,49	2,56	2,94	3,27	3,49
		120 *4 3/4*		2,81	3,11	3,40	3,63	2,81	3,11	3,40	3,63
		140 *5 1/2*		2,81	3,11	3,40	3,63	2,81	3,11	3,40	3,63
		160 *6 1/4*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		180 *7 1/8*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		200 *8*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		220 *8 5/8*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		240 *9 1/2*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		260 *10 1/4*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		280 *11*		3,05	3,39	3,71	3,98	3,05	3,39	3,71	3,98
		300 *11 3/4*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		320 *12 5/8*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		340 *13 3/8*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		360 *14 1/4*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		380 *15*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		400 *15 3/4*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		440 *17 1/4*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		480 *19*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		520 *20 1/2*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		560 *22*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		580 *22 13/16*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32
		600 *23 5/8*		3,29	3,67	4,03	4,32	3,29	3,67	4,03	4,32

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 52.

STRUCTURAL VALUES | LATERAL RESISTANCE

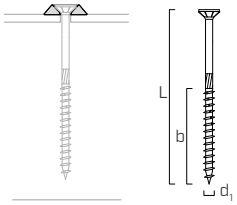
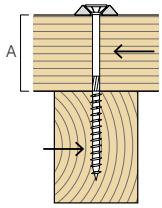
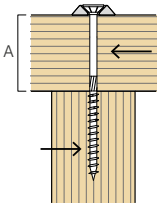
HUS 15°

geometry					SHEAR[1] [2]							
					steel-to-CLT α=75°				steel-to-CLT α=75°			
												
	$d_{1,HBS}$ [mm] [in]	L [mm]	L [in]	S_{PLATE} [mm] [in]	factored lateral resistance N_r [3] G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r [4] G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]
HUS 15°	8 0.32	80	3 1/8	6,4 1/4	2,20	2,50	2,80	3,05	2,22	2,53	2,83	3,08
		100	4		2,39	2,73	3,07	3,35	2,41	2,77	3,11	3,35
		120	4 3/4		2,67	2,99	3,27	3,49	2,70	2,99	3,27	3,49
		140	5 1/2		2,70	2,99	3,27	3,49	2,70	2,99	3,27	3,49
		160	6 1/4		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		180	7 1/8		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		200	8		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		220	8 5/8		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		240	9 1/2		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		260	10 1/4		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		280	11		2,94	3,27	3,58	3,84	2,94	3,27	3,58	3,84
		300	11 3/4		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		320	12 5/8		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		340	13 3/8		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		360	14 1/4		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		380	15		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		400	15 3/4		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		440	17 1/4		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		480	19		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		520	20 1/2		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		560	22		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		580	22 13/16		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18
		600	23 5/8		3,18	3,55	3,90	4,18	3,18	3,55	3,90	4,18

α = screw-to-grain angle

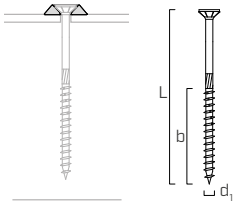
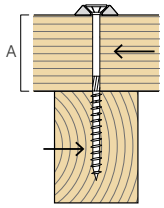
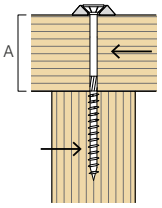
NOTES and GENERAL PRINCIPLES on page 52.

HUS/HUS EVO

geometry					SHEAR[1] [2]							
					timber-to-timber α=90°				timber-to-timber α=0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[5] [6]			
					G				G			
	$d_{1,HBS}$ [mm] *[in]*	L [mm]	L *[in]*	b [mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
HUS HUS EVO	6 0.24	80	*3 1/8*	40	35	0,90	1,08	1,26	1,41	0,66	0,81	0,86	0,93
		90	*3 1/2*	50	35	0,99	1,14	1,29	1,41	0,70	0,88	0,94	1,03
		100	*4*	50	45	1,09	1,26	1,38	1,48	0,73	0,90	0,94	1,03
		110	*4 3/8*	60	45	1,09	1,26	1,38	1,48	0,77	0,95	0,99	1,09
		120	*4 3/4*	60	55	1,14	1,27	1,38	1,48	0,77	0,95	0,99	1,09
		130	*5 1/8*	60	65	1,14	1,27	1,38	1,48	0,77	0,95	0,99	1,09
		140	*5 1/2*	75	60	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		150	*6*	75	70	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		160	*6 1/4*	75	80	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		180	*7 1/8*	75	100	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		200	*8*	75	120	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		220	*8 5/8*	75	140	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		240	*9 1/2*	75	160	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		260	*10 1/4*	75	180	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		280	*11*	75	200	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		300	*11 3/4*	75	220	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		320	*12 5/8*	75	240	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		340	*13 3/8*	75	260	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		360	*14 1/4*	75	280	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		380	*15*	75	300	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
		400	*15 3/4*	75	320	1,14	1,27	1,38	1,48	0,83	1,04	1,08	1,18
HUS HUS EVO	8 0.32	80	*3 1/8*	52	22	1,11	1,33	1,56	1,75	0,74	0,97	1,03	1,16
		100	*4*	52	42	1,35	1,62	1,89	2,12	0,98	1,26	1,37	1,51
		120	*4 3/4*	60	54	1,59	1,91	2,18	2,39	1,13	1,44	1,44	1,57
		140	*5 1/2*	60	74	1,76	2,02	2,23	2,39	1,13	1,44	1,44	1,57
		160	*6 1/4*	80	74	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		180	*7 1/8*	80	94	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		200	*8*	80	114	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		220	*8 5/8*	80	134	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		240	*9 1/2*	80	154	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		260	*10 1/4*	80	174	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		280	*11*	80	194	1,85	2,05	2,23	2,39	1,22	1,59	1,58	1,72
		300	*11 3/4*	100	194	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		320	*12 5/8*	100	214	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		340	*13 3/8*	100	234	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		360	*14 1/4*	100	254	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		380	*15*	100	274	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		400	*15 3/4*	100	294	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		440	*17 1/4*	100	334	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		480	*19*	100	374	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		520	*20 1/2*	100	414	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		560	*22*	100	454	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		580	*22 13/16*	100	474	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88
		600	*23 5/8*	100	494	1,85	2,05	2,23	2,39	1,32	1,73	1,71	1,88

STRUCTURAL VALUES | LATERAL RESISTANCE

HUS/HUS EVO

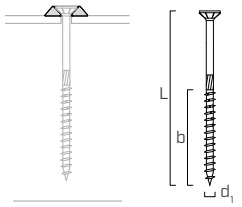
geometry					SHEAR[1] [2]							
					timber-to-timber α=90°				timber-to-timber α=0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [5] [6]			
					G				G			
	$d_{1,HBS}$	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
	[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
HUS	10 0.40	80	*3 1/8*	52	21	1,35	1,62	1,89	2,13	0,91	1,20	1,24	1,38
		100	*4*	52	41	1,63	1,96	2,29	2,57	1,19	1,54	1,63	1,82
		120	*4 3/4*	60	53	1,91	2,30	2,68	3,01	1,41	1,84	1,96	2,14
		140	*5 1/2*	60	73	2,19	2,63	3,00	3,28	1,54	2,01	1,96	2,14
		160	*6 1/4*	80	73	2,48	2,88	3,18	3,40	1,65	2,19	2,12	2,31
		180	*7 1/8*	80	93	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		200	*8*	80	113	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		220	*8 5/8*	80	133	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		240	*9 1/2*	80	153	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		260	*10 1/4*	80	173	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		280	*11*	80	193	2,60	2,92	3,18	3,40	1,65	2,19	2,12	2,31
		300	*11 3/4*	100	193	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		320	*12 5/8*	100	213	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		340	*13 3/8*	100	233	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		360	*14 1/4*	100	253	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		380	*15*	100	273	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		400	*15 3/4*	100	293	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		440	*17 1/4*	100	333	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		480	*19*	100	373	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		520	*20 1/2*	100	413	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		560	*22*	100	453	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
		600	*23 5/8*	100	493	2,63	2,92	3,18	3,40	1,76	2,38	2,28	2,49
HUS	12 0.48	120	*4 3/4*	80	31	2,17	2,57	2,87	3,12	1,41	1,96	1,97	2,21
		160	*6 1/4*	80	71	2,81	3,34	3,76	4,06	1,95	2,65	2,50	2,73
		200	*8*	80	111	3,04	3,47	3,79	4,06	1,95	2,65	2,50	2,73
		240	*9 1/2*	80	151	3,04	3,47	3,79	4,06	1,95	2,65	2,50	2,73
		280	*11*	80	191	3,04	3,47	3,79	4,06	1,95	2,65	2,50	2,73
		320	*12 5/8*	120	191	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		360	*14 1/4*	120	231	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		400	*15 3/4*	120	271	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		440	*17 1/4*	120	311	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		480	*19*	120	351	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		520	*20 1/2*	120	391	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		560	*22*	120	431	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		600	*23 5/8*	120	471	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		700	*27 1/2*	120	571	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		800	*31 1/2*	120	671	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		900	*35 1/2*	120	771	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13
		1000	*39 3/8*	120	871	3,13	3,47	3,79	4,06	2,20	3,04	2,86	3,13

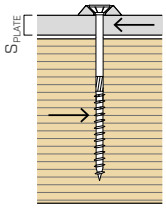
α = screw-to-grain angle

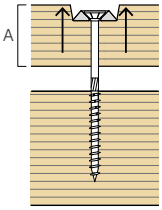
NOTES and GENERAL PRINCIPLES on page 52.

STRUCTURAL VALUES | LATERAL AND HEAD PULL-THROUGH RESISTANCE

HUS/HUS EVO



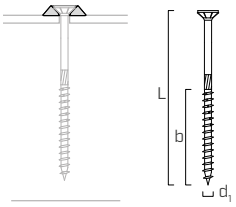
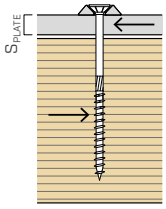
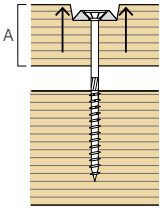




geometry						SHEAR[1] [2] steel-to-timber				TENSION head pull-through with HUS washer			
						factored lateral resistance N_r				factored head pull-through resistance P_{pt}			
						G				G			
	$d_{1,HBS}$	L		b	A	S_{PLATE}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
	[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
HUS HUS EVO	6 0.24	80	*3 1/8*	40	35	3,2 *1/8*	1,69	1,87	2,04	2,17	1,91	2,29	2,67	2,99
		90	*3 1/2*	50	35		1,78	1,98	2,16	2,30	1,91	2,29	2,67	2,99
		100	*4*	50	45		1,78	1,98	2,16	2,30	1,91	2,29	2,67	2,99
		110	*4 3/8*	60	45		1,87	2,08	2,28	2,43	1,91	2,29	2,67	2,99
		120	*4 3/4*	60	55		1,87	2,08	2,28	2,43	1,91	2,29	2,67	2,99
		130	*5 1/8*	60	65		1,87	2,08	2,28	2,43	1,91	2,29	2,67	2,99
		140	*5 1/2*	75	60		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		150	*6*	75	70		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		160	*6 1/4*	75	80		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		180	*7 1/8*	75	100		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		200	*8*	75	120		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		220	*8 5/8*	75	140		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		240	*9 1/2*	75	160		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		260	*10 1/4*	75	180		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		280	*11*	75	200		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		300	*11 3/4*	75	220		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		320	*12 5/8*	75	240		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		340	*13 3/8*	75	260		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		360	*14 1/4*	75	280		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		380	*15*	75	300		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
		400	*15 3/4*	75	320		2,01	2,24	2,46	2,63	1,91	2,29	2,67	2,99
HUS HUS EVO	8 0.32	80	*3 1/8*	52	22	3,2 *1/8*	2,53	2,89	3,25	3,54	2,69	3,23	3,77	4,23
		100	*4*	52	42		2,77	3,13	3,41	3,63	2,69	3,23	3,77	4,23
		120	*4 3/4*	60	54		2,92	3,24	3,54	3,77	2,69	3,23	3,77	4,23
		140	*5 1/2*	60	74		2,92	3,24	3,54	3,77	2,69	3,23	3,77	4,23
		160	*6 1/4*	80	74		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		180	*7 1/8*	80	94		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		200	*8*	80	114		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		220	*8 5/8*	80	134		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		240	*9 1/2*	80	154		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		260	*10 1/4*	80	174		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		280	*11*	80	194		3,17	3,52	3,86	4,13	2,69	3,23	3,77	4,23
		300	*11 3/4*	100	194		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		320	*12 5/8*	100	214		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		340	*13 3/8*	100	234		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		360	*14 1/4*	100	254		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		380	*15*	100	274		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		400	*15 3/4*	100	294		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		440	*17 1/4*	100	334		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		480	*19*	100	374		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		520	*20 1/2*	100	414		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		560	*22*	100	454		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		580	*22 13/16*	100	474		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23
		600	*23 5/8*	100	494		3,41	3,81	4,17	4,48	2,69	3,23	3,77	4,23

STRUCTURAL VALUES | LATERAL AND HEAD PULL-THROUGH RESISTANCE

HUS/HUS EVO

geometry						SHEAR[1] [2] steel-to-timber				TENSION head pull-through with HUS washer			
													
	$d_{1,HBS}$	L		b	A	S_{PLATE}	factored lateral resistance N_r				factored head pull-through resistance P_{pt}			
							G				G			
	[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm] *[in]*	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
							[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
HUS	10 0.40	80	*3 1/8*	52	21	6,4 *1/4*	3,20	3,64	4,07	4,42	3,51	4,21	4,91	5,51
		100	*4*	52	41		3,48	3,98	4,46	4,86	3,51	4,21	4,91	5,51
		120	*4 3/4*	60	53		3,88	4,43	4,83	5,15	3,51	4,21	4,91	5,51
		140	*5 1/2*	60	73		4,01	4,43	4,83	5,15	3,51	4,21	4,91	5,51
		160	*6 1/4*	80	73		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		180	*7 1/8*	80	93		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		200	*8*	80	113		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		220	*8 5/8*	80	133		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		240	*9 1/2*	80	153		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		260	*10 1/4*	80	173		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		280	*11*	80	193		4,31	4,79	5,23	5,59	3,51	4,21	4,91	5,51
		300	*11 3/4*	100	193		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		320	*12 5/8*	100	213		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		340	*13 3/8*	100	233		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		360	*14 1/4*	100	253		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		380	*15*	100	273		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		400	*15 3/4*	100	293		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		440	*17 1/4*	100	333		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		480	*19*	100	373		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		520	*20 1/2*	100	413		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		560	*22*	100	453		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
		600	*23 5/8*	100	493		4,62	5,14	5,63	6,03	3,51	4,21	4,91	5,51
HUS	12 0.48	120	*4 3/4*	80	31	6,4 *1/4*	4,84	5,55	6,18	6,60	4,64	5,57	6,50	7,29
		160	*6 1/4*	80	71		5,09	5,65	6,18	6,60	4,64	5,57	6,50	7,29
		200	*8*	80	111		5,09	5,65	6,18	6,60	4,64	5,57	6,50	7,29
		240	*9 1/2*	80	151		5,09	5,65	6,18	6,60	4,64	5,57	6,50	7,29
		280	*11*	80	191		5,09	5,65	6,18	6,60	4,64	5,57	6,50	7,29
		320	*12 5/8*	120	191		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		360	*14 1/4*	120	231		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		400	*15 3/4*	120	271		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		440	*17 1/4*	120	311		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		480	*19*	120	351		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		520	*20 1/2*	120	391		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		560	*22*	120	431		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		600	*23 5/8*	120	471		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		700	*27 1/2*	120	571		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		800	*31 1/2*	120	671		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		900	*35 1/2*	120	771		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29
		1000	*39 3/8*	120	871		5,83	6,50	7,14	7,65	4,64	5,57	6,50	7,29

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 52.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3, and are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- HBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(2) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in Table 1A of the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(3) The projected embedment length of the screw within the main member was taken as equal to its penetration length into the point-side member.

(4) The length along the axis of the screw within the main member was taken as equal to its penetration length into the point-side member.

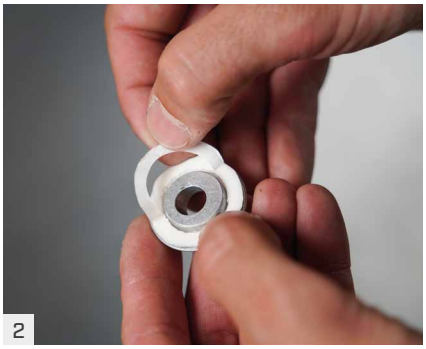
(5) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(6) HBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

HUS 15° INSTALLATION



Drill a D_F = 20 mm diameter hole in the metal plate at the insertion point of the HUS815 washer.



We recommend applying HUSBAND adhesive underneath the HUS815 washer to facilitate application.



Remove the liner and apply the washer at the hole, paying attention to the insertion direction.



Drill a guide hole with a diameter of 5 mm and a minimum length of 20 mm, preferably using the JIGVGU945 template to ensure the correct installation direction.

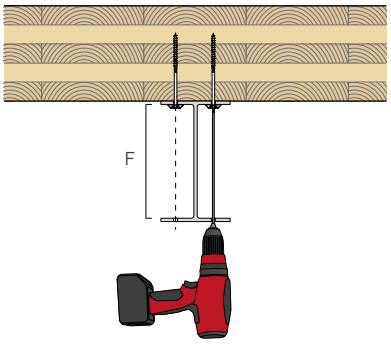


Install the HBS screw of the desired length. Do not use pulse screw guns.
Pay attention when tightening the connection.



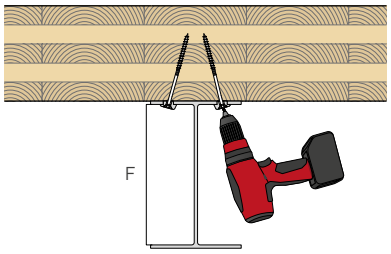
Installation completed.
The 15° screw angle ensures that the distance to the head of the panel (or beam) is maintained.

STEEL-TIMBER INSTALLATION FROM BELOW



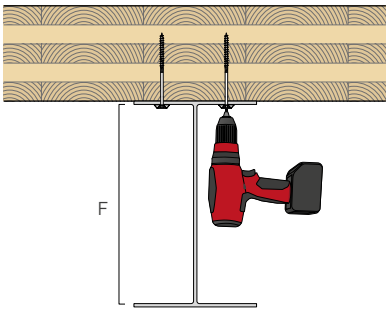
F < 200 mm

If the clearance (F) is small, the screws are installed using a long insert; both flanges must be drilled.



F = 200 - 300 mm

In this F range, there are not enough long bits and not enough free space for the operator to manoeuvre. The slight inclination of the HUS 15° allows for easy fastening.



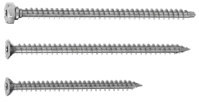
F > 300 mm

When sufficient free space is available for installation, a HUS washer can also be used, within the minimum distances.

RELATED PRODUCTS



HBS



VGS



CATCH



TORQUE LIMITER

TBS

FLANGE HEAD SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

INTEGRATED WASHER

The flange head serves as washer and ensures high head strength and pull-through. Ideal in the presence of wind or variations in timber dimensions.

3 THORNS TIP

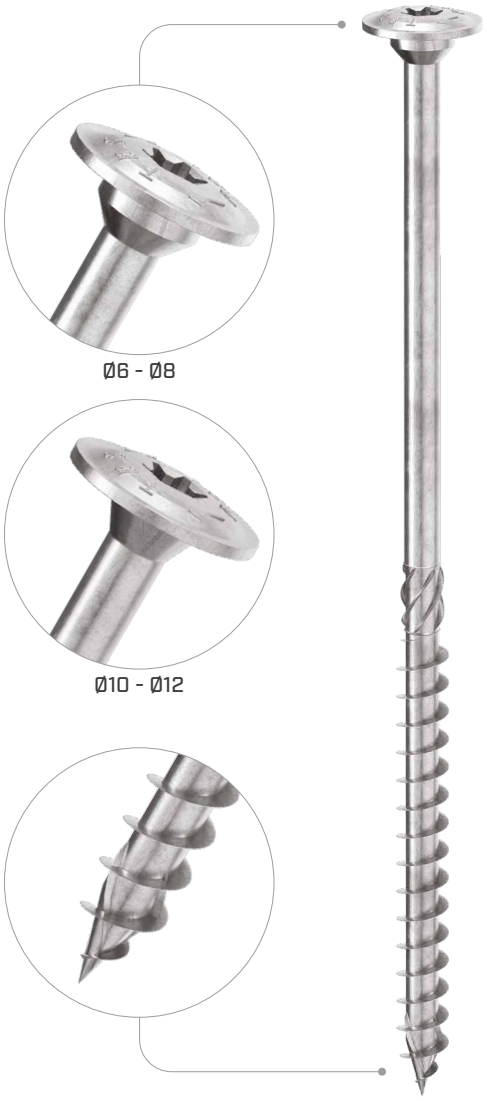
Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

NEW-GENERATION WOODS

Tested and certified for use on a wide variety of engineered timbers such as CLT, GL, LVL, OSB and Beech LVL. Extremely versatile, the TBS screw guarantees the use of new-generation woods for the creation of increasingly innovative and sustainable structures.

FAST

With the 3 THORNS tip, screw grip becomes more reliable and faster, while maintaining the usual mechanical performance. More speed, less effort.



BIT INCLUDED

DIAMETER [mm]	6 (6 – 12) 16
LENGTH [mm]	40 (40 – 1000) 1000
SERVICE CONDITION	EC1 DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED — electrogalvanized carbon steel
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- fibreboard and MDF panels
- solid timber and glulam
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.



SECONDARY BEAMS

Ideal for fastening joists to sill beams to achieve high wind uplift resistance. The flange head guarantees excellent tensile strength which means the use of additional lateral fastening systems can be avoided.

I-JOIST

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

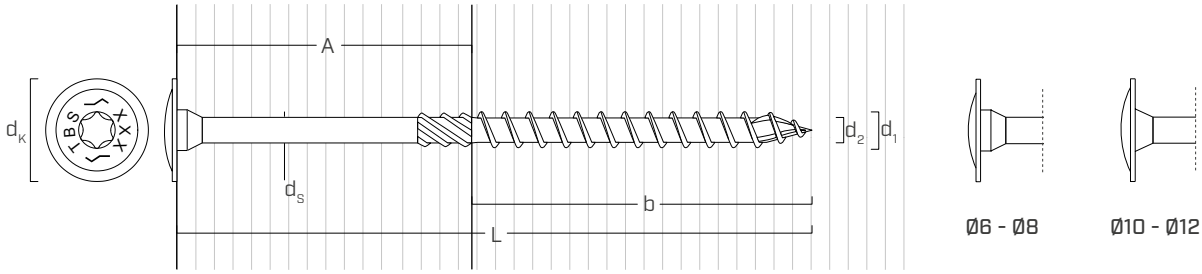


Fastening SIP panels with 8 mm diameter TBS screws.



Fastening CLT walls with TBS screws.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**6**	**8**	**10**	**12**
Head diameter	d_K	[mm]	15,50	19,00	25,00	29,00
Root diameter	d_2	[mm]	3,95	5,40	6,40	6,80
Shank diameter	d_S	[mm]	4,30	5,80	7,00	8,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	4,0	5,0	6,0	7,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	6,0	7,0	8,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**6**	**8**	**10**	**12**
Factored tensile strength	Φf_u	[kN]		8,56	14,70	19,51	22,11
Bending yield strength	F_{yb}	[MPa]		1188	1047	1080	1114
Factored shear strength of the screw	Φv_s	[kN]		4,71	8,79	12,35	13,95
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,38	69,83	87,29	104,75
			G=0.42	60,60	80,80	101,00	121,20
			G=0.49	68,55	91,40	114,26	137,11
			G=0.55	75,19	100,25	125,32	150,38
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	1,79	2,51	3,85	4,78
			G=0.42	2,15	3,01	4,62	5,74
			G=0.49	2,50	3,51	5,39	6,69
			G=0.55	2,81	3,94	6,05	7,51

CODES AND DIMENSIONS

d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
6 TX 30	15,5	TBS660	60	40	20	100
		TBS670	70	40	30	100
		TBS680	80	50	30	100
		TBS690	90	50	40	100
		TBS6100	100	60	40	100
		TBS6120	120	75	45	100
		TBS6140	140	75	65	100
		TBS6160	160	75	85	100
		TBS6180	180	75	105	100
		TBS6200	200	75	125	100
		TBS6220	220	100	120	100
		TBS6240	240	100	140	100
		TBS6260	260	100	160	100
		TBS6280	280	100	180	100
		TBS6300	300	100	200	100
		TBS6320	320	100	220	100
		TBS6360	360	100	260	100
		TBS6400	400	100	300	100
8 TX 40	19,0	TBS840	40	32	8	100
		TBS860	60	52	8	100
		TBS880	80	52	28	50
		TBS8100	100	52	48	50
		TBS8120	120	80	40	50
		TBS8140	140	80	60	50
		TBS8160	160	100	60	50
		TBS8180	180	100	80	50
		TBS8200	200	100	100	50
		TBS8220	220	100	120	50
		TBS8240	240	100	140	50
		TBS8260	260	100	160	50
		TBS8280	280	100	180	50
		TBS8300	300	100	200	50
		TBS8320	320	100	220	50
		TBS8340	340	100	240	50
		TBS8360	360	100	260	50
		TBS8380	380	100	280	50
		TBS8400	400	100	300	50
		TBS8440	440	100	340	50
		TBS8480	480	100	380	50
		TBS8520	520	100	420	50
		TBS8560	560	100	460	50
		TBS8580	580	100	480	50
		TBS8600	600	100	500	50

d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
10 TX 50	25,0	TBS10100	100	52	48	50
		TBS10120	120	60	60	50
		TBS10140	140	60	80	50
		TBS10160	160	80	80	50
		TBS10180	180	80	100	50
		TBS10200	200	100	100	50
		TBS10220	220	100	120	50
		TBS10240	240	100	140	50
		TBS10260	260	100	160	50
		TBS10280	280	100	180	50
		TBS10300	300	100	200	50
		TBS10320	320	120	200	50
		TBS10340	340	120	220	50
		TBS10360	360	120	240	50
		TBS10380	380	120	260	50
		TBS10400	400	120	280	50
		TBS10440	440	120	320	50
		TBS10480	480	120	360	50
		TBS10520	520	120	400	50
		TBS10560	560	120	440	50
		TBS10600	600	120	480	50
12 TX 50	29,0	TBS12200	200	120	80	25
		TBS12240	240	120	120	25
		TBS12280	280	120	160	25
		TBS12320	320	120	200	25
		TBS12360	360	120	240	25
		TBS12400	400	140	260	25
		TBS12440	440	140	300	25
		TBS12480	480	140	340	25
		TBS12520	520	140	380	25
		TBS12560	560	140	420	25
		TBS12600	600	140	460	25
		TBS12800	800	160	640	25
		TBS121000	1000	160	840	25

RELATED PRODUCTS



TBS MAX



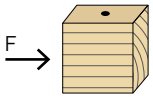
XYLOFON WASHER



TORQUE LIMITER

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

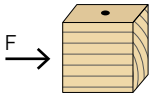
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**12·d‡**	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
S_Q	**5·d**	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
a_L	**15·d‡**	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
a	**10·d‡**	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_Q	**10·d**	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_P	**5·d**	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*

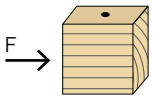
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



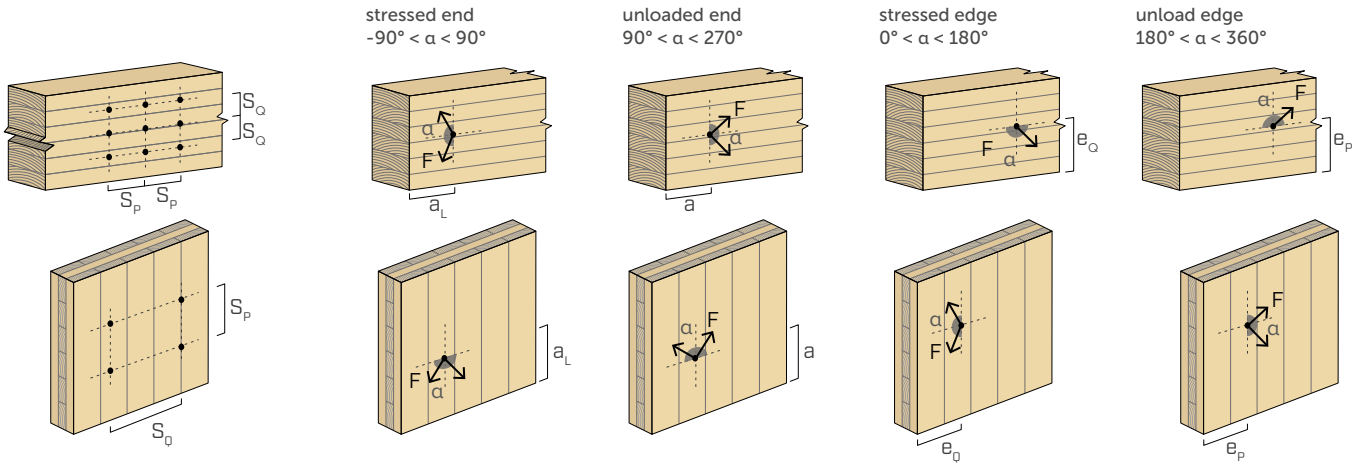
d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**18·d**	108	*4 1/4*	144	*5 11/16*	180	*7 1/8*	216	*8 1/2*
S_Q	**7·d**	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
a_L	**22·d**	132	*5 3/16*	176	*6 15/16*	220	*8 5/8*	264	*10 3/8*
a	**15·d**	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
e_Q	**12·d**	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	*144*	*5 11/16*
e_P	**7·d**	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*

screws inserted **WITH pre-drilled hole**



d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**5·d†**	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
S_Q	**4·d**	24	*15/16*	32	*1 1/4*	40	*1 9/16*	48	*1 7/8*
a_L	**12·d†**	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
a	**7·d†**	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_Q	**7·d**	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_P	**3·d**	18	*11/16*	24	*15/16*	30	*1 3/16*	36	*1 7/16*

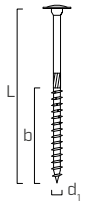
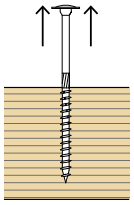
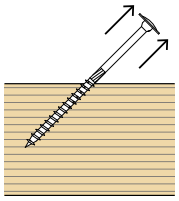
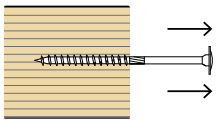
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

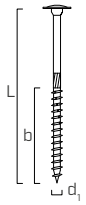
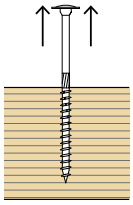
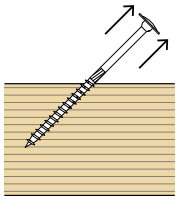
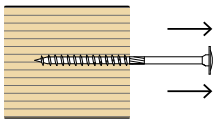
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

TENSION[1]

geometry			thread withdrawal α = 90°				thread withdrawal α = 45°				end grain α = 0°				steel tension
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
d_1	L		b	G 0.35	G 0.42	G 0.49	G 0.55	G 0.35	G 0.42	G 0.49	G 0.55	G 0.35	G 0.42	G 0.49	G 0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	60	*2 3/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	8,56
	70	*2 3/4*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	80	*3 1/8*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	90	*3 1/2*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	100	*4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	120	*4 3/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	180	*7 1/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	200	*8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	220	*8 5/8*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	240	*9 1/2*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	260	*10 1/4*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	280	*11*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	300	*11 3/4*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	320	*12 5/8*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	360	*14 1/4*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
	400	*15 3/4*	100	3,45	3,99	4,51	4,95	3,13	3,62	4,10	4,50	1,72	1,99	2,26	2,47	
8 *0.32*	40	*1 9/16*	32	1,17	1,36	1,54	1,68	1,07	1,23	1,40	1,53	0,59	0,68	0,77	0,84	14,7
	60	*2 3/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	80	*3 1/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	100	*4*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	120	*4 3/4*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	140	*5 1/2*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	160	*6 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	180	*7 1/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	200	*8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	220	*8 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	240	*9 1/2*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	260	*10 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	280	*11*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	300	*11 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	320	*12 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	340	*13 3/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	360	*14 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	380	*15*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	400	*15 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	440	*17 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	480	*19*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	520	*20 1/2*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	560	*22*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	580	*22 13/16*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	600	*23 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	

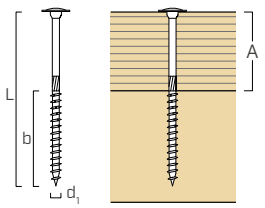
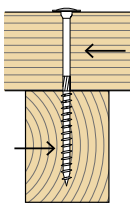
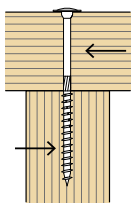
α = screw-to-grain angle

TENSION[1]

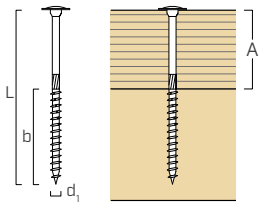
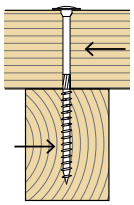
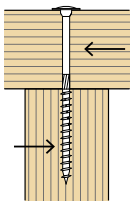
geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal end grain α = 0°				steel tension
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	100	*4*	52	2,57	2,97	3,36	3,68	2,33	2,70	3,05	3,35	1,28	1,48	1,68	1,84	
	120	*4 3/4*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	140	*5 1/2*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	160	*6 1/4*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	180	*7 1/8*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
	200	*8*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	220	*8 5/8*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	240	*9 1/2*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	260	*10 1/4*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	280	*11*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
10 *0.40*	300	*11 3/4*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	19,51
	320	*12 5/8*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	340	*13 3/8*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	360	*14 1/4*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	380	*15*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	400	*15 3/4*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	440	*17 1/4*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	480	*19*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	520	*20 1/2*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	560	*22*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	600	*23 5/8*	120	6,72	7,78	8,80	9,65	6,11	7,07	8,00	8,77	3,36	3,89	4,40	4,82	
	200	*8*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	240	*9 1/2*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	280	*11*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	320	*12 5/8*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	360	*14 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	400	*15 3/4*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
12 *0.48*	440	*17 1/4*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	22,11
	480	*19*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	520	*20 1/2*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	560	*22*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	600	*23 5/8*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	800	*31 1/2*	160	10,85	12,56	14,20	15,58	9,87	11,41	12,91	14,16	5,43	6,28	7,10	7,79	
	1000	*39 3/8*	160	10,85	12,56	14,20	15,58	9,87	11,41	12,91	14,16	5,43	6,28	7,10	7,79	

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 67.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
d_1	L		b	A[5]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	20	0,90	1,07	1,23	1,37	0,51	0,60	0,70	0,78
	70	*2 3/4*	40	30	1,00	1,18	1,37	1,52	0,61	0,72	0,84	0,93
	80	*3 1/8*	50	30	1,10	1,27	1,43	1,57	0,69	0,82	0,95	1,06
	90	*3 1/2*	50	40	1,19	1,38	1,57	1,72	0,77	0,87	0,98	1,06
	100	*4*	60	40	1,19	1,38	1,57	1,72	0,85	0,97	1,09	1,19
	120	*4 3/4*	75	45	1,24	1,44	1,60	1,72	0,98	1,12	1,26	1,38
	140	*5 1/2*	75	65	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	160	*6 1/4*	75	85	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
6	180	*7 1/8*	75	105	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
0.24	200	*8*	75	125	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	220	*8 5/8*	100	120	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	240	*9 1/2*	100	140	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	260	*10 1/4*	100	160	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	280	*11*	100	180	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	300	*11 3/4*	100	200	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	320	*12 5/8*	100	220	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	360	*14 1/4*	100	260	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	400	*15 3/4*	100	300	1,29	1,45	1,60	1,72	1,05	1,19	1,31	1,42
	40	*1 9/16*	32	10	0,77	0,92	1,06	1,18	0,41	0,49	0,56	0,63
	60	*2 3/8*	52	15	1,16	1,39	1,62	1,82	0,66	0,79	0,91	1,01
	80	*3 1/8*	52	28	1,40	1,68	1,96	2,20	0,85	1,01	1,17	1,31
	100	*4*	52	48	1,64	1,97	2,29	2,58	1,09	1,28	1,43	1,55
	120	*4 3/4*	80	40	1,73	1,99	2,25	2,46	1,30	1,55	1,79	1,99
	140	*5 1/2*	80	60	1,97	2,28	2,54	2,73	1,44	1,64	1,84	2,00
	160	*6 1/4*	100	60	1,97	2,28	2,54	2,73	1,53	1,77	2,01	2,21
	180	*7 1/8*	100	80	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	200	*8*	100	100	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	220	*8 5/8*	100	120	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	240	*9 1/2*	100	140	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	260	*10 1/4*	100	160	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
8	280	*11*	100	180	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
0.32	300	*11 3/4*	100	200	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	320	*12 5/8*	100	220	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	340	*13 3/8*	100	240	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	360	*14 1/4*	100	260	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	380	*15*	100	280	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	400	*15 3/4*	100	300	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	440	*17 1/4*	100	340	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	480	*19*	100	380	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	520	*20 1/2*	100	420	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	560	*22*	100	460	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	580	*22 13/16*	100	480	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	600	*23 5/8*	100	500	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21

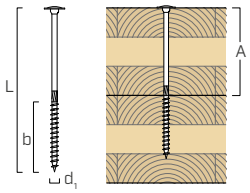
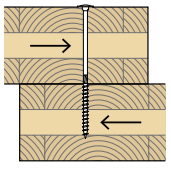
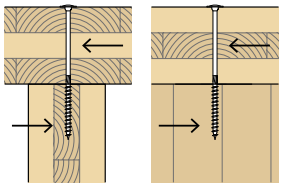
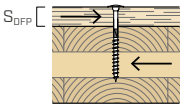
α = screw-to-grain angle

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
d_1	L		b	A[5]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	100	*4*	52	48	2,04	2,43	2,80	3,13	1,29	1,53	1,77	1,98
	120	*4 3/4*	60	60	2,36	2,83	3,30	3,70	1,56	1,80	2,00	2,17
	140	*5 1/2*	60	80	2,64	3,08	3,48	3,82	1,59	1,80	2,00	2,17
	160	*6 1/4*	80	80	2,92	3,33	3,67	3,94	1,85	2,11	2,36	2,56
	180	*7 1/8*	80	100	2,95	3,33	3,67	3,94	1,85	2,11	2,36	2,56
	200	*8*	100	100	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	220	*8 5/8*	100	120	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	240	*9 1/2*	100	140	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	260	*10 1/4*	100	160	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	280	*11*	100	180	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
10	300	*11 3/4*	100	200	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
0.40	320	*12 5/8*	120	200	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	340	*13 3/8*	120	220	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	360	*14 1/4*	120	240	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	380	*15*	120	260	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	400	*15 3/4*	120	280	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	440	*17 1/4*	120	320	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	480	*19*	120	360	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	520	*20 1/2*	120	400	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	560	*22*	120	440	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	600	*23 5/8*	120	480	2,97	3,33	3,67	3,94	2,22	2,57	2,92	3,21
	200	*8*	120	80	3,48	3,99	4,40	4,74	2,63	3,05	3,46	3,81
	240	*9 1/2*	120	120	3,57	3,99	4,40	4,74	2,63	3,05	3,46	3,81
	280	*11*	120	160	3,57	3,99	4,40	4,74	2,63	3,05	3,46	3,81
	320	*12 5/8*	120	200	3,57	3,99	4,40	4,74	2,63	3,05	3,46	3,81
	360	*14 1/4*	120	240	3,57	3,99	4,40	4,74	2,63	3,05	3,46	3,81
	400	*15 3/4*	140	260	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
	440	*17 1/4*	140	300	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
12	480	*19*	140	340	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
0.48	520	*20 1/2*	140	380	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
	560	*22*	140	420	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
	600	*23 5/8*	140	460	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
	700	*27 1/2*	140	560	3,57	3,99	4,40	4,74	2,76	3,20	3,61	3,90
	800	*31 1/2*	160	640	3,57	3,99	4,40	4,74	2,89	3,26	3,61	3,90
	900	*35 1/2*	160	740	3,57	3,99	4,40	4,74	2,89	3,26	3,61	3,90
	1000	*39 3/8*	160	840	3,57	3,99	4,40	4,74	2,89	3,26	3,61	3,90

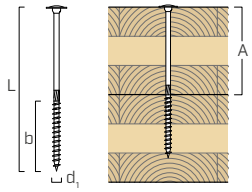
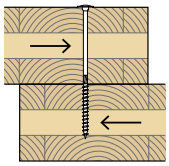
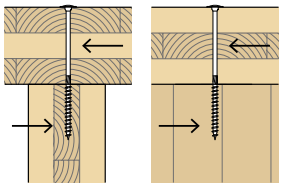
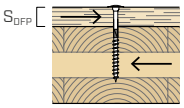
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 67.

SHEAR[4]

geometry					CLT-CLT lateral face α = 90°				CLT-CLT α = 0°				spline joint lateral face α = 90°				
																	
					factored lateral resistance N_r (6)				factored lateral resistance N_r (2)(3)					factored lateral resistance N_r			
d_1	L		b	A(6)	G				G				S_{DFP}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	35	0,70	0,84	0,97	1,08	0,48	0,58	0,65	0,70		1,00	1,13	1,27	1,35
	70	*2 3/4*	40	40	0,84	1,00	1,15	1,29	0,57	0,64	0,71	0,76		1,09	1,22	1,30	1,35
	80	*3 1/8*	50	45	0,97	1,16	1,33	1,45	0,61	0,69	0,76	0,83		1,23	1,30	1,33	1,35
	90	*3 1/2*	50	50	1,11	1,29	1,45	1,58	0,65	0,73	0,82	0,89		1,23	1,30	1,33	1,35
	100	*4*	60	55	1,17	1,36	1,54	1,66	0,69	0,78	0,87	0,95		1,26	1,30	1,33	1,35
	120	*4 3/4*	75	65	1,24	1,39	1,54	1,66	0,77	0,88	0,98	1,07		1,26	1,30	1,33	1,35
	140	*5 1/2*	75	75	1,24	1,39	1,54	1,66	0,85	0,97	1,09	1,19		1,26	1,30	1,33	1,35
	160	*6 1/4*	75	85	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31		1,26	1,30	1,33	1,35
6	180	*7 1/8*	75	105	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31	12,7	1,26	1,30	1,33	1,35
0.24	200	*8*	75	125	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31	*1/2*	1,26	1,30	1,33	1,35
	220	*8 5/8*	100	120	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	240	*9 1/2*	100	140	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	260	*10 1/4*	100	160	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	280	*11*	100	180	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	300	*11 3/4*	100	200	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	320	*12 5/8*	100	220	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	360	*14 1/4*	100	260	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	400	*15 3/4*	100	300	1,24	1,39	1,54	1,66	1,01	1,14	1,27	1,37		1,26	1,30	1,33	1,35
	40	*1 9/16*	32	25	0,52	0,62	0,72	0,80	0,32	0,39	0,45	0,51		1,02	1,11	1,20	1,28
	60	*2 3/8*	52	35	0,86	1,02	1,18	1,32	0,59	0,70	0,82	0,91		1,48	1,64	1,73	1,81
	80	*3 1/8*	52	45	1,19	1,42	1,64	1,83	0,80	0,96	1,11	1,20		1,70	1,90	2,04	2,15
	100	*4*	52	55	1,52	1,82	2,10	2,35	1,00	1,13	1,26	1,36		1,91	2,09	2,14	2,18
	120	*4 3/4*	80	65	1,73	2,08	2,36	2,59	1,11	1,26	1,40	1,52		2,03	2,09	2,14	2,18
	140	*5 1/2*	80	75	1,91	2,21	2,44	2,62	1,21	1,38	1,54	1,67		2,03	2,09	2,14	2,18
	160	*6 1/4*	100	85	1,98	2,21	2,44	2,62	1,32	1,50	1,68	1,83		2,03	2,09	2,14	2,18
	180	*7 1/8*	100	95	1,98	2,21	2,44	2,62	1,39	1,61	1,82	1,98		2,03	2,09	2,14	2,18
	200	*8*	100	100	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	220	*8 5/8*	100	120	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	240	*9 1/2*	100	140	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	260	*10 1/4*	100	160	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
8	280	*11*	100	180	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10	19,1	2,03	2,09	2,14	2,18
0.32	300	*11 3/4*	100	200	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10	*3/4*	2,03	2,09	2,14	2,18
	320	*12 5/8*	100	220	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	340	*13 3/8*	100	240	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	360	*14 1/4*	100	260	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	380	*15*	100	280	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	400	*15 3/4*	100	300	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	440	*17 1/4*	100	340	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	480	*19*	100	380	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	520	*20 1/2*	100	420	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	560	*22*	100	460	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	580	*22 13/16*	100	480	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	600	*23 5/8*	100	500	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18

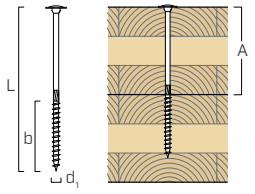
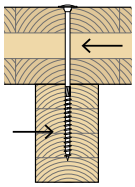
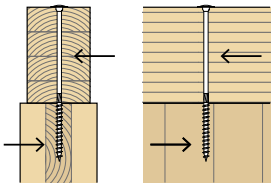
α = screw-to-grain angle

geometry					SHEAR[4]											
					CLT-CLT lateral face α = 90°				CLT-CLT α = 0°				spline joint lateral face α = 90°			
																
					factored lateral resistance N_r (6)				factored lateral resistance N_r (2)(3)					factored lateral resistance N_r		
d_1	L		b	A(6)	G				G				S_{DFP}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
10 *0.40*	100	*4*	52	55	1,80	2,13	2,47	2,75	1,19	1,42	1,64	1,78	25,4 *1*	2,36	2,65	2,94	3,18
	120	*4 3/4*	60	60	2,19	2,63	3,06	3,44	1,44	1,71	1,90	2,06		2,74	3,05	3,18	3,23
	140	*5 1/2*	60	80	2,44	2,91	3,30	3,62	1,51	1,71	1,90	2,06		2,84	3,05	3,18	3,23
	160	*6 1/4*	80	80	2,69	3,20	3,53	3,80	1,76	2,01	2,24	2,44		3,02	3,10	3,18	3,23
	180	*7 1/8*	80	100	2,78	3,20	3,53	3,80	1,76	2,01	2,24	2,44		3,02	3,10	3,18	3,23
	200	*8*	100	100	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	220	*8 5/8*	100	120	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	240	*9 1/2*	100	140	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	260	*10 1/4*	100	160	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	280	*11*	100	180	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	300	*11 3/4*	100	200	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	320	*12 5/8*	120	200	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	340	*13 3/8*	120	220	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	360	*14 1/4*	120	240	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	380	*15*	120	260	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	400	*15 3/4*	120	280	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	440	*17 1/4*	120	320	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	480	*19*	120	360	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	520	*20 1/2*	120	400	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	560	*22*	120	440	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
	600	*23 5/8*	120	480	2,86	3,20	3,53	3,80	2,10	2,44	2,77	3,05		3,02	3,10	3,18	3,23
12 *0.48*	200	*8*	120	105	3,43	3,84	4,23	4,56	2,28	2,61	2,92	3,18	25,4 *1*	3,60	3,70	3,78	3,84
	240	*9 1/2*	120	120	3,43	3,84	4,23	4,56	2,50	2,90	3,29	3,62		3,60	3,70	3,78	3,84
	280	*11*	120	160	3,43	3,84	4,23	4,56	2,50	2,90	3,29	3,62		3,60	3,70	3,78	3,84
	320	*12 5/8*	120	200	3,43	3,84	4,23	4,56	2,50	2,90	3,29	3,62		3,60	3,70	3,78	3,84
	360	*14 1/4*	120	240	3,43	3,84	4,23	4,56	2,50	2,90	3,29	3,62		3,60	3,70	3,78	3,84
	400	*15 3/4*	140	260	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	440	*17 1/4*	140	300	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	480	*19*	140	340	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	520	*20 1/2*	140	380	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	560	*22*	140	420	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	600	*23 5/8*	140	460	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	700	*27 1/2*	140	560	3,43	3,84	4,23	4,56	2,62	3,04	3,45	3,77		3,60	3,70	3,78	3,84
	800	*31 1/2*	160	640	3,43	3,84	4,23	4,56	2,73	3,15	3,49	3,77		3,60	3,70	3,78	3,84
	900	*35 1/2*	160	740	3,43	3,84	4,23	4,56	2,73	3,15	3,49	3,77		3,60	3,70	3,78	3,84
	1000	*39 3/8*	160	840	3,43	3,84	4,23	4,56	2,73	3,15	3,49	3,77		3,60	3,70	3,78	3,84

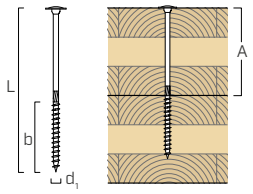
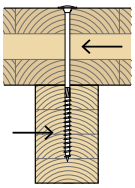
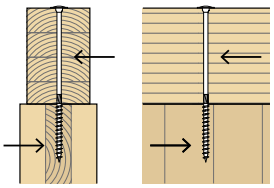
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 67.

SHEAR[4]

geometry					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
					G				G			
d_1 [mm] *[in]*	L [mm]	L *[in]*	b [mm]	A [mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
	60	*2 3/8*	40	20	0,88	1,04	1,20	1,32	0,49	0,59	0,68	0,75
	70	*2 3/4*	40	30	0,97	1,15	1,33	1,46	0,59	0,70	0,81	0,89
	80	*3 1/8*	50	30	1,05	1,22	1,37	1,51	0,67	0,80	0,92	1,01
	90	*3 1/2*	50	40	1,14	1,32	1,50	1,64	0,73	0,84	0,93	1,01
	100	*4*	60	40	1,14	1,32	1,50	1,64	0,82	0,93	1,04	1,13
	120	*4 3/4*	75	45	1,19	1,37	1,56	1,69	0,93	1,07	1,21	1,32
	140	*5 1/2*	75	65	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	160	*6 1/4*	75	85	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
6	180	*7 1/8*	75	105	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
0.24	200	*8*	75	125	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	220	*8 5/8*	100	120	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	240	*9 1/2*	100	140	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	260	*10 1/4*	100	160	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	280	*11*	100	180	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	300	*11 3/4*	100	200	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	320	*12 5/8*	100	220	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	360	*14 1/4*	100	260	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	400	*15 3/4*	100	300	1,27	1,42	1,57	1,69	1,02	1,16	1,28	1,38
	40	*1 9/16*	32	10	0,79	0,93	1,07	1,19	0,40	0,48	0,55	0,62
	60	*2 3/8*	52	15	1,22	1,47	1,71	1,92	0,67	0,80	0,92	1,02
	80	*3 1/8*	52	28	1,37	1,64	1,91	2,15	0,83	0,98	1,14	1,27
	100	*4*	52	48	1,58	1,90	2,21	2,48	1,07	1,23	1,37	1,48
	120	*4 3/4*	80	40	1,66	1,91	2,15	2,36	1,26	1,50	1,73	1,92
	140	*5 1/2*	80	60	1,88	2,17	2,46	2,67	1,38	1,57	1,76	1,92
	160	*6 1/4*	100	60	1,88	2,17	2,46	2,67	1,46	1,69	1,92	2,11
	180	*7 1/8*	100	80	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	200	*8*	100	100	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	220	*8 5/8*	100	120	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	240	*9 1/2*	100	140	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	260	*10 1/4*	100	160	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
8	280	*11*	100	180	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
0.32	300	*11 3/4*	100	200	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	320	*12 5/8*	100	220	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	340	*13 3/8*	100	240	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	360	*14 1/4*	100	260	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	380	*15*	100	280	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	400	*15 3/4*	100	300	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	440	*17 1/4*	100	340	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	480	*19*	100	380	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	520	*20 1/2*	100	420	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	560	*22*	100	460	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	580	*22 13/16*	100	480	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	600	*23 5/8*	100	500	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11

α = screw-to-grain angle

geometry				SHEAR[4]							
				CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
				G				G			
d_1 [mm] *[in]*	L [mm]	L *[in]*	b [mm]	A [mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
	100	*4*	52	48	1,98	2,35	2,71	3,02	1,26	1,49	1,73	1,92
	120	*4 3/4*	60	60	2,27	2,73	3,18	3,57	1,52	1,72	1,92	2,07
	140	*5 1/2*	60	80	2,53	3,03	3,45	3,79	1,52	1,72	1,92	2,07
	160	*6 1/4*	80	80	2,80	3,25	3,59	3,87	1,78	2,02	2,26	2,45
	180	*7 1/8*	80	100	2,91	3,26	3,59	3,87	1,78	2,02	2,26	2,45
	200	*8*	100	100	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	220	*8 5/8*	100	120	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	240	*9 1/2*	100	140	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	260	*10 1/4*	100	160	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	280	*11*	100	180	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
10 *0.40*	300	*11 3/4*	100	200	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	320	*12 5/8*	120	200	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	340	*13 3/8*	120	220	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	360	*14 1/4*	120	240	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	380	*15*	120	260	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	400	*15 3/4*	120	280	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	440	*17 1/4*	120	320	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	480	*19*	120	360	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	520	*20 1/2*	120	400	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	560	*22*	120	440	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	600	*23 5/8*	120	480	2,91	3,26	3,59	3,87	2,12	2,45	2,78	3,06
	200	*8*	120	80	3,31	3,84	4,31	4,64	2,52	2,92	3,31	3,64
	240	*9 1/2*	120	120	3,49	3,91	4,31	4,64	2,52	2,92	3,31	3,64
	280	*11*	120	160	3,49	3,91	4,31	4,64	2,52	2,92	3,31	3,64
	320	*12 5/8*	120	200	3,49	3,91	4,31	4,64	2,52	2,92	3,31	3,64
	360	*14 1/4*	120	240	3,49	3,91	4,31	4,64	2,52	2,92	3,31	3,64
	400	*15 3/4*	140	260	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	440	*17 1/4*	140	300	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
12 *0.48*	480	*19*	140	340	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	520	*20 1/2*	140	380	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	560	*22*	140	420	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	600	*23 5/8*	140	460	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	700	*27 1/2*	140	560	3,49	3,91	4,31	4,64	2,63	3,06	3,47	3,80
	800	*31 1/2*	160	640	3,49	3,91	4,31	4,64	2,75	3,18	3,52	3,80
	900	*35 1/2*	160	740	3,49	3,91	4,31	4,64	2,75	3,18	3,52	3,80
	1000	*39 3/8*	160	840	3,49	3,91	4,31	4,64	2,75	3,18	3,52	3,80

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 67.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The specified head pull-through design values are taken from the ELC-4645 report. The withdrawal and head pull-through values provided in this datasheet are also applicable to CLT connections.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_1$) or the main member ($8d_1$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- TBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) TBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

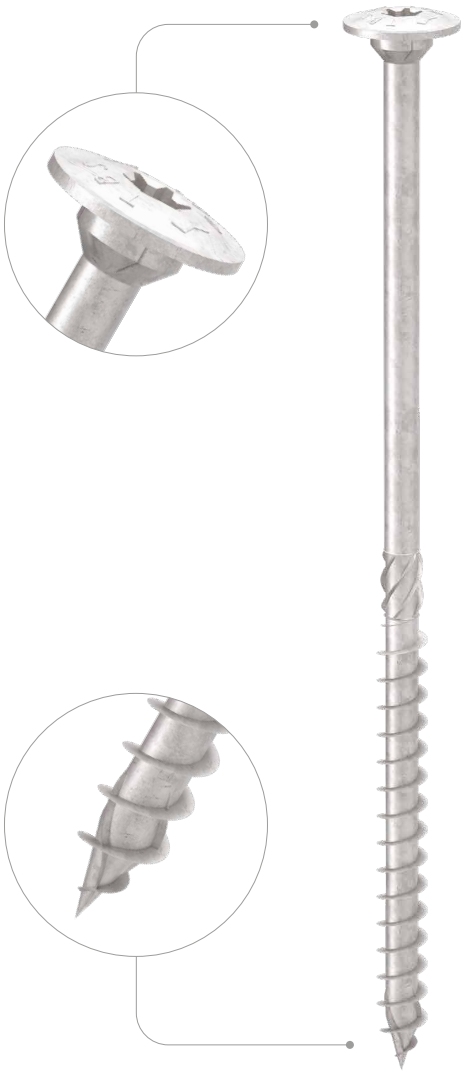
(5) The side-member thickness, A, for TBS 8 x 40 mm and 8 x 60 mm was set to 10 mm and 15 mm, respectively, to ensure the connection is not governed by failure mode (a).

(6) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

TBS EVO

FLANGE HEAD SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030



C4 EVO COATING

Multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. Can be used in service class 3 outdoor applications and under class C4 atmospheric corrosion conditions.

INTEGRATED WASHER

The flange head serves as washer and ensures high head strength and pull-through. Ideal in the presence of wind or variations in timber dimensions.

AUTOCLAVE-TREATED TIMBER

The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use in ACQ-treated wood.

T3 TIMBER CORROSIVITY

Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch and pine. For more information see the "TIMBER SCREWS AND DECK FASTENING" catalogue at www.rothoblaas.com

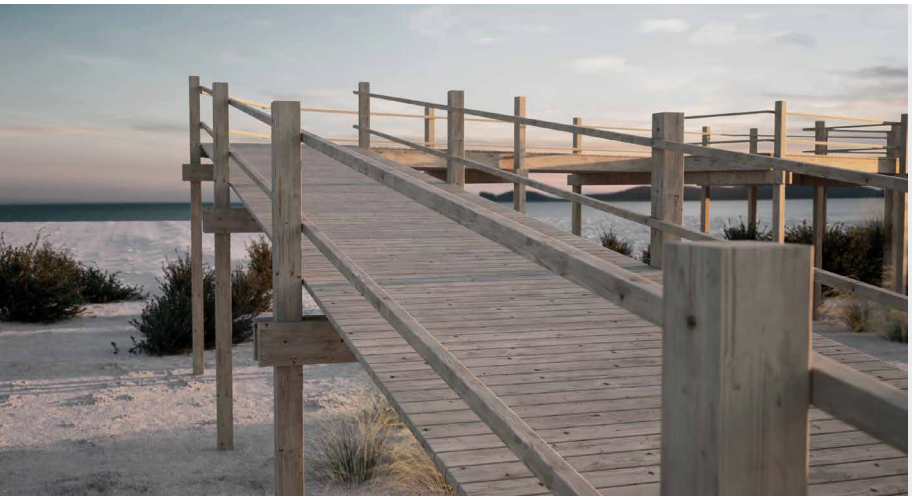
MANUALS

BIT INCLUDED

DIAMETER [mm]	6 (6 – 10) 16
LENGTH [mm]	40 (60 – 400) 1000
SERVICE CONDITION	EC1 EC3
ATMOSPHERIC CORROSIVITY	C1 C2 C3 C4
WOOD CORROSIVITY	T1 T2 T3
MATERIAL	C4 EVO COATING — carbon steel with C4 EVO coating
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.



OUTDOOR WALKWAYS

Ideal for the construction of outdoor structures such as walkways and arcades. Values also certified for screw insertion parallel to the grain. Ideal for fastening aggressive woods containing tannins.

SIP PANELS

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

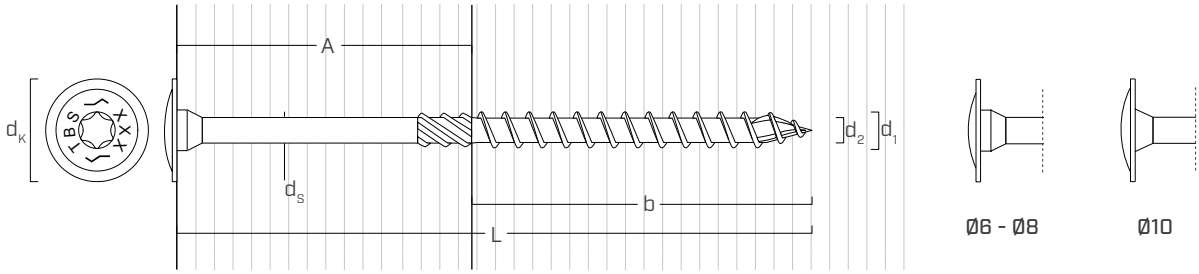


Fastening Wood Trusses outdoors.



Multi-ply beam fastening.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**6**	**8**	**10**
Head diameter	d_K	[mm]	15,50	19,00	25,00
Root diameter	d_2	[mm]	3,95	5,40	6,40
Shank diameter	d_S	[mm]	4,30	5,80	7,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	4,0	5,0	6,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	6,0	7,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

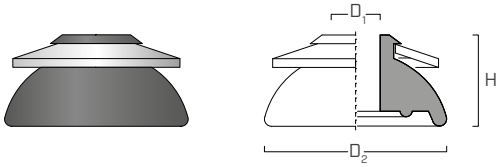
Nominal diameter	**d_1**	**[mm]**		**6**	**8**	**10**
Factored tensile strength	Φf_u	[kN]		8,56	14,70	19,51
Bending yield strength	F_{yb}	[MPa]		1188	1047	1080
Factored shear strength of the screw	Φv_s	[kN]		4,71	8,79	12,35
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,38	69,83	87,29
			G=0.42	60,60	80,80	101,00
			G=0.49	68,55	91,40	114,26
			G=0.55	75,19	100,25	125,32
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	1,79	2,51	3,85
			G=0.42	2,15	3,01	4,62
			G=0.49	2,50	3,51	5,39
			G=0.55	2,81	3,94	6,05

CODES AND DIMENSIONS

d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
6 TX 30	15,5	**TBSEVO660**	60	40	20	100
		TBSEVO680	80	50	30	100
		TBSEVO6100	100	60	40	100
		TBSEVO6120	120	75	45	100
		TBSEVO6140	140	75	65	100
		TBSEVO6160	160	75	85	100
		TBSEVO6180	180	75	105	100
		TBSEVO6200	200	75	125	100
8 TX 40	19,0	**TBSEVO8100**	100	52	48	50
		TBSEVO8120	120	80	40	50
		TBSEVO8140	140	80	60	50
		TBSEVO8160	160	100	60	50
		TBSEVO8180	180	100	80	50
		TBSEVO8200	200	100	100	50
		TBSEVO8220	220	100	120	50
		TBSEVO8240	240	100	140	50
		TBSEVO8280	280	100	180	50
		TBSEVO8320	320	100	220	50
		TBSEVO8360	360	100	260	50
		TBSEVO8400	400	100	300	50

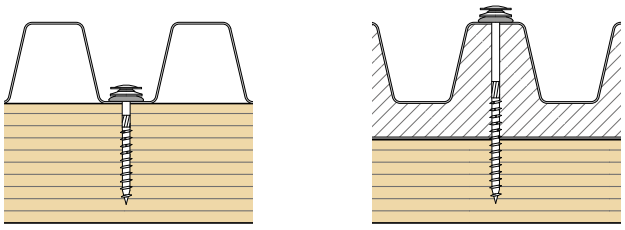
d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
10 TX 50	25,0	**TBSEVO10120**	120	60	60	50
		TBSEVO10140	140	60	80	50
		TBSEVO10160	160	80	80	50
		TBSEVO10180	180	80	100	50
		TBSEVO10200	200	100	100	50
		TBSEVO10220	220	100	120	50
		TBSEVO10240	240	100	140	50
		TBSEVO10280	280	100	180	50

WBAZ WASHER



CODE	screw [mm]	D_2 [mm]	H [mm]	D_1 [mm]	pcs
WBAZ25A2	6,0 - 6,5	25	15	6,5	100

INSTALLATION

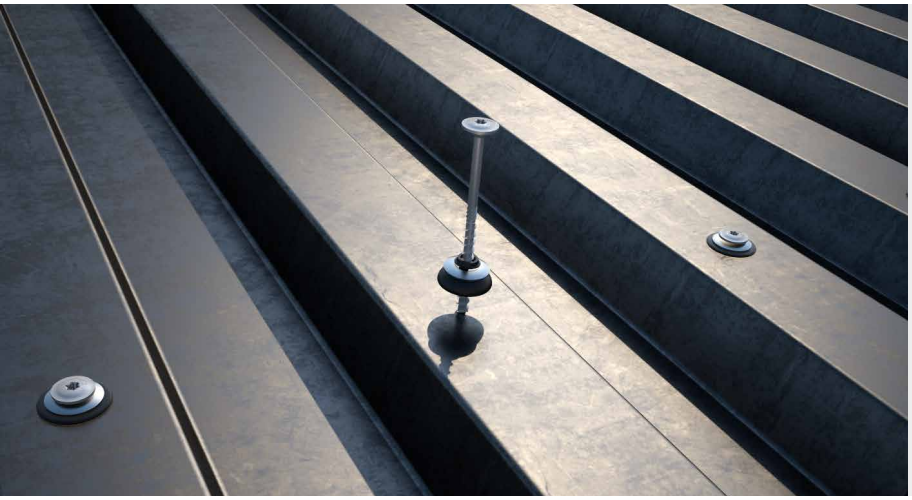


TBS EVO + WBAZ Ø x L	fastening package [mm]
6 x 60	min. 0 - max. 30
6 x 80	min. 10 - max. 50
6 x 100	min. 30 - max. 70
6 x 120	min. 50 - max. 90
6 x 140	min. 70 - max. 110
6 x 160	min. 90 - max. 130
6 x 180	min. 110 - max. 150
6 x 200	min. 130 - max. 170



Correct tightening | Excessive tightening | Insufficient tightening | Tightening off axis

NOTE: The thickness of the washer after installation is approximately 8-9 mm.
The maximum thickness of the fastening package was calculated by ensuring a minimum penetration length into the wood of 4·d.

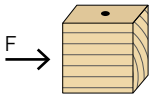


FASTENING METAL SHEET

Can be installed on sheets up to 0,7 mm thick without pre-drilling. TBS EVO Ø6 mm is ideal when used in combination with washer WBAZ. For outdoor use (Service class 3).

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

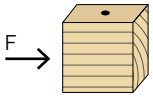
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*
S_P	12·d‡	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*
S_Q	5·d	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*
a_L	15·d‡	90	*3 1/2*	120	*4 3/4*	150	*6*
a	10·d‡	60	*2 3/8*	80	*3 1/8*	100	*4*
e_Q	10·d	60	*2 3/8*	80	*3 1/8*	100	*4*
e_P	5·d	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*

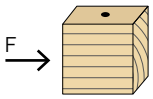
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



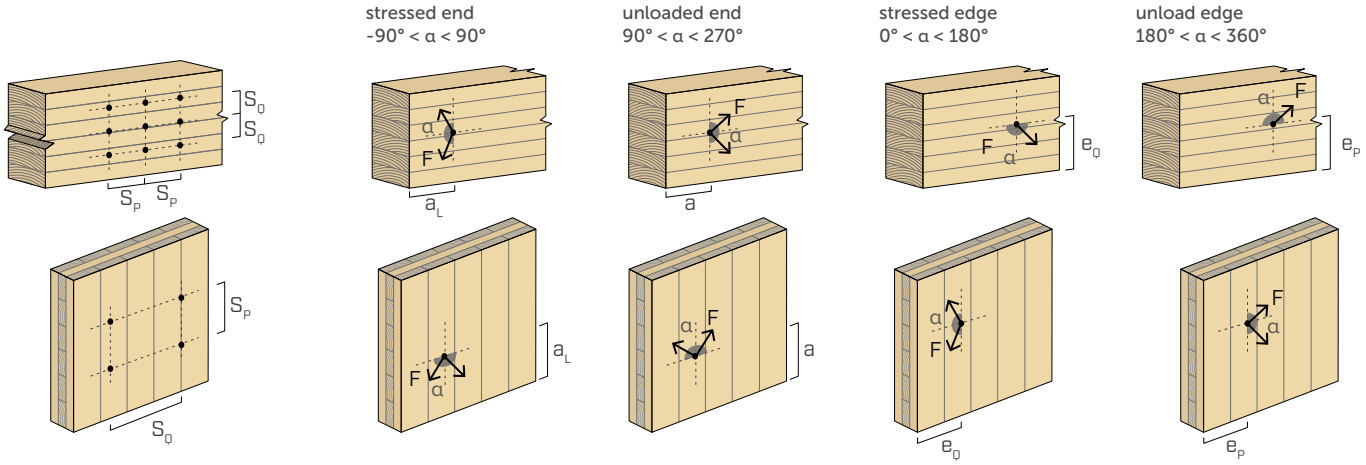
d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*
S_P	18·d	108	*4 1/4*	144	*5 11/16*	180	*7 1/8*
S_Q	7·d	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*
a_L	22·d	132	*5 3/16*	176	*6 15/16*	220	*8 5/8*
a	15·d	90	*3 1/2*	120	*4 3/4*	150	*6*
e_Q	12·d	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*
e_P	7·d	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*

screws inserted **WITH pre-drilled hole**



d_1		6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*
S_P	5·d†	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*
S_Q	4·d	24	*15/16*	32	*1 1/4*	40	*1 9/16*
a_L	12·d†	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*
a	7·d†	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*
e_Q	7·d	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*
e_P	3·d	18	*11/16*	24	*15/16*	30	*1 3/16*

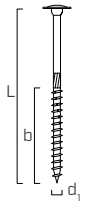
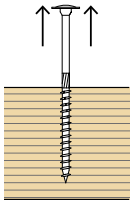
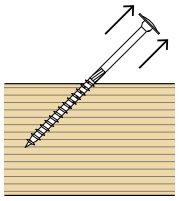
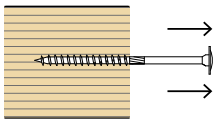
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

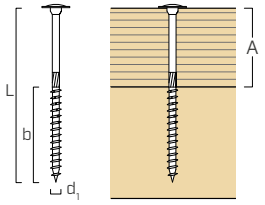
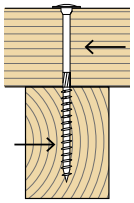
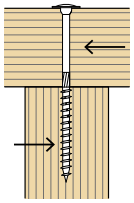
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

TENSION[1]

geometry			thread withdrawal α = 90°				thread withdrawal α = 45°				end grain α = 0°				steel tension
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
d_1	L	b	G 0.35	G 0.42	G 0.49	G 0.55	G 0.35	G 0.42	G 0.49	G 0.55	G 0.35	G 0.42	G 0.49	G 0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	80	*3 1/8*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	100	*4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
6	120	*4 3/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	8,56
0.24	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	180	*7 1/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	200	*8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	100	*4*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	120	*4 3/4*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	140	*5 1/2*	80	3,52	4,07	4,61	5,05	3,20	3,70	4,19	4,59	1,76	2,04	2,30	2,53	
	160	*6 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	180	*7 1/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
8	200	*8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
0.32	220	*8 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	14,7
	240	*9 1/2*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	280	*11*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	320	*12 5/8*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	360	*14 1/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	400	*15 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	120	*4 3/4*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	140	*5 1/2*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	160	*6 1/4*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
10	180	*7 1/8*	80	4,28	4,95	5,60	6,14	3,89	4,50	5,09	5,58	2,14	2,47	2,80	3,07	
0.40	200	*8*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	19,51
	220	*8 5/8*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	240	*9 1/2*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	
	280	*11*	100	5,50	6,36	7,20	7,90	5,00	5,78	6,55	7,18	2,75	3,18	3,60	3,95	

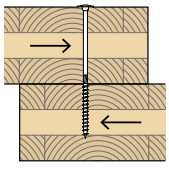
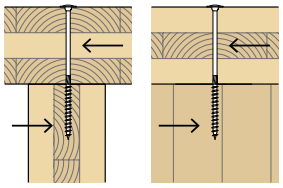
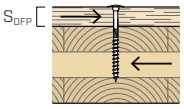
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 77.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	20	0,90	1,07	1,23	1,37	0,51	0,60	0,70	0,78
	80	*3 1/8*	50	30	1,10	1,27	1,43	1,57	0,69	0,82	0,95	1,06
	100	*4*	60	40	1,19	1,38	1,57	1,72	0,85	0,97	1,09	1,19
6	120	*4 3/4*	75	45	1,24	1,44	1,60	1,72	0,98	1,12	1,26	1,38
0.24	140	*5 1/2*	75	65	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	160	*6 1/4*	75	85	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	180	*7 1/8*	75	105	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	200	*8*	75	125	1,29	1,45	1,60	1,72	0,98	1,12	1,26	1,38
	100	*4*	52	48	1,64	1,97	2,29	2,58	1,09	1,28	1,43	1,55
	120	*4 3/4*	80	40	1,73	1,99	2,25	2,46	1,30	1,55	1,79	1,99
	140	*5 1/2*	80	60	1,97	2,28	2,54	2,73	1,44	1,64	1,84	2,00
	160	*6 1/4*	100	60	1,97	2,28	2,54	2,73	1,53	1,77	2,01	2,21
	180	*7 1/8*	100	80	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
8	200	*8*	100	100	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
0.32	220	*8 5/8*	100	120	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	240	*9 1/2*	100	140	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	280	*11*	100	180	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	320	*12 5/8*	100	220	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	360	*14 1/4*	100	260	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	400	*15 3/4*	100	300	2,06	2,31	2,54	2,73	1,53	1,77	2,01	2,21
	120	*4 3/4*	60	60	2,36	2,83	3,30	3,70	1,56	1,80	2,00	2,17
	140	*5 1/2*	60	80	2,64	3,08	3,48	3,82	1,59	1,80	2,00	2,17
	160	*6 1/4*	80	80	2,92	3,33	3,67	3,94	1,85	2,11	2,36	2,56
10	180	*7 1/8*	80	100	2,95	3,33	3,67	3,94	1,85	2,11	2,36	2,56
0.40	200	*8*	100	100	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	220	*8 5/8*	100	120	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	240	*9 1/2*	100	140	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96
	280	*11*	100	180	2,97	3,33	3,67	3,94	2,10	2,42	2,72	2,96

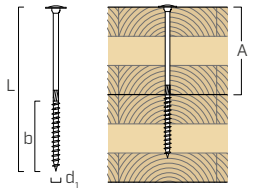
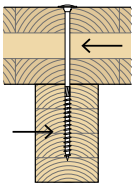
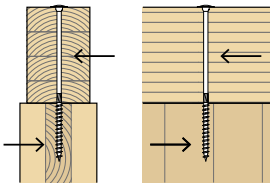
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 77.

geometry					SHEAR[4] CLT-CLT lateral face α = 90°				SHEAR[4] CLT-CLT α = 0°				SHEAR[4] spline joint lateral face α = 90°				
																	
					factored lateral resistance N_r (5)				factored lateral resistance N_r (2)(3)					factored lateral resistance N_r			
d_1	L		b	A	G				G				S_{DFP}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	35	0,70	0,84	0,97	1,08	0,48	0,58	0,65	0,70		1,00	1,13	1,27	1,35
	80	*3 1/8*	50	45	0,97	1,16	1,33	1,45	0,61	0,69	0,76	0,83		1,23	1,30	1,33	1,35
	100	*4*	60	55	1,17	1,36	1,54	1,66	0,69	0,78	0,87	0,95		1,26	1,30	1,33	1,35
6	120	*4 3/4*	75	65	1,24	1,39	1,54	1,66	0,77	0,88	0,98	1,07	12,7	1,26	1,30	1,33	1,35
0.24	140	*5 1/2*	75	75	1,24	1,39	1,54	1,66	0,85	0,97	1,09	1,19	*1/2*	1,26	1,30	1,33	1,35
	160	*6 1/4*	75	85	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31		1,26	1,30	1,33	1,35
	180	*7 1/8*	75	105	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31		1,26	1,30	1,33	1,35
	200	*8*	75	125	1,24	1,39	1,54	1,66	0,93	1,07	1,20	1,31		1,26	1,30	1,33	1,35
	100	*4*	52	55	1,52	1,82	2,10	2,35	1,00	1,13	1,26	1,36		1,91	2,09	2,14	2,18
	120	*4 3/4*	80	65	1,73	2,08	2,36	2,59	1,11	1,26	1,40	1,52		2,03	2,09	2,14	2,18
	140	*5 1/2*	80	75	1,91	2,21	2,44	2,62	1,21	1,38	1,54	1,67		2,03	2,09	2,14	2,18
	160	*6 1/4*	100	85	1,98	2,21	2,44	2,62	1,32	1,50	1,68	1,83		2,03	2,09	2,14	2,18
	180	*7 1/8*	100	95	1,98	2,21	2,44	2,62	1,39	1,61	1,82	1,98		2,03	2,09	2,14	2,18
8	200	*8*	100	100	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10	19,1	2,03	2,09	2,14	2,18
0.32	220	*8 5/8*	100	120	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10	*3/4*	2,03	2,09	2,14	2,18
	240	*9 1/2*	100	140	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	280	*11*	100	180	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	320	*12 5/8*	100	220	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	360	*14 1/4*	100	260	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	400	*15 3/4*	100	300	1,98	2,21	2,44	2,62	1,45	1,68	1,91	2,10		2,03	2,09	2,14	2,18
	120	*4 3/4*	60	60	2,19	2,63	3,06	3,44	1,44	1,71	1,90	2,06		2,74	3,05	3,18	3,23
	140	*5 1/2*	60	80	2,44	2,91	3,30	3,62	1,51	1,71	1,90	2,06		2,84	3,05	3,18	3,23
	160	*6 1/4*	80	80	2,69	3,20	3,53	3,80	1,76	2,01	2,24	2,44		3,02	3,10	3,18	3,23
10	180	*7 1/8*	80	100	2,78	3,20	3,53	3,80	1,76	2,01	2,24	2,44	25,4	3,02	3,10	3,18	3,23
0.40	200	*8*	100	100	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82	*1*	3,02	3,10	3,18	3,23
	220	*8 5/8*	100	120	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	240	*9 1/2*	100	140	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23
	280	*11*	100	180	2,86	3,20	3,53	3,80	2,00	2,31	2,58	2,82		3,02	3,10	3,18	3,23

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 77.

geometry					SHEAR[4]							
					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
d_1	L		b	A	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*	40	20	0,88	1,04	1,20	1,32	0,49	0,59	0,68	0,75
	80	*3 1/8*	50	30	1,05	1,22	1,37	1,51	0,67	0,80	0,92	1,01
	100	*4*	60	40	1,14	1,32	1,50	1,64	0,82	0,93	1,04	1,13
6	120	*4 3/4*	75	45	1,19	1,37	1,56	1,69	0,93	1,07	1,21	1,32
0.24	140	*5 1/2*	75	65	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	160	*6 1/4*	75	85	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	180	*7 1/8*	75	105	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	200	*8*	75	125	1,27	1,42	1,57	1,69	0,93	1,07	1,21	1,32
	100	*4*	52	48	1,58	1,90	2,21	2,48	1,07	1,23	1,37	1,48
	120	*4 3/4*	80	40	1,66	1,91	2,15	2,36	1,26	1,50	1,73	1,92
	140	*5 1/2*	80	60	1,88	2,17	2,46	2,67	1,38	1,57	1,76	1,92
	160	*6 1/4*	100	60	1,88	2,17	2,46	2,67	1,46	1,69	1,92	2,11
	180	*7 1/8*	100	80	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
8	200	*8*	100	100	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
0.32	220	*8 5/8*	100	120	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	240	*9 1/2*	100	140	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	280	*11*	100	180	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	320	*12 5/8*	100	220	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	360	*14 1/4*	100	260	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	400	*15 3/4*	100	300	2,02	2,26	2,48	2,67	1,46	1,69	1,92	2,11
	120	*4 3/4*	60	60	2,27	2,73	3,18	3,57	1,52	1,72	1,92	2,07
	140	*5 1/2*	60	80	2,53	3,03	3,45	3,79	1,52	1,72	1,92	2,07
	160	*6 1/4*	80	80	2,80	3,25	3,59	3,87	1,78	2,02	2,26	2,45
10	180	*7 1/8*	80	100	2,91	3,26	3,59	3,87	1,78	2,02	2,26	2,45
0.40	200	*8*	100	100	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	220	*8 5/8*	100	120	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	240	*9 1/2*	100	140	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83
	280	*11*	100	180	2,91	3,26	3,59	3,87	2,02	2,32	2,60	2,83

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 77.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Specified head pull-through capacities are taken from the ELC-4645 report. The withdrawal and head pull-through values provided in this datasheet are also applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_1$) or the main member ($8d_1$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- TBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) TBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

TBS MAX

XL FLANGE HEAD SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

FLANGE HEAD OF INCREASED SIZE

The oversized head provides excellent head pull-through strength and joint tightening capacity.

LONGER THREAD

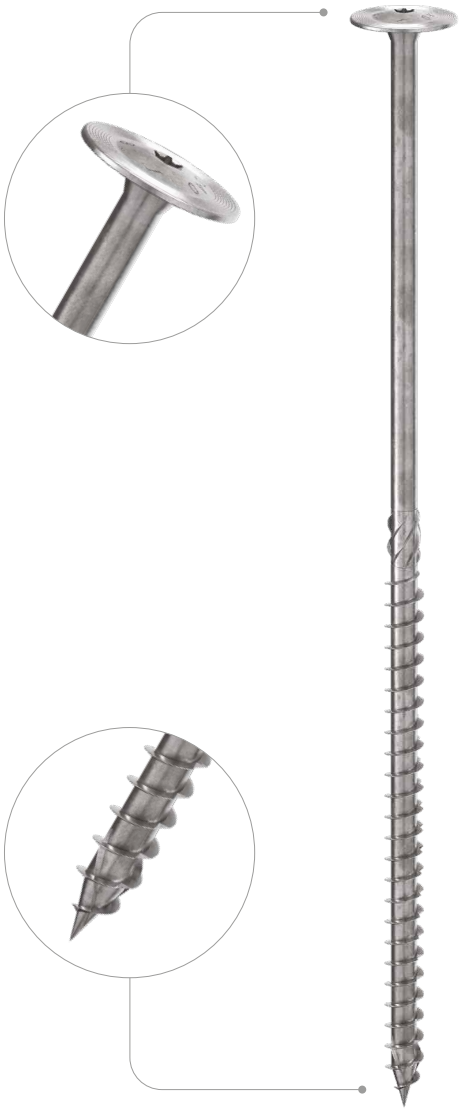
The oversized thread of the TBS MAX guarantees excellent withdrawal resistance and closing strength of the joint.

RIBBED FLOORS

Thanks to its large head and oversized thread, it is the ideal screw in the production of ribbed floors (Rippendecke). Used in conjunction with SHARP METAL, it optimises the number of fasteners by avoiding the use of presses when gluing timber elements together.

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

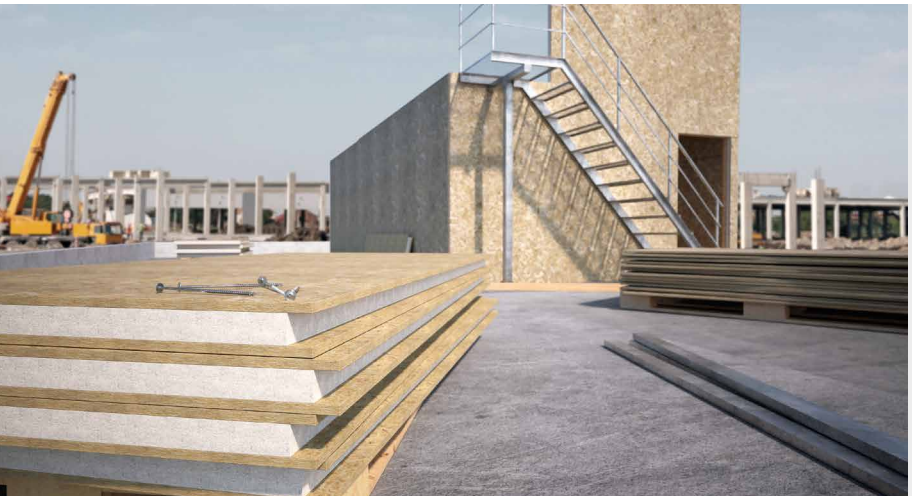


BIT INCLUDED

DIAMETER [mm]	6 — 8 — 16
LENGTH [mm]	40 — 120 — 400 — 1000
SERVICE CONDITION	EC1 DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED — electrogalvanized carbon steel
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- fibreboard and MDF panels
- SIP and ribbed panels.
- solid timber and glulam
- CLT and LVL
- high density woods

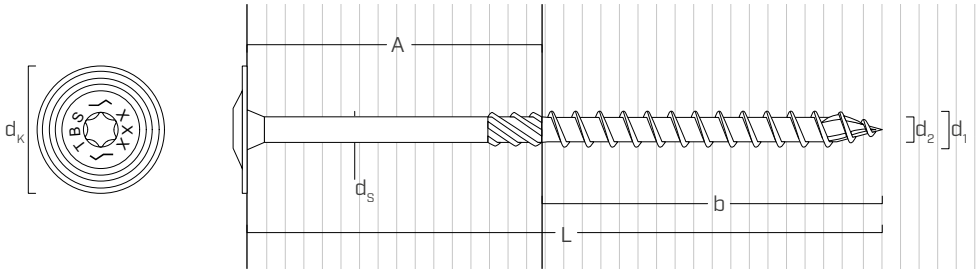
(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
8 TX 40	24,5	**TBSMAX8120**	120	100	20	50
		TBSMAX8160	160	120	40	50
		TBSMAX8180	180	120	60	50
		TBSMAX8200	200	120	80	50
		TBSMAX8220	220	120	100	50

d_1 [mm]	d_K [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
8 TX 40	24,5	**TBSMAX8240**	240	120	120	50
		TBSMAX8280	280	120	160	50
		TBSMAX8320	320	120	200	50
		TBSMAX8360	360	120	240	50
		TBSMAX8400	400	120	280	50

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**8**
Head diameter	d_K	[mm]	24,50
Root diameter	d_2	[mm]	5,40
Shank diameter	d_S	[mm]	5,80
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**8**
Factored tensile strength	Φf_u	[kN]		14,70
Bending yield strength	F_{yb}	[MPa]		1047
Factored shear strength of the screw	Φv_s	[kN]		8,79
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	69,83
			G=0.42	80,80
			G=0.49	91,40
			G=0.55	100,25
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	3,73
			G=0.42	4,48
			G=0.49	5,23
			G=0.55	5,87



TBS MAX FOR RIB TIMBER

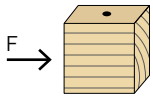
With its increased thread (120 mm) and enlarged head (24,5 mm), the TBS MAX guarantees excellent grip and superb joint closure. Ideal for the production of ribbed floors (Rippendecke), optimising the number of fastenings.

SHARP METAL

Ideal in combination with the SHARP METAL system, as the enlarged head guarantees excellent joint tightening, making the use of glue unnecessary when connecting wooden elements together.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

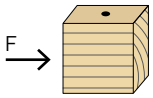
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		8 [mm]	*0.32 [in]*
S_P	12·d‡	96	*3 3/4*
S_Q	5·d	40	*1 9/16*
a_L	15·d‡	120	*4 3/4*
a	10·d‡	80	*3 1/8*
e_Q	10·d	80	*3 1/8*
e_P	5·d	40	*1 9/16*

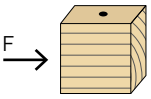
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



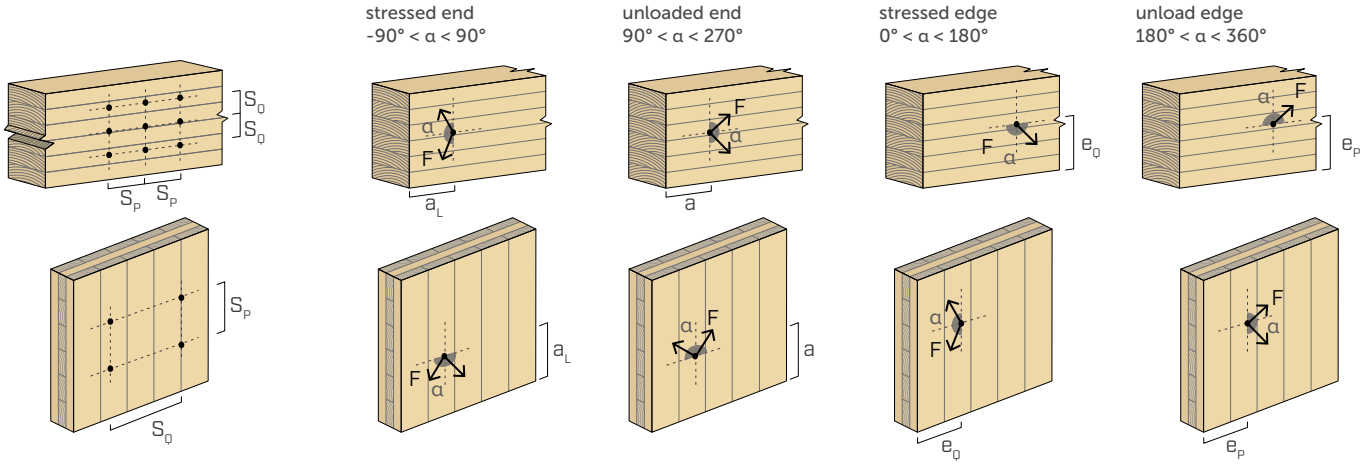
d_1		8 [mm]	*0.32 [in]*
S_P	18·d	144	*5 11/16*
S_Q	7·d	56	*2 3/16*
a_L	22·d	176	*6 15/16*
a	15·d	120	*4 3/4*
e_Q	12·d	96	*3 3/4*
e_P	7·d	56	*2 3/16*

screws inserted **WITH pre-drilled hole**



d_1		8 [mm]	*0.32 [in]*
S_P	5·d†	40	*1 9/16*
S_Q	4·d	32	*1 1/4*
a_L	12·d†	96	*3 3/4*
a	7·d†	56	*2 3/16*
e_Q	7·d	56	*2 3/16*
e_P	3·d	24	*15/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

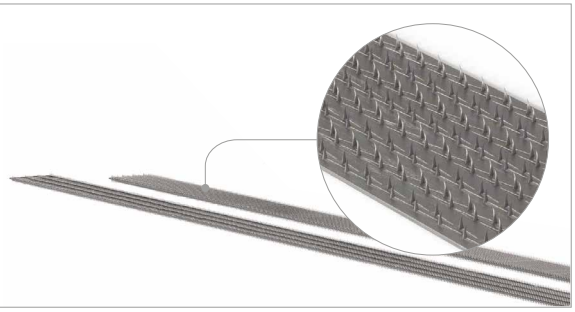
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

SHARP METAL

STEEL HOOKED PLATES

The joint between the two timber elements is made by the mechanical engagement of the metal hooks in the timber. The system is non-invasive can be disassembled.

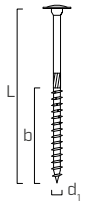
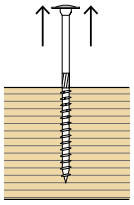
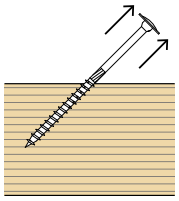
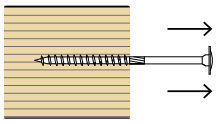
www.rothoblaas.com



STRUCTURAL VALUES | AXIAL TENSION

STRENGTH VALUES
CSA 086:24

TENSION[1]

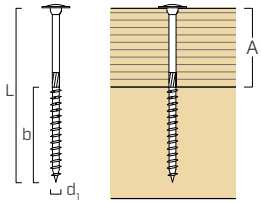
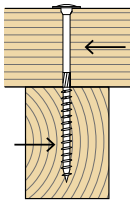
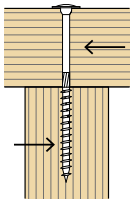
geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal end grain α = 0°				steel tension
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	100	4,50	5,20	5,89	6,46	4,09	4,73	5,35	5,87	2,25	2,60	2,94	3,23	
	160	*6 1/4*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	180	*7 1/8*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	200	*8*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
8	220	*8 5/8*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	14,7
0.32	240	*9 1/2*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	280	*11*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	320	*12 5/8*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	360	*14 1/4*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	
	400	*15 3/4*	120	5,47	6,33	7,17	7,86	4,98	5,76	6,51	7,15	2,74	3,17	3,58	3,93	

α = screw-to-grain angle

STRUCTURAL VALUES | LATERAL RESISTANCE

STRENGTH VALUES
CSA 086:24

SHEAR[4]

geometry					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		b	A	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	100	20	1,71	1,96	2,21	2,42	1,28	1,51	1,74	1,94
	160	*6 1/4*	120	40	1,95	2,25	2,55	2,80	1,71	2,03	2,29	2,51
	180	*7 1/8*	120	60	2,19	2,54	2,84	3,06	1,84	2,13	2,35	2,52
	200	*8*	120	80	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
8	220	*8 5/8*	120	100	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
0.32	240	*9 1/2*	120	120	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
	280	*11*	120	160	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
	320	*12 5/8*	120	200	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
	360	*14 1/4*	120	240	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52
	400	*15 3/4*	120	280	2,28	2,56	2,84	3,06	1,84	2,13	2,35	2,52

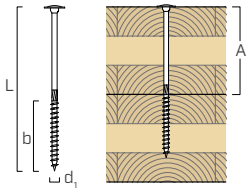
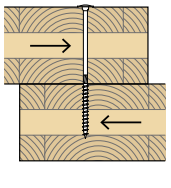
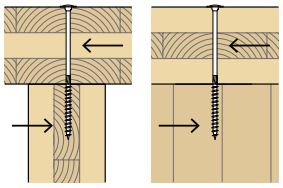
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 83.

STRUCTURAL VALUES | LATERAL RESISTANCE

STRENGTH VALUES
CSA 086:24

SHEAR[4]

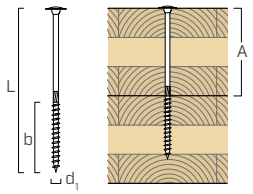
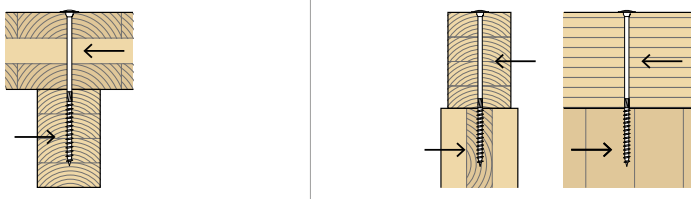
geometry					CLT-CLT lateral face α = 90°				CLT-CLT α = 0°				spline joint lateral face α = 90°				
																	
					factored lateral resistance N_r [5]				factored lateral resistance N_r [2][3]				S_{DFP}	factored lateral resistance N_r			
d_1	L		b	A	G				G					G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	100	65	1,87	2,22	2,50	2,72	1,11	1,26	1,40	1,52		2,33	2,39	2,44	2,48
	160	*6 1/4*	120	85	2,19	2,47	2,74	2,96	1,32	1,50	1,68	1,83		2,33	2,39	2,44	2,48
	180	*7 1/8*	120	95	2,19	2,47	2,74	2,96	1,42	1,62	1,82	1,98		2,33	2,39	2,44	2,48
	200	*8*	120	105	2,19	2,47	2,74	2,96	1,52	1,75	1,96	2,14		2,33	2,39	2,44	2,48
8	220	*8 5/8*	120	115	2,19	2,47	2,74	2,96	1,63	1,87	2,10	2,29	19,1	2,33	2,39	2,44	2,48
0.32	240	*9 1/2*	120	120	2,19	2,47	2,74	2,96	1,75	2,04	2,27	2,44	*3/4*	2,33	2,39	2,44	2,48
	280	*11*	120	160	2,19	2,47	2,74	2,96	1,75	2,04	2,27	2,44		2,33	2,39	2,44	2,48
	320	*12 5/8*	120	200	2,19	2,47	2,74	2,96	1,75	2,04	2,27	2,44		2,33	2,39	2,44	2,48
	360	*14 1/4*	120	240	2,19	2,47	2,74	2,96	1,75	2,04	2,27	2,44		2,33	2,39	2,44	2,48
	400	*15 3/4*	120	280	2,19	2,47	2,74	2,96	1,75	2,04	2,27	2,44		2,33	2,39	2,44	2,48

α = screw-to-grain angle

STRUCTURAL VALUES | LATERAL RESISTANCE

STRENGTH VALUES
CSA 086:24

SHEAR[4]

geometry					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
d_1	L		b	A	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	100	20	1,66	1,91	2,15	2,36	1,23	1,46	1,68	1,86
	160	*6 1/4*	120	40	1,88	2,17	2,45	2,70	1,65	1,98	2,27	2,46
	180	*7 1/8*	120	60	2,09	2,43	2,76	3,01	1,76	2,05	2,29	2,46
	200	*8*	120	80	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
8	220	*8 5/8*	120	100	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
0.32	240	*9 1/2*	120	120	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
	280	*11*	120	160	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
	320	*12 5/8*	120	200	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
	360	*14 1/4*	120	240	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46
	400	*15 3/4*	120	280	2,23	2,52	2,79	3,01	1,76	2,05	2,29	2,46

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 83.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Specified head pull-through capacities are taken from the ELC-4645 report. The withdrawal and head pull-through values provided in this datasheet are also applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_1$) or the main member ($8d_1$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- TBS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) TBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

SHS AISI410

60° COUNTERSUNK SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

SMALL HEAD AND 3 THORNS TIP

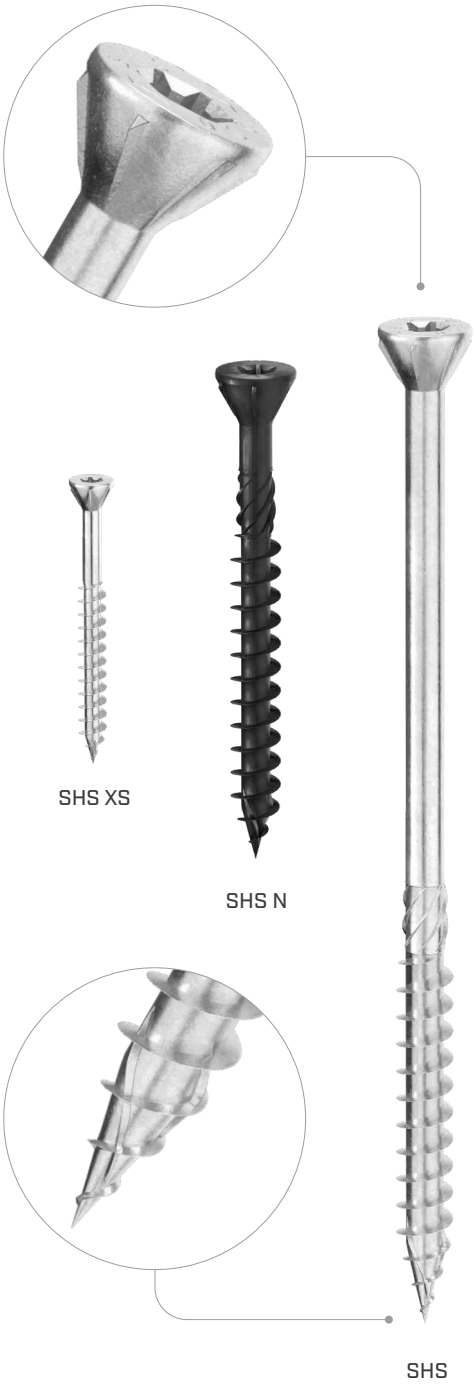
The concealed 60° head and 3 THORNS tip allow easy insertion of the screw into small thickness without creating openings in the timber.

OUTDOOR ON ACID WOOD

Martensitic stainless steel. This stainless steels offers the highest mechanical performance compared to the other available stainless steels. Suitable for outdoor applications and on acid wood, but away from corrosive agents (chlorides, sulphides, etc.).

SMALL ELEMENTS FASTENING

The smaller diameter versions are ideal for fixing beads or small elements, the 3.5 mm diameter version is perfectly suited for fastening tongue-and-groove boards.



CANADIAN DESIGN VALUES

USA, EU and more design values available online.

BIT INCLUDED

DIAMETER [mm]	3	3,5 – 8	12
LENGTH [mm]	12	40 – 280	1000
SERVICE CONDITION	EC1 EC3 WET		
ATMOSPHERIC CORROSIVITY	C1 C2		
WOOD CORROSIVITY	T1 T2 T3 T4		
MATERIAL	410 AISI	martensitic stainless steel AISI 410	



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT, LVL
- high-density woods and acid woods





WINDOWS AND DOORS ON THE OUTSIDE

SHS AISI140 is the right choice for fastening small outdoor elements such as beads, façades and window/door frames.



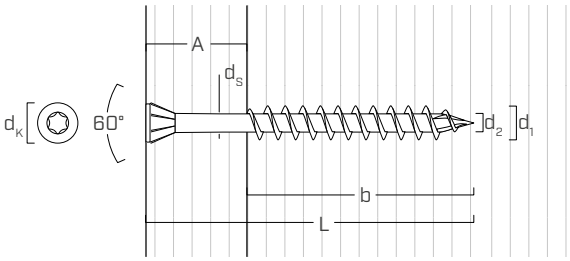
External casing slats fixed with 6 and 8 mm diameter SHS AISI410 screws.



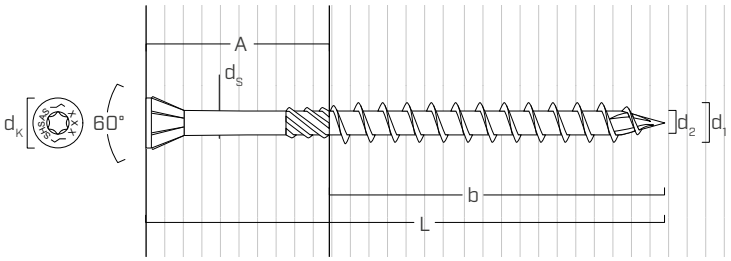
Fastening hardwood and acid wood in far-from-sea environments with SHS AISI410 8 mm diameter.

GEOMETRY AND MECHANICAL CHARACTERISTICS

SHSAS Ø3,5



SHSAS Ø4,5 - Ø5 - Ø6 - Ø8



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**3,5**	**4,5**	**5**	**6**	**8**
Head diameter	d_K	[mm]	5,75	7,50	8,50	11,00	13,00
Root diameter	d_2	[mm]	2,15	2,80	3,40	3,95	5,40
Shank diameter	d_S	[mm]	2,50	3,15	3,65	4,30	5,80
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	2,0	2,5	3,0	4,0	5,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	-	-	3,5	4,0	6,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**4,5**	**5**	**6**	**8**
Factored tensile strength	Φf_u	[kN]		5,39	5,86	8,47	15,78
Bending yield strength	F_{yb}	[MPa]		1102	981	896	1074
Factored shear strength of the screw	Φv_s	[kN]		2,81	3,19	4,95	8,79
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	47,06	52,29	52,38	69,83
			G=0.42	54,45	60,50	60,60	80,80
			G=0.49	61,60	68,44	68,55	91,40
			G=0.55	67,56	75,07	75,19	100,3
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,39	0,49	0,79	1,06
			G=0.42	0,47	0,59	0,95	1,27
			G=0.49	0,55	0,69	1,10	1,48
			G=0.55	0,62	0,78	1,24	1,66

CODES AND DIMENSIONS

SHS XS AISI410



d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
3,5 TX 10	SHS3540AS(*)	40	26	14	500
	SHS3550AS(*)	50	34	16	500
	SHS3560AS(*)	60	40	20	500
4,5 TX 20	SHS4550AS	50	30	20	200
	SHS4560AS	60	35	25	200
	SHS4570AS	70	40	30	200
5 TX 25	SHS550AS	50	24	26	200
	SHS560AS	60	30	30	200
	SHS570AS	70	35	35	100
	SHS580AS	80	40	40	100
	SHS5100AS	100	50	50	100

(*) Not ELC-4645 addressed

SHS N AISI410 - black version



d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4,5 TX 20	SHS4550ASN	50	30	20	100
	SHS4560ASN	60	35	25	100
5 TX 25	SHS550ASN	50	24	26	100
	SHS560ASN	60	30	30	200

SHS AISI410



d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
6 TX 30	SHS680AS	80	40	40	100
	SHS6100AS	100	50	50	100
	SHS6120AS	120	60	60	100
	SHS6140AS	140	75	65	100
	SHS6160AS	160	75	85	100
	SHS6180AS	180	75	105	100
	SHS6200AS	200	75	125	100
8 TX 40	SHS8120AS	120	60	60	100
	SHS8140AS	140	60	80	100
	SHS8160AS	160	80	80	100
	SHS8180AS	180	80	100	100
	SHS8200AS	200	80	120	100
	SHS8220AS	220	80	140	100
	SHS8240AS	240	80	160	100
	SHS8260AS	260	80	180	100
	SHS8280AS	280	80	200	100

APPLICATION

Oak
Quercus petraea
ρ_k = 665-760 kg/m³
pH ~ 3,9

Oak or European oak
Quercus robur
ρ_k = 690-960 kg/m³
pH = 3,4-4,2

Douglas fir
Pseudotsuga menziesii
ρ_k = 510-750 kg/m³
pH = 3,3-5,8

American black cherry
Prunus serotina
ρ_k = 490-630 kg/m³
pH ~ 3,9

European chestnut
Castanea sativa
ρ_k = 580-600 kg/m³
pH = 3,4-3,7

Red oak
Quercus rubra
ρ_k = 550-980 kg/m³
pH = 3,8-4,2

Blue Douglas fir
Pseudotsuga taxifolia
ρ_k = 510-750 kg/m³
pH = 3,1-4,4

Maritime pine
Pinus pinaster
ρ_k = 500-620 kg/m³
pH ~ 3,8

Possible installation on acid wood but away from corrosive agents (chlorides, sulphides, etc.).

Find out the pH and density of the various wood species on page 10.



"aggressive" woods high acidity



"standard" timbers low acidity

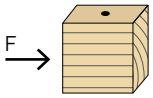


FAÇADES IN DARK TIMBER

Specially designed to match façades made of charred wood, the black SHS N variant ensures perfect compatibility and offers an excellent aesthetic result. Thanks to its strength to corrosion, it is suitable for outdoor use, allowing to create striking and long-lasting black façades.

MINIMUM DISTANCES FOR SHEAR LOADS

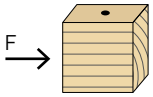
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	12·d‡	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
S_Q	5·d	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
a_L	15·d‡	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
a	10·d‡	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_Q	10·d	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_P	5·d	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*

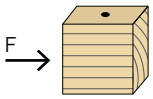
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



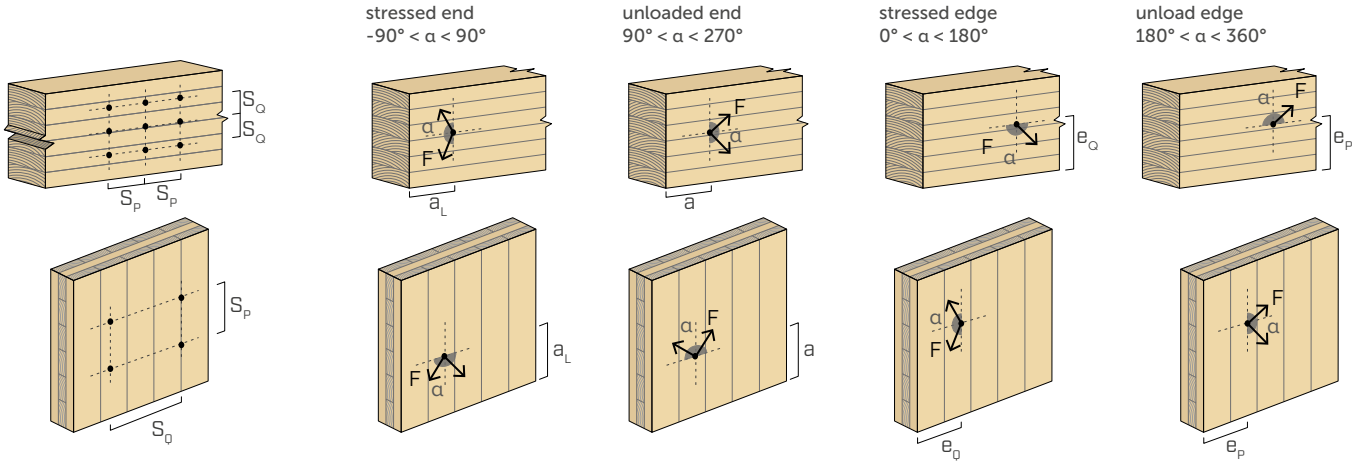
d_1		4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	18·d	81	*3 3/16*	90	*3 1/2*	108	*4 1/4*	144	*5 11/16*
S_Q	7·d	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
a_L	22·d	99	*3 7/8*	110	*4 3/8*	132	*5 3/16*	176	*6 15/16*
a	15·d	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
e_Q	12·d	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
e_P	7·d	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*

screws inserted **WITH pre-drilled hole**



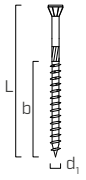
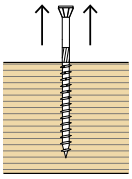
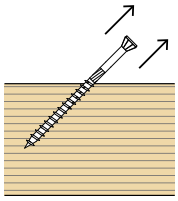
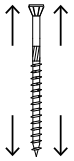
d_1		4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	5·d†	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
S_Q	4·d	18	*11/16*	20	*13/16*	24	*15/16*	32	*1 1/4*
a_L	12·d†	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
a	7·d†	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_Q	7·d	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_P	3·d	14	*9/16*	15	*9/16*	18	*11/16*	24	*15/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



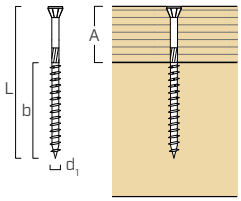
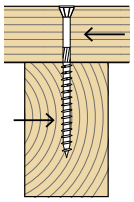
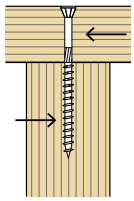
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

geometry			TENSION[1]												
			thread withdrawal												steel tension
			α = 90°				α = 45°				end grain α = 0°				
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
4.5 *0.18*	50	*1 15/16*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	5,39
	60	*2 3/8*	35	1,00	1,16	1,32	1,44	0,91	1,06	1,20	1,31	0,50	0,58	0,66	0,72	
	70	*2 3/4*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
5 *0.20*	50	*1 15/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	5,86
	60	*2 3/8*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	70	*2 3/4*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	80	*3 1/8*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	100	*4*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
6 *0.24*	80	*3 1/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	8,47
	100	*4*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	120	*4 3/4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	180	*7 1/8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	200	*8*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
8 *0.32*	120	*4 3/4*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,83	15,78
	140	*5 1/2*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,83	
	160	*6 1/4*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	180	*7 1/8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	200	*8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	220	*8 5/8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	240	*9 1/2*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	260	*10 1/4*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	280	*11*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	

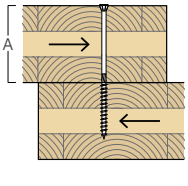
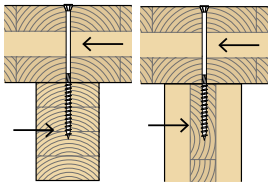
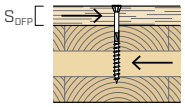
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 93.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
4.5 *0.18*	50	*1 15/16*	30	20	0,47	0,55	0,62	0,68	0,33	0,39	0,46	0,50
	60	*2 3/8*	35	25	0,52	0,60	0,68	0,74	0,37	0,43	0,48	0,53
	70	*2 3/4*	40	30	0,56	0,64	0,70	0,75	0,39	0,45	0,50	0,55
5 *0.20*	50	*1 15/16*	24	26	0,52	0,62	0,73	0,81	0,39	0,47	0,53	0,57
	60	*2 3/8*	30	30	0,60	0,73	0,85	0,95	0,44	0,50	0,56	0,61
	70	*2 3/4*	35	35	0,69	0,83	0,91	0,97	0,46	0,52	0,59	0,64
	80	*3 1/8*	40	40	0,75	0,83	0,91	0,97	0,48	0,55	0,61	0,67
	100	*4*	50	50	0,75	0,83	0,91	0,97	0,51	0,59	0,66	0,72
6 *0.24*	80	*3 1/8*	40	40	0,92	1,10	1,20	1,28	0,62	0,71	0,79	0,87
	100	*4*	50	50	0,99	1,10	1,20	1,28	0,66	0,75	0,85	0,93
	120	*4 3/4*	60	60	0,99	1,10	1,20	1,28	0,69	0,80	0,90	0,99
	140	*5 1/2*	75	65	0,99	1,10	1,20	1,28	0,75	0,87	0,95	1,02
	160	*6 1/4*	75	85	0,99	1,10	1,20	1,28	0,75	0,87	0,95	1,02
	180	*7 1/8*	75	105	0,99	1,10	1,20	1,28	0,75	0,87	0,95	1,02
	200	*8*	75	125	0,99	1,10	1,20	1,28	0,75	0,87	0,95	1,02
8 *0.32*	120	*4 3/4*	60	60	1,63	1,95	2,21	2,35	1,10	1,25	1,40	1,52
	140	*5 1/2*	60	80	1,73	1,99	2,21	2,35	1,10	1,25	1,40	1,52
	160	*6 1/4*	80	80	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	180	*7 1/8*	80	100	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	200	*8*	80	120	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	220	*8 5/8*	80	140	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	240	*9 1/2*	80	160	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	260	*10 1/4*	80	180	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67
	280	*11*	80	200	1,83	2,02	2,21	2,35	1,19	1,36	1,53	1,67

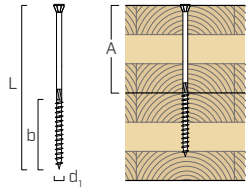
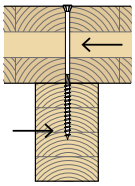
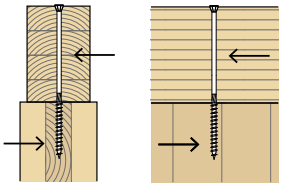
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 93.

geometry					SHEAR[4] CLT-CLT lateral face α = 90°				CLT-CLT narrow face α = 0°				spline joint lateral face α = 90°				
																	
					factored lateral resistance N_r [5]				factored lateral resistance N_r [2][3]					factored lateral resistance N_r			
d_1	L		b	A	G				G				S_{DFP}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]
6 *0.24*	80	*3 1/8*	40	40	0,84	1,01	1,15	1,23	0,58	0,67	0,75	0,82	12,7 *1/2*	0,95	0,98	1,00	1,02
	100	*4*	50	50	0,94	1,05	1,15	1,23	0,62	0,71	0,80	0,88		0,95	0,98	1,00	1,02
	120	*4 3/4*	60	60	0,94	1,05	1,15	1,23	0,65	0,75	0,85	0,93		0,95	0,98	1,00	1,02
	140	*5 1/2*	75	75	0,94	1,05	1,15	1,23	0,67	0,78	0,88	0,96		0,95	0,98	1,00	1,02
	160	*6 1/4*	75	85	0,94	1,05	1,15	1,23	0,71	0,82	0,91	0,98		0,95	0,98	1,00	1,02
	180	*7 1/8*	75	105	0,94	1,05	1,15	1,23	0,71	0,82	0,91	0,98		0,95	0,98	1,00	1,02
	200	*8*	75	125	0,94	1,05	1,15	1,23	0,71	0,82	0,91	0,98		0,95	0,98	1,00	1,02
8 *0.32*	120	*4 3/4*	60	60	1,48	1,78	2,07	2,25	1,03	1,18	1,32	1,44	19,1 *3/4*	1,69	1,75	1,80	1,84
	140	*5 1/2*	60	80	1,61	1,85	2,09	2,25	1,03	1,18	1,32	1,44		1,69	1,75	1,80	1,84
	160	*6 1/4*	80	80	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	180	*7 1/8*	80	100	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	200	*8*	80	120	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	220	*8 5/8*	80	140	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	240	*9 1/2*	80	160	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	260	*10 1/4*	80	180	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84
	280	*11*	80	200	1,75	1,93	2,11	2,25	1,12	1,28	1,44	1,57		1,69	1,75	1,80	1,84

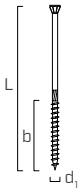
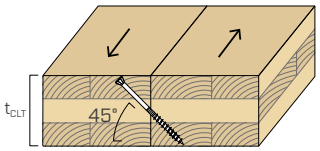
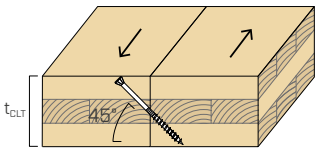
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 93.

geometry					SHEAR[4]							
					CLT-timber lateral face α = 90°				timber-CLT narrow face α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r [2][3]			
d_1	L		b	A	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	80	*3 1/8*	40	40	0,88	1,04	1,17	1,25	0,59	0,67	0,76	0,83
	100	*4*	50	50	0,97	1,07	1,17	1,25	0,62	0,72	0,81	0,88
	120	*4 3/4*	60	60	0,97	1,07	1,17	1,25	0,66	0,76	0,86	0,94
	140	*5 1/2*	75	75	0,97	1,07	1,17	1,25	0,71	0,82	0,93	0,99
	160	*6 1/4*	75	85	0,97	1,07	1,17	1,25	0,71	0,82	0,93	0,99
	180	*7 1/8*	75	105	0,97	1,07	1,17	1,25	0,71	0,82	0,93	0,99
	200	*8*	75	125	0,97	1,07	1,17	1,25	0,71	0,82	0,93	0,99
8 *0.32*	120	*4 3/4*	60	60	1,55	1,86	2,11	2,30	1,04	1,19	1,33	1,45
	140	*5 1/2*	60	80	1,71	1,96	2,15	2,30	1,04	1,19	1,33	1,45
	160	*6 1/4*	80	80	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	180	*7 1/8*	80	100	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	200	*8*	80	120	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	220	*8 5/8*	80	140	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	240	*9 1/2*	80	160	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	260	*10 1/4*	80	180	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58
	280	*11*	80	200	1,79	1,98	2,15	2,30	1,13	1,29	1,45	1,58

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 93.

geometry					SHEAR[4][6]							
					butt-joint α = 90°				butt-joint α = 45°			
												
					factored lateral resistance N_r				factored lateral resistance N_r			
					G				G			
d_1	L		b	t_{CLT}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
6 *0.24*	100	*4*	50	70	0,81	0,88	0,95	1,01	0,50	0,61	0,71	0,76
	120	*4 3/4*	60	85	0,81	0,88	0,95	1,01	0,61	0,67	0,72	0,76
	140	*5 1/2*	75	100	0,81	0,88	0,95	1,01	0,61	0,67	0,72	0,76
	160	*6 1/4*	75	115	0,81	0,88	0,95	1,01	0,61	0,67	0,72	0,76
	180	*7 1/8*	75	125	0,81	0,88	0,95	1,01	0,61	0,67	0,72	0,76
	200	*8*	75	140	0,81	0,88	0,95	1,01	0,61	0,67	0,72	0,76
8 *0.32*	120	*4 3/4*	60	85	1,30	1,56	1,81	1,96	0,74	0,89	1,04	1,16
	140	*5 1/2*	60	100	1,43	1,63	1,83	1,96	0,86	1,04	1,21	1,32
	160	*6 1/4*	80	115	1,56	1,71	1,85	1,96	0,99	1,19	1,38	1,48
	180	*7 1/8*	80	125	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48
	200	*8*	80	140	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48
	220	*8 5/8*	80	155	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48
	240	*9 1/2*	80	170	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48
	260	*10 1/4*	80	185	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48
	280	*11*	80	200	1,56	1,71	1,85	1,96	1,08	1,24	1,39	1,48

α = screw-to-grain angle

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- SHS AISI410 screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) SHS AISI410 screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The CLT-to-CLT boundary conditions are equally applicable to half-lap connections. Use the nearest connection geometry to determine the appropriate values.

(6) The lateral resistance calculation for butt joints assumes the screws are installed on the CLT member's narrow face.

KKF AISI410

PAN HEAD SCREW

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

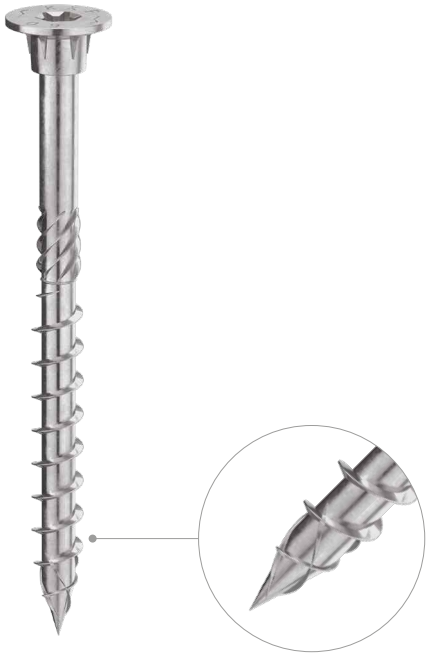


PAN HEAD
The flat under-head accompanies absorption of the shavings, preventing the wood from cracking and thus ensuring excellent surface finish.

LONGER THREAD
Special asymmetric "umbrella" thread with increased length (60%) for higher grip. Fine thread for the utmost precision when tightening is complete.

OUTDOOR APPLICATIONS ON ACID WOOD
Martensitic stainless steel. This stainless steels offers the highest mechanical performance compared to the other available stainless steels. Suitable for outdoor applications and on acid wood, but away from corrosive agents (chlorides, sulphides, etc.).

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



BIT INCLUDED

DIAMETER [mm]

3,5 | 4 | 6 | 8

LENGTH [mm]

20 | 20 | 120 | 320

SERVICE CONDITION

EC1 EC3 WET

ATMOSPHERIC CORROSIVITY

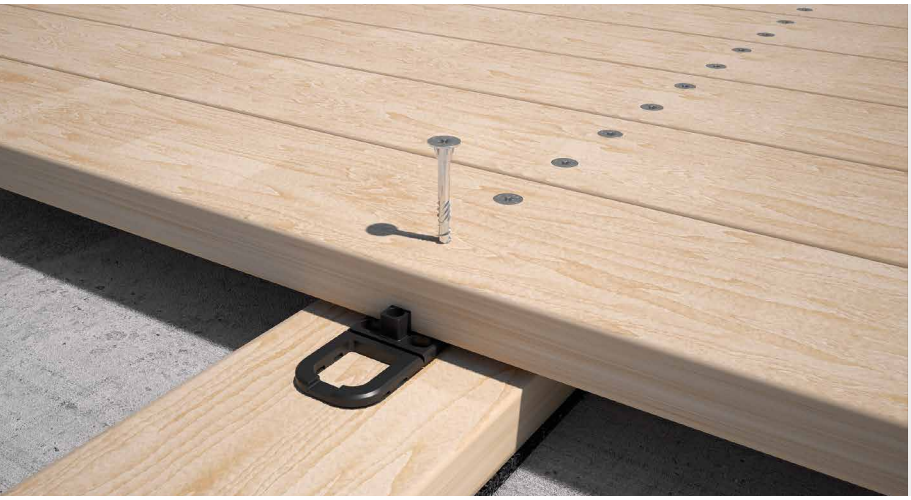
C1 C2

WOOD CORROSIVITY

T1 T2 T3 T4

MATERIAL

410 AISI — AISI410 martensitic stainless steel



FIELDS OF USE

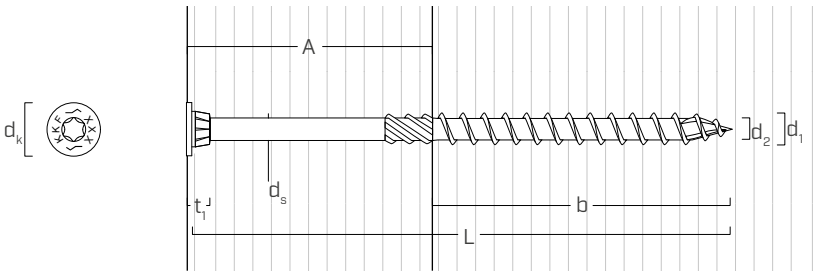
Outdoor use. Wooden boards with density < 780 kg/m³ (without pre-drill). WPC boards (with pre-drill).

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4 TX 20	**KKF430**	30	18	12	500
	KKF435	35	20	15	500
	KKF440	40	24	16	500
	KKF445	45	30	15	200
	KKF450	50	30	20	200
4,5 TX 20	**KKF4520**	20	15	5	200
	KKF4540	40	24	16	200
	KKF4545	45	30	15	200
	KKF4550	50	30	20	200
	KKF4560	60	35	25	200
	KKF4570	70	40	30	200

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
5 TX 25	**KKF540**	40	24	16	200
	KKF550	50	30	20	200
	KKF560	60	35	25	200
	KKF570	70	40	30	100
	KKF580	80	50	30	100
	KKF590	90	55	35	100
	KKF5100	100	60	40	100
6 TX 30	**KKF680**	80	50	30	100
	KKF6100	100	60	40	100
	KKF6120	120	75	45	100

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**4**	**4,5**	**5**	**6**
Head diameter	d_K	[mm]	7,70	8,70	9,65	11,65
Root diameter	d_2	[mm]	2,60	3,05	3,25	4,05
Shank diameter	d_S	[mm]	2,90	3,35	3,60	4,30
Head thickness	t_1	[mm]	5,00	5,00	6,00	7,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	2,5	2,5	3,0	4,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	-	-	3,5	4,0

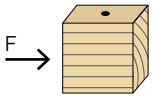
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**4**	**4,5**	**5**	**6**
Factored tensile strength	Φf_u	[kN]		3,48	5,39	5,86	8,47
Bending yield strength	F_{yb}	[MPa]		1066	1102	981	896
Factored shear strength of the screw	Φv_s	[kN]		2,04	2,81	3,19	4,95
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	41,83	47,06	52,29	52,38
			G=0.42	48,4	54,45	60,5	60,6
			G=0.49	54,75	61,6	68,44	68,55
			G=0.55	60,05	67,56	75,07	75,19
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,41	0,52	0,62	0,87
			G=0.42	0,50	0,62	0,75	1,05
			G=0.49	0,58	0,72	0,87	1,22
			G=0.55	0,65	0,81	0,98	1,37

MINIMUM DISTANCES FOR SHEAR LOADS

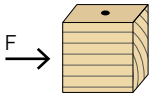
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*
S_P	**12·d‡**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*
S_Q	**5·d**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*
a_L	**15·d‡**	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*
a	**10·d‡**	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*
e_Q	**10·d**	40	*1 9/16*	45	*1 3/4*	50	*1 15/16*	60	*2 3/8*
e_P	**5·d**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*

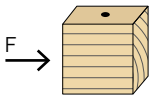
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



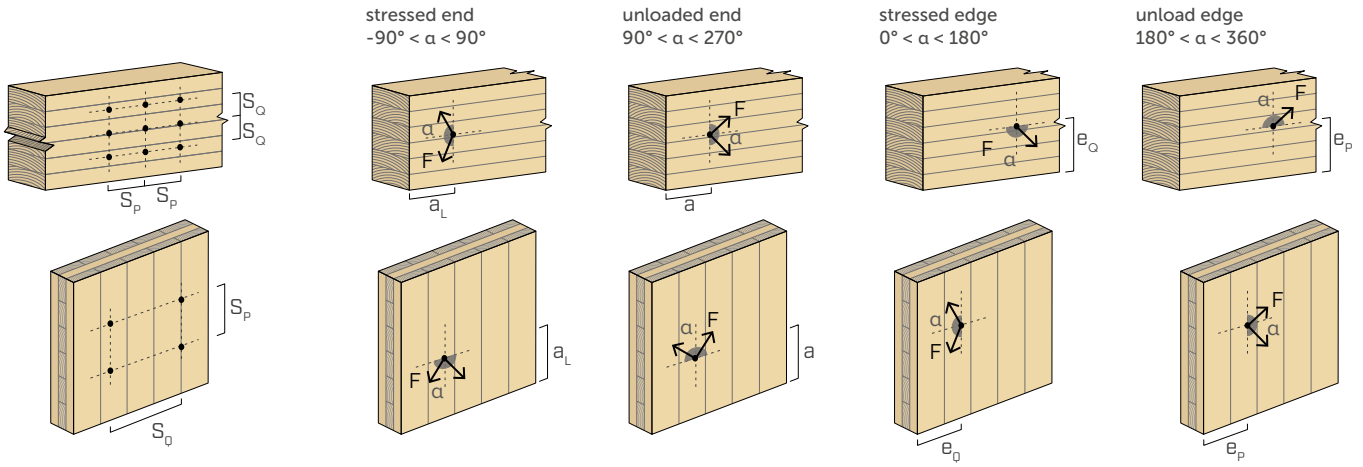
d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*
S_P	**18·d**	72	*2 13/16*	81	*3 3/16*	90	*3 1/2*	108	*4 1/4*
S_Q	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*
a_L	**22·d**	88	*3 7/16*	99	*3 7/8*	110	*4 3/8*	132	*5 3/16*
a	**15·d**	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*
e_Q	**12·d**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*
e_P	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*

screws inserted **WITH pre-drilled hole**



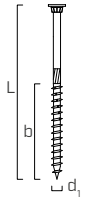
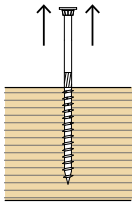
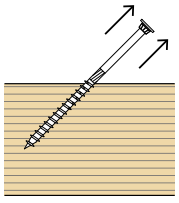
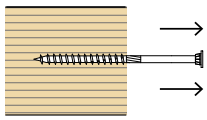
d_1		4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*
S_P	**5·d†**	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*
S_Q	**4·d**	16	*5/8*	18	*11/16*	20	*13/16*	24	*15/16*
a_L	**12·d†**	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*
a	**7·d†**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*
e_Q	**7·d**	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*
e_P	**3·d**	12	*1/2*	14	*9/16*	15	*9/16*	18	*11/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



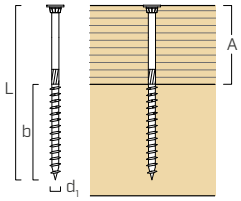
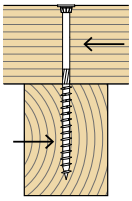
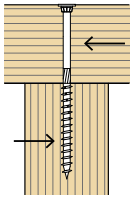
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

geometry				TENSION[1]											
				thread withdrawal										steel tension	
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	30	*1 3/16*	18	0,41	0,47	0,54	0,59	0,37	0,43	0,49	0,53	0,20	0,24	0,27	0,29	3,48
	35	*1 3/8*	20	0,47	0,54	0,61	0,67	0,43	0,49	0,56	0,61	0,23	0,27	0,31	0,34	
	40	*1 9/16*	24	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42	
	45	*1 3/4*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	50	*1 15/16*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
4.5 *0.18*	40	*1 9/16*	24	0,64	0,74	0,84	0,92	0,58	0,68	0,76	0,84	0,32	0,37	0,42	0,46	5,39
	45	*1 3/4*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	50	*1 15/16*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	60	*2 3/8*	35	1,00	1,16	1,32	1,44	0,91	1,06	1,20	1,31	0,50	0,58	0,66	0,72	
	70	*2 3/4*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
5 *0.20*	40	*1 9/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	5,86
	50	*1 15/16*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	60	*2 3/8*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	70	*2 3/4*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	80	*3 1/8*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
	90	*3 1/2*	55	1,83	2,12	2,40	2,63	1,66	1,93	2,18	2,39	0,92	1,06	1,20	1,31	
	100	*4*	60	2,01	2,33	2,63	2,89	1,83	2,12	2,40	2,63	1,01	1,16	1,32	1,45	
6 *0.24*	80	*3 1/8*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	8,47
	100	*4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	120	*4 3/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 99.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	30	*1 3/16*	18	12	0,29	0,35	0,41	0,46	0,19	0,23	0,27	0,30
	35	*1 3/8*	20	15	0,33	0,40	0,46	0,52	0,23	0,27	0,31	0,35
	40	*1 9/16*	24	16	0,37	0,44	0,51	0,57	0,26	0,31	0,36	0,40
	45	*1 3/4*	30	15	0,40	0,46	0,51	0,56	0,27	0,33	0,38	0,43
	50	*1 15/16*	30	20	0,43	0,50	0,56	0,62	0,31	0,37	0,42	0,46
4.5 *0.18*	40	*1 9/16*	24	16	0,41	0,49	0,58	0,65	0,29	0,34	0,39	0,44
	45	*1 3/4*	30	15	0,45	0,54	0,63	0,69	0,31	0,37	0,43	0,48
	50	*1 15/16*	30	20	0,49	0,59	0,69	0,76	0,35	0,42	0,49	0,55
	60	*2 3/8*	35	25	0,57	0,67	0,75	0,82	0,40	0,48	0,54	0,59
	70	*2 3/4*	40	30	0,62	0,71	0,81	0,87	0,44	0,50	0,56	0,62
5 *0.2*	40	*1 9/16*	24	16	0,45	0,55	0,64	0,71	0,31	0,37	0,42	0,47
	50	*1 15/16*	30	20	0,54	0,65	0,76	0,83	0,39	0,46	0,54	0,60
	60	*2 3/8*	35	25	0,63	0,73	0,82	0,90	0,45	0,53	0,60	0,66
	70	*2 3/4*	40	30	0,68	0,78	0,88	0,95	0,48	0,55	0,62	0,68
	80	*3 1/8*	50	30	0,68	0,78	0,88	0,95	0,52	0,60	0,67	0,74
	90	*3 1/2*	55	35	0,72	0,81	0,89	0,95	0,53	0,62	0,70	0,76
	100	*4*	60	40	0,73	0,81	0,89	0,95	0,55	0,64	0,71	0,76
6 *0.24*	80	*3 1/8*	50	30	0,89	1,02	1,15	1,26	0,64	0,77	0,88	0,97
	100	*4*	60	40	0,99	1,14	1,26	1,35	0,72	0,83	0,94	1,03
	120	*4 3/4*	75	45	1,04	1,15	1,26	1,35	0,78	0,90	1,00	1,08

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 99.

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- KKF AISI410 screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) KKF AISI410 installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

SCI A2 | AISI304

COUNTERSUNK SCREW

CE
EN 14592



3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

SUPERIOR STRENGTH

New tip, special asymmetrical umbrella thread, elongated reamer cutter and under-head cutting ribs provide the screw with higher torsional strength and safer screwing.

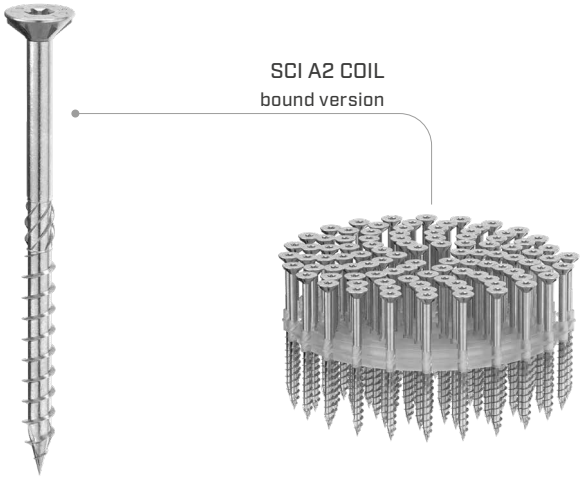
A2 | AISI304

A2 austenitic stainless steel. It offers high corrosion resistance. Suitable for outdoor applications up to 1 km from the sea in class C4 on most acid woods in class T4.

NORTH AMERICAN TESTED

Tested in accordance with ASTM F1575 for bending yield strength and ASTM D1761-20 for withdrawal strength. Tensile testing was conducted in accordance with AISI S904-17.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



BIT INCLUDED

DIAMETER [mm]

3,5 — 8

LENGTH [mm]

20 — 25 — 320 — 320

SERVICE CONDITION

WET

ATMOSPHERIC CORROSIVITY

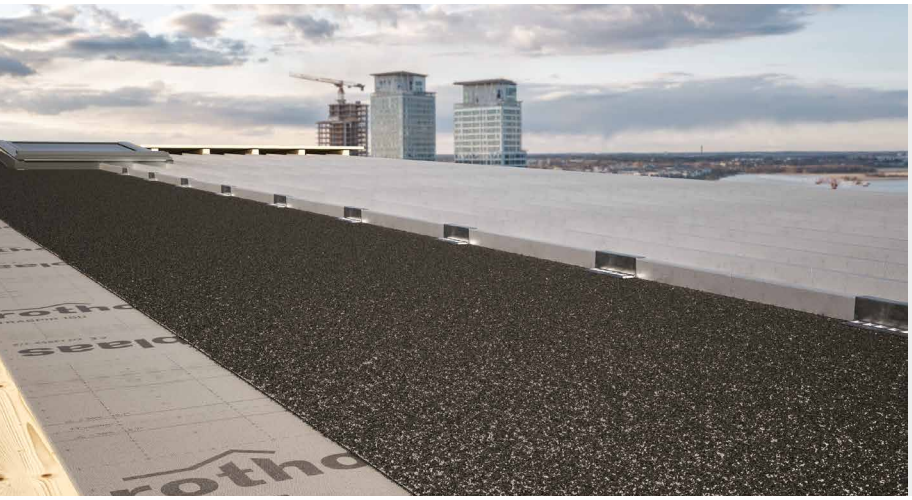
C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3 T4

MATERIAL

A2 AISI 304 — A2 | AISI304 austenitic stainless steel (CRC II)



FIELDS OF USE

Use in aggressive outdoor environments.
Wooden boards with density of < 470 kg/m³ (without pre-drill) and < 620 kg/m³ (with pre-drill).

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
3,5 TX 15	SCI3525(*)	25	18	7	500
	SCI3530(*)	30	18	12	500
	SCI3535(*)	35	18	17	500
	SCI3540(*)	40	18	22	500
4 TX 20	SCI4030	30	18	12	500
	SCI4035	35	18	17	500
	SCI4040	40	24	16	500
	SCI4045	45	30	15	200
	SCI4050	50	30	20	400
	SCI4060	60	35	25	200
4,5 TX 20	SCI4535	35	24	11	400
	SCI4540	40	24	16	400
	SCI4545	45	30	15	400
	SCI4550	50	30	20	200
	SCI4560	60	35	25	200
	SCI4570	70	40	30	200
	SCI4580	80	40	40	200
5 TX 25	SCI5040	40	20	20	200
	SCI5045	45	24	21	200
	SCI5050	50	24	26	200
	SCI5060	60	30	30	200
	SCI5070	70	35	35	100
	SCI5080	80	40	40	100
	SCI5090	90	45	45	100
	SCI50100	100	50	50	100

(*) Not holding CE marking.

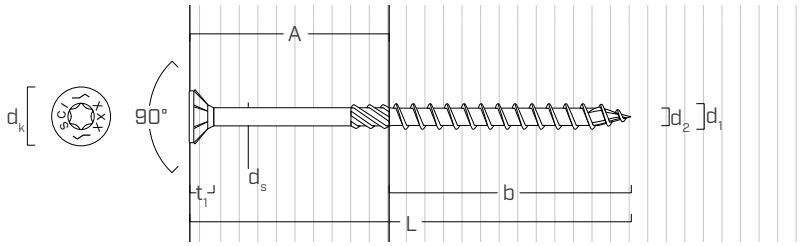
d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
6 TX 30	SCI6060	60	30	30	100
	SCI6080	80	40	40	100
	SCI60100	100	50	50	100
	SCI60120	120	60	60	100
	SCI60140	140	75	65	100
	SCI60160	160	75	85	100
8 TX 40	SCI80120	120	60	60	100
	SCI80160	160	80	80	100
	SCI80200	200	80	120	100
	SCI80240	240	80	160	100
	SCI80280	280	80	200	100
	SCI80320	320	80	240	100

SCI A2 COIL

Bound version available for fast and accurate installation. Ideal for large projects.

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
4 TX 20	SCICOIL4025	25	18	7	3006
5 TX 25	SCICOIL5050	50	30	20	1250
	SCICOIL5060	60	35	25	1250
	SCICOIL5070	70	40	30	625

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	[mm]	3,5	4	4,5	5	6	8
Head diameter	d_K	[mm]	7,00	8,00	9,00	10,00	12,00	14,50
Root diameter	d_2	[mm]	2,25	2,55	2,80	3,40	3,95	5,40
Shank diameter	d_S	[mm]	2,45	2,75	3,15	3,65	4,30	5,80
Head thickness	t_1	[mm]	3,50	3,80	4,25	4,65	5,30	6,00
Pre-drilling hole diameter(1)	d_V	[mm]	2,0	2,5	3,0	3,0	4,0	5,0

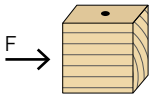
(1) For high density materials, pre-drilled holes are recommended based on the wood specie.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		3,5	4	4,5	5	6	8
Factored tensile strength	Φf_u	[kN]		-	-	2,52	3,37	5,23	8,04
Bending yield strength	F_{yb}	[MPa]		833	650	591	486	574	523
Factored shear strength of the screw	Φv_s	[kN]		0,86	1,10	1,33	1,96	2,95	4,95
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	36,60	41,83	47,06	52,29	52,38	69,83
			G=0.42	42,35	48,40	54,45	60,50	60,60	80,80
			G=0.49	47,91	54,75	61,60	68,44	68,55	91,40
			G=0.55	52,55	60,05	67,56	75,07	75,19	100,30
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,35	0,44	0,55	0,66	0,92	1,28
			G=0.42	0,42	0,53	0,66	0,80	1,10	1,53
			G=0.49	0,48	0,62	0,77	0,93	1,29	1,79
			G=0.55	0,54	0,70	0,86	1,04	1,45	2,01

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

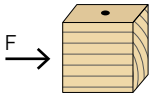
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**12·d‡**	96	*1 5/8*	120	*1 7/8*	144	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
S_Q	**5·d**	40	*11/16*	50	*13/16*	60	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
a_L	**15·d‡**	120	*2 1/16*	150	*2 3/8*	180	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
a	**10·d‡**	80	*1 3/8*	100	*1 9/16*	120	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_Q	**10·d**	80	*1 3/8*	100	*1 9/16*	120	*1 3/4*	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*
e_P	**5·d**	40	*11/16*	50	*13/16*	60	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*

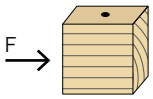
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



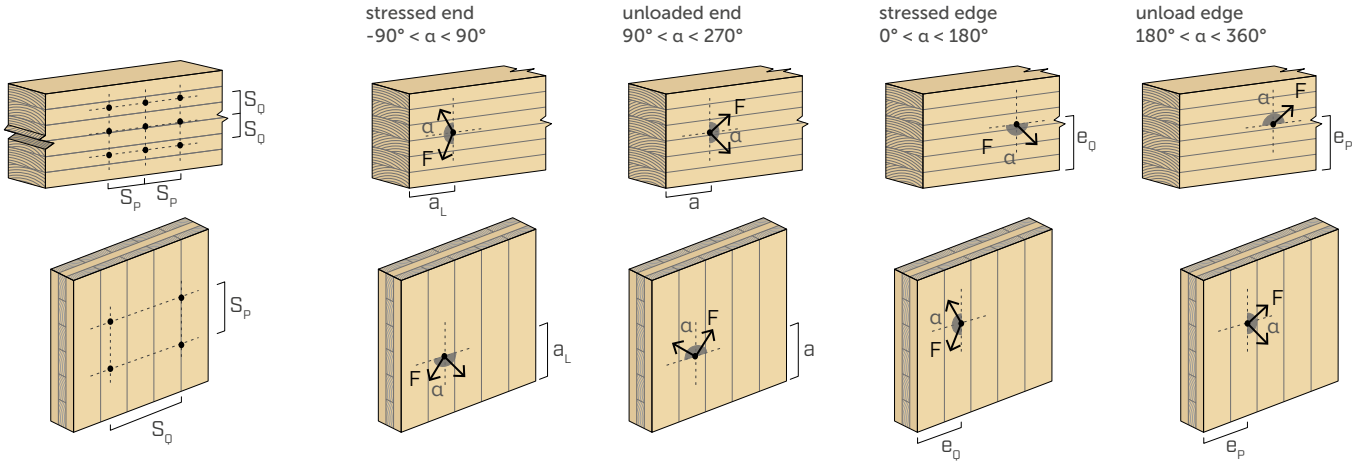
d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**18·d**	63	*2 1/2*	72	*2 13/16*	81	*3 3/16*	90	*3 1/2*	108	*4 1/4*	144	*5 11/16*
S_Q	**7·d**	25	*1*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
a_L	**22·d**	77	*3 1/16*	88	*3 7/16*	99	*3 7/8*	110	*4 3/8*	132	*5 3/16*	176	*6 15/16*
a	**15·d**	53	*2 1/16*	60	*2 3/8*	68	*2 11/16*	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*
e_Q	**12·d**	42	*1 5/8*	48	*1 7/8*	*54*	*2 1/8*	*60*	*2 3/8*	72	*2 13/16*	96	*3 3/4*
e_P	**7·d**	25	*1*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*

screws inserted **WITH pre-drilled hole**



d_1		3,5 [mm]	*0.14 [in]*	4 [mm]	*0.16 [in]*	4,5 [mm]	*0.18 [in]*	5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*
S_P	**5·d†**	18	*11/16*	20	*13/16*	23	*7/8*	25	*1*	30	*1 3/16*	40	*1 9/16*
S_Q	**4·d**	14	*9/16*	16	*5/8*	18	*11/16*	20	*13/16*	24	*15/16*	32	*1 1/4*
a_L	**12·d†**	42	*1 5/8*	48	*1 7/8*	54	*2 1/8*	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*
a	**7·d†**	25	*1*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_Q	**7·d**	25	*1*	28	*1 1/8*	32	*1 1/4*	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*
e_P	**3·d**	11	*7/16*	12	*1/2*	14	*9/16*	15	*9/16*	18	*11/16*	24	*15/16*

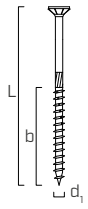
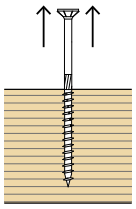
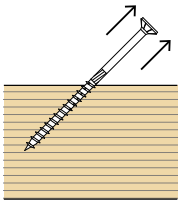
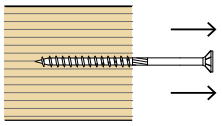
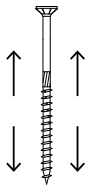
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

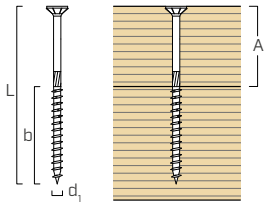
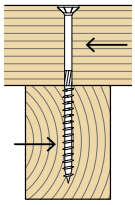
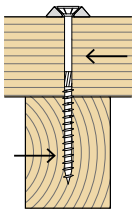
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

STRUCTURAL VALUES | AXIAL TENSION

geometry			TENSION[1]												
			thread withdrawal												steel tension
			α = 90°				α = 45°				end grain α = 0°				
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
			G				G				G				
d_1	L		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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3,5 *0.14*	25	*1*	18	0,37	0,43	0,49	0,53	0,34	0,39	0,44	0,48	0,19	0,21	0,24	0,27	-
	30	*1 3/16*	18	0,37	0,43	0,49	0,53	0,34	0,39	0,44	0,48	0,19	0,21	0,24	0,27	
	35	*1 3/8*	18	0,37	0,43	0,49	0,53	0,34	0,39	0,44	0,48	0,19	0,21	0,24	0,27	
	40	*1 9/16*	18	0,37	0,43	0,49	0,53	0,34	0,39	0,44	0,48	0,19	0,21	0,24	0,27	
4 *0.16*	30	*1 3/16*	18	0,41	0,47	0,54	0,59	0,37	0,43	0,49	0,53	0,20	0,24	0,27	0,29	-
	35	*1 3/8*	18	0,41	0,47	0,54	0,59	0,37	0,43	0,49	0,53	0,20	0,24	0,27	0,29	
	40	*1 9/16*	24	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42	
	45	*1 3/4*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	50	*1 15/16*	30	0,76	0,88	1,00	1,09	0,69	0,80	0,91	0,99	0,38	0,44	0,50	0,55	
	60	*2 3/8*	35	0,91	1,05	1,19	1,30	0,83	0,95	1,08	1,18	0,45	0,53	0,59	0,65	
4,5 *0.16*	35	*1 3/8*	24	0,64	0,74	0,84	0,92	0,58	0,68	0,76	0,84	0,32	0,37	0,42	0,46	2,52
	40	*1 9/16*	24	0,64	0,74	0,84	0,92	0,58	0,68	0,76	0,84	0,32	0,37	0,42	0,46	
	45	*1 3/4*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	50	*1 15/16*	30	0,84	0,97	1,10	1,21	0,76	0,88	1,00	1,10	0,42	0,49	0,55	0,60	
	60	*2 3/8*	35	1,00	1,16	1,32	1,44	0,91	1,06	1,20	1,31	0,50	0,58	0,66	0,72	
	70	*2 3/4*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
	80	*3 1/8*	40	1,17	1,35	1,53	1,68	1,06	1,23	1,39	1,53	0,58	0,68	0,77	0,84	
5 *0.20*	40	*1 9/16*	20	0,55	0,64	0,72	0,79	0,50	0,58	0,65	0,72	0,27	0,32	0,36	0,39	3,37
	45	*1 3/4*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	
	50	*1 15/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	
	60	*2 3/8*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	70	*2 3/4*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	80	*3 1/8*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	90	*3 1/2*	45	1,46	1,69	1,92	2,10	1,33	1,54	1,74	1,91	0,73	0,85	0,96	1,05	
	100	*4*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
6 *0.24*	60	*2 3/8*	30	0,88	1,02	1,15	1,26	0,80	0,93	1,05	1,15	0,44	0,51	0,58	0,63	5,23
	80	*3 1/8*	40	1,25	1,44	1,63	1,79	1,13	1,31	1,48	1,63	0,62	0,72	0,82	0,89	
	100	*4*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	
	120	*4 3/4*	60	1,98	2,29	2,59	2,84	1,80	2,08	2,36	2,58	0,99	1,15	1,30	1,42	
	140	*5 1/2*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
	160	*6 1/4*	75	2,53	2,93	3,31	3,63	2,30	2,66	3,01	3,30	1,26	1,46	1,66	1,82	
8 *0.32*	120	*4 3/4*	60	2,54	2,94	3,33	3,65	2,31	2,67	3,02	3,32	1,27	1,47	1,66	1,83	8,04
	160	*6 1/4*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	200	*8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	240	*9 1/2*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	280	*11*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	
	320	*12 5/8*	80	3,52	4,07	4,61	5,06	3,20	3,70	4,19	4,60	1,76	2,04	2,30	2,53	

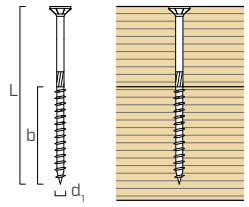
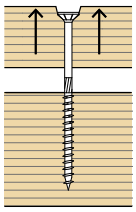
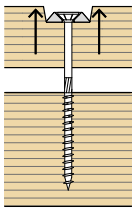
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 106.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber with HUS A4 washer α = 90°			
												
					factored lateral resistance N_r				factored lateral resistance N_r			
					G				G			
d_1	L		b	A	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3,5 *0.14*	25	*1*	18	7	0,23	0,27	0,32	0,35	-	-	-	-
	30	*1 3/16*	18	12	0,26	0,31	0,37	0,40	-	-	-	-
	35	*1 3/8*	18	17	0,30	0,36	0,41	0,46	-	-	-	-
	40	*1 9/16*	18	22	0,33	0,38	0,43	0,46	-	-	-	-
4 *0.16*	30	*1 3/16*	18	12	0,30	0,36	0,42	0,47	-	-	-	-
	35	*1 3/8*	18	17	0,34	0,40	0,47	0,52	-	-	-	-
	40	*1 9/16*	24	16	0,36	0,41	0,47	0,51	-	-	-	-
	45	*1 3/4*	30	15	0,35	0,40	0,46	0,50	-	-	-	-
	50	*1 15/16*	30	20	0,39	0,45	0,49	0,53	-	-	-	-
	60	*2 3/8*	35	25	0,40	0,45	0,49	0,53	-	-	-	-
4,5 *0.16*	35	*1 3/8*	24	11	0,37	0,43	0,48	0,52	-	-	-	-
	40	*1 9/16*	24	16	0,41	0,47	0,53	0,59	-	-	-	-
	45	*1 3/4*	30	15	0,40	0,46	0,52	0,57	-	-	-	-
	50	*1 15/16*	30	20	0,44	0,51	0,58	0,62	-	-	-	-
	60	*2 3/8*	35	25	0,47	0,52	0,58	0,62	-	-	-	-
	70	*2 3/4*	40	30	0,47	0,52	0,58	0,62	-	-	-	-
	80	*3 1/8*	40	40	0,47	0,52	0,58	0,62	-	-	-	-
5 *0.20*	40	*1 9/16*	20	20	0,46	0,55	0,65	0,73	-	-	-	-
	45	*1 3/4*	24	21	0,51	0,61	0,69	0,76	-	-	-	-
	50	*1 15/16*	24	26	0,55	0,65	0,72	0,77	-	-	-	-
	60	*2 3/8*	30	30	0,59	0,65	0,72	0,77	-	-	-	-
	70	*2 3/4*	35	35	0,59	0,65	0,72	0,77	-	-	-	-
	80	*3 1/8*	40	40	0,59	0,65	0,72	0,77	-	-	-	-
	90	*3 1/2*	45	45	0,59	0,65	0,72	0,77	-	-	-	-
	100	*4*	50	50	0,59	0,65	0,72	0,77	-	-	-	-
6 *0.24*	60	*2 3/8*	30	30	0,75	0,90	1,03	1,11	0,76	0,90	1,03	1,13
	80	*3 1/8*	40	40	0,84	0,94	1,03	1,11	0,99	1,11	1,21	1,30
	100	*4*	50	50	0,84	0,94	1,03	1,11	1,08	1,21	1,33	1,43
	120	*4 3/4*	60	60	0,84	0,94	1,03	1,11	1,16	1,32	1,45	1,56
	140	*5 1/2*	75	65	0,84	0,94	1,03	1,11	1,16	1,32	1,47	1,60
	160	*6 1/4*	75	85	0,84	0,94	1,03	1,11	1,16	1,32	1,47	1,60
8 *0.32*	120	*4 3/4*	60	60	1,37	1,53	1,67	1,79	1,78	1,99	2,19	2,35
	160	*6 1/4*	80	80	1,37	1,53	1,67	1,79	1,82	2,07	2,30	2,50
	200	*8*	80	120	1,37	1,53	1,67	1,79	1,82	2,07	2,30	2,50
	240	*9 1/2*	80	160	1,37	1,53	1,67	1,79	1,82	2,07	2,30	2,50
	280	*11*	80	200	1,37	1,53	1,67	1,79	1,82	2,07	2,30	2,50
	320	*12 5/8*	80	240	1,37	1,53	1,67	1,79	1,82	2,07	2,30	2,50

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 106.

				TENSION							
geometry				head pull-through				head pull-through with HUS A4 washer			
											
				factored head pull-through resistance P_{pt}				factored head pull-through resistance P_{pt}			
				G				G			
d_1	L		b	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3,5 *0.14*	25	*1*	18	0,24	0,29	0,34	0,38	-	-	-	-
	30	*1 3/16*	18	0,24	0,29	0,34	0,38	-	-	-	-
	35	*1 3/8*	18	0,24	0,29	0,34	0,38	-	-	-	-
	40	*1 9/16*	18	0,24	0,29	0,34	0,38	-	-	-	-
4 *0.16*	30	*1 3/16*	18	0,31	0,37	0,43	0,49	-	-	-	-
	35	*1 3/8*	18	0,31	0,37	0,43	0,49	-	-	-	-
	40	*1 9/16*	24	0,31	0,37	0,43	0,49	-	-	-	-
	45	*1 3/4*	30	0,31	0,37	0,43	0,49	-	-	-	-
	50	*1 15/16*	30	0,31	0,37	0,43	0,49	-	-	-	-
	60	*2 3/8*	35	0,31	0,37	0,43	0,49	-	-	-	-
4,5 *0.16*	35	*1 3/8*	24	0,38	0,46	0,54	0,60	-	-	-	-
	40	*1 9/16*	24	0,38	0,46	0,54	0,60	-	-	-	-
	45	*1 3/4*	30	0,38	0,46	0,54	0,60	-	-	-	-
	50	*1 15/16*	30	0,38	0,46	0,54	0,60	-	-	-	-
	60	*2 3/8*	35	0,38	0,46	0,54	0,60	-	-	-	-
	70	*2 3/4*	40	0,38	0,46	0,54	0,60	-	-	-	-
	80	*3 1/8*	40	0,38	0,46	0,54	0,60	-	-	-	-
5 *0.20*	40	*1 9/16*	20	0,47	0,56	0,65	0,73	-	-	-	-
	45	*1 3/4*	24	0,47	0,56	0,65	0,73	-	-	-	-
	50	*1 15/16*	24	0,47	0,56	0,65	0,73	-	-	-	-
	60	*2 3/8*	30	0,47	0,56	0,65	0,73	-	-	-	-
	70	*2 3/4*	35	0,47	0,56	0,65	0,73	-	-	-	-
	80	*3 1/8*	40	0,47	0,56	0,65	0,73	-	-	-	-
	90	*3 1/2*	45	0,47	0,56	0,65	0,73	-	-	-	-
	100	*4*	50	0,47	0,56	0,65	0,73	-	-	-	-
6 *0.24*	60	*2 3/8*	30	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
	80	*3 1/8*	40	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
	100	*4*	50	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
	120	*4 3/4*	60	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
	140	*5 1/2*	75	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
	160	*6 1/4*	75	0,64	0,77	0,90	1,01	1,91	2,29	2,67	2,99
8 *0.32*	120	*4 3/4*	60	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23
	160	*6 1/4*	80	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23
	200	*8*	80	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23
	240	*9 1/2*	80	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23
	280	*11*	80	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23
	320	*12 5/8*	80	0,89	1,07	1,25	1,41	2,69	3,23	3,77	4,23

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 106.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- SCI A2 screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

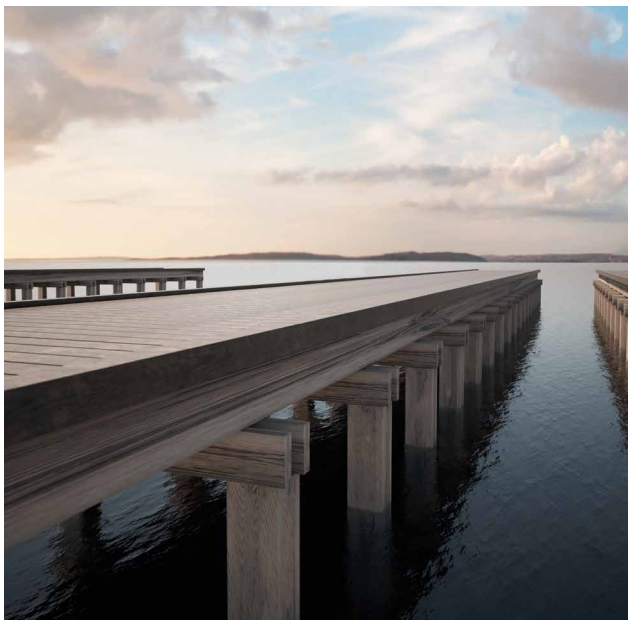
(3) SCI A2 screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.



SCI A4 | AISI316

COUNTERSUNK SCREW



SUPERIOR STRENGTH

Special asymmetrical umbrella thread, elongated reamer cutter and under-head cutting ribs provide the screw with higher torsional strength and safer screwing.

A4 | AISI316

A4 | AISI316 austenitic stainless steel for high corrosion resistance. Ideal for environments adjacent to the sea in corrosivity class C5 and for insertion on the most aggressive timbers in class T5.

T5 TIMBER CORROSIVITY

Suitable for use in applications on aggressive woods with an acidity (pH) level below 4 such as oak, Douglas fir and chestnut, and in wood moisture conditions above 20%.

NORTH AMERICAN TESTED

Tested in accordance with ASTM F1575 for bending yield strength and ASTM D1761-20 for withdrawal strength. Tensile testing was conducted in accordance with AISI S904-17.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



BIT INCLUDED

DIAMETER [mm]

3,5 — 5 — 8

LENGTH [mm]

20 — 50 — 100 — 320

SERVICE CONDITION

WET

ATMOSPHERIC CORROSIVITY

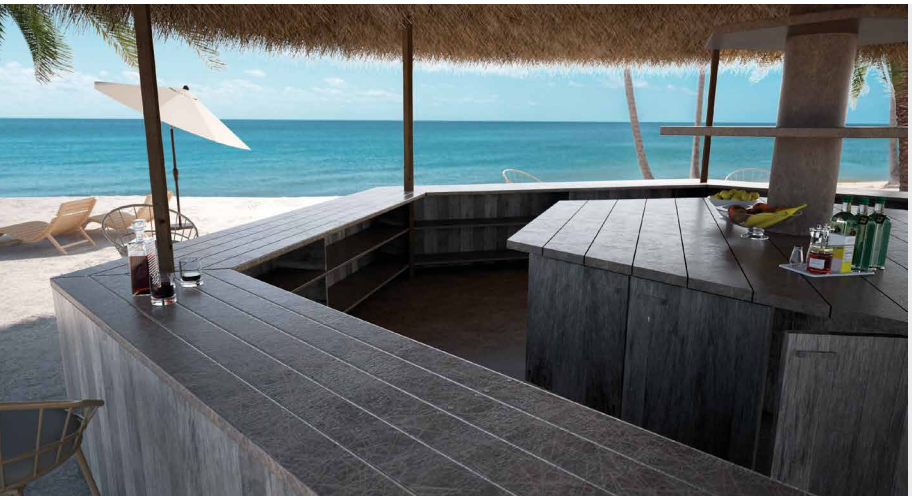
C1 C2 C3 C4 C5

WOOD CORROSIVITY

T1 T2 T3 T4 T5

MATERIAL

A4 AISI 316 — A4 | AISI316 austenitic stainless steel (CRC III)



FIELDS OF USE

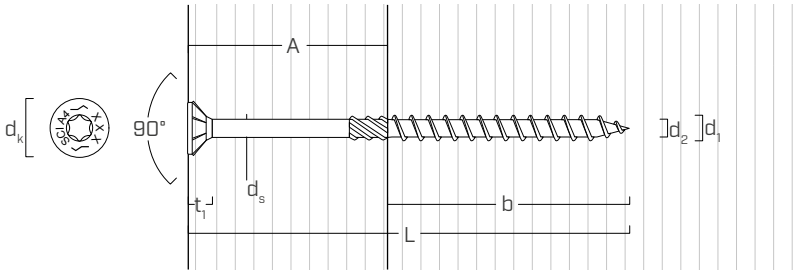
Outdoor use in highly aggressive environments. Wooden boards with density of < 470 kg/m³ (without pre-drill) and < 620 kg/m³ (with pre-drill).

CODES AND DIMENSIONS

SCI A4 | AISI316

d_1 [mm]	CODE	L [mm]	b [mm]	A [mm]	pcs
5 TX 25	**SCI5050A4**	50	24	26	200
	SCI5060A4	60	30	30	200
	SCI5070A4	70	35	35	100
	SCI5080A4	80	40	40	100
	SCI5090A4	90	45	45	100
	SCI50100A4	100	50	50	100

GEOMETRY AND MECHANICAL CHARACTERISTICS



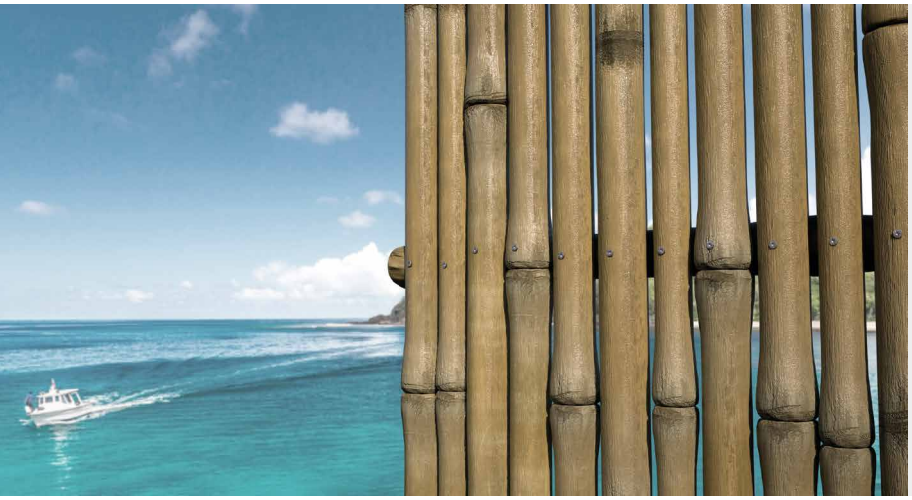
GEOMETRY

Nominal diameter	d_1	[mm]	5
Head diameter	d_K	[mm]	10,00
Root diameter	d_2	[mm]	3,40
Shank diameter	d_S	[mm]	3,65
Head thickness	t_1	[mm]	4,65
Pre-drilling hole diameter(1)	d_V	[mm]	3,0

(1) For high density materials, pre-drilled holes are recommended based on the wood specie.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		5
Factored tensile strength	Φf_u	[kN]		3,31
Bending yield strength	F_{yb}	[MPa]		515
Factored shear strength of the screw	Φv_s	[kN]		1,96
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29
			G=0.42	60,50
			G=0.49	68,44
			G=0.55	75,07
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,66
			G=0.42	0,80
			G=0.49	0,93
			G=0.55	1,04

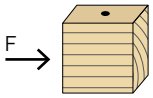


MARINE ENVIRONMENTS

Can be used in aggressive environments and in areas near the sea thanks to the A4 | AISI316 stainless steel.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

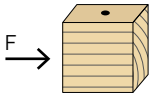
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*
S_P	12·d‡	60	*2 3/8*
S_Q	5·d	25	*1*
a_L	15·d‡	75	*2 15/16*
a	10·d‡	50	*1 15/16*
e_Q	10·d	50	*1 15/16*
e_P	5·d	25	*1*

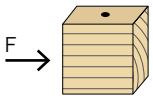
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



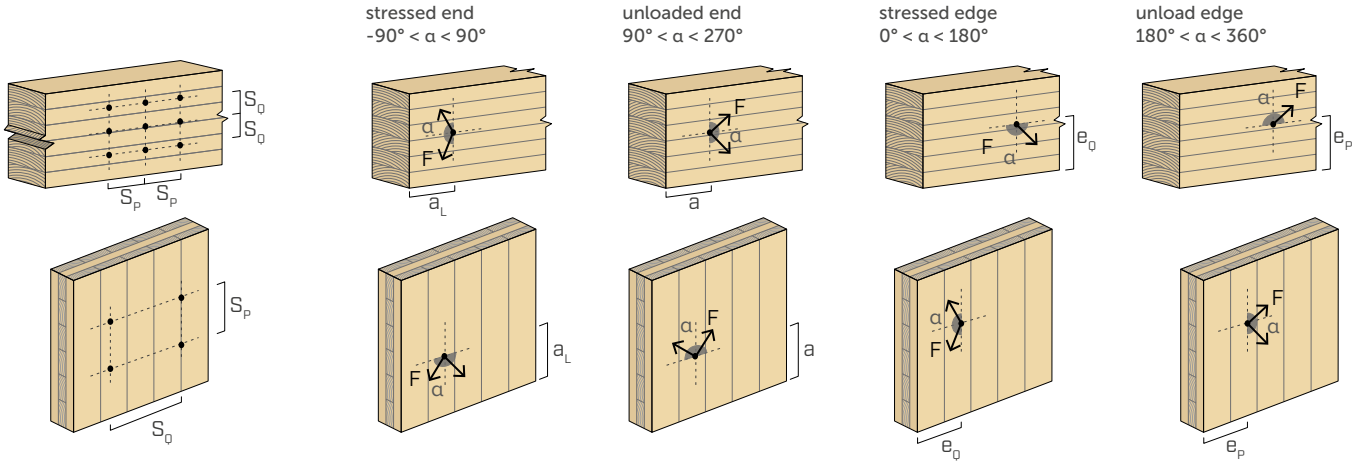
d_1		5 [mm]	*0.20 [in]*
S_P	18·d	90	*3 1/2*
S_Q	7·d	35	*1 3/8*
a_L	22·d	110	*4 3/8*
a	15·d	75	*2 15/16*
e_Q	12·d	*60*	*2 3/8*
e_P	7·d	35	*1 3/8*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*
S_P	5·d†	25	*1*
S_Q	4·d	20	*13/16*
a_L	12·d†	60	*2 3/8*
a	7·d†	35	*1 3/8*
e_Q	7·d	35	*1 3/8*
e_P	3·d	15	*9/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle

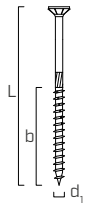
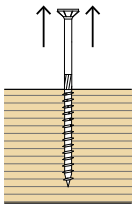
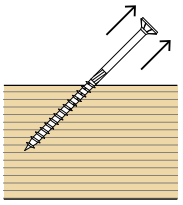
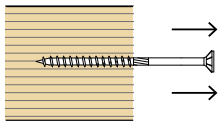
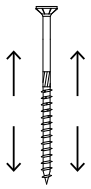


NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

VALEURS STATIQUES | TRACTION AXIALE

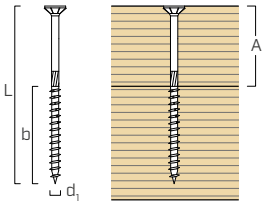
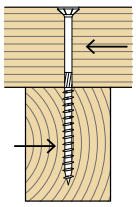
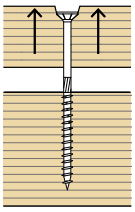
VALEURS DE RÉSISTANCE
CSA O86:24

géométrie				TRACTION[1]											
				extraction du filetage											traction acier
				α = 90°				α = 45°				bois de bout α = 0°			
															
				résistance de calcul à l'arrachement P_{rw}				résistance de calcul à l'arrachement P_{rw}				résistance de calcul à l'arrachement P_{rw}[2][3]			résistance de calcul à la traction T_{rs}
				G				G				G			
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0,20*	50	*1 15/16*	24	0,70	0,80	0,91	1,00	0,63	0,73	0,83	0,91	0,35	0,40	0,46	0,50	3,31
	60	*2 3/8*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	
	70	*2 3/4*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	80	*3 1/8*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	90	*3 1/2*	45	1,46	1,69	1,92	2,10	1,33	1,54	1,74	1,91	0,73	0,85	0,96	1,05	
	100	*4*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	

α = angle entre vis et fil du bois

VALEURS STATIQUES | RÉSISTANCE LATÉRALE

VALEURS DE RÉSISTANCE
CSA O86:24

géométrie					CISAILLEMENT[4]				TRACTION			
					bois-bois α = 90°				résistance à la pénétration de la tête			
												
					résistance latérale de calcul N_r				résistance de calcul à la pénétration de la tête P_{pt}			
					G				G			
d_1	L		b	A	0,35	0,42	0,49	0,55	0,35	0,42	0,49	0,55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0,20*	50	*1 15/16*	24	26	0,55	0,65	0,73	0,79	0,47	0,56	0,65	0,73
	60	*2 3/8*	30	30	0,60	0,67	0,73	0,79	0,47	0,56	0,65	0,73
	70	*2 3/4*	35	35	0,60	0,67	0,73	0,79	0,47	0,56	0,65	0,73
	80	*3 1/8*	40	40	0,60	0,67	0,73	0,79	0,47	0,56	0,65	0,73
	90	*3 1/2*	45	45	0,60	0,67	0,73	0,79	0,47	0,56	0,65	0,73
	100	*4*	50	50	0,60	0,67	0,73	0,79	0,47	0,56	0,65	0,73

α = angle entre vis et fil du bois

NOTES et PRINCIPES GÉNÉRAUX à la page 112.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- SCI A4 screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) SCI A4 screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

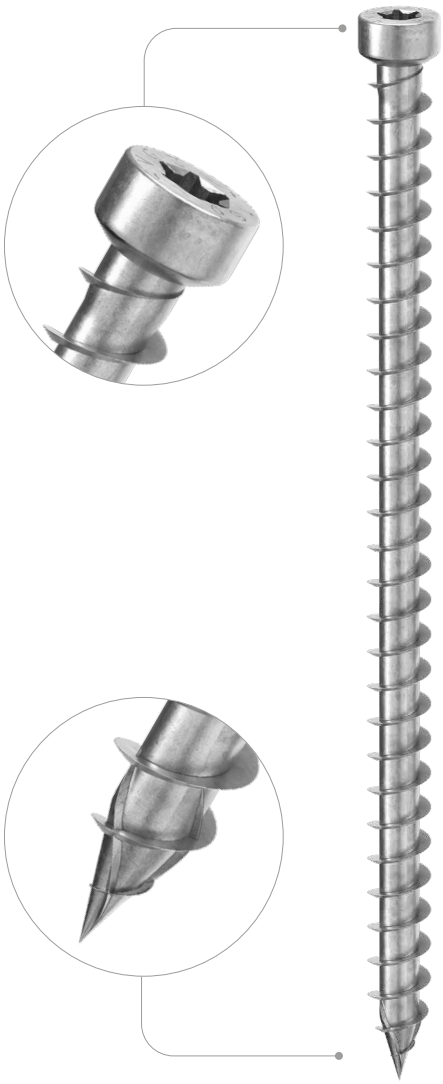
(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.



VGZ

FULL THREADED SCREW WITH CYLINDRICAL HEAD

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030



3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

STRUCTURAL APPLICATIONS

Structural connector approved for timber applications subjected to stresses in any direction according to ICC ELC-4645 listing report in Canada. Cyclical SEISMIC-REV tests according to EN 12512.

CYLINDRICAL HEAD

It allows the screw to penetrate and pass through the surface of the wood substrate. Ideal for concealed joints, timber couplings and structural re-inforcements. It is the right choice to ensure strength in fire conditions.

TIMBER FRAME

Also ideal for joining small timber elements such as the crossbeams and uprights of light frame structures.

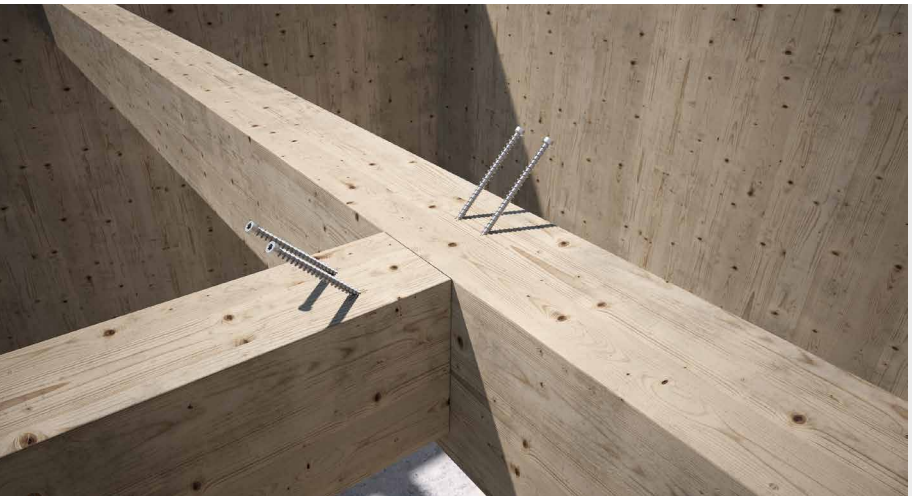
VIDEO

BIT INCLUDED

DIAMETER [mm]	5 — 7 — 11 — 11
LENGTH [mm]	80 — 80 — 1000 — 1000
SERVICE CONDITION	EC1 DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED — electrogalvanized carbon steel
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

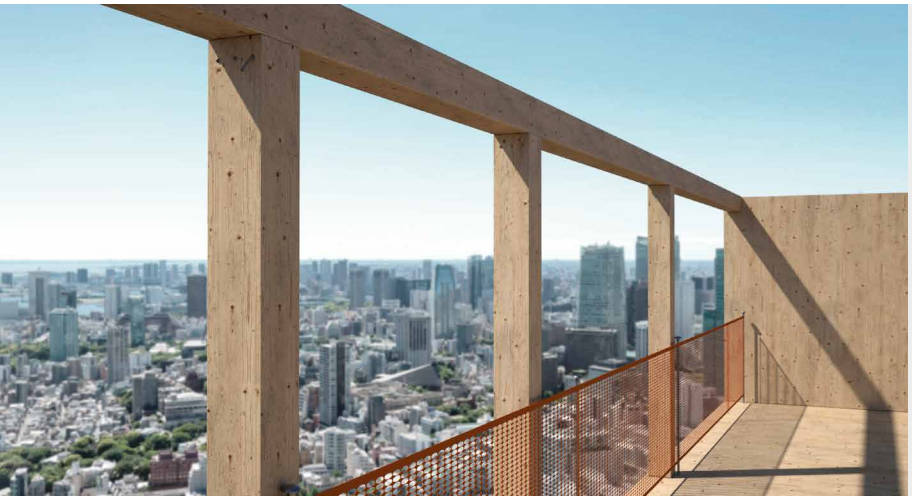
USA, EU and more design values available online.



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.



STRUCTURAL RESTORATION

Ideal for coupling beams in structural renovations and new works. Can also be used parallel to the grain thanks to the special approval.

CLT, LVL

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

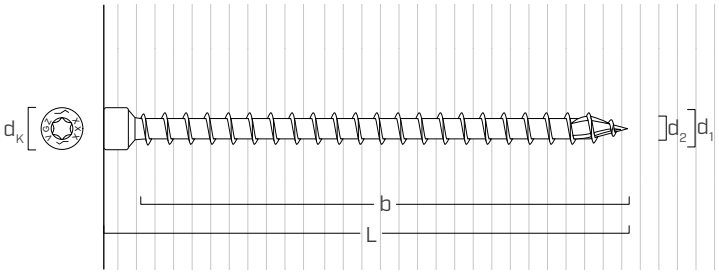


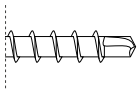
Very high stiffness in side-by-side joining of CLT floors. Application with double inclination at 45°, perfect combined with the JIG VGZ template.



Reinforcement orthogonal to grain for hanging load due to joining of main-secondary beams.

GEOMETRY AND MECHANICAL CHARACTERISTICS





Ø9 | L > 520 mm
Ø11 | L > 600 mm

GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**7**	**9**	**11**
Head diameter	d_K	[mm]	9,50	11,50	13,50
Root diameter	d_2	[mm]	4,60	5,90	6,60
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	4,0	5,0	6,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	5,0	6,0	7,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

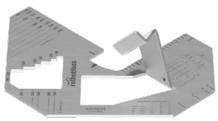
Nominal diameter	**d_1**	**[mm]**		**7**	**9**	**11**
Factored tensile strength	Φf_u	[kN]		10,64	17,84	23,17
Bending yield strength	F_{yb}	[MPa]		1111	1069	1026
Factored shear strength of the screw	Φv_s	[kN]		6,38	10,50	13,14
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	61,1	78,56	96,02
			G=0.42	70,7	90,9	111,1
			G=0.49	79,98	102,8	125,7
			G=0.55	87,72	112,8	137,9

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
7 TX 30	VGZ780	80	70	50	
	VGZ7100	100	90	50	
	VGZ7120	120	110	50	
	VGZ7140	140	130	50	
	VGZ7160	160	150	50	
	VGZ7180	180	170	50	
	VGZ7200	200	190	50	
	VGZ7220	220	210	50	
	VGZ7240	240	230	50	
	VGZ7260	260	250	50	
	VGZ7280	280	270	50	
	VGZ7300	300	290	50	
	VGZ7320	320	310	50	
	VGZ7340	340	330	50	
	VGZ7360	360	350	50	
	VGZ7380	380	370	50	
	VGZ7400	400	390	50	
9 TX 40	VGZ9160	160	150	50	
	VGZ9180	180	170	50	
	VGZ9200	200	190	50	
	VGZ9220	220	210	50	
	VGZ9240	240	230	50	
	VGZ9260	260	250	25	
	VGZ9280	280	270	50	
	VGZ9300	300	290	50	
	VGZ9320	320	310	50	
	VGZ9340	340	330	50	
	VGZ9360	360	350	50	
	VGZ9380	380	370	50	
	VGZ9400	400	390	50	
	VGZ9440	440	430	25	
	VGZ9480	480	470	25	
	VGZ9520	520	510	25	
	VGZ9560	560	550	25	
	VGZ9600	600	590	25	

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
11 TX 50	VGZ11150	150	140	25	
	VGZ11200	200	190	25	
	VGZ11250	250	240	25	
	VGZ11275	275	265	25	
	VGZ11300	300	290	25	
	VGZ11325	325	315	25	
	VGZ11350	350	340	25	
	VGZ11375	375	365	25	
	VGZ11400	400	390	25	
	VGZ11425	425	415	25	
	VGZ11450	450	440	25	
	VGZ11475	475	465	25	
	VGZ11500	500	490	25	
	VGZ11525	525	515	25	
	VGZ11550	550	540	25	
	VGZ11575	575	565	25	
	VGZ11600	600	590	25	
	VGZ11650	650	630	25	
	VGZ11700	700	680	25	
	VGZ11750	750	730	25	
	VGZ11800	800	780	25	
	VGZ11850	850	830	25	
	VGZ11900	900	880	25	
	VGZ11950	950	930	25	
	VGZ111000	1000	980	25	

RELATED PRODUCTS



JIG VGZ 45°

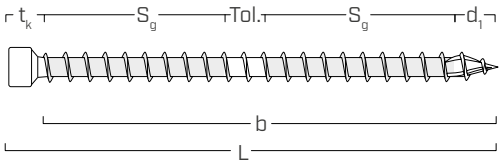
TEMPLATE FOR 45° SCREWS



JIG VGZ 45° TEMPLATE

Installation at 45° using the JIG VGZ steel template.

EFFECTIVE THREAD USED IN CALCULATION



b = $S_{g,tot}$ = L - t_K represents the entire length of the threaded part (see table above)

S_g = (b - d_1 - Tol.)/2 represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

t_K = 10 mm or 20 mm depending on screw length.

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report.

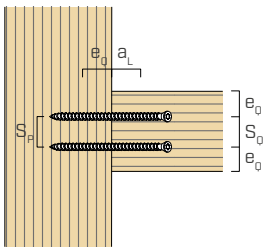
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

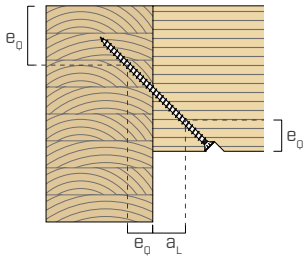
d_1		7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**7·d†**	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
S_Q	**5·d**	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
a_L	**10·d†**	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
a	**7·d†**	49	*1 15/19*	63	*2 1/2*	77	*3 1/16*
e_Q	**4·d**	28	*1 1/8*	36	*1 7/16*	44	*1 3/4*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.

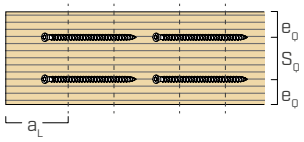
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



plan



front



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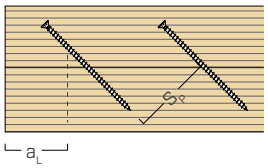
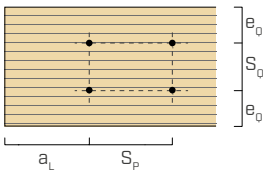


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN



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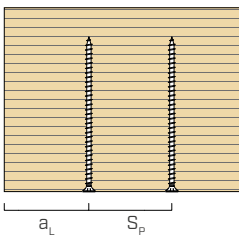
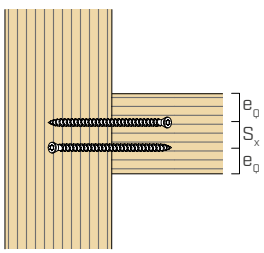
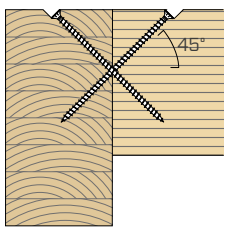


front

CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



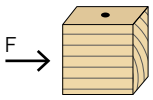
plan



front

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

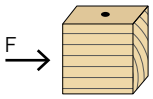
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**12·d‡**	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
S_Q	**5·d**	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
a_L	**15·d‡**	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
a	**10·d‡**	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_Q	**10·d**	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_P	**5·d**	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
S_x	**2·d**	14	*9/16*	18	*11/16*	22	*7/8*

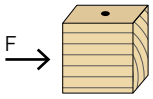
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



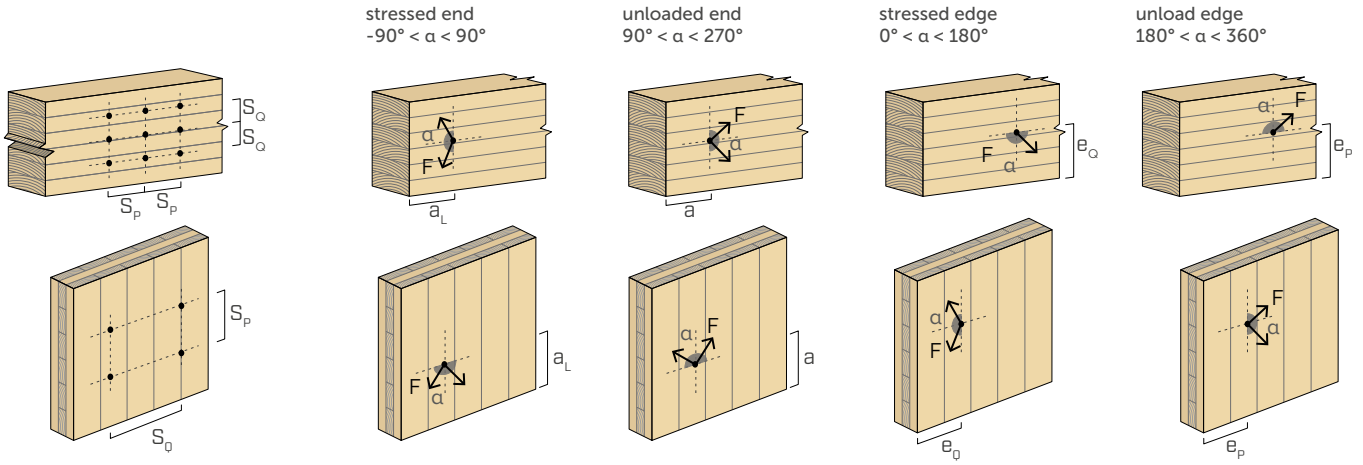
d_1		7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**18·d**	126	*4 15/16*	162	*6 3/8*	198	*7 13/16*
S_Q	**7·d**	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
a_L	**22·d**	154	*6 1/16*	198	*7 13/16*	242	*9 1/2*
a	**15·d**	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
e_Q	**12·d**	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
e_P	**7·d**	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
S_x	**3·d**	21	*13/16*	27	*1 1/16*	33	*1 5/16*

screws inserted **WITH pre-drilled hole**



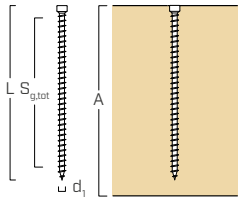
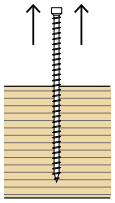
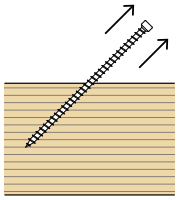
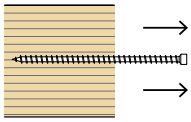
d_1		7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**5·d†**	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
S_Q	**4·d**	28	*1 1/8*	36	*1 7/16*	44	*1 3/4*
a_L	**12·d†**	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
a	**7·d†**	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_Q	**7·d**	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_P	**3·d**	21	*13/16*	27	*1 1/16*	33	*1 5/16*
S_x	**1.5·d**	11	*7/16*	14	*9/16*	17	*11/16*

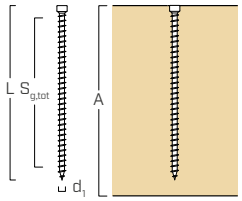
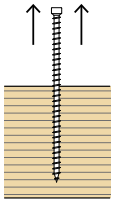
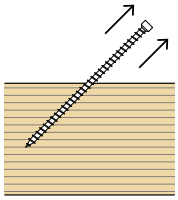
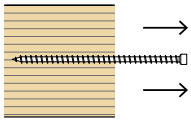
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

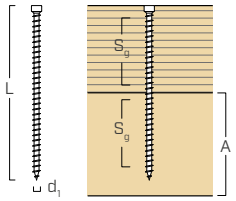
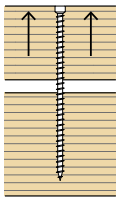
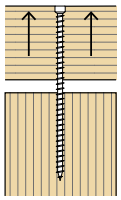
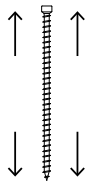
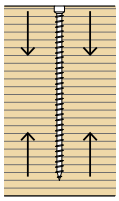
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

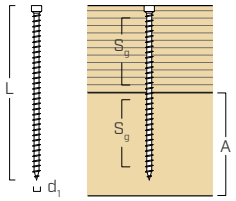
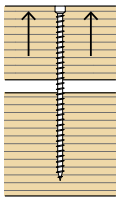
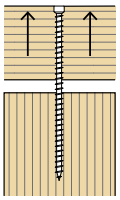
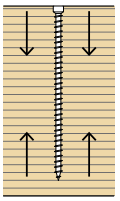
geometry				TENSION/COMPRESSION[1]											
				total thread withdrawal											
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
				G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	2,45	2,83	3,21	3,52	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	3,23	3,73	4,22	4,63	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	4,00	4,63	5,24	5,75	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	4,78	5,53	6,26	6,87	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	5,56	6,43	7,28	7,98	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	6,34	7,33	8,30	9,10	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	7,12	8,23	9,31	10,22	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	7,89	9,13	10,33	11,33	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	8,67	10,03	11,35	12,45	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	9,45	10,93	12,37	13,56	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	10,23	11,83	13,39	14,68	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	11,00	12,73	14,40	15,80	6,05	7,00	7,92	8,69
	320	*12 5/8*	303	330	12,96	15,00	16,96	18,61	11,78	13,63	15,42	16,91	6,48	7,50	8,48	9,30
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	12,56	14,53	16,44	18,03	6,91	7,99	9,04	9,92
	360	*14 1/4*	343	370	14,67	16,98	19,20	21,06	13,34	15,43	17,46	19,15	7,34	8,49	9,60	10,53
	380	*15*	363	390	15,53	17,96	20,32	22,29	14,11	16,33	18,48	20,26	7,76	8,98	10,16	11,14
	400	*15 3/4*	383	410	16,38	18,95	21,44	23,52	14,89	17,23	19,49	21,38	8,19	9,48	10,72	11,76
9 *0.36*	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	8,05	9,31	10,53	11,56	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	10,05	11,63	13,15	14,43	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	12,05	13,94	15,77	17,30	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	14,05	16,25	18,38	20,17	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	16,05	18,57	21,00	23,04	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	18,05	20,88	23,62	25,91	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	19,05	22,04	24,92	27,35	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	21,05	24,35	27,54	30,22	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	23,05	26,67	30,16	33,09	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	25,05	28,98	32,77	35,96	13,78	15,94	18,03	19,78
	560	*22*	541	570	29,75	34,42	38,93	42,72	27,05	31,29	35,39	38,83	14,88	17,21	19,47	21,36
	600	*23 5/8*	581	610	31,95	36,97	41,81	45,88	29,05	33,61	38,01	41,71	15,98	18,48	20,90	22,94

geometry					TENSION/COMPRESSION[1] total thread withdrawal α = 90°				α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	129	160	8,67	10,03	11,35	12,45	7,88	9,12	10,32	11,32	4,34	5,02	5,68	6,23
	200	*8*	179	210	12,03	13,92	15,75	17,28	10,94	12,66	14,32	15,71	6,02	6,96	7,88	8,64
	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	275	*10 7/8*	254	285	17,07	19,75	22,35	24,52	15,52	17,96	20,32	22,29	8,54	9,88	11,17	12,26
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
	325	*12 3/4*	304	335	20,43	23,64	26,75	29,35	18,58	21,49	24,32	26,68	10,22	11,82	13,37	14,67
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	375	*14 3/4*	354	385	23,79	27,53	31,15	34,17	21,63	25,03	28,32	31,07	11,90	13,77	15,57	17,09
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	425	*16 3/4*	404	435	27,15	31,42	35,55	39,00	24,69	28,56	32,32	35,45	13,58	15,71	17,77	19,50
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	26,21	30,33	34,32	37,65	14,42	16,68	18,87	20,71
	475	*18 11/16*	454	485	30,52	35,31	39,95	43,82	27,74	32,10	36,32	39,84	15,26	17,65	19,97	21,91
11 *0.44*	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	525	*20 11/16*	504	535	33,88	39,20	44,35	48,65	30,80	35,63	40,32	44,23	16,94	19,60	22,17	24,33
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	32,32	37,40	42,32	46,42	17,78	20,57	23,27	25,53
	575	*22 5/8*	554	585	37,24	43,08	48,75	53,48	33,85	39,17	44,31	48,62	18,62	21,54	24,37	26,74
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95
	650	*25 9/16*	619	660	41,61	48,14	54,47	59,75	37,82	43,76	49,51	54,32	20,80	24,07	27,23	29,88
	700	*27 1/2*	669	710	44,97	52,03	58,87	64,58	40,88	47,30	53,51	58,71	22,48	26,01	29,43	32,29
	750	*29 1/2*	719	760	48,33	55,92	63,26	69,41	43,93	50,83	57,51	63,10	24,16	27,96	31,63	34,70
	800	*31 1/2*	769	810	51,69	59,81	67,66	74,23	46,99	54,37	61,51	67,48	25,84	29,90	33,83	37,12
	850	*33 7/16*	819	860	55,05	63,69	72,06	79,06	50,04	57,90	65,51	71,87	27,52	31,85	36,03	39,53
	900	*35 1/2*	869	910	58,41	67,58	76,46	83,88	53,10	61,44	69,51	76,26	29,20	33,79	38,23	41,94
	950	*37 3/8*	919	960	61,77	71,47	80,86	88,71	56,15	64,97	73,51	80,65	30,88	35,74	40,43	44,36
	1000	*39 3/8*	969	1010	65,13	75,36	85,26	93,54	59,21	68,51	77,51	85,03	32,57	37,68	42,63	46,77

α = screw-to-grain angle

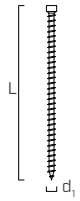
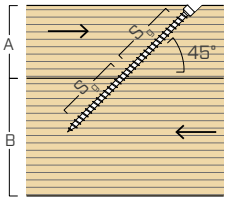
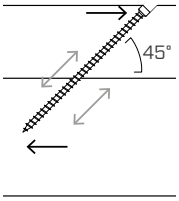
NOTES and **GENERAL PRINCIPLES** on page 138.

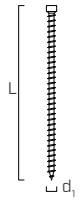
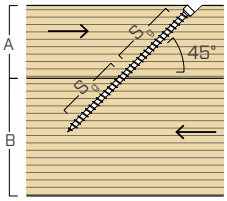
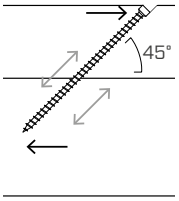
geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				G				G					
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	25	45	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64	10,34
	100	*4*	35	55	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07		
	120	*4 3/4*	45	65	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38		
	140	*5 1/2*	55	75	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	160	*6 1/4*	65	85	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00		
	180	*7 1/8*	75	95	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30		
	200	*8*	85	105	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61		
	220	*8 5/8*	95	115	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92		
	240	*9 1/2*	105	125	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22		
	260	*10 1/4*	115	135	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53		
	280	*11*	125	145	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84		
	300	*11 3/4*	135	155	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14		
	320	*12 5/8*	145	165	6,20	7,18	8,12	8,90	3,10	3,59	4,06	4,45		
	340	*13 3/8*	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76		
	360	*14 1/4*	165	185	7,06	8,17	9,24	10,13	3,53	4,08	4,62	5,07		
	380	*15*	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37		
	400	*15 3/4*	185	205	7,91	9,16	10,36	11,36	3,96	4,58	5,18	5,68		
9 *0.36*	160	*6 1/4*	65	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84	16,37
	180	*7 1/8*	75	95	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96		
	200	*8*	85	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	220	*8 5/8*	95	115	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75		
	240	*9 1/2*	105	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	260	*10 1/4*	115	135	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54		
	280	*11*	125	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	300	*11 3/4*	135	155	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33		
	320	*12 5/8*	145	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	340	*13 3/8*	155	175	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12		
	360	*14 1/4*	165	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	380	*15*	175	195	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91		
	400	*15 3/4*	185	205	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30		
	440	*17 1/4*	205	225	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09		
	480	*19*	225	245	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88		
	520	*20 1/2*	245	265	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67		
	560	*22*	265	285	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46		
	600	*23 5/8*	285	305	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25		

geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal								steel tension	buckling
				α = 90°				end grain α = 0°					α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				G				G					
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	60	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	200	*8*	85	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	275	*10 7/8*	120	143	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79		
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	325	*12 3/4*	145	168	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00		
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	375	*14 3/4*	170	193	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21		
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	425	*16 3/4*	195	218	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41		
	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	475	*18 11/16*	220	243	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62		
11 *0.44*	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34	23,17	19,66
	525	*20 11/16*	245	268	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82		
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		
	575	*22 5/8*	270	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03		
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		
	650	*25 9/16*	305	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72		
	700	*27 1/2*	330	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93		
	750	*29 1/2*	355	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13		
	800	*31 1/2*	380	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34		
	850	*33 7/16*	405	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55		
	900	*35 1/2*	430	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75		
	950	*37 3/8*	455	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96		
	1000	*39 3/8*	480	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17		

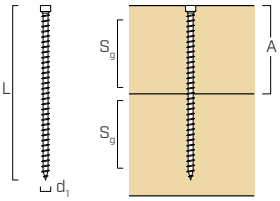
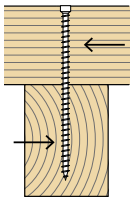
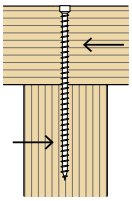
α = screw-to-grain angle

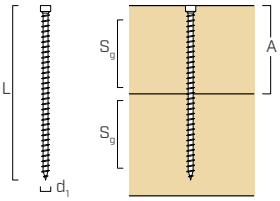
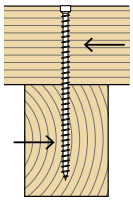
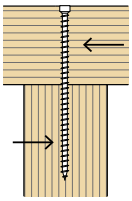
NOTES and GENERAL PRINCIPLES on page 138.

geometry			SLIDING[4]							steel tension
			timber-to-timber							
										
						factored lateral resistance N_r[5]				factored tension resistance T_{rs}
						G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	25	35	50	0,82	0,95	1,08	1,18	7,52
	100	*4*	35	40	55	1,15	1,34	1,51	1,66	
	120	*4 3/4*	45	45	60	1,48	1,72	1,94	2,13	
	140	*5 1/2*	55	55	70	1,81	2,10	2,38	2,61	
	160	*6 1/4*	65	60	75	2,14	2,48	2,81	3,08	
	180	*7 1/8*	75	70	85	2,47	2,86	3,24	3,55	
	200	*8*	85	75	90	2,80	3,24	3,67	4,03	
	220	*8 5/8*	95	85	100	3,13	3,63	4,10	4,50	
	240	*9 1/2*	105	90	105	3,46	4,01	4,53	4,97	
	260	*10 1/4*	115	95	110	3,79	4,39	4,97	5,45	
	280	*11*	125	105	120	4,12	4,77	5,40	5,92	
	300	*11 3/4*	135	110	125	4,45	5,15	5,83	6,39	
	320	*12 5/8*	145	120	135	4,78	5,54	6,26	6,87	
	340	*13 3/8*	155	125	140	5,11	5,92	6,69	7,34	
	360	*14 1/4*	165	130	145	5,44	6,30	7,13	7,82	
	380	*15*	175	140	155	5,77	6,68	7,56	8,29	
	400	*15 3/4*	185	145	160	6,10	7,06	7,99	8,76	
9 *0.36*	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96	12,61
	180	*7 1/8*	75	70	85	3,18	3,68	4,16	4,57	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18	
	220	*8 5/8*	95	85	100	4,03	4,66	5,27	5,79	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40	
	260	*10 1/4*	115	95	110	4,88	5,64	6,38	7,00	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61	
	300	*11 3/4*	135	110	125	5,73	6,63	7,49	8,22	
	320	*12 5/8*	145	120	135	6,15	7,12	8,05	8,83	
	340	*13 3/8*	155	125	140	6,58	7,61	8,60	9,44	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05	
	380	*15*	175	140	155	7,42	8,59	9,71	10,66	
	400	*15 3/4*	185	145	160	7,85	9,08	10,27	11,27	
	440	*17 1/4*	205	160	175	8,70	10,06	11,38	12,49	
	480	*19*	225	175	190	9,54	11,04	12,49	13,70	
	520	*20 1/2*	245	190	205	10,39	12,03	13,60	14,92	
	560	*22*	265	205	220	11,24	13,01	14,71	16,14	
	600	*23 5/8*	285	215	230	12,09	13,99	15,82	17,36	

			SLIDING[4]							
geometry			timber-to-timber							steel tension
										
						factored lateral resistance N_r[5]				factored tension resistance T_{rs}
						G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	60	60	75	3,11	3,60	4,07	4,47	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19	
	275	*10 7/8*	120	100	115	6,22	7,20	8,14	8,94	
	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	
	325	*12 3/4*	145	120	135	7,52	8,70	9,84	10,80	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91	
	375	*14 3/4*	170	135	150	8,81	10,20	11,54	12,66	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78	
	425	*16 3/4*	195	155	170	10,11	11,70	13,24	14,52	
	450	*17 3/4*	210	165	180	10,89	12,60	14,25	15,64	
	475	*18 11/16*	220	170	185	11,41	13,20	14,93	16,38	
11 *0.44*	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50	16,38
	525	*20 11/16*	245	190	205	12,70	14,70	16,63	18,24	
	550	*21 5/8*	260	200	215	13,48	15,60	17,65	19,36	
	575	*22 5/8*	270	205	220	14,00	16,20	18,33	20,10	
	600	*23 5/8*	285	215	230	14,78	17,10	19,34	21,22	
	650	*25 9/16*	305	240	255	15,81	18,30	20,70	22,71	
	700	*27 1/2*	330	255	270	17,11	19,80	22,40	24,57	
	750	*29 1/2*	355	275	290	18,41	21,30	24,10	26,43	
	800	*31 1/2*	380	290	305	19,70	22,80	25,79	28,30	
	850	*33 7/16*	405	310	325	21,00	24,30	27,49	30,16	
	900	*35 1/2*	430	325	340	22,29	25,80	29,19	32,02	
	950	*37 3/8*	455	345	360	23,59	27,30	30,88	33,88	
	1000	*39 3/8*	480	360	375	24,89	28,80	32,58	35,74	

NOTES and GENERAL PRINCIPLES on page 138.

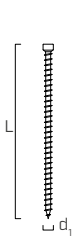
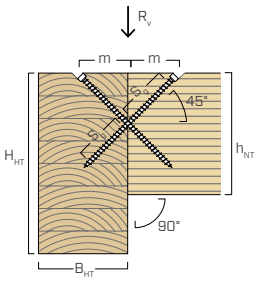
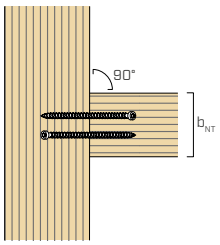
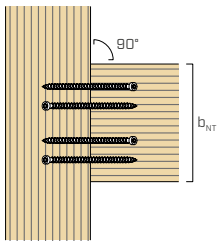
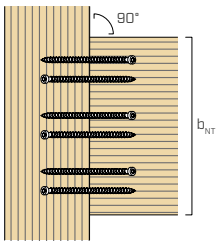
geometry				SHEAR[6] timber-to-timber							
				α = 90°				α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
				G				G			
d_1	L		S_g	A[7]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	25	40	1,14	1,36	1,57	1,76	0,76	0,90	1,00	1,08
	100	*4*	35	50	1,47	1,74	1,98	2,11	0,90	1,02	1,13	1,23
	120	*4 3/4*	45	60	1,74	1,93	2,12	2,26	0,99	1,13	1,26	1,38
	140	*5 1/2*	55	70	1,84	2,06	2,26	2,42	1,09	1,25	1,40	1,52
	160	*6 1/4*	65	80	1,95	2,18	2,40	2,57	1,19	1,36	1,53	1,67
	180	*7 1/8*	75	90	2,06	2,30	2,54	2,73	1,29	1,47	1,66	1,79
	200	*8*	85	100	2,16	2,43	2,68	2,88	1,38	1,58	1,74	1,87
	220	*8 5/8*	95	110	2,27	2,55	2,82	3,03	1,47	1,65	1,81	1,94
	240	*9 1/2*	105	120	2,38	2,67	2,96	3,15	1,53	1,71	1,88	2,02
	260	*10 1/4*	115	130	2,49	2,75	2,97	3,15	1,58	1,77	1,95	2,10
	280	*11*	125	140	2,51	2,75	2,97	3,15	1,63	1,83	2,02	2,17
	300	*11 3/4*	135	150	2,51	2,75	2,97	3,15	1,69	1,89	2,09	2,25
	320	*12 5/8*	145	160	2,51	2,75	2,97	3,15	1,74	1,96	2,16	2,33
	340	*13 3/8*	155	170	2,51	2,75	2,97	3,15	1,79	2,02	2,23	2,38
	360	*14 1/4*	165	180	2,51	2,75	2,97	3,15	1,85	2,08	2,25	2,38
	380	*15*	175	190	2,51	2,75	2,97	3,15	1,90	2,08	2,25	2,38
	400	*15 3/4*	185	200	2,51	2,75	2,97	3,15	1,90	2,08	2,25	2,38
9 *0.36*	160	*6 1/4*	65	80	2,85	3,17	3,48	3,73	1,61	1,83	2,05	2,23
	180	*7 1/8*	75	90	2,98	3,33	3,66	3,93	1,73	1,98	2,21	2,41
	200	*8*	85	100	3,12	3,49	3,84	4,13	1,85	2,12	2,38	2,59
	220	*8 5/8*	95	110	3,26	3,65	4,02	4,32	1,97	2,26	2,54	2,77
	240	*9 1/2*	105	120	3,40	3,81	4,20	4,52	2,09	2,40	2,70	2,90
	260	*10 1/4*	115	130	3,53	3,97	4,38	4,72	2,21	2,54	2,79	3,00
	280	*11*	125	140	3,67	4,13	4,56	4,90	2,33	2,62	2,88	3,09
	300	*11 3/4*	135	150	3,81	4,28	4,62	4,90	2,41	2,70	2,97	3,19
	320	*12 5/8*	145	160	3,91	4,28	4,62	4,90	2,48	2,78	3,06	3,29
	340	*13 3/8*	155	170	3,91	4,28	4,62	4,90	2,55	2,86	3,15	3,39
	360	*14 1/4*	165	180	3,91	4,28	4,62	4,90	2,62	2,94	3,24	3,49
	380	*15*	175	190	3,91	4,28	4,62	4,90	2,69	3,02	3,33	3,59
	400	*15 3/4*	185	200	3,91	4,28	4,62	4,90	2,76	3,10	3,42	3,69
	440	*17 1/4*	205	220	3,91	4,28	4,62	4,90	2,89	3,24	3,49	3,70
	480	*19*	225	240	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	520	*20 1/2*	245	260	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	560	*22*	265	280	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	600	*23 5/8*	285	300	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70

geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	60	75	3,24	3,81	4,17	4,47	1,86	2,12	2,37	2,57
	200	*8*	85	100	3,84	4,29	4,72	5,07	2,22	2,54	2,85	3,11
	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	275	*10 7/8*	120	138	4,47	5,02	5,55	5,98	2,76	3,18	3,51	3,77
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	325	*12 3/4*	145	163	4,86	5,32	5,75	6,09	3,07	3,44	3,78	4,07
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	375	*14 3/4*	170	188	4,86	5,32	5,75	6,09	3,28	3,68	4,06	4,37
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	425	*16 3/4*	195	213	4,86	5,32	5,75	6,09	3,49	3,92	4,33	4,60
	450	*17 3/4*	210	225	4,86	5,32	5,75	6,09	3,59	4,02	4,35	4,60
	475	*18 11/16*	220	238	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
11	500	*19 3/4*	235	250	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
0.44	525	*20 11/16*	245	263	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	550	*21 5/8*	260	275	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	575	*22 5/8*	270	288	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	600	*23 5/8*	285	300	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	650	*25 9/16*	300	325	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	700	*27 1/2*	325	350	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	750	*29 1/2*	350	375	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	800	*31 1/2*	375	400	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	850	*33 7/16*	400	425	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	900	*35 1/2*	425	450	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	950	*37 3/8*	450	475	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	1000	*39 3/8*	475	500	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60

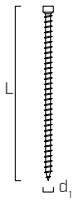
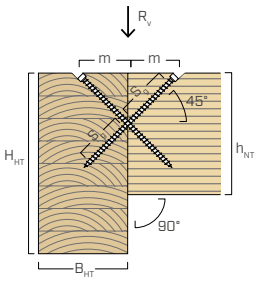
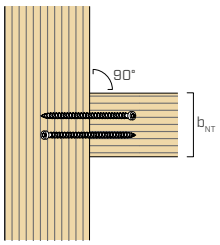
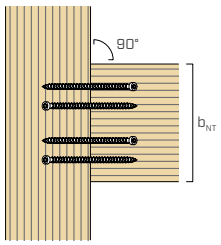
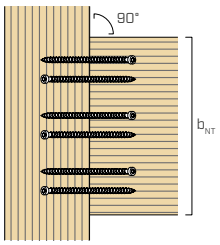
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 138.

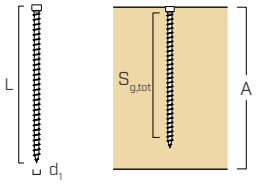
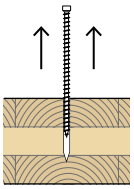
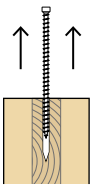
MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

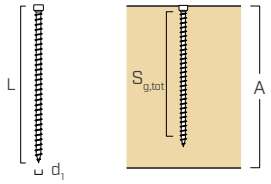
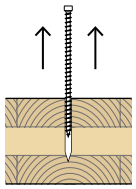
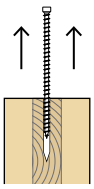
geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
								0.42	0.49		0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	45	70	25	31	70	1,59	1,80	105	3,18	3,60	140	4,77	5,40
	100	*4*	55	85	35	38		2,23	2,52		4,45	5,04		6,68	7,56
	120	*4 3/4*	60	100	45	45		2,86	3,24		5,73	6,48		8,59	9,72
	140	*5 1/2*	70	115	55	53		3,50	3,96		7,00	7,92		10,50	11,88
	160	*6 1/4*	75	130	65	60		4,14	4,68		8,27	9,36		12,41	14,04
	180	*7 1/8*	80	140	75	67		4,77	5,40		9,54	10,80		14,32	16,20
	200	*8*	90	155	85	74		5,41	6,12		10,82	12,24		16,22	18,35
	220	*8 5/8*	95	170	95	81		6,04	6,84		12,09	13,68		18,13	20,51
	240	*9 1/2*	105	185	105	88		6,68	7,56		13,36	15,12		20,04	22,67
	260	*10 1/4*	110	200	115	95		7,32	8,28		14,63	16,56		21,95	24,83
	280	*11*	120	215	125	102		7,95	9,00		15,91	17,99		23,86	26,99
	300	*11 3/4*	125	225	135	109		8,59	9,72		17,18	19,43		25,77	29,15
	320	*12 5/8*	130	240	145	116		9,23	10,44		18,45	20,87		27,68	31,31
	340	*13 3/8*	140	255	155	123		9,86	11,16		19,72	22,31		29,59	33,47
	360	*14 1/4*	145	270	165	130		10,50	11,88		21,00	23,75		31,50	35,63
	380	*15*	155	285	175	137		11,13	12,60		22,27	25,19		33,40	37,79
	400	*15 3/4*	160	300	185	144		11,77	13,32		23,54	26,63		35,31	39,95
9 *0.36*	160	*6 1/4*	75	130	65	60	90	5,32	6,01	135	10,63	12,03	180	15,95	18,04
	180	*7 1/8*	80	140	75	67		6,14	6,94		12,27	13,88		18,41	20,82
	200	*8*	90	155	85	74		6,95	7,86		13,91	15,73		20,86	23,59
	220	*8 5/8*	95	170	95	81		7,77	8,79		15,54	17,58		23,31	26,37
	240	*9 1/2*	105	185	105	88		8,59	9,71		17,18	19,43		25,77	29,14
	260	*10 1/4*	110	200	115	95		9,41	10,64		18,82	21,28		28,22	31,92
	280	*11*	120	215	125	102		10,23	11,56		20,45	23,13		30,68	34,69
	300	*11 3/4*	125	225	135	109		11,04	12,49		22,09	24,98		33,13	37,47
	320	*12 5/8*	130	240	145	116		11,86	13,41		23,72	26,83		35,59	40,24
	340	*13 3/8*	140	255	155	123		12,68	14,34		25,36	28,68		38,04	43,02
	360	*14 1/4*	145	270	165	130		13,50	15,27		27,00	30,53		40,49	45,80
	380	*15*	155	285	175	137		14,32	16,19		28,63	32,38		42,95	48,57
	400	*15 3/4*	160	300	185	144		15,13	17,12		30,27	34,23		45,40	51,35
	440	*17 1/4*	175	325	205	159		16,77	18,97		33,54	37,93		50,31	56,90
	480	*19*	190	355	225	173		18,41	20,82		36,81	41,63		55,22	62,45
	520	*20 1/2*	200	385	245	187		20,04	21,49		40,08	42,99		60,13	64,48
	560	*22*	215	410	265	201		21,49	21,49		42,99	42,99		64,48	64,48
	600	*23 5/8*	230	440	285	215		21,49	21,49		42,99	42,99		64,48	64,48

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
								0.42	0.49		0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]
	150	*6*	70	120	60	56		6,00	6,79		12,00	13,57		18,00	20,36
	200	*8*	90	155	85	74		8,50	9,62		17,00	19,23		25,50	28,85
	250	*10*	105	190	110	91		11,00	12,44		22,00	24,89		33,00	37,33
	275	*10 7/8*	115	210	120	98		12,00	13,57		24,00	27,15		35,99	40,72
	300	*11 3/4*	125	225	135	109		13,50	15,27		27,00	30,54		40,49	45,82
	325	*12 3/4*	130	245	145	116		14,50	16,40		29,00	32,81		43,49	49,21
	350	*13 3/4*	140	260	160	127		16,00	18,10		32,00	36,20		47,99	54,30
	375	*14 3/4*	150	280	170	134		17,00	19,23		33,99	38,46		50,99	57,69
	400	*15 3/4*	160	300	185	144		18,50	20,93		36,99	41,86		55,49	62,78
	425	*16 3/4*	165	315	195	152		19,50	22,06		38,99	44,12		58,49	66,18
	450	*17 3/4*	180	335	210	162		21,00	23,76		41,99	47,51		62,99	71,27
	475	*18 11/16*	185	350	220	169		22,00	24,89		43,99	49,77		65,99	74,66
11 *0.44*	500	*19 3/4*	195	370	235	180	110	23,50	25,81	165	46,99	51,63	220	70,49	77,44
	525	*20 11/16*	200	385	245	187		24,50	25,81		48,99	51,63		73,49	77,44
	550	*21 5/8*	215	405	260	197		25,81	25,81		51,63	51,63		77,44	77,44
	575	*22 5/8*	220	420	270	205		25,81	25,81		51,63	51,63		77,44	77,44
	600	*23 5/8*	230	440	285	215		25,81	25,81		51,63	51,63		77,44	77,44
	650	*25 9/16*	245	475	305	229		25,81	25,81		51,63	51,63		77,44	77,44
	700	*27 1/2*	260	510	330	247		25,81	25,81		51,63	51,63		77,44	77,44
	750	*29 1/2*	280	545	355	265		25,81	25,81		51,63	51,63		77,44	77,44
	800	*31 1/2*	300	580	380	282		25,81	25,81		51,63	51,63		77,44	77,44
	850	*33 7/16*	315	615	405	300		25,81	25,81		51,63	51,63		77,44	77,44
	900	*35 1/2*	335	650	430	318		25,81	25,81		51,63	51,63		77,44	77,44
	950	*37 3/8*	350	685	455	335		25,81	25,81		51,63	51,63		77,44	77,44
	1000	*39 3/8*	370	720	480	353		25,81	25,81		51,63	51,63		77,44	77,44

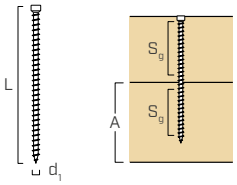
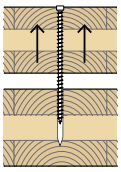
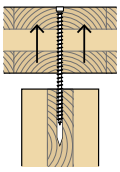
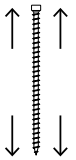
NOTES and GENERAL PRINCIPLES on page 138.

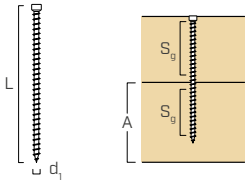
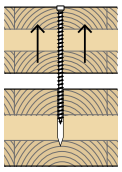
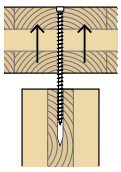
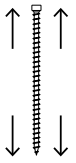
geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	6,05	7,00	7,92	8,69
	320	*12 5/8*	303	330	12,96	15,00	16,96	18,61	6,48	7,50	8,48	9,30
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	6,91	7,99	9,04	9,92
	360	*14 1/4*	343	370	14,67	16,98	19,20	21,06	7,34	8,49	9,60	10,53
	380	*15*	363	390	15,53	17,96	20,32	22,29	7,76	8,98	10,16	11,14
	400	*15 3/4*	383	410	16,38	18,95	21,44	23,52	8,19	9,48	10,72	11,76
9 *0.36*	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	13,78	15,94	18,03	19,78
	560	*22*	541	570	29,75	34,42	38,93	42,72	14,88	17,21	19,47	21,36
	600	*23 5/8*	581	610	31,95	36,97	41,81	45,88	15,98	18,48	20,90	22,94

geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	129	160	8,67	10,03	11,35	12,45	4,34	5,02	5,68	6,23
	200	*8*	179	210	12,03	13,92	15,75	17,28	6,02	6,96	7,88	8,64
	250	*10*	229	260	15,39	17,81	20,15	22,11	7,70	8,90	10,07	11,05
	275	*10 7/8*	254	285	17,07	19,75	22,35	24,52	8,54	9,88	11,17	12,26
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	9,38	10,85	12,27	13,47
	325	*12 3/4*	304	335	20,43	23,64	26,75	29,35	10,22	11,82	13,37	14,67
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	11,06	12,79	14,47	15,88
	375	*14 3/4*	354	385	23,79	27,53	31,15	34,17	11,90	13,77	15,57	17,09
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	12,74	14,74	16,67	18,29
	425	*16 3/4*	404	435	27,15	31,42	35,55	39,00	13,58	15,71	17,77	19,50
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	14,42	16,68	18,87	20,71
	475	*18 11/16*	454	485	30,52	35,31	39,95	43,82	15,26	17,65	19,97	21,91
11	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	16,10	18,63	21,07	23,12
0.44	525	*20 11/16*	504	535	33,88	39,20	44,35	48,65	16,94	19,60	22,17	24,33
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	17,78	20,57	23,27	25,53
	575	*22 5/8*	554	585	37,24	43,08	48,75	53,48	18,62	21,54	24,37	26,74
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	19,46	22,51	25,47	27,95
	650	*25 9/16*	619	660	41,61	48,14	54,47	59,75	20,80	24,07	27,23	29,88
	700	*27 1/2*	669	710	44,97	52,03	58,87	64,58	22,48	26,01	29,43	32,29
	750	*29 1/2*	719	760	48,33	55,92	63,26	69,41	24,16	27,96	31,63	34,70
	800	*31 1/2*	769	810	51,69	59,81	67,66	74,23	25,84	29,90	33,83	37,12
	850	*33 7/16*	819	860	55,05	63,69	72,06	79,06	27,52	31,85	36,03	39,53
	900	*35 1/2*	869	910	58,41	67,58	76,46	83,88	29,20	33,79	38,23	41,94
	950	*37 3/8*	919	960	61,77	71,47	80,86	88,71	30,88	35,74	40,43	44,36
	1000	*39 3/8*	969	1010	65,13	75,36	85,26	93,54	32,57	37,68	42,63	46,77

α = screw-to-grain angle

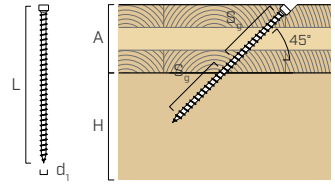
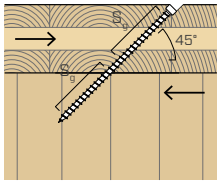
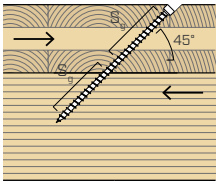
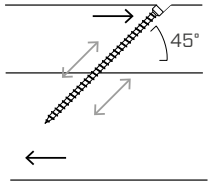
NOTES and GENERAL PRINCIPLES on page 138.

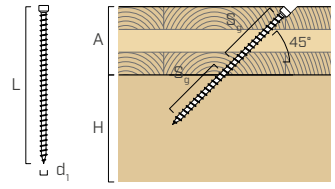
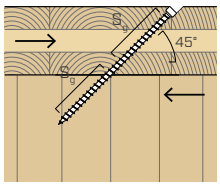
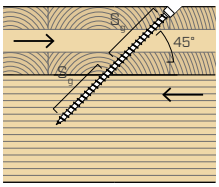
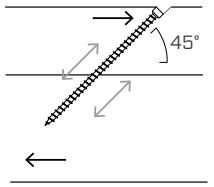
geometry					TENSION[1]								steel tension
					partial thread withdrawal								
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	25	45	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64
	100	*4*	35	55	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07	
	120	*4 3/4*	45	65	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38	
	140	*5 1/2*	55	75	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69	
	160	*6 1/4*	65	85	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00	
	180	*7 1/8*	75	95	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30	
	200	*8*	85	105	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61	
	220	*8 5/8*	95	115	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92	
	240	*9 1/2*	105	125	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22	
	260	*10 1/4*	115	135	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53	
	280	*11*	125	145	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84	
	300	*11 3/4*	135	155	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14	
	320	*12 5/8*	145	165	6,20	7,18	8,12	8,90	3,10	3,59	4,06	4,45	
	340	*13 3/8*	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76	
	360	*14 1/4*	165	185	7,06	8,17	9,24	10,13	3,53	4,08	4,62	5,07	
	380	*15*	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37	
	400	*15 3/4*	185	205	7,91	9,16	10,36	11,36	3,96	4,58	5,18	5,68	
9 *0.36*	160	*6 1/4*	65	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84
	180	*7 1/8*	75	95	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96	
	200	*8*	85	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36	
	220	*8 5/8*	95	115	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75	
	240	*9 1/2*	105	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15	
	260	*10 1/4*	115	135	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54	
	280	*11*	125	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94	
	300	*11 3/4*	135	155	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33	
	320	*12 5/8*	145	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72	
	340	*13 3/8*	155	175	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12	
	360	*14 1/4*	165	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51	
	380	*15*	175	195	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91	
	400	*15 3/4*	185	205	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30	
	440	*17 1/4*	205	225	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09	
	480	*19*	225	245	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88	
	520	*20 1/2*	245	265	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67	
	560	*22*	265	285	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46	
	600	*23 5/8*	285	305	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25	

geometry					TENSION[1]								steel tension
					total thread withdrawal								
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	60	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90	
	200	*8*	85	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10	
	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	
	275	*10 7/8*	120	143	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79	
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52	
	325	*12 3/4*	145	168	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00	
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72	
	375	*14 3/4*	170	193	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21	
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93	
	425	*16 3/4*	195	218	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41	
	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14	
	475	*18 11/16*	220	243	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62	
11 *0.44*	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34	23,17
	525	*20 11/16*	245	268	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82	
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55	
	575	*22 5/8*	270	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03	
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76	
	650	*25 9/16*	305	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72	
	700	*27 1/2*	330	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93	
	750	*29 1/2*	355	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13	
	800	*31 1/2*	380	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34	
	850	*33 7/16*	405	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55	
	900	*35 1/2*	430	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75	
	950	*37 3/8*	455	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96	
	1000	*39 3/8*	480	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17	

α = screw-to-grain angle

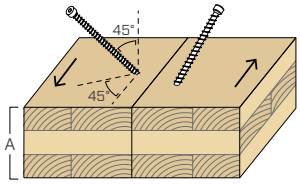
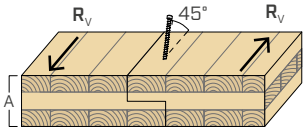
NOTES and GENERAL PRINCIPLES on page 138.

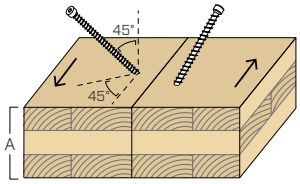
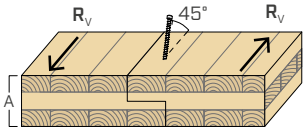
geometry					SLIDING[4]				steel tension
					CLT - CLT α=0°		CLT - timber α=45°		
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
					G		G		
d_1	L		S_g	A	H_{min}	0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	80	*3 1/8*	25	35	50	0,44	0,49	0,87	0,99	7,52
	100	*4*	35	40	55	0,61	0,69	1,22	1,39	
	120	*4 3/4*	45	45	60	0,79	0,89	1,57	1,78	
	140	*5 1/2*	55	55	70	0,96	1,09	1,92	2,18	
	160	*6 1/4*	65	60	75	1,14	1,29	2,27	2,57	
	180	*7 1/8*	75	70	85	1,31	1,48	2,62	2,97	
	200	*8*	85	75	90	1,49	1,68	2,97	3,36	
	220	*8 5/8*	95	85	100	1,66	1,88	3,32	3,76	
	240	*9 1/2*	105	90	105	1,84	2,08	3,67	4,16	
	260	*10 1/4*	115	95	110	2,01	2,28	4,02	4,55	
	280	*11*	125	105	120	2,19	2,47	4,37	4,95	
	300	*11 3/4*	135	110	125	2,36	2,67	4,72	5,34	
	320	*12 5/8*	145	120	135	2,54	2,87	5,07	5,74	
	340	*13 3/8*	155	125	140	2,71	3,07	5,42	6,14	
	360	*14 1/4*	165	130	145	2,89	3,27	5,77	6,53	
	380	*15*	175	140	155	3,06	3,46	6,12	6,93	
	400	*15 3/4*	185	145	160	3,24	3,66	6,47	7,32	
9 *0.36*	160	*6 1/4*	65	60	75	1,46	1,65	2,92	3,31	12,61
	180	*7 1/8*	75	70	85	1,69	1,91	3,37	3,82	
	200	*8*	85	75	90	1,91	2,16	3,82	4,33	
	220	*8 5/8*	95	85	100	2,14	2,42	4,27	4,83	
	240	*9 1/2*	105	90	105	2,36	2,67	4,72	5,34	
	260	*10 1/4*	115	95	110	2,59	2,93	5,17	5,85	
	280	*11*	125	105	120	2,81	3,18	5,62	6,36	
	300	*11 3/4*	135	110	125	3,04	3,43	6,07	6,87	
	320	*12 5/8*	145	120	135	3,26	3,69	6,52	7,38	
	340	*13 3/8*	155	125	140	3,49	3,94	6,97	7,89	
	360	*14 1/4*	165	130	145	3,71	4,20	7,42	8,40	
	380	*15*	175	140	155	3,94	4,45	7,87	8,90	
	400	*15 3/4*	185	145	160	4,16	4,71	8,32	9,41	
	440	*17 1/4*	205	160	175	4,61	5,22	9,22	10,43	
	480	*19*	225	175	190	5,06	5,72	10,12	11,45	
	520	*20 1/2*	245	190	205	5,51	6,23	11,02	12,47	
	560	*22*	265	205	220	5,96	6,74	11,92	13,48	
	600	*23 5/8*	285	215	230	6,41	7,25	12,82	14,50	

geometry					SLIDING[4]				steel tension
					CLT - CLT α=0°		CLT - timber α=45°		
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
					G		G		
d_1	L		S_g	A	H_{min}	0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
	150	*6*	60	60	75	1,65	1,87	3,30	3,73	
	200	*8*	85	75	90	2,34	2,64	4,67	5,29	
	250	*10*	110	95	110	3,02	3,42	6,05	6,84	
	275	*10 7/8*	120	100	115	3,30	3,73	6,60	7,47	
	300	*11 3/4*	135	110	125	3,71	4,20	7,42	8,40	
	325	*12 3/4*	145	120	135	3,99	4,51	7,97	9,02	
	350	*13 3/4*	160	130	145	4,40	4,98	8,80	9,95	
	375	*14 3/4*	170	135	150	4,67	5,29	9,35	10,58	
	400	*15 3/4*	185	145	160	5,09	5,76	10,17	11,51	
	425	*16 3/4*	195	155	170	5,36	6,07	10,72	12,13	
	450	*17 3/4*	210	165	180	5,77	6,53	11,55	13,07	
	475	*18 11/16*	220	170	185	6,05	6,84	12,10	13,69	
11 *0.44*	500	*19 3/4*	235	180	195	6,46	7,31	12,92	14,62	16,38
	525	*20 11/16*	245	190	205	6,74	7,62	13,47	15,24	
	550	*21 5/8*	260	200	215	7,15	8,09	14,30	16,18	
	575	*22 5/8*	270	205	220	7,42	8,40	14,85	16,80	
	600	*23 5/8*	285	215	230	7,84	8,87	15,67	17,73	
	650	*25 9/16*	305	240	255	8,39	9,49	16,77	18,98	
	700	*27 1/2*	330	255	270	9,07	10,27	18,15	20,53	
	750	*29 1/2*	355	275	290	9,76	11,04	19,52	22,09	
	800	*31 1/2*	380	290	305	10,45	11,82	20,90	23,64	
	850	*33 7/16*	405	310	325	11,14	12,60	22,27	25,20	
	900	*35 1/2*	430	325	340	11,82	13,38	23,65	26,75	
	950	*37 3/8*	455	345	360	12,51	14,15	25,02	28,31	
	1000	*39 3/8*	480	360	375	13,20	14,93	26,40	29,86	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 138.

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)[10]			half-lap joint α=45°	
									
					factored lateral resistance N_r[5]		factored tension resistance T_{rs}	factored lateral resistance N_r[5]	factored tension resistance T_{rs}
					G			G	
d_1	L		S_g	A	0.42	0.49		0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	80	*3 1/8*	25	65	0,77	0,87		0,95	1,08	
	100	*4*	35	80	1,07	1,21		1,34	1,51	
	120	*4 3/4*	45	95	1,38	1,56		1,72	1,94	
	140	*5 1/2*	55	110	1,69	1,91		2,10	2,38	
	160	*6 1/4*	65	125	1,99	2,25		2,48	2,81	
	180	*7 1/8*	75	135	2,30	2,60		2,86	3,24	
	200	*8*	85	150	2,60	2,95		3,24	3,67	
	220	*8 5/8*	95	165	2,91	3,29		3,63	4,10	
7 *0.28*	240	*9 1/2*	105	180	3,22	3,64	5,32	4,01	4,53	7,52
	260	*10 1/4*	115	195	3,52	3,99		4,39	4,97	
	280	*11*	125	210	3,83	4,33		4,77	5,40	
	300	*11 3/4*	135	220	4,14	4,68		5,15	5,83	
	320	*12 5/8*	145	235	4,44	5,03		5,54	6,26	
	340	*13 3/8*	155	250	4,75	5,37		5,92	6,69	
	360	*14 1/4*	165	265	5,06	5,72		6,30	7,13	
	380	*15*	175	280	5,36	6,07		6,68	7,56	
	400	*15 3/4*	185	295	5,67	6,41		7,06	7,99	
	160	*6 1/4*	65	125	2,56	2,90		3,19	3,61	
	180	*7 1/8*	75	135	2,95	3,34		3,68	4,16	
	200	*8*	85	150	3,35	3,79		4,17	4,72	
	220	*8 5/8*	95	165	3,74	4,23		4,66	5,27	
	240	*9 1/2*	105	180	4,14	4,68		5,15	5,83	
	260	*10 1/4*	115	195	4,53	5,12		5,64	6,38	
	280	*11*	125	210	4,92	5,57		6,14	6,94	
	300	*11 3/4*	135	220	5,32	6,01		6,63	7,49	
9 *0.36*	320	*12 5/8*	145	235	5,71	6,46	8,92	7,12	8,05	12,61
	340	*13 3/8*	155	250	6,11	6,90		7,61	8,60	
	360	*14 1/4*	165	265	6,50	7,35		8,10	9,16	
	380	*15*	175	280	6,89	7,80		8,59	9,71	
	400	*15 3/4*	185	295	7,29	8,24		9,08	10,27	
	440	*17 1/4*	205	320	8,07	9,13		10,06	11,38	
	480	*19*	225	350	8,86	10,02		11,04	12,49	
	520	*20 1/2*	245	380	9,65	10,91		12,03	13,60	
	560	*22*	265	405	10,44	11,80		13,01	14,71	
	600	*23 5/8*	285	435	11,23	12,70		13,99	15,82	

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)[10]			half-lap joint α=45°	
									
					factored lateral resistance N_r[5]		factored tension resistance T_{rs}	factored lateral resistance N_r[5]	factored tension resistance T_{rs}
					G			G	
d_1 [mm] *[in]*	L [mm]	L *[in]*	S_g [mm]	A [mm]	0.42 [kN]	0.49 [kN]	[kN]	0.42 [kN]	0.49 [kN]	[kN]
11 *0.44*	150	*6*	60	115	2,89	3,27	11,59	3,60	4,07	16,38
	200	*8*	85	150	4,09	4,63		5,10	5,77	
	250	*10*	110	185	5,30	5,99		6,60	7,47	
	275	*10 7/8*	120	205	5,78	6,54		7,20	8,14	
	300	*11 3/4*	135	220	6,50	7,35		8,10	9,16	
	325	*12 3/4*	145	240	6,98	7,90		8,70	9,84	
	350	*13 3/4*	160	255	7,70	8,72		9,60	10,86	
	375	*14 3/4*	170	275	8,18	9,26		10,20	11,54	
	400	*15 3/4*	185	295	8,91	10,08		11,10	12,56	
	425	*16 3/4*	195	310	9,39	10,62		11,70	13,24	
	450	*17 3/4*	210	330	10,11	11,44		12,60	14,25	
	475	*18 11/16*	220	345	10,59	11,98		13,20	14,93	
	500	*19 3/4*	235	365	11,31	12,80		14,10	15,95	
	525	*20 11/16*	245	380	11,80	13,35		14,70	16,63	
	550	*21 5/8*	260	400	12,52	14,16		15,60	17,65	
	575	*22 5/8*	270	415	13,00	14,71		16,20	18,33	
	600	*23 5/8*	285	435	13,72	15,52		17,10	19,34	
	650	*25 9/16*	305	470	14,68	16,61		18,30	20,70	
	700	*27 1/2*	330	505	15,89	17,98		19,80	22,40	
	750	*29 1/2*	355	540	17,09	19,34		21,30	24,10	
	800	*31 1/2*	380	575	18,29	20,70		22,80	25,79	
	850	*33 7/16*	405	610	19,50	22,06		24,30	27,49	
	900	*35 1/2*	430	645	20,70	23,42		25,80	29,19	
	950	*37 3/8*	455	680	21,91	24,78		27,30	30,88	
	1000	*39 3/8*	480	715	23,11	26,15		28,80	32,58	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 138.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- VGZ screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}) and the steel strength (T_{rs}). Similarly, the factored compression resistance of the connector (P_{rc}) is determined as the lower value between the withdrawal resistance (P_{rw}) and the buckling capacity (P_{rb}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) VGZ screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) For fully threaded screws, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile resistance.

(5) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(6) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

(8) The number of cross pairs, n_F, has been taken as 2.0 and 3.0 for configurations with two and three screw pairs, respectively, in accordance with CSA O86:24. However, when evaluating the effective number of screws in axially stressed connector pairs, Rothoblaas recommends using reduced values of 1.9 and 2.7 for two and three pairs, respectively. This recommendation accounts for the fact that the load-bearing capacity of a multi-screw connection—with screws of the same size and type—may be lower than the sum of the individual screw capacities, due to group effects and non-uniform load distribution within the connection. Discretion and engineering judgment must be exercised.

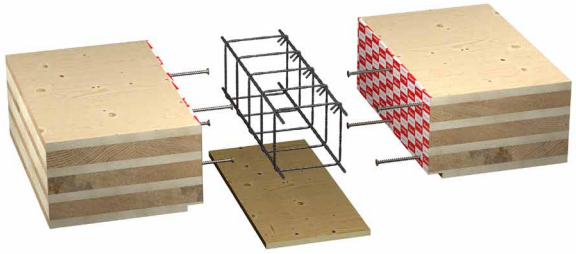
(9) The factored shear resistance, R_v, of crossed screws is determined by taking the minimum of $2.P_{rt}.\cos(\beta)$, $2.P_{rc}.\cos(\beta)$, and $V_{rs}/\sin(\beta)$, where P_{rt} represents the factored axial resistance of screws loaded in tension, P_{rc} represents the factored axial resistance of screws loaded in compression, and V_{rs} represents the factored shear resistance of screws. This approach accounts for the directional component of the axial forces relative to the shear plane and ensures a conservative estimate by considering the governing case among all conditions.

(10) The sliding strengths of the connectors inserted with double inclination (45°-45°) were evaluated considering an α angle of 60° between the grain and the connector; in fact, the geometry of the joint requires that the connectors have to be inserted at an angle of 45° with respect to the face of the CLT panel and at an angle of 45° with respect to the shear plane between the two panels. The use of the JIG VGZ 45 template is recommended for professional installation of the connectors in this application.

TC FUSION

TIMBER-TO-CONCRETE
JOINT SYSTEM

The innovation of VGS, VGZ and RTR all-thread connectors for timber-concrete applications.



INSTALLATION SUGGESTIONS

TIMBER-TO-TIMBER JOINT WITH CROSSED CONNECTORS

TIGHTENING THE JOINT



For correct installation of the joint, we recommend tightening the elements before inserting the connectors.



Insert a partially threaded screw (e.g. HBS680) to bring the elements closer together.



The HBS screw eliminated the initial gap between the elements.
After positioning the VGZ connectors, it can be removed.

INSERTION OF CONNECTORS



To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template.



After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.



Repeat the procedure to install the inserted screw from the main beam to the secondary beam.

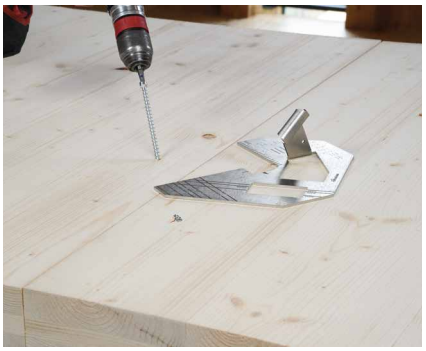
JOINT BETWEEN CLT PANELS WITH CONNECTORS INCLINED IN BOTH DIRECTIONS (45°-45°)



To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template positioned at 45° to the panel head.



After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.



Repeat the procedure to install the screw in the adjoining panel and continue this alternating sequence according to the distances provided in the design.

RELATED PRODUCTS



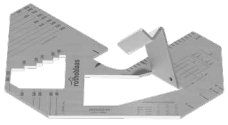
HBS



CATCH



BIT



JIG VGZ 45°

VGZ EVO

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

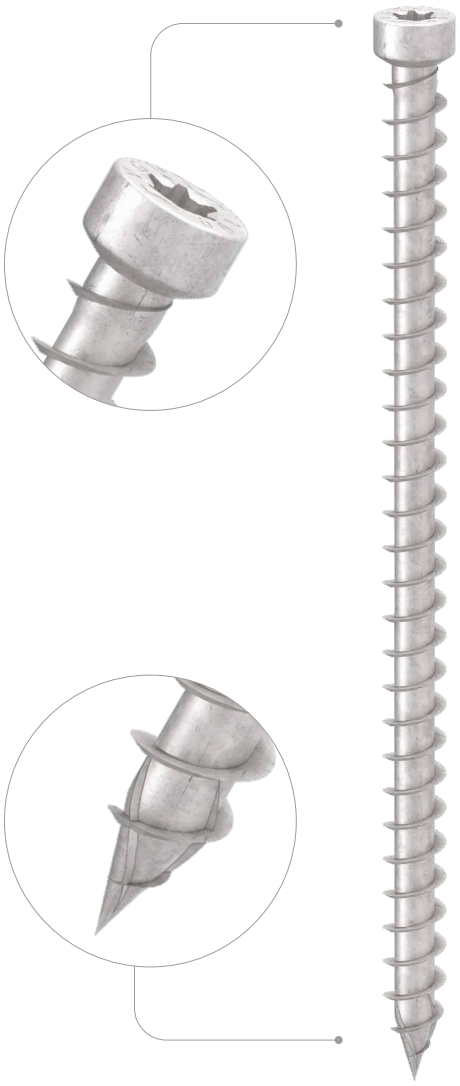
FULLY THREADED SCREW WITH CYLINDRICAL HEAD

C4 EVO COATING
Multilayer coating with a surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. Can be used in exposure condition 3 outdoor applications and under class C4 atmospheric corrosion conditions.

AUTOCLAVE-TREATED TIMBER
The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

STRUCTURAL APPLICATIONS
Deep thread and high resistance steel for excellent tensile performance. Approved for structural applications subject to stresses in any direction vs the grain (0° - 90°). Reduced minimum distances.

CYLINDRICAL HEAD
It allows the screw to penetrate and pass through the surface of the wood substrate. Ideal for concealed joints, timber couplings and structural reinforcements. It is the right choice for increased fire performance.

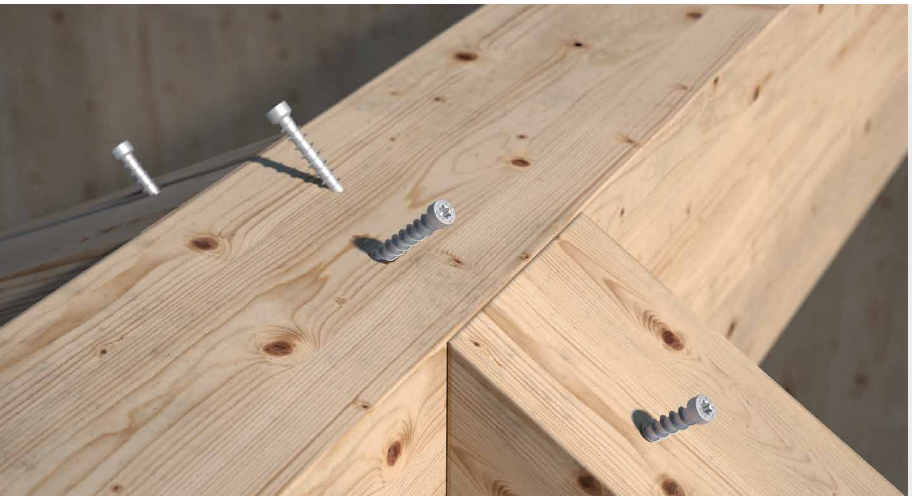


VIDEO

BIT INCLUDED

DIAMETER [mm]	5 — 5 to 11 — 11
LENGTH [mm]	80 — 80 to 600 — 1000
SERVICE CONDITION	EC1, EC3
ATMOSPHERIC CORROSIVITY	C1, C2, C3, C4
WOOD CORROSIVITY	T1, T2, T3
MATERIAL	C4 EVO COATING — carbon steel with C4 EVO coating
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



FIELDS OF USE
- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above).

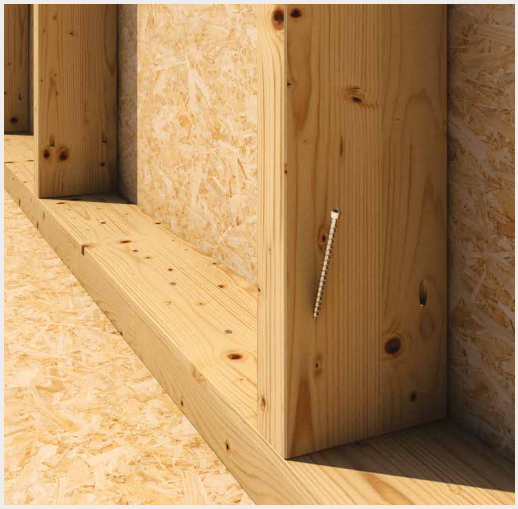


TRUSS & RAFTER JOINTS

Ideal for joining small timber elements such as the crossbeams and uprights of light frame structures. Certified for application parallel to the grain and with reduced minimum distances.

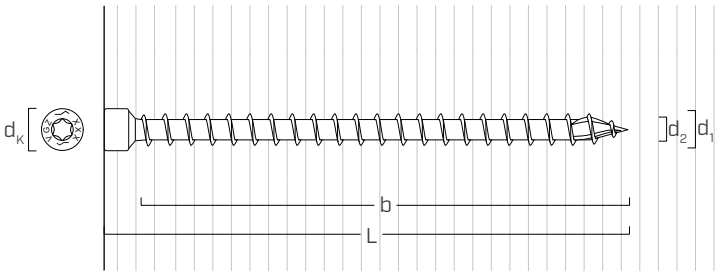


Fastening Wood Trusses outdoors.



Fastening the uprights of light frame structures with VGZ EVO Ø5 mm.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	**[mm]**	**5,3**	**5,6**	**7**	**9**	**11**
Head diameter	d_K	[mm]	8,00	8,00	9,50	11,50	13,50
Root diameter	d_2	[mm]	3,60	3,80	4,60	5,90	6,60
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,5	3,5	4,0	5,0	6,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	4,0	5,0	6,0	7,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

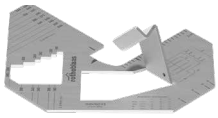
Nominal diameter	**d_1**	**[mm]**		**5,3**	**5,6**	**7**	**9**	**11**
Factored tensile strength	Φf_u	[kN]		7,49	8,08	10,64	17,84	23,17
Bending yield strength	F_{yb}	[MPa]		1021	1021	1111	1069	1026
Factored shear strength of the screw	Φv_s	[kN]		3,91	4,36	6,38	10,50	13,14
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	55,43	58,56	61,1	78,56	96,02
			G=0.42	64,13	67,76	70,7	90,9	111,1
			G=0.49	72,55	76,56	79,98	102,8	125,7
			G=0.55	79,57	84,07	87,72	112,8	137,9

CODES AND DIMENSIONS

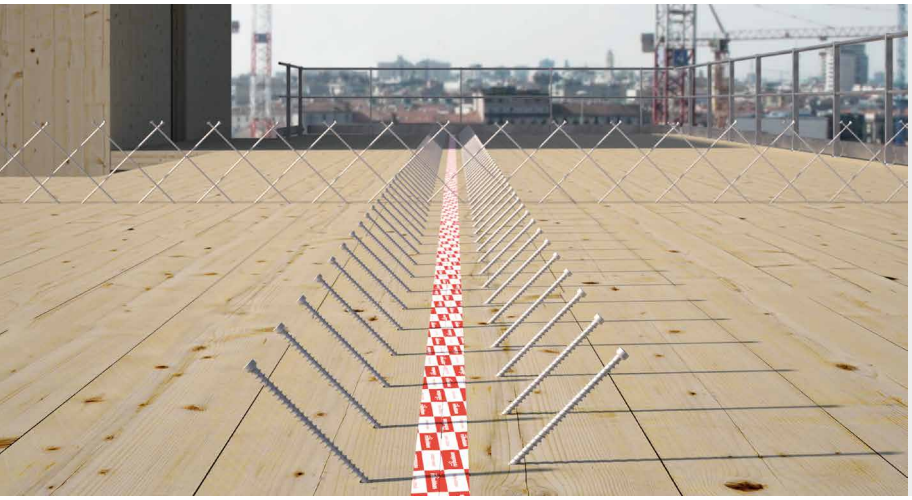
d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5,3 TX 25	VGZEVO580	80	70	50
	VGZEVO5100	100	90	50
	VGZEVO5120	120	110	50
5,6 TX 25	VGZEVO5140	140	130	50
	VGZEVO5150	150	140	50
	VGZEVO5160	160	150	50
7 TX 30	VGZEVO780	80	70	50
	VGZEVO7100	100	90	50
	VGZEVO7120	120	110	50
	VGZEVO7140	140	130	50
	VGZEVO7160	160	150	50
	VGZEVO7180	180	170	50
	VGZEVO7200	200	190	50
	VGZEVO7220	220	210	50
	VGZEVO7240	240	230	50
	VGZEVO7260	260	250	50
	VGZEVO7280	280	270	50
	VGZEVO7300	300	290	50
	VGZEVO7340	340	330	50
	VGZEVO7380	380	370	50
9 TX 40	VGZEVO9160	160	150	50
	VGZEVO9180	180	170	50
	VGZEVO9200	200	190	50
	VGZEVO9220	220	210	50
	VGZEVO9240	240	230	50
	VGZEVO9260	260	250	50
	VGZEVO9280	280	270	50
	VGZEVO9300	300	290	50
	VGZEVO9320	320	310	25
	VGZEVO9340	340	330	25
	VGZEVO9360	360	350	25
	VGZEVO9380	380	370	25
	VGZEVO9400	400	390	25
	VGZEVO9440	440	430	25
	VGZEVO9480	480	470	25
	VGZEVO9520	520	510	25

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
11 TX 50	VGZEVO11250	250	240	25
	VGZEVO11300	300	290	25
	VGZEVO11350	350	340	25
	VGZEVO11400	400	390	25
	VGZEVO11450	450	440	25
	VGZEVO11500	500	490	25
	VGZEVO11550	550	540	25
	VGZEVO11600	600	590	25

RELATED PRODUCTS



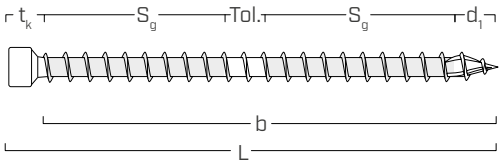
JIG VGZ 45°
TEMPLATE FOR 45° SCREWS



OUTDOOR STRUCTURAL PERFORMANCE

Values also tested, certified and calculated for CLT and high density woods such as Microllam® LVL. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

EFFECTIVE THREAD USED IN CALCULATION



b = $S_{g,tot}$ = L - t_K represents the entire length of the threaded part (see table above)

S_g = (b - d_1 - Tol.)/2 represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

t_K = 10 mm or 20 mm depending on screw length.

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report.

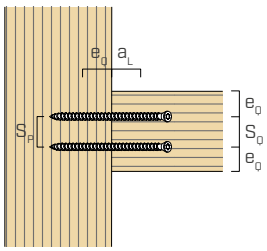
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

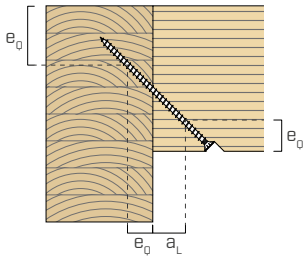
d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	7·d†	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
S_Q	5·d	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
a_L	10·d†	53	*2 1/16*	56	*2 3/16*	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
a	7·d†	37	*1 7/16*	40	*1 9/16*	49	*1 15/19*	63	*2 1/2*	77	*3 1/16*
e_Q	4·d	22	*7/8*	23	*7/8*	28	*1 1/8*	36	*1 7/16*	44	*1 3/4*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.

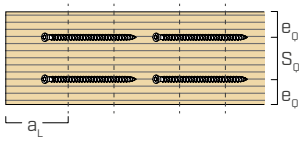
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



plan



front



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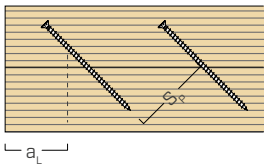
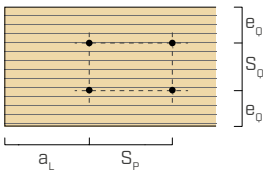
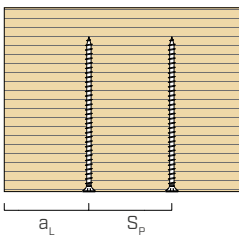


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

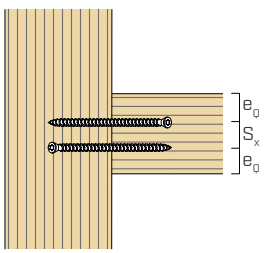


plan

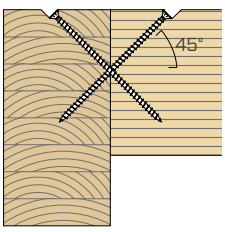


front

CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



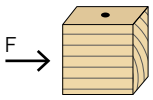
plan



front

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

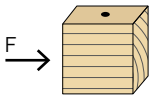
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**12·d‡**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
S_Q	**5·d**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
a_L	**15·d‡**	80	*3 1/8*	84	*3 5/16*	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
a	**10·d‡**	53	*2 1/16*	56	*2 3/16*	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_Q	**10·d**	53	*2 1/16*	56	*2 3/16*	70	*2 3/4*	90	*3 1/2*	110	*4 3/8*
e_P	**5·d**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
S_x	**2·d**	11	*7/16*	12	*1/2*	14	*9/16*	18	*11/16*	22	*7/8*

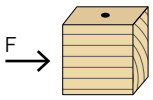
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



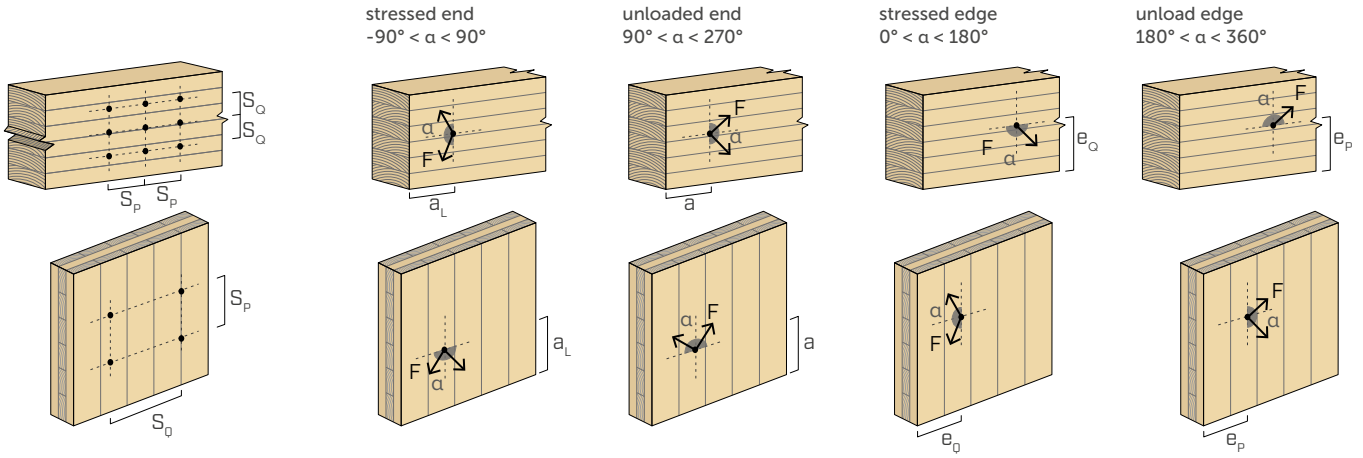
d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**18·d**	96	*3 3/4*	101	*4*	126	*4 15/16*	162	*6 3/8*	198	*7 13/16*
S_Q	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
a_L	**22·d**	117	*4 5/8*	124	*4 7/8*	154	*6 1/16*	198	*7 13/16*	242	*9 1/2*
a	**15·d**	80	*3 1/8*	84	*3 5/16*	105	*4 1/8*	135	*5 5/16*	165	*6 1/2*
e_Q	**12·d**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
e_P	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
S_x	**3·d**	16	*5/8*	17	*11/16*	21	*13/16*	27	*1 1/16*	33	*1 5/16*

screws inserted **WITH pre-drilled hole**



d_1		5,3 [mm]	*0.21 [in]*	5,6 [mm]	*0.23 [in]*	7 [mm]	*0.28 [in]*	9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**5·d†**	27	*1 1/16*	28	*1 1/8*	35	*1 3/8*	45	*1 3/4*	55	*2 3/16*
S_Q	**4·d**	22	*7/8*	23	*7/8*	28	*1 1/8*	36	*1 7/16*	44	*1 3/4*
a_L	**12·d†**	64	*2 1/2*	68	*2 11/16*	84	*3 5/16*	108	*4 1/4*	132	*5 3/16*
a	**7·d†**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_Q	**7·d**	37	*1 7/16*	40	*1 9/16*	49	*1 15/16*	63	*2 1/2*	77	*3 1/16*
e_P	**3·d**	16	*5/8*	17	*11/16*	21	*13/16*	27	*1 1/16*	33	*1 5/16*
S_x	**1.5·d**	8	*5/16*	9	*3/8*	11	*7/6*	14	*9/16*	17	*11/16*

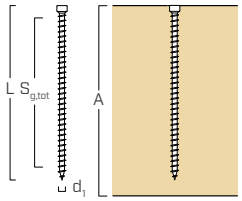
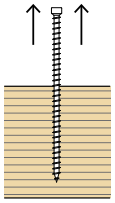
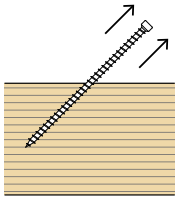
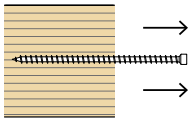
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle

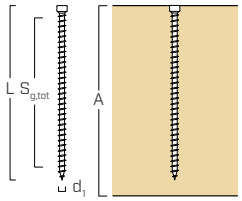
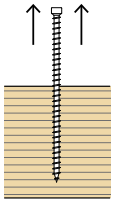
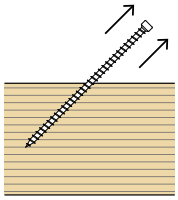
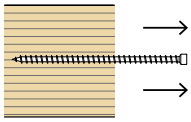


NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

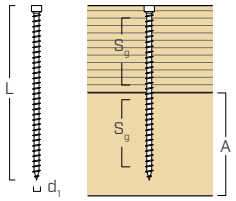
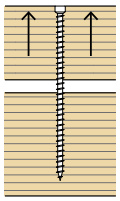
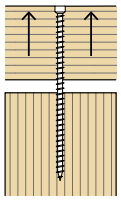
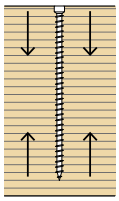
TENSION/COMPRESSION[1]

geometry					total thread withdrawal α = 90°				total thread withdrawal α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	65	90	2,52	2,92	3,30	3,62	2,29	2,65	3,00	3,29	1,26	1,46	1,65	1,81
	100	*4*	85	110	3,30	3,82	4,32	4,73	3,00	3,47	3,92	4,30	1,65	1,91	2,16	2,37
	120	*4 3/4*	105	130	4,07	4,71	5,33	5,85	3,70	4,29	4,85	5,32	2,04	2,36	2,67	2,92
5.6 *0.23*	140	*5 1/2*	125	150	5,12	5,93	6,70	7,36	4,66	5,39	6,09	6,69	2,56	2,96	3,35	3,68
	150	*6*	135	160	5,53	6,40	7,23	7,94	5,03	5,82	6,58	7,22	2,77	3,20	3,62	3,97
	160	*6 1/4*	145	170	5,94	6,88	7,77	8,53	5,40	6,25	7,06	7,76	2,97	3,44	3,89	4,27
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	2,45	2,83	3,21	3,52	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	3,23	3,73	4,22	4,63	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	4,00	4,63	5,24	5,75	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	4,78	5,53	6,26	6,87	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	5,56	6,43	7,28	7,98	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	6,34	7,33	8,30	9,10	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	7,12	8,23	9,31	10,22	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	7,89	9,13	10,33	11,33	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	8,67	10,03	11,35	12,45	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	9,45	10,93	12,37	13,56	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	10,23	11,83	13,39	14,68	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	11,00	12,73	14,40	15,80	6,05	7,00	7,92	8,69
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	12,56	14,53	16,44	18,03	6,91	7,99	9,04	9,92
	380	*15*	363	390	15,53	17,96	20,32	22,29	14,11	16,33	18,48	20,26	7,76	8,98	10,16	11,14
9 *0.36*	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	8,05	9,31	10,53	11,56	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	10,05	11,63	13,15	14,43	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	12,05	13,94	15,77	17,30	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	14,05	16,25	18,38	20,17	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	16,05	18,57	21,00	23,04	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	18,05	20,88	23,62	25,91	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	19,05	22,04	24,92	27,35	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	21,05	24,35	27,54	30,22	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	23,05	26,67	30,16	33,09	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	25,05	28,98	32,77	35,96	13,78	15,94	18,03	19,78

geometry				TENSION/COMPRESSION[1] total thread withdrawal α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	26,21	30,33	34,32	37,65	14,42	16,68	18,87	20,71
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	32,32	37,40	42,32	46,42	17,78	20,57	23,27	25,53
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95

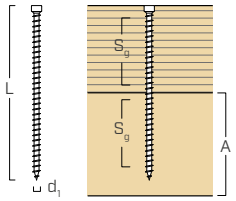
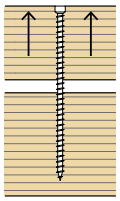
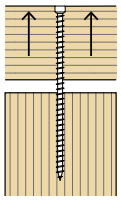
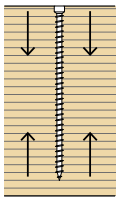
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 164.

geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
				G				G					
d_1	L		S_g	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	0,97	1,12	1,27	1,39	0,49	0,56	0,63	0,70	7,49	5,82
	100	*4*	35	1,36	1,57	1,78	1,95	0,68	0,79	0,89	0,97		
	120	*4 3/4*	45	1,75	2,02	2,29	2,51	0,87	1,01	1,14	1,25		
5.6 *0.23*	140	*5 1/2*	55	2,25	2,61	2,95	3,24	1,13	1,30	1,47	1,62	8,08	6,48
	150	*6*	60	2,46	2,85	3,22	3,53	1,23	1,42	1,61	1,77		
	160	*6 1/4*	65	2,66	3,08	3,48	3,83	1,33	1,54	1,74	1,91		
7 *0.28*	80	*3 1/8*	25	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64	10,34
	100	*4*	35	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07		
	120	*4 3/4*	45	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38		
	140	*5 1/2*	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	160	*6 1/4*	65	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00		
	180	*7 1/8*	75	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30		
	200	*8*	85	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61		
	220	*8 5/8*	95	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92		
	240	*9 1/2*	105	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22		
	260	*10 1/4*	115	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53		
	280	*11*	125	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84		
	300	*11 3/4*	135	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14		
	340	*13 3/8*	155	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76		
	380	*15*	175	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37		
9 *0.36*	160	*6 1/4*	65	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84	16,37
	180	*7 1/8*	75	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96		
	200	*8*	85	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	220	*8 5/8*	95	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75		
	240	*9 1/2*	105	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	260	*10 1/4*	115	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54		
	280	*11*	125	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	300	*11 3/4*	135	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33		
	320	*12 5/8*	145	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	340	*13 3/8*	155	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12		
	360	*14 1/4*	165	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	380	*15*	175	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91		
	400	*15 3/4*	185	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30		
	440	*17 1/4*	205	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09		
	480	*19*	225	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88		
	520	*20 1/2*	245	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67		

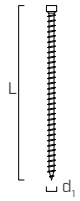
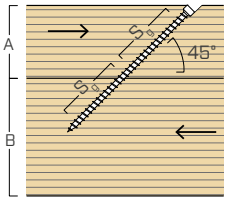
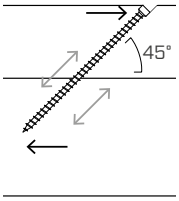
STRUCTURAL VALUES | WITHDRAWAL RESISTANCE

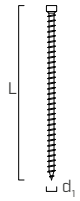
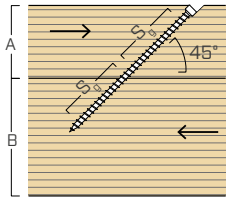
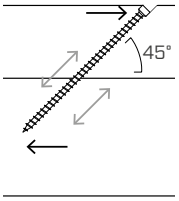
TENSION/COMPRESSION[1]

geometry					partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
														
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G 0.35	G 0.42	G 0.49	G 0.55	G 0.35	G 0.42	G 0.49	G 0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	23,17	19,66
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		

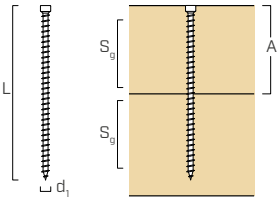
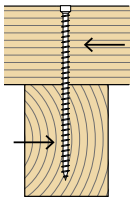
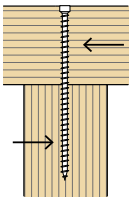
α = screw-to-grain angle

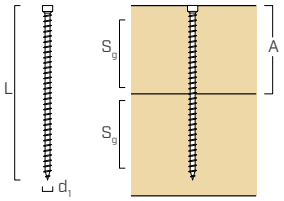
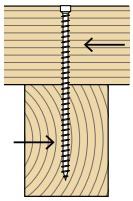
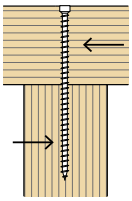
NOTES and GENERAL PRINCIPLES on page 164.

geometry			SLIDING[4]							steel tension
			timber-to-timber							
										
						factored lateral resistance N_r[5]				factored tension resistance T_{rs}
						G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	35	50	0,75	0,87	0,98	1,07	5,30
	100	*4*	35	40	55	1,05	1,21	1,37	1,50	
	120	*4 3/4*	45	45	60	1,35	1,56	1,76	1,93	
5.6 *0.23*	140	*5 1/2*	55	55	70	1,74	2,01	2,27	2,50	5,71
	150	*6*	60	60	75	1,90	2,20	2,48	2,72	
	160	*6 1/4*	65	60	75	2,06	2,38	2,69	2,95	
7 *0.28*	80	*3 1/8*	25	35	50	0,82	0,95	1,08	1,18	7,52
	100	*4*	35	40	55	1,15	1,34	1,51	1,66	
	120	*4 3/4*	45	45	60	1,48	1,72	1,94	2,13	
	140	*5 1/2*	55	55	70	1,81	2,10	2,38	2,61	
	160	*6 1/4*	65	60	75	2,14	2,48	2,81	3,08	
	180	*7 1/8*	75	70	85	2,47	2,86	3,24	3,55	
	200	*8*	85	75	90	2,80	3,24	3,67	4,03	
	220	*8 5/8*	95	85	100	3,13	3,63	4,10	4,50	
	240	*9 1/2*	105	90	105	3,46	4,01	4,53	4,97	
	260	*10 1/4*	115	95	110	3,79	4,39	4,97	5,45	
	280	*11*	125	105	120	4,12	4,77	5,40	5,92	
	300	*11 3/4*	135	110	125	4,45	5,15	5,83	6,39	
	340	*13 3/8*	155	125	140	5,11	5,92	6,69	7,34	
	380	*15*	175	140	155	5,77	6,68	7,56	8,29	
9 *0.36*	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96	12,61
	180	*7 1/8*	75	70	85	3,18	3,68	4,16	4,57	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18	
	220	*8 5/8*	95	85	100	4,03	4,66	5,27	5,79	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40	
	260	*10 1/4*	115	95	110	4,88	5,64	6,38	7,00	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61	
	300	*11 3/4*	135	110	125	5,73	6,63	7,49	8,22	
	320	*12 5/8*	145	120	135	6,15	7,12	8,05	8,83	
	340	*13 3/8*	155	125	140	6,58	7,61	8,60	9,44	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05	
	380	*15*	175	140	155	7,42	8,59	9,71	10,66	
	400	*15 3/4*	185	145	160	7,85	9,08	10,27	11,27	
	440	*17 1/4*	205	160	175	8,70	10,06	11,38	12,49	
	480	*19*	225	175	190	9,54	11,04	12,49	13,70	
	520	*20 1/2*	245	190	205	10,39	12,03	13,60	14,92	

			SLIDING[4]							
geometry			timber-to-timber							steel tension
										
						factored lateral resistance N_r[5]				factored tension resistance T_{rs}
d_1	L		S_g	A	B_{min}	G 0.35	G 0.42	G 0.49	G 0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	95	110	5,70	6,60	7,47	8,19	16,38
	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78	
	450	*17 3/4*	210	165	180	10,89	12,60	14,25	15,64	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50	
	550	*21 5/8*	260	200	215	13,48	15,60	17,65	19,36	
	600	*23 5/8*	285	215	230	14,78	17,10	19,34	21,22	

NOTES and GENERAL PRINCIPLES on page 164.

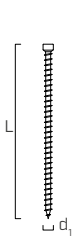
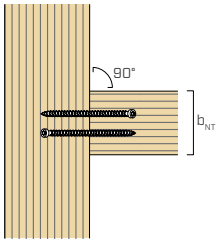
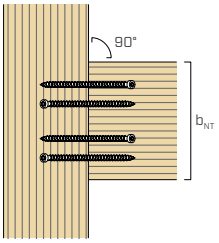
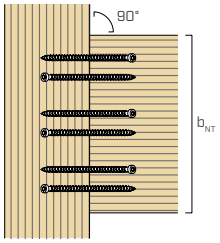
geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	40	0,96	1,11	1,21	1,30	0,57	0,65	0,73	0,79
	100	*4*	35	50	1,10	1,22	1,34	1,44	0,66	0,75	0,84	0,92
	120	*4 3/4*	45	60	1,19	1,33	1,47	1,57	0,74	0,85	0,96	1,04
5.6 *0.23*	140	*5 1/2*	55	70	1,40	1,57	1,73	1,86	0,88	1,01	1,14	1,23
	150	*6*	60	75	1,45	1,63	1,79	1,93	0,93	1,06	1,18	1,27
	160	*6 1/4*	65	80	1,50	1,69	1,86	2,00	0,97	1,10	1,21	1,30
7 *0.28*	80	*3 1/8*	25	40	1,14	1,36	1,57	1,76	0,76	0,90	1,00	1,08
	100	*4*	35	50	1,47	1,74	1,98	2,11	0,90	1,02	1,13	1,23
	120	*4 3/4*	45	60	1,74	1,93	2,12	2,26	0,99	1,13	1,26	1,38
	140	*5 1/2*	55	70	1,84	2,06	2,26	2,42	1,09	1,25	1,40	1,52
	160	*6 1/4*	65	80	1,95	2,18	2,40	2,57	1,19	1,36	1,53	1,67
	180	*7 1/8*	75	90	2,06	2,30	2,54	2,73	1,29	1,47	1,66	1,79
	200	*8*	85	100	2,16	2,43	2,68	2,88	1,38	1,58	1,74	1,87
	220	*8 5/8*	95	110	2,27	2,55	2,82	3,03	1,47	1,65	1,81	1,94
	240	*9 1/2*	105	120	2,38	2,67	2,96	3,15	1,53	1,71	1,88	2,02
	260	*10 1/4*	115	130	2,49	2,75	2,97	3,15	1,58	1,77	1,95	2,10
	280	*11*	125	140	2,51	2,75	2,97	3,15	1,63	1,83	2,02	2,17
	300	*11 3/4*	135	150	2,51	2,75	2,97	3,15	1,69	1,89	2,09	2,25
	340	*13 3/8*	155	170	2,51	2,75	2,97	3,15	1,79	2,02	2,23	2,38
	380	*15*	175	190	2,51	2,75	2,97	3,15	1,90	2,08	2,25	2,38
9 *0.36*	160	*6 1/4*	65	80	2,85	3,17	3,48	3,73	1,61	1,83	2,05	2,23
	180	*7 1/8*	75	90	2,98	3,33	3,66	3,93	1,73	1,98	2,21	2,41
	200	*8*	85	100	3,12	3,49	3,84	4,13	1,85	2,12	2,38	2,59
	220	*8 5/8*	95	110	3,26	3,65	4,02	4,32	1,97	2,26	2,54	2,77
	240	*9 1/2*	105	120	3,40	3,81	4,20	4,52	2,09	2,40	2,70	2,90
	260	*10 1/4*	115	130	3,53	3,97	4,38	4,72	2,21	2,54	2,79	3,00
	280	*11*	125	140	3,67	4,13	4,56	4,90	2,33	2,62	2,88	3,09
	300	*11 3/4*	135	150	3,81	4,28	4,62	4,90	2,41	2,70	2,97	3,19
	320	*12 5/8*	145	160	3,91	4,28	4,62	4,90	2,48	2,78	3,06	3,29
	340	*13 3/8*	155	170	3,91	4,28	4,62	4,90	2,55	2,86	3,15	3,39
	360	*14 1/4*	165	180	3,91	4,28	4,62	4,90	2,62	2,94	3,24	3,49
	380	*15*	175	190	3,91	4,28	4,62	4,90	2,69	3,02	3,33	3,59
	400	*15 3/4*	185	200	3,91	4,28	4,62	4,90	2,76	3,10	3,42	3,69
	440	*17 1/4*	205	220	3,91	4,28	4,62	4,90	2,89	3,24	3,49	3,70
	480	*19*	225	240	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	520	*20 1/2*	245	260	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70

geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2][3]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	450	*17 3/4*	210	225	4,86	5,32	5,75	6,09	3,59	4,02	4,35	4,60
	500	*19 3/4*	235	250	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	550	*21 5/8*	260	275	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	600	*23 5/8*	285	300	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60

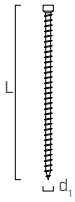
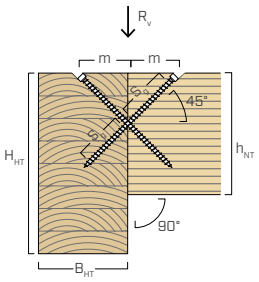
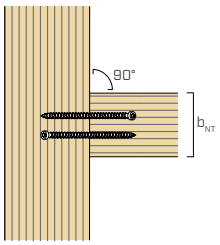
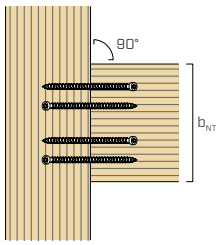
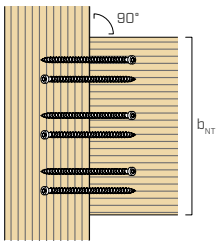
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 164.

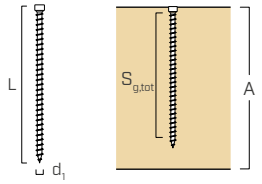
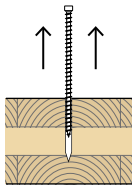
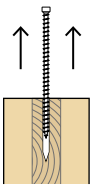
MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

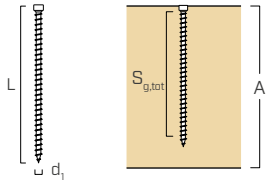
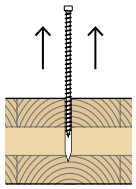
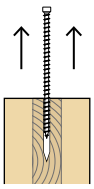
geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
								0.42	0.49		0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]	[mm]	[kN]	[kN]
5,3 *0,21*	80	*3 1/8*	45	70	25	31	53	1,44	1,63	80	2,89	3,26	106	4,33	4,90
	100	*4*	55	85	35	38		2,02	2,29		4,04	4,57		6,06	6,86
	120	*4 3/4*	60	100	45	45		2,60	2,94		5,19	5,88		7,79	8,81
5,6 *0,23*	140	*5 1/2*	70	115	55	53	56	3,35	3,79	84	6,71	7,58	112	10,06	11,37
	150	*6*	70	120	60	56		3,66	4,13		7,32	8,27		10,98	12,40
	160	*6 1/4*	75	130	65	60		3,96	4,48		7,93	8,96		11,89	13,44
7 *0,28*	80	*3 1/8*	45	70	25	31	70	1,59	1,80	105	3,18	3,60	140	4,77	5,40
	100	*4*	55	85	35	38		2,23	2,52		4,45	5,04		6,68	7,56
	120	*4 3/4*	60	100	45	45		2,86	3,24		5,73	6,48		8,59	9,72
	140	*5 1/2*	70	115	55	53		3,50	3,96		7,00	7,92		10,50	11,88
	160	*6 1/4*	75	130	65	60		4,14	4,68		8,27	9,36		12,41	14,04
	180	*7 1/8*	80	140	75	67		4,77	5,40		9,54	10,80		14,32	16,20
	200	*8*	90	155	85	74		5,41	6,12		10,82	12,24		16,22	18,35
	220	*8 5/8*	95	170	95	81		6,04	6,84		12,09	13,68		18,13	20,51
	240	*9 1/2*	105	185	105	88		6,68	7,56		13,36	15,12		20,04	22,67
	260	*10 1/4*	110	200	115	95		7,32	8,28		14,63	16,56		21,95	24,83
	280	*11*	120	215	125	102		7,95	9,00		15,91	17,99		23,86	26,99
	300	*11 3/4*	125	225	135	109		8,59	9,72		17,18	19,43		25,77	29,15
	340	*13 3/8*	140	255	155	123		9,86	11,16		19,72	22,31		29,59	33,47
	380	*15*	155	285	175	137		11,13	12,60		22,27	25,19		33,40	37,79
9 *0.36*	160	*6 1/4*	75	130	65	60	90	5,32	6,01	135	10,63	12,03	180	15,95	18,04
	180	*7 1/8*	80	140	75	67		6,14	6,94		12,27	13,88		18,41	20,82
	200	*8*	90	155	85	74		6,95	7,86		13,91	15,73		20,86	23,59
	220	*8 5/8*	95	170	95	81		7,77	8,79		15,54	17,58		23,31	26,37
	240	*9 1/2*	105	185	105	88		8,59	9,71		17,18	19,43		25,77	29,14
	260	*10 1/4*	110	200	115	95		9,41	10,64		18,82	21,28		28,22	31,92
	280	*11*	120	215	125	102		10,23	11,56		20,45	23,13		30,68	34,69
	300	*11 3/4*	125	225	135	109		11,04	12,49		22,09	24,98		33,13	37,47
	320	*12 5/8*	130	240	145	116		11,86	13,41		23,72	26,83		35,59	40,24
	340	*13 3/8*	140	255	155	123		12,68	14,34		25,36	28,68		38,04	43,02
	360	*14 1/4*	145	270	165	130		13,50	15,27		27,00	30,53		40,49	45,80
	380	*15*	155	285	175	137		14,32	16,19		28,63	32,38		42,95	48,57
	400	*15 3/4*	160	300	185	144		15,13	17,12		30,27	34,23		45,40	51,35
	440	*17 1/4*	175	325	205	159		16,77	18,97		33,54	37,93		50,31	56,90
	480	*19*	190	355	225	173		18,41	20,82		36,81	41,63		55,22	62,45
	520	*20 1/2*	200	385	245	187		20,04	21,49		40,08	42,99		60,13	64,48

MAIN BEAM-SECONDARY BEAM SHEAR CONNECTION[8]

geometry			main beam secondary beam				1 pair			2 pairs			3 pairs		
															
d_1	L		$B_{HT,min}$	$H_{HT,min}$ $h_{NT,min}$	S_g	m	$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G		$b_{NT,min}$	factored shear resistance R_v [9] G	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[mm]	[mm]	0.42 [kN]	0.49 [kN]	[mm]	0.42 [kN]	0.49 [kN]	[mm]	0.42 [kN]	0.49 [kN]
11 *0.44*	250	*10*	105	190	110	91	110	11,00	12,44	165	22,00	24,89	220	33,00	37,33
	300	*11 3/4*	125	225	135	109		13,50	15,27		27,00	30,54		40,49	45,82
	350	*13 3/4*	140	260	160	127		16,00	18,10		32,00	36,20		47,99	54,30
	400	*15 3/4*	160	300	185	144		18,50	20,93		36,99	41,86		55,49	62,78
	450	*17 3/4*	180	335	210	162		21,00	23,76		41,99	47,51		62,99	71,27
	500	*19 3/4*	195	370	235	180		23,50	25,81		46,99	51,63		70,49	77,44
	550	*21 5/8*	215	405	260	197		25,81	25,81		51,63	51,63		77,44	77,44
	600	*23 5/8*	230	440	285	215		25,81	25,81		51,63	51,63		77,44	77,44

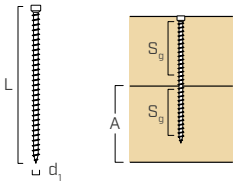
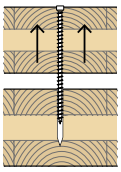
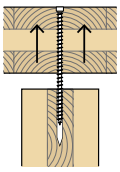
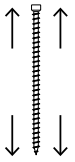
NOTES and GENERAL PRINCIPLES on page 164.

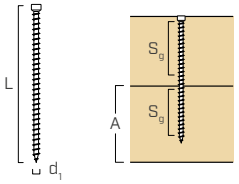
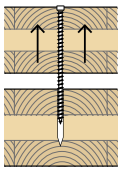
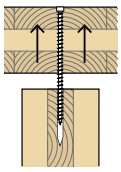
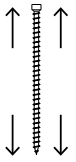
geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	65	90	2,52	2,92	3,30	3,62	1,26	1,46	1,65	1,81
	100	*4*	85	110	3,30	3,82	4,32	4,73	1,65	1,91	2,16	2,37
	120	*4 3/4*	105	130	4,07	4,71	5,33	5,85	2,04	2,36	2,67	2,92
5.6 *0.23*	140	*5 1/2*	124	150	5,12	5,93	6,70	7,36	2,56	2,96	3,35	3,68
	150	*6*	134	160	5,53	6,40	7,23	7,94	2,77	3,20	3,62	3,97
	160	*6 1/4*	144	170	5,94	6,88	7,77	8,53	2,97	3,44	3,89	4,27
7 *0.28*	80	*3 1/8*	63	90	2,69	3,12	3,53	3,87	1,35	1,56	1,76	1,93
	100	*4*	83	110	3,55	4,11	4,65	5,10	1,77	2,05	2,32	2,55
	120	*4 3/4*	103	130	4,41	5,10	5,77	6,32	2,20	2,55	2,88	3,16
	140	*5 1/2*	123	150	5,26	6,09	6,89	7,55	2,63	3,04	3,44	3,78
	160	*6 1/4*	143	170	6,12	7,08	8,01	8,78	3,06	3,54	4,00	4,39
	180	*7 1/8*	163	190	6,97	8,07	9,13	10,01	3,49	4,03	4,56	5,00
	200	*8*	183	210	7,83	9,06	10,25	11,24	3,91	4,53	5,12	5,62
	220	*8 5/8*	203	230	8,68	10,05	11,37	12,47	4,34	5,02	5,68	6,23
	240	*9 1/2*	223	250	9,54	11,04	12,48	13,69	4,77	5,52	6,24	6,85
	260	*10 1/4*	243	270	10,39	12,03	13,60	14,92	5,20	6,01	6,80	7,46
	280	*11*	263	290	11,25	13,02	14,72	16,15	5,62	6,51	7,36	8,07
	300	*11 3/4*	283	310	12,10	14,01	15,84	17,38	6,05	7,00	7,92	8,69
	340	*13 3/8*	323	350	13,81	15,99	18,08	19,83	6,91	7,99	9,04	9,92
	380	*15*	363	390	15,53	17,96	20,32	22,29	7,76	8,98	10,16	11,14
9 *0.36*	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	7,18	8,30	9,39	10,30
	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	7,73	8,94	10,11	11,09
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	13,78	15,94	18,03	19,78

geometry					TENSION[1]							
					total thread withdrawal							
					lateral α=90°				narrow α=0°			
												
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]			
					G				G			
d_1	L		$S_{g,tot}$	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	229	260	15,39	17,81	20,15	22,11	7,70	8,90	10,07	11,05
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	9,38	10,85	12,27	13,47
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	11,06	12,79	14,47	15,88
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	12,74	14,74	16,67	18,29
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	14,42	16,68	18,87	20,71
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	16,10	18,63	21,07	23,12
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	17,78	20,57	23,27	25,53
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	19,46	22,51	25,47	27,95

α = screw-to-grain angle

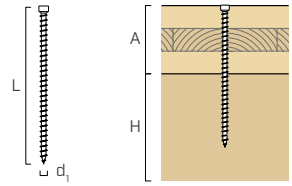
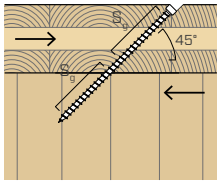
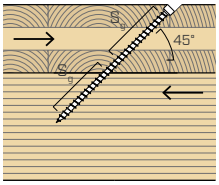
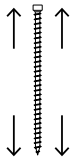
NOTES and GENERAL PRINCIPLES on page 164.

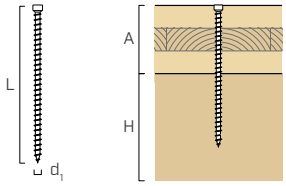
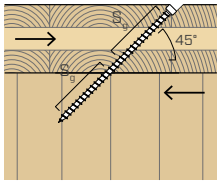
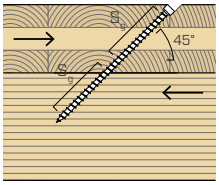
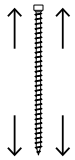
geometry					TENSION[1]								steel tension
					partial thread withdrawal								
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	45	0,97	1,12	1,27	1,39	0,49	0,56	0,63	0,70	7,49
	100	*4*	35	55	1,36	1,57	1,78	1,95	0,68	0,79	0,89	0,97	
	120	*4 3/4*	45	65	1,75	2,02	2,29	2,51	0,87	1,01	1,14	1,25	
5.6 *0.23*	140	*5 1/2*	55	75	2,25	2,61	2,95	3,24	1,13	1,30	1,47	1,62	8,08
	150	*6*	60	80	2,46	2,85	3,22	3,53	1,23	1,42	1,61	1,77	
	160	*6 1/4*	65	85	2,66	3,08	3,48	3,83	1,33	1,54	1,74	1,91	
7 *0.28*	80	*3 1/8*	25	45	1,07	1,24	1,40	1,54	0,53	0,62	0,70	0,77	10,64
	100	*4*	35	55	1,50	1,73	1,96	2,15	0,75	0,87	0,98	1,07	
	120	*4 3/4*	45	65	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38	
	140	*5 1/2*	55	75	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69	
	160	*6 1/4*	65	85	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00	
	180	*7 1/8*	75	95	3,21	3,71	4,20	4,61	1,60	1,86	2,10	2,30	
	200	*8*	85	105	3,64	4,21	4,76	5,22	1,82	2,10	2,38	2,61	
	220	*8 5/8*	95	115	4,06	4,70	5,32	5,83	2,03	2,35	2,66	2,92	
	240	*9 1/2*	105	125	4,49	5,20	5,88	6,45	2,25	2,60	2,94	3,22	
	260	*10 1/4*	115	135	4,92	5,69	6,44	7,06	2,46	2,85	3,22	3,53	
	280	*11*	125	145	5,35	6,19	7,00	7,68	2,67	3,09	3,50	3,84	
	300	*11 3/4*	135	155	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,14	
	340	*13 3/8*	155	175	6,63	7,67	8,68	9,52	3,31	3,84	4,34	4,76	
	380	*15*	175	195	7,48	8,66	9,80	10,75	3,74	4,33	4,90	5,37	
9 *0.36*	160	*6 1/4*	65	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57	17,84
	180	*7 1/8*	75	95	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96	
	200	*8*	85	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36	
	220	*8 5/8*	95	115	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75	
	240	*9 1/2*	105	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15	
	260	*10 1/4*	115	135	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54	
	280	*11*	125	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94	
	300	*11 3/4*	135	155	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33	
	320	*12 5/8*	145	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72	
	340	*13 3/8*	155	175	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12	
	360	*14 1/4*	165	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51	
	380	*15*	175	195	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91	
	400	*15 3/4*	185	205	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30	
	440	*17 1/4*	205	225	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09	
	480	*19*	225	245	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88	
	520	*20 1/2*	245	265	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67	

geometry					TENSION[1]								
					total thread withdrawal								steel tension
					lateral α=90°				narrow α=0°				
													
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
					G				G				
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31	23,17
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52	
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72	
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93	
	450	*17 3/4*	210	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14	
	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34	
	550	*21 5/8*	260	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55	
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76	

α = screw-to-grain angle

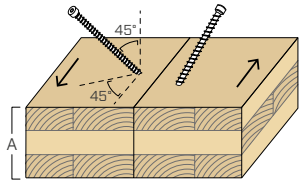
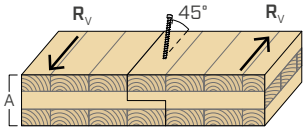
NOTES and GENERAL PRINCIPLES on page 164.

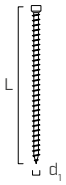
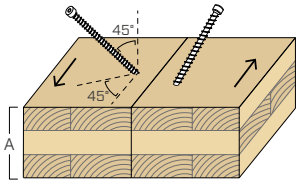
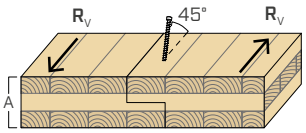
geometry					SLIDING[4]				steel tension
					CLT - CLT α=0°		CLT - timber α=45°		
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
					G		G		
d_1	L		S_g	A	H_{min}	0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	35	50	0,40	0,45	0,79	0,90	5,30
	100	*4*	35	40	55	0,56	0,63	1,11	1,26	
	120	*4 3/4*	45	45	60	0,71	0,81	1,43	1,62	
5.6 *0.23*	140	*5 1/2*	55	55	70	0,92	1,04	1,84	2,08	5,71
	150	*6*	60	60	75	1,01	1,14	2,01	2,27	
	160	*6 1/4*	65	60	75	1,09	1,23	2,18	2,46	
7 *0.28*	80	*3 1/8*	25	35	50	0,44	0,49	0,87	0,99	7,52
	100	*4*	35	40	55	0,61	0,69	1,22	1,39	
	120	*4 3/4*	45	45	60	0,79	0,89	1,57	1,78	
	140	*5 1/2*	55	55	70	0,96	1,09	1,92	2,18	
	160	*6 1/4*	65	60	75	1,14	1,29	2,27	2,57	
	180	*7 1/8*	75	70	85	1,31	1,48	2,62	2,97	
	200	*8*	85	75	90	1,49	1,68	2,97	3,36	
	220	*8 5/8*	95	85	100	1,66	1,88	3,32	3,76	
	240	*9 1/2*	105	90	105	1,84	2,08	3,67	4,16	
	260	*10 1/4*	115	95	110	2,01	2,28	4,02	4,55	
	280	*11*	125	105	120	2,19	2,47	4,37	4,95	
	300	*11 3/4*	135	110	125	2,36	2,67	4,72	5,34	
	340	*13 3/8*	155	125	140	2,71	3,07	5,42	6,14	
	380	*15*	175	140	155	3,06	3,46	6,12	6,93	
9 *0.36*	160	*6 1/4*	65	60	75	1,46	1,65	2,92	3,31	12,61
	180	*7 1/8*	75	70	85	1,69	1,91	3,37	3,82	
	200	*8*	85	75	90	1,91	2,16	3,82	4,33	
	220	*8 5/8*	95	85	100	2,14	2,42	4,27	4,83	
	240	*9 1/2*	105	90	105	2,36	2,67	4,72	5,34	
	260	*10 1/4*	115	95	110	2,59	2,93	5,17	5,85	
	280	*11*	125	105	120	2,81	3,18	5,62	6,36	
	300	*11 3/4*	135	110	125	3,04	3,43	6,07	6,87	
	320	*12 5/8*	145	120	135	3,26	3,69	6,52	7,38	
	340	*13 3/8*	155	125	140	3,49	3,94	6,97	7,89	
	360	*14 1/4*	165	130	145	3,71	4,20	7,42	8,40	
	380	*15*	175	140	155	3,94	4,45	7,87	8,90	
	400	*15 3/4*	185	145	160	4,16	4,71	8,32	9,41	
	440	*17 1/4*	205	160	175	4,61	5,22	9,22	10,43	
	480	*19*	225	175	190	5,06	5,72	10,12	11,45	
	520	*20 1/2*	245	190	205	5,51	6,23	11,02	12,47	

geometry					SLIDING[4]				steel tension
					CLT - CLT α=0°		CLT - timber α=45°		
									
					factored lateral resistance N_r[5]		factored lateral resistance N_r[5]		factored tension resistance T_{rs}
d_1	L		S_g	A	H_{min}	G		G		
						0.42	0.49	0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	95	110	3,02	3,42	6,05	6,84	16,38
	300	*11 3/4*	135	110	125	3,71	4,20	7,42	8,40	
	350	*13 3/4*	160	130	145	4,40	4,98	8,80	9,95	
	400	*15 3/4*	185	145	160	5,09	5,76	10,17	11,51	
	450	*17 3/4*	210	165	180	5,77	6,53	11,55	13,07	
	500	*19 3/4*	235	180	195	6,46	7,31	12,92	14,62	
	550	*21 5/8*	260	200	215	7,15	8,09	14,30	16,18	
	600	*23 5/8*	285	215	230	7,84	8,87	15,67	17,73	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 164.

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)[10]			half-lap joint α=45°	
									
					factored lateral resistance N_r[5]		factored tension resistance T_{rs}	factored lateral resistance N_r[5]	factored tension resistance T_{rs}
d_1	L		S_g	A	G			G	
					0.42	0.49		0.42	0.49	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5.3 *0.21*	80	*3 1/8*	25	65	0,69	0,79	3,75	0,87	0,98	5,30
	100	*4*	35	80	0,97	1,10		1,21	1,37	
	120	*4 3/4*	45	95	1,25	1,41		1,56	1,76	
5.6 *0.23*	140	*5 1/2*	55	110	1,61	1,82	4,04	2,01	2,27	5,71
	150	*6*	60	115	1,76	1,99		2,20	2,48	
	160	*6 1/4*	65	125	1,91	2,16		2,38	2,69	
7 *0.28*	80[3]	*3 1/8*	25	65	0,77	0,87	5,32	0,95	1,08	7,52
	100	*4*	35	80	1,07	1,21		1,34	1,51	
	120	*4 3/4*	45	95	1,38	1,56		1,72	1,94	
	140	*5 1/2*	55	110	1,69	1,91		2,10	2,38	
	160	*6 1/4*	65	125	1,99	2,25		2,48	2,81	
	180	*7 1/8*	75	135	2,30	2,60		2,86	3,24	
	200	*8*	85	150	2,60	2,95		3,24	3,67	
	220	*8 5/8*	95	165	2,91	3,29		3,63	4,10	
	240	*9 1/2*	105	180	3,22	3,64		4,01	4,53	
	260	*10 1/4*	115	195	3,52	3,99		4,39	4,97	
	280	*11*	125	210	3,83	4,33		4,77	5,40	
	300	*11 3/4*	135	220	4,14	4,68		5,15	5,83	
	320	*12 5/8*	145	235	4,44	5,03		5,54	6,26	
	340	*13 3/8*	155	250	4,75	5,37		5,92	6,69	
	380	*15*	175	280	5,36	6,07		6,68	7,56	
9 *0.36*	160	*6 1/4*	65	125	2,56	2,90	8,92	3,19	3,61	12,61
	180	*7 1/8*	75	135	2,95	3,34		3,68	4,16	
	200	*8*	85	150	3,35	3,79		4,17	4,72	
	220	*8 5/8*	95	165	3,74	4,23		4,66	5,27	
	240	*9 1/2*	105	180	4,14	4,68		5,15	5,83	
	260	*10 1/4*	115	195	4,53	5,12		5,64	6,38	
	280	*11*	125	210	4,92	5,57		6,14	6,94	
	300	*11 3/4*	135	220	5,32	6,01		6,63	7,49	
	320	*12 5/8*	145	235	5,71	6,46		7,12	8,05	
	340	*13 3/8*	155	250	6,11	6,90		7,61	8,60	
	360	*14 1/4*	165	265	6,50	7,35		8,10	9,16	
	380	*15*	175	280	6,89	7,80		8,59	9,71	
	400	*15 3/4*	185	295	7,29	8,24		9,08	10,27	
	440	*17 1/4*	205	320	8,07	9,13		10,06	11,38	
	480	*19*	225	350	8,86	10,02		11,04	12,49	
	520	*20 1/2*	245	380	9,65	10,91		12,03	13,60	

geometry					SLIDING[4]				
					butt joint (double inclination at 45° + 45°)(10)			half-lap joint α=45°	
									
					factored lateral resistance N_r(5)		factored tension resistance T_{rs}	factored lateral resistance N_r(5)	factored tension resistance T_{rs}
d_1	L		S_g	A	G			G	
					0.42	0.49		0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	250	*10*	110	185	5,30	5,99	11,59	6,60	7,47	16,38
	300	*11 3/4*	135	220	6,50	7,35		8,10	9,16	
	350	*13 3/4*	160	255	7,70	8,72		9,60	10,86	
	400	*15 3/4*	185	295	8,91	10,08		11,10	12,56	
	450	*17 3/4*	210	330	10,11	11,44		12,60	14,25	
	500	*19 3/4*	235	365	11,31	12,80		14,10	15,95	
	550	*21 5/8*	260	400	12,52	14,16		15,60	17,65	
	600	*23 5/8*	285	435	13,72	15,52		17,10	19,34	

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 164.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- VGZ screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}) and the steel strength (T_{rs}). Similarly, the factored compression resistance of the connector (P_{rc}) is determined as the lower value between the withdrawal resistance (P_{rw}) and the buckling capacity (P_{rb}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) VGZ screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) For fully threaded screws, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile resistance.

(5) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(6) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

(8) The number of cross pairs, n_F, has been taken as 2.0 and 3.0 for configurations with two and three screw pairs, respectively, in accordance with CSA O86:24. However, when evaluating the effective number of screws in axially stressed connector pairs, Rothoblaas recommends using reduced values of 1.9 and 2.7 for two and three pairs, respectively. This recommendation accounts for the fact that the load-bearing capacity of a multi-screw connection—with screws of the same size and type—may be lower than the sum of the individual screw capacities, due to group effects and non-uniform load distribution within the connection. Discretion and engineering judgment must be exercised.

(9) The factored shear resistance, R_v, of crossed screws is determined by taking the minimum of $2.P_{rt}.\cos(\beta)$, $2.P_{rc}.\cos(\beta)$, and $V_{rs/\sin}(\beta)$, where P_{rt} represents the factored axial resistance of screws loaded in tension, P_{rc} represents the factored axial resistance of screws loaded in compression, and V_{rs} represents the factored shear resistance of screws. This approach accounts for the directional component of the axial forces relative to the shear plane and ensures a conservative estimate by considering the governing case among all conditions.

(10) The sliding strengths of the connectors inserted with double inclination (45°-45°) were evaluated considering an α angle of 60° between the grain and the connector; in fact, the geometry of the joint requires that the connectors have to be inserted at an angle of 45° with respect to the face of the CLT panel and at an angle of 45° with respect to the shear plane between the two panels. The use of the JIG VGZ 45 template is recommended for professional installation of the connectors in this application.

INSTALLATION SUGGESTIONS

TIMBER-TO-TIMBER JOINT WITH CROSSED CONNECTORS

TIGHTENING THE JOINT



For correct installation of the joint, we recommend tightening the elements before inserting the connectors.



Insert a partially threaded screw (e.g. HBS680) to bring the elements closer together.



The HBS screw eliminated the initial gap between the elements.
After positioning the VGZ connectors, it can be removed.

INSERTION OF CONNECTORS



To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template.



After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.



Repeat the procedure to install the inserted screw from the main beam to the secondary beam.

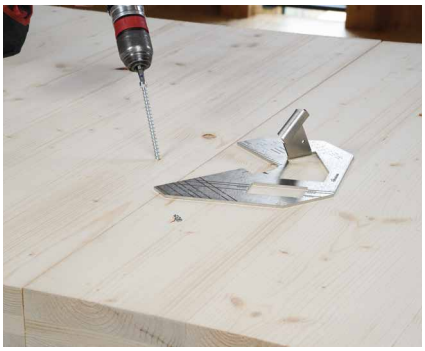
JOINT BETWEEN CLT PANELS WITH CONNECTORS INCLINED IN BOTH DIRECTIONS (45°-45°)



To ensure the correct positioning and inclination of the VGZ screws, we recommend using the JIGVGZ45 template positioned at 45° to the panel head.



After tightening about one third of the screw, remove the JIGVGZ45 template and continue with the installation.



Repeat the procedure to install the screw in the adjoining panel and continue this alternating sequence according to the distances provided in the design.

RELATED PRODUCTS



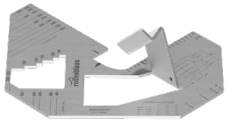
HBS



CATCH



BIT

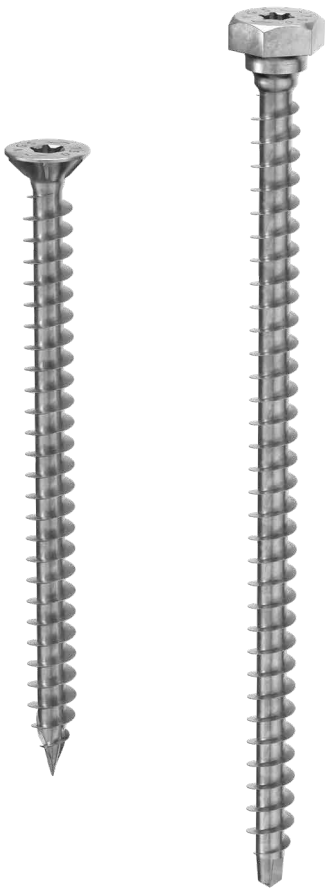


JIG VGZ 45°

VGS

ELC-4645 | ESR-4645 | UKTA-0836 22/6195 | ETA-11/0030

FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD



3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.

CERTIFICATION FOR TIMBER AND CONCRETE

Structural connector approved for timber applications according to ICC ELC-4645 listing report in Canada and for timber-concrete applications according to ETA-22/0806.

TENSILE STRENGTH

Deep thread and high strength steel for excellent tensile or sliding performance. Approved for structural applications subject to stresses in any direction vs the grain (0° ÷ 90°). Can be used on steel plates in combination with the VGU or HUS washers.

COUNTERSUNK OR HEXAGONAL HEAD

Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements. Hexagonal head L > 600 mm to facilitate gripping with screwdriver.

MANUALS

BIT INCLUDED

DIAMETER [mm]	9 **9** — **15** 15
LENGTH [mm]	80 **80** — **2000** 2000
SERVICE CONDITION	EC1 DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED — electrogalvanized carbon steel
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,rec}$



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

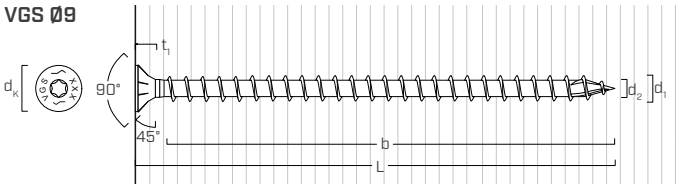


TC FUSION

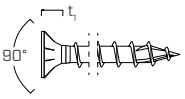
The ETA-22/0806 approval of the TC FUSION system allows the VGS screws to be used together with the reinforcements in the concrete so that the panel floor slabs and the bracing core can be bonded together with a small integration of the casting.

GEOMETRY AND MECHANICAL CHARACTERISTICS

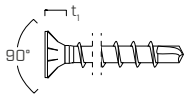
VGS Ø9



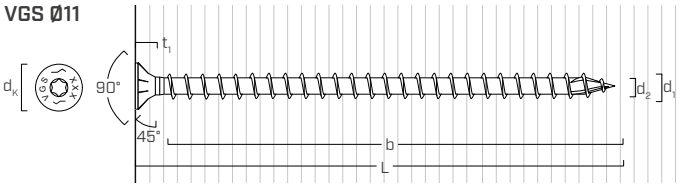
L ≤ 520 mm



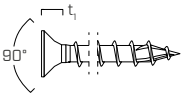
L > 520 mm



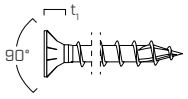
VGS Ø11



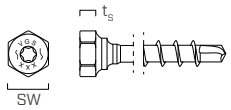
L ≤ 250 mm



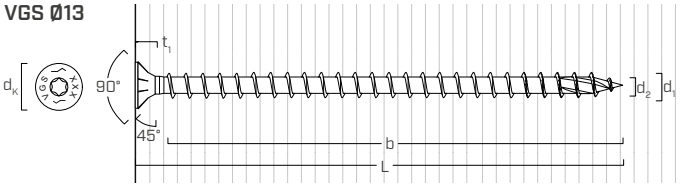
250 mm < L ≤ 600 mm



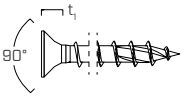
L > 600 mm



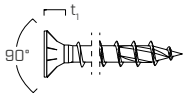
VGS Ø13



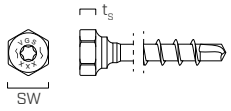
L ≤ 250 mm



250 mm < L ≤ 600 mm



L > 600 mm



GEOMETRY

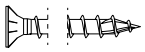
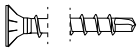
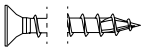
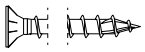
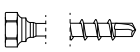
Nominal diameter	**d_1**	**[mm]**	**9**	**11**	**11**	**13**	**13**
Length	L	[mm]	-	≤ 600 mm	> 600 mm	≤ 600 mm	> 600 mm
Countersunk head diameter	d_K	[mm]	16,00	19,30	-	22,00	-
Countersunk head thickness	t_1	[mm]	6,50	8,20	-	9,40	-
Wrench size	SW	-	-	-	SW 17	-	SW 19
Hexagonal head thickness	t_s	[mm]	-	-	6,40	-	7,50
Root diameter	d_2	[mm]	5,90	6,60	6,60	8,00	8,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	6,0	8,0	8,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	7,0	9,0	9,0

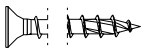
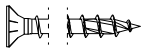
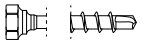
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

Nominal diameter	**d_1**	**[mm]**		**9**	**11**	**13**
Factored tensile strength	Φf_u	[kN]		17,84	23,17	31,96
Bending yield strength	F_{yb}	[MPa]		1069	1026	960
Factored shear strength of the screw	Φv_s	[kN]		10,50	13,14	19,30
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	78,56	96,02	113,5
			G=0.42	90,9	111,1	131,3
			G=0.49	102,8	125,7	148,5
			G=0.55	112,8	137,9	162,9

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
9 TX40	VGS9100	100	90	50	
	VGS9120	120	110	50	
	VGS9140	140	130	50	
	VGS9160	160	150	50	
	VGS9180	180	170	50	
	VGS9200	200	190	50	
	VGS9220	220	210	50	
	VGS9240	240	230	50	
	VGS9260	260	250	50	
	VGS9280	280	270	50	
	VGS9300	300	290	50	
	VGS9320	320	310	50	
	VGS9340	340	330	50	
	VGS9360	360	350	50	
	VGS9380	380	370	50	
	VGS9400	400	390	50	
	VGS9440	440	430	25	
	VGS9480	480	470	25	
	VGS9520	520	510	25	
	VGS9560	560	550	25	
	VGS9600	600	590	25	
11 TX 50	VGS1180	80	70	25	
	VGS11100	100	90	25	
	VGS11125	125	115	25	
	VGS11150	150	140	25	
	VGS11175	175	165	25	
	VGS11200	200	190	25	
	VGS11225	225	215	25	
	VGS11250	250	240	25	
	VGS11275	275	265	25	
	VGS11300	300	290	25	
	VGS11325	325	315	25	
	VGS11350	350	340	25	
	VGS11375	375	365	25	
	VGS11400	400	390	25	
	VGS11425	425	415	25	
	VGS11450	450	440	25	
	VGS11475	475	465	25	
	VGS11500	500	490	25	
	VGS11525	525	515	25	
	VGS11550	550	540	25	
	VGS11575	575	565	25	
	VGS11600	600	590	25	
11 SW 17 TX 50	VGS11650	650	630	25	
	VGS11700	700	680	25	
	VGS11750	750	730	25	
	VGS11800	800	780	25	
	VGS11850	850	830	25	
	VGS11900	900	880	25	
	VGS11950	950	930	25	
	VGS111000	1000	980	25	

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
13 TX 50	VGS1380	80	70	25	
	VGS13100	100	90	25	
	VGS13150	150	140	25	
	VGS13200	200	190	25	
	VGS13250	250	240	25	
	VGS13300	300	280	25	
	VGS13350	350	330	25	
	VGS13400	400	380	25	
	VGS13450	450	430	25	
	VGS13500	500	480	25	
	VGS13550	550	530	25	
	VGS13600	600	580	25	
13 SW 19 TX 50	VGS13650	650	630	25	
	VGS13700	700	680	25	
	VGS13750	750	730	25	
	VGS13800	800	780	25	
	VGS13850	850	830	25	
	VGS13900	900	880	25	
	VGS13950	950	930	25	
	VGS131000	1000	980	25	
	VGS131100	1100	1080	25	
	VGS131200	1200	1180	25	
	VGS131300	1300	1280	25	
	VGS131400	1400	1380	25	
	VGS131500	1500	1480	25	

RELATED PRODUCTS



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VGU
45° WASHER FOR VGS



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TORQUE LIMITER



WASP
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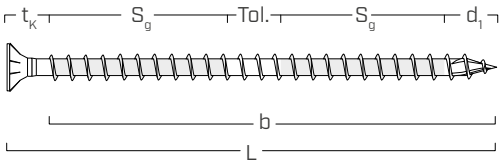
EFFECTIVE THREAD USED IN CALCULATION



b = $\mathbf{S_{g,tot}}$ = L - t_K

represents the entire length of the threaded part (see table above)

$\mathbf{S_g}$ = (b - d_1 - Tol.)/2

represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

t_K = 10 mm or 20mm depending on head type and diameter

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report.

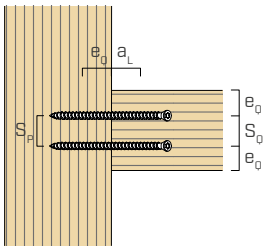
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

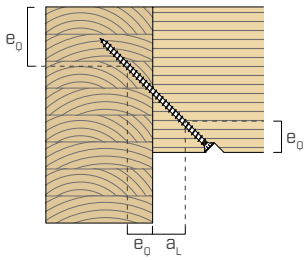
d_1		**9** [mm]	***0.36*** *[in]*	**11** [mm]	***0.44*** *[in]*	**13** [mm]	***0.52*** *[in]*
S_P	**7·d†**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
S_Q	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
a_L	**10·d†**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_Q	**4·d**	36	*1 7/16*	44	*1 3/4*	52	*2 1/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.

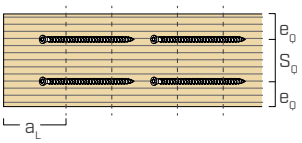
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



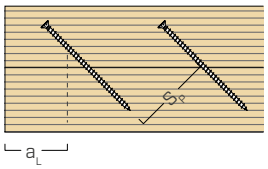
plan



front

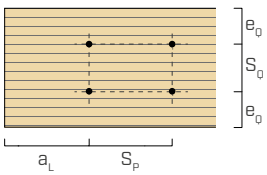


plan

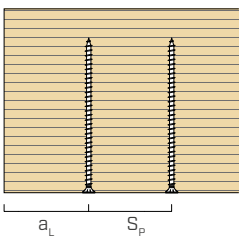


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

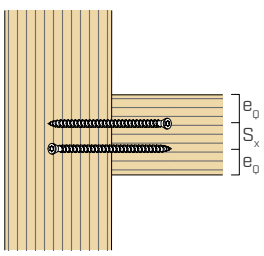


plan

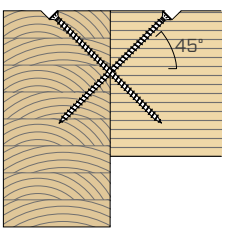


front

CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



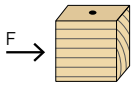
plan



front

MINIMUM DISTANCES FOR SHEAR LOADS

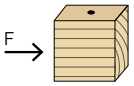
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**12·d‡**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
S_Q	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
a_L	**15·d‡**	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
a	**10·d‡**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_Q	**10·d**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_P	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
S_x	**2·d**	18	*11/16*	22	*7/8*	26	*1 1/32*

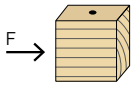
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



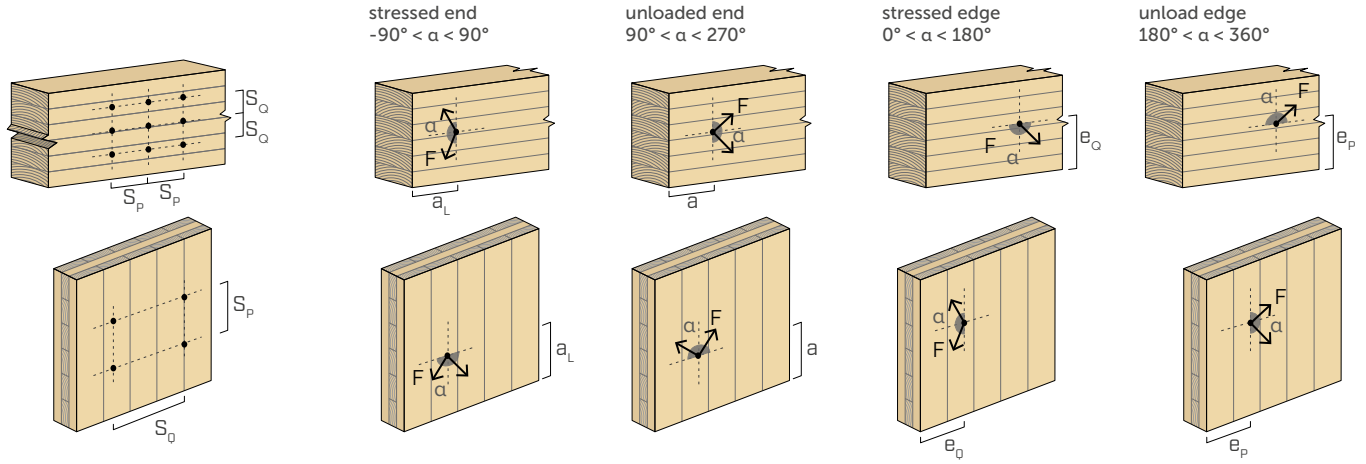
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**18·d**	162	*6 3/8*	198	*7 13/16*	234	*9 1/4*
S_Q	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
a_L	**22·d**	198	*7 13/16*	242	*9 1/2*	286	*11 1/4*
a	**15·d**	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
e_Q	**12·d**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
e_P	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
S_x	**3·d**	27	*1 1/16*	33	*1 5/16*	39	*1 9/16*

screws inserted **WITH pre-drilled hole**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	**5·d†**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
S_Q	**4·d**	36	*1 7/16*	44	*1 3/4*	52	*2 1/16*
a_L	**12·d†**	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
a	**7·d†**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_Q	**7·d**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_P	**3·d**	27	*1 1/16*	33	*1 5/16*	39	*1 9/16*
S_x	**1,5·d**	13,5	*9/16*	16,5	*5/8*	19,5	*3/4*

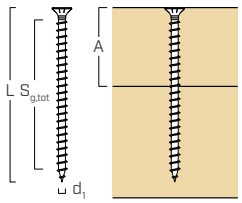
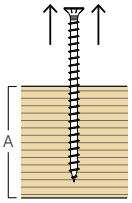
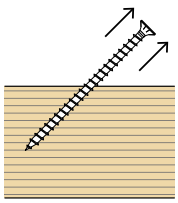
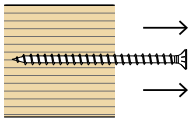
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



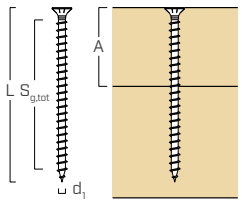
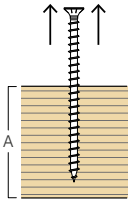
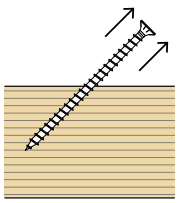
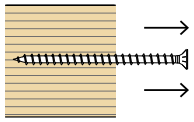
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA-O86:2024.

TENSION/COMPRESSION[1]

geometry				total thread withdrawal											
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
				G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	100	*4*	81	110	4,45	5,15	5,83	6,40	4,05	4,69	5,30	5,81	2,23	2,58	2,91	3,20
	120	*4 3/4*	101	130	5,55	6,43	7,27	7,97	5,05	5,84	6,61	7,25	2,78	3,21	3,63	3,99
	140	*5 1/2*	121	150	6,65	7,70	8,71	9,55	6,05	7,00	7,92	8,69	3,33	3,85	4,35	4,78
	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	180	*7 1/8*	161	190	8,85	10,24	11,59	12,71	8,05	9,31	10,53	11,56	4,43	5,12	5,79	6,36
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	220	*8 5/8*	201	230	11,05	12,79	14,46	15,87	10,05	11,63	13,15	14,43	5,53	6,39	7,23	7,94
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	260	*10 1/4*	241	270	13,25	15,33	17,34	19,03	12,05	13,94	15,77	17,30	6,63	7,67	8,67	9,51
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
9	300	*11 3/4*	281	310	15,45	17,88	20,22	22,19	14,05	16,25	18,38	20,17	7,73	8,94	10,11	11,09
0.36	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	340	*13 3/8*	321	350	17,65	20,43	23,10	25,35	16,05	18,57	21,00	23,04	8,83	10,21	11,55	12,67
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
	380	*15*	361	390	19,85	22,97	25,98	28,50	18,05	20,88	23,62	25,91	9,93	11,49	12,99	14,25
	400	*15 3/4*	381	410	20,95	24,24	27,42	30,08	19,05	22,04	24,92	27,35	10,48	12,12	13,71	15,04
	440	*17 1/4*	421	450	23,15	26,79	30,30	33,24	21,05	24,35	27,54	30,22	11,58	13,39	15,15	16,62
	480	*19*	461	490	25,35	29,33	33,17	36,40	23,05	26,67	30,16	33,09	12,68	14,67	16,59	18,20
	520	*20 1/2*	501	530	27,55	31,88	36,05	39,56	25,05	28,98	32,77	35,96	13,78	15,94	18,03	19,78
	560	*22*	541	570	29,75	34,42	38,93	42,72	27,05	31,29	35,39	38,83	14,88	17,21	19,47	21,36
	600	*23 5/8*	581	610	31,95	36,97	41,81	45,88	29,05	33,61	38,01	41,71	15,98	18,48	20,90	22,94
	80	*3 1/8*	59	90	3,97	4,59	5,19	5,70	3,61	4,17	4,72	5,18	1,98	2,29	2,60	2,85
	100	*4*	79	110	5,31	6,14	6,95	7,63	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81
	125	*4 15/16*	104	135	6,99	8,09	9,15	10,04	6,35	7,35	8,32	9,13	3,50	4,04	4,58	5,02
	150	*6*	129	160	8,67	10,03	11,35	12,45	7,88	9,12	10,32	11,32	4,34	5,02	5,68	6,23
	175	*6 7/8*	154	185	10,35	11,98	13,55	14,87	9,41	10,89	12,32	13,51	5,18	5,99	6,78	7,43
	200	*8*	179	210	12,03	13,92	15,75	17,28	10,94	12,66	14,32	15,71	6,02	6,96	7,88	8,64
	225	*8 7/8*	204	235	13,71	15,87	17,95	19,69	12,47	14,42	16,32	17,90	6,86	7,93	8,97	9,85
	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	275	*10 7/8*	254	285	17,07	19,75	22,35	24,52	15,52	17,96	20,32	22,29	8,54	9,88	11,17	12,26
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
11	325	*12 3/4*	304	335	20,43	23,64	26,75	29,35	18,58	21,49	24,32	26,68	10,22	11,82	13,37	14,67
0.44	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	375	*14 3/4*	354	385	23,79	27,53	31,15	34,17	21,63	25,03	28,32	31,07	11,90	13,77	15,57	17,09
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	425	*16 3/4*	404	435	27,15	31,42	35,55	39,00	24,69	28,56	32,32	35,45	13,58	15,71	17,77	19,50
	450	*17 3/4*	429	460	28,83	33,36	37,75	41,41	26,21	30,33	34,32	37,65	14,42	16,68	18,87	20,71
	475	*18 11/16*	454	485	30,52	35,31	39,95	43,82	27,74	32,10	36,32	39,84	15,26	17,65	19,97	21,91
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	525	*20 11/16*	504	535	33,88	39,20	44,35	48,65	30,80	35,63	40,32	44,23	16,94	19,60	22,17	24,33
	550	*21 5/8*	529	560	35,56	41,14	46,55	51,06	32,32	37,40	42,32	46,42	17,78	20,57	23,27	25,53

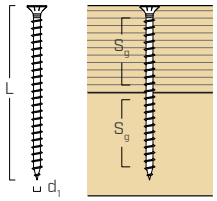
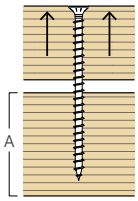
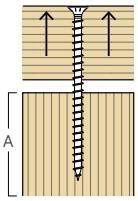
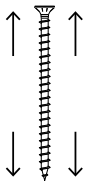
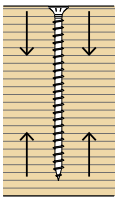
TENSION/COMPRESSION[1]

geometry				total thread withdrawal											
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	554	585	37,24	43,08	48,75	53,48	33,85	39,17	44,31	48,62	18,62	21,54	24,37	26,74
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95
	650	*25 9/16*	619	660	41,61	48,14	54,47	59,75	37,82	43,76	49,51	54,32	20,80	24,07	27,23	29,88
	700	*27 1/2*	669	710	44,97	52,03	58,87	64,58	40,88	47,30	53,51	58,71	22,48	26,01	29,43	32,29
	750	*29 1/2*	719	760	48,33	55,92	63,26	69,41	43,93	50,83	57,51	63,10	24,16	27,96	31,63	34,70
	800	*31 1/2*	769	810	51,69	59,81	67,66	74,23	46,99	54,37	61,51	67,48	25,84	29,90	33,83	37,12
	850	*33 7/16*	819	860	55,05	63,69	72,06	79,06	50,04	57,90	65,51	71,87	27,52	31,85	36,03	39,53
	900	*35 1/2*	869	910	58,41	67,58	76,46	83,88	53,10	61,44	69,51	76,26	29,20	33,79	38,23	41,94
	950	*37 3/8*	919	960	61,77	71,47	80,86	88,71	56,15	64,97	73,51	80,65	30,88	35,74	40,43	44,36
	1000	*39 3/8*	969	1010	65,13	75,36	85,26	93,54	59,21	68,51	77,51	85,03	32,57	37,68	42,63	46,77
13 *0.52*	80	*3 1/8*	57	90	4,53	5,25	5,93	6,50	4,12	4,77	5,39	5,91	2,26	2,62	2,96	3,25
	100	*4*	77	110	6,12	7,09	8,00	8,78	5,56	6,44	7,28	7,98	3,06	3,54	4,00	4,39
	150	*6*	127	160	10,09	11,69	13,20	14,48	9,17	10,63	12,00	13,17	5,05	5,85	6,60	7,24
	200	*8*	177	210	14,06	16,29	18,40	20,18	12,78	14,81	16,73	18,35	7,03	8,15	9,20	10,09
	250	*10*	227	260	18,04	20,90	23,60	25,88	16,40	19,00	21,45	23,53	9,02	10,45	11,80	12,94
	300	*11 3/4*	267	310	21,21	24,58	27,75	30,45	19,28	22,34	25,23	27,68	10,61	12,29	13,88	15,22
	350	*13 3/4*	317	360	25,19	29,18	32,95	36,15	22,90	26,53	29,96	32,86	12,59	14,59	16,48	18,07
	400	*15 3/4*	367	410	29,16	33,78	38,15	41,85	26,51	30,71	34,68	38,04	14,58	16,89	19,07	20,92
	450	*17 3/4*	417	460	33,13	38,38	43,35	47,55	30,12	34,90	39,41	43,23	16,57	19,19	21,67	23,78
	500	*19 3/4*	467	510	37,10	42,99	48,54	53,25	33,73	39,08	44,13	48,41	18,55	21,49	24,27	26,63
	550	*21 5/8*	517	560	41,08	47,59	53,74	58,95	37,34	43,26	48,86	53,59	20,54	23,79	26,87	29,48
	600	*23 5/8*	567	610	45,05	52,19	58,94	64,66	40,95	47,45	53,58	58,78	22,52	26,10	29,47	32,33
	650	*25 9/16*	617	660	49,02	56,79	64,14	70,36	44,56	51,63	58,31	63,96	24,51	28,40	32,07	35,18
	700	*27 1/2*	667	710	52,99	61,40	69,33	76,06	48,18	55,82	63,03	69,14	26,50	30,70	34,67	38,03
	750	*29 1/2*	717	760	56,97	66,00	74,53	81,76	51,79	60,00	67,76	74,33	28,48	33,00	37,27	40,88
	800	*31 1/2*	767	810	60,94	70,60	79,73	87,46	55,40	64,18	72,48	79,51	30,47	35,30	39,86	43,73
	850	*33 7/16*	817	860	64,91	75,20	84,93	93,16	59,01	68,37	77,21	84,69	32,46	37,60	42,46	46,58
	900	*35 1/2*	867	910	68,88	79,81	90,12	98,86	62,62	72,55	81,93	89,88	34,44	39,90	45,06	49,43
	950	*37 3/8*	917	960	72,86	84,41	95,32	104,57	66,23	76,74	86,66	95,06	36,43	42,20	47,66	52,28
	1000	*39 3/8*	967	1010	76,83	89,01	100,52	110,27	69,84	80,92	91,38	100,24	38,41	44,51	50,26	55,13
	1100	*43 5/16*	1067	1110	84,77	98,22	110,91	121,67	77,07	89,29	100,83	110,61	42,39	49,11	55,46	60,84
	1200	*47 1/4*	1167	1210	92,72	107,42	121,31	133,07	84,29	97,66	110,28	120,98	46,36	53,71	60,65	66,54
	1300	*51 3/16*	1267	1310	100,66	116,63	131,70	144,48	91,51	106,02	119,73	131,34	50,33	58,31	65,85	72,24
	1400	*55 1/8*	1367	1410	108,61	125,83	142,10	155,88	98,73	114,39	129,18	141,71	54,30	62,92	71,05	77,94
	1500	*59 1/16*	1467	1510	116,55	135,04	152,49	167,28	105,96	122,76	138,63	152,07	58,28	67,52	76,25	83,64

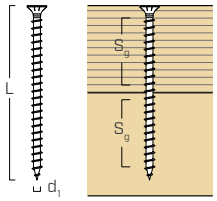
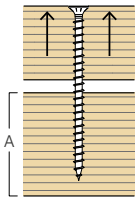
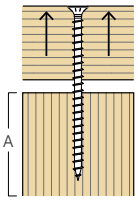
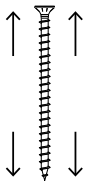
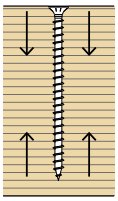
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 180.

TENSION/COMPRESSION[1]

geometry				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G			G					
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	100	*4*	35,0	55	1,92	2,23	2,52	2,76	0,96	1,11	1,26	1,38	17,84	16,37
	120	*4 3/4*	45,0	65	2,47	2,86	3,24	3,55	1,24	1,43	1,62	1,78		
	140	*5 1/2*	55,0	75	3,02	3,50	3,96	4,34	1,51	1,75	1,98	2,17		
	160	*6 1/4*	65,0	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57		
	180	*7 1/8*	75,0	95	4,12	4,77	5,40	5,92	2,06	2,39	2,70	2,96		
	200	*8*	85,0	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	220	*8 5/8*	95,0	115	5,22	6,04	6,84	7,50	2,61	3,02	3,42	3,75		
	240	*9 1/2*	105,0	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	260	*10 1/4*	115,0	135	6,32	7,32	8,28	9,08	3,16	3,66	4,14	4,54		
	280	*11*	125,0	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	300	*11 3/4*	135,0	155	7,42	8,59	9,71	10,66	3,71	4,30	4,86	5,33		
	320	*12 5/8*	145,0	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	340	*13 3/8*	155,0	175	8,52	9,86	11,15	12,24	4,26	4,93	5,58	6,12		
	360	*14 1/4*	165,0	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
	380	*15*	175,0	195	9,62	11,14	12,59	13,82	4,81	5,57	6,30	6,91		
	400	*15 3/4*	185,0	205	10,17	11,77	13,31	14,61	5,09	5,89	6,66	7,30		
	440	*17 1/4*	205,0	225	11,27	13,04	14,75	16,19	5,64	6,52	7,38	8,09		
	480	*19*	225,0	245	12,37	14,32	16,19	17,77	6,19	7,16	8,10	8,88		
	520	*20 1/2*	245,0	265	13,47	15,59	17,63	19,35	6,74	7,79	8,82	9,67		
	560	*22*	265,0	285	14,57	16,86	19,07	20,92	7,29	8,43	9,53	10,46		
	600	*23 5/8*	285,0	305	15,67	18,13	20,51	22,50	7,84	9,07	10,25	11,25		
11 *0.44*	80	*3 1/8*	25,0	45	1,68	1,94	2,20	2,41	0,84	0,97	1,10	1,21	23,17	19,66
	100	*4*	35,0	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69		
	125	*4 15/16*	45,0	68	3,02	3,50	3,96	4,34	1,51	1,75	1,98	2,17		
	150	*6*	60,0	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	175	*6 7/8*	70,0	93	4,70	5,44	6,16	6,76	2,35	2,72	3,08	3,38		
	200	*8*	85,0	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	225	*8 7/8*	95,0	118	6,39	7,39	8,36	9,17	3,19	3,69	4,18	4,59		
	250	*10*	110,0	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	275	*10 7/8*	120,0	143	8,07	9,33	10,56	11,58	4,03	4,67	5,28	5,79		
	300	*11 3/4*	135,0	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	325	*12 3/4*	145,0	168	9,75	11,28	12,76	14,00	4,87	5,64	6,38	7,00		
	350	*13 3/4*	160,0	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	375	*14 3/4*	170,0	193	11,43	13,22	14,96	16,41	5,71	6,61	7,48	8,21		
	400	*15 3/4*	185,0	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	425	*16 3/4*	195,0	218	13,11	15,17	17,16	18,82	6,55	7,58	8,58	9,41		
	450	*17 3/4*	210,0	230	14,11	16,33	18,48	20,27	7,06	8,17	9,24	10,14		
	475	*18 11/16*	220,0	243	14,79	17,11	19,36	21,24	7,39	8,55	9,68	10,62		
	500	*19 3/4*	235,0	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	525	*20 11/16*	245,0	268	16,47	19,05	21,56	23,65	8,23	9,53	10,78	11,82		
	550	*21 5/8*	260,0	280	17,48	20,22	22,88	25,10	8,74	10,11	11,44	12,55		

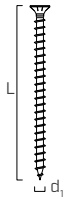
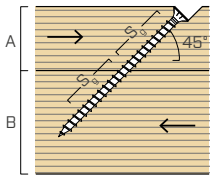
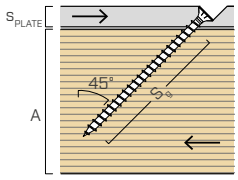
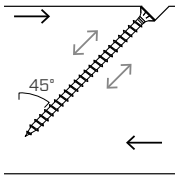
TENSION/COMPRESSION[1]

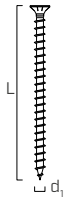
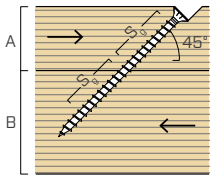
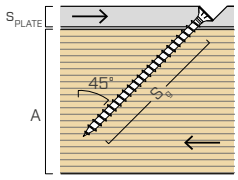
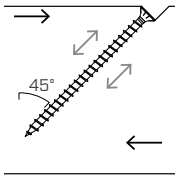
geometry				partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G				G				
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	270,0	293	18,15	21,00	23,76	26,06	9,07	10,50	11,88	13,03	23,17	19,66
	600	*23 5/8*	285,0	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		
	650	*25 9/16*	305,0	330	20,50	23,72	26,84	29,44	10,25	11,86	13,42	14,72		
	700	*27 1/2*	330,0	355	22,18	25,66	29,04	31,85	11,09	12,83	14,52	15,93		
	750	*29 1/2*	355,0	380	23,86	27,61	31,24	34,27	11,93	13,80	15,62	17,13		
	800	*31 1/2*	380,0	405	25,54	29,55	33,44	36,68	12,77	14,78	16,72	18,34		
	850	*33 7/16*	405,0	430	27,22	31,50	35,64	39,09	13,61	15,75	17,82	19,55		
	900	*35 1/2*	430,0	455	28,90	33,44	37,84	41,51	14,45	16,72	18,92	20,75		
	950	*37 3/8*	455,0	480	30,58	35,39	40,04	43,92	15,29	17,69	20,02	21,96		
	1000	*39 3/8*	480,0	505	32,26	37,33	42,24	46,33	16,13	18,66	21,12	23,17		
13 *0.52*	80	*3 1/8*	25,0	45	1,99	2,30	2,60	2,85	0,99	1,15	1,30	1,43	31,96	27,02
	100	*4*	35,0	55	2,78	3,22	3,64	3,99	1,39	1,61	1,82	2,00		
	150	*6*	60,0	80	4,77	5,52	6,24	6,84	2,38	2,76	3,12	3,42		
	200	*8*	85,0	105	6,75	7,82	8,84	9,69	3,38	3,91	4,42	4,85		
	250	*10*	110,0	130	8,74	10,13	11,43	12,54	4,37	5,06	5,72	6,27		
	300	*11 3/4*	130,0	155	10,33	11,97	13,51	14,82	5,16	5,98	6,76	7,41		
	350	*13 3/4*	155,0	180	12,31	14,27	16,11	17,67	6,16	7,13	8,06	8,84		
	400	*15 3/4*	180,0	205	14,30	16,57	18,71	20,53	7,15	8,28	9,36	10,26		
	450	*17 3/4*	205,0	230	16,29	18,87	21,31	23,38	8,14	9,44	10,65	11,69		
	500	*19 3/4*	230,0	255	18,27	21,17	23,91	26,23	9,14	10,59	11,95	13,11		
	550	*21 5/8*	255,0	280	20,26	23,47	26,51	29,08	10,13	11,74	13,25	14,54		
	600	*23 5/8*	280,0	305	22,25	25,77	29,11	31,93	11,12	12,89	14,55	15,96		
	650	*25 9/16*	305,0	330	24,23	28,08	31,70	34,78	12,12	14,04	15,85	17,39		
	700	*27 1/2*	330,0	355	26,22	30,38	34,30	37,63	13,11	15,19	17,15	18,81		
	750	*29 1/2*	355,0	380	28,20	32,68	36,90	40,48	14,10	16,34	18,45	20,24		
	800	*31 1/2*	380,0	405	30,19	34,98	39,50	43,33	15,10	17,49	19,75	21,67		
	850	*33 7/16*	405,0	430	32,18	37,28	42,10	46,18	16,09	18,64	21,05	23,09		
	900	*35 1/2*	430,0	455	34,16	39,58	44,70	49,03	17,08	19,79	22,35	24,52		
	950	*37 3/8*	455,0	480	36,15	41,88	47,30	51,88	18,07	20,94	23,65	25,94		
	1000	*39 3/8*	480,0	505	38,14	44,18	49,90	54,73	19,07	22,09	24,95	27,37		
	1100	*43 5/16*	530,0	555	42,11	48,79	55,09	60,44	21,05	24,39	27,55	30,22		
	1200	*47 1/4*	580,0	605	46,08	53,39	60,29	66,14	23,04	26,69	30,15	33,07		
	1300	*51 3/16*	630,0	655	50,05	57,99	65,49	71,84	25,03	29,00	32,74	35,92		
	1400	*55 1/8*	680,0	705	54,03	62,59	70,69	77,54	27,01	31,30	35,34	38,77		
	1500	*59 1/16*	730,0	755	58,00	67,20	75,88	83,24	29,00	33,60	37,94	41,62		

α = screw-to-grain angle

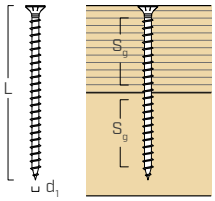
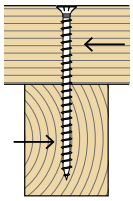
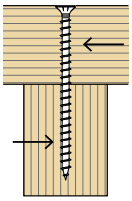
NOTES and GENERAL PRINCIPLES on page 180.

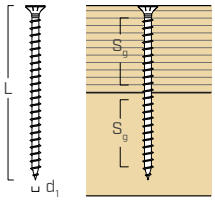
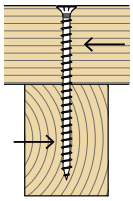
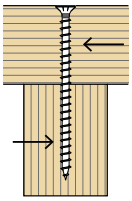
SLIDING[3]

geometry			timber-to-timber							steel-to-timber							steel tension
																	
						factored lateral resistance N_r[4]							factored lateral resistance N_r[4]				factored tension resistance T_{rs}
						G							G				
d_1	L		S_g	A	B_{min}	0.35	0.42	0.49	0.55	S_{PLATE}[5]	S_g	A_{min}	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
	100	*4*	35	40	55	1,48	1,72	1,94	2,13		70	70	2,97	3,44	3,89	4,26	
	120	*4 3/4*	45	45	60	1,91	2,21	2,50	2,74		90	85	3,82	4,42	5,00	5,48	
	140	*5 1/2*	55	55	70	2,33	2,70	3,05	3,35		110	100	4,67	5,40	6,11	6,70	
	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96		130	115	5,51	6,38	7,22	7,92	
	180	*7 1/8*	75	70	85	3,18	3,68	4,16	4,57		150	125	6,36	7,36	8,33	9,14	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18		170	140	7,21	8,34	9,44	10,35	
	220	*8 5/8*	95	80	95	4,03	4,66	5,27	5,79		190	155	8,06	9,33	10,55	11,57	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40		210	170	8,91	10,31	11,66	12,79	
	260	*10 1/4*	115	95	110	4,88	5,64	6,38	7,00		230	185	9,76	11,29	12,77	14,01	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61		250	200	10,61	12,27	13,88	15,23	
9	300	*11 3/4*	135	110	125	5,73	6,63	7,49	8,22	15,9	270	210	11,45	13,25	14,99	16,45	12,61
0.36	320	*12 5/8*	145	115	130	6,15	7,12	8,05	8,83	*5/8*	290	225	12,30	14,23	16,10	17,66	
	340	*13 3/8*	155	125	140	6,58	7,61	8,60	9,44		310	240	13,15	15,22	17,21	18,88	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05		330	255	14,00	16,20	18,32	20,10	
	380	*15*	175	140	155	7,42	8,59	9,71	10,66		350	270	14,85	17,18	19,43	21,32	
	400	*15 3/4*	185	145	160	7,85	9,08	10,27	11,27		370	285	15,70	18,16	20,54	22,54	
	440	*17 1/4*	205	160	175	8,70	10,06	11,38	12,49		410	310	17,39	20,12	22,76	24,97	
	480	*19*	225	175	190	9,54	11,04	12,49	13,70		450	340	19,09	22,09	24,98	27,41	
	520	*20 1/2*	245	190	205	10,39	12,03	13,60	14,92		490	370	20,79	24,05	27,20	29,85	
	560	*22*	265	200	215	11,24	13,01	14,71	16,14		530	395	22,48	26,01	29,42	32,28	
	600	*23 5/8*	285	215	230	12,09	13,99	15,82	17,36		570	425	24,18	27,98	31,64	34,72	
	80	*3 1/8*	25	35	50	1,30	1,50	1,70	1,86		40	50	2,07	2,40	2,71	2,98	
	100	*4*	35	40	55	1,81	2,10	2,38	2,61		60	65	3,11	3,60	4,07	4,47	
	125	*4 15/16*	45	50	65	2,33	2,70	3,05	3,35		85	85	4,41	5,10	5,77	6,33	
	150	*6*	60	60	75	3,11	3,60	4,07	4,47		110	100	5,70	6,60	7,47	8,19	
	175	*6 7/8*	70	65	80	3,63	4,20	4,75	5,21		135	120	7,00	8,10	9,16	10,05	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33		160	135	8,30	9,60	10,86	11,91	
	225	*8 7/8*	95	85	100	4,93	5,70	6,45	7,07		185	155	9,59	11,10	12,56	13,78	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19		210	170	10,89	12,60	14,25	15,64	
	275	*10 7/8*	120	100	115	6,22	7,20	8,14	8,94		235	190	12,18	14,10	15,95	17,50	
11	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	19,1	260	205	13,48	15,60	17,65	19,36	16,38
0.44	325	*12 3/4*	145	120	135	7,52	8,70	9,84	10,80	*3/4*	285	225	14,78	17,10	19,34	21,22	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91		310	240	16,07	18,60	21,04	23,08	
	375	*14 3/4*	170	135	150	8,81	10,20	11,54	12,66		335	260	17,37	20,10	22,74	24,94	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78		360	275	18,67	21,60	24,43	26,81	
	425	*16 3/4*	195	155	170	10,11	11,70	13,24	14,52		385	295	19,96	23,10	26,13	28,67	
	450	*17 3/4*	210	165	180	10,89	12,60	14,25	15,64		410	315	21,26	24,60	27,83	30,53	
	475	*18 11/16*	220	170	185	11,41	13,20	14,93	16,38		435	330	22,55	26,10	29,53	32,39	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50		460	350	23,85	27,60	31,22	34,25	
	525	*20 11/16*	245	190	205	12,70	14,70	16,63	18,24		485	365	25,15	29,10	32,92	36,11	
	550	*21 5/8*	260	200	215	13,48	15,60	17,65	19,36		510	385	26,44	30,60	34,62	37,98	

geometry			SLIDING[3] timber-to-timber								steel-to-timber								steel tension
																			
						factored lateral resistance N_r[4]							factored lateral resistance N_r[4]						factored tension resistance T_{rs}
d_1	L		S_g	A	B_{min}	G 0.35	G 0.42	G 0.49	G 0.55	S_{PLATE}[5]	S_g	A_{min}	G 0.35	G 0.42	G 0.49	G 0.55			
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]			[kN]
11 *0.44*	575	*22 5/8*	270	205	220	14,00	16,20	18,33	20,10	19,1 *3/4*	535	400	27,74	32,10	36,31	39,84			16,38
	600	*23 5/8*	285	220	235	14,78	17,10	19,34	21,22		560	420	29,03	33,59	38,01	41,70			
	650	*25 9/16*	305	230	245	15,81	18,30	20,70	22,71		-	-	-	-	-	-			
	700	*27 1/2*	330	250	265	17,11	19,80	22,40	24,57		-	-	-	-	-	-			
	750	*29 1/2*	355	265	280	18,41	21,30	24,10	26,43		-	-	-	-	-	-			
	800	*31 1/2*	380	285	300	19,70	22,80	25,79	28,30		-	-	-	-	-	-			
	850	*33 7/16*	405	305	320	21,00	24,30	27,49	30,16		-	-	-	-	-	-			
	900	*35 1/2*	430	320	335	22,29	25,80	29,19	32,02		-	-	-	-	-	-			
	950	*37 3/8*	455	340	355	23,59	27,30	30,88	33,88		-	-	-	-	-	-			
	1000	*39 3/8*	480	355	370	24,89	28,80	32,58	35,74		-	-	-	-	-	-			
13 *0.52*	80	*3 1/8*	25	35	50	1,53	1,78	2,00	2,20	22,2 *7/8*	35	50	2,15	2,49	2,81	3,08			22,60
	100	*4*	35	40	55	2,15	2,49	2,81	3,08		55	65	3,37	3,91	4,41	4,84			
	150	*6*	60	60	75	3,68	4,26	4,81	5,28		105	100	6,44	7,46	8,42	9,24			
	200	*8*	85	80	95	5,21	6,04	6,82	7,48		155	135	9,50	11,01	12,43	13,63			
	250	*10*	110	95	110	6,74	7,81	8,82	9,68		205	170	12,56	14,56	16,44	18,03			
	300	*11 3/4*	130	110	125	7,97	9,23	10,42	11,43		255	205	15,63	18,11	20,45	22,43			
	350	*13 3/4*	155	125	140	9,50	11,01	12,43	13,63		305	240	18,69	21,66	24,46	26,83			
	400	*15 3/4*	180	145	160	11,03	12,78	14,43	15,83		355	275	21,76	25,21	28,47	31,23			
	450	*17 3/4*	205	165	180	12,56	14,56	16,44	18,03		405	310	24,82	28,76	32,48	35,62			
	500	*19 3/4*	230	180	195	14,10	16,33	18,44	20,23		455	345	27,89	32,31	36,48	40,02			
	550	*21 5/8*	255	200	215	15,63	18,11	20,45	22,43		505	380	30,95	35,86	40,49	44,42			
	600	*23 5/8*	280	215	230	17,16	19,88	22,45	24,63		555	415	34,01	39,41	44,50	48,82			
	650	*25 9/16*	305	235	250	18,69	21,66	24,46	26,83		-	-	-	-	-	-			
	700	*27 1/2*	330	250	265	20,22	23,43	26,46	29,03		-	-	-	-	-	-			
	750	*29 1/2*	355	270	285	21,76	25,21	28,47	31,23		-	-	-	-	-	-			
	800	*31 1/2*	380	285	300	23,29	26,98	30,47	33,43		-	-	-	-	-	-			
	850	*33 7/16*	405	305	320	24,82	28,76	32,48	35,62		-	-	-	-	-	-			
	900	*35 1/2*	430	320	335	26,35	30,53	34,48	37,82		-	-	-	-	-	-			
	950	*37 3/8*	455	340	355	27,89	32,31	36,48	40,02		-	-	-	-	-	-			
	1000	*39 3/8*	480	355	370	29,42	34,08	38,49	42,22		-	-	-	-	-	-			
	1100	*43 5/16*	530	390	405	32,48	37,63	42,50	46,62		-	-	-	-	-	-			
	1200	*47 1/4*	580	430	445	35,55	41,18	46,51	51,02		-	-	-	-	-	-			
	1300	*51 3/16*	630	465	480	38,61	44,73	50,52	55,42		-	-	-	-	-	-			
	1400	*55 1/8*	680	500	515	41,68	48,28	54,53	59,81		-	-	-	-	-	-			
	1500	*59 1/16*	730	535	550	44,74	51,83	58,54	64,21		-	-	-	-	-	-			

NOTES and GENERAL PRINCIPLES on page 180.

geometry				SHEAR[6] timber-to-timber							
				α = 90°				α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1	L		S_g	A[7]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	100	*4*	35	50	1,78	2,12	2,45	2,74	1,16	1,38	1,56	1,69
	120	*4 3/4*	45	60	2,18	2,59	3,00	3,34	1,37	1,55	1,73	1,87
	140	*5 1/2*	55	70	2,58	3,01	3,30	3,53	1,49	1,69	1,89	2,05
	160	*6 1/4*	65	80	2,85	3,17	3,48	3,73	1,61	1,83	2,05	2,23
	180	*7 1/8*	75	90	2,98	3,33	3,66	3,93	1,73	1,98	2,21	2,41
	200	*8*	85	100	3,12	3,49	3,84	4,13	1,85	2,12	2,38	2,59
	220	*8 5/8*	95	110	3,26	3,65	4,02	4,32	1,97	2,26	2,54	2,77
	240	*9 1/2*	105	120	3,40	3,81	4,20	4,52	2,09	2,40	2,70	2,90
	260	*10 1/4*	115	130	3,53	3,97	4,38	4,72	2,21	2,54	2,79	3,00
	280	*11*	125	140	3,67	4,13	4,56	4,90	2,33	2,62	2,88	3,09
	300	*11 3/4*	135	150	3,81	4,28	4,62	4,90	2,41	2,70	2,97	3,19
	320	*12 5/8*	145	160	3,91	4,28	4,62	4,90	2,48	2,78	3,06	3,29
	340	*13 3/8*	155	170	3,91	4,28	4,62	4,90	2,55	2,86	3,15	3,39
	360	*14 1/4*	165	180	3,91	4,28	4,62	4,90	2,62	2,94	3,24	3,49
	380	*15*	175	190	3,91	4,28	4,62	4,90	2,69	3,02	3,33	3,59
	400	*15 3/4*	185	200	3,91	4,28	4,62	4,90	2,76	3,10	3,42	3,69
	440	*17 1/4*	205	220	3,91	4,28	4,62	4,90	2,89	3,24	3,49	3,70
	480	*19*	225	240	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	520	*20 1/2*	245	260	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	560	*22*	265	280	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
	600	*23 5/8*	285	300	3,91	4,28	4,62	4,90	2,95	3,24	3,49	3,70
11 *0.44*	80	*3 1/8*	25	40	1,60	1,91	2,21	2,47	1,04	1,24	1,44	1,61
	100	*4*	35	50	2,07	2,46	2,85	3,18	1,34	1,59	1,84	2,03
	125	*4 15/16*	45	63	2,66	3,15	3,65	4,07	1,68	1,91	2,12	2,30
	150	*6*	60	75	3,24	3,81	4,17	4,47	1,86	2,12	2,37	2,57
	175	*6 7/8*	70	88	3,63	4,05	4,45	4,77	2,04	2,33	2,61	2,84
	200	*8*	85	100	3,84	4,29	4,72	5,07	2,22	2,54	2,85	3,11
	225	*8 7/8*	95	113	4,05	4,54	5,00	5,37	2,40	2,75	3,09	3,38
	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	275	*10 7/8*	120	138	4,47	5,02	5,55	5,98	2,76	3,18	3,51	3,77
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	325	*12 3/4*	145	163	4,86	5,32	5,75	6,09	3,07	3,44	3,78	4,07
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	375	*14 3/4*	170	188	4,86	5,32	5,75	6,09	3,28	3,68	4,06	4,37
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	425	*16 3/4*	195	213	4,86	5,32	5,75	6,09	3,49	3,92	4,33	4,60
	450	*17 3/4*	210	225	4,86	5,32	5,75	6,09	3,59	4,02	4,35	4,60
	475	*18 11/16*	220	238	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	500	*19 3/4*	235	250	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	525	*20 11/16*	245	263	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	550	*21 5/8*	260	275	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60

geometry				SHEAR[6] timber-to-timber							
				α = 90°				α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1	L		S_g	A[7]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	575	*22 5/8*	270	288	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	600	*23 5/8*	285	300	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	650	*25 9/16*	300	325	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	700	*27 1/2*	325	350	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	750	*29 1/2*	350	375	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	800	*31 1/2*	375	400	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	850	*33 7/16*	400	425	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	900	*35 1/2*	425	450	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	950	*37 3/8*	450	475	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	1000	*39 3/8*	475	500	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
13 *0.52*	80	*3 1/8*	20	40	1,79	2,13	2,46	2,75	1,16	1,39	1,61	1,80
	100	*4*	30	50	2,32	2,76	3,19	3,56	1,50	1,78	2,07	2,31
	150	*6*	55	75	3,66	4,35	5,02	5,60	2,33	2,64	2,94	3,18
	200	*8*	80	100	4,95	5,53	6,06	6,50	2,75	3,13	3,50	3,80
	250	*10*	105	125	5,45	6,10	6,71	7,22	3,16	3,62	4,06	4,43
	300	*11 3/4*	125	150	5,81	6,52	7,18	7,73	3,58	4,11	4,62	5,03
	350	*13 3/4*	150	175	6,30	7,09	7,83	8,33	4,00	4,56	5,01	5,39
	400	*15 3/4*	175	200	6,65	7,28	7,87	8,33	4,32	4,85	5,34	5,74
	450	*17 3/4*	200	225	6,65	7,28	7,87	8,33	4,57	5,13	5,66	6,10
	500	*19 3/4*	225	250	6,65	7,28	7,87	8,33	4,82	5,42	5,95	6,30
	550	*21 5/8*	250	275	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	600	*23 5/8*	275	300	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	650	*25 9/16*	300	325	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	700	*27 1/2*	325	350	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	750	*29 1/2*	350	375	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	800	*31 1/2*	375	400	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	850	*33 7/16*	400	425	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	900	*35 1/2*	425	450	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	950	*37 3/8*	450	475	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1000	*39 3/8*	475	500	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1100	*43 5/16*	525	550	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1200	*47 1/4*	575	600	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1300	*51 3/16*	625	650	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1400	*55 1/8*	675	700	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	1500	*59 1/16*	725	750	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30

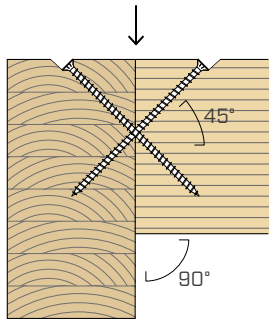
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 180.

STRUCTURAL VALUES | FURTHER APPLICATIONS

SHEAR CONNECTION WITH CROSSED CONNECTORS

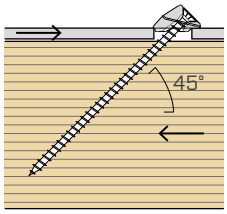
VGS Ø9 - 11 mm



STRUCTURAL VALUES in the Canadian VGZ datasheet.

SLIDING CONNECTION WITH VGU WASHER

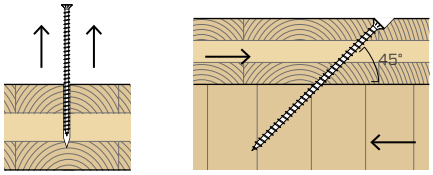
VGS Ø9 - 11 - 13 mm



STRUCTURAL VALUES in the Canadian VGU datasheet.

CONNECTIONS WITH CLT ELEMENTS

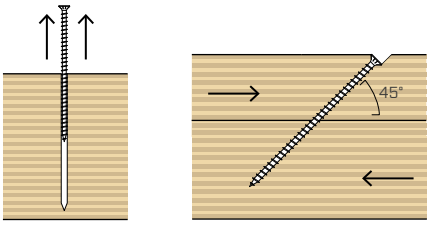
VGS Ø9 - 11 mm



STRUCTURAL VALUES in the Canadian VGZ datasheet.

CONNECTIONS WITH LVL ELEMENTS

VGS Ø9 - 11 mm



STRUCTURAL VALUES in the European VGZ datasheet.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA-O86 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- VGS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA-O86 2024 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA-O86 2024 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}.The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) For fully threaded screws, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile resistance.

(4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(5) The plate thickness (S_{PLATE}) are understood to be the minimum values to allow the countersunk head of the screw to be accommodated.

(6) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

INSTALLATION SUGGESTIONS

MANUALS

LONG SCREWS



Thanks to CATCH, even longer screws can be screwed on quickly and safely without the risk of the bit slipping. Can be combined with TORQUE LIMITER.

VGS + VGU

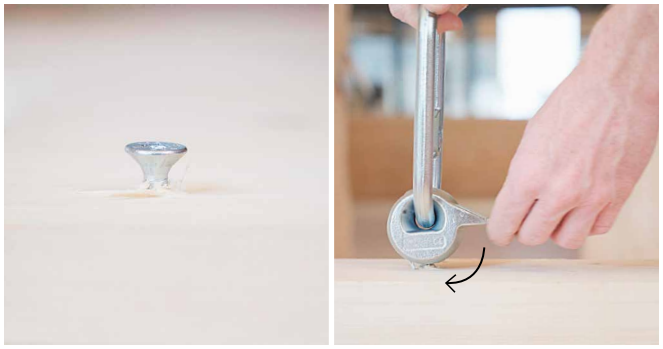


The JIG VGU template makes it easy to prepare a 45° angle pre-drill, thus facilitating subsequent tightening of the VGS screws inside the washer. A pre-drill length of at least 20 mm is recommended.



To ensure control of the applied torque, the correct TORQUE LIMITER model must be used depending on the chosen connector.

VGS +WASPL

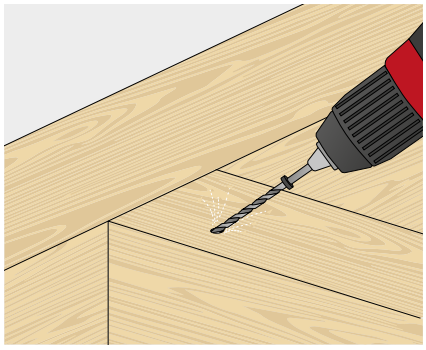


Insert the screw so that the head protrudes 15 mm and engage the WASPL hook.

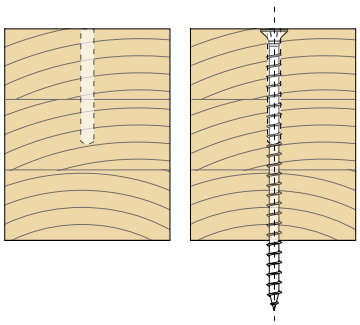


After lifting, the WASPL hook releases quickly and easily ready for use again.

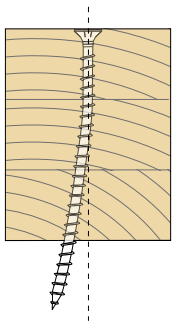
IMPORTANCE OF THE PILOT HOLE



pilot hole



insertion with pilot hole



insertion without pilot hole

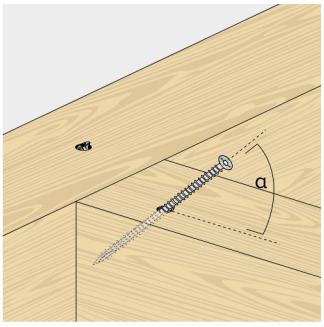
Deviation of the screw from the direction of screwing often occurs during installation.
This phenomenon is linked to the very conformation of the wood material, which is inhomogeneous and non-uniform, e.g. due to the localised presence of knots or physical properties dependent on grain direction. The operator's skill also plays an important role.

The use of pilot holes facilitates the insertion of screws, particularly long ones, allowing a very precise insertion direction.

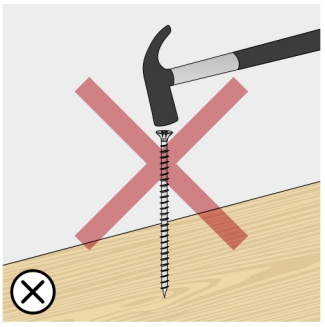
INSTALLATION INSTRUCTIONS



In the case of installation of screws used in timber-to-timber (softwood) structural connections, a pulse screw gun/screwdriver can also be used.

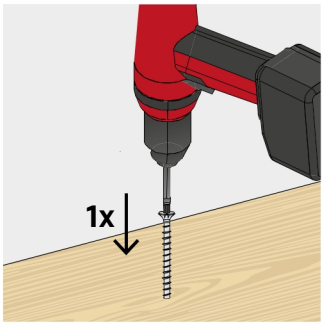


Respect the insertion angle with the help of a pilot hole and/or installation template.



Do not hammer the screw tips into the timber.

The screw cannot be reused.

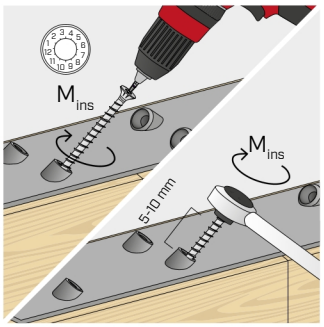


In general, it is recommended to install the connector in a single operation, without stopping and restarting which could create additional stress in the screw.

STEEL-TO-TIMBER APPLICATION

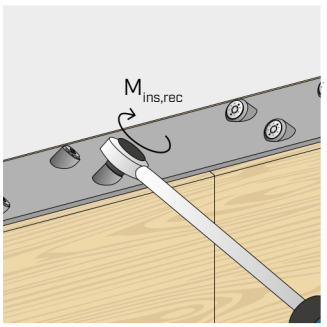


The use of pulse screw guns/impact wrenches is not permitted.

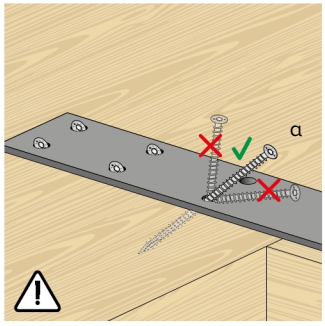


Ensure correct tightening. We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

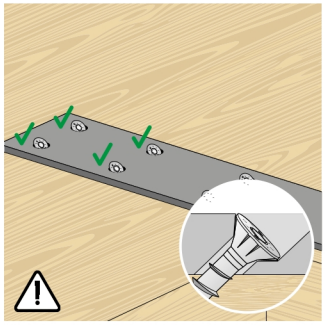
VGS	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø9	9	20
Ø11 L < 400 mm	11	30
Ø11 L ≥ 400 mm	11	40
Ø13	13	50



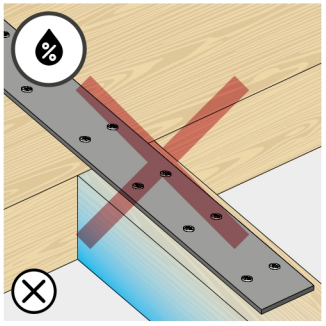
After installation, the fasteners can be inspected using a torque wrench.



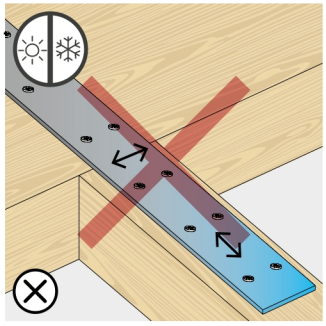
Avoid bending.



The installation of multiple screws must be performed to guarantee that loads are distributed evenly to all fasteners.

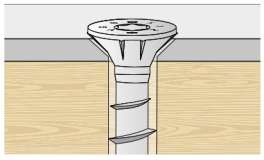


Shrinkage or swelling of timber elements due to changes in moisture content must be avoided.

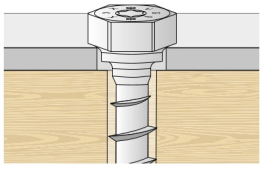


Avoid dimensional changes in the metal, e.g. due to large temperature fluctuations.

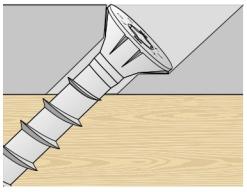
SHAPED PLATE



Countersunk hole.

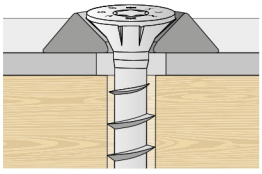


Cylindrical hole.

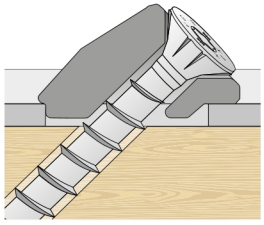


Inclined countersunk hole.

WASHERS

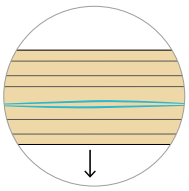


Cylindrical hole with countersunk washer HUS.

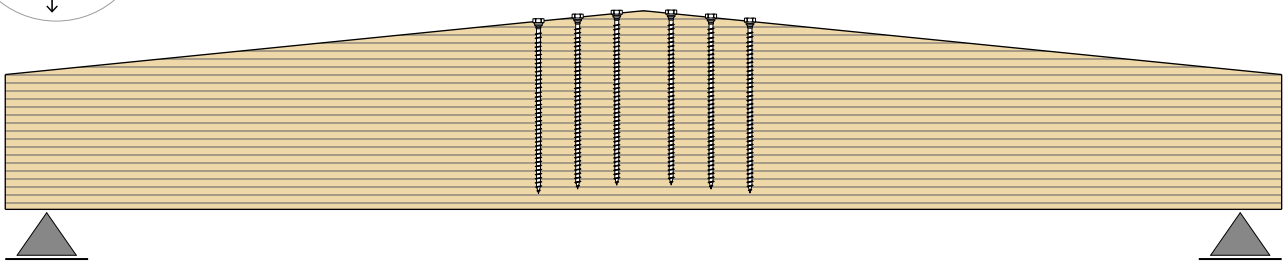


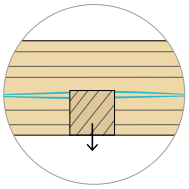
Slotted hole with VGU washer.

APPLICATION EXAMPLES: REINFORCEMENT

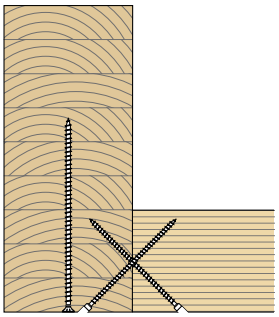


TAPERED BEAMS
apex tension reinforcement perpendicular to grain





HANGING LOAD
tension reinforcement perpendicular to grain



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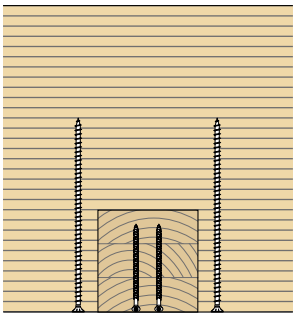

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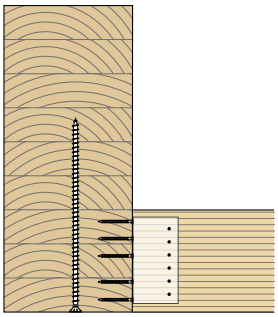

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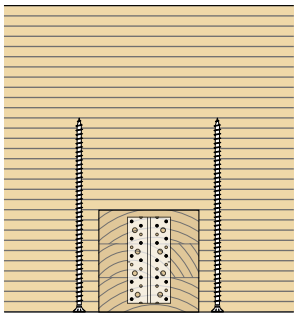
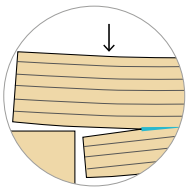
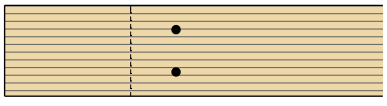


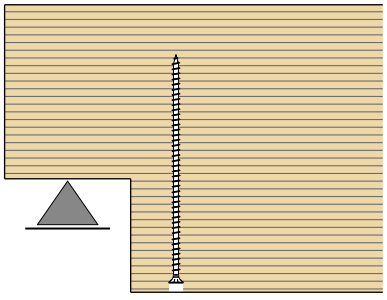
front



NOTCH
tension reinforcement
perpendicular to grain



plan



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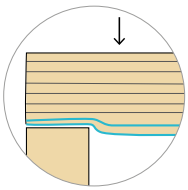
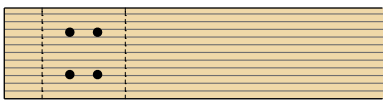
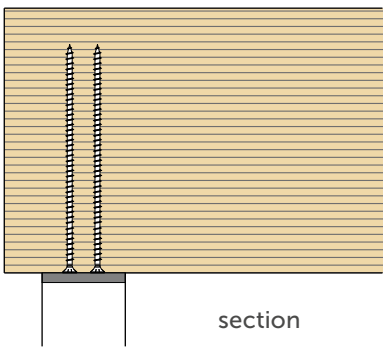


SUPPORT
compression reinforcement
perpendicular to grain



plan



section

VGS EVO

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

FULLY THREADED SCREW WITH COUNTERSUNK OR HEXAGONAL HEAD

C4 EVO COATING

Surface treatment of epoxy resin and aluminium flakes. No rust after 1440 hours of salt spray exposure test, as per ISO 9227. Can be used in wet service outdoor applications and under class C4 atmospheric corrosion conditions.

STRUCTURAL APPLICATIONS

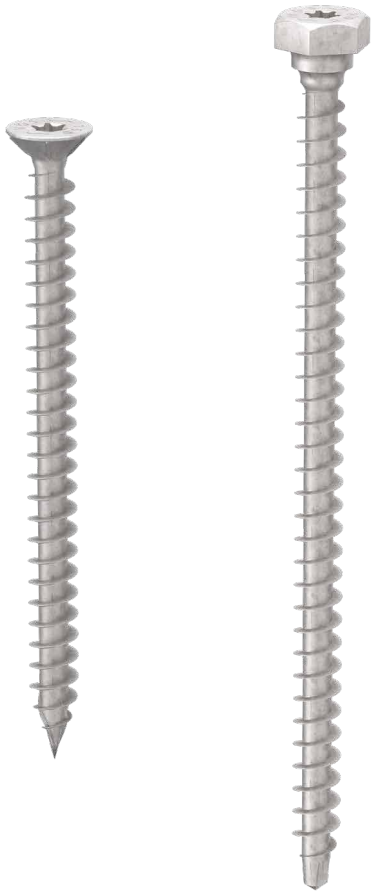
Approved for structural applications subject to stresses in any direction vs the grain (0° - 90°). Safety certified by numerous tests carried out for any direction of insertion. Cyclical SEISMIC-REV tests according to EN 12512. Countersunk head up to L = 600 mm, ideal for use on plates or for concealed reinforcements.

AUTOCLAVE-TREATED TIMBER

The C4 EVO coating has been certified according to US acceptance criterion AC257 for outdoor use with ACQ-treated timber.

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements.



VIDEO MANUALS

BIT INCLUDED

DIAMETER [mm]	9 (9 – 13) 15
LENGTH [mm]	80 (100 – 800) 2000
SERVICE CONDITION	EC1 EC3
ATMOSPHERIC CORROSIVITY	C1 C2 C3 C4
WOOD CORROSIVITY	T1 T2 T3
MATERIAL	C4 EVO COATING — carbon steel with C4 EVO coating
CORE HARDNESS	<390 HV — as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,rec}$



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above).



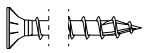
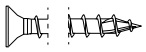
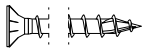
OUTDOOR STRUCTURAL PERFORMANCE

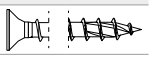
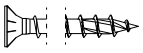
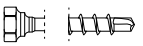
Ideal for fastening timber framed panels and trusses (Rafter, Truss). Values also tested, certified and calculated for high density woods. Ideal for fastening timber-framed panels and lattice beams (Rafter, Truss).

CLT & LVL

Values also tested, certified and calculated for CLT and high density woods such as laminated veneer lumber (LVL).

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
9 TX 40	VGSEVO9120	120	110	50	
	VGSEVO9160	160	150	50	
	VGSEVO9200	200	190	50	
	VGSEVO9240	240	230	50	
	VGSEVO9280	280	270	50	
	VGSEVO9320	320	310	25	
	VGSEVO9360	360	350	25	
11 TX 50	VGSEVO11100	100	90	25	
	VGSEVO11150	150	140	25	
	VGSEVO11200	200	190	25	
	VGSEVO11250	250	240	25	
	VGSEVO11300	300	290	25	
	VGSEVO11350	350	340	25	
	VGSEVO11400	400	390	25	
	VGSEVO11500	500	490	25	
	VGSEVO11600	600	590	25	

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
13 TX 50	VGSEVO13200	200	190	25	
	VGSEVO13300	300	280	25	
	VGSEVO13400	400	380	25	
	VGSEVO13500	500	480	25	
	VGSEVO13600	600	580	25	
13 SW 19 TX 50	VGSEVO13700	700	680	25	
	VGSEVO13800	800	780	25	

RELATED PRODUCTS



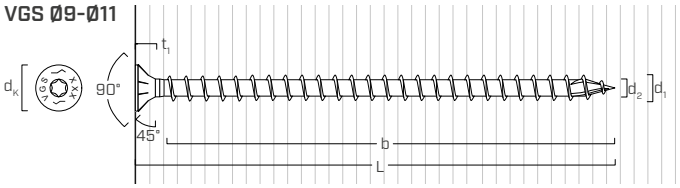
VGU EVO



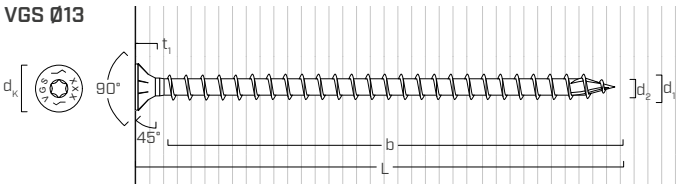
TORQUE LIMITER

GEOMETRY AND MECHANICAL CHARACTERISTICS

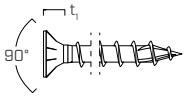
VGS Ø9-Ø11



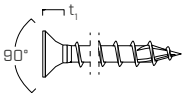
VGS Ø13



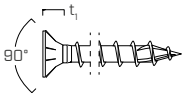
VGS Ø9
120 mm ≤ L ≤ 360 mm



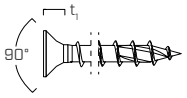
VGS Ø11
L ≤ 250 mm



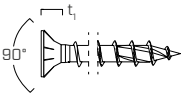
VGS Ø11
250 mm < L ≤ 600 mm



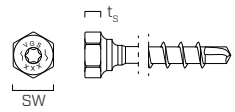
VGS Ø13
L ≤ 250 mm



VGS Ø13
250 mm < L ≤ 600 mm



VGS Ø13
L > 600 mm



GEOMETRY

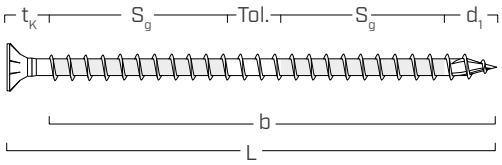
Nominal diameter	d_1	[mm]	9	11	13	13
Length	L	[mm]	-	-	≤ 600 mm	> 600 mm
Countersunk head diameter	d_K	[mm]	16,00	19,30	22,00	-
Countersunk head thickness	t_1	[mm]	6,50	8,20	9,40	-
Wrench size	SW	-	-	-	-	SW 19
Hexagonal head thickness	t_s	[mm]	-	-	-	7,50
Root diameter	d_2	[mm]	5,90	6,60	8,00	8,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	8,0	8,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	9,0	9,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

Nominal diameter	d_1	[mm]		9	11	13
Factored tensile strength	Φf_u	[kN]		17,84	23,17	31,96
Bending yield strength	F_{yb}	[MPa]		1069	1026	960
Factored shear strength of the screw	Φv_s	[kN]		10,50	13,14	19,30
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	78,56	96,02	113,5
			G=0.42	90,9	111,1	131,3
			G=0.49	102,8	125,7	148,5
			G=0.55	112,8	137,9	162,9

EFFECTIVE THREAD USED IN CALCULATION



b = $\mathbf{S_{g,tot}}$ = L - t_K

represents the entire length of the threaded part (see table above)

$\mathbf{S_g}$ = (b - d_1 - Tol.)/2

represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

t_K = 10 mm or 20mm depending on head type and diameter

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report.

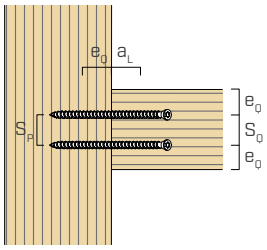
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

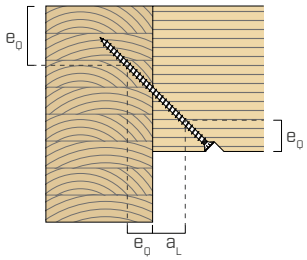
d_1		**9** [mm]	***0.36*** *[in]*	**11** [mm]	***0.44*** *[in]*	**13** [mm]	***0.52*** *[in]*
S_P	**7·d†**	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
S_Q	**5·d**	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
a_L	**10·d†**	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_Q	**4·d**	36	*1 7/16*	44	*1 3/4*	52	*2 1/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.

SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



plan



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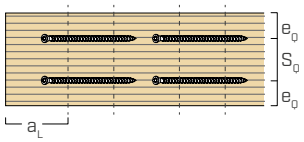

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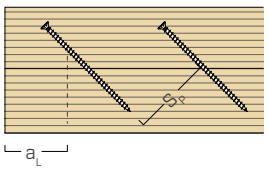
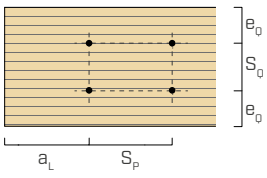
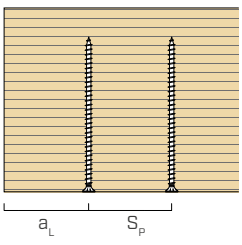


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

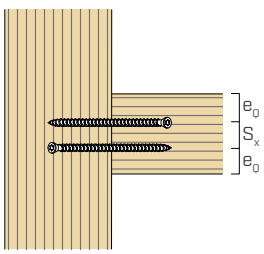


plan



front

CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



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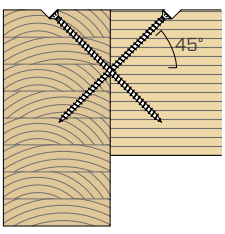
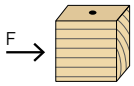


front

MINIMUM DISTANCES FOR SHEAR LOADS

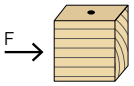
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	12·d‡	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
S_Q	5·d	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
a_L	15·d‡	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
a	10·d‡	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_Q	10·d	90	*3 1/2*	110	*4 3/8*	130	*5 1/8*
e_P	5·d	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
S_x	2·d	18	*11/16*	22	*7/8*	26	*1 1/32*

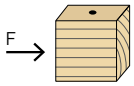
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



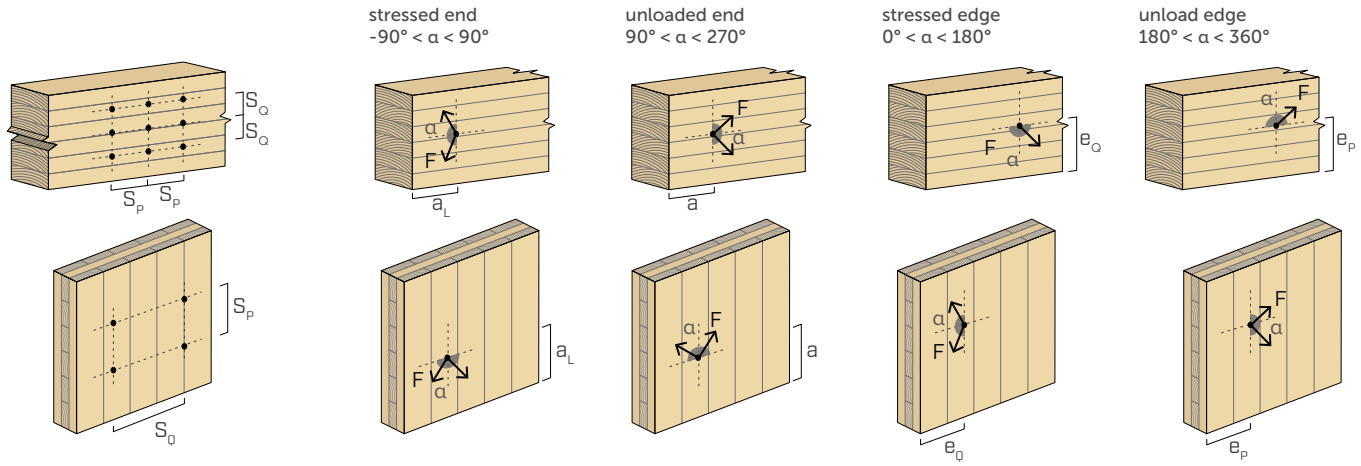
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	18·d	162	*6 3/8*	198	*7 13/16*	234	*9 1/4*
S_Q	7·d	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
a_L	22·d	198	*7 13/16*	242	*9 1/2*	286	*11 1/4*
a	15·d	135	*5 5/16*	165	*6 1/2*	195	*7 11/16*
e_Q	12·d	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
e_P	7·d	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
S_x	3·d	27	*1 1/16*	33	*1 5/16*	39	*1 9/16*

screws inserted **WITH pre-drilled hole**



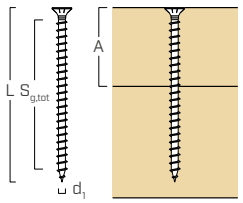
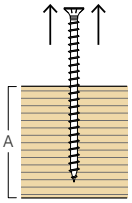
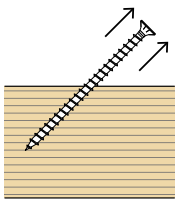
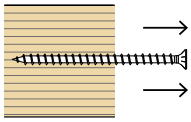
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*	13 [mm]	*0.52 [in]*
S_P	5·d†	45	*1 3/4*	55	*2 3/16*	65	*2 9/16*
S_Q	4·d	36	*1 7/16*	44	*1 3/4*	52	*2 1/16*
a_L	12·d†	108	*4 1/4*	132	*5 3/16*	156	*6 1/8*
a	7·d†	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_Q	7·d	63	*2 1/2*	77	*3 1/16*	91	*3 9/16*
e_P	3·d	27	*1 1/16*	33	*1 5/16*	39	*1 9/16*
S_x	1,5·d	13,5	*9/16*	16,5	*5/8*	19,5	*3/4*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



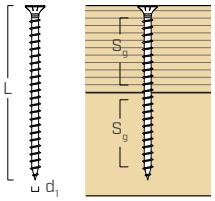
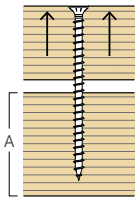
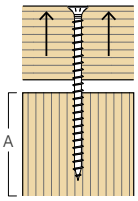
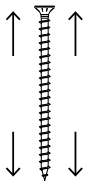
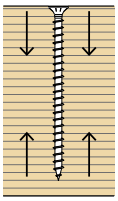
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

geometry					TENSION/COMPRESSION[1] total thread withdrawal											
					α = 90°				α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	101	130	5,55	6,43	7,27	7,97	5,05	5,84	6,61	7,25	2,78	3,21	3,63	3,99
	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
11 *0.44*	100	*4*	79	110	5,31	6,14	6,95	7,63	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81
	150	*6*	129	160	8,67	10,03	11,35	12,45	7,88	9,12	10,32	11,32	4,34	5,02	5,68	6,23
	200	*8*	179	210	12,03	13,92	15,75	17,28	10,94	12,66	14,32	15,71	6,02	6,96	7,88	8,64
	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95
13 *0.52*	200	*8*	177	210	14,06	16,29	18,40	20,18	12,78	14,81	16,73	18,35	7,03	8,15	9,20	10,09
	300	*11 3/4*	267	310	21,21	24,58	27,75	30,45	19,28	22,34	25,23	27,68	10,61	12,29	13,88	15,22
	400	*15 3/4*	367	410	29,16	33,78	38,15	41,85	26,51	30,71	34,68	38,04	14,58	16,89	19,07	20,92
	500	*19 3/4*	467	510	37,10	42,99	48,54	53,25	33,73	39,08	44,13	48,41	18,55	21,49	24,27	26,63
	600	*23 5/8*	567	610	45,05	52,19	58,94	64,66	40,95	47,45	53,58	58,78	22,52	26,10	29,47	32,33
	700	*27 1/2*	667	710	52,99	61,40	69,33	76,06	48,18	55,82	63,03	69,14	26,50	30,70	34,67	38,03
	800	*31 1/2*	767	810	60,94	70,60	79,73	87,46	55,40	64,18	72,48	79,51	30,47	35,30	39,86	43,73

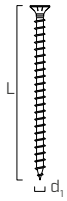
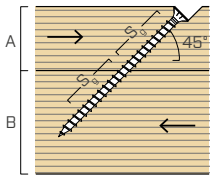
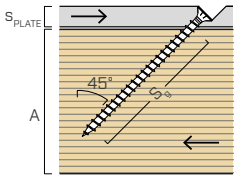
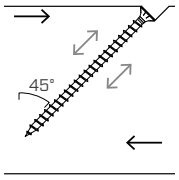
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 193.

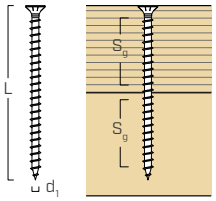
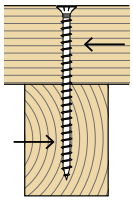
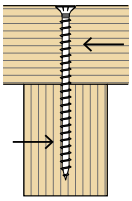
geometry				TENSION/COMPRESSION[1]									
				partial thread withdrawal								steel tension	buckling
				α = 90°				end grain α = 0°					α = 90°
													
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
d_1	L		S_g	A_{min}	G				G				
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45	65	2,47	2,86	3,24	3,55	1,24	1,43	1,62	1,78	17,84	16,37
	160	*6 1/4*	65	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57		
	200	*8*	85	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	240	*9 1/2*	105	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	280	*11*	125	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	320	*12 5/8*	145	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	360	*14 1/4*	165	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
11 *0.44*	100	*4*	35	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69	23,17	19,66
	150	*6*	60	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	200	*8*	85	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	250	*10*	110	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	300	*11 3/4*	135	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	350	*13 3/4*	160	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	400	*15 3/4*	185	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	500	*19 3/4*	235	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	600	*23 5/8*	285	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		
13 *0.52*	200	*8*	85	105	6,75	7,82	8,84	9,69	3,38	3,91	4,42	4,85	31,96	27,02
	300	*11 3/4*	130	155	10,33	11,97	13,51	14,82	5,16	5,98	6,76	7,41		
	400	*15 3/4*	180	205	14,30	16,57	18,71	20,53	7,15	8,28	9,36	10,26		
	500	*19 3/4*	230	255	18,27	21,17	23,91	26,23	9,14	10,59	11,95	13,11		
	600	*23 5/8*	280	305	22,25	25,77	29,11	31,93	11,12	12,89	14,55	15,96		
	700	*27 1/2*	330	355	26,22	30,38	34,30	37,63	13,11	15,19	17,15	18,81		
	800	*31 1/2*	380	405	30,19	34,98	39,50	43,33	15,10	17,49	19,75	21,67		

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 193.

geometry			SLIDING[3] timber-to-timber							steel-to-timber							steel tension
																	
			factored lateral resistance N_r[4]										factored lateral resistance N_r[4]				factored tension resistance T_{rs}
d_1	L		S_g	A	B_{min}	G				S_{PLATE}[5]	S_g	A_{min}	G				
						0.35	0.42	0.49	0.55				0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
	120	*4 3/4*	45	45	60	1,91	2,21	2,50	2,74		90	85	3,82	4,42	5,00	5,48	
	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96		130	115	5,51	6,38	7,22	7,92	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18		170	140	7,21	8,34	9,44	10,35	
9 *0.36*	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40	15,9 *5/8*	210	170	8,91	10,31	11,66	12,79	12,61
	280	*11*	125	105	120	5,30	6,14	6,94	7,61		250	200	10,61	12,27	13,88	15,23	
	320	*12 5/8*	145	115	130	6,15	7,12	8,05	8,83		290	225	12,30	14,23	16,10	17,66	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05		330	255	14,00	16,20	18,32	20,10	
	100	*4*	35	40	55	1,81	2,10	2,38	2,61		60	65	3,11	3,60	4,07	4,47	
	150	*6*	60	60	75	3,11	3,60	4,07	4,47		110	100	5,70	6,60	7,47	8,19	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33		160	135	8,30	9,60	10,86	11,91	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19		210	170	10,89	12,60	14,25	15,64	
11 *0.44*	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05	19,1 *3/4*	260	205	13,48	15,60	17,65	19,36	16,38
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91		310	240	16,07	18,60	21,04	23,08	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78		360	275	18,67	21,60	24,43	26,81	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50		460	350	23,85	27,60	31,22	34,25	
	600	*23 5/8*	285	220	235	14,78	17,10	19,34	21,22		560	420	29,03	33,59	38,01	41,70	
	200	*8*	85	80	95	5,21	6,04	6,82	7,48		155	135	9,50	11,01	12,43	13,63	
	300	*11 3/4*	130	110	125	7,97	9,23	10,42	11,43		255	205	15,63	18,11	20,45	22,43	
	400	*15 3/4*	180	145	160	11,03	12,78	14,43	15,83		355	275	21,76	25,21	28,47	31,23	
13 *0.52*	500	*19 3/4*	230	180	195	14,10	16,33	18,44	20,23	22,2 *7/8*	455	345	27,89	32,31	36,48	40,02	22,60
	600	*23 5/8*	280	215	230	17,16	19,88	22,45	24,63		555	415	34,01	39,41	44,50	48,82	
	700	*27 1/2*	330	250	265	20,22	23,43	26,46	29,03		-	-	-	-	-	-	
	800	*31 1/2*	380	285	300	23,29	26,98	30,47	33,43		-	-	-	-	-	-	

NOTES and GENERAL PRINCIPLES on page 193.

geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45	60	2,18	2,59	3,00	3,34	1,37	1,55	1,73	1,87
	160	*6 1/4*	65	80	2,85	3,17	3,48	3,73	1,61	1,83	2,05	2,23
	200	*8*	85	100	3,12	3,49	3,84	4,13	1,85	2,12	2,38	2,59
	240	*9 1/2*	105	120	3,40	3,81	4,20	4,52	2,09	2,40	2,70	2,90
	280	*11*	125	140	3,67	4,13	4,56	4,90	2,33	2,62	2,88	3,09
	320	*12 5/8*	145	160	3,91	4,28	4,62	4,90	2,48	2,78	3,06	3,29
	360	*14 1/4*	165	180	3,91	4,28	4,62	4,90	2,62	2,94	3,24	3,49
11 *0.44*	100	*4*	35	50	2,07	2,46	2,85	3,18	1,34	1,59	1,84	2,03
	150	*6*	60	75	3,24	3,81	4,17	4,47	1,86	2,12	2,37	2,57
	200	*8*	85	100	3,84	4,29	4,72	5,07	2,22	2,54	2,85	3,11
	250	*10*	110	125	4,26	4,78	5,27	5,68	2,58	2,97	3,34	3,62
	300	*11 3/4*	135	150	4,68	5,27	5,75	6,09	2,94	3,31	3,65	3,92
	350	*13 3/4*	160	175	4,86	5,32	5,75	6,09	3,17	3,56	3,92	4,22
	400	*15 3/4*	185	200	4,86	5,32	5,75	6,09	3,38	3,80	4,20	4,52
	500	*19 3/4*	235	250	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
	600	*23 5/8*	285	300	4,86	5,32	5,75	6,09	3,67	4,02	4,35	4,60
13 *0.52*	200	*8*	80	100	4,95	5,53	6,06	6,50	2,75	3,13	3,50	3,80
	300	*11 3/4*	125	150	5,81	6,52	7,18	7,73	3,58	4,11	4,62	5,03
	400	*15 3/4*	175	200	6,65	7,28	7,87	8,33	4,32	4,85	5,34	5,74
	500	*19 3/4*	225	250	6,65	7,28	7,87	8,33	4,82	5,42	5,95	6,30
	600	*23 5/8*	275	300	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	700	*27 1/2*	325	350	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30
	800	*31 1/2*	375	400	6,65	7,28	7,87	8,33	5,03	5,51	5,95	6,30

α = screw-to-grain angle.

NOTES and **GENERAL PRINCIPLES** on page 193.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- VGS EVO screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}.The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) For fully threaded screws, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile resistance.

(4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(5) The plate thickness (S_{PLATE}) are understood to be the minimum values to allow the countersunk head of the screw to be accommodated.

(6) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

VGS A4

ELC-4645 ESR-4645 ETA-11/0030

FULL THREAD CONNECTOR WITH COUNTERSUNK HEAD

A4 | AISI316

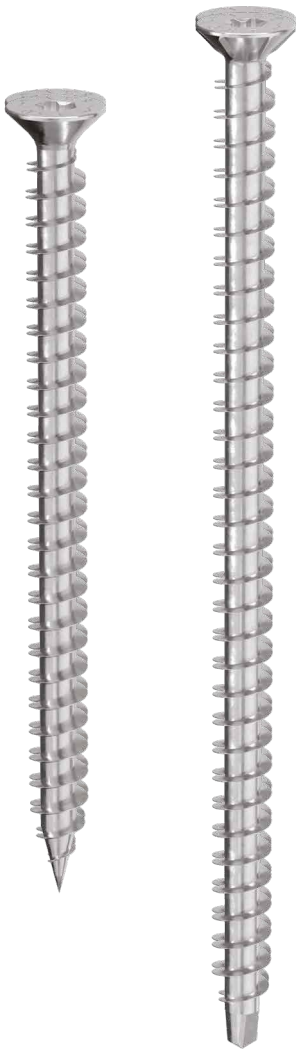
A4 | AISI316 austenitic stainless steel for high corrosion resistance. Ideal for environments adjacent to the sea in corrosivity class C5 and for insertion on the most aggressive timbers in class T5.

T5 TIMBER CORROSIVITY

Suitable for use in applications on aggressive woods with an acidity (pH) level below 4 such as oak, Douglas fir and chestnut, and in wood moisture conditions above 20%.

EXPOSED STRUCTURAL USE

VGS A4 is the structural wood screw with total thread, perfect for making joints that require high tension or sliding strength in extremely aggressive environments.



CANADIAN DESIGN VALUES
USA, EU and more design values available online.

MANUALS

BIT INCLUDED

DIAMETER [mm]	9 (9 – 11) 15
LENGTH [mm]	80 (100 – 600) 2000
SERVICE CONDITION	EC4 WET
ATMOSPHERIC CORROSIVITY	C1 C2 C3 C4 C5
WOOD CORROSIVITY	T1 T2 T3 T4 T5
MATERIAL	A4 AISI 316 — A4 | AISI316 austenitic stainless steel (CRC III)

METAL-to-TIMBER recommended use:

NO IMPACT

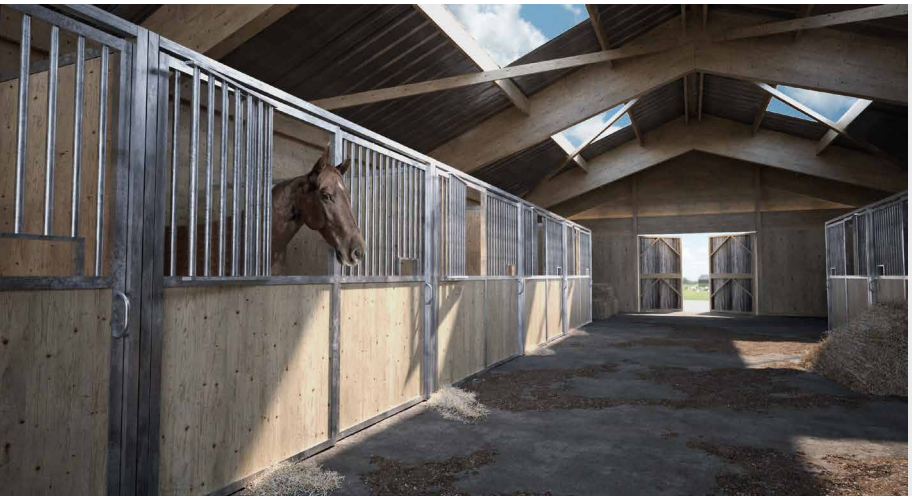
TORQUE LIMITER

$M_{ins,rec}$



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- ACQ, CCA treated timber



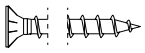
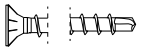
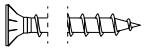
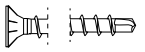
HYBRID STEEL-TIMBER STRUCTURES

Ideal for steel structures where high-strength customised connections are required, particularly in adverse climatic contexts such as the marine environment and acidic woods.

SWELLING OF TIMBER

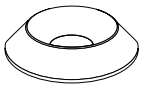
Application in combination with polymeric interlayers such as XYLOFON WASHER gives the joint a certain adaptability to mitigate stresses resulting from shrinkage/swelling of the wood.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs	
9 TX 40	VGS9120A4	120	110	25	
	VGS9160A4	160	150	25	
	VGS9200A4	200	190	25	
	VGS9240A4	240	230	25	
	VGS9280A4	280	270	25	
	VGS9320A4	320	310	25	
	VGS9360A4	360	350	25	
11 TX 50	VGS11100A4	100	90	25	
	VGS11150A4	150	140	25	
	VGS11200A4	200	190	25	
	VGS11250A4	250	240	25	
	VGS11300A4	300	290	25	
	VGS11350A4	350	340	25	
	VGS11400A4	400	390	25	
	VGS11500A4	500	490	25	
	VGS11600A4	600	590	25	

A4
AISI 316

HUS A4 - turned washer

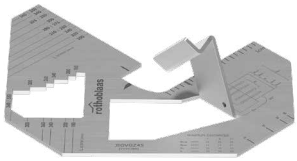


CODE	$d_{VGS\ A4}$ [mm]	pcs
HUS8A4	9	100
HUS10A4	11	50

RELATED PRODUCTS

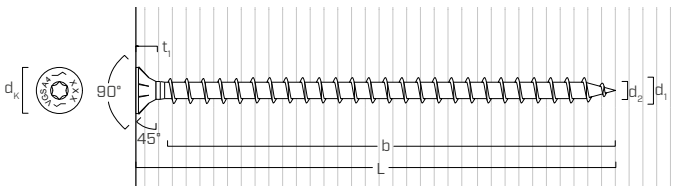


TORQUE LIMITER
TORQUE LIMITER

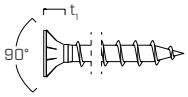


JIG VGZ 45°
TEMPLATE FOR 45° SCREWS

GEOMETRY AND MECHANICAL CHARACTERISTICS

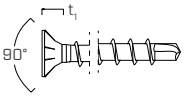


VGS Ø9
L ≤ 240 mm



VGS Ø11
L ≤ 250 mm

VGS Ø9
240 mm < L ≤ 360 mm



VGS Ø11
250 mm < L ≤ 600 mm

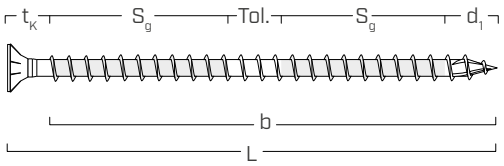
Nominal diameter	d_1	[mm]	9	11
Head diameter	d_K	[mm]	16,00	19,30
Head thickness	t_1	[mm]	6,50	8,20
Root diameter	d_2	[mm]	5,90	6,60
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0

(1)Pre-drilling valid for softwood.
Pre-drilling is mandatory for connectors with L > 400 mm or when fastening to elements with a characteristic density ρ_k>500 kg/m^3.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		9	11
Factored tensile strength	Φf_u	[kN]		12,87	16,36
Bending yield strength	F_{yb}	[MPa]		690	816
Factored shear strength of the screw	Φv_s	[kN]		5,91	7,39
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	78,56	96,02
			G=0.42	90,90	111,10
			G=0.49	102,83	125,68
			G=0.55	112,79	137,85

EFFECTIVE THREAD USED IN CALCULATION



b = $S_{g,tot}$ = L - t_K represents the entire length of the threaded part

S_g = (L - t_K - 10 mm - Tol.)/2 represents the partial length of the threaded part net of a laying tolerance (Tol.) of 10 mm

t_K = 10 mm (countersunk head)

NOTES

- The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report.

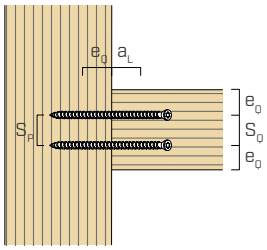
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

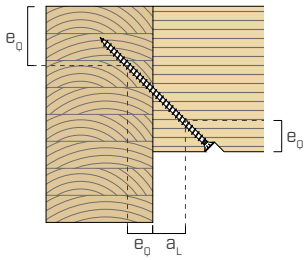
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	7·d†	63	*2 1/2*	77	*3 1/16*
S_Q	5·d	45	*1 3/4*	55	*2 3/16*
a_L	10·d†	90	*3 1/2*	110	*4 3/8*
a	7·d†	63	*2 1/2*	77	*3 1/16*
e_Q	4·d	36	*1 7/16*	44	*1 3/4*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.

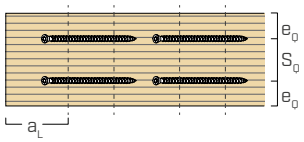
SCREWS UNDER TENSION INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



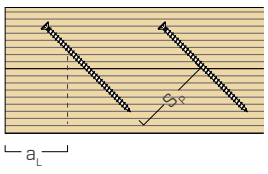
plan



front

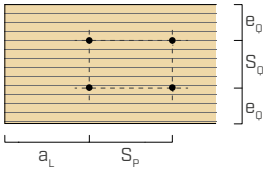


plan

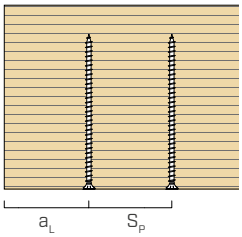


front

SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

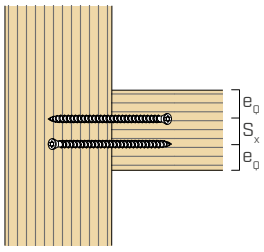


plan

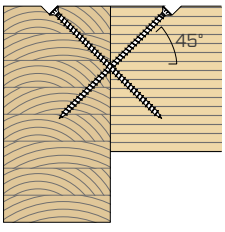


front

CROSSED SCREWS INSERTED WITH AN ANGLE α WITH RESPECT TO THE GRAIN



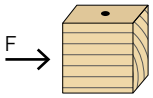
plan



front

MINIMUM DISTANCES FOR SHEAR LOADS

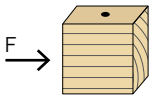
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**12·d‡**	45	*1 3/4*	55	*2 3/16*
S_Q	**5·d**	36	*1 7/16*	44	*1 3/4*
a_L	**15·d‡**	108	*4 1/4*	132	*5 3/16*
a	**10·d‡**	63	*2 1/2*	77	*3 1/16*
e_Q	**10·d**	63	*2 1/2*	77	*3 1/16*
e_P	**5·d**	27	*1 1/16*	33	*1 5/16*
S_x	**2·d**	18	*11/16*	22	*7/8*

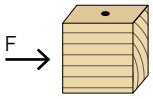
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



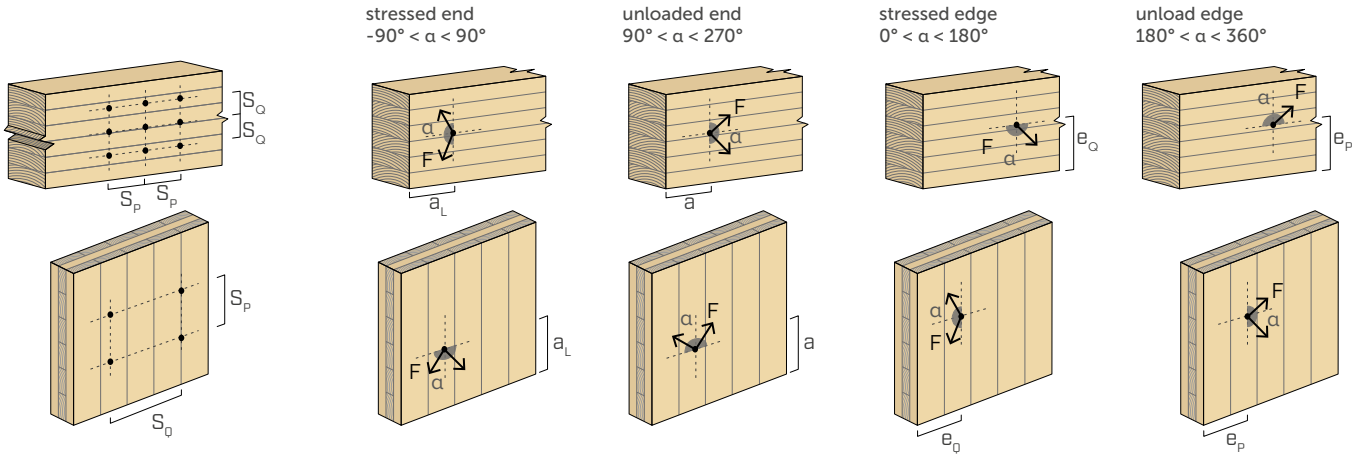
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**18·d**	108	*4 1/4*	132	*5 3/16*
S_Q	**7·d**	45	*1 3/4*	55	*2 3/16*
a_L	**22·d**	135	*5 5/16*	165	*6 1/2*
a	**15·d**	90	*3 1/2*	110	*4 3/8*
e_Q	**12·d**	90	*3 1/2*	110	*4 3/8*
e_P	**7·d**	45	*1 3/4*	55	*2 3/16*
S_x	**3·d**	27	*1 1/16*	33	*1 5/16*

screws inserted **WITH pre-drilled hole**



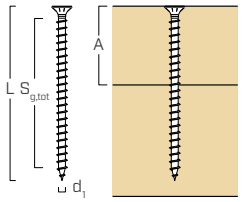
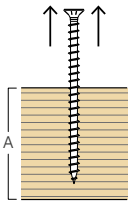
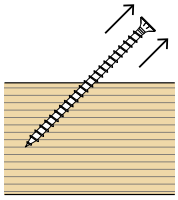
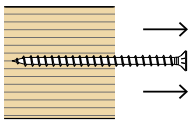
d_1		9 [mm]	*0.36 [in]*	11 [mm]	*0.44 [in]*
S_P	**5·d†**	162	*6 3/8*	198	*7 13/16*
S_Q	**4·d**	63	*2 1/2*	77	*3 1/16*
a_L	**12·d†**	198	*7 13/16*	242	*9 1/2*
a	**7·d†**	135	*5 5/16*	165	*6 1/2*
e_Q	**7·d**	108	*4 1/4*	132	*5 3/16*
e_P	**3·d**	63	*2 1/2*	77	*3 1/16*
S_x	**1.5·d**	14	*9/16*	17	*11/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



NOTES

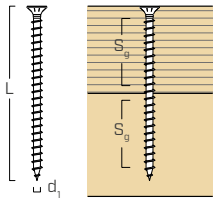
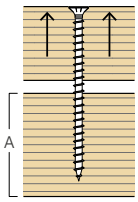
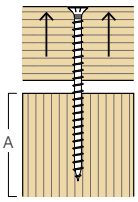
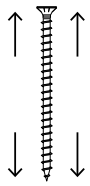
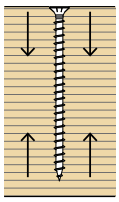
- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA-O86:2024.

geometry					TENSION/COMPRESSION[1] total thread withdrawal α = 90°				α = 45°				end grain α = 0°			
																
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			
					G				G				G			
d_1	L		$S_{g,tot}$	A_{min}	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]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	101	130	5,55	6,43	7,27	7,97	5,05	5,84	6,61	7,25	2,78	3,21	3,63	3,99
	160	*6 1/4*	141	170	7,75	8,97	10,15	11,13	7,05	8,16	9,22	10,12	3,88	4,49	5,07	5,57
	200	*8*	181	210	9,95	11,52	13,02	14,29	9,05	10,47	11,84	12,99	4,98	5,76	6,51	7,15
	240	*9 1/2*	221	250	12,15	14,06	15,90	17,45	11,05	12,78	14,46	15,86	6,08	7,03	7,95	8,73
	280	*11*	261	290	14,35	16,61	18,78	20,61	13,05	15,10	17,07	18,74	7,18	8,30	9,39	10,30
	320	*12 5/8*	301	330	16,55	19,15	21,66	23,77	15,05	17,41	19,69	21,61	8,28	9,58	10,83	11,88
	360	*14 1/4*	341	370	18,75	21,70	24,54	26,93	17,05	19,73	22,31	24,48	9,38	10,85	12,27	13,46
11 *0.44*	100	*4*	79	110	5,31	6,14	6,95	7,63	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81
	150	*6*	129	160	8,67	10,03	11,35	12,45	7,88	9,12	10,32	11,32	4,34	5,02	5,68	6,23
	200	*8*	179	210	12,03	13,92	15,75	17,28	10,94	12,66	14,32	15,71	6,02	6,96	7,88	8,64
	250	*10*	229	260	15,39	17,81	20,15	22,11	13,99	16,19	18,32	20,10	7,70	8,90	10,07	11,05
	300	*11 3/4*	279	310	18,75	21,70	24,55	26,93	17,05	19,73	22,32	24,48	9,38	10,85	12,27	13,47
	350	*13 3/4*	329	360	22,11	25,59	28,95	31,76	20,10	23,26	26,32	28,87	11,06	12,79	14,47	15,88
	400	*15 3/4*	379	410	25,47	29,47	33,35	36,58	23,16	26,80	30,32	33,26	12,74	14,74	16,67	18,29
	500	*19 3/4*	479	510	32,20	37,25	42,15	46,24	29,27	33,87	38,32	42,03	16,10	18,63	21,07	23,12
	600	*23 5/8*	579	610	38,92	45,03	50,95	55,89	35,38	40,94	46,31	50,81	19,46	22,51	25,47	27,95

α = screw-to-grain angle

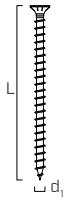
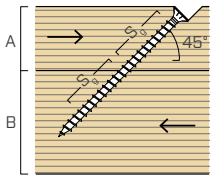
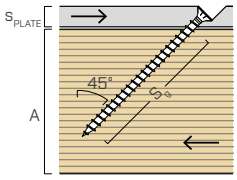
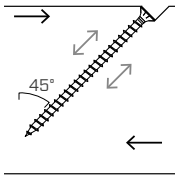
NOTES and **GENERAL PRINCIPLES** on page 203.

TENSION/COMPRESSION[1]

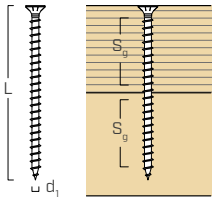
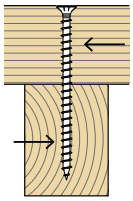
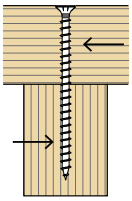
geometry					partial thread withdrawal α = 90°				partial thread withdrawal end grain α = 0°				steel tension	buckling α = 90°
														
					factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}	factored buckling resistance P_{rb}
					G				G					
d_1	L		S_g	A_{min}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55		
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45,0	65	2,47	2,86	3,24	3,55	1,24	1,43	1,62	1,78	12,87	10,56
	160	*6 1/4*	65,0	85	3,57	4,14	4,68	5,13	1,79	2,07	2,34	2,57		
	200	*8*	85,0	105	4,67	5,41	6,12	6,71	2,34	2,70	3,06	3,36		
	240	*9 1/2*	105,0	125	5,77	6,68	7,56	8,29	2,89	3,34	3,78	4,15		
	280	*11*	125,0	145	6,87	7,95	9,00	9,87	3,44	3,98	4,50	4,94		
	320	*12 5/8*	145,0	165	7,97	9,23	10,43	11,45	3,99	4,61	5,22	5,72		
	360	*14 1/4*	165,0	185	9,07	10,50	11,87	13,03	4,54	5,25	5,94	6,51		
11 *0.44*	100	*4*	35,0	55	2,35	2,72	3,08	3,38	1,18	1,36	1,54	1,69	16,36	15,63
	150	*6*	60,0	80	4,03	4,67	5,28	5,79	2,02	2,33	2,64	2,90		
	200	*8*	85,0	105	5,71	6,61	7,48	8,21	2,86	3,31	3,74	4,10		
	250	*10*	110,0	130	7,39	8,55	9,68	10,62	3,70	4,28	4,84	5,31		
	300	*11 3/4*	135,0	155	9,07	10,50	11,88	13,03	4,54	5,25	5,94	6,52		
	350	*13 3/4*	160,0	180	10,75	12,44	14,08	15,44	5,38	6,22	7,04	7,72		
	400	*15 3/4*	185,0	205	12,43	14,39	16,28	17,86	6,22	7,19	8,14	8,93		
	500	*19 3/4*	235,0	255	15,80	18,28	20,68	22,68	7,90	9,14	10,34	11,34		
	600	*23 5/8*	285,0	305	19,16	22,16	25,08	27,51	9,58	11,08	12,54	13,76		

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 203.

geometry			SLIDING[3] timber-to-timber							steel-to-timber							steel tension
																	
d_1	L		S_g	A	B_{min}	factored lateral resistance N_r[4] G				S_{PLATE}[5]	S_g	A_{min}	factored lateral resistance N_r[4] G				factored tension resistance T_{rs}
						0.35	0.42	0.49	0.55				0.35	0.42	0.49	0.55	
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45	45	60	1,91	2,21	2,50	2,74	15,9 *5/8*	90	85	3,82	4,42	5,00	5,48	9,10
	160	*6 1/4*	65	60	75	2,76	3,19	3,61	3,96		130	115	5,51	6,38	7,22	7,92	
	200	*8*	85	75	90	3,61	4,17	4,72	5,18		170	140	7,21	8,34	9,44	10,35	
	240	*9 1/2*	105	90	105	4,45	5,15	5,83	6,40		210	170	8,91	10,31	11,66	12,79	
	280	*11*	125	105	120	5,30	6,14	6,94	7,61		250	200	10,61	12,27	13,88	15,23	
	320	*12 5/8*	145	115	130	6,15	7,12	8,05	8,83		290	225	12,30	14,23	16,10	17,66	
	360	*14 1/4*	165	130	145	7,00	8,10	9,16	10,05		330	255	14,00	16,20	18,32	20,10	
11 *0.44*	100	*4*	35	40	55	1,81	2,10	2,38	2,61	19,1 *3/4*	60	65	3,11	3,60	4,07	4,47	11,57
	150	*6*	60	60	75	3,11	3,60	4,07	4,47		110	100	5,70	6,60	7,47	8,19	
	200	*8*	85	75	90	4,41	5,10	5,77	6,33		160	135	8,30	9,60	10,86	11,91	
	250	*10*	110	95	110	5,70	6,60	7,47	8,19		210	170	10,89	12,60	14,25	15,64	
	300	*11 3/4*	135	110	125	7,00	8,10	9,16	10,05		260	205	13,48	15,60	17,65	19,36	
	350	*13 3/4*	160	130	145	8,30	9,60	10,86	11,91		310	240	16,07	18,60	21,04	23,08	
	400	*15 3/4*	185	145	160	9,59	11,10	12,56	13,78		360	275	18,67	21,60	24,43	26,81	
	500	*19 3/4*	235	180	195	12,18	14,10	15,95	17,50		460	350	23,85	27,60	31,22	34,25	
	600	*23 5/8*	285	220	235	14,78	17,10	19,34	21,22		560	420	29,03	33,59	38,01	41,70	

NOTES and GENERAL PRINCIPLES on page 203.

geometry					SHEAR[6] timber-to-timber							
					α = 90°				α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2]			
d_1	L		S_g	A[7]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
9 *0.36*	120	*4 3/4*	45	60	2,18	2,44	2,67	2,86	1,22	1,39	1,55	1,69
	160	*6 1/4*	65	80	2,46	2,75	3,03	3,25	1,46	1,68	1,88	2,05
	200	*8*	85	100	2,74	3,07	3,39	3,65	1,71	1,96	2,18	2,34
	240	*9 1/2*	105	120	3,01	3,39	3,71	3,93	1,92	2,14	2,36	2,53
	280	*11*	125	140	3,14	3,44	3,71	3,93	2,05	2,30	2,54	2,73
	320	*12 5/8*	145	160	3,14	3,44	3,71	3,93	2,19	2,46	2,72	2,93
	360	*14 1/4*	165	180	3,14	3,44	3,71	3,93	2,33	2,60	2,81	2,97
11 *0.44*	100	*4*	35	50	2,07	2,46	2,85	3,18	1,34	1,59	1,76	1,91
	150	*6*	60	75	3,16	3,52	3,86	4,14	1,76	2,01	2,25	2,45
	200	*8*	85	100	3,58	4,01	4,41	4,74	2,12	2,43	2,73	2,98
	250	*10*	110	125	4,00	4,49	4,96	5,35	2,48	2,85	3,14	3,37
	300	*11 3/4*	135	150	4,33	4,75	5,13	5,43	2,76	3,10	3,41	3,67
	350	*13 3/4*	160	175	4,33	4,75	5,13	5,43	2,97	3,34	3,69	3,97
	400	*15 3/4*	185	200	4,33	4,75	5,13	5,43	3,18	3,58	3,88	4,11
	500	*19 3/4*	235	250	4,33	4,75	5,13	5,43	3,27	3,59	3,88	4,11
	600	*23 5/8*	285	300	4,33	4,75	5,13	5,43	3,27	3,59	3,88	4,11

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 203.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of $S_{g,tot}$ or S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA-O86 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- VGS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA-O86 2024 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA-O86 2024 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}.The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) For fully threaded screws, head pull-through does not govern the connection capacity, instead, thread withdrawal governs. The governing axial resistance is taken as the minimum of the screw's shear, thread withdrawal, and tensile resistances. In this case, the tensile resistance is always lower than the shear resistance, so the governing value is the minimum between thread withdrawal and tensile resistance.

(4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane.

(5) The plate thickness (S_{PLATE}) are understood to be the minimum values to allow the countersunk head of the screw to be accommodated.

(6) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(7) The fixable thickness (A) is considered as half the length of the screw (L/2).

VGS PLATE

PAN HEAD HEX SCREW FOR LIFTING

ELC-4645 ESR-4645 ETA-11/0030 REUSABLE



ONE SCREW FOR ALL TRANSPORT APPLICATIONS

The head shape guarantees full compatibility with all screw-based transport and lifting systems (WASP, WASPL, RAPTOR, RAPTOR MINI and RAPTOR MAXI).

Reusable: less waste, improved cost efficiency

Unlike traditional single-use solutions, this screw is designed for repeated use in transport and lifting operations. Testing carried out in collaboration with the University of Maine and the University of Bologna confirms that performance is maintained after repeated reuse cycles. Following a practical yet rigorous inspection, the screw can be reused for lifting applications.

USE IN STRUCTURAL CONNECTIONS

The screw is certified in Canada for permanent metal-to-timber structural connections in buildings. The optimised head design, featuring a reinforced underhead and no sharp edges, ensures reliable load transfer with an enhanced safety factor, even when used with thick plates.

VIDEO MANUALS

BIT INCLUDED

DIAMETER [mm]	9 — 11 — 15
LENGTH [mm]	60 — 60 — 280 — 2000
SERVICE CONDITION	DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn E-COATING electrogalvanised carbon steel with black E-Coating
CORE HARDNESS	<390 HV as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.

DOWNLOAD AND READ

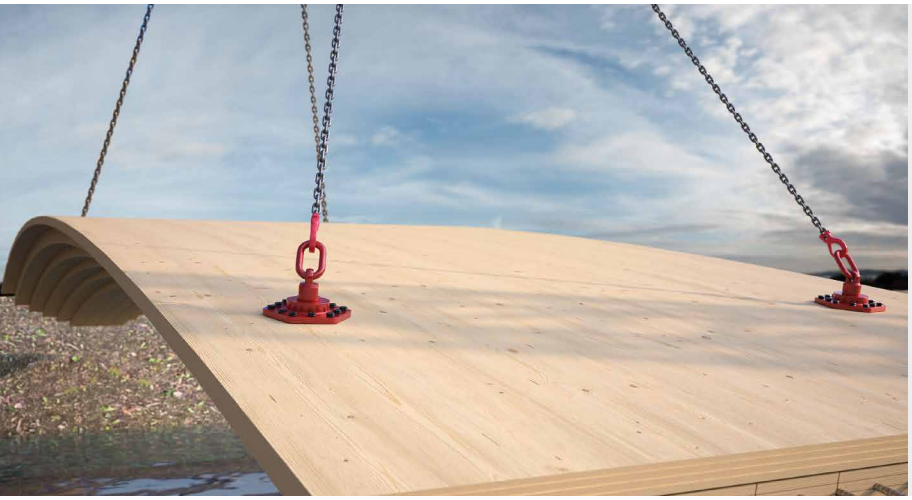
the complete manual before the installation

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,r\epsilon}$ $M_{ins,rec}$



FIELDS OF USE

- WASP
- RAPTOR
- RAPTOR MINI
- RAPTOR MAXI
- structural metal-to-timber connections

REUSABLE

The reusability of the screw for transporting timber elements has been thoroughly analysed and tested. Follow the instructions for use before installation.

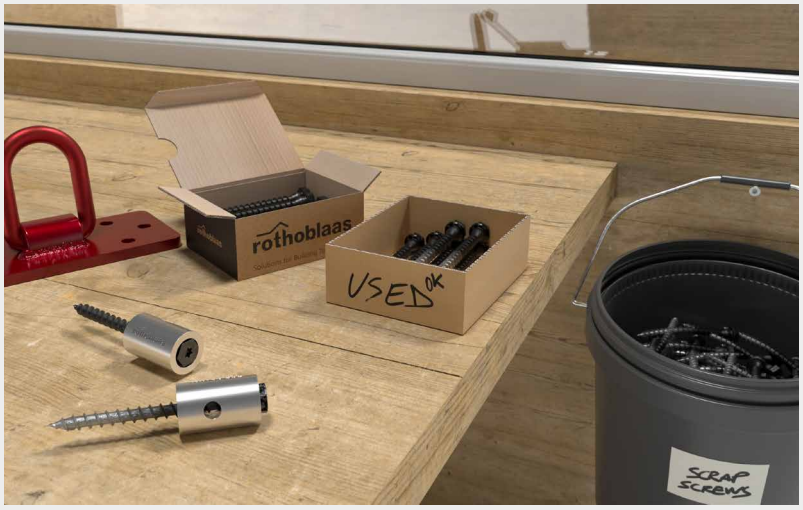


BLACK E-COATING

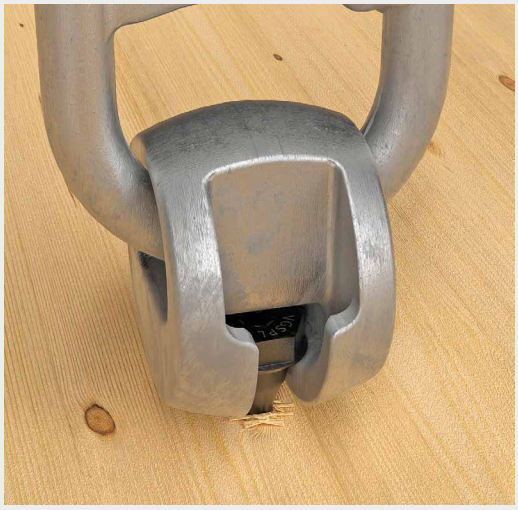
The black finish and “LIFT” head marking allow easy on-site identification and clear differentiation from screws not approved for lifting. The wear of the coating provides a visual indication of the number of reuse cycles.

HEXAGONAL HEAD WITH TORX DRIVE

The combination of a robust hexagonal head and TORX drive allows the screw to be repeatedly installed and removed.

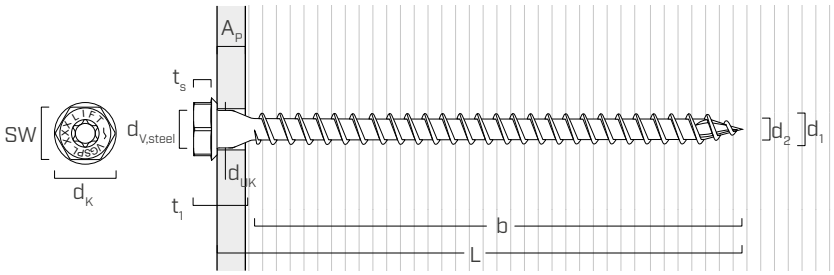


The JIG REUSE enables verification of plastic deformation, thread wear and coating degradation, ensuring safe reuse.



Despite the hexagonal head, VGS PLATE is fully compatible with lifting hooks such as WASP and WASPL, thanks to the integrated pan head washer.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	**d_1**	**[mm]**	**11**
Head diameter	d_K	[mm]	20,00
Root diameter	d_2	[mm]	6,60
Head thickness	t_1	[mm]	16,25
Wrench size	SW	-	17
Hexagonal head thickness	t_s	[mm]	5,75
Underhead diameter	d_{UK}	[mm]	12,00
Steel plate thickness	A_p	[mm]	3 - 20
Hole diameter on steel plate	$d_{v,steel}$	[mm]	13,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	6,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	7,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**11**
Factored tensile strength	Φf_u	[kN]		23,17
Bending yield strength	F_{yb}	[MPa]		1026
Factored shear strength of the screw	Φv_s	[kN]		13,14
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	96,02
			G=0.42	111,10
			G=0.49	125,68
			G=0.55	137,85

CODES AND DIMENSIONS

d_1 [mm] *[in]*	CODE	L [mm]	b [mm]	*L [in]*	*b [in]*	pcs
11 *0.44* SW 17 TX 50	**VGSPL1160**	60	50	*1 15/16*	*1 15/16*	25
	VGSPL1180	80	70	*2 3/4*	*2 3/4*	25
	VGSPL11100	100	90	*3 1/2*	*3 1/2*	25
	VGSPL11120	120	110	*4 3/8*	*4 3/8*	25
	VGSPL11140	140	130	*5 1/8*	*5 1/8*	25
	VGSPL11160	160	150	*6*	*6*	25
	VGSPL11180	180	170	*6 3/4*	*6 3/4*	25
	VGSPL11200	200	190	*7 1/2*	*7 1/2*	25
	VGSPL11240	240	230	*9 1/16*	*9 1/16*	25
	VGSPL11280	280	270	*10 5/8*	*10 5/8*	25

RELATED PRODUCTS



TORQUE LIMITER
TORQUE LIMITER

CODE	stop torque [Nm] *[ft·lbs]*	weight [g] *[lbs]*	pcs
TORLIM1235 incl. TORLIMBIT + TX4050	12 - 35 *9 - 26*	730 *1.61*	1
TORLIM3063 incl. TORLIMBITL + TX5050	30 - 63 *22 - 46*	1180 *2.6*	1



JIG REUSE
INSPECTION JIG FOR REUSABLE SCREWS

CODE	description	pcs
JIGREVGSPL11	inspection jig for reusable screws	1

Lifting system

Solutions engineered for the safe lifting and handling of timber elements.
The product range includes devices designed to accommodate different load configurations and on-site handling requirements.





RAPTOR MINI



RAPTOR



RAPTOR MAXI



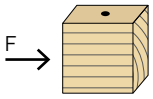
WASP

The comprehensive technical documentation is available at www.rothoblaas.com

rothoblaas.com

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

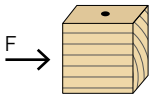
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		**11** [mm]	***0.44*** *[in]*
S_P	**12·d‡**	132	*5 3/16*
S_Q	**5·d**	55	*2 3/16*
a_L	**15·d‡**	165	*6 1/2*
a	**10·d‡**	110	*4 3/8*
e_Q	**10·d**	110	*4 3/8*
e_P	**5·d**	55	*2 3/16*
S_x	**2·d**	22	*7/8*

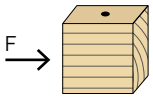
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



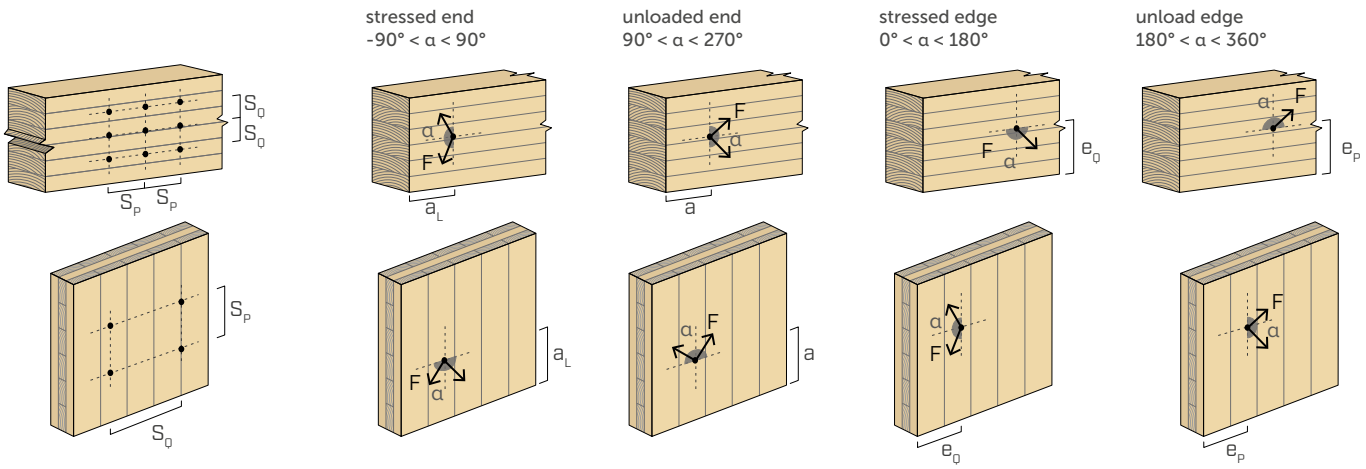
d_1		**11** [mm]	***0.44*** *[in]*
S_P	**18·d**	198	*7 13/16*
S_Q	**7·d**	77	*3 1/16*
a_L	**22·d**	242	*9 1/2*
a	**15·d**	165	*6 1/2*
e_Q	**12·d**	*132*	*5 3/16*
e_P	**7·d**	77	*3 1/16*
S_x	**3·d**	33	*1 5/16*

screws inserted **WITH pre-drilled hole**



d_1		**11** [mm]	***0.44*** *[in]*
S_P	**5·d†**	55	*2 3/16*
S_Q	**4·d**	44	*1 3/4*
a_L	**12·d†**	132	*5 3/16*
a	**7·d†**	77	*3 1/16*
e_Q	**7·d**	77	*3 1/16*
e_P	**3·d**	33	*1 5/16*
S_x	**1.5·d**	17	*11/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw



NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

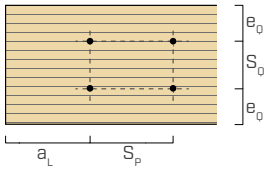
MINIMUM DISTANCES FOR AXIAL STRESSES | TIMBER

screws inserted **WITH and WITHOUT pre-drilled hole**

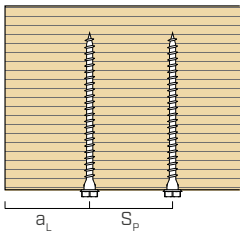
SCREWS INSERTED WITH α = 90° ANGLE WITH RESPECT TO THE GRAIN

d_1		11 [mm]	*0.44* *[in]*
S_P	**7·d†**	77	*3 1/16*
S_Q	**5·d**	55	*2 3/16*
a_L	**10·d†**	110	*4 3/8*
e_Q	**4·d**	44	*1 3/4*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.



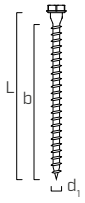
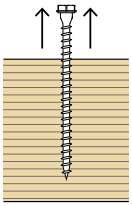
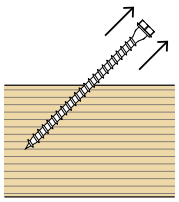
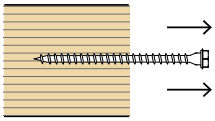
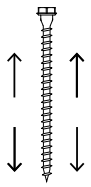
plan



front

STRUCTURAL VALUES | AXIAL TENSION

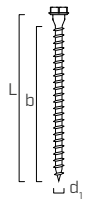
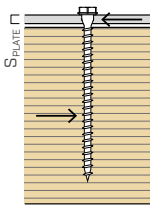
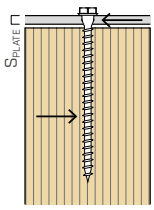
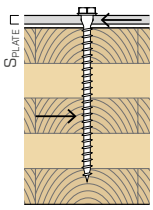
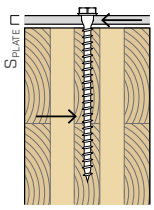
STRENGTH VALUES
CSA O86:24

geometry				TENSION[1]												steel tension
				thread withdrawal α = 90°				thread withdrawal α = 45°				end grain α = 0°				
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
				G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
11 *0.44*	60	*2 3/8*	50	2,62	3,03	3,43	3,76	2,38	2,76	3,12	3,42	1,31	1,52	1,72	1,88	23,17
	80	*3 1/8*	70	3,97	4,59	5,19	5,69	3,61	4,17	4,72	5,18	1,98	2,29	2,60	2,85	
	100	*4*	90	5,31	6,14	6,95	7,62	4,83	5,59	6,32	6,93	2,65	3,07	3,48	3,81	
	120	*4 3/4*	110	6,65	7,70	8,71	9,55	6,05	7,00	7,92	8,68	3,33	3,85	4,35	4,78	
	140	*5 1/2*	130	8,00	9,25	10,47	11,48	7,27	8,41	9,52	10,44	4,00	4,63	5,23	5,74	
	160	*6 1/4*	150	9,34	10,81	12,23	13,41	8,49	9,83	11,12	12,19	4,67	5,41	6,11	6,71	
	180	*7 1/8*	170	10,69	12,37	13,99	15,34	9,72	11,24	12,72	13,95	5,34	6,18	6,99	7,67	
	200	*8*	190	12,03	13,92	15,75	17,27	10,94	12,66	14,32	15,70	6,02	6,96	7,87	8,64	
	240	*9 1/2*	230	14,72	17,03	19,27	21,13	13,38	15,48	17,52	19,21	7,36	8,52	9,63	10,57	
	280	*11*	270	17,41	20,14	22,79	24,99	15,83	18,31	20,71	22,72	8,70	10,07	11,39	12,50	

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 214.

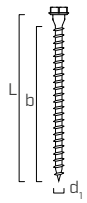
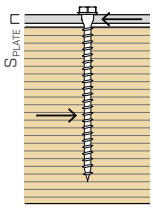
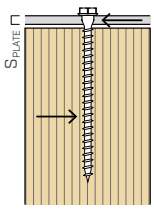
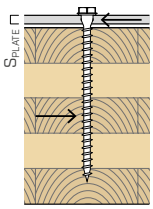
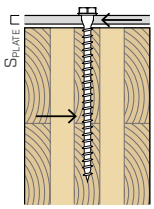
SHEAR[4]

geometry				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-CLT α = 90°				steel-to-CLT α = 0°			
																			
d_1	L		S_{PLATE}	factored lateral resistance N_r				factored lateral resistance P_{rw}[2]				factored lateral resistance N_r				factored lateral resistance P_{rw}[2]			
				G				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	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		3,22	3,65	4,07	4,42	1,70	1,98	2,19	2,36	3,05	3,46	3,85	4,18	1,53	1,84	2,08	2,24
	80	*3 1/8*		3,86	4,40	4,93	5,38	2,04	2,31	2,58	2,79	3,65	4,17	4,67	5,09	1,94	2,20	2,45	2,65
	100	*4*		4,49	5,15	5,78	6,19	2,33	2,65	2,96	3,22	4,26	4,88	5,49	5,97	2,22	2,52	2,82	3,06
	120	*4 3/4*		5,09	5,67	6,22	6,67	2,62	2,99	3,35	3,65	4,87	5,48	6,02	6,45	2,49	2,85	3,19	3,47
	140	*5 1/2*	3,2 *1/8*	5,42	6,06	6,66	7,15	2,91	3,33	3,74	4,08	5,25	5,87	6,46	6,94	2,77	3,17	3,56	3,89
	160	*6 1/4*		5,76	6,45	7,10	7,64	3,19	3,67	4,09	4,39	5,58	6,26	6,90	7,42	3,04	3,49	3,93	4,26
	180	*7 1/8*		6,09	6,84	7,54	8,12	3,48	3,92	4,31	4,64	5,92	6,65	7,34	7,90	3,32	3,80	4,18	4,50
	200	*8*		6,43	7,23	7,98	8,56	3,67	4,12	4,53	4,88	6,26	7,04	7,68	8,13	3,56	3,99	4,40	4,74
	240	*9 1/2*		6,85	7,49	8,09	8,56	4,01	4,50	4,97	5,36	6,50	7,11	7,68	8,13	3,90	4,38	4,84	5,16
	280	*11*		6,85	7,49	8,09	8,56	4,34	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16
	60	*2 3/8*		3,17	3,60	4,01	4,35	1,61	1,93	2,16	2,33	3,00	3,41	3,79	4,11	1,45	1,74	2,03	2,21
	80	*3 1/8*		3,81	4,35	4,87	5,30	2,02	2,29	2,55	2,76	3,61	4,12	4,61	5,02	1,92	2,18	2,42	2,63
	100	*4*		4,44	5,10	5,73	6,19	2,31	2,63	2,94	3,19	4,22	4,83	5,43	5,93	2,20	2,50	2,79	3,04
	120	*4 3/4*		5,08	5,67	6,22	6,67	2,60	2,97	3,33	3,62	4,82	5,48	6,02	6,45	2,47	2,83	3,17	3,45
	140	*5 1/2*	6,4 *1/4*	5,42	6,06	6,66	7,15	2,89	3,31	3,71	4,05	5,25	5,87	6,46	6,94	2,75	3,15	3,54	3,86
	160	*6 1/4*		5,76	6,45	7,10	7,64	3,17	3,65	4,09	4,39	5,58	6,26	6,90	7,42	3,03	3,47	3,91	4,26
	180	*7 1/8*		6,09	6,84	7,54	8,12	3,46	3,92	4,31	4,64	5,92	6,65	7,34	7,90	3,30	3,80	4,18	4,50
	200	*8*		6,43	7,23	7,98	8,56	3,67	4,12	4,53	4,88	6,26	7,04	7,68	8,13	3,56	3,99	4,40	4,74
	240	*9 1/2*		6,85	7,49	8,09	8,56	4,01	4,50	4,97	5,36	6,50	7,11	7,68	8,13	3,90	4,38	4,84	5,16
11	280	*11*		6,85	7,49	8,09	8,56	4,34	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16
0.44	60	*2 3/8*		3,12	3,54	3,94	4,27	1,51	1,82	2,12	2,31	2,96	3,35	3,73	4,04	1,36	1,64	1,91	2,14
	80	*3 1/8*		3,76	4,29	4,80	5,23	2,00	2,27	2,52	2,73	3,57	4,07	4,55	4,95	1,90	2,16	2,40	2,60
	100	*4*		4,40	5,04	5,66	6,18	2,29	2,61	2,91	3,16	4,17	4,78	5,37	5,86	2,18	2,48	2,77	3,01
	120	*4 3/4*		5,03	5,67	6,22	6,67	2,58	2,95	3,30	3,59	4,78	5,48	6,02	6,45	2,46	2,81	3,14	3,42
	140	*5 1/2*	9,5 *3/8*	5,42	6,06	6,66	7,15	2,87	3,28	3,69	4,02	5,25	5,87	6,46	6,94	2,73	3,13	3,51	3,83
	160	*6 1/4*		5,76	6,45	7,10	7,64	3,16	3,62	4,08	4,39	5,58	6,26	6,90	7,42	3,01	3,45	3,88	4,24
	180	*7 1/8*		6,09	6,84	7,54	8,12	3,44	3,92	4,31	4,64	5,92	6,65	7,34	7,90	3,29	3,78	4,18	4,50
	200	*8*		6,43	7,23	7,98	8,56	3,67	4,12	4,53	4,88	6,26	7,04	7,68	8,13	3,56	3,99	4,40	4,74
	240	*9 1/2*		6,85	7,49	8,09	8,56	4,01	4,50	4,97	5,36	6,50	7,11	7,68	8,13	3,90	4,38	4,84	5,16
	280	*11*		6,85	7,49	8,09	8,56	4,34	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16
	60	*2 3/8*		3,03	3,43	3,81	4,13	1,42	1,70	1,99	2,23	2,87	3,25	3,61	3,91	1,28	1,53	1,79	2,01
	80	*3 1/8*		3,67	4,18	4,67	5,09	1,96	2,22	2,47	2,67	3,48	3,96	4,43	4,82	1,82	2,11	2,35	2,54
	100	*4*		4,30	4,93	5,53	6,04	2,25	2,56	2,86	3,10	4,09	4,68	5,25	5,73	2,14	2,43	2,72	2,95
	120	*4 3/4*		4,94	5,62	6,16	6,61	2,54	2,90	3,24	3,53	4,69	5,39	5,96	6,39	2,42	2,76	3,09	3,36
	140	*5 1/2*	12,7 *1/2*	5,38	6,01	6,60	7,09	2,83	3,24	3,63	3,96	5,20	5,82	6,40	6,87	2,69	3,08	3,46	3,77
	160	*6 1/4*		5,71	6,40	7,04	7,57	3,11	3,57	4,02	4,36	5,54	6,21	6,84	7,35	2,97	3,41	3,83	4,18
	180	*7 1/8*		6,05	6,79	7,48	8,05	3,40	3,90	4,28	4,60	5,87	6,60	7,28	7,84	3,25	3,73	4,15	4,46
	200	*8*		6,39	7,17	7,92	8,54	3,65	4,09	4,50	4,84	6,21	6,98	7,68	8,13	3,52	3,97	4,37	4,71
	240	*9 1/2*		6,85	7,49	8,09	8,56	3,99	4,48	4,94	5,33	6,50	7,11	7,68	8,13	3,88	4,36	4,81	5,16
	280	*11*		6,85	7,49	8,09	8,56	4,32	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 214.

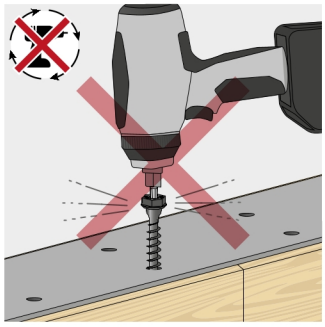
SHEAR[4]

geometry				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-CLT α = 90°				steel-to-CLT α = 0°			
																			
d_1	L		S_{PLATE}	factored lateral resistance N_r				factored lateral resistance P_{rw}[2]				factored lateral resistance N_r				factored lateral resistance P_{rw}[2]			
				G				G				G				G			
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
				[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	2 3/8		2,93	3,31	3,68	3,98	1,32	1,59	1,85	2,08	2,78	3,14	3,48	3,77	1,19	1,43	1,67	1,87
	80	*3 1/8*		3,57	4,06	4,54	4,93	1,92	2,17	2,41	2,60	3,38	3,85	4,30	4,67	1,73	2,06	2,29	2,47
	100	*4*		4,20	4,81	5,40	5,89	2,20	2,50	2,79	3,03	3,99	4,56	5,12	5,58	2,10	2,38	2,66	2,89
	120	*4 3/4*		4,84	5,56	6,09	6,53	2,49	2,84	3,18	3,46	4,59	5,28	5,89	6,31	2,37	2,71	3,03	3,30
	140	*5 1/2*	15,9	5,32	5,95	6,53	7,01	2,78	3,18	3,57	3,89	5,15	5,76	6,33	6,79	2,65	3,03	3,40	3,71
	160	*6 1/4*	*5/8*	5,66	6,34	6,97	7,49	3,07	3,52	3,96	4,32	5,49	6,14	6,77	7,28	2,93	3,36	3,77	4,12
	180	*7 1/8*		6,00	6,72	7,41	7,98	3,36	3,86	4,25	4,56	5,82	6,53	7,21	7,76	3,20	3,68	4,12	4,43
	200	*8*		6,33	7,11	7,85	8,46	3,62	4,06	4,47	4,81	6,16	6,92	7,65	8,13	3,48	3,94	4,34	4,67
	240	*9 1/2*		6,85	7,49	8,09	8,56	3,96	4,45	4,91	5,29	6,50	7,11	7,68	8,13	3,85	4,33	4,78	5,15
	280	*11*		6,85	7,49	8,09	8,56	4,30	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16
	60	2 3/8		2,83	3,19	3,54	3,83	1,23	1,47	1,72	1,93	2,68	3,02	3,35	3,62	1,11	1,33	1,55	1,74
	80	*3 1/8*		3,47	3,94	4,40	4,78	1,83	2,11	2,34	2,54	3,29	3,74	4,17	4,53	1,65	1,97	2,23	2,41
	100	*4*		4,10	4,69	5,26	5,74	2,16	2,45	2,73	2,97	3,89	4,45	4,99	5,44	2,05	2,33	2,60	2,82
	120	*4 3/4*		4,74	5,44	6,02	6,45	2,45	2,79	3,12	3,40	4,50	5,16	5,81	6,23	2,33	2,66	2,97	3,23
11	140	*5 1/2*	19,4	5,27	5,88	6,46	6,93	2,73	3,13	3,51	3,83	5,10	5,69	6,26	6,72	2,61	2,98	3,34	3,64
0.44	160	*6 1/4*	*3/4*	5,61	6,27	6,90	7,42	3,02	3,47	3,90	4,26	5,43	6,08	6,70	7,20	2,88	3,30	3,71	4,05
	180	*7 1/8*		5,94	6,66	7,34	7,90	3,31	3,80	4,21	4,53	5,77	6,47	7,14	7,68	3,16	3,63	4,08	4,39
	200	*8*		6,28	7,05	7,78	8,38	3,60	4,03	4,43	4,77	6,10	6,86	7,58	8,13	3,43	3,91	4,30	4,63
	240	*9 1/2*		6,85	7,49	8,09	8,56	3,93	4,42	4,87	5,25	6,50	7,11	7,68	8,13	3,82	4,30	4,74	5,11
	280	*11*		6,85	7,49	8,09	8,56	4,27	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16
	60	2 3/8		2,73	3,07	3,40	3,68	1,13	1,36	1,59	1,78	2,55	2,91	3,22	3,48	1,02	1,22	1,43	1,60
	80	*3 1/8*		3,36	3,82	4,26	4,63	1,73	2,06	2,28	2,47	3,19	3,62	4,04	4,39	1,56	1,87	2,17	2,34
	100	*4*		4,00	4,57	5,12	5,59	2,11	2,40	2,67	2,90	3,80	4,34	4,86	5,29	2,01	2,28	2,54	2,75
	120	*4 3/4*		4,64	5,32	5,95	6,38	2,40	2,74	3,06	3,33	4,40	5,05	5,68	6,16	2,29	2,60	2,91	3,17
	140	*5 1/2*	22,2	5,22	5,82	6,39	6,86	2,69	3,07	3,45	3,76	5,01	5,63	6,19	6,64	2,56	2,93	3,28	3,58
	160	*6 1/4*	*7/8*	5,55	6,21	6,83	7,34	2,98	3,41	3,83	4,19	5,38	6,02	6,63	7,12	2,84	3,25	3,65	3,99
	180	*7 1/8*		5,89	6,60	7,27	7,82	3,26	3,75	4,18	4,49	5,71	6,41	7,07	7,61	3,11	3,58	4,02	4,35
	200	*8*		6,23	6,99	7,71	8,31	3,55	4,00	4,40	4,73	6,05	6,80	7,51	8,09	3,39	3,88	4,27	4,59
	240	*9 1/2*		6,85	7,49	8,09	8,56	3,91	4,39	4,84	5,21	6,50	7,11	7,68	8,13	3,80	4,26	4,71	5,07
	280	*11*		6,85	7,49	8,09	8,56	4,24	4,75	5,13	5,43	6,50	7,11	7,68	8,13	4,12	4,51	4,87	5,16

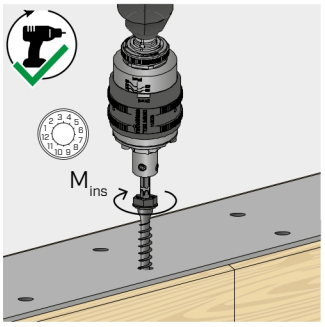
α = screw-to-grain angle

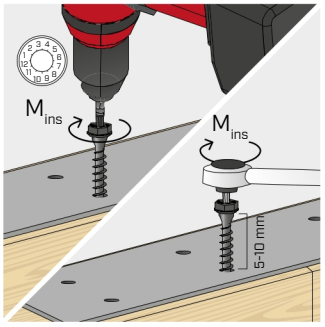
NOTES and **GENERAL PRINCIPLES** on page 214.

INSTALLATION



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

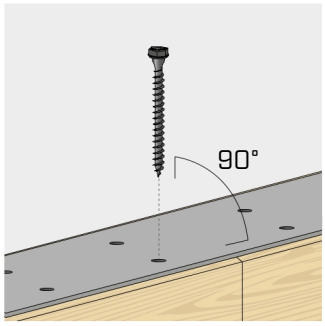




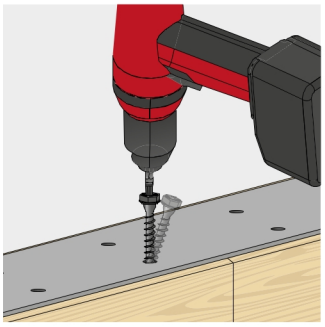
Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

VGSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø11	11	30

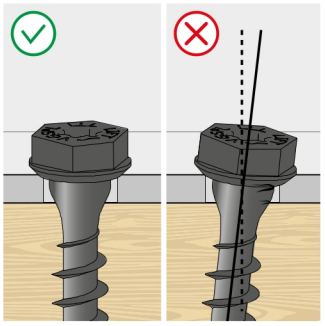
VGSPL	*d_1 [in]*	*$M_{ins,rec}$ [ft·lbs]*
Ø11	*0.44*	*22*



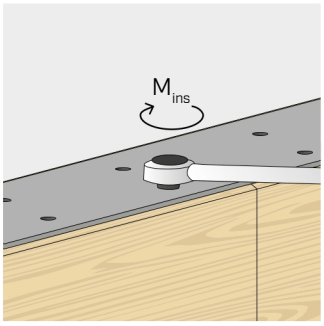
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



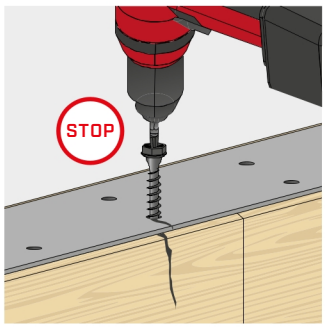
Avoid bending.



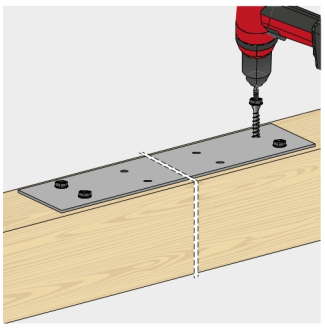
Ensure full contact between the entire surface of the screw head and the metal element.



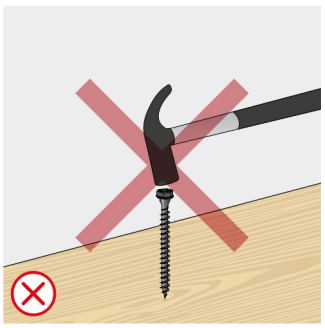
After installation, the fasteners can be inspected using a torque wrench.



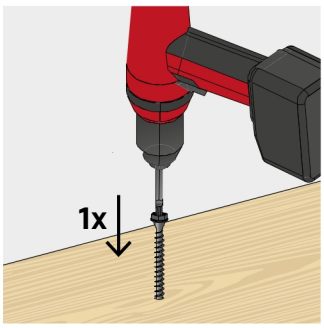
Stop installation if damage to the fastener, timber or metal plates is noticed.



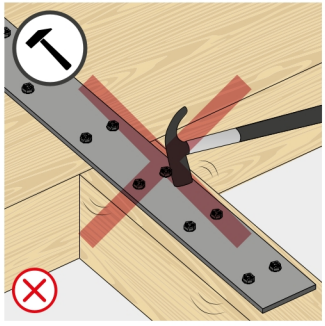
Install the connector assembly by following an installation sequence that ensures uniform tightening of all components.



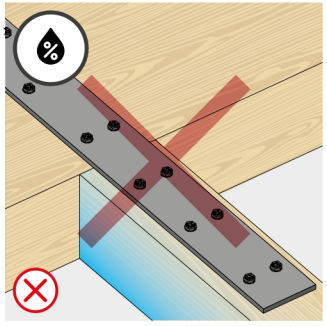
Do not hammer the screw tips into the timber.



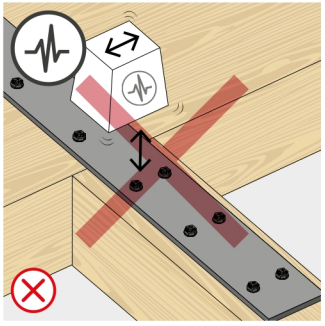
Install screws in one continuous stroke.



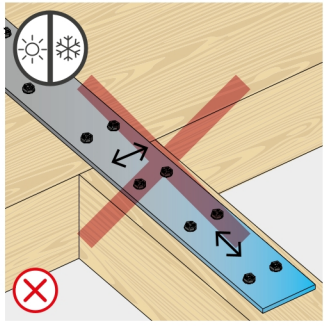
Avoid accidental stress during installation.



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



Use not permitted for dynamic loads.

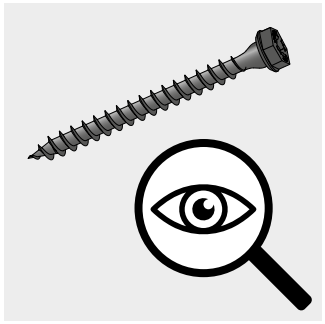


Avoid dimensional changes to the metal.

REUSE CRITERIA | LIFTING SCREW

These provisions apply to all lifting screws prior to reuse. Reuse is permitted only if all checks are successfully passed.

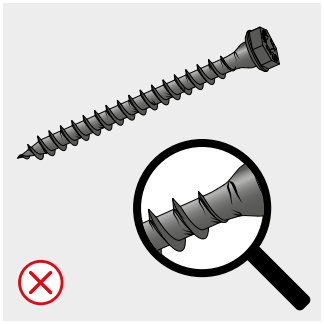
VISUAL INSPECTION



Carefully inspect the condition of the VGS PLATE.



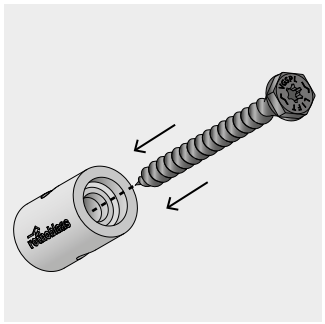


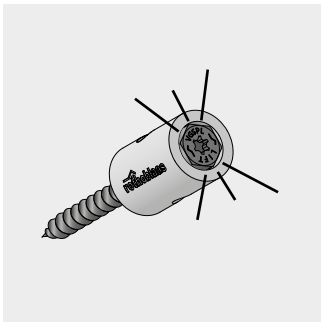


The screw must be fully intact, with no signs of corrosion, coating discontinuity, bending or damage of any kind.

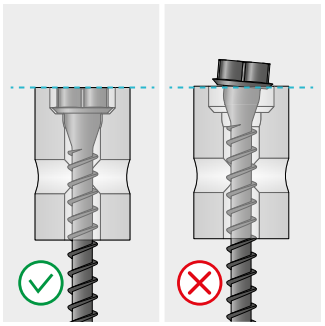
INSPECTIONS WITH JIG REUSE

STRAIGHTNESS (ABSENCE OF PLASTIC DEFORMATION)

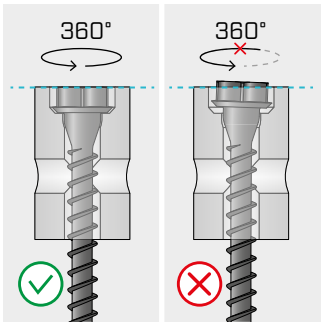




Insert the VGS PLATE into the main bore of the JIG REUSE jig until the head sits firmly against the jig.

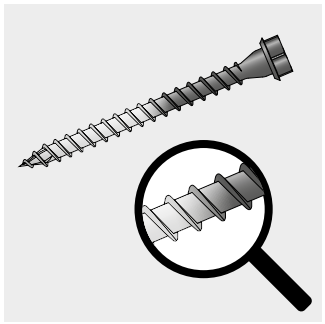


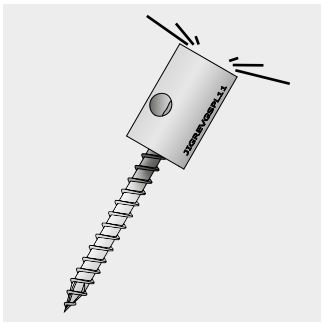
The screw head must be fully seated within the jig.



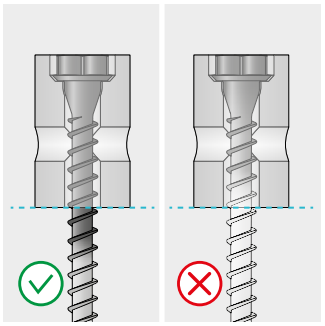
When inserted in the jig, the screw must rotate freely while the head remains fully seated.

NUMBER OF USES

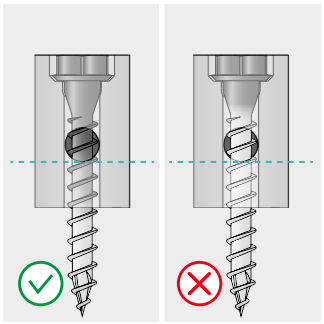




Identify the coating transition zone (wear area) on the VGS PLATE. Carry out this check with the jig and the VGS PLATE in exactly the same position as in the previous inspection.

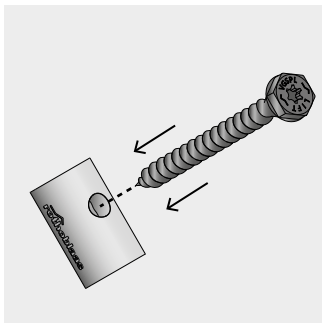


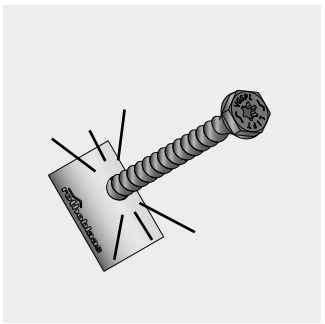
The wear area must remain completely outside the body of the JIG REUSE.



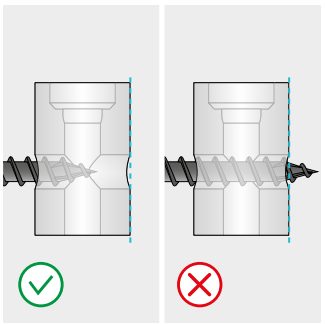
For screws with L ≤ 80 mm, the wear area must be located below the side bore of the JIG REUSE.

THREAD WEAR



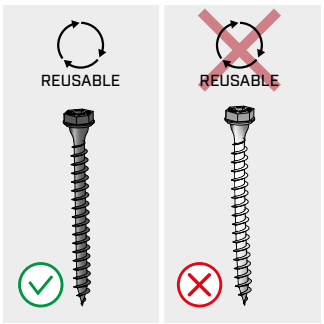


Insert the VGS PLATE into the side bore of the JIG REUSE as deeply as possible.



The tip of the screw must not protrude from the jig.

DISPOSAL



Discard the screw if any one of the above criteria is not met.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Withdrawal values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing the screw tensile capacity and thread withdrawal - the minimum of the two governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_1$) or the main member ($8d_1$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- VGS PLATE screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) VGS PLATE screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

INSTALLATION INSTRUCTIONS AND REUSE CRITERIA

The full installation instructions and the reuse guidelines are available at www.rothoblaas.com



REUSE OF LIFTING CONNECTORS

The extensive experimental campaign carried out in collaboration with universities and research institutions has enabled the characterisation of screw behaviour in lifting systems, with a particular focus on safety, sustainability and innovation.

COMPLETE SCIENTIFIC REPORT
available at
www.rothoblaas.com


rothoblaas

VGU

45° WASHER FOR VGS

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030

SAFETY
The VGU washer makes possible to install VGS screws at a 45° angle on steel plates. Washer head assessed in ELC-4645 listing report.

PRACTICALITY
The ergonomic shape ensures a firm, precise grip during installation. Three versions of washer, compatible with VGS in diameter 9, 11 and 13 mm, are available for plates of variable thickness.
The use of the VGU allows the use of inclined screws on plate without resorting to countersunk holes on the plate, which is generally a time-consuming and costly operation.

C4 EVO COATING
VGU EVO is coated with a surface treatment resistant to high atmospheric corrosivity. Compatible with VGS EVO diameter 9, 11 and 13 mm.



VGU



VGU EVO

CANADIAN DESIGN VALUES
USA, EU and more design values available online.

VIDEO MANUALS

DIAMETER [mm] 9 | **9** | **13** | 15

MATERIAL

VGU WASHER

Zn ELECTRO PLATED electrogalvanized carbon steel

EC1 DRY C2 T2

VGU EVO WASHER

C4 EVO COATING carbon steel with C4 EVO coating

EC1 EC3 C4 T3

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,rec}$

VIDEO
Scan the QR Code and watch the video on our YouTube channel



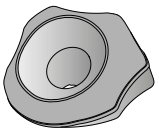
FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods
- steel construction
- metal plates and profiles

CODES AND DIMENSIONS

VGU WASHER

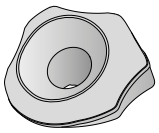
CODE	screw [mm]	$d_{V,S}$ [mm]	pcs
VGU945	VGS Ø9	5	25
VGU1145	VGS Ø11	6	25
VGU1345	VGS Ø13	8	25



$d_{V,S}$ = pre-drilling hole diameter (G< 0.55).

VGU EVO WASHER

CODE	screw [mm]	$d_{V,S}$ [mm]	pcs
VGUEVO945	VGSEVO Ø9	5	25
VGUEVO1145	VGSEVO Ø11	6	25
VGUEVO1345	VGSEVO Ø13	8	25



$d_{V,S}$ = pre-drilling hole diameter (G< 0.55).

JIG VGU TEMPLATE

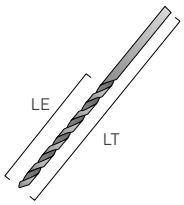
CODE	washer [mm]	d_h [mm]	d_V [mm]	pcs
JIGVGU945	VGU945	5,5	5	1
JIGVGU1145	VGU1145	6,5	6	1
JIGVGU1345	VGU1345	8,5	8	1



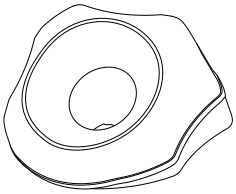
See www.rothoblaas.com for the technical data sheet.

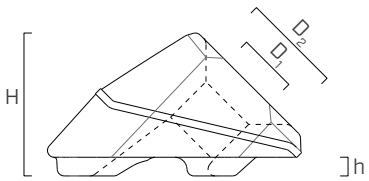
HSS WOOD DRILL BIT

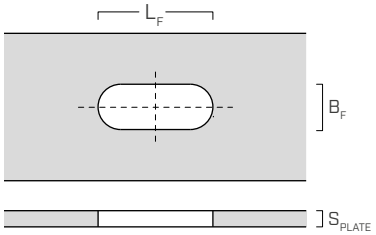
CODE	d_V [mm]	TL [mm]	SL [mm]	pcs
F1599105	5	150	100	1
F1599106	6	150	100	1
F1599108	8	150	100	1



GEOMETRY

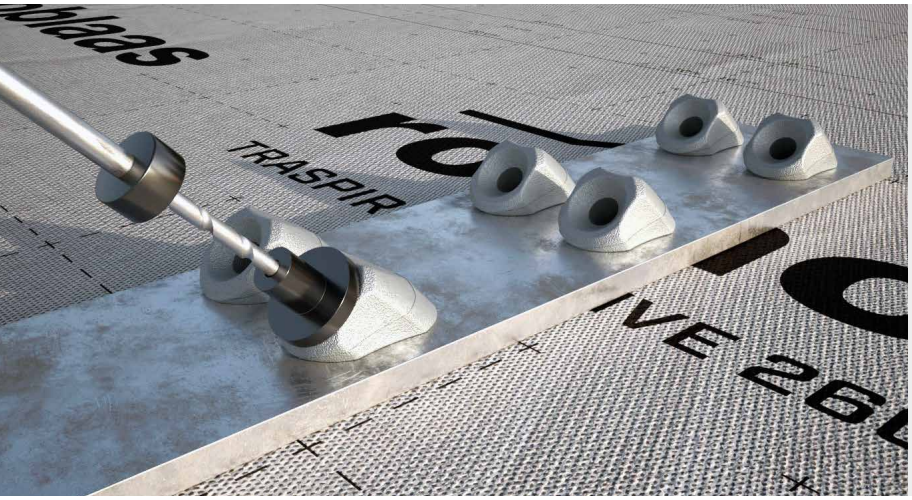






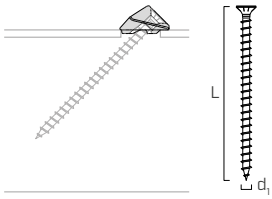
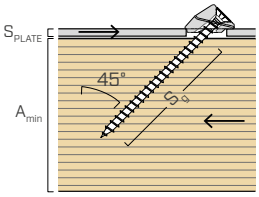
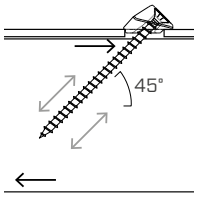
Washer			VGU945 VGUEVO945	VGU1145 VGUEVO1145	VGU1345 VGUEVO1345
VGS screw diameter	d_1	[mm]	9,0	11,0	13,0
VGS screw pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	8,0
Internal diameter	D_1	[mm]	9,70	11,80	14,00
External diameter	D_2	[mm]	19,00	23,00	27,40
Base height	h	[mm]	3,00	3,60	4,30
Global height	H	[mm]	23,00	28,00	33,00
Slotted-hole length	L_F	[mm]	33,0 ÷ 34,0	41,0 ÷ 42,0	49,0 ÷ 50,0
Slotted-hole width	B_F	[mm]	14,0 ÷ 15,0	17,0 ÷ 18,0	20,0 ÷ 21,0
Steel plate thickness(2)	S_{PLATE}	[mm]	3,2 ÷ 12,7	4,8 ÷ 14,3	4,8 ÷ 14,3

(1) Pre-drilling valid for wood with G< 0.55.
(2) For thicker plates than those indicated in the table it is necessary to carry out a countersink in the lower part of the steel plate. Recommended Ø5 mm guide hole (of minimum length 50 mm) for VGS screws of length L > 300 mm.



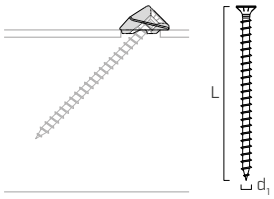
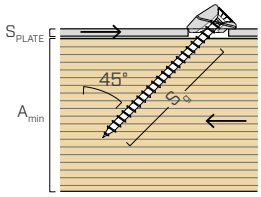
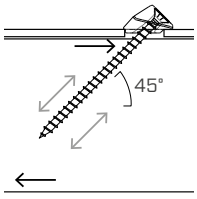
HELPS WITH INSTALLATION

The JIG VGU template makes it easy to prepare a 45° angle pre-drill, thus facilitating subsequent tightening of the VGS screws inside the washer. A pre-drill length of at least 20 mm is recommended.

SLIDING[1][2]										
geometry				steel-to-timber					steel tension	
										
VGS/VGS EVO							factored lateral resistance N_r[4]			factored tension resistance T_{rs}[5]
VGU VGU EVO	d_1	L		S_{PLATE}	S_g	A_{min}[3]	G 0.35	G 0.42	G 0.49	G 0.55	
	[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]
VGU945 VGUEVO945	9 *0.36*	100	*4*	3,2 *1/8*	70	70	2,97	3,44	3,89	4,26	12,61
		120	*4 3/4*		90	85	3,82	4,42	5,00	5,48	
		140	*5 1/2*		110	100	4,67	5,40	6,11	6,70	
		160	*6 1/4*		130	115	5,51	6,38	7,22	7,92	
		180	*7 1/8*		150	125	6,36	7,36	8,33	9,14	
		200	*8*		170	140	7,21	8,34	9,44	10,35	
		220	*8 5/8*		190	155	8,06	9,33	10,55	11,57	
		240	*9 1/2*		210	170	8,91	10,31	11,66	12,79	
		260	*10 1/4*		230	185	9,76	11,29	12,77	14,01	
		280	*11*		250	200	10,61	12,27	13,88	15,23	
		300	*11 3/4*		270	210	11,45	13,25	14,99	16,45	
		320	*12 5/8*		290	225	12,30	14,23	16,10	17,66	
		340	*13 3/8*		310	240	13,15	15,22	17,21	18,88	
		360	*14 1/4*		330	255	14,00	16,20	18,32	20,10	
		380	*15*		350	270	14,85	17,18	19,43	21,32	
		400	*15 3/4*		370	285	15,70	18,16	20,54	22,54	
		440	*17 1/4*		410	310	17,39	20,12	22,76	24,97	
		480	*19*		450	340	19,09	22,09	24,98	27,41	
		520	*20 1/2*		490	370	20,79	24,05	27,20	29,85	
		560	*22*		530	395	22,48	26,01	29,42	32,28	
		600	*23 5/8*		570	425	24,18	27,98	31,64	34,72	
		100	*4*	12,7 *1/2*	55	60	2,33	2,70	3,05	3,35	
		120	*4 3/4*		75	75	3,18	3,68	4,16	4,57	
		140	*5 1/2*		95	90	4,03	4,66	5,27	5,79	
		160	*6 1/4*		115	105	4,88	5,64	6,38	7,00	
		180	*7 1/8*		135	115	5,73	6,63	7,49	8,22	
		200	*8*		155	130	6,58	7,61	8,60	9,44	
		220	*8 5/8*		175	145	7,42	8,59	9,71	10,66	
		240	*9 1/2*		195	160	8,27	9,57	10,82	11,88	
		260	*10 1/4*		215	175	9,12	10,55	11,93	13,10	
		280	*11*		235	190	9,97	11,53	13,04	14,31	
		300	*11 3/4*		255	200	10,82	12,52	14,15	15,53	
		320	*12 5/8*		275	215	11,67	13,50	15,27	16,75	
		340	*13 3/8*		295	230	12,51	14,48	16,38	17,97	
		360	*14 1/4*		315	245	13,36	15,46	17,49	19,19	
		380	*15*		335	260	14,21	16,44	18,60	20,40	
		400	*15 3/4*		355	270	15,06	17,42	19,71	21,62	
		440	*17 1/4*		395	300	16,76	19,39	21,93	24,06	
		480	*19*		435	330	18,45	21,35	24,15	26,50	
		520	*20 1/2*		475	355	20,15	23,31	26,37	28,93	
		560	*22*		515	385	21,85	25,28	28,59	31,37	
		600	*23 5/8*		555	415	23,54	27,24	30,81	33,80	

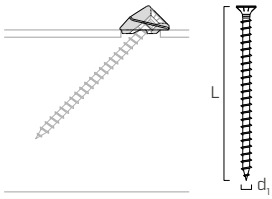
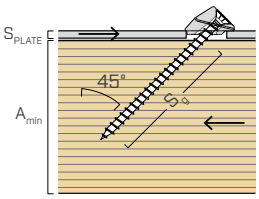
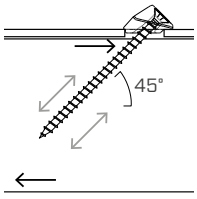
NOTES and GENERAL PRINCIPLES on page 220.

SLIDING[1][2]

geometry				steel-to-timber						steel tension
										
VGS/VGS EVO							factored lateral resistance N_r[4]			factored tension resistance T_{rs}[5]
							G			
VGU VGU EVO	d_1	L		S_{PLATE}	S_g	A_{min}[3]	0.35	0.42	0.49	0.55
	[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
VGU1145 VGUEVO1145	11 *0.44*	80	*3 1/8*	4,8 *3/16*	40	50	2,07	2,40	2,71	2,98
		100	*4*		60	65	3,11	3,60	4,07	4,47
		125	*4 15/16*		85	85	4,41	5,10	5,77	6,33
		150	*6*		110	100	5,70	6,60	7,47	8,19
		175	*6 7/8*		135	120	7,00	8,10	9,16	10,05
		200	*8*		160	135	8,30	9,60	10,86	11,91
		225	*8 7/8*		185	155	9,59	11,10	12,56	13,78
		250	*10*		210	170	10,89	12,60	14,25	15,64
		275	*10 7/8*		235	190	12,18	14,10	15,95	17,50
		300	*11 3/4*		260	205	13,48	15,60	17,65	19,36
		325	*12 3/4*		285	225	14,78	17,10	19,34	21,22
		350	*13 3/4*		310	240	16,07	18,60	21,04	23,08
		375	*14 3/4*		335	260	17,37	20,10	22,74	24,94
		400	*15 3/4*		360	275	18,67	21,60	24,43	26,81
		425	*16 3/4*		385	295	19,96	23,10	26,13	28,67
		450	*17 3/4*		410	315	21,26	24,60	27,83	30,53
		475	*18 11/16*		435	330	22,55	26,10	29,53	32,39
		500	*19 3/4*		460	350	23,85	27,60	31,22	34,25
		525	*20 11/16*		485	365	25,15	29,10	32,92	36,11
		550	*21 5/8*		510	385	26,44	30,60	34,62	37,98
		575	*22 5/8*		535	400	27,74	32,10	36,31	39,84
		600	*23 5/8*		560	420	29,03	33,59	38,01	41,70
		80	*3 1/8*	14,3 *9/16*	25	40	1,30	1,50	1,70	1,86
		100	*4*		45	55	2,33	2,70	3,05	3,35
		125	*4 15/16*		70	70	3,63	4,20	4,75	5,21
		150	*6*		95	90	4,93	5,70	6,45	7,07
		175	*6 7/8*		120	110	6,22	7,20	8,14	8,94
		200	*8*		145	125	7,52	8,70	9,84	10,80
		225	*8 7/8*		170	145	8,81	10,20	11,54	12,66
		250	*10*		195	160	10,11	11,70	13,24	14,52
		275	*10 7/8*		220	180	11,41	13,20	14,93	16,38
		300	*11 3/4*		245	195	12,70	14,70	16,63	18,24
		325	*12 3/4*		270	215	14,00	16,20	18,33	20,10
		350	*13 3/4*		295	230	15,30	17,70	20,02	21,97
		375	*14 3/4*		320	250	16,59	19,20	21,72	23,83
		400	*15 3/4*		345	265	17,89	20,70	23,42	25,69
		425	*16 3/4*		370	285	19,18	22,20	25,11	27,55
		450	*17 3/4*		395	300	20,48	23,70	26,81	29,41
		475	*18 11/16*		420	320	21,78	25,20	28,51	31,27
		500	*19 3/4*		445	335	23,07	26,70	30,20	33,14
		525	*20 11/16*		470	355	24,37	28,20	31,90	35,00
		550	*21 5/8*		495	375	25,66	29,70	33,60	36,86
		575	*22 5/8*		520	390	26,96	31,20	35,29	38,72
		600	*23 5/8*		545	410	28,26	32,70	36,99	40,58

16,38

NOTES and GENERAL PRINCIPLES on page 220.

SLIDING[1][2]										
geometry				steel-to-timber					steel tension	
										
VGS/VGS EVO							factored lateral resistance N_r[4]			factored tension resistance T_{rs}[5]
VGU VGU EVO	d_1 [mm] *[in]*	L [mm]	L *[in]*	S_{PLATE} [mm] *[in]*	S_g [mm]	A_{min}[3] [mm]	G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	[kN]
VGU1345 VGUEVO1345	13 *0.52*	80	*3 1/8*	4,8 *3/16*	35	50	2,15	2,49	2,81	3,08	22,60
		100	*4*		55	65	3,37	3,91	4,41	4,84	
		150	*6*		105	100	6,44	7,46	8,42	9,24	
		200	*8*		155	135	9,50	11,01	12,43	13,63	
		250	*10*		205	170	12,56	14,56	16,44	18,03	
		300	*11 3/4*		255	205	15,63	18,11	20,45	22,43	
		350	*13 3/4*		305	240	18,69	21,66	24,46	26,83	
		400	*15 3/4*		355	275	21,76	25,21	28,47	31,23	
		450	*17 3/4*		405	310	24,82	28,76	32,48	35,62	
		500	*19 3/4*		455	345	27,89	32,31	36,48	40,02	
		550	*21 5/8*		505	380	30,95	35,86	40,49	44,42	
		600	*23 5/8*		555	415	34,01	39,41	44,50	48,82	
		80	*3 1/8*	14,3 *9/16*	20	40	1,23	1,42	1,60	1,76	
		100	*4*		40	50	2,45	2,84	3,21	3,52	
		150	*6*		90	90	5,52	6,39	7,22	7,92	
		200	*8*		140	125	8,58	9,94	11,23	12,31	
		250	*10*		190	160	11,64	13,49	15,24	16,71	
		300	*11 3/4*		240	195	14,71	17,04	19,24	21,11	
		350	*13 3/4*		290	230	17,77	20,59	23,25	25,51	
		400	*15 3/4*		340	265	20,84	24,14	27,26	29,91	
		450	*17 3/4*		390	300	23,90	27,69	31,27	34,30	
		500	*19 3/4*		440	335	26,97	31,24	35,28	38,70	
		550	*21 5/8*		490	370	30,03	34,79	39,29	43,10	
		600	*23 5/8*		540	405	33,09	38,34	43,30	47,50	

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The factored thread withdrawal resistance were evaluated considering a penetration length of S_g, as shown in the table. For intermediate values of S_g it is possible to linearly interpolate.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- VGS screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA-O86 2024 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Check VGS INSTALLATION INSTRUCTIONS on Rothoblaas's website or inside the product box for the complete installation indications.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, (in millimeters), minus the tip length, L_{tip}.The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in Table 2C of the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_W, varies according to connection geometry.

(2) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(3) The fixable thickness (A) is calculated as the sum of the projected lengths of S_g and L_{tip}, plus an additional 15 mm.

(4) The 45° inclined screw is intended to work in withdrawal and the resulting resistance of the connection is given by the projection of the withdrawal resistance (along screw axis) onto the shear plane. For fully threaded screws, the head pull-through resistance is not relevant to the connection capacity; instead, thread withdrawal governs.

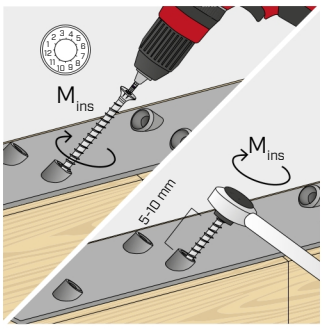
(5) Factored lateral resistance values (N_r) must be compared to the factored tension resistance of the screw (T_{rs}), with the lower value determining the governing resistance.

INSTALLATION INSTRUCTIONS

MANUALS

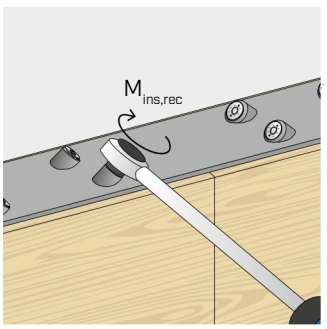


The use of pulse screw guns/impact wrenches is not permitted.

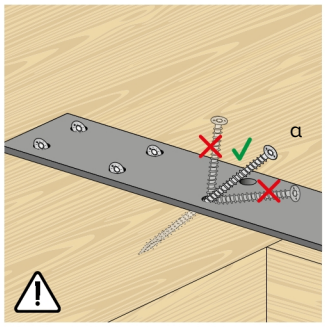


Ensure correct tightening. We recommend the use of torque-controlled screwdrivers, e.g. with **TORQUE LIMITER**. Alternatively, tighten with a torque wrench.

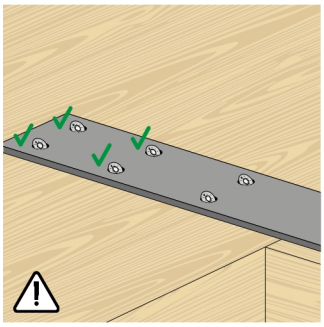
VGS	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø9	9	20
Ø11 L < 400 mm	11	30
Ø11 L ≥ 400 mm	11	40
Ø13	13	50



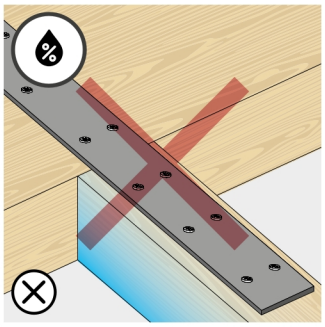
After installation, the fasteners can be inspected using a torque wrench.



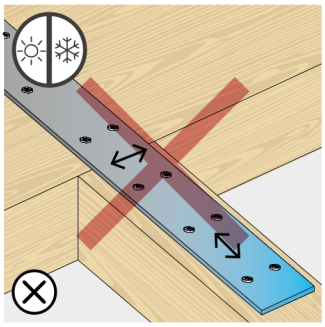
Avoid bending.



The installation of multiple screws must be performed to guarantee that loads are distributed evenly to all fasteners.

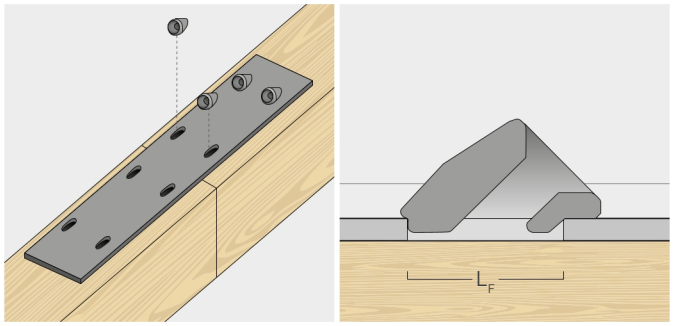


Shrinkage or swelling of timber elements due to changes in moisture content must be avoided.

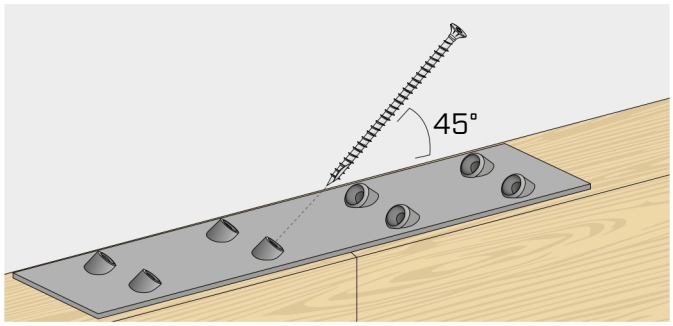


Avoid dimensional changes in the metal, e.g. due to large temperature fluctuations.

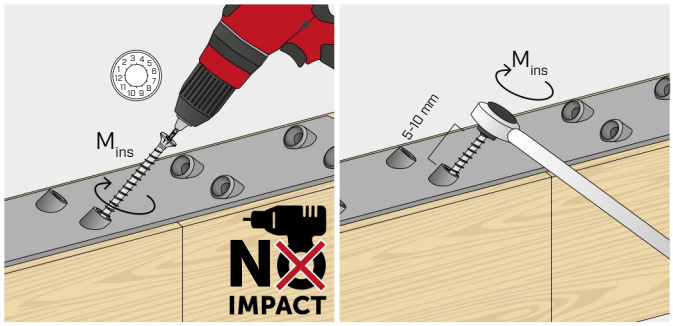
INSTALLATION WITHOUT PRE-DRILL



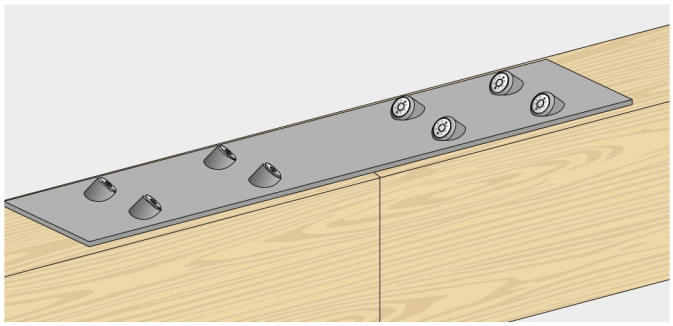
Place the steel plate on the wood and set the VGU washers in the slots provided.



Position the screw and respect the 45° angle of insertion.

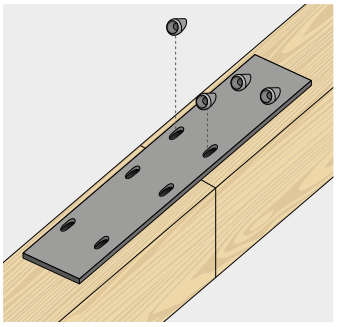


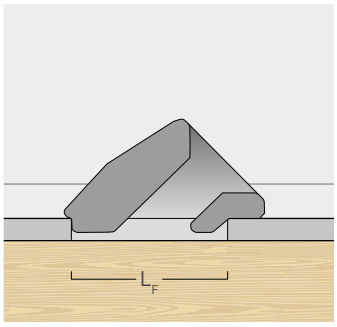
Screw in, ensuring correct tightening.



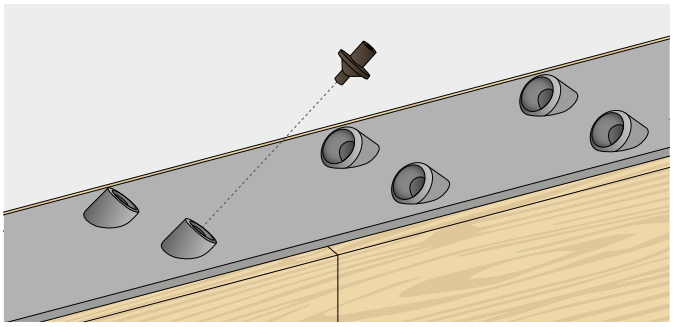
Perform the operation for all washers.
The assembly must be performed so as to guarantee that the stress is evenly distributed among all the installed VGU washers.

INSTALLATION WITH THE AID OF A PRE-DRILL TEMPLATE

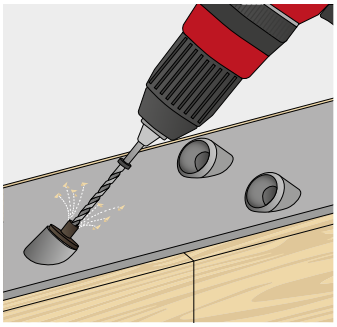


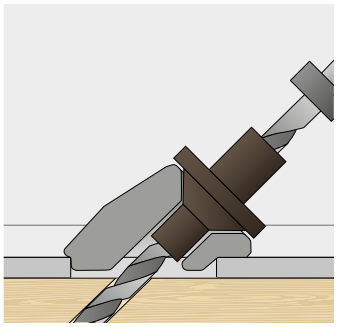


Place the steel plate on the wood and set the VGU washers in the slots provided.

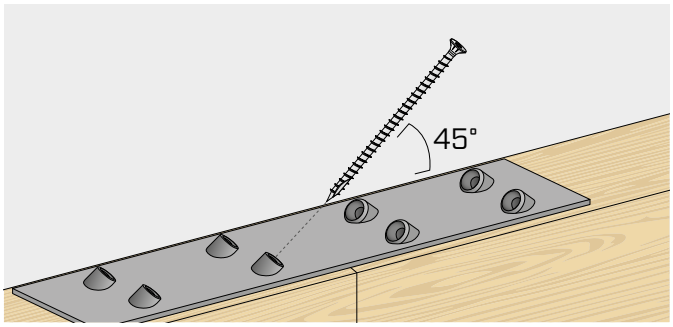


Use the VGU JIG template of the correct diameter by positioning it in the VGU washer

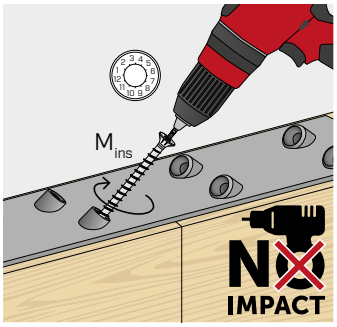


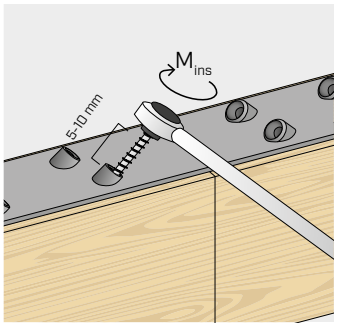


Using the pre-drill template, prepare a pre-drill/guide hole (at least 50 mm length) using an appropriate tip

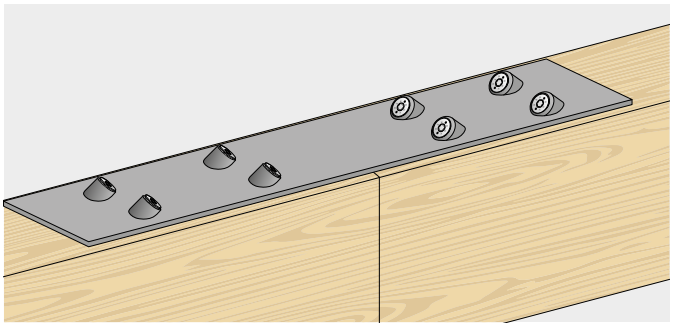


Position the screw and respect the 45° angle of insertion.



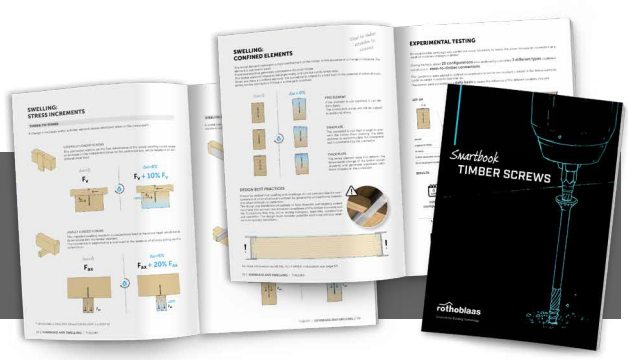


Screw in, ensuring correct tightening.



Perform the operation for all washers.
The assembly must be performed so as to guarantee that the stress is evenly distributed among all the installed VGU washers.

Theory, practice and experimental campaigns:
our experience is in your hands.
Download the SMARTBOOK TIMBER SCREWS.





HBS PLATE

PAN HEAD SCREW FOR PLATES

ELC-4645 ESR-4645 ETA-11/0030

NEW GEOMETRY

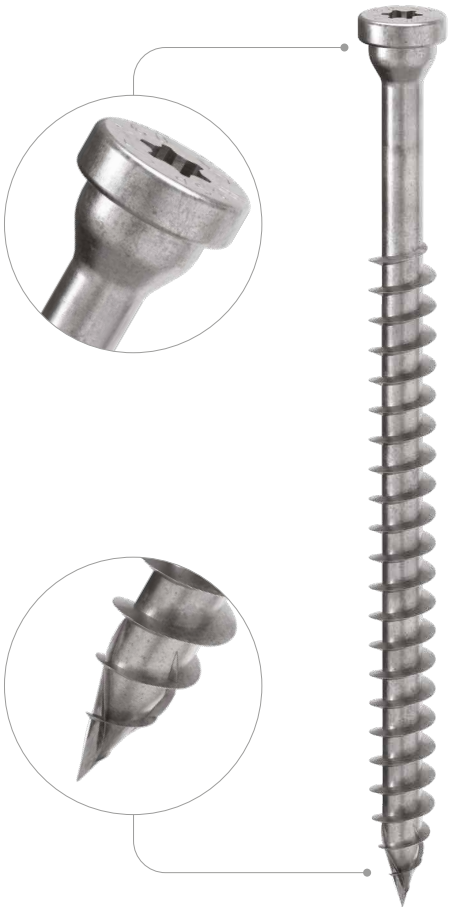
The inner core diameter of the Ø8, Ø10 and Ø12 mm screws has been increased to ensure higher performance in thick plate applications. In steel-timber connections, the new geometry achieves a strength increase of more than 15%.

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.

3 THORNS TIP

Thanks to the 3 THORNS tip, minimum installation distances are reduced. More screws can be used in less space and larger screws in smaller elements. Costs and time for project implementation are reduced.



MANUALS

BIT INCLUDED

DIAMETER [mm]	3	8 – 12	12
LENGTH [mm]	25	60 – 200	200
SERVICE CONDITION	EC1 DRY	
ATMOSPHERIC CORROSIVITY	C1 C2	
WOOD CORROSIVITY	T1 T2	
MATERIAL	Zn ELECTRO PLATED	electrogalvanized carbon steel
CORE HARDNESS	<390 HV	as required in CSA O86:24(1)

CANADIAN DESIGN VALUES

USA, EU and more design values available online.

METAL-to-TIMBER recommended use:

NO IMPACT

TORQUE LIMITER

$M_{ins,rec}$



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.





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.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
8 TX 40	HBSPL860	60	52	1 - 10	100
	HBSPL880	80	55	1 - 15	100
	HBSPL8100	100	75	1 - 15	100
	HBSPL8120	120	95	1 - 15	100
	HBSPL8140	140	110	1 - 20	100
	HBSPL8160	160	130	1 - 20	100
10 TX 40	HBSPL1080	80	60	1 - 10	50
	HBSPL10100	100	75	1 - 15	50
	HBSPL10120	120	95	1 - 15	50
	HBSPL10140	140	110	1 - 20	50
	HBSPL10160	160	130	1 - 20	50
	HBSPL10180	180	150	1 - 20	50

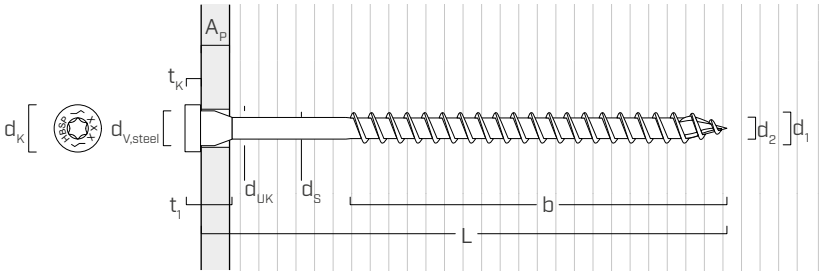
d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
12 TX 50	HBSPL12100	100	75	1 - 15	25
	HBSPL12120	120	90	1 - 20	25
	HBSPL12140	140	110	1 - 20	25
	HBSPL12160	160	120	1 - 30	25
	HBSPL12180	180	140	1 - 30	25
	HBSPL12200	200	160	1 - 30	25

RELATED PRODUCTS



TORQUE LIMITER
TORQUE LIMITER

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	d_1	[mm]	8	10	12
Head diameter	d_K	[mm]	13,50	16,50	18,50
Root diameter	d_2	[mm]	5,90	6,60	7,30
Shank diameter	d_S	[mm]	6,30	7,20	8,55
Head thickness	t_1	[mm]	13,50	16,50	19,50
Washer thickness	t_K	[mm]	4,50	5,00	5,50
Underhead diameter	d_{UK}	[mm]	10,00	12,00	13,00
Hole diameter on steel plate	$d_{V,steel}$	[mm]	11,0	13,0	14,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	7,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	6,0	7,0	8,0

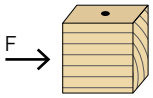
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		8	10	12
Factored tensile strength	Φf_u	[kN]		19,18	24,17	31,08
Bending yield strength	F_{yb}	[MPa]		1018	969	1060
Factored shear strength of the screw	Φv_s	[kN]		10,51	13,14	16,07
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	69,83	87,29	104,75
			G=0.42	80,80	101,00	121,20
			G=0.49	91,40	114,26	137,11
			G=0.55	100,25	125,32	150,38
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	1,13	1,59	1,92
			G=0.42	1,36	1,91	2,30
			G=0.49	1,58	2,23	2,69
			G=0.55	1,78	2,50	3,02

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

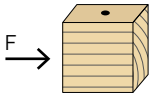
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	12·d‡	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
S_Q	5·d	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
a_L	15·d‡	120	*4 3/4*	150	*6*	180	*7 1/8*
a	10·d‡	80	*3 1/8*	100	*4*	120	*4 3/4*
e_Q	10·d	80	*3 1/8*	100	*4*	120	*4 3/4*
e_P	5·d	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*

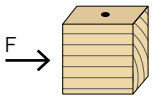
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



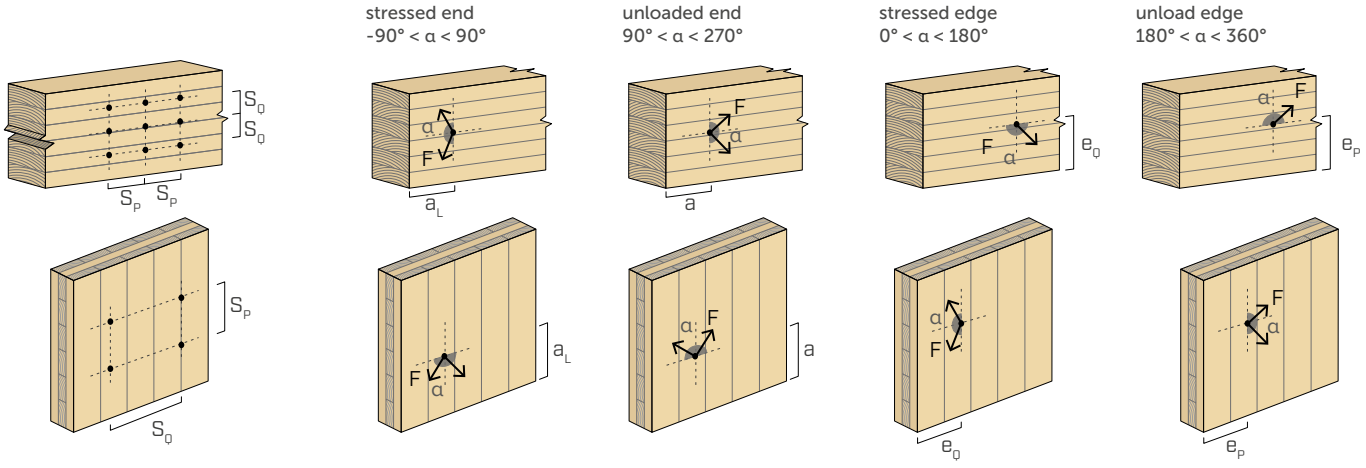
d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	18·d	144	*5 11/16*	180	*7 1/8*	216	*8 1/2*
S_Q	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
a_L	22·d	176	*6 15/16*	220	*8 5/8*	264	*10 3/8*
a	15·d	120	*4 3/4*	150	*6*	180	*7 1/8*
e_Q	12·d	96	*3 3/4*	120	*4 3/4*	*144*	*5 11/16*
e_P	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*

screws inserted **WITH pre-drilled hole**



d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	5·d†	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
S_Q	4·d	32	*1 1/4*	40	*1 9/16*	48	*1 7/8*
a_L	12·d†	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
a	7·d†	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_Q	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_P	3·d	24	*15/16*	30	*1 3/16*	36	*1 7/16*

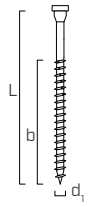
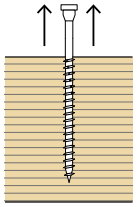
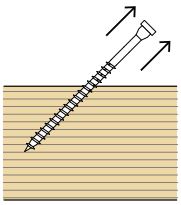
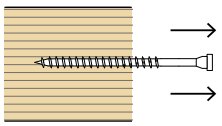
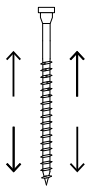
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

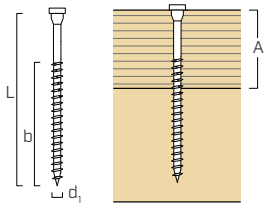
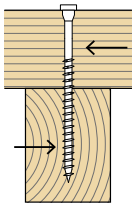
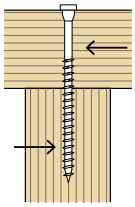
TENSION[1]

geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				end grain α = 0°				steel tension
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
8 *0.32*	60	*2 3/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	19,18
	80	*3 1/8*	55	2,30	2,66	3,01	3,30	2,09	2,42	2,73	3,00	1,15	1,33	1,50	1,65	
	100	*4*	75	3,28	3,79	4,29	4,70	2,98	3,45	3,90	4,27	1,64	1,89	2,14	2,35	
	120	*4 3/4*	95	4,25	4,92	5,57	6,11	3,87	4,47	5,06	5,55	2,13	2,46	2,78	3,05	
	140	*5 1/2*	110	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	160	*6 1/4*	130	5,96	6,90	7,81	8,56	5,42	6,27	7,10	7,78	2,98	3,45	3,90	4,28	
10 *0.40*	80	*3 1/8*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	24,17
	100	*4*	75	3,97	4,60	5,20	5,70	3,61	4,18	4,73	5,18	1,99	2,30	2,60	2,85	
	120	*4 3/4*	95	5,19	6,01	6,80	7,46	4,72	5,46	6,18	6,78	2,60	3,00	3,40	3,73	
	140	*5 1/2*	110	6,11	7,07	8,00	8,77	5,55	6,43	7,27	7,97	3,06	3,54	4,00	4,39	
	160	*6 1/4*	130	7,33	8,48	9,60	10,53	6,67	7,71	8,73	9,57	3,67	4,24	4,80	5,26	
	180	*7 1/8*	150	8,55	9,90	11,20	12,28	7,78	9,00	10,18	11,16	4,28	4,95	5,60	6,14	
12 *0.48*	100	*4*	75	4,62	5,34	6,05	6,63	4,20	4,86	5,50	6,03	2,31	2,67	3,02	3,32	31,08
	120	*4 3/4*	90	5,72	6,62	7,49	8,21	5,20	6,02	6,81	7,46	2,86	3,31	3,74	4,11	
	140	*5 1/2*	110	7,19	8,31	9,41	10,32	6,53	7,56	8,55	9,38	3,59	4,16	4,70	5,16	
	160	*6 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	180	*7 1/8*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	200	*8*	160	10,85	12,56	14,20	15,58	9,87	11,41	12,91	14,16	5,43	6,28	7,10	7,79	

α = screw-to-grain angle

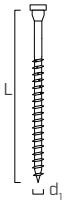
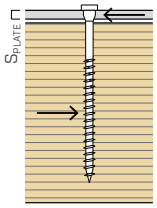
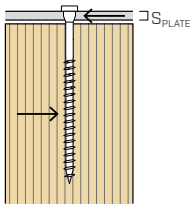
NOTES and GENERAL PRINCIPLES on page 235.

SHEAR[4]

geometry					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
d_1	L		b	A[5]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
8 *0.32*	60	*2 3/8*	52	15	0,92	1,10	1,29	1,44	0,59	0,71	0,83	0,93
	80	*3 1/8*	55	25	1,16	1,39	1,62	1,82	0,76	0,91	1,07	1,20
	100	*4*	75	25	1,40	1,60	1,78	1,93	0,86	1,03	1,20	1,35
	120	*4 3/4*	95	25	1,41	1,60	1,78	1,93	0,95	1,14	1,34	1,50
	140	*5 1/2*	110	30	1,47	1,67	1,86	2,02	1,09	1,30	1,52	1,71
	160	*6 1/4*	130	30	1,47	1,67	1,86	2,02	1,18	1,42	1,60	1,74
10 *0.40*	80	*3 1/8*	60	20	1,40	1,68	1,96	2,20	0,90	1,07	1,25	1,41
	100	*4*	75	25	1,68	2,01	2,23	2,42	1,05	1,26	1,47	1,65
	120	*4 3/4*	95	25	1,77	2,01	2,23	2,42	1,16	1,39	1,63	1,83
	140	*5 1/2*	110	30	1,84	2,09	2,33	2,53	1,32	1,58	1,84	2,07
	160	*6 1/4*	130	30	1,84	2,09	2,33	2,53	1,43	1,71	2,00	2,18
	180	*7 1/8*	150	30	1,84	2,09	2,33	2,53	1,54	1,78	2,00	2,18
12 *0.48*	100	*4*	75	25	1,93	2,32	2,70	3,01	1,21	1,46	1,70	1,91
	120	*4 3/4*	90	30	2,25	2,60	2,89	3,14	1,39	1,67	1,94	2,18
	140	*5 1/2*	110	30	2,29	2,60	2,89	3,14	1,52	1,82	2,12	2,38
	160	*6 1/4*	120	40	2,45	2,79	3,11	3,39	1,74	2,09	2,43	2,73
	180	*7 1/8*	140	40	2,45	2,79	3,11	3,39	1,87	2,24	2,61	2,93
	200	*8*	160	40	2,45	2,79	3,11	3,39	1,99	2,39	2,69	2,93

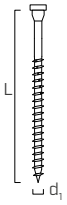
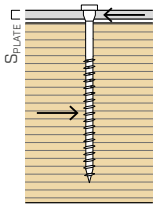
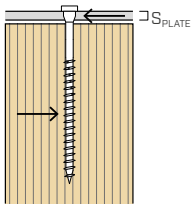
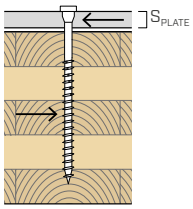
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 235.

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,51	2,85	3,18	3,46	1,36	1,53	1,70	1,84	2,37	2,70	3,01	3,27
	80	*3 1/8*		2,79	3,18	3,57	3,89	1,47	1,67	1,86	2,01	2,63	3,00	3,36	3,66
8	100	*4*		3,27	3,75	4,12	4,40	1,69	1,93	2,15	2,34	3,09	3,54	3,96	4,24
0.32	120	*4 3/4*		3,64	4,05	4,44	4,75	1,91	2,18	2,45	2,67	3,51	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,10	2,40	2,70	2,94	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,32	2,65	2,91	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,45	3,94	4,41	4,80	1,83	2,08	2,31	2,50	3,26	3,72	4,16	4,53
	100	*4*		3,96	4,54	5,10	5,45	2,06	2,34	2,62	2,84	3,74	4,29	4,82	5,25
10	120	*4 3/4*	3,2	4,52	5,02	5,50	5,89	2,32	2,65	2,97	3,24	4,30	4,84	5,31	5,68
0.40	140	*5 1/2*	*1/8*	4,74	5,29	5,80	6,22	2,55	2,92	3,28	3,58	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,82	3,23	3,61	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,08	3,47	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,78	5,47	6,14	6,69	2,52	2,86	3,18	3,46	4,52	5,17	5,80	6,32
	120	*4 3/4*		5,38	6,17	6,80	7,27	2,78	3,17	3,54	3,85	5,09	5,83	6,55	7,01
12	140	*5 1/2*		5,97	6,65	7,28	7,80	3,09	3,53	3,96	4,32	5,74	6,41	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,31	3,79	4,26	4,65	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,62	4,16	4,66	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,93	4,47	4,90	5,26	6,67	7,47	8,23	8,85
	60	*2 3/8*		2,47	2,81	3,13	3,40	1,29	1,51	1,68	1,81	2,34	2,66	2,96	3,21
	80	*3 1/8*		2,75	3,14	3,51	3,83	1,46	1,65	1,84	1,99	2,59	2,96	3,31	3,60
8	100	*4*		3,23	3,71	4,12	4,40	1,68	1,91	2,13	2,32	3,05	3,50	3,93	4,24
0.32	120	*4 3/4*		3,64	4,05	4,44	4,75	1,89	2,16	2,43	2,64	3,51	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,08	2,39	2,68	2,93	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,30	2,64	2,91	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,41	3,88	4,35	4,73	1,81	2,05	2,28	2,47	3,22	3,67	4,11	4,47
	100	*4*		3,92	4,49	5,04	5,45	2,04	2,32	2,59	2,82	3,70	4,24	4,76	5,19
10	120	*4 3/4*	6,4	4,50	5,02	5,50	5,89	2,31	2,63	2,95	3,21	4,26	4,84	5,31	5,68
0.40	140	*5 1/2*	*1/4*	4,74	5,29	5,80	6,22	2,53	2,90	3,26	3,55	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,80	3,21	3,61	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,06	3,47	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,73	5,41	6,07	6,61	2,50	2,83	3,16	3,42	4,48	5,12	5,73	6,25
	120	*4 3/4*		5,33	6,11	6,80	7,27	2,76	3,14	3,51	3,82	5,04	5,78	6,49	7,01
12	140	*5 1/2*		5,97	6,65	7,28	7,80	3,07	3,51	3,93	4,29	5,69	6,41	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,29	3,77	4,23	4,62	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,60	4,13	4,65	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,91	4,47	4,90	5,26	6,67	7,47	8,23	8,85

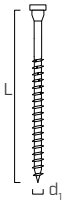
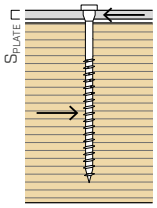
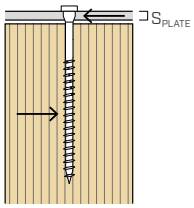
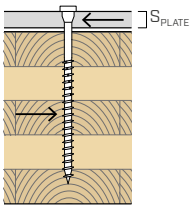
α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 235.

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,41	2,74	3,05	3,31	1,21	1,45	1,64	1,78	2,29	2,59	2,89	3,13
	80	*3 1/8*		2,71	3,09	3,46	3,77	1,44	1,63	1,82	1,97	2,56	2,92	3,26	3,55
8	100	*4*		3,19	3,66	4,11	4,40	1,66	1,89	2,11	2,29	3,02	3,46	3,88	4,24
0.32	120	*4 3/4*		3,64	4,05	4,44	4,75	1,88	2,15	2,40	2,62	3,48	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,07	2,37	2,66	2,90	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,28	2,62	2,91	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,36	3,83	4,28	4,66	1,80	2,03	2,26	2,45	3,18	3,62	4,05	4,41
	100	*4*		3,87	4,43	4,98	5,43	2,02	2,30	2,57	2,79	3,66	4,19	4,70	5,13
10	120	*4 3/4*	9,5	4,46	5,02	5,50	5,89	2,29	2,61	2,92	3,18	4,22	4,84	5,31	5,68
0.40	140	*5 1/2*	*3/8*	4,74	5,29	5,80	6,22	2,52	2,88	3,23	3,52	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,78	3,19	3,59	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,05	3,47	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,68	5,35	6,00	6,53	2,48	2,81	3,13	3,39	4,43	5,06	5,67	6,18
	120	*4 3/4*		5,28	6,05	6,80	7,27	2,74	3,12	3,49	3,79	5,00	5,72	6,43	7,01
12	140	*5 1/2*		5,96	6,65	7,28	7,80	3,05	3,49	3,90	4,25	5,65	6,41	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,27	3,74	4,20	4,59	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,58	4,11	4,62	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,89	4,47	4,90	5,26	6,67	7,47	8,23	8,85
	60	*2 3/8*		2,34	2,65	2,95	3,19	1,14	1,36	1,59	1,72	2,21	2,51	2,79	3,02
	80	*3 1/8*		2,67	3,04	3,40	3,71	1,43	1,61	1,79	1,94	2,52	2,88	3,21	3,50
8	100	*4*		3,16	3,62	4,06	4,40	1,65	1,87	2,09	2,27	2,98	3,42	3,84	4,19
0.32	120	*4 3/4*		3,64	4,05	4,44	4,75	1,86	2,13	2,38	2,60	3,45	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,05	2,35	2,64	2,88	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,27	2,61	2,91	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,32	3,78	4,22	4,59	1,78	2,01	2,23	2,42	3,14	3,57	3,99	4,34
	100	*4*		3,83	4,38	4,92	5,36	2,01	2,28	2,54	2,76	3,62	4,14	4,65	5,07
10	120	*4 3/4*	12,7	4,41	5,02	5,50	5,89	2,27	2,59	2,90	3,16	4,18	4,80	5,31	5,68
0.40	140	*5 1/2*	*1/2*	4,74	5,29	5,80	6,22	2,50	2,86	3,21	3,50	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,76	3,17	3,56	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,03	3,47	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,63	5,29	5,93	6,46	2,46	2,78	3,10	3,36	4,39	5,01	5,61	6,10
	120	*4 3/4*		5,23	5,99	6,73	7,27	2,72	3,10	3,46	3,76	4,95	5,67	6,37	6,95
12	140	*5 1/2*		5,91	6,65	7,28	7,80	3,03	3,46	3,88	4,22	5,60	6,41	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,25	3,72	4,17	4,55	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,56	4,09	4,59	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,87	4,45	4,90	5,26	6,67	7,47	8,23	8,85

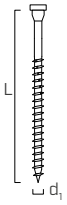
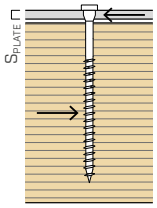
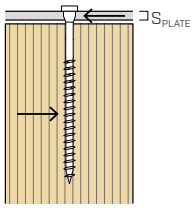
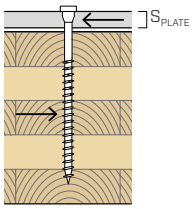
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 235.

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,26	2,56	2,84	3,08	1,06	1,27	1,48	1,66	2,14	2,42	2,69	2,91
	80	*3 1/8*		2,63	3,00	3,35	3,65	1,41	1,60	1,77	1,92	2,49	2,83	3,17	3,44
8	100	*4*		3,12	3,57	4,01	4,37	1,63	1,85	2,07	2,25	2,95	3,38	3,79	4,13
0.32	120	*4 3/4*		3,60	4,05	4,44	4,75	1,85	2,11	2,36	2,57	3,41	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,04	2,33	2,62	2,85	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,25	2,59	2,91	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,27	3,72	4,16	4,52	1,76	1,99	2,21	2,39	3,10	3,53	3,94	4,28
	100	*4*		3,78	4,33	4,85	5,29	1,99	2,26	2,52	2,73	3,58	4,10	4,59	5,01
10	120	*4 3/4*	15,9	4,37	5,02	5,50	5,89	2,25	2,57	2,87	3,13	4,14	4,75	5,31	5,68
0.40	140	*5 1/2*	*5/8*	4,74	5,29	5,80	6,22	2,48	2,84	3,18	3,47	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,75	3,15	3,54	3,86	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,01	3,46	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,58	5,23	5,85	6,38	2,44	2,76	3,07	3,33	4,34	4,95	5,54	6,03
	120	*4 3/4*		5,18	5,93	6,66	7,27	2,70	3,07	3,43	3,73	4,90	5,61	6,30	6,88
12	140	*5 1/2*		5,86	6,65	7,28	7,80	3,01	3,44	3,85	4,19	5,56	6,38	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,23	3,70	4,15	4,52	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,54	4,06	4,56	4,99	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,85	4,43	4,90	5,26	6,67	7,47	8,23	8,85
	60	*2 3/8*		2,18	2,47	2,74	2,96	0,98	1,18	1,38	1,54	2,07	2,34	2,59	2,80
	80	*3 1/8*		2,59	2,95	3,30	3,59	1,40	1,58	1,75	1,90	2,46	2,79	3,12	3,39
8	100	*4*		3,08	3,52	3,95	4,31	1,61	1,83	2,05	2,22	2,92	3,34	3,74	4,08
0.32	120	*4 3/4*		3,56	4,05	4,44	4,75	1,83	2,09	2,34	2,55	3,38	3,88	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,02	2,31	2,59	2,83	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,24	2,57	2,89	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,23	3,67	4,10	4,45	1,71	1,97	2,18	2,36	3,06	3,48	3,88	4,22
	100	*4*		3,74	4,27	4,79	5,22	1,97	2,24	2,49	2,70	3,54	4,05	4,53	4,94
10	120	*4 3/4*	19,1	4,32	4,96	5,50	5,89	2,24	2,55	2,85	3,10	4,10	4,70	5,29	5,68
0.40	140	*5 1/2*	*3/4*	4,74	5,29	5,80	6,22	2,46	2,81	3,16	3,44	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,73	3,13	3,51	3,84	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	2,99	3,44	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,53	5,17	5,78	6,30	2,42	2,74	3,04	3,30	4,30	4,90	5,48	5,96
	120	*4 3/4*		5,13	5,87	6,59	7,19	2,68	3,05	3,40	3,69	4,86	5,56	6,24	6,81
12	140	*5 1/2*		5,81	6,65	7,28	7,80	2,99	3,41	3,82	4,16	5,51	6,33	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,21	3,67	4,12	4,49	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,52	4,04	4,54	4,95	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,83	4,40	4,90	5,26	6,67	7,47	8,23	8,85

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 235.

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,11	2,38	2,63	2,85	0,91	1,09	1,27	1,43	1,99	2,25	2,49	2,69
	80	*3 1/8*		2,56	2,91	3,24	3,53	1,38	1,56	1,73	1,87	2,42	2,75	3,07	3,34
8	100	*4*		3,04	3,48	3,90	4,25	1,60	1,82	2,02	2,20	2,88	3,29	3,69	4,03
0.32	120	*4 3/4*		3,53	4,05	4,44	4,75	1,82	2,07	2,32	2,52	3,34	3,84	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,01	2,29	2,57	2,81	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,22	2,55	2,87	3,12	3,94	4,40	4,84	5,20
	80	*3 1/8*		3,15	3,58	3,99	4,33	1,62	1,93	2,14	2,31	2,99	3,39	3,78	4,10
	100	*4*		3,69	4,22	4,73	5,15	1,95	2,21	2,47	2,68	3,50	4,00	4,48	4,88
10	120	*4 3/4*	22,2	4,28	4,91	5,50	5,89	2,22	2,53	2,82	3,07	4,06	4,66	5,23	5,68
0.40	140	*5 1/2*	*7/8*	4,74	5,29	5,80	6,22	2,44	2,79	3,13	3,41	4,54	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,71	3,11	3,49	3,81	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	2,97	3,42	3,81	4,09	5,19	5,82	6,41	6,89
	100	*4*		4,48	5,11	5,71	6,22	2,40	2,71	3,01	3,26	4,25	4,84	5,41	5,89
	120	*4 3/4*		5,08	5,81	6,52	7,11	2,66	3,02	3,37	3,66	4,81	5,51	6,18	6,74
12	140	*5 1/2*		5,76	6,62	7,28	7,80	2,97	3,39	3,79	4,13	5,47	6,27	7,03	7,53
0.48	160	*6 1/4*		6,15	6,86	7,52	8,06	3,19	3,65	4,09	4,46	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,50	4,01	4,51	4,92	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,81	4,38	4,90	5,26	6,67	7,47	8,23	8,85

α = screw-to-grain angle

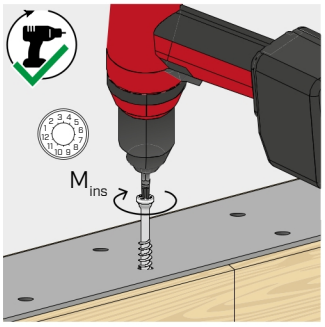
NOTES and GENERAL PRINCIPLES on page 235.

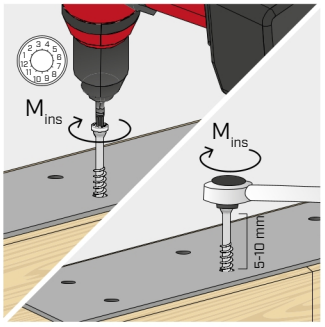
INSTALLATION

MANUALS



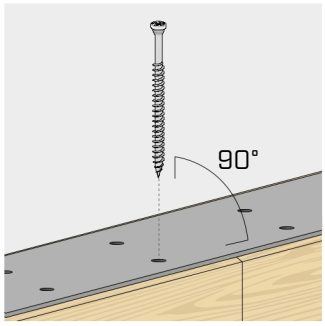
The use of pulse screw guns/impact wrenches is not permitted.



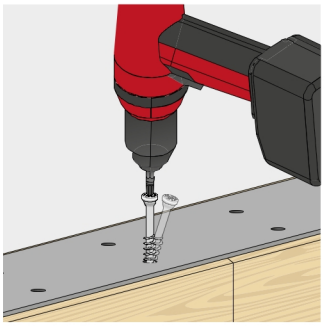


Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

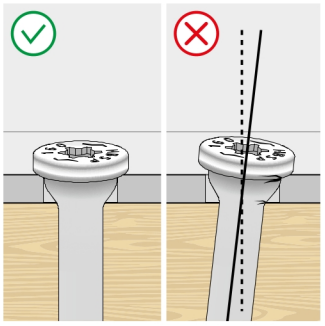
HBSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø8	8	20
Ø10	10	30
Ø12	12	40



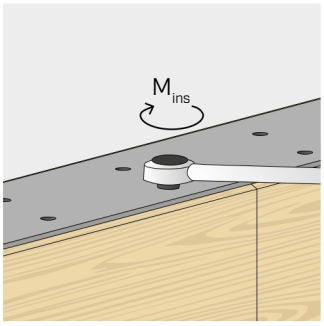
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



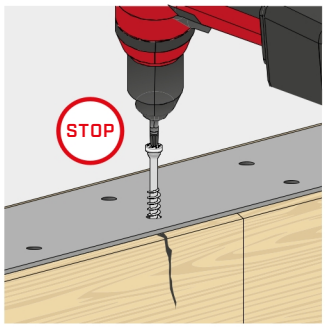
Avoid bending.



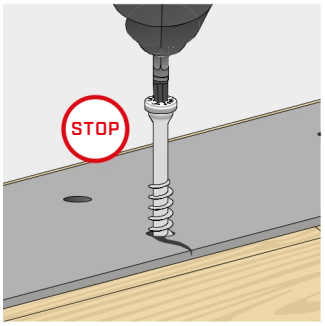
Ensure full contact between the entire surface of the screw head and the metal element



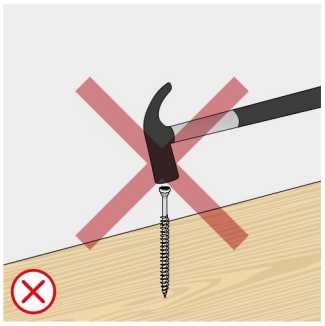
After installation, the fasteners can be inspected using a torque wrench.



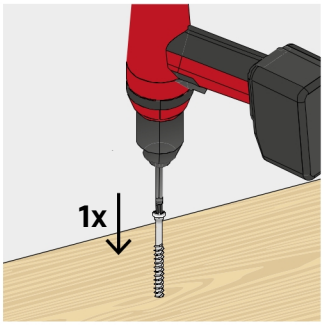
Stop installation if damage to the fastener or timber is noticed.



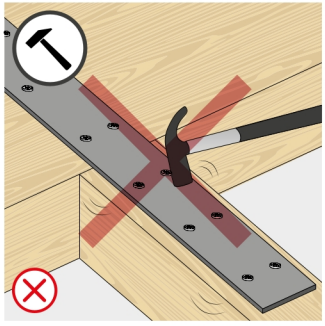
Stop installation if damage to the fastener or metal plates is noticed.



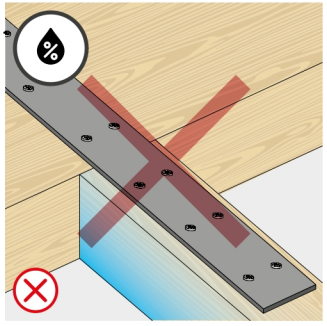
Do not hammer the screw tips into the timber.



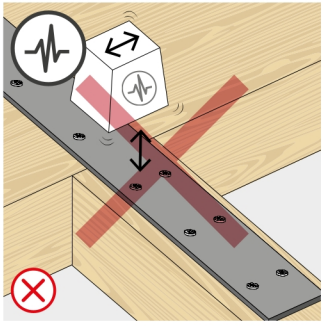
Install screws in one continuous stroke.



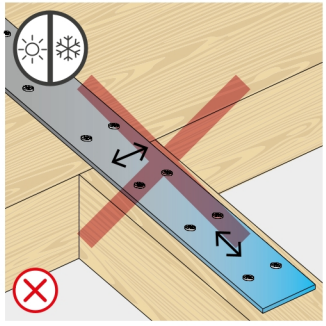
Avoid accidental stress during installation.



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.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_1$) or the main member ($8d_1$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- HBSP screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

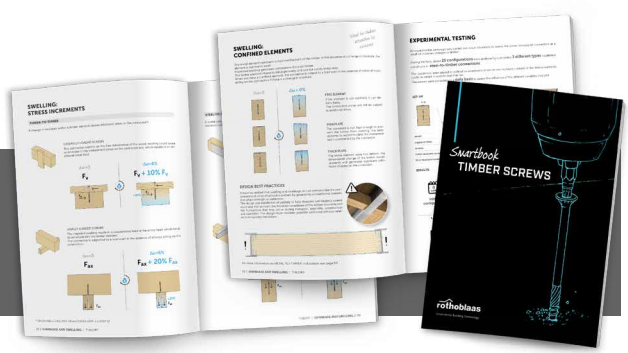
(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) HBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The side-member thickness, A, for HBS PLATE 8 x 60 mm was set to 15 mm to ensure the connection is not governed by failure mode (a).

Theory, practice and experimental campaigns:
our experience is in your hands.
Download the SMARTBOOK TIMBER SCREWS.



HBS PLATE EVO

PAN HEAD SCREW

ELC-4645 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 the **"TIMBER SCREWS AND DECK FASTENING"** catalogue at www.rothoblaas.com)

NEW GEOMETRY

The inner core diameter of the Ø8, Ø10 and Ø12 mm 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.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



HBS P EVO
5,0 | 6,0 mm

HBS PLATE EVO
8,0 | 10,0 | 12,0 mm



MANUALS

BIT INCLUDED

DIAMETER [mm]

3,5 | 5 — 12 | 12

LENGTH [mm]

25 | 50 — 200 | 200

SERVICE CONDITION

EC1 EC3

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3

MATERIAL

C4 EVO COATING — carbon steel with C4 EVO coating

CORE HARDNESS

<390 HV — as required in CSA O86:24(1)



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

HBS P EVO



d_1 [mm]	CODE	L [mm]	b [mm]	A_T [mm]	A_P [mm]	pcs
5 TX 25	HBSPEVO550	50	30	20	1-10	200
	HBSPEVO560	60	35	25	1-10	200
	HBSPEVO570	70	40	30	1-10	100
	HBSPEVO580	80	50	30	1-10	100
6 TX 30	HBSPEVO680	80	50	30	1-10	100
	HBSPEVO690	90	55	35	1-10	100

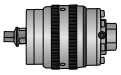


RAPTOR

TRANSPORT PLATE FOR TIMBER ELEMENTS

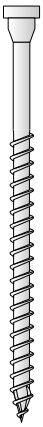
METAL-to-TIMBER recommended use:







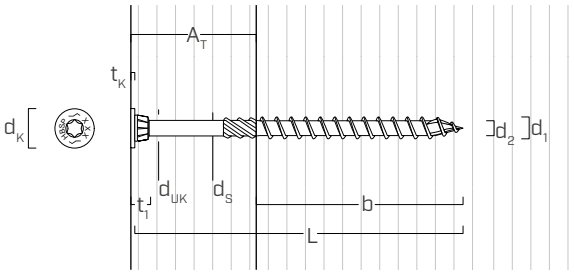
HBS PLATE EVO



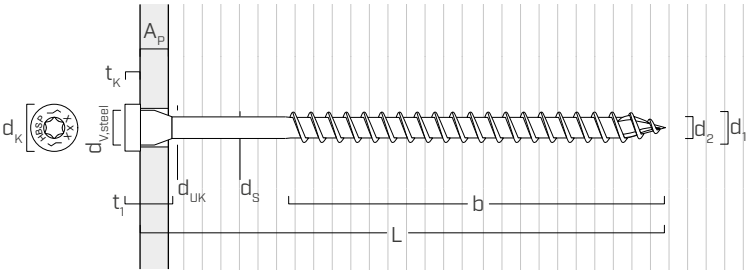
d_1 [mm]	CODE	L [mm]	b [mm]	A_T [mm]	A_P [mm]	pcs
8 TX 40	HBSPLEVO840	40	32	8	1-10	100
	HBSPLEVO860	60	52	8	1-15	100
	HBSPLEVO880	80	55	25	1-15	100
	HBSPLEVO8100	100	75	25	1-15	100
	HBSPLEVO8120	120	95	25	1-15	100
	HBSPLEVO8140	140	110	30	1-20	100
	HBSPLEVO8160	160	130	30	1-20	100
10 TX 40	HBSPLEVO1060	60	52	8	1-15	50
	HBSPLEVO1080	80	60	20	1-15	50
	HBSPLEVO10100	100	75	25	1-15	50
	HBSPLEVO10120	120	95	25	1-15	50
	HBSPLEVO10140	140	110	30	1-20	50
	HBSPLEVO10160	160	130	30	1-20	50
	HBSPLEVO10180	180	150	30	1-20	50
12 TX 50	HBSPLEVO12120	120	90	30	1-15	25
	HBSPLEVO12140	140	110	30	1-20	25
	HBSPLEVO12160	160	120	40	1-20	25
	HBSPLEVO12180	180	140	40	1-30	25
	HBSPLEVO12200	200	160	40	1-30	25

GEOMETRY AND MECHANICAL PROPERTIES

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



HBS PLATE EVO - 8,0 | 10,0 | 12,0 mm



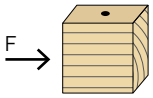
Nominal diameter	d_1	[mm]	5	6	8	10	12
Head diameter	d_K	[mm]	9,65	12,00	13,50	16,50	18,50
Root diameter	d_2	[mm]	3,40	3,95	5,90	6,60	7,30
Shank diameter	d_S	[mm]	3,65	4,30	6,30	7,20	8,55
Head thickness	t_1	[mm]	5,50	6,50	13,50	16,50	19,50
Washer thickness	t_K	[mm]	1,00	1,50	4,50	5,00	5,50
Underhead diameter	d_{UK}	[mm]	6,00	8,00	10,00	12,00	13,00
Hole diameter on steel plate	$d_{V,steel}$	[mm]	7,0	9,0	11,0	13,0	14,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0	4,0	5,0	6,0	7,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	4,0	5,0	6,0	7,0	8,0
Characteristic tensile strength	$f_{tens,k}$	[kN]	7,9	11,3	32,0	40,0	50,0
Characteristic yield moment	$M_{y,k}$	[Nm]	5,4	9,5	33,4	45,0	65,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

Nominal diameter	d_1	[mm]		5	6	8	10	12
Factored tensile strength	Φf_u	[kN]		4,97	8,56	19,18	24,17	31,08
Bending yield strength	F_{yb}	[MPa]		1315	1188	1018	969	1060
Factored shear strength of the screw	ΦV_s	[kN]		3,49	4,71	10,51	13,14	16,07
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29	52,38	69,83	87,29	104,75
			G=0.42	60,50	60,60	80,80	101,00	121,20
			G=0.49	68,44	68,55	91,40	114,26	137,11
			G=0.55	75,07	75,19	100,25	125,32	150,38
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	0,62	0,92	1,13	1,59	1,92
			G=0.42	0,75	1,10	1,36	1,91	2,30
			G=0.49	0,87	1,29	1,58	2,23	2,69
			G=0.55	0,98	1,45	1,78	2,50	3,02

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

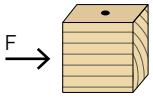
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**12·d‡**	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
S_Q	**5·d**	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
a_L	**15·d‡**	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
a	**10·d‡**	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_Q	**10·d**	50	*1 15/16*	60	*2 3/8*	80	*3 1/8*	100	*4*	120	*4 3/4*
e_P	**5·d**	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*

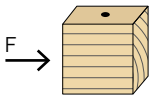
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



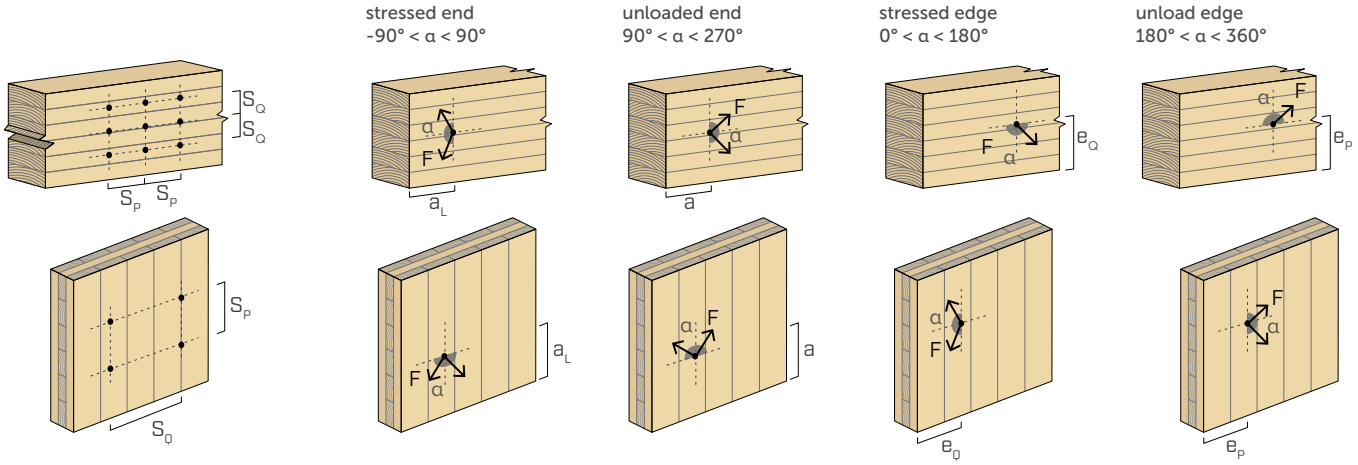
d_1		5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**18·d‡**	90	*3 1/2*	108	*4 1/4*	144	*5 11/16*	180	*7 1/8*	216	*8 1/2*
S_Q	**7·d**	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
a_L	**22·d‡**	110	*4 3/8*	132	*5 3/16*	176	*6 15/16*	220	*8 5/8*	264	*10 3/8*
a	**15·d‡**	75	*2 15/16*	90	*3 1/2*	120	*4 3/4*	150	*6*	180	*7 1/8*
e_Q	**12·d**	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	*144*	*5 11/16*
e_P	**7·d**	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*	6 [mm]	*0.24 [in]*	8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	**5·d†**	25	*1*	30	*1 3/16*	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
S_Q	**4·d**	20	*13/16*	24	*15/16*	32	*1 1/4*	40	*1 9/16*	48	*1 7/8*
a_L	**12·d†**	60	*2 3/8*	72	*2 13/16*	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
a	**7·d†**	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_Q	**7·d**	35	*1 3/8*	42	*1 5/8*	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_P	**3·d**	15	*9/16*	18	*11/16*	24	*15/16*	30	*1 3/16*	36	*1 7/16*

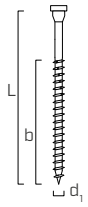
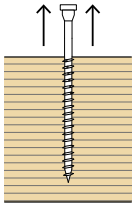
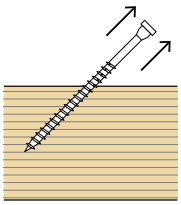
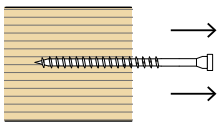
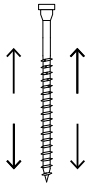
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



NOTES

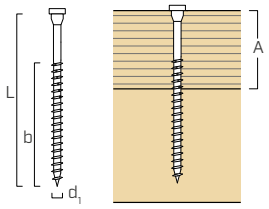
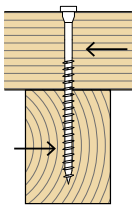
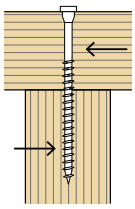
- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

STRUCTURAL VALUES | AXIAL TENSION

geometry			TENSION[1]												steel tension
			thread withdrawal								end grain α = 0°				
			α = 90°				α = 45°								
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
			G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	50	*1 15/16*	30	0,92	1,06	1,20	1,31	0,83	0,96	1,09	1,19	0,46	0,53	0,60	0,66	4,97
	60	*2 3/8*	35	1,10	1,27	1,44	1,58	1,00	1,16	1,31	1,43	0,55	0,64	0,72	0,79	
	70	*2 3/4*	40	1,28	1,48	1,68	1,84	1,16	1,35	1,52	1,67	0,64	0,74	0,84	0,92	
	80	*3 1/8*	50	1,65	1,91	2,16	2,36	1,50	1,73	1,96	2,15	0,82	0,95	1,08	1,18	
6 *0.24*	80	*3 1/8*	50	1,61	1,87	2,11	2,32	1,47	1,70	1,92	2,11	0,81	0,93	1,06	1,16	8,56
	90	*3 1/2*	55	1,80	2,08	2,35	2,58	1,63	1,89	2,14	2,34	0,90	1,04	1,18	1,29	
8 *0.32*	40	*1 9/16*	32	1,17	1,36	1,54	1,68	1,07	1,23	1,40	1,53	0,59	0,68	0,77	0,84	19,18
	60	*2 3/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	
	80	*3 1/8*	55	2,30	2,66	3,01	3,30	2,09	2,42	2,73	3,00	1,15	1,33	1,50	1,65	
	100	*4*	75	3,28	3,79	4,29	4,70	2,98	3,45	3,90	4,27	1,64	1,89	2,14	2,35	
	120	*4 3/4*	95	4,25	4,92	5,57	6,11	3,87	4,47	5,06	5,55	2,13	2,46	2,78	3,05	
	140	*5 1/2*	110	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	160	*6 1/4*	130	5,96	6,90	7,81	8,56	5,42	6,27	7,10	7,78	2,98	3,45	3,90	4,28	
10 *0.40*	60	*2 3/8*	52	2,57	2,97	3,36	3,68	2,33	2,70	3,05	3,35	1,28	1,48	1,68	1,84	24,17
	80	*3 1/8*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	
	100	*4*	75	3,97	4,60	5,20	5,70	3,61	4,18	4,73	5,18	1,99	2,30	2,60	2,85	
	120	*4 3/4*	95	5,19	6,01	6,80	7,46	4,72	5,46	6,18	6,78	2,60	3,00	3,40	3,73	
	140	*5 1/2*	110	6,11	7,07	8,00	8,77	5,55	6,43	7,27	7,97	3,06	3,54	4,00	4,39	
	160	*6 1/4*	130	7,33	8,48	9,60	10,53	6,67	7,71	8,73	9,57	3,67	4,24	4,80	5,26	
	180	*7 1/8*	150	8,55	9,90	11,20	12,28	7,78	9,00	10,18	11,16	4,28	4,95	5,60	6,14	
12 *0.48*	120	*4 3/4*	90	5,72	6,62	7,49	8,21	5,20	6,02	6,81	7,46	2,86	3,31	3,74	4,11	31,08
	140	*5 1/2*	110	7,19	8,31	9,41	10,32	6,53	7,56	8,55	9,38	3,59	4,16	4,70	5,16	
	160	*6 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	180	*7 1/8*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	200	*8*	160	10,85	12,56	14,20	15,58	9,87	11,41	12,91	14,16	5,43	6,28	7,10	7,79	

α = screw-to-grain angle

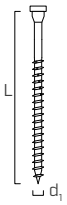
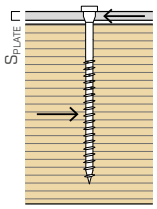
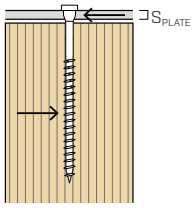
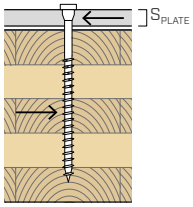
NOTES and GENERAL PRINCIPLES on page 245.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
					G				G			
d_1	L		b	A[5]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	50	*1 15/16*	30	20	0,54	0,65	0,76	0,85	0,39	0,46	0,54	0,60
	60	*2 3/8*	35	25	0,63	0,75	0,88	0,99	0,45	0,54	0,62	0,70
	70	*2 3/4*	40	30	0,71	0,86	0,97	1,06	0,51	0,61	0,69	0,75
	80	*3 1/8*	50	30	0,75	0,86	0,97	1,06	0,54	0,65	0,74	0,81
6 *0.24*	80	*3 1/8*	50	30	0,94	1,08	1,22	1,33	0,65	0,78	0,91	1,02
	90	*3 1/2*	55	35	0,99	1,14	1,29	1,41	0,72	0,86	0,97	1,06
8 *0.32*	40	*1 9/16*	32	10	0,68	0,81	0,95	1,07	0,40	0,47	0,55	0,61
	60	*2 3/8*	52	15	0,92	1,10	1,29	1,44	0,59	0,71	0,83	0,93
	80	*3 1/8*	55	25	1,16	1,39	1,62	1,82	0,76	0,91	1,07	1,20
	100	*4*	75	25	1,40	1,60	1,78	1,93	0,86	1,03	1,20	1,35
	120	*4 3/4*	95	25	1,41	1,60	1,78	1,93	0,95	1,14	1,34	1,50
	140	*5 1/2*	110	30	1,47	1,67	1,86	2,02	1,09	1,30	1,52	1,71
	160	*6 1/4*	130	30	1,47	1,67	1,86	2,02	1,18	1,42	1,60	1,74
10 *0.40*	60	*2 3/8*	52	15	1,12	1,34	1,57	1,76	0,74	0,89	1,04	1,16
	80	*3 1/8*	60	20	1,40	1,68	1,96	2,20	0,90	1,07	1,25	1,41
	100	*4*	75	25	1,68	2,01	2,23	2,42	1,05	1,26	1,47	1,65
	120	*4 3/4*	95	25	1,77	2,01	2,23	2,42	1,16	1,39	1,63	1,83
	140	*5 1/2*	110	30	1,84	2,09	2,33	2,53	1,32	1,58	1,84	2,07
	160	*6 1/4*	130	30	1,84	2,09	2,33	2,53	1,43	1,71	2,00	2,18
	180	*7 1/8*	150	30	1,84	2,09	2,33	2,53	1,54	1,78	2,00	2,18
12 *0.48*	120	*4 3/4*	90	30	2,25	2,60	2,89	3,14	1,39	1,67	1,94	2,18
	140	*5 1/2*	110	30	2,29	2,60	2,89	3,14	1,52	1,82	2,12	2,38
	160	*6 1/4*	120	40	2,45	2,79	3,11	3,39	1,74	2,09	2,43	2,73
	180	*7 1/8*	140	40	2,45	2,79	3,11	3,39	1,87	2,24	2,61	2,93
	200	*8*	160	40	2,45	2,79	3,11	3,39	1,99	2,39	2,69	2,93

α = screw-to-grain angle

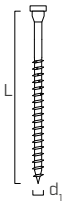
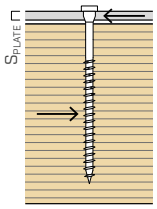
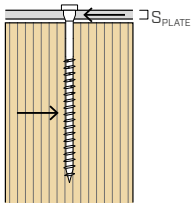
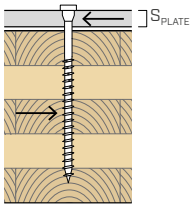
NOTES and **GENERAL PRINCIPLES** on page 245.

SHEAR[4]

geometry			steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
														
d_1 [mm] [in]	L [mm]	L [in]	S_{PLATE} [mm] [in]	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r [2] [3] G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]
5 *0.20*	50	*1 15/16*	3,2 *1/8*	1,18	1,34	1,51	1,64	0,62	0,70	0,78	0,85	1,11	1,27	1,42	1,55
	60	*2 3/8*		1,31	1,50	1,64	1,75	0,68	0,77	0,86	0,94	1,23	1,41	1,58	1,68
	70	*2 3/4*		1,41	1,56	1,70	1,82	0,74	0,84	0,94	1,02	1,35	1,50	1,64	1,75
	80	*3 1/8*		1,50	1,67	1,82	1,95	0,82	0,93	1,05	1,14	1,44	1,60	1,76	1,88
6 *0.24*	80	*3 1/8*		1,78	1,98	2,16	2,30	0,94	1,07	1,20	1,31	1,71	1,90	2,07	2,22
	90	*3 1/2*		1,83	2,03	2,22	2,37	1,00	1,15	1,29	1,41	1,76	1,95	2,13	2,28
8 *0.32*	40	*1 9/16*		2,02	2,28	2,52	2,73	0,88	1,06	1,24	1,39	1,91	2,16	2,39	2,58
	60	*2 3/8*		2,51	2,85	3,18	3,46	1,36	1,53	1,70	1,84	2,37	2,70	3,01	3,27
	80	*3 1/8*		2,79	3,18	3,57	3,89	1,47	1,67	1,86	2,01	2,63	3,00	3,36	3,66
	100	*4*		3,27	3,75	4,12	4,40	1,69	1,93	2,15	2,34	3,09	3,54	3,96	4,24
	120	*4 3/4*		3,64	4,05	4,44	4,75	1,91	2,18	2,45	2,67	3,51	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,10	2,40	2,70	2,94	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,32	2,65	2,91	3,12	3,94	4,40	4,84	5,20
10 *0.40*	60	*2 3/8*		3,05	3,46	3,86	4,19	1,59	1,87	2,07	2,24	2,89	3,27	3,65	3,96
	80	*3 1/8*		3,45	3,94	4,41	4,80	1,83	2,08	2,31	2,50	3,26	3,72	4,16	4,53
	100	*4*		3,96	4,54	5,10	5,45	2,06	2,34	2,62	2,84	3,74	4,29	4,82	5,25
	120	*4 3/4*		4,52	5,02	5,50	5,89	2,32	2,65	2,97	3,24	4,30	4,84	5,31	5,68
	140	*5 1/2*		4,74	5,29	5,80	6,22	2,55	2,92	3,28	3,58	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,82	3,23	3,61	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,08	3,47	3,81	4,09	5,19	5,82	6,41	6,89
12 *0.48*	120	*4 3/4*		5,38	6,17	6,80	7,27	2,78	3,17	3,54	3,85	5,09	5,83	6,55	7,01
	140	*5 1/2*		5,97	6,65	7,28	7,80	3,09	3,53	3,96	4,32	5,74	6,41	7,03	7,53
	160	*6 1/4*		6,15	6,86	7,52	8,06	3,31	3,79	4,26	4,65	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,62	4,16	4,66	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,93	4,47	4,90	5,26	6,67	7,47	8,23	8,85
5 *0.20*	50	*1 15/16*	6,4 *1/4*	1,15	1,31	1,47	1,60	0,61	0,69	0,77	0,83	1,08	1,24	1,38	1,51
	60	*2 3/8*		1,28	1,47	1,64	1,75	0,67	0,76	0,85	0,92	1,21	1,38	1,55	1,68
	70	*2 3/4*		1,41	1,56	1,70	1,82	0,72	0,83	0,92	1,01	1,33	1,50	1,64	1,75
	80	*3 1/8*		1,50	1,67	1,82	1,95	0,80	0,92	1,03	1,13	1,44	1,60	1,76	1,88
6 *0.24*	80	*3 1/8*		1,78	1,98	2,16	2,30	0,93	1,06	1,19	1,29	1,71	1,90	2,07	2,22
	90	*3 1/2*		1,83	2,03	2,22	2,37	0,99	1,13	1,27	1,39	1,76	1,95	2,13	2,28
8 *0.32*	40	*1 9/16*		1,99	2,23	2,47	2,67	0,81	0,97	1,13	1,27	1,82	2,11	2,34	2,52
	60	*2 3/8*		2,47	2,81	3,13	3,40	1,29	1,51	1,68	1,81	2,34	2,66	2,96	3,21
	80	*3 1/8*		2,75	3,14	3,51	3,83	1,46	1,65	1,84	1,99	2,59	2,96	3,31	3,60
	100	*4*		3,23	3,71	4,12	4,40	1,68	1,91	2,13	2,32	3,05	3,50	3,93	4,24
	120	*4 3/4*		3,64	4,05	4,44	4,75	1,89	2,16	2,43	2,64	3,51	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,08	2,39	2,68	2,93	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,30	2,64	2,91	3,12	3,94	4,40	4,84	5,20
10 *0.40*	60	*2 3/8*		3,00	3,41	3,79	4,12	1,51	1,81	2,05	2,21	2,85	3,23	3,59	3,90
	80	*3 1/8*		3,41	3,88	4,35	4,73	1,81	2,05	2,28	2,47	3,22	3,67	4,11	4,47
	100	*4*		3,92	4,49	5,04	5,45	2,04	2,32	2,59	2,82	3,70	4,24	4,76	5,19
	120	*4 3/4*		4,50	5,02	5,50	5,89	2,31	2,63	2,95	3,21	4,26	4,84	5,31	5,68
	140	*5 1/2*		4,74	5,29	5,80	6,22	2,53	2,90	3,26	3,55	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,80	3,21	3,61	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,06	3,47	3,81	4,09	5,19	5,82	6,41	6,89
12 *0.48*	120	*4 3/4*		5,33	6,11	6,80	7,27	2,76	3,14	3,51	3,82	5,04	5,78	6,49	7,01
	140	*5 1/2*		5,97	6,65	7,28	7,80	3,07	3,51	3,93	4,29	5,69	6,41	7,03	7,53
	160	*6 1/4*		6,15	6,86	7,52	8,06	3,29	3,77	4,23	4,62	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,60	4,13	4,65	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,91	4,47	4,90	5,26	6,67	7,47	8,23	8,85

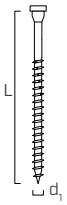
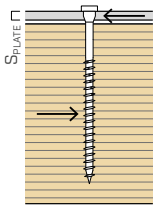
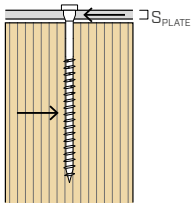
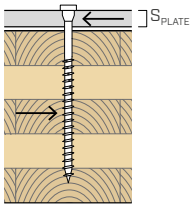
α = screw-to-grain angle

SHEAR[4]

geometry				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
d_1 [mm] [in]	L [mm]	L [in]	S_{PLATE} [mm] [in]	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r [2] [3] G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]
5 *0.20*	50	*1 15/16*	9,5 *3/8*	1,12	1,28	1,43	1,56	0,60	0,68	0,75	0,82	1,06	1,21	1,35	1,47
	60	*2 3/8*		1,25	1,44	1,61	1,75	0,66	0,75	0,83	0,90	1,18	1,35	1,52	1,66
	70	*2 3/4*		1,39	1,56	1,70	1,82	0,71	0,81	0,91	0,99	1,31	1,50	1,64	1,75
	80	*3 1/8*		1,50	1,67	1,82	1,95	0,79	0,91	1,02	1,11	1,44	1,60	1,76	1,88
6 *0.24*	80	*3 1/8*		1,78	1,98	2,16	2,30	0,92	1,04	1,17	1,27	1,68	1,90	2,07	2,22
	90	*3 1/2*		1,83	2,03	2,22	2,37	0,98	1,12	1,25	1,37	1,76	1,95	2,13	2,28
8 *0.32*	40	*1 9/16*		1,83	2,17	2,39	2,58	0,73	0,88	1,02	1,15	1,65	1,98	2,27	2,44
	60	*2 3/8*		2,41	2,74	3,05	3,31	1,21	1,45	1,64	1,78	2,29	2,59	2,89	3,13
	80	*3 1/8*		2,71	3,09	3,46	3,77	1,44	1,63	1,82	1,97	2,56	2,92	3,26	3,55
	100	*4*		3,19	3,66	4,11	4,40	1,66	1,89	2,11	2,29	3,02	3,46	3,88	4,24
	120	*4 3/4*		3,64	4,05	4,44	4,75	1,88	2,15	2,40	2,62	3,48	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,07	2,37	2,66	2,90	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,28	2,62	2,91	3,12	3,94	4,40	4,84	5,20
10 *0.40*	60	*2 3/8*		2,94	3,33	3,70	4,01	1,42	1,70	1,98	2,17	2,78	3,15	3,51	3,80
	80	*3 1/8*		3,36	3,83	4,28	4,66	1,80	2,03	2,26	2,45	3,18	3,62	4,05	4,41
	100	*4*		3,87	4,43	4,98	5,43	2,02	2,30	2,57	2,79	3,66	4,19	4,70	5,13
	120	*4 3/4*		4,46	5,02	5,50	5,89	2,29	2,61	2,92	3,18	4,22	4,84	5,31	5,68
	140	*5 1/2*		4,74	5,29	5,80	6,22	2,52	2,88	3,23	3,52	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,78	3,19	3,59	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,05	3,47	3,81	4,09	5,19	5,82	6,41	6,89
12 *0.48*	120	*4 3/4*		5,28	6,05	6,80	7,27	2,74	3,12	3,49	3,79	5,00	5,72	6,43	7,01
	140	*5 1/2*		5,96	6,65	7,28	7,80	3,05	3,49	3,90	4,25	5,65	6,41	7,03	7,53
	160	*6 1/4*		6,15	6,86	7,52	8,06	3,27	3,74	4,20	4,59	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,58	4,11	4,62	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,89	4,47	4,90	5,26	6,67	7,47	8,23	8,85
5 *0.20*	50	*1 15/16*	12,7 *1/2*	1,09	1,25	1,39	1,51	0,59	0,66	0,74	0,80	1,03	1,18	1,31	1,43
	60	*2 3/8*		1,23	1,40	1,57	1,72	0,65	0,73	0,82	0,89	1,16	1,32	1,48	1,62
	70	*2 3/4*		1,36	1,56	1,70	1,82	0,70	0,80	0,89	0,97	1,28	1,47	1,64	1,75
	80	*3 1/8*		1,50	1,67	1,82	1,95	0,78	0,89	1,00	1,09	1,44	1,60	1,76	1,88
6 *0.24*	80	*3 1/8*		1,75	1,98	2,16	2,30	0,90	1,03	1,15	1,25	1,65	1,90	2,07	2,22
	90	*3 1/2*		1,83	2,03	2,22	2,37	0,97	1,10	1,24	1,35	1,76	1,95	2,13	2,28
8 *0.32*	40	*1 9/16*		1,64	1,97	2,29	2,47	0,66	0,79	0,92	1,03	1,47	1,77	2,06	2,32
	60	*2 3/8*		2,34	2,65	2,95	3,19	1,14	1,36	1,59	1,72	2,21	2,51	2,79	3,02
	80	*3 1/8*		2,67	3,04	3,40	3,71	1,43	1,61	1,79	1,94	2,52	2,88	3,21	3,50
	100	*4*		3,16	3,62	4,06	4,40	1,65	1,87	2,09	2,27	2,98	3,42	3,84	4,19
	120	*4 3/4*		3,64	4,05	4,44	4,75	1,86	2,13	2,38	2,60	3,45	3,91	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,05	2,35	2,64	2,88	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,27	2,61	2,91	3,12	3,94	4,40	4,84	5,20
10 *0.40*	60	*2 3/8*		2,84	3,22	3,58	3,87	1,33	1,59	1,86	2,09	2,69	3,05	3,39	3,67
	80	*3 1/8*		3,32	3,78	4,22	4,59	1,78	2,01	2,23	2,42	3,14	3,57	3,99	4,34
	100	*4*		3,83	4,38	4,92	5,36	2,01	2,28	2,54	2,76	3,62	4,14	4,65	5,07
	120	*4 3/4*		4,41	5,02	5,50	5,89	2,27	2,59	2,90	3,16	4,18	4,80	5,31	5,68
	140	*5 1/2*		4,74	5,29	5,80	6,22	2,50	2,86	3,21	3,50	4,58	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,76	3,17	3,56	3,87	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	3,03	3,47	3,81	4,09	5,19	5,82	6,41	6,89
12 *0.48*	120	*4 3/4*		5,23	5,99	6,73	7,27	2,72	3,10	3,46	3,76	4,95	5,67	6,37	6,95
	140	*5 1/2*		5,91	6,65	7,28	7,80	3,03	3,46	3,88	4,22	5,60	6,41	7,03	7,53
	160	*6 1/4*		6,15	6,86	7,52	8,06	3,25	3,72	4,17	4,55	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,56	4,09	4,59	5,00	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,87	4,45	4,90	5,26	6,67	7,47	8,23	8,85

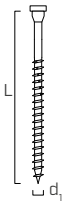
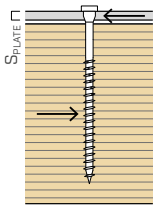
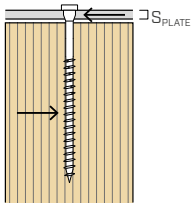
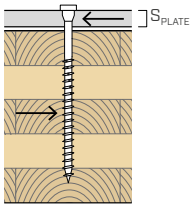
α = screw-to-grain angle

SHEAR[4]

geometry			steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
														
d_1	L	S_{PLATE}	factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
			G				G				G			
[mm] *[in]*	[mm]	[mm] *[in]*	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
	50 *1 15/16*	15,9 *5/8*	1,07	1,21	1,35	1,47	0,58	0,65	0,72	0,78	1,01	1,15	1,28	1,39
5 *0.20*	60 *2 3/8*		1,20	1,37	1,53	1,67	0,63	0,72	0,80	0,87	1,13	1,29	1,45	1,58
	70 *2 3/4*		1,33	1,53	1,70	1,82	0,69	0,79	0,88	0,96	1,26	1,44	1,62	1,75
	80 *3 1/8*		1,50	1,67	1,82	1,95	0,77	0,88	0,99	1,08	1,43	1,60	1,76	1,88
6 *0.24*	80 *3 1/8*		1,72	1,98	2,16	2,30	0,89	1,01	1,13	1,23	1,62	1,86	2,07	2,22
	90 *3 1/2*		1,83	2,03	2,22	2,37	0,95	1,09	1,22	1,33	1,76	1,95	2,13	2,28
	40 *1 9/16*		1,45	1,74	2,03	2,28	0,58	0,70	0,81	0,91	1,30	1,56	1,82	2,05
	60 *2 3/8*		2,26	2,56	2,84	3,08	1,06	1,27	1,48	1,66	2,14	2,42	2,69	2,91
	80 *3 1/8*		2,63	3,00	3,35	3,65	1,41	1,60	1,77	1,92	2,49	2,83	3,17	3,44
8 *0.32*	100 *4*		3,12	3,57	4,01	4,37	1,63	1,85	2,07	2,25	2,95	3,38	3,79	4,13
	120 *4 3/4*		3,60	4,05	4,44	4,75	1,85	2,11	2,36	2,57	3,41	3,91	4,28	4,59
	140 *5 1/2*		3,82	4,26	4,68	5,01	2,04	2,33	2,62	2,85	3,69	4,12	4,52	4,85
	160 *6 1/4*		4,07	4,55	5,00	5,36	2,25	2,59	2,91	3,12	3,94	4,40	4,84	5,20
	60 *2 3/8*		2,75	3,11	3,45	3,73	1,24	1,49	1,73	1,95	2,61	2,94	3,27	3,53
	80 *3 1/8*		3,27	3,72	4,16	4,52	1,76	1,99	2,21	2,39	3,10	3,53	3,94	4,28
10 *0.40*	100 *4*		3,78	4,33	4,85	5,29	1,99	2,26	2,52	2,73	3,58	4,10	4,59	5,01
	120 *4 3/4*		4,37	5,02	5,50	5,89	2,25	2,57	2,87	3,13	4,14	4,75	5,31	5,68
	140 *5 1/2*		4,74	5,29	5,80	6,22	2,48	2,84	3,18	3,47	4,58	5,11	5,61	6,01
	160 *6 1/4*		5,05	5,64	6,20	6,66	2,75	3,15	3,54	3,86	4,89	5,46	6,01	6,45
	180 *7 1/8*		5,36	6,00	6,60	7,09	3,01	3,46	3,81	4,09	5,19	5,82	6,41	6,89
	120 *4 3/4*		5,18	5,93	6,66	7,27	2,70	3,07	3,43	3,73	4,90	5,61	6,30	6,88
12 *0.48*	140 *5 1/2*		5,86	6,65	7,28	7,80	3,01	3,44	3,85	4,19	5,56	6,38	7,03	7,53
	160 *6 1/4*		6,15	6,86	7,52	8,06	3,23	3,70	4,15	4,52	5,94	6,63	7,27	7,80
	180 *7 1/8*		6,52	7,28	8,00	8,59	3,54	4,06	4,56	4,99	6,31	7,05	7,75	8,32
	200 *8*		6,89	7,71	8,48	9,12	3,85	4,43	4,90	5,26	6,67	7,47	8,23	8,85
	50 *1 15/16*	19,1 *3/4*	1,04	1,18	1,32	1,43	0,53	0,64	0,71	0,76	0,98	1,12	1,25	1,35
5 *0.20*	60 *2 3/8*		1,17	1,34	1,50	1,63	0,62	0,71	0,78	0,85	1,11	1,26	1,41	1,54
	70 *2 3/4*		1,30	1,49	1,68	1,82	0,68	0,77	0,86	0,94	1,23	1,41	1,58	1,73
	80 *3 1/8*		1,48	1,67	1,82	1,95	0,76	0,87	0,97	1,06	1,40	1,60	1,76	1,88
6 *0.24*	80 *3 1/8*		1,69	1,94	2,16	2,30	0,88	1,00	1,12	1,21	1,60	1,83	2,05	2,22
	90 *3 1/2*		1,83	2,03	2,22	2,37	0,94	1,07	1,20	1,31	1,73	1,95	2,13	2,28
	40 *1 9/16*		1,26	1,51	1,76	1,98	0,50	0,60	0,70	0,79	1,13	1,36	1,58	1,78
	60 *2 3/8*		2,18	2,47	2,74	2,96	0,98	1,18	1,38	1,54	2,07	2,34	2,59	2,80
	80 *3 1/8*		2,59	2,95	3,30	3,59	1,40	1,58	1,75	1,90	2,46	2,79	3,12	3,39
8 *0.32*	100 *4*		3,08	3,52	3,95	4,31	1,61	1,83	2,05	2,22	2,92	3,34	3,74	4,08
	120 *4 3/4*		3,56	4,05	4,44	4,75	1,83	2,09	2,34	2,55	3,38	3,88	4,28	4,59
	140 *5 1/2*		3,82	4,26	4,68	5,01	2,02	2,31	2,59	2,83	3,69	4,12	4,52	4,85
	160 *6 1/4*		4,07	4,55	5,00	5,36	2,24	2,57	2,89	3,12	3,94	4,40	4,84	5,20
	60 *2 3/8*		2,66	3,00	3,32	3,59	1,15	1,38	1,61	1,81	2,52	2,84	3,15	3,40
	80 *3 1/8*		3,23	3,67	4,10	4,45	1,71	1,97	2,18	2,36	3,06	3,48	3,88	4,22
10 *0.40*	100 *4*		3,74	4,27	4,79	5,22	1,97	2,24	2,49	2,70	3,54	4,05	4,53	4,94
	120 *4 3/4*		4,32	4,96	5,50	5,89	2,24	2,55	2,85	3,10	4,10	4,70	5,29	5,68
	140 *5 1/2*		4,74	5,29	5,80	6,22	2,46	2,81	3,16	3,44	4,58	5,11	5,61	6,01
	160 *6 1/4*		5,05	5,64	6,20	6,66	2,73	3,13	3,51	3,84	4,89	5,46	6,01	6,45
	180 *7 1/8*		5,36	6,00	6,60	7,09	2,99	3,44	3,81	4,09	5,19	5,82	6,41	6,89
	120 *4 3/4*		5,13	5,87	6,59	7,19	2,68	3,05	3,40	3,69	4,86	5,56	6,24	6,81
12 *0.48*	140 *5 1/2*		5,81	6,65	7,28	7,80	2,99	3,41	3,82	4,16	5,51	6,33	7,03	7,53
	160 *6 1/4*		6,15	6,86	7,52	8,06	3,21	3,67	4,12	4,49	5,94	6,63	7,27	7,80
	180 *7 1/8*		6,52	7,28	8,00	8,59	3,52	4,04	4,54	4,95	6,31	7,05	7,75	8,32
	200 *8*		6,89	7,71	8,48	9,12	3,83	4,40	4,90	5,26	6,67	7,47	8,23	8,85

α = screw-to-grain angle

SHEAR[4]

geometry			steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
														
d_1 [mm] *[in]*	L [mm]	L *[in]*	S_{PLATE} [mm] *[in]*	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r [2] [3] G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]	factored lateral resistance N_r G 0.35 [kN]	G 0.42 [kN]	G 0.49 [kN]	G 0.55 [kN]
5 *0.20*	50	*1 15/16*	22,2 *7/8*	0,99	1,12	1,25	1,36	0,48	0,58	0,67	0,73	0,94	1,06	1,18	1,28
	60	*2 3/8*		1,14	1,30	1,46	1,59	0,61	0,69	0,77	0,83	1,08	1,23	1,38	1,50
	70	*2 3/4*		1,28	1,46	1,64	1,79	0,67	0,76	0,85	0,92	1,21	1,38	1,55	1,69
	80	*3 1/8*		1,45	1,67	1,82	1,95	0,75	0,85	0,96	1,04	1,38	1,58	1,76	1,88
6 *0.24*	80	*3 1/8*		1,66	1,90	2,14	2,30	0,87	0,98	1,10	1,19	1,57	1,80	2,02	2,20
	90	*3 1/2*		1,80	2,03	2,22	2,37	0,93	1,06	1,18	1,29	1,70	1,95	2,13	2,28
8 *0.32*	40	*1 9/16*		1,07	1,28	1,49	1,68	0,43	0,51	0,60	0,67	0,96	1,15	1,34	1,51
	60	*2 3/8*		2,11	2,38	2,63	2,85	0,91	1,09	1,27	1,43	1,99	2,25	2,49	2,69
	80	*3 1/8*		2,56	2,91	3,24	3,53	1,38	1,56	1,73	1,87	2,42	2,75	3,07	3,34
	100	*4*		3,04	3,48	3,90	4,25	1,60	1,82	2,02	2,20	2,88	3,29	3,69	4,03
	120	*4 3/4*		3,53	4,05	4,44	4,75	1,82	2,07	2,32	2,52	3,34	3,84	4,28	4,59
	140	*5 1/2*		3,82	4,26	4,68	5,01	2,01	2,29	2,57	2,81	3,69	4,12	4,52	4,85
	160	*6 1/4*		4,07	4,55	5,00	5,36	2,22	2,55	2,87	3,12	3,94	4,40	4,84	5,20
10 *0.40*	60	*2 3/8*		2,56	2,89	3,20	3,45	1,06	1,27	1,48	1,67	2,39	2,73	3,03	3,27
	80	*3 1/8*		3,15	3,58	3,99	4,33	1,62	1,93	2,14	2,31	2,99	3,39	3,78	4,10
	100	*4*		3,69	4,22	4,73	5,15	1,95	2,21	2,47	2,68	3,50	4,00	4,48	4,88
	120	*4 3/4*		4,28	4,91	5,50	5,89	2,22	2,53	2,82	3,07	4,06	4,66	5,23	5,68
	140	*5 1/2*		4,74	5,29	5,80	6,22	2,44	2,79	3,13	3,41	4,54	5,11	5,61	6,01
	160	*6 1/4*		5,05	5,64	6,20	6,66	2,71	3,11	3,49	3,81	4,89	5,46	6,01	6,45
	180	*7 1/8*		5,36	6,00	6,60	7,09	2,97	3,42	3,81	4,09	5,19	5,82	6,41	6,89
12 *0.48*	120	*4 3/4*		5,08	5,81	6,52	7,11	2,66	3,02	3,37	3,66	4,81	5,51	6,18	6,74
	140	*5 1/2*		5,76	6,62	7,28	7,80	2,97	3,39	3,79	4,13	5,47	6,27	7,03	7,53
	160	*6 1/4*		6,15	6,86	7,52	8,06	3,19	3,65	4,09	4,46	5,94	6,63	7,27	7,80
	180	*7 1/8*		6,52	7,28	8,00	8,59	3,50	4,01	4,51	4,92	6,31	7,05	7,75	8,32
	200	*8*		6,89	7,71	8,48	9,12	3,81	4,38	4,90	5,26	6,67	7,47	8,23	8,85

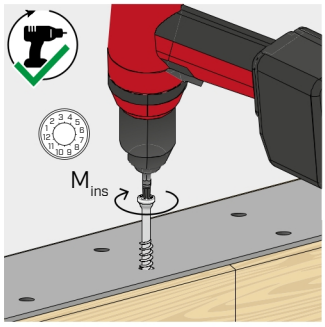
α = screw-to-grain angle

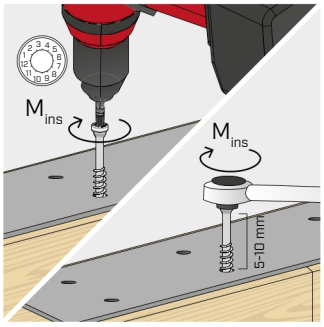
NOTES and GENERAL PRINCIPLES on page 245.

INSTALLATION



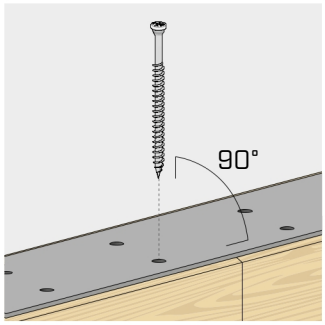
The use of pulse screw guns/impact wrenches is not permitted.



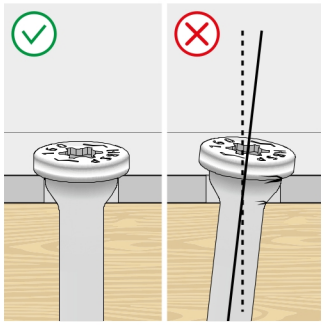


Ensure correct tightening.
We recommend the use of torque-controlled screwdrivers, e.g. with TORQUE LIMITER. Alternatively, tighten with a torque wrench.

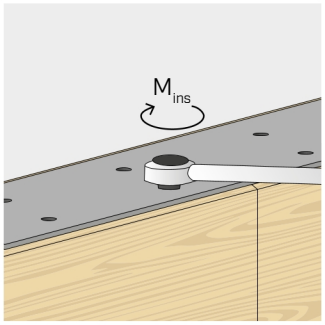
HBSP HBSPL	d_1 [mm]	$M_{ins,rec}$ [Nm]
Ø8	8	20
Ø10	10	30
Ø12	12	40



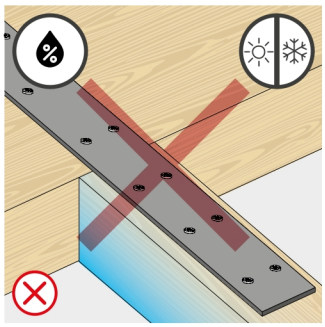
Respect the insertion angle. For very precise inclinations, the use of guide holes or pre-drilling is recommended.



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.



Avoid dimensional changes to the metal and shrinkage and swelling of timber.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- HBSP screws must be positioned in accordance with the minimum distances.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) HBSP screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

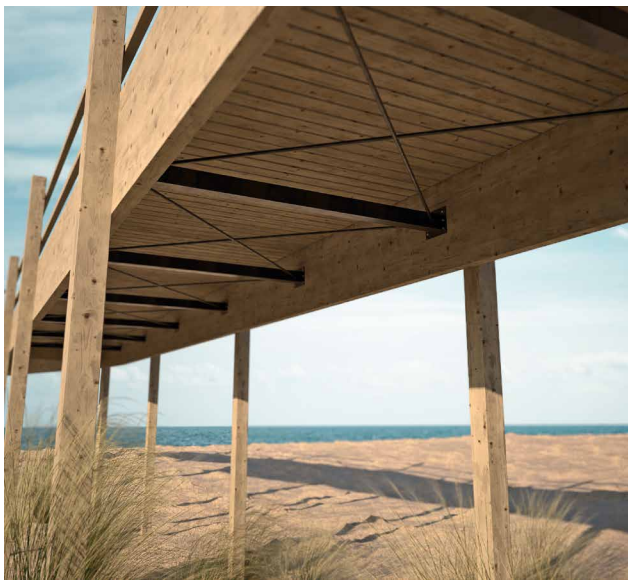
(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The side-member thickness, A, for HBS PLATE 8 x 60 mm was set to 15 mm to ensure the connection is not governed by failure mode (a).

HBS PLATE A4

PAN HEAD SCREW FOR PLATES

ELC-4645 ESR-4645 ETA-11/0030



A4 | AISI316

HBS PLATE version in A4 | AISI316 austenitic stainless steel for high corrosion resistance. Ideal for environments adjacent to the sea in corrosivity class C5 and for insertion on the most aggressive timbers in class T5.

STEEL-TO-TIMBER CONNECTIONS

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.

T5 TIMBER CORROSIVITY

Suitable for use in applications on aggressive woods with an acidity (pH) level below 4 such as oak, Douglas fir and chestnut, and in wood moisture conditions above 20%.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



MANUALS

BIT INCLUDED

DIAMETER [mm]

3,5 | 8 | 12 | 12

LENGTH [mm]

25 | 60 | 200 | 200

SERVICE CONDITION

EC1 EC2 EC3 EC4 WET

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4 C5

WOOD CORROSIVITY

T1 T2 T3 T4 T5

MATERIAL

A4 AISI 316 — A4 | AISI316 austenitic stainless steel (CRC III)



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- ACQ, CCA treated timber

CODES AND DIMENSIONS

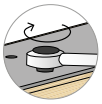
d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
8 TX 40	HBSPL860A4	60	52	1 - 10	100
	HBSPL880A4	80	55	1 - 15	100
	HBSPL8100A4	100	75	1 - 15	100
	HBSPL8120A4	120	95	1 - 15	100
	HBSPL8140A4	140	110	1 - 20	100
	HBSPL8160A4	160	130	1 - 20	100
10 TX 40	HBSPL1080A4	80	60	1 - 10	50
	HBSPL10100A4	100	75	1 - 15	50
	HBSPL10120A4	120	95	1 - 15	50
	HBSPL10140A4	140	110	1 - 20	50
	HBSPL10160A4	160	130	1 - 20	50
	HBSPL10180A4	180	150	1 - 20	50

d_1 [mm]	CODE	L [mm]	b [mm]	A_P [mm]	pcs
12 TX 50	HBSPL12100A4	100	75	1 - 15	25
	HBSPL12120A4	120	90	1 - 20	25
	HBSPL12140A4	140	110	1 - 20	25
	HBSPL12160A4	160	120	1 - 30	25
	HBSPL12180A4	180	140	1 - 30	25
	HBSPL12200A4	200	160	1 - 30	25

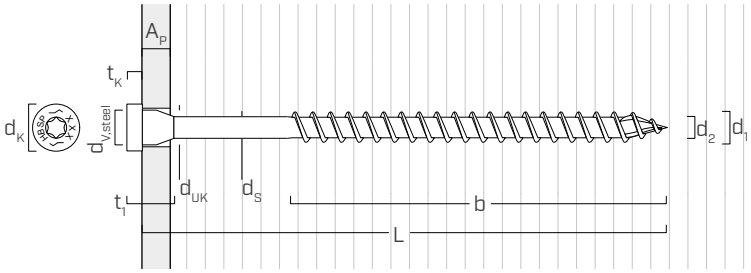
METAL-to-TIMBER recommended use:







GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	d_1	[mm]	8	10	12
Head diameter	d_K	[mm]	13,50	16,50	18,50
Internal thread diameter	d_2	[mm]	5,90	6,60	7,30
Shank diameter	d_s	[mm]	6,30	7,20	8,55
Head thickness	t_1	[mm]	10,00	11,50	13,00
Washer thickness	t_k	[mm]	4,00	4,50	5,00
Underhead diameter	d_{UK}	[mm]	10,00	12,00	13,00
Hole diameter on steel plate	$d_{V,steel}$	[mm]	11,00	13,00	14,00
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	5,0	6,0	7,0

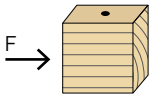
(1) Pre-drilling valid for softwood.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		8	10	12
Factored tensile strength	Φf_u	[kN]		9,23	10,89	17,15
Bending yield strength	F_{yb}	[MPa]		631	619	655
Factored shear strength of the screw	Φv_s	[kN]		5,91	7,39	9,04
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	69,83	87,29	104,75
			G=0.42	80,80	101,00	121,20
			G=0.49	91,40	114,26	137,11
			G=0.55	100,25	125,32	150,38
Specified head pull-through resistance per screw	F_{pt}	[kN]	G=0.35	1,13	1,59	1,92
			G=0.42	1,36	1,91	2,30
			G=0.49	1,58	2,23	2,69
			G=0.55	1,78	2,50	3,02

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

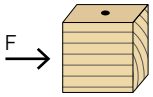
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	12·d‡	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
S_Q	5·d	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
a_L	15·d‡	120	*4 3/4*	150	*6*	180	*7 1/8*
a	10·d‡	80	*3 1/8*	100	*4*	120	*4 3/4*
e_Q	10·d	80	*3 1/8*	100	*4*	120	*4 3/4*
e_P	5·d	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*

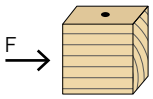
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



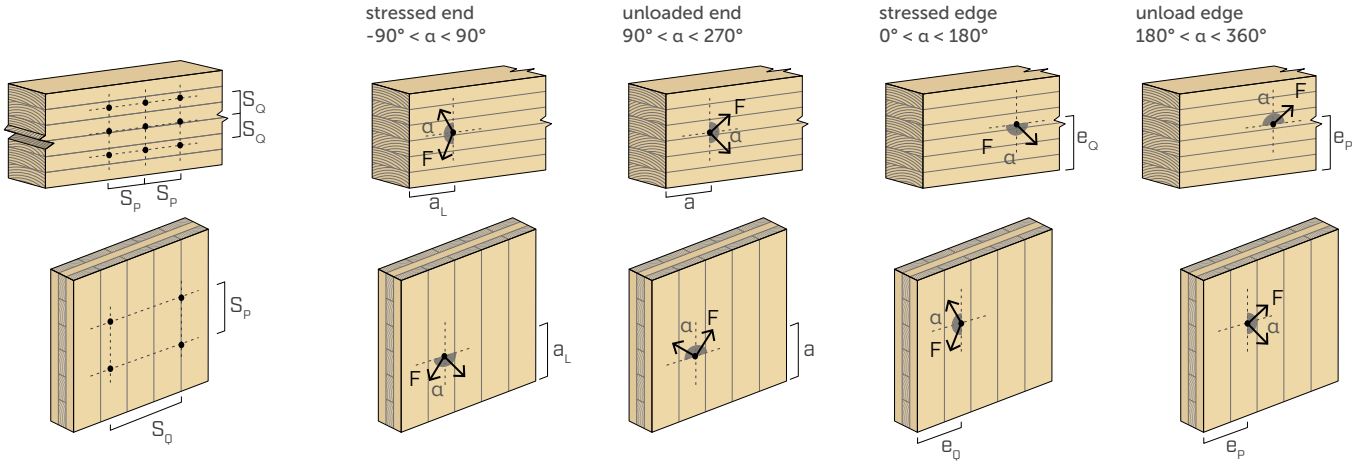
d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	18·d	144	*5 11/16*	180	*7 1/8*	216	*8 1/2*
S_Q	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
a_L	22·d	176	*6 15/16*	220	*8 5/8*	264	*10 3/8*
a	15·d	120	*4 3/4*	150	*6*	180	*7 1/8*
e_Q	12·d	96	*3 3/4*	120	*4 3/4*	*144*	*5 11/16*
e_P	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*

screws inserted **WITH pre-drilled hole**



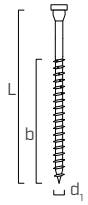
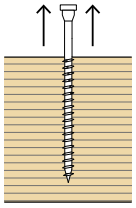
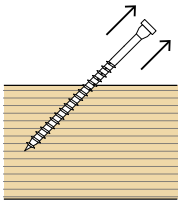
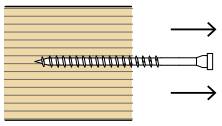
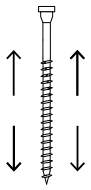
d_1		8 [mm]	*0.32 [in]*	10 [mm]	*0.40 [in]*	12 [mm]	*0.48 [in]*
S_P	5·d†	40	*1 9/16*	50	*1 15/16*	60	*2 3/8*
S_Q	4·d	32	*1 1/4*	40	*1 9/16*	48	*1 7/8*
a_L	12·d†	96	*3 3/4*	120	*4 3/4*	144	*5 11/16*
a	7·d†	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_Q	7·d	56	*2 3/16*	70	*2 3/4*	84	*3 5/16*
e_P	3·d	24	*15/16*	30	*1 3/16*	36	*1 7/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle



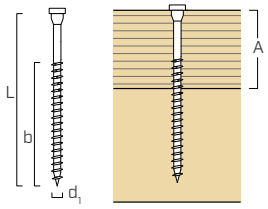
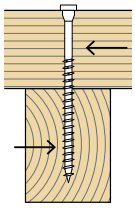
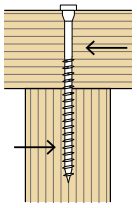
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

geometry				TENSION[1]												steel tension
				thread withdrawal												
				α = 90°				α = 45°				end grain α = 0°				
																
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2][3]				factored tension resistance T_{rs}
				G				G				G				
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
8 *0.32*	60	*2 3/8*	52	2,15	2,49	2,82	3,09	1,96	2,26	2,56	2,81	1,08	1,24	1,41	1,54	9,23
	80	*3 1/8*	55	2,30	2,66	3,01	3,30	2,09	2,42	2,73	3,00	1,15	1,33	1,50	1,65	
	100	*4*	75	3,28	3,79	4,29	4,70	2,98	3,45	3,90	4,27	1,64	1,89	2,14	2,35	
	120	*4 3/4*	95	4,25	4,92	5,57	6,11	3,87	4,47	5,06	5,55	2,13	2,46	2,78	3,05	
	140	*5 1/2*	110	4,99	5,77	6,53	7,16	4,53	5,24	5,93	6,51	2,49	2,88	3,26	3,58	
	160	*6 1/4*	130	5,96	6,90	7,81	8,56	5,42	6,27	7,10	7,78	2,98	3,45	3,90	4,28	
10 *0.40*	80	*3 1/8*	60	3,06	3,54	4,00	4,39	2,78	3,21	3,64	3,99	1,53	1,77	2,00	2,19	10,89
	100	*4*	75	3,97	4,60	5,20	5,70	3,61	4,18	4,73	5,18	1,99	2,30	2,60	2,85	
	120	*4 3/4*	95	5,19	6,01	6,80	7,46	4,72	5,46	6,18	6,78	2,60	3,00	3,40	3,73	
	140	*5 1/2*	110	6,11	7,07	8,00	8,77	5,55	6,43	7,27	7,97	3,06	3,54	4,00	4,39	
	160	*6 1/4*	130	7,33	8,48	9,60	10,53	6,67	7,71	8,73	9,57	3,67	4,24	4,80	5,26	
	180	*7 1/8*	150	8,55	9,90	11,20	12,28	7,78	9,00	10,18	11,16	4,28	4,95	5,60	6,14	
12 *0.48*	100	*4*	75	4,62	5,34	6,05	6,63	4,20	4,86	5,50	6,03	2,31	2,67	3,02	3,32	17,15
	120	*4 3/4*	90	5,72	6,62	7,49	8,21	5,20	6,02	6,81	7,46	2,86	3,31	3,74	4,11	
	140	*5 1/2*	110	7,19	8,31	9,41	10,32	6,53	7,56	8,55	9,38	3,59	4,16	4,70	5,16	
	160	*6 1/4*	120	7,92	9,16	10,37	11,37	7,20	8,33	9,42	10,34	3,96	4,58	5,18	5,68	
	180	*7 1/8*	140	9,39	10,86	12,29	13,47	8,53	9,87	11,17	12,25	4,69	5,43	6,14	6,74	
	200	*8*	160	10,85	12,56	14,20	15,58	9,87	11,41	12,91	14,16	5,43	6,28	7,10	7,79	

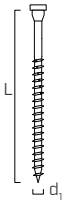
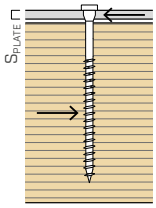
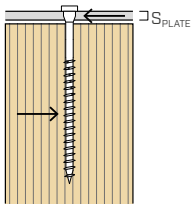
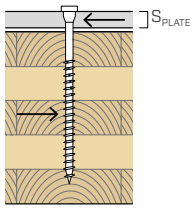
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 255.

geometry					SHEAR[4]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2] [3]			
d_1	L		b	A[5]	G				G			
					0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
8 *0.32*	60	*2 3/8*	52	15	0,92	1,10	1,29	1,44	0,59	0,71	0,83	0,93
	80	*3 1/8*	55	25	1,16	1,39	1,55	1,68	0,76	0,91	1,07	1,20
	100	*4*	75	25	1,22	1,39	1,55	1,68	0,86	1,03	1,20	1,35
	120	*4 3/4*	95	25	1,22	1,39	1,55	1,68	0,95	1,14	1,34	1,46
	140	*5 1/2*	110	30	1,28	1,46	1,63	1,78	1,09	1,27	1,43	1,56
	160	*6 1/4*	130	30	1,28	1,46	1,63	1,78	1,10	1,27	1,43	1,56
10 *0.40*	80	*3 1/8*	60	20	1,40	1,67	1,86	2,02	0,90	1,07	1,25	1,41
	100	*4*	75	25	1,54	1,75	1,96	2,13	1,05	1,26	1,47	1,65
	120	*4 3/4*	95	25	1,54	1,75	1,96	2,13	1,16	1,39	1,63	1,83
	140	*5 1/2*	110	30	1,61	1,84	2,06	2,24	1,32	1,58	1,79	1,96
	160	*6 1/4*	130	30	1,61	1,84	2,06	2,24	1,39	1,59	1,79	1,96
	180	*7 1/8*	150	30	1,61	1,84	2,06	2,24	1,39	1,59	1,79	1,96
12 *0.48*	100	*4*	75	25	1,90	2,16	2,41	2,61	1,21	1,46	1,70	1,91
	120	*4 3/4*	90	30	1,98	2,25	2,52	2,74	1,39	1,67	1,94	2,18
	140	*5 1/2*	110	30	1,98	2,25	2,52	2,74	1,52	1,82	2,12	2,38
	160	*6 1/4*	120	40	2,14	2,44	2,74	2,99	1,74	2,09	2,40	2,63
	180	*7 1/8*	140	40	2,14	2,44	2,74	2,99	1,85	2,13	2,40	2,63
	200	*8*	160	40	2,14	2,44	2,74	2,99	1,85	2,13	2,40	2,63

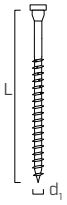
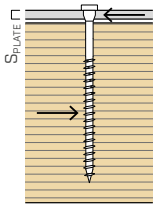
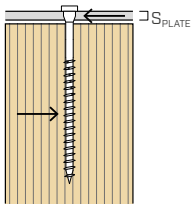
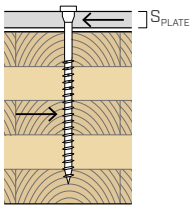
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 255.

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
															
d_1	L		S_{PLATE}	factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
				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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,23	2,55	2,86	3,11	1,18	1,34	1,49	1,62	2,11	2,41	2,70	2,94
	80	*3 1/8*		2,51	2,88	3,15	3,36	1,30	1,48	1,65	1,80	2,37	2,71	3,03	3,23
8	100	*4*		2,85	3,17	3,47	3,71	1,52	1,74	1,95	2,12	2,74	3,06	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,74	1,99	2,22	2,37	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,91	2,13	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		3,13	3,58	4,03	4,31	1,63	1,85	2,07	2,25	2,95	3,38	3,80	4,15
	100	*4*		3,56	3,96	4,34	4,64	1,85	2,12	2,37	2,59	3,43	3,82	4,18	4,48
10	120	*4 3/4*	3,2	3,87	4,32	4,74	5,08	2,12	2,43	2,73	2,97	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*1/8*	4,10	4,58	5,04	5,41	2,35	2,67	2,93	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,55	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,34	4,93	5,39	5,76	2,23	2,55	2,85	3,10	4,10	4,71	5,19	5,55
	120	*4 3/4*		4,71	5,25	5,75	6,16	2,50	2,86	3,21	3,50	4,54	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,81	3,22	3,63	3,89	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	3,03	3,42	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,25	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79
	60	*2 3/8*		2,20	2,51	2,80	3,05	1,17	1,32	1,47	1,60	2,08	2,37	2,65	2,89
	80	*3 1/8*		2,47	2,84	3,15	3,36	1,28	1,46	1,63	1,77	2,33	2,67	3,00	3,23
8	100	*4*		2,85	3,17	3,47	3,71	1,50	1,72	1,93	2,10	2,74	3,06	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,72	1,97	2,22	2,37	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,91	2,13	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		3,08	3,53	3,97	4,31	1,61	1,83	2,04	2,22	2,91	3,34	3,74	4,08
	100	*4*		3,56	3,96	4,34	4,64	1,84	2,10	2,35	2,56	3,40	3,82	4,18	4,48
10	120	*4 3/4*	6,4	3,87	4,32	4,74	5,08	2,10	2,41	2,71	2,96	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*1/4*	4,10	4,58	5,04	5,41	2,33	2,67	2,93	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,55	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,29	4,92	5,39	5,76	2,21	2,52	2,82	3,07	4,06	4,65	5,19	5,55
	120	*4 3/4*		4,71	5,25	5,75	6,16	2,48	2,84	3,18	3,47	4,54	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,79	3,20	3,60	3,89	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	3,01	3,42	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,25	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79

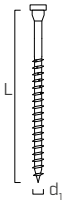
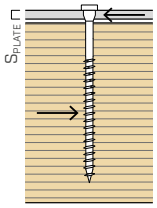
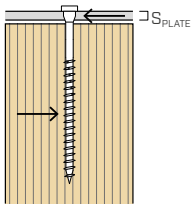
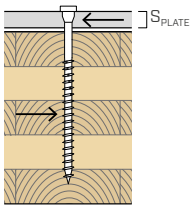
α = screw-to-grain angle

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

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r [2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		2,14	2,44	2,73	2,97	1,14	1,30	1,44	1,56	2,03	2,31	2,58	2,81
	80	*3 1/8*		2,43	2,79	3,13	3,36	1,27	1,44	1,61	1,75	2,30	2,63	2,96	3,23
8	100	*4*		2,85	3,17	3,47	3,71	1,49	1,70	1,90	2,08	2,74	3,06	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,71	1,96	2,20	2,37	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,89	2,13	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		3,04	3,48	3,90	4,26	1,59	1,81	2,02	2,19	2,87	3,29	3,69	4,02
	100	*4*		3,55	3,96	4,34	4,64	1,82	2,08	2,32	2,53	3,36	3,82	4,18	4,48
10	120	*4 3/4*	9,5	3,87	4,32	4,74	5,08	2,08	2,39	2,68	2,93	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*3/8*	4,10	4,58	5,04	5,41	2,31	2,66	2,93	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,55	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,24	4,86	5,39	5,76	2,19	2,50	2,79	3,04	4,01	4,60	5,17	5,55
	120	*4 3/4*		4,71	5,25	5,75	6,16	2,46	2,81	3,15	3,44	4,54	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,77	3,18	3,57	3,89	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	2,99	3,42	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,25	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79
	60	*2 3/8*		2,06	2,35	2,62	2,85	1,11	1,25	1,39	1,51	1,95	2,22	2,48	2,70
	80	*3 1/8*		2,40	2,74	3,08	3,36	1,25	1,42	1,59	1,73	2,26	2,59	2,91	3,17
8	100	*4*		2,85	3,17	3,47	3,71	1,47	1,68	1,88	2,05	2,72	3,06	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,69	1,94	2,18	2,37	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,88	2,13	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		2,99	3,42	3,84	4,19	1,57	1,79	1,99	2,16	2,83	3,24	3,63	3,96
	100	*4*		3,50	3,96	4,34	4,64	1,80	2,05	2,30	2,50	3,32	3,81	4,18	4,48
10	120	*4 3/4*	12,7	3,87	4,32	4,74	5,08	2,07	2,37	2,66	2,90	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*1/2*	4,10	4,58	5,04	5,41	2,29	2,63	2,93	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,55	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,19	4,80	5,39	5,76	2,17	2,47	2,76	3,01	3,96	4,54	5,10	5,55
	120	*4 3/4*		4,71	5,25	5,75	6,16	2,44	2,79	3,12	3,40	4,53	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,75	3,15	3,54	3,87	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	2,97	3,41	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,25	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79

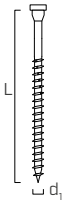
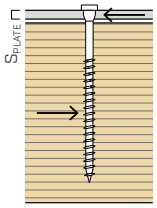
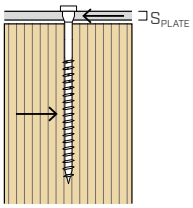
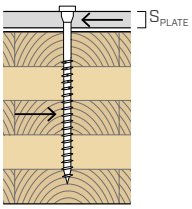
α = screw-to-grain angle

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

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		1,99	2,26	2,52	2,73	1,06	1,21	1,35	1,46	1,88	2,14	2,38	2,59
	80	*3 1/8*		2,36	2,70	3,03	3,30	1,24	1,41	1,57	1,70	2,23	2,55	2,86	3,12
8	100	*4*		2,84	3,17	3,47	3,71	1,46	1,66	1,86	2,03	2,69	3,06	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,67	1,92	2,16	2,35	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,86	2,13	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		2,95	3,37	3,78	4,12	1,56	1,77	1,97	2,13	2,79	3,19	3,58	3,90
	100	*4*		3,46	3,96	4,34	4,64	1,78	2,03	2,27	2,48	3,28	3,76	4,18	4,48
10	120	*4 3/4*	15,9	3,87	4,32	4,74	5,08	2,05	2,34	2,63	2,87	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*5/8*	4,10	4,58	5,04	5,41	2,28	2,61	2,93	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,54	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,14	4,74	5,33	5,76	2,15	2,45	2,74	2,97	3,92	4,49	5,04	5,50
	120	*4 3/4*		4,71	5,25	5,75	6,16	2,42	2,76	3,09	3,37	4,48	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,73	3,13	3,51	3,84	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	2,95	3,39	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,25	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79
	60	*2 3/8*		1,91	2,17	2,41	2,62	0,98	1,17	1,30	1,40	1,81	2,05	2,28	2,48
	80	*3 1/8*		2,32	2,65	2,97	3,24	1,22	1,39	1,55	1,68	2,20	2,51	2,81	3,06
8	100	*4*		2,80	3,17	3,47	3,71	1,44	1,64	1,84	2,00	2,66	3,05	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,66	1,90	2,13	2,33	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,85	2,12	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		2,90	3,32	3,72	4,05	1,54	1,74	1,94	2,11	2,75	3,14	3,52	3,83
	100	*4*		3,41	3,92	4,34	4,64	1,77	2,01	2,25	2,45	3,24	3,71	4,17	4,48
10	120	*4 3/4*	19,1	3,87	4,32	4,74	5,08	2,03	2,32	2,61	2,84	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*3/4*	4,10	4,58	5,04	5,41	2,26	2,59	2,91	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,52	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,09	4,68	5,26	5,74	2,13	2,43	2,71	2,94	3,87	4,43	4,98	5,43
	120	*4 3/4*		4,68	5,25	5,75	6,16	2,40	2,74	3,07	3,34	4,43	5,06	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,71	3,10	3,48	3,80	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	2,93	3,36	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,24	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79

α = screw-to-grain angle

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

geometry				SHEAR[4]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
															
d_1	L		S_{PLATE}	factored lateral resistance N_r				factored lateral resistance N_r[2] [3]				factored lateral resistance N_r			
				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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	60	*2 3/8*		1,83	2,08	2,31	2,50	0,91	1,09	1,25	1,35	1,73	1,96	2,19	2,37
	80	*3 1/8*		2,28	2,61	2,92	3,18	1,21	1,37	1,52	1,65	2,16	2,47	2,76	3,01
8	100	*4*		2,77	3,17	3,47	3,71	1,43	1,63	1,82	1,98	2,62	3,01	3,35	3,58
0.32	120	*4 3/4*		3,09	3,45	3,79	4,06	1,64	1,88	2,11	2,31	2,99	3,34	3,67	3,94
	140	*5 1/2*		3,28	3,66	4,03	4,33	1,83	2,10	2,34	2,51	3,17	3,55	3,91	4,20
	160	*6 1/4*		3,52	3,95	4,35	4,68	2,03	2,27	2,50	2,68	3,42	3,83	4,23	4,55
	80	*3 1/8*		2,83	3,22	3,61	3,93	1,50	1,70	1,90	2,05	2,68	3,06	3,42	3,72
	100	*4*		3,37	3,87	4,34	4,64	1,75	1,99	2,22	2,42	3,20	3,66	4,12	4,48
10	120	*4 3/4*	22,2	3,87	4,32	4,74	5,08	2,01	2,30	2,58	2,82	3,74	4,17	4,58	4,92
0.40	140	*5 1/2*	*7/8*	4,10	4,58	5,04	5,41	2,24	2,57	2,89	3,14	3,97	4,44	4,88	5,25
	160	*6 1/4*		4,40	4,94	5,44	5,85	2,50	2,85	3,13	3,36	4,27	4,79	5,28	5,68
	180	*7 1/8*		4,71	5,29	5,76	5,94	2,70	3,02	3,33	3,58	4,58	5,15	5,61	5,78
	100	*4*		4,03	4,62	5,19	5,66	2,11	2,40	2,68	2,91	3,83	4,38	4,91	5,36
	120	*4 3/4*		4,63	5,25	5,75	6,16	2,38	2,71	3,04	3,31	4,39	5,04	5,55	5,95
12	140	*5 1/2*		5,08	5,67	6,23	6,68	2,69	3,08	3,46	3,77	4,91	5,49	6,03	6,47
0.48	160	*6 1/4*		5,26	5,88	6,47	6,95	2,91	3,34	3,75	4,02	5,09	5,70	6,27	6,74
	180	*7 1/8*		5,63	6,31	6,95	7,47	3,22	3,63	3,99	4,29	5,46	6,12	6,75	7,26
	200	*8*		5,99	6,73	7,43	8,00	3,44	3,85	4,23	4,55	5,83	6,55	7,23	7,79

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 255.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- Head pull-through values have been determined in accordance with CSA O86:24, Clause A.12.12.8.3. Withdrawal and head pull-through values given in this datasheet are likewise applicable to CLT connections.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). Engineering discretion and judgment should be applied to evaluate the potential impact of reduced penetration on the connection's load-carrying capacity.
- Connection design requires comparing head pull-through resistance to both screw tensile capacity and thread withdrawal - the minimum of the three governs.
- G is the mean relative density according to CSA O86:24 Table A12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The tabulated lateral design values are based on both wood members having the same specific gravity G.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Combined shear and tensile stresses shall comply with the interaction criteria outlined in CSA O86:24 Clause 12.12.11.

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry. The factored tensile resistance of the connector (P_{rt}) is governed by the lower value between the withdrawal resistance (P_{rw}), head pull-through resistance (P_{pt}) and the steel strength (T_{rs}).

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) HBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal (20 d_1) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.

(4) Lateral resistances are factored and according to CSA O86:24 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(5) The side-member thickness, A, for HBS PLATE 8 x 60 mm was set to 15 mm to ensure the connection is not governed by failure mode (a).

LBS

ROUND HEAD SCREW FOR PLATES

ELC-4645 ESR-4645 UKTA-0836 22/6195 ETA-11/0030



SCREW FOR PERFORATED PLATES

Cylindrical shoulder designed for fastening metal elements. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.

STATICS

These can be calculated in accordance with the CSA-O86 provisions for the lateral resistance of connections. Excellent shear strength values.

NEW-GENERATION WOODS

Tested and certified for use on a wide variety of engineered timbers such as CLT, GL, LVL, OSB and Beech LVL. The LBS5 version up to a length of 40 mm is approved completely without pre-drilling hole on Beech LVL.

DUCTILITY

Excellent ductility behaviour as evidenced by SEISMIC-REV cyclic tests according to EN 12512.

CANADIAN DESIGN VALUES

USA, EU and more design values available online.



BIT INCLUDED

DIAMETER [mm]

3,5 | 5 | 7 | 12

LENGTH [mm]

25 | 25 | 100 | 200

SERVICE CONDITION

EC1 DRY

ATMOSPHERIC CORROSIVITY

C1 C2

WOOD CORROSIVITY

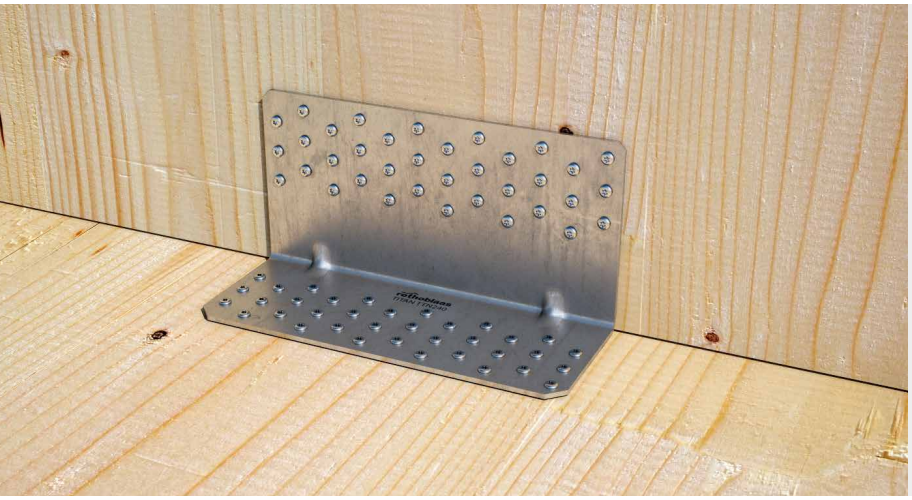
T1 T2

MATERIAL

Zn ELECTRO PLATED electrogalvanized carbon steel

CORE HARDNESS

<390 HV as required in CSA O86:24(1)



FIELDS OF USE

- timber based panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT and LVL
- high density woods

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

d_1 [mm] *[in]*	CODE	L [mm]	b [mm]	pcs
5 *0.20* TX 20	**LBS525**	25	21	500
	LBS540	40	36	500
	LBS550	50	46	200
	LBS560	60	56	200
	LBS570	70	66	200
7 *0.28* TX 30	**LBS760**	60	55	100
	LBS780	80	75	100
	LBS7100	100	95	100

LBS HARDWOOD EVO

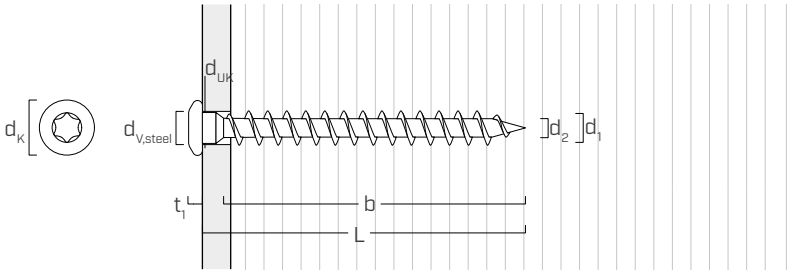
ROUND HEAD SCREW FOR PLATES ON HARDWOODS



DIAMETER [mm]	3		**5**	**7**		12
LENGTH [mm]	25			**60**	**200**	200

Also available in the LBS HARDWOOD EVO version, L from 60 to 200 mm, diameter Ø5 and Ø7 mm.

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	[mm]	**5**	**7**
Head diameter	d_K	[mm]	7,80	11,00
Root diameter	d_2	[mm]	3,00	4,40
Underhead diameter	d_{UK}	[mm]	4,90	7,00
Head thickness	t_1	[mm]	2,40	3,50
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0÷5,5	7,5÷8,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0	4,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5	5,0

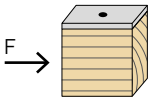
(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

Nominal diameter	**d_1**	**[mm]**		**5**	**7**
Factored tensile strength	Φf_u	[kN]		5,36	11,59
Bending yield strength	F_{yb}	[MPa]		1075	1146
Factored shear strength of the screw	Φv_s	[kN]		2,71	5,84
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29	73,20
			G=0.42	60,50	84,70
			G=0.49	68,44	95,82
			G=0.55	75,07	105,09

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

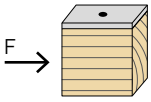
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**12·d‡**	60	*2 3/8*	84	*3 5/16*
S_Q	**5·d**	25	*1*	35	*1 3/8*
a_L	**15·d‡**	75	*2 15/16*	105	*4 1/8*
a	**10·d‡**	50	*1 15/16*	70	*2 3/4*
e_Q	**10·d**	50	*1 15/16*	70	*2 3/4*
e_P	**5·d**	25	*1*	35	*1 3/8*

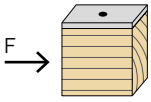
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



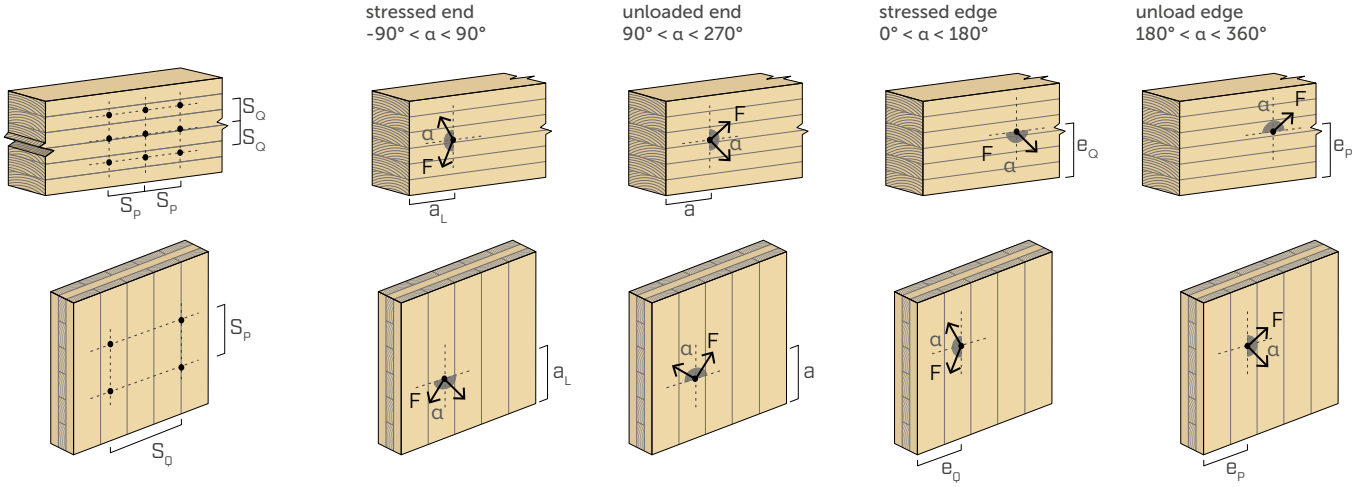
d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**18·d**	90	*3 1/2*	126	*4 15/16*
S_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
a_L	**22·d**	110	*4 3/8*	154	*6 1/16*
a	**15·d**	75	*2 15/16*	105	*4 1/8*
e_Q	**12·d**	60	*2 3/8*	84	*3 5/16*
e_P	**7·d**	35	*1 3/8*	49	*1 15/16*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**5·d†**	25	*1*	35	*1 3/8*
S_Q	**4·d**	20	*13/16*	28	*1 1/8*
a_L	**12·d†**	60	*2 3/8*	84	*3 5/16*
a	**7·d†**	35	*1 3/8*	49	*1 15/16*
e_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
e_P	**3·d**	15	*9/16*	21	*13/16*

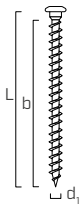
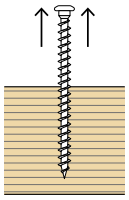
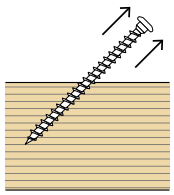
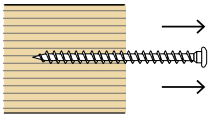
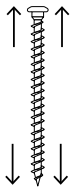
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



NOTES

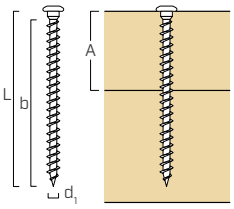
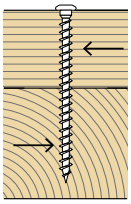
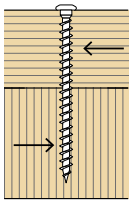
- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.

STRUCTURAL VALUES | AXIAL TENSION

geometry			TENSION[1]											
			thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°				steel tension
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}
			G				G				G				
d_1 [mm] *[in]*	L [mm]	b [mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	[kN]
5 *0.20*	25	21	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42	5,36
	40	36	1,13	1,31	1,49	1,63	1,03	1,19	1,35	1,48	0,57	0,66	0,74	0,81	
	50	46	1,50	1,74	1,96	2,15	1,36	1,58	1,79	1,96	0,75	0,87	0,98	1,08	
	60	56	1,87	2,16	2,44	2,68	1,70	1,96	2,22	2,44	0,93	1,08	1,22	1,34	
	70	66	2,23	2,58	2,92	3,21	2,03	2,35	2,66	2,91	1,12	1,29	1,46	1,60	
7 *0.28*	60	55	2,46	2,85	3,22	3,53	2,24	2,59	2,93	3,21	1,23	1,42	1,61	1,77	11,59
	80	75	3,48	4,03	4,56	5,00	3,17	3,67	4,15	4,55	1,74	2,02	2,28	2,50	
	100	95	4,51	5,22	5,90	6,47	4,10	4,74	5,37	5,89	2,25	2,61	2,95	3,24	

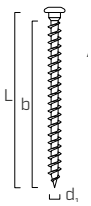
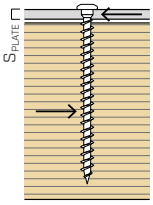
α = screw-to-grain angle

STRUCTURAL VALUES | LATERAL RESISTANCE

geometry				SHEAR[3]							
				wood-to-wood α = 90°				wood-to-wood end grain α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1 [mm] *[in]*	L [mm]	b [mm]	A[4] [mm]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
5 *0.20*	25	21	7,5	0,25	0,30	0,34	0,39	0,16	0,19	0,22	0,24
	40	36	15	0,45	0,53	0,62	0,69	0,31	0,37	0,42	0,47
	50	46	20	0,58	0,69	0,78	0,84	0,39	0,46	0,54	0,60
	60	56	25	0,70	0,80	0,90	0,98	0,47	0,54	0,61	0,66
	70	66	30	0,79	0,90	1,00	1,07	0,52	0,59	0,66	0,72
7 *0.28*	60	55	25	0,91	1,08	1,25	1,40	0,61	0,72	0,83	0,93
	80	75	35	1,26	1,49	1,73	1,90	0,82	0,98	1,13	1,22
	100	95	45	1,60	1,84	2,07	2,23	1,00	1,14	1,27	1,38

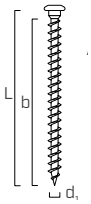
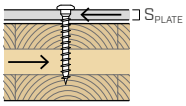
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 262.

geometry			SHEAR steel-to-timber α = 90°			
						
d_1 **[mm]** ***[in]***	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r (3) G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
5 *0.20*	25	21	1,6 *1/16*	0,76	0,86	0,96	1,04
	40	36		1,02	1,17	1,32	1,43
	50	46		1,19	1,33	1,45	1,56
	60	56		1,28	1,43	1,57	1,69
	70	66		1,37	1,54	1,69	1,82
	40	36	3,2 *1/8*	1,01	1,16	1,30	1,42
	50	46		1,19	1,33	1,45	1,56
	60	56		1,28	1,43	1,57	1,69
	70	66		1,37	1,54	1,69	1,82
	40	36	6,4 *1/4*	0,96	1,10	1,23	1,34
	50	46		1,14	1,30	1,42	1,53
	60	56		1,26	1,41	1,54	1,66
	70	66		1,35	1,51	1,66	1,79
	50	46	9,5 *3/8*	1,08	1,24	1,39	1,48
	60	56		1,23	1,37	1,51	1,62
	70	66		1,32	1,48	1,63	1,75
	50	46	12,7 *1/2*	1,02	1,17	1,32	1,44
	60	56		1,20	1,34	1,47	1,57
	70	66		1,29	1,44	1,59	1,70
	50	46	15,9 *5/8*	0,97	1,11	1,24	1,35
	60	56		1,15	1,31	1,43	1,53
	70	66		1,26	1,41	1,55	1,66
	50	46	19,1 *3/4*	0,91	1,04	1,17	1,27
	60	56		1,09	1,25	1,39	1,49
	70	66		1,23	1,38	1,51	1,62
7 *0.28*	60	55	1,6 *1/16*	2,09	2,40	2,69	2,94
	80	75		2,55	2,85	3,13	3,35
	100	95		2,81	3,14	3,46	3,72
	60	55	3,2 *1/8*	2,08	2,38	2,67	2,91
	80	75		2,55	2,85	3,13	3,35
	100	95		2,81	3,14	3,46	3,72
	60	55	6,4 *1/4*	2,02	2,31	2,60	2,83
	80	75		2,50	2,83	3,10	3,33
	100	95		2,79	3,12	3,44	3,69
	60	55	9,5 *3/8*	1,95	2,23	2,49	2,72
	80	75		2,42	2,78	3,05	3,27
	100	95		2,75	3,08	3,38	3,64
	60	55	12,7 *1/2*	1,87	2,14	2,39	2,60
	80	75		2,35	2,70	3,00	3,21
	100	95		2,71	3,03	3,33	3,58
	60	55	15,9 *5/8*	1,80	2,05	2,29	2,49
	80	75		2,27	2,61	2,93	3,15
	100	95		2,67	2,98	3,28	3,52
	60	55	19,1 *3/4*	1,72	1,96	2,19	2,38
	80	75		2,20	2,52	2,83	3,09
	100	95		2,63	2,94	3,22	3,46

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 262.

geometry			SHEAR steel-to-CLT lateral face[5]		
					
d_1 **[mm]** *[in]*	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r[3] E3 G=0.35 [kN]	 E1 and V2 G=0.42 [kN]	 E2 and V1 G=0.49 [kN]
5 *0.20*	25	21	1,6 *1/16*	0,71	0,81	0,90
	40	36		0,97	1,11	1,25
	50	46		1,14	1,28	1,40
	60	56		1,24	1,39	1,52
	70	66		1,33	1,49	1,64
	40	36	3,2 *1/8*	0,96	1,09	1,23
	50	46		1,13	1,28	1,40
	60	56		1,24	1,39	1,52
	70	66		1,33	1,49	1,64
	40	36	6,4 *1/4*	0,91	1,04	1,17
	50	46		1,08	1,24	1,38
	60	56		1,22	1,36	1,50
	70	66		1,31	1,47	1,62
	50	46	9,5 *3/8*	1,03	1,18	1,32
	60	56		1,19	1,33	1,46
	70	66		1,28	1,43	1,58
	50	46	12,7 *1/2*	0,97	1,11	1,25
	60	56		1,14	1,29	1,42
	70	66		1,25	1,40	1,54
	50	46	15,9 *5/8*	0,92	1,05	1,18
	60	56		1,09	1,25	1,38
	70	66		1,22	1,37	1,50
	50	46	19,1 *3/4*	0,86	0,99	1,10
	60	56		1,03	1,19	1,33
	70	66		1,19	1,33	1,46
7 *0.28*	60	55	1,6 *1/16*	1,99	2,27	2,55
	80	75		2,44	2,75	3,02
	100	95		2,72	3,05	3,36
	60	55	3,2 *1/8*	1,97	2,26	2,53
	80	75		2,42	2,75	3,02
	100	95		2,72	3,05	3,36
	60	55	6,4 *1/4*	1,92	2,20	2,46
	80	75		2,38	2,73	3,00
	100	95		2,70	3,03	3,34
	60	55	9,5 *3/8*	1,85	2,11	2,37
	80	75		2,30	2,65	2,95
	100	95		2,66	2,98	3,28
	60	55	12,7 *1/2*	1,78	2,03	2,27
	80	75		2,23	2,56	2,88
	100	95		2,62	2,94	3,23
	60	55	15,9 *5/8*	1,71	1,94	2,17
	80	75		2,16	2,48	2,78
	100	95		2,58	2,89	3,18
	60	55	19,1 *3/4*	1,64	1,86	2,08
	80	75		2,09	2,39	2,69
	100	95		2,54	2,84	3,12

NOTES and **GENERAL PRINCIPLES** on page 262.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 including the withdrawal restrain effect. Listed values are based on standard term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA-O86 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance.
- LBS screws must be positioned in accordance with the minimum distances.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). LBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.
- In the case of combined shear and tensile stress, the interaction between shear and tension must be satisfied.
- G is the mean relative density according to CSA-O86 2024 Table A.12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(4) The fixable thickness (A) is considered as half the length of the screw (L/2) - 5 mm.

(5) The resistance for CLT includes the application of the J_x = 0.9 factor.



LBS EVO

ROUND HEAD SCREW FOR PLATES

ELC-4645 ESR-4645 ETA-11/0030



SCREW FOR PERFORATED PLATES FOR OUTDOOR USE

LBS EVO version designed for steel-timber joints for outdoor use. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.

C4 EVO COATING

The atmospheric corrosion strength class (C4) of the C4 EVO coating was 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.

STATICS

These can be calculated in accordance with the CSA-O86 provisions for the lateral resistance of connections. Excellent shear strength values.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



BIT INCLUDED

DIAMETER [mm]

3,5 — 5 — 7 — 12

LENGTH [mm]

25 — 40 — 100 — 200

SERVICE CONDITION

EC1 EC3

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3

MATERIAL

C4 EVO COATING — carbon steel with C4 EVO coating

CORE HARDNESS

<390 HV — as required in CSA O86:24(1)



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

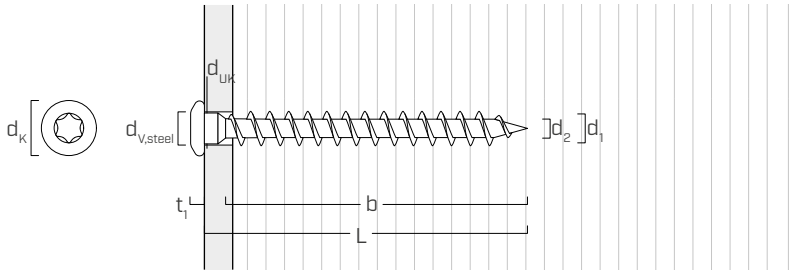
(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

d_1 [mm] *[in]*	CODE	L [mm]	b [mm]	pcs
5 *0.20* TX 20	**LBSEVO540**	40	36	500
	LBSEVO550	50	46	200
	LBSEVO560	60	56	200
	LBSEVO570	70	66	200

d_1 [mm] *[in]*	CODE	L [mm]	b [mm]	pcs
7 *0.28* TX 30	**LBSEVO780**	80	75	100
	LBSEVO7100	100	95	100

GEOMETRY AND MECHANICAL CHARACTERISTICS



GEOMETRY

Nominal diameter	**d_1**	[mm]	**5**	**7**
Head diameter	d_K	[mm]	7,80	11,00
Root diameter	d_2	[mm]	3,00	4,40
Underhead diameter	d_{UK}	[mm]	4,90	7,00
Head thickness	t_1	[mm]	2,40	3,50
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0÷5,5	7,5÷8,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0	4,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5	5,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PARAMETERS

Nominal diameter	**d_1**	**[mm]**		**5**	**7**
Factored tensile strength	Φf_u	[kN]		5,36	11,59
Bending yield strength	F_{yb}	[MPa]		1075	1146
Factored shear strength of the screw	Φv_s	[kN]		2,71	5,84
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29	73,20
			G=0.42	60,50	84,70
			G=0.49	68,44	95,82
			G=0.55	75,07	105,09



T3 TIMBER CORROSIVITY

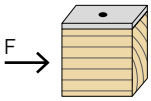
Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch, pine, ash and birch.

STEEL-TO-TIMBER APPLICATION

The LBSEVO screw with diameter 7 is particularly suitable for custom-designed connections, which are characteristic of steel structures.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

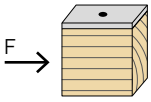
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**12·d‡**	60	*2 3/8*	84	*3 5/16*
S_Q	**5·d**	25	*1*	35	*1 3/8*
a_L	**15·d‡**	75	*2 15/16*	105	*4 1/8*
a	**10·d‡**	50	*1 15/16*	70	*2 3/4*
e_Q	**10·d**	50	*1 15/16*	70	*2 3/4*
e_P	**5·d**	25	*1*	35	*1 3/8*

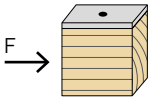
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



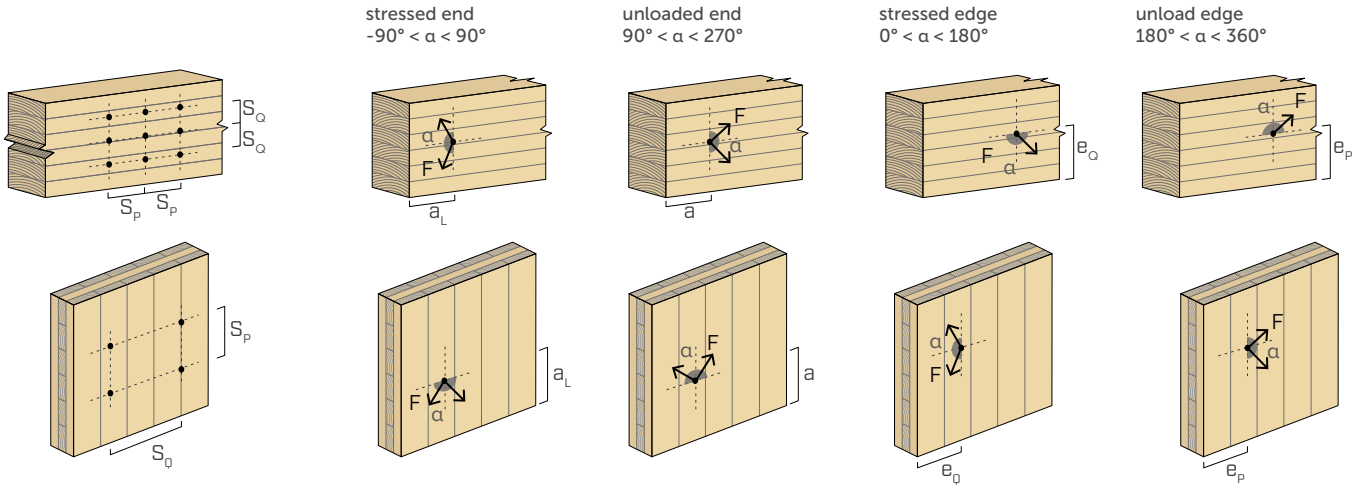
d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**18·d**	90	*3 1/2*	126	*4 15/16*
S_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
a_L	**22·d**	110	*4 3/8*	154	*6 1/16*
a	**15·d**	75	*2 15/16*	105	*4 1/8*
e_Q	**12·d**	60	*2 3/8*	84	*3 5/16*
e_P	**7·d**	35	*1 3/8*	49	*1 15/16*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**5·d†**	25	*1*	35	*1 3/8*
S_Q	**4·d**	20	*13/16*	28	*1 1/8*
a_L	**12·d†**	60	*2 3/8*	84	*3 5/16*
a	**7·d†**	35	*1 3/8*	49	*1 15/16*
e_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
e_P	**3·d**	15	*9/16*	21	*13/16*

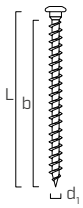
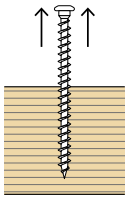
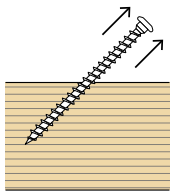
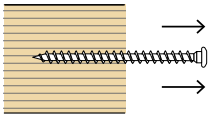
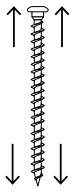
† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



NOTES

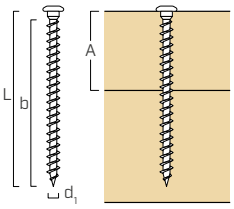
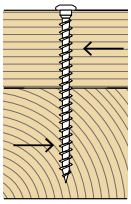
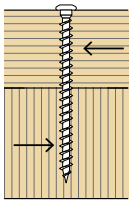
- The minimum spacing and distances comply with Clause 12.12.5 of CSA-O86 2024, where d_1 refers to the nominal diameter of the self-tapping screw.

STRUCTURAL VALUES | AXIAL TENSION

geometry			TENSION[1]											
			thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°				steel tension
															
			factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]				factored tension resistance T_{rs}
			G				G				G				
d_1	L	b	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]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	40	36	1,13	1,31	1,49	1,63	1,03	1,19	1,35	1,48	0,57	0,66	0,74	0,81	5,36
	50	46	1,50	1,74	1,96	2,15	1,36	1,58	1,79	1,96	0,75	0,87	0,98	1,08	
	60	56	1,87	2,16	2,44	2,68	1,70	1,96	2,22	2,44	0,93	1,08	1,22	1,34	
	70	66	2,23	2,58	2,92	3,21	2,03	2,35	2,66	2,91	1,12	1,29	1,46	1,60	
7 *0.28*	80	75	3,48	4,03	4,56	5,00	3,17	3,67	4,15	4,55	1,74	2,02	2,28	2,50	11,59
	100	95	4,51	5,22	5,90	6,47	4,10	4,74	5,37	5,89	2,25	2,61	2,95	3,24	

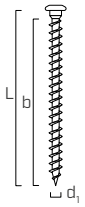
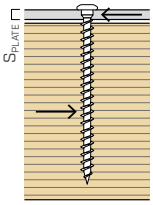
α = screw-to-grain angle

STRUCTURAL VALUES | LATERAL RESISTANCE

geometry				SHEAR[3]							
				wood-to-wood α = 90°				wood-to-wood end grain α = 0°			
											
				factored lateral resistance N_r				factored lateral resistance N_r[2]			
				G				G			
d_1	L	b	A[4]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	40	36	15	0,45	0,53	0,62	0,69	0,31	0,37	0,42	0,47
	50	46	20	0,58	0,69	0,78	0,84	0,39	0,46	0,54	0,60
	60	56	25	0,70	0,80	0,90	0,98	0,47	0,54	0,61	0,66
	70	66	30	0,79	0,90	1,00	1,07	0,52	0,59	0,66	0,72
7 *0.28*	80	75	35	1,26	1,49	1,73	1,90	0,82	0,98	1,13	1,22
	100	95	45	1,60	1,84	2,07	2,23	1,00	1,14	1,27	1,38

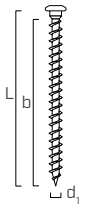
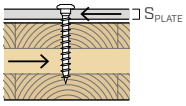
α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 270.

geometry			SHEAR steel-to-timber α = 90°			
						
d_1 **[mm]** ***[in]***	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r (3) G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
5 ***0.20***	40	36	1,6 *1/16*	1,02	1,17	1,32	1,43
	50	46		1,19	1,33	1,45	1,56
	60	56		1,28	1,43	1,57	1,69
	70	66		1,37	1,54	1,69	1,82
	40	36	3,2 *1/8*	1,01	1,16	1,30	1,42
	50	46		1,19	1,33	1,45	1,56
	60	56		1,28	1,43	1,57	1,69
	70	66		1,37	1,54	1,69	1,82
	40	36	6,4 *1/4*	0,96	1,10	1,23	1,34
	50	46		1,14	1,30	1,42	1,53
	60	56		1,26	1,41	1,54	1,66
	70	66		1,35	1,51	1,66	1,79
	50	46	9,5 *3/8*	1,08	1,24	1,39	1,48
	60	56		1,23	1,37	1,51	1,62
	70	66		1,32	1,48	1,63	1,75
	50	46	12,7 *1/2*	1,02	1,17	1,32	1,44
	60	56		1,20	1,34	1,47	1,57
	70	66		1,29	1,44	1,59	1,70
	50	46	15,9 *5/8*	0,97	1,11	1,24	1,35
	60	56		1,15	1,31	1,43	1,53
	70	66		1,26	1,41	1,55	1,66
	50	46	19,1 *3/4*	0,91	1,04	1,17	1,27
	60	56		1,09	1,25	1,39	1,49
	70	66		1,23	1,38	1,51	1,62
7 ***0.28***	80	75	1,6 *1/16*	2,55	2,85	3,13	3,35
	100	95		2,81	3,14	3,46	3,72
	80	75	3,2 *1/8*	2,55	2,85	3,13	3,35
	100	95		2,81	3,14	3,46	3,72
	80	75	6,4 *1/4*	2,50	2,83	3,10	3,33
	100	95		2,79	3,12	3,44	3,69
	80	75	9,5 *3/8*	2,42	2,78	3,05	3,27
	100	95		2,75	3,08	3,38	3,64
	80	75	12,7 *1/2*	2,35	2,70	3,00	3,21
	100	95		2,71	3,03	3,33	3,58
	80	75	15,9 *5/8*	2,27	2,61	2,93	3,15
	100	95		2,67	2,98	3,28	3,52
	80	75	19,1 *3/4*	2,20	2,52	2,83	3,09
	100	95		2,63	2,94	3,22	3,46

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 270.

geometry			SHEAR steel-to-CLT lateral face[5]			
						
d_1 **[mm]** ***[in]***	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r[3] E3 G=0.35 [kN]	 E1 and V2 G=0.42 [kN]	 E2 and V1 G=0.49 [kN]
5 ***0.20***	40	36	1,6 *1/16*	0,97	1,11	1,25
	50	46		1,14	1,28	1,40
	60	56		1,24	1,39	1,52
	70	66		1,33	1,49	1,64
	40	36	3,2 *1/8*	0,96	1,09	1,23
	50	46		1,13	1,28	1,40
	60	56		1,24	1,39	1,52
	70	66		1,33	1,49	1,64
	40	36	6,4 *1/4*	0,91	1,04	1,17
	50	46		1,08	1,24	1,38
	60	56		1,22	1,36	1,50
	70	66		1,31	1,47	1,62
	50	46	9,5 *3/8*	1,03	1,18	1,32
	60	56		1,19	1,33	1,46
	70	66		1,28	1,43	1,58
	50	46	12,7 *1/2*	0,97	1,11	1,25
	60	56		1,14	1,29	1,42
	70	66		1,25	1,40	1,54
	50	46	15,9 *5/8*	0,92	1,05	1,18
	60	56		1,09	1,25	1,38
	70	66		1,22	1,37	1,50
	50	46	19,1 *3/4*	0,86	0,99	1,10
	60	56		1,03	1,19	1,33
	70	66		1,19	1,33	1,46
7 ***0.28***	80	75	1,6 *1/16*	2,44	2,75	3,02
	100	95		2,72	3,05	3,36
	80	75	3,2 *1/8*	2,42	2,75	3,02
	100	95		2,72	3,05	3,36
	80	75	6,4 *1/4*	2,38	2,73	3,00
	100	95		2,70	3,03	3,34
	80	75	9,5 *3/8*	2,30	2,65	2,95
	100	95		2,66	2,98	3,28
	80	75	12,7 *1/2*	2,23	2,56	2,88
	100	95		2,62	2,94	3,23
	80	75	15,9 *5/8*	2,16	2,48	2,78
	100	95		2,58	2,89	3,18
	80	75	19,1 *3/4*	2,09	2,39	2,69
	100	95		2,54	2,84	3,12

NOTES and GENERAL PRINCIPLES on page 270.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA-O86 2024 including the withdrawal restrain effect. Listed values are based on standard term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- The reference lateral design values are calculated for screws inserted without pre-drilling hole as per CSA-O86 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance.
- LBS EVO screws must be positioned in accordance with the minimum distances.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- In the case of combined shear and tensile stress, the interaction between shear and tension must be satisfied.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). LBS screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.
- G is the mean relative density according to CSA-O86 2024 Table A.12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations.

(3) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(4) The fixable thickness (A) is considered as half the length of the screw (L/2) - 5 mm.

(5) The resistance for CLT includes the application of the J_x = 0.9 factor.



LBS HARDWOOD

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

ELC-4645 | ESR-4645 | UKTA-0836 22/6195 | ETA-11/0030

HARDWOOD CERTIFICATION

Special tip with embossed slit elements. Canadian certified according to ELC-4645 allows for use with high density timber without any pre-drill. Approved for structural applications subject to stresses in any direction vs the grain.

LARGER DIAMETER

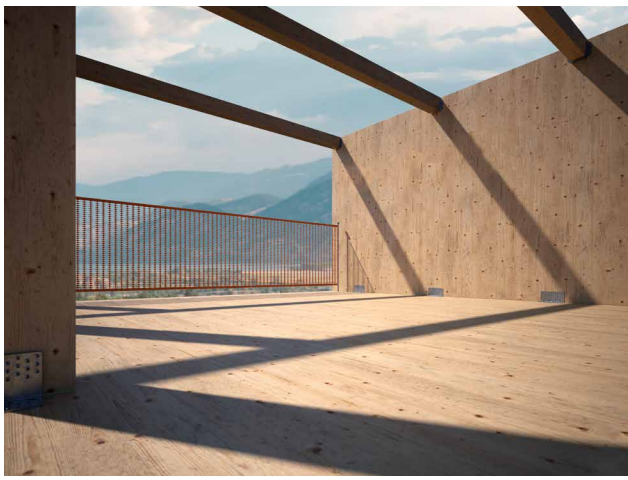
Internal thread diameter increased compared to the LBS version to ensure tightening in the highest density woods. In steel-timber connections, an increase in strength of more than 15 % can be achieved.

SCREW FOR PERFORATED PLATES

Cylindrical shoulder designed for fastening metal elements. Achieves an interlocking effect with the hole in the plate, thus guaranteeing excellent static performance.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.





MANUALS

BIT INCLUDED

DIAMETER [mm]

3,5 — 5 — 12

LENGTH [mm]

25 — 40 — 70 — 200

SERVICE CONDITION

EC1 DRY

ATMOSPHERIC CORROSIVITY

C1 C2

WOOD CORROSIVITY

T1 T2

MATERIAL

Zn ELECTRO PLATED — electrogalvanized carbon steel

CORE HARDNESS

<390 HV — as required in CSA O86:24(1)



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- beech, oak, cypress, ash, eucalyptus, bamboo

(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5 TX 20	**LBSH540**	40	36	500
	LBSH550	50	46	200
	LBSH560	60	56	200
	LBSH570	70	66	200

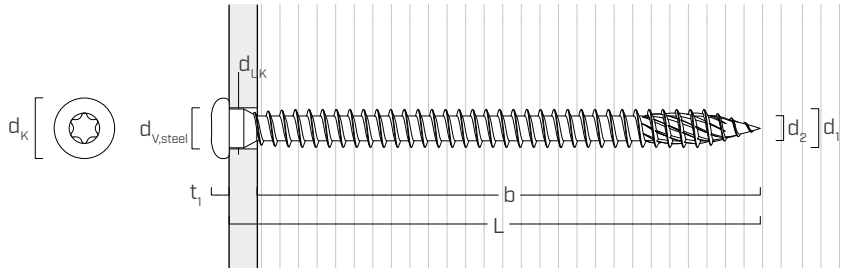
LBS HARDWOOD EVO

ROUND HEAD SCREW FOR PLATES ON HARDWOODS

DIAMETER [mm]	3	5	7	12
LENGTH [mm]	25	60	200	200

Also available in the LBS HARDWOOD EVO version, L from 60 to 200 mm, diameter Ø5 and Ø7 mm.

GEOMETRY AND MECHANICAL CHARACTERISTICS



Nominal diameter	**d_1**	**[mm]**	**5**
Head diameter	d_K	[mm]	7,80
Root diameter	d_2	[mm]	3,48
Underhead diameter	d_{UK}	[mm]	4,90
Head thickness	t_1	[mm]	2,45
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0 - 5,5
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5
Characteristic tensile strength	$f_{tens,k}$	[kN]	11,5
Characteristic yield moment	$M_{y,k}$	[Nm]	9,0

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	**d_1**	**[mm]**		**5**
Factored tensile strength	Φf_u	[kN]		7,09
Bending yield strength	F_{yb}	[MPa]		1122
Factored shear strength of the screw	Φv_s	[kN]		3,65
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29
			G=0.42	60,50
			G=0.49	68,44
			G=0.55	75,07



HARDWOOD PERFORMANCE

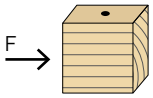
Geometry developed for high performance and use without pre-drill hole on structural woods such as beech, oak, cypress, ash, eucalyptus, bamboo.

BEECH LVL

Values also tested, certified and calculated for high density woods such as beech LVL. Certified for use without pre-drilling, for densities of up to 800 kg/m³.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

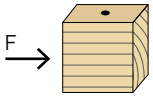
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*
S_P	12·d‡	60	*2 3/8*
S_Q	5·d	25	*1*
a_L	15·d‡	75	*2 15/16*
a	10·d‡	50	*1 15/16*
e_Q	10·d	50	*1 15/16*
e_P	5·d	25	*1*

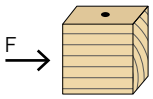
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



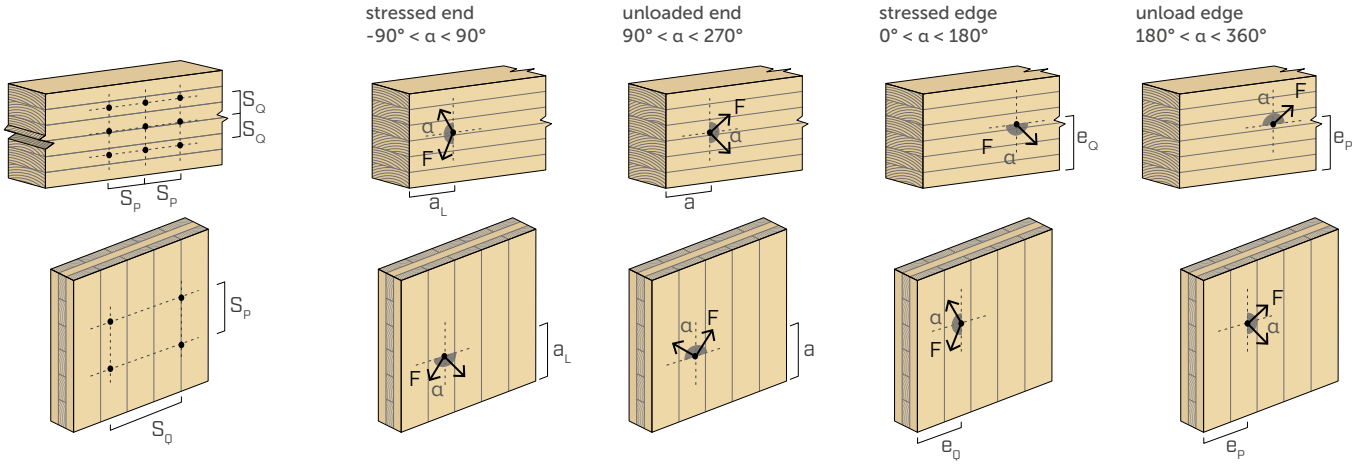
d_1		5 [mm]	*0.20 [in]*
S_P	18·d	90	*3 1/2*
S_Q	7·d	35	*1 3/8*
a_L	22·d	110	*4 3/8*
a	15·d	75	*2 15/16*
e_Q	12·d	60	*2 3/8*
e_P	7·d	35	*1 3/8*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*
S_P	5·d†	25	*1*
S_Q	4·d	20	*13/16*
a_L	12·d†	60	*2 3/8*
a	7·d†	35	*1 3/8*
e_Q	7·d	35	*1 3/8*
e_P	3·d	15	*9/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle

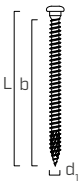
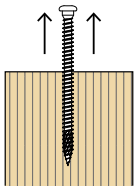
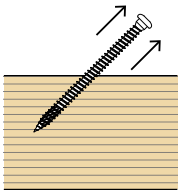
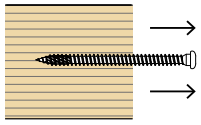


NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

STRUCTURAL VALUES | AXIAL TENSION

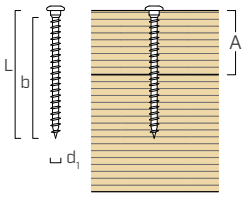
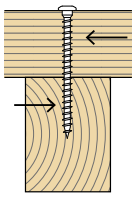
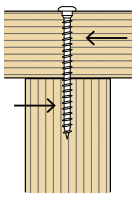
STRENGTH VALUES
CSA 086:24

geometry				TENSION[1]											
				thread withdrawal											steel tension
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]			factored tension resistance T_{rs}
				G				G				G			
d_1	L		b	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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	40	*1 9/16*	36	1,13	1,31	1,49	1,63	1,03	1,19	1,35	1,48	0,57	0,66	0,74	0,81	7,09
	50	*1 15/16*	46	1,50	1,74	1,96	2,15	1,36	1,58	1,79	1,96	0,75	0,87	0,98	1,08	
	60	*2 3/8*	56	1,87	2,16	2,44	2,68	1,70	1,96	2,22	2,44	0,93	1,08	1,22	1,34	
	70	*2 3/4*	66	2,23	2,58	2,92	3,21	2,03	2,35	2,66	2,91	1,12	1,29	1,46	1,60	

α = screw-to-grain angle

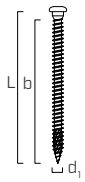
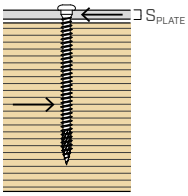
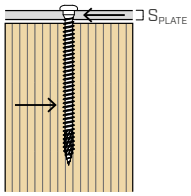
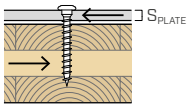
STRUCTURAL VALUES | LATERAL RESISTANCE

STRENGTH VALUES
CSA 086:24

geometry					SHEAR[3]							
					timber-to-timber α = 90°				timber-to-timber α = 0°			
												
					factored lateral resistance N_r				factored lateral resistance N_r[2]			
					G				G			
d_1	L		b	A[4]	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] *[in]*	[mm]	*[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	40	*1 9/16*	36	15	0,45	0,53	0,62	0,69	0,31	0,37	0,42	0,47
	50	*1 15/16*	46	20	0,58	0,69	0,80	0,89	0,39	0,46	0,54	0,60
	60	*2 3/8*	56	25	0,71	0,84	0,98	1,08	0,47	0,56	0,65	0,73
	70	*2 3/4*	66	30	0,84	0,99	1,11	1,21	0,56	0,66	0,73	0,80

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 277.

geometry				SHEAR[3]										
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°		
														
				factored lateral resistance N_r				factored lateral resistance N_r[2]				factored lateral resistance N_r		
				G				G				E3	E1 and V2 G	E2and V1
d_1	L		S_{PLATE}	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	40	*1 9/16*	1,6 *1/16*	1,14	1,29	1,45	1,58	0,60	0,68	0,76	0,82	1,08	1,23	1,37
	50	*1 15/16*		1,31	1,50	1,69	1,84	0,68	0,78	0,87	0,94	1,24	1,43	1,60
	60	*2 3/8*		1,49	1,68	1,84	1,97	0,76	0,87	0,98	1,06	1,41	1,62	1,78
	70	*2 3/4*		1,60	1,78	1,96	2,10	0,84	0,97	1,09	1,18	1,54	1,73	1,90
	40	*1 9/16*	3,2 *1/8*	1,12	1,28	1,43	1,56	0,60	0,68	0,75	0,82	1,06	1,21	1,35
	50	*1 15/16*		1,30	1,49	1,67	1,82	0,68	0,77	0,86	0,94	1,23	1,41	1,58
	60	*2 3/8*		1,48	1,68	1,84	1,97	0,76	0,87	0,97	1,06	1,40	1,61	1,78
	70	*2 3/4*		1,60	1,78	1,96	2,10	0,84	0,96	1,08	1,18	1,54	1,73	1,90
	40	*1 9/16*	6,4 *1/4*	1,07	1,22	1,36	1,48	0,58	0,65	0,72	0,78	1,02	1,16	1,29
	50	*1 15/16*		1,25	1,43	1,60	1,75	0,66	0,75	0,83	0,90	1,19	1,36	1,52
	60	*2 3/8*		1,43	1,64	1,81	1,94	0,74	0,84	0,94	1,02	1,36	1,56	1,75
	70	*2 3/4*		1,58	1,76	1,93	2,07	0,82	0,94	1,05	1,14	1,52	1,70	1,87
	50	*1 15/16*	9,5 *3/8*	1,19	1,36	1,53	1,67	0,63	0,72	0,80	0,87	1,13	1,29	1,45
	60	*2 3/8*		1,37	1,57	1,77	1,90	0,71	0,81	0,91	0,99	1,30	1,49	1,68
	70	*2 3/4*		1,55	1,72	1,89	2,03	0,79	0,91	1,01	1,11	1,47	1,67	1,83
	50	*1 15/16*	12,7 *1/2*	1,14	1,30	1,45	1,58	0,61	0,69	0,76	0,83	1,08	1,23	1,38
	60	*2 3/8*		1,32	1,51	1,69	1,85	0,69	0,78	0,87	0,95	1,25	1,43	1,60
	70	*2 3/4*		1,49	1,69	1,85	1,99	0,77	0,88	0,98	1,07	1,42	1,63	1,79
	50	*1 15/16*	15,9 *5/8*	1,08	1,23	1,38	1,50	0,58	0,66	0,73	0,79	1,02	1,17	1,30
	60	*2 3/8*		1,26	1,44	1,62	1,76	0,66	0,75	0,84	0,91	1,19	1,37	1,53
	70	*2 3/4*		1,44	1,65	1,82	1,94	0,74	0,85	0,95	1,03	1,36	1,56	1,75
	50	*1 15/16*	19,1 *3/4*	1,02	1,16	1,30	1,41	0,53	0,63	0,69	0,75	0,97	1,10	1,23
	60	*2 3/8*		1,20	1,37	1,54	1,68	0,64	0,72	0,80	0,87	1,14	1,30	1,46
	70	*2 3/4*		1,38	1,58	1,78	1,90	0,72	0,82	0,91	0,99	1,31	1,50	1,69

α = screw-to-grain angle

NOTES and GENERAL PRINCIPLES on page 277.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- LBS hardwood screws must be positioned in accordance with the minimum distances.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- In the case of combined shear and tensile stress, the interaction between shear and tension must be satisfied.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). LBS hardwood screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.
- G is the mean relative density according to CSA-O86 2024 Table A.12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55)

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

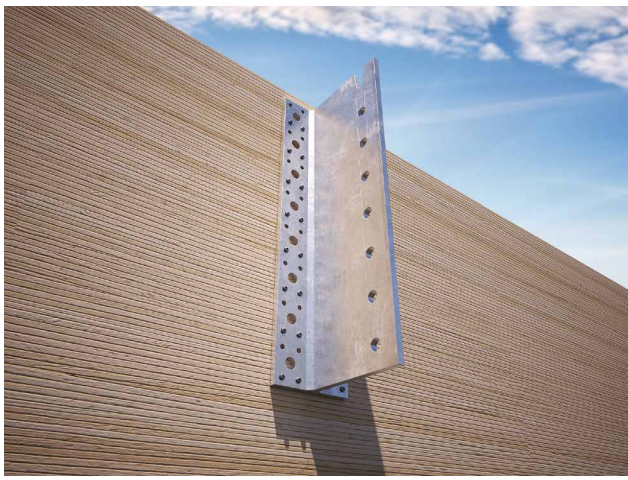
(4) The fixable thickness (A) is considered as half the length of the screw (L/2) - 5 mm.

(5) The resistance for CLT includes the application of the J_x = 0.9 factor.

LBS HARDWOOD EVO

ELC-4645 ESR-4645 ETA-11/0030

ROUND HEAD SCREW FOR PLATES ON HARDWOODS



C4 EVO COATING

The atmospheric corrosion strength class (C4) of the C4 EVO coating was 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 the "**TIMBER SCREWS AND DECK FASTENING**" catalogue at www.rothoblaas.com)

HARDWOOD CERTIFICATION

Special tip with embossed slit elements. Canadian certified according to ELC-4645 allows for use with high density timber without any pre-drill. Approved for structural applications subject to stresses in any direction vs the grain.

ROBUSTNESS

The inner core diameter of the screw has been enlarged compared to the LBS version to ensure screwing in higher density woods. The cylindrical under head is designed for fastening mechanical elements and producing an interlocking effect with the plate hole that provides excellent static performances.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



MANUALS

BIT INCLUDED

DIAMETER [mm]

3,5 — 5 — 7 — 12

LENGTH [mm]

25 — 60 — 200 — 200

SERVICE CONDITION

EC1 EC3

ATMOSPHERIC CORROSIVITY

C1 C2 C3 C4

WOOD CORROSIVITY

T1 T2 T3

MATERIAL

C4 EVO COATING — carbon steel with C4 EVO coating

CORE HARDNESS

<390 HV — as required in CSA O86:24(1)



FIELDS OF USE

- timber based panels
- solid timber and glulam
- CLT and LVL
- high density woods
- ACQ, CCA treated timber

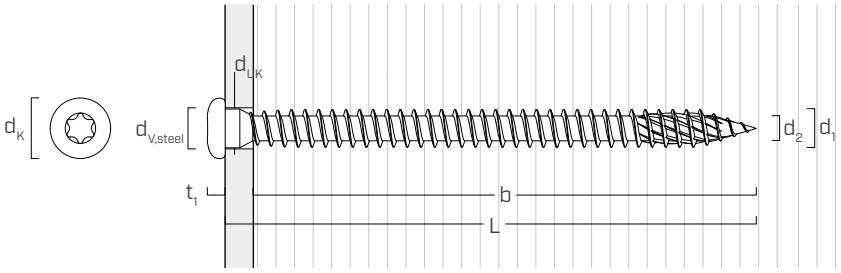
(1) Core hardness < 390 HV guaranteed for structural timber screws diameter 6 mm and above.

CODES AND DIMENSIONS

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
5 TX 20	LBSHEVO580	80	76	200
	LBSHEVO5100	100	96	200
	LBSHEVO5120	120	116	200

d_1 [mm]	CODE	L [mm]	b [mm]	pcs
7 TX 30	LBSHEVO760	60	55	100
	LBSHEVO780	80	75	100
	LBSHEVO7100	100	95	100
	LBSHEVO7120	120	115	100
	LBSHEVO7160	160	155	100
	LBSHEVO7200	200	195	100

GEOMETRY AND MECHANICAL CHARACTERISTICS

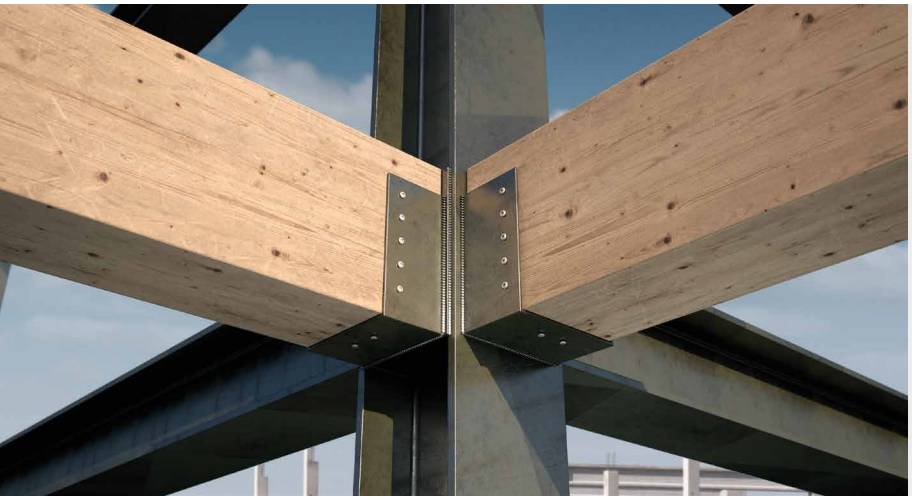


Nominal diameter	d_1	[mm]	5	7
Head diameter	d_K	[mm]	7,80	11,00
Root diameter	d_2	[mm]	3,48	4,85
Underhead diameter	d_{UK}	[mm]	4,90	7,00
Head thickness	t_1	[mm]	2,45	3,50
Hole diameter on steel plate	$d_{V,steel}$	[mm]	5,0 - 5,5	7,5 - 8,0
Pre-drilling hole diameter(1)	$d_{V,S}$	[mm]	3,0	4,0
Pre-drilling hole diameter(2)	$d_{V,H}$	[mm]	3,5	5,0
Characteristic tensile strength	$f_{tens,k}$	[kN]	11,5	21,5
Characteristic yield moment	$M_{y,k}$	[Nm]	9,0	21,5

(1) Pre-drilling valid for softwood.
(2) Pre-drilling valid for hardwood and beech LVL.

MECHANICAL PROPERTIES

Nominal diameter	d_1	[mm]		5	7
Factored tensile strength	Φf_u	[kN]		7,09	14,83
Bending yield strength	F_{yb}	[MPa]		1122	1186
Factored shear strength of the screw	Φv_s	[kN]		3,65	7,09
Specified withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	[N/mm]	G=0.35	52,29	73,20
			G=0.42	60,50	84,70
			G=0.49	68,44	95,82
			G=0.55	75,07	105,09



HYBRID STEEL-TIMBER STRUCTURES

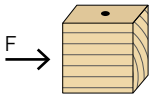
The LBSHEVO Ø7 mm screws are suitable for custom-designed connections, which are characteristic of steel structures. Maximum performance in hardwoods combined with the strengths of steel plates.

T3 TIMBER CORROSIVITY

Coating suitable for use in applications on wood with an acidity level (pH) greater than 4, such as spruce, larch, pine, ash and birch.

MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

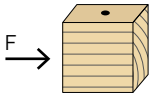
screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.44**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**12·d‡**	60	*2 3/8*	84	*3 5/16*
S_Q	**5·d**	25	*1*	35	*1 3/8*
a_L	**15·d‡**	75	*2 15/16*	105	*4 1/8*
a	**10·d‡**	50	*1 15/16*	70	*2 3/4*
e_Q	**10·d**	50	*1 15/16*	70	*2 3/4*
e_P	**5·d**	25	*1*	35	*1 3/8*

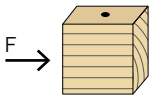
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

screws inserted **WITHOUT pre-drilled hole** — **0.44 < G ≤ 0.50**



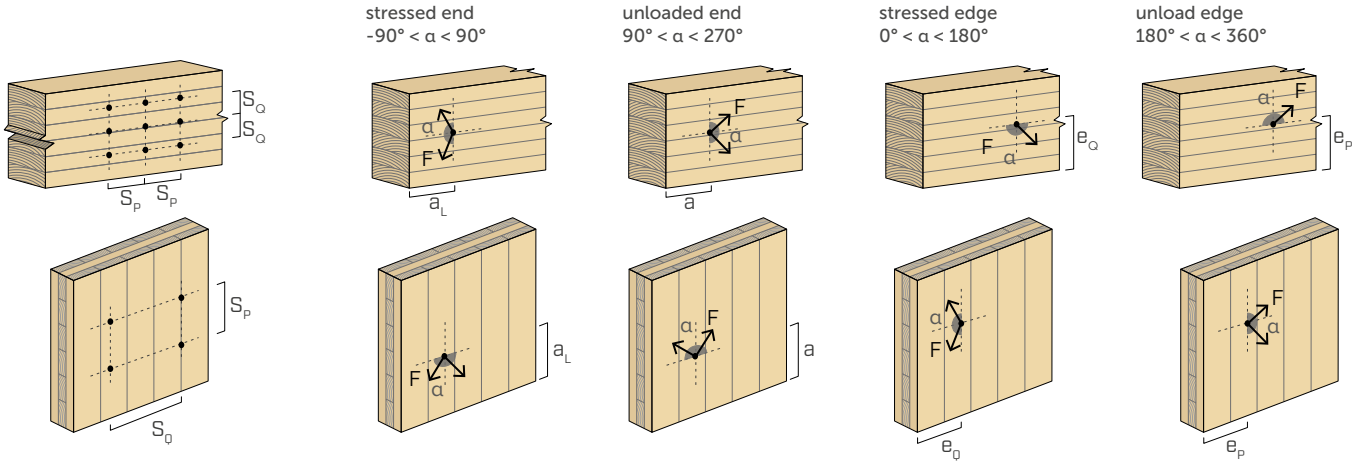
d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**18·d**	90	*3 1/2*	126	*4 15/16*
S_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
a_L	**22·d**	110	*4 3/8*	154	*6 1/16*
a	**15·d**	75	*2 15/16*	105	*4 1/8*
e_Q	**12·d**	60	*2 3/8*	84	*3 5/16*
e_P	**7·d**	35	*1 3/8*	89	*1 15/16*

screws inserted **WITH pre-drilled hole**



d_1		5 [mm]	*0.20 [in]*	7 [mm]	*0.28 [in]*
S_P	**5·d†**	25	*1*	35	*1 3/8*
S_Q	**4·d**	20	*13/16*	28	*1 1/8*
a_L	**12·d†**	60	*2 3/8*	84	*3 5/16*
a	**7·d†**	35	*1 3/8*	49	*1 15/16*
e_Q	**7·d**	35	*1 3/8*	49	*1 15/16*
e_P	**3·d**	15	*9/16*	21	*13/16*

† For Douglas Fir–Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
d = d_1 = nominal diameter of the screw
α = load-to-grain angle

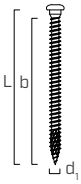
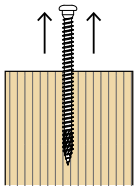
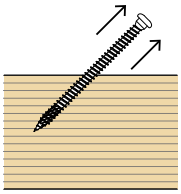
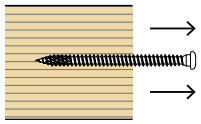
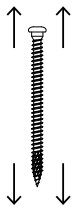


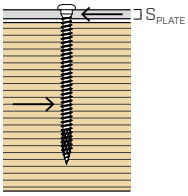
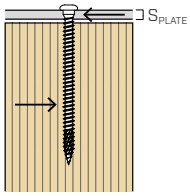
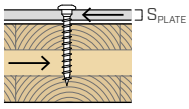
NOTES

- The minimum spacing and distances comply with Clause 12.12.5 of CSA O86:24, where d_1 refers to the nominal diameter of the self-tapping screw.
- The spacing, end, and edge distances for Rothoblaas screws installed in the narrow face of CLT panels shall comply with the specifications outlined in ETA-11/0030.
- The placement of fasteners subjected to axial loading shall be determined in accordance with Clause 12.12.5 of CSA O86:24.

STRUCTURAL VALUES | AXIAL TENSION

STRENGTH VALUES
CSA 086:24

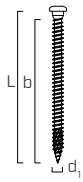
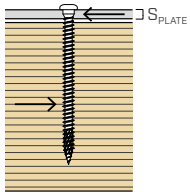
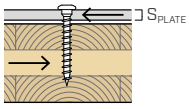
geometry				TENSION[1]											
				thread withdrawal										steel tension	
				α = 90°				α = 45°				end grain α = 0°			
															
				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}				factored withdrawal resistance P_{rw}[2]		factored tension resistance T_{rs}	
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]*	[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
5 *0.20*	80	*3 1/8*	76	0,59	0,68	0,77	0,84	0,53	0,62	0,70	0,76	0,29	0,34	0,38	0,42
	100	*4*	96	1,13	1,31	1,49	1,63	1,03	1,19	1,35	1,48	0,57	0,66	0,74	0,81
	120	*4 3/4*	116	1,50	1,74	1,96	2,15	1,36	1,58	1,79	1,96	0,75	0,87	0,98	1,08
7 *0.28*	60	*2 3/8*	55	2,46	2,85	3,22	3,53	2,24	2,59	2,93	3,21	1,23	1,42	1,61	1,77
	80	*3 1/8*	75	3,48	4,03	4,56	5,00	3,17	3,67	4,15	4,55	1,74	2,02	2,28	2,50
	100	*4*	95	4,51	5,22	5,90	6,47	4,10	4,74	5,37	5,89	2,25	2,61	2,95	3,24
	120	*4 3/4*	115	2,72	3,14	3,55	3,90	2,47	2,86	3,23	3,54	1,36	1,57	1,78	1,95
	160	*6 1/4*	155	3,48	4,03	4,56	5,00	3,17	3,67	4,15	4,55	1,74	2,02	2,28	2,50
	200	*8*	195	3,48	4,03	4,56	5,00	3,17	3,67	4,15	4,55	1,74	2,02	2,28	2,50

geometry				SHEAR[3]											
				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2]				factored lateral resistance N_r			
				G				G				G			
d_1 [mm] *[in]*	L [mm]	L *[in]*	S_{PLATE} [mm] *[in]*	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]	0.35 [kN]	0.42 [kN]	0.49 [kN]	0.55 [kN]
5 *0.20*	80	*3 1/8*	1,6 *1/16*	1,69	1,89	2,08	2,23	0,93	1,06	1,19	1,29	1,64	1,83	2,02	2,17
	100	*4*		1,87	2,10	2,32	2,49	1,08	1,20	1,32	1,42	1,82	2,04	2,25	2,43
	120	*4 3/4*		2,05	2,27	2,45	2,60	1,17	1,31	1,44	1,55	1,97	2,16	2,33	2,47
	80	*3 1/8*	3,2 *1/8*	1,69	1,89	2,08	2,23	0,92	1,06	1,19	1,29	1,64	1,83	2,02	2,17
	100	*4*		1,87	2,10	2,32	2,49	1,08	1,20	1,32	1,42	1,82	2,04	2,25	2,43
	120	*4 3/4*		2,05	2,27	2,45	2,60	1,17	1,31	1,44	1,55	1,97	2,16	2,33	2,47
	80	*3 1/8*	6,4 *1/4*	1,67	1,86	2,05	2,20	0,90	1,03	1,16	1,26	1,61	1,81	1,99	2,14
	100	*4*		1,85	2,08	2,29	2,46	1,06	1,19	1,31	1,41	1,80	2,02	2,23	2,40
	120	*4 3/4*		2,03	2,27	2,45	2,60	1,16	1,30	1,43	1,54	1,97	2,16	2,33	2,47
	80	*3 1/8*	9,5 *3/8*	1,64	1,83	2,01	2,16	0,87	1,00	1,12	1,23	1,59	1,77	1,95	2,09
	100	*4*		1,82	2,04	2,25	2,42	1,03	1,17	1,29	1,39	1,77	1,98	2,19	2,36
	120	*4 3/4*		2,00	2,25	2,45	2,60	1,14	1,28	1,41	1,52	1,95	2,16	2,33	2,47
	80	*3 1/8*	12,7 *1/2*	1,61	1,80	1,97	2,12	0,85	0,97	1,09	1,19	1,56	1,74	1,91	2,05
	100	*4*		1,79	2,01	2,21	2,38	1,01	1,16	1,27	1,37	1,74	1,95	2,15	2,31
	120	*4 3/4*		1,98	2,22	2,45	2,60	1,13	1,26	1,39	1,50	1,92	2,16	2,33	2,47
	80	*3 1/8*	15,9 *5/8*	1,58	1,76	1,94	2,08	0,82	0,94	1,05	1,15	1,53	1,71	1,87	2,01
	100	*4*		1,76	1,97	2,17	2,34	0,98	1,13	1,25	1,34	1,71	1,92	2,11	2,27
	120	*4 3/4*		1,95	2,19	2,41	2,60	1,11	1,25	1,37	1,48	1,89	2,13	2,33	2,47
	80	*3 1/8*	19,1 *3/4*	1,55	1,73	1,90	2,03	0,80	0,91	1,02	1,11	1,48	1,67	1,84	1,97
	100	*4*		1,73	1,94	2,14	2,30	0,96	1,10	1,23	1,32	1,68	1,88	2,07	2,23
	120	*4 3/4*		1,92	2,15	2,38	2,56	1,10	1,23	1,35	1,46	1,86	2,10	2,31	2,47
7 *0.28*	60	2 3/8	1,6 *1/16*	2,24	2,56	2,87	3,12	1,19	1,35	1,50	1,63	2,13	2,43	2,72	2,96
	80	3 1/8		2,72	3,12	3,48	3,72	1,41	1,60	1,79	1,95	2,58	2,96	3,33	3,60
	100	4		3,11	3,47	3,81	4,09	1,62	1,86	2,08	2,27	3,00	3,36	3,69	3,97
	120	4 3/4		3,36	3,77	4,15	4,46	1,84	2,11	2,37	2,56	3,26	3,66	4,03	4,33
	160	6 1/4		3,87	4,33	4,67	4,95	2,20	2,47	2,72	2,93	3,75	4,11	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,46	2,75	2,97	3,14	3,75	4,11	4,44	4,70
	60	2 3/8	3,2 *1/8*	2,23	2,54	2,84	3,10	1,18	1,34	1,49	1,62	2,11	2,41	2,70	2,94
	80	3 1/8		2,70	3,10	3,48	3,72	1,40	1,59	1,78	1,94	2,57	2,94	3,31	3,60
	100	4		3,11	3,47	3,81	4,09	1,61	1,85	2,07	2,26	3,00	3,36	3,69	3,97
	120	4 3/4		3,36	3,77	4,15	4,46	1,83	2,10	2,36	2,56	3,26	3,66	4,03	4,33
	160	6 1/4		3,87	4,33	4,67	4,95	2,20	2,47	2,72	2,93	3,75	4,11	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,46	2,75	2,97	3,14	3,75	4,11	4,44	4,70
	60	2 3/8	6,4 *1/4*	2,17	2,48	2,77	3,02	1,16	1,31	1,46	1,58	2,06	2,35	2,63	2,86
	80	3 1/8		2,65	3,04	3,41	3,70	1,38	1,57	1,75	1,90	2,52	2,89	3,24	3,54
	100	4		3,09	3,45	3,79	4,07	1,59	1,82	2,04	2,23	2,97	3,34	3,67	3,94
	120	4 3/4		3,34	3,75	4,13	4,44	1,81	2,07	2,33	2,55	3,24	3,64	4,01	4,31
	160	6 1/4		3,86	4,33	4,67	4,95	2,19	2,46	2,71	2,92	3,75	4,11	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,45	2,75	2,97	3,14	3,75	4,11	4,44	4,70

α = screw-to-grain angle

NOTES and **GENERAL PRINCIPLES** on page 283.

SHEAR[3]

geometry				steel-to-timber α = 90°				steel-to-timber α = 0°				steel-to-timber α = 90°			
															
				factored lateral resistance N_r				factored lateral resistance N_r[2]				factored lateral resistance N_r			
				G				G				G			
d_1	L		S_{PLATE}	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]*	[mm] *[in]*	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7 *0.28*	60	2 3/8	9,5 *3/8*	2,10	2,39	2,67	2,90	1,10	1,27	1,41	1,53	1,99	2,27	2,53	2,75
	80	3 1/8		2,57	2,95	3,31	3,62	1,34	1,53	1,71	1,85	2,45	2,80	3,14	3,43
	100	4		3,05	3,40	3,74	4,01	1,56	1,78	2,00	2,17	2,90	3,29	3,62	3,88
	120	4 3/4		3,30	3,70	4,07	4,38	1,77	2,03	2,29	2,50	3,20	3,59	3,95	4,25
	160	6 1/4		3,82	4,29	4,67	4,95	2,17	2,44	2,69	2,89	3,72	4,11	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,43	2,73	2,97	3,14	3,75	4,11	4,44	4,70
	60	2 3/8	12,7 *1/2*	2,02	2,30	2,57	2,79	1,03	1,23	1,37	1,48	1,92	2,18	2,44	2,65
	80	3 1/8		2,50	2,86	3,21	3,50	1,31	1,49	1,66	1,80	2,37	2,72	3,05	3,32
	100	4		2,97	3,36	3,68	3,95	1,52	1,74	1,95	2,12	2,83	3,25	3,56	3,83
	120	4 3/4		3,26	3,65	4,02	4,32	1,74	1,99	2,24	2,44	3,16	3,54	3,90	4,19
	160	6 1/4		3,78	4,24	4,67	4,95	2,15	2,41	2,66	2,86	3,67	4,11	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,41	2,71	2,97	3,14	3,75	4,11	4,44	4,70
	60	2 3/8	15,9 *5/8*	1,95	2,21	2,47	2,68	0,96	1,16	1,32	1,43	1,85	2,10	2,34	2,54
	80	3 1/8		2,42	2,77	3,11	3,39	1,27	1,45	1,61	1,75	2,30	2,63	2,95	3,22
	100	4		2,90	3,31	3,63	3,89	1,49	1,70	1,90	2,07	2,75	3,16	3,51	3,77
	120	4 3/4		3,22	3,60	3,97	4,26	1,70	1,95	2,19	2,39	3,12	3,49	3,85	4,13
	160	6 1/4		3,73	4,20	4,64	4,95	2,13	2,39	2,63	2,83	3,63	4,09	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,39	2,69	2,97	3,14	3,75	4,11	4,44	4,70
	60	2 3/8	19,1 *3/4*	1,87	2,12	2,36	2,56	0,90	1,07	1,25	1,38	1,78	2,01	2,24	2,43
	80	3 1/8		2,35	2,68	3,01	3,28	1,24	1,41	1,57	1,70	2,23	2,55	2,85	3,11
	100	4		2,82	3,24	3,58	3,83	1,45	1,66	1,86	2,02	2,68	3,08	3,46	3,71
	120	4 3/4		3,18	3,56	3,91	4,20	1,67	1,91	2,15	2,34	3,08	3,45	3,79	4,08
	160	6 1/4		3,69	4,15	4,58	4,94	2,10	2,37	2,61	2,80	3,59	4,04	4,44	4,70
	200	8		3,96	4,33	4,67	4,95	2,37	2,66	2,94	3,14	3,75	4,11	4,44	4,70

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The reference factored lateral resistance for self-tapping screws has been determined following the guidelines in Clause 12.12 of the CSA O86:24 including the withdrawal restraint effect. Listed values are based on standard long term load duration factor (K_D = 1.0), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0).
- The steel plate is assumed to be ASTM A36 with a minimum ultimate tensile strength, f_u, equal to 58 ksi (400 MPa).
- The reference lateral design values are calculated for screws inserted without pre-drilling as per CSA O86:24 Clause 12.12.10.5.3. The direction of the bearing-to-grain angle does not influence lateral resistance. In the case of screws inserted with pre-drilling, greater resistance values can be obtained.
- LBS hardwood EVO screws must be positioned in accordance with the minimum distances.
- As part of the connection design, the designer must size and verify both the structural wood members and the steel plates separately.
- In the case of combined shear and tensile stress, the interaction between shear and tension must be satisfied.
- Not all screw lengths satisfy the required embedment depth in either the side member ($4d_F$) or the main member ($8d_F$). LBS hardwood screws installed in the end grain may not meet the minimum penetration requirement for withdrawal ($20d_1$) specified in CSA O86:24 Clause 12.12.6.1. Discretion and engineering judgment must be exercised to evaluate the impact of reduced penetration on the connection's capacity.
- G is the mean relative density according to CSA-O86 2024 Table A.12. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).

NOTES

(1) Factored withdrawal resistances were calculated with the entire threaded portion of the screw, b (in millimeters), minus the tip length, L_{tip}. The length of the tip is equal to the nominal diameter of the respective fasteners, d_1, as specified in the ELC-4645 report. Factor for fastener axis-to-grain angle, J_α, and the factor for dowel bearing effect for laterally loaded connections, J_w, varies according to connection geometry.

(2) The angle between the fastener axis and the grain direction of the wood member, α, is taken as zero for the end grain calculations. Self-tapping screws installed perpendicular to the panel edge of CLT are assumed to be installed in the end grain of member.

(3) Lateral resistances are factored and according to CSA-O86 2024 Clause 12.12.10. Values apply to dry service conditions and are representative of a single screw.

(4) The fixable thickness (A) is considered as half the length of the screw (L/2) - 5 mm.

(5) The resistance for CLT includes the application of the J_x = 0.9 factor.

LBA

HIGH BOND NAIL

CE
ETA-22/0002

EXCELLENT PERFORMANCE

The new LBA nails have shear strength values among the highest on the market and make it possible to certify characteristic nail strengths that more closely approximate actual experimental strengths.

CERTIFIED ON CLT AND LVL

Tested according ASTM F1575 for the bending yield strength and ASTM D1761-20 for the withdrawal strength. Certified in CLT and LVL according to ETA-22/0002.

LBA BINDED

The nail is also available in a bound version with the same ETA certification and therefore the same high performance.

STAINLESS STEEL VERSION

The nails are also available with the same certification from ETA in A4|AISI316 stainless steel for outdoor applications, with very high strength values.

CANADIAN DESIGN VALUES

USA, EU and more design values available online.

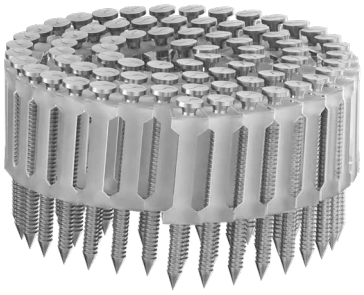




LBA 25 PLA



LBA 34 PLA



LBA COIL

DIAMETER [mm]	3	4 – 6	12
LENGTH [mm]	25	40 – 100	200

MATERIAL

Zn ELECTRO PLATED	electrogalvanized carbon steel	DRY C2 T2
A4 AISI 316	A4 | AISI316 austenitic stainless steel (CRC III)	WET C5 T5



FIELDS OF USE

- timber based panels
- fibreboard and MDF panels
- solid timber
- glulam (Glued Laminated Timber)
- CLT, LVL



CAPACITY DESIGN

The strength values are much closer to the actual experimental strengths, so capacity design can be performed more reliably.

WKR

Values also tested, certified and calculated for fastening standard Rothoblaas plates. Using the nailer speeds up and facilitates installation.

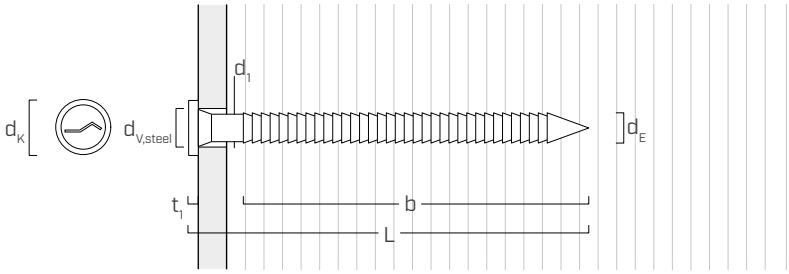


Use with NINO angle brackets allows for some of the most versatile applications: even for beam-to-beam joints.



LBA achieves the highest performance together with the WKR angle brackets with the specific strength values on CLT.

GEOMETRY AND MECHANICAL CHARACTERISTICS



				LBA		LBAI
Nominal diameter	**d_1**		**[mm]**	**4**	**6**	**4**
Head diameter	d_K		[mm]	8,00	12,00	8,00
External diameter	d_E		[mm]	4,40	6,60	4,40
Head thickness	t_1		[mm]	1,50	2,00	1,50
Hole diameter on steel plate	$d_{V,steel}$		[mm]	5,0 - 5,5	7,0 - 7,5	5,0 - 5,5
Pre-drilling hole diameter(1)	d_V		[mm]	3,0	4,5	3,0
Bending yield strength	F_{yb}		[MPa]	645	585	740
Basic withdrawal resistance per millimeter of threaded shank (tip included)	Y_w	G=0.35	[N/mm]	19	28	20
		G=0.42	[N/mm]	22	33	23
		G=0.49	[N/mm]	25	37	26
		G=0.55	[N/mm]	27	40	28

(1) Pre-drilling valid for softwood.

NOTES and **GENERAL PRINCIPLES** on page 292.

CODES AND DIMENSIONS

LOOSE NAILS

LBA

Zn ELECTRO PLATED

d_1 [mm] [in]	CODE	L [mm]	b [mm]	pcs
4 *0.16*	**LBA440**	40	30	250
	LBA450	50	40	250
	LBA460	60	50	250
	LBA475	75	65	250
	LBA4100	100	85	250
6 *0.24*	**LBA660**	60	50	250
	LBA680	80	70	250
	LBA6100	100	85	250

LBAI A4 | AISI316

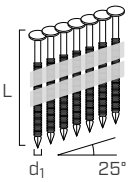
A4 AISI 316

d_1 [mm] [in]	CODE	L [mm]	b [mm]	pcs
4 *0.16*	**LBAI450**	50	40	250

STRIP-BOUND NAILS

LBA 25 PLA - plastic stick binding 25°

Zn ELECTRO PLATED

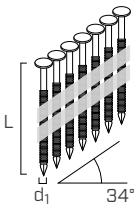


d_1 [mm] [in]	CODE	L [mm]	b [mm]	pcs
4 *0.16*	**LBA25PLA440**	40	30	2000
	LBA25PLA450	50	40	2000
	LBA25PLA460	60	50	2000

Compatible with Anker 25° nailgun HH3522.

LBA 34 PLA - plastic stick binding 34°

Zn ELECTRO PLATED



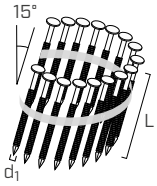
d_1 [mm] [in]	CODE	L [mm]	b [mm]	pcs
4 *0.16*	**LBA34PLA440**	40	30	2000
	LBA34PLA450	50	40	2000
	LBA34PLA460	60	50	2000

Compatible with 34° strip magazine nailgun ATEU0116 and gas nailgun HH12100700.

ROLL-BOUND NAILS

LBA COIL - 15° plastic roll binding

Zn ELECTRO PLATED



d_1 [mm] [in]	CODE	L [mm]	b [mm]	pcs
4 *0.16*	**LBACOIL440**	40	30	1600
	LBACOIL450	50	40	1600
	LBACOIL460	60	50	1600

Compatible with nailgun TJ100091.

NOTE: LBA, LBA 25 PLA, LBA 34 PLA and LBA COIL available in hot-dip galvanised version on request.

RELATED PRODUCTS

CODE	description	$d_{1\ NAIL}$ [mm]	L_{NAIL} [mm]	pcs
HH3731	palm nailer	4÷6	-	1
HH3522	Anker 25° nailgun	4	40 - 60	1
ATEU0116	strip magazine nailgun 34°	4	40 - 60	1
HH12100700	Anker 34° gas nailgun	4	40 - 60	1
TJ100091	Anker coil nailgun 15°	4	40 - 60	1

For more information about nailguns see "TOOLS FOR TIMBER CONSTRUCTION" catalogue.



HH3731



HH3522



ATEU0116

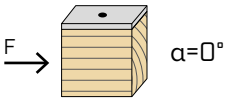


HH12100700



TJ100091

MINIMUM DISTANCES FOR NAILS SUBJECT TO SHEAR | STEEL-TO-TIMBER

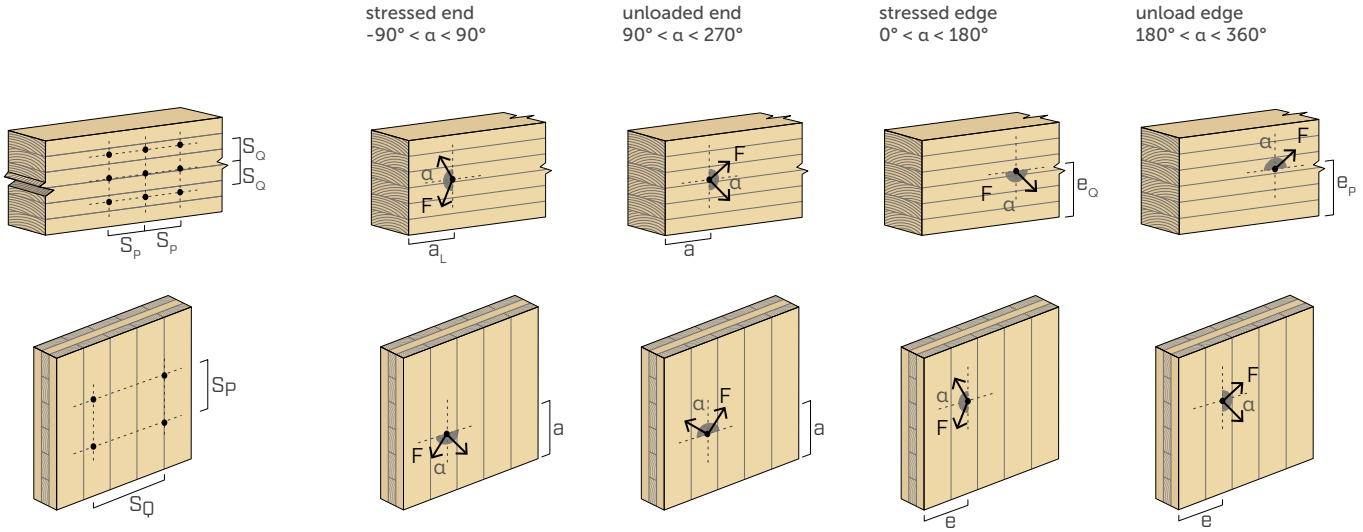


SPRUCE-PINE-FIR AND NORTHERN SPECIES

d_1	[mm] *[in]*	minimum spacing	4 *0.16*	6 *0.24*
S_P	[mm] *[in]*	**16·d**	64 *2 1/2*	96 *3 3/4*
S_Q	[mm] *[in]*	**8·d**	32 *1 1/4*	48 *1 7/8*
a	[mm] *[in]*	**12·d**	48 *1 7/8*	72 *2 13/16*
e	[mm] *[in]*	**4·d**	16 *5/8*	24 *15/16*

DOUGLAS FIR-LARCH, HEM-FIR, AND WESTERN RED CEDAR

d_1	[mm] *[in]*	minimum spacing	4 *0.16*	6 *0.24*
S_P	[mm] *[in]*	**20·d**	80 *3 1/8*	120 *4 3/4*
S_Q	[mm] *[in]*	**10·d**	40 *1 9/16*	60 *2 3/8*
a	[mm] *[in]*	**15·d**	60 *2 3/8*	90 *3 1/2*
e	[mm] *[in]*	**5·d**	20 *13/16*	30 *1 3/16*

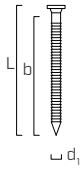
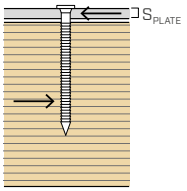


NOTES

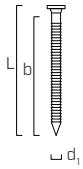
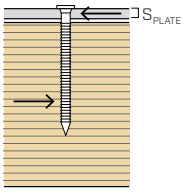
- Minimum distances as per CSA-O86 2019 Clause 12.9.2.1.

NOTES and **GENERAL PRINCIPLES** on page 292.

LBA Ø4-Ø6

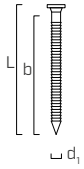
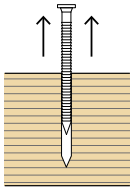
geometry			SHEAR steel-to-timber			
						
d_1 [mm] *[in]*	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r(1) G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
4 *0.16*	40	30	3,2 - 12,7 *1/8 - 1/2*	1,05	1,24	1,42	1,57
	50	40		1,05	1,24	1,42	1,57
	60	50		1,05	1,24	1,42	1,57
	75	65		1,05	1,24	1,42	1,57
	100	85		1,05	1,24	1,42	1,57
6 *0.24*	60	50	3,2 - 12,7 *1/8 - 1/2*	2,24	2,63	3,01	3,33
	80	70		2,24	2,63	3,01	3,33
	100	85		2,24	2,63	3,01	3,33

LBAI Ø4

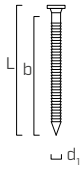
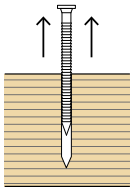
geometry			SHEAR steel-to-timber			
						
d_1 [mm] *[in]*	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r(1) G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
4 *0.16*	50	40	3,2 - 12,7 *1/8 - 1/2*	1,13	1,33	1,52	1,68

NOTES and GENERAL PRINCIPLES on page 292.

LBA Ø4-Ø6

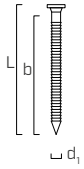
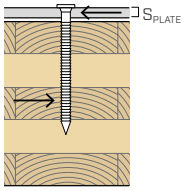
geometry			TENSION timber withdrawal			
						
d_1	L	b	factored withdrawal resistance P_{rw} (2)			
			G=0.35	G=0.42	G=0.49	G=0.55
[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	40	30	0,34	0,40	0,45	0,49
	50	40	0,46	0,53	0,60	0,65
	60	50	0,57	0,66	0,75	0,81
	75	65	0,74	0,86	0,98	1,05
	100	85	0,97	1,12	1,28	1,38
6 *0.24*	60	50	0,84	0,99	1,11	1,20
	80	70	1,18	1,39	1,55	1,68
	100	85	1,43	1,68	1,89	2,04

LBAI Ø4

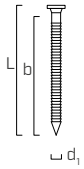
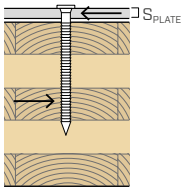
geometry			TENSION timber withdrawal			
						
d_1	L	b	factored withdrawal resistance P_{rw} (2)			
			G=0.35	G=0.42	G=0.49	G=0.55
[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	50	40	0,48	0,55	0,62	0,67

NOTES and GENERAL PRINCIPLES on page 292.

LBA Ø4-Ø6

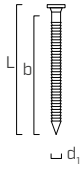
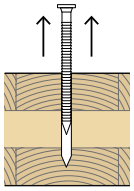
geometry			SHEAR steel-to-CLT			
						
d_1 [mm] *[in]*	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r (1) E3 G=0.35 [kN]	E1 and V2 G=0.42 [kN]	E2 and V1 G=0.49 [kN]
4 *0.16*	40	30	3,2 - 12,7 *1/8 - 1/2*	1,00	1,18	1,35
	50	40		1,00	1,18	1,35
	60	50		1,00	1,18	1,35
	75	65		1,00	1,18	1,35
	100	85		1,00	1,18	1,35
6 *0.24*	60	50	3,2 - 12.7 *1/8 - 1/2*	2,12	2,50	2,86
	80	70		2,12	2,50	2,86
	100	85		2,12	2,50	2,86

LBAI Ø4

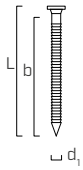
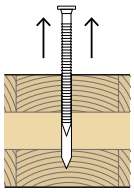
geometry			SHEAR steel-to-CLT			
						
d_1 [mm] *[in]*	L [mm]	b [mm]	steel plate thickness S_{PLATE} [mm] *[in]*	factored lateral resistance N_r (1) E3 G=0.35 [kN]	E1 and V2 G=0.42 [kN]	E2 and V1 G=0.49 [kN]
4 *0.16*	50	40	3,2 - 12,7 *1/8 - 1/2*	1,07	1,26	1,44

NOTES and GENERAL PRINCIPLES on page 292.

LBA Ø4-Ø6

geometry			TENSION CLT withdrawal			
						
d_1	L	b	factored withdrawal resistance P_{rw} (2) (3)			
			G=0.35	G=0.42	G=0.49	G=0.55
[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	40	30	0,31	0,36	0,41	0,44
	50	40	0,41	0,48	0,54	0,58
	60	50	0,51	0,59	0,68	0,73
	75	65	0,67	0,77	0,88	0,95
	100	85	0,87	1,01	1,15	1,24
6 *0.24*	60	50	0,76	0,89	1,00	1,08
	80	70	1,06	1,25	1,40	1,51
	100	85	1,29	1,51	1,70	1,84

LBAI Ø4

geometry			TENSION CLT withdrawal			
						
d_1	L	b	factored withdrawal resistance P_{rw} (2) (3)			
			G=0.35	G=0.42	G=0.49	G=0.55
[mm] *[in]*	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
4 *0.16*	50	40	0,43	0,50	0,56	0,60

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The embedment length considered for each nail is equal to the nail length minus the side plate thickness minus the head thickness (L - S_{PLATE} - t_1). Penetration length is according to CSA-O86 2019 Clause 12.9.2.2.
- The steel plate is assumed to be 300 W and 350 W with a minimum ultimate tensile strength, f_u, equal to 65.3 ksi (450 MPa).
- G is the mean relative density according to CSA-O86 2019 Table A.11. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- The calculated values apply to side grain installation and are valid regardless of the load-to-grain angle. Nails driven into the end grain are not considered to resist any loads in withdrawal.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.

NOTES

(1) Lateral resistances are factored and according to CSA-O86 2019 Clause 12.9.3. Values apply to dry service conditions and are representative of a single nail. Resistance factors were assumed to be equal to 1.0.

(2) Factored withdrawal resistances are applicable to short-term loads only. The resistance values were calculated with the entire threaded portion of the nail, b in millimeters.

(3) The lateral resistance for CLT incorporates the J_X = 0.9 factor.



DOWELS

DOWELS

SBD
SELF-DRILLING DOWEL 296

STA
SMOOTH DOWEL 306

SBD

SELF-DRILLING DOWEL

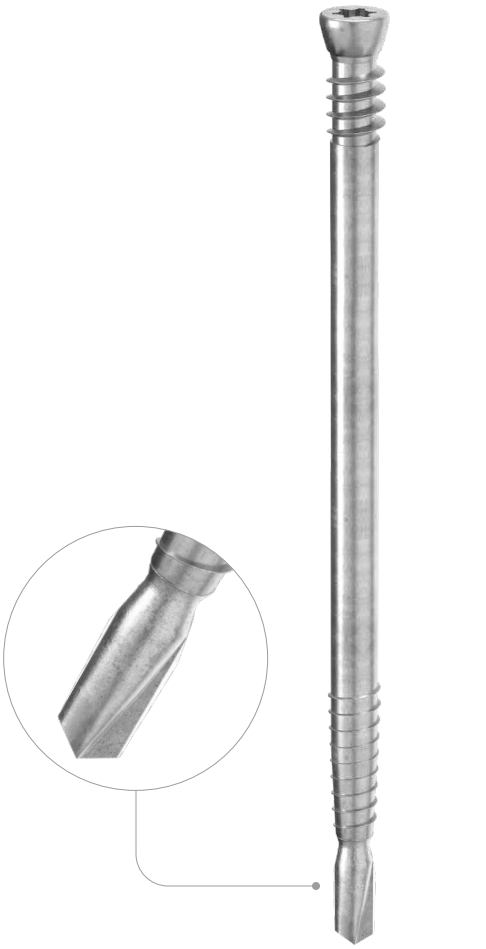
CE
EN 14592

TAPERED TIP
The new tapered self-perforating tip minimises insertion times in timber-to-metal connection systems and guarantees applications in hard-to-reach positions (reduced application force).

GREATER STRENGTH
Higher shear strengths than the previous version.
The 7.5 mm diameter ensures higher shear strengths than other solutions on the market and enables optimisation of the number of fasteners.

DOUBLE THREAD
The thread close to the tip (b_1) facilitates screwing. The longer under-head thread (b_2) allows quick and precise closing of the joint.

CYLINDRICAL HEAD
It allows the dowel to penetrate beyond the surface of the timber substrate. It ensures an optimal appearance and meets fire-strength requisites.



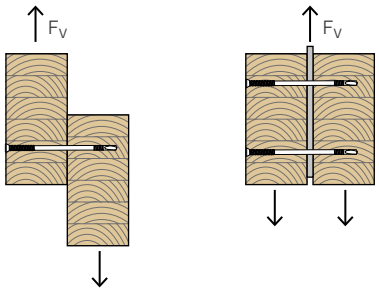
CANADIAN DESIGN VALUES
USA, EU and more design values available online.

VIDEO

BIT INCLUDED

DIAMETER [mm]	7,5 **(7,5)** 20
LENGTH [mm]	55 **(235)** 1000
SERVICE CONDITION	DRY
ATMOSPHERIC CORROSIVITY	C1 C2
WOOD CORROSIVITY	T1 T2
MATERIAL	Zn ELECTRO PLATED electrogalvanized carbon steel

EXTERNAL LOADS





FIELDS OF USE

Self-drilling system for concealed timber-to. steel joints.
It can be used with screw guns running at 600-2100 rpm, minimum applied force 25 kg, with:

- steel S235 ≤ 10.0 mm
- steel S275 ≤ 10.0 mm
- steel S355 ≤ 10.0 mm
- ALUMINI, ALUMIDI and ALUMAXI brackets



MOMENT RESTORING

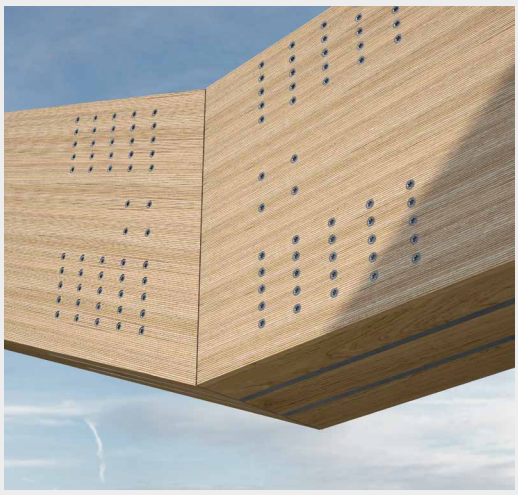
It restores shear and moment forces in concealed centreline joints of large beams.

EXCEPTIONAL SPEED

The only dowel that drills a 5 mm thick S355 plate in 20 seconds (horizontal application with an applied force of 25 kg).
No self-drilling dowel exceeds the application speed of the SBD with its new tip.



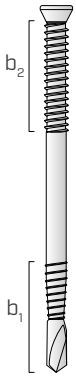
Fastening of Rothoblaas pillar-holder with internal knife plate F70.



Rigid "knee" joint with double internal plate (LVL).

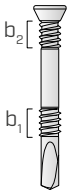
CODES AND DIMENSIONS

SBD L ≥ 95 mm



d_1 [mm] *[in]*	CODE	L [mm]	*L [in]*	b_1 [mm]	b_2 [mm]	pcs
7,5 *0.30* TX 40	**SBD7595**	95	*3 3/4*	40	10	50
	SBD75115	115	*4 1/2*	40	10	50
	SBD75135	135	*5 5/16*	40	10	50
	SBD75155	155	*6 1/8*	40	20	50
	SBD75175	175	*6 7/8*	40	40	50
	SBD75195	195	*7 11/16*	40	40	50
	SBD75215	215	*8 7/16*	40	40	50
	SBD75235	235	*9 1/4*	40	40	50

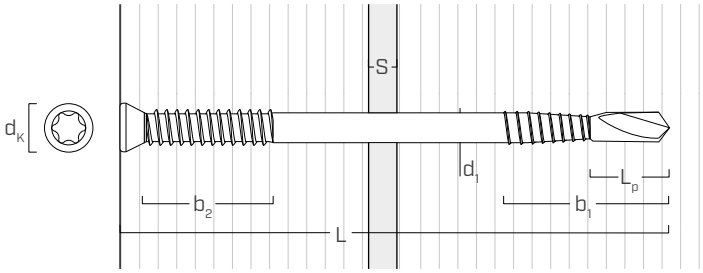
SBD L ≤ 75 mm



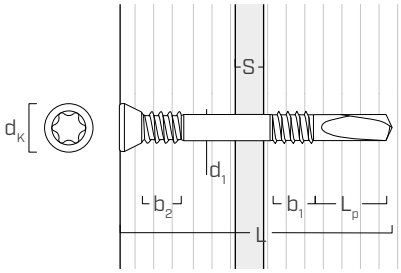
d_1 [mm] *[in]*	CODE	L [mm]	*L [in]*	b_1 [mm]	b_2 [mm]	pcs
7,5 *0.30* TX 40	**SBD7555**	55	*2 3/16*	-	10	50
	SBD7575	75	*2 15/16*	8	10	50

GEOMETRY AND MECHANICAL CHARACTERISTICS

SBD L ≥ 95 mm



SBD L ≤ 75 mm



			SBD L ≥ 95 mm	SBD L ≤ 75 mm
Nominal diameter	**d_1**	**[mm]**	**7,5**	**7,5**
Head diameter	d_K	[mm]	11,00	11,00
Tip length	L_p	[mm]	20,0	24,0
Effective length	L_{eff}	[mm]	L-15,0	L-8,0
Specified bending yield strength	F_{yb}	[MPa]	1034,21	1034,21

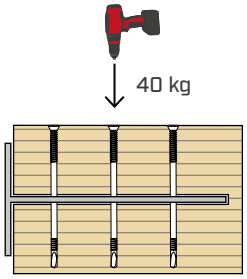
Bending yield strength has been tested and evaluated in accordance with ASTM F1575 and ICC-ES Acceptance Criteria AC233.

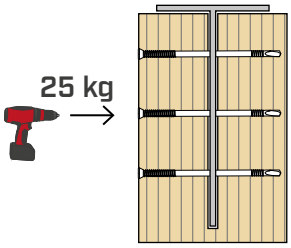
NOTES and **GENERAL PRINCIPLES** on page 304.

INSTALLATION | ALUMINIUM PLATE

plate	single plate [mm]
ALUMINI	6
ALUMIDI	6
ALUMAXI	10

It is suggested to have a milling in the wood equal to the thickness of the plate increased by at least 1 mm.





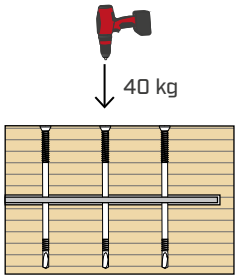
pressure to be applied	40 kg
recommended screwdriver	Mafell A 18M BL
recommended speed	1st gear (600-1000 rpm)

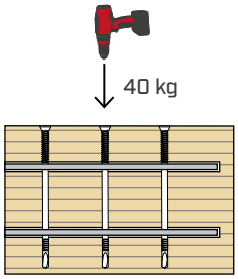
pressure to be applied	25 kg
recommended screwdriver	Mafell A 18M BL
recommended speed	1st gear (600-1000 rpm)

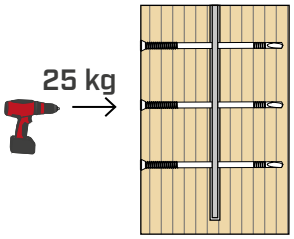
INSTALLATION | STEEL PLATE

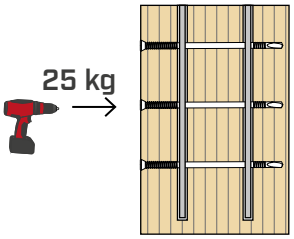
plate	single plate [mm]	double plate [mm]
S235 steel	10	8
S275 steel	10	6
S355 steel	10	5

It is suggested to have a milling in the wood equal to the thickness of the plate increased by at least 1 mm.









pressure to be applied	40 kg
recommended screwdriver	Mafell A 18M BL
recommended speed	2nd gear (1000-1500 rpm)

pressure to be applied	25 kg
recommended screwdriver	Mafell A 18M BL
recommended speed	2nd gear (1500-2000 rpm)

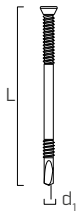
PLATE HARDNESS

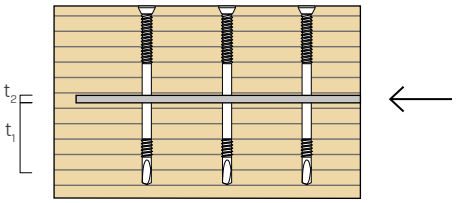
The steel plate hardness can greatly vary the pull-through times of the dowels.
Hardness is in fact defined as the material's strength to drilling or cutting.
In general, the harder the plate, the longer the drilling time.
The hardness of the plate does not always depend on the strength of the steel, it can vary from point to point and is strongly influenced by heat treatments: normalized plates have a medium to low hardness, while the hardening process gives the steel high hardnesses.

STRUCTURAL VALUES | LATERAL RESISTANCE

1 INTERNAL PLATE - DOWEL HEAD INSTALLATION DEPTH 0 mm

geometry	double shear - timber-to-steel-to-timber





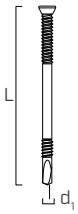
d_1	L		steel plate thickness = t_2	embedment length = t_1[2]	factored lateral resistance N_r[1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
	55	*2 3/16*		15	2,82	1,72	1,24	3,38	2,07	1,49	3,94	2,41	1,74	4,43	2,70	1,95
	75	*2 15/16*		25	4,76	2,91	2,09	5,71	3,49	2,51	6,66	4,07	2,93	7,40	4,57	3,29
	95	*3 3/4*		28	5,34	3,26	2,35	6,41	3,92	2,82	7,07	4,57	3,29	7,58	5,13	3,69
	115	*4 1/2*		33	5,99	3,86	2,78	6,69	4,63	3,33	7,35	5,40	3,89	7,89	5,84	4,37
	135	*5 5/16*	3,2	30	5,83	3,56	2,56	6,57	4,27	3,08	7,21	4,99	3,59	7,74	5,60	4,03
	155	*6 1/8*	*1/8*	50	6,67	4,89	4,00	7,50	5,48	4,47	8,30	6,04	4,91	8,96	6,50	5,28
	175	*6 7/8*		50	6,67	4,89	4,00	7,50	5,48	4,47	8,30	6,04	4,91	8,96	6,50	5,28
	195	*7 11/16*		70	7,45	5,36	4,34	8,43	6,05	4,88	9,39	6,70	5,39	10,18	7,24	5,82
	215	*8 7/16*		65	7,25	5,25	4,26	8,20	5,91	4,78	9,11	6,54	5,27	9,87	7,06	5,68
	235	*9 1/4*		85	8,03	5,72	4,60	9,13	6,47	5,19	10,20	7,20	5,75	11,09	7,80	6,22
	55	*2 3/16*		14	2,62	1,60	1,15	3,15	1,92	1,38	3,67	2,24	1,62	4,12	2,52	1,81
	75	*2 15/16*		24	4,56	2,79	2,01	5,48	3,35	2,41	6,39	3,91	2,81	7,17	4,38	3,16
	95	*3 3/4*		27	5,15	3,15	2,26	6,18	3,77	2,72	7,02	4,40	3,17	7,52	4,94	3,56
	115	*4 1/2*		32	5,95	3,74	2,69	6,64	4,49	3,23	7,29	5,24	3,77	7,83	5,81	4,23
	135	*5 5/16*	4,8	29	5,63	3,44	2,48	6,52	4,13	2,97	7,16	4,82	3,47	7,67	5,41	3,89
	155	*6 1/8*	*3/16*	49	6,63	4,87	3,98	7,46	5,45	4,45	8,24	6,00	4,89	8,90	6,46	5,25
	175	*6 7/8*		49	6,63	4,87	3,98	7,46	5,45	4,45	8,24	6,00	4,89	8,90	6,46	5,25
	195	*7 11/16*		69	7,41	5,34	4,32	8,39	6,02	4,86	9,33	6,67	5,37	10,12	7,21	5,79
	215	*8 7/16*		64	7,21	5,22	4,24	8,15	5,88	4,76	9,06	6,50	5,25	9,81	7,02	5,66
	235	*9 1/4*		84	7,99	5,70	4,58	9,09	6,45	5,17	10,15	7,17	5,73	11,03	7,77	6,19
	55	*2 3/16*		13	2,53	1,54	1,11	3,03	1,85	1,33	3,54	2,16	1,56	3,97	2,43	1,75
	75	*2 15/16*		23	4,47	2,73	1,97	5,36	3,28	2,36	6,25	3,82	2,75	7,02	4,29	3,09
	95	*3 3/4*		26	5,05	3,09	2,22	6,06	3,70	2,67	6,99	4,32	3,11	7,49	4,85	3,49
	115	*4 1/2*		31	5,93	3,68	2,65	6,62	4,42	3,18	7,26	5,15	3,71	7,80	5,78	4,16
7,5	135	*5 5/16*	6,4	29	5,54	3,38	2,44	6,50	4,06	2,92	7,13	4,74	3,41	7,64	5,32	3,83
0.30	155	*6 1/8*	*1/4*	49	6,61	4,85	3,97	7,43	5,44	4,44	8,22	5,99	4,88	8,87	6,44	5,24
	175	*6 7/8*		49	6,61	4,85	3,97	7,43	5,44	4,44	8,22	5,99	4,88	8,87	6,44	5,24
	195	*7 11/16*		69	7,39	5,33	4,32	8,36	6,00	4,85	9,30	6,65	5,36	10,09	7,19	5,78
	215	*8 7/16*		64	7,19	5,21	4,23	8,13	5,86	4,75	9,03	6,49	5,24	9,78	7,00	5,64
	235	*9 1/4*		84	7,97	5,69	4,57	9,06	6,43	5,16	10,12	7,15	5,72	11,00	7,75	6,18
	55	*2 3/16*		12	2,33	1,42	1,03	2,80	1,71	1,23	3,26	1,99	1,44	3,66	2,24	1,61
	75	*2 15/16*		22	4,27	2,61	1,88	5,13	3,13	2,26	5,98	3,66	2,63	6,72	4,10	2,95
	95	*3 3/4*		25	4,86	2,97	2,14	5,83	3,56	2,56	6,80	4,15	2,99	7,43	4,66	3,36
	115	*4 1/2*		30	5,83	3,56	2,56	6,57	4,27	3,08	7,21	4,99	3,59	7,74	5,60	4,03
	135	*5 5/16*	8	28	5,34	3,26	2,35	6,41	3,92	2,82	7,07	4,57	3,29	7,58	5,13	3,69
	155	*6 1/8*	*5/16*	48	6,57	4,83	3,96	7,39	5,41	4,42	8,16	5,95	4,85	8,80	6,40	5,21
	175	*6 7/8*		48	6,57	4,83	3,96	7,39	5,41	4,42	8,16	5,95	4,85	8,80	6,40	5,21
	195	*7 11/16*		68	7,35	5,31	4,30	8,32	5,98	4,83	9,25	6,62	5,33	10,03	7,15	5,75
	215	*8 7/16*		63	7,15	5,19	4,21	8,08	5,83	4,73	8,98	6,45	5,21	9,72	6,96	5,62
	235	*9 1/4*		83	7,93	5,66	4,56	9,02	6,40	5,14	10,07	7,12	5,69	10,94	7,71	6,15
	55	*2 3/16*		11	2,14	1,31	0,94	2,56	1,57	1,13	2,99	1,83	1,32	3,36	2,05	1,48
	75	*2 15/16*		21	4,08	2,49	1,79	4,90	2,99	2,15	5,71	3,49	2,51	6,41	3,92	2,82
	95	*3 3/4*		24	4,66	2,85	2,05	5,59	3,42	2,46	6,53	3,99	2,87	7,33	4,48	3,22
	115	*4 1/2*		29	5,63	3,44	2,48	6,52	4,13	2,97	7,16	4,82	3,47	7,67	5,41	3,89
	135	*5 5/16*	9,6	27	5,15	3,15	2,26	6,18	3,77	2,72	7,02	4,40	3,17	7,52	4,94	3,56
	155	*6 1/8*	*3/8*	47	6,53	4,81	3,94	7,34	5,38	4,40	8,11	5,92	4,83	8,74	6,37	5,19
	175	*6 7/8*		47	6,53	4,81	3,94	7,34	5,38	4,40	8,11	5,92	4,83	8,74	6,37	5,19
	195	*7 11/16*		67	7,31	5,28	4,28	8,27	5,95	4,81	9,20	6,59	5,31	9,96	7,11	5,72
	215	*8 7/16*		62	7,12	5,16	4,20	8,04	5,81	4,71	8,92	6,42	5,19	9,66	6,93	5,59
	235	*9 1/4*		82	7,89	5,64	4,54	8,97	6,38	5,12	10,01	7,08	5,67	10,88	7,67	6,13

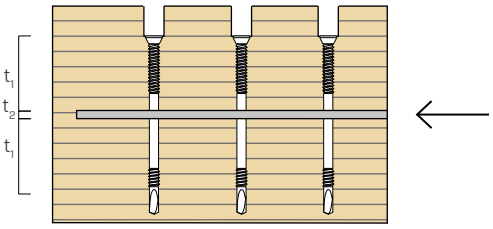
NOTES and GENERAL PRINCIPLES on page 304.

STRUCTURAL VALUES | LATERAL RESISTANCE

1 INTERNAL PLATE - OPTIMAL EMBEDMENT LENGTH

geometry	double shear - timber-to-steel-to-timber



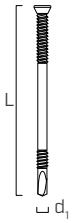


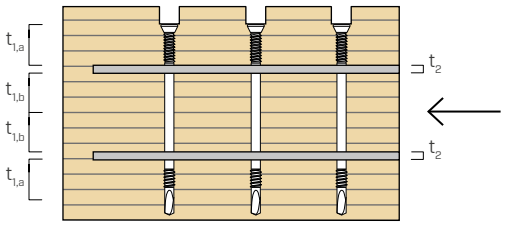
d_1	L		steel plate thickness = t_2	embedment length = t_1 [2]	factored lateral resistance N_r [1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
	55	*2 3/16*		21	4,08	2,49	1,79	4,90	2,99	2,15	5,71	3,49	2,51	6,41	3,92	2,82
	75	*2 15/16*		31	5,93	3,68	2,65	6,62	4,42	3,18	7,26	5,15	3,71	7,80	5,78	4,16
	95	*3 3/4*		38	6,18	4,45	3,21	6,92	5,12	3,85	7,62	5,62	4,49	8,19	6,03	4,94
	115	*4 1/2*		48	6,57	4,83	3,96	7,39	5,41	4,42	8,16	5,95	4,85	8,80	6,40	5,21
	135	*5 5/16*	3,2	58	6,96	5,07	4,13	7,85	5,69	4,62	8,71	6,29	5,09	9,41	6,78	5,48
	155	*6 1/8*	*1/8*	68	7,35	5,31	4,30	8,32	5,98	4,83	9,25	6,62	5,33	10,03	7,15	5,75
	175	*6 7/8*		78	7,74	5,54	4,47	8,78	6,26	5,03	9,79	6,95	5,57	10,64	7,52	6,02
	195	*7 11/16*		88	8,13	5,78	4,64	9,25	6,55	5,24	10,34	7,28	5,81	11,25	7,90	6,29
	215	*8 7/16*		98	8,51	6,02	4,81	9,72	6,83	5,44	10,88	7,62	6,05	11,81	8,27	6,56
	235	*9 1/4*		108	8,90	6,26	4,98	10,18	7,12	5,65	11,16	7,95	6,29	11,81	8,64	6,82
	55	*2 3/16*		20	3,89	2,37	1,71	4,66	2,85	2,05	5,44	3,32	2,39	6,11	3,73	2,69
	75	*2 15/16*		30	5,83	3,56	2,56	6,57	4,27	3,08	7,21	4,99	3,59	7,74	5,60	4,03
	95	*3 3/4*		37	6,14	4,33	3,12	6,87	5,09	3,74	7,56	5,59	4,37	8,13	5,99	4,90
	115	*4 1/2*		47	6,53	4,81	3,94	7,34	5,38	4,40	8,11	5,92	4,83	8,74	6,37	5,19
	135	*5 5/16*	4,8	57	6,92	5,04	4,11	7,80	5,66	4,60	8,65	6,25	5,07	9,35	6,74	5,45
	155	*6 1/8*	*3/16*	67	7,31	5,28	4,28	8,27	5,95	4,81	9,20	6,59	5,31	9,96	7,11	5,72
	175	*6 7/8*		77	7,70	5,52	4,45	8,74	6,23	5,01	9,74	6,92	5,55	10,57	7,49	5,99
	195	*7 11/16*		87	8,09	5,76	4,62	9,20	6,52	5,22	10,28	7,25	5,79	11,18	7,86	6,26
	215	*8 7/16*		97	8,47	5,99	4,79	9,67	6,80	5,42	10,83	7,58	6,03	11,80	8,23	6,53
	235	*9 1/4*		107	8,86	6,23	4,97	10,14	7,09	5,63	11,16	7,91	6,27	11,81	8,61	6,80
	55	*2 3/16*		20	3,79	2,31	1,67	4,55	2,78	2,00	5,30	3,24	2,33	5,95	3,64	2,62
	75	*2 15/16*		30	5,73	3,50	2,52	6,55	4,20	3,03	7,18	4,90	3,53	7,71	5,50	3,96
	95	*3 3/4*		36	6,12	4,27	3,08	6,85	5,08	3,69	7,54	5,57	4,31	8,10	5,98	4,84
	115	*4 1/2*		46	6,51	4,79	3,93	7,32	5,36	4,39	8,08	5,90	4,82	8,71	6,35	5,17
7,5	135	*5 5/16*	6,4	56	6,90	5,03	4,10	7,78	5,65	4,59	8,62	6,24	5,06	9,32	6,72	5,44
0.30	155	*6 1/8*	*1/4*	66	7,29	5,27	4,27	8,25	5,93	4,80	9,17	6,57	5,30	9,93	7,09	5,71
	175	*6 7/8*		76	7,68	5,51	4,44	8,71	6,22	5,00	9,71	6,90	5,54	10,54	7,47	5,98
	195	*7 11/16*		86	8,07	5,74	4,62	9,18	6,50	5,21	10,26	7,23	5,78	11,15	7,84	6,25
	215	*8 7/16*		96	8,46	5,98	4,79	9,65	6,79	5,41	10,80	7,57	6,01	11,76	8,21	6,52
	235	*9 1/4*		106	8,84	6,22	4,96	10,11	7,07	5,62	11,16	7,90	6,25	11,81	8,59	6,78
	55	*2 3/16*		19	3,59	2,20	1,58	4,31	2,64	1,90	5,03	3,07	2,21	5,65	3,45	2,48
	75	*2 15/16*		29	5,54	3,38	2,44	6,50	4,06	2,92	7,13	4,74	3,41	7,64	5,32	3,83
	95	*3 3/4*		35	6,09	4,15	2,99	6,80	4,99	3,59	7,48	5,54	4,19	8,04	5,94	4,70
	115	*4 1/2*		45	6,47	4,77	3,85	7,27	5,34	4,37	8,03	5,87	4,79	8,65	6,31	5,15
	135	*5 5/16*	8	55	6,86	5,01	4,09	7,73	5,62	4,57	8,57	6,20	5,03	9,26	6,68	5,41
	155	*6 1/8*	*5/16*	65	7,25	5,25	4,26	8,20	5,91	4,78	9,11	6,54	5,27	9,87	7,06	5,68
	175	*6 7/8*		75	7,64	5,48	4,43	8,67	6,19	4,98	9,66	6,87	5,51	10,48	7,43	5,95
	195	*7 11/16*		85	8,03	5,72	4,60	9,13	6,47	5,19	10,20	7,20	5,75	11,09	7,80	6,22
	215	*8 7/16*		95	8,42	5,96	4,77	9,60	6,76	5,39	10,75	7,53	5,99	11,70	8,18	6,49
	235	*9 1/4*		105	8,81	6,20	4,94	10,07	7,04	5,60	11,16	7,86	6,23	11,81	8,55	6,76
	55	*2 3/16*		18	3,40	2,08	1,50	4,08	2,49	1,79	4,76	2,91	2,09	5,34	3,26	2,35
	75	*2 15/16*		28	5,34	3,26	2,35	6,41	3,92	2,82	7,07	4,57	3,29	7,58	5,13	3,69
	95	*3 3/4*		34	6,05	4,04	2,91	6,76	4,84	3,49	7,43	5,51	4,07	7,98	5,90	4,57
	115	*4 1/2*		44	6,44	4,75	3,76	7,22	5,31	4,35	7,97	5,84	4,77	8,59	6,27	5,12
	135	*5 5/16*	9,6	54	6,82	4,98	4,07	7,69	5,59	4,55	8,52	6,17	5,01	9,20	6,65	5,39
	155	*6 1/8*	*3/8*	64	7,21	5,22	4,24	8,15	5,88	4,76	9,06	6,50	5,25	9,81	7,02	5,66
	175	*6 7/8*		74	7,60	5,46	4,41	8,62	6,16	4,96	9,60	6,83	5,49	10,42	7,39	5,92
	195	*7 11/16*		84	7,99	5,70	4,58	9,09	6,45	5,17	10,15	7,17	5,73	11,03	7,77	6,19
	215	*8 7/16*		94	8,38	5,93	4,75	9,55	6,73	5,37	10,69	7,50	5,97	11,64	8,14	6,46
	235	*9 1/4*		104	8,77	6,17	4,92	10,02	7,02	5,58	11,16	7,83	6,21	11,81	8,51	6,73

NOTES and GENERAL PRINCIPLES on page 304.

2 INTERNAL PLATES - OPTIMAL EMBEDMENT LENGTH

geometry	double shear - timber-to-steel-to-timber



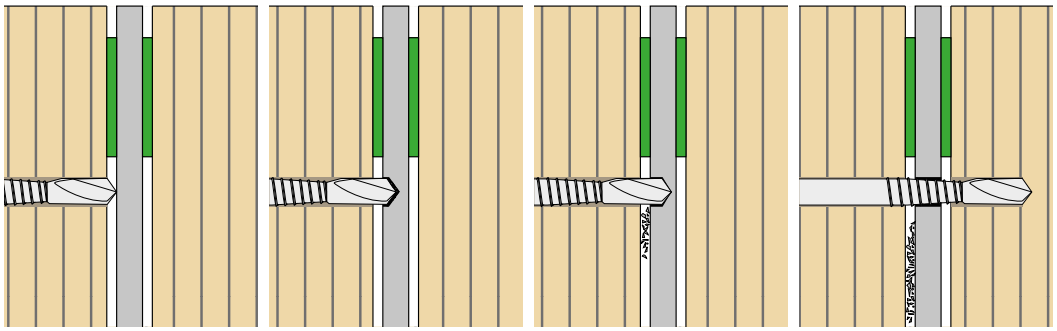


d_1	L		steel plate thickness = t_2	embedment length = $t_{1,a} = t_{1,b}$ (2)	factored lateral resistance N_r (1)											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
7,5 *0.30*	135	*5 5/16*	3,2 *1/8*	28	10,68	6,53	4,70	12,82	7,83	5,64	14,15	9,14	6,58	15,17	10,26	7,39
	155	*6 1/8*		33	11,98	7,72	5,56	13,37	9,26	6,67	14,69	10,80	7,78	15,78	11,69	8,73
	175	*6 7/8*		34	12,07	8,01	5,77	13,49	9,62	6,92	14,83	10,99	8,08	15,93	11,78	9,07
	195	*7 11/16*		40	12,54	9,30	6,80	14,05	10,37	8,16	15,49	11,40	9,34	16,67	12,23	10,01
	215	*8 7/16*		48	13,14	9,66	7,91	14,77	10,81	8,84	16,32	11,91	9,71	17,61	12,81	10,43
	235	*9 1/4*		53	13,53	9,90	8,09	15,24	11,10	9,04	16,87	12,24	9,95	18,22	13,18	10,69
	135	*5 5/16*	4,8 *3/16*	27	10,30	6,29	4,53	12,35	7,55	5,44	14,04	8,81	6,34	15,04	9,89	7,12
	155	*6 1/8*		32	11,90	7,48	5,38	13,28	8,97	6,46	14,58	10,47	7,54	15,65	11,61	8,46
	175	*6 7/8*		33	12,00	7,78	5,60	13,40	9,33	6,72	14,72	10,89	7,84	15,81	11,71	8,80
	195	*7 11/16*		39	12,47	9,21	6,63	13,96	10,32	7,96	15,38	11,33	9,29	16,55	12,16	9,96
	215	*8 7/16*		47	13,06	9,61	7,88	14,68	10,76	8,79	16,22	11,84	9,66	17,49	12,73	10,37
	235	*9 1/4*		52	13,45	9,85	8,05	15,14	11,04	9,00	16,76	12,17	9,90	18,10	13,11	10,64
	135	*5 5/16*	6,4 *1/4*	26	10,10	6,17	4,44	12,12	7,41	5,33	13,99	8,64	6,22	14,98	9,70	6,98
	155	*6 1/8*		31	11,86	7,36	5,30	13,23	8,83	6,36	14,53	10,30	7,42	15,59	11,57	8,33
	175	*6 7/8*		32	11,96	7,66	5,51	13,35	9,19	6,62	14,66	10,72	7,72	15,75	11,67	8,66
	195	*7 11/16*		38	12,43	9,09	6,55	13,91	10,29	7,86	15,32	11,30	9,17	16,48	12,12	9,93
	215	*8 7/16*		46	13,03	9,59	7,86	14,63	10,73	8,77	16,16	11,81	9,64	17,42	12,70	10,34
	235	*9 1/4*		51	13,41	9,83	8,03	15,10	11,01	8,98	16,70	12,14	9,88	18,04	13,07	10,61
	135	*5 5/16*	8 *5/16*	25	9,71	5,94	4,27	11,66	7,12	5,13	13,60	8,31	5,98	14,86	9,33	6,72
	155	*6 1/8*		30	11,66	7,12	5,13	13,14	8,55	6,15	14,42	9,97	7,18	15,47	11,19	8,06
	175	*6 7/8*		31	11,88	7,42	5,34	13,26	8,90	6,41	14,56	10,39	7,48	15,62	11,60	8,39
	195	*7 11/16*		37	12,35	8,86	6,38	13,82	10,23	7,65	15,21	11,23	8,93	16,36	12,05	9,88
	215	*8 7/16*		45	12,95	9,54	7,69	14,54	10,67	8,73	16,05	11,74	9,59	17,30	12,62	10,29
	235	*9 1/4*		50	13,34	9,78	8,00	15,00	10,96	8,94	16,60	12,07	9,83	17,91	13,00	10,56
	135	*5 5/16*	9,6 *3/8*	24	9,32	5,70	4,10	11,19	6,84	4,92	13,05	7,98	5,74	14,65	8,95	6,45
	155	*6 1/8*		29	11,27	6,89	4,96	13,05	8,26	5,95	14,31	9,64	6,94	15,35	10,82	7,79
	175	*6 7/8*		30	11,75	7,18	5,17	13,16	8,62	6,21	14,45	10,05	7,24	15,50	11,29	8,13
	195	*7 11/16*		36	12,27	8,62	6,21	13,73	10,18	7,45	15,11	11,16	8,69	16,24	11,97	9,75
	215	*8 7/16*		44	12,87	9,49	7,52	14,44	10,61	8,69	15,94	11,67	9,54	17,18	12,55	10,24
	235	*9 1/4*		49	13,26	9,73	7,97	14,91	10,90	8,90	16,49	12,01	9,78	17,79	12,92	10,51

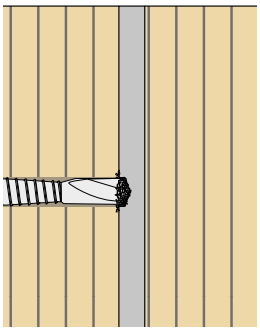
NOTES and GENERAL PRINCIPLES on page 304.

INSTALLATION

It is suggested to have **a milling in the wood equal to the thickness of the plate, increased by at least 1-2 mm**, placing SHIM spacers between the wood and the plate to centre it in the milling.
In this way, the steel residue from the drilling of the metal has an outlet to escape and does not obstruct the passage of the drill through the plate, thus avoiding overheating of the plate and timber and also preventing the generation of smoke during installation.



Cutter increased by 1 mm on each side.



Shavings obstructing the holes in the steel during drilling (spacers not installed).

To avoid breakage of the tip at the moment of pin-plate contact, it is recommended to **reach the plate slowly, pushing with a lower force until the moment of impact and then increasing it to the recommended value** (40 kg for top-down applications and 25 kg for horizontal installations). Try to keep the dowel as perpendicular as possible to the surface of the timber and the plate.



Intact tip after correct installation of the dowel.



Broken (cut) tip due to excessive force during impact with metal.

If the steel plate is too hard, the dowel tip may shrink significantly or even melt. In this case, it is advisable to check the material certificates for any heat treatment or hardness tests performed. Try decreasing the force applied or alternatively changing the type of plate.

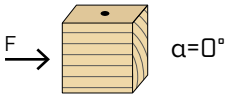


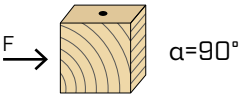
Tip melted during installation on a too hard plate without spacers between timber and plate.



Reduction of the tip when drilling the plate due to the high hardness of the plate.

MINIMUM DISTANCES FOR DOWELS SUBJECT TO SHEAR

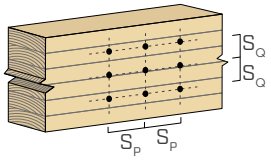




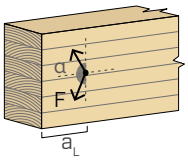
d_1	[mm] *[in]*	minimum distances	7,5 *0.30*
S_P	[mm] *[in]*	**4·d**	30 *1 3/16*
S_Q	[mm] *[in]*	**3·d**	22,5 *7/8*
a_L	[mm] *[in]*	**max (5·d; 50mm)**	50 *1 15/16*
a	[mm] *[in]*	**max (4·d; 50mm)**	50 *1 15/16*
e_Q	[mm] *[in]*	**4·d**	30 *1 3/16*
e_P	[mm] *[in]*	**max (1,5·d; 1/2 S_Q)**	11,25 *7/16*

d_1	[mm] *[in]*	minimum distances	7,5 *0.30*
S_P	[mm] *[in]*	**3·d**	22,5 *7/8*
S_Q	[mm] *[in]*	**3·d**	22,5 *7/8*
a_L	[mm] *[in]*	**max (4·d; 50mm)**	50 *1 15/16*
a	[mm] *[in]*	**max (4·d; 50mm)**	50 *1 15/16*
e_Q	[mm] *[in]*	**4·d**	30 *1 3/16*
e_P	[mm] *[in]*	**1,5·d**	11,25 *7/16*

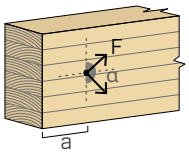
α = load-to-grain angle
d = d_1 = nominal dowel diameter



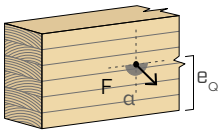
stressed end
-90° < α < 90°



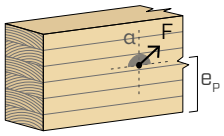
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES

- Minimum distances FOR CONNECTORS SUBJECTED TO SHEAR STRESS in accordance with CSA O86 Clause 12.4.3.

STRUCTURAL VALUES

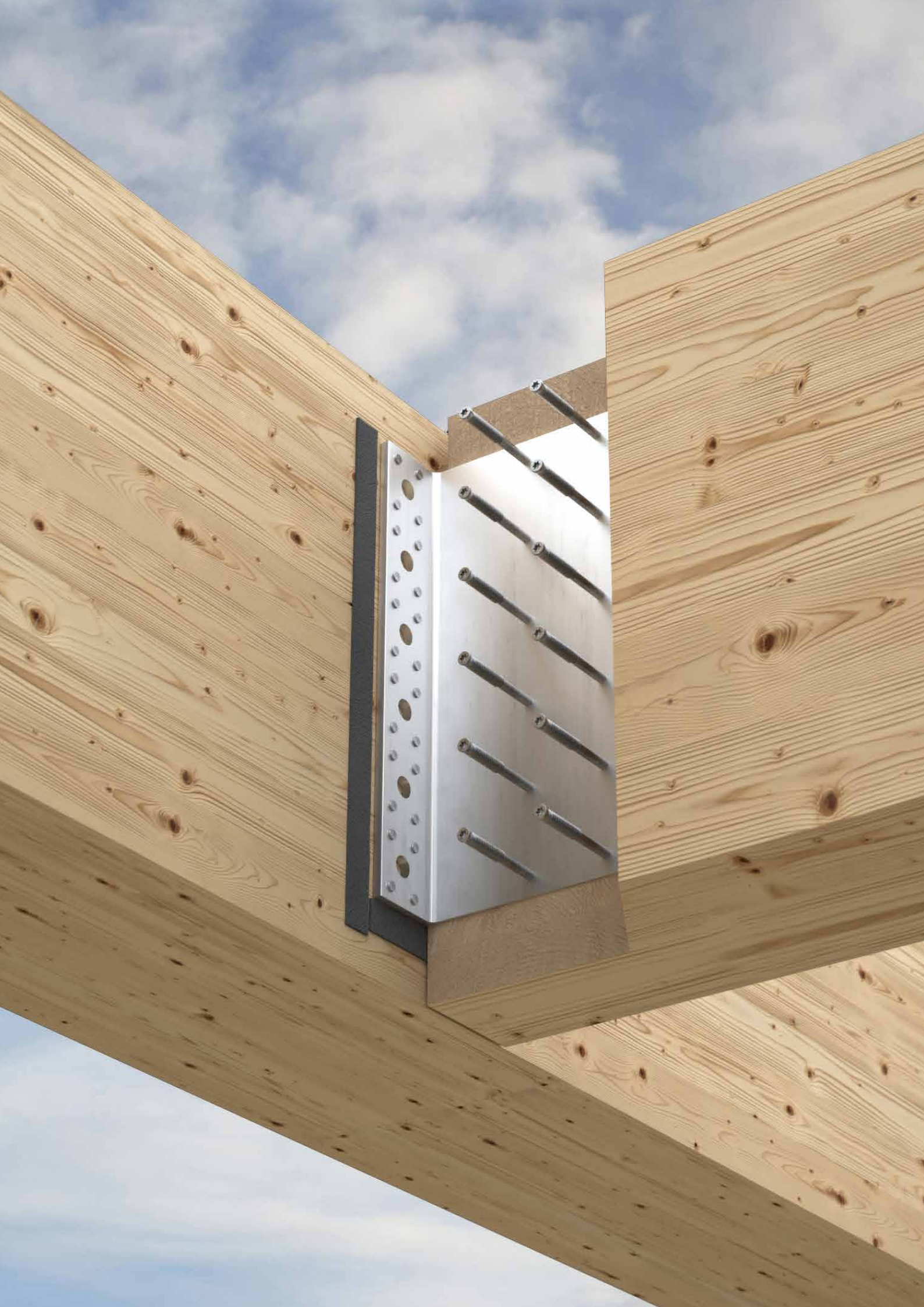
GENERAL PRINCIPLES

- The steel plate is assumed to be 300 W and 350 W with a minimum ultimate tensile strength equal to 65.3 ksi (450 MPa).
- G is the mean relative density according to Table A.11. Most common wood species are assumed such as Northern species (G=0.35), Spruce-Pine-Fir (G=0.42), Douglas Fir (G=0.49), and Southern Pine (G=0.55).
- The effective length is L - 15 mm for SBD L ≥ 95 mm, and L - 8 mm for SBD L ≤ 75 mm.
- The dimension b_1 of the dowel should be positioned at the far right end of the section, after the steel plate. Meanwhile, the head thread b_2 must remain within the wooden part and should not go through the steel plate.
- The dowels must be positioned in accordance with the minimum distances.
- Dimensioning and verification of timber elements and steel plates must be carried out separately.

NOTES

(1) The reference factored lateral resistance (N_r) has been calculated according to Clause 12.4 as per CSA-O86 2019 and are representative of a single dowel. Listed values are based on standard load duration factor (K_D = 1), permanent dry service condition factor (K_{SF} = 1), and treatment factor (K_T = 1).

(2) The embedment length is calculated using the following equation:
$t_1 = (L_{eff} - t_2 - t_{mill})/2$
where L_{eff} is the effective length of the dowel, t_2 is the thickness of the steel plate, and t_{mill} is the thickness of the milled cut in the wood section, 2 mm was considered for the tabulated values.
For the double shear, the calculated values consider that the steel plate is placed in the cross section so that the SBD has the optimum distance between each shear plane, i.e., $t_{1,a} = t_{1,b}$. In the case of a non-symmetrically dowel, the lowest embedment length was considered.



STA

SMOOTH DOWEL

CE
EN 14592

HIGH-RESISTANCE STEEL
Dowel Ø16 and Ø20 made of S355 steel grade to provide higher shear strength to the standard sizes used in structural design.

TAPERED TIP
The end is narrowed for easy insertion inside the prepared hole in the timber. Available in 1,0 m long version.

FOR SEISMIC ZONES
Available upon request in high bond steel and geometry designed to avoid pull-out when used in seismic areas.

STAINLESS STEEL VERSION
Available in A2 | AISI304 stainless steel for outdoor structural applications.

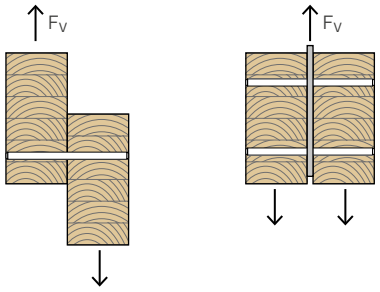
CANADIAN DESIGN VALUES
USA, EU and more design values available online.



STA STAS

DIAMETER [mm]	7,5	8 – 20	
LENGTH [mm]	55	60 – 1000	
MATERIAL			
Zn ELECTRO PLATED	S235-S355 electrogalvanized carbon steel	DRY C2 T2	
A2 AISI 304	A2 stainless steel	WET C4 T4	

EXTERNAL LOADS

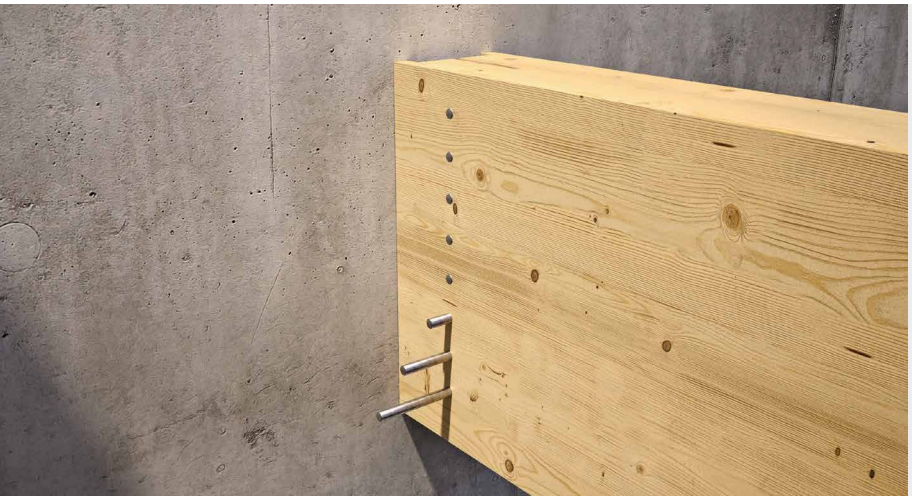




FIELDS OF USE

Assembly and structural connection of timber components for timber-to-timber and timber-to-steel shear connections
- solid timber and glulam
- CLT, LVL
- timber based panels





LARGE STRUCTURES ALSO OUTDOOR

Stainless steel A2 version suitable for outdoor applications up to 1 km from the sea and on class T4 acid wood.

TIMBER-TO-METAL

Ideal for being used with ALU and ALUMEGA brackets in realizing concealed joints. When used with wood taps it meets the fire safety requirements and provides an optimal aesthetic appearance.

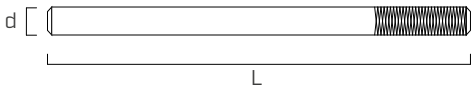
CODES AND DIMENSIONS

Zn ELECTRO PLATED

STA - smooth dowel made of S235-S355 carbon steel

d [mm] [in]	CODE	L [mm]	L [in]	steel	pcs
8 0.32	STA860B	60	2 3/8	S235	100
	STA880B	80	3 1/8	S235	100
	STA8100B	100	4	S235	100
	STA8120B	120	4 3/4	S235	100
	STA8140B	140	5 1/2	S235	100
12 0.48	STA1260B	60	2 3/8	S235	50
	STA1270B	70	2 3/4	S235	50
	STA1280B	80	3 1/8	S235	50
	STA1290B	90	3 1/2	S235	50
	STA12100B	100	4	S235	50
	STA12110B	110	4 3/8	S235	50
	STA12120B	120	4 3/4	S235	50
	STA12130B	130	5 1/8	S235	50
	STA12140B	140	5 1/2	S235	25
	STA12150B	150	6	S235	25
	STA12160B	160	6 1/4	S235	25
	STA12170B	170	6 3/4	S235	25
	STA12180B	180	7 1/8	S235	25
	STA12200B	200	8	S235	25
	STA12220B	220	8 5/8	S235	25
	STA12240B	240	9 1/2	S235	25
	STA12260B	260	10 1/4	S235	25
	STA12280B	280	11	S235	25
	STA12320B	320	12 5/8	S235	25
	STA12340B	340	13 3/8	S235	25
12 0.48	STA121000B	1000	39 3/8	S235	1
16 0.63	STA1680B	80	3 1/8	S355	25
	STA16100B	100	4	S355	25
	STA16110B	110	4 3/8	S355	25
	STA16120B	120	4 3/4	S355	25
	STA16130B	130	5 1/8	S355	25
	STA16140B	140	5 1/2	S355	25
	STA16150B	150	6	S355	25
	STA16160B	160	6 1/4	S355	15
	STA16170B	170	6 3/4	S355	15
	STA16180B	180	7 1/8	S355	15
16 0.63	STA16190B	190	7 1/2	S355	15
	STA16200B	200	8	S355	15
	STA16220B	220	8 5/8	S355	15
	STA16240B	240	9 1/2	S355	15
	STA16260B	260	10 1/4	S355	10
	STA16280B	280	11	S355	10
	STA16300B	300	11 3/4	S355	10
	STA16320B	320	12 5/8	S355	10
	STA16340B	340	13 3/8	S355	10
	STA16360B	360	14 1/4	S355	10
	STA16380B	380	15	S355	10
	STA16400B	400	15 3/4	S355	10
	STA16500B	500	19 3/4	S355	10
16 0.63	STA161000B	1000	39 3/8	S355	1
20 0.79	STA20120B	120	4 3/4	S355	10
	STA20140B	140	5 1/2	S355	10
	STA20160B	160	6 1/4	S355	10
	STA20180B	180	7 1/8	S355	10
	STA20190B	190	7 1/2	S355	10
	STA20200B	200	8	S355	10
	STA20220B	220	8 5/8	S355	10
	STA20240B	240	9 1/2	S355	10
	STA20260B	260	10 1/4	S355	5
	STA20300B	300	11 3/4	S355	5
	STA20320B	320	12 5/8	S355	5
	STA20360B	360	14 1/4	S355	5
	STA20400B	400	15 3/4	S355	5
20 0.79	STA201000B	1000	39 3/8	S355	1

Available upon request the STAS high bond steel and geometry designed to avoid pull-out when used in seismic areas (e.g. STAS16200).
Minimum quantity: 1000 pcs



A2 AISI 304

STA A2 | AISI304 - stainless steel smooth dowel[1]

d [mm] [in]	CODE	L [mm]	L [in]	pcs
12 0.48	STA12100A2	100	4	25
	STA12120A2	120	4 3/4	25
	STA12140A2	140	5 1/2	25
	STA12160A2	160	6 1/4	25
	STA12180A2	180	7 1/8	25
	STA12200A2	200	8	25
	STA12220A2	220	8 5/8	25
	STA12240A2	240	9 1/2	25
	STA12260A2	260	10 1/4	25
16 0.63	STA16120A2	120	4 3/4	25
	STA16140A2	140	5 1/2	10
	STA16150A2	150	6	10
	STA16160A2	160	6 1/4	10
	STA16180A2	180	7 1/8	10
	STA16200A2	200	8	10
	STA16220A2	220	8 5/8	10
	STA16240A2	240	9 1/2	10
	STA16260A2	260	10 1/4	10
	STA16280A2	280	11	10
	STA16300A2	300	11 3/4	10
20 0.79	STA20160A2	160	6 1/4	10
	STA20180A2	180	7 1/8	10
	STA20200A2	200	8	10
	STA20220A2	220	8 5/8	10
	STA20240A2	240	9 1/2	10
	STA20260A2	260	10 1/4	5
	STA20280A2	280	11	5
	STA20300A2	300	11 3/4	5
	STA20320A2	320	12 5/8	5
	STA20340A2	340	13 3/8	5
	STA20360A2	360	14 1/4	5
	STA20380A2	380	15	5

[1]Not holding CE marking.
STA A2 | AISI304 codes are only available on request.

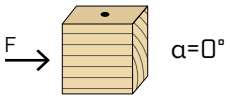
GEOMETRY AND MECHANICAL CHARACTERISTICS



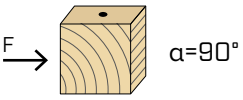
Nominal diameter	d	[mm] *[in]*	8 *0.32*	12 *0.48*	16 *0.63*	20 *0.79*
Length	L	[mm] *[in]*	60 - 140 *2 3/8 - 5 1/2*	60 - 340 *2 3/8 - 13 3/8*	80 - 500 *3 1/8 - 19 3/4*	120 - 400 *4 3/4 - 15 3/4*
Material	steel		S235	S235	S355	S355
Characteristic yield moment	F_{yb}	[MPa]	275,79	275,79	379,21	379,21

Bending yield strength has been tested and evaluated in accordance with ASTM F1575 and ICC-ES Acceptance Criteria AC233.

MINIMUM DISTANCES FOR DOWELS SUBJECT TO SHEAR

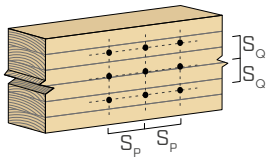


d_1	[mm] *[in]*	minimum distances	8 *0.32*	12 *0.48*	16 *0.63*	20 *0.79*
s_P	[mm] *[in]*	4·d	32 *1 1/4*	48 *1 7/8*	64 *2 1/2*	80 *3 1/8*
s_Q	[mm] *[in]*	3·d	24 *15/16*	36 *1 7/16*	48 *1 7/8*	60 *2 3/8*
a_L	[mm] *[in]*	max (5·d; 50mm)	50 *2*	60 *2 3/8*	80 *3 1/8*	100 *3 15/16*
a	[mm] *[in]*	max (4·d; 50mm)	50 *2*	50 *2*	64 *2 1/2*	80 *3 1/8*
e_Q	[mm] *[in]*	4·d	32 *1 1/4*	48 *1 7/8*	64 *2 1/2*	80 *3 1/8*
e_P	[mm] *[in]*	max (1,5·d; 1/2 S_Q)	12 *1/2*	18 *11/16*	24 *15/16*	30 *1 3/16*

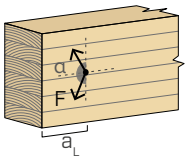


d_1	[mm] *[in]*	minimum distances	8 *0.32*	12 *0.48*	16 *0.63*	20 *0.79*
s_P	[mm] *[in]*	3·d	24 *15/16*	36 *1 7/16*	48 *1 7/8*	60 *2 3/8*
s_Q	[mm] *[in]*	3·d	24 *15/16*	36 *1 7/16*	48 *1 7/8*	60 *2 3/8*
a_L	[mm] *[in]*	max (4·d; 50mm)	50 *2*	60 *2 3/8*	80 *3 1/8*	100 *3 15/16*
a	[mm] *[in]*	max (4·d; 50mm)	50 *2*	50 *2*	64 *2 1/2*	80 *3 1/8*
e_Q	[mm] *[in]*	4·d	32 *1 1/4*	48 *1 7/8*	64 *2 1/2*	80 *3 1/8*
e_P	[mm] *[in]*	1,5·d	12 *1/2*	18 *11/16*	24 *15/16*	30 *1 3/16*

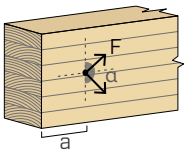
α = load-to-grain angle
d = nominal dowel diameter



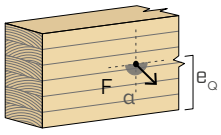
stressed end
-90° < α < 90°



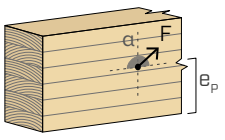
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



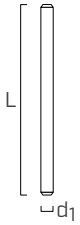
NOTES

- Minimum distances FOR CONNECTORS SUBJECTED TO SHEAR STRESS in accordance with CSA O86 2019 Clause 12.4.3.

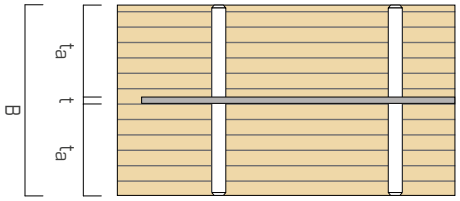
STRUCTURAL VALUES | LATERAL RESISTANCE

1 INTERNAL PLATE

geometry



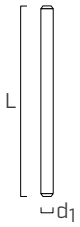
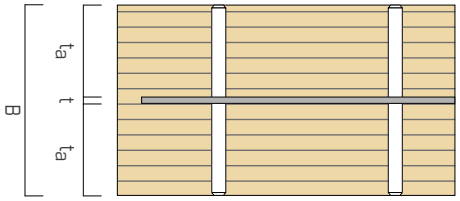
double shear - timber-to-steel-to-timber



d_1	L		steel plate thickness = t_2 [2]	embedment length = t_1 [3]	factored lateral resistance N_r [1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
	60	*2 3/8*	3,2 *1/8*	27,6	3,91	2,87	2,34	4,40	3,21	2,62	4,86	3,54	2,88	5,25	3,81	3,09
	80	*3 1/8*		37,6	4,32	3,12	2,53	4,89	3,51	2,84	5,44	3,89	3,13	5,90	4,20	3,38
	100	*4*		47,6	4,73	3,37	2,71	5,39	3,81	3,05	6,02	4,24	3,39	6,54	4,60	3,66
	120	*4 3/4*		57,6	5,14	3,62	2,89	5,88	4,12	3,27	6,54	4,60	3,64	6,92	4,99	3,95
	140	*5 1/2*		67,6	5,54	3,87	3,07	6,06	4,42	3,49	6,54	4,95	3,90	6,92	5,39	4,23
	60	*2 3/8*	4,8 *3/16*	26,8	3,87	2,85	2,33	4,36	3,19	2,60	4,82	3,51	2,86	5,20	3,78	3,07
	80	*3 1/8*		36,8	4,29	3,10	2,51	4,85	3,49	2,82	5,39	3,86	3,11	5,84	4,17	3,36
8	100	*4*		46,8	4,70	3,35	2,69	5,35	3,79	3,04	5,97	4,21	3,37	6,49	4,57	3,64
0.32	120	*4 3/4*		56,8	5,11	3,60	2,87	5,84	4,09	3,25	6,54	4,57	3,62	6,92	4,96	3,93
	140	*5 1/2*		66,8	5,52	3,85	3,05	6,06	4,39	3,47	6,54	4,92	3,87	6,92	5,36	4,21
	60	*2 3/8*	6,4 *1/4*	26,0	3,84	2,83	2,32	4,32	3,16	2,58	4,77	3,48	2,84	5,15	3,74	3,05
	80	*3 1/8*		36,0	4,25	3,08	2,50	4,81	3,46	2,80	5,35	3,83	3,09	5,79	4,14	3,33
	100	*4*		46,0	4,67	3,33	2,68	5,31	3,77	3,02	5,92	4,19	3,35	6,44	4,54	3,62
	120	*4 3/4*		56,0	5,08	3,58	2,86	5,80	4,07	3,24	6,50	4,54	3,60	6,92	4,93	3,90
	140	*5 1/2*		66,0	5,49	3,83	3,04	6,06	4,37	3,45	6,54	4,89	3,85	6,92	5,33	4,19
	60	*2 3/8*	4,8 *3/16*	26,8	7,68	4,85	3,49	8,57	5,82	4,19	9,42	6,79	4,89	10,11	7,50	5,48
	70	*2 3/4*		31,8	7,98	5,75	4,14	8,93	6,61	4,97	9,83	7,25	5,80	10,57	7,78	6,38
	80	*3 1/8*		36,8	8,27	6,11	4,79	9,28	6,82	5,59	10,24	7,51	6,14	11,04	8,07	6,58
	90	*3 1/2*		41,8	8,57	6,29	5,14	9,64	7,04	5,75	10,66	7,76	6,32	11,50	8,35	6,79
	100	*4*		46,8	8,86	6,47	5,27	9,99	7,26	5,90	11,07	8,01	6,50	11,97	8,63	6,99
	110	*4 3/8*		51,8	9,16	6,65	5,40	10,35	7,48	6,06	11,49	8,26	6,68	12,43	8,92	7,20
	120	*4 3/4*		56,8	9,46	6,83	5,53	10,70	7,69	6,22	11,90	8,52	6,86	12,90	9,20	7,40
	130	*5 1/8*		61,8	9,75	7,01	5,66	11,06	7,91	6,37	12,31	8,77	7,05	13,36	9,49	7,61
	140	*5 1/2*		66,8	10,05	7,19	5,79	11,41	8,13	6,53	12,73	9,02	7,23	13,83	9,77	7,81
	150	*6*		71,8	10,34	7,37	5,92	11,77	8,34	6,68	13,14	9,28	7,41	14,29	10,05	8,01
	160	*6 1/4*		76,8	10,64	7,55	6,05	12,12	8,56	6,84	13,56	9,53	7,59	14,76	10,34	8,22
	170	*6 3/4*		81,8	10,93	7,73	6,19	12,48	8,78	7,00	13,97	9,78	7,78	15,22	10,62	8,42
	180	*7 1/8*		86,8	11,23	7,91	6,32	12,83	8,99	7,15	14,38	10,04	7,96	15,23	10,91	8,63
	200	*8*		96,8	11,82	8,27	6,58	13,34	9,43	7,46	14,39	10,54	8,32	15,23	11,47	9,04
	220	*8 5/8*		106,8	12,19	8,64	6,84	13,34	9,86	7,78	14,39	11,05	8,69	15,23	11,95	9,45
	240	*9 1/2*		116,8	12,19	9,00	7,10	13,34	10,29	8,09	14,39	11,29	9,05	15,23	11,95	9,85
	260	*10 1/4*		126,8	12,19	9,36	7,36	13,34	10,46	8,40	14,39	11,29	9,41	15,23	11,95	10,15
	280	*11*		136,8	12,19	9,55	7,62	13,34	10,46	8,71	14,39	11,29	9,59	15,23	11,95	10,15
	320	*12 5/8*		156,8	12,19	9,55	8,11	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15
12	340	*13 3/8*		166,8	12,19	9,55	8,11	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15
0.48	60	*2 3/8*	6,4 *1/4*	26,0	7,63	4,70	3,39	8,52	5,64	4,06	9,35	6,59	4,74	10,04	7,39	5,32
	70	*2 3/4*		31,0	7,93	5,61	4,04	8,87	6,57	4,84	9,76	7,21	5,65	10,50	7,74	6,34
	80	*3 1/8*		36,0	8,23	6,08	4,69	9,23	6,79	5,57	10,18	7,47	6,11	10,96	8,02	6,55
	90	*3 1/2*		41,0	8,52	6,26	5,12	9,58	7,01	5,72	10,59	7,72	6,29	11,43	8,30	6,75
	100	*4*		46,0	8,82	6,44	5,25	9,94	7,22	5,88	11,01	7,97	6,47	11,89	8,59	6,96
	110	*4 3/8*		51,0	9,11	6,62	5,38	10,29	7,44	6,03	11,42	8,22	6,65	12,36	8,87	7,16
	120	*4 3/4*		56,0	9,41	6,80	5,51	10,65	7,66	6,19	11,83	8,48	6,84	12,82	9,16	7,37
	130	*5 1/8*		61,0	9,70	6,98	5,64	11,00	7,87	6,35	12,25	8,73	7,02	13,29	9,44	7,57
	140	*5 1/2*		66,0	10,00	7,16	5,77	11,36	8,09	6,50	12,66	8,98	7,20	13,75	9,72	7,78
	150	*6*		71,0	10,30	7,34	5,90	11,71	8,31	6,66	13,08	9,24	7,38	14,22	10,01	7,98
	160	*6 1/4*		76,0	10,59	7,52	6,03	12,06	8,52	6,81	13,49	9,49	7,56	14,68	10,29	8,19
	170	*6 3/4*		81,0	10,89	7,70	6,16	12,42	8,74	6,97	13,90	9,74	7,75	15,15	10,58	8,39
	180	*7 1/8*		86,0	11,18	7,88	6,29	12,77	8,96	7,13	14,32	10,00	7,93	15,23	10,86	8,59
	200	*8*		96,0	11,77	8,25	6,55	13,34	9,39	7,44	14,39	10,50	8,29	15,23	11,43	9,00
	220	*8 5/8*		106,0	12,19	8,61	6,81	13,34	9,83	7,75	14,39	11,01	8,66	15,23	11,95	9,41
	240	*9 1/2*		116,0	12,19	8,97	7,08	13,34	10,26	8,06	14,39	11,29	9,02	15,23	11,95	9,82
	260	*10 1/4*		126,0	12,19	9,33	7,34	13,34	10,46	8,38	14,39	11,29	9,39	15,23	11,95	10,15
	280	*11*		136,0	12,19	9,55	7,60	13,34	10,46	8,69	14,39	11,29	9,59	15,23	11,95	10,15
	320	*12 5/8*		156,0	12,19	9,55	8,11	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15
	340	*13 3/8*		166,0	12,19	9,55	8,11	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15

STRUCTURAL VALUES | LATERAL RESISTANCE

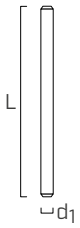
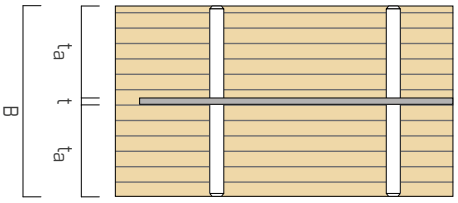
1 INTERNAL PLATE

geometry			double shear - timber-to-steel-to-timber													
																
d_1	L		steel plate thickness = t_2 [2]	embedment length = t_1 [3]	factored lateral resistance N_r [1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
	60	*2 3/8*		25,2	7,46	4,56	3,28	8,46	5,47	3,94	9,29	6,38	4,60	9,96	7,17	5,16
	70	*2 3/4*		30,2	7,88	5,46	3,93	8,82	6,54	4,72	9,70	7,17	5,51	10,43	7,69	6,18
	80	*3 1/8*		35,2	8,18	6,05	4,58	9,17	6,76	5,50	10,11	7,43	6,08	10,89	7,98	6,52
	90	*3 1/2*		40,2	8,47	6,23	5,10	9,52	6,97	5,70	10,53	7,68	6,26	11,36	8,26	6,72
	100	*4*		45,2	8,77	6,41	5,23	9,88	7,19	5,85	10,94	7,93	6,44	11,82	8,54	6,93
	110	*4 3/8*		50,2	9,07	6,59	5,36	10,23	7,41	6,01	11,36	8,18	6,62	12,28	8,83	7,13
	120	*4 3/4*		55,2	9,36	6,77	5,49	10,59	7,62	6,17	11,77	8,44	6,81	12,75	9,11	7,34
	130	*5 1/8*		60,2	9,66	6,95	5,62	10,94	7,84	6,32	12,18	8,69	6,99	13,21	9,40	7,54
	140	*5 1/2*		65,2	9,95	7,13	5,75	11,30	8,06	6,48	12,60	8,94	7,17	13,68	9,68	7,74
12	150	*6*	8	70,2	10,25	7,31	5,88	11,65	8,27	6,63	13,01	9,20	7,35	14,14	9,96	7,95
0.48	160	*6 1/4*	*5/16*	75,2	10,54	7,49	6,01	12,01	8,49	6,79	13,42	9,45	7,54	14,61	10,25	8,15
	170	*6 3/4*		80,2	10,84	7,68	6,14	12,36	8,71	6,95	13,84	9,70	7,72	15,07	10,53	8,36
	180	*7 1/8*		85,2	11,14	7,86	6,27	12,72	8,92	7,10	14,25	9,96	7,90	15,23	10,82	8,56
	200	*8*		95,2	11,73	8,22	6,53	13,34	9,36	7,41	14,39	10,46	8,26	15,23	11,38	8,97
	220	*8 5/8*		105,2	12,19	8,58	6,79	13,34	9,79	7,73	14,39	10,97	8,63	15,23	11,95	9,38
	240	*9 1/2*		115,2	12,19	8,94	7,05	13,34	10,22	8,04	14,39	11,29	8,99	15,23	11,95	9,79
	260	*10 1/4*		125,2	12,19	9,30	7,31	13,34	10,46	8,35	14,39	11,29	9,36	15,23	11,95	10,15
	280	*11*		135,2	12,19	9,55	7,57	13,34	10,46	8,66	14,39	11,29	9,59	15,23	11,95	10,15
	320	*12 5/8*		155,2	12,19	9,55	8,10	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15
	340	*13 3/8*		165,2	12,19	9,55	8,11	13,34	10,46	8,88	14,39	11,29	9,59	15,23	11,95	10,15
	80	*3 1/8*		36,0	13,56	8,29	5,97	16,27	9,94	7,16	18,46	11,60	8,35	19,78	13,02	9,38
	100	*4*		46,0	15,88	10,59	7,62	17,75	12,70	9,15	19,51	14,46	10,67	20,96	15,50	11,98
	110	*4 3/8*		51,0	16,26	11,74	8,45	18,20	13,47	10,14	20,04	14,78	11,83	21,55	15,86	13,00
	120	*4 3/4*		56,0	16,63	12,30	9,28	18,65	13,74	11,13	20,56	15,10	12,36	22,15	16,22	13,26
	130	*5 1/8*		61,0	17,01	12,53	10,11	19,10	14,02	11,47	21,09	15,42	12,60	22,74	16,58	13,52
	140	*5 1/2*		66,0	17,39	12,76	10,45	19,55	14,29	11,67	21,62	15,75	12,83	23,33	16,94	13,78
	150	*6*		71,0	17,76	12,99	10,61	20,00	14,57	11,87	22,15	16,07	13,06	23,92	17,31	14,04
	160	*6 1/4*		76,0	18,14	13,22	10,78	20,45	14,85	12,07	22,67	16,39	13,29	24,51	17,67	14,30
	170	*6 3/4*		81,0	18,52	13,45	10,95	20,91	15,12	12,27	23,20	16,71	13,52	25,10	18,03	14,56
	180	*7 1/8*		86,0	18,89	13,68	11,11	21,36	15,40	12,46	23,73	17,03	13,75	25,69	18,39	14,82
	190	*7 1/2*		91,0	19,27	13,91	11,28	21,81	15,67	12,66	24,25	17,36	13,99	26,28	18,75	15,08
16	200	*8*	6,4	96,0	19,65	14,14	11,44	22,26	15,95	12,86	24,78	17,68	14,22	26,88	19,11	15,34
0.63	220	*8 5/8*	*1/4*	106,0	20,40	14,60	11,77	23,16	16,50	13,26	25,83	18,32	14,68	28,06	19,83	15,86
	240	*9 1/2*		116,0	21,15	15,06	12,10	24,07	17,05	13,66	26,89	18,97	15,15	29,24	20,56	16,38
	260	*10 1/4*		126,0	21,90	15,52	12,44	24,97	17,61	14,05	27,94	19,61	15,61	30,42	21,28	16,90
	280	*11*		136,0	22,66	15,98	12,77	25,87	18,16	14,45	28,99	20,25	16,07	31,04	22,00	17,42
	300	*11 3/4*		146,0	23,41	16,44	13,10	26,78	18,71	14,85	29,32	20,90	16,54	31,04	22,73	17,94
	320	*12 5/8*		156,0	24,16	16,90	13,43	27,18	19,26	15,25	29,32	21,54	17,00	31,04	23,45	18,46
	340	*13 3/8*		166,0	24,83	17,36	13,76	27,18	19,81	15,64	29,32	22,19	17,46	31,04	24,17	18,98
	360	*14 1/4*		176,0	24,83	17,82	14,09	27,18	20,36	16,04	29,32	22,83	17,93	31,04	24,34	19,50
	380	*15*		186,0	24,83	18,28	14,42	27,18	20,92	16,44	29,32	22,99	18,39	31,04	24,34	20,02
	400	*15 3/4*		196,0	24,83	18,74	14,75	27,18	21,30	16,84	29,32	22,99	18,85	31,04	24,34	20,54
	500	*19 3/4*		246,0	24,83	19,46	16,41	27,18	21,30	18,09	29,32	22,99	19,53	31,04	24,34	20,69

NOTES and GENERAL PRINCIPLES on page 314.

STRUCTURAL VALUES | LATERAL RESISTANCE

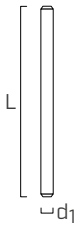
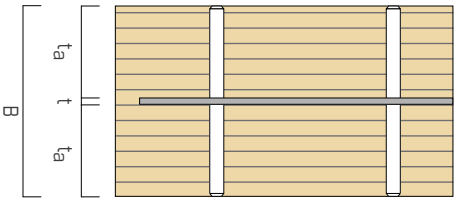
1 INTERNAL PLATE

geometry			double shear - timber-to-steel-to-timber													
																
d_1	L		steel plate thickness = t_2 [2]	embedment length = t_1 [3]	factored lateral resistance N_r [1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
16 *0.63*	80	*3 1/8*	8 *5/16*	35,2	13,26	8,10	5,83	15,91	9,72	7,00	18,37	11,35	8,17	19,69	12,73	9,17
	100	*4*		45,2	15,82	10,40	7,49	17,67	12,48	8,99	19,43	14,41	10,49	20,87	15,44	11,77
	110	*4 3/8*		50,2	16,20	11,55	8,32	18,13	13,42	9,98	19,95	14,73	11,65	21,46	15,80	12,96
	120	*4 3/4*		55,2	16,57	12,27	9,15	18,58	13,70	10,98	20,48	15,05	12,33	22,05	16,16	13,22
	130	*5 1/8*		60,2	16,95	12,50	9,97	19,03	13,97	11,44	21,01	15,37	12,56	22,64	16,52	13,48
	140	*5 1/2*		65,2	17,33	12,73	10,42	19,48	14,25	11,64	21,54	15,70	12,79	23,23	16,89	13,74
	150	*6*		70,2	17,70	12,96	10,59	19,93	14,53	11,84	22,06	16,02	13,02	23,83	17,25	14,00
	160	*6 1/4*		75,2	18,08	13,19	10,75	20,38	14,80	12,04	22,59	16,34	13,25	24,42	17,61	14,26
	170	*6 3/4*		80,2	18,46	13,42	10,92	20,83	15,08	12,23	23,12	16,66	13,49	25,01	17,97	14,52
	180	*7 1/8*		85,2	18,83	13,65	11,08	21,29	15,35	12,43	23,64	16,98	13,72	25,60	18,33	14,78
	190	*7 1/2*		90,2	19,21	13,88	11,25	21,74	15,63	12,63	24,17	17,31	13,95	26,19	18,69	15,04
	200	*8*		95,2	19,59	14,11	11,42	22,19	15,91	12,83	24,70	17,63	14,18	26,78	19,05	15,30
	220	*8 5/8*		105,2	20,34	14,57	11,75	23,09	16,46	13,23	25,75	18,27	14,65	27,97	19,78	15,82
	240	*9 1/2*		115,2	21,09	15,03	12,08	24,00	17,01	13,63	26,80	18,92	15,11	29,15	20,50	16,34
	260	*10 1/4*		125,2	21,84	15,49	12,41	24,90	17,56	14,02	27,86	19,56	15,57	30,33	21,22	16,86
	280	*11*		135,2	22,60	15,95	12,74	25,80	18,11	14,42	28,91	20,20	16,04	31,04	21,95	17,38
	300	*11 3/4*		145,2	23,35	16,41	13,07	26,71	18,67	14,82	29,32	20,85	16,50	31,04	22,67	17,90
	320	*12 5/8*		155,2	24,10	16,87	13,40	27,18	19,22	15,22	29,32	21,49	16,96	31,04	23,39	18,42
	340	*13 3/8*		165,2	24,83	17,33	13,73	27,18	19,77	15,61	29,32	22,13	17,43	31,04	24,11	18,94
	360	*14 1/4*		175,2	24,83	17,79	14,06	27,18	20,32	16,01	29,32	22,78	17,89	31,04	24,34	19,46
	380	*15*		185,2	24,83	18,25	14,40	27,18	20,87	16,41	29,32	22,99	18,35	31,04	24,34	19,98
	400	*15 3/4*		195,2	24,83	18,71	14,73	27,18	21,30	16,80	29,32	22,99	18,82	31,04	24,34	20,50
	500	*19 3/4*		245,2	24,83	19,46	16,38	27,18	21,30	18,09	29,32	22,99	19,53	31,04	24,34	20,69
	80	*3 1/8*	9,6 *3/8*	34,4	12,96	7,92	5,70	15,55	9,51	6,84	18,15	11,09	7,98	19,59	12,45	8,96
	100	*4*		44,4	15,76	10,22	7,36	17,60	12,27	8,83	19,34	14,31	10,30	20,77	15,38	11,56
	110	*4 3/8*		49,4	16,14	11,37	8,19	18,05	13,38	9,82	19,87	14,68	11,46	21,37	15,74	12,87
	120	*4 3/4*		54,4	16,52	12,23	9,01	18,51	13,65	10,82	20,40	15,00	12,29	21,96	16,11	13,18
	130	*5 1/8*		59,4	16,89	12,46	9,84	18,96	13,93	11,41	20,92	15,32	12,52	22,55	16,47	13,44
	140	*5 1/2*		64,4	17,27	12,69	10,40	19,41	14,21	11,61	21,45	15,64	12,75	23,14	16,83	13,70
	150	*6*		69,4	17,64	12,92	10,56	19,86	14,48	11,81	21,98	15,97	12,99	23,73	17,19	13,96
	160	*6 1/4*		74,4	18,02	13,15	10,73	20,31	14,76	12,00	22,51	16,29	13,22	24,32	17,55	14,22
	170	*6 3/4*		79,4	18,40	13,38	10,89	20,76	15,03	12,20	23,03	16,61	13,45	24,91	17,91	14,48
	180	*7 1/8*		84,4	18,77	13,61	11,06	21,21	15,31	12,40	23,56	16,93	13,68	25,51	18,27	14,74
	190	*7 1/2*		89,4	19,15	13,84	11,22	21,67	15,59	12,60	24,09	17,25	13,91	26,10	18,64	15,00
	200	*8*		94,4	19,53	14,07	11,39	22,12	15,86	12,80	24,61	17,58	14,14	26,69	19,00	15,26
	220	*8 5/8*		104,4	20,28	14,53	11,72	23,02	16,41	13,20	25,67	18,22	14,61	27,87	19,72	15,78
	240	*9 1/2*		114,4	21,03	14,99	12,05	23,92	16,97	13,59	26,72	18,86	15,07	29,05	20,44	16,30
	260	*10 1/4*		124,4	21,78	15,45	12,38	24,83	17,52	13,99	27,77	19,51	15,54	30,24	21,17	16,82
	280	*11*		134,4	22,54	15,91	12,71	25,73	18,07	14,39	28,83	20,15	16,00	31,04	21,89	17,34
	300	*11 3/4*		144,4	23,29	16,37	13,05	26,63	18,62	14,79	29,32	20,80	16,46	31,04	22,61	17,86
	320	*12 5/8*		154,4	24,04	16,83	13,38	27,18	19,17	15,18	29,32	21,44	16,93	31,04	23,33	18,38
	340	*13 3/8*		164,4	24,79	17,29	13,71	27,18	19,73	15,58	29,32	22,08	17,39	31,04	24,06	18,90
	360	*14 1/4*		174,4	24,83	17,75	14,04	27,18	20,28	15,98	29,32	22,73	17,85	31,04	24,34	19,42
	380	*15*		184,4	24,83	18,21	14,37	27,18	20,83	16,38	29,32	22,99	18,32	31,04	24,34	19,94
	400	*15 3/4*		194,4	24,83	18,67	14,70	27,18	21,30	16,77	29,32	22,99	18,78	31,04	24,34	20,46
	500	*19 3/4*		244,4	24,83	19,46	16,36	27,18	21,30	18,09	29,32	22,99	19,53	31,04	24,34	20,69

NOTES and GENERAL PRINCIPLES on page 314.

STRUCTURAL VALUES | LATERAL RESISTANCE

1 INTERNAL PLATE

geometry			double shear - timber-to-steel-to-timber													
																
d_1	L		steel plate thickness = t_2 [2]	embedment length = t_1 [3]	factored lateral resistance N_r [1]											
					G=0.35			G=0.42			G=0.49			G=0.55		
					0°	45°	90°	0°	45°	90°	0°	45°	90°	0°	45°	90°
[mm] *[in]*	[mm]	*[in]*	[mm] *[in]*	[mm]	[kN]			[kN]			[kN]			[kN]		
	120	*4 3/4*		56,0	23,96	15,34	11,04	26,75	18,41	13,25	29,39	21,48	15,46	31,56	23,38	17,36
	140	*5 1/2*		66,0	24,86	18,08	13,02	27,83	20,58	15,62	30,65	22,59	18,22	32,97	24,25	19,86
	160	*6 1/4*		76,0	25,75	19,00	14,99	28,90	21,24	17,39	31,90	23,36	19,09	34,38	25,11	20,48
	180	*7 1/8*		86,0	26,65	19,55	15,99	29,98	21,89	17,87	33,16	24,13	19,64	35,79	25,97	21,10
	200	*8*		96,0	27,54	20,09	16,39	31,05	22,55	18,34	34,41	24,89	20,19	37,19	26,83	21,72
	220	*8 5/8*	6,4	106,0	28,44	20,64	16,78	32,13	23,21	18,81	35,66	25,66	20,75	38,60	27,69	22,34
	240	*9 1/2*	*1/4*	116,0	29,34	21,19	17,17	33,20	23,87	19,28	36,92	26,43	21,30	40,01	28,55	22,96
	260	*10 1/4*		126,0	30,23	21,74	17,57	34,28	24,52	19,76	38,17	27,19	21,85	41,42	29,41	23,58
	300	*11 3/4*		146,0	32,02	22,83	18,36	36,43	25,84	20,70	40,68	28,73	22,95	44,23	31,13	24,82
	320	*12 5/8*		156,0	32,92	23,38	18,75	37,50	26,49	21,18	41,94	29,49	23,51	45,64	31,99	25,44
	360	*14 1/4*		176,0	34,71	24,47	19,54	39,65	27,81	22,12	44,45	31,03	24,61	47,35	33,71	26,68
	400	*15 3/4*		196,0	36,50	25,57	20,33	41,45	29,12	23,07	44,73	32,56	25,71	47,35	35,43	27,92
	120	*4 3/4*		54,4	23,82	14,91	10,73	26,58	17,89	12,88	29,19	20,87	15,02	31,34	23,25	16,86
	140	*5 1/2*		64,4	24,71	17,64	12,70	27,65	20,48	15,24	30,45	22,47	17,78	32,75	24,11	19,77
	160	*6 1/4*		74,4	25,61	18,91	14,67	28,73	21,13	17,32	31,70	23,24	19,00	34,15	24,97	20,39
	180	*7 1/8*		84,4	26,51	19,46	15,93	29,81	21,79	17,79	32,96	24,00	19,55	35,56	25,83	21,01
	200	*8*		94,4	27,40	20,01	16,32	30,88	22,45	18,26	34,21	24,77	20,11	36,97	26,69	21,62
20	220	*8 5/8*	9,6	104,4	28,30	20,55	16,72	31,96	23,10	18,74	35,47	25,54	20,66	38,38	27,55	22,24
0.79	240	*9 1/2*	*3/8*	114,4	29,19	21,10	17,11	33,03	23,76	19,21	36,72	26,30	21,21	39,79	28,41	22,86
	260	*10 1/4*		124,4	30,09	21,65	17,51	34,11	24,42	19,68	37,97	27,07	21,76	41,19	29,27	23,48
	300	*11 3/4*		144,4	31,88	22,74	18,29	36,26	25,73	20,63	40,48	28,60	22,87	44,01	30,99	24,72
	320	*12 5/8*		154,4	32,78	23,29	18,69	37,33	26,39	21,10	41,74	29,37	23,42	45,42	31,85	25,34
	360	*14 1/4*		174,4	34,57	24,39	19,48	39,48	27,70	22,05	44,25	30,90	24,52	47,35	33,57	26,58
	400	*15 3/4*		194,4	36,36	25,48	20,27	41,45	29,02	22,99	44,73	32,44	25,63	47,35	35,29	27,82
	120	*4 3/4*		52,9	23,68	14,47	10,42	26,41	17,37	12,50	28,99	20,26	14,59	31,11	22,74	16,37
	140	*5 1/2*		62,9	24,57	17,21	12,39	27,48	20,37	14,87	30,25	22,35	17,35	32,52	23,97	19,47
	160	*6 1/4*		72,9	25,47	18,82	14,36	28,56	21,03	17,23	31,50	23,12	18,92	33,93	24,83	20,29
	180	*7 1/8*		82,9	26,36	19,37	15,87	29,63	21,69	17,72	32,76	23,88	19,47	35,34	25,69	20,91
	200	*8*		92,9	27,26	19,92	16,26	30,71	22,34	18,19	34,01	24,65	20,02	36,75	26,55	21,53
	220	*8 5/8*	12,7	102,9	28,16	20,47	16,65	31,79	23,00	18,66	35,27	25,42	20,57	38,15	27,41	22,15
	240	*9 1/2*	*1/2*	112,9	29,05	21,01	17,05	32,86	23,66	19,13	36,52	26,18	21,12	39,56	28,27	22,77
	260	*10 1/4*		122,9	29,95	21,56	17,44	33,94	24,31	19,61	37,77	26,95	21,68	40,97	29,13	23,38
	300	*11 3/4*		142,9	31,74	22,66	18,23	36,09	25,63	20,55	40,28	28,48	22,78	43,79	30,86	24,62
	320	*12 5/8*		152,9	32,64	23,21	18,63	37,16	26,28	21,03	41,54	29,25	23,33	45,19	31,72	25,24
	360	*14 1/4*		172,9	34,43	24,30	19,41	39,31	27,60	21,97	44,05	30,78	24,43	47,35	33,44	26,48
	400	*15 3/4*		192,9	36,22	25,40	20,20	41,45	28,91	22,92	44,73	32,32	25,54	47,35	35,16	27,72

NOTES and GENERAL PRINCIPLES on page 314.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The values are valid for a beam width equal to or greater than the dowel length. The dowels are installed symmetrically with the steel plate in the center of the beam.
- Listed values are based on standard load duration factor (K_D = 1), permanent dry service condition factor (K_{SF} = 1), and treatment factor (K_T = 1).
- The steel plate is assumed to be 300 W and 350 W with a minimum ultimate tensile strength equal to 65.3 ksi (450 MPa).
- G is the mean relative density according to Table A.11. Most common wood species are assumed such as Northern species (G=0.35), Spruce-Pine-Fir (G=042), Douglas Fir (G=0.49), and Southern Pine (G=0.55).
- Dimensioning and verification of timber elements and steel plates must be carried out separately.

NOTES

(1) The reference factored lateral resistance (N_r) has been calculated for different load-to grain angles according to Clause 12.4 as per CSA-O86 2019 and are representative of a single dowel with two shear planes.

(2) 1/16 inch tolerance has been assumed for the timber slot.

(3) The embedment length is calculated using the following equation $t_1 = (L - t_2 - t_{mill})/ 2$. Where L is the length of the dowel, t_2 is the thickness of the steel plate, and t_{mill} is the thickness of the milled cut in the wood section, 1/16 inch was considered for the tabulated values.

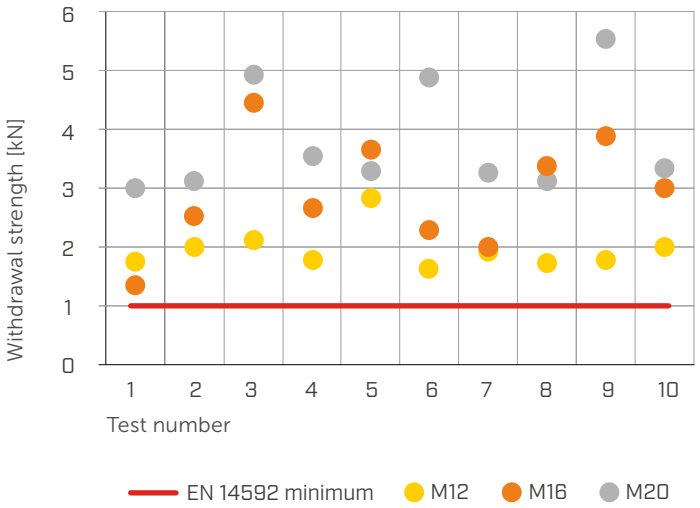
STAS | IMPROVED BOND DOWEL FOR SEISMIC LOADS



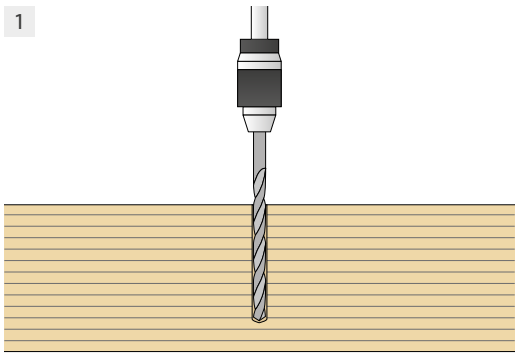
Knurled dowel available on request. Knurling limits the displacement of the dowels from the joint during an earthquake, as stipulated in Eurocode 8, and allows for a pull-out strength of 1 kN, as stipulated in EN 14592:2022.



STAS - WITHDRAWAL VALUES

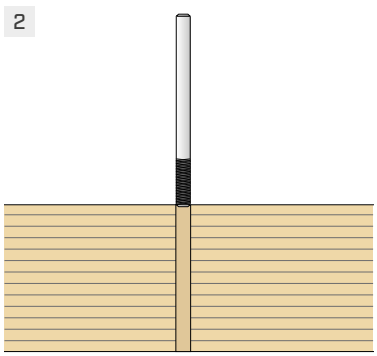


1



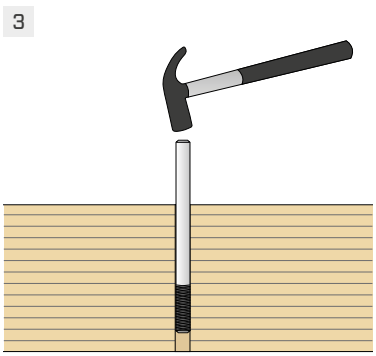
Make a pre-drilling hole with a diameter equal to the diameter of the dowel using a drill press or CNC machine. The hole must be perfectly perpendicular.

2



Clean the hole and place the dowel with the knurling in contact with the timber.

3



Drive the dowel into the hole using a hammer.

BRACKETS AND PLATES

BRACKETS AND PLATES

WKR
TENSILE ANGLE BRACKET FOR BUILDINGS 318

WHT
ANGLE BRACKET FOR TENSILE LOADS 330

TITAN PLATE T
PLATE FOR SHEAR LOADS 340

TITAN PLATE C
PLATE FOR SHEAR LOADS 348

WHT PLATE T
PLATE FOR TENSILE LOADS 356

WHT PLATE C
PLATE FOR TENSILE LOADS 360

LBB
PERFORATED STRAP 367

LBV
PERFORATED PLATE 372

SLOT
CONNECTOR FOR STRUCTURAL PANELS 376

F70
"T" SHAPED POST BASE 384

WKR

TENSILE ANGLE BRACKET FOR BUILDINGS

DESIGN REGISTERED

CE ETA-22/0089

TIMBER FRAME AND CLT

Ideal for timber frame and CLT because of the optimized nailing patterns. Certified configurations with the presence of bedding grout, base plate or concrete kerb.

TIMBER-TO-TIMBER CONFIGURATION

Exceptional strength values also for installation in timber-to-timber configuration. Possibility of installation with passing bolts or with VGS screws or HBS PLATE.

CERTIFICATION WITH GAP

Certification with raised installation opens up numerous application possibilities for solving non-standard connections or managing tolerances in innovative ways.

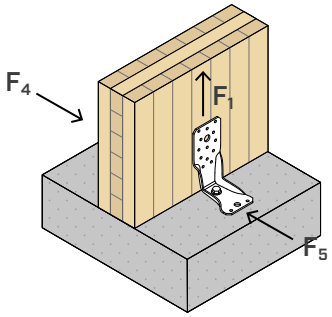
SERVICE CONDITIONS DRY

MATERIAL

S250 Z275 **WKR9530**: carbon steel S250GD+Z275

S235 Fe/Zn12c **WKR13535 | WKR21535 | WKR28535 | WKR53035:**
S235 + Fe/Zn12c carbon steel

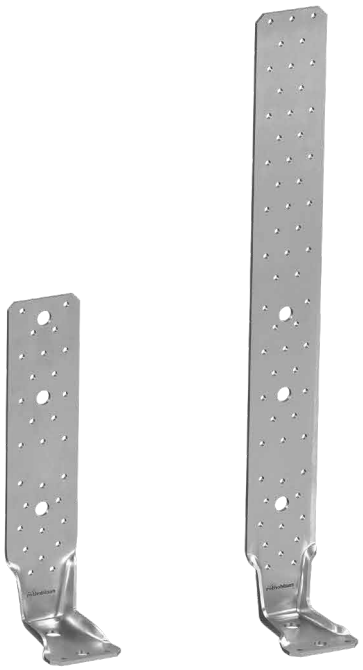
EXTERNAL LOADS

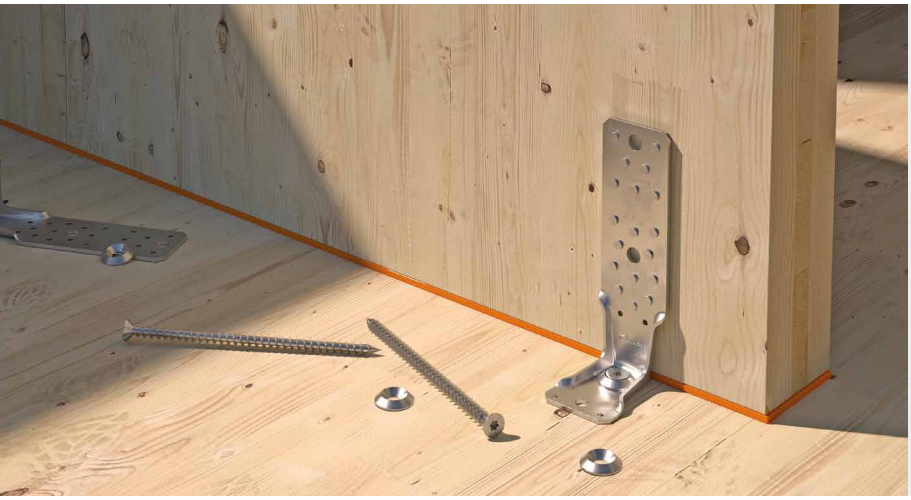


CANADIAN DESIGN VALUES

USA, EU and more design values available online.







FIELDS OF USE

Tension joints with small to medium stress. Also optimised for fastening frame walls. Timber-to-timber, timber-to-concrete and timber-to-steel configurations.

Can be applied to:

- solid timber and glulam
- timber frame
- CLT and LVL panels



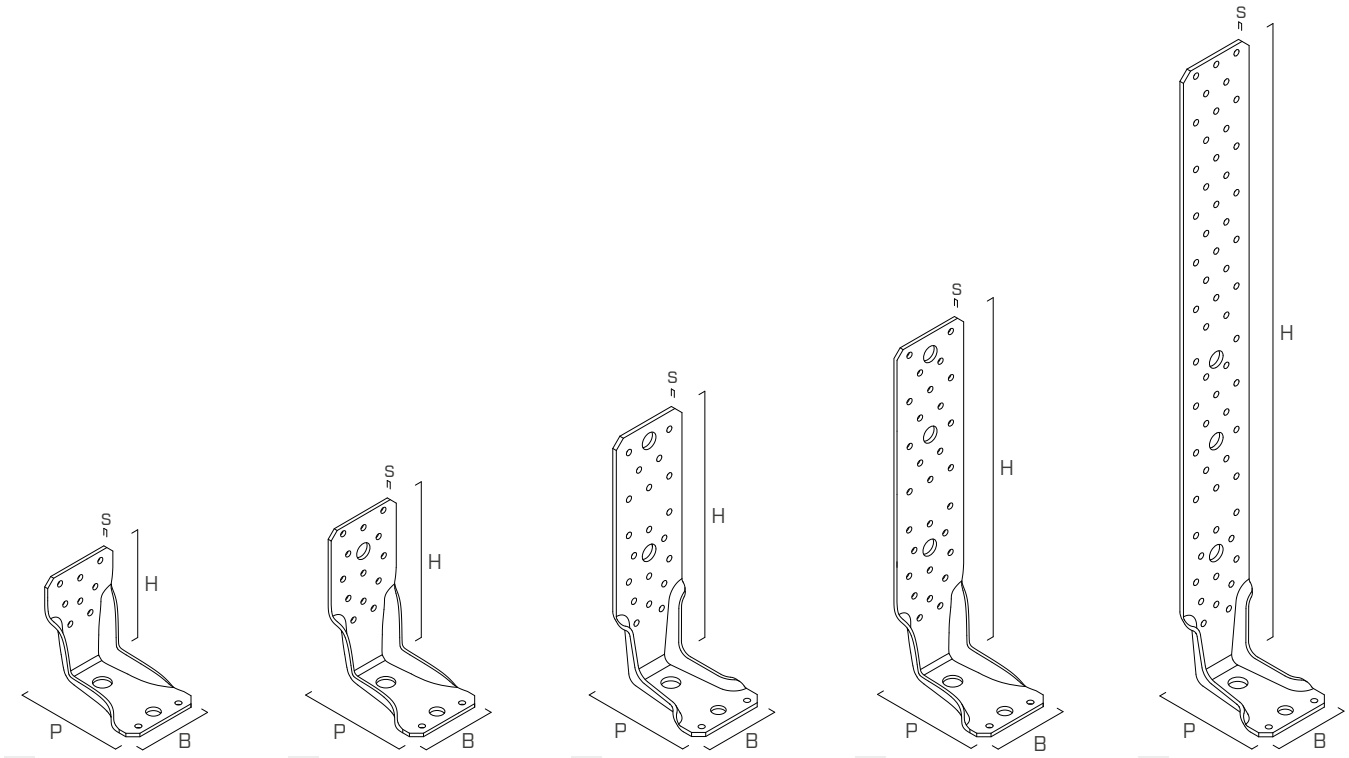
RAISED WALL

Partial nailing patterns allow installation on timber frame or CLT walls in the presence of concrete kerb up to 370 mm high.

PREFABRICATION

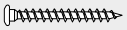
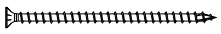
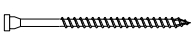
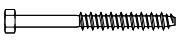
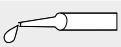
On prefabricated timber frame walls, it is possible to pre-install the anchor in the concrete and the angle bracket on the wall. With a MUT 6334 joint nut and threaded rod, it is possible to complete the connection on site, managing all installation tolerances as best as possible.

CODES AND DIMENSIONS



	CODE	B [mm]	P [mm]	H [mm]	s [mm]	*B [in]*	*P [in]*	*H [in]*	*s [in]*	n_V Ø5 *n_V Ø0.20* [pcs]	n_H Ø14 *n_H Ø0.56* [pcs]	n_H Ø11 *n_H Ø0.44* [pcs]	n_V Ø13,5 *n_V Ø0.53* [pcs]			pcs
1	**WKR9530**	65	85	95	3	*2 9/16*	*3 3/8*	*3 3/4*	*0.12*	8	1	1	-	●	●	25
2	**WKR13535**	65	85	135	3,5	*2 9/16*	*3 3/8*	*5 5/16*	*0.14*	13	1	1	1	●	●	25
3	**WKR21535**	65	85	215	3,5	*2 9/16*	*3 3/8*	*8 7/16*	*0.14*	20	1	1	2	●	●	25
4	**WKR28535**	65	85	287	3,5	*2 9/16*	*3 3/8*	*11 5/16*	*0.14*	29	1	1	3	●	●	25
5	**WKR53035**	65	85	530	3,5	*2 9/16*	*3 3/8*	*20 7/8*	*0.14*	59	1	1	3	●	●	10

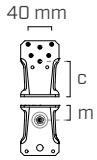
FASTENERS

type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
VGS	fully threaded countersunk screw		11-13	
HUS	turned washer		11-13	
HBS PLATE	pan head screw		10-12	
AB1	CE1 expansion anchor		12	
SKR	screw-in anchor		M12	
VIN-FIX	vinyl ester chemical anchor		M12	
HYB-FIX	hybrid chemical anchor		M12	
EPO-FIX	epoxy chemical anchor		M12	
ULS13373	washer		M12	

FASTENING PATTERNS

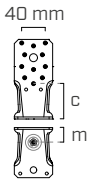
TIMBER-TO-TIMBER

WKR9530



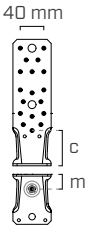
pattern 2

WKR13535



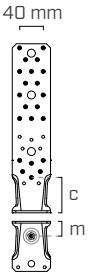
pattern 2

WKR21535



pattern 2

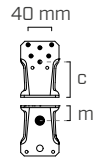
WKR28535



pattern 3

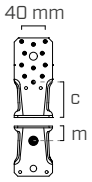
TIMBER-TO-CONCRETE

WKR9530



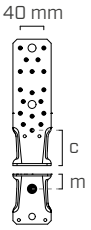
pattern 1

WKR13535

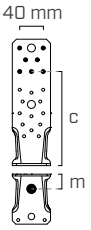


pattern 1

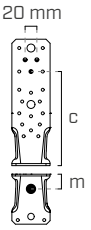
WKR21535



pattern 1

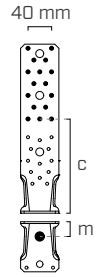


pattern 3

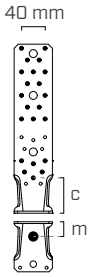


pattern 4

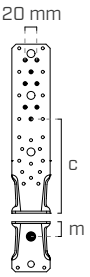
WKR28535



pattern 1

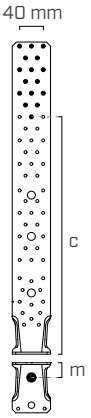


pattern 2

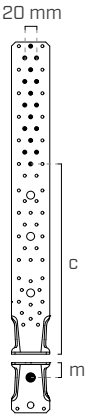


pattern 4

WKR53035



pattern 1

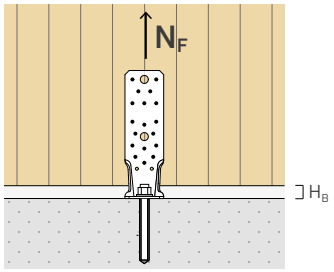


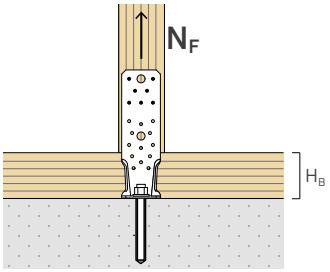
pattern 2

CODE	configuration	fastening holes Ø5 n_V [pcs]	c [mm]	m [mm]	support	
WKR9530	pattern 1	6	60	25	-	●
	pattern 2	6	60		●	-
WKR13535	pattern 1	11	60		-	●
	pattern 2	11	60		●	-
WKR21535	pattern 1	18	60		-	●
	pattern 2	18	60		●	-
	pattern 3	7	160		-	●
	pattern 4	3	160		-	●
WKR28535	pattern 1	16	160		-	●
	pattern 2	22	60		-	●
	pattern 3	22	60		●	-
	pattern 4	8	160		-	●
WKR53035	pattern 1	16	400		-	●
	pattern 2	16	320		-	●

INSTALLATION

MAXIMUM HEIGHT OF THE INTERMEDIATE H_B LAYER

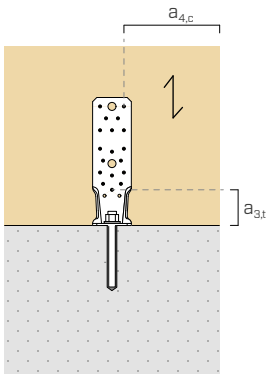




CODE	configuration	$H_{B\,max}$ [mm]				
		nails LBA Ø4		screws LBS Ø5		
		spruce-pine-fir and northern species	douglas fir-larch, hem-fir, and western red cedar	not pre-drilled G ≤ 0.44	not pre-drilled 0.44 < G ≤ 0.5	pre-drilled any G
WKR9530	pattern 1 pattern 2	12	0	-	-	0
WKR13535	pattern 1 pattern 2	12	0	-	-	0
WKR21535	pattern 1 pattern 2	12	0	-	-	0
	pattern 3 pattern 4	112	100	85	50	100
WKR28535	pattern 1	112	100	85	50	100
	pattern 4	12	0	-	-	0
	pattern 2	12	0	-	-	0
	pattern 3	112	100	85	50	100
WKR53035	pattern 1	352	340	325	290	340
	pattern 2	272	260	245	210	260

- The height of the H_B intermediate layer (leveling mortar, sill or timber platform beam) is determined by taking into account the regulatory requirements for fastenings on timber, shown in the minimum distance table.
- Zero values represent that the wall can be installed without a gap

MINIMUM DISTANCES



TIMBER minimum distances			nails LBA Ø4	
			spruce-pine-fir and northern species	douglas fir-larch, hem-fir and western red cedar
timber	**e**	[mm]	≥ 16	≥ 20
	a	[mm]	≥ 48	≥ 60

TIMBER minimum distances			screws LBS Ø5		
			not pre-drilled		pre-drilled
			G ≤ 0.44	0.44< G ≤ 0.5	any G
timber	e_p	[mm]	≥ 25	≥ 35	≥ 15
	a_L	[mm]	≥ 75‡	≥ 110	≥ 60†

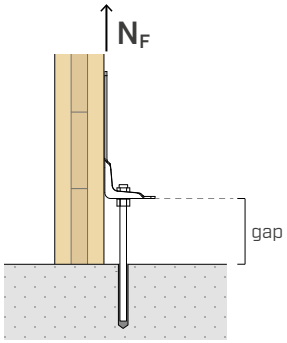
G = mean relative density
† For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

Timber: minimum distances for Cross laminated timber according to section 12.9 placemen t of nails and spikes for LBA nails and section 12.12 placement of self tapping screws for LBS screws in CSA O86 2024.

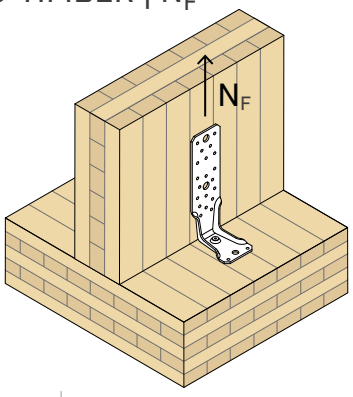
e edge distance perpendicular to grain
e_p unloaded edge distance
a end distance parallel to grain
a_L loaded end distance

INSTALLATION WITH GAP

In the presence of N_F tensile forces, installation of the angle bracket raised above the bearing surface is possible. This makes it possible, for example, to install the angle bracket even with an intermediate H_B layer (bedding grout, base plate or concrete kerb) greater than $H_{B\,max}$. It is advisable to add a lock nut under the horizontal flange to prevent any tension in the connection caused by over-tightening the nut.



STRUCTURAL VALUES | TIMBER-TO-TIMBER | N_F



TIMBER STRENGTH

CODE	configuration	fastening holes Ø5			STEEL-CLT			K_{ser} [3]
					Nr [1][2] factored lateral resistance (K_D=1.15)			
		type	Ø x L [mm]	n_V [pcs]	E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	[N/mm]
WKR9530	**pattern 2**	LBA	Ø4 x 60	6	7,1	7,7	**8,3**	**3750**
		LBS	Ø5 x 50		7,5	8,4	**9,2**	**3325**
WKR13535	**pattern 2**	LBA	Ø4 x 60	11	12,9	14,2	**15,3**	**7075**
		LBS	Ø5 x 50		13,8	15,4	**16,9**	**6150**
WKR21535	**pattern 2**	LBA	Ø4 x 60	18	21,1	23,2	**25,1**	**11750**
		LBS	Ø5 x 50		22,6	25,2	**27,7**	**10075**
WKR28535	**pattern 3**	LBA	Ø4 x 60	22	25,8	28,4	**30,6**	**14400**
		LBS	Ø5 x 50		27,6	30,8	**33,9**	**12325**

STRENGTH ON STEEL SIDE

connector	WKR	$R_{punching,\ screw}$ [*] [kN]
VGS Ø11 + HUS 10	WKR9530 / WKR13535 / WKR21535 / WKR28535	**Prt**
VGS Ø13 + HUS 12		
HBS PLATE Ø10	WKR9530	**16**
	WKR13535 / WKR21535 / WKR28535	**16,8**
HBS PLATE Ø12	WKR9530	**21,6**
	WKR13535 / WKR21535 / WKR28535	**23,2**

[*] The values $R_{punching,\ screw}$ in the table refer to a punching shear failure of the connector in the horizontal flange.

STRENGTH ON ANCHOR SYSTEM SIDE

Strength values of some of the possible fastening solutions.

CODE	configuration	$k_{t//}$	fastening holes Ø14			
			type [4]	P_{rw} [*][5] E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]
WKR9530	**pattern 2**	1,05	HBS PLATE Ø10x140	**7,03**	**8,13**	**9,20**
			HBS PLATE Ø10x180	**9,84**	**11,38**	**12,88**
WKR13535	**pattern 2**	1,05	HBS PLATE Ø12x140	**8,43**	**9,76**	**11,04**
			HBS PLATE Ø12x200	**12,65**	**14,63**	**16,56**
WKR21535	**pattern 2**	1,10	VGS Ø11x150 + HUS10	**9,97**	**11,54**	**13,05**
			VGS Ø11x200 + HUS10	**13,84**	**16,01**	**18,11**
WKR28535	**pattern 3**	1,10	VGS Ø13x150 + HUS12	**11,60**	**13,42**	**15,18**
			VGS Ø13x200 + HUS12	**16,17**	**18,71**	**21,16**

[*] Final values of P_{rw} should take into account the contribution of kt// coefficient in the calculation, see the example on page 328.

NOTES

[1] Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2024. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

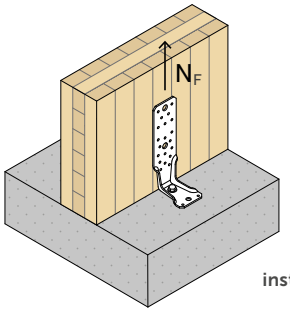
[2] Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

[3] The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m^3.

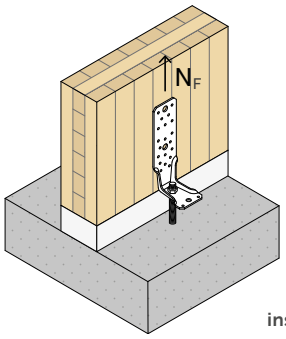
[4] If there are design requirements such as N_F stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the "TIMBER SCREWS AND DECK FASTENING" catalogue).

[5] The P_{rw} values can be consulted in the "TIMBER SCREWS AND DECK FASTENING".

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | N_F



installation without gap



installation with gap

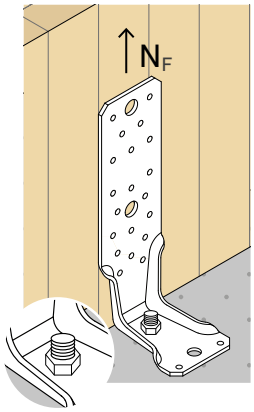
TIMBER STRENGTH

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	STEEL - CLT factored lateral resistance $Nr^{(1)(2)}$ (K_D=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	K_{ser} [3] [N/mm]
WKR9530	pattern 1	LBA	Ø4 x 60	6	7,1	7,7	8,3	3750
		LBS	Ø5 x 50		7,5	8,4	9,2	3325
WKR13535	pattern 1	LBA	Ø4 x 60	11	12,9	14,2	15,3	7075
		LBS	Ø5 x 50		13,8	15,4	16,9	6150
WKR21535	pattern 1	LBA	Ø4 x 60	18	21,1	23,2	25,1	11750
		LBS	Ø5 x 50		22,6	25,2	27,7	10075
	pattern 3	LBA	Ø4 x 60	7	8,2	9,0	9,8	4675
		LBS	Ø5 x 50		8,8	9,8	10,8	3950
	pattern 4	LBA	Ø4 x 60	3	3,5	3,9	4,2	2000
		LBS	Ø5 x 50		3,8	4,2	4,6	1700
WKR28535	pattern 1	LBA	Ø4 x 60	16	18,7	20,7	22,3	9325
		LBS	Ø5 x 50		20,1	22,4	24,6	9000
	pattern 2	LBA	Ø4 x 60	22	25,8	28,4	30,6	14400
		LBS	Ø5 x 50		27,6	30,8	33,9	12325
	pattern 4	LBA	Ø4 x 60	8	9,4	10,3	11,1	5325
		LBS	Ø5 x 50		10,1	11,2	12,3	4500
WKR53035	pattern 1-2	LBA	Ø4 x 60	16	18,7	20,7	22,3	10650
		LBS	Ø5 x 50		20,1	22,4	24,6	9000

STRENGTH ON STEEL SIDE WITHOUT WASHER

CODE	configuration	$R_{punching, bolt}$ (*) no gap [kN]	gap [kN]
WKR9530	pattern 1	20,8	6,64
WKR13535	pattern 1		15,2
WKR21535	pattern 1		15,2
	pattern 3-4		-
WKR28535	pattern 1-4		-
	pattern 2		15,2
WKR53035	pattern 1-2		-

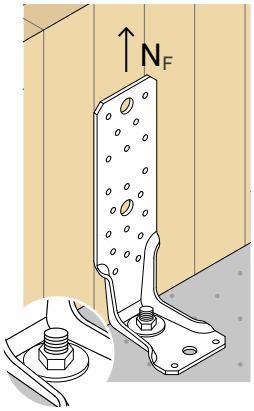
(*) The values $R_{punching, bolt}$ refer to a punching shear failure of the connector in the horizontal flange.



STRENGTH ON STEEL SIDE WITH WASHER ULS13373

CODE	configuration	$R_{punching, bolt}$ (*) no gap [kN]	gap [kN]
WKR9530	pattern 1	20,8	12,8
WKR13535	pattern 1	29,6	28
WKR21535	pattern 1		28
	pattern 3-4		-
WKR28535	pattern 1-4		-
	pattern 2		28
WKR53035	pattern 1-2		-

(*) The values $R_{punching, bolt}$ refer to a punching shear failure of the connector in the horizontal flange.



CONCRETE STRENGTH

Strength values of some of the possible fastening solutions. For additional solutions, different from those indicated in the table, it is possible to use the My Project software available at www.rothoblaas.com.
The values shown in the table have been determined taking into account the contribution of the coefficient kt// in the calculations.

CODE	configuration on concrete	fastening holes Ø14		concrete resistance $R_{concrete}$ (*)(6) no gap				concrete resistance $R_{concrete}$ (*)(6) gap	
		type	Ø x L	pattern 1	pattern 2	pattern 3	pattern 4	pattern 1	pattern 2
			[mm]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
WKR9530 WKR13535	uncracked	VIN-FIX 5.8	M12 x 195	**19,8**	-	-	-	**20,8**	-
		SKR	12 x 90	**10,1**	-	-	-	-	-
		AB1	M12 x 115	**14,2**	-	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**10,9**	-	-	-	**11,5**	-
		HYB-FIX 5.8	M12 x 195	**19,4**	-	-	-	**20,4**	-
		AB1	M12 x 115	**10,2**	-	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**11,7**	-	-	-	**12,2**	-
			M12 x 245	**14,4**	-	-	-	**15,1**	-
		EPO-FIX 8.8	M12 x 195	**12,4**	-	-	-	**13,0**	-
WKR21535	uncracked	VIN-FIX 5.8	M12 x 195	**18,9**	-	**14,3**	**14,3**	**20,8**	-
		SKR	12 x 90	**9,6**	-	**7,3**	**7,3**	-	-
		AB1	M12 x 115	**13,6**	-	**10,3**	**10,3**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**10,4**	-	**7,9**	**7,9**	**11,5**	-
		HYB-FIX 5.8	M12 x 195	**18,5**	-	**14,1**	**14,1**	**20,4**	-
		AB1	M12 x 115	**9,7**	-	**7,4**	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**11,1**	-	**8,4**	**8,4**	**12,2**	-
			M12 x 245	**13,7**	-	**10,4**	**10,4**	**15,1**	-
		EPO-FIX 8.8	M12 x 195	**11,8**	-	**9,0**	**9,0**	**13,0**	-
WKR28535	uncracked	VIN-FIX 5.8	M12 x 195	**14,3**	**18,9**	-	**14,3**	-	**20,8**
		SKR	12 x 90	**7,3**	**9,6**	-	**7,3**	-	-
		AB1	M12 x 115	**10,3**	**13,6**	-	**10,3**	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**7,9**	**10,4**	-	**7,9**	-	**11,5**
		HYB-FIX 5.8	M12 x 195	**14,1**	**18,5**	-	**14,1**	-	**20,4**
		AB1	M12 x 115	**7,4**	**9,7**	-	**7,4**	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**8,4**	**11,1**	-	**8,4**	-	**12,2**
			M12 x 245	**10,4**	**13,7**	-	**10,4**	-	**15,1**
		EPO-FIX 8.8	M12 x 195	**9,0**	**11,8**	-	**9,0**	-	**13,0**
WKR53035	uncracked	VIN-FIX 5.8	M12 x 195	**14,3**	**14,3**	-	-	-	-
		SKR	12 x 90	**7,3**	**7,3**	-	-	-	-
		AB1	M12 x 115	**10,3**	**10,3**	-	-	-	-
	cracked	VIN-FIX 5.8	M12 x 195	**7,9**	**7,9**	-	-	-	-
		HYB-FIX 5.8	M12 x 195	**14,1**	**14,1**	-	-	-	-
		AB1	M12 x 115	**7,4**	**7,4**	-	-	-	-
	seismic	HYB-FIX 8.8	M12 x 195	**8,4**	**8,4**	-	-	-	-
			M12 x 245	**10,4**	**10,4**	-	-	-	-
		EPO-FIX 8.8	M12 x 195	**9,0**	**9,0**	-	-	-	-

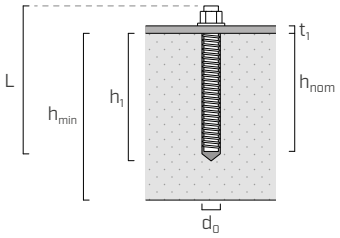
NOTES

- The gap installation must be carried out with only chemical anchors and pre-cut INA threaded rod or MGS to be cut to size.

ANCHORS INSTALLATION PARAMETERS

anchor type		h_{ef}	h_{nom}	h_1	d_0	h_{min}
	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M12 x 195	170	170	175	14	200
HYB-FIX 5.8	M12 x 195	170	170	175	14	200
HYB-FIX 8.8	M12 x 195	170	170	175	14	200
	M12 x 245	210	210	215	14	250
EPO-FIX 8.8	M12 x 195	170	170	175	14	200
SKR	12 x 90	64	87	110	10	200
AB1	M12 x 115	70	85	105	14	200

Precut INA threaded rod, with nut and washer.
MGS threaded rod class 8.8 to be cut to size: for more information, see the "PLATES AND CONNECTORS FOR TIMBER" catalogue, available in the "Catalogues" section of the website www.rothoblaas.com.



t_1	thickness of plate
h_{nom}	nominal embedment depth
h_{eff}	effective anchor embedment depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING N_F

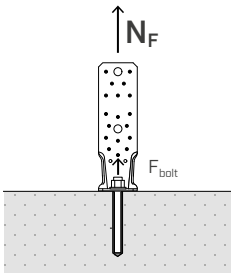
Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt} = k_{t//} \cdot N_r$$

$k_{t//}$ coefficient of eccentricity
N_r axial load on the WKR angle bracket

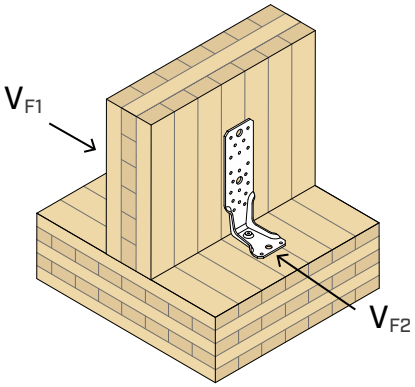
The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: min ($R_{punching, bolt}$, $R_{concrete}$) ≥ F_{bolt}.

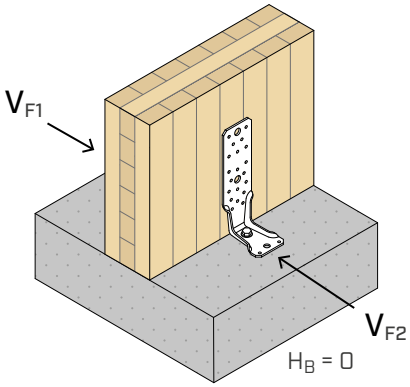
	INSTALLATION WITHOUT GAP		INSTALLATION WITH GAP	
CODE	**configuration**	$k_{t//}$	**configuration**	$k_{t//}$
WKR9530	**pattern 1-2**	1,05	**pattern 2**	1,00
WKR13535	**pattern 1-2**	1,05	**pattern 2**	
WKR21535	**pattern 1-2**	1,10	**pattern 2**	
	pattern 3-4	1,45		
WKR28535	**pattern 2-3**	1,10	**pattern 3**	
	pattern 1-4	1,45		
WKR53035	**pattern 1-2**	1,45	-	-

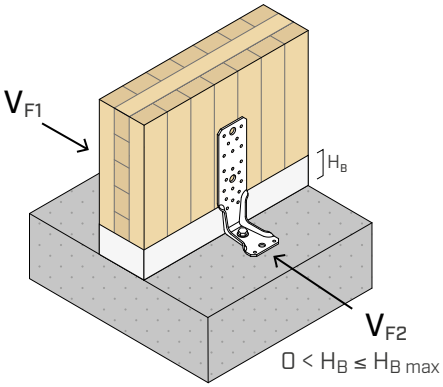


NOTES
(1) Valid for the strength values shown in the table.

STRUCTURAL VALUES | F_4 | F_5







TIMBER-TO-TIMBER

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	factored lateral resistance V_{r1} (7) (K_D=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	factored lateral resistance V_{r2} (7) [kN]	l_{BL} (8) [mm]
WKR9530	**pattern 2**	LBA	Ø4 x 60	6	**7,1**	**7,7**	**8,3**	**1,5**	70,0
		LBS	Ø5 x 50		**7,5**	**8,4**	**9,2**	**3,4**	
WKR13535	**pattern 2**	LBA	Ø4 x 60	11	**12,6**	**14,2**	**15,3**	**3,1**	
		LBS	Ø5 x 50		**13,6**	**15,4**	**16,9**	**3,6**	
WKR21535	**pattern 2**	LBA	Ø4 x 60	18	**13,1**	**16,7**	**19,8**	**3,1**	
		LBS	Ø5 x 50		**15,2**	**20,5**	**25,4**	**3,6**	
WKR28535	**pattern 3**	LBA	Ø4 x 60	22	**13,4**	**17,2**	**20,5**	**3,1**	
		LBS	Ø5 x 50		**14,4**	**19,1**	**23,3**	**3,6**	

TIMBER-TO-CONCRETE

CODE	configuration	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	$H_B = 0$ factored resistance V_{r1} (7) (KD=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	$H_B = 0$ factored resistance V_{r2} (7) [kN]	$0 < H_B \leq H_{B\,max}$ factored resistance V_{r1} (7) (KD=1.15) E3 G = 0.35 [kN]	E1 and V2 G = 0.42 [kN]	E2 and V1 G = 0.49 [kN]	$0 < H_B \leq H_{B\,max}$ factored resistance V_{r2} (7) [kN]	l_{BL} (8) [mm]
WKR9530	**pattern 1**	LBA	Ø4 x 60	6	**7,1**	**7,7**	**8,3**	**1,5**	**7,1**	**7,7**	**8,3**	**1,5**	70,0
		LBS	Ø5 x 50		**7,5**	**8,4**	**9,2**	**3,1**	**7,5**	**8,4**	**9,2**	**3,1**	
WKR13535	**pattern 1**	LBA	Ø4 x 60	11	**12,0**	**14,2**	**15,3**	**3,1**	**12,9**	**14,2**	**15,3**	**3,1**	70,0
		LBS	Ø5 x 50		**12,1**	**15,3**	**16,9**	**3,3**	**13,0**	**15,4**	**16,9**	**3,3**	
WKR21535	**pattern 1**	LBA	Ø4 x 60	18	**12,5**	**16,0**	**19,0**	**2,6**	**14,6**	**19,7**	**24,4**	**2,6**	70,0
		LBS	Ø5 x 50		**12,6**	**16,2**	**19,3**	**3,3**	**14,7**	**19,9**	**24,7**	**3,3**	
WKR28535	**pattern 1**	LBA	Ø4 x 60	16	**8,0**	**10,3**	**12,4**	**0,5**	**18,7**	**20,7**	**22,3**	**0,5**	160,0
		LBS	Ø5 x 50		**8,1**	**10,5**	**12,6**	**0,5**	**20,1**	**22,4**	**24,6**	**0,5**	
	pattern 2	LBA	Ø4 x 60	22	**12,8**	**16,5**	**19,6**	**3,1**	**13,8**	**18,2**	**22,2**	**3,1**	70,0
		LBS	Ø5 x 50		**12,9**	**16,7**	**20,0**	**3,3**	**13,9**	**18,4**	**22,6**	**3,3**	
WKR53035	**pattern 1**	LBA	Ø4 x 60	16	**8,0**	**10,3**	**12,4**	**0,2**	**18,7**	**20,7**	**22,3**	**0,2**	423,0
		LBS	Ø5 x 50		**8,1**	**10,5**	**12,6**	**0,2**	**20,1**	**22,4**	**24,6**	**0,2**	
	pattern 2	LBA	Ø4 x 60	16	**8,0**	**10,3**	**12,4**	**0,2**	**18,7**	**20,7**	**22,3**	**0,2**	343,0
		LBS	Ø5 x 50		**8,1**	**10,5**	**12,6**	**0,2**	**20,1**	**22,4**	**24,6**	**0,2**	

NOTES

(7) In the case of V_{F2} stress, it is required to verify for the simultaneous shear action on the N_F anchor and the additional extraction component N_{ax}.

$$F_{ax,Ed} = \frac{F_{5,Ed} \cdot l_{BL}}{25\ mm}$$

(8) l_{BL} = distance between the last row of at least two connectors and the bearing surface

- The V_{r1} timber resistance is limited by the lateral N_r resistance of the base connector.
- The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m³.

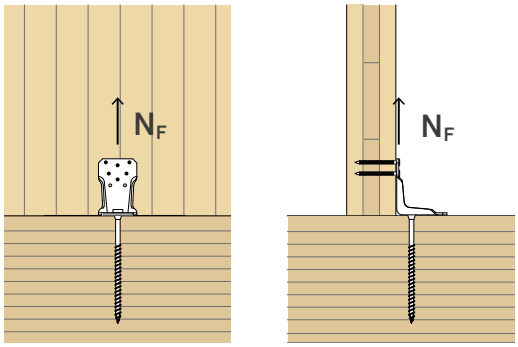
CALCULATION EXAMPLES | DETERMINING RESISTANCE R_{DESIGN}

TIMBER-TO-TIMBER

Project data	
Service condition	Dry service condition
Load duration	Short
Timber	CLT (G = 0.42)

Connector	WKR9530
Configuration	pattern 2
Fastening on timber	nails LBA Ø4 x 60 mm

Screw selection	
HBS PLATE	Ø10 x 140 mm
Pre-drilling hole	without pre-drilled hole



CSA 086; 2024

$K_{t//}$ = 1,05
N_r = 7,7 kN
$R_{punching,\ screw}$ = 16 k_N
P_{rw} = 8,13 kN

$$R_{1,d} = min \begin{cases} \frac{R_{1,k\ timber} \cdot k_{mod}}{\gamma_M} = \mathbf{12,7}\ [kN] \\ \frac{R_{1,k,screw,head}}{\gamma_{M2}} = \mathbf{16,0}\ [kN] \\ \frac{R_{1,k,screw,ax}}{k_{t//}} \cdot \frac{k_{mod}}{\gamma_M} = \mathbf{11,2}\ [kN] \end{cases}$$

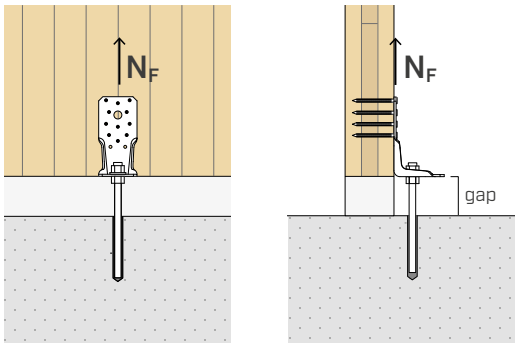
R_{design} = **7,7** kN ✓

TIMBER-TO-CONCRETE | INSTALLATION WITH GAP

Project data	
Service condition	Dry service condition
Load duration	Short
Timber	CLT (G = 0.42)

Connector	WKR13535
Configuration	pattern 1 with gap
Fastening on timber	nails LBA Ø4 x 60 mm

Anchor choice	
VIN-FIX anchor	M12 x 195 (5.8 steel class)
Uncracked concrete	



EN 1995:2014

N_r = 14,2 kN
$R_{punching,\ bolt}$ = 15,2 k_N
$P_{concrete}$ = 20,8 kN

$$R_{1,d} = min \begin{cases} \frac{R_{1,k\ timber} \cdot k_{mod}}{\gamma_M} = \mathbf{23,95}\ [kN] \\ \frac{R_{1,k,bolt,head}}{\gamma_{M2}} = \mathbf{15,2}\ [kN] \\ R_{1,d\ concrete} = \mathbf{28,0}\ [kN] \end{cases}$$

R_{design} = **14,2** kN ✓

GENERAL PRINCIPLES

- Characteristic values comply with the EN 1995:2014 standard in accordance with ETA-22/0089.
- Design values can be obtained from values in the table as follows:

  TIMBER-TO-CONCRETE INSTALLATION

$$R_d = min \begin{cases} \dfrac{R_{k,\,timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k\,bolt,\,head}}{\gamma_{M2}} \end{cases}$$

  TIMBER-TO-TIMBER INSTALLATION

$$R_d = min \begin{cases} \dfrac{R_{k,\,timber} \cdot k_{mod}}{\gamma_M} \\ \dfrac{R_{k,screw,ax}}{k_{t//}} \cdot \dfrac{k_{mod}}{\gamma_M} \\ \dfrac{R_{k,screw,head}}{\gamma_{M2}} \end{cases}$$

- The lateral resistance of LBS screws and LBA nails is determined according to CSA O86:2024, section 12.12 (self-tapping screws) and section 12.9 (nails and spikes), respectively.
- The specified bending yield strength for LBA with a 4 mm diameter is fyb = 645 MPa, and for LBS with a 5 mm diameter is fyb = 1075 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2025. Typical wood species considered include Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- For applications on CLT (Cross Laminated Timber) it is recommended to use nails/screws of adequate length to ensure that the fixing depth involves a sufficient timber thickness to prevent fragile failure for group effects.
- The gap height does not affect the angle bracket resistance N_r.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle failures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- The calculation of the concrete anchors is performed following CSA A23.3:2024, Annex D.
- The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is taken from European Technical Assessment test reports.
- The bond strength of HYB-FIX and EPO-FIX for seismic design is calculated by multiplying τ_{cr} by 0.8, according to Section D.6.5.2 in CSA A23.3:2024.
- The calculation process uses C25/30 concrete without considering edge effects.
- Fastening elements to concrete using anchors not listed in the table must be verified according to the load applied to the anchors.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete must be recalculated according to the design requirements.
- For proper installation of screws, it is recommended to refer to the "TIMBER SCREWS AND DECK FASTENING" catalogue.
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;
  - SKR screw-in anchor according to ETA-24/0024;
  - AB1 mechanical anchor according to ETA-17/0481 (M12).

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2020. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

(3) The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m^3.

(4) If there are design requirements such as N_F stresses of different amounts, or depending on the thickness of the floor slab, it is possible to use Ø11 and Ø13 VGS screws with HUS10 and HUS12 washers and Ø10 and Ø12 HBS PLATE screws of different lengths than those proposed in the table (see the " TIMBER SCREWS AND DECK FASTENING" catalogue).

(5) The P_{rw} values can be consulted in the "TIMBER SCREWS AND DECK FASTENING" catalogue.

(6) The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is based on ETA certifications for VIN-FIX, HYB-FIX, and EPO-FIX chemical anchors.

(7) In the case of V_{F2} stress, it is required to verify for the simultaneous shear action on the N_F anchor and the additional extraction component N_{ax}

$$F_{bolt} = k_{t//} \cdot N_r$$

(8) l_{BL} = distance between the last row of at least two connectors and the bearing surface

- If there are design requirements such as the presence of an intermediate H_B layer (leveling mortar, sill or platform) greater than H_{Bmax}, the installatio of the angle bracket raised above the bearing surface (gap installation) is allowed.

INTELLECTUAL PROPERTY

- A WKR model is protected by the Registered Community Design RCD 015032190-0024.

WHT

ANGLE BRACKET FOR TENSILE LOADS

DESIGN REGISTERED

CE ETA-23/0813

NEW VERSION
The classic Rothoblaas hold-down in an optimised version. Reducing the number of fasteners and modifying steel thickness has led to more efficient fastening without sacrificing performance.

COMPLETE RANGE
Available in 5 sizes to meet all static or seismic performance requirements, for CLT, LVL or timber frame walls.

FREEDOM OF FASTENING
They can be fastened with LBA nails, LBS screws or LBS HARDWOOD in different lengths. Capacity design is made possible by the wide choice of fastenings and partial nailing.

TIMBER FRAME
The new NARROW PATTERN nailing allow installation on frame walls with reduced studs widths (60 mm).

CANADIAN DESIGN VALUES
USA, EU and more design values available online.

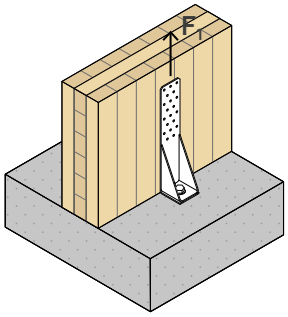
SERVICE CONDITIONS	
	DRY

MATERIAL

S355 Fe/Zn12c — **WHT**: S355 + Fe/Zn12c carbon steel

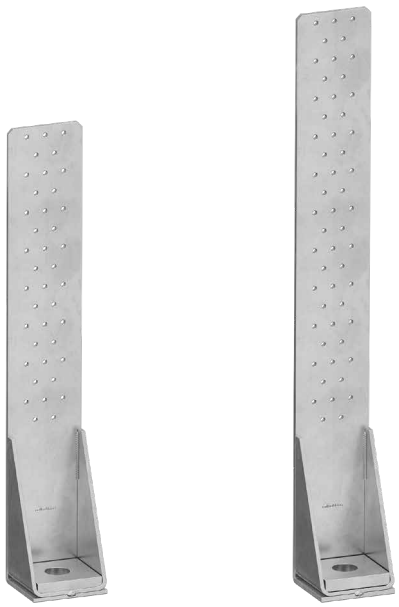
S275 Fe/Zn12c — **WHT WASHER**: S275 + Fe/Zn12c carbon steel

EXTERNAL LOADS



IMPROVED NEW! PERFORMANCES







FIELDS OF USE

Tensile joints for timber walls.
Suitable for walls subject to high stress.
Timber-to-timber, timber-to-concrete and timber-to-steel configurations.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels





HYBRID STRUCTURES

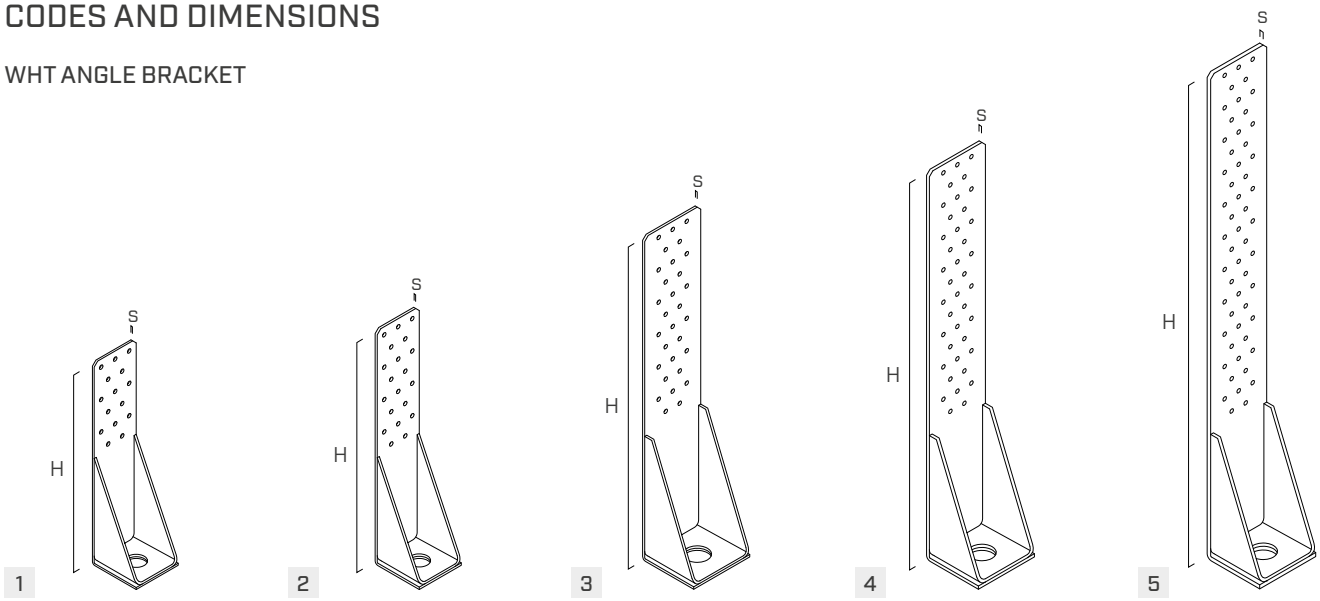
Ideal for tensile connections between timber floors and bracing core in hybrid timber-to-concrete buildings.

RAISED INSTALLATION

The certification with a gap between angle bracket and support allows special requirements such as reinforced concrete kerbs to be supported.

CODES AND DIMENSIONS

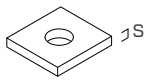
WHT ANGLE BRACKET



	CODE	H [mm]	s [mm]	n_V Ø5 [pcs]	hole [mm]	*H [in]*	*s [in]*	*n_V Ø.20 [pcs]*	*hole [in]*	pcs
1	**WHT15**	250	2,5	15	Ø23	*10*	*0.10*	*15*	*Ø0.91*	20
2	**WHT20**	290	3	20	Ø23	*11 7/16*	*0.12*	*20*	*Ø0.91*	20
3	**WHT30**	400	3	30	Ø29	*15 3/4*	*0.12*	*30*	*Ø1.14*	10
4	**WHT40**	480	4	40	Ø29	*19*	*0.16*	*40*	*Ø1.14*	10
5	**WHT55**	600	5	55	Ø29	*23 5/8*	*0.20*	*55*	*Ø1.14*	1

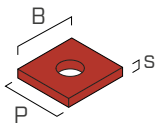
WHTW WASHER

	CODE	hole [mm]	Ø [mm]	s [mm]	*hole [in]*	*s [in]*	WHT15	WHT20	WHT30	WHT40	WHT55	pcs
1	**WHTW6016**	Ø18	M16	6	*Ø0.71*	*0.24*	●	●	-	-	-	1
2	**WHTW6020**	Ø22	M20	6	*Ø0.87*	*0.24*	●	●	-	-	-	1
3	**WHTW8020**	Ø22	M20	10	*Ø0.87*	*0.39*	-	-	●	●	-	1
4	**WHTW8024**	Ø26	M24	10	*Ø1.02*	*0.39*	-	-	●	●	-	1
5	**WHTW8024L**	Ø26	M24	12	*Ø1.02*	*0.47*	-	-	-	-	●	1



ACOUSTIC PROFILE | XYLOFON WASHER

CODE		hole [mm]	P [mm]	B [mm]	s [mm]	*hole [in]*	*P [in]*	*B [in]*	*s [in]*	pcs
XYLW806060	WHT15 WHT20	Ø23	60	60	6	*Ø0.91*	*2 3/8*	*2 3/8*	*0.24*	10
XYLW808080	WHT30 WHT40 WHT55	Ø27	80	80	6	*Ø1.06*	*3 1/8*	*3 1/8*	*0.24*	10

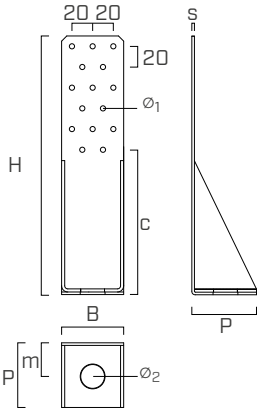


FASTENERS

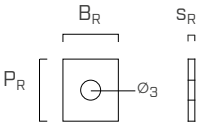
type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
LBS HARDWOOD	round head screw on hardwoods		5	
VIN-FIX	vinyl ester chemical anchor		M16-M20-M24	
HYB-FIX	hybrid chemical anchor		M16-M20-M24	
EPO-FIX	epoxy chemical anchor		M16-M20-M24	
KOS	hexagonal head bolt		M16-M20-M24	

GEOMETRY

WHT			WHT15	WHT20	WHT30	WHT40	WHT55
Height	**H**	[mm]	250	290	400	480	600
Base	**B**	[mm]	60	60	80	80	80
Depth	**P**	[mm]	62,5	63	73	74	75
Vertical flange thickness	**s**	[mm]	2,5	3	3	4	5
Hole position in timber	**c**	[mm]	140	140	170	170	170
Hole position in concrete	**m**	[mm]	32,5	33	38	39	40
Flange holes	**Ø$_1$**	[mm]	5	5	5	5	5
Base hole	**Ø$_2$**	[mm]	23	23	29	29	29



WHTW WASHER			WHTW6016	WHTW6020	WHTW8020	WHTW8024	WHTW8024L
Base	**B$_R$**	[mm]	50	50	70	70	70
Depth	**P$_R$**	[mm]	56	56	66	66	66
Thickness	**s$_R$**	[mm]	6	6	10	10	12
Washer hole	**Ø$_3$**	[mm]	18	22	22	26	26

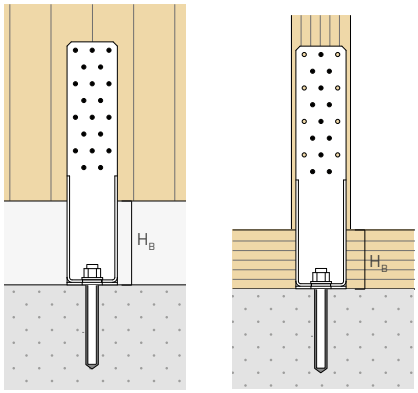


INSTALLATION

MAXIMUM HEIGHT OF THE INTERMEDIATE H$_B$ LAYER

CODE	H$_{B\,max}$ [mm]				
	nails LBA Ø4		screws LBS Ø5		
	spruce-pine-fir and northern species	douglas fir-larch, hem-fir, and western red cedar	not pre-drilled G ≤ 0.44	not pre-drilled 0.44 < G ≤ 0.5	pre-drilled any G
WHT15	92	80	65	30	80
WHT20	92	80	65	30	80
WHT30	122	110	95	60	110
WHT40	122	110	95	60	110
WHT55	122	110	95	60	110

The height of the H$_B$ intermediate layer (leveling mortar, sill or timber platform beam) is determined by taking into account the regulatory requirements for fastenings on timber, shown in the minimum distance table.



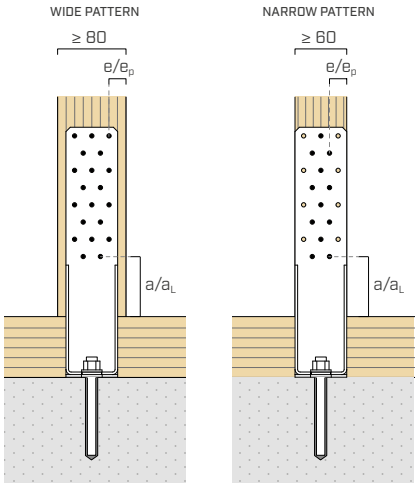
MINIMUM DISTANCES | LBA

TIMBER minimum distances			nails LBA Ø4	
			spruce-pine-fir and northern species	douglas fir-larch, hem-fir and western red cedar
timber	**e**	[mm]	≥ 16	≥ 20
	a	[mm]	≥ 48	≥ 60

TIMBER minimum distances			screws LBS Ø5		
			not pre-drilled		pre-drilled
			G ≤ 0.44	0.44< G ≤ 0.5	any G
timber	**e$_p$**	[mm]	≥ 25	≥ 35	≥ 15
	a$_L$	[mm]	≥ 75‡	≥ 110	≥ 60†

G = mean relative density
† For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡ For Western Red Cedar, this minimum spacing shall be increased by 50%.

Timber: minimum distances for Cross laminated timber according to section 12.9 placemen t of nails and spikes for LBA nails and section 12.12 placement of self tapping screws for LBS screws in CSA O86 2024.



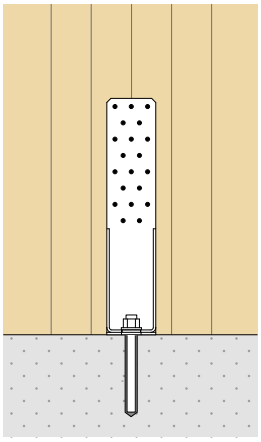
e edge distance perpendicular to grain
e$_p$ unloaded edge distance
a end distance parallel to grain
a$_L$ loaded end distance

INSTALLATION

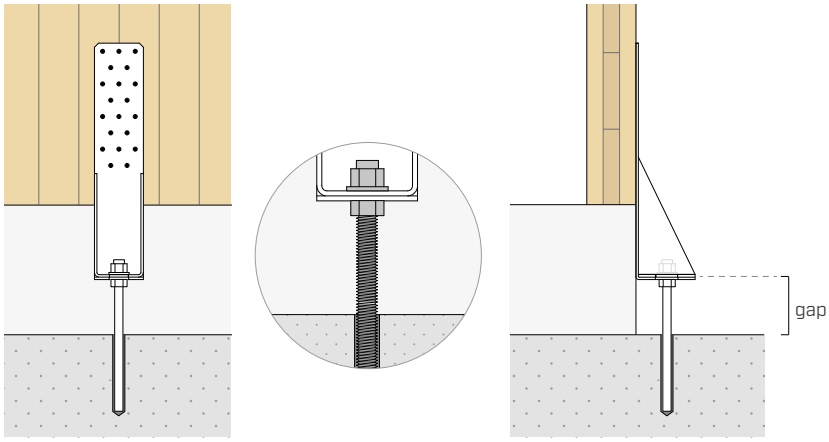
INSTALLATION WITH GAP

Installation of the angle bracket raised above the bearing surface is possible. This makes it possible, for example, to install the angle bracket even with an intermediate layer H_B (bedding grout, base plate or concrete kerb) greater than $H_{B\ max}$ or to manage site tolerances such as the anchor hole being located away from the wall or studs.
In case of installation with gap, it is recommended to install a lock nut below the horizontal flange, to prevent that excessive tightening of the nut may stress the connection.

without gap



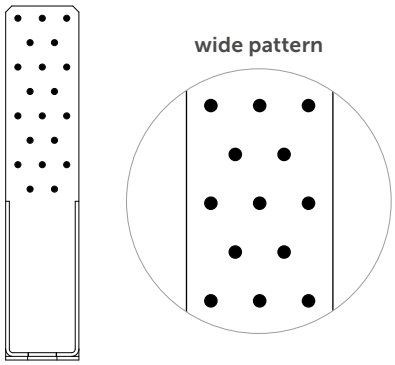
with gap[1]



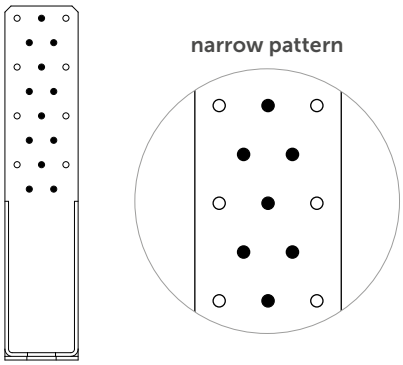
(1) The gap height does not affect the resistance N_r of the angle bracket.

FASTENING PATTERNS

It is possible to install the angle bracket in two specific patterns:
- **wide pattern**: installation of connectors on all columns of the vertical flange;
- **narrow pattern**: installation with narrow nailing, leaving the outermost columns free.



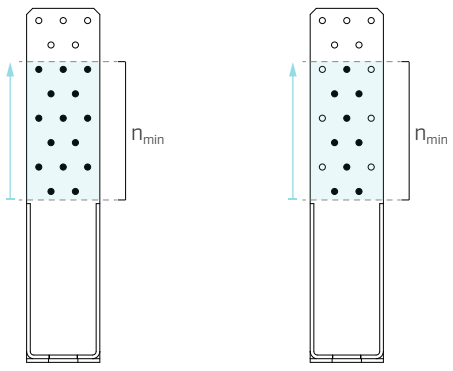
WHT20: total fastening in wide pattern configuration



WHT20: total fastening in narrow pattern configuration

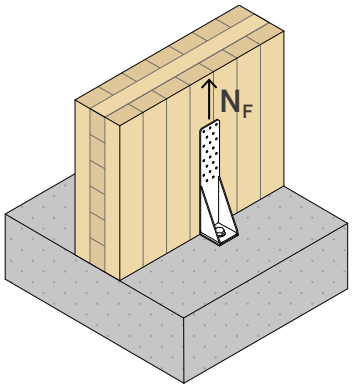
Full or partial fastening patterns can both be adopted. In the case of installation with partial fastening, the number of connectors can be varied, guaranteeing the minimum quantity $\mathbf{n_{min}}$ shown in the table below. The connectors must be installed starting from the bottom holes.

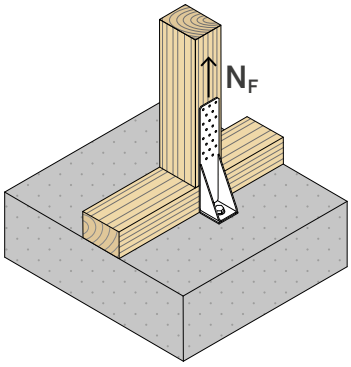
CODE	n_{min} [pcs.]	
	wide pattern	narrow pattern
WHT15	10	6
WHT20	15	9
WHT30	20	12
WHT40	25	15
WHT55	30	18

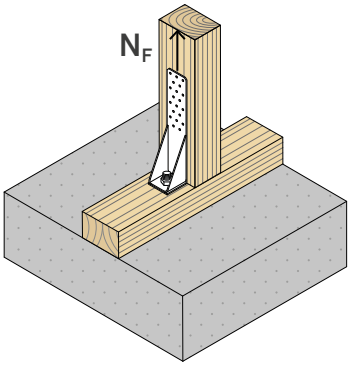


WHT20: partial fastening in wide pattern and narrow pattern respectively, with installation of the minimum number of connectors n_{min}.

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F_1 TO N_F







STRENGTH ON TIMBER SIDE | WIDE PATTERN | total fastening

CODE	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	TIMBER N_r [(1)(2)] factored lateral resistance (K_D=1.15) G = 0.35 [kN]	G = 0.42 [kN]	G = 0.49 [kN]	G = 0.55 [kN]	STEEL no washer R_{steel} [kN]	washer R_{steel} [kN]	no washer K_{ser} [(3)] [N/mm]	washer K_{ser} [(3)] [N/mm]
WHT15	LBA	Ø4 x 60	15	17,7	19,4	20,9	22,1	30	40	5000	5880
	LBS	Ø5 x 70		22,0	24,7	27,2	29,3				
	LBSH	Ø5 x 50		20,8	23,8	26,8	29,1				
WHT20	LBA	Ø4 x 60	20	23,5	25,8	27,9	29,5	40	50	6667	7980
	LBS	Ø5 x 70		29,3	32,9	36,3	39,1				
	LBSH	Ø5 x 50		27,6	31,6	35,6	38,8				
WHT30	LBA	Ø4 x 60	30	35,3	38,7	41,8	44,2	-	70	-	11667
	LBS	Ø5 x 70		44,0	49,4	54,4	58,6				
	LBSH	Ø5 x 50		41,4	47,5	53,3	58,2				
WHT40	LBA	Ø4 x 60	40	46,7	51,7	55,7	59,0	-	90	-	15000
	LBS	Ø5 x 70		58,7	65,8	72,6	78,1				
	LBSH	Ø5 x 50		54,9	62,9	70,6	77,1				
WHT55	LBA	Ø4 x 60	55	63,6	71,0	76,6	81,1	-	120	-	20000
	LBS	Ø5 x 70		80,7	90,5	99,8	107,4				
	LBSH	Ø5 x 50		74,9	85,8	96,4	105,2				

STRENGTH ON TIMBER SIDE | NARROW PATTERN | total fastening

CODE	fastening holes Ø5 type	Ø x L [mm]	n_V [pcs]	TIMBER N_r [(1)(2)] factored lateral resistance Nr (K_D=1.15) G = 0.35 [kN]	G = 0.42 [kN]	G = 0.49 [kN]	G = 0.55 [kN]	STEEL no washer R_{steel} [kN]	washer R_{steel} [kN]	K_{ser} [(3)] [N/mm]
WHT15	LBA	Ø4 x 60	9	10,6	11,6	12,5	13,3	30	-	3360
	LBS	Ø5 x 70		13,2	14,8	16,3	17,6			
	LBSH	Ø5 x 50		12,5	14,3	16,1	17,5			
WHT20	LBA	Ø4 x 60	12	14,1	15,5	16,7	17,7	40	-	4620
	LBS	Ø5 x 70		17,6	19,7	21,8	23,4			
	LBSH	Ø5 x 50		16,6	19,0	21,3	23,3			
WHT30	LBA	Ø4 x 60	18	21,2	23,2	25,1	26,5	-	70	7140
	LBS	Ø5 x 70		26,4	29,6	32,7	35,2			
	LBSH	Ø5 x 50		24,8	28,5	32,0	34,9			
WHT40	LBA	Ø4 x 60	24	28,0	31,0	33,4	33,4	-	90	9240
	LBS	Ø5 x 70		35,2	39,5	43,6	46,9			
	LBSH	Ø5 x 50		32,9	37,7	42,4	46,2			
WHT55	LBA	Ø4 x 60	33	38,1	42,6	46,0	48,7	-	120	13020
	LBS	Ø5 x 70		48,4	54,3	59,9	64,5			
	LBSH	Ø5 x 50		45,0	51,5	57,8	63,1			

STRUCTURAL VALUES | TIMBER-TO-CONCRETE | F_1 TO N_F

USE OF ALTERNATIVE FASTENINGS

It is possible to use screws of shorter or longer lengths than those proposed.In this case, the design values Nr for timber part must be multiplied by a reductive factor k_F:

connector length	k_F	
[mm]	LBA Ø5	LBS Ø5
40	0,72	0,85
50	0,85	1
60	0,92	1,08
70	1	1,16

CONCRETE STRENGTH

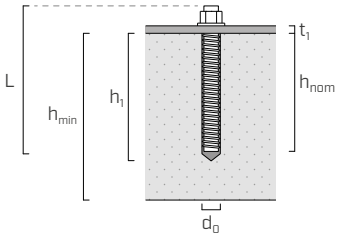
Strength values of some of the possible fastening solutions. For additional solutions, different from those indicated in the table, it is possible to use the My Project software available at www.rothoblaas.com.
The values shown in the table have been determined taking into account the contribution of the coefficient $k_{t//}$ in the calculations.

CODE	configuration on concrete	fastening holes Ø14		concrete resistance $R_{concrete}$ (4)	
		type	Ø x L	no gap	gap
			[mm]	[kN]	[kN]
WHT15 WHT20 no washer	uncracked	VIN-FIX 5.8	M16 x 195	26,9	29,4
			M16 x 245	33,7	36,7
			M20 x 245	41,1	44,9
	cracked	HYB-FIX 5.8	M16 x 195	29,7	32,4
		HYB-FIX 8.8	M16 x 245	37,1	40,5
	seismic	EPO-FIX 8.8	M20 x 245	25,8	28,1
			M20 x 330	37,4	40,8
WHT15 WHT20	uncracked	VIN-FIX 5.8	M16 x 245	33,7	36,7
			M20 x 245	41,1	44,9
	cracked	HYB-FIX 8.8	M16 x 195	29,7	32,4
			M16 x 245	37,1	40,5
	seismic	EPO-FIX 8.8	M20 x 245	25,8	28,1
			M20 x 330	37,4	40,8
WHT30 WHT40	uncracked	VIN-FIX 5.8	M20 x 245	41,1	44,9
		VIN-FIX 5.8	M20 x 330	57,6	62,8
		HYB-FIX 8.8	M20 x 245	66,1	72,1
	cracked	HYB-FIX 5.8	M20 x 245	42,9	46,7
		VIN-FIX 5.8	M24 x 330	37,6	40,9
		EPO-FIX 5.8	M24 x 330	71,1	77,5
	seismic	EPO-FIX 8.8	M24 x 330	42,7	46,5
			M24 x 495	67,1	73,1
WHT55	uncracked	HYB-FIX 8.8	M24 x 330	114,8	125,1
	cracked	EPO-FIX 5.8	M24 x 330	69,9	76,1
		HYB-FIX 8.8	M24 x 495	111,5	121,5
	seismic	EPO-FIX 8.8	M24 x 330	41,9	45,7
			M24 x 495	67,1	73,1

ANCHORS INSTALLATION PARAMETERS

type of rod Ø x L [mm]		WHT type	type of washer	t_1 [mm]	$h_{nom}=h_{ef}$ [mm]	h_1 [mm]	d_0 [mm]	h_{min} [mm]
M16	195	WHT15 / WHT20	WHTW6016	11	160	165	18	200
	245	WHT15 / WHT20	WHTW6016	11	200	205	18	250
M20	245	WHT15 / WHT20	WHTW6020	11	200	205	22	250
	330			11	290	295	22	350
	245	WHT30	WHTW8020	16	200	205	22	250
	330			16	280	285	22	350
	245	WHT40	WHTW8020	16	195	200	22	250
	330			16	275	280	22	350
M24	330	WHT30	WHTW8024	16	280	285	28	350
	330	WHT40 / WHT55	WHTW8024	18	275	280	28	350
	330	WHT55	WHTW8024	21	275	280	28	350
	495	WHT55	WHTW8024L	21	440	445	28	350

Precut INA threaded rod, with nut and washer. MGS threaded rod class 8.8 to be cut to size: for more information, see the "PLATES AND CONNECTORS FOR TIMBER" catalogue, available in the "Catalogues" section of the website www.rothoblaas.com



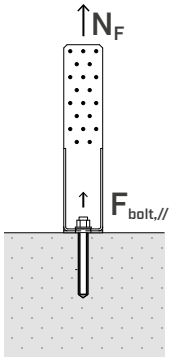
t_1	thickness of plate
h_{nom}	nominal embedment depth
h_{ef}	effective anchor embedment depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING N_F

Fastening elements to the concrete through anchors not listed in the table, shall be verified according to the load acting on the anchors, which can be evaluated through the $k_{t//}$ coefficients. The axial load acting on the anchor can be obtained as follows:

$$F_{bolt} = k_{t//} \cdot N_r$$

$k_{t//}$ coefficient of eccentricity
N_r axial load on the WHT angle bracket



The anchor check is satisfied if the design tensile strength, obtained considering the boundary effects, is greater than the design external load: $R_{concrete} \geq F_{bolt}$.

	INSTALLATION WITH GAP	INSTALLATION WITHOUT GAP
CODE	$k_{t//}$	$k_{t//}$
WHT15	1,00	1,09
WHT20	1,00	1,09
WHT30	1,00	1,09
WHT40	1,00	1,09
WHT55	1,00	1,09

GENERAL PRINCIPLES

- Design values can be obtained from values in the table as follows:

  WIDE AND NARROW PATTERN

$$R_d = min \begin{cases} N_r \\ R_{steel} \\ R_{concrete} \end{cases}$$

- The lateral resistance of LBS & LBSH screws and LBA nails is determined according to CSA O86:2024, section 12.12 (self-tapping screws) and section 12.9 (nails and spikes), respectively.
- The specified bending yield strength for LBA with a 4 mm diameter is f_{yb} = 645 MPa, for LBS with a 5 mm diameter is f_{yb} = 1075 MPa, and for LBSH with a 5 mm diameter is f_{yb} = 1122 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2024. Typical wood species considered include Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- For applications on CLT (Cross Laminated Timber) it is recommended to use nails/screws of adequate length to ensure that the fixing depth involves a sufficient timber thickness to prevent fragile failure for group effects.
- The gap height does not affect the angle bracket resistance N_r.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle failures before reaching the connection strength.
- The calculation of the concrete anchors is performed following CSA A23.3:2024, Annex D.
- The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is taken from European Technical Assessment test reports.
- The bond strength of EPO-FIX for seismic design is calculated by multiplying τ_{cr} by 0.8, according to Section D.6.5.2 in CSA A23.3:2024.
- The calculation process uses C25/30 concrete without considering edge effects.
- Fastening elements to concrete using anchors not listed in the table must be verified according to the load applied to the anchors.
- The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge), the anchors-to-concrete must be recalculated according to the design requirements.
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2020. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

(3) The slip modulus of the shear connection, K_{ser}, is measured through testing on European wood species with a density of 350 kg/m^3.

(4) The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is based on ETA certifications for VIN-FIX, HYB-FIX, and EPO-FIX chemical anchors.



TITAN PLATE T TIMBER

PLATE FOR SHEAR LOADS

DESIGN REGISTERED · UK CA EN 14545 · CE EN 14545

TIMBER-TO-TIMBER
These plates are ideal for the flat connection of the base plate to load-bearing timber panels.

CONTINUOUS CONNECTION
The 1.2 m long TTP1200 version allows the creation of long connections in panel floors, replacing the classic spline joint connection.

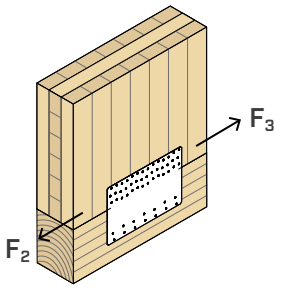
CALCULATED AND CERTIFIED
CE marking according to European standard EN 14545. Available in three versions. TTP300 and TTP1200 versions ideal for CLT.

SERVICE CONDITION DRY

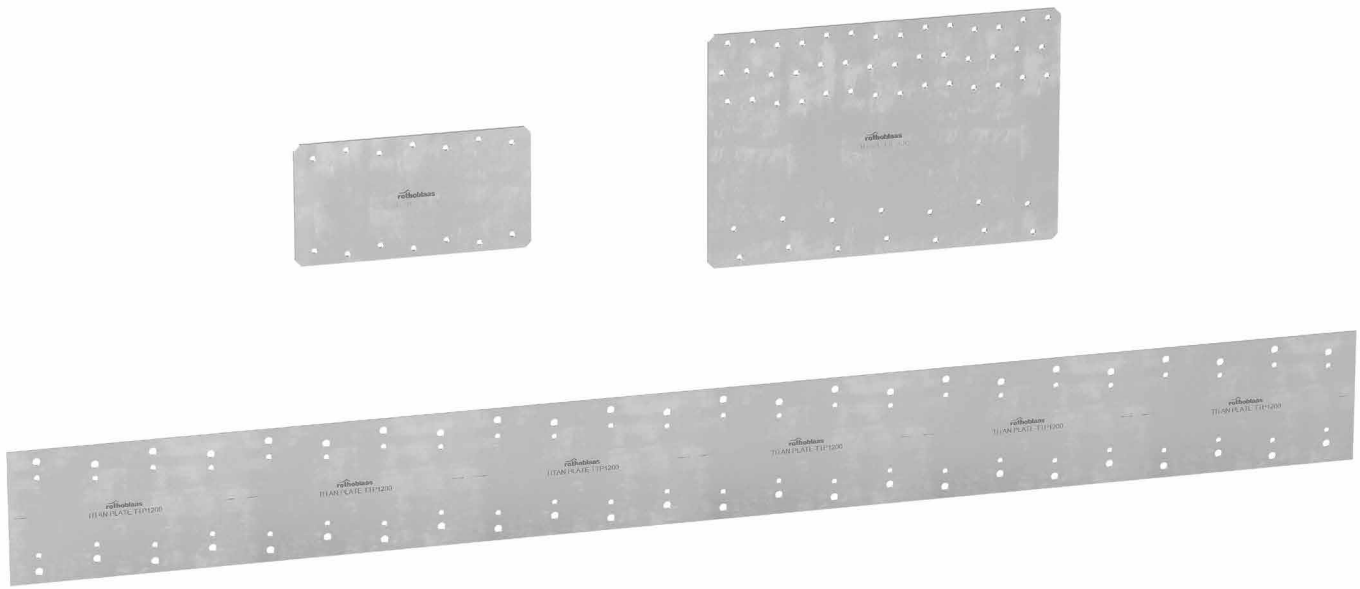
MATERIAL

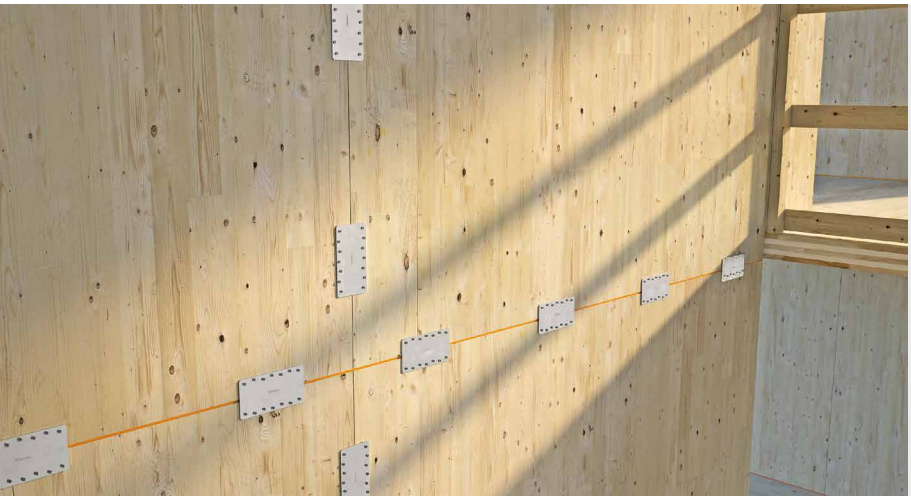
DX51D Z275 DX51D + Z275 carbon steel

EXTERNAL LOADS



CANADIAN DESIGN VALUES
USA, EU and more design values available online.





FIELDS OF USE

Shear joints for timber walls or floors.
Timber-to-timber configuration.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels



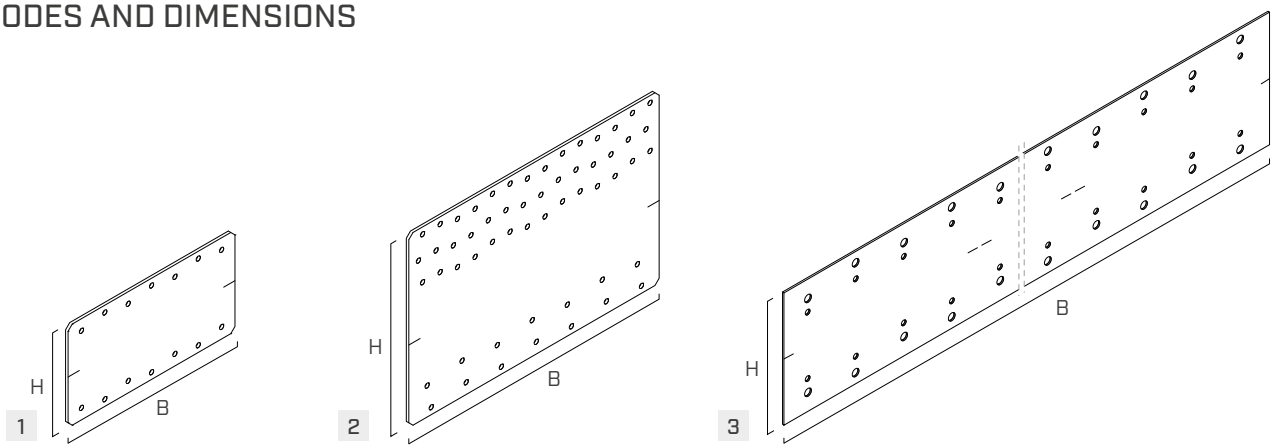
SPLINE STRAP

Ideal for the construction of floors with diaphragm behaviour, restoring shear continuity between the different panels that make up the floor.

FASTENING PATTERNS

The 300 mm version, with asymmetrical nailing, allows fastening on both beams and CLT with optimised fastening patterns.

CODES AND DIMENSIONS



	CODE	B [mm]	H [mm]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n_{V1} Ø5 *n_{V1} Ø0.20* [pcs]	n_{V2} Ø5 *n_{V2} Ø0.20* [pcs]	n_{V1} Ø7 *n_{V1} Ø0.28* [pcs]	n_{V2} Ø7 *n_{V2} Ø0.28* [pcs]		pcs
1	**TTP200**	200	105	2,5	*8*	*4 1/8*	*0.10*	7	7	-	-	●	10
2	**TTP300**	300	200	3	*11 3/4*	*8*	*0.12*	42	14	-	-	●	5
3	**TTP1200**(*)	1200	120	1,5	*47 1/4*	*4 3/4*	*0.06*	48	48	48	48	●	5

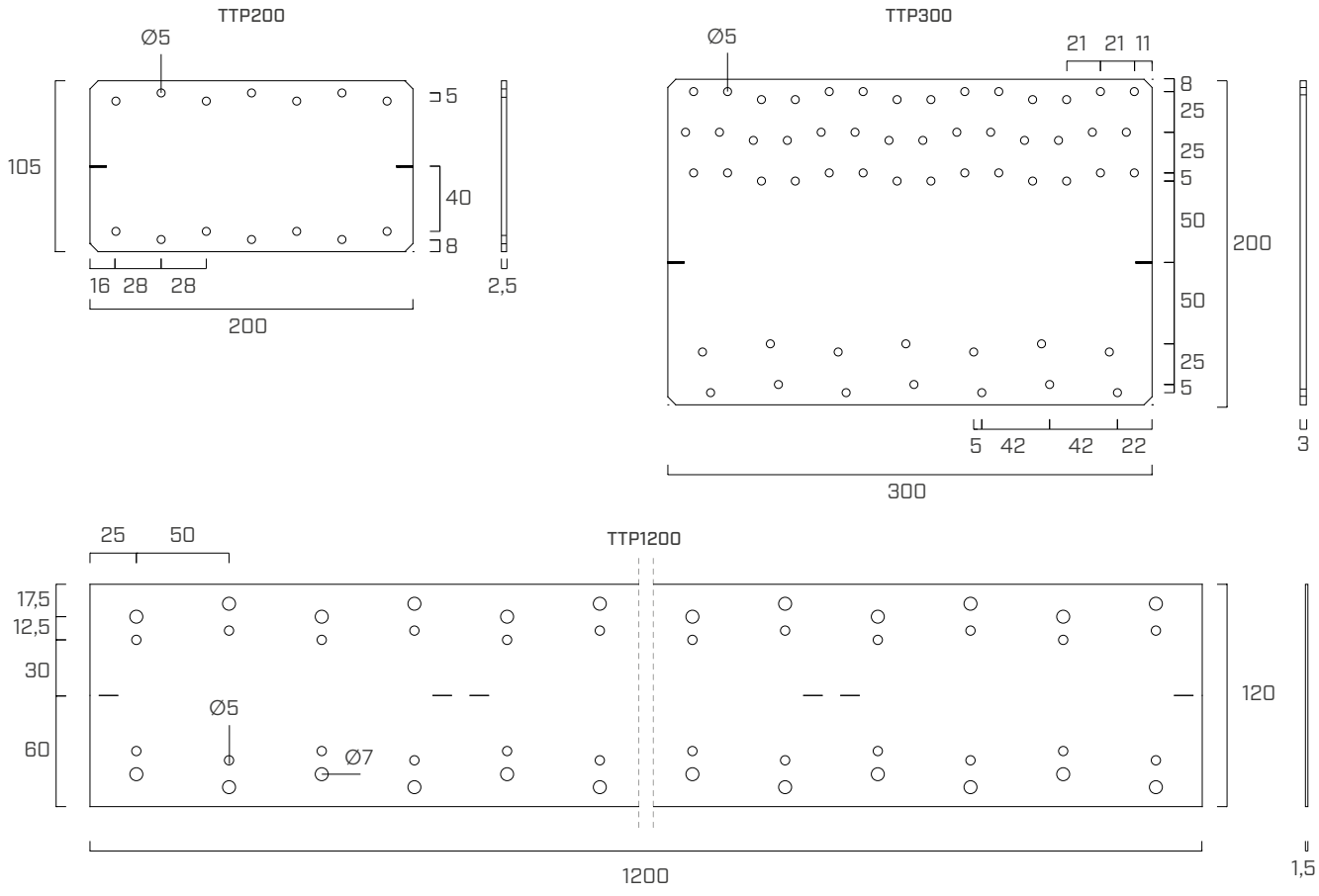
(*)Not holding UKCA marking.

FASTENERS

type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5 - 7	

For proper installation of screws, it is recommended to refer to the "TIMBER SCREWS AND DECK FASTENING" catalogue.

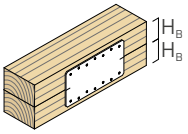
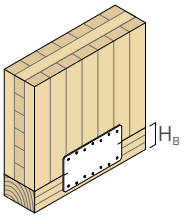
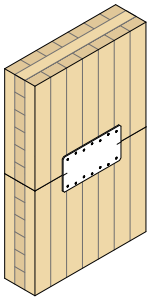
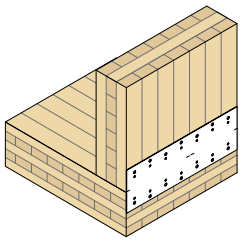
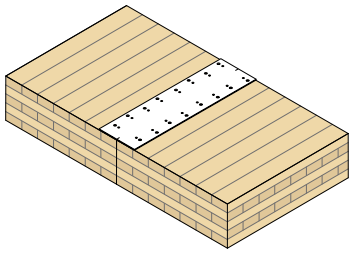
GEOMETRY



INSTALLATION

TITAN PLATE T plates can be used on both CLT and solid timber/glulam elements and must be positioned with the assembly notches at the timber-to-timber interface.

Possible fastening configurations are shown below:

configuration		fasteners	TTP200	TTP300	TTP1200
	**timber-to-timber**	LBA Ø4	●	●	-
		LBS Ø5	-	●	-
	**CLT - timber**	LBA Ø4	●	●	-
		LBS Ø5	-	●	-
	**CLT - CLT** lateral face - lateral face	LBA Ø4	●	●	-
		LBS Ø5	●	●	●
		LBS Ø7	-	-	●
	**CLT - CLT** lateral face - narrow face	LBA Ø4	-	-	-
		LBS Ø5	-	-	-
		LBS Ø7	-	-	●
	**CLT - CLT** lateral face - lateral face	LBA Ø4	●	●	●
		LBS Ø5	●	●	●
		LBS Ø7	-	-	●

MINIMUM HEIGHT OF H_B ELEMENTS

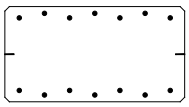
In the case of fastening on beam/platform beam, the relative minimum HB height of the elements is shown in the table with reference to the installation diagrams.

configuration	fasteners	$H_{B\,min}$ [mm]		
		TTP200	TTP300	
		total	partial	total
timber-to-timber	LBA Ø4	75	110	-
	LBS Ø5	-	130	-
CLT - timber	LBA Ø4	75	110	100
	LBS Ø5	-	130	105

The H_B height is determined taking into account the minimum distances for solid timber or glulam consistent with EN 1995:2014 considering a timber density $\rho_k \leq 420$ kg/m^3.

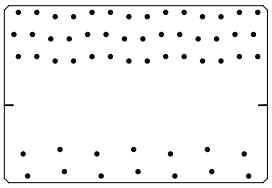
FASTENING PATTERNS

TTP200

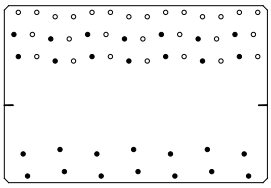


total fastening

TTP300

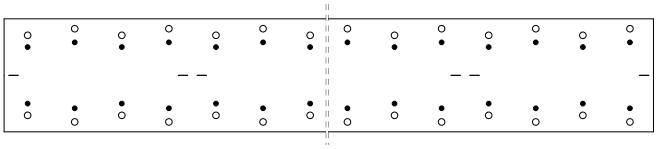


total fastening

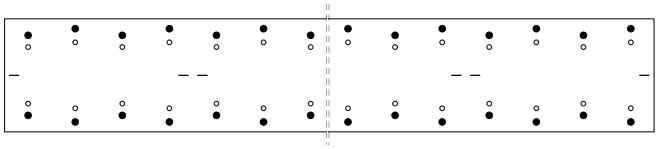


partial fastening

TTP1200



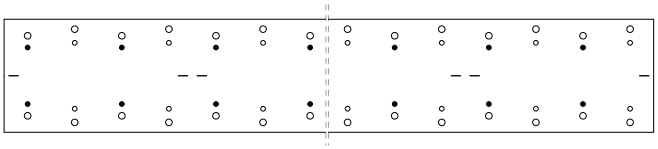
LBA Ø4 - LBS Ø5



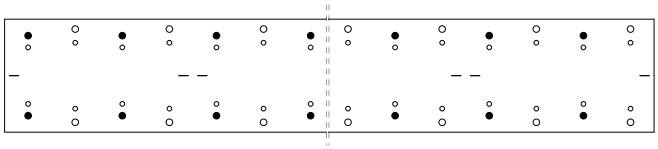
LBS Ø7

total fastening

24+24 fasteners - spacing 50 mm



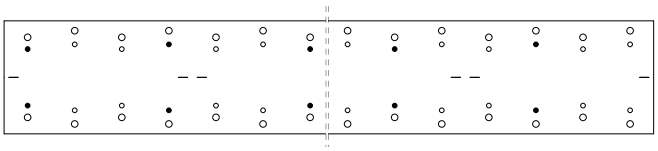
LBA Ø4 - LBS Ø5



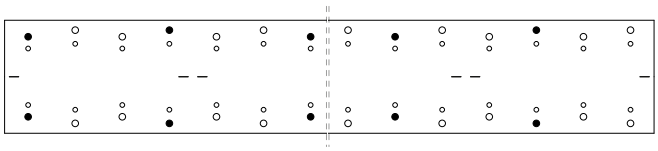
LBS Ø7

partial fastening

12+12 fasteners - spacing 100 mm



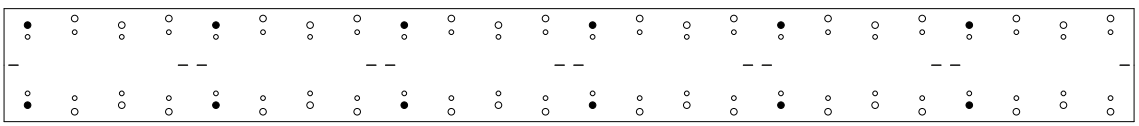
LBA Ø4 - LBS Ø5



LBS Ø7

partial fastening

8+8 fasteners - spacing 150 mm

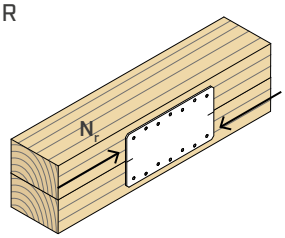


LBS Ø7

partial fastening

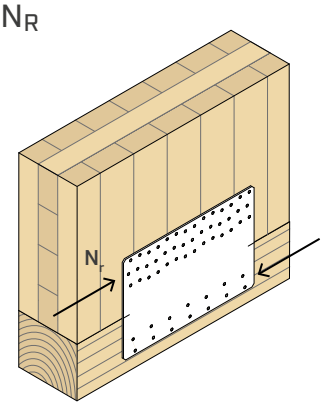
6+ 6 fasteners - spacing 200 mm

STRUCTURAL VALUES | **TTP200** | N_R



configuration	fastening holes				factored lateral resistance N_r (1)(2) (K_D=1.15)			
	type	Ø x L [mm]	n_{V1} [pcs]	n_{V2} [pcs]	G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
total fastening	LBA	Ø4 x 60	7	7	5,7	6,7	7,7	8,5

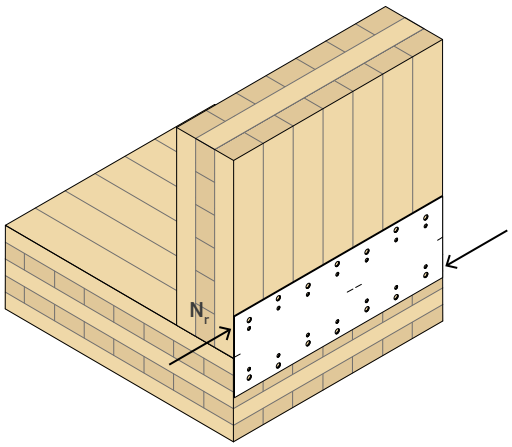
STRUCTURAL VALUES | **TTP300** | N_R



configuration	fastening holes				factored lateral resistance N_r (1)(2)(3) (K_D=1.15)			
	type	Ø x L [mm]	n_{V1} [pcs]	n_{V2} [pcs]	G=0.35 [kN]	G=0.42 [kN]	G=0.49 [kN]	G=0.55 [kN]
total fastening	LBA	Ø4 x 60	42	14	16,6	19,5	22,4	24,8
	LBS	Ø5 x 60	42	14	33,2	39,0	44,7	49,5
partial fastening	LBA	Ø4 x 60	14	14	10,1	11,8	13,6	15,0
	LBS	Ø5 x 60	14	14	20,1	23,7	27,1	30,0

STRUCTURAL VALUES | **TTP1200** | N_R

CLT - CLT
lateral face - narrow face

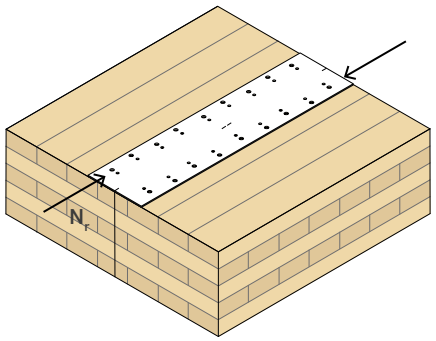


configuration	fastening holes				factored lateral resistance N_r (1)(2)(3)(4) (K_D=1.15)					
	type	Ø x L [mm]	n_{V1} [pcs]	n_{V2} [pcs]	G=0.35		G=0.42		G=0.49	
					[kN]	[kN/m]	[kN]	[kN/m]	[kN]	[kN/m]
total fastening 24+24 fasteners spacing 50 mm	LBS	Ø7 x 100	24	24	61,3	51,1	67,6	56,3	73,9	61,6
partial fastening 12+12 fasteners spacing 100 mm	LBS	Ø7 x 100	12	12	30,9	25,7	34,0	28,3	37,2	31,0

It is possible to cut the plate into modules with a length of 600 mm. The strength in kN/m remains unchanged.

STRUCTURAL VALUES | **TTP1200** | N_R

CLT - CLT
lateral face - lateral face



configuration	fastening holes				factored lateral resistance N_r [(1)(2)(3)] (K_D=1.15)					
	type	Ø x L	n_{V1}	n_{V2}	G=0.35		G=0.42		G=0.49	
		[mm]	[pcs]	[pcs]	[kN]	[kN/m]	[kN]	[kN/m]	[kN]	[kN/m]
total fastening 24+24 fasteners spacing 50 mm	LBA	Ø4 x 60	24	24	27,2	22,7	32,0	26,7	36,6	30,5
	LBS	Ø5 x 60	24	24	51,5	42,9	55,3	46,1	59,1	49,2
	LBS	Ø7 x 100	24	24	91,5	76,3	100,9	84,1	110,2	91,9
partial fastening 12+12 fasteners spacing 100 mm	LBA	Ø4 x 60	12	12	13,7	11,4	16,0	13,4	18,4	15,3
	LBS	Ø5 x 60	12	12	25,8	21,5	27,7	23,1	29,6	24,7
	LBS	Ø7 x 100	12	12	46,1	38,4	50,8	42,3	55,5	46,2
partial fastening 8+8 fasteners spacing 150 mm	LBA	Ø4 x 60	8	8	9,1	7,6	10,7	8,9	12,2	10,2
	LBS	Ø5 x 60	8	8	17,2	14,3	18,5	15,4	19,7	16,4
	LBS	Ø7 x 100	8	8	30,6	25,5	33,7	28,1	36,9	30,7
partial fastening 6+6 fasteners spacing 200 mm	LBS	Ø7 x 100	6	6	23,1	19,2	25,4	21,2	27,8	23,2

It is possible to cut the plate into modules with a length of 600 mm. The strength in kN/m remains unchanged.

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The steel plate made of DX51D + Z275 carbon steel has a specified tensile strength equal to 330 MPa.
- The specified bending yield strength values are as follows: LBA with a diameter of 4mm has f_{yb}= 645 MPa, LBS/LBS EVO with a diameter of 5 mm has f_{yb}= 1066 MPa, and LBS/LBS EVO with a diameter of 7 mm has f_{yb}= 1102 MPa.
- G is the mean relative density according to Table A.11. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- It is admitted that the distance between the center of mass of the two nailed parts generates a transport moment that is already absorbed by the fasteners in the calculated values. For TTP300, the rotational stiffness of the upper section is much greater, therefore the moment was distributed only on this portion of the steel plate.
- Dimensioning and verification of the timber elements must be carried out separately.

NOTES

(1) Strength values are valid for all full/partial configurations indicated in the INSTALLATION section.

(2) The reference factored lateral resistance for nails and wood screws has been determined following the guidelines in Clauses 12.9 and 12.11 of the CSA-O86 2019. Listed values are based on short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0). J factors affecting the resistance where taken as 1.0. Applicable adjustment factors shall be applied according to CSA-O86 2019.
The listed values are independent of the grain direction as per CSA-O86 Clause 12.9 for nails and Clause 12.11 for wood screws.

(3) J_x = 0.9 factor has been used for CLT connections. When using LBS EVO screws, the strength values are equivalent to the specified LBS values listed in the tables.

(4) J_E = 0.67 factor for fastening into end grain has been considered in the calculations of the narrow face connection.

INTELLECTUAL PROPERTY

- TITAN PLATE T plates are protected by the following Registered Community Designs:
  - RCD 008254353-0015;
  - RCD 008254353-0016;
  - RCD 015051914-0006.



Structural connection elements in digital format

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TITAN PLATE C CONCRETE

PLATE FOR SHEAR LOADS

DESIGN REGISTERED UK CA EN 14545 CE EN 14545

VERSATILE
It can be used for continuous connection to the substructure of both CLT and light timber frame walls.

INNOVATIVE
Designed to be partially or completely fastened with nails or screws. Possibility of installation even in the presence of bedding grout.

CALCULATED AND CERTIFIED
Strength values are calculated according to CSA O86:24 and CSA A23.3:24, CE marking according to EN 14545. Available in 2 versions. TCP300 with increased thickness optimised for CLT.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.

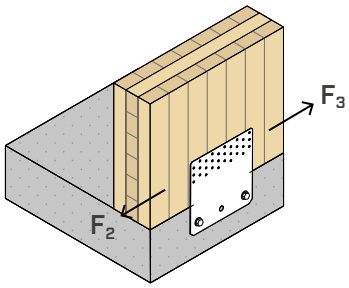
SERVICE CONDITION DRY

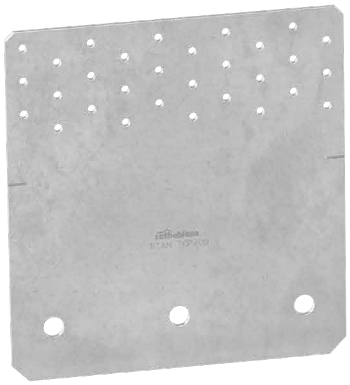
MATERIAL

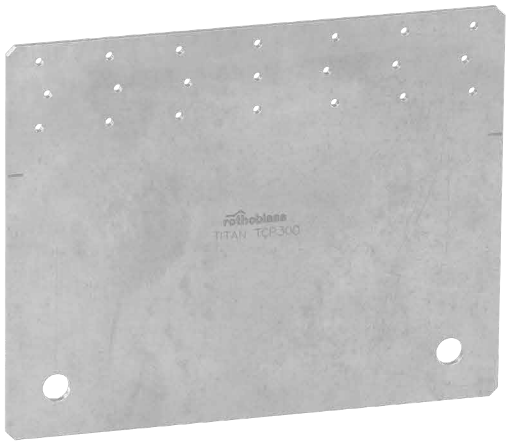
DX51D Z275 **TCP200**: DX51D + Z275 carbon steel

S355 Fe/Zn12c **TCP300**: S355 + Fe/Zn12c carbon steel

EXTERNAL LOADS









FIELDS OF USE

Shear joints for timber walls.
Timber-to-concrete or timber to-steel configurations.
Suitable for walls aligned to the concrete edge.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels





ADDED STOREYS

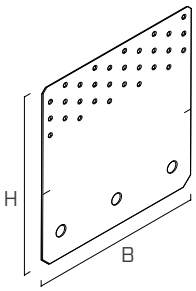
Ideal for making flat joints between concrete or masonry elements and CLT panels. Construction of continuous shear connections.

HYBRID STRUCTURES

Within hybrid timber-to-steel structures, it can be used for shear connections by simply aligning the edge of the timber with the edge of the steel element.

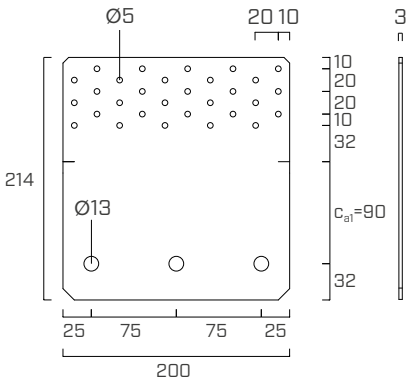
CODES AND DIMENSIONS

CODE	B [mm]	H [mm]	holes	s [mm]	*B [in]*	*H [in]*	*holes*	*s [in]*	n_V Ø5 *n_V Ø0.20* [pcs]		pcs
TCP200	200	214	Ø13	3	*8*	*8 7/16*	*Ø0.52*	*0.12*	30	●	10
TCP300	300	240	Ø17	4	*11 3/4*	*9 1/2*	*Ø0.67*	*0.16*	21	●	5

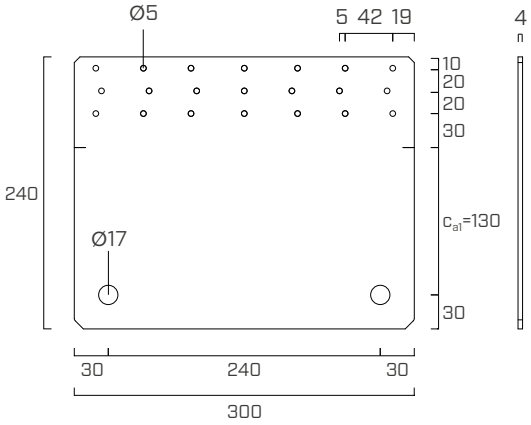


GEOMETRY

TCP200



TCP300



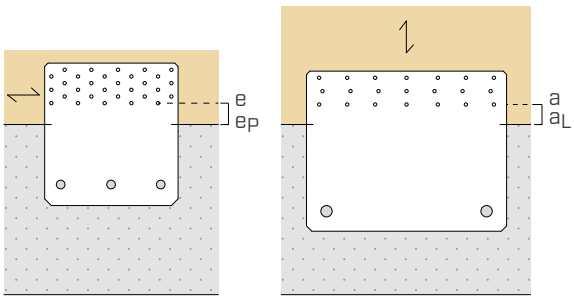
FASTENERS

type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
LBS EVO	C4 EVO round head screw		5	
AB1	CE1 expansion anchor		M12 - M16	
SKR	screw-in anchor		12 - 16	
VIN-FIX	vinyl ester chemical anchor		M12 - M16	
HYB-FIX	hybrid chemical anchor		M12 - M16	
EPO-FIX	epoxy chemical anchor		M12 - M16	

INSTALLATION

TIMBER minimum distances			nails LBA Ø4 spruce-pine-fir and northern species	nails LBA Ø4 douglas fir-larch, hem-fir, and western red cedar
timber	**e**	[mm]	≥ 16	≥ 20
	a	[mm]	≥ 48	≥ 60

TIMBER minimum distances			screws LBS Ø5 not pre-drilled G ≤ 0.44	not pre-drilled 0.44< G ≤ 0.5	pre-drilled any G
timber	e_P	[mm]	≥ 25	≥ 35	≥ 15
	a_L	[mm]	≥ 75‡	≥ 110	≥ 60†



e edge distance perpendicular to grain
e_P unloaded edge distance
a end distance parallel to grain
a_L loaded end distance

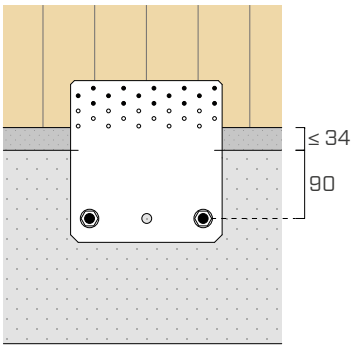
G = mean relative density of wood
†For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡For Western Red Cedar, this minimum spacing shall be increased by 50%.
Timber minimum distances is according to SECTION 12.9 Placemen t of nails and spikes for LBA nails and SECTION 12.12 placement of self tapping screws for LBS screws in CSA O86; 2024

FASTENING PATTERNS

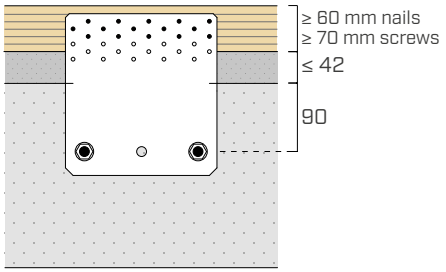
PARTIAL FASTENING

In the presence of design requirements such as varying stress values or the presence of a grout between the wall and the support surface, it is possible to use pre-calculated **partial nailing patterns** or to position the plates as required (e.g. lowered plates). Take care to respect the minimum distances indicated in the table and verify the strength of the anchor-to-concrete group taking into account the increase in distance from the edge (c_{a1}). Below there are some examples of possible limit configurations:

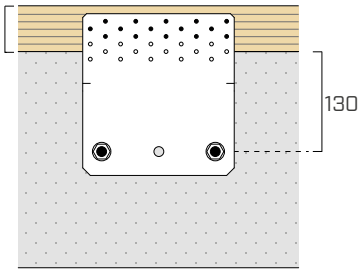
TCP200



partial 15 fasteners - CLT

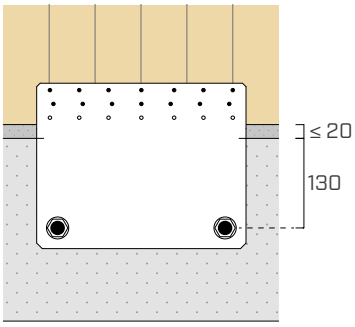


partial 15 fastenings - C/GL

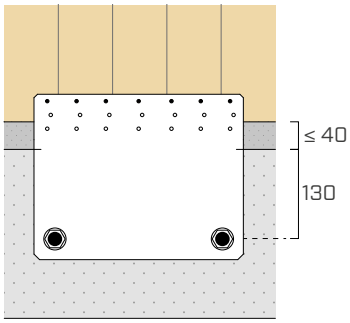


lowered plate - C/GL

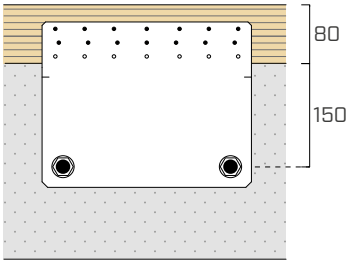
TCP300



partial 14 fastenings - CLT

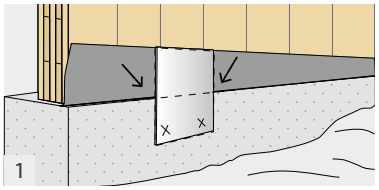


partial 7 fastenings - CLT

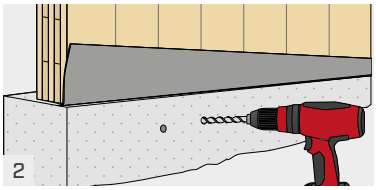


lowered plate - C/GL

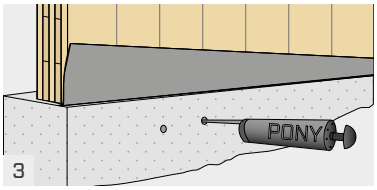
MOUNTING



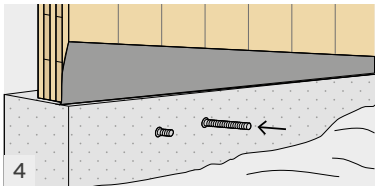
Positioning of the TITAN TCP with the dashed line at the timber-concrete interface and hole marking.



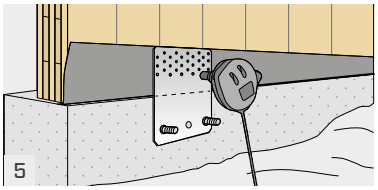
Removal of the TITAN TCP plate and drilling of the concrete support.



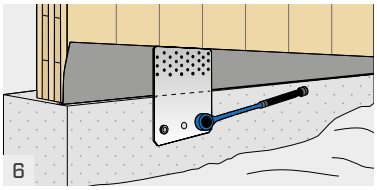
Accurate hole cleaning.



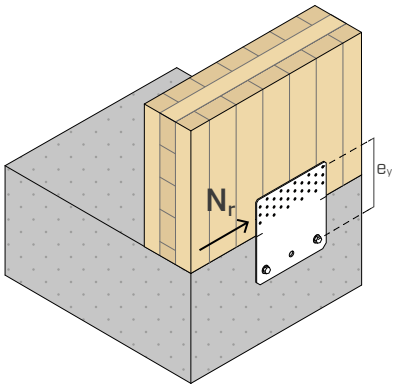
Injection of the anchor and insertion of the threaded rods into the holes.



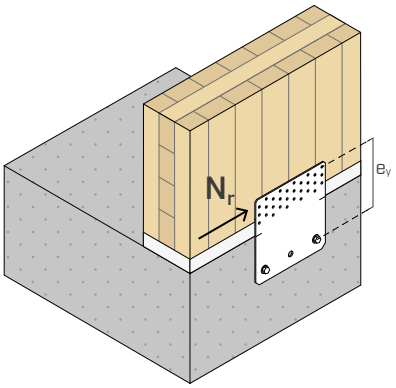
Installation of the TITAN TCP and nailing.



Positioning of nuts and washers by adequate tightening.



total fastening



partial fastening

TIMBER STRENGTH

configuration on timber	TIMBER			STEEL TO TIMBER				STEEL TO CLT			CONCRETE		
	fastening holes Ø5			N_r [1] factored lateral resistance (K_D=1.15)				N_r [1][2] factored lateral resistance (K_D=1.15)			fastening holes Ø13		
	type	Ø x L	n_V	G=0.35	G=0.42	G=0.49	G=0.55	E G = 0.35	E1 and V2 G = 0.42	E2 and V1 G = 0.49	Ø	n_V	e_y [3]
		[mm]	[pcs]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[pcs]	[mm]
total fastening	LBA	Ø4 x 60	30	**37,2**	**40,7**	**43,8**	**46,4**	**35,3**	**38,6**	**41,6**	M12	2	147
	LBS	Ø5 x 60	30	**42,1**	**47,1**	**51,8**	**55,6**	**40,8**	**45,7**	**50,2**			
partial fastening	LBA	Ø4 x 60	15	**18,6**	**20,3**	**21,9**	**23,2**	**17,6**	**19,3**	**20,8**			162
	LBS	Ø5 x 60	15	**21,1**	**23,5**	**25,9**	**27,8**	**20,4**	**22,8**	**25,1**			

CONCRETE STRENGTH

Concrete strength values of some of the possible anchoring solutions, according to the configurations adopted for fastening on timber (e_y). It is assumed that the plate is positioned with the assembly notches at the timber-to-concrete interface (distance between anchor and concrete edge c_{a1} = 90 mm).

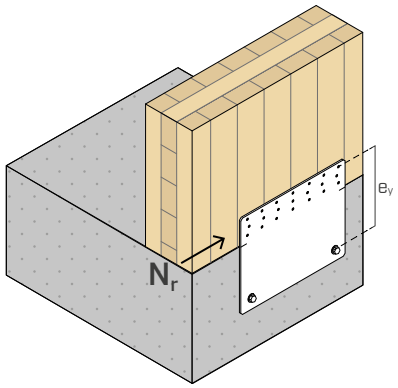
			total fastening (e_y = 147 mm)	partial fastening (e_y = 162 mm)
configuration on concrete	**fastening holes Ø13**		N_r	N_r
	type	**Ø x L**	**concrete resistance**	**concrete resistance**
		[mm]	[kN]	[kN]
uncracked	VIN-FIX 5.8	M12 x 140	**9,7**	**8,8**
		M12 x 195	**9,7**	**8,8**
	SKR	12 x 90	**8,5**	**7,7**
	AB1	M12 x 100	**9,1**	**8,2**
cracked	VIN-FIX 5.8	M12 x 140	**6,9**	**6,3**
		M12 x 195	**6,9**	**6,3**
	SKR	12 x 90	**6,0**	**5,5**
	AB1	M12 x 100	**6,5**	**5,9**
seismic	HYB-FIX 8.8	M12 x 140	**6,9**	**6,3**
		M12 x 195	**6,9**	**6,3**
	EPO-FIX 8.8	M12 x 140	**6,9**	**6,3**

NOTES

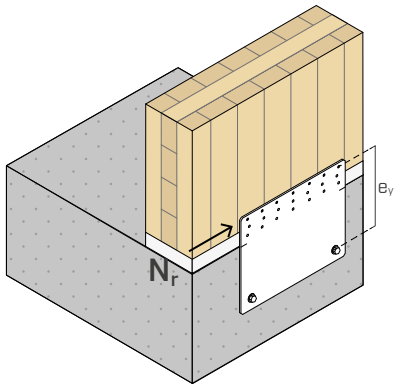
[1] Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2024. Short term load duration factor (K_D = 1,15), dry service condition factor (K_{SF} = 1,0), and treatment factor (K_T = 1,0) are assumed.

[2] Adjustment factor for connections (J_x) is assumed to be equal to 0,9 for CLT connections.

[3] Eccentricity of calculation for verification of the anchor-to-concrete group.



total fastening



partial fastening

TIMBER STRENGTH

configuration on timber	TIMBER			STEEL TO TIMBER				STEEL TO CLT			CONCRETE		
	fastening holes Ø5			N_r [1] factored lateral resistance (K_D=1.15)				N_r [1][2] factored lateral resistance (K_D=1.15)			fastening holes Ø13		
	type	Ø x L	n_V	G=0.35	G=0.42	G=0.49	G=0.55	E G = 0.35	E1 and V2 G = 0.42	E2 and V1 G = 0.49	Ø	n_V	e_y [3]
		[mm]	[pcs]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[pcs]	[mm]
total fastening	LBA	Ø4 x 60	21	**26,1**	**28,6**	**30,9**	**32,7**	**24,5**	**27,1**	**29,3**	M16	2	180
	LBS	Ø5 x 60	21	**29,5**	**33,0**	**36,3**	**39,0**	**28,6**	**32,0**	**35,2**			
partial fastening 14 fasteners	LBA	Ø4 x 60	14	**17,4**	**19,1**	**20,6**	**21,8**	**16,3**	**18,1**	**19,5**			190
	LBS	Ø5 x 60	14	**19,7**	**22,0**	**24,2**	**26,0**	**19,1**	**21,3**	**23,5**			
partial fastening 7 fasteners	LBA	Ø4 x 60	7	**8,7**	**9,5**	**10,3**	**10,9**	**8,2**	**9,0**	**9,8**			200
	LBS	Ø5 x 60	7	**9,8**	**11,0**	**12,1**	**13,0**	**9,5**	**10,7**	**11,7**			

CONCRETE STRENGTH

Concrete strength values of some of the possible anchoring solutions, according to the configurations adopted for fastening on timber (e_y). It is assumed that the plate is positioned with the assembly notches at the timber-to-concrete interface (distance between anchor and concrete edge c_{a1} = 130 mm).

			total fastening (e_y = 180 mm)	partial fastening (e_y = 190 mm)	partial fastening (e_y = 200 mm)
configuration on concrete	fastening holes Ø17		N_r	N_r	N_r
	type	Ø x L	concrete resistance	concrete resistance	concrete resistance
		[mm]	[kN]	[kN]	[kN]
uncracked	VIN-FIX 5.8	M16 x 195	**25,3**	**24,0**	**22,8**
	SKR	16 x 130	**23,3**	**22,1**	**21,0**
	AB1	M16 x 145	**23,3**	**22,1**	**21,0**
cracked	VIN-FIX 5.8	M16 x 195	**18,1**	**17,1**	**16,3**
	SKR	16 x 130	**16,6**	**15,8**	**15,0**
	AB1	M16 x 145	**16,6**	**15,8**	**15,0**
seismic	HYB-FIX 8.8	M16 x 195	**18,1**	**17,1**	**16,3**
		M16 x 245	**18,1**	**17,1**	**16,3**
	EPO-FIX 8.8	M16 x 195	**18,1**	**17,1**	**16,3**

NOTES

[1] Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2024. Short term load duration factor (K_D = 1,15), dry service condition factor (K_{SF} = 1,0), and treatment factor (K_T = 1,0) are assumed.

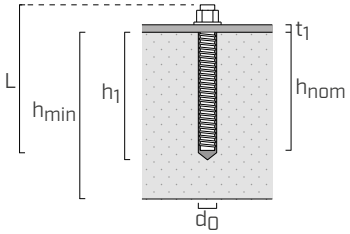
[2] Adjustment factor for connections (J_x) is assumed to be equal to 0,9 for CLT connections.

[3] Eccentricity of calculation for verification of the anchor-to-concrete group.

ANCHORS INSTALLATION PARAMETERS

installation	anchor type		t_1	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCP200	VIN-FIX 5.8 HYB-FIX 8.8 EPO-FIX 8.8	M12 x 140	3	112	112	120	14	150
	SKR	12 x 90	3	64	87	110	10	
	AB1	M12 x 100	3	70	80	85	12	
	VIN-FIX 5.8	M12 x 195	3	170	170	175	14	200
	HYB-FIX 8.8							
TCP300	VIN-FIX 5.8 HYB-FIX 8.8 EPO-FIX 8.8	M16 x 195	4	164	164	170	18	200
	SKR	16 x 130	4	85	126	150	14	
	AB1	M16 x 145	4	85	97	105	16	
	HYB-FIX 8.8	M16 x 245	4	210	210	215	18	250

Precut INA threaded rod, with nut and washer: see www.rothoblaas.com.
MGS threaded rod class 8.8 to be cut to size: see www.rothoblaas.com..



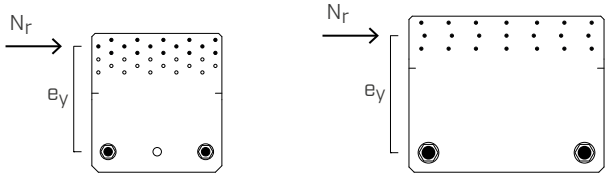
t_1	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchoring depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

ANCHORS VERIFICATION FOR STRESS LOADING N_R

Fastening to concrete using anchors must be verified on the basis of the load acting on the anchors, which depend on the timber fastening configuration.
The position and number of nails/screws determine the ey eccentricity value, understood as the distance between the centre of gravity of the nailing and that of the anchors.

The anchor group must be verified for:

$V_r = N_r$
$M_r = N_r \cdot e_y$



GENERAL PRINCIPLES

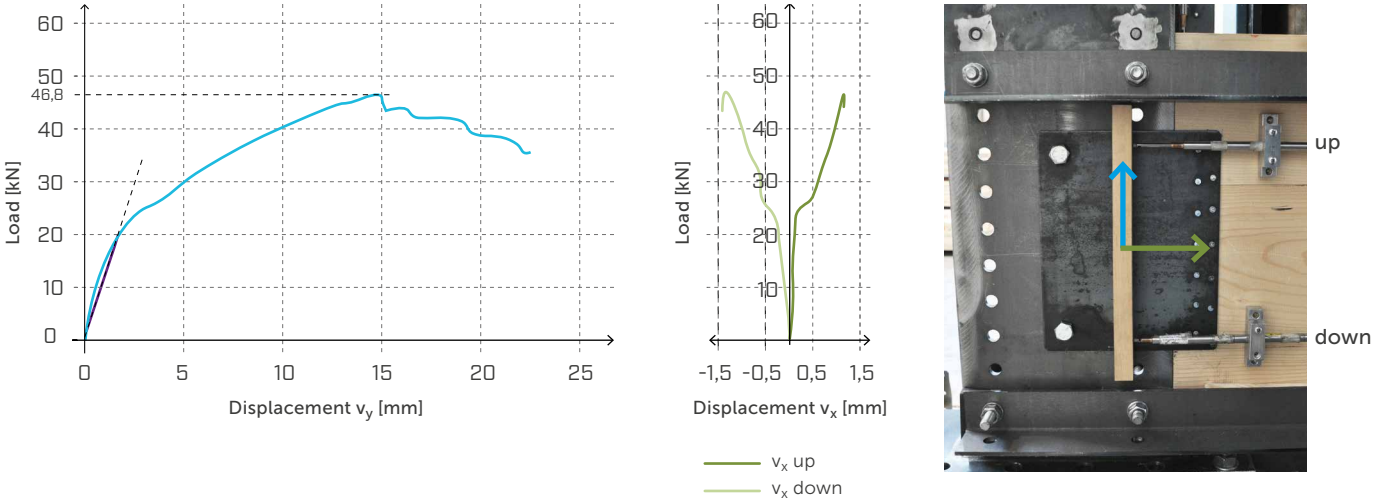
- The lateral resistance of LBS screws and LBA nails is determined according to CSA O86:2024, section 12.12 (self-tapping screws) and section 12.9 (nails and spikes), respectively.
- The specified bending yield strength value of LBS Ø5 is f_{yb} = 1047 MPa and for LBA Ø4 is f_{yb} = 645 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2024. Most common wood species are assumed such as Northern species (G = 0,35), Spruce-Pine-Fir (G = 0,42), Douglas Fir (G = 0,49), and Southern Pine (G =0,55).
- Dimensioning and verification of the timber elements must be carried out separately.
- The calculation of the concrete anchors is performed following CSA A23.3:2024, Annex D.
- The characteristic bond stress of adhesive anchors in uncracked concrete is taken from European Technical Assessment test reports.
- Seismic design is carried out for a heavy seismic zone without ductility requirements for the anchors.
- The bond strength of HYB-FIX and EPO-FIX for seismic design is calculated by multiplying τ_{uncr} by 0.8, according to Section D.6.5.2 in CSA A23.3:2024.
- The anchor calculation is based on C25/30 concrete.
- Edge distance and concrete thickness is not assumed critical for this calculation.
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363;
  - HYB-FIX chemical anchor according to ETA-20/1285;
  - EPO-FIX chemical anchor according to ETA-23/0419;
  - SKR screw-in anchor according to ETA-24/0024;
  - AB1 mechanical anchor according to ETA-17/0481 (M12);
  - AB1 mechanical anchor according to ETA-99/0010 (M16).

INTELLECTUAL PROPERTY

- TITAN PLATE C plates are protected by the following Registered Community Designs:
  - RCD 002383265-0003;
  - RCD 008254353-0014.

EXPERIMENTAL INVESTIGATIONS | TCP300

In order to calibrate the numerical models used for the design and verification of the TCP300 plate, an experimental campaign was carried out in collaboration with the Institute for BioEconomy (IBE) - San Michele all'Adige.
The connection system nailed or screwed to CLT panels (European wood species) has been shear stressed through monotonic tests in displacement control, registering the load, displacement in the two main directions and collapse mode.
The results obtained were used to validate the analytical calculation model for the TCP300 plate, based on the hypothesis that the shear centre is placed at the centre of gravity of the fastenings on timber. Therefore that the anchors, usually the weak point of the system, are stressed not only by the shear actions but also by the local moment.
The study in different fastening configurations (Ø4 nails/Ø5 screws, full nailing, partial nailing with 14 connectors, partial nailing with 7 connectors) shows that the mechanical behaviour of the plate is strongly influenced by the **relative stiffness of the connectors** on timber compared to that of the anchors, in tests simulated by bolting on steel.
In all cases a shear failure mode of the timber fasteners has been observed, which does not result in evident plate rotation. Only in some cases (full nailing) the non-negligible rotation of the plate leads to an increase in stress on the timber fasteners resulting from a redistribution of the local moment with consequent stress relief on the anchors, which represent the limiting point of the overall strength of the system.



Load-to-displacement diagrams for TCP300 specimen with partial nailing (no. 14 LBA Ø4 x 60 mm nails).

Further investigations are necessary in order to define an analytical model that can be generalized to the different configurations of use of the plate that is able to provide the actual stiffness of the system and the redistribution of stresses as the boundary conditions (connectors and base materials) vary.

WHT PLATE T TIMBER

PLATE FOR TENSILE LOADS

DESIGN REGISTERED

UK CA EN 14545

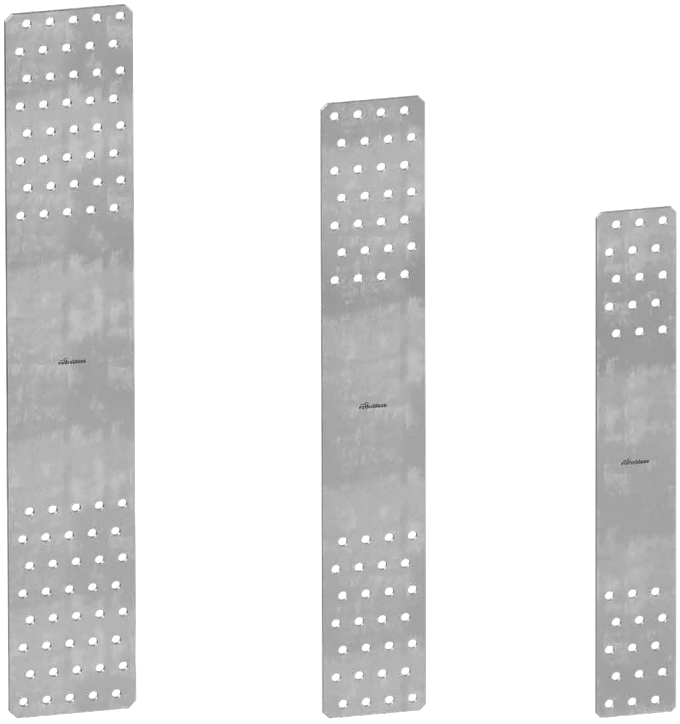
CE EN 14545

COMPLETE RANGE
Available in five versions of different thickness, material and height. HBS PLATE screws enable fast and safe assembly.

TENSION
Ready-to-use plates: calculated, certified for tensile loads on timber-to-timber joints. Available in five different strength levels.

EARTHQUAKE AND MULTISTORY
Ideal for the design of multi-storey buildings for different floor thickness values. Characteristic tensile strength of more than 150 kN.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



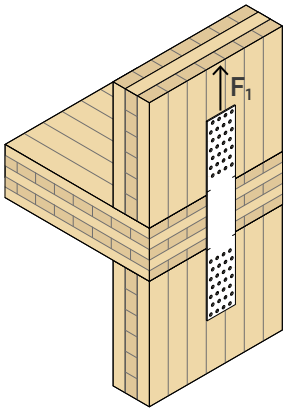
SERVICE CONDITION DRY

MATERIAL

S350 Z275 **WHTPT300** e **WHTPT530**: S350GD + Z275 carbon steel

S355 Fe/Zn12c **WHTPT600, WHTPT720 and WHTPT820**: S355 + Fe/Zn12c carbon steel

EXTERNAL LOADS



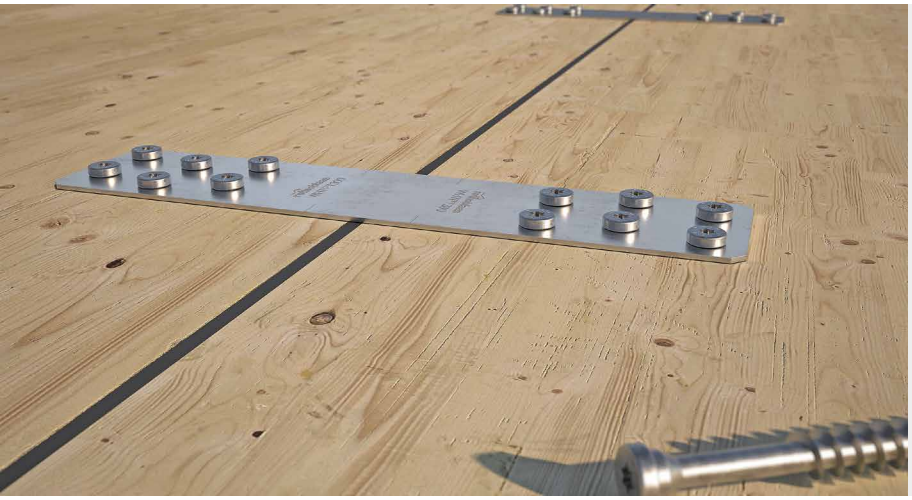




FIELDS OF USE

Tensile joints for timber walls, beams or floors. Timber-to-timber configuration.

Can be applied to:
- solid timber and glulam
- CLT and LVL panels



HBS PLATE

Ideal in combination with HBS PLATE or HBS PLATE EVO screws to securely and reliably fasten plates to timber. Disassembling the connection at the end of its life is quick and safe.

FLOOR JOINTS

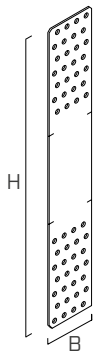
The new models WHTPT530 and WHTPT300 are also suitable for tensile joints between CLT panels in floors.

CODES AND DIMENSIONS

WHT PLATE T

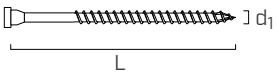
CODE	H	B	s	*H*	*B*	*s*	n_V Ø11 *n_V Ø0.44*	pcs
	[mm]	[mm]	[mm]	*[in]*	*[in]*	*[in]*	[pcs]	
WHTPT300(*)	300	67	2	*11 3/4*	*2 5/8*	*0.08*	6 + 6	10
WHTPT530(*)	530	67	2,5	*20 7/8*	*2 5/8*	*0.10*	8 + 8	10
WHTPT600	594	91	3	*23 3/8*	*3 9/16*	*0.12*	15 + 15	10
WHTPT720	722	118	4	*28 7/16*	*4 5/8*	*0.16*	28 + 28	5
WHTPT820	826	145	5	*32 1/2*	*5 11/16*	*0.20*	40 + 40	1

(*)Not holding UKCA marking.

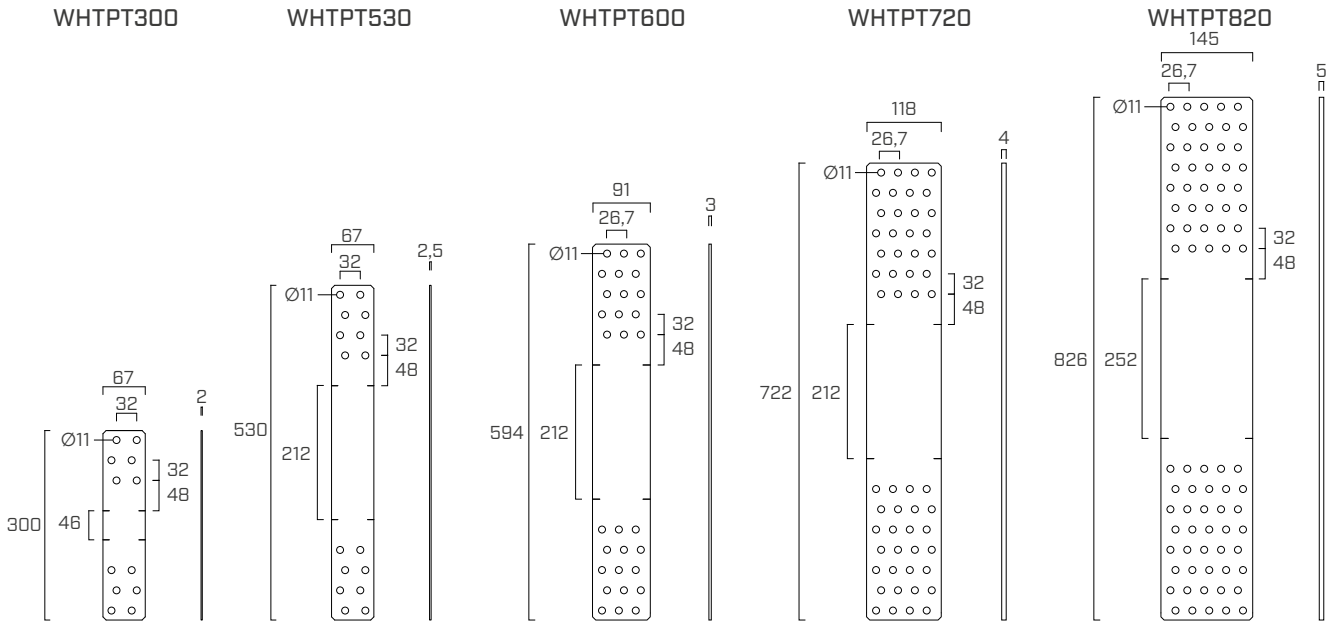


HBS PLATE

CODE	d_1	L	b	*d_1*	*L*	*b*	TX	pcs
	[mm]	[mm]	[mm]	*[in]*	*[in]*	*[in]*		
HBSPL880	8	80	55	*0.32*	*3 1/8*	*2 3/16*	TX40	100
HBSPL8100	8	100	75	*0.32*	*4*	*2 15/16*	TX40	100



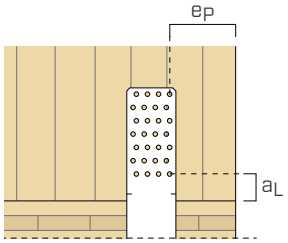
GEOMETRY



INSTALLATION

MINIMUM DISTANCES | INSTALLATION ON WALL

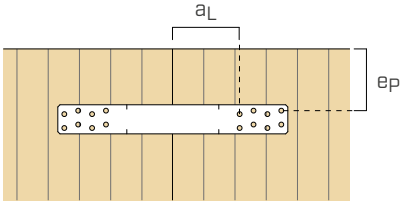
TIMBER minimum distances			screws HBS PLATE Ø8 not pre-drilled G ≤ 0.44	screws HBS PLATE Ø8 not pre-drilled 0.44< G ≤ 0.5	screws HBS PLATE Ø8 pre-drilled any G
CLT	e_P	[mm]	≥ 40	≥ 56	≥ 24
	a_L	[mm]	≥ 120‡	≥ 176	≥ 96†



MINIMUM DISTANCES | INSTALLATION ON FLOOR

By using the WHTPT300 and WHTPT530 plates, the tensile connection between floors can be implemented. The minimum distances for this application are as follows:

TIMBER minimum distances			screws HBS PLATE Ø8 not pre-drilled G ≤ 0.44	screws HBS PLATE Ø8 not pre-drilled 0.44< G ≤ 0.5	screws HBS PLATE Ø8 pre-drilled any G
CLT	e_P	[mm]	≥ 40	≥ 56	≥ 24
	a_L	[mm]	≥ 120‡	≥ 176	≥ 96†

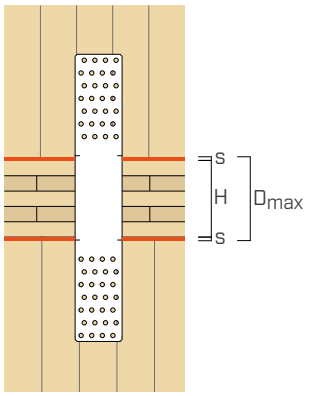


G = mean relative density of wood
†For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡For Western Red Cedar, this minimum spacing shall be increased by 50%.

MAXIMUM DISTANCE BETWEEN PANELS D_{max}

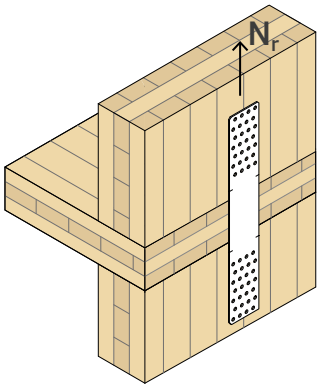
WHT PLATE T plates are designed for different floor thickness values including resilient acoustic profile. The positioning notches, as an assembly aid, indicate the maximum permitted distance (D) between the CLT wall panels in compliance with the minimum distances for HBS PLATE Ø8 mm screws. This distance includes the space required for the acoustic profile housing ($s_{acoustic}$).

CODE	D_{max} [mm]	H_{max} floor [mm]	$s_{acoustic}$ [mm]
WHTPT300	46	-	-
WHTPT530	212	200	6 + 6
WHTPT600	212	200	6 + 6
WHTPT720	212	200	6 + 6
WHTPT820	252	240	6 + 6



STRUCTURAL VALUES | TIMBER-TO-TIMBER | N_R

CODE	fastening holes Ø11		N_r [1][2] factored lateral resistance (K_D=1.15)			
	HBS PLATE Ø x L [mm]	n_V [pcs]	G = 0.35 [kN]	G = 0.42 [kN]	G = 0.49 [kN]	G = 0.55 [kN]
WHTPT300	Ø8 x 80	6+6	16,51	18,92	21,25	22,80
	Ø8 x 100	6+6	17,68	19,58	21,36	22,80
WHTPT530	Ø8 x 80	8+8	21,96	25,16	28,26	30,40
	Ø8 x 100	8+8	23,57	26,11	28,48	30,40
WHTPT600	Ø8 x 80	15 + 15	41,10	47,08	52,88	57,05
	Ø8 x 100	15 + 15	44,22	48,99	53,44	57,05
WHTPT720	Ø8 x 80	28 + 28	76,37	87,47	98,22	106,49
	Ø8 x 100	28 + 28	82,55	91,45	99,75	106,49
WHTPT820	Ø8 x 80	40 + 40	108,60	124,36	139,62	152,14
	Ø8 x 100	40 + 40	117,92	130,64	142,50	152,14



GENERAL PRINCIPLES

- The steel plate made of carbon steel S350 has a specified tensile strength equal to 350 MPa.
- The steel plate made of carbon steel S355 has a specified tensile strength equal to 355 MPa.
- The specified bending yield strength value of HPS PLATE (HBSPL) with a diameter of 8 mm is f_{yb}= 1047 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2025. Most common wood species are assumed such as Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G =0.55).
- Dimensioning and verification of the timber elements must be carried out separately.

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2020. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

INTELLECTUAL PROPERTY

- WHT PLATE T plates are protected by the following Registered Community Designs:
  - RCD 008254353-0019;
  - RCD 008254353-0020;
  - RCD 008254353-0021;
  - RCD 015051914-0007;
  - RCD 015051914-0008.

WHT PLATE C CONCRETE

PLATE FOR TENSILE LOADS

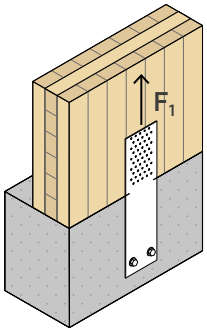
UK CA EN 14545 CE EN 14545

SERVICE CONDITION DRY

MATERIAL

DX51D Z275 DX51D + Z275 carbon steel

EXTERNAL LOADS



TWO VERSIONS

WHT PLATE 440, ideal for platform frame structures; WHT PLATE 540, ideal for CLT panel structures.

LIGHT TIMBER FRAME

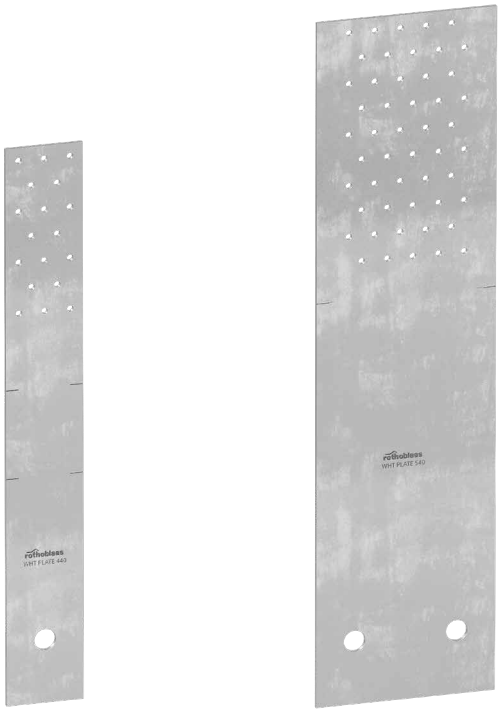
The new partial nailing for the WHTPLATE440 model is optimal for frame walls with a thickness of 60 mm.

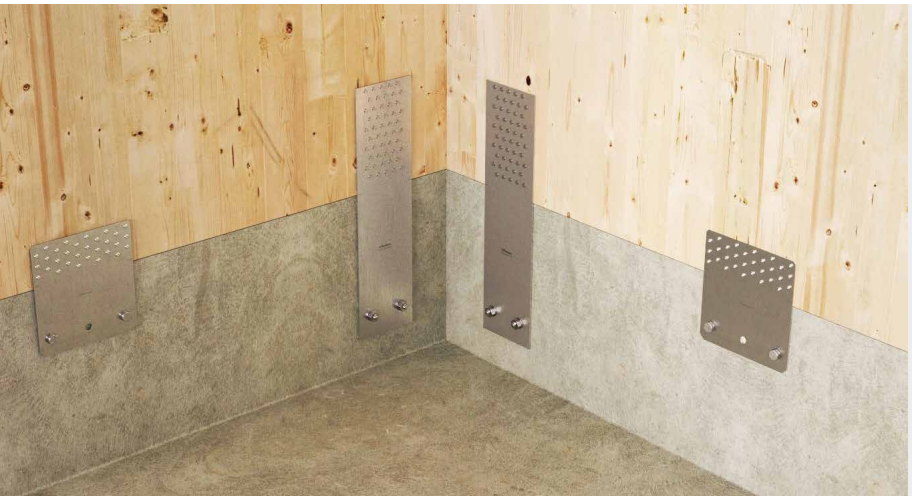
QUALITY

The high tensile strength allows to optimize the number of plates installed, ensuring remarkable time saving.
Values calculated and certified according to CE marking.

CANADIAN DESIGN VALUES

USA, EU and more design values available online.





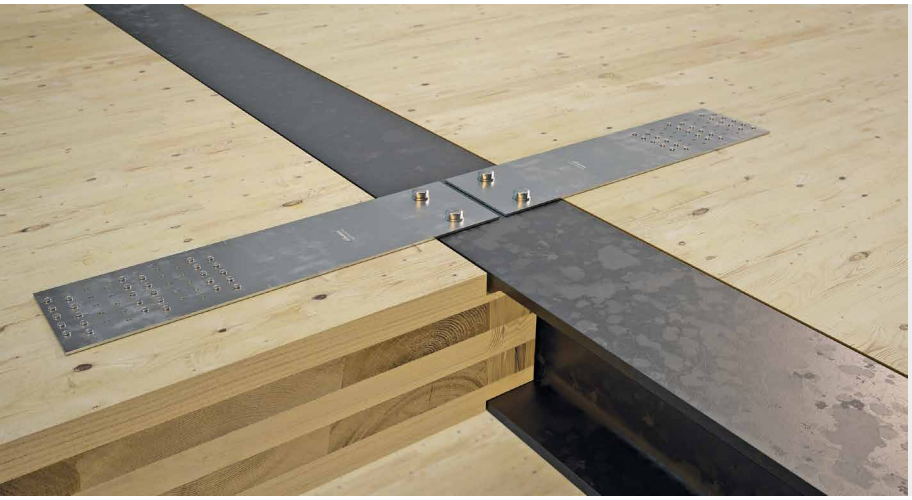
FIELDS OF USE

Tensile joints for timber walls.
Timber-to-concrete or timber to-steel configurations.
Suitable for walls aligned to the concrete edge.

Can be applied to:

- solid timber and glulam
- timber frame
- CLT and LVL panels





TIMBER-TO-CONCRETE

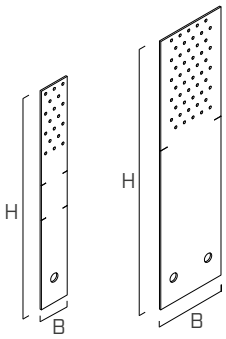
Beside its natural function, it is ideal for solving situations where the transfer of tensile loads from timber to concrete is required.

HYBRID STRUCTURES

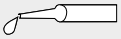
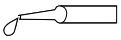
Within hybrid timber-to-steel structures, it can be used for tensile connections by simply aligning the edge of the timber with the edge of the steel element.

CODES AND DIMENSIONS

CODE	B [mm]	H [mm]	holes [mm]	s [mm]	*B [in]*	*H [in]*	*holes [in]*	*s [in]*	n_V Ø5 *n_V Ø.20* [pcs]		pcs
WHTPLATE440	60	440	Ø17	3	*2 3/8*	*17 1/4*	*Ø0.67*	*0.12*	18	●	10
WHTPLATE540	140	540	Ø17	3	*5 1/2*	*21 1/4*	*Ø0.67*	*0.12*	50	●	10

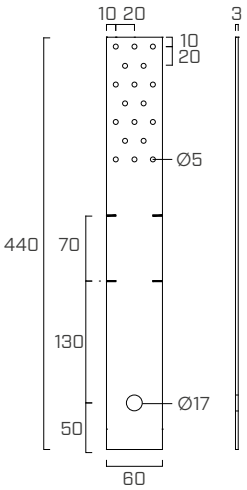


FASTENERS

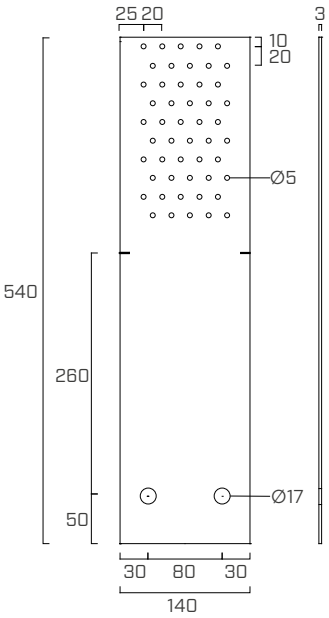
type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
AB1	CE1 expansion anchor		16	
VIN-FIX	vinyl ester chemical anchor		M16	
HYB-FIX	hybrid chemical anchor		M16	
KOS	hexagonal head bolt		M16	

GEOMETRY

WHTPLATE440



WHTPLATE540

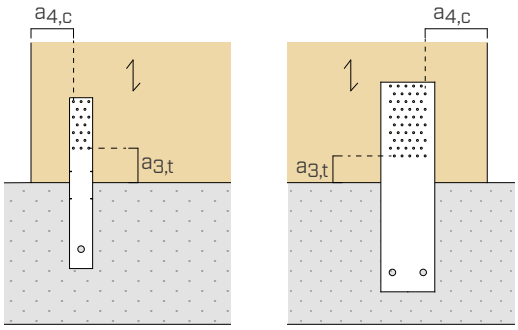


INSTALLATION

MINIMUM DISTANCES | LBA

TIMBER minimum distances			nails LBA Ø4 spruce-pine-fir and northern species	nails LBA Ø4 douglas fir-larch, hem-fir, and western red cedar
timber	e	[mm]	≥ 16	≥ 20
	a	[mm]	≥ 48	≥ 60

TIMBER minimum distances			screws LBA Ø5 not pre-drilled G ≤ 0.44	not pre-drilled 0.44< G ≤ 0.5	pre-drilled any G
timber	e_P	[mm]	≥ 25	≥ 35	≥ 15
	a_L	[mm]	≥ 75‡	≥ 110	≥ 60†



G = mean relative density of wood
†For Douglas Fir-Larch and Western Red Cedar, this minimum spacing shall be increased by 50%.
‡For Western Red Cedar, this minimum spacing shall be increased by 50%.

FASTENING PATTERNS

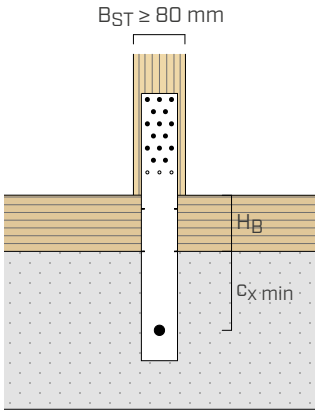
WHTPLATE440

The WHT PLATE 440 can be used for different construction systems (CLT/timber frame) and ground connection systems (with/without platform beam, with/without grout). Depending on the distance from the anchor to the concrete edge, in accordance with the minimum distances of the timber and concrete fasteners, the WHT PLATE 440 must be positioned in way that the anchor is at a distance from the concrete edge:

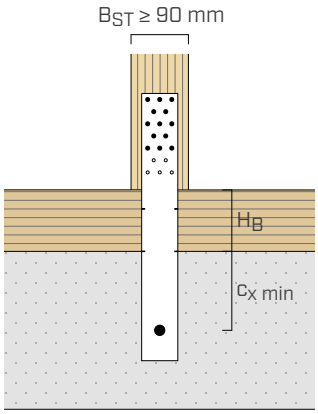
$$130 \text{ mm} \leq c_{a1} \leq 200 \text{ mm}$$

INSTALLATION ON TIMBER FRAME

wide pattern

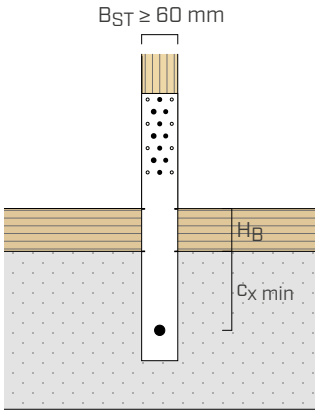


15 fasteners
LBA Ø4 x 60

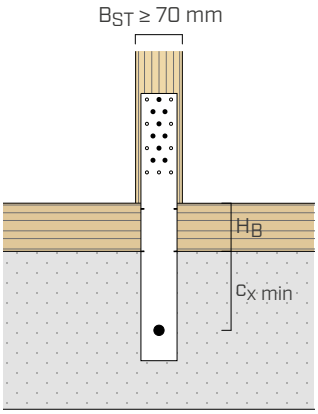


13 fasteners
LBS Ø5 x 60

narrow pattern



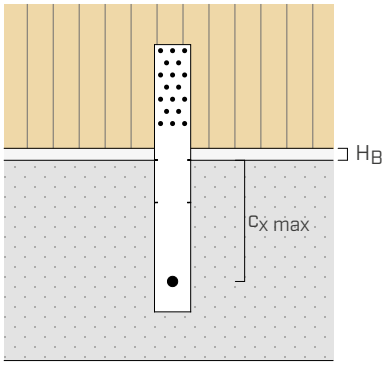
10 fasteners
LBA Ø4 x 60



9 fasteners
LBS Ø5 x 60

INSTALLATION ON CLT

wide pattern



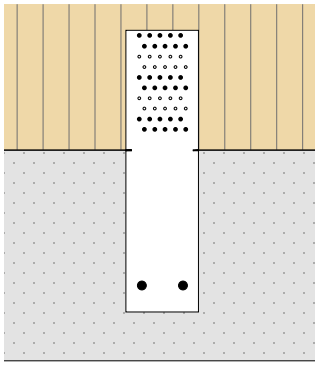
18 fasteners
LBA Ø4 x 60 | LBS Ø5 x 60

c_{a1} [mm]
$c_{a1\,min} = 130$
$c_{a1\,max} = 200$

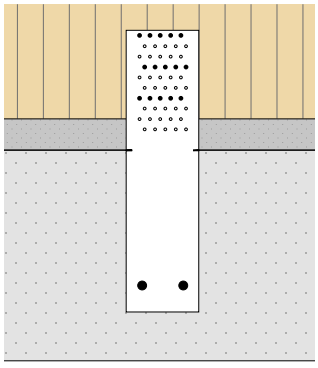
It is possible to install the angle bracket in two specific patterns:
- **wide pattern**: installation of connectors on all columns of the vertical flange;
- **narrow pattern**: installation with narrow nailing, leaving the outermost columns free.

WHTPLATE540

INSTALLATION ON CLT

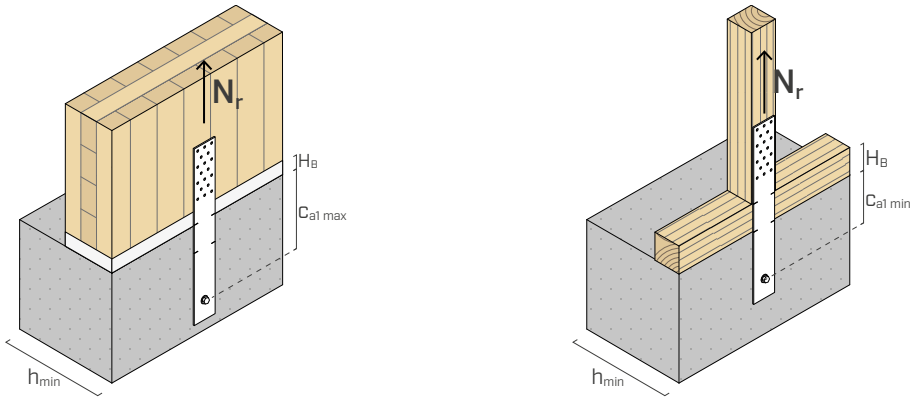


30 fasteners
partial fastening
LBA Ø4 x 60 | LBS Ø5 x 60



15 fasteners
partial fastening
LBA Ø4 x 60 | LBS Ø5 x 60

In the presence of design requirements such as varying stress values or the presence of a **grout** between the wall and the support surface, it is possible to use pre-calculated and optimised **partial nailing** in order to influence the effective number of fastenings on timber. Alternative nailings are possible in accordance with the minimum distances for the connectors.



MINIMUM CONCRETE THICKNESS $h_{min} \geq 200$ mm

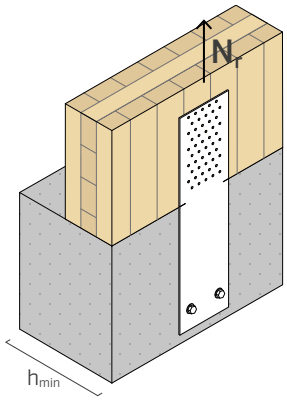
		TIMBER			TIMBER-STEEL				CONCRETE					
configuration	**pattern**	**fastening holes Ø5**			N_r (1)(2) factored lateral resistance (K_D=1.15)				**uncracked**		**cracked**		**seismic**	
		Ø x L	n_V	$H_{B\ max}$	G=0.35	G=0.42	G=0.49	G=0.55	VIN-FIX 5.8 **Ø x L**		VIN-FIX 5.8 **Ø x L**		HYB-FIX 8.8 **Ø x L**	
		[mm]	[pcs]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
$c_{a1\ max}$ = 200 mm	wide pattern	LBA Ø4 x 60	18	20	**21,2**	**23,2**	**25,0**	**26,5**	M16 x 195	**29,6**	M16 x 195	**21,1**	M16 x 195	**21,1**
		LBS Ø5 x 60	18	30	**24,5**	**27,4**	**30,1**	**32,4**						
$c_{a1\ min}$ = 130 mm	wide pattern	LBA Ø4 x 60	15	90	**17,6**	**19,3**	**20,8**	**22,1**	M16 x 195	**19,0**	M16 x 195	**11,5**	M16 x 195	**12,9**
		LBS Ø5 x 60	13	95	**17,7**	**19,8**	**21,8**	**23,4**						
$c_{a1\ min}$ = 130 mm	narrow pattern	LBA Ø4 x 60	10	70	**11,8**	**12,9**	**13,9**	**14,7**	M16 x 195	**19,0**	M16 x 195	**11,5**	M16 x 195	**12,9**
		LBS Ø5 x 60	9	75	**12,2**	**13,7**	**15,1**	**16,2**						

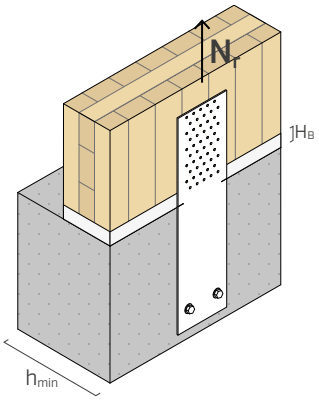
MINIMUM CONCRETE THICKNESS $h_{min} \geq 150$ mm

		TIMBER			TIMBER-STEEL				CONCRETE					
configuration	**pattern**	**fastening holes Ø5**			N_r (1)(2) factored lateral resistance (K_D=1.15)				**uncracked**		**cracked**		**seismic**	
		Ø x L	n_V	$H_{B\ max}$	G=0.35	G=0.42	G=0.49	G=0.55	VIN-FIX 5.8 **Ø x L**		VIN-FIX 5.8 **Ø x L**		HYB-FIX 8.8 **Ø x L**	
		[mm]	[pcs]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
$c_{x\ max}$ = 200 mm	wide pattern	LBA Ø4 x 60	18	20	**21,2**	**23,2**	**25,0**	**26,5**	M16 x 130	**24,8**	M16 x 130	**17,7**	M16 x 130	**17,7**
		LBS Ø5 x 60	18	30	**24,5**	**27,4**	**30,1**	**32,4**						
$c_{x\ min}$ = 130 mm	wide pattern	LBA Ø4 x 60	15	90	**17,6**	**19,3**	**20,8**	**22,1**	M16 x 130	**16,1**	M16 x 130	**11,5**	M16 x 130	**11,5**
		LBS Ø5 x 60	13	95	**17,7**	**19,8**	**21,8**	**23,4**						
$c_{x\ min}$ = 130 mm	narrow pattern	LBA Ø4 x 60	10	70	**11,8**	**12,9**	**13,9**	**14,7**	M16 x 130	**16,1**	M16 x 130	**11,5**	M16 x 130	**11,5**
		LBS Ø5 x 60	9	75	**12,2**	**13,7**	**15,1**	**16,2**						

NOTES

- The concrete strength values are valid if the assembly notches of the WHTPLATE540 plate are positioned at the timber-to-concrete interface (c_{a1} = 260 mm).





MINIMUM CONCRETE THICKNESS $h_{min} \geq 200$ mm

		TIMBER			TIMBER-STEEL				CONCRETE					
configuration	**pattern**	**fastening holes Ø5**			N_r (1)(2) factored lateral resistance (K_D=1.15)				**uncracked**		**cracked**		**seismic**	
		Ø x L	n_V	$H_{B\ max}$	G=0.35	G=0.42	G=0.49	G=0.55	VIN-FIX 5.8 **Ø x L**		VIN-FIX 5.8 **Ø x L**		HYB-FIX 8.8 **Ø x L**	
		[mm]	[pcs]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
partial fastening 2 anchors M16	30 fasteners	LBA Ø4 x 60	30	-	**35,3**	**38,6**	**41,6**	**44,1**	M16 x 195	**42,4**	M16 x 195	**30,3**	M16 x 195	**30,3**
		LBS Ø5 x 60	30	10	**40,8**	**45,7**	**50,2**	**54,0**						
partial fastening 2 anchors M16	15 fasteners	LBA Ø4 x 60	15	60	**17,6**	**19,3**	**20,8**	**22,0**	M16 x 195	**42,4**	M16 x 195	**30,3**	M16 x 195	**30,3**
		LBS Ø5 x 60	15	70	**20,4**	**22,8**	**25,1**	**27,0**						

MINIMUM CONCRETE THICKNESS $h_{min} \geq 150$ mm

		TIMBER			TIMBER-STEEL				CONCRETE					
configuration	**pattern**	**fastening holes Ø5**			N_r (1)(2) factored lateral resistance (K_D=1.15)				**uncracked**		**cracked**		**seismic**	
		Ø x L	n_V	$H_{B\ max}$	G=0.35	G=0.42	G=0.49	G=0.55	VIN-FIX 5.8 **Ø x L**		VIN-FIX 5.8 **Ø x L**		HYB-FIX 8.8 **Ø x L**	
		[mm]	[pcs]	[mm]	[kN]	[kN]	[kN]	[kN]	[mm]	[kN]	[mm]	[kN]	[mm]	[kN]
partial fastening 2 anchors M16	30 fasteners	LBA Ø4 x 60	30	-	**35,3**	**38,6**	**41,6**	**44,1**	M16 x 130	**35,6**	M16 x 130	**25,4**	M16 x 130	**25,4**
		LBS Ø5 x 60	30	10	**40,8**	**45,7**	**50,2**	**54,0**						
partial fastening 2 anchors M16	15 fasteners	LBA Ø4 x 60	15	60	**17,6**	**19,3**	**20,8**	**22,0**	M16 x 130	**35,6**	M16 x 130	**25,4**	M16 x 130	**25,4**
		LBS Ø5 x 60	15	70	**20,4**	**22,8**	**25,1**	**27,0**						

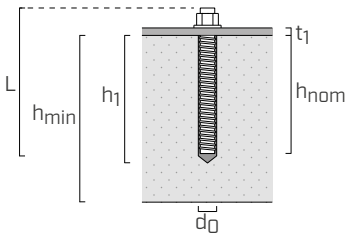
NOTES

- The concrete strength values are valid if the assembly notches of the WHTPLATE540 plate are positioned at the timber-to-concrete interface (c_{a1} = 260 mm).

ANCHORS INSTALLATION PARAMETERS

anchor type		t_1	$h_{nom} = h_{ef}$	h_1	d_0	h_{min}
type	**Ø x L** [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
VIN-FIX 5.8	M16 x 130	3	110	115	18	150
HYB-FIX 8.8	M16 x 195	3	164	170		200

Precut INA threaded rod, with nut and washer: see www.rothoblaas.com.
MGS threaded rod class 8.8 to be cut to size: see page www.rothoblaas.com.



t_{fix}	thickness of plate
h_{nom}	nominal embedment depth
h_{eff}	effective anchor embedment depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

STRUCTURAL VALUES

GENERAL PRINCIPLES

- The lateral resistance of LBS screws and LBA nails is determined according to CSA O86:2024, section 12.12 (self-tapping screws) and section 12.9 (nails and spikes), respectively.
- The steel plate, made of carbon steel S350, has a specified tensile strength of 330 MPa.
- The specified bending yield strength for LBA with a 4 mm diameter is f_{yb} = 645 MPa, and for LBS with a 5 mm diameter is f_{yb} = 1075 MPa.
- G is the mean relative density according to Table A.12 in CSA O86:2024. Typical wood species considered include Northern species (G = 0.35), Spruce-Pine-Fir (G = 0.42), Douglas Fir (G = 0.49), and Southern Pine (G = 0.55).
- Dimensioning and verification of the timber elements must be carried out separately.
- The calculation of the concrete anchors is performed following CSA A23.3:2024, Annex D.
- The anchor and anchor groups are designed for the maximum probable shear force that can be transmitted to the anchors by a non-yielding attachment (case b, Section D.4.3.6.3, CSA A23.3:2024).
- The characteristic bond stress of adhesive anchors in cracked and uncracked concrete is taken from European Technical Assessment test reports.
- Seismic design is carried out for a heavy seismic zone without ductility requirements for the anchors.
- The bond strength of HYB-FIX for seismic design is calculated by multiplying τ_{cr} by 0.8, according to Section D.6.5.2 in CSA A23.3:2024.
- The calculation process uses C25/30 concrete with a thin reinforcing layer and minimum thicknesses as indicated in the corresponding tables.
- It is assumed that there is no eccentricity in the applied load for the anchor groups and that the anchors are sufficiently distant from concrete edges parallel to the applied force.
- Fastening elements to concrete using anchors not listed in the table must be verified according to the load applied to the anchors.
- The product ETAs for the anchors used in the concrete-side strength calculation are indicated below:
  - VIN-FIX chemical anchor according to ETA-20/0363
  - HYB-FIX chemical anchor according to ETA-20/1285

NOTES

(1) Values for factored lateral resistance for self-taping screws are determined following the guidelines in Section 12.12 in CSA-O86 2024. Short term load duration factor (K_D = 1.15), dry service condition factor (K_{SF} = 1.0), and treatment factor (K_T = 1.0) are assumed.

(2) Adjustment factor for connections (J_x) is assumed to be equal to 0.9 for CLT connections.

LBB

PERFORATED STRAP

CE
EN 14545

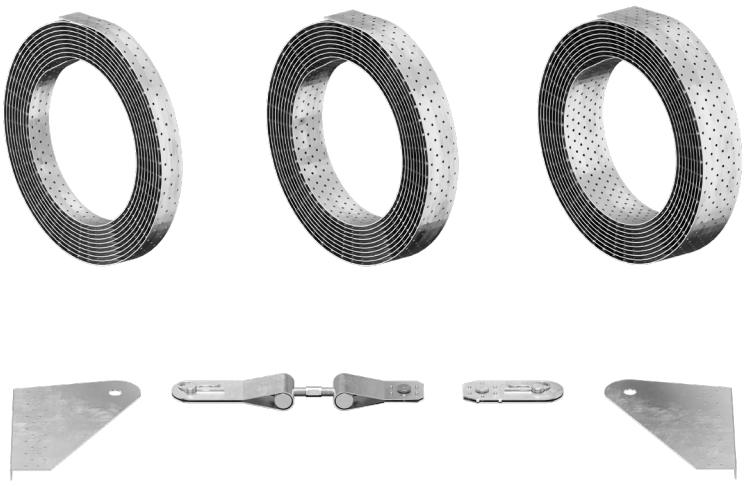


TWO THICKNESSES
Simple and effective system to achieve floor bracing. It is available in thicknesses of 1,5 and 3,0 mm.

SPECIAL STEEL
Made with S350GD high strength steel. The 1,5 mm thick version offers extreme performance to tensile forces with minimal thickness.

TENSIONING
The CLIPFIX60 accessory allows the strap to be tensioned and anchored firmly at the ends. By using a GEKO or SKORPIO panel pullers together with the CLAMP1 accessory, the perforated strap can be tensioned.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



SERVICE CONDITION

DRY

MATERIAL

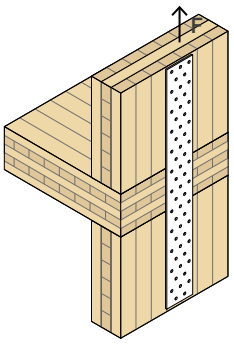
S350 Z275 **LBB 1,5 mm**: S350GD + Z275 carbon steel

S250 Z275 **LBB 3,0 mm**: S250GD + Z275 carbon steel

THICKNESS [mm]

1,5 mm | 3,0 mm

EXTERNAL LOADS





FIELD OF USE

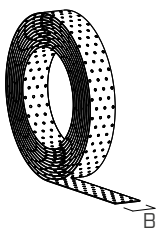
Economical solution for tensile joints with small to medium stress.
Rolls of 25 or 50 m allow for very long connections.
Timber-to-timber configuration.

Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels

CODES AND DIMENSIONS

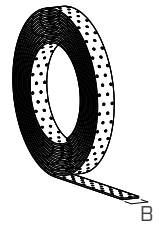
LBB 1,5 mm

CODE	B [mm]	H [m]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n Ø5 *n Ø.20* [pcs]		pcs
LBB40	40	50	1,5	*1 9/16*	*1 15/16*	*0.06*	75/m *23 / ft.*	●	1
LBB60	60	50	1,5	*2 3/8*	*1 15/16*	*0.06*	125/m *38 / ft.*	●	1
LBB80	80	25	1,5	*3 1/8*	*1 15/16*	*0.06*	175/m *53 / ft.*	●	1



LBB 3,0 mm

CODE	B [mm]	H [m]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n Ø5 *n Ø.20* [pcs]		pcs
LBB4030	40	50	3	*1 9/16*	*1 15/16*	*0.12*	75/m *23 / ft.*	●	1

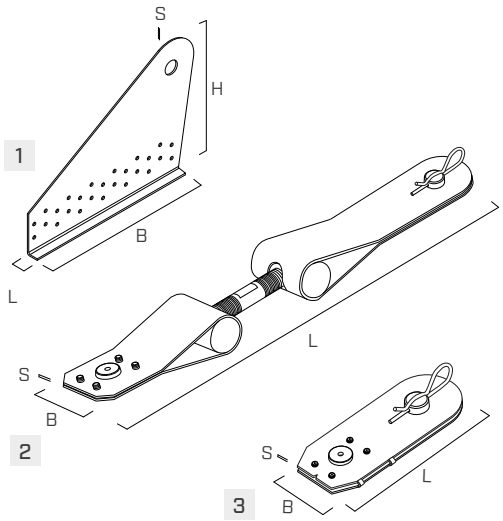


CLIPFIX

CODE	LBB type	LBB width	pcs
CLIPFIX60	LBB40 | LBB60	40 mm | 60 mm *1 9/16 in | 2 3/8 in*	1

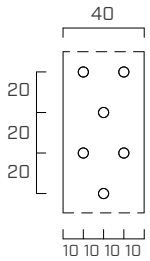
SET COMPRISED OF:	B [mm] *[in]*	H [mm] *[in]*	L [mm] *[in]*	s [mm] *[in]*	n Ø5 *n Ø.20* pcs	pcs
1 Terminal plate	289 *11 3/8*	198 *7 13/16*	15 *9/16*	2 *0.08*	26	4[(1)]
2 Clip-Fix tensioner	60 *2 3/8*	-	300-350 *11 3/4 - 13 3/4*	2 *0.08*	7	2
3 Clip-Fix Terminal	60 *2 3/8*	-	157 *6 3/16*	2 *0.08*	7	2

[(1)]The set includes two right-hand and two left-hand plates.
The Clip-Fix tensioners and terminals are compatible for installation of the LBB40 and LBB60 perforated straps.

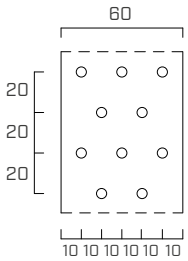


GEOMETRY

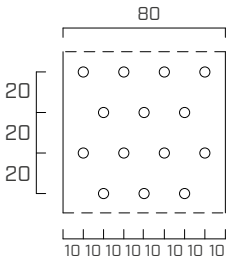
LBB40 / LBB4030



LBB60



LBB80



FASTENERS

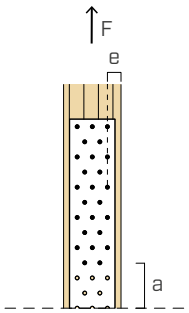
type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	
LBS EVO	C4 EVO round head screw		5	

INSTALLATION

MINIMUM DISTANCES

Spruce-Pine-Fir and Northern Species			nail LBA Ø4	screw LBS Ø5
edge distance perpendicular to grain	**e**	[mm]	≥ 16	≥ 20
end distance parallel to grain	**a**	[mm]	≥ 48	≥ 60

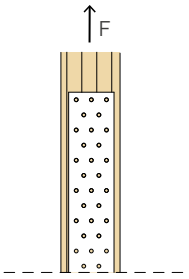
Douglas Fir-Larch, Hem-Fir, and Western Red Cedar			nail LBA Ø4	screw LBS Ø5
edge distance perpendicular to grain	**e**	[mm]	≥ 20	≥ 25
end distance parallel to grain	**a**	[mm]	≥ 60	≥ 75



STRUCTURAL VALUES | TIMBER-TO-TIMBER | F

STRENGTH OF THE SYSTEM

The tensile strength of the system (T_r) is the minimum between the $T_{r,steel}$ plate side tensile strength and the shear resistance of the connectors used for fastening $n_F \cdot N_r$.
If the connectors are placed in several consecutive rows and the load direction is parallel to the grain, the following design criteria must be applied.



$$T_r = min \begin{cases} T_{r,steel} \\ \Sigma (n_{Ri} \cdot n_{ci} \cdot N_r) \end{cases}$$

Where n_{Ri} is the number of fastener rows parallel to the grain, and n_{ci} is the number of fasteners in each row.

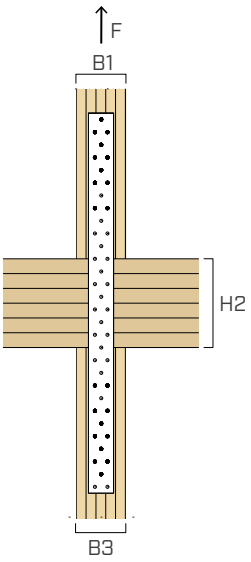
PLATE - TENSILE STRENGTH

type	B	s	net area holes	factored tensile resistance $T_{r,steel}$
	[mm]	[mm]	[pcs]	[kN]
LBB 1,5 mm	40	1,5	2	**9,2**
	60	1,5	3	**15,7**
	80	1,5	4	**20,9**
LBB 3,0 mm	40	3,0	2	**14,5**

CONNECTORS SHEAR RESISTANCE

For other N_r strength values of the LBA Anker nails and LBS screws, please refer to the "TIMBER SCREWS AND DECK FASTENING" catalogue and the Canadian technical datasheets.

CALCULATION EXAMPLE | DETERMINING RESISTANCE



Project data		
Factored tension force	T_f	8 kN
Service-condition		Dry service condition
Load duration		short[1]
Sawn Lumber (D.Fir)	G	0,49[2]
Element 1	B1	89 mm
Element 2	H2	140 mm
Element 3	B3	89 mm

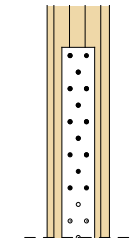
perforated strap LBB40
B = 40 mm
s = 1,5 mm

Anker nail LBA440[4]
d_1 = 4,0 mm
L = 40 mm

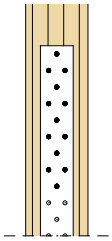
perforated plate LBV401200[3]
B = 40 mm
s = 2,0 mm
H = 600 mm

Anker nail LBA440[4]
d_1 = 4,0 mm
L = 40 mm

EVALUATION OF THE STRENGTH OF THE SYSTEM



perforated strap
LBB40



perforated plate
LBV401200

PLATE - TENSILE STRENGTH

perforated strap LBB40			
$T_{r,steel}$	=	9,2	kN

perforated plate LBV401200[3]			
$T_{r,steel}$	=	9,7	kN

CONNECTOR - LATERAL RESISTANCE

perforated strap LBB40			
φ	=	0,8	
N_u	=	1,8	kN
n_s	=	1,0	shear planes
K_D	=	1,15	
J_F	=	1,0	
N_r	=	1,63	kN
n_F	=	14	fasteners
n_{c1}	=	5	fasteners
n_{R1}	=	2	rows
n_{c2}	=	4	fasteners
n_{R2}	=	1	rows
$\sum (n_{Ri} \cdot n_{ci} \cdot N_r)$	=	**22,8**	**kN**

perforated plate LBV401200[3]			
φ	=	0,8	
N_u	=	1,8	kN
n_s	=	1,0	shear planes
K_D	=	1,15	
J_F	=	1,0	
N_r	=	1,63	kN
n_F	=	13	fasteners
n_{c1}	=	4	fasteners
n_{R1}	=	2	rows
n_{c2}	=	5	fasteners
n_{R2}	=	1	rows
$\sum (n_{Ri} \cdot n_{ci} \cdot N_r)$	=	**21,2**	**kN**

STRENGTH OF THE SYSTEM

$$T_r = min \begin{cases} T_{r,steel} \\ \sum (n_{Ri} \cdot n_{ci} \cdot N_r) \end{cases}$$

perforated strap LBB40			
T_r	=	9,2	kN

perforated plate LBV401200[3]			
T_r	=	9,7	kN

VERIFICATION	$T_r \geq T_f$	9,2 kN	≥	8,0	kN	✓
		verification passed				

VERIFICATION	$T_r \geq T_f$	9,7 kN	≥	8,0	kN	✓
		verification passed				

NOTES

(1) For short term loading, a load duration factor K_D of 1.15 was applied.

(2) G represents the mean relative density as specified in CSA-O86:2024, Table A.12. In the design example, Douglas Fir (G=0.49) has been considered.

(3) Plate LBV401200 is considered cut to a length of 600 mm.

(4) In the calculation example, LBA Anker nails are used. The fastening can also be done with LBS screws.

GENERAL PRINCIPLES

- The LBB 1.5 mm is assumed to have a minimum specified yield strength (F_y) of 350 MPa and a minimum specified tensile strength (F_u) of 420 MPa.
- The LBB 3 mm is assumed to have a minimum specified yield strength (F_y) of 250 MPa and a minimum specified tensile strength (F_u) of 330 MPa.
- The factored tensile resistance of the steel is determined based on the tensile capacity of the governing net area of the steel plate.
- Minimum distances as per CSA-O86 2024 Clause 12.9.2.1.
- Dimensioning and verification of the timber elements must be carried out separately.
- To optimize the connection system, it is recommended to use a number of connectors which can provide a shear capacity that does not exceed the tensile strength of the tape/plate.
- It is recommended to place the connectors symmetrically with respect to the load direction.

LBV

PERFORATED PLATE

CE
EN 14545

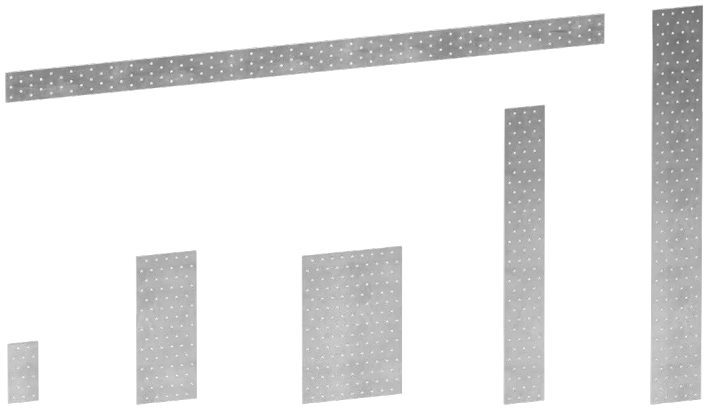


WIDE RANGE
Several versions are available, designed to face all timber construction needs. The LBV plates can create simple beam and joist joints through to the most important inter-story connections.

READY FOR USE
An "off the shelf solution" that meets the most common requirements and minimises installation times. It offers an excellent cost to performance ratio.

EFFICIENCY
The new LBA nails have been tested according to ASTM F1575 for bending yield strength and ASTM D1761-20 for withdrawal resistance, delivering outstanding strength with a reduced number of fasteners.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



SERVICE CONDITION

DRY

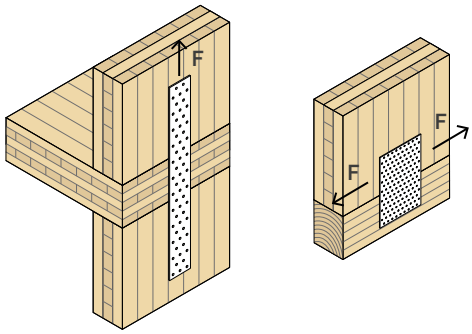
MATERIAL

S250 Z275 S250GD + Z275 carbon steel

THICKNESS [mm]

1,5 mm | 2,0 mm

EXTERNAL LOADS





FIELD OF USE

Tension joints with small to medium stresses through a simple and cost-effective solution. Timber-to-timber configuration.

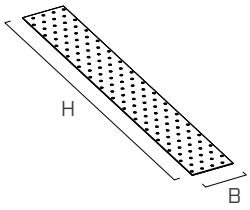
Can be applied to:
- solid timber and glulam
- timber frame
- CLT and LVL panels

CODES AND DIMENSIONS

LBV 1,5 mm

S250 Z275

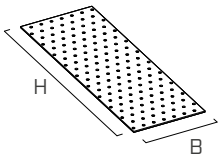
CODE	B [mm]	H [mm]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n Ø5 *n Ø0.20* [pcs]		pcs
LBV60600	60	600	1,5	*2 3/8*	*23 5/8*	*0.06*	75	●	10
LBV60800	60	800	1,5	*2 3/8*	*31 1/2*	*0.06*	100	●	10
LBV80600	80	600	1,5	*3 1/8*	*23 5/8*	*0.06*	105	●	10
LBV80800	80	800	1,5	*3 1/8*	*31 1/2*	*0.06*	140	●	10
LBV100800	100	800	1,5	*4*	*31 1/2*	*0.06*	180	●	10



LBV 2,0 mm

S250 Z275

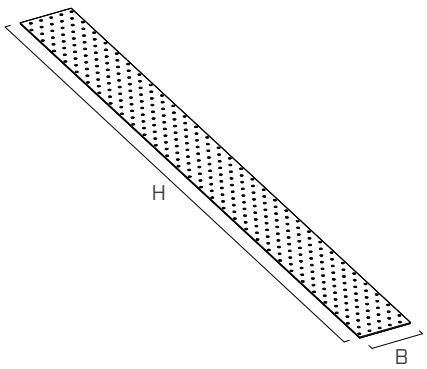
CODE	B [mm]	H [mm]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n Ø5 *n Ø0.20* [pcs]		pcs
LBV40120	40	120	2,0	*1 9/16*	*4 3/4*	*0.08*	9	●	200
LBV40160	40	160	2,0	*1 9/16*	*6 1/4*	*0.08*	12	●	50
LBV60140	60	140	2,0	*2 3/8*	*5 1/2*	*0.08*	18	●	50
LBV60200	60	200	2,0	*2 3/8*	*8*	*0.08*	25	●	100
LBV60240	60	240	2,0	*2 3/8*	*9 1/2*	*0.08*	30	●	100
LBV80200	80	200	2,0	*3 1/8*	*8*	*0.08*	35	●	50
LBV80240	80	240	2,0	*3 1/8*	*9 1/2*	*0.08*	42	●	50
LBV80300	80	300	2,0	*3 1/8*	*11 3/4*	*0.08*	53	●	50
LBV100140	100	140	2,0	*4*	*5 1/2*	*0.08*	32	●	50
LBV100200	100	200	2,0	*4*	*8*	*0.08*	45	●	50
LBV100240	100	240	2,0	*4*	*9 1/2*	*0.08*	54	●	50
LBV100300	100	300	2,0	*4*	*11 3/4*	*0.08*	68	●	50
LBV100400	100	400	2,0	*4*	*15 3/4*	*0.08*	90	●	20
LBV100500	100	500	2,0	*4*	*19 3/4*	*0.08*	112	●	20
LBV120200	120	200	2,0	*4 3/4*	*8*	*0.08*	55	●	50
LBV120240	120	240	2,0	*4 3/4*	*9 1/2*	*0.08*	66	●	50
LBV120300	120	300	2,0	*4 3/4*	*11 3/4*	*0.08*	83	●	50
LBV140400	140	400	2,0	*5 1/2*	*15 3/4*	*0.08*	130	●	15
LBV160400	160	400	2,0	*6 1/4*	*15 3/4*	*0.08*	150	●	15
LBV200300	200	300	2,0	*8*	*11 3/4*	*0.08*	142	●	15



LBV 2,0 x 1200 mm

S250 Z275

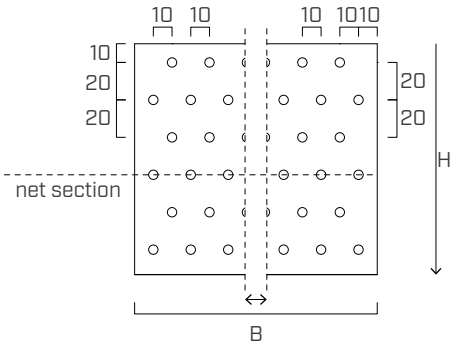
CODE	B [mm]	H [mm]	s [mm]	*B [in]*	*H [in]*	*s [in]*	n Ø5 *n Ø0.20* [pcs]		pcs
LBV401200	40	1200	2,0	*1 9/16*	*47 1/4*	*0.08*	90	●	20
LBV601200	60	1200	2,0	*2 3/8*	*47 1/4*	*0.08*	150	●	20
LBV801200	80	1200	2,0	*3 1/8*	*47 1/4*	*0.08*	210	●	20
LBV1001200	100	1200	2,0	*4*	*47 1/4*	*0.08*	270	●	10
LBV1201200	120	1200	2,0	*4 3/4*	*47 1/4*	*0.08*	330	●	10
LBV1401200	140	1200	2,0	*5 1/2*	*47 1/4*	*0.08*	390	●	10
LBV1601200	160	1200	2,0	*6 1/4*	*47 1/4*	*0.08*	450	●	10
LBV1801200	180	1200	2,0	*7 1/8*	*47 1/4*	*0.08*	510	●	10
LBV2001200	200	1200	2,0	*8*	*47 1/4*	*0.08*	570	●	5
LBV2201200	220	1200	2,0	*8 5/8*	*47 1/4*	*0.08*	630	●	5
LBV2401200	240	1200	2,0	*9 1/2*	*47 1/4*	*0.08*	690	●	5
LBV2601200	260	1200	2,0	*10 1/4*	*47 1/4*	*0.08*	750	●	5
LBV2801200	280	1200	2,0	*11*	*47 1/4*	*0.08*	810	●	5
LBV3001200	300	1200	2,0	*11 3/4*	*47 1/4*	*0.08*	870	●	5
LBV4001200	400	1200	2,0	*15 3/4*	*47 1/4*	*0.08*	1170	●	5



FASTENERS

type	description		d [mm]	support
LBA	high bond nail		4	
LBS	round head screw		5	

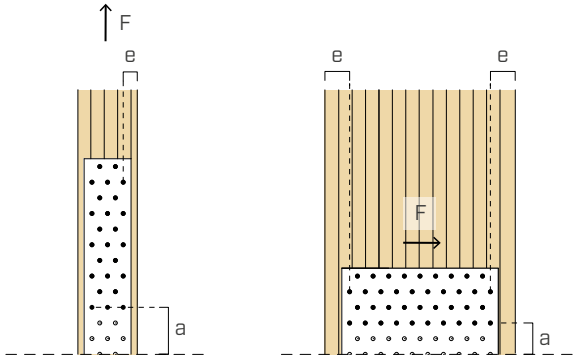
GEOMETRY



B	net area holes	B	net area holes	B	net area holes
[mm]	pcs	[mm]	[pcs]	[mm]	[pcs]
40	2	140	7	240	12
60	3	160	8	260	13
80	4	180	9	280	14
100	5	200	10	300	15
120	6	220	11	400	20

INSTALLATION

MINIMUM DISTANCES



Spruce-Pine-Fir and Northern Species			nail LBA Ø4	screw LBS Ø5
edge distance perpendicular to grain	**e**	[mm]	≥ 16	≥ 20
end distance parallel to grain	**a**	[mm]	≥ 48	≥ 60

Douglas Fir-Larch, Hem-Fir, and Western Red Cedar			nail LBA Ø4	screw LBS Ø5
edge distance perpendicular to grain	**e**	[mm]	≥ 20	≥ 25
end distance parallel to grain	**a**	[mm]	≥ 60	≥ 75

STRUCTURAL VALUES | TIMBER-TO-TIMBER | F

STRENGTH VALUES
CSA-S16 2024
CSA-O86 2024

STRENGTH OF THE SYSTEM

The tensile strength of the system (T_r) is the minimum between the $T_{r,steel}$ plate side tensile strength and the shear resistance of the connectors used for fastening $n_F \cdot N_r$.
If the connectors are placed in several consecutive rows and the load direction is parallel to the grain, the following design criteria must be applied.

$$T_r = min \begin{cases} T_{r,steel} \\ \Sigma (n_{Ri} \cdot n_{ci} \cdot N_r) \end{cases}$$

Where n_{Ri} is the number of fastener rows parallel to the grain, and n_{ci} is the number of fasteners in each row.

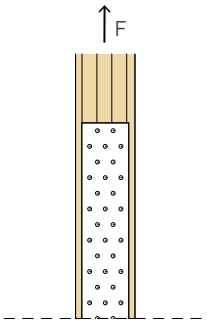


PLATE - TENSILE STRENGTH

type	B	s	net area holes	factored tensile resistance $T_{r,steel}$
	[mm]	[mm]	[pcs]	[kN]
LBV 1,5 mm	60	1,5	3	**12,3**
	80	1,5	4	**16,4**
	100	1,5	5	**20,5**
LBV 2,0 mm	40	2,0	2	**9,7**
	60	2,0	3	**16,4**
	80	2,0	4	**21,9**
	100	2,0	5	**27,3**
	120	2,0	6	**32,8**
	140	2,0	7	**38,3**
	160	2,0	8	**43,8**
	180	2,0	9	**49,2**
	200	2,0	10	**54,7**
	220	2,0	11	**60,2**
	240	2,0	12	**65,6**
	260	2,0	13	**71,1**
	280	2,0	14	**76,6**
	300	2,0	15	**82,0**
	400	2,0	20	**109,4**

CALCULATION EXAMPLE |TIMBER-TO-TIMBER JOINT

An example of the connection calculation can be found in the Canadian technical datasheet for LBB.

GENERAL PRINCIPLES

- The LBV plate is assumed to have a minimum specified yield strength (F_y) of 250 MPa and a minimum specified tensile strength (F_u) of 330 MPa.
- The factored tensile resistance of the steel is determined based on the tensile capacity of the governing net area of the steel plate.
- Dimensioning and verification of the timber elements must be carried out separately.
- It is recommended to place the connectors symmetrically with respect to the load direction.
- Minimum distances as per CSA-O86 2024 Clause 12.9.2.1.

SLOT

CONNECTOR FOR STRUCTURAL PANELS

VIDEO PATENTED DESIGN REGISTERED ETA-19/0167

MONOLITHIC PANEL
It allows very high stiff joints and can transfer exceptional shear stresses between the panels. Ideal for walls and floors.

TOLERANCE
The wedge shape makes the insertion easy into the groove. It is possible to increase the thickness of the routing cut to handle all kinds of tolerances using shims.

FAST INSTALLATION
Possibility of assembly with inclined auxiliary screws that make tightening between panels easy. The honeycomb geometry and lightweight aluminium ensure excellent performance: one connector can replace up to 60 Ø6 screws.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.

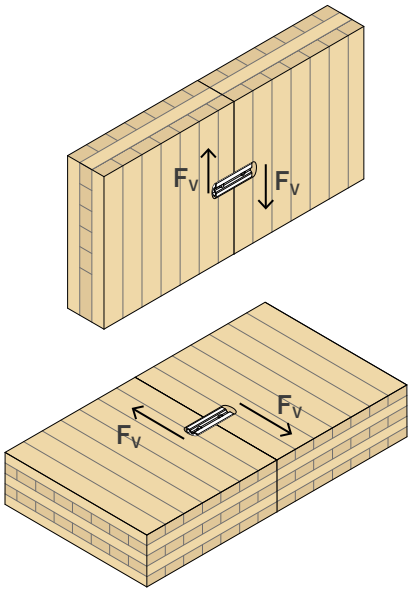


SERVICE CONDITION DRY

MATERIAL

alu 6005A EN AW-6005A aluminium alloy

EXTERNAL LOADS



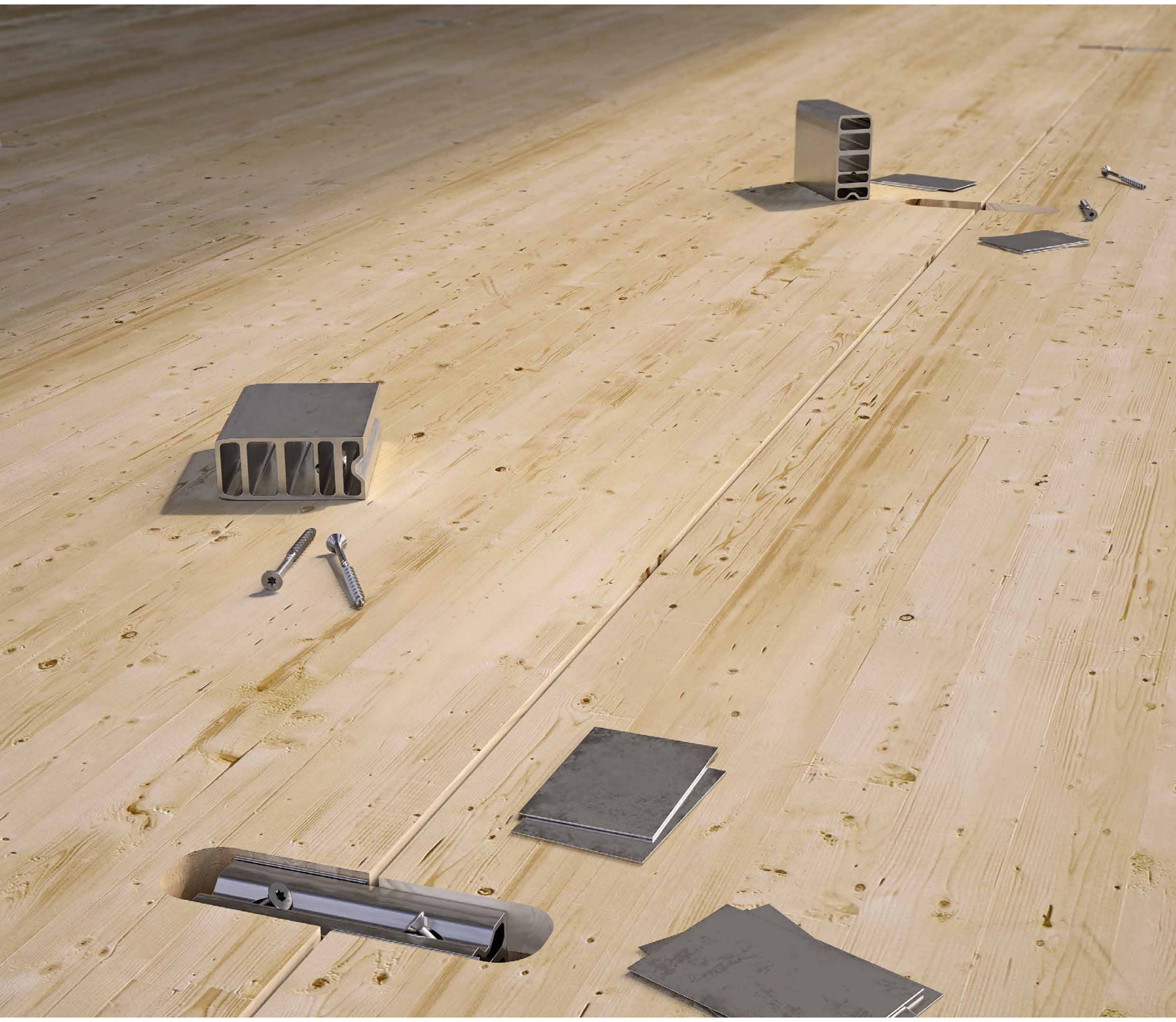
VIDEO
Scan the QR Code and watch the video on our YouTube channel

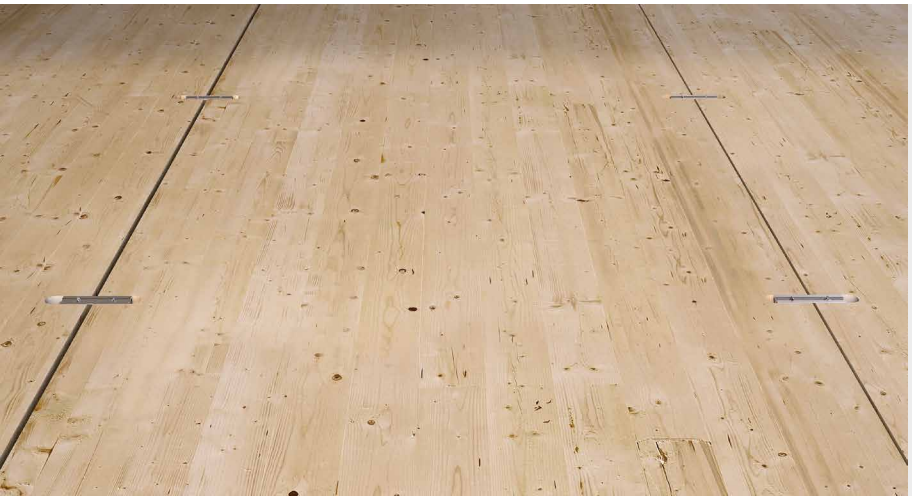


FIELDS OF USE

Panel-to-panel shear connections.
High-stiffness connections in rigid diaphragm floors or in multi-panel walls with monolithic behaviour.
The connector also serves as an installation tool to close the gap between panels.

Can be applied to:
- CLT, LVL or glulam panel floors and walls





MONOLITHIC BEHAVIOUR

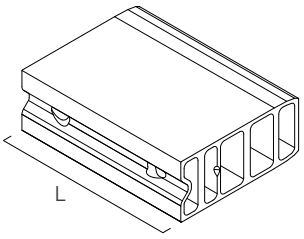
Ideal for panel wall and floor joints. It enables monolithic behaviour to be created between panels cut in the factory with small dimensions for transportation needs.

GLULAM, CLT, LVL

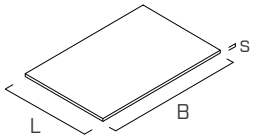
CE mark according to ETA. Values tested, certified and calculated also on glulam, CLT, LVL Softwood and LVL Hardwood.

CODES AND DIMENSIONS

CODE	L [mm]	*L* *[in]*	pcs
SLOT90	120	*4 3/4*	10



CODE	B [mm]	L [mm]	s [mm]	*B* *[in]*	*L* *[in]*	*s* *[in]*	pcs
SHIMS609005	89	60	0,5	*3 1/2*	*2 3/8*	*0.02*	100
SHIMS609010	89	60	1	*3 1/2*	*2 3/8*	*0.04*	50



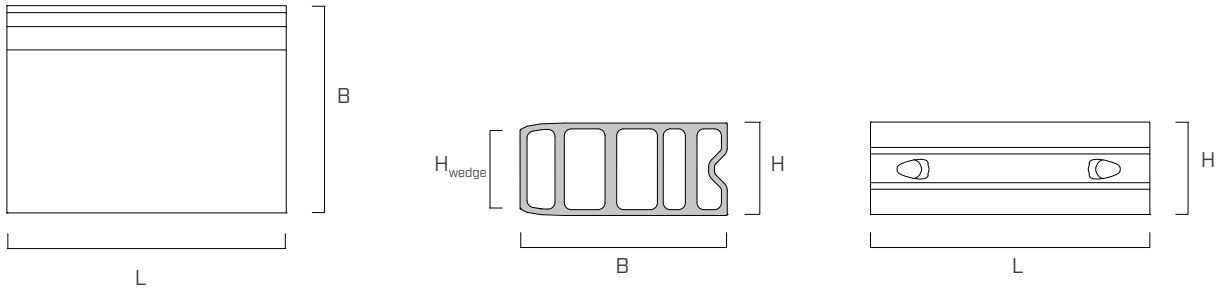
Material: bright zinc plated carbon steel

FASTENERS

type	description	d [mm]	L [mm]	support
HBS	countersunk screw	6	120	
HBS	countersunk screw	8	140	

For further details please see the "TIMBER SCREWS AND DECK FASTENING" catalogue.

GEOMETRY

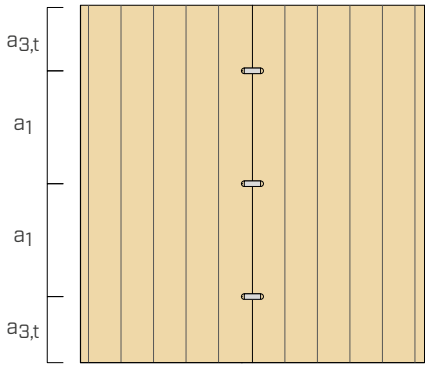


B [mm]	H [mm]	H_{wedge} [mm]	L [mm]	n_{screws} [pcs]
89	40	34	120	2

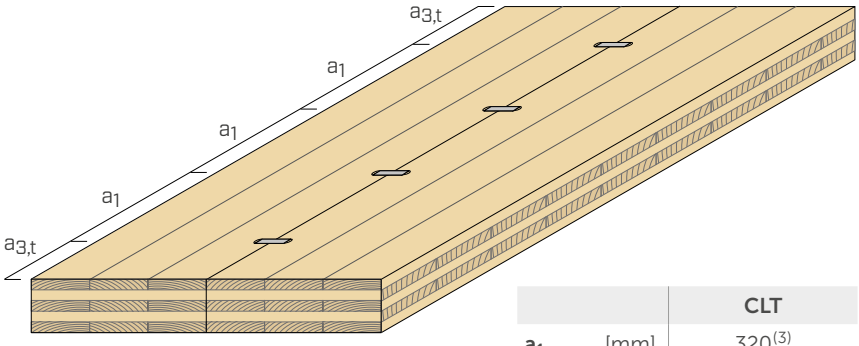
The screws are optional and not included in the package.

MINIMUM DISTANCES

SHEAR WALL



FLOOR SLAB

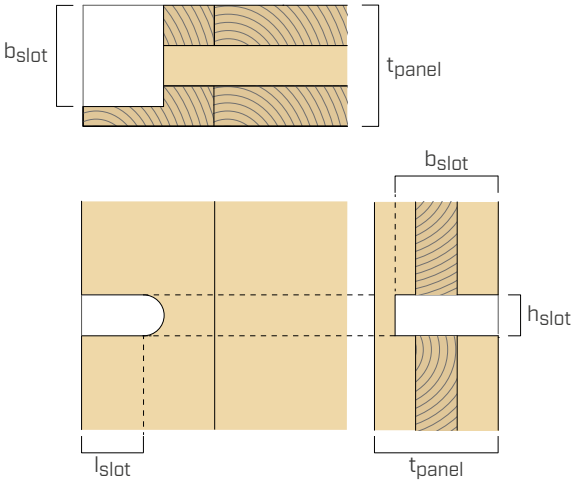


		CLT
a_1	[mm]	320(3)
$a_{3,t}$	[mm]	320(3)

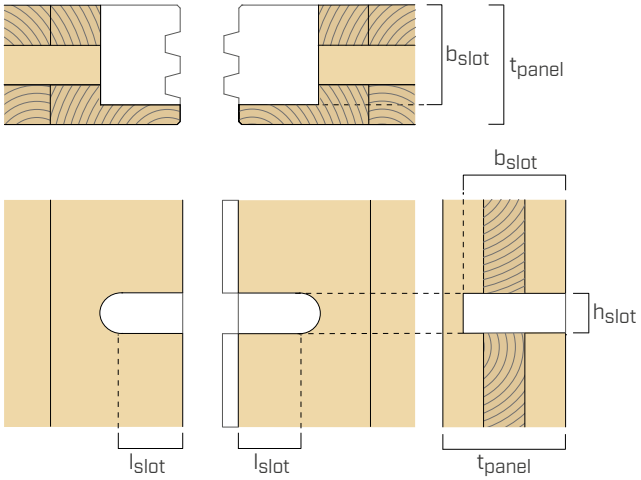
GEOMETRY

ROUTING IN THE PANEL

PANEL WITH FLAT EDGE



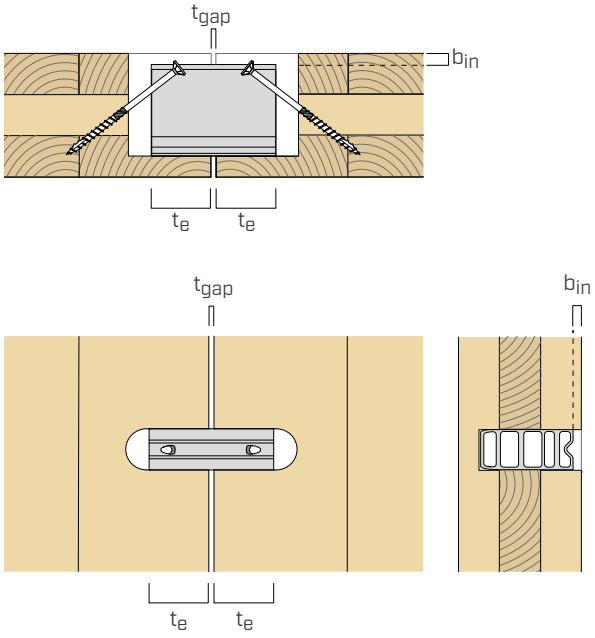
TONGUE-AND-GROOVE JOINT



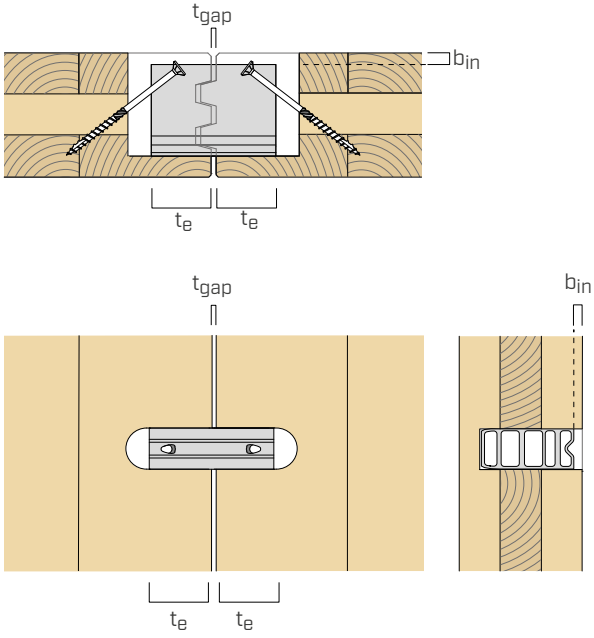
$b_{slot,min}$ [mm]	$l_{slot,min}$ [mm]	$t_{panel,min}$ [mm]	h_{slot} (1) [mm]
90	60	90	40,5

INSTALLATION

PANEL WITH FLAT EDGE



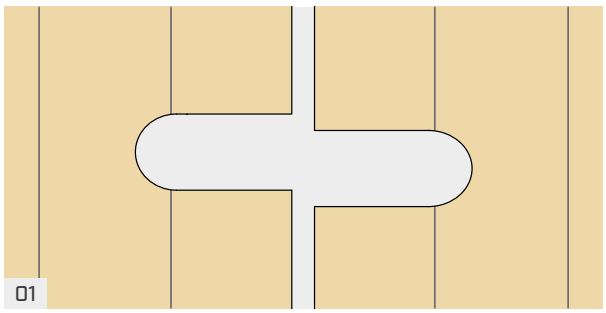
TONGUE-AND-GROOVE JOINT

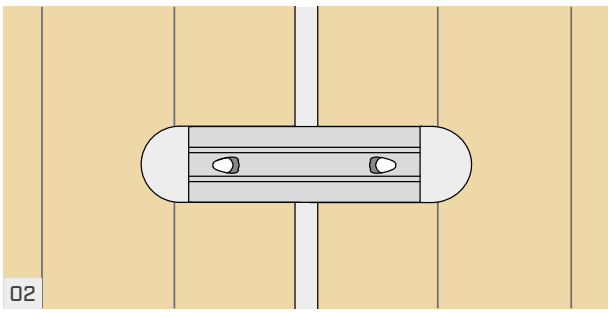


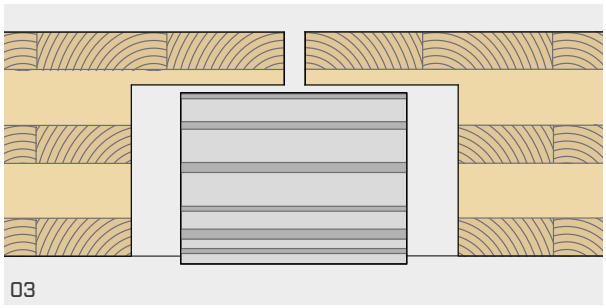
$t_{gap,max}$ (2) [mm]	$b_{in,max}$ [mm]	$t_{e,min}$ [mm]
5	t_{panel}-90 (5)	57,5

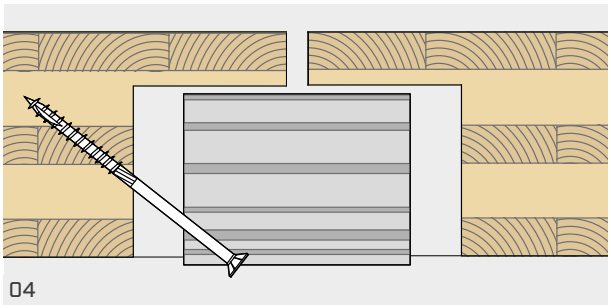
USE OF THE CONNECTOR AS ASSEMBLY EQUIPMENT

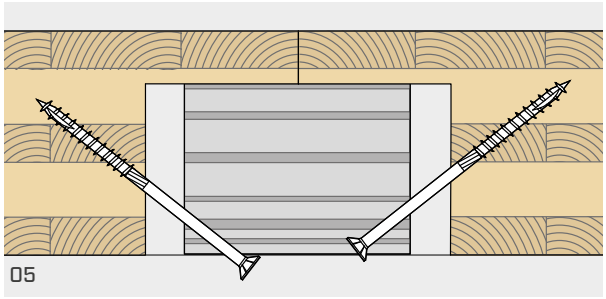
The connector can also be used as assembly equipment, thanks to its wedge shape and the presence of screws.

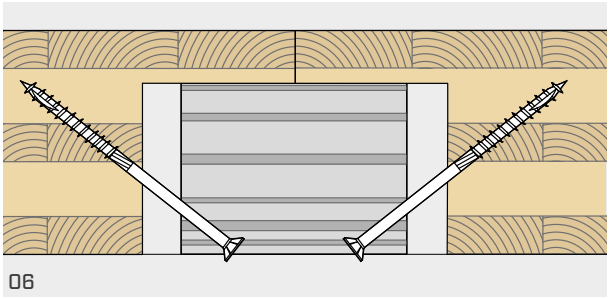










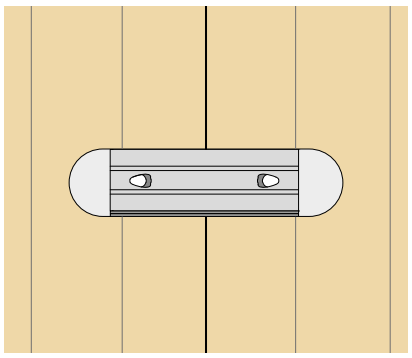


USE OF SHIM ACCESSORIES

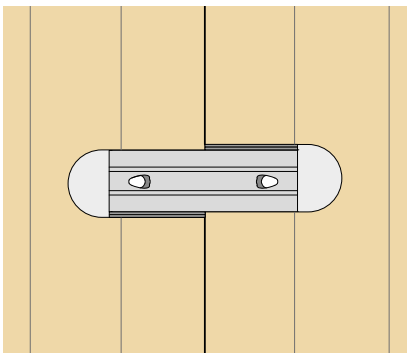
The connector is designed for a h_{slot} thickness of 40.5 mm but a different nominal h_{slot} size can be set. For example, by using an oversized routing, all tolerances in the connection can be compensated for:

- tolerance on total routing thickness h_{slot}.
- tolerance on the reciprocal positioning of the two grooves on the opposing panels.

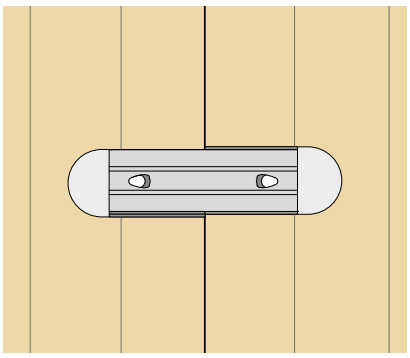
Depending on the actual situation on site, the different spacer models can be combined.



Spacers positioned on one side only, to compensate for the thickness of the routing.



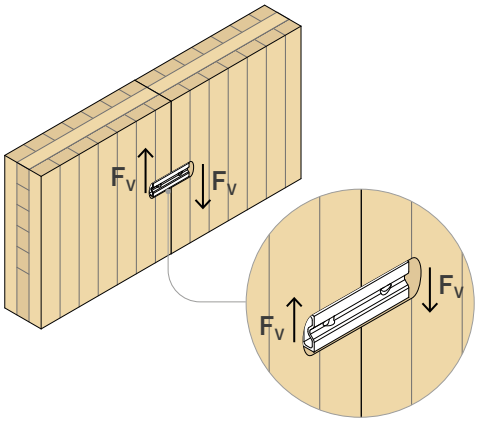
Spacers positioned on opposite sides, to compensate for a misalignment of the two grooves.

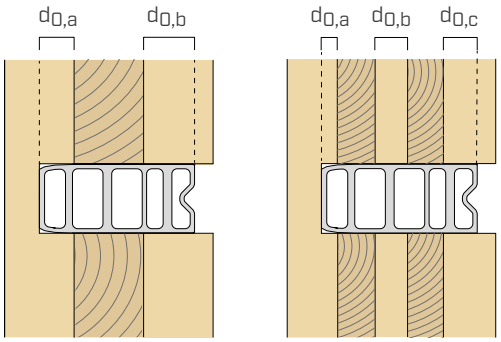


Combination of spacers for use in intermediate situations.

STRUCTURAL VALUES

CLT type	Accumulated layer thickness of CLT		Stress Grade	Layup	P_r [3][4] [kN]	k_{ser} [kN/mm]
CLT by ANSI/APA PRG 320-2018	Σd_0[mm]	54,0	E1	105, 175, 245, 315	24,0	18,5
		54,0	E2	105, 175, 245, 315	22,5	21,5
		54,0	E3	105, 175, 245, 315	18,8	15,8
		54,0	V1	105, 175, 245, 315	17,3	21,5
		54,0	V2	105, 175, 245, 315	14,4	18,5
CLT by Nordic structures	Σd_0[mm]	69,9	E1	89-3s, 143-5s, 197-7s	31,2	18,5
		54,0	E1	105-3s, 175-5s, 245-7s	24,1	18,5
		70,0	E1	213-7l, 245-7l, 267-9l	31,2	18,5





$$\Sigma d_0 = d_{0,a} + d_{0,b} + d_{0,c}$$

NOTES

(1) The h_{slot} thickness of 40.5 mm is to be regarded as indicative and depends on the precision of the specific machine used to cut the panels. When using the connector for the first time, it is recommended that 41.0 mm be grooved and to shim the joints, if any, using SHIM. For subsequent uses, it may be considered whether to reduce to 40.5 mm.

(2) The calculated values considered no gap between panels and a bearing width of 22 mm.

(3) For CLT e LVL with cross grain veneer, in case of installation with $a_1 < 480$ mm or $a_{3,t} < 480$ mm, the strength is reduced with a k_{a1} coefficient, as provided by ETA-19/0167.

$$k_{a1} = 1 - 0{,}001 \cdot \left(480 - min\left\{ a_1; a_{3,t} \right\}\right)$$

(4) All resistances are factored and according to CSA-O86 Clause 6.5.5 and refer to the axial resistance of the longitudinal layers. The product shall be used in dry service conditions. K_{Zc}=1.3, and K_D=1.15 (short term), other factors were all assumed to be equal to 1.0.

(5) The connector can be installed in any position within the panel thickness as long as the cumulative longitudinal layers in contact with the SLOT connector are the same as the tabulated values. The strength values are based on the surface mount installation where b_{in}=0.

GENERAL PRINCIPLES

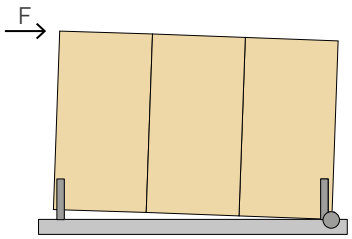
- The contact surface between the panels can be flat or "male-female" shaped, see the image in the INSTALLATION section.
- A minimum of two connectors must be used within one connection. The resistance is proportional to the number of slots with the same cumulative thickness.
- The connectors must be inserted with the same pull-through depth (t_e) into both elements to be fastened.
- The two inclined screws are optional and have no influence on the strength and stiffness calculation.
- The modulus of elasticity, E (MPa), and the compression parallel to the grain of the panels, f_c (MPa) were obtained from the CLT Nordic design guide and ANSI/PRG 320-2018 documents.
- Slip modulus according to ETA-19/0167. Density conversion values according to the Technical Design Guide Canada.

INTELLECTUAL PROPERTY

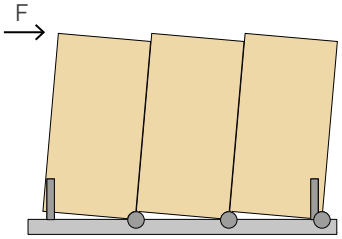
- The SLOT connector is protected by the following patents: EN102018000005662 | US11.274.436.
- It is also protected by the following Registered Community Designs: RCD 005844958-0001 | RCD 005844958-0002.

CLT MULTI-PANEL WALLS WITH HOLD-DOWN AT THE ENDS

SINGLE-WALL BEHAVIOUR



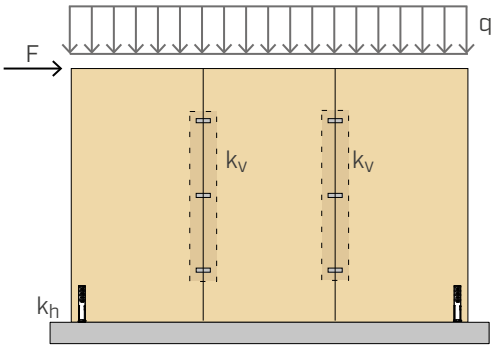
COUPLED PANEL BEHAVIOUR



There are two possible rotational behaviours of the multi-panel CLT wall, determined by multiple parameters. At equal conditions, it can be stated that the k_v/k_h stiffness ratio determines the rotational behaviour of the wall, where:

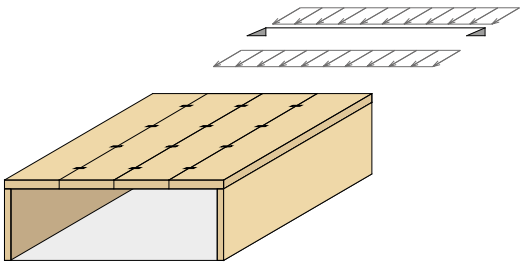
- k_v total shear stiffness of the connection between panels;
- k_h tensile strength of the hold-down.

At equal conditions, it can be stated that for high k_v/k_h values (i.e. for high k_v values) the kinematic behaviour of the wall tends to be similar to the single wall behaviour. This type of wall is much easier to design than a wall with coupled panel behaviour, due to the simplicity of modelling.



MULTIPANEL CLT FLOORS

The distribution of horizontal loads (earthquake or wind) from the floor to the lower walls depends on the stiffness of the floor in its own plane. A stiff floor allows the transmission of horizontal external loads to the underlying walls with diaphragm behaviour. The stiff diaphragm behaviour is much easier to design than a deformable floor in its own plane, due to the simplicity in the structural outline of the floor. In addition, many international seismic regulations, require the presence of a stiff diaphragm as a requirement to obtain the building plan regularity and therefore a better seismic response of the building.



THE ADVANTAGE OF HIGH STIFFNESS CERTIFIED BY TEST

The use of the SLOT connector, characterized by high stiffness and strength values, leads to undoubted advantages, both in the case of multi-panel CLT wall and in the case of the diaphragm floor. These strength and stiffness values are experimentally validated and are certified according to ETA-19/0167; this means that the designer is provided with certified, precise and reliable data.



F70

“T” SHAPED POST BASE

VIDEO

DESIGN REGISTERED

CE ETA-10/0422

PARTIAL INTERLOCKING
Bending moment resistant for partial bracing of canopies and shelters. Strength and stiffness values tested.

INVISIBLE
The internal knife plate is used to create a totally concealed joint. Designed to accommodate columns of all dimensions. Hot-dip galvanisation and aluminium versions ensure durability in outdoor settings.

TWO VERSIONS
Without holes, to be used with self-drilling dowels; with holes, to be used with smooth dowels or bolts.

ALUMIDI
For compression and shear stress, the ALUMIDI aluminium bracket can be used as a post base with SBD self-drilling dowels.

CANADIAN DESIGN VALUES
USA, EU and more design values available online.



SERVICE CONDITION WET

MATERIAL

S235 HDGS5 — **F70** versions **80**, **100**, **140**: carbon steel S235 with hot-dip galvanising 55 µm

S355 HDGS5 — **F70** versions **180** and **220**: S355 carbon steel with hot-dip galvanising 55 µm

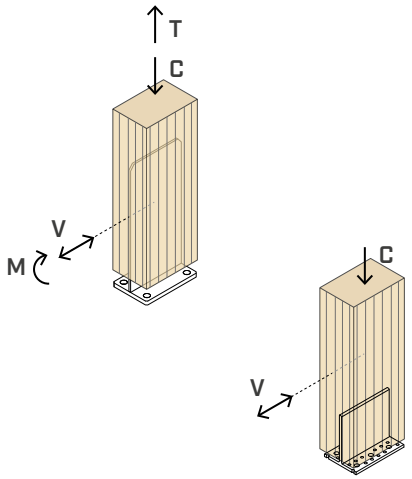
S235 HDG — **F70LIFT**: S235 hot dip bright zinc plated carbon steel

alu 6005A — **ALUMIDI**: EN AW-6005A° aluminium alloy

GROUND CLEARANCE

from 21 to 40 mm

EXTERNAL LOADS



VIDEO
Scan the QR Code and watch the video on our YouTube channel



FIELDS OF USE

Ground joints for moment-resistant columns in one direction.
Pergolas, carports, gazebos.

Suitable for columns in:
- solid timber softwood and hardwood
- Glulam, LVL



VERSATILE

It can be used not only as a post holder but also for the construction of cantilever beams (such as canopies, roofs, etc.).

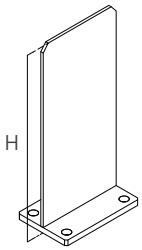
SPECIAL STRUCTURES

By means of a tension plate and a compression plate, it is possible to produce joints for large glulam columns.

CODES AND DIMENSIONS

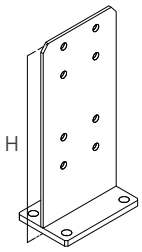
F70

CODE	H	bottom plate	base holes	knife plate thickness	pcs
	[mm] *[in]*	[mm] *[in]*	[n. x mm] *[n. x in]*	[mm] *[in]*	
F7080	156 *6 1/8*	80 x 80 x 6 *3 1/8 x 3 1/8 x 0.24*	4 x Ø9 *4 x Ø0.35*	4 *0.16*	1
F70100	206 *8 1/8*	100 x 100 x 6 *4 x 4 x 0.24*	4 x Ø9 *4 x Ø0.35*	6 *0.24*	1
F70140	308 *12 1/8*	140 x 140 x 8 *5 1/2 x 5 1/2 x 0.31*	4 x Ø11,5 *4 x Ø0.45*	8 *0.31*	1
F70180	400 *15 3/4*	180 x 120 x 12 *7 1/8 x 4 3/4 x 0.47*	4 x Ø18 *4 x Ø0.71*	6 *0.24*	1
F70220	400 *15 3/4*	220 x 140 x 15 *8 5/8 x 5 1/2 x 0.59*	4 x Ø18 *4 x Ø0.71*	6 *0.24*	1



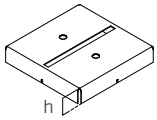
F70 L

CODE	H	bottom plate	base holes	knife plate thickness	knife plate hole	pcs
	[mm] *[in]*	[mm] *[in]*	[n. x mm] *[n. x in]*	[mm] *[in]*	[n. x mm] *[n. x in]*	
F70100L	206 *8 1/8*	100 x 100 x 6 *4 x 4 x 0.24*	4 x Ø9 *4 x Ø0.35*	6 *0.24*	4 x Ø13 *4 x Ø0.51*	1
F70140L	308 *12 1/8*	140 x 140 x 8 *5 1/2 x 5 1/2 x 0.31*	4 x Ø11,5 *4 x Ø0.45*	8 *0.31*	6 x Ø13 *6 x Ø0.51*	1
F70180L	400 *15 3/4*	180 x 120 x 12 *7 1/8 x 4 3/4 x 0.47*	4 x Ø18 *4 x Ø0.71*	6 *0.24*	8 x Ø13 *8 x Ø0.51*	1
F70220L	400 *15 3/4*	220 x 140 x 15 *8 5/8 x 5 1/2 x 0.59*	4 x Ø18 *4 x Ø0.71*	6 *0.24*	12 x Ø13 *12 x Ø0.51*	1



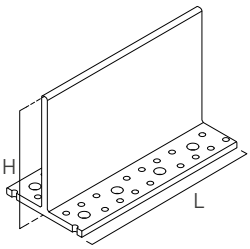
F70 LIFT

CODE	h	plate	thickness	suitable for	pcs
	[mm] *[in]*	[mm] *[in]*	[mm] *[in]*		
LIFT44	25 *1*	89 x 89 *3 1/2 x 3 1/2*	3 *0.12*	F7080	1
F70100LIFT	20 *13/16*	120 x 120 *4 3/4 x 4 3/4*	2 *0.08*	F70100-F70100L	1
LIFT66	25 *1*	136 x 136 *5 3/8 x 5 3/8*	3 *0.12*	F70100-F70100L	1
F70140LIFT	22 *7/8*	160 x 160 *6 1/4 x 6 1/4*	2 *0.08*	F70140-F70140L	1
LIFT88	25 *1*	184 x 184 *7 1/4 x 7 1/4*	3 *0.12*	F70140-F70140L	1

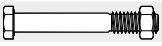
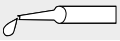
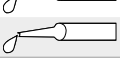


ALUMIDI

CODE	H		type	L		pcs
	[mm]	*[in]*		[mm]	*[in]*	
ALUMIDI80	109,4	*4 5/16*	without holes	80	*3 1/8*	25
ALUMIDI120	109,4	*4 5/16*	without holes	120	*4 3/4*	25
ALUMIDI160	109,4	*4 5/16*	without holes	160	*6 1/4*	25
ALUMIDI200	109,4	*4 5/16*	without holes	200	*8*	15
ALUMIDI240	109,4	*4 5/16*	without holes	240	*9 1/2*	15

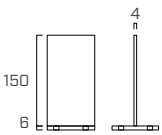


FASTENERS

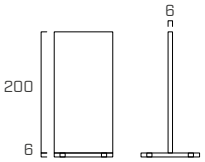
type	description		d [mm]	support
LBS	round head screw		5	
SBD	self-drilling dowel		7,5	
STA	smooth dowel		12	
KOS/KOT	hexagonal/round head bolt		M12	
SKR/SKR EVO	screw-in anchor		7,5 - 8 - 10 - 16	
AB1	CE1 expansion anchor		M10 - M16	
ABE A4	CE1 expansion anchor		M8 - M10	
VIN-FIX	vinyl ester chemical anchor		M8 - M10 - M16	
HYB-FIX	hybrid chemical anchor		M8 - M10 - M16	
EPO-FIX	epoxy chemical anchor		M8 - M10 - M16	

GEOMETRY

F7080



F70100



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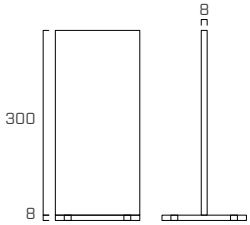
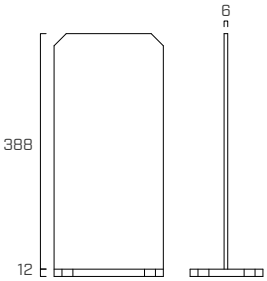
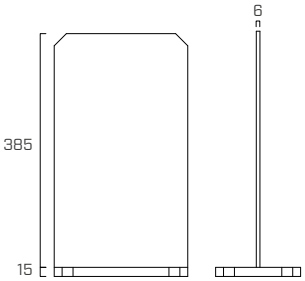
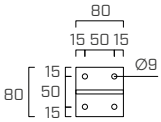


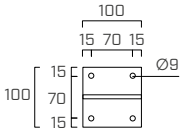
F70180

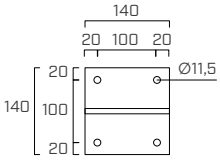


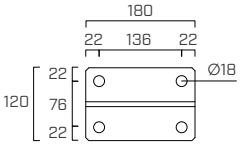
F70220

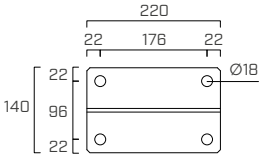












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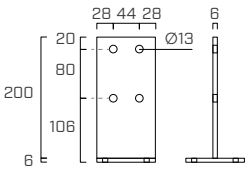

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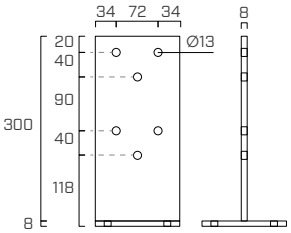

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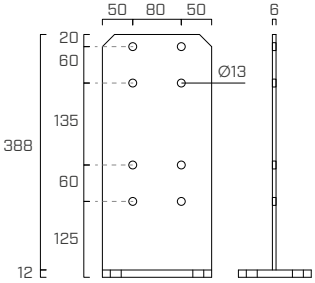

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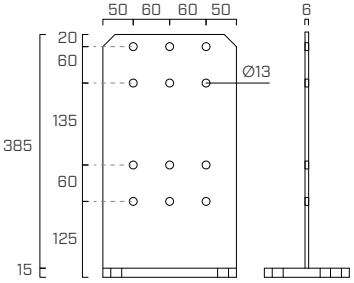
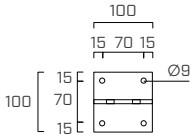
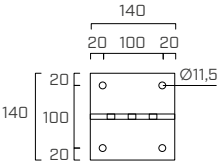
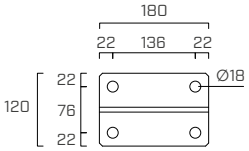
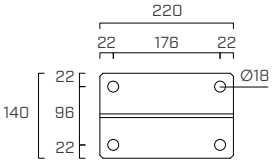


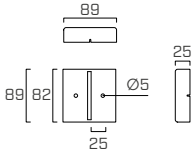




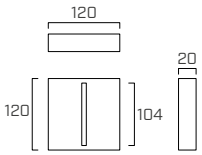




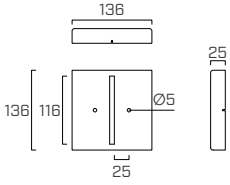
LIFT44



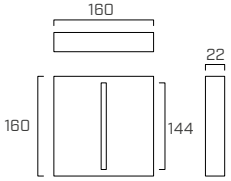
F70100LIFT



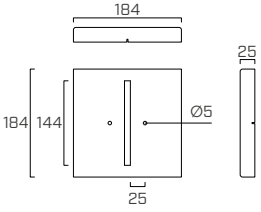
LIFT66



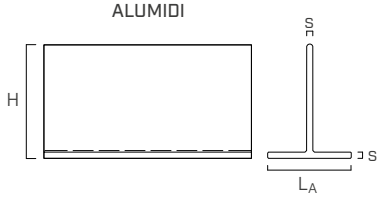
F70140LIFT

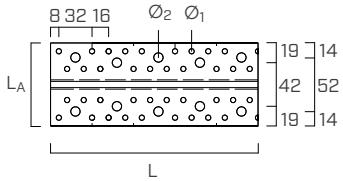


LIFT88



ALUMIDI



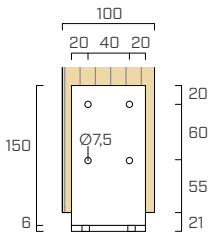


ALUMIDI			
thickness	**s**	[mm]	6
flange width	**L_A**	[mm]	80
height	**H**	[mm]	109,4
small flange-holes	**$Ø_1$**	[mm]	5,0
large flange-holes	**$Ø_2$**	[mm]	9,0

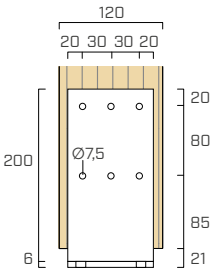
FASTENING CONFIGURATIONS

F70 WITH SBD SELF-DRILLING DOWELS

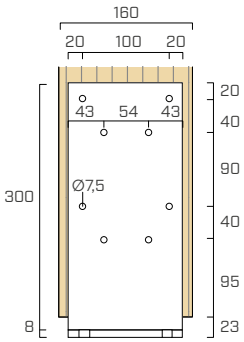
F7080



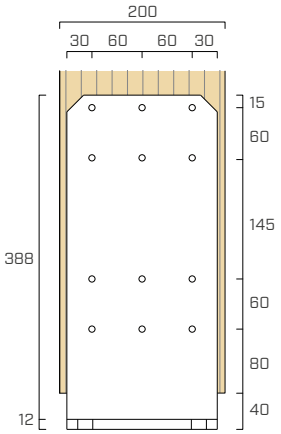
F70100



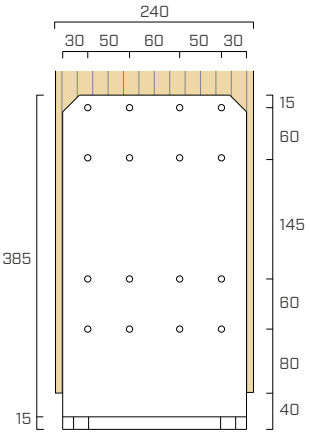
F70140



F70180

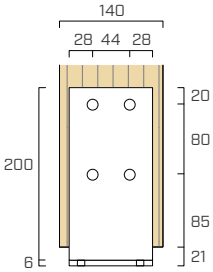


F70220

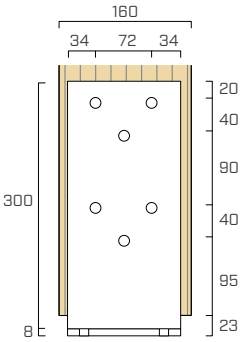


F70 WITH STA SMOOTH DOWELS OR BOLTS

F70100L



F70140L



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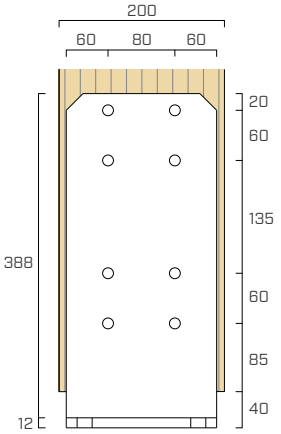
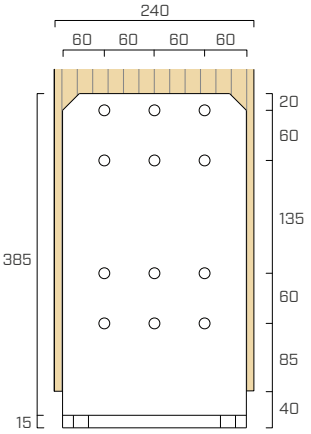
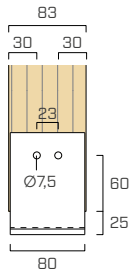


F70220L



ALUMIDI WITH SBD SELF-DRILLING DOWELS

ALUMIDI80



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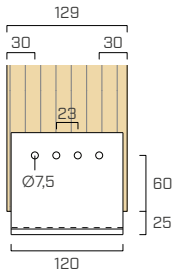

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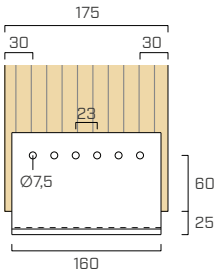
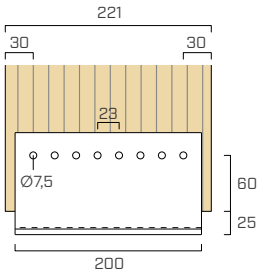
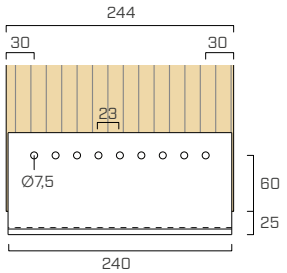
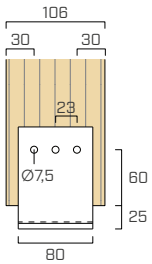


ALUMIDI200



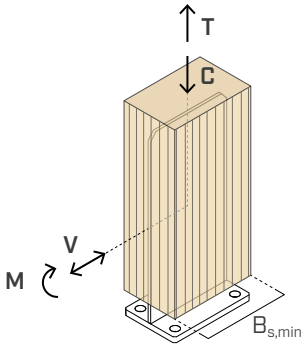
ALUMIDI240

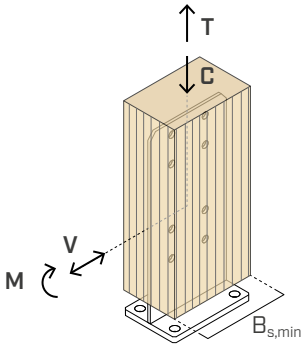




STRUCTURAL VALUES | F70

STRENGTH VALUES
CSA-O86 2019
CSA-S16 2014





F70

CODE	fasteners for timber SBD Ø7,5[1]	column $B_{s,min}$	COMPRESSION		TENSION		SHEAR		MOMENT	
	pcs - Ø x L [mm]	[mm]	$C_{r,timber}$[3] [kN]	$C_{r,steel}$[4] [kN]	$T_{r,timber}$[3] [kN]	$T_{r,steel}$ [kN]	$V_{r,timber}$ [kN]	$V_{r,steel}$[5] [kN]	$M_{r,timber}$[3][6] [kNm]	$M_{r,steel}$[7] [kNm]
F7080	4-Ø7,5x75	100x100	**20,5**	**30,7**	**14,7**	**24,4**	**9,1**	**4,7**	**0,4**	**0,5**
F70100	6-Ø7,5x95	120x120	**32,0**	**60,3**	**37,7**	**21,8**	**13,4**	**13,7**	**0,7**	**2,0**
F70140	8-Ø7,5x115	160x160	**47,1**	**122,2**	**64,1**	**37,9**	**23,2**	**17,2**	**1,3**	**3,5**
F70180	12-Ø7,5x155	160x200	**91,5**	**110,7**	**103,8**	**217,9**	**36,6**	**25,7**	**2,5**	**6,5**
F70220	16-Ø7,5x175	200x240	**121,0**	**141,6**	**155,4**	**318,9**	**51,6**	**45,1**	**4,1**	**11,4**

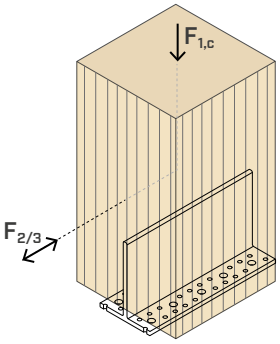
F70 L

CODE	fasteners for timber STA Ø12[2]	column $B_{s,min}$	COMPRESSION		TENSION		SHEAR		MOMENT	
	pcs - Ø x L [mm]	[mm]	$C_{r,timber}$[3] [kN]	$C_{r,steel}$[4] [kN]	$T_{r,timber}$[3] [kN]	$T_{r,steel}$ [kN]	$V_{r,timber}$ [kN]	$V_{r,steel}$[5] [kN]	$M_{r,timber}$[3][6] [kNm]	$M_{r,steel}$[7] [kNm]
F70100L	4-Ø12x120	140x140	**32,3**	**60,3**	**39,1**	**21,8**	**18,0**	**13,7**	**0,8**	**2,0**
F70140L	6-Ø12x140	160x160	**55,7**	**139,7**	**75,4**	**37,9**	**26,2**	**16,7**	**1,5**	**3,5**
F70180L	8-Ø12x160	160x200	**90,1**	**102,8**	**79,7**	**217,9**	**32,2**	**25,7**	**2,5**	**6,5**
F70220L	12-Ø12x180	200x240	**132,4**	**131,4**	**135,2**	**314,6**	**45,2**	**45,1**	**4,5**	**11,4**

STIFFNESS

CODE	fasteners for timber	configuration pcs - Ø [mm]	$K_{2/3,ser}$ [kNm/rad]
F70100	SBD	6 - Ø7,5	60
F70140		8 - Ø7,5	190
F70180		12 - Ø7,5	640
F70220		16 - Ø7,5	900
F70100L	STA	4 - Ø12	50
F70140L		6 - Ø12	190
F70180L		8 - Ø12	580
F70220L		12 - Ø12	700

NOTES and GENERAL PRINCIPLES on page 390.



				COMPRESSION
CODE	L	fasteners for timber SBD Ø7,5[1]	column $B_{s,min}$	$C_{r,\ timber}$[3]
	[mm]	pcs - Ø x L [mm]	[mm]	[kN]
ALUMIDI80	80	2-Ø7,5x75	83	**6,4**
ALUMIDI80	80	3-Ø7,5x95	106	**10,4**
ALUMIDI120	120	4-Ø7,5x115	129	**15,1**
ALUMIDI160	160	6-Ø7,5x155	175	**26,2**
ALUMIDI200	200	8-Ø7,5x195	221	**39,4**
ALUMIDI240	240	9-Ø7,5x235	244	**48,3**

				SHEAR
CODE	L	fasteners for timber SBD Ø7,5[1]	column $B_{s,min}$	$V_{r,\ timber}$
	[mm]	pcs - Ø x L [mm]	[mm]	[kN]
ALUMIDI80	80	2-Ø7,5x75	83	**7,0**
ALUMIDI80	80	3-Ø7,5x95	106	**11,6**
ALUMIDI120	120	4-Ø7,5x115	129	**18,6**
ALUMIDI160	160	6-Ø7,5x155	175	**31,7**
ALUMIDI200	200	8-Ø7,5x195	221	**46,1**
ALUMIDI240	240	9-Ø7,5x235	244	**56,2**

NOTES

(1) SBD Ø7,5, F_{yb}= 1034.2 MPa. Bending yield strength has been tested and evaluated in accordance with ASTM F1575 and ICC-ES Acceptance Criteria AC233.

(2) STA smooth dowel Ø12, F_{yb}= 275.8 MPa. Bending yield strength has been tested and evaluated in accordance with ASTM F1575 and ICC-ES Acceptance Criteria AC233.

(3) The effective length is L - 15 mm for SBD L ≥ 95 mm, and L - 8 mm for SBD with L ≤ 75 mm. For STA, L_{eff} = L. The embedment length is calculated using the following equation: $t_1 = (L_{eff} - t_2 - t_{mill})/2$ where L_{eff} is the effective length of the dowel, t_2 is the thickness of the steel plate, and t_{mill} is the thickness of the milled cut in the wood section, 2 mm was considered for the tabulated values.

(4) A milling of 2 mm has been considered to facilitate the escape of steel residues when drilling with SBD. This tolerance is also assumed to provide lateral restraint against buckling within the timber section. However, this assumption should be verified on a project-by-project basis, considering actual tolerances.

(5) The lateral force on the steel plate was calculated by considering the shear force applied at the center of the dowel group, which leads to a bending moment on the bottom plate.

(6) The moment capacities were calculated by introducing eccentricity to the axial compression failure mode. Eccentricity was calculated based on the assumption of e = d/6 + L/500. Where L is the length of the knife plate and d is the depth of the column. Values need to be recalculated for each real project using the actual length of compressive members.

(7) Moment resistance values are based on results obtained from the testing campaign.

GENERAL PRINCIPLES

- The calculations provided adhere to engineering design principles and comply with CSA 086-19 and CSA S16-14 standards. The timber resistance values reflect the minimum of the ductile and brittle failure modes, while the steel values indicate the governing capacity among the plate, weld, and dowel bearing.
- Timber can be used in both dry and wet service conditions according to CSA-O86. The listed values were calculated considering all factors (K_D=K_{SF}=K_T=K_{Sv}=K_{St}) to be equal to 1.0.
- The governing factored capacity between the timber and steel should be taken in the final design.
- Glulam (Douglas Fir-Larch 16c-E) with G = 0.49 were used for the timber sections. Steel (S235) for F70 versions 80, 100, and 140, and steel (S355) for F70 versions 180 and 220 were used in the calculated values.
- A fitting tolerance of 2 mm was used for the dowel holes in the timber section, and a 1 mm tolerance was applied for the steel holes on the knife plate.
- To prevent splitting and ensure load transfer occurs solely through the dowel, it is recommended to maintain a minimum gap of 15 mm between the top of the knife plate and the timber.
- The strength values indicated in the table are valid in compliance with the fasteners positioning and the timber column according to the configurations indicated.
- The moment and shear strength values are calculated individually not taking into account the stabilizing contributions, if any, deriving from the compressive stress that influence the overall strength of the connection. In case of combined loading the verification must be carried out separately. Refer to ETA-10/0422 (F70) and ETA-09/0361 (ALUMIDI).
- Dimensioning and verification of timber and concrete elements must be carried out separately.

INTELLECTUAL PROPERTY

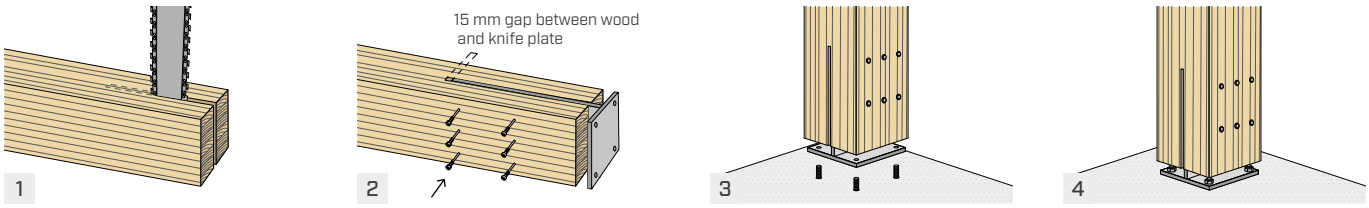
- Some models of F70 post bases are protected by the following Registered Community Designs:
  - RCD 015032190-0014;
  - RCD 015032190-0015.

UK CONSTRUCTION PRODUCT EVALUATION

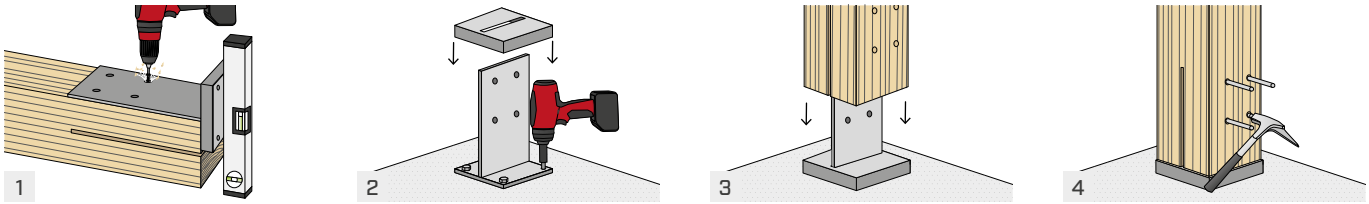
- UKTA-0836-22/6374.

MOUNTING

F70 or ALUMIDI with SBD self-drilling dowels

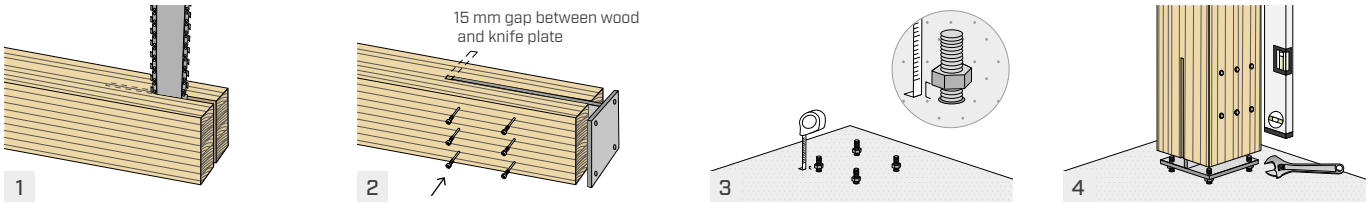


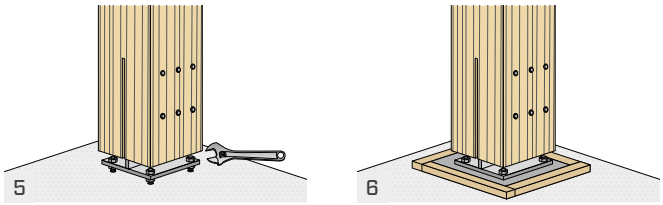
F70 L with STA dowels



ASSEMBLY WITH POSSIBILITY OF ADJUSTMENT

As an alternative to classic positioning, it is possible to assemble the product by leveling it as follows:





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Publication date: 10/2026

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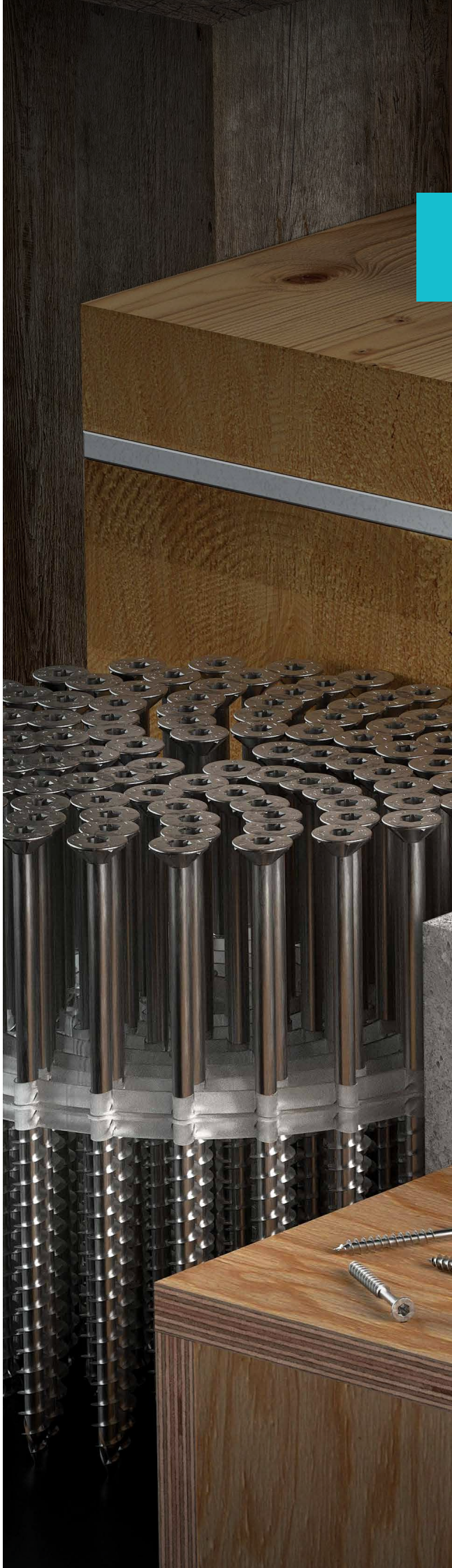

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