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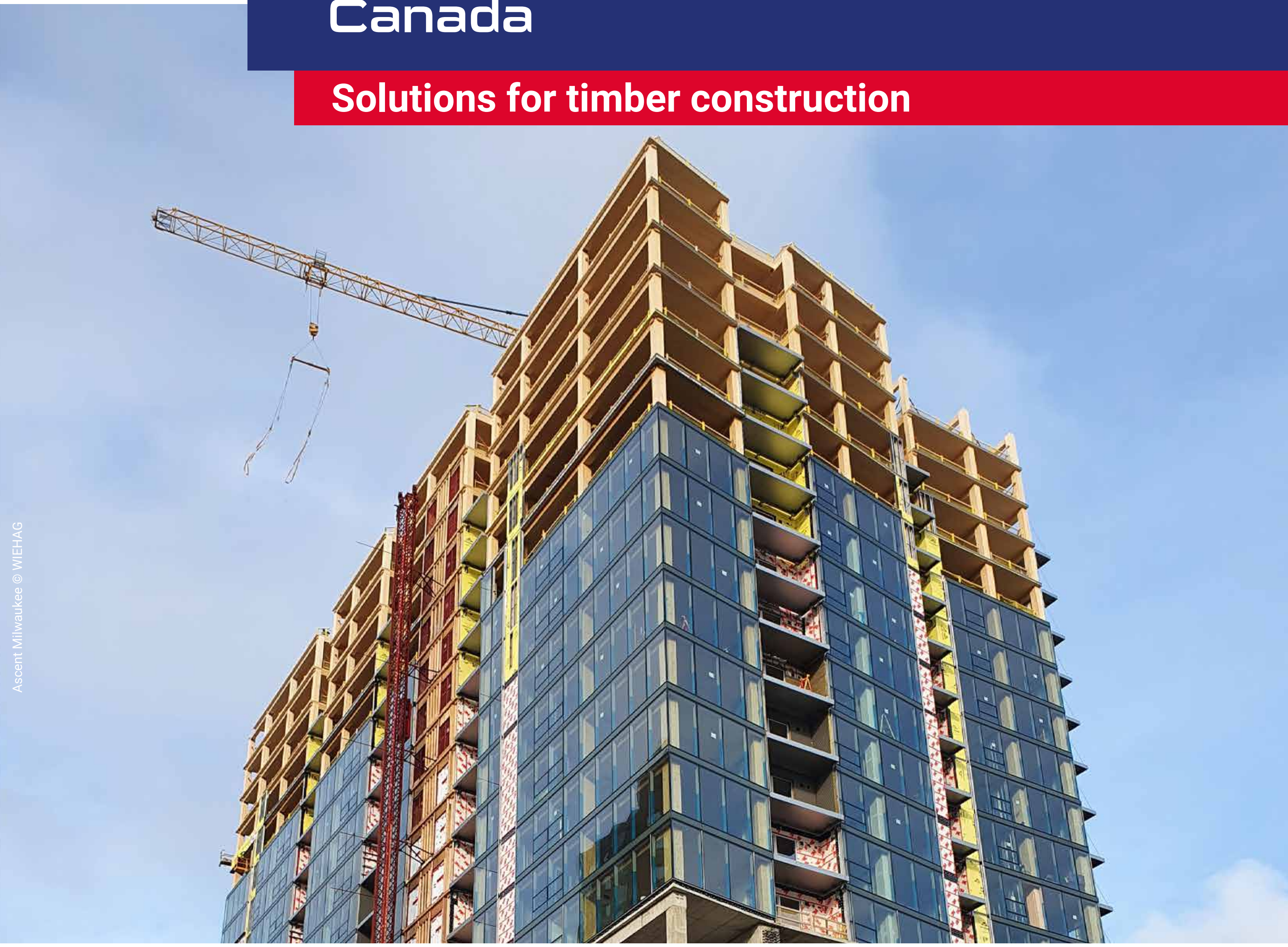
Design Guide
Canada

Solutions for timber construction



Disclaimer

All included contributions and illustrations in this document are for general information purposes. Schmid Schrauben Hainfeld aims to provide the information correctly, completely and in line with state-of-the-art design methods. This document provides the user with several information for RAPID® Wood-drilling Screws only. It is the responsibility of the user to evaluate if what listed in this document is applicable to the specific design case. However, Schmid Schrauben Hainfeld doesn't assume any liability for the content of this document and cannot give warranties of any kind, neither for any direct or consequentially loss or damage caused by mistakes in the design. Reliance on the content of this document and references to the same are strictly at the user's risk. Please contact the authors with any feedback in case of errors or new findings.

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About us

With more than 180 years of experience in Austria, Schmid Schrauben Hainfeld is one of Europe's technology leaders in screw production and fastening solution.
Originally founded as a nail and scythe factory, the potential of wood construction screws was recognized early on. Today, we produce high-tech screws for timber constructions with around 150 employees. Compared to conventional wood screws our self-tapping RAPID® screws are optimized in material properties and geometry. We offer a high performing fastener and reliable product, which is based on our profound knowledge of the forging trade. Building of all shapes and sizes are build with screws of Schmid Schrauben Hainfeld and confirm the high quality and durability.
Our mission and vision drive us to always deliver the best solutions and push the boundaries of what is possible in fastening technology. With focus on innovation, quality and sustainability, we are ready to actively shape the future and are a reliable partner for our worldwide customers from timber construction industry, timber design engineers and qualified handcraft.

Approvals:

Z-9.1-435

Our self-tapping screws received our first German national technical approval in 1999.

ETA CE

We switched to the European Technical Approval system (ETA-12/0373) in 2012.

ICC ES

Our RAPID® screws have been ICC-ES certified (ESR-4549) since 2023.

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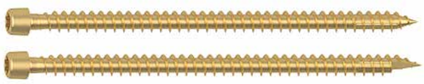


References

Safety & sustainability

Photo © Rubner Holzbau Fotograf Alexander Maria Lohmann

RAPID® screws

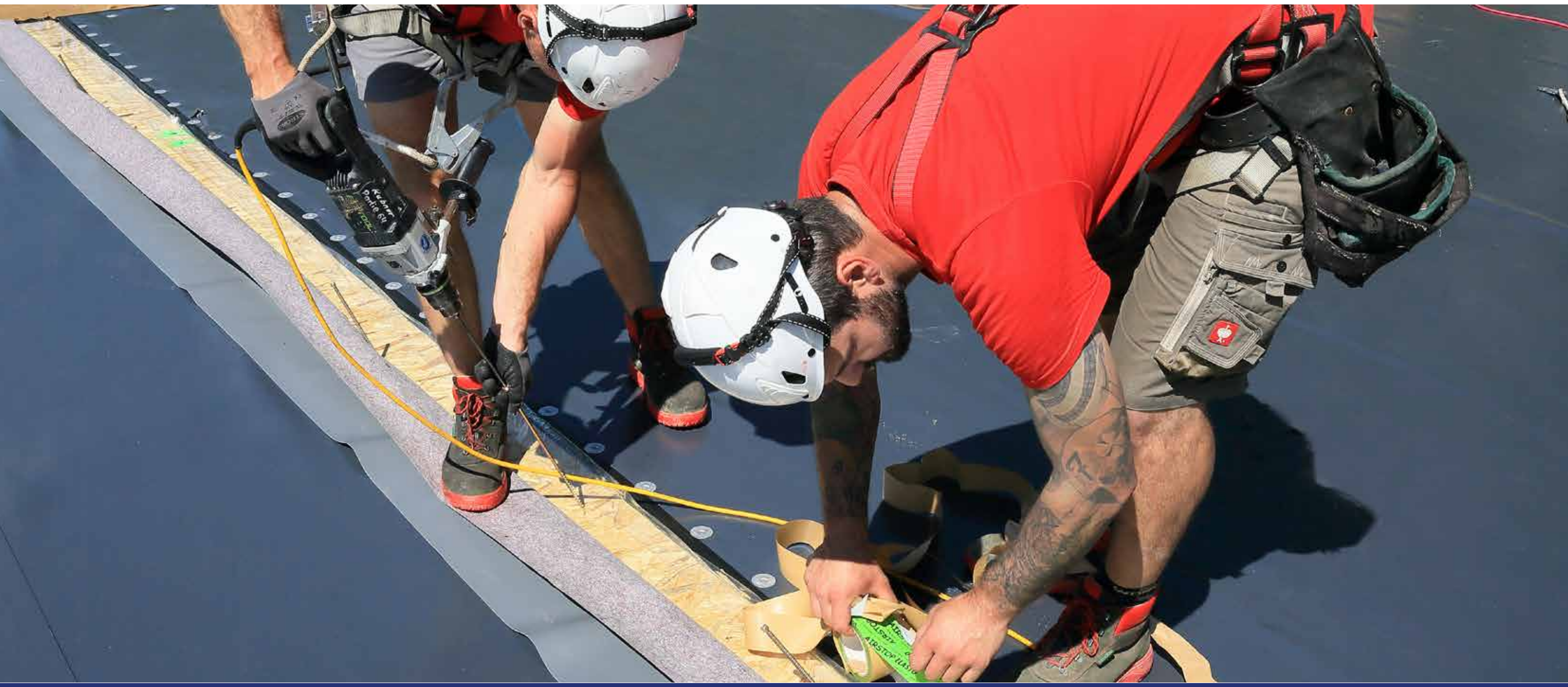
Application of self-tapping and self-drilling RAPID® screws

RAPID® wood drilling screws are self-drilling and self-tapping screws, which can be used to connect or reinforce structural wood elements and wood product elements, as well as connecting these structural elements with steel assemblies.
RAPID® screws are applied according to installation instructions, arrangement conditions and design provision according to CSA O86:2024 and European Technical Approval ETA-12/0373:2022. The latter provides several additional design notes and proposals for special applications, e.g. screws as reinforcement of the timber, fastening of thermal insulation on top of rafters, bending beams and columns under flexible jointing and more.Their application in agreement with Canadian constructions rules and standards is on the responsibility of the professionals and designers. Make sure to review the latest version published.

Application instructions

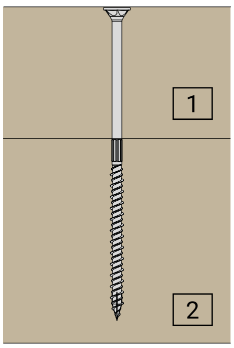
RAPID® screws can be driven into wood and wood based products without pre-drilling or in pre-drilled holes with a diameter not exceeding the inner thread diameter d_R .
For long self-tapping RAPID® screws or screws close to edge or end-grain a positioning hole of approximately five times the diameter ($5d_F$) may lead to greater precisions. Positioning holes do not count as pre-drilled. Ensuring equal loading of all screws in a connection is essential. In general, for all connections—and particularly for steel-to-timber connections—uniform screw insertion is required. A torque controlled application may be necessary. Thereby, the insertion moment must be less than the characteristic torsional strength of the screws, for corresponding values see ETA-12/0373:2022. Usually, in timber constructions insertion moments of 70 % to 80 % of the characteristic tortional strength are applied. The following table shows the torque settings that can be applied to the screwdriver for each screw size. These values are provided as guidelines and recommendations.

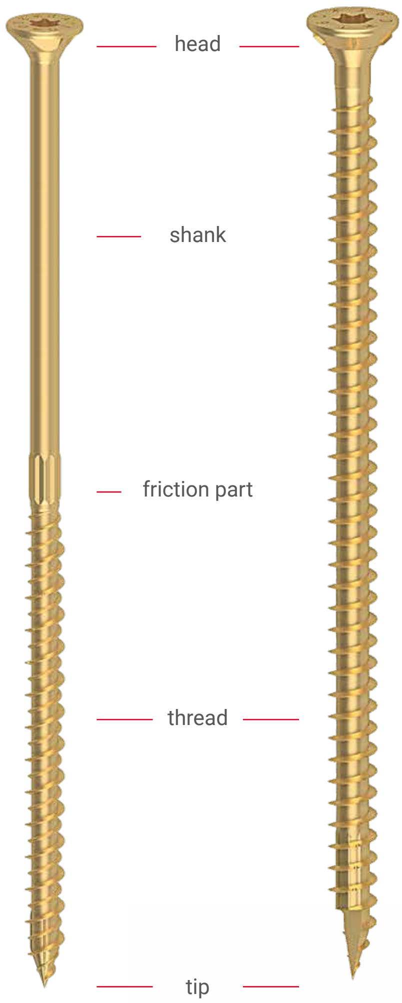
d_F	**approximate torque**
6 mm (1/4“)	8 Nm
8 mm (5/16“)	20 Nm
10 mm (3/8“)	40 Nm
12 mm (1/2“)	50 Nm



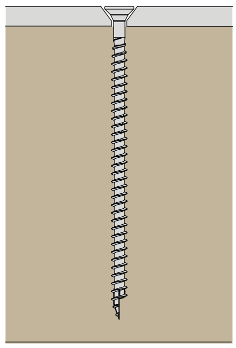
Partial thread vs fullthread

RAPID® partial thread
Partially threaded screws enable a stable connection of two components. The thread must be completely in the lower component (2). Partially thread screws pulls the upper component (1) onto the lower component (2) during the screwing-in process. In case of axial loading the head pull-through and thread pull-out (withdrawal) shall be considered.





RAPID® fullthread
Fully threaded screws are used for versatile connection types. In structural steel-to-wood or wood-to-wood connections the screws are applied perpendicular to the surface or inclined, designated as active fasteners. To reinforce timber element capacity the screws are applied as passive fastener to increase tension or compression perpendicular to grain resistance at transverse connections, openings and more.



T-drive

The T-drive is screwed on with standard T-bits (or TX bits).
The T-drive is the standard commercial designation for a hexalobular internal driving feature. Thanks to the six-star profile, it can distribute high torques evenly over the six sides of the drive and transmit them without additional contact pressure. Further advantages of the T-drive compared to the cross recess, for example, are:

> longer service life (this applies to both the bit and the drive in the screw)
> more precise screwing possible (even at low speeds)
> lower probability of slipping
> automatic screwdriving systems can be used.

RAPID® screws

Head style

90° countersunk head with milling pockets

- > Milling pockets reduce tearing and splitting in the wood.
- > Sinks the head mills completely into the wood
- > Fits well in steel chamfers holes, without damaging the surface.

90° countersunk head with milling ribs

- > The ribs ensure optimum countersinking in the wood.
- > Reduce tearing and splitting in the wood.
- > Can be used in steel chamfers holes.

Washer head

- > Highest permissible head pull-through values allow high force transmission and ensure stable and strong connections.
- > No additional washers required, therefore faster and cheaper processing.

SuperSenkFix head

- > Innovative combination of countersunk head and washer head.
- > Clean and flush countersinking in connections with high head pull-through values – optimal for visible screwed connections.
- > Fits perfect in steel holes thanks to the shoulder under head.

Dual head

- > The external hexagon enables high force transmission during screw fastening, even with an impact driver (avoid hard screwdriving).
- > Using the T-drive saves time when screwing different screws.
- > Fits perfect in steel holes thanks to the shoulder under head.

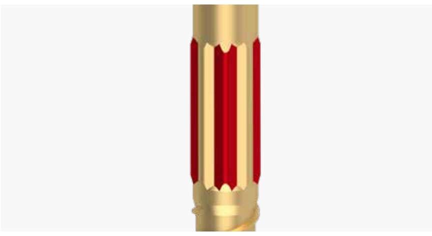
Cylinder head

- > The small head allows very deep countersinking in wood (use long bits) - good for visible connections.
- > Minimize splitting effect of the wood.
- > Not suitable for metal-to-wood connections.

Photo © Timberframing, Frans Masereel Centrum

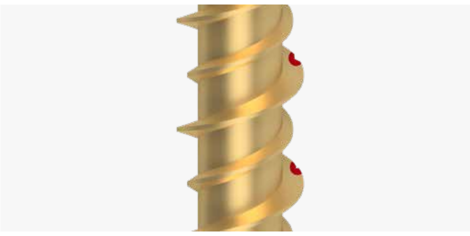
Special features

Friction part (compressing)



- > The straight friction part compacts the wood so that the smooth shank is exposed and does not rub.
- > Reduction of the screw-in torque, saves energy and time.

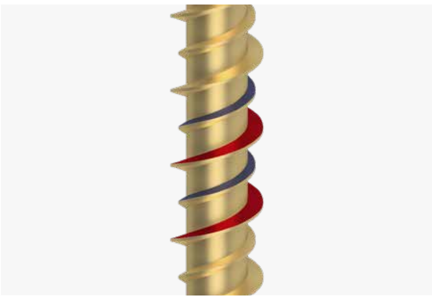
Cutting groove



- > All thread types are equipped with a cutting groove.
- > It cuts the wood fibers and thus reduces the screw-in torque.

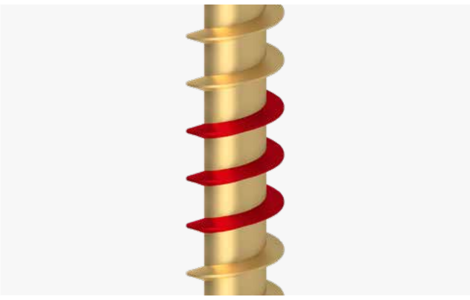
Thread

HiLo thread



- > Is a double thread in which one flank is lower.
- > The high thread pitch enables very fast screwing in, saves time - compared to conventional wood construction screws.
- > The high structural properties guarantee a secure hold, even for oblique and cross grained wood screw connections.

Single thread



- > Provides constant low screw-in torques.
- > Excellent withdrawal values and high tensile strength.
- > These highest structural properties even under compressive stress, are ideal for reinforcements.

RAPID® screws

Tips

All tip types for RAPID® screws are patented and all these tips are also self-drilling and self-tapping. This means that the wood does not have to be pre-drilled, but it may be pre-drilled.

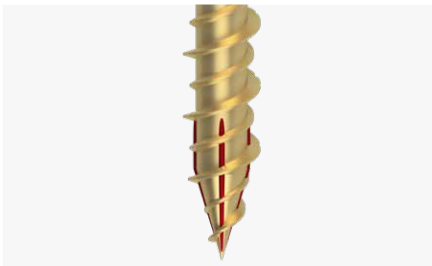
Exceptions are species with a high risk of splitting, such as Cedar, where we recommend pre-drilling.

The different tips were developed to reduce the biting time and the screwing torque as well as to minimize the splitting effect.

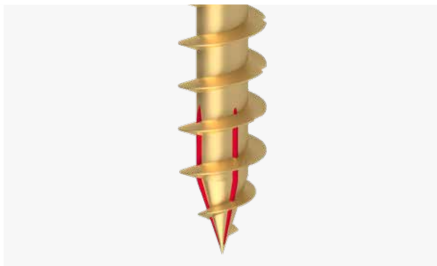
They have much less splitting and lower screw-in resistance compared to conventional wood construction screws.

Extra advantage with the half tip: no warping in the wood, the screw remains in the desired screw line.

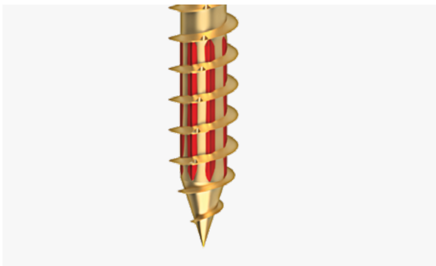
Tip with ridged core and HiLo thread
(compressor option 2)



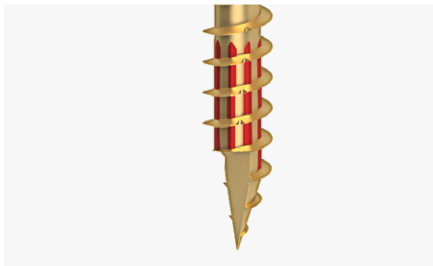
Tip with ridged core and single thread
(compressor option 2)

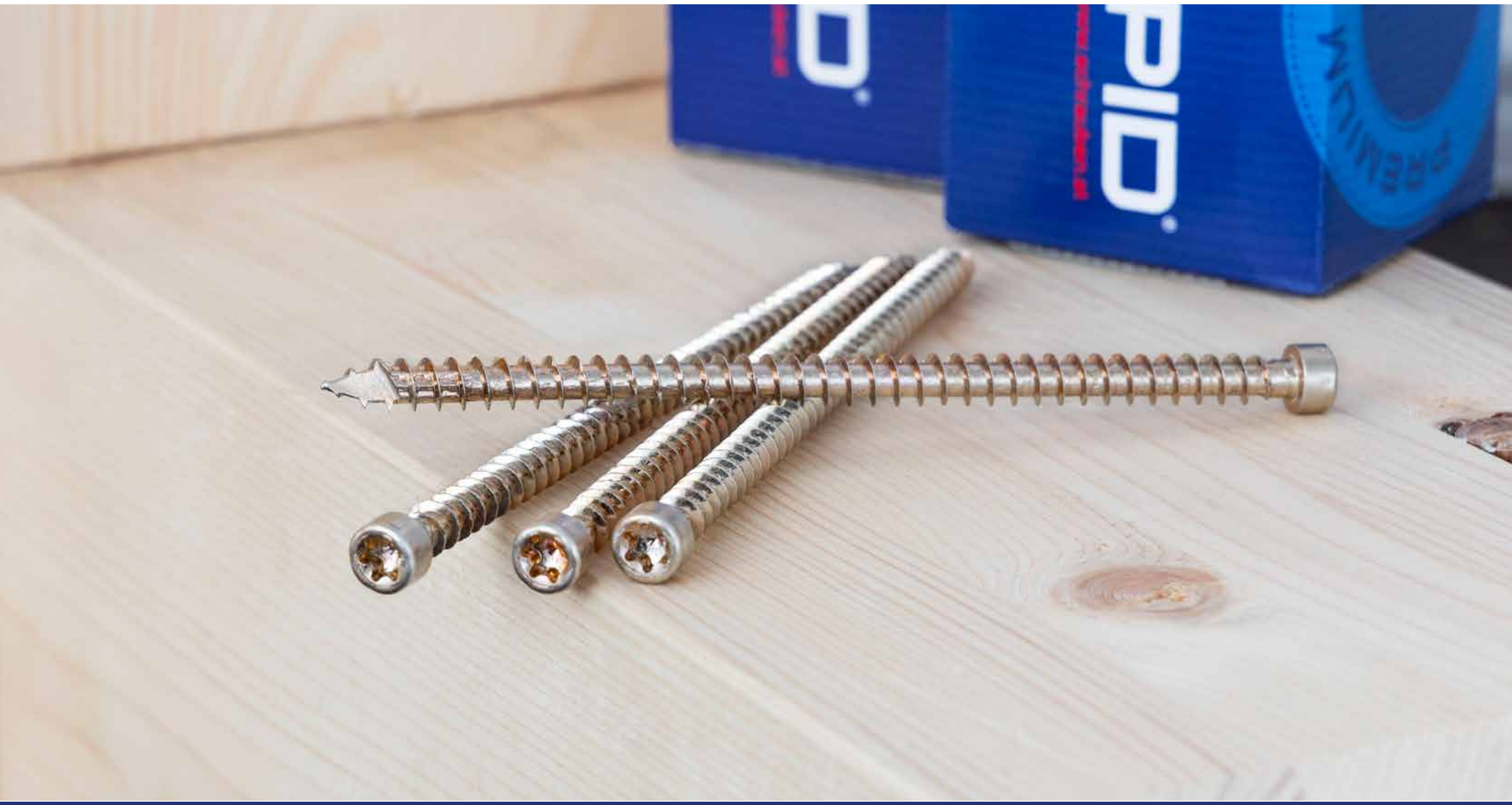


Full tip with compressor and single thread
(compressor option 1)

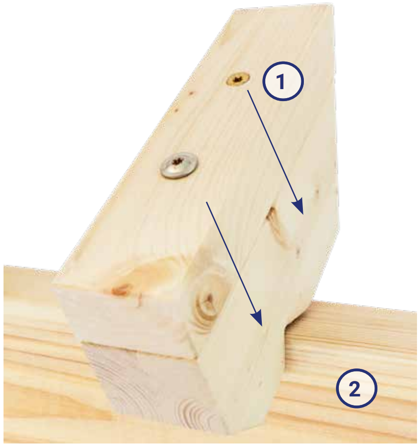


Half tip (HSP) with compressor and single thread
(compressor option 1)





Applications RAPID® partial thread



DOUBLING RAFTERS (1)
The doubling to reinforce the rafter is usually carried out on the top or side of the rafter. RAPID® countersunk head is used here, which can be effortlessly recessed.

RAFTERS (2)
Partial thread screws, eg. RAPID® washer head, transfer the wind suction load and shear forces to the substructure through the screw heads.

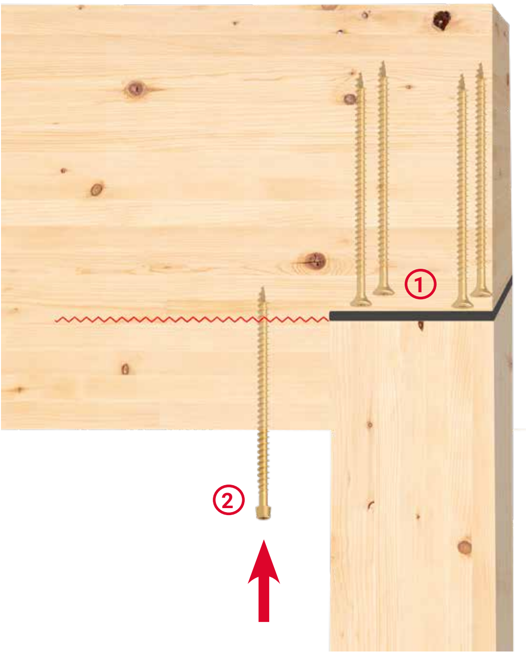
METAL PLATES AND SHAPED SHEET METAL PARTS
RAPID® Dual - and RAPID® SuperSenkFix screws are optimal for metal plates and shaped sheet metal parts.
These screws have an underhead shoulder which allows them to be optimally centred and to fit perfectly in the metal.

CLT WALLS AND FLOORS
RAPID® screws are approved according to ETA-12/0373:2022 for application generally in side and end grain (0° and 90°), as well as for in side face and narrow edge of Cross-Laminated-Timber (CLT). Therefore RAPID® screws, especially the RAPID® SuperSenkFix, are ideal to connect wall and floor CLT panels.

Corner and wall screw connections are pulled tightly together and securely screwed with RAPID® SuperSenkFix.

Photos © Baumturm Ruegen, Die Erlebnis Akademie AG

Applications RAPID® fullthread

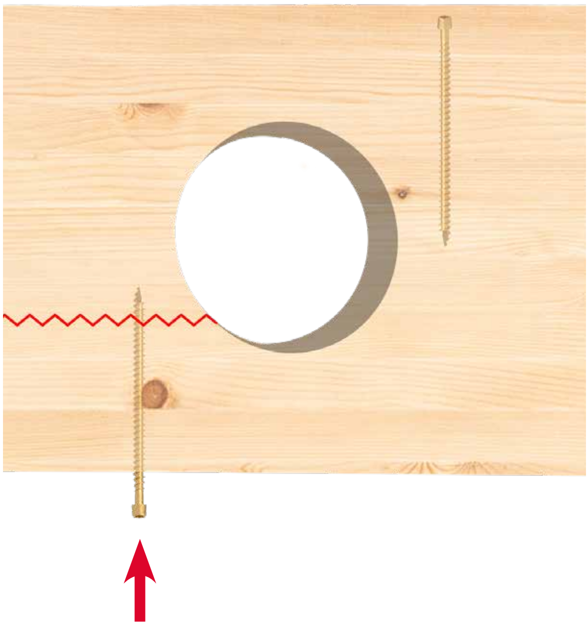


BEARING REINFORCEMENT WITH STEEL PLATE AND FULLTHREAD SCREWS (1)

RAPID® fullthread screws transfer the support load from the timber section directly to the steel plate through the screw heads. They distribute the force evenly into the end grain of the support.

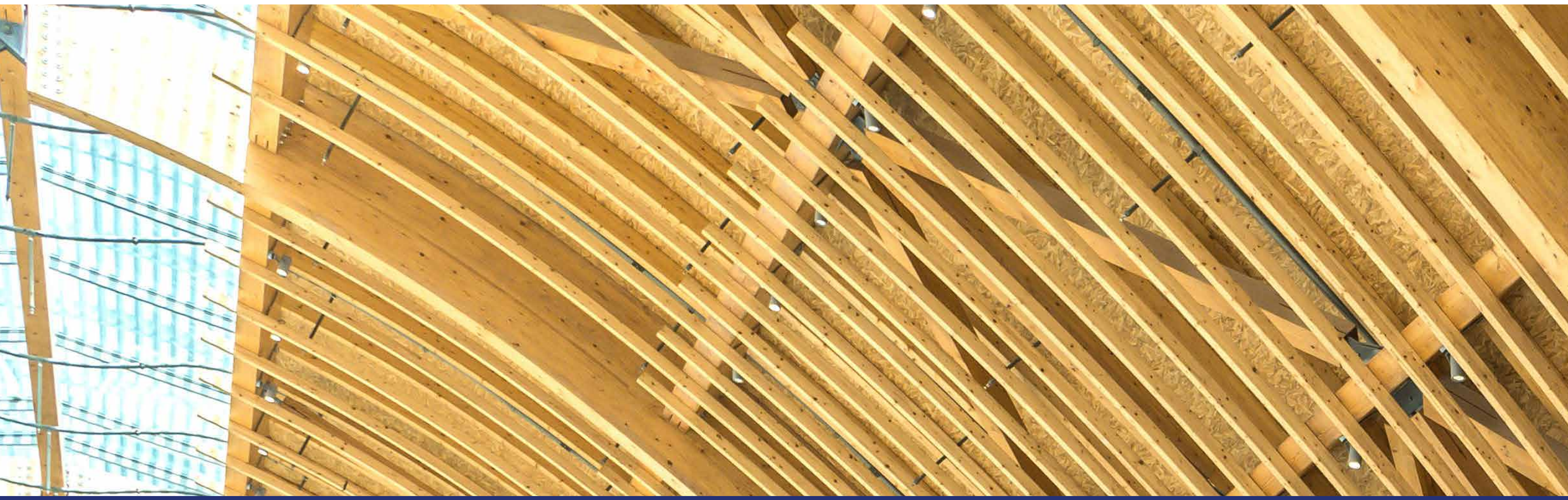
TRANSVERSE TENSILE REINFORCEMENT FOR NOTCHING (2)

The structural engineer must review the requirement. If the transverse tensile load is too high for the timber section, RAPID® fullthread screws will be used to reinforce and secure the beam to prevent splitting along the red line area.



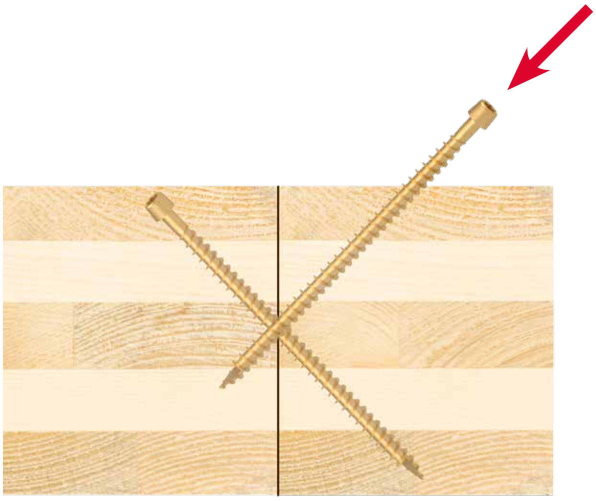
REINFORCEMENT OF OPENINGS WITH LONG FULLTHREAD SCREWS

The area marked in red indicates the risk of cracking. Aiming the same thread length above and below this mark increases the beam resistance.
The advantage of RAPID® fullthread screws with cylinder head is, that with using a long bit the screw heads can be sunken for an optimal positioning.



CROSS LAMINATED TIMBER (IN PLANE JOINT)
RAPID® fullthread cylinderhead are used to create a shear-resistant screwing pattern for cross laminated timber panels.

TIP: the connection should first be pulled tightly together using e.g., partial thread screws or a beam puller.
The pitch of the screws should be oriented in the direction of the main load.



CONNECTIONS AT THE BASE POINT OF THE SUPPORT
RAPID® fullthread screws with a countersunk head are best suited for this application. Shear forces and wind suction are effectively transferred. The RAPID® screws offers a high degree of security with 500 hours of corrosion resistance, more available under request.

Info: In areas exposed to weather (wet service condition > 19 %), stainless steel screws should be used in accordance with the timber structure design code. It is the designer responsibility to investigate the extent of the corrosion protection requirements.

Photo © Rubner Holzbau - Mactan Cebu Airport

Comparable terms

between CSA O86:2024-06 and ETA-12/0373:2022

Listed variables are only similar, but do not assume to be the equal. Consider the given definitions, respectively, which are reproduced from the standard and approvals as accurately as possible.

CSA O86:2024-06		ETA-12/0373:2022	
SCREW DIMENSIONS			
d_F ...	nominal and outside thread diameter, [mm]	d ... Dim ...	outer thread diameter, [mm], alternative term ø screw diameter, screw size, [mm]
d_W ...	head diameter, [mm]	d_k...	head diameter, [mm]
d_S ...	smooth-shank diameter, [mm]	d_s ...	shank diameter, [mm]
d_R ...	root (inner thread) diameter, [mm]	d_i ...	inner thread diameter, [mm]
		d_{ef} ...	effective diameter used to determine lateral loading values, [mm]
L ...	nominal screw length, [mm]	L ...	screw length, [mm]
L_T ...	thread length, [mm]	b ...	thread length (including the point length), [mm]
L_{tip} ...	length of the tapered tip (pointed length), [mm]	l_p ... l_{sp} ...	length of drilling tip, [mm] length of tip, [mm]
ARRANGEMENT PARAMETERS			
L_{et} ...	effective threaded length penetration, [mm]	l_{ef} ...	threaded part in the timber member, including the point at point side member, [mm]
α ...	angle between the fastener axis and the grain direction of wood member, [°]	α ...	angle between fastener axis and grain direction of the timber member, [°]
β ...	angle between the fastener axis and the shear plane of a connection, [°]		
θ ...	angle between the direction of applied load and the grain direction of wood member, [°]	γ ...	angle between the applied load and the grain direction of the timber member, [°]
S_P ...	spacing parallel to grain	a_1 ...	spacing between fasteners parallel to grain
S_Q ...	spacing perpendicular to grain	a_2 ...	spacing between fasteners perpendicular to grain
a_L ...	loaded end distance	$a_{1,CG}$ ...	end distance of the centre of gravity of the threaded part in the timber member for axially loaded screws
e_Q ...	loaded edge distance	$a_{2,CG}$ ...	edge distance of the centre of gravity of the threaded part in the timber member for axially loaded screws
a ...	unloaded end distance	$a_{3,c}$ ...	unloaded end distance for laterally loaded screws
a_L ...	loaded end distance	$a_{3,t}$ ...	loaded end distance for laterally loaded screws
e_P ...	unloaded edge distance	$a_{4,c}$ ...	unloaded edge distance for laterally loaded screws
e_Q ...	loaded edge distance	$a_{4,t}$ ...	loaded edge distance for laterally loaded screws
S_X ...	spacing perpendicular to grain for cross pairs when loaded parallel to grain	a_{cross} ...	spacing between crossing screws for a crossed screw couple perpendicular to a plane parallel to the grain
RELEVANT WOOD MEMBER PARAMETERS			
G ...	mean ovendry relative density, [any unit used]	ρ_k ... ρ_{mean} ...	characteristic density of the wooden member, [kg/m³] mean density of the wooden member, [kg/m³]

UNIT CONVERSION FACTORS:

1 psi ≡ 0.00689 N/mm²
1 psi ≡ 6.89 kPa
1 MPa ≡ 1 N/mm² ≡ 10 bar
1 N/mm² ≡ 145.038 psi

1 in ≡ 25.4 mm
1 lbf ≡ 4.448 N
1 N ≡ 0.225 lbf
1 ft-lbs ≡ 1.3558 Nm

CSA O86:2024-06		ETA-12/0373:2022	
RESISTANCE PARAMETERS			
y_w … P_{rw} …	specified withdrawal resistance per millimetre of thread length penetration, [N/mm] factored withdrawal resistance, [N]	$f_{ax,90,k}$ … $f_{ax,90,d}$ …	characteristic withdrawal parameter, [N/mm²] design withdrawal parameter, [N/mm²]
f_{pt} … P_{pt} …	specified head pull-through resistance per screw, [N] factored head pull-through resistance, [N]	$f_{head,k}$ … $f_{head,d}$ …	characteristic head pull-through parameter, [N/mm²] design head pull-through parameter, [N/mm²]
n_u …	unit lateral yielding resistance of a screw per shear plane, [N]	$F_{v,k}$ … $F_{v,d}$ …	characteristic lateral resistance of a screw, [N] corresponding design resistance, [N]
t …	thickness of wood side member, [mm]	t …	member thickness, [mm]
$t_{s,s}$ …	thickness of steel side member, [mm]	t …	member thickness, [mm]
t_s … T_{rs} …	specified tensile resistance of self-tapping screws, [N] factored tensile resistance, [N]	$f_{tens,k}$ … $f_{tens,d}$ …	characteristic tensile strength, [kN] design tensile strength, [kN]
		$M_{y,k}$ …	characteristic yield moment, [Nmm]
f_y …	specified yield strength in bending of self-tapping screws [MPa]	$f_{y,k}$ …	characteristic yield strength, [N/mm²]
n_F …	number of fasteners in the connection	n_{ef} … n_{ef} …	effective number of screws in a row parallel to grain for laterally loaded screws effective number of screws in a group for axially loaded screws

Instruction notes to designers and professionals

01) Provided design and application information in this document are based on the Canadian Standard CSA O86 Engineering Design in Wood (version 2024-06), as well as on the European Technical Approval ETA-12/0373 (version 2022-03-30). Additionally, Schmid RAPID® screws are assessed by the ICC-ES Evaluation Report ESR-4549.

02) General connections and details in this document may differ from project specific inside conditions or requirements and cannot be assumed to be valid for all of them.

03) The herein suggestions, shown details, listed values and application conditions for a screw, a crossed screws pair or for a screw group are based on the bearing capacity of the fasteners. Additionally, the capacity of possibly further steel components and the wood element itself must be verified with reference to the corresponding standards. This includes among other things the capacity against all possible brittle wood failure modes in the area of the connection, as e.g. shear, rolling shear, net tension, any kind of plug or block shear failure and splitting failure due to stresses perpendicular-to-grain. The resistance to brittle failures of wood members has to be determined according to CSA O86:2024, further suggestion provide ETA-12/0373:2022.

04) RAPID® screws are intended to be used only in untreated wood applications and installed and used throughout the service life in dry service conditions (≤ 19 %) and temperature ≤ 50°C, consequently, result K_{SF} = 1.0 and K_T = 1.0. Factored withdrawal, head pull-through, tensile and buckling resistance values, P_{rw}, P_{th}, T_{rs} and P_{rb} respectively, provided in the tables within this document are determined considering the safety factors K_{SF}, K_T, K_D and/or Φ as indicated in each case. Deviations from this must be considered separately.

05) The minimum penetration (thread) length for withdrawal of screws installed in the side of the member is $4d_F$ and according to ETA-12/0373:2022 including the screw tip length L_{tip}. The required minimum penetration length for withdrawal of the screws in end grain and an angle between the screw axis and the grain of $\alpha < 15°$ is $20d_F$. Even partial threaded screws can fulfil this required embedded length in the end grain.

Instruction notes to designers and professionals

06) Generally, at least two RAPID® screws must be used in a connection. For connections in end grain and an angle between the screw axis and the grain of $\alpha < 15°$ at least 4 screws must be used. Both requirements are in accordance with CSA O86:2024 as well as ETA-12/0373:2022.

07) If RAPID® screws are used as reinforcement against perpendicular to grain splitting, as well as against longitudinal to grain shear failure even solely one screw or as many as required, respectively, can be applied. Highly probable crack position with anchorage on both sides including the required design provision must be considered for each kind of application. ETA-12/0373:2022 provides several positioning and verification proposals for reinforcement applications in accordance with European Timber Construction Standard EN 1995-1-1:2014.

08) RAPID® screws can be applied according to ETA-12/0373:2022 in the panel face, as well as the panel edge (narrow face) of Cross Laminated Timber (CLT), spacing, distance and minimum embedded length requirements are provided.

09) In shear connections with screws inclined in one direction only, $30° \leq \alpha \leq 60°$, and where the screws are loaded (mainly) axially in tension, the members are pressed together due to the load equilibrium. An example of such a connection is shown on page 20. CSA O86:2024 consider J_w determining the corresponding withdrawal resistance. According to ETA-12/0373:2022 friction can be considered in this case by the friction coefficient μ. As this overlaps with J_w, for CSA O86: 2024 design μ must not be applied.

10) Screw strength, withdrawal and head pull-through capacity differs depending on the screw type (partial thread, fullthread, head type).

11) Structural outer steel elements must be designed in accordance with applicable Canadian steel standards.

12) RAPID® screws shall be subjected according to ETA-12/0373:2022 to static and quasi static actions only. Ductility requirements may fulfil the entire connection including outer steel plates or assemblies.

13) Withdrawal and head pull-through parameter in ETA-12/0373:2022 are referenced to a characteristic density of ρ_k = 350 kg/m³ and a moisture content of 12 %, which correspond according to AC233:2024 to a specific (oven-dry) gravity of 0.39. Tables values in this Design Guide Canada are referenced to S-P-F with G = 0.42. To adjust the resistance values which base solely on withdrawal or head pull-through parameter to other classes listed in CSA O86:2024 table A.12 following factors are supposed

$$P_{rw,G} = c_{\text{dens-w}} \cdot P_{rw,G=0.42} \quad \text{withdrawal}$$

$$P_{pt,G} = c_{\text{dens-pt}} \cdot P_{pt,G=0.42} \quad \text{head pull-through}$$

species – product (where screws is located):

ρ_k [kg/m³]	G [-]	$c_{dens\text{-}w}$	$c_{dens\text{-}pt}$
NORTHERN SPECIES – LUMBER			
315	0.35	0.83	0.87
SOFTWOOD C24 – LUMBER according to European standard EN 338:2016 and basis for values in ETA-12/0373:2022			
350	0.39	0.93	0.95
SPRUCE-PINE-FIR – LUMBER, CLT (V2, E1)			
375	0.42	1.00	1.00
SPRUCE-PINE – GLUED-LAMINATED TIMBER			
390	0.44	1.04	1.03
HEM-FIR – LUMBER & GLUED-LAMINATED TIMBER			
410	0.46	1.10	1.07
DOUGLAS FIR-LARCH - LUMBER & GLUED-LAMINATED TIMBER			
435	0.49	1.18	1.13

14) The factored shear resistance v_s is specified as mechanical resistance value (bar with circular full cross-section with diameter d_R and f_y) including a resistance factor of 0.6.

15) Specific withdrawal (y_w), head pull-through (f_{pt}), tensile (t_s) resistance and specified yield strength in bending f_y base on parameters provided by ETA-12/0373:2022 including the conversion to agreement with statistical requirements of CSA O86:2024 and units.

Engineering Screw Design acc. to CSA O86:2024

RESISTANCE IN AXIAL TENSION

Generally, the factored resistance of screws loaded axial in tension P_{rt}, in N, is

$$P_{rt} = \begin{cases} \min\{P_{rw};\ P_{pt};\ T_{rs}\} & \text{for partial threaded screws} \\ \min\{P_{rw};\ T_{rs}\} & \text{for fullthread screws} \end{cases}$$

with

withdrawal resistance P_{rw}, in N

$$P_{rw} = \phi \cdot Y_w \cdot L_{et} \cdot n_F \cdot J_\alpha \cdot J_w$$

head pull-through resistance P_{pt}, in N

$$P_{pt} = \phi \cdot F_{pt} \cdot n_F$$

tensile resistance T_{rs}, in N

$$T_{rs} = \phi \cdot t_s \cdot n_F$$

Φ ...	resistance factor for withdrawal (Φ = 0.7), for tensile resistance (Φ = 0.6), for head pull-through for wood-based side members (Φ = 0.7) and of steel side members (Φ = 0.4)
Y_w ...	factored withdrawal resistance per millimetre of thread length penetration, in N/mm
F_{pt} ...	= $f_{pt} \cdot (K_D \cdot K_{SF} \cdot K_T)$, factored head pull-through resistance for wood-based side members, in N = f_{pt} for steel side members, in N
L_{et} ...	effective thread length penetration (including the tip length L_{tip} within the member with the screw tip), in mm. In case of the thread penetrates more than one wood members or the thread length differ between both side of a potential crack plane (reinforcement), the smaller thread length part must be used.
J_α ...	factor for fastener axis-to-grain angle α

$$J_\alpha = \begin{cases} (\sin^2\alpha + 1.2 \cdot \cos^2\alpha)^{-1} & \text{for } 30° < \alpha \le 90° \\ 0.5 + 0.37 \cdot \dfrac{\alpha}{30°} & \text{for } \alpha \le 30° \end{cases}$$

J_w ... factor for dowel bearing effect for laterally loaded connection design

$$J_w = \begin{cases} \dfrac{\beta}{150°} + 0.9 & \text{for } 30° < \beta \le 60° \text{ and } \theta = 0° \\ 1.0 & \text{for all other cases} \end{cases}$$

n_F ... total number of screws in the connection; Schmid Schrauben Hainfeld recommend to consider a group effect for the resistance in axial tension by substitution of the total number of screws n_F with the effective number of screws $n_{F,ef}$ as follows:

- $n_{F,ef} = n_F^{0.9}$, generally, for connections with mainly axially loaded screws
- $n_{F,ef}$ = max $\{n_F^{0.9};\ 0.9 \cdot n_F\}$, for laterally loaded connections with mainly axially loaded, parallel and equally tightened (torque controlled) screws and 30° ≤ β ≤ 60°
- $n_{F,ef} = n_F$ for screws with fullthread used as reinforcement or line shaped (single row) connections with in-between spacing of $S_P \ge 25d_F$

CSA O86:2024 provides the design of
COMBINED LATERAL AND AXIAL LOADING.

LATERAL DESIGN

Connections with screws perpendicular to shear plane, β = 90° or 60° < β < 90° (consider separate requirements for end-grain and panel edge of CLT)
Corresponding factored lateral loads are verified by:

N_r ... factored lateral yielding resistance, in N

$N_r = \phi_y \cdot n_u \cdot n_s \cdot n_F$

V_{rs} ... factored shear resistance of screws, in N

$V_{rs} = \phi \cdot v_s \cdot n_F$

P_{Br} ... factored brittle failure resistance, in N

Q_{Sr} ... factored splitting resistance, in N

with

Φ_y ...	resistance factor for yielding failures (Φ_y = 0.8)
n_u ...	unit lateral yielding resistance per shear plane, in N, in accordance with CSA O86:2024 of items a) to g), partly permitted to be increased due to the withdrawal restraint effect.
n_s ...	number of shear planes in the connection
Φ ...	resistance factor for shear failure (Φ = 0.6)
v_s ...	specified shear resistance
n_F ...	number of fasteners in the connection; Schmid Schrauben Hainfeld recommend to consider a group effect by the effective number of screws $n_{F,ef}$ as follows: $n_{F,ef} = n_{F,\parallel}^{kef} \cdot n_{F,row}$ with $n_{F,\parallel}$ as number of screws in a row parallel-to-grain, $n_{F,row}$ as number of rows and k_{ef} as e.g. G ≤ 0.44 as follows:

requirements acc. to			
S_P	CSA O86	ETA-12/0373	k_{ef}
$4d_F$	not allowed	pre-drilled	0.50
$5d_F$	pre-drilled		0.50
$7d_F$	pre-drilled		0.70
$10d_F$	pre-drilled		0.85
$12d_F$			0.85
≥ $14d_F$			1.00

CONNECTIONS WITH INCLINED SCREWS, 30° ≤ β ≤ 60° AND LOADED IN TENSION

Corresponding factored lateral loads are verified by:

V_{rs} / sinβ ... with V_{rs} as factored shear resistance of screws, in N

P_{rt} · cosβ ... with P_{rt} as factored resistance of screws loaded in tension, in N

Resistance of brittle failure of wood members loaded parallel to grain, θ = 0°, in N

CONNECTIONS WITH INCLINED SCREWS IN CROSS PAIRS

Corresponding factored lateral loads are verified by:

V_{rs} / sinβ ... with V_{rs} as factored factored shear resistance of screws, in N

2 · P_{rt} · cosβ ... with P_{rt} as factored resistance of screws loaded in tension, in N

2 · P_{rc} · cosβ ... with P_{rc} as factored resistance of screws loaded in compression according to CSA O86:2024, in N

Spacing and distance

Connection geometry requirements based on outside thread diameter d_F installed into side grain of sawn lumber, structural and structural glued laminated timber (GL) and the panel face of cross laminated timber (CLT).

LATERALLY LOADED screws (installed into side grain)		**CSA O86:2024** Canadian Standard			**ETA-12/0373:2022** European Technical Approval		
Condition			$G \leq 0.44$	$G \leq 0.50$	$\rho_k \leq 420$ kg/m³		$\rho_k \leq 500$ kg/m³
		pre-drilled hole	not pre-drilled hole (self-drilled)		pre-drilled or screw with half tip in not pre-drilled hole	not pre-drilled hole	pre-drilled hole
END DISTANCE							
Loaded end	a_L	$12d_F$[+]	$15d_F$[++]	$22d_F$	$12d_F$	$15d_F$	$20d_F$
Unloaded end	a	$7d_F$	$10d_F$[++]	$15d_F$	$7d_F$	$10d_F$[1)]	$15d_F$
EDGE DISTANCE							
Loading edge	e_Q	$7d_F$	$10d_F$	$12d_F$	$7d_F$	$10d_F$	$12d_F$
Unloaded edge	e_P	$3d_F$	$5d_F$	$7d_F$	$3d_F$	$5d_F$[2)]	$7d_F$
SPACING PARALLEL TO GRAIN							
Loading parallel to grain, $\theta = 0°$	S_P	$5d_F$[+]	$12d_F$[++]	$18d_F$	$5d_F$	$12d_F$	$15d_F$
Loading perpendicular to grain, $\theta = 90°$	S_P	-	-	-	$4d_F$	$5d_F$	$7d_F$
SPACING PERPENDICULAR TO GRAIN							
Lateral loading	S_Q	$4d_F$	$5d_F$	$7d_F$	$3d_F$	$5d_F$	$7d_F$
SPACING PERPENDICULAR TO GRAIN FOR CROSS PAIRS							
Lateral loading	S_X	$2d_F$	$3d_F$	$1.5d_F$	$1.5d_F$		

AXIALLY LOADED screws (installed into side grain)		**CSA O86:2024** Canadian Standard	**ETA-12/0373:2022** European Technical Approval		
Condition		$G \leq 0.50$ pre-drilled and not pre-drilled holes	$\rho_k \leq 500$ kg/m³ pre-drilled and not pre-drilled holes		
END DISTANCE					
Loaded end	a_L	$10d_F$	$5d_F$[3)]		
EDGE DISTANCE					
Loaded edge	e_Q	$4d_F$	$4d_F$[3)]		
SPACING PARALLEL TO GRAIN					
	S_P	$7d_F$	$5d_F$		
SPACING PERPENDICULAR TO GRAIN					
	S_Q	$5d_F$	$5d_F$	$3d_F$ if $S_P \cdot S_Q \geq 21d_F^2$	$2.5d_F$ if $S_P \cdot S_Q \geq 25d_F^2$

Placement requirements in side grain according to CSA O86:2024 apply even for self-tapping screws in the panel face of CLT, see page 21.

+ 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 %.

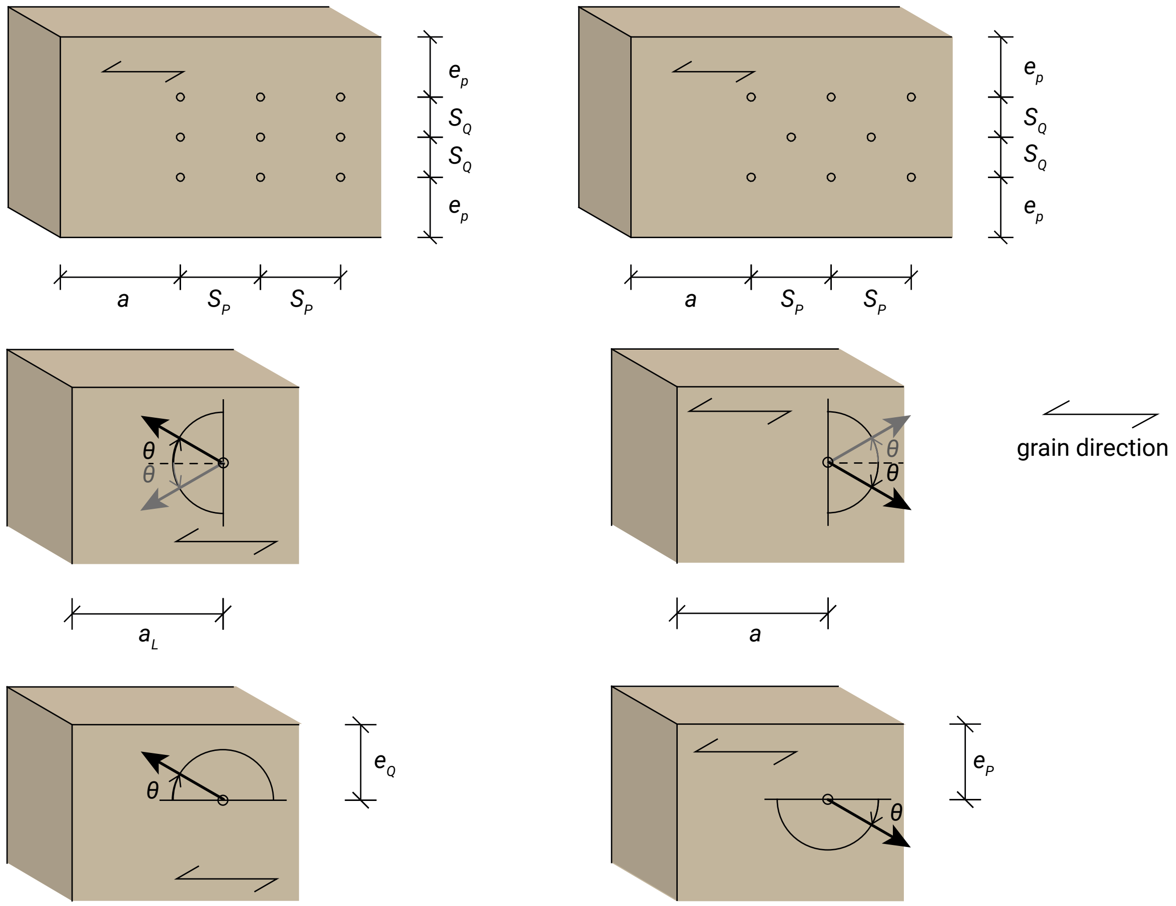
1) $15d_F$ for member thickness $t < 5d_F$ with $d_F \geq 8$ mm.

2) $3d_F$ if $a_L \geq 25d_F$ and $S_P \geq 25d_F$, even with $t < 5d_F$.

3) Distance of the centre of gravity of the threaded part in the timber member.

Note: Drilled holes for positioning, guidance or orientation (pilot holes) are not considered as predrilled.

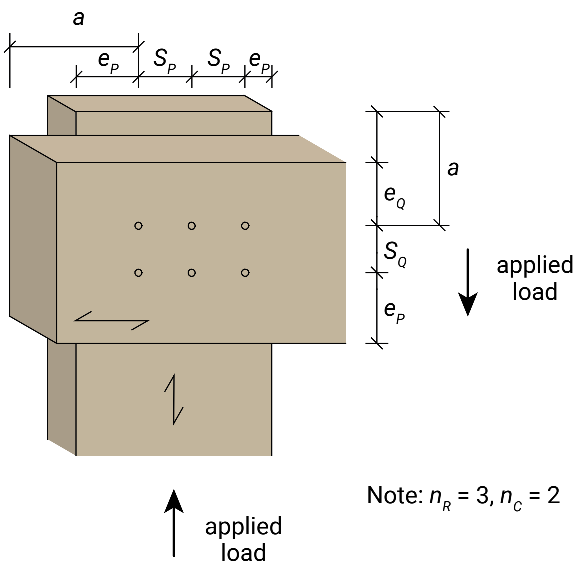
SPACING, END AND EDGE DISTANCES DEFINITIONS FOR RAPID® SCREWS INSTALLED PERPENDICULAR TO GRAIN (INTO SIDE GRAIN) ACCORDING TO CSA O86:2024 (LATERALLY RESISTANCE)



MINIMUM THICKNESS

of sawn lumber and structural glued laminated timber (GL) for softwood species S-P-F for screws installed with or without pre-drilling according to ETA-12/0373:2022 or CSA O86:2024 is

	NOMINAL THREAD DIAMETER d_F			
	6 mm 1/4”	8 mm 5/16”	10 mm 3/8”	12 mm 1/2”
MINIMUM MEMBER THICKNESS *t* FOR SCREWS LOADED acc. to ETA-12/0373:2022				
Laterally	24 mm 15/16”	30 mm 1-3/16”	40 mm 1-9/16”	80 mm 3-3/16”
(Mainly) axially	$12d_F$			
MINIMUM SIDE MEMBER THICKNESS *t* acc. to CSA O86:2024				
In wood ($4d_F$)	24 mm	32 mm	40 mm	48 mm
In wood structural panels ($2d_F$)	12 mm	16 mm	20 mm	24 mm

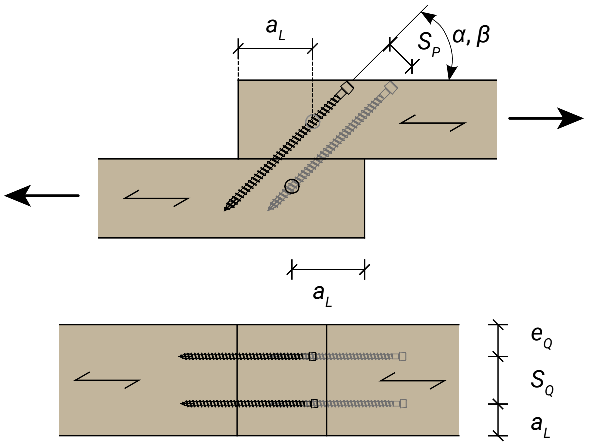


> Woods at risk of splitting (e.g. Douglas Fir, Silver Fir) should be pre-drilled or a higher minimum thickness used or in accordance with product specifications.
> If the timber does not meet the minimum thickness, it should generally be pre-drilled.

The minimum penetration (thread) length for withdrawal of the screws into the side of the member is $4d_F$ and the minimum penetration length in end wood is $20d_F$.

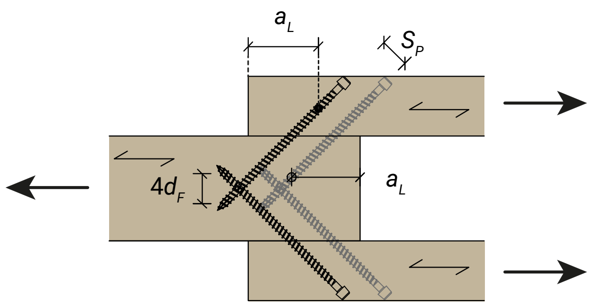
APPLICATIONS WITH MAINLY AXIALLY LOADED SCREWS

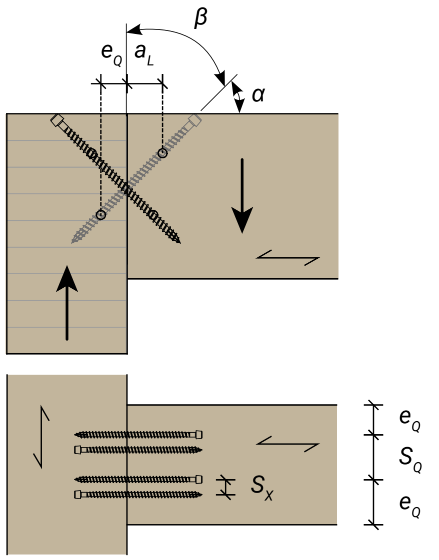
Spacing, end and edge distances definitions for inclined RAPID® screws and crossed screw pairs according to CSA O86:2024 (mainly axially loaded)



connections with inclined screws
spacing measured to the centre of the threaded part in each member.

Tension lap joint with inclined and in tension loaded screws.
Overlap screws in case of such symmetric joints with at least $4d_F$ to avoid tension perpendicular to grain failure in the middle member.
Spacing measured to the centre of the treaded part in each member.

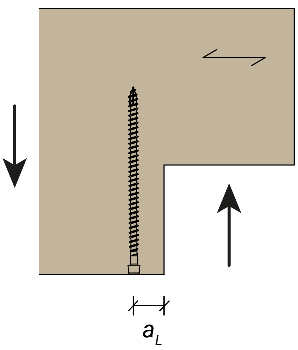




4 crossed screws
(2 screw pairs)

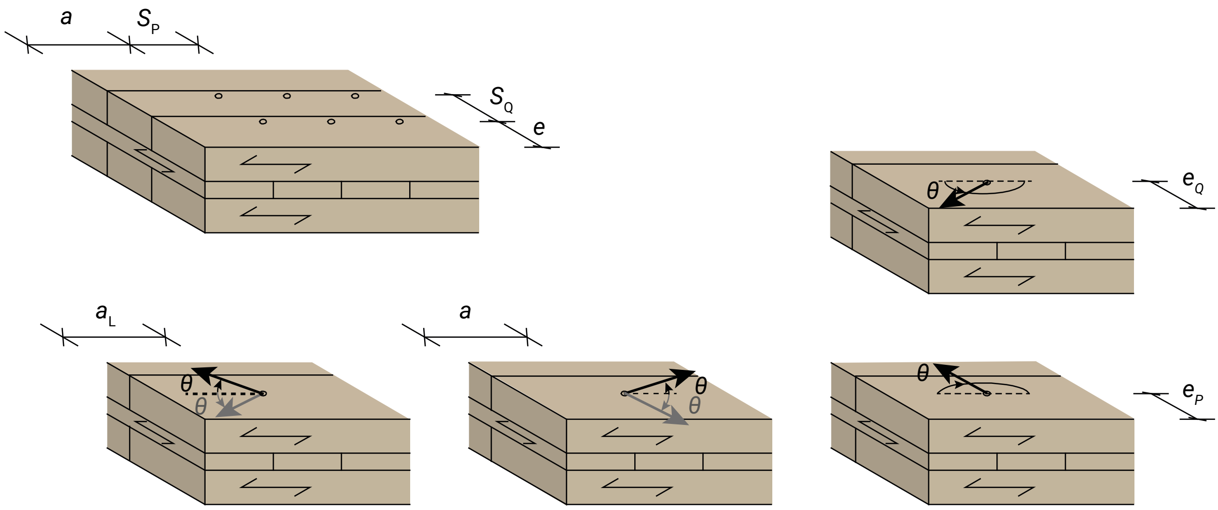
Main to secondary beam connection with 4 crossed screws (2 screw pairs).
End distance in accordance with CSA O86:2024 with $a_L \geq 10d_F$ result in screw length requirements of $42d_F$.
Application with end distance in accordance with ETA-12/0373:2022 result in more practicable application with symmetrical arrangement. The applied values for a_L are on the responsibility of the designer.

Reinforcement with axially loaded screws
Tension perpendicular to the grain reinforcement with one or more screws in a row perpendicular to the grain. End distances according to ETA-12/0373:2022 provides screw position and reinforcement closer to the potential crack building zone.



Spacing and distances, CLT

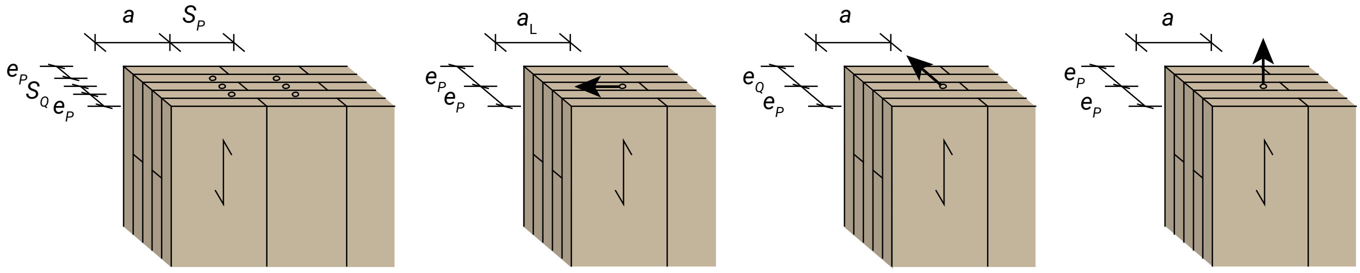
SPACING, END AND EDGE DISTANCES DEFINITIONS FOR RAPID® SCREWS IN THE PANEL FACE OF CLT (SHOWN FOR LATERALLY LOADING)



	END DISTANCE		EDGE DISTANCE		SPACING BETWEEN TWO FASTENERS	
	LOADED	UNLOADED	LOADED	UNLOADED		
	a_L	a	e_Q	e_P	S_P	S_Q
according to CSA O86:2024 G ≤ 0.44, S-P-F	$15d_F$	$10d_F$	$10d_F$	$5d_F$	$12d_F$	$5d_F$
according to ETA-12/0373:2022 for axially and laterally loading [1)]	$6d_F$	$6d_F$	$6d_F$	$2.5d_F$	$4d_F$	$2.5d_F$

[1)] provided that a minimum thickness of the cross laminated timber element is $10d_F$ as well as a minimum penetration length of the screws is $4d_F$.

SPACING, END AND EDGE DISTANCES DEFINITIONS FOR RAPID® SCREWS IN THE NARROW FACE OF CLT ACCORDING TO ETA-12/0373:2022



	END DISTANCE		EDGE DISTANCE		SPACING BETWEEN TWO FASTENERS	
	loading parallel to the plane of CLT and toward end	loading perpendicular to the plane of CLT or away from end	loading perpendicular to the plane of CLT and toward edge	loading perpendicular to the plane of CLT and away from edge	in a row parallel to the plain of CLT	in a row perpendicular to the plain of CLT
	a_L	a	e_Q	e_P	S_P	S_Q
according to ETA-12/0373:2022 for axially and laterally loading [2)]	$12d_F$	$7d_F$	$5d_F$	$3d_F$	$10d_F$	$3d_F$

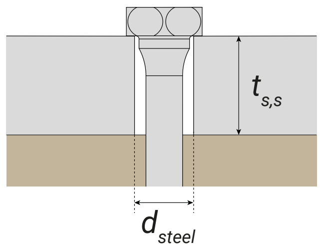
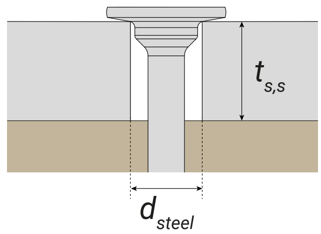
[2)] provided that a minimum thickness of the cross laminated timber element is $10d_F$ as well as a minimum penetration length of the screws is $10d_F$.

Note: CSA O86:2024 provide smaller minimum spacing and distances for similar rivet fasteners.

Metal/wood connections

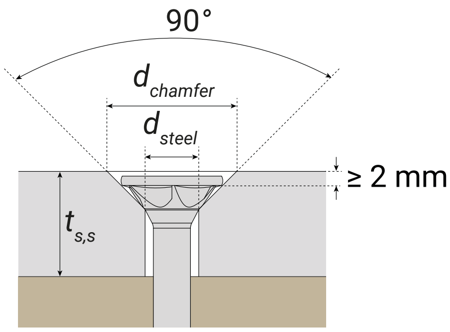
Recommendations base on ETA-12/0373:2022

Reference values for the calculation of steel-to-wood connections can be taken from the tables in this brochure. The capacity of the steel elements must be verified separately according to corresponding standards.
Schmid Schrauben Hainfeld recommend drilling a cylindrical hole in the metal with a diameter of d_{steel}, where the diameter should be a maximum of d_{steel} + 1 mm. For convenience, we have listed common drill sizes in the tables, but the hole in the metal can be made in other ways too.
The RAPID® Dual and SuperSenkFix heads are designed especially for application in metal-to-wood connections. The screw automatically centres in the hole during screwing in and results in a perfect fit.

	RAPID® Dual (Dual)		RAPID® SuperSenkFix (SSF)	
				
screw size d_F	**d_{steel}**	**drill size**	**d_{steel}**	**drill size**
6 mm (1/4”)	–	–	8.5 mm	(11/32”)
8 mm (5/16”)	8 mm	(11/32”)	10.5 mm	(27/64”)
10 mm (3/8”)	10 mm	(27/64”)	13.5 mm	(17/32”)
12 mm (1/2”)	12 mm	(1/2”)	–	–

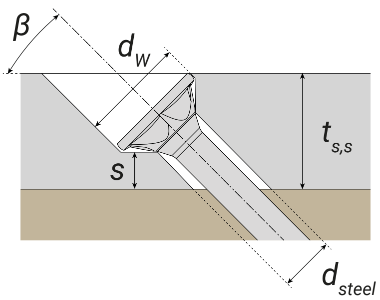
90° COUNTERSUNK BORE HOLES: provide the RAPID® Countersunk head with sufficient support on the chamfer. The screw automatically centres while screwing in.

RAPID® countersunk head (CS)
recommended cylindrical bore hole diameter $d_{steel} \geq d_F$
and chamfer diameter $d_{chamfer}$



screw size d_F	min. $d_{chamfer}$	d_{steel}	drill size
6 mm (1/4”)	15 mm (0.591 in)	6 mm	(1/4”)
8 mm (5/16”)	19 mm (0.748 in)	8 mm	(21/64”)
10 mm (3/8”)	23 mm (0.906 in)	10 mm	(13/32”)
12 mm (1/2”)	25 mm (0.984 in)	12 mm	(1/2”)

RAPID® countersunk head (CS)
recommended cylindrical bore hole diameter $d_{steel} \geq d_F$
and chamfer diameter $d_{chamfer} \geq d_W$



$s \geq 3$ mm (0.118 in) for $\beta > 45°$
$s \geq 2$ mm (0.079 in) in for $30° \leq \beta \leq 45°$

screw size d_F	d_W	d_{steel}	drill size
6 mm (1/4”)	12 mm (0.472 in)	6 mm	1/4”
8 mm (5/16”)	15 mm (0.591 in)	8 mm	21/64”
10 mm (3/8”)	18.5 mm (0.728 in)	10 mm	13/32”
12 mm (1/2”)	21 mm (0.827 in)	12 mm	1/2”


Grand Palais Éphémère

Screw production

FROM WIRE TO SCREW

The RAPID® screws are made from special carbon steel wire. The wire is wound onto spools and then drawn to the desired diameter. In a heading machine, the wire material is cut into blanks of the desired length and then cold-formed, shaping them into the basic screw head configuration. After cold heading, the bolts undergo thread rolling to finalize the screw's geometry.

HEAT TREATMENT

The screws undergo a special heat treatment process to ensure high performance. This allows them to withstand high tensile loads while remaining very ductile and tough. RAPID® screws can be bent by more than 45° without cracking or breaking.

HYDROGEN EMBRITTLEMENT

With years of experience, we have developed reliable processes for forming, hardening, and coating screws. We work with partners to prevent hydrogen embrittlement, especially during hardening and electroplating. We also collaborate with universities to create standards to avoid this issue.
The case-hardening process in CSA O86:2024 section 17.6.4 leads to a significant higher surface hardness than core hardness, making screws vulnerable to hydrogen embrittlement. Schmid RAPID® screws are produced by a heat treatment that ensures consistent hardness from core to surface, reducing this risk significant. For more details, see Andreas Ringhofer's dissertation at Graz University of Technology (2017). Thus, Schmid RAPID® screws are reliable and have no potential risk to fail under dry conditions as per CSA O86:2024.

COATINGS

After the heat treatment, the screws are sent to electroplating, where different coatings (YellWin, BlueWin) can be applied. Using an electroplating process, they are galvanized in different layer thicknesses and then the color (eg. yellow, blue) is passivated or thick-film passivated. Each screw is finished with a sliding coating to ensure low-friction screwing.

QUALITY CONTROL

All screws undergo continuous testing during the production process. For example, the geometry is measured, the mechanical properties are checked after hardening and the coating is checked after the electroplating process. The screws are only packaged ready for dispatch once all checks have been passed.

SCAN TO WATCH
THE VIDEO:
"FROM WIRE TO SCREW"

Corrosion resistance & intended application

Depending on the designation, the screws are provided with different levels of corrosion resistance. The type of coating for each type of screw can be seen on the pages of the individual products (tables with the technical values).
The corrosion resistance is verified through the salt spray test in accordance with EN ISO 9227. Under standard conditions, the specimens are placed in a test chamber where a saline solution (typically a solution of sodium chloride) is sprayed on them. The examination is limited by a previously determined test period, ranging from a few- to several thousand hours. At the end of the test period, the corrosion phenomena occurring on the test specimens are assessed as white and red rust.
The following illustrates how long the coatings protect the RAPID® screws against the standardized corrosive salt atmosphere without rusting red on the head:

YELLWIN*
Color: **yellow**
Corrosion-resistant: **approx. 100 h**

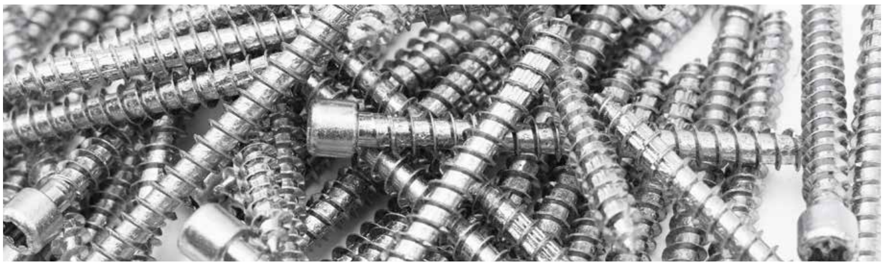
YELLWIN 500+
Color: **yellow**
Corrosion-resistant: **approx. 500 h**

BLUEWIN
Color: **blue**
Corrosion-resistant: **approx. 50 h**

BLUEWIN 700+
Color: **blue**
Corrosion-resistant: **approx. 700 h**

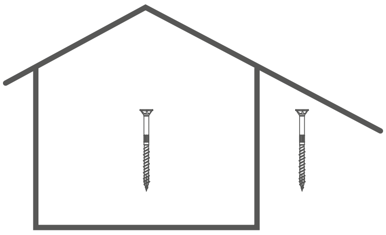
ZNNI 1000+ *
Color: **gray**
Corrosion-resistant: **approx. 1000 h**

ZNNI 1500+ *
Color: **gray**
Corrosion-resistant: **approx. 1500 h**



INTENDED APPLICATION – WHERE CAN RAPID® SCREWS BE USED?

The following applies to all our carbon steel screws: RAPID® screws are suitable for use in dry conditions with a wood moisture content of less than 19 %, as specified by the CSA O86:2024. This comply close to the European standard. But in common European understanding and in accordance with the new Eurocode 5 version (2024) the yearly average of solid wood base product should not exceed 16 %. These conditions are typically met in indoor environments or outdoor areas protected by a roof. For wood with a pH value below 4, we recommend ensuring that the wood moisture content remains below 16 %. Please also observe the instructions of the national standards.



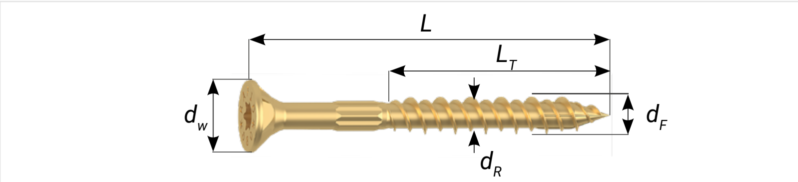
Attention, it is important to ensure dry conditions for all materials – such as wood and screws – even during the installation, including transport and storage at construction site. They have to be protected from excessive moisture.

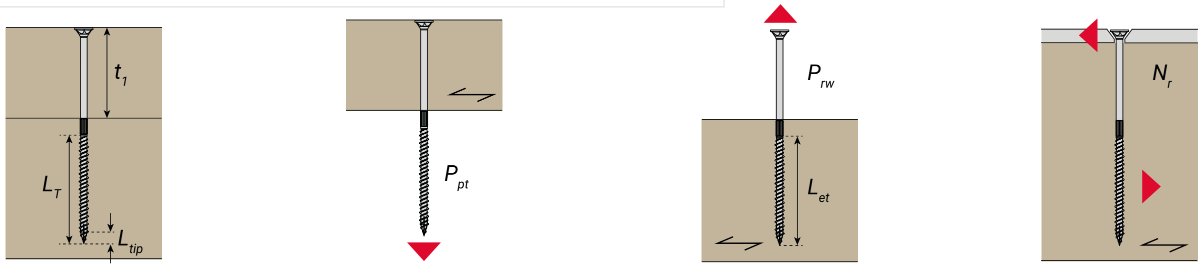
* available on request

6 mm RAPID® partial thread countersunk head

T-drive (T30), countersunk head, milling pockets, friction part (≤ 60 mm without friction part), HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	12.0	4.0	4.3	61.2	1678	11879	900





d_F = 6 mm (1/4")				AXIAL in tension α=β=90°						LATERAL α = β = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
50	(2")	30	(1-3/16")	1.35	1.17	0.76	1.48	1.29	0.84	1.50	1.38	1.07
60	(2-3/8")	40	(1-1/2")	1.35	1.17	0.76	1.97	1.71	1.11	1.50	1.38	1.07
70	(2-3/4")	40	(1-1/2")	1.35	1.17	0.76	1.97	1.71	1.11	1.50	1.38	1.07
80	(3-1/8")	50	(2")	1.35	1.17	0.76	2.46	2.14	1.39	1.50	1.38	1.07
90	(3-1/2")	50	(2")	1.35	1.17	0.76	2.46	2.14	1.39	1.50	1.38	1.07
100	(4")	60	(2-3/8")	1.35	1.17	0.76	2.96	2.57	1.67	1.50	1.38	1.07
110	(4-3/8")	60	(2-3/8")	1.35	1.17	0.76	2.96	2.57	1.67	1.50	1.38	1.07
120	(4-3/4")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
130	(5-1/8")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
140	(5-1/2")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
150	(6")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
160	(6-1/4")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
180	(7-1/8")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
200	(7-7/8")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
220	(8-5/8")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
240	(9-1/2")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
260	(10-1/4")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
280	(11")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07
300	(11-3/4")	70	(2-3/4")	1.35	1.17	0.76	3.45	3.00	1.95	1.50	1.38	1.07

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, f_u ≥ 360 MPa and thickness $t_{s,s}$ ≥ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at α = β = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and a threaded length completely located in the lower member L_{et} = L_T . Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 7.13 kN.

[3] tabled values for lateral yielding resistance N_r provided for Φ=0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

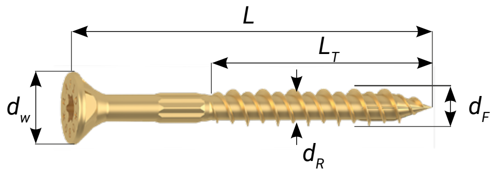
Factored shear resistance V_{rs} = 6.35 kN.

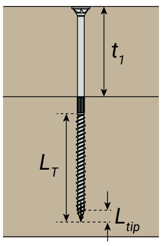
Typos and printing errors reserved.

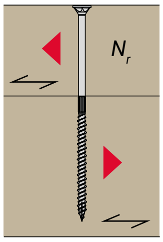
6 mm RAPID® partial thread countersunk head

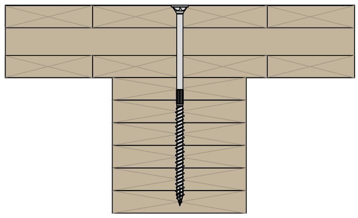
T-drive (T30), countersunk head, milling pockets, friction part (≤ 60 mm without friction part), HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	12.0	4.0	4.3	61.2	1678	11879	900









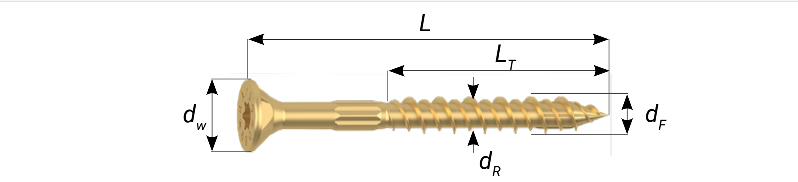
d_F = 6 mm (1/4")						LATERAL $\alpha = \beta = 90°$				LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]			
						WOOD-TO-WOOD				CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1]			t_1	N_r [2]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
50	(2")	30	(1-3/16")	-	-	-	-	-	-	-	-	-
60	(2-3/8")	40	(1-1/2")	-	-	-	-	-	-	-	-	-
70	(2-3/4")	40	(1-1/2")	30	(1-3/16")	1.02	0.88	0.57	-	-	-	-
80	(3-1/8")	50	(2")	30	(1-3/16")	1.02	0.92	0.63	-	-	-	-
90	(3-1/2")	50	(2")	40	(1-9/16")	1.12	1.00	0.68	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	1.12	1.00	0.71	-	-	-	-
110	(4-3/8")	60	(2-3/8")	50	(2")	1.17	1.07	0.76	-	-	-	-
120	(4-3/4")	70	(2-3/4")	50	(2")	1.17	1.07	0.76	-	-	-	-
130	(5-1/8")	70	(2-3/4")	60	(2-3/8")	1.17	1.07	0.81	-	-	-	-
140	(5-1/2")	70	(2-3/4")	60	(2-3/8")	1.17	1.07	0.81	-	-	-	-
150	(6")	70	(2-3/4")	80	(3-2/16")	1.17	1.07	0.82	-	-	-	-
160	(6-1/4")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	90	1.20	1.10	0.84
180	(7-1/8")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	90	1.20	1.10	0.84
200	(7-7/8")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	120	1.20	1.10	0.84
220	(8-5/8")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	120	1.20	1.10	0.84
240	(9-1/2")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	160	1.20	1.10	0.84
260	(10-1/4")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	160	1.20	1.10	0.84
280	(11")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	160	1.20	1.10	0.84
300	(11-3/4")	70	(2-3/4")	90	(3-1/2")	1.17	1.07	0.82	160	1.20	1.10	0.84

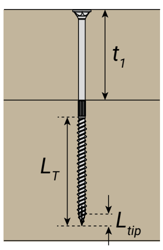
[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 6.35 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

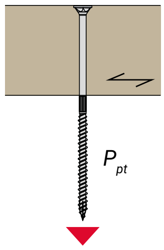
8 mm RAPID® partial thread countersunk head

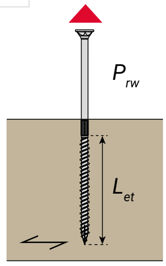
T-drive (T40), countersunk head, milling pockets, friction part, HiLo thread, core ribs, YellWin 500+ coating

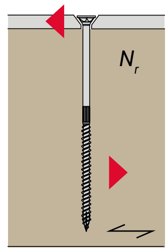
PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	15.0	5.4	5.9	75.3	2227	20827	900











d_F = 8 mm (5/16”)				AXIAL in tension α=β=90°						LATERAL $α = β = 90°$		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
				P_{pt} [1]			P_{rw} [2]			N_r [3]		
L		L_T		K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	1.79	1.56	1.01	3.03	2.63	1.71	2.44	2.25	1.76
90	(3-1/2")	50	(2")	1.79	1.56	1.01	3.03	2.63	1.71	2.44	2.25	1.76
100	(4")	60	(2-3/8")	1.79	1.56	1.01	3.64	3.16	2.05	2.44	2.25	1.76
120	(4-3/4")	80	(3-1/8")	1.79	1.56	1.01	4.85	4.21	2.74	2.44	2.25	1.76
140	(5-1/2")	80	(3-1/8")	1.79	1.56	1.01	4.85	4.21	2.74	2.44	2.25	1.76
160	(6-1/4")	80	(3-1/8")	1.79	1.56	1.01	4.85	4.21	2.74	2.44	2.25	1.76
180	(7-1/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
200	(7-7/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
220	(8-5/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
240	(9-1/2")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
260	(10-1/4")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
280	(11")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
300	(11-3/4")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
320	(12-5/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
340	(13-3/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
360	(14-1/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
380	(15")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
400	(15-3/4")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
420	(16-1/2")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
440	(17-5/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
460	(18-1/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
480	(18-7/8")	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76
500	(19-5/8)	100	(4")	1.79	1.56	1.01	6.06	5.27	3.42	2.44	2.25	1.76

[1] tabled values for factored head pull-through resistance provided for $Φ = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$ and $n_F = 1$; minimum requirements for the steel plate, $f_u ≥ 360$ MPa and thickness $t_{s,s} ≥ 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at $α = β = 90°$ provided for $Φ = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_a = 1.0$, $J_w = 1.0$ and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for $Φ = 0.6$ and $n_F = 1$ result in $T_{rs} = 12.50$ kN.

[3] tabled values for lateral yielding resistance N_r provided for $Φ=0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect.

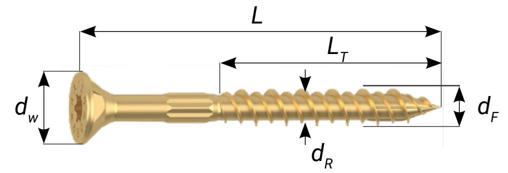
Factored shear resistance $V_{rs} = 15.37$ kN.

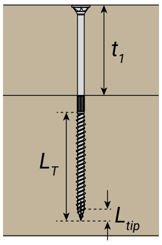
Typos and printing errors reserved.

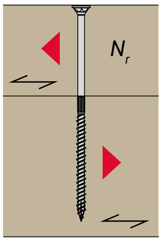
8 mm RAPID® partial thread countersunk head

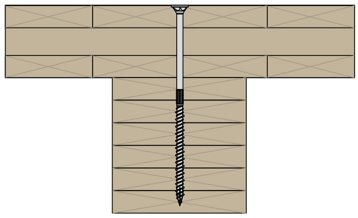
T-drive (T40), countersunk head, milling pockets, friction part, HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16")	15.0	5.4	5.9	75.3	2227	20827	900









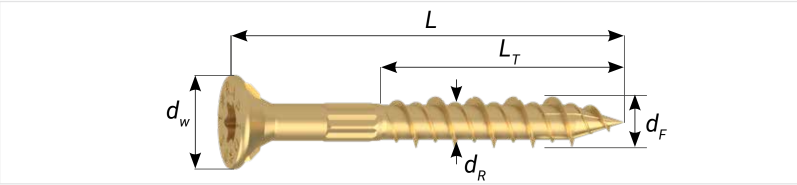
d_F = 8 mm (5/16")						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]			
				WOOD-TO-WOOD					CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1]			t_1	N_r [2]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
80	(3-1/8")	50	(2")	30	(1-3/16")	1.43	1.24	0.81	-	-	-	-
90	(3-1/2")	50	(2")	40	(1-9/16")	1.55	1.35	0.87	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	1.60	1.44	0.94	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	1.60	1.44	1.04	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	1.83	1.63	1.17	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	1.83	1.63	1.17	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	1.83	1.63	1.17	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	90	1.92	1.76	1.36
220	(8-5/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	120	1.92	1.76	1.36
240	(9-1/2")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	120	1.92	1.76	1.36
260	(10-1/4")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	120	1.92	1.76	1.36
280	(11")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
300	(11-3/4")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
320	(12-5/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
340	(13-3/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
360	(14-1/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
380	(15")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
400	(15-3/4")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
420	(16-1/2")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
440	(17-5/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
460	(18-1/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
480	(18-7/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36
500	(19-5/8")	100	(4")	90	(3-1/2")	1.88	1.72	1.33	160	1.92	1.76	1.36

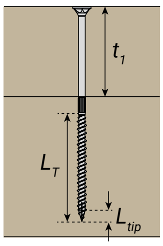
[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 15.37 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

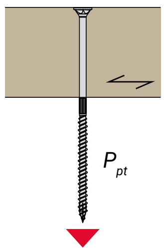
10 mm RAPID® partial thread countersunk head

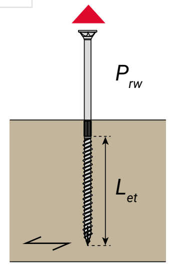
T-drive (T50), countersunk head, milling fins, friction part, HiLo thread, core ribs, YellWin 500+ coating

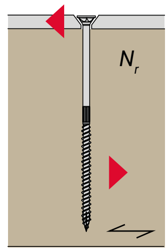
PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	18.5	6.2	7.1	81.7	3333	33230	900











d_F = 10 mm (3/8”)				AXIAL in tension α=β=90°						LATERAL $α = β = 90°$		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	2.68	2.33	1.52	3.29	2.86	1.86	3.26	3.00	2.34
100	(4")	60	(2-3/8")	2.68	2.33	1.52	3.95	3.43	2.23	3.26	3.00	2.34
120	(4-3/4")	80	(3-1/8")	2.68	2.33	1.52	5.26	4.58	2.98	3.26	3.00	2.34
140	(5-1/2")	80	(3-1/8")	2.68	2.33	1.52	5.26	4.58	2.98	3.26	3.00	2.34
160	(6-1/4")	80	(3-1/8")	2.68	2.33	1.52	5.26	4.58	2.98	3.26	3.00	2.34
180	(7-1/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
200	(7-7/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
220	(8-5/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
240	(9-1/2")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
260	(10-1/4")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
280	(11")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
300	(11-3/4")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
320	(12-5/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
340	(13-3/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
360	(14-1/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
380	(15")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
400	(15-3/4")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
420	(16-1/2")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
440	(17-5/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
460	(18-1/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
480	(18-7/8")	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34
500	(19-5/8)	100	(4")	2.68	2.33	1.52	6.58	5.72	3.72	3.26	3.00	2.34

[1] tabled values for factored head pull-through resistance provided for $Φ = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$ and $n_F = 1$; minimum requirements for the steel plate, $f_u ≥ 360$ MPa and thickness $t_{s,s} ≥ 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at $α = β = 90°$ provided for $Φ = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_α = 1.0$, $J_w = 1.0$ and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for $Φ = 0.6$ and $n_F = 1$ result in $T_{rs} = 19.94$ kN.

[3] tabled values for lateral yielding resistance N_r provided for $Φ$=0.8, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect.

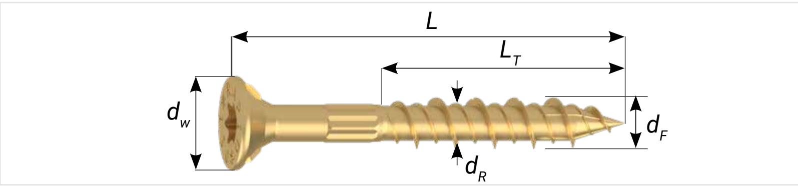
Factored shear resistance $V_{rs} = 15.26$ kN.

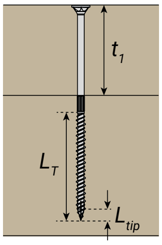
Typos and printing errors reserved.

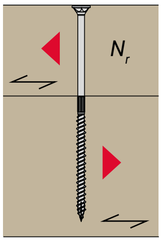
10 mm RAPID® partial thread countersunk head

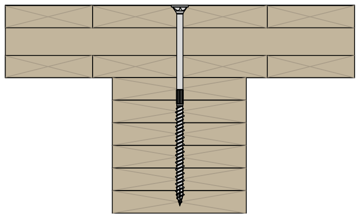
T-drive (T50), countersunk head, milling fins, friction part, HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	18.5	6.2	7.1	81.7	3333	33230	900









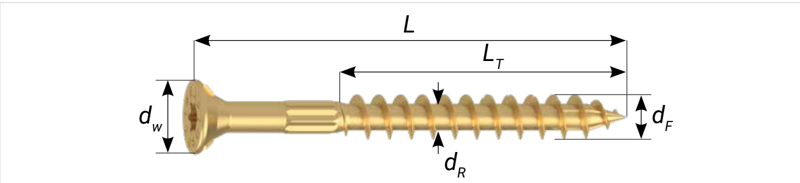
d_F = 10 mm (3/8")						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ 2)			
						WOOD-TO-WOOD			CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r 1)			t_1	N_r 2)		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
80	(3-1/8")	50	(2")	30	(1-3/16")	1.77	1.54	1.00	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	2.05	1.78	1.16	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.08	1.86	1.31	-	-	-	-
140	(5-1/2")	80	(3-1/8")	40	(1-9/16")	2.08	1.86	1.35	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.32	2.07	1.48	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	2.32	2.07	1.48	-	-	-	-
200	(7-7/8")	100	(4")	60	(2-3/8")	2.32	2.07	1.48	90	2.35	2.10	1.51
220	(8-5/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	90	2.59	2.37	1.71
240	(9-1/2")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	120	2.59	2.37	1.71
260	(10-1/4")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	120	2.59	2.37	1.71
280	(11")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
300	(11-3/4")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
320	(12-5/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
340	(13-3/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
360	(14-1/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
380	(15")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
400	(15-3/4")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
420	(16-1/2")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
440	(17-5/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
460	(18-1/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
480	(18-7/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71
500	(19-5/8")	100	(4")	90	(3-1/2")	2.52	2.31	1.69	160	2.59	2.37	1.71

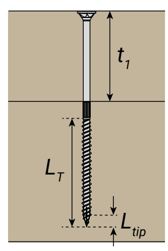
1) tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 15.26 kN.
2) tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of *G* = 0.42 as upper element and glue laminated timber of *G* = 0.44.
Typos and printing errors reserved.

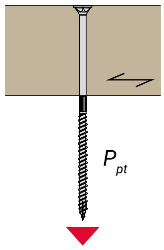
12 mm RAPID® partial thread countersunk head

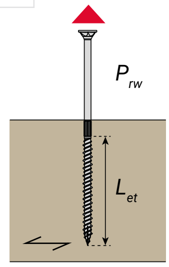
T-drive (T50), countersunk head, milling fins, friction part, Single thread, core ribs, YellWin 500+ coating

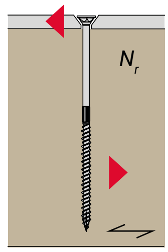
PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	12 (1/2")	21.0	7.0	8.2	103.6	3624	37838	900











d_F = 12 mm (1/2")				AXIAL in tension α=β=90°						LATERAL *α* = *β* = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
100	(4")	60	(2-3/8")	2.92	2.54	1.65	5.00	4.35	2.83	3.94	3.64	2.84
120	(4-3/4")	80	(3-1/8")	2.92	2.54	1.65	6.67	5.80	3.77	3.94	3.64	2.84
140	(5-1/2")	80	(3-1/8")	2.92	2.54	1.65	6.67	5.80	3.77	3.94	3.64	2.84
160	(6-1/4")	80	(3-1/8")	2.92	2.54	1.65	6.67	5.80	3.77	3.94	3.64	2.84
180	(7-1/8")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
200	(7-7/8")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
220	(8-5/8")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
240	(9-1/2")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
260	(10-1/4")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
280	(11")	100	(4")	2.92	2.54	1.65	8.34	7.25	4.71	3.94	3.64	2.84
300	(11-3/4")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84
320	(12-5/8")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84
340	(13-3/8")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84
360	(14-1/8")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84
380	(15")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84
400	(15-3/4")	120	(4-3/4")	2.92	2.54	1.65	10.00	8.70	5.65	3.94	3.64	2.84

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, f_u ≥ 360 MPa and thickness $t_{s,s}$ ≥ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at *α* = *β* = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and a threaded length completely located in the lower member L_{et} = L_T . Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.70 kN.

[3] tabled values for lateral yielding resistance N_r provided for Φ=0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

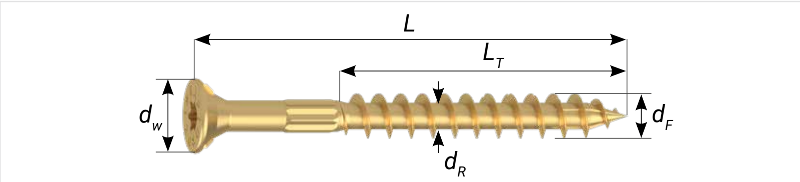
Factored shear resistance V_{rs} = 32.43 kN.

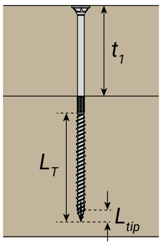
Typos and printing errors reserved.

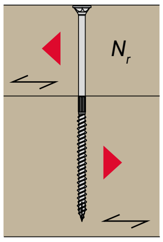
12 mm RAPID® partial thread countersunk head

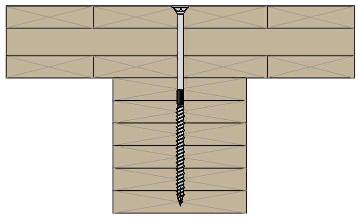
T-drive (T50), countersunk head, milling fins, friction part, Single thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	12 (1/2")	21.0	7.0	8.2	103.6	3624	37838	900









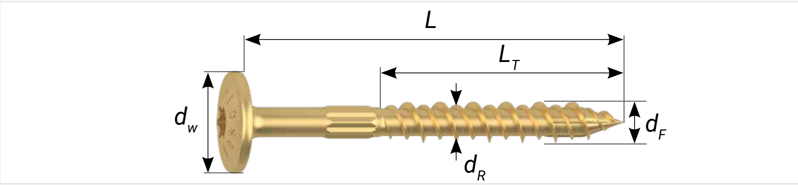
d_F = 12 mm (1/2")						LATERAL $\alpha = \beta = 90°$ WOOD-TO-WOOD			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2)] CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1)]			t_1	N_r [2)]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
100	(4")	60	(2-3/8")	40	(1-9/16")	2.23	1.94	1.26	-	-	-	-
120	(4-3/4")	80	(3-1/8")	60	(2-3/8")	2.53	2.20	1.43	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.65	2.38	1.60	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.65	2.38	1.71	-	-	-	-
180	(7-1/8")	100	(4")	80	(2-3/8")	2.91	2.60	1.86	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	3.03	2.71	1.93	90	3.09	2.76	1.97
220	(8-5/8")	100	(4")	90	(3-1/2")	3.03	2.71	1.93	90	3.09	2.76	1.97
240	(9-1/2")	100	(4")	90	(3-1/2")	3.03	2.71	1.93	120	3.09	2.76	1.97
260	(10-1/4")	100	(4")	90	(3-1/2")	3.03	2.71	1.93	120	3.09	2.76	1.97
280	(11")	100	(4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
300	(11-3/4")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
320	(12-5/8")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
340	(13-3/8")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
360	(14-1/8")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
380	(15")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97
400	(15-3/4")	120	(4-3/4")	90	(3-1/2")	3.03	2.71	1.93	160	3.09	2.76	1.97

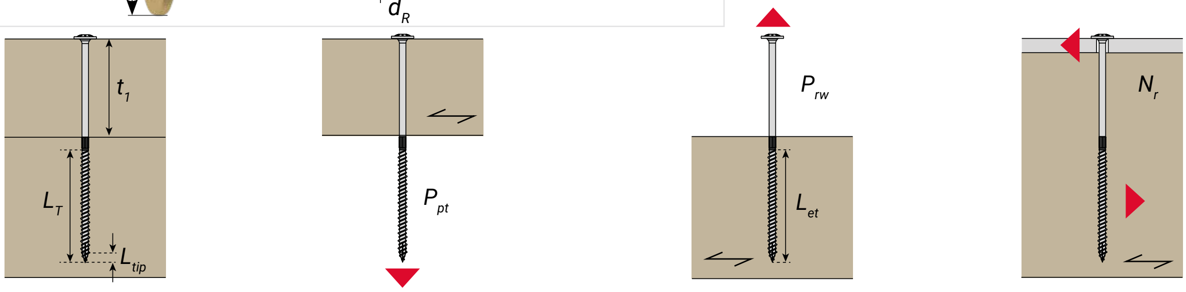
[1)] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 32.43 kN.
[2)] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of *G* = 0.42 as upper element and glue laminated timber of *G* = 0.44.
Typos and printing errors reserved.

6 mm RAPID® partial thread washer head

T-drive (T30), washer head, friction part, HiLo thread, core ribs,
YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	14.0	4.0	4.3	61.2	2754	11879	900





d_F = 6 mm (1/4")				AXIAL in tension α=β=90°						LATERAL α = β = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
60	(2-3/8")	40	(1-1/2")	2.22	1.93	1.25	1.97	1.71	1.11	1.65	1.51	1.16
80	(3-1/8")	50	(2")	2.22	1.93	1.25	2.46	2.14	1.39	1.70	1.55	1.18
100	(4")	60	(2-3/8")	2.22	1.93	1.25	2.96	2.57	1.67	1.70	1.55	1.18
120	(4-3/4")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
140	(5-1/2")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
160	(6-1/4")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
180	(7-1/8")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
200	(7-7/8")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
220	(8-5/8")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
240	(9-1/2")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
260	(10-1/4")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
280	(11")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18
300	(11-3/4")	70	(2-3/4")	2.22	1.93	1.25	3.45	3.00	1.95	1.70	1.55	1.18

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, f_u ≥ 360 MPa and thickness $t_{s,s}$ ≥ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at $\alpha = \beta$ = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 7.13 kN.

[3] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

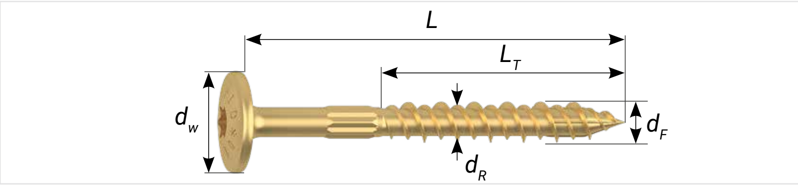
Factored shear resistance V_{rs} = 6.35 kN.

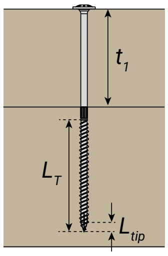
Typos and printing errors reserved.

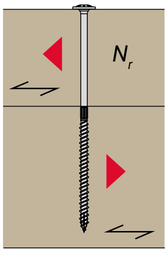
6 mm RAPID® partial thread washer head

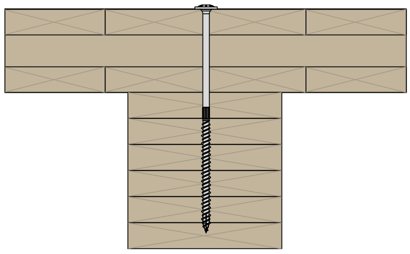
T-drive (T30), washer head, friction part, HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	14.0	4.0	4.3	61.2	2754	11879	900









d_F = 6 mm (1/4")						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]			
				WOOD-TO-WOOD					CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1]			t_1	N_r [2]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
60	(2-3/8")	40	(1-1/2")	-	-	-	-	-	-	-	-	-
80	(3-1/8")	50	(2")	30	(1-3/16")	1.24	1.11	0.75	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	1.33	1.18	0.83	-	-	-	-
120	(4-3/4")	70	(2-3/4")	50	(2")	1.39	1.26	0.88	-	-	-	-
140	(5-1/2")	70	(2-3/4")	60	(2-3/8")	1.39	1.26	0.93	-	-	-	-
160	(6-1/4")	70	(2-3/4")	90	(3-1/2")	1.39	1.26	0.94	90	1.42	1.29	0.96
180	(7-1/8")	70	(2-3/4")	100	(4")	1.39	1.26	0.94	90	1.42	1.29	0.96
200	(7-7/8")	70	(2-3/4")	120	(4-3/4")	1.39	1.26	0.94	120	1.42	1.29	0.96
220	(8-5/8")	70	(2-3/4")	140	(5-1/2")	1.39	1.26	0.94	140	1.42	1.29	0.96
240	(9-1/2")	70	(2-3/4")	160	(6-5/16")	1.39	1.26	0.94	160	1.42	1.29	0.96
260	(10-1/4")	70	(2-3/4")	160	(6-5/16")	1.39	1.26	0.94	160	1.42	1.29	0.96
280	(11")	70	(2-3/4")	160	(6-5/16")	1.39	1.26	0.94	160	1.42	1.29	0.96
300	(11-3/4")	70	(2-3/4")	160	(6-5/16")	1.39	1.26	0.94	160	1.42	1.29	0.96

[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 6.35 kN.

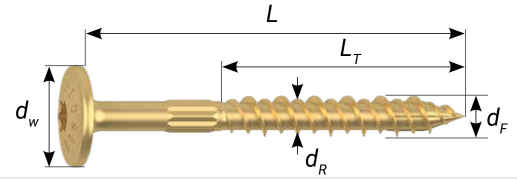
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.

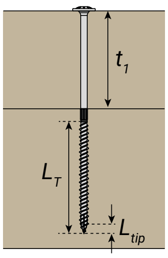
Typos and printing errors reserved.

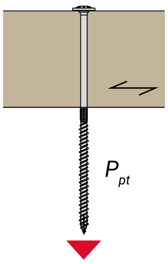
8 mm RAPID® partial thread washer head

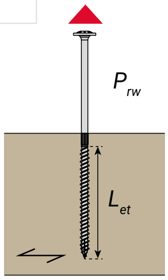
T-drive (T40), washer head, friction part, HiLo thread, core ribs,
YellWin 500+ coating

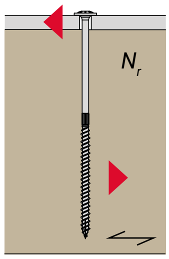
PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	20.0	5.4	5.9	75.3	5925	20827	900











d_F = 8 mm (5/16”)				AXIAL in tension α=β=90°						LATERAL *α* = *β* = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	4.77	4.15	2.70	3.03	2.63	1.71	2.75	2.52	1.93
100	(4")	60	(2-3/8")	4.77	4.15	2.70	3.64	3.16	2.05	2.90	2.65	2.02
120	(4-3/4")	80	(3-1/8")	4.77	4.15	2.70	4.85	4.21	2.74	3.18	2.90	2.18
140	(5-1/2")	80	(3-1/8")	4.77	4.15	2.70	4.85	4.21	2.74	3.18	2.90	2.18
160	(6-1/4")	80	(3-1/8")	4.77	4.15	2.70	4.85	4.21	2.74	3.18	2.90	2.18
180	(7-1/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
200	(7-7/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
220	(8-5/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
240	(9-1/2")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
260	(10-1/4")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
280	(11")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
300	(11-3/4")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
320	(12-5/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
340	(13-3/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
360	(14-1/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
380	(15")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
400	(15-3/4")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
450	(17-3/4")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18
500	(19-5/8")	100	(4")	4.77	4.15	2.70	6.06	5.27	3.42	3.18	2.90	2.18

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, f_u ≥ 360 MPa and thickness $t_{s,s}$ ≥ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at *α* = *β* = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member L_{et} = L_T . Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 12.50 kN.

[3] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

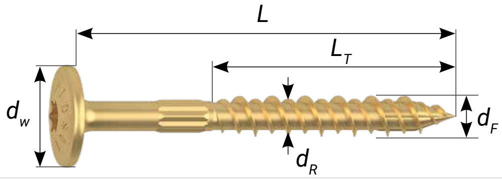
Factored shear resistance V_{rs} = 11.36 kN.

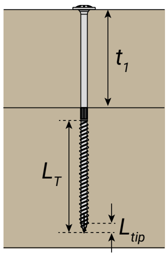
Typos and printing errors reserved.

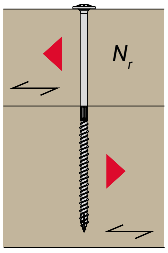
8 mm RAPID® partial thread washer head

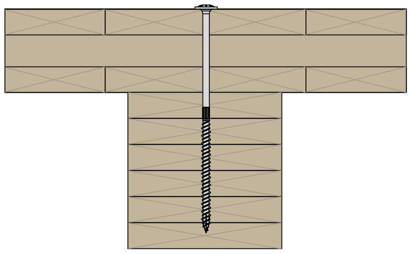
T-drive (T40), washer head, friction part, HiLo thread, core ribs,
YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	20.0	5.4	5.9	75.3	5925	20827	900









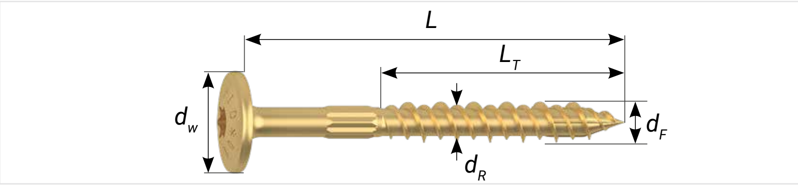
d_F = 8 mm (5/16”)						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ 2)			
						WOOD-TO-WOOD			CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r 1)			t_1	N_r 2)		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
80	(3-1/8")	50	(2")	30	(1-3/16")	1.73	1.51	0.98	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	2.07	1.84	1.20	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.31	2.09	1.46	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(1-9/16")	2.57	2.28	1.59	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.57	2.28	1.59	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	2.57	2.28	1.59	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	90	2.66	2.41	1.78
220	(8-5/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	90	2.66	2.41	1.78
240	(9-1/2")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	120	2.66	2.41	1.78
260	(10-1/4")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	120	2.66	2.41	1.78
280	(11")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
300	(11-3/4")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
320	(12-5/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
340	(13-3/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
360	(14-1/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
380	(15")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
400	(15-3/4")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
450	(17-3/4")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78
500	(19-5/8")	100	(4")	90	(3-1/2")	2.62	2.37	1.75	160	2.66	2.41	1.78

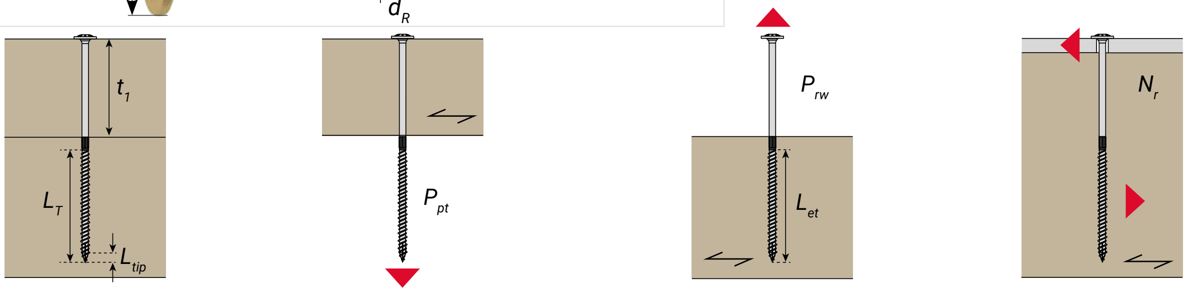
1) tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 11.36 kN.
2) tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

10 mm RAPID® partial thread washer head

T-drive (T50), washer head, friction part, HiLo thread, core ribs, YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	25.0	6.2	7.1	81.7	7583	33230	900





d_F = 10 mm (3/8")				AXIAL in tension α=β=90°						LATERAL α = β = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
100	(4")	60	(2-3/8")	6.10	5.31	3.45	3.95	3.43	2.23	3.58	3.28	2.51
120	(4-3/4")	80	(3-1/8")	6.10	5.31	3.45	5.26	4.58	2.98	3.91	3.56	2.70
140	(5-1/2")	80	(3-1/8")	6.10	5.31	3.45	5.26	4.58	2.98	3.91	3.56	2.70
160	(6-1/4")	80	(3-1/8")	6.10	5.31	3.45	5.26	4.58	2.98	3.91	3.56	2.70
180	(7-1/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
200	(7-7/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
220	(8-5/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
240	(9-1/2")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
260	(10-1/4")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
280	(11")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
300	(11-3/4")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
320	(12-5/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
340	(13-3/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
360	(14-1/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
380	(15")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
400	(15-3/4")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
450	(17-3/4")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82
500	(19-5/8")	100	(4")	6.10	5.31	3.45	6.58	5.72	3.72	4.12	3.75	2.82

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

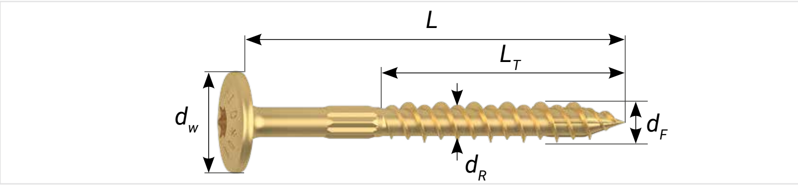
[2] tabled values for factored withdrawal resistance at $\alpha = \beta$ = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 19.94 kN.

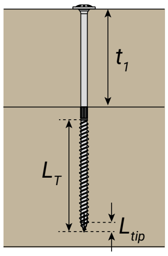
[3] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.
Factored shear resistance V_{rs} = 15.26 kN.
Typos and printing errors reserved.

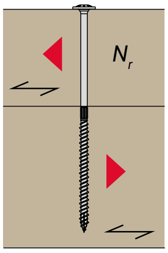
10 mm RAPID® partial thread washer head

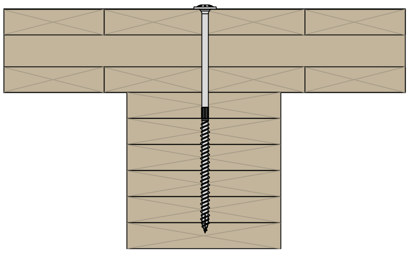
T-drive (T50), washer head, friction part, HiLo thread, core ribs,
YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	25.0	6.2	7.1	81.7	7583	33230	900









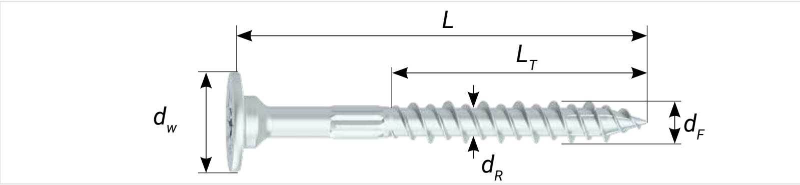
d_F = 10 mm (3/8")						LATERAL $\alpha = \beta = 90°$ WOOD-TO-WOOD			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2)] CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1)]			t_1	N_r [2)]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
100	(4")	60	(2-3/8")	40	(1-9/16")	2.36	2.05	1.33	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.72	2.43	1.68	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.96	2.63	1.83	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.96	2.63	1.85	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	3.17	2.82	1.97	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	90	3.45	3.12	2.19
220	(8-5/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	90	3.45	3.12	2.19
240	(9-1/2")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	120	3.45	3.12	2.19
260	(10-1/4")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	120	3.45	3.12	2.19
280	(11")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
300	(11-3/4")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
320	(12-5/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
340	(13-3/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
360	(14-1/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
380	(15")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
400	(15-3/4")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
450	(17-3/4")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19
500	(19-5/8")	100	(4")	90	(3-1/2")	3.38	3.05	2.17	160	3.45	3.12	2.19

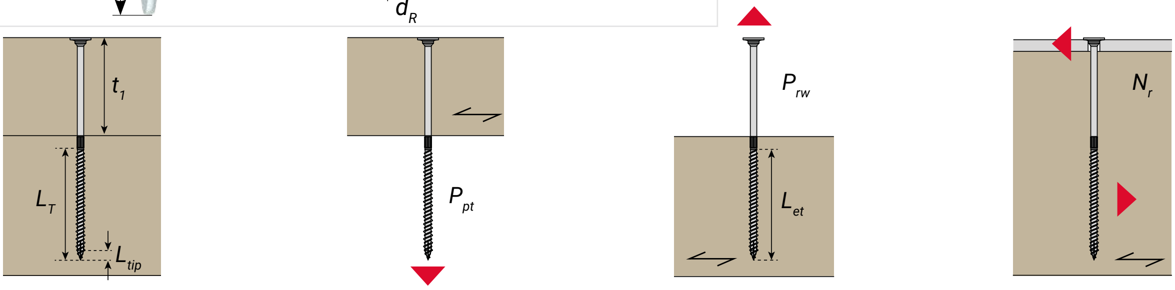
[1)] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 15.26 kN.
[2)] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of *G* = 0.42 as upper element and glue laminated timber of *G* = 0.44.
Typos and printing errors reserved.

6 mm RAPID® partial thread SuperSenkFix

T-drive (T30), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	13.0	4.0	4.3	61.2	2673	11879	900





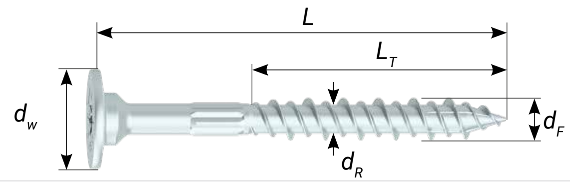
d_F = 6 mm (1/4")				AXIAL in tension α=β=90°						LATERAL $α = β = 90°$		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD 3)		
L		L_T		P_{pt} 1)			P_{rw} 2)			N_r 3)		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	2.15	1.87	1.22	2.46	2.14	1.39	1.70	1.55	1.18
100	(4")	60	(2-3/8")	2.15	1.87	1.22	2.96	2.57	1.67	1.70	1.55	1.18
120	(4-3/4")	70	(2-3/4")	2.15	1.87	1.22	3.45	3.00	1.95	1.70	1.55	1.18
140	(5-1/2")	70	(2-3/4")	2.15	1.87	1.22	3.45	3.00	1.95	1.70	1.55	1.18
160	(6-1/4")	70	(2-3/4")	2.15	1.87	1.22	3.45	3.00	1.95	1.70	1.55	1.18
180	(7-1/8")	70	(2-3/4")	2.15	1.87	1.22	3.45	3.00	1.95	1.70	1.55	1.18
200	(7-7/8")	70	(2-3/4")	2.15	1.87	1.22	3.45	3.00	1.95	1.70	1.55	1.18

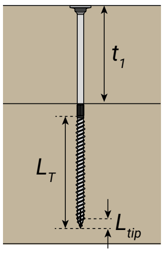
1) tabled values for factored head pull-through resistance provided for $Φ$ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.
2) tabled values for factored withdrawal resistance at $α = β = 90°$ provided for $Φ$ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for $Φ$ = 0.6 and n_F = 1 result in T_{rs} = 7.13 kN.
3) tabled values for lateral yielding resistance N_r provided for $Φ$ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.
Factored shear restistance V_{rs} = 6.35 kN.
Typos and printing errors reserved.

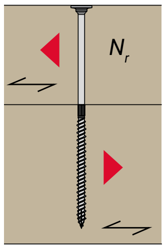
6 mm RAPID® partial thread SuperSenkFix

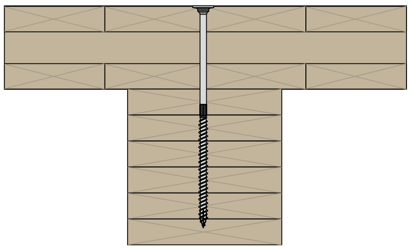
T-drive (T30), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	6 (1/4")	13.0	4.0	4.3	61.2	2673	11879	900









d_F = 6 mm (1/4")				LATERAL $\alpha = \beta = 90°$					LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]				
				WOOD-TO-WOOD					CLT TO GLUE LAMINATED TIMBER				
L		L_T		t_1		N_r [1]			t_1	N_r [2]			
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN	
80	(3-1/8")	50	(2")	30	(1-3/16")	1.23	1.09	0.74	-	-	-	-	
100	(4")	60	(2-3/8")	40	(1-9/16")	1.32	1.17	0.82	-	-	-	-	
120	(4-3/4")	70	(2-3/4")	50	(2")	1.37	1.24	0.87	-	-	-	-	
140	(5-1/2")	70	(2-3/4")	50	(2")	1.37	1.24	0.87	-	-	-	-	
160	(6-1/4")	70	(2-3/4")	90	(3-1/2")	1.37	1.24	0.93	-	-	-	-	
180	(7-1/8")	70	(2-3/4")	90	(3-1/2")	1.37	1.24	0.93	90.00	1.40	1.27	0.95	
200	(7-7/8")	70	(2-3/4")	90	(3-1/2")	1.37	1.24	0.93	120.00	1.40	1.27	0.95	

[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear resistance V_{rs} = 6.35 kN.

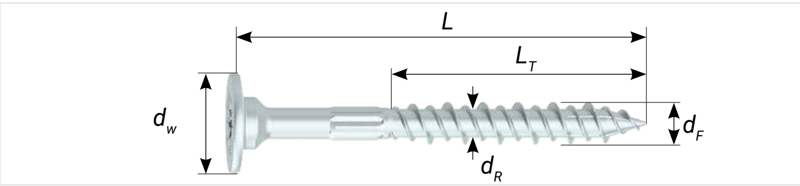
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.

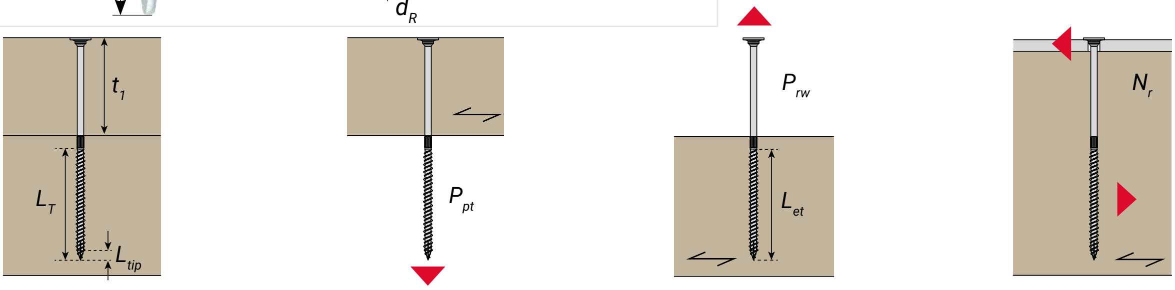
Typos and printing errors reserved.

8 mm RAPID® partial thread SuperSenkFix

T-drive (T40), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	19.0	5.4	5.9	75.3	6686	20827	900





d_F = 8 mm (5/16”)				AXIAL in tension α=β=90°						LATERAL α = β = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	5.38	4.68	3.04	3.03	2.63	1.71	2.75	2.52	1.93
100	(4")	60	(2-3/8")	5.38	4.68	3.04	3.64	3.16	2.05	2.90	2.65	2.02
120	(4-3/4")	80	(3-1/8")	5.38	4.68	3.04	4.85	4.21	2.74	3.20	2.91	2.19
140	(5-1/2")	80	(3-1/8")	5.38	4.68	3.04	4.85	4.21	2.74	3.20	2.91	2.19
160	(6-1/4")	80	(3-1/8")	5.38	4.68	3.04	4.85	4.21	2.74	3.20	2.91	2.19
180	(7-1/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
200	(7-7/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
220	(8-5/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
240	(9-1/2")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
260	(10-1/4")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
280	(11")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
300	(11-3/4")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
320	(12-5/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
340	(13-3/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
360	(14-1/8")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
380	(15")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27
400	(15-3/4")	100	(4")	5.38	4.68	3.04	6.06	5.27	3.42	3.34	3.03	2.27

1) tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

2) tabled values for factored withdrawal resistance at $\alpha = \beta = 90°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 12.50 kN.

3) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

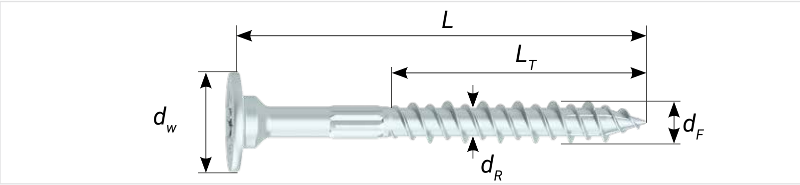
Factored shear resistance V_{rs} = 11.36 kN.

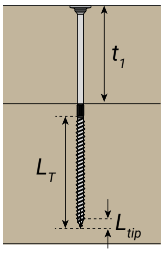
Typos and printing errors reserved.

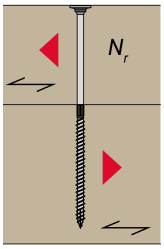
8 mm RAPID® partial thread SuperSenkFix

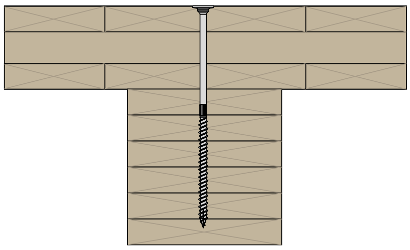
T-drive (T40), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	19.0	5.4	5.9	75.3	6686	20827	900









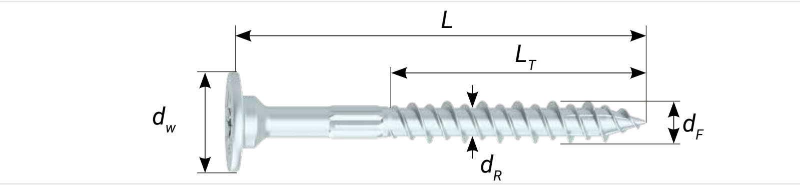
d_F = 8 mm (5/16”)						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ 2)			
				WOOD-TO-WOOD					CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r 1)			t_1	N_r 2)		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
80	(3-1/8")	50	(2")	30	(1-3/16")	1.73	1.51	0.98	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	2.07	1.84	1.20	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.31	2.10	1.47	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.59	2.30	1.60	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.59	2.30	1.60	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	2.72	2.41	1.67	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	90	2.82	2.54	1.87
220	(8-5/8")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	90	2.82	2.54	1.87
240	(9-1/2")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	120	2.82	2.54	1.87
260	(10-1/4")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	120	2.82	2.54	1.87
280	(11")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	120	2.82	2.54	1.87
300	(11-3/4")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87
320	(12-5/8")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87
340	(13-3/8")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87
360	(14-1/8")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87
380	(15")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87
400	(15-3/4")	100	(4")	90	(3-1/2")	2.77	2.50	1.83	160	2.82	2.54	1.87

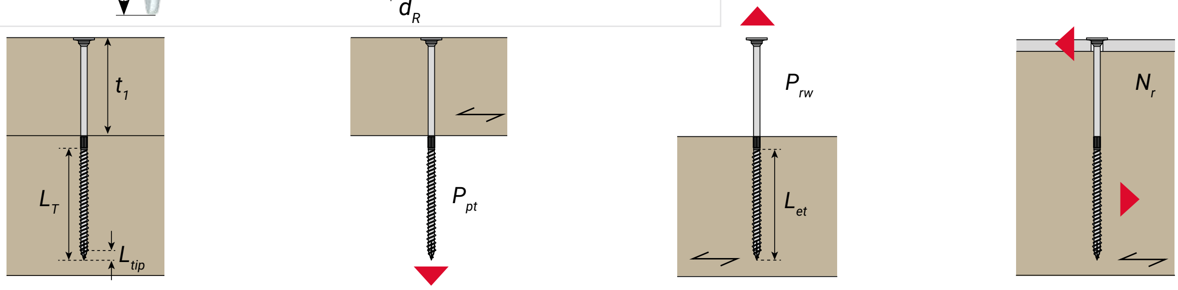
1) tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 11.36 kN.
2) tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of $G = 0.42$ as upper element and glue laminated timber of $G = 0.44$.
Typos and printing errors reserved.

10 mm RAPID® partial thread SuperSenkFix

T-drive (T50), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	24.0	6.2	7.1	81.7	5989	33230	900





d_F = 10 mm (3/18")				AXIAL in tension α=β=90°						LATERAL $\alpha = \beta = 90°$		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		**L_T**		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
120	(4-3/4")	80	(3-1/8")	4.82	4.19	2.73	5.26	4.58	2.98	3.80	3.47	2.64
140	(5-1/2")	80	(3-1/8")	4.82	4.19	2.73	5.26	4.58	2.98	3.80	3.47	2.64
160	(6-1/4")	80	(3-1/8")	4.82	4.19	2.73	5.26	4.58	2.98	3.80	3.47	2.64
180	(7-1/8")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
200	(7-7/8")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
220	(8-5/8")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
240	(9-1/2")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
260	(10-1/4")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
280	(11")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
300	(11-3/4")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
350	(13-3/8")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64
400	(15-3/4")	100	(4")	4.82	4.19	2.73	6.58	5.72	3.72	3.80	3.47	2.64

[1] tabled values for factored head pull-through resistance provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$ and $n_F = 1$; minimum requirements for the steel plate, $f_u \geq 360$ MPa and thickness $t_{s,s} \geq 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at $\alpha = \beta = 90°$ provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_\alpha = 1.0$, $J_w = 1.0$ and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for $\Phi = 0.6$ and $n_F = 1$ result in $T_{rs} = 19.94$ kN.

[3] tabled values for lateral yielding resistance N_r provided for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect.

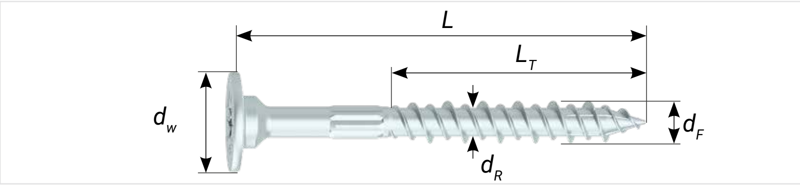
Factored shear resistance $V_{rs} = 15.26$ kN.

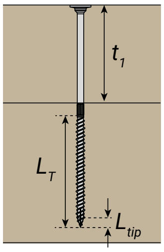
Typos and printing errors reserved.

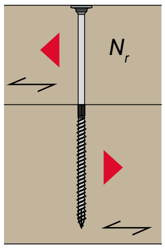
10 mm RAPID® partial thread SuperSenkFix

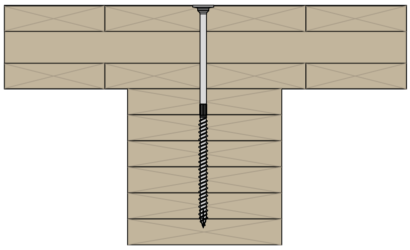
T-drive (T50), SuperSenkFix head, shoulder, friction part, HiLo thread, core ribs, BlueWin 700+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	24.0	6.2	7.1	81.7	5989	33230	900









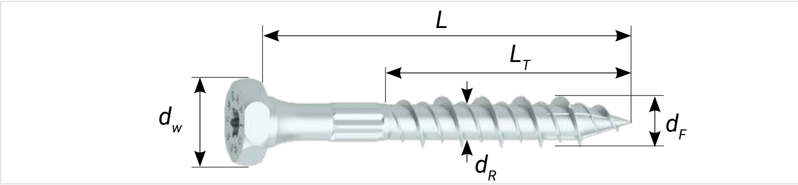
d_F = 10 mm (3/18")						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]			
						WOOD-TO-WOOD			CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1]			t_1	N_r [2]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.61	2.33	1.61	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.85	2.54	1.77	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.85	2.54	1.79	-	-	-	-
180	(7-1/8")	100	(4")	60	(2-3/8")	2.85	2.54	1.79	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	-	-	-	-
220	(8-5/8")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	90	3.12	2.84	2.01
240	(9-1/2")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	120	3.12	2.84	2.01
260	(10-1/4")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	120	3.12	2.84	2.01
280	(11")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	160	3.12	2.84	2.01
300	(11-3/4")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	160	3.12	2.84	2.01
350	(13-3/8")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	160	3.12	2.84	2.01
400	(15-3/4")	100	(4")	90	(3-1/2")	3.06	2.78	1.99	160	3.12	2.84	2.01

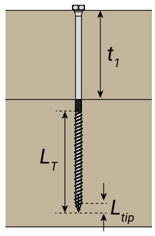
[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 15.26 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

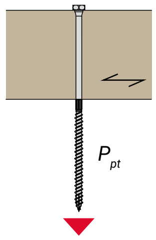
8 mm RAPID® partial thread Dual

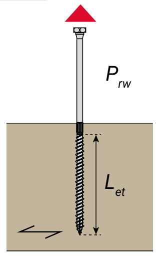
T-drive (T30) & hexagonal drive (SW12), Dual head, shoulder, friction part, HiLo thread, core ribs, BlueWin coating

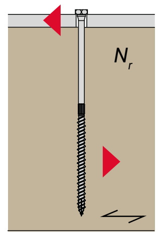
PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16")	12.0	5.4	5.9	75.3	1896	20827	900











d_F = 8 mm (5/16")				AXIAL in tension α=β=90°						LATERAL $\alpha = \beta$ = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD 3)		
L		L_T		P_{pt} 1)			P_{rw} 2)			N_r 3)		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
50	(2")	30	(1-3/16")	1.53	1.33	0.86	1.82	1.58	1.03	2.37	2.19	1.72
60	(2-3/8")	40	(1-1/2")	1.53	1.33	0.86	2.42	2.11	1.37	2.37	2.19	1.72
70	(2-3/4")	40	(1-1/2")	1.53	1.33	0.86	2.42	2.11	1.37	2.37	2.19	1.72
80	(3-1/8")	50	(2")	1.53	1.33	0.86	3.03	2.63	1.71	2.37	2.19	1.72
100	(4")	60	(2-3/8")	1.53	1.33	0.86	3.64	3.16	2.05	2.37	2.19	1.72
120	(4-3/4")	80	(3-1/8")	1.53	1.33	0.86	4.85	4.21	2.74	2.37	2.19	1.72
140	(5-1/2")	80	(3-1/8")	1.53	1.33	0.86	4.85	4.21	2.74	2.37	2.19	1.72
160	(6-1/4")	80	(3-1/8")	1.53	1.33	0.86	4.85	4.21	2.74	2.37	2.19	1.72
180	(7-1/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
200	(7-7/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
220	(8-5/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
240	(9-1/2")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
260	(10-1/4")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
280	(11")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
300	(11-3/4")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
320	(12-5/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
340	(13-3/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
360	(14-1/8")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
380	(15")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72
400	(15-3/4")	100	(4")	1.53	1.33	0.86	6.06	5.27	3.42	2.37	2.19	1.72

1) tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

2) tabled values for factored withdrawal resistance at $\alpha = \beta$ = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 12.50 kN.

3) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

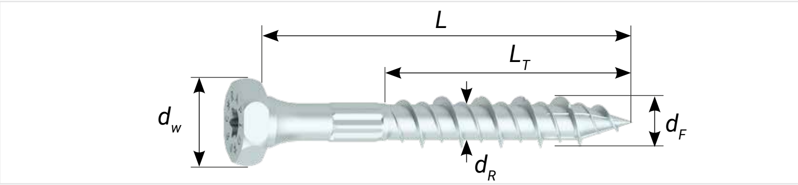
Factored shear resistance V_{rs} = 11.36 kN.

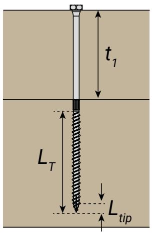
Typos and printing errors reserved.

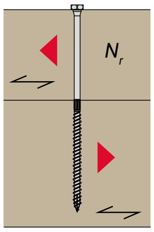
8 mm RAPID® partial thread Dual

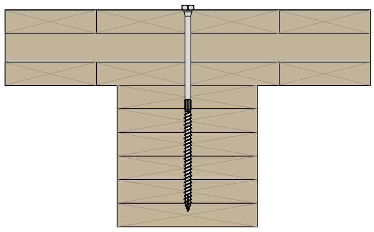
T-drive (T30) & hexagonal drive (SW12), Dual head, shoulder, friction part, HiLo thread, core ribs, BlueWin coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	8 (5/16”)	12.0	5.4	5.9	75.3	1896	20827	900









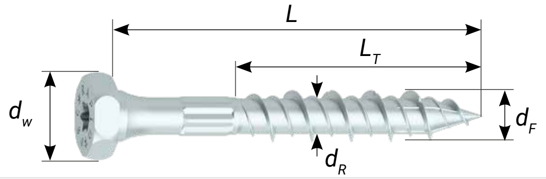
d_F = 8 mm (5/16”)						LATERAL $\alpha = \beta = 90°$			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]				
						WOOD-TO-WOOD			CLT TO GLUE LAMINATED TIMBER				
L		**L_T**		t_1		N_r [1]			t_1	N_r [2]			
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN	
50	(2")	30	(1-3/16")	-	-	-	-	-	-	-	-	-	
60	(2-3/8")	40	(1-1/2")	-	-	-	-	-	-	-	-	-	
70	(2-3/4")	40	(1-1/2")	30	(1-3/16")	1.24	1.08	0.70	-	-	-	-	
80	(3-1/8")	50	(2")	30	(1-3/16")	1.36	1.18	0.77	-	-	-	-	
100	(4")	60	(2-3/8")	40	(1-9/16")	1.54	1.38	0.91	-	-	-	-	
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	1.54	1.38	1.00	-	-	-	-	
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	1.76	1.58	1.13	-	-	-	-	
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	1.76	1.58	1.13	-	-	-	-	
180	(7-1/8")	100	(4")	60	(2-3/8")	1.76	1.58	1.13	-	-	-	-	
200	(7-7/8")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	90	1.85	1.70	1.32	
220	(8-5/8")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	90	1.85	1.70	1.32	
240	(9-1/2")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	120	1.85	1.70	1.32	
260	(10-1/4")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	120	1.85	1.70	1.32	
280	(11")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
300	(11-3/4")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
320	(12-5/8")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
340	(13-3/8")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
360	(14-1/8")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
380	(15")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	
400	(15-3/4")	100	(4")	90	(3-1/2")	1.81	1.66	1.29	160	1.85	1.70	1.32	

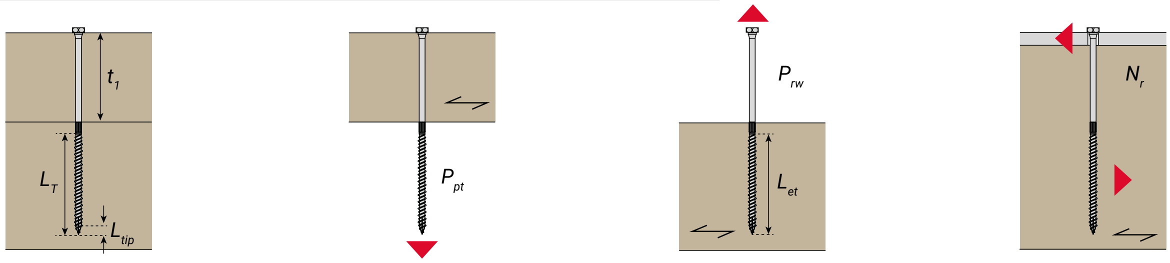
[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 11.36 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

10 mm RAPID® partial thread Dual

T-drive (T40) & hexagonal drive (SW15), Dual head, shoulder, friction part, HiLo thread, core ribs, BlueWin coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	15.0	6.2	7.1	81.7	3000	33230	900





d_F = 10 mm (3/8")				AXIAL in tension α=β=90°						LATERAL $\alpha = \beta$ = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD 3)		
L		L_T		P_{pt} 1)			P_{rw} 2)			N_r 3)		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
60	(2-3/8")	40	(1-1/2")	2.41	2.10	1.36	2.63	2.29	1.49	3.19	2.94	2.30
70	(2-3/4")	40	(1-1/2")	2.41	2.10	1.36	2.63	2.29	1.49	3.19	2.94	2.30
80	(3-1/8")	50	(2")	2.41	2.10	1.36	3.29	2.86	1.86	3.19	2.94	2.30
100	(4")	60	(2-3/8")	2.41	2.10	1.36	3.95	3.43	2.23	3.19	2.94	2.30
120	(4-3/4")	80	(3-1/8")	2.41	2.10	1.36	5.26	4.58	2.98	3.19	2.94	2.30
140	(5-1/2")	80	(3-1/8")	2.41	2.10	1.36	5.26	4.58	2.98	3.19	2.94	2.30
160	(6-1/4")	80	(3-1/8")	2.41	2.10	1.36	5.26	4.58	2.98	3.19	2.94	2.30
180	(7-1/8")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
200	(7-7/8")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
220	(8-5/8")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
240	(9-1/2")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
260	(10-1/4")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
280	(11")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
300	(11-3/4")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
350	(13-3/8")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30
400	(15-3/4")	100	(4")	2.41	2.10	1.36	6.58	5.72	3.72	3.19	2.94	2.30

1) tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

2) tabled values for factored withdrawal resistance at $\alpha = \beta$ = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 19.94 kN.

3) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

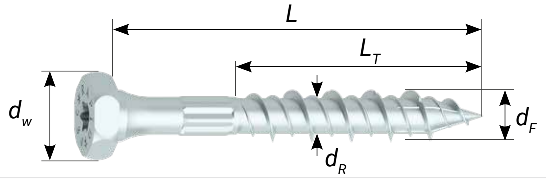
Factored shear resistance V_{rs} = 15.26 kN.

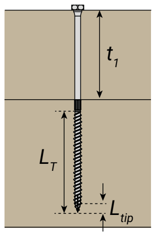
Typos and printing errors reserved.

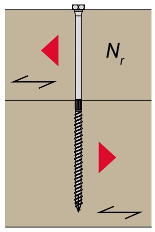
10 mm RAPID® partial thread Dual

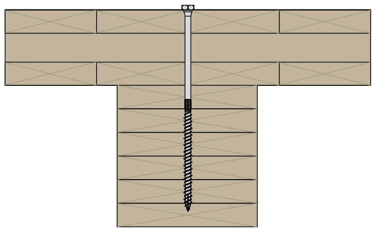
T-drive (T40) & hexagonal drive (SW15), Dual head, shoulder, friction part, HiLo thread, core ribs, BlueWin coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	10 (3/8")	15.0	6.2	7.1	81.7	3000	33230	900









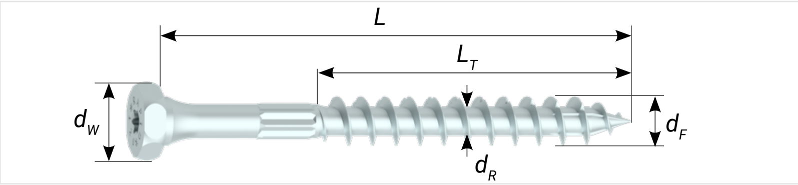
d_F = 10 mm (3/8")						LATERAL $\alpha = \beta = 90°$				LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2]				
						WOOD-TO-WOOD				CLT TO GLUE LAMINATED TIMBER				
L		L_T		t_1		N_r [1]			t_1	N_r [2]				
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65		
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN		
60	(2-3/8")	40	(1-1/2")	-	-	-	-	-	-	-	-	-		
70	(2-3/4")	40	(1-1/2")	-	-	-	-	-	-	-	-	-		
80	(3-1/8")	50	(2")	40	(1-9/16")	1.70	1.48	0.96	-	-	-	-		
100	(4")	60	(2-3/8")	60	(2-3/8")	1.98	1.72	1.12	-	-	-	-		
120	(4-3/4")	80	(3-1/8")	60	(2-3/8")	2.25	1.96	1.27	-	-	-	-		
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.25	2.02	1.43	-	-	-	-		
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.25	2.02	1.44	-	-	-	-		
180	(7-1/8")	100	(4")	60	(2-3/8")	2.25	2.02	1.44	-	-	-	-		
200	(7-7/8")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	90	2.52	2.31	1.67		
220	(8-5/8")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	90	2.52	2.31	1.67		
240	(9-1/2")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	120	2.52	2.31	1.67		
260	(10-1/4")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	120	2.52	2.31	1.67		
280	(11")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	160	2.52	2.31	1.67		
300	(11-3/4")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	160	2.52	2.31	1.67		
350	(13-3/8")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	160	2.52	2.31	1.67		
400	(15-3/4")	100	(4")	90	(3-1/2")	2.46	2.25	1.65	160	2.52	2.31	1.67		

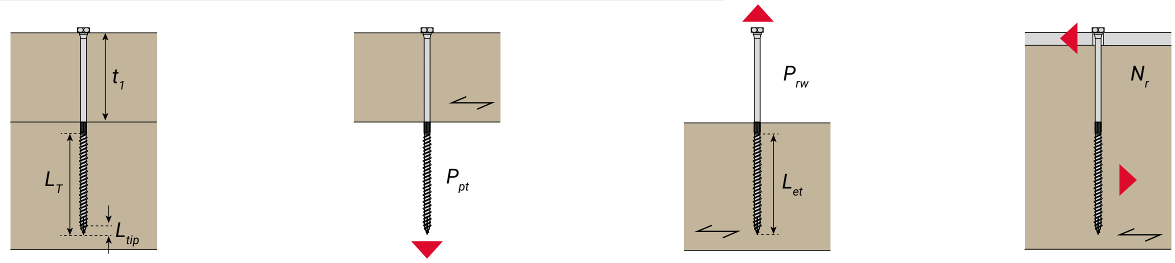
[1] tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 15.26 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of $G = 0.42$ as upper element and glue laminated timber of $G = 0.44$.
Typos and printing errors reserved.

12 mm RAPID® partial thread Dual

T-drive (T40) & hexagonal drive (SW17), Dual head, shoulder, friction part,
Single thread, core ribs, BlueWin coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	12 (1/2")	17.0	7.0	8.2	103.6	3945	37838	900





d_F = 12 mm (1/2")				AXIAL in tension α=β=90°						LATERAL $\alpha = \beta$ = 90°		
				HEAD PULL-THROUGH			WITHDRAWAL			STEEL-TO-WOOD [3]		
L		L_T		P_{pt} [1]			P_{rw} [2]			N_r [3]		
				K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	kN	kN	kN	kN	kN	kN	kN	kN	kN
80	(3-1/8")	50	(2")	3.18	2.76	1.80	4.17	3.62	2.36	4.01	3.69	2.88
100	(4")	60	(2-3/8")	3.18	2.76	1.80	5.00	4.35	2.83	4.01	3.69	2.88
120	(4-3/4")	80	(3-1/8")	3.18	2.76	1.80	6.67	5.80	3.77	4.01	3.69	2.88
140	(5-1/2")	80	(3-1/8")	3.18	2.76	1.80	6.67	5.80	3.77	4.01	3.69	2.88
160	(6-1/4")	80	(3-1/8")	3.18	2.76	1.80	6.67	5.80	3.77	4.01	3.69	2.88
180	(7-1/8")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
200	(7-7/8")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
220	(8-5/8")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
240	(9-1/2")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
260	(10-1/4")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
280	(11")	100	(4")	3.18	2.76	1.80	8.34	7.25	4.71	4.01	3.69	2.88
300	(11-3/4")	120	(4-3/4")	3.18	2.76	1.80	10.00	8.70	5.65	4.01	3.69	2.88
350	(14-1/8")	120	(4-3/4")	3.18	2.76	1.80	10.00	8.70	5.65	4.01	3.69	2.88
400	(15-3/4")	120	(4-3/4")	3.18	2.76	1.80	10.00	8.70	5.65	4.01	3.69	2.88

[1] tabled values for factored head pull-through resistance provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0 and n_F = 1; minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.

[2] tabled values for factored withdrawal resistance at $\alpha = \beta$ = 90° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and a threaded length completely located in the lower member $L_{et} = L_T$. Factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.70 kN.

[3] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.

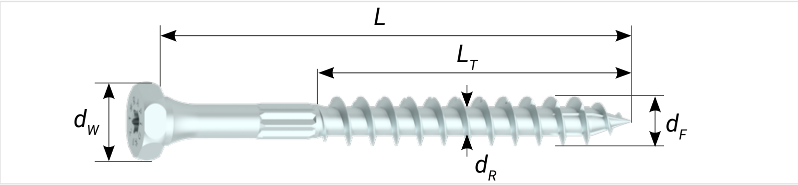
Factored shear resistance V_{rs} = 19.46 kN.

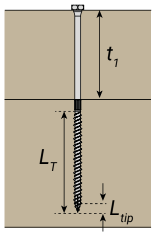
Typos and printing errors reserved.

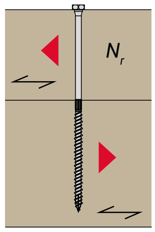
12 mm RAPID® partial thread Dual

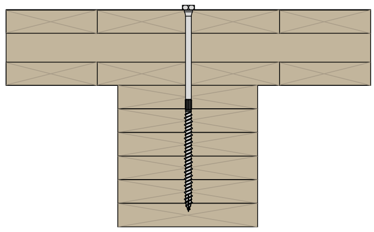
T-drive (T40) & hexagonal drive (SW17), Dual head, shoulder, friction part, Single thread, core ribs, BlueWin coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	d_S	y_w	f_{pt} (wood)	t_s	f_y
	mm (in)	mm	mm	mm	N/mm	N	N	MPa
	12 (1/2")	17.0	7.0	8.2	103.6	3945	37838	900









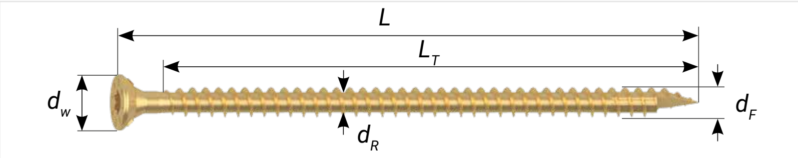
d_F = 12 mm (1/2")						LATERAL $\alpha = \beta = 90$ WOOD-TO-WOOD			LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ [2] CLT TO GLUE LAMINATED TIMBER			
L		L_T		t_1		N_r [1]			t_1	N_r [2]		
						K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	(in)	mm	(in)	kN	kN	kN	mm	kN	kN	kN
80	(3-1/8")	50	(2")	-	-	-	-	-	-	-	-	-
100	(4")	60	(2-3/8")	40	(1-9/16")	2.30	2.00	1.30	-	-	-	-
120	(4-3/4")	80	(3-1/8")	40	(1-9/16")	2.46	2.21	1.47	-	-	-	-
140	(5-1/2")	80	(3-1/8")	60	(2-3/8")	2.71	2.43	1.64	-	-	-	-
160	(6-1/4")	80	(3-1/8")	60	(2-3/8")	2.71	2.43	1.75	-	-	-	-
180	(7-1/8")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	-	-	-	-
200	(7-7/8")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	90	3.16	2.82	2.01
220	(8-5/8")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	90	3.16	2.82	2.01
240	(9-1/2")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	120	3.16	2.82	2.01
260	(10-1/4")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	120	3.16	2.82	2.01
280	(11")	100	(4")	90	(3-1/2")	3.09	2.77	1.97	160	3.16	2.82	2.01
300	(11-3/4")	120	(4-3/4")	90	(3-1/2")	3.09	2.77	1.97	160	3.16	2.82	2.01
350	(14-1/8")	120	(4-3/4")	90	(3-1/2")	3.09	2.77	1.97	160	3.16	2.82	2.01
400	(15-3/4")	120	(4-3/4")	90	(3-1/2")	3.09	2.77	1.97	160	3.16	2.82	2.01

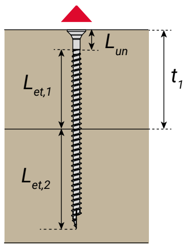
[1] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 19.46 kN.
[2] tabled values for lateral yielding resistance N_r is provided for for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect, threaded length completely located in the lower member and CLT of G = 0.42 as upper element and glue laminated timber of G = 0.44.
Typos and printing errors reserved.

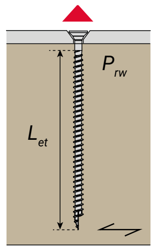
8 mm RAPID® fullthread countersunk head

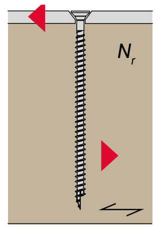
T-drive (T40), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	15.0	5.1	82.0	21847	950









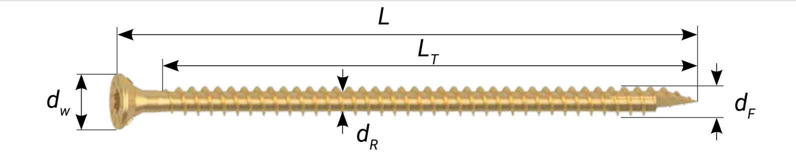
d_F = 8 mm (5/16")		AXIAL in tension, $\alpha = \beta = 90°$									LATERAL, $\alpha = \beta = 90°$		
		WOOD-TO-WOOD				STEEL-TO-WOOD					STEEL-TO-WOOD		
L		t_1 = 0.5·L	P_{rt} = min { P_{rw} 1); T_{rs} 2) }			$L_{et} = L_T$		P_{rt} = min { P_{rw} 1); T_{rs} 2) } 3)			N_r 3) 4)		
			K_D	K_D	K_D			K_D	K_D	K_D	K_D	K_D	K_D
			1.15	1.00	0.65			1.15	1.00	0.65	1.15	1.00	0.65
mm	(in)	mm	kN	kN	kN	mm	(in)	kN	kN	kN	kN	kN	kN
120	(4-3/4")	60	3.30	2.87	1.87	110	4.33	7.26	6.32	4.11	3.68	3.32	2.43
140	(5-1/2")	70	3.96	3.45	2.24	130	5.12	8.58	7.46	4.85	3.72	3.47	2.62
160	(6-1/4")	80	4.62	4.02	2.61	150	5.91	9.90	8.61	5.60	3.72	3.47	2.81
180	(7-1/8")	90	5.28	4.59	2.99	170	6.69	11.23	9.76	6.34	3.72	3.47	2.81
200	(7-7/8")	100	5.94	5.17	3.36	190	7.48	12.55	10.91	7.09	3.72	3.47	2.81
220	(8-5/8")	110	6.60	5.74	3.73	210	8.27	13.11	12.06	7.84	3.72	3.47	2.81
240	(9-1/2")	120	7.26	6.32	4.11	230	9.06	13.11	13.11	8.58	3.72	3.47	2.81
260	(10-1/4")	130	7.92	6.89	4.48	250	9.84	13.11	13.11	9.33	3.72	3.47	2.81
280	(11")	140	8.58	7.46	4.85	270	10.63	13.11	13.11	10.08	3.72	3.47	2.81
300	(11-3/4")	150	9.24	8.04	5.23	290	11.42	13.11	13.11	10.82	3.72	3.47	2.81
325	(12-3/4")	163	10.07	8.76	5.69	315	12.40	13.11	13.11	11.76	3.72	3.47	2.81
350	(13-3/4")	175	10.90	9.47	6.16	340	13.39	13.11	13.11	12.69	3.72	3.47	2.81
375	(14-3/4")	188	11.72	10.19	6.62	365	14.37	13.11	13.11	13.11	3.72	3.47	2.81
400	(15-3/4")	200	12.55	10.91	7.09	390	15.35	13.11	13.11	13.11	3.72	3.47	2.81
450	(17-3/4")	225	13.11	11.48	7.46	428	16.85	13.11	13.11	13.11	3.72	3.47	2.81
500	(19-5/8")	250	13.11	12.92	8.40	478	18.82	13.11	13.11	13.11	3.72	3.47	2.81
600	(23-5/8")	300	13.11	13.11	10.26	578	22.76	13.11	13.11	13.11	3.72	3.47	2.81

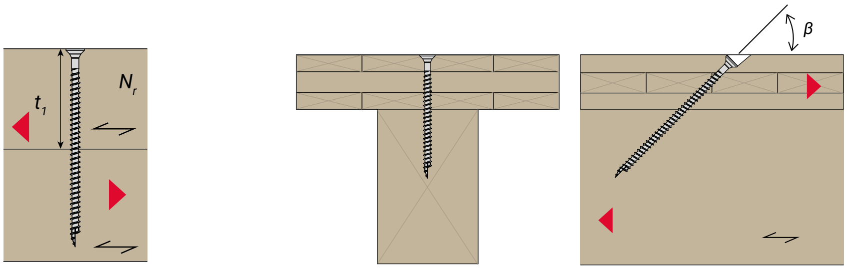
1) factored withdrawal resistance at $\alpha = \beta = 90°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and equal specific gravity of both members
2) factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN
3) minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549
4) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.
Factored shear restistance V_{rs} = 10.90 kN.
Typos and printing errors reserved

8 mm RAPID® fullthread countersunk head

T-drive (T40), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	15.0	5.1	82.0	21847	950





d_F = 8 mm (5/16")		LATERAL $\alpha = \beta = 90°$				MAINLY AXIAL $\alpha = \beta = 45°$ and $\theta = 0°$			
		WOOD-TO-WOOD				CLT FLOOR TO WOOD			
L		$t_1 = 0.5 \cdot L$	N_r [1]			t_1	P_{rt} [2] $\cdot \cos\beta$		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	60	2.09	1.82	1.18	-	-	-	-
140	(5-1/2")	70	2.32	2.10	1.40	-	-	-	-
160	(6-1/4")	80	2.49	2.25	1.61	-	-	-	-
180	(7-1/8")	90	2.65	2.39	1.75	-	-	-	-
200	(7-7/8")	100	2.66	2.48	1.84	-	-	-	-
220	(8-5/8")	110	2.66	2.48	1.93	-	-	-	-
240	(9-1/2")	120	2.66	2.48	2.00	-	-	-	-
260	(10-1/4")	130	2.66	2.48	2.00	90	5.59	4.86	3.16
280	(11")	140	2.66	2.48	2.00	90	5.59	4.86	3.16
300	(11-3/4")	150	2.66	2.48	2.00	90	5.59	4.86	3.16
325	(12-3/4")	163	2.66	2.48	2.00	90	5.59	4.86	3.16
350	(13-3/4")	175	2.66	2.48	2.00	120	5.59	4.86	3.16
375	(14-3/4")	188	2.66	2.48	2.00	120	5.59	4.86	3.16
400	(15-3/4")	200	2.66	2.48	2.00	140	5.59	4.86	3.16
450	(17-3/4")	225	2.66	2.48	2.00	140	4.83	4.20	2.73
500	(19-5/8)	250	2.66	2.48	2.00	140	4.83	4.20	2.73
600	(23-5/8)	300	2.66	2.48	2.00	140	4.83	4.20	2.73

[1] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 10.90 kN.

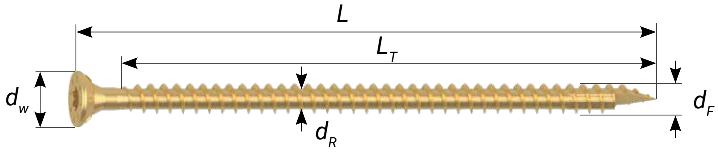
[2] tabled values base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a =0.91, J_w =1.2 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN. Factored shear restistance V_{rs} / sin45°= 15.42 kN.

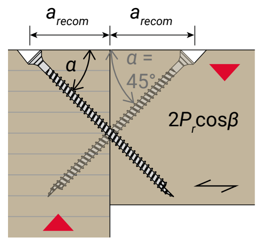
Typos and printing errors reserved.

8 mm RAPID® fullthread countersunk head

T-drive (T40), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	15.0	5.1	82.0	21847	950





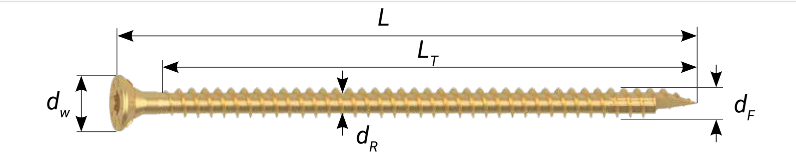
d_F = 8 mm (5/16")		recommended geometric dimensions for intersection point in the middle of the secondary beam axis		MAINLY AXIAL β = 45° — 1 SYMMETRIC SCREW PAIR							
L		$H_{secondary\ beam}$	$W_{main\ beam}$	a_{recom}	$2 \cdot P_{rt}$ [1] $\cdot \cos\beta$			$2 \cdot P_{rc}$ [2] $\cdot \cos\beta$			$V_{rs} / \sin\beta$
					K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	mm		kN	kN	kN	kN	kN	kN	kN
120	(4-3/4")	-	-	-	-	-	-	-	-	-	-
140	(5-1/2")	-	-	-	-	-	-	-	-	-	-
160	(6-1/4")	-	-	-	-	-	-	-	-	-	-
180	(7-1/8")	-	-	-	-	-	-	-	-	-	-
200	(7-7/8")	-	-	-	-	-	-	-	-	-	-
220	(8-5/8")	-	-	-	-	-	-	-	-	-	-
240	(9-1/2")	180	≥ 100	$11.5 \cdot d_F$	9.56	8.31	5.40	9.56	8.31	5.40	15.42
260	(10-1/4")	200	≥ 100	$12.5 \cdot d_F$	10.52	9.15	5.95	10.52	9.15	5.95	15.42
280	(11")	220	≥ 100	$13.5 \cdot d_F$	11.44	9.95	6.47	11.44	9.95	6.47	15.42
300	(11-3/4")	220	≥ 120	$14 \cdot d_F$	11.96	10.40	6.76	11.96	10.40	6.76	15.42
325	(12-3/4")	240	≥ 120	$15.5 \cdot d_F$	13.34	11.60	7.54	13.34	11.60	7.54	15.42
350	(13-3/4")	260	≥ 140	$16.5 \cdot d_F$	14.36	12.49	8.12	14.27	12.49	8.12	15.42
375	(14-3/4")	280	≥ 140	$17.5 \cdot d_F$	15.32	13.32	8.66	14.27	13.32	8.66	15.42
400	(15-3/4")	300	≥ 140	$18.5 \cdot d_F$	16.28	14.16	9.20	14.27	14.16	9.20	15.42
450	(17-3/4")	340	≥ 160	$21 \cdot d_F$	17.67	15.36	9.98	14.27	14.27	9.98	15.42
500	(19-5/8")	360	≥ 180	$23 \cdot d_F$	18.54	17.03	11.07	14.27	14.27	11.07	15.42
600	(23-5/8")	440	≥ 220	$27.5 \cdot d_F$	18.54	18.54	13.51	14.27	14.27	13.51	15.42

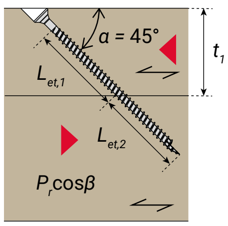
[1] value base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α =0.91, J_w =1.0 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN.
[2] value base and factored buckling resistance provided for for Φ = 0.8, K_{CS} = 0.65 and n_F = 1
Factored shear resistance V_{rs} = 10.90 kN.
Typos and printing errors reserved

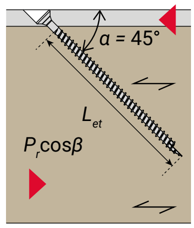
8 mm RAPID® fullthread countersunk head

T-drive (T40), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	15.0	5.1	82.0	21847	950







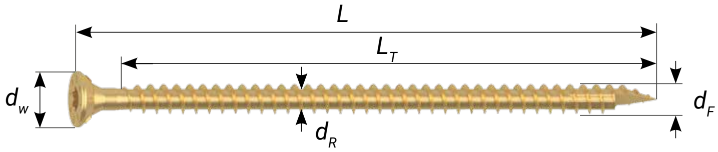
d_F = 8 mm (5/16")		MAINLY AXIAL $\alpha = \beta = 45°$				MAINLY AXIAL $\alpha = \beta = 45°$				
		WOOD-TO-WOOD with min { $L_{et,1}$; $L_{et,2}$ }				STEEL-TO-WOOD				
L		t_1	P_{rt} [1) 2)] · cosβ			L_{et}	P_{rt} [1)] · cosβ			V_{rs} / sinβ
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	kN	kN	kN	mm	kN	kN	kN	kN
120	(4-3/4")	50	2.71	2.36	1.53	106	5.40	4.69	3.05	15.42
140	(5-1/2")	50	2.71	2.36	1.53	126	6.42	5.58	3.63	15.42
160	(6-1/4")	60	3.43	2.98	1.94	146	7.44	6.47	4.20	15.42
180	(7-1/8")	60	3.43	2.98	1.94	166	8.46	7.35	4.78	15.42
200	(7-7/8")	60	3.43	2.98	1.94	186	9.27	8.24	5.35	15.42
220	(8-5/8")	80	4.87	4.24	2.75	206	9.27	9.12	5.93	15.42
240	(9-1/2")	80	4.87	4.24	2.75	226	9.27	9.27	6.51	15.42
260	(10-1/4")	80	4.87	4.24	2.75	246	9.27	9.27	7.08	15.42
280	(11")	100	6.31	5.49	3.57	266	9.27	9.27	7.66	15.42
300	(11-3/4")	100	6.31	5.49	3.57	286	9.27	9.27	8.23	15.42
325	(12-3/4")	120	7.75	6.74	4.38	311	9.27	9.27	8.95	15.42
350	(13-3/4")	120	7.75	6.74	4.38	336	9.27	9.27	9.27	15.42
375	(14-3/4")	140	9.19	7.99	5.20	361	9.27	9.27	9.27	15.42
400	(15-3/4")	140	9.19	7.99	5.20	386	9.27	9.27	9.27	15.42
450	(17-3/4")	160	9.27	8.72	5.67	424	9.27	9.27	9.27	15.42
500	(19-5/8")	180	9.27	9.27	6.48	474	9.27	9.27	9.27	15.42
600	(23-5/8")	200	9.27	9.27	7.29	574	9.27	9.27	9.27	15.42

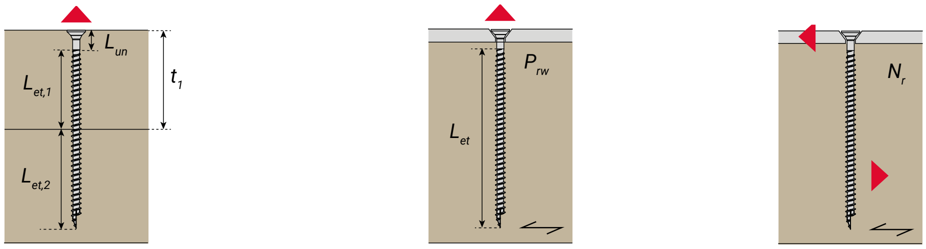
[1)] value base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 0.91, J_w = 1.2 and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN
[2)] equal specific gravity of both members
[3)] minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549.
Factored shear resistance V_{rs} = 10.90 kN.
Typos and printing errors reserved

10 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	18.5	6.3	93.0	36967	950





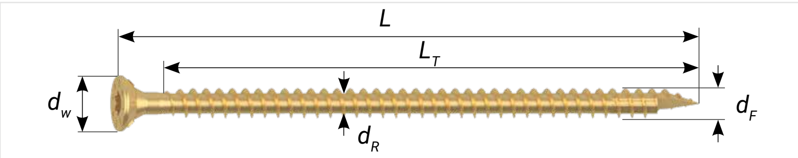
d_F = 10 mm (3/8”)		AXIAL in tension, $\alpha = \beta = 90°$									LATERAL, $\alpha = \beta = 90°$		
		WOOD-TO-WOOD				STEEL-TO-WOOD					STEEL-TO-WOOD		
L		t_1 = 0.5·L	P_{rt} = min { P_{rw} 1); T_{rs} 2) }			$L_{et} = L_T$		P_{rt} = min { P_{rw} 1); T_{rs} 2) } 3)			N_r 3) 4)		
			K_D 1.15	K_D 1.00	K_D 0.65			K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	(in)	kN	kN	kN	kN	kN	kN
120	(4-3/4")	60	3.59	3.12	2.03	108	4.25	8.08	7.03	4.57	4.77	4.32	3.22
160	(6-1/4")	80	5.09	4.42	2.88	148	5.83	11.07	9.63	6.26	5.49	4.97	3.64
180	(7-1/8")	90	5.84	5.08	3.30	168	6.61	12.57	10.93	7.11	5.49	5.13	3.85
200	(7-7/8")	100	6.58	5.73	3.72	188	7.40	14.07	12.23	7.95	5.49	5.13	4.06
220	('8-5/8")	110	7.33	6.38	4.14	208	8.19	15.56	13.53	8.80	5.49	5.13	4.15
240	('9-1/2")	120	8.08	7.03	4.57	228	8.98	17.06	14.84	9.64	5.49	5.13	4.15
260	('10-1/4")	130	8.83	7.68	4.99	248	9.76	18.56	16.14	10.49	5.49	5.13	4.15
280	(11")	140	9.58	8.33	5.41	268	10.55	20.05	17.44	11.33	5.49	5.13	4.15
300	(11-3/4")	150	10.33	8.98	5.84	288	11.34	21.55	18.74	12.18	5.49	5.13	4.15
325	(12-3/4")	163	10.36	9.01	5.86	301	11.85	22.18	19.59	12.73	5.49	5.13	4.15
350	(13-3/4")	175	11.30	9.83	6.39	326	12.83	22.18	21.21	13.79	5.49	5.13	4.15
375	(14-3/4")	188	12.23	10.64	6.92	351	13.82	22.18	22.18	14.85	5.49	5.13	4.15
400	(15-3/4")	200	13.17	11.45	7.44	376	14.80	22.18	22.18	15.90	5.49	5.13	4.15
450	(17-3/4")	225	15.04	13.08	8.50	426	16.77	22.18	22.18	18.02	5.49	5.13	4.15
500	(19-5/8")	250	16.91	14.71	9.56	476	18.74	22.18	22.18	20.13	5.49	5.13	4.15
600	(23-5/8")	300	20.65	17.96	11.67	576	22.68	22.18	22.18	22.18	5.49	5.13	4.15
700	(27-5/8")	350	22.18	21.21	13.79	676	26.61	22.18	22.18	22.18	5.49	5.13	4.15
800	(31-1/2")	400	22.18	22.18	15.90	776	30.55	22.18	22.18	22.18	5.49	5.13	4.15
1000	(39-3/8")	500	22.18	22.18	20.13	976	38.43	22.18	22.18	22.18	5.49	5.13	4.15

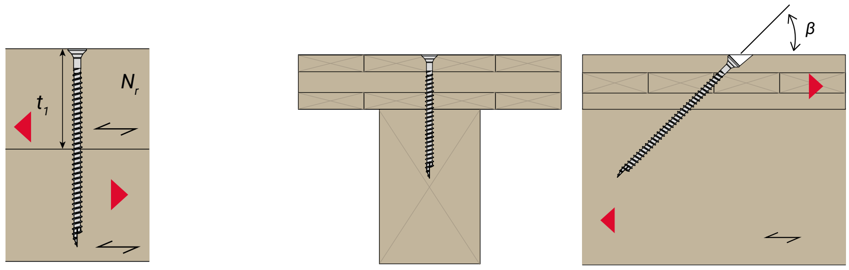
1) factored withdrawal resistance at $\alpha = \beta = 90°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and equal specific gravity of both members
2) factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.18 kN
3) minimum requirements for the steel plate, $f_u \geq$ 360 MPa and thickness $t_{s,s} \geq$ 6.0 mm, prevent steel head pull-through, compare with ICC-ESR-4549
4) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect.
Factored shear restistance V_{rs} = 16.63 kN.
Typos and printing errors reserved

10 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	18.5	6.3	93.0	36967	950





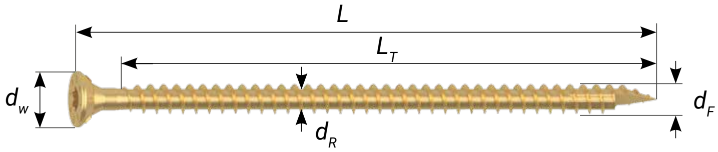
d_F = 10 mm (3/8")		LATERAL $\alpha = \beta = 90°$				MAINLY AXIAL $\alpha = \beta = 45°$ and $\theta = 0°$			
		WOOD-TO-WOOD				CLT FLOOR TO WOOD			
L		$t_1 = 0.5 \cdot L$	N_r [1]			t_1	P_{rt} [2] $\cdot \cos\beta$		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	60	2.36	2.05	1.33	-	-	-	-
160	(6-1/4")	80	3.22	2.80	1.82	-	-	-	-
180	(7-1/8")	90	3.42	3.10	2.07	-	-	-	-
200	(7-7/8")	100	3.61	3.26	2.31	-	-	-	-
220	('8-5/8")	110	3.80	3.43	2.51	-	-	-	-
240	('9-1/2")	120	3.93	3.59	2.62	-	-	-	-
260	('10-1/4")	130	3.93	3.67	2.73	90	6.12	5.32	3.46
280	(11")	140	3.93	3.67	2.83	90	6.12	5.32	3.46
300	(11-3/4")	150	3.93	3.67	2.94	90	6.12	5.32	3.46
325	(12-3/4")	163	3.93	3.67	2.94	90	5.43	4.72	3.07
350	(13-3/4")	175	3.93	3.67	2.96	120	5.43	4.72	3.07
375	(14-3/4")	188	3.93	3.67	2.96	120	5.43	4.72	3.07
400	(15-3/4")	200	3.93	3.67	2.96	140	5.43	4.72	3.07
450	(17-3/4")	225	3.93	3.67	2.96	140	5.43	4.72	3.07
500	(19-5/8")	250	3.93	3.67	2.96	140	5.43	4.72	3.07
600	(23-5/8")	300	3.93	3.67	2.96	140	5.43	4.72	3.07
700	(27-5/8")	350	3.93	3.67	2.96	140	5.43	4.72	3.07
800	(31-1/2")	400	3.93	3.67	2.96	140	5.43	4.72	3.07
1000	(39-3/8")	500	3.93	3.67	2.96	140	5.43	4.72	3.07

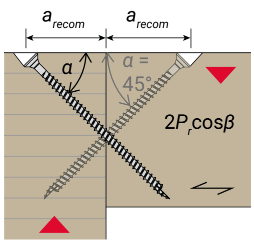
[1] tabled values for lateral yielding resistance N_r provided for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 16.63 kN.
[2] tabled values base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_a = 0.91$, $J_w = 1.2$ and equal specific gravity of both members and factored tensile resistance provided for $\Phi = 0.6$ and $n_F = 1$ result in T_{rs} = 22.18 kN. Factored shear restistance V_{rs} / sin45°= 23.53 kN.
Typos and printing errors reserved.

10 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	18.5	6.3	93.0	36967	950





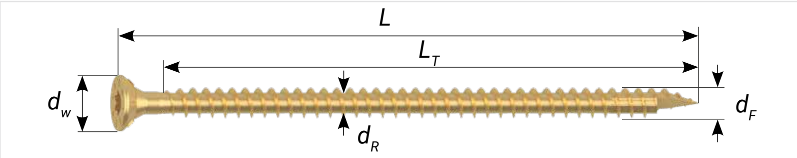
d_F = 10 mm (3/8")		recommended geometric dimensions for intersection point in the middle of the secondary beam axis		MAINLY AXIAL β = 45°								
				1 SYMMETRIC SCREW PAIR								
L				a_{recom}	$2 \cdot P_{rt}$ 1) $\cdot \cos\beta$			$2 \cdot P_{rc}$ 2) $\cdot \cos\beta$			$V_{rs} / \sin\beta$
		$H_{secondary\ beam}$	$W_{main\ beam}$		K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	mm		kN	kN	kN	kN	kN	kN	kN
120	(4-3/4")	-	-	-	-	-	-	-	-	-	-
160	(6-1/4")	-	-	-	-	-	-	-	-	-	-
180	(7-1/8")	-	-	-	-	-	-	-	-	-	-
200	(7-7/8")	-	-	-	-	-	-	-	-	-	-
220	('8-5/8")	-	-	-	-	-	-	-	-	-	-
240	(9-1/2")	-	-	-	-	-	-	-	-	-	-
260	(10-1/4")	-	-	-	-	-	-	-	-	-	-
280	(11")	220	≥ 120	$11 \cdot d_F$	12.86	11.18	7.27	12.86	11.18	7.27	23.53
300	(11-3/4")	240	≥ 120	$11.5 \cdot d_F$	13.60	11.83	7.69	13.60	11.83	7.69	23.53
325	(12-3/4")	260	≥ 120	$12.5 \cdot d_F$	13.81	12.01	7.80	13.81	12.01	7.80	23.53
350	(13-3/4")	280	≥ 140	$13.5 \cdot d_F$	15.17	13.19	8.57	15.17	13.19	8.57	23.53
375	(14-3/4")	280	≥ 140	$14 \cdot d_F$	15.85	13.78	8.96	15.85	13.78	8.96	23.53
400	(15-3/4")	300	≥ 160	$15 \cdot d_F$	17.21	14.96	9.73	17.21	14.96	9.73	23.53
450	(17-3/4")	340	≥ 180	$17 \cdot d_F$	19.93	17.33	11.26	19.93	17.33	11.26	23.53
500	(19-5/8")	380	≥ 180	$18.5 \cdot d_F$	21.97	19.10	12.42	21.78	19.10	12.42	23.53
600	(23-5/8")	440	≥ 220	$22 \cdot d_F$	26.73	23.25	15.11	21.78	21.78	15.11	23.53
700	(27-5/8")	520	≥ 260	$25.5 \cdot d_F$	31.37	27.39	17.80	21.78	21.78	17.80	23.53
800	(31-1/2")	580	≥ 300	$29 \cdot d_F$	31.37	31.37	20.49	21.78	21.78	20.49	23.53
1000	(39-3/8")	740	≥ 360	$36.5 \cdot d_F$	31.37	31.37	26.26	21.78	21.78	21.78	23.53

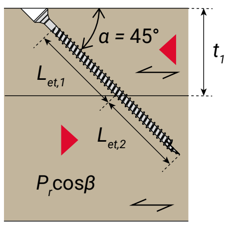
1) value base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α =0.91, J_w =1.0 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.18 kN.
2) value base and factored buckling resistance provided for for Φ = 0.8, K_{CS} = 0.65 and n_F = 1
Factored shear resistance V_{rs} = 16.63 kN.
Typos and printing errors reserved

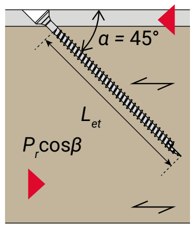
10 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	18.5	6.3	93.0	36967	950







d_F = 10 mm (3/8")		MAINLY AXIAL $α = β = 45°$				MAINLY AXIAL $α = β = 45°$				
		WOOD-TO-WOOD with min { $L_{et,1}$; $L_{et,2}$ }				STEEL-TO-WOOD				
L		t_1	P_{rt} 1) 2) · cosβ			L_{et}	P_{rt} 1) · cosβ			V_{rs} / sinβ
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	kN	kN	kN	mm	kN	kN	kN	kN
120	(4-3/4")	40	2.04	1.77	1.15	103	5.95	5.17	3.36	23.53
160	(6-1/4")	60	3.67	3.19	2.08	143	8.25	7.18	4.67	23.53
180	(7-1/8")	60	3.67	3.19	2.08	163	9.41	8.18	5.32	23.53
200	(7-7/8")	60	3.67	3.19	2.08	183	10.56	9.19	5.97	23.53
220	('8-5/8")	80	5.30	4.61	3.00	203	11.72	10.19	6.62	23.53
240	('9-1/2")	80	5.30	4.61	3.00	223	12.87	11.19	7.28	23.53
260	('10-1/4")	80	5.30	4.61	3.00	243	14.03	12.20	7.93	23.53
280	(11")	100	6.94	6.03	3.92	263	15.18	13.20	8.58	23.53
300	(11-3/4")	100	6.94	6.03	3.92	283	15.68	14.20	9.23	23.53
325	(12-3/4")	120	7.88	6.85	4.45	296	15.68	14.86	9.66	23.53
350	(13-3/4")	120	7.88	6.85	4.45	321	15.68	15.68	10.47	23.53
375	(14-3/4")	120	7.88	6.85	4.45	346	15.68	15.68	11.29	23.53
400	(15-3/4")	140	9.51	8.27	5.37	371	15.68	15.68	12.10	23.53
450	(17-3/4")	160	11.14	9.69	6.30	421	15.68	15.68	13.74	23.53
500	(19-5/8")	180	12.77	11.11	7.22	471	15.68	15.68	15.37	23.53
600	(23-5/8")	200	14.41	12.53	8.14	571	15.68	15.68	15.68	23.53
700	(27-5/8")	240	15.68	15.37	9.99	671	15.68	15.68	15.68	23.53
800	(31-1/2")	280	15.68	15.68	11.83	771	15.68	15.68	15.68	23.53
1000	(39-3/8")	360	15.68	15.68	15.53	971	15.68	15.68	15.68	23.53

1) value base on factored withdrawal resistance at $α = β = 45°$ provided for $Φ = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_α = 0.91$, $J_w = 1.2$ and factored tensile resistance provided for $Φ = 0.6$ and $n_F = 1$ result in $T_{rs} = 22.18$ kN

2) equal specific gravity of both members

3) minimum requirements for the steel plate, $f_u \geq 360$ MPa and thickness $t_{s,s} \geq 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549.

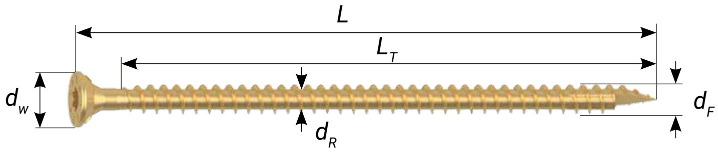
Factored shear resistance $V_{rs} = 16.63$ kN.

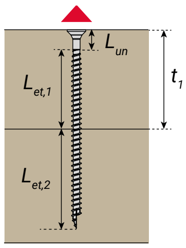
Typos and printing errors reserved

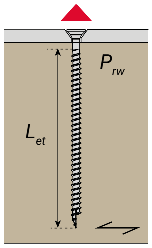
12 mm RAPID® fullthread countersunk head

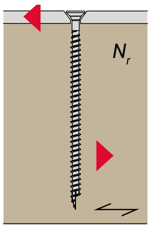
T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	21.0	7.0	103.6	42537	938









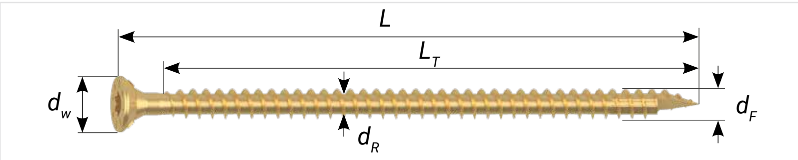
d_F = 12 mm (1/2")		AXIAL in tension, $\alpha = \beta = 90°$									LATERAL, $\alpha = \beta = 90°$		
		WOOD-TO-WOOD				STEEL-TO-WOOD					STEEL-TO-WOOD		
L		t_1 = 0.5·L	P_{rt} = min { P_{rw} [1]; T_{rs} [2] }			$L_{et} = L_T$		P_{rt} = min { P_{rw} [1]; T_{rs} [2] } [3]			N_r [3) 4)]		
			K_D 1.15	K_D 1.00	K_D 0.65			K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	(in)	kN	kN	kN	kN	kN	kN
200	(7-7/8")	100	6.67	5.80	3.77	180	7.09	15.01	13.05	8.48	6.56	6.13	4.60
220	(8-5/8")	110	7.50	6.52	4.24	200	7.87	16.67	14.50	9.42	6.56	6.13	4.83
240	('9-1/2")	120	8.34	7.25	4.71	220	8.66	18.34	15.95	10.37	6.56	6.13	4.96
260	('10-1/4")	130	9.17	7.97	5.18	240	9.45	20.01	17.40	11.31	6.56	6.13	4.96
280	(11")	140	10.00	8.70	5.65	260	10.24	21.68	18.85	12.25	6.56	6.13	4.96
300	(11-3/4")	150	10.84	9.42	6.13	280	11.02	23.34	20.30	13.19	6.56	6.13	4.96
350	(13-3/4")	175	12.92	11.24	7.30	330	12.99	25.52	23.92	15.55	6.56	6.13	4.96
400	(15-3/4")	200	15.01	13.05	8.48	380	14.96	25.52	25.52	17.91	6.56	6.13	4.96
500	(19-5/8")	250	19.18	16.67	10.84	480	18.90	25.52	25.52	22.62	6.56	6.13	4.96
600	(23-5/8")	300	23.34	20.30	13.19	580	22.83	25.52	25.52	25.52	6.56	6.13	4.96
700	(27-5/8")	350	25.52	23.92	15.55	680	26.77	25.52	25.52	25.52	6.56	6.13	4.96
800	(31-1/2")	400	25.52	25.52	17.91	780	30.71	25.52	25.52	25.52	6.56	6.13	4.96
1000	(39-3/8")	500	25.52	25.52	22.62	980	38.58	25.52	25.52	25.52	6.56	6.13	4.96

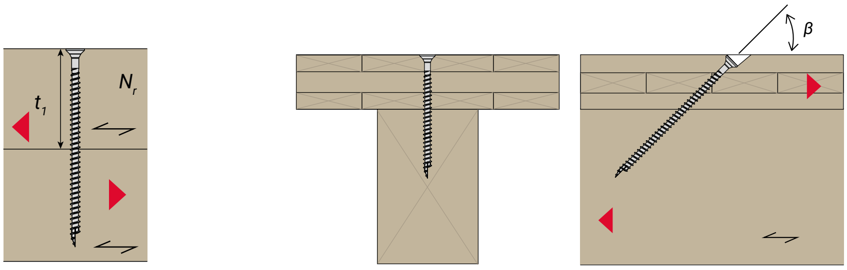
[1] factored withdrawal resistance at $\alpha = \beta = 90°$ provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_\alpha = 1.0$, $J_w = 1.0$ and equal specific gravity of both members
[2] factored tensile resistance provided for $\Phi = 0.6$ and $n_F = 1$ result in $T_{rs} = 25.52$ kN
[3] minimum requirements for the steel plate, $f_u \geq 360$ MPa and thickness $t_{s,s} \geq 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549
[4] tabled values for lateral yielding resistance N_r provided for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect.
Factored shear restistance $V_{rs} = 20.54$ kN.
Typos and printing errors reserved

12 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	21.0	7.0	103.6	42537	938





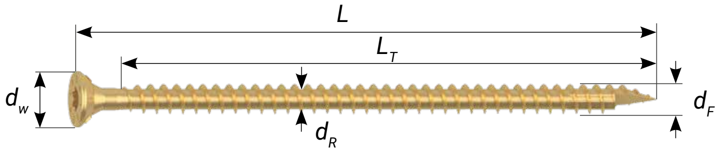
d_F = 12 mm (1/2”)			LATERAL $\alpha = \beta = 90°$ WOOD-TO-WOOD			MAINLY AXIAL $\alpha = \beta = 45°$ and $\theta = 0°$ CLT FLOOR TO WOOD			
L		$t_1 = 0.5 \cdot L$	N_r [1)]			t_1	P_{rt} [2)] · cos*β*		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN
200	(7-7/8")	100	4.01	3.64	2.39	-	-	-	-
220	(8-5/8")	110	4.22	3.82	2.66	-	-	-	-
240	('9-1/2")	120	4.43	4.00	2.92	-	-	-	-
260	('10-1/4")	130	4.64	4.18	3.06	90	6.22	5.41	3.52
280	(11")	140	4.69	4.36	3.18	90	6.22	5.41	3.52
300	(11-3/4")	150	4.69	4.38	3.30	90	6.22	5.41	3.52
350	(13-3/4")	175	4.69	4.38	3.53	120	6.22	5.41	3.52
400	(15-3/4")	200	4.69	4.38	3.53	140	6.22	5.41	3.52
500	(19-5/8")	250	4.69	4.38	3.53	140	6.22	5.41	3.52
600	(23-5/8")	300	4.69	4.38	3.53	140	6.22	5.41	3.52
700	(27-5/8")	350	4.69	4.38	3.53	140	6.22	5.41	3.52
800	(31-1/2")	400	4.69	4.38	3.53	140	6.22	5.41	3.52
1000	(39-3/8")	500	4.69	4.38	3.53	140	6.22	5.41	3.52

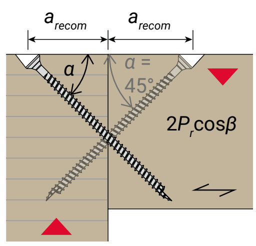
[1)] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 20.54 kN.
[2)] tabled values base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a =0.91, J_w =1.2 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 25.52 kN. Factored shear restistance V_{rs} / sin45°= 29.04 kN.

12 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	21.0	7.0	103.6	42537	938





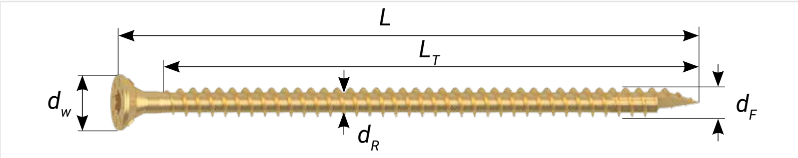
d_F = 12 mm (1/2")		recommended geometric dimensions for intersection point in the middle of the secondary beam axis		MAINLY AXIAL β = 45° — 1 SYMMETRIC SCREW PAIR							
L				a_{recom}	$2 \cdot P_{rt}$ [1] $\cdot \cos\beta$			$2 \cdot P_{rc}$ [2] $\cdot \cos\beta$			$V_{rs} / \sin\beta$
		$H_{secondary\ beam}$	$W_{main\ beam}$		K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	mm		kN	kN	kN	kN	kN	kN	kN
200	(7-7/8")	-	-	-	-	-	-	-	-	-	-
220	(8-5/8")	-	-	-	-	-	-	-	-	-	-
240	(9-1/2")	-	-	-	-	-	-	-	-	-	-
260	(10-1/4")	-	-	-	-	-	-	-	-	-	-
280	(11")	-	-	-	-	-	-	-	-	-	-
300	(11-3/4")	-	-	-	-	-	-	-	-	-	-
350	(13-3/4")	280	≥ 140	$11.5 \cdot d_F$	17.65	15.35	9.98	17.65	15.35	9.98	29.04
400	(15-3/4")	300	≥ 160	$12.5 \cdot d_F$	19.47	16.93	11.00	19.47	16.93	11.00	29.04
500	(19-5/8")	380	≥ 180	$15.5 \cdot d_F$	24.93	21.67	14.09	24.93	21.67	14.09	29.04
600	(23-5/8")	440	≥ 220	$18.5 \cdot d_F$	30.38	26.42	17.17	26.55	26.42	17.17	29.04
700	(27-5/8")	520	≥ 260	$21.5 \cdot d_F$	35.84	31.17	20.26	26.55	26.55	20.26	29.04
800	(31-1/2")	580	≥ 300	$24.5 \cdot d_F$	36.09	35.91	23.34	26.55	26.55	23.34	29.04
1000	(39-3/8")	740	≥ 360	$30.5 \cdot d_F$	36.09	36.09	29.51	26.55	26.55	26.55	29.04

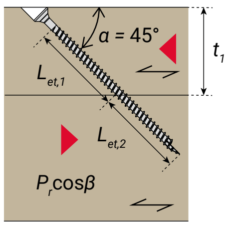
[1] value base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α =0.91, J_w =1.0 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 25.52 kN.
[2] value base and factored buckling resistance provided for for Φ = 0.8, K_{CS} = 0.65 and n_F = 1
Factored shear resistance V_{rs} = 20.54 kN.
Typos and printing errors reserved

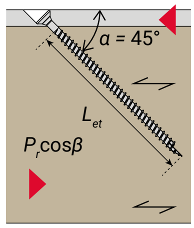
12 mm RAPID® fullthread countersunk head

T-drive (T50), countersunk head, milling fins, Single thread, core ribs, half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	21.0	7.0	103.6	42537	938







d_F = 12 mm (1/2")		MAINLY AXIAL $\alpha = \beta = 45°$				MAINLY AXIAL $\alpha = \beta = 45°$				
		WOOD-TO-WOOD with min { $L_{et,1}$; $L_{et,2}$ }				STEEL-TO-WOOD				
L		t_1	P_{rt} 1) 2) · cosβ			L_{et}	P_{rt} 1) · cosβ			V_{rs} / sinβ
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	
in	(mm)	mm	kN	kN	kN	mm	kN	kN	kN	kN
200	(7-7/8")	60	3.50	3.04	1.98	174	11.19	9.73	6.33	29.04
220	(8-5/8")	80	5.31	4.62	3.00	194	12.48	10.85	7.05	29.04
240	(9-1/2")	80	5.31	4.62	3.00	214	13.76	11.97	7.78	29.04
260	(10-1/4")	80	5.31	4.62	3.00	234	15.05	13.09	8.51	29.04
280	(11")	100	7.13	6.20	4.03	254	16.34	14.20	9.23	29.04
300	(11-3/4")	100	7.13	6.20	4.03	274	17.62	15.32	9.96	29.04
350	(13-3/4")	120	8.95	7.79	5.06	324	18.05	18.05	11.78	29.04
400	(15-3/4")	140	10.77	9.37	6.09	374	18.05	18.05	13.60	29.04
500	(19-5/8")	180	14.41	12.53	8.14	474	18.05	18.05	17.23	29.04
600	(23-5/8")	200	16.23	14.11	9.17	574	18.05	18.05	18.05	29.04
700	(27-5/8")	240	18.05	17.28	11.23	674	18.05	18.05	18.05	29.04
800	(31-1/2")	280	18.05	18.05	13.29	774	18.05	18.05	18.05	29.04
1000	(39-3/8")	360	18.05	18.05	17.40	974	18.05	18.05	18.05	29.04

1) value base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_a = 0.91$, $J_w = 1.2$ and factored tensile resistance provided for $\Phi = 0.6$ and $n_F = 1$ result in $T_{rs} = 25.52$ kN

2) equal specific gravity of both members

3) minimum requirements for the steel plate, $f_u \geq 360$ MPa and thickness $t_{s,s} \geq 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549.

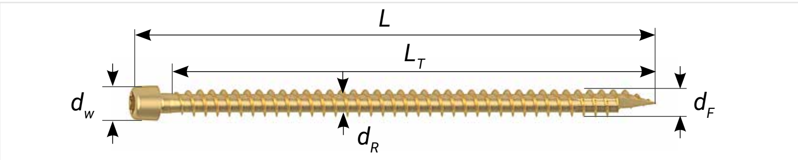
Factored shear resistance $V_{rs} = 20.54$ kN.

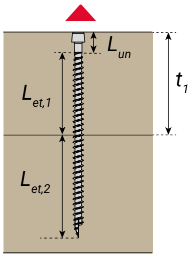
Typos and printing errors reserved

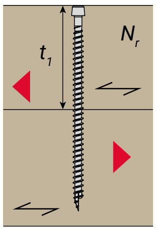
8 mm RAPID® fullthread cylinder head

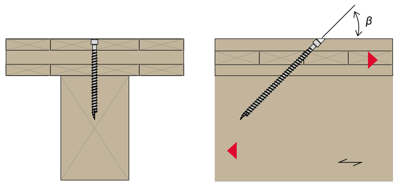
T-drive (T40), cylinder head, single thread, core ribs, from 4-3/4” to 15-3/4” with full tip, from 17-3/4” with half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	5.1	82.0	21847	950	938









d_F = 8 mm (5/16”)		AXIAL IN TENSION, $\alpha = \beta = 90°$				LATERAL [3) 5)]				MAINLY AXIAL α = β = 45° and θ = 0°			
		WOOD-TO-WOOD				WOOD-TO-WOOD				CLT FLOOR TO WOOD			
L		t_1 = 0.5 · L	P_{rt} = min { P_{rw} [1)] ; T_{rs} [2)] }			t_1 = 0.5 · L	N_r [3)]			t_1	P_{rt} [4)] · cosβ		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	60	3.30	2.87	1.87	60	2.09	1.82	1.18	-	-	-	-
140	(5-1/2")	70	3.96	3.45	2.24	70	2.32	2.10	1.40	-	-	-	-
160	(6-1/4")	80	4.62	4.02	2.61	80	2.49	2.25	1.61	-	-	-	-
180	(7-1/8")	90	5.28	4.59	2.99	90	2.65	2.39	1.75	-	-	-	-
200	(7-7/8")	100	5.94	5.17	3.36	100	2.66	2.48	1.84	-	-	-	-
220	(8-5/8")	110	6.60	5.74	3.73	110	2.66	2.48	1.93	-	-	-	-
240	(9-1/2")	120	7.26	6.32	4.11	120	2.66	2.48	2.00	-	-	-	-
260	(10-1/4")	130	7.92	6.89	4.48	130	2.66	2.48	2.00	90	5.77	5.02	3.26
280	(11")	140	8.58	7.46	4.85	140	2.66	2.48	2.00	90	5.77	5.02	3.26
300	(11-3/4")	150	9.24	8.04	5.23	150	2.66	2.48	2.00	90	5.77	5.02	3.26
325	(12-3/4")	163	10.07	8.76	5.69	163	2.66	2.48	2.00	90	5.77	5.02	3.26
350	(13-3/4")	175	10.90	9.47	6.16	175	2.66	2.48	2.00	120	7.93	6.90	4.48
375	(14-3/4")	188	11.72	10.19	6.62	188	2.66	2.48	2.00	120	7.93	6.90	4.48
400	(15-3/4")	200	12.55	10.91	7.09	200	2.66	2.48	2.00	140	9.27	8.15	5.30
450	(17-3/4")	225	13.11	11.48	7.46	225	2.66	2.48	2.00	140	8.61	7.48	4.86
500	(19-5/8")	250	13.11	12.92	8.40	250	2.66	2.48	2.00	140	8.61	7.48	4.86
600	(23-5/8")	300	13.11	13.11	10.26	300	2.66	2.48	2.00	140	8.61	7.48	4.86

1) factored withdrawal resistance at $\alpha = \beta = 90°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 1.0, J_w = 1.0 and equal specific gravity of both members

2) factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN.

3) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 10.90 kN.

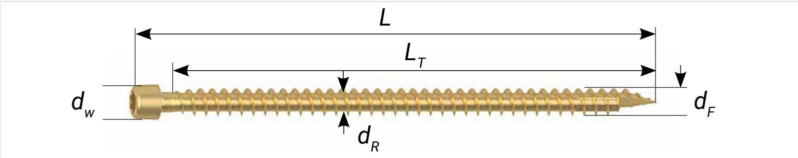
4) tabled values base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α =0.91, J_w =1.2 and equal specific gravity of both members and factored tensile resistance provided for Φ =0.6 and n_F = 1. Factored shear restistance V_{rs} / sin45° = 15.42 kN.

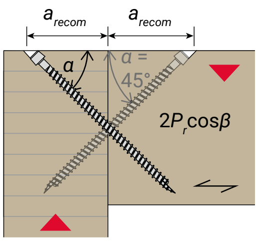
Typos and printing errors reserved

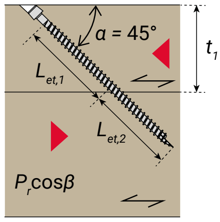
8 mm RAPID® fullthread countersunk head

T-drive (T40), cylinder head, single thread, core ribs, from 4-3/4" to 15-3/4" with full tip, from 17-3/4" half tip, YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	8 (5/16")	5.1	82.0	21847	950	938







d_F = 8 mm (5/16")		recommended geometric dimensions for intersection point in the middle of the secondary beam axis			MAINLY AXIAL $β$ = 45°						V_{rs} / sin$β$	MAINLY AXIAL $α$ = $β$ = 45°			
					1 SYMMETRIC SCREW PAIR							WOOD-TO-WOOD with min { $L_{et,1}$; $L_{et,2}$ }			
L				a_{recom}	2 · P_{rt} [1] · cos$β$			2 · P_{rc} [2] · cos$β$				t_1	P_{rt} [3] · cos$β$		
					K_D	K_D	K_D	K_D	K_D	K_D			K_D	K_D	K_D
		$H_{secondary\ beam}$	$W_{main\ beam}$		1.15	1.00	0.65	1.15	1.00	0.65			1.15	1.00	0.65
mm	(in)	mm	mm		kN	kN	kN	kN	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	-	-	-	-	-	-	-	-	-	-	50	2.71	2.36	1.53
140	(5-1/2")	-	-	-	-	-	-	-	-	-	-	50	2.89	2.51	1.63
160	(6-1/4")	-	-	-	-	-	-	-	-	-	-	60	3.61	3.14	2.04
180	(7-1/8")	-	-	-	-	-	-	-	-	-	-	60	3.61	3.14	2.04
200	(7-7/8")	-	-	-	-	-	-	-	-	-	-	60	3.61	3.14	2.04
220	(8-5/8")	-	-	-	-	-	-	-	-	-	-	80	5.05	4.39	2.85
240	(9-1/2")	180	≥ 100	11.5 · d_F	9.67	8.41	5.46	9.67	8.41	5.46	15.42	80	5.05	4.39	2.85
260	(10-1/4")	200	≥ 100	12.5 · d_F	10.41	9.05	5.88	10.41	9.05	5.88	15.42	80	5.05	4.39	2.85
280	(11")	220	≥ 100	13.5 · d_F	11.14	9.69	6.30	11.14	9.69	6.30	15.42	100	6.49	5.64	3.67
300	(11-3/4")	220	≥ 120	14 · d_F	12.26	10.66	6.93	12.26	10.66	6.93	15.42	100	6.49	5.64	3.67
325	(12-3/4")	240	≥ 120	15.5 · d_F	13.04	11.34	7.37	13.04	11.34	7.37	15.42	120	7.93	6.90	4.48
350	(13-3/4")	260	≥ 140	16.5 · d_F	14.20	12.35	8.03	14.20	12.35	8.03	15.42	120	7.93	6.90	4.48
375	(14-3/4")	280	≥ 140	17.5 · d_F	15.37	13.36	8.69	14.27	13.36	8.69	15.42	140	9.22	8.02	5.21
400	(15-3/4")	300	≥ 140	18.5 · d_F	16.53	14.37	9.34	14.27	14.27	9.34	15.42	140	9.27	8.15	5.30
450	(17-3/4")	340	≥ 160	21 · d_F	17.96	15.62	10.15	14.27	14.27	10.15	15.42	160	9.27	8.87	5.77
500	(19-5/8")	360	≥ 180	23 · d_F	18.54	17.29	11.24	14.27	14.27	11.24	15.42	180	9.27	9.27	6.58
600	(23-5/8")	440	≥ 220	27.5 · d_F	18.54	18.54	13.68	14.27	14.27	13.68	15.42	200	9.27	9.27	7.39

[1] value base on factored withdrawal resistance at $α = β = 45°$ provided for $Φ$ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, $J_α$ =0.91, J_w = 1.0 and equal specific gravity of both members and factored tensile resistance provided for $Φ$ = 0.6 and n_F = 1 result in T_{rs} = 13.11 kN.

[2] value base factored tensile resistance provided for $Φ$ = 0.6 and n_F = 1 and factored buckling resistance provided for for $Φ$ = 0.8, K_{CS} = 0.65 and n_F = 1

[3] value base on factored withdrawal resistance at $α = β = 45°$ provided for $Φ$ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, $J_α$ = 0.91, J_w = 1.2 and factored tensile resistance provided for $Φ$ = 0.6 and n_F = 1 and equal specific gravity of both members

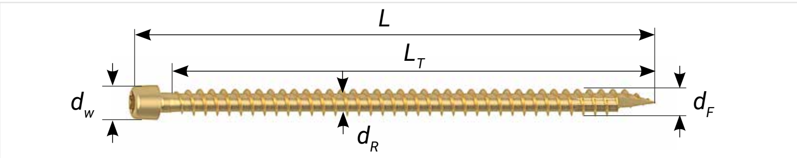
Factored shear resistance V_{rs} = 10.90 kN.

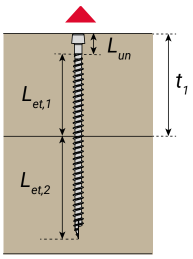
Typos and printing errors reserved

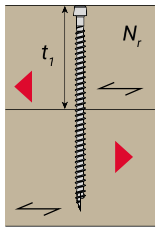
10 mm RAPID® fullthread cylinder head

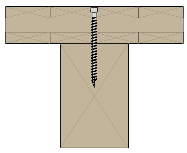
T-drive (T50), cylinder head, single thread, core ribs, half tip,
YellWin 500+ coating

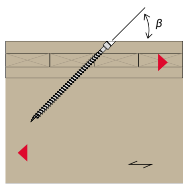
PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	6.3	93.0	36967	950	938











d_F = 10 mm (3/8")		AXIAL IN TENSION, $\alpha = \beta = 90°$				LATERAL [3) 5)]				MAINLY AXIAL $\alpha = \beta = 45°$ and $\theta = 0°$			
		WOOD-TO-WOOD				WOOD-TO-WOOD				CLT FLOOR TO WOOD			
L		t_1 = 0.5 · L	P_{rt} = min { P_{rw} [1)]; T_{rs} [2)] }			t_1 = 0.5 · L	N_r [3)]			t_1	P_{rt} [4)] · cosβ		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	60	3.59	3.12	2.03	60	2.36	2.05	1.33	-	-	-	-
160	(6-1/4")	80	5.09	4.42	2.88	80	3.22	2.80	1.82	-	-	-	-
180	(7-1/8")	90	5.84	5.08	3.30	90	3.42	3.10	2.07	-	-	-	-
200	(7-7/8")	100	6.58	5.73	3.72	100	3.61	3.26	2.31	-	-	-	-
220	('8-5/8")	110	7.33	6.38	4.14	110	3.80	3.43	2.51	-	-	-	-
240	('9-1/2")	120	8.08	7.03	4.57	120	3.93	3.59	2.62	-	-	-	-
260	('10-1/4")	130	8.83	7.68	4.99	130	3.93	3.67	2.73	90	6.36	5.53	3.60
280	(11")	140	9.58	8.33	5.41	140	3.93	3.67	2.83	90	6.36	5.53	3.60
300	(11-3/4")	150	10.33	8.98	5.84	150	3.93	3.67	2.94	90	6.36	5.53	3.60
325	(12-3/4")	163	10.36	9.01	5.86	163	3.93	3.67	2.94	90	5.67	4.93	3.21
350	(13-3/4")	175	11.30	9.83	6.39	175	3.93	3.67	2.96	120	8.12	7.06	4.59
375	(14-3/4")	188	12.23	10.64	6.92	188	3.93	3.67	2.96	120	8.12	7.06	4.59
400	(15-3/4")	200	13.17	11.45	7.44	200	3.93	3.67	2.96	140	9.75	8.48	5.51
450	(17-3/4")	225	15.04	13.08	8.50	225	3.93	3.67	2.96	140	9.75	8.48	5.51
500	(19-5/8")	250	16.91	14.71	9.56	250	3.93	3.67	2.96	140	9.75	8.48	5.51
600	(23-5/8")	300	20.65	17.96	11.67	300	3.93	3.67	2.96	140	9.75	8.48	5.51
700	(27-5/8")	350	22.18	21.21	13.79	350	3.93	3.67	2.96	140	9.75	8.48	5.51
800	(31-1/2")	400	22.18	22.18	15.90	400	3.93	3.67	2.96	140	9.75	8.48	5.51
1000	(39-3/8")	500	22.18	22.18	20.13	500	3.93	3.67	2.96	140	9.75	8.48	5.51

1) factored withdrawal resistance at $\alpha = \beta = 90°$ provided for Φ =0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a = 1.0, J_w = 1.0 and equal specific gravity of both members

2) factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.18 kN.

3) tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 16.63 kN.

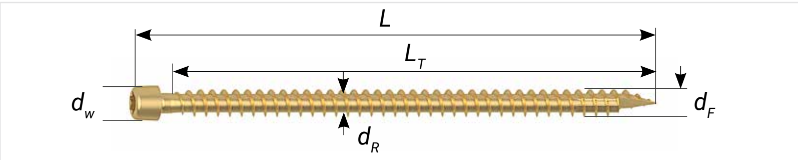
4) tabled values base on factored withdrawal resistance at $\alpha = \beta = 45°$ provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_a =0.91, J_w =1.2 and equal specific gravity of both members and factored tensile resistance provided for Φ =0.6 and n_F = 1. Factored shear restistance V_{rs} / sin45° = 23.53 kN.

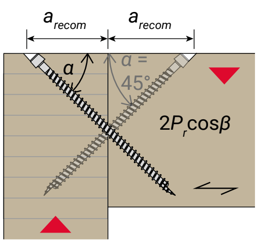
Typos and printing errors reserved

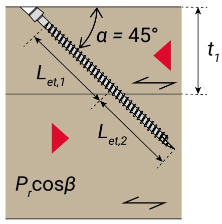
10 mm RAPID® fullthread countersunk head

T-drive (T50), cylinder head, single thread, core ribs, half tip,
YellWin 500+ coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	10 (3/8")	6.3	93.0	36967	950	938







d_F = 10 mm (3/8")		recommended geometric dimensions for intersection point in the middle of the secondary beam axis			MAINLY AXIAL β = 45° – 1 SYMMETRIC SCREW PAIR						V_{rs} / sinβ	MAINLY AXIAL $\alpha = \beta$ = 45° – WOOD-TO-WOOD with min { $L_{et,1}$; $L_{et,2}$ }			
L		$H_{secondary\ beam}$	$W_{main\ beam}$	a_{recom}	$2 \cdot P_{rt}$[1] $\cdot$ cosβ			$2 \cdot P_{rc}$[2] $\cdot$ cosβ				t_1	P_{rt}[3] $\cdot$ cosβ		
					K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65			K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	mm		kN	kN	kN	kN	kN	kN	kN	mm	kN	kN	kN
120	(4-3/4")	-	-	-	-	-	-	-	-	-	-	40	2.28	1.99	1.29
160	(6-1/4")	-	-	-	-	-	-	-	-	-	-	60	3.92	3.41	2.21
180	(7-1/8")	-	-	-	-	-	-	-	-	-	-	60	3.92	3.41	2.21
200	(7-7/8")	-	-	-	-	-	-	-	-	-	-	60	3.92	3.41	2.21
220	(8-5/8")	-	-	-	-	-	-	-	-	-	-	80	5.55	4.83	3.14
240	(9-1/2")	-	-	-	-	-	-	-	-	-	-	80	5.55	4.83	3.14
260	(10-1/4")	-	-	-	-	-	-	-	-	-	-	80	5.55	4.83	3.14
280	(11")	-	-	-	-	-	-	-	-	-	-	100	7.18	6.24	4.06
300	(11-3/4")	240	≥ 120	$11.5 \cdot d_F$	13.70	11.91	7.74	13.70	11.91	7.74	23.53	100	7.18	6.24	4.06
325	(12-3/4")	260	≥ 120	$12.5 \cdot d_F$	14.22	12.36	8.04	14.22	12.36	8.04	23.53	120	8.12	7.06	4.59
350	(13-3/4")	280	≥ 140	$13.5 \cdot d_F$	15.58	13.55	8.80	15.58	13.55	8.80	23.53	120	8.12	7.06	4.59
375	(14-3/4")	280	≥ 140	$14 \cdot d_F$	16.26	14.14	9.19	16.26	14.14	9.19	23.53	120	8.12	7.06	4.59
400	(15-3/4")	300	≥ 160	$15 \cdot d_F$	17.62	15.32	9.96	17.62	15.32	9.96	23.53	140	9.75	8.48	5.51
450	(17-3/4")	340	≥ 180	$17 \cdot d_F$	20.34	17.69	11.50	20.34	17.69	11.50	23.53	160	11.39	9.90	6.44
500	(19-5/8")	380	≥ 180	$18.5 \cdot d_F$	22.38	19.46	12.65	21.78	19.46	12.65	23.53	180	13.02	11.32	7.36
600	(23-5/8")	440	≥ 220	$22 \cdot d_F$	27.14	23.60	15.34	21.78	21.78	15.34	23.53	200	14.65	12.74	8.28
700	(27-5/8")	520	≥ 260	$25.5 \cdot d_F$	31.37	27.74	18.03	21.78	21.78	18.03	23.53	240	15.68	15.58	10.13
800	(31-1/2")	580	≥ 300	$29 \cdot d_F$	31.37	31.37	20.72	21.78	21.78	20.72	23.53	280	15.68	15.68	11.97
1000	(39-3/8")	740	≥ 360	$36.5 \cdot d_F$	31.37	31.37	26.49	21.78	21.78	21.78	23.53	360	15.68	15.68	15.66

[1] value base on factored withdrawal resistance at $\alpha = \beta$ = 45° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α =0.91, J_w = 1.0 and equal specific gravity of both members and factored tensile resistance provided for Φ = 0.6 and n_F = 1 result in T_{rs} = 22.18 kN.

[2] value base factored tensile resistance provided for Φ = 0.6 and n_F = 1 and factored buckling resistance provided for for Φ = 0.8, K_{CS} = 0.65 and n_F = 1

[3] value base on factored withdrawal resistance at $\alpha = \beta$ = 45° provided for Φ = 0.7, K_{SF} = 1.0, K_T = 1.0, n_F = 1, J_α = 0.91, J_w = 1.2 and factored tensile resistance provided for Φ = 0.6 and n_F = 1 and equal specific gravity of both members

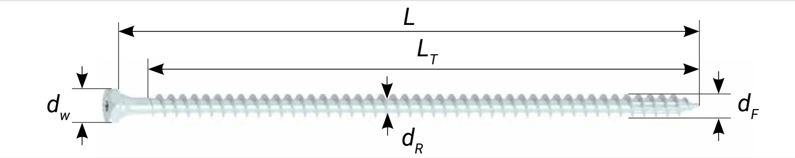
Factored shear resistance V_{rs} = 16.63 kN.

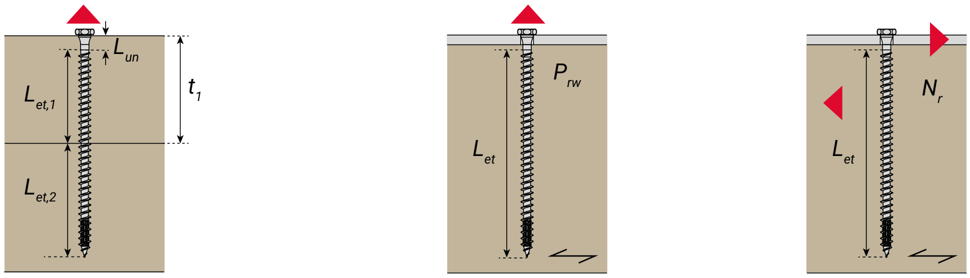
Typos and printing errors reserved

12 mm RAPID® fullthread T-Lift

T-drive (T40) & hexagonal drive (SW 17), Dual head, Single thread, core ribs, full tip, BlueWin coating

PROPERTIES AND VALUES FOR G = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	17.0	7.0	103.6	42537	938





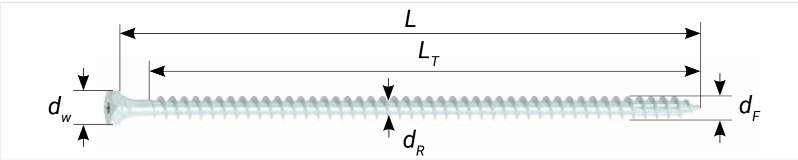
d_F = 12 mm (1/2")		AXIAL IN TENSION, $\alpha = \beta = 90°$							LATERAL $\alpha = \beta = 90°$ and $\theta = 0°$ to 90°		
		WOOD-TO-WOOD				STEEL-TO-WOOD			STEEL-TO-WOOD		
L		$t_1 = 0.5 \cdot L$	$P_{rt} = \min\{P_{rw}$ [1]; T_{rs} [2]$\}$			$L_{et} = L_T$	$P_{rt} = \min\{P_{rw}$ [1]; T_{rs} [2]$\}$ [3]			N_r [3] [4]		
			K_D 1.15	K_D 1.00	K_D 0.65		K_D 1.15	K_D 1.00	K_D 0.65	K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN	mm	kN	kN	kN	kN	kN	kN
60	(2-3/8")	-	-	-	-	48	4.00	3.48	2.26	4.28	2.90	1.89
80	(3-1/8")	-	-	-	-	68	5.67	4.93	3.20	4.70	4.30	3.28
100	(4")	-	-	-	-	85	7.09	6.16	4.00	5.12	4.66	3.52
120	(4-3/4")	-	-	-	-	105	8.75	7.61	4.95	5.53	5.02	3.75
140	(5-1/2")	70	4.84	4.20	2.73	125	10.42	9.06	5.89	5.95	5.38	3.99
160	(6-1/4")	80	5.67	4.93	3.20	145	12.09	10.51	6.83	6.37	5.75	4.22
180	(7-1/8")	90	6.50	5.65	3.68	165	13.75	11.96	7.77	6.56	6.11	4.46
220	(8-5/8")	110	8.17	7.10	4.62	205	17.09	14.86	9.66	6.56	6.13	4.93
300	(11-3/4")	150	11.51	10.00	6.50	285	23.76	20.66	13.43	6.56	6.13	4.96
380	(15")	190	14.17	12.32	8.01	365	25.52	25.52	17.20	6.56	6.13	4.96

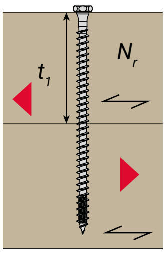
[1] factored withdrawal resistance at $\alpha = \beta = 90°$ provided for $\Phi = 0.7$, $K_{SF} = 1.0$, $K_T = 1.0$, $n_F = 1$, $J_a = 1.0$, $J_w = 1.0$ and equal specific gravity of both members
[2] factored tensile resistance provided for $\Phi = 0.6$ and $n_F = 1$ result in T_{rs} = 25.52 kN
[3] minimum requirements for the steel plate, $f_u \geq 360$ MPa and thickness $t_{s,s} \geq 6.0$ mm, prevent steel head pull-through, compare with ICC-ESR-4549
[4] tabled values for lateral yielding resistance N_r provided for $\Phi = 0.8$, $n_s = 1.0$ and $n_F = 1$, including the withdrawal restraint effect.
Factored shear resistance V_{rs} = 20.54 kN.
Typos and printing errors reserved

12 mm RAPID® fullthread T-Lift

T-drive (T40) & hexagonal drive (SW 17), Dual head, Single thread, core ribs, full tip, BlueWin coating

PROPERTIES AND VALUES FOR *G* = 0.42	d_F	d_w	d_R	y_w	t_s	f_y
	mm (in)	mm	mm	N/mm	N	MPa
	12 (1/2")	17.0	7.0	103.6	42537	938





d_F = 12 mm (1/2")		LATERAL $\alpha = \beta = 90°$ WOOD-TO-WOOD			
L		$t_1 = 0.5 \cdot L$	N_r [1)]		
			K_D 1.15	K_D 1.00	K_D 0.65
mm	(in)	mm	kN	kN	kN
60	(2-3/8")	-	-	-	-
80	(3-1/8")	-	-	-	-
100	(4")	-	-	-	-
120	(4-3/4")	-	-	-	-
140	(5-1/2")	70	3.01	2.61	1.70
160	(6-1/4")	80	3.47	3.02	1.96
180	(7-1/8")	90	3.94	3.42	2.22
220	(8-5/8")	110	4.39	3.96	2.75
300	(11-3/4")	150	4.69	4.38	3.39
380	(15")	190	4.69	4.38	3.53

[1)] tabled values for lateral yielding resistance N_r provided for Φ = 0.8, n_s = 1.0 and n_F = 1, including the withdrawal restraint effect and equal specific gravity of both members. Factored shear restistance V_{rs} = 20.54 kN.

Typos and printing errors reserved.

Idaho Central Credit Union Arena

The 4,000-seat arena is the new home for the Vandal's varsity basketball teams and a gathering place for a variety of school and community events.
One of the many unique features of this project is the efficient timber/steel portal frame that spans 120' to allow for viewing from the secondary seating at the practice rink. The entire frame was pre-assembled on site into three large components to minimize work at height. Complex timber engineering was required to design the thrust connection between beam and column to transfer over 450,000 lbs. of compression. The kingpost trusses span over 150 ft. across the main arena. One of the key challenges was installation of these heavy elements with a crane in the bowl. A parametric model of the trusses was created using genetic algorithms to perform a structural optimization on the trusses, while respecting aesthetic numerous objectives. This created structural efficiency and, importantly, reduced weights of the prefabricated pieces. This also allowed the project budget to be maintained.
Due to the high forces acting on the beams and supports, special, high-quality RAPID® fullthread screws were also used.

Photos © Structure Craft

Facts & Figures:

Customer:
University of Idaho

Architect:
Opsis Architecture, USA

Location:
Moscow, ID, USA

Structural Engineer & Builder:
Structure Craft, Canada

Completion:
2021

Lookout tower on the Pyramidenkogel

At a height of 100 meters, the observation tower on the Pyramidenkogel is the highest wooden observation tower in the world. A successful collaboration between Rubner Holzbau Ober-Grafendorf and Schmid Schrauben Hainfeld.
The construction consists of 500 m3 of glulam and 1,000 m2 of cross-laminated timber. The tower is given its unusual shape by 16 solid and elliptically arranged larch glulam columns, which spiral upwards.
The structure stretches over 10 levels, above which there are two outdoor platforms offering a 360° view.

The highlight is the skybox, which has been designed with panoramic windows. This level can be reached either via steps or by elevator. The 120-meter-long slide down to the first floor can also be used.
The assembly was carried out by Rubner Holzbau. The rapid construction of the viewing tower was made possible by precise prefabrication in the production facility in Obergrafendorf. Screws from Schmid Schrauben Hainfeld were used for this. This prefabrication enables rapid construction progress and consequently a corresponding cost advantage.

Photos © Rubner Holzbau

Facts & Figures:

Customer:
Pyramidenkogel Infrastruktur GmbH & Co KG

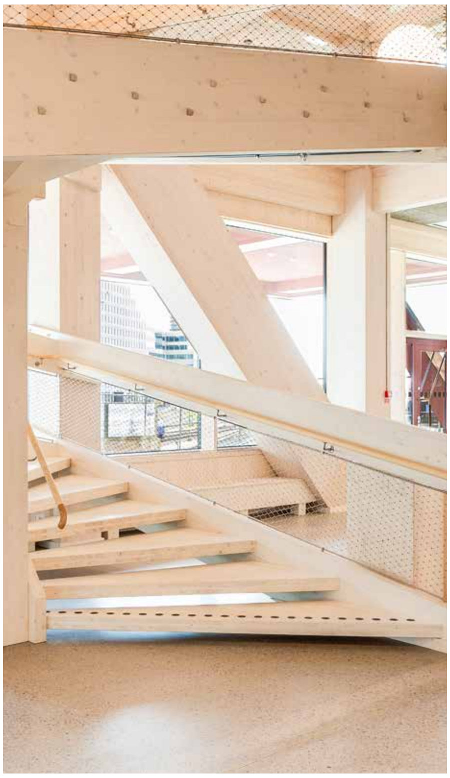
Architect:
Klaura, Kaden + Partner, Austria

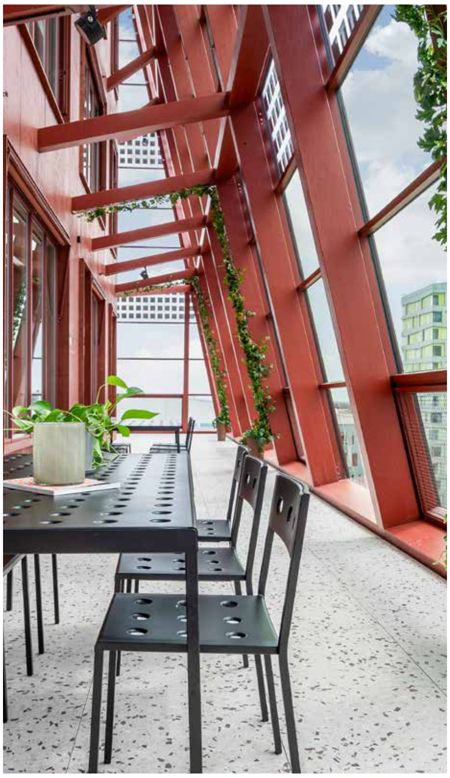
Location:
Austria

Structural Engineer & Builder:
Rubner Holzbau, Austria

Completion:
2013

Fyrtornet





Fyrtornet is an innovative office building in the Hyllie district of Malmö and part of the "Embassy of Sharing" project. It will be completed in 2024 as Sweden's tallest wooden building with 11 floors. The sustainable design is based on wood and integrates solar energy and geothermal energy. With a focus on circular economy and the global goals of Agenda 2030, Fyrtornet offers flexible workspaces, a library, green terraces and energy-efficient systems.
Wood as a building material plays a central role in this project. 1,640 m³ of cross-laminated timber (CLT) and 1,030 m³ of glulam were used to build the structure.

The timber, project planning, statics, work planning and prefabrication were provided by our partner Binderholz and b_project. Wood not only offers stability, but also contributes to minimizing the CO2 footprint. The use of prefabricated timber construction elements meant that the construction time could be significantly reduced. Our RAPID® screws, which were perfectly suited to the project thanks to their outstanding technical values, such as load-bearing capacity and small edge distances, also made a significant contribution to the realization of the project.

Binderholz, Photos © Granitor

Facts & Figures:

Customer:
Granitor Projects AB

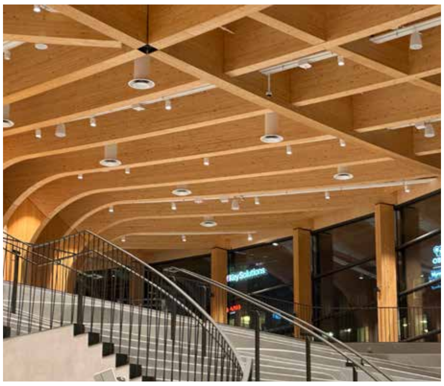
Architect:
Wingårdhs, Sweden

Location:
Sweden

Timber construction:
Binderholz, Austria

Completion:
2024

World of Volvo



The “World of Volvo” in Gothenburg is a pioneering construction project that impresses with its technical refinement and innovative use of wood. Developed by WIEHAG Holding GmbH a long-standing partner of Schmid Schrauben Hainfeld, in close cooperation with renowned architects and engineers, this building represents a perfect symbiosis of aesthetics and functionality.
A technical highlight of the “World of Volvo” is its impressive wood structure, which not only provides a breathtaking architectural appearance, but also meets the highest demands for load-bearing capacity and safety. Precise planning and implementation of this structure was made possible by the expertise of Ramboll, a world-leading engineering and consulting company offering innovative solutions for complex construction projects.
For the new Stockholm landmark, WIEHAG supplied 6,000 m ³ BSH: 3,600 m ³ for pillars and beams, 2,400 m ³ for roof and ceiling elements. The three largest timber beams measure 34 m in length each.
In addition to the visitor center, the World of Volvo will also offer space for events and culinary experiences.

Photos © WIEHAG Holding GmbH

Facts & Figures:

Customer:
AB Volvo and Volvo Cars

Architect:
Henning Larsen

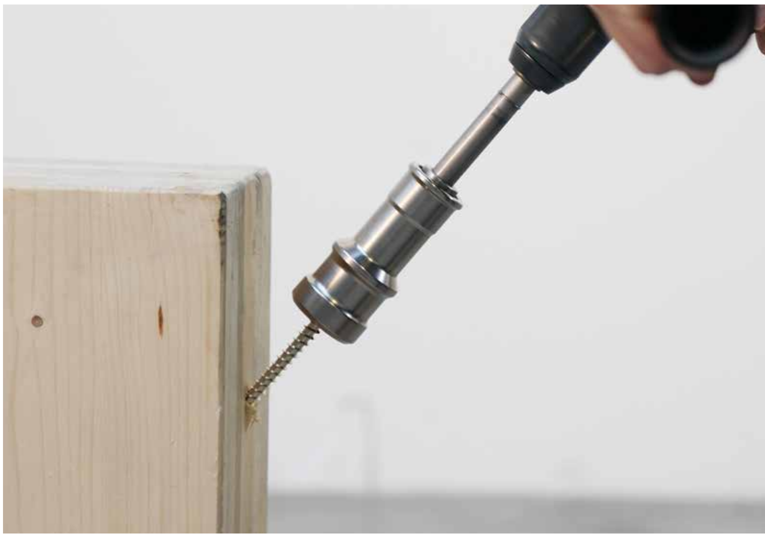
Location:
Sweden

Wooden roof construction and engineering:
WIEHAG GmbH

Completion:
2023

RAPID® Secure: screw-in tool

The RAPID® Secure screw-in tool represents a completely new technology for secure screwing in wood construction.
With this solution, long RAPID® wood drilling screws can be screwed securely and quickly with all screwdrivers (for 1/2" drill chuck size) without any problems.The screw head is held securely in place and is firmly connected with the RAPID® Secure. There is no way for the bit to slip off and no need to press down.
The RAPID® Secure screw-in tool makes screwing in RAPID® wood drilling screws extremly safe and easy. The tool can be used with conventional screwdrivers and gives your workers security even in inconvenient screwing positions.



BENEFITS FROM USING THE RAPID® SECURE:

> Increased work safety for employees
> After being locked into place, the screw cannot be loosened and fits tightly on the bit - no pressing down while screwing in and less wear - bit holds for much longer
> Easier to screw in difficult and dangerous work positions and situations

USE THE RAPID® SECURE WITH RAPID® SCREWS:	
RAPID® SECURE L, T 40	8 mm RAPID® countersunk head 8 mm RAPID® cylinder head 10 mm RAPID® Dual
RAPID® SECURE L, special bit T50	10 mm RAPID® cylinder head
RAPID® SECURE XL, T 40	8 mm RAPID® washer head 8 mm RAPID® SuperSenkFix 12 mm RAPID® Dual 12 mm RAPID® T-Lift
RAPID® SECURE XL, T 50	10 mm RAPID® countersunk head 12 mm RAPID® SuperSenkFix 10 mm RAPID® countersunk head

SCAN TO WATCH THE VIDEO

USER MANUAL RAPID® SECURE L

USER MANUAL RAPID® SECURE XL

Responsibility for the future

FAIR PLAY
We naturally comply with statutory regulations. They are many times more stringent than those of other regions regarding the handling of carbon dioxide, energy, waste and chemicals.

HEALTH IN THE WORKPLACE
We are mindful of our employees' health and rely on healthy, environmentally friendly chemicals and raw materials wherever possible. For example, we have established the use of Cr(VI)-free corrosion protection in our Premium RAPID® screws.

SOCIAL STANDARDS
It is self-evident that the exploitation of workers and child labour have no place in an Austrian company. However, we ensure that these and other social standards are adhered to in the companies of our suppliers and partners as well.

HIGHEST PRODUCT QUALITY
Our premium products make it possible to implement more efficient application solutions with fewer screws, which helps to conserve resources. Furthermore, our high-quality screws ensure a longer service life along with faster and easier processing.

RECYCLING
Thanks to the good anti-friction coating and geometry of our premium products, they can be removed from the timber without a trace. This allows individual beams and joists to be reassembled into new structures, thus saving resources.

ENERGY-SAVING PRODUCTION
The switch to electrically operated forklifts and LED lights, along with new energy-saving technologies and machinery in production and heat recovery in the hardening process, has helped our production to become more environmentally friendly.

ENVIRONMENTAL PRODUCT DECLARATION (EPD)
With our EPD, you can visualise the CO2 values of a screw from production to disposal.
In order to create sustainable supply chain management and fulfil international supply chain laws, we cooperate with external external specialists.

CONTINUAL IMPROVEMENT
We strive to continually improve our carbon footprint. The ISO 50001 energy management system and the ISO 14001 environmental management system help to make sure of this. Suggestions to improve each individual employee's work routine are actively communicated on an ongoing basis.

ONGOING ANALYSES OF ENERGY FLOW
We analyse our energy flow on an ongoing basis, as well as resource consumption, so that we can quickly counteract "energy guzzlers" or wastage. At the same time, we also work actively on developments and optimisations in the area of energy recovery from production.

schmid schrauben hainfeld

Experience
We have been specialists in the manufacture of wood construction screws for over 180 years.

Sustainability
We take care of our environment and manufacture according to ISO 14001 and ISO 50001.

Always available
Our warehouse is always stocked with our extensive range.

Your screw - your brand
We manufacture screws exactly according to your wishes.

Special hardening
Our screws are viscoplastic and bendable by at least 45° - elastic and high-strength.

Service orientation
Whether with calculations, expertise or experience - we are there for our customers.

Statics
Our screws have above-average mechanical values for pull-out and head pull-through.

Safety
Our screws are approved according to ETA 12/0373 and ICC-ESR-4549.

Highest quality
We manufacture according to ISO 9001 and are externally monitored by Holzforschung Austria.


Photo © Rubner Holzbau - Mactan Cebu Airport

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