

CONSTRUCTION WITH WOOD



Windklang Erbeskopf; Hunsrück
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Applications and screw types

Applications for wood construction screws

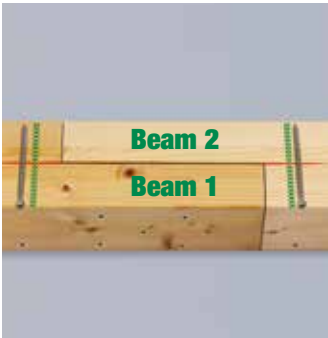
Partial thread with washer head

like a screw clamp.

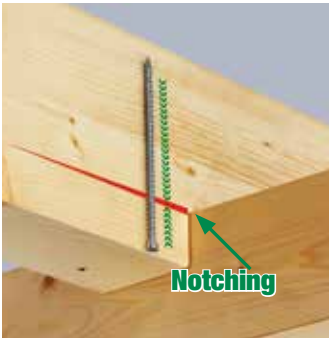
The SPAX partial thread with washer head acts like a screw clamp that pulls two components firmly together, even where a vice cannot be used (e.g. beams on stud frames). However, stud frame connections parallel to the fibre are not statically correct. This is achieved through reinforcement using SPAX full threads.

The full thread reinforces a component.

Notching significantly reduces the load-bearing capacity of the beam. Without reinforcement, the wood will crack along the red line under load. The full thread strengthens the beam at this point, holds the wood fibres together and reduces the risk of breakage. Applications:



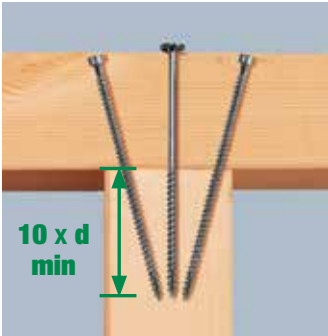
Beam **extension** with overlap (notching) *Transversal tensile reinforcement*



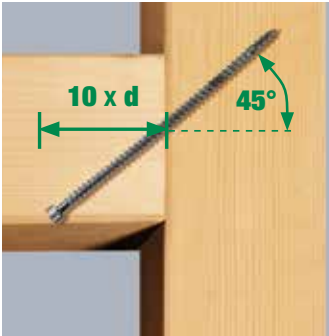
Notch reinforcement
Transversal tensile reinforcement

Full thread connects two components

⊗ T-connection beams on stud frames; see instructions p. 8 and 9



⊗ Connection of tie bar to stud frame; Screw 45° from bottom to top



T-connection with SPAX

Two components that were previously pulled together with the SPAX partial thread with washer head are expertly and securely connected with the SPAX full thread. SPAX full threads replace the need for visible angle brackets. Connections with the SPAX full thread save time and money compared to nailing on angle brackets. The connection is invisible and more attractive than the nailed-on wood connectors.

A T-connection with SPAX takes place in two steps:

1. **Tightening** of the two components with SPAX partial thread with washer head.
2. **Load-bearing connection** with SPAX full thread.

To do this, two SPAX full threads are screwed diagonally through the upper component into the lower post.

For a correct connection with SPAX full threads, the following must be taken into account:

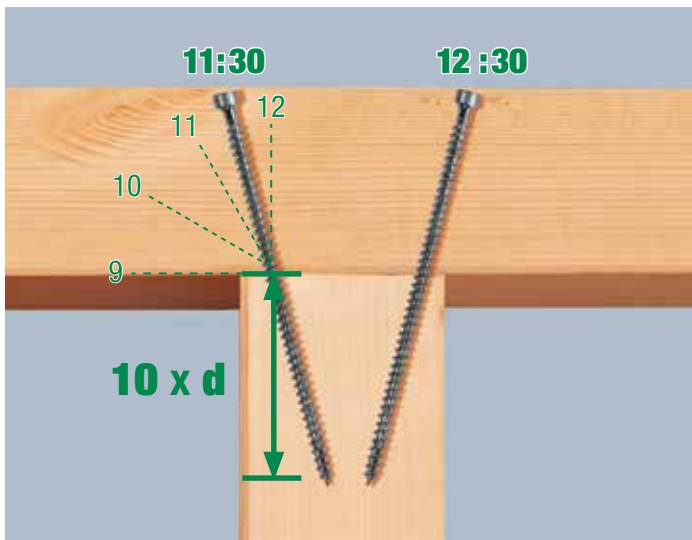
- ✖ **Edge clearance** $3 \times d$, or $5 \times d$ (see p. 2)
- ✖ **Penetration depth** into the lower component: $10 \times d$
- ✖ **Screw-in angle** 15° to 20°

approx.

11:30

or

12:30



Alternatively, the screws can also be fastened from the bottom up. The same values apply for angle and penetration depth.



Video: "SPAX carport"

<https://www.youtube.com/watch?v=9i97vnmmRi0>

T-connection – the right dimensions

SPAX diameter: in accordance with beam size

- 6 mm diameter for beam widths of 70 mm to 100 mm
- 8 mm diameter for beam widths > 100 mm



If you use screws that are too thick, you risk falling below the minimum spacing and the formation of cracks



Use SPAX full threads and partial threads with the same diameter: fewer tool changes = faster work

Length partial thread with washer head

depending on the height of the supported beam and the diameter of the screws.

SPAX partial thread with washer head, **6 mm** diameter:

Beam height + **70 mm** e.g.: Beam 95 mm: SPAX length = $95 + 70 = 165$ mm **Minimum length**

SPAX partial thread with washer head **8 mm** diameter:

Beam height + **80 mm** e.g.: Beam 160 mm: SPAX length = $160 + 80 = 240$ mm **Minimum length**

Length full thread

depending on: Height of the supported beam **and** screw diameter.

Penetration depth into lower component = at least **10 x d**. In other words,

SPAX full thread, **6 mm** diameter: Penetration depth at least **60 mm**

SPAX full thread, **8 mm** diameter: Penetration depth at least **80 mm**

Simplified calculation for a screw-in angle between 15° and 20°:

Length of full thread = length of partial thread with washer head + 10%.

Example: Beam 95 x 95 mm

Partial thread washer head 6 x 165 mm

min. calculation: Length of partial thread + **10%**. $165 + 10\% = 182$ mm **min.**

Full thread cylindrical head 6 x 200 mm

Example: Beam height 160 mm

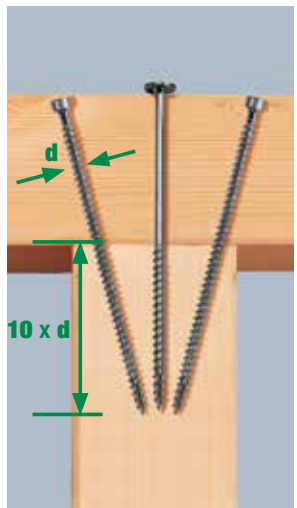
Partial thread washer head 8 x 240 mm.

Calculation: Length of partial thread + **10%**. $240 + 10\% = 264$ mm

Full thread cylindrical head 8 x 280 mm

Please note:

- The longer the thread in the 2nd component, the higher the load capacity
- Flatter screw-in angle requires longer full thread screws
- Avoid crossing full thread screws.



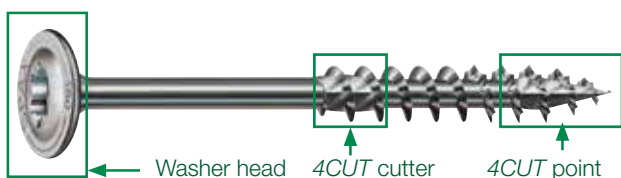
Long screws/wood construction

The special properties of full threads and partial threads are utilised in wood construction.

Partial thread with washer head

A partial thread screw exerts a "vice effect". The washer head can exert very high pressure. Like a screw clamp, it pulls components like beams and rafters firmly together. It does not matter whether the SPAX is screwed into the components from above or overhead from below. With SPAX, both components are always pulled tightly together.

Thanks to the patented **4CUT point** and the **4CUT cutter** a SPAX 8 x 400 can be screwed in without pre-drilling. The **4CUT** cutter is attached to the upper end of the thread on all SPAX from a length of 160 mm. Thanks to the **4CUT** cutter, screwing in a SPAX 8 x 400 hardly requires any more force than screwing in an 8 x 160.



Full thread with flat countersunk head or cylindrical head

This SPAX is a screw with a thread all the way up the head for all lengths, including an 8 x 600! The SPAX thread **anchors** into the wood over its full length. The SPAX screw reinforces both **individual** components and connections between **several** components.

In **one** component only, the SPAX screw reinforces the wood against compression or tension.

The SPAX screw ensures a statically correct connection **of two** components with a high load-bearing capacity.

The **cylindrical head** is just large enough to accommodate the appropriate bit and sinks easily into the component. Thanks to its geometry, the cylindrical head does not cause any wedging on the wood and minimises the splitting effect of the screw. Before screwing in the SPAX full thread with cylindrical head, pull both components together with a SPAX partial thread with washer head.



Wood is a natural building material. Wood can be easily split along the grain by simply driving in a wedge. This splitting effect can also be caused by incorrect nailing or screwing, especially with solid wood. Splitting the wood along the screw connection significantly reduces the load-bearing capacity of the connection and can even render it ineffective. This creates the risk of gaps forming during screwing, particularly along the **edges** of a component. Therefore, when screwing into wood, **minimum edge clearances** must be observed.

Standard – approval

The shape and strength of classic wood screws are determined by a DIN standard, for example DIN 571 hexagon head wood screws. DIN-compliant screws are subject to **standardised technical rules** regardless of the manufacturer. Modern wood screws such as SPAX are not subject to any standards. The technical properties and the rules for processing non-standard products are described in individual **assessments**. The European Assessment ETA (European Technical Assessment) replaces national regulations. For example, ETA-12/0114 for SPAX. No CE mark is issued without an ETA assessment. The use of construction products without a CE mark is not permitted and constitutes a performance defect. An **assessment** only applies to screws from the manufacturer for which the rating is issued. Screws from other manufacturers are subject to different ratings and require different, sometimes larger edge clearances! The values listed in the SPAX assessment only apply to the SPAX screws for the corresponding application, "type of load".

Minimum spacing

for SPAX with *4CUT* or *CUT* point

for construction wood: Spruce, fir, pine, larch
(for Douglas fir: spacing + 50%)

Spacing depends on d
(screw diameter)

- Beam side = $3 \times d$
- Beam end (end grain) = $5 \times d$
- Screw to screw = $5 \times d$

Only valid for:

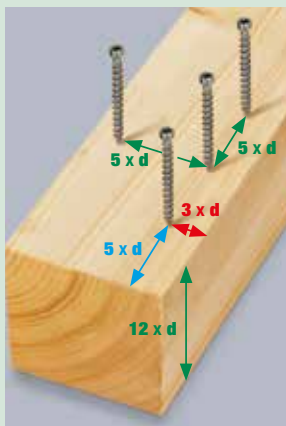
Beam height at least $12 \times d$

Example SPAX diameter = 6 mm

$12 \times 6 = 72 \text{ mm}$ Beam height min.

axial load (pull-out force)

see also SPAX approval ETA-12/0114



Wood screws

Unlike a metal screw, a wood screw forms its counter-thread in the wood itself. The force with which a screw can be inserted is determined by two factors:

✖ Screw strength

(danger – screw shear force in hardwood)

The ultimate strength of a screw is influenced by the diameter of the screw core and the strength of the steel.

✖ Retention force of the counter thread in the wood

(Danger – destruction of the counter-thread in chipboard and soft woods). The retention force of the counter-thread is influenced by the shape and length of the screw thread that is anchored in the wood.

Hardening

Carbon steel screws are **hardened** by heating (approx. 900°) and subsequent quenching (approx. 60°). Reheating after quenching (approx. 350°) gives the screw the desired strength **and** flexibility. High-quality stainless steel (e.g. A2 or A4) cannot be hardened. SPAX screws made of A2 or A4 stainless steel are therefore not as strong as hardened SPAX made of carbon steel.

SPAX 4CUT – pre-drilling

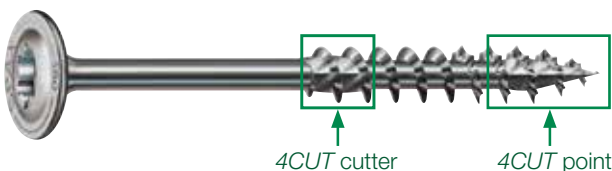
Pre-drilling screw connections in wood is recommended for two reasons:

- ✖ Easier screwing in and reduced risk of screw shearing in hardwoods.
- ✖ Reduces the risk of immediate or delayed splitting of the fibre around the screw connection.

The SPAX **4CUT point** cuts into the thread turn, similar to a drill point. This patented feature minimises the screw-in force required and reduces the risk of splitting. The **4CUT** point enables edge clearances that are otherwise only possible by pre-drilling (see approval SPAX ETA-12/0114)

From a length of 160 mm, the SPAX partial thread also features a **4CUT** cutter at the end of the thread.

The **4CUT** cutter has a larger diameter than the **4CUT** point and pre-mills the thread of the threadless shank.

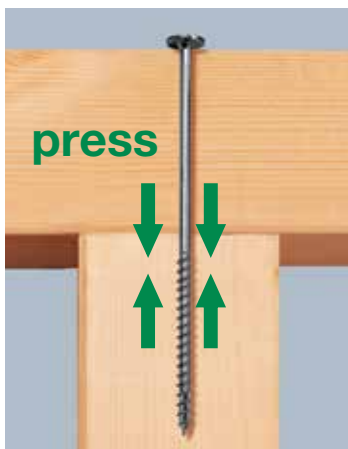


Thread

Partial thread

Wood to wood screw connections are traditionally executed with **partial-thread** screws. The threadless shank of the partial-thread screw should extend completely through the upper component. As the screw is inserted further, the screw head will press the upper component against the lower component.

The partial-thread screw works in a similar way to a **vice**: The thread pulls and the screw head presses the upper part against the lower part. To achieve this **sealing effect** the length of the threadless shank must correspond to the height of the upper component.

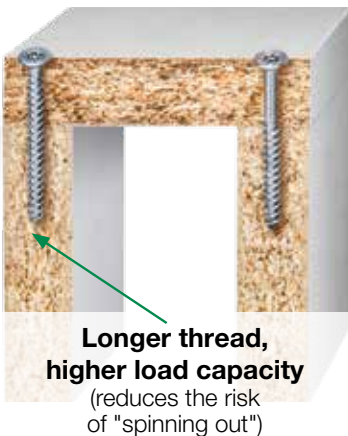


Full thread

Soft materials, such as chipboard or softwood, can only absorb a limited amount of force. If the tightening force is too high, the counter-thread can be destroyed; the screw "spins".

Full-thread screws form a longer counter-thread that can absorb more pressure.

A full-thread screw will therefore not "spin" as easily in chipboard as a partial-thread screw.



However, a full-thread screw does not have the same sealing effect as a partial-thread screw.

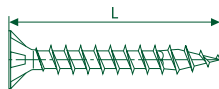
The screw makes a few turns on the second component before the tip sinks in and pulls the screw. As the screw turns without "pulling", the overlying component is pushed upwards. A gap forms which cannot be tightened again by the full thread. Before using full-thread screws, both components must therefore be pressed firmly together.

Heads

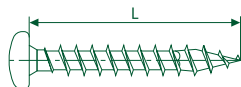
Screw heads can either sink into or rest on the upper component. The flat countersunk head countersinks into the wood or into a component with a countersunk hole, while a protruding head (round head, pan head, washer head, etc.) does not countersink and may sit above the component.

Important: the **"screw length"** always refers only to the length that is countersunk into the component. Examples:

✖ Flat countersunk head 4 x 40: the length 40 mm is measured from the screw tip to the uppermost edge of the head.



✖ Pan head 4 x 40: the length 40 mm is measured from the screw tip to the lowest edge of the head.



A flat countersunk head can be easily countersunk into the upper component in construction wood (spruce/fir) and also screwed deep into it. The flat countersunk head has a low **"pull-through torque"**; the retention force and contact pressure of the flat countersunk head in wood are limited. A protruding head needs to be moved with significantly greater force so that the head sinks into the wood. The wider a head rests on the upper component, the more clamping force the screw can transfer.

Drives



DIN wood screws used to be screwed in with a **slot**.



The first SPAX was launched in 1967 with a **cross recess Z**, which became the standard from then on.

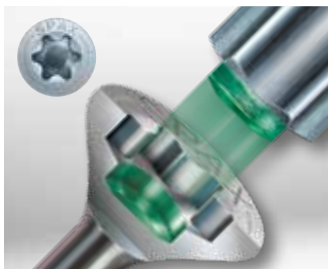


For some time, the **T-STAR plus** drive has been used to screw in particularly long screws.

Due to its geometry, T-STAR *plus* allows significantly higher force transmission. However, the cylindrical shape means that there the SPAX bit has to have a **good fit** in the screw head, otherwise it will wobble.

SPAX T-STAR plus bits guarantee a good fit in the SPAX screw.

The **pilot pin** at the tip of the SPAX bit fits perfectly in the opening on the T-STAR *plus* drive. A precise fit and pilot pins enable safe working.



Corrosion protection

A hardened screw is made of corrosive carbon steel and will oxidise quickly if left unprotected. To delay the onset of rust, screws made of hardened steel are zinc-plated. The zinc layer formed in this process is "passivated", or protected by a further layer. In the past, "chromium 6" was used to passivate the zinc coating ("yellow" screws). Chromium 6 is very toxic and the use of this substance is gradually being prohibited.

WIROX

WIROX ("silver" colour), the standard galvanisation with high corrosion protection from SPAX. Thanks to a special production process and different coating thicknesses, SPAX with optimised WIROX surface offers significantly higher corrosion protection compared to conventional blue galvanised screws. The zinc coating thickness has been increased by 25% and is now 10 µm – meaning that the screws comply with class T2/C2nw in accordance with EN 14592. WIROX is chromium 6-free and therefore significantly more environmentally friendly than conventional surfaces, both in production and in use.

YELLOX without chromium 6

YELLOX ("yellow" colour), replaces the traditional "yellow passivated" produced using chromium 6. YELLOX is manufactured without chromium 6 and is therefore much more environmentally friendly than conventional surfaces, both in terms of its production and in use. YELLOX is not only resistant, but also poses no risk to health or the environment.

Stainless steels

No galvanising can replace stainless steel! Stainless-steel screws are required by Eurocode 5 for constructions in exposed areas. SPAX stainless-steel screws are manufactured in two standard grades: A2 and A4 (for use in coastal areas). SPAX does not manufacture screws from hardenable (martensitic) C1 stainless steel. C1 steel contains fewer precious metals and is therefore less resistant to corrosion. The specific hardening process of C1 steels removes the flexibility from these screws. C1 steel screws can break when certain types of wood swell and shrink. The regulations of the carpentry trade for decking therefore prohibit the use of hardened C1 screws.

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