Deutsches Institut für Bautechnik

DIBt

National Technical Approval

Approval body for construction products and construction types

Construction testing institute

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Approval No.:
Z-9.1-449

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from: **1st August 2012**
to: **1st August 2017**

Applicant:
SPAX International GmbH & Co.KG
Kölner Straße 71-77
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Approved Product:
SPAX® screws
for fastening timber

National Technical Approval has herewith been granted for the above named product.
This National Technical Approval comprises 13 pages and 17 appendices.
This National Technical Approval replaces the National Technical Approval No. Z-9.1-449 dated 11th March 2011. The product was first granted National Technical Approval on 2nd March 1999.

DIBt

I GENERAL PROVISIONS

1 The National Technical Approval certifies the suitability and applicability of the product pursuant to the building regulations of the Federal States of Germany.

2 Wherever demands are placed upon the particular expertise and experience of the persons assigned to undertake the manufacture of construction products and construction types according to Section 17, Paragraph 5 of the Model Building Regulation respective state rules in the National Technical Approvals, it must be taken into account that this expertise and experience can also be proved by means of equivalent evidence from other member states of the European Union. This may also apply for equivalent evidence presented within the context of the Agreement on the European Economic Area (EEA) or other bilateral agreements.

3 The National Technical Approval shall not exempt the holder from acquiring all approvals, permissions and certificates legally required for the completion of the relevant building project.

4 The National Technical Approval is granted without prejudice to the rights of third parties, in particular private property rights.

5 Irrespective of other regulations laid down in the “Special Regulations”, the manufacturer and distributor of the approved product must forward copies of the National Technical Approval to the user of the approved product and inform him that a copy of the National Technical Approval must be kept available at the location at which the product is used. On request, all authorities involved in the realisation of the construction project must be handed a copy of the National Technical Approval.

6 The National Technical Approval may only be reproduced in its entirety. The publication of this document is only permitted with the explicit consent of Deutsches Institut für Bautechnik. Texts and graphics in printed promotional material shall not contradict the National Technical Approval. Translations of the National Technical Approval must bear the following notice: “Translation of the original German document; translation not examined by Deutsches Institut für Bautechnik”.

7 The National Technical Approval can be revoked at any time. The terms and regulations governing National Technical Approvals may be amended, and extended at any time, especially if this is warranted as a result of technological development.

II SPECIAL PROVISIONS

1 Approved Product and Area of Application

1.1 Approved Product

The SPAX® screws according to this National Technical Approval are wood connectors with an outer thread diameter of $d_1 \geq 8$ mm that are manufactured from high-carbon steel or stainless steel. The high-carbon steel screws are equipped with electroplated coatings or with non-electrolytically applied zinc lamellar coatings complete with an additional organic top coat. They serve to connect timber parts manufactured from solid timber and glue-laminated timber, laminated veneer lumber, composite laminated board or composite laminated beam manufactured from pine wood, from timber products licensed by a National Technical Approval, or from steel parts to timber parts manufactured from solid timber and glue-laminated timber or from laminated veneer lumber, composite laminated board or composite laminated beam manufactured from pine wood licensed by a National Technical Approval.

1.2 Area of Application

The SPAX® screws may be used as wood connectors for supporting wood structures that are to be dimensioned and implemented according to standard DIN 1052[1] unless otherwise stipulated in this National Technical Approval.

The dimensioning may also be based on DIN V ENV 1995-1-1:1994-06-Eurocode 5: Design, calculation and dimensioning of timber structures; part 1-1: General dimensioning rules and dimensioning rules for building construction in connection with the national application document “Guidelines for the application of DIN V ENV 1995-1-1”, February 1995 edition, unless otherwise stipulated.

The screws can be used for joining timber construction components in accordance with National Technical Approval if the National Technical Approval granted for the timber component permits the use of screws to this end approved by the general building authority.

The SPAX® screws may not be used for connections to timber products.

However, the timber product boards named below may be connected to timber parts according to Section 1.1 using the SPAX® screws:

– Plywood according to DIN EN 13986[2] (DIN EN 636[3]) and DIN V 20000-1[4] or according to National Technical Approval
– Synthetic-bonded chipboard according to DIN EN 13986 (DIN EN 312[5]) and DIN V 2000-1 or according to National Technical Approval
– Type OSB/3 and OSB/4 OSB boards (Oriented Strand Boards) according to DIN EN 13986 (DIN EN 300[6]) and DIN V 20000-1 or OSB boards according to National Technical Approval

1	DIN1052:2008-12	Design, calculation and dimensioning of timber structures, general dimensioning rules and dimensioning rules for building construction
2	DIN EN 13986:2005-03	Timber materials for use in construction – properties, conformity assessment and identification
3	DIN EN 636:2003-11	Plywood specifications
4	DIN V 20000-1:2005-12	Use of building products in structures – Part 1: timber materials
5	DIN EN 312:2003-11	Particle board specifications
6	DIN EN 300:2006-09	Boards of long, slender, oriented strand board (OSB) – definitions – classification and specifications,

- Fibreboards according to DIN EN 13986 (DIN EN 622-2[7] and 622-3[8]) and DIN V 20000-1 or according to National Technical Approval, minimum gross density 650 kg/m^3
- Cement-bonded chipboard according to DIN EN 13986 (DIN EN 634-2[9]) and DIN V 2000-1 or according to National Technical Approval
- Plaster-bonded chipboard according to National Technical Approval

Screws that are screwed in without pre-drilling may only be screwed into timber parts made from solid timber, glue-laminated timber and from laminated veneer lumber, board or beam wood provided that spruce, pine or fir wood is used. This analogously also applies for screwing into timber parts according to National Technical Approval.

These screws can be driven in the cover surfaces, narrow edge faces, and end edge faces (grain cut timber) of “KERTO” veneer timber “KERTO-S” and “KERTO-Q” in accordance with the National Technical Approval No. Z-9.1-100[10], hereinafter called “KERTO-S” and “KERTO-Q”. Screws applied to end edge faces must be subjected to pull-out loads only.

The screws may only be used for mainly static loads (see DIN 1055-3: 2006-03).

The screws may be screwed into grain cut timber made from solid timber, glue-laminated timber or composite laminated board or composite laminated beam made from pine wood at an angle of $15° \leq \alpha \leq 90°$ (α = angle between the screw axis and grain direction).

The following applies to the field of application of the screws depending upon the environmental conditions:

- The Standard DIN 1052:2008-12 Paragraph 6.3 with Table 2 for zinc plated high-carbon steel screws. They must not be used in the field of application according to DIN 1052:2008-12 Table 2, Column 3.
- National Technical Approval number Z-30.3-6 for stainless steel screws. The stainless steel according to works standard[11] D 41 fulfils the requirements placed upon Resistance Class II with regard to corrosion, and the stainless steel according to works standard D 64 fulfils the requirements placed upon Resistance Class III according to approval number Z-30.3-6.

2 Provisions specific to SPAX® Screws

2.1 Properties and composition

2.1.1 The shape, dimensions and dimensional deviations of the screw must conform to the specifications in appendices 1 to 14.

2.1.2 The screws specified in appendices 1 to 10 must be made of carbon steel in accordance with factory standards D 20, D 21 or D 22.

2.1.3 The screws according to appendices 11 to 14 must be manufactured from stainless steel according to works standards D 41 and D 64. The wire must have a minimum tensile strength of R_m = 560N/mm^2.

7	DIN EN 622-2:2003-10	Fibreboard Specifications Part 2: Specifications for hard boards
8	DIN EN 622-3:2003-10	Fibreboard Specifications Part 3: Specifications for medium-hard boards
9	DIN EN 634-2:2007-05	Cement bonded particle board – requirements – Part 2: specifications for particle boards bonded with Portland cement (PZ) for use in dry, moist and outdoor areas.
10	Z-9.1-100	KERTO laminated veneer lumber,

11 The internal factory standards are on file at Deutsches Institut für Bautechnik.

2.1.4 The characteristic values of the axial load-bearing capacity $R_{t,u,k}$ of the screws must not be less than those specified in Table 1.

Table 1: Characteristic values of axial load-bearing capacity $R_{t,u,k}$

Outer Thread Diameter d_1 mm	Characteristic Values of Axial Load-Bearing Capacity $R_{t,u,k}$ N	
	High-carbon steel screws	Stainless steel screws
8.0	17,000	12,600
10.0	28,000	-
12.0	38,000	-

2.1.5 The characteristic values of the torque at fracture $M_{t,u,k}$ must not be less than those specified in Table 2.

Table 2: Characteristic values of torque at fracture $M_{t,u,k}$

Outer Thread Diameter d_1 mm	Characteristic Values of Torque at Fracture $M_{t,u,k}$ Nm	
	High-carbon steel screws	Stainless steel screws
8.0	21,000	17,600
10.0	40,000	-
12.0	70,000	-

2.1.6 The screws must be capable of being bent to an angle of 45° without breaking.

2.1.7 Shape, dimensions and dimensional variations of the washers must correspond to the specifications contained in Appendix 15. The washers must be made of steel.

2.2 Identification

The packaging of the screws and the manufacturer‘s delivery note must bear the mark of conformity (Ü mark) in accordance with relevant acts issued by the Federal States. The use of this mark is only permitted if the requirements specified in section 2.3 are met.

The packages and delivery note must also contain the following information:

– Description of the subject of approval (the description „stainless“ is to be entered when dealing with stainless steel screws and the description “SPAX®III Screws” is to be entered when dealing with screws with a particular point shape according to appendices 6 to 10)
– Screw type and screw size
– High-carbon steel screw corrosion protection, where present
– Stainless steel screw corrosion resistance class

2.3 Proof of conformity

2.3.1 General

Proof of conformity of the screws with this National Technical Approval must be provided individually for each manufacturing plant and by means of a certificate of conformity based on internal production inspection and regular external production inspection, including an original inspection of the screw in accordance with the provisions below.

For granting the certificate of conformity and the external product inspection, including all necessary products inspections, the manufacturer of the screw must commission an authorised certification body as well as an approved inspection body.

The declaration that a certificate of conformity has been issued shall be provided by the manufacturer by labelling the construction product with the mark of conformity whilst stating the intended use.

The certification body must file a copy of the certificate of conformity with Deutsches Institut für Bautechnik.

2.3.2 Internal Production Inspection

An internal production inspection system must be established and operated at each manufacturing plant. In this context, the internal inspection must provide for the continuous monitoring of production by the manufacturer. The inspection system must ensure that the building products manufactured at the relevant plant conform to the specifications laid down in this National Technical Approval.

The internal production inspection system must comprise the following procedures as a minimum requirement:

- The raw wire must meet the requirements of the works certificate “2.2” according to DIN EN 10204[12]; compliance with the requirements specified in Section 2.1.2 and 2.1.3 must be checked on the basis of the test certificate
- Testing of the tensile strength and the breaking torque of the screw: One of these tests may be foregone if, in consultation with the inspecting body, the implemented test also allows conclusions to be drawn as regards the adherence of the requirements concerning the untested characteristic.
- 45° bending test
- Inspection of the screw dimensions

All further provisions associated with the internal production inspection system must be set forth in the supervision contract.

The results of the internal production inspection shall be recorded and evaluated. As a minimum requirement the records must contain the following details:

- Name of the building product or the raw material and the parts
- Nature of the inspection or testing
- Date of manufacture and inspection of the product or the raw material and the parts
- Results of the tests and inspection and, as far as applicable, a comparison with the specifications
- Signature of person responsible for the internal production inspection

The records must be kept for at least five years, and must be made available to the external inspection body responsible for the external production control. On request, these records must be made available to Deutsches Institut für Bautechnik an the relevant building supervisory board.

In the event of inadequate test results, the manufacturer is required to take the necessary corrective measures immediately. Non-conforming building products must be identified as such and handled in a way to fully exclude confusion with conforming products. After the situation has been rectified, the relevant test must be repeated without delay to the extent technically feasible and actually required to verify that the non-conformity has been eliminated.

12 DIN EN 10204:2005-01 Metal Products - Test Certification Methods,

2.3.3 External Production Inspection

The in-house production control is to be checked regularly by a third party monitoring at every manufacturer's works, at least however once per year.

Within the context of third party monitoring, an initial testing is to be carried out on the screws and samples for random sample testing are to be taken. The sample taking and the testing are the responsibility of the recognised inspecting body respectively. At least the breaking torque, bending angle and the dimensions of the screws are to be tested.

The results of the certification and external production inspection must be kept for at least five years. On request, these records must be made available by the certification body or the authorised inspection body to Deutsches Institut für Bautechnik and the relevant building supervisory board.

3 Provisions for design and dimensioning

3.1 General

For design and dimensioning DIN 1052 applies, unless provided otherwise below. The National Technical Approvals for the timber building components in use are to be adhered to.

Provided the following provisions are adhered to, the dimensions may also be determined in accordance with DIN V ENV 1995-1-1:1994-06 (in conjunction with the National Application Document).

Screw-in depths under $4 \cdot d_1$ (d_1 = outer thread diameter) may not be taken into account.

The calculation value of the slip modulus Kser for the evidence concerning fitness for use of the SPAX® screw with total thread stressed in the axial direction amounts to the following per cutting edge:

$$K_{ser} = 780 \cdot d_1^{0.2} \cdot l_{ef}^{0.4} \text{ (in N/mm)} \qquad (1)$$

Wherein:

l_{ef} = the respective thread length in both of the individual cross sections in mm

d_1 = outer thread diameter of the screw in mm

The calculation value of the slip modulus for proving the load bearing capacity is assumed to be 2/3 of the calculation value of the slip modulus for proving concerning fitness for use.

3.2 Dimensioning according to DIN 1052:2008-12 or DIN V ENV 1995-1-1 (in combination with the national application document)

3.2.1 Perpendicular load to the screw axis (shearing)

When dimensioning according to DIN 1052:2008-12 or according to DIN V ENV 1995-1-1:1994-06, the outer thread diameter d_1 according to Appendices 1 to 14 may be taken into account as screw diameter d.

For the characteristic yield moment values, the values indicated in Table 3 apply.

Table 3: Characteristic Values of Yield Moment $M_{y,k}$

Outer Thread Diameter d_1	Characteristic Values of Torque at Fracture $M_{t,u,k}$ Nm	
mm	High-carbon steel screws	Stainless steel screws
8.0	20,000	16,700
10.0	30,000	-
12.0	48,000	-

Shearing loads must not be taken into account with regard to screws in front surfaces of “KERTO-S” or “KERTO-Q”.

For screws subject to shear loads driven into the narrow edge faces of “KERTO-Q”, an actual embedding strength of 1/3 of that of the cover surface must be assumed.

When pre-drilling the drill hole for the SPAX® screws, the embediment strength $f_{h,k}$ of the timber materials can be assumed as when dealing with nails in pre-drilled timber parts.

3.2.2 Load in the direction of the screw axis

The characteristic value of the extraction resistance for screws screwed in at an angle of $15° \leq \alpha \leq 90°$ may:

$R_{ax,k} = k_{ax} \cdot f_{1,k} \cdot l_{ef} \cdot d_1$ (in N) (2)

be taken into account with

k_{ax} = $0.3 + (0.7 \cdot \alpha)/45°$ for $15° \leq \alpha \leq 45°$ (3)

k_{ax} = 1.0 for $\alpha \geq 45°$

k_{ax} = 1.25 for $\alpha = 90°$ and $d_1 = 8.0$ mm for solid timber,
glue-laminated timber and composite laminated board or composite laminated beam

α = angle between the screw axis and the grain direction,

$15° \leq \alpha \leq 90°$ for solid timber (pine wood), glue-laminated timber (pine wood) and composite laminated board and composite laminated beam

$30° \leq \alpha \leq 90°$ for veneer wood with National Technical Approval

$f_{1,k}$ = $80 \cdot 10^{-6} \cdot \rho_k^2$ (in N/mm²) for solid timber, glue-laminated timber and composite laminated board or composite laminated beam. (4)

If screws are screwed into the upper surfaces of “KERTO-S” and “KERTO-Q” at an angle of $30° \leq \alpha \leq 90°$, then $f_{1,k}$ with

$f_{1,k}$ = $70 \cdot 10^{-6} \cdot \rho_k^2$ (in N/mm²) for d_1=8 mm and (5)

$f_{1,k}$ = $80 \cdot 10^{-6} \cdot \rho_k^2$ (in N/mm²) for d_1=8 mm (6)

is to be assumed. These values are to be reduced by 20% where screws are screwed into the edges and front surfaces.

Where:

l_{ef} = thread length in the timber section with the screw tip mm. Only the thread length l_{gV} or l_{gT} according to Appendices 1 - 14 may be taken into account as the screw-in depth l_{ef}. Screw-in depths lef smaller than $4 \cdot d_1$ may not be taken into account.

d_1 = outer thread diameter of the screw in mm

ρ_k = characteristic gross density of the timber material in kg/m³

Due to the risk of head pull-through and the risk of the screw threading pull-through through screwed-on timber parts, the characteristic value of the extraction resistance on screws stressed due to extraction may be taken into account with

$$R_{ax,k} = \max \left\{ \begin{array}{l} f_{2,k} \cdot d_k^{\,2} \\ k_{ax} \cdot f_{1,k} \cdot l_{ef,k} \cdot d_1 \end{array} \right. \text{ in N} \qquad (7)$$

Wherein:

$f_{2,k}$ = characteristic value of the head pull-through parameters in N/mm²

$$f_{2,k} = 80 \cdot 10^{-6} \cdot \rho_k^{\,2} \qquad (8)$$

For flange head, washer head and pan head screws with flange:

$$f_{2,k} = 100 \cdot 10^{-6} \cdot \rho_k^{\,2} \qquad (9)$$

ρ_k = characteristic gross density in kg/m³, maximum 500 kg/m³, maximum 380 kg/m³ for timber boards

d_k = head diameter of the screw and the outer diameter of the washer respectively in mm as per appendices 1 to 15. Washer diameters of > 35 mm must not be considered.

$l_{ef,k}$ = thread length in timber part to be connected (head-side screw area) in mm

When connecting timber product boards with thicknesses of ≥ 12 to ≤ 20 mm, the characteristic value of the head pull-through parameter can be mathematically calculated with

$f_{2,k}$ = 8 N/mm²

The equations (7) and (9) apply to screws with an outer thread diameter of d_1 = 12 mm when using wood based panels only together with washers.

When connecting timber product boards, a maximum of 400 N may be taken into account when dealing with board thicknesses of under 12 mm, wherein the minimum thicknesses according to Section 4.4 are to be observed.

Equation (7) is not authoritative with regard to steel plate-wood connections.

The dimensioning value $R_{t,u,d}$ determined from the characteristic value of the load capability of the screw for tensile load $R_{t,u,k}$ according to Table 1 may not be exceeded.

3.2.3 Combined load

With regard to connections placed under stress both by impact in the direction of the screw axis (F_{ax}) as well as an impact perpendicular to it (F_{la}), the following must hold true:

$$\left(\frac{F_{ax,d}}{R_{ax,d}}\right)^2 + \left(\frac{F_{la,d}}{R_{la,d}}\right)^2 \leq 1 \qquad (10)$$

Here, $F_{ax,d}$ and $F_{la,d}$ are the dimensioning values of the impacts in the direction of / perpendicular to the direction of the screw axis and $R_{ax,d}$ and $R_{la,d}$ are the dimensioning values of the load capabilities of the connections respectively for the case of sole stress in the direction of / perpendicular to the direction of the screw axis.

4 Provisions for production

4.1 For production DIN 1052 applies, unless provided otherwise below. The National Technical Approvals for timber building components are to be observed.

4.2 The screws may only be used for the fastening of solid timber parts (soft wood) and elements made of glue-laminated timber, laminated veneer according to the National Technical Approval and and wood based panels in accordance with Section 3.1, or for fastening steel parts to solid timber parts (soft wood), and elements made of glue-laminated timber or laminated veneer according to the National Technical Approval.

This National Technical Approval does not apply to connections to particle boards including OSB boards, fibre boards or plywood panels. For fastening in solid timber, glue-laminated timber, laminated veneer lumber, the screws may only be used for products made of spruce, pine or spruce fir. This applies also to the use of screws for fastening timber construction components in accordance with National Technical Approval.

Screws with an outer thread diameter of $d_1 \geq 8$ mm that are screwed in without pre-drilling may only be screwed into timber parts made from solid timber, glue-laminated timber and from laminated veneer lumber, composite laminated board or composite laminated beam provided that spruce, pine or fir wood is used. This analogously also applies to screwing into timber parts according to the National Technical Approval.

These screws may be driven into the cover surfaces, narrow edge faces, and end edge faces of “KERTO” veneer timber “KERTO-S” and “KERTO-Q” in accordance with the National Technical Approval No. Z-9.1-100, hereinafter called “KERTO-S” and “KERTO-Q”. Screws applied to end edge faces must be subjected to pull-out loads only.

4.3 The screws may only be driven with the tools recommended for that purpose by the manufacturer.

When pre-drilling the timber part for the SPAX® screws, the diameter of the drill hole is to be selected such that it conforms to the core diameter $d_2\,{}^{+0.0\text{ mm}}_{-0.5\text{ mm}}$ of the SPAX® screws.

The holes in steel components are to be pre-drilled with a suitable diameter. In cement-bonded particle boards, the screw holes must be predrilled with a diameter of $0.7 \cdot d_1$. In timber building components the screws must be driven without pre-drilling.

The screw thread may also be in the fastened timber component.

The screws must be countersunk into the timber construction components such that the screw head is flush with the surface of the fastened part, but for washer head, pan head and hex head with head part k protruding. Deeper countersinking is not permitted.

The countersunk screws may be used together with washers in accordance with appendix 15. The full surface of the washer must rest against the timber when the screw has been driven. High-carbon steel countersunk screws may only be used with high-carbon steel washers and stainless steel screws may only be used with stainless steel washers.

4.4 When dealing with SPAX® screws with an outer thread diameter of $d_1 = 8$ mm, that will be screwed into timber parts that have not been pre-drilled, the thickness of the timber parts to be connected must measure at least 30 mm, when dealing with screws with $d_1 = 10$ mm, the thickness must measure at least 40 mm and when dealing with screws with $d_1 = 12$ mm, the thickness must measure at least 80 mm.

When connecting timber boards to timber parts according to Section 1.1 using SPAX® screws, their board thickness must measure at least $1.2 \cdot d_1$ (d_1 = outer thread diameter of the screw).

Furthermore, the board thickness must be not less than

6 mm for plywood and fibreboard, not less than

8 mm for synthetic-bonded chipboard, OSB boards and not less than

10 mm for plaster-bonded chipboard.

The regulations of the National Technical Approvals apply with regard to the minimum thicknesses of timber parts according to National Technical Approvals.

4.5. For end grain connections solid timber must be at least half-cut and the timber moisture content must not exceed 18% at the time of fastening.

4.6 Minimum distances

4.6.1 Perpendicular load to the screw axis (shearing)

4.6.1.1 Timber parts that have not been pre-drilled

The values according to DIN 1052 must be adhered to as minimum distances of the screws when dealing with timber parts regulated by the standard, as with nails with pre-drilled nail holes, wherein the outer thread diameter d_1 according to appendices 1 to 14 is to be considered as the screw diameter.

The distance of the screws from the edge in the grain direction must amount to at least $15 \cdot d_1$.

The values according to DIN 1052 must be adhered to as minimum distances of the SPAX® screws with CUT point or 4CUT point when dealing with timber parts regulated by the standard, as with nails with pre-drilled nail holes. The minimum distance a_1 parallel to the grain direction must not be lower than $5 \cdot d_1$ and the minimum distance to the end grain $a_{3,c}$ or $a_{3,t}$ must not be lower than $12 \cdot d_1$. The named minimum distances only apply under the prerequisite that a minimum wood cross section of $40 \cdot d_1^2$ and a minimum thickness of the timber parts of $7 \cdot d_1$ are adhered to. If the minimum wood cross section of $40 \cdot d_1^2$ is not reached, the values according to DIN 1052 shall be adhered to as minimum distances for the screws when dealing with timber parts regulated by the standard, as with nails with nail holes that have not been pre-drilled.

When dealing with SPAX® screws without CUT point or 4CUT point that have to be screwed into timber parts that have not been pre-drilled, and if the distance to each other in the grain direction and to the end grain measures at least $25 \cdot d_1$ then the distance to the unstressed edge may be reduced to $3 \cdot d_1$ perpendicular to the grain direction.

When dealing with Douglas-fir, the minimum distances in the grain direction are to be increased by 50%.

4.6.1.2 Pre-drilled timber parts

The values according to DIN 1052 must be adhered to as minimum distances of the SPAX® screws in pre-drilled timber parts when dealing with timber parts regulated by the standard, as with nails with pre-drilled nail holes.

4.6.1.3 For minimum distances in timber construction components in accordance with the National Technical Approval, the provisions of the National Technical Approvals apply.

4.6.2 Load in the direction of the screw axis

When dealing with screws that are planned to be exclusively stressed in the direction of the screw axis with an outer thread diameter of d_1 = 8 mm or with CUT point or 4CUT point, the following minimum distances may be used as a basis when dealing with timber parts that have not been pre-drilled (see Appendices 16 and 17):

Distance a_1 between the screw axes
in a plane parallel to grain direction: $a_1 = 5 \cdot d_1$

Distance a_2 between the screw axes
at right angles to a plane parallel to grain direction: $a_2 = 5 \cdot d_1$

Distance $a_{3,c}$ between the centre of gravity of the portion of the screw in the timber and the end grain face: $a_{3,c} = 5 \cdot d_1$

Distance $a_{4,c}$ between the centre of gravity of the portion of the screw in the timber and the side face: $a_{4,c} = 4 \cdot d_1$

For screws with CUT point or 4CUT point: $a_{4,c} = 3 \cdot d_1$

The distance a_2 between the screw axes may be reduced to $2.5 \cdot d_1$, provided each screw has a connecting face of $a_1 \cdot a_2 = 25 \cdot d_1^2$. The distances also apply when screwing into pre-drilled timber parts.

For screws that crossover, the axis distance a_2 can be assumed as shown below:

$$a_2 = \max \begin{cases} 1.5 \cdot d_1 & \text{for } 70° < \alpha_k \leq 90° \\ 2.5 \cdot d_1 \left(1 - \frac{\alpha_k}{180°}\right) & \text{for } 0° < \alpha_k \leq 70° \end{cases} \quad (11)$$

α_k See Appendix 17 for crossing angle of the screws

Minimum distances a_1 and a_2 are to be observed between screws arranged in parallel belonging to adjacent screw intersections.

4.6.3 Minimum distances for connections using "KERTO-S" and "KERTO-Q".

For connections with "KERTO-Q" (narrow edge faces) and "KERTO-S" subject to shear loads, the minimum distances laid down in DIN 1052 must be complied with; the same applies to nails without pre-drilling. The screw diameter d1 is calculated as the outer thread diameter as specified in the Appendices 1 to 14.

For the distances of screws driven into the cover surfaces of "KERTO-Q" the values in Table 5 of the National Technical Approval No. Z-9.1-100 dated 26/05/2006 apply.

For screws which, according to the construction design, are subject to loads in screw axis direction exclusively and are driven into "KERTO-Q" or "KERTO-S" with a minimum thickness of $t = 6 \cdot d_1$, the following minimum distances apply (see Appendices 16 to 17):

Distance a_1 between the screw axes in a plane parallel to grain direction: $a_1 = 5 \cdot d_1$

Distance a_2 between the screw axes at right angles to a plane parallel to grain direction: $a_2 = 5 \cdot d_1$

Distance $a_{3,c}$ between the centre of gravity of the portion of the screw in the timber and the end grain face: $a_{3,c} = 5 \cdot d_1$

Distance $a_{4,c}$ between the centre of gravity of the portion of the screw in the timber and the side face: $a_{4,c} = 3 \cdot d_1$

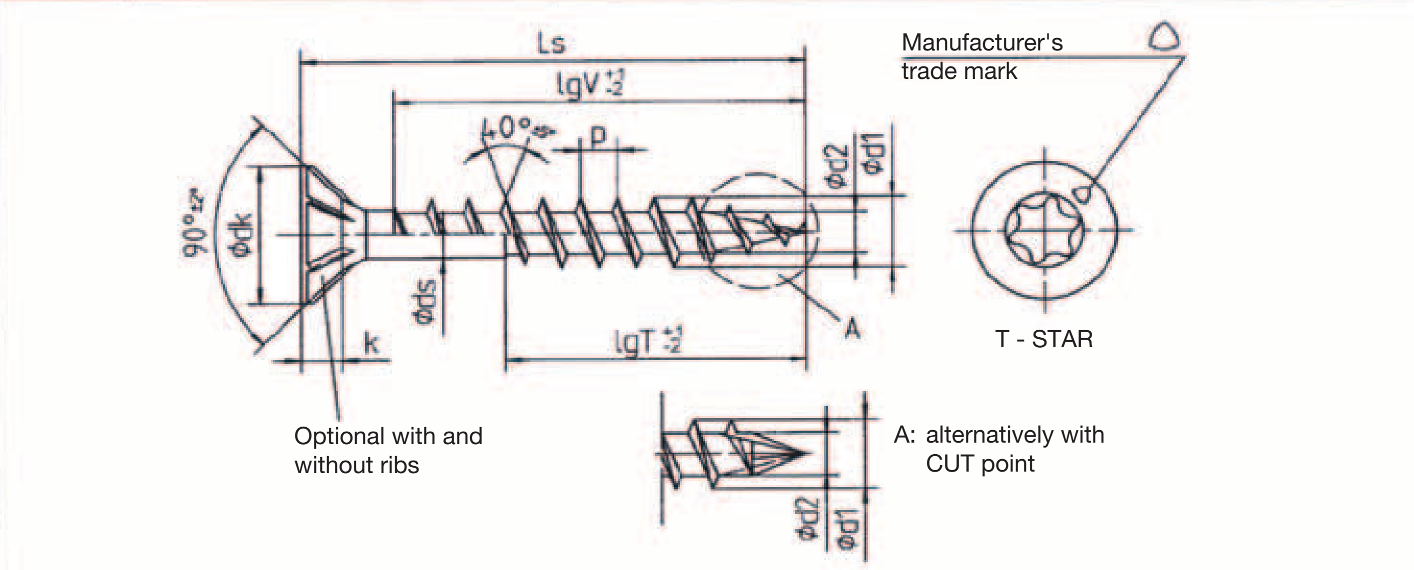
The distance a_2 between the screw axes may be reduced to $2.5 \cdot d_1$, provided each screw has a connecting face of $a_1 \cdot a_2 = 25 \cdot d_1^2$

For screws that crossover, the axis distance a_2 according to Equation (11) can be assumed.

Minimum distances a_1 and a_2 are to be observed between the screws arranged in parallel belonging to adjacent screw intersections.

Rainer Schäpel
Head of Division

SPAX®-S Countersunk head		Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



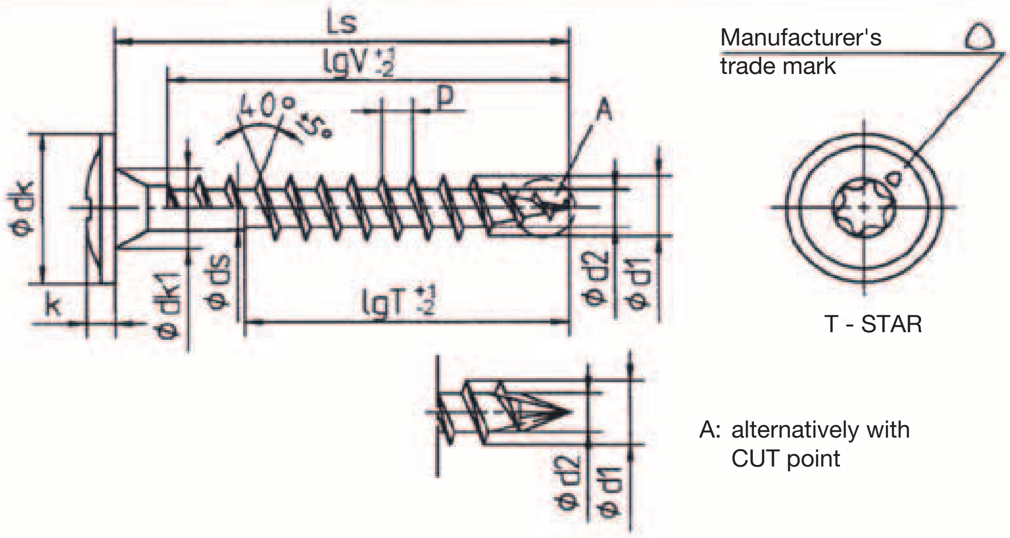
Nominal diameter		**8.0**	**10.0**	**12.0**
d1	thread size	8.1	10.1	12.1
	permissible tolerance		±0.40	
dk	head diameter	15.1	18.6	22.6
	permissible tolerance		-0.60	
d2	core diameter	5.0	6.1	7.5
	permissible tolerance	-0.30		-0.50
ds	shank diameter	5.70	6.80	8.50
	permissible tolerance		±0.25	
k	height of head, max.	4.4	5.4	6.6
p	thread pitch	4.0	5.0	6.0
	permissible tolerance		±0.1 x p	
T-STAR	size	T40	T50	T50

Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)					
Nom. dim.	min	max	lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	32.0					
45	***43.5***	***46.5***	***37.0***					
50	48.5	51.5	42.0	32.0	40.0			
55	***53.5***	***56.5***	***47.0***	***32.0***	***45.0***			
60	58.5	61.5	52.0	37.0	50.0		50.0	
65	***63.5***	***66.5***	***57.0***	***37.0***	***55.0***	***40.0***	***55.0***	
70	68.5	71.5	61.0	42.0	60.0	40.0	60.0	
75	***73.5***	***76.5***	***61.0***	***42.0***	***60.0***	***450***	***60.0***	
80	78.5	81.5	70.0	47.0	70.0	50.0	70.0	50.0
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***
100	98.5	101.5	80.0	57.0	80.0	60.0	80.0	60.0
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
120	118.5	121.5	80.0	70.0	80.0	70.0		80.0
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
140	138.0	142.0		80.0		80.0		80.0
150	***148.0***	***152.0***		***80.0***		***80.0***		***100.0***
160	158.0	162.0		80.0		80.0		100.0
180	***178.0***	***182.0***		***80.0***		***80.0***		***100.0***
200	198.0	202.0		80.0		80.0		100.0
to								
600	***597.0***	***602.0***		***80.0***		***80.0***		***100.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

ABC	**SPAX®-S** Washer head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



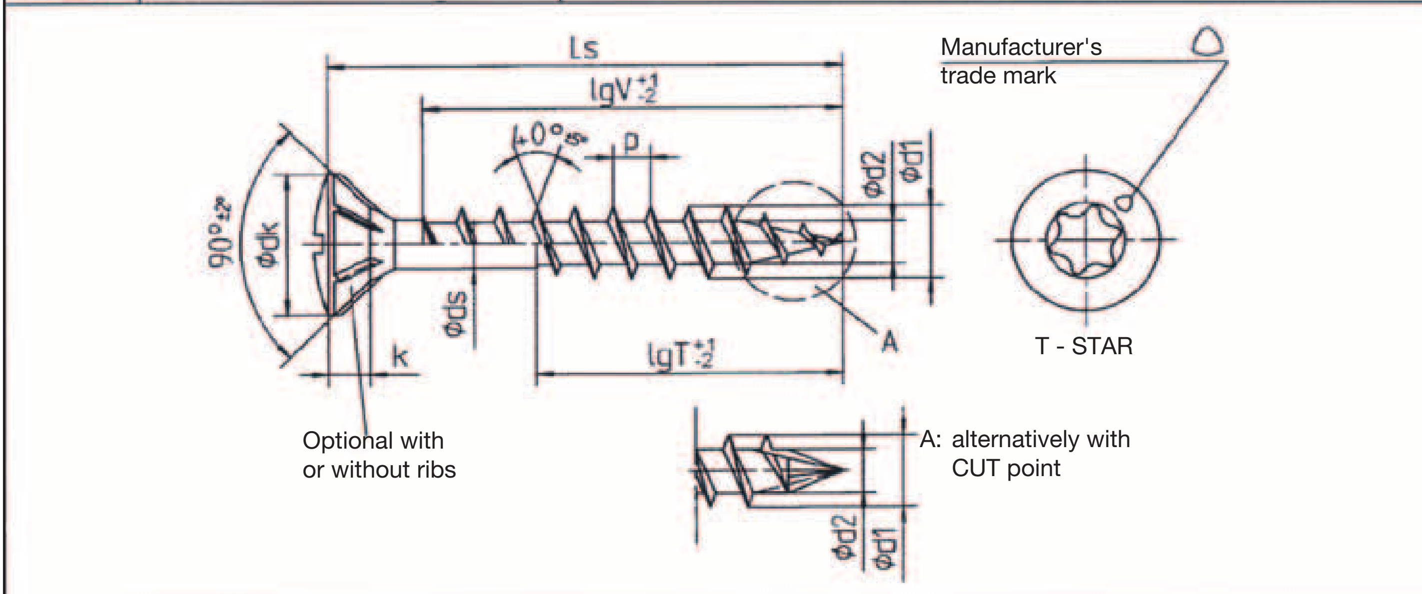
Nominal diameter		**8.0**			**10.0**	**12.0**		
d1	thread size	8.1			10.1	12.1		
	permissible tolerance	±0.40						
dk	head diameter	18.0	21.0	23.0	26.0	31.0		
	permissible tolerance	±1.5						
dk1	countersink diameter	9.0			12.0	14.0		
	permissible tolerance	+0.30						
d2	core diameter	5.0			6.1	7.5		
	permissible tolerance	-0.30				-0.5		
ds	shank diameter	5.70			6.80	8.50		
	permissible tolerance	±0.25						
k	height of head, max.	4.0			4.7	5.6		
p	thread pitch	4.0			5.0	6.0		
	permissible tolerance	±0.1 x p						
T-STAR	size	T40			T50			

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	37.0					
45	***43.5***	***46.5***	***42.0***					
50	48.5	51.5	46.0	32.0				
55	***53.5***	***56.5***	***51.0***	***32.0***	***50.0***		***50.0***	
60	58.5	61.5	56.0	37.0	55.0		55.0	
65	***63.5***	***66.5***	***61.0***	***37.0***	***60.0***	***40.0***	***60.0***	
70	68.5	71.5	61.0	42.0	60.0	40.0	60.0	
75	***73.5***	***76.5***	***70.0***	***42.0***	***70.0***	***45.0***	***70.0***	
80	78.5	81.5	70.0	47.0	70.0	50.0	70.0	50.0
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***
100	98.5	101.5	80.0	57.0	80.0	60.0	80.0	60.0
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
120	118.5	121.5	80.0	70.0	80.0	70.0		80.0
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
140	138.0	142.0		80.0		80.0		80.0
150	***148.0***	***152.0***		***80.0***		***80.0***		***100.0***
160	158.0	162.0		80.0		80.0		100.0
180	***178.0***	***182.0***		***80.0***		***80.0***		***100.0***
200	198.0	202.0		80.0		80.0		100.0
to								
600	***597.0***	***602.0***		***80.0***		***80.0***		***100.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

	SPAX®-S Raised countersunk head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



Nominal diameter		**8.0**	**10.0**	**12.0**				
d1	thread size	8.1	10.1	12.1				
	permissible tolerance		±0.40					
dk	head diameter	15.1	18.6	22.6				
	permissible tolerance		-0.60					
d2	core diameter	5.0	6.1	7.5				
	permissible tolerance	-0.30		-0.50				
ds	shank diameter	5.70	6.80	8.50				
	permissible tolerance		±0.25					
k	height of head, max.	4.4	5.4	6.6				
p	thread pitch	4.0	5.0	6.0				
	permissible tolerance		±0.1 x p					
T-STAR	size	T40	T50	T50				

Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)													
Nom. dim.	min	max	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	32.0													
45	***43.5***	***46.5***	***37.0***													
50	48.5	51.5	42.0	32.0	40.0											
55	***53.5***	***56.5***	***47.0***	***32.0***	***45.0***											
60	58.5	61.5	52.0	37.0	50.0		50.0									
65	***63.5***	***66.5***	***57.0***	***37.0***	***55.0***	***40.0***	***55.0***									
70	68.5	71.5	61.0	42.0	60.0	40.0	60.0									
75	***73.5***	***76.5***	***61.0***	***42.0***	***60.0***	***450***	***60.0***									
80	78.5	81.5	70.0	47.0	70.0	50.0	70.0	50.0								
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***								
100	98.5	101.5	80.0	57.0	80.0	60.0	80.0	60.0								
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***								
120	118.5	121.5	80.0	70.0	80.0	70.0		80.0								
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***								
140	138.0	142.0		80.0		80.0		80.0								
150	***148.0***	***152.0***		***80.0***		***80.0***		***100.0***								
160	158.0	162.0		80.0		80.0		100.0								
180	***178.0***	***182.0***		***80.0***		***80.0***		***100.0***								
200	198.0	202.0		80.0		80.0		100.0								
to																
600	***597.0***	***602.0***		***80.0***		***80.0***		***100.0***								

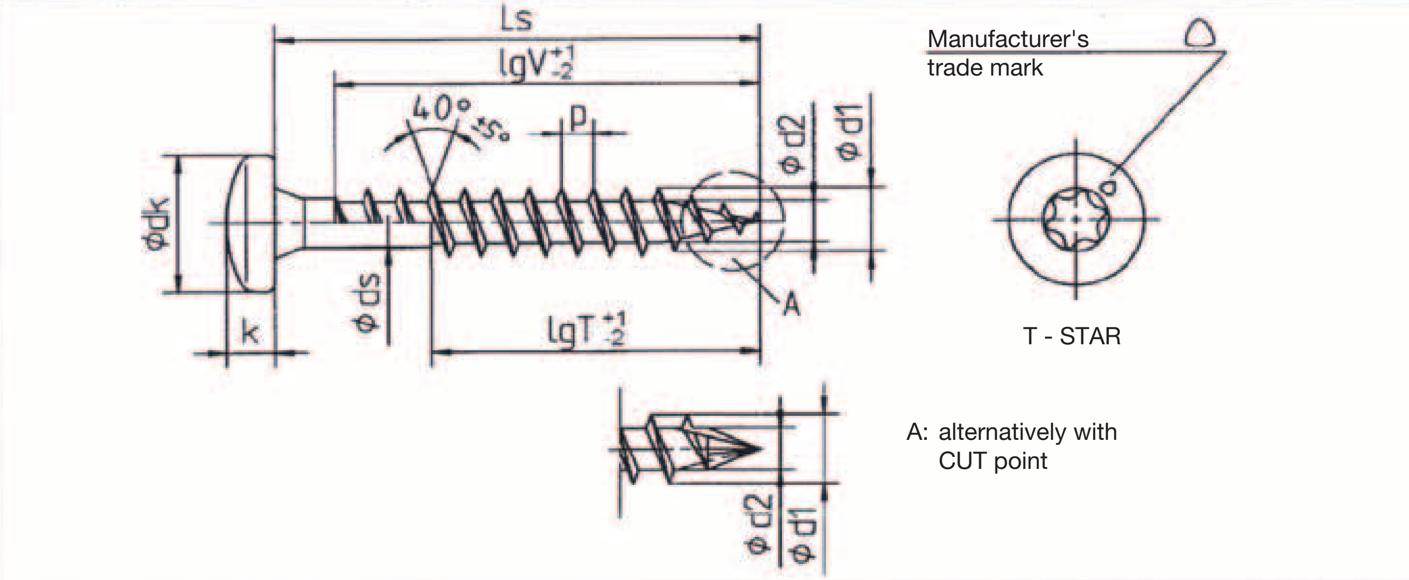
Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

SPAX®-S
Pan head

Self-drilling screw with full and partial thread

Material: cold rolled wire according to SPAX Factory Norm
Screws of high carbon steel



Nominal diameter		**8.0**	**10.0**	**12.0**
d1	thread size	8.1	10.1	12.1
	permissible tolerance	±0.40		
dk	head diameter	15.5	19.0	23.0
	permissible tolerance	-0.60		
d2	core diameter	5.0	6.1	7.5
	permissible tolerance	-0.30		-0.50
ds	shank diameter	5.70	6.80	8.50
	permissible tolerance	±0.25		
k	height of head, max.	5.7	7.1	8.5
R	pan radius approx.	16.0	20.0	24.0
p	thread pitch	4.0	5.0	6.0
	permissible tolerance	±0.1 x p		
T-STAR	size	T40	T50	T50

Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)					
Nom. dim.	min	max	lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	37.0					
45	***43.5***	***46.5***	***42.0***					
50	48.5	51.5	46.0	32.0				
55	***53.5***	***56.5***	***51.0***	***32.0***	***50.0***		***50.0***	
60	58.5	61.5	56.0	37.0	55.0		55.0	
65	***63.5***	***66.5***	***61.0***	***37.0***	***60.0***	***40.0***	***60.0***	
70	68.5	71.5	61.0	42.0	60.0	40.0	60.0	
75	***73.5***	***76.5***	***70.0***	***42.0***	***70.0***	***45.0***	***70.0***	
80	78.5	81.5	70.0	47.0	70.0	50.0	70.0	50.0
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***
100	98.5	101.5	80.0	57.0	80.0	60.0	80.0	60.0
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
120	118.5	121.5	80.0	70.0	80.0	70.0		80.0
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
140	138.0	142.0		80.0		80.0		80.0
150	***148.0***	***152.0***		***80.0***		***80.0***		***100.0***
160	158.0	162.0		80.0		80.0		100.0
180	***178.0***	***182.0***		***80.0***		***80.0***		***100.0***
200	198.0	202.0		80.0		80.0		100.0
to								
600	***597.0***	***602.0***		***80.0***		***80.0***		***100.0***

Intermediate lengths on Ls possible

Other thread lengths in the range $\geq 4 \cdot d1$ to max. standard length permitted

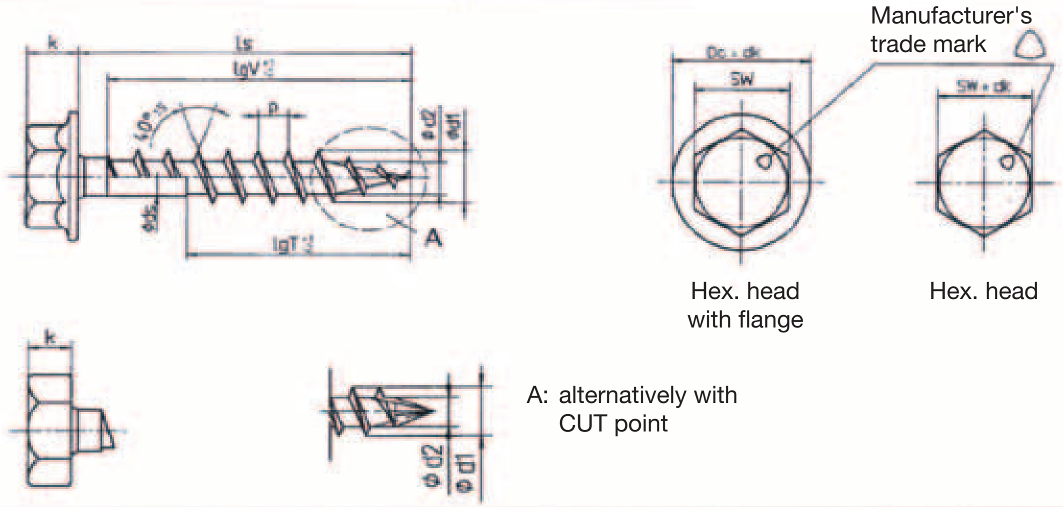
SPAX®-S

Hex. head with/without flange

Self-drilling screw with full and partial thread

Material: cold rolled wire according to SPAX Factory Norm

Screws of high carbon steel

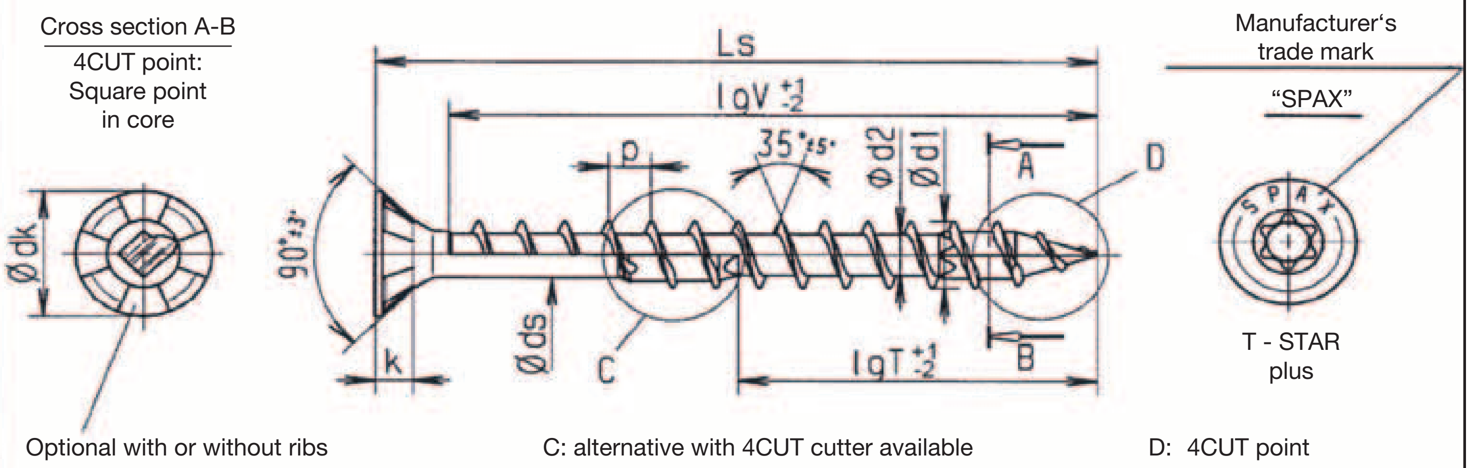


			with flange						no flange					
Nominal diameter			**8.0**		**10.0**		**12.0**		**8.0**		**10.0**		**12.0**	
d1	thread size		8.1		10.1		12.1		8.1		10.1		12.1	
	permissible tolerance		±0.40						±0.40					
SW	width across flat		10		13		16		10		13		16	
Dc	flange diameter		17.0		20.8		24.7							
	permissible tolerance		-1.00											
d2	core diameter		5.0		6.1		7.5		5.0		6.1		7.5	
	permissible tolerance		-0.30				-0.50		-0.30				-0.50	
ds	shank diameter		5.70		6.80		8.50		5.70		6.80		8.50	
	permissible tolerance		±0.25						±0.25					
k	height of head, max.		8.5		9.7		12.1		6.0		7.0		8.0	
p	thread pitch		4.0		5.0		6.0		4.0		5.0		6.0	
	permissible tolerance		±0.1 x p						±0.1 x p					
Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)											
Nom. dim.	min	max	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	37.0						37.0					
45	***43.5***	***46.5***	***42.0***						***42.0***					
50	48.5	51.5	46.0	32.0	45.0				46.0	32.0	45.0			
55	***53.5***	***56.5***	***51.0***	***32.0***	***50.0***		***50.0***		***51.0***	***32.0***	***50.0***		***50.0***	
60	58.5	61.5	56.0	37.0	55.0		55.0		56.0	37.0	55.0		55.0	
65	***63.5***	***66.5***	***61.0***	***37.0***	***60.0***	***40.0***	***60.0***		***61.0***	***37.0***	***60.0***	***40.0***	***60.0***	
70	68.5	71.5	61.0	42.0	60.0	40.0	60.0		61.0	42.0	60.0	40.0	60.0	
75	***73.5***	***76.5***	***70.0***	***42.0***	***70.0***	***45.0***	***70.0***		***70.0***	***42.0***	***70.0***	***45.0***	***70.0***	
80	78.5	81.5	70.0	47.0	70.0	50.0	70.0	50.0	70.0	47.0	70.0	50.0	70.0	50.0
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***	***80.0***	***52.0***	***80.0***	***55.0***	***80.0***	***55.0***
100	98.5	101.5	80.0	57.0	80.0	60.0	80.0	60.0	80.0	57.0	80.0	60.0	80.0	60.0
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
120	118.5	121.5	80.0	70.0	80.0	70.0		80.0	80.0	70.0	80.0	70.0		80.0
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***	***80.0***	***70.0***	***80.0***	***70.0***		***80.0***
140	138.0	142.0		80.0		80.0		80.0		80.0		80.0		80.0
150	***148.0***	***152.0***		***80.0***		***80.0***		***100.0***		***80.0***		***80.0***		***100.0***
160	158.0	162.0		80.0		80.0		100.0		80.0		80.0		100.0
180	***178.0***	***182.0***		***80.0***		***80.0***		***100.0***		***80.0***		***80.0***		***100.0***
200	198.0	202.0		80.0		80.0		100.0		80.0		80.0		100.0
to														
600	***597.0***	***602.0***		***80.0***		***80.0***		***100.0***		***80.0***		***80.0***		***100.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

	SPAX® Countersunk head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



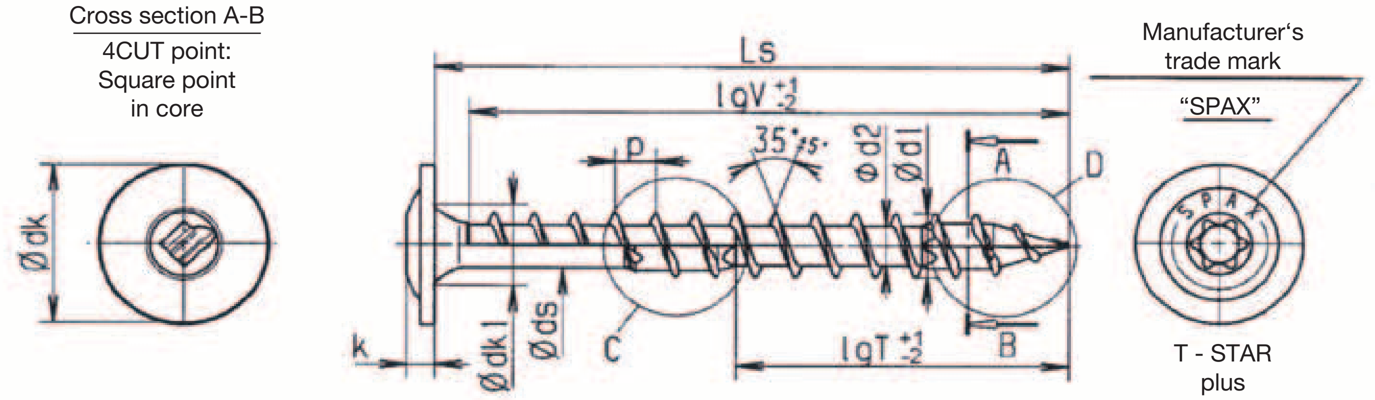
Nominal diameter		8.0
d1	thread size	8.1
	permissible tolerance	±0.40
dk	head diameter	15.1
	permissible tolerance	-0.60
d2	core diameter	5.0
	permissible tolerance	±0.20
ds	shank diameter	5.70
	permissible tolerance	±0.25
k	height of head, max.	4.4
p	thread pitch	4.8
	permissible tolerance	±0.1 x p
T-STAR plus	size	T40

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT
40	38.5	41.5	32.0	
45	***43.5***	***46.5***	***37.0***	
50	48.5	51.5	42.0	32.0
55	***53.5***	***56.5***	***47.0***	***32.0***
60	58.5	61.5	52.0	37.0
65	***63.5***	***66.5***	***57.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***61.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0
180	***178.0***	***182.0***		***80.0***
200	198.0	202.0		80.0
to				
600	***597.0***	***602.0***		***80.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

	Washer head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



C: alternative with 4CUT cutter available D: 4CUT point

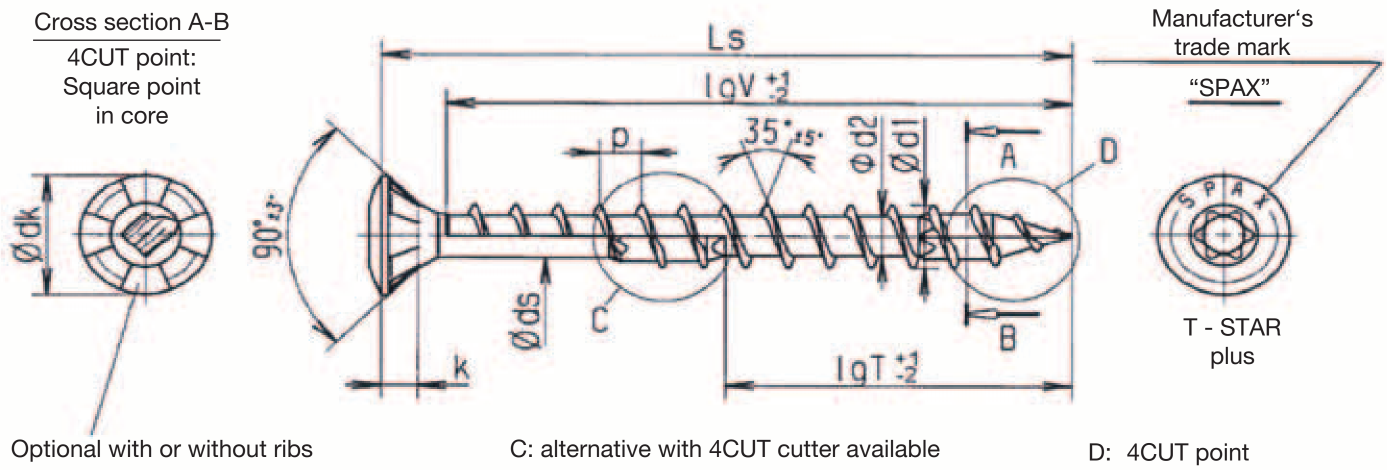
Nominal diameter		**8.0**			
d1	thread size	8.1			
	permissible tolerance	±0.40			
dk	head diameter	18.0	20.0	22,0	24,0
	permissible tolerance	±1.0			
dk1	countersink diameter	9.00			
	permissible tolerance	+0.50			
d2	core diameter	5.0			
	permissible tolerance	±0.20			
ds	shank diameter	5.70			
	permissible tolerance	±0.25			
k	height of head, max.	4.3			
p	thread pitch	4.8			
	permissible tolerance	±0.1 x p			
T-STAR plus	size	T40			

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT
40	38.5	41.5	37.0	
45	***43.5***	***46.5***	***42.0***	
50	48.5	51.5	46.0	32.0
55	***53.5***	***56.5***	***51.0***	***32.0***
60	58.5	61.5	56.0	37.0
65	***63.5***	***66.5***	***61.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***70.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0
180	***178.0***	***182.0***		***80.0***
200	198.0	202.0		80.0
to				
600	***597.0***	***602.0***		***80.0***

Intermediate lengths on Ls possible
$\boxed{\quad}$ = Preferred size

Other thread lengths in the range ≥ 4 · d1
to max. standard length permitted

	Raised countersunk head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



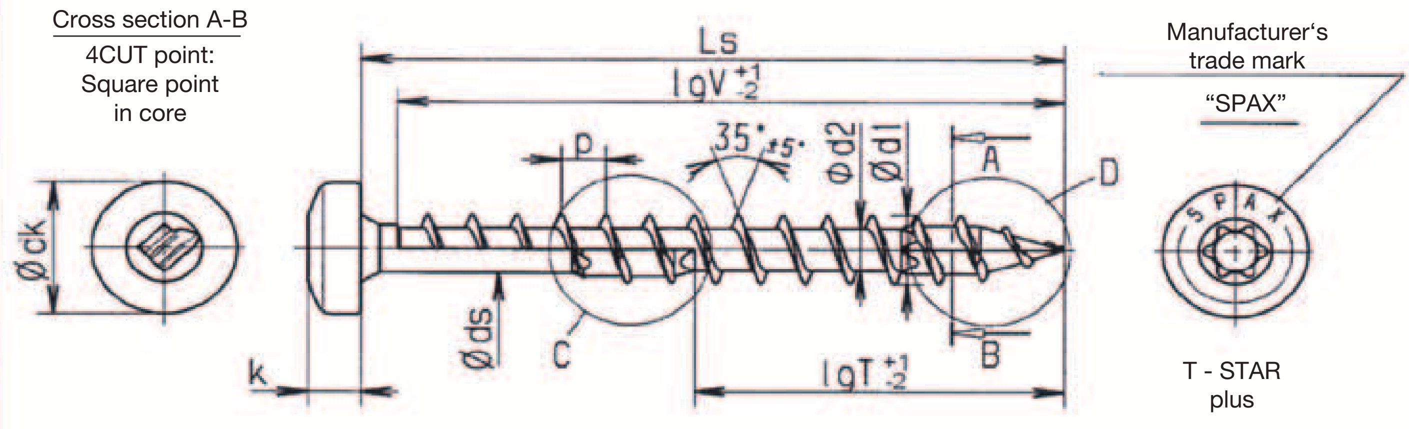
Nominal diameter		**8.0**						
d1	thread size	8.1						
	permissible tolerance	±0.40						
dk	head diameter	15.1						
	permissible tolerance	-0.60						
d2	core diameter	5.0						
	permissible tolerance	±0.20						
ds	shank diameter	5.70						
	permissible tolerance	±0.25						
k	height of head, max.	4.4						
p	thread pitch	4.8						
	permissible tolerance	±0.1 x p						
T-STAR plus	size	T40						

Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)	
Nom. dim.	min	max	lgV	lgT
40	38.5	41.5	32.0	
45	***43.5***	***46.5***	***37.0***	
50	48.5	51.5	42.0	32.0
55	***53.5***	***56.5***	***47.0***	***32.0***
60	58.5	61.5	52.0	37.0
65	***63.5***	***66.5***	***57.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***61.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0
180	***178.0***	***182.0***		***80.0***
200	198.0	202.0		80.0
to				
600	***597.0***	***602.0***		***80.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1
to max. standard length permitted

A B C	SPAX® Pan head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Screws of high carbon steel



C: alternative with 4CUT cutter available

D: 4CUT point

Nominal diameter		**8.0**						
d1	thread size	8.1						
	permissible tolerance	±0.40						
dk	head diameter	15.5						
	permissible tolerance	-0.60						
d2	core diameter	5.0						
	permissible tolerance	±0.20						
ds	shank diameter	5.70						
	permissible tolerance	±0.25						
k	height of head, max.	6.0						
p	thread pitch	4.8						
	permissible tolerance	±0.1 x p						
T-STAR plus	size	T40						

Ls			Standard thread lengths (full thread = lgV / partial thread = lgT)	
Nom. dim.	min	max	lgV	lgT
40	38.5	41.5	37.0	
45	***43.5***	***46.5***	***42.0***	
50	48.5	51.5	46.0	32.0
55	***53.5***	***56.5***	***51.0***	***32.0***
60	58.5	61.5	56.0	37.0
65	***63.5***	***66.5***	***61.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***70.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0
180	***178.0***	***182.0***		***80.0***
200	198.0	202.0		80.0
to				
600	***597.0***	***602.0***		***80.0***

Intermediate lengths on Ls possible

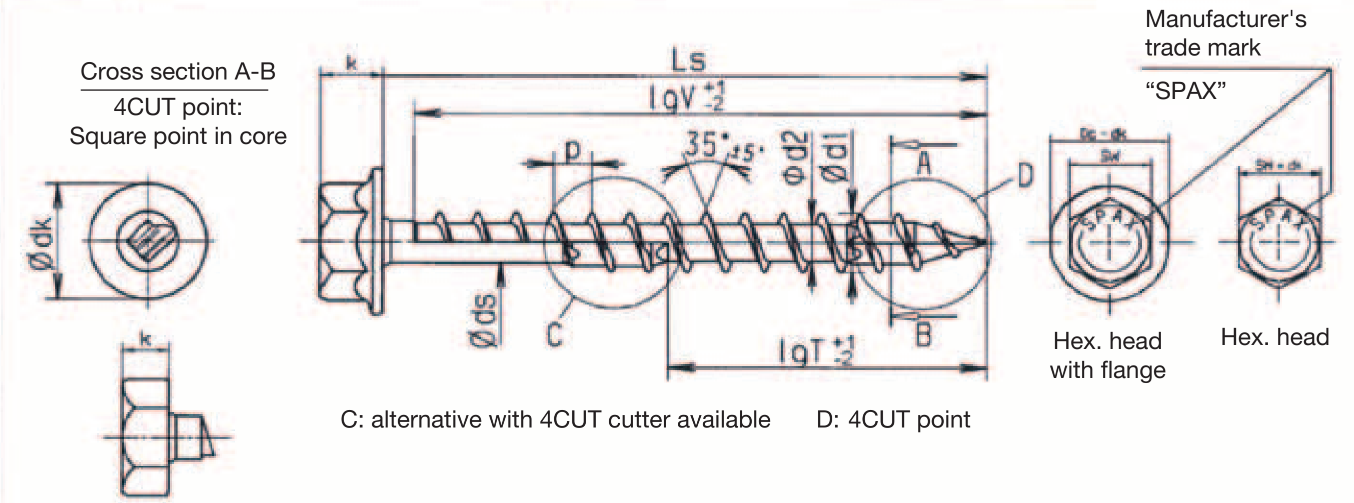
Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

SPAX®

Hex. head with/without flange

Self-drilling screw with full and partial thread

Material: cold rolled wire according to SPAX Factory Norm
Screws of high carbon steel



		with flange	no flange
Nominal diameter		**8.0**	**8.0**
d1	thread size	8.1	8.1
	permissible tolerance	±0.40	±0.40
dk	width across flat	10	10
Dc	flange diameter	17.0	-
	permissible tolerance	-1.00	-
d2	core diameter	5.0	5.0
	permissible tolerance	±0.20	±0.20
ds	shank diameter	5.70	5.70
	permissible tolerance	±0.25	±0.25
k	height of head, max.	4.4	4.4
p	thread pitch	4.8	4.8
	permissible tolerance	±0.1 x p	±0.1 x p

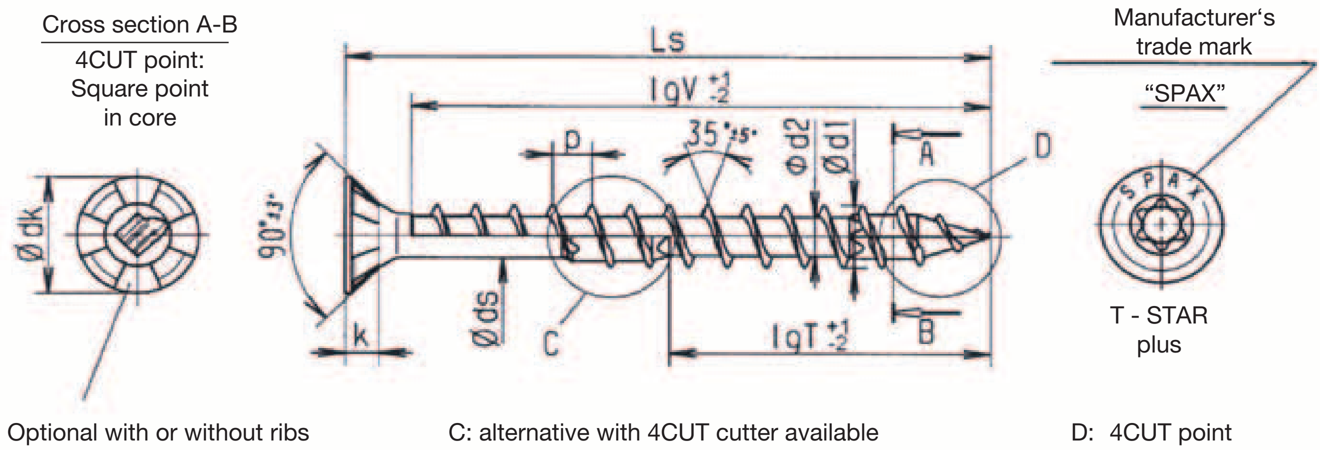
Standard thread lengths (full thread = lgV / partial thread = lgT)

Ls Nom. dim.	min	max	lgV (with flange)	lgT (with flange)	lgV (no flange)	lgT (no flange)
40	38.5	41.5	32.0		32.0	
45	***43.5***	***46.5***	***37.0***		***37.0***	
50	48.5	51.5	42.0	32.0	42.0	32.0
55	***53.5***	***56.5***	***47.0***	***32.0***	***47.0***	***32.0***
60	58.5	61.5	52.0	37.0	52.0	37.0
65	***63.5***	***66.5***	***57.0***	***37.0***	***57.0***	***37.0***
70	68.5	71.5	61.0	42.0	61.0	42.0
75	***73.5***	***76.5***	***61.0***	***42.0***	***61.0***	***42.0***
80	78.5	81.5	70.0	47.0	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***	***80.0***	***70.0***
140	138.0	142.0		80.0		80.0
150	***148.0***	***152.0***		***80.0***		***80.0***
160	158.0	162.0		80.0		80.0
180	***178.0***	***182.0***		***80.0***		***80.0***
200	198.0	202.0		80.0		80.0
to						
600	***597.0***	***602.0***		***80.0***		***80.0***

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

Self-drilling screw with full and partial thread		
SPAX® Countersunk head	Material: cold rolled wire according to SPAX Factory Norm Stainless steel screws	



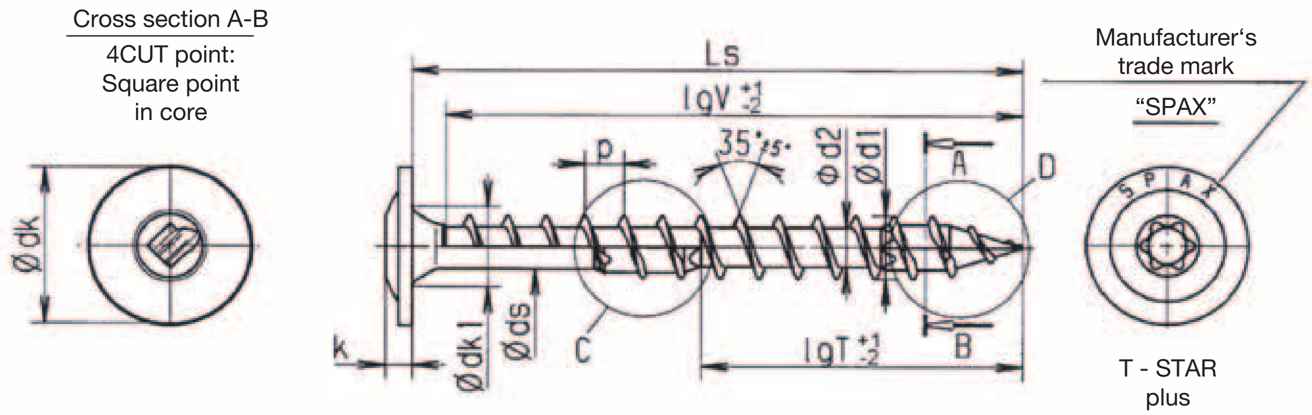
Nominal diameter		**8.0**						
d1	thread size	8.1						
	permissible tolerance	±0.40						
dk	head diameter	15.1						
	permissible tolerance	-0.60						
d2	core diameter	5.3						
	permissible tolerance	±0.20						
ds	shank diameter	5.70						
	permissible tolerance	±0.25						
k	height of head, max.	4.4						
p	thread pitch	4.8						
	permissible tolerance	±0.1 x p						
T-STAR plus	size	T40						

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT
40	38.5	41.5	32.0	
45	***43.5***	***46.5***	***37.0***	
50	48.5	51.5	42.0	32.0
55	***53.5***	***56.5***	***47.0***	***32.0***
60	58.5	61.5	52.0	37.0
65	***63.5***	***66.5***	***57.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***61.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

	SPAX® Washer head	Self-drilling screw with full and partial thread Material: cold rolled wire according to SPAX Factory Norm Stainless steel screws



C: alternative with 4CUT cutter available

D: 4CUT point

Nominal diameter		**8.0**						
d1	thread size	8.1						
	permissible tolerance	±0.40						
dk	head diameter	18.0	20.0	22.0	24.0			
	permissible tolerance	±1.0						
dk1	countersink diameter	9.00						
	permissible tolerance	+0.50						
d2	core diameter	5.3						
	permissible tolerance	±0.20						
ds	shank diameter	5.70						
	permissible tolerance	±0.25						
k	height of head, max.	4.3						
p	thread pitch	4.8						
	permissible tolerance	±0.1 x p						
T-STAR plus	size	T40						

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT	lgV	lgT	lgV	lgT	lgV	lgT
40	38.5	41.5	37.0							
45	***43.5***	***46.5***	***42.0***							
50	48.5	51.5	46.0	32.0						
55	***53.5***	***56.5***	***51.0***	***32.0***						
60	58.5	61.5	56.0	37.0						
65	***63.5***	***66.5***	***61.0***	***37.0***						
70	68.5	71.5	61.0	42.0						
75	***73.5***	***76.5***	***70.0***	***42.0***						
80	78.5	81.5	70.0	47.0						
90	***88.5***	***91.5***	***80.0***	***52.0***						
100	98.5	101.5	80.0	57.0						
110	***108.5***	***111.5***	***80.0***	***70.0***						
120	118.5	121.5	80.0	70.0						
130	***128.0***	***132.0***	***80.0***	***70.0***						
140	138.0	142.0		80.0						
150	***148.0***	***152.0***		***80.0***						
160	158.0	162.0		80.0						

Intermediate lengths on Ls possible

▭ = Preferred size

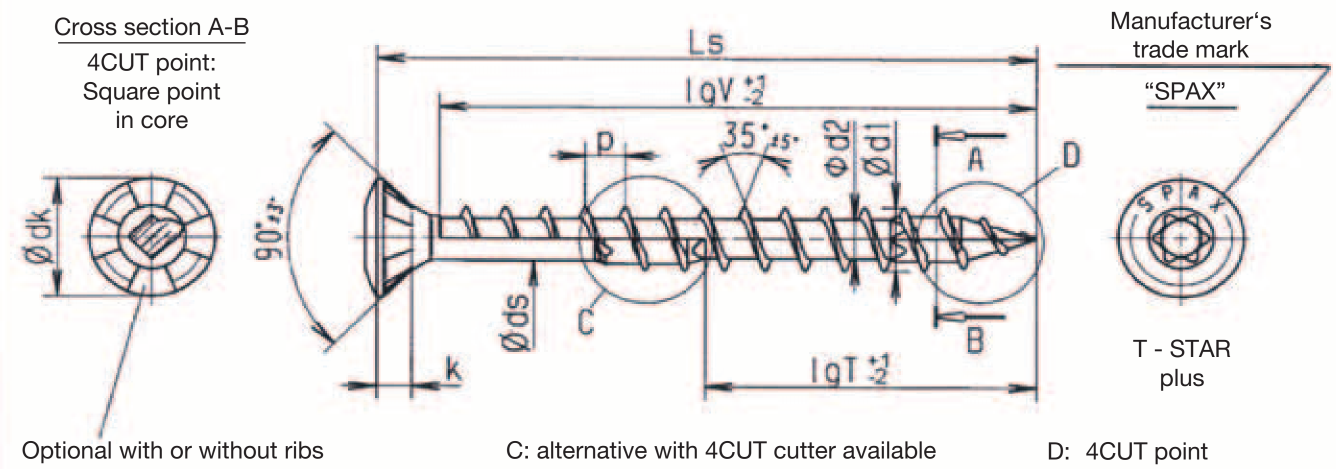
Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

SPAX®

Raised countersunk head

Self-drilling screw with full and partial thread

Material: cold rolled wire according to SPAX Factory Norm
Stainless steel screws



Nominal diameter		**8.0**						
d1	thread size	8.1						
	permissible tolerance	±0.40						
dk	head diameter	15.1						
	permissible tolerance	-0.60						
d2	core diameter	5.3						
	permissible tolerance	±0.20						
ds	shank diameter	5.70						
	permissible tolerance	±0.25						
k	height of head, max.	4.4						
p	thread pitch	4.8						
	permissible tolerance	±0.1 x p						
T-STAR plus	size	T40						

Ls Nom. dim.	min	max	lgV	lgT	Standard thread lengths (full thread = lgV / partial thread = lgT)										
40	38.5	41.5	32.0												
45	***43.5***	***46.5***	***37.0***												
50	48.5	51.5	42.0	32.0											
55	***53.5***	***56.5***	***47.0***	***32.0***											
60	58.5	61.5	52.0	37.0											
65	***63.5***	***66.5***	***57.0***	***37.0***											
70	68.5	71.5	61.0	42.0											
75	***73.5***	***76.5***	***61.0***	***42.0***											
80	78.5	81.5	70.0	47.0											
90	***88.5***	***91.5***	***80.0***	***52.0***											
100	98.5	101.5	80.0	57.0											
110	***108.5***	***111.5***	***80.0***	***70.0***											
120	118.5	121.5	80.0	70.0											
130	***128.0***	***132.0***	***80.0***	***70.0***											
140	138.0	142.0		80.0											
150	***148.0***	***152.0***		***80.0***											
160	158.0	162.0		80.0											

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

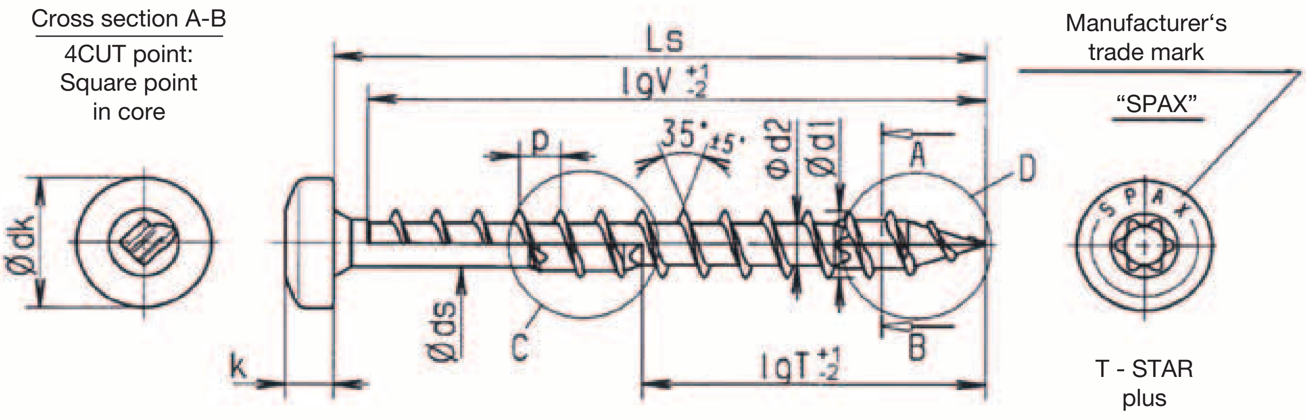
SPAX®

Pan head

Self-drilling screw with full and partial thread

Material: cold rolled wire according to SPAX Factory Norm

Stainless steel screws



C: alternative with 4CUT cutter available

D: 4CUT point

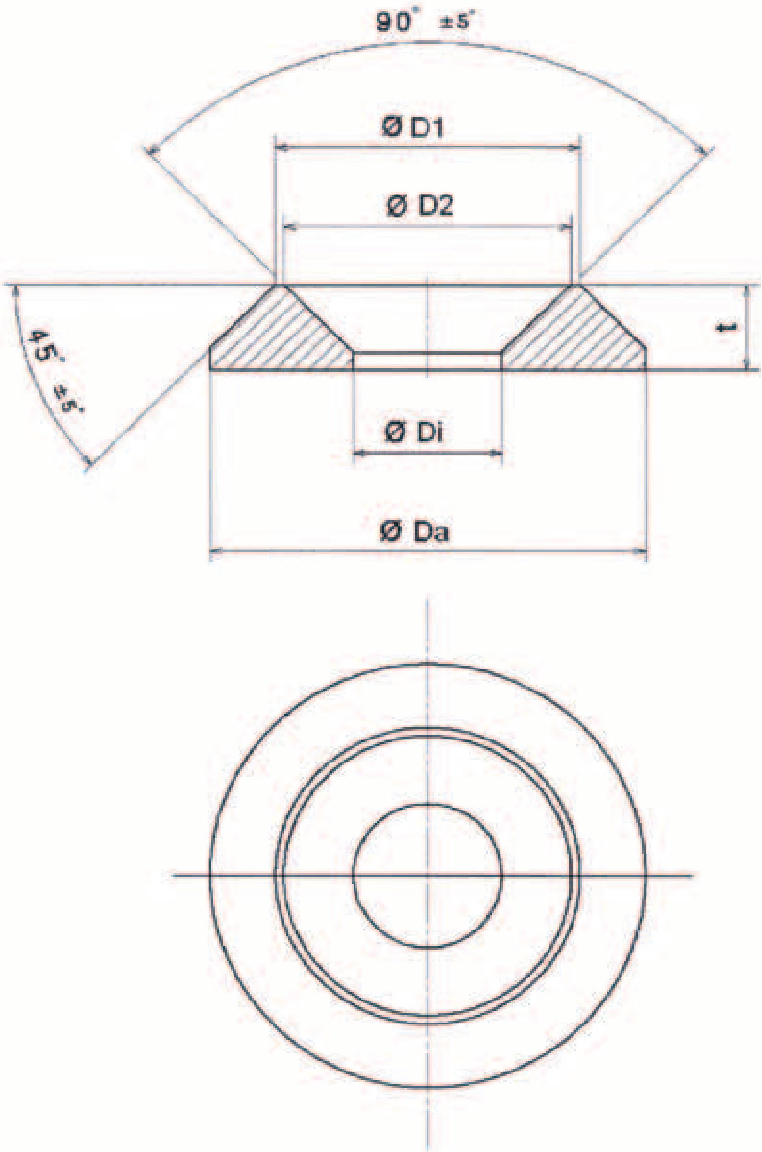
Nominal diameter		8.0
d1	thread size	8.1
	permissible tolerance	±0.40
dk	head diameter	15.5
	permissible tolerance	-0.60
d2	core diameter	5.3
	permissible tolerance	±0.20
ds	shank diameter	5.70
	permissible tolerance	±0.25
k	height of head, max.	6.0
p	thread pitch	4.8
	permissible tolerance	±0.1 x p
T-STAR plus	size	T40

Ls Nom. dim.	min	max	Standard thread lengths (full thread = lgV / partial thread = lgT) lgV	lgT
40	38.5	41.5	37.0	
45	***43.5***	***46.5***	***42.0***	
50	48.5	51.5	47.0	32.0
55	***53.5***	***56.5***	***52.0***	***32.0***
60	58.5	61.5	57.0	37.0
65	***63.5***	***66.5***	***61.0***	***37.0***
70	68.5	71.5	61.0	42.0
75	***73.5***	***76.5***	***70.0***	***42.0***
80	78.5	81.5	70.0	47.0
90	***88.5***	***91.5***	***80.0***	***52.0***
100	98.5	101.5	80.0	57.0
110	***108.5***	***111.5***	***80.0***	***70.0***
120	118.5	121.5	80.0	70.0
130	***128.0***	***132.0***	***80.0***	***70.0***
140	138.0	142.0		80.0
150	***148.0***	***152.0***		***80.0***
160	158.0	162.0		80.0

Intermediate lengths on Ls possible

Other thread lengths in the range ≥ 4 · d1 to max. standard length permitted

ABC	SPAX® Washer	Washer for screws with countersunk and raised countersunk head
		Material: Free cutting or stainless steel Dimensions in mm

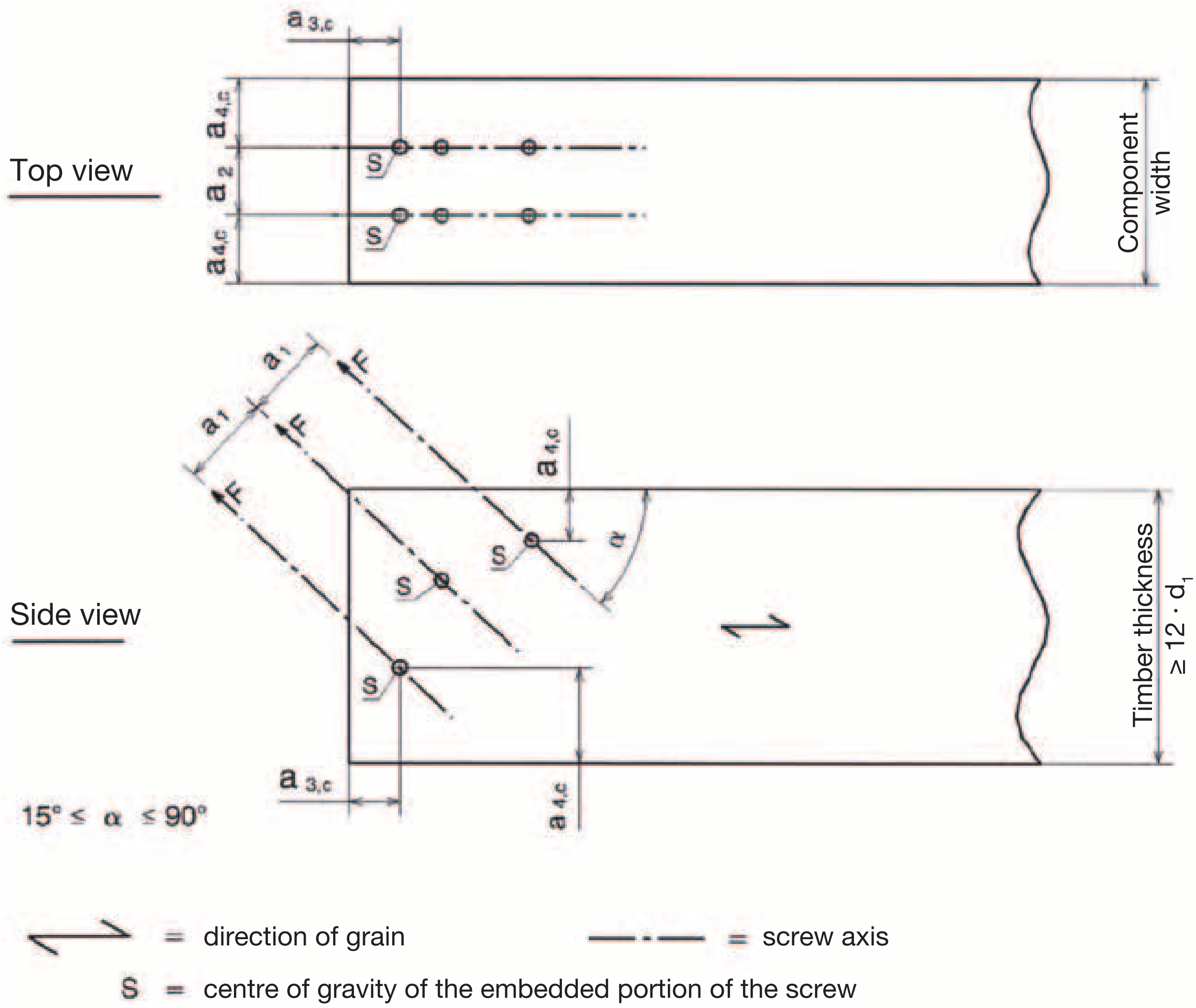


Thread size	6.0	8.0	10.0	12.0	Tolerance
ØDa	18.0	25.0	32.0	40.0	
ØDi	6.5	8.5	11.0	13.0	
ØD1	13.5	17.5	22.5	27.0	± 0.3
ØD2	12.5	16.5	21.5	26.0	
t	3.5	5.0	5.6	7.0	

SPAX®

Minimum distances for screws with $d_1 \leq 8$ mm or with CUT or 4CUT point, planned to be exclusively stressed in the shaft direction.

Parallel arrangement (example for 3 pairs of screws)

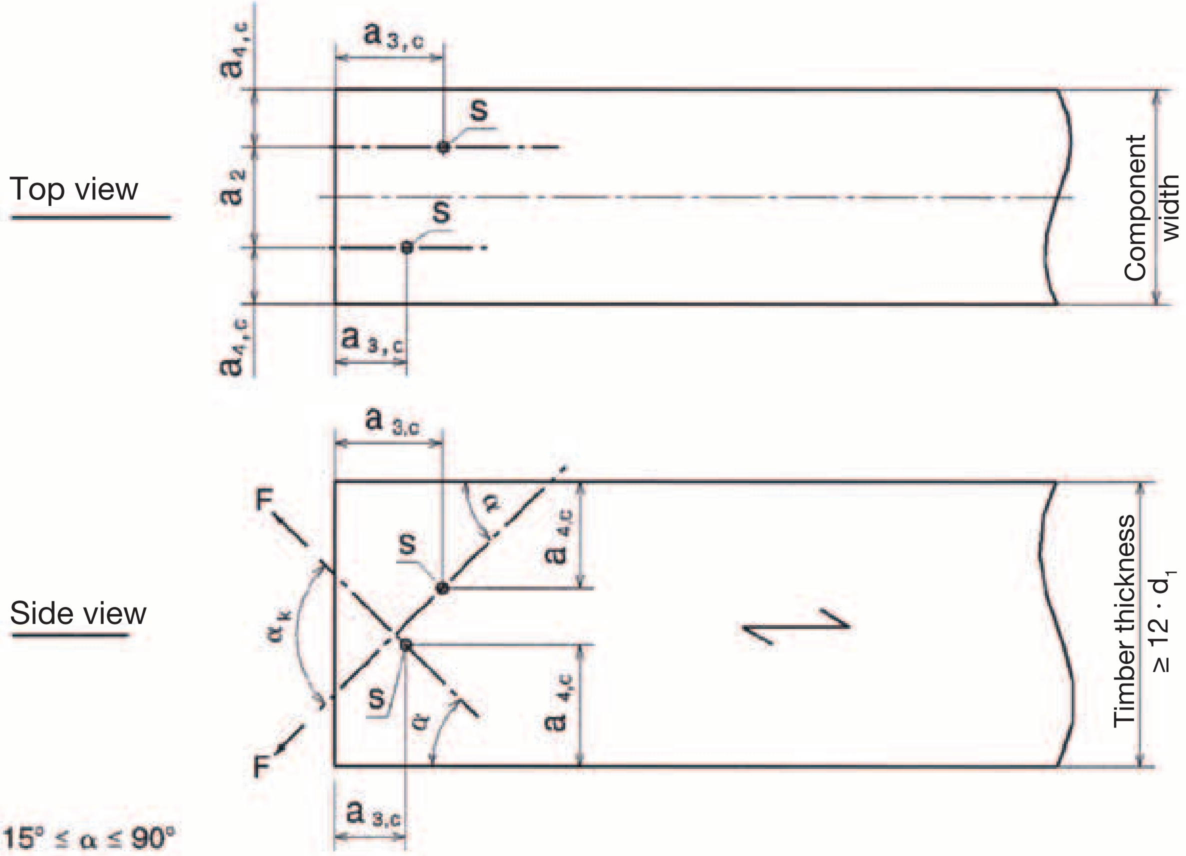


$a_1 = 5 \cdot d_1$	$a_{3,c} = 5 \cdot d_1$
$a_2 = 2.5 \cdot d_1$	$a_{4,c} = 4 \cdot d_1$ $a_{4,c} = 3 \cdot d_1$ for CUT or 4CUT point
$a_1 \cdot a_2 = 25 \cdot d_1^2$	

The stipulations in Section 4.6 of the approval apply to KERTO-S and KERTO-Q.

Minimum distances for screws with $d_1 \leq 8$ mm or with CUT or 4CUT point, planned to be exclusively stressed in the shaft direction.

Crosswise arrangement (example for 1 pair of screws)



$15° \leq \alpha \leq 90°$

= direction of grain   = screw axis

S = centre of gravity of the embedded portion of the screw

$a_1 = 5 \cdot d_1$	$a_{3,c} = 5 \cdot d_1$
$a_2 = \max \begin{cases} 1.5 \cdot d_1 & 70° < \alpha_k \leq 90° \\ 2.5 \cdot d_1 \left(1 - \frac{\alpha_k}{180}\right) & 30° \leq \alpha_k \leq 70° \end{cases}$	$a_{4,c} = 4 \cdot d_1$ $a_{4,c} = 3 \cdot d_1$ for CUT or 4CUT point
$a_1 \cdot a_2 = 25 \cdot d_1^2$	

The stipulations in Section 4.6 of the approval apply to KERTO-S and KERTO-Q.