Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten

Bautechnisches Prüfamt

Eine vom Bund und den Ländern
gemeinsam getragene Anstalt des
öffentlichen Rechts

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Authorised
and notified according
to Article 10 of the Council
Directive of 21 December 1988
on the approximation of laws,
regulations and administrative
provisions of Member States
relating to construction
products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-11/0106

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	HSK Schrauben *HSK Self-tapping screws*
Zulassungsinhaber *Holder of approval*	HSK Hamburger Schraubenkontor Duvenstedter Damm 72 22397 Hamburg DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Holzschrauben als Holzverbindungsmittel *Self-tapping screws for use in timber constructions*
Geltungsdauer: vom *Validity:* *from* bis *to*	28 February 2011 28 February 2016
Herstellwerke *Manufacturing plants*	L1016, W1239, O1209, M1105 O1213, C1230, D1030, M1222
Diese Zulassung umfasst *This Approval contains*	36 Seiten einschließlich 4 Anhänge *36 pages including 4 annexes*

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I   LEGAL BASES AND GENERAL CONDITIONS

1   This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

-    Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];

-    Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by law of 31 October 2006[5];

-    Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6].

2   Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3   This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4   This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5   Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6   The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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[1]   Official Journal of the European Communities L 40, 11 February 1989, p. 12
[2]   Official Journal of the European Communities L 220, 30 August 1993, p. 1
[3]   Official Journal of the European Union L 284, 31 October 2003, p. 25
[4]   *Bundesgesetzblatt Teil I 1998*, p. 812
[5]   *Bundesgesetzblatt Teil I 2006*, p. 2407, 2416
[6]   Official Journal of the European Communities L 17, 20 January 1994, p. 34

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II   SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1   Definition of product and intended use

1.1   Definition of the construction product

DNS, DRIBO, SPARIBO, Vi-PORT HBS and HBS screws are self-tapping screws made from special carbon or stainless steel. Screws made from carbon steel are hardened, electrogalvanised and yellow or blue chromated. The outer thread diameter is not less than 3.0 mm and not greater than 10.0 mm. The overall length of the screws is ranging from 16 mm to 500 mm. Further dimensions are shown in Annex 1. The washers are made from carbon steel. The dimensions of the washers are given in Annex 1. Screws made from stainless steel are used without washers.

1.2   Intended use

The screws are intended to be used for connecting wood-based members, where requirements for mechanical resistance and stability and safety in use in the sense of the essential Requirements N 1 and N 4 of Council Directive 89/106/EEC shall be fulfilled.

The screws are used for connections in load bearing timber structures between wood-based members or between those members and steel members:

–   Solid timber of softwood of strength classes C14 - C40 according to EN 338[7]/ EN 14081-1[8],

–   Glued laminated timber of at least strength class GL24c according to EN 1194[9]/ EN 14080[10],

–   Laminated veneer lumber LVL according to EN 14374[11], arrangement of the screws only perpendicular to the plane of the veneers,

–   Glued laminated solid timber Duo- and Triobalken according to prEN 14080[12]:2009 or national provisions that apply at the installation site.

The screws may be used for connecting the following wood-based panels to the timber members mentioned above:

–   Plywood according to EN 636[13] and EN 13986[14],

–   Oriented Strand Board, OSB according to EN 300[15] and EN 13986,

–   Particleboard according to EN 312[16] and EN 13986,

–   Fibreboards according to EN 622-2[17], EN 622-3[18] and EN 13986.

[7]	EN 338:2009	Timber structures - Strength classes
[8]	EN 14081-1:2005	Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
[9]	EN 1194:1999	Timber structures - Glued laminated timber - Strength classes and determination of characteristic values
[10]	EN 14080:2005	Timber structures - Glued laminated timber - Requirements
[11]	EN 14374:2004	Timber structures - Structural laminated veneer lumber - Requirements
[12]	prEN 14080:2009	Timber structures - Glued laminated timber and Glued laminated solid timber - Requirements
[13]	EN 636:2003	Plywood - Specifications
[14]	EN 13986:2004	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
[15]	EN 300:2006	Oriented strand boards (OSB) - Definition, classification and specifications
[16]	EN 312:2010	Particleboards - Specifications
[17]	EN 622-2:2004	Fibreboards - Specifications - Part 2: Requirements for hardboards
[18]	EN 622-3:2004	Fibreboards - Specifications - Part 3: Requirements for medium boards

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Wood-based panels shall only be arranged on the side of the screw head.

Vi-PORT HBS screws with d = 8 mm and a full thread may be used for reinforcing of timber structures perpendicular to the grain.

HSK screws with an outer thread diameter of at least 6 mm may also be used for the fixing of thermal insulation material on rafters.

According to EN 1995-1-1[19] the screws made from carbon steel with d > 4 mm may be used in timber structures subject to climate conditions defined by service classes 1 and 2. According to EN 1995-1-1 the screws made from carbon steel with d ≤ 4 mm may be used in timber structures subject to climate conditions defined by service class 1. Regarding environmental conditions national provisions shall apply at the building site.

Screws made of stainless steel may also be used in conditions defined by service class 3. The scope of the screws including environmental conditions shall be defined according to national provisions that apply at the installation site.

The screws may be used for connections subject to static or quasi static loading.

The provisions made in this European technical approval are based on an assumed working life of the screws of 50 years, provided that the conditions laid down in section 4.2 for the installation are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2   Characteristics of product

	Characteristic	Assessment of characteristic
2.1 Mechanical resistance and stability *)		
2.1.1	Dimensions	See Annex 1
2.1.2	Characteristic yield moment	See Annex 2
2.1.3	Characteristic withdrawal parameter	See Annex 2
2.1.4	Characteristic head pull-through parameter	See Annex 2
2.1.5	Characteristic tensile strength	See Annex 2
2.1.6	Characteristic yield strength	See Annex 2
2.1.7	Characteristic torsional strength	See Annex 2
2.1.8	Insertion moment	See Annex 2

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[19]   EN 1995-1-1:2004+A1:2008   Design of timber structures - Part 1-1: General - Common rules and rules for buildings
*)   See section 2.1 of this ETA

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2.1.9	Spacing, end and edge distances of the screws and minimum thickness of the wood based material	See Annex 2
2.1.10	Slip modulus for mainly axially loaded screws	See Annex 2
2.2 Safety in case of fire		
2.2.1	Reaction to fire	Self-tapping screws are made of steel classified as Euroclass A1 in accordance with EC decision 96/603/EC, as amended by EC decision 2000/605/EC.
2.3 Hygiene, health and the environment		
2.3.1	Content and/or release of dangerous substances	The product does not contain cadmium. There is no risk that chrome VI - contained in the chromated carbon steel screw - will be released by consideration of all possible release scenarios. [**]
2.4 Safety in use		
2.4.1	Dimensions	See Annex 1
2.4.2	Characteristic yield moment	See Annex 2
2.4.3	Characteristic withdrawal parameter	See Annex 2
2.4.4	Characteristic head pull-through parameter	See Annex 2
2.4.5	Characteristic tensile strength	See Annex 2
2.4.6	Characteristic yield strength	See Annex 2
2.4.7	Characteristic torsional strength	See Annex 2
2.4.8	Insertion moment	See Annex 2
2.4.9	Spacing, end and edge distances of the screws and minimum thickness of the wood based material	See Annex 2
2.4.10	Slip modulus for mainly axially loaded screws	See Annex 2

[**]   In accordance with http://europa.eu.int-/comm/enterprise/construction/internal/dangsub/dangmain.htm. In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

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Protection against noise	Not relevant
Energy economy and heat retention	Not relevant
2.5 General aspects relating to fitness for use	
2.5.1 Durability against corrosion	See Annex 2
2.5.2 Serviceability	The assessment for mechanical resistance and stability as well as durability against corrosion covers this property.

2.1 Mechanical resistance and stability

Annexes 2 to 4 contain the load-carrying capacities for HSK self-tapping screws.

The design and construction shall be carried out according to national provisions that apply at the installation site in line with the partial safety factor format, e.g. in accordance with EN 1995-1-1.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the decision 97/638/EC of the European Commission[20] the system 2 + of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:
  (1) initial type-testing of the product;
  (2) factory production control;
  (3) testing of samples taken at the factory in accordance with a prescribed test plan.

(b) Tasks for the approved body:
  (4) certification of factory production control on the basis of:
    – initial inspection of factory and of factory production control;
    – continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval supplied with the relevant inspection documents as laid down in the control plan.

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[20]   Official Journal of the European Communities L 268/36 of 19 September 1997

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The factory production control shall be in accordance with the "control plan relating to the European technical approval" which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.[21]

The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as steel rods or wire, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and corrosion protection.

The manufactured components shall be checked visually and for dimensions. The control plan includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan. The records shall include at least the following information:

- Designation of the product, basic material and components,
- Type of control or testing,
- Date of manufacture of the product and date of testing of the product or basic material and components,
- Result of control and testing and, if appropriate, comparison with requirements,
- Signature of person responsible for factory production control.

The records shall be presented to the approved body involved in the continuous surveillance and shall be presented to Deutsches Institut für Bautechnik on request.

3.2.1.2   Initial type testing

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between Deutsches Institut für Bautechnik and the notified body.

3.2.1.3   Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of screws in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval.

3.2.2   Tasks for the approved bodies

The approved body shall perform the

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control, in accordance with the provisions laid down in the control plan.

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[21]   The "control plan" is a confidential part of the European technical approval and only handed over to the approved body/bodies involved in the procedure of attestation of conformity. See section 3.2.2.

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3.2.2.1   Initial inspection of factory and factory production control

The approved body should ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the screws with this European technical approval.

3.2.2.2   Continuous surveillance

The approved body shall visit the factory at least once a year for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the control plan.

3.2.2.3   Other tasks of the approved body

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The results of certification and continuous surveillance shall be made available on demand by the certification body to Deutsches Institut für Bautechnik.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3   CE marking

The CE marking shall be affixed on each packaging of the self-tapping screws. The letters "CE" shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

‒   the name and address of the producer (legal entity responsible for the manufacture),

‒   the last two digits of the year in which the CE marking was affixed,

‒   the number of the EC certificate for the factory production control,

‒   the number of the European technical approval,

‒   name of the product,

‒   outer thread diameter and length of the self-tapping screws,

‒   type and mean thickness of the corrosion protection, if relevant,

‒   Stainless steel including the material number, if relevant.

4   Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1   Manufacturing

HSK self-tapping screws shall be manufactured in accordance with the provisions of this European technical approval using the manufacturing processes as identified at the inspection of the plant by the notified inspection body and laid down in the technical documentation.

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The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, shall be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2   Installation

The screws shall be fastened in wood-based members without pre-drilling. The screw holes in steel members shall be pre-drilled with an adequate diameter greater than the outer thread diameter.

A minimum of two screws shall be used for connections in load-bearing timber structures.

If screws with an outer thread diameter $d \geq 8$ mm are used in load-bearing timber structures, the structural solid or glued laminated timber, laminated veneer lumber, cross-laminated timber and similar glued members shall be from spruce, pine or fir.

In the case of fastening battens on thermal insulation material in rafters the screws shall be driven in the rafter through the battens and the thermal insulation material without pre-drilling in one sequence.

Countersunk head screws made of carbon steel may be used with washers according to Annex 1. After inserting the screw the washers shall touch the surface of the wood-based member completely.

By fastening screws in wood-based members the head of the screws shall be flush with the surface of the wood-based member. For flange and hexagon head screws the head part k or k_1 remains unconsidered.

5   Indications to the manufacturer
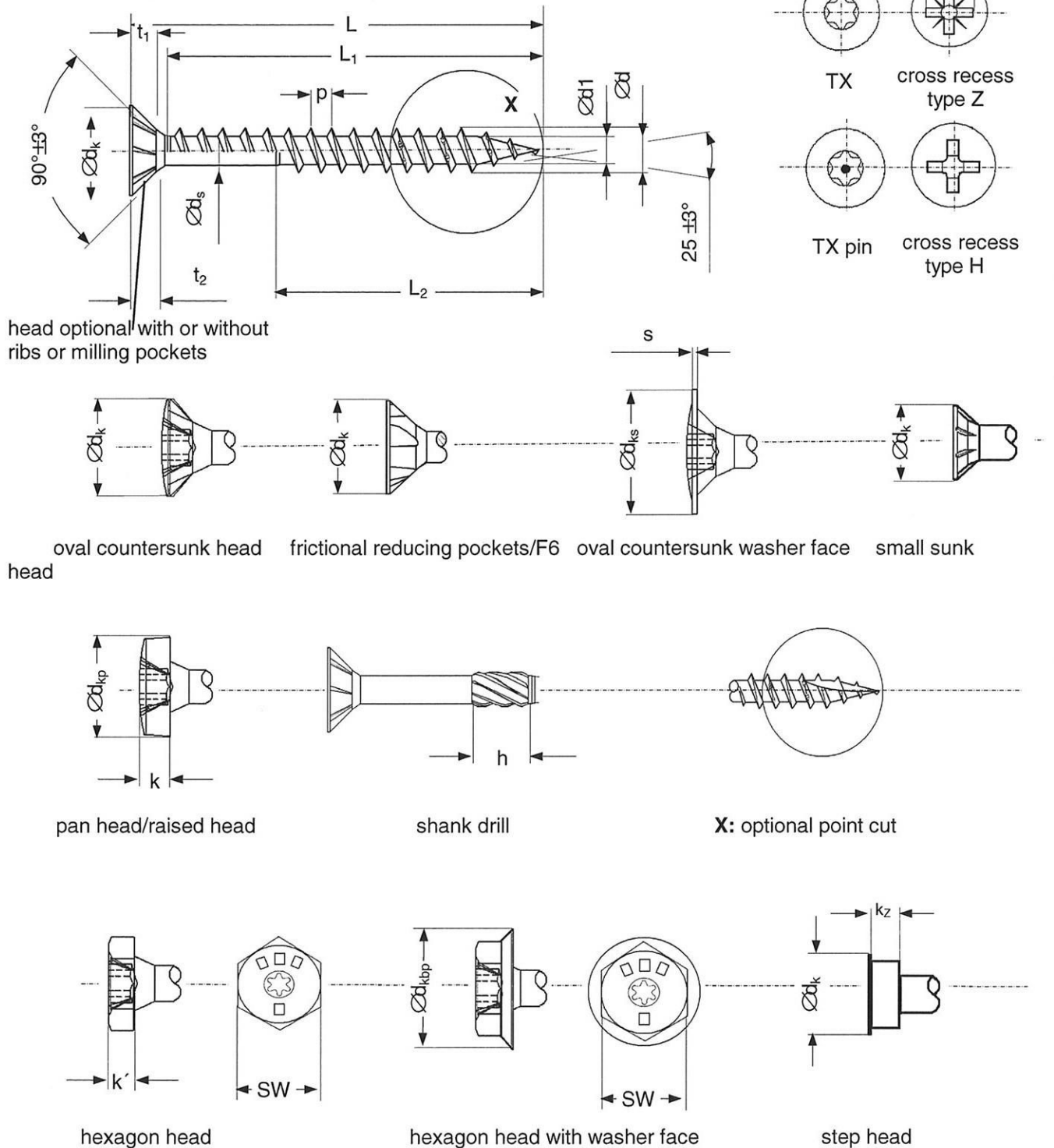
5.1   Use, maintenance, repair

The assessment of the fitness for use is based on the assumption that no maintenance is required during the assumed intended working life.

Georg Feistel   *beglaubigt:*
Head of Department   Dewitt

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ANNEX 1 - Dimensions

**DNS chipboard screws single thread
made of carbon steel and stainless steel**

Screw drives

TX

cross recess
type Z

TX pin

cross recess
type H

head optional with or without
ribs or milling pockets

oval countersunk head

frictional reducing pockets/F6

oval countersunk washer face

small sunk
head

pan head/raised head

shank drill

X: optional point cut

hexagon head

hexagon head with washer face

step head

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Dimensions in mm

Ø d - 0,5	d_k ± 0,5	Ø d_1 + 0,3	Ø d_s ± 0,1	p ±10 %	Screw drives					h
					Type TX	t_1 min.	Type Z	m	t_2 min.	
3,0 +0,1	5,7	1,8	2,2	1,5	10	1,0	1	3,2	1,8	5,0
3,5 +0,1	6,6	2,1	2,6	1,8	15	1,3	2	4,3	2,0	6,0
4,0 +0,1	7,5	2,4	2,8	2,0	20	1,4	2	5,0	2,5	7,0
4,5 +0,1	8,4	2,6	3,1	2,2	20	1,7	2	5,4	3,1	8,0
5,0 +0,2	9,4	2,9	3,5	2,6 (2,2)	25	1,9	2	5,4	3,1	8,0
5,5 +0,2	8,0	3,6	4,1	2,2	20	1,9	-	-	-	-
6,0 +0,2	11,2	3,6	4,1 +0,4	3,1 (2,6)	30	2,0	3	7,0	3,5	10,0

Table title: **DNS wood screws countersunk head single thread**

thread pitch (p) for stainless steel screws in brackets

oval countersunk head		Small sunk head 60°/ step head			oval countersunk washer face			pan head/raised head			hexagon head			hexagon head with washer face	
Ø d - 0,5	d_k ± 0,5	d ± 0,5	k_Z ± 0,2	L ± 1,5	Ø d - 0,5	d_{ks} ± 0,3	S ± 0,2	Ø d - 0,5	d_{kp} - 0,5	k ± 0,2	Ø d - 0,5	SW	k´	Ø d - 0,5	d_{kbp} max
3,0 +0,1	5,7				3,0 +0,1	7,1	0,6	3,0 +0,1	6,0	2,3					
3,5 +0,1	6,6	5,0	2,0		3,5 +0,1	8,1	0,6	3,5 +0,1	7,0	2,6					
4,0 +0,1	7,5	6,0	2,25		4,0 +0,1	9,2	0,9	4,0 +0,1	8,0	3,0					
4,5 +0,1	8,4	7,0	2,5		4,5 +0,1	10,3	0,9	4,5 +0,1	9,0	3,2					
5,0 +0,2	9,4	8,0	2,75		5,0 +0,2	11,0 ±0,5	1,1	5,0 +0,2	10,0	3,7	5,0 +0,2	8,0	3,5	5,0 +0,2	11,4
5,5 +0,2		7,8	2,8	35,0											
6,0 +0,2	11,2	11,0	3,25		6,0 +0,2	13,8 ±0,7	1,1	6,0 +0,2	12,0	4,5	6,0 +0,2	10,0	4,0	6,0 +0,2	13,6

| L	3,0		3,5		4,0		4,5		5,0		6,0	
	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 2,0	L_2 ± 2,0	L_1 ± 2,0	L_2 ± 2,0
16,0 - 0,90	12											
20,0 - 1,05	16		16		15							
25,0 - 1,05	21	16,5 (15)	21	16,5 (15)	20	16,5 (15)	20		19			
30,0 - 1,05	26	20 (18)	26	20 (18)	25	20 (18)	25	20 (18)	24		24	
35,0 - 1,25	31	23 (21)	31	23 (21)	30	23 (21)	30	23 (21)	29		29	
40,0 - 1,25	36	26 (24)	36	26 (24)	35	26 (24)	35	26 (24)	34	26 (24)	34	
45,0 - 1,25	41	30 (27)	41	30 (27)	40	30 (27)	40	30 (27)	39	30 (27)	39	
50,0 - 1,25		33 (30)	47	33 (30)	45	33 (30)	45	33 (30)	44	33 (30)	44	33 (30)
55,0 - 1,50					50	33 (30)	55	33 (30)	54	33 (30)	54	33 (30)
60,0 - 1,50					55	40 (36)	55	40 (36)	54	40 (36)	54	40 (36)
70,0 - 1,50						46 (42)	65	46 (42)	64	46 (40)	64	46 (42)
80,0 - 1,50						52 (48)		52 (48)	74	52 (48)	74	52 (48)
90,0 - 1,75										59 (54)		59 (54)
100,0 - 1,75										66 (60)		66 (60)
110,0 - 1,75										66 (60)		74 (65)
120,0 - 1,75										74 (65)		74 (70)
130,0 - 1,75												74 (70)
140,0 - 2,00												74 (70)
150,0 - 1,75												74 (70)
160,0 - 2,00												74 (70)
180,0 - 2,00												74 (70)
200,0 - 3,00												74 (70)
220,0 - 3,00												74 (70)
240,0 - 3,00												74 (70)
2600 - 3,00												74 (70)
280,0 - 3,00												74 (70)
300,0 - 3,00												74 (70)

L1 = full thread
L2 = part thread   thread length of stainless steel screws in brackets

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DNS chipboard screws double thread made of carbon steel
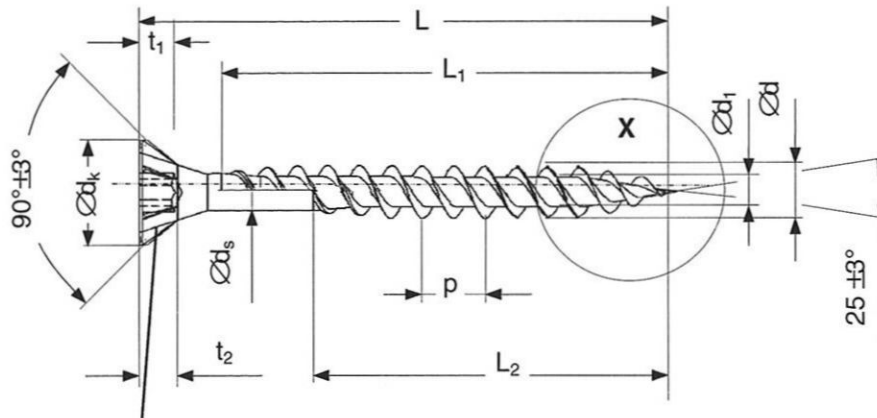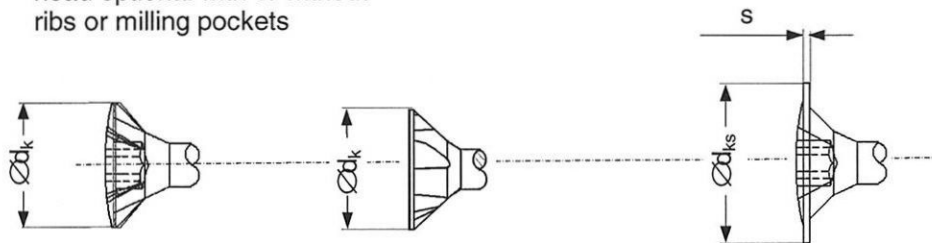
Screw drives

head optional with or without
ribs or milling pockets
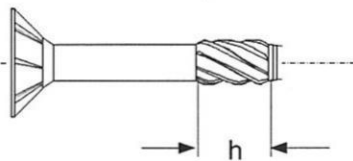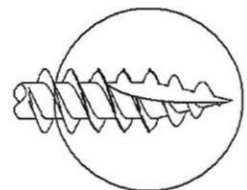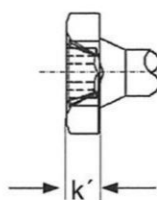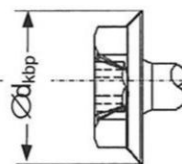
cross recess
type Z

TX

TX Pin

cross recess
type H

oval contersunk head   frictional reducing pockets/F6   oval countersunk washer face
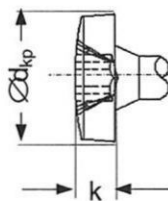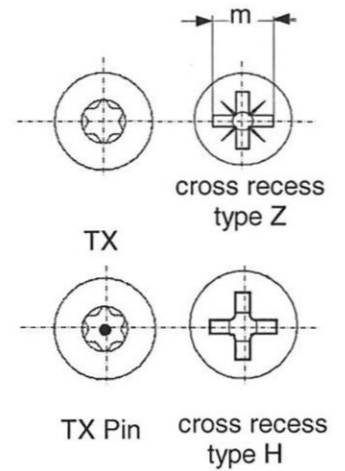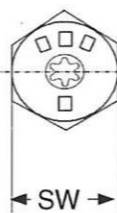
pan head/raised head

shank drill

X: optional point cut

hexagon head

hexagon head with washer face

milling pockets head

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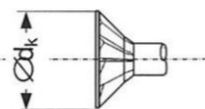
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Dimensions in mm

DNS wood screws countersunk head double thread										
Ø d - 0,5	d_k ± 0,5	Ø d_1 ± 0,3	Ø d_s ± 0,1	p ±10 %	Screw drives					h
					Type TX	t_1 min.	Type Z	m	t_2 min.	
$3,0^{+0,1}$	5,7	1,8	2,2	3,1	10	1,0	1	3,2	1,8	5,0
$3,5^{+0,1}$	6,6	2,1	2,6	3,7	15	1,3	2	4,3	2,0	6,0
$4,0^{+0,1}$	7,5	2,4	2,8	4,1	20	1,4	2	5,0	2,5	7,0
$4,5^{+0,1}$	8,4	2,6	3,1	4,5	20	1,7	2	5,4	3,1	8,0
$5,0^{+0,2}$	9,4	3,0	3,5	5,5	25	1,9	2	5,4	3,1	8,0
$6,0^{+0,2}$	11,2	3,6	$4,1^{+0,4}$	6,6	30	2,0	3	7,0	3,5	10,0

oval countersunk head		oval countersunk washer face			pan head/raised head			hexagon head			with washer face	
Ø d - 0,5	d_k ± 0,5	Ø d - 0,5	d_{ks} ± 0,3	S ± 0,2	Ø d - 0,5	d_{kp} - 0,5	k ± 0,2	Ø d - 0,5	SW	k´	Ø d - 0,5	d_{kbp} max.
$3,0^{+0,1}$	5,7	$3,0^{+0,1}$	7,1	0,6	$3,0^{+0,1}$	6,0	2,3					
$3,5^{+0,1}$	6,6	$3,5^{+0,1}$	8,1	0,6	$3,5^{+0,1}$	7,0	2,6					
$4,0^{+0,1}$	7,5	$4,0^{+0,1}$	9,2	0,9	$4,0^{+0,1}$	8,0	3,0					
$4,5^{+0,1}$	8,4	$4,5^{+0,1}$	10,3	0,9	$4,5^{+0,1}$	9,0	3,2					
$5,0^{+0,2}$	9,4	$5,0^{+0,2}$	11,0 ± 0,5	1,1	$5,0^{+0,2}$	10,0	3,7	$5,0^{+}_{0,2}$	8,0	3,5	$5,0^{+0,2}$	11,4
$6,0^{+0,2}$	11,2	$6,0^{+0,2}$	13,8 ± 0,7	1,1	$6,0^{+0,2}$	12,0	4,5	$6,0^{+}_{0,2}$	10,0	4,0	$6,0^{+0,2}$	13,6

L	3,0		3,5		4,0		4,5		5,0		6,0	
	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 1,5	L_2 ± 1,5	L_1 ± 2,0	L_2 ± 2,0	L_1 ± 2,0	L_2 ± 2,0
16,0 - 0,90	12											
20,0 - 1,05	16		16		15							
25,0 - 1,05	21	15	21	15	20	15	20		19			
30,0 - 1,05	26	19	26	19	25	19	25	19	24		24	
35,0 - 1,25	31	22	31	22	30	22	30	22	29		29	
40,0 - 1,25	36	27	36	26	35	26	35	26	34	26	34	
45,0 - 1,25	41	28	41	28	40	28	40	28	39	28	39	
50,0 - 1,25		31	47	31	45	31	45	31	44	31	44	31
55,0 - 1,50					50	31	55	31	54	31	54	31
60,0 - 1,50					55	39	55	39	54	39	54	39
70,0 - 1,50						45	65	45	64	45	64	45
80,0 - 1,50						52		52	74	52	74	52
90,0 - 1,75										58		58
100,0 - 1,75										65		65
110,0 - 1,75										74		74
120,0 - 1,75										74		74
130,0 - 1,75												74
140,0 - 2,00												74
150,0 - 1,75												74
160,0 - 2,00												74
180,0 - 2,00												74
200,0 - 3,00												125
220,0 - 3,00												125
240,0 - 3,00												125
260,0 - 3,00												125
280,0 - 3,00												125
300,0 - 3,00												125

L1 = full thread
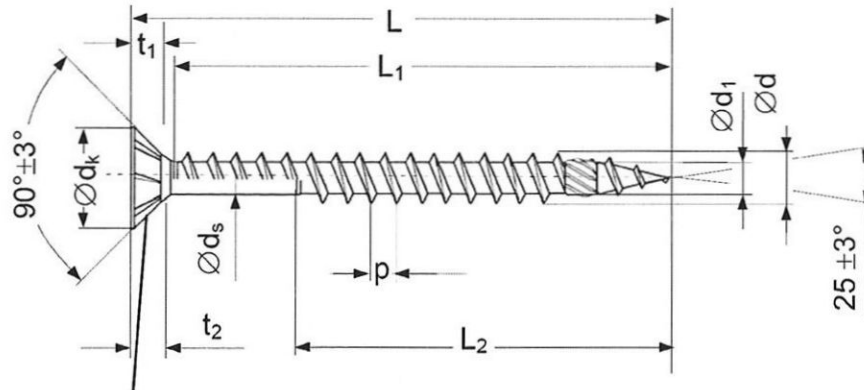L2 = part thread

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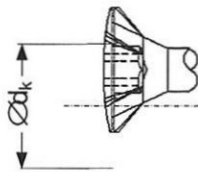Bautechnik

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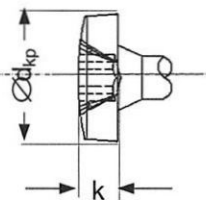## DRIBO wood screws single thread made of carbon steel and stainless steel
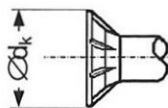
Screw drives

head optional with or without
ribs or milling pockets

TX   cross recess
type Z

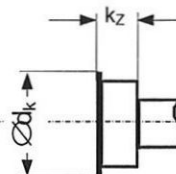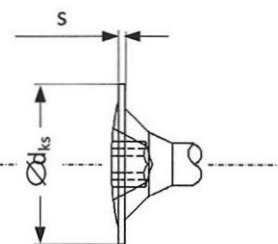TX pin   cross recess
type H

oval contersunk head   pan head/raised head
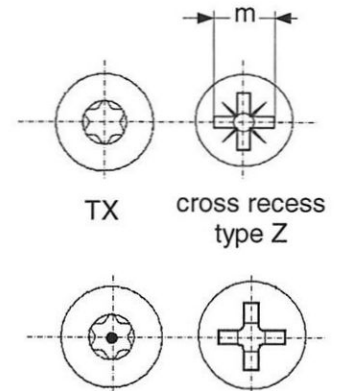
Small sunk head   step head   oval countersunk washer face

shank drill

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Dimensions in mm

Ø d -0,5	dk -0,5	Ø d1 +0,3	Ø ds ±0,1	p ±10 %	Screw drives					h
					Type TX	t1 min.	Type Z	m	t2 min.	
3,0 +0,1	6,0	1,8	2,2	1,5	10	1,0	1	3,2	1,8	5,0
3,5 +0,1	7,0	2,1	2,6	1,8	15	1,3	2	4,3	2,0	6,0
4,0 +0,1	8,0	2,4	2,9	1,9	20	1,4	2	5,0	2,5	7,0
4,5 +0,1	9,0	2,6	3,1	2,2	20	1,7	2	5,4	3,1	8,0
5,0 +0,2	10,0	3,0	3,6	2,6 (2,2)	25	1,9	2	5,4	3,1	8,0
5,5 +0,2	7,8 ±0,2	3,5	4,1	2,4	20	1,8	-	-	-	9,0
6,0 +0,2	12,0	3,6	4,1 +0,4	3,1 (2,6)	25	2,0	3	7,0	3,5	10,0

Table title: **DRIBO wood screws countersunk head single thread**

thread pitch (p) for stainless steel screws in brackets

oval countersunk head		small head/step head			pan head/raised head			oval countersunk washer face		
Ø d -0,5	dk ±0,5	Ø d -0,5	Ø dk ±0,3	kz ±0,2	Ø d -0,5	Ø dkp -0,5	k ±0,2	Ø d -0,5	dks ±0,7	s ±0,2
3,0 +0,1	6,0	3,0 +0,1			3,0 +0,1	6,0	2,3			
3,5 +0,1	7,0	3,5 +0,1	5,0	2,0	3,5 +0,1	7,0	2,6			
4,0 +0,1	8,0	4,0 +0,1	6,0	2,25	4,0 +0,1	8,0	3,0			
4,5 +0,1	9,0	4,5 +0,1	7,0	2,5	4,5 +0,1	9,0	3,2			
5,0 +0,2	10,0	5,0 +0,2	8,0	2,75	5,0 +0,2	10,0	3,7	5,0 +0,2	11,0	1,2
		5,5 +0,2	7,8	2,8						
6,0 +0,2	11,2	6,0 +0,2	11,0	3,25	6,0 +0,2	12,0	4,5	6,0 +0,2	13,8	1,2

L	3,0 L1±1,5	3,0 L2±1,5	3,5 L1±1,5	3,5 L2±1,5	4,0 L1±1,5	4,0 L2±1,5	4,5 L1±1,5	4,5 L2±1,5	5,0 L1±2,0	5,0 L2±2,0	6,0 L1±2,0	6,0 L2±2,0
12,0 - 0,90												
16,0 - 0,90	12											
20,0 - 1,05	16		16									
25,0 - 1,05	21	15	21	15	20	15	20		19			
30,0 - 1,05	26	18	26	18	25	18	25	18	24		24	
35,0 - 1,25	31	21	31	21	30	21	30	21	29		29	
40,0 - 1,25	36	24	36	24	35	24	35	24	34	24	34	
45,0 - 1,25		27		27	40	27	40	27	39	27	39	
50,0 - 1,25				30	45	30	45	30	44	30	44	30
55,0 - 1,50							55	33	54	33	54	33
60,0 - 1,50					55	39	55	36	54	36	54	36
70,0 - 1,50							65	42	64	42	64	42
80,0 - 1,50									74	48	74	48
90,0 - 1,75										54		54
100,0 - 1,75										60		60
110,0 - 1,75												66
120,0 - 1,75												66
130,0 - 1,75												66
140,0 - 2,00												66
150,0 - 1,75												66
160,0 - 2,00												66
180,0 - 2,00												66

L1 = full thread
L2 = part thread

DRIBO Decking Screw d = 5,5 L2 = 35,0 mm ±1,5

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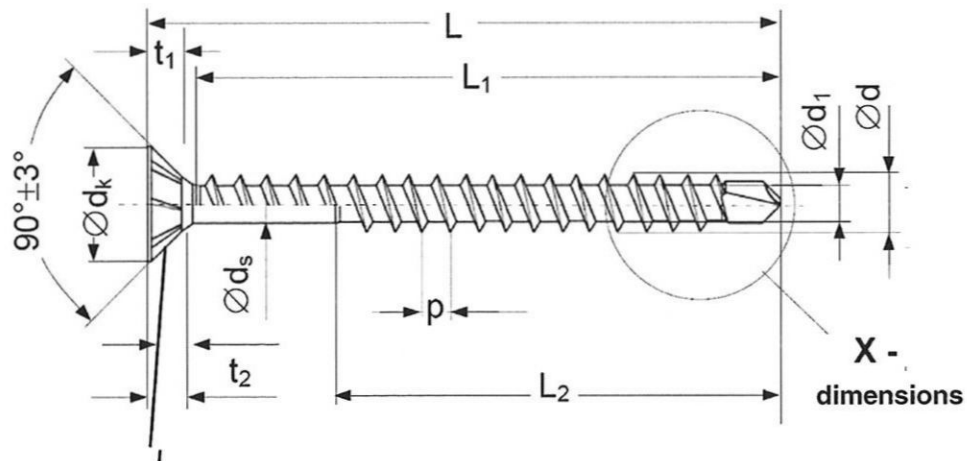für
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SPARIBO chipboard screws with tapping point made of carbon steel and stainless steel
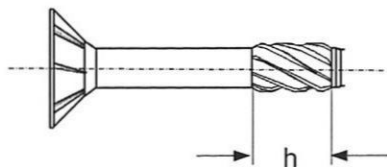
Screw drives

head optional with or without
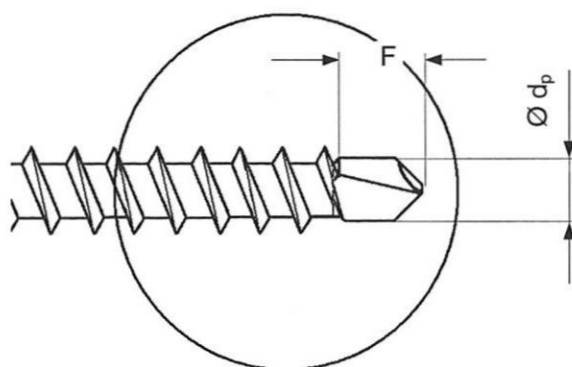ribs or milling pockets

TX

cross recess
Typ Z

TX pin

Cross recess
typ H

oval contersunk head

pan head/raised head

shank drill

X - dimensions

tapping point

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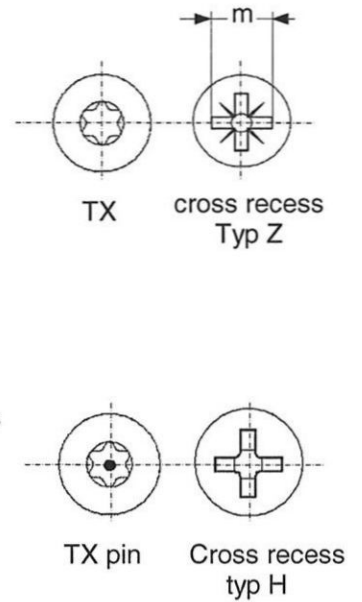
Dimensions in mm

SPARIBO wood screws tapping point countersunk head carbon steel												
⌀ d -0,5	d_k -0,5	⌀ d_1 +0,3	⌀ d_s ±0,1	p ±10 %	Screw drives					h	F ca.	⌀ d_p
					Type TX	t_1 min.	Type Z	m	t_2 min.			
$3,5^{+0,1}$	7,0	2,1	2,6	1,5	15	1,3	2	4,3	2,0	6,0	3,2	2,7
$4,0^{+0,1}$	8,0	2,4	2,8	1,8	20	1,4	2	5,0	2,5	7,0	4,3	2,9
$4,5^{+0,1}$	9,0	2,6	3,25	2,0	20	1,7	2	5,4	3,1	8,0	4,7	3,2
$5,0^{+0,2}$	10,0	2,9	3,6	2,3	25	1,9	2	5,4	3,1	8,0	4,7	3,4
$6,0^{+0,2}$	12,0	3,6	4,38	2,6	25	2,0	3	7,0	3,5	10,0	6,0	4,2

oval countersunk head		pan head/raised head		
⌀ d -0,5	d_k ±0,5	⌀ d -0,5	d_{kp} -0,5	⌀ d_1 +0,3
$3,5^{+0,1}$	7,0	$3,5^{+0,1}$	7,0	2,2
$4,0^{+0,1}$	8,0	$4,0^{+0,1}$	8,0	2,5
$4,5^{+0,1}$	9,0	$4,5^{+0,1}$	9,0	2,8
$5,0^{+0,2}$	10,0	$5,0^{+0,2}$	10,0	3,5
$6,0^{+0,2}$	11,2	$6,0^{+0,2}$	12,0	4,5

SPARIBO wood screws tapping point countersunk head stainless steel						
⌀ d -0,3	⌀ d_s ±0,15	p ±10 %	Screw drive		F ca.	⌀ d_p ±0,2
			Type TX	t_1 min.		
$3,5^{+0,1}$	2,4	1,5	15	1,3	2,8	2,2
$4,0^{+0,1}$	3,0	1,8	20	1,4	3,2	2,9
$4,5^{+0,1}$	3,45	2,0	20	1,7	3,7	3,2
$5,0^{+0,5}$	4,0	2,2	25	1,9	4,5	3,9
$6,0^{+0,65}$	$4,5^{+0,65}$	2,2	25	2,0	4,9	4,9

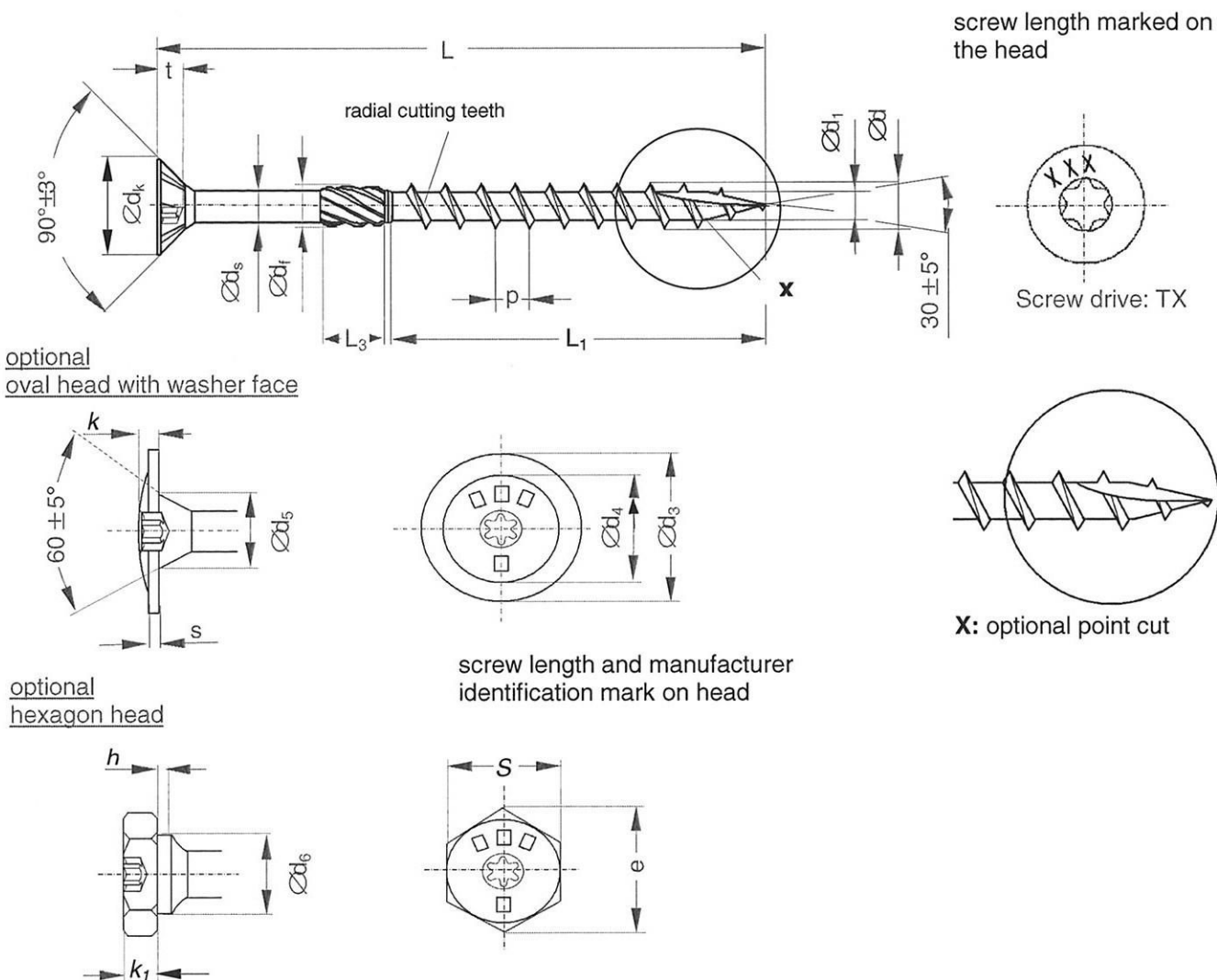L1 = thread length full thread
L2 = thread length part thread carbon steel = 0,66 x L_1 (in brackets)
L2 = thread length part thread stainless steel = 0,60 x L_1

L	3,5		4,0		4,5		5,0		6,0	
	L_{1} ± 1,5	L_{2} ± 1,5	L_{1} ± 1,5	L_{2} ± 1,5	L_{1} ± 1,5	L_{2} ± 1,5	L_{1} ± 2,0	L_{2} ± 2,0	L_{1} ± 2,0	L_{2} ± 2,0
12,0 - 0,90										
16,0 - 0,90										
20,0 - 1,05	16		15							
25,0 - 1,05	21	16,5 (15)	20	16,5 (15)	20		19			
30,0 - 1,05	26	20 (18)	25	20 (18)	25	20 (18)	24		24	
35,0 - 1,25	31	23 (21)	30	23 (21)	30	23 (21)	29		29	
40,0 - 1,25	36	26 (24)	35	26 (24)	35	26 (24)	34	26 (24)	34	
45,0 - 1,25		30 (27)	40	30 (27)	40	30 (27)	39	30 (27)	39	
50,0 - 1,25		33 (30)	45	33 (30)		33 (30)	44	33 (30)	44	33 (30)
55,0 - 1,50				33 (30)		33 (30)	54	33 (30)	54	33 (30)
60,0 - 1,50				39 (36)		40 (36)	54	40 (36)	54	40 (36)
70,0 - 1,50				46 (46)				46 (42)	64	46 (42)
80,0 - 1,50								52 (48)		52 (48)
90,0 - 1,75								59 (54)		59 (54)
100,0 - 1,75								66 (60)		66 (60)
110,0 - 1,75										66
120,0 - 1,75										66
130,0 - 1,75										
140,0 - 2,00										
150,0 - 1,75										
160,0 - 2,00										
180,0 - 2,00										
200,0 - 3,00										
220,0 - 3,00										

thread length carbon steel screws in brackets

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Vi-PORT HBS wood screws coarse thread made of carbon steel

screw length marked on the head

Screw drive: TX

radial cutting teeth

X: optional point cut

**optional
oval head with washer face**

**optional
hexagon head**

screw length and manufacturer
identification mark on head

Ø d +0,2 -0,5	d_k ± 0,6	Ø d_1 ± 0,3	Ø d_s ± 0,1	Ø d_f ± 0,3	Screw drive		p ±10 %		Ø d_3 ± 1,0	Ø d_4 ± 0,5	Ø d_5 ± 0,5	k	s ± 0,3	Screw drive	
					Type	depth TX t min.								Type	depth TX t min
8,0	14,5	5,2	5,78	7,0	TX 40	3,0	5,5	oval head with washer face	20,0	16,0	9,0	4,0	1,6	TX 40	3,0
10,0	17,8	6,25	7,00	8,25	TX 40	3,5	6,6		24,0	18,0	11,0	4,8	2,0	TX 40	3,5

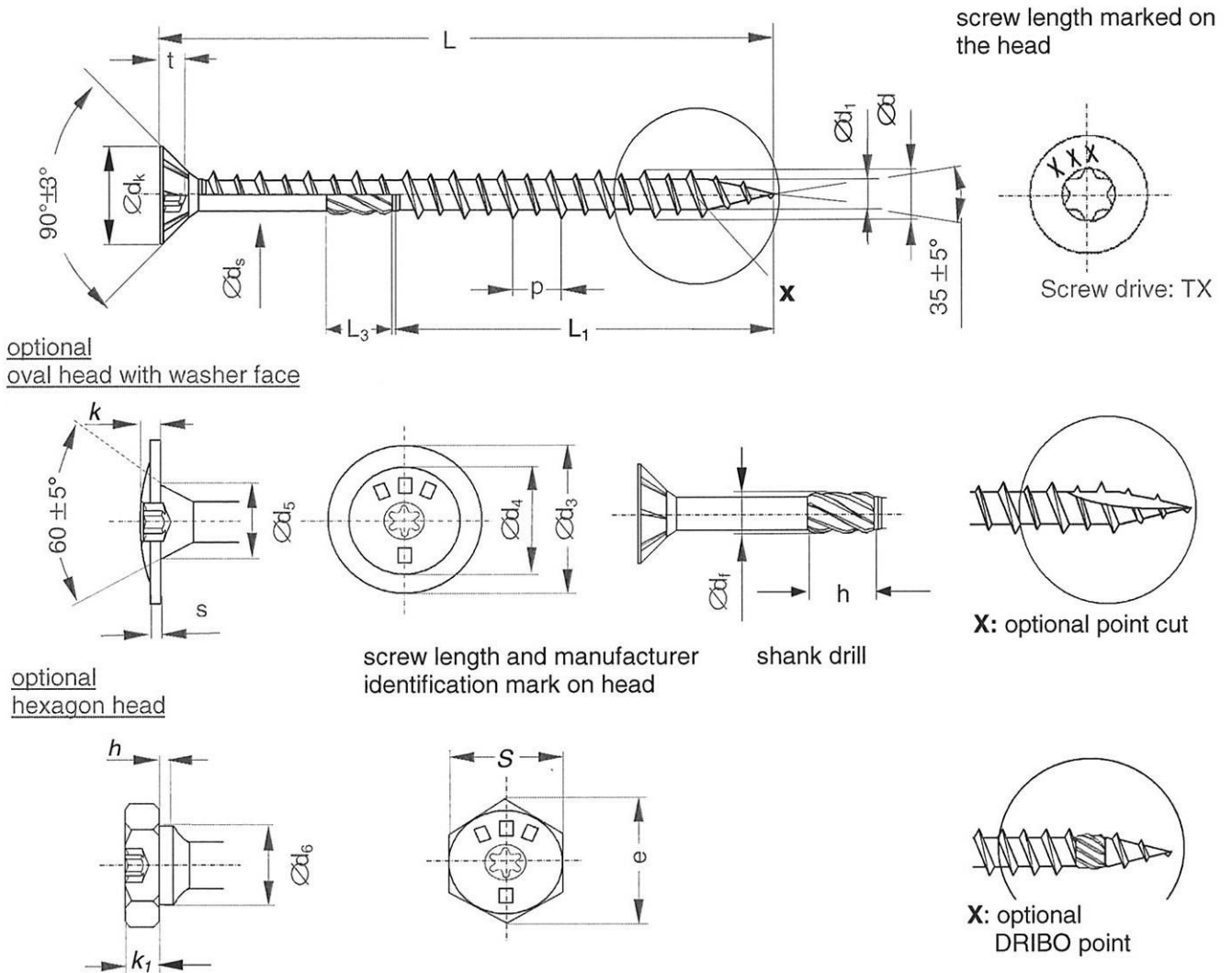| Ø d		L = 0– 120 + 0,5 – 1,75	L = 121 – 500 + 0,5 – 2,50	L_3		Ø d_6 + 0,1 – 0,5	k_1 + 1,5 – 0,5	h + 1,7 – 0,2	e + 1,0 – 0,2	SW + 0,1 – 0,3	Screw drive	
											Type	depth TX t min.
8,0	L_1	50	80	9,8 – 13,0	hexagon head	8,0	4,5	2,0	13,07	12,0	TX 40	2,66
10,0	L_1	50	80	9,8 – 13,0		10,0	5,0	2,25	16,30	15,0	TX 40	3,42

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HBS wood screws HiLO- thread stainless steel

screw length marked on
the head

Screw drive: TX

optional
oval head with washer face

screw length and manufacturer
identification mark on head

shank drill

X: optional point cut

optional
hexagon head

X: optional
DRIBO point

Ø d +0,2 -0,5	d_k ± 0,6	Ø d_1 ± 0,3	Ø d_s ± 0,1	Ø d_f ± 0,3	Screw drive		p ±10 %	oval head with washer face	Ø d_3 ± 1,0	Ø d_4 ± 0,5	Ø d_5 ± 0,5	k	s ± 0,3	Screw drive	
					Type	depth TX t min.								Type	depth TX t min.
8,0	14,5	5,0	5,70	6,5	TX 40	3,0	6,7		20,0	15,0	10,0	3,4	1,6	TX 40	2,80
10,0	17,8	6,4	7,06	7,8	TX 40	3,5	7,7		24,0	18,0	12,0	4,7	2,0	TX 40	2,51

Ød		L = 40/50/60/80 + 0,5 − 1,5 full thread	L = 80/100 + 0,5 − 1,75	L = 120 −200 + 0,5 − 2,50	L_3	hexagon head	Ø d_6 + 0,1 − 0,5	k_1 + 1,5 − 0,5	h + 1,7 − 0,2	e + 1,0 − 0,3	SW + 0,1 − 0,3	Screw drive	
												Type	depth TX t min.
8,0	L_1	35/45/55/75	50/60	80	9,8 – 13,0		8,0	4,5	2,0	13,07	12,0	TX 40	2,66
10,0	L_1	35/45/55/75	50/60	80	9,8 – 13,0		10,0	5,0	2,25	16,30	15,0	TX 40	3,42

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Vi-PORT cup washers / countersunk washers made of carbon steel
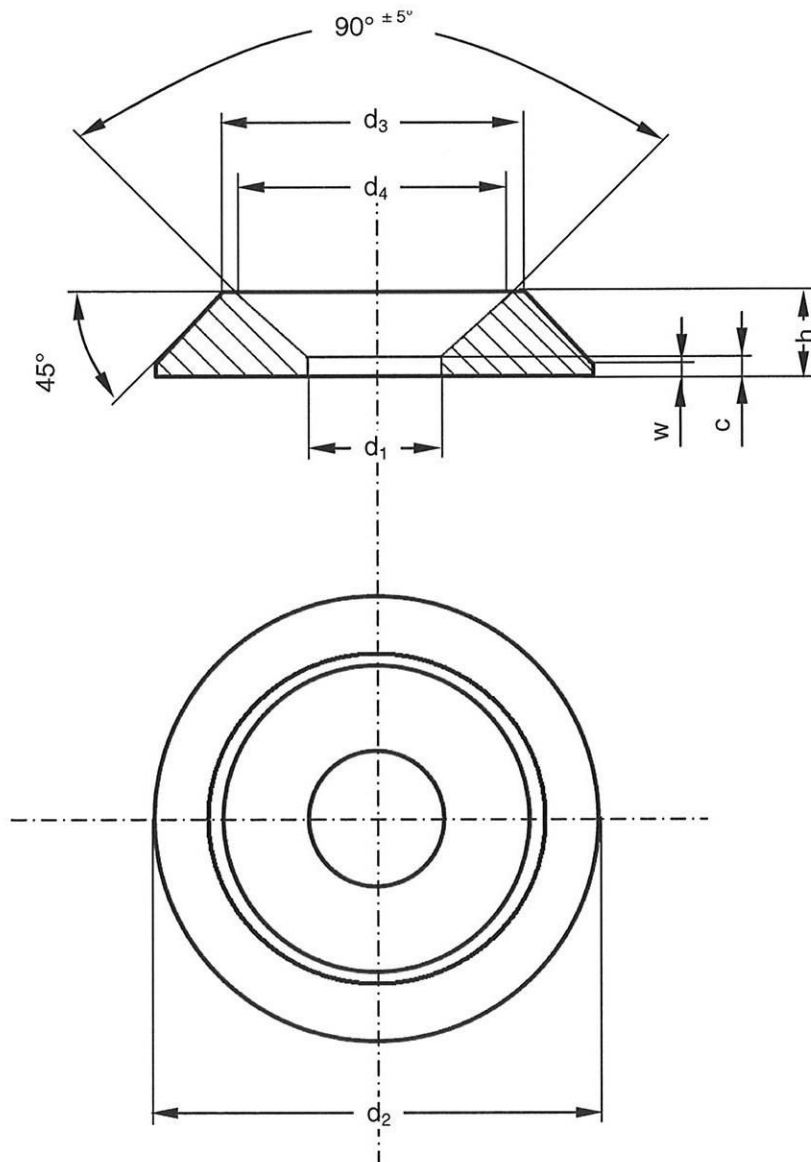
	d_1	d_2	d_3	d_4	h	w	c
Ø 8,0	$8,5^{\pm 0,3}$	$25,0^{\pm 0,3}$	$17,5^{\pm 0,3}$	$16,5^{\pm 0,3}$	$5,0^{\pm 0,3}$	~ 1,25	~ 1,0
Ø 10,0	$11,0^{\pm 0,3}$	$32,0^{\pm 0,3}$	$22,5^{\pm 0,3}$	$21,5^{\pm 0,3}$	$6,0^{\pm 0,3}$	~ 1,4	~ 0,75

The washers made from carbon steel shall be only used with screws made from carbon steel. Screws made from stainless steel shall not be used with the washers made from carbon steel.

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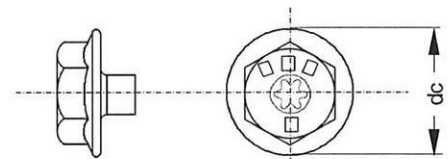
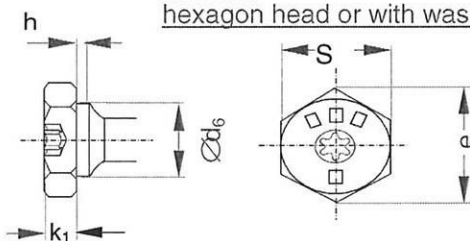## Vi-PORT HBS wood screws full thread made of carbon steel
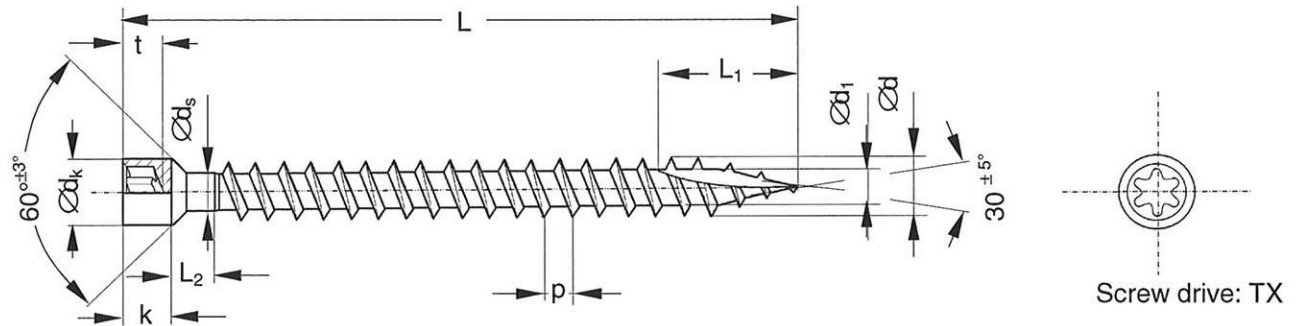
Screw drive: TX

optional
oval head with washer face
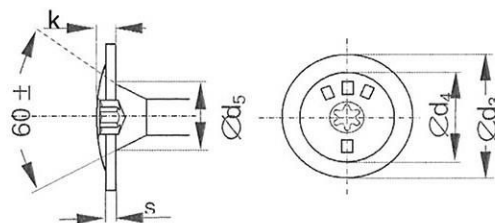
optional
countersunk head
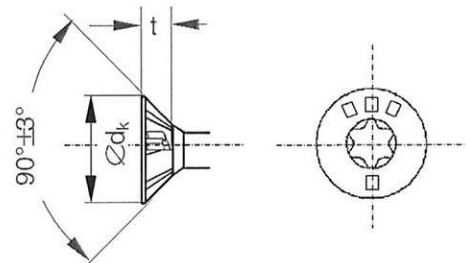
optional
hexagon head or with washer face

∅ d +0,2 -0,5	d_k - 0,5	∅ d_1 ± 0,3	∅ d_s ± 0,1	k	p ± 5%	Screw drive		L_1 ± 2,5	L_2 ± 2,0	oval head with washer face	∅ d_3 ± 1,0	∅ d_4 ± 0,5	∅ d_5 ± 0,5	k	s ± 0,3	Screw drive	
						Type	depth TX t min.									Type	depth TX t min.
8,0	9,9	5,2	5,78	7,0	5,5	TX 40	4,0	17,5	12,0		20,0	15,0	9,0	4,0	1,6	TX 40	3,0

	d_k ± 0,6	Screw drive			∅ d_6 + 0,1 − 0,5	k_1 + 1,5 − 0,5	h + 1,7 − 0,2	e + 1,0 − 0,3	SW + 0,1 − 0,3	dc ± 1,0	Screw drive		L tolerance
		Type	depth TX t min.								Type	depth TX t min.	
countersunk head	14,5	TX 40	2,5	hexagon head	8,0	4,5	2,0	13,07	12,0	20,0	TX 40	2,66	80 – 120 ± 0 – 1,75 121 – 320 ± 0 – 2,50

thread length max.
300

dimensions in mm

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ANNEX 2 – Characteristic values of the load-carrying capacities

Table 2.1   Characteristic load-carrying capacities of HSK self-tapping screws

Outer thread diameter [mm]			3.0	3.5	4.0	4.5	5.0	5.5	6.0	8.0	10.0
Characteristic yield moment $M_{y,k}$ [Nm]	Carbon steel		1.6	2.3	3.3	4.5	5.9	7.6	9.5	20.0	30.0
	Stainless steel		0.9	1.4	1.9	2.6	3.4	4.4	5.5	12.0	21.0
Characteristic tensile strength $f_{tens,k}$ [kN]	Carbon steel	Other screws	2.8	3.8	5.0	6.4	7.9	9.5	11.3	15.1	23.6
		Vi-Port HBS Full thread								20.1	
	Stainless steel		1.8	2.4	3.1	4.0	4.9	5.9	7.1	12.6	19.6
Characteristic torsional moment $f_{tor,k}$ [Nm]	Carbon steel	Other screws	1.6	2.0	3.5	5.0	6.0	9.0	12.0	22.0	36.0
		Vi-Port HBS Full thread								30.0	
	Stainless steel		1.0	1.4	2.2	3.0	4.0	6.0	8.0	18.0	34.0

General

The minimum penetration length of screws in the load-carrying wood-based members shall be 4 · d.

Laterally loaded screws

The outer thread diameter d shall be used as effective diameter of the screw according to EN 1995-1-1.

Axially loaded screws

The axial slip modulus K_{ser} of the threaded part of a screw for the serviceability limit state shall be taken independent of angle α to the grain as:

$$K_{ser} = 780 \cdot d^{0,2} \cdot l_{ef}^{0,4} \quad [N/mm] \tag{2.1}$$

Where

d   outer thread diameter of the screw [mm]
l_{ef} penetration length of the screw in the wood-based member [mm].

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Axial withdrawal capacity

The characteristic withdrawal parameter at an angle of $30° < \alpha \leq 90°$ to the grain based on a characteristic density of the wood-based member of 350 kg/m³ is

$f_{ax,k} = 11.0$ N/mm² for all screws with d = 10.0 mm and HBS-screws with d = 8.0 mm and

$f_{ax,k} = 12.5$ N/mm² for the remaining screws.

Head pull-through capacity

The characteristic value of the head pull-through parameter for HSK screws for a characteristic density of 350 kg/m³ of the timber and for wood-based panels like

- plywood according to EN 636 and EN 13986
- oriented Strand Board, OSB according to EN 300 and EN 13986
- particleboard according to EN 312 and EN 13986
- fibreboards according to EN 622-2, EN 622-3 and EN 13986

with a thickness of more than 20 mm is

$f_{head,k} = 9.4$ N/mm².

For wood-based panels a maximum characteristic density of 380 kg/m³ shall be used in equation (8.40b) of EN 1995-1-1.

The head diameter shall be equal to or greater than $1.8 \cdot d_s$, where d_s is the smooth shank or the inner thread diameter. Otherwise the characteristic head pull-through capacity in equation (8.40b) is for all wood-based materials: $F_{ax,\alpha,RK} = 0$.

For wood based panels with a thickness between 12 mm and 20 mm the characteristic value of the head pull-through parameter for HSK screws is:

$f_{head,k} = 8$ N/mm²

For wood based panels with a thickness of less than 12 mm the characteristic head pull-through capacity for HSK screws shall be based on a characteristic value of the head pull-through parameter of 8 N/mm², and limited to 400 N complying with the minimum thickness of the wood based panels of 1.2·d, with d as outer thread diameter and the values in Table 2.2.

Table 2.2   Minimum thickness of wood based panels

Wood based panel	Minimum thickness in mm
Plywood	6
Oriented Strand Boards, OSB	8
Particleboards	8
Fibreboards (hardboards and medium boards)	6

Outer diameter of washer $d_k > 32$ mm shall not be considered.

Compressive capacity

The design axial capacity $F_{ax,Rd}$ of Vi-PORT HBS screws with d =8 mm and a full thread embedded in timber is the minimum of the axial resistance against pushing-in and the buckling resistance of the screw.

$$F_{ax,Rd} = \min \{f_{ax,d} \cdot d \cdot \ell_{ef}; \kappa_c \cdot N_{pl,d}\} \qquad (2.2)$$

$f_{ax,d}$ design value of the axial withdrawal capacity of the threaded part of the screw [N/mm²]

d   outer thread diameter of the screw [mm]

l_{ef} penetration length of the threaded part of the screw in the timber member [mm]

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κ_c according to EN 1993-1-1[22]:

$$\kappa_c = 1 \qquad \text{für } \overline{\lambda}_k \leq 0{,}2 \tag{2.3}$$

$$\kappa_c = \frac{1}{k + \sqrt{k^2 - \overline{\lambda}_k^2}} \qquad \text{für } \overline{\lambda}_k > 0{,}2 \tag{2.4}$$

$$k = 0{,}5 \cdot \left[1 + 0{,}49 \cdot \left(\overline{\lambda}_k - 0{,}2\right) + \overline{\lambda}_k^2\right] \tag{2.5}$$

and a relative slenderness ratio $\overline{\lambda}_k = \sqrt{\dfrac{N_{pl,k}}{N_{ki,k}}}$ (2.6)

where:

$N_{pl,k}$ characteristic plastic normal force related to the net cross-section

of the inner thread diameter: $N_{pl,k} = \pi \cdot \dfrac{d_1^2}{4} \cdot f_{y,k}$ (2.7)

$f_{y,k}$ characteristic yield strength, $f_{y,k} = 1000$ N/mm² for Vi-PORT HBS screws

$$N_{pl,d} = \frac{N_{pl,k}}{\gamma_{M1}} \tag{2.8}$$

γ_{M1} partial factor according to EN 1993-1-1 or to the particular national annex
characteristic ideal elastic buckling load:

$$N_{ki,k} = \sqrt{c_h \cdot E_S \cdot I_S} \quad [N] \tag{2.9}$$

elastic foundation of the screw:

$$c_h = (0{,}19 + 0{,}012 \cdot d) \cdot \rho_k \cdot \left(\frac{90° + \alpha}{180°}\right) \; [N/mm^2] \tag{2.10}$$

modulus of elasticity:
$E_s = 210000$ N/mm²
second moment of area:

$$I_s = \frac{\pi \cdot d_1^4}{64} \quad [mm^4] \tag{2.11}$$

d_1 inner thread diameter of the screw [mm]

α angle between screw axis and grain direction, $30° < \alpha \leq 90°$

Spacing, end and edge distances of the screws and minimum thickness of the wood based material
Minimum thickness for structural members is $t = 30$ mm for screws with $d \leq 8$ mm, $t = 40$ mm for screws with $d = 10$ mm and $t = 80$ mm for screws with $d = 12$ mm.

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[22]   EN 1993-1-1:2005   Eurocode 3: Design of steel structures. Part 1-1: General rules and rules for buildings

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Laterally loaded screws

For HSK screws in non-predrilled holes minimum spacing and distances are given in EN 1995-1-1:2004+A1:2008, clause 8.3.1.2 and Table 8.2 as for nails in non-predrilled holes.

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

Minimum distances from loaded or unloaded ends shall be $15 \cdot d$ for screws with outer thread diameter $d > 8$ mm and timber thickness $t < 5 \cdot d$.

Minimum distances from the unloaded edge perpendicular to the grain may be reduced to $3 \cdot d$ also for timber thickness $t < 5 \cdot d$, if the spacing parallel to the grain and the end distance is at least $25 \cdot d$.

Axially loaded screws

For Vi-PORT HBS screws with $d = 8$ mm and a full thread loaded only axially, the following minimum spacings, end and edge distances apply alternatively for solid timber, glued laminated timber and similar glued products based on a minimum timber thickness of $10 d$ and a minimum width of $8 d$ or 60 mm, whichever is the greater:

Spacing a_1 in a plane parallel to grain:	a_1	$= 5 d$
Spacing a_2 perpendicular to a plane parallel to grain:	a_2	$= 2.5 d$
End distance of the centre of gravity of the threaded part in the timber member:	$a_{1,c}$	$= 10 d$
Edge distance of the centre of gravity of the threaded part in the timber member:	$a_{2,c}$	$= 4 d$
Product of spacing a_1 and a_2:	$a_1 \cdot a_2$	$= 25 d^2$

For a crossed screw couple the minimum spacing between the crossing screws is $1.5 \cdot d$.

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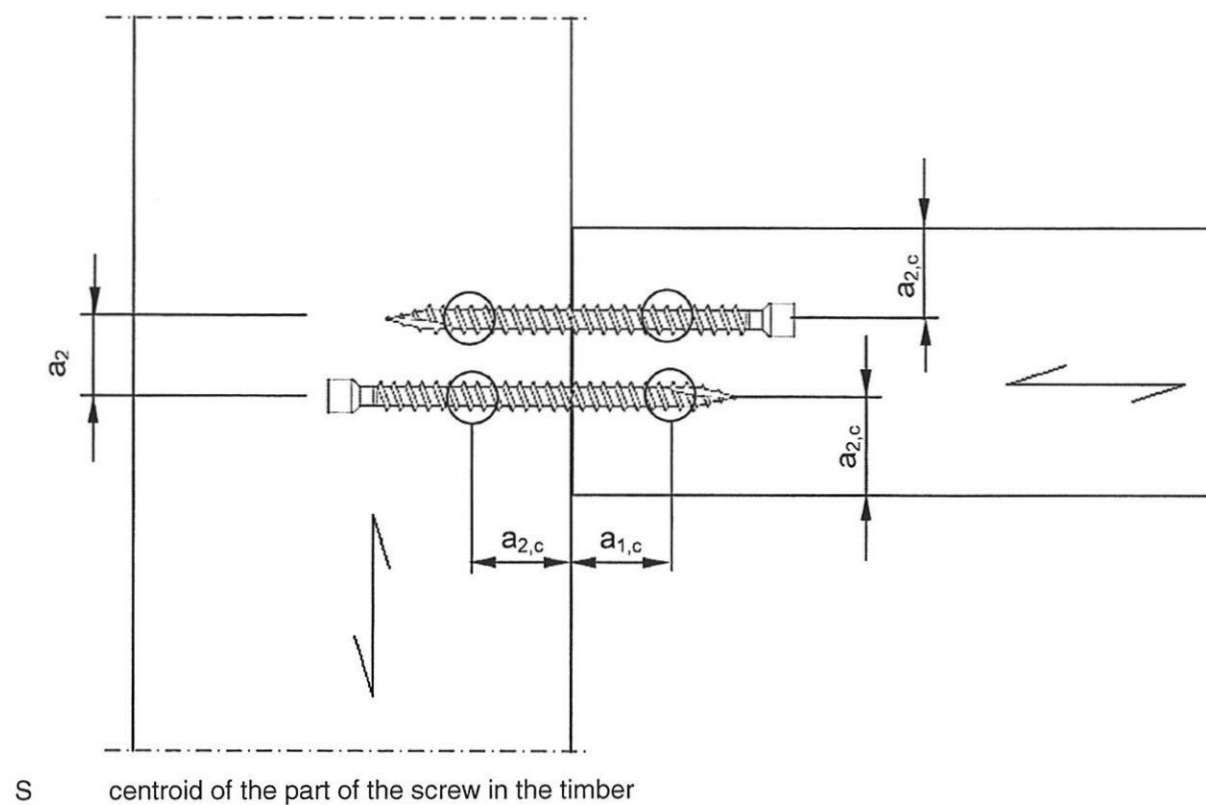European technical approval
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Examples of use for Vi-PORT HBS screws with d =8 mm and a full thread

Header-joist connection

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S   centroid of the part of the screw in the timber

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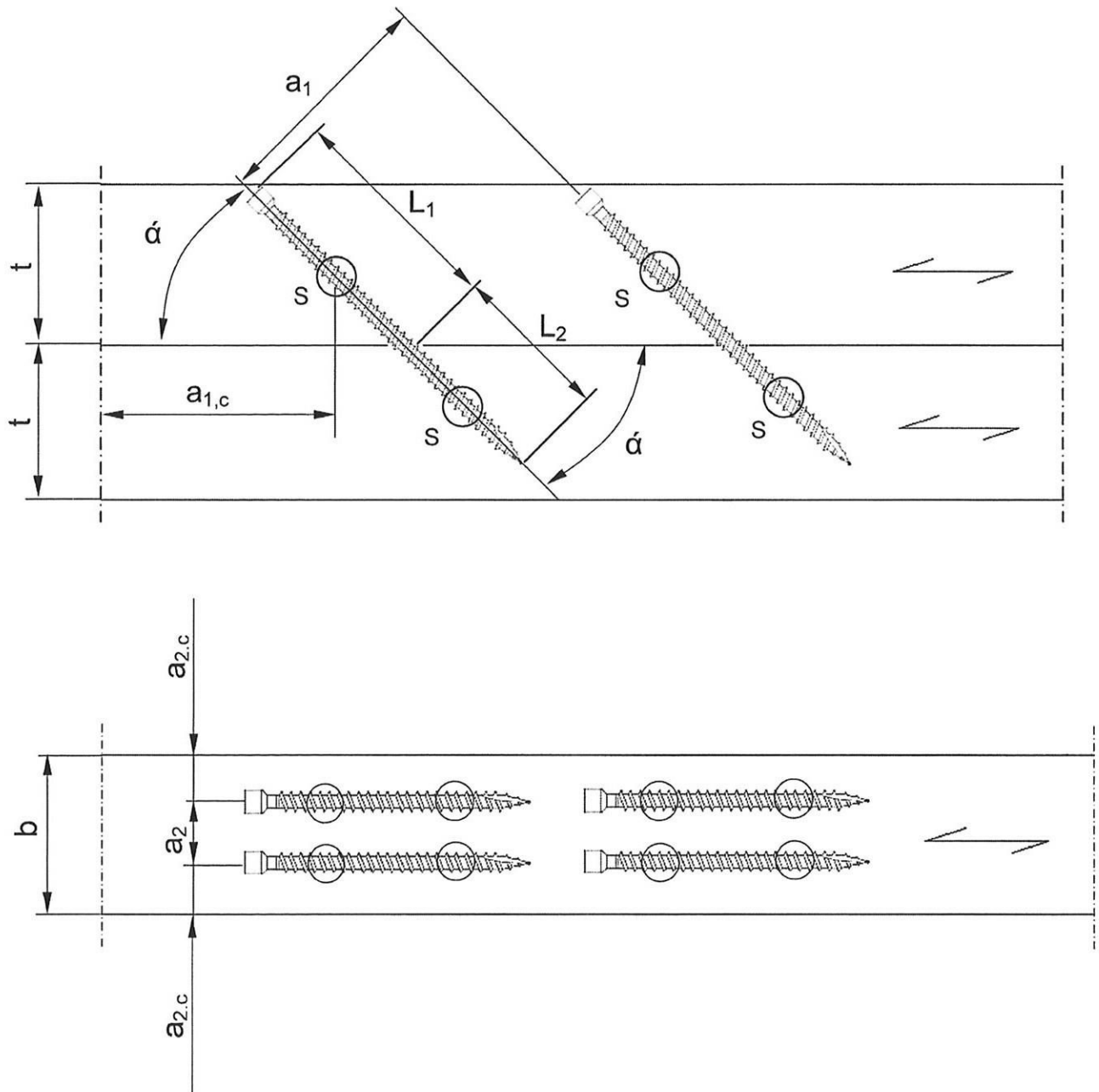Institut
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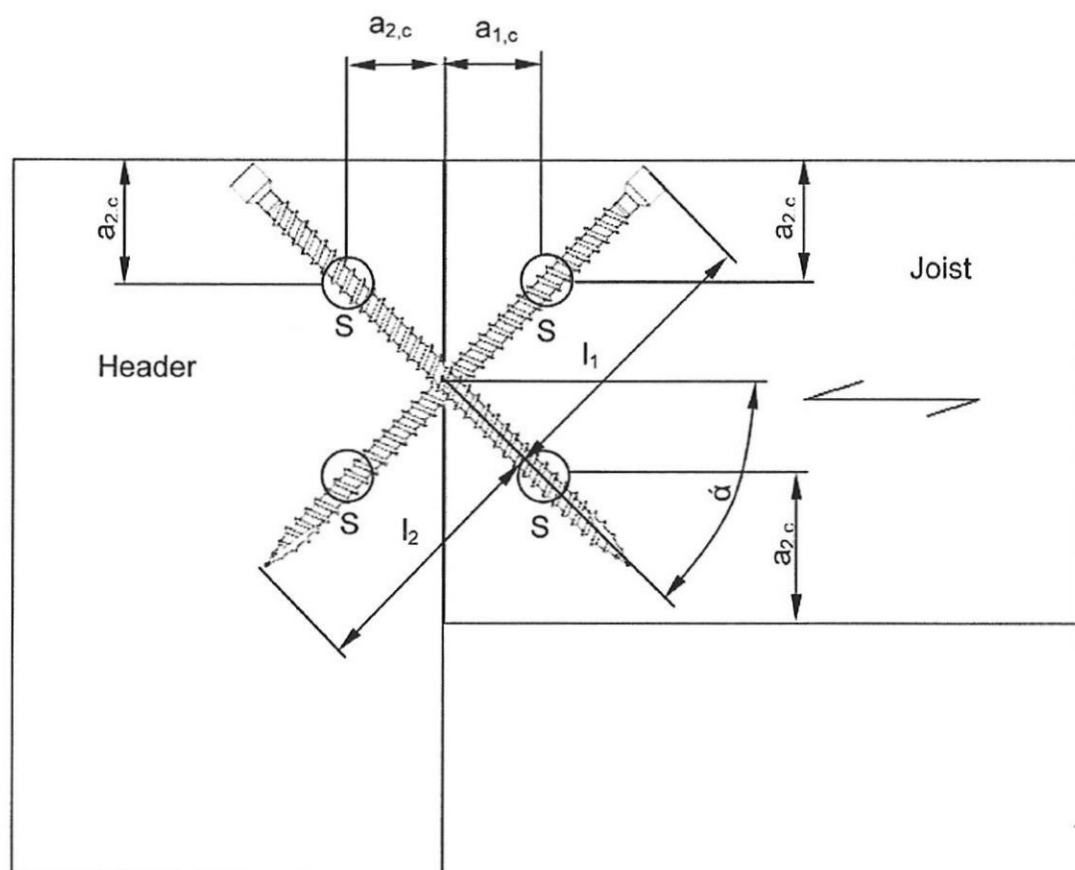
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Parallel inclined screws to connect wood-based members

S   Centroid of the part of the screw in the timber
t   Thickness of the wood-based member $t \geq 12 \cdot d$
b   Width of the wood-based member $t \geq 8 \cdot d$ or 60 mm, whichever is the greater

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Insertion moment

For wood-based members with a density of $\rho \leq 450$ kg/m³ the ratio between the characteristic torsional strength $f_{tor,k}$ and the mean value of insertion moment $R_{tor,mean}$ fulfills the requirement for all screws.

Durability against corrosion

Screws made from carbon steel are electrogalvanised and yellow or blue chromated. The mean thickness of the zinc coating of the screws is 5 µm.

Steel no. 1.4567 and 1.4578 is used for screws made from stainless steel.

ANNEX 3 - Compression reinforcement perpendicular to the grain

General

Only Vi-PORT HBS screws with $d = 8$ mm and a full thread shall be used for compression reinforcement perpendicular to the grain.

The compression force shall evenly be distributed to the screws used as compression reinforcement.

The screws are driven into the timber member perpendicular to the contact surface under an angle between the screw axis and the grain direction of 45° to 90°. The screw heads shall be flush with the timber surface.

Reinforcing screws for wood-based panels are not covered by this European technical approval.

Design

For the design of reinforced contact areas the following conditions shall be met independently of the angle between the screw axis and the grain direction.

The design resistance of a reinforced contact area is:

$$R_{90,d} = \min \begin{cases} k_{c,90} \cdot B \cdot \ell_{ef,1} \cdot f_{c,90,d} + n \cdot \min \{R_{ax,d}; \kappa_c \cdot N_{pl,d}\} \\ B \cdot \ell_{ef,2} \cdot f_{c,90,d} \end{cases} \qquad (3.1)$$

where:

$k_{c,90}$ parameter according to EN 1995-1-1:2004+A1: 2008, 6.1.5

B bearing width [mm]

$\ell_{ef,1}$ effective contact length according to EN 1995-1-1:2004+A1: 2008, 6.1.5 [mm]

$f_{c,90,d}$ design compressive strength perpendicular to the grain [N/mm²]

n number of reinforcing screws, $n = n_0 \cdot n_{90}$

n_0 number of reinforcing screws arranged in a row parallel to the grain

n_{90} number of reinforcing screws arranged in a row perpendicular to the grain

$$R_{ax,d} = f_{ax,d} \cdot d \cdot \ell_{ef} \quad [N] \qquad (3.2)$$

$f_{ax,d}$ design value of the axial withdrawal capacity of the threaded part of the screw [N/mm²]

d outer thread diameter of the screw [mm]

$$\kappa_c \cdot N_{pl,d} = \frac{\kappa_c \cdot N_{pl,k}}{\gamma_{M1}} \quad \text{with } \kappa_c \cdot N_{pl,k} \text{ according to Table 3.1} \qquad [N] \qquad (3.3)$$

$\ell_{ef,2}$ effective contact length in the plane of the screw tips (see Figure 3.1) [mm]

$\quad \ell_{ef,2} = \{\ell_{ef} + (n_0 - 1) \cdot a_1 + \min(\ell_{ef} ; a_{1,c})\}$ for end supports (see Figure 3.1 left)

$\quad \ell_{ef,2} = \{2 \cdot \ell_{ef} + (n_0 - 1) \cdot a_1\}$ for intermediate supports (see Figure 3.1 right)

ℓ_{ef} threaded length of the screw in the timber member [mm]

γ_{M1} partial factor according to EN 1993-1-1[23] or to the particular national annex

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[23]   EN 1993-1-1:2005   Eurocode 3: Design of steel structures. Part 1-1: General rules and rules for buildings

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Table 3.1: Characteristic load-carrying capacity $\kappa_c \cdot N_{pl,k}$ for Vi-PORT HBS screws in N

ρ_k [kg/m³]	d [mm]
	8.0
310	11.800
350	12.200
380	12.500
410	12.700
450	13.000

The characteristic load-carrying capacity $\kappa_c \cdot N_{pl,k}$ are based on a characteristic yield strength of the screws of $f_{y,k} = 1000$ N/mm².
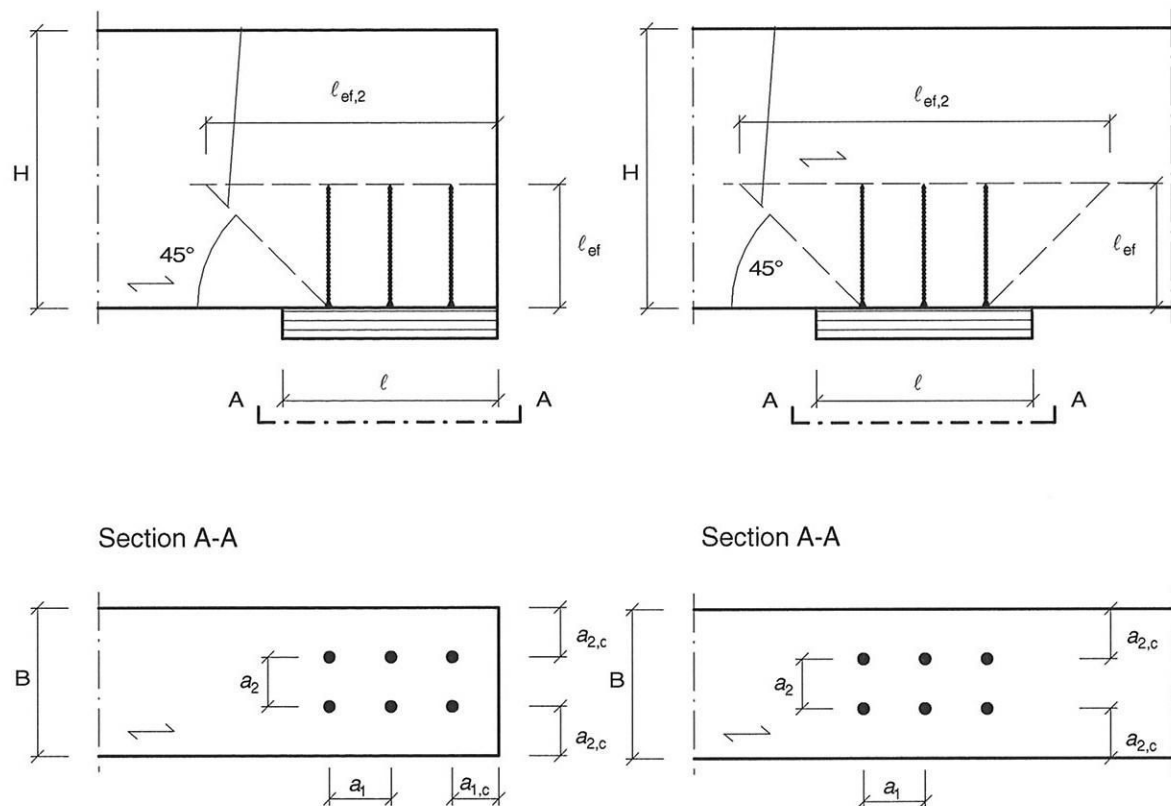

Section A-A   Section A-A

Figure 3.1: Reinforced end support (left) and reinforced intermediate support (right)

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ANNEX 4 - Fastening of thermal insulation material on top of rafters

General

The thickness of the thermal insulation material may be up to 300 mm. The thermal insulation material shall be applicable as insulation on top of rafters according to national provisions that apply at the installation site. The minimum compressive stress of the thermal insulation material at 10 % deformation, measured according to EN 826[24], shall be $\sigma_{(10\,\%)} = 0.05$ N/mm².

The battens have to be from solid timber according to EN 338/ EN 14081-1. The minimum thickness t and the minimum width b of the battens are given as follows:

$b_{min} = 50$ mm $t_{min} = 30$ mm.

The spacing between screws e_s shall be not more than 1.75 m.

Friction forces shall not be considered for the design of the characteristic axial capacity of the screws.

The anchorage of wind suction forces as well as the bending stresses of the battens, respectively, shall be considered for design. Screws perpendicular to the grain of the rafter (angle $\alpha = 90$ °) may be arranged if necessary.

Mechanical model

The system of rafter, thermal insulation material on top of rafter and counter battens parallel to the rafter may be considered as a beam on elastic foundation. The counter batten represents the beam, and the thermal insulation material on top of the rafter the elastic foundation. The counter batten is loaded perpendicular to the axis by point loads F_b transferred by regularly spaced battens. Further point loads F_s are caused by the shear load of the roof due to dead and snow load, which are transferred from the screw heads into the counter battens.
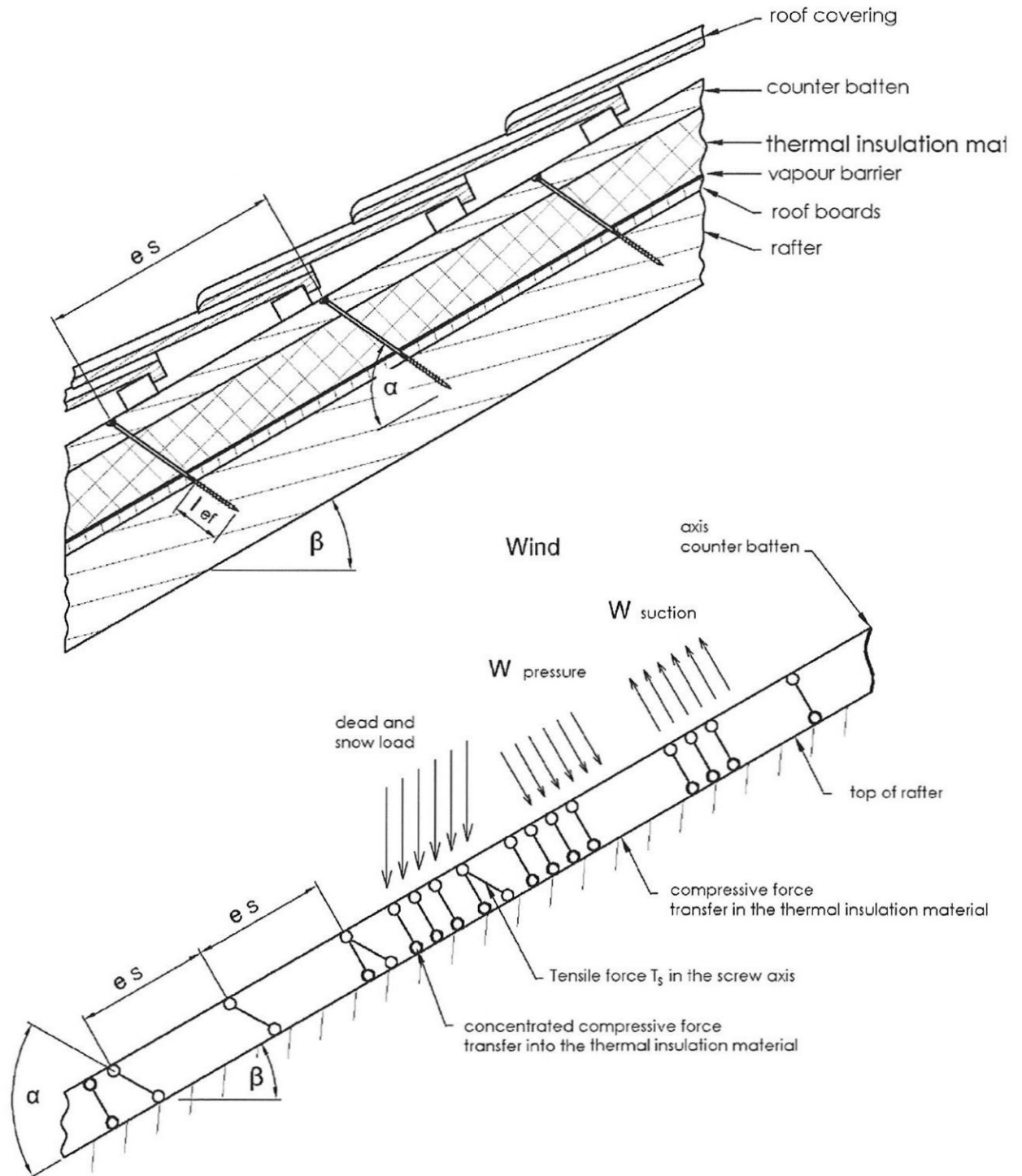
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[24]   EN 826:1996   Thermal insulating products for building applications - Determination of compression behaviour

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roof covering

counter batten

thermal insulation mat

vapour barrier

roof boards

rafter

e_s

α

l_{ef}

β

Wind

axis
counter batten

$W_{suction}$

$W_{pressure}$

dead and
snow load

top of rafter

compressive force
transfer in the thermal insulation material

Tensile force T_s in the screw axis

concentrated compressive force
transfer into the thermal insulation material

e_s

e_s

α

β

Figure 4.1   Fastening of the thermal insulation material on top of rafters - structural system

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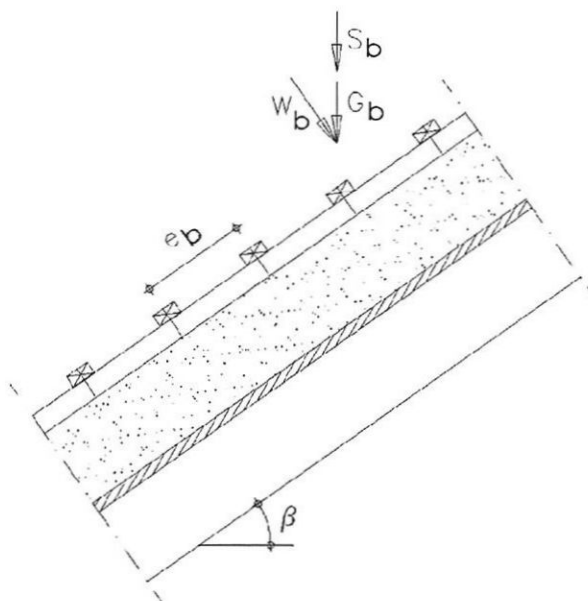
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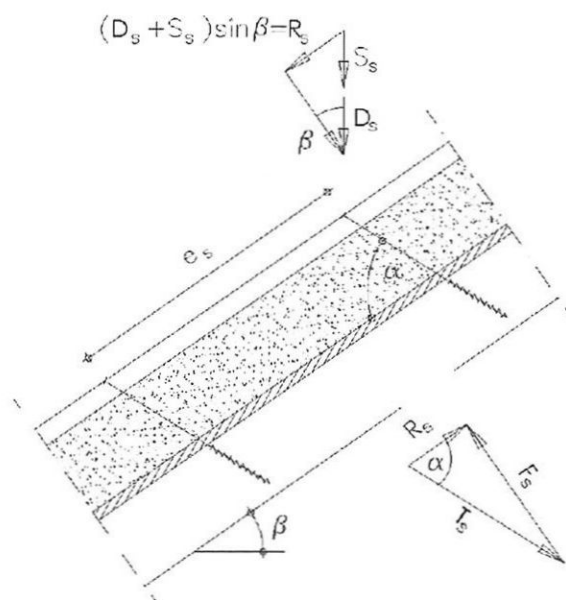
Figure 4.2   Point loads F_b perpendicular to the battens

Figure 4.3   Point loads F_s perpendicular to the battens, load application in the area of the screw heads

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Design of the battens

It's assumed that the spacing between the counter battens exceeds the characteristic length l_{char}.
The bending stresses are calculated as:

$$M = \frac{(F_b + F_s) \cdot l_{char}}{4} \tag{4.1}$$

where

$$l_{char} = \text{characteristic length } l_{char} = \sqrt[4]{\frac{4 \cdot EI}{w_{ef} \cdot K}} \tag{4.2}$$

EI = bending stiffness of the batten
K = coefficient of subgrade
w_{ef} = effective width of the thermal insulation material
F_b = point loads perpendicular to the battens
F_s = point loads perpendicular to the battens, load application in the area of the
     screw heads

The coefficient of subgrade K may be calculated from the modulus of elasticity E_{HI} and the thickness t_{HI} of the thermal insulation material if the effective width w_{ef} of the thermal insulation material under compression is known. Due to the load extension in the thermal insulation material the effective width w_{ef} is greater than the width of the batten or rafter, respectively. For further calculations, the effective width w_{ef} of the thermal insulation material may be determined according to:

$$w_{ef} = w + t_{HI}/2 \tag{4.3}$$

where
w = minimum from width of the batten or rafter, respectively
t_{HI} = thickness of the thermal insulation material

$$K = \frac{E_{HI}}{t_{HI}} \tag{4.4}$$

The following condition shall be satisfied:

$$\frac{\sigma_{m,d}}{f_{m,d}} = \frac{M_d}{W \cdot f_{m,d}} \leq 1 \tag{4.5}$$

For the calculation of the section modulus W the net cross section shall be considered.

The shear stresses shall be calculated according to:

$$V = \frac{(F_b + F_s)}{2} \tag{4.6}$$

The following condition need to be satisfied:

$$\frac{\tau_d}{f_{v,d}} = \frac{1.5 \cdot V_d}{A \cdot f_{v,d}} \leq 1 \tag{4.7}$$

For the calculation of the cross section area the net cross section shall be considered.

Design of the thermal insulation material

The compressive stresses in the thermal insulation material shall be calculated according to:

$$\sigma = \frac{1.5 \cdot F_b + F_s}{2 \cdot l_{char} \cdot w} \tag{4.8}$$

The design value of the compressive stress shall not be greater than 110 % of the compressive strength at 10 % deformation calculated according to EN 826.

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Design of the screws

The screws are loaded predominantly axial. The axial tension force in the screw may be calculated from the shear loads of the roof R_s:

$$T_S = \frac{R_S}{\cos\alpha} \tag{4.9}$$

The load-carrying capacity of axially loaded screws is the minimum design value of the axial withdrawal capacity of the threaded part of the screw, the head pull-through capacity of the screw and the tensile capacity of the screw according to Annex 2.

In order to limit the deformation of the screw head for thermal insulation material with thickness over 200 mm or with compressive strength below 0.12 N/mm², respectively, the axial withdrawal capacity of the screws shall be reduced by the factors k_1 and k_2:

$$F_{ax,\alpha,Rd} = \min\left\{ \frac{f_{ax,d} \cdot d \cdot l_{ef} \cdot k_1 \cdot k_2}{1.2 \cdot \cos^2\alpha + \sin^2\alpha} \cdot \left(\frac{\rho_k}{350}\right)^{0.8}; f_{head,d} \cdot d_h^2 \cdot \left(\frac{\rho_k}{350}\right)^{0.8}; \frac{f_{tens,k}}{\gamma_{M2}} \right\} \tag{4.10}$$

where:

$f_{ax,d}$	design value of the axial withdrawal capacity of the threaded part of the screw
d	outer thread diameter of the screw
l_{ef}	penetration length of the threaded part of the screw in the rafter, 40 mm ≥ l_{ef} ≥ 100 mm
ρ_k	characteristic density of the wood-based member [kg/m³]
α	angle α between screw axis and grain direction, 30° ≤ α ≤ 90°
$f_{head,d}$	design value of the head pull-through capacity of the screw
d_h	head diameter
$f_{tens,k}$	characteristic tensile capacity of the screw according to Annex 2
γ_{M2}	partial factor according to EN 1993-1-1 or to the particular national annex
k_1	min {1; 200/t_{HI}}
k_2	min {1; $\sigma_{10\%}$/0.12}
t_{HI}	thickness of the thermal insulation material [mm]
$\sigma_{10\%}$	compressive stress of the thermal insulation material under 10 % deformation [N/mm²]

If equation (4.10) is fulfilled, the deflection of the battens does not need to be considered.