



Austrian Institute of Construction Engineering
Schenkenstrasse 4 | T+43 1 533 65 50
1010 Vienna | Austria | F+43 1 533 64 23
www.oib.or.at | mail@oib.or.at



European Technical Assessment

ETA-12/0373
of 29.12.2025

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
Austrian Institute of Construction Engineering

Trade name of the construction product

Schmid screws RAPID®, StarDrive GPR,
StarDrive and SP

Product family to which the construction product belongs

Screws for use in timber constructions

Manufacturer

Schmid Schrauben Hainfeld GmbH
Landstal 10
3170 Hainfeld
AUSTRIA

Manufacturing plant

Schmid Schrauben Hainfeld GmbH

This European Technical Assessment contains

78 pages including 10 Annexes, which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

European Assessment Document (EAD)
130118-01-0603 "Screws and threaded rods for use in timber constructions".

This European Technical Assessment replaces

European Technical Assessment ETA-12/0373 of 30.03.2022.

Translations of the European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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Specific parts

1 Technical description of the product

This European Technical Assessment¹ (ETA) applies to the screws for use in timber constructions “Schmid screws RAPID®, StarDrive GPR, StarDrive and SP” hereinafter referred to as Schmid screws. Schmid screws are self-tapping screws divided into a point, optionally a compressor and/or cutting groove, thread, optionally a friction part, shank, and head of the screw. The screws are made from special carbon or stainless steel. The screws from special carbon steel are hardened. They are anti-friction coated and are electrogalvanized and passivated (e.g. yellow, blue,...), provided with a zinc-nickel coating or hot-dip galvanized. The washers are made from carbon steel. Possible outer thread diameters as well as overall lengths for the Schmid screws are given in Table 1.

A bending angle of 45° is reached for all screws.

The screws and washers correspond to the specifications given from Annex 0 to Annex 6. The material characteristics, dimensions and tolerances of the product not indicated in these Annexes, are given in the technical file² of the European Technical Assessment.

Table 1: Possible outer thread diameter and overall length of screws

Type of Schmid screws	Outer thread diameter		Overall length	
	min.	max.	min.	max.
	mm	mm	mm	mm
RAPID®	4	16	20	1000
Stardrive GPR and StarDrive	4	12	20	600
SP	4	6	20	200

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document

2.1 Intended use

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 class C14 or better and solid timber of hardwood of strength class D18 or better according to EN 338³ and EN 14081-1⁴,
- Glued laminated timber and glued solid timber of softwood of strength class GL20 or better according to EN 14080⁵ or glued laminated timber of hardwood according to European Technical Assessments (ETA) or national provisions that apply on the installation site,
- Laminated veneer lumber LVL according to EN 14374⁶,
- Cross laminated timber according to European Technical Assessments or national provisions that apply on the installation site.

¹ The ETA-12/0373 was firstly issued in 2012 as European technical approval with validity from 05.11.2012, amended and converted in 2017 to the European Technical Assessment ETA-12/0373 of 03.11.2017, amended in 2020 to the European Technical Assessment ETA-12/0373 of 23.12.2020, amended in 2022 to the European Technical Assessment ETA-12/0373 of 30.03.2022 and amended in 2025 to the European Technical Assessment ETA-12/0373 of 29.12.2025.

² The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

³ EN 338:2016

⁴ EN 14081-1:2005+A1:2011

⁵ EN 14080:2013

⁶ EN 14374:2004

- Cement-bonded particle boards according EN 634-1⁷ and EN 13986⁸ or ETA or national provisions that apply on the installation site.

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

- Laminated veneer lumber LVL according to EN 14374 or ETA,
- Solid wood panels according to EN 13353⁹ and EN 13986 or ETA,
- Plywood according to EN 636¹⁰ and EN 13986 or ETA,
- Oriented strand boards, OSB, according to EN 300¹¹ and EN 13986 or ETA,
- Particleboards according to EN 312¹² and EN 13986 or ETA,
- Fibreboards according to EN 622-2¹³, EN 622-3¹⁴ and EN 13986 or ETA,
- Cement-bonded particle boards according EN 634-1 and EN 13986 or ETA or national provisions that apply on the installation site,
- Engineered wood products according to ETA, provided that the ETA for the product provides provisions for the use of self-tapping screws and these provisions are applied.

Compression and tension reinforcement perpendicular to the grain with fully threaded screws as well as shear reinforcement with fully threaded screws with a diameter $d \geq 8$ mm is allowed.

In addition, screws with $6 \text{ mm} \leq d \leq 12 \text{ mm}$ may be used for fixing of thermal insulation on rafters and walls.

For engineered wood products according to a European Technical Assessment (ETA) including provisions for the use of self-tapping screws, the provisions of the ETA of the engineered wood product apply.

The product shall be subjected to static and quasi static actions only.

The product is intended to be used in service classes 1, 2 and 3 according to EN 1995-1-1¹⁵. The scope of the screws regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions.

Hot-dip galvanised screws with a minimum thickness of the zinc coating of $55 \mu\text{m}$ as well as screws made of stainless steel may be used in conditions defined by service class 3. The field of application of the screws made of stainless steel shall be defined according to EN 1993-1-4¹⁶ or national provisions that apply at the installation site.

⁷ EN 634-1:1995

⁸ EN 13986:2004+A1:2015

⁹ EN 13353:2022

¹⁰ EN 636:2012+A1:2015

¹¹ EN 300:2006

¹² EN 312:2010

¹³ EN 622-2:2004/AC:2005

¹⁴ EN 622-3:2004

¹⁵ EN 1995-1-1:2004 + AC:2006 + A1:2008 +A2:2014

¹⁶ EN 1993-1-4:2006 + A1:2015 + A2:2020

Table 2: Maximum thickness or penetration depth for Schmid screws driven through or in one element of laminated veneer lumber LVL of beech or related products made of hardwood with a maximum characteristic density of 740 kg/m³ without predrilling

Type of Schmid screws		acc. to Table A6.1			acc. to Table A6.2			
Outer thread diameter <i>d</i>	mm	8	10	12	5	6	8	10
maximum thickness or penetration depth	mm	200	390	360	45	50	100	90

All other Schmid screws made of carbon steel with an outer thread diameter $5 \text{ mm} \leq d \leq 16 \text{ mm}$ may be driven into laminated veneer lumber LVL of beech or related products of hardwood with predrilling; screws with an outer thread diameter $d = 8 \text{ mm}$ (see Table A6.4) may be driven into laminated veneer lumber LVL of beech or related products of hardwood without predrilling.

At least four screws shall be used in a connection with screws ($4 \text{ mm} \leq d \leq 16 \text{ mm}$) inserted in the timber member with an angle between screw axis and grain direction of less than 15° . The penetration length of the threaded part of the partly or fully threaded screw shall be at least $20 d$.

The use of only one screw in load-bearing connections is possible for screws ($4 \text{ mm} \leq d \leq 16 \text{ mm}$) loaded in axial direction and angles between grain direction and screw axis $\varepsilon \geq 15^\circ$ provided that a minimum penetration length of the threaded part of the screw of $20 d$ can be ensured. Hereby, the load-bearing capacity of the screw must be reduced by 50%. This reduction is not necessary for screws used as reinforcement perpendicular to the grain of wood-based members.

To ensure a proper installation for screws with lengths of more than 800 mm a guiding hole of $5 d$ is recommended.

For mounting of steel plates and wood-based panels the screw head must be placed on top of these members.

The structural members which are connected with Schmid screws shall

- be in accordance with Clause 2.1;
- ensure minimum spacing and edge distances in accordance with EN 1995-1-1 and Annex 6.

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of Schmid screws of 50 years, when installed in the works, provided that the screws are subject to appropriate installation, use and maintenance (see Clause 2.2). These provisions are based upon the current state of the art and the available knowledge and experience¹⁷.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

¹⁷ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product can also be shorter than the assumed working life.

3 Performance of the product and reference to the methods used for its assessment

3.1 Essential characteristics of the product

Table 1: Essential characteristics of the wood-concrete composite slab kit and methods for assessment as well as performance of the product

Essential characteristic	Method of assessment	Performance
Basic requirement for construction works 1: Mechanical resistance and stability		
Dimensions	EAD 130118-01-0603, Clause 2.2.1	Annex 0 to Annex 5
Characteristic yield moment	EAD 130118-01-0603, Clause 2.2.2	Annex 6
Bending angle	EAD 130118-01-0603, Clause 2.2.3	≥ 45°
Characteristic withdrawal parameter	EAD 130118-01-0603, Clause 2.2.4	Annex 6
Characteristic head pull-trough parameter	EAD 130118-01-0603, Clause 2.2.5	Annex 6
Characteristic tensile strength	EAD 130118-01-0603, Clause 2.2.6	Annex 6
Characteristic yield strength	EAD 130118-01-0603, Clause 2.2.7	Annex 6
Characteristic torsional strength	EAD 130118-01-0603, Clause 2.2.8	Annex 6
Insertion moment	EAD 130118-01-0603, Clause 2.2.9	Annex 6
Spacing, end and edge distances of the screws and minimum thickness of the wood-based material	EAD 130118-01-0603, Clause 2.2.10	Annex 6
Slip modulus for mainly axially loaded screws	EAD 130118-01-0603, Clause 2.2.11	Annex 6
Durability against corrosion	EAD 130118-01-0603, Clause 2.2.12	Clause 3.1.1
Basic requirement for construction works 2: Safety in case of fire		
Reaction to fire	EAD 130118-01-0603, Clause 2.2.13	Clause 3.1.2
Basic requirement for construction works 4: Safety and accessibility in use		
Same as BWR 1		

3.1.1 Durability against corrosion

The product is intended to be used in service classes 1, 2 and 3 according to EN 1995-1-1.

The screws and washers made from carbon steel are electrogalvanized and yellow or blue passivated, coated with a zinc-nickel coating or hot-dip galvanized. The minimum thickness of the zinc coating of the screws is 5 µm and the minimum thickness of the zinc-nickel coating is 4 µm. The minimum thickness of the zinc coating of hot-dip galvanized screws is 55 µm.

Steel no. 1.4567 or 14578 or equivalent according to EN 10088-1¹⁸, is used for screws made from stainless steel.

Durability of Schmid screws is in accordance with EN 1995-1-1 or national provisions that apply on the installation site.

3.1.2 Reaction to fire

Schmid screws are made from steel classified as Euroclass A1 in accordance with Commission Decision 96/603/EC, as amended by Commission Decision 2000/605/EC.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of the screws for use in timber constructions for the intended use, and in relation to the requirements for mechanical resistance and stability, for safety in case of fire and for safety and accessibility in use in the sense of the basic requirements for construction works № 1, 2 and 4 of Regulation (EU) № 305/2011 has been made in accordance with the European Assessment Document EAD 130118-01-0603, "Screws and threaded rods for use in timber constructions".

3.2.2 Identification

The European Technical Assessment for the screws for use in timber constructions is issued on the basis of agreed data that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are implemented, as an amendment of the European Technical Assessment is possibly necessary.

4 Assessment and verification of constancy of performance (thereinafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/176/EC¹⁹ the system of assessment and verification of constancy of performance to be applied to "Schmid screws RAPID[®], StarDrive GPR, StarDrive and SP" is System 3. System 3 is detailed in Commission Delegated Regulation (EU) № 568/2014²⁰ of 18 February 2014, Annex, 1.4., and provides for the following items

- (a) The manufacturer shall carry out factory production control.
- (b) The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.

¹⁸ EN 10088-1:2023

¹⁹ Official Journal of the European Communities OJ L 73, 14.3.1997, p. 19

²⁰ Official Journal of the European Communities OJ L 157, 27.5.2014, p. 76

4.2 Construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 3 shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in point 4.1 (b).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer shall establish and continuously maintain a factory production control. All procedures and specifications adopted by the manufacturer shall be documented in a systematic manner. The factory production control shall ensure the constancy of performances of Schmid screws with regard to the essential characteristics.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials shall be subject to controls by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents presented by the manufacturer of the raw materials.

The frequencies of controls conducted during manufacturing and on the finalised product are defined by taking account of the manufacturing process of the product and are laid down in the control plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components
- Type of control or test
- Date of manufacture of the product and date of testing of the product or basic materials or components
- Results of controls and tests and, if appropriate, comparison with requirements
- Name and signature of person responsible for factory production control

The records shall be kept at least for ten years time after the construction product has been placed on the market. On request they shall be presented to Österreichisches Institut für Bautechnik.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, the manufacturer shall issue a declaration of performance.

Issued in Vienna on 23.12.2025
by Österreichisches Institut für Bautechnik

The original document is signed by:

Thomas Rockenschaub
Managing Director

Table A0.1 Code system for Schmid screws

Code	Parameter	Code		Annex
I	Screw diameter	Dimension in 0.1 mm	DDD	0 to 6
II	Length	Dimension in mm	LLL	6
III	Thread length	Dimension in mm	bbb	-
IV	Head	Letters	A to T	1
V	Shank	Number	0 to 2	2
VI	Under head "Unterkopf"	Letters	A to T	1
VII	Compressor	Number	0 to 3	2
VIII	Thread	Letters	A to E	3
IX	Cutting groove	Number	0 or 1	3
X	Point	Letters	A to F	4
XI	Characteristic head pull-through parameter	Number	0	-
	90° head	Number	1	6, Table A6.8
	180° head and washer	Number	2	6, Table A6.9
XII	Other product characteristics	Letters	A to F	6, Table A6.1 to A6.4

Example:

RAPID® CS 5x70/37

Code 050x070/037 A1B 0C1 A1C

Screw diameter

5 mm

Length

70 mm

Thread length

37 mm

Head

Countersunk head $d_k=10$ mm, according to Annex 1, Table for head "A"

Shank

Shank with friction part

Under head

Cutter ribs according to head B

Compressor

without compressor

Thread

Double thread

Cutting groove

Thread with cutting groove

Point

Regular point

Char. head pull-through parameter

according to Annex 6, Table A6.8 (for 90° heads)

Other product characteristics

according to Annex 6, Table A6.2

Schmid screws



Annex 0

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Code system and screw assembly

Table A0.2 Alternative code system for Schmid screws

Code long	Code short
RAPID fullthread countersunk head or RAPID Vollgewinde Senkkopf	RAPID FT CS
RAPID fullthread cylinderhead or RAPID Vollgewinde Zylinderkopf	RAPID FT CL or RAPID FT CY
RAPID fullthread head type acc. to Annex 1 (e.g. small CS) or RAPID Vollgewinde <i>Kopf lt. Anhang 1</i> (z.B. kleiner Senkkopf)	RAPID FT C
RAPID countersunk head or RAPID Senkkopf	RAPID CS
RAPID washerhead or RAPID Tellerkopf	RAPID WH
RAPID Dual hexagonhead	RAPID Dual or RAPID HH
RAPID SuperSenkFix	RAPID SSF
RAPID head type acc. to Annex 1 (e.g. small CS) or RAPID <i>Kopf lt. Anhang 1</i> (z.B. kleiner Senkkopf)	RAPID C
StarDrive GPR countersunk head	StarDrive GPR CS
StarDrive GPR washerhead	StarDrive GPR WH
StarDrive GPR head type acc. to Annex 1 (e.g. small CS)	StarDrive GPR C
StarDrive head type acc. to Annex 1 (e.g. small CS)	StarDrive C
SP head type acc. to Annex 1 (e.g. small CS)	SP C

Example:

*RAPID countersunk head 5x70/37
RAPID Senkkopf 5x70/37
RAPID CS 5x70/37*

Schmid screws

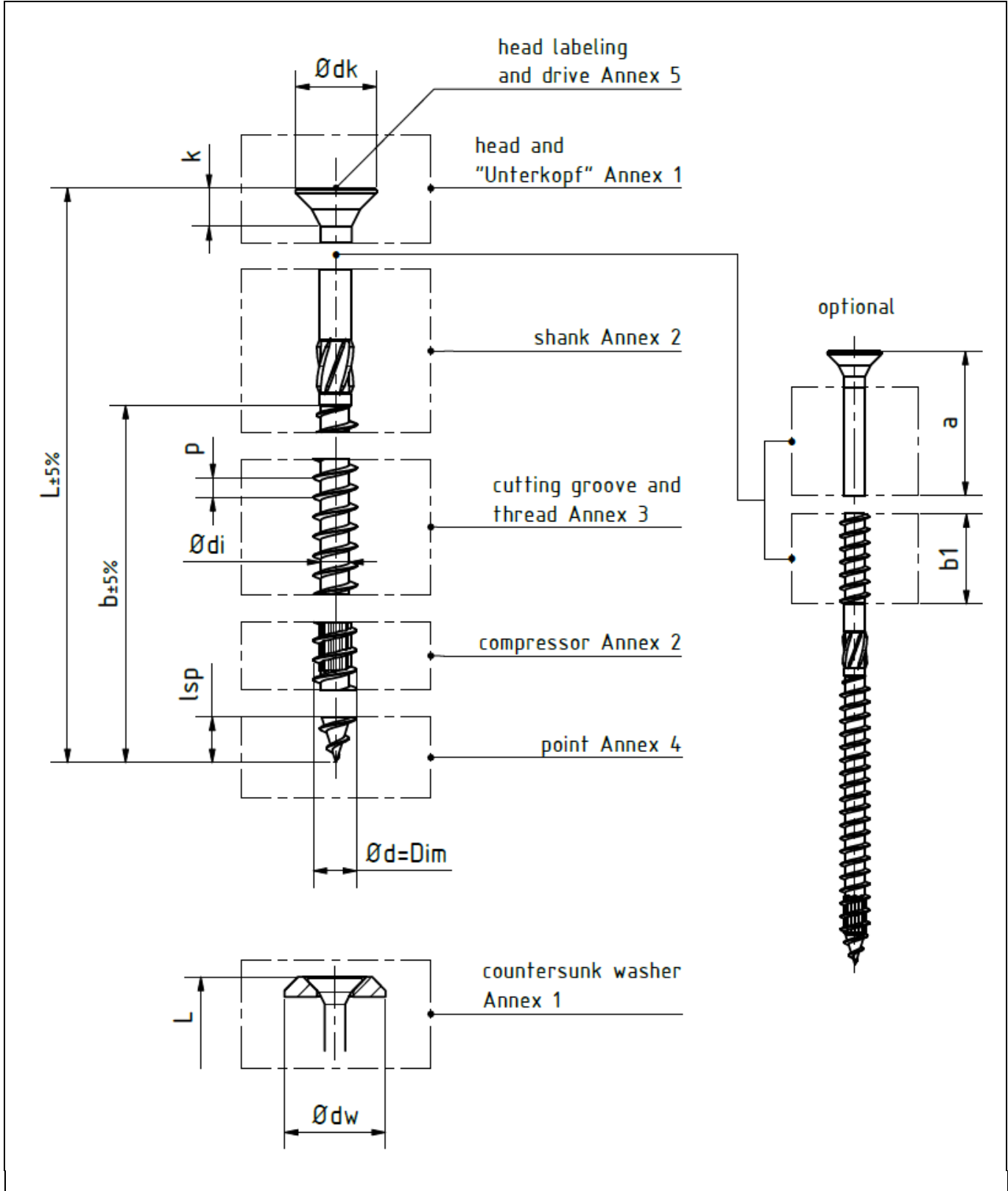


Annex 0

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Code system and screw assembly

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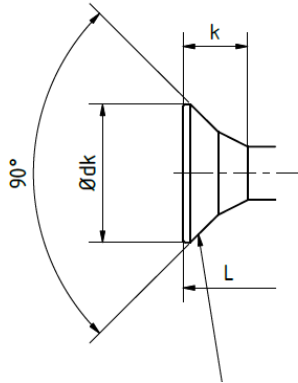
Schmid screws



Code system and screw assembly

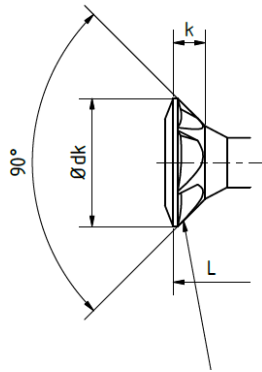
Annex 0
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

head "A"
countersunk head



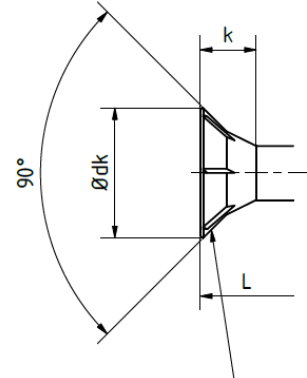
0-30 UKR
(e.g. 0)

head "B"
countersunk head
with raise



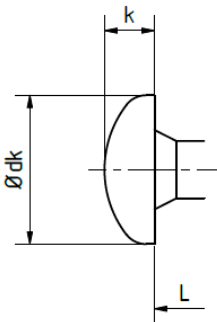
0-30 UKR
(e.g. 6)

head "C"
small countersunk head

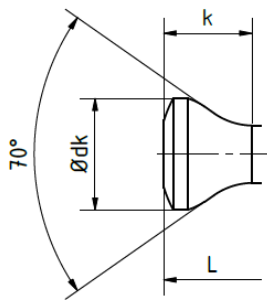


0-30 UKR
(e.g. 6)

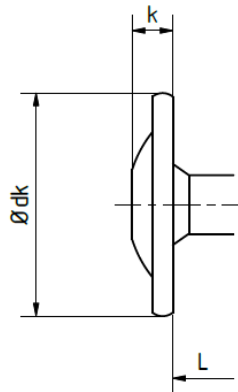
head "D"
pan head



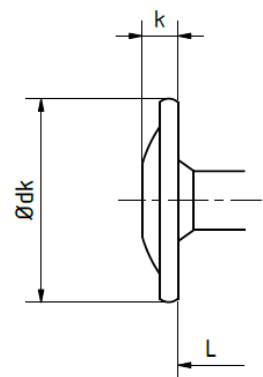
head "E"
pear head



head "F"
washer head



head "G"
small washer head



UKR... milling ribs or milling pockets
 Heads "A", "B", "C" are 90° heads
 Heads "D", "F", "G" are 180° heads

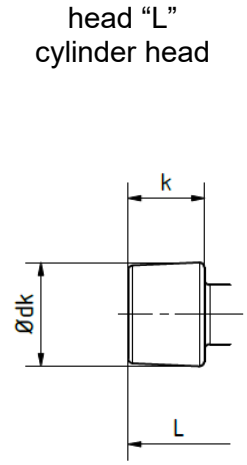
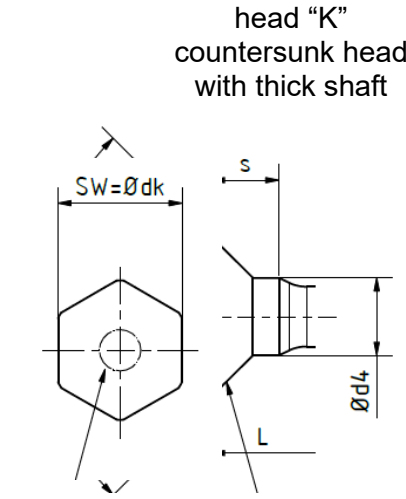
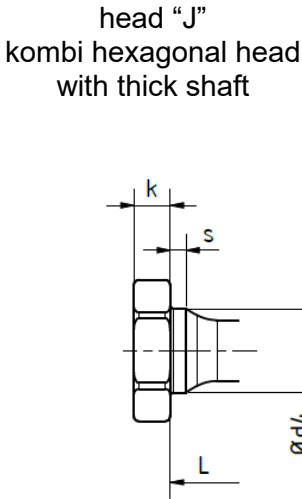
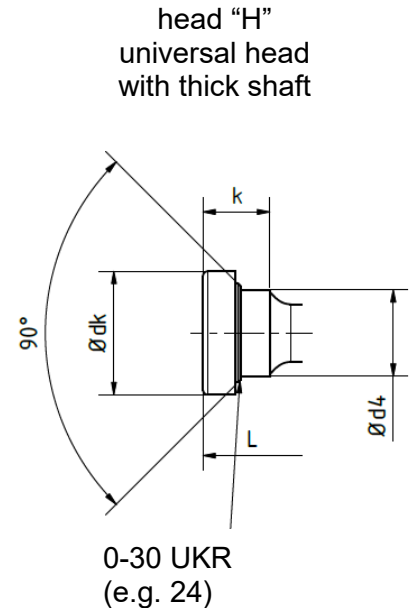
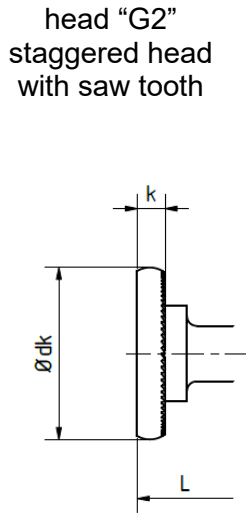
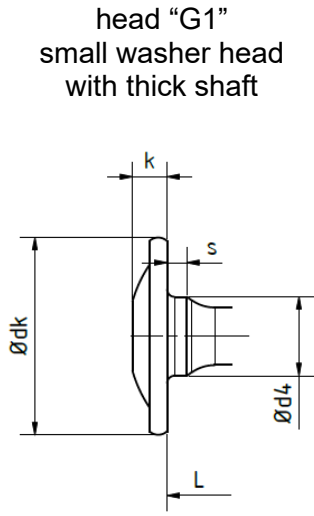
Schmid screws



Annex 1

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Screw head geometry



(e.g. 0)

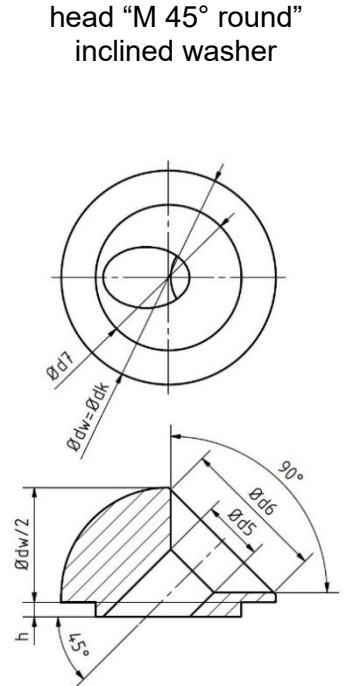
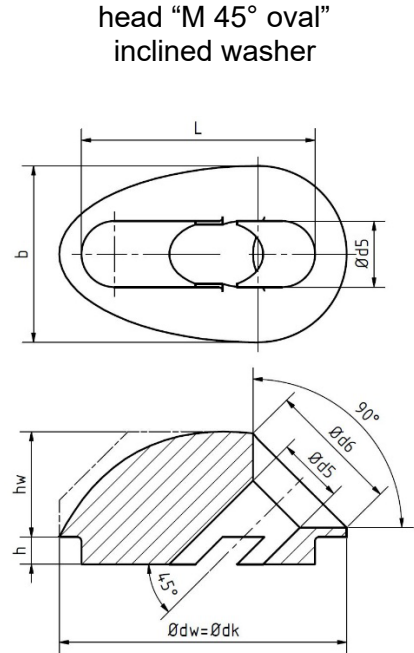
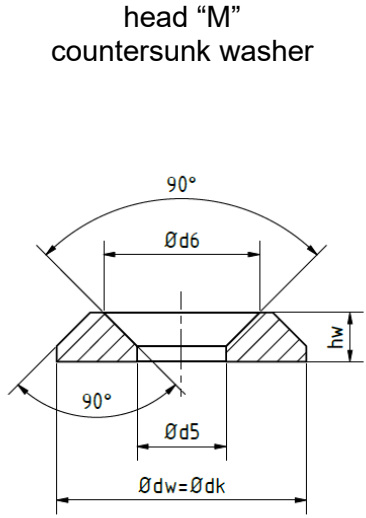
Head "K" is a 90° head
 Heads "G1", "G2", "H", "J" are 180° heads



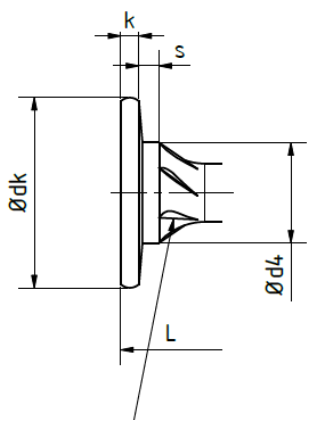
Annex 1
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Screw head geometry

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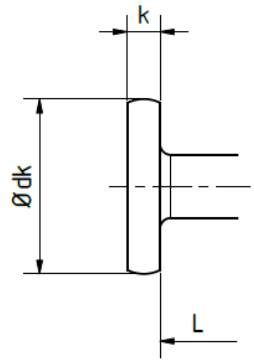


head "N"
SuperSenkFix head

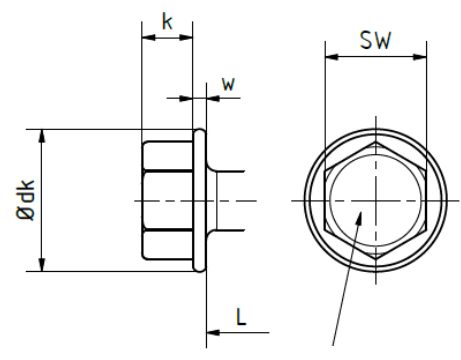


0-30 UKR
(e.g. 8)

head "O"
flat head



head "P"
hexagonal head
with washer
alternative with T-drive



drive types
see Annex 5

Heads "M", "M45", "M45 round", "N", "O", "P" are 180° heads

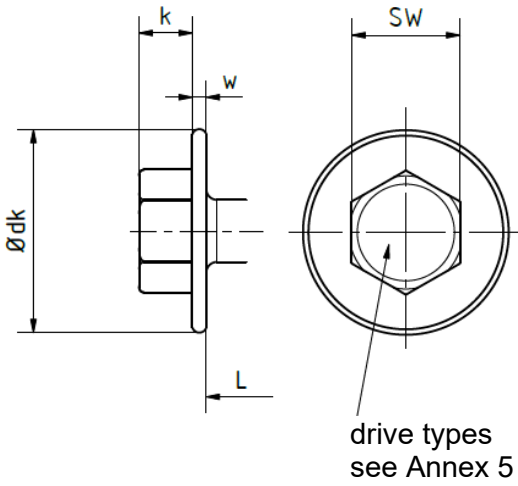


Screw head geometry

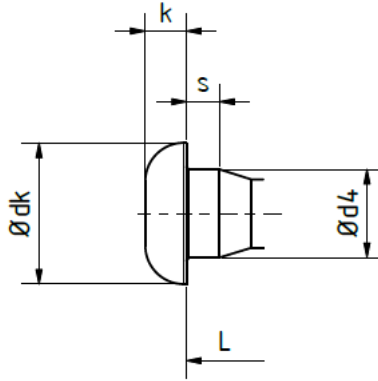
Annex 1
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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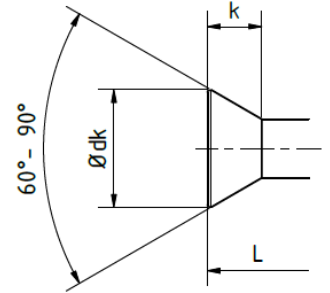
head "R"
 hexagonal head
 with large washer
 alternative with T-drive



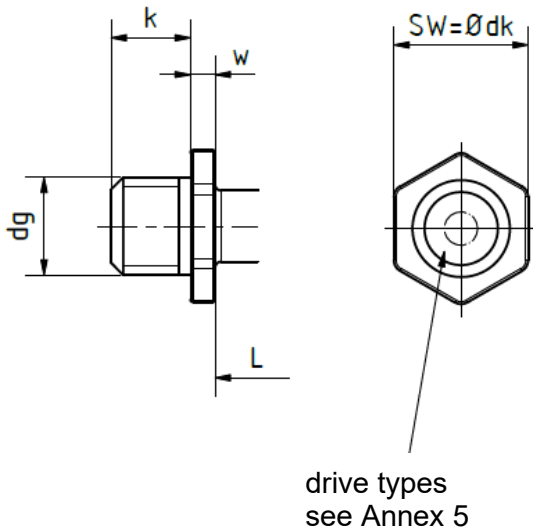
head "S"
 round pan head
 with thick shaft



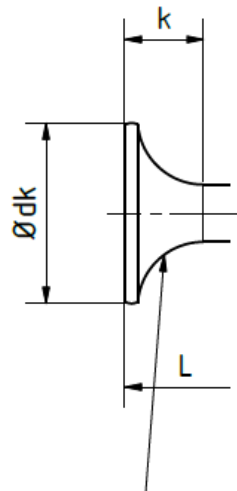
head "T"
 60°-90° countersunk head



head "U"
 thread head
 with (hexagon)washer



head "V"
 trumpet head



Heads "T", "V" are 90° heads
 Heads "R", "S", "U" are 180° heads

0-30 UKR
 (e.g. 0)

Schmid screws



Annex 1

of European Technical Assessment
 ETA-12/0373 of 29.12.2025


Screw head geometry

Dim	head "A" countersunk head				head "B" countersunk head with raise				head "C" small countersunk head				head "D" pan head				head "E" pear head			
	Ødk		k		Ødk		k		Ødk		k		Ødk		k		Ødk		k	
4,0	8,0	±0.70	3,0	±0.30	8,0	±0.70	4,0	±0.40	7,0	±0.60	2,6	±0.26	8,0	±0.55	1,2	±0.24				
4,5	9,0	±0.70	3,5	±0.35	9,0	±0.70	4,5	±0.45	8,0	±0.70	3,0	±0.30	9,0	±0.60	1,4	±0.28				
5,0	10,0	±0.80	4,5	±0.45	10,0	±0.80	5,5	±0.55	9,0	±0.70	3,5	±0.35	1,0	±0.65	1,5	±0.30				
6,0	12,0	±0.90	5,5	±0.55	12,0	±0.90	6,6	±0.66	11,0	±0.80	4,5	±0.45	12,0	±0.70	1,7	±0.34	10,3	±0.51	7,0	±1.00
7,0	14,0	±1.00	6,0	±0.60	14,0	±1.00	7,2	±0.72	12,0	±0.90	5,5	±0.55	14,0	±0.85	2,1	±0.42	11,0	±0.55	7,2	±1.20
8,0	15,0	±1.20	7,0	±0.70	15,0	±1.20	8,3	±0.83	14,0	±1.00	6,0	±0.60					11,5	±0.65	7,5	±1.20
10,0	18,5	±1.50	9,0	±0.90	18,5	±1.50	10,5	±1.05	15,0	±1.20	7,0	±0.70					12,0	±0.75	9,5	±1.50
12,0	20,0	±2.00	10,0	±1.00	21,0	±2.00	12,0	±1.20	18,5	±1.50	9,0	±0.90					16,0	±0.90	13,0	±2.00
16,0	26,0	±2.50	11,0	±1.10					20,0	±2.00	7,0	±0.70								

Dim	head "F" washer head				head "G" small washer head				head "G1" small washer head with thick shank						head "G2" staggered head with saw tooth						
	Ødk		k		Ødk		k		Ødk		k		Ød4		s		Ødk		k		
4,0	11,0	±0.60	2,2	±0.80	9,6	±0.50	2,2	±0.80									8,5	±0.50	1,9	±0.60	
4,5	12,0	±0.70	2,4	±0.80	10,8	±0.60	2,4	±0.80										9,5	±0.50	2,0	±0.60
5,0	14,0	±0.80	2,6	±0.90	12,5	±0.70	2,6	±0.90	12,5	±0.70	2,6	±0.90	5,0	±0.50	1,5	±1.0	10,5	±0.60	2,2	±0.80	
6,0	17,0	±1.00	3,0	±1.00	14,0	±0.80	3,0	±1.00	14,0	±0.80	3,0	±1.00	6,0	±0.60	1,8	±1.0	13,0	±0.70	2,4	±0.80	
7,0	18,0	±1.20	3,3	±1.00	17,0	±1.00	3,3	±1.00	17,0	±1.00	3,3	±1.00	7,0	±0.70	2,1	±1.0					
8,0	22,0	±1.50	3,5	±1.00	20,0	±1.50	3,5	±1.00	20,0	±1.50	3,5	±1.00	8,0	±0.80	2,8	±1.0	18,0	±1.20	2,6	±0.90	
10,0	27,0	±2.00	4,7	±1.20	25,0	±2.00	4,5	±1.20	25,0	±2.00	4,5	±1.20	10,0	±1.00	3,0	±1.0	22,0	±1.50	3,3	±1.00	
12,0	30,0	±2.00	5,8	±1.50	27,0	±2.00	4,7	±1.20	27,0	±2.00	4,7	±1.20	12,0	±1.20	3,4	±1.0					

Dim	head "H" universal head with thick shank				head "J" kombi (dual) hexagon head with thick shank						head "K" countersunk head with thick shank									
	Ødk		k		Ød4		SW=Ødk		k		s		Ød4		Ødk		s		Ød4	
4,0															8,0	±0.70	4,0	±1.50	4,0	±0.40
4,5															9,0	±0.70	4,5	±1.50	4,5	±0.45
5,0															10,0	±0.80	4,8	±1.50	5,0	±0.50
6,0	9,5	±0.47	5,5	±1.00	6,0	±0.60	7,0	-0.35	2,0	±1.30	1,5	±1.00	5,0	±0.50	12,0	±0.90	5,8	±1.50	6,0	±0.60
7,0	11,0	±0.55	6,0	±1.30	7,0	±0.70	10,0	-0.50	4,0	±1.30	2,1	±1.00	7,0	±0.70	13,0	±1.00	7,0	±1.50	7,0	±0.70
8,0	12,5	±0.62	7,0	±1.50	8,0	±0.80	12,0	-0.60	4,5	±1.30	2,8	±1.00	8,0	±0.80	14,0	±1.20	8,5	±1.50	7,5	±0.75
10,0	15,0	±0.75	8,0	±1.80	10,0	±1.00	15,0	-0.75	5,0	±1.30	3,0	±1.00	10,0	±1.00	18,5	±1.50	10,0	±2.50	10,0	±1.00
12,0	17,0	±0.85	9,0	±2.00	12,0	±1.20	17,0	-0.85	5,5	±1.30	3,4	±1.00	12,0	±1.20	21,0	±2.00	12,0	±3.50	12,0	±1.20
16,0							24,0	-1,20	8,0	±1.30	4,8	±1.00	16,0	±1.60						

Dim	head "L" cylinder head				head "M" countersunk washer				head "N" supersenkfix head											
	Ødk		k		Ødw=Ødk		Ød5		Ød6		hw		Ødk		Ød4		k		s	
4,0																				
4,5																				
5,0																				
6,0	8,15	±0.40	4,7	±0.80	22,0	±2.00	8,5	±2.00	13,5	±1.50	4,5	±1.00	12,0	±0.60	6,0	±0.30	1,4	±1.00	1,4	±0.30
7,0	9,2	±0.46	6,0	±0.90	25,0	±2.00	9,0	±2.00	16,0	±1.60	5,5	±1.00	13,0	±0.65	8,0	±0.40	1,8	±1.00	1,8	±0.30
8,0	10,2	±0.51	7,5	±1.00	28,0	±2.00	10,0	±2.00	17,5	±2.00	5,5	±1.00								
10,0	13,4	±0.67	8,0	±1.00	35,0	±3.00	12,0	±2.00	22,5	±2.20	6,5	±1.50	19,0	±1.50	10,0	±0.50	2,4	±1.00	2,4	±0.30
12,0	14,2	±0.71	10,0	±1.50	42,0	±3.00	14,0	±2.00	25,0	±2.50	7,5	±1.50	24,0	±2.50	13,0	±0.65	3,0	±1.00	3,0	±0.30
16,0													26,0	±2.50	13,0	±0.65	3,0	±1.00	3,0	±0.30

 <p>Schmid screws schrauben hainfeld</p>	<p>Annex 1 of European Technical Assessment ETA-12/0373 of 29.12.2025</p>
<p>Screw head geometry</p>	

NOTE: head "M 45° round" can alternatively be of cylindrical shape with dw

Dim	head "M 45° round" inclined washer									head "M 45° oval" inclined washer														
	Ødw=Ødk		Ød5		Ød6		Ød7		h	Ødw=Ødk		b	hw		L	Ød5		Ød6		h				
4,0																								
4,5																								
5,0																								
6,0	20,0	±2.00	7,0	±1.00	12,0	±1.20	13,0	±1.30	1,9	±0.50	30,0	±3.00	17,0	±1.70	13,5	±1.40	22,7	±2.70	7,0	±1.00	14,5	±1.50	2,7	±0.50
7,0																								
8,0	25,0	±2.50	9,0	±1.00	15,0	±1.50	16,0	±1.60	1,9	±0.50	39,0	±3.90	24,0	±2.40	16,0	±1.60	31,7	±3.20	9,0	±1.00	19,0	±1.90	3,7	±0.50
10,0	32,0	±3.20	11,5	±1.50	19,0	±1.90	20,0	±2.00	2,4	±0.50	52,0	±5.20	29,0	±2.90	21,4	±2.20	43,7	±4.40	11,5	±1.50	24,0	±2.40	4,7	±0.50
12,0	36,0	±3.60	13,5	±1.50	21,0	±2.10	23,0	±2.30	2,4	±0.50	59,0	±5.90	30,0	±3.00	23,5	±2.40	49,7	±5.00	13,5	±1.50	26,0	±2.60	5,6	±0.50
16,0																								

Dim	head "N" supersenkfix head						head "O" flat head					
	Ødk		Ød4		k		s		Ødk		k	
4,0												
4,5												
5,0	12,0	±0.60	6,0	±0.30	1,4	±1.00	1,4	±0.30				
6,0	13,0	±0.65	8,0	±0.40	1,8	±1.00	1,8	±0.30				
7,0									13,0	±0.65	2,5	±0.50
8,0	19,0	±1.50	10,0	±0.50	2,4	±1.00	2,4	±0.30	16,0	±0.80	3,0	±0.60
10,0	24,0	±2.50	13,0	±0.65	3,0	±1.00	3,0	±0.30				
12,0	26,0	±2.50	13,0	±0.65	3,0	±1.00	3,0	±0.30				
16,0									25,0	±2.00	8,0	±1.00

Dim	head "P" hexagon head with washer						head "R" hexagon head with large washer						head "S" round pan head with thick shank												
	Ødk		k		w		SW		Ødk		k		w		SW		Ødk		k		s		Ød4		
4,0																									
4,5																									
5,0																		7,5	±0.50	3,0	±0.50	3,2	±0.50	4,7	±0.50
5,5																									
6,0																									
7,5	13,0	±0.65	5,0	±1.30	1,3	±0.20	10	-0,50	18,0	±0.90	5,0	±1.30	1,3	±0.20	10	-0,50									
8,0									19,0	±0.95	5,3	±1.30	1,3	±0.20	13	-0,65									
9,5	16,0	±0.80	7,0	±1.30	1,5	±0.30	13	-0,65	21,0	±1.05	7,0	±1.30	1,5	±0.30	13	-0,65									
10,0	19,0	±0.95	5,3	±1.30	1,3	±0.20	13	-0,65																	
12,0																									

Dim	head "T" countersunk head 60-90°				head "U" head with thread						head "V" trumpet head			
	Ødk		k		SW=Ødk		k		w	dg	Ødk		k	
4.0	6.8	±0.40	3.3	±0.60										
4.5											8.5	±0.70	4.0	±0.40
5.0											11.5	±0.80	4.5	±0.45
5.5	7.5	±0.50	4.0	±0.80							12.5	±0.90	5.0	±0.50
6.0														
7.5	10.0	±0.50	5.0	±1.00										
8.0	12.0	±0.60	4.0	±0.80										
9.5														
10.0	14.0	±0.70	8.0	±1.60	13	-0.65	8.0	±1.80	4.0	±1.00	M10			
12.0	16.0	±0.80	9.3	±1.80	17	-0.85	15.0	±2.00	4.5	±1.50	M12			
16.0					22	-1.10	16.0	±1.30	6.0	±2.00	M16			

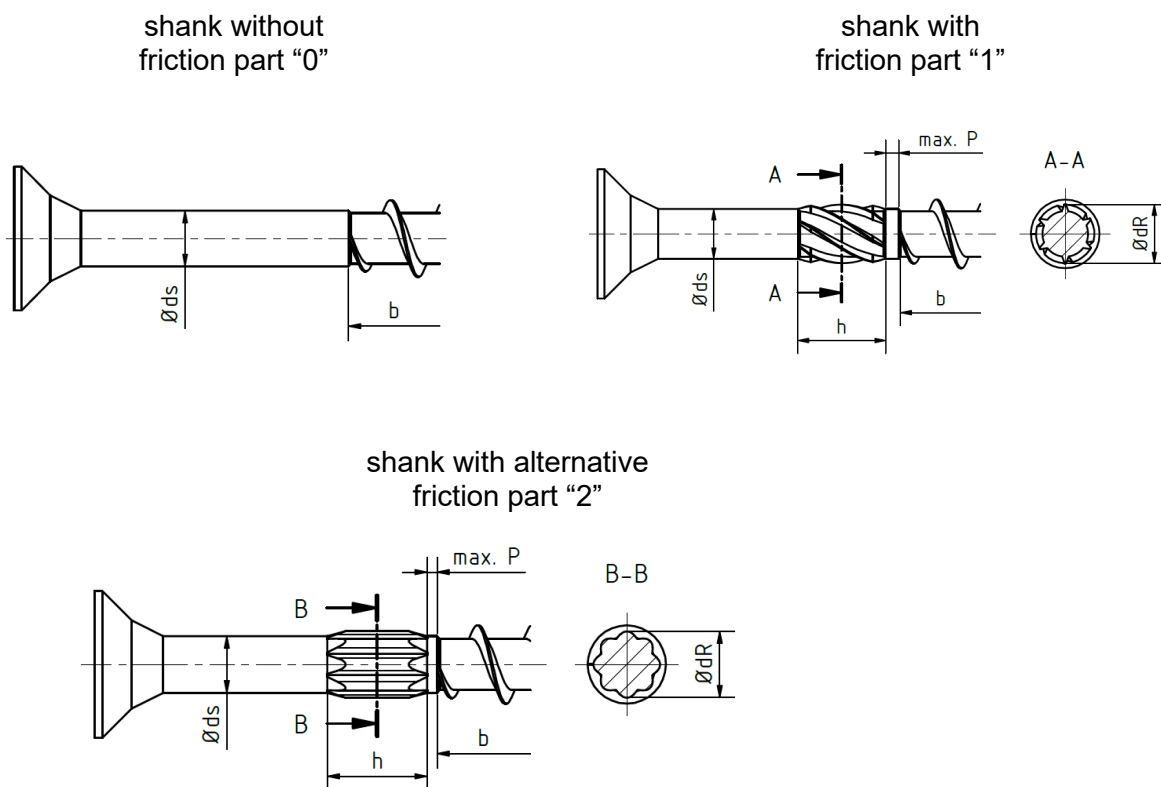
Schmid screws



Screw head geometry

Annex 1

of European Technical Assessment
ETA-12/0373 of 29.12.2025



Number of flanks: 5-8

Dim	$\varnothing ds$	alternativ $\varnothing ds$		friction part "1"						friction part "2"		
				$\varnothing dR$		h	alternativ h		$\varnothing dR$		alternativ $\varnothing dR$	h
4,0	2,8 ±0.14			3,2 ±0.30	6,2 ±1.00	3,4 ±1.00			3,1 ±0.30			6,2 ±1.00
4,5	3,2 ±0.16			3,6 ±0.30	8,2 ±1.00	3,8 ±1.00			3,5 ±0.30			8,2 ±1.00
5,0	3,6 ±0.18			4,1 ±0.40	8,2 ±1.00	4,2 ±1.00			3,9 ±0.40			8,2 ±1.00
6,0	4,3 ±0.22	4,9 ±0.25		5,0 ±0.50	10,2 ±1.00	5,0 ±1.00			4,7 ±0.50	5,3 ±0.50		10,2 ±1.00
7,0	5,0 ±0.25			6,0 ±0.60	10,2 ±1.00				5,4 ±0.50			10,2 ±1.00
8,0	5,9 ±0.29	6,4 ±0.32		6,8 ±0.60	10,2 ±1.00				6,2 ±0.60	7,0 ±0.70		10,2 ±1.00
10,0	7,1 ±0.35	8,0 ±0.40		8,3 ±0.80	10,2 ±1.00				7,7 ±0.80	8,6 ±0.90		10,2 ±1.00
12,0	8,2 ±0.41	9,6 ±0.48		9,7 ±0.90	14,2 ±1.00				9,0 ±0.90	10,4 ±1.00		14,2 ±1.00
16,0	11,5 ±0.58			13,3 ±1.30	18,2 ±1.00				12,3 ±1.30			18,2 ±1.00

Schmid screws

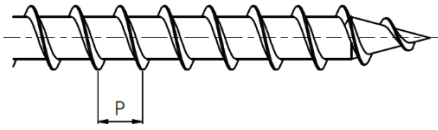


Annex 2

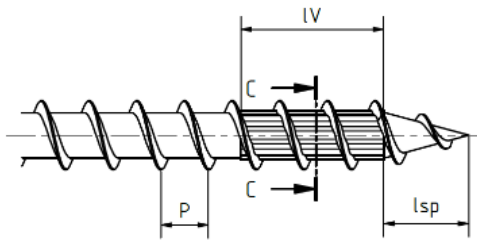
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ETA-12/0373 of 29.12.2025

Shank and compressor geometry

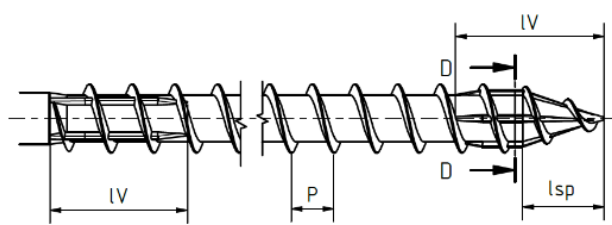
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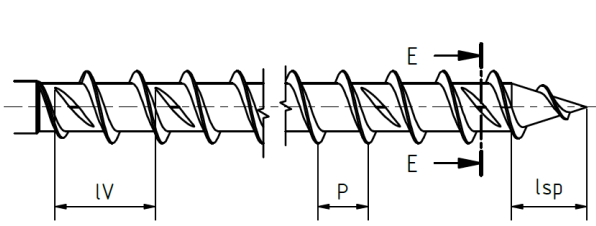
without compressor "0"



with compressor "1"



with alternative compressor "2"



with alternative compressor "3"

Dim	dV		alternativ dV	
4,0	2,9	±0.29		
4,5	3,2	±0.32		
5,0	3,7	±0.37		
6,0	4,4	±0.43	4,9	±0.49
7,0	5,0	±0.50		
8,0	6,0	±0.60	6,4	±0.64
10,0	7,1	±0.72	8,0	±0.80
12,0	7,9	±0.80	9,6	±0.96
16,0	11,8	±1.20		

number of flanks: 4-8
 IV = 2P to 4P

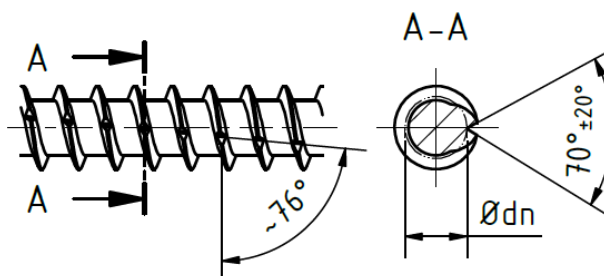
thread types according to Annex 3
 lsp (lp) according to Annex 4



Annex 2
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Shank and compressor geometry

thread with cutting groove "1" (without cutting groove "0")



Dim	Ød		thread "A" single thread			thread "B" coarse thread			thread "C" double thread					
			Ødi	P		Ødi	P		Ødi	P				
4,0	4,0	±0.20	2,55	±0.15	1,8	±0.18	2,50	±0.15	2,2	±0.22	2,50	±0.15	3,4	±0.34
4,5	4,5	±0.22	2,75	±0.15	2,0	±0.20	2,70	±0.15	2,4	±0.24	2,75	±0.15	3,8	±0.38
5,0	5,0	±0.25	3,15	±0.16	2,2	±0.22	3,25	±0.17	2,7	±0.27	3,05	±0.16	4,2	±0.42
6,0	6,0	±0.30	3,80	±0.19	2,6	±0.26	3,95	±0.20	3,6	±0.36	3,75	±0.19	5,0	±0.50
7,0	7,0	±0.35	4,35	±0.22	3,3	±0.33	4,40	±0.22	4,6	±0.46	4,30	±0.22	6,4	±0.64
8,0	8,0	±0.40	5,10	±0.26	3,8	±0.38	5,30	±0.26	5,6	±0.56	5,20	±0.26	7,8	±0.78
10,0	10,0	±0.60	6,30	±0.31	4,6	±0.46	6,20	±0.50	6,6	±0.66	6,10	±0.31	9,7	±0.97
12,0	12,0	±0.70	7,05	±0.35	6,0	±0.60	6,90	±0.60	6,6	±0.66	6,80	±0.34	13,4	±1.34
16,0	15,5	±0.80	10,70	±0.54	8,0	±0.80	10,70	±0.54	9,0	±0.90				

Dim	thread "H" HiLo thread							thread "E" ("E1", "E2") hardwood and ductile thread				cutting groove		
	Ødi	alternativ Ødi	Ød3	P			Ødi	P			Ødn			
4,0	2,45	±0.15		3,3	±0.16	3,4	±0.34	3,00	±0.15	2,0	±0.20	3,7	±0.37	
4,5	2,75	±0.15		3,7	±0.18	3,8	±0.38	3,40	±0.17	2,2	±0.22	4,1	±0.41	
5,0	3,25	±0.16		4,1	±0.20	4,2	±0.42	3,80	±0.19	2,5	±0.25	4,5	±0.45	
6,0	4,00	±0.20		5,0	±0.25	5,0	±0.50	4,50	±0.23	3,0	±0.30	5,4	±0.54	
7,0	4,40	±0.22		5,4	±0.27	5,4	±0.54	5,30	±0.27	3,5	±0.35	6,3	±0.63	
8,0	5,35	±0.28		6,8	±0.34	6,7	±0.67	6,10	±0.31	4,0	±0.40	7,2	±0.72	
10,0	6,20	±0.31	6,80	±0.34	7,9	±0.40	7,7	±0.77	7,30	±0.37	5,0	±0.50	8,6	±0.86
12,0	7,10	±0.36	7,80	±0.39	9,1	±0.46	8,7	±0.87	8,40	±0.42	6,0	±0.60	9,6	±0.96
16,0								10,70	±0.54	8,0	±0.80	13,0	±1.30	

Ød...similar for all threads

Schmid screws

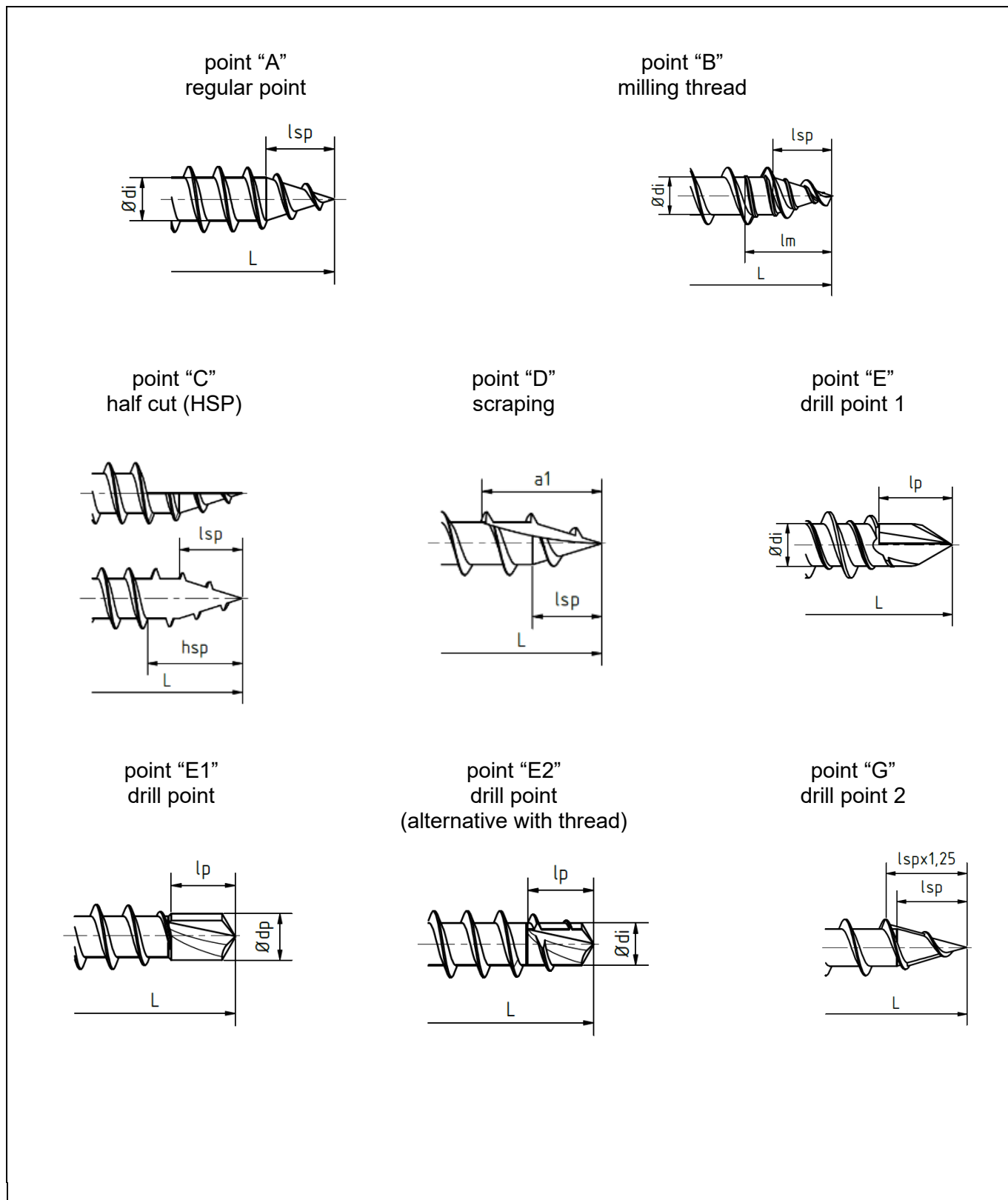



Annex 3

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ETA-12/0373 of 29.12.2025

Thread and cutting groove geometry

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<p style="text-align: center;">Schmid screws</p> 	<p style="text-align: center;">Annex 4 of European Technical Assessment ETA-12/0373 of 29.12.2025</p>
<p style="text-align: center;">Point geometry</p>	

Dim	lsp		hsp		a1		lp		Ødp	
4,0	4,6	±1.50	5,4	±2.00	8,5	±2.00	3,3	±1.00	2,8	±0.28
4,5	5,0	±1.60	6,0	±2.00	9,0	±2.00	3,9	±1.00	3,1	±0.31
5,0	6,0	±1.70	7,0	±2.00	10,5	±2.00	4,5	±1.50	3,4	±0.34
6,0	7,3	±1.90	8,5	±2.00	12,5	±2.50	6,0	±2.00	4,1	±0.41
7,0	7,0	±2.00	9,5	±2.00	14,3	±2.50	6,0	±2.50	5,0	±0.50
8,0	8,2	±2.10	11,0	±2.50	16,5	±3.00	6,0	±3.00	6,0	±0.60
10,0	10,1	±2.30	13,0	±3.00	19,5	±3.00	6,0	±3.00	7,2	±0.72
12,0	11,2	±2.60	15,0	±3.00	22,5	±3.00	6,0	±3.00	8,3	±0.83
16,0	15,0	±3.50	16,0	±3.00	23,5	±3.00	6,0	±3.00	11,5	±1.15

lsp (lp) = similar for all points
 P and Ødi according to Annex 3



Point geometry

Annex 4

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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A.6 Load bearing capacity of Schmid screws

The characteristic load bearing capacities in Tables A6.1 to A6.4 are given for timber of strength class C24 according to EN 338 ($\rho_{k,ref} = 350 \text{ kg/m}^3$) unless specified otherwise in the following.

If relevant, the design block shear failure resistance of a timber member has to be proven.

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<p style="text-align: center;">Schmid screws</p>  <p style="text-align: center;">schrauben hainfeld</p>	<p style="text-align: center;">Annex 6</p> <p style="text-align: center;">of European Technical Assessment ETA-12/0373 of 29.12.2025</p>
<p style="text-align: center;">Characteristic data of the screws</p>	

Table A6.1: Characteristic load bearing capacities of Schmid screws RAPID fullthread (FT); screw diameter 6 to 16 mm

Product characteristic ¹⁾				Screw diameter ²⁾				
				6	8	10	12	16
Max. length	carbon steel	l_{max}	mm	220	1000	1000	1000	500 ⁵⁾
	stainless steel			-	300	510	-	-
Characteristic tensile strength	carbon steel	$f_{tens,k}$	kN	12.5	24.1	40.0	46.7 45.0 ⁴⁾	88.6
	stainless steel			-	13.5	18.5	-	-
Characteristic yield moment	carbon steel	$M_{y,k}$	Nm	10.0	20.3	36.7	48.5	112.9
	stainless steel			-	- ⁶⁾	- ⁶⁾	-	-
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)		$f_{ax,k,90^\circ}$	N/mm ²	13.5	13.1	12.5	11.2	11.0
Characteristic yield strength		$f_{y,k}$	N/mm ²	950 (carbon steel) 500 (stainless steel)				
Characteristic torsional strength	carbon steel	$f_{tor,k}$	Nm	10.5	25.8	55.0	73.0	194.7
	stainless steel			-	17.5	27.0	-	-
Ratio characteristic torsional strength to mean insertion moment	carbon steel $\rho_{k,ref} = 450 \text{ kg/m}^3$	$f_{tor,k} / R_{tor,m}$	-	≥ 1.5	≥ 1.5	≥ 1.5	≥ 1.5	-
	$\rho_{k,ref} = 480 \text{ kg/m}^3$			-	-	-	-	≥ 1.5
	stainless steel $\rho_{k,ref} = 480 \text{ kg/m}^3$ $\rho_{k,ref} = 534 \text{ kg/m}^3$ ³⁾			-	≥ 1.5	≥ 1.5	-	-
Slip modulus		K_{ser}	N/mm	see A.6.1.7 and A.6.2.4				

¹⁾ Product characteristic group D (6 mm) and E according to ETA-12/0373 of 03.11.2017.

²⁾ For intermediate screw diameters the conservative value of the next screw diameter may be used.

³⁾ Max. screw length is 440 mm.

⁴⁾ RAPID T-Lift with full thread.

⁵⁾ Max. length without predrilling. If predrilling with a diameter 11 mm is applied, l_{max} can be increased up to 1000 mm.

⁶⁾ Calculation is possible according to Eurocode 5, Equation (8.14) for round cross section. ($d = d_i$, $f_u = 600 \text{ N/mm}^2$).



Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Characteristic data of the screws

**Table A6.2: Characteristic load bearing capacities of Schmid screws RAPID partial thread;
screw diameter 4 to 12 mm**

Product characteristic ¹⁾				Screw diameter ²⁾						
				4	4.5	5	6	8	10	12
Max. length	carbon steel	l_{max}	mm	70	80	120	300	600 ⁵⁾	600 ⁵⁾	600 ⁵⁾
	stainless steel			-	-	-	-	440	450	-
Characteristic tensile strength	carbon steel	$f_{tens,k}$	kN	5.0	7.0	8.8	13.1	23.3	35.0	42.0
	stainless steel			-	-	-	-	13.5	18.5	-
Characteristic yield moment	carbon steel	$M_{y,k}$	Nm	3.1	4.2	5.9	10.7	22.6	33.6	46.9
	stainless steel			-	-	-	-	- ⁶⁾	- ⁶⁾	-
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)		$f_{ax,k,90^\circ}$	N/mm ²	14.3	13.3	13.6	13.0	10.9	11.0	8.9 ³⁾ 11.2 ⁴⁾
Characteristic yield strength		$f_{y,k}$	N/mm ²	900 (carbon steel) 500 (stainless steel)						
Characteristic torsional strength	carbon steel	$f_{tor,k}$	Nm	3.5	4.9	6.6	10.9	28.0	52.5	59.6
	stainless steel			-	-	-	-	17.5	27.0	-
Ratio characteristic torsional strength to mean insertion moment	carbon steel $\rho_{k,ref} = 450 \text{ kg/m}^3$	$f_{tor,k} / R_{tor,m}$	-	≥ 1.5						
	stainless steel $\rho_{k,ref} = 480 \text{ kg/m}^3$			-	-	-	-	≥ 1.5	-	
Slip modulus		K_{ser}	N/mm	see A.6.1.7 and A.6.2.4						

¹⁾ Product characteristic group C according to ETA-12/0373 of 03.11.2017.

²⁾ For intermediate screw diameters the conservative value of the next screw diameter may be used.

³⁾ Single thread, HiLo thread, double thread.

⁴⁾ Single thread and compressor.

⁵⁾ $l > 500 \text{ mm}$ for screws with friction part, only.

⁶⁾ Calculation is possible according to Eurocode 5, Equation (8.14) for round cross section. ($d = d_i, f_u = 600 \text{ N/mm}^2$).



Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Characteristic data of the screws

Table A6.3: Characteristic load bearing capacities of Schmid screws StarDrive GPR, StarDrive and SP; screw diameter 4 to 6 mm

Product characteristic ¹⁾			Screw diameter ²⁾			
			4	4.5	5	6
Max. length	l_{max}	mm	70	80	120	300
Characteristic tensile strength	$f_{tens,k}$	kN	5.0	5.8	8.5	12.4
Characteristic yield moment	$M_{y,k}$	Nm	3.2	4.9	6.5	10.1
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	$f_{ax,k,90^\circ}$	N/mm ²	14.8	13.8	12.8	12.1 ³⁾ 13.5 ⁴⁾
Characteristic withdrawal parameter in cement bonded particle boards acc. to EN 13986 in lateral surface and narrow side	$f_{ax,k,lat}$	N/mm ²	20.3	19.7	19.2	18.0
	$f_{ax,k,narr}$		24.3	22.4	20.5	16.6
Characteristic yield strength	$f_{y,k}$	N/mm ²	900			
Characteristic torsional strength	$f_{tor,k}$	Nm	3.0	4.2	6.2	9.5
Ratio characteristic torsional strength to mean insertion moment ($\rho_{k,ref} = 450 \text{ kg/m}^3$)	$f_{tor,k} / R_{tor,m}$	-	≥ 1.5			
Slip modulus	K_{ser}	N/mm	see A.6.1.7 and A.6.2.4			

¹⁾ Minimum of product characteristic group A and B according to ETA-12/0373 of 03.11.2017.

²⁾ For intermediate screw diameters the conservative value of the next screw diameter may be used.

³⁾ Single thread.

⁴⁾ Coarse thread.



Characteristic data of the screws

Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table A6.3 continued: Characteristic load bearing capacities of Schmid screws StarDrive GPR, StarDrive, SP, RAPID® Top-2-Roof and RAPID® EG; screw diameter 7 to 12 mm

Product characteristic ¹⁾				Screw diameter ²⁾			
				7	8	10	12
Max. length	carbon steel	l_{max}	mm	300	600 ⁵⁾	600 ⁵⁾	600 ⁵⁾
	stainless steel			-	240	450	-
Characteristic tensile strength	carbon steel	$f_{tens,k}$	kN	17.1	22.0	32.0	42.0
	stainless steel			-	13.5	18.5	-
Characteristic yield moment	carbon steel	$M_{y,k}$	Nm	12.6	21.0	33.0	46.9
	stainless steel			-	- ⁶⁾	- ⁶⁾	-
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)		$f_{ax,k,90^\circ}$	N/mm ²	11.5 ³⁾	10.7 ³⁾	9.5 ³⁾	8.9 ³⁾
				-	13.1 ⁴⁾	12.5 ⁴⁾	11.2 ⁴⁾
Characteristic yield strength		$f_{y,k}$	N/mm ²	900 (carbon steel) 500 (stainless steel)			
Characteristic torsional strength	carbon steel	$f_{tor,k}$	Nm	16.1	24.8	44.8	59.6
	stainless steel			-	17.5	27.0	-
Ratio characteristic torsional strength to mean insertion moment	carbon steel $\rho_{k,ref} = 450 \text{ kg/m}^3$	$f_{tor,k} / R_{tor,m}$	-	≥ 1.5			
	stainless steel $\rho_{k,ref} = 480 \text{ kg/m}^3$			-	≥ 1.5	≥ 1.5	-
Slip modulus		K_{ser}	N/mm	see A.6.1.7 and A.6.2.4			

¹⁾ Minimum of product characteristic group A and B according to ETA-12/0373 of 03.11.2017.

²⁾ For intermediate screw diameters the conservative value of the next screw diameter may be used.

³⁾ Single thread.

⁴⁾ Coarse thread.

⁵⁾ $l > 500 \text{ mm}$ for screws with friction part, only.

⁶⁾ Calculation is possible according to Eurocode 5, Equation (8.14) for round cross section. ($d = d_i$, $f_u = 600 \text{ N/mm}^2$).

Schmid screws



Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Characteristic data of the screws

Table A6.4: Characteristic load bearing capacities of Schmid screws RAPID®; screw diameter 8 mm and 12 mm

Product characteristic			Hardwood ¹⁾	Ductile
			Screw diameter	
			8	12
Max. length	l_{max}	mm	400 ²⁾	510
Characteristic tensile strength	$f_{tens,k}$	kN	32.8	55.7 ³⁾ 61.2 ⁴⁾
Characteristic yield moment	$M_{y,k}$	Nm	42.8	77.3
Characteristic withdrawal parameter angle screw-axis to grain: 90° and 0° $\rho_{k,ref, BE} = 625 \text{ kg/m}^3$ $\rho_{k,ref, LVL-BE} = 740 \text{ kg/m}^3$ $\rho_{k,ref, Fi} = 350 \text{ kg/m}^3$	$f_{ax,k}$	N/mm ²	$f_{ax,k, BE, 90^\circ} = 38.7$ $f_{ax,k, LVL-BE, 90^\circ} = 50.1$ $f_{ax,k, Fi, 90^\circ} = 13.1$	$f_{ax,k, Fi, 90^\circ} = 11.8$
			-	$f_{ax,k, Fi, 0^\circ} = 7.0$
Characteristic yield strength	$f_{y,k}$	N/mm ²	950	950
Characteristic torsional strength	$f_{tor,k}$	Nm	39.5	100.5
Ratio characteristic torsional strength to mean insertion moment ($\rho_{k,ref} = 740 \text{ kg/m}^3$)	$f_{tor,k} / R_{tor,m}$	-	≥ 1.5	≥ 1.5
Characteristic head pull-through parameter Head diameter $d_k = 15 \text{ mm}$ (90° head) $\rho_{k,ref} = 620 \text{ kg/m}^3$	$f_{head,k}$	N/mm ²	$f_{head,k, Bu} = 40.4$	-
Characteristic head pull-through parameter Head diameter $d_k = 22 \text{ mm}$ (180° head) $\rho_{k,ref, BE} = 620 \text{ kg/m}^3$ $\rho_{k,ref, LVL-BE} = 730 \text{ kg/m}^3$	$f_{head,k}$	N/mm ²	$f_{head,k, Bu} = 53.8$ $f_{head,k, FSH-Bu} = 60.8$	-
Slip modulus	K_{ser}	N/mm	see A.6.1.7 and A.6.2.4	

¹⁾ Product characteristic group F according to ETA-12/0373 of 03.11.2017.

²⁾ If the screw is inserted in other products than laminated veneer lumber LVL of beech (BE) or related products of hardwood, the maximum lengths $l_{max} = 600 \text{ mm}$ and $l_{max} = 1000 \text{ mm}$ apply for RAPID Hardwood with partial thread and with full thread respectively.

³⁾ RAPID fullthread with thread E "ductile".

⁴⁾ RAPID fullthread with thread E.

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table A6.5: Minimum spacing, end and edge distances of only axially loaded Schmid screws (except CLT)

Designation		Variant 1	Variant 2
Boundary condition	$a_1 \cdot a_2$	$\geq 25 d^2$	$\geq 21 d^2$
Spacing in a plane parallel to the grain	a_1	$5 d$	$7 d$
Spacing perpendicular to a plane parallel to the grain	a_2	$2.5 d$	$3 d$
Spacing between the crossing screws for a crossed screw couple perpendicular to a plane parallel to the grain	a_{cross}	$1.5 d$	
End distance of the centre of gravity of the threaded part in the timber member	$a_{1,c}$	$5 d$	
Edge distance of the centre of gravity of the threaded part in the timber member	$a_{2,c}$	$4 d$	

Provided that a minimum thickness of the cross laminated timber of $10 d$ as well as a minimum penetration length of the screws of $4 d$ in the wide face or $10 d$ in the narrow face are met, the minimum spacings, end and edge distances given in Table A6.6 apply.

Table A6.6: Minimum spacings, end and edge distances of Schmid screws in cross laminated timber (axially and/or laterally loaded)

	a_1	$a_{3,t}$	$a_{3,c}$	a_2	$a_{4,t}$	$a_{4,c}$
Wide face (see Figure A6.1)	$4 d$	$6 d$	$6 d$	$2.5 d$	$6 d$	$2.5 d$
Narrow face (see Figure A6.1)	$10 d$	$12 d$	$7 d$	$3 d$	$5 d$	$3 d$

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

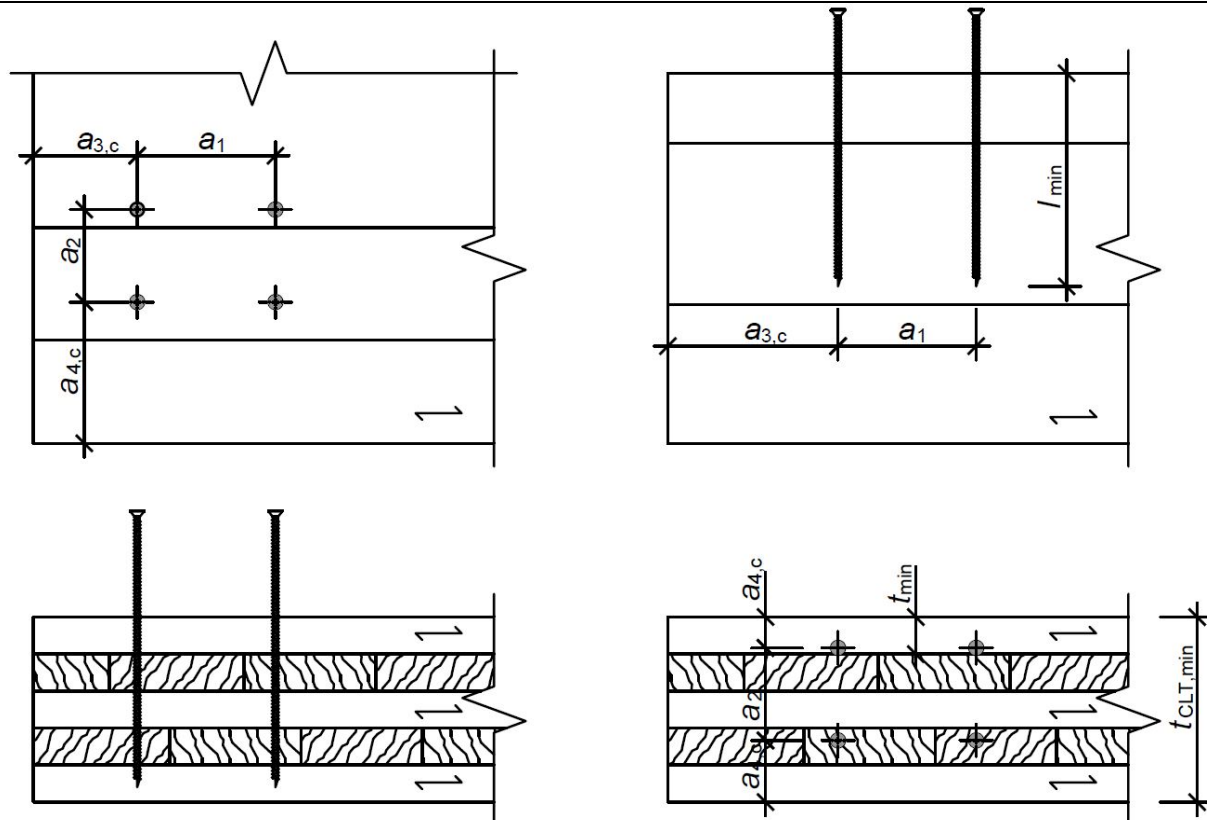


Figure A6.1: Definition of minimum spacings, end and edge distances in the wide face (left) and narrow face (right) of cross laminated timber

Schmid screws

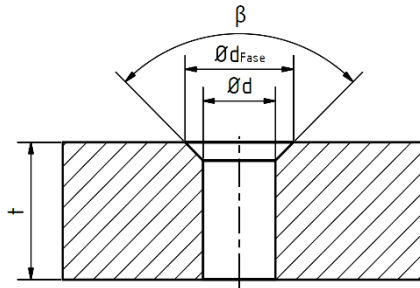


Characteristic data of the screws

Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

For connections between timber and a metal member of steel or aluminium sufficient contact of the screw head must be ensured. This is fulfilled for countersunk heads with countersunk washer as well as heads with a flat bottom side (180° heads e.g. washer head “G”) for 90° drillings. Alternatively, countersunk head screws may be used in 90° countersunk drillings where the diameter of the chamfer is at least 1.5 times the diameter of the drilling, see Figure A.6.2. The diameter d of the drilling must be greater than the diameter of the screw.



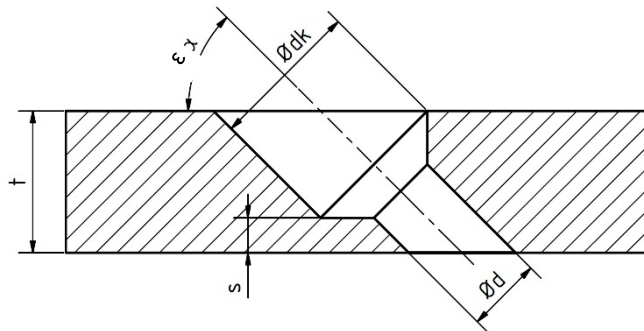
$$d_{Fase} = d \cdot 1.5 \text{ in mm}$$

d = diameter of the drilling in mm

d_{Fase} = diameter of the chamfer in mm

Figure A6.2: Drilling of Schmid screws with countersunk head in metal members

For countersunk head screws used in countersunk drillings of metal members under an angle $30^\circ \leq \epsilon < 90^\circ$ the drilling must be greater than the head diameter d_k and the outer thread diameter d of the screw. Hereby, the minimum thickness s of the steel member underneath the screw head according to Figure A6.3 is required.



$$\epsilon > 45^\circ \quad s \geq 3\text{mm}$$

$$30^\circ \leq \epsilon \leq 45^\circ \quad s \geq 2\text{mm}$$

Figure A6.3: Inclined drilling of Schmid screws with countersunk head in metal members

Alternatively, screws with inclined washers can be used for inclined metal-wood connections.

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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A.6.1.3 Characteristic withdrawal parameter

The characteristic withdrawal parameter for Schmid screws for angles $0^\circ \leq \varepsilon \leq 90^\circ$ between screw-axis and direction of wood-fibre may be calculated as

$$f_{ax,calc,k} = f_{ax,k,90^\circ} \cdot k_{ax} \cdot k_{sys} \cdot \left(\frac{\rho_k}{\rho_{k,ref}} \right)^{k_p}$$

$$k_{ax} = \begin{cases} 1.0 & \text{for } 30^\circ \leq \varepsilon \leq 90^\circ \\ 0.3 \cdot k_{gap} + \frac{\varepsilon}{30^\circ} (1 - 0.3 \cdot k_{gap}) & \text{for } 0^\circ \leq \varepsilon < 30^\circ \end{cases}$$

$$k_{gap} = \begin{cases} 0.9 & \text{for narrow face in CLT} \\ 1.0 & \text{other} \end{cases}$$

$$k_{sys} = \begin{cases} 1.0 & \text{for solid timber} \\ \text{see Table A6.7} & \text{for layered timber} \end{cases}$$

$$k_p = \begin{cases} 1.10 & \text{for softwood and } 15^\circ \leq \varepsilon \leq 90^\circ \\ 1.25 - 0.05 d & \text{for softwood and } 0^\circ \leq \varepsilon < 15^\circ \\ 1.40 & \text{for ring porous hardwood and } 0^\circ \leq \varepsilon \leq 90^\circ \\ 1.70 & \text{for diffuse porous hardwood and } 0^\circ \leq \varepsilon \leq 90^\circ \end{cases}$$

Examples for ring porous hardwoods: chestnut, ash, oak

Examples for diffuse porous hardwoods: poplar, birch, beech

$f_{ax,k,90^\circ}$ characteristic withdrawal parameter according to Tables 6.1 to 6.4 in N/mm²

$\rho_{k,ref}$ reference characteristic density of timber raw material in kg/m³ in which the screw is driven (350 kg/m³ (C24) for Tables A6.1 to A6.3 or according to Table A6.4)

ρ_k characteristic density of timber raw material in kg/m³ in which the screw is driven

ε angle between screw axis and grain direction

k_{sys} system factor according to Table A6.7

n number of screwed layers

Table A6.7: System factor k_{sys} depending on the number of layers n for screw insertion in GLT or CLT

n	1	2	3	4	5	≥ 6
k_{sys}	1.00	1.06	1.10	1.12	1.13	1.15

Schmid screws



Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Characteristic data of the screws

The characteristic withdrawal capacity of Schmid screws in the narrow face of cross laminated timber may be alternatively determined independent of the angle between screw axis and grain direction as

$$F_{ax,Rk} = 20 \cdot d^{0,8} \cdot l_{ef}^{0,9}$$

unless otherwise specified in the technical specification of the cross laminated timber.

A.6.1.4 Characteristic head pull-through capacity for timber

The characteristic head pull-through capacities for timber with a char. density $\rho_{k,ref} = 350 \text{ kg/m}^3$ and for a timber thickness $\geq 20 \text{ mm}$ is given in Table A.6.8 and A.6.9.

For softwood with a deviating density the characteristic head pull-through parameter shall be corrected by the factor

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^{0,8}$$

Where

ρ_k Characteristic density of timber in kg/m^3

For the characteristic withdrawal parameter the correction according to A.6.1.3 applies.

Table A6.8: Characteristic head pull-through capacities of Schmid screws in structural timber for 90° heads; head diameter 8 to 21 mm

Group 1			Head diameter d_k (90° heads) ¹⁾							
Product characteristic			8	9	10	12	14	15	18.5	21
Characteristic head pull-through parameter ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	$f_{head,k}$	N/mm ²	17.1	17.6	14.6	14.6	13.1	12.4	12.2	10.3

¹⁾ Linear interpolation is possible for head diameters in between the stated values

Table A6.9: Characteristic head pull-through capacities of Schmid screws in structural timber for washers and 180° heads; (head) diameter 12.5 to 24 mm

Group 2			Head diameter d_k (180° heads) ¹⁾						
Product characteristic			9	13	14	19	20	22	24
Characteristic head pull-through parameter ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	$f_{head,k}$	N/mm ²	16.0	-	16.7	-	17.6	20.4	-
	$f_{head,k}$ head "N"		-	19.7	-	22.9	23.5	14.6	12.3

¹⁾ Linear interpolation is possible for head diameters in between the stated values



Characteristic data of the screws

Annex 6
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Table A6.9 continued: Characteristic head pull-through capacities of Schmid screws in structural timber for washers and 180° heads; (head) diameter 25 to 42 mm

Group 2			Head diameter d_k (180° heads) ¹⁾			
Product characteristic			25	27	33	42
Characteristic head pull-through parameter ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	$f_{head,k}$	N/mm ²	15.2	14.5	10.0	6.5
	$f_{head,k}$ head "N"		-	-	-	-

¹⁾ Linear interpolation is possible for head diameters in between the stated values

A.6.1.5 Characteristic head pull-through capacity for wood based panels

The characteristic value of the head pull-through parameter for a characteristic density of 380 kg/m³ of the timber and for the following wood based panels

- Plywood according to EN 636 and EN 13986,
- Oriented strand boards, OSB, according to EN 300 and EN 13986,
- Solid wood panels according to EN 13353 and EN 13986,
- Particleboard according to EN 312 and EN 13986,
- Fibreboards according to EN 622-2, EN 622-3 and EN 13986,
- Cement-bonded particle boards according to EN 634-1 and EN 13986

is given in Table A.6.10.

Table A6.10: Characteristic value of the head pull-through parameter in dependence of the thickness of the wood-based panels t_{WBP}

t_{WBP}	$\leq 12 \text{ mm}$	$12 \text{ mm} < t_{WBP} \leq 20 \text{ mm}$	$> 20 \text{ mm}$
$f_{head,k}$	8 N/mm ² *	8 N/mm ²	10 N/mm ²

* limited to 400 N complying with the minimum thicknesses of the wood based panels of 1.2 d, with d as outer thread diameter

For plywood with a minimum of 7 layers and a minimum thickness of 18 mm, the characteristic value of the head pull-through parameter for a characteristic density of 490 kg/m³ is ($d_k \geq 18.8 \text{ mm}$)

$f_{head,k} = 16 \text{ N/mm}^2$

In addition the minimum thicknesses of Table A.6.11 apply.



Characteristic data of the screws

Annex 6
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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Table A6.11 Minimum thicknesses of wood based panels

Wood based panel	Minimum thickness in mm
Plywood	6
Oriented strand board, OSB	8
Solid wood panels	12
Particleboard	8
Fibreboards	6
Cement-bonded particle boards	8

A.6.1.6 Compressive loading for fully threaded screws

The design load carrying capacity for Schmid screws with a full thread for an angle $30^\circ \leq \varepsilon \leq 90^\circ$ between screw-axis and direction of wood-fibre for axial compressive loading is given as

$$F_{ax,Rd} = \min \left(f_{ax,calc,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M}; \kappa_c \cdot \frac{N_{pl,k}}{\gamma_{M1}} \right)$$

with

$f_{ax,calc,k}$ char. withdrawal capacity of the threaded part of the screw according to Clause A.6.1.3 in N/mm²

d outer thread diameter of the screw in mm

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

k_{mod} modification factor for duration of load and moisture content according to EN 1995-1-1

γ_M partial safety factor for connections according to EN 1995-1-1

γ_{M1} partial safety factor according to EN 1993-1-1

$$\kappa_c = \begin{cases} 1.0 & \text{for } \bar{\lambda}_k \leq 0.2 \\ \frac{1.0}{k + \sqrt{k^2 - \bar{\lambda}_k^2}} & \text{for } \bar{\lambda}_k > 0.2 \end{cases}$$

$$k = 0.5 \left[1 + 0.49 \cdot (\bar{\lambda}_k - 0.2) + \bar{\lambda}_k^2 \right]$$

Schmid screws



Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Characteristic data of the screws

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The related slenderness ratio

$$\bar{\lambda}_k = \sqrt{\frac{N_{pl,k}}{N_{ki,k}}}$$

with

$N_{pl,k}$ characteristic value of the plastic normal force load bearing capacity of the net cross-section, related to the inner thread diameter d_i (or shank diameter d_s if relevant) of the screws in N

$$N_{pl,k} = \frac{\pi \cdot d_i^2}{4} \cdot f_{y,k}$$

$f_{y,k}$ characteristic yield strength of Schmid screws in N/mm² according to Table A6.1 to A6.4

$N_{ki,k}$ characteristic ideal elastic buckling load in N

$$N_{ki,k} = \sqrt{c_h \cdot E_s \cdot I_s}$$

c_h elastic foundation of the Schmid screws in the wooden member in N/mm²

$$c_h = (0.19 + 0.012 \cdot d) \cdot \rho_k \cdot \left(\frac{90 + \alpha}{180}\right)$$

E_s modulus of elasticity of Schmid screws in N/mm², $E_s = 210\,000$ N/mm²

I_s area moment of inertia of Schmid screws in mm⁴

ρ_k characteristic density of the wood-based member in kg/m³

$$I_s = \frac{\pi \cdot d_i^4}{64}$$

A.6.1.7 Slip modulus for axially loaded screws

The total axial slip modulus $K_{ser,ax,tot}$ for a single Schmid screw for the serviceability limit state shall be determined for timber-to-timber or wood-based product-to-timber connection based on a serial spring model. The model accounts for the slip modulus of each shear plane and, if relevant, the slip modulus of the unthreaded shank, as exemplified for a partially threaded screw in Figure A6.4. For partially threaded screws, it must be ensured that the entire threaded section is located within a single wood member.

$$\frac{1}{K_{ser,ax,tot}} = \frac{1}{K_{ser,ax}} + \frac{1}{K_{ser,shank}} + \frac{1}{K_{ser,head}} \quad \text{Schmid partial thread screw}$$

$$\frac{1}{K_{ser,ax,tot}} = \frac{1}{K_{ser,ax,1}} + \frac{1}{K_{ser,ax,2}} \quad \text{Schmid fullthread screw}$$

Schmid screws



Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Characteristic data of the screws

with

$K_{ser,ax,tot}$ total axial slip modulus of a connection with a single Schmid screw for the serviceability limit state, in N/mm

$K_{ser,ax,i}$ axial slip modulus of the threaded part per cutting surface for the serviceability limit state, in N/mm

$K_{ser,shank}$ slip modulus of the free Schmid screw shank für the serviceability limit state, in N/mm

$$K_{ser,shank} = \frac{E_s \cdot A_s}{l_{shank}}$$

E_s modulus of elasticity of Schmid screws in N/mm², $E_s = 210\,000$ N/mm² (carbon steel)

A_s cross section area of the shank of Schmid screws, in mm²

$$A_s = \frac{d_s^2 \cdot \pi}{4}$$

d_s diameter of the Schmid screw shank, in mm

l_{shank} length of the free Schmid screw shank, in mm

$K_{ser,head}$ slip modulus for head pull-through of Schmid screws for the serviceability limit state, in N/mm

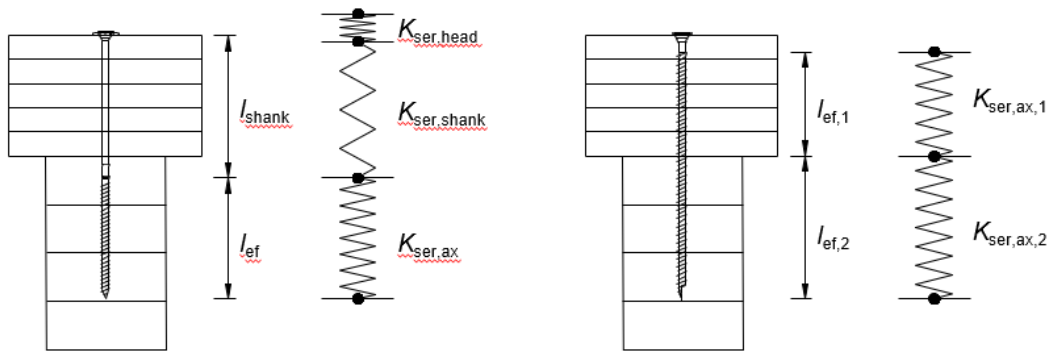


Figure A6.1: serial spring model to determine the total axial slip modulus $K_{ser,ax,tot}$ of a timber-to-timber or wood-based product-to-timber connection; exemplary (left) for a partial thread screw and (right) for a full thread screw

The total axial slip modulus $K_{ser,ax,tot}$ for a single screw for the serviceability limit state shall be determined for a steel-to-timber or steel-to-wood-based product connection based on a serial spring model. The model shall consider the slip modulus for each shear plane and, where applicable, the slip modulus of the unthreaded shank of the screw.

$$\frac{1}{K_{ser,ax,tot}} = \frac{1}{K_{ser,ax}} + \frac{1}{K_{ser,shank}} \quad \text{Schmid partial thread screw}$$

$$\frac{1}{K_{ser,ax,tot}} = \frac{1}{K_{ser,ax}} \quad \text{Schmid fullthread screw}$$

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

The axial slip modulus $K_{ser,ax}$ of the threaded part per cutting surface for the serviceability limit state shall be taken for screws independent of angle ε to the grain as

$$K_{ser,ax} = k_{HA} \cdot d \cdot l_{ef} \text{ in N/mm}$$

with

d outer thread diameter of the screw in mm

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

k_{HA} coefficient depending on the type of wood of the wood-based member according to Table A6.12

Table A6.12: Coefficient k_{HA} depending on the type of wood of the wood-based member

Type of wood	Reference density ρ_m in kg/m ³	Coefficient k_{HA}
softwood	420	25
chestnut	530	48
ash	660	62
poplar	485	34
birch	635	54
beech	740	78
LVL beech*	840	53
* according to EN 14374 or European Technical Assessment		

The coefficients listed in Table A6.12 apply to Schmid screws installed with or without pre-drilling, provided that the pre-drilling diameter does not exceed 75% of the outer thread diameter.

The slip modulus $K_{ser,head}$ for head pull-through for the serviceability limit state shall be taken for Schmid screws for an angle to the grain of $30^\circ \leq \varepsilon \leq 90^\circ$, for solid timber, glued laminated timber, glued solid timber, solid wood panels timber with $\rho_{mean} \leq 580 \text{ kg/m}^3$ and in the side face of cross laminated timber as

$$K_{ser,head} = 0.006 \cdot d_k \cdot \rho_{mean}^{1.48} \text{ in N/mm} \quad \text{for } 180^\circ \text{ heads}$$

$$K_{ser,head} = 0.008 \cdot d_k \cdot \rho_{mean}^{1.39} \text{ in N/mm} \quad \text{for } 90^\circ \text{ heads}$$

with

d_k head diameter of the Schmid screw, in mm

ρ_{mean} mean density of the timber, in kg/m³

Schmid screws



Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Characteristic data of the screws

The slip modulus $K_{ser,head}$ for head pull-through for the serviceability limit state shall be taken for Schmid screws in the side face of laminated veneer lumber of Douglas Fir (LVL of DF) depending as given in Table A6.13.

Table A.6.13: slip modulus for head pull-through $K_{ser,head}$ for the serviceability limit state for laminated veneer lumber of Douglas Fir (LVL of DF)

screw diameter	head type	head diameter	slip modulus	head type	head diameter	slip modulus
d [mm]		d_k [mm]	$K_{ser,head}$ [N/mm]		d_k [mm]	$K_{ser,head}$ [N/mm]
6	Counter Sunk „A“	12.0	–	washer head „G“	14.0	1470
8	Counter Sunk „A“	15.0	790	washer head „G“	20.0	2080
10	Counter Sunk „A“	18.5	1090	washer head „G“	25.0	2140
12	Counter Sunk „A“	21.0	1220	washer head „G“	–	–

A.6.2 Laterally loaded screws (perpendicular to the screw axis)

A.6.2.1 General

For verification of the load bearing capacity of laterally loaded Schmid screws the failure mechanisms according to EN 1995-1-1 shall be taken into account with unlimited contribution of the rope-effect ($F_{ax,Rk}/4$) i.e. the limitation by the percentage of the Johansen part can be ignored. The minimum thicknesses, spacings and distances according to A.6.2.2 must be taken into account.

NOTES:

- 1) Hereby, the outer thread diameter d is used as effective diameter of the screw in accordance with EN 1995-1-1.
- 2) For steel-timber connections with a ratio of $t/d \geq 1$ with Schmid screws with 180° head the equations for thick steel plate may be applied even without compliance of the maximum tolerance on hole diameters.
- 3) For connections between timber and a steel member where the special head shape of the Schmid screws enables a precise fit into the drilling of the steel member the equations for thick steel plate may be used in case of steel thicknesses $t \geq 1.5$ mm. The height of the flange s must be greater than the thickness of the steel member.
- 4) In the case of a connection with a group of screws loaded perpendicular to the screw axis the effective number of screws is to be taken as for nails according to EN 1995-1-1 if the connection area of the timber is not reinforced according to Clause A.8.2.3.

Schmid screws



Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Characteristic data of the screws

A.6.2.2 Spacing, end and edge distances of the screws and minimum thicknesses

For Schmid screws which are loaded only laterally, the minimum spacing, end and edge distances according to Table A6.14 apply.

Table A6.14: Minimum spacing, end and edge distances of only laterally loaded Schmid screws

Type	Spacing/distances
Predrilled wooden members Schmid screws with drill point or HSP in non-predrilled holes of softwood members	Analogous to pre-drilled nails according to EN 1995-1-1
Non-predrilled wooden members with Schmid screws without drill point	Analogous to non-predrilled nails according to EN 1995-1-1

NOTES:

- 1) For Schmid screws RAPID Hardwood inserted into non-predrilled wooden members of hardwood (strength classes D according to EN 338) or LVL made of beech according to EN 14374 or ETA, the minimum distances apply analogous to non-predrilled nails according to EN 1995-1-1 for a characteristic density of $420 \text{ kg/m}^3 \leq \rho_k \leq 500 \text{ kg/m}^3$.
- 2) For screws with outer thread diameter $d \geq 8 \text{ mm}$ in non-predrilled holes in wood-based members with thickness $t < 5 d$, the minimum distances for loaded and unloaded ends shall be $15 d$.
- 3) Minimum distances from the unloaded edge perpendicular to the grain may be reduced to $3 d$ also for timber thickness $t < 5 d$, if the spacing parallel to the grain and the end distance is at least $25 d$.
- 4) Minimum spacings, end and edge distances of laterally loaded Schmid screws in wide face and narrow face of cross laminated timber are given in Table A6.6.

The minimum thickness for structural members shall be in accordance with Table A6.15.

Table A6.15: Minimum thickness for structural members for laterally loaded Schmid screws $d \leq 12 \text{ mm}$

Screw diameter		< 8	8	10	12
Minimum thickness t for structural members	mm	24	30	40	80

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
ETA-12/0373 of 29.12.2025

A.6.2.3 Characteristic embedment strength

EN 1995-1-1 applies for the embedment strength of Schmid screws in wooden members unless specified otherwise below.

The characteristic embedment strength of Schmid screws installed in wooden members of solid wood, glued laminated timber, glued solid timber, solid wood panels or laminated veneer lumber (made of softwood) may be determined as follows:

$$f_{h,k} = k_{\epsilon} \cdot k_{\beta} \cdot k_{\alpha} \cdot f_{h,k,ref} \text{ in N/mm}^2$$

with

$f_{h,k,ref}$ as reference characteristic embedment strength, for non-predrilled members

$$f_{h,k,ref} = 0.082 \cdot \rho_k \cdot d^{-0.3} \text{ in N/mm}^2$$

and for pre-drilled members

$$f_{h,k,ref} = 0.082 \cdot \rho_k \cdot (1 - 0.01 \cdot d) \text{ in N/mm}^2$$

and

$$k_{\epsilon} = \frac{1}{2.5 \cdot \cos^2 \epsilon + \sin^2 \epsilon}$$

ϵ angle between screw axis and grain direction

$$k_{\beta} = \begin{cases} \frac{1.0}{1.5 \cdot \cos^2 \beta + \sin^2 \beta} & \text{screws inserted in LVL made of softwood} \\ 1.0 & \text{others} \end{cases}$$

β angle between screw axis and the wide face of LVL

$$k_{\alpha} = k_{90} \cdot \cos^2 \alpha + \sin^2 \alpha$$

α angle between load and grain direction

$$k_{90} = \begin{cases} 1.10 & \text{in the member of the head side} \\ 1.20 & \text{in the member of the point side} \end{cases}$$

ρ_k characteristic density of the wooden member in kg/m³

d outer thread diameter of the screw in mm

The Equations above may be applied for Schmid screws within single softwood layers in cross laminated timber, if the single layer is considered as a separate softwood member and the minimum spacing, end and edge distances are observed for the single layer. Hereby, ρ_k is the characteristic density of the cover layer.

The characteristic embedment strength of Schmid screws in the narrow face of cross laminated timber may be determined independent of the angle between screw axis and grain direction as

$$f_{h,k} = 20 \cdot d^{-0.5}$$

unless otherwise specified in the technical specification of the cross laminated timber.

Schmid screws



Characteristic data of the screws

Annex 6

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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A.6.2.4 Slip modulus for screws loaded perpendicular to the screw axis

The slip modulus $K_{ser,v}$ per shear joint for the serviceability limit state shall be taken for screws independent of angle ε to the grain as

$$K_{ser,v} = k_v \cdot d^{1.7} \text{ in N/mm}$$

with

k_v coefficient depending on the direction of load on the type of the connection and the predrilling according to Table A6.16

Table A6.16: Coefficient k_v depending on the direction of load on the type of the connection and the predrilling

Direction of load	Non-predrilled		Pre-drilled	
	Wood-wood	Metal-wood	Wood-wood	Metal-wood
Parallel to the direction of the grain $K_{ser,v,0}$	32	64	$1.6 \cdot \rho_k^{0.5}$	$3.2 \cdot \rho_k^{0.5}$
Perpendicular to the direction of the grain $K_{ser,v,90}$	16	32	$0.8 \cdot \rho_k^{0.5}$	$1.6 \cdot \rho_k^{0.5}$

Linear interpolation is possible for arbitrary angles between load direction and angle of the grain.

For the connection of two wooden members with different characteristic densities ρ_k for the determination of k_v may be determined by

$$\rho_k = \sqrt{\rho_{k,1} \cdot \rho_{k,2}}$$

with

$\rho_{k,1}$ characteristic density of wooden member 1 in kg/m^3

$\rho_{k,2}$ characteristic density of wooden member 2 in kg/m^3



Characteristic data of the screws

Annex 6
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

A.7 Schmid screws in selected steel-wood and wood-wood connections

A.7.1 Steel-wood connections

Design for equally tightened screws (torque controlled) in a steel member under an angle $30^\circ \leq \varepsilon \leq 60^\circ$ (see Figure A7.1) may follow:

$$F_{\alpha,Rd} = F_{ax,Rd} \cdot (\cos \varepsilon + \mu \cdot \sin \varepsilon)$$

with

$$F_{ax,Rd} = n_{ef} \cdot \min \left\{ \begin{array}{l} f_{ax,calc,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{f_{tens,k}}{\gamma_{M2}} \end{array} \right.$$

where:

- $F_{\alpha,Rd}$ load bearing capacity of inclined screws in N
- n_{ef} effective number of screws according to A.6.1.1
- k_{mod} modification factor for duration of load and moisture content according to EN 1995-1-1
- γ_M partial safety factor for connections according to EN 1995-1-1
- γ_{M2} partial safety factor according to EN 1993-1-1
- ε angle between screw axis and grain direction
- μ friction coefficient between steel member and timber surface, $\mu = 0.3$

NOTES:

- 1) The real thread length of the screw is to be considered.
- 2) Occurring tensile stresses perpendicular to grain have to be verified for $h_{ef} : h < 0.7$. A related reinforcement with fully threaded Schmid screws is shown in Figure A7.1.
- 3) For arrangement of the Schmid screws perpendicular to the grain verification shall follow Clause A.6.2.
- 4) For combined loading (more than one loading component to be transferred by the screwed joint) the regulations according to A6.3 shall be considered.

Figure A7.1 shows an example of metal-to-timber connection with inclined Schmid Screws located in the end-grain or in side-grain.

Schmid screws



Annex 7

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Bending beams under flexible jointing

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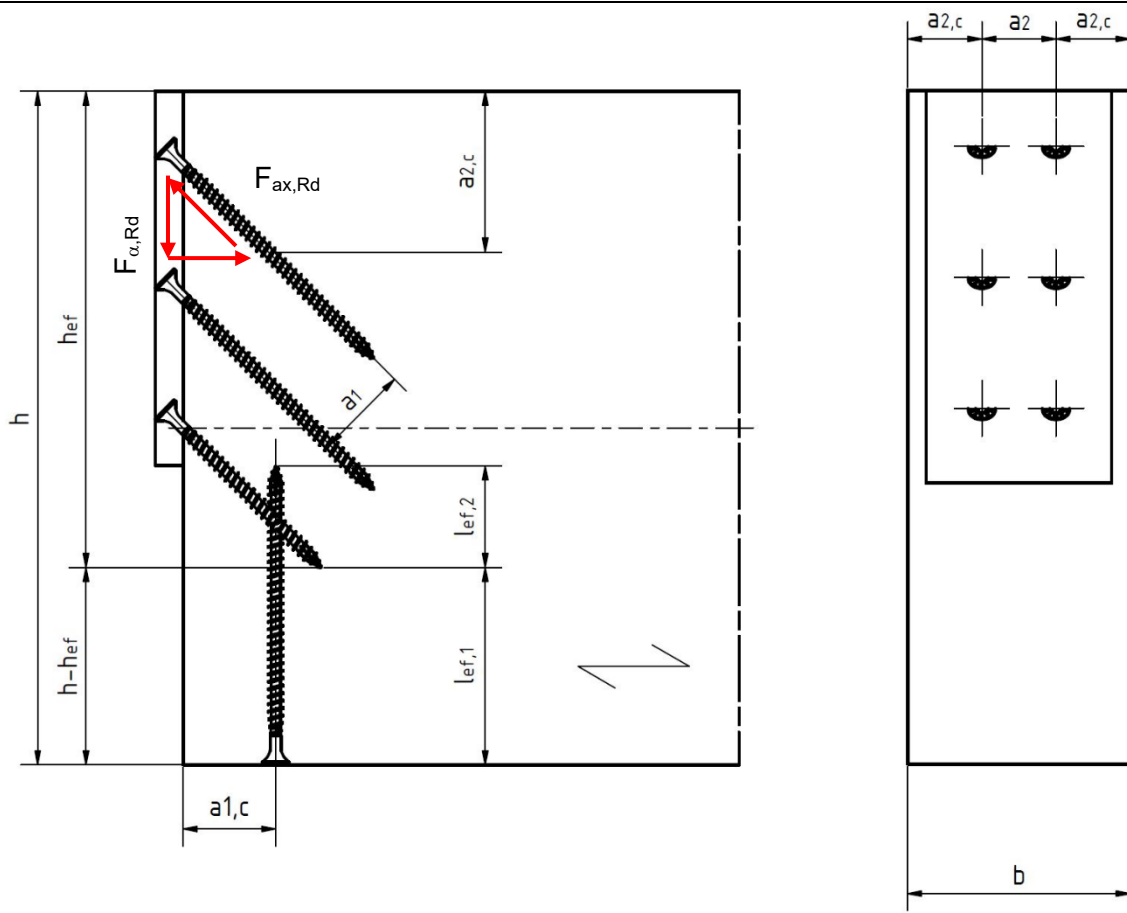


Figure A7.1: Example of metal-to-timber connection with inclined Schmid Screws located in the end-grain or in side-grain

Schmid screws



Annex 7

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Bending beams under flexible jointing

The screws may be used in connections between timber and a steel member, e.g. wind bracing or tensile splice in solid timber, glued laminated timber and glued solid timber of softwood. The screws are driven into the timber member under an angle between the screw axis and the grain direction of $\varepsilon \leq 90^\circ$.

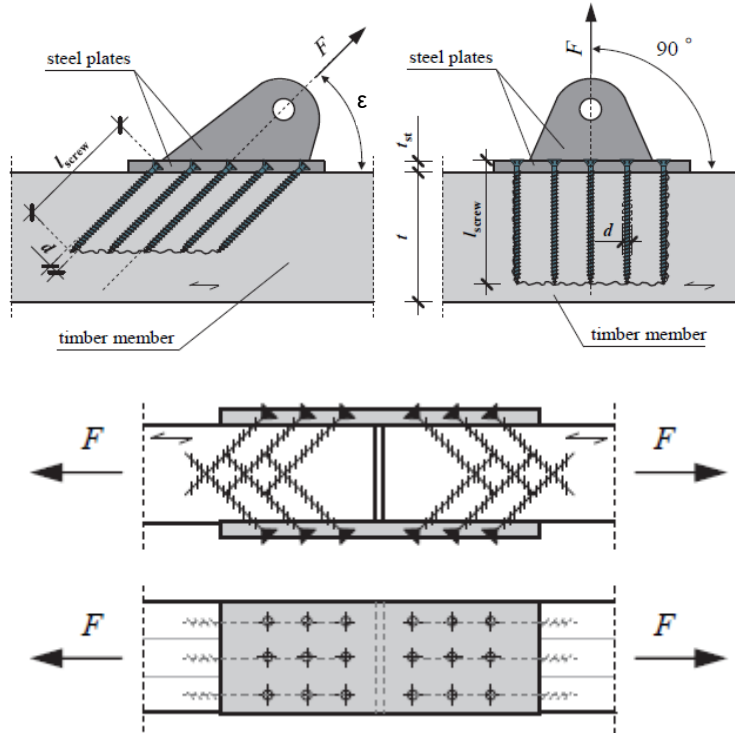


Figure A7.2: Example of metal-to-timber connection with inclined Schmid screws and Schmid screws arranged perpendicular to the grain



Annex 7
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Bending beams under flexible jointing

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A.7.2 Bending beams and columns under flexible jointing

A.7.2.1 General

Schmid screws may be used in connections in multi-part bending beams and columns under flexible jointing. Design of these connections shall follow EN 1995-1-1 considering Annex 6 as well as the provisions in the following.

A.7.2.2 Number of effective Schmid screws per joint

Deviating from Annex 6 the effective number of screws $n = n_{ef}$ for edge distances $a_1 \geq 14 d$.

A.7.2.3 Slip modulus per joint and fastener in the serviceability limit state

The slip modulus K_{ser} per shear joint and fastener for the serviceability limit state shall be taken as

$$K_{ser} = K_{ser,V} \cdot \sin \varepsilon \cdot (\sin \varepsilon - \mu \cdot \cos \varepsilon) + K_{ser,ax} \cdot \cos \varepsilon \cdot (\cos \varepsilon + \mu \cdot \sin \varepsilon)$$

with

$K_{ser,V}$ slip modulus for mainly laterally loaded screws according to Clause A.6.2.4 in N/mm

$K_{ser,ax}$ slip modulus for mainly axially loaded screws according to Clause A.6.1.7 in N/mm taking into account a serial system effect of the wooden members to be connected as well as additional flexibility for partially threaded Schmid screws (head compression, free shaft expansion)


ε angle between screw axis and span direction

μ friction coefficient between the timber members for screws inclined in the same direction, $\mu = 0.3$

A.7.2.4 Slip modulus per joint and fastener in the ultimate limit state

The slip modulus per joint and fastener in the ultimate limit state K_u may be determined from K_{ser} , see Clause A.7.2.3, according to EN 1995-1-1.

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<p style="text-align: center;">Bending beams under flexible jointing</p>	

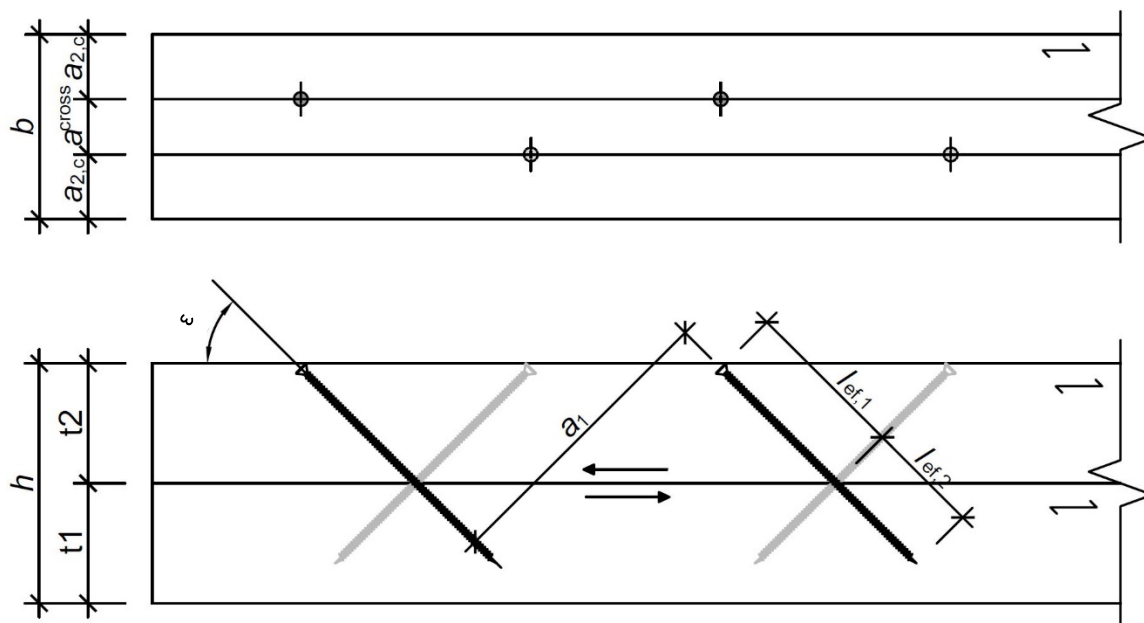


Figure A7.3: Example of flexible jointed bending beam or ribbed plate

Schmid screws



Bending beams under flexible jointing

Annex 7

of European Technical Assessment
ETA-12/0373 of 29.12.2025

A8 Schmid screws for reinforcement of timber members for timber members loaded perpendicular to the grain and shear

A.8.1 Reinforcement of timber members loaded in compression perpendicular to the grain (reinforcement of supports)

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 must be flush with the timber surface.

Reinforcing screws for wood-based panels are not covered by this European Technical Assessment.

The design resistance of a reinforced contact area is:

$$R_{90,d} = \min \left\{ \begin{array}{l} k_{c,90} \cdot B_1 \cdot l_{ef,1} \cdot f_{c,90,d} + n \cdot \min \left(F_{ax,Rd}; k_c \cdot \frac{N_{pl,k}}{\gamma_{M1}} \right) \\ B_2 \cdot l_{ef,2} \cdot f_{c,90,d} \end{array} \right. \text{ in N}$$

In addition to Clause A.6.1.6 the following parameters apply

$k_{c,90}$	parameter considering the type of loading, the risk of splitting and the degree of the compression deformation according to EN 1995-1-1, 6.1.5
B_1	bearing width in mm (minimum of steel plate and wooden member)
l	contact length in mm
B_2	Width of the wooden member in the plane of the screw point in mm
$l_{ef,1}$	effective contact length according to EN 1995-1-1, 6.1.5, in mm
$f_{c,d,90}$	design compressive strength perpendicular to the grain in N/mm ²
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
$l_{ef,2}$	effective contact length in the plane of the screw points in mm
	$l_{ef,2} = l_{ef} + (n_0 - 1) \cdot a_1 + \min(l_{ef}; a_{1,c})$ end supports
	$l_{ef,2} = 2 \cdot l_{ef} + (n_0 - 1) \cdot a_1$ intermediate supports
l_{ef}	penetration length of the threaded part of the screw in the timber member in mm
$a_{1,c}$	given spacing to end distance of the centre of gravity of the threaded part in the timber member in mm
a_1	given spacing of Schmid screws in a plane parallel to the grain and screw axis
γ_{M1}	partial safety factor according to EN 1993-1-1

Schmid screws



Annex 8

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Reinforcement with Schmid screws

If the reinforcement screws are screwed into the wooden member from both sides and the following recommendations are observed, the second line in the Equation for calculation of the design resistance may be omitted.

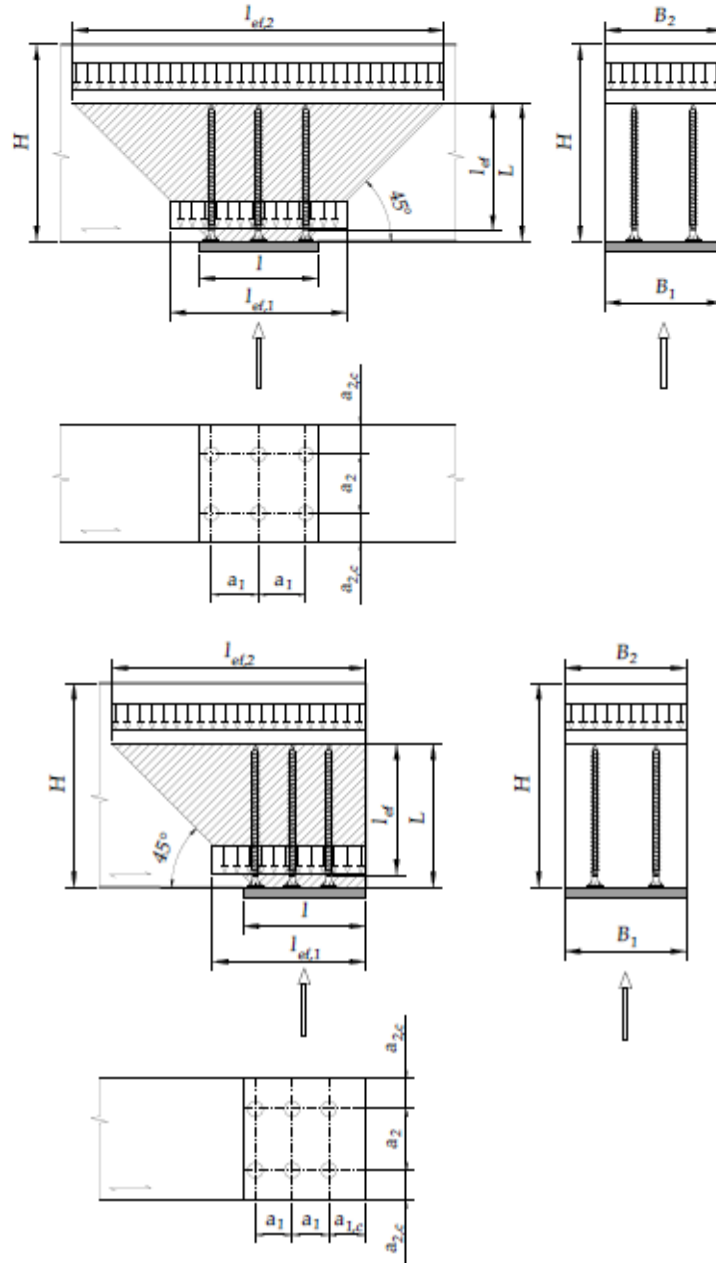


Figure A8.1: Reinforcement of timber members loaded in compression perpendicular to the grain: end support (bottom) intermediate support (top)



Reinforcement with Schmid screws

Annex 8
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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For both sided reinforcement of timber members loaded in compression perpendicular to the grain for load transfer (see Figure A8.2) the contact surfaces on the bottom and top side of the wooden member must be arranged symmetrically. Arrangement of the reinforcing screws must be symmetrically and alternating. The minimum spacings according to A6.1.2 must be observed. The overlap l_{lap} of the reinforcement screw threads should be at least $10 d$.

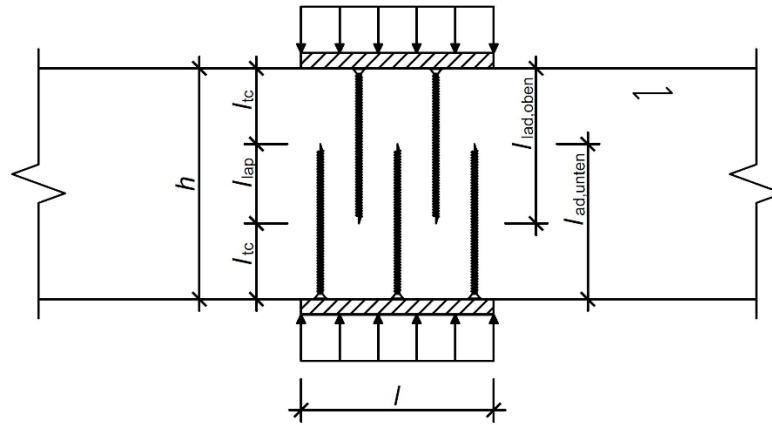


Figure A8.2: Reinforcement of timber members loaded in compression perpendicular to the grain for load transfer

A.8.2 Reinforcement of timber members loaded in tension perpendicular to the grain

Fully threaded screws may be used as tensile reinforcement perpendicular to the grain of the timber members. The screws are driven into the timber member under an angle between the screw axis and the grain direction of 90° . A minimum of two screws shall be used for tensile reinforcement perpendicular to the grain. Only one screw may be used when the minimum penetration depth of the screws below and above the potential crack is $20 \cdot d$ where d is the outer thread diameter of the screw.

A.8.2.1 Tension reinforcement for transverse connections and notches

Tension reinforcement of transverse connections and notches in wooden members may be designed as follows:

$$1.3 \cdot V_d \cdot \left[3 \cdot \left(1 - \frac{h_{ef}}{h} \right)^2 - 2 \cdot \left(1 - \frac{h_{ef}}{h} \right)^3 \right] \leq F_{ax,Rd} \quad \text{for notches}$$

$$F_{90,Ed} \cdot \left[1 - 3 \cdot \left(\frac{a}{h} \right)^2 + 2 \cdot \left(\frac{a}{h} \right)^3 \right] \leq F_{ax,Rd} \quad \text{for transverse connections}$$

where

$$F_{ax,Rd} = n_{90} \cdot \min \left\{ \begin{array}{l} f_{ax,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{f_{tens,k}}{\gamma_{M2}} \end{array} \right. \quad \text{for reinforcement acc. to Figure A8.3 and A8.4}$$

Schmid screws



Reinforcement with Schmid screws

Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

V_d	design value of the lateral force in N
$F_{90,Ed}$	design value of the force acting in the connection perpendicular to the grain of the timber members in N
h_{ef}	effective height/thickness of the timber member above the notch in mm
h	height/thickness of the timber member in mm
a	distance of the furthest fastener of the transverse connection from the loaded edge of the wooden member in mm (Figure A8.4)
l_{ef}	smaller value of the penetration depth below or above the plane of the potential crack in mm
k_{mod}	modification factor for duration of load and moisture content according to EN 1995 1-1
γ_M	partial safety factor for connections according to EN 1995-1-1, Table 2.3
γ_{M2}	partial safety factor according to EN 1993-1-1
n_{90}	number of reinforcing screws arranged in a row perpendicular to the grain (NOTE: Outside of the transverse connection or in the case of notches in general, only one screw may be taken into account in longitudinal direction of the beam)

Schmid screws

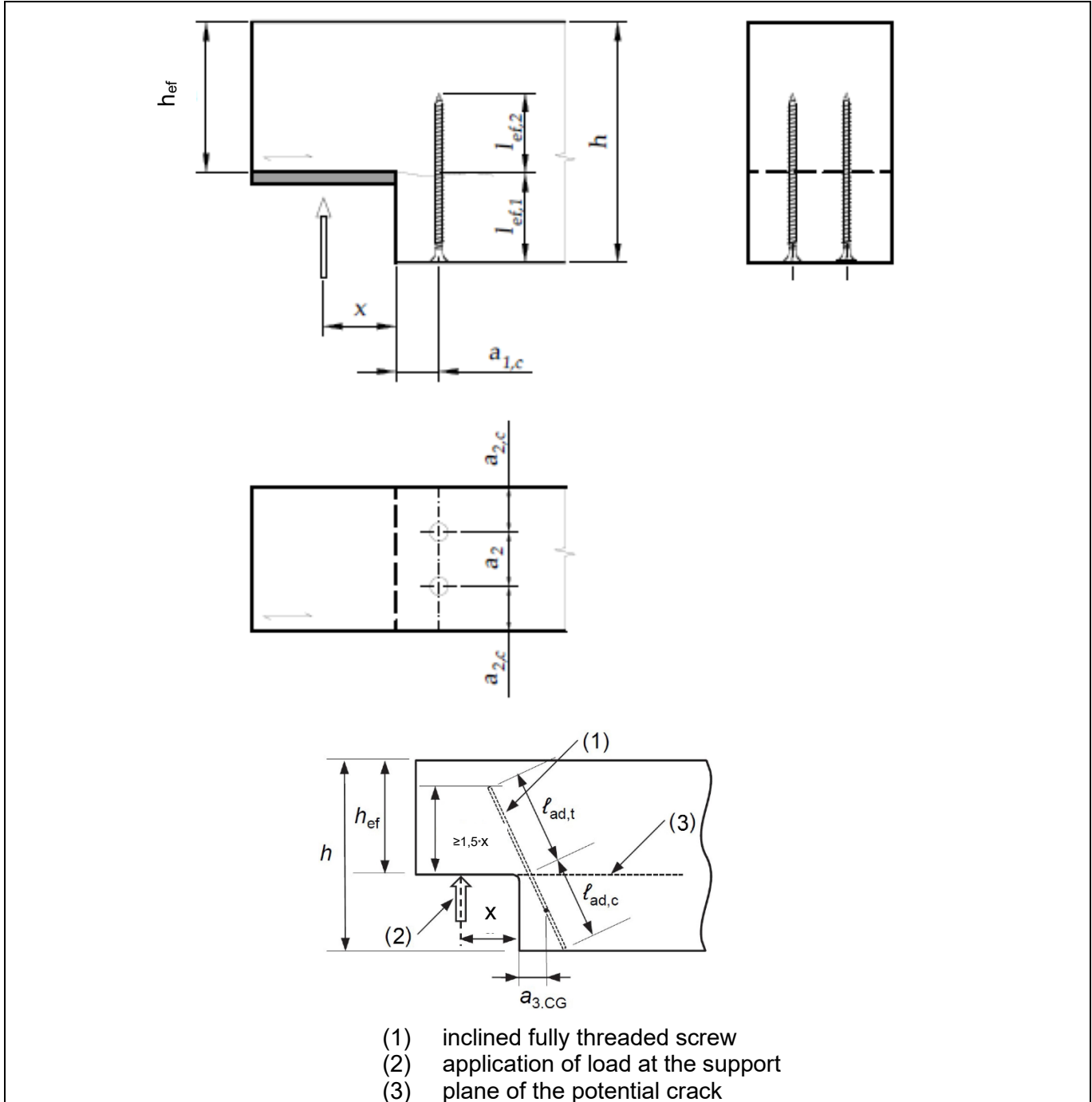


Reinforcement with Schmid screws

Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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- (1) inclined fully threaded screw
- (2) application of load at the support
- (3) plane of the potential crack

Figure A8.3: Reinforcement of notches with screws arranged under an angle of 90° or inclined screws

<p>Schmid screws</p>	<p>Annex 8</p> <p>of European Technical Assessment ETA-12/0373 of 29.12.2025</p>
<p>Reinforcement with Schmid screws</p>	

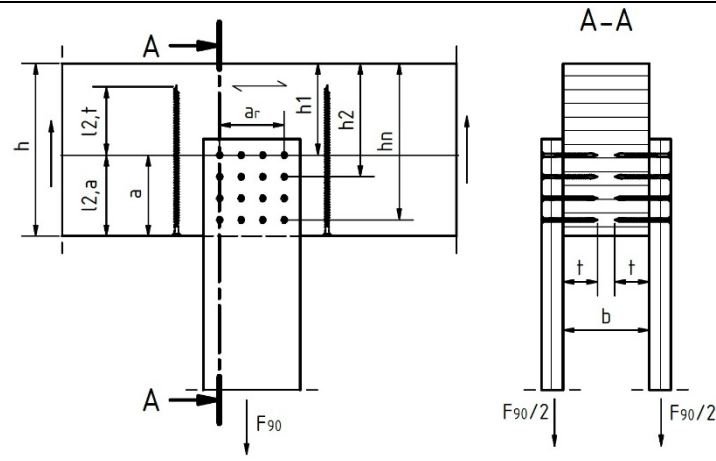


Figure A8.4: Reinforcement of transverse connections with Schmid screws

A.8.2.2 Openings

Openings in wooden members may be designed as follows:

$$F_{t,V,d} + F_{t,M,d} \leq F_{ax,Rd}$$

where

$$F_{t,V,d} = \frac{V_d \cdot h_d}{4 \cdot h} \cdot \left(3 - \frac{h_d^2}{h^2} \right)$$

$$F_{t,M,d} = 0.008 \cdot \frac{M_d}{h_r}$$

$$F_{ax,Rd} = n_{90} \cdot \min \left\{ \begin{array}{l} f_{ax,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{f_{tens,k}}{\gamma_{M2}} \end{array} \right. \text{ for reinforcement acc. to Figure A8.5}$$

with

- $F_{t,V,d}$ design value of tension force perpendicular to the grain due to lateral force V_d in N
- $F_{t,M,d}$ design value of tension force perpendicular to the grain due to bending moment M_d in N
- h_d height of the opening for rectangular openings or 70 % of opening diameter for circular openings in mm
- h_r min (h_{ro} ; h_{ru}) for rectangular openings or min ($h_{ro} + 0.15 h_d$; $h_{ru} + 0.15 h_d$) for circular openings in mm
- l_{ef} smaller value of the penetration depth below or above the plane of the potential crack in mm

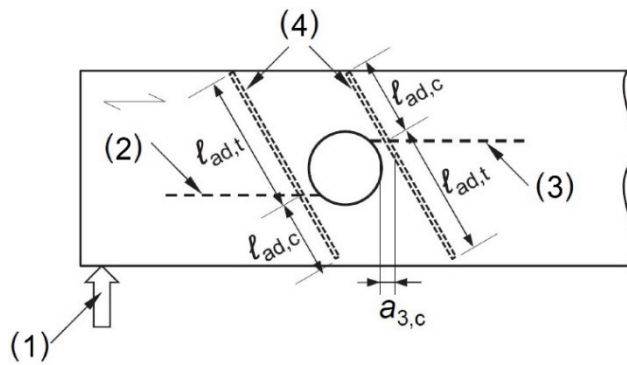
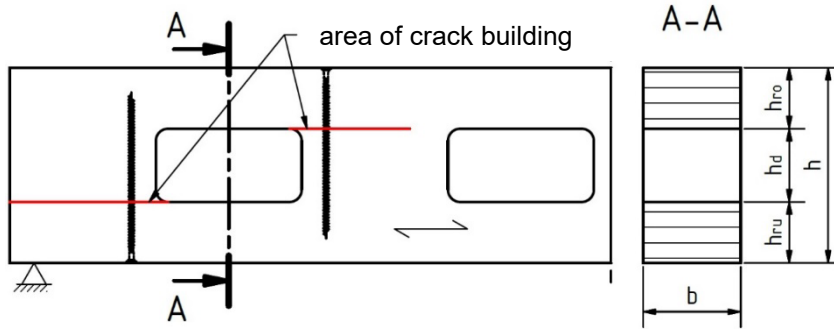
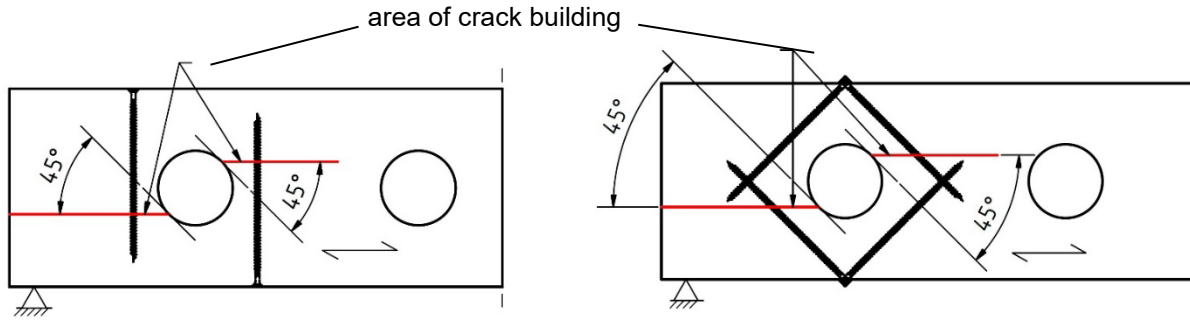


Reinforcement with Schmid screws

Annex 8
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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k_{mod} modification factor for duration of load and moisture content according to EN 1995 1-1
 γ_M partial safety factor for connections according to EN 1995-1-1, Table 2.3
 γ_{M2} partial safety factor according to EN 1993-1-1
 n_{90} number of reinforcing screws arranged in a row perpendicular to the grain



- (1) application of load at the support
- (2) (3) plane of the potential crack
- (4) inclined fully threaded screw

Figure A8.5: Reinforcement of openings with Schmid screws

Schmid screws



Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Reinforcement with Schmid screws

A.8.2.3 Connections with dowel-type fasteners stressed with shear loads

In connections with dowel-type fasteners stressed with shear loads (connection loaded in direction of the grain) the number of effective screws n_{ef} may be taken as $n_{ef} = n$ for side and middle wood of each connection reinforced according to Figure A8.6 and

$$\frac{0.3 \cdot F_{v,0,Ed}}{F_{ax,Rd}} \leq 1$$

where

$F_{v,0,Ed}$ Design value of the stress per fastener parallel to the grain in N
 Side wood: stress per fastener and shear plane
 Middle wood: Summed up stress per fastener and both shear planes

$$F_{ax,Rd} = n_{90} \cdot \min \left\{ \begin{array}{l} f_{ax,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{f_{tens,k}}{\gamma_{M2}} \end{array} \right.$$

with

- l_{ef} smaller value of the penetration depth of the thread of the screw and the point in mm
- k_{mod} modification factor for duration of load and moisture content according to EN 1995 1-1
- γ_M partial safety factor for connections according to EN 1995-1-1
- γ_{M2} partial safety factor according to EN 1993-1-1
- n_{90} number of reinforcing screws arranged in a row perpendicular to the grain per side or middle wood

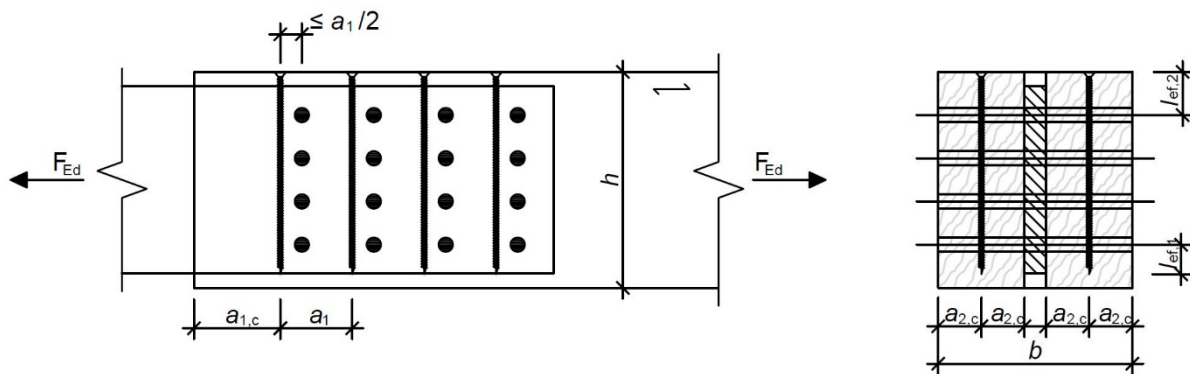


Figure A8.6: Reinforcement of connections stressed with shear loads

Schmid screws



Reinforcement with Schmid screws

Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

A.8.2.4 Shear reinforcement

Fully threaded screws may be used as shear reinforcement of solid timber, glued laminated timber and glued solid timber of softwood. The provisions are valid for straight beams with constant rectangular cross-section. The screws are driven into the timber member under an angle between the screw axis and the grain direction of 45°.

A minimum of four screws shall be used for shear reinforcement in a line parallel to the grain whereas the spacing between the screws shall not exceed the depth h of the timber member. If the screws are arranged in one line parallel to the grain, it shall be done centrally in relation to the beam width.

The effect of the reinforcement is limited to the shaded part of the timber member. Outside this area sufficient shear strength of the cross section must be verified.

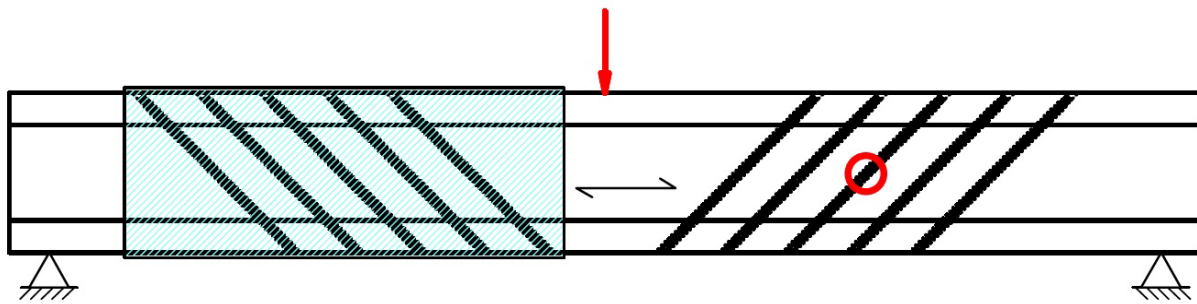


Figure A8.7: Shear reinforcement with Schmid screws

Shear reinforcement may be designed according to

$$\tau_d \leq \frac{f_{v,d} \cdot \kappa_\tau}{\eta_H}$$

where

τ_d design value of shear stress in N/mm²

$f_{v,d}$ design value of shear strength in N/mm²

$$\kappa_\tau = 1 - 0.46 \cdot \sigma_{90,d} - 0.052 \cdot \sigma_{90,d}^2$$

$\sigma_{90,d}$ design value of stress perpendicular to the grain in N/mm²

$$\sigma_{90,d} = \frac{F_{ax,d}}{\sqrt{2} \cdot b \cdot a_1}$$

b width of the timber member in mm

a_1 spacing of screws parallel to the grain in mm

$$F_{ax,d} = \frac{\sqrt{2} \cdot (1 - \eta_H) \cdot V_d \cdot a_1}{h}$$

Schmid screws



Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Reinforcement with Schmid screws

electronic copy

V_d design shear force in N
 h height of the timber member in mm

$$\eta_H = \frac{G \cdot b}{G \cdot b + \frac{1}{2 \cdot \sqrt{2} \cdot \left(\frac{6}{\pi \cdot d \cdot h \cdot k_{ax}} + \frac{a_1}{EA_s} \right)}}$$

G mean value of shear modulus of the timber member in N/mm²
 d outer thread diameter of the screw in mm
 k_{ax} connection stiffness between screw and timber member in N/mm³,
 $k_{ax} = 12.5$ N/mm³ for RAPID® fully threaded screw with $d = 8$ mm
 EA_s axial stiffness of one screw in N

$$EA_s = \frac{E \cdot \pi \cdot d_i^2}{4}$$

d_i inner thread diameter of the screw in mm

The axial capacity of the screw shall fulfil

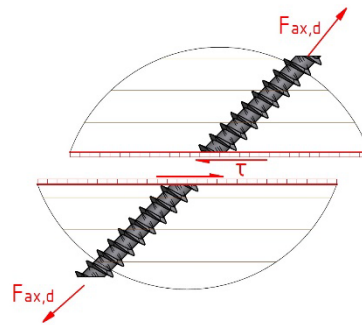
$$\frac{F_{ax,d}}{F_{ax,Rd}} \leq 1$$

where

$$F_{ax,Rd} = n_{90} \cdot \min \left\{ \begin{array}{l} f_{ax,k} \cdot d \cdot l_{ef} \cdot \frac{k_{mod}}{\gamma_M} \\ \frac{f_{tens,k}}{\gamma_{M2}} \end{array} \right.$$

with

l_{ef} 50 % of the penetration depth of the thread in mm
 k_{mod} modification factor for duration of load and moisture content according to EN 1995 1-1
 γ_M partial safety factor for connections according to EN 1995-1-1
 γ_{M2} partial safety factor according to EN 1993-1-1
 n_{90} number of reinforcing screws arranged in a row perpendicular to the grain



Schmid screws



Reinforcement with Schmid screws

Annex 8

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

A.9. Fastening of thermal insulation

A.9.1 Fastening of thermal insulation material (on top of rafters and facades)

Schmid screws with an outer thread diameter of at least 6 mm and lengths between 120 mm and 600 mm may be used for fixing of thermal insulation material on rafters or on wood-based members in vertical facades. Screws with partial thread and head “E” and “L” according to Annex 1 are excluded from fixing wood-based panels on rafters with thermal insulation material as interlayer.

The angle between grain direction and screw axis shall be $30^\circ \leq \epsilon \leq 90^\circ$.

The thickness of the **thermal insulation material** is max. 400 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 **battens** are made from solid timber strength class C24 according to EN 338 and EN 14081-1. The minimum thickness and width of the battens is:

Table A9.1 Minimum thickness and width of the battens

Screw diameter d in mm	b_{min}	t_{min}
	mm	mm
≤ 8	50	30
10	60	40
12	80	50

Instead of battens the following **wood-based panels** may be used to cover the thermal insulation material if they are suitable for that use:

- 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.

The minimum thickness of the wood-based panels shall be 22 mm.

The word batten in the following includes the meaning of the above mentioned wood-based panels.

The **substructure** is made from solid timber strength class C24 according to EN 338 and EN 14081-1, cross laminated timber according to European Technical Assessments or laminated veneer lumber according to EN 14374. The minimum width is $b_{min} = 50$ mm for Schmid screws with $d \leq 6$ mm, $b_{min} = 60$ mm for Schmid screws with $d \leq 10$ mm, and for screws with an outer thread diameter of 12 mm the minimum width $b_{min} = 80$ mm.

Schmid screws



Annex 9

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

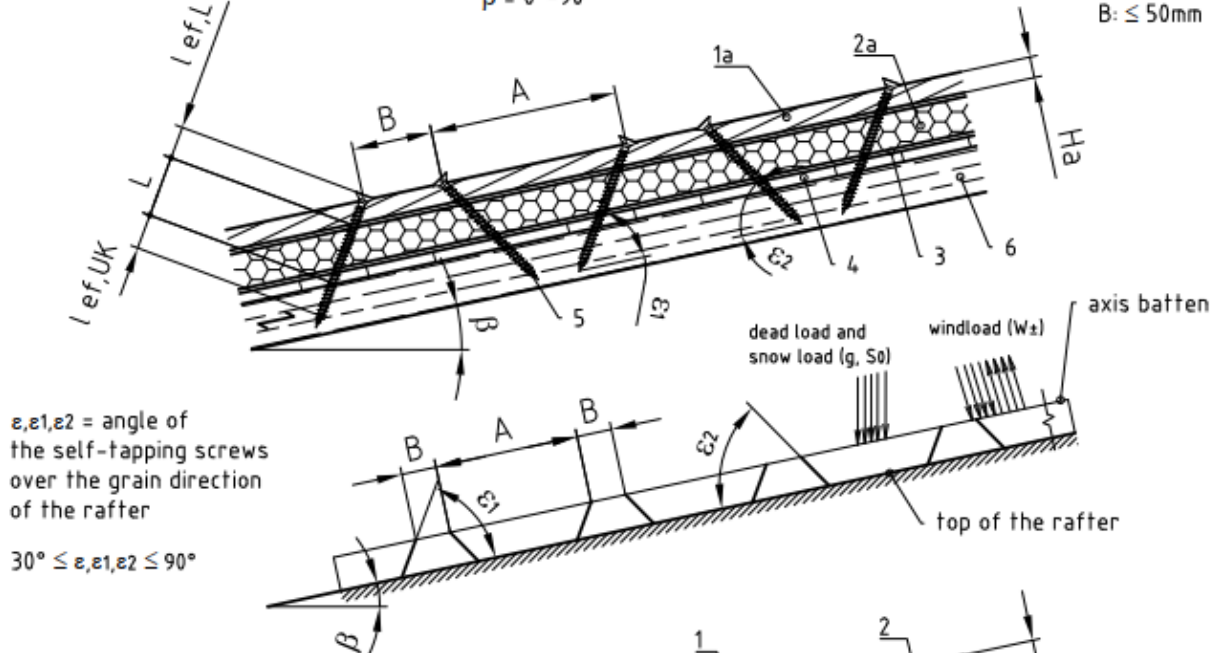
Fastening of thermal insulation material

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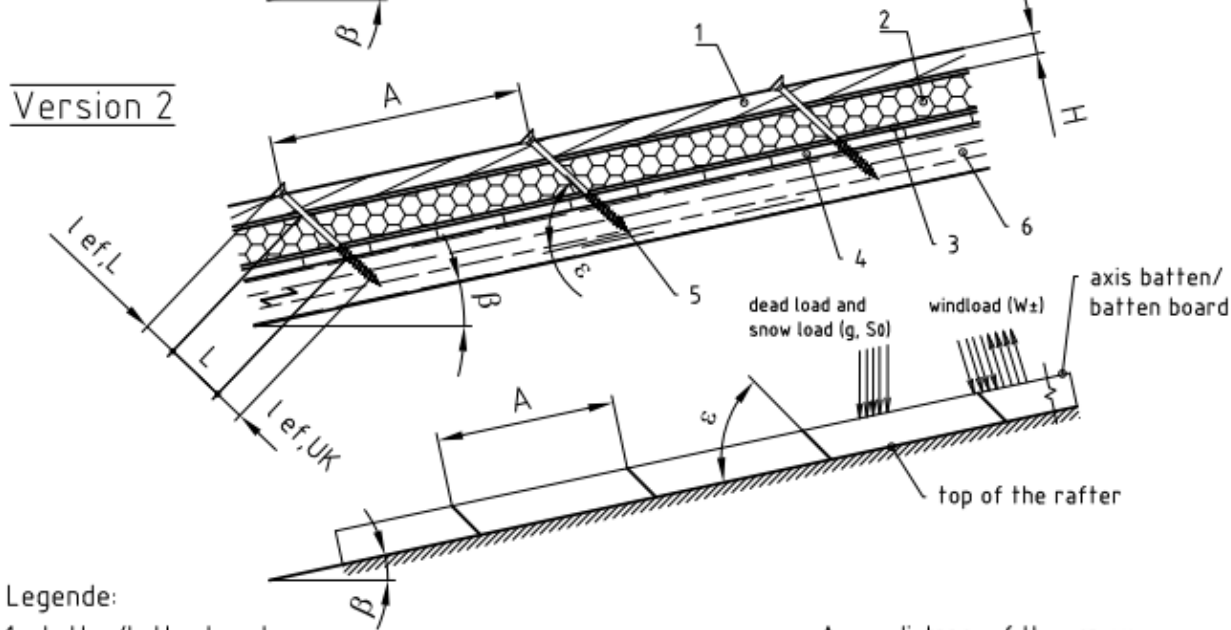
Version 1

roof, facade
 $\beta = 0^\circ - 90^\circ$

A: acc. to statics
 B: $\leq 50\text{mm}$



Version 2



Legende:

- | | |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|
| 1 batten/batten board | A distance of the screws |
| 1a batten | H thickness batten/batten board |
| 2 heat insulation (till 300mm), pressure resistant (min. 0,05 N/mm ²) | Ha thickness batten |
| 2a heat insulation (till 400mm), not pressure resistant | $l_{ef,L}$ penetration length in the batten/batten board |
| 3 vapour barrier | $l_{ef,UK}$ penetration length in the rafter |
| 4 roof boards | |
| 5 self-tapping screws | |
| 6 rafter | |



Annex 9
 of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Fastening of thermal insulation material

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Table A9.2 Buckling capacity of the screws

Free screw length l between lath and rafter (mm)	$\kappa_c \cdot N_{pl,k}$ (kN) for Schmid screws acc. to Table A6.1					RAPID® Top-2-Roof	
	Outer thread diameter d					d	
	6	8	10	12	16	8	8
	thread is part of the free screw length					thread is part of the free screw length	only the shank is part of the free screw length
	Inner thread diameter d _i					d _i	Shank diameter d _s
	3.8	5.2	6.2	6.9	10.7	5.3	5.8
≤ 35	4.396	11.681	19.024	25.125	71.392	12.340	15.888
60	2.497	7.576	13.516	18.834	62.440	8.080	10.902
80	1.706	5.416	10.070	14.470	54.654	5.800	7.985
100	1.232	4.008	7.621	11.154	46.825	4.300	5.986
120	0.930	3.068	5.912	8.747	39.595	3.296	4.617
140	0.726	2.418	4.699	7.000	33.360	2.600	3.657
160	0.582	1.952	3.815	5.710	28.195	2.100	2.962
180	0.477	1.608	3.156	4.739	23.991	1.730	2.446
200	0.398	1.347	2.652	3.992	20.582	1.450	2.053
220	0.337	1.144	2.259	3.407	17.808	1.232	1.747
240	0.289	0.984	1.947	2.941	15.535	1.060	1.504
260	0.251	0.855	1.695	2.563	13.657	0.921	1.308
280	0.220	0.750	1.489	2.254	12.092	0.808	1.148
300	0.194	0.663	1.318	1.997	10.776	0.715	1.016
320	-	0.591	1.175	1.781	9.660	0.636	0.905
340	-	0.529	1.054	1.599	8.707	0.570	0.812
360	-	0.477	0.950	1.443	7.887	0.514	0.732
380	-	0.432	0.862	1.309	7.176	0.466	0.663
400	-	0.393	0.785	1.193	6.557	0.424	0.604

A.9.3 Parallel inclined screws

The screws are predominantly loaded in tension whereas corresponding thermal insulation material is loaded in compression. The minimum compression stress of the thermal insulation material at 10 % deformation, measured according to EN ISO 29469²¹, shall be $\sigma_{(10\%)} \geq 0.05$ N/mm². Hereby systems with battens or wood-based panels may be used.

²¹ EN ISO 29469:2022



Fastening of thermal insulation material

Annex 9

of European Technical Assessment
ETA-12/0373 of 29.12.2025

A.10 Equivalence and conversion factors between ETA-12/0373 and EN 1995-1-1:2025

A.10.1 Comparable denotations and design parameters of EN 1995-1-1:2025

Comparable wording and designation of screw and fastener relevant denotations and design parameters between the present ETA-12/0373 and the final draft EN 1995-1-1:2025 are listed in Table A10.1, Table A10.2 and Table A10.3.

Table A10.1: Comparable denotations and parameters of EN 1995-1-1:2025 and present ETA-12/0373 – SCREW GEOMETRY

present ETA-12/0373			EN 1995-1-1:2025		
	unit	definition		unit	definition
d	mm	nominal screw and outer thread diameter	d	mm	outer thread diameter
d_s	mm	shank diameter	d_s	mm	shank diameter
d_k	mm	head diameter	d_{head}	mm	head diameter
d_i	mm	inner thread diameter	d_1	mm	inner thread diameter
L	mm	screw length	l	mm	screw length
b	mm	length of threaded part of the screw	l_g	mm	profiled length of the threaded part of screws
	mm	$L - b$	l_{head}	mm	length of a screw head without fully developed thread
l_p	mm	drill point length, excluded at threaded part l_{ef} in the point side member	l_p	mm	point length, tip length excluded at threaded part l_w in the point side member
l_{sp}	mm	length of threaded point, included at threaded part l_{ef} in the point side member			

Schmid screws



Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table A10.2: Comparable denotations and parameters of EN 1995-1-1:2025 and present ETA-12/0373 – CONNECTION GEOMETRY

		present ETA-12/0373			EN 1995-1-1:2025
	unit	definition		unit	definition
ε	°	angle between the screw axis and the grain direction of the timber member (term α used in formerly versions of ETA-12/0373)	ε	°	angle between the fastener axis and the grain direction
β	°	angle between the screw axis and the wide face of LVL	β	°	angle between the fastener axis and the surface of the wide face
α	°	angle between the load and the grain direction of the timber member (term ε used in formerly versions of ETA-12/0373)	α	°	angle between the direction of the force acting in the shear plane and the grain direction
–	–	–	δ	°	angle between the fastener axis and the shear plane
$a_{1,c}$	mm	end distance of the centre of gravity of the threaded part in the timber member of only axially loaded Schmid screws	$a_{3,ct}$	mm	end distance of the centroid of the withdrawal length of the dowel-type fastener in the member
$a_{2,c}$	mm	edge distance of the centre of gravity of the threaded part in the timber member of only axially loaded Schmid screws	$a_{4,ct}$	mm	edge distance of the centroid of the withdrawal length of the dowel-type fastener in the member
a_{cross}	mm	spacing between the crossing screws for a crossed screw couple perpendicular to a plane parallel to the grain	–	–	minimum distance between crossing fasteners
l_{ef}	mm	effective threaded part in the timber member; including the length of a threaded point l_{sp} or rather h_{sp} at the point side member	l_w	mm	withdrawal length in the timber member, without point length l_p at point side member
–	–	–	l_d	mm	effective depth of penetration in the timber member, $l_w + l_p$

Schmid screws



Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table A10.3: Comparable denotations and parameters of EN 1995-1-1:2025 and present ETA-12/0373 – RESISTANCE

present ETA-12/0373			EN 1995-1-1:2025		
	unit	definition		unit	definition
$F_{ax,Rk} = f_{ax,calc,k} \cdot d \cdot l_{ef}$			$F_{w,k} = \pi \cdot d \cdot l_w \cdot f_{w,k}$		
$F_{ax,Rk}$	N	characteristic axial resistance per screw (withdrawal)	$F_{w,k}$	N	characteristic withdrawal resistance per screw
$f_{ax,calc,k} = f_{ax,k,90} \cdot k_{ax} \cdot k_{sys} \cdot (\rho_k / \rho_{k,ref})^{k_p}$			$f_{w,k} = k_{screw} \cdot k_w \cdot k_{mat} \cdot d^{-0.33} \cdot (\rho_k / \rho_{k,ref})^{k_p}$		
$f_{ax,calc,k}$	N/mm ²	characteristic withdrawal parameter	–	–	–
$f_{ax,k,90}$	N/mm ²	characteristic reference withdrawal parameter $f_{ax,k,90}$ referenced to characteristic density $\rho_{k,ref}$	–	–	–
–	–	–	$f_{w,k}$	N/mm ²	characteristic withdrawal parameter
–	–	–	k_{screw}	N/mm ²	factor for the characteristic withdrawal strength
k_{sys}	–	system factor considering the number of screwed layers	k_{mat}	–	material parameter for the number of laminations
k_{ax}	–	parameter for the angle between the fastener axis and the grain direction	k_w	–	parameter for the angle between the fastener axis and the grain direction
k_p	–	exponent of density factor depending on timber species	k_p	–	exponent of density factor depending on timber species
$F_{ax,Rk} = f_{head,k} \cdot d_k^2 \cdot (\rho_k / \rho_{k,ref})^{0.8}$			$F_{pull,k}$ is determined including the head diameter d_{head} and a density factor, the characteristic compression strength perpendicular-to-grain $f_{c,90,k}$ or alternatively $f_{head,k}$ determined by testing		
$F_{ax,Rk}$	N	characteristic axial resistance per screw (head pull-through)	$F_{pull,k}$	N	characteristic head pull-through resistance
$f_{head,k}$	N/mm ²	characteristic head pull-through parameter referenced to characteristic density $\rho_{k,ref}$, determined in accordance with EN 1383 as F_{max} / d_k^2	$f_{head,k}$	N/mm ²	characteristic head pull-through strength, determined as $F_{t,max} / A_{head}$

Schmid screws



Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table A10.3 continued: Comparable denotations and parameters of EN 1995-1-1:2025 and present ETA-12/0373 – RESISTANCE

present ETA-12/0373			EN 1995-1-1:2025		
	unit	definition		unit	definition
$F_{ax,Rk}$	N	characteristic axial resistance per screw (compressive , including withdrawal and buckling resistance)	$F_{c,k}$	N	characteristic axial compressive resistance (against buckling)
K_c	–	buckling factor	ϕ_c	–	–
$f_{tens,k}$	N	characteristic tensile resistance	$F_{t,k}$	N	characteristic tensile resistance
$F_{v,Rk}$	N	characteristic lateral resistance per shear plane and fastener (according to EN 1995-1-1:2014)	$F_{v,k}$	N	characteristic lateral resistance per shear plane and fastener, determined by the dowel-effect contribution $F_{D,k}$ and the rope effect contribution $F_{rp,k}$
$f_{h,k}$	N/mm ²	characteristic embedment strength	$f_{h,k}$	N/mm ²	characteristic embedment strength
$f_{h,k} = k_\epsilon \cdot k_\beta \cdot k_\alpha \cdot f_{h,k,ref}$					
$f_{h,k,ref}$	N/mm ²	characteristic reference embedment strength for solid wood, glued laminated timber, glued solid timber, solid wood panels or laminated veneer lumber (made of softwood) and referenced to $\alpha = 90^\circ$, $\epsilon = 90^\circ$ and $\beta = 90^\circ$	$f_{h,\beta,k}$	N/mm ²	characteristic embedment strength for structural lumber (SL), parallel laminated timber (PL) and cross layered timber (CL) and considering the angle β between the screw axis and the grain;
k_ϵ	–	factor to consider the angle ϵ between the screw axis and the grain			$f_{h,\beta,\epsilon,k}$ considers additionally the angle β between the screw axis and the wide face of LVL;
k_β	–	factor to consider the angle β between the screw axis and the wide face of LVL			$f_{h,\alpha,k}$ considers additionally the angle α between the load direction and the grain for softwood LVL and glued laminated veneer lumber (GLVL) and for $d > 12$ mm and predrilled application
k_α	–	factor to consider the angle α between the load direction and the grain			
$M_{y,k}$	Nm	characteristic yield moment	$M_{y,k}$	Nm	characteristic yield moment

Schmid screws



Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Relation to EN 1995-1-1:2025

A.10.2 Withdrawal strength class

The classification to the categories of the characteristic withdrawal strength k_{screw} and characteristic withdrawal strength $f_{w,k}$ according to EN 1995-1-1:2025 results for $\rho_{k,ref} = 350 \text{ kg/m}^3$ to

$$k_{screw} = f_{ax,k,90} / (\pi \cdot d^{-0.33}) \cdot l_d / (l_d - l_p)$$

$$f_{w,k} (\rho_k = 350 \text{ kg/m}^3) = f_{ax,k,90} / \pi \cdot l_d / (l_d - l_p)$$

with

$f_{ax,k,90}$ characteristic reference withdrawal parameter of Table A6.1, A6.2, A6.3 and A6.4

d outer thread diameter

l_d tested effective depth of penetration

l_p point length

Table 10.4: Factor for the characteristic withdrawal strength k_{screw} and classification to withdrawal category according to EN 1995-1-1:2025 – Screws acc. to Table A6.1

Screws acc. to Table A6.1			6	8	10	12	16
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	$f_{w,k}$	N/mm ²	4.91	4.55	4.34	3.89	3.89
Factor for the characteristic withdrawal strength angle screw-axis to grain: 90° ($\rho_{k,ref} = 350 \text{ kg/m}^3$)	k_{screw}	N/mm ²	8.87	9.04	9.28	8.83	9.71
Withdrawal category	-	-	k8	k9	k9	k8	k9
Categorized factor for the characteristic withdrawal strength	-	N/mm ²	8	9	9	8	9

Schmid screws



Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

Table 10.5: Factor for the characteristic withdrawal strength k_{screw} and classification to withdrawal category according to EN 1995-1-1:2025 – Screws acc. to Table A6.2

Screws acc. to Table A6.2			4	4.5	5	6	8	10	12
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,\text{ref}} = 350 \text{ kg/m}^3$)	$f_{w,k}$	N/mm ²	4.99	4.84	4.76	4.73	3.78	3.82	3.24 ¹⁾ 3.89 ²⁾
Factor for the characteristic withdrawal strength angle screw-axis to grain: 90° ($\rho_{k,\text{ref}} = 350 \text{ kg/m}^3$)	k_{screw}	N/mm ²	7.89	7.95	8.10	8.54	7.52	8.17	7.35 ¹⁾ 8.83 ²⁾
Withdrawal category	-	-	k7	k7	k8	k8	k7	k8	k7 ¹⁾ k8 ²⁾
Categorized factor for the characteristic withdrawal strength	-	N/mm ²	7	7	8	8	7	8	7 ¹⁾ 8 ²⁾

¹⁾ Coarse thread, HiLo thread, double thread

²⁾ Single thread and compressor

Table 10.6: Factor for the characteristic withdrawal strength k_{screw} and classification to withdrawal category according to EN 1995-1-1:2025 – Screws acc. to Table A6.3

Screws acc. to Table A6.3			4	4.5	5	6	7	8	10	12
Characteristic withdrawal parameter angle screw-axis to grain: 90° ($\rho_{k,\text{ref}} = 350 \text{ kg/m}^3$)	$f_{w,k}$	N/mm ²	5.21	5.02	4.44	4.20 ¹⁾ 4.77 ²⁾	3.99 ¹⁾	3.89 ¹⁾ 4.73 ²⁾	3.46 ¹⁾ 4.55 ²⁾	3.24 ¹⁾ 3.89 ²⁾
Factor for the characteristic withdrawal strength angle screw-axis to grain: 90° ($\rho_{k,\text{ref}} = 350 \text{ kg/m}^3$)	k_{screw}	N/mm ²	8.23	8.25	7.56	7.59 ¹⁾ 8.62 ²⁾	7.59 ¹⁾	7.73 ¹⁾ 9.39 ²⁾	7.39 ¹⁾ 9.72 ²⁾	7.35 ¹⁾ 8.83 ²⁾
Withdrawal category	-	-	k8	k8	k7	k7 ¹⁾ k8 ²⁾	k7 ²⁾	k7 ¹⁾ k9 ²⁾	k7 ¹⁾ k9 ²⁾	k7 ¹⁾ k8 ²⁾
Categorized factor for the characteristic withdrawal strength	-	N/mm ²	8	8	7	7 ¹⁾ 8 ²⁾	7 ²⁾	7 ¹⁾ 9 ²⁾	7 ¹⁾ 9 ²⁾	7 ¹⁾ 8 ²⁾

¹⁾ Single thread

²⁾ Coarse thread

Schmid screws



Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Relation to EN 1995-1-1:2025

Table 10.7: Factor for the characteristic withdrawal strength k_{screw} and classification to withdrawal category according to EN 1995-1-1:2025 – Screws acc. to Table A6.4

Screws acc. to Table A6.4			hardwood	Ductile
			8	12
Characteristic withdrawal parameter angle screw-axis to grain: 90° $\rho_{k,\text{ref, BE}} = 625 \text{ kg/m}^3$ $\rho_{k,\text{ref, LVL-BE}} = 740 \text{ kg/m}^3$ $\rho_{k,\text{ref, Fi}} = 350 \text{ kg/m}^3$	$f_{w,k}$	N/mm ²	$f_{w,k, \text{BE}} = 14.70$ $f_{w,k, \text{LVL-BE}} = 19.03$ $f_{w,k, \text{Fi}} = 4.55$	$f_{w,k, \text{Fi}} = 4.10$
Factor for the characteristic withdrawal strength, angle screw- axis to grain: 90° $\rho_{k,\text{ref, BE}} = 625 \text{ kg/m}^3$ $\rho_{k,\text{ref, LVL-BE}} = 740 \text{ kg/m}^3$ $\rho_{k,\text{ref, Fi}} = 350 \text{ kg/m}^3$	k_{screw}	N/mm ²	$k_{\text{screw, BE, 90}^\circ} = 29.2$ $k_{\text{screw, LVL-BE, 90}^\circ} = 37.8$ $k_{\text{screw, Fi, 90}^\circ} = 9.04$	$k_{\text{screw, Fi}} = 9.30$
Withdrawal category	-	-	k29 k37 k9	k9
Categorized factor for the characteristic withdrawal strength	-	N/mm ²	29 37 9	9

Schmid screws



Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

A.10.3 Tensile strength class

The classification to the categories of the characteristic tensile strength $f_{u,k}$ according to EN 1995-1-1:2025 result to

$$f_{u,k} = 4 \cdot F_{\text{tens},k} / (\pi \cdot d_1^2)$$

with

$F_{\text{tens},k}$ characteristic tensile resistance of Table A6.1, A6.2, A6.3 and A6.4

d_1 inner thread diameter (d_i according to present ETA-12/0373)

Table 10.8: Classification to category of characteristic tensile strength $f_{u,k}$ according to EN 1995-1-1:2025 – Screws acc. to Table A6.1

Screws acc. to Table A6.1				6	8	10	12	16
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1102	1180	1283	1213 1169 ¹⁾	985
	stainless steel			-	661	593	-	-
Tensile category	carbon steel	-	-	ts11	ts11	ts12	ts12 ts11 ¹⁾	ts9
	stainless steel			-	ts6	ts5	-	-
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1100	1100	1200	1200 1100 ¹⁾	900
	stainless steel			-	600	500	-	-

¹⁾ RAPID T-Lift with full thread

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Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
ETA-12/0373 of 29.12.2025

Table 10.9: Classification to category of characteristic tensile strength $f_{u,k}$ according to EN 1995-1-1:2025 – Screws acc. to Table A6.2

Screws acc. to Table A6.2				4	4.5	5	6
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1061	1179	1204	1186
Tensile category	carbon steel	-	-	ts10	ts11	ts12	ts11
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1000	1100	1200	1100
				8	10	12	
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1141	1198	1156	
	stainless steel			661	633	-	
Tensile category	carbon steel	-	-	ts11	ts12	ts11	
	stainless steel			ts6	ts6	-	
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1100	1200	1100	
	stainless steel			600	600	-	

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Relation to EN 1995-1-1:2025

Annex 10

of European Technical Assessment
 ETA-12/0373 of 29.12.2025

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Table 10.10: Classification to category of characteristic tensile strength $f_{u,k}$ according to EN 1995-1-1:2025 – Screws acc. to Table A6.3

Screws acc. to Table A6.3				4	4.5	5	6
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1019	1013	1025	1012
Tensile category	carbon steel	-	-	ts10	ts10	ts10	ts10
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1000	1000	1000	1000
				7	8	10	12
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1125	997	1060	1123
	stainless steel			-	661	633	-
Tensile category	carbon steel	-	-	ts11	ts10	ts10	ts11
	stainless steel			-	ts6	ts6	-
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1100	1000	1000	1100
	stainless steel			-	600	600	-

Table 10.11: Classification to category of characteristic tensile strength $f_{u,k}$ according to EN 1995-1-1:2025 – Screws acc. to Table A6.4

Screws acc. to Table A6.4				hardwood	Ductile
				8	12
Characteristic tensile strength	carbon steel	$f_{u,k}$	[N/mm ²]	1122	1055 ¹⁾ 1159 ²⁾
Tensile category	carbon steel	-	-	ts11	ts10 ¹⁾ ts11 ²⁾
categorized value for the characteristic tensile strength	carbon steel	-	[N/mm ²]	1100	1000 ¹⁾ 1100 ²⁾

¹⁾ RAPID fullthread with thread E “ductile”.

²⁾ RAPID fullthread with thread E



Relation to EN 1995-1-1:2025

Annex 10
of European Technical Assessment
ETA-12/0373 of 29.12.2025