ZAVOD ZA GRADBENIŠTVO SLOVENIJE
SLOVENIAN NATIONAL BUILDING AND CIVIL ENGINEERING INSTITUTE

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of www.eota.eu

Dimičeva 12,
1000 Ljubljana, Slovenia
Tel.: +386 (0)1 280 44 72, +386 (0)1 280 45 37
Fax: +386 (0)1 280 44 84
e-mail: info.ta@zag.si
http://www.zag.si

European Technical Assessment

ETA-23/0747
of 30.09.2025

English version prepared by ZAG

General Part

Technical Assessment Body issuing the European Technical Assessment	**ZAG**
Trade name of the construction product	**ESSVE Construction screws ET-T, HF(HEX), W(WAF), Wood screws ESSDRIVE**
Product family to which the construction product belongs	**13: Structural timber products, elements and ancillaries**
Manufacturer	**ESSVE AB** **P.O. Box 7091** **SE-16407 Kista** https://www.essve.com/
Manufacturing plant	**Plant 1, 2, 3, 4**
This European Technical Assessment contains	**22 pages including Annex A 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	**EAD 130118-01-0603, Screws and threaded rods for use in timber construction, edition February 2019**

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

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.

Specific parts

1 Technical description of the product

ESSVE Construction screws ET-T, HF (HEX), W (WAF), Woodscrews ESSDRIVE are dowel type self-tapping screws to be used in timber structures. The following types of fasteners are subject of this ETA (see also Annex A):

- Construction screws ET-T, diameters 6.5 and 8.2 mm, Material: hardened carbon steel, Cylindrical head, CorrSeal corrosion protection.
- Construction screws HF(HEX), diameters 6, 8 and 10 mm, Material: hardened carbon steel, Hexagon head with flange, CorrSeal corrosion protection.
- Construction screws W(WAF), diameters 6, 8 and 10 mm, Material: hardened carbon steel, Wafer head, Electro zinc plated (EZP) or CorrSeal corrosion protection.
- Construction screws W(WAF), diameters 6, 8 and 10 mm, Material: austenitic stainless steel A4 (SAE 316), Wafer head.
- ESSDRIVE screws, diameters 6 and 8 mm, Material: hardened carbon steel, Countersunk head, CorrSeal corrosion protection or Electro zinc plated (EZP).

Screws made from stainless steel are not hardened.

Screws subject of this ETA have diameters in range $6 \le d \le 10$ mm, minimum threaded length $4 \cdot d$ ($l_g \ge 4 \cdot d$), ratio d_1/d in range 0.62 - 0.70, tolerances according to EAD 130118-01-0603, Table 1, and bending angle α at least $45 / d^{0.7} + 20$ (in °).

Detailed dimensions of products are presented in Annex A.

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

The products are to be used for connections in timber constructions, e. g.:

− timber / timber, wood-based panels / timber, steel / timber connections, steel / wood - based panels,

− reinforcement of timber in areas of high tensile stresses perpendicular to the grain or compression stresses perpendicular to the grain (e.g. supports of beams),

− fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical façades.

Wood and various wood based materials / structural members can be used:

- Structural timber with rectangular cross section (EN 14081-1);
- Structural finger jointed solid timber (EN 15497);
- Glued solid timber, glue laminated timber (glulam), blocked glued glulam (EN 15497);
- Cross laminated timber (ETA according to EAD 130005-00-0304);
- Solid wood slab element (ETA according to EAD 130002-00-0304);
- Laminated veneer lumber / Glue laminated timber made of hardwood LVL (EN 14374 or ETA according to EAD 130010-01-0304);
- Wood based panels - Plywood (EN 13986 / EN 636);
- Other engineering products subject according to ETA where provisions for use of screws are given.

The general use conditions for which this EAD is valid are given in EN 1995-1-1. The use of the screws shall be limited to static and quasi-static actions, the design of the connections shall be based on the characteristic load-carrying capacities of the screw taking into consideration national provisions.

Depending on the durability of the fastener coating or of the stainless steel which the fasteners are made of they are used in constructions in Service classes 1 to 3 conditions according to EN 1995-1-1 considering the admissible service conditions and the admissible corrosive category according to EN ISO 12944-2 (and as informative according to prEN 1995-1-1:2023). Resistance to corrosion shall take into consideration national provisions at the installation site considering environmental conditions.

The provisions made in this ETA are based on an assumed intended working life (not the same as producer guarantee) for the intended of product taking into consideration proper use and maintenance of 50 years. These provisions are based upon the current state of the art and the available knowledge and experience. The actual working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for the works.

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

The assessment is performed according to EAD 130118-01-0603: Screws and threaded rods for use in timber construction, edition February 2019. If not dated the latest release of referenced documents should always be taken into consideration.

Table 1: Performance of the product

Product-type: Screws for use in timber construction		**Intended use:** For use in connections in load bearing timber structures	
Basic Work Requirements (BWR)	**Essential characteristics of construction product**	**Assessment method**	**Product performance***
BWR 1 (Mechanical resistance and stability)	Dimensions	Clause 3.1.1	Clause 3.1.1 Annex A1 - A5
	Characteristic yield moment	Clause 3.1.2	Clause 3.1.2
	Bending angle	Clause 3.1.3	Clause 3.1.3
	Characteristic withdrawal parameter	Clause 3.1.4	Clause 3.1.4
	Characteristic head pull-trough parameter of screws	Clause 3.1.5	Clause 3.1.5
	Characteristic tensile strength	Clause 3.1.6	Clause 3.1.6
	Characteristic yield strength	Clause 3.1.7	Clause 3.1.7
	Characteristic torsional strength	Clause 3.1.8	Clause 3.1.8
	Insertion moment	Clause 3.1.9	Clause 3.1.9
	Spacing, end and edge distances of the screws or threaded rods and minimum thickness of the timber material	Clause 3.1.10	Clause 3.1.10
	Slip modulus for mainly axially loaded screws	Clause 3.1.11	Clause 3.1.11
	Durability against corrosion	Clause 3.1.12	Clause 3.1.12
BWR 2 (Safety in case of fire)	Reaction to fire	Clause 3.2.1	Clause 3.2.1
BWR 4 (Safety and accessibility in use)	Same as BWR 1		

* NPA – No performance assessed.

This ETA is issued for the products on the basis of agreed data, deposited with Slovenian National Building and Civil Engineering Institute (hereinafter ZAG), which identifies the product that has been assessed and judged. Changes to the production process or the product itself, which could result in this deposited data being incorrect, should be notified to ZAG before the changes are introduced. ZAG will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment, and / or alteration to the ETA, shall be necessary.

Product characteristics are based on proved data provided by producer or by appropriate standards. Relevance of defined product characteristics is related to validity of standard / reports used in preparation of ETA.

3.1 Mechanical resistance and stability (BWR 1)

3.1.1. Dimensions

Dimensions of screws were measured according to the provisions of EN 14592 and are presented in Annexes A1 - A6.

3.1.2. Characteristic yield moment

The values of characteristic yield moments were determined by tests according to EN 409 and evaluated according to EN 14358. Values are given in Annex A7. No cracks were observed at angle α_k.

3.1.3. Bending angle

The bending angles of the screws were determined by tests according to EAD 130118-01-0603, Ch. 2.2.3. The plastic bending angles of all types of screws are ≥ 45°.

3.1.4. Characteristic withdrawal parameter

The values of characteristic withdrawal parameters were determined on solid timber / glulam by tests according to EN 1382, without pre-drilling; values given in Annex A8 are corrected with factor k_ρ.

3.1.5. Characteristic head pull-trough parameter of screws

The values of characteristic head pull-trough parameters were determined on solid timber / glulam by tests according to EN 1383 (see Annex A9), without pre-drilling. For other materials values given in Annex A9 were taken from EAD 130118-01-0603, Ch. 2.2.5.1.

3.1.6. Characteristic tensile strength

The values of characteristic tensile strengths of screws were determined by testing (EAD 130118-01-0603, Ch. 2.2.6, values are presented in Annex A10.

3.1.7. Characteristic yield strength

The values of characteristic yield strengths of screws were determined by testing (EAD 130118-01-0603, Ch. 2.2.7, values are presented in Annex A11.

3.1.8. Characteristic torsional strength

The values of characteristic torsional strengths of screws were determined by testing (EAD 130118-01-0603, Ch. 2.2.8.1), without pre-drilling, values are presented in Annex A12.

3.1.9. Insertion moment

The values of insertion moments of screws were determined by testing (EAD 130118-01-0603, Ch. 2.2.9), without pre-drilling, values are presented in Annex A12.

3.1.10. Spacing, end and edge distances of the screws or threaded rods and minimum thickness of the timber material

The values of spacing, end and edge distances of the screws were determined by testing (EAD 130118-01-0603, Ch. 2.2.10.2), values for some types are presented in Annex A13**,** for others no performance assessed (NPA) option is applied.

3.1.11. Slip modulus for mainly axially loaded screws

No performance assessed (NPA) option is applied.

3.1.12. Durability against corrosion

Type and thickness of corrosion protection / type of stainless steel is given in Annex A1. Contact between screws, acid (in terms of metal corrosion) timber species and other components of the joint made from metal shall not result in corrosion in the intended use. Contact between screws and timber preservative treated against biological attack or fire retardants shall not result in corrosion in the intended use. If screws are used in preservative treated timber the compatibility has to be assessed.

Screws with electro zinc plated (EZP) corrosion protection can be used in Use classes 1 and 2 (acc. to EN 1995-1-1) and screws with CorrSeal corrosion protection or stainless steel in Use classes 1, 2 and 3 (acc. to EN 1995-1-1).

3.2 Safety in case of fire (BWR 2)

3.2.1 Reaction to fire

Screws made from steel / stainless steel are classified as Class A1 of reaction to fire in accordance with EN 13501-1 and European Commission Decision 96/603/EC amended by European Commission Decisions 2000/605/EC and 2003/424/EC.

It is assumed that due to thin layer of lubricants / coatings do not contribute to fire growth or the fully developed fire and have no significant influence to the smoke hazard.

3.2 Safety and accessibility in use (BWR 4)

Same as BWR 1.

3.3 General aspects

3.3.1 Identification

The identification parameters and reference to product specifications is given in Annex A.

3.3.2 Installation

The installation (pre-drilling, minimum spacing and edge and end distances) shall be carried out in accordance with EN 1995-1-1, an appropriate national provisions and instructions from manufacturer.

Pre-drilling is not required but optional; the drill dimension d_{drill} shall not be larger than the one given in Table 2.

Table 2: Pre-drilling: drill dimensions.

			Softwood	Hardwood
Product	d [mm]	d_1 [mm]	d_{drill} [mm]	d_{drill} [mm]
ET-T	6.5	4.0	4.0	4.0
ET-T	8.2	5.7	5.5	6.0
HF(HEX)	6	3.8	3.5	4.0
HF(HEX)	8	5.3	5.0	5.5
HF(HEX)	10	6.6	6.5	7.0
W(WAF)	6	3.8	3.5	4.0
W(WAF)	8	5.3	5.0	5.5
W(WAF)	10	6.6	6.5	7.0
ESSDRIVE	6	3.8	3.5	4.0
ESSDRIVE	8	5.4	5.0	5.5

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied

According to the Commission Decision 97/176/EC, the system of assessment and verification of constancy of performance (AVCP) (see Annex V of Regulation (EU) No 305/2011 and Commission Delegated Regulation (EU) No 568/2014) to be applied for specified use of the product is **3**.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the EAD 130118-01-0603, Ch. 3.

Issued in Ljubljana on 30.09.2025

Signed by:

mag. Franc Capuder, univ. dipl. inž. grad.

Head of Service of TAB

ANNEX A: Products description / characteristic

Index:

A1	ESSVE screws - products overview
A2	Construction screws ET-T, ø 6.5, 8.2 mm
A3	Construction screws HF(HEX), ø 6, 8, 10 mm (EZP, CorrSeal)
A4	Construction screws W(WAF), ø 6, 8, 10 mm (EZP, CorrSeal)
A5	Construction screws W(WAF), ø 6, 8, 10 mm (Austenitic stainless steel)
A6	Wood screws ESSDRIVE, ø 6, 8 mm (EZP, CorrSeal)
A7	Characteristic yield moment and plastic bending angle
A8	Characteristic withdrawal parameter
A9	Characteristic head pull-trough parameter
A10	Characteristic tensile strength and Characteristic yield strength
A11	Characteristic torsional strength / Insertion moment
A12	Spacing, end and edge distances of the screws
A13	Fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical façades

A1: ESSVE screws – products overview

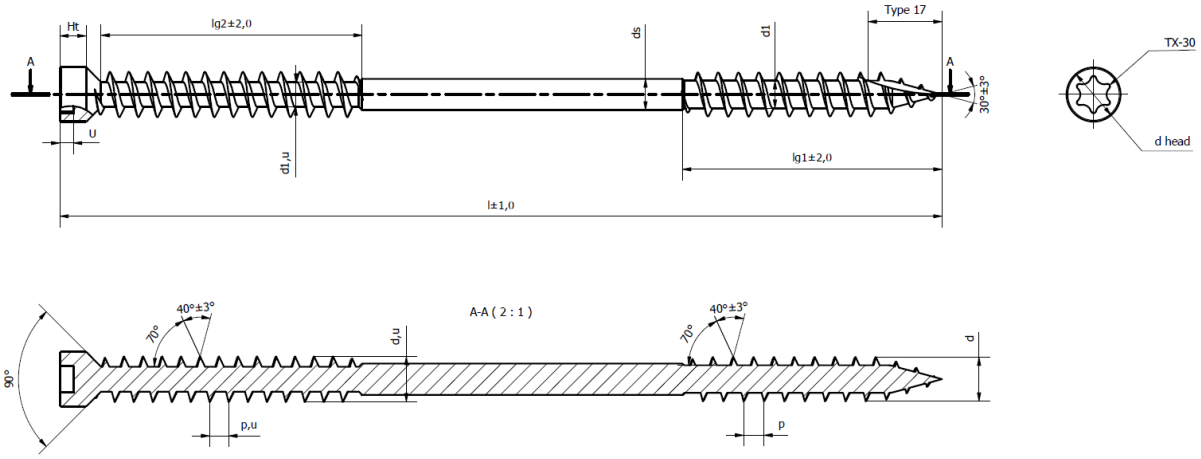
Table A1: Products overview.

Screw type	d [mm]	l [mm]	Head type	Steel grade	Coating type***
ET-T	6.5	65 - 220	Cylindrical	Hardened carbon steel	CorrSeal*
	8.2	90 - 330			
HF(HEX)	6	40 - 220	Hex	Hardened carbon steel	CorrSeal*
	8	40 - 340			
	10	40 - 240			
W(WAF)	6	40 - 220	Wafer	Hardened carbon steel	EZP**
	8	40 - 340			
	10	40 - 240			
W(WAF)	6	40 - 220	Wafer	Hardened carbon steel	CorrSeal*
	8	40 - 340			
	10	40 - 240			
W(WAF)	6	70 - 120	Wafer	Austenitic stainless steel A4 (SAE 316)	
	8	40 - 150			
	10	40 - 150			
ESSDRIVE	6	40 - 240	Countersunk	Hardened carbon steel	EZP**
	8	40 - 300			
ESSDRIVE	6	40 - 240	Countersunk	Hardened carbon steel	CorrSeal*
	8	40 - 300			

* CorrSeal: Zinc - based coating, min 23 µm.
** EZP: Electro zinc plated, min. 5 µm.
***Alternative corrosion protection: to be declared in accordance with EN 14592 / EN 1995-1-1.

A2: Construction screws ET-T, ø 6.5, 8.2 mm

ET-T, ø 6.5 mm

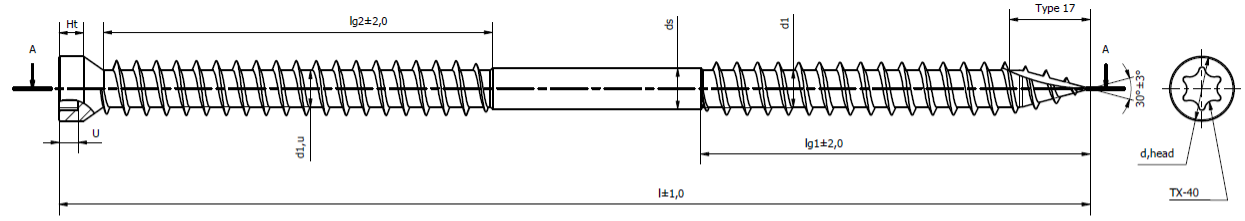


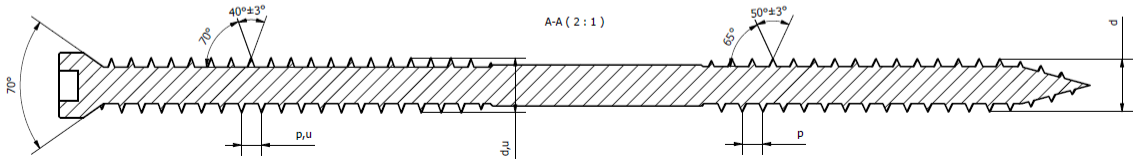
d	6.5 mm
d,u	6.7 mm
d1	4.1 mm
d1,u	3.6 mm
p	3.1 mm
p,u	2.8 mm
d,s	4.6 mm

d head	8.0 mm
Ht	3.9 mm
U	2 mm

l [mm]	lg1 [mm]	lg2 [mm]
65	22	22
90	38	38
130	38	38
160	60	60
190	80	80
220	95	95

ET-T, ø 8.2 mm





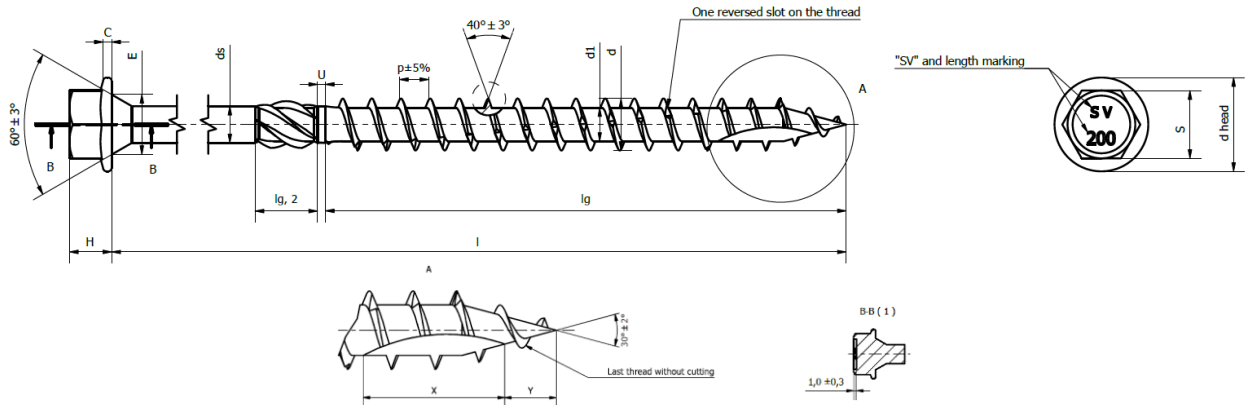
d	8.2 mm
d,u	8.5 mm
d1	5.7 mm
d1,u	5.6 mm
p	3.3 mm
d,s	6.3 mm
d,head	10 mm

l [mm]	lg1 [mm]	lg2 [mm]	p,u [mm]	Ht [mm]	U [mm]
90	38	38	2.9	3.8	3.0
130	38	38	2.9	3.8	3.0
160	60	60	3.0	3.8	3.0
190	80	80	3.0	3.8	3.0
220	95	95	3.0	3.8	3.0
245	107	107	3.0	4.8	4.0
275	107	107	3.0	4.8	4.0
300	135	135	3.1	4.8	4.0
330	135	135	3.1	4.8	4.0

Construction screws ET-T, HF(HEX), W(WAF)
Wood screws ESSDRIVE

Annex A (2/15)

A3: Construction screws HF(HEX), ø 6, 8, 10 mm



Size [mm]	d [mm]	d1 [mm]	ds [mm]	P [mm]	E [mm]	C [mm]	H [mm]	S [mm]	d head [mm]	X* [mm]	Y* [mm]
6	6.0	3.8	4.2	4.5	7.9	min. 1.0	max. 5.8	7.9	13.0	16.5	5.0
8	8.0	5.3	5.8	5.2	10,0	min. 1.1	max. 6.6	9.9	15.0	17.0	5.0
10	10.0	6.6	7.0	5.6	11.5	min. 1.2	max. 8.1	12.9	18.0	20.0	5.0

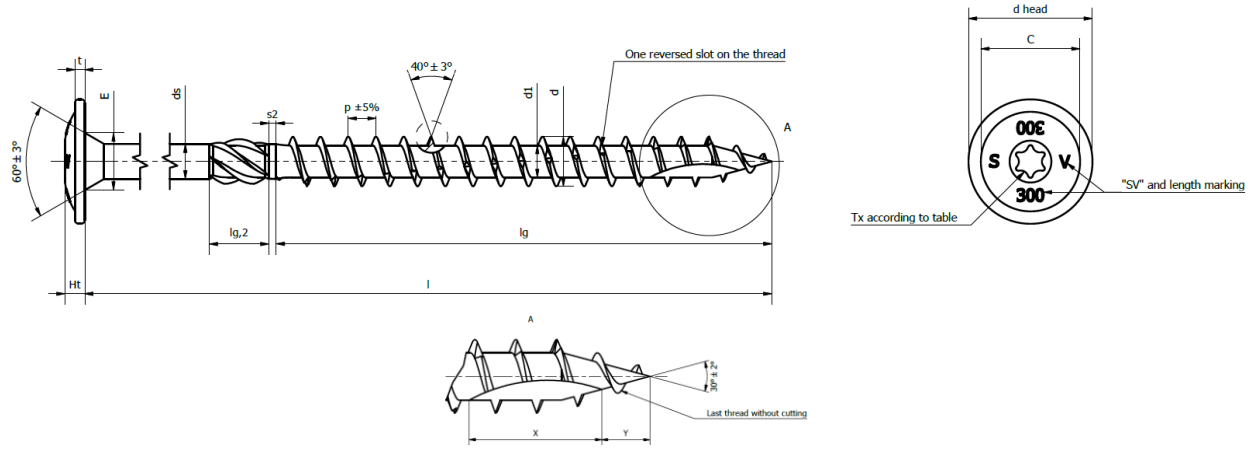
* L ≥ 60 mm, L < 60 mm: Type 17-cut.

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
6x40	40	40	Not available
6x50	50		
6x60	60		12
6x70	70		
6x80	80	50	
6x90	90		
6x100	100	75	
6x120	120		
6x140	140		
6x160	160		
6x180	180		
6x200	200		
6x220	220		

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
8x40	40	Full	Not available
8x50	50		
8x60	60	50	12
8x70	70		
8x80	80		
8x90	90		
8x100	100	60	
8x120	120	80	
8x140	140		
8x160	160		
8x180	180		
8x200	200	100	
8x220	220		
8x240	240		
8x280	280		
8x300	300		
8x320	320		
8x340	340		

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
10x40	40	Full	Not available
10x50	50		
10x60	60		
10x70	70	60	
10x80	80		
10x100	100		12
10x120	120	80	
10x140	140		
10x160	160		
10x180	180		
10x200	200	100	
10x220	220		
10x240	240		

A4: Construction screws W(WAF), ø 6, 8, 10 mm (EZP, CorrSeal)



Size [mm]	d [mm]	d1 [mm]	P [mm]	E [mm]	Ht [mm]	t [mm]	s2 [mm]	d head [mm]	C [mm]	Tx	Txdepth [mm]	ds [mm]	X* [mm]	Y* [mm]
6	6.0	3.9	4.5	8.0	2.9	1.6	1.5	15.3	11.0	30	2.7	4.2	16.5	5.0
8	8.0	5.4	5.2	10.0	3.4	1.8	1.5	22.0	16.0	40	3.4	5.8	17.0	5.0
10	10.0	6.6	5.6	11.5	4.0	2.0	NA	25.0	20.0	40	3.8	7.0	20.0	5.0

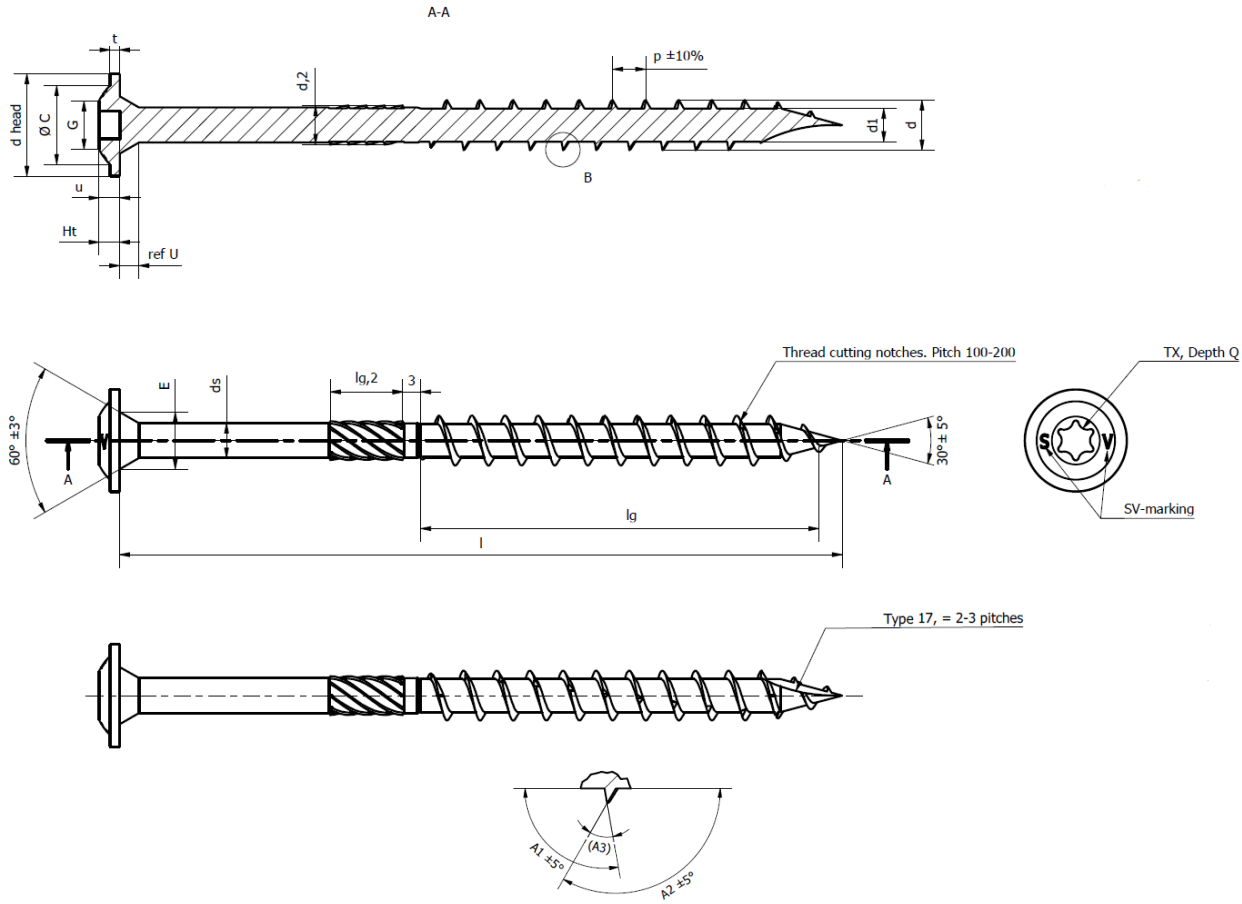
* L ≥ 60 mm, L < 60 mm: Type 17-cut.

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
6x40	40	40	Not available
6x50	50		
6x60	60		12
6x70	70		
6x80	80	50	
6x90	90		
6x100	100	75	
6x120	120		
6x140	140		
6x160	160		
6x180	180		
6x200	200		
6x220	220		

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
8x40	40	Full	Not available
8x50	50		
8x60	60	50	12
8x70	70		
8x80	80		
8x90	90		
8x100	100	60	
8x120	120	80	
8x140	140		
8x160	160		
8x180	180		
8x200	200	100	
8x220	220		
8x240	240		
8x280	280		
8x300	300		
8x320	320		
8x340	340		

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
10x40	40	Full	Not available
10x50	50		
10x60	60		
10x70	70	60	
10x80	80		
10x100	100		12
10x120	120	80	
10x140	140		
10x160	160		
10x180	180		
10x200	200	100	
10x220	220		
10x240	240		

A5: Construction screws W(WAF), ø 6, 8, 10 mm (Austenitic stainless steel)



Size [mm]	A1 [°]	A2 [°]	A3 [°]	d head [mm]	C [mm]	d [mm]	d,2 [mm]	d,1 [mm]	ds [mm]	F [mm]	Ht [mm]	p [mm]	u [mm]
6	110	115	45	14.0	11.0	6.0	4.8	3.8	4.3	7.5	2.9	4.5	2.7
8	100	120	40	17.0	13.0	8.0	6.5	5.3	5.8	10.0	3.6	5.5	3.3
10	100	120	40	21.0	17.0	10.0	7.8	6.3	7.0	12.0	4.0	6.6	3.6

Size [mm]	t [mm]	TX [mm]	U [mm]	G [mm]
6	1.4	TX30	2.5	6.4
8	1.8	TX40	3.0	8.0
10	2.0	TX40	4.0	8.0

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
6x70	70	50	NA
6x80	80		12
6x90	90		
6x100	100		
6x120	120	70	

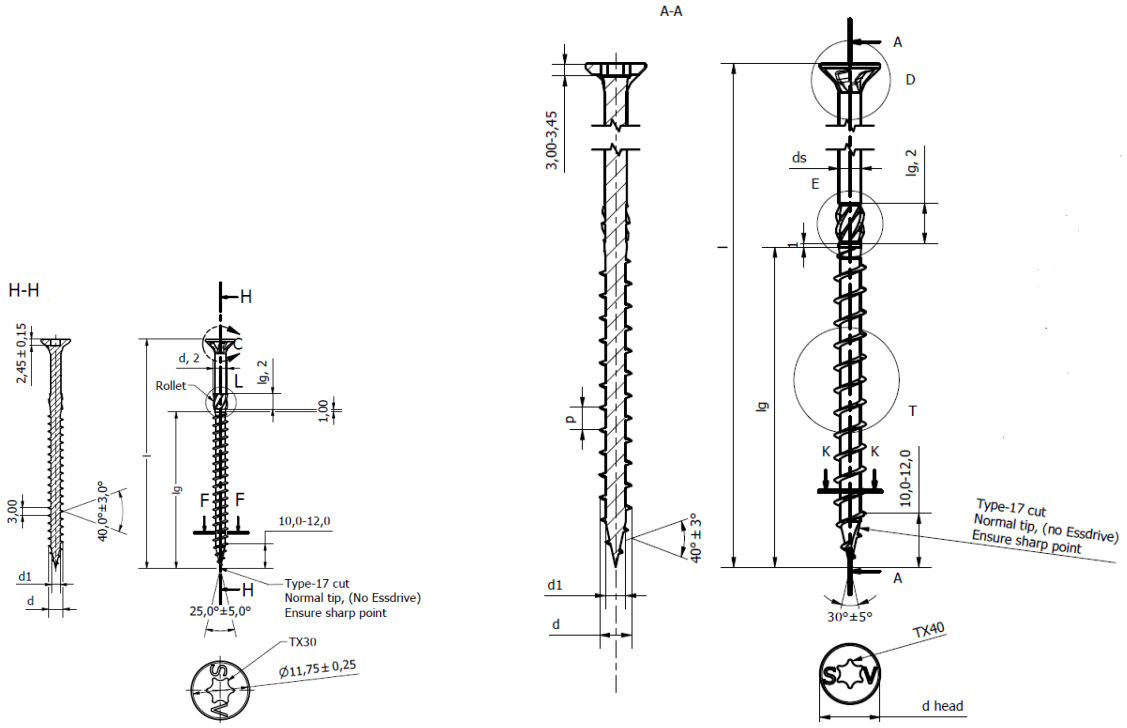
Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
8x40	40	Full	NA
8x50	50		
8x60	60	50	
8x70	70		
8x80	80		12
8x90	90		
8x100	100		
8x120	120	70	
8x140	140	80	
8x150	160		

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]
10x40	40	Full	NA
10x50	50		
10x60	60	50	
10x70	70		
10x80	80	70	
10x90	90		
10x100	100		12
10x120	120		
10x140	140	90	
10x150	160		

Construction screws ET-T, HF(HEX), W(WAF)
Wood screws ESSDRIVE

Annex A (5/15)

A6: Wood screws ESSDRIVE, ø 6, 8 mm (EZP, CorrSeal)



Size [mm]	l [mm]	lg [mm]	lg,2 [mm]	d,2 [mm]
6x40	40	24	NA	NA
6x50	50	30		
6x60	60	36		
6x70	70	42	6	4.7
6x80	80			
6x90	90			
6x100	100	52		
6x110	110	62		
6x120	120	72		
6x130	130			
6x140	140			
6x150	150			
6x160	160			
6x180	180			
6x200	200			
6x220	220			
6x240	240			

Size [mm]	l [mm]	lg [mm]	lg,2 [mm]	d,2 [mm]
8x80	80	48	12	7.1
8x100	100	60		
8x120	120	80		
8x140	140			
8x160	160			
8x200	200			
8x220	220			
8x240	240			
8x250	250			
8x260	260			
8x280	280			
8x300	300			

d head	11.7 mm
d	6.0 mm
d1	3.8 mm
ds	4.2 mm
p	3.0 mm

d head	15.0 mm
d	8.0 mm
d1	5.4 mm
ds	5.8 mm
p	5.6 mm

A7: Characteristic yield moment and plastic bending angle

Table A7: Characteristic yield moment.

Screw type	d [mm]	$M_{y,k}$ [Nmm]	Steel grade	Coating type
ET-T	6.5	8 800	Hardened carbon steel	CorrSeal
	8.2	28 300		
HF(HEX) W (WAF)	6	11 900	Hardened carbon steel	EZP CorrSeal
	8	25 500		
	10	36 600		
W(WAF)	6	6 300	Austenitic stainless steel A4 (SAE 316)	
	8	11 600		
	10	19 800		
ESSDRIVE	6	7 300	Hardened carbon steel	EZP, CorrSeal
	8	19 700		

Plastic bending angle for all types of screws: > 45°.

A8: Characteristic withdrawal parameter

Table A8_1: Characteristic withdrawal parameter $f_{ax,k}$ (solid timber (≥ C24), glulam (≥ GL 24), cross laminated timber, $\rho_k \geq 350$ kg/m³), perpendicular / parallel to grain.

Screw type	d [mm]	$f_{ax,k}$ [N/mm²] perpendicular	$f_{ax,k}$ [N/mm²] parallel	Coating type
ET-T	6.5	17.3	8.9*	CorrSeal
	8.2	15.3	7.8*	
HF(HEX) W(WAF)	6	10.9	/	EZP, CorrSeal
	8	12.5	/	
	10	10.0	/	
W(WAF)	6	16.1	12.3	Austenitic stainless steel A4 (SAE 316)
	8	15.5	11.3	
	10	14.1	10.3	
ESSDRIVE	6	14.6	/	EZP, CorrSeal
	8	11.2	/	

* informative, calculation based on 10 specimens.

Table A8_2: Characteristic withdrawal parameter $f_{ax,k}$ (solid timber (≥ C24), glulam (≥ GL 24), cross laminated timber, $\rho_k \geq 350$ kg/m³), α = 60°.

Screw type	d [mm]	$f_{ax,k}$ [N/mm²]	Coating type
ET-T	6.5	15.1	CorrSeal
	8.2	15.5	

For angles α between screw axis and grain direction 15° ≤ α° < 45° the characteristic withdrawal capacity $F_{ax,\alpha,Rk}$ should multiply by factor k_{ax}:

$$k_{ax} = 0.3 + \frac{0.7 \cdot \alpha}{45°}$$

Characteristic withdrawal capacity of connections with axially loaded screws shall be calculated as:

$$F_{ax,\alpha,Rk} = k_{ax} \cdot n_{ef} \cdot f_{ax,90,k} \cdot d \cdot l_{ef} \cdot \left(\frac{\rho_k}{350}\right)^{0.8}$$

k_{ax} factor to consider the influence of the angle between screw axis and grain direction and the long - term behaviour (k_{ax} = 1 for 45° ≤ α° ≤ 90°)
n_{ef} effective number of screws according to EN 1995-1-1
$f_{ax,90,k}$ short-term characteristic withdrawal parameter for an angle α between screw axis and grain direction of 90° 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
ρ_k characteristic density of the timber member in kg/m³

A9: Characteristic head pull-trough parameter

Table A9_1: Characteristic head pull-trough parameter $f_{head,k}$ (solid timber (≥ C24), glulam (≥ GL 24), cross laminated timber, $\rho_k \geq 350$ kg/m³).

Screw type	d [mm]	d head [mm]	$f_{head,k}$ [N/mm²]	Coating type
ET-T	6.5	8	NPA	CorrSeal
	8.2	10	NPA	
HF(HEX)	6	13	17.1	CorrSeal
	8	15	16.6	
	10	18	19.7	
W(WAF)	6	15.3	16.3	EZP, CorrSeal
	8	22	12.6	
	10	25	15.5	
W(WAF)	6	14	24.7	Austenitic stainless steel A4 (SAE 316)
	8	17	24.5	
	10	21	20.8	
ESSDRIVE	6	11.7	17.7	EZP, CorrSeal
	8	15	17.6	

Table A9_2: Other timber and timber based products.

Material	$f_{head,k}$ [N/mm²]
Timber and timber based products, $\rho_k \geq 350$ kg/m³, thickness ≥ 20 mm: − 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, − Particleboards according to EN 312 and EN 13986, − Cement-bonded particle boards according to EN 634-2 and EN 13986, − Fibreboards according to EN 622-2, EN 622-3 and EN 13986.	10
Wood based panels, thickness less than 12 mm, minimum thicknesses of the wood based panels: 1.2 • (outer screw thread diameter) and minimum board thickness: − Plywood and fibreboards (hardboards and medium boards): 6 mm, − Oriented strand boards, particleboards, cement-bonded particle board: 8 mm, − Solid wood panels: 12 mm.	8 $F_{ax,Rk,max.}$ = 400 N

Characteristic head pull-through capacity (EN 1995-1-1):

$$F_{ax,\alpha,Rk} = n_{ef} \cdot f_{head,k} \cdot d_h^2 \cdot \left(\frac{\rho_k}{350}\right)^{0.8}$$

n_{ef} effective numer of screws according to EN 1995-1-1
f_{head} characteristic head pull-trough parameter in N/mm²
d_h diameter of the screw head in mm
ρ_k characteristic density of the timber member in kg/m³

REMARK: Conversion of the characteristic head pull-through parameter $f_{head,k}^{EN\ 1383}$ in the characteristic head pull-through strength (prEN 1995-1-1):

$$f_{head,k} = \frac{4}{\pi} f_{head,k}^{EN\ 1383}$$

A10: Characteristic tensile strength and Characteristic yield strength

Table A10_1: Characteristic tensile strength.

Screw type	d [mm]	$f_{tens,k}$ [kN]	Steel grade	Coating type
ET-T	6.5	14.8	Hardened carbon steel	CorrSeal
	8.2	30.1		
HF(HEX)	6	13.3	Hardened carbon steel	CorrSeal
	8	24.6		
	10	33.6		
W(WAF)	6	13.3	Hardened carbon steel	EZP, CorrSeal
	8	24.6		
	10	33.6		
W(WAF)	6	7.7	Austenitic stainless steel A4 (SAE 316)	
	8	15.7		
	10	21.9		
ESSDRIVE	6	13.5	Hardened carbon steel	EZP, CorrSeal
	8	28.7		

Table A10_2: Characteristic yield strength.

Screw type	d [mm]	$f_{y,k}$ [N/mm^2]	Steel grade
ET-T	6.5	≥ 900	Hardened carbon steel
	8.2		
HF(HEX)	6	≥ 900	Hardened carbon steel
	8		
	10		
W(WAF)	6	≥ 900	Hardened carbon steel
	8		
	10		
W(WAF)	6	≥ 380	Austenitic stainless steel A4 (SAE 316)
	8		
	10		
ESSDRIVE	6	≥ 900	Hardened carbon steel
	8		

A11: Characteristic torsional strength / Insertion moment

Table A11: Characteristic torsional strength $f_{tor,k}$.

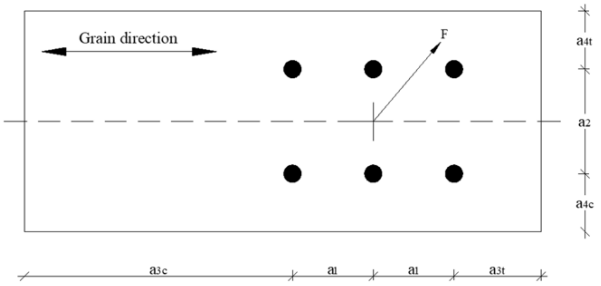
Screw type	d [mm]	$f_{tor,k}$ [Nm]	Steel grade	Coating type
ET-T	6.5	11.3	Hardened carbon steel	CorrSeal
	8.2	34.5		
HF(HEX)	6	12.4	Hardened carbon steel	CorrSeal
	8	28.2		
	10	46.3		
W(WAF)	6	12.4	Hardened carbon steel	EZP, CorrSeal
	8	28.2		
	10	46.3		
W(WAF)	6	8.7	Austenitic stainless steel A4 (SAE 316)	
	8	19.6		
	10	33.3		
ESSDRIVE	6	10.4	Hardened carbon steel	EZP, CorrSeal
	8	29.7		

Ratio of the characteristic torsional strength to the mean insertion moment for all type of screws:

$$\frac{f_{tor,k}}{R_{tor,mean}} \geq 1.5$$

A12: Spacing, end and edge distances of the screws

For screws in solid wood (strength classes C16 up to C40 and D30 up to D70 according to EN 14081-1) and glued laminated timber (strength class GL24 up to GL36 according to EN 14080) the spacing, end and edge distances and the minimum thickness of the timber material are to be determined according to EN 1995-1-1, Clause 8.3.1.2 and Table 8.2 (Figure A12).



(1) loaded end
(2) unloaded end
(3) loaded edge
(4) unloaded edge
α angle between the force and grain direction

Figure A12: Spacing, end and edge distances of the screws.

For screws ET-T, d = 6.5 mm, the minimum spacing, end and edge distances of the screws are given in Table A12.

Table A12: Spacing, end and edge distances for the screws ET-T, d = 6.5 mm.

Screw type	a_1	a_2	$a_{3,c}$	$a_{3,t}$	$a_{4,c}$	$a_{4,t}$
ET-T 6.5 mm	6d	3d	8d	8d	3d	3d
	40 mm	20 mm	50 mm	50 mm	20 mm	20 mm

A13_1: Fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical façades

A13.1 General

ESSVE Construction screws ET-T, HF(HEX), W(WAF), Wood screws ESSDRIVE may also be used for fixation of various thermal insulation materials in roof and wall structures. Length of the screws has to be sufficient to ensure the lower thread is fully embedded in base load bearing structure / elements (Figure A13).

Max. spacing between the screws is limited to e_s = 1.75 m.

The angle between grain direction and screw axis should be 30° ≤ α ≤ 90°.

The thickness of insulation material is $h_{TI,max,\alpha=90°}$ = 250 mm ($h_{TI,max,\alpha=60°}$ = 205 mm). The minimum compressive stress of the thermal insulation material at 10 % deformation shall be $\sigma_{TI,C,10\%,min}$ = 0.05 N/mm² (EN 826:2013).
Minimum counter battens dimensions are presented in Table A13. The minimum strength class of timber elements is C24 (EN 338). Alternative board materials, listed in Chapter 2, can be used as alternative.

Table A13: Minimum counter battens dimensions.

Screw diameter [mm]	Batten width (2 · (4 · d)) [mm]	Batten thickness (4 · d) [mm]
6.0	48	24
6.5	52	26
8.0	64	32
8.2	65	33
10.0	80	40

Base load bearing structure / elements (rafters, studs, panels, etc.) can be made of solid timber (EN 14081-1) (min. C24), glue laminated timber (EN 14080), (min. GL 24), cross laminated timber or LVL Laminated veneer lumber (EN 14374) / Glue laminated timber made of hardwood LVL (ETA according to EAD). Min. width of timber / timber composites is limited to 60 mm.

Only the mechanical resistance is subject of this Annex, building physic performance is not subject of this assessment.

Basic mechanical model of counter battens, thermal insulation material and timber based base material (rafter, etc.) is a beam on elastic foundation: counter battens present the beam; thermal insulation installed above base material presents the elastic foundation.

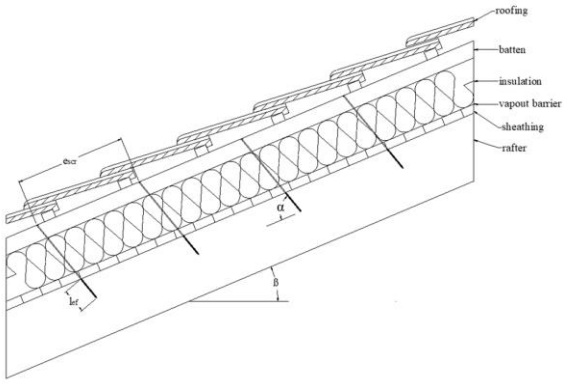


Figure A13: Fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical facades.

A13_2: Fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical façades

DESIGN OF COUNTER BATTNES:

Design shall follow EN 1995-1-1.

Friction forces shall not be taken into consideration in the design of the axial capacity of the screws.

a.) Bending:

Bending moment: $M_k = \frac{(F_{b,k}+F_{s,k})}{4} \cdot l_{ch}$; $l_{ch} = \sqrt[4]{\frac{4EI}{b_{ef} \cdot K}}$

$F_{b,k}$	characteristic point loads perpendicular to the battens (dead, wind, snow, etc.)
$F_{b,k}$	characteristic loads perpendicular to the battens (screw load application)
l_{ch}	characteristic length
EI	counter batten bending stiffness: $I = bh^3/12$
b_{ef}	effective width: $b_{ef} = b + h_{TI}/2$
h_{TI}	thickness of thermal insulation material
K	coefficient of subgrade reaction: $K = E_{TI}/h_{TI}$
b, h	width and height of counter batten (net dimensions)

$$\frac{\sigma_{m,d}}{f_{m,d}} = \frac{M_d}{W \cdot f_{m,d}} \leq 1;\ W = \frac{bh^2}{6}$$

b.) Shear:

Shear force: $V = \frac{(F_b+F_s)}{2}$

$$\frac{\tau_d}{f_{v,d}} = \frac{V_d}{A_s \cdot f_{m,d}} \leq 1;\ A_s = \frac{A}{1.5} = \frac{b \cdot h}{1.5}$$

DESIGN OF THERMAL INSULATION MATERIAL (in compression):

$$\sigma_k = \frac{1.5 \cdot F_{b,k} + F_{s,k}}{2 \cdot l_{ch} \cdot b} \leq 1.1 \cdot \sigma_{TI,C,10\%}$$

$\sigma_{TI,C,10\%}$ compressive stresses in thermal insulation at 10 % deformation calculated according to EN 826:2013

DESIGN OF SCREWS (parallel inclined screws):

Axial tension force in screw:

$$T_{S,k} = \frac{R_{S,k}}{\cos \alpha};\ R_{S,k} = \left(G_{s,k} + S_{s,k}\right) \cdot \sin \beta$$

A13_3: Fastening of battens on thermal insulation systems on top of rafters or on timber members in vertical façades

Axial withdrawal capacity of screw (min value of design value of the axial withdrawal capacity of the threaded part of the screw, the head pull-through capacity of the screw and the tensile capacity of the screw according to Annexes A8 - A10):

$$F_{ax,\alpha,Rd} = min \begin{cases} f_{ax,d} \cdot d \cdot l_{ef} \cdot k_1 \cdot k_2 \cdot \left(\frac{\rho_k}{350}\right)^{0.8} \\ f_{head,d} \cdot d_h^2 \cdot \left(\frac{\rho_k}{350}\right)^{0.8} \\ f_{tens,d} \end{cases}$$

$f_{ax,d}$	design value of the axial withdrawal parameter of screw
d	thread diameter of screw
l_{ef}	effective penetration length in base material (rafter) (≤ 6 • d)
k_{ax}	factor to consider the influence of the angle between screw axis and grain direction and the long-term behaviour (k_{ax} = 1 for 45° ≤ α° ≤ 90°; k_{ax} = 0.3 + (0.7 • α° / 45°) for 45° ≤ α°≤ 90°)
k_1	reduction factor – dimensions of thermal insulation material (k_1 = min {1; 200 / h_{TI} [mm]})
k_2	reduction factor – stresses in thermal insulation material (k_2 = min {1; $\sigma_{TI,C,10\%}$ [N/mm] / 0.12})
ρ_k	characteristic density of base material (rafter)
$f_{head,d}$	design value of the head pull-through capacity of the screw
d_h	head diameter
$f_{tens,d}$	design tensile strength of the screw