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European Technical Assessment

ETA 20/0049
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General Part

Technical Assessment Body issuing the European Technical Assessment
Technický a zkušební ústav stavební Praha, s.p.

Trade name of the construction product	**HPLConstruction screw**
Product family to which the construction product belongs	Product area code: 13 Screws for use in timber constructions
Manufacturer	Hašpl a.s. Ke Koupališti 172 549 32 Velké Poříčí Czech Republic
Manufacturing plant	Plant 1 Plant 2
This European Technical Assessment contains	26 pages including 3 Annexes, which form an integral part of this European Technical 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 constructions

1 Technical description of the product

HPLConstruction screws are made from carbon steel C10B21. Surface of the screws is covered by yellow zinc 5 µ or by blue zinc 5 µ. Type of head is wafer or countersunk. The screws are with full thread or partial thread. The thread is self-drilling. All screws fulfill the requirement for a minimum bending angle of $\alpha = (45/d^{0.7} + 20)$. The screws are used for connections in load bearing timber structures between wood-based members.

1.1 Shape and dimensions

The outer thread diameter is not less than 3.0 mm and not greater than 10.0 mm. The overall length of the screws is ranging from 20 mm to 400 mm. Further dimensions are shown in Annex 1.

The ratio of inner thread diameter to outer thread diameter d_1/d ranges for all tested screws from 0.61 to 0.67.

The screws are threaded over a minimum length $l_g \geq 4 \cdot d$.

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

The screws are intended to be used for connecting wood-based members where requirements for mechanical resistance and stability and safety in use shall be fulfilled. The screws are used for connections in load bearing timber structures between wood-based members:

- Solid timber (softwood) of strength classes C14 - C 40 according to EN 338[1] / EN 14081-1[2]
- Glued laminated timber (softwood) of at least strength class GL24c/GL24h according to EN 14080[3]
- Laminated veneer lumber LVL according to EN 14374[4], arrangement of the screws only perpendicular to the plane of the veneers
- Glued laminated solid timber according to EN 14080[3]
- Cross laminated timber according to European Technical Assessments or national provisions that apply at the installation site

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

- Plywood according to EN 636+A1[5] and EN 13986+A1[6]
- Oriented Strand Board, OSB according to EN 300[7] and EN 13986+A1[6]
- Particleboard according to EN 312[8] and EN 13986+A1[6]
- Fibreboards according to EN 622-2[9], EN 622-3[10] and EN 13986+A1[6]

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1 EN 338 Timber structures - Strength classes
2 EN 14081-1 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
3 EN 14080 Timber structures - Glued laminated timber and glued solid timber - Requirements
4 EN 14374 Timber structures - Structural laminated veneer lumber - Requirements
5 EN 636 Plywood - Specification
6 EN 13986 Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
7 EN 300 Oriented strand boards (OSB) - Definition, classification and specifications
8 EN 312 Particleboards - Specifications
9 EN 622-2 Fibreboards - Specifications - Part 2: Requirements for hardboards
10 EN 622-3 Fibreboards - Specifications - Part 3: Requirements for medium boards

- Cement-bonded particle boards according to national provisions that apply at the building site
- Solid-wood panels according to national provisions that apply at the building site

Wood-based panels shall only be arranged on the side of the screw head.
According to EN 1995-1-1[11] the screws made from special stainless or carbon steel with $d > 4$ mm may be used in timber structures subject to climate conditions defined by service classes 1 and 2. According to EN 1995-1-1 the screws made from special stainless or carbon steel with $d \leq 4$ mm may be used in timber structures subject to climate conditions defined by service class 1. Regarding environmental conditions national provisions shall apply at the building site.

Corrosive categories according to EN ISO 12944-2 shall be taken into account.

The use of the screws shall be limited to static and quasi/static actions.

The provisions made in this European Technical Assessment are based on an assumed minimum working life of 50 years, provided that the screws are subject to appropriate use and maintenance.

The indications given as to the working life cannot be interpreted as a guarantee given by the producer or Technical Assessment Body but are regarded only as a mean for choosing the right products in relation to the expected economically reasonable working life of the works.

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

The assessment of the fitness for use of the HPLConstruction screws according to the basic work requirements (BWR) were carried out in compliance with EAD 130118-01-0603.

The European Technical Assessment is issued for the screws on the basis of agreed data and information, deposited at Technický a zkušební ústav stavební Praha, s.p., which identifies screws that has been assessed and judged. Changes to the screws or production process which could result in this deposited data and information being incorrect should be notified to Technický a zkušební ústav stavební Praha, s.p. before the changes are introduced. Technický a zkušební ústav stavební Praha, s.p. 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 or alternations to the ETA shall be necessary.

Table 1 Essential characteristics of the product

	Essential characteristic	Performance
3.1 BWR 1: Mechanical resistance and stability		
3.1.1	Dimensions	See Annex 1 and Annex 2
3.1.2	Characteristic yield moment	See Annex 2
3.1.3	Characteristic withdrawal parameter	See Annex 2
3.1.4	Characteristic head pull-through parameter	See Annex 2
3.1.5	Characteristic tensile strength	See Annex 2
3.1.6	Characteristic yield strength	See Annex 2
3.1.7	Characteristic torsional strength	See Annex 2
3.1.8	Insertion moment	See Annex 2
3.1.9	Bending angle	See Annex 2
3.1.10	Durability against corrosion	The screws are covered by yellow zinc 5 µ or by blue zinc 5 µ
3.1.11	Spacing, end and edge distances of the screws and minimum thickness of the wood-based	Point 3.1.11 No performance assessed

[11] EN 1995-1-1 Design of timber structures - Part 1-1: General - Common rules and rules for buildings

	Essential characteristic	Performance
	material	
3.1.12	Slip modulus for mainly axially loaded screws	No performance assessed
3.2 BWR 2: Safety in case of fire		
3.2.1	Reaction to fire	All screws are made from carbon steel C10B21 classified as Euroclass A in accordance with EC Decision 1996/603/EC, as amended by EC
BWR 4: Safety and accessibility in use		
Same as BWR 1		

3.1 Mechanical resistance and stability (BWR 1)

Annex 2 contains essential characteristics for all screws. The design and construction shall be carried out according to national provisions that apply at the installation site in line with the partial safety factor format, e.g. in accordance with EN 1995-1-1.

3.1.1 Dimensions

The dimensions have been measured according to provisions in EN 14592+A1. The dimensions are stated in tables at Annex 1 and measured values in tables at Annex 2.

3.1.2 Characteristic yield moment

The characteristic yield moment $M_{y,k}$ has been determined by tests according to EN 409. The test results are stated in tables at Annex 2.

3.1.3 Characteristic withdrawal parameter

The characteristic withdrawal parameters $f_{ax,0,k}$ and $f_{ax,90,k}$ have been determined by tests according to EN 1382. Density of used timber is mentioned in tables at Annex 2. The test results are stated in tables at Annex 2.

For angles α between screw axis and grain direction $15° \le \alpha < 45°$ the characteristic withdrawal capacity $F_{ax,\alpha,Rk}$ shall be determined according to equation:

$$F_{ax,\alpha,Rk} = k_{ax} \cdot f_{ax,90,k} \cdot d \cdot l_{ef} \cdot (\rho_k/350)^{0,8}$$

where

k_{ax} factor to consider the influence of the angle between screw axis and grain direction and the long term behaviour
$k_{ax} = 0,3+(0,7 \cdot \alpha)/45°$

$f_{ax,90,k}$ 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 wood-based member in kg/m³

For angle α between screw axis and grain direction $0° \le \alpha < 15°$ the following requirements were fulfilled and relevant equations can be used:

1. $f_{ax,0,k} / f_{ax,90,k} \ge 0.6$
2. The penetration length of the screws in the timber member shall be

$$l_{pen,req} = \min \begin{cases} \dfrac{4 \cdot d}{\sin \alpha} \\ 20 \cdot d \end{cases}$$

3. At least four screws shall be used in a connection with screws inserted in the timber member with an angle between screw axis and grain direction of less than 15°.

3.1.4 Characteristic head pull-through parameter

The characteristic head pull-through parameter $f_{head,k}$ has been determined by tests according to EN 1383. Density of used timber is mentioned under tables at Annex 2. The test results are stated in tables at Annex 2.

3.1.5 Characteristic tensile strength

The characteristic tensile strength $f_{tens,k}$ has been determined by tests according to EN 1383. The test results are stated in tables at Annex 2.

3.1.6 Characteristic yield strength

The characteristic yield strength has been determined by tests according to EN 1383. The test results are stated in tables at Annex 2.

3.1.7 Characteristic torsional strength

The characteristic torsional strength $f_{tor,k}$ has been determined by tests according to EN ISO 10666. The test results are stated in tables at Annex 2.

3.1.8 Insertion moment

The characteristic insertion moment $R_{tor,k}$ has been determined by tests according to EN 15737. The characteristic torsional ratio $f_{tor,k}/R_{tor,k} \geq 1.5$ has been fulfilled for all types of screws. The test results are stated in tables at Annex 2.

3.1.9 Bending angle

The bending angle α has been determined for each diameter of the screw. The test results are stated in tables at Annex 2. All screws fulfill the requirement for a minimum bending angle of $\alpha = (45/d^{0.7} + 20)$.

3.1.10 Durability against corrosion

The screws are made from carbon steel C10B21 with corrosion protection layer. Surface of the screws is covered by yellow zinc 5 µ or by blue zinc 5 µ.

3.1.11 Spacing, end and edge distances of the screws and minimum thickness of the wood-based material

No performance assessed.

Laterally loaded screws
For screws the minimum spacing, end and edge distances are given in EN 1995-1-1, clause 8.7.1.

Axially loaded screws
For screws the minimum spacing, end and edge distances are given in EN 1995-1-1, clause 8.7.2 and Table 8.6.

3.1.12 Slip modulus for mainly axially loaded screws

No performance assessed.

3.2 Safety in case of fire (BWR 2)

3.2.1 Reaction to fire

All screws are made from carbon steel C10B21 classified as Euroclass A in accordance with EC Decision 1996/603/EC, as amended by EC.

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

According to the Decision 1997/0176/EC [12], of the European Commission the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011 and Commission delegated Regulation (EU) No 568/2014) given in the following table applies:

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Fasteners for structural timber products	Structural timber products		3

[12] 1997/0176/EC - European Commission decision of 17/2/1997, published in the Official Journal of the European Communities No L 73/19

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 control plan deposited at the Technický a zkušební ústav stavební Praha, s.p.

Issued in Prague on 27/06/2021

By

Mária Schaan
Head of the TAB

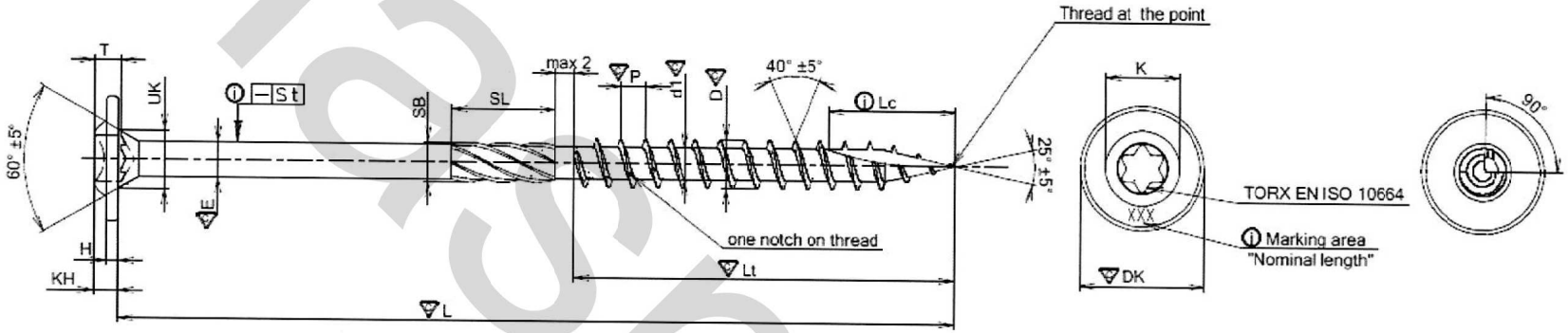
TECHNICKÝ A ZKUŠEBNÍ ÚSTAV STAVEBNÍ PRAHA, s.p.
Technical and Test Institute for Construction Prague, SOE
ZÚS
Czech Republic
Technical Assessment Body
Subjekt pro technické posuzování

Annexes:

Annex 1	Dimensions and tolerances of HPLConstruction screws
Annex 2	Essential characteristics of HPLConstruction screws
Annex 3	Reference documents

Annex 1 Dimensions and tolerances of HPLConstruction screws

HPLConstruction screw with wafer head

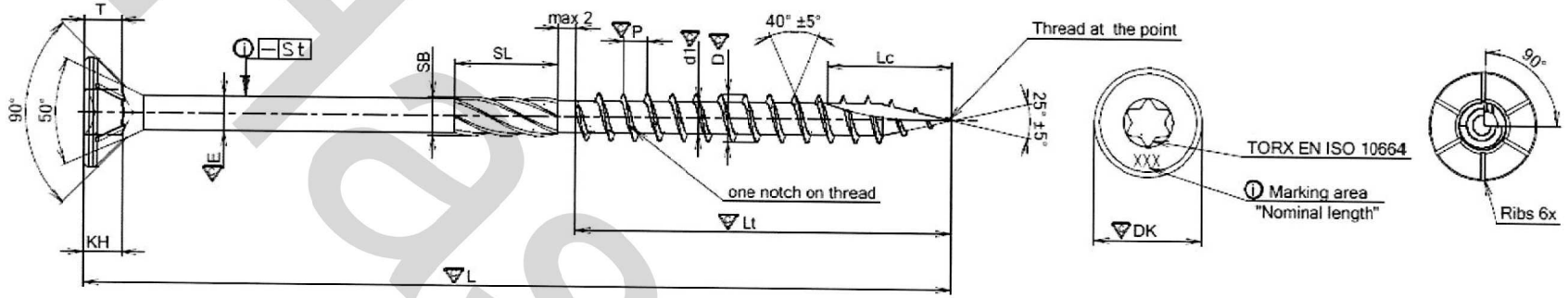


L	40	50	60	70	80	90	100	110	120	130	140	150	160	180	200	220	240	260	280	300	320	340	360	380	400	Bending angle	
St	0,30		0,46		0,61			0,76		0,92			1,07	1,22		1,83	2,03	2,24	2,44		3,30	3,55	3,81		4,06		
Dia.	Lt																									angle (min.)	bending mandrel
Ø5	25	30	35	35	50		60			80																35°	10
Ø6	25	30	35	35	50		60			80																33°	12
Ø8			35		50		60			80																31°	16
Ø10					50		60			80																29°	20

	Description
ⓘ	Important
▽	Critical - must be reach
☑	Variable

SIZE	DK	K	KH	H	UK	D	d1	E	SB	SL	Lc	P	TORX	T (100% depth)	Torque (mim)	Lt (tol)	L (tol)	Case depth
5,0	11,5-12,5	6,5-8,5	2,50-3,30	1,30-1,50	5,0-6,0	4,75-5,15	2,8-3,2	3,35-3,55	4,0-4,3	8,0-13,0	12,0-14,0	3,1-3,5	25	2,5-2,9	6,2 N/m	±1,5	±2	0,10-0,23
6,0	14,5-16,0	10,0-12,0	2,70-3,50	1,60-1,80	7,3-8,5	5,8-6,2	3,8-4,15	4,20-4,40	4,6-5,0	8,0-13,0	12,0-14,0	4,3-4,9	30	2,9-3,3	10,8 N/m	±1,5	±2	0,10-0,28
8,0	20,5-22,5	15,0-17,0	3,40-4,75	1,70-2,0	9,0-10,0	7,8-8,3	5,1-5,5	5,70-5,90	6,2-6,9	11,0-13,0	17,0-19,0	5,3-5,9	40	3,1-3,6	28,0 N/m	±1,5	±2	0,10-0,28
10,0	24,0-26,0	19,0-21,0	3,80-4,40	2,0-2,2	11,3-12,5	9,6-10,3	6,0-6,5	6,90-7,20	7,6-8,0	11,0-13,0	17,0-19,0	6,4-7,1	40	3,3-3,8	44,0 N/m	±1,5	±2	0,10-0,28

HPLConstruction screw with countersunk head



L	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	160	180	200	220	240	260	280	300	320	340	360	380	400
St							0,30		0,46		0,61			0,76		0,92			1,07		1,22		1,83	2,03	2,24		2,44			3,30	3,55		3,81		4,06
Dia.	Lt																													
Ø3		Full		15		25																								
Ø3,5		Full		15		25		30																						
Ø4		Full		16		25		30		35																				
Ø4,5			Full	18		25		30		35																				
Ø5			Full	20		25		30		35		50		60		80														
Ø6						25		30		35		50		60						80										
Ø8										35		50		60								80								
Ø10												50		60								80								

	Description
ⓘ	Important
▽	Critical - must be reach
V	Variable

SIZE	DK	KH	D	d1	E	SB	SL	Lc	P	TORX	T (Nm)	Torque (mim)	Lt (tol.)	L (tol.)	Case depth	Bending angle	
																angle (min.)	bending mandrel
3,0	5,60-6,00	1,7-2,1	2,80-3,10	1,70-2,00	2,05-2,20	2,5-2,7	3,0-4,0	5,0-6,0	1,9-2,3	10	1,3-1,6	1,5 N/m	±1,5		0,08-0,18	41°	6
3,5	6,60-7,00	1,8-2,2	3,30-3,65	1,90-2,20	2,35-2,55	2,7-2,9	3,0-4,0	6,0-7,0	2,0-2,45	15	1,5-1,8	2,0 N/m	±1,5	L<=30	0,08-0,18	39°	7
4,0	7,50-8,00	2,5-2,9	3,75-4,10	2,30-2,60	2,65-2,90	3,0-3,5	4,0-5,0	7,0-8,0	2,3-2,8	20	1,8-2,1	3,0 N/m	±1,5	±1,7	0,10-0,23	38°	8
4,5	8,50-9,00	2,8-3,2	4,25-4,65	2,60-2,90	3,05-3,30	3,4-3,9	6,0-7,0	8,0-9,0	2,5-3,1	25	1,9-2,3	4,4 N/m	±1,5		0,10-0,23	36°	9
5,0	9,50-10,00	3,1-3,4	4,75-5,15	2,8-3,2	3,35-3,55	4,0-4,3	8,0-10,0	12,0-14,0	3,1-3,5	25	2,0-2,4	6,2 N/m	±1,5		0,10-0,23	35°	10
6,0	11,50-12,0	3,5-4,0	5,8-6,2	3,8-4,15	4,20-4,40	4,6-5,0	8,0-10,0	12,0-14,0	4,3-4,9	30	2,5-2,9	10,8 N/m	±1,5	L>30	0,10-0,28	33°	12
8,0	14,4-15,2	4,7-5,2	7,8-8,3	5,1-5,5	5,70-5,90	6,2-6,9	11,0-13,0	17,0-19,0	5,3-5,9	40	3,1-3,6	28,0 N/m	±1,5	±2	0,10-0,28	31°	16
10,0	17,4-18,2	6,0-6,5	9,6-10,3	6,0-6,5	6,90-7,20	7,6-8,0	11,0-13,0	17,0-19,0	6,4-7,1	40	3,3-3,8	44,0 N/m	±1,5		0,10-0,28	29°	20

Annex 2 Essential characteristics of HPLConstruction screws

Mechanical resistance and stability (BWR 1)

Table 2 HPLConstruction screw diameter M3.0, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, blue zinc 5 µm (Plant 1)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	3.0	3.07	
d_1 (mm)	3.0	2.02	
d_h (mm)	3.0	6.02	
d_s (mm)	3.0	2.22	
p pitch thread (mm)	3.0	1.80	
l_g (mm)	3.0	23.83	
l (mm)	3.0	44.08	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	3.0	1523	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	3.0	17.12 (*)	
$f_{ax,0,k}$ (N/mm²)	3.0	12.77 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	3.0	26.02 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	3.0	3.65	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	3.0	1270.5	
$R_{p0.2}$ (MPa)	3.0	1238.7	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	3.0	C24	1.55/0.48=3.25
	3.0	480 kg/m³	1.55/0.54=2.85
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	3.0	53.78°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	3.0	34.5	

* density of timber 350 kg/m³

Table 3 HPLConstruction screw diameter M3.5, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 1)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	3.5	3.52	
d_1 (mm)	3.5	2.24	
d_h (mm)	3.5	6.78	
d_s (mm)	3.5	2.45	
p pitch thread (mm)	3.5	2.16	
l_g (mm)	3.5	29.47	
l (mm)	3.5	49.23	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	3.5	2134	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	3.5	16.81 (*)	
$f_{ax,0,k}$ (N/mm²)	3.5	13.02 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	3.5	25.69 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	3.5	4.54	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	3.5	1285.8	
$R_{p0.2}$ (MPa)	3.5	1279.9	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	3.5	C24	2.21/0.69=3.20
	3.5	480 kg/m³	2.21/0.79=2.81
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	3.5		54.52°
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	3.5		33.0

* density of timber 350 kg/m³

Table 4 HPLConstruction screw diameter M4.0, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 1)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	4.0	3.96	
d_1 (mm)	4.0	2.48	
d_h (mm)	4.0	7.78	
d_s (mm)	4.0	2.75	
p pitch thread (mm)	4.0	2.70	
l_g (mm)	4.0	34.63	
l (mm)	4.0	68.36	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	4.0	3484	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	4.0	16.32 (*)	
$f_{ax,0,k}$ (N/mm²)	4.0	11.84 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	4.0	24.12 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	4.0	5.77	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	4.0	1357.8	
$R_{p0.2}$ (MPa)	4.0	1326.2	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	4.0	C24	3.41/1.08=3.17
	4.0	480 kg/m³	3.41/1.23=2.78
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	4.0		50.61°
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	4.0		30.8

* density of timber 350 kg/m³

Table 5 HPLConstruction screw diameter M4.5, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, blue zinc 5 µm (Plant 1)

3.1.1	Average value of geometry			
	ø [mm]	Partial thread		
d (mm)	4.5	4.55		
d_1 (mm)	4.5	2.79		
d_h (mm)	4.5	9.01		
d_s (mm)	4.5	3.14		
p pitch thread (mm)	4.5	2.89		
l_g (mm)	4.5	34.48		
l (mm)	4.5	79.23		
3.1.2	Characteristic yield moment			
$M_{y,k}$ (Nmm)	ø [mm]	Thread section	Smooth section	
	4.5	4262	7581	
3.1.3	Characteristic withdrawal parameter			
	ø [mm]			
$f_{ax,90,k}$ (N/mm²)	4.5	16.12 (*)		
$f_{ax,0,k}$ (N/mm²)	4.5	12.64 (*)		
3.1.4	Characteristic head pull-through parameter			
$f_{head,k}$ (N/mm²)	ø [mm]			
	4.5	23.11 (*)		
3.1.5	Characteristic tensile capacity			
$f_{tens,k}$ (kN)	ø [mm]			
	4.5	7.23		
3.1.6	Characteristic yield strength			
	ø [mm]			
R_m (MPa)	4.5	1318.0		
$R_{p0.2}$ (MPa)	4.5	1306.3		
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material		
	4.5	C24	4.63/1.97=2.35	
	4.5	480 kg/m³	4.63/2.24=2.07	
3.1.9	Bending angle			
Bending angle (°)	ø [mm]			
	4.5	51.21°		
3.1.10	Average value of durability against corrosion (protective layer thickness)			
Protective layer thickness (µm)	ø [mm]			
	4.5	27.2		

* density of timber 350 kg/m³

Table 6 HPLConstruction screw diameter M5.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm or blue zinc 5 µm (Plant 1)

3.1.1	Average value of geometry			
	ø [mm]	Partial thread		
d (mm)	5.0	5.00		
d_1 (mm)	5.0	3.11		
d_h^{csk} (mm)	5.0	9.79		
d_h^{wafer} (mm)	5.0	11.68		
d_s (mm)	5.0	3.42		
p pitch thread (mm)	5.0	3.20		
l_g (mm)	5.0	49.38		
l^{csk} (mm)	5.0	79.23		
l^{wafer} (mm)	5.0	138.77		
3.1.2	Characteristic yield moment			
$M_{y,k}$ (Nmm)	ø [mm]			
	5.0	5766		
3.1.3	Characteristic withdrawal parameter			
	ø [mm]			
$f_{ax,90,k}$ (N/mm²)	5.0	15.66 (*)		
$f_{ax,0,k}$ (N/mm²)	5.0	13.06 (*)		
3.1.4	Characteristic head pull-through parameter			
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head	
	5.0	22.85 (*)	26.51 (*)	
3.1.5	Characteristic tensile capacity			
$f_{tens,k}$ (kN)	ø [mm]			
	5.0	8.03		
3.1.6	Characteristic yield strength			
	ø [mm]			
R_m (MPa)	5.0	1174.9		
$R_{p0.2}$ (MPa)	5.0	1166.7		
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 80 mm	Length 140 mm
	5.0	C24	5.95/2.93=2.03	5.95/2.57=2,32
	5.0	480 kg/m³	5.95/3.35=1.78	5.95/2.93=2.03
3.1.9	Bending angle			
Bending angle (°)	ø [mm]			
	5.0	47.58°		
3.1.10	Average value of durability against corrosion (protective layer thickness)			
Protective layer thickness (µm)	ø [mm]			
	5.0	27.9		

* density of timber 350 kg/m³

Table 7 HPLConstruction screw diameter M6.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm or blue zinc 5 µm (Plant 1)

3.1.1	Average value of geometry			
	ø [mm]	Partial thread		
d (mm)	6.0	5.97		
d_1 (mm)	6.0	3.94		
d_h^{csk} (mm)	6.0	11.60		
d_h^{wafer} (mm)	6.0	14.73		
d_s (mm)	6.0	4.24		
p pitch thread (mm)	6.0	5.20		
l_g (mm)	6.0	48.03		
l^{csk} (mm)	6.0	78.92		
l^{wafer} (mm)	6.0	299.68		
3.1.2	Characteristic yield moment			
$M_{y,k}$ (Nmm)	ø [mm]			
	6.0	10516		
3.1.3	Characteristic withdrawal parameter			
	ø [mm]			
$f_{ax,90,k}$ (N/mm²)	6.0	15.04 (*)		
$f_{ax,0,k}$ (N/mm²)	6.0	12.29 (*)		
3.1.4	Characteristic head pull-through parameter			
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head	
	6.0	21.99 (*)	25.24 (*)	
3.1.5	Characteristic tensile capacity			
$f_{tens,k}$ (kN)	ø [mm]			
	6.0	13.49		
3.1.6	Characteristic yield strength			
	ø [mm]			
R_m (MPa)	6.0	1234.6		
$R_{p0.2}$ (MPa)	6.0	1183.8		
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 80 mm	Length 300 mm
	6.0	C24	12.22/4.93=2.48	12.22/5.16=2.37
	6.0	480 kg/m³	12.22/5.62=2.17	12.22/5.88=2.08
3.1.9	Bending angle			
Bending angle (°)	ø [mm]			
	6.0	59.52°		
3.1.10	Average value of durability against corrosion (protective layer thickness)			
Protective layer thickness (µm)	ø [mm]			
	6.0	30.1		

* density of timber 350 kg/m³

Table 8 HPLConstruction screw diameter M8.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, blue zinc 5 µm (Plant 1)

3.1.1	Average value of geometry			
	ø [mm]	Partial thread		
d (mm)	8.0	8.02		
d_1 (mm)	8.0	5.40		
d_h^{csk} (mm)	8.0	14.76		
d_h^{wafer} (mm)	8.0	20.68		
d_s (mm)	8.0	5.84		
p pitch thread (mm)	8.0	5.45		
l_g (mm)	8.0	58.00		
l^{csk} (mm)	8.0	98.90		
l^{wafer} (mm)	8.0	399.59		
3.1.2	Characteristic yield moment			
$M_{y,k}$ (Nmm)	ø [mm]			
	8.0	22850		
3.1.3	Characteristic withdrawal parameter			
	ø [mm]			
$f_{ax,90,k}$ (N/mm²)	8.0	15.05 (*)		
$f_{ax,0,k}$ (N/mm²)	8.0	10.61 (*)		
3.1.4	Characteristic head pull-through parameter			
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head	
	8.0	23.52 (*)	25.23 (*)	
3.1.5	Characteristic tensile capacity			
$f_{tens,k}$ (kN)	ø [mm]			
	8.0	23.29		
3.1.6	Characteristic yield strength			
	ø [mm]			
R_m (MPa)	8.0	1133.1		
$R_{p0.2}$ (MPa)	8.0	1042.7		
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 100 mm	Length 400 mm
	8.0	C24	27.57/9.77=2.82	27.57/9.28=2.97
	8.0	480 kg/m³	27.57/11.14=2.47	27.57/10.58=2.61
3.1.9	Bending angle			
Bending angle (°)	ø [mm]			
	8.0	45.19°		
3.1.10	Average value of durability against corrosion (protective layer thickness)			
Protective layer thickness (µm)	ø [mm]			
	8.0	11.3		

* density of timber 350 kg/m³

Table 9 HPL Construction screws diameter M10.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: **C10B21, yellow zinc 5 µm or blue zinc** 5 µm (Plant 1)

3.1.1	Average value of geometry			
	ø [mm]	Partial thread		
d (mm)	10.0	10.04		
d_1 (mm)	10.0	6.28		
d_h^{csk} (mm)	10.0	17.49		
d_h^{wafer} (mm)	10.0	24.25		
d_s (mm)	10.0	6.97		
p pitch thread (mm)	10.0	6.58		
l_g (mm)	10.0	78.38		
l^{csk} (mm)	10.0	138.77		
l^{wafer} (mm)	10.0	399.86		
3.1.2	Characteristic yield moment			
$M_{y,k}$ (Nmm)	ø [mm]			
	10.0	32540		
3.1.3	Characteristic withdrawal parameter			
	ø [mm]			
$f_{ax,90,k}$ (N/mm²)	10.0	15.03 (*)		
$f_{ax,0,k}$ (N/mm²)	10.0	10.42 (*)		
3.1.4	Characteristic head pull-through parameter			
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head	
	10.0	21.87 (*)	23.16 (*)	
3.1.5	Characteristic tensile capacity			
$f_{tens,k}$ (kN)	ø [mm]			
	10.0	32.12		
3.1.6	Characteristic yield strength			
	ø [mm]			
R_m (MPa)	10.0	1151.6		
$R_{p0.2}$ (MPa)	10.0	1122.1		
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 140 mm	Length 400 mm
	10.0	C24	49.61/17.51=2.83	49.61/14.72=3.37
	10.0	480 kg/m³	49.61/19.96=2.49	49.61/16.78=2.96
3.1.9	Bending angle			
Bending angle (°)	ø [mm]			
	10.0	36.14°		
3.1.10	Average value of durability against corrosion (protective layer thickness)			
Protective layer thickness (µm)	ø [mm]			
	10.0	13.1		

* density of timber 350 kg/m³

Table 10 HPLConstruction screw diameter M3.0, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	3.0	3.03	
d_1 (mm)	3.0	1.94	
d_h (mm)	3.0	5.79	
d_s (mm)	3.0	2.15	
p pitch thread (mm)	3.0	2.09	
l_g (mm)	3.0	23.48	
l (mm)	3.0	44.15	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	3.0	1287	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	3.0	17.03 (*)	
$f_{ax,0,k}$ (N/mm²)	3.0	11.92 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	3.0	26.94 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	3.0	2.93	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	3.0	1005.7	
$R_{p0.2}$ (MPa)	3.0	1089.2	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	3.0	C24	1.12/0.39=2.85
	3.0	480 kg/m³	1.12/0.45=2.50
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	3.0	45.06°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	3.0	26.3	

* density of timber 350 kg/m³

Table 11 HPLConstruction screw diameter M3.5, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	3.5	3.57	
d_1 (mm)	3.5	2.26	
d_h (mm)	3.5	6.69	
d_s (mm)	3.5	2.45	
p pitch thread (mm)	3.5	2.17	
l_g (mm)	3.5	29.75	
l (mm)	3.5	48.89	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	3.5	2037	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	3.5	16.68 (*)	
$f_{ax,0,k}$ (N/mm²)	3.5	11.77 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	3.5	25.62 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	3.5	4.32	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	3.5	1197.0	
$R_{p0.2}$ (MPa)	3.5	1179.7	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	3.5	C24	2.15/0.65=3.32
	3.5	480 kg/m³	2.15/0.74=2.91
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	3.5	49.91°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	3.5	30.7	

* density of timber 350 kg/m³

Table 12 HPLConstruction screw diameter M4.0, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	4.0	4.04	
d_1 (mm)	4.0	2.48	
d_h (mm)	4.0	7.94	
d_s (mm)	4.0	2.76	
p pitch thread (mm)	4.0	2.58	
l_g (mm)	4.0	35.98	
l (mm)	4.0	78.76	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]	Thread section	Smooth section
	4.0	3003	5945
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	4.0	16.67 (*)	
$f_{ax,0,k}$ (N/mm²)	4.0	12.91 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	4.0	24.59 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	4.0	5.22	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	4.0	1197.1	
$R_{p0.2}$ (MPa)	4.0	1094.0	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	4.0	C24	3.21/1.07=3.01
	4.0	480 kg/m³	3.21/1.22=2.64
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	4.0	49.83°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	4.0	23.1	

* density of timber 350 kg/m³

Table 13 HPLConstruction screw diameter M4.5, countersunk head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	4.5	4.41	
d_1 (mm)	4.5	2.81	
d_h (mm)	4.5	8.81	
d_s (mm)	4.5	3.15	
p pitch thread (mm)	4.5	2.72	
l_g (mm)	4.5	34.74	
l (mm)	4.5	78.67	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]	Thread section	Smooth section
	4.5	4289	8160
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	4.5	16.57 (*)	
$f_{ax,0,k}$ (N/mm²)	4.5	12.97 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]		
	4.5	23.84 (*)	
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	4.5	7.19	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	4.5	1292.6	
$R_{p0.2}$ (MPa)	4.5	1281.2	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	
	4.5	C24	4.54/1.65=2.76
	4.5	480 kg/m³	4.54/1.88=2.42
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	4.5	45.21°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	4.5	23.5	

* density of timber 350 kg/m³

Table 14 HPLConstruction screw diameter M5.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	5.0	4.92	
d_1 (mm)	5.0	3.21	
d_h^{csk} (mm)	5.0	9.83	
d_h^{wafer} (mm)	5.0	11.77	
d_s (mm)	5.0	3.45	
p pitch thread (mm)	5.0	3.37	
l_g (mm)	5.0	49.80	
l^{csk} (mm)	5.0	89.33	
l^{wafer} (mm)	5.0	138.92	
3.1.2	Characteristic yield moment		
$M_{y,k}$ (Nmm)	ø [mm]		
	5.0	6161	
3.1.3	Characteristic withdrawal parameter		
	ø [mm]		
$f_{ax,90,k}$ (N/mm²)	5.0	16.01 (*)	
$f_{ax,0,k}$ (N/mm²)	5.0	12.76 (*)	
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head
	5.0	23.16 (*)	26.45 (*)
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$ (kN)	ø [mm]		
	5.0	8.40	
3.1.6	Characteristic yield strength		
	ø [mm]		
R_m (MPa)	5.0	1153.4	
$R_{p0.2}$ (MPa)	5.0	1134.1	
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 90 mm	Length 140 mm
	5.0	C24	6.77/1.60=4.24	6.77/1.97=3.44
	5.0	480 kg/m³	6.77/1.82=3.72	6.77/2.25=3.01
3.1.9	Bending angle		
Bending angle (°)	ø [mm]		
	5.0	39.47°	
3.1.10	Average value of durability against corrosion (protective layer thickness)		
Protective layer thickness (µm)	ø [mm]		
	5.0	14.5	

* density of timber 350 kg/m³

Table 15 HPLConstruction screw diameter M6.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry	
	ø [mm]	Partial thread
d (mm)	6.0	6.12
d_1 (mm)	6.0	4.04
d_h^{csk} (mm)	6.0	11.81
d_h^{wafer} (mm)	6.0	15.41
d_s (mm)	6.0	4.33
p pitch thread (mm)	6.0	4.84
l_g (mm)	6.0	60.42
l^{csk} (mm)	6.0	99.00
l^{wafer} (mm)	6.0	299.07

3.1.2	Characteristic yield moment	
$M_{y,k}$ (Nmm)	ø [mm]	
	6.0	9895

3.1.3	Characteristic withdrawal parameter	
	ø [mm]	
$f_{ax,90,k}$ (N/mm²)	6.0	15.92 (*)
$f_{ax,0,k}$ (N/mm²)	6.0	12.69 (*)

3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head
	6.0	21.92 (*)	25.14 (*)

3.1.5	Characteristic tensile capacity	
$f_{tens,k}$ (kN)	ø [mm]	
	6.0	14.95

3.1.6	Characteristic yield strength	
	ø [mm]	
R_m (MPa)	6.0	1301.6
$R_{p0.2}$ (MPa)	6.0	1283.7

3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 100 mm	Length 300 mm
	6.0	C24	13.95/3.44=4.05	13.95/3.98=3.51
	6.0	480 kg/m³	13.95/3.92=3.56	13.95/4.53=3.08

3.1.9	Bending angle	
Bending angle (°)	ø [mm]	
	6.0	55.62°

3.1.10	Average value of durability against corrosion (protective layer thickness)	
Protective layer thickness (µm)	ø [mm]	
	6.0	24.9

* density of timber 350 kg/m³

Table 16 HPLConstruction screw diameter M8.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm or blue zinc 5 µm (Plant 2)

3.1.1	Average value of geometry		
	ø [mm]	Partial thread	
d (mm)	8.0	8.05	
d_1 (mm)	8.0	5.34	
d_h^{csk} (mm)	8.0	14.61	
d_h^{wafer} (mm)	8.0	21.21	
d_s (mm)	8.0	5.76	
p pitch thread (mm)	8.0	5.49	
l_g (mm)	8.0	50.25	
l^{csk} (mm)	8.0	100.26	
l^{wafer} (mm)	8.0	399.63	

3.1.2	Characteristic yield moment	
$M_{y,k}$ (Nmm)	ø [mm]	
	8.0	20427

3.1.3	Characteristic withdrawal parameter	
	ø [mm]	
$f_{ax,90,k}$ (N/mm²)	8.0	15.12 (*)
$f_{ax,0,k}$ (N/mm²)	8.0	12.51 (*)

3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head
	8.0	23.61 (*)	25.73 (*)

3.1.5	Characteristic tensile capacity	
$f_{tens,k}$ (kN)	ø [mm]	
	8.0	24.79

3.1.6	Characteristic yield strength	
	ø [mm]	
R_m (MPa)	8.0	1228.8
$R_{p0.2}$ (MPa)	8.0	1210.4

3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 100 mm	Length 400 mm
	8.0	C24	29.15/5.57=5.23	29.15/8.46=3.44
	8.0	480 kg/m³	29.15/6.35=4.59	29.15/9.65=3.02

3.1.9	Bending angle	
Bending angle (°)	ø [mm]	
	8.0	50.73°

3.1.10	Average value of durability against corrosion (protective layer thickness)	
Protective layer thickness (µm)	ø [mm]	
	8.0	16.9

* density of timber 350 kg/m³

Table 17 HPLConstruction screw diameter M10.0, countersunk head or wafer head, Torx recess, self-drilling partial thread, material: C10B21, yellow zinc 5 µm (Plant 2)

3.1.1	Average value of geometry	
	ø [mm]	Partial thread
d (mm)	10.0	9.85
d_1 (mm)	10.0	6.36
d_h^{csk} (mm)	10.0	17.64
d_h^{wafer} (mm)	10.0	24.94
d_s (mm)	10.0	7.02
p pitch thread (mm)	10.0	6.59
l_g (mm)	10.0	48.38
l^{csk} (mm)	10.0	78.93
l^{wafer} (mm)	10.0	401.53

3.1.2	Characteristic yield moment	
$M_{y,k}$ (Nmm)	ø [mm]	
	10.0	37222

3.1.3	Characteristic withdrawal parameter	
	ø [mm]	
$f_{ax,90,k}$ (N/mm²)	10.0	14.28 (*)
$f_{ax,0,k}$ (N/mm²)	10.0	11.29 (*)

3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$ (N/mm²)	ø [mm]	CSK head	Wafer head
	10.0	21.35 (*)	23.15 (*)

3.1.5	Characteristic tensile capacity	
$f_{tens,k}$ (kN)	ø [mm]	
	10.0	30.77

3.1.6	Characteristic yield strength	
	ø [mm]	
R_m (MPa)	10.0	1075.8
$R_{p0.2}$ (MPa)	10.0	903.1

3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
$f_{tor,k}$ / $R_{tor,k}$ (Nm) / (Nm)	ø [mm]	Material	Length 80 mm	Length 400 mm
	10.0	C24	51.34/9.23=5.56	51.34/17.38=2.95
	10.0	480 kg/m³	51.34/10.52=4.88	51.34/19.81=2.59

3.1.9	Bending angle	
Bending angle (°)	ø [mm]	
	10.0	47.42°

3.1.10	Average value of durability against corrosion (protective layer thickness)	
Protective layer thickness (µm)	ø [mm]	
	10.0	13.7

* density of timber 350 kg/m³

Annex 3 Reference documents

[1] European Assessment Document EAD 130118-01-0603 Screws and threaded rods for use in timber constructions (edition March 2019)