

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-12/0521  
of 25 June 2018**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

BTI DoTec and Drilltec screws

Product family  
to which the construction product belongs

BTI DoTec und Drilltec screws for use in timber  
constructions

Manufacturer

BTI Befestigungstechnik GmbH & Co. KG  
Salzstraße 51  
74653 Ingelfingen  
DEUTSCHLAND

Manufacturing plant

plant 1, plant 2, plant 3, plant 4, plant 5

This European Technical Assessment  
contains

32 pages including 4 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

EAD 130118-00-0603

This version replaces

ETA-12/0521 issued on 18 June 2013

**European Technical Assessment**

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## Specific Part

### 1 Technical description of the product

BTI DoTec and Drilltec screws are self-tapping screws made from special carbon or martensitic stainless steel. The screws are hardened. Screws made from carbon steel have a corrosion protection according to Annex A.2.6. 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 17 mm to 600 mm. Further dimensions are shown in Annex 4. The washers are made from carbon steel. The dimensions of the washers are given in Annex A.4.9.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the screws are used in compliance with the specifications and conditions given in Annex 1 and 2.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the screws of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Dimensions	See Annex 4
Characteristic yield moment	See Annex 2
Characteristic withdrawal parameter	See Annex 2
Characteristic head pull-through parameter	See Annex 2
Characteristic tensile strength	See Annex 2
Characteristic yield strength	No performance assessed
Characteristic torsional strength	See Annex 2
Insertion moment	See Annex 2
Spacing, end and edge distances of the screws and minimum thickness of the wood based material	See Annex 2
Slip modulus for mainly axially loaded screws	See Annex 2

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

#### 3.3 Safety and accessibility in use (BWR 4)

Same as BWR 1

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

In accordance with EAD No. 130118-00-0603 the applicable European legal act is: 97/176/EC.  
The system to be applied 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 control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 25 June 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Dewitt

## Annex 1 Specifications of intended use

### A.1.1 Use of the BTI DoTec and Drilltec screws only for:

- Static and quasi-static loads

### A.1.2 Base materials

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

- Solid timber (softwood) according to EN 14081-1<sup>1</sup>,
- Glued laminated timber (softwood) according to EN 14080<sup>2</sup>,
- Laminated veneer lumber LVL of softwood according to EN 14374<sup>3</sup>, arrangement of the screws only perpendicular to the plane of the veneers,
- Glued solid timber (softwood) according to EN 14080 or national provisions that apply at the installation site,
- Cross-laminated timber (softwood) according to European Technical Approvals/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<sup>4</sup> and EN 13986<sup>5</sup>,
- Oriented Strand Board, OSB according to EN 300<sup>6</sup> and EN 13986,
- Particleboard according to EN 312<sup>7</sup> and EN 13986,
- Fibreboards according to EN 622-2<sup>8</sup>, EN 622-3<sup>9</sup> and EN 13986,
- Cement-bonded particle boards according to EN 634-2<sup>10</sup> and EN 13986,
- Solid-wood panels according to EN 13353<sup>11</sup> and EN 13986.

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

BTI DoTec and Drilltec screws with an outer thread diameter of at least 6 mm may be used for the fixing of thermal insulation material on top of rafters or on wood-based members in vertical façades.

1	EN 14081-1:2005+A1:2011	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
2	EN 14080:2013	Timber structures - Glued laminated timber and glued solid timber - Requirements
3	EN 14374:2004	Timber structures - Structural laminated veneer lumber - Requirements
4	EN 636:2012+A1:2015	Plywood - Specifications
5	EN 13986:2004+A1:2015	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
6	EN 300:2006	Oriented strand boards (OSB) – Definition, classification and specifications
7	EN 312:2010	Particleboards - Specifications
8	EN 622-2:2004	Fibreboards – Specifications – Part 2: Requirements for hardboards
9	EN 622-3:2004	Fibreboards - Specifications - Part 3: Requirements for medium boards
10	EN 634-2:2007	Cement-bonded particleboards – Specifications – Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions
11	EN 13353:2008+A1:2011	Solid wood panels (SWP) – Requirements

BTI DoTec and Drilltec screws	Annex 1
Specifications of intended use	

### A.1.3 Use Conditions (environmental conditions)

The corrosion protection of the BTI DoTec and Drilltec screws is specified in Annex A.2.6. With regards to the use and the environmental conditions, the national provisions of the place of installation apply.

### A.1.4 Installation provisions

EN 1995-1-1<sup>12</sup> in conjunction with the respective national annex applies for the installation.

A minimum of two screws shall be used for connections in load bearing timber structures. This does not apply for special situations specified in National Annexes to EN 1995-1-1.

The screws are driven into the wood-based member made of softwood without pre-drilling or in pre-drilled holes with a diameter not exceeding the inner thread diameter  $d_1$ . The screw holes in steel members shall be pre-drilled with an adequate diameter greater than the outer thread diameter.

If screws with an outer thread diameter  $d \geq 8$  mm are driven into the wood-based member without pre-drilling, the structural solid or glued laminated timber, laminated veneer lumber and similar glued members shall be from spruce, pine or fir.

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

Countersunk head screws may be used with washers according to Annex A.4.9. After inserting the screw the washers shall touch the surface of the wood-based member completely.

By fastening screws in wood-based members the head of the screws shall be flush with the surface of the wood-based member. For screws with pan head, small countersunk washer head, washer head and hexagonal head with or without washer the head part remains unconsidered.

<sup>12</sup> EN 1995-1-1: 2004+AC:2006+A1:2008+A2:2014 Eurocode 5: Design of timber structures – Part 1-1: General - Common rules and rules for buildings

BTI DoTec and Drilltec screws	Annex 1
Installation provisions	

## ANNEX 2 – Characteristic values of the load-carrying capacities

Table A.2.1 Characteristic load-carrying capacities of BTI DoTec and Drilltec screws

Outer thread diameter [mm]	3.0	3.5	4.0	4.5	5.0	6.0	8.0	10.0
Characteristic yield moment $M_{y,k}$ [Nm]	1.6	2.3	3.3	4.5	5.9	9.5	20.0	36.0
Characteristic tensile strength $f_{tens,k}$ [kN]	2.8	3.8	5.0	6.4	7.9	11.0	20.0	30.0
Characteristic torsional strength $f_{tor,k}$ [Nm]	1.5	2.5	3.2	4.3	6.5	10.0	25.0	40.0

### A.2.1 General

The minimum penetration length of the threaded part of the screw in the wood-based members  $l_{ef}$  shall be

$$l_{ef} = \frac{4 \cdot d}{\sin \alpha} \quad (2.1)$$

where

$\alpha$  angle between screw axis and grain direction

$d$  outer thread diameter of the screw.

The inner thread diameter  $d_1$  of the screws shall be greater than the maximal width of the gaps in the layer of cross laminated timber.

### A.2.2 Laterally loaded screws

#### A.2.2.1 General

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

The embedding strength for the screws in wood-based members or in wood-based panels shall be taken from EN 1995-1-1 or from national provisions that apply at the installation site unless otherwise specified in the following.

#### A.2.2.2 Cross laminated timber

The embedding strength for screws arranged in the edge surfaces parallel to the plane of cross laminated timber may be assumed according to equation (2.2) independent of the angle between screw axis and grain direction,  $0^\circ \leq \alpha \leq 90^\circ$ :

$$f_{h,k} = 20 \cdot d^{-0,5} \text{ in N/mm}^2 \quad (2.2)$$

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

Where  $d$  is the outer thread diameter of the screws in mm.

Equation (2.2) is only valid for softwood layers. The provisions in the European Technical Approval/ Assessment or in national provisions of the cross laminated timber apply.

The embedding strength for screws in the wide face of cross laminated timber should be assumed as for solid timber based on the characteristic density of the outer layer. Where applicable, the angle between force and grain direction of the outer layer shall be taken into account. The direction of the lateral force shall be perpendicular to the screw axis and parallel to the wide face of the cross laminated timber.

For angles  $45^\circ \leq \alpha < 90^\circ$  between screw axis and grain direction of the outer layer the characteristic load-carrying capacity may be assumed as 2/3 of the corresponding value for  $\alpha = 90^\circ$ , if only the penetration depth perpendicular to the wide face is taken into account.

BTI DoTec and Drilltec screws	Annex 2
Characteristic load-bearing capacity values	

### A.2.3 Axially loaded screws

#### A.2.3.1 Axial slip modulus

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

$$K_{ser} = 780 \cdot d^{0,2} \cdot l_{ef}^{0,4} \quad [N/mm] \quad (2.3)$$

Where

$d$  outer thread diameter of the screw [mm]

$l_{ef}$  penetration length of the of the threaded part of the screw in the wood-based member [mm].

#### A.2.3.2 Axial withdrawal capacity

The characteristic withdrawal parameter of the BTI DoTec and Drilltec screws at an angle  $\alpha = 90^\circ$  to the grain based on a characteristic density of the wood-based member  $\rho_a$  of 350 kg/m<sup>3</sup> is

$f_{ax,k} = 12.0 \text{ N/mm}^2$  for screws with  $3.0 \text{ mm} \leq d \leq 8.0 \text{ mm}$

$f_{ax,k} = 10.0 \text{ N/mm}^2$  for screws with  $d = 10.0 \text{ mm}$ .

For LVL a maximum characteristic density of 500 kg/m<sup>3</sup> shall be used in equation (8.40a) of EN 1995-1-1.

For screws penetrating more than one layer of cross laminated timber the different layers may be taken into account proportionally. In the lateral surfaces of the cross laminated timber the screws shall be fully inserted in one layer of cross-laminated timber.

#### A.2.3.3 Head pull-through capacity

The characteristic value of the head pull-through parameter for the of the BTI DoTec and Drilltec screws for a characteristic density  $\rho_a$  of 350 kg/m<sup>3</sup> of the timber and for wood-based panels like

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

with a thickness of more than 20 mm is

$f_{head,k} = 12.0 \text{ N/mm}^2$  for screws with hexagonal, washer or pan head

$f_{head,k} = 10.0 \text{ N/mm}^2$  for the remaining screws.

For wood-based panels a maximum characteristic density of 380 kg/m<sup>3</sup> and for LVL a maximum characteristic density of 500 kg/m<sup>3</sup> shall be used in equation (8.40b) of EN 1995-1-1.

The head diameter shall be equal to or greater than  $1.8 \cdot d_s$ , where  $d_s$  is the smooth shank or the inner thread diameter. Otherwise the characteristic head pull-through capacity in equation (8.40b) of EN 1995-1-1 is for all wood-based materials:  $F_{ax,\alpha,RK} = 0$ .

For wood based panels with a thickness  $12 \text{ mm} \leq t \leq 20 \text{ mm}$  the characteristic value of the head pull-through parameter for the screws is:

$$f_{head,k} = 8 \text{ N/mm}^2$$

For wood based panels with a thickness of less than 12 mm the characteristic head pull-through capacity for screws shall be based on a characteristic value of the head pull-through parameter of 8 N/mm<sup>2</sup>, and limited to 400 N complying with the minimum thickness of the wood based panels of  $1.2 \cdot d$ , with  $d$  as outer thread diameter and the values in Table A.2.2.

BTI DoTec and Drilltec screws	Annex 2
Characteristic load-bearing capacity values	



Table A.2.2 Minimum thickness of wood based panels

Wood based panel	Minimum thickness [mm]
Plywood	6
Fibreboards (hardboards and medium boards)	6
Oriented Strand Boards, OSB	8
Particleboards	8
Cement-bonded particle board	8
Solid wood Panels	12

In steel-to-timber connections the head pull-through capacity is not governing.

#### A.2.4 Spacing, end and edge distances of the screws and minimum thickness of the wood based material

##### A.2.4.1 General

Minimum thickness for structural members made from solid timber, glued laminated timber, glued solid timber, laminated veneer lumber and cross laminated timber is  $t = 24$  mm for screws with  $d \leq 6$  mm,  $t = 30$  mm for screws with  $d = 8$  mm and  $t = 40$  mm for screws with  $d = 10$  mm.

##### A.2.4.2 Laterally and/or axially loaded screws

Screws in pre-drilled holes

For BTI DoTec and Drilltec screws in pre-drilled holes the minimum spacings, end and edge distances are given in EN 1995-1-1, clause 8.3.1.2 and Table 8.2 as for nails in pre-drilled holes. Here, the outer thread diameter  $d$  shall be considered.

Screws in non pre-drilled holes

For BTI DoTec and Drilltec screws minimum spacing and distances are given in EN 1995-1-1, clause 8.3.1.2 and Table 8.2 as for nails in non-predrilled holes. Here, the outer thread diameter  $d$  shall be considered.

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

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

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

##### A.2.4.3 Only axially loaded screws

For BTI DoTec and Drilltec screws the minimum spacings, end and edge distances are given in EN 1995-1-1, clause 8.3.1.2 and Table 8.2 as for nails in non-predrilled holes and clause 8.7.2, Table 8.6.

BTI DoTec and Drilltec screws	Annex 2
Spacing, end and edge distances and minimum thickness of structural members	

A.2.4.4 Cross laminated timber

The minimum requirements for spacing, end and edge distances of screws in the plane or edge surfaces of cross laminated timber are summarised in Table A.2.3. The definition of spacing, end and edge distance is shown in Figure A.2.1 and Figure A.2.2. The minimum spacing, end and edge distances in the edge surfaces are independent of the angle between screw axis and grain direction. They may be used based on the following conditions:

- Minimum thickness of cross laminated timber:  $10 \cdot d$
- Minimum penetration depth in the edge surface:  $10 \cdot d$

For load components perpendicular to the plane surface (see Figure A.2.2 right), the tensile stresses perpendicular to the grain should be transferred by reinforcing screws.

Table A.2.3: Minimum spacing, end and edge distances of screws in the plane or edge surfaces of cross laminated timber

	$a_1$	$a_{3,t}$	$a_{3,c}$	$a_2$	$a_{4,t}$	$a_{4,c}$
Plane surface (see Figure A.2.1)	$4 \cdot d$	$6 \cdot d$	$6 \cdot d$	$2.5 \cdot d$	$6 \cdot d$	$2.5 \cdot d$
Edge surface (see Figure A.2.2)	$10 \cdot d$	$12 \cdot d$	$7 \cdot d$	$4 \cdot d$	$6 \cdot d$	$3 \cdot d$

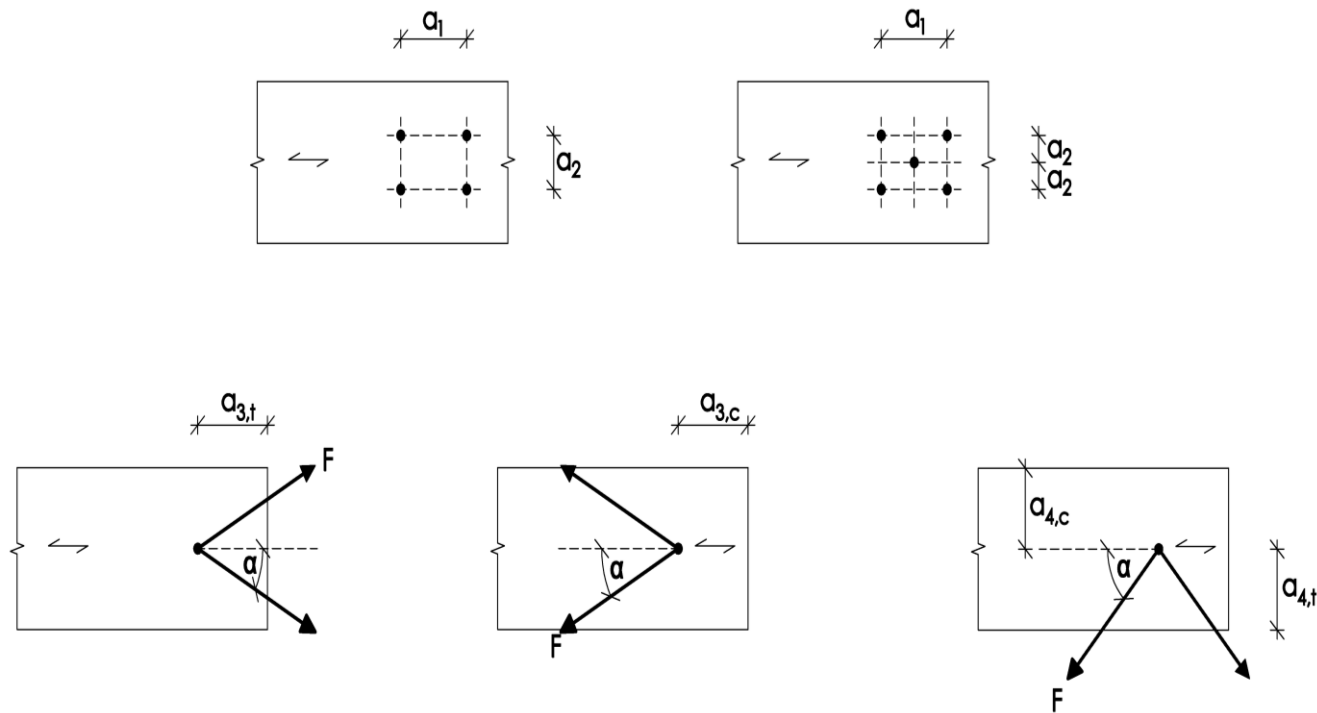


Figure A.2.1: Definition of spacing, end and edge distances in the plane surface

BTI DoTec and Drilltec screws	Annex 2
Spacing, end and edge distances and minimum thickness of structural members	

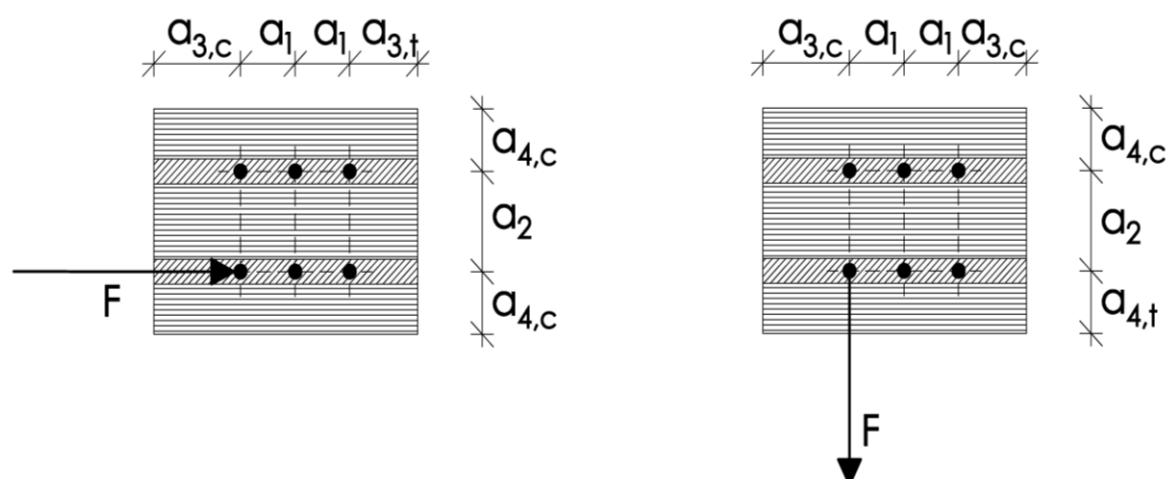


Figure A.2.2: Definition of spacing, end and edge distances in the edge surface

### A.2.5 Insertion moment

The ratio between the characteristic torsional strength  $f_{\text{tor},k}$  and the mean value of insertion moment  $R_{\text{tor,mean}}$  fulfills the requirement for all screws.

### A.2.6 Durability against corrosion

BTI DoTec and Drilltec screws made from carbon steel may have the coatings according to Table A.2.4

Table A.2.4 Coatings of the BTI DoTec and Drilltec screws

Coating		Thickness of the coating [ $\mu\text{m}$ ]
electrogalvanised	blue chromated	3 - 5
	yellow chromated	
Aluminium-zinc-flake coating		5 - 8

Steel no. 1.4006 is used for screws made from martensitic stainless steel.  
Contact corrosion shall be avoided.

BTI DoTec and Drilltec screws	Annex 2
Insertion moment and durability against corrosion	

## ANNEX 3 - Fastening of thermal insulation material on top of rafters

### A.3.1 General

BTI DoTec and Drilltec screws with an outer thread diameter of at least 6 mm may be used for the fixing of thermal insulation material on top of rafters or on wood-based members in vertical façades. In the following, the meaning of the word rafter includes wood-based members with inclinations between 0° and 90°.

The thickness of the thermal insulation material may be up to 300 mm. The thermal insulation material shall be applicable as insulation on top of rafters or for façades according to national provisions that apply at the installation site.

The battens have to be from solid timber according to EN 338/ EN 14081-1. The minimum thickness  $t$  and the minimum width  $b$  of the battens are given in table A.3.1:

Table A.3.1 Minimum thickness and minimum width of the battens

Outer thread diameter [mm]	Minimum thickness $t$ [mm]	Minimum width $b$ [mm]
6 and 8	30	50
10	40	60

Instead of battens the wood-based panels specified in chapter A.3.2.1 may be used. Only screws with countersunk head shall be used for fixing wood-based panels on rafters with thermal insulation material as interlayer.

The minimum width of the rafters shall be 60 mm.

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

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

The anchorage of wind suction forces as well as the bending stresses of the battens shall be considered for design. Screws perpendicular to the grain of the rafter (angle  $\alpha = 90^\circ$ ) may be arranged where required considering the design of the battens.

### A.3.2 Parallel inclined screws and thermal insulation material in compression

#### A.3.2.1 Mechanical model

The system of rafter, thermal insulation material on top of rafter and counter battens parallel to the rafter may be considered as a beam on elastic foundation. The counter batten represents the beam, and the thermal insulation material on top of the rafter the elastic foundation. The minimum compressive stress of the thermal insulation material at 10 % deformation, measured according to EN 826<sup>13</sup>, shall be  $\sigma_{(10\%)} = 0.05 \text{ N/mm}^2$ . The counter batten is loaded perpendicular to the axis by point loads  $F_b$  transferred by regularly spaced battens. Further point loads  $F_s$  are caused by the shear load of the roof due to dead and snow load, which are transferred from the screw heads into the counter battens.

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 includes the meaning of wood-based panels in the following.

<sup>13</sup> EN 826:2013 Thermal insulating products for building applications - Determination of compression behaviour

BTI DoTec and Drilltec screws	Annex 3
Fastening of thermal insulation material on top of rafters	

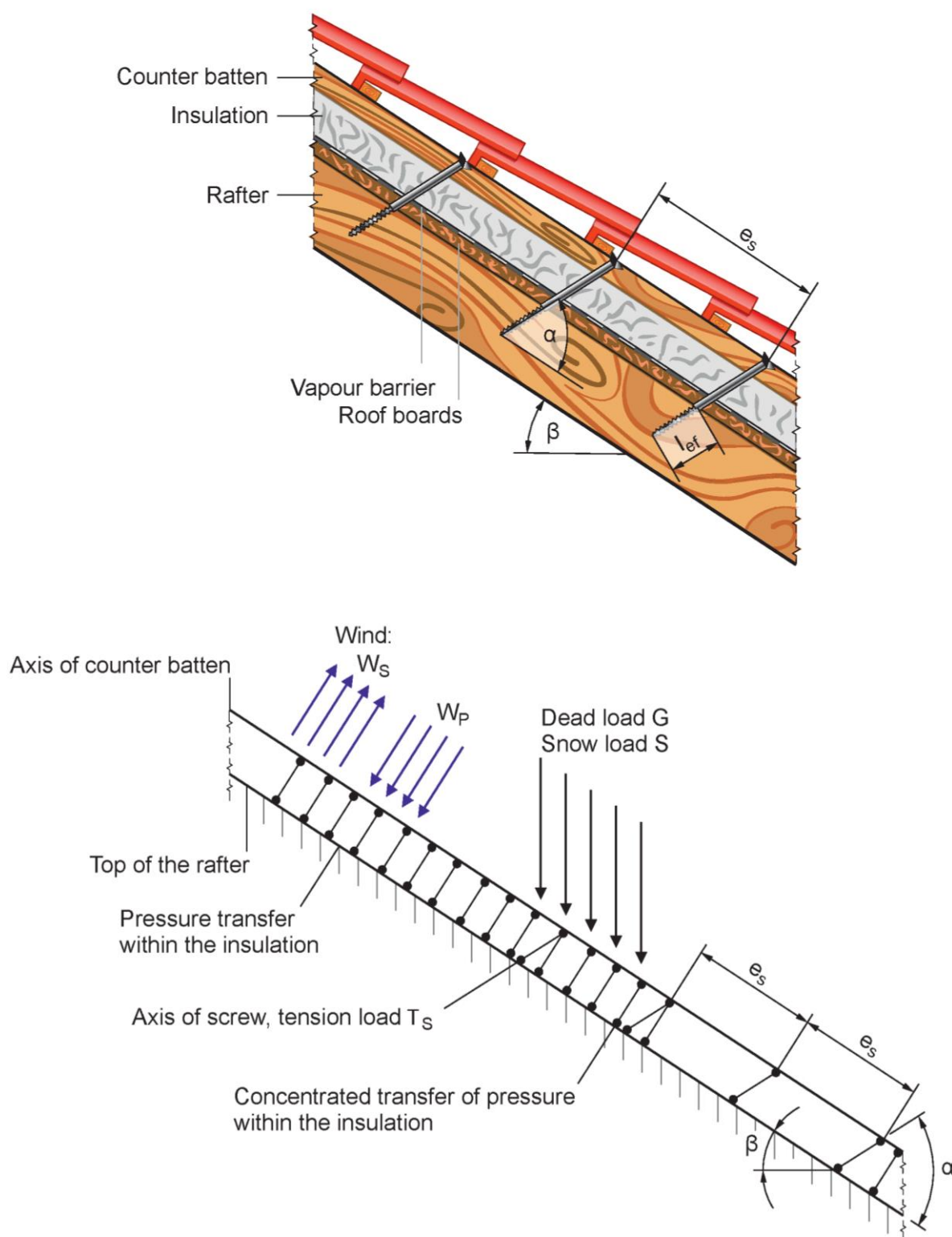


Figure A.3.1 Fastening of the thermal insulation material on top of rafters - structural system

BTI DoTec and Drilltec screws	Annex 3
Fastening of thermal insulation material on top of rafters	

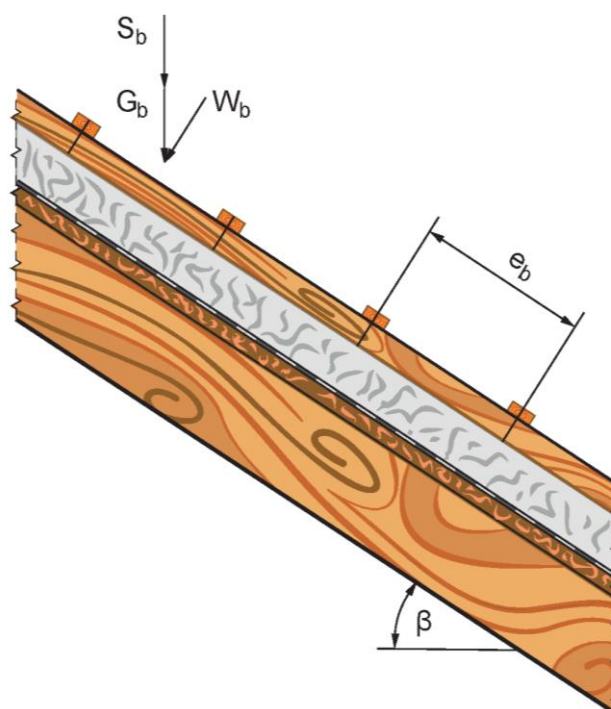


Figure A.3.2 Point loads  $F_b$  perpendicular to the battens

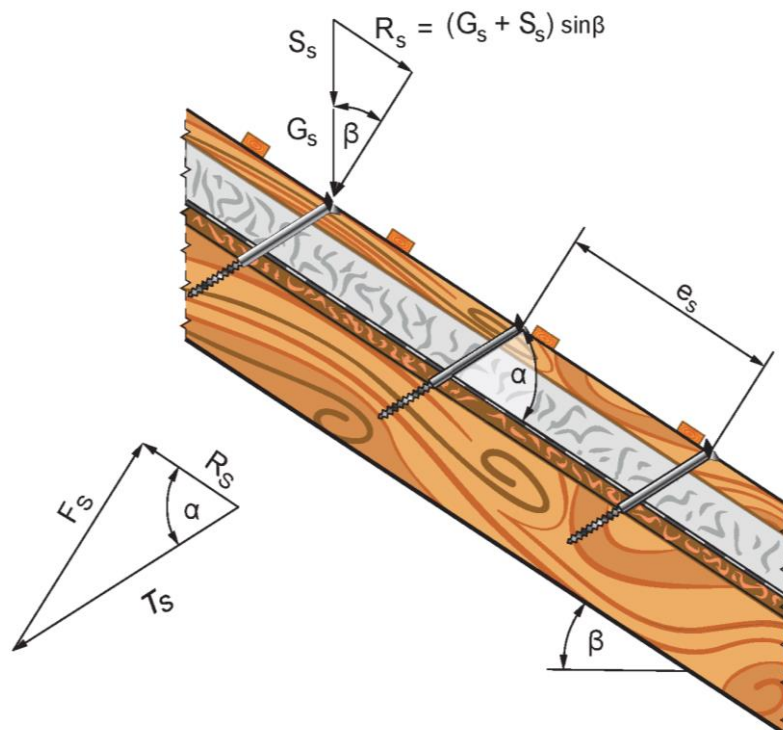


Figure A.3.3 Point loads  $F_s$  perpendicular to the battens, load application in the area of the screw heads

BTI DoTec and Drilltec screws	Annex 3
Fastening of thermal insulation material on top of rafters	

### A.3.2.2 Design of the battens

It's assumed that the spacing between the counter battens exceeds the characteristic length  $l_{\text{char}}$ .

The characteristic values of the bending stresses are calculated as:

$$M_k = \frac{(F_{b,k} + F_{s,k}) \cdot l_{\text{char}}}{4} \quad (3.1)$$

where

$$l_{\text{char}} = \text{characteristic length } l_{\text{char}} = \sqrt[4]{\frac{4 \cdot EI}{w_{\text{ef}} \cdot K}} \quad (3.2)$$

$EI$  = bending stiffness of the batten

$K$  = coefficient of subgrade

$w_{\text{ef}}$  = effective width of the thermal insulation material

$F_{b,k}$  = point loads perpendicular to the battens

$F_{s,k}$  = point loads perpendicular to the battens, load application in the area of the screw heads

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

$$w_{\text{ef}} = w + t_{\text{HI}} / 2 \quad (3.3)$$

where

$w$  = minimum from width of the batten or rafter, respectively

$t_{\text{HI}}$  = thickness of the thermal insulation material

$$K = \frac{E_{\text{HI}}}{t_{\text{HI}}} \quad (3.4)$$

The following condition shall be satisfied:

$$\frac{\sigma_{m,d}}{f_{m,d}} = \frac{M_d}{W \cdot f_{m,d}} \leq 1 \quad (3.5)$$

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

The characteristic values of the shear stresses shall be calculated according to:

$$V_k = \frac{(F_{b,k} + F_{s,k})}{2} \quad (3.6)$$

The following condition need to be satisfied:

$$\frac{\tau_d}{f_{v,d}} = \frac{1.5 \cdot V_d}{A \cdot f_{v,d}} \leq 1 \quad (3.7)$$

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

BTI DoTec and Drilltec screws	Annex 3
Fastening of thermal insulation material on top of rafters	



### A.3.2.3 Design of the thermal insulation material

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

$$\sigma_k = \frac{1.5 \cdot F_{b,k} + F_{s,k}}{2 \cdot l_{char} \cdot w} \quad (3.8)$$

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

### A.3.2.4 Design of the screws

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

$$T_{S,k} = \frac{R_{S,k}}{\cos \alpha} \quad (3.9)$$

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

In order to limit the deformation of the screw head for thermal insulation material with thickness over 220 mm or with compressive strength below 0.12 N/mm<sup>2</sup>, respectively, the axial withdrawal capacity of the screws shall be reduced by the factors  $k_1$  and  $k_2$ :

$$F_{ax,\alpha,Rd} = \min \left\{ \frac{f_{ax,d} \cdot d \cdot l_{ef} \cdot k_1 \cdot k_2}{1.2 \cdot \cos^2 \alpha + \sin^2 \alpha} \cdot \left( \frac{\rho_k}{350} \right)^{0.8}; f_{head,d} \cdot d_h^2 \cdot \left( \frac{\rho_k}{350} \right)^{0.8}; \frac{f_{tens,k}}{\gamma_{M2}} \right\} \quad (3.10)$$

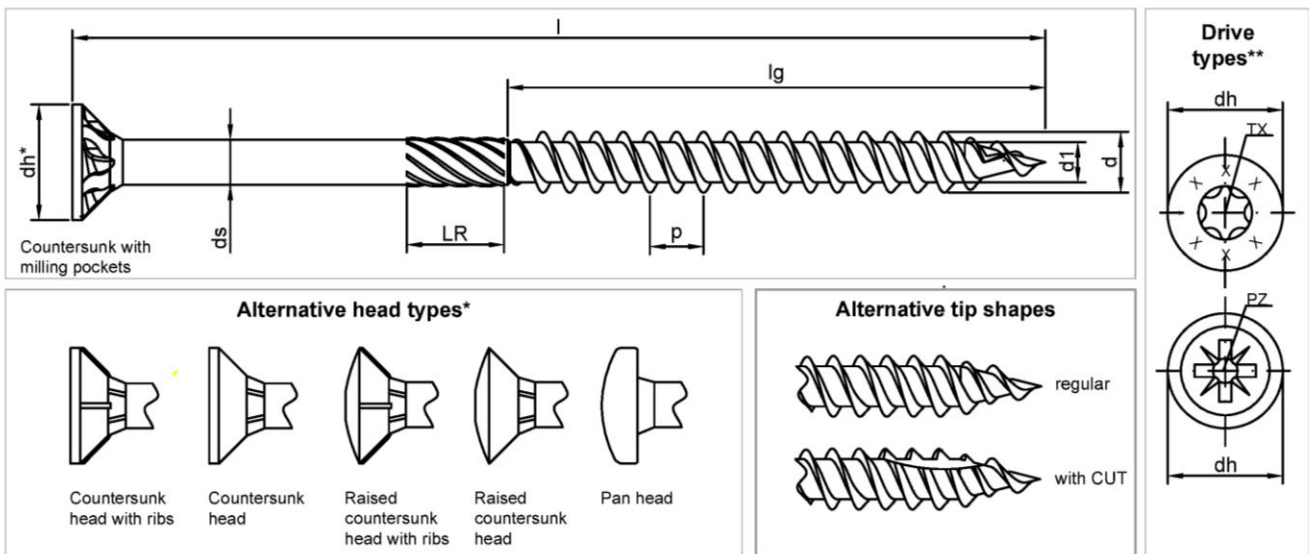
where:

$f_{ax,d}$	design value of the axial withdrawal parameter of the threaded part of the screw in the rafter [N/mm <sup>2</sup> ]
$d$	outer thread diameter of the screw [mm]
$l_{ef}$	penetration length of the threaded part of the screw in the rafter [mm], $l_{ef} \geq 40$ mm
$\rho_k$	characteristic density of the wood-based member [kg/m <sup>3</sup> ], for LVL $\rho_k \leq 500$ kg/m <sup>3</sup>
$\alpha$	angle $\alpha$ between screw axis and grain direction, $30^\circ \leq \alpha \leq 90^\circ$
$f_{head,d}$	design value of the head pull-through parameter of the screw [N/mm <sup>2</sup> ]
$d_h$	head diameter of the screw [mm]
$f_{tens,k}$	characteristic tensile capacity of the screw according to Annex 2 [N]
$\gamma_{M2}$	partial factor according to EN 1993-1-1 in conjunction with the particular national annex
$k_1$	$\min \{1; 220/t_{HI}\}$
$k_2$	$\min \{1; \sigma_{10\%}/0.12\}$
$t_{HI}$	thickness of the thermal insulation material [mm]
$\sigma_{10\%}$	compressive stress of the thermal insulation material under 10 % deformation [N/mm <sup>2</sup> ]

If equation (3.10) is fulfilled, the deflection of the battens does not need to be considered when designing the load-carrying capacity of the screws.

BTI DoTec and Drilltec screws	Annex 3
Fastening of thermal insulation material on top of rafters	





Nominal diameter [mm]		3.0	3.5	4.0	4.5	5.0	6.0
d	Outer diameter (thread)	3.0 ±0.3	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
d <sub>1</sub>	Inner diameter (thread)	2.0 ±0.3	2.2 ±0.3	2.5 ±0.3	2.9 ±0.3	3.3 ±0.3	3.9 ±0.3
d <sub>s</sub>	Shank diameter	2.2 ±0.3	2.6 ±0.3	3.0 ±0.3	3.3 ±0.3	3.7 ±0.3	4.5 ±0.3
d <sub>h</sub>	Head diameter	5.7 ±0.5	7.0 ±0.6	7.5 ±0.5	8.5 ±0.6	9.5 ±0.6	11.5 ±0.6
p	Thread pitch (double thread)	2.7 ±10%	3.2 ±10%	3.6 ±10%	4.0 ±10%	4.4 ±10%	5.2 ±10%
TX	Size (alternatives)	10	15 / 20	15 / 20	20 / 25	20 / 25	25 / 30
PZ	Size	1	2	2	2	2	3
Nominal length [mm]							
l	Tolerance	Secondary rough thread LR (optional)	l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>
20	±1.7	4	12 ±1.5				
25			17 ±1.5	17 ±1.5	17 ±1.5		
30			18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	20 ±1.7
35	±2.0		21 ±1.7	21 ±1.7	21 ±1.7	21 ±1.7	21 ±1.7
40			24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	25 ±1.7
45			25 ±1.7	25 ±1.7	25 ±1.7	25 ±1.7	28 ±1.7
50	±2.3	8		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
55				34 ±2.0	34 ±2.0	34 ±2.0	34 ±2.0
60				38 ±2.0	38 ±2.0	38 ±2.0	38 ±2.0
70-80	±2.7	12			44 ±2.0	44 ±2.0	44 ±2.0
90-100						54 ±2.3	54 ±2.3
110-120						70 ±2.3	70 ±2.3
130-180							70 ±2.3
200-240	±3.6						70 ±2.3
260-300	±4.1						70 ±2.3

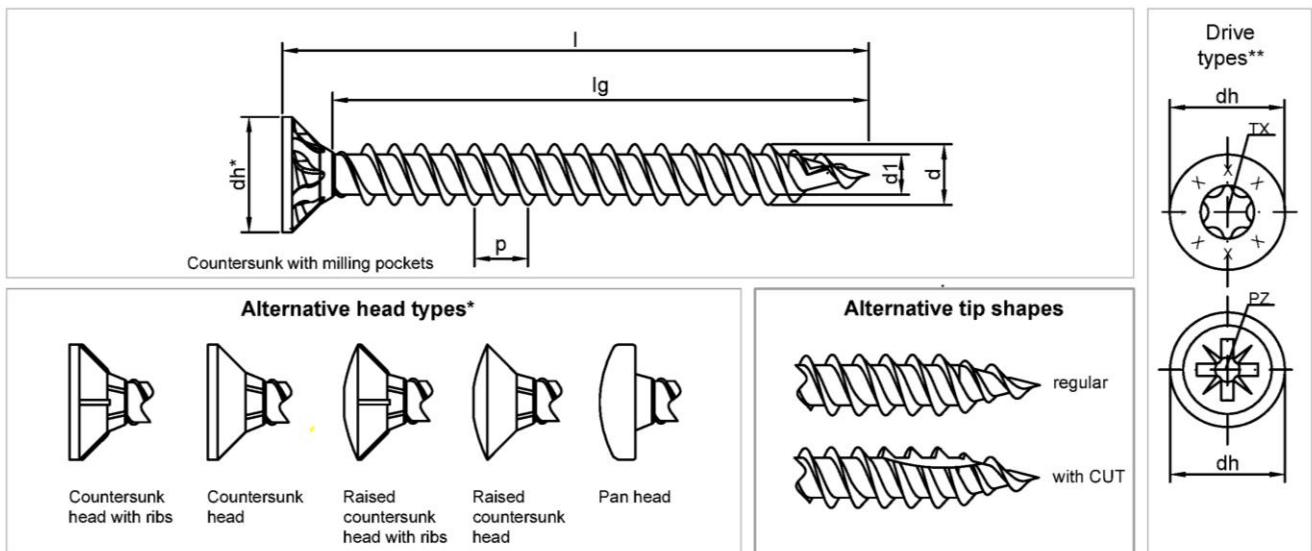
\* For all head shapes, the same head diameter apply.

\*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec 2 screws  
with partial and double thread and different head and tip shapes

Annex 4.1



Nominal diameter [mm]		3.0	3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.0 ±0.3	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.0 ±0.3	2.2 ±0.3	2.5 ±0.3	2.9 ±0.3	3.3 ±0.3	3.9 ±0.3
<b>d<sub>h</sub></b>	Head diameter	5.7 ±0.5	7.0 ±0.6	7.5 ±0.5	8.5 ±0.6	9.5 ±0.6	11.5 ±0.6
<b>p</b>	Thread pitch (double thread)	2.7 ±10%	3.2 ±10%	3.6 ±10%	4.0 ±10%	4.4 ±10%	5.2 ±10%
<b>TX</b>	Size (alternatives)	10	15 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	1	2	2	2	2	3
Nominal length [mm]							
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
17	±1.5	13 ±1.5					
20	±1.7	16 ±1.5	16 ±1.5	16 ±1.5			
25		21 ±1.7	20 ±1.7	20 ±1.7	19 ±1.7		
30		26 ±1.7	25 ±1.7	25 ±1.7	24 ±1.7	24 ±1.7	
35	±2.0	30 ±2.0	30 ±1.7	30 ±2.0	29 ±1.7	29 ±1.7	
40		35 ±2.0	35 ±2.0	35 ±2.0	34 ±2.0	34 ±2.0	32 ±2.0
45		40 ±2.0	40 ±2.0	40 ±2.0	39 ±2.0	39 ±2.0	37 ±2.0
50		45 ±2.0	45 ±2.0	45 ±2.0	44 ±2.0	44 ±2.0	42 ±2.0
55	±2.3			50 ±2.0	49 ±2.0	49 ±2.0	47 ±2.0
60				55 ±2.3	54 ±2.3	54 ±2.3	52 ±2.3
70						64 ±2.3	62 ±2.3
80						72 ±2.3	72 ±2.3
90	±2.7					84 ±2.7	82 ±2.7
100							92 ±2.7
120							112 ±2.7

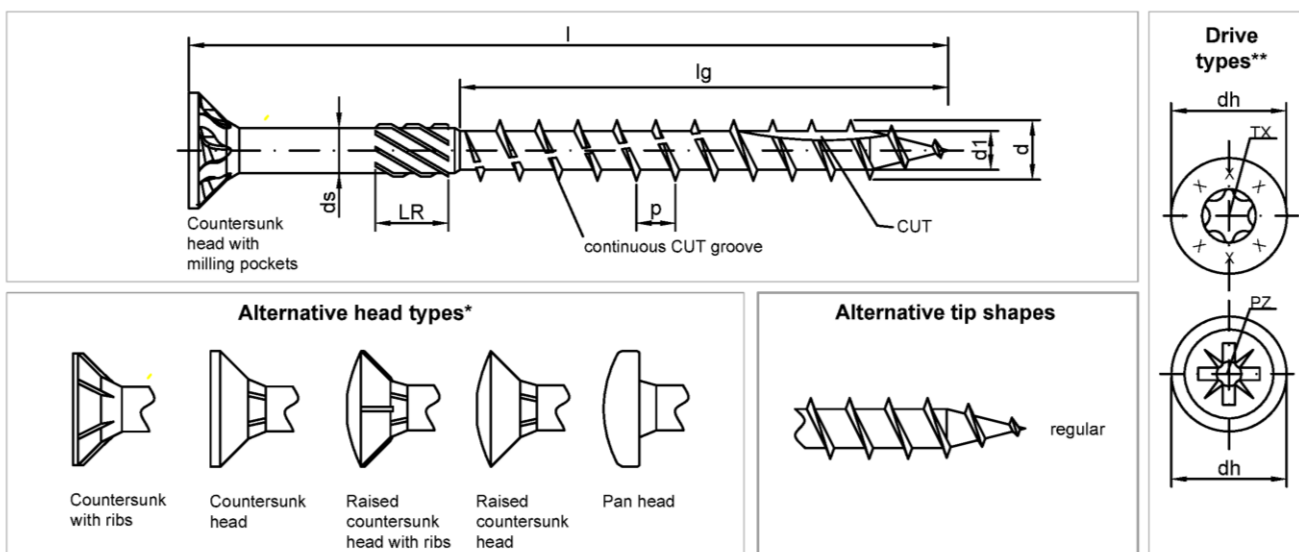
\* For all head shapes, the same head diameter apply.

\*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec 2 screws  
with full and double thread and different head and tip shapes

Annex 4.2



Nominal diameter [mm]		8.0	8.0	10.0	10.0
d	Outer diameter (thread)	8.0 ±5%	8.0 ±5%	10.0 ±5%	10.0 ±5%
d <sub>1</sub>	Inner diameter (thread)	5.4 ±0.3	5.4 ±0.3	6.4 ±5%	6.4 ±5%
d <sub>s</sub>	Shank diameter	5.8 ±0.3	5.8 ±0.3	7.0 ±5%	7.0 ±5%
d <sub>h</sub>	Head diameter	15.0 ±5%	15.0 ±5%	18.4 ±5%	18.4 ±5%
p	Thread pitch (single thread)	5.2 ±10%	5.2 ±10%	5.6 ±10%	5.6 ±10%
TX	Size	40	40	40	40
PZ	Size	3	3	4	4

Nominal length [mm]		Secondary rough thread LR (optional)	Thread length [mm]			
l	Tolerance		l <sub>g</sub>	l <sub>g</sub> (alternative)	l <sub>g</sub>	l <sub>g</sub> (alternative)
80	±2.3	12	52 ±2.3		52 ±2.3	
90	±2.7		52 ±2.3		52 ±2.3	
100-120			80 ±2.3	52 ±2.3	80 ±2.3	52 ±2.3
130-180	±3.2		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
200-240	±3.6		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
260-300	±4.1		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
320-400	±4.5		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
420-500	±4.9		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
520-600	±5.5		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7

\* For all head shapes, the same head diameter apply.

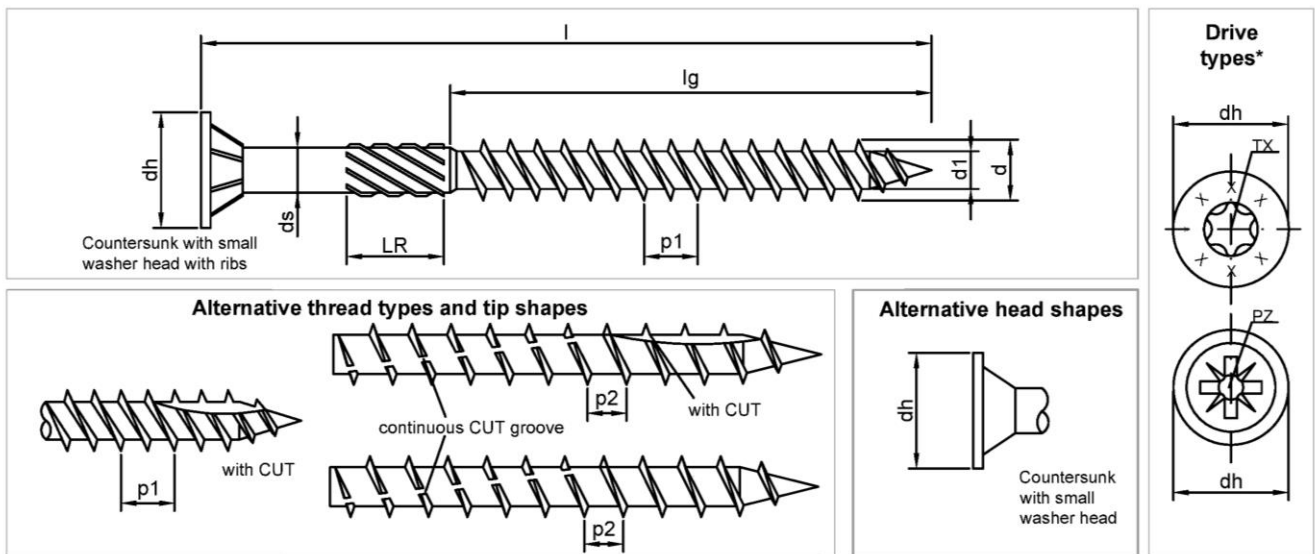
\*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec 2 screws  
with partial thread and different head and tip shapes

Annex 4.3





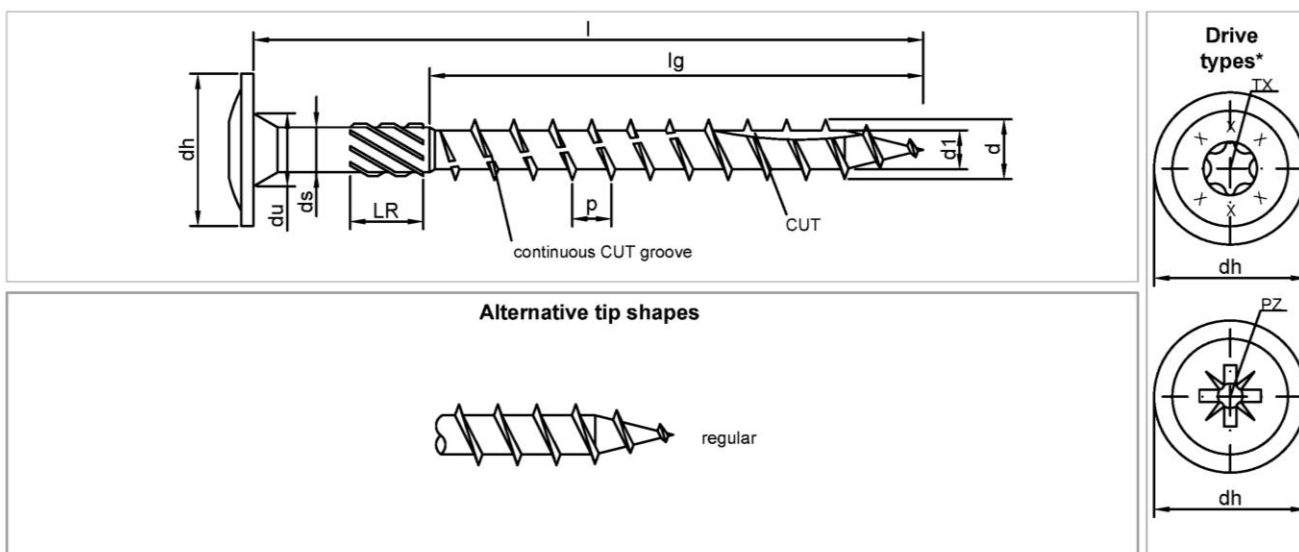
Nominal diameter [mm]		4.0	4.5	5.0	6.0	8.0	10.0	
d	Outer diameter (thread)	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3	8.0 ±5%	10.0 ±5%	
d <sub>1</sub>	Inner diameter (thread)	2.6 ±0.3	2.9 ±0.3	3.3 ±0.3	3.9 ±0.3	5.4 ±0.3	6.4 ±5%	
d <sub>s</sub>	Shank diameter	3.0 ±0.3	3.3 ±0.3	3.7 ±0.3	4.5 ±0.3	5.8 ±0.3	7.0 ±5%	
d <sub>h</sub>	Head diameter	8.3 ±0.6	9.3 ±0.6	10.5 ±0.6	12.5 ±5%	14.5 ±5%	18.5 ±5%	
p <sub>1</sub>	Thread pitch (double thread)	3.6 ±10%	4.0 ±10%	4.4 ±10%	5.2 ±10%	-	-	
p <sub>2</sub>	Thread pitch (single thread)	-	-	-	-	5.2 ±10%	5.6 ±10%	
TX	Size (alternatives)	15 / 20	20 / 25	20 / 25	25 / 30	30 / 40	40 / 50	
PZ	Size	2	2	2	3	3 / 4	4	
Nominal length [mm]		Secondary rough thread LR (optional)	Thread length [mm]					
I	Tolerance		I <sub>g</sub>	I <sub>g</sub>	I <sub>g</sub>	I <sub>g</sub>	I <sub>g</sub>	I <sub>g</sub>
30	±1.7	4	18 ±1.5					
40	±2.0		24 ±1.7	24 ±1.7				
45			25 ±1.7	25 ±1.7				
50	±2.3	8	30 ±1.7	30 ±1.7	30 ±1.7			
60			38 ±2.0	38 ±2.0	38 ±2.0	38 ±2.0		
70			44 ±2.0	44 ±2.0	44 ±2.0	44 ±2.0		
80	±2.7	12		44 ±2.0	44 ±2.0	44 ±2.0	52 ±2.3	52 ±2.3
90					54 ±2.3	54 ±2.3	52 ±2.3	52 ±2.3
100					54 ±2.3	54 ±2.3	52 ±2.3	52 ±2.3
120					70 ±2.3	70 ±2.3	80 ±2.3	80 ±2.3
140						70 ±2.3	80 ±2.3	80 ±2.3
150-180	±3.2					70 ±2.3	80 ±2.3	80 ±2.3
200-240	±3.6					70 ±2.3	80 ±2.3	80 ±2.3
260-300	±4.1					70 ±2.3	80 ±2.3	80 ±2.3
320-400	±4.5						80 ±2.3	80 ±2.3
420-440	±4.9						80 ±2.3	80 ±2.3

\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with different thread types CSK washer heads and tip shapes

Annex 4.4



Nominal diameter [mm]		6.0	8.0	8.0	10.0	10.0
d	Outer diameter (thread)	6.0 ±0.3	8.0 ±5%	8.0 ±5%	10.0 ±5%	10.0 ±5%
d <sub>1</sub>	Inner diameter (thread)	3.9 ±0.3	5.4 ±0.3	5.4 ±0.3	6.4 ±5%	6.4 ±5%
d <sub>s</sub>	Shank diameter	4.5 ±0.3	5.8 ±0.3	5.8 ±0.3	7.0 ±5%	7.0 ±5%
d <sub>h</sub>	Head diameter	15.5 ±5%	22.0 ±5%	22.0 ±5%	25 ±5%	25 ±5%
du	Transition diameter (head side)	7.5 ±0.5	10.0 ±0.5	10.0 ±0.5	12.0 ±0.6	12.0 ±0.6
p	Thread pitch (single thread)	4.5 ±10%	5.2 ±10%	5.2 ±10%	5.6 ±10%	5.6 ±10%
TX	Size (alternatives)	25 / 30	30 / 40	30 / 40	40 / 50	40 / 50
PZ	Size	3	3	3	4	4

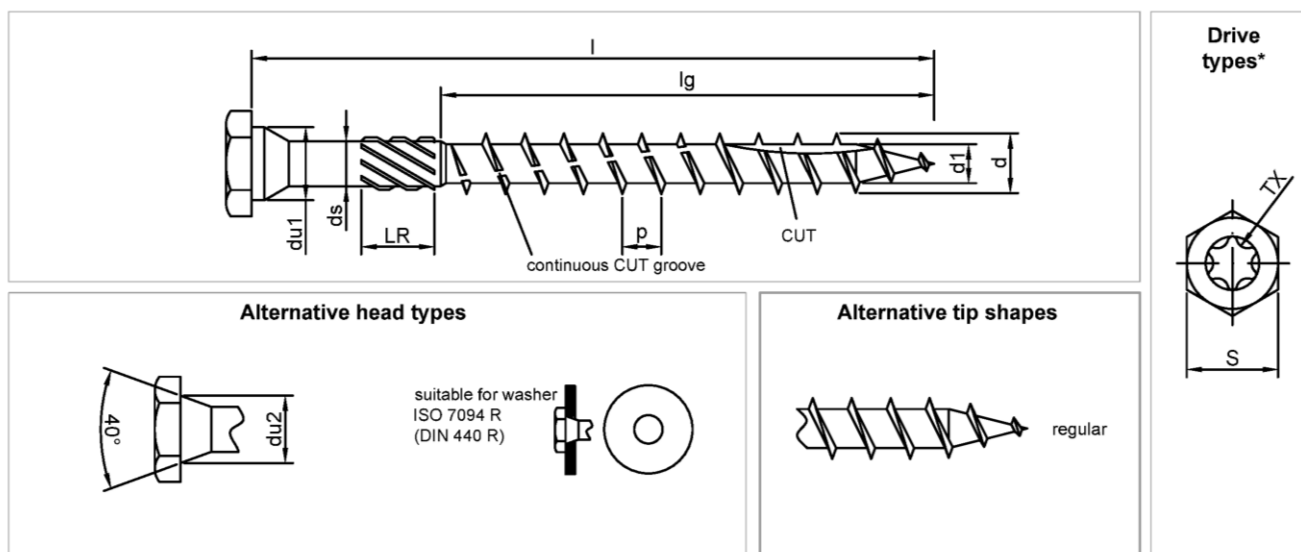
Nominal length [mm]		Secondary rough thread LR (optional)	Thread length [mm]				
I	Tolerance		l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub> (alternative)	l <sub>g</sub>	l <sub>g</sub> (alternative)
60	±2.3	8	30 ±1.7				
70			30 ±1.7				
80			40 ±2.0	52 ±2.3		52 ±2.3	
90	±2.7	12	40 ±2.0	52 ±2.3		52 ±2.3	
100-120			50 ±2.0	80 ±2.3	52 ±2.3	80 ±2.3	52 ±2.3
140-180			75 ±2.3	80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
200-240			75 ±2.3	80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
260-300			75 ±2.3	80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
320-400				80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
420-500				80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
520-600	±5.5			80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7

\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with partial thread, washer head and different tip shapes

Annex 4.5



Nominal diameter [mm]		8.0	8.0	10.0	10.0	
d	Outer diameter (thread)	8.0 ±5%	8.0 ±5%	10.0 ±5%	10.0 ±5%	
d <sub>1</sub>	Inner diameter (thread)	5.4 ±0.3	5.4 ±0.3	6.4 ±5%	6.4 ±5%	
d <sub>s</sub>	Shank diameter	5.8 ±0.3	5.8 ±0.3	7.0 ±5%	7.0 ±5%	
p	Thread pitch	5.2 ±10%	5.2 ±10%	5.6 ±10%	5.6 ±10%	
du <sub>1</sub>	Transition diameter (head side)	10.0 ±0.5	10.0 ±0.5	12.0 ±0.6	12.0 ±0.6	
du <sub>2</sub>	Transition diameter (head side)	9.0 ±0.4	9.0 ±0.4	11.0 ±0.5	11.0 ±0.5	
S	Hexagon	12	12	15	15	
TX	Size	40	40	40	40	
Nominal length [mm]		Secondary rough thread LR (optional)	Thread length [mm]			
l	Tolerance		l <sub>g</sub>	l <sub>g</sub> (alternative)	l <sub>g</sub>	l <sub>g</sub> (alternative)
80	±2.3	12	52 ±2.3		52 ±2.3	
90	±2.7		52 ±2.3		52 ±2.3	
100-120			80 ±2.3		80 ±2.3	
130-180	±3.2		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
200-240	±3.6		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
260-300	±4.1		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
320-400	±4.5		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
420-500	±4.9		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7
520-600	±5.5		80 ±2.3	100 ±2.7	80 ±2.3	100 ±2.7

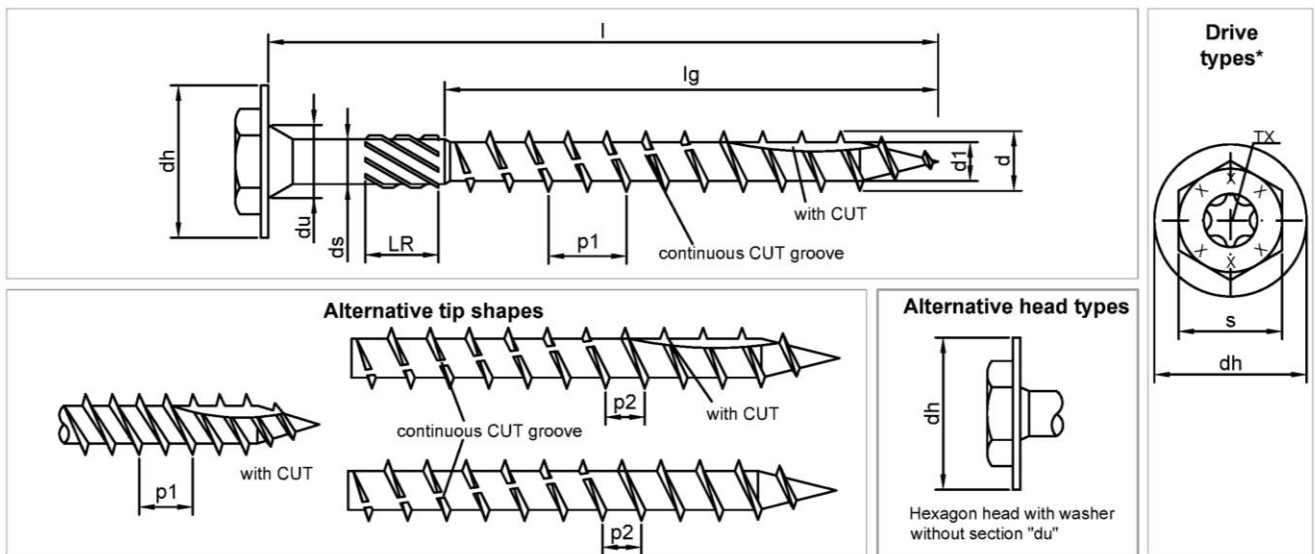
\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with partial thread, different HEX heads and tip shapes

Annex 4.6





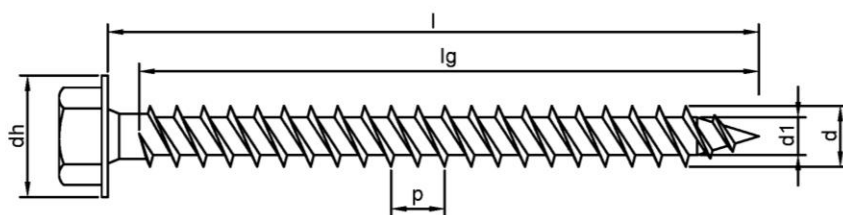
Nominal diameter [mm]		4.0	4.5	5.0	6.0	8.0	10.0		
d	Outer diameter (thread)	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3	8.0 ±5%	10.0 ±5%		
d <sub>1</sub>	Inner diameter (thread)	2.6 ±0.3	2.9 ±0.3	3.3 ±0.3	3.9 ±0.3	5.4 ±0.3	6.4 ±5%		
d <sub>s</sub>	Shank diameter	3.0 ±0.3	3.3 ±0.3	3.7 ±0.3	4,5 ±0.3	5.8 ±0.3	7.0 ±5%		
d <sub>h</sub>	Head diameter	7.5 ±0.5	8.5 ±0.6	9.5 ±0.6	11.5 ±0.6	22.0 ±5%	25.0 ±5%		
p <sub>1</sub>	Thread pitch (double thread)	3.6 ±10%	4.0 ±10%	4.4 ±10%	5.2 ±10%	-	-		
p <sub>2</sub>	Thread pitch (single thread)	-	-	-	-	5.2 ±10%	5.6 ±10%		
du	Transition diameter (head side)	-	-	-	-	10.0 ±0.5	12.0 ±0.6		
S	Hexagon	7	7	8	10	12	15		
TX	Size (alternatives)	15 / 20	20 / 25	20 / 25	25 / 30	30 / 40	40 / 50		
Nominal length [mm]		Secondary rough thread LR (optional)	Thread length [mm]						
l	Tolerance		l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>	l <sub>g</sub>		
25	±1.7	4	17 ±1.5						
30			18 ±1.5	20 ±1.7	20 ±1.7				
35			21 ±1.7	21 ±1.7	21 ±1.7				
40	±2.0		24 ±1.7	24 ±1.7	24 ±1.7	25 ±1.7			
45			25 ±1.7	25 ±1.7	25 ±1.7	28 ±1.7			
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7				
55	±2.3	8	34 ±2.0	34 ±2.0	34 ±2.0	34 ±2.0			
60			38 ±2.0	38 ±2.0	38 ±2.0	38 ±2.0			
70			44 ±2.0	44 ±2.0	44 ±2.0	44 ±2.0			
80				44 ±2.0	44 ±2.0	44 ±2.0	52 ±2.3	52 ±2.3	
90	±2.7		12			54 ±2.3	54 ±2.3	52 ±2.3	52 ±2.3
100					54 ±2.3	54 ±2.3	80 ±2.3	80 ±2.3	
110-120					70 ±2.3	70 ±2.3	80 ±2.3	80 ±2.3	
130-180		±3.2				70 ±2.3	80 ±2.3	80 ±2.3	
200-240				±3.6			70 ±2.3	80 ±2.3	80 ±2.3
260-300					±4.1			70 ±2.3	80 ±2.3
320-400		±4.5							80 ±2.3
420-440	±4.9							80 ±2.3	80 ±2.3

\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with partial thread, different HEX washer heads and tip shapes

Annex 4.7



Alternative tip shapes



Nominal diameter [mm]		4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.6 ±0.3	2.9 ±0.3	3.3 ±0.3	3.9 ±0.3
<b>d<sub>h</sub></b>	Head diameter	7.5 ±0.5	8.5 ±0.6	9.5 ±0.6	11.5 ±0.6
<b>p</b>	Thread pitch (double thread)	3.6 ±10%	4.0 ±10%	4.4 ±10%	5.2 ±10%
<b>S</b>	Hexagon	6.0	7.0	8.0	10.0
<b>TX</b>	Size (alternatives)	15 / 20	20 / 25	20 / 25	25 / 30
Nominal length [mm]		Thread length [mm]			
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
20	±1.7	16 ±1.5			
25		20 ±1.7			
30		25 ±1.7	24 ±1.7	24 ±1.7	
35	±2.0	30 ±1.7	29 ±1.7	29 ±1.7	
40		35 ±2.0	34 ±2.0	34 ±2.0	32 ±2.0
45		40 ±2.0	39 ±2.0	39 ±2.0	37 ±2.0
50	±2.3	45 ±2.0	44 ±2.0	44 ±2.0	42 ±2.0
55		50 ±2.0	49 ±2.0	49 ±2.0	47 ±2.0
60		55 ±2.3	54 ±2.3	54 ±2.3	52 ±2.3
70				64 ±2.3	62 ±2.3
80				72 ±2.3	72 ±2.3

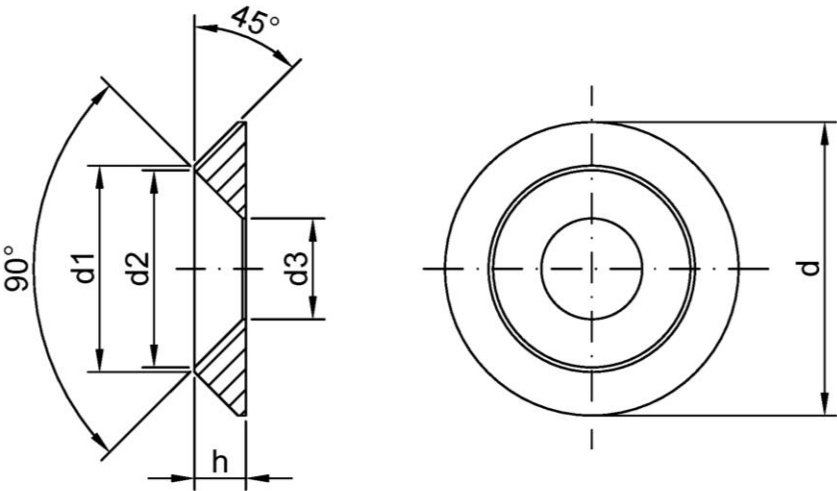
\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with full and double thread, HEX washer head and different tip shapes

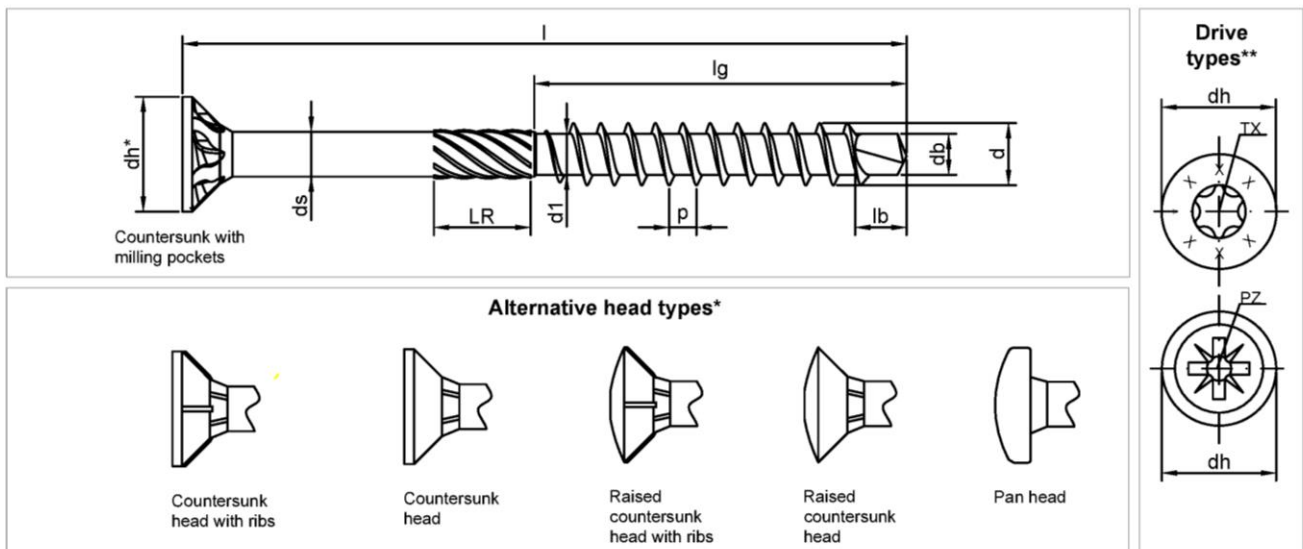
Annex 4.8





Nominal diameter (screw) [mm]		8.0	10.0
d	Outer diameter	25.0 ±0.5	32.0 ±0.5
d <sub>1</sub>	Diameter chamfer edge (outer)	17.5 ±0.5	22.5 ±0.5
d <sub>2</sub>	Diameter chamfer edge (inner)	16.5 ±0.5	21.5 ±0.5
d <sub>3</sub>	Inner diameter	8.5 ±0.3	11.0 ±0.3
h	Height	5.0 ±0.3	5.6 ±0.3

BTI DoTec and Drilltec screws	Annex 4.9
Washer (for timber constructions screws) with CSK head	



Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.2 ±0.3	2.5 ±0.3	2.7 ±0.3	3.1 ±0.3	3.7 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.5 ±0.3	2.8 ±0.3	3.1 ±0.3	3.5 ±0.3	4.2 ±0.3
<b>d<sub>h</sub></b>	Head diameter	6.7 ±0.5	7.5 ±0.5	8.5 ±0.6	9.5 ±0.6	11.5 ±0.6
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>l<sub>b</sub></b>	Drillbit length	3.5 ±5%	4.0 ±5%	4.5 ±5%	5.0 ±5%	5.1 ±5%
<b>d<sub>b</sub></b>	Drillbit diameter	2.1 ±5%	2.4 ±5%	2.6 ±5%	3.0 ±5%	3.6 ±5%
<b>TX</b>	Size (alternatives)	10 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
Nominal length [mm]		Secondary rough thread LR (optional)				
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	18 ±1.5	18 ±1.5	18 ±1.5		
30		21 ±1.7	21 ±1.7	21 ±1.7	21 ±1.7	24 ±1.7
35	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
40		26 ±1.7	26 ±1.7	26 ±1.7	26 ±1.7	26 ±1.7
45		28 ±1.7	28 ±1.7	28 ±1.7	28 ±1.7	28 ±1.7
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80	±2.7	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90-100		54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
110-120		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
130-180				70 ±2.3	70 ±2.3	70 ±2.3
200-240						70 ±2.3
260-300						70 ±2.3

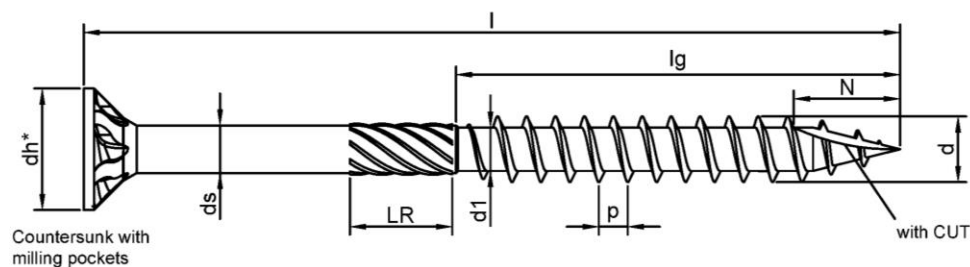
\* For all head shapes, the same head diameter apply.

\*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

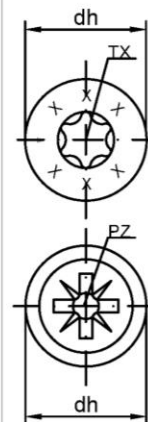
BTI DoTec and Drilltec screws

BTI Drilltec screws  
with partial thread, drill bit and different head shapes

Annex 4.10



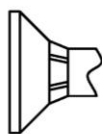
Drive types\*\*



Alternative head types\*



Countersunk head with ribs



Countersunk head



Raised countersunk head with ribs



Raised countersunk head



Pan head

Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.2 ±0.3	2.6 ±0.3	2.8 ±0.3	3.3 ±0.3	3.7 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.5 ±0.3	2.9 ±0.3	3.2 ±0.3	3.6 ±0.3	4.2 ±0.3
<b>d<sub>h</sub></b>	Head diameter	7.0 ±0.5	8.0 ±0.5	9.0 ±0.6	10.0 ±0.6	12.0 ±0.6
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>N</b>	CUT length	7.0 ±5%	8.0 ±5%	9.0 ±5%	10.0 ±5%	11.0 ±5%
<b>TX</b>	Size (alternatives)	10 / 15 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
<b>LR</b>	Secondary rough thread LR (optional)	4.0	5.0	7.0	8.5	10.5
Nominal length [mm]						
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	16 ±1.5	16 ±1.5			
30		18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	24 ±1.7
40	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80		48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90	±2.7	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
100-110		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
120			70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3
130-180	±3.2			70 ±2.3	70 ±2.3	70 ±2.3
200-240	±3.6					70 ±2.3
260-300	±4.1					70 ±2.3

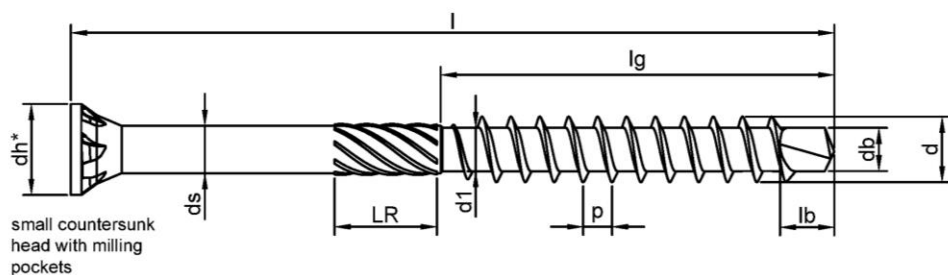
\* For all head shapes, the same head diameter apply. \*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI Drilltec screws  
with partial thread and different head shapes

Annex 4.11

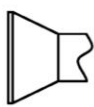




Alternative head types\*



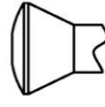
small countersunk head with ribs



small countersunk head



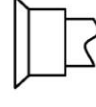
small raised countersunk head with ribs



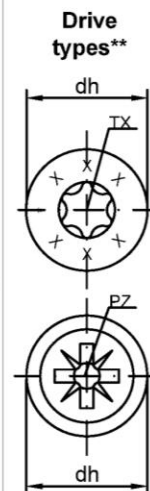
small raised countersunk head



small pan head



cylinder with small countersunk head



Drive types\*\*

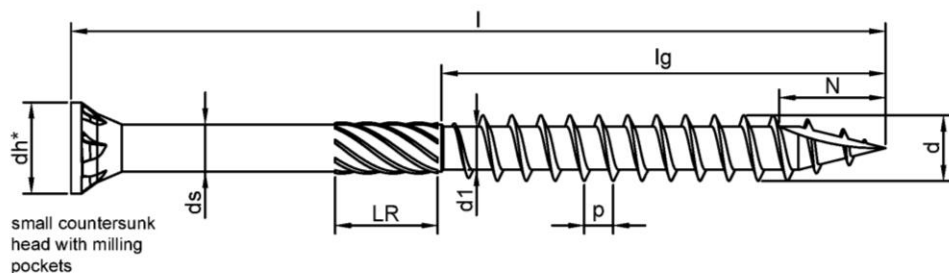
Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.2 ±0.3	2.5 ±0.3	2.7 ±0.3	3.1 ±0.3	3.7 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.5 ±0.3	2.8 ±0.3	3.1 ±0.3	3.5 ±0.3	4.2 ±0.3
<b>d<sub>h</sub></b>	Head diameter	5.0 ±0.5	6.0 ±0.5	7.0 ±0.5	7.5 ±0.5	11.0 ±0.6
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>l<sub>b</sub></b>	Drillbit length	3.5 ±5%	4.0 ±5%	4.5 ±5%	5.0 ±5%	5.1 ±5%
<b>d<sub>b</sub></b>	Drillbit diameter	2.1 ±5%	2.4 ±5%	2.6 ±5%	3.0 ±5%	3.6 ±5%
<b>TX</b>	Size (alternatives)	10 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
Nominal length [mm]		Secondary rough thread LR (optional)				
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	18 ±1.5	18 ±1.5	18 ±1.5		
30		21 ±1.7	21 ±1.7	21 ±1.7	21 ±1.7	24 ±1.7
35	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
40		26 ±1.7	26 ±1.7	26 ±1.7	26 ±1.7	26 ±1.7
45		28 ±1.7	28 ±1.7	28 ±1.7	28 ±1.7	28 ±1.7
50	±2.3	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60		36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80	±2.7	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90-100		54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
110-120		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
130-180				70 ±2.3	70 ±2.3	70 ±2.3
200-240						70 ±2.3
260-300	±4.1					70 ±2.3

\* For all head shapes, the same head diameter apply. \*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI Drilltec ZK screws  
with partial thread, drill bit and different ornamental head shapes

Annex 4.12



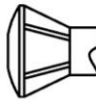
Alternative head types\*



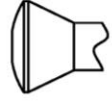
small countersunk head with ribs



small countersunk head



small raised countersunk head with ribs



small raised countersunk head



small pan head



cylinder with small countersunk head



Drive types\*\*

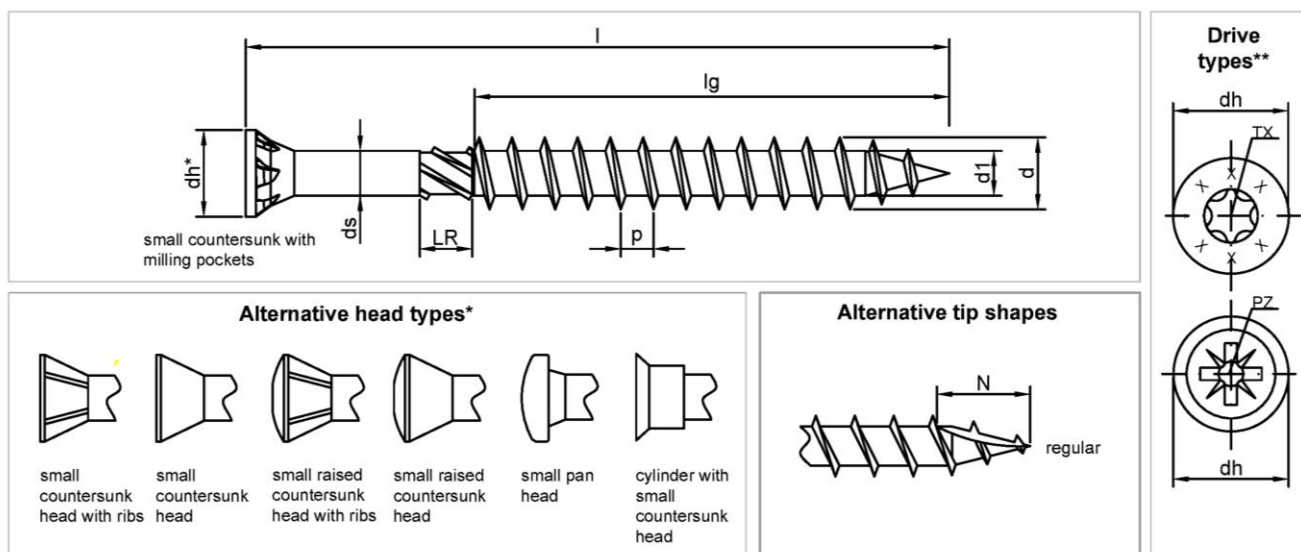
Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.2 ±0.3	2.6 ±0.3	2.8 ±0.3	3.3 ±0.3	3.7 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.5 ±0.3	2.9 ±0.3	3.2 ±0.3	3.6 ±0.3	4.2 ±0.3
<b>d<sub>h</sub></b>	Head diameter	5.0 ±0.5	6.0 ±0.5	7.0 ±0.5	7.5 ±0.5	11.0 ±0.6
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>N</b>	CUT length	7.0 ±5%	8.0 ±5%	9.0 ±5%	10.0 ±5%	11.0 ±5%
<b>TX</b>	Size (alternatives)	10 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
<b>LR</b>	Secondary rough thread (optional)	4.0	5.0	7.0	8.5	10.5
Nominal length [mm]						
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	16 ±1.5	16 ±1.5			
30		18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	24 ±1.7
40	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80		48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90	±2.7	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
100-110		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
120			70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3
130-180	±3.2			70 ±2.3	70 ±2.3	70 ±2.3
200-240	±3.6					70 ±2.3
260-300	±4.1					70 ±2.3

\* For all head shapes, the same head diameter apply. \*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI Terratec screws  
with partial thread and different ornamental head shapes

Annex 4.13



Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.1 ±0.3	2.3 ±0.3	2.5 ±0.3	2.9 ±0.3	3.5 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.2 ±0.3	2.5 ±0.3	2.7 ±0.3	3.1 ±0.3	3.6 ±0.3
<b>d<sub>h</sub></b>	Head diameter	5.0 ±0.5	6.0 ±0.5	7.0 ±0.5	7.5 ±0.5	11.0 ±0.6
<b>N</b>	CUT length	6.5 ±5%	7.5 ±5%	8.5 ±5%	9.5 ±5%	11.0 ±5%
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>TX</b>	Size (alternatives)	10 / 20	15 / 20	15 / 20	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
<b>LR</b>	Secondary rough thread LR (optional)	4.0	5.0	7.0	8.5	10.5
Nominal length [mm]						
<b>l</b>	<b>Tolerance</b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	16 ±1.5	16 ±1.5			
30		18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	24 ±1.7
40	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80	±2.7	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90		54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
100-110		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
120-180	±3.2	70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3
200-240	±3.6					70 ±2.3
260-300	±4.1					70 ±2.3

\* For all head shapes, the same head diameter apply.

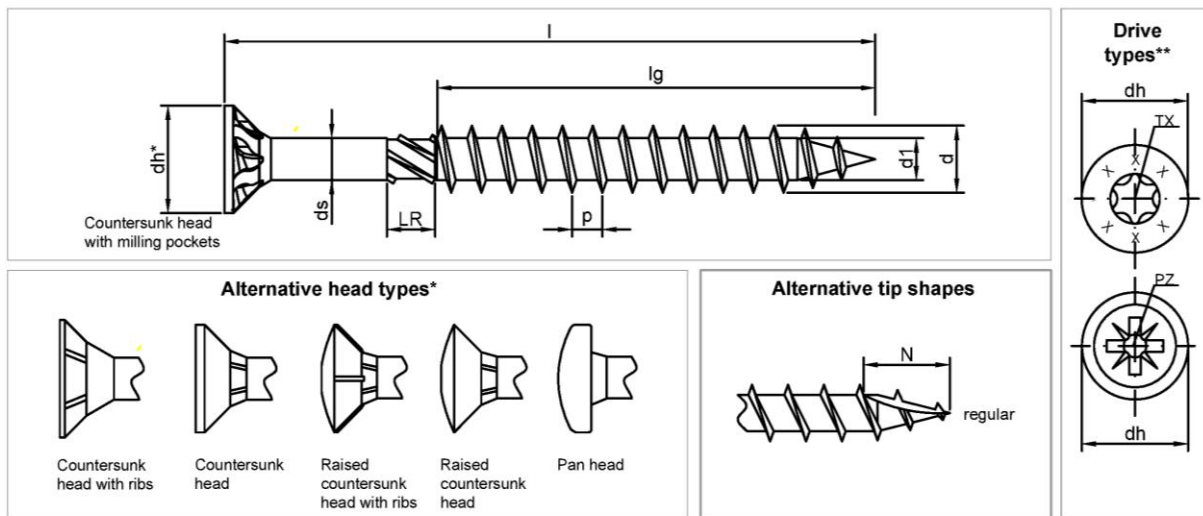
\*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI Drilltec CUT screws  
with partial thread and different ornamental head and tip shapes

Annex 4.14





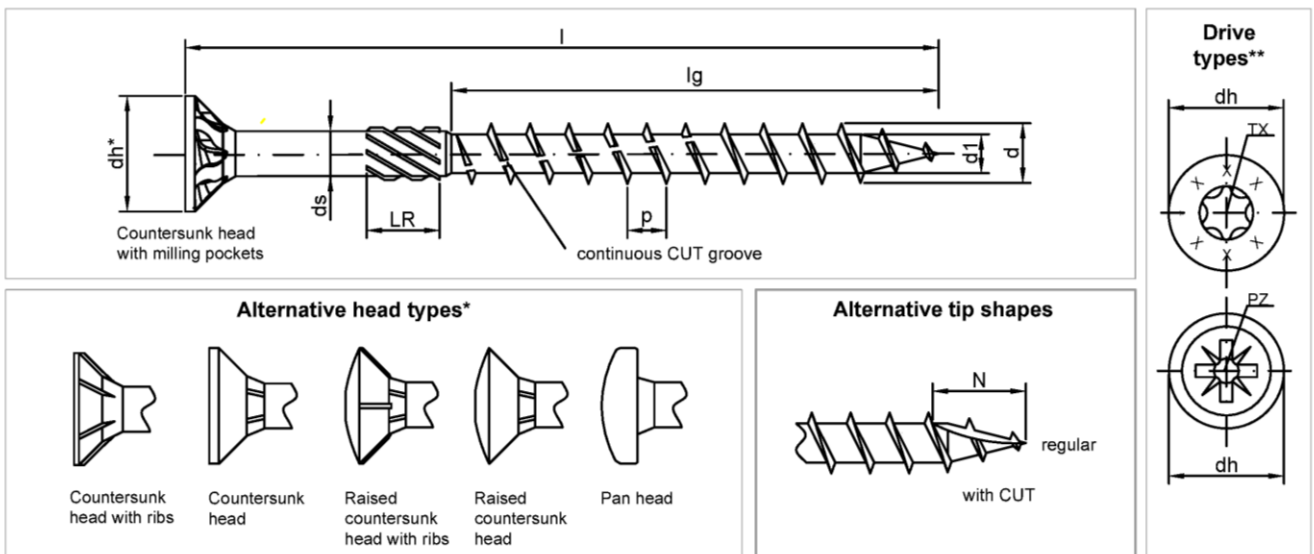
Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.1 ±0.3	2.3 ±0.3	2.5 ±0.3	2.9 ±0.3	3.5 ±0.3
<b>d<sub>s</sub></b>	Shank diameter	2.2 ±0.3	2.5 ±0.3	2.7 ±0.3	3.1 ±0.3	3.6 ±0.3
<b>d<sub>h</sub></b>	Head diameter	7.3 ±0.5	8.3 ±0.6	9.3 ±0.6	10.3 ±0.6	11.8 ±0.6
<b>N</b>	CUT length	6.5 ±5%	7.5 ±5%	8.5 ±5%	9.5 ±5%	11.0 ±5%
<b>p</b>	Thread pitch	1.6 ±10%	1.8 ±10%	2.0 ±10%	2.2 ±10%	2.6 ±10%
<b>TX</b>	Size (alternatives)	10 / 20	15 / 20	20 / 25	20 / 25	25 / 30
<b>PZ</b>	Size	2	2	2	2	3
<b>LR</b>	Secondary rough thread (optional)	4.0	5.0	7.0	8.5	10.5
Nominal length [mm]						
<b>l</b>	Tolerance	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
25	±1.7	16 ±1.5	16 ±1.5			
30		18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	24 ±1.7
40	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0
80		48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0
90	±2.7	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3
100-110		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3
120			70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3
130-140	±3.2		70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3
150-180				70 ±2.3	70 ±2.3	70 ±2.3
200-240	±3.6					70 ±2.3
260-300	±4.1					70 ±2.3

\* For all head shapes, the same head diameter apply. \*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI Drilltec SG screws  
with partial thread and different head and tip shapes

Annex 4.15



Nominal diameter [mm]		3.5	4.0	4.5	5.0	6.0	8.0	10.0
<b>d</b>	Outer diameter (thread)	3.5 ±0.3	4.0 ±0.3	4.5 ±0.3	5.0 ±0.3	6.0 ±0.3	8.0 ±5%	10.0 ±5%
<b>d<sub>1</sub></b>	Inner diameter (thread)	2.1 ±0.3	2.5 ±0.3	2.7 ±0.3	3.2 ±0.3	4.0 ±0.3	5.3 ±0.3	6.3 ±5%
<b>d<sub>s</sub></b>	Shank diameter	2.3 ±0.3	2.7 ±0.3	3.0 ±0.3	3.7 ±0.3	4.2 ±0.3	5.8 ±0.3	7.0 ±5%
<b>d<sub>h</sub></b>	Head diameter	6.8 ±0.5	7.8 ±0.5	8.8 ±0.6	9.8 ±0.6	11.8 ±0.6	14.5 ±5%	17.8 ±5%
<b>N</b>	CUT length	6.5 ±5%	7.5 ±5%	8.5 ±5%	9.5 ±5%	11.0 ±5%	12.0 ±5%	14.0 ±5%
<b>p</b>	Thread pitch (coarse thread)	2.2 ±10%	2.5 ±10%	2.8 ±10%	3.1 ±10%	3.6 ±10%	5.2 ±10%	5.6 ±10%
<b>TX</b>	Size (alternatives)	15 / 20	15 / 20	20 / 25	20 / 25	25 / 30	30 / 40	40 / 50
<b>PZ</b>	Size	2	2	2	2	3	3	4
<b>LR</b>	Secondary rough thread LR (optional)	4.0	5.0	7.0	7.9	4.9 (l up to 100) 9.9 (l from 110)	9.9	9.9
Nominal length [mm]								
<b>l</b>	<b>Tolerance</b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>	<b>l<sub>g</sub></b>
30	±1.7	18 ±1.5	18 ±1.5	18 ±1.5	20 ±1.7	24 ±1.7		
40	±2.0	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7	24 ±1.7		
50		30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7	30 ±1.7		
60	±2.3	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0	36 ±2.0		
70		42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	42 ±2.0	
80		48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	48 ±2.0	
90	±2.7	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	54 ±2.3	
100		60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	60 ±2.3	80 ±2.3	
110		66 ±2.3	66 ±2.3	66 ±2.3	66 ±2.3	66 ±2.3	80 ±2.3	
120		70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3	80 ±2.3	
130-140	±3.2	70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3	70 ±2.3	80 ±2.3	
150-180						70 ±2.3	80 ±2.3	80 ±2.3
200-240	±3.6					70 ±2.3	80 ±2.3	80 ±2.3
260-300	±4.1					70 ±2.3	80 ±2.3	80 ±2.3
320-400	±4.5					70 ±2.3	80 ±2.3	80 ±2.3

\* For all head shapes, the same head diameter apply. \*\* Alternative head markings with clear reference to the respective manufacturing plant are possible.

BTI DoTec and Drilltec screws

BTI DoTec screws  
with partial and coarse thread and different head and tip shapes

Annex 4.16