



ETA-Danmark A/S  
Göteborg Plads 1  
DK-2150 Nordhavn  
Tel. +45 72 24 59 00  
Fax +45 72 24 59 04  
Internet www.etadanmark.dk

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according to Article 29 of the  
Regulation (EU)  
No 305/2011 of the European  
Parliament and of the Council of  
9 March 2011

MEMBER OF EOTA



## European Technical Assessment ETA-07/0245 of 2025/01/15

### I General Part

**Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S**

**Trade name of the construction product:**

SIMPSON STRONG-TIE® Joist End connector  
SIMPSON STRONG-TIE® concealed beam hangers

**Product family to which the above construction product belongs:**

Three-dimensional nailing plate (connector for wood to wood connections and wood to concrete or steel connections)

**Manufacturing plant:**

SIMPSON STRONG-TIE A/S  
Hedegaardsvej 4 – 11, Boulstrup  
DK-8300 Odder  
Tel. +45 87 81 74 00  
Fax +45 87 81 74 09  
SIMPSON STRONG-TIE Manufacturing facilities

**This European Technical Assessment contains:**

143 pages including annexes which form an integral part of the document

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

EAD 130186-00-0603 for Three-dimensional nailing plates

**This version replaces:**

The ETA with the same number and issued on 2018-08-15

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## **II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT**

### **1 Technical description of product**

The SIMSPON Strong-Tie Concealed Beam Hangers are three dimensional nailing plates made of pre-galvanized steel Grade S 250 GD + (min. Z 275) according to EN 10346 or stainless steel 1.4401 and 1.4404 according to EN 10088 or a stainless steel with a minimum characteristic yield stress of 235 N/mm<sup>2</sup> or a minimum ultimate tensile strength of 330 N/mm<sup>2</sup>, or aluminium AlMgSi 0,7 according to DIN 1749-1. The range addressed by this approval consists of various hangers which have in common the necessity to practice a notch and holes in the joist for the dowels path : TU, TUS, ETNM, BTN, BT4, BT, BTC, BTALU, BT FLEX, CBH, Janebo-family. They are intended for wood-wood connections and wood-concrete connections with angles varying from 30° to 90°. The geometry and standard dimensions are given in Annexes D.

ETB are two-piece non-welded, face-fixed connectors to be used in timber to timber connections.

ICS and ICST are two-piece non-welded element-connectors to be used in timber to timber connections.

EL connectors are one-piece non-welded, face-fixed connectors to be used in timber to timber connections as well as connections between a timber joist and a concrete structure or a steel member.

ELS connectors are one-piece non-welded, face-fixed connectors to be used in timber to timber connections.

The connectors are made from aluminium grade EN AW-6082 T6 according to EN 755-2 with minimum yield strength of 250 MPa, a minimum tensile strength of 295 MPa and a minimum ultimate strain of 8%. Dimensions, hole positions and aluminium type are shown in Annex D6 to D8. Typical installations are shown in Annex C.

A coloured top paint can be applied to all connectors

### **2 Specification of the intended use in accordance with the applicable European Assessment document (hereinafter EAD)**

The intended use of the SIMPSON Strong-Tie Concealed Beam Hangers is to establish connections of joists with rectangular cross sections to their support, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled.

The joist may be either of solid sawn or Engineering Wood Product listed in Annex C1.

The support may also be either a solid sawn element, an Engineering Wood Product listed in Annex C1, or

concrete. With regard to moisture behaviour of the support and/or joist, the use is possible in service classes 1 and 2 as defined in EN 1995-1-1:2004 for the Concealed Beam Hangers made out of galvanised steel. The use is possible in service class 1, 2 and 3 defined in EN 1995-1-1:2004 for Concealed Beam Hangers made out of stainless steel 1.4401 and 1.4404 according to EN 10088, or another stainless steel as described before in structures subject to internal or external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used). A concealed joist hanger produced from steel, which is resistant for these atmospheres, may be used in these areas.

The scope of the connectors regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions.

No performance has been determined in relation to ductility of a joint under cyclic testing. These connectors contribution to the performance of structures in seismic zones, therefore, has not been assessed.

In the case of EL, ELS, ETB, ATFN, EGCL & EGCM connectors however, they should not be used in areas where they may support seismic actions.

The ETB, EL and EL-S connectors are intended for use in making end-grain to side-grain connections in load bearing timber structures, as a connection between a timber joist and a solid timber or wood based header, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled. The EL connectors are also intended for use in making an end-grain connection between a timber joist and a concrete structure or a steel member.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the connectors of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, 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

Characteristic	Assessment of characteristic
<b>3.1 Mechanical resistance and stability (BWR 1)*)</b>	
Joint Strength - Characteristic load-carrying capacity	See Annex D
Joint Stiffness	See Annex D
Joint ductility	No performance assessed
Resistance to seismic actions	No performance assessed
Resistance to corrosion and deterioration	See section 3.6
<b>3.2 Safety in case of fire (BWR 2)</b>	
Reaction to fire	SIMPSON Strong-Tie Concealed Beam Hangers and Joist End connectors are made from steel classified as <b>Euroclass A1</b> in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364
Resistance to fire	No performance assessed
<b>3.3 General aspects related to the performance of the product</b>	
	The SIMPSON Strong-Tie Concealed Beam Hangers and Joist End connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3

\*) See additional information in section 3.4 – 3.6.

### 3.4 Mechanical resistance and stability

See annex D for characteristic load-carrying capacities of the SIMPSON Strong-Tie Concealed Beam Hangers and SIMPSON Strong-Tie Joist End connectors.

The mechanical capacities of the concealed beam hangers and Joist End connectors are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. They should be used for designs in accordance with EN-1995-1-1 (Eurocode 5) or a similar national timber code.

The load-bearing capacities given in Annexes D of the concealed beam hangers and Joist End connectors have been determined based on the use of connector nails in accordance to ETA-04/0013 and screws are described in Annex C3. It is allowed to use connector screws or connector nails 4.0 x 50 or 4.2 x 50 or 4.2 x 60 in accordance to ETA-04/0013. Case by case calculations have to be carried out to determine the load-bearing capacity of the connection.

The design also allows the use of threaded nails in accordance to EN 14592 with a diameter in the range 4.0-4.2 mm and a minimum length of 35 mm, assuming a thick steel plate when calculating the lateral nail load-bearing capacity. If no calculations are made a reduction factor equal to the ratio between the characteristic withdrawal capacity of the actual used threaded nail and the characteristic withdrawal capacity of the corresponding connector nail according to table B1 in ETA-04/0013 is applicable for all load-bearing capacities of the connection.

No performance has been determined in relation to ductility of a joint under cyclic testing.

The contribution to the performance of structures in seismic zones, therefore, has not been assessed

### 3.5 Aspects related to the performance of the product

#### 3.5.1 Corrosion protection in service class 1, 2 and 3.

The thickness of galvanisation (Z275 according to EN 10143) or the aluminium AlMgSi 0,7 is such that a reasonable durability may be expected in service classes 1 and 2 according to EN 1995-1-1:2004, in the conditions stated in 1.1 above. ZM310 can be used as corrosion protection in service class 3 (applicable for all steel thicknesses).

The use of stainless steel 1.4401 and 1.4404 according to EN 10088 extends the scope to service class 3 according to EN 1995-1-1:2004 in the conditions stated in 1.1 above.

The ETB, ELEM-S, EGCL and EGCM connectors have been assessed as having satisfactory durability and

serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1 and 2

The ATFN connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1

Serviceability of the Concealed Beam Hangers is understood as their ability to resist loads without unacceptable deformations.

### 3.6 General aspects related to the use of the product

Concealed Beam Hangers and Joist End connectors are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

SIMPSON Strong-Tie Concealed Beam Hangers and Joist End connectors shall be installed on the basis of a specific structural design for each installation, using the load-bearing capacities given in Annexes D and applying the appropriate  $k_{mod}$  factor depending on the relevant service class / load duration and the appropriate National partial safety factor for materials.

The fixing of the Concealed Beam Hangers and Joist End connectors to the support shall use the appropriate nails or screws in case of solid wood or wood-based support, appropriate CE marked metal anchors for use in concrete in case of concrete support. The load bearing capacities indicated in the Annexes are given provided that the fixing device has been appropriately designed and installed.

The Concealed Beam Hangers shall be installed by appropriately qualified personnel, following an installation plan and relevant construction details worked out for each individual building project. The installation plan shall be based on the manufacturers general guide and provisions for installing SIMPSON Strong-Tie connections

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

##### **4.1 AVCP system**

According to the decision 97/638/EC of the European Commission<sup>1</sup>, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

#### **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 ETA-Danmark prior to CE marking

Issued in Copenhagen on 2025-01-15 by



Thomas Bruun  
Managing Director, ETA-Danmark

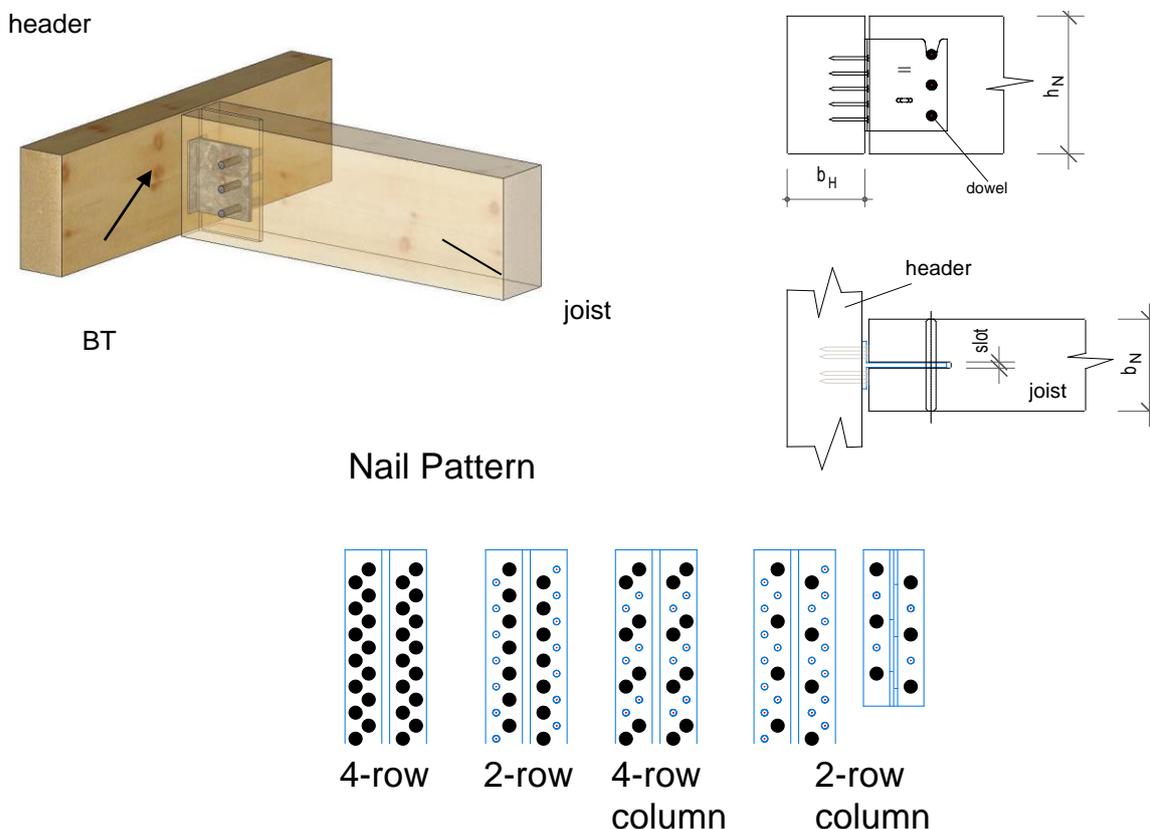
## Annex A Revision History

Revision History	
Issue	update
3	<p>TU for force direction axial and lateral</p> <p>Update BTN, BT4, BTALU up to size 240</p> <p>BT280 up to BT600</p> <p>BTC120 up to BTC600</p> <p>Merged with the ETA 07/0245 Joist End connectors ET, ETB, ELS</p> <p>Added the possibility for a slope <math>&lt; 0^\circ</math></p>
4	Add ETS
5	BT - Update of the tables 13 to 20 in annex D1
6	<p>New definition of force directions</p> <p>BTN, BT4, BTALU, BT - several revisions</p> <p>BTALU – Download with dowels <math>\varnothing 7</math>, <math>\varnothing 8</math>, <math>\varnothing 10</math> and <math>\varnothing 12</math></p> <p>BTx for Racking</p> <p>BTC - all types added in the tables</p> <p>Fire resistant for concealed beam hangers/hidden connectors - principle</p> <p>TU, TUB, TUS, TUBS - several revisions</p> <p>Addition of new product range Janebo: JHHU, JHDU, JHGU, JHH, JHD</p> <p>Addition of new product: ICST</p> <p>Some more correction / clarifications, update of standards reference</p>
7	<p>ATF - renamed to ATFN</p> <p>modified depth of holes from 2,8 to 3,1, and d=12 to d=10</p> <p>Change the corrosion protection to Chrome VI free</p> <p>Add the fire rules to get F30 with timber protection</p> <hr/> <p>BTN/BT4/BTALU/BT</p> <p>Update tables for BT acc to modifications made next to mistake identified</p> <p>Table 9 to 12: values corrected</p> <p>Table 33 and 34 values for BTN corrected</p> <p>Table 34 the number of SD's and nails are corrected</p> <hr/> <p>BTC</p> <p>Table D4-3, additional option for timber size b=60mm.</p> <p>added the option for slope connections</p> <hr/> <p>CBH</p> <p>added the types of fastener to header for CBH, table D9-3</p> <p>to added the size CBH105</p> <p>CBH - thickness changed from 3,0 to 2,5mm</p> <hr/> <p>Janebo</p> <p>correct a typing error in the formula (the index 2 in the box shall be 4)</p>

	added the product names/sizes for types without uplift hook
	Correction of some typing errors. to add additional coatings: Z800 and ZM310
	Add product family EGCM & all relating data
	Add product family EGCL & all relating data
	Add product family BT Flex & all relating data
	Add product family BTCALU & all relating data
	Amends regarding painted products: "The connectors can be applied with a coloured top paint"
	Wording change about seismic actions
	Btx – alterations about the eccentricity for load direction F3
	BT – texts enlarged
	BTN – delete “-c” from table 33
	BT4 - Table 34: the value BT4-280-c for CSA5,0x50 shall be 36,5 instead of 29,5.
	BTALU - Table D1-1 Size specification (page 38): all lengths of BTALU should be 4 mm shorter
	BTALU - Create a hint after table 34 - where table 35 is located
	Alterations to tables to show CKT or C24 for header material
	BT – text boxes enlarged
	BT – update of product tables to show 106mm dimension
	BTALU - add in page 40 and in page 58 to 62 that values given for Ø7 dowels are also valid for Ø7.5 dowels
	BTALU - tables 85-86-87 correct dowels diameter which should be Ø12 instead of Ø10
8	BTALU – several updates
	BTALU – additional information included/updated for fastener numbers (page 40)
	TUS - Angles range should be modified for TUS from 1 to 89 instead of from 30 to 85 °
	TUS – Indicate naming alternatives as the TU/S
	Table D4-6 – R3 should be changed into R4
	CBH – Update the list of product for R2 (with the ratio of dowels)
	CBH - Include the option and data for CBH105-Z
	CBH - New nailing pattern on post for CBH range
	ETS - Adjust table D10-1 size and change min width for ETS100 from 70 to 75 mm
	ATF - page 123: Formula for R_1.J.K shall be for one fastener; page 124: e_H shall in the end of line e_H too
	TUB - Add F2 & F4 for TUB, check in folder ProdMaster/TU TUS TUB TUBS/Design Mode
	TUB - Include thickness modification of TU/TUB range within ETA
	TU - Include load modification for R3,k and R4,k within ETA acc to ETA annex
	TU – Update of tables within Annex D2
	BTC & ETNM - Include additional data for capacities of BTC and ETNM with SSH screws
	EL – Update of table D9-2 to include ZPRO coating
	Sort Annex D into alphabetical order by product name

## Annex B Typical Installation

### B.1 Typical installation for Concealed Beam Hangers



Other nail pattern is described in annex D.

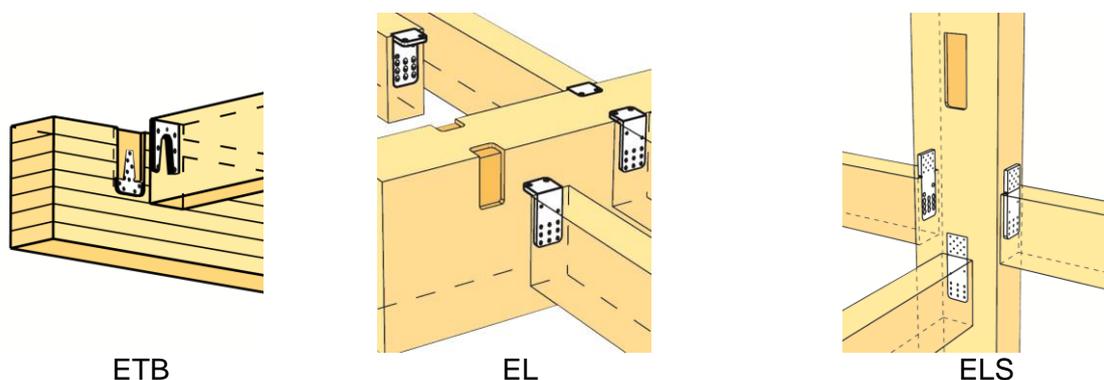
Concealed joist hangers ("BT" in the following text)

A BT connection is deemed fit for its intended use under following conditions:

1. BT can be fastened to wood-based members by nails or screws.
2. There shall be nails or screws in all holes or a partial nailing pattern as shown in Annex A and prescribed in Annex B can be used.
3. The characteristic capacity of the BT connection is calculated according to the manufacturer's technical documentation.
4. The concealed Joist Hangers connection is designed in accordance with Eurocode 5 or an appropriate National Code.
5. The thickness of the beam shall be at least  $l$ , where  $l$  is the length of the fasteners in the beam. This is in accordance with Eurocode 5.
6. The depth of the Joist shall be so large that the steel dowel has at least a distance of  $3d$  to the edge, where  $d$  = the diameter of the steel dowel.
7. The depth of the beam shall be so large that the fasteners have at least a distance according EN 1995-1-1, in relation to the force direction.

8. The slot for the BT in the joist may be  $t +1/ +2$  mm , where  $t$  = the thickness of the bar of the BT, for the type TU12, TUS12, the slot may be 6 mm, for the other size of type TU, TUS, the slot may be 9-10mm
9. For connection to concrete the anchor bolts shall be mounted according to the approval of the used anchor bolt
10. For connection to steel the bolts shall be mounted according the relevant standard
11. The backside of the BT shall have contact along the full height of the connector.
12. BT made from stainless steel shall only be fastened with fasteners made from suitable stainless steel. Zinc-coated concealed joist hangers shall not be fastened with fasteners of stainless steel.
13. Nails or screws to be used shall have a diameter, which fits to the holes of the BTs. They shall have a diameter which is not smaller than the diameter of the hole minus 1 mm.
14. The execution of the connection shall be in accordance with the approval holder's technical literature.

## B.2 Typical Installation for End Grain Connectors : ETB, EL, ELS, EGCM & EGCL



The connection to the header or the column for the ETB and ELS can be made with Nails or CSA screws and screws only for Type EL, EGCM & EGCL  
The connection to the end grain of the joist is made with screws according to the corresponding Annex. The angle between the Joist End connector and the screws is  $45^\circ$ . A slope and a skew is possible in these product ranges.

An ETB, EL, EL-S EGCM & EGCL connection is deemed fit for its intended use provided:

1. The header shall be restrained against rotation.
2. If the connection only has a connector on one side of the header, the eccentricity moment from the joists shall be considered when verifying the strength of the header.
3. For a header with joists from both sides but with different reaction forces a similar consideration applies.
4. There shall be nails or screws in all holes or a partial nailing pattern as prescribed in Annex D.
5. For EL connectors fastened to timber frame members as shown in arrangement 1 (see following), only the thread length in the timber member may be taken into account.
6. For EL connectors fastened to timber frame members as shown in arrangement 2 (see following), the sheathing (e.g. OSB) must be flush with the header surface.
7. The gap between the side grain of the header and the vertical flap of the hanger shall be limited.

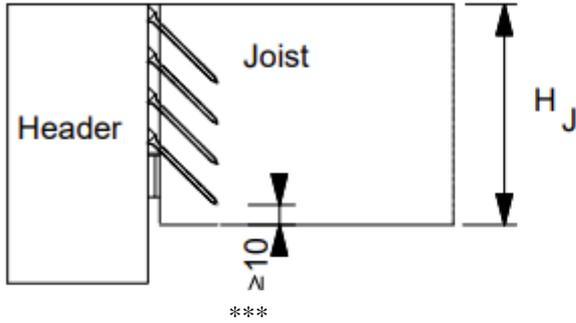
The gap between the side grain of the header and the vertical flap of the connector shall be maximum 3 mm for connections made with the EL connector. For connections made with the

ETB, ELS, EGCM and EGCL connectors the gap between the member surface and the connector shall be maximum 1 mm.

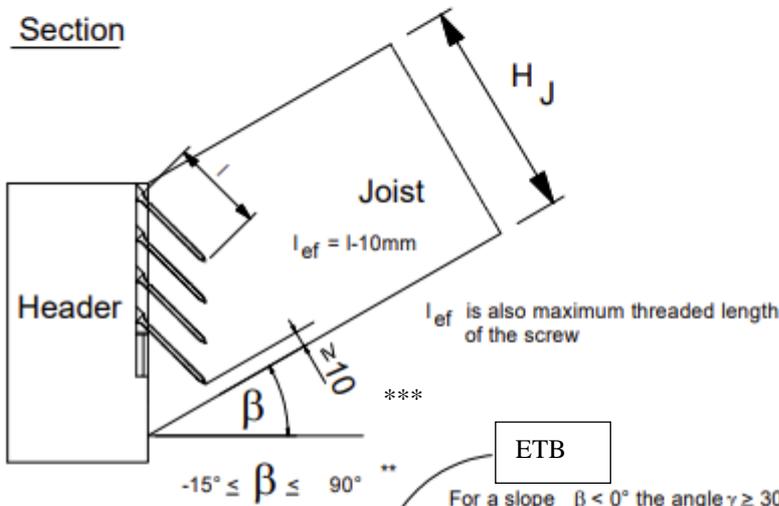
8. The EL connector shall be in close contact with the concrete or steel over the horizontal flap.
9. For ETB, EL, EL-S EGCM and EGCL connectors the width of the header shall be at least  $l+4d$ , where  $l$  is the length and  $d$  is the diameter of the nails or screws in the header.
10. For ETB, EL, EL-S EGCM and EGCL connectors the depth of the joist shall allow an edge distance of at least 10 mm between the screw tip and the adjacent joist surface.
11. The header shall have a plane surface against the whole ETB, EL, EL-S, EGCM or EGCL connector.
12. Nails or screws to be used shall have a diameter, which fits the holes of the ETB, EL, EL-S, EGCM and EGCL connectors.
13. Minimum end and edge distance for the nails/screws have to be observed according to the standard or, if applicable, according to the relevant assessment of the fastener.

ETB, EGCM and EGCL

Section



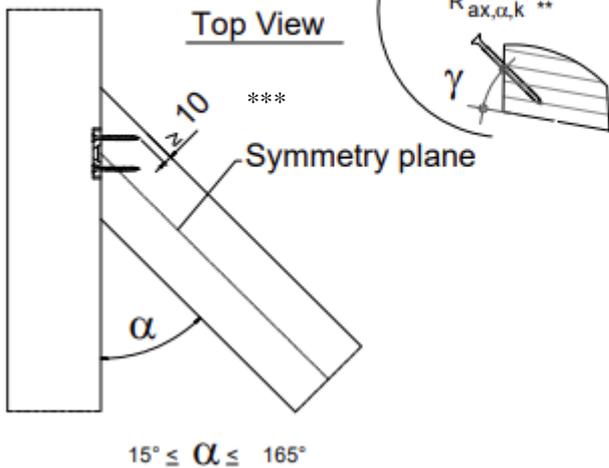
Section



ETB

For a slope  $\beta < 0^\circ$  the angle  $\gamma \geq 30^\circ$ , in accordance with the approval of the screws, which is used to determine  $R_{ax,\alpha,k}$  \*\*

Top View



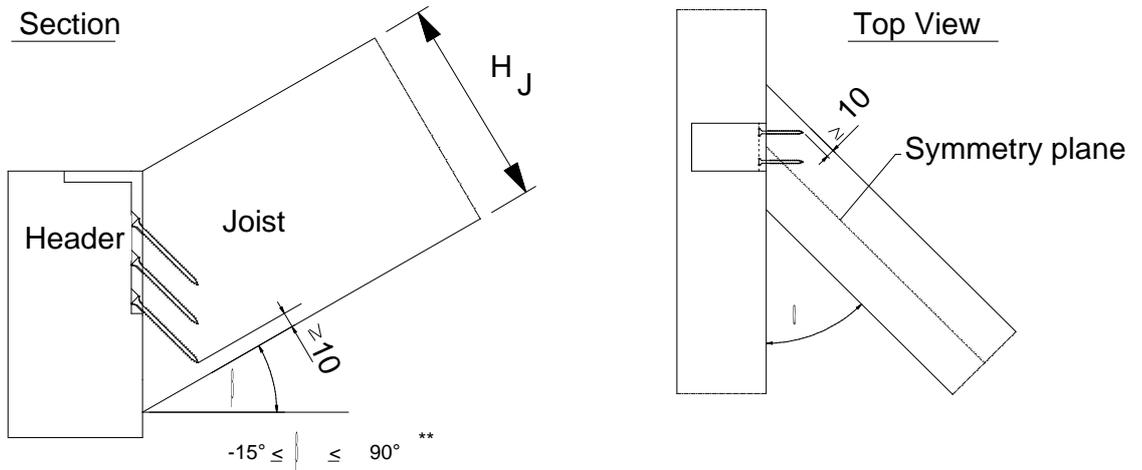
EGCL  
For a slope of  $\beta < 0^\circ$  the screw values on the joist must be determined according to the grain direction regarding the  $\gamma$  - angle.

\*\* if  $\gamma < 30^\circ$  and the screws are covered by approval for this application, the values for the connector may be evaluated accordingly.

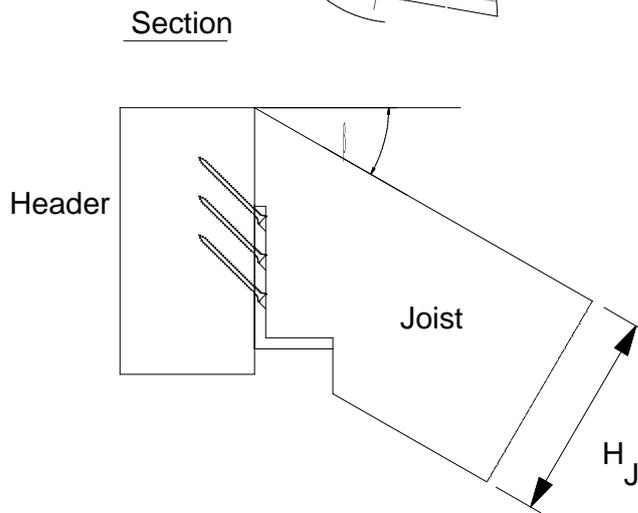
\*\* if  $\gamma < 30^\circ$  and the screws are covered by approval for this application, the values for the connector may be evaluated accordingly.

\*\*\* the 10mm value may be under run for EGCL, separate values for EGCL are 8mm

EL



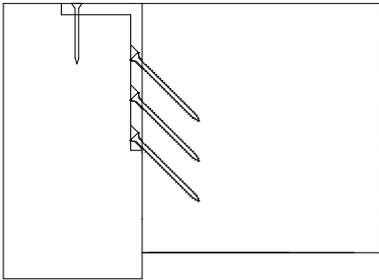
For a slope  $\gamma < 0^\circ$  the angle  $\geq 30^\circ$ ,  
 in accordance with the approval of the  
 screws, which is used to determine  
 $R_{ax,j,k}$  \*\*



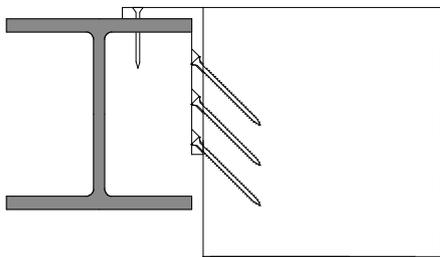
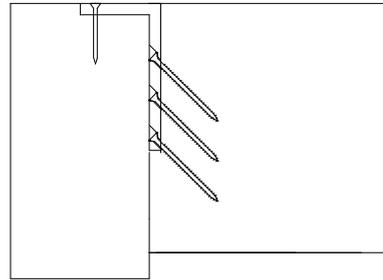
\*\* if  $\gamma < 30^\circ$  and the screws are covered by approval for this application, the values for the connector may be evaluated accordingly.

### Installations

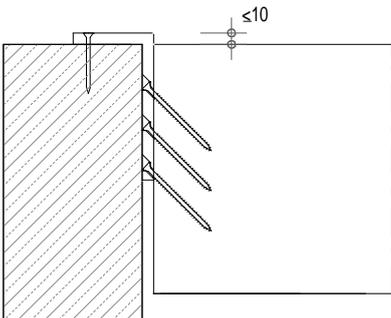
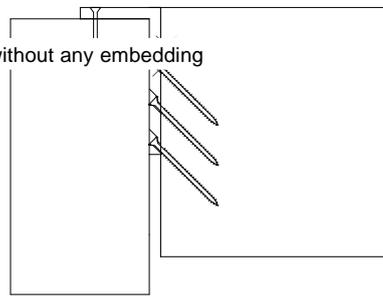
embed in the header



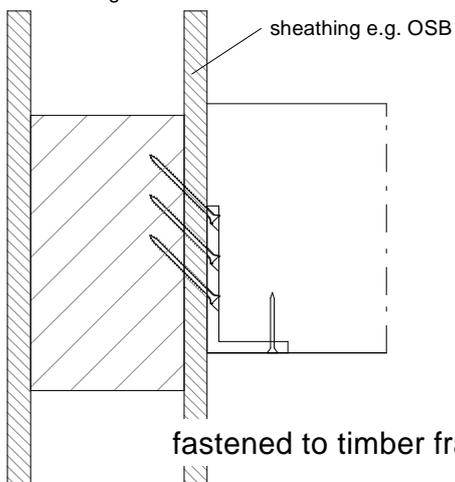
embed in the header and the front of joist



without any embedding

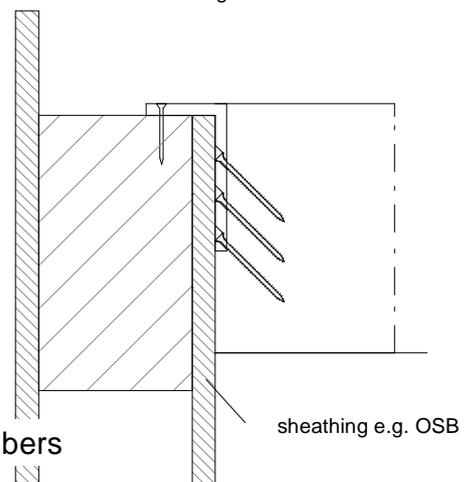


Arrangement 1



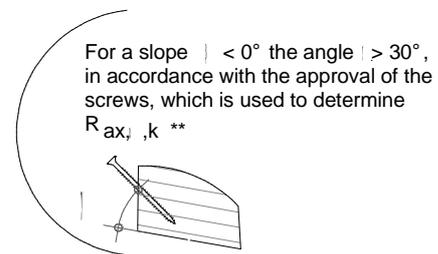
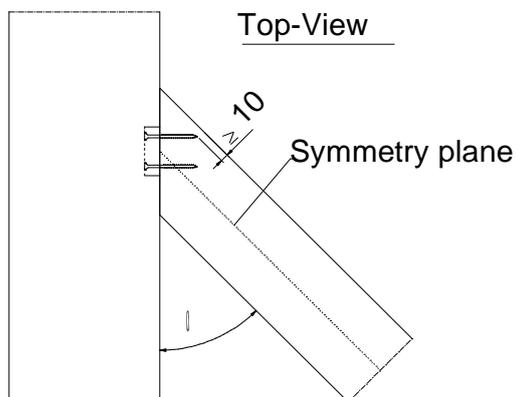
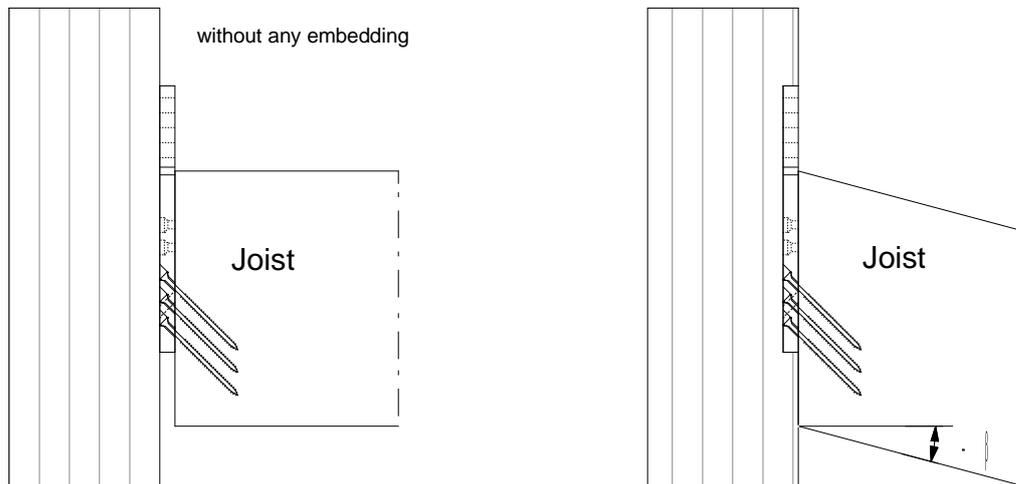
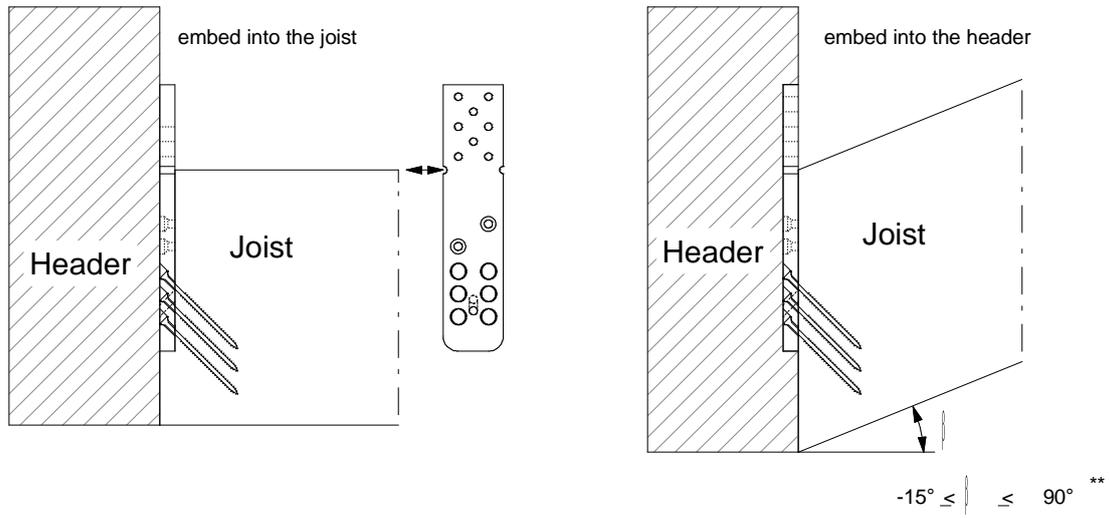
fastened to timber frame members

Arrangement 2



ELS

Section



\* if  $\gamma < 30^\circ$  and the screws are covered by approval for this application, the values for the connector may be evaluated accordingly.

### B.3 Typical Installation for Connectors for Studs : ICST:

#### ICST

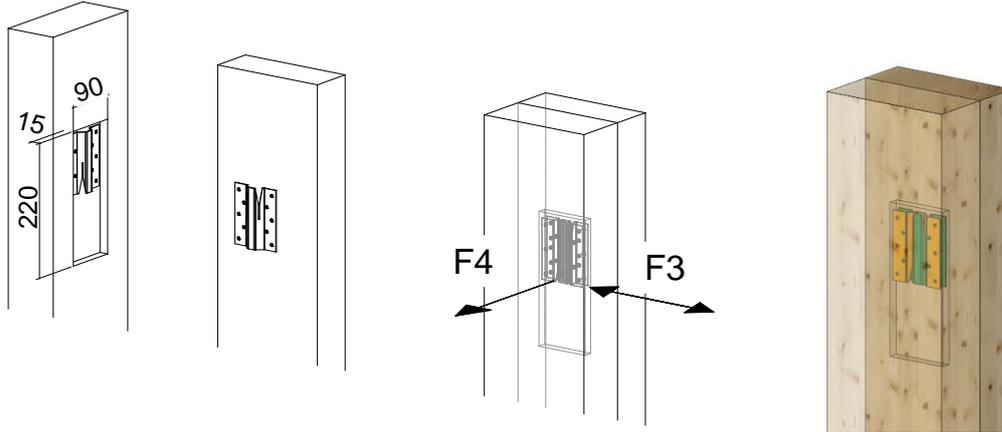
Routing is necessary on 1 side only. This routing should be 15 mm deep, 90 mm wide and 220 mm long as a minimum.

The distance between the ICST and the end of the timber elements should be 100 mm as a minimum.

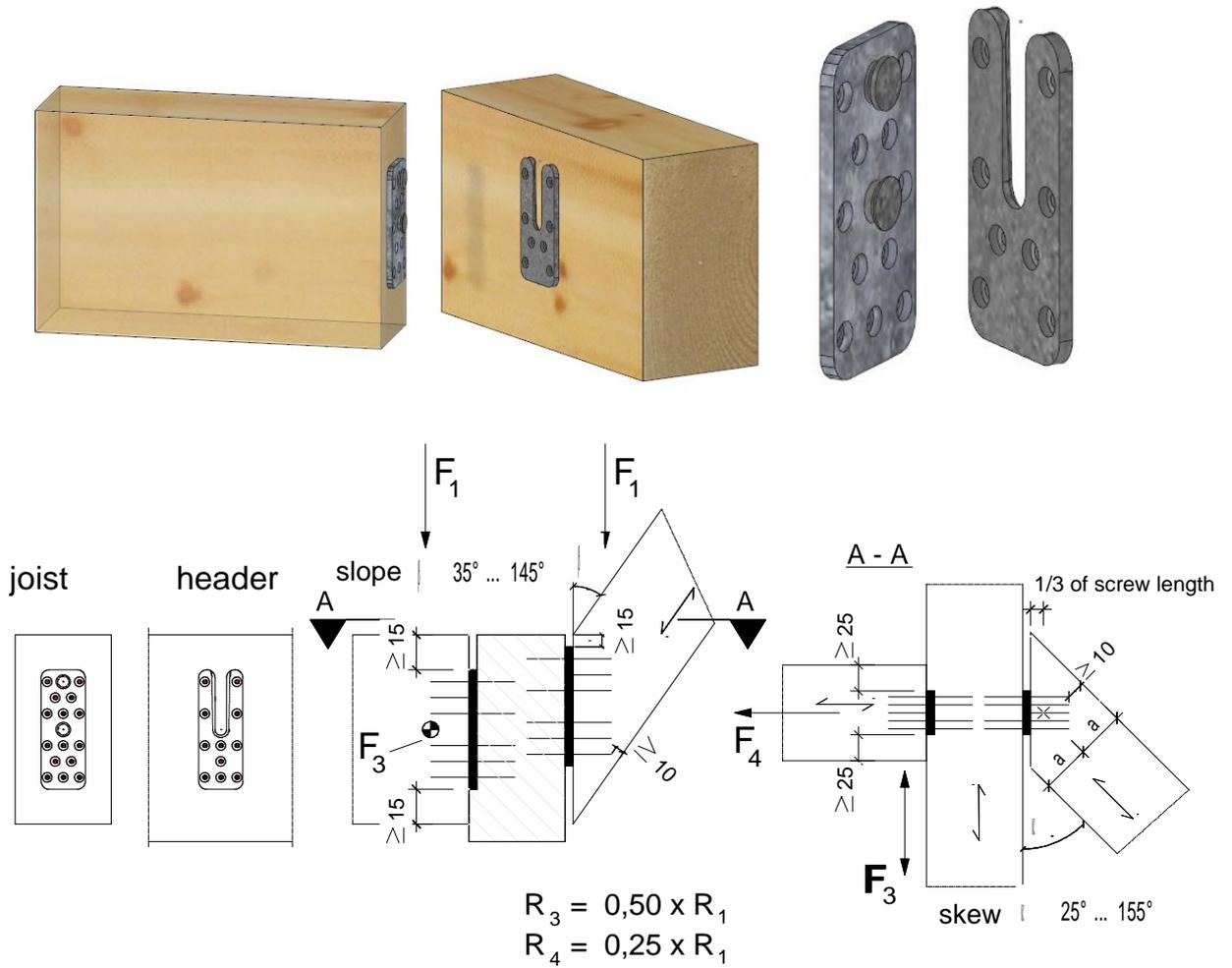
ICST is composed of two parts, which will be face to face in final position.

The guiding central part of the connector facilitates the timber assembly.

The ICST connector is intended in the case of “closed” walls (installation of exterior and interior wall coverings).

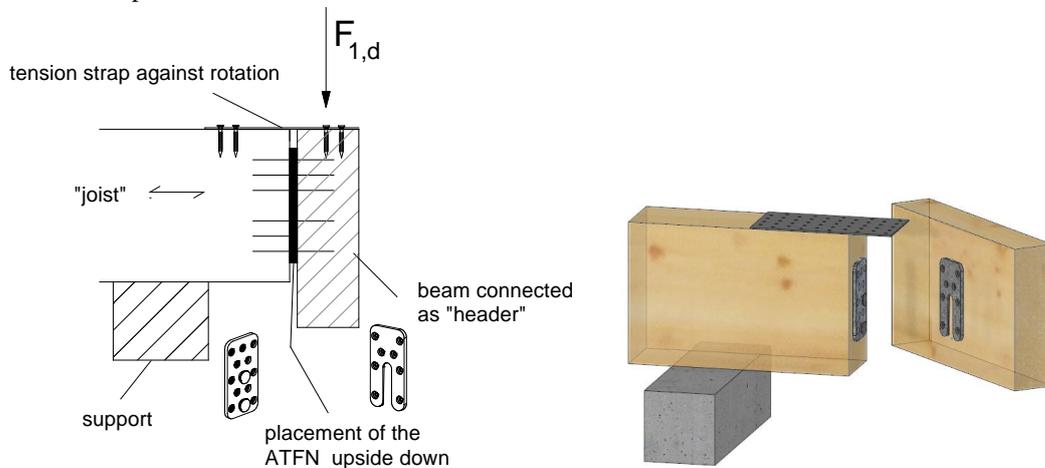


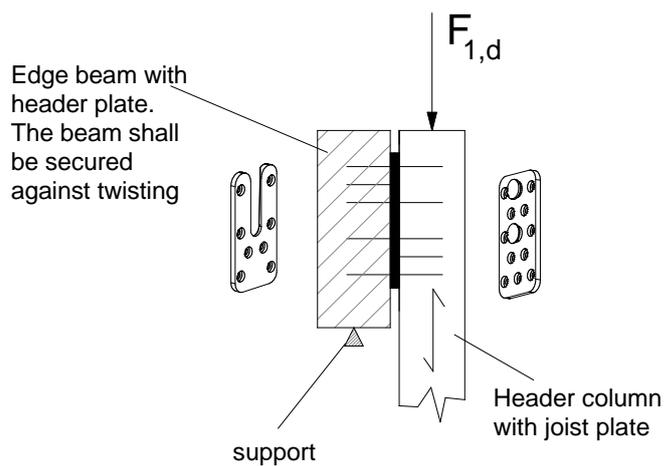
### B.4 Typical Installation of Steel End Grain Connectors: ATFN



The distances to the border according to the picture above have to be considered.

Additional option for installation:

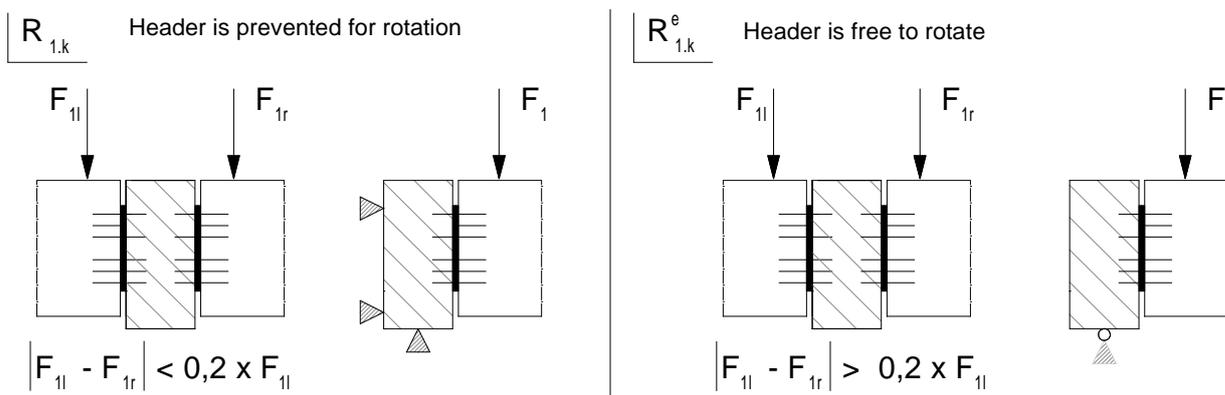




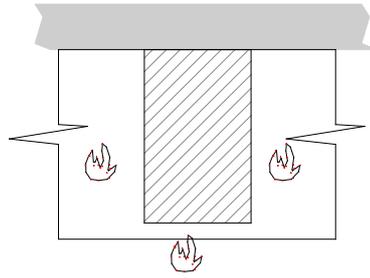
The routing can be made a) in the joist with 10mm, b) in the header with 10mm, or c) in both parts with together  $\leq 10$ mm.



The connection to the header can be made with nails in the case where the header is prevented from rotation. In other cases, the CSA screws have to be installed.



## B.5 Installation for fire justification



Fire from max 3 sides.

- **Concealed beam Hangers:** (TU, CBH, BT, BT4, BTN, BTALU, BTCALU, BTC, Janebo)  
Below are the parameters for the concealed beam hangers for a 30min and a 60min fire resistance.

### Routing is compulsory

	Fire Resistant period - timber C24	
	30mm	60min
$t_1$ (mm)	50	50.00
$a_{fi}$ (mm)	10	30*
$d_{g1}$ (mm)	10 [30]	30 [Not Applicable]
$d_{g2}$ (mm)	20 [30]	60 [Not Applicable]

\*must be plugs

For BTALU connector use values between [ ]

For connection with a gap of  $\leq 1$ mm  $d_{g2}$  can be decreased to  $d_{g1}$ , this does not apply for the BTALU.

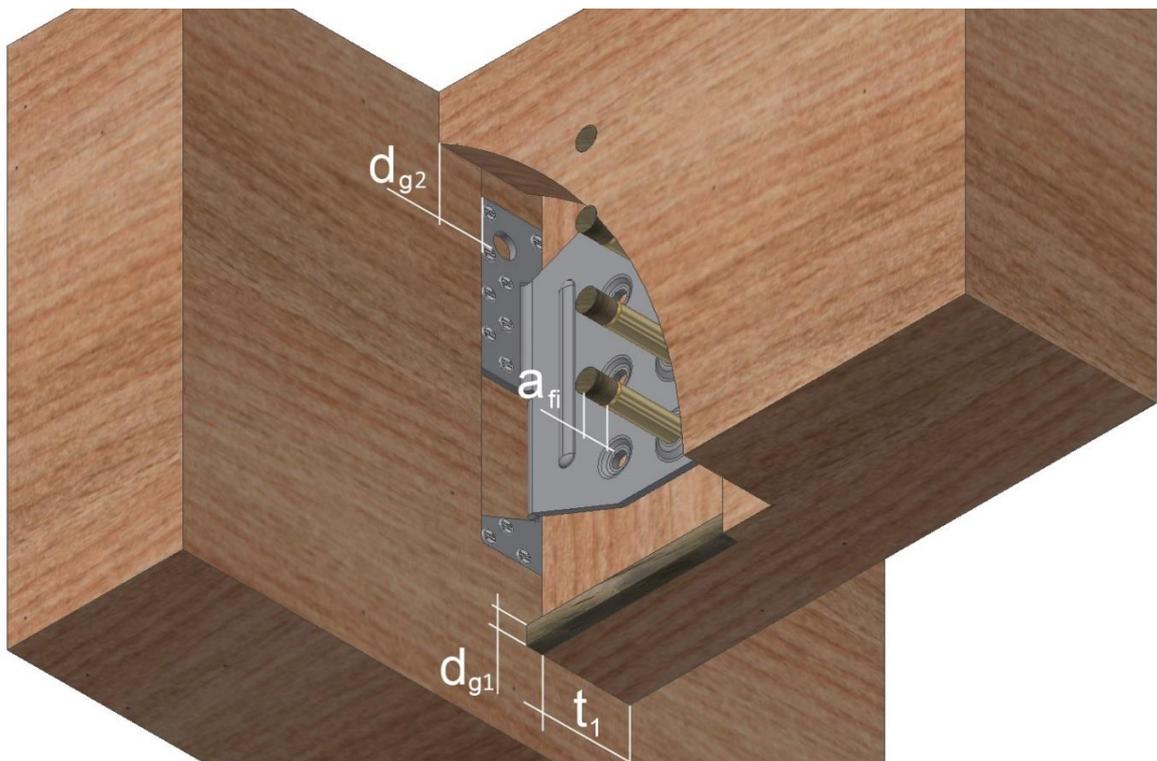
$t_1$ : thickness of the timber member on each side of the connector

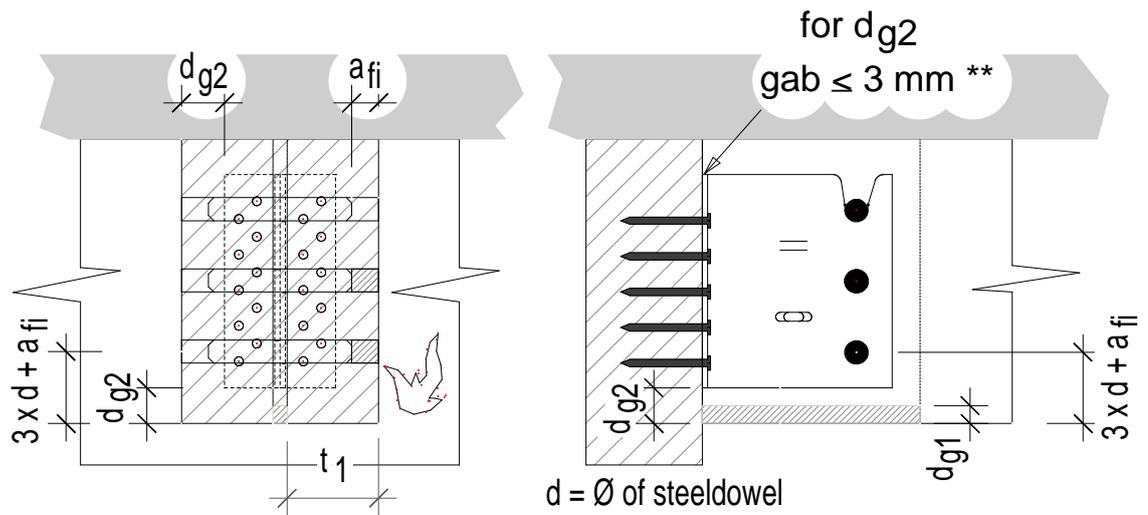
$a_{fi}$ : the end and edge distance to dowels (can be plugs)

$d_{g1}$ : thickness of the glued-in strips

$d_{g2}$ : thickness of timber for overlapping for the back plate with a gap  $\leq 3$  mm,

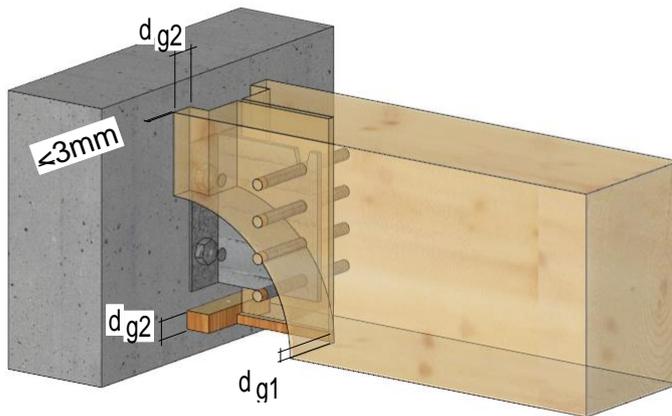
gap = the distance between the end of the joist and the surface of the header





\*\* For connector type BTALU and BTCALU: the gap is limited by  $\leq 1\text{mm}$ .

- **BTC ; CBH bolted, BTCALU**



The gap is limited by  $\leq 3\text{mm}$

- **Hidden connector:** ATFN, EGCM, EGCL, ETB, ETSN, EL/ELS, ICST

Hidden connector such as ATFN, EGCM, EGCL, ETB, ETSN, EL/ELS and ICST can also be justified by using this solution. In this case, a routing is compulsory. A thickness of timber  $d_g$  on each side of the connector must be respected.

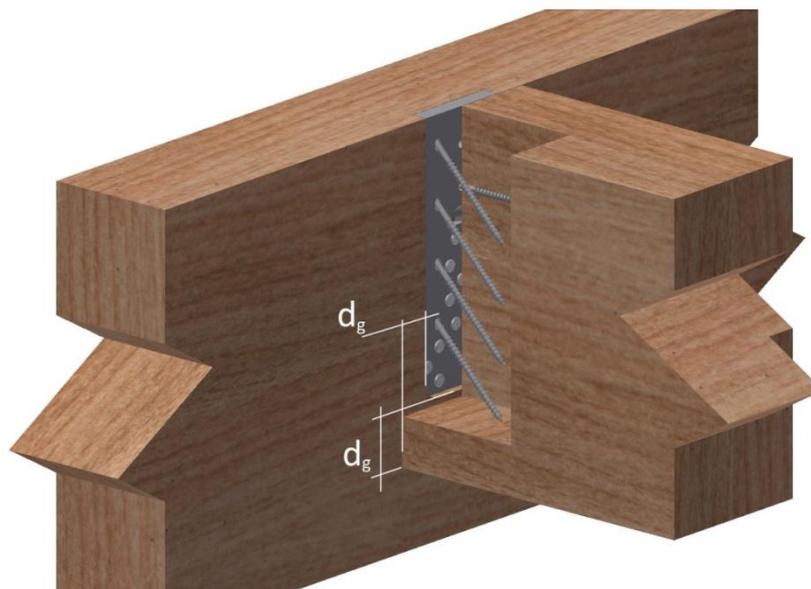
		Fire Resistant period - timber C24	
		30mm	60min
$d_g$ (mm)	ETSN, ICST	10	30
	ATFN, ETB, EL/ELS, EGCL, EGCM	30	-
$a_1$ (mm)	ETSN	40	55
	ICST		
	ATFN, ETB, EL/ELS, EGCL, EGCM	40	-
$a_3$ (mm)	ETSN,	28	58
	ATFN, ETB, EL/ELS,	28	-
	EGCM, EGCL		

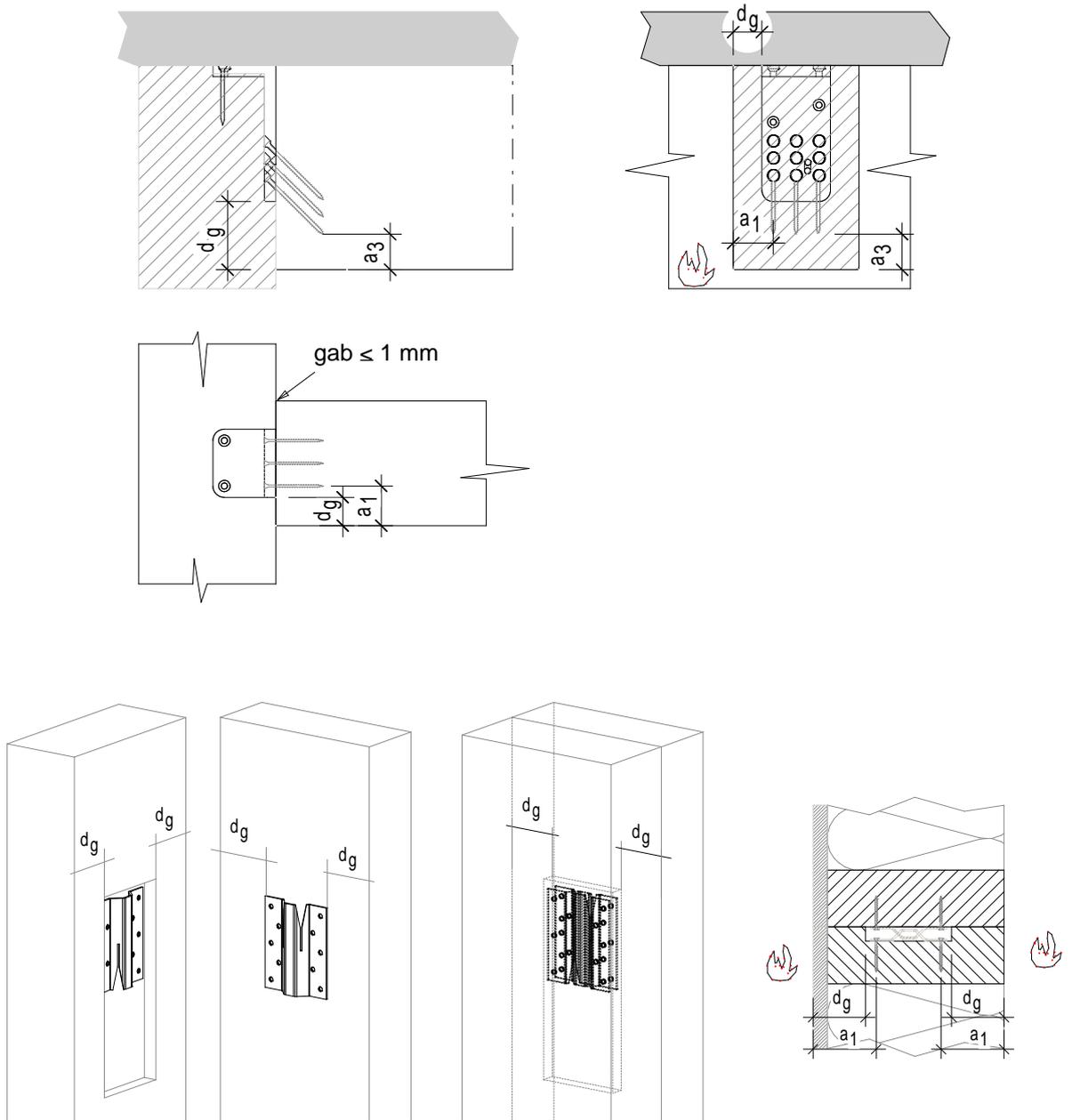
$d_g$ : thickness of the timber protection

$a_1$ : edge distance of the axis of the fastener

$a_3$ : edge distance of the point of the fastener

The protection of the top of the connector is made with the deck, a timber element, or other protective materials.





For ICS and ICST; fire from max 2 sides

## Annex C Design

### C.1 Basis of Design

Characteristic capacities of the concealed joist hangers with nails or screws.

The formulas are applicable for connectors made from stainless steel with a characteristic yield stress of at least 235 Mpa or a characteristic ultimate tensile strength of at least 330 Mpa and for ordinary steel of the quality S250GD + Z275 according to EN 10346 or S235JR according to EN10025, or aluminium AlMgSi 0,7 to DIN 1749-1.

The Joist End connectors are made from aluminium grade EN AW-6082 T6 according to EN 755-2 with minimum yield strength of 250 MPa, a minimum tensile strength of 295 MPa and a minimum ultimate strain of 8 %.

The ATFN connector is made from:

Plates; S355MC according to EN10149

Pins: steel with a minimum yield strength of 580N/mm<sup>2</sup> a minimum tensile strength of 610 N/mm<sup>2</sup> and a minimum ultimate strain of 16%. The pins are connected with the plates by compression strain

Requirements for the header or the joist for the concealed beam hangers:

- The wood members can be of solid timber, glued laminated timber and similar glued members, or wood-based structural members.
- The requirements of the wood members can be fulfilled by using the following materials:
- Solid timber classified to C24 or better according to EN 338
- Glued members of timber classified to C24 or better according to EN 338 when structural adhesives are used.
- Glued laminated timber classified to GL24c or better according to EN 1194.
- Solid Wood Panels, SWP according to EN 13353.
- Laminated Veneer Lumber LVL according to EN 14374
- Plywood according to EN 636
- Other Engineering Wood products classified for their resistance and with certified mechanical performances for fasteners

The characteristic density of the wood members shall be at least 350 kg/m<sup>3</sup>. Lower densities are applicable but the load bearing capacities shall be reduced by the  $k_{dens}$  factor, given by

Where  $\rho_k$  is the characteristic density of the timber in kg/m<sup>3</sup>.

In case of concrete support, concrete shall be specified according to EN 206-1 with a resistance class within the following range : C20/25 to C50/60.

The wood members shall have a thickness which is larger than the penetration depth of the fasteners into the members

Requirements for the header or the joist for the Joist End connectors:

For screws or nails in the end grain of the wood (joist) the requirement to the material of the wood members can be fulfilled by using the following materials:

- Solid timber classified to C14-C40 according to EN 338 / EN 14081,
- Glued members of timber classified to GL24c or better according to EN 1194 / EN 14080,
- Solid Wood Panels, SWP according to EN 13353,

For nailing in the side of the wood members (header) the requirement to the wood members can be fulfilled by using the following materials:

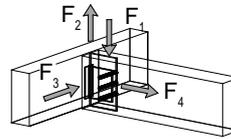
- Solid timber classified to C14-C40 according to EN 338 / EN 14081,
- Glued members of timber classified C14-C40 according to EN 338 / EN 14081 when structural adhesives are used.
- Glued members of timber classified to GL24c or better according to EN 1194 / EN 14080,
- Solid Wood Panels, SWP according to EN 13353,
- Laminated Veneer Lumber LVL according to EN 14374,
- Parallam PSL,
- Laminated Strand Lumber LSL e.g. Parallam PSL and Timber Strand,
- Oriented Strand Board OSB according to EN 300
- Duo- and Triobalken,
- Layered wood plates,
- Plywood according to EN 636
- For EWP (Engineered Wood Products), please refer to the manufacturer's specifications.

The load-carrying formulas stated in Annex B are applicable for a wood density from 290 kg/m<sup>3</sup> to 460 kg/m<sup>3</sup>. It is allowed to use wood with a density up to 500 kg/m<sup>3</sup>. However, increased load-carrying capacity than that for a density of 460 kg/m<sup>3</sup> should not be employed. For density between 420 and 500 kg/m<sup>3</sup> pre-drilling of nail and screw holes are necessary.

## C.2 Definition of force directions

The characteristic load-carrying capacities are for the following force directions:

- $F_1$  Downward
- $F_2$  Uplift
- $F_3$  Lateral – horizontal
- $F_4$  Axial in the middle of the beam



Concealed joist hangers type BTN, BT4, BTALU, BTCALU, BTx, BTCx

Force direction  $F_1$ :

These are given in different tables for each connection.

“Table for connection with header free from rotation”. Here it is assumed, that the connection has a BT both sides of the header and the difference between the active forces is no more than 20%, or the header is clamped. In this case the calculation for the header may be made separately.

“Table for connection with header free to rotate”. Here the eccentricity of the BT is used so the moment is absorbed in the BT – connection.

For the capacity for the header with  $b = 240$  mm it is to multiply the values for  $b_{HT} = 180$ mm with the factor 0,77.

For an uplift force, the upper dowel in the cut-out hole may not be used for the calculation.

Force direction  $F_2$ :

The values for  $F_1$  can be used where the number of steel dowel has to reduce by the upper one in the “cut-out” hole.

How to use the tables:

$R_{1,k}$	the used fastener and size		nail pattern	
	CNA 4,0x50	4-row	length of steeldowel	
Length SD [mm]	80	100		
number of SD	$n_N$	[kN]	$n_N$	[kN]
3	20	18,2	20	19,4
	44	32,2	44	34,5
4	28	29,5	28	31,2
	48	43,0	52	46,1
5	36	41,9	36	44,3
	56	53,9	60	57,6

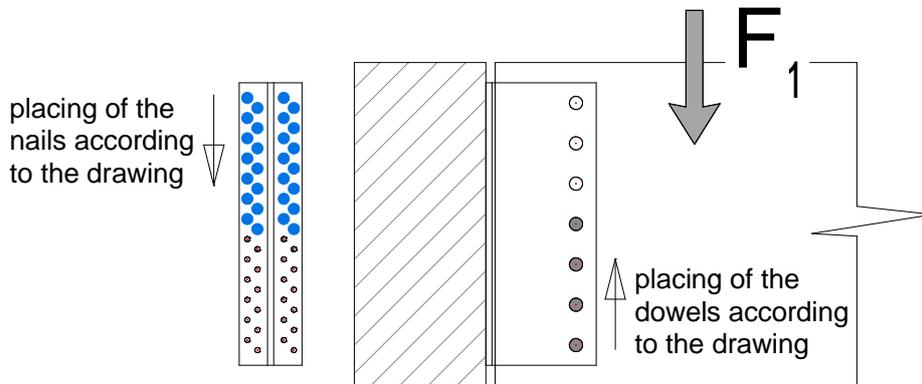
number of steel dowel

number of nails

capacity for the nails/steel dowel

Sample: a connection with a BT with 4 Steel dowel with a length of 100mm, the width of joist is min. 100mm, nail pattern = 4-row, and 28 nails 4,0x50 is  $R_{1,k} = 31,2$  kN.  
for the same connection with 52 nails  $R_{1,k} = 46,1$  kN.

For using another number of nails, it must be between the number of fasteners listed in the table, the capacity may be determined by linear interpolation based on the number of nails. In the sample before the number of nails may be between 28 and 52.



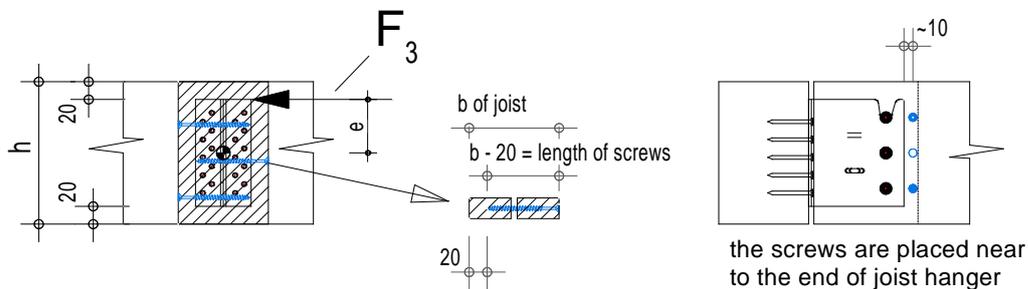
Force direction  $F_3$ :

These are given in the table, with and without screws. For connections with screws, the screws are inserted perpendicular next to the BT, see following picture.

The screws for reinforcement of the joist shall have a length  $<$  the width of the joist. The assumed length for the tables in Annex B is width of the joist  $-20\text{mm}$ . The screws are inserted from both sides. The screws shall be fully threaded.

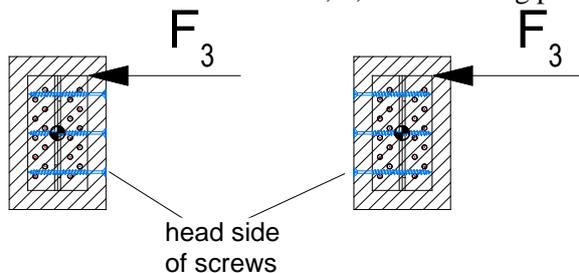
$b$  des Nebenträgers

$b - 20 = \text{Länge der Schraube}$



The Eccentricity ' $e$ ' for the load direction  $F_3$  is considered with the size from the centre of the BTx to the top of the BTx

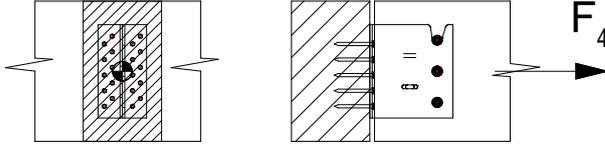
Where screws are inserted from one side, it shall be the side of the applied force. Otherwise the capacity is reduced with the factor 0,8 ; see following picture



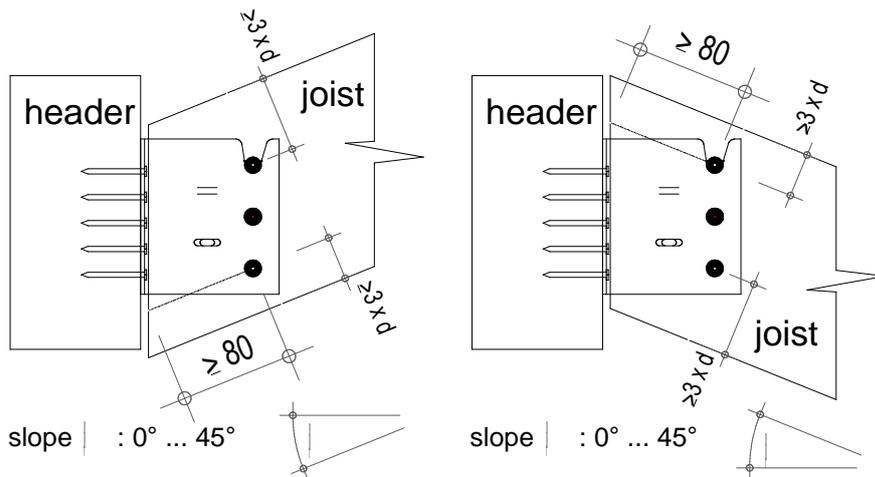
Use the table values      use the table values  $\times 0,8$

Force direction  $F_4$

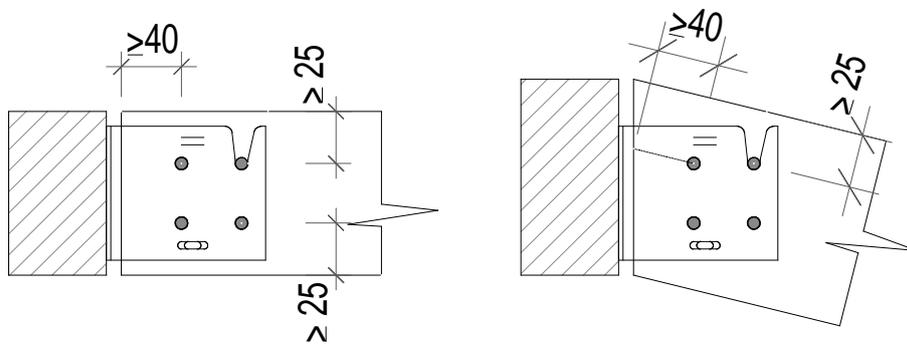
The force is in the direction of joist and in the middle of the joist.



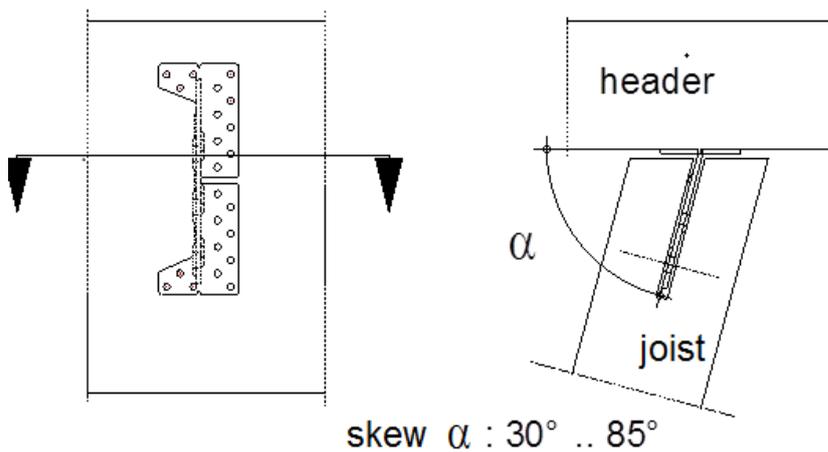
General



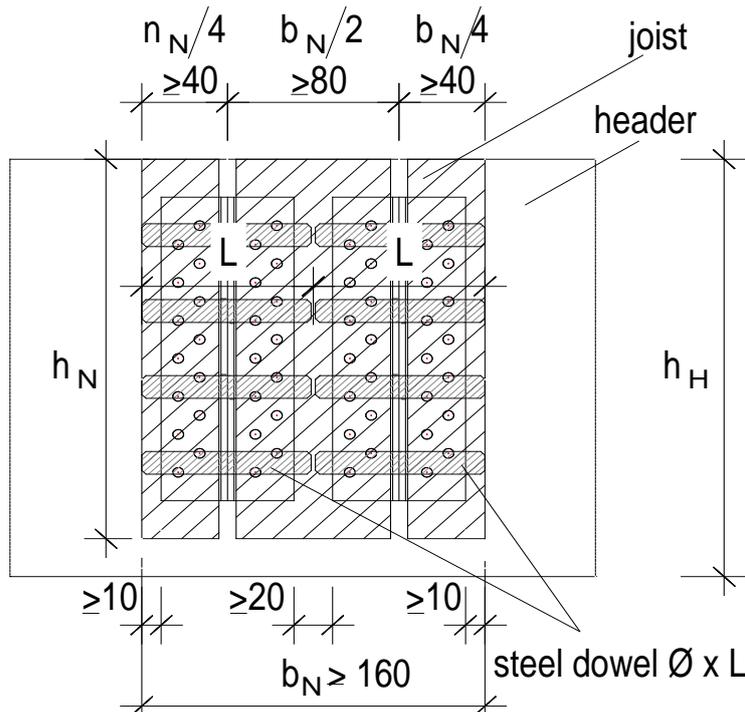
Type BTN-90 and BT4-90.



For the TUS type additional skews are possible:



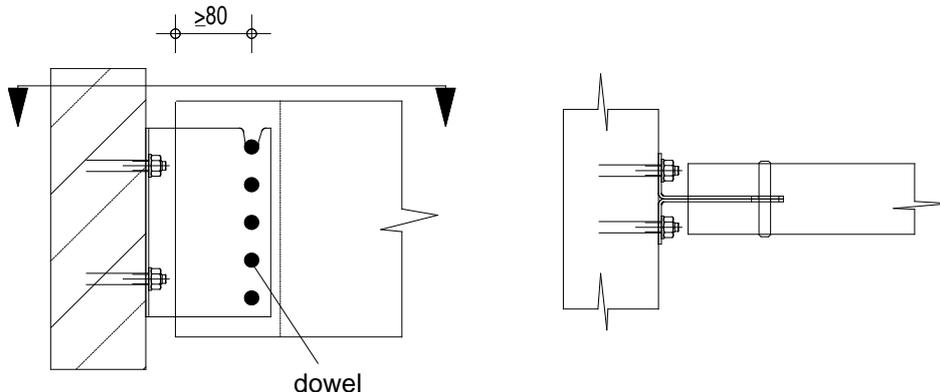
The above picture shows a skew to the left side. The design for right is the same.



For installations where the BT connectors are next to each other, the value for one BT may be multiplied by 2  
 For  $F_2$  – it is necessary to use screws for reinforcement with a minimum length of  $B_N - 20\text{mm}$   
 The length of the steel dowel for each BT =  $L_{\text{max}} = 0.5 \times B_N$

The dowels should be inserted from both sides meeting in the middle of the joist.

Connection to concrete / steel



The connection for force direction  $F_1$  is with min. 2 anchor bolts, used in the upper holes.

For an uplift force,  $F_2$  and  $F_3$  a minimum of 4 anchor bolts, must be used in the upper and lower holes.

### Racking check

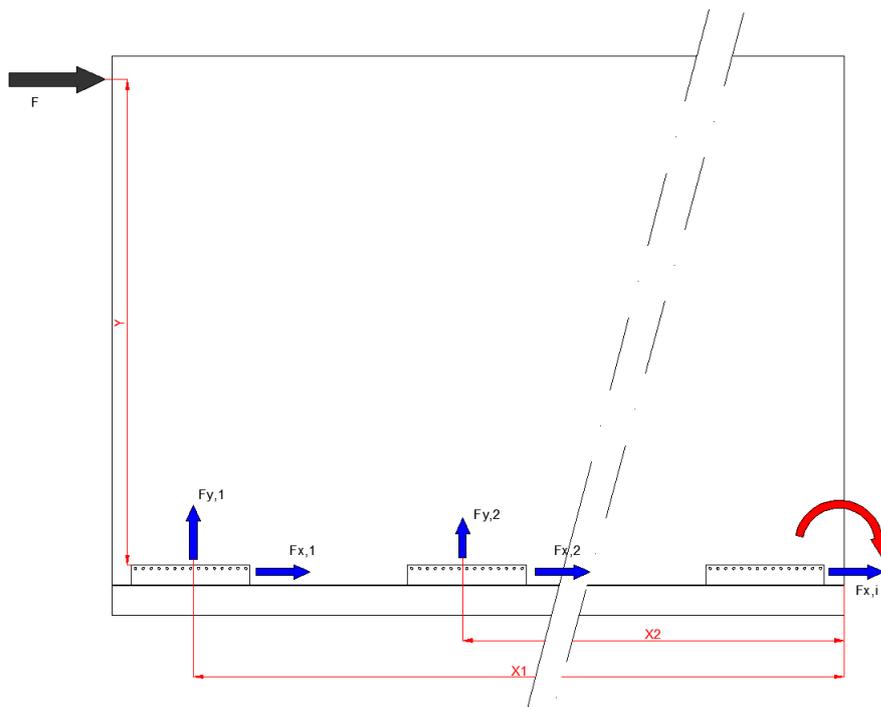
Due to the high rigidity of CLT wall, the racking load can be transferred to the BTALU at the bottom and decomposed as an axial load and a lateral load.

$$F = F_{x,1} + F_{x,2} + \dots + F_{x,i} \text{ and } F_{x,1} = F_{x,2} = \dots = F_{x,i}$$

$$F_{y,1} = F \times x_1 \times y / (\sum(x_i^2))$$

Optional : For the other BTALU :  $F_{y,i} = x_i/x_1 \times F_{y,1}$

The use of formulas provides no gap between wall and floor members. With  $F$  the racking load,  $Y$  the height of the wall and  $X_i$  the distance between the BTALU and the rotation point. It is assume, that the “pressure” area is close to the end of the CLT wall, and the last Connector (it’s the right one in the picture below) doesn’t absorb any axial load.



A

Then interaction formula must be used on the first BTALU:

$$\left(\frac{F_{y,1}}{R_{y,1}}\right)^2 + \left(\frac{F_{x,1}}{R_{x,1}}\right)^2 \leq 1$$

With

$R_{y,1}$  the resistance of the first BTALU to tension loads

$R_{x,1}$  the resistance of the first BTALU to downloads

### Characteristic capacities $R_{4,k}$ for BTALU with steel dowel Ø7, 8 and 10mm

Tension resistance of BTALU is calculated using the following equation:

[Equation 1]

$$R_{4,k} = \min(n_d \times F_{lat,SD,Rk}; n_N \times F_{ax,Rk})$$

$n_d$  is the number of dowels

$n_N$  is the number of nails/screws

$F_{lat,SD,Rk}$  is the characteristic load-carrying capacity per dowel in the timber for both shear planes (acc.to EN1995-1-1 §8.6).

$F_{ax,Rk}$  is the axial capacity of the fastener in the header

The slot to be used with the BTALU is 7 to 8 mm thick.

See the additional information below table 34 for placing the nails/ steel dowel, respectively the number for using in the calculation.

### Steel dowels

The steel dowels must be mechanically equivalent or greater than S235JR ( $f_{y,k,min} = 235$  N/mm).

The standard spacing between dowels is 40mm. If the spacing increases and the number of dowels remain the same, the capacity with standard spacing can be used as normally it increases the values.

For dowels Ø8 the values can be used with a distance between the header and the dowels of 89mm to 93mm

### ETB, EL, ELS, ETSN, EGCL and EGCM

#### Header parts:

For ETB use CNA nails or CSA screws,

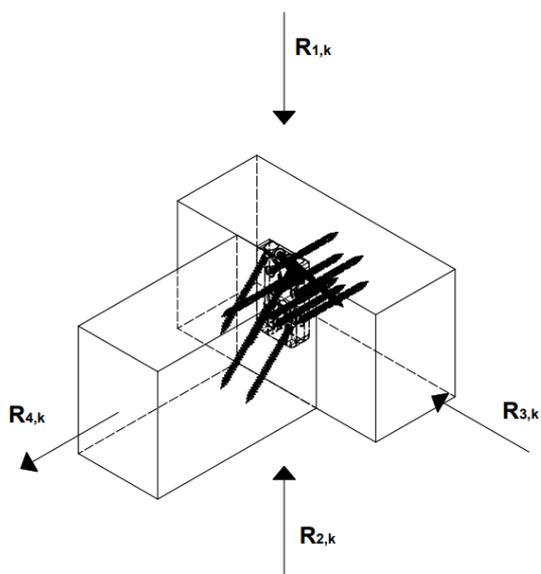
For ETSN it must be CSA screws?

For EGCL it may be CSA screws or TTUFS screws.

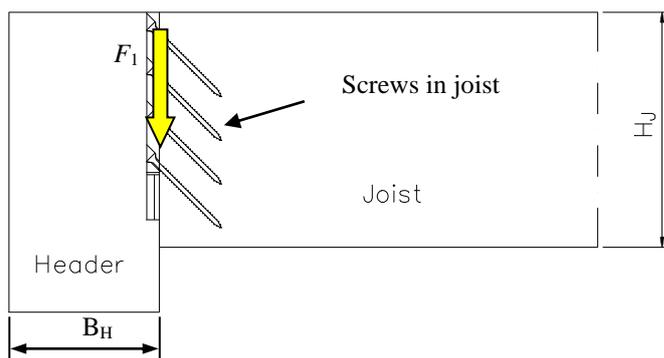
For EGCM it may be TTUFS or CSFT screws only with CSA screws for ETSN and EGCL connectors. It can also be TTUFS screws for EGCL, and TTUFS or CSFT screws for EGCM. The part in the joist must be fixed with screws with an angle of  $45^\circ$  to the connector. For ETSN, the part in the joist has to be fixed with screws with an angle of  $35^\circ$  to the connector. The screws must have an angle between grain of timber and the screw according to the approval of the screws. For the ETB, EGCM, and EGCL and ETSN both parts of the connector are to be fixed separately on the header and the joist before assembly of the connection.

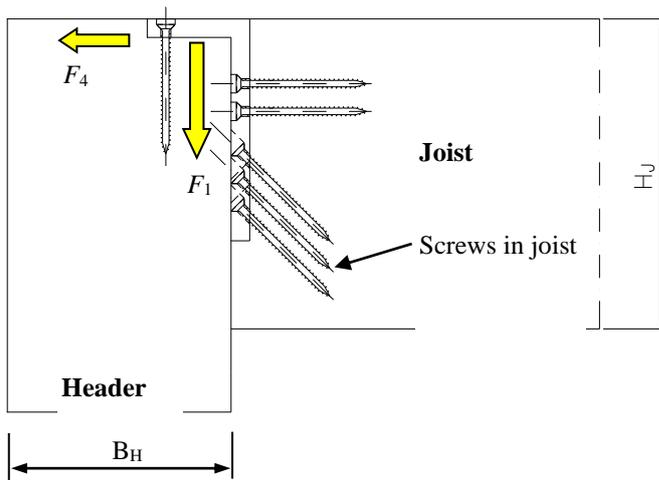
For the EGCM and EGCL, two optional screws must be inserted to resist the uplift, lateral and tensile forces. These screws are installed from the joist part reaching into the header with an angle of  $37.2^\circ$  by EGCM and  $45^\circ$  by EGCL.

→ Drawing with all load directions for EGCM and EGCL:



For the types EL and EL-S the connector has to be fixed to the joist and then connected to the header or the column.





### C.3 Fastener specification and capacities

Nail & screw type (According to ETA04/0013 Annex A Drawing 1 & 2)	Size [mm]		Finish
	Diameter	Length	
Connector nail	4	35, 40, 50, 60, 75, 100	Electroplated Zinc
Connector Screw	5	35, 40, 50	
Connector Nail	4,2	35, 50, 60	
Connector Nail	4	35, 40, 50, 60, 75, 100	Stainless steel (as described)
Connector Screw	5	35, 40, 50	

Other fastener	Size [mm]		Finish
	Diameter	Length	
Screws according to EN14592 or according to an ETA	4	Up to 200	Electroplated Zinc
Screws according to EN14592	5	60-120	Electroplated Zinc
Connector screw according to EN 14592	6	85-110	Zinc flake coating
Screws according to EN14592	8	Up to 300	Electroplated Zinc
Dowel according to EN14592	7		Electroplated Zinc hot dip galvanised stainless steel
	8	-	
	10	-	
	12	-	
	SDD7.5	-	
Bolt M8	8	-	For relevant concealed joist hanger see the assumed characteristic capacities of the bolt connection andf compare with the specification of the manufacturer
Bolt M10	10	-	
Bolt M12	12	-	

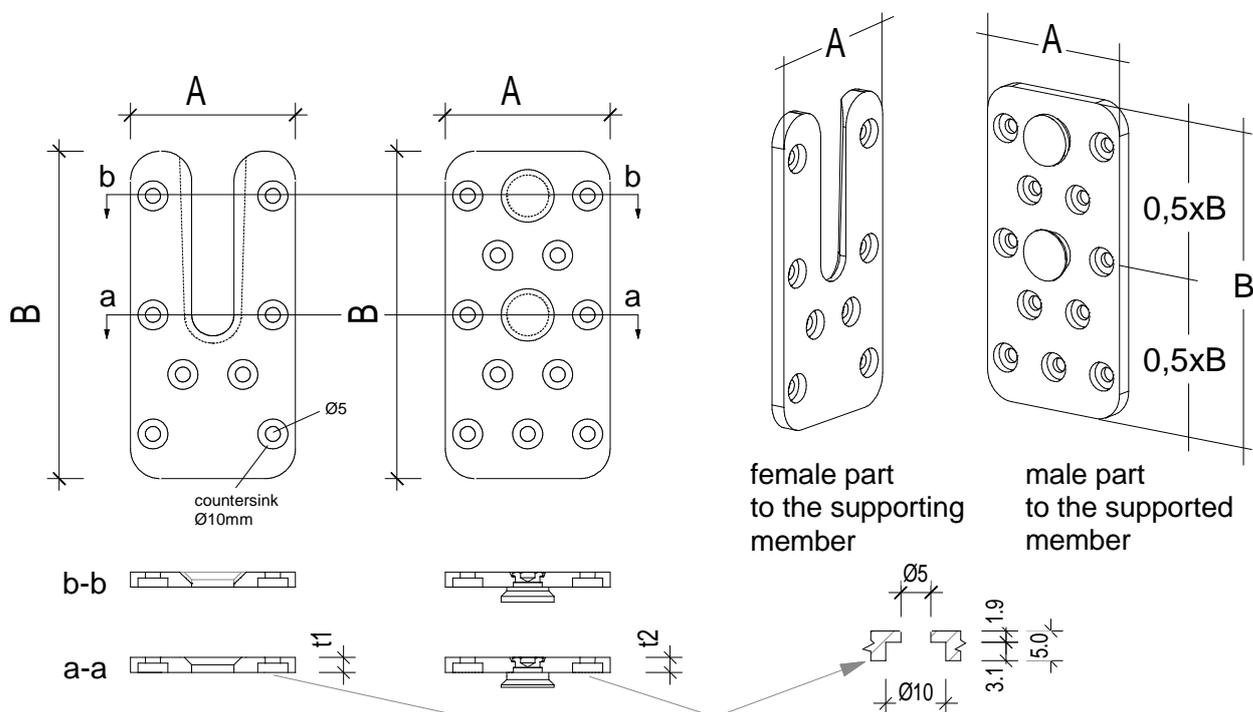
The capacities are given in the named standards or relevant approvals.

## Annex D- Product definition and capacities

### D1 ATFN

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ATFN					

### Drawings



Model	A [mm]	B [mm]	t1 [mm]	t2 [mm]	No of Holes	
					Female Part	Male Part
ATFN55/110	55	110	5	5	8	11
ATFN55/150	55	150	5	5	11	15
ATFN55/190	55	190	5	5	14	21
ATFN75/150	75	150	5	5	17	22
ATFN75/190	75	190	5	5	21	28

### Material specification

Plates: S355MC according to EN10149 + -Fe/Zn12/A or Fe/Zn12/B acc. to EN 2081

Pins: steel with a minimum yield strength of 580N/mm<sup>2</sup> a minimum tensile strength of 610 N/mm<sup>2</sup> and a minimum ultimate strain of 16%. The pins are connected with the plates by compression strain

Connection to the supporting member: CNA-nails and CSA-screws according to ETA04/0013

Connection to the supported member: CSA-screws according to ETA04/0013

For installation for fire justification, see clause B6

### Characteristic capacities

For connection, where the header is prevented for rotation:

$$R_{1,k} = \min (R_{1,J,k}; R_{1,H,k})$$

$$R_{3,k} = 0,5 \times R_{1,k}$$

$$R_{4,k} = 0,25 \times R_{1,k}$$

For connection, where the header is free to rotate:

$$R_{1,k}^e = \min (R_{1,J,k}^e; R_{1,H,k}^e)$$

$$R_{3,k}^e = 0,5 \times R_{1,k}^e$$

$$R_{4,k}^e = 0,25 \times R_{1,k}^e$$

For load combination:

$$\left( \frac{F_{1,d}}{R_{1,d}} \right)^2 + \left( \frac{F_{3,d}}{R_{3,d}} \right)^2 + \left( \frac{F_{4,d}}{R_{4,d}} \right)^2 \leq 1,0$$

For  $R_{i,d}$  correspondingly

Where:

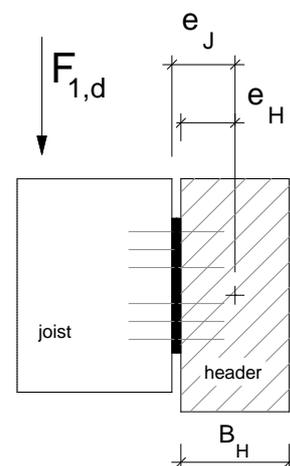
$$R_{1,J,k} = n_J \times \min \left\{ \begin{array}{l} 240 \times f_{h,J,k} \left[ \sqrt{2 + \frac{1,84}{f_{h,J,k}}} - 1 \right] + 2 \times \rho_{k,J}^{0,8} \\ 375 \sqrt{f_{h,J,k}} + 2 \times \rho_{k,J}^{0,8} \\ 240 \times f_{h,J,k} \end{array} \right.$$

$$R_{1,H,k} = \frac{1}{\sqrt{\left( \frac{1}{n_H \times R_{lat,H,k}} \right)^2 + \left( \frac{10 \times z_{max,H}}{I_{p,H} \times R_{ax,H,k}} \right)^2}}$$

$$R_{1,J,k}^e = \frac{1}{\sqrt{\left( \frac{1}{R_{1,J,k}} \right)^2 + \left( \frac{e_J \times z_{max,J}}{I_{p,J} \times 7,5 \times \rho_{k,J}} \right)^2}}$$

$$R_{1.H.k}^e = \frac{1}{\sqrt{\left(\frac{1}{n_H \times R_{lat.H.k}}\right)^2 + \left(\frac{e_H \times z_{max.H}}{I_{p.H} \times R_{ax.H.k}}\right)^2}}$$

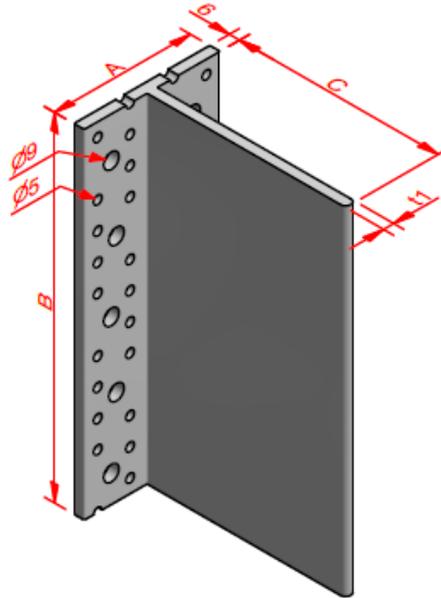
- $n_J$  number of screws in the joist
- $n_H$  number of screws/nails in the header/column
- $f_{h.J.k}$  joist embedding strength in N/mm<sup>2</sup>;  $f_{h.J.k} = 0,0047 \cdot \rho_{k.J}^{1.24}$
- $\rho_{k.J}$  characteristic density of joist in kg/m<sup>3</sup>;  $\rho_{k.J} \leq 460 \text{ kg/m}^3$
- $R_{lat.H.k}$  the characteristic lateral capacity of the fastener in the header
- $R_{lat.J.k}$  the characteristic lateral capacity of the fastener in the joist
- $R_{ax.H.k}$  the characteristic axial capacity of the fastener in the header
- $R_{ax.J.k}$  the characteristic axial capacity of the fastener in the joist
- $e_J$  eccentricity of the joist connection in mm , generally  $e_J = 0,5 B_H + 10 \text{ mm}$
- $e_H$  eccentricity of the header connection in mm; generally  $e_H = 0,5 B_H$
- $B_H$  header width in mm



Model	$I_{p.H} / z_{max.H}$	$I_{p.J} / z_{max.J}$
ATFN55/110	156	260
ATFN55/150	286	474
ATFN55/190	436	752
ATFN75/150	424	619
ATFN75/190	910	1000

## D2 BTCALU

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
BTCALU					

**Table D2-1: Drawings****Table D2-2: Dimensions and number of fastener**

Model	A [mm]	B [mm]	C [mm]	t1 [mm]	No of Holes	
					Ø5	Ø9
BTCALU90	80	90	117	6	16	4
BTCALU120	80	120	117	6	22	6
BTCALU160	80	160	117	6	30	8
BTCALU200	80	200	117	6	38	10
BTCALU240	80	240	117	6	46	12
BTCALU280	80	280	117	6	54	14
BTCALU320	80	320	117	6	62	16
BTCALU360	80	360	117	6	70	18
BTCALU400	80	400	117	6	78	20
BTCALU440	80	440	117	6	86	22
BTCALU480	80	480	117	6	94	24
BTCALU520	80	520	117	6	102	26
BTCALU560	80	560	117	6	110	28
BTCALU600	80	600	117	6	118	30

**Table D2-3: Material specification**

Material thickness	Product	Material Grades	Coating Specification
6	BTCALU	Aluminium AlMgSi0.7,	

**Characteristic Capacities**

The maximum declarable load capacities for BTCALU are:

$$R_{1,k} = R_{2,k} = \min \left\{ \frac{n_d \times R_{lat,d,k}}{\sqrt{\left(\frac{1}{n_h \times R_{lat,h,k}}\right)^2 + \left(\frac{1}{k_{h,R1/R2} \times R_{ax,h,k} \times k_{anchor}}\right)^2}} \right.$$

$$R_{4,k} = \min \left\{ n_d \times R_{lat,d,k} \right.$$

With:

$n_d$  Number of dowels in the joist

$R_{lat,d,k}$  Characteristic lateral capacity of one dowel in the joist (two shear planes)

$n_h$  Number of fasteners in the header

$n_{h,ef}$  Effective number of fasteners in the header

$R_{lat,h,k}$  Characteristic lateral capacity per fastener in the header, max 32,4 kN for fasteners in Ø9 holes

$R_{ax,h,k}$  Characteristic axial capacity per fastener in the header, max. 23,3 kN for fasteners in Ø9 holes

$k_{h,R1}$  Shape factor for  $R_1$

$k_{h,R2}$  Shape factor for  $R_2$

$k_{anchor}$  Bolt factor which is 1,0 for fasteners in Ø5 holes and 0,67 for fasteners in Ø9 holes

**Table D2-4: Characteristic Capacities**

Model	Connector Height [mm]	Nail Pattern 1			Nail Pattern 2				Nail Pattern 3			
		$n_h$	$n_{h,ef}$	$k_{h,(R1/R2)}$	$n_h$	$n_{h,ef}$	$k_{h,R1}$	$k_{h,R2}$	$n_h$	$n_{h,ef}$	$k_{h,R1}$	$k_{h,R2}$
BTCALU90	90	4	4	0,62	2	2	0,62	*)	2	2	0,62	*)
BTCALU120	120	6	6	1,94	4	4	1,55	1,41	2	2	1,55	*)
BTCALU160	160	8	8	3,62	4	4	2,59	1,41	4	4	2,33	2,18
BTCALU200	200	10	10	5,83	6	6	3,88	3,7	4	4	3,3	2,18
BTCALU240	240	12	12	8,54	6	6	5,44	3,7	4	4	4,5	2,18
BTCALU280	280	14	14	11,78	8	8	7,25	7,02	6	6	5,83	5,64
BTCALU320	320	16	16	15,53	8	8	9,32	7,02	6	6	7,32	5,64
BTCALU360	360	18	18	19,81	10	10	11,65	11,37	6	6	9,03	5,64
BTCALU400	400	20	20	24,51	10	10	14,24	11,37	8	8	10,87	10,64
BTCALU440	440	22	22	29,51	12	12	17,09	16,75	8	8	12,89	10,64
BTCALU480	480	24	24	34,74	12	12	20,19	16,75	8	8	15,11	10,64
BTCALU520	520	26	26	40,13	14	14	23,56	23,17	10	10	17,48	17,19
BTCALU560	560	28	28	45,65	14	14	27,18	23,17	10	10	20,01	17,19
BTCALU600	600	30	30	51,26	16	16	31,07	30,63	10	10	22,75	17,19

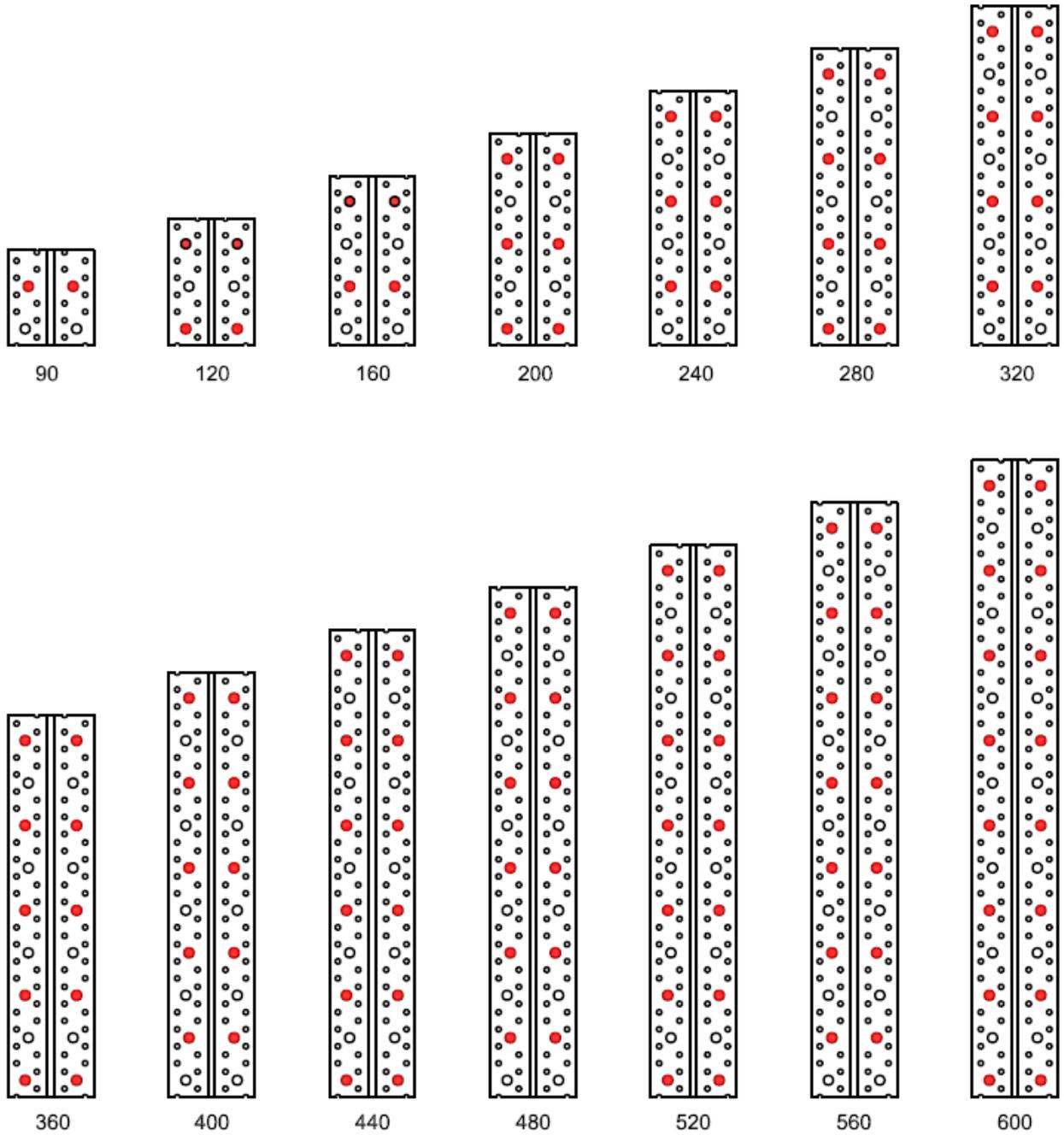
\*) F2 loads not possible for that Nail Pattern

Model	Connector Height [mm]	Nail Pattern 4			Nail Pattern 5 **)		
		$n_h$	$n_{h,ef}$	$k_{h,(R1/R2)}$	$n_h$	$n_{h,ef}$	$k_{h,(R1/R2)}$
BTCALU90	90	16	7	5,61	10	6	3,5
BTCALU120	120	22	11	8,56	14	8	6,46
BTCALU160	160	30	15	15,49	18	10	10,16
BTCALU200	200	38	19	24,49	22	12	15,00
BTCALU240	240	46	23	35,57	26	14	20,93
BTCALU280	280	54	27	48,72	30	16	27,92
BTCALU320	320	62	31	63,95	34	18	35,95
BTCALU360	360	70	35	81,24	38	20	45,04
BTCALU400	400	78	39	100,6	42	22	55,16
BTCALU440	440	86	43	122,04	46	24	66,33
BTCALU480	480	94	47	145,55	50	26	78,53
BTCALU520	520	102	51	171,13	54	28	91,77
BTCALU560	560	110	55	198,78	58	30	106,05
BTCALU600	600	118	59	228,5	62	32	121,37

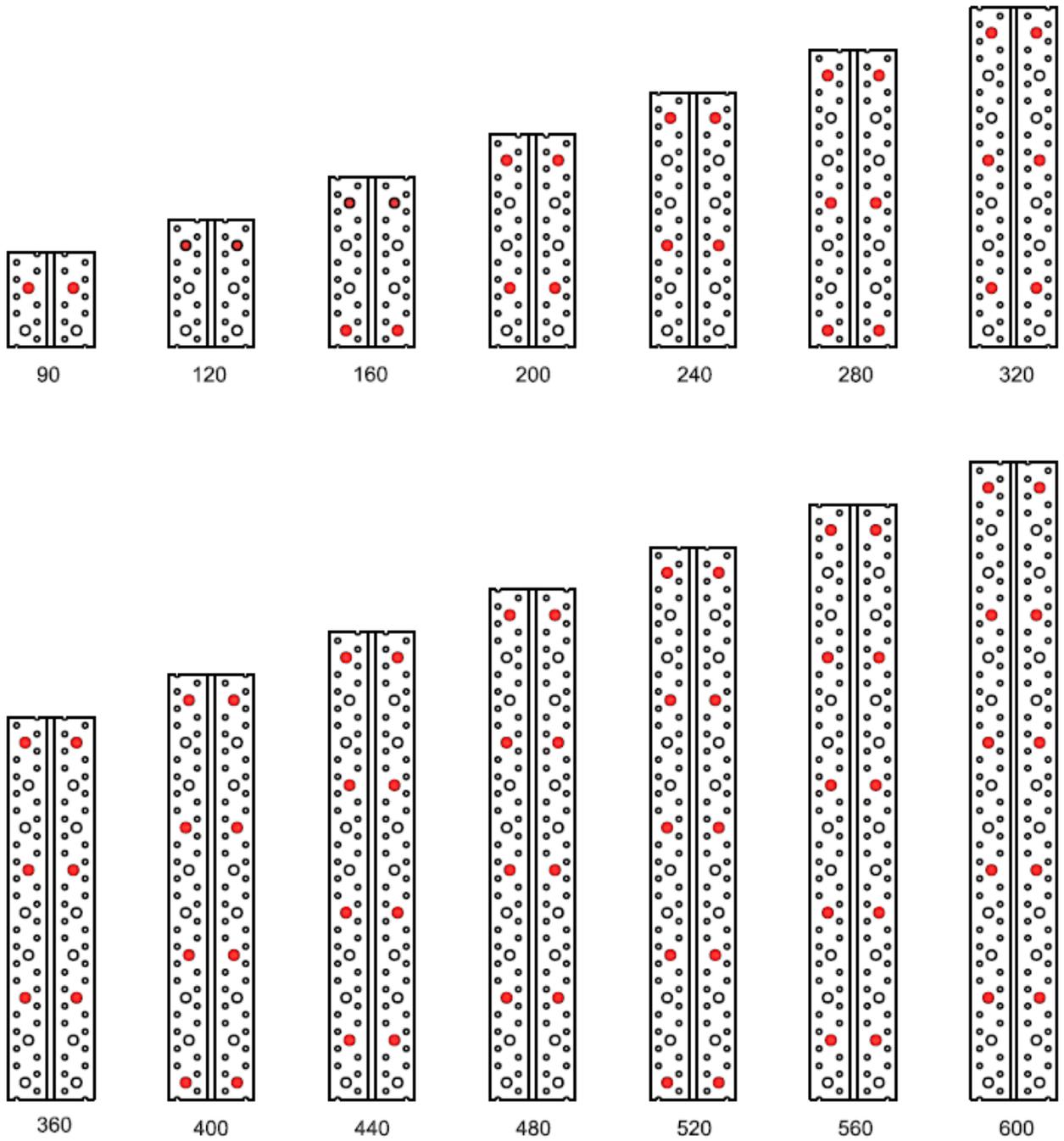
\*\*) Nail pattern 5 can be used both on timber beams and timber columns

**Nail Pattern 1** refers to full nailing meaning a fastener in all  $\varnothing 9$  holes.

**Nail Pattern 2** refers to two fasteners in each second row of the  $\varnothing 9$  holes, starting from the top:

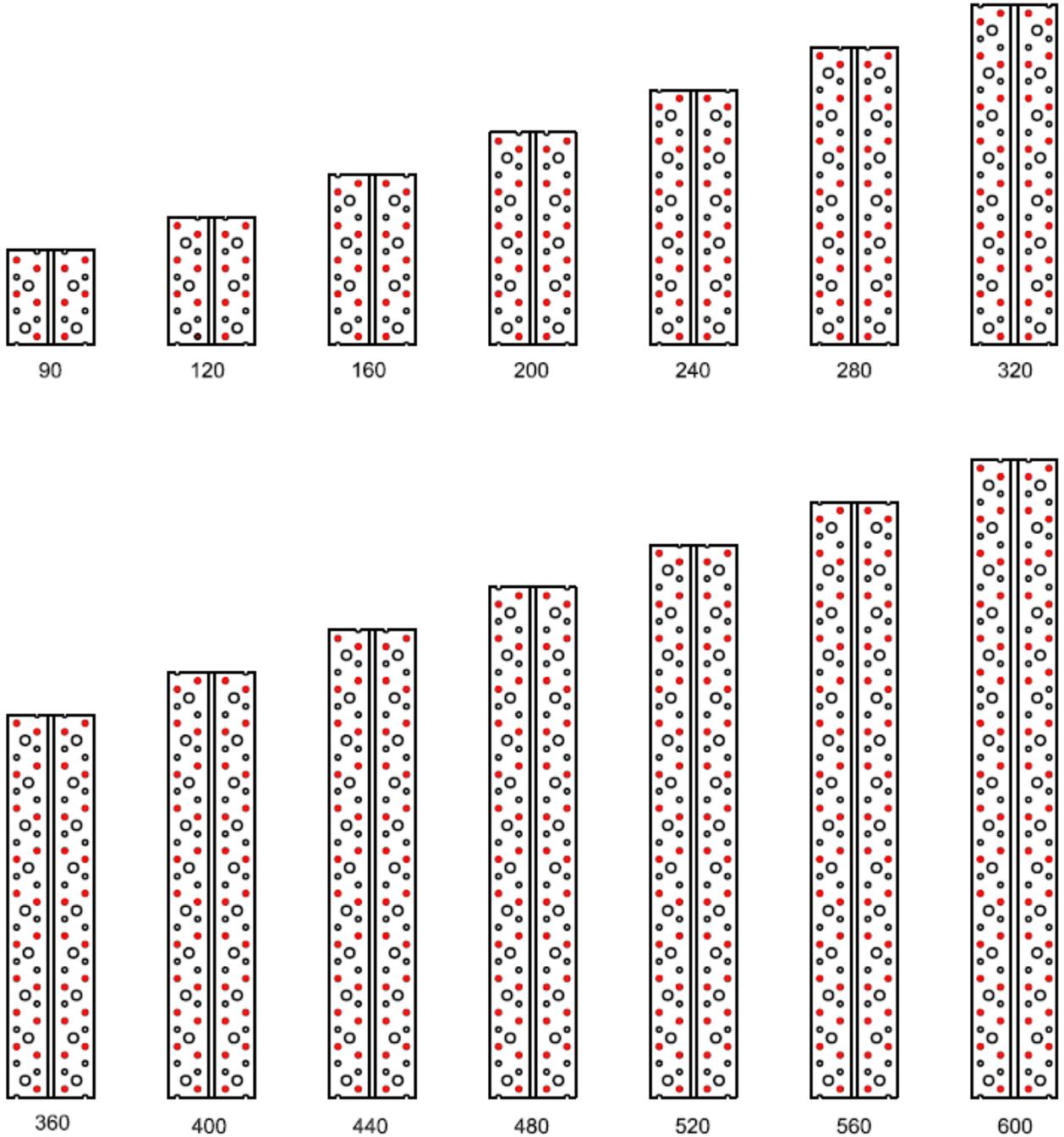


**Nail Pattern 3** refers to two fasteners in each third row of the  $\text{Ø}9$  holes, starting from the top:



**Nail Pattern 4** refers to full nailing meaning a fastener in all  $\text{Ø}5$  holes.

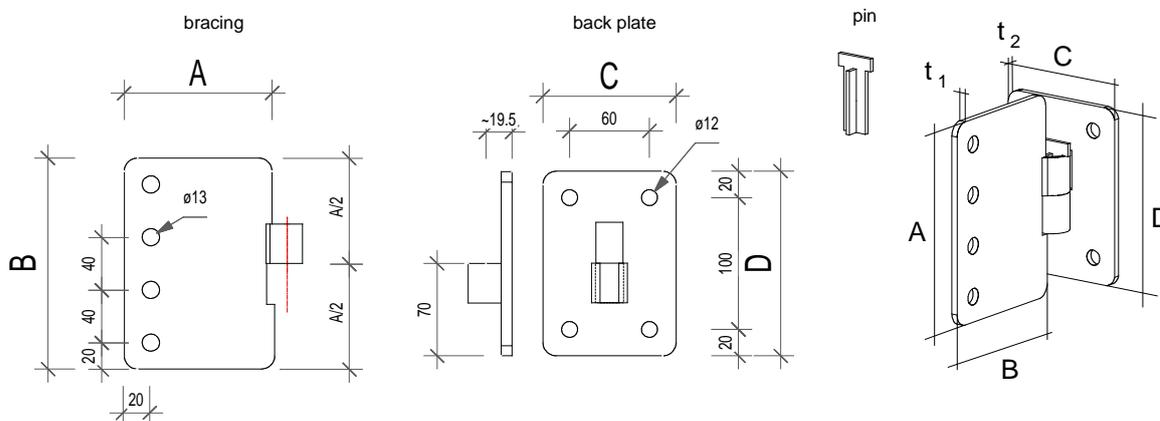
**Nail Pattern 5** refers to one fasteners approx. in each second  $\text{Ø}5$  hole. This nail pattern can be used both on timber beams and timber columns:



**D3 BT FLEX**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
BT FLEX					

**Figure D3-1: Drawings**

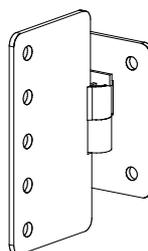
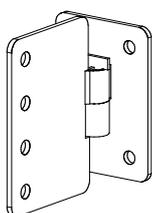
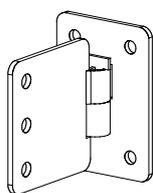


The corner of back plate and bracings can be rounded or angled

BT FLEX-120

BT FLEX-160

BT FLEX-200



**Table D3-2: Dimensions and number of fastener**

Model	A [mm]	B [mm]	C [mm]	D [mm]	t [mm]	No of Holes	
						ø12	ø13
Back Plate			100	140	8	4	
Bracing	120	122			5		3
Bracing	160	122			5	8	4
Bracing	200	122			5	11	5

**Table D3-3: Material specification**

Material thickness	Material Grades	Coating Specification
5, 6, 8	S235	Electro-Galvanised
5, 6, 8	stainless steel (as described)	
ø12	S235 or S355	Electro-Galvanised
ø12	stainless steel (as described)	

**Table D3-4: Characteristic capacities :**

Characteristic capacities for timber grade C24:

No of SD	Characteristic Capacity - $R_{1,k}$ for steel dowel with $F_{u,k}=360\text{N/mm}^2$ (S235)					
	b = Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
3	9.7*	10.4*	11.5*	12.9*	14.4*	15.6*
4	15.8*	16.9*	18.7*	20.8	23.2	25.4
5	22.9	24.5	27.1	30.1	min(33.5; 33.8/kmod)	min(37.0; 33.8/kmod)

b = min of width of timber and length of the dowel

SD = steel dowel  $\varnothing 12\text{mm}$  S235 with  $f_{y,k} = 360 \text{ N/mm}^2$

\* These combination are also possible with a back plate with  $t=6 \text{ mm}$ .

No of SD	Characteristic Capacity - $R_{1,k}$ for steel dowel with $F_{u,k}=470\text{N/mm}^2$ (S355)					
	b = Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
3	11	11.5	12.4	13.6	15.0	16.5
4	17.8	18.6	20.1	22.0	24.2	26.6
5	26	27.0	29.1	min(31.9; 33.8/kmod)	min(35.1; 33.8/kmod)	min(37.7; 33.8/kmod)

For different slope  $\beta$

$\beta =$	0°	15°	30°	45°
factor	1	0.95	0.9	0.85

The skew  $\alpha$  has no influence to the capacity.

The anchorage has to check with following forces:

$$R_{\text{bolt,lat}} = F_{1,d} / 4 \quad (\text{each bolt})$$

$$R_{\text{bolt,ax}} = F_{1,d} \times 0.15 \quad (\text{the both upper bolts})$$

**D4**    **BTN, BT4, BTALU, BTx**

<b>BT4/BT</b>
---------------

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
BTN					2 rows
BT4					4 rows
BTALU					ALU
BT					-

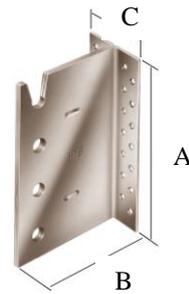
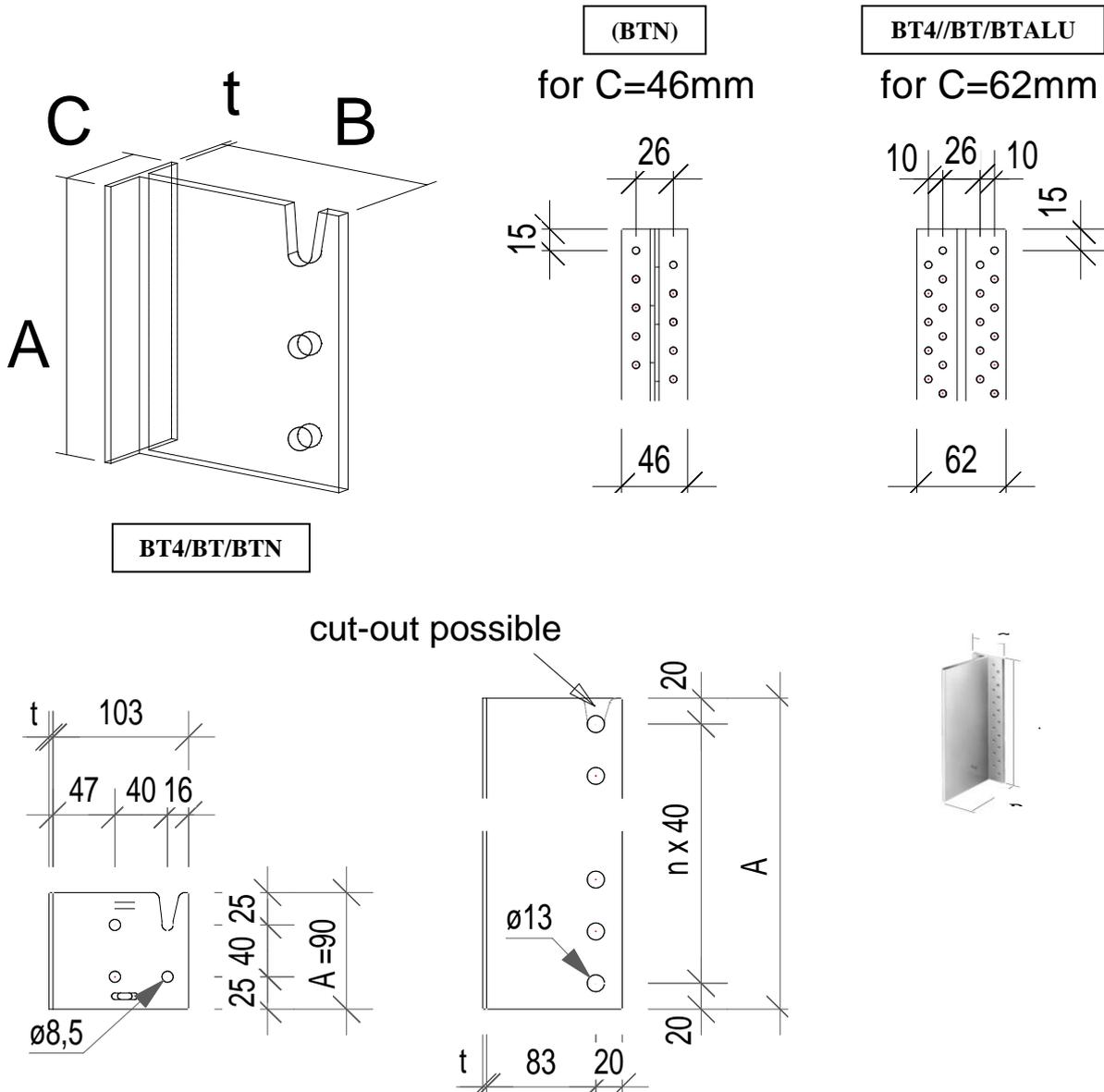


Figure D4-1: Dimension drawing of concealed joist hangers



Type BTALU connectors are produced without holes for the dowels, these holes should be made before or during installation by the user, the hole pattern is shown above., the holes can be made also with other diameters ( $\varnothing$  of steel dowel : 7, 8 and 10 mm)

The concealed joist hanger BTN and BT4 up to size 240 are supplied with the cut-out for the upper dowel and it's an option for the other sizes.

### Additional Option for outside using

For the types BTALU, up to size 240, and the BT made from stainless steel also up to size 240, it's allowed to reduce the distance of the steel dowel to the end grain of the joist like the following. In this case, full threaded screws have to be placed as given in the picture. An approval/assessment for the screw and the given distances is necessary.

The minimum edge and end distances for the full threaded screws have to be observe according to the approval/assessment of the used screws.

For a construction in this way the load directions F1, F2 and F4 are possible.

This application is an option for service class 3, e.g. balcony, where a distance is meaningful for a good aeration.

A professional construction for a wood preservation is required.

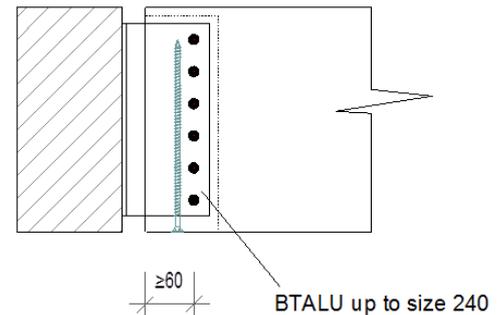
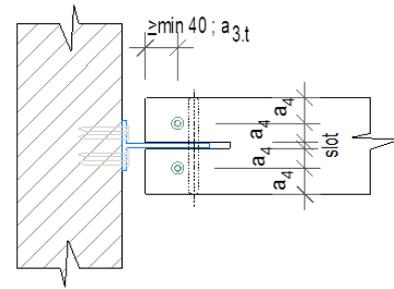


Table D4-1: Size specification

Model	A [mm]	B [mm]	C [mm]	t [mm]	Holes	
					Ø5mm	Ø13mm dowel
BTN90	90	103	46	3	8	4*
BTN120	120	103	46	3	10	3
BTN160	160	103	46	3	14	4
BTN200	200	103	46	3	18	5
BTN240	240	103	46	3	22	6
BT4-90	90	103	62	3	16	4*
BT4-120	120	103	62	3	20	3
BT4-160	160	103	62	3	28	4
BT4-200	200	103	62	3	36	5
BT4-240	240	103	62	3	44	6
BTALU90	89	103	62	3	16	4*,**
BTALU120	119	103	62	3	20	3**
BTALU160	159	103	62	3	28	4**
BTALU200	198	103	62	3	36	5**
BTALU240	238	103	62	3	44	6**
BTALUx***	up to 600	103	62	3	up to 112	up to 12**
BTx ***	up to 600	103	62	3	up to 112	up to 12**

Table D4-2: Material specification

Material thickness	Product	Material Grades	Coating Specification
3	BT4 / BT / BTN	S250 GD	Z275
6	BTALU	Aluminium AW-06005A, according to EN755-2:2008	
3	BT4 / BT / BTN	stainless steel (as described)	

For installation for fire justification, see clause B6

**Characteristic capacities**

The tables are based on a timber having a density of 350 kg/m<sup>3</sup> and a slope of 0°  
For other configurations the following modification are necessary:

For different density the values must be multiplied by:

$\rho_k =$	380	410	430
factor	1.05	1.1	1.13

For different slope:

$\beta =$	0°	15°	30°	45°
factor	1	0.95	0.9	0.85

SD = Steel dowel

For using steel dowels with a length of 60mm the values for steel dowel with 80mm may be multiplied by 0,95; only for the types BTN90 and BT4-90 the values for a dowel with l=60mm are given directly.

Characteristic capacity  $R_{1,k}$  [kN] for BTN90/ BT4-90 and steel dowel Ø8mm

BTN90/BT4-90		$R_{1,k}$ [kN]			to beam
CNA4.0x50					kg/m <sup>3</sup>
$n_N$	Timber width = length of steel dowel [mm]				
	60	80	100	≥120	
8	8.3	9.3	10.3	11.02	
16	10.8	11.8	12.9	13.72	

BTN90/BT4-90		$R_{1,k}$ [kN]			to column
CNA4.0x50					kg/m <sup>3</sup>
$n_N$	Timber width = length of steel dowel [mm]				
	60	80	100	≥120	
4	7.1	7.9	8.6	8.9	
8	9	9.9	10.9	11.6	

BTN90 / BT4-90  
column nailing



	BTN90/BT4-90		$R_{3,k}$ [kN]			to column
	CNA4.0x50					kg/m <sup>3</sup>
	$n_N$	Timber width = length of steel dowel [mm]				
		60	80	100	≥120	
without screws	4	1.2	1.6	2	2.4	
	8	1.5	1.9	2.3	2.7	
with screws	4	1.7	3.4	4.7	5	
	8	1.9	3.7	4.7	5.8	

The characteristic capacities for the different load directions  $F_1$ ,  $F_2$ ,  $F_3$  for the other dimensions of BTs, please refer to table 1 to 35 on the following pages. The connections are with steel dowel  $\varnothing 12\text{mm}$ , except for BT90 with  $\varnothing 8\text{mm}$

The values in the tables 1 to 34 are also for the concealed joist hangers BTALU with  $\varnothing 12\text{mm}$  steel dowel.

If the number of fasteners (CNA/CSA) indicated in the performance tables cannot be installed due to the limited number of holes in the particular hanger size, the linear interpolation should be used to get reduced performance of the connection corresponding to the actual number of fasteners installed.

### Tables for BTN, BT4, BT, BTALU

No of Table	Force direction	Nails/Screws	Nail Pattern	Support member as a...	Supported member	$b_H$	
1	$F_1$	CNA4.0x50	4-Row	Header	C24		
2		CNA4.0x60					
3		CSA5.0x50					
4		CNA4.0x50	2-Row				Column
5		CNA4.0x60					
6		CSA5.0x50					
7		CNA4.0x50	4-Row				
8		CNA4.0x60					
9		CSA5.0x50					
10		CNA4.0x50	2-Row				
11		CNA4.0x60					
12		CSA5.0x50					
13	$F_1$ f. H	CNA4.0x60	4-Row	Header	120		
14					180		
15					120		
16					180		
17		CSA5.0x50	2-Row		120		
18					180		
19					120		
20					180		

F1 f.H. : header is free for rotation

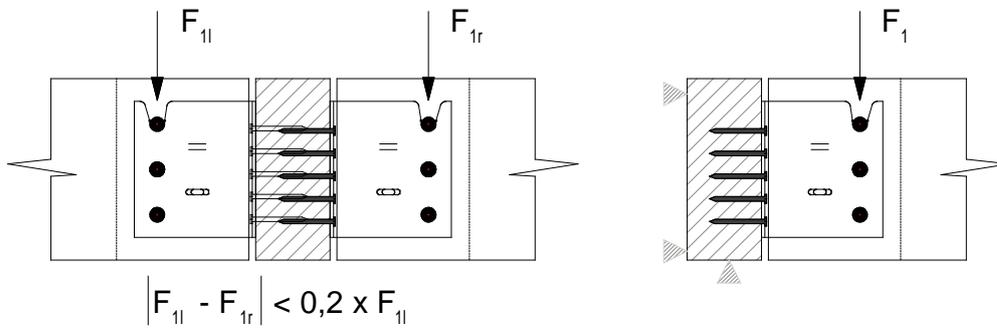
No of Table	Force direction	Nails/Screws	Reinforcement with/without screws	Supporting member as a...	Supporting member grade	
21	$F_3$	CNA4.0x50	with screws	Header	C24	
22			without screws			
23		CNA4.0x60	with screws			
24			without screws			
25		CSA5.0x50	with screws			Column
26			without screws			
27		CNA4.0x50	with screws			
28			without screws			
29		CNA4.0x60	with screws			
30			without screws			
31		CSA5.0x50	with screws			
32			without screws			
33		$F_4$	all	Header		
34			all	Column		

Tables for force direction F1 for BTALU only

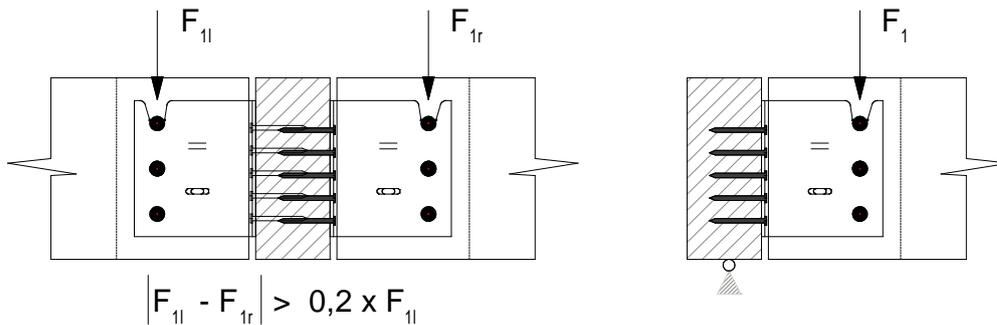
No of Table	Force direction	Nails/Screws	Nail Pattern	Support member as a...	Supported member	Steel dowel $\phi$
35	F <sub>1</sub>	CNA4.0x50	4-Row	Header	C24	SD $\phi$ 7, or $\phi$ 7.5
36		CNA4.0x60				
37		CSA5.0x50				
38		CNA4.0x50				
39		CNA4.0x60	2-Row			
40		CSA5.0x50				
41		CNA4.0x50	4-Row	Column		
42		CNA4.0x60				
43		CSA5.0x50				
44		CNA4.0x50				
45		CNA4.0x60	2-Row			
46		CSA5.0x50				
47		CNA4.0x50	4-Row	Column		
48		CNA4.0x60				
49		CSA5.0x50	4-Row	Header		
50		CNA4.0x50				
51		CNA4.0x60				
52		CSA5.0x50				
53		CNA4.0x50	2-Row			
54		CNA4.0x60				
55		CSA5.0x50	4-Row	Column		
56		CNA4.0x50				
57		CNA4.0x60				
58		CSA5.0x50				
59		CNA4.0x50	2-Row			
60		CNA4.0x60				
61		CSA5.0x50	4-Row	Column		
62		CNA4.0x50				
63		CNA4.0x60	4-Row	Column		
64		CSA5.0x50				

No of Table	Force direction	Nails/Screws	Nail pattern	Support member as a...	Support member	Steel dowel $\phi$	
65	F <sub>1</sub>	CNA4.0x50	4-Row	Header	C24	SD $\phi$ 10	
66		CNA4.0x60					
67		CSA5.0x50					
68		CNA4.0x50					
69		CNA4.0x60	2-Row				
70		CSA5.0x50					
71		CNA4.0x50	4-Row				Column
72		CNA4.0x60					
73		CSA5.0x50					
74		CNA4.0x50					
75		CNA4.0x60	2-Row				
76		CSA5.0x50					
77		CNA4.0x50	4-Row	Column			
78		CNA4.0x60					
79		CSA5.0x50	4-Row	Header			
80		CNA4.0x50					
81		CNA4.0x60					
82		CSA5.0x50					
83		CNA4.0x50	4-Row	Header	C24		
84		CNA4.0x60					
85		CSA5.0x40					
86		CNA4.0x50					
87		CNA4.0x60	2-Row				
88		CSA5.0x40					
89		CNA4.0x50	4-row	Column	C24/CLT		
90		CNA4.0x60					
91		CSA5.0x40					
92		CNA4.0x50					
93		CNA4.0x60	2-row	Column	C24		
94		CSA5.0x40					
95		CNA4.0x50	4-row / 2-Row	Header / Column	C24/CLT		
96		CNA4.0x60					
97	CSA5.0x40						

Refer to Tables 1 to 12: for header with clamped or lateral hold, or nearly same load each side (free from rotation)



Refer to Tables 13 to 20: header free to rotate, and/or unequal load on both side



For tables 21 to 32: The note *with screws* or *without screws* means extra screws for an reinforcement of the timber perpendicular to the fibre.

#### Load direction $F_2$ (uplift)

The topmost steel dowel in the cut out hole shall not be considered.

The capacities for  $R_{2,k}$  shall be modified in relation to one steel dowel less, e.g. for a BTN120/ BT120 with 3 steel dowels, the uplift capacity shall be reduced to:  $(3-1) / 3 = 0,67$

For the BTN90/ BT4-90 it shall be  $(4-1) / 4 = 0,75$

For the types 160 and up: the values have to be increased for the effective number of steel dowel, or simplified using the method as described before.

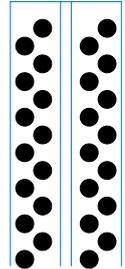
**For combination of load direction the following equation should be used:**

$$\left( \frac{F_{1,d}}{R_{1,d}} \right) + \left( \frac{F_{2,d}}{R_{2,d}} \right) + \left( \frac{F_{3,d}}{R_{3,d}} \right) + \left( \frac{F_{4,d}}{R_{4,d}} \right) \leq 1$$

$F_1$  and  $F_2$  have to be considered independently

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.x50											Table 1
	4-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	18.2	20	19.4	20	20.7	20	22.3	20	23.9	20	23.9
	44	32.2	44	34.5	48	37.6	48	41.2	52	45.0	52	49.1
4	28	29.5	28	31.2	28	33.3	28	35.7	28	38.2	28	38.5
	48	43.0	52	46.1	56	50.1	56	55.0	60	60.1	64	65.5
5	36	41.9	36	44.3	36	47.2	36	50.4	36	53.9	36	54.9
	56	53.9	60	57.6	60	62.7	64	68.7	68	75.1	72	81.9
6	44	54.9	44	57.9	44	61.7	44	65.9	44	70.3	44	72.3
	64	64.6	64	69.2	68	75.3	72	82.4	76	90.1	80	98.3
7	52	68.0	56	74.4	60	82.0	64	90.3	68	99.1	72	108.3
	68	75.4	72	80.7	76	87.8	80	96.1	84	105.2	88	114.7
8	56	78.5	60	85.5	64	93.8	68	103.0	72	112.8	80	125.7
	72	86.2	76	92.3	80	100.5	84	109.9	88	120.2	96	131.2
9	64	91.6	68	99.0	72	108.2	76	118.4	80	129.3	88	143.0
	80	97.0	84	103.8	88	113.0	92	123.6	96	135.3	104	147.6
10	68	102.2	72	110.3	76	120.2	80	131.4	88	145.5	92	158.0
	84	107.8	88	115.4	92	125.6	96	137.4	104	150.3	108	164.0
11	72	112.9	76	121.5	80	132.3	88	146.6	92	159.6	100	175.4
	88	118.6	92	126.9	96	138.1	104	151.2	108	165.3	116	180.4
12	76	123.6	80	132.9	88	146.5	92	159.7	100	175.8	100	188.1
	92	129.3	96	138.4	104	150.7	108	164.9	116	180.4	116	195.8

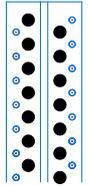
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 2
	4-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	19.7	20	20.8	20	22.2	20	23.7	20	25.3	20	25.4
	40	32.2	40	34.5	40	37.6	44	41.1	48	45.0	48	49.1
4	28	31.8	28	33.5	28	35.6	28	37.9	28	40.4	28	40.9
	44	43.1	48	46.1	48	50.2	52	54.9	52	60.0	56	65.6
5	36	44.9	36	47.2	36	50.2	36	53.4	36	56.8	36	58.1
	52	53.8	52	57.7	56	62.7	60	68.6	60	75.1	64	82.0
6	44	58.4	44	61.4	44	65.2	44	69.5	44	73.9	44	76.3
	56	64.6	60	69.2	60	75.3	64	82.5	68	90.2	72	98.4
7	44	65.8	48	72.5	52	80.3	56	88.9	60	97.9	64	107.3
	60	75.4	64	80.7	68	87.8	72	96.1	76	105.2	80	114.7
8	52	79.5	52	83.8	56	92.4	60	101.8	64	111.8	72	125.2
	68	86.2	68	92.3	72	100.5	76	109.9	80	120.3	88	131.2
9	56	90.3	60	98.0	64	107.4	68	117.7	72	128.7	76	140.2
	72	97.0	76	103.8	80	113.0	84	123.6	88	135.3	92	147.6
10	60	101.1	64	109.4	68	119.6	72	130.8	76	142.8	84	158.0
	76	107.8	80	115.3	84	125.5	88	137.4	92	150.3	100	164.0
11	64	112.0	68	120.9	72	131.8	76	144.0	84	159.6	88	173.1
	80	118.6	84	126.9	88	138.1	92	151.1	100	165.4	104	180.4
12	68	122.9	72	132.4	80	146.4	84	159.6	88	173.7	96	190.9
	84	129.4	88	138.5	96	150.7	100	164.9	104	180.4	112	196.8



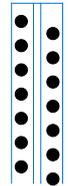
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 3
	4-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	28.2	20	29.2	20	30.5	20	31.9	20	33.3	20	33.8
	24	32.3	28	34.5	28	37.6	28	41.2	32	45.0	32	49.1
4	28	42.7	28	44.6	28	46.9	28	49.2	28	51.5	28	52.8
	32	43.0	32	46.1	32	50.2	36	54.9	36	60.1	40	65.5
5	36	53.8	36	57.6	36	62.5	36	66.4	36	69.9	36	72.6
	36	53.8	36	57.6	40	62.7	40	68.6	44	75.1	44	81.9
6	44	64.6	44	69.2	44	75.3	44	82.3	44	87.9	44	92.4
	40	64.6	40	69.2	44	75.3	48	82.4	48	90.1	52	98.3
7	28	60.6	28	63.2	32	71.9	36	81.1	40	90.6	40	92.8
	44	75.4	44	80.8	48	87.8	52	96.1	56	105.2	56	114.7
8	32	71.6	32	74.5	36	83.7	40	93.4	44	103.5	48	112.8
	48	86.2	48	92.3	52	100.4	56	109.9	60	120.2	64	131.2
9	36	82.6	36	85.7	40	95.4	44	105.6	48	116.0	56	132.8
	52	97.0	52	103.8	56	113.0	60	123.7	64	135.3	72	147.6
10	40	93.6	44	102.8	44	106.9	52	123.9	56	135.0	60	145.5
	56	107.8	60	115.3	60	125.5	68	137.4	72	150.3	76	164.0
11	44	104.5	48	114.0	52	124.7	56	135.9	60	147.3	68	165.4
	60	118.5	64	126.9	68	138.1	72	151.1	76	165.3	84	180.4
12	48	115.3	52	125.2	56	136.3	60	147.7	68	166.2	72	177.7
	64	129.3	68	138.4	72	150.7	76	164.9	84	180.4	88	196.8

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 4
	2-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	14.5	10	15.6	10	16.9	10	18.3	10	19.5	10	19.5
	32	32.2	32	34.6	34	37.6	36	41.1	38	45.0	40	49.1
4	14	23.2	14	24.7	14	26.6	14	28.5	14	30.1	14	30.1
	36	43.0	38	46.2	40	50.2	42	55.0	44	60.0	48	65.5
5	18	32.7	18	34.7	18	37.0	18	39.1	18	39.9	18	39.9
	42	53.9	44	57.6	46	62.8	48	68.6	52	75.1	54	82.0
6	22	42.6	22	45.0	22	47.5	22	48.8	22	48.8	22	48.8
	46	64.6	50	69.2	52	75.3	54	82.4	58	90.2	58	97.0
7	44	70.9	46	76.0	48	82.2	50	88.9	50	93.7	50	97.0
	52	75.4	54	80.8	56	87.8	58	95.5	58	101.8	58	107.4
8	48	81.4	50	87.0	50	91.9	50	97.0	50	101.9	50	104.4
	56	86.2	58	92.2	58	98.8	58	105.1	58	111.1	58	115.5
9	50	90.1	50	94.3	50	99.4	50	104.4	50	108.6	50	110.0
	58	96.2	58	101.3	58	107.4	58	113.6	58	119.3	58	122.7
10	50	96.9	50	101.2	50	106.1	50	110.0	50	110.8	50	110.8
	58	104.2	58	109.2	58	115.2	58	121.1	58	126.0	58	127.8
11	50	103.2	50	107.3	50	110.6	50	110.8	50	110.8	50	110.8
	58	111.3	58	116.4	58	122.2	58	127.1	58	128.5	58	128.5
12	50	108.6	50	110.8	50	110.8	50	110.8	50	110.8	50	110.8
	58	118.0	58	122.8	58	127.5	58	128.5	58	128.5	58	128.5

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 5
	2-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	15.2	10	16.3	10	17.6	10	18.9	10	20.1	10	20.1
	28	32.3	30	34.5	30	37.6	32	41.2	34	45.1	36	49.1
4	14	24.3	14	25.8	14	27.6	14	29.5	14	31.3	14	31.3
	34	43.0	34	46.1	36	50.2	38	55.0	40	60.1	42	65.5
5	18	34.2	18	36.1	18	38.4	18	40.6	18	42.3	18	42.4
	38	53.9	40	57.6	42	62.7	44	68.7	46	75.1	50	81.9
6	22	44.5	22	46.8	22	49.4	22	51.6	22	52.0	22	52.0
	42	64.7	44	69.2	46	75.3	50	82.4	52	90.1	56	98.4
7	38	68.7	42	76.1	44	82.4	48	91.4	50	98.6	50	102.8
	46	75.4	50	80.7	52	87.9	56	96.1	58	105.2	58	112.4
8	44	81.6	46	87.4	48	94.3	50	101.7	50	106.8	50	110.0
	52	86.2	54	92.3	56	100.4	58	109.1	58	116.2	58	122.1
9	48	92.4	50	98.6	50	103.9	50	109.2	50	113.8	50	115.9
	56	97.0	58	103.8	58	111.6	58	118.6	58	124.8	58	129.2
10	50	101.2	50	105.6	50	110.8	50	115.4	50	118.1	50	118.2
	58	107.5	58	113.4	58	120.1	58	126.5	58	132.0	58	134.8
11	50	107.6	50	111.9	50	116.3	50	118.2	50	118.2	50	118.2
	58	115.7	58	121.1	58	127.4	58	133.0	58	136.7	58	137.1
12	50	113.3	50	116.8	50	118.2	50	118.2	50	118.2	50	118.2
	58	122.7	58	127.9	58	133.5	58	137.0	58	137.1	58	137.1



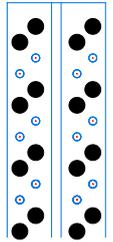
2-row



No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 6
	2-Row Header:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	19.0	10	19.8	10	20.7	10	21.7	10	22.7	10	22.7
	20	32.2	20	34.5	22	37.6	22	41.1	24	45.0	26	49.1
4	14	29.3	14	30.4	14	31.6	14	32.8	14	33.9	14	33.9
	24	43.0	24	46.1	26	50.1	28	54.9	30	60.0	32	65.5
5	18	40.0	18	41.2	18	42.6	18	43.9	18	44.8	18	44.9
	28	53.8	30	57.6	30	62.7	34	68.6	36	75.1	38	81.9
6	22	50.8	22	52.2	22	53.6	22	54.7	22	55.2	22	55.2
	32	64.6	34	69.2	36	75.3	38	82.4	42	90.1	44	98.3
7	28	65.2	30	70.5	32	76.2	36	85.9	38	91.9	42	101.6
	36	75.4	38	80.7	40	87.8	44	96.1	46	105.2	50	114.7
8	32	76.0	34	81.5	36	87.4	40	97.3	44	107.5	48	117.5
	40	86.2	42	92.2	44	100.4	48	109.9	52	120.2	56	131.2
9	36	86.7	38	92.3	42	102.3	46	112.6	50	123.0	50	124.3
	44	97.0	46	103.8	50	113.0	54	123.6	58	135.3	58	141.5
10	40	97.3	42	103.0	46	113.2	50	123.6	50	125.1	50	125.5
	48	107.8	50	115.4	54	125.5	58	137.3	58	142.4	58	144.3
11	44	107.8	48	117.6	50	124.0	50	125.4	50	125.5	50	125.5
	52	118.5	56	126.9	58	137.9	58	142.8	58	144.9	58	145.5
12	48	118.3	50	124.2	50	125.4	50	125.5	50	125.5	50	125.5
	56	129.3	58	138.1	58	142.9	58	145.1	58	145.6	58	145.6

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 7
	4-Row Column:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	15.5	12	16.6	12	17.9	12	19.4	12	20.7	12	20.7
	32	32.2	32	34.5	36	37.6	36	41.2	40	45.0	40	49.2
4	16	24.4	16	26.0	16	27.9	16	30.0	16	32.0	16	32.0
	40	43.0	40	46.1	40	50.2	44	54.9	48	60.0	48	65.5
5	20	34.1	20	36.2	20	38.7	20	41.2	20	43.4	20	43.5
	44	53.8	44	57.7	48	62.7	52	68.6	52	75.2	56	81.9
6	24	44.3	24	46.8	24	49.7	24	52.3	24	53.2	24	53.2
	48	64.6	52	69.2	52	75.4	56	82.4	60	90.1	60	98.0
7	36	62.7	40	69.9	44	77.9	44	82.3	44	86.6	44	88.7
	52	75.5	56	80.7	60	87.8	60	96.1	60	103.2	60	109.2
8	40	73.4	44	81.0	44	85.4	44	90.0	44	94.1	44	95.5
	56	86.2	60	92.2	60	99.7	60	106.6	60	112.9	60	118.0
9	44	84.0	44	87.9	44	92.4	44	96.3	44	97.5	44	97.5
	60	96.9	60	102.4	60	108.9	60	115.4	60	121.5	60	125.5
10	44	90.4	44	94.1	44	97.3	44	97.5	44	97.5	44	97.5
	60	105.4	60	110.7	60	117.0	60	123.4	60	128.8	60	131.3
11	44	95.8	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5
	60	112.9	60	118.2	60	124.4	60	130.0	60	133.0	60	133.0
12	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5
	60	119.8	60	125.0	60	130.5	60	133.0	60	133.0	60	133.0

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 8
	4-Row Column:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	16.5	12	17.5	12	18.8	12	20.2	12	21.6	12	21.6
	28	32.3	32	34.5	32	37.6	32	41.1	36	45.0	36	49.2
4	16	25.8	16	27.3	16	29.2	16	31.2	16	33.2	16	33.2
	36	43.0	36	46.1	36	50.2	40	54.9	40	60.0	44	65.5
5	20	35.9	20	37.9	20	40.3	20	42.8	20	45.1	20	45.3
	40	53.8	40	57.7	44	62.7	44	68.7	48	75.1	52	81.9
6	24	46.4	24	48.8	24	51.7	24	54.5	24	56.5	24	56.6
	44	64.6	44	69.2	48	75.3	52	82.4	56	90.1	56	98.4
7	32	61.7	36	69.2	36	72.9	40	81.8	44	91.0	44	93.6
	48	75.4	52	80.7	52	87.9	56	96.1	60	105.2	60	113.8
8	36	72.6	40	80.6	44	89.5	44	94.2	44	98.4	44	100.3
	52	86.2	56	92.2	60	100.4	60	109.8	60	117.8	60	124.3
9	40	83.4	44	91.9	44	96.4	44	100.7	44	103.7	44	104.0
	56	97.0	60	103.8	60	112.5	60	120.3	60	127.0	60	132.1
10	44	94.3	44	98.2	44	102.2	44	104.0	44	104.0	44	104.0
	60	107.8	60	114.5	60	121.8	60	128.7	60	134.8	60	138.2
11	44	99.9	44	103.1	44	104.0	44	104.0	44	104.0	44	104.0
	60	117.0	60	122.8	60	129.5	60	135.8	60	140.5	60	141.7
12	44	103.8	44	104.0	44	104.0	44	104.0	44	104.0	44	104.0
	60	124.5	60	130.0	60	136.2	60	140.9	60	141.8	60	141.8

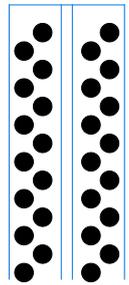


4-row column

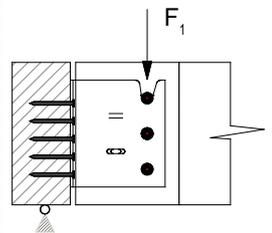
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 9
	4-Row Column:											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	21.4	12	22.3	12	23.3	12	24.4	12	25.4	12	25.5
	20	32.2	20	34.6	24	37.6	24	41.1	24	45.1	28	49.1
4	16	32.1	16	33.3	16	34.6	16	35.9	16	37.2	16	37.4
	24	43.0	28	46.1	28	50.1	28	54.9	32	60.0	32	65.5
5	20	43.1	20	44.4	20	46.0	20	47.5	20	48.8	20	49.0
	28	53.8	32	57.6	32	62.7	36	68.6	36	75.1	40	81.9
6	24	54.1	24	55.6	24	57.3	24	58.8	24	59.8	24	60.0
	32	64.6	36	69.2	36	75.3	40	82.4	44	90.1	44	98.3
7	20	49.9	24	59.0	24	60.0	28	69.7	32	79.4	36	88.6
	36	75.4	40	80.7	40	87.9	44	96.1	48	105.2	52	114.7
8	24	60.0	28	69.5	32	79.2	32	80.2	36	90.1	40	99.7
	40	86.2	44	92.2	48	100.4	48	109.9	52	120.3	56	131.2
9	28	70.2	32	79.9	36	89.8	40	99.8	44	109.9	44	110.3
	44	97.0	48	103.8	52	113.0	56	123.6	60	135.3	60	145.0
10	32	80.3	36	90.2	40	100.2	44	110.3	44	110.4	44	110.4
	48	107.8	52	115.3	56	125.5	60	137.4	60	146.1	60	148.8
11	36	90.4	40	100.4	44	110.4	44	110.4	44	110.4	44	110.4
	52	118.5	56	126.9	60	138.1	60	146.5	60	149.4	60	150.3
12	40	100.4	44	110.4	44	110.4	44	110.4	44	110.4	44	110.4
	56	129.3	60	138.4	60	146.5	60	149.5	60	150.6	60	150.6



No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.x60											Table 13
	4-Row Header - Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	20	7.4	20	8.2	20	9.1	20	10.2	20	11.0	20	11.0
4	20	12.1	20	13.4	24	15.0	24	16.7	24	18.2	24	18.2
5	24	17.9	24	19.8	28	22.1	28	24.6	28	26.8	28	26.8
6	28	24.6	32	27.1	32	30.3	32	33.7	36	36.9	36	36.9
7	32	32.0	36	35.4	36	39.4	40	43.9	40	48.2	40	48.2
8	36	40.2	40	44.4	40	49.4	44	55.0	48	60.7	48	60.7
9	40	49.1	44	54.1	48	60.2	48	66.9	52	74.1	52	74.2
10	48	58.4	48	64.3	52	71.5	56	79.4	60	87.9	60	88.5
11	52	68.2	52	75.0	56	83.3	60	92.5	64	102.4	64	103.5
12	56	78.4	60	86.1	64	95.6	68	106.1	72	117.3	72	119.2

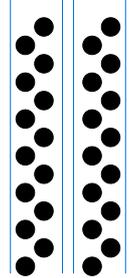


No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 14
	4-Row Header: Header is free to rotate. BHT = 180											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	20	6.2	20	6.9	20	7.7	20	8.6	20	9.3	20	9.3
4	20	10.2	24	11.3	24	12.7	24	14.1	28	15.3	28	15.3
5	28	15.1	28	16.8	28	18.7	32	20.9	32	22.7	32	22.7
6	32	20.9	32	23.1	36	25.8	36	28.8	40	31.3	40	31.3
7	36	27.4	40	30.4	40	33.9	44	37.7	44	41.2	44	41.2
8	40	34.7	44	38.3	44	42.7	48	47.6	52	52.1	52	52.1
9	44	42.6	48	47.0	52	52.3	56	58.3	56	64.1	56	64.1
10	52	51.0	52	56.2	56	62.6	60	69.7	64	76.9	64	76.9
11	60	59.9	60	66.0	64	73.5	64	81.7	68	90.4	72	90.6
12	60	69.3	64	76.3	68	84.8	72	94.3	76	104.3	76	104.9

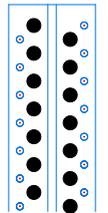


No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 15
	4-Row Header: Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	20	7.4	20	8.2	20	9.1	20	10.2	20	11.0	20	11.0
4	20	12.1	20	13.4	20	15.0	20	16.7	20	18.2	20	18.2
5	20	17.9	20	19.8	20	22.1	20	24.6	20	26.8	20	26.8
6	20	24.6	20	27.1	20	30.3	24	33.7	24	36.9	24	36.9
7	24	32.0	24	35.4	24	39.4	28	43.9	28	48.2	28	48.2
8	24	40.2	28	44.4	28	49.4	32	55.0	32	60.7	32	60.7
9	28	49.1	32	54.1	32	60.2	36	66.9	40	74.1	40	74.2
10	32	58.4	36	64.3	36	71.5	40	79.4	44	87.9	44	88.5
11	36	68.2	40	75.0	44	83.3	44	92.5	48	102.4	48	103.5
12	40	78.4	44	86.1	48	95.6	52	106.1	56	117.3	56	119.2

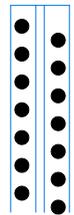
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 16	
	4-Row Header: Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	6.2	20	6.9	20	7.7	20	8.6	20	9.3	20	9.3
4	20	10.2	20	11.3	20	12.7	20	14.1	20	15.3	20	15.3
5	20	15.1	20	16.8	20	18.7	20	20.9	20	22.7	20	22.7
6	20	20.9	20	23.1	24	25.8	24	28.8	24	31.3	24	31.3
7	24	27.4	24	30.4	28	33.9	28	37.7	32	41.2	32	41.2
8	28	34.7	28	38.3	32	42.7	32	47.6	36	52.1	36	52.1
9	32	42.6	32	47.0	36	52.3	36	58.3	40	64.1	40	64.1
10	20	23.2	20	23.2	24	31.4	24	31.4	28	40.4	28	40.4
10	36	51.0	36	56.2	40	62.6	40	69.7	44	76.9	44	76.9
11	24	31.4	24	31.4	28	40.4	32	49.9	32	49.9	32	49.9
11	40	59.9	40	66.0	44	73.5	48	81.7	48	90.4	48	90.6
12	24	31.4	28	40.4	32	49.9	36	59.8	40	70.0	40	70.0
12	40	69.3	44	76.3	48	84.8	52	94.3	56	104.3	56	104.9



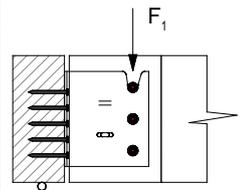
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 17	
	2-Row Header: Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	10	7.4	12	8.2	12	9.1	12	10.2	14	11.0	14	11.0
4	14	12.1	14	13.4	16	15.0	16	16.7	18	18.2	18	18.2
5	18	17.9	18	19.8	20	22.1	20	24.6	22	26.8	22	26.8
6	20	24.6	22	27.1	24	30.3	26	33.7	26	36.9	26	36.9
7	16	17.0	18	20.9	20	24.9	22	29.2	24	33.6	24	33.6
7	24	32.0	26	35.4	28	39.4	30	43.9	32	48.2	32	48.2
8	20	24.9	22	29.2	24	33.6	26	38.2	28	42.9	28	42.9
8	28	40.2	30	44.4	32	49.4	34	55.0	36	60.7	36	60.7
9	24	33.6	26	38.2	28	42.9	30	47.6	34	57.4	34	57.4
9	32	49.1	34	54.1	36	60.2	38	66.9	42	74.1	42	74.2
10	28	42.9	30	47.6	32	52.5	36	62.4	40	72.5	40	72.5
10	36	58.4	38	64.3	40	71.5	44	79.4	48	87.9	48	88.5
11	32	52.5	34	57.4	38	67.5	40	72.5	44	82.7	46	87.8
11	40	68.2	42	75.0	46	83.3	48	92.5	52	102.4	54	103.5
12	36	62.4	38	67.5	42	77.6	46	87.8	50	98.0	50	98.0
12	44	78.4	46	86.1	50	95.6	54	106.1	58	117.3	58	118.4



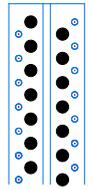
2-row



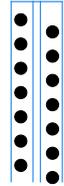
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 18	
	2-Row Header: Header is free to rotate. BHT = 180											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	10	5.1	10	5.1	10	5.1	10	5.1	10	5.1	10	5.1
3	12	6.2	12	6.9	14	7.7	14	8.6	14	9.3	14	9.3
4	14	9.5	14	9.5	14	9.5	14	9.5	14	9.5	14	9.5
4	16	10.2	16	11.3	18	12.7	18	14.1	20	15.3	20	15.3
5	18	14.9	18	14.9	18	14.9	18	14.9	18	14.9	18	14.9
5	20	15.1	20	16.8	22	18.7	22	20.9	24	22.7	24	22.7
6	22	20.9	24	23.1	26	25.8	28	28.8	28	31.3	28	31.3
6	18	14.9	20	18.1	22	21.4	24	25.0	26	28.7	26	28.7
7	26	27.4	28	30.4	30	33.9	32	37.7	34	41.2	34	41.2
7	22	21.4	24	25.0	26	28.7	28	32.6	30	36.7	30	36.7
8	30	34.7	32	38.3	34	42.7	36	47.6	38	52.1	38	52.1
8	26	28.7	28	32.6	30	36.7	32	40.9	36	49.7	36	49.7
9	34	42.6	36	47.0	38	52.3	40	58.3	44	64.1	44	64.1
9	30	36.7	32	40.9	34	45.3	38	54.3	40	58.9	40	58.9
10	38	51.0	40	56.2	42	62.6	46	69.7	48	76.9	48	76.9
10	34	45.3	36	49.7	40	58.9	42	63.6	46	73.3	46	73.3
11	42	59.9	44	66.0	48	73.5	50	81.7	54	90.4	54	90.6
11	38	54.3	40	58.9	44	68.4	48	78.1	50	83.1	50	83.1
12	46	69.3	48	76.3	52	84.8	56	94.3	58	103.1	58	103.1



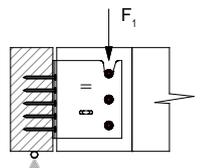
No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 19	
	2-Row Column: Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	7.4	10	8.2	10	9.1	10	10.2	10	11.0	10	11.0
4	10	12.1	10	13.4	10	15.0	12	16.7	12	18.2	12	18.2
5	12	17.9	12	19.8	14	22.1	14	24.6	16	26.8	16	26.8
6	14	24.6	16	27.1	16	30.3	18	33.7	20	36.9	20	36.9
7	10	15.5	10	15.5	12	20.4	14	25.5	16	30.7	16	30.7
	18	32.0	18	35.4	20	39.4	22	43.9	24	48.2	24	48.2
8	12	20.4	14	25.5	16	30.7	18	36.0	20	41.4	20	41.4
	20	40.2	22	44.4	24	49.4	26	55.0	28	60.7	28	60.7
9	16	30.7	18	36.0	20	41.4	22	46.8	26	57.5	26	57.5
	24	49.1	26	54.1	28	60.2	30	66.9	34	74.1	34	74.2
10	20	41.4	22	46.8	24	52.1	28	62.9	30	68.2	30	68.2
	28	58.4	30	64.3	32	71.5	36	79.4	38	87.9	38	88.5
11	22	46.8	26	57.5	28	62.9	32	73.5	36	84.1	36	84.1
	30	68.2	34	75.0	36	83.3	40	92.5	44	102.4	44	103.5
12	26	57.5	30	68.2	34	78.8	38	89.3	42	99.8	42	99.8
	34	78.4	38	86.1	42	95.6	46	106.1	50	117.3	50	119.2



2-row



No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 20	
	2-Row Column: Header is free to rotate. BHT = 120											
	Width of timber = length of SD $\varnothing$ 12 dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	6.2	10	6.9	10	7.7	10	8.6	10	9.3	10	9.3
4	10	10.2	10	11.3	12	12.7	12	14.1	12	15.3	12	15.3
5	12	15.1	14	16.8	14	18.7	16	20.9	16	22.7	16	22.7
6	16	20.9	16	23.1	18	25.8	18	28.8	20	31.3	20	31.3
7	10	11.6	12	15.7	12	15.7	14	20.2	16	24.9	16	24.9
	18	27.4	20	30.4	20	33.9	22	37.7	24	41.2	24	41.2
8	12	15.7	14	20.2	16	24.9	18	29.9	20	35.0	20	35.0
	20	34.7	22	38.3	24	42.7	26	47.6	28	52.1	28	52.1
9	16	24.9	18	29.9	20	35.0	22	40.2	24	45.5	24	45.5
	24	42.6	26	47.0	28	52.3	30	58.3	32	64.1	32	64.1
10	20	35.0	20	35.0	24	45.5	26	50.8	28	56.2	28	56.2
	28	51.0	28	56.2	32	62.6	34	69.7	36	76.9	36	76.9
11	22	40.2	24	45.5	28	56.2	30	61.6	34	72.4	34	72.4
	30	59.9	32	66.0	36	73.5	38	81.7	42	90.4	42	90.6
12	26	50.8	28	56.2	32	67.0	36	77.8	38	83.2	40	88.6
	34	69.3	36	76.3	40	84.8	44	94.3	46	104.3	48	104.9



**R<sub>3,k</sub> beam to beam**

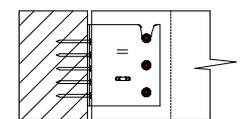
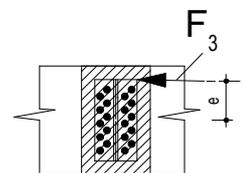
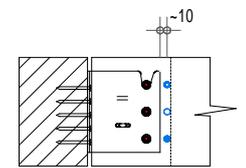
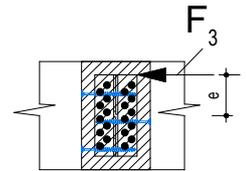
R <sub>3,k</sub>	CNA4.0x50			with screws* - [C24]						Table 21	
	Quantity		Joist Min. b/h [mm]	Width of Timber [mm]						160	180
	Type	SD		Nails	60	80	100	120	140		
90-2	4	8	... / 100	1.9	3.7	4.7	5.7	5.7	5.7	5.7	
120-2	3	10	... / 160	2.0	3.1	4.8	4.8	4.8	4.8	4.8	
160-2	4	14	... / 200	2.7	4.2	6.5	6.5	6.5	6.5	6.5	
200-2	5	18	... / 240	3.3	4.7	7.3	8.3	8.3	8.3	8.3	
240-2	6	22	... / 280	4.0	5.0	7.7	10.0	10.0	10.0	10.0	
280-2	7	26	... / 320	4.6	5.8	8.1	11.7	11.8	11.8	11.8	
320-2	8	30	... / 360	5.2	6.5	8.6	12.4	13.6	13.6	13.6	
360-2	9	34	... / 400	5.8	7.2	9.1	13.0	15.4	15.4	15.4	
400-2	10	38	... / 440	6.5	7.9	9.7	13.7	17.2	17.2	17.2	
440-2	11	42	... / 480	7.2	8.7	10.6	14.4	18.8	19.1	19.1	
480-2	12	46	... / 520	7.8	9.6	11.4	14.4	19.7	20.9	20.9	
520-2	12	50	... / 560	8.5	10.4	12.3	15.2	20.2	22.7	22.7	
560-2	12	54	... / 600	9.2	11.3	13.2	15.4	21.1	24.5	24.5	
600-2	12	58	... / 640	9.8	12.1	14.1	16.6	21.5	26.4	26.4	
90-4	4	16	... / 100	1.9	3.7	4.7	5.8	6.8	7.8	8.9	
120-4	3	20	... / 160	2.2	3.1	4.8	6.6	8.3	10.1	10.5	
160-4	4	28	... / 200	2.9	4.7	7.3	9.9	12.5	13.7	13.7	
200-4	5	36	... / 240	3.5	5.0	8.1	13.0	16.7	17.1	17.1	
240-4	6	44	... / 280	4.2	5.4	8.6	13.7	19.7	20.5	20.5	
280-4	7	52	... / 320	4.8	6.1	9.1	13.7	21.1	24.0	24.0	
320-4	8	60	... / 360	5.5	6.8	9.6	14.4	21.1	27.6	27.6	
360-4	9	68	... / 400	6.1	7.6	9.7	14.5	21.8	30.0	31.2	
400-4	10	76	... / 440	6.7	8.3	10.3	15.2	22.2	32.0	34.8	
440-4	11	84	... / 480	7.3	9.1	11.0	15.2	22.2	32.0	38.4	
480-4	12	92	... / 520	7.9	9.8	11.9	16.1	23.2	32.0	41.6	
520-4	12	100	... / 560	8.6	10.6	12.8	16.1	23.4	32.0	44.0	
560-4	12	108	... / 600	9.2	11.3	13.8	16.9	23.4	33.6	45.1	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	24.2	33.6	46.1	

\* - with/without screws: for reinforcement of the joists. see Annex C2

R <sub>3,k</sub>	CNA4.0x50			without screws* - [C24]						Table 22	
	Quantity		Joist Min. b/h [mm]	Width of Timber [mm]						160	180
	Type	SD		Nails	60	80	100	120	140		
90-2	4	8	... / 100	1.4	1.8	2.2	2.6	3.0	3.4	3.8	
120-2	3	10	... / 160	2.0	2.6	3.2	3.8	4.4	4.9	4.8	
160-2	4	14	... / 200	2.7	3.4	4.1	4.8	5.6	6.2	6.5	
200-2	5	18	... / 240	3.3	4.1	5.1	5.9	6.7	7.7	8.3	
240-2	6	22	... / 280	4.0	4.9	5.9	6.9	8.1	8.9	9.9	
280-2	7	26	... / 320	4.6	5.8	6.8	8.2	9.2	10.5	11.4	
320-2	8	30	... / 360	5.2	6.5	7.9	9.2	10.4	11.8	12.9	
360-2	9	34	... / 400	5.8	7.2	8.8	10.2	11.6	13.1	14.6	
400-2	10	38	... / 440	6.5	7.9	9.7	11.3	12.9	14.5	16.1	
440-2	11	42	... / 480	7.2	8.7	10.6	12.3	14.3	15.8	17.6	
480-2	12	46	... / 520	7.8	9.6	11.4	13.3	15.5	17.1	19.0	
520-2	12	50	... / 560	8.5	10.4	12.3	14.3	16.7	18.6	20.5	
560-2	12	54	... / 600	9.2	11.3	13.2	15.4	17.9	20.0	22.0	
600-2	12	58	... / 640	9.8	12.1	14.1	16.6	19.1	21.6	23.4	
90-4	4	16	... / 100	1.5	1.9	2.3	2.7	3.1	3.6	4.0	
120-4	3	20	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2	
160-4	4	28	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.7	
200-4	5	36	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5	
240-4	6	44	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	11.1	
280-4	7	52	... / 320	4.8	6.1	7.3	8.5	9.9	11.3	12.7	
320-4	8	60	... / 360	5.5	6.8	8.3	9.7	11.1	12.9	14.3	
360-4	9	68	... / 400	6.1	7.6	9.2	10.9	12.4	14.4	15.9	
400-4	10	76	... / 440	6.7	8.3	10.1	12.1	13.8	15.8	17.5	
440-4	11	84	... / 480	7.3	9.1	11.0	13.2	15.2	17.2	19.1	
480-4	12	92	... / 520	7.9	9.8	11.9	14.3	16.6	18.7	20.7	
520-4	12	100	... / 560	8.6	10.6	12.8	15.4	17.8	20.1	22.2	
560-4	12	108	... / 600	9.2	11.3	13.8	16.5	19.1	21.5	23.8	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	20.4	23.0	25.4	

\* - with/without screws: for reinforcement of the joists. see Annex C2

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



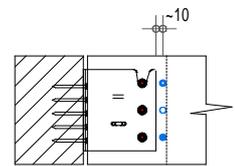
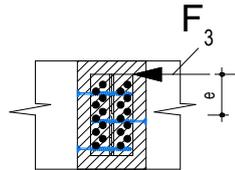
Type: the first number gives the size of the concealed joisthangers, the second number is given for the nailing - means 2-row or 4-row

**R<sub>3,k</sub> beam to beam**

R <sub>3,k</sub>	CNA4.0x60		Joist Min. b/h [mm]	with screws* - [C24]						Table 23	
	Quantity			Width of Timber [mm]						160	180
	Type	SD	Nails	60	80	100	120	140	160		
90-2	4	8	... / 100	1.9	3.7	4.7	5.8	6.8	6.9	6.9	
120-2	3	10	... / 160	2.2	3.1	4.8	5.8	5.8	5.8	5.8	
160-2	4	14	... / 200	2.9	4.7	7.1	7.9	7.9	7.9	7.9	
200-2	5	18	... / 240	3.5	5.0	7.8	10.0	10.0	10.0	10.0	
240-2	6	22	... / 280	4.2	5.4	8.6	11.9	12.1	12.1	12.1	
280-2	7	26	... / 320	4.8	6.1	9.1	12.9	14.3	14.3	14.3	
320-2	8	30	... / 360	5.5	6.8	9.6	13.7	16.5	16.5	16.5	
360-2	9	34	... / 400	6.1	7.6	9.7	14.4	18.6	18.6	18.6	
400-2	10	38	... / 440	6.7	8.3	10.3	15.0	19.9	20.8	20.8	
440-2	11	42	... / 480	7.3	9.1	11.0	15.2	20.8	23.0	23.0	
480-2	12	46	... / 520	7.9	9.8	11.9	16.1	21.3	25.2	25.2	
520-2	12	50	... / 560	8.6	10.6	12.8	16.1	22.2	27.4	27.4	
560-2	12	54	... / 600	9.2	11.3	13.8	16.9	23.4	29.2	29.6	
600-2	12	58	... / 640	9.8	12.1	14.7	17.6	23.4	30.6	31.8	
90-4	4	16	... / 100	1.9	3.7	4.7	5.8	6.8	7.8	8.9	
120-4	3	20	... / 160	2.2	3.1	4.8	6.6	8.3	10.1	11.9	
160-4	4	28	... / 200	2.9	4.7	7.3	9.9	12.5	15.1	16.5	
200-4	5	36	... / 240	3.5	5.0	8.1	13.0	16.7	20.2	20.6	
240-4	6	44	... / 280	4.2	5.4	8.6	13.7	20.2	23.5	24.8	
280-4	7	52	... / 320	4.8	6.1	9.1	13.7	21.1	26.7	29.0	
320-4	8	60	... / 360	5.5	6.8	9.6	14.4	21.1	29.9	33.3	
360-4	9	68	... / 400	6.1	7.6	9.7	14.5	21.8	30.6	37.5	
400-4	10	76	... / 440	6.7	8.3	10.3	15.2	22.2	32.0	41.2	
440-4	11	84	... / 480	7.3	9.1	11.0	15.2	22.2	32.0	44.0	
480-4	12	92	... / 520	7.9	9.8	11.9	16.1	23.2	32.0	44.0	
520-4	12	100	... / 560	8.6	10.6	12.8	16.1	23.4	32.0	44.0	
560-4	12	108	... / 600	9.2	11.3	13.8	16.9	23.4	33.6	45.1	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	24.2	33.6	46.1	

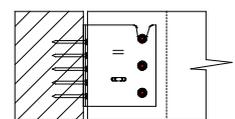
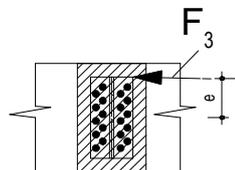
\* - with/without screws: for reinforcement of the joists. see Annex C2

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



R <sub>3,k</sub>	CNA4.0x60		Joist Min. b/h [mm]	without screws* - [C24]						Table 24	
	Quantity			Width of Timber [mm]						160	180
	Type	SD	Nails	60	80	100	120	140	160		
90-2	4	8	... / 100	1.5	1.9	2.3	2.7	3.1	3.6	4.0	
120-2	3	10	... / 160	2.2	2.9	3.5	4.1	4.6	5.2	5.7	
160-2	4	14	... / 200	2.9	3.6	4.4	5.2	6.0	6.6	7.3	
200-2	5	18	... / 240	3.5	4.4	5.4	6.4	7.2	8.1	9.0	
240-2	6	22	... / 280	4.2	5.3	6.4	7.4	8.6	9.5	10.5	
280-2	7	26	... / 320	4.8	6.1	7.3	8.5	9.9	11.1	12.0	
320-2	8	30	... / 360	5.5	6.8	8.3	9.7	11.1	12.5	13.9	
360-2	9	34	... / 400	6.1	7.6	9.2	10.9	12.4	13.9	15.4	
400-2	10	38	... / 440	6.7	8.3	10.1	12.1	13.8	15.3	17.0	
440-2	11	42	... / 480	7.3	9.1	11.0	13.2	15.2	16.7	18.5	
480-2	12	46	... / 520	7.9	9.8	11.9	14.3	16.5	18.2	20.1	
520-2	12	50	... / 560	8.6	10.6	12.8	15.4	17.8	19.8	21.6	
560-2	12	54	... / 600	9.2	11.3	13.8	16.5	19.1	21.5	23.2	
600-2	12	58	... / 640	9.8	12.1	14.7	17.6	20.4	23.0	24.9	
90-4	4	16	... / 100	1.5	1.9	2.3	2.7	3.1	3.6	4.0	
120-4	3	20	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2	
160-4	4	28	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.7	
200-4	5	36	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5	
240-4	6	44	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	11.1	
280-4	7	52	... / 320	4.8	6.1	7.3	8.5	9.9	11.3	12.7	
320-4	8	60	... / 360	5.5	6.8	8.3	9.7	11.1	12.9	14.3	
360-4	9	68	... / 400	6.1	7.6	9.2	10.9	12.4	14.4	15.9	
400-4	10	76	... / 440	6.7	8.3	10.1	12.1	13.8	15.8	17.5	
440-4	11	84	... / 480	7.3	9.1	11.0	13.2	15.2	17.2	19.1	
480-4	12	92	... / 520	7.9	9.8	11.9	14.3	16.6	18.7	20.7	
520-4	12	100	... / 560	8.6	10.6	12.8	15.4	17.8	20.1	22.2	
560-4	12	108	... / 600	9.2	11.3	13.8	16.5	19.1	21.5	23.8	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	20.4	23.0	25.4	

\* - with/without screws: for reinforcement of the joists. see Annex C2



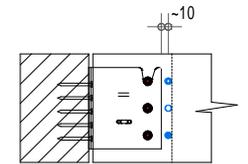
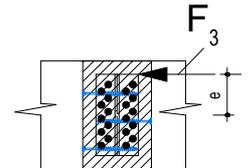
Type: the first number gives the size of the concealed joisthangers, the second number is given for the nailing - means 2-row or 4-row

**R<sub>3,k</sub> beam to column**

R <sub>3,k</sub>	CNA5.0x50		Joist Min. b/h [mm]	with screws* - [C24]						Table 25	
	Quantity			Width of Timber [mm]						160	180
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180	
90-2	4	8	... / 100	1.9	3.7	4.7	5.8	6.8	7.3	7.3	
120-2	3	10	... / 160	2.2	3.1	4.8	6.2	6.2	6.2	6.2	
160-2	4	14	... / 200	2.9	4.7	7.3	8.4	8.4	8.4	8.4	
200-2	5	18	... / 240	3.5	5.0	8.1	10.6	10.6	10.6	10.6	
240-2	6	22	... / 280	4.2	5.4	8.6	12.4	12.9	12.9	12.9	
280-2	7	26	... / 320	4.8	6.1	9.1	13.4	15.2	15.2	15.2	
320-2	8	30	... / 360	5.5	6.8	9.6	14.4	17.6	17.6	17.6	
360-2	9	34	... / 400	6.1	7.6	9.7	14.5	19.3	19.9	19.9	
400-2	10	38	... / 440	6.7	8.3	10.3	15.2	20.6	22.2	22.2	
440-2	11	42	... / 480	7.3	9.1	11.0	15.2	21.6	24.6	24.6	
480-2	12	46	... / 520	7.9	9.8	11.9	16.1	22.2	26.9	26.9	
520-2	12	50	... / 560	8.6	10.6	12.8	16.1	23.4	29.2	29.3	
560-2	12	54	... / 600	9.2	11.3	13.8	16.9	23.4	30.6	31.6	
600-2	12	58	... / 640	9.8	12.1	14.7	17.6	24.2	31.4	34.0	
90-4	4	16	... / 100	1.9	3.7	4.7	5.8	6.8	7.8	8.9	
120-4	3	20	... / 160	2.2	3.1	4.8	6.6	8.3	10.1	11.9	
160-4	4	28	... / 200	2.9	4.7	7.3	9.9	12.5	15.1	17.6	
200-4	5	36	... / 240	3.5	5.0	8.1	13.0	16.7	20.2	22.0	
240-4	6	44	... / 280	4.2	5.4	8.6	13.7	20.2	23.5	26.4	
280-4	7	52	... / 320	4.8	6.1	9.1	13.7	21.1	26.7	30.2	
320-4	8	60	... / 360	5.5	6.8	9.6	14.4	21.1	29.9	33.9	
360-4	9	68	... / 400	6.1	7.6	9.7	14.5	21.8	30.6	37.5	
400-4	10	76	... / 440	6.7	8.3	10.3	15.2	22.2	32.0	41.2	
440-4	11	84	... / 480	7.3	9.1	11.0	15.2	22.2	32.0	44.0	
480-4	12	92	... / 520	7.9	9.8	11.9	16.1	23.2	32.0	44.0	
520-4	12	100	... / 560	8.6	10.6	12.8	16.1	23.4	32.0	44.0	
560-4	12	108	... / 600	9.2	11.3	13.8	16.9	23.4	33.6	45.1	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	24.2	33.6	46.1	

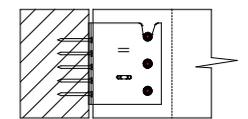
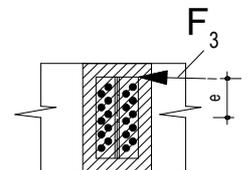
\* - with/without screws: for reinforcement of the joists. see Annex C2

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



R <sub>3,k</sub>	CNA5.0x50		Joist Min. b/h [mm]	without screws* - [C24]						Table 26	
	Quantity			Width of Timber [mm]						160	180
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180	
90-2	4	8	... / 100	1.5	1.9	2.3	2.7	3.1	3.6	4.0	
120-2	3	10	... / 160	2.2	2.9	3.5	4.2	4.8	5.4	5.9	
160-2	4	14	... / 200	2.9	3.6	4.4	5.3	6.2	6.9	7.5	
200-2	5	18	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.3	
240-2	6	22	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	10.8	
280-2	7	26	... / 320	4.8	6.1	7.3	8.5	9.9	11.3	12.6	
320-2	8	30	... / 360	5.5	6.8	8.3	9.7	11.1	12.9	14.3	
360-2	9	34	... / 400	6.1	7.6	9.2	10.9	12.4	14.4	15.9	
400-2	10	38	... / 440	6.7	8.3	10.1	12.1	13.8	15.8	17.5	
440-2	11	42	... / 480	7.3	9.1	11.0	13.2	15.2	17.2	19.1	
480-2	12	46	... / 520	7.9	9.8	11.9	14.3	16.6	18.7	20.7	
520-2	12	50	... / 560	8.6	10.6	12.8	15.4	17.8	20.1	22.2	
560-2	12	54	... / 600	9.2	11.3	13.8	16.5	19.1	21.5	23.8	
600-2	12	58	... / 640	9.8	12.1	14.7	17.6	20.4	23.0	25.4	
90-4	4	16	... / 100	1.5	1.9	2.3	2.7	3.1	3.6	4.0	
120-4	3	20	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2	
160-4	4	28	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.7	
200-4	5	36	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5	
240-4	6	44	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	11.1	
280-4	7	52	... / 320	4.8	6.1	7.3	8.5	9.9	11.3	12.7	
320-4	8	60	... / 360	5.5	6.8	8.3	9.7	11.1	12.9	14.3	
360-4	9	68	... / 400	6.1	7.6	9.2	10.9	12.4	14.4	15.9	
400-4	10	76	... / 440	6.7	8.3	10.1	12.1	13.8	15.8	17.5	
440-4	11	84	... / 480	7.3	9.1	11.0	13.2	15.2	17.2	19.1	
480-4	12	92	... / 520	7.9	9.8	11.9	14.3	16.6	18.7	20.7	
520-4	12	100	... / 560	8.6	10.6	12.8	15.4	17.8	20.1	22.2	
560-4	12	108	... / 600	9.2	11.3	13.8	16.5	19.1	21.5	23.8	
600-4	12	116	... / 640	9.8	12.1	14.7	17.6	20.4	23.0	25.4	

\* - with/without screws: for reinforcement of the joists. see Annex C2

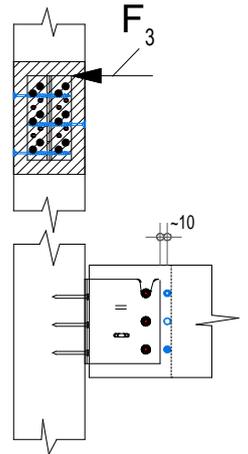


Type: the first number gives the size of the concealed joist hangers, the second number is given for the nailing - means 2-row or 4-row

**R<sub>3,k</sub> beam to column**

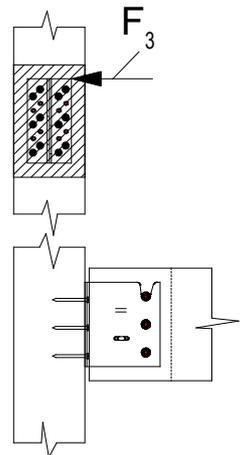
R <sub>3,k</sub>	CNA4.0x50		Joist Min. b/h [mm]	with screws* - [C24]						Table 27	
	Quantity			Width of Timber [mm]							
	Type	SD		Nails	60	80	100	120	140	160	180
120-2	3	6	... / 160	1.8	3.1	4.1	4.1	4.1	4.1	4.1	
160-2	4	8	... / 200	2.3	3.6	3.9	3.9	3.9	3.9	3.9	
200-2	5	10	... / 240	2.9	4.2	6.3	6.3	6.3	6.3	6.3	
240-2	6	12	... / 280	3.4	4.2	6.1	6.1	6.1	6.1	6.1	
280-2	7	14	... / 280	3.9	5.0	7.3	8.5	8.5	8.5	8.5	
320-2	8	16	... / 320	4.3	5.7	7.3	8.3	8.3	8.3	8.3	
360-2	8	18	... / 360	5.0	6.3	8.1	10.7	10.7	10.7	10.7	
400-2	10	20	... / 400	5.4	6.9	8.3	10.5	10.5	10.5	10.5	
440-2	10	22	... / 440	6.1	7.6	9.4	12.2	12.9	12.9	12.9	
480-2	10	24	... / 480	6.4	8.2	10.1	12.1	12.7	12.7	12.7	
520-2	12	26	... / 520	7.1	9.0	11.0	13.0	15.1	15.1	15.1	
560-2	12	28	... / 560	7.5	9.4	11.8	13.5	14.9	14.9	14.9	
600-2	12	30	... / 600	8.1	10.3	12.6	14.8	17.3	17.3	17.3	
120-4	3	12	... / 160	2.2	3.1	4.8	6.6	8.3	8.8	8.8	
160-4	4	16	... / 200	2.9	4.7	7.3	8.3	8.3	8.3	8.3	
200-4	5	20	... / 240	3.5	5.0	8.1	12.4	12.9	12.9	12.9	
240-4	6	24	... / 280	4.2	5.4	8.6	12.2	12.5	12.5	12.5	
280-4	7	28	... / 280	4.8	6.1	9.1	13.7	17.2	17.2	17.2	
320-4	8	32	... / 320	5.5	6.8	9.6	14.4	16.8	16.8	16.8	
360-4	8	36	... / 360	6.1	7.6	9.7	14.5	20.2	21.5	21.5	
400-4	10	40	... / 400	6.7	8.3	10.3	15.2	20.2	21.2	21.2	
440-4	10	44	... / 440	7.3	9.1	11.0	15.2	22.2	25.9	25.9	
480-4	10	48	... / 480	7.9	9.8	11.9	16.1	22.2	25.5	25.5	
520-4	12	52	... / 520	8.6	10.6	12.8	16.1	23.4	29.2	30.3	
560-4	12	56	... / 560	9.2	11.3	13.8	16.9	23.4	29.2	29.9	
600-4	12	60	... / 600	9.8	12.1	14.7	17.6	24.2	32.0	34.7	

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



\* - with/without screws: for reinforcement of the joists. see Annex C2

R <sub>3,k</sub>	CNA4.0x50		Joist Min. b/h [mm]	without screws* - [C24]						Table 28	
	Quantity			Width of Timber [mm]							
	Type	SD		Nails	60	80	100	120	140	160	180
120-2	3	6	... / 160	1.8	2.4	3.0	3.6	4.1	4.1	4.1	
160-2	4	8	... / 200	2.3	3.0	3.6	3.9	3.9	3.9	3.9	
200-2	5	10	... / 240	2.9	3.8	4.6	5.5	6.2	6.3	6.3	
240-2	6	12	... / 280	3.4	4.2	5.2	6.0	6.1	6.1	6.1	
280-2	7	14	... / 280	3.9	5.0	6.3	7.4	8.3	8.5	8.5	
320-2	8	16	... / 320	4.3	5.7	6.8	7.9	8.3	8.3	8.3	
360-2	8	18	... / 360	5.0	6.3	7.8	9.3	10.6	10.7	10.7	
400-2	10	20	... / 400	5.4	6.9	8.3	9.9	10.5	10.5	10.5	
440-2	10	22	... / 440	6.1	7.6	9.4	11.1	12.7	12.9	12.9	
480-2	10	24	... / 480	6.4	8.2	10.1	11.7	12.7	12.7	12.7	
520-2	12	26	... / 520	7.1	9.0	11.0	13.0	14.8	15.1	15.1	
560-2	12	28	... / 560	7.5	9.4	11.8	13.5	14.9	14.9	14.9	
600-2	12	30	... / 600	8.1	10.3	12.6	14.8	16.9	17.3	17.3	
120-4	3	12	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2	
160-4	4	16	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.5	
200-4	5	20	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5	
240-4	6	24	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	10.8	
280-4	7	28	... / 280	4.8	6.1	7.3	8.5	9.9	11.3	12.7	
320-4	8	32	... / 320	5.5	6.8	8.3	9.7	11.1	12.9	14.3	
360-4	8	36	... / 360	6.1	7.6	9.2	10.9	12.4	14.4	15.9	
400-4	10	40	... / 400	6.7	8.3	10.1	12.1	13.8	15.8	17.5	
440-4	10	44	... / 440	7.3	9.1	11.0	13.2	15.2	17.2	19.1	
480-4	10	48	... / 480	7.9	9.8	11.9	14.3	16.6	18.7	20.7	
520-4	12	52	... / 520	8.6	10.6	12.8	15.4	17.8	20.1	22.2	
560-4	12	56	... / 560	9.2	11.3	13.8	16.5	19.1	21.5	23.8	
600-4	12	60	... / 600	9.8	12.1	14.7	17.6	20.4	23.0	25.4	



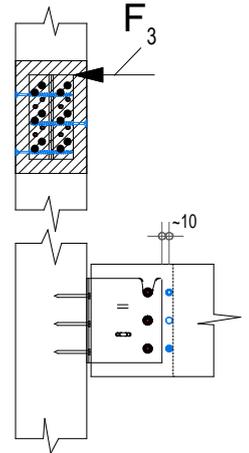
Type: the first number gives the size of the concealed joisthangers, the second number is given for the nailing - means 2-row or 4-row

\* - with/without screws: for reinforcement of the joists. see Annex C2

**R<sub>3,k</sub> beam to column**

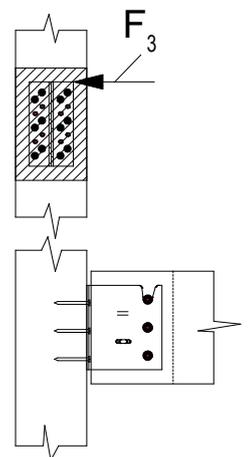
R <sub>3,k</sub>	CNA4.0x60		Joist Min. b/h [mm]	with screws* - [C24]						Table 29				
	Quantity			Width of Timber [mm]						60	80	100	120	140
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180				
120-2	3	6	... / 160	2.0	3.1	4.4	4.4	4.4	4.4	4.4				
160-2	4	8	... / 200	2.5	3.8	4.2	4.2	4.2	4.2	4.2				
200-2	5	10	... / 240	3.2	4.4	6.6	6.7	6.7	6.7	6.7				
240-2	6	12	... / 280	3.6	4.6	6.5	6.5	6.5	6.5	6.5				
280-2	7	14	... / 280	4.3	5.4	7.7	9.0	9.0	9.0	9.0				
320-2	8	16	... / 320	4.8	5.9	7.7	8.8	8.8	8.8	8.8				
360-2	8	18	... / 360	5.4	6.9	8.6	11.4	11.4	11.4	11.4				
400-2	10	20	... / 400	5.9	7.3	8.8	11.2	11.2	11.2	11.2				
440-2	10	22	... / 440	6.5	8.2	9.8	12.6	13.7	13.7	13.7				
480-2	10	24	... / 480	7.0	8.7	10.6	12.6	13.5	13.5	13.5				
520-2	12	26	... / 520	7.6	9.6	11.4	13.7	16.1	16.1	16.1				
560-2	12	28	... / 560	8.1	10.3	12.2	14.1	15.9	15.9	15.9				
600-2	12	30	... / 600	8.7	11.0	13.0	15.3	18.4	18.4	18.4				
120-4	3	12	... / 160	2.2	3.1	4.8	6.6	8.3	9.4	9.4				
160-4	4	16	... / 200	2.9	4.7	7.3	8.9	8.9	8.9	8.9				
200-4	5	20	... / 240	3.5	5.0	8.1	12.8	13.7	13.7	13.7				
240-4	6	24	... / 280	4.2	5.4	8.6	12.7	13.3	13.3	13.3				
280-4	7	28	... / 280	4.8	6.1	9.1	13.7	18.3	18.3	18.3				
320-4	8	32	... / 320	5.5	6.8	9.6	14.4	17.9	17.9	17.9				
360-4	8	36	... / 360	6.1	7.6	9.7	14.5	21.1	22.9	22.9				
400-4	10	40	... / 400	6.7	8.3	10.3	15.2	21.1	22.6	22.6				
440-4	10	44	... / 440	7.3	9.1	11.0	15.2	22.2	27.6	27.6				
480-4	10	48	... / 480	7.9	9.8	11.9	16.1	23.2	27.2	27.2				
520-4	12	52	... / 520	8.6	10.6	12.8	16.1	23.4	30.6	32.3				
560-4	12	56	... / 560	9.2	11.3	13.8	16.9	23.4	30.6	31.9				
600-4	12	60	... / 600	9.8	12.1	14.7	17.6	24.2	33.6	37.0				

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



\* - with/without screws: for reinforcement of the joists. see Annex C2

R <sub>3,k</sub>	CNA4.0x60		Joist Min. b/h [mm]	without screws* - [C24]						Table 30				
	Quantity			Width of Timber [mm]						60	80	100	120	140
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180				
120-2	3	6	... / 160	2.0	2.6	3.1	3.7	4.2	4.4	4.4				
160-2	4	8	... / 200	2.5	3.1	3.7	4.2	4.2	4.2	4.2				
200-2	5	10	... / 240	3.2	3.9	4.9	5.7	6.4	6.7	6.7				
240-2	6	12	... / 280	3.6	4.6	5.5	6.3	6.5	6.5	6.5				
280-2	7	14	... / 280	4.3	5.4	6.5	7.7	8.7	9.0	9.0				
320-2	8	16	... / 320	4.8	5.9	7.1	8.2	8.8	8.8	8.8				
360-2	8	18	... / 360	5.4	6.9	8.1	9.6	10.9	11.4	11.4				
400-2	10	20	... / 400	5.9	7.3	8.8	10.2	11.2	11.2	11.2				
440-2	10	22	... / 440	6.5	8.2	9.8	11.5	13.1	13.7	13.7				
480-2	10	24	... / 480	7.0	8.7	10.6	12.1	13.5	13.5	13.5				
520-2	12	26	... / 520	7.6	9.6	11.4	13.4	15.3	16.1	16.1				
560-2	12	28	... / 560	8.1	10.3	12.2	14.1	15.9	15.9	15.9				
600-2	12	30	... / 600	8.7	11.0	13.0	15.3	17.4	18.4	18.4				
120-4	3	12	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2				
160-4	4	16	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.7				
200-4	5	20	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5				
240-4	6	24	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	11.1				
280-4	7	28	... / 280	4.8	6.1	7.3	8.5	9.9	11.3	12.7				
320-4	8	32	... / 320	5.5	6.8	8.3	9.7	11.1	12.9	14.3				
360-4	8	36	... / 360	6.1	7.6	9.2	10.9	12.4	14.4	15.9				
400-4	10	40	... / 400	6.7	8.3	10.1	12.1	13.8	15.8	17.5				
440-4	10	44	... / 440	7.3	9.1	11.0	13.2	15.2	17.2	19.1				
480-4	10	48	... / 480	7.9	9.8	11.9	14.3	16.6	18.7	20.7				
520-4	12	52	... / 520	8.6	10.6	12.8	15.4	17.8	20.1	22.2				
560-4	12	56	... / 560	9.2	11.3	13.8	16.5	19.1	21.5	23.8				
600-4	12	60	... / 600	9.8	12.1	14.7	17.6	20.4	23.0	25.4				



Type: the first number gives the size of the concealed joisthangers, the second number is given for the nailing - means 2-row or 4-row

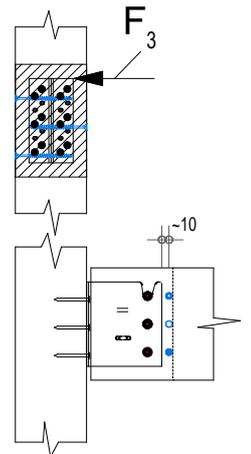
\* - with/without screws: for reinforcement of the joists. see Annex C2

**R<sub>3,k</sub> beam to column**

R <sub>3,k</sub>	CSA5.0x50		Joist Min. b/h [mm]	with screws* - [C24]							Table 31	
	Quantity			Width of Timber [mm]							160	180
	SD	Nails		60	80	100	120	140	160	180		
120-2c	3	6	... / 160	2.2	3.1	4.7	4.7	4.7	4.7	4.7	4.7	
160-2c	4	8	... / 200	2.9	4.2	4.4	4.4	4.4	4.4	4.4	4.4	
200-2c	5	10	... / 240	3.5	5.0	7.0	7.1	7.1	7.1	7.1	7.1	
240-2c	6	12	... / 280	4.2	5.4	6.9	6.9	6.9	6.9	6.9	6.9	
280-2c	7	14	... / 280	4.8	6.1	8.8	9.6	9.6	9.6	9.6	9.6	
320-2c	8	16	... / 320	5.5	6.8	8.8	9.4	9.4	9.4	9.4	9.4	
360-2c	8	18	... / 360	6.1	7.6	9.7	12.0	12.1	12.1	12.1	12.1	
400-2c	10	20	... / 400	6.7	8.3	10.3	11.9	11.9	11.9	11.9	11.9	
440-2c	10	22	... / 440	7.3	9.1	11.0	13.9	14.6	14.6	14.6	14.6	
480-2c	10	24	... / 480	7.9	9.8	11.9	13.9	14.4	14.4	14.4	14.4	
520-2c	12	26	... / 520	8.6	10.6	12.8	15.7	17.1	17.1	17.1	17.1	
560-2c	12	28	... / 560	9.2	11.3	13.8	15.7	16.9	16.9	16.9	16.9	
600-2c	12	30	... / 600	9.8	12.1	14.7	17.6	19.4	19.6	19.6	19.6	
120-4c	3	12	... / 160	2.2	3.1	4.8	6.6	8.3	9.9	9.9	9.9	
160-4c	4	16	... / 200	2.9	4.7	7.3	9.4	9.4	9.4	9.4	9.4	
200-4c	5	20	... / 240	3.5	5.0	8.1	13.0	14.6	14.6	14.6	14.6	
240-4c	6	24	... / 280	4.2	5.4	8.6	13.7	14.2	14.2	14.2	14.2	
280-4c	7	28	... / 280	4.8	6.1	9.1	13.7	19.3	19.4	19.4	19.4	
320-4c	8	32	... / 320	5.5	6.8	9.6	14.4	19.0	19.0	19.0	19.0	
360-4c	8	36	... / 360	6.1	7.6	9.7	14.5	21.8	24.4	24.4	24.4	
400-4c	10	40	... / 400	6.7	8.3	10.3	15.2	22.2	24.0	24.0	24.0	
440-4c	10	44	... / 440	7.3	9.1	11.0	15.2	22.2	29.2	29.3	29.3	
480-4c	10	48	... / 480	7.9	9.8	11.9	16.1	23.2	28.9	28.9	28.9	
520-4c	12	52	... / 520	8.6	10.6	12.8	16.1	23.4	32.0	34.3	34.3	
560-4c	12	56	... / 560	9.2	11.3	13.8	16.9	23.4	33.6	33.9	33.9	
600-4c	12	60	... / 600	9.8	12.1	14.7	17.6	24.2	33.6	39.3	39.3	

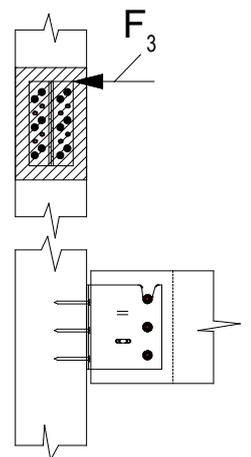
\* - with/without screws: for reinforcement of the joists. see Annex C2

screw 6,0x L  
with L = b-20mm  
  
(for timber with b=60mm  
use screws 5,0x50)  
  
number of screws =  
number of steel dowel



R <sub>3,k</sub>	CSA5.0x50		Joist Min. b/h [mm]	without screws* - [C24]							Table 32	
	Quantity			Width of Timber [mm]							160	180
	SD	Nails		60	80	100	120	140	160	180		
120-2c	3	6	... / 160	2.2	2.9	3.5	4.2	4.5	4.7	4.7	4.7	
160-2c	4	8	... / 200	2.9	3.6	4.2	4.4	4.4	4.4	4.4	4.4	
200-2c	5	10	... / 240	3.5	4.4	5.4	6.4	6.9	7.1	7.1	7.1	
240-2c	6	12	... / 280	4.2	5.3	6.2	6.7	6.9	6.9	6.9	6.9	
280-2c	7	14	... / 280	4.8	6.1	7.3	8.5	9.2	9.6	9.6	9.6	
320-2c	8	16	... / 320	5.5	6.8	8.2	8.9	9.4	9.4	9.4	9.4	
360-2c	8	18	... / 360	6.1	7.6	9.2	10.8	11.6	12.2	12.1	12.1	
400-2c	10	20	... / 400	6.7	8.3	10.1	11.3	11.8	11.9	11.9	11.9	
440-2c	10	22	... / 440	7.3	9.1	11.0	13.1	13.9	14.6	14.6	14.6	
480-2c	10	24	... / 480	7.9	9.8	11.9	13.4	14.2	14.4	14.4	14.4	
520-2c	12	26	... / 520	8.6	10.6	12.8	15.4	16.3	17.1	17.1	17.1	
560-2c	12	28	... / 560	9.2	11.3	13.8	15.7	16.7	16.9	16.9	16.9	
600-2c	12	30	... / 600	9.8	12.1	14.7	17.6	18.7	19.5	19.6	19.6	
120-4c	3	12	... / 160	2.2	2.9	3.5	4.2	4.8	5.6	6.2	6.2	
160-4c	4	16	... / 200	2.9	3.6	4.4	5.3	6.2	7.0	7.7	7.7	
200-4c	5	20	... / 240	3.5	4.4	5.4	6.4	7.4	8.4	9.5	9.5	
240-4c	6	24	... / 280	4.2	5.3	6.4	7.4	8.6	9.8	11.1	11.1	
280-4c	7	28	... / 280	4.8	6.1	7.3	8.5	9.9	11.3	12.7	12.7	
320-4c	8	32	... / 320	5.5	6.8	8.3	9.7	11.1	12.9	14.3	14.3	
360-4c	8	36	... / 360	6.1	7.6	9.2	10.9	12.4	14.4	15.9	15.9	
400-4c	10	40	... / 400	6.7	8.3	10.1	12.1	13.8	15.8	17.5	17.5	
440-4c	10	44	... / 440	7.3	9.1	11.0	13.2	15.2	17.2	19.1	19.1	
480-4c	10	48	... / 480	7.9	9.8	11.9	14.3	16.6	18.7	20.7	20.7	
520-4c	12	52	... / 520	8.6	10.6	12.8	15.4	17.8	20.1	22.2	22.2	
560-4c	12	56	... / 560	9.2	11.3	13.8	16.5	19.1	21.5	23.8	23.8	
600-4c	12	60	... / 600	9.8	12.1	14.7	17.6	20.4	23.0	25.4	25.4	

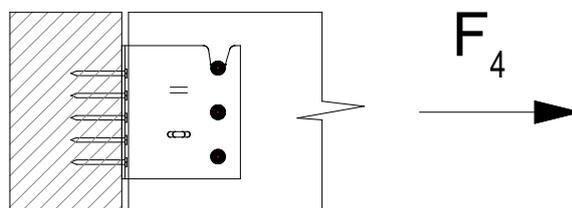
\* - with/without screws: for reinforcement of the joists. see Annex C2



Type: the first number gives the size of the concealed joisthangers, the second number is given for the nailing - means 2-row or 4-row

**R<sub>4</sub> beam to beam**

R <sub>4,k</sub>	Quantity		Joist Min. b/h [mm]	Table 33				
				fastener				
Type	SD	Nails		CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x40	CSA5.0x50
BTN90	4	8	... / 100	5.9	7.8	9.8	14.3	14.3
BTN120	3	10	... / 160	7.4	9.8	12.2	17.6	19.1
BTN160	4	14	... / 200	10.3	13.7	16.7	24.4	25.2
BTN200	5	18	... / 240	13.2	17.6	21.2	31.1	31.2
BTN240	6	22	... / 280	16.2	21.6	25.8	37.3	37.3
BT4-90	4	16	... / 100	5.9	7.8	9.8	14.3	14.3
BT4-120	3	20	... / 160	7.4	9.8	12.2	17.6	19.1
BT4-160	4	28	... / 200	10.3	13.7	16.7	24.4	25.2
BT4-200	5	36	... / 240	13.2	17.6	21.2	31.1	31.2
BT4-240	6	44	... / 280	16.2	21.6	25.8	37.3	37.3
BT4-280	7	52	... / 320	19.1	25.5	30.3	44.5	44.5
BT4-320	8	60	... / 360	22.0	29.4	34.8	51.2	56.9
BT4-360	9	68	... / 400	25.0	33.3	39.3	57.9	64.0
BT4-400	10	76	... / 440	27.9	37.2	43.9	64.6	71.0
BT4-440	11	84	... / 480	30.9	41.2	48.4	71.3	78.1
BT4-480	12	92	... / 520	33.8	45.1	52.9	78.0	85.1
BT4-520	12	100	... / 560	36.8	49.0	57.4	84.7	92.2
BT4-560	12	108	... / 600	39.7	52.9	62.0	91.4	99.2
BT4-600	12	116	... / 640	42.6	56.8	66.5	98.2	106.3
BTALU120	3	20	... / 160	7.4	9.8	12.2	21.8	30.6
BTALU160	4	28	... / 200	10.3	13.7	17.2	30.5	42.8
BTALU200	5	36	... / 240	13.2	17.6	22.0	39.2	55.1
BTALU240	6	44	... / 280	16.2	21.6	27.0	48.0	67.3
BTALU280	7	52	... / 320	19.1	25.5	31.8	56.7	79.6
BTALU320	8	60	... / 360	22.0	29.4	36.8	65.4	91.8
BTALU360	9	68	... / 400	25.0	33.3	41.6	74.1	104.0
BTALU400	10	76	... / 440	27.9	37.2	46.7	82.8	116.3
BTALU440	11	84	... / 480	30.9	41.2	51.4	91.6	128.5
BTALU480	12	92	... / 520	33.8	45.1	56.4	100.3	140.8
BTALU520	12	100	... / 560	36.8	49.0	61.2	109.0	153.0
BTALU560	12	108	... / 600	39.7	52.9	66.2	117.7	165.2
BTALU600	12	116	... / 640	42.6	56.8	71.0	126.4	177.5



See also the comment below table 34

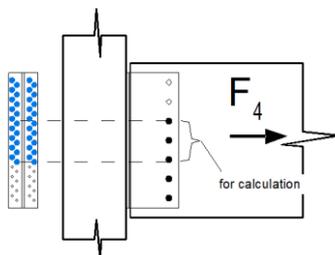
**R4 beam to column**

R <sub>4,k</sub>	Quantity		Joist Min. b/h [mm]	Table 34				
				fastener				
Type	SD	Nails	b/h [mm]	CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x40	CSA5.0x50
BTN90-c	4	4	... / 100	2.9	3.9	4.9	8.7	8.7
BTN120-c	3	6	... / 160	4.4	5.9	7.4	12.7	15.7
BTN160-c	4	8	... / 200	5.9	7.8	9.8	16.9	20.9
BTN200-c	5	10	... / 240	7.4	9.8	12.3	21.1	26.1
BTN240-c	6	12	... / 280	8.8	11.8	14.7	25.3	31.3
BT4-90-c	4	8	... / 100	2.9	3.9	4.9	8.7	8.7
BT4-120-c	3	12	... / 160	4.4	5.9	7.4	12.7	15.7
BT4-160-c	4	16	... / 200	5.9	7.8	9.8	16.9	20.9
BT4-200-c	5	20	... / 240	7.4	9.8	12.3	21.1	26.1
BT4-240-c	6	24	... / 280	8.8	11.8	14.7	25.3	31.3
BT4-280-c	7	28	... / 320	10.3	13.7	17.2	29.5	36.5
BT4-320-c	8	32	... / 360	11.8	15.7	19.6	33.7	41.8
BT4-360-c	9	36	... / 400	13.2	17.6	22.1	38.0	47.0
BT4-400-c	10	40	... / 440	14.7	19.6	24.5	42.2	52.2
BT4-440-c	11	44	... / 480	16.2	21.6	27.0	46.4	57.5
BT4-480-c	12	40	... / 520	17.6	23.5	29.4	50.6	62.7
BT4-520-c	12	52	... / 560	19.1	25.5	31.9	54.8	67.9
BT4-560-c	12	56	... / 600	20.6	27.4	34.3	59.1	73.1
BT4-600-c	12	60	... / 640	22.1	29.4	36.8	63.3	78.4
BTALU120-c	3	12	... / 160	4.4	5.9	7.4	13.1	18.4
BTALU160-c	4	16	... / 200	5.9	7.8	9.8	17.4	24.5
BTALU200-c	5	20	... / 240	7.4	9.8	12.3	21.8	30.6
BTALU240-c	6	24	... / 280	8.8	11.8	14.7	26.2	36.7
BTALU280-c	7	28	... / 320	10.3	13.7	17.2	30.5	42.8
BTALU320-c	8	32	... / 360	11.8	15.7	19.6	34.9	49.0
BTALU360-c	9	36	... / 400	13.2	17.6	22.1	39.2	55.1
BTALU400-c	10	40	... / 440	14.7	19.6	24.5	43.6	61.2
BTALU440-c	11	44	... / 480	16.2	21.6	27.0	48.0	67.3
BTALU480-c	12	48	... / 520	17.6	23.5	29.4	52.3	73.4
BTALU520-c	12	52	... / 560	19.1	25.5	31.9	56.7	79.6
BTALU560-c	12	56	... / 600	20.6	27.4	34.3	61.0	85.7
BTALU600-c	12	60	... / 640	22.1	29.4	36.8	65.4	91.8

C=

index for column nailing

Basis of the values for force direction F<sub>4</sub> is, that the force is acting in the middle of the steel dowel and in the middle of the nail group. In case of a asymmetric placing of steel dowel and nails, calculate with the number of fasteners in the overlapping area – see picture below

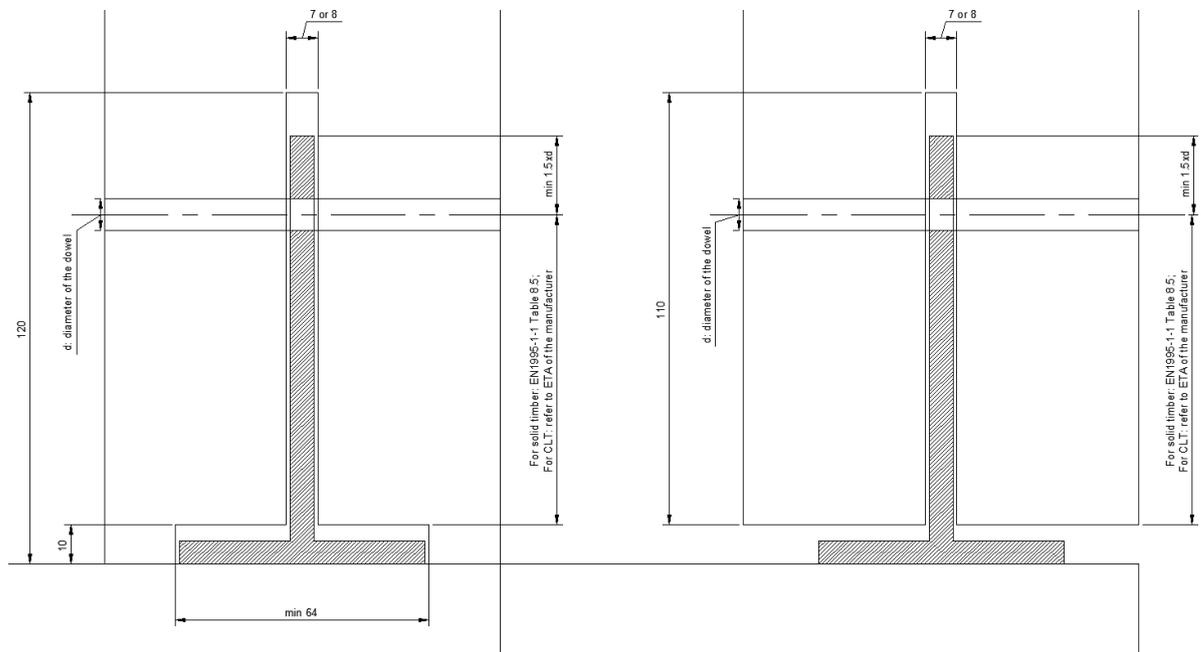


Note - For the installation shown above – such as for wall elements, in accordance with the images on page 32 (when used for steel dowels of Ø 7, Ø 8, Ø 10 or Ø 12mm), then the formula in *Equation 1* for calculating F<sub>4</sub> capacity is valid. (for [*Equation 1*] – see page 31)

## Force direction F4

### Additional information:

- The BTALU can be used with CNA nails of a diameter of  $\text{Ø}4$  mm with a length from 35 to 100mm and CSA screws of a diameter of  $\text{Ø}5$  mm and a length from 35 to 50mm. Capacity of these fasteners can be found in ETA-04/0013.
- The load is located on the centre of gravity of the dowels
- The dowels must be distributed equally across the whole height of the hanger.
- The nails must be distributed equally across all around the dowels
- For solid timber: The spacing and edge distance to the timber must respect rules given by EUROCODE 5 (EN1995-1-1 §8.6 Table 8.5)
- For CLT: the spacing and edge distance to the timber must respect rules from ETA of the CLT manufacturer.
- The minimum distance between the edge of the hangers and the dowels is equal to  $1,5 \times d$  (d is the diameter of the dowels)
- All dowels must have the same diameter, length and yield capacity.



No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 35	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	11.6	20	12.7	20	13.0	20	13.0	20	13.0	20	20	13.0
	32	15.4	32	17.8	36	20.3	36	20.3	36	20.3	36	36	20.3
4	20	14.6	20	16.3	24	19.0	24	19.0	24	19.0	24	24	19.0
	36	20.5	36	23.8	40	27.1	40	27.1	40	27.1	40	40	27.1
5	24	20.1	24	22.4	28	25.7	28	25.7	28	25.7	28	28	25.7
	40	25.7	40	29.7	44	34.0	44	34.0	44	34.0	44	44	34.0
6	28	25.8	32	30.8	32	32.7	32	32.7	32	32.7	32	32	32.7
	44	30.8	48	35.7	48	40.8	48	40.8	48	40.8	48	48	40.8
7	32	31.6	32	35.4	36	39.9	36	39.9	36	39.9	36	36	39.9
	48	36.0	48	41.6	52	47.5	52	47.5	52	47.5	52	52	47.5
8	32	35.7	36	42.1	40	47.3	40	47.3	40	47.3	40	40	47.3
	48	41.1	52	47.6	56	54.3	56	54.3	56	54.3	56	56	54.3
9	36	41.6	40	48.8	44	54.7	44	54.7	44	54.7	44	44	54.7
	52	46.3	56	53.6	60	61.2	60	61.2	60	61.2	60	60	61.2
10	40	47.6	44	55.4	48	62.2	48	62.2	48	62.2	48	48	62.2
	56	51.4	60	59.5	64	68.0	64	68.0	64	68.0	64	64	68.0
11	44	53.4	48	62.0	52	69.7	52	69.7	52	69.7	52	52	69.7
	60	56.5	64	65.4	68	74.8	68	74.8	68	74.8	68	68	74.8
12	44	57.9	52	68.6	56	77.1	56	77.1	56	77.1	56	56	77.1
	60	61.7	68	71.4	72	81.6	72	81.6	72	81.6	72	72	81.6

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 36	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	14.4	20	14.4	20	14.4	20	14.4	20	14.4	20	20	14.4
	28	19.7	28	19.7	32	20.3	32	20.3	32	20.3	32	32	20.3
4	20	18.1	20	18.1	20	18.1	20	18.1	20	18.1	20	20	18.1
	36	26.7	36	26.7	36	27.1	36	27.1	36	27.1	36	36	27.1
5	24	24.9	24	24.9	24	24.9	24	24.9	24	24.9	24	24	24.9
	40	33.9	40	33.9	40	33.9	40	33.9	40	33.9	40	40	33.9
6	28	32.2	28	32.2	28	32.2	28	32.2	28	32.2	28	28	32.2
	44	40.8	44	40.8	44	40.8	44	40.8	44	40.8	44	44	40.8
7	32	39.6	32	39.6	32	39.6	32	39.6	32	39.6	32	32	39.6
	48	47.5	48	47.5	48	47.5	48	47.5	48	47.5	48	48	47.5
8	36	47.3	36	47.3	36	47.3	36	47.3	36	47.3	36	36	47.3
	52	54.3	52	54.3	52	54.3	52	54.3	52	54.3	52	52	54.3
9	40	54.9	40	54.9	40	54.9	40	54.9	40	54.9	40	40	54.9
	56	61.0	56	61.0	56	61.1	56	61.1	56	61.1	56	56	61.1
10	40	60.3	40	60.3	44	62.6	44	62.6	44	62.6	44	44	62.6
	56	67.8	56	67.8	60	67.9	60	67.9	60	67.9	60	60	67.9
11	44	68.0	44	68.0	44	68.0	44	68.0	44	68.0	44	44	68.0
	60	74.7	60	74.7	60	74.7	60	74.7	60	74.7	60	60	74.7
12	48	75.7	48	75.7	48	75.7	48	75.7	48	75.7	48	48	75.7
	64	81.6	64	81.6	64	81.6	64	81.6	64	81.6	64	64	81.6

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 37	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]
3	20	15.4	20	17.8	20	20.3	20	20.3	20	20.3	20	20	20.3
	20	15.4	20	17.8	20	20.3	20	20.3	20	20.3	20	20	20.3
4	20	25.3	20	25.3	20	25.3	20	25.3	20	25.3	20	20	25.3
	20	25.3	20	25.3	24	27.1	24	27.1	24	27.1	24	24	27.1
5	20	29.1	20	29.1	20	29.1	20	29.1	20	29.1	20	20	29.1
	24	33.1	24	33.1	28	33.9	28	33.9	28	33.9	28	28	33.9
6	20	33.1	20	33.1	20	33.1	20	33.1	20	33.1	20	20	33.1
	28	40.6	28	40.6	32	40.7	32	40.7	32	40.7	32	32	40.7
7	20	37.4	20	37.4	20	37.4	20	37.4	20	37.4	20	20	37.4
	32	47.6	32	47.6	32	47.6	32	47.6	32	47.6	32	32	47.6
8	20	41.7	20	41.7	20	41.7	20	41.7	20	41.7	20	20	41.7
	36	53.5	36	53.5	36	54.3	36	54.3	36	54.3	36	36	54.3
9	20	46.0	20	46.0	24	50.3	24	50.3	24	50.3	24	24	50.3
	36	61.0	36	61.0	40	61.1	40	61.1	40	61.1	40	40	61.1
10	24	54.7	24	54.7	24	54.7	24	54.7	24	54.7	24	24	54.7
	40	68.0	40	68.0	40	68.0	40	68.0	40	68.0	40	40	68.0
11	28	63.3	28	63.3	28	63.3	28	63.3	28	63.3	28	28	63.3
	44	74.2	44	74.2	44	74.7	44	74.7	44	74.7	44	44	74.7
12	28	67.4	28	67.4	28	67.4	28	67.4	28	67.4	28	28	67.4
	44	81.5	44	81.5	44	81.5	44	81.5	44	81.5	44	44	81.5



No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 41
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 7 or $\varnothing$ 7.5mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	8.3	8	9.4	12	12.4	12	12.4	12	12.4	12	12.4
	24	18.0	24	20.5	28	23.3	28	25.7	28	25.7	28	25.7
4	12	14.1	16	18.3	16	19.8	16	19.8	16	19.8	16	19.8
	28	24.2	32	27.5	32	31.5	32	33.9	32	33.9	32	33.9
5	16	20.6	16	22.8	20	28.0	20	28.0	20	28.0	20	28.0
	32	30.3	32	34.5	36	39.5	36	42.3	36	42.3	36	42.3
6	20	27.6	20	30.4	24	36.6	28	40.4	28	40.4	28	40.4
	36	36.4	36	41.6	40	47.4	44	50.9	44	50.9	44	50.9
7	20	32.0	24	38.4	28	45.3	28	45.8	28	45.8	28	45.8
	36	42.5	40	48.6	44	55.3	44	59.5	44	59.5	44	59.5
8	24	39.3	28	46.4	32	54.1	32	55.0	32	55.0	32	55.0
	40	48.8	44	55.6	48	63.1	48	68.1	48	68.1	48	68.1
9	28	46.7	32	54.5	36	62.9	36	64.2	36	64.2	36	64.2
	44	54.9	48	62.4	52	71.0	52	76.8	52	76.8	52	76.8
10	32	54.0	36	62.5	40	71.7	40	73.5	40	73.5	40	73.5
	48	60.9	52	69.3	56	78.8	56	85.4	56	85.4	56	85.4
11	32	58.7	36	67.7	44	80.4	44	82.8	44	82.8	44	82.8
	48	67.1	52	76.3	60	86.8	60	94.0	60	94.0	60	94.0
12	36	66.0	40	75.7	44	86.1	44	88.3	44	88.3	44	88.3
	52	73.3	56	83.4	60	94.7	60	101.3	60	101.3	60	101.3

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 42
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 7 or $\varnothing$ 7.5mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	8.8	8	9.8	8	10.5	12	13.4	12	13.4	12	13.4
	20	18.0	24	20.5	24	23.7	28	25.1	28	25.1	28	25.1
4	8	12.3	12	16.5	12	17.8	16	21.2	16	21.2	16	21.2
	24	24.3	28	27.5	28	31.6	32	33.7	32	33.7	32	33.7
5	12	18.8	16	24.0	16	26.0	20	29.9	20	29.9	20	29.9
	28	30.5	32	34.5	32	39.5	36	42.3	36	42.3	36	42.3
6	16	25.9	20	32.0	20	34.9	24	39.0	24	39.0	24	39.0
	32	36.4	36	41.5	36	47.4	40	50.9	40	50.9	40	50.9
7	20	33.4	20	36.8	24	44.0	24	44.2	24	44.2	24	44.2
	36	42.5	36	48.6	40	55.2	40	59.6	40	59.6	40	59.6
8	20	37.8	24	45.1	28	53.0	28	53.7	28	53.7	28	53.7
	36	48.8	40	55.5	44	63.0	44	68.3	44	68.3	44	68.3
9	24	45.4	28	53.4	32	62.1	32	63.2	32	63.2	32	63.2
	40	54.9	44	62.4	48	70.9	48	77.0	48	77.0	48	77.0
10	28	53.1	28	58.4	32	67.5	36	72.8	36	72.8	36	72.8
	44	60.9	44	69.3	48	78.9	52	85.5	52	85.5	52	85.5
11	28	57.6	32	66.7	36	76.6	40	82.4	40	82.4	40	82.4
	44	67.1	48	76.4	52	86.9	56	94.0	56	94.0	56	94.0
12	32	65.3	36	75.1	40	85.6	44	91.9	44	91.9	44	91.9
	48	73.2	52	83.3	56	94.8	60	102.4	60	102.4	60	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 43
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 7 or $\varnothing$ 7.5mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	11.5	8	12.4	8	13.1	8	13.1	8	13.1	8	13.1
	16	18.0	16	20.5	16	23.7	20	25.1	20	25.1	20	25.1
4	8	14.5	8	15.8	8	16.9	8	16.9	8	16.9	8	16.9
	16	24.3	20	27.5	20	31.3	20	34.1	20	34.1	20	34.1
5	8	17.8	8	19.3	8	20.1	8	20.1	8	20.1	8	20.1
	20	30.3	20	34.6	24	39.2	24	42.3	24	42.3	24	42.3
6	8	20.1	8	20.1	12	29.3	12	29.3	12	29.3	12	29.3
	24	36.4	24	41.5	28	47.2	28	50.9	28	50.9	28	50.9
7	8	20.1	12	30.1	12	30.1	16	38.9	16	38.9	16	38.9
	24	42.6	28	48.4	28	55.3	32	59.5	32	59.5	32	59.5
8	12	30.1	12	30.1	16	40.2	20	48.7	20	48.7	20	48.7
	28	48.7	28	55.5	32	63.0	36	68.1	36	68.1	36	68.1
9	12	30.1	16	40.2	20	50.2	20	50.2	20	50.2	20	50.2
	28	54.9	32	62.4	36	70.9	36	77.0	36	77.0	36	77.0
10	16	40.2	20	50.2	24	60.2	24	60.2	24	60.2	24	60.2
	32	60.9	36	69.3	40	78.8	40	85.3	40	85.3	40	85.3
11	16	40.2	20	50.2	24	60.2	28	70.2	28	70.2	28	70.2
	32	67.1	36	76.4	40	86.9	44	93.9	44	93.9	44	93.9
12	20	50.2	24	60.2	28	70.3	32	80.1	32	80.1	32	80.1
	36	73.1	40	83.2	44	94.7	48	102.4	48	102.4	48	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 44
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	11.6	10	12.5	12	15.5	12	15.5	12	15.5	12	15.5
	18	18.0	18	20.7	20	23.7	20	25.2	20	25.2	20	25.2
4	12	16.7	14	20.2	16	24.0	16	24.0	16	24.0	16	24.0
	20	24.4	22	27.8	24	31.5	24	33.8	24	33.8	24	33.8
5	16	24.2	18	28.4	20	32.8	20	33.1	20	33.1	20	33.1
	24	30.3	26	34.5	28	39.2	28	42.6	28	42.6	28	42.6
6	18	29.8	20	34.5	22	39.4	22	39.7	22	39.7	22	39.7
	26	36.6	28	41.7	30	47.3	30	49.8	30	49.8	30	49.8
7	20	35.5	22	40.6	22	43.6	22	43.7	22	43.7	22	43.7
	28	42.6	30	48.3	30	52.8	30	54.3	30	54.3	30	54.3
8	22	41.2	22	44.4	22	47.2	22	47.2	22	47.2	22	47.2
	30	48.5	30	53.2	30	57.3	30	58.4	30	58.4	30	58.4
9	22	44.7	22	47.7	22	48.8	22	48.8	22	48.8	22	48.8
	30	52.9	30	57.4	30	61.5	30	62.1	30	62.1	30	62.1
10	22	47.7	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	56.9	30	61.3	30	64.9	30	65.2	30	65.2	30	65.2
11	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	60.5	30	64.6	30	66.5	30	66.5	30	66.5	30	66.5
12	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	63.8	30	66.5	30	66.5	30	66.5	30	66.5	30	66.5

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 45
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	10.6	8	11.5	10	14.5	10	14.5	10	14.5	10	14.5
	16	18.0	16	20.6	18	23.7	18	25.1	18	25.1	18	25.1
4	10	15.7	12	19.4	14	23.3	14	23.3	14	23.3	14	23.3
	18	24.4	20	27.7	22	31.3	22	34.0	22	34.0	22	34.0
5	14	23.6	14	25.4	16	29.9	18	32.7	18	32.7	18	32.7
	22	30.3	22	34.5	24	39.3	26	42.8	26	42.8	26	42.8
6	16	29.3	18	34.1	20	39.2	22	42.4	22	42.4	22	42.4
	24	36.4	26	41.5	28	47.4	30	50.9	30	50.9	30	50.9
7	18	35.1	20	40.4	22	45.9	22	46.2	22	46.2	22	46.2
	26	42.7	28	48.6	30	55.0	30	57.6	30	57.6	30	57.6
8	20	41.0	22	46.6	22	49.5	22	49.6	22	49.6	22	49.6
	28	48.8	30	55.3	30	60.2	30	61.8	30	61.8	30	61.8
9	22	46.8	22	49.9	22	51.9	22	51.9	22	51.9	22	51.9
	30	54.8	30	60.1	30	64.5	30	65.5	30	65.5	30	65.5
10	22	49.9	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	59.3	30	64.1	30	68.1	30	68.7	30	68.7	30	68.7
11	22	51.9	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	63.1	30	67.6	30	70.6	30	70.7	30	70.7	30	70.7
12	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	66.5	30	70.2	30	70.9	30	70.9	30	70.9	30	70.9

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 46
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	4	8.3	4	9.0	6	12.4	6	12.4	6	12.4	6	12.4
	12	18.0	12	20.5	14	23.3	14	25.1	14	25.1	14	25.1
4	6	13.5	6	14.3	8	18.4	8	18.4	8	18.4	8	18.4
	14	24.1	14	27.7	16	31.3	16	33.7	16	33.7	16	33.7
5	8	18.9	10	23.4	10	24.2	12	28.2	12	28.2	12	28.2
	16	30.3	18	34.5	18	39.2	20	42.3	20	42.3	20	42.3
6	10	24.3	12	29.1	14	34.1	16	38.2	16	38.2	16	38.2
	18	36.4	20	41.5	22	47.2	24	50.9	24	50.9	24	50.9
7	12	29.6	14	34.6	16	39.7	18	44.1	18	44.1	18	44.1
	20	42.5	22	48.5	24	55.1	26	59.9	26	59.9	26	59.9
8	14	34.9	18	44.3	20	49.6	22	54.1	22	54.1	22	54.1
	22	48.8	26	55.4	28	63.0	30	68.1	30	68.1	30	68.1
9	16	40.1	20	49.8	22	55.0	22	55.1	22	55.1	22	55.1
	24	54.9	28	62.4	30	71.0	30	72.8	30	72.8	30	72.8
10	20	49.7	22	55.1	22	55.2	22	55.2	22	55.2	22	55.2
	28	60.9	30	69.3	30	73.7	30	74.2	30	74.2	30	74.2
11	22	55.0	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2
	30	67.0	30	73.2	30	74.9	30	75.1	30	75.1	30	75.1
12	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2
	30	72.2	30	74.7	30	75.3	30	75.3	30	75.3	30	75.3

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50											Table 47
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	7.0	8	7.7	12	10.8	12	11.3	12	11.3	12	11.3
	24	18.0	24	20.5	28	23.3	28	25.7	28	25.7	28	25.7
4	12	12.2	16	16.3	16	17.5	16	18.3	16	18.3	16	18.3
	28	24.1	32	27.5	32	31.4	32	33.8	32	33.8	32	33.8
5	16	18.4	16	19.9	20	25.0	20	26.1	20	26.1	20	26.1
	32	30.3	32	34.5	36	39.5	36	42.3	36	42.3	36	42.3
6	20	25.2	20	27.2	24	33.1	28	38.7	28	38.7	28	38.7
	36	36.4	36	41.5	40	47.4	44	50.9	44	50.9	44	50.9
7	24	32.4	24	34.9	28	41.6	32	47.7	32	47.7	32	47.7
	40	42.5	40	48.6	44	55.3	48	59.5	48	59.5	48	59.5
8	24	36.2	28	42.9	32	50.3	36	56.9	36	56.9	36	56.9
	40	48.8	44	55.6	48	63.1	52	68.1	52	68.1	52	68.1
9	28	43.7	32	51.1	36	59.2	36	61.9	36	61.9	36	61.9
	44	54.9	48	62.4	52	70.9	52	76.7	52	76.7	52	76.7
10	32	51.3	36	59.3	40	68.1	40	71.2	40	71.2	40	71.2
	48	60.9	52	69.3	56	78.8	56	85.3	56	85.3	56	85.3
11	32	55.4	36	63.8	44	77.0	44	80.6	44	80.6	44	80.6
	48	67.0	52	76.3	60	86.8	60	94.0	60	94.0	60	94.0
12	36	63.0	40	72.1	44	81.9	44	85.6	44	85.6	44	85.6
	52	73.3	56	83.4	60	94.7	60	100.9	60	100.9	60	100.9

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60											Table 48
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	7.5	8	8.1	8	8.9	12	12.3	12	12.3	12	12.3
	24	18.0	24	20.5	24	23.7	28	25.1	28	25.1	28	25.1
4	8	10.6	12	14.2	12	15.4	16	19.8	16	19.8	16	19.8
	24	24.3	28	27.5	28	31.5	32	33.7	32	33.7	32	33.7
5	12	16.4	16	21.3	16	23.0	20	28.2	20	28.2	20	28.2
	28	30.5	32	34.5	32	39.5	36	42.3	36	42.3	36	42.3
6	16	23.3	20	29.1	20	31.3	24	37.2	24	37.2	24	37.2
	32	36.4	36	41.5	36	47.4	40	50.9	40	50.9	40	50.9
7	20	30.7	20	33.2	24	40.1	24	41.9	24	41.9	24	41.9
	36	42.5	36	48.6	40	55.1	40	59.5	40	59.5	40	59.5
8	20	34.5	24	41.5	28	49.1	28	51.3	28	51.3	28	51.3
	36	48.8	40	55.5	44	63.0	44	68.2	44	68.2	44	68.2
9	24	42.3	28	49.9	32	58.3	32	60.9	32	60.9	32	60.9
	40	54.8	44	62.4	48	70.9	48	76.9	48	76.9	48	76.9
10	28	50.2	28	54.2	32	62.9	36	70.5	36	70.5	36	70.5
	44	60.9	44	69.3	48	78.8	52	85.5	52	85.5	52	85.5
11	28	54.2	32	62.8	36	72.2	40	80.1	40	80.1	40	80.1
	44	67.1	48	76.4	52	86.9	56	94.0	56	94.0	56	94.0
12	32	62.1	36	71.4	40	81.4	44	89.8	44	89.8	44	89.8
	48	73.1	52	83.2	56	94.8	60	102.4	60	102.4	60	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50											Table 49
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing 7$ or $\varnothing 7.5$ mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	10.5	8	11.1	8	11.8	8	12.2	8	12.2	8	12.2
	16	18.0	16	20.5	16	23.7	20	25.1	20	25.1	20	25.1
4	8	13.0	8	13.9	8	14.9	8	15.5	8	15.5	8	15.5
	16	24.2	20	27.5	20	31.3	20	34.1	20	34.1	20	34.1
5	8	15.7	8	17.8	8	19.8	8	19.8	8	19.8	8	19.8
	20	30.3	20	34.5	24	39.2	24	42.3	24	42.3	24	42.3
6	8	20.1	8	20.1	12	26.9	12	27.8	12	27.8	12	27.8
	24	36.4	24	41.5	28	47.2	28	50.9	28	50.9	28	50.9
7	8	20.1	12	30.1	12	30.1	16	37.4	16	37.4	16	37.4
	24	42.5	28	48.4	28	55.3	32	59.5	32	59.5	32	59.5
8	12	30.1	12	30.1	16	40.2	20	47.2	20	47.2	20	47.2
	28	48.7	28	55.5	32	63.0	36	68.1	36	68.1	36	68.1
9	12	30.1	16	40.2	20	50.2	20	50.2	20	50.2	20	50.2
	28	54.9	32	62.4	36	70.9	36	77.0	36	77.0	36	77.0
10	16	40.2	20	50.2	24	59.1	24	59.4	24	59.4	24	59.4
	32	60.9	36	69.3	40	78.8	40	85.3	40	85.3	40	85.3
11	16	40.2	20	50.2	24	60.2	28	69.3	28	69.3	28	69.3
	32	67.0	36	76.4	40	86.9	44	93.9	44	93.9	44	93.9
12	20	50.2	24	60.2	28	70.3	32	79.3	32	79.3	32	79.3
	36	73.1	40	83.2	44	94.7	48	102.4	48	102.4	48	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 50	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	20	12.3	20	13.4	20	14.4	24	16.8	24	16.8	24	16.8	
	32	18.3	36	20.5	36	23.5	40	25.1	40	25.1	40	25.1	
4	20	15.9	24	19.6	28	23.8	28	23.8	28	23.8	28	23.8	
	36	24.1	40	27.8	44	31.5	44	34.1	44	34.1	44	34.1	
5	28	24.1	28	26.5	32	31.4	36	34.4	36	34.4	36	34.4	
	44	30.3	44	34.6	48	39.5	52	42.5	52	42.5	52	42.5	
6	32	30.5	36	35.9	36	39.4	40	42.6	40	42.6	40	42.6	
	48	36.5	52	41.5	52	47.2	56	51.3	56	51.3	56	51.3	
7	36	37.2	40	43.2	44	49.9	44	51.2	44	51.2	44	51.2	
	52	42.6	56	48.5	60	55.2	60	59.8	60	59.8	60	59.8	
8	40	43.9	44	50.7	48	58.1	48	59.9	48	59.9	48	59.9	
	56	48.7	60	55.5	64	63.2	64	68.2	64	68.2	64	68.2	
9	40	48.8	48	58.1	52	66.4	56	71.3	56	71.3	56	71.3	
	56	54.8	64	62.4	68	71.1	72	76.9	72	76.9	72	76.9	
10	44	55.6	52	65.6	56	74.7	60	80.1	60	80.1	60	80.1	
	60	61.0	68	69.4	72	79.0	76	85.5	76	85.5	76	85.5	
11	48	62.4	52	71.4	60	83.0	64	88.9	64	88.9	64	88.9	
	64	67.1	68	76.3	76	86.9	80	94.1	80	94.1	80	94.1	
12	52	69.2	56	78.9	64	91.3	68	97.8	68	97.8	68	97.8	
	68	73.3	72	83.3	80	94.8	84	102.6	84	102.6	84	102.6	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 51	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	20	13.6	20	14.7	20	15.7	20	15.7	20	15.7	20	15.7	
	28	18.1	32	20.5	32	23.5	36	25.1	36	25.1	36	25.1	
4	20	17.1	20	18.7	24	23.0	24	23.0	24	23.0	24	23.0	
	32	24.1	36	27.8	40	31.3	40	34.2	40	34.2	40	34.2	
5	24	23.4	24	25.8	28	30.9	28	31.1	28	31.1	28	31.1	
	40	30.3	40	34.7	44	39.5	44	42.4	44	42.4	44	42.4	
6	24	27.7	28	33.2	32	39.2	36	42.7	36	42.7	36	42.7	
	40	36.4	44	41.6	48	47.4	52	50.9	52	50.9	52	50.9	
7	28	34.6	32	40.8	36	47.6	40	51.5	40	51.5	40	51.5	
	44	42.6	48	48.6	52	55.3	56	59.8	56	59.8	56	59.8	
8	32	41.7	36	48.6	40	56.2	44	60.5	44	60.5	44	60.5	
	48	48.8	52	55.5	56	63.2	60	68.4	60	68.4	60	68.4	
9	36	48.7	40	56.4	44	64.8	48	69.5	48	69.5	48	69.5	
	52	54.9	56	62.5	60	71.1	64	77.0	64	77.0	64	77.0	
10	40	55.8	44	64.1	48	73.3	52	78.7	52	78.7	52	78.7	
	56	61.0	60	69.5	64	79.0	68	85.5	68	85.5	68	85.5	
11	44	62.7	48	71.8	52	81.9	56	87.8	56	87.8	56	87.8	
	60	67.1	64	76.4	68	86.9	72	94.1	72	94.1	72	94.1	
12	44	67.9	52	79.5	56	90.4	60	96.9	60	96.9	60	96.9	
	60	73.2	68	83.3	72	94.8	76	102.6	76	102.6	76	102.6	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 52	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	20	18.0	20	20.8	20	23.0	20	23.7	20	23.7	20	23.7	
	20	18.0	20	20.8	24	23.3	24	25.1	24	25.1	24	25.1	
4	20	23.5	20	25.5	20	27.4	20	27.8	20	27.8	20	27.8	
	24	24.1	24	27.6	28	31.3	28	33.7	28	33.7	28	33.7	
5	20	27.3	20	29.6	20	32.1	20	32.3	20	32.3	20	32.3	
	24	30.4	28	34.5	28	39.3	32	42.3	32	42.3	32	42.3	
6	20	31.2	20	34.0	20	37.0	20	37.1	20	37.1	20	37.1	
	28	36.6	32	41.5	32	47.4	36	50.9	36	50.9	36	50.9	
7	20	35.2	20	38.6	20	42.1	20	42.1	20	42.1	20	42.1	
	32	42.5	32	48.5	36	55.2	36	59.5	36	59.5	36	59.5	
8	20	39.4	20	43.3	24	51.4	24	51.8	24	51.8	24	51.8	
	32	48.7	36	55.5	40	63.0	40	68.4	40	68.4	40	68.4	
9	20	43.7	24	51.9	28	60.8	28	61.6	28	61.6	28	61.6	
	36	54.9	40	62.4	44	70.9	44	77.0	44	77.0	44	77.0	
10	24	51.7	24	56.4	28	65.7	32	71.4	32	71.4	32	71.4	
	40	60.9	40	69.4	44	79.0	48	85.3	48	85.3	48	85.3	
11	24	55.9	28	65.2	32	75.1	36	81.3	36	81.3	36	81.3	
	40	67.2	44	76.4	48	86.9	52	93.9	52	93.9	52	93.9	
12	28	63.9	32	73.8	36	84.4	36	86.0	36	86.0	36	86.0	
	44	73.1	48	83.2	52	94.7	52	102.4	52	102.4	52	102.4	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50										Table 53	
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	16	13.4	16	14.5	18	17.2	20	19.0	20	19.0	20	19.0
	24	18.0	24	20.5	26	23.5	28	25.7	28	25.7	28	25.7
4	20	19.8	22	23.1	24	26.7	24	27.0	24	27.0	24	27.0
	28	24.2	30	27.6	32	31.5	32	33.9	32	33.9	32	33.9
5	22	25.1	26	30.6	28	34.8	30	37.4	30	37.4	30	37.4
	30	30.4	34	34.6	36	39.5	38	42.7	38	42.7	38	42.7
6	26	32.1	28	36.7	32	43.2	34	46.2	34	46.2	34	46.2
	34	36.6	36	41.6	40	47.4	42	51.3	42	51.3	42	51.3
7	30	39.2	32	44.5	36	51.7	38	55.1	38	55.1	38	55.1
	38	42.7	40	48.6	44	55.3	46	59.9	46	59.9	46	59.9
8	32	45.0	36	52.3	38	58.8	42	64.1	42	64.1	42	64.1
	40	48.8	44	55.6	46	63.1	50	68.4	50	68.4	50	68.4
9	36	52.1	38	58.7	42	67.3	46	73.2	46	73.2	46	73.2
	44	54.9	46	62.4	50	71.1	54	77.0	54	77.0	54	77.0
10	38	58.0	42	66.5	46	75.9	50	82.2	50	82.2	50	82.2
	46	61.1	50	69.5	54	79.0	58	85.5	58	85.5	58	85.5
11	40	63.9	46	74.2	50	84.3	50	88.1	50	88.1	50	88.1
	48	67.1	54	76.4	58	86.9	58	93.4	58	93.4	58	93.4
12	44	70.9	48	80.8	50	90.4	50	93.9	50	93.9	50	93.9
	52	73.3	56	83.4	58	94.3	58	100.2	58	100.2	58	100.2

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 54	
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	11.5	14	14.2	16	17.0	16	17.0	16	17.0	16	17.0
	20	18.0	22	20.7	24	23.7	24	25.1	24	25.1	24	25.1
4	16	18.1	18	21.5	20	25.1	22	27.4	22	27.4	22	27.4
	24	24.3	26	27.7	28	31.6	30	34.1	30	34.1	30	34.1
5	20	25.2	22	29.3	24	33.7	26	36.3	26	36.3	26	36.3
	28	30.5	30	34.7	32	39.5	34	42.7	34	42.7	34	42.7
6	22	30.9	26	37.3	28	42.4	30	45.4	30	45.4	30	45.4
	30	36.5	34	41.5	36	47.4	38	51.3	38	51.3	38	51.3
7	26	38.3	28	43.7	32	51.2	34	54.7	34	54.7	34	54.7
	34	42.7	36	48.6	40	55.2	42	59.7	42	59.7	42	59.7
8	28	44.2	32	51.8	34	58.3	36	62.1	36	62.1	36	62.1
	36	48.8	40	55.5	42	63.1	44	68.3	44	68.3	44	68.3
9	32	51.7	34	58.3	38	67.2	40	71.5	40	71.5	40	71.5
	40	54.9	42	62.5	46	71.1	48	77.0	48	77.0	48	77.0
10	34	57.6	38	66.4	40	74.4	44	80.8	44	80.8	44	80.8
	42	61.1	46	69.4	48	78.9	52	85.5	52	85.5	52	85.5
11	36	63.6	40	73.0	44	83.2	48	90.2	48	90.2	48	90.2
	44	67.1	48	76.4	52	86.9	56	94.0	56	94.0	56	94.0
12	38	69.6	42	79.6	48	91.9	50	97.7	50	97.7	50	97.7
	46	73.2	50	83.3	56	94.8	58	102.6	58	102.6	58	102.6

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 55	
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	14.1	10	15.0	10	15.9	10	15.9	10	15.9	10	15.9
	14	18.2	16	20.5	16	23.7	18	25.1	18	25.1	18	25.1
4	10	17.0	10	18.3	12	22.3	12	22.3	12	22.3	12	22.3
	16	24.3	18	27.7	20	31.3	20	34.1	20	34.1	20	34.1
5	12	22.7	12	24.4	14	29.0	16	32.1	16	32.1	16	32.1
	20	30.3	20	34.6	22	39.4	24	42.3	24	42.3	24	42.3
6	14	28.6	16	33.5	18	38.7	18	38.9	18	38.9	18	38.9
	22	36.4	24	41.5	26	47.2	26	51.0	26	51.0	26	51.0
7	16	34.5	18	39.8	20	45.4	22	49.0	22	49.0	22	49.0
	24	42.6	26	48.6	28	55.3	30	59.9	30	59.9	30	59.9
8	18	40.4	20	46.1	24	55.1	26	59.1	26	59.1	26	59.1
	26	48.8	28	55.5	32	63.0	34	68.1	34	68.1	34	68.1
9	20	46.3	24	55.3	26	61.6	28	65.7	28	65.7	28	65.7
	28	54.9	32	62.4	34	71.1	36	77.0	36	77.0	36	77.0
10	22	52.1	26	61.5	30	71.3	32	75.8	32	75.8	32	75.8
	30	61.0	34	69.3	38	78.8	40	85.3	40	85.3	40	85.3
11	24	57.8	28	67.6	32	77.7	34	82.2	34	82.2	34	82.2
	32	67.1	36	76.4	40	86.9	42	94.0	42	94.0	42	94.0
12	26	63.5	30	73.5	36	87.3	38	92.2	38	92.2	38	92.2
	34	73.1	38	83.3	44	94.7	46	102.6	46	102.6	46	102.6

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 56
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	8.3	8	9.4	12	12.4	12	12.4	12	12.4	12	12.4
	24	18.0	24	20.5	28	23.3	28	25.7	28	25.7	28	25.7
4	12	14.1	16	18.3	16	19.8	16	19.8	16	19.8	16	19.8
	28	24.2	32	27.5	32	31.5	32	33.9	32	33.9	32	33.9
5	16	20.6	16	22.8	20	28.0	20	28.0	20	28.0	20	28.0
	32	30.3	32	34.5	36	39.5	36	42.3	36	42.3	36	42.3
6	20	27.6	20	30.4	24	36.6	28	40.4	28	40.4	28	40.4
	36	36.4	36	41.6	40	47.4	44	50.9	44	50.9	44	50.9
7	20	32.0	24	38.4	28	45.3	28	45.8	28	45.8	28	45.8
	36	42.5	40	48.6	44	55.3	44	59.5	44	59.5	44	59.5
8	24	39.3	28	46.4	32	54.1	32	55.0	32	55.0	32	55.0
	40	48.8	44	55.6	48	63.1	48	68.1	48	68.1	48	68.1
9	28	46.7	32	54.5	36	62.9	36	64.2	36	64.2	36	64.2
	44	54.9	48	62.4	52	71.0	52	76.8	52	76.8	52	76.8
10	32	54.0	36	62.5	40	71.7	40	73.5	40	73.5	40	73.5
	48	60.9	52	69.3	56	78.8	56	85.4	56	85.4	56	85.4
11	32	58.7	36	67.7	44	80.4	44	82.8	44	82.8	44	82.8
	48	67.1	52	76.3	60	86.8	60	94.0	60	94.0	60	94.0
12	36	66.0	40	75.7	44	86.1	44	88.3	44	88.3	44	88.3
	52	73.3	56	83.4	60	94.7	60	101.3	60	101.3	60	101.3

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 57
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	8.8	8	9.8	8	10.5	12	13.4	12	13.4	12	13.4
	20	18.0	24	20.5	24	23.7	28	25.1	28	25.1	28	25.1
4	8	12.3	12	16.5	12	17.8	16	21.2	16	21.2	16	21.2
	24	24.3	28	27.5	28	31.6	32	33.7	32	33.7	32	33.7
5	12	18.8	16	24.0	16	26.0	20	29.9	20	29.9	20	29.9
	28	30.5	32	34.5	32	39.5	36	42.3	36	42.3	36	42.3
6	16	25.9	20	32.0	20	34.9	24	39.0	24	39.0	24	39.0
	32	36.4	36	41.5	36	47.4	40	50.9	40	50.9	40	50.9
7	20	33.4	20	36.8	24	44.0	24	44.2	24	44.2	24	44.2
	36	42.5	36	48.6	40	55.2	40	59.6	40	59.6	40	59.6
8	20	37.8	24	45.1	28	53.0	28	53.7	28	53.7	28	53.7
	36	48.8	40	55.5	44	63.0	44	68.3	44	68.3	44	68.3
9	24	45.4	28	53.4	32	62.1	32	63.2	32	63.2	32	63.2
	40	54.9	44	62.4	48	70.9	48	77.0	48	77.0	48	77.0
10	28	53.1	28	58.4	32	67.5	36	72.8	36	72.8	36	72.8
	44	60.9	44	69.3	48	78.9	52	85.5	52	85.5	52	85.5
11	28	57.6	32	66.7	36	76.6	40	82.4	40	82.4	40	82.4
	44	67.1	48	76.4	52	86.9	56	94.0	56	94.0	56	94.0
12	32	65.3	36	75.1	40	85.6	44	91.9	44	91.9	44	91.9
	48	73.2	52	83.3	56	94.8	60	102.4	60	102.4	60	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 58
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	11.5	8	12.4	8	13.1	8	13.1	8	13.1	8	13.1
	16	18.0	16	20.5	16	23.7	20	25.1	20	25.1	20	25.1
4	8	14.5	8	15.8	8	16.9	8	16.9	8	16.9	8	16.9
	16	24.3	20	27.5	20	31.3	20	34.1	20	34.1	20	34.1
5	8	17.8	8	19.3	8	20.1	8	20.1	8	20.1	8	20.1
	20	30.3	20	34.6	24	39.2	24	42.3	24	42.3	24	42.3
6	8	20.1	8	20.1	12	29.3	12	29.3	12	29.3	12	29.3
	24	36.4	24	41.5	28	47.2	28	50.9	28	50.9	28	50.9
7	8	20.1	12	30.1	12	30.1	16	38.9	16	38.9	16	38.9
	24	42.6	28	48.4	28	55.3	32	59.5	32	59.5	32	59.5
8	12	30.1	12	30.1	16	40.2	20	48.7	20	48.7	20	48.7
	28	48.7	28	55.5	32	63.0	36	68.1	36	68.1	36	68.1
9	12	30.1	16	40.2	20	50.2	20	50.2	20	50.2	20	50.2
	28	54.9	32	62.4	36	70.9	36	77.0	36	77.0	36	77.0
10	16	40.2	20	50.2	24	60.2	24	60.2	24	60.2	24	60.2
	32	60.9	36	69.3	40	78.8	40	85.3	40	85.3	40	85.3
11	16	40.2	20	50.2	24	60.2	28	70.2	28	70.2	28	70.2
	32	67.1	36	76.4	40	86.9	44	93.9	44	93.9	44	93.9
12	20	50.2	24	60.2	28	70.3	32	80.1	32	80.1	32	80.1
	36	73.1	40	83.2	44	94.7	48	102.4	48	102.4	48	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50										Table 59	
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	11.6	10	12.5	12	15.5	12	15.5	12	15.5	12	15.5
	18	18.0	18	20.7	20	23.7	20	25.2	20	25.2	20	25.2
4	12	16.7	14	20.2	16	24.0	16	24.0	16	24.0	16	24.0
	20	24.4	22	27.8	24	31.5	24	33.8	24	33.8	24	33.8
5	16	24.2	18	28.4	20	32.8	20	33.1	20	33.1	20	33.1
	24	30.3	26	34.5	28	39.2	28	42.6	28	42.6	28	42.6
6	18	29.8	20	34.5	22	39.4	22	39.7	22	39.7	22	39.7
	26	36.6	28	41.7	30	47.3	30	49.8	30	49.8	30	49.8
7	20	35.5	22	40.6	22	43.6	22	43.7	22	43.7	22	43.7
	28	42.6	30	48.3	30	52.8	30	54.3	30	54.3	30	54.3
8	22	41.2	22	44.4	22	47.2	22	47.2	22	47.2	22	47.2
	30	48.5	30	53.2	30	57.3	30	58.4	30	58.4	30	58.4
9	22	44.7	22	47.7	22	48.8	22	48.8	22	48.8	22	48.8
	30	52.9	30	57.4	30	61.5	30	62.1	30	62.1	30	62.1
10	22	47.7	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	56.9	30	61.3	30	64.9	30	65.2	30	65.2	30	65.2
11	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	60.5	30	64.6	30	66.5	30	66.5	30	66.5	30	66.5
12	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8
	30	63.8	30	66.5	30	66.5	30	66.5	30	66.5	30	66.5

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 60	
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	10.6	8	11.5	10	14.5	10	14.5	10	14.5	10	14.5
	16	18.0	16	20.6	18	23.7	18	25.1	18	25.1	18	25.1
4	10	15.7	12	19.4	14	23.3	14	23.3	14	23.3	14	23.3
	18	24.4	20	27.7	22	31.3	22	34.0	22	34.0	22	34.0
5	14	23.6	14	25.4	16	29.9	18	32.7	18	32.7	18	32.7
	22	30.3	22	34.5	24	39.3	26	42.8	26	42.8	26	42.8
6	16	29.3	18	34.1	20	39.2	22	42.4	22	42.4	22	42.4
	24	36.4	26	41.5	28	47.4	30	50.9	30	50.9	30	50.9
7	18	35.1	20	40.4	22	45.9	22	46.2	22	46.2	22	46.2
	26	42.7	28	48.6	30	55.0	30	57.6	30	57.6	30	57.6
8	20	41.0	22	46.6	22	49.5	22	49.6	22	49.6	22	49.6
	28	48.8	30	55.3	30	60.2	30	61.8	30	61.8	30	61.8
9	22	46.8	22	49.9	22	51.9	22	51.9	22	51.9	22	51.9
	30	54.8	30	60.1	30	64.5	30	65.5	30	65.5	30	65.5
10	22	49.9	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	59.3	30	64.1	30	68.1	30	68.7	30	68.7	30	68.7
11	22	51.9	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	63.1	30	67.6	30	70.6	30	70.7	30	70.7	30	70.7
12	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0	22	52.0
	30	66.5	30	70.2	30	70.9	30	70.9	30	70.9	30	70.9

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 61	
	2-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	4	8.3	4	9.0	6	12.4	6	12.4	6	12.4	6	12.4
	12	18.0	12	20.5	14	23.3	14	25.1	14	25.1	14	25.1
4	6	13.5	6	14.3	8	18.4	8	18.4	8	18.4	8	18.4
	14	24.1	14	27.7	16	31.3	16	33.7	16	33.7	16	33.7
5	8	18.9	10	23.4	10	24.2	12	28.2	12	28.2	12	28.2
	16	30.3	18	34.5	18	39.2	20	42.3	20	42.3	20	42.3
6	10	24.3	12	29.1	14	34.1	16	38.2	16	38.2	16	38.2
	18	36.4	20	41.5	22	47.2	24	50.9	24	50.9	24	50.9
7	12	29.6	14	34.6	16	39.7	18	44.1	18	44.1	18	44.1
	20	42.5	22	48.5	24	55.1	26	59.9	26	59.9	26	59.9
8	14	34.9	18	44.3	20	49.6	22	54.1	22	54.1	22	54.1
	22	48.8	26	55.4	28	63.0	30	68.1	30	68.1	30	68.1
9	16	40.1	20	49.8	22	55.0	22	55.1	22	55.1	22	55.1
	24	54.9	28	62.4	30	71.0	30	72.8	30	72.8	30	72.8
10	20	49.7	22	55.1	22	55.2	22	55.2	22	55.2	22	55.2
	28	60.9	30	69.3	30	73.7	30	74.2	30	74.2	30	74.2
11	22	55.0	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2
	30	67.0	30	73.2	30	74.9	30	75.1	30	75.1	30	75.1
12	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2
	30	72.2	30	74.7	30	75.3	30	75.3	30	75.3	30	75.3

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50											Table 62
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	7.0	8	7.7	12	10.8	12	11.3	12	11.3	12	11.3
	24	18.0	24	20.5	28	23.3	28	25.7	28	25.7	28	25.7
4	12	12.2	16	16.3	16	17.5	16	18.3	16	18.3	16	18.3
	28	24.1	32	27.5	32	31.4	32	33.8	32	33.8	32	33.8
5	16	18.4	16	19.9	20	25.0	20	26.1	20	26.1	20	26.1
	32	30.3	32	34.5	36	39.5	36	42.3	36	42.3	36	42.3
6	20	25.2	20	27.2	24	33.1	28	38.7	28	38.7	28	38.7
	36	36.4	36	41.5	40	47.4	44	50.9	44	50.9	44	50.9
7	24	32.4	24	34.9	28	41.6	32	47.7	32	47.7	32	47.7
	40	42.5	40	48.6	44	55.3	48	59.5	48	59.5	48	59.5
8	24	36.2	28	42.9	32	50.3	36	56.9	36	56.9	36	56.9
	40	48.8	44	55.6	48	63.1	52	68.1	52	68.1	52	68.1
9	28	43.7	32	51.1	36	59.2	36	61.9	36	61.9	36	61.9
	44	54.9	48	62.4	52	70.9	52	76.7	52	76.7	52	76.7
10	32	51.3	36	59.3	40	68.1	40	71.2	40	71.2	40	71.2
	48	60.9	52	69.3	56	78.8	56	85.3	56	85.3	56	85.3
11	32	55.4	36	63.8	44	77.0	44	80.6	44	80.6	44	80.6
	48	67.0	52	76.3	60	86.8	60	94.0	60	94.0	60	94.0
12	36	63.0	40	72.1	44	81.9	44	85.6	44	85.6	44	85.6
	52	73.3	56	83.4	60	94.7	60	100.9	60	100.9	60	100.9

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60											Table 63
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	7.5	8	8.1	8	8.9	12	12.3	12	12.3	12	12.3
	24	18.0	24	20.5	24	23.7	28	25.1	28	25.1	28	25.1
4	8	10.6	12	14.2	12	15.4	16	19.8	16	19.8	16	19.8
	24	24.3	28	27.5	28	31.5	32	33.7	32	33.7	32	33.7
5	12	16.4	16	21.3	16	23.0	20	28.2	20	28.2	20	28.2
	28	30.5	32	34.5	32	39.5	36	42.3	36	42.3	36	42.3
6	16	23.3	20	29.1	20	31.3	24	37.2	24	37.2	24	37.2
	32	36.4	36	41.5	36	47.4	40	50.9	40	50.9	40	50.9
7	20	30.7	20	33.2	24	40.1	24	41.9	24	41.9	24	41.9
	36	42.5	36	48.6	40	55.1	40	59.5	40	59.5	40	59.5
8	20	34.5	24	41.5	28	49.1	28	51.3	28	51.3	28	51.3
	36	48.8	40	55.5	44	63.0	44	68.2	44	68.2	44	68.2
9	24	42.3	28	49.9	32	58.3	32	60.9	32	60.9	32	60.9
	40	54.8	44	62.4	48	70.9	48	76.9	48	76.9	48	76.9
10	28	50.2	28	54.2	32	62.9	36	70.5	36	70.5	36	70.5
	44	60.9	44	69.3	48	78.8	52	85.5	52	85.5	52	85.5
11	28	54.2	32	62.8	36	72.2	40	80.1	40	80.1	40	80.1
	44	67.1	48	76.4	52	86.9	56	94.0	56	94.0	56	94.0
12	32	62.1	36	71.4	40	81.4	44	89.8	44	89.8	44	89.8
	48	73.1	52	83.2	56	94.8	60	102.4	60	102.4	60	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50											Table 64
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 8mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	10.5	8	11.1	8	11.8	8	12.2	8	12.2	8	12.2
	16	18.0	16	20.5	16	23.7	20	25.1	20	25.1	20	25.1
4	8	13.0	8	13.9	8	14.9	8	15.5	8	15.5	8	15.5
	16	24.2	20	27.5	20	31.3	20	34.1	20	34.1	20	34.1
5	8	15.7	8	17.8	8	19.8	8	19.8	8	19.8	8	19.8
	20	30.3	20	34.5	24	39.2	24	42.3	24	42.3	24	42.3
6	8	20.1	8	20.1	12	26.9	12	27.8	12	27.8	12	27.8
	24	36.4	24	41.5	28	47.2	28	50.9	28	50.9	28	50.9
7	8	20.1	12	30.1	12	30.1	16	37.4	16	37.4	16	37.4
	24	42.5	28	48.4	28	55.3	32	59.5	32	59.5	32	59.5
8	12	30.1	12	30.1	16	40.2	20	47.2	20	47.2	20	47.2
	28	48.7	28	55.5	32	63.0	36	68.1	36	68.1	36	68.1
9	12	30.1	16	40.2	20	50.2	20	50.2	20	50.2	20	50.2
	28	54.9	32	62.4	36	70.9	36	77.0	36	77.0	36	77.0
10	16	40.2	20	50.2	24	59.1	24	59.4	24	59.4	24	59.4
	32	60.9	36	69.3	40	78.8	40	85.3	40	85.3	40	85.3
11	16	40.2	20	50.2	24	60.2	28	69.3	28	69.3	28	69.3
	32	67.0	36	76.4	40	86.9	44	93.9	44	93.9	44	93.9
12	20	50.2	24	60.2	28	70.3	32	79.3	32	79.3	32	79.3
	36	73.1	40	83.2	44	94.7	48	102.4	48	102.4	48	102.4

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 65	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	24	17.4	24	18.6	28	22.6	28	24.1	32	27.3	32	27.3	
	40	24.7	40	27.3	44	30.3	44	33.8	48	37.3	48	37.4	
4	28	24.7	32	29.1	32	31.2	36	36.4	40	40.4	40	40.4	
	44	33.0	48	36.4	48	40.5	52	45.0	56	49.8	56	49.9	
5	32	32.5	36	37.6	40	43.3	44	49.4	48	54.3	48	54.3	
	48	41.3	52	45.5	56	50.6	60	56.3	64	62.3	64	62.5	
6	40	43.3	40	46.6	44	53.0	48	59.9	52	65.4	52	65.4	
	56	49.6	56	54.6	60	60.8	64	67.6	68	74.8	68	75.1	
7	44	51.7	48	58.1	52	65.4	56	73.3	60	80.0	60	80.0	
	60	57.9	64	63.7	68	70.9	72	78.8	76	87.2	76	87.5	
8	48	60.2	52	67.3	56	75.5	60	84.2	64	91.6	64	91.6	
	64	66.2	68	72.9	72	81.0	76	90.1	80	99.8	80	100.1	
9	52	68.9	56	76.7	60	85.6	68	97.4	72	106.3	72	106.3	
	68	74.5	72	82.0	76	91.2	84	101.4	88	112.2	88	112.6	
10	56	77.5	60	86.0	64	95.8	72	108.5	76	118.2	76	118.2	
	72	82.7	76	91.1	80	101.3	88	112.6	92	124.7	92	125.2	
11	60	86.2	64	95.4	68	106.1	76	119.6	80	130.2	84	132.6	
	76	91.0	80	100.2	84	111.4	92	123.9	96	137.1	100	137.6	
12	64	94.9	68	104.8	76	118.1	80	130.7	88	144.6	88	144.6	
	80	99.3	84	109.3	92	121.6	96	135.2	104	149.6	104	150.2	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 66	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	20	16.4	20	17.6	24	21.8	24	23.2	28	26.7	28	26.7	
	36	24.7	36	27.3	40	30.3	40	33.7	44	37.3	44	37.4	
4	24	23.9	28	28.6	28	30.7	32	36.1	32	36.8	32	36.8	
	40	33.0	44	36.4	44	40.5	48	45.0	48	49.8	48	50.0	
5	28	32.0	32	37.4	32	40.3	36	46.5	40	51.3	40	51.3	
	44	41.4	48	45.5	48	50.6	52	56.3	56	62.3	56	62.5	
6	32	40.5	36	46.5	40	53.3	44	60.5	48	66.4	48	66.4	
	48	49.6	52	54.6	56	60.7	60	67.5	64	74.8	64	75.0	
7	36	49.2	40	55.9	44	63.5	48	71.5	52	78.0	52	78.0	
	52	57.9	56	63.8	60	70.9	64	78.8	68	87.2	68	87.5	
8	40	58.1	44	65.5	48	73.8	52	82.7	56	90.0	56	90.0	
	56	66.1	60	72.9	64	81.1	68	90.1	72	99.7	72	100.1	
9	44	67.0	48	75.1	52	84.2	60	96.5	64	105.3	64	105.3	
	60	74.4	64	82.0	68	91.2	76	101.4	80	112.2	80	112.6	
10	48	76.0	52	84.7	56	94.6	64	107.7	68	117.4	68	117.4	
	64	82.7	68	91.1	72	101.3	80	112.6	84	124.7	84	125.2	
11	52	84.9	56	94.3	60	105.1	68	119.0	72	129.5	72	129.5	
	68	91.0	72	100.2	76	111.4	84	123.9	88	137.2	88	137.7	
12	56	93.8	60	103.9	68	117.6	72	130.3	76	141.7	80	144.5	
	72	99.3	76	109.3	84	121.6	88	135.2	92	149.6	96	150.1	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 67	
	4-Row Nailing: Header												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	20	23.9	20	25.2	20	26.7	20	28.2	20	28.7	20	28.7	
	24	24.7	24	27.3	24	30.4	28	33.7	28	37.3	28	37.4	
4	20	28.4	20	30.0	20	31.9	20	33.9	20	34.3	20	34.3	
	28	33.0	28	36.4	32	40.5	32	45.0	36	49.8	36	49.9	
5	20	33.0	20	35.2	20	37.7	20	40.2	24	45.8	24	45.8	
	32	41.3	32	45.5	36	50.6	36	56.3	40	62.3	40	62.5	
6	20	38.0	20	40.7	24	48.3	24	51.4	28	57.6	28	57.6	
	32	49.6	36	54.6	40	60.7	40	67.6	44	74.8	44	75.0	
7	20	43.1	24	50.7	28	59.1	28	62.8	32	69.5	32	69.5	
	36	57.9	40	63.7	44	70.9	44	78.9	48	87.2	48	87.5	
8	24	52.7	28	60.9	28	64.9	32	74.1	36	81.4	36	81.4	
	40	66.1	44	72.9	44	81.0	48	90.1	52	99.7	52	100.1	
9	28	62.3	32	71.0	32	75.5	36	85.4	40	93.2	40	93.2	
	44	74.4	48	82.0	48	91.2	52	101.4	56	112.2	56	112.6	
10	32	71.9	32	76.2	36	86.2	40	96.5	48	111.0	48	111.0	
	48	82.7	48	91.1	52	101.3	56	112.6	64	124.7	64	125.1	
11	32	76.7	36	86.3	40	96.8	44	107.5	52	122.7	52	122.7	
	48	91.0	52	100.2	56	111.5	60	123.9	68	137.1	68	137.6	
12	36	86.3	40	96.4	44	107.3	52	124.4	56	134.3	56	134.3	
	52	99.3	56	109.3	60	121.6	68	135.2	72	149.6	72	150.1	

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											Table 68
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	20	19.6	22	22.5	22	23.9	24	27.3	26	29.9	26	29.9
	28	24.7	30	27.3	30	30.4	32	33.8	34	37.4	34	37.5
4	24	27.6	26	31.1	28	35.1	30	39.3	32	42.6	32	42.6
	32	33.1	34	36.4	36	40.5	38	45.1	40	49.9	40	50.0
5	28	36.0	30	40.2	32	44.9	36	51.7	38	55.8	38	55.8
	36	41.4	38	45.6	40	50.6	44	56.3	46	62.4	46	62.6
6	32	44.7	34	49.5	38	56.6	40	62.4	44	69.3	44	69.3
	40	49.6	42	54.6	46	60.7	48	67.6	52	74.8	52	75.1
7	36	53.5	38	58.9	42	66.7	46	75.0	48	80.7	50	82.8
	44	57.9	46	63.7	50	70.9	54	78.8	56	87.2	58	87.5
8	40	62.3	44	69.9	46	76.9	50	85.9	50	90.1	50	90.1
	48	66.2	52	72.9	54	81.1	58	90.1	58	97.9	58	97.9
9	44	71.1	46	77.8	50	87.0	50	93.5	50	97.1	50	97.1
	52	74.4	54	82.0	58	91.2	58	99.7	58	105.9	58	105.9
10	48	79.9	50	87.3	50	94.1	50	100.6	50	103.6	50	103.6
	56	82.7	58	91.1	58	99.8	58	107.9	58	113.1	58	113.1
11	50	87.4	50	93.8	50	100.7	50	107.0	50	109.0	50	109.0
	58	91.0	58	99.0	58	107.4	58	115.4	58	119.8	58	119.8
12	50	93.4	50	100.0	50	106.7	50	110.8	50	110.8	50	110.8
	58	98.3	58	106.1	58	114.5	58	122.2	58	125.5	58	125.5

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60											Table 69
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	16	17.7	18	20.7	20	24.1	22	27.7	22	28.2	24	30.7
	24	24.8	26	27.3	28	30.3	30	33.7	30	37.3	32	37.4
4	20	26.0	22	29.7	24	33.8	26	38.1	28	41.4	28	41.4
	28	33.0	30	36.4	32	40.5	34	45.1	36	49.9	36	50.0
5	24	34.8	26	39.1	28	43.9	32	51.1	34	55.3	34	55.3
	32	41.3	34	45.5	36	50.6	40	56.3	42	62.3	42	62.6
6	28	43.8	30	48.7	34	56.2	36	62.1	40	69.2	40	69.2
	36	49.6	38	54.6	42	60.7	44	67.6	48	74.8	48	75.0
7	32	52.9	34	58.4	38	66.5	40	73.2	44	81.0	44	81.0
	40	57.9	42	63.8	46	70.9	48	78.8	52	87.3	52	87.6
8	36	62.0	38	68.1	42	76.9	46	86.2	48	92.7	48	92.7
	44	66.1	46	72.9	50	81.0	54	90.1	56	99.7	56	100.0
9	38	69.4	42	77.9	46	87.3	50	97.4	50	102.1	50	102.1
	46	74.4	50	82.0	54	91.2	58	101.4	58	110.7	58	110.7
10	42	78.6	46	87.5	50	97.7	50	104.7	50	108.6	50	108.6
	50	82.7	54	91.1	58	101.3	58	111.4	58	118.6	58	118.6
11	46	87.6	48	95.6	50	104.5	50	111.3	50	114.2	50	114.2
	54	91.0	56	100.2	58	110.6	58	119.6	58	125.4	58	125.4
12	48	95.1	50	103.6	50	110.8	50	116.6	50	117.9	50	117.9
	56	99.3	58	108.9	58	118.3	58	126.9	58	131.3	58	131.3

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50											Table 70
	2-Row Nailing: Header											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	10	16.5	10	17.4	12	21.4	12	22.4	14	25.8	14	25.8
	16	24.7	18	27.3	20	30.3	20	33.7	22	37.3	22	37.4
4	12	23.0	14	27.3	16	31.9	16	33.4	18	37.1	18	37.1
	20	33.0	22	36.4	24	40.5	24	45.1	26	49.8	26	50.0
5	16	32.7	16	34.3	18	39.3	20	44.5	24	52.3	24	52.3
	24	41.3	24	45.5	26	50.7	28	56.3	32	62.3	32	62.5
6	18	39.5	20	44.6	22	50.0	24	55.6	28	63.8	28	63.8
	26	49.6	28	54.6	30	60.8	32	67.5	36	74.8	36	75.0
7	22	49.4	24	54.9	26	60.7	30	70.1	32	75.1	32	75.1
	30	57.9	32	63.7	34	70.9	38	78.8	40	87.2	40	87.5
8	24	56.1	28	65.1	30	71.3	34	81.1	36	86.3	36	86.3
	32	66.2	36	72.9	38	81.0	42	90.1	44	99.7	44	100.0
9	28	66.0	30	72.0	34	81.8	38	92.0	42	101.4	42	101.4
	36	74.4	38	82.0	42	91.2	46	101.4	50	112.2	50	112.6
10	30	72.4	34	82.1	38	92.3	42	102.7	46	112.3	46	112.3
	38	82.7	42	91.1	46	101.3	50	112.6	54	124.7	54	125.1
11	34	82.3	38	92.2	42	102.7	46	113.4	50	123.2	50	123.2
	42	91.0	46	100.2	50	111.4	54	123.9	58	137.1	58	137.4
12	36	88.5	40	98.7	46	113.1	50	123.9	50	125.0	50	125.0
	44	99.3	48	109.3	54	121.6	58	135.2	58	142.1	58	142.1

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50										Table 71	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	13.1	16	17.2	16	18.5	16	19.7	20	23.5	20	23.5
	28	24.7	32	27.3	32	30.3	32	33.8	36	37.3	36	37.4
4	16	20.7	20	25.6	20	27.6	24	33.3	24	33.7	24	33.7
	32	33.1	36	36.4	36	40.5	40	45.0	40	49.9	40	50.0
5	20	29.0	24	34.7	24	37.3	28	43.9	32	49.0	32	49.0
	36	41.4	40	45.5	40	50.6	44	56.3	48	62.3	48	62.5
6	24	37.7	28	44.1	32	51.2	32	54.7	36	60.3	36	60.3
	40	49.6	44	54.6	48	60.7	48	67.6	52	74.8	52	75.1
7	28	46.6	32	53.7	36	61.4	40	69.6	40	71.8	44	76.3
	44	57.9	48	63.7	52	70.9	56	78.8	56	87.2	60	87.5
8	32	55.7	36	63.3	40	71.7	44	80.6	44	83.3	44	83.3
	48	66.2	52	72.9	56	81.0	60	90.1	60	99.2	60	99.3
9	36	64.8	40	72.9	44	82.0	44	87.7	44	89.9	44	89.9
	52	74.4	56	82.0	60	91.2	60	100.7	60	107.8	60	107.8
10	40	73.8	44	82.6	44	88.6	44	94.1	44	95.6	44	95.6
	56	82.7	60	91.1	60	100.7	60	109.4	60	115.3	60	115.3
11	44	82.9	44	88.6	44	94.4	44	97.5	44	97.5	44	97.5
	60	91.0	60	99.8	60	108.8	60	117.2	60	122.2	60	122.2
12	44	88.5	44	94.1	44	97.5	44	97.5	44	97.5	44	97.5
	60	99.0	60	107.3	60	116.1	60	124.3	60	128.3	60	128.3

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 72	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	11.2	12	15.1	12	16.4	16	21.3	16	21.3	16	21.3
	24	24.8	28	27.3	28	30.3	32	33.7	32	37.3	32	37.4
4	12	18.7	16	23.7	16	25.6	20	31.5	20	31.7	20	31.7
	28	33.0	32	36.4	32	40.5	36	45.0	36	49.8	36	50.0
5	16	27.1	20	33.0	20	35.5	24	42.3	28	47.7	28	47.7
	32	41.3	36	45.5	36	50.6	40	56.3	44	62.3	44	62.5
6	20	36.0	24	42.6	28	50.0	28	53.4	32	59.2	32	59.2
	36	49.6	40	54.6	44	60.7	44	67.6	48	74.8	48	75.0
7	24	45.2	28	52.5	32	60.5	32	64.6	36	70.9	36	70.9
	40	57.9	44	63.7	48	70.9	48	78.8	52	87.3	52	87.6
8	28	54.5	32	62.4	36	71.1	40	80.2	40	82.7	40	82.7
	44	66.1	48	72.9	52	81.0	56	90.1	56	99.7	56	100.0
9	32	63.8	36	72.3	40	81.6	44	91.4	44	94.3	44	94.3
	48	74.4	52	82.0	56	91.2	60	101.4	60	111.9	60	112.1
10	36	73.2	40	82.1	44	92.1	44	97.9	44	100.1	44	100.1
	52	82.7	56	91.1	60	101.3	60	112.3	60	120.7	60	120.7
11	40	82.5	40	87.9	44	98.2	44	103.0	44	103.9	44	103.9
	56	91.0	56	100.2	60	111.3	60	121.2	60	127.9	60	127.9
12	40	87.8	44	97.7	44	103.0	44	104.0	44	104.0	44	104.0
	56	99.3	60	109.3	60	119.7	60	128.9	60	134.2	60	134.2

No of SD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 73	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	13.7	8	14.7	8	15.7	8	16.6	8	16.6	8	16.6
	16	24.7	20	27.3	20	30.3	20	33.7	24	37.3	24	37.4
4	8	17.6	8	18.8	8	19.8	8	20.1	12	26.9	12	26.9
	20	33.0	24	36.4	24	40.5	24	45.1	28	49.8	28	49.9
5	8	20.1	8	20.1	12	29.5	12	30.1	16	37.7	16	37.7
	24	41.3	24	45.5	28	50.6	28	56.3	32	62.3	32	62.5
6	12	29.9	12	30.1	16	39.6	16	40.2	20	48.6	20	48.6
	28	49.6	28	54.6	32	60.7	32	67.5	36	74.8	36	75.0
7	16	39.4	16	40.2	20	49.7	24	59.0	24	59.3	24	59.3
	32	57.9	32	63.7	36	70.9	40	78.8	40	87.2	40	87.5
8	16	40.2	20	50.2	24	59.9	28	69.6	28	69.8	28	69.8
	32	66.2	36	72.9	40	81.0	44	90.1	44	99.7	44	100.0
9	20	50.2	24	60.2	28	70.0	32	79.9	36	89.0	36	89.0
	36	74.4	40	82.0	44	91.2	48	101.4	52	112.2	52	112.6
10	24	60.2	28	70.2	32	80.2	36	90.2	40	99.6	40	99.6
	40	82.7	44	91.1	48	101.3	52	112.6	56	124.7	56	125.1
11	28	70.3	32	80.2	36	90.3	40	100.4	44	110.0	44	110.0
	44	91.0	48	100.2	52	111.4	56	123.9	60	137.1	60	137.6
12	28	70.3	32	80.3	40	100.4	44	110.4	44	110.4	44	110.4
	44	99.3	48	109.3	56	121.6	60	135.2	60	145.9	60	145.9



No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50											Table 77	
	4-Row Nailing: Column												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	12	11.5	16	15.4	16	16.3	16	17.2	20	22.1	20	22.1	
	28	24.7	32	27.3	32	30.3	32	33.8	36	37.3	36	37.4	
4	16	18.5	20	23.3	20	24.6	24	30.2	24	31.7	24	31.8	
	32	33.0	36	36.4	36	40.5	40	45.0	40	49.8	40	50.0	
5	20	26.4	24	31.9	28	38.1	28	40.1	32	47.0	32	47.1	
	36	41.4	40	45.5	44	50.6	44	56.3	48	62.3	48	62.5	
6	24	34.8	28	41.0	32	47.8	32	50.4	36	57.9	36	58.0	
	40	49.6	44	54.6	48	60.7	48	67.5	52	74.8	52	75.1	
7	28	43.6	32	50.3	36	57.8	40	65.8	44	74.2	44	74.3	
	44	57.9	48	63.7	52	70.9	56	78.8	60	87.2	60	87.5	
8	32	52.6	36	59.9	40	68.0	44	76.6	44	80.4	44	80.6	
	48	66.2	52	72.9	56	81.0	60	90.1	60	98.7	60	99.0	
9	36	61.7	40	69.5	44	78.2	44	82.5	44	86.6	44	86.7	
	52	74.4	56	82.0	60	91.2	60	100.1	60	106.4	60	106.7	
10	40	70.9	44	79.2	44	83.8	44	88.2	44	92.3	44	92.4	
	56	82.7	60	91.1	60	100.2	60	107.2	60	113.1	60	113.4	
11	44	80.0	44	84.4	44	89.2	44	97.5	44	97.5	44	97.5	
	60	91.0	60	99.5	60	107.0	60	113.6	60	119.4	60	119.6	
12	44	85.0	44	89.5	44	97.5	44	97.5	44	97.5	44	97.5	
	60	98.8	60	106.1	60	113.2	60	119.6	60	125.1	60	125.3	

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60											Table 78	
	4-Row Nailing: Column												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	8	9.5	12	13.2	12	14.0	16	18.8	16	19.8	16	19.8	
	24	24.8	28	27.3	28	30.3	32	33.7	32	37.3	32	37.4	
4	16	20.1	16	21.1	16	22.4	20	28.2	20	29.6	20	29.7	
	32	33.0	32	36.4	32	40.5	36	45.0	36	49.8	36	50.0	
5	16	24.3	20	29.9	24	36.4	24	38.4	28	45.6	28	45.7	
	32	41.3	36	45.5	40	50.6	40	56.3	44	62.3	44	62.5	
6	20	32.9	24	39.3	28	46.5	28	49.0	32	56.9	32	57.0	
	36	49.6	40	54.6	44	60.7	44	67.6	48	74.8	48	75.0	
7	24	42.0	28	49.0	32	56.8	32	59.9	36	68.4	36	68.5	
	40	57.9	44	63.7	48	70.9	48	78.8	52	87.3	52	87.6	
8	28	51.3	32	58.9	36	67.3	40	76.3	44	85.6	44	85.7	
	44	66.1	48	72.9	52	81.0	56	90.1	60	99.7	60	100.0	
9	32	60.7	36	68.8	40	77.8	44	87.3	44	91.4	44	91.6	
	48	74.4	52	82.0	56	91.2	60	101.4	60	111.6	60	111.9	
10	36	70.2	40	78.8	44	88.3	44	92.9	44	97.0	44	97.1	
	52	82.7	56	91.1	60	101.3	60	112.0	60	119.4	60	119.6	
11	40	79.6	44	88.7	44	93.6	44	98.7	44	101.9	44	101.9	
	56	91.0	60	100.2	60	111.1	60	119.4	60	125.8	60	126.0	
12	40	84.4	44	93.7	44	98.9	44	104.0	44	104.0	44	104.0	
	56	99.3	60	109.3	60	118.4	60	125.7	60	131.5	60	131.7	

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50											Table 79	
	4-Row Nailing: Column												
	Width of timber = length of SD $\varnothing$ 10mm dowels [mm]												
	80		100		120		140		160		180		
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]		
3	8	12.4	8	13.0	8	13.7	8	14.4	8	15.2	8	15.2	
	20	24.7	20	27.3	20	30.3	20	33.7	24	37.3	24	37.4	
4	8	15.7	8	16.7	8	18.9	8	20.1	12	25.3	12	25.3	
	20	33.0	24	36.4	24	40.5	24	45.1	28	49.8	28	49.9	
5	8	20.1	8	20.1	12	27.2	12	30.1	16	36.1	16	36.1	
	24	41.3	24	45.5	28	50.6	28	56.3	32	62.3	32	62.5	
6	12	28.4	12	30.1	16	37.0	20	45.6	20	47.0	20	47.0	
	28	49.6	28	54.6	32	60.7	36	67.5	36	74.8	36	75.0	
7	16	37.4	16	40.2	20	47.3	24	56.5	24	57.9	24	57.9	
	32	57.9	32	63.7	36	70.9	40	78.8	40	87.2	40	87.5	
8	16	40.2	20	49.7	24	57.7	28	67.2	28	68.6	32	77.0	
	32	66.2	36	72.9	40	81.0	44	90.1	44	99.7	48	100.0	
9	20	50.2	24	59.0	28	68.1	32	77.9	36	87.8	36	87.9	
	36	74.4	40	82.0	44	91.2	48	101.4	52	112.2	52	112.6	
10	24	60.2	28	68.7	32	78.4	36	88.4	40	98.5	40	98.6	
	40	82.7	44	91.1	48	101.3	52	112.6	56	124.7	56	125.1	
11	28	69.8	32	78.8	36	88.8	40	98.9	44	109.1	44	109.2	
	44	91.0	48	100.2	52	111.4	56	123.9	60	137.1	60	137.6	
12	28	70.3	32	80.3	40	99.0	44	110.4	44	110.4	44	110.4	
	44	99.3	48	109.3	56	121.6	60	135.2	60	145.2	60	145.4	

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50										Table 80	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 12mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	16	16.8	16	17.4	20	22.1	20	23.0	24	28.6	24	29.6
	32	32.2	32	34.5	36	37.6	36	41.2	40	45.0	40	49.2
4	24	29.6	24	30.6	24	31.8	28	38.0	32	44.7	32	46.3
	40	43.0	40	46.1	40	50.1	44	54.9	48	60.0	48	65.5
5	28	39.2	28	40.6	32	47.1	36	54.3	36	56.4	40	64.1
	44	53.8	44	57.7	48	62.7	52	68.6	52	75.2	56	81.9
6	32	49.3	36	55.8	36	58.1	40	65.8	44	73.9	44	76.7
	48	64.6	52	69.2	52	75.3	56	82.4	60	90.1	60	97.5
7	36	59.7	40	66.6	44	74.4	44	77.6	44	80.7	44	83.8
	52	75.5	56	80.7	60	87.8	60	96.0	60	101.8	60	106.2
8	40	70.1	44	77.5	44	80.7	44	84.1	44	87.4	44	90.6
	56	86.2	60	92.2	60	99.2	60	104.7	60	109.4	60	113.6
9	44	80.7	44	83.4	44	86.8	44	91.1	44	97.5	44	97.5
	60	96.8	60	101.7	60	106.9	60	111.8	60	116.3	60	120.4
10	44	86.4	44	89.2	44	95.4	44	97.5	44	97.5	44	97.5
	60	104.4	60	108.7	60	113.5	60	118.3	60	122.7	60	126.6
11	44	91.8	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5
	60	111.0	60	115.0	60	119.8	60	124.4	60	132.5	60	133.0
12	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5	44	97.5
	60	117.0	60	121.0	60	125.4	60	133.0	60	133.0	60	133.0

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60										Table 81	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 12mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	12	14.5	16	19.1	16	19.8	16	20.7	20	26.5	20	27.5
	28	32.3	32	34.5	32	37.6	32	41.1	36	45.0	36	49.2
4	20	27.6	20	28.5	20	29.7	24	36.2	28	43.3	28	44.8
	36	43.0	36	46.1	36	50.1	40	54.9	44	60.0	44	65.5
5	24	37.5	24	38.8	28	45.7	28	47.6	32	55.3	36	63.5
	40	53.8	40	57.6	44	62.7	44	68.7	48	75.1	52	81.9
6	28	47.9	28	49.6	32	57.1	36	65.2	40	73.7	40	76.3
	44	64.6	44	69.2	48	75.3	52	82.4	56	90.1	56	98.4
7	32	58.6	36	66.0	36	68.6	40	77.2	44	86.3	44	89.3
	48	75.4	52	80.7	52	87.9	56	96.1	60	105.2	60	113.0
8	36	69.4	40	77.1	44	85.8	44	89.3	44	92.6	44	95.7
	52	86.2	56	92.2	60	100.4	60	109.8	60	116.2	60	121.0
9	40	80.2	44	88.3	44	91.7	44	95.2	44	100.5	44	104.0
	56	97.0	60	103.8	60	112.2	60	118.4	60	123.4	60	127.7
10	44	91.0	44	93.9	44	97.2	44	104.0	44	104.0	44	104.0
	60	107.8	60	114.0	60	119.9	60	125.1	60	129.7	60	133.7
11	44	96.2	44	99.0	44	104.0	44	104.0	44	104.0	44	104.0
	60	116.3	60	121.0	60	126.2	60	131.1	60	135.3	60	139.2
12	44	101.8	44	104.0	44	104.0	44	104.0	44	104.0	44	104.0
	60	122.8	60	127.1	60	131.9	60	136.3	60	141.8	60	141.8

No of SD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50										Table 82	
	4-Row Nailing: Column											
	Width of timber = length of SD $\varnothing$ 12mm dowels [mm]											
	80		100		120		140		160		180	
$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	$n_N$	[kN]	
3	8	14.1	8	14.6	8	15.2	8	16.2	8	17.7	12	23.5
	20	32.2	20	34.6	24	37.6	24	41.1	24	45.1	28	49.1
4	8	19.0	12	24.5	12	25.4	12	26.3	16	34.2	16	35.2
	24	43.0	28	46.1	28	50.1	28	54.9	32	60.0	32	65.5
5	12	27.6	16	35.1	16	36.2	20	44.7	20	45.8	24	54.9
	28	53.8	32	57.6	32	62.7	36	68.6	36	75.1	40	81.9
6	16	37.8	20	46.0	20	47.1	24	56.1	28	65.5	28	66.7
	32	64.6	36	69.2	36	75.3	40	82.4	44	90.1	44	98.3
7	20	48.1	24	56.8	24	58.0	28	67.3	32	77.0	36	86.8
	36	75.4	40	80.7	40	87.9	44	96.1	48	105.2	52	114.7
8	24	58.5	28	67.6	32	77.1	32	78.3	36	88.2	40	98.1
	40	86.2	44	92.2	48	100.4	48	109.9	52	120.3	56	131.2
9	28	68.9	32	78.2	36	87.9	40	97.9	44	108.0	44	109.1
	44	97.0	48	103.8	52	113.0	56	123.6	60	135.3	60	144.2
10	32	79.3	36	88.8	40	98.6	44	108.7	44	110.4	44	110.4
	48	107.8	52	115.3	56	125.5	60	137.4	60	145.0	60	147.2
11	36	90.4	40	99.2	44	109.2	44	110.4	44	110.4	44	110.4
	52	118.5	56	126.9	60	138.1	60	145.4	60	147.7	60	149.1
12	40	100.4	44	110.4	44	110.4	44	110.4	44	110.4	44	110.4
	56	129.3	60	138.4	60	145.5	60	148.0	60	149.5	60	150.6

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50										Table 83
	4-Row Nailing: Header (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	20	13.4	20	14.4	24	17.7	24	18.6	28	21.3	
	36	21.3	36	23.5	40	26	40	28.8	44	30.2	
4	24	19.7	28	23.6	28	25.2	32	29.6	32	29.6	
	40	28.6	44	31.5	44	34.7	48	38.6	48	41.1	
5	28	26.6	32	31.1	36	36	36	38.5	40	41.7	
	44	35.5	48	39.5	52	43.7	52	47.9	56	52.1	
6	36	36.3	36	39	40	44.6	44	50.5	48	54.4	
	52	42.9	52	47.2	56	52.4	60	58	64	62.4	
7	40	43.8	44	49.5	44	53.4	48	60	52	64.3	
	56	50.2	60	55.2	60	61	64	67.5	68	73	
8	44	51.4	48	57.7	52	64.7	56	72	56	74.4	
	60	57.4	64	63.2	68	69.9	72	77.2	72	83.3	
9	48	59.1	52	66	56	73.6	60	81.7	64	87.4	
	64	64.6	68	71.1	72	78.7	76	86.9	80	93.9	
10	52	66.8	56	74.3	60	82.6	64	91.5	68	97.7	
	68	71.7	72	79	76	87.5	80	96.6	84	104.4	
11	56	74.5	60	82.6	64	91.7	68	101.3	72	108.1	
	72	78.9	76	86.9	80	96.2	84	106.2	88	114.7	
12	60	82.2	64	90.9	68	100.7	72	111.2	76	118.5	
	76	86.1	80	94.8	84	105	88	115.9	92	125.1	

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60										Table 84
	4-Row Nailing: Header (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	20	14.7	20	15.7	20	16.7	20	17.6	20	17.6	
	32	21.4	32	23.4	36	25.7	36	28.8	36	30.2	
4	20	18.8	24	22.8	24	24.4	28	29	28	29	
	36	28.6	40	31.1	40	34.9	44	38.5	44	41.6	
5	24	25.9	28	30.6	28	32.9	32	38.2	36	41.8	
	40	35.6	44	39.5	44	43.3	48	48.2	52	51.9	
6	28	33.4	32	38.8	36	44.6	36	47.8	40	51.6	
	44	42.8	48	47.4	52	52.4	52	57.7	56	62.6	
7	32	41.3	36	47.2	40	53.6	44	60.5	44	61.9	
	48	50	52	55.3	56	61.2	60	67.5	60	72.8	
8	36	49.2	40	55.7	44	62.8	48	70.4	52	75.5	
	52	57.2	56	63.2	60	70	64	77.3	68	83.2	
9	40	57.2	44	64.3	48	72.1	52	80.4	56	86	
	56	64.5	60	71.1	64	78.7	68	87	72	93.9	
10	44	65.2	48	72.9	52	81.4	56	90.4	60	96.6	
	60	71.7	64	79	68	87.5	72	96.6	76	104.4	
11	48	73.2	52	81.5	56	90.7	60	100.4	64	107.2	
	64	78.9	68	86.9	72	96.2	76	106.3	80	114.8	
12	52	81.1	56	90	60	99.9	64	110.4	68	117.8	
	68	86.1	72	94.8	76	105	80	115.9	84	125.2	

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50										Table 85
	4-Row Nailing: Header (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	20	21.5	20	22.9	20	24.3	20	25.5	20	25.9	
	20	21.5	20	22.9	20	24.3	24	29	24	30.6	
4	20	25.8	20	27.3	20	28.9	20	30.5	20	30.6	
	24	28.7	24	31.1	24	33.2	28	38.6	28	40.6	
5	20	29.9	20	31.8	20	33.8	20	35.8	20	35.8	
	28	35.5	28	39.3	28	42.3	32	48.2	32	50.9	
6	20	34.2	20	36.6	20	39.1	20	41.5	20	41.5	
	28	42	32	47.4	32	51.5	36	57.9	36	61.3	
7	20	38.8	20	41.6	20	44.5	24	52	24	52.1	
	32	49.9	36	55.2	36	60.7	40	67.6	40	71.9	
8	20	43.5	24	50.9	24	54.3	28	62.5	28	62.8	
	36	57.4	40	62.7	40	69.8	44	77.3	44	82.4	
9	24	52.3	24	55.8	28	64.2	32	73	32	73.6	
	40	64.4	40	70.8	44	78.7	48	86.9	48	93	
10	24	56.8	28	65.2	32	74.1	36	83.4	36	84.4	
	40	71.3	44	79	48	87.5	52	96.5	52	103.6	
11	28	65.7	32	74.6	36	84	40	93.9	40	95.2	
	44	78.9	48	86.9	52	96.1	56	106	56	114.2	
12	32	74.6	36	83.9	40	93.9	44	104.3	44	105.9	
	48	86	52	94.6	56	104.6	60	115.5	60	124.7	

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50									Table 86
	2-Row Nailing: Header (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	18	16.1	18	17	20	19.8	22	22.7	22	22.8
	26	21.3	26	23.5	28	26.2	30	29	30	30.7
4	22	23.3	24	26.5	26	29.9	28	33.5	28	34
	30	28.7	32	31.5	34	34.8	36	38.5	36	41.5
5	26	30.9	28	34.6	30	38.6	32	42.9	34	45.8
	34	35.9	36	39.5	38	43.7	40	48.3	42	52.2
6	30	38.7	32	43	34	47.6	36	52.5	38	55.8
	38	43	40	47.4	42	52.5	44	57.9	46	62.4
7	34	46.6	36	51.4	38	56.7	42	64	44	67.9
	42	50.1	44	55.3	46	61.2	50	67.6	52	73
8	36	53.1	40	59.9	42	65.9	46	73.7	48	78.2
	44	57.3	48	63.2	50	70	54	77.3	56	83.5
9	40	61.1	42	67.1	46	75.1	50	83.5	50	86.7
	48	64.6	50	71.1	54	78.7	58	86.9	58	93.1
10	44	69	46	75.6	50	84.2	50	90.4	50	93.1
	52	71.7	54	79	58	87.5	58	95.6	58	100.6
11	46	75.7	50	84.1	50	90.6	50	97	50	99.3
	54	78.9	58	86.9	58	95.4	58	103.2	58	107.4
12	50	83.6	50	90.1	50	96.8	50	103.3	50	105
	58	86.1	58	94.3	58	102.5	58	110.2	58	113.9

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x60									Table 87
	2-Row Nailing: Header (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	14	14.2	16	16.9	18	19.8	18	20.8	20	23.1
	22	21.2	24	23.7	26	26	26	28.6	28	31.3
4	18	21.6	20	24.9	22	28.5	24	32.2	24	32.5
	26	28.5	28	31.6	30	35	32	38.6	32	41.2
5	22	29.5	24	33.4	26	37.6	28	42	30	44.9
	30	35.8	32	39.5	34	43.7	36	48.3	38	52.2
6	26	37.7	28	42.1	30	46.9	32	51.9	34	55.3
	34	43	36	47.4	38	52.5	40	57.9	42	62.5
7	28	44.2	32	50.9	34	56.3	36	62	38	65.8
	36	50	40	55.2	42	61.2	44	67.6	46	72.9
8	32	52.6	34	58	38	65.8	40	72.1	42	76.4
	40	57.4	42	63.2	46	69.9	48	77.3	50	83.3
9	36	60.9	38	66.9	40	73.5	44	82.2	48	89.1
	44	64.5	46	71.1	48	78.6	52	86.9	56	93.8
10	38	67.6	42	75.7	44	83	48	92.3	50	97.6
	46	71.7	50	79	52	87.4	56	96.6	58	104.1
11	40	74.3	44	82.9	48	92.4	50	100.7	50	103.8
	48	78.8	52	86.9	56	96.2	58	105.9	58	112
12	44	82.6	48	91.7	50	100.2	50	107.1	50	109.6
	52	86.1	56	94.8	58	104.8	58	113.8	58	118.8

No of SDD	Characteristic Capacity - $R_{1,k}$ [C24] - CSA5.0x50									Table 88
	2-Row Nailing: Header (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	10	15.1	10	15.8	10	16.7	10	17.4	10	17.4
	14	20.5	16	23.7	16	25.3	18	28.9	18	30.1
4	10	18.3	10	19.5	12	23.4	14	27.5	14	27.5
	18	28.7	18	30.7	20	34.7	22	38.6	22	40.7
5	12	24.5	14	28.8	16	33.3	18	38	18	38.1
	20	35.4	22	39.4	24	43.7	26	48.1	26	51.4
6	16	33.7	16	35.4	18	40.3	20	45.3	22	48.9
	24	42.9	24	46.7	26	51.8	28	57.3	30	62
7	18	40	20	45.1	22	50.4	24	55.8	26	59.7
	26	50.2	28	55.3	30	61.1	32	67.4	34	72.7
8	20	46.3	22	51.6	26	60.5	28	66.3	30	70.4
	28	57	30	62.7	34	69.8	36	77.2	38	83.2
9	24	55.7	26	61.4	28	67.2	32	76.7	34	81.1
	32	64.4	34	71.1	36	78.4	40	86.9	42	93.8
10	26	61.9	28	67.7	32	77.2	36	87	38	91.7
	34	71.7	36	78.7	40	87.5	44	96.3	46	104.3
11	28	68	32	77.4	36	87.2	38	93.6	42	102.2
	36	78.6	40	86.9	44	95.8	46	105.8	50	114.8
12	32	77.4	34	83.6	38	93.6	42	103.8	46	112.7
	40	85.9	42	94.6	46	104.8	50	115.8	54	125.2

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50									
	4-Row Nailing: Column (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	8	9.3	8	10.2	12	13.5	12	14.1	16	17.1
	24	20.9	24	22.1	28	26.2	28	28	32	30.6
4	12	15.6	16	19.7	16	21.3	20	25.9	20	25.9
	28	28	32	31.5	32	34.6	36	38.5	36	41.5
5	16	22.8	20	27.7	20	29.8	24	35.3	24	35.3
	32	35.3	36	39.5	36	43.2	40	48.3	40	51.3
6	20	30.6	24	36.2	24	38.9	28	45.2	32	49.4
	36	42.7	40	47.4	40	51.9	44	57.9	48	62.3
7	24	38.6	28	44.9	28	48.2	32	55.2	36	59.7
	40	50	44	55.3	44	60.7	48	67.4	52	73
8	28	46.8	32	53.6	36	61	36	65.2	40	70.1
	44	57.3	48	63.2	52	69.6	52	77.1	56	83.5
9	32	55.1	36	62.4	40	70.4	40	75.2	44	80.6
	48	64.6	52	71	56	78.4	56	86.7	60	93.8
10	36	63.4	40	71.2	40	76.4	44	85.2	44	86.7
	52	71.7	56	78.8	56	87.2	60	96.3	60	102.1
11	36	68.5	40	76.8	44	85.8	44	91.4	44	92.5
	52	78.6	56	86.7	60	96	60	104.4	60	109.3
12	40	76.8	44	85.6	44	91.5	44	96.4	44	96.9
	56	85.9	60	94.8	60	103.5	60	111.7	60	115.9

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60									
	4-Row Nailing: Column (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	8	9.8	8	10.6	8	11.6	8	12.2	12	15
	20	19.7	24	23.7	24	25.5	24	27	28	31.3
4	8	13.9	12	17.8	12	19.3	16	23.8	16	23.8
	24	27.1	28	31.6	28	34.1	32	38.6	32	41.2
5	12	21	16	25.9	16	27.9	20	33.5	20	33.5
	28	34.8	32	39.5	32	42.9	36	48.3	36	51.2
6	16	28.8	20	34.6	20	37.1	24	43.7	24	43.7
	32	42.5	36	47.4	36	51.8	40	57.9	40	61.4
7	20	37	24	43.5	24	46.6	28	53.9	32	58.8
	36	50	40	55.2	40	60.7	44	67.6	48	72.5
8	24	45.4	28	52.5	28	56.2	32	64.1	36	69.4
	40	57.4	44	62.9	44	69.7	48	77.2	52	83.2
9	28	54	28	57.8	32	65.9	36	74.4	40	80.1
	44	64.5	44	70.7	48	78.6	52	86.9	56	93.8
10	28	58.9	32	66.9	36	75.6	40	84.7	44	90.8
	44	71.3	48	78.9	52	87.4	56	96.6	60	104.3
11	32	67.5	36	76	40	85.2	44	94.9	44	96.5
	48	78.8	52	86.9	56	96.2	60	106.3	60	113.5
12	36	76	40	85.1	44	94.8	44	100.4	44	101.5
	52	86.1	56	94.8	60	104.9	60	114.9	60	120.8

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50									
	4-Row Nailing: Column (Slope = 0)									
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]									
	93		113		133		153		173	
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	
3	8	12.4	8	13.2	8	14	8	14.6	8	14.6
	16	18.1	16	23.7	16	25.3	16	26.5	16	26.9
4	8	15.8	8	16.9	8	18.1	8	18.8	8	18.8
	16	26.6	16	28	20	34.7	20	36.8	20	37.6
5	8	19.3	8	20.1	8	17.7	8	17.7	8	17.7
	20	35.3	20	37.4	24	43.7	24	47.1	24	48.4
6	8	20.1	8	20.1	12	30.1	12	28.1	12	28.1
	24	42.9	24	46.6	28	50.6	28	57.3	28	59.3
7	8	20.1	12	30.1	12	30.1	16	40	16	40
	24	48.4	28	55.3	28	59.3	32	67.3	32	70.1
8	12	30.1	16	39.9	16	37.7	20	50.2	20	50.2
	28	57	32	62.3	32	69	36	77.2	36	80.8
9	16	39	16	40.2	20	46.5	24	60.2	24	60.2
	32	64.5	32	69.8	36	78.4	40	86.9	40	91.5
10	16	40.2	20	50.2	24	59.2	28	70.2	28	70.2
	32	70.3	36	78.7	40	87.5	44	96.3	44	102.1
11	20	50.2	24	60	28	69.8	32	80.2	32	80.2
	36	78.6	40	86.9	44	95.8	48	105.2	48	112.7
12	24	58.4	28	69.5	28	68.7	32	76.3	36	90.2
	40	86	44	93.5	44	103.1	48	113.8	52	123.3

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x50										Table 92
	2-Row Nailing: Column (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	10	12.5	12	15.4	12	16.3	14	19.4	14	19.4	
	18	21.1	20	23.7	20	25.6	22	28.9	22	30.1	
4	14	20.3	16	23.8	16	25.1	18	28.9	20	31.7	
	22	28.6	24	31.5	24	34.4	26	38.3	28	41.7	
5	18	28.5	18	30.2	20	34.3	22	38.7	22	38.9	
	26	35.7	26	39	28	43.3	30	47.9	30	49.9	
6	20	34.7	22	39.1	22	41.2	22	43.3	22	43.3	
	28	42.9	30	47.3	30	50.8	30	53.7	30	54.7	
7	22	40.9	22	43.2	22	45.4	22	47.2	22	47.2	
	30	49.4	30	52.6	30	55.7	30	58.5	30	59.1	
8	22	44.7	22	46.9	22	48.6	22	48.3	22	48.3	
	30	54	30	57	30	60.1	30	62.8	30	63	
9	22	47.8	22	48.6	22	45.1	22	45.1	22	45.1	
	30	58	30	61.1	30	63.9	30	66	30	66	
10	22	45.3	22	48.8	22	48.8	22	48.8	22	48.8	
	30	61.8	30	64.6	30	66.4	30	65.2	30	65.2	
11	22	48.8	22	48.8	20	44.3	20	44.3	20	44.3	
	30	64.9	30	66.5	28	60.7	28	60.7	28	60.7	
12	22	48.8	22	48.8	22	48.8	22	48.8	22	48.8	
	30	66.5	30	66.5	30	66.5	30	66.5	30	66.5	

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CNA4.0x60										Table 93
	2-Row Nailing: Column (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	8	11.5	10	14.4	10	15.3	12	18.5	12	18.5	
	16	20.9	18	23.7	18	25.5	20	28.9	20	30.2	
4	12	19.4	12	20.6	14	24.4	16	28.4	16	28.4	
	20	28.7	20	30.7	22	34.6	24	38.6	24	40.4	
5	14	25.5	16	29.6	18	34	20	38.5	22	41.8	
	22	35.3	24	39.3	26	43.7	28	48.3	30	52	
6	18	34.3	20	38.9	22	43.7	22	45.8	22	45.9	
	26	43	28	47.4	30	52.5	30	56.7	30	58.5	
7	20	40.6	22	45.5	22	47.8	22	49.7	22	49.7	
	28	49.9	30	55	30	58.7	30	61.8	30	62.8	
8	22	46.9	22	49.2	22	51.1	22	52	22	52	
	30	56.5	30	60.1	30	63.3	30	66.1	30	66.6	
9	22	50.1	22	51.8	22	50.7	22	45.1	22	45.1	
	30	61	30	64.2	30	67.2	30	69.5	30	69.6	
10	22	52	22	52	22	52	22	52	22	52	
	30	64.8	30	67.7	30	70.1	30	70.9	30	70.9	
11	22	51.8	22	52	22	52	22	52	22	52	
	30	68.1	30	70.3	30	70.5	30	62.3	30	62.3	
12	22	52	22	52	22	52	22	52	22	52	
	30	70.4	30	70.2	30	68.7	30	68.7	30	68.7	

No of SDD	Characteristic Capacity - $R_{1,k}$ [CLT] - CSA5.0x50										Table 94
	2-Row Nailing: Column (Slope = 0)										
	Width of timber = length of SDD $\varnothing$ 7.5mm dowels [mm]										
	93		113		133		153		173		
$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]	$n_N$	$F_k$ [kN]
3	4	9	4	9.6	4	10	6	13.5	6	13.5	
	10	18.8	12	23	12	23.9	14	28.3	14	28.9	
4	6	14.3	6	14.9	8	19.1	10	23.3	10	23.3	
	14	28.3	14	29.5	16	34.1	18	38.6	18	39.7	
5	8	19.7	10	24.2	12	28.9	12	29.4	14	33.6	
	16	34.6	18	39.1	20	43.7	20	45.8	22	50.5	
6	10	25	12	29.8	14	34.7	16	39.5	18	43.9	
	18	40.7	20	45.7	22	50.9	24	56.2	26	61.1	
7	14	34.7	16	39.6	18	44.7	20	49.7	22	54.2	
	22	49.9	24	55.1	26	60.8	28	66.5	30	71.6	
8	16	40	18	45	22	54.7	22	55.1	22	55.1	
	24	56.2	26	61.7	30	69.7	30	73	30	73.5	
9	20	49.8	22	55	22	55.2	22	54.9	22	54.9	
	28	64.2	30	71	30	73.4	30	74.5	30	74.7	
10	22	55.1	22	55.1	22	54.1	22	52.8	22	52.8	
	30	71.4	30	73.6	30	74.7	30	75.3	30	75.3	
11	22	55	22	55.2	22	55.2	22	55.2	22	55.2	
	30	73.7	30	74.8	30	75.3	30	75.1	30	75.1	
12	22	55.2	22	55.2	22	55.2	22	55.2	22	55.2	
	30	74.8	30	75.3	30	74.9	30	73.7	30	73.7	

Model	Height	Fasteners		Characteristic Capacity - Tension - C24/CLT [kN]	Table 95
		Header CNA4.0x50	Joist SDD $\varnothing 7.5\text{mm}$	Width of timber = length of SDD $\varnothing 7.5\text{mm}$ dowels [mm]	
BTALU 120	120	20 (9)	3	8.82	
BTALU 160	160	28 (13)	4	12.74	
BTALU 200	200	36 (17)	5	16.66	
BTALU 240	240	44 (21)	6	20.58	
BTALU 280	280	52 (25)	7	24.5	
BTALU 320	320	60 (29)	8	28.42	
BTALU 360	360	68 (33)	9	32.34	
BTALU 400	400	76 (37)	10	36.26	
BTALU 440	440	84 (41)	11	40.18	
BTALU 480	480	92 (45)	12	44.1	
BTALU 520	520	100 (49)	12	48.02	
BTALU 560	560	108 (53)	12	51.94	
BTALU 600	600	116 (57)	12	55.86	
BTALU 1200	1200	236 (117)	28	114.66	

(1) the number between () is the number of nails considered for calculation.

Model	Height	Fasteners		Characteristic Capacity - Tension - C24/CLT [kN]	Table 96
		Header CNA4.0x60	Joist SDD $\varnothing 7.5\text{mm}$	Width of timber = length of SDD $\varnothing 7.5\text{mm}$ dowels [mm]	
BTALU 120	120	20 (9)	3	11.07	
BTALU 160	160	28 (13)	4	15.99	
BTALU 200	200	36 (17)	5	20.91	
BTALU 240	240	44 (21)	6	25.83	
BTALU 280	280	52 (25)	7	30.75	
BTALU 320	320	60 (29)	8	35.67	
BTALU 360	360	68 (33)	9	40.59	
BTALU 400	400	76 (37)	10	45.51	
BTALU 440	440	84 (41)	11	50.43	
BTALU 480	480	92 (45)	12	55.35	
BTALU 520	520	100 (49)	12	60.27	
BTALU 560	560	108 (53)	12	62.61	
BTALU 600	600	116 (57)	12	62.61	
BTALU 1200	1200	236 (117)	28	143.91	

(1) the number between () is the number of nails considered for calculation.

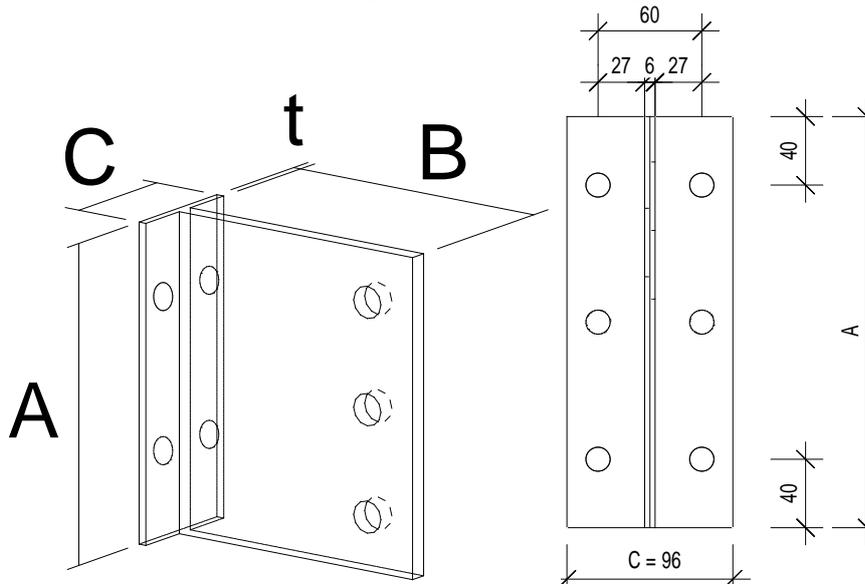
Model	Height	Fasteners		Characteristic Capacity - Tension - C24/CLT [kN]	Table 97
		Header CSA5.0x50	Joist SDD $\varnothing 7.5\text{mm}$	Width of timber = length of SDD $\varnothing 7.5\text{mm}$ dowels [mm]	
BTALU 120	120	20 (9)	3	15.65	
BTALU 160	160	28 (13)	4	20.87	
BTALU 200	200	36 (17)	5	26.09	
BTALU 240	240	44 (21)	6	31.31	
BTALU 280	280	52 (25)	7	36.52	
BTALU 320	320	60 (29)	8	41.74	
BTALU 360	360	68 (33)	9	46.96	
BTALU 400	400	76 (37)	10	52.18	
BTALU 440	440	84 (41)	11	57.39	
BTALU 480	480	92 (45)	12	62.61	
BTALU 520	520	100 (49)	12	62.61	
BTALU 560	560	108 (53)	12	62.61	
BTALU 600	600	116 (57)	12	62.61	
BTALU 1200	1200	236 (117)	28	146.09	

(1) the number between () is the number of nails considered for calculation.

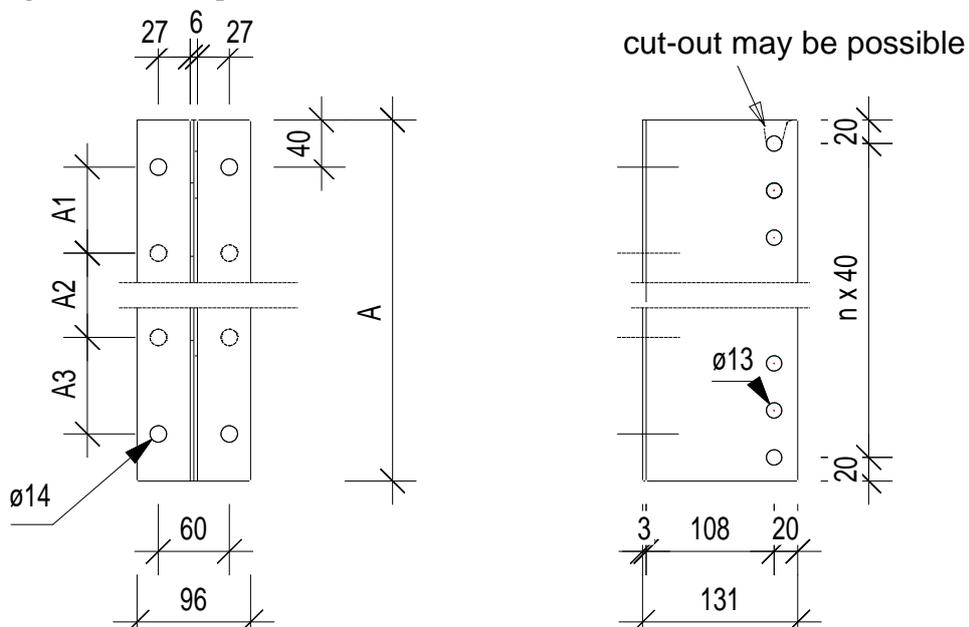
**D5 BTCx**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
BTCx				BTCx	

**Figure D5-1: Dimension drawing of concealed joist hangers**



**Figure D5-2: Size specification**



**Table D5-1: Size specification**

Model	A [mm]	A1 [mm]	A2 [mm]	A3 [mm]	B [mm]	C [mm]	t [mm]	No of Holes	
								Ø14mm Anchor	Ø13mm Dowel
BTC120	120				128	96	3	2	3
BTC160	160	80			128	96	3	3	4
BTC200	200	120			128	96	3	3	5
BTC240	240	160			128	96	3	3	6
BTC280	280	100	100		128	96	3	6	7
BTC320	320	120	120		128	96	3	6	8
BTC360	360	140	140		128	96	3	6	9
BTC400	400	120	120	80	128	96	3	8	10
BTC440	440	120	120	120	128	96	3	8	11
BTC480	480	120	120	160	128	96	3	8	12
BTC520	520	160	160	120	128	96	3	8	13
BTC560	560	160	160	160	128	96	3	8	14
BTC600	600	160	160	200	128	96	3	8	15

**Table D5-2: Material specification**

Material thickness	Material Grades	Coating Specification
3	S250 GD	Z275
3	stainless steel (as described)	

For installation for fire justification, see clause B6

**Table D5-3: Characteristic capacities  $R_{1,k}$  and  $R_{2,k}$** 

The tables are based on a slope of  $0^\circ$

For other configurations the following modification are necessary:

$\beta =$	$0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$
factor	1	0.95	0.9	0.85

only for less as 7 SD, for 7 or more SD no reducing is necessary

Characteristic capacity  $R_{1,k}$  and  $R_{2,k}$  [kN]

Number of SD	Characteristic Capacity $R_{1,k}$ & $R_{2,k}$ [kN] for b b = min width [mm] of timber and length of dowel					
	80	100	120	140	160	180
3	11.5	12.7	14.2	15.8	17.2	
4	18.5	20.4	22.8	25.3	27.2	
5	26.7	29.4	32.7	36.4	40.3	
6	35.8	39.4	43.8	48.6	53.8	54.3
7	45.6	50.1	55.6	61.7	68.3	69.4
8	56.0	61.4	68.1	75.5	83.4	85.5
9	66.8	73.1	80.9	89.6	99.0	102.2
10	77.9	85.1	94.0	104.1	114.8	119.5
11	89.1	97.2	107.3	118.7	130.9	133.3
12	100.5	109.5	120.7	133.4	147.0	147.0

SD = Steel Dowel

The topmost steel dowel in the cut out hole shall not be considered for  $R_{2,k}$

For using steel dowels with a length of 60mm the values for steel dowel with 80mm may be multiplied by 0,95.

The necessary capacity of the bolts should be calculated as:

$$R_{bolt,lat,d} \geq \frac{F_{1,d}}{n}$$

For the upper bolts additional:

$$R_{bolt,ax,d} \geq \frac{F_{1,d} \times 14,4}{d}$$

With:

$R_{bolt,lat,d}$  design capacity of one anchor bolt for shear load, but max. 14,0 kN

$R_{bolt,ax,d}$  design capacity of one anchor bolt for tension load

d height of the BTC -10mm [mm]

n number of anchor bolts

**Table D5-4: Characteristic capacities  $R_{3,k}$** 

It is assumed that the force  $F_3$  is action at the top of the BTC. For a force  $F_3$  with a lower distance to the middle of the BTC, the same capacities may be to use

Type	Quantity		Joist Min. b/h [mm]	without screws - [C24]						
	SD	Bolts		$R_{3,k}$ [kN] for b =						
				60	80	100	120	140	160	180
BTC120	3	2	... / 160	2.6	2.9	3.5	4.0	4.5	5.2	5.3
BTC160	4	4	... / 200	3.2	3.9	4.4	5.0	5.9	6.5	7.0
BTC200	5	4	... / 240	4.0	4.9	5.5	6.3	7.2	7.8	8.8
BTC240	6	4	... / 280	4.8	5.7	6.6	7.5	8.4	9.1	10.4
BTC280	7	6	... / 320	5.6	6.5	7.6	8.7	9.6	10.4	11.9
BTC320	8	6	... / 360	6.4	7.3	8.6	9.7	10.8	11.8	13.4
BTC360	9	6	... / 400	7.2	8.1	9.5	10.8	12.0	13.2	14.9
BTC400	10	8	... / 440	8.0	8.9	10.5	11.9	13.2	14.7	16.4
BTC440	11	8	... / 480	8.8	9.7	11.4	13.0	14.4	16.1	17.8
BTC480	12	8	... / 520	9.6	10.6	12.4	14.1	15.6	17.6	19.3
BTC520	12	8	... / 560	10.4	11.4	13.3	15.1	16.8	19.1	20.8
BTC560	12	8	... / 600	11.2	12.3	14.3	16.2	18.0	20.5	22.3
BTC600	12	8	... / 640	12.0	13.2	15.2	17.3	19.2	22.0	23.8

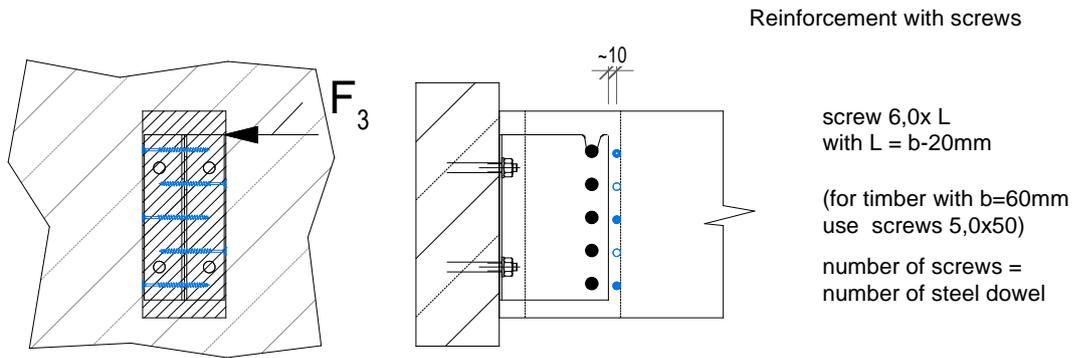
SD = steel dowel

**Table D5-5: Characteristic capacities  $R_{3,k}$  with screws for reinforcement**

It is assumed that the force  $F_3$  is in action at the top of the BTC. For a force  $F_3$  with a lower distance to the middle of the BTC, the same capacities may be to use

Type	Quantity		Joist Min. b/h [mm]	with screws* - [C24]						
	SD	Bolts		$R_{3,k}$ [kN] for b =						
				60	80	100	120	140	160	180
BTC120	3	2	... / 160	2.6	2.9	4.4	5.3	5.3	5.3	5.3
BTC160	4	4	... / 200	3.2	4.3	6.6	7.0	7.0	7.0	7.0
BTC200	5	4	... / 240	4.0	5.5	8.6	8.8	8.8	8.8	8.8
BTC240	6	4	... / 280	4.8	6.3	8.8	10.6	10.6	10.6	10.6
BTC280	7	6	... / 320	5.6	6.8	9.6	12.3	12.3	12.3	12.3
BTC320	8	6	... / 360	6.4	7.5	10.1	14.1	14.1	14.1	14.1
BTC360	9	6	... / 400	7.2	8.1	11.0	15.2	15.8	15.8	15.8
BTC400	10	8	... / 440	8.0	8.9	11.0	15.2	17.6	17.6	17.6
BTC440	11	8	... / 480	8.8	9.7	12.1	16.1	19.3	19.3	19.3
BTC480	12	8	... / 520	9.6	10.6	12.8	17.1	21.1	21.1	21.1
BTC520	12	8	... / 560	10.4	11.4	13.3	17.1	22.9	22.9	22.9
BTC560	12	8	... / 600	11.2	12.3	14.3	17.6	24.6	24.6	24.6
BTC600	12	8	... / 640	12.0	13.2	15.2	18.8	24.6	26.4	26.4

\* See clause C.2



The connection of the bolts to the concrete must be checked:

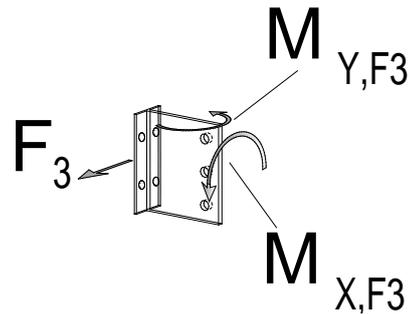
The bolt group must be able to resist the min :

$$F_{3,d} \text{ [kN]}$$

$$M_{Y,F3,d} = F_{3,d} \times 40 \text{ mm [kNmm]}$$

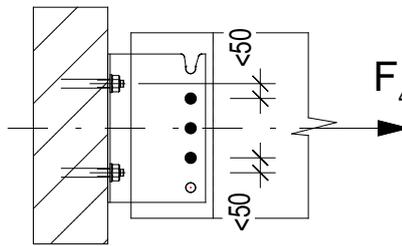
$$M_{X,F3,d} = F_{3,d} \times (A/2) \text{ [kNmm]} ,$$

with A = the height of the BTC [mm]



**Table D5-6: Characteristic capacities F4,k**

Number of bolts	R4,k [kN]	min no of dowels
2	6.7/kmod	3
4	13.4/kmod	3
6	20.1/kmod	5
8	26.8/kmod	6



The force is acting in the middle of the joist.

The dowel and anchor bolts should be placed symmetrical to the centreline of the joist, and with a max distance of the anchor to the dowel of 50mm.

It should be checked, that the capacity of bolt is:  $R_{bolt,ax,d} \geq \frac{F_{4,d} \times 1,44}{n_b}$

Where:

$R_{bolt,ax,d}$  the axial design capacity of each anchor bolts / bolts

$n_b$  the number of anchor bolts / bolts

$F_{4,d}$  the design load in direction of the joist

For combination it should be checked:

$$\left( \frac{F_{1or2,d}}{R_{1or2,d}} \right)^2 + \left( \frac{F_{3,d}}{R_{3,d}} \right)^2 + \left( \frac{F_{4,d}}{R_{4,d}} \right)^2 \leq 1$$

$$\left(\frac{F_{1,d}}{R_{1,d}}\right)^2 + \left(\frac{F_{2,d}}{R_{2,d}}\right)^2 + \left(\frac{F_{3,d}}{R_{3,d}}\right)^2 + \left(\frac{F_{4,d}}{R_{4,d}}\right)^2 \leq 1$$

$F_1$  and  $F_2$  have to be considered independently

The anchor bolts should be checked separately for the combination of loads.

**Table D5-7** Characteristic capacities  $R_{1,k}$  and  $R_{2,k}$  – BTC with SSH screws

Model	Fasteners				Characteristic Capacity - [C24]							
	Header		Joist		R1,k	R2,k						
	Qty	Type	Qty	Type		Width of timber = length of dowels [mm]						
						60	80	100	120	140	160	
BTC120	2	SSH12,0x60	3	STD12	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
BTC160	4	SSH12,0x60	4	STD12	20.1	18.1	18.3	18.7	19.0	19.4	19.6	19.6
BTC200	4	SSH12,0x60	5	STD12	20.1	19.6	19.8	20	20.1	20.1	20.1	20.1
BTC240	4	SSH12,0x60	6	STD12	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
BTC280	6	SSH12,0x60	7	STD12	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2
BTC320	6	SSH12,0x60	8	STD12	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2
BTC360	6	SSH12,0x60	9	STD12	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2
BTC400	8	SSH12,0x60	10	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
BTC440	8	SSH12,0x60	11	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
BTC480	8	SSH12,0x60	12	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
BTC520	8	SSH12,0x60	12	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
BTC560	8	SSH12,0x60	12	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
BTC600	8	SSH12,0x60	12	STD12	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2

**Table D5-8** Characteristic capacities  $R_{3,k}$  – BTC with SSH screws

Model	Fasteners				Characteristic Capacity - [C24]							
	Header		Joist		R3,k							
	Qty	Type	Qty	Type	Length of Dowels [mm]							
					60	80	100	120	140	160	180	200
BTC120	2	SSH12,0x60	3	STD12	1.8	2.4	3	3.6	4.2	4.9	5.5	6.2
BTC160	4	SSH12,0x60	4	STD12	2.5	3.2	3.9	4.7	5.5	6.3	7.1	7.9
BTC200	4	SSH12,0x60	5	STD12	3	3.8	4.7	5.7	6.6	7.6	8.6	9.5
BTC240	4	SSH12,0x60	6	STD12	3.3	4.3	5.3	6.4	7.6	8.7	9.8	11.0
BTC280	6	SSH12,0x60	7	STD12	4.1	5.2	6.4	7.7	8.9	10.2	11.5	12.8
BTC320	6	SSH12,0x60	8	STD12	4.7	5.9	7.2	8.7	10.1	11.5	13	14.4
BTC360	6	SSH12,0x60	9	STD12	4.9	6.3	7.8	9.4	11	12.6	14.2	15.8
BTC400	8	SSH12,0x60	10	STD12	5.7	7.3	8.9	10.6	12.3	14.1	15.9	17.6
BTC440	8	SSH12,0x60	11	STD12	6.3	8	9.7	11.6	13.5	15.4	17.3	19.3
BTC480	8	SSH12,0x60	12	STD12	6.6	8.4	10.3	12.4	14.4	16.5	18.6	20.7
BTC520	8	SSH12,0x60	12	STD12	6.8	8.8	10.9	13.1	15.4	17.6	19.9	22.1
BTC560	8	SSH12,0x60	12	STD12	7.1	9.3	11.5	13.9	16.3	18.7	21.1	23.6
BTC600	8	SSH12,0x60	12	STD12	7.4	9.7	12.1	14.6	17.2	19.8	22.4	25

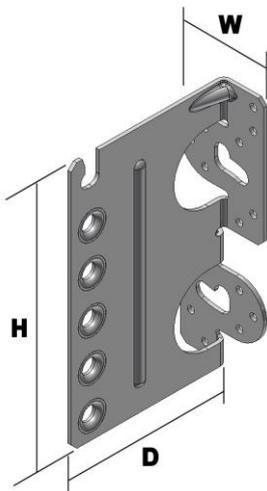
**Table D5-9** Characteristic capacities  $R_{4,k}$  BTC with SSH screws

Model	Fasteners				Characteristic Capacity - [C24] - $R_{4,k}$
	Header		Joist		
	Qty	Type	Qty	Type	
	BTC120	2	SSH12.0x60	3	
BTC160	4	SSH12.0x60	4	STD12	10/kmod
BTC200	4	SSH12.0x60	5	STD12	12.6/kmod
BTC240	4	SSH12.0x60	6	STD12	12.6/kmod
BTC280	6	SSH12.0x60	7	STD12	17.6/kmod
BTC320	6	SSH12.0x60	8	STD12	20.2/kmod
BTC360	6	SSH12.0x60	9	STD12	20.2/kmod
BTC400	8	SSH12.0x60	10	STD12	25.2/kmod
BTC440	8	SSH12.0x60	11	STD12	27.8/kmod
BTC480	8	SSH12.0x60	12	STD12	27.8/kmod
BTC520	8	SSH12.0x60	12	STD12	27.8/kmod
BTC560	8	SSH12.0x60	12	STD12	27.8/kmod
BTC600	8	SSH12.0x60	12	STD12	27.8/kmod

**D6 CBH**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
CBH xxx/2.5					
CBH xxx/3					

xxx = size of CBH

**Figure D6-1: Drawings****Table D6-1: Dimensions and number of fastener**

Model	W [mm]	H [mm]	D [mm]	Thickness [mm]	Skew Angle	
					Degree	Direction
CBH105/2,5	40	105	100	2.5	90°	~
CBH105/3	40	105	103,5	3	90°	~
CBH150/2,5	60	150	113,5	2.5	90°	~
CBH150/3	60	150	117	3	90°	~
CBH180/2,5	60	180	113,5	2.5	90°	~
CBH180/3	60	180	117	3	90°	~
CBH220/2,5	60	220	113,5	2.5	90°	~
CBH220/3	60	220	117	3	90°	~

Model	Header fasteners		Joist Fasteners
	Nails or Screws*	Bolts Anchors Wood Screws	Ø10.0 SD Dowels
CBH105/2,5	8	2 x Ø8	3
CBH105/3	8	2 x Ø8	3
CBH150/2,5	14	2 x Ø10	5
CBH150/3	14	2 x Ø10	5
CBH180/2,5	16	2 x Ø10	6
CBH180/3	16	2 x Ø10	6
CBH220/2,5	22	2 x Ø10	7
CBH220/3	22	2 x Ø10	7

\* According to ETA 04/0013 or according to EN14592

Washer for a wood/ rigid support connection.

The minimum dimension has to be used:

Bolt Ø10 + Washer M10 (Øext = 20 – Øint = 11mm)

Bolt Ø8 + Washer M8 (Øext = 16 – Øint = 8,5mm) for CBH105

**Table D6-2: Material specification**

Material thickness	Material Grades	Coating Specification
2.5	S250 GD	Z275 or ZM310
2.5	stainless steel (as described)	

For installation for fire justification, see clause B6

**Table D6-3: Characteristic capacities  $R_{1,k}$  [kN] timber to timber:**

Characteristic value [kN] of a CBH concealed Joist hangers for connections between timber header beam and timber supported joist. Header fastener: CNA4,0x60.

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Timber header & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 0^\circ$						$\beta = 5^\circ$						$\beta = 10^\circ$					
CBH150	18	18.6	20.7	22.4	24	24.0	17.8	18.4	20.3	22	23.8	23.8	17.5	18.1	20.0	21.6	23.4	23.5
CBH180	25	26.4	29.5	32.1	32.6	32.6	24.7	26.1	29.1	31.6	32.4	32.4	24.3	25.6	28.5	31	32.1	32.1
CBH220	32.6	34.2	37.9	41.1	42.8	42.8	32.2	33.7	37.3	40.4	42.4	42.4	31.8	33.2	36.6	39.7	42	42.0

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Timber header & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 15^\circ$						$\beta = 20^\circ$						$\beta = 25^\circ$					
CBH150	17.3	17.9	19.6	21.2	22.9	23.3	17.1	17.6	19.3	20.8	22.4	23	16.9	17.4	19	20.4	22	22.7
CBH180	24	25.2	28	30.5	31.8	31.8	23.6	24.8	27.5	29.9	31.4	31.4	23.4	24.5	27	29.3	31.1	31.1
CBH220	31.4	32.7	35.9	38.9	41.6	41.6	31	32.3	35.3	38.2	41.1	41.1	30.7	31.8	34.8	37.5	40.4	40.7

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Timber header & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 30^\circ$						$\beta = 35^\circ$						$\beta = 40^\circ$					
CBH150	16.7	17.2	18.7	20.1	21.6	22.5	16.6	17	18.4	19.8	21.2	22.3	16.5	16.8	18.2	19.5	20.9	22.1
CBH180	23.1	24.1	26.6	28.8	30.8	30.8	22.8	23.8	26.2	28.4	30.5	30.5	22.7	23.6	25.9	28	30.1	30.3
CBH220	30.4	31.5	34.3	37	39.7	40.4	30.1	31.2	33.9	36.5	39.1	40	30	31	33.6	36.1	38.7	39.8

Model	Characteristic Capacity - $R_{1,k}$ [C24] -					
	CBH: Timber header & Timber					
	Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
Slope	$\beta = 45^\circ$					
CBH150	16.3	16.7	18	19.3	20.6	21.9
CBH180	22.5	23.4	25.6	27.6	29.7	30.1
CBH220	29.8	30.8	33.3	35.7	38.3	39.5

Intermediary values can be determined by interpolation.

The capacities for  $R_{2,k}$  shall be modified in relation to one steel dowel less, mean e.g. for a CBH150 with 5 steel dowel, the uplift capacity shall be reduced to:  $(5-1) / 5 = 0,80$ .

The topmost steel dowel in the cut out hole shall not be considered.

**Table D6-4: Characteristic capacities  $R_{1,k}$  [kN] timber to steel/concrete:**

Characteristic values [kN] for connection where the CBH joist hanger is bolted to a steel or reinforced concrete structural member and carrying a timber supported joist.

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Bolted to a steel, or reinforced concrete header & Timber Supported Joist																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 0^\circ$						$\beta = 5^\circ$						$\beta = 10^\circ$					
CBH150	12.4	13.2	15.6	17.7	19.5	19.5	12.2	13	15.2	17.3	19.3	19.3	12	12.7	14.9	16.9	19	19
CBH180	19.3	21.1	25.2	28.8	29.7	29.7	18.9	20.7	24.6	28.1	29.2	29.2	18.5	20.2	23.9	27.4	28.8	28.8
CBH220	23.8	25.9	30.6	34.9	37.1	37.1	23.4	25.4	29.8	34	36.6	36.6	22.9	24.8	29	33	36	36

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Bolted to a steel, or reinforced concrete header & Timber Supported Joist																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 15^\circ$						$\beta = 20^\circ$						$\beta = 25^\circ$					
CBH150	11.7	12.4	14.5	16.4	18.4	18.7	11.5	12.1	14.1	15.9	17.9	18.3	11.3	11.8	13.7	15.4	17.3	18
CBH180	18.2	19.7	23.3	26.6	28.3	28.3	17.8	19.2	22.6	25.8	27.8	27.8	17.4	18.8	22	25	27.3	27.3
CBH220	22.4	24.2	28.2	32.1	35.3	35.3	22	23.6	27.4	31.1	34.7	34.7	21.5	23	26.7	30.2	34	34.1

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Bolted to a steel, or reinforced concrete header & Timber Supported Joist																	
	Width of timber = length of dowels [mm]																	
	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
Slope	$\beta = 30^\circ$						$\beta = 35^\circ$						$\beta = 40^\circ$					
CBH150	11	11.6	13.4	15	16.8	17.7	10.8	11.3	13	14.6	16.3	17.4	10.7	11.1	12.7	14.2	15.9	17.1
CBH180	17	18.3	21.4	24.3	26.8	26.8	16.7	17.9	20.9	23.6	26.4	26.4	16.4	17.6	20.4	23.1	26	26
CBH220	21.1	22.5	26	29.4	33	33.5	20.7	22.1	25.4	28.6	32.2	33	20.4	21.7	24.9	28	31.4	32.6

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CBH: Bolted to a steel, or reinforced concrete header & Timber Supported Joist					
	Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
Slope	$\beta = 45^\circ$					
CBH150	10.5	10.9	12.5	13.9	15.5	16.9
CBH180	16.2	17.3	20	22.6	25.4	25.7
CBH220	20.1	21.3	24.4	27.4	30.8	32.2

2. Max characteristic capacity [kN] of the steel part  $F_{k,steel}$

Model	$F_{k,steel}$
CBH150	15.9
CBH180	23.3
CBH220	26.1

3. Design capacity of the CBH –  $F_{d,CBH}$

$$F_{d,CBH} = \min \left\{ \begin{array}{l} \frac{F_{k,dowels} \times k_{mod}}{\gamma_M} \\ \frac{F_{k,steel}}{\gamma_M} \end{array} \right.$$

**Table D6-5: Characteristic capacities timber to timber CBH105:**

R1,k [kN]	Width of timber = length of steel dowels [mm]		
	45	50	60
CNA 4.0x40	8.9	8.9	9.2
CNA 4.0x50	9.6	9.6	9.9
CNA 4.0x60	min. of: 10.2 ; 11.2/kmod	min. of: 10.3 ; 11.2/kmod	min. of: 10.5 ; 11.2/kmod
CSA 5.0x35	min. of: 10.6 ; 11.2/kmod	min. of: 10.6 ; 11.2/kmod	min. of: 10.8 ; 11.2/kmod
CSA 5.0x40	min. of: 12 ; 11.2/kmod	min. of: 12 ; 11.2/kmod	min. of: 12.2 ; 11.2/kmod
CSA 5.0x50	min. of: 13.6 ; 11.2/kmod	min. of: 13.7 ; 11.2/kmod	min. of: 13.8 ; 11.2/kmod

**Table D6-6: Characteristic capacities timber to timber CBH105:**

R2,k [kN]	Width of timber = length of steel dowels [mm]		
	45	50	60
CNA 4.0x40	6.4	6.5	6.6
CNA 4.0x50	7.1	7.2	7.3
CNA 4.0x60	7.7	7.8	7.9
CSA 5.0x35	8.4	8.5	8.6
CSA 5.0x40	9.8	9.8	9.9
CSA 5.0x50	min. of: 11.5 ; 11.2/kmod	min. of: 11.5 ; 11.2/kmod	min. of: 11.6 ; 11.2/kmod

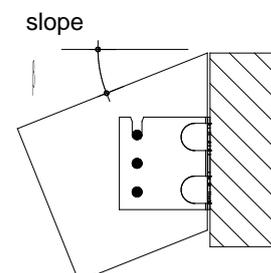
**Table D6-7: Characteristic capacities timber to steel/concrete CBH105/2,5:**

[kN]	Width of timber = length of steel dowels [mm]
	≥ 45mm
R1.k	min. of: 13.6 ; 11.2/kmod
R2.k	min. of: 11.5 ; 11.2/kmod

For sloped connection shall be use the following factors for the values from Table D6-5 to D6-7:

For different slope  $\beta$

$\beta =$	0°	15°	30°	45°
factor	1	0,95	0,9	0,85



**Table D6-8: Characteristic capacities [kN] timber beam to timber post**

Characteristic value of a CBH concealed beam hanger for connections between a timber header post and a timber supported joist with CNA4.0x60 in the header.

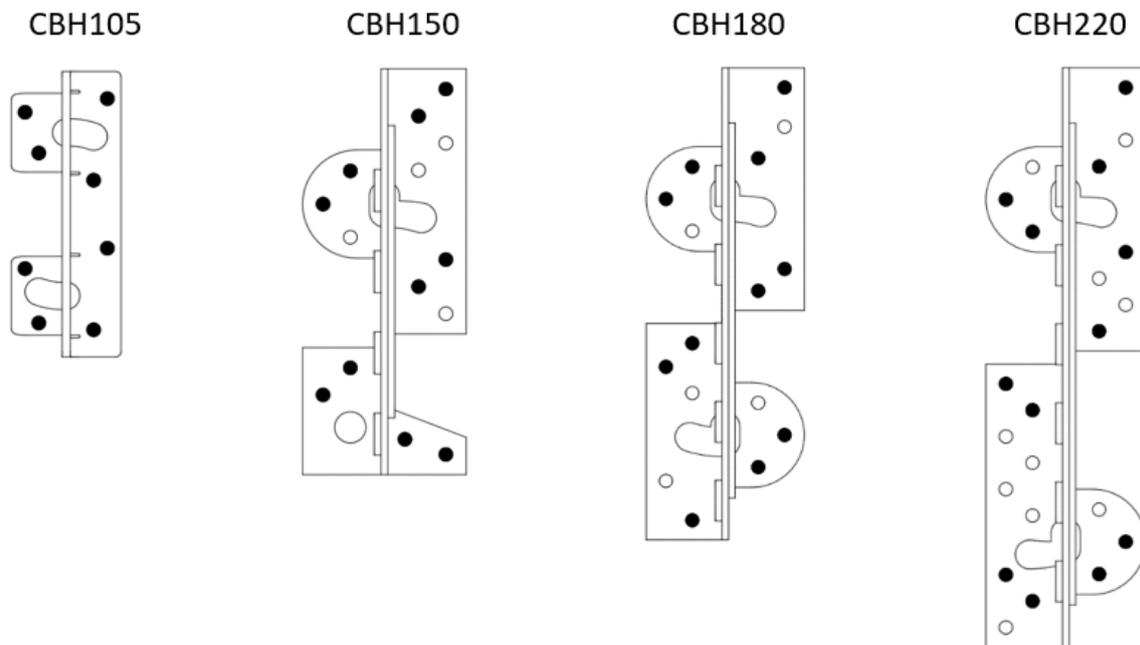
Model	Characteristic Capacity - R1,k [C24] - CBH: Timber header Post & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
Slope	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
	$\beta = 0^\circ$						$\beta = 5^\circ$						$\beta = 10^\circ$					
CBH150	16.9	18.2	19.9	21.5	22.1	22.1	16.7	18.0	19.6	21.2	22.1	22.1	16.4	17.7	19.3	20.9	22	22.0
CBH180	21.4	22.2	22.3	22.3	22.3	22.3	21.2	22.1	22.3	22.3	22.3	22.3	21	22.0	22.3	22.3	22.3	22.3
CBH220	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1

Model	Characteristic Capacity - R1,k [C24] - CBH: Timber header & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
Slope	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
	$\beta = 15^\circ$						$\beta = 20^\circ$						$\beta = 25^\circ$					
CBH150	16.2	17.4	18.9	20.5	21.8	21.8	15.9	17	18.5	20.1	21.6	21.7	15.7	16.7	18.2	19.7	21.2	21.5
CBH180	20.7	21.7	22.3	22.3	22.3	22.3	20.5	21.5	22.3	22.3	22.3	22.3	20.3	21.2	22.2	22.3	22.3	22.3
CBH220	24.9	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1

Model	Characteristic Capacity - R1,k [C24] - CBH: Timber header & Timber Supported Joist																	
	Header fastener: CNA4.0x60																	
	Width of timber = length of dowels [mm]																	
Slope	60	80	100	120	140	160	60	80	100	120	140	160	60	80	100	120	140	160
	$\beta = 30^\circ$						$\beta = 35^\circ$						$\beta = 40^\circ$					
CBH150	15.5	16.5	17.8	19.3	20.8	21.2	15.3	16.2	17.5	19	20.5	21	15.1	16	17.2	18.6	20.1	20.8
CBH180	20.1	21	22	22.3	22.3	22.3	19.9	20.8	21.8	22.3	22.3	22.3	19.7	20.6	21.7	22.3	22.3	22.3
CBH220	24.4	25	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1

Model	Characteristic Capacity - R1,k [C24] - CBH:					
	Timber header & Timber Supported Joist					
	Width of timber = length of dowels [mm]					
Slope	60	80	100	120	140	160
	$\beta = 45^\circ$					
CBH150	15	15.8	17	18.4	19.8	20.7
CBH180	19.6	20.4	21.5	22.3	22.3	22.3
CBH220	23.9	24.7	25.1	25.1	25.1	25.1

Nail patterns beam to post



**Table D6-9: Characteristic capacities timber beam to timber post CBH105**

R1,k [kN]	Width of timber = length of steel dowels [mm]		
	40	60	80
CNA 4.0x40	8.5	9.1	9.8
CNA 4.0x50	9.2	9.7	min. of: 10.5; 11.2/kmod
CNA 4.0x60	9.7	min. of: 10.3; 11.2/kmod	min. of: 11.1; 11.2/kmod
CSA 5.0x35	min. of: 10.8; 11.2/kmod	min. of: 11.3; 11.2/kmod	min. of: 11.8; 11.2/kmod
CSA 5.0x40	min. of: 11.6; 11.2/kmod	min. of: 12.2; 11.2/kmod	min. of: 12.7; 11.2/kmod
CSA 5.0x50	min. of: 13.1; 11.2/kmod	min. of: 13.7; 11.2/kmod	min. of: 14.3; 11.2/kmod

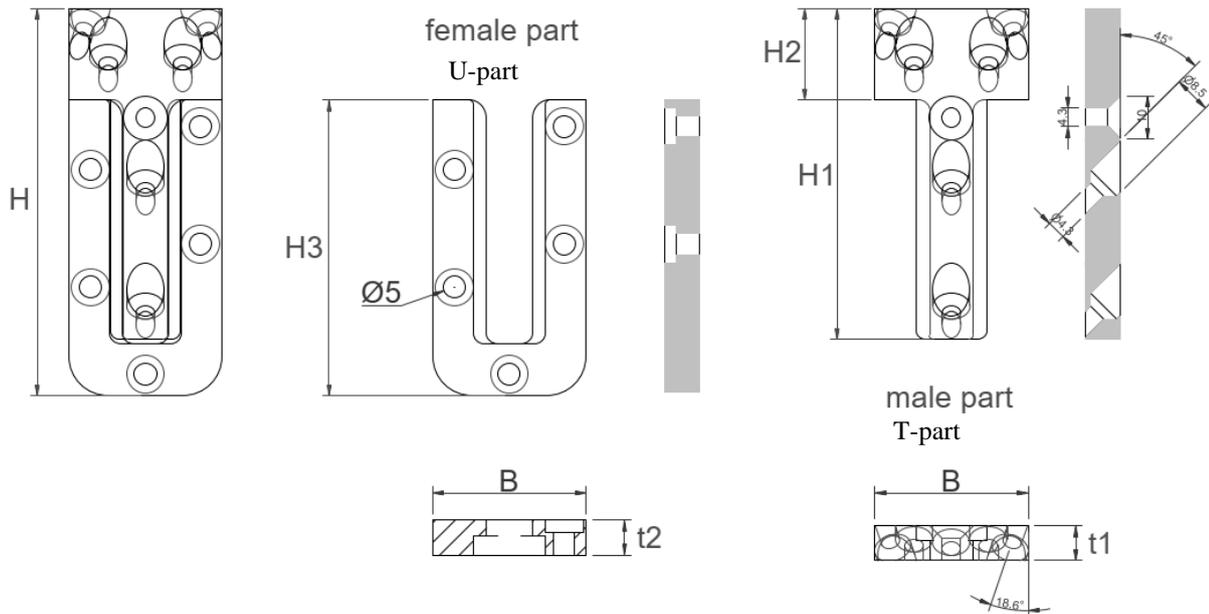
**Table D6-10: Characteristic capacities timber beam to timber post CBH105**

R1,k [kN]	Width of timber = length of steel dowels [mm]		
	40	60	80
CNA 4.0x40	5.6	6	6.5
CNA 4.0x50	6.1	6.4	6.9
CNA 4.0x60	6.4	6.8	7.3
CSA 5.0x35	7.1	7.5	7.8
CSA 5.0x40	7.6	8	8.4
CSA 5.0x50	8.6	9	9.4

**D7 EGCL**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
EGCL					

Figure D7-1: Drawings



The nailing pattern is the same on beam header or post, all the holes must be used with fasteners. The 90° holes on the male part are for fixing the part before screwing the inclined fasteners.

Table D7-1: Dimensions and number of fasteners

Model	H [mm]	B [mm]	H1 [mm]	H2 [mm]	H3 [mm]	t1=t2 [mm]	Number of Holes		
							Ø4 Screws		Ø5 Screws
							45°	90°	90°
EGCL60	61	35	48	21	40	8	3+2	1	3
EGCL90	89	35	76	21	68	8	4+2	1	5
EGCL120	117	35	104	21	96	8	5+2	1	7

Table D7-2: Material specifications

Material thickness	Material Grades	Coating Specification
8	Aluminium EN AW-6082 T6 According to EN755-2	-

**Characteristic capacities:****R<sub>1,k</sub> – Downward**

$$R_{1,k} = \min (n_h * R_{lat,k} ; n_j * \frac{R_{ax,\alpha,k}}{\sqrt{2}})$$

$n_h$  number of fasteners in the header, 90° screwed in

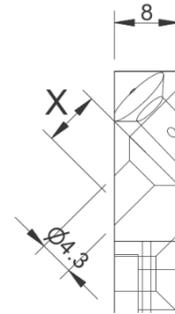
$n_j$  number of fasteners in the joist, 45° screwed in

$R_{lat,k}$  characteristic value of the load carrying capacity of a laterally loaded screw in single shear in a steel to timber connection with a thick steel plate according to EN 1995-1-1 [N] or ETA 04/0013

$R_{ax,\alpha,k}$  characteristic axial load carrying capacity of the inclined screw in the joist according to EN 1995-1-1 [N] , for the angle between the fibre of timber and the axis of the screw.

For the timber member on the joist and header side the load carrying capacity shall be determined according to EN 1995-1-1.

The effective screw length shall be determined without the screw channel inside the connector.

**R<sub>2,k</sub> – Uplift**

$$R_{2,k} = \min \left\{ \frac{1 * R_{lat,k} + n_j * R_{lat,\alpha,k}}{\sqrt{2}} ; \frac{n_{H,top} * R_{ax,\alpha,k}}{\sqrt{2}} \right\}$$

- for the full threaded screws parallel to the grain in the joist:

$$f_{h,end,k} = \frac{0,019 * \rho_k^{1,24} * d^{-0,3}}{2,5 * \cos^2 \varepsilon + \sin^2 \varepsilon} \text{ in } \frac{N}{mm^2}$$

$$R_{lat,k} = 2,0 * \sqrt{M_{y,k} * f_{h,\alpha,k} * d} + 0,25 * R_{ax,\alpha,k}$$

- for the full threaded inclined screws in the joist:

$$f_{h,end,\alpha,k} = \frac{0,019 * \rho_k^{1,24} * d^{-0,3}}{2,5 * \cos^2 \varepsilon + \sin^2 \varepsilon} \text{ in } \frac{N}{mm^2}$$

$$R_{lat,\alpha,k} = 1,0 * \sqrt{2 * M_{y,k} * f_{h,end,\alpha,k} * d}$$

$R_{ax,\alpha,k}$  characteristic axial load carrying capacity of the inclined screw in the header according to EN 1995-1-1 [N], for the angle between the fiber of timber and the axis of the screw.

$n_{x,y}$  : defined in chapter “Lateral”

**R<sub>3,k</sub> – Lateral**

Depending on the use of additional reinforcement screws, higher lateral load resistances can be achieved.

For the joist timber member  
without reinforcement screws

$$R_{2,k} = \min \left\{ R_{screws,k} \right. \\ \left. R_{2,timber,j,k} \right.$$

with reinforcement screws

$$R_{2,k} = \min \left\{ \begin{array}{l} R_{screws,k} \\ \max \left\{ (R_{t,90,k} * 1,5) \right. \\ \left. R_{2,timber,j,k} \right. \\ \left. V_{j,k} \text{ (remaining part)} \right\} \end{array} \right.$$

$$R_{screws,k} = \min \left\{ n_{j,top} * R_{lat,end,k} \right. \\ \left. n_{H,top} * R_{lat,side,k} \right. + \min \left\{ n_{j,webs} * R_{lat,end,k} \right. \\ \left. n_{H,webs} * R_{lat,side,k} \right.$$

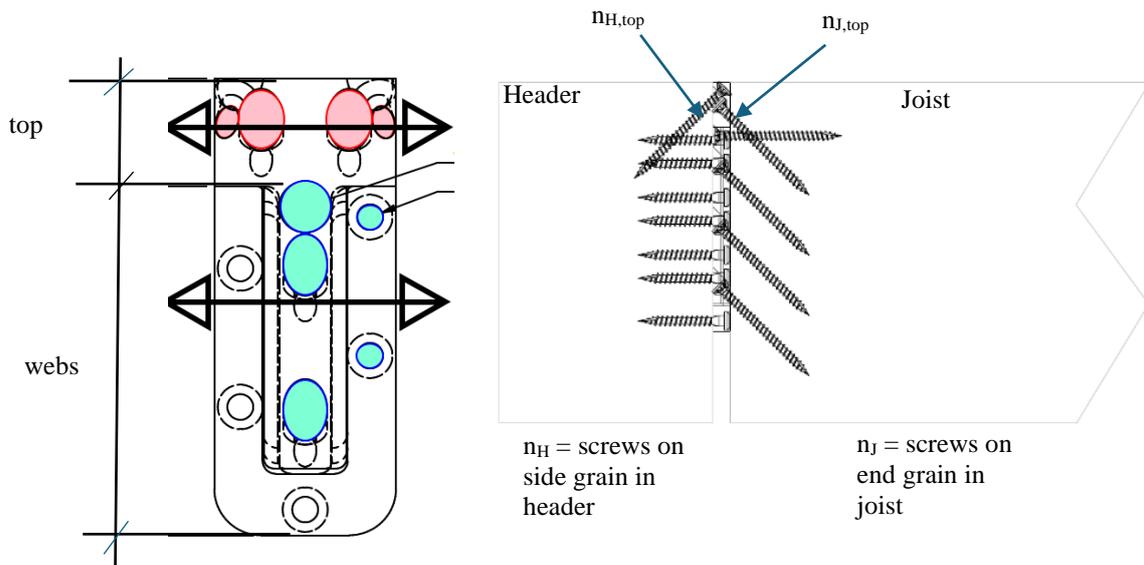


Table D15-3: Effective number of activated screws for lateral resistance

	EGCL 60		EGCL 90		EGCL 120	
	top	webs	top	webs	top	webs
$n_J$ (Joist, T-part)	2	2	2	3	2	4
$n_H$ (header; T/U-part)	2	1.5	2	2	2	3

$R_{lat,side,k}$  characteristic value of the load carrying capacity of a laterally loaded screw in single shear in a steel to timber connection with a thick steel plate according to EN 1995-1-1 [N] or ETA 04/0013

$R_{lat,end,k}$  characteristic value of the load carrying capacity of a laterally loaded screw in single shear in a steel to timber connection with a thick steel plate according to EN 1995-1-1 [N]

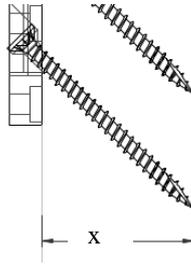
$$\text{Where: } f_{h,end,a,k} = \frac{0,019 * \rho_k^{1,24} * d^{-0,3}}{2,5 * \cos^2 \epsilon + \sin^2 \epsilon} \text{ in } \frac{N}{mm^2}$$

Timber failure:

$R_{2,timber,j,k}$  characteristic value of the load carrying capacity using the model of a notched support according to EN 1995-1-1, 6.5.2 [N]

For the joist timber member without reinforcement screws, the reduction factor  $k_v$  shall be determined with:

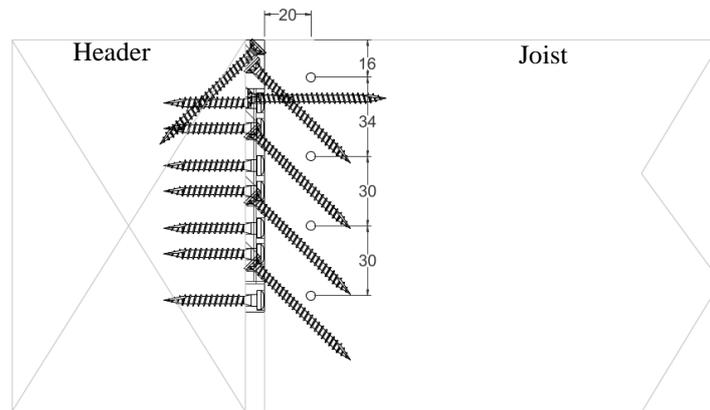
$x$  = the distance is the length of the screw projected on the horizontal axis



For the joist timber member with reinforcement screws, the reduction factor  $k_v$  shall be determined with:

$$x = \sqrt{\frac{2 \cdot M_{y,d}}{f_{h,d} \cdot d}}$$

The reinforcement screws in the joist shall be placed according to the following picture.



$R_{t,90,k}$  = resistance of the reinforcement against transverse tension failure according to DIN EN 1995-1-1/NA:2013-08, 6.8.3 or DIN 1052:2008-12, 11.4.2 [N]

$V_{j,k}$  (remaining part) = shear resistance of the remaining part in the joist member (half cross section if the connector is placed centred) according to EN 1995-1-1, 6.1.7 [N]

**$R_{4,k}$  – Axial**

$$R_{4,k} = \min \left\{ \begin{array}{l} n_{H,web} \cdot R_{ax,Rk} + n_{H,top} \cdot (R_{lat,Rk} \cdot \sqrt{2}) \\ (n_{j,web} + n_{j,top}) \cdot (R_{lat,Rk} \cdot \sqrt{2}) \end{array} \right.$$

$R_{ax,Rk}$  characteristic value of the load carrying capacity of an axial loaded screw according to ETA 04/0013

For the full threaded inclined screws in the header and joist:

$$f_{h, \varepsilon, d, k} = \frac{0,019 \cdot \rho_k^{1,24} \cdot d^{-0,3}}{2,5 \cdot \cos^2 \varepsilon + \sin^2 \varepsilon} \text{ in } \frac{N}{mm^2}$$

$$R_{lat,k} = 1,0 * \sqrt{2 * M_{y,k} * f_{h, \text{end}, \alpha, k} * d}$$

### Load superimposition

In case the connection is charged by an axial and a lateral load at the same time, the following proof must be fulfilled:

$$\left( \frac{F_{1/2,d}}{R_{1/2,d}} \right) + \left( \frac{F_{3,d}}{R_{3,d}} \right) + \left( \frac{F_{4,d}}{R_{4,d}} \right) \leq 1,0$$



Model	H [mm]	H1 [mm]	H2 [mm]	Ø6.5 Holes	
				Header Part	Joist part
EGCM90	90	90	90	6	7
EGCM150	150	150	150	11	12
EGCM210	210	210	210	16	15
EGCM270	270	270	270	21	18

Table D8-2: Material specifications

Material thickness	Material Grades	Coating Specification
16/01/1900	Aluminium EN AW-6082 T6 according to EN755-2	-

For installation in fire conditions, see Annex B6.

### Characteristic capacities:

#### $R_{1,k}$ – Download

$$R_{1,k} = \min(n_{ef,h} * R_{iat,h,k}, n_{ef,j} * \frac{R_{ax,j,k}}{\sqrt{2}})$$

$n_{ef,h}$  effective number of fasteners in the header

$n_{ef,j}$  effective number of fasteners in the joist

$R_{iat,h,k}$  characteristic value of the load carrying capacity of a laterally loaded screw in single shear in a steel to timber connection with a thick steel plate according to EN-1995-1-1 [N]

$R_{ax,j,k}$  characteristic axial load carrying capacity of the inclined screw in the joist according to EN1995-1-1 [N]

Once we have rotation in timber elements, we must consider a moment that gives us the following formula:

$$R'_{1,k} = \frac{R_{1,k}}{\sqrt[3]{1 + \left(\frac{e - e_{lim}}{e_M}\right)^3}}$$

With

Model	$e_{lim}$ [mm]	$e_M$ [mm]	
		CSFT6.0x85	CSFT6.0x110
EGCM90	29.1	12.58	11.33
EGCM150	65	19.94	18
EGCM210	100	27.66	24.26
EGCM270	135	35.61	30.45

Where  $e$  is the eccentricity of the force exerted in mm

### $R_{2,k}$ – Upload

$$R_{2,h,k} = 0.8 * n_{uplift\ screws} * R_{ax,uplift\ screws,k}$$

$n_{uplift\ screws}$  number of screws installed to prevent the uplift of the joist element. For the EGCM range, it is equal to 2.

$R_{ax,uplift\ screws,k}$  characteristic axial load carrying capacity of the inclined screw in the header according to EN1995-1-1 [N]

Once we have rotation in timber elements, we can use the same formula as we have for  $R'_{1,k}$ .

### $R_{3,k}$ – Lateral

$$R_{3,k} = \min(R_{3,timber,k}, R_{3,EGCM,k})$$

With,

$$R_{3,timber,k} = \frac{b * h_{ef} * k_v * f_{v,k}}{1.5}$$

$b$  is the height of the timber joist.

$h_{ef}$  is the distance between the edge of the joist and the first range of screws.

$k_v$  is a reduction factor

$f_{v,k}$  is the shear characteristic resistance of timber.

$$R_{3,EGCM,k} = \min(R_{3,j,k}, R_{3,h,k})$$

With,

$$R_{3,j,k} = n_{ef,j,45^\circ} * R_{lat,j,45^\circ,k} + n_{ef,j,90^\circ} * R_{lat,j,90^\circ,k}$$

$$R_{3,h,k} = n_{ef,h} * R_{lat,h,k}$$

$n_{ef,j,45^\circ}$  effective number of 45° screws in the joist

$R_{lat,j,45^\circ,k}$  characteristic shear load carrying capacity of the inclined screw in the joist according to EN1995-1-1 [N]

$n_{ef,j,90^\circ}$  effective number of 90° screws in the joist

$R_{lat,j,90^\circ,k}$  characteristic shear load carrying capacity of the 90° screw in the joist according to EN1995-1-1 [N]

If we have rotation in timber elements, we must consider a moment that gives us the following formula:

$$R'_{3,k} = \frac{R_{3,k}}{\sqrt[3]{1 + \left(\frac{e}{e_3}\right)^3}}$$

With,

Model	e <sub>3</sub> [mm]			
	Beam Header		Post Header	
	CSFT6.0x85	CSFT6.0x100	CSFT6.0x85	CSFT6.0x100
EGCM90	15.4	20.25	9.58	12.77
EGCM150	16.8	20.98	13.45	15.16
EGCM210	15.4	20.27	11.26	15.01
EGCM270	17.24	21.56	13.68	18.25

#### R<sub>4,k</sub> – Axial

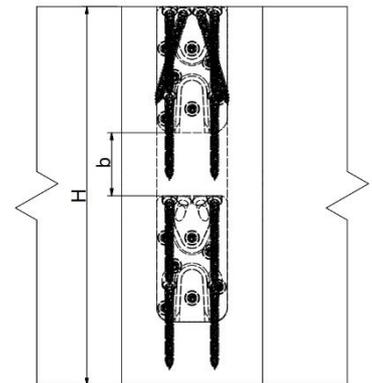
$$R_{4,k} = \min(n_{ef,h} * R_{ax,h,k}, n_{ef,j,45^\circ} * R_{lat,j,45^\circ,k} + n_{ef,j,90^\circ} * R_{ax,j,90^\circ,k})$$

#### Multiple connectors installation

It is possible to use more than one EGCM per connection to reach bigger joist sections and to have higher performances. Then, we can install two connectors one on top of the other or by side. In both cases, we must respect minimum distances between the connectors.

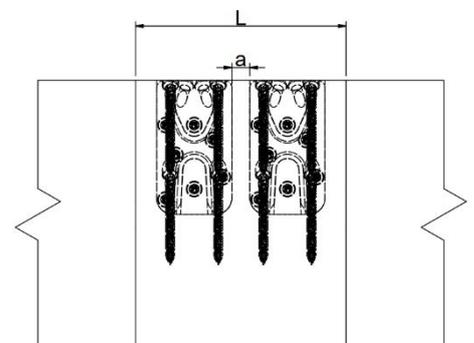
- Vertical installation

	CSFT6.0x85		CSFT6.0x110	
	a [mm]	L [mm]	a [mm]	L [mm]
EGCM90	45	270	45	285
EGCM150	45	390	45	405
EGCM210	45	510	45	525
EGCM270	45	630	45	645



- Horizontal installation

Model	CSFT6.0x85		CSFT6.0x110	
	a [mm]	L [mm]	a [mm]	L [mm]
EGCM90	12	137	20	145
EGCM150	12	137	20	145
EGCM210	12	137	20	145
EGCM270	12	137	20	145

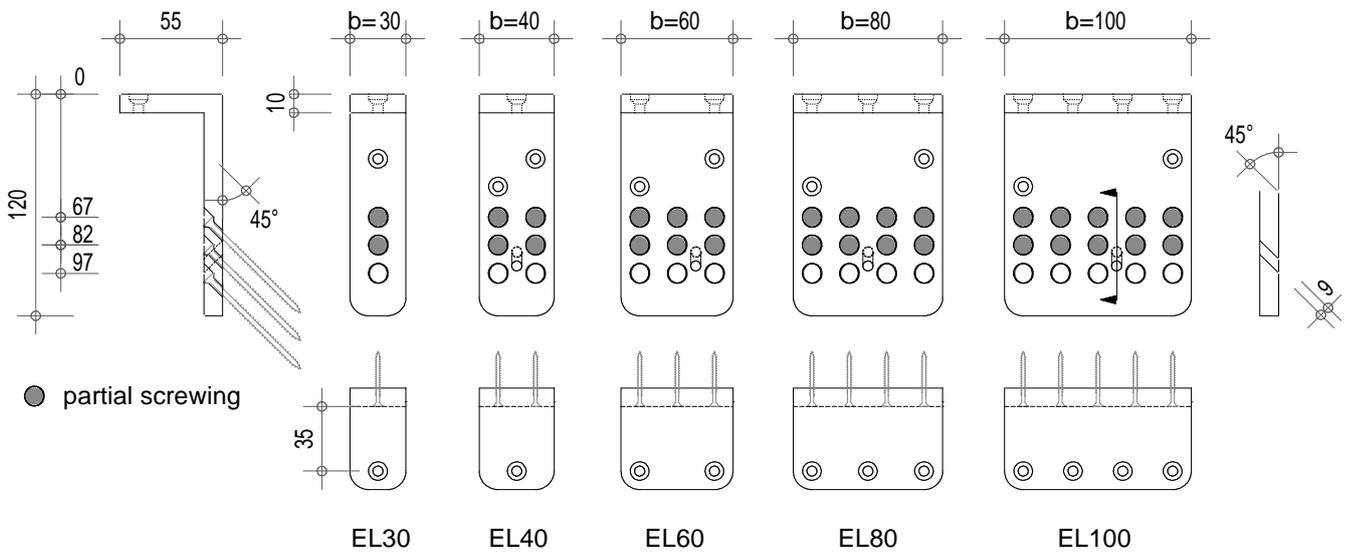


**D9 EL**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ELxx					

xx = size of EL

**Figure D9-1: Drawings**



**Table D9-1: dimensions and number of fastener**

Model	No of $\varnothing 5.4$ Holes	
	45°	Top
EL30	3	1
EL40	6	1
EL60	9	2
EL80	12	3
EL100	15	4

**Table D9-2: Material specification**

Material thickness	Material Grades	Coating Specification
6	6082 T6 according to EN 755-2	
10	stainless steel (as described)	

For installation for fire justification, see clause B6

**Table D9-3: Characteristic capacities :**

$$R_{1,k} = \min \left\{ \begin{array}{l} \frac{n_J^{0,9} \times R_{ax,\alpha,k}}{\sqrt{2}} \\ \frac{k_{c,90} \times f_{c,90ck} \times A_{ef} \times b}{A} \times \left( 11,25 + \sqrt{\frac{25 \times f_{y,k} \times A}{k_{c,90} \times f_{c,90,k} \times A_{ef}}} - 380 \right) \\ \frac{278 \times b}{k_{mod}} \end{array} \right.$$

$$R_{4,k} = \min \left\{ \begin{array}{l} 0,3 \times F_{1,d} \\ n_H \times R_{lat,k} \end{array} \right.$$

$n_J$  number of screws in the joist

$n_H$  number of screws in the upper surface of the header

$k_{c,90}$  Factor according to EN 1995-1-1:A1 taking into account the load configuration, the possibility of splitting and the degree of compressive deformation

$f_{c,90,k}$  Characteristic compressive strength perpendicular to the grain in N/mm<sup>2</sup>

$A_{ef}$  Effective contact area perpendicular to the grain in mm<sup>2</sup> according to EN 1995-1-1:A1

$A$  Actual contact area perpendicular to the grain in mm<sup>2</sup>

$b$  Width of the SIMPSON STRONG-TIE® EL hanger in mm

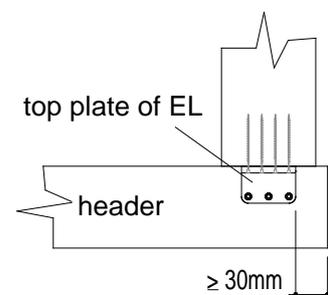
$f_{y,k}$  Aluminium minimum yield strength in N/mm<sup>2</sup>;  $f_{y,k} = 250$  N/mm<sup>2</sup>

$F_{1,d}$  design value of the joist support load perpendicular to the joist axis in N

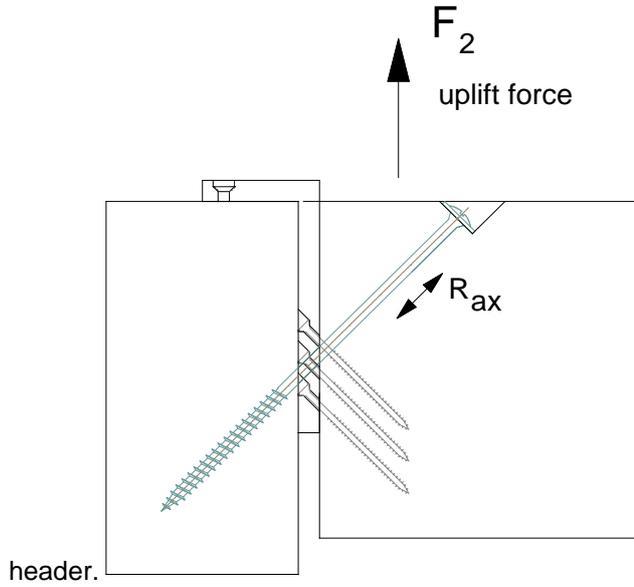
$R_{ax,\alpha,k}$  characteristic axial load-carrying capacity of the screws in the joist according to EN 1995-1-1:2004:2008+A1:2008(E) in N, for the angle between the fiber of timber and the axis of the screw.

$R_{lat,k}$  Characteristic value of the load-carrying-capacity of a laterally loaded header nail or screw in N

Model	A [mm]	$A_{ef}$ [mm]	$A_{ef}/A$
EL30	1350	3600	2.67
EL40	1800	4500	2.5
EL60	2700	5400	2
EL80	3600	6300	1.75
EL100	4500	7200	1.6



The value  $A_{ef}$  based on minimum distance of 30mm between the EL and the end of



An uplift force may be adsorbed by an extra screw as shown above.

$$R_{2,k} = \frac{R_{ax,k(Screw)}}{\sqrt{2}}$$

$R_{ax,k(Screw)}$  Characteristic axial load-carrying capacity of the extra screw as the min of threaded part and pull through capacity of the head.

## D10 ELS

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ELSxx					

xx = Size of ELS

Figure D10-1: Drawings

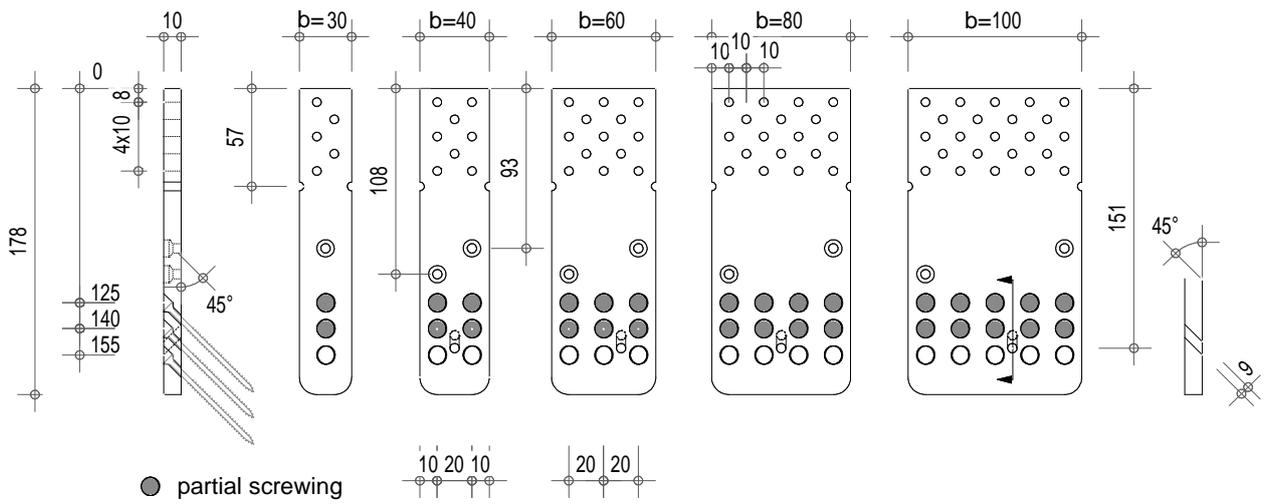


Table D10-1: dimensions and number of fastener

Model	No of $\varnothing 5.4$ Holes	
	45°	Top
ELS30	3	5
ELS40	6	8
ELS60	9	13
ELS80	12	18
ELS100	15	23

Table D10-2: Material specification

Material thickness	Material Grades	Coating Specification
10	Aluminium EN AW-6082 T6 according to	

For installation for fire justification, see clause B6

**Table D10-3:Characteristic capacities :**

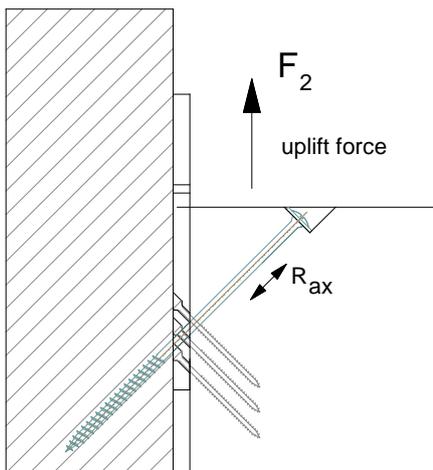
$$R_{1,k} = \min \left\{ \begin{array}{l} \frac{n_J^{0,9} \times R_{ax,\alpha,k}}{\sqrt{2}} \\ n_H \times R_{lat,k} \end{array} \right.$$

$n_J$  number of screws in the joist

$n_H$  number of screws in the upper surface of the header

$R_{ax,\alpha,k}$  characteristic axial load-carrying capacity of the screws in the joist according to EN 1995-1-1:2004:2008+A1:2008(E)  
For a connection with a slope  $< 0^\circ$ , it shall be check the permission for angle between the fiber of timber and the axis of the screw.

$R_{lat,k}$  characteristic value of the load-carrying-capacity of a laterally loaded header nail or screw in N



An uplift force may be adsorbed by an extra screw as shown above.

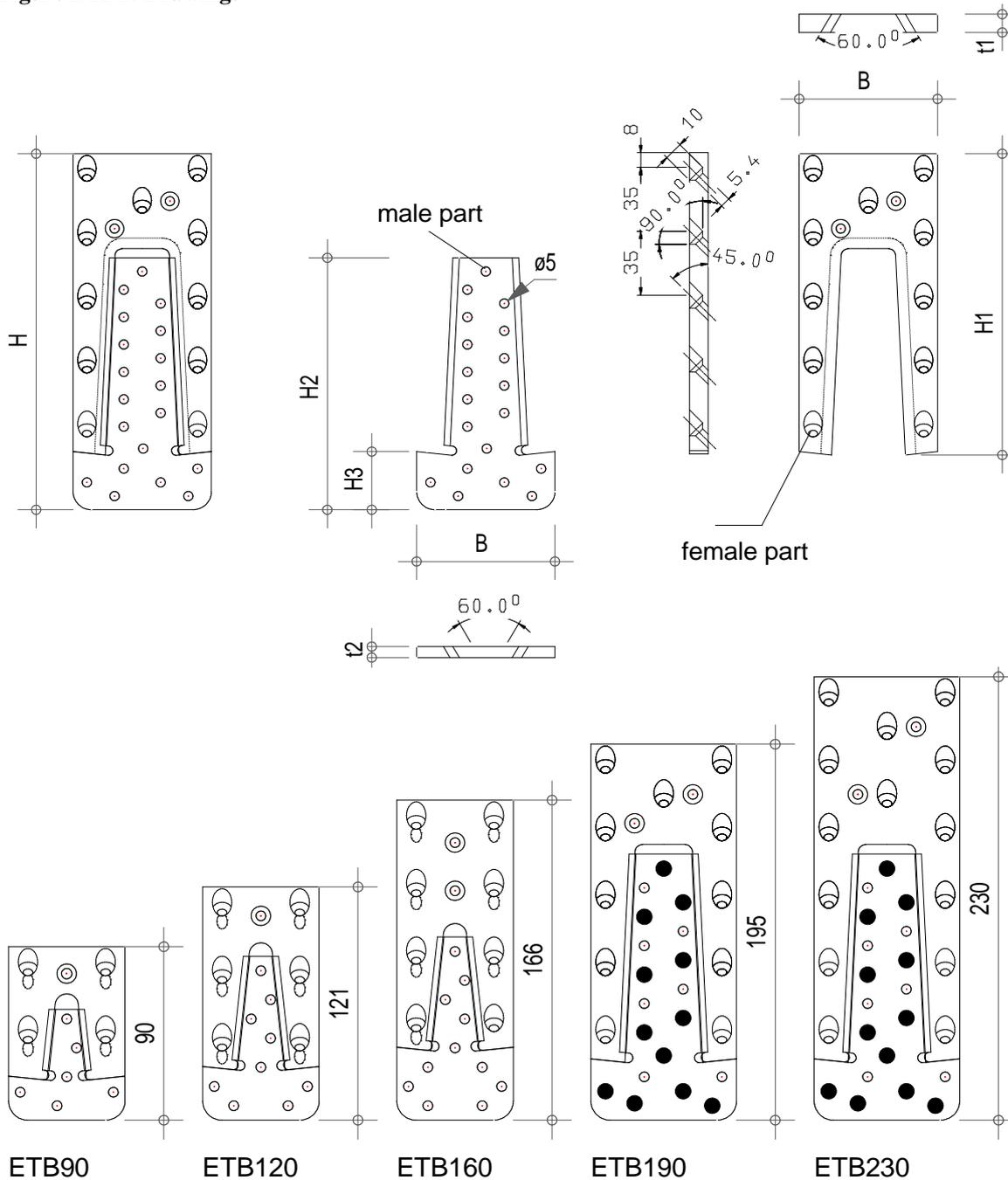
$$R_{2,k} = \frac{R_{ax,k(Screw)}}{\sqrt{2}}$$

$R_{ax,k}$  characteristic axial load-carrying capacity of the extra screw as the min of threaded part and pull through capacity of the head.

**D11 ETB**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ETB					

**Figure D11-1: Drawings**



● partial nailing or screwing for column connections

⊙ for fixing before screwing

**Table D11-1: dimensions and number of fastener**

Model	H [mm]	B [mm]	H1 [mm]	H2 [mm]	H3 [mm]	t1 [mm]	t2 [mm]	No of Holes	
								Ø5.4	Ø5
ETB90	90	60	69	58	22,8	10	6	4	6
ETB120	121	60	95	85	27,8	10	6	6	9
ETB160	166	60	130	95	37,8	10	6	8	11
ETB190	195	75	165	138	31,8	10	6	11	19
ETB230	230	75	200	138	31,8	10	6	14	19

**Table D11-2: Material specification**

Material thickness	Material Grades	Coating Specification
6	6082 T6 according to EN 755-2	
10	stainless steel (as described)	

For installation for fire justification, see clause B6

**Table D11-3: Characteristic capacities :****ETB connectors - Force downward**

$$R_{1,k} = \min \left\{ \begin{array}{l} \frac{n_J^{0,9} \times R_{ax,\alpha,k}}{\sqrt{2}} \\ n_H \times R_{lat,k} \end{array} \right.$$

$n_J$  number of screws in the joist

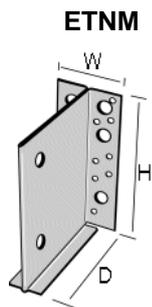
$n_H$  number of screws or nails in the side grain of the header or column

$R_{lat,k}$  Characteristic value of the load-carrying-capacity of a laterally loaded header/column nail or screw in single shear in a steel-to-timber connection with a thick steel plate according to EN 1995-1-1 or ETA 04/0013 in N

$R_{ax,\alpha,k}$  characteristic axial load-carrying capacity of the screws in the joist according to EN 1995-1-1:2004:2008+A1:2008(E) in N, for the angle between the fiber of timber and the axis of the screw.

**D12 Concealed joist hanger ETNM**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ETNM	ETNM				

**Figure D12-1: drawings****Table D3-1: size specification**

Model	W [mm]	H [mm]	D [mm]	Thickness [mm]	Skew Angle	
					Degree	Direction
ETNM135/130/2	70	135	130	3	90°	~
ETNM155/130/2	70	155	130	3	90°	~
ETNM185/130/2	70	185	130	3	90°	~
ETNM230/130/2	80	230	130	3	90°	~

**Table D12-2 number of fastener**

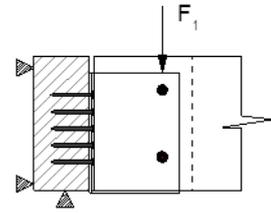
Model	Header fasteners			Joist Fasteners	
	Ø4.0 Connector Nails	Bolt M12 Concrete Screw	SSH Ø12	Ø8.0 SD Dowels	Ø12.0 SD Dowels
ETNM135/130/2	14	5	4	~	2
ETNM155/130/2	15	6	4	~	2
ETNM185/130/2	18	6	4	~	2
ETNM230/130/2	22	6	4	~	3

**Table D12-3: Material specification**

Material thickness	Material Grades	Coating Specification
3	S250 GD	Z275
3	stainless steel (as described)	

**Table D12-4: Characteristic capacities ETNM  $R_{1,k}$   
Beam to beam**

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50 Full Nailing: Beam to Beam					
	Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
ETNM135	11.7	12.2	13.1	14.2	15.4	16.6
ETNM155	14.4	15.0	16	17.2	18.6	20
ETNM185	17.1	17.8	18.9	20.4	22.0	23.8
ETNM230	26.2	27.0	28.6	30.6	32.8	35.1



**Table D12-5: Characteristic capacities ETNM  $R_{1,k}$   
Beam to post**

Model	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50 Full Nailing: Beam to Post					
	Width of timber = length of dowels [mm]					
	60	80	100	120	140	160
ETNM135	11	11.6	12.5	13.6	14.7	15.9
ETNM155	13.1	13.7	14.7	15.8	17.1	18.4
ETNM185	15.5	16.2	17.3	18.7	20.3	21.9
ETNM230	25.1	25.9	27.4	29.3	31.3	33.4

*Table D12-6 Characteristic capacities  $R_{1,k}$  – ETNM with SSH screws*

Model	Fasteners				Characteristic Capacity - $R_{1,k}$ [C24]					
	Header		Joist		Width of timber = length of dowels					
	Qty	Type	Qty	Type	60	80	100	120	140	160
ETNM135	4	SSH12.0x60	2	STD12	17.4	18	19	20.2	21.5	22.8
ETNM155	4	SSH12.0x60	2	STD12	18.2	18.8	19.8	21.1	22.4	23.6
ETNM185	4	SSH12.0x60	2	STD12	19.2	19.8	20.9	22.2	23.5	24.6
ETNM230	4	SSH12.0x60	2	STD12	24.7	24.9	25	25	25	25

Figure D12-2: Nail pattern ETNM

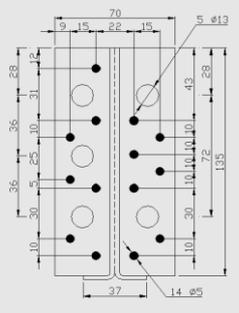
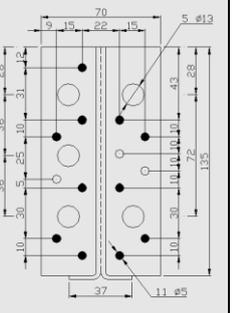
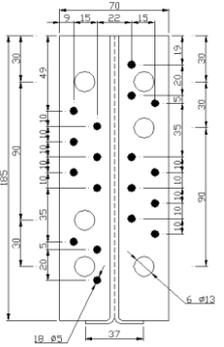
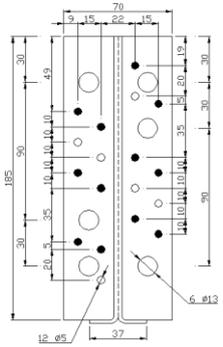
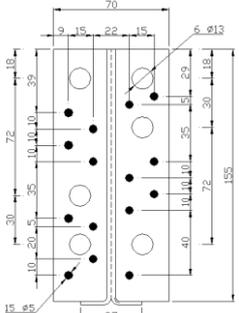
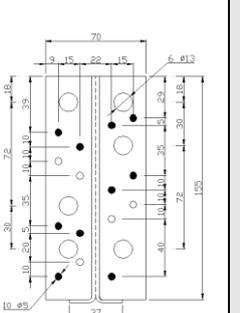
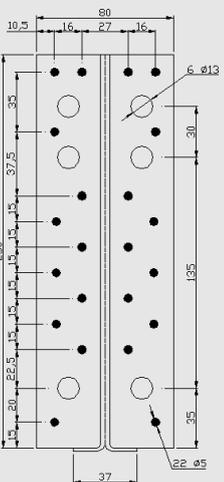
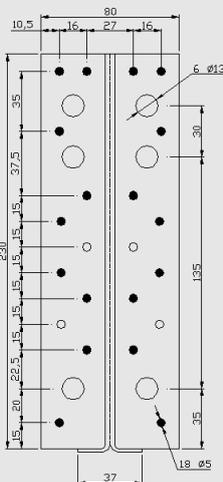
TYPE	BEAM to BEAM	BEAM to POST	TYPE	BEAM to BEAM	BEAM to POST
135			185		
	14 nails 2 dowels Ø12	11 nails 2 dowels Ø12		18 nails 5 dowels Ø2	12 nails 5 dowels Ø12
155			230		
	15 nails 2 dowels Ø12	10 nails 2 dowels Ø12		22 nails 3 dowels Ø12	18 nails 3 dowels Ø12

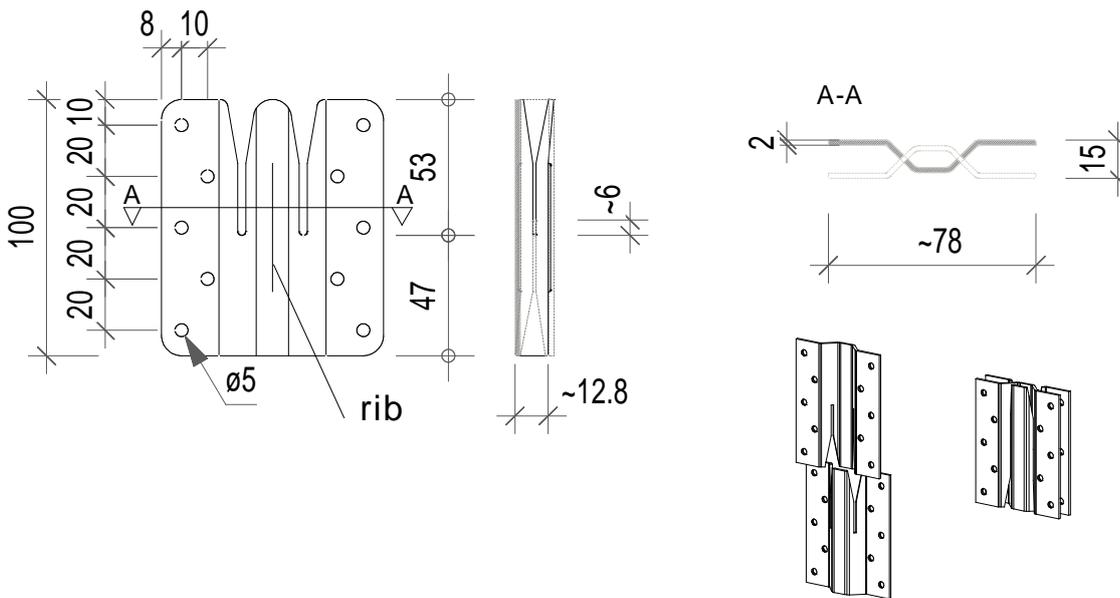
Figure D12-3 Screw pattern ETNM with SSH Screws

<p>ETNM135/130/2</p> <p>4 SSH12.0</p> <p>2 Dowels Ø12</p>	<p>ETNM155/130/2</p> <p>4 SSH12.0</p> <p>2 Dowels Ø12</p>	<p>ETNM185/130/2</p> <p>4 SSH12.0</p> <p>2 Dowels Ø12</p>	<p>ETNM230/130/2</p> <p>4 SSH12.0</p> <p>3 Dowels Ø12</p>

**D13 ICST**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
ICST					

**Figure D14-1: Drawings**

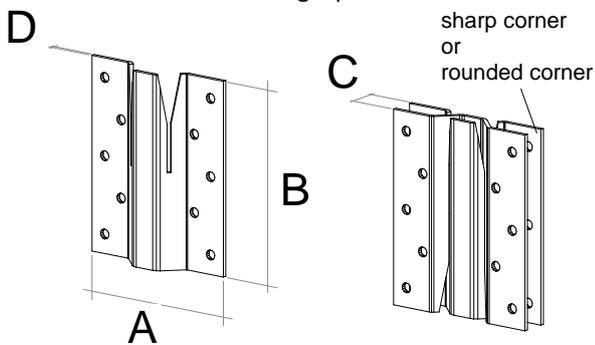


For a connection 2 single pieces have to be use as a pair

**Table D13-1: Size specification**

Model	A [mm]	B [mm]	C [mm]	D [mm]	Number of Fasteners	
					Supporting Member	Supported Member
ICST	78	100	15	2	10	10

The ICST consists of two single pieces



**Table D13-2: Material specification**

Material thickness	Material Grades	Coating Specification
2	S250 GD according to EN 10326:2004	Z275 according to EN 10326:2004

Or stainless steel according to clause II-1

For installation for fire justification, see clause B6

**Figure D13-3: Nail/screw pattern**

Full nailing

e.g. CNA 4,0xl nails , CSA5,0xl screws

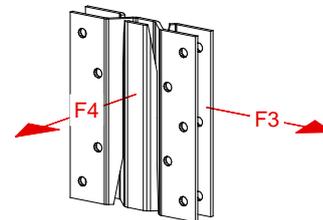
**Table D13-3: Characteristic capacity [kN]**

Model	Characteristic capacities [kN] per connection (one pair)			
	$R_{3,k}$		$R_{3,k}$	
ICST - 1 pair (2 single pieces)	Min of:	$6.72 \cdot R_{lat,k}$	Min of:	$4 \times R_{ax,k}$
		$16.9/k_{mod}$		$5.35/k_{mod}$

With

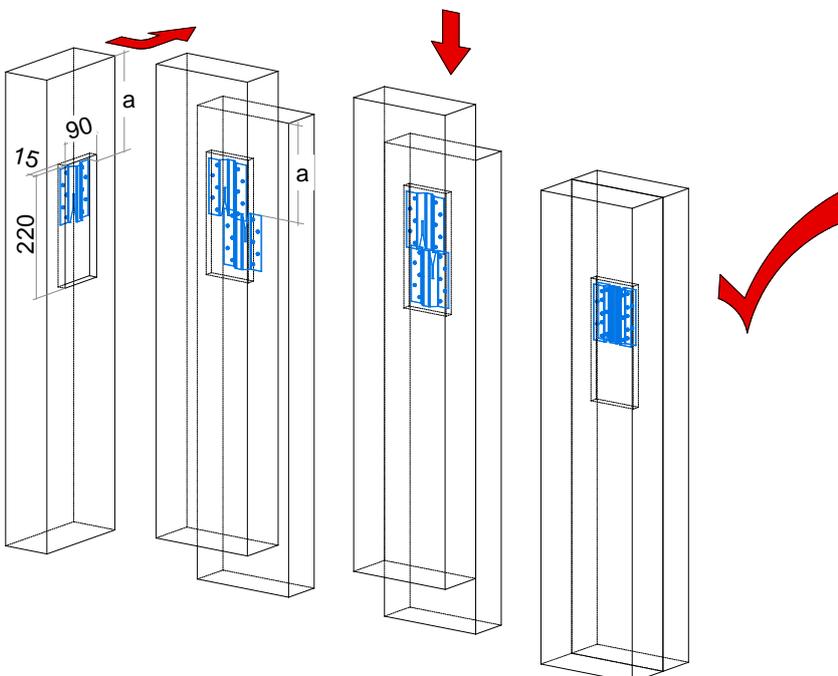
$R_{lat,k}$  = the lateral capacity of one single used fastener

$R_{ax,k}$  = the axial capacity of one single used fastener



For connection between timber elements (e.g. two wall elements) multiple ICST may be used.

The two single pieces are to place on the “same” high (for example same distance “a” from the top as described below), by the mounting the elements are to fit into each other.

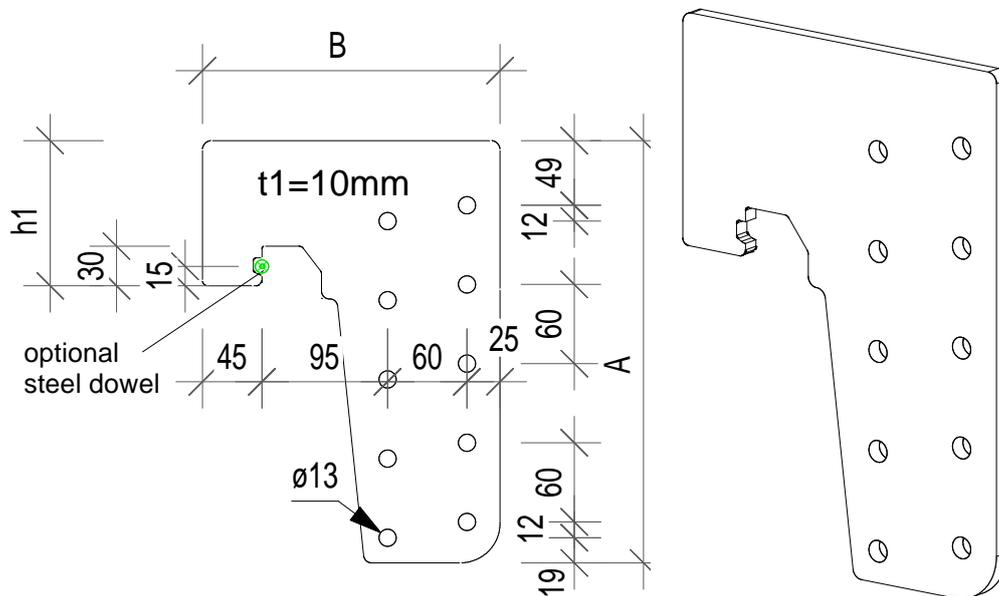


**D14 Janebo : JHHU, JHDU, JHGU, JHH, JHD, JHG**

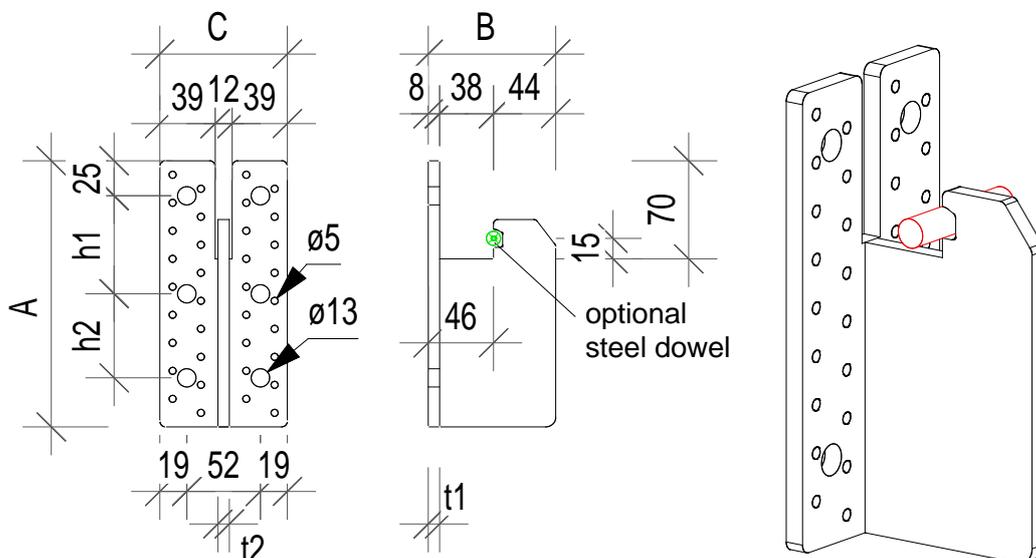
Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
JHHxx					
JHD1-xx					JHDxx
JHGxx					
JHHUxx					
JHDUxx					
JHGUxx					

Types with the “U” are for products with steel dowel for uplift;

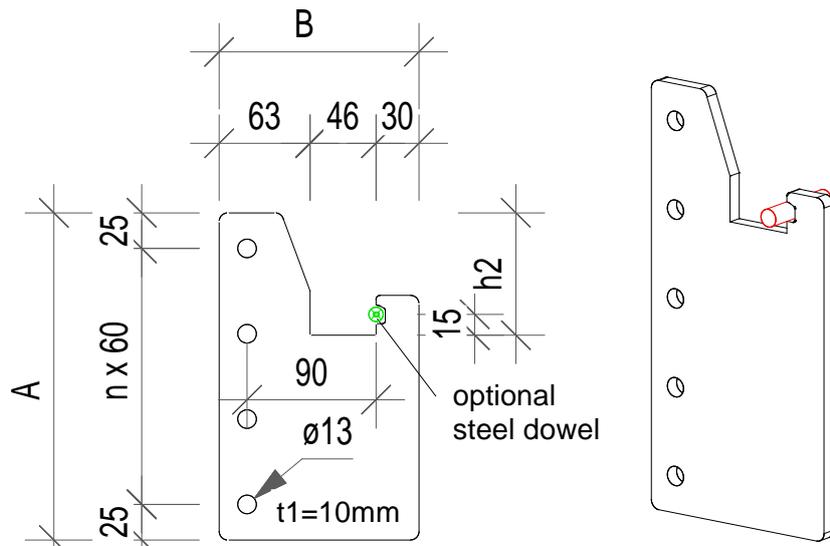
**Drawings**



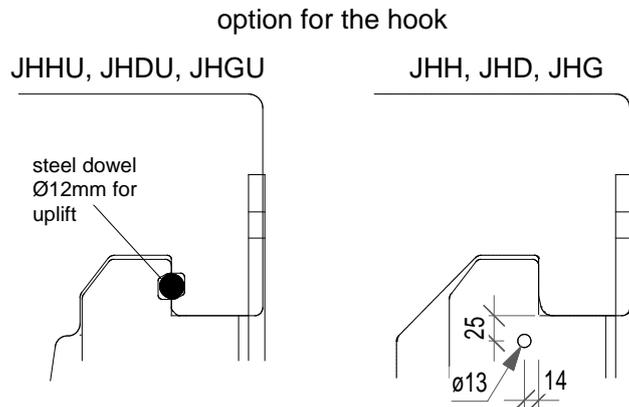
**Figure D14-1: Dimensioned drawings of JHHU**



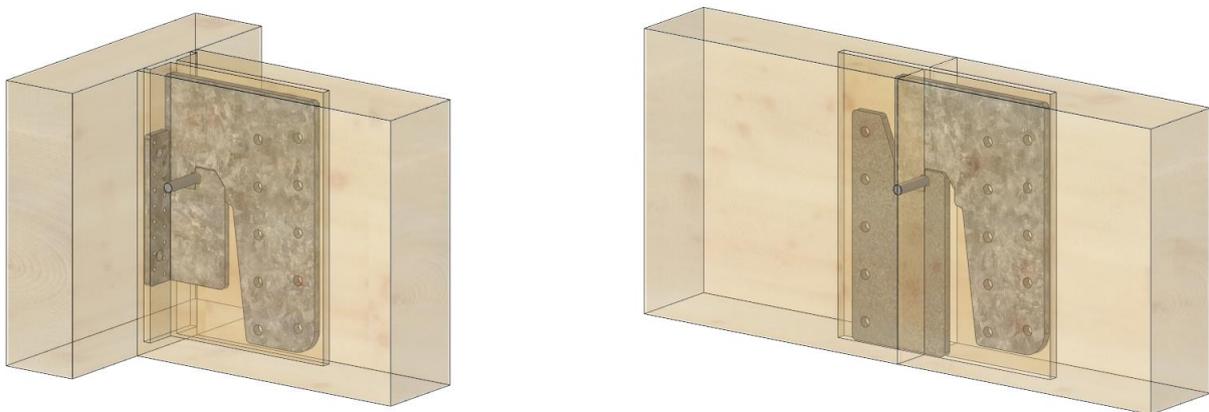
**Figure D14-2: Dimensioned drawings of JH DU**



**Figure D14-3: Dimensioned drawings for JH GU**



**Figure D14-4: The hook for all types can be made in two different version, for an uplift force only the left one can be use.**



**Figure D14-5: example of use, for an uplift force ( $F_2$ ) the steel dowel as shown in figure D12-4 on the left one has to be installed**

**Table D14-1: Size specification**

Model	A [mm]	B [mm]	C [mm]	t1 [mm]	t2 [mm]	h1 [mm]	h2 [mm]	No of Holes	
								Ø5	Ø13mm
JHH140/JHHU140	140	225		10		110			4
JHH180/JHHU180	180	225		10		110			6
JHH200/JHHU200	200	225		10		110			6
JHH260/JHHU260	260	225		10		110			8
JHH320/JHHU320	320	225		10		110			10
JHH380/JHHU380	380	225		10		140			12
JHH440/JHHU440	440	225		10		170			14
JHH500/JHHU500	500	225		10		170			16
JHH560/JHHU560	560	225		10		170			18
JHH620/JHHU620	620	225		10		170			20
JH DU20/JHD1-20	110	90	90	8	8	60		20	2
JH DU24/JHD1-24	130	90	90	8	8	80		24	2
JH DU36/JHD1-36	190	90	90	8	8	140		36	4
JHD1-48/JHD1-48	250	90	90	8	8	100	100	48	4
JH DU60/JHD1-60	310	90	90	8	9	130	130	60	6
JH DU72/JHD72	370	90	90	8	9	130	130	72	6
JH DU84/JHD84	430	90	90	8	9	130	130	84	6
JH DU96/JHD96	490	90	90	8	9	130	130	96	6
JH GU200/JHG200	170	139		10			86		3
JH GU260/JHG260	230	139		10			86		4
JH GU320/JHG320	290	139		10			86		5
JH GU380/JHG380	350	139		10			116		6
JH GU440/JHG440	410	139		10			146		7
JH GU500/JHG500	470	139		10			146		8
JH GU560/JHG560	530	139		10			146		9
JH GU620/JHG620	590	139		10			146		10

**Material specification**

Standard material:

S355JR according to EN10025 + electroplated zinc Fe/Zn12/B according to EN2081 or comparable

Alternative:

S235JR according to EN10025 + electroplated zinc Fe/Zn12/B according to EN2081 or comparable

The capacities [kN] in the tables are based on the application with the following fastener:

CNA-nails and CSA-screws according to ETA04/0013

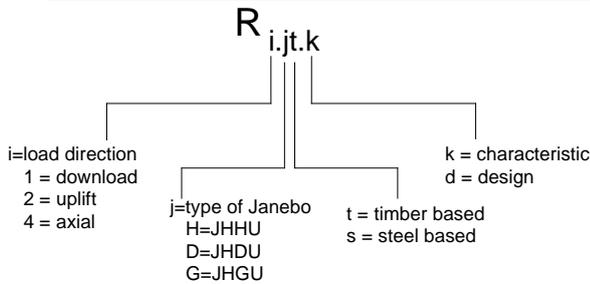
Steel dowel Ø12mm with  $f_{u,k} = 360 \text{ N/mm}^2$ 

For installation for fire justification, see clause B6

### Characteristic capacities

The checks below have to be made for both parts of a connection, eg: JHH with JHDU or JHHU with JHGU, the weakest part is decisive.

$$R_{i,j,d} = \min \left\{ R_{i,jt,k} ; \frac{R_{i,js,k}}{k_{\text{mod}}} \right\} \times k_{\text{mod}} / \gamma_M$$



$$R_{i,jt,d} = R_{i,jt,k} \times k_{\text{mod}} / \gamma_M$$

$$R_{i,js,d} = R_{i,js,k} / \gamma_M$$

$$\eta_{1,j,s} = \frac{F_{1,d}}{R_{1,js,d}}$$

$$\eta_{1,j,t} = \frac{F_{1,d}}{R_{1,jt,d}}$$

Or for uplift:

$$\eta_{1,j,s} = \frac{F_{2,d}}{R_{2,js,d}}$$

$$\eta_{1,j,t} = \frac{F_{2,d}}{R_{2,jt,d}}$$

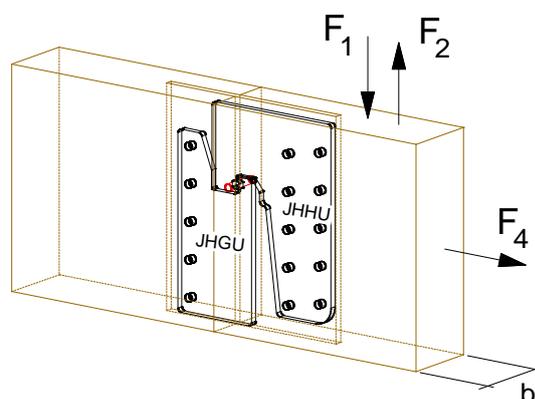
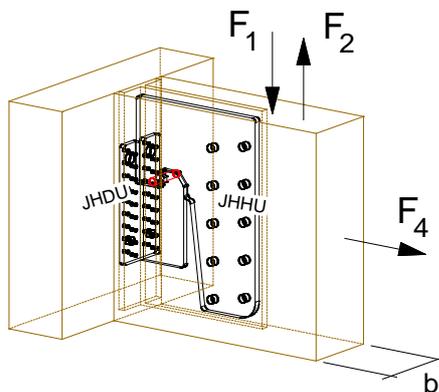
The factors  $k_{4,j,t}$  and  $k_{4,j,s}$  are given in the table for the respective values  $\eta_i$ .

Check:

$$\frac{F_{1,d}}{R_{1,j,d}} \leq 1 \quad \text{and} \quad \frac{F_{4,d}}{R_{4,jt,d}} \leq k_{4,jt} \quad \text{and} \quad \frac{F_{4,d}}{R_{4,js,d}} \leq k_{4,js}$$

Or for uplift (only for the types ...U/xx):

$$\frac{F_{2,d}}{R_{2,j,d}} \leq 1 \quad \text{and} \quad \frac{F_{4,d}}{R_{4,jt,d}} \leq k_{4,jt} \quad \text{and} \quad \frac{F_{4,d}}{R_{4,js,d}} \leq k_{4,js}$$



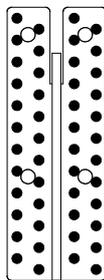
For timber elements with a density  $\rho_k > 350 \text{ kg/m}^3$ , values can be increased as shown by the following table:

Ri.jt.k values may be increased			
	to $\rho_k \text{ [kg/m}^3\text{]}$		
from $\rho$	380	410	430
350	1.04	1.08	1.11

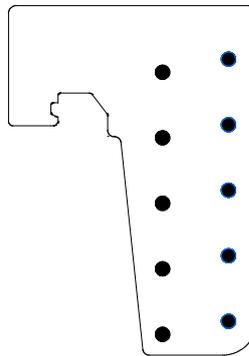
The values from the tables D12-2, D12-4 and D12-6 are based on a full nailing, using of all steel dowel holes.

standard connection  
to use all nailholes / all holes for steel dowel

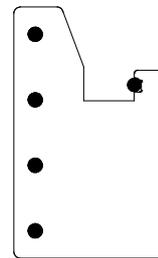
JHDXx



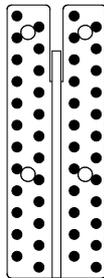
JHHUxx



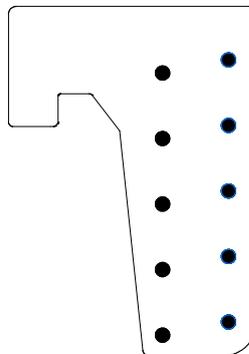
JHGUxx



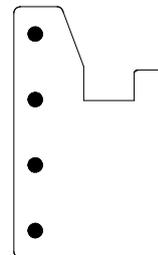
JHD1-xx  
JHDxx



JHHxx



JHGxx



The steel based capacities for products, made from the material S235JG, have to be multiply with the factor 0,65 .



**Table D14-4: capacities JHDU [kN]**

Model	R <sub>1,Dt.k</sub> [kN]					R <sub>1,Ds.k</sub>	R <sub>2,Ds.k</sub>	R <sub>4,Ds.k</sub>
	CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x50	CSA5.0x80			
JHDU20	16.8	22.0	26.7	44.6	62.8	44	22.8	16.4
JHDU24	23.1	30.0	36.2	56.1	77.8	68.9	22.8	17.1
JHDU36	44.2	56.5	66.6	89.6	121.7	134	22.8	24
JHDU48	66.3	83.8	97.6	122.2	164.7	134	22.8	31.2
JHDU60	88.5	111.0	128.3	154.5	207.3	150.8	25.7	38.5
JHDU72	110.3	137.8	158.4	186.5	249.8	150.8	25.7	41.5
JHDU84	131.9	164.2	188.2	218.4	292.1	150.8	25.7	41.5
JHDU96	153.3	190.4	217.7	250.2	334.3	150.8	25.7	41.5
Model	R <sub>4,Dt.k</sub> [kN]							
	CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x50	CSA5.0x80			
JHDU20	14.7	19.6	24.5	64.0	107.7	44	22.8	16.4
JHDU24	6.5	8.7	10.9	28.5	47.9	68.9	22.8	17.1
JHDU36	8.4	11.2	14.0	36.7	61.7	134	22.8	24
JHDU48	10.5	14.0	17.5	45.7	76.9	134	22.8	31.2
JHDU60	12.6	16.8	21.1	55.0	92.5	150.8	25.7	38.5
JHDU72	14.8	19.7	24.7	64.4	108.4	150.8	25.7	41.5
JHDU84	17.0	22.6	28.3	73.9	124.3	150.8	25.7	41.5
JHDU96	19.2	25.5	31.9	83.4	140.3	150.8	25.7	41.5
Model	R <sub>2,Dt.k</sub> [kN]							
	CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x50	CSA5.0x80			
JHDU20	9.7	12.8	15.9	33.8	50.9	44	22.8	16.4
JHDU24	13.8	18.2	22.5	44.9	66.2	68.9	22.8	17.1
JHDU36	29.4	38.4	46.7	79.4	112.1	134	22.8	24
JHDU48	48.3	62.5	75.1	113.6	156.9	134	22.8	31.2
JHDU60	69.1	88.6	105.3	147.1	200.9	150.8	25.7	38.5
JHDU72	90.8	115.6	136.1	180.1	244.3	150.8	25.7	41.5
JHDU84	112.8	142.9	167.1	212.8	287.3	150.8	25.7	41.5
JHDU96	135.0	170.2	197.9	245.2	330.1	150.8	25.7	41.5

**Table D14-5: factors for load combination for JHDU**

Model	factor $k_{4,D_s}$										
	$\eta_{1,D,s}$										
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
JHDU20	1.00	0.94	0.88	0.81	0.73	0.64	0.55	0.44	0.31	0.17	0.00
JHDU24	1.00	0.96	0.91	0.85	0.78	0.70	0.60	0.50	0.37	0.21	0.00
JHDU36	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.65	0.00
JHDU48	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHDU60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHDU72	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHDU84	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHDU96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

Model	factor $k_{4,D_t}$										
	$\eta_{1,D,t}$										
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
JHDU20	1.00	0.91	0.82	0.73	0.64	0.54	0.44	0.33	0.23	0.12	0.00
JHDU24	1.00	0.92	0.83	0.74	0.65	0.55	0.45	0.35	0.24	0.12	0.00
JHDU36	1.00	0.93	0.86	0.78	0.69	0.60	0.50	0.39	0.27	0.14	0.00
JHDU48	1.00	0.94	0.88	0.80	0.72	0.64	0.54	0.43	0.31	0.17	0.00
JHDU60	1.00	0.95	0.89	0.83	0.75	0.67	0.57	0.46	0.31	0.19	0.00
JHDU72	1.00	0.96	0.90	0.84	0.77	0.69	0.60	0.49	0.36	0.21	0.00
JHDU84	1.00	0.96	0.91	0.86	0.79	0.71	0.62	0.51	0.38	0.22	0.00
JHDU96	1.00	0.97	0.92	0.87	0.80	0.73	0.64	0.53	0.40	0.24	0.00

**Table D14-6: Capacities JHGU [kN], b= length of steel dowel = min. width of joist**

Model	Characteristic Capacity [kN]												$R_{1.Gs.k}$	$R_{2.Gs.k}$	$R_{4.Gs.k}$
	Width of timber = length of SD dowels [mm]														
	80		100		120		140		160		180				
	$R_{1.Gt.k}$	$R_{4.Gt.k}$	$R_{1.Gt.k}$	$R_{4.Gt.k}$	$R_{1.Gt.k}$	$R_{4.Gt.k}$	$R_{1.Gt.k}$	$R_{4.Gt.k}$	$R_{1.Gt.k}$	$R_{4.Gt.k}$	$R_{1.Gt.k}$	$R_{4.Gt.k}$			
JHGU200	19.5	30.7	21.3	33.9	23.6	37.9	29	42.3	29	46.8	30.3	46.8	96.1	28.5	29.5
JHGU260	29.6	29.4	32.2	32.5	35.6	36.3	39.4	40.5	43.5	44.8	46.2	44.8	173.7	28.5	29.5
JHGU320	40.3	30.9	43.7	34.1	48.1	38.2	53.2	42.6	58.7	47.1	63.1	47.1	167.6	28.5	29.5
JHGU380	51.4	40.3	55.5	44.5	61	49.7	67.4	55.5	74.2	61.4	80.7	61.4	167.6	28.5	29.5
JHGU440	62.6	50.2	67.4	55.5	74	62.0	81.6	69.2	89.8	76.5	98.5	76.5	167.6	28.5	29.5
JHGU500	73.8	51.2	79.4	56.6	87	63.3	95.8	70.7	105.4	78.1	115.5	78.1	167.6	28.5	29.5
JHGU560	85.1	53.1	91.4	58.7	100	65.6	110	73.2	120.9	80.9	132.5	80.9	167.6	28.5	29.5
JHGU620	96.3	55.4	103.3	61.2	112.9	68.4	124.1	76.4	136.4	84.5	149.3	84.5	167.6	28.5	29.5

**Table D14-7: factors for load combination for JHGU**

Model	factor $k_{4.Gs}$										
	$\eta 1.G.s$										
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
JHGU200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.68	0.36	0.00
JHGU260	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.00
JHGU320	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHGU380	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
JHGU440	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.03
JHGU500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.03
JHGU560	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.03
JHGU620	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.09

Model	factor $k_{4.Gt}$										
	$\eta 1.G.t$										
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
JHGU200	1.00	0.92	0.83	0.75	0.65	0.56	0.46	0.35	0.24	0.13	0.00
JHGU260	1.00	0.93	0.85	0.77	0.68	0.58	0.48	0.37	0.26	0.14	0.00
JHGU320	1.00	0.93	0.86	0.78	0.69	0.60	0.50	0.39	0.28	0.15	0.00
JHGU380	1.00	0.94	0.87	0.79	0.71	0.62	0.52	0.41	0.29	0.16	0.00
JHGU440	1.00	0.94	0.88	0.81	0.73	0.64	0.54	0.43	0.31	0.17	0.00
JHGU500	1.00	0.95	0.89	0.82	0.74	0.65	0.56	0.45	0.32	0.18	0.00
JHGU560	1.00	0.95	0.89	0.83	0.75	0.67	0.57	0.46	0.34	0.19	0.00
JHGU620	1.00	0.95	0.90	0.84	0.76	0.68	0.59	0.48	0.35	0.20	0.00

**Connection to Column:**

It's possible to use the JH DU also for connection to column, in this case it is to use a nail pattern as shown following

In this case, the capacity for connection to beam shall be multiply with the factors are given in the following both tables.

**Table D14-8: Column factors JH DU**

Model	Factors for "Column" nail pattern		
	$R_{1.Dt.k}$	$R_{4.Dt.k}$	$R_{2.Dt.k}$
JH DU20	0.61	0.25	0.62
JH DU24	0.51	0.57	0.54
JH DU36	0.56	0.58	0.56
JH DU48	0.5	0.54	0.51
JH DU60	0.53	0.55	0.53
JH DU72	0.5	0.53	0.5
JH DU84	0.52	0.53	0.52
JH DU96	0.5	0.52	0.5

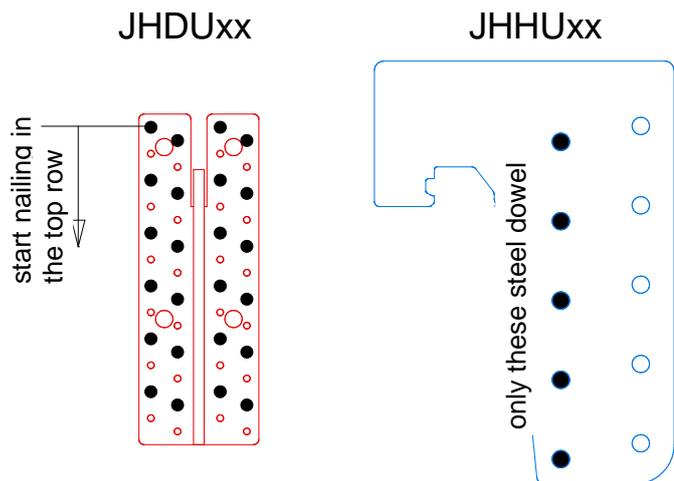
factors for "column" nail pattern

**Table D14-9: Column factors JH HU**

factors for "column" dowel pattern

Model	Factors for "Column" dowel pattern	
	$R_{1.Ht.k}$	$R_{4.Ht.k}$
JH HU140	0.47	0.78
JH HU180	0.51	0.76
JH HU200	0.51	0.73
JH HU260	0.54	0.64
JH HU320	0.56	0.62
JH HU380	0.57	0.64
JH HU440	0.59	0.62
JH HU500	0.61	0.61
JH HU560	0.62	0.61
JH HU620	0.64	0.6

column / partial connection



### Connection to concrete / rigid support

#### Force direction $F_1 / F_2$

The anchorage has to have a capacity, to absorb the following described forces.

Download:

Each of the both upper bolts has to have a axial capacity of min:

$$R_{ax.bolt.d} \geq F_{1,d} \times 24mm / (e_{bolt} \times 2)$$

Uplift (only for connection with minimum 4 bolts):

Both lower bolts have to have an axial capacity of min:

$$R_{ax.bolt.d} \geq F_{2,d} \times 64mm / (e_{bolt} \times 2)$$

Each of the bolts must have a lateral capacity of min:

$$R_{lat.bolt.d} \geq F_{1,d} / n_{bolt}$$

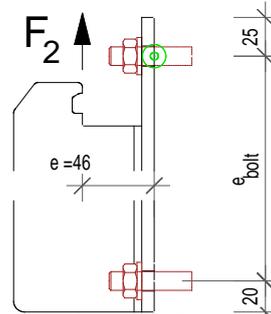
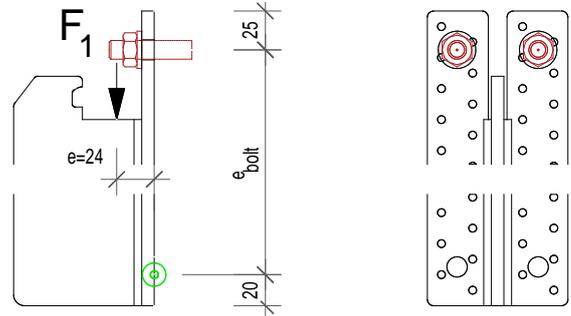
or

$$R_{lat.bolt.d} \geq F_{2,d} / n_{bolt}$$

with:

$$e_{bolt} = \text{size A} - 50mm$$

$$n_{bolt} = \text{number of all bolts}$$



The limit for the axial force is given with 5,3 kN for each of the upper bolts, and a limit for the lateral force in each bolt with 30,0 kN.



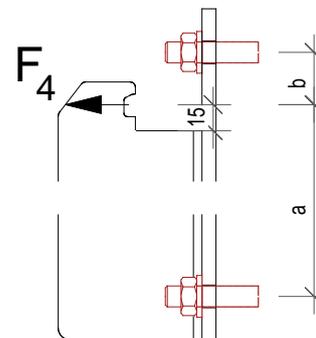
The active force in the bolts can be determined also with software, e.g. anchor designer

#### Force direction $F_4$

The force in the upper bolts have to be calculate as following:

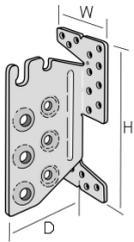
$$F_{upper.bolt.ax.d} = F_{4,d} \times a / ((a+b) \times 2)$$

The limit for the axial force is also given with 5,3 kN for each of the upper bolts.

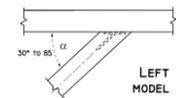
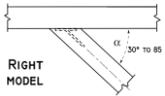


**D15 TU, TUS**

Model	Alternative names				Previous name
	Branch 36 (UK)	Branch 40 (France)	Branch 46 (Denmark)	Branch 47 (Germany)	
TU	TU				JANE TUS
TUS	TU/S	TU/S	TU/S	TU/S	JANE TUS

**Figure D15-1: drawings; Table D15-1: size specification****TU**

Model	W [mm]	H [mm]	D [mm]	Thickness [mm]	Skew Angle	
					Degree	Direction
TU12	40	96	101	3	90°	~
TU16	60	134	108	3	90°	~
TU20	60	174	108	3	90°	~
TU24	60	214	108	3	90°	~
TU28	60	254	108	3	90°	~

**TUS**

Model	W [mm]	H [mm]	D [mm]	Thickness [mm]	Skew Angle	
					Degree	Direction
TU/SL12	60	96	101	3	30-89°	Left
TU/SL16	60	134	108	3	30-89°	Left
TU/SL20	60	174	108	3	30-89°	Left
TU/SL24	60	214	108	3	30-89°	Left
TU/SL28	60	254	108	3	30-89°	Left
TU/SR12	60	96	101	3	30-89°	Right
TU/SR16	60	134	108	3	30-89°	Right
TU/SR20	60	174	108	3	30-89°	Right
TU/SR24	60	214	108	3	30-89°	Right
TU/SR28	60	254	108	3	30-89°	Right

Model	Header fasteners		Joist Fasteners	
	Ø4.0 Connector Nails	Bolt M12 Concrete Screw	Ø8.0 SD Dowels	Ø12.0 SD Dowels
TU12	6	~	4	~
TU16	18	~	~	3
TU20	22	~	~	4
TU24	26	~	~	5
TU28	30	~	~	6
TUS12	6	~	4	~
TUS16	18	~	~	3
TUS20	22	~	~	4
TUS24	26	~	~	5
TUS28	30	~	~	6

**Table D15-2: Material specification**

Material thickness	Material Grades	Coating Specification
3	S250 GD	Z275
3	stainless steel (as described)	

For installation for fire justification, see clause B6.

**Table D15-3: Characteristic capacities  $R_{1,k}$  [kN] TU and TUS full nailing**

Skew	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											
	Full Nailing: Beam to Beam											
	Width of timber = length of dowels [mm]											
	60	80	120	160	60	80	120	160	60	80	120	160
90°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TU12	8.1	9.0	10.7	10.7	8.1	9.0	10.7	10.7	8.1	9.0	10.7	10.7
TU16	17.5	18.1	20.5	23.5	16.6	17.0	18.8	21.2	15.9	16.4	17.9	20.0
TU20	26.7	27.6	31.1	35.6	25.3	25.8	28.5	32.2	24.4	25.1	27.4	30.5
TU24	36.6	37.7	42.5	48.3	34.8	35.5	39.1	43.9	33.6	34.7	37.8	42.0
TU28	46.9	48.3	54.1	61.1	44.5	45.6	50	55.9	43.4	44.9	48.7	53.9
45°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TUS12	7.4	8.2	9.5	9.5	6.9	7.6	9.1	9.1	6.6	7.1	8.5	8.7
TUS16	16.3	16.9	18.9	21.4	15.6	15.9	17.4	19.5	15	15.4	16.6	18.4
TUS20	24.9	25.6	28.7	32.3	23.7	24.1	26.5	29.5	22.9	23.5	25.4	28.0
TUS24	34.2	35.2	39.2	44.1	32.6	33.2	36.3	40.4	31.5	32.5	35	38.6
TUS28	44	45.2	50.3	56.1	42	42.8	46.7	51.7	40.8	42.0	45.3	49.7
85°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TUS12	7.6	8.4	9.7	9.7	7.1	7.7	9.3	9.3	6.7	7.3	8.7	8.9
TUS16	16.7	17.3	19.5	22.1	15.9	16.2	17.9	20.1	15.3	15.7	17.1	18.9
TUS20	25.6	26.4	29.6	33.4	24.3	24.8	27.2	30.5	23.4	24.1	26.1	28.9
TUS24	35.1	36.2	40.4	45.3	33.5	34.1	37.3	41.6	32.3	33.3	36.1	39.8
TUS28	45.2	46.5	51.6	57.0	43	43.9	48	53.1	41.8	43.2	46.6	51.2

Intermediary values can be determined by interpolation.

For a skew between 30° and 45° the values for 45° shall be used.

The capacities for  $R_{2,k}$  shall be modified in relation to one steel dowel less, mean e.g. for a TU20 with 4 steel dowel, the uplift capacity shall be reduced to:  $(4-1) / 4 = 0,75$ .

The topmost steel dowel in the cut out hole shall not be considered.

**Table D15-4: Characteristic capacities  $R_{1,k}$  [kN] TU and TUS**

with nail pattern as given below

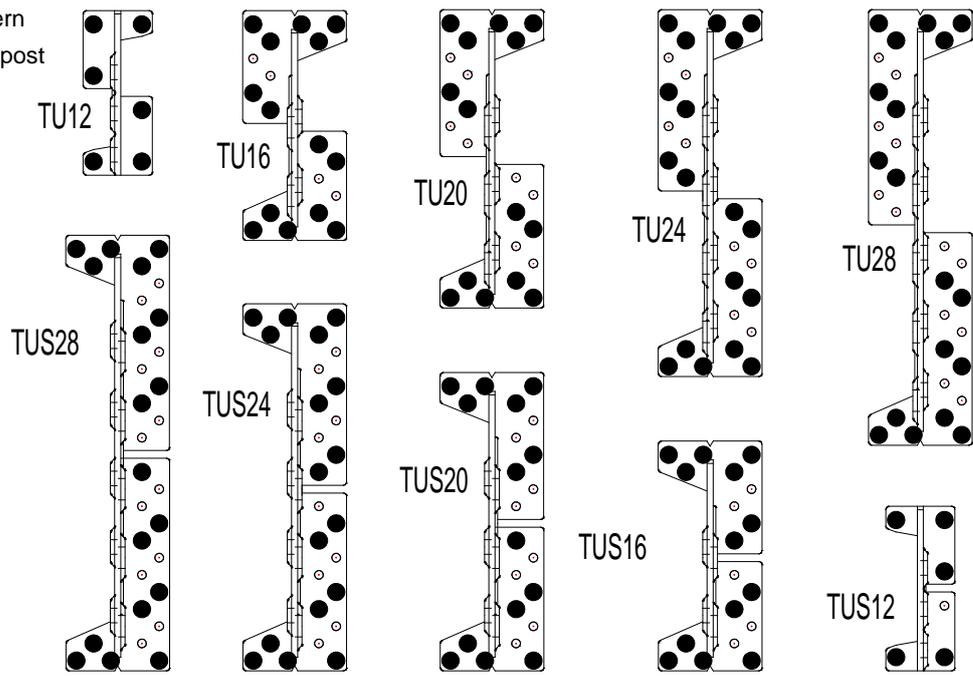
Skew	Characteristic Capacity - $R_{1,k}$ [C24] - CNA4.0x50											
	Full Nailing: Beam to Post											
	Width of timber = length of dowels [mm]											
	60	80	120	160	60	80	120	160	60	80	120	160
90°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TU12	8.1	9.0	10.7	10.7	8.1	9.0	10.7	10.7	8.1	9.0	10.7	10.7
TU16	16.1	16.7	19	21.9	15.2	15.5	17.3	19.7	14.5	14.9	16.4	18.4
TU20	22.9	23.7	26.8	30.1	21.6	22.2	24.6	27.7	20.7	21.3	23.4	26.1
TU24	31.9	33.0	36.9	39.9	30.2	30.9	34.1	37.9	29	30.0	32.7	36.2
TU28	39	38.9	39.9	39.9	36.3	36.9	39.6	39.9	35	36.0	38.6	39.9
45°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TUS12	7.4	8.2	9.5	9.5	6.9	7.6	9.1	9.1	6.6	7.1	8.5	8.7
TUS16	15	15.5	17.4	19.7	14.2	14.5	16	18.0	13.7	14.0	15.2	16.9
TUS20	21.3	22.0	24.5	26.1	20.2	20.7	22.7	25.2	19.5	20.0	21.7	23.9
TUS24	29.5	30.4	33.7	34.4	28.1	28.7	31.4	34.3	27.1	27.8	30.1	33.0
TUS28	35.3	36.1	36.1	36.1	33.9	34.4	36.1	36.1	32.8	33.5	35.8	36.1
85°	$\beta = 0^\circ$				$\beta = 25^\circ$				$\beta = 45^\circ$			
TUS12	7.6	8.4	9.7	9.7	7.1	7.7	9.3	9.3	6.7	7.3	8.7	8.9
TUS16	15.3	15.9	17.9	20.3	14.5	14.8	16.4	18.5	13.9	14.3	15.5	17.4
TUS20	21.8	22.5	25	26.1	20.6	21.1	23.2	25.6	19.8	20.4	22.2	24.4
TUS24	30.3	31.2	34.1	34.4	28.8	29.4	32.1	34.4	27.7	28.5	30.9	33.6
TUS28	35.7	36.1	36.1	36.1	34.5	35.0	36.1	36.1	33.4	34.2	36	36.1

Intermediary values shall be determined by interpolation.

For a skew between 30° and 45° the values for 45° shall be used.

The capacities for  $R_{2,k}$  shall be modified as described below the table D2-3

nail pattern  
beam to post



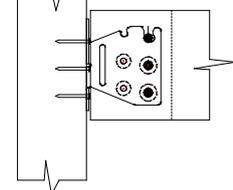
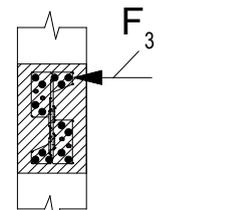
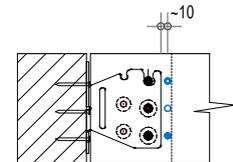
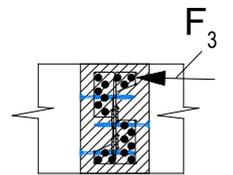
**Table D15-5: Characteristic capacities  $R_{3,k}$  [kN] TU**

$R_{3,k}$	CNA4.0x40		Joist Min.	with screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.5	3.3	4.5	4.5	4.5	4.5	4.5
TU16	3	18	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.6
TU20	4	22	... / 200	2.0	3.6	6.7	9.9	12.5	13.3	13.3
TU24	5	26	... / 240	2.5	3.8	7.0	11.9	15.1	15.1	15.1
TU28	6	30	... / 280	2.9	4.1	7.3	11.9	17.0	17.0	17.0
TU12c	4	6	... / 120	1.5	3.3	4.5	4.5	4.5	4.5	4.5
TU16c	3	14	... / 160	1.5	3.1	4.8	6.6	8.3	9.2	9.2
TU20c	4	14	... / 200	2.0	3.6	6.7	9.4	9.4	9.4	9.4
TU24c	5	18	... / 240	2.5	3.8	7.0	10.9	10.9	10.9	10.9
TU28c	6	18	... / 280	2.9	4.1	7.3	11.3	11.3	11.3	11.3

screw 6,0x L  
with L = b-20mm

(for timber with b=60mm  
use screws 5,0x50)

number of screws =  
number of steel dowel



$R_{3,k}$	CNA4.0x40		Joist Min.	without screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16	3	18	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20	4	22	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24	5	26	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28	6	30	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2
TU12c	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16c	3	14	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20c	4	14	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24c	5	18	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28c	6	18	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2

$R_{3,k}$	CNA4.0x50		Joist Min.	with screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.5	3.3	5.4	5.4	5.4	5.4	5.4
TU16	3	18	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.9
TU20	4	22	... / 200	2.0	3.6	6.7	9.9	12.5	15.1	16.0
TU24	5	26	... / 240	2.5	3.8	7.0	11.9	16.7	18.2	18.2
TU28	6	30	... / 280	2.9	4.1	7.3	11.9	19.3	20.4	20.4
TU12c	4	6	... / 120	1.1	3.3	5.4	5.4	5.4	5.4	5.4
TU16c	3	14	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.1
TU20c	4	14	... / 200	2.0	3.6	6.7	9.9	11.2	11.2	11.2
TU24c	5	18	... / 240	2.5	3.8	7.0	11.9	13.1	13.1	13.1
TU28c	6	18	... / 280	2.9	4.1	7.3	11.9	13.6	13.6	13.6

$R_{3,k}$	CNA4.0x50		Joist Min.	without screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16	3	18	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20	4	22	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24	5	26	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28	6	30	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2
TU12c	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16c	3	14	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20c	4	14	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24c	5	18	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28c	6	18	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2

c = index for column nailing

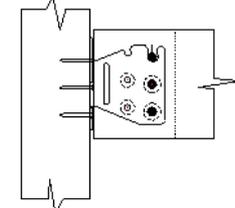
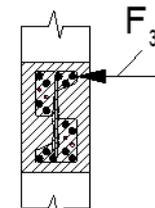
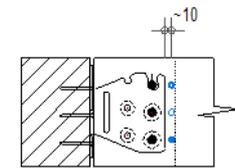
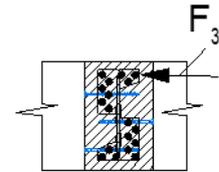
**Table D15-6: Characteristic capacities  $R_{3,k}$  [kN] TU**

$R_{3,k}$	CSA5.0x40		Joist Min.	with screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.5	3.3	5.4	5.4	5.4	5.4	5.4
TU16	3	18	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.9
TU20	4	22	... / 200	2.0	3.6	6.7	9.9	12.5	15.1	16.2
TU24	5	26	... / 240	2.5	3.8	7.0	11.9	16.7	18.4	18.4
TU28	6	30	... / 280	2.9	4.1	7.3	11.9	19.3	20.6	20.6
TU12c	4	6	... / 120	1.5	3.3	5.4	5.4	5.4	5.4	5.4
TU16c	3	14	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.2
TU20c	4	14	... / 200	2.0	3.6	6.7	9.9	11.4	11.4	11.4
TU24c	5	18	... / 240	2.5	3.8	7.0	11.9	13.3	13.3	13.3
TU28c	6	18	... / 280	2.9	4.1	7.3	11.9	13.8	13.8	13.8

$R_{3,k}$	CSA5.0x40		Joist Min.	without screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16	3	18	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20	4	22	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24	5	26	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28	6	30	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2
TU12c	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16c	3	14	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20c	4	14	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24c	5	18	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28c	6	18	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2

$R_{3,k}$	CSA5.0x50		Joist Min.	with screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.5	3.3	5.8	6.3	6.3	6.3	6.3
TU16	3	18	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.9
TU20	4	22	... / 200	2.0	3.6	6.7	9.9	12.5	15.1	17.8
TU24	5	26	... / 240	2.5	3.8	7.0	11.9	16.7	20.2	21.5
TU28	6	30	... / 280	2.9	4.1	7.3	11.9	19.3	23.5	24.1
TU12c	4	6	... / 120	1.5	3.3	5.8	6.4	6.3	6.3	6.3
TU16c	3	14	... / 160	1.5	3.1	4.8	6.6	8.3	10.1	11.9
TU20c	4	14	... / 200	2.0	3.6	6.7	9.9	12.5	13.3	13.3
TU24c	5	18	... / 240	2.5	3.8	7.0	11.9	15.6	15.6	15.6
TU28c	6	18	... / 280	2.9	4.1	7.3	11.9	16.1	16.1	16.1

$R_{3,k}$	CSA5.0x50		Joist Min.	with screws - [C24]						
	Quantity			$R_{3,k}$ [kN] for b =						
Type	SD	Nails	b/h [mm]	60	80	100	120	140	160	180
TU12	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16	3	18	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20	4	22	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24	5	26	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28	6	30	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2
TU12c	4	6	... / 120	1.1	1.6	2.1	2.7	3.2	3.7	4.3
TU16c	3	14	... / 160	1.5	2.1	2.8	3.6	4.2	5.0	5.7
TU20c	4	14	... / 200	2.0	2.8	3.7	4.5	5.4	6.4	7.1
TU24c	5	18	... / 240	2.5	3.5	4.4	5.6	6.5	7.7	8.8
TU28c	6	18	... / 280	2.9	4.1	5.3	6.5	7.6	8.9	10.2



screw 6,0x L  
with L = b-20mm

(for timber with b=60mm  
use screws 5,0x50)

number of screws =  
number of steel dowel

**c = index for  
column nailing**

**Table D15-7: Characteristic capacities  $R_{4k}$  [kN] TU**

Type	Quantity		Joist Min. b/h [mm]	$R_{4,k}$ [kN] - C24 timber				
	SD	Nails		CNA4.0x40	CNA4.0x50	CNA4.0x60	CSA5.0x40	CSA5.0x40
TU12	4	6	... / 120	3.6	4.5	5.3	6.1	6.1
TU16	3	18	... / 160	4.8	5.9	7.0	8.4	8.4
TU20	4	22	... / 200	6.5	7.9	9.3	11.9	11.9
TU24	5	26	... / 240	8.2	9.9	11.5	15.4	15.4
TU28	6	30	... / 280	9.9	11.8	13.8	18.9	18.9
TU12c	4	6	... / 120	3.6	4.5	5.3	6.1	6.1
TU16c	3	14	... / 160	3.9	4.8	5.6	8.4	8.4
TU20c	4	14	... / 200	5.1	6.2	7.2	11.0	11.9
TU24c	5	18	... / 240	5.9	7.6	8.7	13.1	15.4
TU28c	6	18	... / 280	6.6	8.8	10.3	15.2	18.9

