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

Authorised and notified 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-10/0440 of 2020/11/12

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 Roof Connectors
Product family to which the above construction product belongs:	Three-dimensional nailing plate (timber-to-timber/timber-to-concrete/timber to steel wind bracing)
Manufacturer:	SIMPSON STRONG-TIE Int. Ltd For local branch refer to www.strongtie.eu
Manufacturing plant:	SIMPSON STRONG-TIE Manufacturing facilities
This European Technical Assessment contains:	81 pages including 3 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 issued on 2020-01-07

Table with the product names and alternative names for different countries

Product name	Alternative name			
	DK	F	UK	D
BNSP25		TF/27025		
BNSP40		TF/27040		
BNSP60		TF/27060		
BNSP80				
BNSP25B				
BNSP40/60B				
BNKK25				
BNKK25-14				
BNKK40/60				
BNKK40/60-14				
FMBS				
FMB				
BNK25				
BNK25-14				
BNK40/60				
BNK40/60-14				
BNF25				
BNF25-14				
BNF40				
BNF40-14				
BNG25				
BNG25-14				
BNG60				
BNG60-14				
BNU25				
BNU25-14				
BNU40				
BNU40-14				
BNU25T				
DAB73T				
DAB22				
DLV				
DLVS73				
CST				
BNW1				
BNW2				
BNWA				
BNWM12				
BNWM16				
WSP				
WSD				
WSB				
WSP-12				
WSP-14				
WSD-12				
WSD-14				
WSB-12				
WSB-14				
Bandlock coupler				
Bandlock tension strap				
Bandlock tension strap for anchor				
Bandlock coupler with dowel for anchor plate				
Bandlock Pro – BPTD and BPST				

2 SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT 7

1 DEFINITION OF PRODUCT AND INTENDED USE 7
Technical description of product and intended use 7
Intended use 7
3 CHARACTERISTICS OF PRODUCT AND ASSESSMENT 8
3.9 Methods of assessment 9
Safety principles and partial factors 9
3.10 Mechanical resistance and stability 9
3.11 Related aspects of serviceability 10
3.11.1 Corrosion protection in service class 1 and 2 10
3.11.2 Corrosion protection in service class 3. 10
3.12 General aspects related to the use of the product 10
4 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE (AVCP) 11
4.1 AVCP system 11
5 TECHNICAL DETAILS NECESSARY FOR THE IMPLEMENTATION OF THE AVCP SYSTEM, AS FORESEEN IN THE APPLICABLE EAD 11

ANNEX A – REVISION HISTORY 12

ANNEX B - PRODUCT DETAILS AND DEFINITIONS 14

TYPICAL INSTALLATION 14
Wind bracing connectors BNF, BNG, BNK placed on the topside of the rafters 14
Wind bracing connector BNU placed on the lower side of the rafters 15
Wind bracing connectors DAB73T and BNU25T 16
Wind bracing connector BNW 16
Anchoring to concrete BNG60 17
Connection of Battens 17
Connector for Stability of Trusses - CST 17
WSP, WSD and WSB 18
Bandlock Pro Connectors – BPTD and BPST 20
FASTENERS 21
PRODUCTION DRAWINGS 22
Tension straps and couplers 22
BNSP25 22
BNSP40 22
BNSP60 22
BNSP80 22
BNSP25B 22
BNSP4060B 23
FMBS 23
FMB 24
BF25M5 (Clips 23) 24
BF4060M5 (Clips 20) 24
BNKK25 / BNKK25-14 25
BNKK40/60 / BNKK40/60-14 25
Bandlock coupler, 40 mm 26
Bandlock tension strap, 40 mm 27
Bandlock tension strap for anchor, 40 mm 28
Bandlock coupler with dowel for anchor plate, 40 mm 29
Bandlock coupler, 60 mm 30
Bandlock tension strap, 60 mm 31
Bandlock tension strap for anchor, 60 mm 32
Bandlock coupler with dowel for anchor plate, 60 mm 33
Bandlock Pro connectors BPTD and BPST 34
Mid anchor plates 36
BNK25 / BNK25-14 36
BNK40/60 / BNK40/60-14 37
End anchor plates 37
BNF25 / BNF25-14 37
BNF40 / BNF40-14 38
BNG60 / BNG60-14 39
Wind bracing connectors 39

BNU25 / BNU25-14 ... 39
BNU40 / BNU40-14 ... 40
BNW1 ... 40
BNW2 ... 40
WSP, WSD, WSB ... 41
Wind bracing link set ... *42*
BNWA ... 42
Tie rods ... *42*
BNWM12 ... 42
BNWM16 ... 42
Diagonal bracing kit ... *43*
BNU25T ... 43
DAB73T ... 43
Diagonal bracing connector ... *44*
DAB22 ... 44
Batten connectors ... *45*
DLVS ... 45
DLV ... 45
DLV50/30 ... 46
Connector for Stability of Trusses ... *47*
CST ... 47
FASTENER PATTERN ... 48
Tension straps and couplers ... *48*
BNSP25 ... 48
BNSP40 ... 48
BNSP60 ... 49
BNSP80 ... 49
BNSP25B ... 50
BNSP4060B ... 50
FMBS ... 51
FMB ... 52
BNKK25 / BNKK25-14 ... 52
BNKK40/60/ BNKK40/60-14 ... 53
Mid anchor plates ... *54*
BNK25 / BNK25-14 ... 54
BNK40/60 / BNK40/60-14 ... 54
End anchor plates ... *55*
BNF25 / BNF25-14 ... 55
BNF40 / BNF40-14 ... 55
BNG25 / BNG25-14 ... 56
BNG60 / BNG60-14 ... 57
Wind bracing connectors ... *59*
BNU25 / BNU25-14 ... 59
BNU40 / BNU40-14 ... 59
BNW1 ... 60
BNW2 ... 60
WSP, WSD, WSB ... 61
Wind bracing link set ... *62*
BNWA ... 62
Diagonal bracing kit ... *62*
BNU25T ... 62
DAB73T ... 62
Batten connectors ... *63*
DLVS ... 63
DLV ... 63
ANNEX C - CHARACTERISTIC LOAD-CARRYING CAPACITY ... 65
DESIGN BASIS – GENERAL ... 65
Strength modification factors for service classes and load-duration classes ... *65*
Density ... *66*
Combined forces ... *66*
Timber splitting ... *66*
TENSION STRAPS AND COUPLERS ... 67
BNSP, BNKK, FMBS, FMB ... *67*
Bandlock coupler and tension straps ... *69*

Bandlock Pro Connectors *69*
MID ANCHORS 70
BNK *70*
END ANCHORS 71
BNF and BNG *71*
WIND BRACING CONNECTORS 72
BNU *72*
BNW *73*
WSP, WSD, WSB *74*
ANCHORS FOR CONNECTIONS TO CONCRETE 76
BNG *76*
WSD *77*
BATTEN CONNECTORS 78
DAB22 ..... *78*
DLVS73 ..... *78*
DLV *79*
DLV50/30 ..... *80*
CONNECTOR FOR STABILITY OF TRUSSES 81
CST *81*

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

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

2 SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Definition of product and intended use

Technical description of product and intended use
The connectors are one piece, non-welded connectors. They are intended for timber-to-timber, steel-to-steel, timber-to-concrete, steel-to-concrete or timber-to-steel connections fastened by a range of nails, screws, dowels or bolts.

The connectors are manufactured from continuously hot-dip coated steel according to EN 10346 with tolerances according to EN 10143. The grades are S250GD or S350GD and the coatings are min. Z275 or min. ZM310. Welded parts are manufactured from S235JR according to EN 10025-2 and electro galvanized to EN ISO 4042.

The connectors can also be produced from stainless steel number 1.4401 or number 1.4404 according to EN 10088-2 or a stainless steel with a minimum characteristic 0,2% yield stress of 240 MPa, a minimum 1,0% yield stress of 270 MPa and a minimum ultimate tensile strength of 530 MPa. Tolerances are according to EN ISO 9445.

The connectors can be applied with a coloured top paint.

Dimensions, hole positions and typical installations are shown in Annex A.

Intended use
The connectors are intended for use in making wind bracing connections in load bearing structures, typically as a connection in stabilizing structures between two timber members or between a timber member and a concrete or steel member, 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 wood members can be of solid timber, glued laminated timber and similar glued members, or wood-based structural members with a characteristic density from 290 kg/m^3 to 420 kg/m^3.

This 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 C14 – C40 according to EN338 / EN14081 when structural adhesives are used.
- Glued laminated 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.
- Laminated Strand Lumber, e.g. Parallam and Timber Strand.
- Plywood according to EN 636
- Oriented Strand Board, OSB according to EN 300.

Annex C states the load-carrying capacities of the connections for a characteristic density of 350 kg/m^3.
For timber or wood based material with a lower characteristic density than 350 kg/m^3 the load-carrying capacities shall be reduced by the k_{dens} factor:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5}$$

Where ρ_k is the characteristic density of the timber in kg/m^3.

The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code. The wood members shall have a thickness which is larger than the penetration depth of the nails or screws into the members and shall also fulfill the minimum sizes mentioned in the tables of Annex C.

The connectors are primarily for use in timber structures subject to the dry, internal conditions defined by service class 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading.

The connectors can also be used in outdoor timber structures, service class 3, when a corrosion protection in accordance with Eurocode 5 or coating ZM310 is applied, or when stainless steel is used. See specification under “Technical description of the product”.

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 and in conjunction with the admissible service conditions according to EN 1995-1-1 and the admissible corrosivity category as described and defined in EN ISO 12944-2.

The provisions made in this European Technical Assessment are based on an assumed intended working life for the three-dimensional nailing plate 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 selecting the appropriate product in relation to the expected economically reasonable working life of the works.

3 Characteristics of product and assessment

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*) (BWR1)	
Characteristic load-carrying capacity	See Annex C
Stiffness	No performance assessed (NPA)
Ductility in cyclic testing	No performance Assessed (NPA)
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The connectors are made from steel classified as Euroclass A1 in accordance with Commission Delegated Regulation 2016/364, EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.8 General aspects related to the performance of the product	The connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species (including timbers preserved with organic solvent, boron diffusion and related preservatives) described in Eurocode 5 and subject to the conditions defined by service classes 1, 2 and 3.
Identification	Each connector bears the manufacturer's identification mark and the product type. The CE Marking appears on the packaging. See Annex D

*) See additional information in section 3.9 – 3.12.

3.9 Methods of assessment

Safety principles and partial factors

The characteristic load-carrying capacities have been calculated considering different ratios between the partial factors for timber connections, steel cross sections and bolt/anchor in concrete.

According to clause 6.3.5 of EN 1990 (Eurocode – Basis of structural design) the characteristic resistance for structural members that comprise more than one material acting in association should be calculated as:

$$R_d = \frac{1}{\gamma_{M,1}} R\left\{\eta_1 X_{k,1}; \eta_i X_{k,i(i>1)} \frac{\gamma_{m.1}}{\gamma_{m,i}}; a_d\right\}$$

Where $\gamma_{M,1}$ is the global partial factor for material 1 (in this case wood), $\gamma_{m,1}$ is the partial factor on the material 1 and $\gamma_{m,i}$ are material partial factors for the other materials, i.e. the calculations are made with material parameters modified by multiplication by:

$$k_{modi} = \frac{\gamma_{m,1}}{\gamma_{m,i}}$$

The characteristic load-carrying capacities for a connection between timber and steel have been calculated considering a ratio between the partial factor for timber connections and steel cross sections:

$$k_{modi} = \frac{1{,}30}{1{,}10} = 1{,}18 \quad \text{for steel yield strength}$$

$$k_{modi} = \frac{1{,}30}{1{,}25} = 1{,}04 \quad \text{for steel ultimate strength}$$

For k_{modi} > the factor stated above the characteristic load-carrying capacities stated in Annex B are valid (on the safe side).
For k_{modi} < the factor stated above the load-carrying capacities stated in Annex C have to be multiplied by a factor:

$$k_{safe} = \frac{k_{modi}}{actual\ factor\ stated\ above}$$

3.10 Mechanical resistance and stability

See annex C for load-duration modification of the characteristic load-carrying capacity in service class 1 and 2 and service class 3 and determination of the design capacities.

The characteristic capacities of the connectors are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. The capacities should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

The connector can be installed using different nailing patterns. The nailing pattern for each connector is described and shown in Annex A and the characteristic load carrying capacity is stated in Annex C.

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.

No performance has been determined in relation to the joint's stiffness properties - to be used for the analysis of the serviceability limit state.

Fasteners in Connectors

Connector nails and screws in accordance with ETA-04/0013

The load bearing capacities of most of the connectors have been determined based on the use of Connector nails CNA4,0x40 or CNA4,0x50 in accordance with ETA-04/0013. Further, Connector screws CSA 4,0x30 according to EN 14592 are used. It is allowed to use Connector screws CSA5,0x35, CSA5,0x40 or CSA5,0x50 or Connector nails CNA4,2x35, CNA4,2x50 or CNA4,2x60 in accordance with ETA-04/0013 with the same or better performance than the CNA 4,0 mm connector nails and still achieve the same load-bearing capacity of the connection.

Threaded nails in accordance with EN 14592

The design model also allows the use of threaded nails in accordance with EN 14592 with a diameter in the range 3,1 – 4,2 mm and a minimum length of 35 mm, assuming a thick steel plat 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 4.1 in ETA-04/0013 is applicable for all load bearing capacities of the connection.

Other fasteners

The load bearing capacities of the connector DLV has been determined based on the use of 3,1 mm and 3,4 mm smooth shank nails according to EN 14592.

M12 bolts are used to fasten the connectors to the timber members and connectors to concrete. The bolts are in accordance with EN 14592 with an ultimate strength of 800 MPa.

Ø12, Ø14 and Ø20 dowels are used to connect the steel parts. The dowels are in accordance with EN 14592 with a yield strength of 235 MPa and an ultimate strength of 360 MPa.

Stainless steel
For connectors produced from stainless steel number 1.4401 or number 1.4404 according to EN 10088-2:2005, the characteristic load carrying capacities for service class 1 and 2 can be considered as the same as those published in this document subject to the use of stainless CNA connector nails covered by the ETA-04/0013 or stainless threaded nails in accordance to the standard EN 14592 respecting the rules given in the paragraph "fasteners" above. When using stainless screws, the characteristic load carrying capacities can be considered as the same as those published in this document for connector nails covered by the ETA-04/0013 subject to the lateral and withdrawal capacities of the stainless screws are at least equal to those of CNA connector nails covered by the ETA-04/0013.

3.11 Related aspects of serviceability

3.11.1 Corrosion protection in service class 1 and 2.
In accordance with ETAG 015 shall the connector have a zinc coating weight of min. Z275. The steel employed is S250GD or S350GD with min. Z275 alternatively ZM310 according to EN 10346.

3.11.2 Corrosion protection in service class 3.
In accordance with Eurocode 5 connectors with a thickness up to 3 mm shall be made from stainless steel. Connectors with a thickness from 3 to 5 mm can be made from stainless steel or from S250GD or S350GD with min. Z350 according to EN 10346.
Alternatively, ZM310 can be used as corrosion protection in service class 3 (applicable for all steel thicknesses).

3.12 General aspects related to the use of the product

The connectors are manufactured in accordance with the provisions of the European Technical Assessment using the automated manufacturing process as identified during the inspection of the plant by ETA-Danmark A/S and the approved body and laid down in the technical documentation.

The pattern of nails, screws or bolts used shall be as defined in Annex A and Annex B.

The connection is considered fit for use provided that the structural member to which the roof connectors are fixed shall be:

- For all connectors except the Batten Connectors DLVS and DLV: Restrained against rotation.
- As described in section 2.1 of this ETA report

The actual end bearing capacity of the timber member to be used in conjunction with the roof connector is checked by the designer of the structure to ensure it is not less than the connector capacity and, if necessary, the roof connector capacity reduced accordingly.

The timber member shall be free from wane under the connector.

The gap between the timber members does not exceed 3 mm.

There are no specific requirements relating to preparation of the timber members.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/638/EC of the European Commission1, 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 foreseen 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 2020-11-12 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A – Revision History

Modifications and additions to the previous ETA-10/0440 valid from 2011-01-31 to 2016-01-31	
Page	**Modification**
8	Steel-to-concrete added
20	Update of production drawings
21	Addition of production drawing FMBS
21	Addition of production drawing FMB
22	Addition of production drawing BF25M5, BF4060M5, BNKK25-14, BNKK40/60-14
23	Addition of production drawing BNK25-14
24	Addition of production drawing BNF25-14, BNF40-14
25	Addition of production drawing BNG25-14, BNG60-14
26	Addition of production drawing BNU25-14, BNU40-14
31	Addition of production drawing CST
32-42	Addition of fastener pattern
41	Number of nail corrected to 13
48	Update and additions to Table 1
49	Update and additions to Table 2
50	Update and additions to Table 3
51	Update and additions to Table 4
52	Update and additions to Table 5
54	Update and additions to Table 7
56	Addition of Table 9

Modifications and additions to the previous ETA-10/0440 valid from 2013-05-28 to 2018-05-28	
Page	**Modification**
9	Removed section about BOAX & added new section
10	Addition of Ø14 & added S350GD steel
19	Addition of WSP, WSD & WSB products – typical installation
21	Update to table
26	Addition of production drawing BNK40/60-14
29	Update to images of BNW1 & BNW2
33	Update to table - DLV name
34	Addition of DLV50/30 product
36-41	Update to images
51	Addition of DLV50/30
54	Update to table 1
55	Update to table 2
56	Update to table 3
57	Update to table 4
60	Replacement of text for product BNG
62	DLV50/30 – characteristic capacities
64	Addition of WSP, WSD, WSB products
	General update: addition of ZM310 coating where Z275 coating is specified

Modifications and additions to the previous ETA-10/0440 valid from 2018-02-06	
Page	**Modification**
All	Minor typos and table formatting etc. corrected
2, 25-32, 66	Addition of Bandlock couplers
38, 58, 70-71	Restructuring of WSP, WSD and WSB from Annex C into Annex B and C
38	Adding alternative geometry/products for WSP, WSD and WSB
65	Table 2, addition of 1,5x40 mm Strap and correction of notes
71	Update of Table 8 (addition of WSP-12/14 & WSD-12/14 & WSB-12/14)
73	Update of Table 10 (addition of WSD-12 & WSD-14)

Modifications and additions to the previous ETA-10/0440 valid from 2020-01-07	
Page	**Modification**
2, 20, 34, 69	Addition of Bandlock Pro connectors BPTD and BPST
7	Addition of coloured connectors
7, 26-33	Correction of steel type for welded Bandlock parts
67-68	Layout of Table 1 and 2 is changed
75	Table 9: Characteristic capacity of Straps corrected

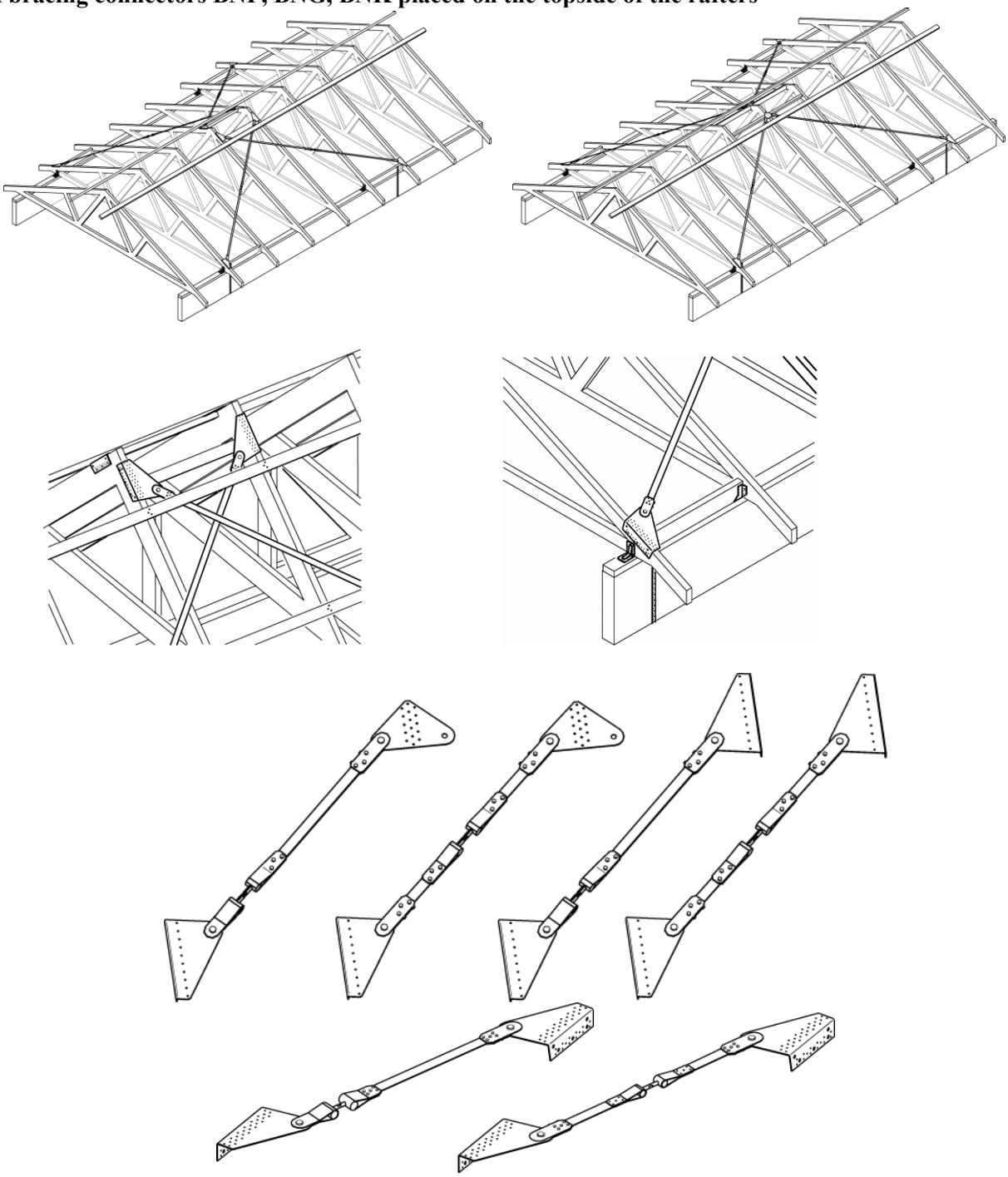
Annex B - Product details and definitions

Typical installation

Typically, the connectors are used in a stabilizing structure between two timber members. The connectors are used in combination with steel bracing straps or diagonal battens.

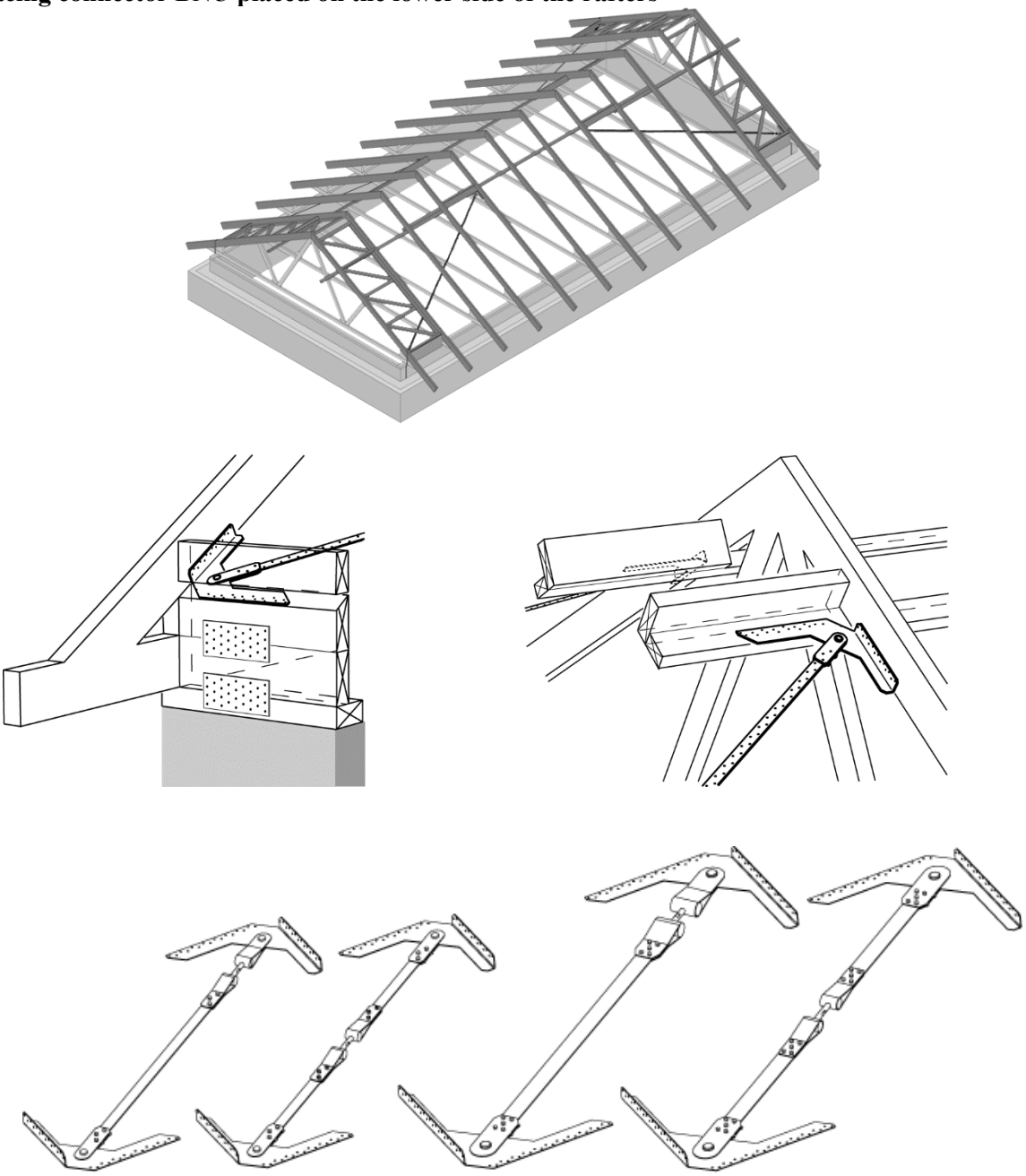
The distance from the center of the holes in which the steel bracing straps are fastened to the connectors to the end of the steel bracing strap shall be minimum 3d=15 mm.

Wind bracing connectors BNF, BNG, BNK placed on the topside of the rafters



Examples of connections between a bracing strap and the connectors

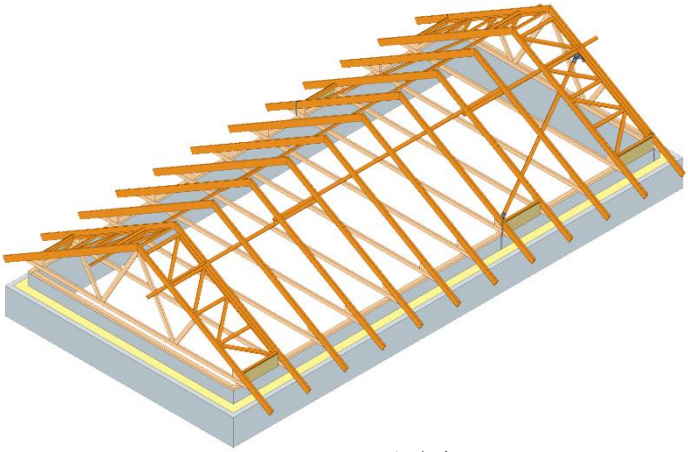
Wind bracing connector BNU placed on the lower side of the rafters

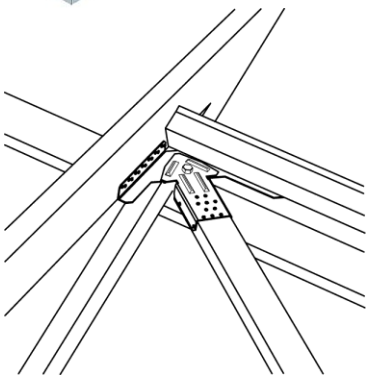


Examples of connections between a bracing strap and the connectors

Wind bracing connectors DAB73T and BNU25T

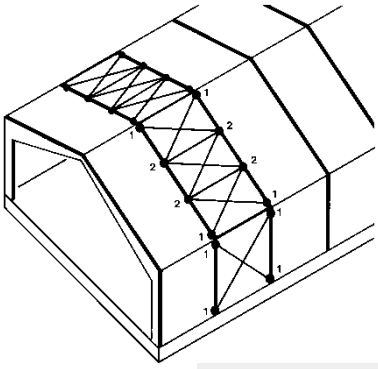
Wind bracing connector DAB73T fastened to a diagonal batten and wind bracing connector BNU25T fastened in line with the underside of the rafter

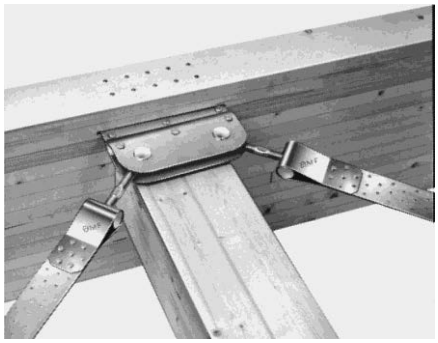




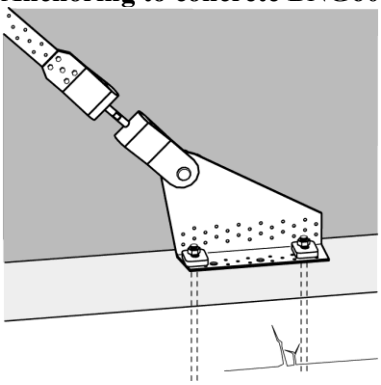
Wind bracing connector BNW

The BNW connectors are placed in a milled recess and fastened with dowels.

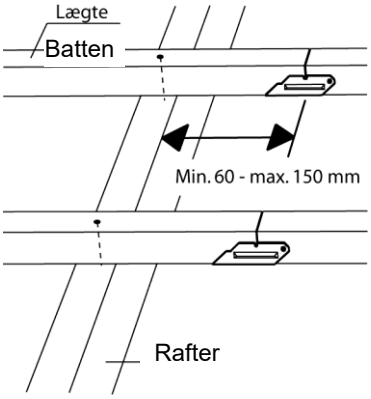




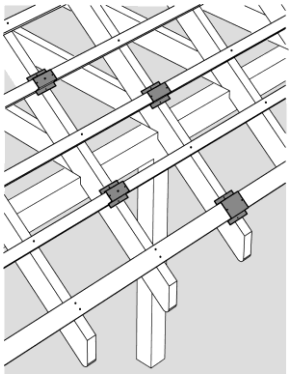
Anchoring to concrete BNG60



Connection of Battens



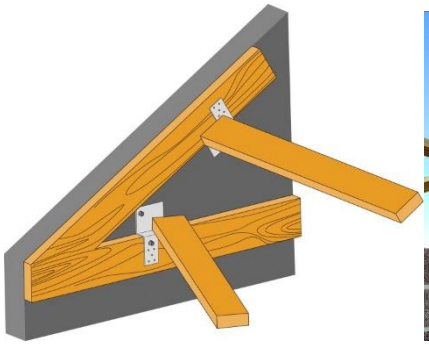
DLVS



DLV

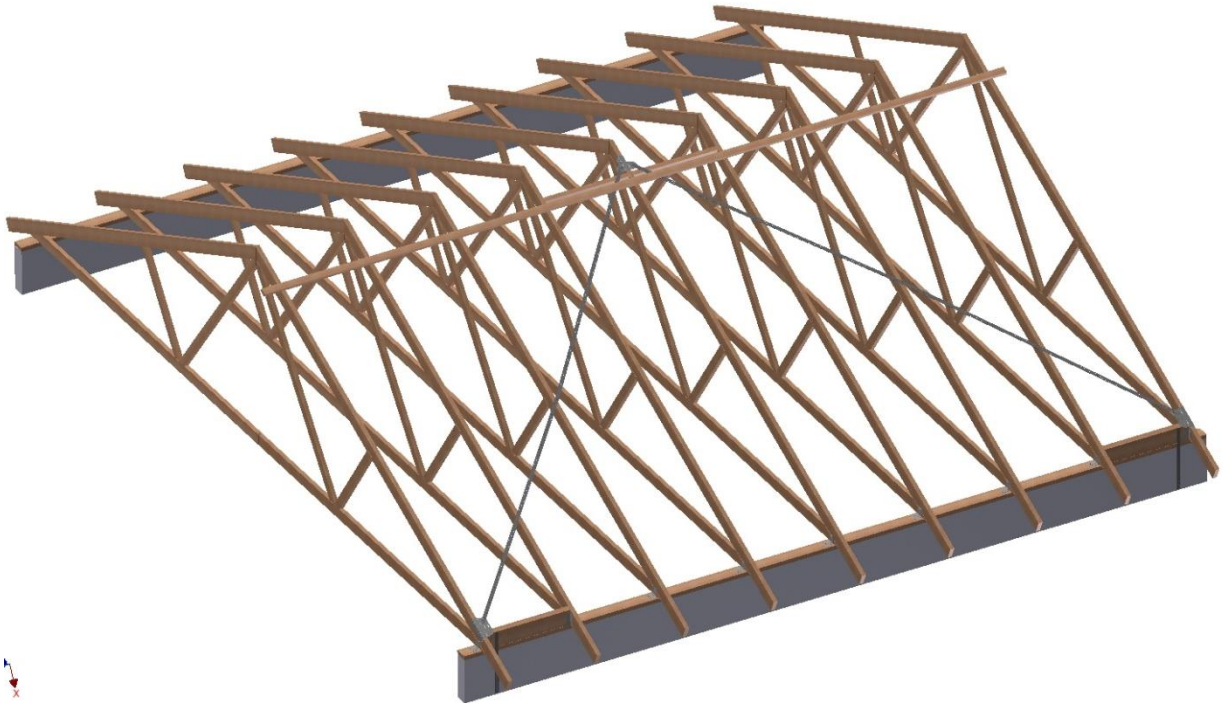
DAB22

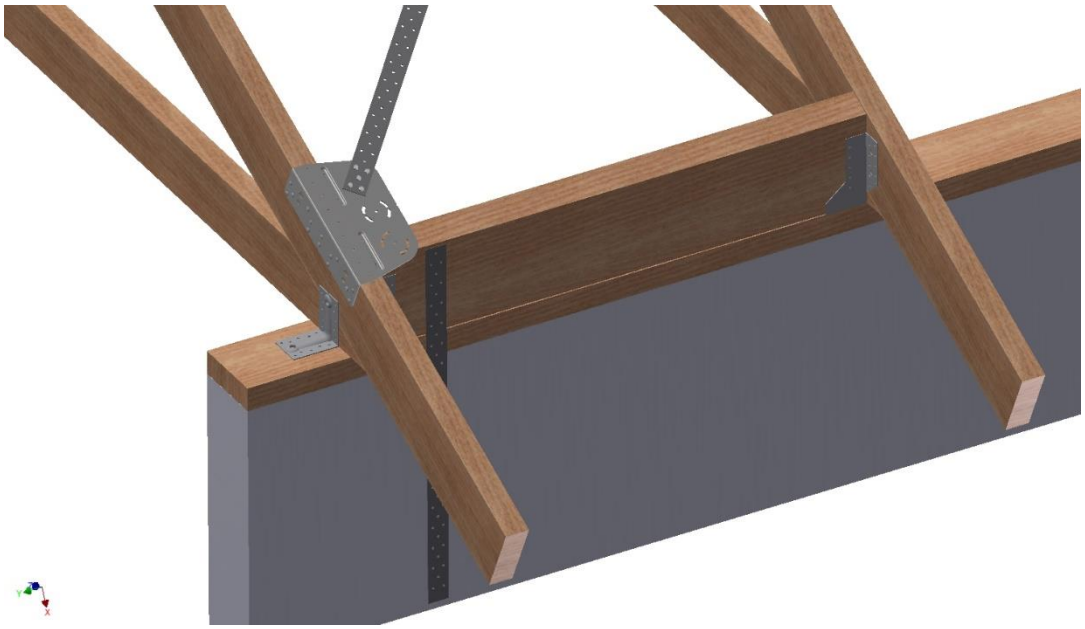
Connector for Stability of Trusses - CST

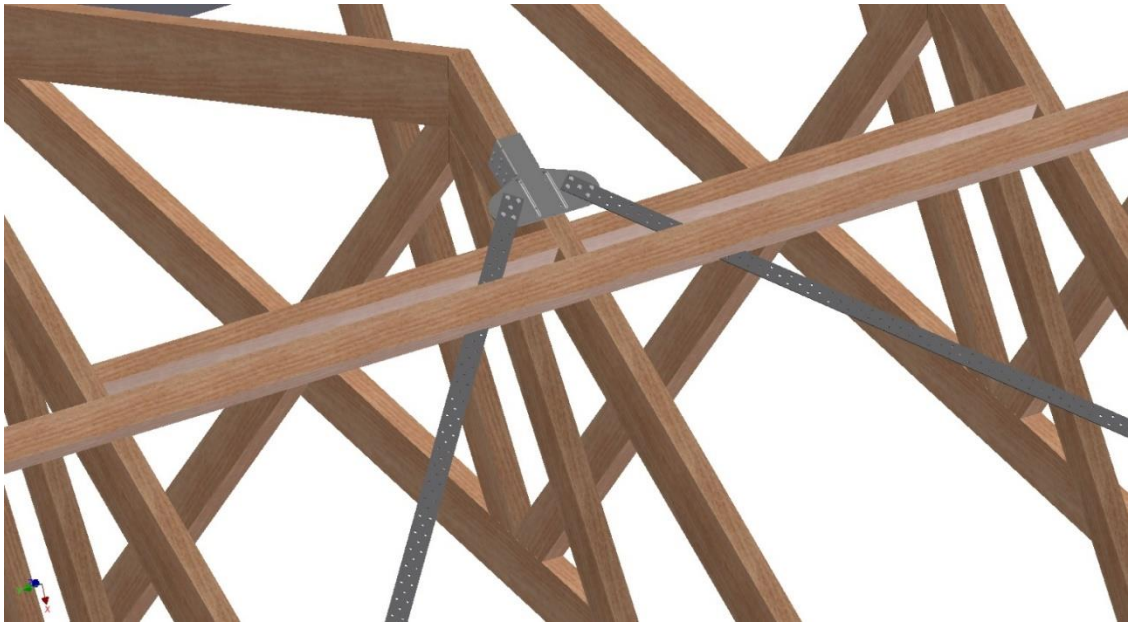


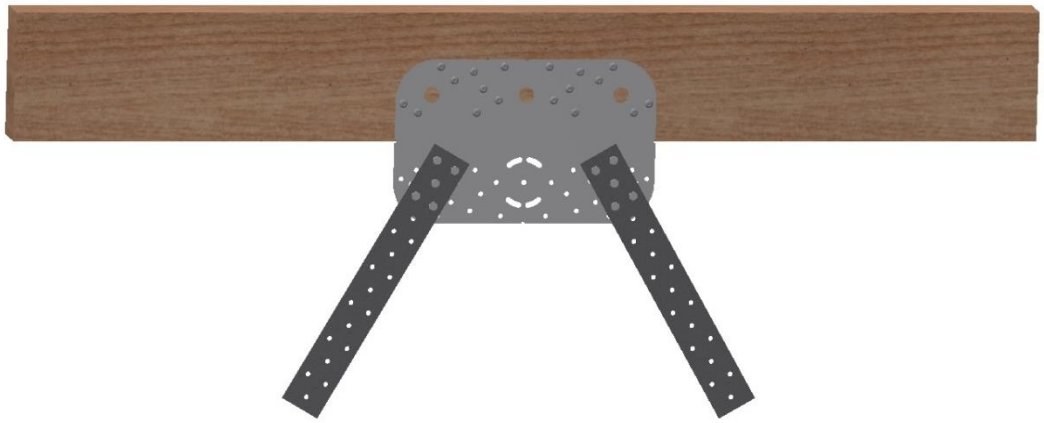
CST

WSP, WSD and WSB



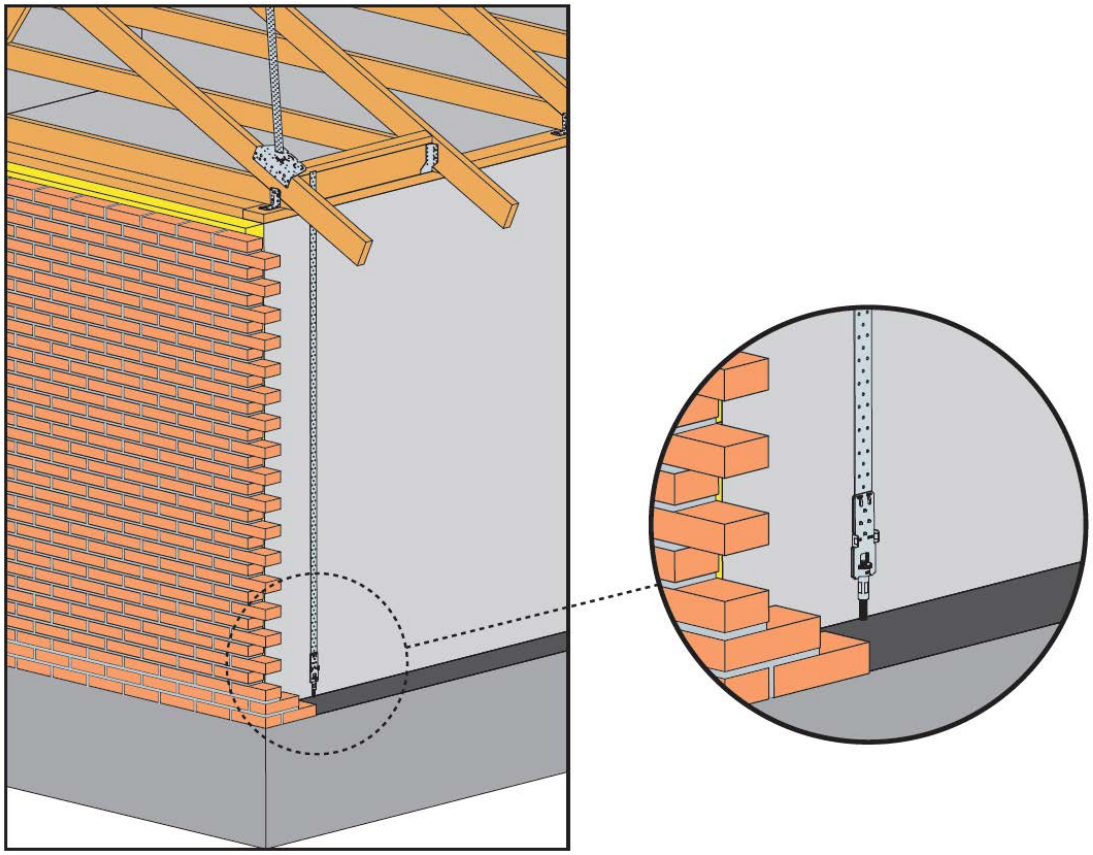




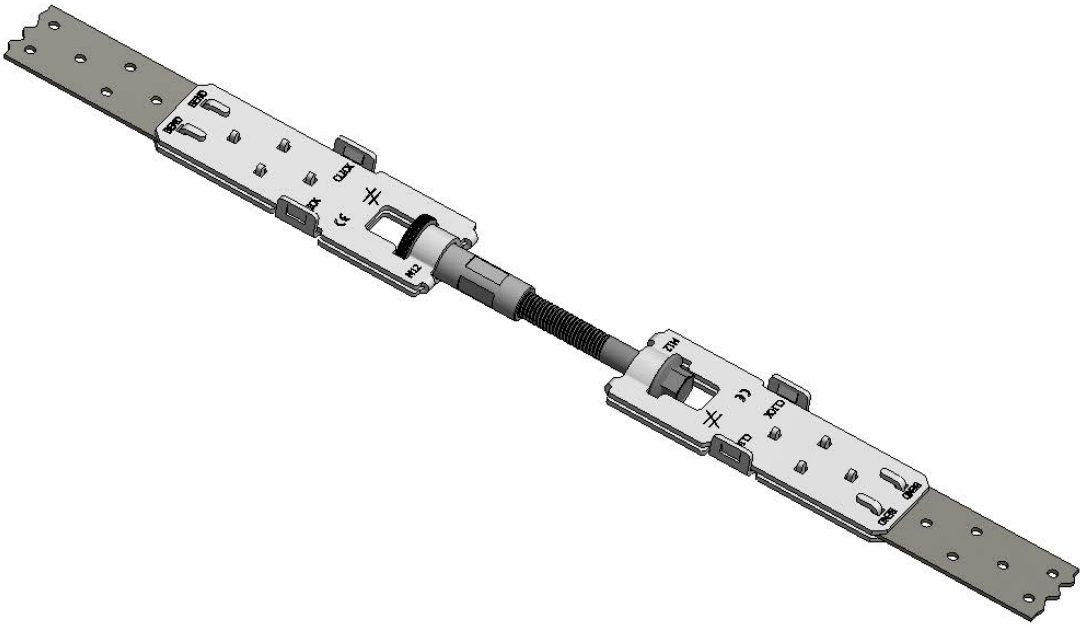


Bandlock Pro Connectors – BPTD and BPST

BPTD – Strap Tie Down



BPST – Strap Tightener



Fasteners

Connector nails and screws	Nail and screw size		Finish
According to ETA-04/0013	Diameter [mm]	Length [mm]	
Connector nail	3,1	40	Electroplated zinc
Connector nail	4,0	35 – 60	Electroplated zinc
Connector screw	5,0	35 – 50	Electroplated zinc
Connector nail	4,2	35 - 60	Electroplated zinc

Nails and screws	Nail and screw size		Finish
According to EN 14592	Diameter [mm]	Length [mm]	
Smooth shank nail	3,1	-	Electroplated zinc
Smooth shank nail	3,4	-	Electroplated zinc
Connector screw	4,0	30	Electroplated zinc

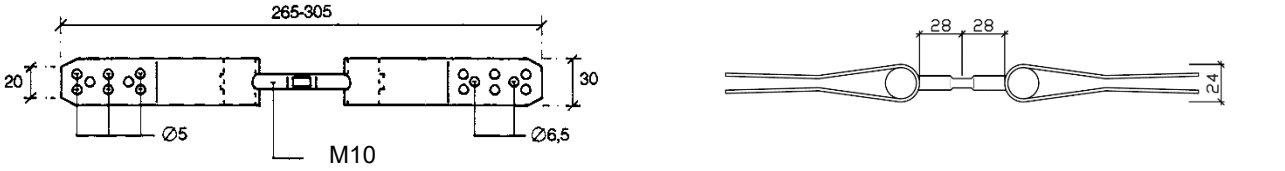
Bolt type	Bolt size		Finish
	Diameter [mm]	Length [mm]	
Dowel S235JR according to EN10025:2004	12 and 20	-	Electro-galvanised
Dowel S235JR according to EN 14592	8	-	Electro-galvanised
M5 Bolts 8.8 according to EN ISO 4017 with nuts according EN ISO 4032	5,0	12	Electro-galvanised
M12 Bolts 8.8 according to EN 14592	12	-	See specification from manufacturer

Production drawings

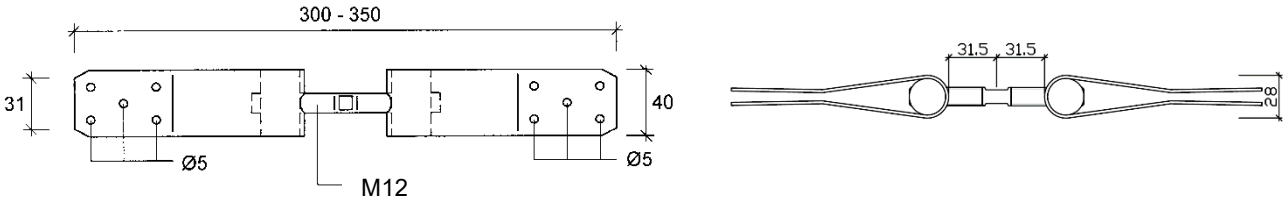
General note: Regarding the size of the hole for the dowel e.g. "Ø21/Ø15" – the last digit "Ø15" refers to the system "-14"

Tension straps and couplers
Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.
Electro-galvanized dowels 11SMn30 according to EN 10277.
2,0 mm pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

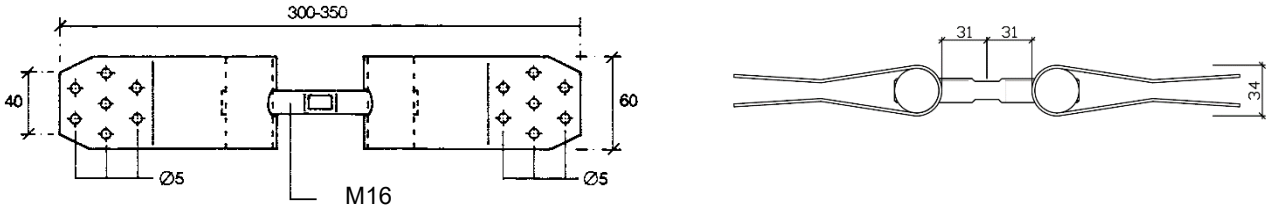
BNSP25



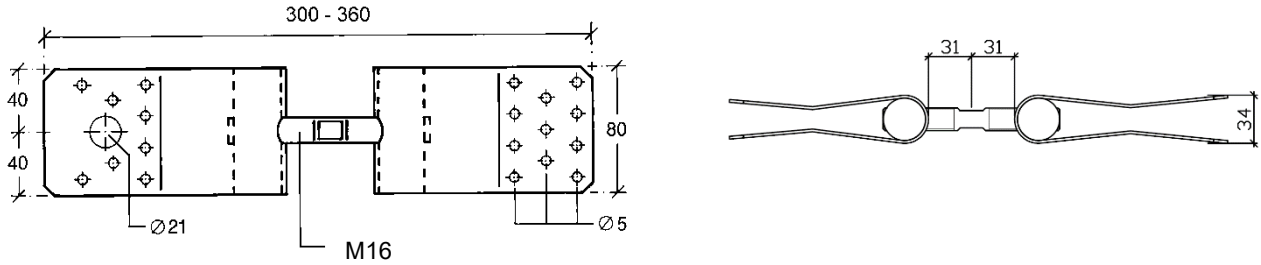
BNSP40



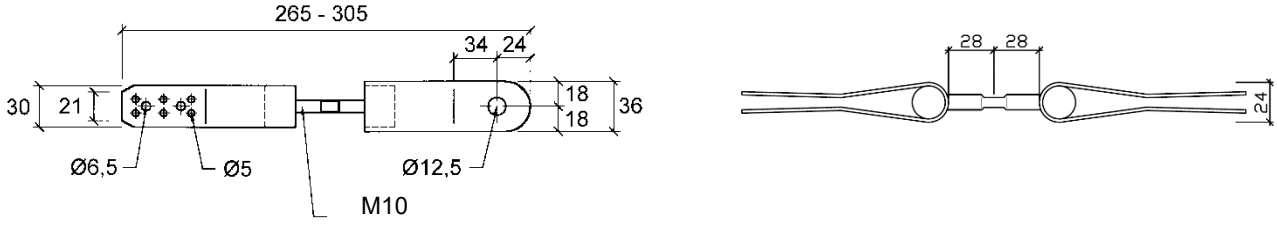
BNSP60



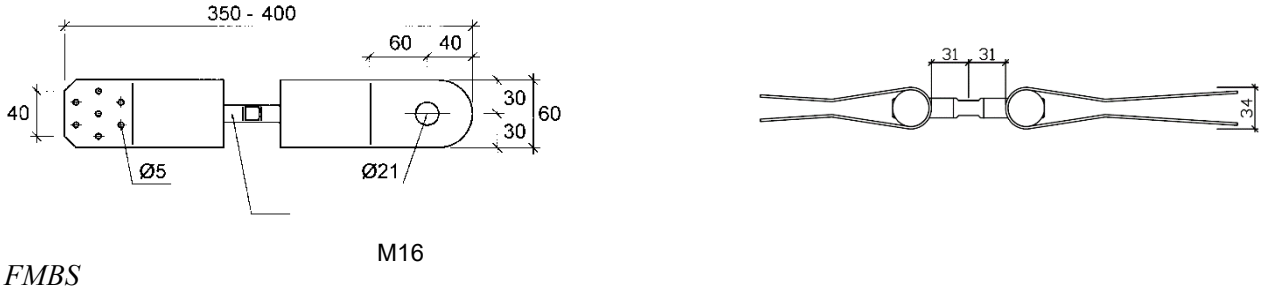
BNSP80



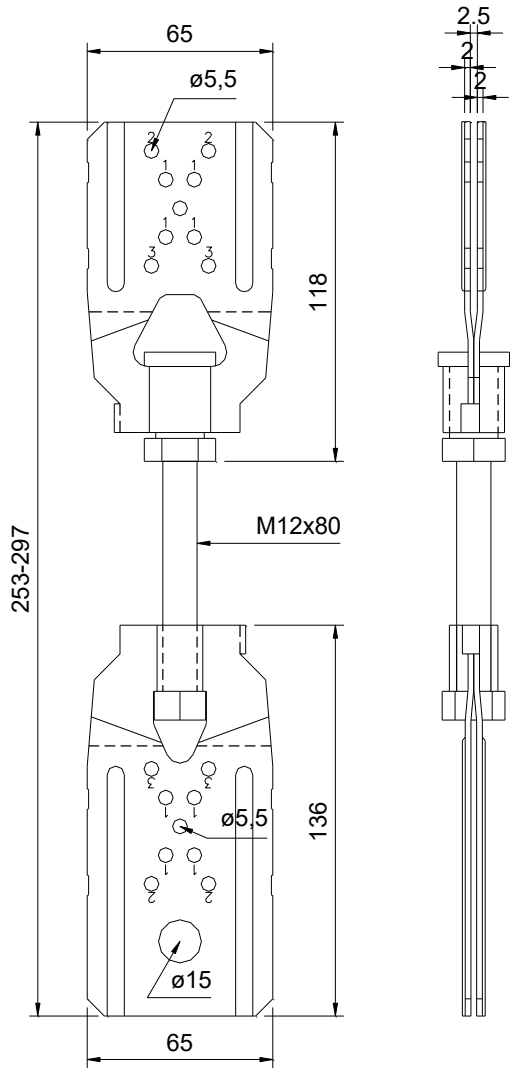
BNSP25B



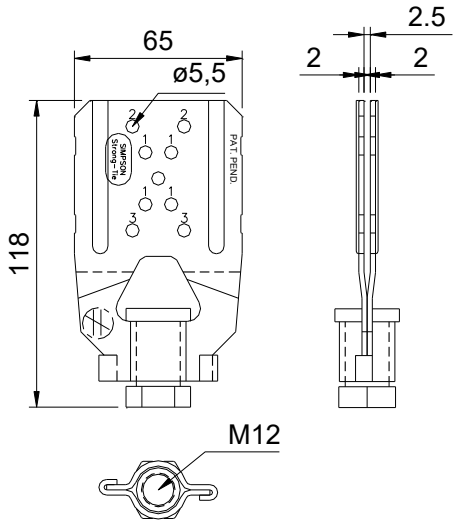
BNSP4060B



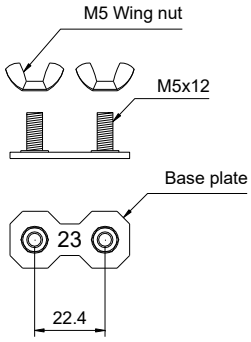
FMBS



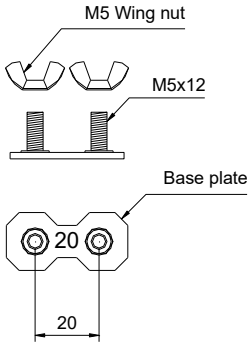
FMB



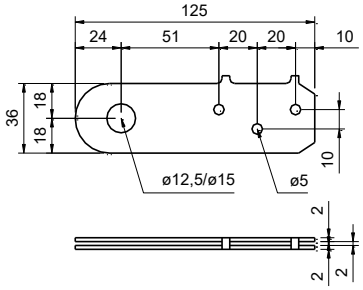
BF25M5 (Clips 23)



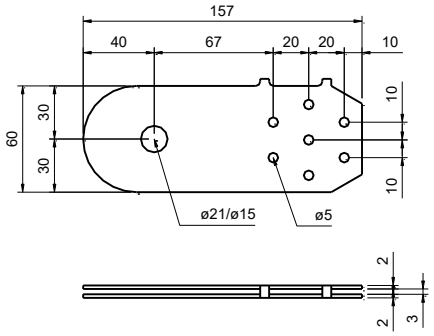
BF4060M5 (Clips 20)



BNKK25 / BNKK25-14

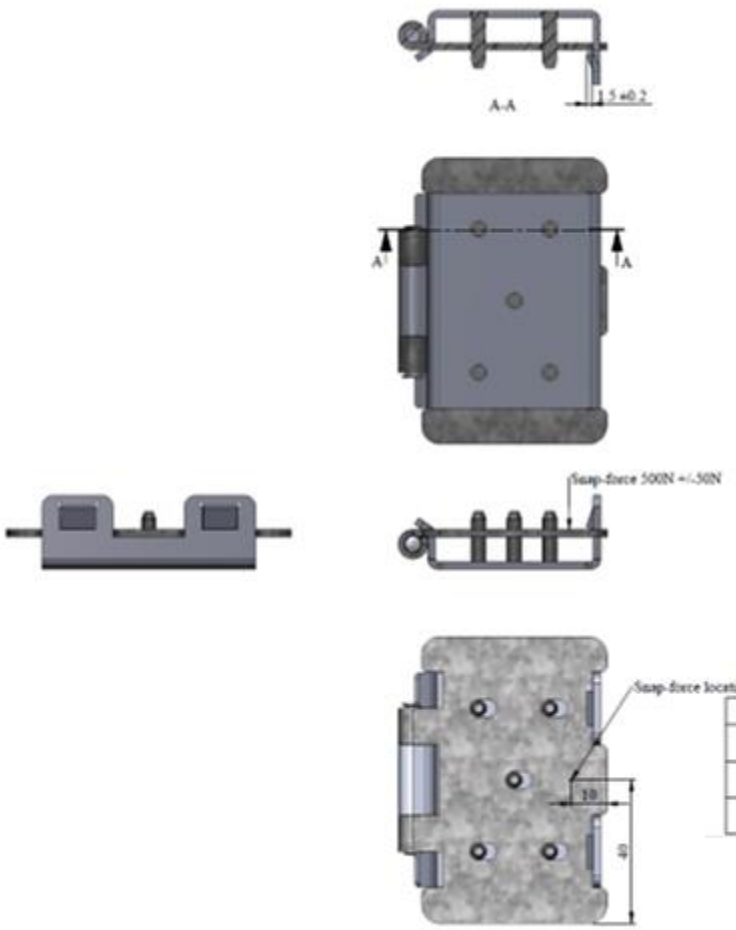


BNKK40/60 / BNKK40/60-14



Bandlock coupler, 40 mm

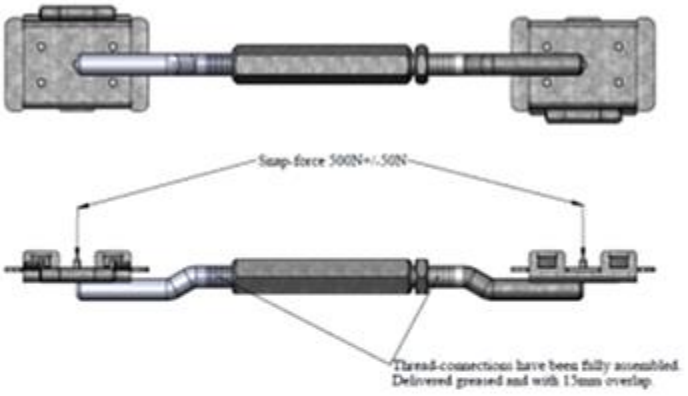
The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.

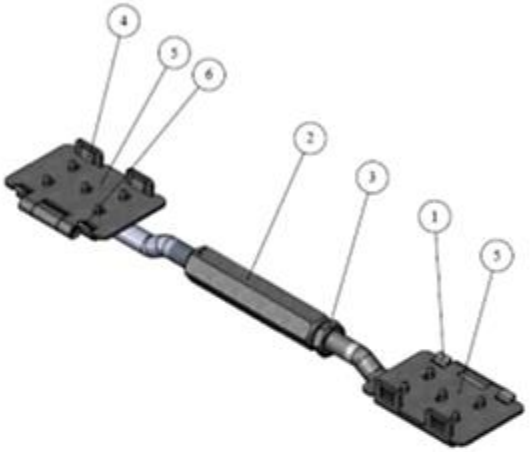


ITEM NO.	PART NUMBER	QTY.
1	20090025_Bandlock bottom assembly	1
2	20090003_Bandlock top	1
3	20090006_Pin for hinge	1

Bandlock tension strap, 40 mm

The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.

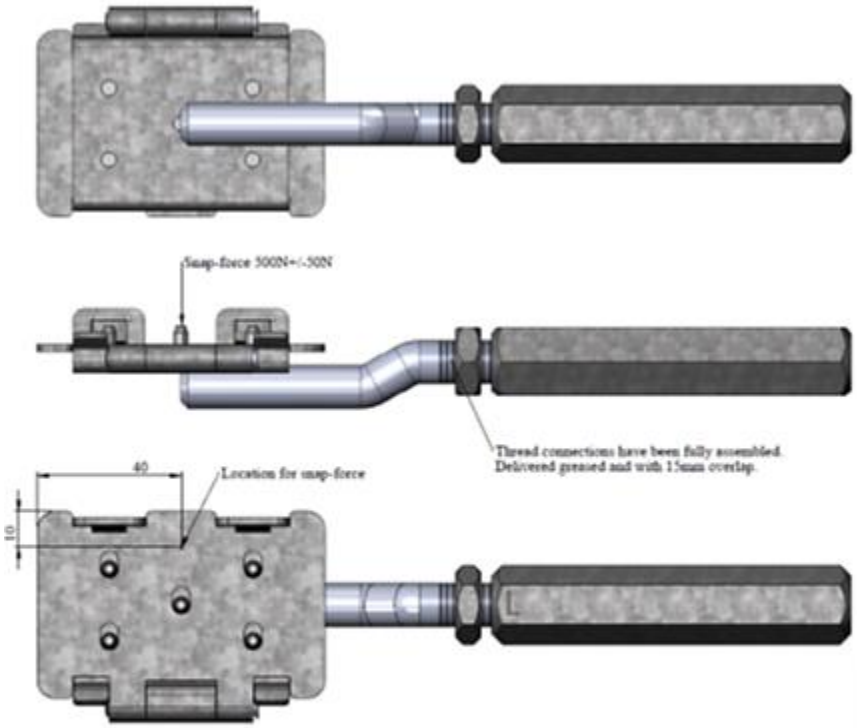


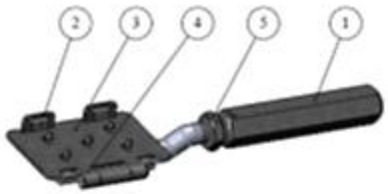


ITEM NO.	PART NUMBER	QTY.
1	20090027_Tightener for bandlock bottom R assembly	1
2	20090009_Bushing long	1
3	20090010_Bushing short	1
4	20090026_Tightener for bandlock bottom L assembly	1
5	20090003_Bandlock top	2
6	20090006_Pin for hinge	2

Bandlock tension strap for anchor, 40 mm

The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.

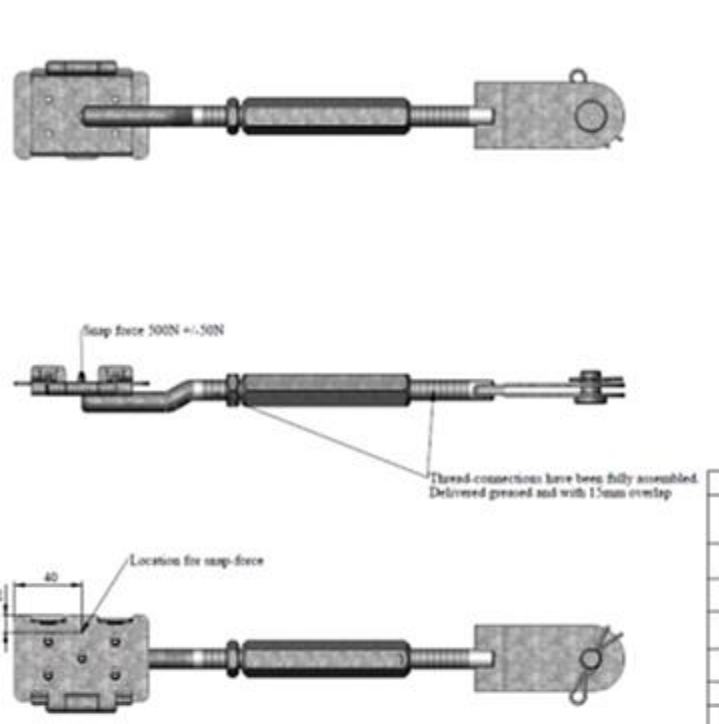


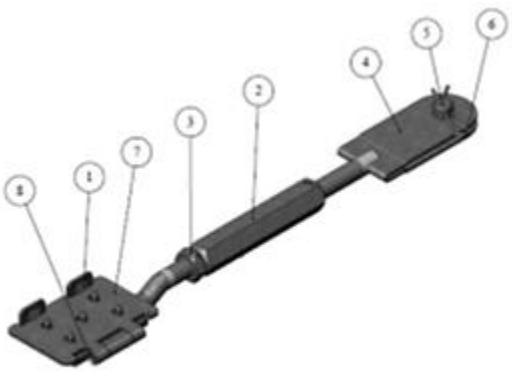


ITEM NO.	PART NUMBER	QTY.
1	20090009_Bushing long	1
2	20090026_Tightener for bandlock bottom L assembly	1
3	20090003_Bandlock top	1
4	20090006_Pin for hinge	1
5	20140004_Bushing short L	1

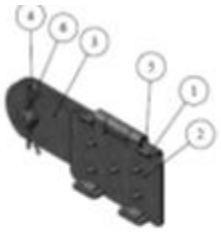
Bandlock coupler with dowel for anchor plate, 40 mm

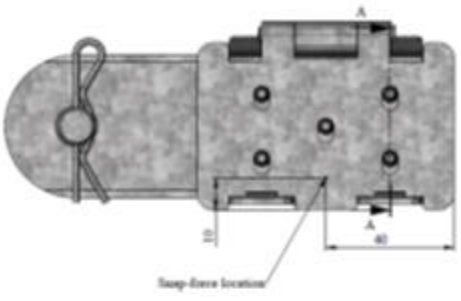
The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.





ITEM NO.	PART NUMBER	QTY.
1	20090027_Tightener for bandlock bottom R assembly	1
2	20090009_Bushing long	1
3	20090010_Bushing short	1
4	20090028_Tightener head assembly	1
5	20090016 Pin for tightener	1
6	20090017_Split fix tightener	1
7	20090003_Bandlock top	1
8	20090006_Pin for hinge	1

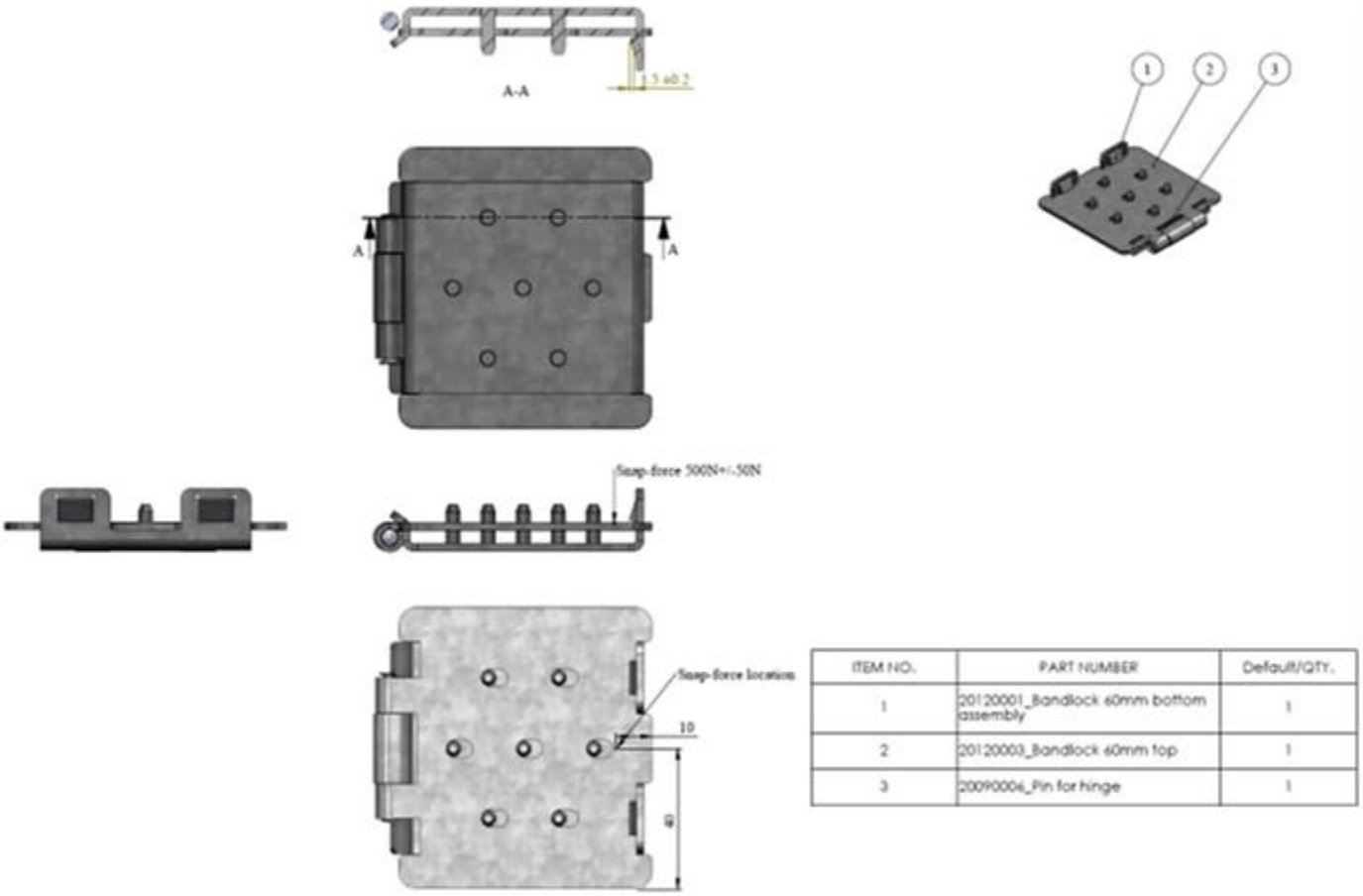




ITEM NO.	PART NUMBER	QTY.
1	20090029_Bandlock for pin connection bottom assembly	1
2	20090003_Bandlock top	1
3	20090018_Plate for pin connection	1
4	20090017_Split for tightener	1
5	20090006_Pin for hinge	1
6	20090016 Pin for tightener	1

Bandlock coupler, 60 mm

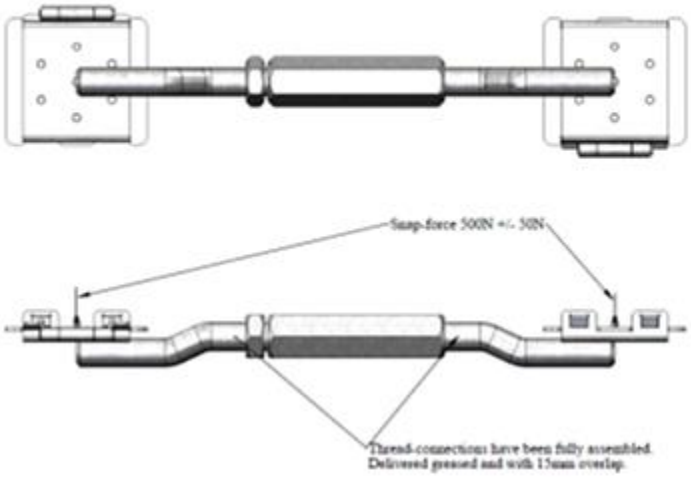
The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.

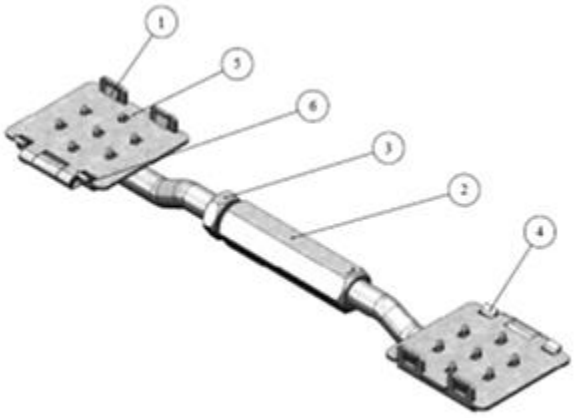


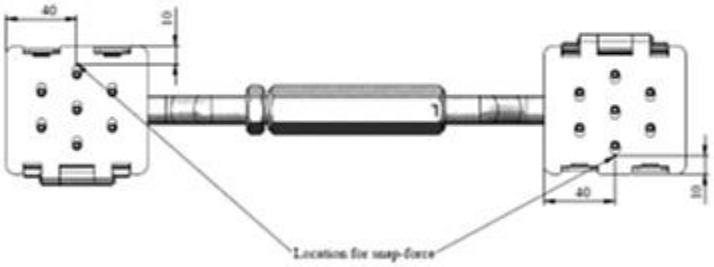
ITEM NO.	PART NUMBER	Default/QTY.
1	20120001_Bandlock 60mm bottom assembly	1
2	20120003_Bandlock 60mm top	1
3	20090006_Pin for hinge	1

Bandlock tension strap, 60 mm

The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.



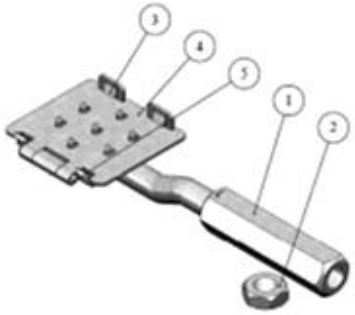


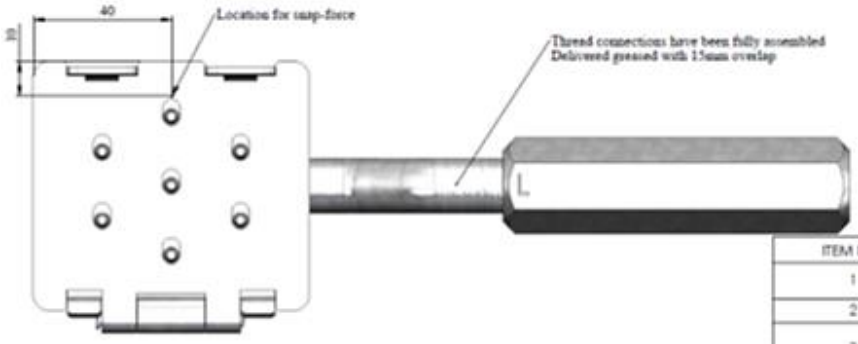


ITEM NO.	PART NUMBER	Default/QTY.
1	20120005_Bandlock 60mm tightener bottom R assembly	1
2	20120007_Bandlock 60mm bushing long	1
3	20120008_Bandlock 60mm bushing short	1
4	20120006_Bandlock 60mm tightener bottom L assembly	1
5	20120003_Bandlock 60mm top	2
6	20090006_Pin for hinge	2

Bandlock tension strap for anchor, 60 mm

The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.



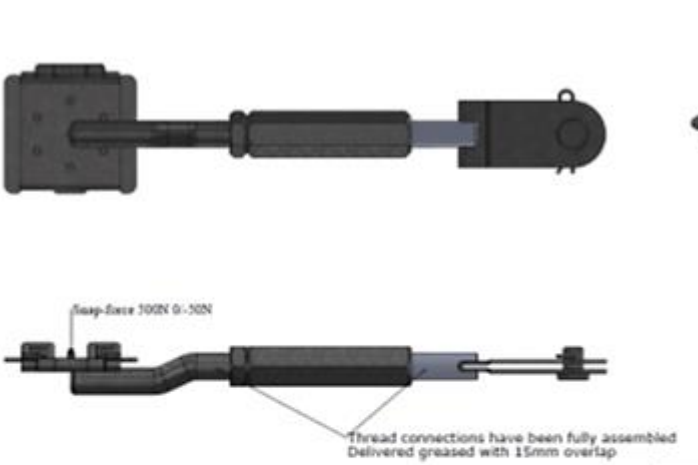


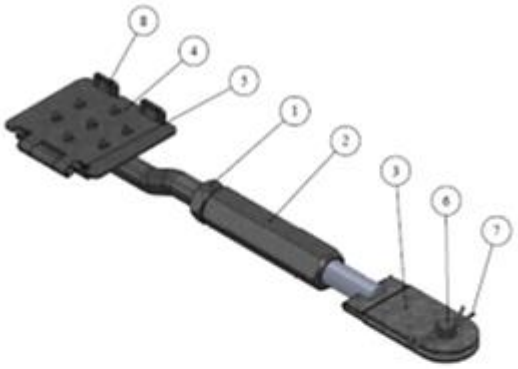
Bushing short attached to tightener with wire

ITEM NO.	PART NUMBER	QTY.
1	20120007_Bandlock 60mm bushing long	1
2	20120008_Bandlock 60mm bushing short	1
3	20120006_Bandlock 60mm tightener bottom L assembly	1
4	20120003_Bandlock 60mm top	1
5	20090006_Pin for hinge	1

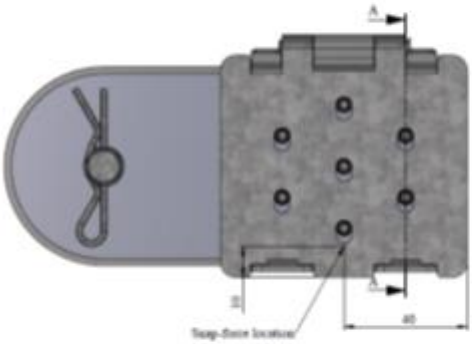
Bandlock coupler with dowel for anchor plate, 60 mm

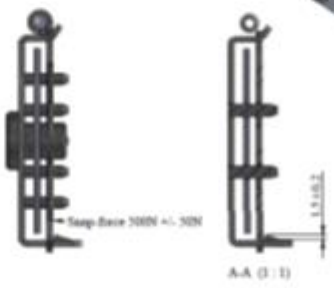
The main parts are made from S235JR steel according to EN 10025-2 with tolerances according to EN 10051 with electric galvanized white finish, sealed surface 12-30 µm. The material compositions of smaller parts such as bushings, pins and rods are deposited with ETA-Danmark.

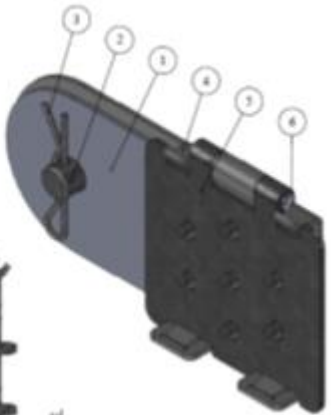




ITEM NO.	PART NUMBER	QTY.
1	20120008_Bandlock 60mm bushing short	1
2	20120007_Bandlock 60mm bushing long	1
3	20120012_Bandlock 60mm tightener head assembly	1
4	20120003_Bandlock 60mm top	1
5	20090006_Pin for hinge	1
6	20090016 Pin for tightener	1
7	20090017_Split for tightener	1
8	20120005_Bandlock 60mm tightener bottom # assembly	1







ITEM NO.	PART NUMBER	QTY.
1	20120009_Bandlock 60mm plate for pin connection	1
2	20090016 Pin for tightener	1
3	20090017_Split for tightener	1
4	20120017_Bandlock 60mm for pin connection bottom assembly	1
5	20120003_Bandlock 60mm top	1
6	20090006_Pin for hinge	1

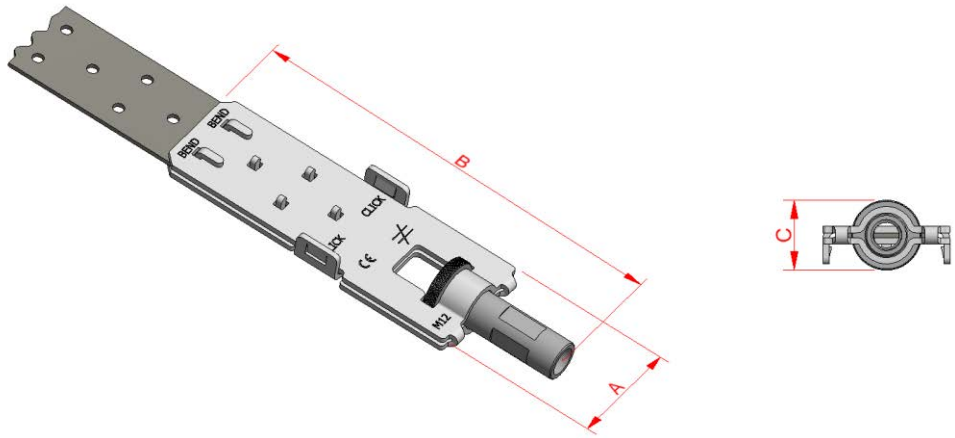
Bandlock Pro connectors BPTD and BPST

Connector Size Range

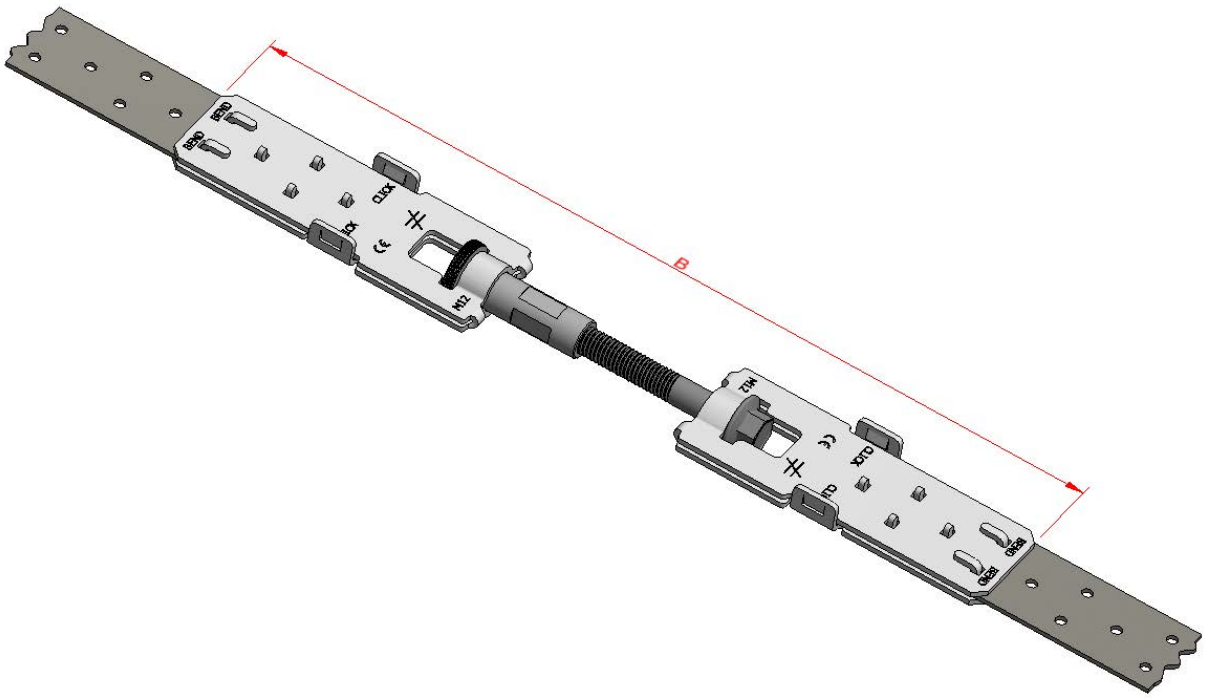
Item No	Dimensions [mm]			
	A	B	C	Thickness
BPTD	51	185	28	2,5
BPST	51	~325-365	28	2,5

The Wind Bracing Strap shown on the images above are not part of the Connector, but has been included to show the Application in use.

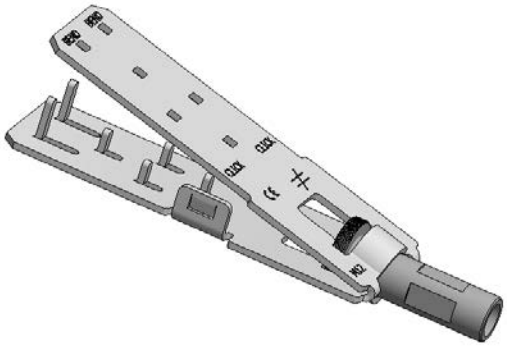
BPTD – Bandlock Pro Strap Tie Down:



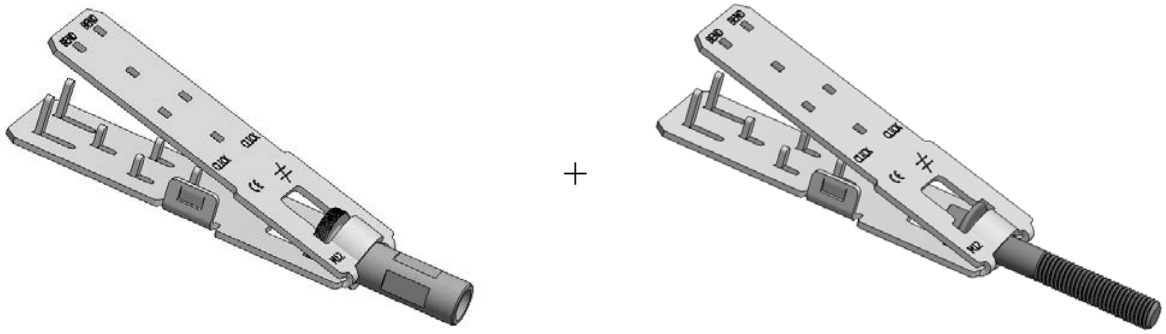
BPST – Bandlock Pro Strap Tightener:



Bandlock Pro BPTD as delivered:



Bandlock Pro BPST as delivered:



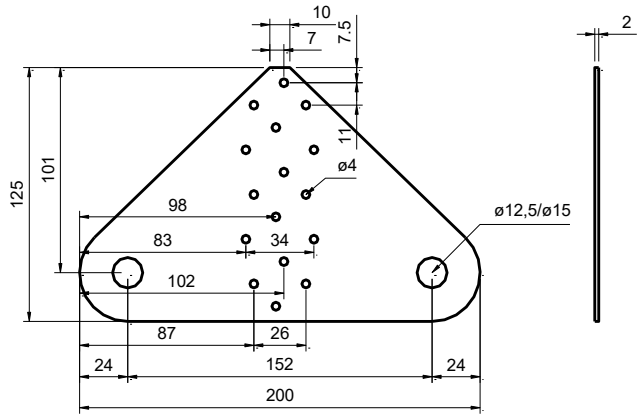
Material Specification

Material Thickness	Material Grades	Coating Specification
2,5 mm	S250 or DX51D to EN 10346:2009	Z275/ZM310

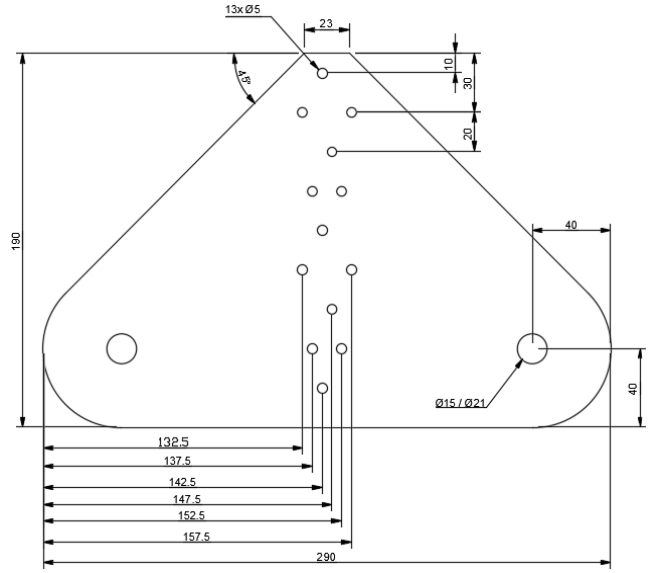
Mid anchor plates

Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

BNK25 / BNK25-14

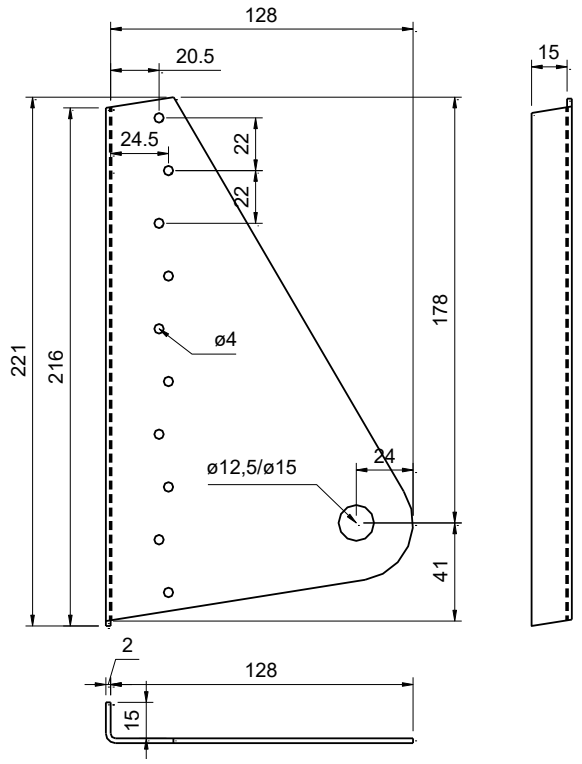


BNK40/60 / BNK40/60-14

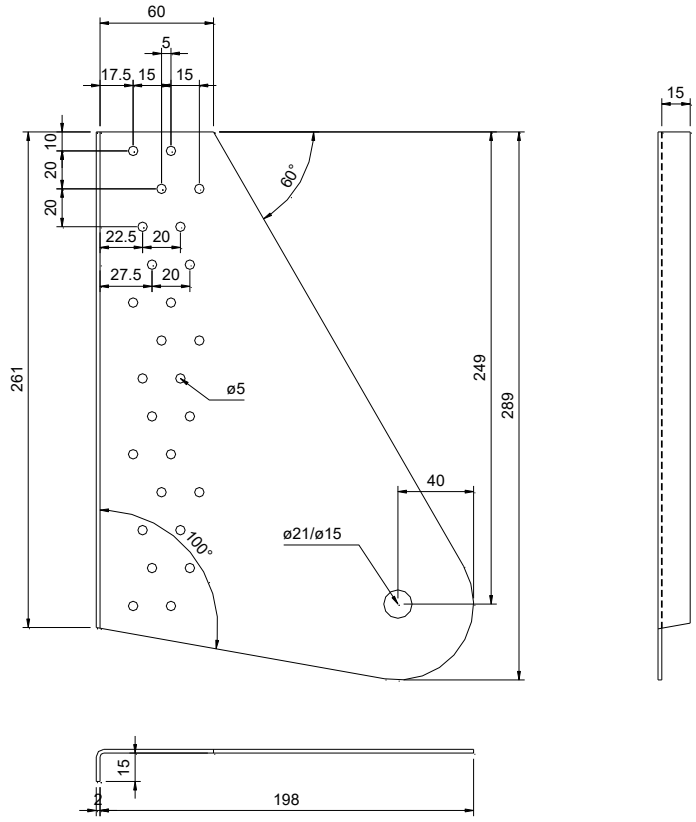


End anchor plates
Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

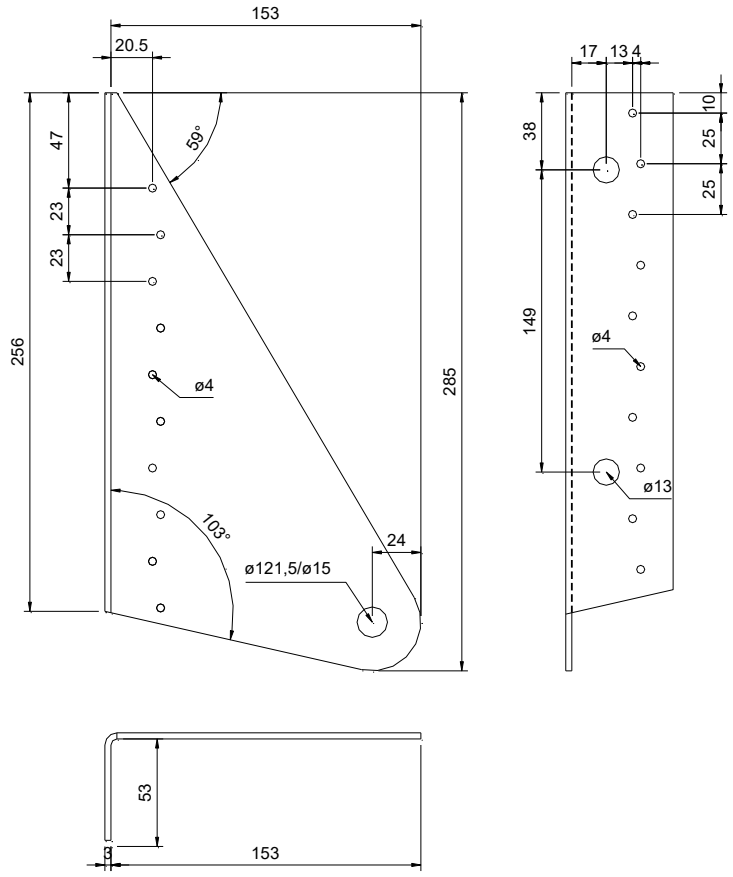
BNF25 / BNF25-14



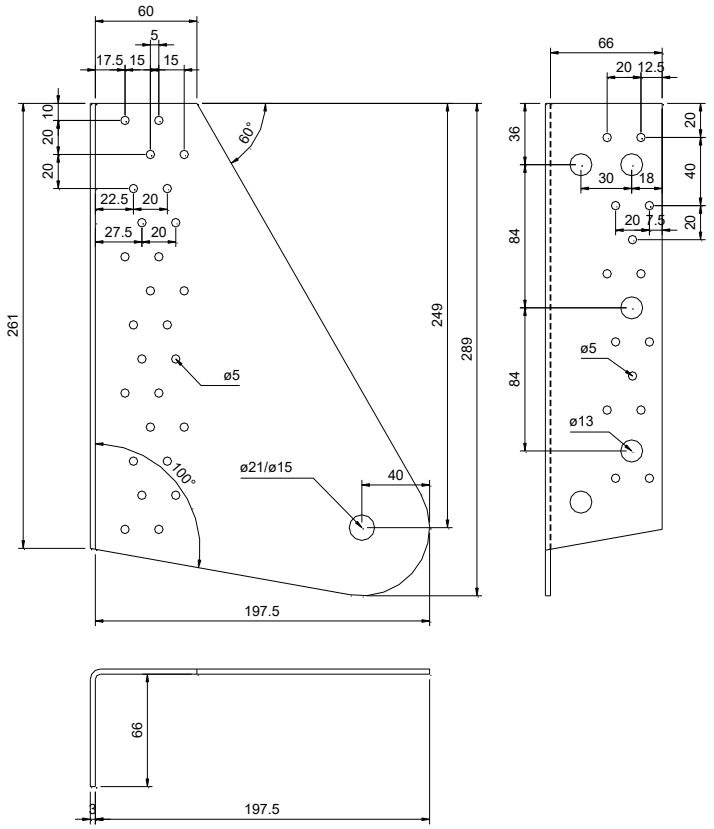
BNF40 / BNF40-14



BNG25 / BNG25-14



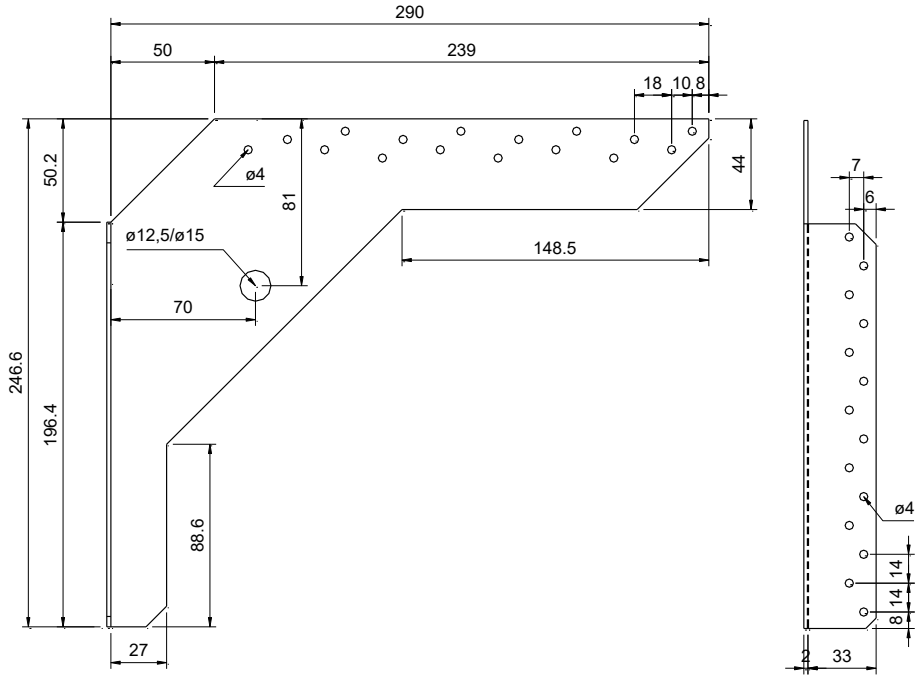
BNG60 / BNG60-14



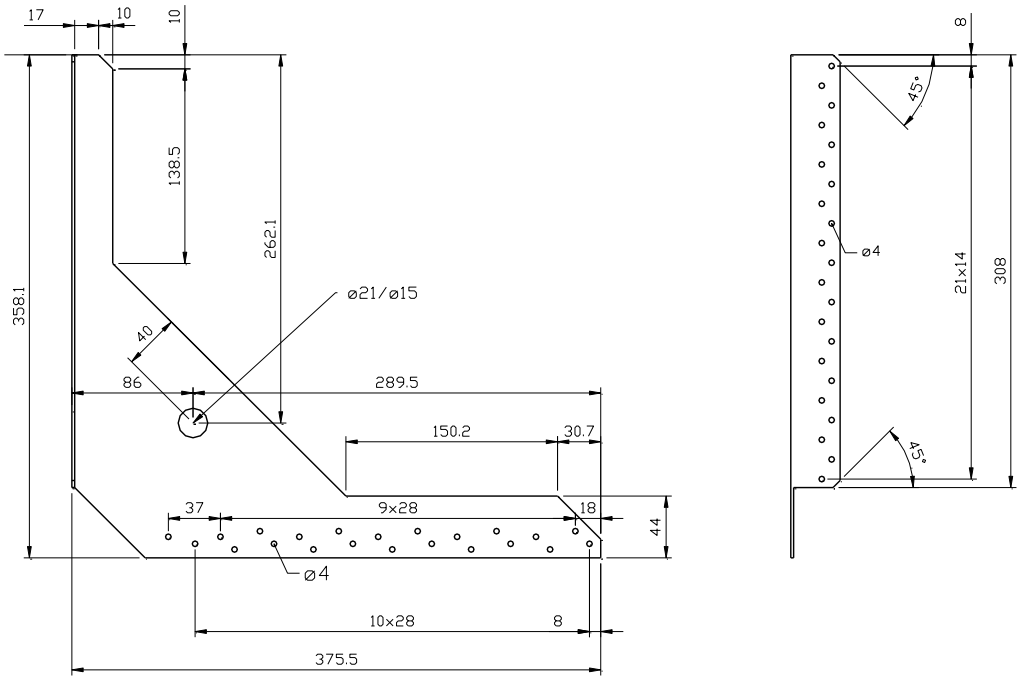
Wind bracing connectors

Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.
Electro-galvanized dowels 95Mn 28K according to DIN 1651.

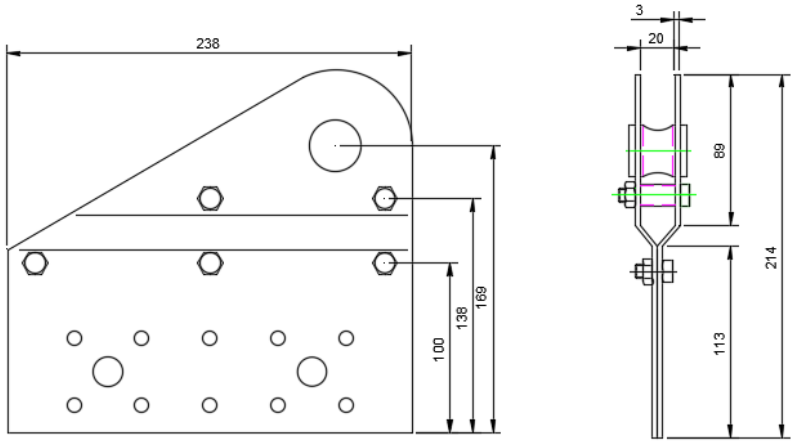
BNU25 / BNU25-14



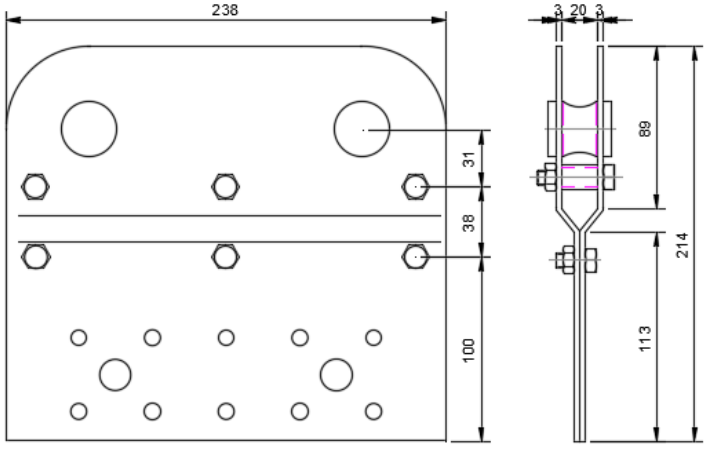
BNU40 / BNU40-14



BNW1



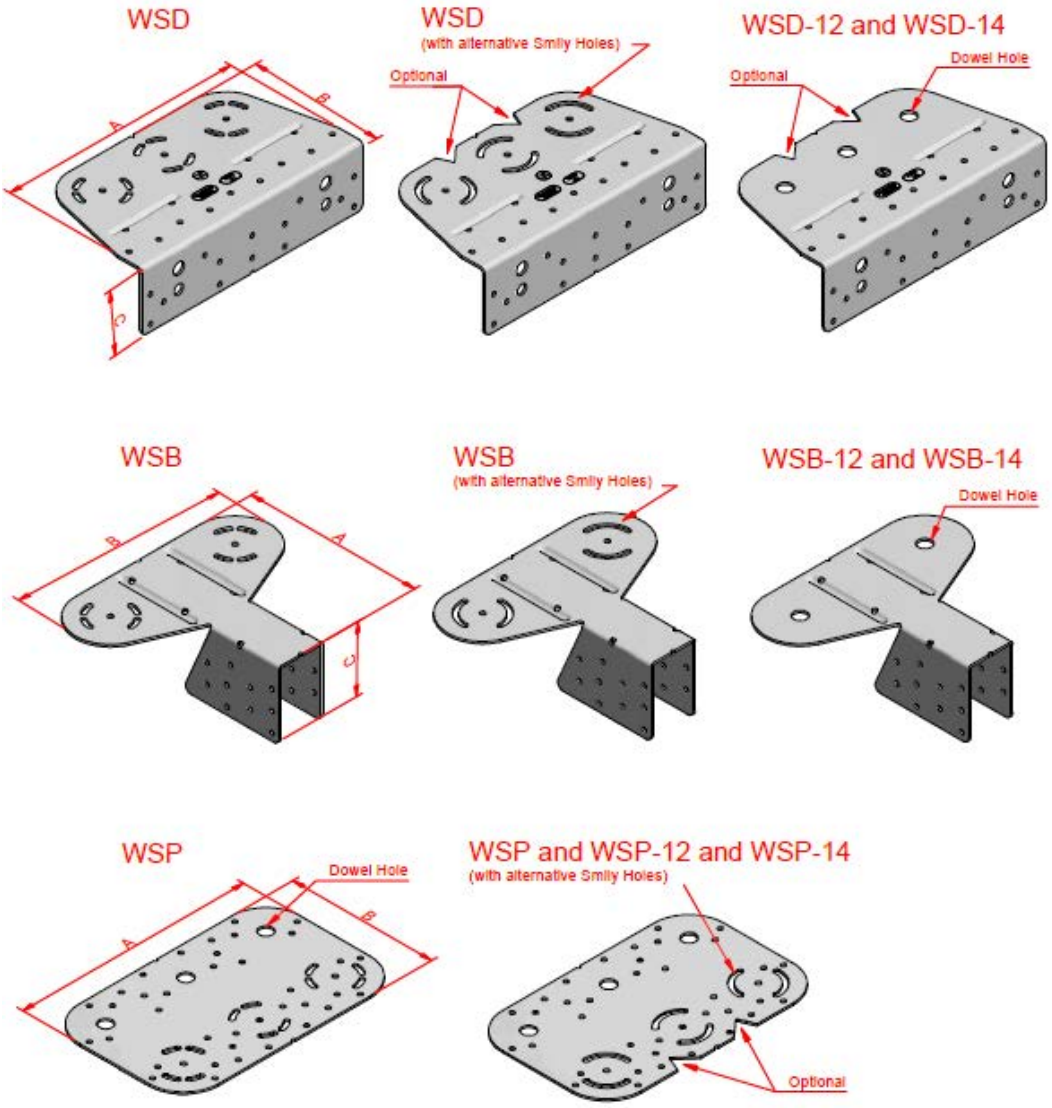
BNW2



WSP, WSD, WSB

Connector Size Range

Item No.	A	B	C	t	Ø5	Ø11	Ø13	Dowel Holes	Width of Smily
WSD	255	140	68	2,5	13	2	2	-	97°
WSD (alternative Smily)	255	140	68	2,5	13	2	2	-	112°
WSD-12	255	140	68	2,5	13	2	2	3 x Ø12,5	-
WSD-14	255	140	68	2,5	13	2	2	3 x Ø15	-
WSB	188	224	80	2,5	26	-	-	-	97°
WSB (alternative Smily)	188	224	80	2,5	26	-	-	-	112°
WSB-12	188	224	80	2,5	26	-	-	2 x Ø12,5	-
WSB-14	188	224	80	2,5	26	-	-	2 x Ø15	-
WSP	255	160	-	2,0	36	-	-	3 x Ø15	97°
WSP (alternative Smily)	255	160	-	2,0	36	-	-	3 x Ø15	112°
WSP-12	255	160	-	2,0	36	-	-	3 x Ø12,5	112°
WSP-14	255	160	-	2,0	36	-	-	3 x Ø15	112°



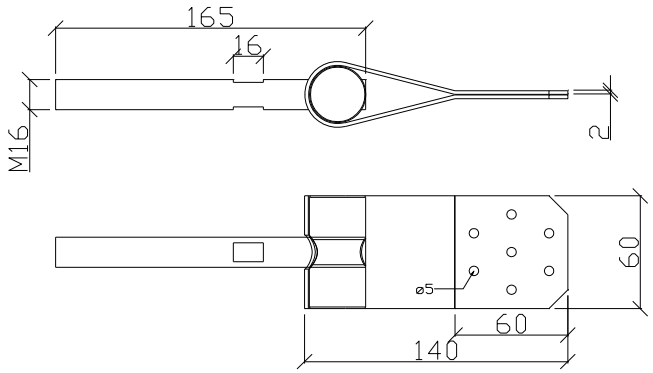
Material Specification

Material Thickness	Material Grades	Coating Specification
2,0 and 2,5 mm	S250 or DX51D to EN 10346:2009	Z275/ZM310

Wind bracing link set

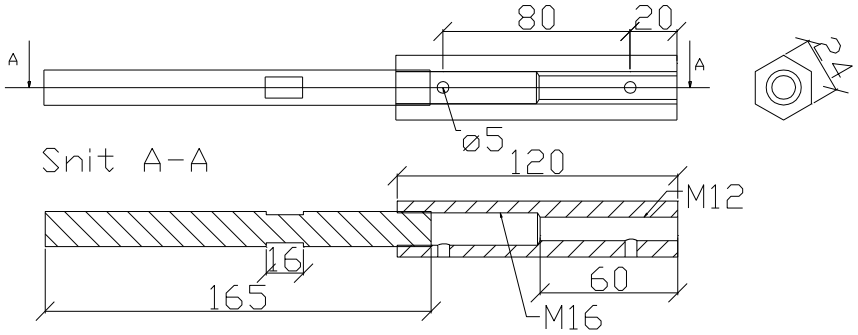
Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.
Electro-galvanized dowels 11SMn30 according to EN 10277.
2,0 mm pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

BNWA

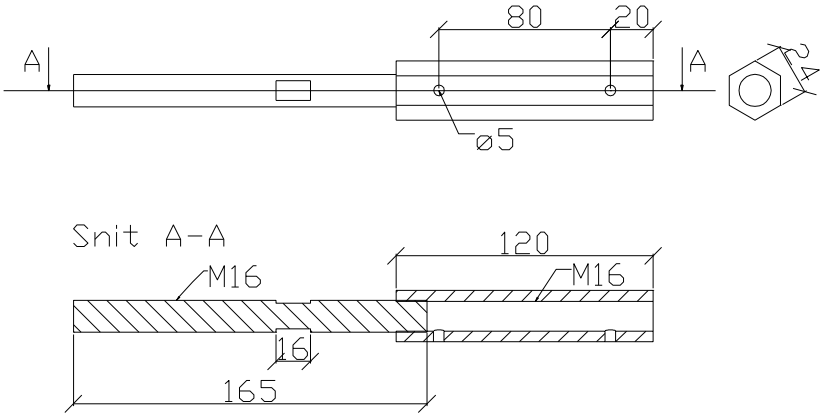


Tie rods
Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.
Electro-galvanized nut with internal thread 11SMn30 according to EN10277.

BNWM12



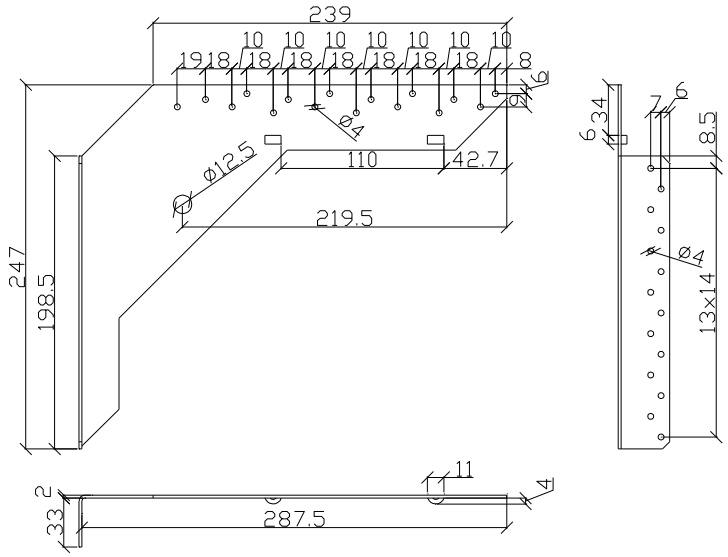
BNWM16



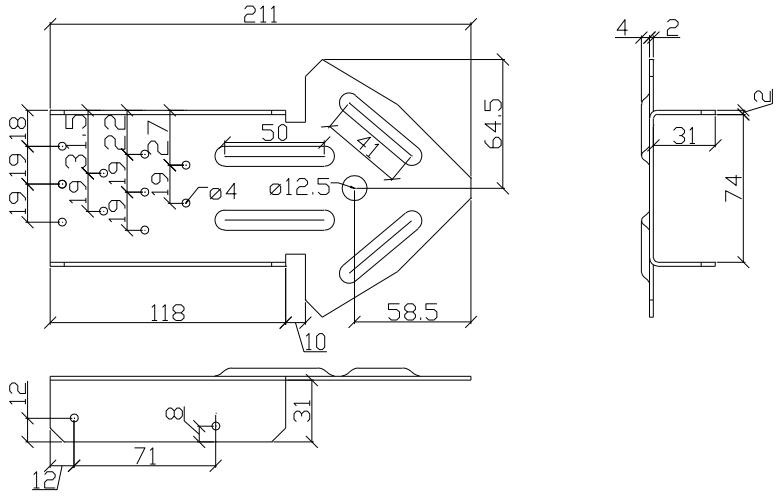
Diagonal bracing kit

Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

BNU25T



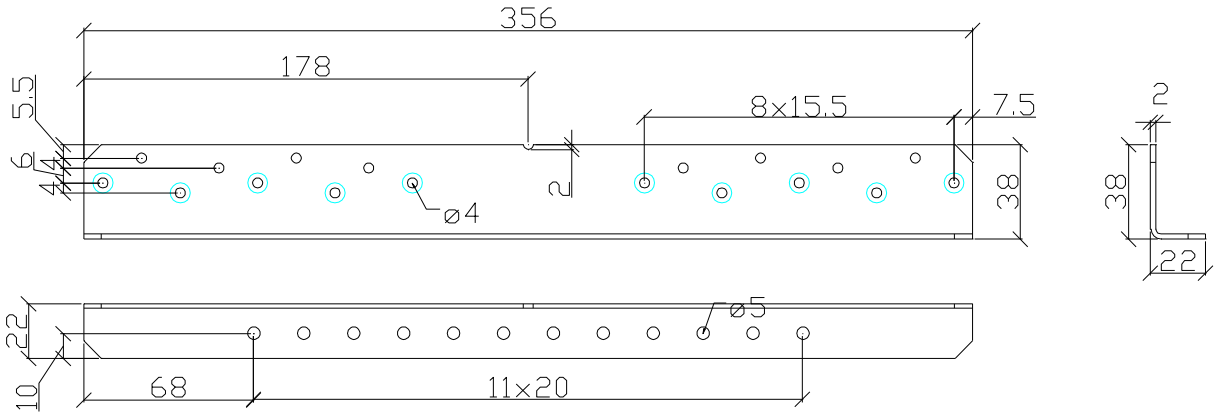
DAB73T



Diagonal bracing connector

Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

DAB22

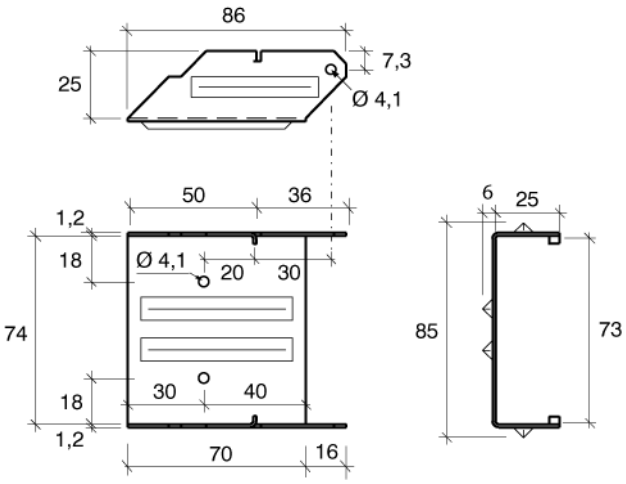


Ø4 mm holes marked with a blue circle refers to the nailing pattern. Marked holes is to be used with a 38 mm batten, all holes are to be used with bigger battens.

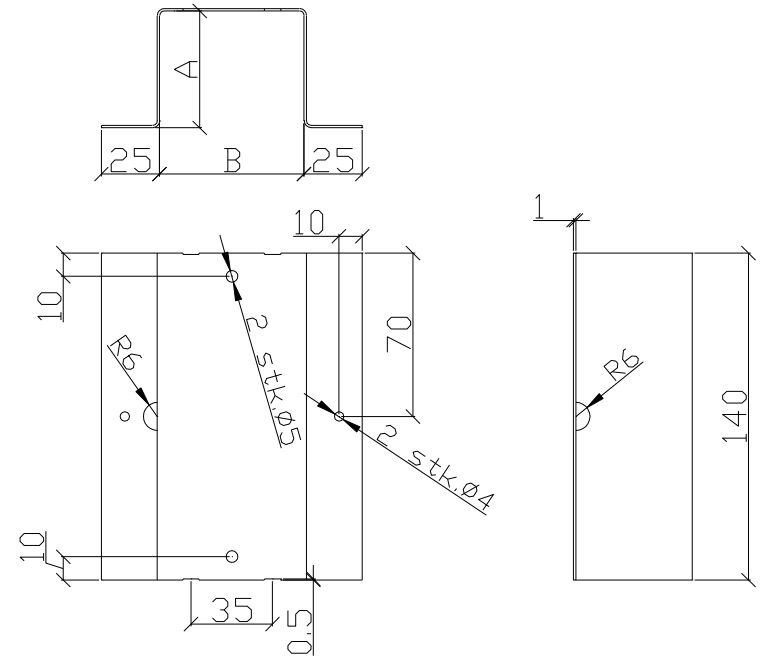
Batten connectors

Pre-galvanized steel S250GD + Z275/ZM310 according to EN 10346 with tolerances according to EN 10143.

DLVS

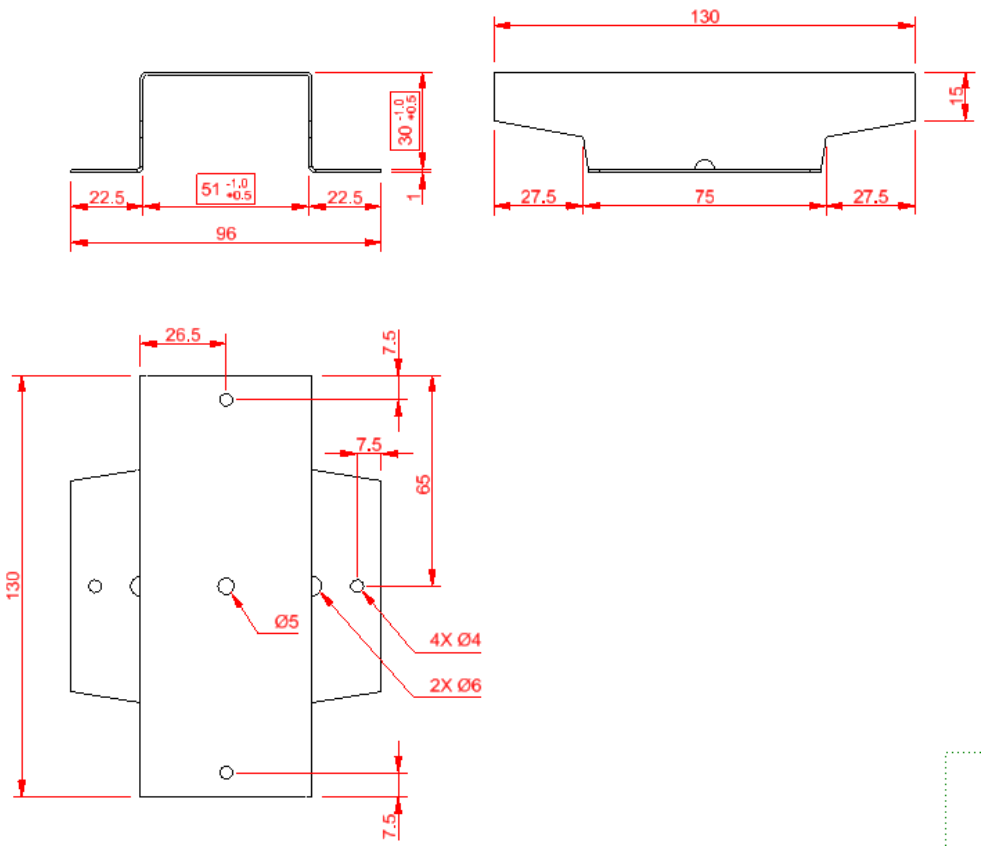


DLV



Type	A Height [mm]	B Width [mm]
DLV A/B	40-50	50-102

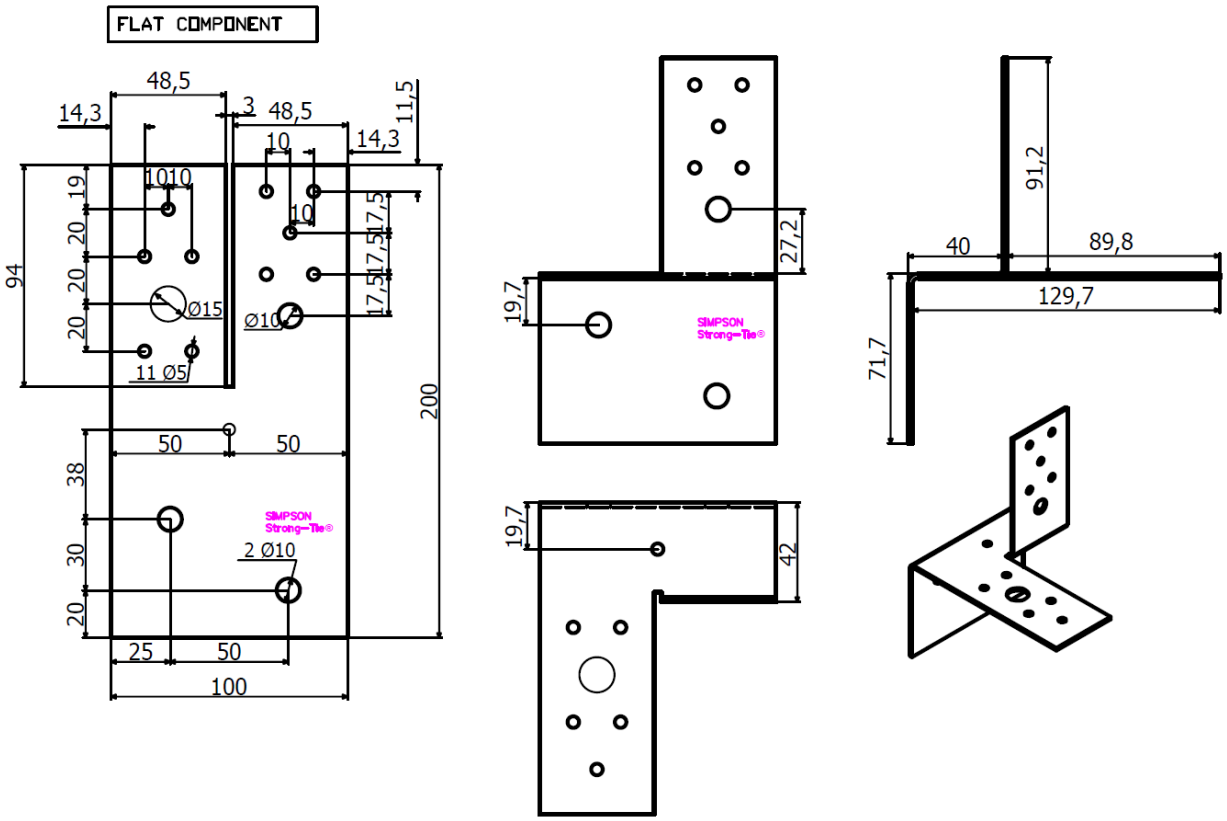
DLV50/30

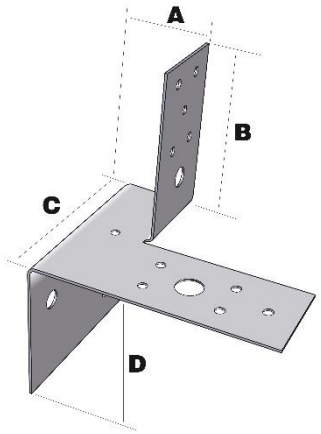

130
15
30 +0.5 -1.0
1
22.5
51 +0.5 -1.0
22.5
96
27.5
75
27.5
26.5
7.5
7.5
65
130
Ø5
4X Ø4
2X Ø6
7.5

Connector for Stability of Trusses

CST

2 mm thick pre-galvanized steel S250GD + Z (min Z275) /ZM310 according to EN 10346:2009 with tolerances according to EN 10143:2006.
2 mm thick Stainless steel: 1.4401 and/or 1.4404 according to EN 10088:2005, or stainless steel as described before.





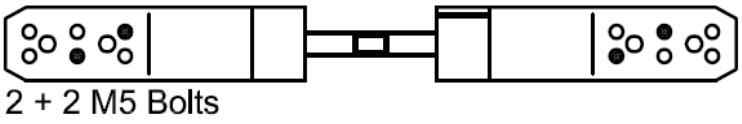
Dimensions

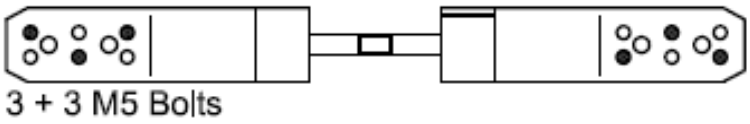
Model number	Dimensions (mm)				Holes		
					Concrete support	Supported beams	
	A	B	C	D		Truss	Bracing
CST	40	91,2	100	69,7	2 - Ø10	5 - Ø5 or 1 - Ø10	5 - Ø5 or 1 - Ø15

Fastener pattern

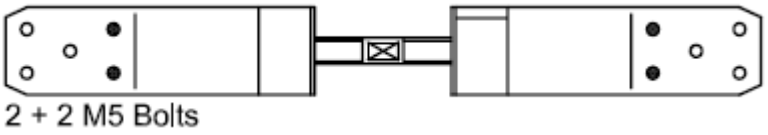
Tension straps and couplers

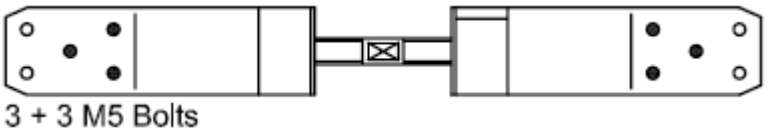
BNSP25

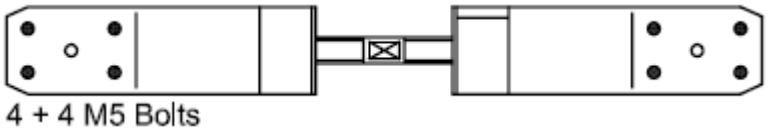


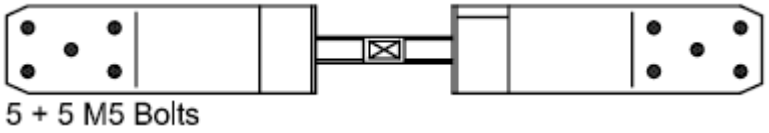


BNSP40

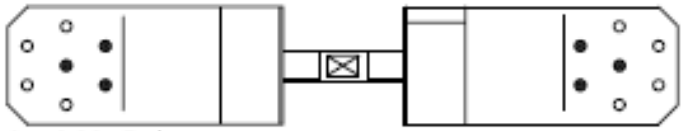




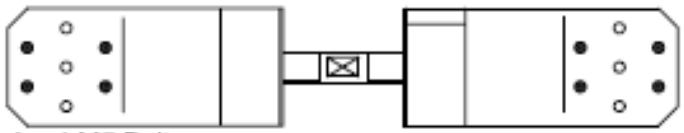




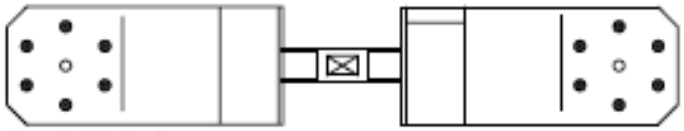
BNSP60



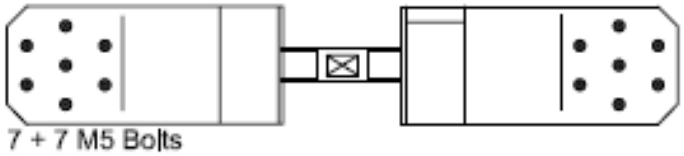
3 + 3 M5 Bolts



4 + 4 M5 Bolts

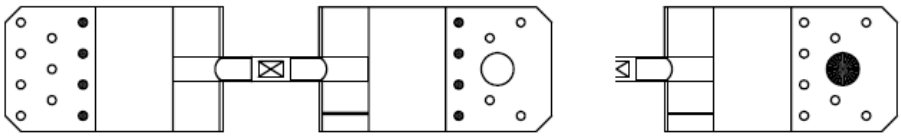


6 + 6 M5 Bolts

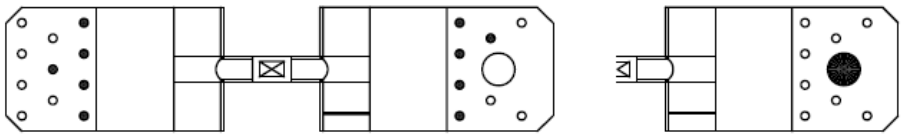


7 + 7 M5 Bolts

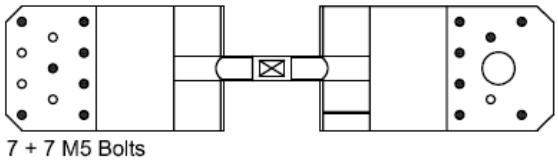
BNSP80



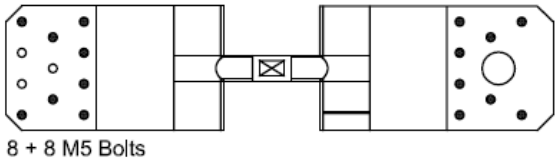
4 + 4 M5 Bolts or 4 M5 Bolts + 1 Ø20 Dowel



5 + 5 M5 Bolts or 5 M5 Bolts + 1 Ø20 Dowel

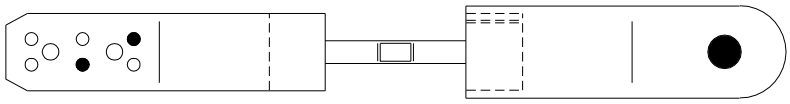


7 + 7 M5 Bolts

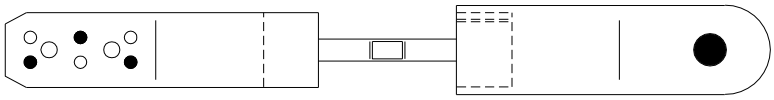


8 + 8 M5 Bolts

BNSP25B

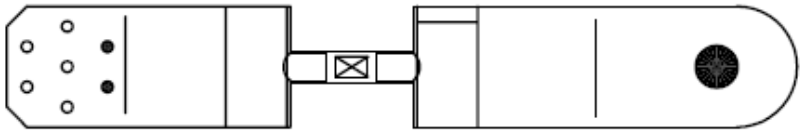


2 M5 bolts or 1 Clips 23 + 1 Ø12 Dowel

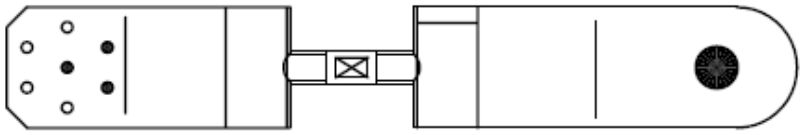


3 M5 bolts + 1 Ø12 Dowel

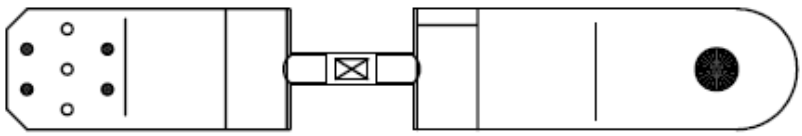
BNSP4060B



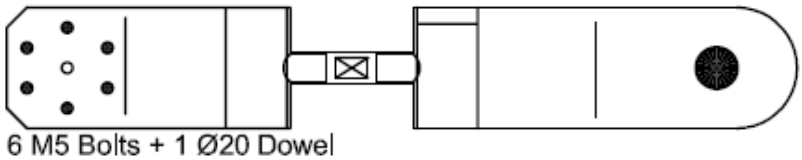
2 M5 Bolts + 1 Ø20 Dowel



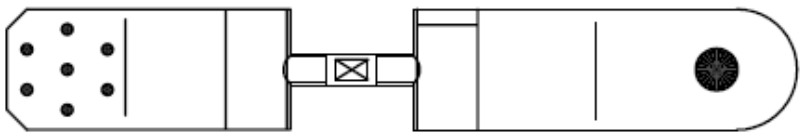
3 M5 Bolts + 1 Ø20 Dowel



4 M5 Bolts + 1 Ø20 Dowel

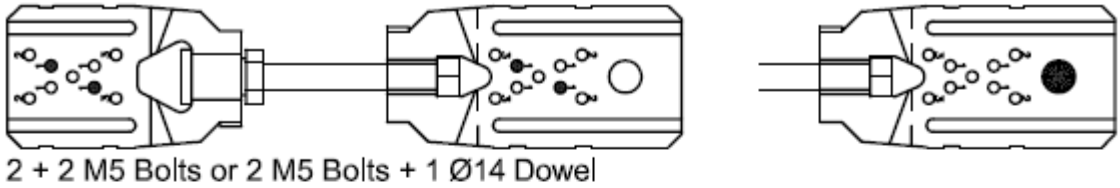


6 M5 Bolts + 1 Ø20 Dowel

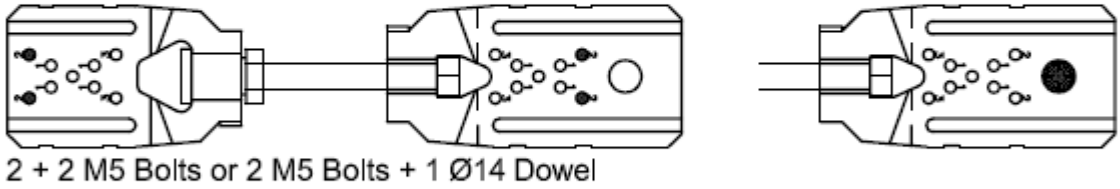


7 M5 Bolts + 1 Ø20 Dowel

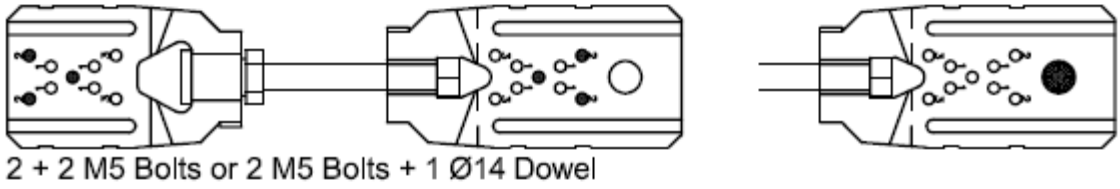
FMBS



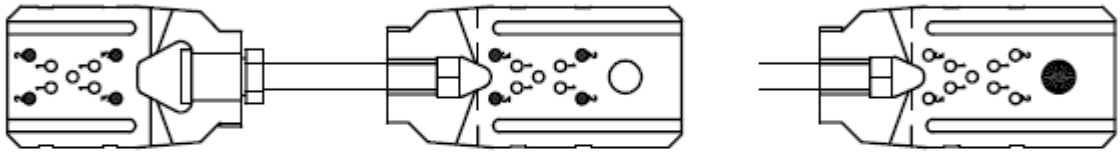
2 + 2 M5 Bolts or 2 M5 Bolts + 1 Ø14 Dowel



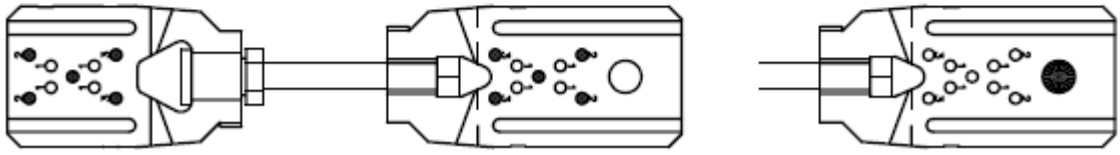
2 + 2 M5 Bolts or 2 M5 Bolts + 1 Ø14 Dowel



2 + 2 M5 Bolts or 2 M5 Bolts + 1 Ø14 Dowel

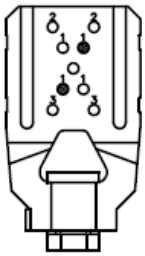


2 + 2 M5 Bolts or 2 M5 Bolts + 1 Ø14 Dowel

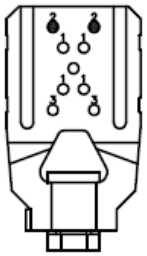


2 + 2 M5 Bolts or 2 M5 Bolts + 1 Ø14 Dowel

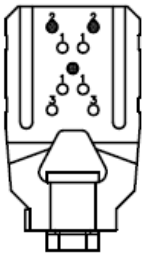
FMB



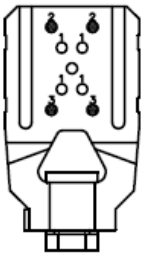
2 M5 Bolts



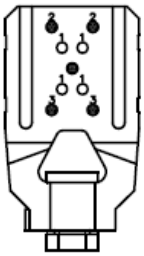
2 M5 Bolts



3 M5 Bolts

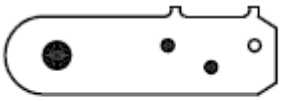


4 M5 Bolts

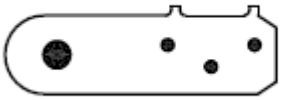


5 M5 Bolts

BNKK25 / BNKK25-14

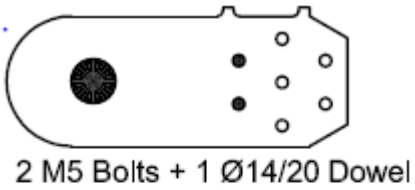


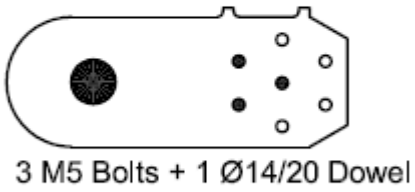
2 M5 Bolts + 1 Ø12/14 Dowel

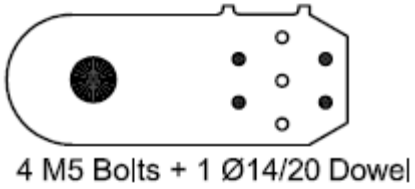


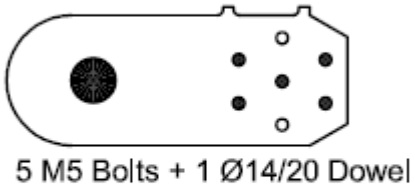
3 M5 Bolts + 1 Ø12/14 Dowel

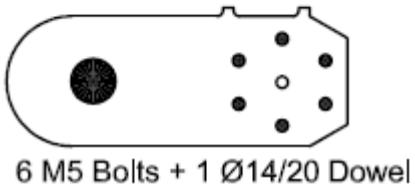
BNKK40/60/ BNKK40/60-14







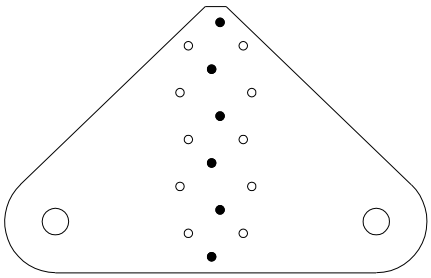




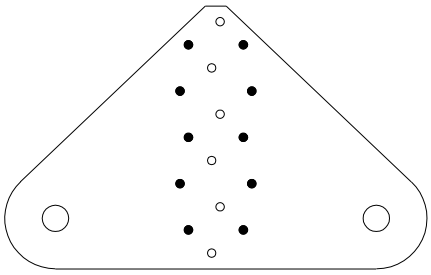
NOTE:
For 25 mm straps, 2 M5 bolts can be submitted by one BF25M5 (clips 23)
For all other straps, 2 M5 bolts can be submitted by one BF4060MF (clips 20)

Mid anchor plates

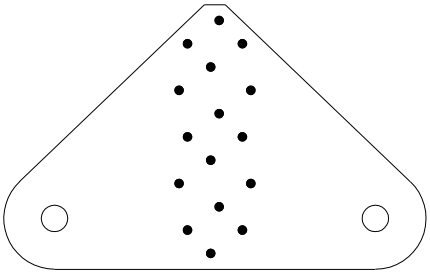
BNK25 / BNK25-14



Timber width: b≥43
6 CNA3,1x40 connector nails
in middle row

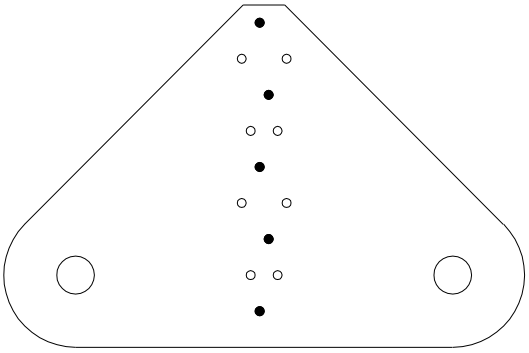


Timber width: b≥74
10 CNA3,1x40 connector nails
in outer rows

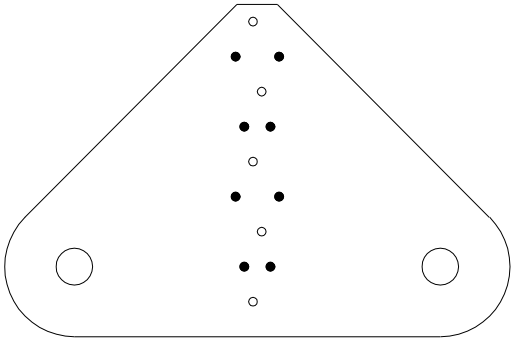


Timber width: b≥74
16 CNA3,1x40 connector nails
in all rows

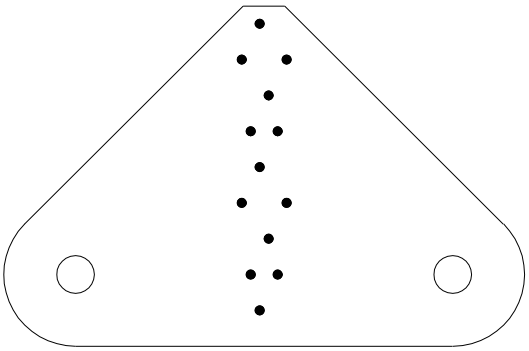
BNK40/60 / BNK40/60-14



Timber width: b≥56
5 CNA4,0xl connector nails
in middle row



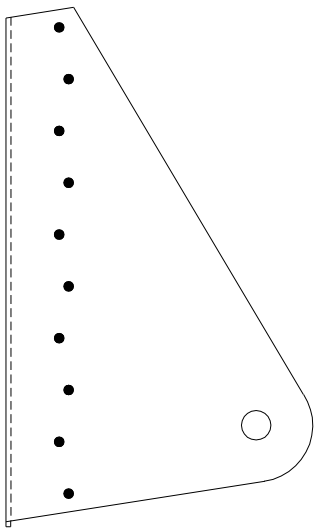
Timber width: b≥79
8 CNA4,0xl connector nails
in outer rows



Timber width: b≥79
13 CNA4,0xl connector nails
in all rows

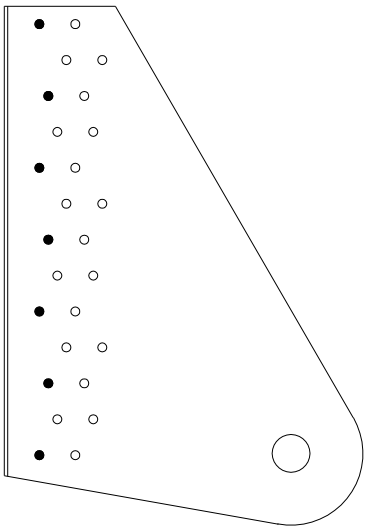
End anchor plates

BNF25 / BNF25-14

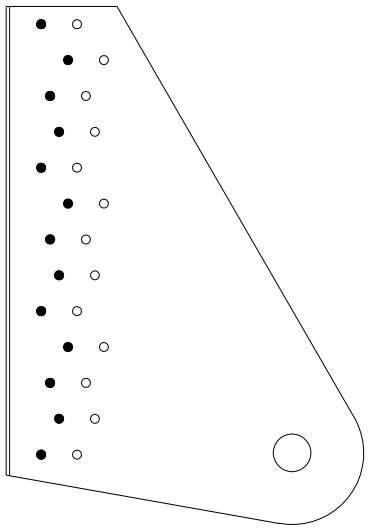


Timber width: b≥43
10 CNA3,1x40 connector nails

BNF40 / BNF40-14

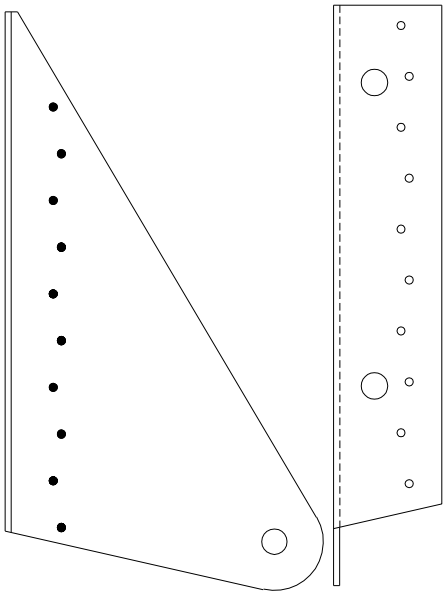


Timber width: b≥45
7 CNA4,0xl connector nails

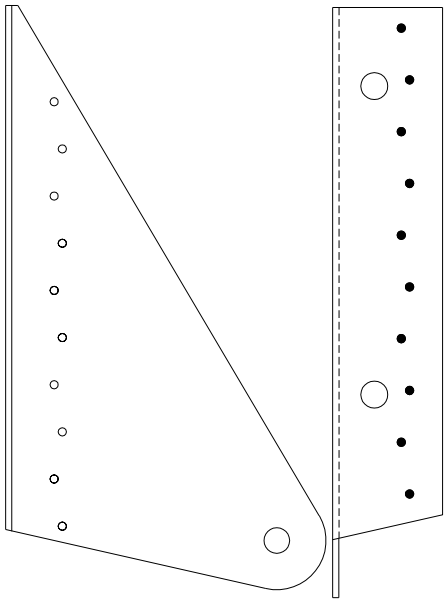


Timber width: b≥58
13 CNA4,0xl connector nails

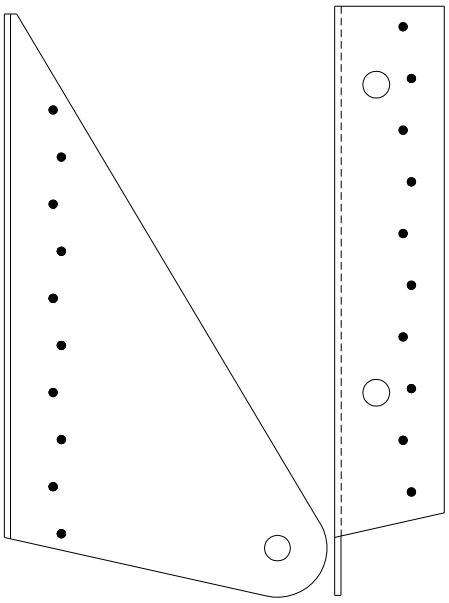
BNG25 / BNG25-14



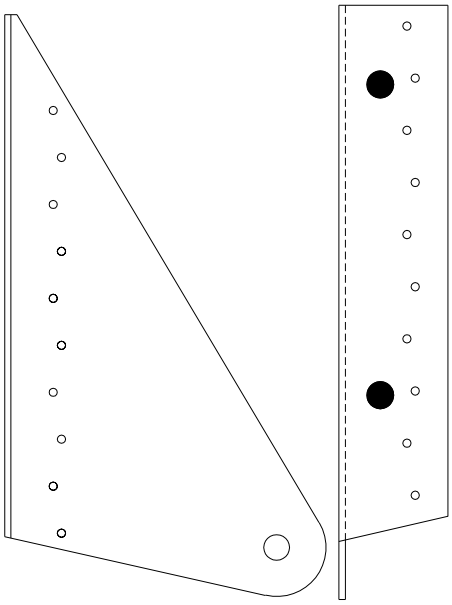
Timber width: b≥45
10 CNA3,1x40 connector nails
in face of connector



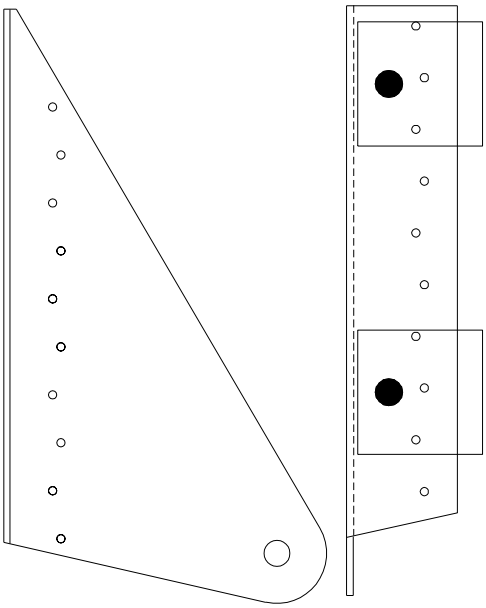
Timber width: b≥45
10 CNA3,1x40 connector nails
in edge flap of connector



Timber width: b≥50
10+10 CNA3,1x40 connector nails
in face and edge flap of connector

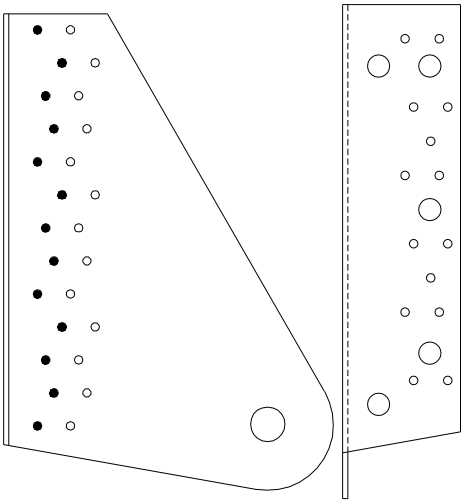


Timber width: b≥45
2M12 bolts
in edge flap of connector

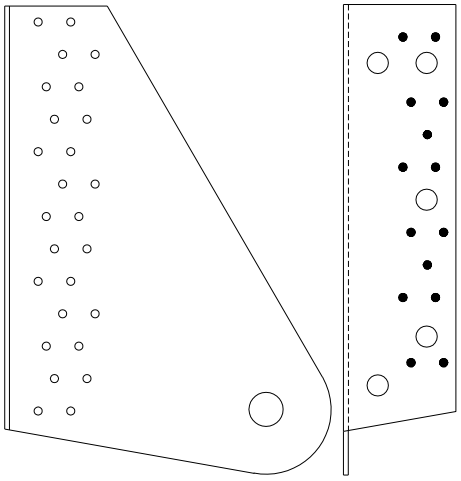


Timber width: b≥45
2M12 bolts with washer
in edge flap of connector

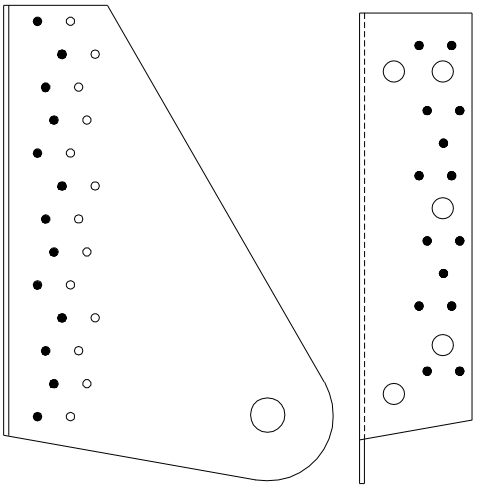
BNG60 / BNG60-14



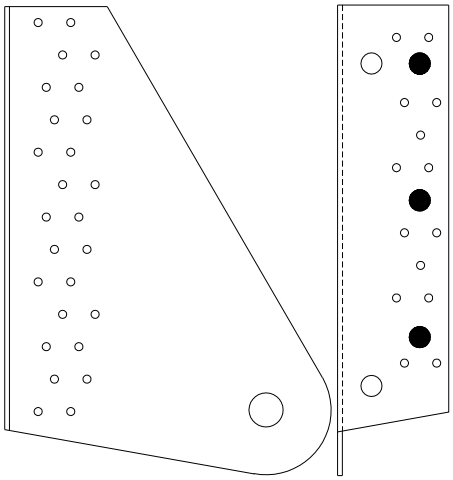
Timber width: b≥58
13 CNA4,0xl connector nails
in face of connector



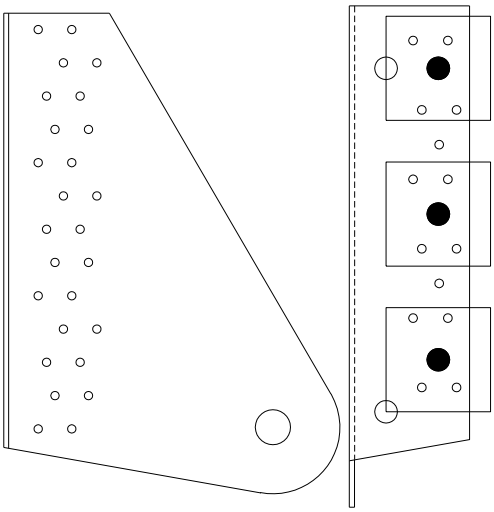
Timber width: b≥45
14 CNA4,0xl connector nails
in edge flap of connector



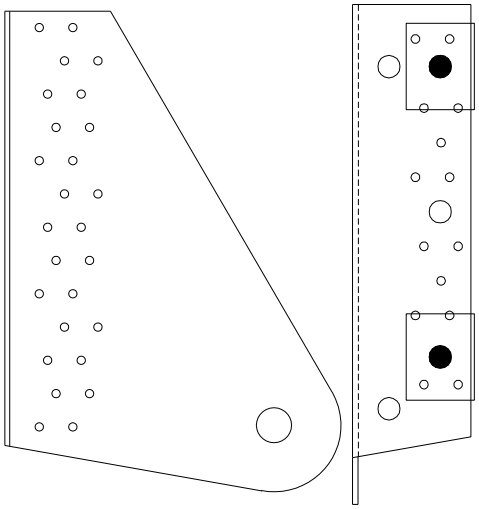
Timber width: b≥58
13+14 CNA4,0xl connector nails
in face and edge flap of connector



Timber width: b≥58
3 M12 bolts
in edge flap of connector



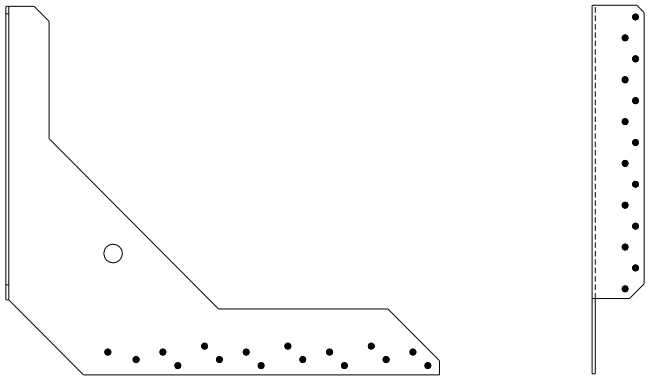
Timber width: b≥58
3 M12 bolts with washer
in edge flap of connector



Timber width: b≥58
2 M12 bolts with washer
in edge flap of connector

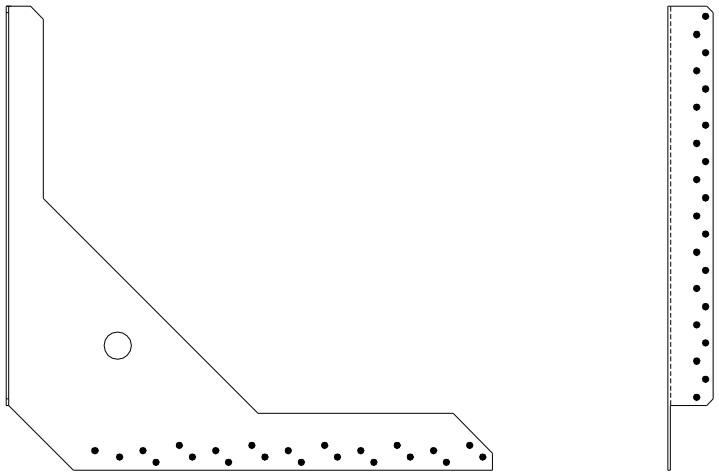
Wind bracing connectors

BNU25 / BNU25-14



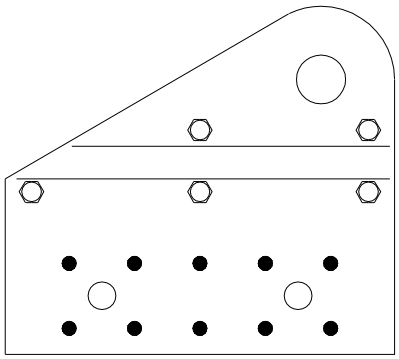
Timber width: b≥45
14+16 CSA4,0x30 connector screws

BNU40 / BNU40-14



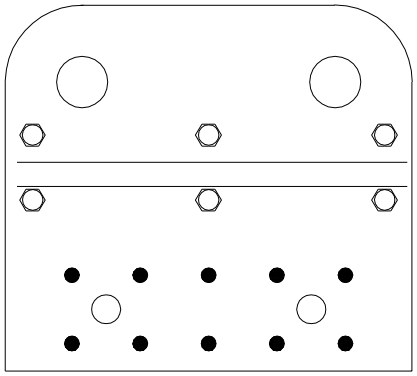
Timber width: b≥45
22+22 CSA4,0x30 connector screws

BNW1



10 Ø8 dowels

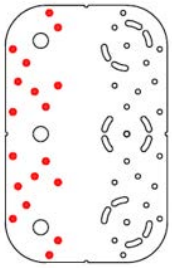
BNW2



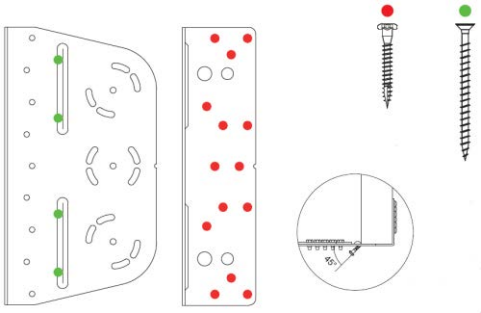
10 Ø8 dowels

WSP, WSD, WSB

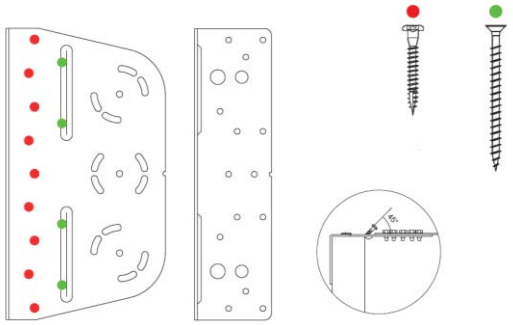
WSP Nailing pattern 1:



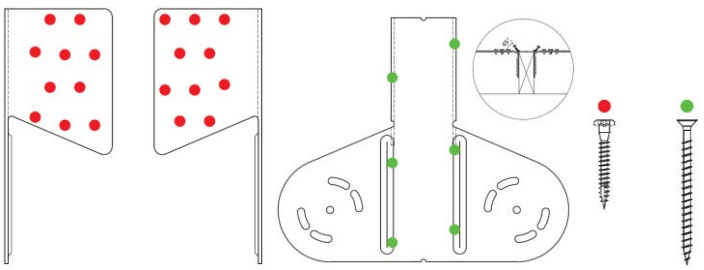
WSD Nailing pattern 1:



WSD Nailing pattern 2:

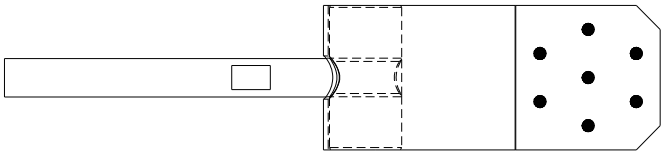


WSB Nailing pattern 1:



Wind bracing link set

BNWA

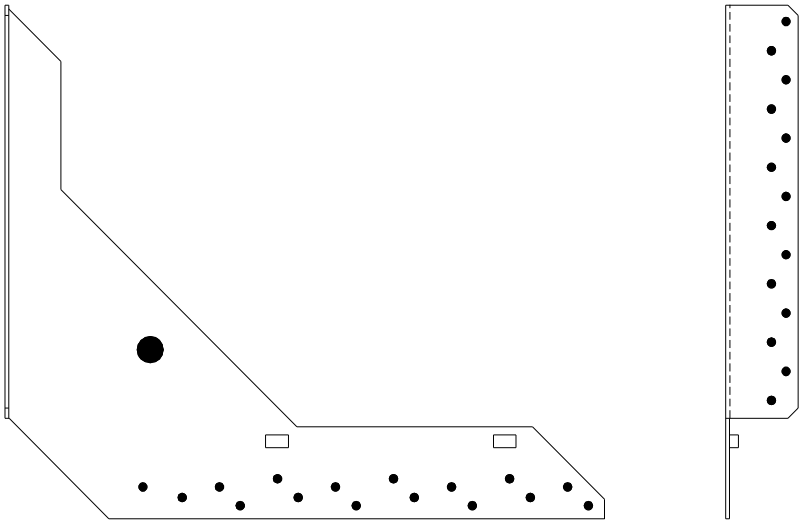


7 M5 bolts

The distance from the center of the holes in which the steel bracing straps are fastened to the connectors to the end of the bracing strap shall be minimum 3d=15 mm.

Diagonal bracing kit

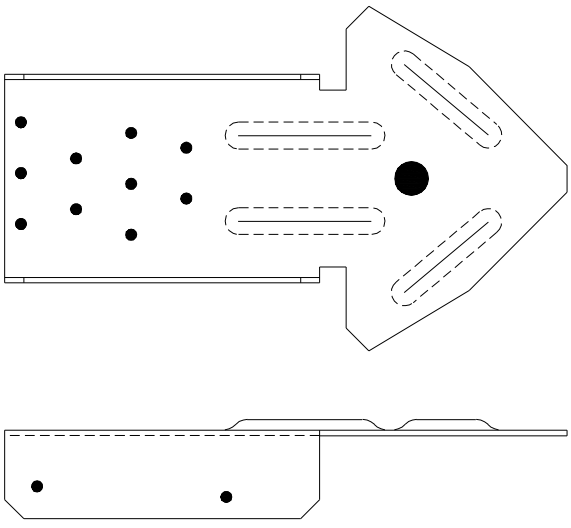
BNU25T



Timber width: b≥45

14+16 CSA4,0x30 connector screws

DAB73T

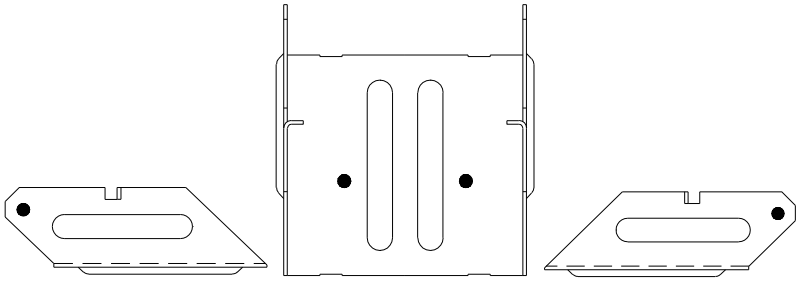


Timber width: b=73 mm

10 +2+2 CSA4,0x30 connector screws + 1 M12 bolt

Batten connectors

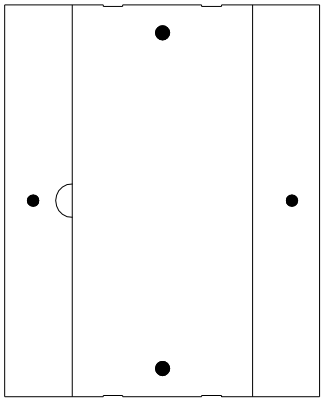
DLVS



Timber width: b=73 mm

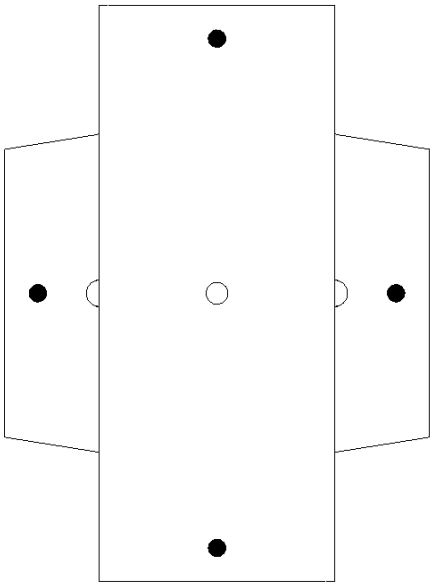
1+2+1 CSA4,0x30 connector screws

DLV



1+2+1 CNA4,0xl connector nails or smooth nails 3,1xl or 3,4xl (always CNA4,0xl in batten)

DLV50/30



2 fastener (CNA3,1x60 , CSA4,0x30 , smooth nail 3,1x80 or smooth nail 3,4x90) in rafter
+
2 screws CSA4,0x30 in batten (fasteners in batten are only needed if so F_1 is acting)

- Batten: b/h = 50/30mm
- Rafter: min. width – see table below

Rafter min. width

CNA3,1x60	CSA4,0x30	Nail 3,1x80	Nail 3,4x90
43,4 mm	53,9 mm	43,4 mm	47,6 mm

Annex C - Characteristic load-carrying capacity

Design Basis – general

Strength modification factors for service classes and load-duration classes
The design values of the load-carrying capacities R_d shall be calculated from the characteristic capacities R_k for the actual service class and load-duration class from the following expression:

$$R_d = \frac{R_k \; x \; k_{mod}}{\gamma_M}$$

with the material partial coefficient γ_M for wood connections. The load duration factor k_{mod} is taken from Eurocode 5 and is for service classes 1 and 2 given in Table A.

Table A. Factor k_{mod} for service class 1 and 2

Load duration classes and k_{mod} factors for service class 1 and 2				
P	L	M	S	I
Permanent	Long term	Medium term	Short term	Instantaneous
0,6	0,7	0,8	0,9	1,1

The modified characteristic capacities stated in this Annex B are valid for service class 1 and 2.
In some cases, where the capacity is controlled by the properties of the steel components only there is no influence of the load duration, so k_{mod} shall be taken as 1,0. Such cases are indicated by “Steel” in the heading of the following tables. The material partial factor shall anyhow be taken as the one for wood connections.

For Service class 3 load duration factor k_{mod} is given in table B.

Table B. Factor k_{mod} for service class 3

Load duration classes and k_{mod} factors for service class 3				
P	L	M	S	I
Permanent	Long term	Medium term	Short term	Instantaneous
0,5	0,55	0,65	0,7	0.9

For service class 3 the modified characteristic capacities can on the safe side be determined by using a reduction factor = 0,78 times the modified characteristic capacity in service class 1 and 2. Alternatively the modified characteristic capacity for service class 3 can be determined by using the reduction factor stated in Table C times the modified characteristic capacity in service class 1 and 2.

Table C. Reduction factor to apply for a service class 3 use (k_{mod} ratio)

Reduction factor for service class 3 use (k_{mod} factors ratio)				
P	L	M	S	I
Permanent	Long term	Medium term	Short term	Instantaneous
0.83	0.78	0.81	0.78	0.81

Density
The characteristic load-carrying capacities of the connections are stated for a characteristic density of 350 kg/m^3.
For timber or wood based material with a lower characteristic density than 350 kg/m^3 the load-carrying capacities shall be reduced by the k_{dens} factor:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^{0,5}$$

Where ρ_k is the characteristic density of the timber in kg/m^3.

Combined forces
A few of the connectors are used in connections subjected to combined forces in the principle directions. For these connectors requirements for the combined forces are given separately.

Timber splitting
The risk of splitting of the timber or wood shall be evaluated for the specific connections. For the connectors used in lattice structures for wind stabilization or stabilization of compressed members of the structure the design of the connection will typically prevent the splitting of the timber or wood. If this is not the case it shall be checked by the rules of Eurocode 5 or a similar national Timber Code that splitting will not occur.

Tension straps and couplers

Force direction on tension straps:

Force direction on couplers:

BNSP, BNKK, FMBS, FMB

Table 1. Characteristic tensile capacities of couplers.

Item	Dowel Size [mm]	Characteristic capacity R_k [kN]
BNSP25	-	23,5
BNSP25B	12,0	21,6
BNSP40	-	35,8
BNSP60	-	53,7
BNSP4060B	20,0	43,6
BNSP80	-	59,3
	20,0	38,1
BNKK25	12,0	26,4
BNKK25-14	14,0	25,6
BNKK40/60	20,0	44,6
BNKK40/60-14	14,0	42,7
FMBS	-	37,1
	14,0	27,8
FMB	-	37,1

- The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0.

Table 2. Characteristic tensile capacities of bracing straps (only informative). Further, the necessary number of M5 bolts to achieve at least the tensile strength of the bracing straps are stated (double shear connection).

Wind bracing Strap	Steel grade	Dimension of Strap [mm]	Characteristic tensile strength of Strap [kN]	Necessary No. of M5 bolts to achieve the tensile strength of the Strap
BAN2025	S250	25x2,0	12,4	2
BAN1540	S350	40x1,5	17,7	3
BAN0940	S550	40x0,9	18,5	4
BAN2040	S250	40x2,0	18,5	2
BAN3040	S250	40x3,0	27,8	3
BAN1560	S350	60x1,5	26,5	4
BAN2060	S250	60x2,0	27,8	3
BAN1580	S350	80x1,5	35,4	5
BAN2080	S250	80x2,0	37,1	4

- To achieve the characteristic capacity for the bracing straps stated in Table 2 a minimum distance of 15 mm from the M5 bolts to the end of the bracing strap is necessary.
- The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0
- The partial safety coefficient γ_M for wood connections should be used – please refer to Annex C, Design Bases, for further info

Bandlock coupler and tension straps

Table 3. Characteristic tensile capacities of tension straps and couplers.

Tension straps or couplers	Dowel diameter [mm]	Characteristic capacity R_k [kN]
Connection with Bandlock tension strap and Bandlock coupler	12	26,3

Bandlock Pro Connectors

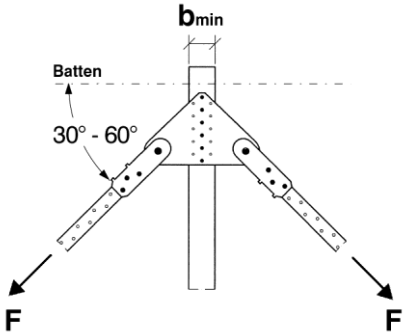
Table 4. Characteristic tensile capacities of tension straps and couplers.

Tension straps or couplers	Characteristic capacity R_k [kN]
BPTD and BPST (all 6 pins in use, 2 bended)	27,5

Mid anchors

BNK

Force direction for mid anchor



The fastener patterns used for the mid anchors are

- Nails in the middle row
- Nails in both outer rows
- Nails in all rows

see Annex B.

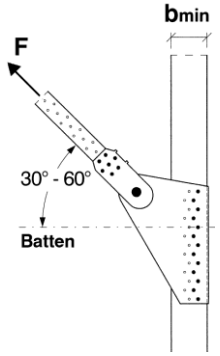
Table 5. Characteristic tensile capacities of mid anchors in KN for a tensile force in one side. The capacity of the connection is the minimum value due to the fasteners and the steel respectively. The capacities in the rightmost column are controlled only by the steel components so k_{mod} shall be taken as 1,0.

Anchor	Nails in	Nail type CNA	b_{min} [mm]	Angle with battens							Steel
				60°	55°	50°	45°	40°	35°	30°	R_k, kN
				Characteristic capacity R_k [kN]							
BNK25 / BNK25-14	Middle row	3,1x40	43	4,9	5,3	5,8	6,3	6,3	7,5	8,2	12,8
	Outer rows	3,1x40	74	7,7	8,3	9,1	10,1	11,2	11,7	13,8	
	All rows	3,1x40	74	12,6	13,6	14,9	16,4	17,5	19,2	22,0	
BNK40/60 BNK40/60-14	Middle row	4,0 x40	56	6,1	6,6	7,2	7,9	8,6	9,1	8,8	21,4
	Outer rows	4,0 x40	79	8,5	9,5	10,7	12,0	13,4	14,6	13,9	
	All rows	4,0 x40	79	14,6	16,1	17,9	19,9	22,0	23,7	22,7	
	Middle row	4,0x50	56	7,4	8,0	8,8	9,6	10,4	11,1	10,7	
	Outer rows	4,0x50	79	10,3	11,6	13,0	14,5	16,2	17,7	16,9	
	All rows	4,0x50	79	17,7	19,6	21,8	24,1	26,6	28,8	27,6	

End anchors

BNF and BNG

Force direction for end anchors



The end anchors can be fastened by nailing in the face of the anchor into the top of the timber and/or in the edge flap into the side of the timber. When nailing into the edge flap, the anchor shall always be placed over the timber. The end anchors can be fastened by bolts in the edge of the anchor into the side of the timber. In this case, the anchor shall be placed either over the timber or on the side of the timber. The bolts shall be installed in the holes farthest away from the bend line of the anchor. See annex A for the different fastener patterns of the anchors.

Table 6. Characteristic load-carrying capacities of end anchors in KN. The capacity of the connection is the minimum value due to the fasteners and the steel respectively. The capacities in the rightmost column are controlled only by the steel components so k_{mod} shall be taken as 1,0.

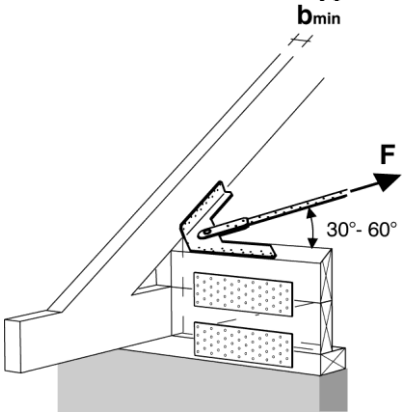
Anchor	Nails or bolts		b_{min} mm	Angle with battens							Steel
				60º	55º	50º	45º	40º	35º	30º	R_k, KN
	Pcs	Type		Due to Fasteners: Characteristic capacity R_k [kN]							
BNF25 / BNF25-14	10	CNA3,1x40	43	15,6	16,7	17,8	18,9	21,3	21,6	21,0	12,8
BNF40 / BNF40-14	7	CNA4,0x40	45	12,0	13,3	14,3	15,5	17,1	19,0	20,1	21,4
BNF40 / BNF40-14	7	CNA4,0x50	48	16,5	18,2	19,7	22,0	24,0	25,6	25,8	21,4
BNF40 / BNF40-14	6+7	CNA4,0x40	58	21,7	23,2	24,4	30,2	31,6	30,5	27,7	21,4
BNF40 / BNF40-14	6+7	CNA4,0x50	58	26,6	26,3	24,4	35,6	36,8	35,1	31,7	21,4
Nails only on face of connector											
BNG25 / BNG25-14	10	CNA3,1x40	45	15,3	16,2	17,3	18,8	21,8	23,6	25,2	19,2
BNG60 / BNG60-14	2x6	CNA4,0x40	58	10,9	23,8	28,7	31,1	33,7	28,2	24,8	32,0 [1)]
BNG60 / BNG60-14	2x6	CNA4,0x50	58	10,9	23,8	29,4	31,9	39,6	32,0	27,7	32,0 [1)]
Nails only on edge flap of connector											
BNG25 / BNG25-14	10	CNA3,1x40	45	14,7	15,6	16,7	18,1	19,9	20,5	15,5	19,2
BNG60 / BNG60-14	14	CNA4,0x40	45	15,0	19,5	19,7	26,8	31,6	31,0	24,7	32,0 [1)]
BNG60 / BNG60-14	14	CNA4,0x50	50	15,0	19,5	19,7	26,8	31,6	31,0	24,7	32,0 [1)]
Nails on face and edge flap of connector											
BNG25 / BNG25-14	10+10	CNA3,1x40	50	23,3	28,1	32,0	35,1	26,8	26,3	21,9	19,2
BNG60 / BNG60-14	2x6+14	CNA4,0x40	58	40,8	37,7	32,2	34,9	35,9	36,5	34,4	32,0 [1)]
BNG60 / BNG60-14	2x6+14	CNA4,0x50	58	44,2	39,8	33,4	35,4	36,4	37,5	35,7	32,0 [1)]
Connector over the timber with bolts											
BNG25 / BNG25-14	2	M12 bolts	45	8,2	8,6	9,2	10,0	11,0	12,3	14,1	19,2
BNG25 / BNG25-14	2	M12 bolts	58	10,5	11,1	11,9	12,9	14,2	15,9	15,5	19,2
BNG60 / BNG60-14	3	M12 bolts	58	13,1	13,8	14,8	16,0	17,6	19,8	22,7	32,0 [1)]
BNG60 / BNG60-14	3	M12 bolts	75	16,9	17,9	19,1	20,7	22,8	25,5	29,3	32,0 [1)]
Connector on the side of the timber with bolts and washers											
BNG25 / BNG25-14	2	M12 bolts	45	8,2	8,6	9,2	10,0	11,0	12,3	14,1	19,2
BNG25 / BNG25-14	2	M12 bolts	58	10,5	11,1	11,9	12,9	14,2	15,9	18,2	19,2
BNG60 / BNG60-14	3	M12 bolts	58	11,9	12,5	13,4	14,5	16,0	15,7	12,8	32,0 [1)]
BNG60 / BNG60-14	3	M12 bolts	75	11,9	12,5	13,4	14,5	16,0	15,7	12,8	32,0 [1)]

1) 40,8 kN for steel S350GD.

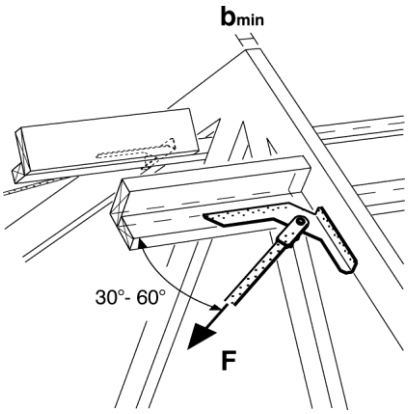
Wind Bracing Connectors

BNU

Force direction of end anchor type BNU



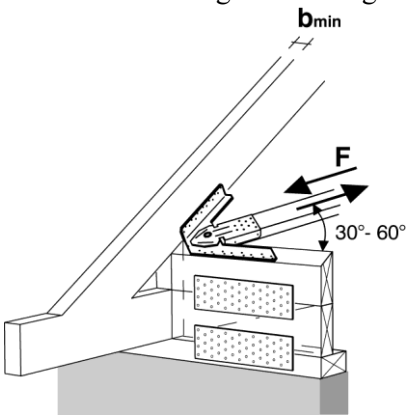
BNU at bulkhead over facade



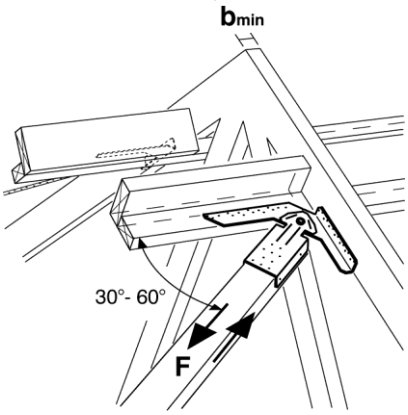
BNU at ridge

The BNU anchors are fastened to the timber with CSA4,0x30 connector screws in all holes.

Force direction of Diagonal bracing kit (BNU25T and DAB73T)



BNU25T at bulkhead over façade



BNU25T at ridge

The BNU25T anchors are installed together with the DAB73T diagonal bracing connector.

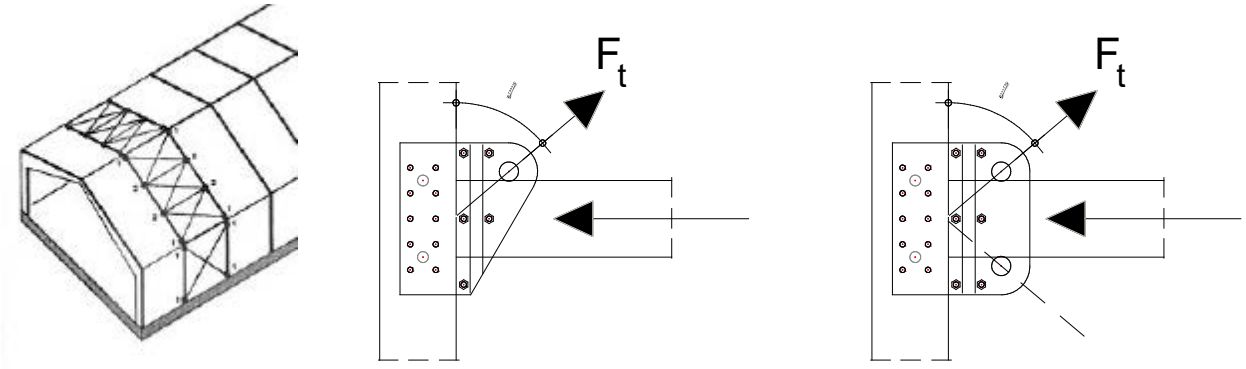
Table 7. Characteristic load-carrying capacities of BNU end anchors in kN

Anchor	CSA Screws		b_{min} [mm]	Angle with battens							Steel
				60°	55°	50°	45°	40°	35°	30°	R_k, kN
	Number	Size		Characteristic Capacity R_k [kN]							
Connectors and steel bracing straps											
BNU25 / BNU25-14	14+16	4,0x30	45	11,1	11,7	12,5	13,6	14,9	16,7	17,4	12,8
BNU40 / BNU40-14	22+22	4,0x30	45	19,4	20,5	21,9	23,8	25,2	23,6	22,3	21,4
Connectors and diagonal timber batten 38 x 73 mm of the strength class C18 and DAB73T with fasteners in all holes. In compression. Max. distance between the trusses: 1000 mm.											
BNU25T	14+16	4,0x30	45				9,3	9,3	9,3	9,3	
Connectors and diagonal timber batten 38 x 73 mm of the strength class C18 and DAB73T with fasteners in all holes. In tension.											
BNU25T	14+16	4,0x30	45	9,9	10,4	11,2	12,1	13,3	12,4	11,1	

BNW

The BNW connectors BNW1 and BNW2 are used for wind stabilization lattice girders.

Force direction:



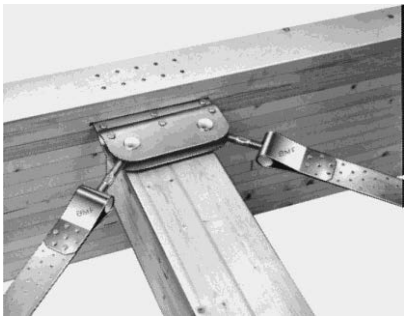
For Ø8 mm dowels of a length of 120 mm or 140 mm in all holes and installed as described in Annex A the characteristic load-carrying capacity of the BNW1 and the BNW2 connectors is given in table 6. For both connectors it is assumed that the connection is subjected to one diagonal tensile force as shown above.

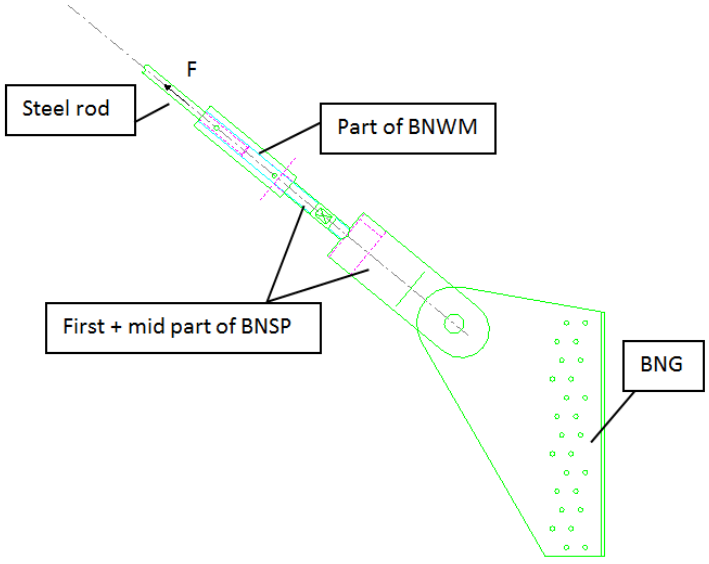
Table 8. Characteristic load-carrying capacities of BNW connectors in kN. The capacity of a connection is the minimum value due to the fasteners and the steel respectively.

Angle with rafter α	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°
Dowel Ø8, length 120 mm																	
$R_{t,k}$ [kN]	22,1	22,8	23,8	25,0	26,6	28,6	31,2	34,6	39,2	45,6	54,9	69,8	61,2	49,1	41,2	35,6	31,6
Dowel Ø8, length 140 mm																	
$R_{t,k}$ [kN]	23,4	24,1	25,1	26,4	28,1	30,2	33,0	36,6	41,5	48,2	58,2	74,0	65,5	52,9	44,5	38,6	34,3

The tensile capacities of the accessories for the connection to the BNW1 or BNW2 are given by:

- BNWA $N_{R,k} = 61,8$ kN
- BNWM16 $N_{R,k} = 117,6$ kN
- BNWM12 $N_{R,k} = 63,1$ kN

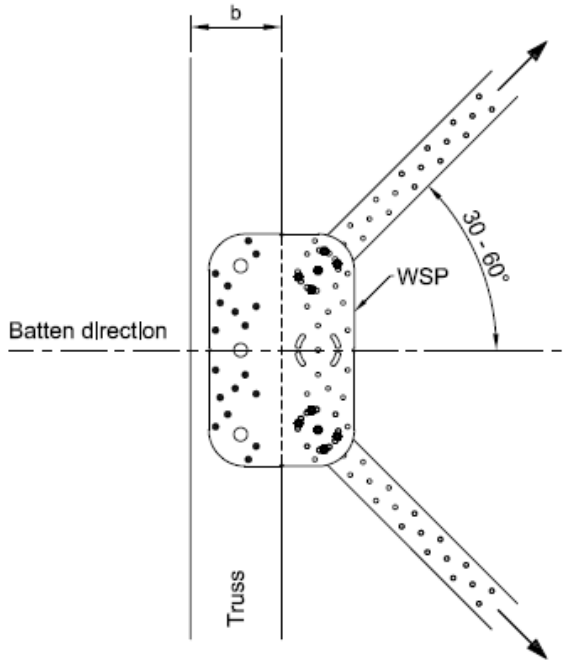




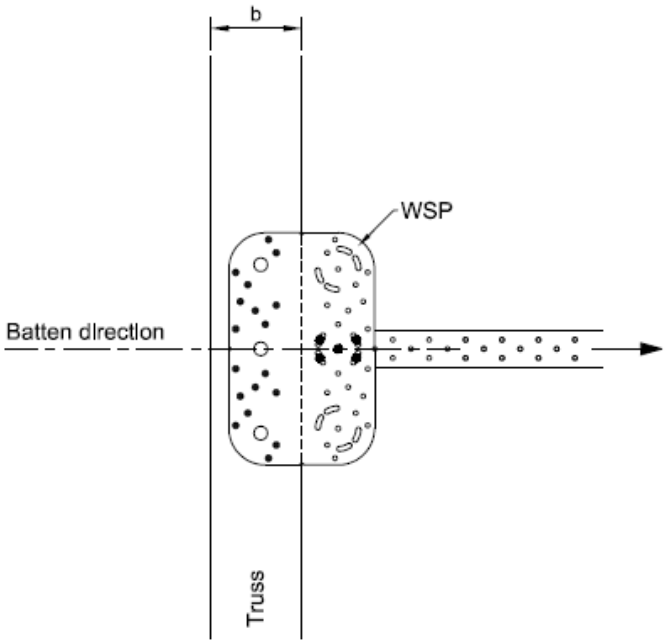
WSP, WSD, WSB

Force direction for Wind Bracing Connectors WSP

Angle between Strap and Batten direction: 30 - 60°

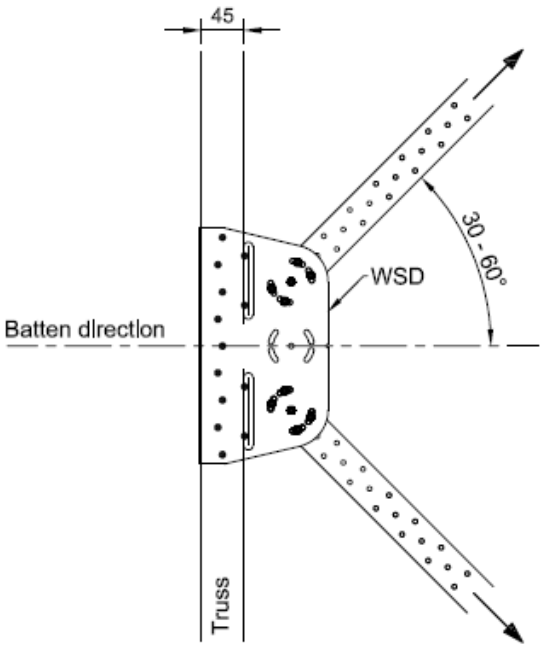


Angle between Strap and Batten direction: 0 ± 15°

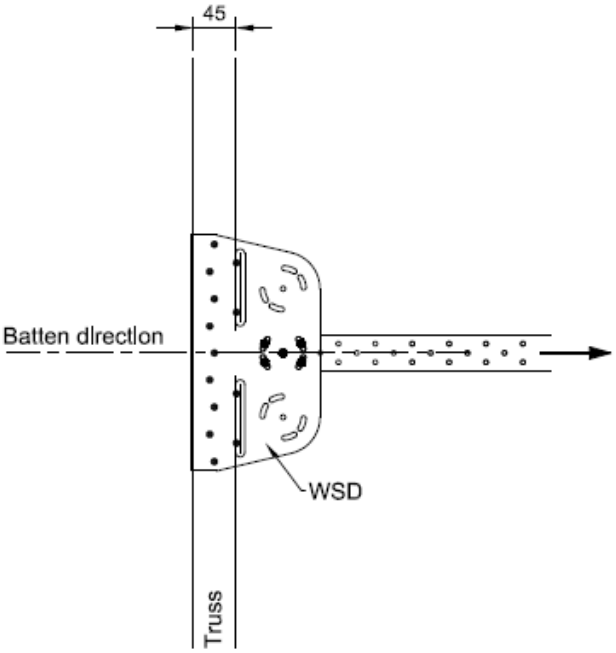


Force direction for Wind Bracing Connectors WSD

Angle between Strap and Batten direction: 30 - 60°



Angle between Strap and Batten direction: 0 ± 15°



Force direction for Wind Bracing Connectors WSB

Angle between Truss and Strap: 30 - 60°

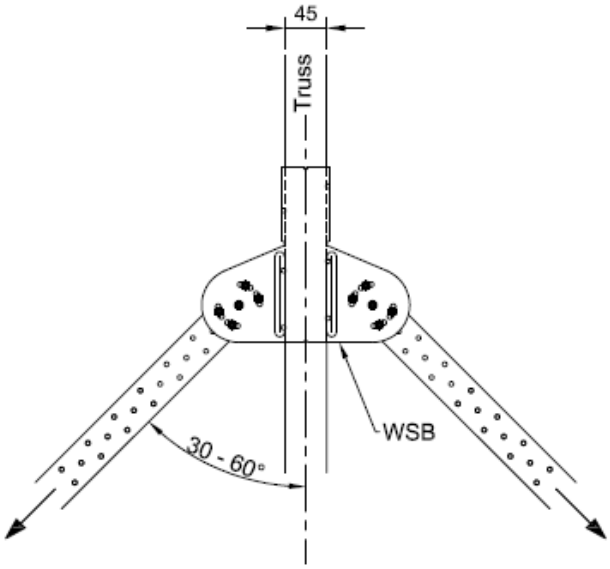


Table 9. Characteristic capacities:

Item No.	Nailing pattern	CSA5,0x40		Wood Screw 4)	Timber size		Characteristic Load carrying capacity [kN] 3)						
					b min.	h min.	WSP & WSD: Angle between Batten and Strap WSB: Angle between Truss and Strap					Wind Bracing Strap [kN]	
		Top	Back	45°	mm	mm	60°	45°	30°	15°	0°	2x25 mm	2x40 mm & 0,9x40 mm
WSP WSP-12 WSP-14	1	18	0	0	95	45	19,7	19,4	19,2	19,1	19,1	12,4 1)	18,5 2)
WSD WSD-12 WSD-14	1	0	14	4	45	80	19,8	19,2	18,6	17,9	17,3		
	2	9	0	4	45	80	18,2	17,4	16,6	14,7	12,8		
WSB WSB-12 WSB-14	1	0	20	6	45	90	18,4	17,6	16,8	-	-		

1) Number of M5 Bolts for 2x25 mm Strap: 3
2) Number of M5 Bolts for 2x40 mm Strap: 4 and for 0,9x40 mm Strap: 5
3) Capacities for angles in-between the stated, can be found by interpolation. The Truss must be prevented against rotation to achieve full capacity.
4) Min. 4,5x70 mm and $R_{ax,k} \geq 2,6$ kN

Anchors for connections to concrete

BNG

Force direction for BNG anchor:
BNG Anchors can be fastened to a cracked/non cracked concrete Foundation as shown below. 2 x M12 Anchor Bolts with US40/50/10 Washer shall be installed in the Holes closest to the bend line of the Connector.

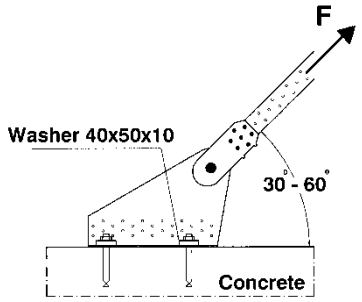


Table 10. Resulting force $F_{b,ax,d}$ *and* $F_{b,lat,d}$ in the heaviest loaded Bolt can be calculated:

Item No.	Bolt factor	Steel [kN]
BNG25 / BNG25-14	$For\ \alpha = 30-41°:\quad F_{b,ax,d} = F_d \times 1{,}56 \times \frac{\frac{129}{\tan\alpha} - 74}{149} \times \sin\alpha$ $For\ \alpha = 42-60°:\quad F_{b,ax,d} = F_d \times 1{,}56 \times \frac{223 - \frac{129}{\tan\alpha}}{149} \times \sin\alpha$ $For\ \alpha = 30-60°:\quad F_{b,lat,d} = F_d \times 0{,}5 \times \cos\alpha$	19,2
BNG60 / BNG60-14	$For\ \alpha = 30-54°:\quad F_{b,ax,d} = F_d \times 1{,}61 \times \frac{\frac{158}{\tan\alpha} - 15}{198} \times \sin\alpha$ $For\ \alpha = 54-60°:\quad F_{b,ax,d} = F_d \times 1{,}61 \times \frac{213 - \frac{158}{\tan\alpha}}{198} \times \sin\alpha$ $For\ \alpha = 30-60°:\quad F_{b,lat,d} = F_d \times 0{,}5 \times \cos\alpha$	32,0 [1)]

1) 40,8 kN for steel S350GD.

WSD

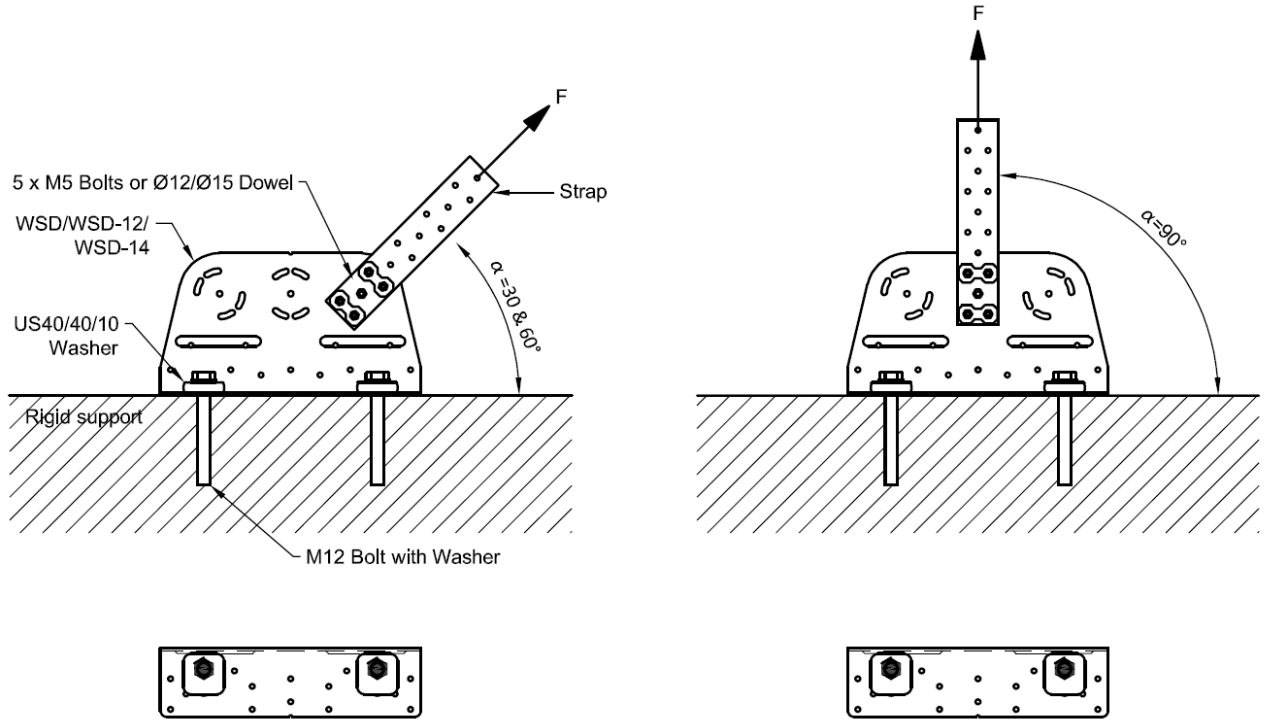


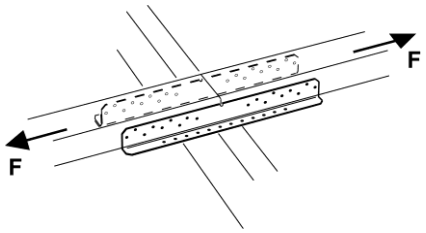
Table 11. Characteristic Load carrying capacity.

Item	Fasteners		Characteristic Load carrying capacity [kN] 1)				
	Flange A	Flange B	Angle between strap and support a 2)				
			30°	45°	60°	75°	90°
WSD	2 x M12 Bolts 3) with US40/40/10 Washer	5 x M5 Bolts	29,3	28,0	26,7	28,2	29,7
WSD-12 WSD-14	2 x M12 3) Bolts with US40/40/10 Washer	Ø12 or Ø15 Dowel 4)	25,4				

1) k_{mod} = 1,0 for all load durations.
2) Capacities for angles in between the stated, can be found by interpolation.
3) Each bolt must have a capacity: $R_{Bolt,ax,d} \geq F_d$ x 0,9 & $R_{Bolt,lat,d} \geq F_d$ x 0,5 x cosa
4) Connection to Strap via Coupler

Batten Connectors

DAB22



A couple of DAB22 diagonal batten connectors each with 9 CSA4,0x30 connector screws in each end has a characteristic tensile or compression capacity of:

R_k = 24,7 kN

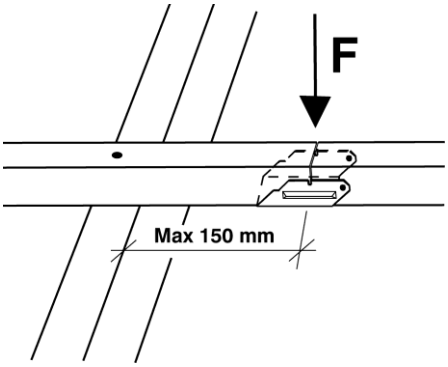
If fewer screws are employed the characteristic tensile or compression capacity is:

$R_k = n \cdot 2{,}74$ kN

where n is the number of screws in each end of one of the two DAB22's.

DLVS73

Force direction for DLVS73:

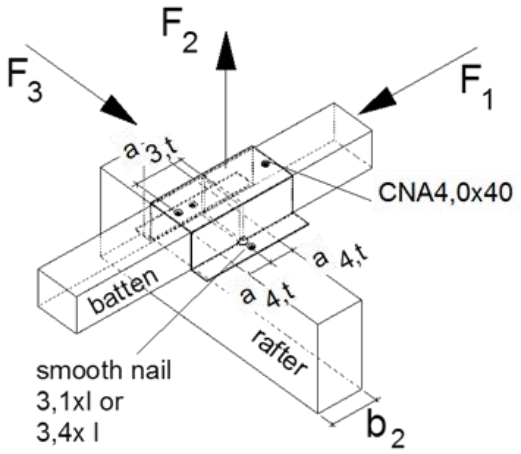


The characteristic capacity for a shear force using 4 CSA4,0x30 connector screws – see Annex A:

R_k = 2,33 kN

DLV

The characteristic load-carrying capacities in the 3 principle directions are for nails in all holes. In the batten shall CNA 4,0x40 mm connector nails be used.



$$R_{1,k} = \min\begin{cases} R_{lat,rafternail,k} \times 2 \\ 1{,}27kN \end{cases}$$

In the following expression the constant term 1,48 kN is divided by k_{mod} because it depends only on the strength of the steel, this to compensate the multiplication by k_{mod} by the determination of the design value.

$$R_{2,k} = \min\begin{cases} 2 \times R_{ax,rafternail,k} \\ \dfrac{1{,}48kN}{k_{\mathrm{mod}}} \end{cases}$$

$$R_{3,k} = R_{lat,rafternail,k} + 0{,}31/k_{mod}$$

For combination of load directions it should be to check the following formulas:

For smooth nails in the rafter:

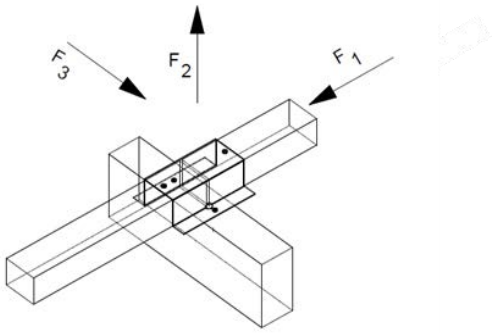
$$\sqrt{\left(\frac{F_1}{R_1}\right)^2 + \left(\frac{F_3}{R_3}\right)^2} + \left(\frac{F_2}{R_2}\right) \le 1{,}0$$

For threaded nails in the rafter:

$$\left(\frac{F_1}{R_1}\right)^2 + \left(\frac{F_3}{R_3}\right)^2 + \left(\frac{F_2}{R_2}\right)^2 \le 1{,}0$$

DLV50/30

The characteristic load-carrying capacities in the 3 principle directions are for fasteners in all holes.



The CSA4,0x30 connector screws in the batten shall only be used if F_1 is acting.

Table 12. Characteristic load-carrying capacities of DLV50/30 connector

Fastener in rafter	Characteristic capacities [kN]		
	$R_{1,k}$ (Screws in batten: CSA4,0x30)	**$R_{2,k}$ (No fasteners in batten necessary)**	**$R_{3,k}$ (No fasteners in batten necessary)**
CNA3,1x60	1,13	0,79 / k_{mod}	0,34 / k_{mod} + 1,4 / $k_{mod}^{0,4}$
CSA4,0x30	1,13	0,79 / k_{mod}	0,34 / k_{mod} + 1,36
Nail 3,1x80	1,13	min (1,18 ; 0,79 / k_{mod})	0,34 / k_{mod} + 0,76
Nail 3,4x90	1,13	0,79 / k_{mod}	0,34 / k_{mod} + 0,88

For combination of load directions, it should be to check the following formulas:

For smooth nails in the rafter:
$$\sqrt{\left(\frac{F_1}{R_1}\right)^2+\left(\frac{F_3}{R_3}\right)^2}+\left(\frac{F_2}{R_2}\right) \le 1{,}0$$

For threaded nails (or screws) in the rafter:
$$\left(\frac{F_1}{R_1}\right)^2+\left(\frac{F_3}{R_3}\right)^2+\left(\frac{F_2}{R_2}\right)^2 \le 1{,}0$$

Connector for Stability of Trusses

CST

Connector for Stability of Trusses

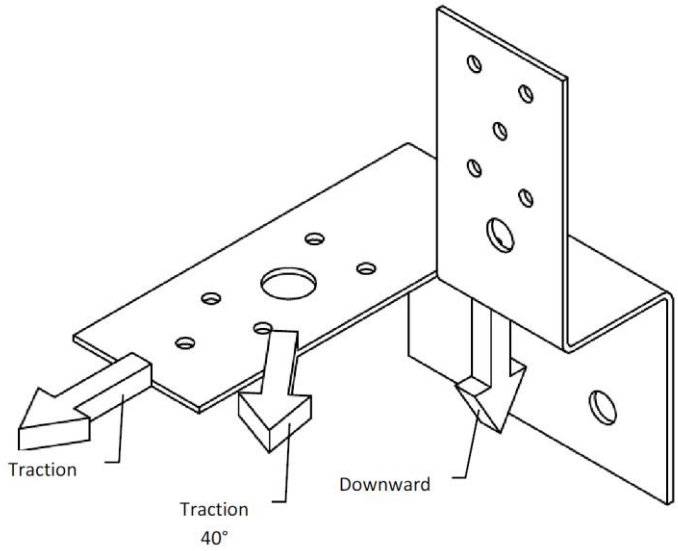


Table 13. Characteristic load-carrying capacities of CST connectors in kN.

Model number	Fasteners	Characteristic values (kN)		
		Downward	Traction	Traction with an angle of 40°
CST	3 Ø8	15,81	7,52	3,68