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MEMBER OF EOTA

Authorised and notified according to Article 10 of the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products

European Technical Approval ETA-10/0440

This ETA replaces the previous ETA with the same number and validity from 2011-01-31 to 2016-01-31

Trade name:	Simpson Strong-Tie Roof Connectors				
Holder of approval:	SIMPSON STRONG-TIE A/S Hedegaardsvej 4 – 11, Boulstrup DK-8300 Odder Tel. +45 87 81 74 00 Fax +45 87 81 74 09 Internet www.strongtie.dk				
Generic type and use of construction product:	Three-dimensional nailing plate (timber-to-timber/timber-to-concrete/timber to steel wind bracing)				
Valid from:	2013-05-28				
to:	2018-05-28				
Manufacturing plant:	Simpson Strong-Tie A/S Hedegaardsvej 4-11, Boulstrup 8300 Odder Denmark	Simpson Strong-Tie 5151 S. Airport Way Stockton CA 95206 USA	Simpson Strong-Tie 2600 International Street Columbus, OH 43228 USA	Simpson Strong-Tie ZAC des Quatre Chemins 85400 Sainte Gemme La Plaine France	Simpson Strong-Tie Winchester Road Cardinal Point Tamworth Staffordshire B78 3HG United Kingdom

This European Technical Approval contains: 56 pages including 3 annexes which form an integral part of the document



European Organisation for Technical Approvals

Europæisk Organisation for Tekniske Godkendelser

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				
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				

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I LEGAL BASIS AND GENERAL CONDITIONS

1. This European Technical Approval is issued by ETA-Danmark A/S in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹⁾, as amended by Council Directive 93/68/EEC of 22 July 1993²⁾.
 - Bekendtgørelse 559 af 27-06-1994 (afløser bekendtgørelse 480 af 25-06-1991) om ikrafttræden af EF direktiv af 21. december 1988 om indbyrdes tilnærmelse af medlemsstaternes love og administrative bestemmelser om byggevarer.
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC³⁾.
 - EOTA Guideline ETAG 015 *Three-dimensional nailing plates*, September 2002 edition.
2. ETA-Danmark A/S is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.
3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.
4. This European Technical Approval may be withdrawn by ETA-Danmark A/S pursuant to Article 5(1) of Council Directive 89/106/EEC.
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6. This European Technical Approval is issued by ETA-Danmark A/S in Danish. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1) Official Journal of the European Communities N° L40, 11 Feb 1989, p 12.

2) Official Journal of the European Communities N° L220, 30 Aug 1993, p 1.

3) Official Journal of the European Communities N° L 17, 20 Jan 1994, p 34.

II SPECIAL CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

Definition of the product

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.

Most of the connectors are made from pre-galvanized steel Grade S 250 GD + min. Z275 according to EN 10346 with tolerances according to EN 10143.

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.

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 Essential Requirements 1 and 4 of Council Directive 89/106/EEC 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/m³ to 420 kg/m³.

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/m³.

For timber or wood based material with a lower characteristic density than 350 kg/m³ 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/m³.

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 is applied, or when stainless steel as specified under “Definition of the product” is used.

Assumed working life

The assumed intended working life of the angle brackets for the intended use is 50 years, provided that they are subject to appropriate use and maintenance.

The information on the working life should not be regarded as a guarantee provided by the manufacturer or ETA-Danmark A/S. An “assumed intended working life” means that it is expected that, when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

2 Characteristics of product and assessment

ETAG para.	Characteristic	Assessment of characteristic
2.1	Mechanical resistance and stability*)	
6.1.1	Characteristic load-carrying capacity	See Annex C
6.1.2	Stiffness	No performance determined
6.1.3	Ductility in cyclic testing	No performance determined
2.2	Safety in case of fire	
6.2.1	Reaction to fire	The connectors are made from steel classified as Euroclass A1 in accordance with EN 13501-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
2.3	Hygiene, health and the environment	
6.3.1	Influence on air quality	No dangerous materials **)
2.4	Safety in use	Not relevant
2.5	Protection against noise	Not relevant
2.6	Energy economy and heat retention	Not relevant
2.7	Related aspects of serviceability	
6.7.1	Durability	The connectors have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the dry internal conditions defined by service class 1, 2 and 3
6.7.2	Serviceability	
6.7.3	Identification	

*) See page 9 of this ETA

***) In accordance with <http://europa.eu.int/-/comm/enterprise/construction/internal/dangsub/dangmain.htm> In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

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

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

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:

$$k_{modi} = 1,18 \quad (EC5: k_{modi} = \frac{1,30}{1,10} = 1,18)$$

The characteristic load-carrying capacities for a connection between steel and concrete have been calculated considering a ratio between the partial factor for steel connections and partial factor of the bolt/anchor for the actual load:

UPAT:

$$F_{ax}: k_{modi} = 0,75 \quad (EC5: k_{modi} = \frac{1,35}{1,8} = 0,75)$$

$$F_{lat}: k_{modi} = 1,08 \quad (EC5: k_{modi} = \frac{1,35}{1,25} = 1,08)$$

BoAX

$$F_{ax}: k_{modi} = 0,75 \quad (EC5: k_{modi} = \frac{1,35}{1,8} = 0,75)$$

$$F_{lat}: k_{modi} = 0,9 \quad (EC5: k_{modi} = \frac{1,35}{1,5} = 0,9)$$

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

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

2.1 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. The bolts are in accordance with EN 14592 with an ultimate strength of 800 MPa.

Ø12 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.

Further, for some BNG connectors, anchor bolts are assumed as fasteners to a concrete structure. For such connectors it is stated at the tables with load-carrying capacities (Annex C) which characteristic capacities that have been assumed for the bolt connection. Bolts as fasteners to a steel structure with at least the same capacities can also be used.

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.

2.7 Related aspects of serviceability

2.7.1 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 S250 GD with min. Z275 according to EN 10346.

2.7.2 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 S250 GD with min. Z 350 according to EN 10346.

3 Attestation of Conformity and CE marking

3.1 Attestation of Conformity system

The system of attestation of conformity is 2+ described in Council Directive 89/106/EEC (Construction Products Directive) Annex III.

- a) Tasks for the manufacturer:
 - (1) Factory production control,
 - (2) Initial type testing of the product,
- b) Tasks for the notified body:
 - (1) Initial inspection of the factory and the factory production control,
 - (2) Continuous surveillance

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan¹. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as sheet metal, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and zinc coating thickness.

The manufactured components are checked visually and for dimensions.

The control plan, which is part of the technical documentation of this European Technical Approval, includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control and has been agreed between the approval holder and ETA-Danmark A/S.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- Designation of the product, basic material and components;
- Type of control or testing;
- Date of manufacture of the product and date of testing of the product or basic material and components;
- Result of control and testing and, if appropriate, comparison with requirements;
- Signature of person responsible for factory production control.

The records shall be presented to ETA-Danmark A/S on request

3.2.1.1 Initial type testing of the product

For initial type testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type testing has to be agreed between ETA-Danmark A/S and the notified body

3.2.2. Tasks of notified bodies

3.2.2.1 Initial inspection of the factory and the factory production control

The approved body should ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the connectors with the specifications given in part 2.

¹ The control plan has been deposited at the ETA-Danmark A/S and is only made available to the approved bodies involved in the conformity attestation procedure.

3.2.2.2 Continuous surveillance

The approved body shall visit the factory at least twice a year for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the control plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body to ETA-Danmark A/S. Where the provisions of the European Technical Approval and the control plan are no longer fulfilled, the certificate of conformity shall be withdrawn by the approved body.

3.3 CE marking

The CE marking shall be affixed on each packaging of connectors. The initials "CE" shall be accompanied by the following information:

- Name or identifying mark of the manufacturer
- The last two digits of the year in which the marking was affixed
- Number of the EC certificate of conformity
- Number of the ETA Guideline (ETAG no. 015)
- Number of the European Technical Approval
- Name and size of product

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The connectors are manufactured in accordance with the provisions of the European Technical Approval 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.

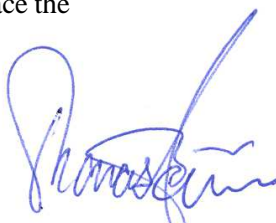
4.2 Installation

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

4.3 Maintenance and repair

Maintenance is not required during the assumed intended working life.

Should repair prove necessary, it is normal to replace the connector.



Thomas Bruun
Manager, 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

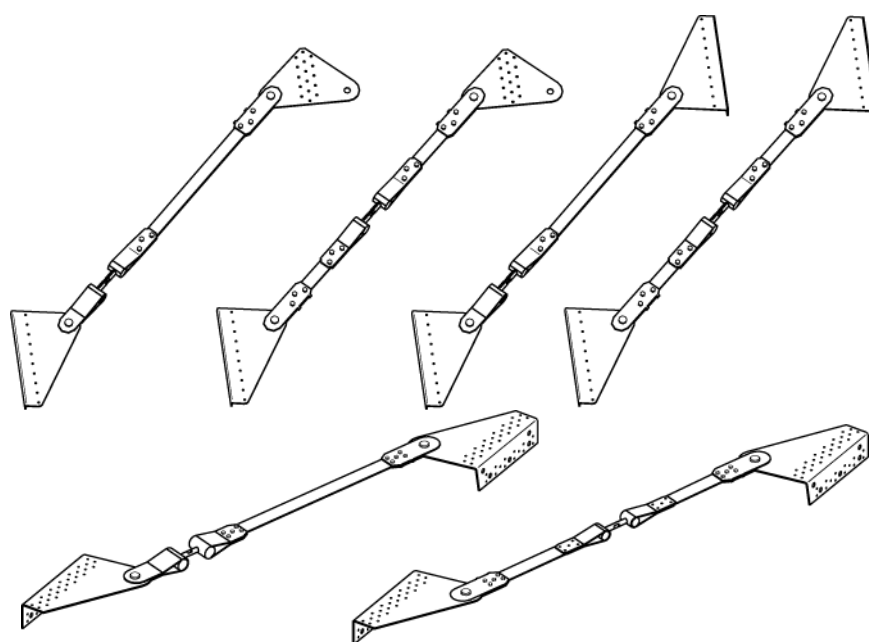
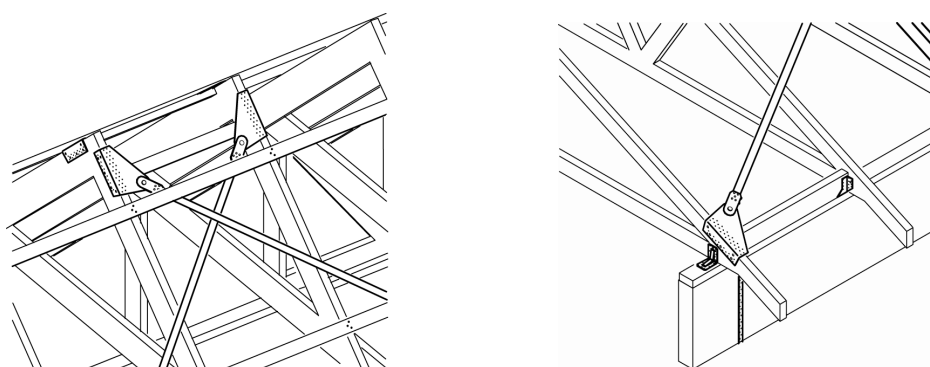
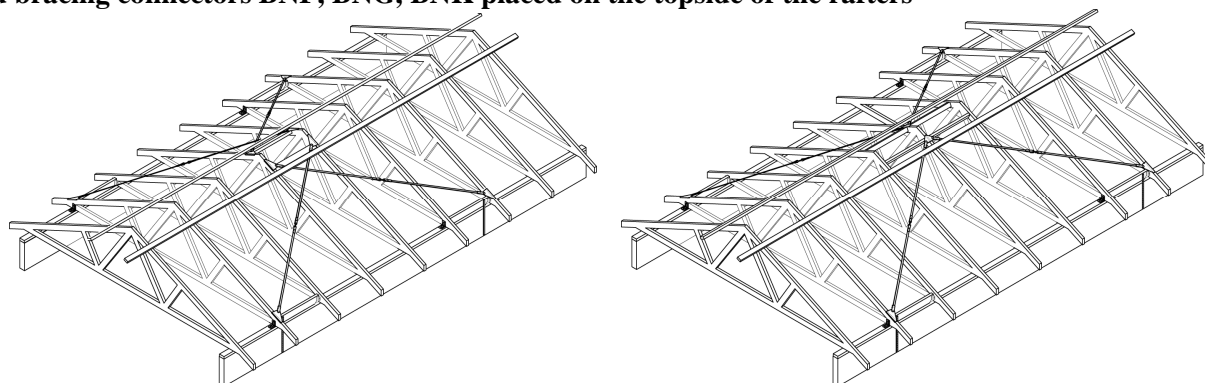
Annex B - Product details and definitions

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.

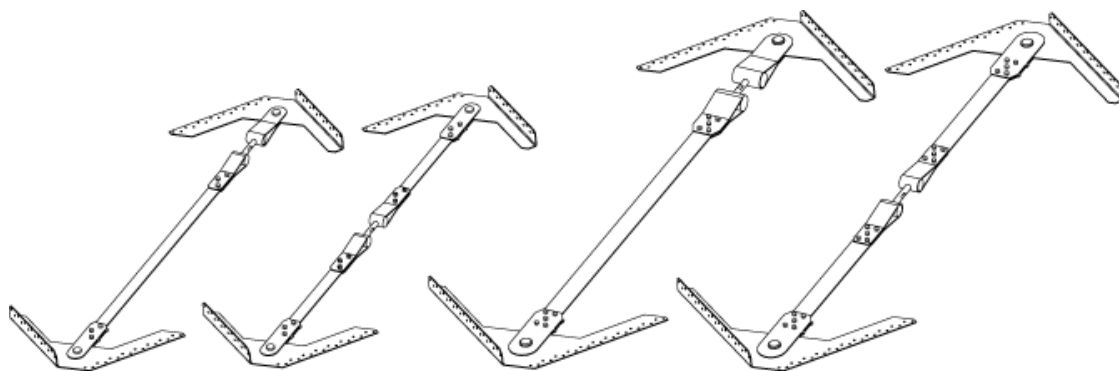
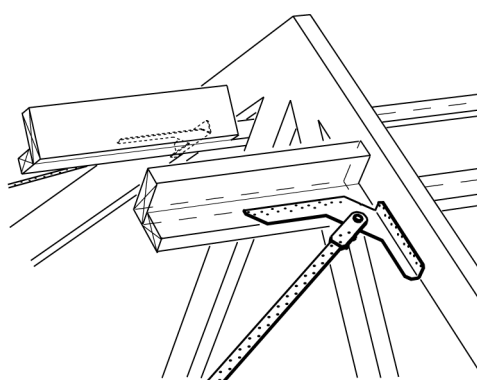
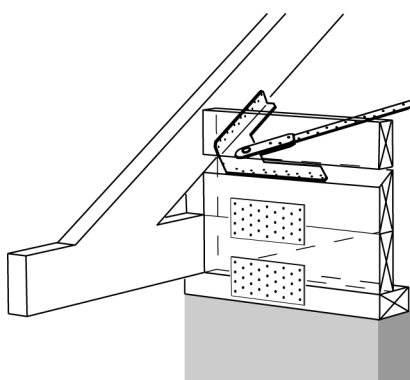
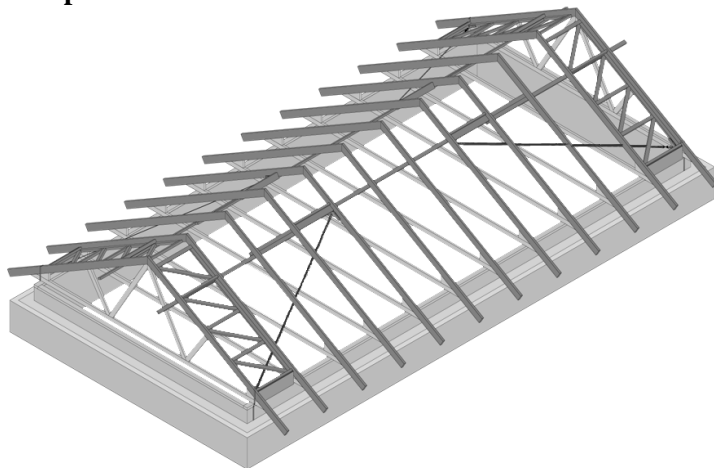
The distance from the centre of the holes in which the steel bracing straps are fastened to the connectors to the end of the steel bracing strap shall be minimum $3d=15$ mm.

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



Examples of connections between a bracing strap and the connectors

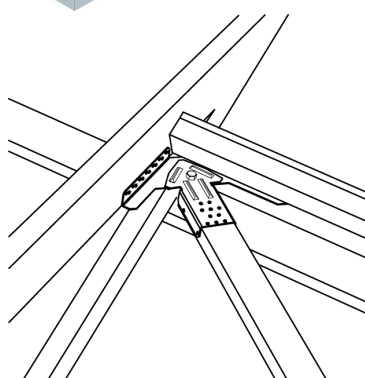
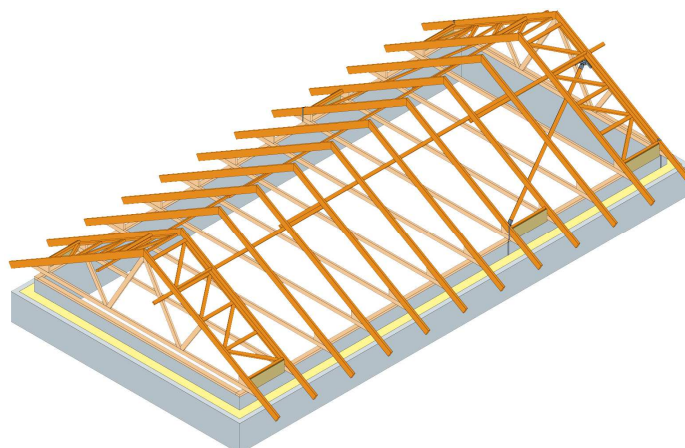
Wind bracing connector BNU placed on the lower side of the rafters



Examples of connections between a bracing strap and the connectors

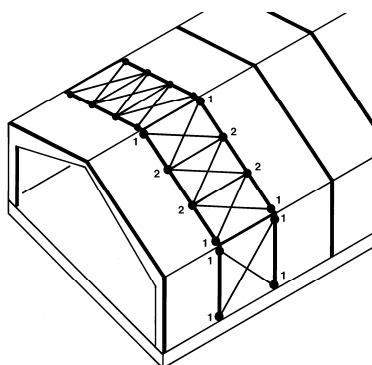
Wind bracing connectors DAB73T and BNU25T

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

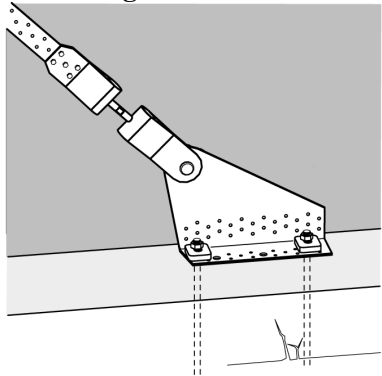


Wind bracing connector BNW

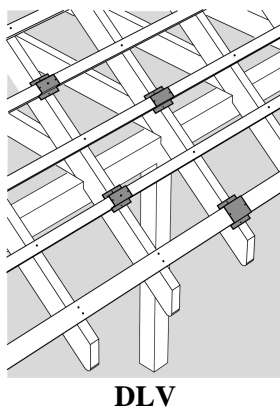
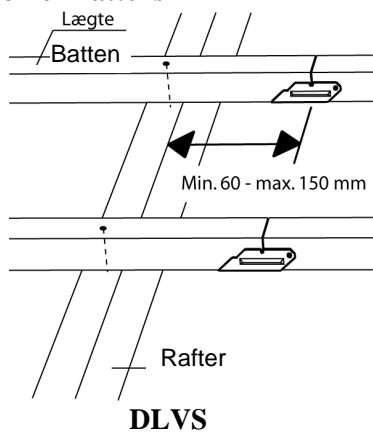
The BNW connectors are placed in a milled recess and fastened with dowels.



Anchoring to concrete BNG60

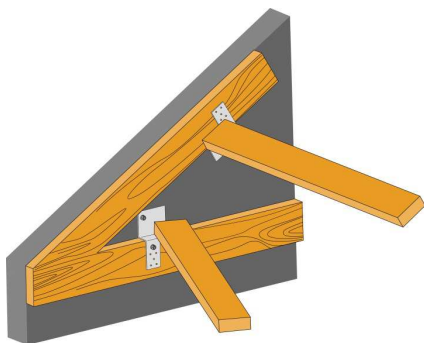


Connection of Battens



DAB22

Connector for Stability of Trusses - CST



CST



Fasteners

Connector nails and screws	Nail and screw size		Finish
	Diameter [mm]	Length [mm]	
According to ETA-04/0013			
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
	Diameter [mm]	Length [mm]	
According to EN 14592			
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
UPAT UKA 3 EAP M12 anchor according to ETA-06/0132	12	-	See specification from manufacturer
BoAX-II M12 according to ETA-08/0276	12	-	Electroplated zinc

Production drawings

General note: Regarding the size of the hole for the dowel e.g. “ $\varnothing 21/\varnothing 15$ ” – the last digit “ $\varnothing 15$ ” refers to the system “-14”

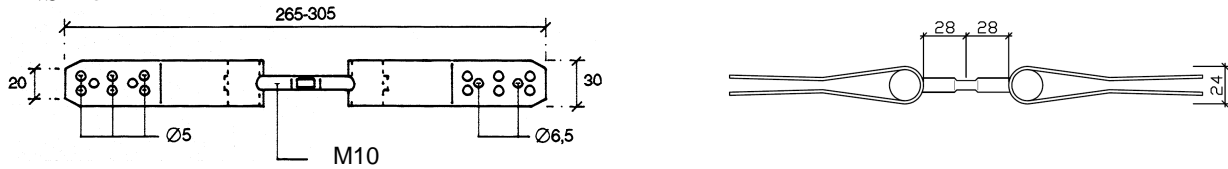
Tension straps and couplers

Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.

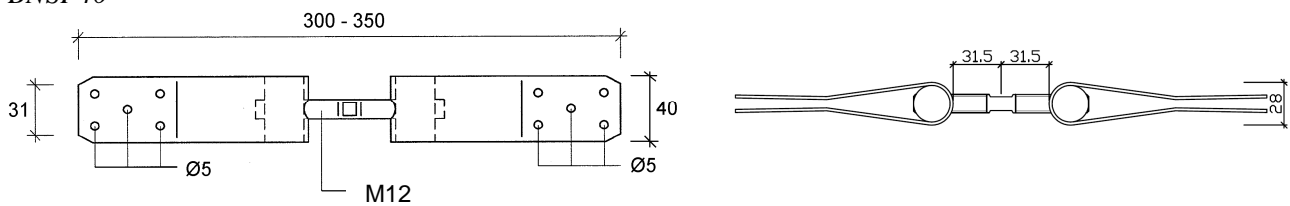
Electro-galvanized dowels 11 S Mn 30 according to EN 10277.

2,0 mm pre-galvanized steel S250GD + Z275 according to EN 10346 with tolerances according to EN 10143.

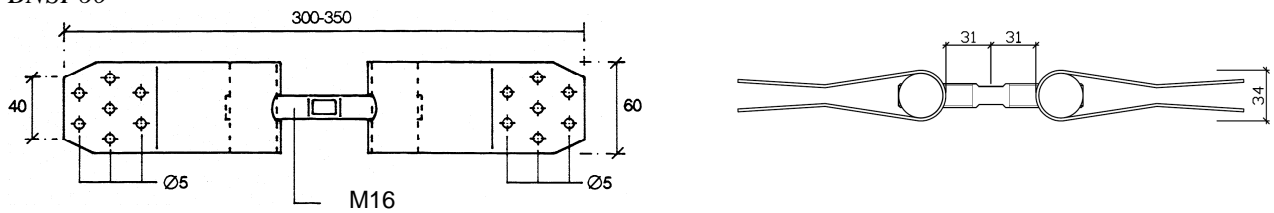
BNSP25



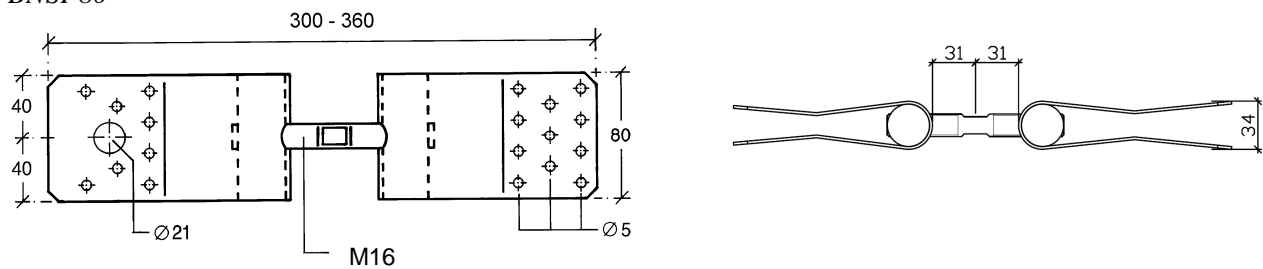
BNSP40



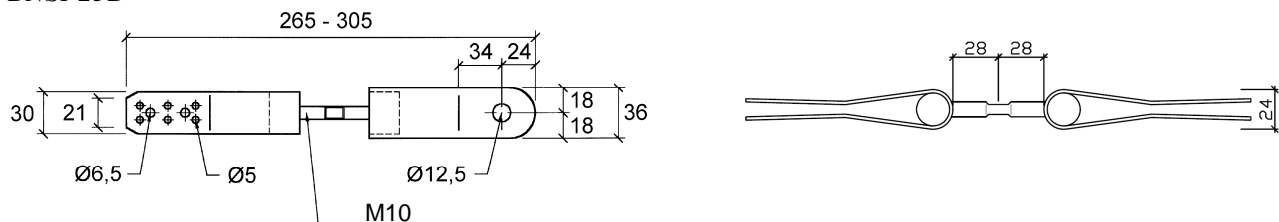
BNSP60



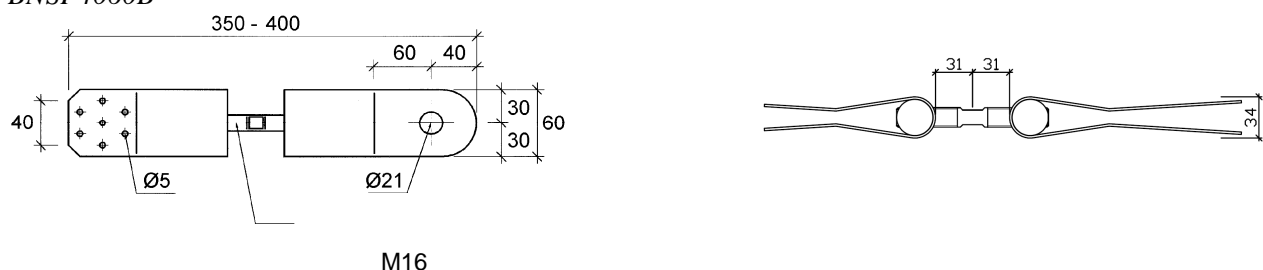
BNSP80



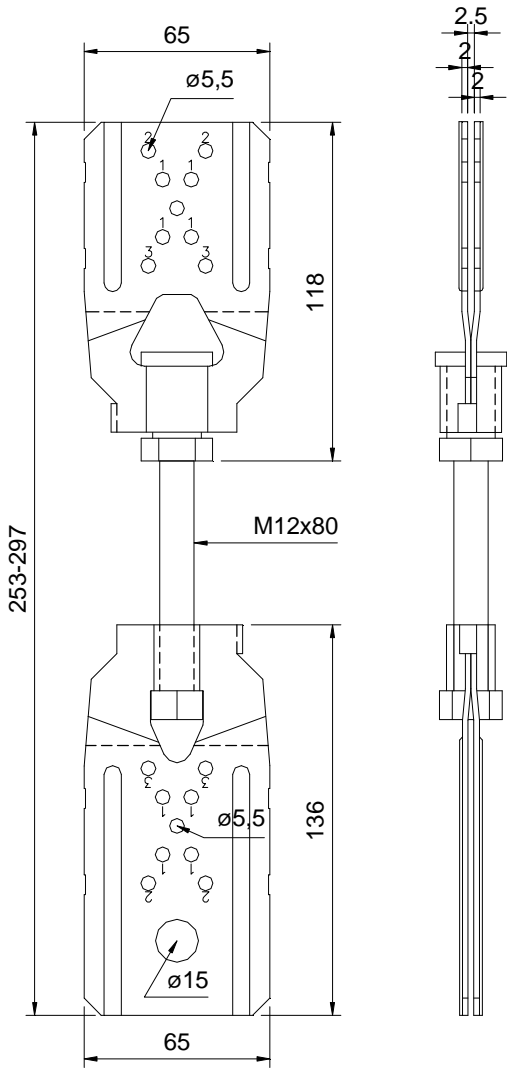
BNSP25B



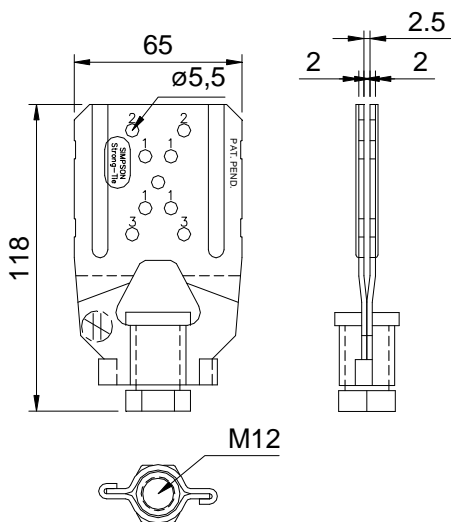
BNSP4060B



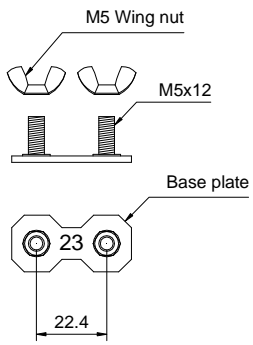
FMBS



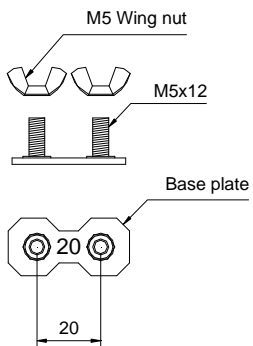
FMB



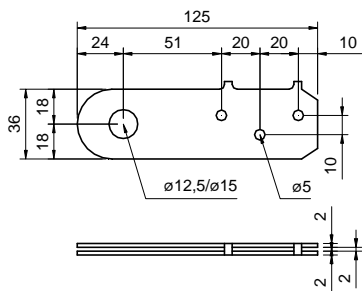
BF25M5 (Clips 23)



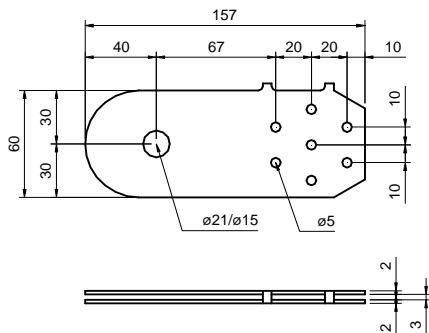
BF4060M5 (Clips 20)



BNKK25 / BNKK25-14



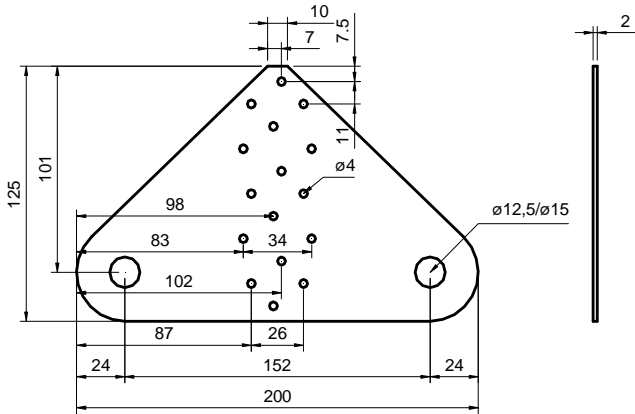
BNKK40/60 / BNKK40/60-14



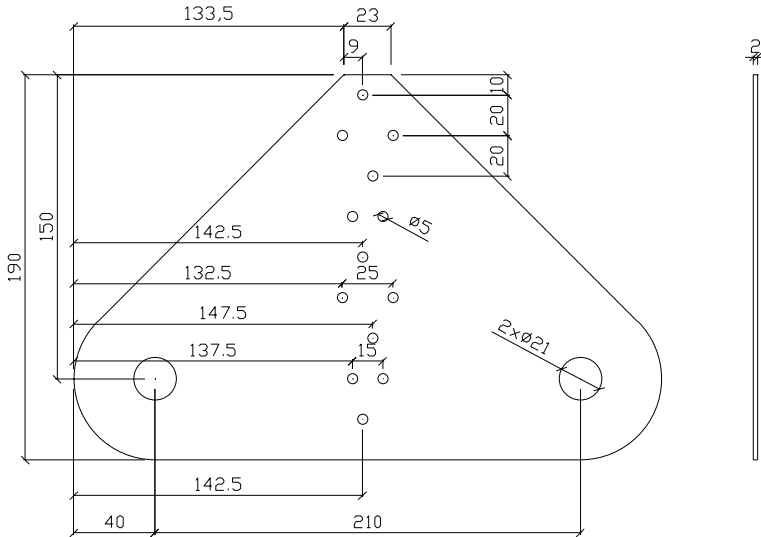
Mid anchor plates

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

BNK25 / BNK25-14



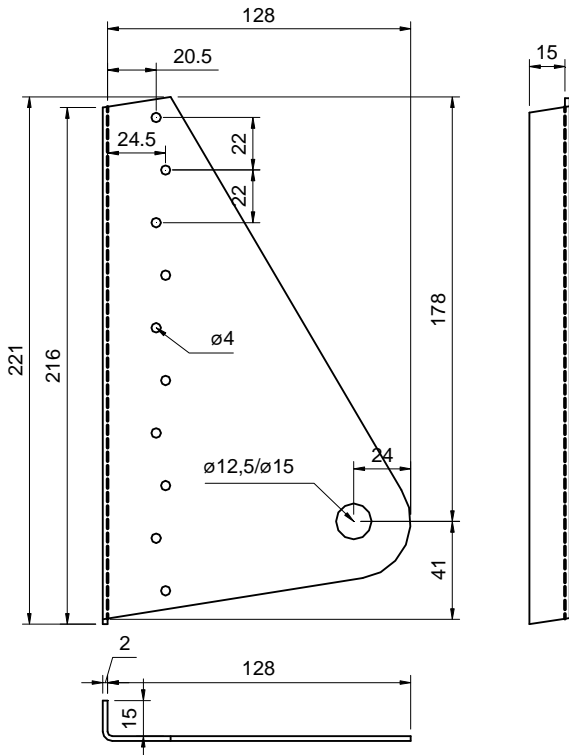
BNK40/60



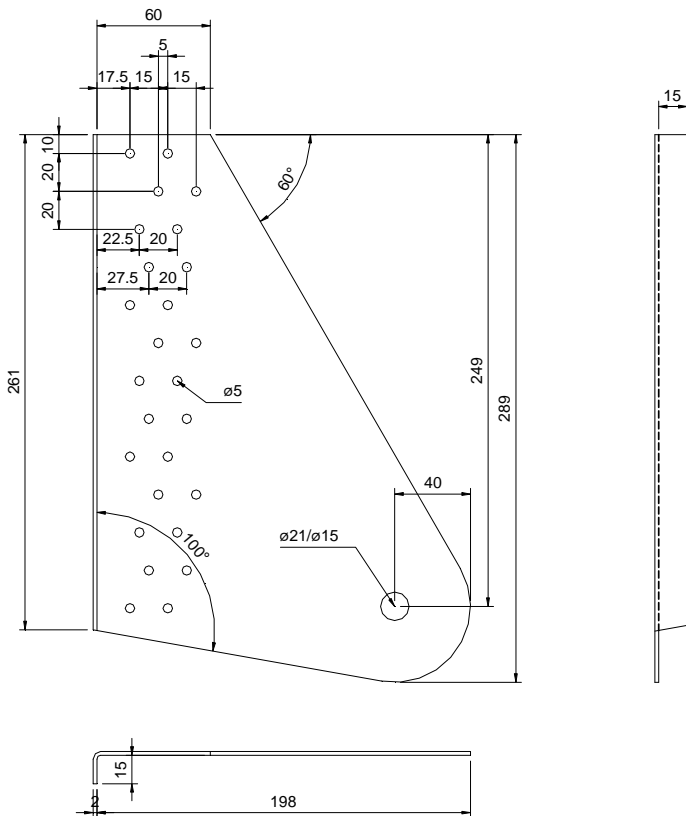
End anchor plates

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

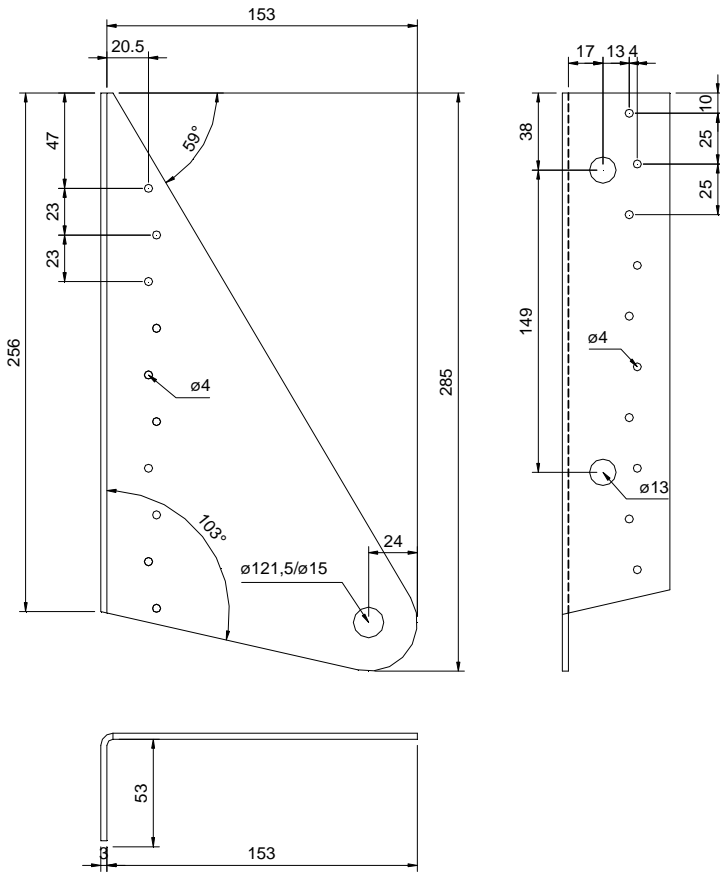
BNF25 / BNF25-14



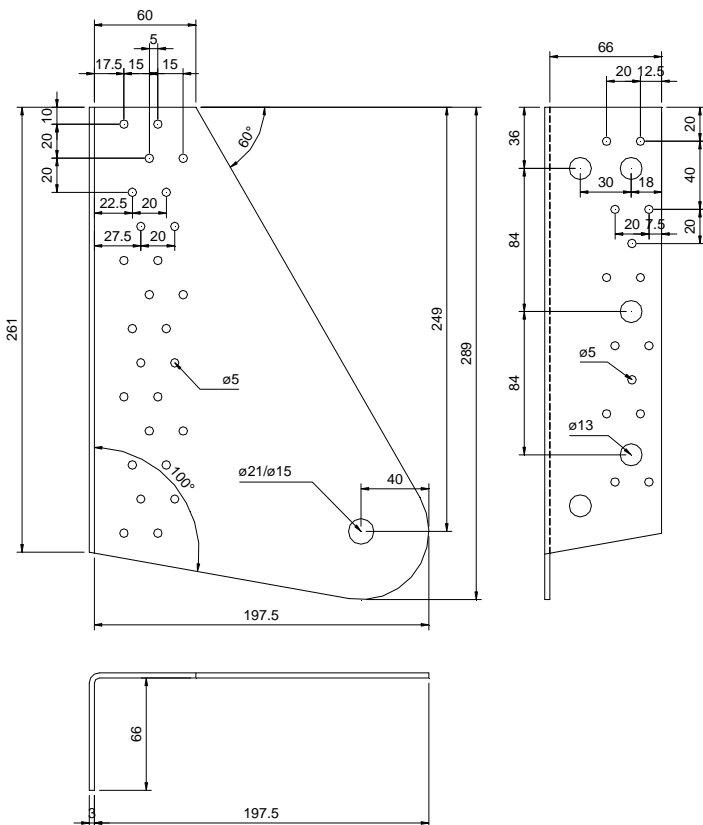
BNF40 / BNF40-14



BNG25 / BNG25-14



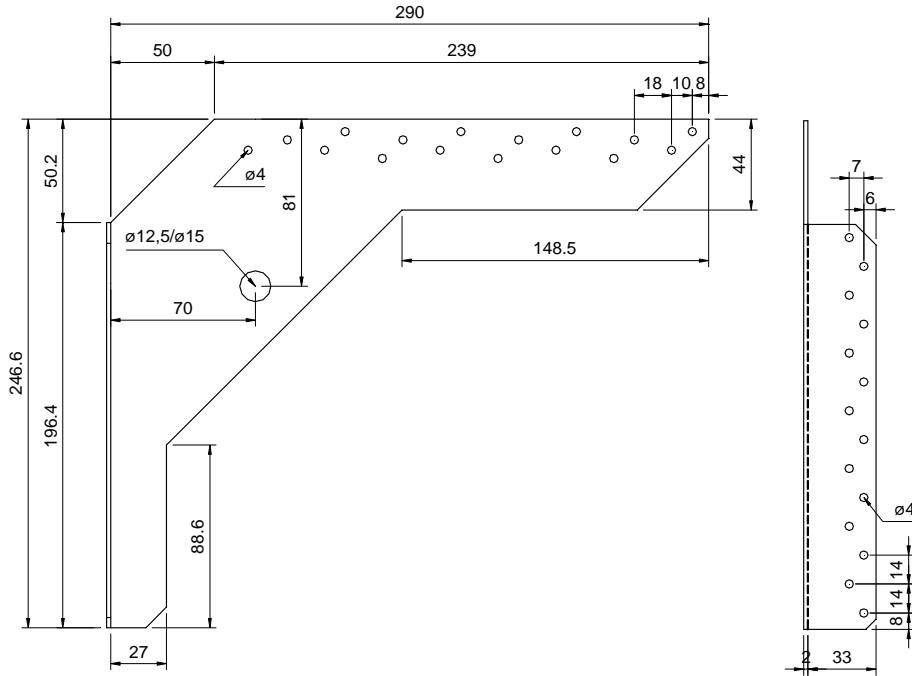
BNG60 / BNG60-14



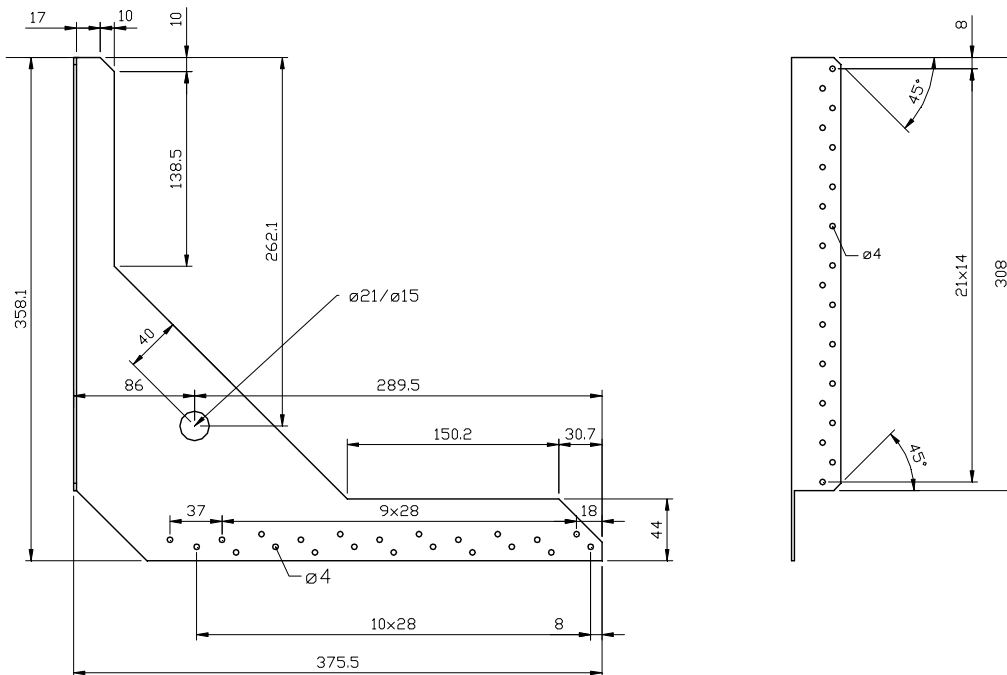
Wind bracing connectors

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

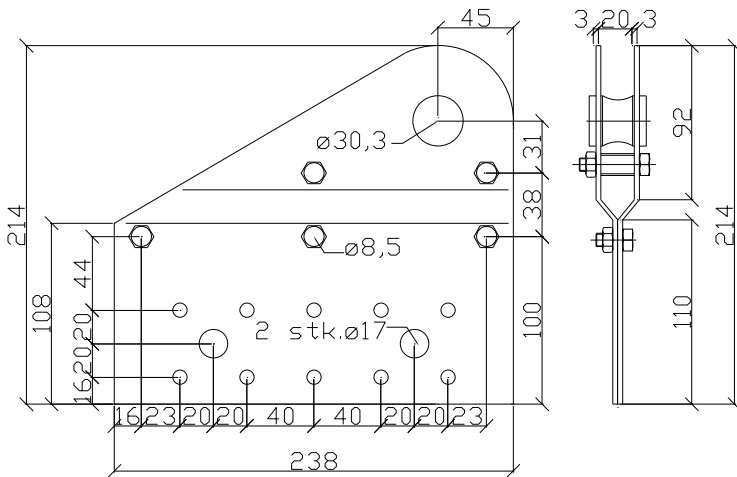
BNU25 / BNU25-14



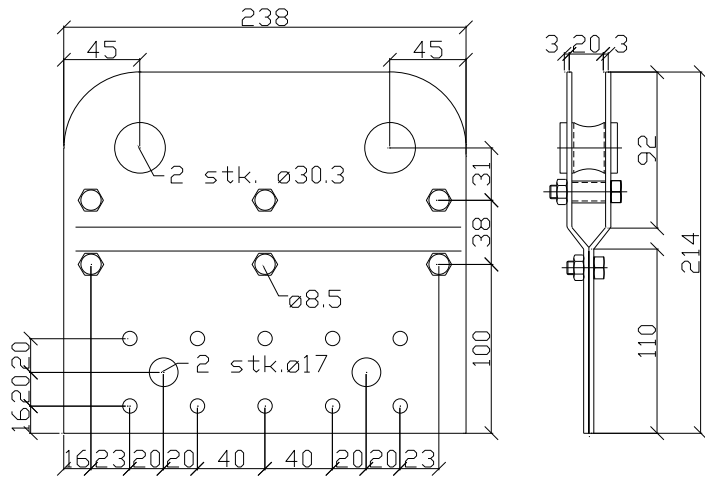
BNU40 / BNU40-14



BNW1



BNW2



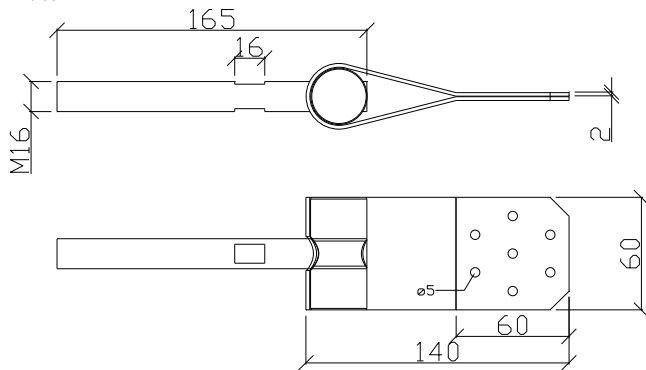
Wind bracing link set

Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.

Electro-galvanized dowels 11 S Mn 30 according to EN 10277.

2,0 mm pre-galvanized steel S250GD + Z275 according to EN 10346 with tolerances according to EN 10143.

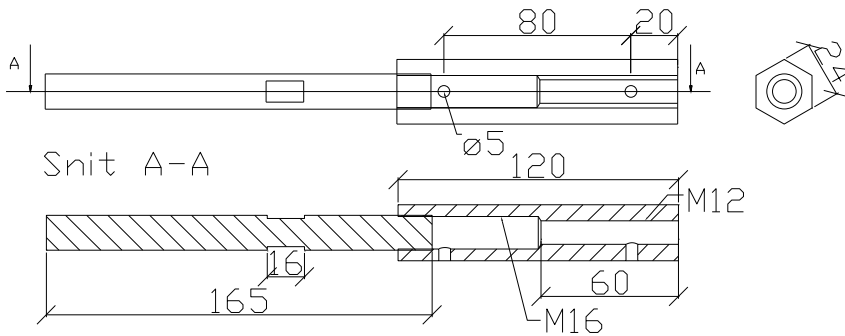
BNWA



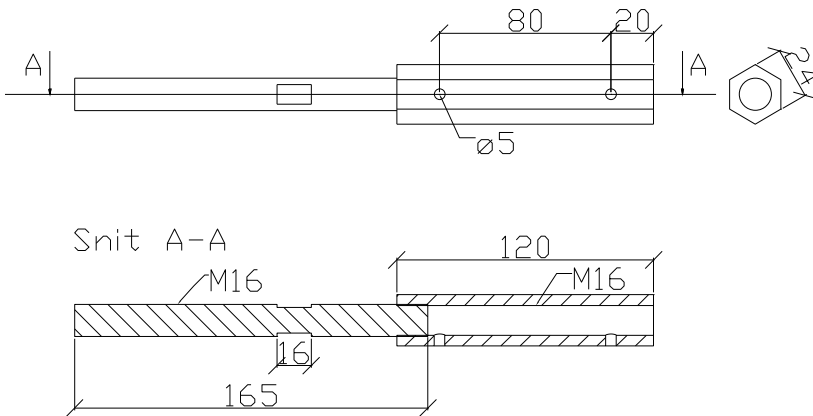
Tie rods

Electro-galvanized threaded rod with right and left thread S355J2G3C+C according to EN 10278.
 Electro-galvanized nut with internal thread 11S Mn 30 according to EN10277.

BNWM12



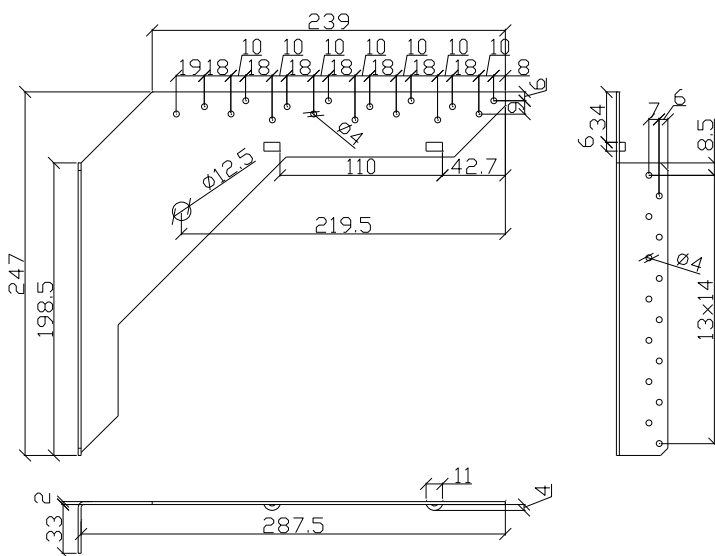
BNWM16



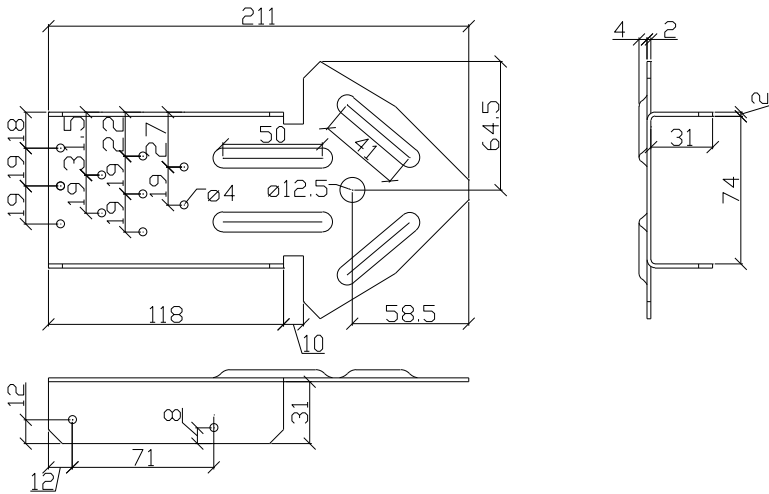
Diagonal bracing kit

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

BNU25T



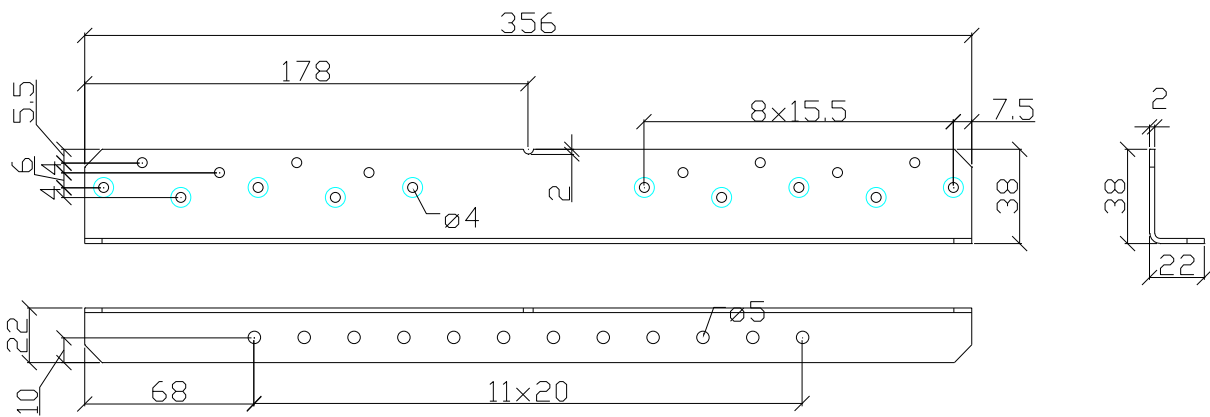
DAB73T



Diagonal bracing connector

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

DAB22

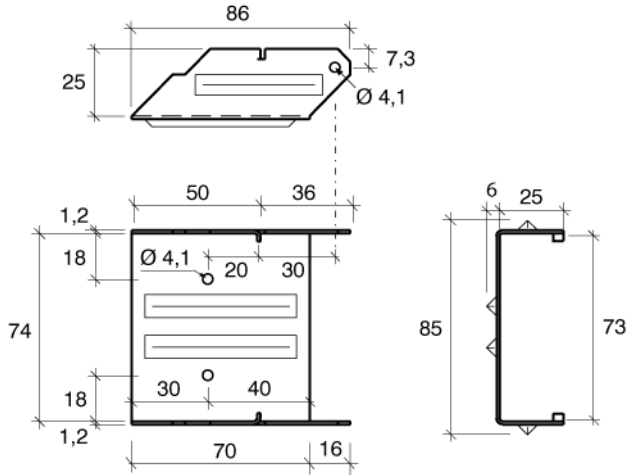


Ø4 mm holes marked with a blue circle refers to the nailing pattern. Marked holes is to be used with a 38 mm batten, all holes is to be used with bigger battens.

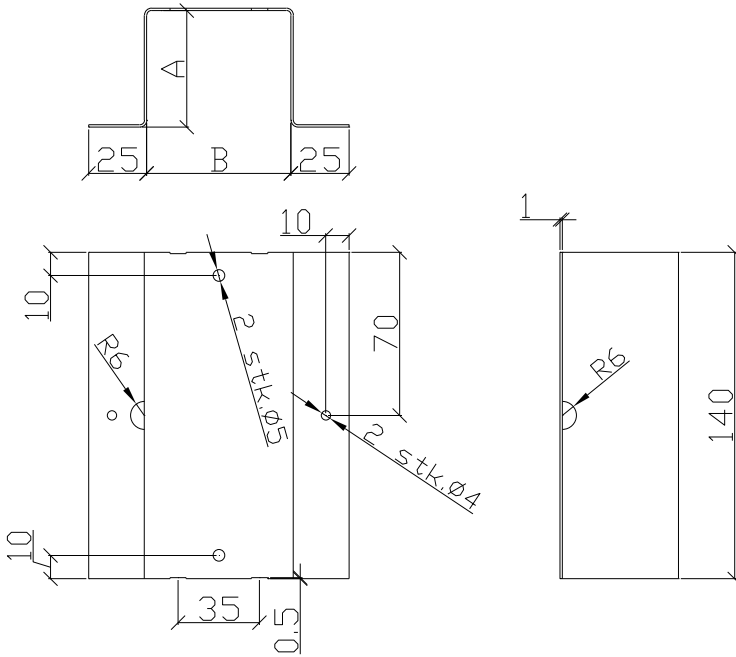
Batten connectors

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

DLVS



DLV



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

Fastener pattern

Tension straps and couplers

BNSP25

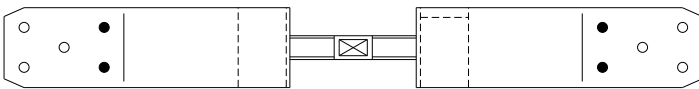


2+2 M5 bolts or 1+1 Clips 23

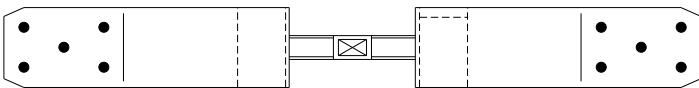


3+3 M5 bolts

BNSP40

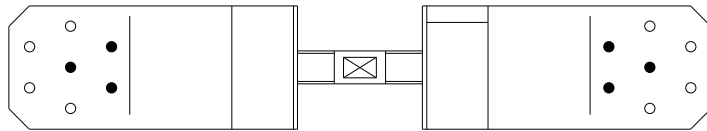


2+2 M5 bolts or 1+1 Clips 20

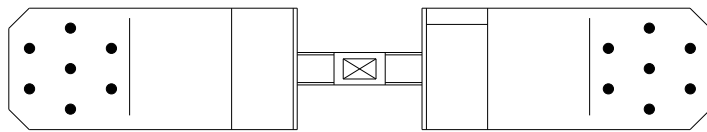


5+5 M5 bolts

BNSP60

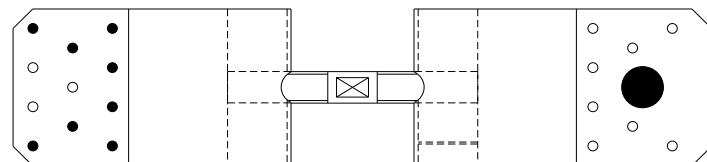


For bracing strap 2,0x60 mm and 3,0x40 mm. 3+3 M5 bolts

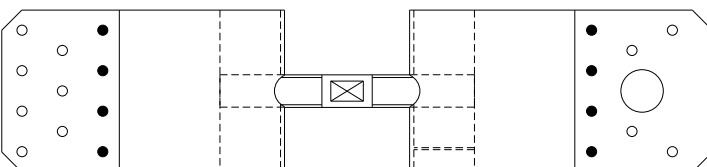


7+7 M5 bolts

BNSP80

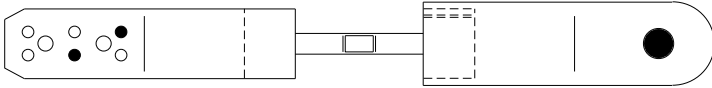


8 M5 bolts + 1 Ø20 Dowel

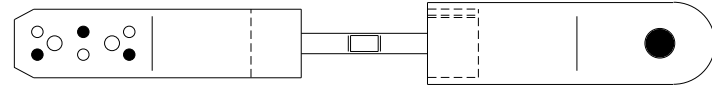


4+4 M5 bolts or 2+2 Clips 20

BNSP25B

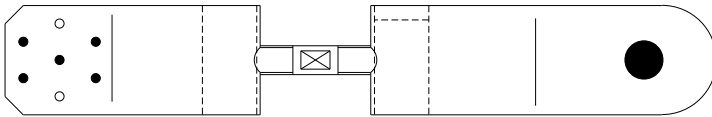


2 M5 bolts or 1 Clips 23 + 1 Ø12 Dowel

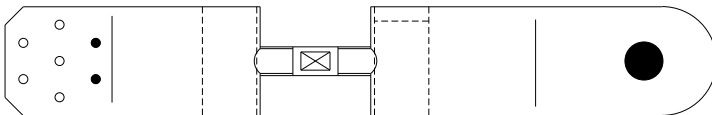


3 M5 bolts + 1 Ø12 Dowel

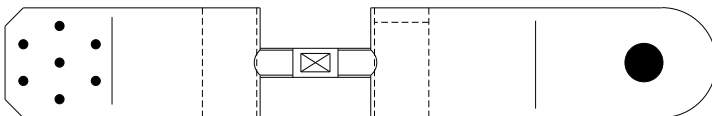
BNSP4060B



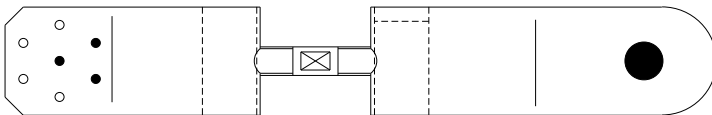
For 40 mm bracing strap. 5 M5 bolts + 1 Ø20 dowel



For bracing strap 2,0x40 mm. 2 M5 bolts or 1 Clips 20 + 1 Ø20 dowel

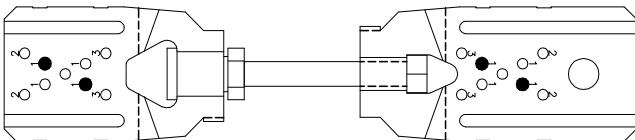


For 60 mm bracing strap. 7 M5 bolts + 1 Ø20 dowel

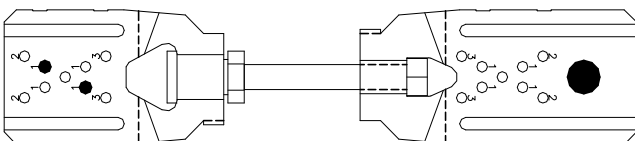


For bracing strap 2,0x60 mm and 3,0x40 mm. 3 M5 bolts + 1 Ø20 dowel

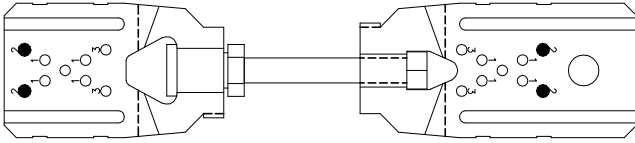
FMBS



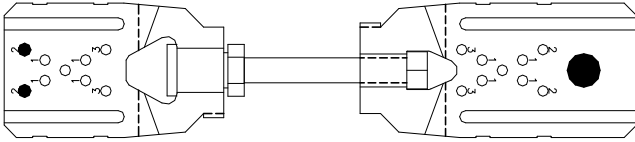
For 2,0x25 mm wind bracing strap: 2+2 M5 bolts or 1+1 Clips 23



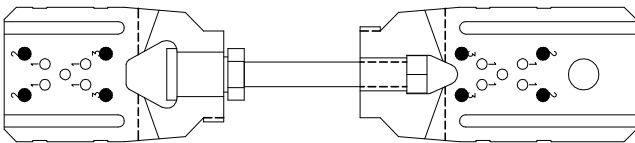
For 2,0x25 mm wind bracing strap: 2 M5 bolts or 1 Clips 23 + 1 ø14 dowel



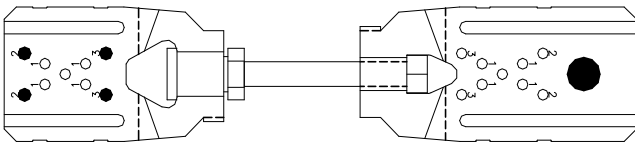
For 1,5x40 mm wind bracing strap: 2+2 M5 bolts or 1+1 Clips 20
For 2,0x40 mm wind bracing strap: 2+2 M5 bolts or 1+1 Clips 20



For 1,5x40 mm wind bracing strap: 2 M5 bolts or 1 Clips 20 + 1 ø14 dowel
For 2,0x40 mm wind bracing strap: 2 M5 bolts or 1 Clips 20 + 1 ø14 dowel

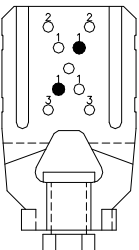


For 0,9x40 mm wind bracing strap: 4+4 M5 bolts or 2+2 Clips 20
For 3,0x40 mm wind bracing strap: 4+4 M5 bolts or 2+2 Clips 20
For 2,0x60 mm wind bracing strap: 4+4 M5 bolts or 2+2 Clips 20
For 2,0x80 mm wind bracing strap: 4+4 M5 bolts or 2+2 Clips 20

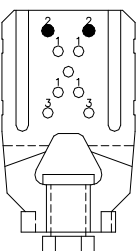


For 0,9x40 mm wind bracing strap: 4 M5 bolts or 2 Clips 20 + 1 ø14 dowel
For 3,0x40 mm wind bracing strap: 4 M5 bolts or 2 Clips 20 + 1 ø14 dowel
For 2,0x60 mm wind bracing strap: 4 M5 bolts or 2 Clips 20 + 1 ø14 dowel

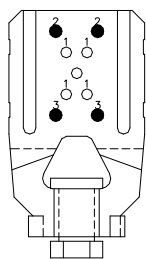
FMB



For 2,0x25 mm wind bracing strap: 2 M5 bolts or 1 Clips 23

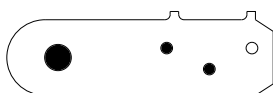


For 1,5x40 mm wind bracing strap: 2 M5 bolts or 1 Clips 20
For 2,0x40 mm wind bracing strap: 2 M5 bolts or 1 Clips 20

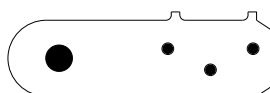


- For 0,9x40 mm wind bracing strap: 4 M5 bolts or 2 Clips 20
- For 2,0x60 mm wind bracing strap: 4 M5 bolts or 2 Clips 20
- For 3,0x40 mm wind bracing strap: 4 M5 bolts or 2 Clips 20
- For 2,0x80 mm wind bracing strap: 4 M5 bolts or 2 Clips 20

BNKK25 / BNKK25-14

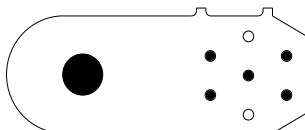


For bracing strap 2,0x25 mm
2 M5 bolts or 1 Clips 23 + 1 Ø12/Ø14 dowel

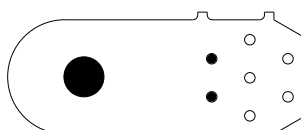


For bracing strap 25 mm
3 M5 bolts + 1 Ø12/Ø14 dowel

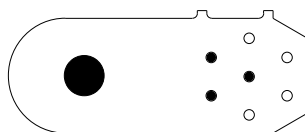
BNKK40/60



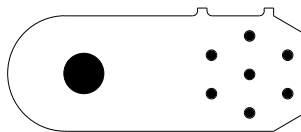
For 40 mm bracing strap.
5 M5 bolts + 1 Ø20 dowel



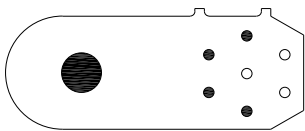
For bracing strap 2,0x40 mm.
2 M5 bolts or 1 Clips 20 + 1 Ø20 dowel



For bracing strap 2,0x60 mm and 3,0x40 mm.
3 M5 bolts + 1 Ø20 dowel

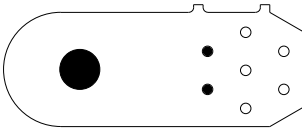


For 60 mm bracing strap.
7 M5 bolts + 1 Ø20 dowel

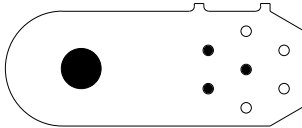


For bracing strap 2,0x80 mm
4 M5 bolts + 1 Ø20 dowel

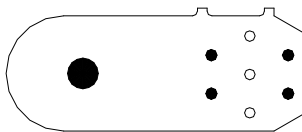
BNKK40/60-14



For 2,0x40 mm bracing strap
2 M5 bolts or 1 Clips 20 + 1 Ø14 dowel

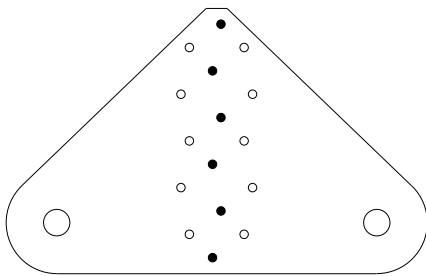


For bracing strap 2,0x60 mm and 3,0x40 mm
3 M5 bolts + 1 Ø14 dowel

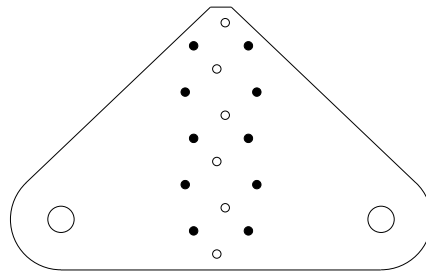


For wind bracing strap 0,9x40 mm
4 M5 bolts or 2 Clips 20 + 1 ø14 dowel

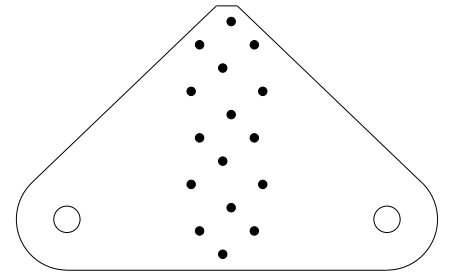
Mid anchor plates
BNK25 / BNK25-14



Timber width: $b \geq 43$
6 CNA3,1x40 connector nails
in middle row

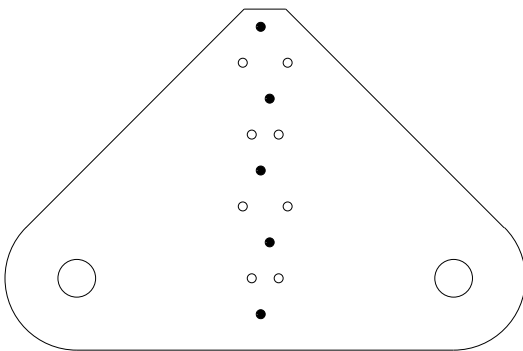


Timber width: $b \geq 74$
10 CNA3,1x40 connector nails
in outer rows

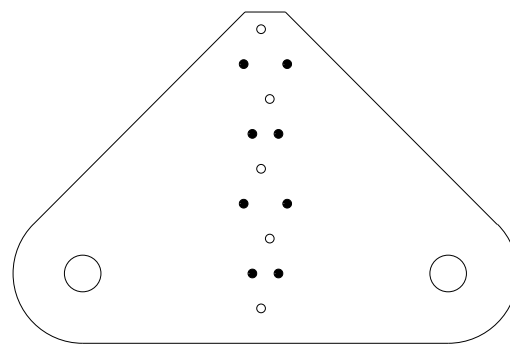


Timber width: $b \geq 74$
16 CNA3,1x40 connector nails
in all rows

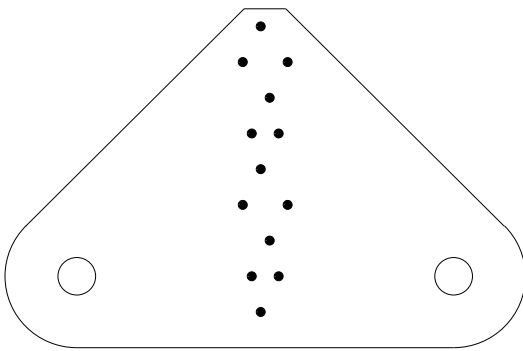
BNK40/60 / BNK40/60-14



Timber width: $b \geq 56$
5 CNA4,0x1 connector nails
in middle row



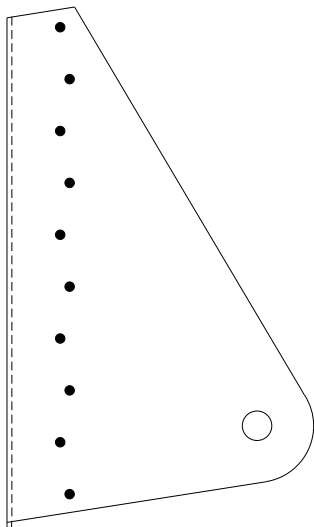
Timber width: $b \geq 79$
8 CNA4,0x1 connector nails
in outer rows



Timber width: $b \geq 79$
13 CNA4,0x1 connector nails
in all rows

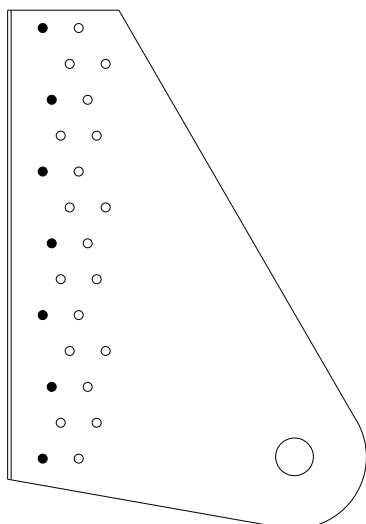
End anchor plates

BNF25 / BNF25-14

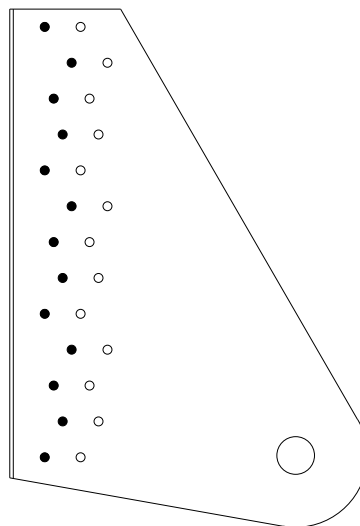


Timber width: $b \geq 43$
10 CNA3,1x40 connector nails

BNF40 / BNF40-14

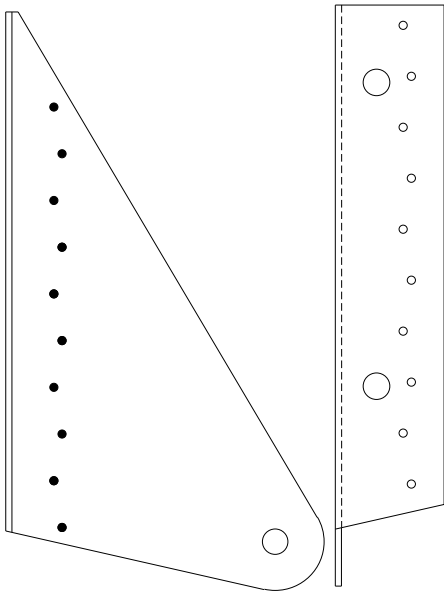


Timber width: $b \geq 45$
7 CNA4,0x1 connector nails

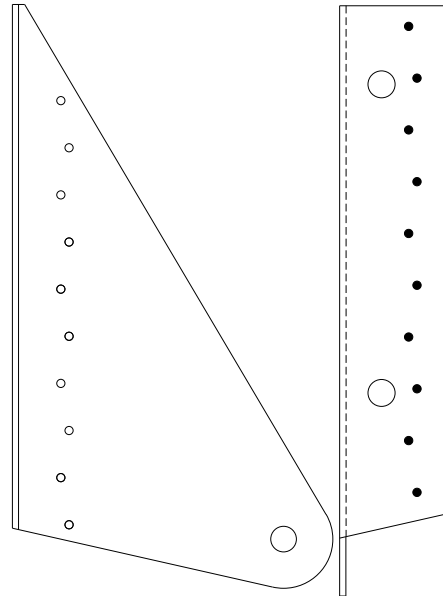


Timber width: $b \geq 58$
13 CNA4,0x1 connector nails

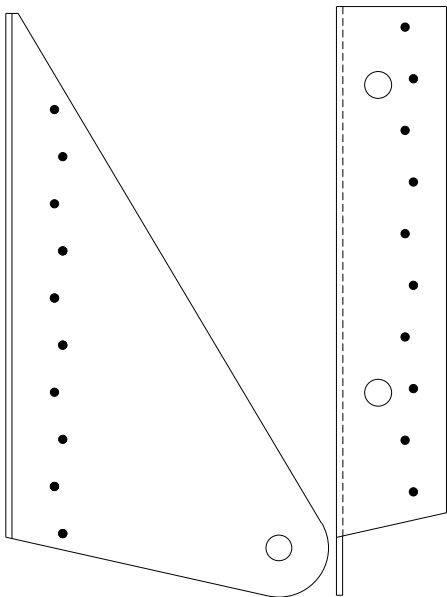
BNG25 / BNG25-14



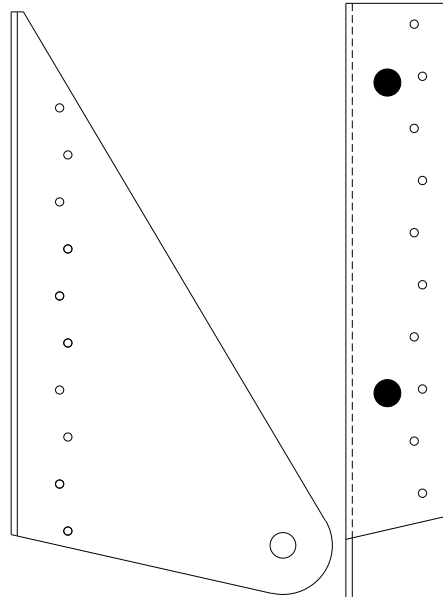
Timber width: $b \geq 45$
10 CNA3,1x40 connector nails
in face of connector



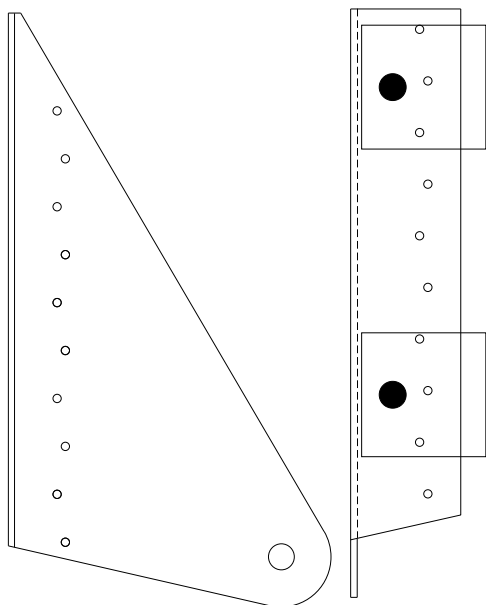
Timber width: $b \geq 45$
10 CNA3,1x40 connector nails
in edge flap of connector



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

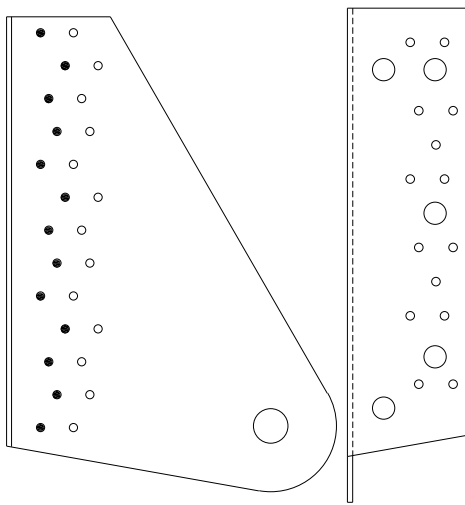


Timber width: $b \geq 45$
2M12 bolts
in edge flap of connector

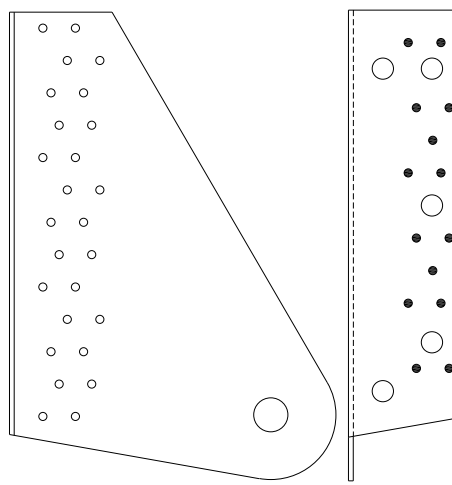


Timber width: $b \geq 45$
2M12 bolts with washer
in edge flap of connector

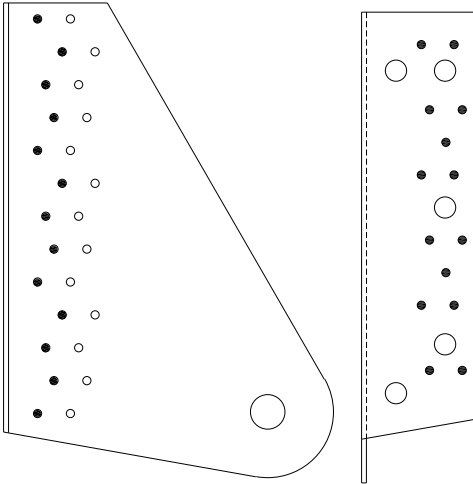
BNG60 / BNG60-14



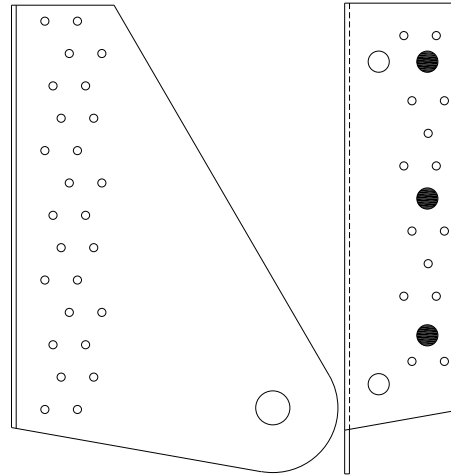
Timber width: $b \geq 58$
13 CNA4,0x1 connector nails
in face of connector



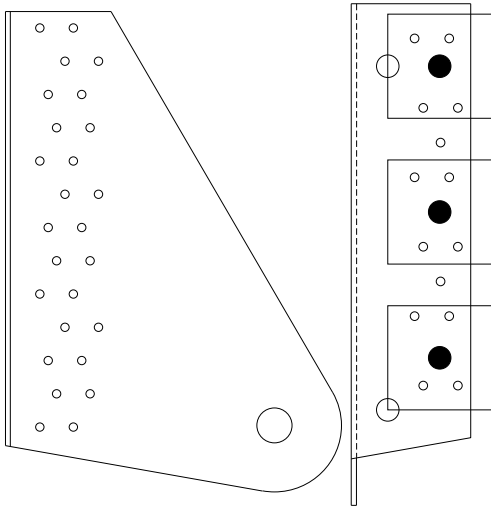
Timber width: $b \geq 45$
14 CNA4,0x1 connector nails
in edge flap of connector



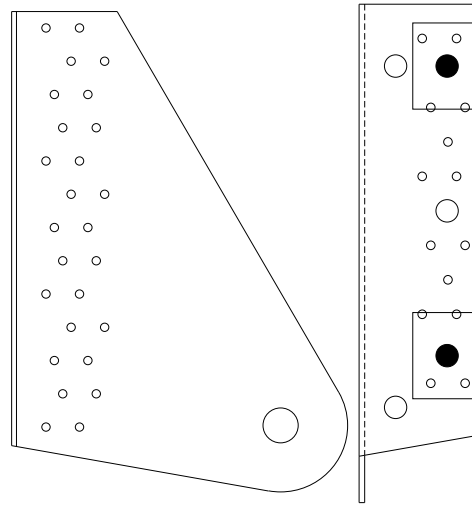
Timber width: $b \geq 58$
13+14 CNA4,0x1 connector nails
in face and edge flap of connector



Timber width: $b \geq 58$
3 M12 bolts
in edge flap of connector



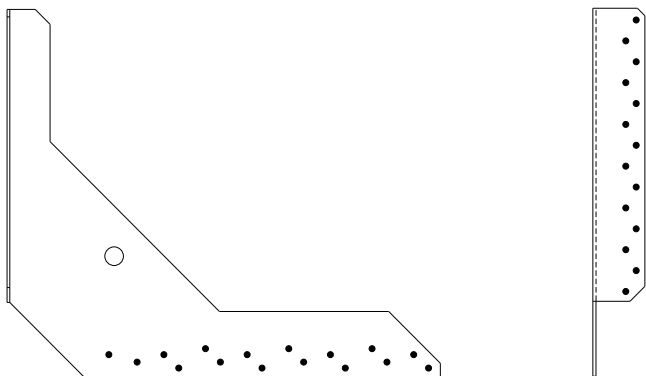
Timber width: $b \geq 58$
3 M12 bolts with washer
in edge flap of connector



Timber width: $b \geq 58$
2 M12 bolts with washer
in edge flap of connector

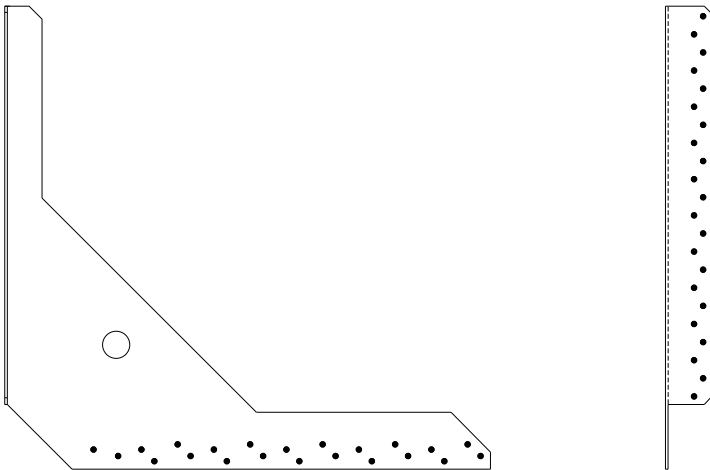
Wind bracing connectors

BNU25 / BNU25-14



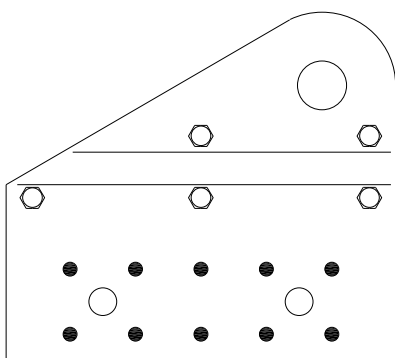
Timber width: $b \geq 45$
14+16 CSA4,0x30 connector screws

BNU40 / BNU40-14



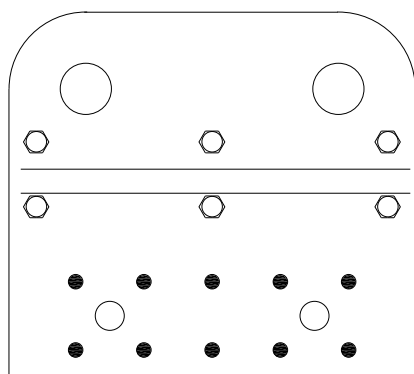
Timber width: $b \geq 45$
22+22 CSA4,0x30 connector screws

BNW1



10 Ø8 dowels

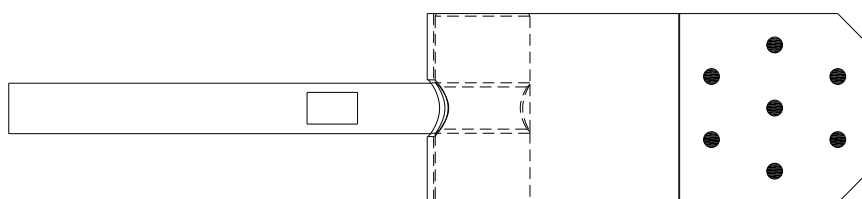
BNW2



10 Ø8 dowels

Wind bracing link set

BNWA

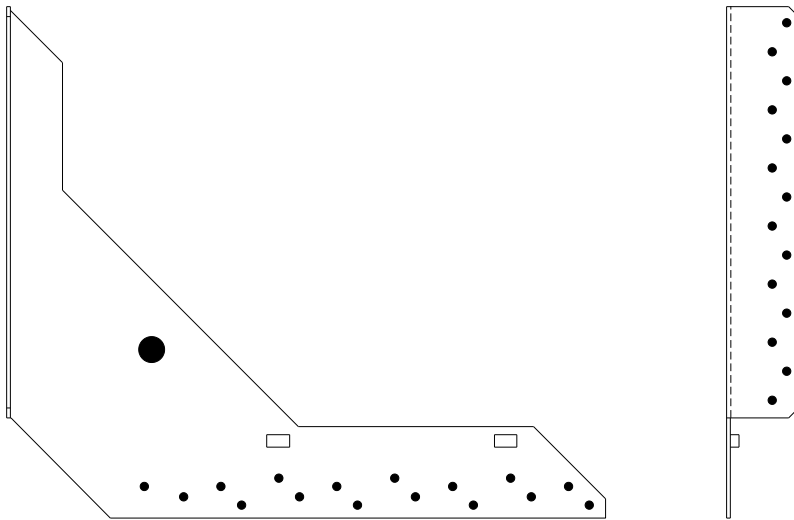


7 M5 bolts

The distance from the centre 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.

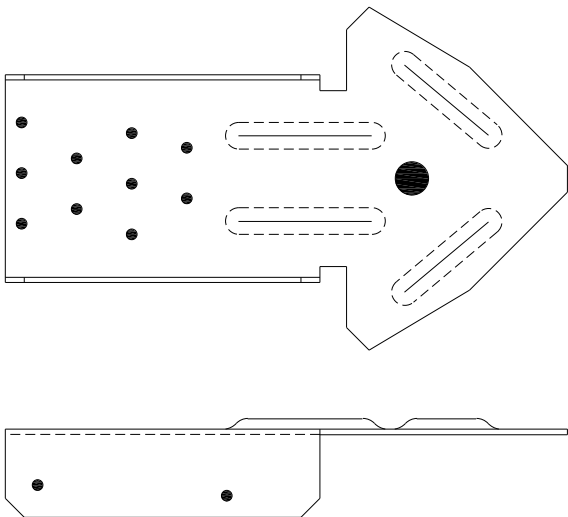
Diagonal bracing kit

BNU25T



Timber width: $b \geq 45$
14+16 CSA4,0x30 connector screws

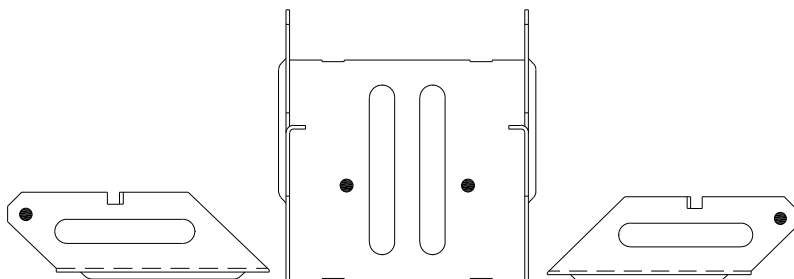
DAB73T



Timber width: $b=73$ mm
10 +2+2 CSA4,0x30 connector screws + 1 M12 bolt

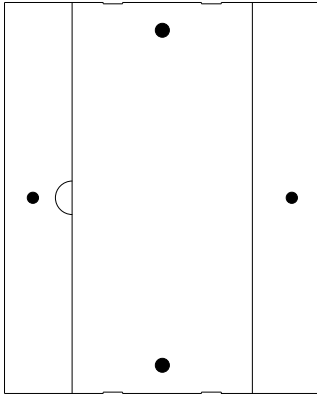
Batten connectors

DLVS



Timber width: $b=73$ mm
1+2+1 CSA4,0x30 connector screws

DLV



1+2+1 CNA4,0x1 connector nails or smooth nails 3,1x1 or 3,4x1 (always CNA4,0x1 in batten)

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:

$$R_d = \frac{k_{\text{mod}} \cdot R_k}{\gamma_M}$$

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/m³. For timber or wood based material with a lower characteristic density than 350 kg/m³ 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/m³.

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

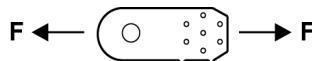


Table 1. Characteristic tensile capacities of tension straps and couplers. The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0.

Tension straps or couplers	Dowel diameter [mm]	Number of M5 bolts	Characteristic capacity R_k [kN]
BNSP 25	-	3 + 3	22,2
BNSP25B	12	3	22,2
BNSP 40	-	5 + 5	35,7
BNSP 60	-	7 + 7	55,6
BNSP4060B	20	7	46,0
	20	5	46,0
BNSP80	-	7+7	60,5
	20	5	46,0
BNKK25	12	3	27,6
BNKK25-14	14	3	27,9
BNKK4060B	20	7	46,0
	20	5	46,0
BNKK40/60-14	14	4	32,2
FMBS	-	4+4	38,6
	14	4	35,6
FMB	-	4	38,6

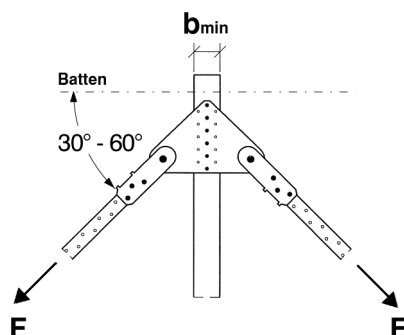
Table 2. Characteristic tensile capacities of tension straps and couplers. Further, the necessary number of M5 bolts to achieve at least the tensile strength of the bracing straps are stated. The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0.

Tension straps or couplers	Dowel diameter [mm]	Number of M5 bolts to achieve at least the tensile strength as that of the corresponding bracing strap Position of bolts: see Annex A	Characteristic capacity R_k [kN]	Corresponding bracing strap
BNSP 25	-	2 + 2	18,6	2,0x25 mm
BNSP25B	12	2	18,6	2,0x25 mm
BNSP 40	-	2 + 2	18,6	2,0x40 and 1,5x40 mm
BNSP 60	-	3 + 3	27,9	2,0x60 and 3,0x40 mm
BNSP4060B	20	2	18,6	2,0x40 and 1,5x40 mm
	20	3	27,9	2,0x60 and 3,0x40 mm
BNSP80	-	4+4	37,2	2,0x80 mm
	20	4	37,2	2,0x80 mm
BNKK25	12	2	18,6	2,0x25 mm
BNKK25-14	14	2	18,6	2,0x25 mm
BNKK4060B	20	2	18,6	2,0x40 and 1,5x40 mm
	20	3	27,9	2,0x60 and 3,0x40 mm
	20	4	37,2	2,0x80 mm
BNKK40/60-14	14	2	18,6	2,0x40 mm
	14	3	27,9	2,0x60 and 3,0x40 mm
	14	4	32,2	0,9x40 mm
FMBS	-	2+2	18,6	2,0x25 and 2,0x40 and 1,5x40 mm
	-	3+3	27,9	2,0x60 and 3,0x40 mm
	-	4+4	37,2	0,9x40 and 2,0x80 mm
	14	2	18,6	2,0x25 and 2,0x40 and 1,5x40 mm
	14	3	27,9	2,0x60 and 3,0x40 mm
	14	4	35,6	0,9x40 mm
FMB	-	2	18,6	2,0x25 / 2,0x40 / 1,5x40mm
	-	3	27,9	2,0x60 and 3,0x40 mm
	-	4	37,2	0,9x40 and 2,0x80 mm

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.

Mid anchors

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

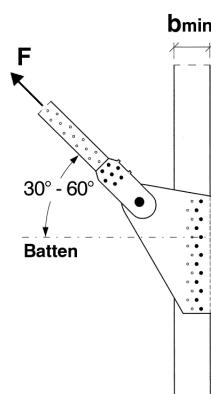
see Annex B.

Table 3. 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 R_k , KN
				60	55	50	45	40	35	30	
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	Middle row	4,0 x40	56	6,1	6,6	7,2	7,9	8,6	9,1	8,8	21,8
	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 type BNF and BNG

Force direction for end anchors



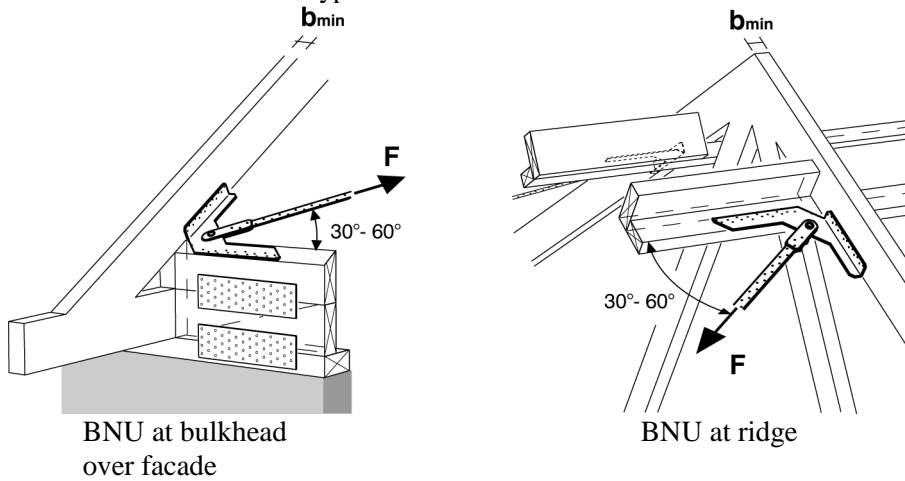
The end anchors can be fastened by nailing in the face of the anchor into the top of the timber and/or in the edge flap into the side of the timber. When nailing into the edge flap the anchor shall always be placed over the timber. The end anchors can be fastened by bolts in the edge of the anchor into the side of the timber. In this case shall the anchor 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 4. 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 R_k , KN
	Pcs	Type		60°	55°	50°	45°	40°	35°	30°	
				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
BNG60 / BNG60-14	2x6	CNA4,0x50	58	10,9	23,8	29,4	31,9	39,6	32,0	27,7	32,0
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
BNG60 / BNG60-14	14	CNA4,0x50	50	15,0	19,5	19,7	26,8	31,6	31,0	24,7	32,0
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
BNG60 / BNG60-14	2x6+14	CNA4,0x50	58	44,2	39,8	33,4	35,4	36,4	37,5	35,7	32,0
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
BNG60 / BNG60-14	3	M12 bolts	75	16,9	17,9	19,1	20,7	22,8	25,5	29,3	32,0
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
BNG60 / BNG60-14	3	M12 bolts	75	11,9	12,5	13,4	14,5	16,0	15,7	12,8	32,0

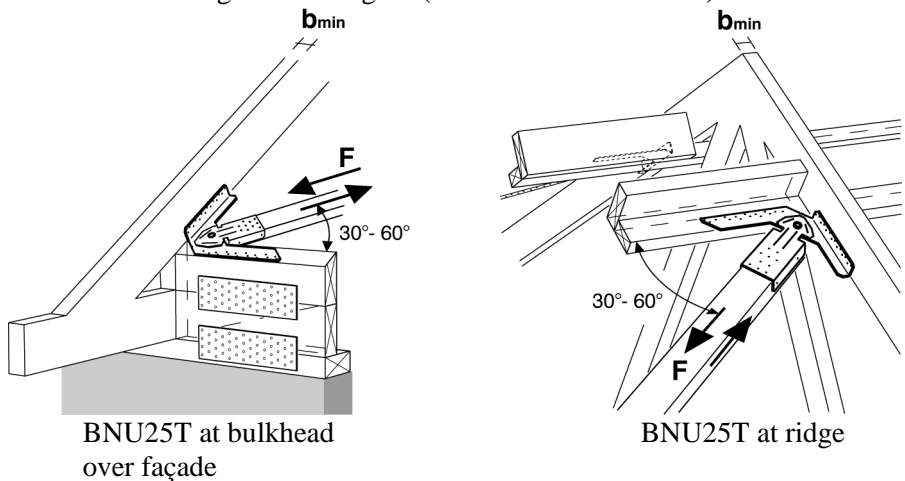
End anchors type BNU

Force direction of end anchor type BNU



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)



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

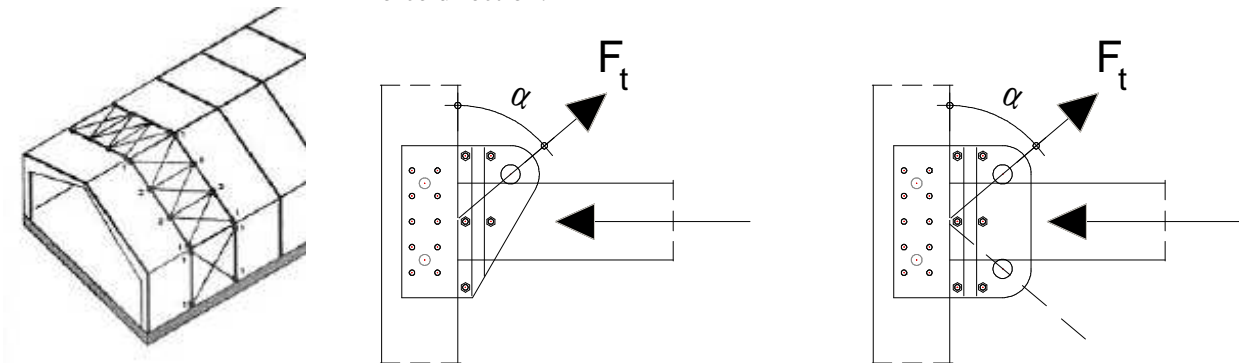
Table 5. Characteristic load-carrying capacities of BNU end anchors in kN

Anchor	CSA Screws		b_{min} [mm]	Angle with battens						Steel R_k , KN	
	number	Size		60	55	50	45	40	35		30
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 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 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 connector for wind stabilization

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

Force direction:



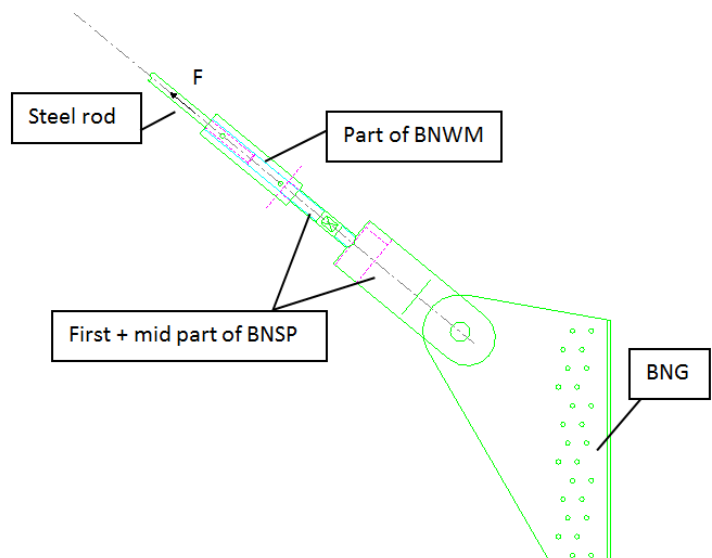
For Ø8 mm dowels of a length of 120 mm or 140 mm in all holes and installed as described in Annex A the characteristic load-carrying capacity of the BNW1 and the BNW2 connectors is given in table 6. For both connectors it is assumed that the connection is subjected to one diagonal tensile force as shown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

Table 6. 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

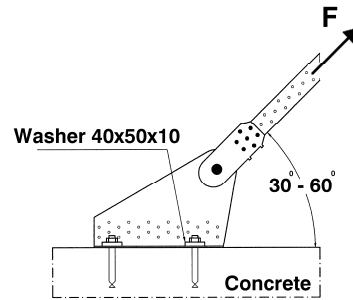
The tensile capacities of the accessories for the connection to the BNW1 or BNW2 are given by:

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



BNG anchors for connections to concrete foundation

Force direction for BNG anchor:



BNG anchors can be fastened to an uncracked/cracked concrete foundation as shown below. 2 M12 anchor bolts shall be used. The anchors shall be installed in the holes closest to the bend line of the anchor.

Table 7. Characteristic load-carrying capacities of end anchors bolted to the foundation in kN. 2 M12 anchor bolts bonded into uncracked concrete at least of the quality C20/25. M12 anchors with a characteristic withdrawal capacity of 30 kN and a lateral load-carrying capacity of 19 kN, such as UPAT UKA 3 EAP (calculated and installed as described in technical sheet from the manufacturer). The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0.

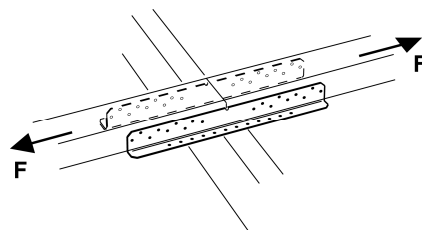
Anchor	Anchors		Angle with horizontal							Steel R_k , KN
			30	35	40	45	50	55	60	
	Number	Type	Characteristic capacity, R_k [kN]							
BNG25 / BNG25-14	2	UPAT UKA 3 EAP	17,8	20,2	20,6	20,6	17,6	15,5	13,9	19,2
BNG60 / BNG60-14	2	UPAT UKA 3 EAP	16,6	17,8	19,1	21,1	23,5	25,5	22,5	32,0

Table 8. Characteristic load-carrying capacities of end anchors bolted to the foundation in kN. 2 M12 anchor bolts bonded into cracked concrete at least of the quality C20/25. M12 anchors with a characteristic withdrawal capacity of 12 kN and a lateral load-carrying capacity of 23 kN, such as BoAX-II (calculated and installed as described in ETA-08/0276). The characteristic capacities are controlled only by the steel components so k_{mod} shall be taken as 1,0.

Anchor	Anchors		Angle with horizontal							Steel R_k , KN
			30	35	40	45	50	55	60	
	Number	Type	Characteristic capacity, R_k [kN]							
BNG25 / BNG25-14	2	BoAX-II M12	11,1	12,8	15,3	12,6	9,8	7,9	6,7	
BNG60 / BNG60-14	2	BoAX-II M12	8,5	9,2	10,0	11,0	12,3	13,2	10,5	

If anchor bolts with smaller withdrawal or lateral capacity are used then the characteristic load-carrying capacity of the BNG anchor connection shall be reduced proportionally with the lowest capacity in the axial and lateral direction of the bolt.

Diagonal batten connector



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:

$$R_k = 24,7 \text{ kN}$$

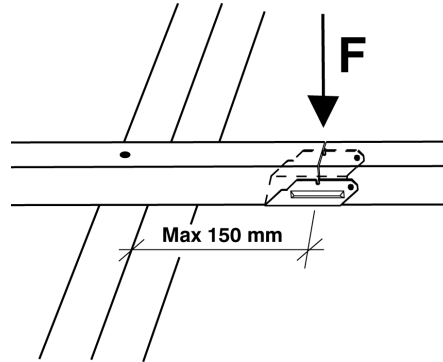
If fewer screws are employed the characteristic tensile or compression capacity is:

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

where n is the number of screws in each end of one of the two DAB22s.

Batten connector DLVS73

Force direction for DLVS73:

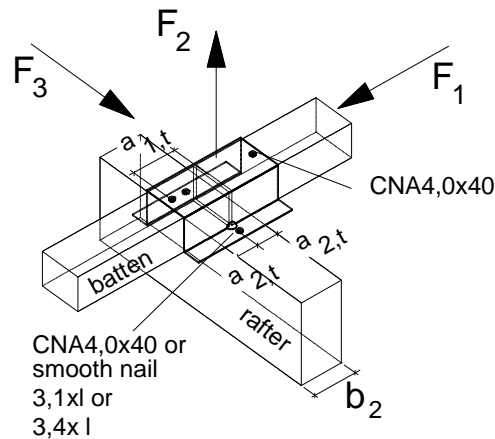


The characteristic capacity for a shear force using 4 CSA4,0x30 connector screws – see Annex A:

$$R_k = 2,33 \text{ kN}$$

Batten connector 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.



$$R_{1,k} = \min \left\{ \begin{array}{l} R_{lat,rafternail,k} \times 2 \\ 1,27 \text{ kN} \end{array} \right.$$

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.

$$R_{2,k} = \min \left\{ \begin{array}{l} 2 \times R_{ax,rafternail,k} \\ \frac{1,48 \text{ kN}}{k_{mod}} \end{array} \right.$$

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

For combined forces the following inequality shall be fulfilled.

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

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

CST

Connector for Stability of Trusses

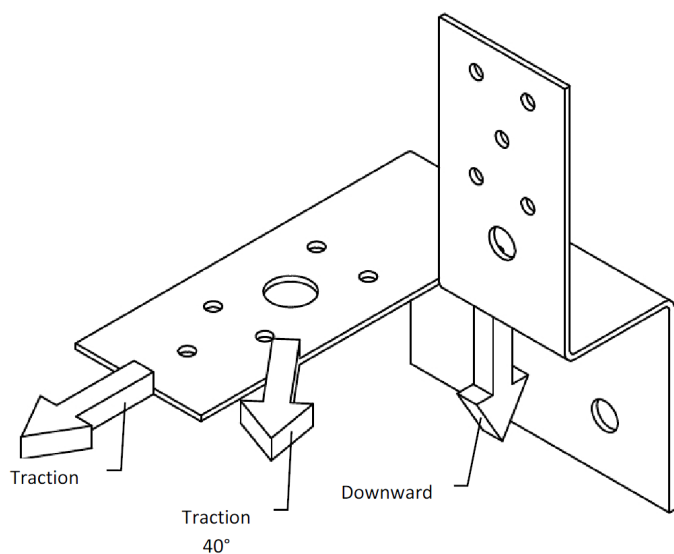


Table 9. Characteristic load-carrying capacities of CST connectors in kN.

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