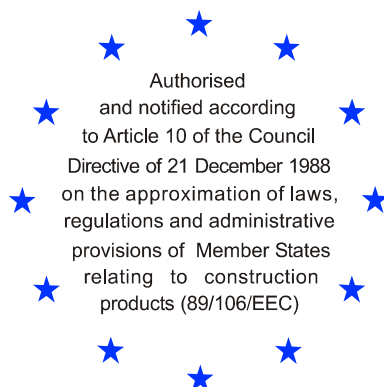


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Anstalt des öffentlichen Rechts

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DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-09/0301

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

BB-Balkenverbinder

Zulassungsinhaber
Holder of approval

BB Stanz- und Umformtechnik GmbH
Nordhäuser Straße 42
06536 Berga
DEUTSCHLAND

Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

Blechformteile (BB-Verbinder als Holzverbindungsmittel)
*Three-dimensional nailing plates (BB-connector for wood to wood
connections)*

Geltungsdauer: vom
Validity: from
bis
to

12 January 2010
11 January 2015

Herstellwerk
Manufacturing plant

BB Stanz- und Umformtechnik GmbH
Nordhäuser Straße 42
06536 Berga
DEUTSCHLAND

Diese Zulassung umfasst
This Approval contains

19 Seiten einschließlich 3 Anhänge
19 pages including 3 annexes



Europäische Organisation für Technische Zulassungen
European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik 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, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauprodukten-gesetz - BauPG) vom 28. April 1998⁴, as amended by law of 31 October 2006⁵;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶;
 - Guideline for European technical approval of "Three-dimensional nailing plates", ETAG 015.
- 2 Deutsches Institut für Bautechnik 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 Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. 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 L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I* 1998, p. 812
5 *Bundesgesetzblatt Teil I* 2006, p.2407, 2416
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

BB-Balkenverbinder are two-piece non-welded timber connectors. They are fastened to the timber construction elements with screws and used for connecting the timber construction elements with each other.

The connectors are made in different sizes of cold-formed galvanized steel sheet S250GD+Z275 according to EN 10346:2009. Dimensions, hole positions, arrangement of fasteners and typical installations are shown in Annex A and in Annex C. The beam connectors are made of steel sheets with tolerances according to EN 10143:2006.

1.2 Intended use

The beam connectors are used for connecting the timber construction elements (header and joist or column and joist), where requirements for "Mechanical resistance and stability" in the sense of the Essential Requirement 1 of Council Directive 89/106/EEC shall be fulfilled.

The structural behaviour of the construction elements and the support conditions shall correspond to the indications given in Annex B.

BB-Balkenverbinder may be installed as connections between the following wood based members:

- Solid timber of softwood of strength classes C14 – C40 according to EN 338:2003 / EN 14081-1:2005,
- Glued laminated timber of at least strength class GL24c according to EN 1194:1999 / EN 14080:2005,
- Laminated veneer lumber LVL according to EN 14374:2004 (only header or column), connection only perpendicular to the plane of the veneers,
- Parallel strand lumber Parallam PSL (only header or column), connection only perpendicular to the plane of the veneers,
- Laminated strand lumber Intrallam LSL (only header or column), connection only perpendicular to the plane of the veneers,
- Plywood according to EN 636:2003 / EN 13986:2004 (only header),
- Oriented Strand Board, OSB according to EN 300:2006 / EN 13986 (only header),
- Glued laminated solid timber Duo- and Triobalken according to prEN 14080:2009,
- Solid wood panels according to EN 13353:2008 / EN 13986:2004.

Annex B states the formula for the calculation of the load-carrying capacities of the *BB-Balkenverbinder*.

The calculation methods are appropriate for a characteristic wood density or wood based material density of 290 kg/m³ up to 460 kg/m³. In case the wood or the wood based material have a larger density, this may not be used in the formulas for the load-carrying capacities of the *BB-Balkenverbinder*.

The design and construction of the connections shall be carried out according to the national provisions that apply at the installation site of the certified object in line with the partial safety factor format, e.g. in accordance with Eurocode 5.

The forces acting in connection with the beam connectors are the following F_x , F_y and F_z , as shown in the figure below. The forces F_x and F_z are acting in the symmetry plane of the beam connector. The force F_y is acting with the distance e_j above the center of gravity of the nail connection at the joist. It is assumed that the line of action of the force is acting directly at the end of the joist.

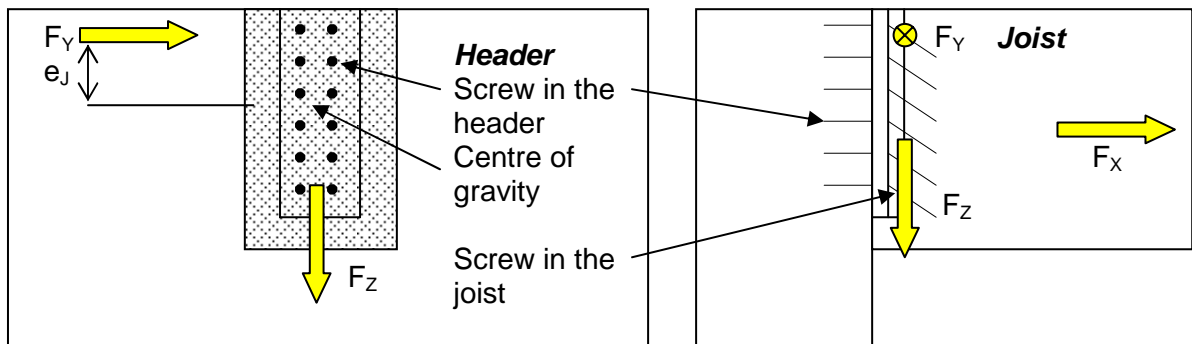


Figure 1: Acting forces in a connection with *BB-Balkenverbindern*

The beam connectors may be used in timber structures subject to climate conditions defined by service classes 1 and 2 according to EN 1995-1-1:2004+A1:2008. The beam connectors may be used for connections subject to static or quasi static loading. They may only be used for connections on torsion-resistant headers and headers sufficiently secured against rotation.

In case of a one-sided connection of beam connectors the eccentricity moment exposing the header on torsion or the column on bending shall be taken into account when verifying the header and its supports or the column. In case of two-sided connections, where the reaction forces F_N of opposing joists do not differ more than 20%, the eccentricity moment may be neglected.

The provisions made in this European technical approval are based on an assumed working life of the beam connectors of 50 years, provided that the beam connectors are subject to appropriate use and maintenance. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2 Characteristics of product and methods of verification

2.1 Characteristics

ETAG paragraph	Characteristic	Assessment of characteristic
6.1	Mechanical resistance and stability *)	
6.1.1	Load-carrying capacities	See Annex B
6.1.2	Stiffness	No performance determined
6.1.3	Ductility in cyclic testing	No performance determined
6.2	Safety in case of fire	
	Reaction to fire	<i>BB-Balkenverbinder</i> are made from steel classified as Euroclass A1 in accordance with EC decision 96/603/EC, amended by EC Decision 2000/605/EC.
	Resistance to fire	Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, however not for a single connector. Therefore there is no performance determined to this aspect of this Essential Requirement.
6.3	Hygiene, health and the environment	
6.3.1	Release of dangerous substances	No dangerous substances **)
6.4	Safety in use	Not relevant
6.5	Protection against noise	Not relevant
6.6	Energy economy and heat retention	Not relevant
6.7	Related aspects of serviceability ***)	
6.7.1	Durability	<i>BB-Balkenverbinder</i> have been assessed as having satisfactory durability and serviceability provided they are used in timber structures using the timber species described in Eurocode 5 and are subject to the conditions defined by service classes 1 and 2.
6.7.2	Serviceability	
6.7.3	Identification	See Annex A

*) See section 2.2 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.

***) See section 2.3 of this ETA

2.2 Mechanical resistance and stability

Annex B contains the equations for the calculating of the characteristic load-carrying capacities of *BB-Balkenverbinder*.

The characteristic load-carrying capacities are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. The design and construction of the connections shall be carried out according to national provisions that apply at the installation site of the certified object in line with the partial safety factor format, e.g. in accordance with Eurocode 5.

The design equations are based on the use of screws according to EN 14592 following the Table in Annex A on page 11.

No performance has been determined in relation to ductility of a connection under cyclic testing. Therefore the contribution to the performance of structures under seismic loading has not been assessed.

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

2.3 Aspects of serviceability

2.3.1 Corrosion protection in service classes 1 and 2

In accordance with ETAG 015 the beam connectors consist of galvanized steel sheet of the types S250GD+Z250 according to EN 10346.

2.3.2 In relation to the required corrosion protection for the screws to be used with the beam connectors national provisions that apply at the installation site of the certified object shall be considered e.g. Eurocode 5. In accordance with Eurocode 5 – Table 4.1 – the screws to be used may be of uncoated steel for service classes 1 and 2 if there is no special corrosive condition.

2.3.3 If preservative treatment of timber is used, national regulations apply.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 97/638/EC of the European Commission⁷ system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

a) Tasks for the manufacturer:

- 1) initial type-testing of the product;
- 2) factory production control;
- 3) testing of samples taken at the factory in accordance with a prescribed test plan.

b) Tasks for the approved body:

- 4) certification of factory production control on the basis of:
 - initial inspection of factory and of factory production control;
 - continuous surveillance, assessment and approval of factory production control.

Note: Approved body are also named "notified body"

⁷ Official Journal of European Communities L 268/36 of 01.10.1997

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. The factory production control shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval supplied with the relevant inspection documents as laid down in the control plan.⁸

The factory production control shall be in accordance with the "Control plan of relating to the European technical approval ETA-09/0301 issued on 12 January 2010" which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited within Deutsches Institut für Bautechnik.

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 shall be checked visually and for dimensions. The control plan includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan. The records shall 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 the approved body involved in the continuous surveillance and shall be presented to Deutsches Institut für Bautechnik on request.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of beam connectors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may 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 Deutsches Institut für Bautechnik and the notified body.

⁸ The "control plan" is a confidential part of the European technical approval and only handed over to the approved body or bodies involved in the procedure of attestation of conformity.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval ETA-09/0301 issued on 12 January 2010.

3.2.2 Tasks for the approved bodies

The approved body shall perform the following tasks in accordance with the provisions of the control plan:

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

3.2.2.1 Initial inspection of factory and 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 beam connectors with this European technical approval.

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.

3.2.2.3 Other tasks of the approved body

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The results of certification and continuous surveillance shall be made available on demand by the certification body to Deutsches Institut für Bautechnik.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform the Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of *BB-Balkenverbinder*. The letters "CE" shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval,
- the number of the guideline for European technical approval (ETAG 015),
- the name and size of product.

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

4.1 Manufacturing

BB-Balkenverbinder shall be manufactured in accordance with the provisions of this European technical approval using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

4.2 Installation

The connection with *BB-Balkenverbinder* is deemed fit for its intended use provided:

The connection of the connectors to the construction elements is carried out at the factory. The connectors and the timber elements connected with that shall be classified according to Annex C.

The header or column shall be free from wane under the joist plate.

If the header carries a joist only on one side the eccentricity moment from

$$M_v = F_J (B_H / 2)$$

shall be considered at the strength verification of the header and its supports.

Where:

F_J	Reaction force from the joist
B_H	Width of header

The same applies when the header has connections on both sides but with forces which differ more than 20 %.

BB-Balkenverbinder shall be fastened to joists and headers or columns by screws according to in the Table in Annex A.

All holes on joists and headers shall be supplied with screws. The arrangement of the screws for the connection to columns is shown in the product drawings.

The design and construction of the connections shall be carried out according to national provisions that apply at the installation site of the certified object in line with the partial safety factor format, e.g. in accordance with Eurocode 5.

Splitting of the header or joist caused by tensile forces perpendicular to the grain shall be considered in calculation.

BB-Balkenverbinder may only be used for connections on torsion-resistant headers and headers sufficiently secured against rotation.

The gap between the side grain of the header and the header plate of the connector as well as the gap between the joist plate and the header plate and the gap between the end grain of the joist and the joist plate shall be limited. Any of these gaps shall be maximum 1 mm. The joists and the connectors shall be installed strain-free, if suitable calculation is not carried out.

For *BB-Balkenverbinder* the width of the header or column shall be at least equal to the screw length. In case of two-sided connections the width of the header or columns shall be at least $l + 4d$, where l is the length and d the diameter of the screws in the header or column. For the connectors the depth of the joist shall allow an edge distance of at least 10 mm between the screw tip and the adjacent joist surface.

The width of the joist shall allow an edge distance of at least 12,5 mm between the side surfaces of the joist and the adjacent connector edges. The adjacent connector edges and the depth of the joist shall allow an edge distance of at least 15 mm between the top and bottom surfaces of the joist and the adjacent connector edges.

The header or column shall have a plane surface against the whole beam connector.

The requirements to the timber members being joined shall be taken into account.

Installation is carried out by personnel under the direction of supervisors, all of whom are appropriately qualified for this work.

Installation is in accordance with the manufacturer's technical documentation.

5 Recommendations

5.1 Packaging, transport and storage

BB-Balkenverbinder are packed in boxes bearing the manufacturer's name, product type, dimensions, quantity, date of manufacture and batch reference details.

In relation to transportation and storage, *BB-Balkenverbinder* should be treated as conventional metallic building products.

5.2 Use, maintenance and repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life. Should repair prove necessary, it is normal for the beam connector to be replaced.

Bender
Deutsches Institut für Bautechnik
Berlin, 12 January 2010

beglaubigt:
Niebur

Annex A

Product details

Fastener types and sizes

Screw diameter [mm]	Length [mm] Min – max	Type
5.0	80 - 120	Screws according to EN 14592:2009 with a minimum thread length of 72 mm
Values of strength		
Characteristic value of yield moment $M_{y,k} \geq 5900 \text{ Nmm}$		
Characteristic value of withdrawal parameter $f_{ax,k} \geq 10 \text{ N/mm}^2$ in timber with a characteristic density $\rho_k = 350 \text{ kg/m}^3$		

BB-Balkenverbinder 90x70

Two-piece connector consisting of a joist plate and suitable header plate of 3.0 mm thick, galvanized steel sheet S250GD+Z275 according to EN 10346:2009 with a tolerance according to EN 10143:2006

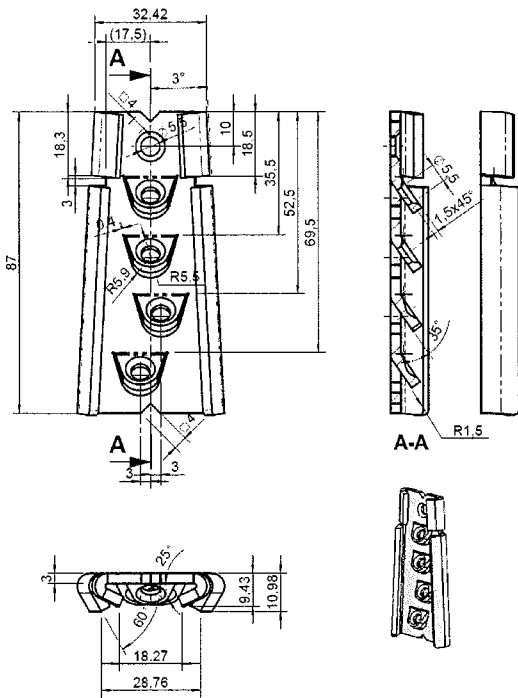


Figure A.1 Header plate of the Joist plate of the beam connector 90 x 70

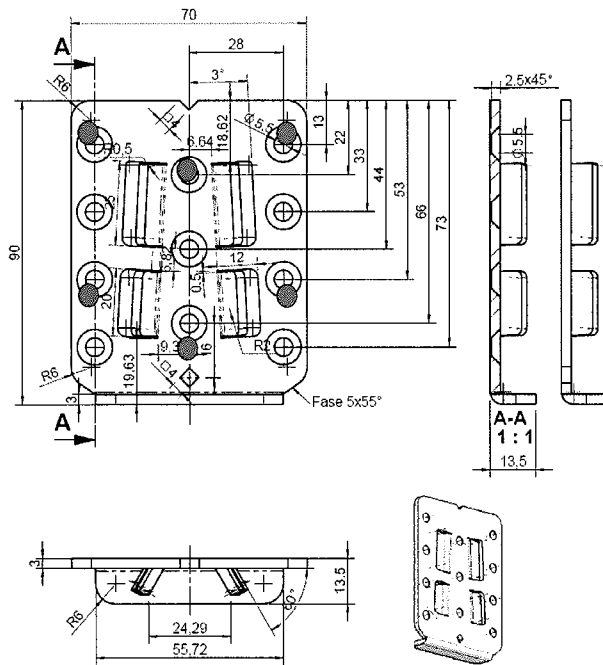


Figure A.2 beam connector 90 x 70
(●screws for column connection)

BB-Balkenverbinder 125x70

Two-piece connector consisting of a joist plate and suitable header plate of 3.0 mm thick galvanized steel sheet S250GD+Z275 according to EN 10346:2009 with a tolerance according to EN 10143:2006

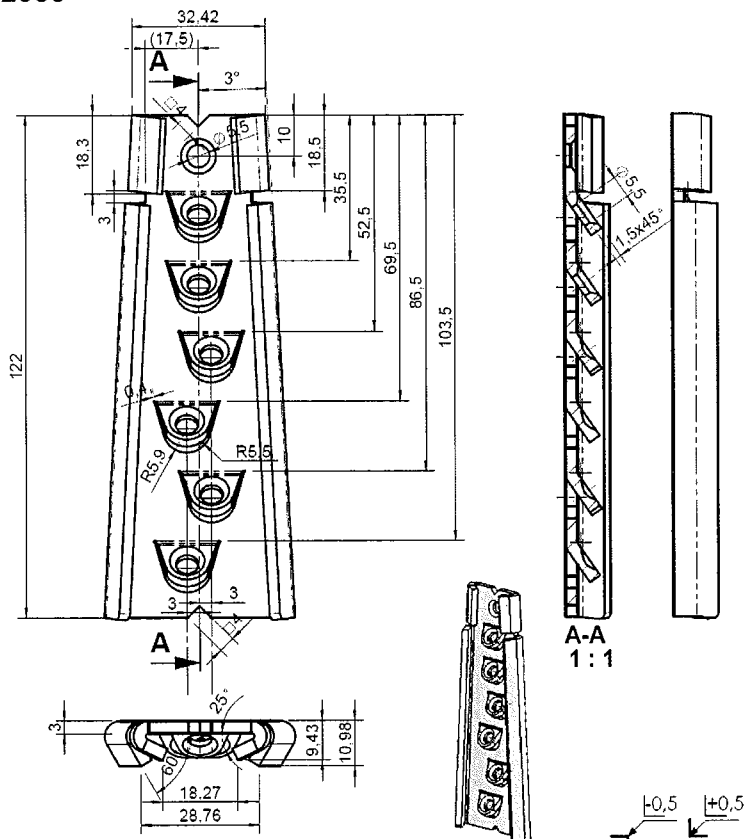


Figure A.3 Joist plate of the beam connector 125 x 70

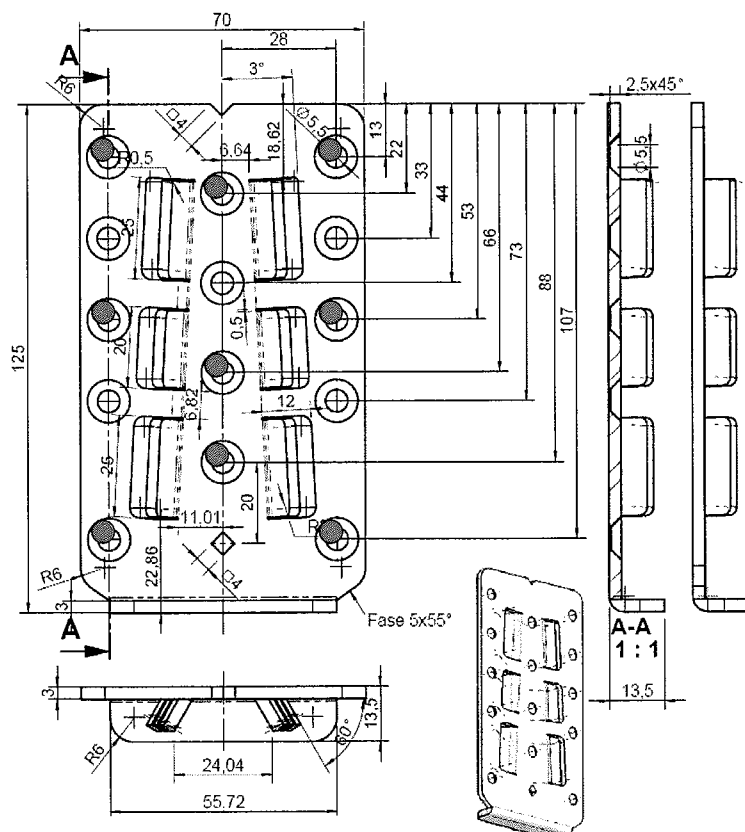


Figure A.4 Header plate of the beam connector 125 x 70 (● screws for column connection)

BB-Balkenverbinder 150x70

Two-piece connector consisting of a joist plate and suitable header plate of 3.0 mm thick, galvanized steel sheet S250GD+Z275 according to EN 10346:2009 with a tolerance according to EN 10143: 2006

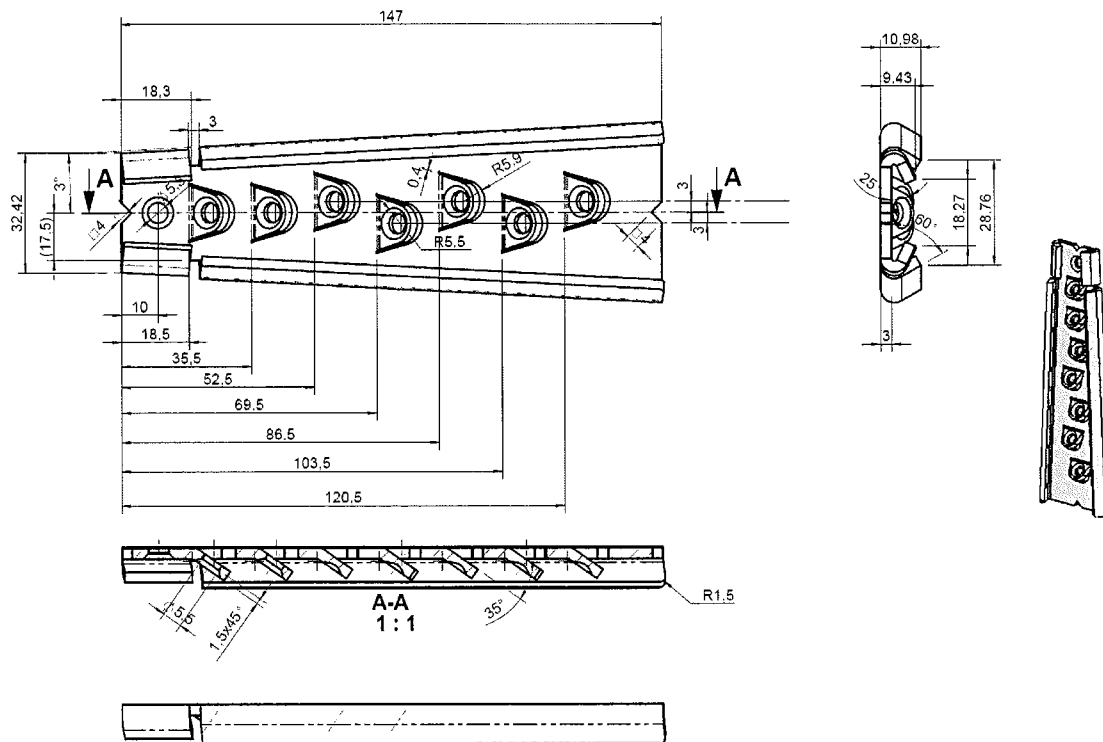


Figure A.5 Joist plate of the beam connector 150 x 70

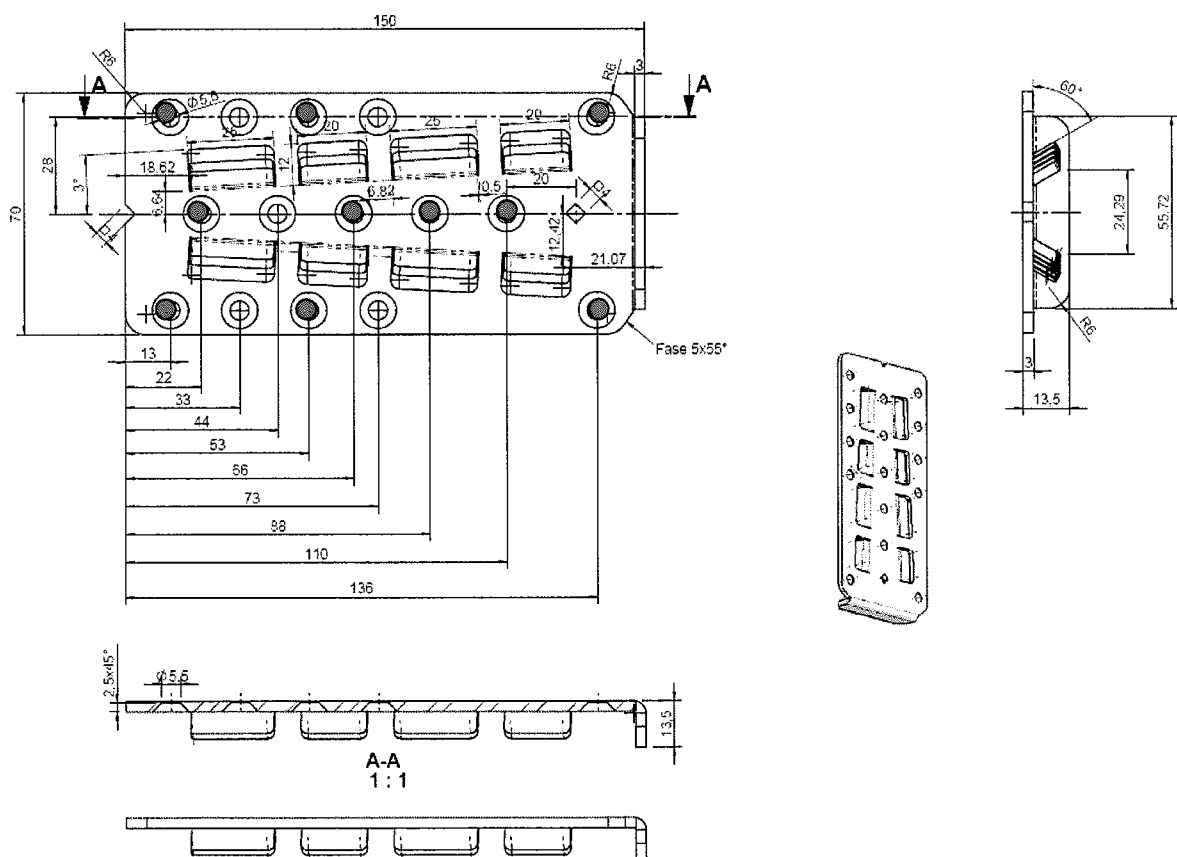


Figure A.6 Header plate of the beam connector 150 x 70 (● screws for column connection)

BB-Balkenverbinder 190x70

Two-piece connector consisting of a joist plate and suitable header plate of 3.0 mm thick, galvanized steel sheet S250GD+Z275 according to EN 10346:2009 with a tolerance according to EN 10143: 2006

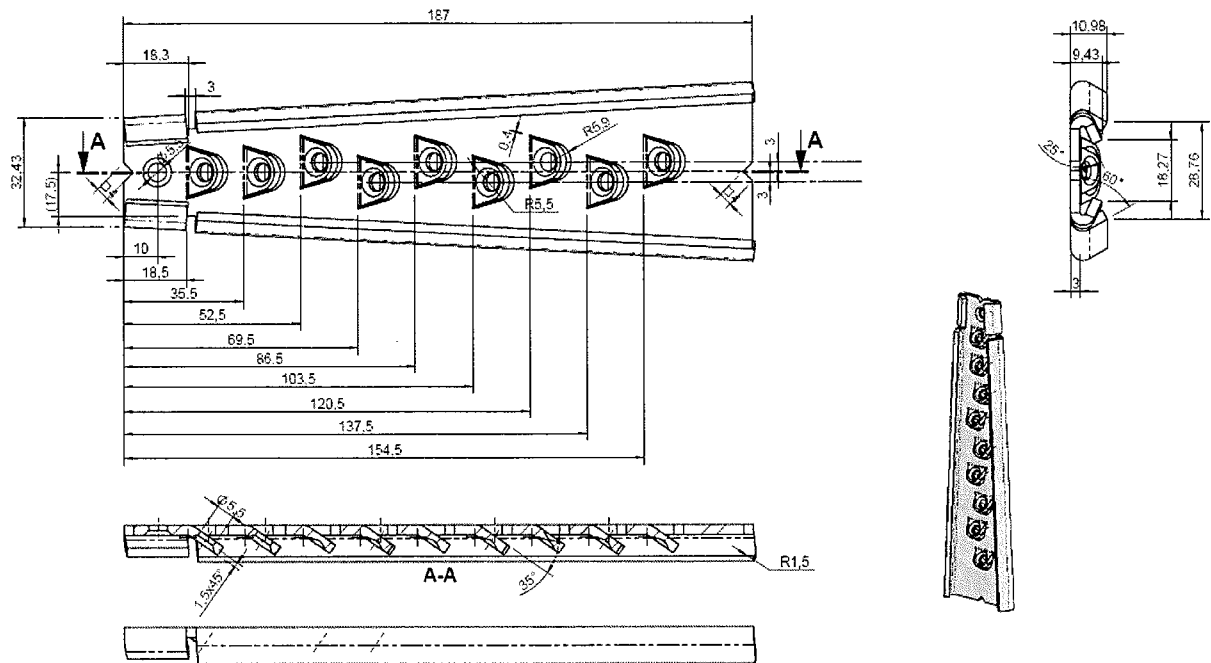


Figure A.7 Joist plate of the beam connector 190 x 70

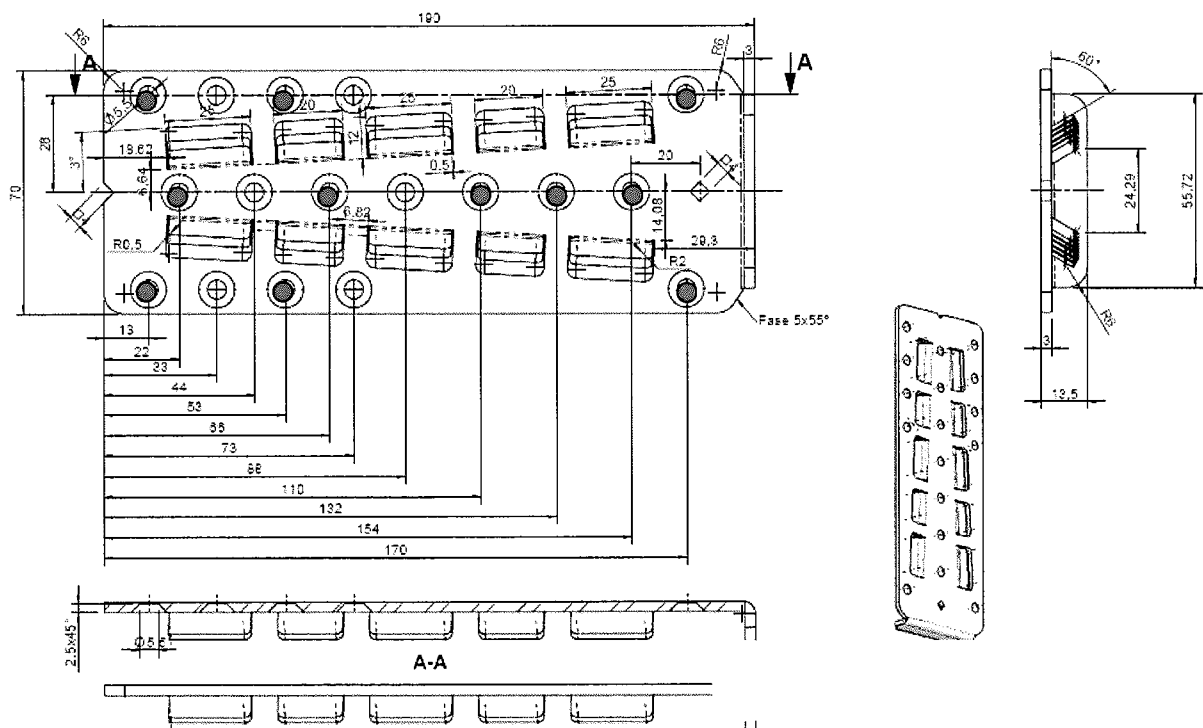


Figure A.8 Header plate of the beam connector 190 x 70 (●screws for column connection)

Annex B

Design values of the load-carrying capacity

The forces $F_{X,Ed}$ and $F_{Z,Ed}$ act in the symmetry plane of the beam connector. The force $F_{Y,Ed}$ acts in a distance e_j of the centre of gravity of the joist connection. It is assumed that the forces $F_{Y,Ed}$ and $F_{Z,Ed}$ are acting right at the end of the joist.

The header shall be secured against rotation around its own axis. If the connection is carried out on one side of the header or the column only, the eccentricity moment or the bending moment shall be taken into account. This applies accordingly, if the reaction forces on both sides of the header differ by more than 20 %.

In case of connections to headers all holes of the header plate shall be provided with screws, in case of connections to columns only the marked holes.

The width of the header or columns shall be at least equal to the screw length, in case of two-sided connections the width shall be at least $l + 4d$, where l is the length and d the diameter of the screws in the header connection. The distance between the screw tip and the adjacent joist surface shall be at least 10 mm.

For the calculation of design values, the partial material factor and the modification factor for timber or wood-based members are used.

Force direction perpendicular to the connector plates:

$$F_{X,Rd} = \min \left\{ \begin{array}{l} \frac{A}{\gamma_{M,S}} \\ \frac{B_X \cdot k_p \cdot k_{mod}}{\gamma_{M,T}} \end{array} \right. \quad (B.1)$$

Force direction lateral:

$$F_{Y,Rd} = \frac{B_Y \cdot k_p \cdot k_{mod} \cdot k_e}{\gamma_{M,T}} \quad (B.2)$$

Force direction downward:

$$F_{Z,Rd} = \frac{B_Z \cdot k_p \cdot k_{mod}}{\gamma_{M,T}} \quad (B.3)$$

Force direction upward:

$$F_{Z,Rd} = 0 \quad (B.3a)$$

Combined loading:

$$\left(\frac{F_{X,Ed}}{F_{X,Rd}} \right)^2 + \left(\frac{F_{Y,Ed}}{F_{Y,Rd}} \right)^2 + \left(\frac{F_{Z,Ed}}{F_{Z,Rd}} \right)^2 \leq 1 \quad (B.4)$$

Where:

A , B_X , B_Y and B_Z are constants in kN (see Table B.1),

$\gamma_{M,S}$ Partial safety factor for steel in bending,

$\gamma_{M,T}$ Partial safety factor for timber or wood-based material,

k_p Factor taking into account the characteristic density of joist or header/column,

$$k_p = \sqrt{\frac{\rho_k}{350}}$$

- ρ_k Lower characteristic density of joist or header/column in kg/m³; $\rho_k \leq 460 \text{ kg/m}^3$,
- k_{mod} Modification factor to consider the load duration influence and the wood moisture,
- k_e Factor taking into account the eccentricity of the load $F_{Y,Ed}$,
- $k_e = \frac{1}{1 + \frac{6 \cdot e_J}{\ell}}$
- e_J Eccentricity of the force $F_{Y,Ed}$ with regard to the centroid of the joist connection in mm (see Figure 1),
- ℓ Connector length; $90 \text{ mm} \leq \ell \leq 190 \text{ mm}$.

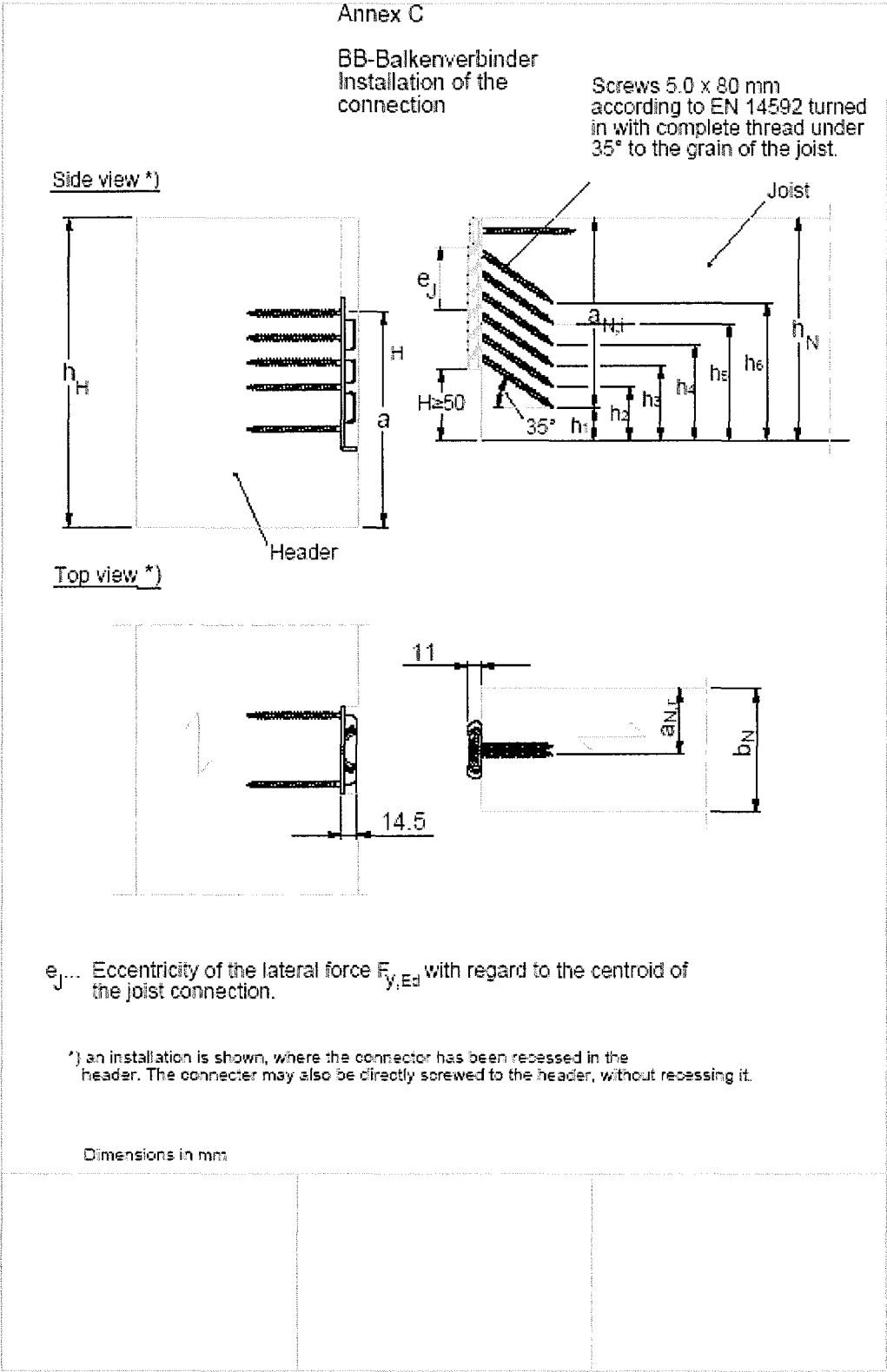
Table B.1: Constants A, B_x, B_y and B_z

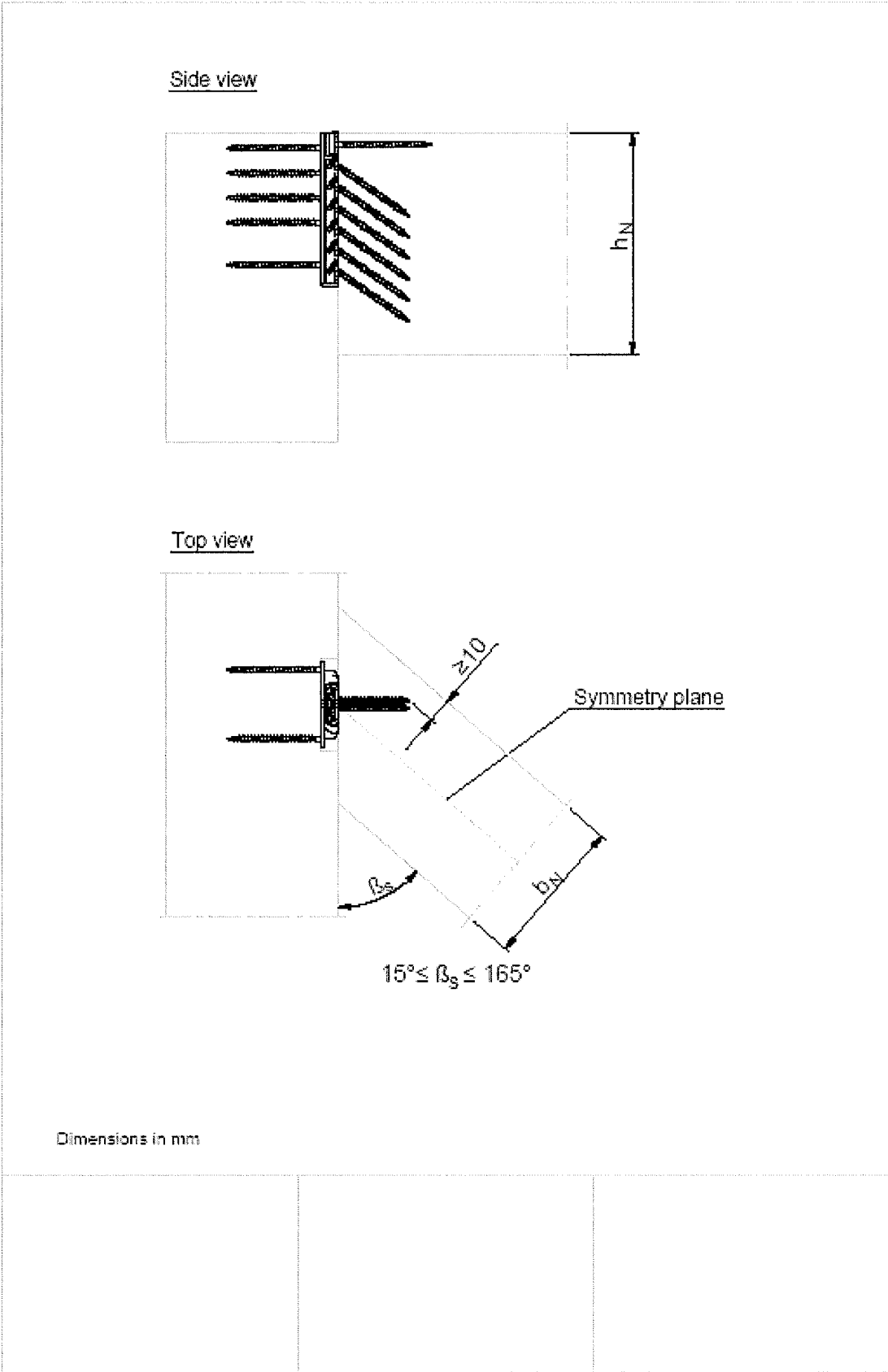
Type	90x70	125x70	150x70	190x70
A [kN]	2.43	3.79	4.87	6.22
B _x [kN]	3.79	5.46	6.27	7.86
B _y [kN]	5.15	7.73	9.02	11.6
B _z [kN]	8.78	12.6	14.5	18.2

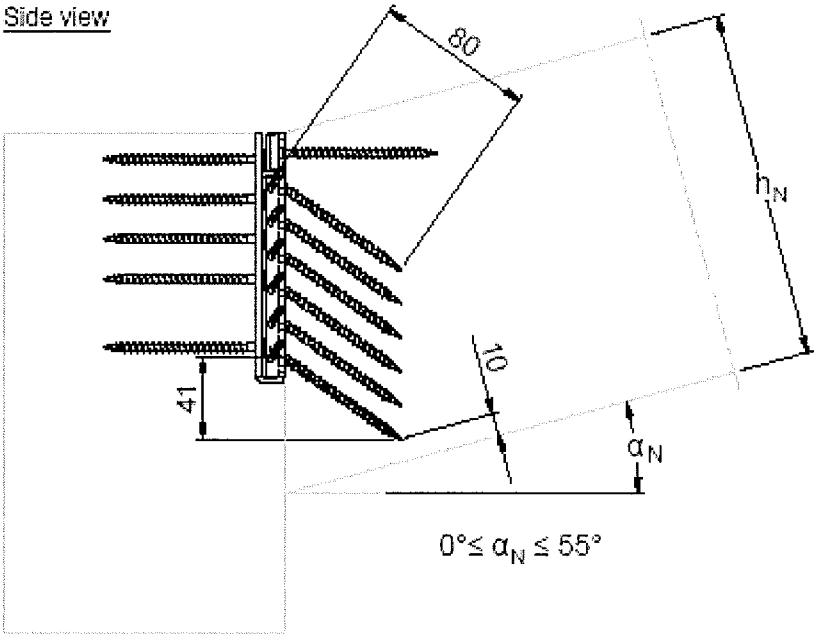
Splitting

If tensile stress perpendicular to the grain has to be proved, it can be carried out according to EN 1995-1-1:2004+A1:2008, clause 8.1.4.

Annex C







Dimensions in mm

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