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

MEMBER OF EOTA

European Technical Assessment ETA-09/0217 of 02/09/2014

General Part

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

Trade name of the construction product:	Drüeke & Springob Hold downs type 1311, 1312, 1313, 1314, 4110, 4111, 4112, 4113, 4114, 4115, 4116, 4117, 4118, 4119
Product family to which the above construction product belongs:	Three-dimensional nailing plate (Hold downs for timber-to-timber or timber to concrete connections)
Manufacturer:	Drüeke & Springob GmbH Bahnstrasse 19 57439 Attendorn - Kraghammer Tel. +49 02722 - 7771 Fax +49 02722 – 7922
Manufacturing plant:	Drüeke & Springob GmbH Bahnstrasse 19 57439 Attendorn - Kraghammer
This European Technical Assessment contains:	14 pages including 2 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	Guideline for European Technical Approval (ETAG) No. 015 Three Dimensional Nailing Plates, April 2013, used as European Assessment Document (EAD).
This version replaces:	The ETA with the same number issued on 2009-09-09 and expiry on 2014-09-09

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
Drüeke & Springob Hold downs are one-piece non-welded, face-fixed angle brackets to be used in timber to timber or in timber to concrete or to steel connections. They are connected to construction members made of timber or wood-based products with profiled (ringed shank) nails according to EN 14592 and to concrete or steel members with bolts or metal anchors.

The hold downs with a steel plate thickness of less than 6 mm are made from pre-galvanized steel DX 51 D / Z 275 according to EN 10346:2009 with $R_e \geq 295$ N/mm², $R_m \leq 360$ N/mm² and $A_{80} \geq 22\%$, the hold downs with a steel plate thickness of 6mm and 8mm are made from S235 according to EN10025-2:2005. Dimensions, hole positions and typical installations are shown in Annex A. Drüeke & Springob angle brackets are made from steel with tolerances according to EN 10143.

2 Specification of the intended use in accordance with the applicable EAD

The hold downs are intended for use in making connections in load bearing timber structures, as a connection between a beam and a purlin, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Work Requirements 1 and 4 of the Regulation 305/2011 (EU) shall be fulfilled.

The connection may be with a single hold down (see Annex A).

The static and kinematical behaviour of the timber members or the supports shall be as described in Annex B.

The wood members may be of solid timber, glued laminated timber and similar glued members, or wood-based structural members with a characteristic density from 290 kg/m^3 to 420 kg/m^3. This requirement to the material of the wood members can be fulfilled by using the following materials:

- Structural solid timber classified to C14-C40 according to EN 338 / EN 14081,
- Glulam classified to GL24-GL36 according to EN 1194 / EN 14080,
- LVL according to EN 14374,
- Parallam PSL,
- Intrallam LSL,
- Duo- and Triobalken,
- Layered wood plates,
- Plywood according to EN 636

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

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^2$$

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

The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code. The wood members shall have a thickness which is larger than the penetration depth of the nails into the members.

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

Some of the hold downs may also be used for connections between a timber member and a member of concrete or steel.

The scope of the connectors regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions and in conjunction with the admissible service conditions according to EN 1995-1-1 and the admissible corrosivity category as described and defined in EN ISO 12944-2

Assumed working life
The assumed intended working life of the hold downs 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. 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.

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

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability (BWR 1)*)	
Characteristic load-carrying capacity	See Annex B
Stiffness	No performance determined
Ductility in cyclic testing	No performance determined
3.2 Safety in case of fire (BWR 2)	
Reaction to fire	The hold downs are made from steel classified as **Euroclass A1** in accordance with EN 13501-1:2007+A1:2009 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
3.3 Hygiene, health and the environment (BWR 3)	
Influence on air quality	The product does not contain/release dangerous substances specified in TR 034, dated March 2012
3.7 Sustainable use of natural resources (BWR 7)	No Performance Determined
3.8 General aspects related to the performance of the product	The hold downs have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1 and 2
Identification	See Annex A

*) See additional information in section 3.9 – 3.12.

In addition to the specific clauses relating to dangerous substances contained in this European technical Assessment, 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 Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.9 Methods of verification

Safety principles and partial factors

The characteristic load-carrying capacities are based on the characteristic values of the nail connections and the steel plates. To obtain design values the capacities have to be divided by different partial factors for the material properties, the nail connection in addition multiplied with the coefficient k_{mod}.

According to EN 1990 (Eurocode – Basis of design) paragraph 6.3.5 the design value of load-carrying capacity may be determined by reducing the characteristic values of the load-carrying capacity with different partial factors.

Thus, the characteristic values of the load–carrying capacity are determined also for timber failure $F_{Rk,H}$ (obtaining the embedment strength of nails subjected to shear or the withdrawal capacity of the most loaded nail, respectively) as well as for steel plate failure $F_{Rk,S}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

$$F_{Rd} = \min\left\{\frac{k_{mod} \cdot F_{Rk,H}}{\gamma_{M,H}}; \frac{F_{Rk,S}}{\gamma_{M,S}}\right\}$$

Therefore, for timber failure the load duration class and the service class are included. The different partial factors γ_M for steel or timber, respectively, are also correctly taken into account.

3.10 Mechanical resistance and stability

See annex B for the characteristic load-carrying capacity in the directions $F_{1.}$

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

Threaded nails (ringed shank nails) in accordance to EN 14592

In the formulas in Annex B the capacities for threaded nails calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral nail load-carrying-capacity.

The load bearing capacities of the brackets has been determined based on the use of connector nails 4,0 x 40 mm in accordance with the German national approval for the nails.

The characteristic withdrawal capacity of the nails has to be determined by calculation in accordance with EN 1995-1-1: 2004, paragraph 8.3.2 (head pull-through is not relevant):

$$F_{ax,Rk} = f_{ax,k} \times d \times t_{pen}$$

Where:

$f_{ax,k}$ Characteristic value of the withdrawal parameter in N/mm^2

d Nail diameter in mm

t_{pen} Penetration depth of the profiled shank including the nail point in mm, $t_{pen} \geq 31$ mm

Based on tests by Versuchsanstalt für Stahl, Holz und Steine, University of Kalrsruhe, the characteristic value of the withdrawal resistance for the threaded nails used can be calculated as:

$$f_{ax,k} = 50 \times 10^{-6} \times \sigma_k^{\,2}$$

Where:

σ_k Characteristic density of the timber in kg/m^3

The shape of the nail directly under the head shall be in the form of a truncated cone with a diameter under the nail head which exceeds the hole diameter.

The design models allow the use of fasteners described in the table on page 9 in Annex A

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

3.11 Aspects related to the performance of the product

Corrosion protection in service class 1 and 2.

In accordance with ETAG 015 the hold downs with a steel plate thickness of less than 6 mm are made from pre-galvanized steel DX 51 D / Z 275 according to EN 10346:2009 with $R_e \geq 295$ N/mm², $R_m \leq 360$ N/mm² and $A_{80} \geq 22\%$, and the hold downs with a steel plate thickness of 6mm and 8mm are made from S235 according to EN10025-2:2005

3.12 General aspects related to the use of the product

Drüeke & Springob hold downs are 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

Drüeke & Springob hold downs are 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

4.2 Installation

The nailing pattern used shall be either the maximum or the minimum pattern as defined in Annex A.

The following provisions concerning installation apply:

The structural members – the components 1 and 2 shown in the figure on page 14 - to which the brackets are fixed shall be:

- Restrained against rotation.
- Strength class C14 or better, see section 1 of this ETA
- Free from wane under the bracket.
- The actual end bearing capacity of the timber member to be used in conjunction with the bracket is checked by the designer of the structure to ensure it is not less than the bracket capacity and, if necessary, the bracket capacity reduced accordingly.
- The gap between the timber members does not exceed 3 mm.
- There are no specific requirements relating to preparation of the timber members.

The execution of the connection shall be in accordance with the approval holder's technical literature.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/638/EC of the European Commission1, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark

Issued in Copenhagen on 2014-09-02 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details definitions

Table A.1 Materials specification

Bracket number	Bracket type	Thickness (mm)	Steel specification	Coating specification
1311	75 x 75 x 50	6,0	S235	-
1312	100 x 75 x 60	6,0	S235	-
1313	150 x 75 x 60	8,0	S235	-
1314	100 x 50 x 50	8,0	S235	-
4110	200 x 40 x 40	2,0	DX 51 D	Z 275
4111	300 x 40 x 40	2,0	DX 51 D	Z 275
4112	400 x 40 x 40	2,0	DX 51 D	Z 275
4113	500 x 40 x 40	2,0	DX 51 D	Z 275
4114	600 x 40 x 40	2,0	DX 51 D	Z 275
4115	200 x 40 x 40	4,0	DX 51 D	Z 275
4116	300 x 40 x 40	4,0	DX 51 D	Z 275
4117	400 x 40 x 40	4,0	DX 51 D	Z 275
4118	500 x 40 x 40	4,0	DX 51 D	Z 275
4119	600 x 40 x 40	4,0	DX 51 D	Z 275

Table A.2 Range of sizes

Bracket number	Bracket type	Height (mm) vertical		Height (mm) horizontal		Width (mm)	
1311	75 x 75 x 50	74	76	74	76	49	51
1312	100 x 75 x 60	99	101	74	76	59	61
1313	150 x 75 x 60	149	151	74	76	59	61
1314	100 x 50 x 50	99	101	49	51	49	51
4110	200 x 40 x 40	199	201	39	41	39	41
4111	300 x 40 x 40	299	301	39	41	39	41
4112	400 x 40 x 40	399	401	39	41	39	41
4113	500 x 40 x 40	499	501	39	41	39	41
4114	600 x 40 x 40	599	601	39	41	39	41
4115	200 x 40 x 40	199	201	39	41	39	41
4116	300 x 40 x 40	299	301	39	41	39	41
4117	400 x 40 x 40	399	401	39	41	39	41
4118	500 x 40 x 40	499	501	39	41	39	41
4119	600 x 40 x 40	599	601	39	41	39	41

Table A.3 Fastener specification

Nail type	**Nail size (mm)**		**Finish**
According to EN 14592	Diameter	Length	
Threaded nail	4,0	40	Electroplated zinc

In the load-carrying-capacities of the nailed connection in Annex B the capacities for threaded nails calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral nail load-carrying-capacity.
The load-carrying-capacities of the angle brackets have been determined based on the use of connector nails 4,0 x 40 mm in accordance with the German national approval for the nails.
The characteristic withdrawal capacity of the nails has to be determined by calculation in accordance with EN 1995-1-1:2004, paragraph 8.3.2 (head pull-through is not relevant):

$F_{ax,Rk} = f_{ax,k} \times d \times t_{pen}$

Where:
$f_{ax,k}$ Characteristic value of the withdrawal parameter in N/mm^2
d Nail diameter in mm
t_{pen} Penetration depth of the profiled shank including the nail point in mm, $t_{pen} \geq 31$ mm

Based on tests by Versuchsanstalt für Stahl, Holz und Steine, University of Kalrsruhe, the characteristic value of the withdrawal resistance for the threaded nails used can be calculated as:

$f_{ax,k} = 50 \times 10^{-6} \times \rho_k^2$

Where:
ρ_k Characteristic density of the timber in kg/m^3
The shape of the nail directly under the head shall be in the form of a truncated cone with a diameter under the nail head which exceeds the hole diameter.

BOLTS diameter	**Correspondence Hole diameter**	**Bolts type**
12.0	Max. 2 mm. larger than the bolt diameter	See specification of the manufacturer

METAL ANCHORS diameter	**Correspondence Hole diameter**	**Anchors type**
12.0	Max. 2 mm. larger than the anchor diameter	See specification of the manufacturer

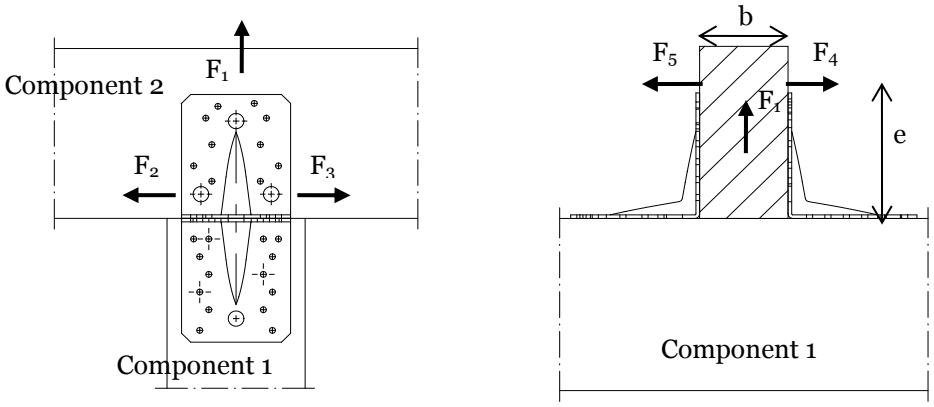
Annex B
Characteristic load-carrying capacities

Table B.1: Force F_1, 1 hold down / connection

Bracket number	Bracket type	Type of anchorage		$F_{1,Rk}$ [kN]	
				Timber	Steel
1311	75 x 75 x 50		Bolt/Metal anchor[1)]		2,40
1312	100 x 75 x 60		Bolt/Metal anchor[1)]		2,40
1313	150 x 75 x 60		Bolt/Metal anchor[1)]		4,20
1314	100 x 50 x 50		Bolt/Metal anchor[1)]		5,24
1311	75 x 75 x 50		Encased in concrete		38,6
1312	100 x 75 x 60		Encased in concrete		38,6
1313	150 x 75 x 60		Encased in concrete		51,4
1314	100 x 50 x 50		Encased in concrete		51,4
4110	200x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,62 per nail	1,00
4111	300x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,62 per nail	1,00
4112	400x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,62 per nail	1,00
4113	500x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,62 per nail	1,00
4114	600x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,62 per nail	1,00
4115	200x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,57 per nail	3,45
4116	300x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,57 per nail	3,45
4117	400x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,57 per nail	3,45
4118	500x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,57 per nail	3,45
4119	600x40x40	At least 4 nails in the upper holes	Bolt/Metal anchor[1)]	1,57 per nail	3,45
4110	200x40x40	At least 4 nails in the upper holes	Encased in concrete	1,62 per nail	13,6
4111	300x40x40	At least 4 nails in the upper holes	Encased in concrete	1,62 per nail	13,6
4112	400x40x40	At least 4 nails in the upper holes	Encased in concrete	1,62 per nail	13,6
4113	500x40x40	At least 4 nails in the upper holes	Encased in concrete	1,62 per nail	13,6
4114	600x40x40	At least 4 nails in the upper holes	Encased in concrete	1,62 per nail	13,6
4115	200x40x40	At least 4 nails in the upper holes	Encased in concrete	1,57 per nail	27,2
4116	300x40x40	At least 4 nails in the upper holes	Encased in concrete	1,57 per nail	27,2
4117	400x40x40	At least 4 nails in the upper holes	Encased in concrete	1,57 per nail	27,2
4118	500x40x40	At least 4 nails in the upper holes	Encased in concrete	1,57 per nail	27,2
4119	600x40x40	At least 4 nails in the upper holes	Encased in concrete	1,57 per nail	27,2

[1)] A washer according to EN ISO 7091:2000 with a nominal size 12 is used.

Definitions of forces, their directions and eccentricity
Forces - Beam to beam connection



Fastener specification
Holes are marked with numbers referring to the nailing pattern in Annex A.

Single angle bracket per connection
Acting forces

F_1 Lifting force acting in the central axis of the angle bracket. The component 2 shall be prevented from rotation. If the component 2 is prevented from rotation the load-carrying capacity will be half of a connection with double angle brackets.

Wane
Wane is not allowed, the timber has to be sharp-edged in the area of the angle brackets.

Timber splitting
For the lifting force F_1 it must be checked in accordance with Eurocode 5 or a similar national Timber Code that splitting will not occur.

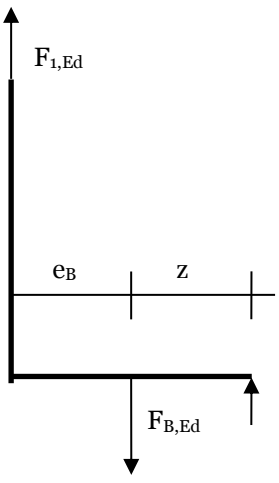
Connection to concrete or steel with a bolt or metal anchor
The tensile load $F_{B,Ed}$ for the design of a bolt or metal anchor is calculated as:

$$F_{B,Ed} = F_{1,d} \cdot \left(1 + \frac{e_B}{z}\right)$$

Where:

e_B Eccentricity of the bolt with regard to the force F_1

z Distance between the bolt and the end of the horizontal flap of the angle bracket



Combined forces
If the forces F_1 and F_2/F_3 or F_4/F_5 act at the same time, the following inequality shall be fulfilled:

$$\left(\frac{F_{1,d}}{F_{Rd,1}}\right)^2+\left(\frac{F_{2,d}}{F_{Rd,2}}\right)^2+\left(\frac{F_{3,d}}{F_{Rd,3}}\right)^2+\left(\frac{F_{4,d}}{F_{Rd,4}}\right)^2+\left(\frac{F_{5,d}}{F_{Rd,5}}\right)^2 \le 1$$

The forces F_2 and F_3 or F_4 and F_5 are forces with opposite direction. Therefore only one force F_2 or F_3, and F_4 or F_5, respectively, is able to act simultaneously with F_1, while the other shall be set to zero.

If the load F_4/F_5 is applied with an eccentricity e, a design for combined loading **for connections with double angle brackets** is required. Here, an additional force ΔF_1 has to be added to the existing force F_1.

$$\Delta F_{1,d} = F_{4,d} / F_{5,d} \cdot \frac{e}{B}$$

B is the width of component 2.

Drüeke & Springob hold downs

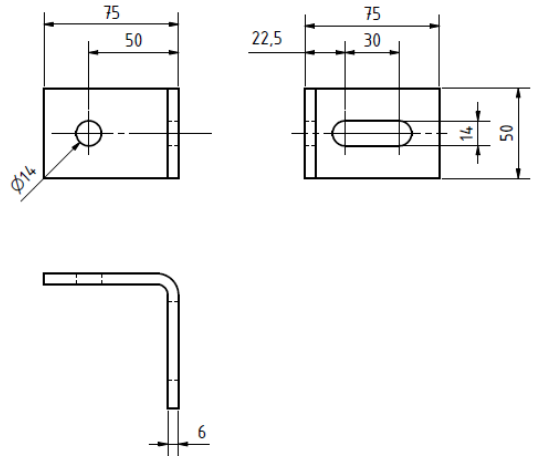


Figure B. 1 Dimensions of Angle Bracket 1311

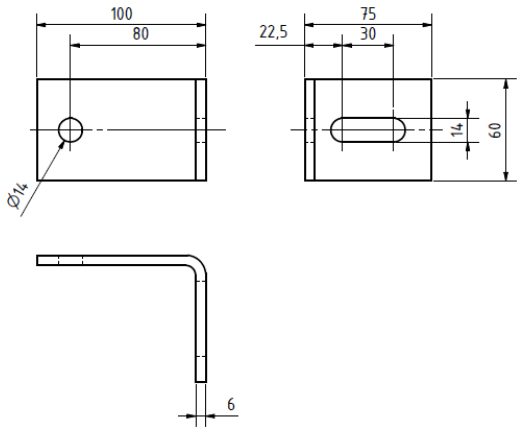


Figure B. 2 Dimensions of Angle Bracket 1312

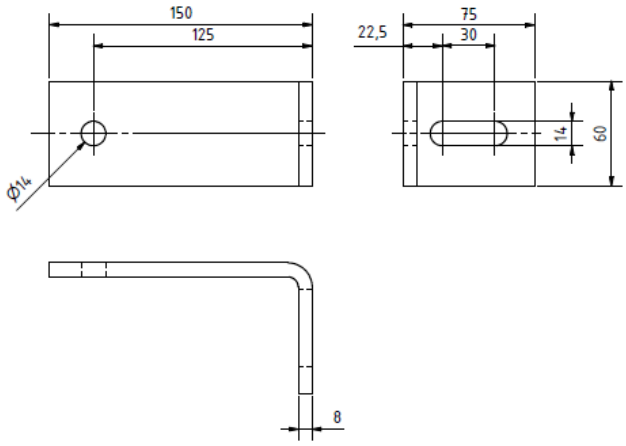


Figure B. 3 Dimensions of Angle Bracket 1313

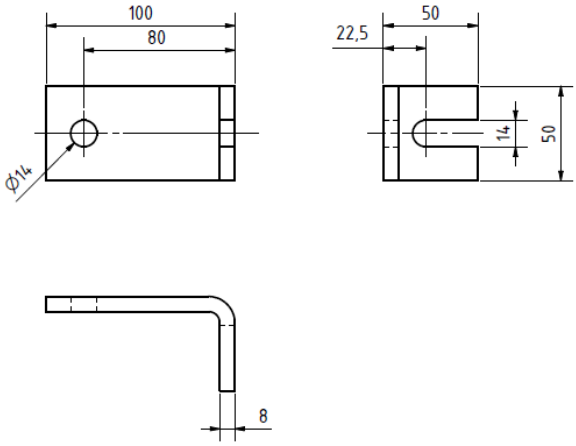
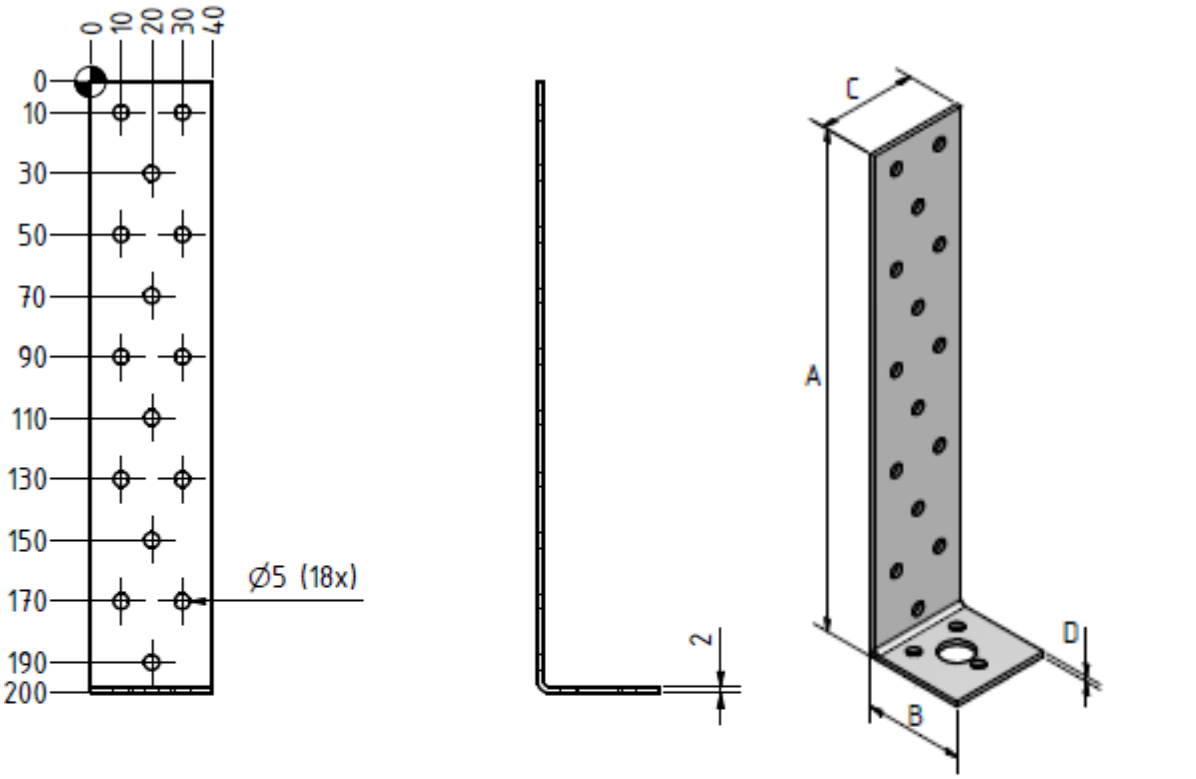


Figure B. 4 Dimensions of Angle Bracket 1314



Art. Nr.	Bezeichnug	A	B	C	D	Lochanzahl
4110	200x40x40x2	200	40	40	2	18/1
4111	300x40x40x2	300	40	40	2	25/1
4112	400x40x40x2	400	40	40	2	33/1
4113	500x40x40x2	500	40	40	2	40/1
4114	600x40x40x2	600	40	40	2	47/1
4115	200x40x40x4	200	40	40	4	18/1
4116	300x40x40x4	300	40	40	4	25/1
4117	400x40x40x4	400	40	40	4	33/1
4118	500x40x40x4	500	40	40	4	40/1
4119	600x40x40x4	600	40	40	4	47/1

Figure B. 5 Angle brackets 4110 - 4119