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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

European Technical Assessment ETA-12/0584 of 28/11/2017

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:	GAH Alberts Cantilever brackets type 8659 lengths 120, 140, 160,180, 200, 220, 240, 260, 280, 300, 320, 340, 360
Product family to which the above construction product belongs:	Three-dimensional nailing plate (Cantilever Bracket for timber-to-timber connections)
Manufacturer:	Gust. Alberts GmbH + Co. KG Blumenthal 2 D-58849 Herscheid Tel. +49 2357 907 0 Fax +49 2357 907 189 Internet www.gah.de
Manufacturing plant:	Gust. Alberts GmbH + Co. KG Blumenthal 2 D-58849 Herscheid
This European Technical Assessment contains:	17 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 2013-06-28 and expiry on 2018-01-07

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
GAH Alberts cantilever brackets are one-piece non-welded, face-fixed cantilever brackets to be used in timber to timber connections. They are connected to construction members made of timber or wood-based products with profiled (ringed shank) nails according to EN 14592.

The cantilever brackets are made from pre-galvanized steel DX 51 D / Z 275 according to EN 10346:2009 with $R_e \geq 250$ N/mm², $R_m \geq 330$ N/mm² and $A_{80} \geq 22\%$. Dimensions, hole positions and typical installations are shown in Annex B. GAH Alberts cantilever brackets are made from steel with tolerances according to EN 10143.

Additionally, the cantilever brackets can be made from stainless steel 1.4016, 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088-2:2005 provided that the yield strength f_y for these steel grades is at least the same as the minimum yield strength of the zinc coated steel normally used for the brackets. The ultimate strength f_u and the ultimate strain A_{80} shall exceed the corresponding minimum values for the zinc coated steel.

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

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

The connection always consists of a pair of cantilever brackets on each side of the fastened timber member (see Annex B).

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,
- Cross laminated timber,
- Plywood according to EN 636

Annex B states the load-carrying capacities of the cantilever bracket 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 the characteristic density of the timber in kg/m^3.

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

The scope of the brackets regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions. Section 3.11 of this ETA contains the corrosion protection for GAH Alberts cantilever brackets made from carbon steel and the material number of the stainless steel.

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

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

Characteristic	Assessment of characteristic
3.1 Mechanical resistance and stability*)	
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	
Reaction to fire	The cantilever brackets are made from steel classified as **Euroclass A1** in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364
3.3 Hygiene, health and the environment	
Influence on air quality	No dangerous materials
3.7 Sustainable use of natural resources (BR7)	No Performance Assessed
3.8 General aspects related to the performance of the product	The cantilever brackets have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1, 2 and 3
Identification	See Annex A

*) See additional information in section 3.8 – 3.9.

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 multiplied with different partial factors for the material properties, in addition the nail connection with the coefficient k_{mod}.

According to EN 1990 (Eurocode – Basis of design) paragraph 6.3.5 the design value of load-carrying capacity can 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 different directions F_1 to $F_{45.}$

The characteristic capacities of the cantilever brackets 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/mm²
d Nail diameter in mm
t_{pen} Penetration depth of the profiles shank in mm
$t_{pen} \geq 30$ 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/m³

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

3.11.1 Corrosion protection in service class 1 and 2.

In accordance with ETAG 015 the cantilever brackets are made from pre-galvanized steel DX 51 D / Z 275 according to EN 10327:2004 with minimum yield strength R_e of 250 MPa, a minimum tensile strength R_m of 330 MPa and a minimum ultimate strain A_{80} of 22 % .

3.11.2 Corrosion protection in service class 3.

In accordance with Eurocode 5 the cantilever brackets are made from stainless steel 1.4016, 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088-2:2005 and the nails shall be produced from stainless steel.

3.12 General aspects related to the fitness for use of the product

The cantilever ties are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation

The following provisions concerning installation apply:

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 32 - to which the brackets are fixed shall be:

- The structural members – the components 1 and 2 shown in annex B - to which the brackets are fixed shall be:
  - Restrained against rotation.
  - Strength class C14 or better, see section 3 of this evaluation report
  - 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 prior to CE marking.

Issued in Copenhagen on 2017-11-28 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details definitions

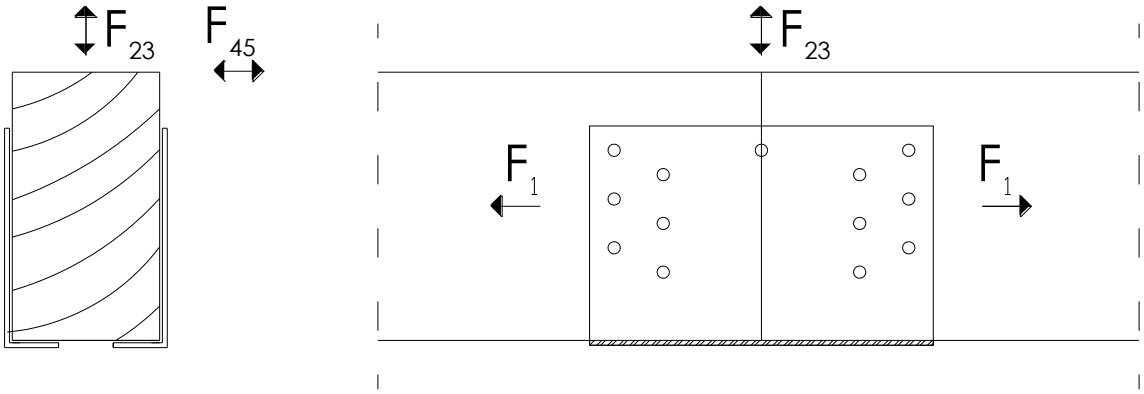
Table A.1 Materials specification

Bracket type	Thickness (mm)	Steel specification	Coating specification
120	2,0	DX 51 D	Z 275
140	2,0	DX 51 D	Z 275
160	2,0	DX 51 D	Z 275
180	2,0	DX 51 D	Z 275
200	2,0	DX 51 D	Z 275
220	2,0	DX 51 D	Z 275
240	2,0	DX 51 D	Z 275
260	2,0	DX 51 D	Z 275
280	2,0	DX 51 D	Z 275
300	2,0	DX 51 D	Z 275
320	2,0	DX 51 D	Z 275
340	2,0	DX 51 D	Z 275
360	2,0	DX 51 D	Z 275

Table A.2 Range of sizes

Bracket type	Height (mm) vertical		Height (mm) horizontal		Width (mm)	
120	121	123	21	23	179	181
140	141	143	21	23	179	181
160	161	163	21	23	179	181
180	181	183	21	23	179	181
200	201	203	21	23	179	181
220	221	223	21	23	179	181
240	241	243	21	23	179	181
260	261	263	21	23	179	181
280	281	283	21	23	179	181
300	301	303	21	23	179	181
320	321	323	21	23	179	181
340	341	343	21	23	179	181
360	361	363	21	23	179	181

Annex B
Characteristic load-carrying capacities



Direction of load

$$F_{1,Rk} = 2 \cdot \frac{F_{v,Rk}}{\sqrt{\left(\frac{e \cdot y_{max}}{I_{p,H}} + \frac{1}{n_H}\right)^2 + \left(\frac{e \cdot x_{max}}{I_{p,H}}\right)^2}} = n_{ef,1} \cdot F_{v,Rk} \quad (1)$$

$$F_{23,Rk} = 2 \cdot \frac{F_{v,Rk}}{\sqrt{\left(\frac{e \cdot x_{max}}{I_{p,H}} + \frac{1}{n_H}\right)^2 + \left(\frac{e \cdot y_{max}}{I_{p,H}}\right)^2}} = n_{ef,23} \cdot F_{v,Rk} \quad (2)$$

$$F_{45,Rk} = \begin{cases} F_{45,S,Rk} & ; \text{bending edge down} \\ \min \begin{cases} F_{45,H,Rk} \\ F_{45,S,Rk} \end{cases} & ; \text{bending edge up} \end{cases} \quad (3)$$

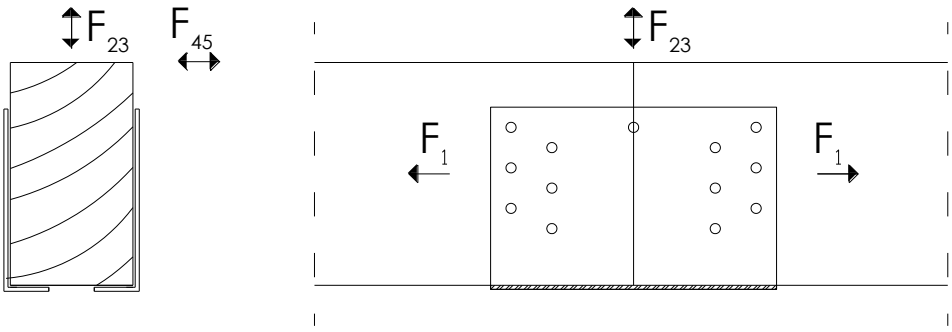
Where:

$F_{v,Rk}$ Characteristic lateral load-carrying capacity of a nail in a steel-to-timber connection with an outer thick steel plate

Table B.1: GAH Alberts cantilever brackets: Characteristic load-carrying capacity $F_{45,Rk}$ and effective number of nails n_{ef} per connection with two brackets

type	results					
	$n_{ef,1}$		$n_{ef,23}$	$F_{45,Rk}$		
	h purlin = H + 20 mm	h purlin = H + 40 mm		bending edge down	bending edge up	
				$F_{45,S,Rk}$	$F_{45,S,Rk}$	$F_{45,H,Rk}$
[-]	[-]	[-]	[-]	[kN]	[kN]	[kN]
120	18,0	11,8	4,25	3,07	10,7	7,6
140	22,0	15,1	6,03	3,49	11,3	9,1
160	26,0	18,5	8,10	3,92	11,8	10,6
180	30,0	22,1	10,4	4,34	12,3	12,1
200	34,0	25,7	13,0	4,76	12,8	13,7
220	38,0	29,4	15,9	5,18	13,3	15,2
240	42,0	33,2	18,9	5,60	13,8	16,7
260	46,0	37,0	22,1	6,03	14,3	18,2
280	50,0	40,8	25,5	6,45	14,8	19,7
300	54,0	44,6	29,1	6,87	15,2	21,3
320	58,0	48,4	32,7	7,29	15,7	22,8
340	62,0	52,3	36,5	7,71	16,1	24,3
360	66,0	56,2	40,4	8,13	16,6	25,8

Definitions of forces, their directions - Beam to beam connection



Fastener specification
The holes on the left and the right side are to be fully nailed.

Cantilever brackets in pairs per connection
The cantilever brackets must be placed at each side opposite to each other, symmetrically to the component axis.

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

Timber splitting
For the lifting force F_{23} it must be checked in accordance with Eurocode 5 or a similar national Timber Code that splitting will not occur.

GAH Alberts cantilever brackets

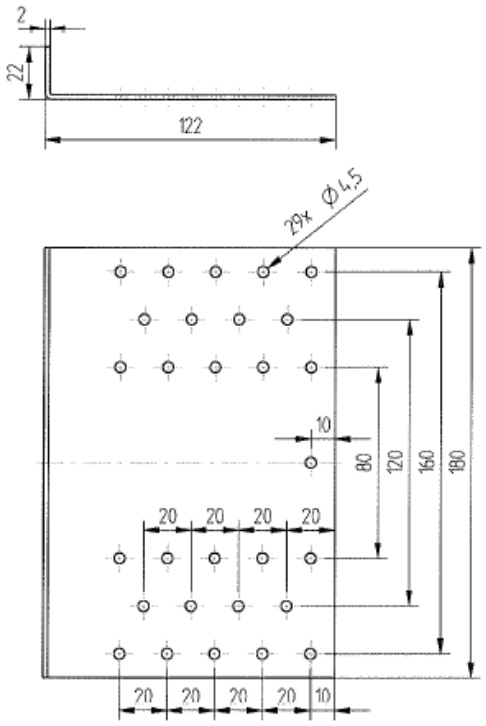


Figure B. 1 Dimensions of cantilever bracket 120

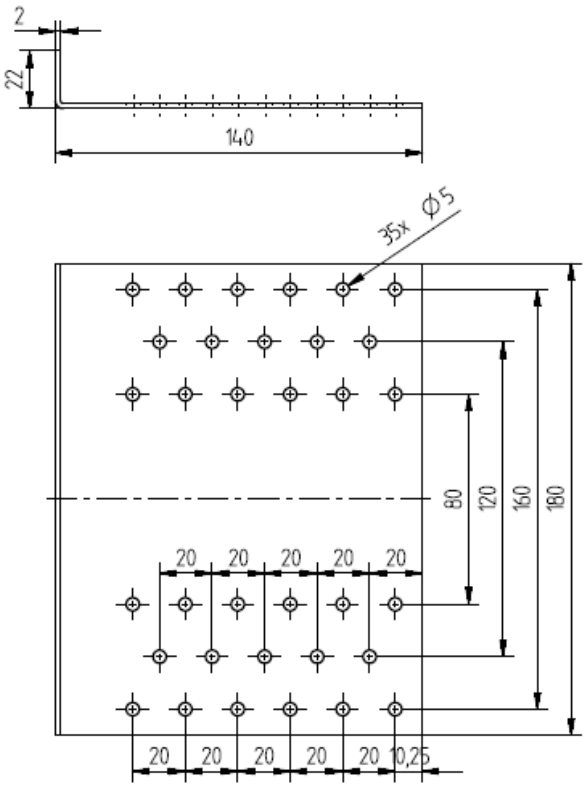


Figure B. 2 Dimensions of cantilever bracket 140

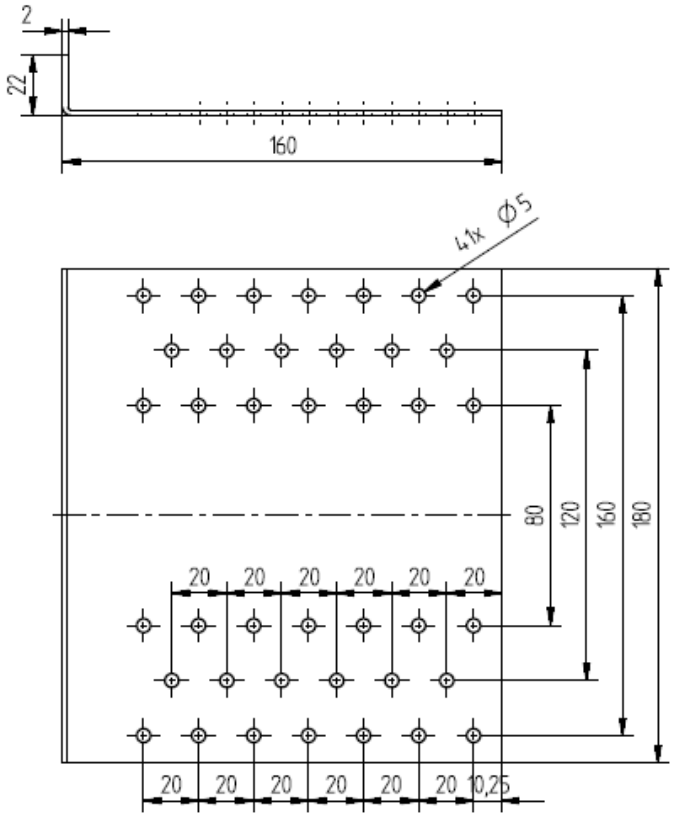


Figure B. 3 Dimensions of cantilever bracket 160

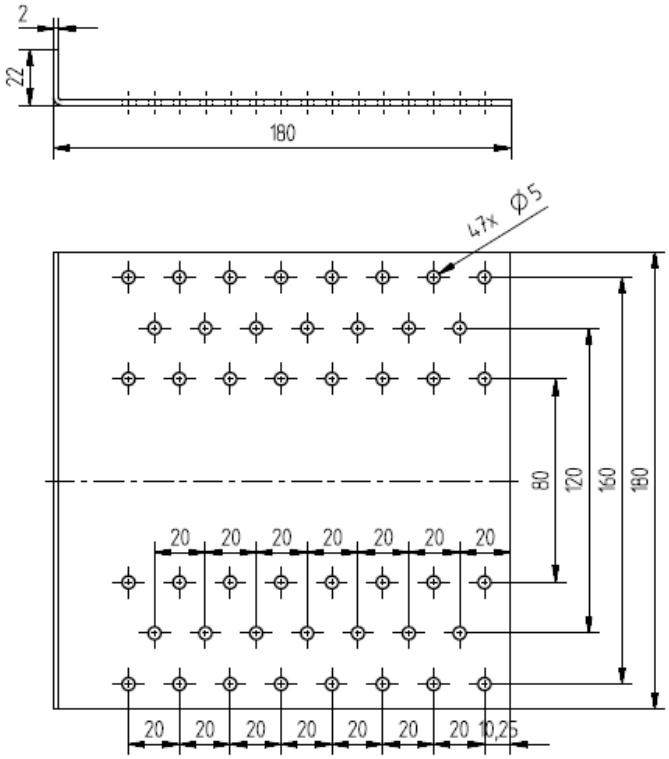


Figure B. 4 Dimensions of cantilever bracket 180

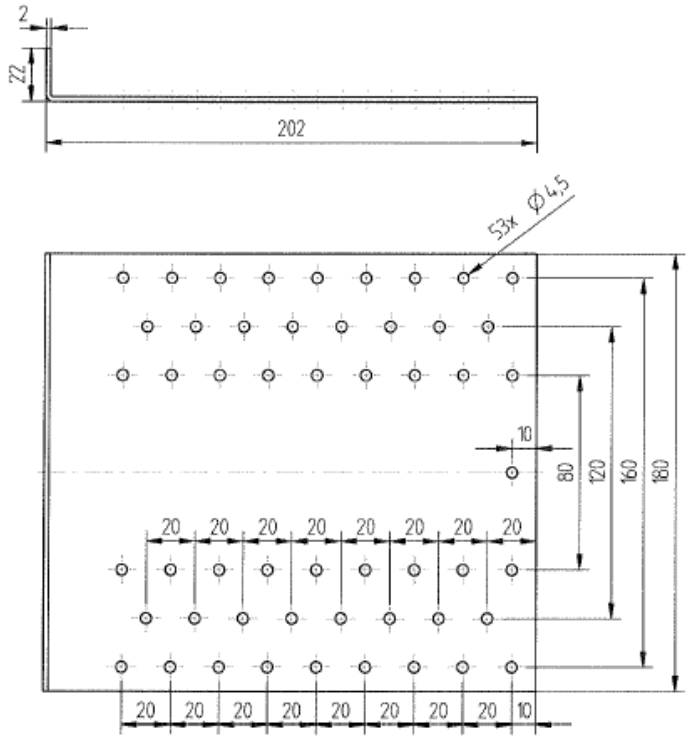


Figure B. 5 Dimensions of cantilever bracket 200

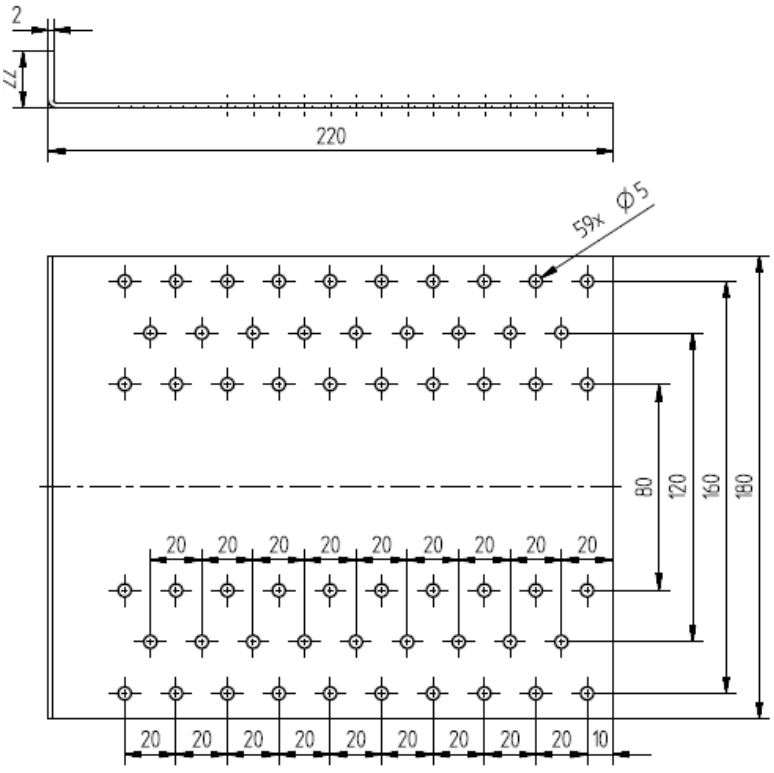


Figure B. 6 Dimensions of cantilever bracket 220

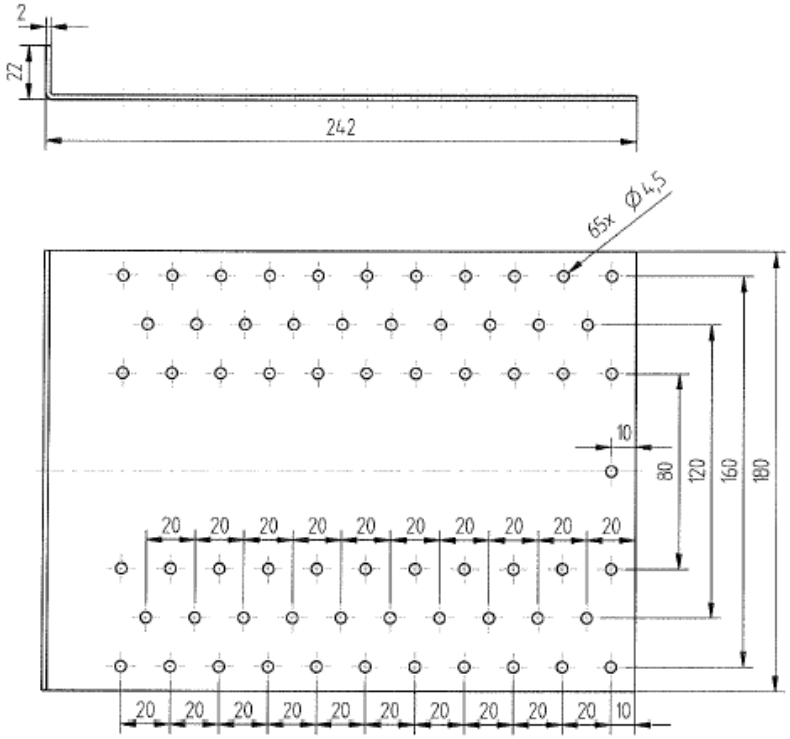


Figure B. 7 Dimensions of cantilever bracket 240

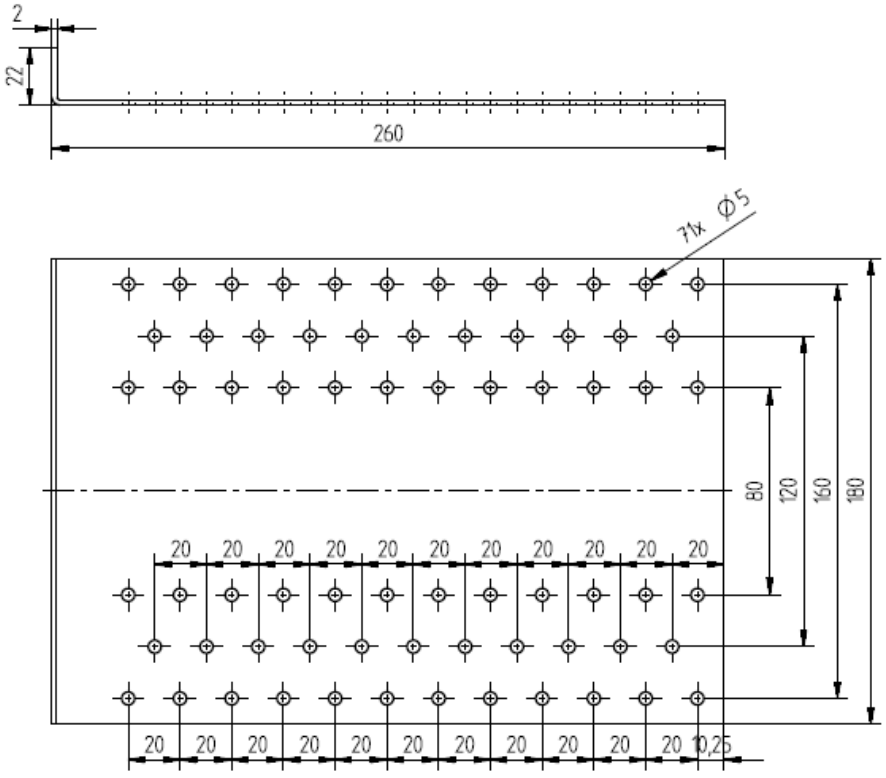


Figure B. 8 Dimensions of cantilever bracket 260

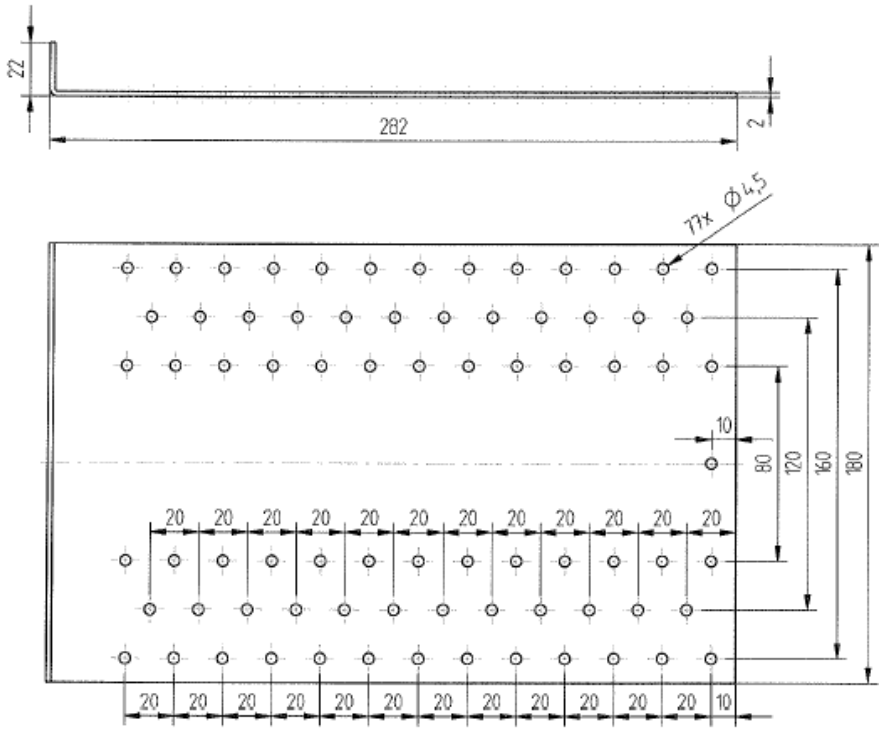


Figure B. 9 Dimensions of cantilever bracket 280

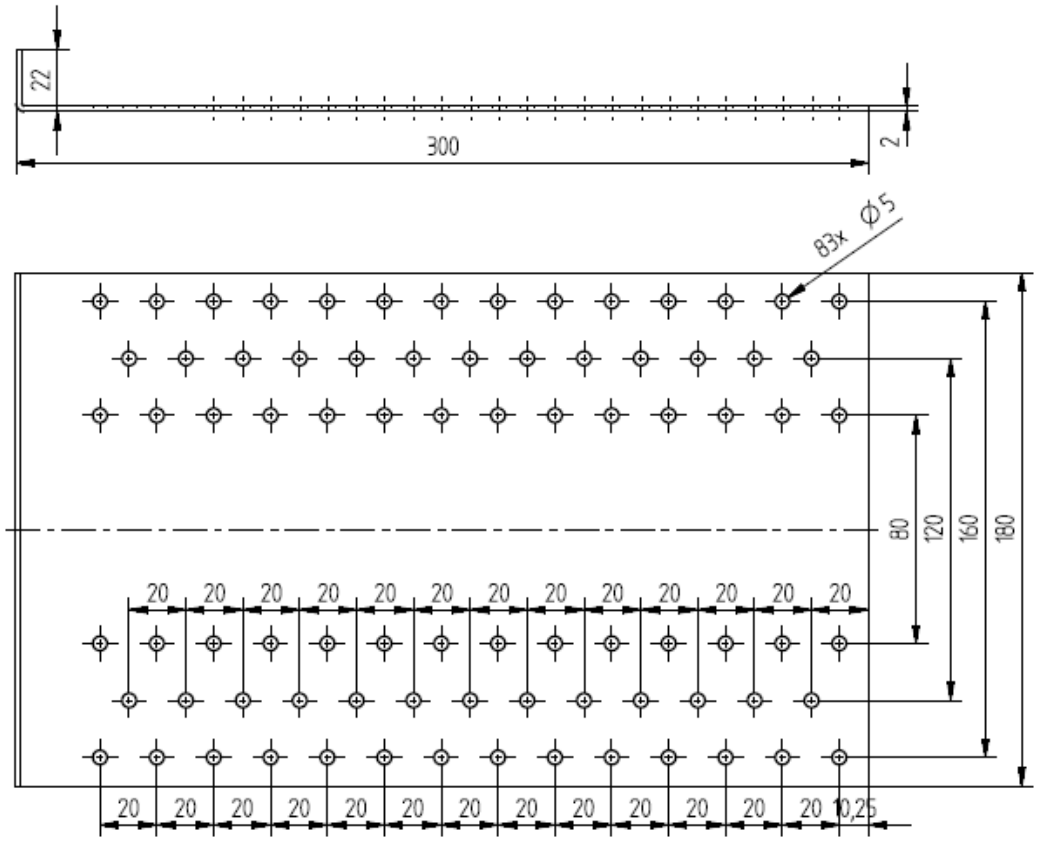


Figure B. 10 Dimensions of cantilever bracket 300

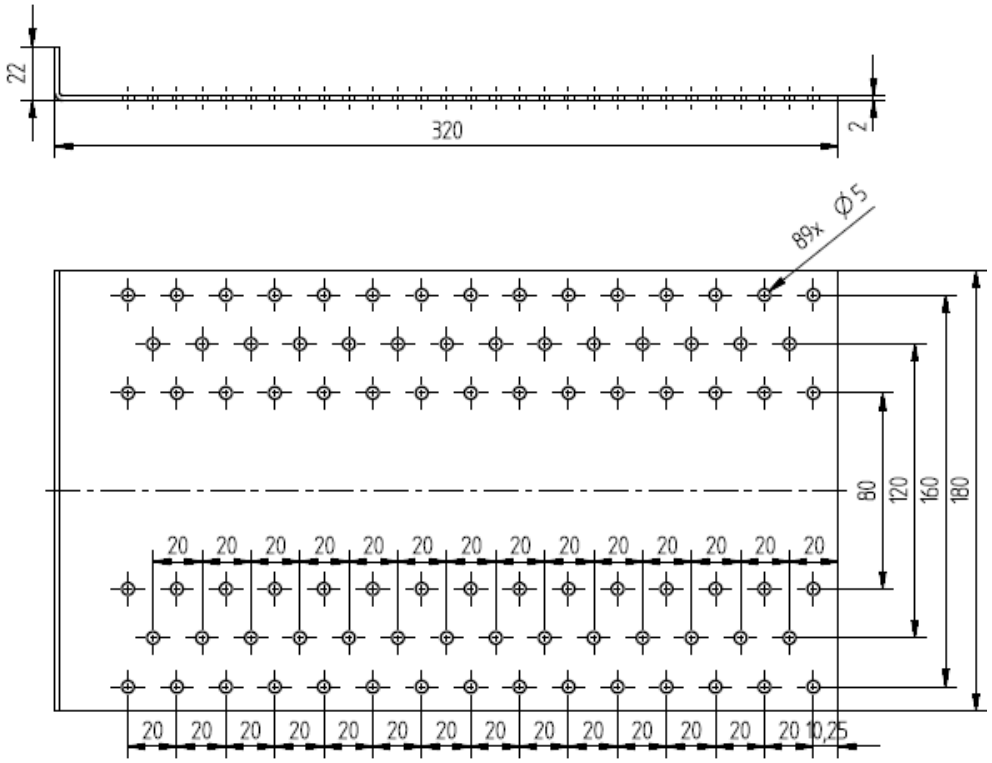


Figure B. 11 Dimensions of cantilever bracket 320

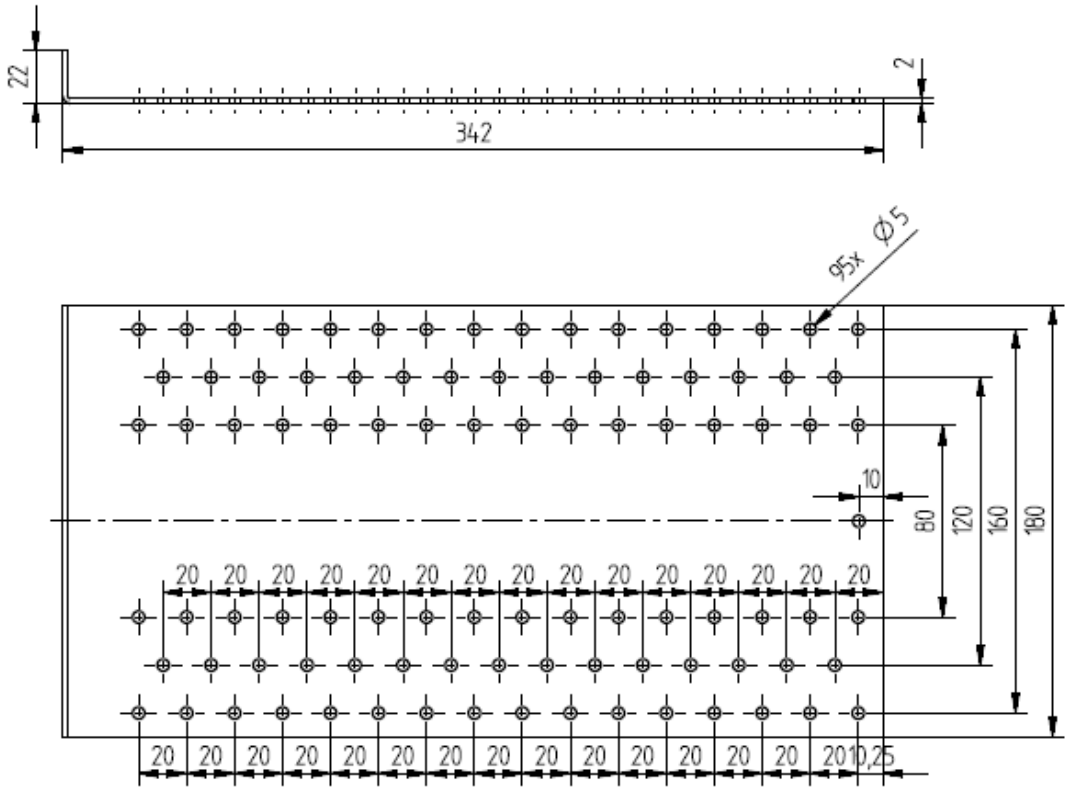


Figure B. 12 Dimensions of cantilever bracket 340

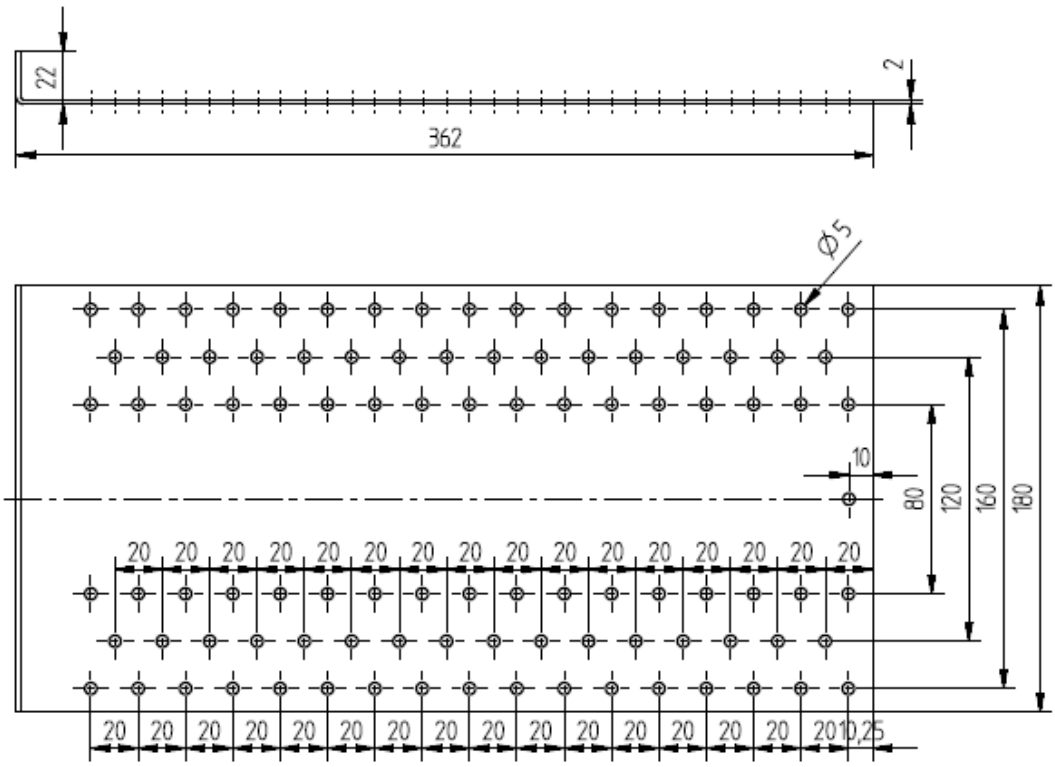


Figure B. 13 Dimensions of cantilever bracket 360

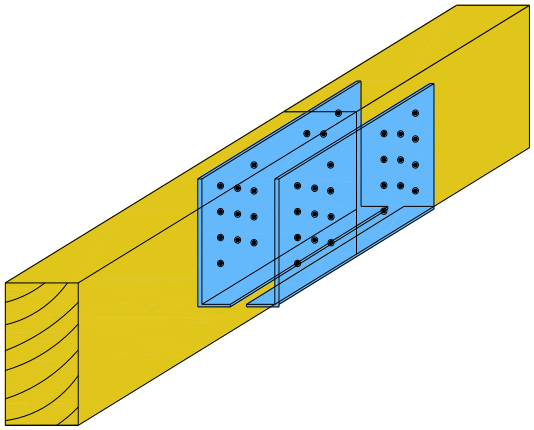


Figure B. 14 Typical installation