ETA-Danmark A/S
Göteborg Plads 1
DK-2150 Nordhavn
Tel. +45 72 24 59 00
Fax +45 72 24 59 04
Internet www.etadanmark.dk

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

MEMBER OF EOTA

European Technical Assessment ETA-13/0349 of 2018-05-28

I General Part

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

Trade name of the construction product:	FraP cantilever brackets type W and type B
Product family to which the above construction product belongs:	Three-dimensional nailing plate (cantilever brackets to be used in timber to timber connections)
Manufacturer:	FraP Metall GmbH Triftstrasse 21B D-16348 Wandlitz Tel. +49 33 397 64 313 Fax +49 33 397 64 314 Internet www.frap-metall.de
Manufacturing plant:	UAB Toga FMG Obeniu k. Kietaviskiu sen. LT-21413 Elektrénu sav.
This European Technical Assessment contains:	24 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 previous ETA with the same number issued on 2013-05-28 and expiry on 2018-05-28

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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
FraP cantilever brackets types B and W 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 $A_{80} \geq 19\%$ or from stainless steel (1.4301, 1.4401, 1.4541, 1.4571 or 1.4016 according to EN 10088) with equivalent characteristics. Dimensions, hole positions and typical installations are shown in Annex B. FraP cantilever brackets are made from steel with tolerances according to EN 10143.

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 according to EN 338 / EN 14081,
- Glulam 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:

For load direction F_{23}: $k_{dens} = \left(\frac{\rho_k}{350} \right)^{0,5}$

For load direction F_{45}: $k_{dens} = \left(\frac{\rho_k}{350} \right)^{2}$

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 cantilever brackets 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.

The cantilever brackets may 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 with similar or better characteristic yield and ultimate strength is employed.

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.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the connectors 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*) (BWR1)	
Characteristic load-carrying capacity	See Annex B
Stiffness	No performance assessed
Ductility in cyclic testing	No performance assessed
3.2 Safety in case of fire (BWR2)	
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 (BWR3)	
Influence on air quality	The product does not contain/release dangerous substances specified in TR 034, dated March 2012 0**)
3.7 Sustainable use of natural resources (BWR7)	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 3.9 – 3.11.

**) 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.

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.

3.9 Mechanical resistance and stability

See annex B for the characteristic load-carrying capacity in the different directions F_{23} 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.

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

3.10 Aspects related to the performance of the product

3.10.1 Corrosion protection in service class 1, 2 and 3.

In accordance with ETAG 015 the concealed beam hangers have a zinc coating weight of min Z275. The steel employed is pre-galvanized steel Grade DX51D + Z275 according to EN 10346:2009 with $R_e \geq 250$ N/mm², $R_m \geq 330$ N/mm² and $A_{80} \geq 19\%$ or from stainless steel (1.4301, 1.4401, 1.4541, 1.4571 or 1.4016 according to EN 10088) with equivalent characteristics.

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

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

Wane under the flaps of the angle bracket is allowed provided it does not occur under the nails. Wane can reduce the load-bearing capacity of the connection.

A gap between the connector and the timber member is not allowed. However, where the angle bracket is used for a connection between a beam and a column a gap of 5 mm is allowed.

4 Attestation 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 2018-05-28 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
W 120	2,0	DX 51 D or stainless steel	Z 275
W 140	2,0	DX 51 D or stainless steel	Z 275
W 160	2,0	DX 51 D or stainless steel	Z 275
W 180	2,0	DX 51 D or stainless steel	Z 275
W 200	2,0	DX 51 D or stainless steel	Z 275
W 220	2,0	DX 51 D or stainless steel	Z 275
W 240	2,0	DX 51 D or stainless steel	Z 275
W 260	2,0	DX 51 D or stainless steel	Z 275
B 125	2,0	DX 51 D or stainless steel	Z 275
B 150	2,0	DX 51 D or stainless steel	Z 275
B 175	2,0	DX 51 D or stainless steel	Z 275
B 200	2,0	DX 51 D or stainless steel	Z 275
* $R_e \geq 250$ N/mm², $R_m \geq 330$ N/mm² and $A_{80} \geq 19\%$			

Table A.2 Range of sizes

Bracket type	Height (mm) vertical		Height (mm) horizontal		Width (mm)		Thickness (mm)	Hole positions (mm)
W 120	121	123	21	23	179	181	± 0,13	± 0,5
W 140	141	143	21	23	179	181	± 0,13	± 0,5
W 160	161	163	21	23	179	181	± 0,13	± 0,5
W 180	181	183	21	23	179	181	± 0,13	± 0,5
W 200	201	203	21	23	179	181	± 0,13	± 0,5
W 220	221	223	21	23	179	181	± 0,13	± 0,5
W 240	241	243	21	23	179	181	± 0,13	± 0,5
W 260	261	263	21	23	179	181	± 0,13	± 0,5
B 125	129	131	26	29	179	181	± 0,13	± 0,5
B 150	154	158	29	31	179	181	± 0,13	± 0,5
B 175	179	183	29	35	179	181	± 0,13	± 0,5
B 200	204	206	29	35	179	181	± 0,13	± 0,5

Table A.3 Fastener specification

Nail type	**Nail size (mm)**		**Finish**
According to EN 14592	Diameter	Length	
Threaded nail	4,0	50	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 cantilever brackets have been determined based on the use of connector nails 4,0 x 50 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, $t_{pen} \geq 40$ mm

Based on tests by Versuchsanstalt für Stahl, Holz und Steine, Karlsruhe Institute of Technology, 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.

FraP cantilever brackets

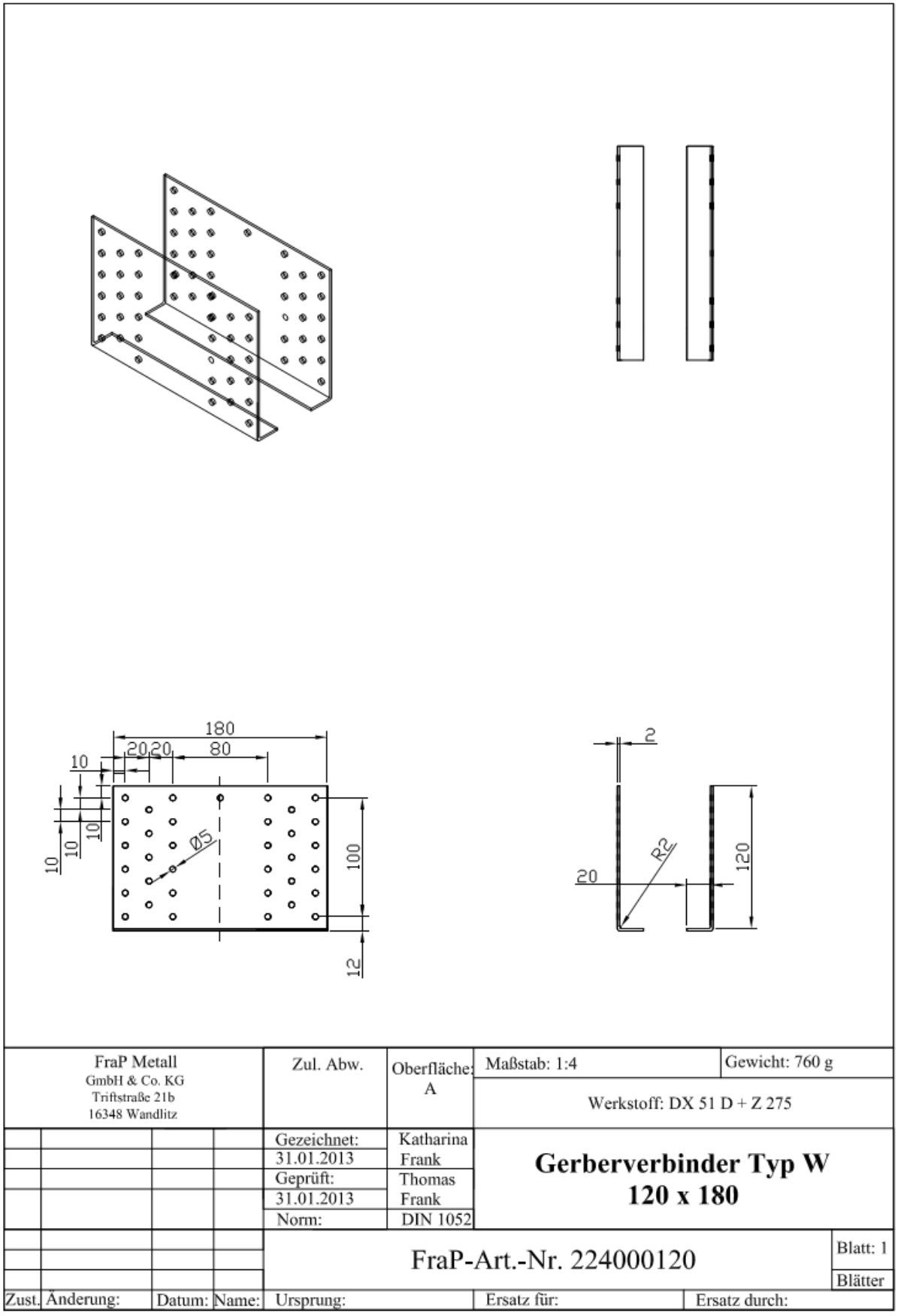
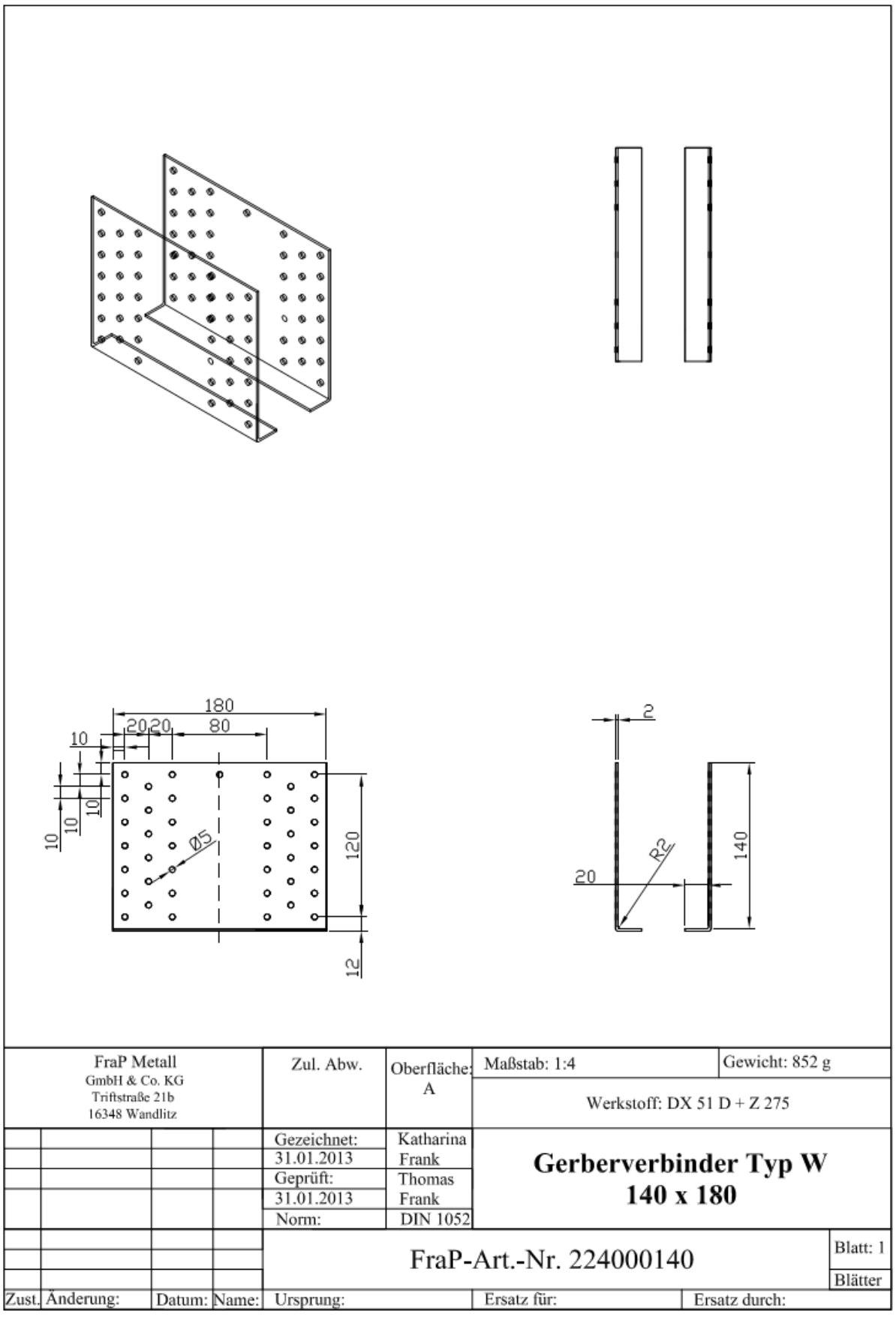


Figure A. 1 Dimensions of cantilever bracket W 120



FraP Metall GmbH & Co. KG Triftstraße 21b 16348 Wandlitz				Zul. Abw.	Oberfläche: A	Maßstab: 1:4	Gewicht: 852 g
						Werkstoff: DX 51 D + Z 275	
				Gezeichnet:	Katharina Frank	**Gerberverbinder Typ W 140 x 180**	
				31.01.2013			
				Geprüft:	Thomas Frank		
				31.01.2013			
				Norm:	DIN 1052		
				FraP-Art.-Nr. 224000140			Blatt: 1 Blätter
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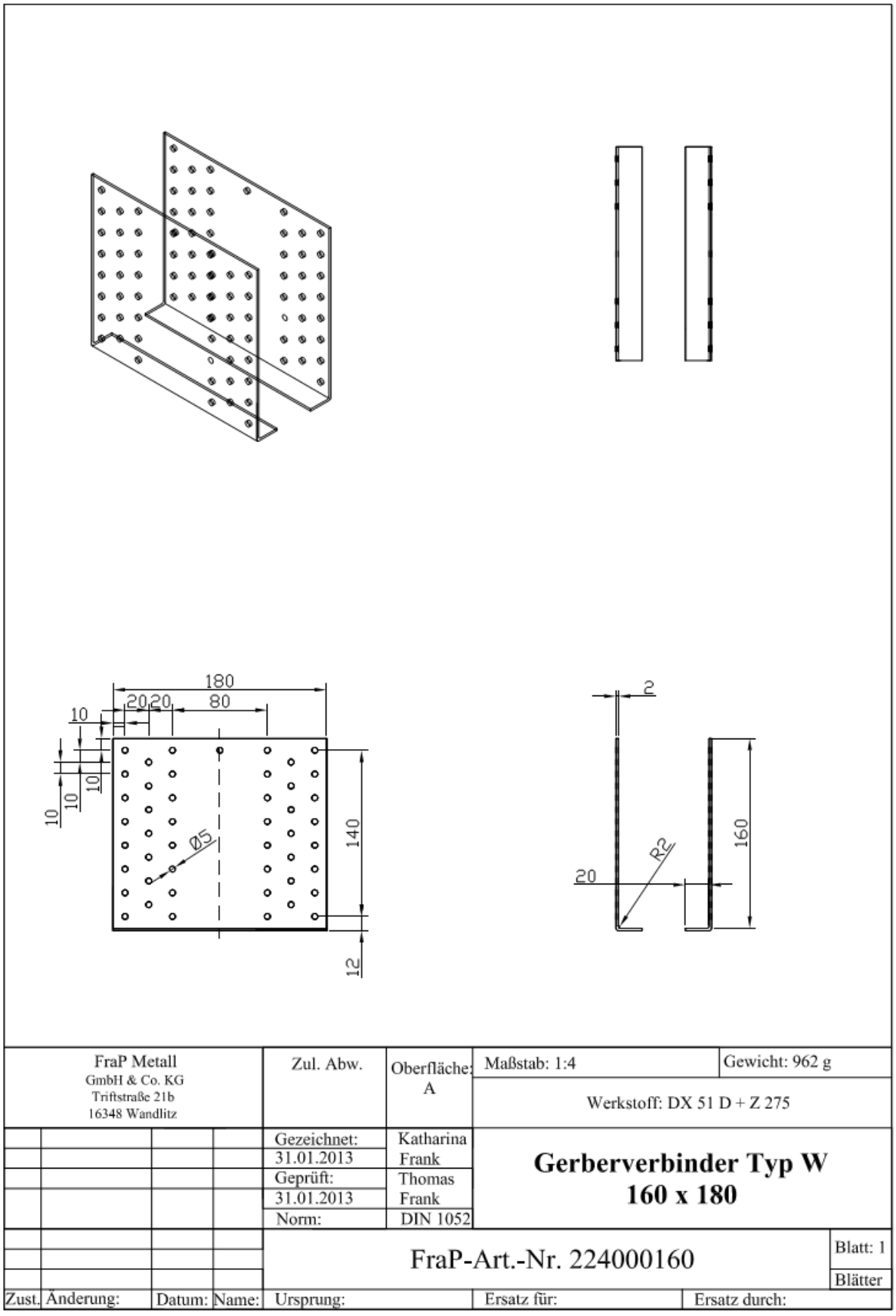
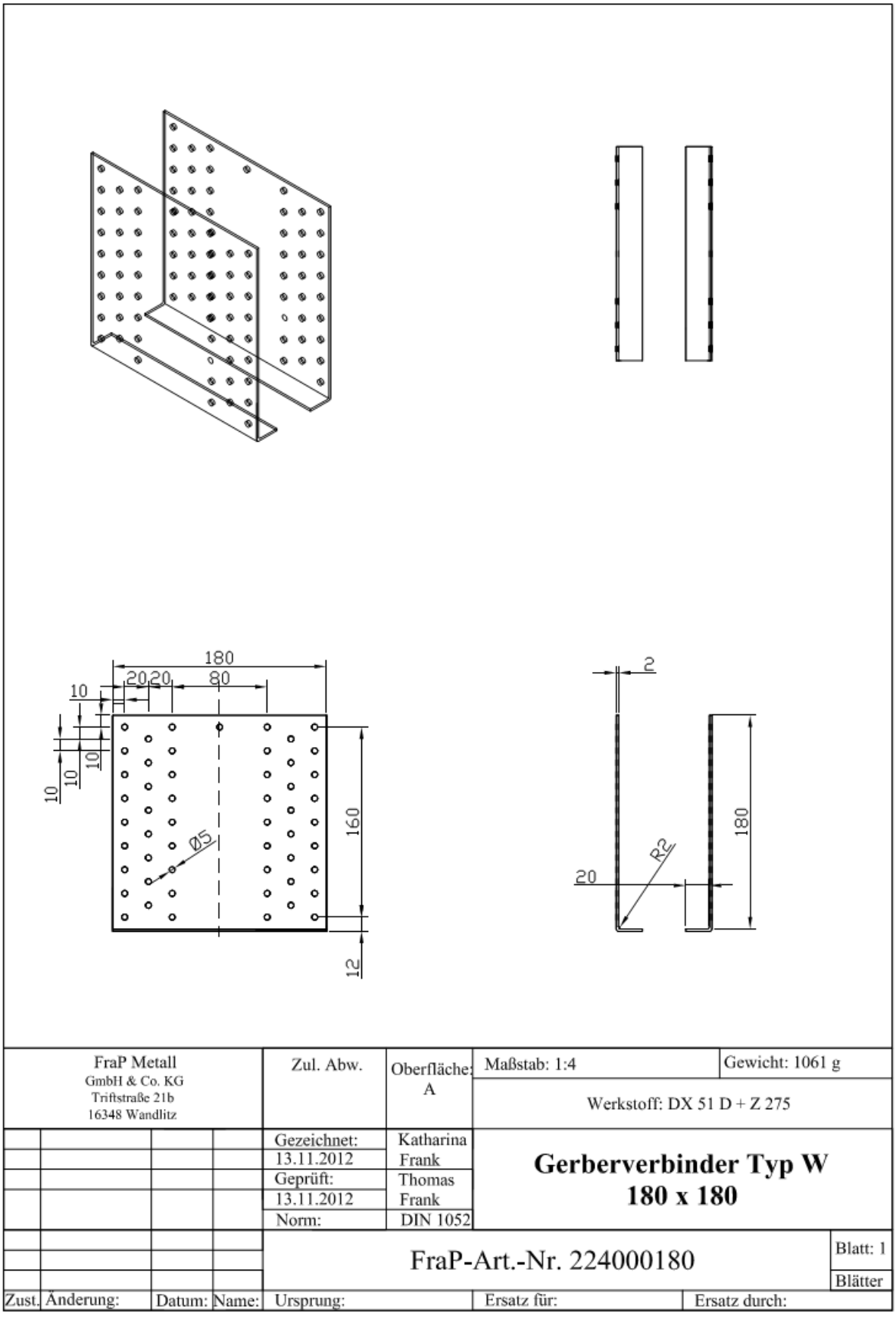
Figure A. 2 Dimensions of cantilever bracket W 140



FraP Metall GmbH & Co. KG Triftstraße 21b 16348 Wandlitz				Zul. Abw.	Oberfläche: A	Maßstab: 1:4	Gewicht: 962 g
						Werkstoff: DX 51 D + Z 275	
				Gezeichnet:	Katharina Frank	**Gerberverbinder Typ W 160 x 180**	
				31.01.2013			
				Geprüft:	Thomas Frank		
				31.01.2013			
				Norm:	DIN 1052		
				FraP-Art.-Nr. 224000160			Blatt: 1 Blätter
Zust.	Änderung:	Datum:	Name:	Ursprung:		Ersatz für:	Ersatz durch:

Figure A. 3 Dimensions of cantilever bracket W 160



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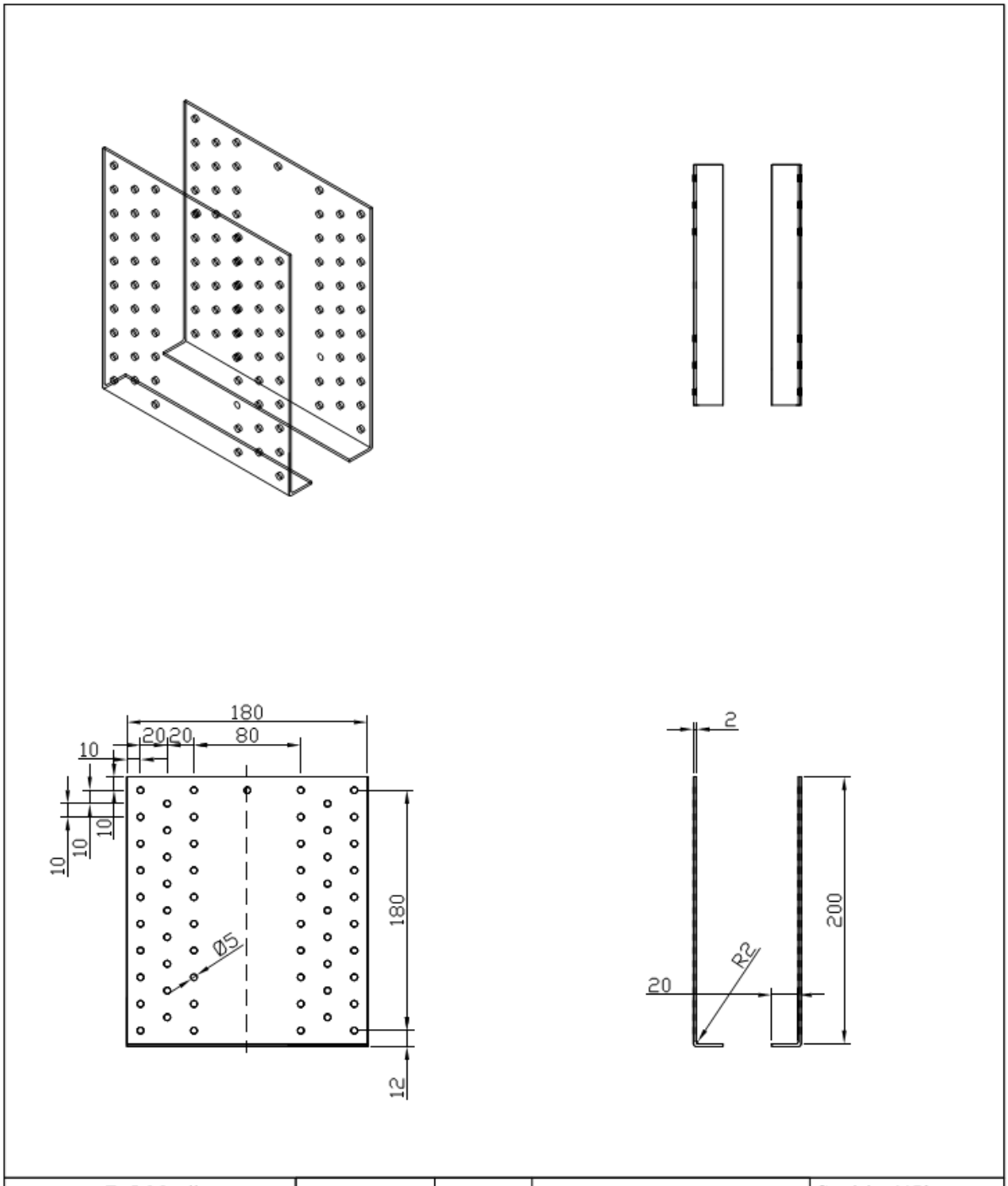
				Gezeichnet:	Katharina Frank	**Gerberverbinder Typ W 180 x 180**	
				13.11.2012			
				Geprüft:	Thomas Frank		
				13.11.2012			
				Norm:	DIN 1052		
				FraP-Art.-Nr. 224000180			Blatt: 1
							Blätter
Zust.	Änderung:	Datum:	Name:	Ursprung:		Ersatz für:	Ersatz durch:

Figure A. 4 Dimensions of cantilever bracket W 180



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						Werkstoff: DX 51 D + Z 275	
				Gezeichnet: 13.11.2012	Katharina Frank	**Gerberverbinder Typ W 200 x 180**	
				Geprüft: 13.11.2012	Thomas Frank		
				Norm:	DIN 1052		
				FraP-Art.-Nr. 224000200			Blatt: 1 Blätter
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Figure A. 5 Dimensions of cantilever bracket W 200

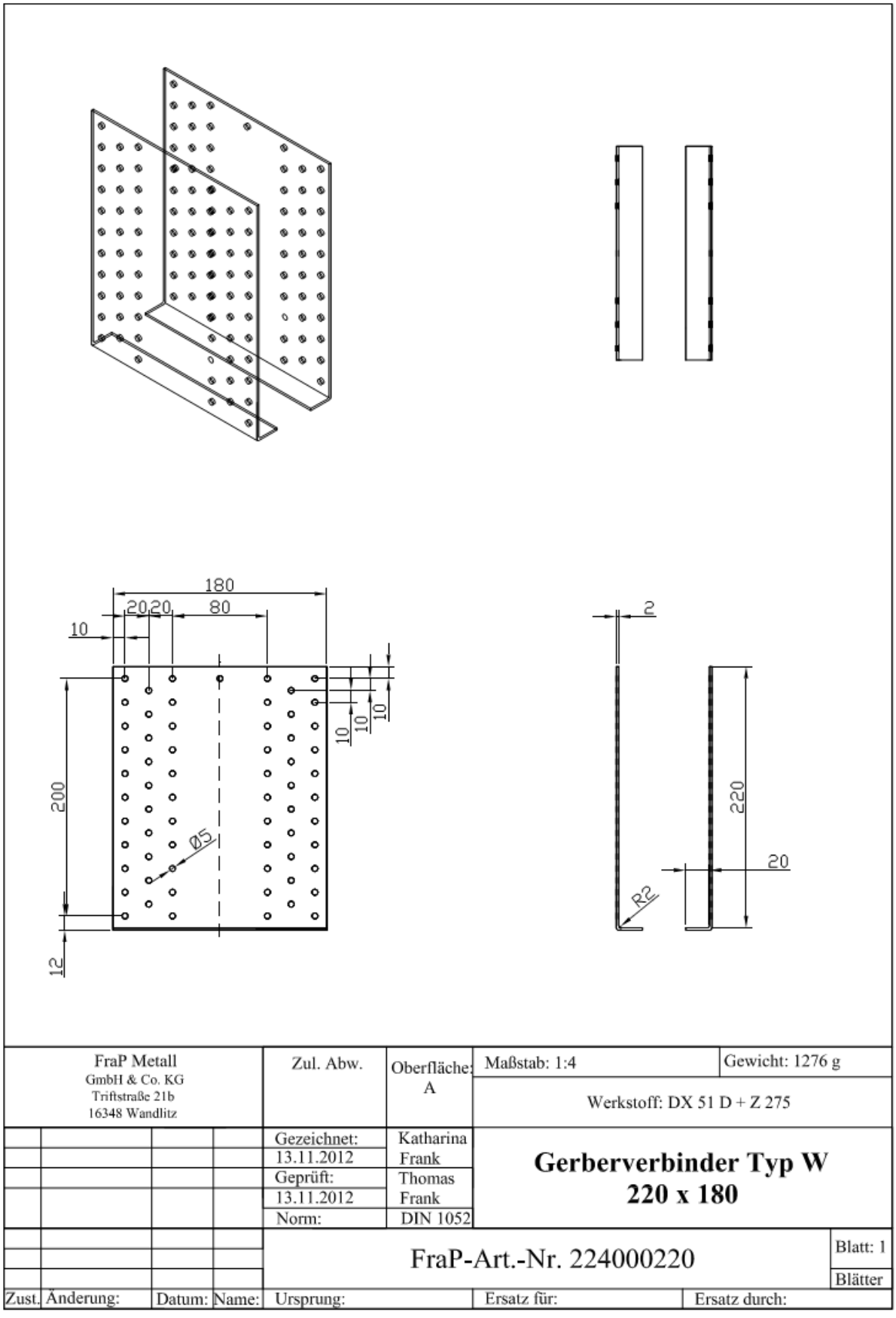
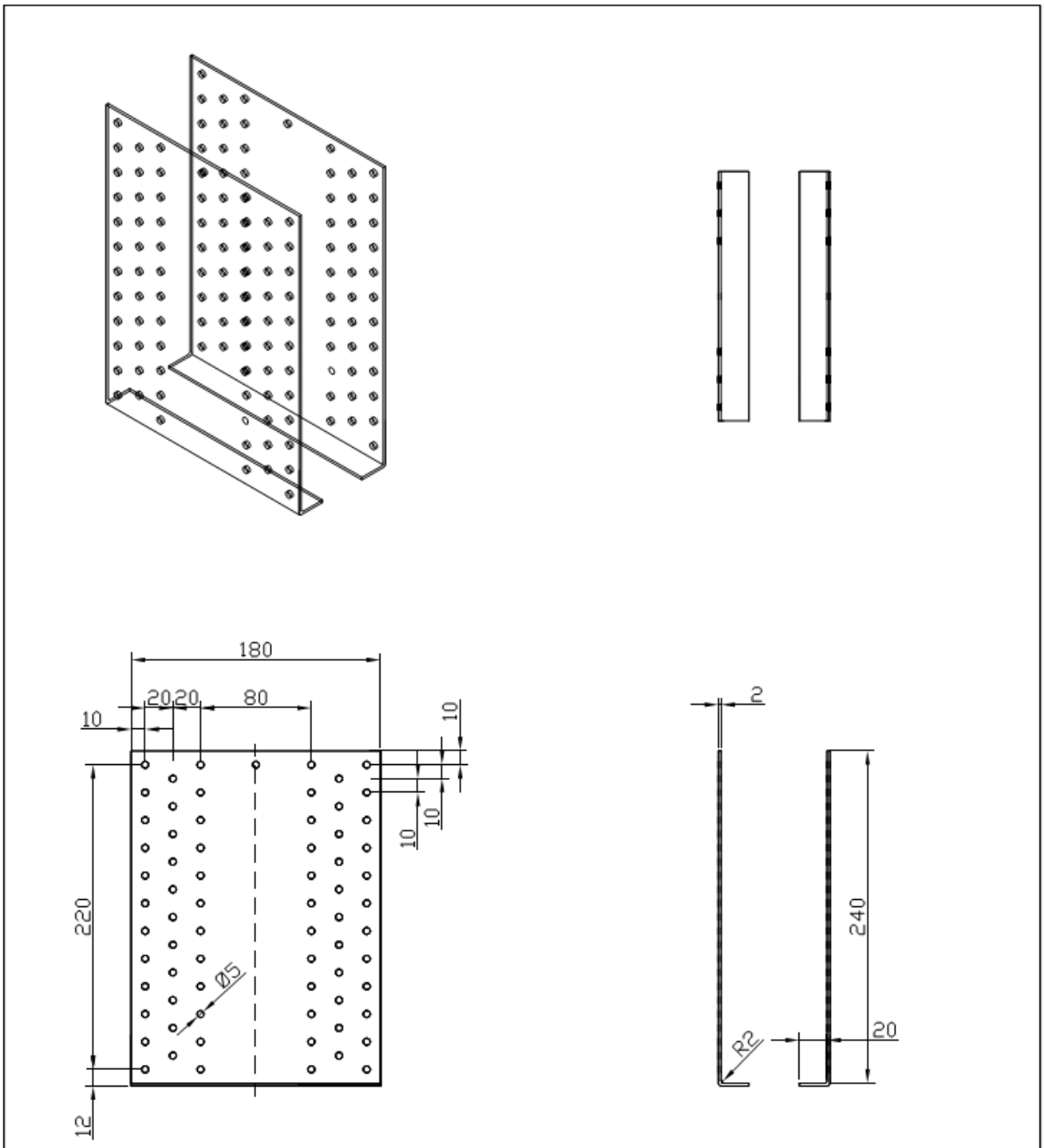


Figure A. 6 Dimensions of cantilever bracket W 220



FraP Metall GmbH & Co. KG Triftstraße 21b 16348 Wandlitz				Zul. Abw.	Oberfläche: A	Maßstab: 1:4 / Gewicht:1392 g Werkstoff: DX 51 D + Z 275
				Gezeichnet:	Katharina Frank	**Gerberverbinder Typ W 240 x 180**
				13.11.2012		
				Geprüft:	Thomas Frank	
				13.11.2012		
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				FraP-Art.-Nr. 224000240		Blatt: 1 Blätter
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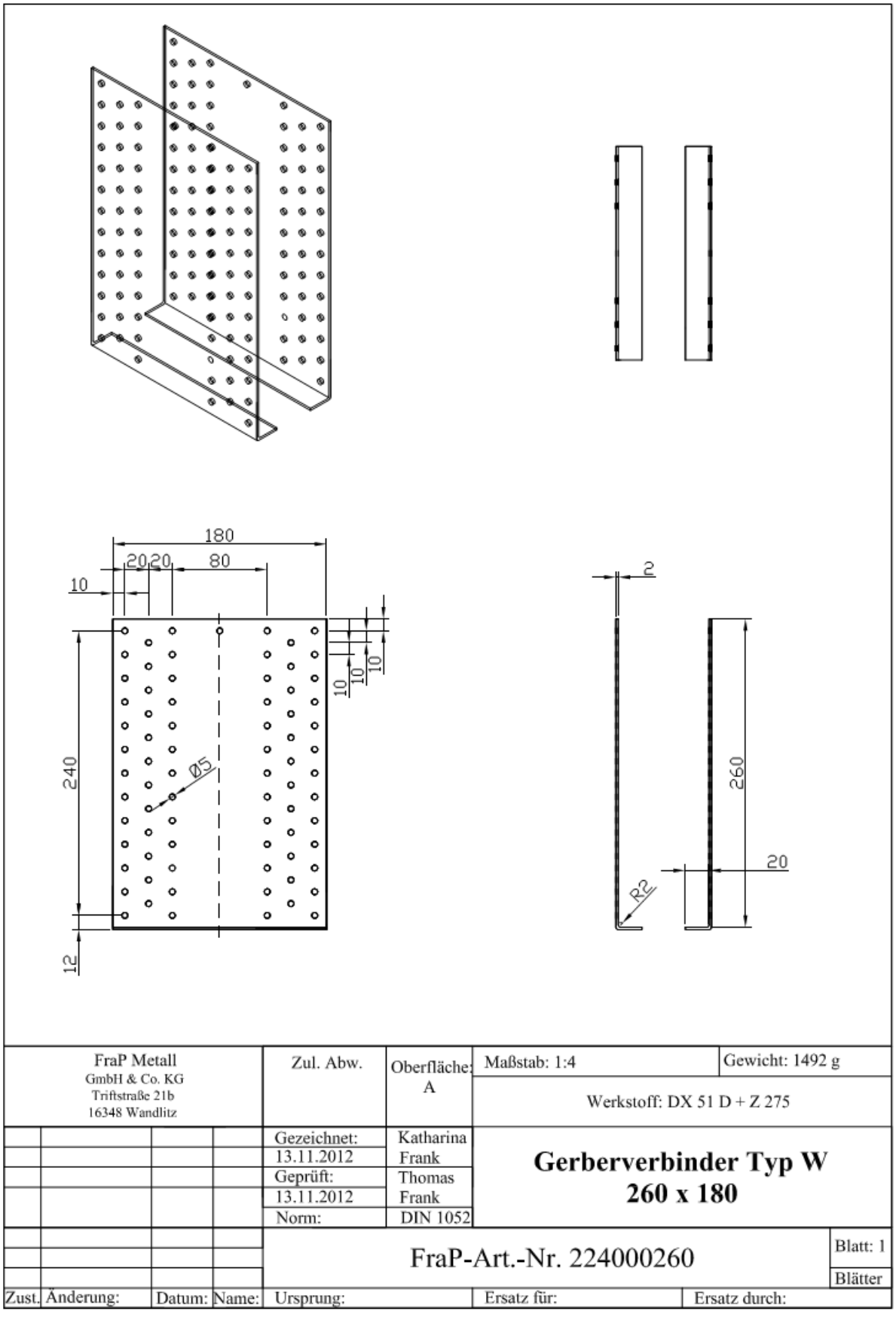
Figure A. 7 Dimensions of cantilever bracket W 240



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						Werkstoff: DX 51 D + Z 275	
				Gezeichnet:	Katharina Frank	**Gerberverbinder Typ W 260 x 180**	
				13.11.2012			
				Geprüft:	Thomas Frank		
				13.11.2012			
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				FraP-Art.-Nr. 224000260			Blatt: 1 Blätter
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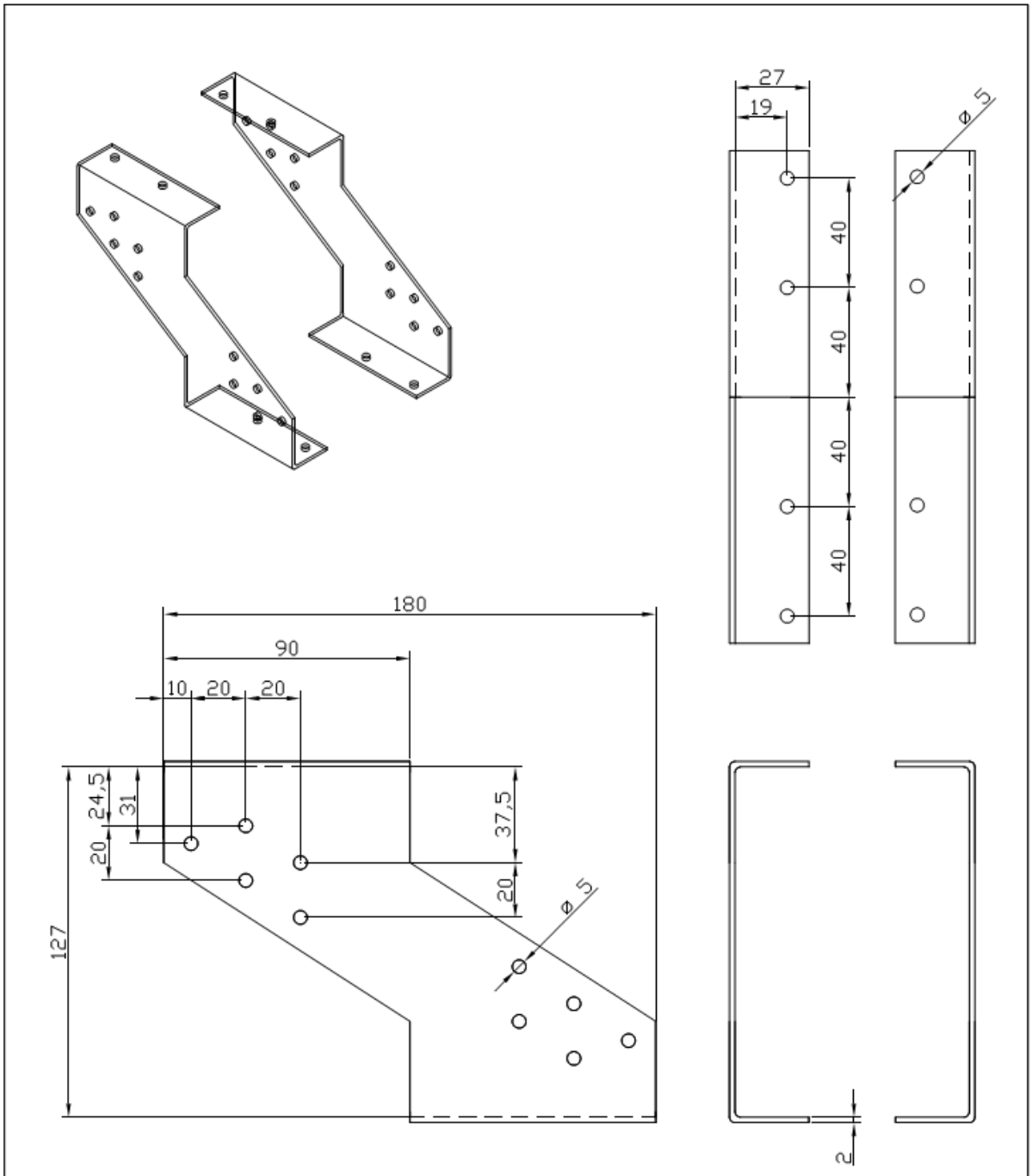
Figure A. 8 Dimensions of cantilever bracket W 260



FraP Metall GmbH & Co. KG Triftstraße 21b 16348 Wandlitz				Zul. Abw.	Oberfläche: A	Maßstab: 1:2	Gewicht: 462 g
						Werkstoff: DX 51 D + Z 275	
				Gezeichnet:	Tobias Frank	**Gerberverbinder Typ B 125**	
				14.11.2012			
				Geprüft:	Thomas Frank		
				14.12.2012			
				Norm:	DIN 1052		
				FraP-Art.-Nr. 224125902			Blatt: 1 Blätter
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Figure A. 9 Dimensions of cantilever bracket B 125

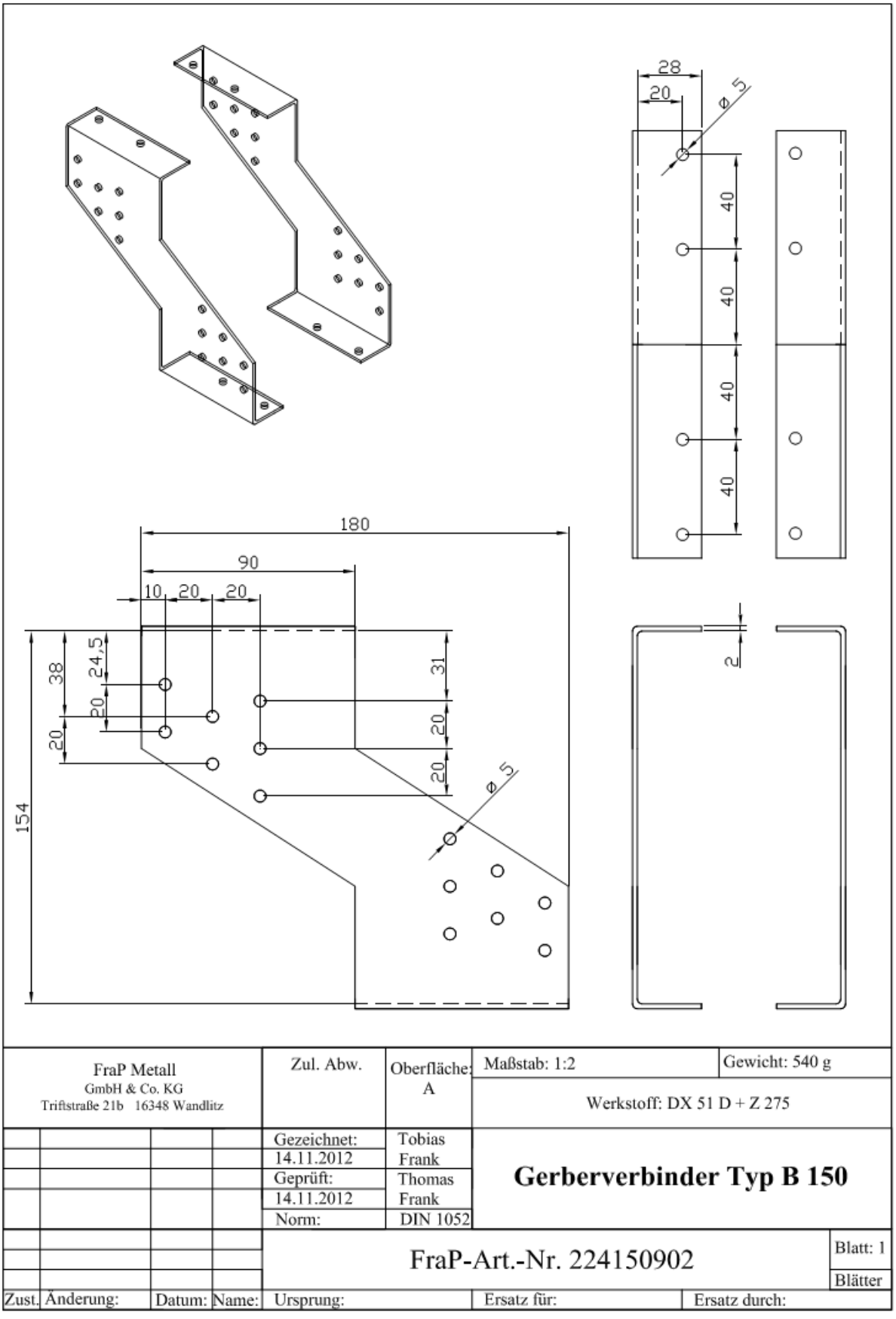
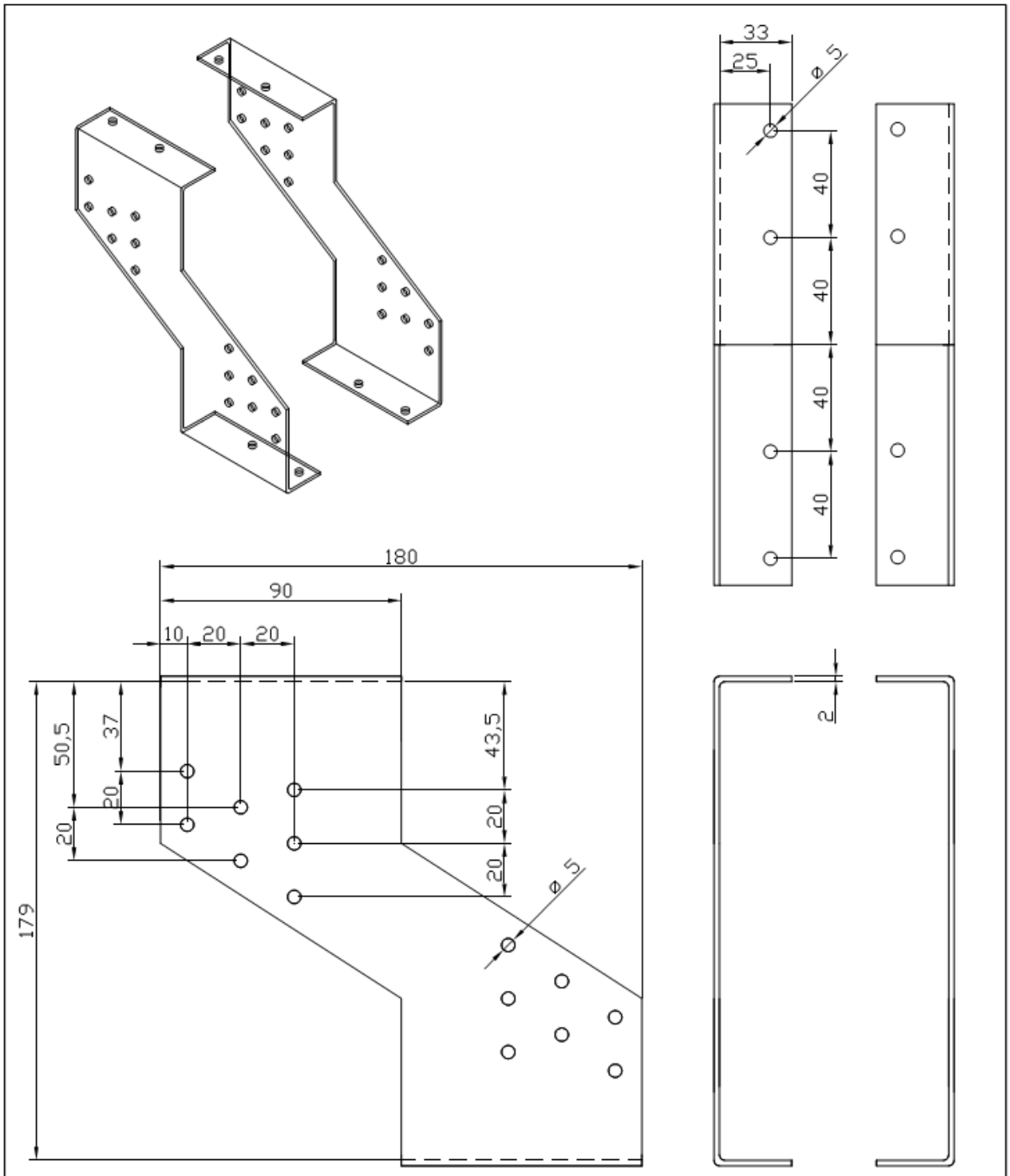
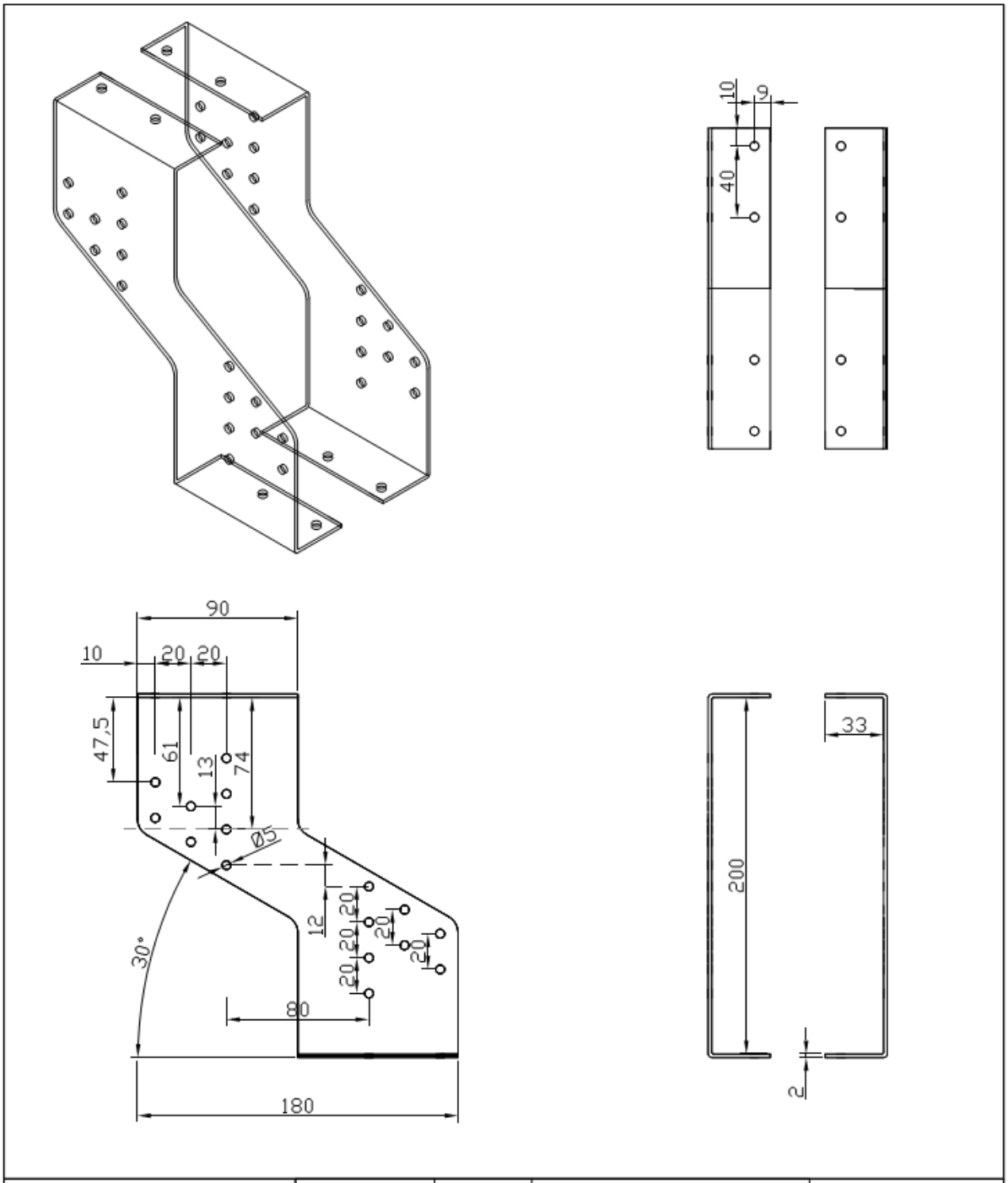


Figure A. 10 Dimensions of cantilever bracket B 150



FraP Metall GmbH & Co. KG Triftstraße 21b 16348 Wandlitz			Zul. Abw.	Oberfläche: A	Maßstab: 1:2 / Gewicht: 606 g Werkstoff: DX 51 D + Z 275
			Gezeichnet:	Tobias Frank	**Gerberverbinder Typ B 175**
			14.11.2012		
			Geprüft:	Thomas Frank	
			14.11.2012		
			Norm:	DIN 1052	
			FraP-Art.-Nr. 224175902		Blatt: 1 Blätter
Zust.	Änderung:	Datum: Name:	Ursprung:	Ersatz für:	Ersatz durch:

Figure A. 11 Dimensions of cantilever bracket B 175



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				14.11.2012			
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Figure A. 12 Dimensions of cantilever bracket B 200

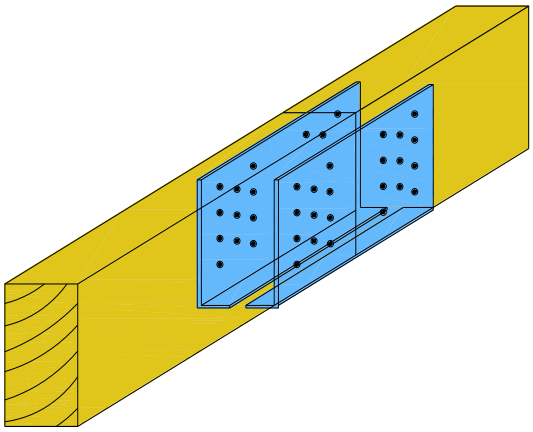
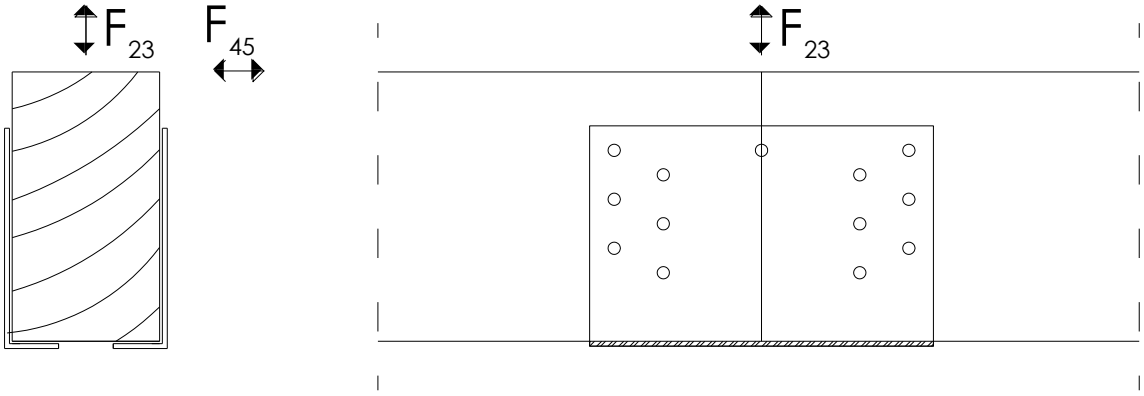


Figure A. 13 Typical installation

Annex B

B.1 Characteristic load-carrying capacities for cantilever brackets type W



Direction of load for type W

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

$$F_{45,Rk} = \begin{cases} F_{45,S,Rk} & ; \text{bending edge down} \\ \min \begin{cases} F_{45,T,Rk} \\ F_{45,S,Rk} \end{cases} & ; \text{bending edge up} \end{cases} \quad (2)$$

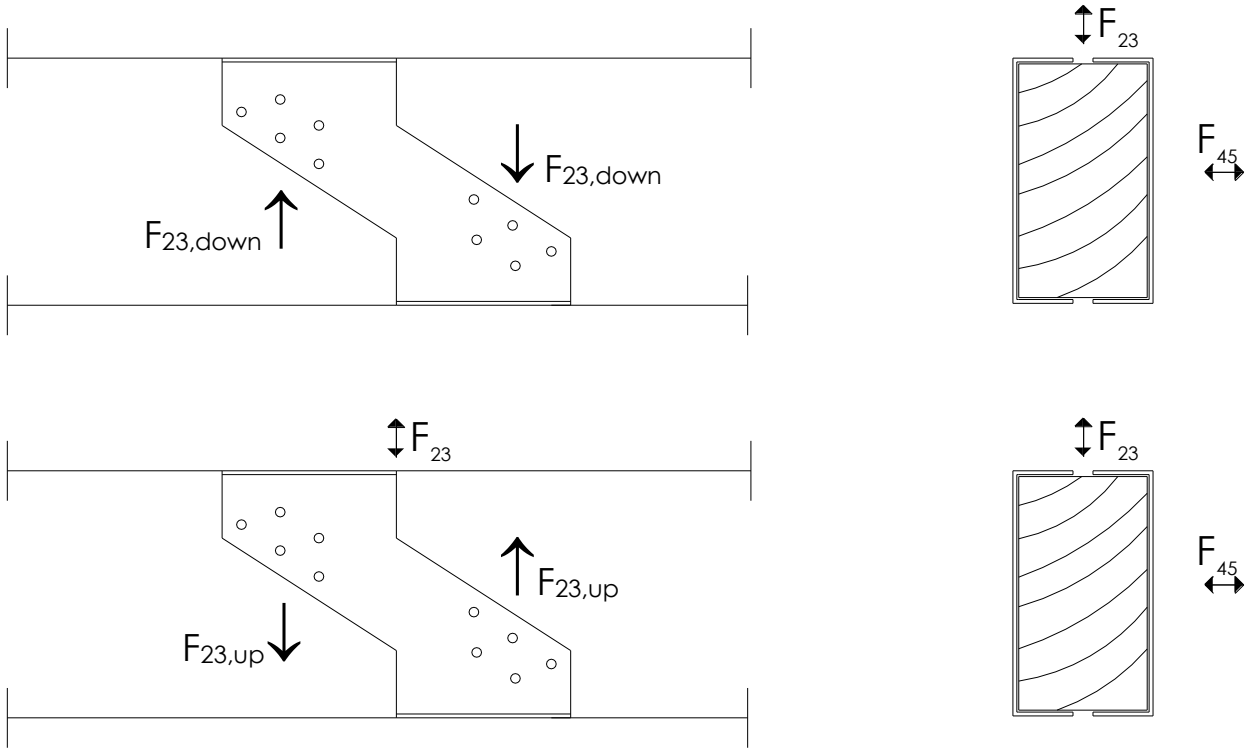
Where:

$F_{v,Rk}$ Characteristic load-carrying capacity of a nail loaded in shear

Table B.1: FraP cantilever brackets type W: Characteristic load $F_{45,Rk}$ for ρ_k = 350 kg/m³ and effective number of nails n_{ef}

type	$\mathbf{n_{ef,23}}$	$\mathbf{F_{45,Rk}}$	
		bending edge down	bending edge up
		$F_{45,S,Rk}$	$F_{45,T,Rk}$
[-]	[-]	[kN]	[kN]
W 120	4,25	3,17	9,80
W 140	6,03	3,60	11,8
W 160	8,10	4,04	12,5
W 180	10,5	4,47	12,9
W 200	13,1	4,90	13,3
W 220	15,9	5,34	13,7
W 240	18,9	5,77	14,2
W 260	22,1	6,21	14,6

B.2 Characteristic load-carrying capacities for cantilever brackets type B



Directions of load for type B

$$F_{23,Rk} = \begin{cases} 2 \cdot \dfrac{F_{v,Rk}}{\sqrt{\left(\dfrac{e \cdot x_{max}}{I_p} + \dfrac{1}{n}\right)^2 + \left(\dfrac{e \cdot z_{max}}{I_p}\right)^2}} = n_{ef,23,down} \cdot F_{v,Rk} \text{ for loading down} \\ F_{90,Rk,23} \text{ for loading up} \end{cases} \quad (3)$$

$$F_{45,Rk} = n \cdot F_{ax,Rk} \quad (4)$$

Where:

$F_{v,Rk}$ Characteristic load-carrying capacity of a nail loaded in shear

Table B.2: FraP cantilever brackets type B: Characteristic load-carrying capacity for ρ_k = 350 kg/m³ and effective number of nails n_{ef}

type	$\mathbf{n_{ef,23,down}}$	$\mathbf{F_{23,Rk}}$		$\mathbf{F_{45,Rk}}$
		$\mathbf{F_{Rk,23,down}}$	$\mathbf{F_{Rk,23,up}}$	$\mathbf{F_{45,S,Rk}}$
	[-]	[kN]	[kN]	[kN]
B 125	4,69	8,78	6,40	3,92
B 150	6,27	11,7	9,77	5,88
B 175	7,26	13,6	10,4	5,88
B 200	8,99	16,8	11,0	7,84

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 cantilever bracket type W it must be checked in accordance with Eurocode 5 or a similar national Timber Code that splitting will not occur in load case F_{23}.