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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-24/0517 of 2025/02/11

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:	Rotho Blaas WBR Angle Brackets
Product family to which the above construction product belongs:	Three-dimensional nailing plate (Angle Bracket for timber-to-timber or timber-to-concrete or steel connections)
Manufacturer:	ROTHO BLAAS SRL Via dell'Adige 2/1 IT-39040 Cortaccia (BZ) Tel. + 39 0471 818400 Fax + 39 0471 818484 Internet www.rothoblaas.com
Manufacturing plant:	ROTHO BLAAS SRL Held on file by ETA-Danmark AS
This European Technical Assessment contains:	21 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:	EAD 130186-00-0603, Three-dimensional nailing plates
This version replaces:	

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

Technical description of the product
Rotho Blaas WBR angle brackets are one-piece non-welded, face-fixed angle brackets to be used in timber to timber or in timber to concrete or timber to steel connections. They are connected to construction members made of timber or wood-based products with threaded (ringed shank) according to EN 14592 or ETA-22/0002 or screws type LBS according to ETA-11/0030 and to concrete or steel members with bolts or metal anchors.

The angle brackets with a steel plate thickness of up to 3,0 mm are made from the following material:

- steel S235 / Z 275 or FeZn12c according to EN 10025:2005 with $R_e \geq 235$ N/mm², $R_m \leq 510$ N/mm² and $A_{80} \geq 26\%$
- steel S355 / Z 275 or FeZn12c according to EN 10025:2005 with $R_e \geq 355$ N/mm², $R_m \leq 630$ N/mm² and $A_{80} \geq 22\%$
- steel S275 / Z 275 or FeZn12c according to EN 10025:2005 with $R_e \geq 275$ N/mm², $R_m \leq 560$ N/mm² and $A_{80} \geq 23\%$
- steel DX51D / Z 275 or FeZn12c according to EN 10346:2015 with $R_e \geq 235$ N/mm², $R_m \leq 500$ N/mm² and $A_{80} \geq 22\%$
- steel S250GD / Z 275 according to EN 10346:2015 with $R_e \geq 250$ N/mm², $R_m \leq 470$ N/mm² and $A_{80} \geq 19\%$
- Stainless steel with $R_e \geq 235$ N/mm², $R_m \leq 630$ N/mm² and $A_{80} \geq 22\%$

Dimensions, hole positions and typical installations are shown in Annex B. Rotho Blaas WBR angle brackets are made from steel with tolerances according to EN 10143.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

The angle brackets are intended for use in making connections in load bearing timber structures, as a connection between a beam and a purlin, or as a connection between wall and floor elements or as wall-to-wall connection and on concrete/steel elements, 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 may be with a single angle bracket or with an angle bracket 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 A and 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 440 kg/m^3. The wood members may be of Laminated Veneer Lumber (LVL) with a characteristic density up to 500 kg/m^3 with nails/screws in the wide face of the LVL component. This requirement to the material of the wood members can be fulfilled by using the following materials:

- Structural solid timber according to EN 14081,
- Glulam according to EN 14080 or ETA,
- Glued solid timber according to EN14080,
- LVL according to EN 14374 or ETA,
- Parallam PSL,
- Intrallam LSL,
- Cross laminated timber according to ETA,
- Plywood according to EN 636 or ETA,
- Engineered wood products with certified load-carrying capacities for connections with dowel-type fasteners.

Annex B states the load-carrying capacities of the angle bracket connections for a characteristic density of 350 kg/m³. For timber or wood-based material with a lower or higher characteristic density than 350 kg/m³ the load-carrying capacities shall be converted by the factor k_{dens}:

In load case F_1, timber-to-timber:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^{0,8}$$

In load case F_1, timber-to-concrete or timber-to-steel:

$$k_{dens} = 1$$

In load case $F_{2/3}$ and F_4:

$$k_{dens} = \left(\frac{\rho_k}{350} \right)^{0,5}$$

In load case F_4, F_5, and F_{45}:

$$k_{dens} = 1$$

where ρ_k is the characteristic density of the timber material in kg/m^3.

If a wood-based panel, GFB or a soundproofing interlayer with a thickness of not more than 26 mm is placed between the connector plate and the timber member, the lateral load-carrying capacity of the nail or screw, respectively, has to take into account the effect of the interlayer.

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 angle 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 angle brackets can also be used in outdoor timber structures, service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield strength and ultimate strength is employed.

The angle brackets may also be used for connections between a timber member and a member of concrete or steel.

The scope of the angle brackets 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.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the angle brackets 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)	
Joint Strength - Characteristic load-carrying capacity	See Annex B
Joint Stiffness	No performance assessed
Joint ductility	No performance assessed
Resistance to seismic actions	No performance assessed
Resistance to corrosion and deterioration	See section 3.6
3.2 Safety in case of fire (BWR2)	
Reaction to fire	The angle brackets are made from steel classified as Euroclass **A1** in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364
Resistance to fire	No performance assessed

*) See additional information in section 3.4 – 3.7.

3.4 Methods of verification
Safety principles and partial factors

The characteristic load-carrying capacities are based on the characteristic values of the dowel-type connections and the steel plates. To obtain design values the capacities must be divided by different partial factors for the material properties, in case of failure of connections between the angle bracket or hold down to a timber member 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 combined timber and steel plate failure $F_{Rk,T}$ (obtaining the compressive strength perpendicular to grain or the embedment strength of fasteners subjected to shear or the withdrawal capacity of the most loaded fastener, respectively) as well as for pure concrete or steel plate failure $F_{Rk,C/S}$. The design value of the load–carrying capacity is the smaller value of both load–carrying capacities.

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

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

3.5 Mechanical resistance and stability

See annex B for the characteristic load-carrying capacity in the different directions F_1, F_2, F_3, F_4 and F_5.

The characteristic capacities of the angle brackets are determined by calculation as described in the EAD 130186-00-0603. 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.

Other connector nails or screws according to EN 14592 or ETA with the same or better performance than the fasteners given in table A.4 may be used.

3.6 Aspects related to the performance of the product

3.6.1 Corrosion protection in service class 1 and 2.
In accordance with EAD 130186-00-0603 for the angle brackets produced from:

- steel S235 / Z 275 or FeZn12c treated according to EN 10025:2005 with $R_e \geq 235$ N/mm², $R_m \leq 510$ N/mm² and $A_{80} \geq 26\%$
- steel S355 / Z 275 or FeZn12c treated according to EN 10025:2005 with $R_e \geq 355$ N/mm², $R_m \leq 630$ N/mm² and $A_{80} \geq 22\%$
- steel S275 / Z 275 or FeZn12c according to EN 10025:2005 with $R_e \geq 275$ N/mm², $R_m \leq 560$ N/mm² and $A_{80} \geq 23\%$
- steel DX51D / Z 275 or FeZn12c according to EN 10346:2015 with $R_e \geq 235$ N/mm², $R_m \leq 500$ N/mm² and $A_{80} \geq 22\%$
- steel S250GD / Z 275 according to EN 10346:2015 with $R_e \geq 250$ N/mm², $R_m \leq 470$ N/mm² and $A_{80} \geq 19\%$

3.6.2 Corrosion protection in service class 3.
In accordance with EAD 130186-00-0603 for the angle brackets produced from:

- Stainless steel with $R_e \geq 235$ N/mm², $R_m \leq 630$ N/mm² and $A_{80} \geq 22\%$

3.7 General aspects related to the use of the product

The angle brackets 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 fastener pattern used shall be as defined in Annex A.

The following provisions apply:

- The structural members – the components 1 and 2 shown in the figure on page 13 - to which the brackets are fixed shall be:
  - Restrained against rotation.
  - Strength class C14 or better, see section II.2 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 minimum nail's or screw's end and edge distances according to EN 1995-1-1:2010 or ETA have to be provided for.

- For CLT, minimum nail's end and edge distances are:
  $a_{3,t}$ = (7 + 3 cos α) d
  $a_{3,c}$ = 6 d
  $a_{4,t}$ = (3 + 4 cos α) d
  $a_{4,c}$ = 3 d
  α is the angle between load and grain direction of the outer layers.

- For CLT, minimum screw's spacing, end and edge distances are:
  a_1 = 4 d
  a_2 = 2,5 d
  $a_{3,t}$ = 6 d
  $a_{3,c}$ = 6 d
  $a_{4,t}$ = 6 d
  $a_{4,c}$ = 2,5 d
  α is the angle between load and grain direction of the outer layers.

- There are no specific requirements relating to preparation of the timber members.

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

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

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 provided for 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 2025-02-11 by

Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Product details definitions

Table A.1 Materials specification

Angle Bracket type	Thickness (mm)	Steel specification	Coating specification
WBR07015	1,5	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275
WBR07020	2,0	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275
WBR09015	1,5	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275
WBR09025	2,5	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275
WBR10020	2,0	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275
WBR10030	3,0	S235/S355/S275/DX51D/S250GD	FeZn12c / Z 275

Table A.2 Range of sizes

Angle Bracket type	Height (mm) vertical		Height (mm) horizontal		Width (mm)	
WBR07015	69	71	69	71	54	56
WBR07020	69	71	69	71	54	56
WBR09015	89	91	89	91	64	66
WBR09025	89	91	89	91	64	66
WBR10020	104	106	104	106	89	91
WBR10030	104	106	104	106	89	91

Table A.3 Fastener specification

Fastener	Minimum Length	Minimum Threaded Length	Fastener type
Rotho Blaas nail 4.0 mm, type LBA	40 mm	30 mm	Ringed shank nails according to ETA-22/0002
Ringed shank nail 4.0 mm	40 mm	30 mm	Ringed shank nails according to EN 14592
Rotho Blaas screw 5.0 mm, type LBS	40 mm	35 mm	Self-tapping screws according to ETA-11/0030

In the load-carrying-capacities of the nailed or screwed connection in Annex B the capacities calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral fastener load-carrying-capacity. The load-carrying-capacities of the angle brackets have been determined based on the use of Rotho Blaas nail 4.0 mm, type LBA in accordance with ETA-22/0002 and self-tapping LBS screws according to ETA-11/0030. The characteristic withdrawal capacity of the nails or screws must be determined by calculation in accordance with EN 1995-1-1:2010, paragraph 8.3.2:

$$F_{ax,Rk} = f_{ax,k} \cdot d \cdot t_{pen} \left(\frac{\rho_k}{350} \right)^{0,8}$$ for the nails 4.0 mm

$$F_{ax,\alpha,Rk} = \min \left\{ f_{tens,k}; \frac{n_{ef} \cdot k_{ax} \cdot f_{ax,k} \cdot d \cdot \ell_{ef}}{k_\beta} \left(\frac{\rho_k}{\rho_a} \right)^{0,8} \right\}$$ for the screws 5.0 mm

where:

n_{ef} Effective number of fasteners
$f_{ax,k}$ Characteristic value of the withdrawal parameter in N/mm^2
d Nail or screw diameter in mm
t_{pen} Penetration depth of the ringed shank including the nail tip in mm
ρ_k Characteristic density of the timber in kg/m^3
ρ_a Characteristic density of the timber in kg/m^3 according to $f_{ax,k}$

$f_{ax,k}$, $f_{tens,k}$, ρ_a, k_{ax} and k_β see ETA-11/0030 or ETA-22/0002.

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

Bolts diameter	Correspondent hole diameter	Bolts type
10.0 mm	Max. 2 mm larger than the bolt diameter	See specification of the manufacturer

Metal Anchors diameter	Correspondent Hole diameter	Anchors type
10.0 mm	Max. 2 mm larger than the anchor diameter	See specification of the manufacturer

Annex B
Characteristic load-carrying capacities and slip moduli

Table B.1: Force F_1, 1 angle bracket / connection timber to timber

WBR Angle bracket	Fastener pattern	Timber-to-timber connection ρ_k = 350 kg/m³	
		$F_{1,t,Rk}$ [kN]	
		LBA nails 4x60 [a]	LBS screws 5x60 [b]
WBR07015	Full	2,0	5,0
WBR07015	Partial	2,0	5,0
WBR07020	Full	2,0	5,0
WBR07020	Partial	2,0	5,0
WBR09015	Full	2,1	5,4
WBR09015	Partial	2,1	5,4
WBR09025	Full	2,1	5,4
WBR09025	Partial	2,1	5,4
WBR10020	Full	4,1	11,0
WBR10020	Partial	4,1	11,0
WBR10030	Full	4,1	11,0
WBR10030	Partial	4,1	11,0

[a] For LBA nails with shorter length, $F_{1,Rk}$ must be reduced by $\min\{F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}\}$
For ringed shank nails according to EN 14592, $F_{1,Rk}$ must be reduced by $\min\{F_{v,EN14592,Rk}/F_{v,LBA,60,Rk}$; $F_{ax,EN14592,Rk}/F_{ax,LBA,60,Rk}\}$

[b] For LBS screws with shorter length, $F_{1,Rk}$ must be reduced by $\min\{F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}\}$

Table B.2: Force F_1, 1 angle bracket / Load-carrying capacity of fasteners in the vertical flange and of the steel - connection timber to rigid support

WBR Angle bracket	Fastener pattern	Timber-to-rigid support connection ρ_k = 350 kg/m³			
		$F_{1,t,Rk}$ [kN]		$F_{1,s,Rk}$ [kN]	Bolts $k_{t//}$
		LBA nails 4x60 [a]	LBS screws 5x60 [b]		
WBR07015	Full	16,0	14,5	0,87	1,00
WBR07020	Full	16,0	14,5	0,97	1,00
WBR09015	Full	21,3	19,3	0,54	1,00
WBR09025	Full	21,3	19,3	0,85	1,00
WBR10020	Full	26,6	24,1	8,6	1,15
WBR10030	Full	26,6	24,1	13,8	1,15

[a] For LBA nails with shorter length, $F_{1,Rk}$ must be reduced by $\min\{F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}\}$
For ringed shank nails according to EN 14592, $F_{1,Rk}$ must be reduced by $\min\{F_{v,EN14592,Rk}/F_{v,LBA,60,Rk}$; $F_{ax,EN14592,Rk}/F_{ax,LBA,60,Rk}\}$

[b] For LBS screws with shorter length, $F_{1,Rk}$ must be reduced by $\min\{F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}\}$

Table B.3: Force $F_{2/3}$, 1 angle bracket / connection timber to timber

WBR Angle bracket	Fastener pattern	$F_{2/3,t,Rk}$ [kN] for timber-to-timber connection ρ_k = 350 kg/m³	
		LBA nails 4x60 [a]	LBS screws 5x60 [b]
WBR07015	Full	5,6	5,9
WBR07015	Partial	3,9	4,0
WBR07020	Full	5,6	5,9
WBR07020	Partial	3,9	4,0
WBR09015	Full	6,8	7,1
WBR09015	Partial	5,6	5,5
WBR09025	Full	6,8	7,1
WBR09025	Partial	5,6	5,5
WBR10020	Full	9,3	10,1
WBR10020	Partial	6,1	8,5
WBR10030	Full	9,3	10,1
WBR10030	Partial	6,1	8,5

[a] For LBA nails with shorter length, $F_{2/3,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$}
For ringed shank nails according to EN 14592, $F_{1,Rk}$ must be reduced by min{$F_{v,EN14592,Rk}/F_{v,LBA,60,Rk}$; $F_{ax,EN14592,Rk}/F_{ax,LBA,60,Rk}$}

[b] For LBS screws with shorter length, $F_{2/3,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$}

Table B.4: Force $F_{2/3}$, 1 angle bracket / connection timber to rigid support

WBR Angle bracket	Fastener pattern	$F_{2/3,t,Rk}$ [kN] for timber-to-timber connection ρ_k = 350 kg/m³	
		LBA nails 4x60 [a]	LBS screws 5x60 [b]
WBR07015	Full	1,9	3,3
WBR07020	Full	1,9	3,3
WBR09015	Full	1,9	3,7
WBR09025	Full	1,9	3,7
WBR10020	Full	8,6	7,8
WBR10030	Full	8,6	7,8

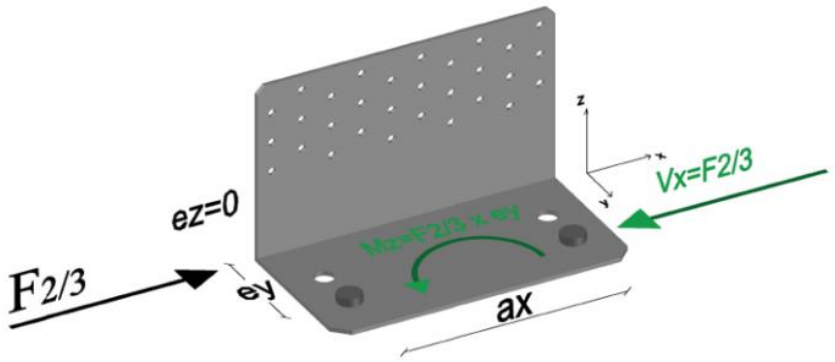
Shear loads per bolt or metal anchor, see Figure below:

- In x-direction: ± $F_{2/3,Ed}$ for WBR07015/07020 and WBR09015/09025,
  ± 0,5 · $F_{2/3,Ed}$ for WBR10020/10030
- In y-direction: ± 0,37 · $F_{2/3,Ed}$ for WBR10020/10030

[a] For LBA nails with shorter length, $F_{2/3,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$}
For ringed shank nails according to EN 14592, $F_{1,Rk}$ must be reduced by min{$F_{v,EN14592,Rk}/F_{v,LBA,60,Rk}$; $F_{ax,EN14592,Rk}/F_{ax,LBA,60,Rk}$}

[b] For LBS screws with shorter length, $F_{2/3,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$}

Explanation for footnotes in Table B.4



$F_{2/3}$

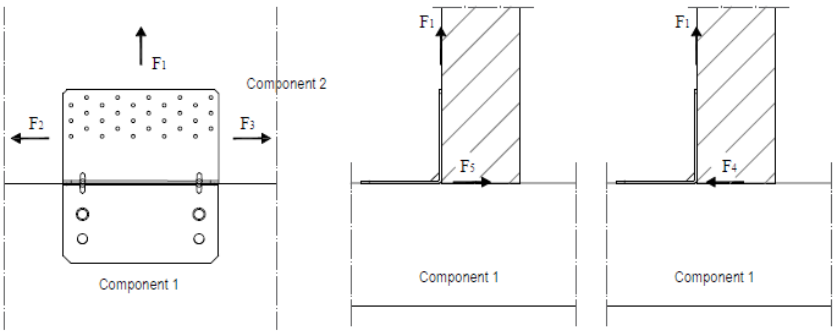
$M_z = F_{2/3} * e_y$

Table B.5: 1 angle bracket for force F_4 and F_5, and 2 angle brackets for force $F_{4/5}$ / connection timber to timber or connection timber to rigid support

WBR Angle bracket	Fastener pattern	Timber-to-timber or timber-to-rigid support connection ρ_k = 350 kg/m³					
		LBA nails 4x60 [a] or LBS screws 5x60 [b] Component 2: CLT			LBA nails 4x60 [a] or LBS screws 5x60 [b] Component 2: glulam		
		$F_{4,t,Rk}$ [kN]	$F_{5,s,Rk}$ [kN]	$F_{4/5,t,Rk}$ [kN]	$F_{4,t,Rk}$ [kN]	$F_{5,s,Rk}$ [kN]	$F_{4/5,t,Rk}$ [kN]
WBR07015	Full or partial	6,3	1,1	7,4	5,9	1,1	7,0
WBR07020	Full or partial	7,0	1,4	8,4	6,6	1,4	8,0
WBR09015	Full or partial	6,6	1,2	7,7	6,2	1,2	7,4
WBR09025	Full or partial	8,9	2,1	11,1	8,4	2,1	10,5
WBR10020	Full or partial	11,1	2,2	13,3	10,5	2,2	12,7
WBR10030	Full or partial	14,9	2,6 [c] 3,9 [d]	17,5 [e] 18,8 [f]	14,0	2,6 [c] 3,9 [d]	16,6 [e] 17,9 [f]

[a] For LBA nails with shorter length, $F_{4,Rk}$, $F_{5,Rk}$ and $F_{45,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$
For ringed shank nails according to EN 14592, $F_{1,Rk}$ must be reduced by min{$F_{v,EN14592,Rk}/F_{v,LBA,60,Rk}$; $F_{ax,EN14592,Rk}/F_{ax,LBA,60,Rk}$}
[b] For LBS screws with shorter length, $F_{4,Rk}$, $F_{5,Rk}$ and $F_{45,Rk}$ must be reduced by min{$F_{v,short,Rk}/F_{v,60,Rk}$; $F_{ax,short,Rk}/F_{ax,60,Rk}$}
[c] $F_{5,t,Rk}$ for LBA nails
[d] $F_{5,t,Rk}$ for LBS screws
[e] For LBA nails
[f] For LBS screws

Definitions of forces, their directions and eccentricity
Forces – Example:



Fastener specification
Nailing patterns are given in figures B.4 to B.6.

Double angle brackets per connection
The angle brackets must be placed at each side opposite to each other, symmetrically to the component axis.
Acting forces

F_1	Lifting force acting along the central axis of the joint.
F_2 and F_3	Lateral force acting in the joint between the component 2 and component 1 in the component 2 direction
F_4 and F_5	Lateral force acting in the component 1 direction along the central axis of the joint.

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.
F_2 and F_3	Lateral force acting in the joint between the component 2 and the component 1 in the component 2 direction. The component 2 shall be prevented from rotation.
F_4 and F_5	Lateral force acting in the component 1 direction along the central axis of the joint. The components must be prevented from rotation. F_4 causes compression between the angle bracket or hold-down and component 2; F_5 causes tension between the angle bracket and component 2.

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 and for force F_5 it must be checked in accordance with Eurocode 5 or a similar national Timber Code that splitting will not occur.

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:

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

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.

Rotho Blaas Angle Brackets

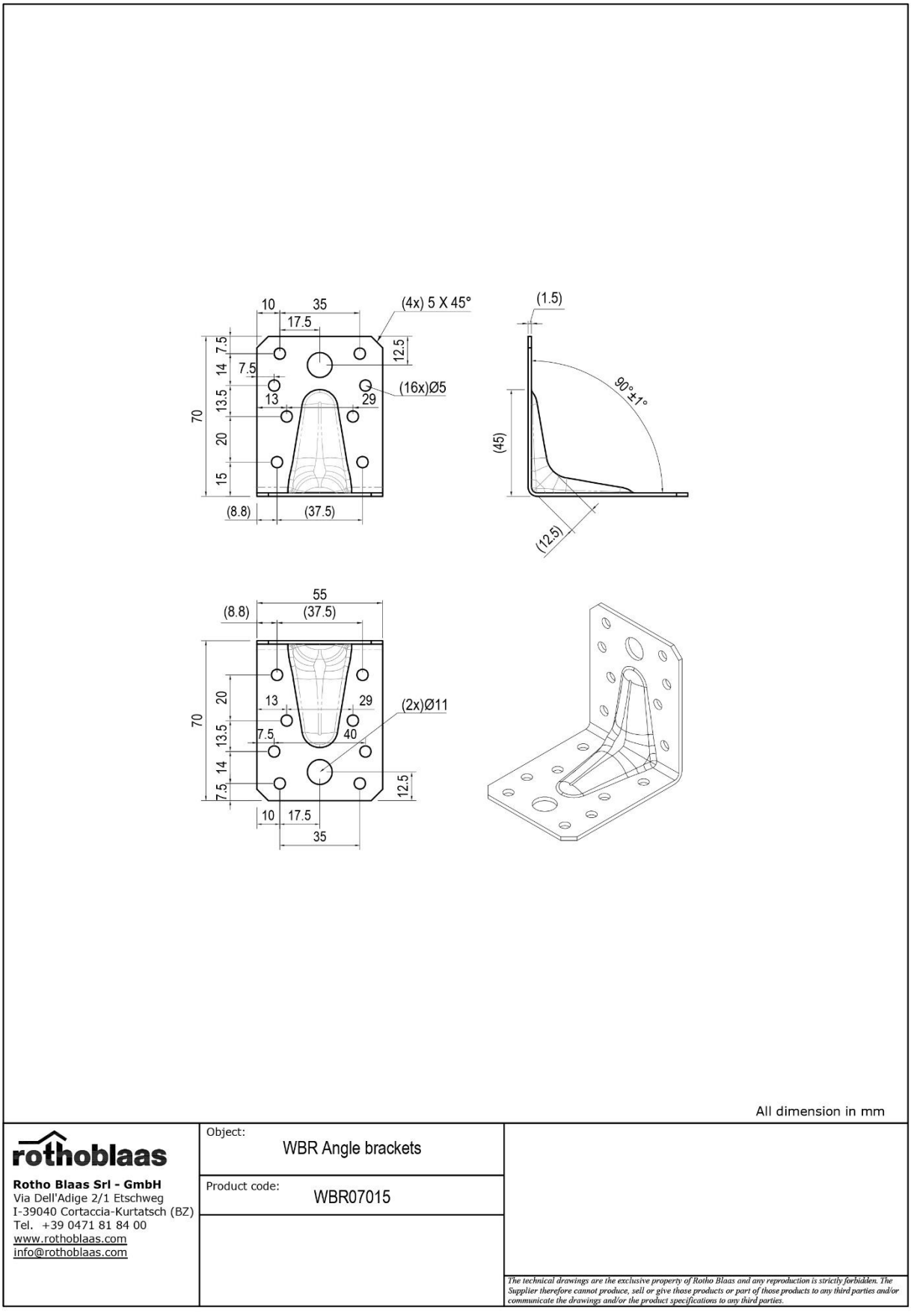
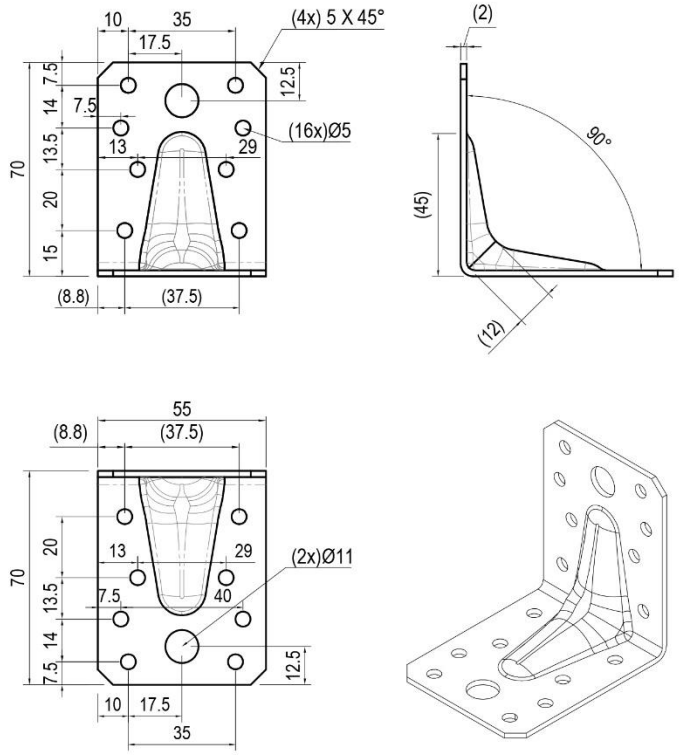


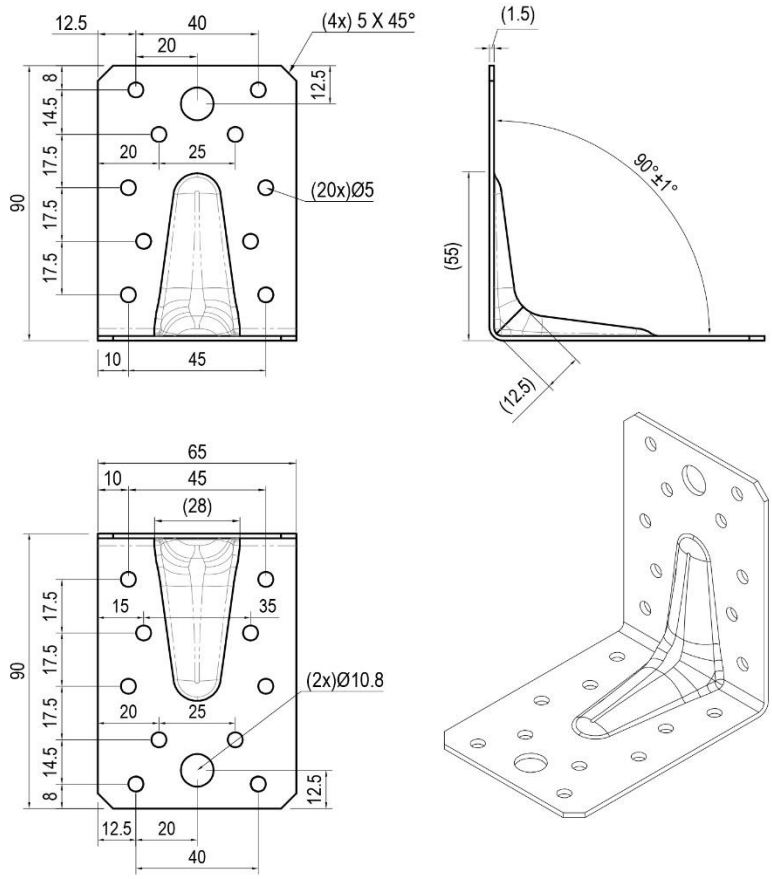
Figure B.1 Dimensions of Angle Bracket WBR07015



All dimension in mm

rothoblaas **Rotho Blaas Srl - GmbH** Via Dell'Adige 2/1 Etschweg I-39040 Cortaccia-Kurtatsch (BZ) Tel. +39 0471 81 84 00 www.rothoblaas.com info@rothoblaas.com	Object: WBR Angle brackets Product code: WBR07020	

Figure B.2 Dimensions of Angle Bracket WBR07020



All dimension in mm

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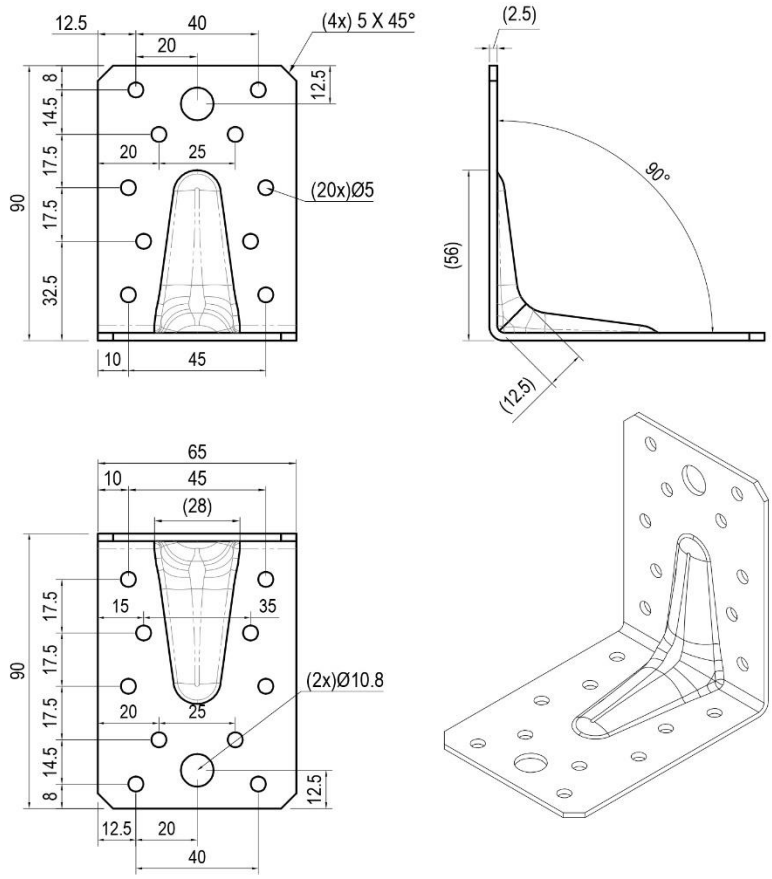
Figure B.3 Dimensions of Angle Bracket WBR09015



All dimension in mm

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Figure B.4 Dimensions of Angle Bracket WBR09025

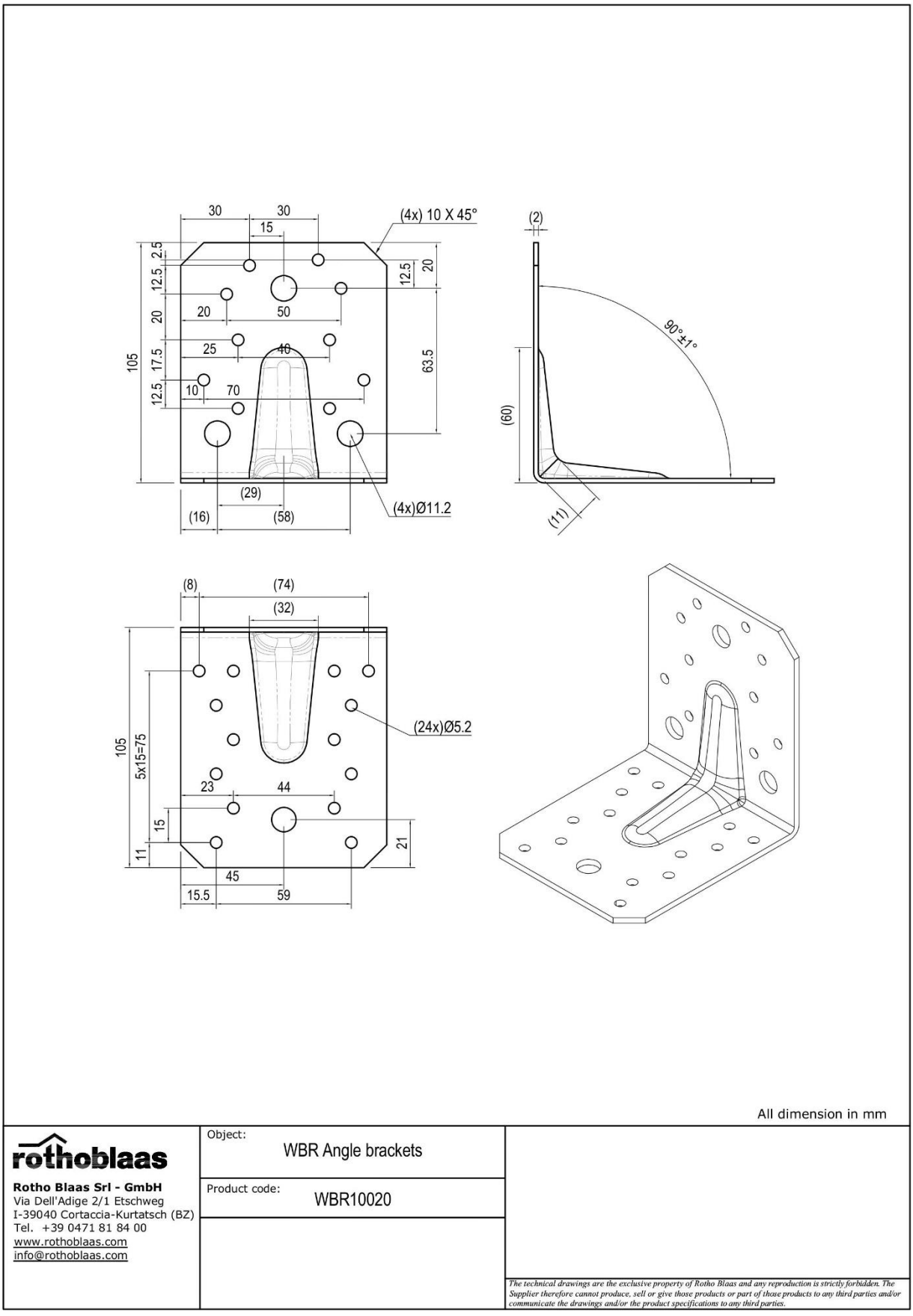


Figure B.5 Dimensions of Angle Bracket WBR10020

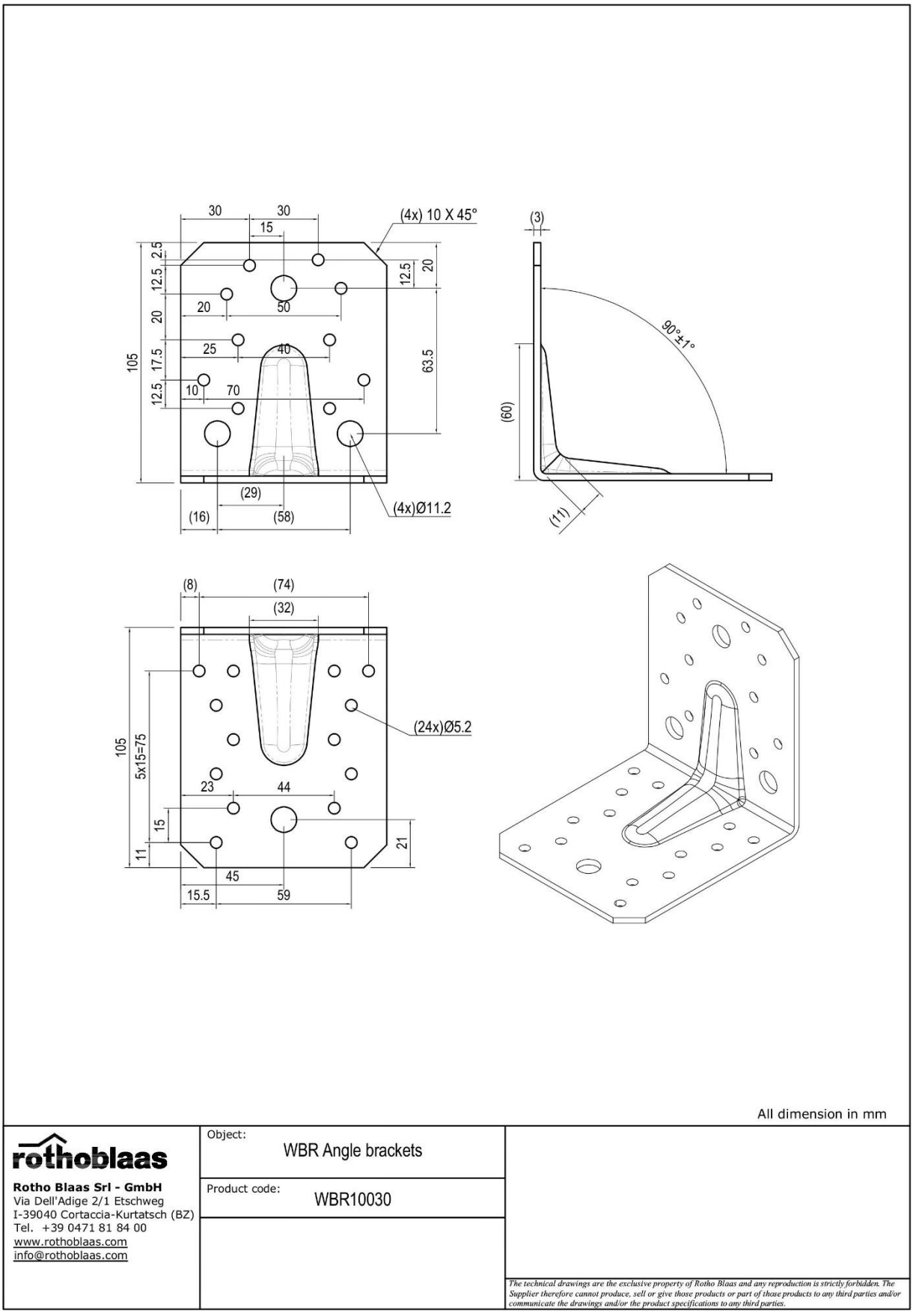
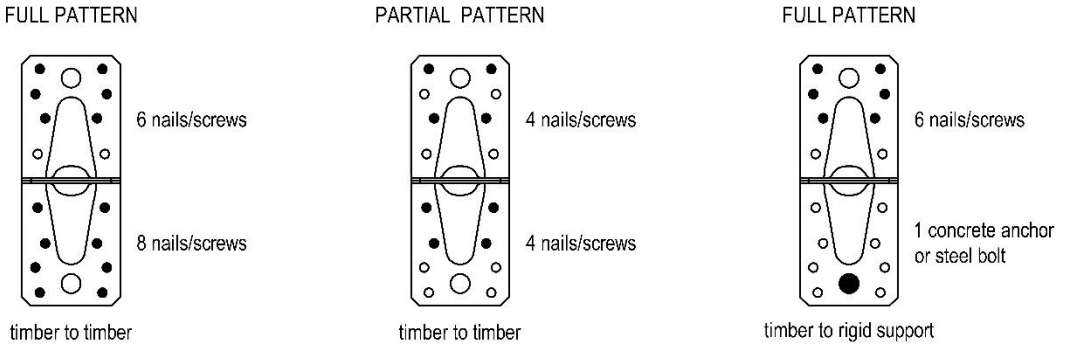
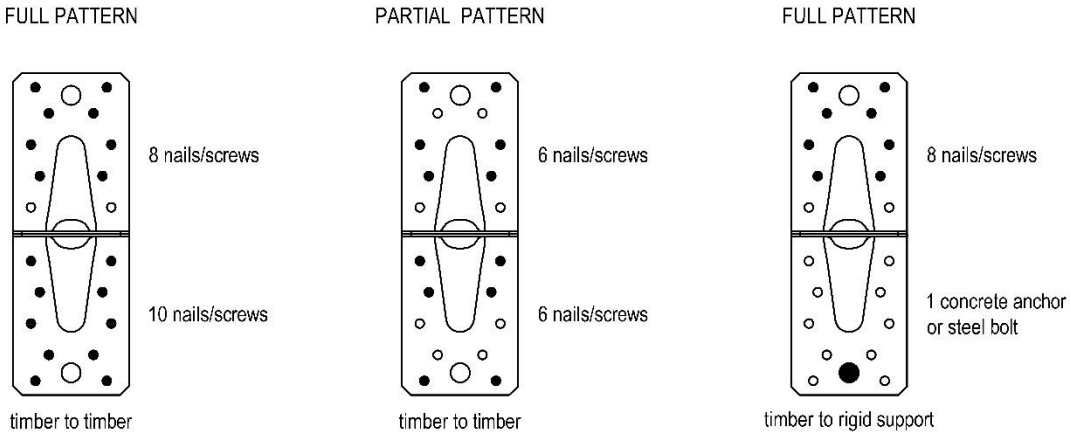


Figure B.6 Dimensions of Angle Bracket WBR10030

Nailing pattern for WBR07015 / WBR07020



Nailing pattern for WBR09015 / WBR09020



Nailing pattern for WBR10020 / WBR10030

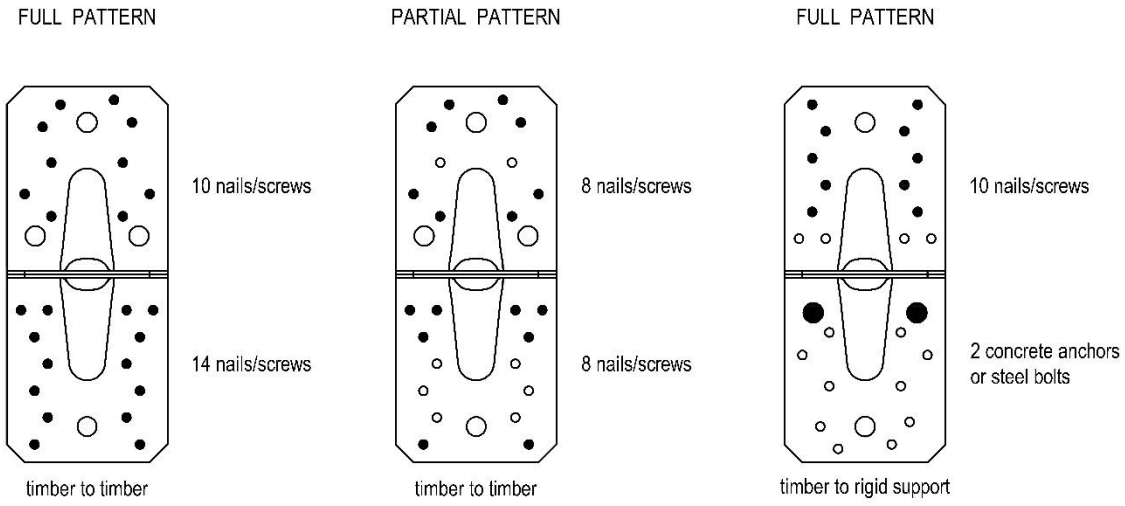


Figure B. 7 Nailing patterns for WBR Angle Brackets