

Declaration of Performance



No **5 - 008 - 230170 - 2023/01**

1.) Unique identification code of the product-type:
Three-dimensional nailing plates / EJOT angle brackets

2.) Intended use:
Angle brackets for timber-to-timber, timber-to-steel or timber-to-concrete connections

3.) Manufacturer:
EJOT Baubefestigungen GmbH, In der Stockwiese 35, 57334 Bad Laasphe - Germany

4.) System of AVCP:
System 2+

5.) European Assesment Document: **EAD 130186-00-0603**
 European Technical Assessment: **ETA-23/0170**
 Technical assessment body: **ETA-DANMARK A/S**
 Notified body: **1336 - Inspecta Estonia OÜ**

6.) Declared Performance:
 a) Mechanical resistance and stability (BWR 1) and safety and accessibility (BWR 4)

Essential characteristic	Performance
Characteristic load-carrying capacity	See Annex B
Stiffness	NPD
Ductility in cyclic testing	NPD
Resistance to seismic actions	NPD
Resistance to corrosion and deterioration	The angle 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 and 2. 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 and ultimate strength is employed.

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b) Safety in case of fire (BWR 2)

Essential characteristic	Performance
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	NPD

c) Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance

d) Protection against noise (BWR 5)

Essential characteristic	Performance

e) Energy economy and heat retention (BWR 6)

Essential characteristic	Performance

f) Sustainable use of natural resources (BWR 7)

Essential characteristic	Performance

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Dr. Jens Weber
(Name)

Bad Laasphe, 17/02/2023
(Place and date of issue)

(Signature)

Annex B
Characteristic load-carrying capacities

Table 1: Force F_1 Column, 2 angle brackets / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (column)	
			Timber	Steel
angle bracket 50	-	-	-	-
angle brackets type 40/60	-	-	-	-
angle brackets type 50/60	-	-	-	-
angle brackets type 60/60	-	-	-	-
angle bracket 70	1,2,3	12,13,14,15,16,20,21,22	3,05	1,81
angle bracket 70R	1,2,3	11,12,13,14,18,19,20	2,04	2,40
angle bracket type 60/80	1,2,3	13,14,15,16,17,18,19,20,21,22, 23,24	3,82	4,08
angle bracket type 80/80	1,2,3	15,16,17,18,19,20,21,22,23,24, 25,26,27,28	3,68	4,71
angle bracket type 40/90	1,2	11,12,14,15,19,20	2,35	2,37
angle bracket 90	1,2	12,13,16,17,21,22	2,37	3,02
angle bracket 90 R	1,2	12,13,16,17,21,22	2,37	9,76
angle bracket type 80/100	1,2,3,4,5,6,7	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35	3,85	4,91
angle bracket type 100/100	1,2,3,4,5,7,8,9,1 0	26,27,28,29,30,31,32,33,34,36, 37,38,39, 40,41,42,43,44,46,47,48,49	5,29	7,63

Table 2: Force F_1 Column, 1 angle bracket / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (column)	
			Timber	Steel
angle bracket 50	-	-	-	-
angle brackets type 40/60	-	-	-	-
angle brackets type 50/60	-	-	-	-
angle brackets type 60/60	-	-	-	-
angle bracket 70	1,2,3	12,13,14,15,16,20,21,22	1,53	0,91
angle bracket 70R	1,2,3	11,12,13,14,18,19,20	1,02	1,20
angle bracket type 60/80	1,2,3	13,14,15,16,17,18,19,20,21,22, 23,24	1,91	2,04
angle bracket type 80/80	1,2,3	15,16,17,18,19,20,21,22,23,24, 25,26,27,28	1,84	2,36
angle bracket type 40/90	1,2	11,12,14,15,19,20	1,18	1,19
angle bracket 90	1,2	12,13,16,17,21,22	1,18	1,51
angle bracket 90 R	1,2	12,13,16,17,21,22	1,18	4,88
angle bracket type 80/100	1,2,3,4,5,6,7	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35	1,93	2,45
angle bracket type 100/100	1,2,3,4,5,7,8,9,1 0	26,27,28,29,30,31,32,33,34,36, 37,38,39, 40,41,42,43,44,46,47,48,49	2,64	3,82

Table 3: Force F_1 Purlin, 2 angle brackets / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
angle bracket 50	1,2	6,7,8	1,87	1,46
angle brackets type 40/60	1,2,3,4	7,8,9,10,11,12	2,35	2,47
angle brackets type 50/60	1,2,3,5,6	10,11,12,13,14,16,17	2,41	3,63
angle brackets type 60/60	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	3,61	4,08
angle bracket 70	1,2,3,7,8	12,13,14,15,16,20,21,22	3,05	1,81
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	2,04	2,40
angle bracket type 60/80	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	3,82	4,08
angle bracket type 80/80	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	3,68	4,71
angle bracket type 40/90	1,2,4,5,6,7	11,12,14,15,19,20	2,35	2,37
angle bracket 90	1,2,4,5,6,7	12,13,16,17,21,22	2,37	3,02
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	2,37	9,76
angle bracket type 80/100	1,2,3,4,5,6,7,8,9,10,11,12,13,14	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35	3,85	4,91
angle bracket type 100/100	1,2,3,4,5,7,8,9,10,11,12,13,14,15,17,18,19,20	26,27,28,29,30,31,32,33,34,36,37,38,39,40,41,42,43,44,46,47,48,49	5,29	7,63

Table 4: Force F_1 Purlin, 1 angle bracket / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
angle bracket 50	1,2	6,7,8	0,93	0,73
angle brackets type 40/60	1,2,3,4	7,8,9,10,11,12	1,18	1,24
angle brackets type 50/60	1,2,3,5,6	10,11,12,13,14,16,17	1,20	1,81
angle brackets type 60/60	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	1,80	2,04
angle bracket 70	1,2,3,7,8	12,13,14,15,16,20,21,22	1,53	0,91
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	1,02	1,20
angle bracket type 60/80	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	1,91	2,04
angle bracket type 80/80	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	1,84	2,36
angle bracket type 40/90	1,2,4,5,6,7	11,12,14,15,19,20	1,18	1,19
angle bracket 90	1,2,4,5,6,7	12,13,16,17,21,22	1,18	1,51
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	1,18	4,88
angle bracket type 80/100	1,2,3,4,5,6,7,8,9,10,11,12,13,14	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35	1,93	2,45
angle bracket type 100/100	1,2,3,4,5,7,8,9,10,11,12,13,14,15,17,18,19,20	26,27,28,29,30,31,32,33,34,36,37,38,39,40,41,42,43,44,46,47,48,49	2,64	3,82

Table 5: Forces $F_{2,3}$, 2 angle brackets / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
angle bracket 50	1,2	6,7,8	2,07
angle brackets type 40/60	1,2,3,4	7,8,9,10,11,12	4,24
angle brackets type 50/60	1,2,3,5,6	10,11,12,13,14,16,17	5,33
angle brackets type 60/60	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	7,58
angle bracket 70	1,2,3,7,8	12,13,14,15,16,20,21,22	5,71
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	5,56
angle bracket type 60/80	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22, 23,24	9,66
angle bracket type 80/80	1,2,3,4,5,6,7,8,9, 10	15,16,17,18,19,20,21,22,23,24, 25,26,27,28	11,4
angle bracket type 40/90	1,2,4,5,6,7	11,12,14,15,19,20	5,06
angle bracket 90	1,2,4,5,6,7	12,13,16,17,21,22	5,89
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	5,89
angle bracket type 80/100	1,2,3,4,5,6,7,8,9, 10,11,12,13,14	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35	13,9
angle bracket type 100/100	1,2,3,4,5,7,8,9,1 0, 11,12,13,14,15,1 7, 18,19,20	26,27,28,29,30,31,32,33,34,36, 37,38,39, 40,41,42,43,44,46,47,48,49	20,3

Table 6: Forces $F_{2,3}$, 1 angle bracket / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
angle bracket 50	1,2	6,7,8	2,07
angle brackets type 40/60	1,2,3,4	7,8,9,10,11,12	4,24
angle brackets type 50/60	1,2,3,5,6	10,11,12,13,14,16,17	5,33
angle brackets type 60/60	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	7,58
angle bracket 70	1,2,3,7,8	12,13,14,15,16,20,21,22	5,71
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	5,56
angle bracket type 60/80	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21, 22,23,24	9,66
angle bracket type 80/80	1,2,3,4,5,6,7,8,9, 10	15,16,17,18,19,20,21,22,23, 24,25,26,27,28	11,4
angle bracket type 40/90	1,2,4,5,6,7	11,12,14,15,19,20	5,06
angle bracket 90	1,2,4,5,6,7	12,13,16,17,21,22	5,89
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	5,89
angle bracket type 80/100	1,2,3,4,5,6,7,8,9, 10,11,12,13,14	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35	13,9
angle bracket type 100/100	1,2,3,4,5,7,8,9,10, 11,12,13,14,15,17, 18,19,20	26,27,28,29,30,31,32,33,34,36, 37,38,39, 40,41,42,43,44,46,47,48,49	10,1

Table 7: Basic Forces $F_{4,5}$, 2 angle brackets / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{4,5,Rk}$ [kN]	
			Timber	Steel
angle bracket 50	1,2	6,7,8	5,38	2,24
angle brackets type 40/60	1,2,3,4	7,8,9,10,11,12	5,08	2,81
angle brackets type 50/60	1,2,3,5,6	10,11,12,13,14,16,17	5,56	3,62
angle brackets type 60/60	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	7,40	4,11
angle bracket 70	1,2,3,7,8	12,13,14,15,16,20,21,22	5,92	4,27
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	5,85	5,43
angle bracket type 60/80	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	8,14	4,34
angle bracket type 80/80	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	9,81	6,01
angle bracket type 40/90	1,2,4,5,6,7	11,12,14,15,19,20	5,44	2,99
angle bracket 90	1,2,4,5,6,7	12,13,16,17,21,22	8,52	4,45
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	8,55	7,96
angle bracket type 80/100	1,2,3,4,5,6,7,8,9,10,11,12,13,14	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35	10,7	5,88
angle bracket type 100/100	1,2,3,4,5,7,8,9,10,11,12,13,14,15,17,18,19,20	26,27,28,29,30,31,32,33,34,36,37,38,39,40,41,42,43,44,46,47,48,49	12,5	7,33

Table 8: Basic Forces F_4 , 1 angle bracket / connection

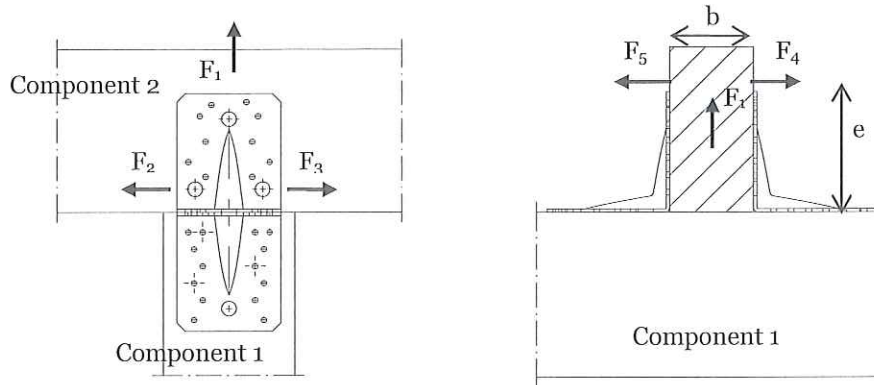
Bracket type	Nail number n_V	Nail number n_H	$F_{4,Rk}$ [kN]	
			Timber	Steel
angle bracket 70	1,2,3,7,8	11,12,13,18,15,19,20	5,85	4,24
angle bracket 70R	1,2,4,5,6,7	12,13,16,17,21,22	8,55	6,38

Table 9: Basic Forces F_5 , 1 angle bracket / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{5,Rk}$ [kN]	
			Timber	Steel
angle bracket 70R	1,2,3,7,8	11,12,13,18,15,19,20	1,28	1,40
angle bracket 90 R	1,2,4,5,6,7	12,13,16,17,21,22	1,70	1,73

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.

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. If the load is applied with an eccentricity e , a design for combined loading is required.

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.
- 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. If the component 2 is prevented from rotation the load-carrying capacity will be half of a connection with double angle brackets.
- F_4 and F_5 Lateral force acting in the component 1 direction in the height of the top edge of component 2. F_4 is the lateral force towards the angle bracket; F_5 is the lateral force away from the angle bracket. Only the characteristic load-carrying capacities for angle brackets with ribs are given.

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.

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:

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

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.

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 .

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

B is the width of component 2.