

Leistungserklärung / Declaration of Performance 2009100351_014CPR2022-11-042_2024

- **Eindeutiger Kenncode des Produkttyps / Unique identification code of the product type**
HV2400, HV2420, HV2430, HV2431, HV2432, HV2620, HVG2400, HVG2420

- **Verwendungszweck(e) / Usage(s)**
Winkel für Holz-Holz- und Holz-Beton-Verbindungen
angle bracket for timber-to-timber and timber-to-concrete connections

- **Hersteller / Manufacturer**
Conmetall Meister GmbH
Hafenstraße 26
29223 Celle Germany

- **System(e) zur Bewertung und Überprüfung der Leistungsbeständigkeit /
System(s) for evaluating and verifying constancy of performance**
System 2+

- **Europäisch Technische Bewertung / European Technical Assessment**
Europäisches Bewertungsdokument / *European evaluation document*:
EAD 130186-00-0603 01.07.2018
Europäisch technische Bewertung / *European technical evaluation*:
ETA 20/0273 19.08.2022
Technische Bewertungsstelle / *Technical Assessment Body*:
Eurofins Expert Services Oy
Notifizierte Stelle / *Notified body*:
1336



■ **Wesentliche Merkmale und erklärte Leistung(en) /**
Essential features and stated performance(s)

Wesentliches Merkmal <i>Essential features</i>	Leistung <i>Performance</i>	Harmonisierte technische Spezifikation <i>Harmonized technical specification</i>
Charakteristische Tragfähigkeit <i>Joint strength</i>	Siehe Annex 2 3.1	ETA-20/0273; 3.1
Steifigkeit der Verbindung <i>Joint stiffness</i>	NPD	ETA-20/0273
Duktilität der Verbindung <i>Joint ductility</i>	NPD	ETA-20/0273
Widerstandsfähigkeit gegen seismische Einflüsse <i>Resistance to seismic actions</i>	NPD	ETA-20/0273
Widerstandsfähigkeit gegen Korrosion und Beschädigung <i>Resistance to corrosion and deterioration</i>	Nutzungsklasse 1 & 2 gem. Eurocode 5 <i>Service classes 1 & 2 acc. Eurocode 5</i>	ETA-20/0273; 3.1 EAD 130186-00-0603 EN1995-1-1
Brandverhalten <i>Reaction to fire</i>	Stahl klassifiziert als Euroklasse A1 <i>Steel classified as Euroclass A1</i>	ETA-20/0273; 3.2 EN 13501-1
Brandresistenz <i>Resistance to fire</i>	NPD	ETA-20/0273;

Tab.1 Wesentliche Merkmale / *essential features*

Kenncode <i>Identification code</i>	Dimensionen <i>Dimensions [mm]</i>	Kenncode aus ETA <i>Identificatin code from ETA</i>
HV2400 / HVG2400	40x40x20x2	71402
HV2420 / HVG2420	50x50x40x2	71116
HV2430	50x50x35x2,5	73111
HV2431	90x90x40x2,5	73104
HV2432	90x90x65x2,5	73107
HV2620	90x90x40x2,5	71105

Tab.2 Produkt Details / *Product details*



Die Leistung des vorstehenden Produkts entspricht der erklärten Leistung / den erklärten Leistungen.
Für die Erstellung der Leistungserklärung im Einklang mit der Verordnung (EU) Nr. 305/2011 ist allein der obengenannte Hersteller verantwortlich.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

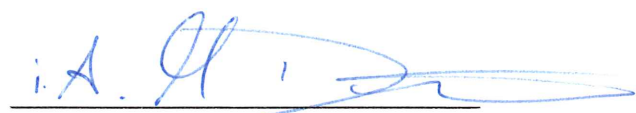
The performance of the above product is the declared performance. The above manufacturer is solely responsible for drawing up the declaration of performance in accordance with Regulation (EU) No 305/2011.

Signed for the manufacturer and on behalf of the manufacturer of:

Conmetall Meister GmbH
Celle, 27.04.2024



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ANNEX 2. CHARACTERISTIC LOAD-CARRYING CAPACITIES

Characteristic resistances for Arras CF Angle Brackets - calculation method

Load carrying capacity of non-sliding angle bracket connections

The design resistance R_d of the angle bracket connection is

$$R_d = k_{\text{mod}} \frac{R_k}{\gamma_M} \quad (1)$$

where k_{mod} is the modification factor according to EN 1995-1-1 taking into account the effect of the duration of the load and moisture content for timber, γ_M is the partial factor for the resistance of connections according to the relevant National annex of EN 1995-1-1 and R_k is the characteristic resistance of the angle bracket connection.

When the connection made by the angle bracket is loaded by a shear force at the plane of flange A in the middle of the flange, it shall be checked that the conditions according to equations (2) to (4) are fulfilled

$$F_d \leq R_{A,d} \quad (2)$$

$$F_{x,d} \leq R_{B,x,d} \quad (3)$$

$$F_{z,d} \leq \begin{cases} R_{B,z,t,d} & \text{when the connection is in tension} \\ R_{B,z,c,d} & \text{when the connection is in compression} \end{cases} \quad (4)$$

where $F_{x,d}$ is the component in the direction of the bent edge of the angle bracket from the connection force F_d and $F_{z,d}$ is the component perpendicular to $F_{x,d}$ from the connection force F_d . The obtuse-angled Angle Bracket 135° connectors 73104, 73107 and 73111 may be loaded only by a shear force parallel to the bent edge: $F_d = F_{x,d}$.

In addition, when the connection is loaded in tension, the following interaction equation shall be fulfilled:

$$\left(\frac{F_{z,d}}{R_{B,z,t,d}} \right)^2 + \left(\frac{F_{x,d}}{R_{B,x,d}} \right)^2 \leq 1 \quad (5)$$

Characteristic resistance

$$R_{A,k} = n_A F_{A,v,Rk} \quad (6)$$

where n_A is number of fasteners at flange A, $F_{A,v,Rk}$ is the characteristic lateral load-carrying capacity of the fastener in the timber part against flange A according to EN 1995-1-1, equation (7) for steel plate thickness t less than or equal to $d/2$ and (8) for thicker steel plates of thickness greater than or equal to d :

$$F_{v,Rk} = \min \begin{cases} 0,4 f_{h,k} t_1 d & (a) \\ 1,15 \sqrt{2 M_{y,Rk} f_{h,k} d} + \frac{F_{ax,Rk}}{4} & (b) \end{cases} \quad (7)$$



$$F_{v,Rk} = \min \left\{ \begin{array}{l} f_{h,k} t_1 d \quad (a) \\ f_{h,k} t_1 d \left[\sqrt{2 + \frac{4 M_{y,Rk}}{f_{h,k} d t_1^2}} - 1 \right] + \frac{F_{ax,Rk}}{4} \quad (b) \\ 2,3 \sqrt{M_{y,Rk} f_{h,k} d} + \frac{F_{ax,Rk}}{4} \quad (c) \end{array} \right. \quad (8)$$

where $t_1 = L - t$ when L is the length of the fastener, t is the thickness of steel plate, $M_{y,k}$ is according to standards EN 14592 and EN 409 experimentally determined characteristic value of the yield moment of the fastener, $F_{ax,Rk}$ is the withdrawal resistance of the fastener according to Eq. (10) limited at maximum to $1/3$ with nails and $1/2$ with screws from the load-carrying capacity $F_{v,Rk}$ and the characteristic value of the embedding strength

$$f_{h,k} = 0,082 \rho_k d^{-0,3} \quad \text{N/mm}^2 \quad (9)$$

The characteristic withdrawal resistance of the nail

$$F_{ax,Rk} = f_{ax,k} d t_{pen} \leq f_{tens,k} \quad (10a)$$

and for the screw

$$F_{ax,Rk} = n^{-0,1} f_{tens,k} d l_{ef} \left(\frac{\rho_k}{\rho_u} \right)^{0,8} \leq n^{-0,1} f_{tens,k} \quad (10b)$$

where $f_{ax,k}$ is the withdrawal parameter determined by testing according to standards EN 14592 and EN 1382 for the actual timber material with density ρ_a , $f_{tens,k}$ is the experimentally determined tensile resistance of the fastener together with a steel plate, t_{pen} is the penetration depth of the profiled part of the nail in timber, n is the number of the screws in the flange of connector, l_{ef} is the length of threaded part of the screw and ρ_k is the characteristic density of timber in the actual connection. If the penetration depth for an anchor nail is less than $t_{pen} \leq 8d = 32$ mm, the resistance according to Eq. (10a) is reduced by $(t_{pen}/8\text{mm} - 3)$.

Eq. (8) may be used for angular ring shank nails, if the length of the conical part is at least 4 mm and the diameter of the cone at the head of the nail is at least 5,2 mm. Otherwise linear interpolation of equations (7) and (8) is used for the steel plate thicknesses between 2 and 4 mm.

Characteristic resistance

$$R_{B,xk} = k_m F_{B,v,Rk} \quad (11)$$

where $F_{B,v,Rk}$ is the characteristic lateral load-carrying capacity of the fastener in the timber part against flange B, according to EN 1995-1-1, and the factor k_m depends on the placement of the fasteners. Values of k_m are given in Table A2.1 for cases, where fasteners are used in all 5 mm holes of the angle bracket.

Characteristic tension resistance for angular brackets without reinforcement ribs

$$R_{B,z,k} = \min \left\{ \begin{array}{l} F_{n,1} + F_{n,2} - 3 \cdot \frac{F_{n,1} \cdot d_1 + F_{n,2} \cdot d_2 - \frac{B \cdot t_d^2}{4} \cdot f_y}{2L_B + d_2} \quad (a) \\ \frac{t_d^2 f_y}{4 d_1} \cdot (B + B_{net,1}) \quad (b) \\ \frac{t_d^2 f_y}{4 d_2} \cdot (B + B_{net,2}) + \frac{F_{n,1} (d_2 - d_1)}{d_2} \quad (c) \\ F_{n,1} + F_{n,2} \quad (d) \end{array} \right. \quad (12)$$

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where

- d_1 distance between the bent edge and the hole row nearest to it in flange B ($i = 1$),
- d_2 distance between the bent edge and the hole row second nearest to it in flange B ($i = 2$),
- B the width of the angular bracket,
- t_d is the thickness of the Angle Bracket to be used in calculations (= the minimum thickness minus the thickness of the zinc coating),
- f_y yield strength of the steel of the Angle Bracket,
- L_B the length of flange B from the middle of the bent edge,
- $B_{net,i}$ the net width of the Angle Bracket at hole row i and

$$F_{n,i} = n F_{ax,Rk} \quad (13)$$

when n is the number of fasteners at row i and $F_{ax,Rk}$ is the characteristic withdrawal resistance of the fastener in the timber member against flange B according to EN 1995-1-1.

If there are fasteners only in one or two rows at flange B, in expression (12) equation (a) is inserted by $F_{n,2} = 0$ and $d_2 = d_1$ and equation (c) needs not to be checked.

Characteristic tension resistance for a angle bracket with reinforcement rib

$$R_{B,z,l,k} = \min \left\{ \begin{array}{l} \frac{\sum F_{a,j} + F_{n,1} - 3 \cdot \frac{F_{n,1} \cdot d_1 - \frac{B \cdot t_d^2}{4} \cdot f_y}{2L_B - 2a + d_2}}{\quad} \quad (a) \\ \frac{t_d^2 f_y}{4(a + d_1)} \cdot (B + B_{net,1}) + \frac{\sum (F_{a,j}(a + d_1 - a_j))}{a + d_1} \quad (b) \\ \sum F_{a,j} + F_{n,1} \quad (c) \end{array} \right. \quad (14)$$

where

- d_1 distance between the end of the reinforcement fold and the hole row nearest to it in flange B ($i = 1$)
- a is the length of the stiffener ridge in flange B
- a_j is distance between bent edge and the fastener row j
- B the width of the angle bracket at the end of reinforcement rib
- t_d is the thickness of the connector to be used in calculations (= the minimum thickness minus the thickness of the zinc coating)
- f_y yield strength of the steel of the connector
- L_B the length of flange B from the middle of the bent edge
- $B_{net,i}$ the net width of the angle bracket at hole row i

$$F_{n,1} = n F_{ax,Rk} \quad (15)$$

$$F_{a,j} = n_j F_{ax,Rk} \quad (16)$$

when m is the number of fasteners in the row nearest to the end of the reinforcement fold (i), n_j is the number of fasteners at row j in the part of flange B with the reinforcement and $F_{ax,Rk}$ is the characteristic withdrawal resistance of the fastener in the timber member against flange B according to EN 1995-1-1.

If the flange B of the connector only has one row of fasteners on the part without stiffener rib, in equation (14) is inserted $F_{n,1} = 0$.

For a stiffened connector that have no fasteners on the reinforcement area, the tension capacity may be calculated as maximum of equations (12) and (14). Then in expression (12), the flange length L_B is taken as distance between the end of the reinforcement rib and the end of the flange.



Characteristic compression resistance for angle brackets without reinforcement

$$R_{B,z,c,k} = t_d \cdot \sqrt{3 \cdot B \cdot B_{net} \cdot f_y \cdot f_{c,90,k}} \quad (17)$$

where t_d , B and f_y are defined as for equation (12) and B_{net} is the smallest net width of the flange B and $f_{c,90,k}$ is the characteristic compression strength perpendicular to the timber member against flange B.

Characteristic compression resistance for angle brackets with reinforcements

$$R_{z,c,B,k} = 3 \cdot a \cdot B_{ef} \cdot f_{c,90,k} + t_d \cdot \sqrt{3 \cdot B \cdot B_{net} \cdot f_y \cdot f_{c,90,k}} \quad (18)$$

where a is the length of the reinforcement rib from the bent edge of the angular bracket, B_{ef} is the width of the angular bracket minus the width of the reinforcement and the other symbols as for equation (17).

Calculated characteristic compression resistances of Arras CF Angle Brackets are shown in Tables A2.3 and A2.4 for connections of sawn timber of strength class C24.

For a timber-to-concrete angle bracket connection, the resistance of the corresponding timber-to-timber connection may be used, provided that the lateral load carrying capacity and axial tension capacity of the fastener group of flange B in concrete are greater or equal than the capacities of the fastener group of flange B in timber member.

Load carrying capacity of long adjustable brackets no 74402 and 74406

In design of long adjustable hole brackets following condition shall be fulfilled

$$\left(\frac{F_{z,t,d}}{R_{B,z,t,d}} \right)^2 + \left(\frac{F_{y,t,d}}{R_{A,y,t,d}} \right)^2 \leq 1 \quad (19)$$

where $F_{z,t,d}$ is the design tension load perpendicular to flange B and $F_{y,t,d}$ is the design tension load perpendicular to the sliding flange A.

The design capacities are as follows

$$R_{B,z,t,d} = \min \left\{ \begin{array}{l} \frac{k_{mod}}{\gamma_M} \cdot R_{t,z,k} \\ \frac{k_{mod}}{\gamma_M} \cdot R_{v,z,k} \\ \frac{R_{b,z,k}}{\gamma_{M,1}} \end{array} \right. \quad (20)$$

$$R_{A,y,t,d} = \min \left\{ \begin{array}{l} \frac{k_{mod}}{\gamma_M} \cdot R_{t,y,k} \\ \frac{k_{mod}}{\gamma_M} \cdot R_{v,y,k} \\ \frac{R_{t,y,k}}{\gamma_{M,1}} \end{array} \right. \quad (21)$$

where $\gamma_{M,1}$ is the partial safety factor in accordance with the relevant national annex of standard EN 1993-1-3, k_{mod} is the modification factor for load duration and moisture content according to EN 1995-1-1 and γ_M is the partial safety factor of connection in accordance with the relevant national annex of standard EN 1995-1-1.

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The characteristic lateral load capacities of the fastener connections are as follows

$$R_{v,z,k} = F_{v,A,Rk} \quad (22)$$

$$R_{v,y,k} = 2,213 F_{v,B,Rk} \quad (23)$$

$$R_{b,z,k} = 824 \text{ N} \quad (24)$$

where $F_{v,A,Rk}$ is the lateral load-carrying capacity per fastener in the sliding part and $F_{v,B,Rk}$ is similarly the load-carrying capacity per fastener in nailing plate side, see equations (7) and (8).

The characteristic capacities for connector no 74402 are as follows:

$$R_{t,z,k} = \min \left\{ \begin{array}{l} 1,2 F_{ax,B,Rk} + 939 \text{ N} \\ 6 F_{bx,B,Rk} \end{array} \right. \quad (25)$$

$$R_{t,y,k} = \min \left\{ \begin{array}{l} 0,358 F_{ax,A,Rk} + 923 \text{ N} \\ F_{ax,A,Rk} \end{array} \right. \quad (26)$$

$$R_{t,y,k} = 1807 \text{ N} \quad (27)$$

where $F_{ax,A,Rk}$ is the withdrawal capacity of the sliding fastener and $F_{ax,B,Rk}$ is the withdrawal capacity of nailing plate side fastener, see equations (10a) and (10b).

The characteristic capacities for connector no 74406 are respectively:

$$R_{t,z,k} = \min \left\{ \begin{array}{l} 1,672 F_{bx,B,Rk} + 1309 \text{ N} \\ 6 F_{bx,B,Rk} \end{array} \right. \quad (28)$$

$$R_{t,y,k} = \min \left\{ \begin{array}{l} 0,496 F_{ax,A,Rk} + 1278 \text{ N} \\ F_{ax,A,Rk} \end{array} \right. \quad (29)$$

$$R_{t,y,k} = 3413 \text{ N} \quad (30)$$

Structural requirements

Connections with the angle brackets shall fulfil the minimum spacing and edge and end distance requirements specified in EN 1995-1-1. The minimum distances a_1 and a_2 in table 8.2 of EN 1995-1-1 can be multiplied by a factor of 0,7 (nailed steel-to-timber connections).

If angle brackets are placed on both sides of the timber, the point of the fastener shall be at most $4d$ from the surface of the opposing side, where d is the nominal diameter of the fastener.

It is not possible to fill all holes by fasteners in all configurations and loading combinations of the angle brackets. In partial fixing the fasteners shall always be placed in the row nearest to the end of the flange and as near as possible to the bent edge of the angle bracket. Additionally, the fasteners should be positioned symmetrically.

The sliding angle brackets are always fixed from all holes of 5 mm diameter.

All fasteners in same flange shall be identical. The opposing flanges may have different fasteners.



Table A2.1. Article numbers of the non-sliding Arras CF Angle Brackets, nominal dimensions, grade of steel plate, number of fasteners in flange B n_B , eccentricity of the fastener group e , sum of the moment arms for the fastener group Σn and values for factor k_m when the fasteners are used in all 5 mm diameter of holes.

Art. No.	Size (mm)	Grade	n_B	e (mm)	Σn (mm)	k_m
71101	30x30x25x2,0	DX51D	2	20,0	16,1	0,645
71102	50x50x35x2,0	DX51D	4	25,5	72,1	1,729
71103	65x65x55x2,0	DX51D	6	36,7	155,9	2,673
71104	70x70x55x2,0	DX51D	10	38,6	222,1	3,653
71105	90x90x40x2,5	DX51D	8	49,8	191,1	2,621
71107	100x100x55x2,5	DX51D	9	56,3	319,0	3,552
71109	50x50x55x2,5	DX51D	4	26,8	93,8	2,144
71112	105x105x90x2,0	DX51D	11	50,1	416,6	4,735
71115	90x90x65x2,0	DX51D	8	54,1	241,3	2,958
71116	50x50x40x2,0	DX51D	4	30,0	65,9	1,500
71127	90x90x40x2,0	DX51D	8	50,0	185,5	2,554
71131	100x100x55x2,0	DX51D	9	56,5	319,0	3,543
71132	120x120x90x2,5	DX51D	11	49,9	416,3	4,745
71210	90x90x40x2,5	A2, AISI 304	8	49,8	191,1	2,621
71304	70x70x55x2,0	DX51D	9	40,8	202,4	3,412
71305	105x105x90x2,0	DX51D	10	51,8	399,4	4,494
71306	120x120x90x2,5	DX51D	10	51,6	399,4	4,507
71307	140x140x90x2,5	DX51D	13	69,4	614,8	5,351
71308	90x90x65x2,0	DX51D	8	54,1	243,0	2,974
71311	90x90x90x2,5	DX51D	8	41,0	287,4	3,951
71320	40x40x40x2,0	DX 51D	4	21,0	68,8	2,023
71321	40x40x40x2,5	DX51D	4	20,8	68,8	2,037
71322	60x60x40x2,0	DX51D	6	31,0	125,7	2,532
71323	60x60x40x2,5	DX51D	6	30,8	125,7	2,544
71324	80x80x40x2,0	DX51D	8	41,5	201,2	3,088
71325	80x80x40x2,5	DX51D	8	41,3	201,2	3,100
71326	100x100x40x2,0	DX51D	10	51,5	295,2	3,692
71327	100x100x40x2,5	DX51D	10	51,3	295,5	3,703
71328	120x80x40x2,0	DX51D	8	41,5	201,2	3,088
71329	120x80x40x2,5	DX51D	8	41,3	201,2	3,100
71332	160x40x40x2,0	DX51D	4	21,5	68,8	1,996
71333	160x40x40x2,5	DX51D	4	21,3	68,8	2,010
71335	200x40x40x2,5	DX51D	4	21,3	68,8	2,010
71340	90x90x65x2,0	DX51D	8	48,3	233,6	3,100
71345	90x90x65x2,0	DX51D	11	44,2	282,8	4,046
71402	40x40x20x2,0	DX51D	2	20,2	22,8	0,744
71460	90x90x65x2,5	A4, AISI 316	8	53,9	243,0	2,983
71461	40x40x40x2,0	A4, AISI 316	4	21,0	58,4	1,684
71462	50x50x35x2,0	A4, AISI 316	4	25,5	72,1	1,729
71463	90x90x65x2,5	A4, AISI 316	8	53,9	243,0	2,983
71464	60x60x40x2,0	A4, AISI 316	6	31,0	110,2	2,260
71465	70x70x55x2,5	A4, AISI 316	9	40,5	202,4	3,425
71466	50x50x35x2,5	A4, AISI 316	4	25,3	72,1	1,739
71467	60x60x60x2,0	A4, AISI 316	9	31,0	200,8	3,779
71468	90x90x65x2,0	A4, AISI 316	8	54,1	243,0	2,974
71469	105x105x90x2,5	A4, AISI 316	10	51,6	399,4	4,507
71470	105x105x90x2,5	A4, AISI 316	11	49,9	416,6	4,748
71502	80x60x60x2,5	DX51D	9	28,8	200,8	3,945
71506	160x80x60x2,5	DX51D	12	41,3	318,3	4,712
71507	160x80x80x2,5	DX51D	16	41,3	483,3	6,786
71510	200x100x100x2,5	DX51D	25	46,8	945,8	11,20
71512	60x40x60x2,5	DX51D	6	18,8	106,6	2,989

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Table A2.1. continued

Art. No.	Size (mm)	Grade	n_B	e (mm)	Σh (mm)	k_m
71551	150x90x65x2,5	DX51D	6	62,8	149,6	1,885
71552	170x90x65x2,5	DX51D	6	62,8	149,6	1,885
71553	190x90x65x2,5	DX51D	6	62,8	149,6	1,885
71554	150x150x65x2,5	DX51D	10	85,8	361,2	3,065
71555	170x170x65x2,5	DX51D	12	98,4	514,5	3,699
71556	190x190x65x2,5	DX51D	15	114,6	758,2	4,628
73001	90x40x40x2,5	DX51D	2	17,8	20,0	0,982
73002	140x40x40x2,5	DX51D	4	21,3	62,6	1,782
73006	90x50x55x2,5	DX51D	7	26,8	139,5	3,119
73007	90x40x40x3,0	DX51D	2	17,5	20,0	0,992
73201	180x20x40x2,0	DX51D	2	9,0	20,0	1,487
73202	280x20x40x2,0	DX51D	2	9,0	20,0	1,487
73203	380x20x40x2,0	DX51D	2	9,0	20,0	1,487
73605	90x90x40x2,5	DX51D	8	49,8	191,1	2,621
73606	140x40x40x2,5	DX51D	4	21,3	65,9	1,856
73609	50x50x55x2,5	DX51D	4	26,8	93,8	2,144
73610	65x65x55x2,0	DX51D	6	36,7	155,9	2,673
73612	50x50x40x2,0	DX51D	4	30,0	65,9	1,500
73622	50x50x40x2,5	DX51D	4	29,8	65,9	1,508
73623	65x65x55x3,0	DX51D	6	36,2	155,9	2,695
73624	65x65x55x2,5	DX51D	6	36,4	155,9	2,684
73104	90x90x40x2,5	DX51D	8	87,1	191,1	1,736
73107	90x90x65x2,5	DX51D	8	94,1	243,0	2,005
73111	50x50x35x2,5	DX51D	4	50,3	72,1	1,092

Table A2.2. Article numbers of the sliding Arras CF Angle Brackets and their nominal dimensions, types and number of fasteners in flanges A and B.

Art. No.	Size (mm)	Type	n_A	n_B
74402	35x35x130x2,0	non-reinforced	1	6
74406	35x35x130x2,0	stiffened by 3 ribs	1	6

Table A2.3. Characteristic compression resistance $R_{B,z,c,k}$ for unreinforced Arras CF Angle Brackets used with sawn timber in strength class C24. For compression capacities with other strength classes, the characteristic resistance $R_{B,z,c,k}$ should be multiplied by the factor $\sqrt{f_{c,90,k}/2,5}$, where $f_{c,90,k}$ is the characteristic compression strength perpendicular to the grain of the actual timber grade in N/mm².

Art. No.	Size (mm)	f_y (N/mm ²)	t_d (mm)	B (mm)	B_{net} (mm)	$R_{B,z,c,k}$ (kN)
71101	30x30x25x2,0	250	1,81	25	20	1,75
71102	50x50x35x2,0	250	1,81	35	25	2,32
71103	65x65x55x2,0	250	1,81	55	45	3,90
71104	70x70x55x2,0	250	1,81	55	34	3,39
71105	90x90x40x2,5	250	2,29	40	29	3,38
71107	100x100x55x2,5	250	2,29	55	40	4,65
71109	50x50x55x2,5	250	2,29	55	45	4,93
71112	105x105x90x2,0	250	1,81	90	63	5,90
71115	90x90x65x2,0	250	1,81	65	51	4,51
71116	50x50x40x2,0	250	1,81	40	29	2,67
71127	90x90x40x2,0	250	1,81	40	29	2,67
71131	100x100x55x2,0	250	1,81	55	40	3,68
71132	120x120x90x2,5	250	2,29	90	63	7,47

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Table A2.3. continued

Art. No.	Size (mm)	f_y (N/mm ²)	l_d (mm)	B (mm)	B_{net} (mm)	$R_{B,z,c,k}$ (kN)
71210	90x90x40x2,5	220	2,38	40	29	3,29
71320	40x40x40x2,0	250	1,81	40	29	2,67
71321	40x40x40x2,5	250	2,29	40	29	3,38
71322	60x60x40x2,0	250	1,81	40	29	2,67
71323	60x60x40x2,5	250	2,29	40	29	3,38
71324	80x80x40x2,0	250	1,81	40	29	2,67
71325	80x80x40x2,5	250	2,29	40	29	3,38
71326	100x100x40x2,0	250	1,81	40	29	2,67
71327	100x100x40x2,5	250	2,29	40	29	3,38
71328	120x80x40x2,0	250	1,81	40	29	2,67
71329	120x80x40x2,5	250	2,29	40	29	3,38
71332	160x40x40x2,0	250	1,81	40	29	2,67
71333	160x40x40x2,5	250	2,29	40	29	3,38
71335	200x40x40x2,5	250	2,29	40	29	3,38
71345	90x90x65x2,0	250	1,81	65	45	4,24
71402	40x40x20x2,0	250	1,81	20	15	1,36
71461	40x40x40x2,0	240	1,90	40	30	2,79
71462	50x50x35x2,0	240	1,90	35	25	2,38
71463	90x90x65x2,5	240	2,38	65	51	5,81
71464	60x60x40x2,0	240	1,90	40	30	2,79
71466	50x50x35x2,5	240	2,38	35	25	2,99
71467	60x60x60x2,0	240	1,90	60	45	4,19
71470	105x105x90x2,5	240	2,38	90	63	7,60
71502	80x60x60x2,5	250	2,29	60	45	5,15
71506	160x80x60x2,5	250	2,29	60	45	5,15
71507	160x80x80x2,5	250	2,29	80	60	6,87
71510	200x100x100x2,5	250	2,29	100	75	8,59
71512	60x40x60x2,5	250	2,29	60	45	5,15
73001	90x40x40x2,5	250	2,29	40	29	3,38
73002	140x40x40x2,5	250	2,29	40	29	3,38
73006	90x50x55x2,5	250	2,29	55	34	4,29
73007	90x40x40x3,0	250	2,76	40	29	4,07
73201	180x20x40x2,0	250	1,81	40	30	2,72
73202	280x20x40x2,0	250	1,81	40	30	2,72
73203	380x20x40x2,0	250	1,81	40	30	2,72



Table A2.4. Characteristic compression resistance $R_{B,z,c,k}$ for reinforced Arras CF Angle Brackets used with sawn timber in strength class C24. For compression capacities with other strength classes, the characteristic resistance $R_{B,z,c,k}$ should be multiplied by the factor $\sqrt{f_{c,90,k}}/2,5$, where $f_{c,90,k}$ is the characteristic compression strength perpendicular to the grain of the actual timber grade.

Art. No.	Size (mm)	f_y (N/mm ²)	t_a (mm)	B (mm)	a (mm)	B_{ef} (mm)	B_{net} (mm)	$R_{B,z,c,k}$ (kN)
71304	70x70x55x2,0	250	1,81	55	36,5	33	35	12,5
71305	105x105x90x2,0	250	1,81	90	76	55	68	37,5
71306	120x120x90x2,5	250	2,29	90	76,3	55	68	39,2
71307	140x140x90x2,5	250	2,29	90	76,3	55	68	39,2
71308	90x90x65x2,0	250	1,81	65	55	31	44	17,0
71311	90x90x90x2,5	250	2,29	90	76,3	55	68	31,5
71340	90x90x65x2,0	250	1,81	65	55	31	45	17,0
71460	90x90x65x2,5	240	2,38	65	45	40	45	19,0
71465	70x70x55x2,5	240	2,38	55	36,3	31	35	12,9
71468	90x90x65x2,0	240	2,38	65	55	31	45	18,2
71469	105x105x90x2,5	240	2,38	90	65	60	70	37,3
71551	150x90x65x2,5	250	2,29	65	71,3	48	44	25,7
71552	170x90x65x2,5	250	2,29	65	71,3	48	44	25,7
71553	190x90x65x2,5	250	2,29	65	71,3	48	44	25,7
71554	150x150x65x2,5	250	2,29	65	71,3	48	44	30,9
71555	170x170x65x2,5	250	2,29	65	71,3	48	44	30,9
71556	190x190x65x2,5	250	2,29	65	71,3	48	44	30,9
73605	90x90x40x2,5	250	2,29	40	9	29	29	5,3
73606	140x40x40x2,5	250	2,29	40	9	29	29	5,3
73609	50x50x55x2,5	250	2,29	55	9	44	45	7,9
73610	65x65x55x2,0	250	1,81	55	9	44	45	6,9
73612	50x50x40x2,0	250	1,81	40	9	29	29	4,6
73622	50x50x40x2,5	250	2,29	40	9	29	29	5,3
73623	65x65x55x3,0	250	2,76	55	9	44	45	8,9
73624	65x65x55x2,5	250	2,29	55	9	44	45	7,9



Table A2.5. Characteristic tension resistance $R_{B,z,l,k}$ for unreinforced Arras CF Angle Bracket connections when anchor nails 4x50, $f_{ax,k} = 6 \text{ N/mm}^2$ and $t_{pen} = 34 \text{ mm}$, are used in all holes.

Art. No.	Size (mm)	L_B (mm)	d_1 (mm)	n_1	$B_{rel,1}$ (mm)	$F_{n,1}$ (N)	d_2 (mm)	n_2	$B_{rel,2}$ (mm)	$F_{n,2}$ (N)	$F_{z,l,k}$ (a) (N)	$F_{z,l,k}$ (b) (N)	$F_{z,l,k}$ (c) (N)	$F_{z,l,k}$ (d) (N)	$R_{B,z,l,k}$ (kN)
71101	30x30x25x2,0	29	16	1	20	816	24	0	20	0	526	576	656	816	0,53
71102	50x50x35x2,0	48,5	10,5	2	25	1632	40,5	0	25	0	1414	1170	1512	1632	1,17
71103	65x65x55x2,0	64	14	2	45	1632	40	2	45	1632	1891	1463	1573	3264	1,46
71104	70x70x55x2,0	71	21	3	40	2448	34	2	45	1632	2450	926	1538	4080	0,93
71105	90x90x40x2,5	88,75	17,75	2	30	1632	41,75	2	30	1632	2115	1293	1488	3264	1,29
71107	100x100x55x2,5	98,75	11,75	2	45	1632	31,75	2	45	1632	2571	2789	2060	3264	2,06
71109	50x50x55x2,5	48,75	13,75	2	45	1632	39,75	0	45	0	1536	2384	1892	1632	1,54
71112	105x105x90x2,0	104	15,75	4	70	3264	33,25	1	63	816	3332	2080	2660	4080	2,08
71115	90x90x65x2,0	89	15,5	2	55	1632	51	2	55	1632	2017	1585	1618	3264	1,59
71116	50x50x40x2,0	49	18	2	30	1632	42	0	30	0	1178	796	1274	1632	0,80
71127	90x90x40x2,0	89	18	2	30	1632	42	2	30	1632	2040	796	1274	3264	0,80
71131	100x100x55x2,0	99	11,5	2	45	1632	31,5	2	45	1632	2494	1780	1686	3264	1,69
71132	120x120x90x2,5	118,75	15,5	4	70	3264	33	1	63	816	3547	3383	3251	4080	3,25
71210	90x90x40x2,5	88,5	17,75	2	30	1632	41,75	2	20	1632	2103	1229	1386	3264	1,23
71320	40x40x40x2,0	39	11	2	30	1632	31	0	30	0	1363	1303	1515	1632	1,30
71321	40x40x40x2,5	38,75	10,75	2	30	1632	30,75	0	30	0	1509	2134	1808	1632	1,51
71322	60x60x40x2,0	59	11	2	30	1632	31	2	30	1632	2049	1303	1515	3264	1,30
71323	60x60x40x2,5	58,75	10,75	2	30	1632	30,75	2	30	1632	2159	2134	1808	3264	1,81
71324	80x80x40x2,0	79	11,5	2	30	1632	31,5	2	30	1632	2283	1246	1491	3264	1,25
71325	80x80x40x2,5	78,75	11,25	2	30	1632	31,25	2	30	1632	2370	2039	1779	3264	1,78
71326	100x100x40x2,0	99	11,5	2	30	1632	31,5	2	30	1632	2454	1246	1491	3264	1,25
71327	100x100x40x2,5	88,75	11,25	2	30	1632	31,25	2	30	1632	2456	2039	1779	3264	1,78
71328	120x80x40x2,0	79	11,5	2	30	1632	31,5	2	30	1632	2283	1246	1491	3264	1,25
71329	120x80x40x2,5	78,75	11,25	2	30	1632	30,75	2	30	1632	2381	2039	1781	3264	1,78
71332	160x40x40x2,0	39	11,5	2	30	1632	31,5	0	30	0	1342	1246	1491	1632	1,25
71333	160x40x40x2,5	38,75	11,25	2	30	1632	31,25	0	30	0	1487	2039	1779	1632	1,49
71335	200x40x40x2,5	38,75	11,25	2	30	1632	31,25	0	30	0	1487	2039	1779	1632	1,49
71345	90x90x65x2,0	89	14	3	55	2448	36	3	55	2448	3367	1755	2179	4896	1,76
71402	40x40x20x2,0	39	10,2	1	15	816	31,2	0	15	0	953	703	779	816	0,70
71461	40x40x40x2,0	39	11	2	30	1632	31	0	30	0	1376	1378	1542	1632	1,38
71462	50x50x35x2,0	48,5	10,5	2	25	1632	40,5	0	25	0	1549	1238	1530	1632	1,24
71463	90x90x65x2,5	88,75	15,25	2	55	1632	50,75	2	55	1632	2139	2674	1945	3264	1,95
71464	60x60x40x2,0	59	11	2	30	1632	31	2	30	1632	2058	1378	1542	3264	1,38
71466	50x50x35x2,5	48,25	10,25	2	25	1632	40,25	0	25	0	1557	1989	1723	1632	1,56
71467	60x60x60x2,0	59	11	3	45	2448	31	3	45	2448	3088	2068	2313	4896	2,07
71470	105x105x90x2,5	103,75	15,5	4	70	3264	33	1	63	816	3495	3508	3307	4080	3,31
71502	80x60x60x2,5	58,75	8,75	3	45	2448	28,75	3	45	2448	3416	3933	2900	4896	2,90
71506	160x80x60x2,5	78,75	11,25	3	45	2448	31,25	3	45	2448	3454	3059	2668	4896	2,67
71507	160x80x80x2,5	78,75	11,25	4	60	3264	31,25	4	60	3264	4535	4079	3557	6528	3,56
71510	200x100x100x2,5	88,75	8,75	5	75	4080	28,75	5	75	4080	6566	6555	4833	8160	4,83
71512	60x40x60x2,5	38,75	8,75	3	45	2448	28,75	0	45	0	2219	3933	2900	2448	2,22
73001	90x40x40x2,5	38,75	19	2	30	1632					939	1208		1632	0,94
73002	140x40x40x2,5	40,25	9,25	2	30	1632	33,25	0	30	0	1580	2480	1868	1632	1,58
73006	90x50x55x2,5	48,75	11,75	2	45	1632	23,75	2	34	1632	2277	2789	2053	3264	2,05
73007	90x40x40x3,0	38,5	17,5	2	30	1632					1038	1904		1632	1,04
73201	180x20x40x2,0	19	9	2	30	1632					1523	1593		1632	1,52
73202	280x20x40x2,0	19	9	2	30	1632					1119	1593		1632	1,12
73203	380x20x40x2,0	19	9	2	30	1632					1119	1593		1632	1,12



Table A2.6. Characteristic tension resistance $R_{B,z,k}$ for reinforced Arras CF Angle Bracket connections when anchor nails 4x50, $f_{a,k} = 6 \text{ N/mm}^2$ and $t_{pen} = 34 \text{ mm}$, are used in all holes.

Tension resistances according to equation (14):

Art. No.	Size (mm)	L_B (mm)	a (mm)	a_1 (mm)	n_{a1}	$F_{a,1}$ (N)	a_2 (mm)	n_{a2}	$F_{a,2}$ (N)	d_1 (mm)	n_1	$B_{net,1}$ (mm)	$F_{n,1}$ (N)	$F_{z1,k}$ (a) (N)	$F_{z1,k}$ (b) (N)	$F_{z1,k}$ (c) (N)	$R_{B,z1,k}$ (kN)
71304	70x70x55x2,0	71,0	36,5	21,0	2	1632	34,0	2	1632	9,5	2	35	1632	4734	1713	4896	4,73
71305	105x105x90x2,0	104,0	76,0	15,8	4	3264	51,3	2	1632	6,3	2	80	1632	6925	3676	6528	6,53
71306	120x120x90x2,5	118,8	76,3	15,5	4	3264	51,0	2	1632	5,8	2	80	1632	7193	3943	6528	6,53
71307	140x140x90x2,5	138,8	76,3	15,5	4	3264	51,0	2	1632	5,8	2	80	1632	8990	3943	6528	6,53
71308	90x90x65x2,0	89,0	55,0	15,5	2	1632	51,0	2	1632	13,0	2	55	1632	4603	2029	4896	4,60
71311	90x90x90x2,5	88,8	76,3	15,5	4	3264	51,0	2	1632	6,0	0	80	0	7751	3946	4896	4,90
71340	90x90x65x2,0	89,0	55,0	14,0	2	1632	37,0	2	1632	6,0	2	55	1632	5039	2302	4896	4,90
71460	90x90x65x2,5	88,8	45,0	15,3	2	1632				5,8	2	55	1632	3673	1945	3264	3,26
71465	70x70x55x2,5	71,3	36,3	21,3	2	1632	34,3	2	1632	10,0	2	35	1632	4985	1967	4896	4,90
71468	90x90x65x2,0	89,0	55,0	15,5	2	1632	51,0	2	1632	13,0	2	55	1632	4632	2050	4896	4,63
71469	105x105x90x2,5	103,8	65,0	15,5	4	3264	51,0	2	1632	17,0	2	80	1632	8818	3969	6528	6,53
71551	150x90x65x2,5	88,8	71,3	45,8	2	1632	63,8	2	1632	7,5	0	44	0	4768	1447	3264	3,26
71552	170x90x65x2,5	88,8	71,3	45,8	2	1632	63,8	2	1632	7,5	0	44	0	4768	1448	3264	3,26
71553	190x90x65x2,5	88,8	71,3	45,8	2	1632	63,8	2	1632	7,5	0	44	0	4768	1448	3264	3,26
71554	150x150x65x2,5	148,8	71,3	45,8	2	1632	63,8	2	1632	7,5	2	44	1632	5063	1448	4896	4,90
71555	170x170x65x2,5	168,8	71,3	45,8	2	1632	63,8	2	1632	7,5	2	44	1632	5030	1448	4896	4,90
71556	190x190x65x2,5	188,8	71,3	45,8	2	1632	63,8	2	1632	7,5	2	44	1632	5008	1448	4896	4,90
73605	90x90x40x2,5	88,8	9,0							8,8	2	30	1632	1611	1293	1632	1,61
73606	140x40x40x2,5	40,3	9,0							0,3	2	30	1632	2239	2480	1632	2,24
73609	50x50x55x2,5	48,8	9,0							4,8	2	45	1632	1998	2384	1632	2,00
73610	65x65x55x2,0	64,0	9,0							5,0	2	55	1632	1713	1609	1632	1,63
73612	50x50x40x2,0	49,0	9,0							9,0	2	30	1632	1413	796	1632	1,41
73622	50x50x40x2,5	48,8	9,0							8,8	2	30	1632	1592	1293	1632	1,59
73623	65x65x55x3,0	63,5	9,0							4,5	2	45	1632	2130	3527	1632	2,13
73624	65x65x55x2,5	63,8	9,0							4,8	2	45	1632	1902	2384	1632	1,90

For stiffened connectors of 73600 –series, resistances also according to equation (12) with reduced flange length L_B (= from rib to flange end):

Art. No.	Size (mm)	L_B (mm)	d_1 (mm)	n_1	$B_{net,1}$ (mm)	$F_{n,1}$ (N)	d_2 (mm)	n_2	$B_{net,2}$ (mm)	$F_{n,2}$ (N)	$F_{z1,k}$ (a) (N)	$F_{z1,k}$ (b) (N)	$F_{z1,k}$ (c) (N)	$F_{z1,k}$ (d) (N)	$R_{B,z1,k}$ (kN)
73605	90x90x40x2,5	79,75	8,75	2	30	1632	32,75	2	30	1632	2412	2622	1897	3264	1,90
73606	140x40x40x2,5	31,25	0,25	2	30	1632	24,25	0	30	0	2071	91772	2561	1632	2,07
73609	50x50x55x2,5	39,75	4,75	2	45	1632	30,75	0	45	0	1912	6900	2446	1632	1,91
73610	65x65x55x2,0	55	5	2	55	1632	31	2	45	1632	2254	4505	2029	3264	2,03
73612	50x50x40x2,0	40	9	2	30	1632	33	0	30	0	1459	1593	1621	1632	1,46
73622	50x50x40x2,5	39,75	8,75	2	30	1632	32,75	0	30	0	1601	2622	1897	1632	1,60
73623	65x65x55x3,0	54,5	4,5	2	45	1632	30,5	2	45	1632	2599	10580	2952	3264	2,60
73624	65x65x55x2,5	54,75	4,75	2	45	1632	30,75	2	45	1632	2410	6900	2446	3264	2,41

