

Leistungserklärung / Declaration of Performance

2009100351_008CPR2023-09-141_2024

- **Eindeutiger Kenncode des Produkttyps / Unique identification code of the product type**
HV2425, HV2630, HV2640, HV2660, HV2700, HV2720, HV2775, HV2810, HVG2410, HVG2630, HVG2655, HVG2700, HVG2720

- **Verwendungszweck(e) / Usage(s)**
Winkel für Holz zu Holz Verbindungen /
Angle bracket for timber to timber 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 11/0485 11.09.2023
Technische Bewertungsstelle / *Technical Assessment Body:*
ETA Danmark A/S
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>
Verbindungsfestigkeit – Charakteristische Tragfähigkeit <i>Joint Strength - Characteristic load-carrying capacity</i>	Annex B	ETA-11/0485; 3.1
Steifigkeit der Verbindung <i>Joint Stiffness</i>	Annex B	ETA-11/0485; 3.1
Duktilität der Verbindung <i>Joint ductility</i>	NPD	ETA-11/0485; 3.1
Widerstandsfähigkeit gegen seismische Einflüsse <i>Resistance to seismic actions</i>	NPD	ETA-11/0485; 3.1
Widerstandsfähigkeit gegen Korrosion und Beschädigung <i>Resistance to corrosion and deterioration</i>	Nutzungsklasse 1 und 2 <i>Service class 1 and 2</i> DX 51 D / Z 275.	ETA-11/0485; 3.1, 3.6 EAD 130186-00-0603 EN 10346
Brandverhalten <i>Reaction to fire</i>	Stahl klassifiziert als Euroklasse A1 <i>Steel classified as Euroclass A1</i>	ETA-11/0485; 3.2 EN 13501-1
Allgemeine Aspekte im Zusammenhang mit der Leistung des Produkts <i>General aspects related to the performance of the product</i>	Nutzungsklasse 1, 2 & 3 bei Holzkonstruktionen unter Verwendung von Holzarten gem. Eurocode 5 <i>Service class 1, 2 & 3 for timber constructions using timber species according to Eurocode 5</i>	ETA-11/0485; 3.3

Tab.1 Wesentliche Merkmale / *essential features*

Kenncode <i>Identification code</i>	Winkel-Typ <i>Angle bracket type</i>	Stahl Spezifikation <i>Steel specification</i>	Spezifikation der Beschichtung <i>coating specification</i>
HV2425	40 x 40 x 100 x 2,0	DX 51 D / S250GD	Z 275
HV2630 / HVG2630	90 x 90 x 65 x 2,5 with bolt hole	DX 51 D / S250GD	Z 275
HV2640	105 x 105 x 90 x 3,0	DX 51 D / S250GD	Z 275
HV2660	105 x 105 x 90 x 3,0 with rib	DX 51 D / S250GD	Z 275
HV2700 / HVG2700	40 x 40 x 60 x 2,5	DX 51 D / S250GD	Z 275
HV2720 / HVG2720	60 x 60 x 50 x 2,5	DX 51 D / S250GD	Z 275
HV2775	60 x 60 x 100 x 2,5	DX 51 D / S250GD	Z 275
HV2810	60 x 60 x 100 x 2,5	DX 51 D / S250GD	Z 275
HVG2410	40 x 40 x 40 x 2,0	DX 51 D / S250GD	Z 275
HVG2655	105 x 105 x 90 x 3,0 with rib	DX 51 D / S250GD	Z 275

Tab.2 Produkt Details / *Product details*



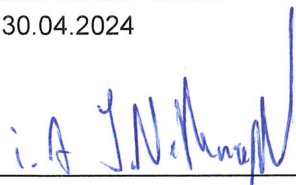
Die Leistung des vorstehenden Produkts entspricht der erklärten Leistung / den erklärten Leistungen.
Für die Erstellung der Leistungserklärung im Einklang mit der Verordnung (EU) Nr. 305/2011 ist allein der obengenannte Hersteller verantwortlich.

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, 30.04.2024



i. A. Yannik Nothnagel
Leitung Einkauf Eisenwaren
Head of purchasing ironmongery



i. A. Marcel Dartsch
Standortverantwortlicher Qualitätsmanagement Celle
Site Manager Quality Management Celle



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
75 x 60 x 60 x 2,0, short rib, long hole	1,2,3	10,11,12,14,15,16	2,81	1,49
75 x 60 x 60 x 2,5, short rib, long hole	1,2	8,10,11,12,13	1,87	2,02
75 x 60 x 60 x 2,5, short rib, two long holes	1,2,3	9,10,11,13,14,15	2,81	2,33
80 x 80 x 40 x 2,0	1,2	9,10,11,12,13,14,15,16	2,50	1,55
80 x 80 x 40 x 2,5	1,2	9,10,11,12,13,14,15,16	2,50	2,43
80 x 80 x 50 x 2,0 with bolt hole	1,2	12,13,14,15,16,18,19,20,21,22	2,47	1,93
80 x 80 x 50 x 2,5 with bolt hole	1,2	12,13,14,15,16,18,19,20,21,22	2,47	3,02
80 x 80 x 60 x 2,0	1,2,3	13,14,15,16,17,18,19,20,21,22, 23,24	3,82	2,61
80 x 80 x 80 x 2,0	1,2,3	15,16,17,18,19,20,21,22,23,24, 25,26,27,28	4,90	2,78
80 x 80 x 100 x 2,0	1,2,3,4	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35,36	6,13	3,48
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4	20,21,22,23,24,25,26,27,28,30, 31,32,33,34,35,36,37,38	4,94	3,87
80 x 80 x 100 x 2,5	1,2,3,4	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35,36	6,13	5,44
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4	20,21,22,23,24,25,26,27,28,30, 31,32,33,34,35,36,37,38	4,94	6,04
90 x 40 x 40 x 2,5	1,2,4,5	11,12	1,36	1,47
90 x 60 x 60 x 2,0, short rib, long hole	1,2,3,4,5,6	10,11,12,14,15,16	2,81	1,49
90 x 60 x 60 x 2,0, short rib, two long holes	1,2,4,5,6	10,11,13,14,15	1,87	1,33
90 x 60 x 60 x 2,5, short rib, long hole	1,2,3,4,5,6	10,12,14,15,16	2,81	2,02
90 x 60 x 60 x 2,5, short rib, two long holes	1,2,4,5,6	10,11,13,14,15	1,87	2,07
90 x 60 x 60 x 2,5, short rib, three long holes	1,2,4	8,9,11,12,13	1,87	2,07
90 x 90 x 65 x 2,5 with bolt hole	1,2,5,6	16,17,18,20,21,22,24,25,26,29,30	3,44	3,24
90 x 90 x 65 x 2,5 with bolt hole, long hole	1,2,5,6	16,17,18,20,21,22,24,25,26,29,30	3,44	3,24
90 x 90 x 65 x 2,5 with rib	1,2,5,6	13,14,16,17,19,20,23,24	2,29	11,47
90 x 90 x 90 x 3,0	1,2	14,15,16,17,18,21,22,25,26, 27,28	5,94	5,22



Bracket type	Nail number n _v	Nail number n _{II}	F _{1,Rk} [kN] (column)	
			Timber	Steel
90 x 90 x 90 x 3,0 with hook	1,2	14,15,16,17,18,21,22,25,26, 27,28	5,94	5,22
90 x 90 x 90 x 3,0 with rib	1,2	13,14,15,16,19,20,23,24,25,26	4,75	13,9
90 x 90 x 90 x 3,0 with rib, with hook	1,2	13,14,15,16,19,20,23,24,25,26	4,75	13,9
100 x 100 x 40 x 2,0	1,2,3,4	11,12,13,14,15,16,17,18,19,20	2,59	1,55
100 x 100 x 40 x 2,5	1,2,3,4	11,12,13,14,15,16,17,18,19,20	2,59	2,43
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6	16,17,18,19,20,22,23,24,25, 26,28,29	2,55	1,86
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6	16,17,18,19,20,22,23,24,25,26, 28,29	2,55	2,90
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5	13,14,15,16,20,21,22,23,24	2,56	8,33
100 x 100 x 60 x 2,0	1,2,3,4,5,6	16,17,18,19,20,21,22,23,24,25, 26,27,28,29,30	3,95	2,61
100 x 100 x 60 x 2,5	1,2,3,4,5,6	16,17,18,19,20,21,22,23,24,25, 26,27,28,29,30	3,95	4,08
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7	19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35,36	5,11	2,78
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9	24,25,26,27,28,29,30,31,32,33, 34,35,36,37,38,39,40,41,42,43, 44,45,46	6,42	3,63
100 x 100 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	26,27,28,29,30,31,32,33,34,36, 37,38,39,40,41,42,43,44,46,47, 48,49	5,14	3,87
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9	24,25,26,27,28,29,30,31,32,33, 34,35,36,37,38,39,40,41,42,43, 44,45,46	6,42	5,66
105 x 105 x 90 x 2,5, rib, with bolt hole	1,2,4,5	16,17,18,19,22,23,26,29,31,32	4,57	10,3
105 x 105 x 90 x 2,5 with bolt hole, long hole	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	5,71	3,52
105 x 105 x 90 x 3,0	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	6,15	5,22
105 x 105 x 90 x 3,0 with hook	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	6,15	5,22
105 x 105 x 90 x 3,0 with rib	1,2,4,5	16,17,18,19,22,23,26,29,31,32	4,92	14,1
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5	16,17,18,19,22,23,26,29,31,32	4,92	14,1
120 x 120 x 90 x 3,0	3,4,6,7	19,20,21,22,23,26,27,30,33,35, 36,38	6,31	5,22
120 x 120 x 90 x 3,0 with hook	3,4,6,7	19,20,21,22,23,26,27,30,33,35, 36,38	6,31	5,22



Bracket type	Nail number n_v	Nail number n_H	$F_{1,Rk}$ [kN] (column)	
			Timber	Steel
120 x 120 x 90 x 3,0 with rib	3,4,6,7	18,19,20,21,24,25,28,31,33,34,36	5,05	14,7
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7	18,19,20,21,24,25,28,31,33,34,36	5,05	14,7
130 x 50 x 65 x 2,5 with bolt hole and long hole	1,2,4,5,8,9,11	17,18,19,21,22	2,01	4,15
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10	22,23,24,25,26,29,30,33,36,38,39,41,43,44	6,46	5,22
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10	22,23,24,25,26,29,30,33,36,38,39,41,43,44	6,46	5,22
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10	21,22,23,24,27,28,31,34,36,37,39,41,42	5,17	13,5
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10	21,22,23,24,27,28,31,34,36,37,39,41,42	5,17	13,5

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

Bracket type	Nail number n_v	Nail number n_H	$F_{1,Rk}$ [kN] (column)	
			Timber	Steel
75 x 60 x 60 x 2,0, short rib, long hole	1,2,3	10,11,12,14,15,16	1,40	0,75
75 x 60 x 60 x 2,5, short rib, long hole	1,2	8,10,11,12,13	0,94	1,01
75 x 60 x 60 x 2,5, short rib, two long holes	1,2,3	9,10,11,13,14,15	1,40	1,17
80 x 80 x 40 x 2,0	1,2	9,10,11,12,13,14,15,16	1,25	0,78
80 x 80 x 40 x 2,5	1,2	9,10,11,12,13,14,15,16	1,25	1,21
80 x 80 x 50 x 2,0 with bolt hole	1,2	12,13,14,15,16,18,19,20,21,22	1,23	0,97
80 x 80 x 50 x 2,5 with bolt hole	1,2	12,13,14,15,16,18,19,20,21,22	1,23	1,51
80 x 80 x 60 x 2,0	1,2,3	13,14,15,16,17,18,19,20,21,22,23,24	1,91	1,31
80 x 80 x 80 x 2,0	1,2,3	15,16,17,18,19,20,21,22,23,24,25,26,27,28	2,45	1,39
80 x 80 x 100 x 2,0	1,2,3,4	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	3,06	1,74
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	2,47	1,93
80 x 80 x 100 x 2,5	1,2,3,4	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	3,06	2,72
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	2,47	3,02
90 x 40 x 40 x 2,5	1,2,4,5	11,12	0,68	0,73



Bracket type	Nail number n _V	Nail number n _H	F _{1,Rk} [kN] (column)	
			Timber	Steel
90 x 60 x 60 x 2,0, short rib, long hole	1,2,3,4,5,6	10,11,12,14,15,16	1,40	0,75
90 x 60 x 60 x 2,0, short rib, two long holes	1,2,4,5,6	10,11,13,14,15	0,94	0,66
90 x 60 x 60 x 2,5, short rib, long hole	1,2,3,4,5,6	10,12,14,15,16	1,40	1,01
90 x 60 x 60 x 2,5, short rib, two long holes	1,2,4,5,6	10,11,13,14,15	0,94	1,04
90 x 60 x 60 x 2,5, short rib, three long holes	1,2,4	8,9,11,12,13	0,94	1,04
90 x 90 x 65 x 2,5 with bolt hole	1,2,5,6	16,17,18,20,21,22,24,25,26,29,30	1,72	1,62
90 x 90 x 65 x 2,5 with bolt hole, long hole	1,2,5,6	16,17,18,20,21,22,24,25,26,29,30	1,72	1,62
90 x 90 x 65 x 2,5 with rib	1,2,5,6	13,14,16,17,19,20,23,24	1,15	5,73
90 x 90 x 90 x 3,0	1,2	14,15,16,17,18,21,22,25,26,27,28	2,97	2,61
90 x 90 x 90 x 3,0 with hook	1,2	14,15,16,17,18,21,22,25,26,27,28	2,97	2,61
90 x 90 x 90 x 3,0 with rib	1,2	13,14,15,16,19,20,23,24,25,26	2,37	6,94
90 x 90 x 90 x 3,0 with rib, with hook	1,2	13,14,15,16,19,20,23,24,25,26	2,37	6,94
100 x 100 x 40 x 2,0	1,2,3,4	11,12,13,14,15,16,17,18,19,20	1,30	0,78
100 x 100 x 40 x 2,5	1,2,3,4	11,12,13,14,15,16,17,18,19,20	1,30	1,21
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6	16,17,18,19,20,22,23,24,25,26,28,29	1,28	0,93
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6	16,17,18,19,20,22,23,24,25,26,28,29	1,28	1,45
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5	13,14,15,16,20,21,22,23,24	1,28	4,16
100 x 100 x 60 x 2,0	1,2,3,4,5,6	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	1,97	1,31
100 x 100 x 60 x 2,5	1,2,3,4,5,6	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	1,97	2,04
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	2,55	1,39
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46	3,21	1,81
100 x 100 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	26,27,28,29,30,31,32,33,34,36,37,38,39,40,41,42,43,44,46,47,48,49	2,57	1,93
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46	3,21	2,83
105 x 105 x 90 x 2,5, rib, with bolt hole	1,2,4,5	16,17,18,19,22,23,26,29,31,32	2,28	5,14
105 x 105 x 90 x 2,5 with bolt hole, long hole	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	2,86	1,76



Bracket type	Nail number n_v	Nail number n_H	$F_{1,Rk}$ [kN] (column)	
			Timber	Steel
105 x 105 x 90 x 3,0	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	3,07	2,61
105 x 105 x 90 x 3,0 with hook	1,2,4,5	17,18,19,20,21,24,25,28,31,33,34	3,07	2,61
105 x 105 x 90 x 3,0 with rib	1,2,4,5	16,17,18,19,22,23,26,29,31,32	2,46	7,03
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5	16,17,18,19,22,23,26,29,31,32	2,46	7,03
120 x 120 x 90 x 3,0	3,4,6,7	19,20,21,22,23,26,27,30,33,35,36,38	3,15	2,61
120 x 120 x 90 x 3,0 with hook	3,4,6,7	19,20,21,22,23,26,27,30,33,35,36,38	3,15	2,61
120 x 120 x 90 x 3,0 with rib	3,4,6,7	18,19,20,21,24,25,28,31,33,34,36	2,52	7,37
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7	18,19,20,21,24,25,28,31,33,34,36	2,52	7,36
130 x 50 x 65 x 2,5 with bolt hole and long hole	1,2,4,5,8,9,11	17,18,19,21,22	1,01	2,08
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10	22,23,24,25,26,29,30,33,36,38,39,41,43,44	3,23	2,61
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10	22,23,24,25,26,29,30,33,36,38,39,41,43,44	3,23	2,61
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10	21,22,23,24,27,28,31,34,36,37,39,41,42	2,58	6,74
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10	21,22,23,24,27,28,31,34,36,37,39,41,42	2,58	6,74

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
40 x 40 x 40 x 2,0	1,2	5,6,7,8	2,00	1,55
40 x 40 x 40 x 2,5	1,2	5,6,7,8	2,00	2,43
40 x 40 x 50 x 2,0	1,2,3	6,7,8,9,10	3,15	2,03
40 x 40 x 50 x 2,5	1,2,3	6,7,8,9,10	3,15	3,17
40 x 40 x 60 x 2,0	1,2,3	7,8,9,10,11,12	3,15	2,61
40 x 40 x 60 x 2,5	1,2,3	7,8,9,10,11,12	3,15	4,08
40 x 40 x 80 x 2,0	1,2,3	8,9,10,11,12,13,14	3,83	2,90
40 x 40 x 80 x 2,5	1,2,3	8,9,10,11,12,13,14	3,78	4,35
40 x 40 x 100 x 2,0	1,2,3,4	10,11,12,13,14,15,16,17,18	4,83	3,63
40 x 40 x 100 x 2,5	1,2,3,4	10,11,12,13,14,15,16,17,18	4,83	5,66
50 x 50 x 55 x 2,5	1,2	6,7,9,10	1,96	3,24
60 x 35 x 60 x 2,0	1,2,4,5	7,9	1,14	1,29

Bracket type	Nail number n_V	Nail number n_H	$F_{t,Rk}$ [kN] (purlin)	
			Timber	Steel
60 x 60 x 20 x 2,0	1,2	4,5	1,17	0,78
60 x 60 x 20 x 2,5	1,2	4,5	1,17	1,21
60 x 60 x 30 x 2,0	1,2,3	6,7,8,9,10	2,34	1,04
60 x 60 x 30 x 2,5	1,2,3	6,7,8,9,10	2,34	1,62
60 x 60 x 40 x 2,0	1,2,3,4	7,8,9,10,11,12	2,34	1,55
60 x 60 x 50 x 2,0	1,2,3,4,5	8,9,10,11,12,13,14,15	3,61	2,03
60 x 60 x 50 x 2,0 with bolt hole	1,2,3,5,6	10,11,12,13,14,16,17	2,30	1,93
60 x 60 x 50 x 2,5	1,2,3,4,5	8,9,10,11,12,13,14,15	3,61	3,17
60 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	3,61	2,61
60 x 60 x 80 x 2,0	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	4,60	2,90
60 x 60 x 80 x 2,5	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	4,59	4,53
60 x 60 x 90 x 2,0	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	4,60	3,38
60 x 60 x 90 x 2,5	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	4,60	5,29
60 x 60 x 100 x 2,0	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25,26,27,28	5,75	3,63
60 x 60 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26,27,28,29	4,60	3,87
60 x 60 x 100 x 2,5	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25,26,27,28	5,75	5,66
60 x 60 x 100 x 2,5 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26,27,28,29	4,60	6,04
60 x 65 x 55 x 3,0	1,2,3,4	8,9,11,12,13,14	2,06	3,92
65 x 65 x 55 x 2,5	1,2,3,4	8,9,13,14	2,21	3,24
75 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,14,15,16	2,81	1,49
75 x 60 x 60 x 2,5	1,2,4	8,10,11,12,13	1,87	2,02
75 x 60 x 60 x 2,5	1,2,3,4,5	9,10,11,13,14,15	2,81	2,33
80 x 80 x 20 x 2,0	1,2,3	5,6,7,8	1,25	0,78
80 x 80 x 20 x 2,5	1,2,3	5,6,7,8	1,25	1,21
80 x 80 x 40 x 2,0	1,2,3,4,5,6	9,10,11,12,13,14,15,16	2,50	1,55
80 x 80 x 40 x 2,5	1,2,3,4,5,6	9,10,11,12,13,14,15,16	2,50	2,43
80 x 80 x 50 x 2,0 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	2,47	1,93
80 x 80 x 50 x 2,5 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	2,47	3,02
80 x 80 x 60 x 2,0	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	3,82	2,61
80 x 80 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	4,90	2,78



Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
80 x 80 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	6,13	3,48
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	4,94	3,87
80 x 80 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	6,13	5,44
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	4,94	6,04
90 x 40 x 40 x 2,5	1,2,4,5,6,7	11,12	1,36	1,47
90 x 60 x 60 x 2,0	1,2,3,4,5,6,7,9	10,11,12,14,15,16	2,81	1,49
90 x 60 x 60 x 2,0	1,2,4,5,6,7,9	10,11,13,14,15	1,87	1,33
90 x 60 x 60 x 2,5	1,2,3,4,5,6,7,9	10,12,14,15,16	2,81	2,02
90 x 60 x 60 x 2,5	1,2,4,5,6,7,9	10,11,13,14,15	1,87	2,07
90 x 60 x 60 x 2,5	1,2,4,5,6	8,9,11,12,13	1,87	2,07
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	3,44	3,24
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	3,44	3,24
90 x 90 x 65 x 2,5	1,2,5,6,8,9	13,14,16,17,19,20,23,24	2,29	11,47
90 x 90 x 90 x 3,0	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	5,94	5,22
90 x 90 x 90 x 3,0 with hook	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	5,94	5,22
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24,25,26	4,75	13,9
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24,25,26	4,75	13,9
100 x 100 x 40 x 2,0	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	2,59	1,55
100 x 100 x 40 x 2,5	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	2,59	2,43
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	2,55	1,86
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	2,55	2,90
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	2,56	8,33
100 x 100 x 60 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	3,95	2,61
100 x 100 x 60 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	3,95	4,08
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13,14	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	5,11	2,78
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46	6,42	3,63



Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
100 x 100 x 100 x 2,0 with bolt hole	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	5,14	3,87
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11, 12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40,41, 42,43,44,45,46	6,42	5,66
105 x 105 x 90 x 2,5	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	4,57	10,27
105 x 105 x 90 x 2,5	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28, 31,33,34	5,71	3,52
105 x 105 x 90 x 3,0	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	6,15	5,22
105 x 105 x 90 x 3,0 with hook	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31, 33,34	6,15	5,22
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	4,92	14,1
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	4,92	14,1
120 x 120 x 90 x 3,0	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33, 35,36,38	6,31	5,22
120 x 120 x 90 x 3,0 with hook	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33, 35,36,38	6,31	5,22
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33, 34,36	5,05	14,7
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33, 34,36	5,05	14,7
130 x 50 x 65 x 2,5	1,2,4,5,8,9,12, 13,14,15	17,18,19,21,22	2,01	4,15
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36, 38,39,41,43,44	6,46	5,22
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36, 38,39,41,43,44	6,46	5,22
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36, 37,39,41,42	5,17	13,5
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36, 37,39,41,42	5,17	13,5

Table 4: Force F_1 Purlin, 2 angle brackets / connection

Bracket type	Nail number n_V	k_t	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
60 x 35 x 60 x 2,5	1,2,3,4,5	3,0	15,9	1,36
60 x 35 x 60 x 2,0	1,2	3,0	6,41	0,87



Table 5: Force F_1 Purlin, L angle bracket / connection

Bracket type	Nail number n_V	Nail number n_{II}	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
40 x 40 x 40 x 2,0	1,2	5,6,7,8	1,00	0,78
40 x 40 x 40 x 2,5	1,2	5,6,7,8	1,00	1,21
40 x 40 x 50 x 2,0	1,2,3	6,7,8,9,10	1,58	1,02
40 x 40 x 50 x 2,5	1,2,3	6,7,8,9,10	1,58	1,59
40 x 40 x 60 x 2,0	1,2,3	7,8,9,10,11,12	1,58	1,31
40 x 40 x 60 x 2,5	1,2,3	7,8,9,10,11,12	1,58	2,04
40 x 40 x 80 x 2,0	1,2,3	8,9,10,11,12,13,14	1,92	1,45
40 x 40 x 80 x 2,5	1,2,3	8,9,10,11,12,13,14	1,89	2,18
40 x 40 x 100 x 2,0	1,2,3,4	10,11,12,13,14,15,16,17,18	2,42	1,81
40 x 40 x 100 x 2,5	1,2,3,4	10,11,12,13,14,15,16,17,18	2,42	2,83
50 x 50 x 55 x 2,5	1,2	6,7,9,10	0,98	1,62
60 x 35 x 60 x 2,0	1,2,4,5	7,9	0,57	0,65
60 x 60 x 20 x 2,0	1,2	4,5	0,59	0,39
60 x 60 x 20 x 2,5	1,2	4,5	0,59	0,61
60 x 60 x 30 x 2,0	1,2,3	6,7,8,9,10	1,17	0,52
60 x 60 x 30 x 2,5	1,2,3	6,7,8,9,10	1,17	0,81
60 x 60 x 40 x 2,0	1,2,3,4	7,8,9,10,11,12	1,17	0,78
60 x 60 x 50 x 2,0	1,2,3,4,5	8,9,10,11,12,13,14,15	1,80	1,02
60 x 60 x 50 x 2,0 with bolt hole	1,2,3,5,6	10,11,12,13,14,16,17	1,15	0,97
60 x 60 x 50 x 2,5	1,2,3,4,5	8,9,10,11,12,13,14,15	1,80	1,59
60 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	1,80	1,31
60 x 60 x 80 x 2,0	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19, 20,21,22	2,30	1,45
60 x 60 x 80 x 2,5	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19, 20,21,22	2,29	2,27
60 x 60 x 90 x 2,0	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20, 21,22,23,24	2,30	1,69
60 x 60 x 90 x 2,5	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20, 21,22,23,24	2,30	2,64
60 x 60 x 100 x 2,0	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	2,87	1,81
60 x 60 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23, 24,26,27,28,29	2,30	1,93
60 x 60 x 100 x 2,5	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	2,87	2,83
60 x 60 x 100 x 2,5 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23, 24,26,27,28,29	2,30	3,02
60 x 65 x 55 x 3,0	1,2,3,4	8,9,11,12,13,14	1,03	1,96
65 x 65 x 55 x 2,5	1,2,3,4	8,9,13,14	1,10	1,62



Bracket type	Nail number n _v	Nail number n _H	F _{1,Rk} [kN] (purlin)	
			Timber	Steel
75 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,14,15,16	1,40	0,75
75 x 60 x 60 x 2,5	1,2,4	8,10,11,12,13	0,94	1,01
75 x 60 x 60 x 2,5	1,2,3,4,5	9,10,11,13,14,15	1,40	1,17
80 x 80 x 20 x 2,0	1,2,3	5,6,7,8	0,63	0,39
80 x 80 x 20 x 2,5	1,2,3	5,6,7,8	0,63	0,61
80 x 80 x 40 x 2,0	1,2,3,4,5,6	9,10,11,12,13,14,15,16	1,25	0,78
80 x 80 x 40 x 2,5	1,2,3,4,5,6	9,10,11,12,13,14,15,16	1,25	1,21
80 x 80 x 50 x 2,0 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20, 21,22	1,23	0,97
80 x 80 x 50 x 2,5 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20, 21,22	1,23	1,51
80 x 80 x 60 x 2,0	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20, 21,22,23,24	1,91	1,31
80 x 80 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	2,45	1,39
80 x 80 x 100 x 2,0	1,2,3,4,5,6,7,8,9, 10,11,12,13	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	3,06	1,74
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4,5,6,7,8,9, 11,12,13,14	20,21,22,23,24,25,26,27,28, 30,31,32,33,34,35,36,37,38	2,47	1,93
80 x 80 x 100 x 2,5	1,2,3,4,5,6,7,8,9, 10,11,12,13	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	3,06	2,72
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4,5,6,7,8,9, 11,12,13,14	20,21,22,23,24,25,26,27,28, 30,31,32,33,34,35,36,37,38	2,47	3,02
90 x 40 x 40 x 2,5	1,2,4,5,6,7	11,12	0,68	0,73
90 x 60 x 60 x 2,0	1,2,3,4,5,6,7,9	10,11,12,14,15,16	1,40	0,75
90 x 60 x 60 x 2,0	1,2,4,5,6,7,9	10,11,13,14,15	0,94	0,66
90 x 60 x 60 x 2,5	1,2,3,4,5,6,7,9	10,12,14,15,16	1,40	1,01
90 x 60 x 60 x 2,5	1,2,4,5,6,7,9	10,11,13,14,15	0,94	1,04
90 x 60 x 60 x 2,5	1,2,4,5,6	8,9,11,12,13	0,94	1,04
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24, 25,26,29,30	1,72	1,62
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24, 25,26,29,30	1,72	1,62
90 x 90 x 65 x 2,5	1,2,5,6,8,9	13,14,16,17,19,20,23,24	1,15	5,73
90 x 90 x 90 x 3,0	1,2,5,6,8	14,15,16,17,18,21,22,25, 26,27,28	2,97	2,61
90 x 90 x 90 x 3,0 with hook	1,2,5,6,8	14,15,16,17,18,21,22,25, 26,27,28	2,97	2,61
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24,25,26	2,37	6,94
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24,25,26	2,37	6,94
100 x 100 x 40 x 2,0	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	1,30	0,78
100 x 100 x 40 x 2,5	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	1,30	1,21



Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6,7,8,9,11, 12	16,17,18,19,20,22,23,24, 25,26,28,29	1,28	0,93
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6,7,8,9,11, 12	16,17,18,19,20,22,23,24,25,26,28,2 9	1,28	1,45
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	1,28	4,16
100 x 100 x 60 x 2,0	1,2,3,4,5,6,7,8,9,10, 11,12	16,17,18,19,20,21,22,23,24, 25,26,27,28,29,30	1,97	1,31
100 x 100 x 60 x 2,5	1,2,3,4,5,6,7,8,9, 10,11,12	16,17,18,19,20,21,22,23,24, 25,26,27,28,29,30	1,97	2,04
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7,8,9, 10,11,12,13,14	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	2,55	1,39
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16, 17,18	24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40,41, 42,43,44,45,46	3,21	1,81
100 x 100 x 100 x 2,0 with bolt hole	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	2,57	1,93
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16, 17,18	24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40, 41,42,43,44,45,46	3,21	2,83
105 x 105 x 90 x 2,5	1,2,4,5,8,9	16,17,18,19,22,23,26, 29,31,32	2,28	5,14
105 x 105 x 90 x 2,5	1,2,4,5,8,9,11	17,18,19,20,21,24,25, 28,31,33,34	2,86	1,76
105 x 105 x 90 x 3,0	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28, 31,33,34	3,07	2,61
105 x 105 x 90 x 3,0 with hook	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28, 31,33,34	3,07	2,61
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	2,46	7,03
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	2,46	7,03
120 x 120 x 90 x 3,0	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30, 33,35,36,38	3,15	2,61
120 x 120 x 90 x 3,0 with hook	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30, 33,35,36,38	3,15	2,61
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	2,52	7,37
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	2,52	7,36
130 x 50 x 65 x 2,5	1,2,4,5,8,9,12, 13,14,15	17,18,19,21,22	1,01	2,08
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10,13, 14,16	22,23,24,25,26,29,30,33, 36,38,39,41,43,44	3,23	2,61

Bracket type	Nail number n_V	Nail number n_H	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10,13, 14,16	22,23,24,25,26,29,30,33, 36,38,39,41,43,44	3,23	2,61
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	2,58	6,74
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	2,58	6,74

Table 6: Force F_1 Purlin, 1 angle bracket / connection

Bracket type	Nail number n_V	k_t	$F_{1,Rk}$ [kN] (purlin)	
			Timber	Steel
60 x 35 x 60 x 2,5	1,2,3,4,5	3,0	7,95	0,68
60 x 35 x 60 x 2,0	1,2	3,0	3,21	0,44

Table 7: Forces $F_{2,3}$, 2 angle brackets / connection

Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
40 x 40 x 40 x 2,0	1,2	5,6,7,8	3,36
40 x 40 x 40 x 2,5	1,2	5,6,7,8	3,40
40 x 40 x 50 x 2,0	1,2,3	6,7,8,9,10	5,52
40 x 40 x 50 x 2,5	1,2,3	6,7,8,9,10	5,49
40 x 40 x 60 x 2,0	1,2,3	7,8,9,10,11,12	6,53
40 x 40 x 60 x 2,5	1,2,3	7,8,9,10,11,12	6,50
40 x 40 x 80 x 2,0	1,2,3	8,9,10,11,12,13,14	7,71
40 x 40 x 80 x 2,5	1,2,3	8,9,10,11,12,13,14	7,58
40 x 40 x 100 x 2,0	1,2,3,4	10,11,12,13,14,15,16,17,18	11,6
40 x 40 x 100 x 2,5	1,2,3,4	10,11,12,13,14,15,16,17,18	11,5
50 x 50 x 55 x 2,5	1,2	6,7,9,10	4,21
60 x 35 x 60 x 2,0	1,2,4,5	7,9	4,83
60 x 60 x 20 x 2,0	1,2	4,5	1,65
60 x 60 x 20 x 2,5	1,2	4,5	1,64
60 x 60 x 30 x 2,0	1,2,3	6,7,8,9,10	2,80
60 x 60 x 30 x 2,5	1,2,3	6,7,8,9,10	2,82
60 x 60 x 40 x 2,0	1,2,3,4	7,8,9,10,11,12	4,46
60 x 60 x 50 x 2,0	1,2,3,4,5	8,9,10,11,12,13,14,15	6,93
60 x 60 x 50 x 2,0 with bolt hole	1,2,3,5,6	10,11,12,13,14,16,17	5,57
60 x 60 x 50 x 2,5	1,2,3,4,5	8,9,10,11,12,13,14,15	6,89
60 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	8,38
60 x 60 x 80 x 2,0	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	11,3



Bracket type	Nail number n _V	Nail number n _H	F _{2,3,Rk} [kN]
			Timber
60 x 60 x 80 x 2,5	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	11,3
60 x 60 x 90 x 2,0	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	13,4
60 x 60 x 90 x 2,5	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	13,3
60 x 60 x 100 x 2,0	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25,26,27,28	17,0
60 x 60 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26,27,28,29	15,5
60 x 60 x 100 x 2,5	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25,26,27,28	16,9
60 x 60 x 100 x 2,5 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26,27,28,29	14,2
60 x 65 x 55 x 3,0	1,2,3,4	8,9,11,12,13,14	5,81
65 x 65 x 55 x 2,5	1,2,3,4	8,9,13,14	5,34
75 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,14,15,16	5,76
75 x 60 x 60 x 2,5	1,2,4	8,10,11,12,13	3,46
75 x 60 x 60 x 2,5	1,2,3,4,5	9,10,11,13,14,15	5,27
80 x 80 x 20 x 2,0	1,2,3	5,6,7,8	2,47
80 x 80 x 20 x 2,5	1,2,3	5,6,7,8	2,45
80 x 80 x 40 x 2,0	1,2,3,4,5,6	9,10,11,12,13,14,15,16	5,96
80 x 80 x 40 x 2,5	1,2,3,4,5,6	9,10,11,12,13,14,15,16	5,92
80 x 80 x 50 x 2,0 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	7,38
80 x 80 x 50 x 2,5 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	7,33
80 x 80 x 60 x 2,0	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	10,6
80 x 80 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	12,7
80 x 80 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	19,0
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	18,8
80 x 80 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	18,9
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	18,7
90 x 40 x 40 x 2,5	1,2,4,5,6,7	11,12	3,05
90 x 60 x 60 x 2,0	1,2,3,4,5,6,7,9	10,11,12,14,15,16	6,70
90 x 60 x 60 x 2,0	1,2,4,5,6,7,9	10,11,13,14,15	6,18
90 x 60 x 60 x 2,5	1,2,3,4,5,6,7,9	10,12,14,15,16	6,01
90 x 60 x 60 x 2,5	1,2,4,5,6,7,9	10,11,13,14,15	6,13
90 x 60 x 60 x 2,5	1,2,4,5,6	8,9,11,12,13	5,30
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	7,51
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	7,52
90 x 90 x 65 x 2,5	1,2,5,6,8,9	13,14,16,17,19,20,23,24	7,20



Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
90 x 90 x 90 x 3,0	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	8,68
90 x 90 x 90 x 3,0 with hook	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	8,68
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24,25,26	7,60
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24,25,26	7,60
100 x 100 x 40 x 2,0	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	7,37
100 x 100 x 40 x 2,5	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	7,32
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	9,16
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	9,10
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	6,99
100 x 100 x 60 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26, 27,28,29,30	12,6
100 x 100 x 60 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26, 27,28,29,30	12,6
100 x 100 x 80 x 2,0	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, 30,31,32,33,34,35,36	15,9
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32,33,34,35, 36,37,38,39,40,41,42,43,44,45,46	23,1
100 x 100 x 100 x 2,0 with bolt hole	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	21,9
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32,33,34,35, 36,37,38,39,40,41,42,43,44,45,46	22,9
105 x 105 x 90 x 2,5	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	7,51
105 x 105 x 90 x 2,5	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	7,10
105 x 105 x 90 x 3,0	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	9,22
105 x 105 x 90 x 3,0 with hook	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	9,22
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	8,24
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	8,24
120 x 120 x 90 x 3,0	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33,35,36,38	9,36
120 x 120 x 90 x 3,0 with hook	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33,35,36,38	9,36
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33,34,36	8,38
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33,34,36	8,38
130 x 50 x 65 x 2,5	1,2,4,5,8,9,12,13,14,15	17,18,19,21,22	7,59



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Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36,38,39,41,43,44	10,9
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36,38,39,41,43,44	10,9
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36,37,39,41,42	9,86
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36,37,39,41,42	9,86



Table 8: Forces $F_{2,3}$, L angle bracket / connection

Bracket type	Nail number n_v	Nail number n_{lf}	$F_{2,3,Rk}$ [kN]
			Timber
40 x 40 x 40 x 2,0	1,2	5,6,7,8	1,68
40 x 40 x 40 x 2,5	1,2	5,6,7,8	1,70
40 x 40 x 50 x 2,0	1,2,3	6,7,8,9,10	2,76
40 x 40 x 50 x 2,5	1,2,3	6,7,8,9,10	2,74
40 x 40 x 60 x 2,0	1,2,3	7,8,9,10,11,12	3,27
40 x 40 x 60 x 2,5	1,2,3	7,8,9,10,11,12	3,25
40 x 40 x 80 x 2,0	1,2,3	8,9,10,11,12,13,14	3,85
40 x 40 x 80 x 2,5	1,2,3	8,9,10,11,12,13,14	3,79
40 x 40 x 100 x 2,0	1,2,3,4	10,11,12,13,14,15,16,17,18	5,79
40 x 40 x 100 x 2,5	1,2,3,4	10,11,12,13,14,15,16,17,18	5,76
50 x 50 x 55 x 2,5	1,2	6,7,9,10	2,10
60 x 35 x 60 x 2,0	1,2,4,5	7,9	2,41
60 x 60 x 20 x 2,0	1,2	4,5	0,83
60 x 60 x 20 x 2,5	1,2	4,5	0,82
60 x 60 x 30 x 2,0	1,2,3	6,7,8,9,10	1,40
60 x 60 x 30 x 2,5	1,2,3	6,7,8,9,10	1,41
60 x 60 x 40 x 2,0	1,2,3,4	7,8,9,10,11,12	2,23
60 x 60 x 50 x 2,0	1,2,3,4,5	8,9,10,11,12,13,14,15	3,47
60 x 60 x 50 x 2,0 with bolt hole	1,2,3,5,6	10,11,12,13,14,16,17	2,79
60 x 60 x 50 x 2,5	1,2,3,4,5	8,9,10,11,12,13,14,15	3,45
60 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	4,19
60 x 60 x 80 x 2,0	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	5,67
60 x 60 x 80 x 2,5	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19,20,21,22	5,63
60 x 60 x 90 x 2,0	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	6,70
60 x 60 x 90 x 2,5	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20,21,22,23,24	6,66
60 x 60 x 100 x 2,0	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25, 26,27,28	8,48
60 x 60 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26,27, 28,29	7,74
60 x 60 x 100 x 2,5	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22,23,24,25, 26,27,28	8,43
60 x 60 x 100 x 2,5 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23,24,26, 27,28,29	7,11
60 x 65 x 55 x 3,0	1,2,3,4	8,9,11,12,13,14	2,90
65 x 65 x 55 x 2,5	1,2,3,4	8,9,13,14	2,67
75 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,14,15,16	2,88
75 x 60 x 60 x 2,5	1,2,4	8,10,11,12,13	1,73



Bracket type	Nail number n_V	Nail number n_H	$F_{2,3,Rk}$ [kN]
			Timber
75 x 60 x 60 x 2,5	1,2,3,4,5	9,10,11,13,14,15	2,63
80 x 80 x 20 x 2,0	1,2,3	5,6,7,8	1,24
80 x 80 x 20 x 2,5	1,2,3	5,6,7,8	1,23
80 x 80 x 40 x 2,0	1,2,3,4,5,6	9,10,11,12,13,14,15,16	2,98
80 x 80 x 40 x 2,5	1,2,3,4,5,6	9,10,11,12,13,14,15,16	2,96
80 x 80 x 50 x 2,0 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	3,69
80 x 80 x 50 x 2,5 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20,21,22	3,67
80 x 80 x 60 x 2,0	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20,21,22,23,24	5,29
80 x 80 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22,23,24,25,26,27,28	6,35
80 x 80 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	9,49
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	9,41
80 x 80 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12,13	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	9,43
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4,5,6,7,8,9,11,12,13,14	20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38	9,37
90 x 40 x 40 x 2,5	1,2,4,5,6,7	11,12	1,52
90 x 60 x 60 x 2,0	1,2,3,4,5,6,7,9	10,11,12,14,15,16	3,35
90 x 60 x 60 x 2,0	1,2,4,5,6,7,9	10,11,13,14,15	3,09
90 x 60 x 60 x 2,5	1,2,3,4,5,6,7,9	10,12,14,15,16	3,01
90 x 60 x 60 x 2,5	1,2,4,5,6,7,9	10,11,13,14,15	3,06
90 x 60 x 60 x 2,5	1,2,4,5,6	8,9,11,12,13	2,65
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	3,75
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25,26,29,30	3,76
90 x 90 x 65 x 2,5	1,2,5,6,8,9	13,14,16,17,19,20,23,24	3,60
90 x 90 x 90 x 3,0	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	4,34
90 x 90 x 90 x 3,0 with hook	1,2,5,6,8	14,15,16,17,18,21,22,25,26,27,28	4,34
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24,25,26	3,80
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24,25,26	3,80
100 x 100 x 40 x 2,0	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	3,68
100 x 100 x 40 x 2,5	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18,19,20	3,66
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	4,58



Bracket type	Nail number n _v	Nail number n _H	F _{2,3,Rk} [kN]
			Timber
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24,25,26,28,29	4,55
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	3,49
100 x 100 x 60 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	6,32
100 x 100 x 60 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12	16,17,18,19,20,21,22,23,24,25,26,27,28,29,30	6,28
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13,14	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	7,95
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46	11,6
100 x 100 x 100 x 2,0 with bolt hole	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	10,9
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46	11,5
105 x 105 x 90 x 2,5	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	3,76
105 x 105 x 90 x 2,5	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	3,55
105 x 105 x 90 x 3,0	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	4,61
105 x 105 x 90 x 3,0 with hook	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31,33,34	4,61
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	4,12
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	4,12
120 x 120 x 90 x 3,0	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33,35,36,38	4,68
120 x 120 x 90 x 3,0 with hook	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30,33,35,36,38	4,68
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33,34,36	4,19
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31,33,34,36	4,19
130 x 50 x 65 x 2,5	1,2,4,5,8,9,12,13,14,15	17,18,19,21,22	3,80
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36,38,39,41,43,44	5,44
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10,13,14,16	22,23,24,25,26,29,30,33,36,38,39,41,43,44	5,44
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36,37,39,41,42	4,93
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34,36,37,39,41,42	4,93



Table 9: 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
40 x 40 x 40 x 2,0	1,2	5,6,7,8	7,13	2,04
40 x 40 x 40 x 2,5	1,2	5,6,7,8	6,07	2,66
40 x 40 x 50 x 2,0	1,2,3	6,7,8,9,10	9,09	2,27
40 x 40 x 50 x 2,5	1,2,3	6,7,8,9,10	7,08	2,91
40 x 40 x 60 x 2,0	1,2,3	7,8,9,10,11,12	9,76	2,90
40 x 40 x 60 x 2,5	1,2,3	7,8,9,10,11,12	9,10	3,75
40 x 40 x 80 x 2,0	1,2,3	8,9,10,11,12,13,14	12,1	4,20
40 x 40 x 80 x 2,5	1,2,3	8,9,10,11,12,13,14	11,4	5,67
40 x 40 x 100 x 2,0	1,2,3,4	10,11,12,13,14,15,16,17,18	14,3	5,21
40 x 40 x 100 x 2,5	1,2,3,4	10,11,12,13,14,15,16,17,18	14,5	6,89
50 x 50 x 55 x 2,5	1,2	6,7,9,10	7,53	4,04
60 x 35 x 60 x 2,0	1,2,4,5	7,9	4,15	3,99
60 x 60 x 20 x 2,0	1,2	4,5	2,46	1,14
60 x 60 x 20 x 2,5	1,2	4,5	2,41	1,42
60 x 60 x 30 x 2,0	1,2,3	6,7,8,9,10	3,34	1,49
60 x 60 x 30 x 2,5	1,2,3	6,7,8,9,10	3,32	1,84
60 x 60 x 40 x 2,0	1,2,3,4	7,8,9,10,11,12	5,29	2,24
60 x 60 x 50 x 2,0	1,2,3,4,5	8,9,10,11,12,13,14,15	7,14	2,58
60 x 60 x 50 x 2,0 with bolt hole	1,2,3,5,6	10,11,12,13,14,16,17	6,04	2,75
60 x 60 x 50 x 2,5	1,2,3,4,5	8,9,10,11,12,13,14,15	6,83	3,22
60 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,13,14,15,16,17,18	7,72	3,29
60 x 60 x 80 x 2,0	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19, 20,21,22	9,10	4,33
60 x 60 x 80 x 2,5	1,2,3,4,5,6,7	12,13,14,15,16,17,18,19, 20,21,22	9,09	5,52
60 x 60 x 90 x 2,0	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20, 21,22,23,24	11,2	5,00
60 x 60 x 90 x 2,5	1,2,3,4,5,6,7,8	13,14,15,16,17,18,19,20, 21,22,23,24	11,1	6,58
60 x 60 x 100 x 2,0	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	12,0	5,52
60 x 60 x 100 x 2,0 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23, 24,26,27,28,29	11,9	5,54
60 x 60 x 100 x 2,5	1,2,3,4,5,6,7,8,9	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	11,6	7,10
60 x 60 x 100 x 2,5 with bolt hole	1,2,3,4,5,7,8,9,10	16,17,18,19,20,21,22,23, 24,26,27,28,29	11,6	7,32
60 x 65 x 55 x 3,0	1,2,3,4	8,9,11,12,13,14	6,45	4,79

Bracket type	Nail number n _V	Nail number n _H	F _{4,5,Rk} [kN]	
			Timber	Steel
65 x 65 x 55 x 2,5	1,2,3,4	8,9,13,14	7,79	4,12
75 x 60 x 60 x 2,0	1,2,3,4,5,6	10,11,12,14,15,16	7,21	3,65
75 x 60 x 60 x 2,5	1,2,4	8,10,11,12,13	4,57	4,74
75 x 60 x 60 x 2,5	1,2,3,4,5	9,10,11,13,14,15	7,15	4,56
80 x 80 x 20 x 2,0	1,2,3	5,6,7,8	2,93	1,11
80 x 80 x 20 x 2,5	1,2,3	5,6,7,8	2,77	1,49
80 x 80 x 40 x 2,0	1,2,3,4,5,6	9,10,11,12,13,14,15,16	5,86	2,23
80 x 80 x 40 x 2,5	1,2,3,4,5,6	9,10,11,12,13,14,15,16	5,53	2,97
80 x 80 x 50 x 2,0 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20, 21,22	6,79	2,72
80 x 80 x 50 x 2,5 with bolt hole	1,2,3,4,5,7,8	12,13,14,15,16,18,19,20, 21,22	6,53	3,71
80 x 80 x 60 x 2,0	1,2,3,4,5,6,7,8,9	13,14,15,16,17,18,19,20, 21,22,23,24	8,56	3,35
80 x 80 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	10,3	4,39
80 x 80 x 100 x 2,0	1,2,3,4,5,6,7,8,9, 10,11,12,13	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	13,3	5,49
80 x 80 x 100 x 2,0 with bolt hole	1,2,3,4,5,6,7,8,9,11, 12,13,14	20,21,22,23,24,25,26,27,28, 30,31,32,33,34,35,36,37,38	13,2	5,50
80 x 80 x 100 x 2,5	1,2,3,4,5,6,7,8,9, 10,11,12,13	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	12,6	7,53
80 x 80 x 100 x 2,5 with bolt hole	1,2,3,4,5,6,7,8,9, 11,12,13,14	20,21,22,23,24,25,26,27,28, 30,31,32,33,34,35,36,37,38	12,8	7,33
90 x 40 x 40 x 2,5	1,2,4,5,6,7	11,12	4,01	3,08
90 x 60 x 60 x 2,0	1,2,3,4,5,6,7,9	10,11,12,14,15,16	8,27	5,41
90 x 60 x 60 x 2,0	1,2,4,5,6,7,9	10,11,13,14,15	7,94	5,08
90 x 60 x 60 x 2,5	1,2,3,4,5,6,7,9	10,12,14,15,16	6,98	5,98
90 x 60 x 60 x 2,5	1,2,4,5,6,7,9	10,11,13,14,15	6,97	5,99
90 x 60 x 60 x 2,5	1,2,4,5,6	8,9,11,12,13	6,46	5,84
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25, 26,29,30	7,06	4,59
90 x 90 x 65 x 2,5	1,2,5,6,9,10	16,17,18,20,21,22,24,25, 26,29,30	6,82	4,50
90 x 90 x 65 x 2,5	1,2,5,6,8,9	13,14,16,17,19,20,23,24	6,93	6,98
90 x 90 x 90 x 3,0	1,2,5,6,8	14,15,16,17,18,21,22,25, 26,27,28	11,3	7,73
90 x 90 x 90 x 3,0 with hook	1,2,5,6,8	14,15,16,17,18,21,22,25, 26,27,28	11,3	7,54
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	9,77	10,1



Bracket type	Nail number n_V	Nail number n_H	$F_{4,5,Rk}$ [kN]	
			Timber	Steel
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	9,79	9,75
100 x 100 x 40 x 2,0	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18, 19,20	6,18	2,18
100 x 100 x 40 x 2,5	1,2,3,4,5,6,7,8	11,12,13,14,15,16,17,18, 19,20	5,96	2,96
100 x 100 x 50 x 2,0 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24, 25,26,28,29	7,19	2,66
100 x 100 x 50 x 2,5 with bolt hole	1,2,3,5,6,7,8,9,11,12	16,17,18,19,20,22,23,24, 25,26,28,29	7,08	3,64
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	6,22	5,28
100 x 100 x 60 x 2,0	1,2,3,4,5,6,7,8,9,10, 11,12	16,17,18,19,20,21,22,23, 24,25,26,27,28,29,30	9,02	3,31
100 x 100 x 60 x 2,5	1,2,3,4,5,6,7,8,9,10, 11,12	16,17,18,19,20,21,22,23, 24,25,26,27,28,29,30	8,77	4,32
100 x 100 x 80 x 2,0	1,2,3,4,5,6,7,8,9,10, 11,12,13,14	19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36	11,1	4,27
100 x 100 x 100 x 2,0	1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16, 17,18	24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40,41, 42,43,44,45,46	14,1	5,37
100 x 100 x 100 x 2,0 with bolt hole	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	14,1	5,37
100 x 100 x 100 x 2,5	1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16, 17,18	24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40,41, 42,43,44,45,46	13,7	7,41
105 x 105 x 90 x 2,5	1,2,4,5,8,9	16,17,18,19,22,23,26,29,31,32	9,00	9,12
105 x 105 x 90 x 2,5	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28, 31,33,34	6,34	6,55
105 x 105 x 90 x 3,0	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31, 33,34	11,5	7,98
105 x 105 x 90 x 3,0 with hook	1,2,4,5,8,9,11	17,18,19,20,21,24,25,28,31, 33,34	11,5	7,39
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	10,1	10,2
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	10,1	8,91
120 x 120 x 90 x 3,0	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30, 33,35,36,38	11,5	8,01
120 x 120 x 90 x 3,0 with hook	3,4,6,7,10,11,13	19,20,21,22,23,26,27,30, 33,35,36,38	5,74	7,42
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	10,4	10,5

Bracket type	Nail number n_v	Nail number n_{II}	$F_{4,5,Rk}$ [kN]	
			Timber	Steel
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	10,4	9,97
130 x 50 x 65 x 2,5	1,2,4,5,8,9,12, 13,14,15	17,18,19,21,22	5,88	6,07
140 x 140 x 90 x 3,0	1,2,3,6,7,9,10,13, 14,16	22,23,24,25,26,29,30,33, 36,38,39,41,43,44	12,5	6,28
140 x 140 x 90 x 3,0 with hook	1,2,3,6,7,9,10,13, 14,16	22,23,24,25,26,29,30,33, 36,38,39,41,43,44	12,5	6,40
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	10,9	9,73
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	10,9	9,73

Table 10: Basic Force $F_{4,5}$, 2 angle brackets / connection

Bracket type	Nail number n_v	$k_1 \perp$	$k_1 \parallel$	$F_{4,5Rk}$ [kN]	
				Timber	Steel
60 x 35 x 60 x 2,5	1,2,3,4,5	0,79	0,26	6,00	4,16
60 x 35 x 60 x 2,0	1,2	0,93	0,18	4,86	3,57

Table 11: Basic Forces F_4 , 1 angle bracket / connection

Bracket type	Nail number n_v	Nail number n_{II}	$F_{4,Rk}$ [kN]	
			Timber	Steel
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	9,77	8,44
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	9,79	8,13
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	6,22	4,03
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	11,3	7,68
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	10,1	7,61
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	10,4	8,76
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	10,4	8,34
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	10,9	8,12
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	10,9	8,12



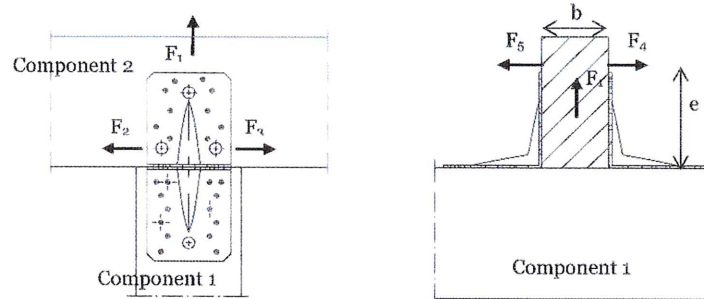
Table 12: Basic Forces F_s , 1 angle bracket / connection

Bracket type	Nail number n_v	Nail number n_H	$F_{s,Rk}$ [kN]	
			Timber	Steel
90 x 90 x 90 x 3,0 with rib	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	1,58	2,06
90 x 90 x 90 x 3,0 with rib, with hook	1,2,5,6	13,14,15,16,19,20,23,24, 25,26	1,62	2,02
100 x 100 x 55 x 2,5 with rib	1,2,3,4,5,9,10	13,14,15,16,20,21,22,23,24	1,47	5,07
105 x 105 x 90 x 3,0 with rib	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	1,55	2,10
105 x 105 x 90 x 3,0 with rib, with hook	1,2,4,5,8,9	16,17,18,19,22,23,26,29, 31,32	1,55	2,10
120 x 120 x 90 x 3,0 with rib	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	1,70	2,35
120 x 120 x 90 x 3,0 with rib, with hook	3,4,6,7,10,11	18,19,20,21,24,25,28,31, 33,34,36	1,70	2,26
140 x 140 x 90 x 3,0 with rib	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	1,80	2,46
140 x 140 x 90 x 3,0 with rib, with hook	1,2,3,6,7,9,10,13,14	21,22,23,24,27,28,31,34, 36,37,39,41,42	1,80	2,46



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.

Connection to timber, concrete or steel with a bolt or metal anchor

The tensile load $F_{B,Ed}$ for the design of a bolt or metal anchor is calculated as:

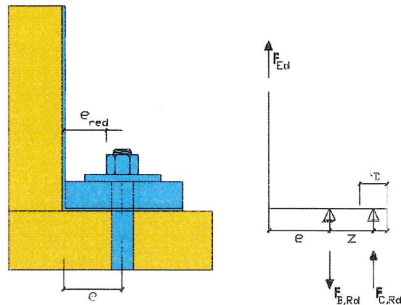
$$F_{B,t,Ed} = k_t \cdot F_{Ed} \text{ for tensile load}$$

$$F_{B,v,Ed} = F_{Ed} \text{ for shear load}$$



Where:

$F_{B,t,Ed}$	Bolt tensile load in N
$F_{B,v,Fd}$	Bolt shear load in N
k_t	Coefficient taking into account the moment arm ($k_t=1+e/z$)
F_{Fd}	Load on vertical flap of the angle bracket in N



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 .

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

B is the width of component 2.