

# Leistungserklärung / Declaration of Performance

## 18266\_00031(03)\_2025

- **Eindeutiger Kenncode des Produkttyps / Unique identification code of the product type**  
HV2760, HV2770

- **Verwendungszweck(e) / Usage(s)**  
Winkel und Niederhalter für Holz-Holz-, Holz-Stahl- oder Holz-Beton-Verbindungen / *Angles and hold-down clamps for wood-wood, wood-steel or wood-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-11/0296 09.04.2025

Technische Bewertungsstelle / *Technical Assessment Body:*

ETA-Danmark A/S

Notifizierte Stelle / *Notified body:*

0769

- **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>Characteristic load-carrying capacity</i>	Annex B	ETA11/0296 P3.1
Steifigkeit der Verbindung / <i>Joint Stiffness</i>	Annex B	ETA11/0296 P3.1
Duktilität der Verbindung / <i>Joint ductility</i>	NPD	ETA11/0296 P3.1
Widerstandsfähigkeit gegen seismische Einwirkungen / <i>Resistance to seismic actions</i>	NPD	ETA11/0296 P3.1
Widerstandsfähigkeit gegen Korrosion und Verfall / <i>Resistance to corrosion and deterioration</i>	S250GD + Z275 Korrosionsschutz in Nutzungsklasse 1 und 2 <i>Corrosion protection in service class 1 and 2</i>	ETA11/0296 P3.6 EAD 130186-00-0603 EN 10346



Wesentliches Merkmal Essential features	Leistung Performance	Harmonisierte technische Spezifikation Harmonized technical specification
Brandverhalten / <i>Reaction to fire</i>	A1	ETA11/0296 P3.2 EN 1350-1
Feuerresistenz / <i>Resistance to fire</i>	NPD	ETA11/0296 P3.2
Nachhaltiger Gebrauch natürlicher Ressourcen <i>sustainable use of natural resources</i>	NPD	ETA11/0296 P3.7
Allgemeine Aspekte in Bezug auf die Leistung des Produkts / <i>General aspects related to the performance of the product</i>	Nutzungsklassen 1, 2 und 3 bei Holzkonstruktionen unter Verwendung von Holzarten gem. Eurocode 5 <i>Usage classes 1, 2 and 3 for timber constructions using wood species acc. Eurocode 5</i>	ETA11/0296 P3.3
Identifizierung / <i>Identification</i>	Tab 1	ETA11/0296 P3.3

Art.-Nr	Winkel Art Bracket type	ETA Art.-Nr.	Dicke Thickness	Stahl Spezifikation Steel specification	Beschichtung Coating
HV2760	80x80x60	4777000	2,5	S250GD / Z 275	Z275
HV2770	80x80x80	4778000	2,5	S250GD / Z 275	Z275

Tabelle 1: Identifizierung / *Identification*

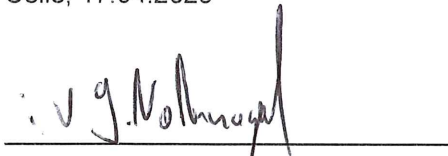
Die Leistung des vorstehenden Produkts entspricht der erklärten Leistung/ den erklärten Leistungen. Für die Erstellung der Leistungserklärung im Einklang mit der Verordnung (EU) Nr. 305/2011 ist allein der obengenannte Hersteller verantwortlich.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

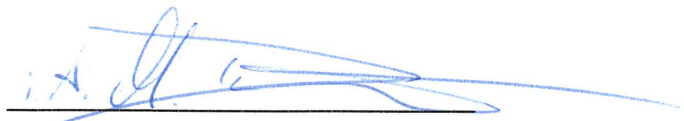
*The performance of the above product is the declared performance. The above manufacturer is solely responsible for drawing up the declaration of performance in accordance with Regulation (EU) No 305/2011.*

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

Conmetall Meister GmbH  
Celle, 17.04.2025



i. V. Yannik Nothnagel  
Leitung Einkauf Eisenwaren /  
*Head of purchasing ironmongery*



i. A. Marcel Dartscht  
Standortverantwortlicher Qualitätsmanagement Celle /  
*Site manager quality management Celle*



**Annex B**

**Angle brackets  
Characteristic load-carrying capacities**

**Table 1:** Force  $F_1$  Column, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{1,Rk}$ [kN] (column)	
				Timber	Steel
40x40x60	4771000	-	-	-	-
50x50x35	4764000	-	-	-	-
60x40x60	4783000	-	-	-	-
60x60x40	4772000	-	-	-	-
60x60x50	4773000	-	-	-	-
60x60x60	4774000	-	-	-	-
60x60x80	4775000	-	-	-	-
60x60x100	4776000	-	-	-	-
70x70x55	4765020	1,2,3	11,12,13,14,16,18,19,20	3,51	1,33
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	2,34	2,65
70x70x55	4765000	1,2,3	9,10,11,12,14,15,16	2,34	2,34
70x70x55 with rib	4765100	1,2,3	9,10,11,12,14,15,16	2,34	7,44
80x60x60	4784000	1,2,3	13,14,15,17,18,19	2,57	4,60
80x80x60	4777000	1,2,3	12,13,14,15,16,17,18,19,20,21,22	2,53	3,13
80x80x80	4778000	1,2,3,4	15,16,17,18,19,20,21,22,23,24,25,26,27,28	3,80	4,06
80x80x100	4779000	1,2,3,4,5	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	5,06	5,00
90x48x48	4759000	1,2,4	10,11,13,14	1,98	2,85
90x48x76	4759100	1,2,3,6	16,17,21,22,23	2,30	7,07
90x48x116	4759200	1,2,3,4,5	22,23,25,26,29,30,31	3,96	7,20
90x90x40	4766000	1,2	11,12,14,15,19,20	2,40	1,88
90x90x65	4767150	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	3,75	1,31
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	4,17	5,12
90x90x65	4767000	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	3,75	2,60
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	4,17	6,14
90x90x65	4767000-A	1,2	12,13,16,17,21,22	2,41	2,46
90x90x65 with rib	4769000-A	1,2	12,13,16,17,21,22	2,41	6,90
100x100x60	4780000	1,2,3,4,5	15,16,17,18,19,20,21,22,23,24,25,26,27,28	2,64	3,13
100x100x80	4781000	1,2,3,4,5,6,7	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34	3,96	4,06
100x100x90	4768000	1,2,3,4,5,6,8,9	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	2,62	6,92
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	5,25	20,9
100x100x100	4782000	1,2,3,4,5,6,7,8,9	23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44	5,28	5,00
105x105x90	4768020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	5,16	3,27
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	8,12	8,68



105x105x90	4768300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	5,16	5,25
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	8,12	11,7
140x40x40	4784200	1,2,6,7,9,10	16,17,19,20	2,34	4,22

**Table 2:** Force  $F_1$  Column, l angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{1,Rk}$ [kN] (column)	
				Timber	Steel
40x40x60	4771000	-	-	-	-
50x50x35	4764000	-	-	-	-
60x40x60	4783000	-	-	-	-
60x60x40	4772000	-	-	-	-
60x60x50	4773000	-	-	-	-
60x60x60	4774000	-	-	-	-
60x60x80	4775000	-	-	-	-
60x60x100	4776000	-	-	-	-
70x70x55	4765020	1,2,3	11,12,13,14,16,18,19,20	1,75	0,67
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	1,17	1,32
70x70x55	4765000	1,2,3	9,10,11,12,14,15,16	1,17	1,17
70x70x55 with rib	4765100	1,2,3	9,10,11,12,14,15,16	1,17	3,72
80x60x60	4784000	1,2,3	13,14,15,17,18,19	1,28	2,30
80x80x60	4777000	1,2,3	12,13,14,15,16,17,18,19,20,21,22	1,27	1,56
80x80x80	4778000	1,2,3,4	15,16,17,18,19,20,21,22,23,24,25,26,27,28	1,90	2,03
80x80x100	4779000	1,2,3,4,5	19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36	2,53	2,50
90x48x48	4759000	1,2,4	10,11,13,14	0,99	1,43
90x48x76	4759100	1,2,3,6	16,17,21,22,23	1,15	3,54
90x48x116	4759200	1,2,3,4,5	22,23,25,26,29,30,31	1,98	3,60
90x90x40	4766000	1,2	11,12,14,15,19,20	1,20	0,94
90x90x65	4767150	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	1,88	0,66
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	2,08	2,56
90x90x65	4767000	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	1,88	1,30
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	2,08	3,07
90x90x65	4767000-A	1,2	12,13,16,17,21,22	1,21	1,23
90x90x65 with rib	4769000-A	1,2	12,13,16,17,21,22	1,21	3,45
100x100x60	4780000	1,2,3,4,5	15,16,17,18,19,20,21,22,23,24,25,26,27,28	1,32	1,56
100x100x80	4781000	1,2,3,4,5,6,7	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34	1,98	2,03
100x100x90	4768000	1,2,3,4,5,6,8,9	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	1,31	3,46
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	2,62	10,43
100x100x100	4782000	1,2,3,4,5,6,7,8,9	23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44	2,64	2,50
105x105x90	4768020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	2,58	1,63



105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	4,06	4,34
105x105x90	4768300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	2,58	2,63
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	4,06	5,83
140x40x40	4784200	1,2,6,7,9,10	16,17,19,20	1,17	2,11

**Table 3:** Force  $F_1$  Column, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_v$	max. number of nails*	Bolt number $n_B$	$F_{1,Rk}$ [kN] (column)		Bolt factor $k_{lt}$
					Timber	Steel	
70x70x55	4765020	20,19,18	3	9,4	9,73	2,06	0,7
70x70x55 with rib	4765120	16,15,14	3	4	9,73	0,54	2,0
90x90x65	4767150	23,22,20,19,18	5	11,10	16,3	1,69	0,6
90x90x65 with rib	4769150	20,19,17,16,15	5	10,9	16,3	4,68	0,6
90x90x65	4767000	23,22,20,19,18	5	11,10	16,1	3,36	0,6
90x90x65 with rib	4769000	20,19,17,16,15	5	10,9	16,1	7,03	0,6
105x105x90	4768020	40,39,38,37,35,34,33,32	8	19,18	25,9	4,98	0,6
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	8	19,18	25,9	11,4	0,6
105x105x90	4768300	40,39,38,37,35,34,33,32	8	19,18	25,5	8,00	0,6
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	8	19,18	25,5	18,4	0,6
PKR 95 x 85	4756000	1,2,3,4,5,6	6	11	18,9	17,2	0,73
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11, 12	11	17	37,7	17,2	0,73
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10, 11, 12,13,15,16,17,18,19,20,21, 22,23,24,26,27,28,29,30,31	28	36	88,0	17,2	0,73
PKR 95 x 85 with slotted hole	4756100	1,2,3,4,5,6	6	11	18,9	9,00	0,93
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12	11	17	37,7	9,00	0,93
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10, 11, 12,13,15,16,17,18,19,20,21, 22,23,24,26,27,28,29,30,31	28	36	88,0	9,00	0,93

\*A smaller number of nails may be used.  $F_{1,Rk}$  for timber failure has to be reduced accordingly.



**Table 4:** Force  $F_1$  Column, 1 angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	max. number of nails*	Bolt number $n_H$	$F_{1,Rk}$ [kN] (column)		Bolt factor $k_{dH}$
					Timber	Steel	
70x70x55	4765020	20,19,18	3	9,4	4,86	1,03	1,3
70x70x55 with rib	4765120	16,15,14	3	4	4,86	0,27	4,1
90x90x65	4767150	23,22,20,19,18	5	11,10	8,17	0,85	1,3
90x90x65 with rib	4769150	20,19,17,16,15	5	10,9	8,17	2,34	1,3
90x90x65	4767000	23,22,20,19,18	5	11,10	8,04	1,68	1,3
90x90x65 with rib	4769000	20,19,17,16,15	5	10,9	8,04	3,51	1,3
105x105x90	4768020	40,39,38,37,35,34,33,32	8	19,18	13,0	2,49	1,2
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	8	19,18	13,0	5,71	1,2
105x105x90	4768300	40,39,38,37,35,34,33,32	8	19,18	12,8	4,00	1,2
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	8	19,18	12,8	9,18	1,2
PKR 95 x 85	4756000	1,2,3,4,5,6	6	11	9,43	8,58	1,45
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12	11	17	18,9	8,58	1,45
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10, 11, 12,13,15,16,17,18,19,20,21, 22,23,24,26,27,28,29,30,31	28	36	44,0	8,58	1,45
PKR 95 x 85 with slotted hole	4756100	1,2,3,4,5,6	6	11	9,43	4,50	1,86
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12	11	17	18,9	4,50	1,86
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10, 11, 12,13,15,16,17,18,19,20,21, 22,23,24,26,27,28,29,30,31	28	36	44,0	4,50	1,86

\*A smaller number of nails may be used.  $F_{1,Rk}$  for timber failure has to be reduced accordingly.

**Table 5:** Force  $F_1$  Purlin, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{1,Rk}$ [kN] (purlin)	
				Timber	Steel
40x40x60	4771000	1,2	6,7,8,9,10	1,95	3,13
50x50x35	4764000	1,2	6,7,9,10	1,99	1,26
60x40x60	4783000	1,2,3	9,10,12,13	1,65	2,20
60x60x40	4772000	1,2,3	6,7,8,9,10	1,17	2,19
60x60x50	4773000	3,4	9,10,15,16	2,35	2,50
60x60x60	4774000	1,2,3,4,5	9,10,11,12,13,14,15,16	2,35	3,13
60x60x80	4775000	1,2,3,4,5,6,7	11,12,13,14,15, 16,17,18,19,20	3,52	4,06
60x60x100	4776000	1,2,3,4,5,6,7,8,9	14,15,16,17,18,19,20, 21,22,23,24,25,26,27	5,87	4,69
70x70x55	4765020	1,2,3,5,6,7	11,12,13,14,16,18,19,20	3,51	1,33
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	2,34	2,65
70x70x55	4765000	1,2,3,5,6	9,10,11,12,14,15,16	2,34	2,34
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	2,34	7,44
80x60x60	4784000	1,2,3,7,8	13,14,15,17,18,19	2,57	4,60
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17, 18,19,20,21,22	2,76	6,25



80x80x80	4778000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	4,15	8,13
80x80x100	4779000	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	5,06	5,00
90x48x48	4759000	1,2,4,5,6,7	10,11,13,14	1,98	2,85
90x48x76	4759100	1,2,3,6,7,8,9,10,11,12	16,17,21,22,23	2,30	7,07
90x48x116	4759200	1,2,3,4,5,8,9,10,11,12,13,15,16,17,18	22,23,25,26,29,30,31	3,96	7,20
90x90x40	4766000	1,2,6,7	11,12,14,15,19,20	2,40	1,88
90x90x65	4767150	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	3,75	1,31
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	4,17	5,12
90x90x65	4767000	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	3,75	2,60
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	4,17	6,14
90x90x65	4767000-A	1,2,6,7,8,9	12,13,16,17,21,22	2,41	2,46
90x90x65 with rib	4769000-A	1,2,6,7,8,9	12,13,16,17,21,22	2,41	6,90
100x100x60	4780000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	2,64	3,13
100x100x80	4781000	1,2,3,4,5,6,7,8,9,10,11,12,13,14	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34	3,96	4,06
100x100x90	4768000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	2,62	6,92
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	5,25	20,86
100x100x100	4782000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44	5,28	5,00
105x105x90	4768020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	5,16	3,27
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	8,12	8,68
105x105x90	4768300	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	5,16	5,25
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	8,12	11,7
140x40x40	4784200	1,2,6,7,9,10,11,12	16,17,19,20	2,34	4,22



**Table 6:** Force  $F_{1,Rk}$  Purlin, 1 angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{1,Rk}$ [kN] (purlin)	
				Timber	Steel
40x40x60	4771000	1,2	6,7,8,9,10	0,98	1,56
50x50x35	4764000	1,2	6,7,9,10	1,00	0,63
60x40x60	4783000	1,2,3	9,10,12,13	0,83	1,10
60x60x40	4772000	1,2,3	6,7,8,9,10	0,59	1,09
60x60x50	4773000	3,4	9,10,15,16	1,17	1,25
60x60x60	4774000	1,2,3,4,5	9,10,11,12,13,14,15,16	1,17	1,56
60x60x80	4775000	1,2,3,4,5,6,7	11,12,13,14,15,16,17,18,19,20	1,76	2,03
60x60x100	4776000	1,2,3,4,5,6,7,8,9	14,15,16,17,18,19,20,21,22,23,24,25,26,27	2,93	2,34
70x70x55	4765020	1,2,3,5,6,7	11,12,13,14,16,18,19,20	1,75	0,67
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	1,17	1,32
70x70x55	4765000	1,2,3,5,6	9,10,11,12,14,15,16	1,17	1,17
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	1,17	3,72
80x60x60	4784000	1,2,3,7,8	13,14,15,17,18,19	1,28	2,30
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17,18,19,20,21,22	1,38	3,13
80x80x80	4778000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	2,07	4,06
80x80x100	4779000	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	2,53	2,50
90x48x48	4759000	1,2,4,5,6,7	10,11,13,14	0,99	1,43
90x48x76	4759100	1,2,3,6,7,8,9,10,11,12	16,17,21,22,23	1,15	3,54
90x48x116	4759200	1,2,3,4,5,8,9,10,11,12,13,15,16,17,18	22,23,25,26,29,30,31	1,98	3,60
90x90x40	4766000	1,2,6,7	11,12,14,15,19,20	1,20	0,94
90x90x65	4767150	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	1,88	0,66
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	2,08	2,56
90x90x65	4767000	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	1,88	1,30
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	2,08	3,07
90x90x65	4767000-A	1,2,6,7,8,9	12,13,16,17,21,22	1,21	1,23
90x90x65 with rib	4769000-A	1,2,6,7,8,9	12,13,16,17,21,22	1,21	3,45
100x100x60	4780000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	1,32	1,56
100x100x80	4781000	1,2,3,4,5,6,7,8,9,10,11,12,13,14	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34	1,98	2,03
100x100x90	4768000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	1,31	3,46
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	2,62	10,43
100x100x100	4782000	1,2,3,4,5,6,8,9,10	23,24,25,26,27,28,29,30	2,64	2,50





		11,12,13,14,15,16,17,18	31,32,33,34,35,36,37,38,39,40,41,42,43,44		
105x105x90	4768020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	2,58	1,63
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	4,06	4,34
105x105x90	4768300	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	2,58	2,63
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	4,06	5,83
140x40x40	4784200	1,2,6,7,9,10,11,12	16,17,19,20	1,17	2,11

**Table 7:** Force  $F_1$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail/Screw number nv	max. number of nails/screws*	Bolt number $n_H$	$F_{t,Rk}$ [kN] (purlin)		Bolt factor $k_{t,H}$
					Timber	Steel	
70x70x55	4765020	20,19,18,16,15,14	6	9,4	19,5	2,06	0,7
70x70x55 with rib	4765120	16,15,14,12,11	5	4	16,2	0,54	2,0
90x90x65	4767150	23,22,20,19,18,17,16,15	8	11,10	26,1	1,69	0,6
90x90x65 with rib	4769150	20,19,17,16,15,14,13	7	10,9	22,9	4,68	0,6
90x90x65	4767000	23,22,20,19,18,17,16,15	8	11,10	25,7	3,36	0,6
90x90x65 with rib	4769000	20,19,17,16,15,14,13	7	10,9	22,5	7,03	0,6
105x105x90	4768020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	51,9	4,98	0,6
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	51,9	11,4	0,6
105x105x90	4768300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	51,1	8,00	0,6
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	51,1	18,4	0,6
60x60x60	4757060	1,2,4,5	4	8,9	7,71	2,85	0,7
80x60x60	4757080	1,2,5,6,8,9	6	12,13	11,6	2,85	0,7
100x60x60	4757100	2,3,6,7,10,11,13,14	8	17,18	15,4	2,85	0,7
120x60x60	4757120	1,2,4,5,8,9,12,13,16,17,19,20	12	23,24	23,1	2,85	0,7
140x60x60	4757140	1,2,5,6,8,9,12,13,16,17,20,21	12	23,24	23,1	2,85	0,7
160x60x60	4757160	2,3,6,7,10,11,13,14,17,18,21	11	22,23	21,2	2,85	0,7
180x60x60	4757180	1,2,4,5,8,9,12,13,16,17,19,20	12	23,24	23,1	2,85	0,7
200x60x60	4757200	1,2,5,6,8,9,12,13,16,17,20,21	12	23,24	23,1	2,85	0,7
220x60x60	4757220	2,3,6,7,10,11,13,14,17,18,21,22	12	24,25	23,1	2,85	0,7
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	9	11	28,3	17,2	0,73
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	14	17	47,1	17,2	0,73
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	31	36	97,4	17,2	0,73
PKR 95 x 85	4756100	1,2,3,4,5,6,7,8,9	9	11	28,3	9,00	0,93



with slotted hole							
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12,13,14,15	14	17	47,1	9,00	0,93
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	31	36	97,4	9,00	0,93

\*A smaller number of nails may be used.  $F_{t,Rk}$  for timber failure has to be reduced accordingly.

**Table 8:** Force  $F_1$  Purlin, l angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail/Screw number $n_V$	max. number of nails/screws*	Bolt number $n_{II}$	$F_{t,Rk}$ [kN] (purlin)		Bolt factor $k_{t,II}$
					Timber	Steel	
70x70x55	4765020	20,19,18,16,15,14	6	9,4	9,73	1,03	1,3
70x70x55 with rib	4765120	16,15,14,12,11	5	4	8,11	0,27	4,1
90x90x65	4767150	23,22,20,19,18,17,16,15	8	11,10	13,1	0,85	1,3
90x90x65 with rib	4769150	20,19,17,16,15,14,13	7	10,9	11,4	2,34	1,3
90x90x65	4767000	23,22,20,19,18,17,16,15	8	11,10	12,9	1,68	1,3
90x90x65 with rib	4769000	20,19,17,16,15,14,13	7	10,9	11,3	3,51	1,3
105x105x90	4768020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	25,9	2,49	1,2
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	25,9	5,71	1,2
105x105x90	4768300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	25,5	4,00	1,2
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	16	19,18	25,5	9,18	1,2
60x60x60	4757060	1,2,4,5	4	8,9	3,85	1,43	1,5
80x60x60	4757080	1,2,5,6,8,9	6	12,13	5,78	1,43	1,5
100x60x60	4757100	2,3,6,7,10,11,13,14	8	17,18	7,71	1,43	1,5
120x60x60	4757120	1,2,4,5,8,9,12,13,16,17,19,20	12	23,24	11,6	1,43	1,5
140x60x60	4757140	1,2,5,6,8,9,12,13,16,17,20,21	12	23,24	11,6	1,43	1,5
160x60x60	4757160	2,3,6,7,10,11,13,14,17,18,21	11	22,23	10,6	1,43	1,5
180x60x60	4757180	1,2,4,5,8,9,12,13,16,17,19,20	12	23,24	11,6	1,43	1,5
200x60x60	4757200	1,2,5,6,8,9,12,13,16,17,20,21	12	23,24	11,6	1,43	1,5
220x60x60	4757220	2,3,6,7,10,11,13,14,17,18,21,22	12	24,25	11,6	1,43	1,5
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	9	11	14,1	8,58	1,45
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	14	17	23,6	8,58	1,45
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	31	36	48,7	8,58	1,45
PKR 95 x 85 with slotted hole	4756100	1,2,3,4,5,6,7,8,9	9	11	14,1	4,50	1,86
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12,13,14,15	14	17	23,6	4,50	1,86
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,	31	36	48,7	4,50	1,86



		22,23,24,26,27,28,29,30,31, 32,33,34				
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\*A smaller number of nails may be used.  $F_{1,RR}$  for timber failure has to be reduced accordingly.

**Table 9:** Force  $F_1$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	screw number $n_v$	Bolt number $n_H$	$F_{1,RR}$ [kN] (purlin)		Bolt factor $k_{t,II}$
				Timber	Steel	
60x60x60	4757060	1,2,4,5	8,9	7,71	2,85	0,7
80x60x60	4757080	1,2,5,6	12,13	7,71	2,85	0,7
100x60x60	4757100	2,3,6,7,10,11	17,18	11,6	2,85	0,7
120x60x60	4757120	1,2,4,5,8,9	23,24	11,6	2,85	0,7
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	15,4	2,85	0,7
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	15,4	2,85	0,7
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	15,4	2,85	0,7
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	15,4	2,85	0,7
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	15,4	2,85	0,7

**Table 10:** Force  $F_1$  Purlin, 1 angle bracket / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	screw number $n_v$	Bolt number $n_H$	$F_{1,RR}$ [kN] (purlin)		Bolt factor $k_{t,II}$
				Timber	Steel	
60x60x60	4757060	1,2,4,5	8,9	3,85	1,43	1,5
80x60x60	4757080	1,2,5,6	12,13	3,85	1,43	1,5
100x60x60	4757100	2,3,6,7,10,11	17,18	5,78	1,43	1,5
120x60x60	4757120	1,2,4,5,8,9	23,24	5,78	1,43	1,5
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	7,71	1,43	1,5
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	7,71	1,43	1,5
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	7,71	1,43	1,5
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	7,71	1,43	1,5
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	7,71	1,43	1,5

**Table 11:** Compressive force  $F_{1,c}$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	screw number $n_v$	Bolt number $n_H$	$F_{1,c,RR}$ [kN] (purlin)	
				Timber	Steel <sup>1)</sup>
60x60x60	4757060	1,2,4,5	8,9	7,71	53,9
80x60x60	4757080	1,2,5,6	12,13	7,71	43,3
100x60x60	4757100	2,3,6,7,10,11	17,18	11,6	38,3
120x60x60	4757120	1,2,4,5,8,9	23,24	11,6	23,4
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	15,4	20,8
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	15,4	16,8
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	15,4	11,4
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	15,4	9,69
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	15,4	8,29

<sup>1)</sup> Partial factor  $\gamma_{M1}$  according to EN 1993 has to be taken into account



**Table 12:** Compressive force  $F_{1,c}$  Purlin, 1 angle bracket / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	screw number $n_V$	Bolt number $n_H$	$F_{1,c,Rk}$ [kN] (purlin)	
				Timber	Steel <sup>1)</sup>
60x60x60	4757060	1,2,4,5	8,9	3,85	26,9
80x60x60	4757080	1,2,5,6	12,13	3,85	21,6
100x60x60	4757100	2,3,6,7,10,11	17,18	5,78	19,1
120x60x60	4757120	1,2,4,5,8,9	23,24	5,78	11,7
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	7,71	10,4
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	7,71	8,40
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	7,71	5,73
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	7,71	4,84
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	7,71	4,14

<sup>1)</sup> Partial factor  $\gamma_{M1}$  according to EN 1993 has to be taken into account

**Table 13:** Forces  $F_{2/3}$  Column, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{2/3,Rk}$ [kN] (column)
				Timber
70x70x55	4765020	1,2,3	11,12,13,14,16,18,19,20	4,47
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	4,36
90x90x65	4767150	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	7,22
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	7,03
90x90x65	4767000	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	7,14
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	6,95
105x105x90	4768020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	12,5
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	12,5
105x105x90	4768300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	12,4
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	12,4
80x80x60	4777000	1,2,3	12,13,14,15,16,17,18,19,20,21,22	3,33
80x80x80	4778000	1,2,3,4	15,16,17,18,19,20,21,22,23,24,25,26,27,28	4,70



**Table 14:** Forces  $F_{2/3}$  Column, 1 angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{2/3,Rk}$ [kN]
				(column) Timber
70x70x55	4765020	1,2,3	11,12,13,14,16,18,19,20	2,24
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	2,18
90x90x65	4767150	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	3,61
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	3,51
90x90x65	4767000	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	3,57
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	3,48
105x105x90	4768020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	6,27
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	6,27
105x105x90	4768300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	6,20
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	6,20
80x80x60	4777000	1,2,3	12,13,14,15,16,17, 18,19,20,21,22	1,67
80x80x80	4778000	1,2,3,4	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	2,35

**Table 15:** Forces  $F_{2/3}$  Purlin, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{2/3,Rk}$ [kN]
				(purlin) Timber
40x40x60	4771000	1,2	6,7,8,9,10	5,23
50x50x35	4764000	1,2	6,7,9,10	2,86
60x40x60	4783000	1,2,3	9,10,12,13	3,82
60x60x40	4772000	1,2,3	6,7,8,9,10	2,82
60x60x50	4773000	3,4	9,10,15,16	2,24
60x60x60	4774000	1,2,3,4,5	9,10,11,12,13,14,15,16	7,56
60x60x80	4775000	1,2,3,4,5,6,7	11,12,13,14,15, 16,17,18,19,20	9,39
60x60x100	4776000	1,2,3,4,5,6,7,8,9	14,15,16,17,18,19,20, 21,22,23,24,25,26,27	15,52
70x70x55	4765020	1,2,3,5,6,7	11,12,13,14,16,18,19,20	7,81
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	6,50
70x70x55	4765000	1,2,3,5,6	9,10,11,12,14,15,16	5,71
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	5,67
80x60x60	4784000	1,2,3,7,8	13,14,15,17,18,19	5,92
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17, 18,19,20,21,22	8,55
80x80x80	4778000	1,2,3,4,5,6,7, 8,9,10,11	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	12,3
80x80x100	4779000	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	18,76
90x48x48	4759000	1,2,4,5,6,7	10,11,13,14	5,08
90x48x76	4759100	1,2,3,6,7,8,9,10,	16,17,21,22,23	6,60



		11,12		
90x48x116	4759200	1,2,3,4,5,8,9,10,11, 12,13,15,16,17,18	22,23,25,26,29,30,31	13,53
90x90x40	4766000	1,2,6,7	11,12,14,15,19,20	4,37
90x90x65	4767150	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	9,96
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	9,07
90x90x65	4767000	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	9,83
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	8,95
90x90x65	4767000- A	1,2,6,7,8,9	12,13,16,17,21,22	6,02
90x90x65 with rib	4769000- A	1,2,6,7,8,9	12,13,16,17,21,22	6,99
100x100x60	4780000	1,2,3,4,5,6,7, 8,9,10,11	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	11,11
100x100x80	4781000	1,2,3,4,5,6,7,8,9, 10,11,12,13,14	18,19,20,21,22,23,24,25,26, 27,28,29,30,31,32,33,34	14,31
100x100x90	4768000	1,2,3,4,5,6,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28, 29,30,31,33,34,35,36,37,38	17,49
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28, 29,30,31,33,34,35,36,37,38	17,49
100x100x 100	4782000	1,2,3,4,5,6,8,9,10,11 12,13,14,15,16,17,18	23,24,25,26,27,28,29,30,31,32, 33,34,35,36,37,38,39,40,41,42, 43,44	25,59
105x105x90	4768020	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	20,9
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	20,9
105x105x90	4768300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	20,6
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	20,6
140x40x40	4784200	1,2,6,7,9,10,11,12	16,17,19,20	6,16

**Table 16:** Forces  $F_{2/3}$  Purlin, I angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_v$	Nail number $n_{II}$	$F_{2/3,RR}$ [kN]
				(purlin) Timber
40x40x60	4771000	1,2	6,7,8,9,10	2,61
50x50x35	4764000	1,2	6,7,9,10	1,43
60x40x60	4783000	1,2,3	9,10,12,13	1,91
60x60x40	4772000	1,2,3	6,7,8,9,10	1,41
60x60x50	4773000	3,4	9,10,15,16	1,12
60x60x60	4774000	1,2,3,4,5	9,10,11,12,13,14,15,16	3,78
60x60x80	4775000	1,2,3,4,5,6,7	11,12,13,14,15, 16,17,18,19,20	4,70
60x60x100	4776000	1,2,3,4,5,6,7,8,9	14,15,16,17,18,19,20, 21,22,23,24,25,26,27	7,76
70x70x55	4765020	1,2,3,5,6,7	11,12,13,14,16,18,19,20	3,90
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	3,25
70x70x55	4765000	1,2,3,5,6	9,10,11,12,14,15,16	2,85
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	2,84



80x60x60	4784000	1,2,3,7,8	13,14,15,17,18,19	2,96
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17, 18,19,20,21,22	4,27
80x80x80	4778000	1,2,3,4,5,6,7, 8,9,10,11	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	6,17
80x80x100	4779000	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	9,38
90x48x48	4759000	1,2,4,5,6,7	10,11,13,14	2,54
90x48x76	4759100	1,2,3,6,7,8,9,10, 11,12	16,17,21,22,23	3,30
90x48x116	4759200	1,2,3,4,5,8,9,10,11, 12,13,15,16,17,18	22,23,25,26,29,30,31	6,76
90x90x40	4766000	1,2,6,7	11,12,14,15,19,20	2,18
90x90x65	4767150	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	4,98
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	4,53
90x90x65	4767000	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	4,91
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	4,47
90x90x65	4767000-A	1,2,6,7,8,9	12,13,16,17,21,22	3,01
90x90x65 with rib	4769000-A	1,2,6,7,8,9	12,13,16,17,21,22	3,49
100x100x60	4780000	1,2,3,4,5,6,7, 8,9,10,11	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	5,56
100x100x80	4781000	1,2,3,4,5,6,7,8,9, 10,11,12,13,14	18,19,20,21,22,23,24,25,26, 27,28,29,30,31,32,33,34	7,15
100x100x90	4768000	1,2,3,4,5,6,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28, 29,30,31,33,34,35,36,37,38	8,75
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28, 29,30,31,33,34,35,36,37,38	8,75
100x100x100	4782000	1,2,3,4,5,6,8,9, 10,11,12,13,14, 15,16,17,18	23,24,25,26,27,28,29,30,31, 32,33,34,35,36,37,38,39, 40,41,42,43,44	12,80
105x105x90	4768020	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	10,4
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	10,4
105x105x90	4768300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	10,3
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	10,3
140x40x40	4784200	1,2,6,7,9,10,11,12	16,17,19,20	3,08



**Table 17:** Forces  $F_{2/3}$  Column, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (column)	Bolt factor
				Timber	$k_{t,c}$
70x70x55	4765020	20,19,18	9,4	2,03	0,7
70x70x55 with rib	4765120	16,15,14	4	1,06	0,5
90x90x65	4767150	23,22,20,19,18	11,10	4,38	0,3
90x90x65 with rib	4769150	20,19,17,16,15	10,9	4,38	0,3
90x90x65	4767000	23,22,20,19,18	11,10	4,31	0,3
90x90x65 with rib	4769000	20,19,17,16,15	10,9	4,31	0,3
105x105x90	4768020	40,39,38,37,35,34,33,32	19,18	6,75	0,3
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	19,18	6,75	0,3
105x105x90	4768300	40,39,38,37,35,34,33,32	19,18	6,64	0,3
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	19,18	6,64	0,3

**Table 18:** Forces  $F_{2/3}$  Column, 1 angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (column)	Bolt factor
				Timber	$k_{t,c}$
70x70x55	4765020	20,19,18	9,4	1,01	1,4
70x70x55 with rib	4765120	16,15,14	4	0,53	1,0
90x90x65	4767150	23,22,20,19,18	11,10	2,19	0,7
90x90x65 with rib	4769150	20,19,17,16,15	10,9	2,19	0,7
90x90x65	4767000	23,22,20,19,18	11,10	2,15	0,7
90x90x65 with rib	4769000	20,19,17,16,15	10,9	2,15	0,7
105x105x90	4768020	40,39,38,37,35,34,33,32	19,18	3,37	0,6
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	19,18	3,37	0,6
105x105x90	4768300	40,39,38,37,35,34,33,32	19,18	3,32	0,6
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	19,18	3,32	0,6





**Table 19:** Forces  $F_{2/3}$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail/Screw number $n_v$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (purlin)	
				Timber	Bolt factor $k_t$
70x70x55	4765020	20,19,18,16,15,14	9,4	5,95	0,7
70x70x55 with rib	4765120	16,15,14,12,11	4	2,20	0,5
90x90x65	4767150	23,22,20,19,18,17,16,15	11,10	7,68	0,3
90x90x65 with rib	4769150	20,19,17,16,15,14,13	10,9	7,14	0,3
90x90x65	4767000	23,22,20,19,18,17,16,15	11,10	7,56	0,3
90x90x65 with rib	4769000	20,19,17,16,15,14,13	10,9	7,03	0,3
105x105x90	4768020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	17,0	0,3
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	17,0	0,3
105x105x90	4768300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	16,7	0,3
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	16,7	0,3
60x60x60	4757060	1,2,4,5	8,9	3,13	0,4
80x60x60	4757080	1,2,5,6,8,9	12,13	3,99	0,4
100x60x60	4757100	2,3,6,7,10,11,13,14	17,18	4,72	0,4
120x60x60	4757120	1,2,4,5,8,9,12,13,16,17,19,20	23,24	6,13	0,4
140x60x60	4757140	1,2,5,6,8,9,12,13,16,17,20,21	23,24	5,34	0,4
160x60x60	4757160	2,3,6,7,10,11,13,14,17,18,21	22,23	3,69	0,4
180x60x60	4757180	1,2,4,5,8,9,12,13,16,17,19,20	23,24	3,85	0,4
200x60x60	4757200	1,2,5,6,8,9,12,13,16,17,20,21	23,24	3,52	0,4
220x60x60	4757220	2,3,6,7,10,11,13,14,17,18,21,22	24,25	3,24	0,4
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	11	3,56	0,5
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	6,04	0,5
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	11,2	0,5
PKR 95 x 85 with slotted hole	4756100	1,2,3,4,5,6,7,8,9	11	2,83	0,5
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	4,74	0,5
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	8,58	0,5



**Table 20:** Forces  $F_{2/3}$  Purlin, L angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail/Screw number $n_v$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (purlin)	
				Timber	$k_t$
70x70x55	4765020	20,19,18,16,15,14	9,4	2,98	1,4
70x70x55 with rib	4765120	16,15,14,12,11	4	1,10	1,0
90x90x65	4767150	23,22,20,19,18,17,16,15	11,10	3,84	0,7
90x90x65 with rib	4769150	20,19,17,16,15,14,13	10,9	3,57	0,7
90x90x65	4767000	23,22,20,19,18,17,16,15	11,10	3,78	0,7
90x90x65 with rib	4769000	20,19,17,16,15,14,13	10,9	3,52	0,7
105x105x90	4768020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	8,48	0,6
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	8,48	0,6
105x105x90	4768300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	8,35	0,6
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	8,35	0,6
60x60x60	4757060	1,2,4,5	8,9	1,56	0,7
80x60x60	4757080	1,2,5,6,8,9	12,13	1,99	0,7
100x60x60	4757100	2,3,6,7,10,11,13,14	17,18	2,36	0,7
120x60x60	4757120	1,2,4,5,8,9,12,13,16,17,19,20	23,24	3,07	0,7
140x60x60	4757140	1,2,5,6,8,9,12,13,16,17,20,21	23,24	2,67	0,7
160x60x60	4757160	2,3,6,7,10,11,13,14,17,18,21	22,23	1,85	0,7
180x60x60	4757180	1,2,4,5,8,9,12,13,16,17,19,20	23,24	1,92	0,7
200x60x60	4757200	1,2,5,6,8,9,12,13,16,17,20,21	23,24	1,76	0,7
220x60x60	4757220	2,3,6,7,10,11,13,14,17,18,21,22	24,25	1,62	0,7
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	11	1,78	1,0
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	3,02	1,0
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	5,60	1,0
PKR 95 x 85 with slotted hole	4756100	1,2,3,4,5,6,7,8,9	11	1,42	1,0
PKR 135 x 85 with slotted hole	4756110	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	2,37	1,0
PKR 285 x 85 with slotted hole	4756120	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	4,29	1,0



**Table 21:** Forces  $F_{2/3}$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	Screw number $n_v$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (purlin)	
				Timber	Steel
60x60x60	4757060	1,2,4,5	8,9	2,36	0,4
80x60x60	4757080	1,2,5,6	12,13	2,52	0,4
100x60x60	4757100	2,3,6,7,10,11	17,18	3,31	0,4
120x60x60	4757120	1,2,4,5,8,9	23,24	2,46	0,4
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	3,05	0,4
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	2,72	0,4
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	2,25	0,4
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	2,06	0,4
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	1,91	0,4

**Table 22:** Forces  $F_{2/3}$  Purlin, 1 angle bracket / connection, connection timber to concrete/steel for fastened purlin at a distance to the ground

Type	Product number	Screw number $n_v$	Bolt number $n_H$	$F_{2/3,Rk}$ [kN] (purlin)	
				Timber	Steel
60x60x60	4757060	1,2,4,5	8,9	1,18	0,7
80x60x60	4757080	1,2,5,6	12,13	1,26	0,7
100x60x60	4757100	2,3,6,7,10,11	17,18	1,65	0,7
120x60x60	4757120	1,2,4,5,8,9	23,24	1,23	0,7
140x60x60	4757140	1,2,5,6,8,9,12,13	23,24	1,52	0,7
160x60x60	4757160	2,3,6,7,10,11,13,14	22,23	1,36	0,7
180x60x60	4757180	1,2,4,5,8,9,12,13	23,24	1,12	0,7
200x60x60	4757200	1,2,5,6,8,9,12,13	23,24	1,03	0,7
220x60x60	4757220	2,3,6,7,10,11,13,14	24,25	0,96	0,7

**Table 23:** Basic Forces  $F_{4/5}$  Column, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_v$	Nail number $n_H$	$F_{4/5,Rk}$ [kN] (column)	
				Timber	Steel
70x70x55	4765020	1,2,3	11,12,13,14,16,18,19,20	2,34	2,09
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	3,31	2,55
90x90x65	4767150	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	2,31	2,43
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	4,52	4,01
90x90x65	4767000	1,2,4,5,6	12,13,14,15,17,18,19,20,22,23	3,46	3,27
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	5,07	4,70
105x105x90	4768020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	3,90	4,57
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	6,25	6,40
105x105x90	4768300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	5,33	5,63
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	7,37	7,35



**Table 24:** Basic Forces  $F_{4/5}$  Purlin, 2 angle brackets / connection, connection timber to timber

Type	Product number	Nail number $n_v$	Nail number $n_H$	$F_{4/5,Rk}$ [kN] (purlin)	
				Timber	Steel
40x40x60	4771000	1,2	6,7,8,9,10	7,17	3,60
50x50x35	4764000	1,2	6,7,9,10	7,58	2,01
60x40x60	4783000	1,2,3	9,10,12,13	7,19	3,91
60x60x40	4772000	1,2,3	6,7,8,9,10	4,01	2,39
60x60x50	4773000	3,4	9,10,15,16	5,64	2,71
60x60x60	4774000	1,2,3,4,5	9,10,11,12,13,14,15,16	6,51	3,65
60x60x80	4775000	1,2,3,4,5,6,7	11,12,13,14,15,16,17,18,19,20	9,70	5,12
60x60x100	4776000	1,2,3,4,5,6,7,8,9	14,15,16,17,18,19,20,21,22,23,24,25,26,27	12,41	6,22
70x70x55	4765020	1,2,3,5,6,7	11,12,13,14,16,18,19,20	5,58	2,36
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	7,01	2,91
70x70x55	4765000	1,2,3,5,6	9,10,11,12,14,15,16	5,52	3,60
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	5,87	4,43
80x60x60	4784000	1,2,3,7,8	13,14,15,17,18,19	5,33	3,70
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17,18,19,20,21,22	12,8	13,0
80x80x80	4778000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	18,3	17,0
80x80x100	4779000	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	13,08	6,62
90x48x48	4759000	1,2,4,5,6,7	10,11,13,14	3,54	4,76
90x48x76	4759100	1,2,3,6,7,8,9,10,11,12	16,17,21,22,23	7,21	6,99
90x48x116	4759200	1,2,3,4,5,8,9,10,11,12,13,15,16,17,18	22,23,25,26,29,30,31	10,18	11,03
90x90x40	4766000	1,2,6,7	11,12,14,15,19,20	5,23	3,25
90x90x65	4767150	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	4,87	2,59
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	8,94	4,47
90x90x65	4767000	1,2,4,5,6,7,8,9	12,13,14,15,17,18,19,20,22,23	7,65	3,61
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	8,96	5,17
90x90x65	4767000-A	1,2,6,7,8,9	12,13,16,17,21,22	6,19	4,48
90x90x65 with rib	4769000-A	1,2,6,7,8,9	12,13,16,17,21,22	6,55	6,25
100x100x60	4780000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	7,77	3,73
100x100x80	4781000	1,2,3,4,5,6,7,8,9,10,11,12,13,14	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34	11,23	5,22
100x100x90	4768000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	11,94	7,53
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	13,37	11,71
100x100x100	4782000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18	23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44	14,16	6,51
105x105x90	4768020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	7,67	5,22
105x105x90	4770020	1,2,3,4,6,7,8,9,10,11,	20,21,22,23,24,25,26,27,28,29,	13,4	7,89



with rib		12,13,14,15,16,17	30,31,32,33,34,35,37,38,39,40		
105x105x90	4768300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	11,0	6,67
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11, 12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	15,2	9,24
140x40x40	4784200	1,2,6,7,9,10,11,12	16,17,19,20	4,97	3,04

**Table 25:** Basic Forces  $F_4$  Column, I angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{4,Rk}$ [kN] (column)	
				Timber	Steel
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	3,07	2,36
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	4,06	3,61
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	4,41	4,09
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	5,82	5,96
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	6,68	6,67

**Table 26:** Basic Forces  $F_4$  Purlin, I angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_V$	Nail number $n_H$	$F_{4,Rk}$ [kN] (purlin)	
				Timber	Steel
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	6,33	2,32
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	5,87	3,18
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	7,97	3,60
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	8,64	4,04
90x90x65 with rib	4769000- A	1,2,6,7,8,9	12,13,16,17,21,22	6,55	4,40
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9, 10,11,12,13,14, 15,16,17	20,21,22,23,24,25,26,27,28, 29,30,31,33,34,35,36,37,38	13,37	7,94
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10, 11,12,13,14,15,16, 17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	10,0	5,92
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10, 11,12,13,14,15,16, 17	20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,37,38,39,40	11,5	6,68
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17, 18,19,20,21,22	5,28	5,28
80x80x80	4778000	1,2,3,4,5,6,7, 8,9,10,11	15,16,17,18,19,20,21,22, 23,24,25,26,27,28	6,95	6,95



**Table 27:** Basic Forces  $F_s$  Column, L angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_v$	Nail number $n_{II}$	$F_{s,Rk}$ [kN] (column)	
				Timber	Steel
70x70x55 with rib	4765120	1,2,3	9,10,11,12,14,15,16	1,76	0,39
90x90x65 with rib	4769150	1,2,4,5,6	11,12,13,14,15,16,17,19,20	1,69	0,59
90x90x65 with rib	4769000	1,2,4,5,6	11,12,13,14,15,16,17,19,20	1,83	0,84
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	1,94	0,92
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	2,30	1,25

**Table 28:** Basic Forces  $F_s$  Purlin, L angle bracket / connection, connection timber to timber

Type	Product number	Nail number $n_v$	Nail number $n_{II}$	$F_{s,Rk}$ [kN] (purlin)	
				Timber	Steel
70x70x55 with rib	4765120	1,2,3,5,6	9,10,11,12,14,15,16	1,43	0,88
70x70x55 with rib	4765100	1,2,3,5,6	9,10,11,12,14,15,16	1,66	1,23
90x90x65 with rib	4769150	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	1,73	0,97
90x90x65 with rib	4769000	1,2,4,5,6,7,8	11,12,13,14,15,16,17,19,20	1,96	1,37
90x90x65 with rib	4769000-A	1,2,6,7,8,9	12,13,16,17,21,22	1,88	1,90
100x100x90 with rib	4770000	1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38	4,42	3,88
105x105x90 with rib	4770020	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	3,67	2,26
105x105x90 with rib	4770300	1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17	20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40	4,21	3,19
80x80x60	4777000	1,2,3,4,5,6,7,8	12,13,14,15,16,17,18,19,20,21,22	1,10	1,20
80x80x80	4778000	1,2,3,4,5,6,7,8,9,10,11	15,16,17,18,19,20,21,22,23,24,25,26,27,28	2,20	1,56



**Table 29:** Basic Forces  $F_{4/5}$  Column, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{4/5,Rk}$ [kN] (column)		Bolt factor	
				Timber	Steel	$k_{t,II}$	$k_{t,...}$
70x70x55	4765020	20,19,18	9,4	2,48	2,02	0,1	0,5
70x70x55 with rib	4765120	16,15,14	4	3,72	2,49	0,1	0,9
90x90x65	4767150	23,22,20,19,18	11,10	2,55	2,42	0,1	0,5
90x90x65 with rib	4769150	20,19,17,16,15	10,9	5,04	2,65	0,2	0,4
90x90x65	4767000	23,22,20,19,18	11,10	3,71	3,31	0,1	0,4
90x90x65 with rib	4769000	20,19,17,16,15	10,9	5,57	3,32	0,2	0,4
105x105x90	4768020	40,39,38,37,35,34,33,32	19,18	4,25	4,38	0,1	0,5
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	19,18	7,09	4,69	0,2	0,5
105x105x90	4768300	40,39,38,37,35,34,33,32	19,18	5,72	5,49	0,1	0,5
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	19,18	8,22	6,21	0,2	0,4

**Table 30:** Basic Forces  $F_{4/5}$  Purlin, 2 angle brackets / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{4/5,Rk}$ [kN] (purlin)		Bolt factor	
				Timber	Steel	$k_{t,II}$	$k_{t,...}$
70x70x55	4765020	20,19,18,16,15,14	9,4	6,08	2,21	0,1	0,4
70x70x55 with rib	4765120	16,15,14,12,11	4	5,67	2,96	0,2	0,7
90x90x65	4767150	23,22,20,19,18,17,16,15	11,10	5,50	2,53	0,1	0,4
90x90x65 with rib	4769150	20,19,17,16,15,14,13	10,9	7,99	2,99	0,3	0,4
90x90x65	4767000	23,22,20,19,18,17,16,15	11,10	8,47	3,63	0,2	0,4
90x90x65 with rib	4769000	20,19,17,16,15,14,13	10,9	8,18	3,72	0,2	0,4
105x105x90	4768020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	8,83	4,95	0,1	0,4
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	13,3	5,97	0,3	0,4
105x105x90	4768300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	12,0	6,41	0,2	0,4
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	13,6	7,73	0,3	0,4
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	11	9,36	8,03	0,78	0,78
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	13,5	8,52	0,76	0,76
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	10,4	8,74	0,76	0,76

**Table 31:** Basic Force  $F_a$  Column, 1 angle bracket / connection, connection timber to concrete/steel



Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{4,Rk}$ [kN] (column)		Bolt factor	
				Timber	Steel	$k_{t,H}$	$k_{t,-}$
70x70x55 with rib	4765120	16,15,14	4	3,31	2,22	0,0	1,0
90x90x65 with rib	4769150	20,19,17,16,15	10,9	4,36	2,29	0,0	0,5
90x90x65 with rib	4769000	20,19,17,16,15	10,9	4,77	2,85	0,1	0,5
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	19,18	6,46	4,27	0,1	0,5
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	19,18	7,38	5,57	0,1	0,5

**Table 32:** Basic Force  $F_4$  Purlin, 1 angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{4,Rk}$ [kN] (purlin)		Bolt factor	
				Timber	Steel	$k_{t,H}$	$k_t$
70x70x55 with rib	4765120	16,15,14,12,11	4	7,00	2,20	0,0	1,0
90x90x65 with rib	4769150	20,19,17,16,15,14,13	10,9	8,73	2,31	0,0	0,5
90x90x65 with rib	4769000	20,19,17,16,15,14,13	10,9	9,45	2,87	0,0	0,5
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	11,5	4,35	0,0	0,5
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	13,0	5,59	0,0	0,5
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	11	9,36	6,28	-	1,0
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	13,5	6,50	-	1,0
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	10,4	6,64	-	1,0

**Table 33:** Basic Force  $F_5$  Column, 1 angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_V$	Bolt number $n_H$	$F_{5,Rk}$ [kN] (column)		Bolt factor	
				Timber	Steel	$k_{t,H}$	$k_{t,-}$
70x70x55 with rib	4765120	16,15,14	4	2,02	0,39	1,3	1,0
90x90x65 with rib	4769150	20,19,17,16,15	10,9	1,81	0,91	1,6	0,5
90x90x65 with rib	4769000	20,19,17,16,15	10,9	1,80	1,22	1,6	0,5
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32	19,18	1,97	0,92	1,9	0,5
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32	19,18	2,15	1,36	2,0	0,5





**Table 34:** Basic Force  $F_5$  Purlin, L angle bracket / connection, connection timber to concrete/steel

Type	Product number	Nail number $n_v$	Bolt number $n_{II}$	$F_{5,Rk}$ [kN] (purlin)		Bolt factor	
				Timber	Steel	$k_{t,II}$	$k_{t,\dots}$
70x70x55 with rib	4765120	16,15,14,12,11	4	1,45	0,80	0,7	1,0
90x90x65 with rib	4769150	20,19,17,16,15,14,13	10,9	1,84	1,69	1,1	0,5
90x90x65 with rib	4769000	20,19,17,16,15,14,13	10,9	1,87	2,20	1,1	0,5
105x105x90 with rib	4770020	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	3,61	3,07	1,0	0,5
105x105x90 with rib	4770300	40,39,38,37,35,34,33,32,31,30,29,28,27,26,25,24	19,18	3,76	4,63	0,9	0,5
PKR 95 x 85	4756000	1,2,3,4,5,6,7,8,9	11	2,04	5,43	1,74	1,0
PKR 135 x 85	4756010	1,2,3,4,5,7,8,9,10,11,12,13,14,15	17	2,40	3,50	1,47	1,0
PKR 285 x 85	4756020	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34	36	2,51	3,74	1,43	1,0



**Hold-downs**  
**Characteristic load-carrying capacities**

**Table 35:** Force  $F_t$  Column and Purlin, 1 hold-down / connection, connection timber to concrete/steel

hold-down <sup>1)</sup>	capacity per nail in the vertical flange $F_{VM,Rk}$ [kN]	concrete	Bolt	Steel		
			$k_{t,II}$	moment capacity $F_{m,Rk}$ [kN]	shear capacity $F_{c,Rk}$ [kN]	tensile capacity <sup>2)</sup> $F_{t,Rk}$ [kN]
4791000	$n \cdot 1,62$	see EN 1992	3,44	8,54	11,0	16,6
4791400	$n \cdot 1,57$		3,44	10,9	23,1	35,6
4792000	$n \cdot 1,62$		3,44	8,54	11,0	16,6
4792400	$n \cdot 1,57$		3,44	10,9	23,1	35,6
4793000	$n \cdot 1,62$		3,44	8,54	11,0	16,6
4793400	$n \cdot 1,57$		3,44	10,9	23,1	35,6
4794000	$n \cdot 1,62$		3,44	8,54	11,0	16,6
4794400	$n \cdot 1,57$		3,44	10,9	23,1	35,6
4824000	$n \cdot 1,60$		3,09	8,86	17,3	26,7
4825000	$n \cdot 1,60$		3,09	8,86	17,3	26,7
4826000	$n \cdot 1,60$		3,09	8,86	17,3	26,7
4827000	$n \cdot 1,60$		3,09	8,86	17,3	26,7

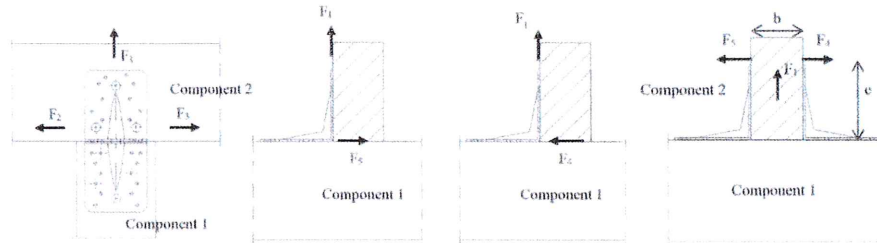
<sup>1)</sup> Washer according to the engineering drawing 4790000 must be used

<sup>2)</sup> Partial factor  $\gamma_{M,2}$  has to be taken into account



### Definitions of forces, their directions and eccentricity

#### Forces – Example: Beam to beam connection



#### Fastener specification

Holes are marked with numbers referring to the nailing pattern in Annex B.

#### Acting forces

- $F_1$  Lifting force acting in the central axis of the joint. The components shall be prevented from rotation.
  - $F_{1,c}$  Compressing force acting in the central axis of the joint in case of a fastened purlin (component 2) at a distance to the ground (component 1). The components must be prevented from rotation.
  - $F_2$  and  $F_3$  Lateral force acting in the joint between the component 2 and the component 1 in the component 2 direction. The components must be prevented from rotation.
  - $F_4$  and  $F_5$  Lateral force acting in the component 1 direction along the central axis of the joint. The components must be prevented from rotation.
- Only for double angle brackets per connection: The load may be applied with an eccentricity  $e$ , then a design for combined loading is required.

#### Double angle brackets per connection

The angle brackets must be placed at each side opposite to each other, symmetrically to the component axis.

#### Wane

Wane is not allowed, the timber has to be sharp-edged in the area of the 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:

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

The forces  $F_2$  and  $F_3$  or  $F_4$  and  $F_5$  are forces with opposite direction. Therefore only one force  $F_2$  or  $F_3$ , and  $F_4$  or  $F_5$ , respectively, is able to act simultaneously with  $F_1$ , while the other shall be set to zero.

If the load  $F_{4/5,Ed}$  is applied with an eccentricity  $e$ , a design for combined loading **for connections with double angle brackets** is required. Here, an additional force  $\Delta F_1$  has to be added to the existing force  $F_1$ .

$$\Delta F_{1,Ed} = F_{4/5,Ed} \cdot \frac{e}{b} \quad b \text{ is the width of component 2.}$$

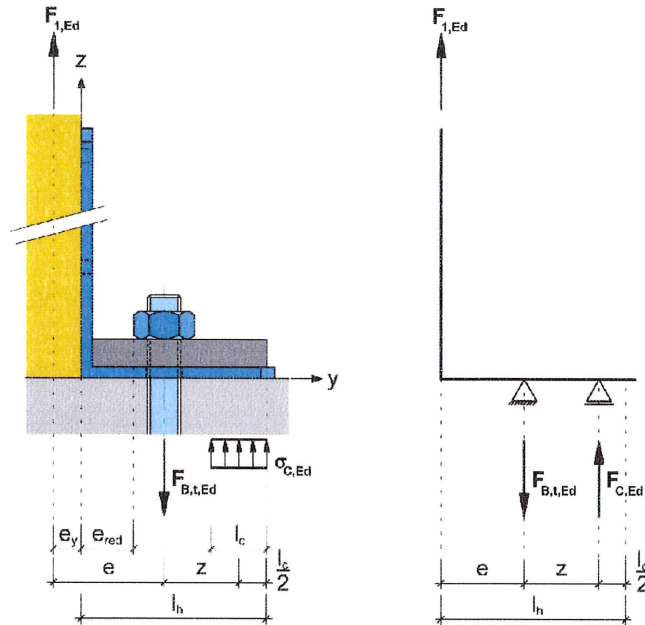


### Connection of timber to concrete or steel with bolts or metal anchors

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

$$F_{B,t,Ed} = k_{t,\parallel} \cdot F_{Ed}$$

$$F_{B,v,Ed} = k_{t,\perp} \cdot F_{Ed}$$



where:

- $F_{B,t,Ed}$  Resulting tensile load on the maximally loaded bolt in the group in N
- $F_{B,v,Ed}$  Resulting shear load on the maximally loaded bolt in the group in N
- $k_{t,\parallel}$  Coefficient taking into account the resulting axial force
- $k_{t,\perp}$  Coefficient taking into account the moment arm or hole tolerance, respectively
- $F_{1,Ed}$  Load on vertical flap of the angle bracket or pair of angle brackets in N
- $B$  Width of the washer in mm
- $\sigma_{C,Ed}$  compressive stress on the support in  $N/mm^2$
- $l_c$  Length of the section under compressive stress in mm (usually 10 mm for angle brackets, 18 mm for hold-downs)



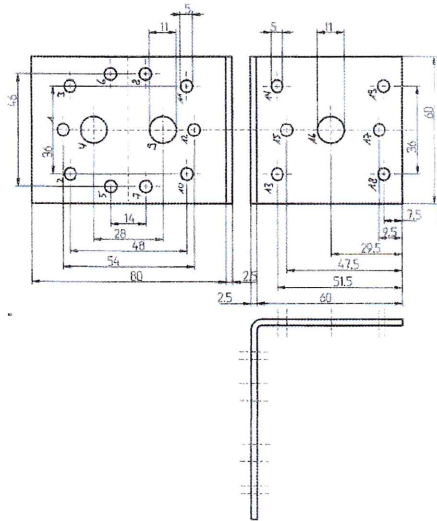


Figure B. 13 Dimensions of Angle Bracket 4784000  
80x60x60

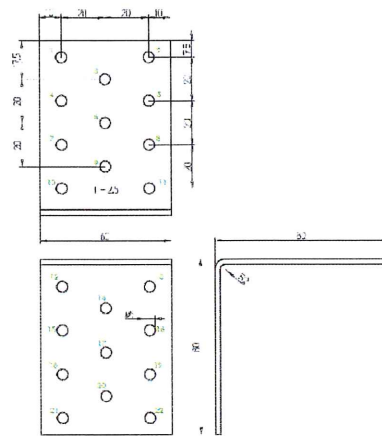


Figure B. 14 Dimensions of Angle Bracket 4777000  
80x80x60

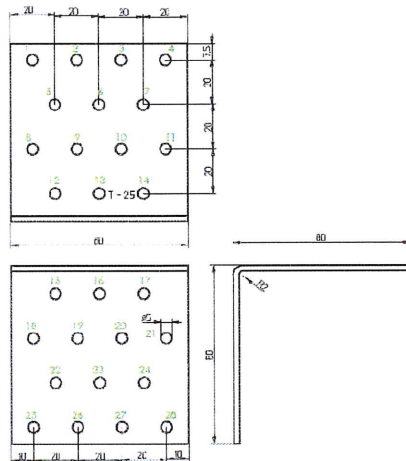


Figure B. 15 Dimensions of Angle Bracket 4778000  
80x60x80

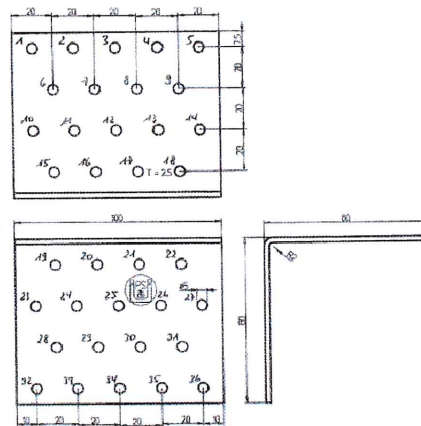


Figure B. 16 Dimensions of Angle Bracket 4779000  
80x80x100



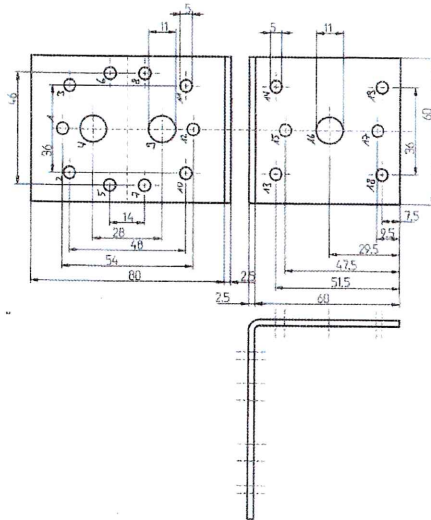


Figure B. 13 Dimensions of Angle Bracket 4784000  
80x60x60

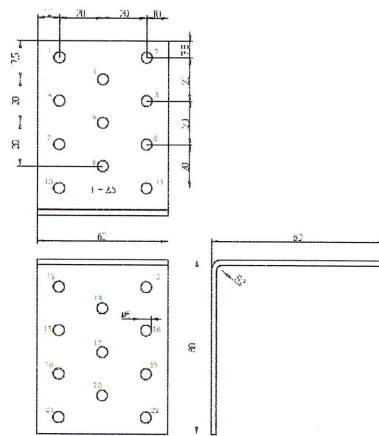


Figure B. 14 Dimensions of Angle Bracket 4777000  
80x80x60

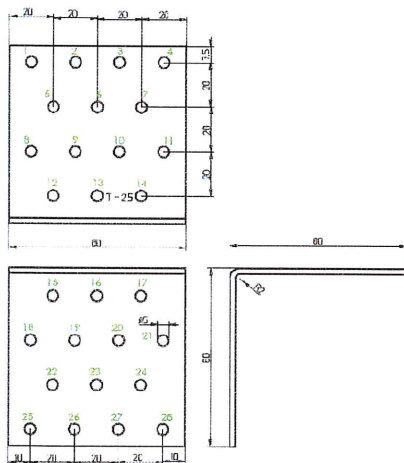


Figure B. 15 Dimensions of Angle Bracket 4778000  
80x60x80

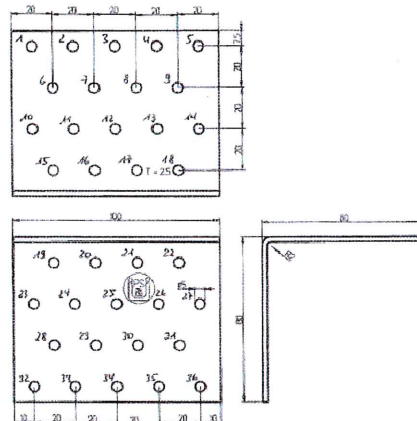


Figure B. 16 Dimensions of Angle Bracket 4779000  
80x80x100

