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European Technical Assessment

ETA 09/0205 of 29/06/2018

Technical Assessment Body Issuing the ETA:	Exova BM TRADA
Trade Name of the Construction Product	Waelbers WoodConnectors
Product Family to which the Construction Product Belongs	EC PAC 13 – Three Dimensional Nailing Plates
Manufacturer	Metaalindustrie Waelbers B.V. Hoge Akkers 13, 7961 AR, Ruinerwold The Netherlands
Manufacturing Plant	Metaalindustrie Waelbers B.V. Hoge Akkers 13, 7961 AR, Ruinerwold The Netherlands
This European Technical Assessment Contains	136 Pages including 45 Annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) No. 305/2011, on the basis of	ETAG 015, Issue 2012, used as an EAD
This Version Replaces	ETA Valid from 30/06/2013 to 29/06/18

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1 Technical Description of Product and Intended Use

1.1 Technical Description of the Product

Waelbers WoodConnectors are three-dimensional nailing plates for timber-to-timber or timber-to-concrete connections, enabling connection through nails or screws (in timber members) and bolts (in concrete supports). The Angle Bracket, Joist Hanger and Special Connectors are one-piece non-welded, face-fixed parts. The Column Bases are welded from steel plates and columns.

This ETA covers a range of angle brackets, joist hangers, special connectors and column bases as detailed in Table 1. For the purposes of this ETA, a distinction is made between Series I and Series II Angle Bracket and Joist Hanger connectors, whereby Series I connectors were included in the previous edition of the ETA, and Series II connectors have introduced in this edition. Of the remaining connectors, only the Waelbers Column Base connectors were included in the previous edition

Table 1: Waelbers 3-Dimensional Connector Models

Waelbers 3-Dimensional Connector Models				
Model ID	**Description**	**Steel Grade**	**Timber to Timber**	**Timber to Concrete**
ANGLE BRACKETS - SERIES I				
H1R & H2R	Non-welded L shaped steel plate with one or two ribs	DX51D+Z275	X	X
2-Pan or 3-Pan	Non-welded L (2-segments) or J (3 segments) shape steel plates ribbed all along the plate	DX51D+Z275		X
ANGLE BRACKETS - SERIES II				
Drempelhoek	Narrow thick symmetrical angle bracket	S235JR	X	
Drempelhoek DLD	Narrow thick symmetrical angle bracket	S235JR	X	
Hoek	Thin general purpose angle bracket	DX51D+Z275	X	X
Hoek 135°	135° angle bracket		X	X
Hoekanker	Angle bracket		X	X
Hoekanker met ril	Angle bracket with 1 rib		X	X
Hoekanker met 2 rillen	Angle bracket with 2 ribs		X	X
Hoekanker met 3 rillen	Angle bracket with 3 ribs		X	X
Kruiskoppeling	Wide angle bracket		X	
Langgathoek	Angle brackets with obround holes		X	X
Langgathoek met ril	Angle brackets with obround holes and rib		X	X
Neusijzer	Narrow thick symmetrical angle bracket	DD-11	X	
Verbindingshoek	Symmetrical general purpose angle bracket	DX51D+Z275	X	
Versterkingshoek	Small assembly symmetrical angle bracket		X	
Versterkingshoek ongelijkzijdig	Small assembly non-symmetrical angle bracket		X	

Waelbers 3-Dimensional Connector Models				
Model ID	**Description**	**Steel Grade**	**Timber to Timber**	**Timber to Concrete**
JOIST HANGERS - SERIES I				
RD (standard), RDD (closed), RD2D (split) and RD2dd (split closed)	Non-welded face-fixed Hanger Connector	DX51D+Z275	X	X
JOIST HANGERS - SERIES II				
Raveeldrager dicht	Closed joist hanger	DX51D+Z275	X	X
Raveeldrager zwaar	Joist hanger		X	X
Raveeldrager met strip	Joist hanger with lower face plate		X	
Regeldrager	Small-size joist hanger		X	
SPECIAL CONNECTORS				
Kruiskoppeling L/R	2-part rafter tie	DX51D+Z275	X	
Gripanker	Folded angle bracket		X	
Ruitersteun	Ridge board connector		X	
COLUMN BASES				
Waelbers Column Bases	Two-part column connector with adjustable height	S235JR / 11SMNPB30		X
Paalhouder verstelbaar 90x90	Adjustable column base connector	S235JR / 11SMNPB30		X
Paalhouder verstelbaar 80x80/100x140	Adjustable column base connector with slotted steel column	S235JR / 11SMNPB30		X

This ETA covers the standard range of sizes of angle brackets, joist hangers, special connectors and column bases given in Annex 2 Annex 3 Annex 4 and Annex 5 respectively, as well as other intermediate sizes contained within the extreme dimensions of the standard ranges.

1.2 Characteristics of Product

The characteristics of the Waelbers Connectors in the range covered by this ETA have been derived in accordance with ETAG 015:2012.

1.2.1 Steel, Raw Material and Surface Finish/Coating

Waelbers Connectors are manufactured from different steel grades with various surface finish / coatings, as described in Table 1 and Table 2.

1.2.1.1 Steel Grades

The steel grades used for manufacturing of, made from +Z275 S235JR (EN 10025-2) mild steel, drawing steel DD-11 (EN 10111) or (hot dip) pre-galvanised steel DX51D.

Column base connectors are made from two Electrolytic Galvanizing S235JR steel plates welded to an Automat steel 11SMNPB30 column.

The steel grade for each connector type is given in Table 1.

1.2.1.2 Surface Coatings

The surface coatings of the steel grades used for manufacturing of Waelbers Connectors are given in Table 2, which also shows the corresponding standard and the nomenclature used when referring to the steel grades in the further tables of this ETA.

Table 2: Surface Coatings

Surface Finish	Reference (Colour or Variant)	Standard	Thickness
None (Stainless steel)	Self-Colour		
Zinc Electro Plating	White Zinc Plating	EN 2081	Fe/Zn 12c
	Yellow Zinc Plating		
	Galvanized Zinc Plating		
Zinc Plating + Powder Coating	Black Powder Coating	EN 2081	Fe/Zn 5c + 50 Micron Powder Coating
	White Powder Coating		
	Brown Powder Coating		
Hot Dip Galvanizing	Hop Dip Galvanizing	EN 1461	55 micron
Geomet Coating	Magni Coating	EN ISO 10683	8-10 micron
Brass Electro Plating	Brass Electro Plating		1 micron

2 Specification of the Intended Use in Accordance with the Applicable EAD

The connectors are intended for use as a connection between timber elements, in end-grain to side-grain or side-grain to side-grain connections, and as a connection of a timber element to a concrete support, where requirements for mechanical resistance and stability shall be fulfilled.

The calculation methods provided in the Annexes for connecters fixed to timber components are only allowed for timber with a characteristic density $\rho_k \leq 420$ kg/m³. The design of the connections shall be in accordance with EN 1995-1-1 (Eurocode 5) or an appropriate national code.

It is a condition that the parts of angle brackets and joist hangers connected to a timber element are fixed with fasteners in all holes of the appropriate diameter (full nailing). Similarly, it is a condition that connectors fastened to concrete supports are fixed in all appropriate holes with torque-controlled mechanical expansion anchor bolts within the scope of ETAG 001:2001-08-Annex C.

Standard fasteners and mechanical anchor bolts are presented in Annex 6. Alternative fasteners may be used, provided their characteristics comply with the specifications given in Annex 6 and the corresponding load-carrying capacity of the connection is determined as set out in the relevant calculation Annex

The ductility of Waelbers WoodConnectors in seismic conditions (cyclic testing) has not been evaluated.

The zinc-coated parts are for use in timber or concrete structures subject to dry, internal conditions defined by Service Classes 1 and 2 of EN 1995-1-1 (Eurocode 5). The connectors and connections made thereof may be taken to have a service life of 50 years, provided that there is no mechanical damage or insect attack.

Table 3: Performance of the Product and References to the Methods Used for its Assessment

BWR	ETAG Clause No.	Essential Characteristic	Product Performance
1	2.4	Mechanical Resistance and Stability	Clause 3.1
2	2.4.2	Safety in Case of Fire	
	2.4.2.1	Reaction to Fire	Clause 3.2.1
	4.4.2.2	Resistance to Fire	Clause 3.2.2
3	2.4.3	Hygiene, Health & the Environment	
	2.4.3	Release of Dangerous Substances	Clause 3.3.1
4	2.4.4	Safety in Use	Clause 3.4
5	2.4.5	Protection against Noise	Clause 3.5
6	2.4.6	Energy Economy & Heat Retention	Clause 3.6
7	-	Sustainable Use of Natural Resources	Not Relevant
-	-	General Aspects Related to the Performance of the Product	Clause 3.7

3 Methods of Verification

3.1 Mechanical Resistance and Stability

The following aspects of performance are relevant to this essential requirement.

3.1.1 Joint Strength

Characteristic load-carrying capacities for a range of sizes of Waelbers WoodConnectors connected with standard fasteners are given in the Annexes listed in Table 4.

Table 4: Connector Type and Designation Listed by Annex

Annex	Connector Type/Designation	Timber to Timber	Timber to Concrete
Annex 8 Angle Brackets – Series I			
A8.4	H1R and H2R	y	
A8.5	H1R and H2R		y
A8.6	2-Pan and 3-Pan		y
Annex 9 Angle Brackets – Series II			
A9.4	Drempelhoek & Drempelhoek DLD	y	
A9.5	Hoek & Hoek 135°	y	
A9.6	Hoekanker	y	
A9.7	Hoekanker met Ril & Hoekanker met 2 Rillen	y	
A9.8	Hoekanker met 3 Rillen	y	
A9.9	Kruiskoppeling & Neusijzer	y	
A9.10	Langgathoek & Langgathoek met Ril	y	
A9.11	Verbindingshoek	y	
A9.12	Versterkingshoek & Versterkingshoek Ongelijkzijdig	y	
A9.13	Hoek & Hoek 135° - Timber to Plate [1]		y
A9.14	Hoek & Hoek 135° - Timber to Plate [2]		y
A9.15	Hoekanker - Timber to Plate [1]		y
A9.16	Hoekanker - Timber to Plate [2]		y
A9.17	Hoekanker met Ril & Hoekanker met 2 Rillen - Timber to Plate [1]		y

Annex	Connector Type/Designation	Timber to Timber	Timber to Concrete
A9.18	Hoekanker met Ril & Hoekanker met 2 Rillen - Timber to Plate [2]		y
A9.19	Hoekanker met 3 Rillen		y
A9.20	Langgathoek & Langgathoek met Ril		y
Annex 10 Joist Hangers – Series I			
A10.5	RD and RDD	y	
A10.6	RD2d and RD2dd	y	
A10.7	RD and RDD		y
A10.8	RD2d and RD2dd		y
Annex 11 Joist Hangers – Series II			
A11.4	Raveeldrager Dicht & Raveeldrager Zwaar	y	
A11.5	Raveeldrager met Strip	y	
A11.6	Regeldrager	y	
A11.7	Raveeldrager Dicht & Raveeldrager Zwaar		y
Annex 13 Special Connectors			
A13.4	Kruiskoppeling L/R	y	
A13.5	Gripanker	y	
A13.6	Ruitersteun	y	
Annex 14 Column Bases			
	Waelbers Column Bases		
	Paalhouder Verstelbaar 90x90		
	Paalhouder Verstelbaar 80x80/100x140		

Characteristic load-carrying capacities of other intermediate sizes and/or alternative components or fasteners can be established in accordance with the methods given in:

Annex 8 - A8.7	Angle Brackets – Series I
Annex 9 - A9.21	Angle Brackets – Series II
Annex 10 - A10.9	Joist Hangers – Series I
Annex 11 - A11.8	Joist Hangers – Series II
Annex 13 - A13.7	Special Connectors

Characteristic load-carrying capacities of joist hangers shall be adjusted in the case of combined loading in more than one direction, as described in Annex 12.

These properties should be used for designs in accordance with EN 1995-1-1:2004/A1 (Eurocode 5) or an appropriate national code. The load-carrying capacities have been derived by calculation or design assisted by testing (angle brackets, joist hangers and special connectors) or by testing (column base).

These properties have been developed based on the assumptions given in §3.7.1 as applicable.

3.1.2 Joint Stiffness

No performance has been determined in relation to the joint stiffness properties to be used for the analysis of serviceability limit states.

In accordance with EN 26891, deflections during testing are limited to 15 mm. Therefore, a maximum deflection of 15 mm can be assumed when developing the full characteristic load-carrying capacities.

3.1.3 Ductility in Cyclic Conditions

Waelbers WoodConnectors are for use in non-dissipative or low dissipative structures. No performance has been determined in relation to ductility of a joint under cyclic testing. Where national regulations may require it, an additional evaluation shall be carried out.

3.2 Safety in case of Fire

3.2.1 Reaction to Fire

The connectors and associated fasteners are classified as non-combustible and meet the requirements of Class A1 according to EN 13501-1:2002 and EC Decision 96/603/EC, amended by EC Decision 2000/605/EC.

3.2.2 Resistance to Fire

No performance assessed.

3.3 Hygiene, Health and the Environment

3.3.1 Content and/or Release of Dangerous Substances

Not relevant.

3.4 Safety in Use

Not Relevant.

3.5 Protection against Noise

Not Relevant.

3.6 Energy Economy and Heat Retention

Not Relevant.

3.7 General Aspects Related to the Performance of the Product

3.7.1 Installation

The ETA is issued under the assumption that the execution of the works shall be in accordance with the manufacturer's technical literature.

Waelbers WoodConnectors are deemed fit for its intended use provided:

- The joints are designed in accordance with Eurocode 5 or an appropriate National Code using the design data given in or determined as given in Annex 7 to Annex 67.
- Design and detailing of structures must be carried out by a suitably experienced persons in accordance with the manufacturer's instructions and the requirements of this ETA
- Verifiable calculation, notes and drawings are prepared taking account of the loads to be resisted
- The width of joists narrower than the exact joist hanger width does not exceed the tolerance of +0/- 4mm to the joist hanger width
- The header or beam supporting a joist is adequately restrained against rotation
- Fasteners are installed in all available (and appropriate) holes
- Screw holes in timber for column bases shall be pre-drilled

- Timber should be free of wane in the connectors
- The actual maximum bearing capacity of the joist itself is checked separately by the designer of the structure
- The eccentricity of the acting forces relative to the axis of the connection is not excessive
- Angle brackets or 2-part joist hangers are always applied symmetrically to the timber members
- It has been installed correctly by appropriately qualified personnel using adequate tools, in accordance with the relevant building regulations, the manufacturer's specifications and the drawing prepared for that purpose.

3.7.2 Durability

The zinc-coated Waelbers WoodConnectors are suitable for use in Service Classes 1 and 2 according to Eurocode 5, and Use Classes 1 and 2 as specified in EN 335.

Steel products with this coating are suitable for use in environments with Corrosivity Categories C1 and C2 as defined in Table 1 of EN ISO 12944-2.

In Service Classes 1 and 2, where the moisture content of timbers will not exceed 20%, the risk of fungal decay is low.

Durability of the timber elements may be reduced by attack from insects such as the House Longhorn beetle (*Hylotrupes bajulus*), dry wood termites and the common furniture beetle (*Anobium punctatum*) in regions where these may be found.

3.7.3 Serviceability

3.7.4 Dimensional Stability

Not relevant.

3.7.4.1 Unacceptable Deformation

The acceptable deformation of the connectors is limited either during initial type testing or by application of Eurocode 5 connection design to 15 mm (in accordance with EN 26891).

3.7.5 Identification of the Product

The product shall be identified with the mark of the manufacturer and the CE marking information.

3.7.6 Packaging, Transport and Storage

The connectors are packed in boxes. For conventional metallic products no recommendations are necessary for transport and storage.

Connectors damaged during storage or transport must be discarded. Only sound connectors should be installed.

3.7.7 Use, Maintenance and Repair

The assessment of fitness for use is based on the assumption that maintenance is not required during the assumed intended working life.

Should repair be necessary, this is normally achieved by replacement. An assessment must be made by a design professional in each case.

4 Assessment and Verification of Constancy of Performance (hereinafter AVCP) System Applied, with reference to its Legal Base

4.1 System of Assessment and Verification of Constancy of Performance

According to Decision 2003/728/EC of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance to be applied to Three Dimensional Nailing Plates for use as Connectors is System 2+. System 2+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014 Annex 1.2, and provides for the following items.

(a) The manufacturer shall carry out:

  (i) an assessment of the performance of the construction product on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of that product;

  (ii) factory production control;

  (iii) testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan.

(b) The notified factory production control certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of conformity of the factory production control on the basis of the outcome of the following assessments and verifications carried out by that body:

  (i) initial inspection of the manufacturing plant and of factory production control;

  (ii) continuing surveillance, assessment and evaluation of factory production control.

In addition, the manufacturer shall draw up a Declaration of Performance (DoP) of the product.

5 Technical Details necessary for the Implementation of the AVCP System, as foreseen in the applicable EAD

5.1 Tasks for the Manufacturer

5.1.1 Initial Type Testing of the Product

Initial Type Testing (ITT) and Assessment has been undertaken under the responsibility of the manufacturer to verify that the production line in question is able to manufacture products in conformity with this ETAss.

The ITT has covered testing of Angle Brackets, Joist hangers, Special Connectors and Column Bases to confirm the characteristic load-carrying capacities developed by calculation (angle-brackets; joist hangers and Special Connectors) or determine them directly (Column Bases).

Any changes in materials or the production process which would result in a change in the product characteristics, the tests and/or assessments shall be repeated for the appropriate characteristics. In such cases the necessary type testing has to be agreed between Exova BM TRADA and the Notified Body.

5.1.2 Factory Production Control (FPC)

The manufacturer has a factory production control system (FPC) and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of policies,

procedures and work instructions. This FPC system ensures that the product is in conformity with this European Technical Assessment.

The manufacturer shall only use raw materials or components that are supplied with the relevant inspection documents. All incoming raw materials shall be subject to inspection, verification, controls and tests (as applicable) by the manufacturer.

The results of FPC are recorded and evaluated. These records include but are not limited to:

- Product specification and designation, basic materials and components
- Type(s) of control testing
- Date of manufacture of the product and date of testing of the product or basic material and components
- Result of control and testing and, if appropriate, comparison with requirements
- Signature of the person responsible for FPC

These records shall be presented to Exova BM TRADA upon request.

5.1.3 Factory Testing / Assessment

In this context, testing is taken to mean physical testing and/or visual examination of the product/process.

The final products are checked visually and for dimensions as detailed in a prescribed test plan, which is part of the factory production control.

The manufacturer may only use the raw materials listed in the technical documentation of this ETA. The raw materials shall be subject to controls by the manufacturer.

The control shall include the test certificates presented by suppliers (comparison with nominal values), including verification of dimensions and determination of material properties, e.g. chemical composition, mechanical properties and thickness of the zinc coating.

Details of the factory production control such as frequency, test methods, specificities, etc. are laid down in the prescribed test plan which has been deposited with Exova BM TRADA and is made available to the notified bodies involved in the conformity attestation procedure.

All measuring and testing equipment shall be regularly calibrated and inspected according to the documented FPC system. Production records shall be kept for each batch of connectors for at least 5 years.

5.2 Tasks of Notified Body

5.2.1 Initial Inspection of Factory and of Factory Production Control

An assessment of each production unit shall be carried out by the Notified Body to demonstrate that the factory production control is in conformity with the ETA and any subsidiary information. This assessment shall be based on an initial inspection of the factory. Subsequently continuous surveillance of factory production control, including verification that tests are being carried out to the prescribed test plan, is necessary to ensure continuing conformity with the ETA.

5.2.2 Continuing Surveillance

The Notified Body shall visit the factory twice a year for regular inspection. It shall be verified that the system of factory production control and the specified manufacturing process is maintained in accordance with this European Technical Assessment.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, to Exova BM TRADA. In cases where the provisions of this European Technical Assessment are no longer fulfilled, the conformity certificate shall be withdrawn.

Issued in High Wycombe, United Kingdom on 29/06/2018

By

Niresh Somlie

Principal Technical Officer

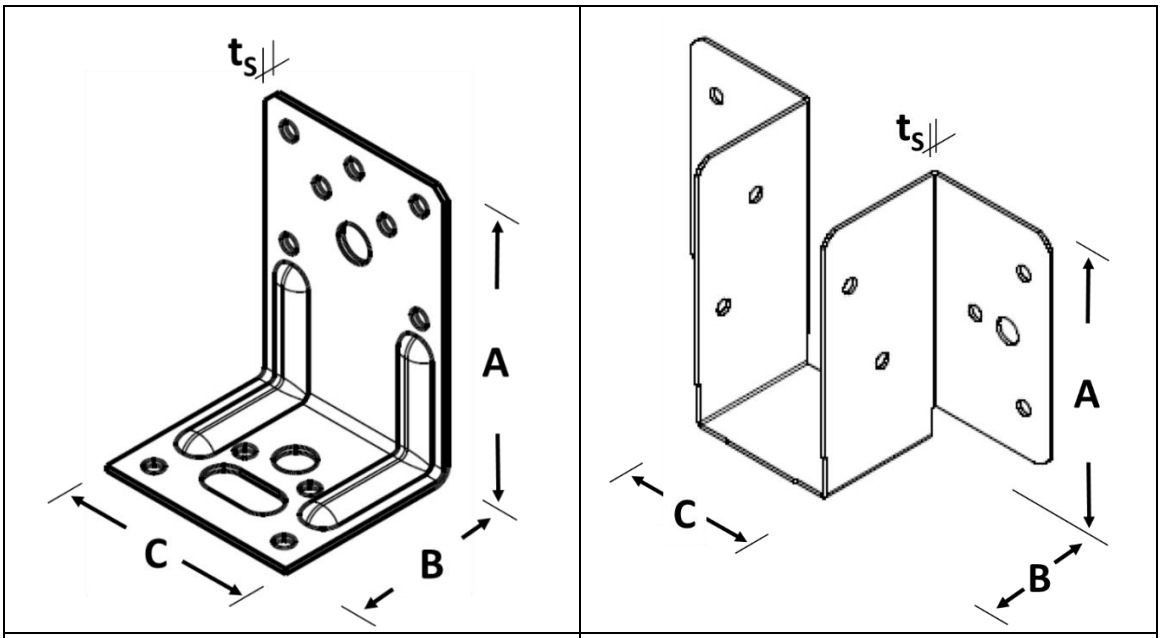
ANNEX 1 DEFINITION OF NOMENCLATURE OF DIMENSIONS

To facilitate the reading of the following tables, in relation with the connectors' drawings (see annexes), and unless stated otherwise, the following dimension references apply:

- t_s thickness of steel plate
- A vertical dimension / height of vertical face
- B horizontal dimension / width of horizontal face OR hanger seat length
- C connector length / applying to whole connector or both faces OR hanger seat width

General: Dimensions of the angle brackets and joist hangers are given as indicated in Figure A 1-1 below.

Figure A 1-1 Angle Brackets and Joist Hangers – Nomenclature of Dimensions



Angle Bracket	Joist Hanger

Exceptions: In some instances (mainly for special connectors), additional or alternative dimensions are necessary: these are then defined in the corresponding section, and a specific note refers to the corresponding drawing.

Furthermore, in the tables, faces are identified by numbers [1] and/or [2] and/or letters [S] (side face / second face) or [U] (seat under the supported element). The exact key is given at the beginning of the relevant section or below the corresponding table.

ANNEX 2 DESCRIPTION OF THE ANGLE BRACKET PRODUCTS

Figure A 2-1 H1R (left) and H2R (right)

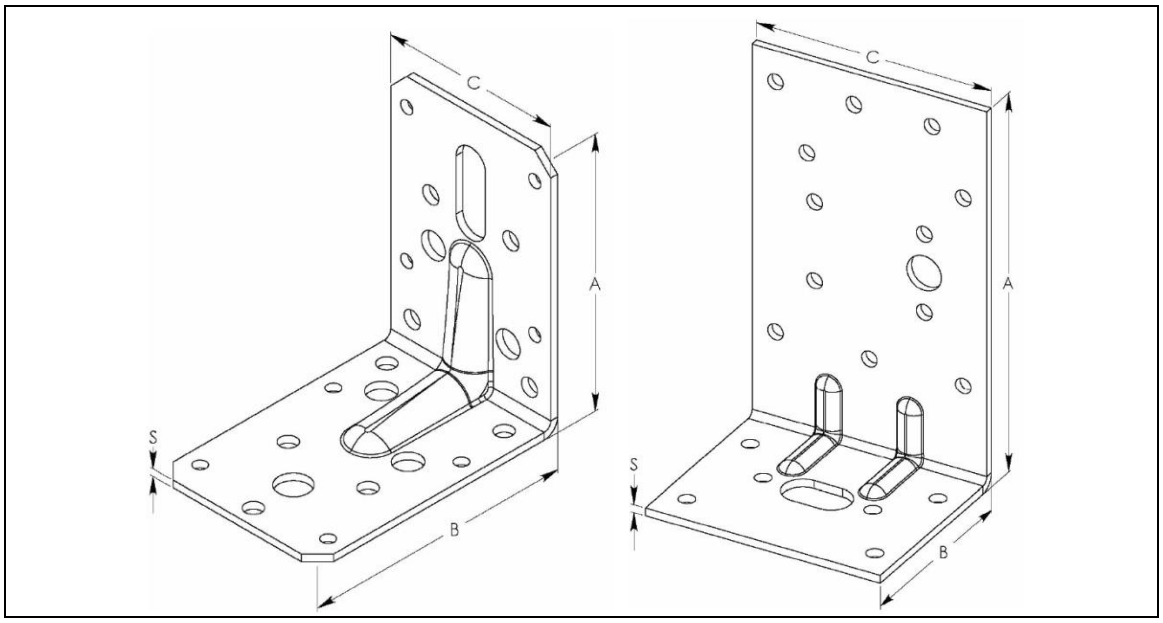


Table A 2-1 H1R and H2R Angle Bracket Series

Series	Reference	Dimensions (mm)			
		A	B	C	S
H1R	H1R 70x70x55x2	70.0	70.0	55.0	2.0
	H1R 90x90x60x2.5	90.0	90.0	60.0	2.5
	H1R 105x105x90x2.5	105.0	105.0	45.0	2.5
	H1R 125x125x45x2.5	125.0	125.0	45.0	2.5
	H1R 150x150x60x2.5	150.0	150.0	60.0	2.5
H2R	H2R 80x50x80	80.0	50.0	80.0	2.0
	H2R 80x60x60	80.0	60.0	75.0	2.0
	H2R 100x60x75	100.0	60.0	75.0	2.5
	H2R 120x60x80	120.0	60.0	80.0	2.5
	H2R 120x60x75	120.0	60.0	75.0	2.5
	H2R 140x60x75	140.0	60.0	75.0	2.5
	H2R 160x60x75	160.0	60.0	75.0	2.5
	H2R1s 75x48	75.0	48.0	65.0	1.5
	H2R2s 75x48	75.0	48.0	65.0	1.5

Figure A 2-2 2-Pan (Left) and 3-Pan (Right) Angle Bracket Series

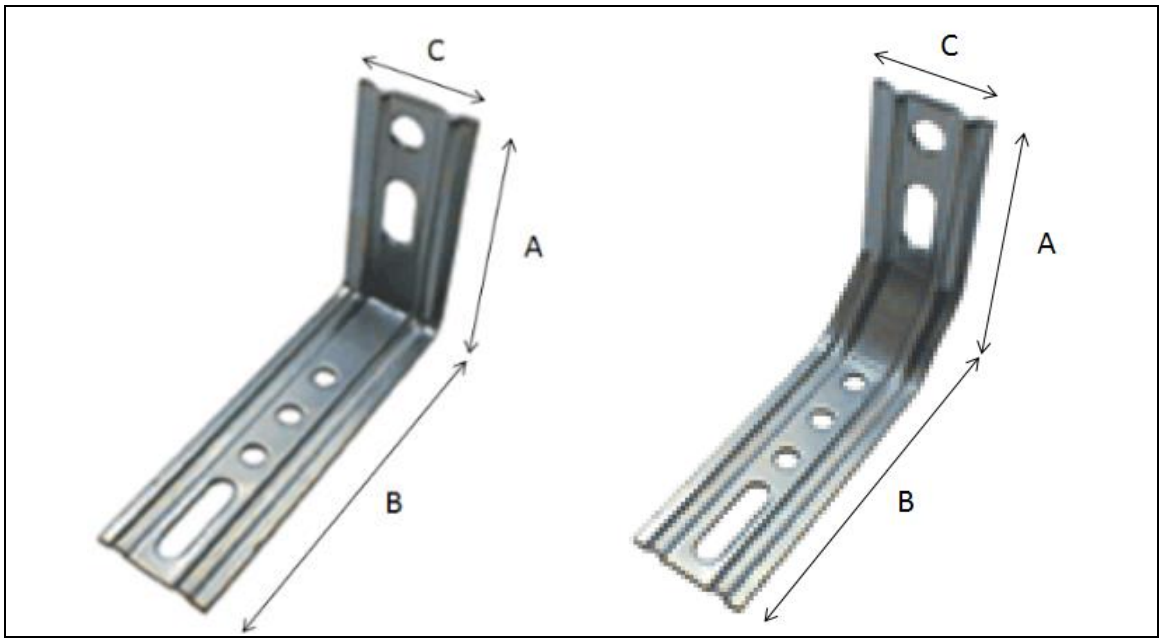


Table A 2-2 2 Pan and 3-Pan Angle Bracket Series

Series	Reference	Segments	Dimensions [mm]			
			A	B	C	S
2-Pan	2-Pan 30 x 65 x 30	2	65.0	30.0	30.0	2.0
	2-Pan 40 x 65 x 30	2	65.0	40.0	30.0	2.0
	2-Pan 50 x 65 x 30	2	65.0	50.0	30.0	2.0
	2-Pan 60 x 65 x 30	2	65.0	60.0	30.0	2.0
	2-Pan 70 x 65 x 30	2	65.0	70.0	30.0	2.0
	2-Pan 80 x 65 x 30	2	65.0	80.0	30.0	2.0
	2-Pan 90 x 65 x 30	2	65.0	90.0	30.0	2.0
	2-Pan 100 x 65 x 30	2	65.0	100.0	30.0	2.0
	2-Pan 110 x 65 x 30	2	65.0	110.0	30.0	2.0
	2-Pan 120 x 65 x 30	2	65.0	120.0	30.0	2.0
	2-Pan 130 x 65 x 30	2	65.0	130.0	30.0	2.0
	2-Pan 140 x 65 x 30	2	65.0	140.0	30.0	2.0
	2-Pan 150 x 65 x 30	2	65.0	150.0	30.0	2.0
	2-Pan 160 x 65 x 30	2	65.0	160.0	30.0	2.0
3-Pan	3-Pan 55 x 70 x 30	3	70.0	55.0	30.0	2.0
	3-Pan 65 x 70 x 30	3	70.0	65.0	30.0	2.0
	3-Pan 75 x 70 x 30	3	70.0	75.0	30.0	2.0
	3-Pan 85 x 70 x 30	3	70.0	85.0	30.0	2.0
	3-Pan 95 x 70 x 30	3	70.0	95.0	30.0	2.0
	3-Pan 105 x 70 x 30	3	70.0	105.0	30.0	2.0
	3-Pan 115 x 70 x 30	3	70.0	115.0	30.0	2.0
	3-Pan 125 x 70 x 30	3	70.0	125.0	30.0	2.0
	3-Pan 135 x 70 x 30	3	70.0	135.0	30.0	2.0
	3-Pan 145 x 70 x 30	3	70.0	145.0	30.0	2.0
	3-Pan 155 x 70 x 30	3	70.0	155.0	30.0	2.0
	3-Pan 165 x 70 x 30	3	70.0	165.0	30.0	2.0

Figure A 2-3 Angle Bracket Model – Drempelhoek

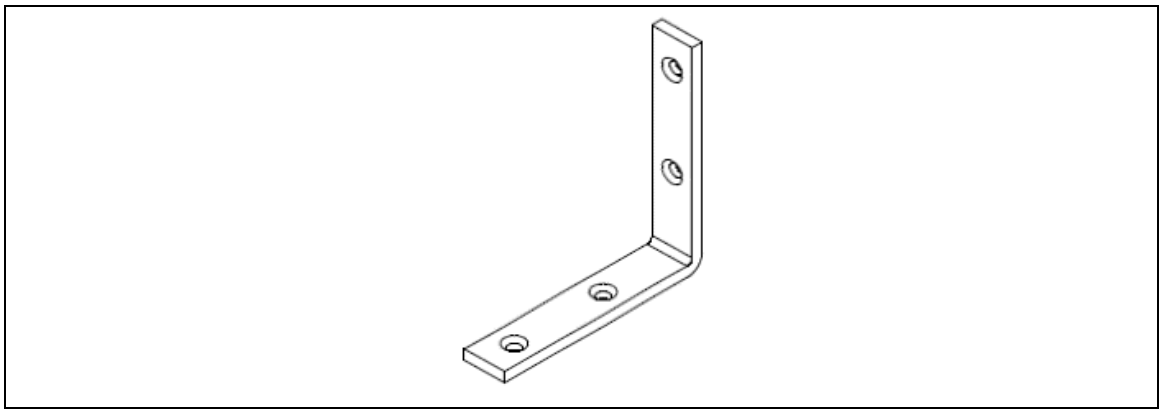


Table A 2-3 Angle Bracket Model – Drempelhoek

Drempelhoek	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
100x100x20	5.0	100	100	20	2x 6.0	2x 6.0
125x125x20		125	125			
150x150x25		150	150	25		
175x175x25		175	175			
200x200x25	5.0	200	200	25	3x 6.0	3x 6.0
250x250x30	6.0	250	250	30		
300x300x30		300	300			

Figure A 2-4 Angle Bracket Model – Drempelhoek DLD

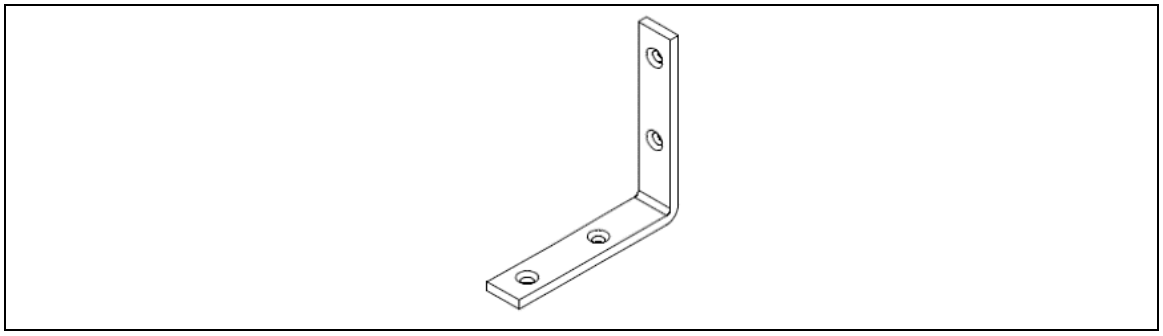


Table A 2-4 Angle Bracket Model – Drempelhoek DLD

Drempelhoek DLD	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
100x100x20	5.0	100	100	20	2x 6.7	2x 6.7
120x120x20		120	120			
140x140x20		140	140			
160x160x20		160	160		3x 6.7	3x 6.7
180x180x20		180	180			

Figure A 2-5 Angle Bracket Model – Model Hoek

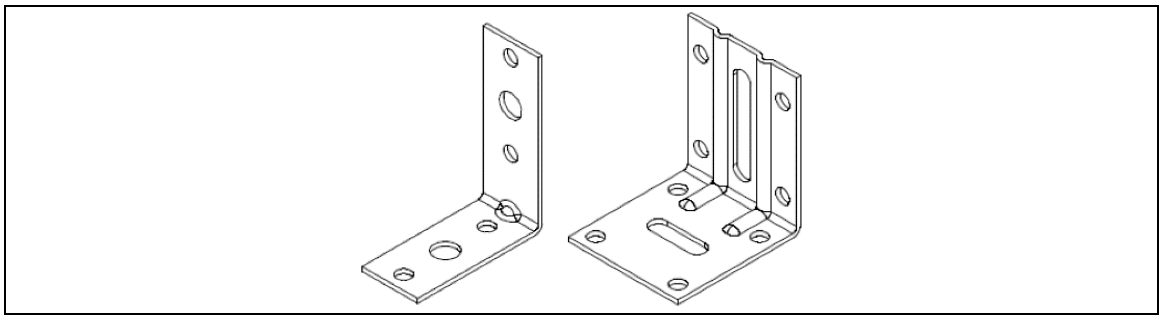


Table A 2-5 Angle Bracket Model – Model Hoek

Hoek	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
55x20x45 (SR)	1.5	55	20	45	2x 5.0 1x 8.0	2x 5.0 1x 8.0
55x20x75 (SR)				75	3x 5.0 1x 8.0 1x 10.8	
55x20x105 (SR)				105	4x 5.0 2x 8.0 1x 10.8	
45x40x50 (2R)	1.5	45	40	50	4x 5.0 (V) 1x 6.5x35	4x 5.0 (H) 1x 6.0x20
45x40x106 (2R)				106	8x 5.0 (V) 2x 6.5x35	
45x40x150 (2R)				150	10x 5.0 (V) 3x 6.5x35	

Figure A 2-6 Angle Bracket Model – Model Hoek 135°

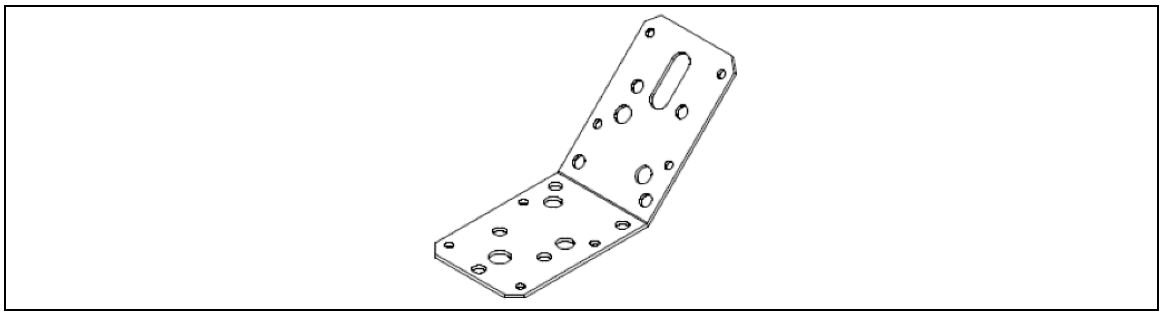


Table A 2-6 Angle Bracket Model – Model Hoek 135°

Hoek 135°	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
70x70x55 135°	2.0	70	70	55	10x 5.0 1x 11.0	10x 5.0 1x 11.0
90x90x60 135°	2.0	90	90	60	4x 4.5 4x 6.7 2x 9.0 (V) 1x 11.0x30	4x 4.5 5x 6.7 2x 9.0 1x 11.0
50x50x35 135°	2.5	50	50	35	4x 5.0 1x 11.0	4x 5.0 1x 11.0

Figure A 2-7 Angle Bracket Model – Model Hoekanker

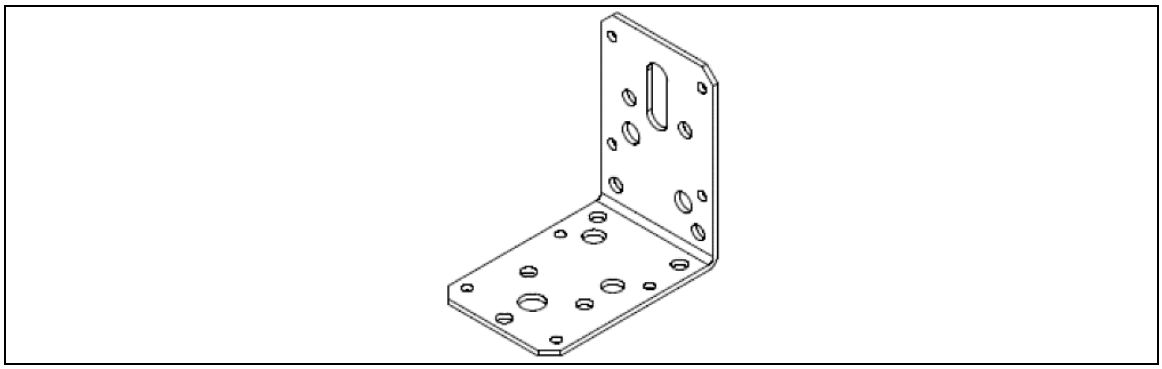


Table A 2-7 Angle Bracket Model – Model Hoekanker

Hoekanker	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
55x55x50x1.5	1.5	55	55	50	6x 5.0 1x 10.0	6x 5.0 1x 10.0
50x50x35x2.5	2.5	50	50	35	4x 5.0 1x 11.0	4x 5.0 1x 11.0
50x50x57x2.5	2.5	50	50	57	6x 5.0 (V) 1x 13.0x30	6x 5.0 (V) 1x 13.0x30
70x70x30x2.0	2.0	70	70	30	5x 5.0	5x 5.0
70x70x55x2.0	2.0	70	70	55	10x 5.0 1x 11.0	10x 5.0 1x 11.0
40x100x60x2.5	2.5	40	100	60	8x 5.0 1x 11.0 (V) 1x 11.0x30	4x 5.0 1x 11.0
40x60x60x2.0	2.0	40	60	60	5x 4.5 2x 6.7 (V) 1x 11.0x30	5x 4.5 2x 9.0 1x 11.0
40x60x60x2.5	2.5	40	60	60		
90x90x60x2.0	2.0	90	90	60	4x 4.5 4x 6.7 2x 9.0 (V) 1x 11.0x30	4x 4.5 5x 6.7 2x 9.0 1x 11.0
90x90x60x2.5	2.5	90	90	60		
150x90x60x2.5	2.5	150	90	60	7x 4.5 5x 6.7 4x 9.0 (V) 1x 11.0x30	3x 4.5 3x 6.7 2x 9.0 1x 11.0
105x105x90x2.5	2.5	105	105	90	10x 5.0 3x 13.0	14x 5.0 1x 13.0
125x125x45x2.5	2.5	125	125	45	5x 4.5 3x 6.7 (V) 1x 10.0x20	5x 4.5 3x 6.7 1x 10.0
125x125x55x2.5	2.5	125	125	55	8x 4.0	8x 4.0
150x150x60x2.5	2.5	150	150	60	10x 4.5 2x 6.7 2x 9.0 (H) 1x 11.0x30	10x 4.5 2x 6.7 2x 9.0 (V) 1x 11.0x30
60x60x40x2.0 (2SR)	2.0	60	60	40	4x 5.0 (H) 1x 10.0x22	6x 5.0 (V) 1x 10.0x30

Figure A 2-8 Angle Bracket Model – Model Hoekanker met Ril

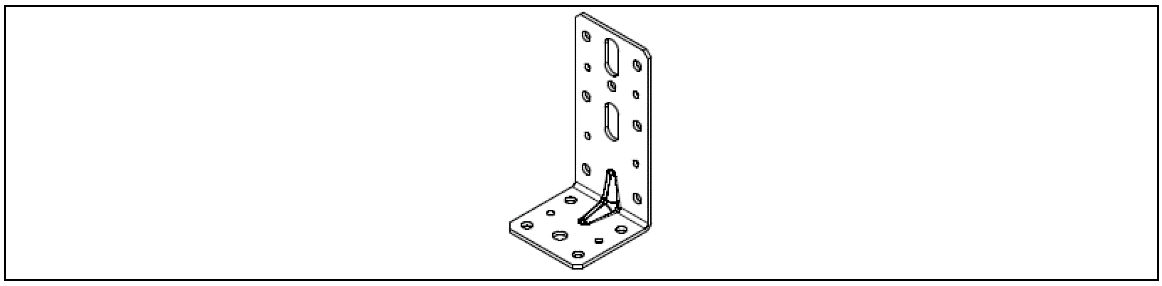


Table A 2-8 Angle Bracket Model – Model Hoekanker met Ril

Hoekanker met Ril	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
90x90x60x2.0 (1R)	2.0	90	90	60	4x 4.5 4x 6.0 2x 9.0 (V) 1x 11.0x30	4x 4.5 5x 6.0 2x 9.0 1x 11.0
125x125x55x2.5 (1R)	2.5	125	125	55	8x 4.0	8x 4.0
60x80x60x2.5 (1R)	2.5	60	80	60	2x 4.5 4x 6.5 (V) 1x 11.0x25	2x 4.5 4x 6.5 1x 8.5
60x120x60x2.5 (1R)			120		4x 4.5 7x 6.5 (V) 2x 11.0x25	
60x180x60x2.5 (1R)			180		6x 4.5 10x 6.5 (V) 3x 11.0x25	
150x90x60x2.5 (1R)	2.5	150	90	60	7x 4.5 5x 6.7 4x 9.0 (V) 1x 11.0x30	3x 4.5 3x 6.7 2x 9.0 1x 11.0

Figure A 2-9 Angle Bracket Model – Model Hoekanker met Twee Rillen

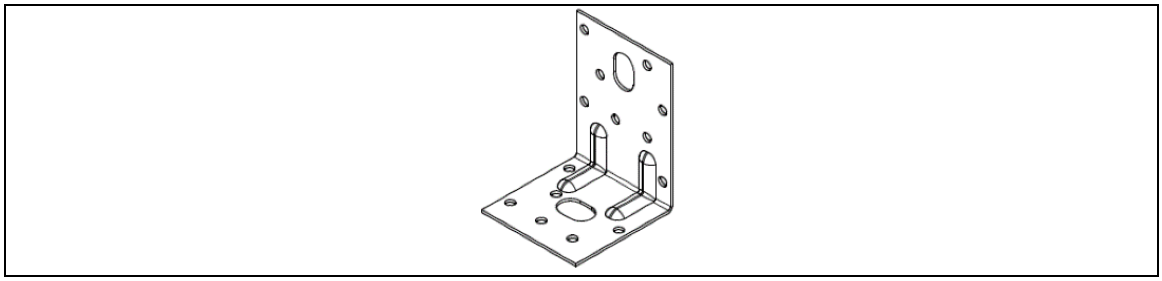


Table A 2-9 Angle Bracket – Model Hoekanker met Twee Rillen

Hoekanker Met 2 Rillen	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
80x60x60x1.5 (2R)	1.5	80	60	60	8x 5.0 (V) 1x 13.0x20	6x 5.0 (H) 1x 13.0x20
78x50x55x1.5 (2R)	1.5	78	50	55	7x 5.0 1x 9.8	4x 5.0 1x 9.8 (H) 1x 10.0x22

Figure A 2-10 Angle Bracket Model – Model Hoekanker met Drie Rillen

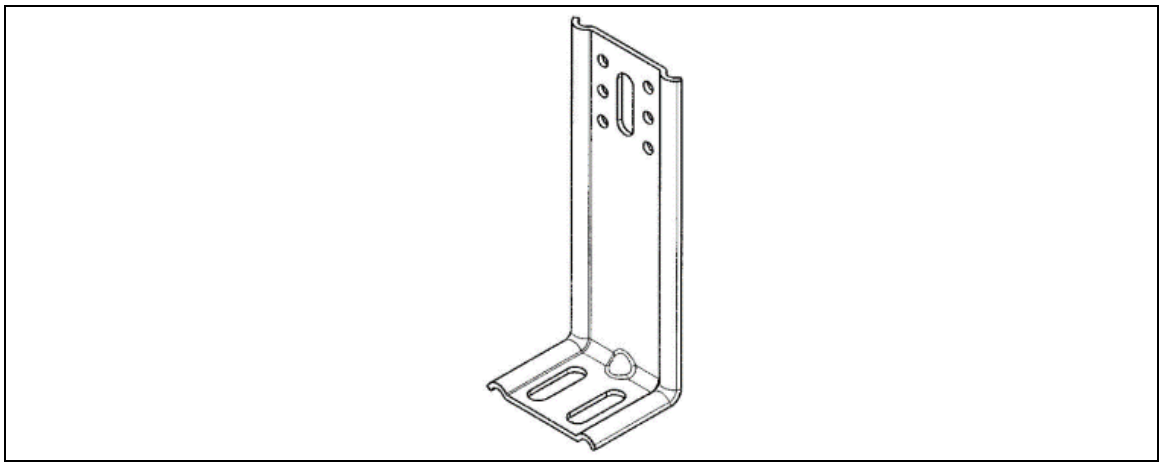


Table A 2-10 Angle Bracket Model – Model Hoekanker met Drie Rillen

Hoekanker met 3 Rillen	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
60x50x63x2.5 (3R)	2.5	60	50	63	6x 5.5 (V) 1x 9.0x30	(V) 2x 9.0x30
80x50x63x2.5 (3R)		80				
100x50x63x2.5 (3R)		100				
120x50x63x2.5 (3R)		120				
140x50x63x2.5 (3R)		140				
160x50x63x2.5 (3R)		160				
180x50x63x2.5 (3R)		180				
200x50x63x2.5 (3R)		200				
220x50x63x2.5 (3R)		220				
240x50x63x2.5 (3R)		240				
260x50x63x2.5 (3R)		260				
280x50x63x2.5 (3R)		280				
300x50x63x2.5 (3R)		300				
320x50x63x2.5 (3R)		320				
340x50x63x2.5 (3R)		340				
350x50x63x2.5 (3R)		350				

Figure A 2-11 Angle Bracket Model – Kruiskoppeling

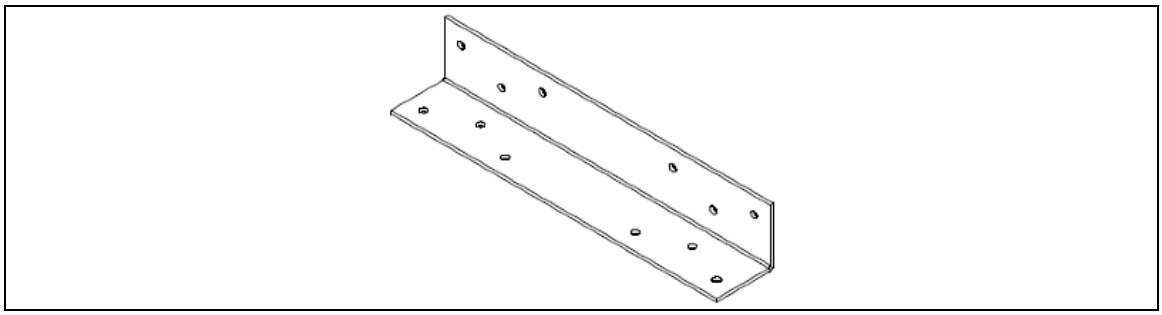


Table A 2-11 Angle Bracket Model – Kruiskoppeling

Kruiskoppeling	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
35x35x110	2.0	35	35	110	4x 4.0	4x 4.0
35x35x200				200	6x 4.0	6x 4.0
35x35x300				300		
50x50x260				260	26x 5.0	26x 5.0

Figure A 2-12 Angle Bracket Model – Neusijzer

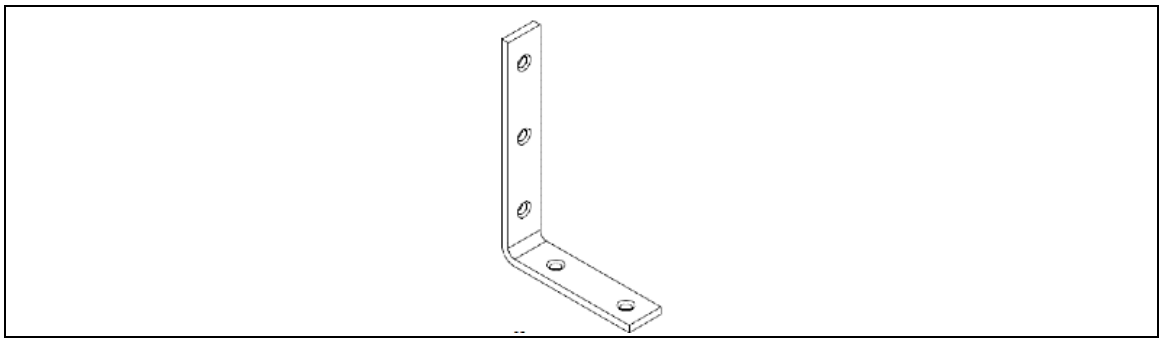


Table A 2-12 Angle Bracket Model – Neusijzer

	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
90° - 150x100x25	5.0	150	100	25	3x 7.0	2x 7.0
135° - 150x100x25						
90° - 150x80x25			80			

Figure A 2-13 Angle Bracket Model – Langgathoek

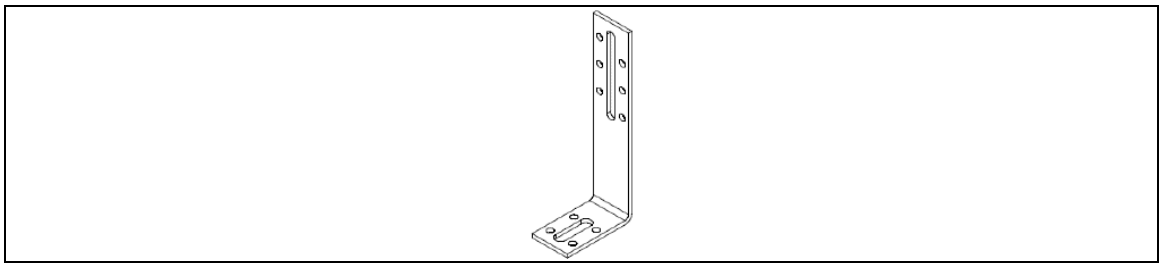


Table A 2-13 Angle Bracket Model – Langgathoek

Langgathoek	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
50x55x30x2.0	2.0	50	55	30	4x 5.0 (V) 1x 6.5x30	4x 5.0 (V) 1x 8.5x30
70x55x30x2.0		70			5x 5.0 (V) 1x 6.5x50	
80x55x30x2.5	2.5	80			6x 5.0 (V) 1x 6.5x55	
100x55x30x2.5		100			6x 5.0 (V) 1x 6.5x65	
120x55x30x3.0	3.0	120				
140x55x30x3.0		140				
160x55x30x3.0		160				

Figure A 2-14 Angle Bracket Model – Langgathoek met Ril

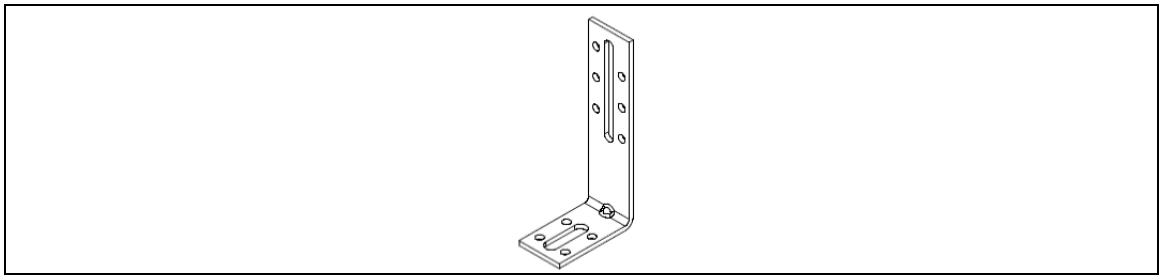


Table A 2-14 Angle Bracket Model – Langgathoek met Ril

Langgathoek mit Ril	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
50x55x30x2.0 (SR)	2.0	50	55	30	4x 5.0 (V) 1x 6.5x30	4x 5.0 (V) 1x 8.5x30
70x55x30x2.0 (SR)		70			5x 5.0 (V) 1x 6.5x50	
80x55x30x2.5 (SR)	2.5	80			6x 5.0 (V) 1x 6.5x55	
100x55x30x2.5 (SR)		100			6x 5.0 (V) 1x 6.5x65	
120x55x30x3.0 (SR)	3.0	120				
140x55x30x3.0 (SR)		140				
160x55x30x3.0 (SR)		160				

Figure A 2-15 Angle Bracket Model – Verbindingshoek

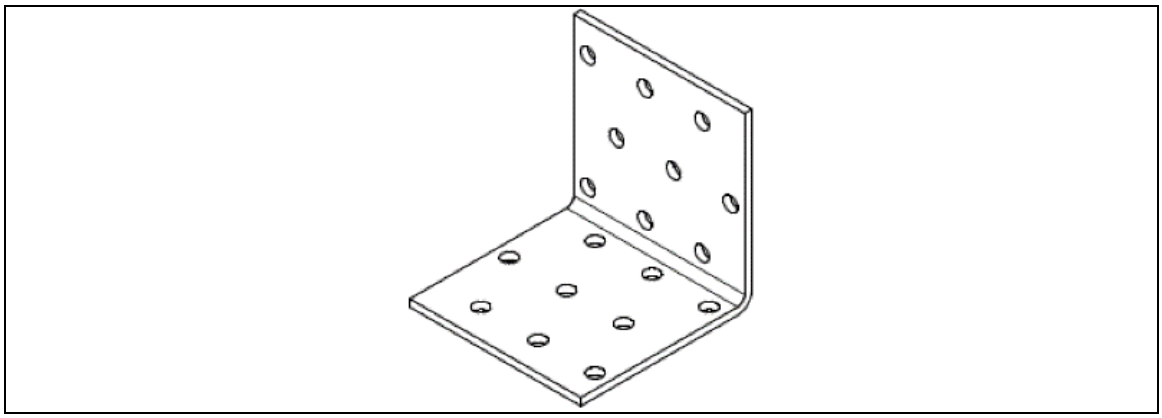


Table A 2-15 Angle Bracket Model – Verbindingshoek

Verbindingshoek	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
40x40x60x2.5	2.5	40	40	60	5x 5.0	5x 5.0
60x60x40x2.5	2.5	60	60	40	6x 5.0	6x 5.0
60x60x50x2.5	2.5	60	60	50	8x 5.0	8x 5.0
60x60x60x2.5	2.5	60	60	60	9x 5.0	9x 5.0
60x60x80x2.5	2.5	60	60	80	12x 5.0	12x 5.0
60x60x100x2.5	2.5	60	60	100	15x 5.0	15x 5.0
60x60x140x2.5	2.5	60	60	140	21x 5.0	21x 5.0
75x75x40x2.0	2.0	75	75	40	8x 5.0	8x 5.0
80x80x60x2.5	2.5	80	80	60	12x 5.0	12x 5.0
80x80x80x2.5	2.5	80	80	80	16x 5.0	16x 5.0
100x100x40x2.0	2.0	100	100	40	10x 5.0	10x 5.0
100x100x60x2.5	2.5	100	100	60	15x 5.0	15x 5.0
100x100x80x2.5	2.5	100	100	80	20x 5.0	20x 5.0
100x100x100x2.5	2.5	100	100	100	25x 5.0	25x 5.0

Figure A 2-16 Angle Bracket Model – Versterkingshoek

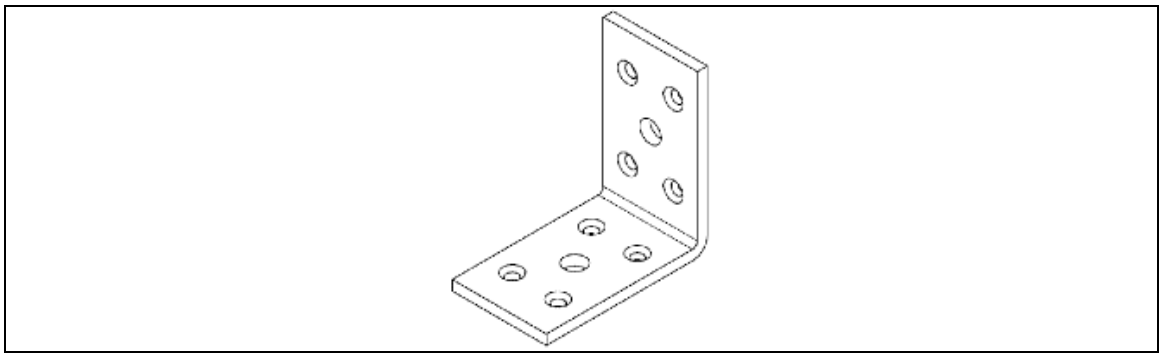


Table A 2-16 Angle Bracket Model – Versterkingshoek

Versterkingshoek	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
30x30x30x2.0	2.0	30	30	30	2x 5.0	2x 5.0
40x40x40x2.0	2.0	40	40	40	4x 5.0	4x 5.0
60x60x60x2.0	2.0	60	60	60	4x 5.0	4x 5.0
50x50x40x2.0	2.0	50	50	40	6x 5.0	6x 5.0
65x65x40x4.0	4.0	65	65	40	4x 5.0 1x 8.5	4x 5.0 1x 8.5

Figure A 2-17 Angle Bracket Model – Versterkingshoek Ongelijkzijdig

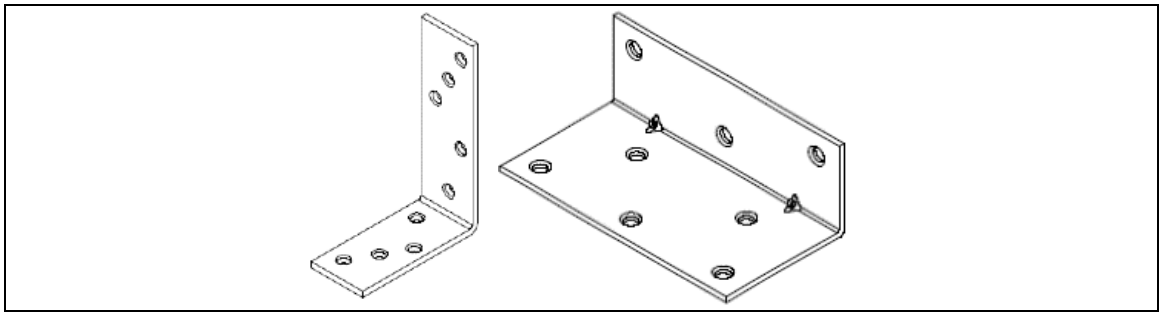


Table A 2-17 Angle Bracket Model – Versterkingshoek Ongelijkzijdig

Versterkingshoek ongelijkzijdig	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
100x75x30x3.0	3.0	100	75	30	3x 5.5	2x 5.5
125x85x40x4.0	4.0	125	85	40	5x 6.5	4x 6.5
40x25x75x2.0	2.0	40	25	75	2x 6.0	3x 6.0
60x40x115x2.5	2.5	60	40	115	3x 6.0	5x 6.0

ANNEX 3 DESCRIPTION OF THE JOIST HANGER PRODUCTS

Figure A 3-1 RD (left) and RDD (right) Joist hangers

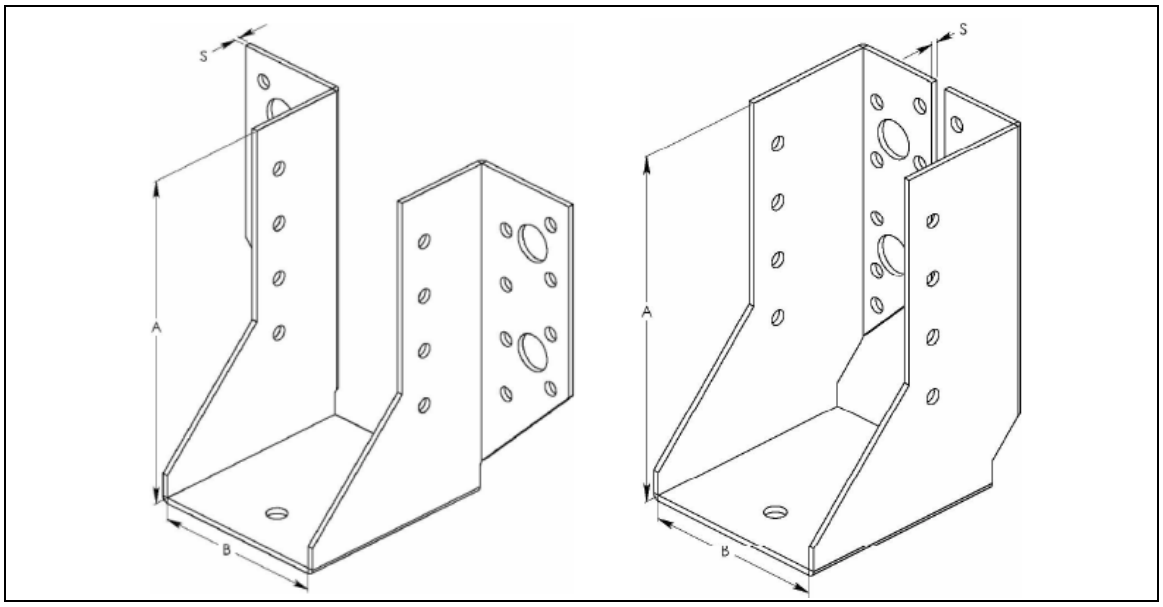


Table A 3-1 Minimum/Maximum Dimensions of RD and RDD Joist hangers

Series	Reference	Dimensions (mm)		
		A	B	S
RD	RD 210 32x 89	89.0	32.0	2.0
	RD 210 80x65	65.0	80.0	2.0
	RD 250 32x109	109.0	32.0	2.0
	RD 250 80x85	85.0	80.0	2.0
	RD 300 32x134	134.0	32.0	2.0
	RD 300 80x110	110.0	80.0	2.0
	RD 335 32x151.5	151.5	32.0	2.0
	RD 335 140x97.5	97.5	140.0	2.0
	RD 380 32x174	174.0	32.0	2.0
	RD 380 140x120	120.0	140.0	2.0
	RD 440 32x204	204.0	32.0	2.0
	RD 440 120x160	160.0	120.0	2.0
	RD 500 32x234	234.0	32.0	2.0
	RD 500 140x 180	180.0	140.0	2.0
RDD	RDD 250 63x93,5	93.5	63.0	2.0
	RDD 250 80x85	85.0	80.0	2.0
	RDD 300 63x118,5	118.5	63.0	2.0
	RDD 300 80x110	110.0	80.0	2.0
	RDD 335 59x138	138.0	59.0	2.0
	RDD 335 140x97.5	97.5	140.0	2.0
	RDD 380 63x158,5	158.5	63.0	2.0
	RDD 380 140x120	120.0	140.0	2.0
	RDD 440 63x188,5	188.5	63.0	2.0
	RDD 440 120x160	160.0	120.0	2.0
	RDD 500 80x 210	210.0	80.0	2.0
	RDD 500 140x 180	180.0	140.0	2.0

Figure A 3-2 RD2d (left) and RD2dd (right) Joist hangers

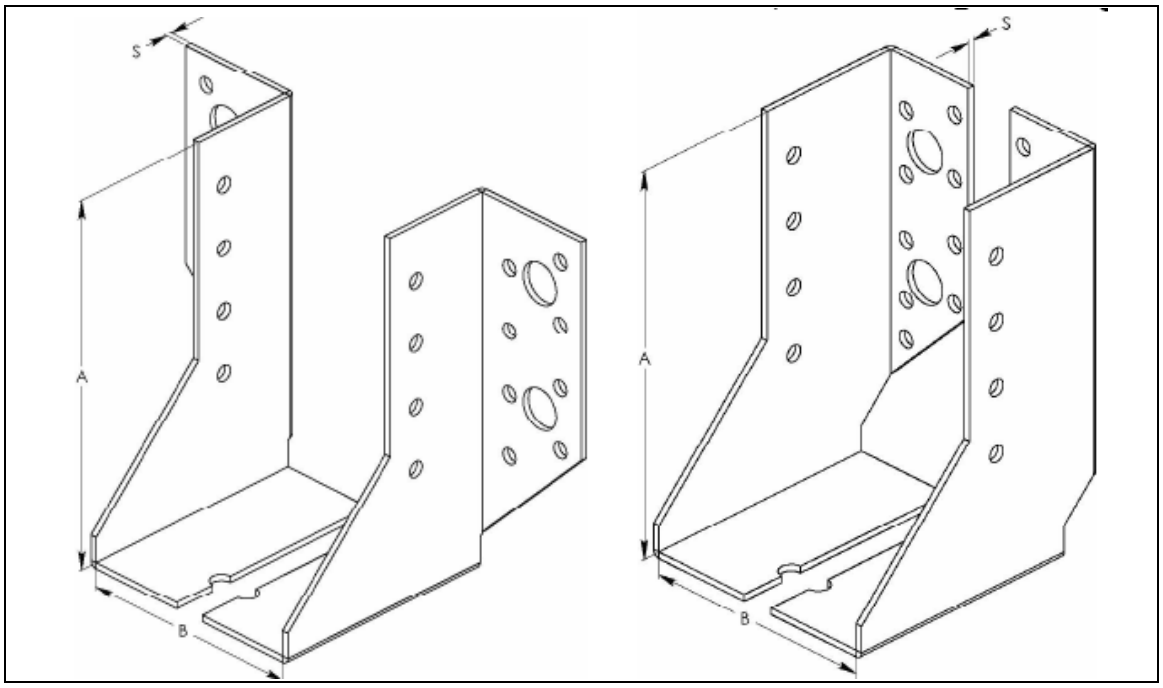


Table A 3-2 Minimum/Maximum Dimensions of RD2d and RD2dd Joist hangers

Series	Reference	Dimensions (mm)		
		A	B	S
RD2 d	RD2d 300 32x134	134	32	2.0
	RD2d 300 80x110	110	80	2.0
	RD2d 335 32x151.5	151.5	32	2.0
	RD2d 335 140x97.5	97.5	140	2.0
	RD2d 380 32x174	174	32	2.0
	RD2d 380 140x120	120	140	2.0
RD2 dd	RD2dd 300 63x118.5	118.5	63.0	2.0
	RD2dd 300 80x110	110	80	2.0
	RD2dd335 63x136	136.0	63.0	2.0
	RD2dd335 140x97.5	97.5	140	2.0
	RD2dd 380 75x152.5	152.5	75.0	2.0
	RD2dd 380 140x120	120	140	2.0

Figure A 3-3 Joist hanger Model – Raveeldrager Dicht

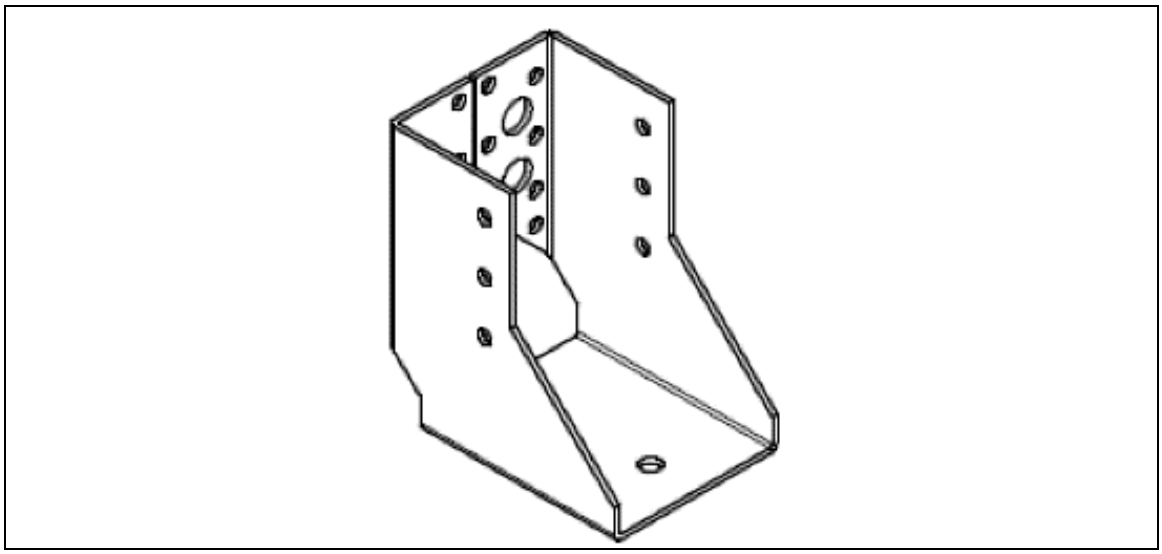


Table A 3-3 Joist hanger Model – Raveeldrager Dicht

Raveeldrager dicht	Dimensions				Holes in [1] FACE	Holes in [2] SIDE	Holes in [U] SEAT
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø	Nb x Ø
100x75x50x2.0	2.0	100	75	50	(2x) 7x 5.0 (2x) 2x 11.0	(2x) 3x 5.0	(1x) 1x 7.0
96x75x59x2.0	2.0	96		59			

Figure A 3-4 Joist hanger Model – Raveeldrager Zwaar

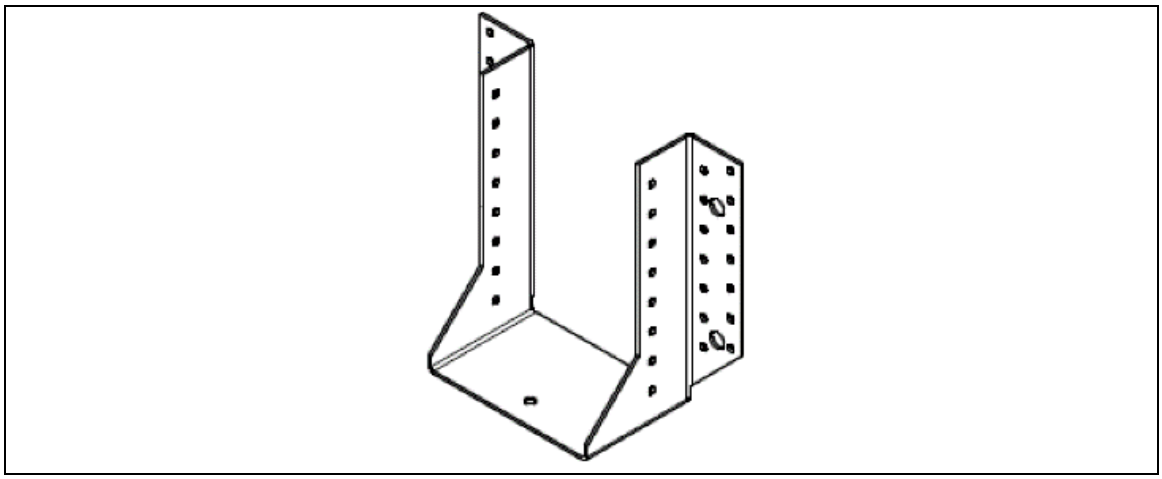


Table A 3-4 Joist hanger Model – Raveeldrager Zwaar

Raveeldrager Zwaar	Dimensions				Holes in [1] FACE	Holes in [2] SIDE	Holes in [U] SEAT
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø	Nb x Ø
180x80x120x2.0	2.0	180	80	120	(2x) 14x 5.0 (2x) 2x 11.0	(2x) 8x 5.0	(1x) 1x 7.0

Figure A 3-5 Joist hanger Model – Raveeldrager met Strip

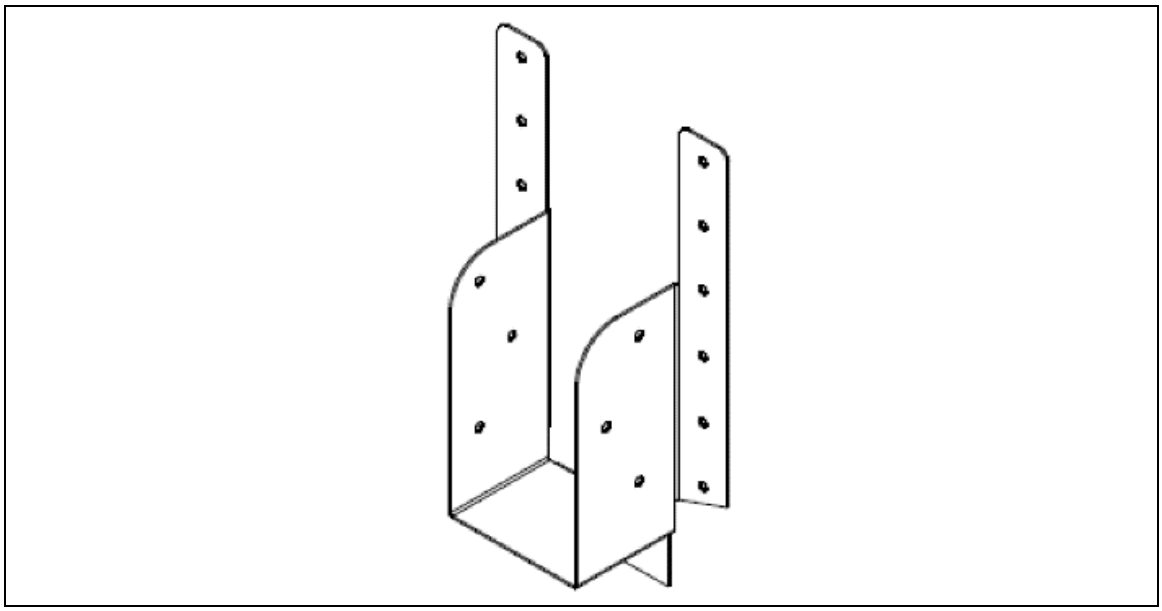


Table A 3-5 Joist hanger Model – Raveeldrager met Strip

Raveeldrager Met Strip	Dimensions				Holes in [1] FACE	Holes in [2] SIDE	Holes in [U] SEAT STRIP
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø	Nb x Ø
190x32	1.0	194	50	32	(2x) 6x 4.0	(2x) 3x4.0	(1x) 1x4.0
190x38		191		38			
190x46		187		46			
190x50		185		50			
190x59		181		59			(1x) 2x4.0
190x63		179		63			
190x71		175		71			
190x75		173		75			
225x38		226		38	(2x) 7x 4.0	(2x) 4x4.0	(1x) 1x4.0
225x46		222		46			
225x50		220		50			
225x59		216		59			(1x) 2x4.0
225x63		214		63			
225x71		210		71			
225x75		208		75			

Figure A 3-6 Joist hanger Model – Regeldrager

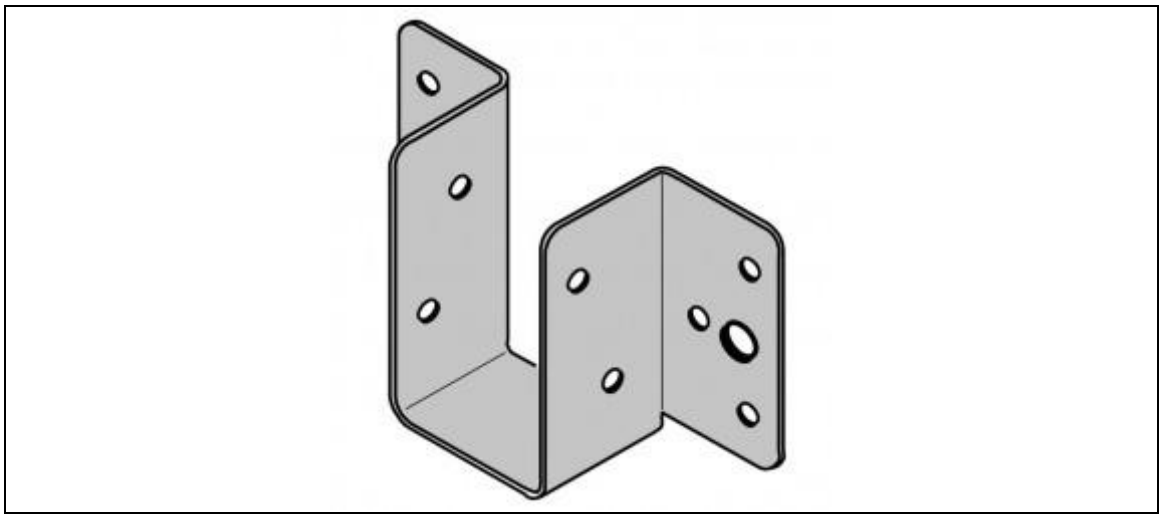


Table A 3-6 Joist hanger Model – Regeldrager

Regeldrager	Dimensions				Holes in [1] FACE	Holes in [2] SIDE	Holes in [U] SEAT
Reference	t_s	*A*	*B*	*C*	Nb x Ø	Nb x Ø	Nb x Ø
Regeldrager 25mm	1.0	76	34	25	(2x) 3x 4.0 (2x) 1x 6.7	(2x) 2x 4.0	n/a
Regeldrager 28mm		75		28			
Regeldrager 32mm		73		32			
Regeldrager 34mm		72		34			
Regeldrager 38mm		70		38			
Regeldrager 40mm		69		40			
Regeldrager 46mm		66		46			
Regeldrager 50mm		64		50			
Regeldrager 55mm	1.25	72		55			
Regeldrager 59mm		70		59			
Regeldrager 63mm		68		63			

ANNEX 4 DESCRIPTION OF SPECIAL CONNECTORS

Figure A 4-1 Special Connector – Rafter Tie – Kruiskoppeling L/R

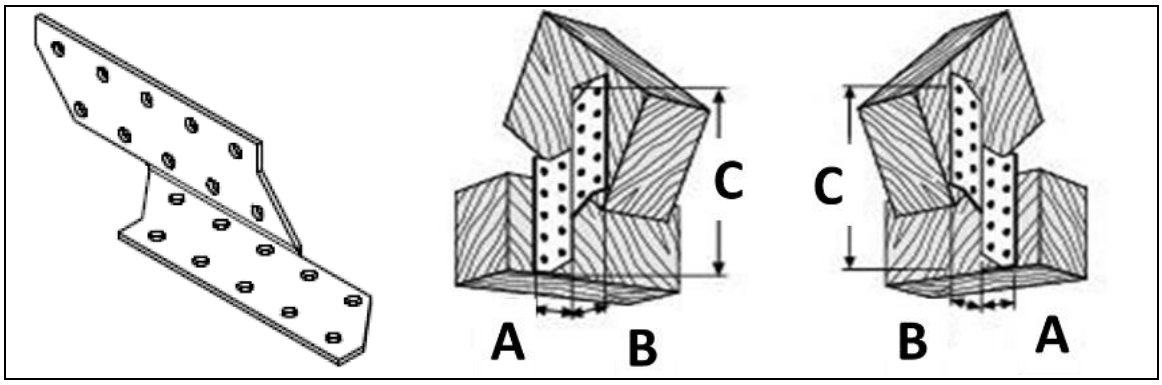


Table A 4-1 Special Connector – Rafter Tie – Kruiskoppeling L/R

Kruiskoppeling L/R	Dimensions				Holes in [1]	Holes in [2]
Reference	t_s	A	B	C	Nb x Ø	Nb x Ø
170x32x32 (L)	2.0	32	32	170	10x 5.0	10x 5.0
170x32x32 (R)						
210x32x32 (L)				210	14x 5.0	14x 5.0
210x32x32 (R)						

[1] face connected to support

[2] face connected to rafter

Figure A 4-2 Special Connector – Folded Angle – Model Gripanker

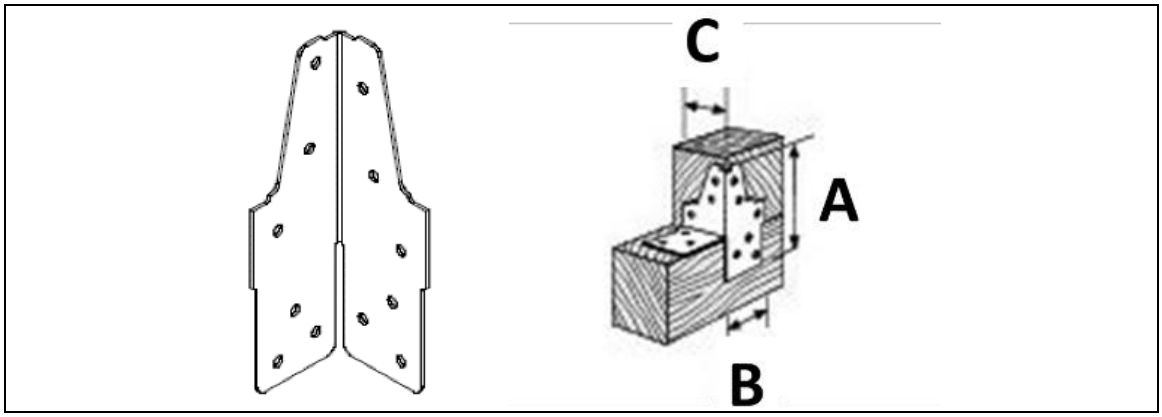


Table A 4-2 Special Connector – Folded Angle – Model Gripanker

Gripanker	Drawing Ref.	Dimensions					Holes in [1]	Holes in [S]
Reference		t_s	A	B	C	D	Nb x Ø	Nb x Ø
Gripanker	46000	1.25	40	40	126	42	(2x) 3x 4.0	(2x) 3x 4.0

[1] non-foldable faces

[S] foldable faces which are therefore either second faces or side faces

Figure A 4-3 Special Connector – Ridge Board Connector – Model Ruitersteun

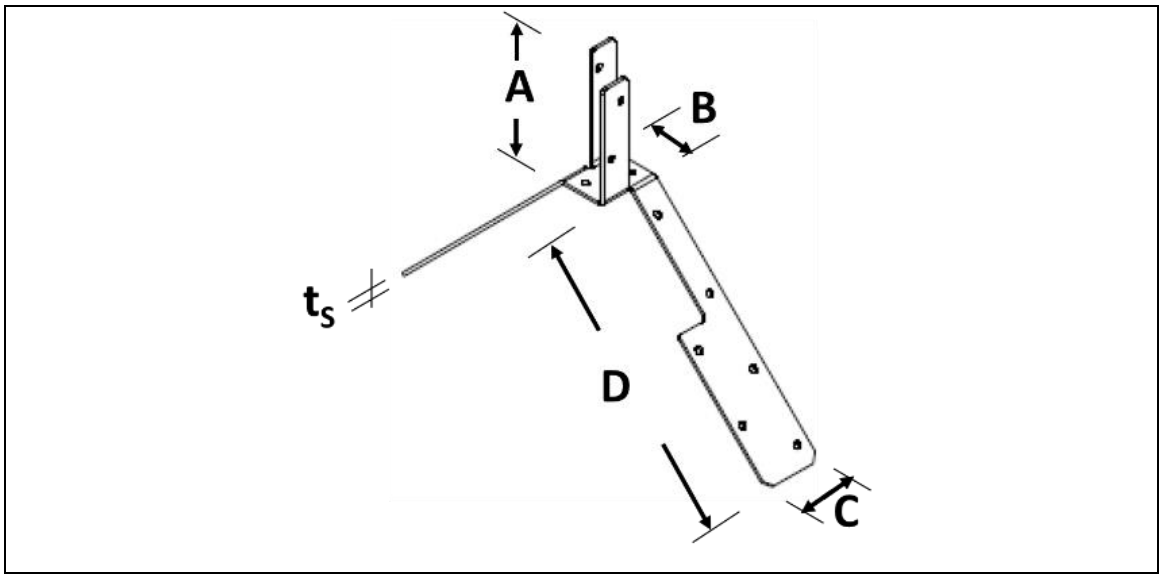


Table A 4-3 Special Connector – Ridge Board Connector – Model Ruitersteun

Ruitersteun	Dimensions					Holes in [1]	Holes in [2]	Holes in [S]
Reference	t_s	A	B	C	D	Nb x Ø	Nb x Ø	Nb x Ø
28x30	2.0	74	28	30	174	(2x) 2x 4.5	(1x) 2x 4.5	(2x) 6x4.5
32x30			32		173			
38x30			38		170			

[1] vertical face

[2] horizontal face

[S] side faces (connected to rafters)

ANNEX 5 DESCRIPTION OF THE COLUMN BASE PRODUCTS

Figure A 5-1 Waelbers Column Base

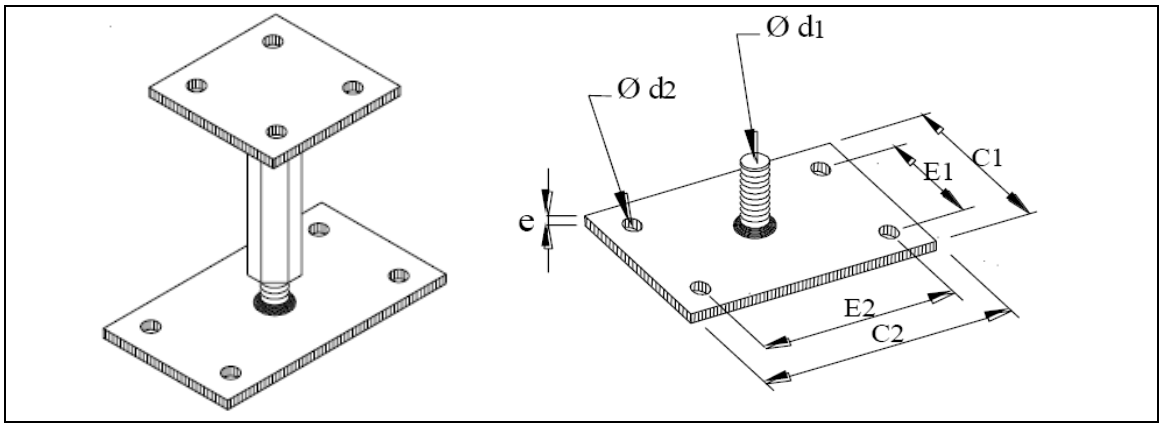


Table A 5-1 Column Base Dimensions

Support Element	e [mm]	d1 [mm]	d2 [mm]	C1 [mm]	C2 [mm]	E1 [mm]	E2 [mm]
Top Plate	6	19.8	11.5	89.8		55	
Bottom Plate	6	19.8	11.5	90	159.9	55	125

Figure A 5-2 Waelbers Column Base – Model Paalhouder Verstelbaar 90 x 90

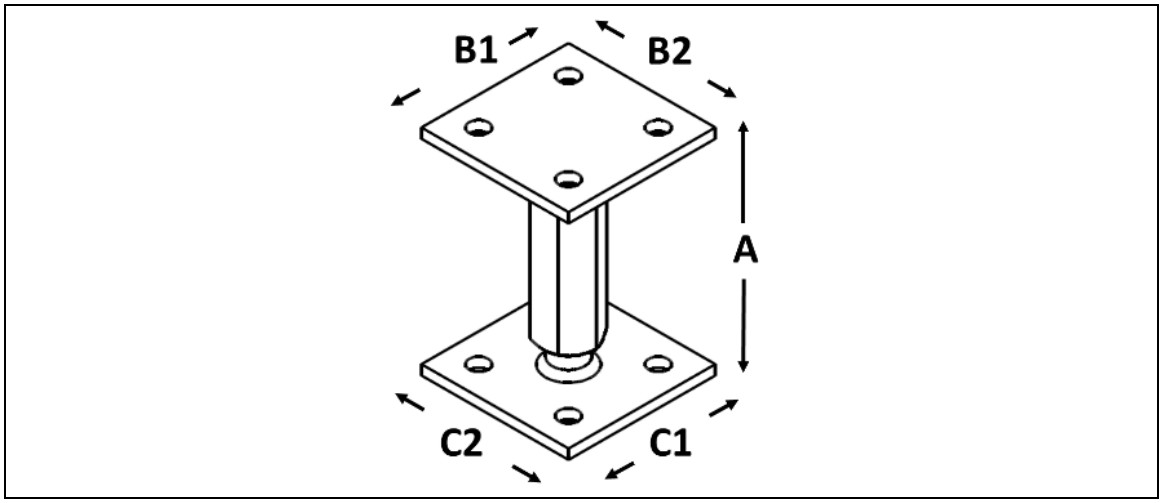


Table A 5-2 Column Base Dimensions - Model Paalhouder Verstelbaar 90 x 90

	Dimensions						Holes
Reference	t_s	A	B1	B2	C1	C2	Nb x Ø
Paalhouder verstelbaar 90x90	6.0	115-180	90	90	90	90	[T] 4x 11.5 [B] 4x 11.5

Figure A 5-3 Waelbers Column Base – Model Paalhouder Verstelbaar 80x80/100x140

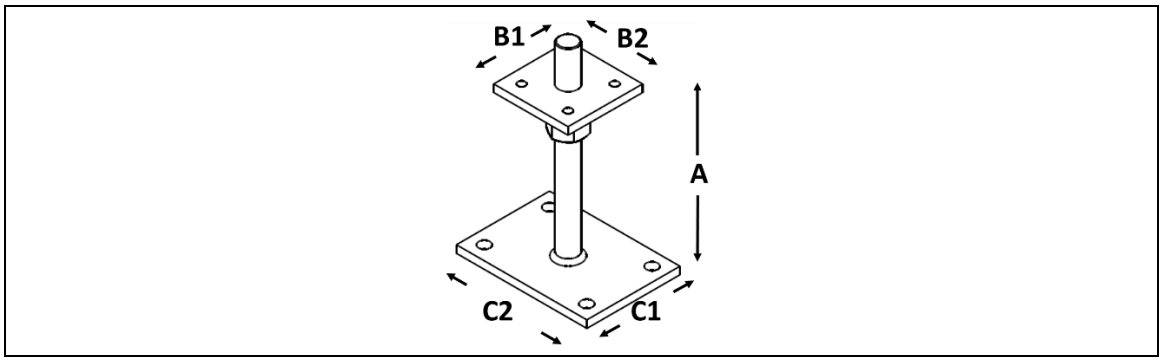


Table A 5-3 Column Base Dimensions - Model Paalhouder Verstelbaar 80x80/100x140

	Dimensions						Holes
Reference	**t_s**	**A**	**B1**	**B2**	**C1**	**C2**	**Nb x Ø**
Paalhouder verstelbaar 80x80/100x140	5.0	100-180	80	80	100	140	[T] 4x 8.0 [B] 4x 11.5

ANNEX 6 PROPERTIES OF MATERIALS AND FASTENERS

In the relevant Annexes the characteristic load-carrying capacities of Waelbers WoodConnectors are presented in two ways:

- Standard load-carrying capacities:

These capacities have been calculated for standard connector sizes and prescribed standard fasteners and components (as described in this Annex) and allow a direct reading of the load-carrying capacity in each direction for load applied to each plate.

- Detailed load-carrying capacities by failure mode:

These capacities have been calculated for standard connector sizes and prescribed standard fasteners and components (as described in this Annex) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

The method for determining capacities for alternative grades and/or fasteners is described in separately for each series of connectors

This Annex describes the standard fasteners and components, used for the standard load-carrying capacities tables, and the requirements placed by the calculation method on alternative grades and/or fasteners to be used with the detailed load-carrying capacities tables.

A6.1 Wood Based Member (Joist or Header)

A6.1.1 Standard component

The connected timber members are assumed to be C24 timber with a characteristic density ρ_k = 350 kg/m³.

A6.1.2 Requirement for Alternative Grade:

Other timber, glulam, LVL or further wood-based products may be used provided they fit geometrically with the relevant connector. Timber must be strength graded to EN14081. Other wood-based products must be approved for structural use.

The calculation methods given in the Annexes for connections to timber are only applicable tor timber members with a characteristic density $\rho_k \leq$ 420 kg/m³.

A6.2 Concrete

A6.2.1 Standard component

The concrete support is assumed to be non-cracked with a characteristic compression strength measured on cubes with a side length of 150 mm of:

$f_{ck,cube}$ = 25 N/mm²

(value of concrete strength class C20/25 according to EN 206-1)

A6.2.2 Requirement for Alternative Grade:

Alternative concrete supports shall comply with EN 206-1 and with the provisions of the ETA for the mechanical expansion anchor bolt used.

A6.3 Plate material

A6.3.1 Standard component

The plates for the Waelbers angle brackets and joist hangers covered by this ETA are made from (hot dip) pre-galvanized steel DX51D+Z275, with minimum characteristic yield strength of:

$f_{y,k}$ = 270 N/mm²

A6.3.2 Requirement for Alternative Grade:

Changes made to the product are subject to initial type-testing and assessment prior to their use. However, the calculation methods given in the Annexes are applicable to alternative steel grades with minimum characteristic yield strength equal or greater than that of the standard component.

A6.4 Nails

A6.4.1 Standard component

The standard nails used for developing the load carrying capacities are 4.0mm diameter threaded nails CE marked to EN 14592, with characteristics as listed in Table A 6-1below.

Table A 6-1 Standard Nail Characteristics

Threaded Nail Characteristics	Diameter *d* (mm)	4.0		
	Length *L* (mm)	35	40	50
Penetration depth	t_1 (mm)	30	35	45
Pointside penetration length of the threaded part in the pointside member	t_{pen} (mm)	20	25	35
Characteristic embedment strength	$f_{h,k}$ (N/mm²)	18.93	18.93	18.93
Characteristic yield moment	$M_{y,Rk}$ (Nmm)	6620	6620	6620
Characteristic pointside withdrawal strength	$f_{ax,k}$ (N/mm²)	6.00	6.00	6.00
Characteristic withdrawal capacity	$F_{ax,Rk}$ (N)	480	600	840
Characteristic shear capacity Thin steel plate ($t_s \leq 0.5\ d$)	$F_{v,Rk,THIN}$ (N) *when*	909 $t_s \leq 2.0$ mm	1060 $t_s \leq 2.0$ mm	1324 $t_s \leq 2.0$ mm
Characteristic shear capacity Thick steel plate ($t_s \geq 1\ d$)	$F_{v,Rk,THICK}$ (N) *when*	1359 $t_s \geq 4.0$ mm	1506 $t_s \geq 4.0$ mm	1825 $t_s \geq 4.0$ mm

4.0x35mm or 4.0x40mm nails have been used in the calculation of load-carrying capacities, as shown in the relevant tables in the Annexes.

A6.4.2 Requirements for Alternative Nails

Alternative nails shall comply with EN 14592 and with following requirements:

- Nails must be threaded, twisted or ring nails
- Nail diameter shall be equal to or greater than 4.0mm
- Nail length shall be equal to or greater to the lengths indicated in Table A 6-1
- Characteristic performance values shall be at least equal to those in Table A 6-1

A6.5 Screws

A6.5.1 Standard component

Standard screw characteristics used for developing the load-carrying capacities are given in Table A 6-2 below.

For Series I Angle Brackets and Series I Joist Hangers, the standard screws are 5.0x35mm electro-galvanised steel screws from Simpson Strong-Tie, referenced CSA5,0X35.

For Series II Angle Brackets, Series II Joist Hangers, and Special Connectors 5.0x40mm, 5.0x50mm, 6.0x40mm, 6.0x50mm or 8.0x60mm screws have been used.

For column base products, the screws shall be at least 10mm diameter and provide an effective anchorage (threaded) length of 40mm to meet the characteristics of those used in testing and develop the declared load-carrying capacities. Screw holes shall be pre-drilled in column timbers.

A6.5.2 Requirements for alternative screws

Alternative screws shall comply with EN 14592 and with following requirements:

- Screw diameter shall be equal to or greater than 4.0mm
- Screw lengths shall be equal to or greater to the lengths indicated in Table A 6-2
- Characteristic performance values shall be at least equal to those in Table A 6-2

A6.6 Mechanical Anchor Bolts

A6.6.1 Standard Component

The standard mechanical anchor bolts used for developing the load-carrying capacities are one of the following, depending on the connector:

- Spit Fix II Torque-controlled expansion anchor bolts, made of galvanised steel, for use in non-cracked concrete, covered by ETA-01/0008.
- Spit Fix 3 Torque-controlled expansion anchor, made of galvanised steel, for use in non-cracked concrete, covered by ETA-13/0005

The bolt diameter shall be that indicated in the tables listing the characteristic load-carrying capacities, as the bolt hole dimensions vary with the connector type and sizes.

A6.6.2 Requirement for alternative fastener

Alternative mechanical expansion anchor bolts shall be covered by an ETA in accordance with ETAG 001: 2001-08 and their characteristic resistances calculated per ETAG 001: 2001-08-Annex C.

The bolt diameter shall be that indicated in the tables listing the characteristic load-carrying capacities, as the bolt hole dimensions vary with the connector type and sizes.

Table A 6-2 Standard Screw Characteristics

Screws Characteristics	Diameter *d* (mm)	5.0			6.0		8.0
	Length *L* (mm)	35	40	50	40	50	60
Penetration depth	t_1 (mm)	30	35	45	36	45	55
Pointside penetration length of the threaded part in the pointside member	t_{pen} (mm)	30	30	35	36	36	48
Characteristic embedment strength	$f_{h,k}$ (N/mm²)	17.71	17.71	17.71	16.77	16.77	26.40
Characteristic yield moment	$M_{y,Rk}$ (Nmm)	11820	11820	11820	18990	18990	20060
Characteristic pointside withdrawal strength	$f_{ax,k}$ (N/mm²)	6.00	6.00	6.00	6.00	6.00	6.00
Characteristic withdrawal capacity	$F_{ax,Rk}$ (N)	900	900	1 050	1 296	1 296	2 304
Characteristic shear load carrying capacity Thin steel plate ($t_s \leq 0.5\ d$)	$F_{v,Rk,THIN}$ (N) *when*	1063 $t_s \leq 2.5$	1240 $t_s \leq 2.5$	1594 $t_s \leq 2.5$	1449 $t_s \leq 3.0$	1811 $t_s \leq 3.0$	3924 $t_s \leq 4.0$
Characteristic shear load carrying capacity Thick steel plate ($t_s \geq 1\ d$)	$F_{v,Rk,THICK}$ (N) *when*	1846 $t_s \geq 5.0$	1963 $t_s \geq 5.0$	2273 $t_s \geq 5.0$	2522 $t_s \geq 6.0$	2770 $t_s \geq 6.0$	5310 $t_s \geq 8.0$

Note: Screw withdrawal capacities have been aligned with those of the nails in Table A 6-1 so that either fastener type may be used without recalculating the shear and withdrawal capacities. This is a conservative assumption, as screw withdrawal capacities are generally higher than those of nails of the same diameter

ANNEX 7 DEFINITION OF LOAD DIRECTIONS FOR CHARACTERISTIC RESISTANCES

This Annex presents the notation used for identifying the load directions for which the characteristic load-carrying capacities are listed in this ETA.

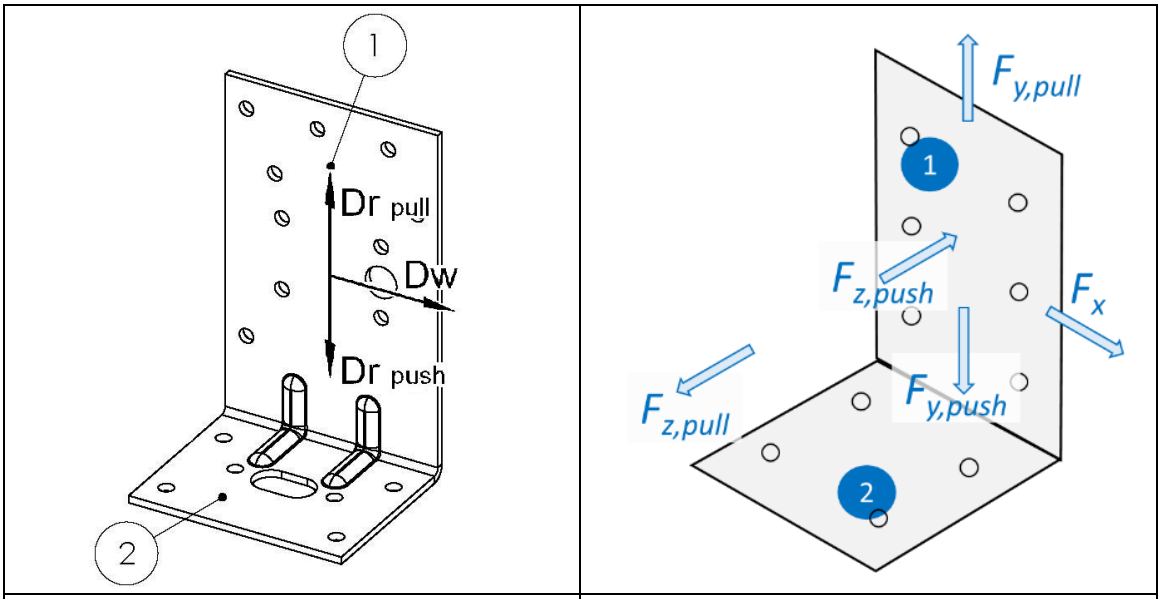
- The notation for the angle brackets and joist hangers that were in the previous version of this ETA has been maintained, and these are denoted as Series I.
- The notation has changed for the angle brackets and joist hangers introduced in this revision of the ETA which are denoted as Series II.
- The notation for the special connectors introduced in this revision is presented.

A7.1 Load Directions and Parts - Angle Brackets

Table A 7-1 Definition of the Load Directions - Angle Brackets

Load Applied To	Plate 1			Plate 2	
Load Direction – Series I	Dw	Dr_{pull}	Dr_{push}	Dr_{pull}	Dr_{push}
Load Direction – Series II	$F_{x,}$	$F_{y,pull,}$	$F_{y,push,}$	$F_{z,pull,}$	$F_{z,push,}$

Figure A 7-1 Notation of Loads and Parts - Angle Brackets



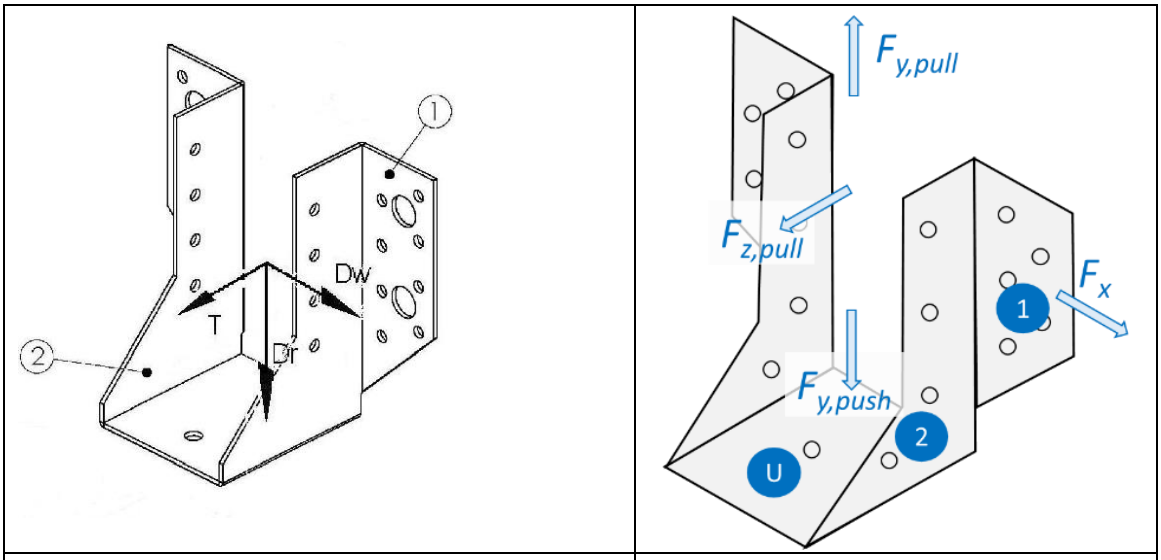
Series I | Series II

A7.2 Load Directions and Parts - Joist Hangers

Table A 7-2 Definition of the Load Directions - Joist Hangers

Load Applied To	Joist / Header Beam			
Load Direction – Series I	Main (Dr)	-	Lateral (Dw)	Tension (T)
Load Direction – Series II	$F_{x,}$	$F_{y,pull,}$	$F_{y,push,}$	$F_{z,pull,}$

Figure A 7-2 Notation of Loads and Parts - Joist Hangers



Series I	Series II

A7.3 Load Directions and Parts - Special Connectors

Table A 7-3 Definition of the Load Directions - Rafter-Tie - Kruiskoppeling L/R

Load Applied To	Plate 1			
Load Direction	$F_{y,pull,}$	$F_{y,push,}$	$F_{z,pull,}$	$F_{z,push,}$

Figure A 7-3 Notation of Loads and Parts - Rafter-Tie - Kruiskoppeling L/R

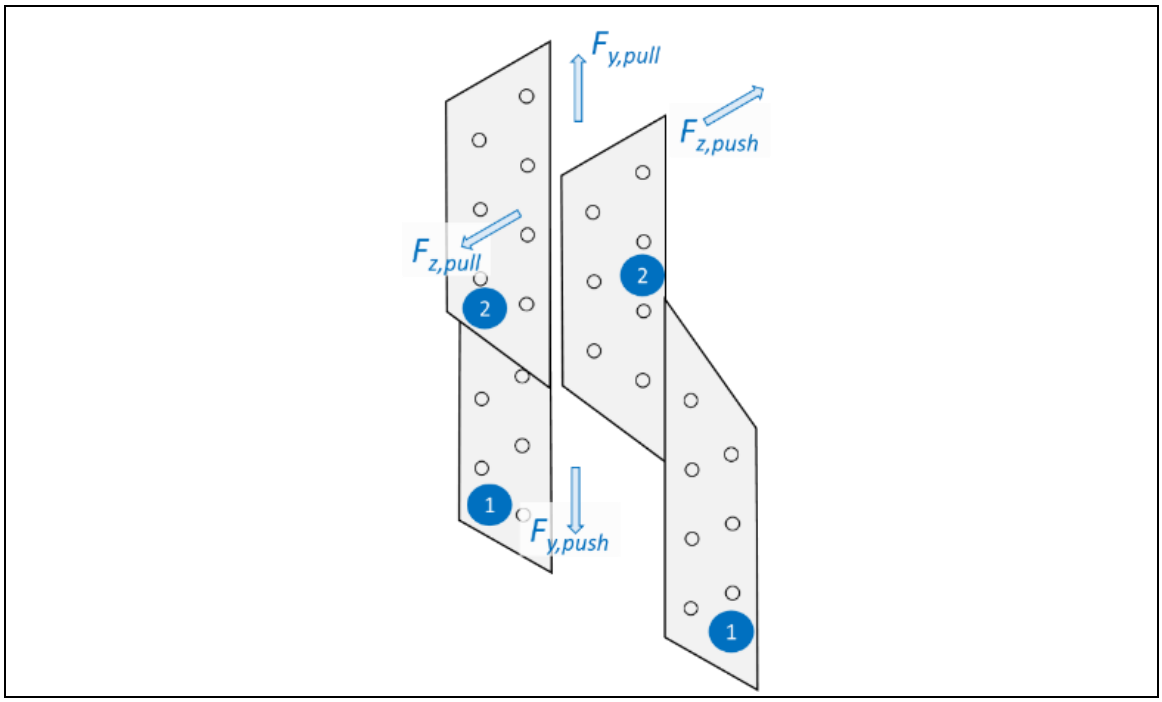


Table A 7-4 Definition of the Load Directions - - Folded Angle Bracket – Gripanker

Load Applied To	Plate 1 and Side [S]			Plate 2 & Side [S]		Plate 2
Load Direction	F_x	$F_{z,pull,}$	$F_{z,push,}$	F_x	$F_{y,pull,}$	$F_{y,push,}$

Figure A 7-4 Notation of Loads and Parts - Folded Angle Bracket – Gripanker

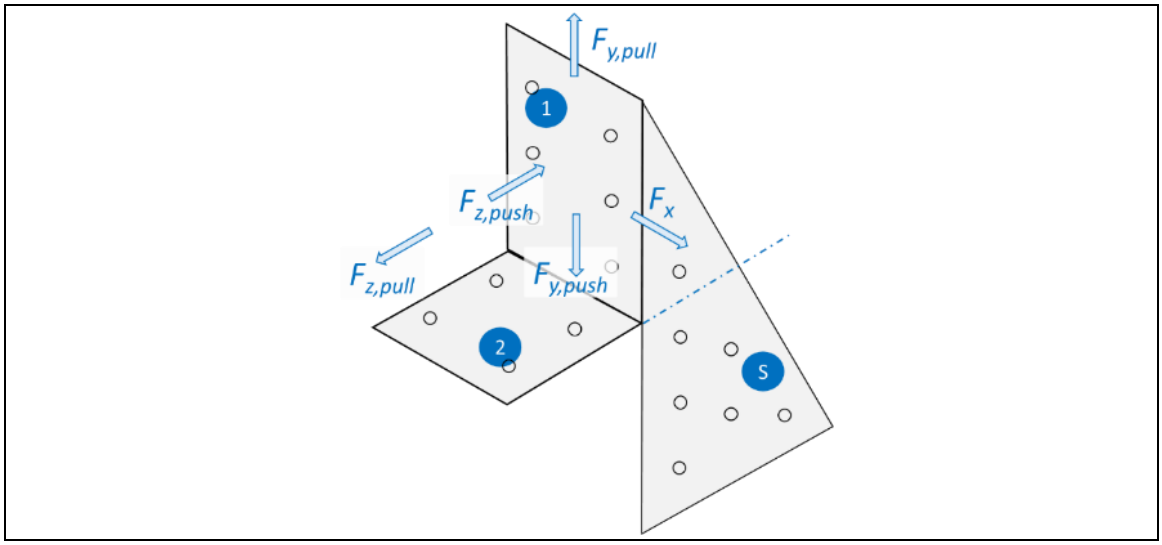
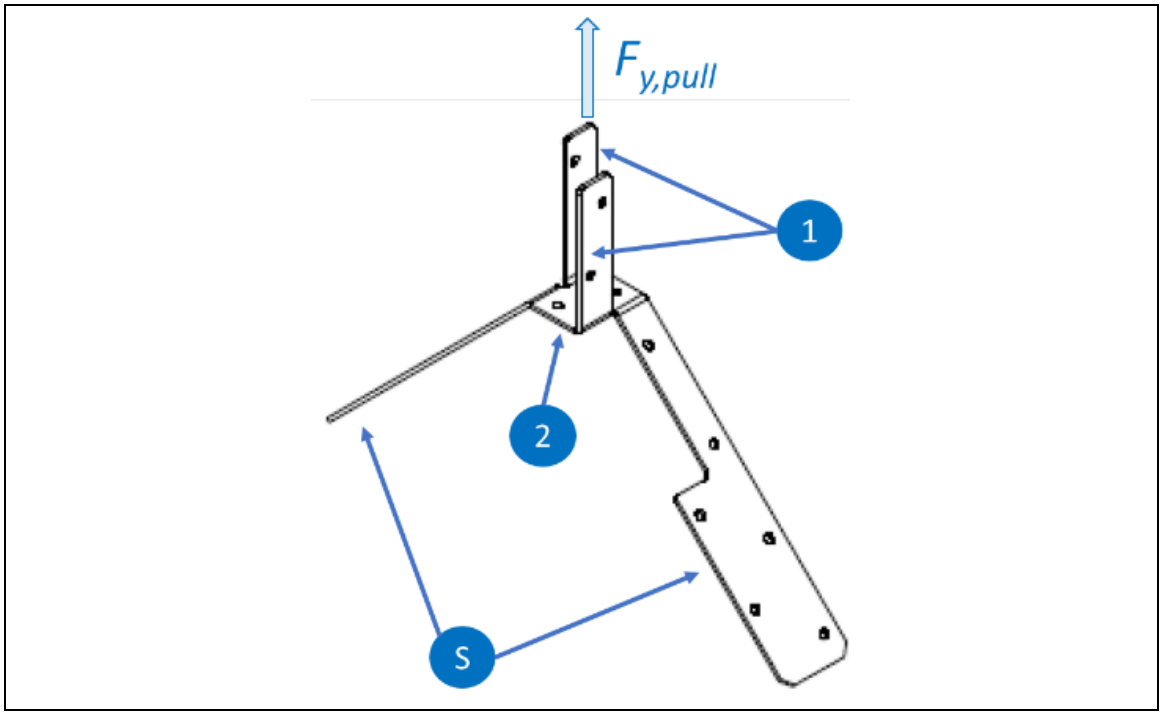


Table A 7-5 Definition of the Load Directions - - Folded Angle Bracket – Gripanker

Load Applied To	Plate 1
Load Direction	$F_{y,pull,}$

Figure A 7-5 Notation of Loads and Parts - Ridge Board Connector – Ruitersteun

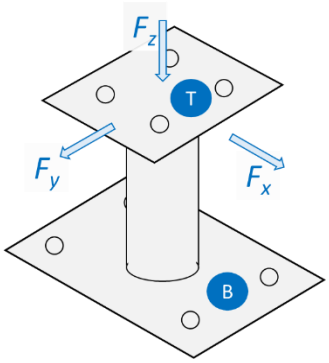


A7.4 Load Directions and Parts – Column Bases

Table A 7-6 Definition of the Load Directions – Column Bases

Load Applied To	Top Plate [T]		
Load Direction	$F_{z,}$	$F_{x,}$	F_{y}

Figure A 7-6 Notation of Loads and Parts – Column Bases



ANNEX 8 ANGLE BRACKETS – SERIES I - LOAD-CARRYING CAPACITIES

A8.1 Tabulated Values

The calculated load-carrying capacities for Series I angle brackets are presented in the following tables for both timber to timber and timber to concrete connections.

Load-carrying Capacities for timber substrates are presented both for nailed connections, using 4.0x40mm threaded nails as defined in Annex 6 §A6.4, and for screwed connections, using CSA5,0X35 Simpson Strong-Tie screws as defined in Annex 6 §A6.5, as described in the tables.

Load carrying capacities for concrete substrates are presented for bolted connections using SPIT FIX II expansion bolts covered by ETA-01/0008 as described in Annex 6 §A6.6. The bolt dimensions depend on the diameter of the bolt hole in the angle bracket.

The notation for the load directions used in the tables is defined in Annex 7 Figure A 7-1.

Tables are presented in two configurations:

- **Standard load-carrying capacities**. These capacities have been calculated for standard angle bracket sizes and prescribed standard fasteners (as described above) and allow a direct reading of the load-carrying capacity in each direction for the load applied to each plate.
- **Detailed load-carrying capacities by failure mode**. These capacities have been calculated for standard angle bracket sizes and prescribed standard fasteners (as described above) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

The method for determining capacities of Series I angle brackets for alternative grades and/or fasteners is described in §A8.7.

A8.2 Standard Load-carrying Capacities - Tables

Table A 8-1	Standard Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Nailed Connection
Table A 8-3	Standard Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Screwed Connection
Table A 8-5	Standard Load-carrying Capacities – H1R & H2R – Concrete [1] to Timber [2] – Nailed Connection
Table A 8-6	Standard Load-carrying Capacities – H1R & H2R – Timber [1] to Concrete [2] – Nailed Connection
Table A 8-9	Standard Load-carrying Capacities – H1R & H2R – Concrete [1] to Timber [2] – Screwed Connection
Table A 8-10	Standard Load-carrying Capacities – H1R & H2R – Timber [1] to Concrete [2] – Screwed Connection
Table A 8-13	Standard Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection
Table A 8-14	Standard Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection
Table A 8-17	Standard Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection
Table A 8-18	Standard Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

A8.3 Detailed Load-carrying Capacities - Tables

A8.4 H1R and H2R – Timber to Timber Connection

Table A 8-1 Standard Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Nailed Connection

Load Applied to	Plate 1 - Timber				Plate 2 - Timber			
Model	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	10	5.50	3.37	4.60	10	5.50	3.37	4.60
H1R 90x90x60x2.5	4	3.64	1.32	2.29	4	3.64	1.32	2.29
H1R 125x125x45x2.5	5	4.54	1.37	1.31	5	4.54	1.37	1.31
H1R 150x150x60x2.5	10	7.50	3.14	4.47	10	7.50	3.14	4.47
H1R 105x105x90x2.5	14	11.25	3.37	5.44	10	9.09	2.71	5.44
H2R 80x50x80	10	8.00	1.76	4.26	4	3.64	3.06	4.26
H2R 80x60x60	8	6.00	1.99	3.41	6	5.45	2.82	3.41
H2R 120x60x80	18	10.00	2.82	6.04	5	4.54	4.54	6.04
H2R 100x60x75	9	8.18	2.54	4.28	6	5.45	2.99	4.28
H2R 120x60x75	12	9.38	2.54	4.46	6	5.45	3.69	4.46
H2R 140x60x75	13	9.38	2.54	4.46	6	5.45	4.37	4.46
H2R 160x60x75	13	9.38	2.54	4.46	6	5.45	4.90	4.46
H2R1s 75x48	7	4.88	2.08	4.64	6	4.88	3.25	4.64
H2R2s 75x48	7	4.88	2.08	4.64	6	4.88	3.25	4.64

(1) 4.0x40mm threaded nails – C24 timber members

Table A 8-2 Detailed Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Nailed Connection

Load applied to	Plate 1 - Timber					Plate 2 - Timber				
Failure Mode	Nails (1)	Connection to timber				Nails (1)	Connection to timber			
		Dr [kN]			Dw [kN]		Dr [kN]			Dw [kN]
		Tension Plate 2	Pull/push Plate 1	Push Plate 2	Lateral		Tension Plate 1	Pull/push Plate 2	Push Plate 1	Lateral
H1R 70x70x55x2	10	3.37	9.09	5.50	4.60	10	3.37	9.09	5.50	4.60
H1R 90x90x60x2.5	4	1.32	3.64	7.50	2.29	4	1.32	3.64	7.50	2.29
H1R 125x125x45x2.5	5	1.37	4.54	5.63	1.31	5	1.37	4.54	5.63	1.31
H1R 150x150x60x2.5	10	3.14	9.09	7.50	4.47	10	3.14	9.09	7.50	4.47
H1R 105x105x90x2.5	14	3.37	12.72	11.25	5.44	10	2.71	9.09	11.25	5.44
H2R 80x50x80	10	1.76	9.09	8.00	4.26	4	3.06	3.64	8.00	4.26
H2R 80x60x60	8	1.99	7.27	6.00	3.41	6	2.82	5.45	6.00	3.41
H2R 120x60x80	18	2.82	16.36	10.00	6.04	5	5.38	4.54	10.00	6.04
H2R 100x60x75	9	2.54	8.18	9.38	4.28	6	2.99	5.45	9.38	4.28
H2R 120x60x75	12	2.54	10.91	9.38	4.46	6	3.69	5.45	9.38	4.46
H2R 140x60x75	13	2.54	11.82	9.38	4.46	6	4.37	5.45	9.38	4.46
H2R 160x60x75	13	2.54	11.82	9.38	4.46	6	4.90	5.45	9.38	4.46
H2R1s 75x48	7	2.08	6.36	4.88	4.64	6	3.25	5.45	4.88	4.64
H2R2s 75x48	7	2.08	6.36	4.88	4.64	6	3.25	5.45	4.88	4.64

(1) 4.0x40mm threaded nails – C24 timber members

Table A 8-3 Standard Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Screwed Connection

Load applied to	Plate 1 - Timber				Plate 2 - Timber			
Model	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	10	5.50	9.13	11.28	10	5.50	9.13	11.28
H1R 90x90x60x2.5	4	7.50	5.62	8.00	4	7.50	5.62	8.00
H1R 125x125x45x2.5	5	5.63	2.55	3.02	5	5.63	2.55	3.02
H1R 150x150x60x2.5	10	4.46	3.32	7.01	10	4.46	3.32	7.01
H1R 105x105x90x2.5	14	11.25	9.13	13.34	10	11.25	7.34	13.34
H2R 80x50x80	10	8.00	4.76	10.46	4	8.00	8.30	10.46
H2R 80x60x60	8	6.00	5.40	8.36	6	6.00	7.64	8.36
H2R 120x60x80	18	10.00	7.64	14.81	5	10.00	11.15	14.81
H2R 100x60x75	9	9.38	6.88	10.49	6	9.38	8.11	10.49
H2R 120x60x75	12	9.38	6.88	10.94	6	9.38	9.99	10.94
H2R 140x60x75	13	9.38	6.88	10.94	6	9.38	11.84	10.94
H2R 160x60x75	13	9.38	6.88	10.94	6	9.38	13.29	10.94
H2R1s 75x48	7	4.88	5.63	11.38	6	4.88	8.80	11.38
H2R2s 75x48	7	4.88	5.63	11.38	6	4.88	8.80	11.38

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

Table A 8-4 Detailed Load-carrying Capacities – H1R & H2R Angle Brackets – Timber to Timber – Screwed Connection

Load applied to	Plate 1 - Timber					Plate 2 - Timber				
Failure Mode	Screws (1)	Connection to timber				Screws (1)	Connection to timber			
		Dr [kN]			Dw [kN]		Dr [kN]			Dw [kN]
		Tension Plate 2	Pull/push Plate 1	Push Plate 2	Lateral		Tension Plate 1	Pull/push Plate 2	Push Plate 1	Lateral
H1R 70x70x55x2	10	9.13	22.30	5.50	11.28	10	9.13	22.30	5.50	11.28
H1R 90x90x60x2.5	4	5.62	8.92	7.50	8.00	4	5.62	11.15	7.50	8.00
H1R 125x125x45x2.5	5	2.55	6.69	5.63	3.02	5	2.55	6.69	5.63	3.02
H1R 150x150x60x2.5	10	3.32	4.46	7.50	7.01	10	3.32	4.46	7.50	7.01
H1R 105x105x90x2.5	14	9.13	31.22	11.25	13.34	10	7.34	22.30	11.25	13.34
H2R 80x50x80	10	4.76	22.30	8.00	10.46	4	8.30	8.92	8.00	10.46
H2R 80x60x60	8	5.40	17.84	6.00	8.36	6	7.64	13.38	6.00	8.36
H2R 120x60x80	18	7.64	40.14	10.00	14.81	5	14.59	11.15	10.00	14.81
H2R 100x60x75	9	6.88	20.07	9.38	10.49	6	8.11	13.38	9.38	10.49
H2R 120x60x75	12	6.88	26.76	9.38	10.94	6	9.99	13.38	9.38	10.94
H2R 140x60x75	13	6.88	28.99	9.38	10.94	6	11.84	13.38	9.38	10.94
H2R 160x60x75	13	6.88	28.99	9.38	10.94	6	13.29	13.38	9.38	10.94
H2R1s 75x48	7	5.63	15.61	4.88	11.38	6	8.80	13.38	4.88	11.38
H2R2s 75x48	7	5.63	15.61	4.88	11.38	6	8.80	13.38	4.88	11.38

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

A8.5 H1R & H2R – Timber to Concrete Connection

Table A 8-5 Standard Load-carrying Capacities – H1R & H2R – Concrete [1] to Timber [2] – Nailed Connection

Load Applied to	Plate 1 - Concrete				Plate 2 - Timber			
Model	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	1xM10	5.50	3.37	4.60	10	9.09	9.00	4.60
H1R 90x90x60x2.5	1xM10	7.50	1.32	2.29	4	3.64	3.64	2.29
H1R 125x125x45x2.5	1xM8	4.70	1.37	1.31	5	4.54	4.54	1.31
H1R 150x150x60x2.5	1xM10	6.08	3.14	4.47	10	9.09	9.00	4.47
H1R 105x105x90x2.5	1xM12	11.25	3.37	5.44	10	9.09	9.09	5.44
H2R 80x50x80	1xM12	8.00	1.76	4.26	4	3.64	3.64	4.26
H2R 80x60x60	1xM12	6.00	1.99	3.41	6	5.45	5.45	3.41
H2R 120x60x80	1xM10	9.76	2.82	6.04	5	4.54	4.54	6.04
H2R 100x60x75	1xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 120x60x75	1xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 140x60x75	2xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 160x60x75	2xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R1s 75x48	1xM10	3.65	2.08	4.64	6	5.45	5.45	4.64
H2R2s 75x48	1xM10	3.65	2.08	4.64	6	5.45	5.45	4.64

Table A 8-6 Standard Load-carrying Capacities – H1R & H2R – Timber [1] to Concrete [2] – Nailed Connection

Load Applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	10	9.09	9.00	4.60	1xM10	5.50	3.37	4.60
H1R 90x90x60x2.5	4	2.29	2.29	9.00	1xM10	1.32	7.50	9.00
H1R 125x125x45x2.5	5	1.31	1.31	4.86	1xM8	1.37	5.63	4.86
H1R 150x150x60x2.5	10	4.47	4.47	6.08	1xM10	3.14	7.50	6.08
H1R 105x105x90x2.5	14	9.49	9.49	27.50	3xM12	2.71	11.25	27.50
H2R 80x50x80	10	5.25	5.25	9.72	1xM12	3.06	5.83	9.72
H2R 80x60x60	8	4.36	4.36	9.72	1xM12	2.82	5.83	9.72
H2R 120x60x80	18	8.09	8.09	9.00	1xM10	5.38	6.08	9.00
H2R 100x60x75	9	4.28	4.28	9.00	1xM10	2.99	6.08	9.00
H2R 120x60x75	12	5.39	5.39	9.00	1xM10	3.69	6.08	9.00
H2R 140x60x75	13	5.74	5.74	9.00	1xM10	4.37	6.08	9.00
H2R 160x60x75	13	5.74	5.74	9.00	1xM10	4.90	6.08	9.00
H2R1s 75x48	7	6.42	6.36	6.08	1xM10	3.25	4.88	6.08
H2R2s 75x48	7	6.42	6.36	6.08	1xM10	3.25	4.88	6.08

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-7 Detailed Load-carrying Capacities – H1R & H2R – Concrete [1] to Timber [2] – Nailed Connection

Load applied to	Plate 1 - Concrete							Plate 2 - Timber					
Failure Mode	Bolts (2)	Connection to timber			Connection to concrete			Nails (1)	Connection to timber		Connection to concrete		
		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]
		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity
H1R 70x70x55x2	1xM10	3.37	5.50	4.60	8.10	8.10	9.76	10	9.09	4.60	8.10	9.00	9.76
H1R 90x90x60x2.5	1xM10	1.32	7.50	2.29	6.08	10.13	9.76	4	3.64	2.29	6.08	9.00	9.76
H1R 125x125x45x2.5	1xM8	1.37	5.63	1.31	8.10	8.10	4.70	5	4.54	1.31	8.10	6.00	4.70
H1R 150x150x60x2.5	1xM10	3.14	7.50	4.47	10.13	6.08	9.76	10	9.09	4.47	10.13	9.00	9.76
H1R 105x105x90x2.5	1xM12	3.37	11.25	5.44	12.15	12.15	13.39	10	9.09	5.44	12.15	13.39	13.39
H2R 80x50x80	1xM12	1.76	8.00	4.26	5.83	9.72	13.39	4	3.64	4.26	5.83	13.39	13.39
H2R 80x60x60	1xM12	1.99	6.00	3.41	5.83	9.72	13.39	6	5.45	3.41	5.83	13.39	13.39
H2R 120x60x80	1xM10	2.82	10.00	6.04	6.08	10.13	9.76	5	4.54	6.04	6.08	9.00	9.76
H2R 100x60x75	1xM10	2.54	9.38	4.46	10.13	10.13	9.76	6	5.45	4.46	10.13	9.00	9.76
H2R 120x60x75	1xM10	2.54	9.38	4.46	10.13	10.13	9.76	6	5.45	4.46	10.13	9.00	9.76
H2R 140x60x75	2xM10	2.54	9.38	4.46	20.25	20.25	13.31	6	5.45	4.46	20.25	13.31	13.31
H2R 160x60x75	2xM10	2.54	9.38	4.46	20.25	20.25	13.31	6	5.45	4.46	20.25	13.31	13.31
H2R1s 75x48	1xM10	2.08	4.88	4.64	6.08	3.65	9.76	6	5.45	4.64	6.08	9.00	9.76
H2R2s 75x48	1xM10	2.08	4.88	4.64	6.08	3.65	9.76	6	5.45	4.64	6.08	9.00	9.76

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-8 Detailed Load-carrying Capacities – H1R & H2R – Timber [1] to Concrete [2] – Nailed Connection

Load applied to	Plate 1 - Timber						Plate 2 - Concrete							
Failure Mode	Nails (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete			
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr	(kN)	Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]	
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity	
H1R 70x70x55x2	10	9.09	4.60	8.10	9.00	9.76	1xM10	3.37	5.50	4.60	8.10	8.10	9.76	
H1R 90x90x60x2.5	4	3.64	2.29	10.13	9.00	9.76	1xM10	1.32	7.50	2.29	10.13	10.13	9.76	
H1R 125x125x45x2.5	5	4.54	1.31	4.86	6.00	4.70	1xM8	1.37	5.63	1.31	4.86	8.10	4.70	
H1R 150x150x60x2.5	10	9.09	4.47	6.08	9.00	9.76	1xM10	3.14	7.50	4.47	6.08	10.13	9.76	
H1R 105x105x90x2.5	14	12.72	9.49	36.45	27.50	27.50	3xM12	2.71	11.25	9.49	36.45	36.45	27.50	
H2R 80x50x80	10	9.09	5.25	9.72	13.39	13.39	1xM12	3.06	8.00	5.25	9.72	5.83	13.39	
H2R 80x60x60	8	7.27	4.36	9.72	13.39	13.39	1xM12	2.82	6.00	4.36	9.72	5.83	13.39	
H2R 120x60x80	18	16.36	8.09	10.13	9.00	9.76	1xM10	5.38	10.00	8.09	10.13	6.08	9.76	
H2R 100x60x75	9	8.18	4.28	10.13	9.00	9.76	1xM10	2.99	9.38	4.28	10.13	6.08	9.76	
H2R 120x60x75	12	10.91	5.39	10.13	9.00	9.76	1xM10	3.69	9.38	5.39	10.13	6.08	9.76	
H2R 140x60x75	13	11.82	5.74	10.13	9.00	9.76	1xM10	4.37	9.38	5.74	10.13	6.08	9.76	
H2R 160x60x75	13	11.82	5.74	10.13	9.00	9.76	1xM10	4.90	9.38	5.74	10.13	6.08	9.76	
H2R1s 75x48	7	6.36	6.42	6.08	9.00	9.76	1xM10	3.25	4.88	6.42	6.08	6.08	9.76	
H2R2s 75x48	7	6.36	6.42	6.08	9.00	9.76	1xM10	3.25	4.88	6.42	6.08	6.08	9.76	

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-9 Standard Load-carrying Capacities – H1R & H2R – Concrete [1] to Timber [2] – Screwed Connection

Load Applied to	Plate 1 - Concrete				Plate 2 - Timber			
Model	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	1xM10	5.50	3.37	4.60	10	9.09	9.00	4.60
H1R 90x90x60x2.5	1xM10	7.50	1.32	2.29	4	3.64	3.64	2.29
H1R 125x125x45x2.5	1xM8	4.70	1.37	1.31	5	4.54	4.54	1.31
H1R 150x150x60x2.5	1xM10	6.08	3.14	4.47	10	9.09	9.00	4.47
H1R 105x105x90x2.5	1xM12	11.25	3.37	5.44	10	9.09	9.09	5.44
H2R 80x50x80	1xM12	8.00	1.76	4.26	4	3.64	3.64	4.26
H2R 80x60x60	1xM12	6.00	1.99	3.41	6	5.45	5.45	3.41
H2R 120x60x80	1xM10	9.76	2.82	6.04	5	4.54	4.54	6.04
H2R 100x60x75	1xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 120x60x75	1xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 140x60x75	2xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R 160x60x75	2xM10	9.38	2.54	4.46	6	5.45	5.45	4.46
H2R1s 75x48	1xM10	3.65	2.08	4.64	6	5.45	5.45	4.64
H2R2s 75x48	1xM10	3.65	2.08	4.64	6	5.45	5.45	4.64

Table A 8-10 Standard Load-carrying Capacities – H1R & H2R – Timber [1] to Concrete [2] – Screwed Connection

Load Applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
H1R 70x70x55x2	10	9.09	9.00	4.60	1xM10	5.50	3.37	4.60
H1R 90x90x60x2.5	4	2.29	2.29	9.00	1xM10	1.32	7.50	9.00
H1R 125x125x45x2.5	5	1.31	1.31	4.86	1xM8	1.37	5.63	4.86
H1R 150x150x60x2.5	10	4.47	4.47	6.08	1xM10	3.14	7.50	6.08
H1R 105x105x90x2.5	14	9.49	9.49	27.50	3xM12	2.71	11.25	27.50
H2R 80x50x80	10	5.25	5.25	9.72	1xM12	3.06	5.83	9.72
H2R 80x60x60	8	4.36	4.36	9.72	1xM12	2.82	5.83	9.72
H2R 120x60x80	18	8.09	8.09	9.00	1xM10	5.38	6.08	9.00
H2R 100x60x75	9	4.28	4.28	9.00	1xM10	2.99	6.08	9.00
H2R 120x60x75	12	5.39	5.39	9.00	1xM10	3.69	6.08	9.00
H2R 140x60x75	13	5.74	5.74	9.00	1xM10	4.37	6.08	9.00
H2R 160x60x75	13	5.74	5.74	9.00	1xM10	4.90	6.08	9.00
H2R1s 75x48	7	6.42	6.36	6.08	1xM10	3.25	4.88	6.08
H2R2s 75x48	7	6.42	6.36	6.08	1xM10	3.25	4.88	6.08

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-11 Detailed Load-carrying Capacities – H1R & H2R Angle Brackets – Concrete [1] to Timber [2] – Screwed Connection

Load Applied to	Plate 1 - Concrete							Plate 2 - Timber					
Failure Mode	Bolts (2)	Connection to timber			Connection to concrete			Screws (1)	Connection to timber		Connection to concrete		
		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]
		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity
H1R 70x70x55x2	1xM10	3.37	5.50	4.60	8.10	8.10	9.76	10	9.09	4.60	8.10	9.00	9.76
H1R 90x90x60x2.5	1xM10	1.32	7.50	2.29	6.08	10.13	9.76	4	3.64	2.29	6.08	9.00	9.76
H1R 125x125x45x2.5	1xM8	1.37	5.63	1.31	8.10	8.10	4.70	5	4.54	1.31	8.10	6.00	4.70
H1R 150x150x60x2.5	1xM10	3.14	7.50	4.47	10.13	6.08	9.76	10	9.09	4.47	10.13	9.00	9.76
H1R 105x105x90x2.5	1xM12	3.37	11.25	5.44	12.15	12.15	13.39	10	9.09	5.44	12.15	13.39	13.39
H2R 80x50x80	1xM12	1.76	8.00	4.26	5.83	9.72	13.39	4	3.64	4.26	5.83	13.39	13.39
H2R 80x60x60	1xM12	1.99	6.00	3.41	5.83	9.72	13.39	6	5.45	3.41	5.83	13.39	13.39
H2R 120x60x80	1xM10	2.82	10.00	6.04	6.08	10.13	9.76	5	4.54	6.04	6.08	9.00	9.76
H2R 100x60x75	1xM10	2.54	9.38	4.46	10.13	10.13	9.76	6	5.45	4.46	10.13	9.00	9.76
H2R 120x60x75	1xM10	2.54	9.38	4.46	10.13	10.13	9.76	6	5.45	4.46	10.13	9.00	9.76
H2R 140x60x75	2xM10	2.54	9.38	4.46	20.25	20.25	13.31	6	5.45	4.46	20.25	13.31	13.31
H2R 160x60x75	2xM10	2.54	9.38	4.46	20.25	20.25	13.31	6	5.45	4.46	20.25	13.31	13.31
H2R1s 75x48	1xM10	2.08	4.88	4.64	6.08	3.65	9.76	6	5.45	4.64	6.08	9.00	9.76
H2R2s 75x48	1xM10	2.08	4.88	4.64	6.08	3.65	9.76	6	5.45	4.64	6.08	9.00	9.76

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-12 Detailed Load-carrying Capacities – H1R & H2R Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

Load Applied to	Plate 1 - Timber						Plate 2 - Concrete							
Failure Mode	Screws (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete			
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]	
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity	
H1R 70x70x55x2	10	9.09	4.60	8.10	9.00	9.76	1xM10	3.37	5.50	4.60	8.10	8.10	9.76	
H1R 90x90x60x2.5	4	3.64	2.29	10.13	9.00	9.76	1xM10	1.32	7.50	2.29	10.13	10.13	9.76	
H1R 125x125x45x2.5	5	4.54	1.31	4.86	6.00	4.70	1xM8	1.37	5.63	1.31	4.86	8.10	4.70	
H1R 150x150x60x2.5	10	9.09	4.47	6.08	9.00	9.76	1xM10	3.14	7.50	4.47	6.08	10.13	9.76	
H1R 105x105x90x2.5	14	12.72	9.49	36.45	27.50	27.50	3xM12	2.71	11.25	9.49	36.45	36.45	27.50	
H2R 80x50x80	10	9.09	5.25	9.72	13.39	13.39	1xM12	3.06	8.00	5.25	9.72	5.83	13.39	
H2R 80x60x60	8	7.27	4.36	9.72	13.39	13.39	1xM12	2.82	6.00	4.36	9.72	5.83	13.39	
H2R 120x60x80	18	16.36	8.09	10.13	9.00	9.76	1xM10	5.38	10.00	8.09	10.13	6.08	9.76	
H2R 100x60x75	9	8.18	4.28	10.13	9.00	9.76	1xM10	2.99	9.38	4.28	10.13	6.08	9.76	
H2R 120x60x75	12	10.91	5.39	10.13	9.00	9.76	1xM10	3.69	9.38	5.39	10.13	6.08	9.76	
H2R 140x60x75	13	11.82	5.74	10.13	9.00	9.76	1xM10	4.37	9.38	5.74	10.13	6.08	9.76	
H2R 160x60x75	13	11.82	5.74	10.13	9.00	9.76	1xM10	4.90	9.38	5.74	10.13	6.08	9.76	
H2R1s 75x48	7	6.36	6.42	6.08	9.00	9.76	1xM10	3.25	4.88	6.42	6.08	6.08	9.76	
H2R2s 75x48	7	6.36	6.42	6.08	9.00	9.76	1xM10	3.25	4.88	6.42	6.08	6.08	9.76	

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

A8.6 2-Pan & 3-Pan – Timber to Concrete Connection

Table A 8-13 Standard Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection

Load applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
2-Pan 30 x 65 x 30	1	0.91	0.91	0.91	2xM8	3.00	0.49	0.91
2-Pan 40 x 65 x 30	2	0.91	0.91	6.45	2xM8	0.86	3.00	6.45
2-Pan 50 x 65 x 30	1	0.91	0.91	6.45	2xM8	0.61	3.00	6.45
2-Pan 60 x 65 x 30	2	0.91	0.91	6.45	2xM8	1.06	3.00	6.45
2-Pan 70 x 65 x 30	2	0.91	0.91	6.45	2xM8	0.85	3.00	6.45
2-Pan 80 x 65 x 30	3	0.91	0.91	6.45	2xM8	1.26	3.00	6.45
2-Pan 90 x 65 x 30	4	1.17	1.17	6.45	2xM8	1.68	3.00	6.45
2-Pan 100 x 65 x 30	4	0.94	0.94	6.45	2xM8	1.47	3.00	6.45
2-Pan 110 x 65 x 30	5	1.39	1.39	6.45	2xM8	1.88	3.00	6.45
2-Pan 120 x 65 x 30	6	1.80	1.80	6.45	2xM8	2.30	3.00	6.45
2-Pan 130 x 65 x 30	6	1.53	1.53	6.45	2xM8	2.09	3.00	6.45
2-Pan 140 x 65 x 30	7	2.25	2.25	6.45	2xM8	2.50	3.00	6.45
2-Pan 150 x 65 x 30	8	2.74	2.74	6.45	2xM8	2.91	3.00	6.45
2-Pan 160 x 65 x 30	8	2.41	2.41	6.45	2xM8	2.70	3.00	6.45

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-14 Standard Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

Load applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
2-Pan 30 x 65 x 30	1	2.23	2.23	2.23	2xM8	3.00	1.33	2.23
2-Pan 40 x 65 x 30	2	2.23	2.23	6.45	2xM8	2.32	3.00	6.45
2-Pan 50 x 65 x 30	1	2.23	2.23	6.45	2xM8	1.66	3.00	6.45
2-Pan 60 x 65 x 30	2	2.23	2.23	6.45	2xM8	2.86	3.00	6.45
2-Pan 70 x 65 x 30	2	2.23	2.23	6.45	2xM8	2.29	3.00	6.45
2-Pan 80 x 65 x 30	3	2.23	2.23	6.45	2xM8	3.00	3.00	6.45
2-Pan 90 x 65 x 30	4	2.87	2.87	6.45	2xM8	3.00	3.00	6.45
2-Pan 100 x 65 x 30	4	2.32	2.32	6.45	2xM8	3.00	3.00	6.45
2-Pan 110 x 65 x 30	5	3.42	3.42	6.45	2xM8	3.00	3.00	6.45
2-Pan 120 x 65 x 30	6	4.42	4.42	6.45	2xM8	3.00	3.00	6.45
2-Pan 130 x 65 x 30	6	3.77	3.77	6.45	2xM8	3.00	3.00	6.45
2-Pan 140 x 65 x 30	7	5.53	5.53	6.45	2xM8	3.00	3.00	6.45
2-Pan 150 x 65 x 30	8	6.45	6.45	6.45	2xM8	3.00	3.00	6.45
2-Pan 160 x 65 x 30	8	5.90	5.90	6.45	2xM8	3.00	3.00	6.45

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-15 Detailed Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection

Load applied to	Plate 1 - Timber						Plate 2 - Concrete							
Failure Mode	Nails (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete			
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]	
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity	
2-Pan 30 x 65 x 30	1	0.91	0.91	12.96	6.45	6.45	2xM8	0.49	3.00	0.91	12.96	12.96	6.45	
2-Pan 40 x 65 x 30	2	1.82	0.91	12.96	6.45	6.45	2xM8	0.86	3.00	0.91	12.96	13.77	6.45	
2-Pan 50 x 65 x 30	1	0.91	0.91	7.78	6.45	6.45	2xM8	0.61	3.00	0.91	7.78	13.77	6.45	
2-Pan 60 x 65 x 30	2	0.91	0.91	7.78	6.45	6.45	2xM8	1.06	3.00	0.91	7.78	13.77	6.45	
2-Pan 70 x 65 x 30	2	0.91	0.91	12.96	6.45	6.45	2xM8	0.85	3.00	0.91	12.96	13.77	6.45	
2-Pan 80 x 65 x 30	3	1.82	0.91	12.96	6.45	6.45	2xM8	1.26	3.00	0.91	12.96	8.26	6.45	
2-Pan 90 x 65 x 30	4	2.73	1.17	12.96	6.45	6.45	2xM8	1.68	3.00	1.17	12.96	8.26	6.45	
2-Pan 100 x 65 x 30	4	2.73	0.94	12.96	6.45	6.45	2xM8	1.47	3.00	0.94	12.96	8.26	6.45	
2-Pan 110 x 65 x 30	5	3.64	1.39	12.96	6.45	6.45	2xM8	1.88	3.00	1.39	12.96	8.26	6.45	
2-Pan 120 x 65 x 30	6	4.54	1.80	12.96	6.45	6.45	2xM8	2.30	3.00	1.80	12.96	8.26	6.45	
2-Pan 130 x 65 x 30	6	4.54	1.53	12.96	6.45	6.45	2xM8	2.09	3.00	1.53	12.96	8.26	6.45	
2-Pan 140 x 65 x 30	7	5.45	2.25	12.96	6.45	6.45	2xM8	2.50	3.00	2.25	12.96	8.26	6.45	
2-Pan 150 x 65 x 30	8	6.36	2.74	12.96	6.45	6.45	2xM8	2.91	3.00	2.74	12.96	13.77	6.45	
2-Pan 160 x 65 x 30	8	6.36	2.41	12.96	6.45	6.45	2xM8	2.70	3.00	2.41	12.96	13.77	6.45	

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-16 Detailed Load-carrying Capacities – 2-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

Load applied to	Plate 1 - Timber						Plate 2 - Concrete							
Failure Mode	Screws (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete			
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]	
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity	
2-Pan 30 x 65 x 30	1	2.23	2.23	12.96	6.45	6.45	2xM8	1.33	3.00	2.23	12.96	12.96	6.45	
2-Pan 40 x 65 x 30	2	4.46	2.23	12.96	6.45	6.45	2xM8	2.32	3.00	2.23	12.96	12.96	6.45	
2-Pan 50 x 65 x 30	1	2.23	2.23	7.78	6.45	6.45	2xM8	1.66	3.00	2.23	7.78	12.96	6.45	
2-Pan 60 x 65 x 30	2	4.46	2.23	7.78	6.45	6.45	2xM8	2.86	3.00	2.23	7.78	12.96	6.45	
2-Pan 70 x 65 x 30	2	4.46	2.23	12.96	6.45	6.45	2xM8	2.29	3.00	2.23	12.96	12.96	6.45	
2-Pan 80 x 65 x 30	3	6.69	2.23	12.96	6.45	6.45	2xM8	3.40	3.00	2.23	12.96	7.78	6.45	
2-Pan 90 x 65 x 30	4	8.92	2.87	12.96	6.45	6.45	2xM8	4.55	3.00	2.87	12.96	7.78	6.45	
2-Pan 100 x 65 x 30	4	8.92	2.32	12.96	6.45	6.45	2xM8	3.98	3.00	2.32	12.96	7.78	6.45	
2-Pan 110 x 65 x 30	5	11.15	3.42	12.96	6.45	6.45	2xM8	5.09	3.00	3.42	12.96	7.78	6.45	
2-Pan 120 x 65 x 30	6	13.38	4.42	12.96	6.45	6.45	2xM8	6.23	3.00	4.42	12.96	7.78	6.45	
2-Pan 130 x 65 x 30	6	13.38	3.77	12.96	6.45	6.45	2xM8	5.66	3.00	3.77	12.96	7.78	6.45	
2-Pan 140 x 65 x 30	7	15.61	5.53	12.96	6.45	6.45	2xM8	6.76	3.00	5.53	12.96	7.78	6.45	
2-Pan 150 x 65 x 30	8	17.84	6.71	12.96	6.45	6.45	2xM8	7.89	3.00	6.71	12.96	12.96	6.45	
2-Pan 160 x 65 x 30	8	17.84	5.90	12.96	6.45	6.45	2xM8	7.33	3.00	5.90	12.96	12.96	6.45	

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-17 Standard Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection

Load applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Nails (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
3-Pan 55 x 70 x 30	1	0.91	0.91	0.91	2xM8	3.00	0.46	0.91
3-Pan 65 x 70 x 30	2	0.91	0.91	6.45	2xM8	0.88	3.00	6.45
3-Pan 75 x 70 x 30	2	0.91	0.91	6.45	2xM8	0.72	3.00	6.45
3-Pan 85 x 70 x 30	3	0.91	0.91	6.45	2xM8	1.12	3.00	6.45
3-Pan 95 x 70 x 30	4	1.10	1.10	6.45	2xM8	1.54	3.00	6.45
3-Pan 105 x 70 x 30	4	0.91	0.91	6.45	2xM8	1.35	3.00	6.45
3-Pan 115 x 70 x 30	5	1.32	1.32	6.45	2xM8	1.75	3.00	6.45
3-Pan 125 x 70 x 30	6	1.70	1.70	6.45	2xM8	2.16	3.00	6.45
3-Pan 135 x 70 x 30	6	1.47	1.47	6.45	2xM8	1.98	3.00	6.45
3-Pan 145 x 70 x 30	7	2.14	2.14	6.45	2xM8	2.38	3.00	6.45
3-Pan 155 x 70 x 30	8	2.59	2.59	6.45	2xM8	2.79	3.00	6.45
3-Pan 165 x 70 x 30	8	2.30	2.30	6.45	2xM8	2.59	3.00	6.45

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-18 Standard Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

Load Applied to	Plate 1 - Timber				Plate 2 - Concrete			
Model	Screws (1)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]	Bolts (2)	Dr_{push} [kN]	Dr_{pull} [kN]	Dw [kN]
3-Pan 55 x 70 x 30	1	2.23	2.23	2.23	2xM8	3.00	1.23	2.23
3-Pan 65 x 70 x 30	2	4.46	4.46	2.23	2xM8	3.00	2.40	2.23
3-Pan 75 x 70 x 30	2	4.46	4.46	2.23	2xM8	3.00	1.96	2.23
3-Pan 85 x 70 x 30	3	6.69	6.45	2.23	2xM8	3.00	3.04	2.23
3-Pan 95 x 70 x 30	4	8.92	6.45	2.69	2xM8	3.00	4.16	2.69
3-Pan 105 x 70 x 30	4	8.92	6.45	2.23	2xM8	3.00	3.67	2.23
3-Pan 115 x 70 x 30	5	11.15	6.45	3.24	2xM8	3.00	4.75	3.24
3-Pan 125 x 70 x 30	6	13.38	6.45	4.17	2xM8	3.00	5.87	4.17
3-Pan 135 x 70 x 30	6	13.38	6.45	3.60	2xM8	3.00	5.36	3.60
3-Pan 145 x 70 x 30	7	15.61	6.45	5.24	2xM8	3.00	6.44	5.24
3-Pan 155 x 70 x 30	8	17.84	6.45	6.36	2xM8	3.00	6.45	6.36
3-Pan 165 x 70 x 30	8	17.84	6.45	5.64	2xM8	3.00	6.45	5.64

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-19 Detailed Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Nailed Connection

Load applied to	Plate 1 - Timber						Plate 2 - Concrete						
Failure Mode	Nails (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete		
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity
3-Pan 55 x 70 x 30	1	0.91	0.91	12.96	6.45	6.45	2xM8	0.46	3.00	0.91	12.96	12.96	6.45
3-Pan 65 x 70 x 30	2	0.91	0.91	12.96	6.45	6.45	2xM8	0.88	3.00	0.91	12.96	12.96	6.45
3-Pan 75 x 70 x 30	2	0.91	0.91	7.78	6.45	6.45	2xM8	0.72	3.00	0.91	7.78	12.96	6.45
3-Pan 85 x 70 x 30	3	1.82	0.91	7.78	6.45	6.45	2xM8	1.12	3.00	0.91	7.78	12.96	6.45
3-Pan 95 x 70 x 30	4	2.73	1.10	12.96	6.45	6.45	2xM8	1.54	3.00	1.10	12.96	12.96	6.45
3-Pan 105 x 70 x 30	4	2.73	0.91	12.96	6.45	6.45	2xM8	1.35	3.00	0.91	12.96	7.78	6.45
3-Pan 115 x 70 x 30	5	3.64	1.32	12.96	6.45	6.45	2xM8	1.75	3.00	1.32	12.96	7.78	6.45
3-Pan 125 x 70 x 30	6	4.54	1.70	12.96	6.45	6.45	2xM8	2.16	3.00	1.70	12.96	7.78	6.45
3-Pan 135 x 70 x 30	6	4.54	1.47	12.96	6.45	6.45	2xM8	1.98	3.00	1.47	12.96	7.78	6.45
3-Pan 145 x 70 x 30	7	5.45	2.14	12.96	6.45	6.45	2xM8	2.38	3.00	2.14	12.96	7.78	6.45
3-Pan 155 x 70 x 30	8	6.36	2.59	12.96	6.45	6.45	2xM8	2.79	3.00	2.59	12.96	7.78	6.45
3-Pan 165 x 70 x 30	8	6.36	2.30	12.96	6.45	6.45	2xM8	2.59	3.00	2.30	12.96	7.78	6.45

(1) 4.0x40mm threaded nails – C24 timber members

(2) SPIT FIX II expansion bolts

Table A 8-20 Detailed Load-carrying Capacities – 3-Pan Angle Brackets – Timber [1] to Concrete [2] – Screwed Connection

Load applied to	Plate 1 - Timber						Plate 2 - Concrete						
Failure Mode	Screws (1)	Connection to timber		Connection to concrete			Bolts (2)	Connection to timber			Connection to concrete		
		Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]		Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]
		Pull/push Plate 2	Lateral Plate 2	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity		Tension Plate 2	Push Plate 2	Lateral Plate 2	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity
3-Pan 55 x 70 x 30	1	2.23	2.23	12.96	6.45	6.45	2xM8	1.23	3.00	2.23	12.96	12.96	6.45
3-Pan 65 x 70 x 30	2	4.46	2.23	12.96	6.45	6.45	2xM8	2.40	3.00	2.23	12.96	25.92	6.45
3-Pan 75 x 70 x 30	2	4.46	2.23	7.78	6.45	6.45	2xM8	1.96	3.00	2.23	7.78	38.88	6.45
3-Pan 85 x 70 x 30	3	6.69	2.23	7.78	6.45	6.45	2xM8	3.04	3.00	2.23	7.78	51.84	6.45
3-Pan 95 x 70 x 30	4	8.92	2.69	12.96	6.45	6.45	2xM8	4.16	3.00	2.69	12.96	64.80	6.45
3-Pan 105 x 70 x 30	4	8.92	2.23	12.96	6.45	6.45	2xM8	3.67	3.00	2.23	12.96	77.76	6.45
3-Pan 115 x 70 x 30	5	11.15	3.24	12.96	6.45	6.45	2xM8	4.75	3.00	3.24	12.96	90.72	6.45
3-Pan 125 x 70 x 30	6	13.38	4.17	12.96	6.45	6.45	2xM8	5.87	3.00	4.17	12.96	103.68	6.45
3-Pan 135 x 70 x 30	6	13.38	3.60	12.96	6.45	6.45	2xM8	5.36	3.00	3.60	12.96	116.64	6.45
3-Pan 145 x 70 x 30	7	15.61	5.24	12.96	6.45	6.45	2xM8	6.44	3.00	5.24	12.96	129.60	6.45
3-Pan 155 x 70 x 30	8	17.84	6.36	12.96	6.45	6.45	2xM8	7.55	3.00	6.36	12.96	142.56	6.45
3-Pan 165 x 70 x 30	8	17.84	5.64	12.96	6.45	6.45	2xM8	7.03	3.00	5.64	12.96	155.52	6.45

(1) CSA5,0X35 Simpson Strong-Tie screws – C24 timber members

(2) SPIT FIX II expansion bolts

A8.7 Angle Brackets Series I – Method for Adjusting Load-carrying Capacities

This section describes the method for determining load-carrying capacities of Series I Angle Brackets for alternative grades and/or fasteners by determining appropriate modification factors for:

- the selected grade and/or fastener(s)
- each of the failure modes of the relevant connection configuration

and applying them by multiplication to the detailed load-carrying capacities in the relevant tables in Annex 8 above.

For each plate and each load direction the minimum value obtained for the corresponding failure modes after applying the adjustment factors provides the characteristic load-carrying capacity for this plate and load direction.

The modification factors for calculating alternative load-carrying capacities of Series I Angle Brackets are given in:

Table A 8-21 Modification Factors of Load-carrying Capacities – Series I Angle Brackets – Timber to Timber

Table A 8-22 Modification Factors of Load-carrying Capacities – Series I Angle Brackets – Timber to Concrete

For connector-to-concrete connections, the bolt shear capacity can be determined in accordance with ETAG 001 Annex C and the corresponding ETA for the bolt. To help the user to determine the appropriate concrete cone area, approximate distances between bolts for Series I Angle Brackets are listed in Table A 8-23.

For more accurate designs, it is recommended to determine the bolt distances manually.

Table A 8-21 Modification Factors of Load-carrying Capacities – Series I Angle Brackets – Timber to Timber

Load applied to	Plate 1 - Timber				Plate 2 - Timber			
Failure Mode	Connection to timber				Connection to timber			
	Dr [kN]			Dw [kN]	Dr [kN]			Dw [kN]
	Tension Plate 2	Pull/push Plate 1	Push Plate 2	Lateral	Tension Plate 1	Pull/push Plate 2	Push Plate 1	Lateral
Alternative timber density (ρ_k in kg/m^3)	(ρ_k /350)^2	ρ_k /350			(ρ_k /350)^2	ρ_k /350		
Alternative nail shear capacity ($F_{lat,Rk}$ in kN)	-	$F_{lat,Rk}$ /0.9			-	$F_{lat,Rk}$ /0.9		
Alternative nail withdrawal capacity ($F_{ax,Rk}$ in kN)	$F_{ax,Rk}$ /0.61	-			$F_{ax,Rk}$ /0.61	-		
Alternative screw shear capacity ($F_{lat,Rk}$ in kN)	-	$F_{lat,Rk}$ /2.23			-	$F_{lat,Rk}$ /2.23		
Alternative screw withdrawal capacity ($F_{ax,Rk}$ in kN)	$F_{ax,Rk}$ /1.66	-			$F_{ax,Rk}$ /1.66	-		

Note: where e.g. $F_{ax,Rk}$/0.61 is indicated, $F_{ax,Rk}$ is the characteristic of the alternative component and ($F_{ax,Rk}$/0.61) is the modification factor used to multiply the standard load-carrying capacity for that failure mode.

Table A 8-22 Modification Factors of Load-carrying Capacities – Series I Angle Brackets – Timber to Concrete

Load applied to	Plate in Contact with Timber					Plate in contact with Concrete					
Failure Mode	Connection to timber		Connection to concrete			Connection to timber			Connection to concrete		
	Dr [kN]	Dw [kN]	Dw [kN]	Dr [kN]	Dw [kN]	Dr [kN]		Dw [kN]	Dw [kN]	Dr [kN]	Dr or Dw [kN]
	Pull/push Plate / Timber	Lateral Plate / Timber	Plate bearing resistance	Bolt tension capacity	Bolt shear capacity	Tension Plate / Timber	Push Plate / Timber	Lateral Plate / Timber	Plate bearing resistance	Plate bearing resistance	Bolt shear capacity
Alternative timber density (ρ_k in kg/m^3)	$\rho_k/350$		-	-	-	$(\rho_k/350)^2$	$\rho_k/350$		-		-
Alternative nail shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}/0.9$		-	-	-	-	$F_{lat,Rk}/0.9$		-		-
Alternative nail withdrawal capacity ($F_{ax,Rk}$ in kN)	-		-	-	-	$F_{ax,Rk}/0.61$	-		-		-
Alternative screw shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}/2.23$		-	-	-	-	$F_{lat,Rk}/2.23$		-		-
Alternative screw withdrawal capacity ($F_{ax,Rk}$ in kN)	-		-	-	-	$F_{ax,Rk}/1.66$	-		-		-
Alternative bolt diameter (d in mm, with d_{ref} = diameter of the prescribed bolt)	-		d/d_{ref}	-	-	-	-		d/d_{ref}		-

Note: where e.g. $F_{ax,Rk}/0.61$ is indicated, $F_{ax,Rk}$ is the characteristic of the alternative component and the result of ($F_{ax,Rk}/0.61$) is the modification factor used to multiply the Standard load-carrying capacity for that failure mode.

A8.8 Bolt Hole Distances – Series I Angle Brackets

Table A 8-23 Approximate Distances between Bolts for Series I Angle Brackets

Series	Product	*d*1 (mm)	*d*2 (mm)
H1R	H1R 105x105x90x2.5 (plate 1)	60	62.5
H2R	H2R 140x60x75 (plate 2)	67.5	
	H2R 160x60x75 (plate 2)	67.5	
2-Pan	2-Pan 30 x 65 x 30	18	
	2-Pan 40 x 65 x 30	18	
	2-Pan 50 x 65 x 30	18	
	2-Pan 60 x 65 x 30	18	
	2-Pan 70 x 65 x 30	18	
	2-Pan 80 x 65 x 30	18	
	2-Pan 90 x 65 x 30	18	
	2-Pan 100 x 65 x 30	18	
	2-Pan 110 x 65 x 30	18	
	2-Pan 120 x 65 x 30	18	
	2-Pan 130 x 65 x 30	18	
	2-Pan 140 x 65 x 30	18	
	2-Pan 150 x 65 x 30	18	
	2-Pan 160 x 65 x 30	18	
3-Pan	3-Pan 55 x 70 x 30	18	
	3-Pan 65 x 70 x 30	18	
	3-Pan 75 x 70 x 30	18	
	3-Pan 85 x 70 x 30	18	
	3-Pan 95 x 70 x 30	18	
	3-Pan 105 x 70 x 30	18	
	3-Pan 115 x 70 x 30	18	
	3-Pan 125 x 70 x 30	18	
	3-Pan 135 x 70 x 30	18	
	3-Pan 145 x 70 x 30	18	
	3-Pan 155 x 70 x 30	18	
	3-Pan 165 x 70 x 30	18	

Note: Only Angle Brackets with multiple bolt holes in one or both of their plates are shown.

ANNEX 9 ANGLE BRACKETS – SERIES II - LOAD-CARRYING CAPACITIES

A9.1 Tabulated Values

The calculated load-carrying capacities for Series II angle brackets are presented in the following tables for both timber to timber and timber to concrete connections.

Load-carrying Capacities for timber substrates are presented both for nailed connections, using threaded nails as defined in Annex 6 §A6.4, and for screwed connections, using CSA5,0X35 Simpson Strong-Tie screws as defined in Annex 6 §A6.5, as described in the tables.

Load carrying capacities for concrete substrates are presented for bolted connections using SPIT FIX 3 expansion bolts covered by ETA-13/0005 as described in Annex 6 §A6.6. The bolt dimensions depend on the diameter of the bolt hole in the angle bracket.

The notation for the load directions used in the tables is defined in Annex 7 Figure A 7-1.

Tables are presented in two configurations:

- **Standard load-carrying capacities**. These capacities have been calculated for standard angle bracket sizes and prescribed standard fasteners (as described above) and allow a direct reading of the load-carrying capacity in each direction for the load applied to each plate.

  The notation used in the tables of standard load-carrying capacities is as follows:

Variables	
F	connection capacity, as defined by subscripts
Subscripts	
x, y, z	x, y or z-direction
push, pull	compression or tension
k	characteristic value

- **Detailed load-carrying capacities by failure mode**. These capacities have been calculated for standard angle bracket sizes and prescribed standard fasteners (as described above) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

  The notation used in the tables of detailed load-carrying capacities is as follows:

Variables	
V	connection capacity in shear, as defined by subscripts
T, C	connection capacity in tension or compression, as defined by subscripts
P	connection capacity in clamping pressure, as defined by subscripts
Subscripts	
rot	load is rotational i.e. lateral (non-centred). If absent, assume an axial (centred) load
bolt	applies to a bolted connection
x, y, z	x, y or z-direction
k	characteristic value
1, 2	plate 1 or plate 2 of the connector

The method for determining capacities of Series II angle brackets for alternative grades and/or fasteners is described in §A9.21.1.

A9.2 Standard Load-carrying Capacities - Tables

A9.3 Detailed Load-carrying Capacities - Tables

A9.4 Angle Brackets II - Drempelhoek & Drempelhoek DLD – Timber to Timber

Table A 9-1 Standard Load-carrying Capacities - Drempelhoek & Drempelhoek DLD – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Drempelhoek	100x100x20	2x 6.0x40	2x 6.0x40	1.56	1.68	4.00	1.68	4.00
	125x125x20			2.02	1.56	4.00	1.56	4.00
	150x150x25			2.29	1.56	4.33	1.56	4.33
	175x175x25			2.55	1.50	4.33	1.50	4.33
	200x200x25	3x 6.0x40	3x 6.0x40	2.75	2.25	5.00	2.25	5.00
	250x250x30			3.55	2.22	6.75	2.22	6.75
	300x300x30			3.78	2.16	6.75	2.16	6.75
Drempelhoek DLD	100x100x20	2x 6.0x40	2x 6.0x40	1.80	1.68	4.00	1.68	4.00
	120x120x20			2.16	1.57	4.00	1.57	4.00
	140x140x20			2.44	1.51	4.00	1.51	4.00
	160x160x20	3x 6.0x40	3x 6.0x40	2.70	2.36	4.00	2.36	4.00
	180x180x20			2.81	2.24	4.00	2.24	4.00

Table A 9-2 Detailed Load-carrying Capacities - Drempelhoek & Drempelhoek DLD – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Drempelhoek	100x100x20	4.33	1.56	1.68	4.00	4.33	1.56	1.68	4.00
	125x125x20	4.33	2.02	1.56	4.00	4.33	2.02	1.56	4.00
	150x150x25	4.33	2.29	1.56	5.00	4.33	2.29	1.56	5.00
	175x175x25	4.33	2.55	1.50	5.00	4.33	2.55	1.50	5.00
	200x200x25	6.49	2.75	2.25	5.00	6.49	2.75	2.25	5.00
	250x250x30	7.57	3.55	2.22	6.75	7.57	3.55	2.22	6.75
	300x300x30	7.57	3.78	2.16	6.75	7.57	3.78	2.16	6.75
Drempelhoek DLD	100x100x20	4.33	1.80	1.68	4.00	4.33	1.80	1.68	4.00
	120x120x20	4.33	2.16	1.57	4.00	4.33	2.16	1.57	4.00
	140x140x20	4.33	2.44	1.51	4.00	4.33	2.44	1.51	4.00
	160x160x20	6.49	2.70	2.36	4.00	6.49	2.70	2.36	4.00
	180x180x20	6.49	2.81	2.24	4.00	6.49	2.81	2.24	4.00

A9.5 Hoek & Hoek 135° – Timber to Timber

Table A 9-3 Standard Load-carrying Capacities - Hoek & Hoek 135° – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoek	55x20x45 (SR)	2x 5.0x40	2x 5.0x40	1.06	1.05	1.50	0.90	1.50
	55x20x75 (SR)	3x 5.0x40	2x 5.0x40	1.06	0.90	1.50	1.50	1.50
	55x20x105 (SR)	4x 5.0x40	2x 5.0x40	1.06	0.90	1.50	1.95	1.50
	45x40x50 (2R)	4x 5.0x40	4x 5.0x40	4.21	2.10	3.00	2.31	3.00
	45x40x106 (2R)	8x 5.0x40	4x 5.0x40	4.21	2.10	3.00	3.90	3.00
	45x40x150 (2R)	10x 5.0x40	4x 5.0x40	4.21	2.10	3.00	4.96	3.00
Hoek 135°	70x70x55 135°	10x 5.0x40	10x 5.0x40	8.88	5.94	5.50	5.94	5.50
	90x90x60 135°	4x 4.0x35	4x 4.0x35	2.29	0.96	3.64	0.96	3.64
		4x 6.0x40	5x 6.0x40	5.25	4.00	5.79	3.89	6.00
	50x50x35 135°	4x 5.0x40	4x 5.0x40	2.44	2.16	4.38	2.16	4.38

(SR) small rib at an angle

(2R) 2 ribs on either face

Table A 9-4 Detailed Load-carrying Capacities - Hoek & Hoek 135° – Timber to Timber

Detailed Capacities			Timber [1]				Timber [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoek	55x20x45 (SR)		2.48	1.06	0.90	1.50	2.48	1.49	1.05	1.50
	55x20x75 (SR)		3.72	1.86	1.50	1.50	2.48	1.06	0.90	1.50
	55x20x105 (SR)		4.96	2.70	1.95	1.50	2.48	1.06	0.90	1.50
	45x40x50 (2R)		4.96	4.21	2.31	3.00	4.96	4.21	2.10	3.00
	45x40x106 (2R)		9.92	6.06	3.90	3.00	4.96	4.21	2.10	3.00
	45x40x150 (2R)		12.40	6.76	5.27	3.00	4.96	4.21	2.10	3.00
Hoek 135°	70x70x55 135°		12.40	8.88	5.94	5.50	12.40	8.88	5.94	5.50
	90x90x60 135°	(a)	3.64	2.29	0.96	6.00	3.64	2.29	0.96	6.00
		(b)	5.79	5.25	3.89	6.00	7.24	5.40	4.00	6.00
	50x50x35 135°		4.96	2.44	2.16	4.38	4.96	2.44	2.16	4.38

A9.6 Hoekanker – Timber To Timber

Table A 9-5 Standard Load-carrying Capacities - Hoekanker – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker	55x55x50x1.5	6x 5.0x40	6x 5.0x40	5.83	3.38	3.75	3.24	3.75
	50x50x35x2.5	4x 5.0x40	4x 5.0x40	2.44	2.16	4.38	2.16	4.38
	50x50x57x2.5	6x 5.0x40	6x 5.0x40	6.17	4.32	7.13	4.32	7.13
	70x70x30x2.0	5x 5.0x40	5x 5.0x40	2.77	2.70	3.00	2.70	3.00
	70x70x55x2.0	10x 5.0x40	10x 5.0x40	8.88	5.94	5.50	5.94	5.50
	40x100x60x2.5	8x 4.0x35	4x 4.0x35	3.64	1.54	7.50	2.33	4.09
	40x60x60x2.0	5x 4.0x35	5x 4.0x35	3.05	1.36	4.54	1.18	4.54
	40x60x60x2.5	5x 4.0x35	5x 4.0x35	3.42	1.49	5.11	1.21	5.11
	90x90x60x2.0	4x 4.0x35	4x 4.0x35	2.29	0.96	3.64	0.96	3.64
		4x 6.0x40	5x 6.0x40	5.25	4.00	5.79	3.89	6.00
	90x90x60x2.5	4x 4.0x35	4x 4.0x35	2.57	1.03	4.09	1.03	4.09
		4x 6.0x40	5x 6.0x40	4.92	4.07	5.79	3.95	7.24
	150x90x60x2.5	7x 4.0x35	3x 4.0x35	2.22	0.89	7.15	2.04	3.06
		5x 6.0x40	3x 6.0x40	3.16	2.39	7.24	3.63	4.35
	105x105x90x2.5	10x 5.0x40	14x 5.0x40	6.26	8.33	11.25	4.52	11.25
	125x125x45x2.5	5x 4.0x35	5x 4.0x35	1.71	1.10	5.11	1.10	5.11
	125x125x55x2.5	8x 4.0x35	8x 4.0x35	3.41	1.98	6.88	1.98	6.88
	150x150x60x2.5	10x 4.0x35	10x 4.0x35	5.03	2.46	7.50	2.46	7.50
	60x60x40x2.0 (2SR)	4x 5.0x40	6x 5.0x40	1.94	3.39	4.00	1.80	4.00

(2SR) 2 small ribs

Table A 9-6 Detailed Load-carrying Capacities - Hoekanker – Timber to Timber

Detailed Capacities			Timber [1]				Timber [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoekanker	55x55x50x1.5		7.44	7.03	3.24	3.75	7.44	5.83	3.38	3.75
	50x50x35x2.5		4.96	2.44	2.16	4.38	4.96	2.44	2.16	4.38
	50x50x57x2.5		7.44	6.17	4.32	7.13	7.44	6.17	4.32	7.13
	70x70x30x2.0		6.20	2.77	2.70	3.00	6.20	2.77	2.70	3.00
	70x70x55x2.0		12.40	8.88	5.94	5.50	12.40	8.88	5.94	5.50
	40x100x60x2.5		8.17	5.22	2.33	7.50	4.09	3.64	1.54	7.50
	40x60x60x2.0		4.54	3.09	1.18	6.00	4.54	3.05	1.36	6.00
	40x60x60x2.5		5.11	3.48	1.21	7.50	5.11	3.42	1.49	7.50
	90x90x60x2.0	(a)	3.64	2.29	0.96	6.00	3.64	2.29	0.96	6.00
		(b)	5.79	5.25	3.89	6.00	7.24	5.34	4.00	6.00
	90x90x60x2.5	(a)	4.09	2.57	1.03	7.50	4.09	2.57	1.03	7.50
		(b)	5.79	4.92	3.95	7.50	7.24	5.14	4.07	7.50
	150x90x60x2.5	(a)	7.15	3.60	2.04	7.50	3.06	2.22	0.89	7.50
		(b)	7.24	4.32	3.63	7.50	4.35	3.16	2.39	7.50
	105x105x90x2.5		12.40	6.26	4.52	11.25	17.35	13.07	8.33	11.25
	125x125x45x2.5		5.11	1.71	1.10	5.63	5.11	1.71	1.10	5.63
	125x125x55x2.5		8.17	3.41	1.98	6.88	8.17	3.41	1.98	6.88
	150x150x60x2.5		10.21	5.03	2.46	7.50	10.21	5.03	2.46	7.50
	60x60x40x2.0 (2SR)		4.96	1.94	1.80	4.00	7.44	4.42	3.39	4.00

A9.7 Hoekanker met Ril & Hoekanker met 2 Rillen – Timber To Timber

Table A 9-7 Standard Load-carrying Capacities - Hoekanker met Ril & Hoekanker met 2 Rillen – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker met ril	90x90x60x2.0 (1R)	4x 4.0x35	4x 4.0x35	2.29	0.96	3.64	0.96	3.64
		4x 6.0x40	4x 6.0x40	4.92	3.96	5.79	3.85	6.00
	125x125x55x2.5 (1R)	4x 4.0x35	4x 4.0x35	3.33	1.94	6.88	1.94	6.88
	60x80x60x2.5 (1R)	2x 4.0x35	2x 4.0x35	0.95	0.75	2.04	0.67	2.04
		4x 6.0x40	4x 6.0x40	4.36	3.30	5.79	3.18	5.79
	60x120x60x2.5 (1R)	4x 4.0x35	2x 4.0x35	1.23	0.75	4.09	1.12	2.04
		7x 6.0x40	4x 6.0x40	4.73	3.30	7.34	4.86	5.79
	60x180x60x2.5 (1R)	6x 4.0x35	2x 4.0x35	1.23	0.75	6.13	1.70	2.04
		10x 6.0x40	4x 6.0x40	4.73	3.30	7.34	5.79	5.79
	150x90x60x2.5 (1R)	7x 4.0x35	3x 4.0x35	2.22	0.89	7.13	2.04	3.06
		5x 6.0x40	3x 6.0x40	3.16	2.39	7.13	3.63	4.35
Hoekanker met 2 rillen	80x60x60x1.5 (2R)	8x 5.0x40	6x 5.0x40	4.98	2.98	4.50	3.89	4.50
	78x50x55x1.5 (2R)	7x 5.0x40	4x 5.0x40	2.58	1.65	4.13	1.91	4.13

(1R) 1 rib on either face

(2R) 2 ribs on either face

Table A 9-8 Detailed Load-carrying Capacities- Hoekanker met Ril & Hoekanker met 2 Rillen – Timber to Timber

Detailed Capacities			Timber [1]				Timber [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoekanker met ril	90x90x60x2.0 (1R)	(a)	3.64	2.29	0.96	6.00	3.64	2.29	0.96	6.00
		(b)	5.79	4.92	3.85	6.00	7.24	5.14	3.96	6.00
	125x125x55x2.5 (1R)		8.17	3.33	1.94	6.88	8.17	3.33	1.94	6.88
	60x80x60x2.5 (1R)	(a)	2.04	0.95	0.67	7.34	2.04	1.23	0.75	7.34
		(b)	5.79	4.36	3.18	7.34	5.79	4.73	3.30	7.34
	60x120x60x2.5 (1R)	(a)	4.09	1.91	1.12	7.34	2.04	1.23	0.75	7.34
		(b)	10.14	5.51	4.86	7.34	5.79	4.73	3.30	7.34
	60x180x60x2.5 (1R)	(a)	6.13	2.79	1.70	7.34	2.04	1.23	0.75	7.34
		(b)	14.49	7.12	7.12	7.34	5.79	4.73	3.30	7.34
	150x90x60x2.5 (1R)	(a)	7.15	3.60	2.04	7.13	3.06	2.22	0.89	7.13
		(b)	7.24	4.32	3.63	7.13	4.35	3.16	2.39	7.13
Hoekanker met 2 rillen	80x60x60x1.5 (2R)		9.92	5.93	3.89	4.50	7.44	4.98	2.98	4.50
	78x50x55x1.5 (2R)		8.68	2.80	1.91	4.13	4.96	2.58	1.65	4.13

A9.8 Hoekanker met 3 Rillen – Timber to Timber

Table A 9-9 Standard Load-carrying Capacities - Hoekanker met 3 Rillen – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker met 3 rillen	60x50x63x2.5 (3R)	6x 5.0x40	2x 8.0x60	3.06	4.61	5.45	0.00 (1)	0.00 (1)
	80x50x63x2.5 (3R)			3.43	4.61	6.13		
	100x50x63x2.5 (3R)			3.43	4.61	6.13		
	120x50x63x2.5 (3R)			3.43	4.61	6.13		
	140x50x63x2.5 (3R)			4.96	4.61	7.81		
	160x50x63x2.5 (3R)			5.93	4.61	6.13		
	180x50x63x2.5 (3R)			7.64	4.61	6.13		
	200x50x63x2.5 (3R)			3.71	4.61	5.45		
	220x50x63x2.5 (3R)			4.17	4.61	6.13		
	240x50x63x2.5 (3R)			5.08	4.61	7.81		
	260x50x63x2.5 (3R)			5.08	4.61	7.81		
	280x50x63x2.5 (3R)			3.49	4.61	5.45		
	300x50x63x2.5 (3R)			3.92	4.61	6.13		
	320x50x63x2.5 (3R)			7.85	4.61	6.13		
	340x50x63x2.5 (3R)			7.85	4.61	6.80		
	350x50x63x2.5 (3R)			6.17	4.61	7.81		

(1) Plate [2] only has obround holes oriented in the z-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-10 Detailed Load-carrying Capacities Capacities - Hoekanker met 3 Rillen – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoekanker met 3 rillen	60x50x63x2.5 (3R)	5.45	3.06	3.51	7.81	7.85	7.85	4.61	7.81
	80x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	7.85	7.85	4.61	7.81
	100x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	7.85	7.85	4.61	7.81
	120x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	7.85	7.85	4.61	7.81
	140x50x63x2.5 (3R)	8.31	4.96	4.43	7.81	7.85	7.85	4.61	7.81
	160x50x63x2.5 (3R)	6.13	5.93	5.20	7.81	7.85	7.85	4.61	7.81
	180x50x63x2.5 (3R)	6.13	7.64	6.79	7.81	7.85	7.85	4.61	7.81
	200x50x63x2.5 (3R)	5.45	3.71	3.40	7.81	7.85	7.85	4.61	7.81
	220x50x63x2.5 (3R)	6.13	4.17	3.58	7.81	7.85	7.85	4.61	7.81
	240x50x63x2.5 (3R)	8.31	5.08	4.40	7.81	7.85	7.85	4.61	7.81
	260x50x63x2.5 (3R)	8.31	5.08	4.40	7.81	7.85	7.85	4.61	7.81
	280x50x63x2.5 (3R)	5.45	3.49	3.30	7.81	7.85	7.85	4.61	7.81
	300x50x63x2.5 (3R)	6.13	3.92	3.48	7.81	7.85	7.85	4.61	7.81
	320x50x63x2.5 (3R)	6.13	8.51	6.88	7.81	7.85	7.85	4.61	7.81
	340x50x63x2.5 (3R)	6.80	9.45	7.25	7.81	7.85	7.85	4.61	7.81
	350x50x63x2.5 (3R)	8.31	6.17	4.90	7.81	7.85	7.85	4.61	7.81

A9.9 Kruiskoppeling & Neusijzer – Timber to Timber

Table A 9-11 Standard Load-carrying Capacities - Kruiskoppeling & Neusijzer – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Kruiskoppeling	35x35x110	4x 4.0x35	4x 4.0x35	5.99	1.60	3.64	1.60	3.64
	35x35x200	6x 4.0x35	6x 4.0x35	16.41	2.24	5.45	2.24	5.45
	35x35x300	6x 4.0x35	6x 4.0x35	28.97	2.24	5.45	2.24	5.45
	50x50x260	26x 5.0x40	26x 5.0x40	63.54	14.43	26.00	14.43	26.00
Neusijzer	90° - 150x100x25	3x 6.0x40	2x 6.0x40	2.07	1.68	5.00	2.46	4.33
	135° - 150x100x25							
	90° - 150x80x25			2.05	1.86	5.00	2.46	4.33

Table A 9-12 Detailed Load-carrying Capacities - Kruiskoppeling & Neusijzer – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Kruiskoppeling	35x35x110	3.64	5.99	1.60	11.00	3.64	5.99	1.60	11.00
	35x35x200	5.45	16.41	2.24	20.00	5.45	16.41	2.24	20.00
	35x35x300	5.45	28.97	2.24	30.00	5.45	28.97	2.24	30.00
	50x50x260	32.23	63.54	14.43	26.00	32.23	63.54	14.43	26.00
Neusijzer	90° - 150x100x25	6.49	2.71	2.46	5.00	4.33	2.07	1.68	5.00
	135° - 150x100x25	6.49	2.71	2.46	5.00	4.33	2.07	1.68	5.00
	90° - 150x80x25	6.49	2.71	2.46	5.00	4.33	2.05	1.86	5.00

A9.10 Langgathoek & Langgathoek met Ril – Timber to Timber

Table A 9-13 Standard Load-carrying Capacities - Langgathoek & Langgathoek met Ril – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Langgathoek	50x55x30x2.0	4x 5.0x40	4x 5.0x40	2.08	2.40	3.00	1.80	3.00
	70x55x30x2.0	5x 5.0x40		1.95	2.06	3.00	3.06	3.00
	80x55x30x2.5	6x 5.0x40		1.95	2.40	3.75	3.76	3.75
	100x55x30x2.5			1.95	2.40	3.75	2.88	3.75
	120x55x30x3.0			1.91	2.52	4.50	2.40	4.50
	140x55x30x3.0			1.53	2.52	4.50	1.96	4.50
	160x55x30x3.0			1.27	2.52	4.50	1.66	4.50
Langgathoek met ril	50x55x30x2.0 (SR)	4x 5.0x40	4x 5.0x40	2.08	2.40	3.00	1.80	3.00
	70x55x30x2.0 (SR)	5x 5.0x40		1.95	2.06	3.00	3.06	3.00
	80x55x30x2.5 (SR)	6x 5.0x40		1.95	2.40	3.75	3.76	3.75
	100x55x30x2.5 (SR)			1.95	2.40	3.75	2.88	3.75
	120x55x30x3.0 (SR)			1.91	2.52	4.50	2.40	4.50
	140x55x30x3.0 (SR)			1.53	2.52	4.50	1.96	4.50
	160x55x30x3.0 (SR)			1.27	2.52	4.50	1.66	4.50

(SR) 1 small rib

Table A 9-14 Detailed Load-carrying Capacities - Langgathoek & Langgathoek met Ril – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Langgathoek	50x55x30x2.0	4.96	2.08	1.80	3.00	4.96	2.83	2.40	3.00
	70x55x30x2.0	6.20	2.86	3.06	3.00	4.96	1.95	2.06	3.00
	80x55x30x2.5	7.44	3.42	3.76	3.75	4.96	1.95	2.40	3.75
	100x55x30x2.5	7.44	2.28	2.88	3.75	4.96	1.95	2.40	3.75
	120x55x30x3.0	8.31	1.91	2.40	4.50	5.54	2.18	2.52	4.50
	140x55x30x3.0	8.31	1.53	1.96	4.50	5.54	2.18	2.52	4.50
	160x55x30x3.0	8.31	1.27	1.66	4.50	5.54	2.18	2.52	4.50
Langgathoek met ril	50x55x30x2.0 (SR)	4.96	2.08	1.80	3.00	4.96	2.83	2.40	3.00
	70x55x30x2.0 (SR)	6.20	2.86	3.06	3.00	4.96	1.95	2.06	3.00
	80x55x30x2.5 (SR)	7.44	3.42	3.76	3.75	4.96	1.95	2.40	3.75
	100x55x30x2.5 (SR)	7.44	2.28	2.88	3.75	4.96	1.95	2.40	3.75
	120x55x30x3.0 (SR)	8.31	1.91	2.40	4.50	5.54	2.18	2.52	4.50
	140x55x30x3.0 (SR)	8.31	1.53	1.96	4.50	5.54	2.18	2.52	4.50
	160x55x30x3.0 (SR)	8.31	1.27	1.66	4.50	5.54	2.18	2.52	4.50

(SR) 1 small rib

A9.11 Verbindingshoek – Timber to Timber

Table A 9-15 Standard Load-carrying Capacities - Verbindingshoek – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Verbindings-hoek	40x40x60x2.5	5x 5.0x40	5x 5.0x40	5.67	3.90	6.20	3.90	6.20
	60x60x40x2.5	6x 5.0x40	6x 5.0x40	4.42	3.86	5.00	3.86	5.00
	60x60x50x2.5	8x 5.0x40	8x 5.0x40	5.35	4.63	6.25	5.01	6.25
	60x60x60x2.5	9x 5.0x40	9x 5.0x40	8.02	5.79	7.50	5.79	7.50
	60x60x80x2.5	12x 5.0x40	12x 5.0x40	12.86	7.71	10.00	7.71	10.00
	60x60x100x2.5	15x 5.0x40	15x 5.0x40	18.72	9.64	12.50	9.64	12.50
	60x60x140x2.5	21x 5.0x40	21x 5.0x40	33.58	13.50	17.50	13.50	17.50
	75x75x40x2.0	8x 5.0x40	8x 5.0x40	5.77	4.25	4.00	4.25	4.00
	80x80x60x2.5	12x 5.0x40	12x 5.0x40	9.86	7.12	7.50	7.12	7.50
	80x80x80x2.5	16x 5.0x40	16x 5.0x40	14.28	9.49	10.00	9.49	10.00
	100x100x40x2.0	10x 5.0x40	10x 5.0x40	6.74	5.40	4.00	5.40	4.00
	100x100x60x2.5	15x 5.0x40	15x 5.0x40	11.31	8.46	7.50	8.46	7.50
	100x100x80x2.5	20x 5.0x40	20x 5.0x40	16.78	11.28	10.00	11.28	10.00
	100x100x100x2.5	25x 5.0x40	25x 5.0x40	23.35	14.10	12.50	14.10	12.50

Table A 9-16 Detailed Load-carrying Capacities - Verbindingshoek – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Verbindingshoek	40x40x60x2.5	6.20	5.67	3.90	7.50	6.20	5.67	3.90	7.50
	60x60x40x2.5	7.44	4.42	3.86	5.00	7.44	4.42	3.86	5.00
	60x60x50x2.5	9.92	7.15	5.01	6.25	8.68	5.35	4.63	6.25
	60x60x60x2.5	11.16	8.02	5.79	7.50	11.16	8.02	5.79	7.50
	60x60x80x2.5	14.88	12.86	7.71	10.00	14.88	12.86	7.71	10.00
	60x60x100x2.5	18.59	18.72	9.64	12.50	18.59	18.72	9.64	12.50
	60x60x140x2.5	26.03	33.58	13.50	17.50	26.03	33.58	13.50	17.50
	75x75x40x2.0	9.92	5.77	4.25	4.00	9.92	5.77	4.25	4.00
	80x80x60x2.5	14.88	9.86	7.12	7.50	14.88	9.86	7.12	7.50
	80x80x80x2.5	19.83	14.28	9.49	10.00	19.83	14.28	9.49	10.00
	100x100x40x2.0	12.40	6.74	5.40	4.00	12.40	6.74	5.40	4.00
	100x100x60x2.5	18.59	11.31	8.46	7.50	18.59	11.31	8.46	7.50
	100x100x80x2.5	24.79	16.78	11.28	10.00	24.79	16.78	11.28	10.00
	100x100x100x2.5	30.99	23.35	14.10	12.50	30.99	23.35	14.10	12.50

A9.12 Versterkingshoek & Versterkingshoek Ongelijkzijdig – Timber to Timber

Table A 9-17 Standard Load-carrying Capacities - Versterkingshoek & Versterkingshoek Ongelijkzijdig – Timber to Timber

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Versterkingshoek	30x30x30x2.0	2x 5.0x40	2x 5.0x40	1.54	1.58	2.48	1.58	2.48
	40x40x40x2.0	4x 5.0x40	4x 5.0x40	2.63	2.70	4.00	2.70	4.00
	60x60x60x2.0	4x 5.0x40	4x 5.0x40	3.29	2.12	4.96	2.12	4.96
	50x50x40x2.0	6x 5.0x40	6x 5.0x40	2.58	3.42	4.00	3.42	4.00
	65x65x40x4.0	4x 5.0x40	4x 5.0x40	2.91	2.84	5.44	2.84	5.44
Versterkingshoek ongelijkzijdig	100x75x30x3.0	3x 5.0x40	2x 5.0x40	1.03	1.03	4.15	1.50	2.77
	125x85x40x4.0	5x 6.0x40	4x 6.0x40	3.11	3.83	6.65	3.87	6.65
	40x25x75x2.0	2x 6.0x40	3x 6.0x40	3.32	2.90	2.90	2.59	4.35
	60x40x115x2.5	3x 6.0x40	4x 6.0x40	5.42	3.70	4.35	3.02	7.24

Table A 9-18 Detailed Load-carrying Capacities - Versterkingshoek & Versterkingshoek Ongelijkzijdig – Timber to Timber

Detailed Capacities		Timber [1]				Timber [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Versterkingshoek	30x30x30x2.0	2.48	1.54	1.58	3.00	2.48	1.54	1.58	3.00
	40x40x40x2.0	4.96	2.63	2.70	4.00	4.96	2.63	2.70	4.00
	60x60x60x2.0	4.96	3.29	2.12	6.00	4.96	3.29	2.12	6.00
	50x50x40x2.0	7.44	2.58	3.42	4.00	7.44	2.58	3.42	4.00
	65x65x40x4.0	5.44	2.91	2.84	6.65	5.44	2.91	2.84	6.65
Versterkingshoek ongelijkzijdig	100x75x30x3.0	4.15	1.59	1.50	4.50	2.77	1.03	1.03	4.50
	125x85x40x4.0	9.03	3.80	3.87	6.65	7.23	3.11	3.83	6.65
	40x25x75x2.0	2.90	4.98	2.59	7.50	4.35	3.32	2.92	7.50
	60x40x115x2.5	4.35	5.42	3.02	14.38	7.24	6.20	3.70	14.38

A9.13 Hoek & Hoek 135° – Timber [1] to Concrete [2] – Timber to Concrete

Table A 9-19 Standard Load-carrying Capacities - Hoek & Hoek 135° – Timber [1] to Concrete [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoek	55x20x45 (SR)	2x 5.0x40	1x M8x55	1.06	2.48	2.48	0.90	1.50
	55x20x75 (SR)	3x 5.0x40		1.86	3.72	3.72	1.50	1.50
	55x20x105 (SR)	4x 5.0x40		2.70	4.49	4.96	1.95	1.50
	45x40x50 (2R)	n/a (1)						
	45x40x106 (2R)	n/a (1)						
	45x40x150 (2R)	n/a (1)						
Hoek 135°	70x70x55 135°	10x 5.0x40	1x M10x65	8.10	8.72	12.40	5.94	5.50
	90x90x60 135°	4x 4.0x35		2.29	3.64	3.64	0.96	6.00
		4x 6.0x40		5.25	5.79	5.79	3.89	6.00
	50x50x35 135°	4x 5.0x40		2.44	4.96	4.96	2.16	4.38

(SR) 1 small rib

(2R) 2 ribs

(1) This reference does not have any bolt hole on this plate/face.

Table A 9-20 Detailed Load-carrying Capacities - Hoek & Hoek 135° – Timber [1] to Concrete [2]

Detailed capacities			Timber [1]				Concrete [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Hoek	55x20x45 (SR)		2.48	1.06	0.90	1.50	4.49	4.86	4.86	4.49
	55x20x75 (SR)		3.72	1.86	1.50	1.50	4.49	4.86	6.08	4.49
	55x20x105 (SR)		4.96	2.70	1.95	1.50	4.49	4.86	6.08	4.49
	45x40x50 (2R)		n/a (1)							
	45x40x106 (2R)		n/a (1)							
	45x40x150 (2R)		n/a (1)							
Hoek 135°	70x70x55 135°		12.40	8.88	5.94	5.50	8.72	8.10	8.10	8.72
	90x90x60 135°	(a)	3.64	2.29	0.96	6.00	8.94	8.10	8.10	8.94
		(b)	5.79	5.25	3.89	6.00	8.94	8.10	8.10	8.94
	50x50x35 135°		4.96	2.44	2.16	4.38	7.83	10.13	10.13	7.83

(SR) 1 small rib

(2R) 2 ribs

(a) Fastener schedule with 4.0x35mm fasteners;

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.14 Hoek & Hoek 135° – Concrete [1] to Timber [2]

Table A 9-21 Standard Load-carrying Capacities - Hoek & Hoek 135° – Concrete [1] to Timber [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoek	55x20x45 (SR)	1x M8x55	2x 5.0x40	1.49	1.05	1.50	2.48	2.48
	55x20x75 (SR)	1x M10x65	2x 5.0x40	1.06	0.90	1.50	2.48	2.48
	55x20x105 (SR)		2x 5.0x40	1.06	0.90	1.50	2.48	2.48
	45x40x50 (2R)	n/a (1)						
	45x40x106 (2R)	n/a (1)						
	45x40x150 (2R)	n/a (1)						
Hoek 135°	70x70x55 135°	1x M10x65	10x 5.0x40	8.10	5.94	5.50	8.72	12.40
	90x90x60 135°		4x 4.0x35	2.29	0.00 (2)	0.00 (2)	3.64	3.64
			5x 6.0x40	5.40			7.24	7.24
	50x50x35 135°		4x 5.0x40	2.44	2.16	4.38	4.96	4.96

(SR) 1 small rib

(2R) 2 ribs

(1) This reference does not have any bolt hole on this plate/face.

(2) Plate [1] only has obround bolt holes oriented in y-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-22 Detailed Load-carrying Capacities - Hoek & Hoek 135° – Concrete [1] to Timber [2]

Detailed Capacities			Concrete [1]				Timber [2]			
Model	Reference		$V_{bolt,k,1}$	$P_{k,x,1}$	$P_{k,y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoek	55x20x45 (SR)		4.49	4.86	4.86	4.49	2.48	1.49	1.05	1.50
	55x20x75 (SR)		7.15	6.08	6.08	7.15	2.48	1.06	0.90	1.50
	55x20x105 (SR)		7.15	6.08	6.08	7.15	2.48	1.06	0.90	1.50
	45x40x50 (2R)		n/a (1)							
	45x40x106 (2R)		n/a (1)							
	45x40x150 (2R)		n/a (1)							
Hoek 135°	70x70x55 135°		8.72	8.10	8.10	8.72	12.40	8.88	5.94	5.50
	90x90x60 135°	(a)	8.94	6.48	8.10	8.94	3.64	2.29	0.96	6.00
		(b)	8.94	6.48	8.10	8.94	7.24	5.40	4.00	6.00
	50x50x35 135°		7.83	10.13	10.13	7.83	4.96	2.44	2.16	4.38

(SR) 1 small rib

(2R) 2 ribs

(a) Fastener schedule with 4.0x35mm fasteners

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.15 Hoekanker – Timber [1] to Concrete [2]

Table A 9-23 Standard Load-carrying Capacities - Hoekanker – Timber [1] to Concrete [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker	55x55x50x1.5	6x 5.0x40	1x M10x65	6.08	7.44	7.44	3.24	3.75
	50x50x35x2.5	4x 5.0x40		2.44	4.96	4.96	2.16	4.38
	50x50x57x2.5	6x 5.0x40	1x M12x80	6.17	7.44	7.44	0.00 (2)	0.00 (2)
	70x70x30x2.0	n/a (1)						
	70x70x55x2.0	10x 5.0x40	1x M10x65	8.10	8.72	12.40	5.94	5.50
	40x100x60x2.5	8x 4.0x35		5.22	8.17	8.17	2.33	7.50
	40x60x60x2.0	5x 4.0x35	2x M8x55	3.09	4.54	4.54	1.18	6.00
	40x60x60x2.5	5x 4.0x35		3.48	5.11	5.11	1.21	7.50
	90x90x60x2.0	4x 4.0x35		2.29	3.64	3.64	0.96	6.00
		4x 6.0x40		5.25	5.79	5.79	3.89	6.00
	90x90x60x2.5	4x 4.0x35		2.57	4.09	4.09	1.03	7.50
		4x 6.0x40		4.92	5.79	5.79	3.95	7.50
	150x90x60x2.5	7x 4.0x35		3.60	7.15	7.15	2.04	7.50
		5x 6.0x40		4.32	7.24	7.24	3.63	7.50
	105x105x90x2.5	10x 5.0x40	1x M12x80	6.26	12.40	12.40	4.52	11.25
	125x125x45x2.5	5x 4.0x35	1x M10x65	1.71	5.11	5.11	1.10	5.63
	125x125x55x2.5	n/a (1)						
	150x150x60x2.5	10x 4.0x35	2x M8x55	5.03	10.21	10.21	2.46	7.50
	60x60x40x2.0 (2SR)	4x 5.0x40	1x M10x65	1.94	4.96	4.96	0.00 (2)	0.00 (2)

(2SR) 2 small ribs

(1) This reference does not have any bolt hole on this plate/face.

(2) Plate [2] only has obround bolt holes oriented in z-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-24 Detailed Load-carrying Capacities - Hoekanker – Timber [1] to Concrete [2]

Detailed Capacities			Timber [1]				Concrete [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Hoekanker	55x55x50x1.5		7.44	7.03	3.24	3.75	8.50	6.08	6.08	8.50
	50x50x35x2.5		4.96	2.44	2.16	4.38	7.83	10.13	10.13	7.83
	50x50x57x2.5		7.44	6.17	4.32	7.13	12.43	9.72	12.15	12.43
	70x70x30x2.0		n/a (1)							
	70x70x55x2.0		12.40	8.88	5.94	5.50	8.72	8.10	8.10	8.72
	40x100x60x2.5		8.17	5.22	2.33	7.50	8.94	10.13	10.13	8.94
	40x60x60x2.0		4.54	3.09	1.18	6.00	11.70	12.96	16.20	11.70
	40x60x60x2.5		5.11	3.48	1.21	7.50	11.70	16.20	20.25	11.70
	90x90x60x2.0	(a)	3.64	2.29	0.96	6.00	11.70	12.96	12.96	11.70
		(b)	5.79	5.25	3.89	6.00	11.70	12.96	12.96	11.70
	90x90x60x2.5	(a)	4.09	2.57	1.03	7.50	11.70	16.20	16.20	11.70
		(b)	5.79	4.92	3.95	7.50	11.70	16.20	16.20	11.70
	150x90x60x2.5	(a)	7.15	3.60	2.04	7.50	11.70	16.20	16.20	11.70
		(b)	7.24	4.32	3.63	7.50	11.70	16.20	16.20	11.70
	105x105x90x2.5		12.40	6.26	4.52	11.25	14.19	12.15	12.15	14.19
	125x125x45x2.5		5.11	1.71	1.10	5.63	8.27	10.13	10.13	8.27
	125x125x55x2.5		n/a (1)							
	150x150x60x2.5		10.21	5.03	2.46	7.50	11.70	16.20	16.20	11.70
	60x60x40x2.0 (2SR)		4.96	1.94	1.80	4.00	8.05	6.48	8.10	8.05

(2SR) 2 small ribs

(a) Fastener schedule with 4.0x35mm fasteners

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.16 Hoekanker – Concrete [1] to Timber [2]

Table A 9-25 Standard Load-carrying Capacities – Hoekanker - Concrete [1] to Timber [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker	55x55x50x1.5	1x M10x65	6x 5.0x40	5.83	3.38	3.75	7.44	7.44
	50x50x35x2.5		4x 5.0x40	2.44	2.16	4.38	4.96	4.96
	50x50x57x2.5	1x M12x80	6x 5.0x40	6.17	0.00 (2)	0.00 (2)	7.44	7.44
	70x70x30x2.0	n/a (1)						
	70x70x55x2.0	1x M10x65	10x 5.0x40	8.10	5.94	5.50	8.72	12.40
	40x100x60x2.5		4x 4.0x35	3.64	1.54	7.50	4.09	4.09
	40x60x60x2.0	1x M10x65	5x 4.0x35	3.05	0.00 (2)	0.00 (2)	4.54	4.54
	40x60x60x2.5		5x 4.0x35	3.42			5.11	5.11
	90x90x60x2.0	2x M8x55	4x 4.0x35	2.29	0.96	6.00	3.64	3.64
			5x 6.0x40	5.34	4.00	6.00	7.24	7.24
	90x90x60x2.5		4x 4.0x35	2.57	1.03	7.50	4.09	4.09
			5x 6.0x40	5.14	4.07	7.50	7.24	7.24
	150x90x60x2.5	3x M8x55	3x 4.0x35	2.22	0.89	7.50	3.06	3.06
			3x 6.0x40	3.16	2.39	7.50	4.35	4.35
	105x105x90x2.5	3x M12x80	14x 5.0x40	13.07	8.33	11.25	17.35	17.35
	125x125x45x2.5	1x M10x65	5x 4.0x35	1.71	0.00 (2)	0.00 (2)	5.11	5.11
	125x125x55x2.5	n/a (1)						
	150x150x60x2.5	2x M8x55	10x 4.0x35	5.03	2.46	7.50	10.21	10.21
	60x60x40x2.0 (2SR)	1x M10x65	6x 5.0x40	0.00 (2)	3.39	4.00	7.44	7.44

(2SR) 2 small ribs

(1) This reference does not have any bolt hole on this plate/face.

(2) Plate [1] only has obround bolt holes oriented in y-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-26 Detailed Load-carrying Capacities - Hoekanker - Concrete [1] to Timber [2]

Detailed Capacities			Concrete [1]				Timber [2]			
Model	Reference		$V_{bolt,k,1}$	$P_{k,x,1}$	$P_{k,y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoekanker	55x55x50x1.5		8.50	6.08	6.08	8.50	7.44	5.83	3.38	3.75
	50x50x35x2.5		7.83	10.13	10.13	7.83	4.96	2.44	2.16	4.38
	50x50x57x2.5		12.43	12.15	12.15	12.43	7.44	6.17	4.32	7.13
	70x70x30x2.0		n/a (1)							
	70x70x55x2.0		8.72	8.10	8.10	8.72	12.40	8.88	5.94	5.50
	40x100x60x2.5		8.94	10.13	10.13	8.94	4.09	3.64	1.54	7.50
	40x60x60x2.0		8.94	6.48	8.10	8.94	4.54	3.05	1.36	6.00
	40x60x60x2.5		8.94	8.10	10.13	8.94	5.11	3.42	1.49	7.50
	90x90x60x2.0	(a)	11.70	12.96	12.96	11.70	3.64	2.29	0.96	6.00
		(b)	11.70	12.96	12.96	11.70	7.24	5.34	4.00	6.00
	90x90x60x2.5	(a)	11.70	16.20	16.20	11.70	4.09	2.57	1.03	7.50
		(b)	11.70	16.20	16.20	11.70	7.24	5.14	4.07	7.50
	150x90x60x2.5	(a)	20.77	24.30	24.30	20.77	3.06	2.22	0.89	7.50
		(b)	20.77	24.30	24.30	20.77	4.35	3.16	2.39	7.50
	105x105x90x2.5		46.84	36.45	36.45	46.84	17.35	13.07	8.33	11.25
	125x125x45x2.5		8.27	8.10	10.13	8.27	5.11	1.71	1.10	5.63
	125x125x55x2.5		n/a (1)							
	150x150x60x2.5		11.70	16.20	16.20	11.70	10.21	5.03	2.46	7.50
	60x60x40x2.0 (2SR)		8.05	8.10	6.48	8.05	7.44	4.42	3.39	4.00

(2SR) 2 small ribs

(a) Fastener schedule with 4.0x35mm fasteners

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.17 Hoekanker met Ril & Hoekanker met 2 Rillen – Timber [1] to Concrete [2]

Table A 9-27 Standard Load-carrying Capacities - Hoekanker met Ril & Hoekanker met 2 Rillen – Timber [1] to Concrete [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker met ril	90x90x60x2.0 (1R)	4x 4.0x35	2x M8x55	2.29	3.64	3.64	0.96	6.00
		4x 6.0x40		4.92	5.79	5.79	3.85	6.00
	125x125x55x2.5 (1R)	n/a (1)						
	60x80x60x2.5 (1R)	2x 4.0x35	1x M8x55	0.95	2.04	2.04	0.67	6.48
		4x 6.0x40		4.36	5.79	5.79	3.18	6.48
	60x120x60x2.5 (1R)	4x 4.0x35		1.91	4.09	4.09	1.12	7.34
		7x 6.0x40		5.51	10.14	10.14	4.86	7.34
	60x180x60x2.5 (1R)	6x 4.0x35		2.79	6.13	6.13	1.70	7.34
		10x 6.0x40		7.12	14.49	14.49	7.12	7.34
	150x90x60x2.5 (1R)	7x 4.0x35	2x M8x55	3.60	7.15	7.15	2.04	6.48
		5x 6.0x40		4.32	7.24	7.24	3.63	6.48
Hoekanker met 2 rillen	80x60x60x1.5 (2R)	8x 5.0x40	1x M12x80	0.00 (2)	9.92	9.92	3.89	4.50
	78x50x55x1.5 (2R)	7x 5.0x40	1x M10x65		8.68	8.68	1.91	3.89

(1R) 1 rib on either face

(2R) 2 ribs on either face

(1) This reference does not have any bolt hole on this plate/face.

(2) Plate [2] only has obround bolt holes oriented in x-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-28 Detailed Load-carrying Capacities - Hoekanker met Ril & Hoekanker met 2 Rillen – Timber [1] to Concrete [2]

Detailed Capacities			Timber [1]				Concrete [2]			
Model	Reference		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Hoekanker met ril	90x90x60x2.0 (1R)	(a)	3.64	2.29	0.96	6.00	11.70	12.96	12.96	11.70
		(b)	5.79	4.92	3.85	6.00	11.70	12.96	12.96	11.70
	125x125x55x2.5 (1R)		n/a (1)							
	60x80x60x2.5 (1R)	(a)	2.04	0.95	0.67	7.34	8.88	10.13	6.48	8.88
		(b)	5.79	4.36	3.18	7.34	8.88	10.13	6.48	8.88
	60x120x60x2.5 (1R)	(a)	4.09	1.91	1.12	7.34	17.77	20.25	12.96	17.77
		(b)	10.14	5.51	4.86	7.34	17.77	20.25	12.96	17.77
	60x180x60x2.5 (1R)	(a)	6.13	2.79	1.70	7.34	26.37	30.38	19.44	26.37
		(b)	14.49	7.12	7.12	7.34	26.37	30.38	19.44	26.37
	150x90x60x2.5 (1R)	(a)	7.15	3.60	2.04	7.13	8.81	10.13	6.48	8.81
		(b)	7.24	4.32	3.63	7.13	8.81	10.13	6.48	8.81
Hoekanker met 2 rillen	80x60x60x1.5 (2R)		9.92	5.93	3.89	4.50	12.59	7.29	5.83	12.59
	78x50x55x1.5 (2R)		8.68	2.80	1.91	4.13	8.72	6.08	3.89	8.72

(1R) 1 rib on either face

(2R) 2 ribs on either face

(a) Fastener schedule with 4.0x35mm fasteners

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.18 Hoekanker met Ril & Hoekanker met 2 Rillen – Concrete [1] to Timber [2]

Table A 9-29 Standard Load-carrying Capacities - Hoekanker met Ril & Hoekanker met 2 Rillen – Concrete [1] to Timber [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker met ril	90x90x60x2.0 (1R)	2x M8x55	4x 4.0x35	2.29	0.00 (1)	0.00 (1)	3.64	3.64
			4x 6.0x40	5.14			5.93	7.24
	125x125x55x2.5 (1R)							
	60x80x60x2.5 (1R)	1x M10x65	2x 4.0x35	1.23	0.75	5.89	2.04	2.04
			4x 6.0x40	4.73	3.30	5.89	5.79	5.79
	60x120x60x2.5 (1R)	2x M10x65	2x 4.0x35	1.23	0.75	5.89	2.04	2.04
			4x 6.0x40	4.73	3.30	5.89	5.79	5.79
	60x180x60x2.5 (1R)	3x M10x65	2x 4.0x35	1.23	0.75	5.89	2.04	2.04
			4x 6.0x40	4.73	3.30	5.89	5.79	5.79
	150x90x60x2.5 (1R)	1x M10x65	3x 4.0x35	2.22	0.89	7.13	3.06	3.06
			3x 6.0x40	3.16	2.39	7.13	4.35	4.35
Hoekanker met 2 rillen	80x60x60x1.5 (2R)	1x M12x80	6x 5.0x40	4.98	0.00 (1)	0.00 (1)	7.44	7.44
	78x50x55x1.5 (2R)	1x M8x55	4x 5.0x40	2.58			4.96	4.96

(1R) 1 rib on either face

(2R) 2 ribs on either face

(1) This reference does not have any bolt holes on this plate/face.

(2) Plate [1] only has obround bolt holes oriented in y-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-30 Detailed Load-carrying Capacities - Hoekanker met Ril & Hoekanker met 2 Rillen – Concrete [1] to Timber [2]

Detailed Capacities			Concrete [1]				Timber [2]			
Model	Reference		$V_{bolt,k,1}$	$P_{k,x,1}$	$P_{k,y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Hoekanker met ril	90x90x60x2.0 (1R)	(a)	5.93	5.18	6.48	5.93	3.64	2.29	0.96	6.00
		(b)	5.93	5.18	6.48	5.93	7.24	5.14	3.96	6.00
	125x125x55x2.5 (1R)		n/a (1)							
	60x80x60x2.5 (1R)	(a)	5.89	8.10	8.10	5.89	2.04	1.23	0.75	7.34
		(b)	5.89	8.10	8.10	5.89	5.79	4.73	3.30	7.34
	60x120x60x2.5 (1R)	(a)	5.89	8.10	8.10	5.89	2.04	1.23	0.75	7.34
		(b)	5.89	8.10	8.10	5.89	5.79	4.73	3.30	7.34
	60x180x60x2.5 (1R)	(a)	5.89	8.10	8.10	5.89	2.04	1.23	0.75	7.34
		(b)	5.89	8.10	8.10	5.89	5.79	4.73	3.30	7.34
	150x90x60x2.5 (1R)	(a)	11.55	16.20	16.20	11.55	3.06	2.22	0.89	7.13
		(b)	11.55	16.20	16.20	11.55	4.35	3.16	2.39	7.13
Hoekanker met 2 rillen	80x60x60x1.5 (2R)		12.59	5.83	7.29	12.59	7.44	4.98	2.98	4.50
	78x50x55x1.5 (2R)		5.75	4.86	4.86	5.75	4.96	2.58	1.65	4.13

(1R) 1 rib on either face

(2R) 2 ribs on either face

(a) Fastener schedule with 4.0x35mm fasteners;

(b) Fastener schedule with 6.0x40mm fasteners

(1) This reference does not have any bolt hole on this plate/face.

A9.19 Hoekanker met 3 Rillen – Timber [1] to Concrete [2]

Table A 9-31 Standard Load-carrying Capacities - Hoekanker met 3 Rillen – Timber [1] to Concrete [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Hoekanker met 3 rillen	60x50x63x2.5 (3R)	6x 5.0x40	2x M8x55	3.06	5.45	5.45	0.00 (1)	0.00 (1)
	80x50x63x2.5 (3R)			3.43	6.13	6.13		
	100x50x63x2.5 (3R)			3.43	6.13	6.13		
	120x50x63x2.5 (3R)			3.43	6.13	6.13		
	140x50x63x2.5 (3R)			4.96	8.31	8.31		
	160x50x63x2.5 (3R)			5.93	6.13	6.13		
	180x50x63x2.5 (3R)			7.64	6.13	6.13		
	200x50x63x2.5 (3R)			3.71	5.45	5.45		
	220x50x63x2.5 (3R)			4.17	6.13	6.13		
	240x50x63x2.5 (3R)			5.08	8.31	8.31		
	260x50x63x2.5 (3R)			5.08	8.31	8.31		
	280x50x63x2.5 (3R)			3.49	5.45	5.45		
	300x50x63x2.5 (3R)			3.92	6.13	6.13		
	320x50x63x2.5 (3R)			8.51	6.13	6.13		
	340x50x63x2.5 (3R)			9.45	6.80	6.80		
	350x50x63x2.5 (3R)			6.17	8.31	8.31		

(1) Plate [2] only has obround bolt holes oriented in z-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-32 Detailed Load-carrying Capacities - Hoekanker met 3 Rillen – Timber [1] to Concrete [2]

Detailed Capacities		Timber [1]				Concrete [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Hoekanker met 3 rillen	60x50x63x2.5 (3R)	5.45	3.06	3.51	7.81	11.82	12.96	16.20	11.82
	80x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	11.82	12.96	16.20	11.82
	100x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	11.82	12.96	16.20	11.82
	120x50x63x2.5 (3R)	6.13	3.43	3.85	7.81	11.82	12.96	16.20	11.82
	140x50x63x2.5 (3R)	8.31	4.96	4.43	7.81	11.82	12.96	16.20	11.82
	160x50x63x2.5 (3R)	6.13	5.93	5.20	7.81	11.82	12.96	16.20	11.82
	180x50x63x2.5 (3R)	6.13	7.64	6.79	7.81	11.82	12.96	16.20	11.82
	200x50x63x2.5 (3R)	5.45	3.71	3.40	7.81	11.82	12.96	16.20	11.82
	220x50x63x2.5 (3R)	6.13	4.17	3.58	7.81	11.82	12.96	16.20	11.82
	240x50x63x2.5 (3R)	8.31	5.08	4.40	7.81	11.82	12.96	16.20	11.82
	260x50x63x2.5 (3R)	8.31	5.08	4.40	7.81	11.82	12.96	16.20	11.82
	280x50x63x2.5 (3R)	5.45	3.49	3.30	7.81	11.82	12.96	16.20	11.82
	300x50x63x2.5 (3R)	6.13	3.92	3.48	7.81	11.82	12.96	16.20	11.82
	320x50x63x2.5 (3R)	6.13	8.51	6.88	7.81	11.82	12.96	16.20	11.82
	340x50x63x2.5 (3R)	6.80	9.45	7.25	7.81	11.82	12.96	16.20	11.82
	350x50x63x2.5 (3R)	8.31	6.17	4.90	7.81	11.82	12.96	16.20	11.82

A9.20 Langgathoek & Langgathoek met Ril – Timber [1] to Concrete [2]

Table A 9-33 Standard Load-carrying Capacities - Langgathoek & Langgathoek met Ril – Timber [1] to Concrete [2]

Angle Bracket		Fasteners		Characteristic Load-carrying Capacity [kN]				
Model	Reference	Member 1	Member 2	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Langgathoek	50x55x30x2.0	4x 5.0x40	1x M8x55	2.08	4.96	4.96	0.00 (1)	0.00 (1)
	70x55x30x2.0	5x 5.0x40		2.86	6.20	6.20		
	80x55x30x2.5	6x 5.0x40		3.42	7.44	7.44		
	100x55x30x2.5			2.28	7.44	7.44		
	120x55x30x3.0			1.91	8.31	8.31		
	140x55x30x3.0			1.53	8.31	8.31		
	160x55x30x3.0			1.27	8.31	8.31		
Langgathoek met ril	50x55x30x2.0 (SR)	4x 5.0x40	1x M8x55	2.08	4.96	4.96	0.00 (1)	0.00 (1)
	70x55x30x2.0 (SR)	5x 5.0x40		2.86	6.20	6.20		
	80x55x30x2.5 (SR)	6x 5.0x40		3.42	7.44	7.44		
	100x55x30x2.5 (SR)			2.28	7.44	7.44		
	120x55x30x3.0 (SR)			1.91	8.31	8.31		
	140x55x30x3.0 (SR)			1.53	8.31	8.31		
	160x55x30x3.0 (SR)			1.27	8.31	8.31		

(1) Plate [2] only has obround bolt holes oriented in z-direction. Fasteners in these obround holes can therefore not provide any shear resistance.

Table A 9-34 Detailed Load-carrying Capacities - Langgathoek & Langgathoek met Ril – Timber [1] to Concrete [2]

Detailed Capacities		Timber [1]				Concrete [2]			
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Langgathoek	50x55x30x2.0	4.96	2.08	1.80	3.00	9.57	10.37	12.96	9.57
	70x55x30x2.0	6.20	2.86	3.06	3.00	9.57	10.37	12.96	9.57
	80x55x30x2.5	7.44	3.42	3.76	3.75	9.57	12.96	16.20	9.57
	100x55x30x2.5	7.44	2.28	2.88	3.75	9.57	12.96	16.20	9.57
	120x55x30x3.0	8.31	1.91	2.40	4.50	9.57	15.55	19.44	9.57
	140x55x30x3.0	8.31	1.53	1.96	4.50	9.57	15.55	19.44	9.57
	160x55x30x3.0	8.31	1.27	1.66	4.50	9.57	15.55	19.44	9.57
Langgathoek met ril	50x55x30x2.0 (SR)	4.96	2.08	1.80	3.00	9.57	10.37	12.96	9.57
	70x55x30x2.0 (SR)	6.20	2.86	3.06	3.00	9.57	10.37	12.96	9.57
	80x55x30x2.5 (SR)	7.44	3.42	3.76	3.75	9.57	12.96	16.20	9.57
	100x55x30x2.5 (SR)	7.44	2.28	2.88	3.75	9.57	12.96	16.20	9.57
	120x55x30x3.0 (SR)	8.31	1.91	2.40	4.50	9.57	15.55	19.44	9.57
	140x55x30x3.0 (SR)	8.31	1.53	1.96	4.50	9.57	15.55	19.44	9.57
	160x55x30x3.0 (SR)	8.31	1.27	1.66	4.50	9.57	15.55	19.44	9.57

(SR) 1 small rib

A9.21 Angle Brackets Series II – Method for Adjusting Load-carrying Capacities

This section describes the method for determining load-carrying capacities of Series II Angle Brackets for alternative grades and/or fasteners by determining appropriate modification factors for:

- The selected grade and/or fastener(s)
- For each of the failure modes of the relevant connection configuration

and applying them by multiplication to the detailed load-carrying capacities in the relevant tables in Annex 9 above.

For each plate and each load direction the minimum value obtained for the corresponding failure modes after applying the adjustment factors provides the characteristic load-carrying capacity for this plate and load direction.

The modification factors for calculating alternative load-carrying capacities of Series II Angle Brackets are given in:

Table A 9-36 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Timber to Timber

Table A 9-37 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Timber [1] to Concrete [2]

Table A 9-38 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Concrete [1] to Timber [2]

For connector-to-concrete connections, the bolt shear capacity can be determined in accordance with ETAG 001 Annex C and the corresponding ETA for the selected bolt.

A9.21.1 Definition of Adjustment Factors for Alternative Grades and Fasteners

Alternative Timber Grade (Either Member)

$k_{\mathrm{v,dens}} = \frac{\rho_{\mathrm{k}}}{350}$ factor for adjustment of fastener shear capacity for characteristic density of the timber grade

$k_{\mathrm{ax,dens}} = \left(\frac{\rho_{\mathrm{k}}}{350}\right)^2$ factor for adjustment of fastener withdrawal capacity for characteristic density of the timber grade

$k_{\mathrm{c}} = \frac{f_{\mathrm{c,90,k}}}{2.5}$ factor for adjustment of compression resistance for $f_{\mathrm{c,90,k}}$ resistance of the timber grade

Alternative Fastener (Either Member)

$k_{\mathrm{v}}, k_{\mathrm{v,bolt}} = \frac{F_{\mathrm{v,Rk}}}{F_{\mathrm{v,Rk,ref}}}$ factors for adjustment of fastener shear capacity

where:

$F_{\mathrm{v,Rk}}$ characteristic shear capacity of the alternative fastener (nail, screw or bolt)

$F_{\mathrm{v,Rk,ref}}$ reference characteristic shear capacity per Table A 6-1 (nails) or Table A 6-2 (screws)

or

reference bolt characteristic shear capacity i.e. that of the indicated bolt in the given configuration

$k_{\mathrm{ax}}, k_{\mathrm{ax,bolt}} = \frac{F_{\mathrm{ax,Rk}}}{F_{\mathrm{ax,Rk,ref}}}$ factor for adjustment of fastener withdrawal or tension capacity

where:

$F_{\mathrm{ax,Rk}}$ characteristic withdrawal (nails, screws) or tension (bolt) capacity of the alternative fastener

$F_{ax,Rk,ref}$ reference characteristic withdrawal capacity per Table A 6-1 (nails) or Table A 6-2 (screws)
or
reference bolt characteristic tension capacity i.e. that of the indicated bolt in the given configuration

Note that the adjustment factors are cumulative, e.g. for an alternative grade and an alternative fastener simultaneously, multiply $T_{k,1}$ listed in the detailed capacity tables by $k_{v,dens}$ x k_{ax}.

The standard capacities are determined as follows:

Table A 9-35 Critical Parameters for Load-carrying Capacities

Load	Timber to Timber	Plate 1 to Timber Plate 2 to Concrete	Plate 1 to Concrete Plate 2 to Timber
$F_{x,k}$	$\min(V_{rot,k,1}; V_{rot,k,1})$	$\min(V_{rot,k,1}; V_{bolt,k,2}; P_{k,x,2})$	$\min(V_{bolt,k,1}; P_{k,x,1}; V_{rot,k,2})$
$F_{y,pull,k}$	$\min(V_{k,1,y}; T_{k,2})$	$\min(V_{k,1,y}; T_{bolt,k,2})$	$\min(V_{bolt,k,1}; P_{k,y,1}; T_{k,2})$
$F_{y,push,k}$	$\min(V_{k,1,y}; C_{k,2})$	$V_{k,1,y}$	$\min(V_{bolt,k,1}; P_{k,y,1}; C_{k,2})$
$F_{z,pull,k}$	$\min(T_{k,1}; V_{k,2,z})$	$\min(T_{k,1}; V_{bolt,k,2}; P_{k,z,2})$	$\min(T_{bolt,k,1}; V_{k,2})$
$F_{z,push,k}$	$\min(C_{k,1}; V_{k,2,z})$	$\min(C_{k,1}; V_{bolt,k,2}; P_{k,z,2})$	$V_{k,2,y}$

Table A 9-36 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Timber to Timber

Alternative fastener and/or Grade		Angle Brackets and Special Connectors – Timber to Timber Connection							
Load applied to		Contact area [1] : Timber				Contact area [2] : Timber			
Adjustment for		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	$k_{v,dens}$		$k_{ax,dens}$	k_c	$k_{v,dens}$		$k_{ax,dens}$	k_c
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	k_v		k_{ax}	-	k_v		k_{ax}	-

Table A 9-37 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Timber [1] to Concrete [2]

Alternative fastener and/or Grade		Angle Brackets – Timber [1] to Concrete [2] Connection							
Load applied to		Contact Area [1] : Timber				Contact Area [2] : Concrete			
Adjustment for		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{bolt,k,2}$	$P_{k,x,2}$	$P_{k,z,2}$	$T_{bolt,k,2}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	$k_{v,dens}$		$k_{ax,dens}$	k_c	-	-	-	-
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	k_v		k_{ax}	-	$k_{v,bolt}$	-	-	$k_{ax,bolt}$

Note: $P_{k,x,2}$ and $P_{k,z,2}$ are dependent only on the bolt diameter and plate thickness which remain unchanged

Table A 9-38 Alternative Fastener and/or Grade – Adjustment Factors for Series II Angle Brackets – Concrete [1] to Timber [2]

Alternative fastener and/or Grade		Angle Brackets – Concrete [1] to Timber [2] Connection							
Load applied to		Contact Area [1] : Concrete				Contact Area [2] : Timber			
Adjustment for		$V_{bolt,k,1}$	$P_{k,x,1}$	$P_{k,y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	-	-	-	-	$k_{v,dens}$		$k_{ax,dens}$	k_c
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	$k_{v,bolt}$	-	-	$k_{ax,bolt}$	k_v		k_{ax}	-

ANNEX 10 JOIST HANGERS - SERIES I – LOAD-CARRYING CAPACITIES

A10.1 Tabulated Values

The calculated load-carrying capacities for Series I joist hangers are presented in the following tables. for both timber to timber and timber to concrete connections

Load-carrying Capacities for timber substrates are presented both for nailed connections, using 4.0x40mm threaded nails as defined in in Annex 6 §A6.4, and screwed connections, using CSA 5.0x35mm Simpson screws as defined in Annex 6 §A6.5, as described in the tables.

Load carrying capacities for concrete substrates are presented for bolted connections using SPIT FIX II expansion bolts covered by ETA-01/0008 as described in Annex 6 §A6.6. The bolt dimensions depend on the diameter of the bolt hole in the angle bracket.

The notation for the load directions used in the tables is defined in Annex 7

A10.2 Load Directions and Parts - Joist Hangers

Table A 7-2.

Tables are presented in two configurations:

- **Standard load-carrying capacities**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) and allow a direct reading of the load-carrying capacity in each direction for the load applied to each plate.
- **Detailed load-carrying capacities by failure mode**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

The method for determining capacities of Series I joist hangers for alternative grades and/or fasteners is described in §A10.9.

The method for determining capacities of joist hangers subject to loading in more than one direction is described in Annex 12 Combined Loading Adjustments for Joist Hangers.

The load-carrying capacity of a joist hanger of dimensions that intermediate to two hangers of the tabulated standard dimensions may be obtained as follows.

- Find the adjacent hangers with smaller and larger dimensions compared to the non-standard hanger from the relevant table for that joist hanger series.
- For each failure mode select the lower characteristic resistance of the adjacent hangers

As an example, Table A 10-1 gives the capacities for a non-standard RD 210 34x88 joist hanger.

Table A 10-1 Load-carrying Capacity of a Joist Hanger of Intermediate Dimensions - Example Calculations

Load Direction	Connection	Load-carrying Capacity [kN]		
		RD 210 32x89	RD 210 38x86	RD 210 34x88
Main (Dr)	Timber to Timber	5.12	5.12	= min(5.12 ; 5.12) = 5.12
Lateral (Dw)		7.27	7.27	= min(7.27 ; 7.27) = 7.27
Tension (T)		1.22	1.26	= min(1.22 ; 1.26) = 1.22
Main (Dr)	Timber to Concrete	11.65	12.25	= min(11.65,12.25) = 11.65
Lateral (Dw)		16.20	16.20	= min(16.20,16.20) = 16.20
Tension (T)		2.42	3.03	= min(2.42,3.03) = 2.42

A10.3 Standard Load-carrying Capacities - Tables

A10.4 Detailed Load-carrying Capacities - Tables

A10.5 RD & RDD – Timber to Timber Connection

Table A 10-2 Standard Load-carrying Capacities – RD 210 to RD 335 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails or Screws (1)		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD 210	RD 210 32x 89	4	8	5.12	7.27	1.22	12.56	17.84	8.92
	RD 210 38x 86	4	8	5.12	7.27	1.26	14.56	17.84	8.92
	RD 210 40x 85	4	8	5.12	7.27	1.29	16.56	17.84	8.92
	RD 210 46x 82	4	8	5.12	7.27	1.29	18.14	17.84	8.92
	RD 210 50x 80	4	8	5.12	7.27	1.29	18.14	17.84	8.92
	RD 210 59x 75,5	4	8	5.12	7.27	1.29	18.14	17.84	8.92
	RD 210 63x 73,5	4	8	5.12	7.27	1.29	18.14	17.84	8.92
	RD 210 80x65	4	8	5.12	7.27	1.29	18.14	17.84	8.92
RD 250	RD 250 32x109	6	12	9.83	10.91	1.22	22.60	26.76	13.38
	RD 250 36x107	6	12	9.83	10.91	1.26	22.60	26.76	13.38
	RD 250 38x106	6	12	9.83	10.91	1.26	22.60	26.76	13.38
	RD 250 40x105	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 46x102	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 50x100	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 59x 95,5	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 63x 93,5	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 71x 89,5	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 75x 87,5	6	12	9.83	10.91	1.29	22.60	26.76	13.38
	RD 250 80x85	6	12	9.83	10.91	1.29	22.60	26.76	13.38
RD 300	RD 300 32x134	8	16	10.45	14.54	1.22	27.06	35.68	17.84
	RD 300 38x131	8	16	10.48	14.54	1.26	27.06	35.68	17.84
	RD 300 40x130	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 50x125	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 59x120,5	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 63x118,5	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 71x114,5	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 75x112,5	8	16	10.52	14.54	1.29	27.06	35.68	17.84
	RD 300 80x110	8	16	10.52	14.54	1.29	27.06	35.68	17.84
RD 335	RD 335 32x151,5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 38x 148.5	12	16	10.48	14.54	1.26	35.98	35.68	26.56
	RD 335 40x 147.5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 46x 144.5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 50x142.5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 59x 138	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 63x 136	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 71x 132	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 75x 130	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 80x 127.5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RD 335 140x97,5	12	16	10.52	14.54	1.29	35.98	35.68	26.56

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws C24 timber members respectively

Table A 10-3 Standard Load-carrying Capacities – RD 380 to RD 500 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Load Direction	Nails / Screws (1)		Nailed Connection			Screwed Connection		
	Dimensions	Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD 380	RD 380 32x174	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 38x171	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 46x167	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 50x165	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 59x160,5	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 63x158,5	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 71x154,5	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 75x152,5	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 80x150	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 90x145	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 100x140	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 120x130	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RD 380 140x120	14	20	10.52	18.18	1.29	40.44	44.60	31.22
RD 440	RD 440 32x204	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 38x201	18	26	10.48	23.63	1.26	49.36	57.98	40.14
	RD 440 63x188,5	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 71x184,5	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 75x182,5	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 80x180	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 90x175	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 95x172.5	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 100x170	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RD 440 120x160	18	26	10.52	23.63	1.29	49.36	57.98	40.14
RD 500	RD 500 32x234	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 46x227	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 59x220.5	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 71x 214,5	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 75x 212,5	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 80x 210	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 90x 205	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 100x 200	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 120x190	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RD 500 140x 180	20	32	10.52	29.08	1.29	53.82	71.36	44.60

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws C24 timber members respectively

Table A 10-4 Standard Load-carrying Capacities – RDD Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails / Screws (1)		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RDD 250	RDD 250 63x93,5	6	14	10.52	12.72	1.29	22.60	31.22	13.38
	RDD 250 71x 89,5	6	14	10.52	12.72	1.29	22.60	31.22	13.38
	RDD 250 75x 87,5	6	14	10.52	12.72	1.29	22.60	31.22	13.38
	RDD 250 80x85	6	14	10.52	12.72	1.29	22.60	31.22	13.38
RDD 300	RDD 300 63x118,5	8	18	10.52	16.36	1.29	27.06	40.14	17.84
	RDD 300 80x110	8	18	10.52	14.54	1.29	27.06	35.68	17.84
RDD 335	RDD 335 59x138	12	18	10.52	16.36	1.29	35.98	40.14	26.76
	RDD 335 63X136	12	18	10.52	16.36	1.29	35.98	40.14	26.76
	RDD 335 71x132	12	18	10.52	16.36	1.29	35.98	40.14	26.76
	RDD 335 80x127,5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
	RDD 335 140x97,5	12	16	10.52	14.54	1.29	35.98	35.68	26.56
RDD 380	RDD 380 63x158,5	14	22	10.52	20.00	1.29	40.44	49.06	31.22
	RDD 380 71x154,5	14	22	10.52	20.00	1.29	40.44	49.06	31.22
	RDD 380 75x152,5	14	22	10.52	20.00	1.29	40.44	49.06	31.22
	RDD 380 100x140	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RDD 380 120x130	14	20	10.52	18.18	1.29	40.44	44.60	31.22
	RDD 380 140x120	14	20	10.52	18.18	1.29	40.44	44.60	31.22
RDD 440	RDD 440 63x188,5	18	30	10.52	27.27	1.29	49.36	66.90	40.14
	RDD 440 80x180	18	26	10.52	23.63	1.29	49.36	57.98	40.14
	RDD 440 120x160	18	26	10.52	23.63	1.29	49.36	57.98	40.14
RDD 500	RDD 500 80x 210	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RDD 500 90x205	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RDD 500 100x200	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RDD 500 120x190	20	32	10.52	29.08	1.29	53.82	71.36	44.60
	RDD 500 140x180	20	32	10.52	29.08	1.29	53.82	71.36	44.60

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws respectively - C24 timber members

Table A 10-5 Detailed Load-carrying Capacities – RD 210 to RD 250 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RD 210	RD 210 32x 89	4	1.22	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 38x 86	4	1.26	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 40x 85	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 46x 82	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 50x 80	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 59x 75,5	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 63x 73,5	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
	RD 210 80x65	4	1.29	9.22	8	5.12	7.27	2.45	4	8.92	9.22	8	12.56	17.84	13.28
RD 250	RD 250 32x109	6	1.22	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 36x107	6	1.26	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 38x106	6	1.26	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 40x105	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 46x102	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 50x100	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 59x 95,5	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 63x 93,5	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 71x 89,5	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 75x 87,5	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92
	RD 250 80x85	6	1.29	9.22	12	9.83	10.91	3.68	6	13.38	9.22	12	24.13	26.76	19.92

(1) 4.0x40mm threaded nails respectively CSA5,0X35 Simpson Strong-Tie screws - C24 timber members

Table A 10-6 Detailed Load-carrying Capacities – RD 300 to RD 335 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RD 300	RD 300 32x134	8	1.22	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 38x131	8	1.26	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 40x130	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 50x125	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 59x120,5	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 63x118,5	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 71x114,5	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 75x112,5	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
	RD 300 80x110	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
RD 335	RD 335 32x151,5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 38x 148.5	12	1.26	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 40x 147.5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 46x 144.5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 50x142.5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 59x 138	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 63x 136	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 71x 132	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 75x 130	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 80x 127.5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RD 335 140x97,5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56

(1) 4.0x40mm threaded nails respectively CSA5,0X35 Simpson Strong-Tie screws - C24 timber members

Table A 10-7 Detailed Load-carrying Capacities – RD 380 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RD 380	RD 380 32x174	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 38x171	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 46x167	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 50x165	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 59x160,5	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 63x158,5	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 71x154,5	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 75x152,5	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 80x150	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 90x145	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 100x140	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 120x130	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RD 380 140x120	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20

(1) 4.0x40mm threaded nails respectively CSA5,0X35 Simpson Strong-Tie screws - C24 timber members

Table A 10-8 Detailed Load-carrying Capacities – RD 440 to RD 500 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RD 440	RD 440 32x204	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 38x201	18	1.26	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 63x188,5	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 71x184,5	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 75x182,5	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 80x180	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 90x175	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 95x172.5	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 100x170	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
	RD 440 120x160	18	1.29	9.22	16	37.77	23.63	8.58	18	40.14	9.22	16	92.68	57.98	43.16
RD 500	RD 500 32x234	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 46x227	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 59x220.5	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 71x 214,5	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 75x 212,5	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 80x 210	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 90x 205	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 100x 200	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 120x190	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RD 500 140x 180	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws respectively - C24 timber members

Table A 10-9 Detailed Load-carrying Capacities – RDD 250 to RDD 380 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RDD 250	RDD 250 63x93,5	6	1.29	9.22	14	18.26	12.72	4.90	6	13.38	9.22	14	44.79	31.22	23.24
	RDD 250 71x 89,5	6	1.29	9.22	14	18.26	12.72	4.90	6	13.38	9.22	14	44.79	31.22	23.24
	RDD 250 75x 87,5	6	1.29	9.22	14	18.26	12.72	4.90	6	13.38	9.22	14	44.79	31.22	23.24
	RDD 250 80x85	6	1.29	9.22	14	18.26	12.72	4.90	6	13.38	9.22	14	44.79	31.22	23.24
RDD 300	RDD 300 63x118,5	8	1.29	9.22	18	28.73	16.36	6.13	8	17.84	9.22	18	70.48	40.14	29.88
	RDD 300 80x110	8	1.29	9.22	16	16.21	14.54	4.90	8	17.84	9.22	16	39.78	35.68	26.56
RDD 335	RDD 335 59x138	12	1.29	9.22	18	25.57	16.36	6.13	12	26.76	9.22	18	62.74	40.14	29.88
	RDD 335 63X136	12	1.29	9.22	18	25.57	16.36	6.13	12	26.76	9.22	18	62.74	40.14	29.88
	RDD 335 71x132	12	1.29	9.22	18	25.57	16.36	6.13	12	26.76	9.22	18	62.74	40.14	29.88
	RDD 335 80x127,5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
	RDD 335 140x97,5	12	1.29	9.22	16	15.98	14.54	4.90	12	26.76	9.22	16	39.22	35.68	26.56
RDD 380	RDD 380 63x158,5	14	1.29	9.22	22	34.63	20.00	7.35	14	31.22	9.22	22	84.96	49.06	36.52
	RDD 380 71x154,5	14	1.29	9.22	22	34.63	20.00	7.35	14	31.22	9.22	22	84.96	49.06	36.52
	RDD 380 75x152,5	14	1.29	9.22	22	34.63	20.00	7.35	14	31.22	9.22	22	84.96	49.06	36.52
	RDD 380 100x140	14	1.29	9.22	20	23.15	18.18	6.13	14	31.22	9.22	20	56.80	44.60	33.20
	RDD 380 120x130	14	1.29	9.22	20	15.98	18.18	6.13	14	31.22	9.22	20	39.22	44.60	33.20
	RDD 380 140x120	14	1.29	9.22	20	15.98	18.18	6.13	14	31.22	9.22	20	39.22	44.60	33.20

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws respectively - C24 timber members

Note: For the closed RDD joist hangers, when the seat width equals or exceeds 80mm, the number of beam nail holes is reduced

Table A 10-10 Detailed Load-carrying Capacities – RDD 440 to RDD 500 Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RDD 440	RDD 440 63x188,5	18	1.29	9.22	30	63.20	27.27	9.80	18	40.14	9.22	30	155.06	66.90	49.80
	RDD 440 80x180	18	1.29	9.22	26	37.77	23.63	8.58	18	40.14	9.22	26	92.68	57.98	43.16
	RDD 440 120x160	18	1.29	9.22	26	37.77	23.63	8.58	18	40.14	9.22	26	92.68	57.98	43.16
RDD 500	RDD 500 80x 210	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RDD 500 90x205	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RDD 500 100x200	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RDD 500 120x190	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12
	RDD 500 140x180	20	1.29	9.22	32	55.60	29.08	9.80	20	44.60	9.22	32	136.42	71.36	53.12

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws respectively - C24 timber members

Note: For the closed RDD joist hangers, when the seat width equals or exceeds 80mm, the number of beam nail holes is reduced

A10.6 RD2d and RD2dd – Timber to Timber Connection

Table A 10-11 Standard Load-carrying Capacities – RD2d and RD2dd Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Load Direction	Nails / Screws (1)		Nailed Connection			Screwed Connection		
	Dimensions	Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD2d 300	RD2d 300 32x134	8	16	7.74	14.54	1.22	24.36	35.68	17.84
	RD2d 300 63x118,5	8	16	7.82	14.54	1.29	24.36	35.68	17.84
	RD2d 300 80x110	8	16	7.82	14.54	1.29	24.36	35.68	17.84
RD2d 335	RD2d 335 32x151.5	12	16	7.74	14.54	1.22	33.28	35.68	26.56
	RD2d 335 63x136	12	16	7.82	14.54	1.29	33.28	35.68	26.56
	RD2d 335 80x127.5	12	16	7.82	14.54	1.29	33.28	35.68	26.56
	RD2d 335 140x97.5	12	16	7.82	14.54	1.29	33.28	35.68	26.56
RD2d 380	RD2d 380 32x174	14	18	7.74	16.36	1.22	37.74	40.14	29.88
	RD2d 380 75x152,5	14	18	7.82	16.36	1.29	37.74	40.14	29.88
	RD2d 380 100x140	14	18	7.82	16.36	1.29	37.74	40.14	29.88
	RD2d 380 140x120	14	18	7.82	16.36	1.29	37.74	40.14	29.88
RD2dd 300	RD2dd 300 80x110	8	18	7.82	16.36	1.29	24.36	40.14	17.84
	RD2dd 300 63x118,5	8	18	7.82	16.36	1.29	24.36	40.14	17.84
RD2dd 335	RD2dd335 63x136	12	18	7.82	16.36	1.29	33.28	40.14	26.76
	RD2dd 335 80x127.5	12	18	7.82	16.36	1.29	33.28	40.14	26.76
	RD2dd 335 140x97.5	12	18	7.82	16.36	1.29	33.28	40.14	26.76
RD2dd 380	RD2dd 380 75x152,5	14	22	7.82	20.00	1.29	37.74	49.06	31.22
	RD2dd 380 100x140	14	22	7.82	20.00	1.29	37.74	49.06	31.22
	RD2dd 380 140x120	14	22	7.82	20.00	1.29	37.74	49.06	31.22

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws C24 timber members respectively

Table A 10-12 Detailed Load-carrying Capacities – RD2d and RD2dd Joist hangers – Timber to Timber – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Nails (1)	to Beam			Lat. Screws (1)	to Joist		Screws (1)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr [kN]	Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Nail shear resistance	Nail shear resistance	Nail tension resistance		Screw shear resistance	Plate bending resistance		Screw shear resistance	Screw shear resistance	Screw tension resistance
RD2d 300	RD2d 300 32x134	8	1.22	6.52	16	16.21	14.54	4.90	8	17.84	6.52	16	39.78	35.68	26.56
	RD2d 300 63x118,5	8	1.29	6.52	16	16.21	14.54	4.90	8	17.84	6.52	16	39.78	35.68	26.56
	RD2d 300 80x110	8	1.29	6.52	16	16.21	14.54	4.90	8	17.84	6.52	16	39.78	35.68	26.56
RD2d 335	RD2d 335 32x151.5	12	1.22	6.52	16	15.98	14.54	4.90	12	26.76	6.52	16	39.22	35.68	26.56
	RD2d 335 63x136	12	1.29	6.52	16	15.98	14.54	4.90	12	26.76	6.52	16	39.22	35.68	26.56
	RD2d 335 80x127.5	12	1.29	6.52	16	15.98	14.54	4.90	12	26.76	6.52	16	39.22	35.68	26.56
	RD2d 335 140x97.5	12	1.29	6.52	16	15.98	14.54	4.90	12	26.76	6.52	16	39.22	35.68	26.56
RD2d 380	RD2d 380 32x174	14	1.22	6.52	18	23.15	16.36	6.13	14	31.22	6.52	18	56.80	40.14	29.88
	RD2d 380 75x152,5	14	1.29	6.52	18	23.15	16.36	6.13	14	31.22	6.52	18	56.80	40.14	29.88
	RD2d 380 100x140	14	1.29	6.52	18	23.15	16.36	6.13	14	31.22	6.52	18	56.80	40.14	29.88
	RD2d 380 140x120	14	1.29	6.52	18	23.15	16.36	6.13	14	31.22	6.52	18	56.80	40.14	29.88
RD2dd 330	RD2dd 300 80x110	8	1.29	6.52	18	28.73	16.36	6.13	8	17.84	6.52	18	70.48	40.14	29.88
	RD2dd 300 63x118,5	8	1.29	6.52	18	28.73	16.36	6.13	8	17.84	6.52	18	70.48	40.14	29.88
RD2dd 335	RD2dd335 63x136	12	1.29	6.52	18	25.57	16.36	6.13	12	26.76	6.52	18	62.74	40.14	29.88
	RD2dd 335 80x127.5	12	1.29	6.52	18	25.57	16.36	6.13	12	26.76	6.52	18	62.74	40.14	29.88
	RD2dd 335 140x97.5	12	1.29	6.52	18	25.57	16.36	6.13	12	26.76	6.52	18	62.74	40.14	29.88
RD2dd 380	RD2dd 380 75x152,5	14	1.29	6.52	22	34.63	20.00	7.35	14	31.22	6.52	22	84.96	49.06	36.52
	RD2dd 380 100x140	14	1.29	6.52	22	34.63	20.00	7.35	14	31.22	6.52	22	84.96	49.06	36.52
	RD2dd 380 140x120	14	1.29	6.52	22	34.63	20.00	7.35	14	31.22	6.52	22	84.96	49.06	36.52

(1) 4.0x40mm threaded nails or CSA5,0X35 Simpson Strong-Tie screws respectively - C24 timber members

A10.7 RD and RDD - Timber to Concrete Connections

Table A 10-13 Standard Load-carrying Capacities – RD 210 and RD 250 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails or Screws / Bolts(1)		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD 210	RD 210 32x 89	4	2x M10	11.65	16.20	2.42	16.20	16.20	8.92
	RD 210 38x 86	4	2x M10	12.25	16.20	3.03	16.20	16.20	8.92
	RD 210 40x 85	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
	RD 210 46x 82	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
	RD 210 50x 80	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
	RD 210 59x 75,5	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
	RD 210 63x 73,5	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
	RD 210 80x65	4	2x M10	12.86	16.20	3.64	16.20	16.20	8.92
RD 250	RD 250 32x109	6	4x M10	12.86	17.79	3.64	17.79	17.79	13.38
	RD 250 36x107	6	4x M10	13.77	18.10	4.54	18.10	18.10	13.38
	RD 250 38x106	6	4x M10	13.77	18.25	4.54	18.25	18.25	13.38
	RD 250 40x105	6	4x M10	14.68	18.41	5.45	18.41	18.41	13.38
	RD 250 46x102	6	4x M10	14.68	18.87	5.45	18.87	18.87	13.38
	RD 250 50x100	6	4x M10	14.68	19.18	5.45	19.18	19.18	13.38
	RD 250 59x 95,5	6	4x M10	14.68	19.87	5.45	19.87	19.87	13.38
	RD 250 63x 93,5	6	4x M10	14.68	20.18	5.45	20.18	20.18	13.38
	RD 250 71x 89,5	6	4x M10	14.68	20.80	5.45	20.80	20.80	13.38
	RD 250 75x 87,5	6	4x M10	14.68	21.11	5.45	21.11	21.11	13.38
	RD 250 80x85	6	4x M10	14.68	21.50	5.45	21.50	21.50	13.38

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively at joist - SPIT FIX II expansion bolts at beam – C24 timber

Table A 10-14 Standard Load-carrying Capacities – RD 300 and RD 335 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Load Direction	Nails or Screws / Bolts[1]		Nailed Connection			Screwed Connection		
	Dimensions	Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD 300	RD 300 32x134	8	4x M12	14.07	30.40	4.85	27.06	30.40	17.84
	RD 300 38x131	8	4x M12	15.28	31.05	6.06	27.06	31.05	17.84
	RD 300 40x130	8	4x M12	16.49	31.26	7.27	27.06	31.26	17.84
	RD 300 50x125	8	4x M12	16.49	32.35	7.27	27.06	32.35	17.84
	RD 300 59x120,5	8	4x M12	16.49	33.33	7.27	27.06	33.33	17.84
	RD 300 63x118,5	8	4x M12	16.49	33.76	7.27	27.06	33.76	17.84
	RD 300 71x114,5	8	4x M12	16.49	34.63	7.27	27.06	34.63	17.84
	RD 300 75x112,5	8	4x M12	16.49	35.06	7.27	27.06	35.06	17.84
	RD 300 80x110	8	4x M12	16.49	35.61	7.27	27.06	35.61	17.84
RD 335	RD 335 32x151,5	12	4x M12	20.13	32.63	10.91	32.63	32.63	26.76
	RD 335 38x 148.5	12	4x M12	18.31	28.35	9.09	28.35	28.35	26.76
	RD 335 40x 147.5	12	4x M12	20.13	28.55	10.91	28.55	28.55	26.76
	RD 335 46x 144.5	12	4x M12	20.13	29.17	10.91	29.17	29.17	26.76
	RD 335 50x142.5	12	4x M12	20.13	29.57	10.91	29.57	29.57	26.76
	RD 335 59x 138	12	4x M12	20.13	30.49	10.91	30.49	30.49	26.76
	RD 335 63x 136	12	4x M12	20.13	30.90	10.91	30.90	30.90	26.76
	RD 335 71x 132	12	4x M12	20.13	31.72	10.91	31.72	31.72	26.76
	RD 335 75x 130	12	4x M12	20.13	32.12	10.91	32.12	32.12	26.76
	RD 335 80x 127.5	12	4x M12	20.13	32.63	10.91	32.63	32.63	26.76
	RD 335 140x97,5	12	4x M12	20.13	38.75	10.91	35.98	38.75	26.76

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively at joist - SPIT FIX II expansion bolts at beam – C24 timber

Table A 10-15 Standard Load-carrying Capacities – RD 380 to RD 500 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails or Screws / Bolts[1]		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD 380	RD 380 32x174	14	4x M12	21.95	31.36	12.72	31.36	31.36	31.22
	RD 380 38x171	14	4x M12	21.95	32.06	12.72	32.06	32.06	31.22
	RD 380 46x167	14	4x M12	21.95	32.98	12.72	32.98	32.98	31.22
	RD 380 50x165	14	4x M12	21.95	33.44	12.72	33.44	33.44	31.22
	RD 380 59x160,5	14	4x M12	21.95	34.48	12.72	34.48	34.48	31.22
	RD 380 63x158,5	14	4x M12	21.95	34.94	12.72	34.94	34.94	31.22
	RD 380 71x154,5	14	4x M12	21.95	35.86	12.72	35.86	35.86	31.22
	RD 380 75x152,5	14	4x M12	21.95	36.32	12.72	36.32	36.32	31.22
	RD 380 80x150	14	4x M12	21.95	36.90	12.72	36.90	36.90	31.22
	RD 380 90x145	14	4x M12	21.95	38.05	12.72	38.05	38.05	31.22
	RD 380 100x140	14	4x M12	21.95	38.88	12.72	38.88	38.88	31.22
	RD 380 120x130	14	4x M12	21.95	38.88	12.72	38.88	38.88	31.22
	RD 380 140x120	14	4x M12	21.95	38.88	12.72	38.88	38.88	31.22
RD 440	RD 440 32x204	18	6x M12	25.58	33.77	16.36	33.77	33.77	33.77
	RD 440 38x201	18	6x M12	22.86	34.51	13.63	34.51	34.51	34.51
	RD 440 63x188,5	18	6x M12	25.58	37.62	16.36	37.62	37.62	37.62
	RD 440 71x184,5	18	6x M12	25.58	38.61	16.36	38.61	38.61	38.61
	RD 440 75x182,5	18	6x M12	25.58	39.11	16.36	39.11	39.11	39.11
	RD 440 80x180	18	6x M12	25.58	39.73	16.36	39.73	39.73	39.73
	RD 440 90x175	18	6x M12	25.58	40.97	16.36	40.97	40.97	40.14
	RD 440 95x172.5	18	6x M12	25.58	41.59	16.36	41.59	41.59	40.14
	RD 440 100x170	18	6x M12	25.58	42.21	16.36	42.21	42.21	40.14
	RD 440 120x160	18	6x M12	25.58	44.69	16.36	44.69	44.69	40.14
RD 500	RD 500 32x234	20	6x M12	27.40	38.89	18.18	38.89	38.89	38.89
	RD 500 46x227	20	6x M12	27.40	40.89	18.18	40.89	40.89	40.89
	RD 500 59x220.5	20	6x M12	27.40	42.75	18.18	42.75	42.75	42.75
	RD 500 71x 214,5	20	6x M12	27.40	44.47	18.18	44.47	44.47	44.47
	RD 500 75x 212,5	20	6x M12	27.40	45.04	18.18	45.04	45.04	44.60
	RD 500 80x 210	20	6x M12	27.40	45.75	18.18	45.75	45.75	44.60
	RD 500 90x 205	20	6x M12	27.40	47.18	18.18	47.18	47.18	44.60
	RD 500 100x 200	20	6x M12	27.40	48.61	18.18	48.61	48.61	44.60
	RD 500 120x190	20	6x M12	27.40	51.47	18.18	51.47	51.47	44.60
	RD 500 140x 180	20	6x M12	27.40	54.33	18.18	53.82	54.33	44.60

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively at joist - SPIT FIX II expansion bolts at beam – C24 timber

Table A 10-16 Standard Load-carrying Capacities – RDD Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails or Screws / Bolts[1]		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RDD 250	RDD 250 63x93,5	6	4x M10	14.31	14.31	5.45	14.31	14.31	13.38
	RDD 250 71x 89,5	6	4x M10	14.68	14.93	5.45	14.93	14.93	13.38
	RDD 250 75x 87,5	6	4x M10	14.68	15.23	5.45	15.23	15.23	13.38
	RDD 250 80x85	6	4x M10	14.07	14.07	5.45	14.07	14.07	13.38
RDD 300	RDD 300 63x118,5	8	4x M12	16.49	25.26	7.27	25.26	25.26	17.84
	RDD 300 80x110	8	4x M12	16.49	24.79	7.27	24.79	24.79	17.84
RDD 335	RDD 335 59x138	12	4x M12	20.13	23.41	10.91	23.41	23.41	23.41
	RDD 335 63X136	12	4x M12	20.13	23.81	10.91	23.81	23.81	23.81
	RDD 335 71x132	12	4x M12	20.13	24.62	10.91	24.62	24.62	24.62
	RDD 335 80x127,5	12	4x M12	20.13	23.66	10.91	23.66	23.66	23.66
	RDD 335 140x97,5	12	4x M12	20.13	29.78	10.91	29.78	29.78	26.76
RDD 380	RDD 380 63x158,5	14	4x M12	21.95	26.31	12.72	26.31	26.31	26.31
	RDD 380 71x154,5	14	4x M12	21.95	27.47	12.72	27.47	27.47	27.47
	RDD 380 75x152,5	14	4x M12	21.95	28.32	12.72	28.32	28.32	28.32
	RDD 380 100x140	14	4x M12	21.95	29.06	12.72	29.06	29.06	29.06
	RDD 380 120x130	14	4x M12	21.95	31.36	12.72	31.36	31.36	31.22
	RDD 380 140x120	14	4x M12	21.95	33.67	12.72	33.67	33.67	31.22
RDD 440	RDD 440 63x188,5	18	6x M12	25.58	29.17	16.36	29.17	29.17	29.17
	RDD 440 80x180	18	6x M12	25.58	28.80	16.36	28.80	28.80	28.80
	RDD 440 120x160	18	6x M12	25.58	33.77	16.36	33.77	33.77	33.77
RDD 500	RDD 500 80x 210	20	6x M12	27.40	32.02	18.18	32.02	32.02	32.02
	RDD 500 90x205	20	6x M12	27.40	34.07	18.18	34.07	34.07	34.07
	RDD 500 100x200	20	6x M12	27.40	36.03	18.18	36.03	36.03	36.03
	RDD 500 120x190	20	6x M12	27.40	38.89	18.18	38.89	38.89	38.89
	RDD 500 140x180	20	6x M12	27.40	41.75	18.18	41.75	41.75	41.75

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively at joist - SPIT FIX II expansion bolts at beam – C24 timber

Table A 10-17 Detailed Load-carrying Capacities – RD 210 and RD 250 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist [kN]		Bolts (2)	to Beam [kN]			Lat. Screws (1)	to Joist [kN]		Bolts (2)	to Beam [kN]		
			Dr or T	Dr		Dr or Dw	Dr or Dw	T		Dr or T	Dr		Dr or Dw	Dr or Dw	T
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RD 210	RD 210 32x 89	4	2.42	9.22	2x M10	16.20	18.24	18.00	4	8.92	9.22	2x M10	16.20	18.24	18.00
	RD 210 38x 86	4	3.03	9.22	2x M10	16.20	18.98	18.00	4	8.92	9.22	2x M10	16.20	18.98	18.00
	RD 210 40x 85	4	3.64	9.22	2x M10	16.20	19.22	18.00	4	8.92	9.22	2x M10	16.20	19.22	18.00
	RD 210 46x 82	4	3.64	9.22	2x M10	16.20	19.98	18.00	4	8.92	9.22	2x M10	16.20	19.98	18.00
	RD 210 50x 80	4	3.64	9.22	2x M10	16.20	20.49	18.00	4	8.92	9.22	2x M10	16.20	20.49	18.00
	RD 210 59x 75,5	4	3.64	9.22	2x M10	16.20	21.66	18.00	4	8.92	9.22	2x M10	16.20	21.66	18.00
	RD 210 63x 73,5	4	3.64	9.22	2x M10	16.20	22.19	18.00	4	8.92	9.22	2x M10	16.20	22.19	18.00
	RD 210 80x65	4	3.64	9.22	2x M10	16.20	18.24	18.00	4	8.92	9.22	2x M10	16.20	18.24	18.00
RD 250	RD 250 32x109	6	3.64	9.22	4x M10	32.40	17.79	17.79	6	13.38	9.22	4x M10	32.40	17.79	17.79
	RD 250 36x107	6	4.54	9.22	4x M10	32.40	18.10	18.10	6	13.38	9.22	4x M10	32.40	18.10	18.10
	RD 250 38x106	6	4.54	9.22	4x M10	32.40	18.25	18.25	6	13.38	9.22	4x M10	32.40	18.25	18.25
	RD 250 40x105	6	5.45	9.22	4x M10	32.40	18.41	18.41	6	13.38	9.22	4x M10	32.40	18.41	18.41
	RD 250 46x102	6	5.45	9.22	4x M10	32.40	18.87	18.87	6	13.38	9.22	4x M10	32.40	18.87	18.87
	RD 250 50x100	6	5.45	9.22	4x M10	32.40	19.18	19.18	6	13.38	9.22	4x M10	32.40	19.18	19.18
	RD 250 59x 95,5	6	5.45	9.22	4x M10	32.40	19.87	19.87	6	13.38	9.22	4x M10	32.40	19.87	19.87
	RD 250 63x 93,5	6	5.45	9.22	4x M10	32.40	20.18	20.18	6	13.38	9.22	4x M10	32.40	20.18	20.18
	RD 250 71x 89,5	6	5.45	9.22	4x M10	32.40	20.80	20.80	6	13.38	9.22	4x M10	32.40	20.80	20.80
	RD 250 75x 87,5	6	5.45	9.22	4x M10	32.40	21.11	21.11	6	13.38	9.22	4x M10	32.40	21.11	21.11
	RD 250 80x85	6	5.45	9.22	4x M10	32.40	21.50	21.50	6	13.38	9.22	4x M10	32.40	21.50	21.50

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Table A 10-18 Detailed Load-carrying Capacities – RD 300 and RD 335 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist [kN]		Bolts (2)	to Beam [kN]			Lat. Screws (1)	to Joist [kN]		Bolts (2)	to Beam [kN]		
			Dr or T	Dr		Dr or Dw	Dr or Dw	T		Dr or T	Dr		Dr or Dw	Dr or Dw	T
			Nail shear resistance	Plate Bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate Bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RD 300	RD 300 32x134	8	4.85	9.22	4x M12	38.88	30.40	30.40	8	17.84	9.22	4x M12	38.88	30.40	30.40
	RD 300 38x131	8	6.06	9.22	4x M12	38.88	31.05	31.05	8	17.84	9.22	4x M12	38.88	31.05	31.05
	RD 300 40x130	8	7.27	9.22	4x M12	38.88	31.26	31.26	8	17.84	9.22	4x M12	38.88	31.26	31.26
	RD 300 50x125	8	7.27	9.22	4x M12	38.88	32.35	32.35	8	17.84	9.22	4x M12	38.88	32.35	32.35
	RD 300 59x120,5	8	7.27	9.22	4x M12	38.88	33.33	33.33	8	17.84	9.22	4x M12	38.88	33.33	33.33
	RD 300 63x118,5	8	7.27	9.22	4x M12	38.88	33.76	33.76	8	17.84	9.22	4x M12	38.88	33.76	33.76
	RD 300 71x114,5	8	7.27	9.22	4x M12	38.88	34.63	34.63	8	17.84	9.22	4x M12	38.88	34.63	34.63
	RD 300 75x112,5	8	7.27	9.22	4x M12	38.88	35.06	35.06	8	17.84	9.22	4x M12	38.88	35.06	35.06
	RD 300 80x110	8	7.27	9.22	4x M12	38.88	35.61	35.61	8	17.84	9.22	4x M12	38.88	35.61	35.61
RD 335	RD 335 32x151,5	12	10.91	9.22	4x M12	38.88	32.63	32.63	12	26.76	9.22	4x M12	38.88	32.63	32.63
	RD 335 38x 148.5	12	9.09	9.22	4x M12	38.88	28.35	28.35	12	26.76	9.22	4x M12	38.88	28.35	28.35
	RD 335 40x 147.5	12	10.91	9.22	4x M12	38.88	28.55	28.55	12	26.76	9.22	4x M12	38.88	28.55	28.55
	RD 335 46x 144.5	12	10.91	9.22	4x M12	38.88	29.17	29.17	12	26.76	9.22	4x M12	38.88	29.17	29.17
	RD 335 50x142.5	12	10.91	9.22	4x M12	38.88	29.57	29.57	12	26.76	9.22	4x M12	38.88	29.57	29.57
	RD 335 59x 138	12	10.91	9.22	4x M12	38.88	30.49	30.49	12	26.76	9.22	4x M12	38.88	30.49	30.49
	RD 335 63x 136	12	10.91	9.22	4x M12	38.88	30.90	30.90	12	26.76	9.22	4x M12	38.88	30.90	30.90
	RD 335 71x 132	12	10.91	9.22	4x M12	38.88	31.72	31.72	12	26.76	9.22	4x M12	38.88	31.72	31.72
	RD 335 75x 130	12	10.91	9.22	4x M12	38.88	32.12	32.12	12	26.76	9.22	4x M12	38.88	32.12	32.12
	RD 335 80x 127.5	12	10.91	9.22	4x M12	38.88	32.63	32.63	12	26.76	9.22	4x M12	38.88	32.63	32.63
	RD 335 140x97,5	12	10.91	9.22	4x M12	38.88	38.75	38.75	12	26.76	9.22	4x M12	38.88	38.75	38.75

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Table A 10-19 Detailed Load-carrying Capacities – RD 380 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Bolts (2)	to Beam			Lat. Screws (1)	to Joist		Bolts (2)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RD 380	RD 380 32x174	14	12.72	9.22	4x M12	38.88	31.36	31.36	14	31.22	9.22	4x M12	38.88	31.36	31.36
	RD 380 38x171	14	12.72	9.22	4x M12	38.88	32.06	32.06	14	31.22	9.22	4x M12	38.88	32.06	32.06
	RD 380 46x167	14	12.72	9.22	4x M12	38.88	32.98	32.98	14	31.22	9.22	4x M12	38.88	32.98	32.98
	RD 380 50x165	14	12.72	9.22	4x M12	38.88	33.44	33.44	14	31.22	9.22	4x M12	38.88	33.44	33.44
	RD 380 59x160,5	14	12.72	9.22	4x M12	38.88	34.48	34.48	14	31.22	9.22	4x M12	38.88	34.48	34.48
	RD 380 63x158,5	14	12.72	9.22	4x M12	38.88	34.94	34.94	14	31.22	9.22	4x M12	38.88	34.94	34.94
	RD 380 71x154,5	14	12.72	9.22	4x M12	38.88	35.86	35.86	14	31.22	9.22	4x M12	38.88	35.86	35.86
	RD 380 75x152,5	14	12.72	9.22	4x M12	38.88	36.32	36.32	14	31.22	9.22	4x M12	38.88	36.32	36.32
	RD 380 80x150	14	12.72	9.22	4x M12	38.88	36.90	36.90	14	31.22	9.22	4x M12	38.88	36.90	36.90
	RD 380 90x145	14	12.72	9.22	4x M12	38.88	38.05	38.05	14	31.22	9.22	4x M12	38.88	38.05	38.05
	RD 380 100x140	14	12.72	9.22	4x M12	38.88	39.21	39.21	14	31.22	9.22	4x M12	38.88	39.21	39.21
	RD 380 120x130	14	12.72	9.22	4x M12	38.88	41.51	41.51	14	31.22	9.22	4x M12	38.88	41.51	41.51
	RD 380 140x120	14	12.72	9.22	4x M12	38.88	43.82	43.82	14	31.22	9.22	4x M12	38.88	43.82	43.82

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Table A 10-20 Detailed Load-carrying Capacities – RD 440 and RD 500 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist [kN]		Bolts (2)	to Beam [kN]			Lat. Screws (1)	to Joist [kN]		Bolts (2)	to Beam [kN]		
			Dr or T	Dr		Dr or Dw	Dr or Dw	T		Dr or T	Dr		Dr or Dw	Dr or Dw	T
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RD 440	RD 440 32x204	18	16.36	9.22	6x M12	58.32	33.77	33.77	18	40.14	9.22	6x M12	58.32	33.77	33.77
	RD 440 38x201	18	13.63	9.22	6x M12	58.32	34.51	34.51	18	40.14	9.22	6x M12	58.32	34.51	34.51
	RD 440 63x188,5	18	16.36	9.22	6x M12	58.32	37.62	37.62	18	40.14	9.22	6x M12	58.32	37.62	37.62
	RD 440 71x184,5	18	16.36	9.22	6x M12	58.32	38.61	38.61	18	40.14	9.22	6x M12	58.32	38.61	38.61
	RD 440 75x182,5	18	16.36	9.22	6x M12	58.32	39.11	39.11	18	40.14	9.22	6x M12	58.32	39.11	39.11
	RD 440 80x180	18	16.36	9.22	6x M12	58.32	39.73	39.73	18	40.14	9.22	6x M12	58.32	39.73	39.73
	RD 440 90x175	18	16.36	9.22	6x M12	58.32	40.97	40.97	18	40.14	9.22	6x M12	58.32	40.97	40.97
	RD 440 95x172.5	18	16.36	9.22	6x M12	58.32	41.59	41.59	18	40.14	9.22	6x M12	58.32	41.59	41.59
	RD 440 100x170	18	16.36	9.22	6x M12	58.32	42.21	42.21	18	40.14	9.22	6x M12	58.32	42.21	42.21
	RD 440 120x160	18	16.36	9.22	6x M12	58.32	44.69	44.69	18	40.14	9.22	6x M12	58.32	44.69	44.69
RD 500	RD 500 32x234	20	18.18	9.22	6x M12	58.32	38.89	38.89	20	44.60	9.22	6x M12	58.32	38.89	38.89
	RD 500 46x227	20	18.18	9.22	6x M12	58.32	40.89	40.89	20	44.60	9.22	6x M12	58.32	40.89	40.89
	RD 500 59x220.5	20	18.18	9.22	6x M12	58.32	42.75	42.75	20	44.60	9.22	6x M12	58.32	42.75	42.75
	RD 500 71x 214,5	20	18.18	9.22	6x M12	58.32	44.47	44.47	20	44.60	9.22	6x M12	58.32	44.47	44.47
	RD 500 75x 212,5	20	18.18	9.22	6x M12	58.32	45.04	45.04	20	44.60	9.22	6x M12	58.32	45.04	45.04
	RD 500 80x 210	20	18.18	9.22	6x M12	58.32	45.75	45.75	20	44.60	9.22	6x M12	58.32	45.75	45.75
	RD 500 90x 205	20	18.18	9.22	6x M12	58.32	47.18	47.18	20	44.60	9.22	6x M12	58.32	47.18	47.18
	RD 500 100x 200	20	18.18	9.22	6x M12	58.32	48.61	48.61	20	44.60	9.22	6x M12	58.32	48.61	48.61
	RD 500 120x190	20	18.18	9.22	6x M12	58.32	51.47	51.47	20	44.60	9.22	6x M12	58.32	51.47	51.47
	RD 500 140x 180	20	18.18	9.22	6x M12	58.32	54.33	54.33	20	44.60	9.22	6x M12	58.32	54.33	54.33

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Table A 10-21 Detailed Load-carrying Capacities – RDD 250 to RDD 335 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Bolts (2)	to Beam			Lat. Screws (1)	to Joist		Bolts (2)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RDD 250	RDD 250 63x93,5	6	5.45	9.22	4x M10	32.40	14.31	14.31	6	13.38	9.22	4x M10	32.40	14.31	14.31
	RDD 250 71x 89,5	6	5.45	9.22	4x M10	32.40	14.93	14.93	6	13.38	9.22	4x M10	32.40	14.93	14.93
	RDD 250 75x 87,5	6	5.45	9.22	4x M10	32.40	15.23	15.23	6	13.38	9.22	4x M10	32.40	15.23	15.23
	RDD 250 80x85	6	5.45	9.22	4x M10	32.40	14.07	14.07	6	13.38	9.22	4x M10	32.40	14.07	14.07
RDD 300	RDD 300 63x118,5	8	7.27	9.22	4x M12	38.88	25.26	25.26	8	17.84	9.22	4x M12	38.88	25.26	25.26
	RDD 300 80x110	8	7.27	9.22	4x M12	38.88	24.79	24.79	8	17.84	9.22	4x M12	38.88	24.79	24.79
RDD 335	RDD 335 59x138	12	10.91	9.22	4x M12	38.88	23.41	23.41	12	26.76	9.22	4x M12	38.88	23.41	23.41
	RDD 335 63X136	12	10.91	9.22	4x M12	38.88	23.81	23.81	12	26.76	9.22	4x M12	38.88	23.81	23.81
	RDD 335 71x132	12	10.91	9.22	4x M12	38.88	24.62	24.62	12	26.76	9.22	4x M12	38.88	24.62	24.62
	RDD 335 80x127,5	12	10.91	9.22	4x M12	38.88	23.66	23.66	12	26.76	9.22	4x M12	38.88	23.66	23.66
	RDD 335 140x97,5	12	10.91	9.22	4x M12	38.88	29.78	29.78	12	26.76	9.22	4x M12	38.88	29.78	29.78

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Note: For the closed RDD joist hangers, when the seat width equals or exceeds 80mm, the number of beam nail holes is reduced

Table A 10-22 Detailed Load-carrying Capacities – RDD 380 to RDD 500 Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Bolts (2)	to Beam			Lat. Screws (1)	to Joist		Bolts (2)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RDD 380	RDD 380 63x158,5	14	12.72	9.22	4x M12	38.88	26.31	26.31	14	31.22	9.22	4x M12	38.88	26.31	26.31
	RDD 380 71x154,5	14	12.72	9.22	4x M12	38.88	27.47	27.47	14	31.22	9.22	4x M12	38.88	27.47	27.47
	RDD 380 75x152,5	14	12.72	9.22	4x M12	38.88	28.32	28.32	14	31.22	9.22	4x M12	38.88	28.32	28.32
	RDD 380 100x140	14	12.72	9.22	4x M12	38.88	29.06	29.06	14	31.22	9.22	4x M12	38.88	29.06	29.06
	RDD 380 120x130	14	12.72	9.22	4x M12	38.88	31.36	31.36	14	31.22	9.22	4x M12	38.88	31.36	31.36
	RDD 380 140x120	14	12.72	9.22	4x M12	38.88	33.67	33.67	14	31.22	9.22	4x M12	38.88	33.67	33.67
RDD 440	RDD 440 63x188,5	18	16.36	9.22	6x M12	58.32	29.17	29.17	18	40.14	9.22	6x M12	58.32	29.17	29.17
	RDD 440 80x180	18	16.36	9.22	6x M12	58.32	28.80	28.80	18	40.14	9.22	6x M12	58.32	28.80	28.80
	RDD 440 120x160	18	16.36	9.22	6x M12	58.32	33.77	33.77	18	40.14	9.22	6x M12	58.32	33.77	33.77
RDD 500	RDD 500 80x 210	20	18.18	9.22	6x M12	58.32	32.02	32.02	20	44.60	9.22	6x M12	58.32	32.02	32.02
	RDD 500 90x205	20	18.18	9.22	6x M12	58.32	34.07	34.07	20	44.60	9.22	6x M12	58.32	34.07	34.07
	RDD 500 100x200	20	18.18	9.22	6x M12	58.32	36.03	36.03	20	44.60	9.22	6x M12	58.32	36.03	36.03
	RDD 500 120x190	20	18.18	9.22	6x M12	58.32	38.89	38.89	20	44.60	9.22	6x M12	58.32	38.89	38.89
	RDD 500 140x180	20	18.18	9.22	6x M12	58.32	41.75	41.75	20	44.60	9.22	6x M12	58.32	41.75	41.75

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

Note: For the closed RDD joist hangers, when the seat width equals or exceeds 80mm, the number of Beam nail holes is reduced

A10.8 RD2d and RD2dd – Timber to Concrete Connection

Table A 10-23 Standard Load-carrying Capacities – RD2d and RD2dd Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Load Direction / Dimensions	Nails or Screws / Bolts[1]		Nailed Connection			Screwed Connection		
		Joist	Beam	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]	Main Dr [kN]	Lateral Dw [kN]	Tens. T [kN]
RD2d 300	RD2d 300 32x134	8	4x M12	11.37	30.40	4.85	24.36	30.40	17.84
	RD2d 300 63x118,5	8	4x M12	13.79	33.76	7.27	24.36	33.76	17.84
	RD2d 300 80x110	8	4x M12	13.79	35.61	7.27	24.36	35.61	17.84
RD2d 335	RD2d 335 32x151.5	12	4x M12	13.79	28.55	7.27	28.55	28.55	26.76
	RD2d 335 63x136	12	4x M12	17.43	31.72	10.91	31.72	31.72	26.76
	RD2d 335 80x127.5	12	4x M12	17.43	33.45	10.91	33.28	33.45	26.76
	RD2d 335 140x97.5	12	4x M12	17.43	38.88	10.91	33.28	38.88	26.76
RD2d 380	RD2d 380 32x174	14	4x M12	15.00	32.29	8.48	32.29	32.29	31.22
	RD2d 380 75x152,5	14	4x M12	19.25	37.25	12.72	37.25	37.25	31.22
	RD2d 380 100x140	14	4x M12	19.25	38.88	12.72	37.74	38.88	31.22
	RD2d 380 140x120	14	4x M12	19.25	38.88	12.72	37.74	38.88	31.22
RD2dd 300	RD2dd 300 80x110	8	4x M12	13.79	29.40	7.27	24.36	29.40	17.84
	RD2dd 300 63x118,5	8	4x M12	13.79	26.31	7.27	24.36	26.31	17.84
RD2dd 335	RD2dd335 63x136	12	4x M12	17.43	23.81	10.91	23.81	23.81	23.81
	RD2dd 335 80x127.5	12	4x M12	17.43	25.86	10.91	25.86	25.86	25.86
	RD2dd 335 140x97.5	12	4x M12	17.43	32.43	10.91	32.43	32.43	26.76
RD2dd 380	RD2dd 380 75x152,5	14	4x M12	19.25	28.32	12.72	28.32	28.32	28.32
	RD2dd 380 100x140	14	4x M12	19.25	31.74	12.72	31.74	31.74	31.22
	RD2dd 380 140x120	14	4x M12	19.25	36.84	12.72	36.84	36.84	31.22

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively at joist - SPIT FIX II expansion bolts at beam – C24 timber

Table A 10-24 Detailed Load-carrying Capacities – RD2d and RD2dd Joist Hangers – Timber to Concrete – Nailed & Screwed Connection

Series / Model	Failure Mode	Nailed Connection							Screwed Connection						
		Lat. Nails (1)	to Joist		Bolts (2)	to Beam			Lat. Screws (1)	to Joist		Bolts (2)	to Beam		
			Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]		Dr or T [kN]	Dr [kN]		Dr or Dw [kN]	Dr or Dw [kN]	T [kN]
			Nail shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity		Screw shear resistance	Plate bending resistance		Bearing resistance	Bolt shear capacity	Bolt tension capacity
RD2d 300	RD2d 300 32x134	8	4.85	6.52	4x M12	38.88	30.40	30.40	8	17.84	6.52	4x M12	38.88	30.40	30.40
	RD2d 300 63x118,5	8	7.27	6.52	4x M12	38.88	33.76	33.76	8	17.84	6.52	4x M12	38.88	33.76	33.76
	RD2d 300 80x110	8	7.27	6.52	4x M12	38.88	35.61	35.61	8	17.84	6.52	4x M12	38.88	35.61	35.61
RD2d 335	RD2d 335 32x151.5	12	7.27	6.52	4x M12	38.88	28.55	28.55	12	26.76	6.52	4x M12	38.88	28.55	28.55
	RD2d 335 63x136	12	10.91	6.52	4x M12	38.88	31.72	31.72	12	26.76	6.52	4x M12	38.88	31.72	31.72
	RD2d 335 80x127.5	12	10.91	6.52	4x M12	38.88	33.45	33.45	12	26.76	6.52	4x M12	38.88	33.45	33.45
	RD2d 335 140x97.5	12	10.91	6.52	4x M12	38.88	39.57	39.57	12	26.76	6.52	4x M12	38.88	39.57	39.57
RD2d 380	RD2d 380 32x174	14	8.48	6.52	4x M12	38.88	32.29	32.29	14	31.22	6.52	4x M12	38.88	32.29	32.29
	RD2d 380 75x152,5	14	12.72	6.52	4x M12	38.88	37.25	37.25	14	31.22	6.52	4x M12	38.88	37.25	37.25
	RD2d 380 100x140	14	12.72	6.52	4x M12	38.88	40.13	40.13	14	31.22	6.52	4x M12	38.88	40.13	40.13
	RD2d 380 140x120	14	12.72	6.52	4x M12	38.88	44.74	44.74	14	31.22	6.52	4x M12	38.88	44.74	44.74
RD2dd 330	RD2dd 300 80x110	8	7.27	6.52	4x M12	38.88	29.40	29.40	8	17.84	6.52	4x M12	38.88	29.40	29.40
	RD2dd 300 63x118,5	8	7.27	6.52	4x M12	38.88	26.31	26.31	8	17.84	6.52	4x M12	38.88	26.31	26.31
RD2dd 335	RD2dd335 63x136	12	10.91	6.52	4x M12	38.88	23.81	23.81	12	26.76	6.52	4x M12	38.88	23.81	23.81
	RD2dd 335 80x127.5	12	10.91	6.52	4x M12	38.88	25.86	25.86	12	26.76	6.52	4x M12	38.88	25.86	25.86
	RD2dd 335 140x97.5	12	10.91	6.52	4x M12	38.88	32.43	32.43	12	26.76	6.52	4x M12	38.88	32.43	32.43
RD2dd 380	RD2dd 380 75x152,5	14	12.72	6.52	4x M12	38.88	28.32	28.32	14	31.22	6.52	4x M12	38.88	28.32	28.32
	RD2dd 380 100x140	14	12.72	6.52	4x M12	38.88	31.74	31.74	14	31.22	6.52	4x M12	38.88	31.74	31.74
	RD2dd 380 140x120	14	12.72	6.52	4x M12	38.88	36.84	36.84	14	31.22	6.52	4x M12	38.88	36.84	36.84

(1) 4.0x40mm threaded nails and CSA5,0X35 Simpson Strong-Tie screws respectively – C24 timber

(2) SPIT FIX II expansion bolts

A10.9 Joist Hangers – Series I – Method for Adjusting Load-carrying Capacities – Timber to Timber & Concrete

This section describes the method for determining load-carrying capacities of Series I Joist Hangers for alternative grades and/or fasteners by determining appropriate modification factors for:

- the selected grade and/or fastener(s)
- each of the failure modes of the relevant connection configuration

and applying them by multiplication to the detailed load-carrying capacities published in the relevant tables in Annex 10 above.

For each plate and each load direction the minimum value obtained for the corresponding failure modes after applying the adjustment factors provides the characteristic load-carrying capacity for this plate and load direction.

The modification factors for calculating alternative load-carrying capacities of Series I Joist Hangers are given in:

Table A 10-25 Modification Factors of Load-carrying Capacities – Series I Joist Hangers – Timber to Timber

Table A 10-26 Modification Factors of Load-carrying Capacities – Series I Joist Hangers – Timber to Concrete

In the case of connector-to-concrete connections, the bolt shear capacity can be in accordance with ETAG 001 Annex C and the corresponding ETA for the bolt. To help the user to determine the appropriate concrete cone area, approximate distances between bolts for Series I Joist Hangers are listed in Table A 10-27, Table A 10-28 and Table A 10-29. The nomenclature for the dimensions is defined in Figure A 10-1.

For more accurate designs, it is recommended to determine the bolt distances manually.

Table A 10-25 Modification Factors of Load-carrying Capacities – Series I Joist Hangers – Timber to Timber

Failure Mode	Connection to Joist		Connection to Header Beam		
	Dr or T [kN]	Dr [kN]	Dr [kN]	Dw [kN]	T [kN]
	Nail/screw shear resistance	Plate bending resistance	Nail/screw shear resistance	Nail/screw shear resistance	Nail/screw tension resistance
Alternative timber density (ρ_k in kg/m³)	ρ_k/350	-	ρ_k/350		(ρ_k/350)²
Alternative nail shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}$/0.9	-	$F_{lat,Rk}$/0.9		-
Alternative nail withdrawal capacity ($F_{ax,Rk}$ in kN)	-	-	-		$F_{ax,Rk}$/0.61
Alternative screw shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}$/2.23	-	$F_{lat,Rk}$/2.23		-
Alternative screw withdrawal capacity ($F_{ax,Rk}$ in kN)	-	-	-		$F_{ax,Rk}$/1.66

Note: where e.g. $F_{ax,Rk}$/0.61 is indicated, $F_{ax,Rk}$ is the characteristic of the alternative component and the result of ($F_{ax,Rk}$/0.61) is the modification factor used to multiply the standard load-carrying capacity for that failure mode.

Table A 10-26 Modification Factors of Load-carrying Capacities – Series I Joist Hangers – Timber to Concrete

Failure Mode	Connection to Joist		Connection to Header Beam		
	Dr or T [kN]	Dr [kN]	Dr or Dw [kN]	Dr or Dw [kN]	T [kN]
	Nail/screw shear resistance	Plate bending resistance	Bearing resistance	Bolt shear capacity	Bolt tension capacity
Alternative timber density (ρ_k in kg/m^3)	ρ_k/350	-	-	-	
Alternative nail shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}$/0.9	-	-	-	
Alternative nail withdrawal capacity ($F_{ax,Rk}$ in kN)	-	-	-	-	
Alternative screw shear capacity ($F_{lat,Rk}$ in kN)	$F_{lat,Rk}$/2.23	-	-	-	
Alternative screw withdrawal capacity ($F_{ax,Rk}$ in kN)	-	-	-	-	
Alternative bolt diameter (d in mm, with d_{ref} = diameter of the prescribed bolt)	-	-	d/d_{ref}	-	

Note: where e.g. $F_{ax,Rk}$/0.61 is indicated, $F_{ax,Rk}$ is the characteristic of the alternative component and the result of ($F_{ax,Rk}$/0.61) is the modification factor used to multiply the standard load-carrying capacity for that failure mode.

A10.10 Bolt Hole Distances – Series I Joist Hangers

Figure A 10-1 Definition of *d*1, *d*2 and *d*3 Bolt Hole Distances for Joist hangers

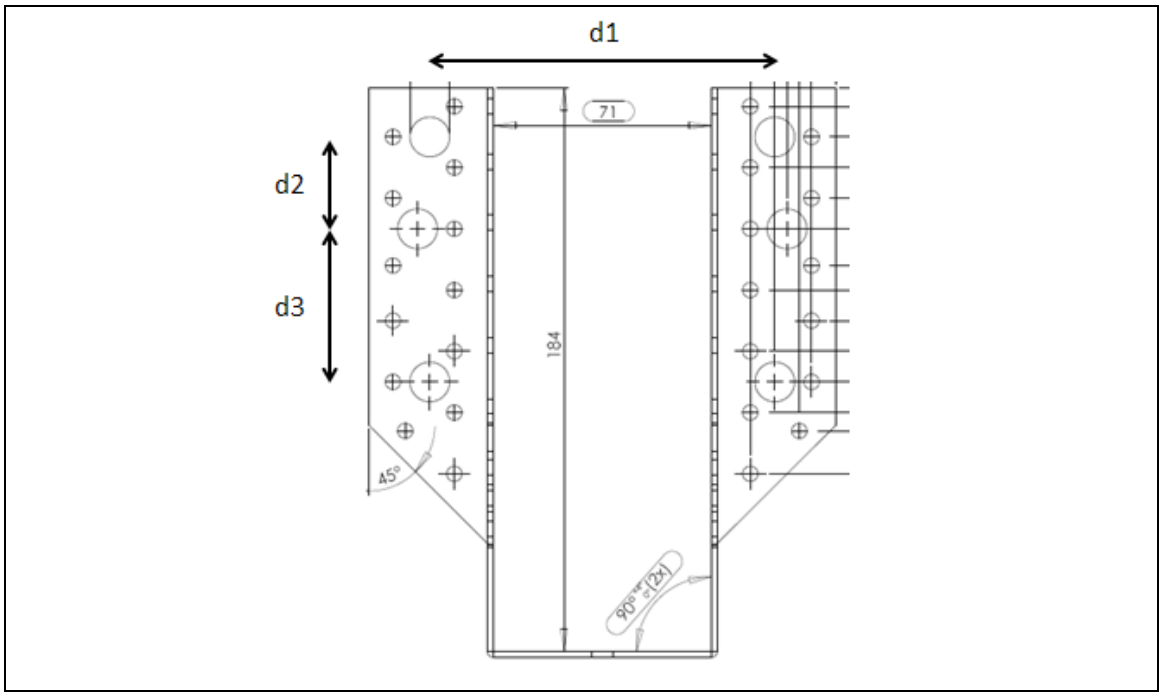


Table A 10-27 Approximate Distances between Bolts for RD 210 to RD 335 Joist hangers

Series / Model	Dimensions	*d*1 (mm)	*d*2 (mm)	*d*3 (mm)
RD 210	RD 210 32x 89	80	0	0
	RD 210 38x 86	86	0	0
	RD 210 40x 85	88	0	0
	RD 210 46x 82	94	0	0
	RD 210 50x 80	98	0	0
	RD 210 59x 75,5	107	0	0
	RD 210 63x 73,5	111	0	0
	RD 210 80x65	80	150	0
RD 250	RD 250 32x109	80	20	0
	RD 250 36x107	84	20	0
	RD 250 38x106	86	20	0
	RD 250 40x105	88	20	0
	RD 250 46x102	94	20	0
	RD 250 50x100	98	20	0
	RD 250 59x 95,5	107	20	0
	RD 250 63x 93,5	111	20	0
	RD 250 71x 89,5	119	20	0
	RD 250 75x 87,5	123	20	0
	RD 250 80x85	128	20	0
RD 300	RD 300 32x134	80	40	0
	RD 300 38x131	86	40	0
	RD 300 40x130	88	40	0
	RD 300 50x125	98	40	0
	RD 300 59x120,5	107	40	0
	RD 300 63x118,5	111	40	0
	RD 300 71x114,5	119	40	0
	RD 300 75x112,5	123	40	0
	RD 300 80x110	128	40	0
RD 335	RD 335 32x151,5	120	30	0
	RD 335 38x 148.5	78	30	0
	RD 335 40x 147.5	80	30	0
	RD 335 46x 144.5	86	30	0
	RD 335 50x142.5	90	30	0
	RD 335 59x 138	99	30	0
	RD 335 63x 136	103	30	0
	RD 335 71x 132	111	30	0
	RD 335 75x 130	115	30	0
	RD 335 80x 127.5	120	30	0
	RD 335 140x97,5	180	30	0

See Figure A 10-1 for definitions of *d*1, *d*2 and *d*3.

Table A 10-28 Approximate Distances between Bolts for RD 380 to RD 500 Joist hangers

Series / Model	Dimensions	*d*1 (mm)	*d*2 (mm)	*d*3 (mm)
RD 380	RD 380 32x174	72	50	0
	RD 380 38x171	78	50	0
	RD 380 46x167	86	50	0
	RD 380 50x165	90	50	0
	RD 380 59x160,5	99	50	0
	RD 380 63x158,5	103	50	0
	RD 380 71x154,5	111	50	0
	RD 380 75x152,5	115	50	0
	RD 380 80x150	120	50	0
	RD 380 90x145	130	50	0
	RD 380 100x140	140	50	0
	RD 380 120x130	160	50	0
	RD 380 140x120	180	50	0
RD 440	RD 440 32x204	72	30	50
	RD 440 38x201	78	30	50
	RD 440 63x188,5	103	30	50
	RD 440 71x184,5	111	30	50
	RD 440 75x182,5	115	30	50
	RD 440 80x180	120	30	50
	RD 440 90x175	130	30	50
	RD 440 95x172.5	135	30	50
	RD 440 100x170	140	30	50
	RD 440 120x160	160	30	50
RD 500	RD 500 32x234	72	60	50
	RD 500 46x227	86	60	50
	RD 500 59x220.5	99	60	50
	RD 500 71x 214,5	111	60	50
	RD 500 75x 212,5	115	60	50
	RD 500 80x 210	120	60	50
	RD 500 90x 205	130	60	50
	RD 500 100x 200	140	60	50
	RD 500 120x190	160	60	50
	RD 500 140x 180	180	60	50

See Figure A 10-1 for definitions of *d*1, *d*2 and *d*3.

Table A 10-29 Approximate Distances between Bolts for RDD, RD2d and RD2dd Joist hangers

Series / Model	Dimensions	*d*1 [mm]	*d*2 [mm]	*d*3 [mm]
RDD 250	RDD 250 63x93,5	35	20	0
	RDD 250 71x 89,5	43	20	0
	RDD 250 75x 87,5	47	20	0
	RDD 250 80x85	32	20	0
RDD 300	RDD 300 63x118,5	35	40	0
	RDD 300 80x110	32	40	0
RDD 335	RDD 335 59x138	31	29	0
	RDD 335 63X136	35	29	0
	RDD 335 71x132	43	29	0
	RDD 335 80x127,5	32	30	0
	RDD 335 140x97,5	92	30	0
RDD 380	RDD 380 63x158,5	35	50	0
	RDD 380 71x154,5	42	50	0
	RDD 380 75x152,5	47	50	0
	RDD 380 100x140	52	50	0
	RDD 380 120x130	72	50	0
	RDD 380 140x120	92	50	0
RDD 440	RDD 440 63x188,5	35	30	50
	RDD 440 80x180	32	30	50
	RDD 440 120x160	72	30	50
RDD 500	RDD 500 80x 210	32	60	50
	RDD 500 90x205	42	60	50
	RDD 500 100x200	52	60	50
	RDD 500 120x190	72	60	50
	RDD 500 140x180	92	60	50
RD2d 300	RD2d 300 32x134	80	40	0
	RD2d 300 63x118,5	111	40	0
	RD2d 300 80x110	128	40	0
RD2d 335	RD2d 335 32x151.5	80	30	0
	RD2d 335 63x136	111	30	0
	RD2d 335 80x127.5	128	30	0
	RD2d 335 140x97.5	188	30	0
RD2d 380	RD2d 380 32x174	80	50	0
	RD2d 380 75x152,5	123	50	0
	RD2d 380 100x140	148	50	0
	RD2d 380 140x120	188	50	0
RD2dd 300	RD2dd 300 80x110	52	52	0
	RD2dd 300 63x118,5	91	50	0
RD2dd 335	RD2dd335 63x136	91	29	0
	RD2dd 335 80x127.5	52	31	0
	RD2dd 335 140x97.5	112	33	0
RD2dd 380	RD2dd 380 75x152,5	103	50	0
	RD2dd 380 100x140	72	52	0
	RD2dd 380 140x120	112	54	0

See Figure A 10-1 for definitions of *d*1, *d*2 and *d*3.

ANNEX 11 JOIST HANGERS – SERIES II –LOAD-CARRYING CAPACITIES

A11.1 Tabulated Values

The calculated load-carrying capacities for Series II joist hangers are presented in the following tables for both timber to timber and timber to concrete connections.

Load-carrying Capacities for timber substrates are presented both for nailed connections, using threaded nails as defined in Annex 6 §A6.4, and for screwed connections, using screws as defined in Annex 6 §A6.5, as described in the tables.

Load carrying capacities for concrete substrates are presented for bolted connections using SPIT FIX 3 expansion bolts covered by ETA-13/0005 as described in Annex 6 §A6.6. The bolt dimensions depend on the diameter of the bolt hole in the angle bracket.

The notation for the load directions used in the tables is defined in Annex 7 Figure A 7-2.

Tables are presented in two configurations:

- **Standard load-carrying capacities**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) and allow a direct reading of the load-carrying capacity in each direction for the load applied to each plate.

  The notation used in the tables of standard load-carrying capacities is as follows:

Variables	
F	connection capacity, as defined by subscripts
Subscripts	
x, y, z	x, y or z-direction
push, pull	compression or tension
k	characteristic value

- **Detailed load-carrying capacities by failure mode**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

  The notation used in the tables of detailed load-carrying capacities is as follows:

Variables	
V	connection capacity in shear, as defined by subscripts
T	connection capacity in tension (withdrawal), as defined by subscripts
M	connection capacity in bending, as defined by subscripts
P	connection capacity in clamping pressure, as defined by subscripts
Subscripts	
rot	load is rotational i.e. lateral (non-centred). If absent, assume an axial (centred) load
bolt	applies to a bolted connection
x, y, z	x, y or z-direction
k	characteristic value
1, 2, [U]	plate 1, plate 2 or seat plate of the connector

The method for determining capacities of Series II angle brackets for alternative grades and/or fasteners is described in §A11.8.

A11.2 Standard Load-carrying Capacities - Tables

A11.3 Detailed Load-carrying Capacities - Tables

A11.4 Raveeldrager Dicht & Raveeldrager Zwaar - Timber to Timber

Table A 11-1 Standard Load-carrying Capacities - Raveeldrager Dicht & Raveeldrager Zwaar - Timber to Timber

Joist hanger		Fasteners			Characteristic Load-carrying Capacity [kN]			
Model	Reference	Member 1	Member 2	Seat [U]	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$
Raveeldrager dicht	100x75x50x2.0	14x 5.0x40	6x 5.0x40	1x 6.0x40	17.35	8.73	16.66	7.44
	96x75x59x2.0							
Raveeldrager zwaar	180x80x120x2.0	28x 5.0x40	16x 5.0x40	1x 6.0x40	34.71	21.13	29.58	14.05

Table A 11-2 Detailed Load-carrying Capacities - Raveeldrager Dicht & Raveeldrager Zwaar - Timber to Timber

Detailed capacities		Timber [1]			Timber [2]	Seat [U]		
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Raveeldrager dicht	100x75x50x2.0	8.68	12.45	3.60	3.72	1.45	1.30	9.22
	96x75x59x2.0	8.68	12.45	3.60	3.72	1.45	1.30	9.22
Raveeldrager zwaar	180x80x120x2.0	17.35	26.38	6.30	9.92	1.45	1.30	9.75

A11.5 Raveeldrager met Strip - Timber to Timber

Table A 11-3 Standard Load-carrying Capacities - Raveeldrager met Strip - Timber to Timber

Joist hanger		Fasteners			Characteristic Load-Carrying Capacity [kN]			
Model	Reference	Member 1	Member 2	Seat [U]	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$
Raveeldrager met strip	190x32	12x 4.0x35	6x 4.0x35	1x 4.0x35	10.91	5.45	8.74	5.45
	190x38							
	190x46							
	190x50							
	190x59			2x 4.0x35				
	190x63							
	190x71							
	190x75							
	225x38	14x 4.0x35	8x 4.0x35	1x 4.0x35	12.72	7.27	10.56	7.27
	225x46							
	225x50							
	225x59			2x 4.0x35				
	225x63							
	225x71							
	225x75							

Table A 11-4 Detailed Load-carrying Capacities - Raveeldrager met Strip - Timber to Timber

Detailed Capacities		Timber [1]			Timber [2]	Seat [U]		
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Raveeldrager met strip	190x32	5.45	16.92	2.88	2.73	0.91	0.00	3.29
	190x38	5.45	16.92	2.88	2.73	0.91	0.00	3.29
	190x46	5.45	16.92	2.88	2.73	0.91	0.00	3.29
	190x50	5.45	16.92	2.88	2.73	0.91	0.00	3.29
	190x59	5.45	16.92	2.88	2.73	1.82	0.00	3.29
	190x63	5.45	16.92	2.88	2.73	1.82	0.00	3.29
	190x71	5.45	16.92	2.88	2.73	1.82	0.00	3.29
	190x75	5.45	16.92	2.88	2.73	1.82	0.00	3.29
	225x38	6.36	25.89	3.36	3.64	0.91	0.00	3.29
	225x46	6.36	25.89	3.36	3.64	0.91	0.00	3.29
	225x50	6.36	25.89	3.36	3.64	0.91	0.00	3.29
	225x59	6.36	25.89	3.36	3.64	1.82	0.00	3.29
	225x63	6.36	25.89	3.36	3.64	1.82	0.00	3.29
	225x71	6.36	25.89	3.36	3.64	1.82	0.00	3.29
	225x75	6.36	25.89	3.36	3.64	1.82	0.00	3.29

A11.6 Regeldrager - Timber to Timber

Table A 11-5 Standard Load-carrying Capacities - Regeldrager - Timber to Timber

Joist hanger		Fasteners			Characteristic Load-carrying Capacity [kN]			
Model	Reference	Member 1	Member 2	Seat [U]	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$
Regeldrager	Regeldrager 25mm	6x 4.0x35	4x 4.0x35	-	5.45	3.64	3.91	0.96
	Regeldrager 28mm							
	Regeldrager 32mm							
	Regeldrager 34mm							
	Regeldrager 38mm							
	Regeldrager 40mm							
	Regeldrager 46mm							
	Regeldrager 50mm							
	Regeldrager 55mm				5.45	3.64	3.83	0.96
	Regeldrager 59mm							
	Regeldrager 63mm							

Table A 11-6 Detailed Load-carrying Capacities - Regeldrager - Timber to Timber

Detailed Capacities		Timber [1]			Timber [2]	Seat [U]		
Model	Reference	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Regeldrager	Regeldrager 25mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 28mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 32mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 34mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 38mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 40mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 46mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 50mm	2.73	1.96	0.48	1.82	0.00	0.00	2.42
	Regeldrager 55mm	2.73	1.91	0.48	1.82	0.00	0.00	3.03
	Regeldrager 59mm	2.73	1.91	0.48	1.82	0.00	0.00	3.03
	Regeldrager 63mm	2.73	1.91	0.48	1.82	0.00	0.00	3.03

A11.7 Raveeldrager Dicht & Raveeldrager Zwaar - Concrete [1] to Timber [2]

Table A 11-7 Standard Load-carrying Capacities - Raveeldrager Dicht & Raveeldrager Zwaar - Concrete [1] to Timber [2]

Joist hanger		Fasteners			Characteristic Load-carrying Capacity [kN]			
Model	Reference	Member 1	Member 2	Seat [U]	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$
Raveeldrager dicht	100x75x50x2.0	4x M10x65	6x 5.0x40	1x 6.0x40	32.40	8.73	16.66	8.65
	96x75x59x2.0							
Raveeldrager zwaar	180x80x120x2.0	4x M10x65	16x 5.0x40	1x 6.0x40	32.40	21.13	29.58	14.05

Table A 11-8 Detailed Load-carrying Capacities - Raveeldrager Dicht & Raveeldrager Zwaar - Concrete [1] to Timber [2]

Detailed Capacities		Concrete [1]			Timber [2]	Seat [U]		
Model	Reference	$V_{bolt,k,1}$	$P_{k,x/y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Raveeldrager dicht	100x75x50x2.0	16.93	16.20	16.93	0.72	1.45	1.30	9.22
	96x75x59x2.0	17.80	16.20	17.80	3.72	1.45	1.30	9.22
Raveeldrager zwaar	180x80x120x2.0	20.35	16.20	18.00	9.92	1.45	1.30	9.75

A11.8 Joist Hangers Series II – Method for Adjusting Load-Carrying Capacities

This section describes the method for determining load-carrying capacities of Series II Joist Hangers for alternative grades and/or fasteners by determining appropriate modification factors for:

- the selected grade and/or fastener(s)
- each of the failure modes of the relevant connection configuration

and applying them by multiplication to the detailed load-carrying capacities in the relevant tables in Annex 11 above.

For each plate and each load direction the minimum value obtained for the corresponding failure modes after applying the adjustment factors provides the characteristic load-carrying capacity for this plate and load direction.

The modification factors for calculating alternative load-carrying capacities of Series II Angle Brackets are given in:

Table A 11-10 Alternative Fastener and/or Grade – Adjustment Factors for Joist Hangers – Timber to Timber

Table A 11-11 Alternative Fastener and/or Grade – Adjustment Factors for Joist Hangers – Timber to Concrete

For connector-to-concrete connections, the bolt shear capacity can be determined in accordance with ETAG 001 Annex C and the corresponding ETA for the selected bolt.

A11.8.1 Definition of Adjustment Factors for Alternative Grades and Fasteners

Alternative Timber Grade (Either Member)

$k_{\mathrm{v,dens}} = \frac{\rho_{\mathrm{k}}}{350}$ factor for adjustment of fastener shear capacity for characteristic density of the timber grade

$k_{\mathrm{ax,dens}} = \left(\frac{\rho_{\mathrm{k}}}{350}\right)^2$ factor for adjustment of fastener withdrawal capacity for characteristic density of the timber grade

$k_{\mathrm{c}} = \frac{f_{\mathrm{c,90,k}}}{2.5}$ factor for adjustment of compression resistance for $f_{\mathrm{c,90,k}}$ resistance of the timber grade

Alternative Fastener (Either Member)

$k_{\mathrm{v}}, k_{\mathrm{v,bolt}} = \frac{F_{\mathrm{v,Rk}}}{F_{\mathrm{v,Rk,ref}}}$ factors for adjustment of fastener shear capacity

where:

$F_{\mathrm{v,Rk}}$ characteristic shear capacity of the alternative fastener (nail, screw or bolt)

$F_{\mathrm{v,Rk,ref}}$ reference characteristic shear capacity per Table A 6-1 (nails) or Table A 6-2 (screws)
or
reference bolt characteristic shear capacity i.e. that of the indicated bolt in the given configuration

$k_{\mathrm{ax}}, k_{\mathrm{ax,bolt}} = \frac{F_{\mathrm{ax,Rk}}}{F_{\mathrm{ax,Rk,ref}}}$ factor for adjustment of fastener withdrawal or tension capacity

where:

$F_{\mathrm{ax,Rk}}$ characteristic withdrawal (nails, screws) or tension (bolt) capacity of the alternative fastener

$F_{\mathrm{ax,Rk,ref}}$ reference characteristic withdrawal capacity per Table A 6-1 (nails) or Table A 6-2 (screws)
or
reference bolt characteristic tension capacity i.e. that of the indicated bolt in the given configuration

Note that the adjustment factors are cumulative, e.g. for an alternative grade and an alternative fastener simultaneously, multiply $T_{k,1}$ listed in the detailed capacity tables by $k_{v,dens}$ x k_{ax}.

The standard capacities are determined as follows:

Table A 11-9 Critical Parameters for Load-carrying Capacities

Load	Timber to Timber	Plate 1 to Concrete Plate 2 to Timber
$F_{x,k}$	$V_{k,1,x}$	$\min(V_{bolt,k,1}; P_{k,x,1})$
$F_{y,pull,k}$	$\min(V_{rot,k,1,y}; V_{k,2,y} + T_{k,[U]})$	$\min(V_{bolt,k,1}; P_{k,y,1}; V_{k,2,y} + T_{k,[U]})$
$F_{y,push,k}$	$\min(V_{rot,k,1,y}; V_{k,2,y} + M_{k,[U]})$	$\min(V_{bolt,k,1}; P_{k,y,1}; V_{k,2,y} + M_{k,[U]})$
$F_{z,pull,k}$	$\min(T_{k,1}; V_{k,2,z} + V_{k,[U],z})$	$\min(T_{bolt,k,1}; V_{k,2,z} + V_{k,[U],z})$

Note: For joist hangers, only Plate 1 can be connected to Concrete; Plate 2 is always connected to Timber.

Table A 11-10 Alternative Fastener and/or Grade – Adjustment Factors for Joist Hangers – Timber to Timber

Alternative fastener and/or Grade		Joist hangers – Timber to Timber Connection						
Load Applied to		Contact Area [1] : Timber			Contact Area [2] : Timber	Seat [U] : Timber		
Adjustment for		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	$k_{v,dens}$		$k_{ax,dens}$	$k_{v,dens}$	$k_{v,dens}$	$k_{ax,dens}$	k_c
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	k_v		k_{ax}	k_v	k_v	k_{ax}	-

Table A 11-11 Alternative Fastener and/or Grade – Adjustment Factors for Joist Hangers – Timber to Concrete

Alternative fastener and/or Grade		Joist hangers – Timber to Concrete Connection						
Load Applied to		Contact area [1] : Concrete			Contact area [2] : Timber	Seat [U] : Timber		
Adjustment for		$V_{bolt,k,1}$	$P_{k,x/y,1}$	$T_{bolt,k,1}$	$V_{k,2}$	$V_{k,[U]}$	$T_{k,[U]}$	$M_{k,[U]}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	-	-	-	$k_{v,dens}$	$k_{v,dens}$	$k_{ax,dens}$	k_c
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	$k_{v,bolt}$	-	$k_{ax,bolt}$	k_v	k_v	k_{ax}	-

Note: $P_{k,x,1}$ and $P_{k,y,1}$ are dependent only on the bolt diameter and plate thickness which remain unchanged

ANNEX 12 COMBINED LOADING ADJUSTMENTS FOR JOIST HANGERS

Characteristic load carrying capacities listed in Annex 10 and Annex 11 are for loading in one of the indicated directions. In the case of combined loading, adjustment of the capacities applies as follows.

A12.1 Combined Tension with Main and/or Lateral Loading

If the pulling (Tension) force on the joist hanger is greater than 30% of the listed characteristic load-carrying capacity, the listed capacities in Main and Lateral directions (single or combined) shall each be reduced by 50%.

A12.2 Combined Main and Lateral Loading

If one of the load components Main or Lateral exceeds 30% of the corresponding listed characteristic load-carrying capacity, the characteristic load-carrying capacity in the other direction shall be reduced based on the combination rule described in Figure A 12-1 and Table A 12-1.

Figure A 12-1 Combined Main and Lateral Load Adjustment for Joist Hangers

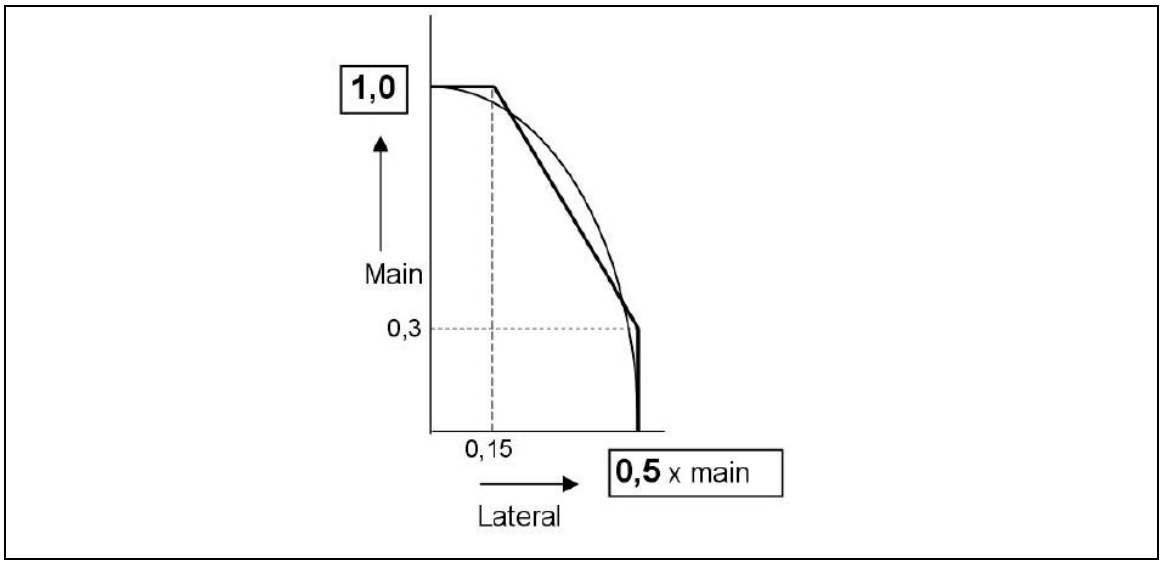


Table A 12-1 Combined Main and Lateral Load Adjustment for Joist Hangers - Values

Main	Lateral
1.00	0.15
0.90	0.20
0.80	0.25
0.70	0.30
0.60	0.35
0.50	0.40
0.40	0.45
0.30	0.50

Linear interpolation between values in the table is allowed.

ANNEX 13 SPECIAL CONNECTORS – LOAD-CARRYING CAPACITIES

A13.1 Tabulated Values

The calculated load-carrying capacities for Special Connectors are presented in the following tables for timber to timber connections.

Load-carrying Capacities are suitable for nailed connections, using threaded nails as defined in Annex 6 §A6.4, or for screwed connections, using screws as defined in Annex 6 §A6.5, as described in the tables.

The notation for the load directions used in the tables is defined in Figure A 7-3, Figure A 7-4 and Figure A 7-5.

Tables are presented in two configurations:

- **Standard load-carrying capacities**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) and allow a direct reading of the load-carrying capacity in each direction for the load applied to each plate.

  The notation used in the tables of standard load-carrying capacities is as follows:

Variables	
F	connection capacity, as defined by subscripts
Subscripts	
x, y, z	x, y or z-direction
push, pull	compression or tension
k	characteristic value

- **Detailed load-carrying capacities by failure mode**. These capacities have been calculated for standard joist hanger sizes and prescribed standard fasteners (as described above) but record the detail of the failure modes in order to allow calculation of capacities for alternative grades and/or fasteners.

  The notation used in the tables of detailed load-carrying capacities is as follows:

Variables	
V	connection capacity in shear, as defined by subscripts
T	connection capacity in tension (withdrawal), as defined by subscripts
M	connection capacity in bending, as defined by subscripts
P	connection capacity in clamping pressure, as defined by subscripts
Subscripts	
rot	load is rotational i.e. lateral (non-centred). If absent, assume an axial (centred) load
bolt	applies to a bolted connection
x, y, z	x, y or z-direction
k	characteristic value
1, 2, [S]	plate 1, plate 2 or side/second face of the connector ([S] is defined more specifically in the table notes))

The method for determining capacities of Special Connectors for alternative grades and/or fasteners is described in §A13.7.

A13.2 Standard Load-carrying Capacities - Tables

A13.3 Detailed Load-carrying Capacities - Tables

A13.4 Kruiskoppeling L/R – Rafter-Tie - Timber to Timber Connection

Table A 13-1 Standard Load-carrying Capacities - Kruiskoppeling L/R – Rafter-Tie

Rafter Tie		Fasteners		Characteristic Load-carrying Capacity [kN]			
Model	Reference	Member 1	Member 2	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Kruiskoppeling L/R	170x32x32 (L)	8x 5.0x40	8x 5.0x40	19.83	19.83	10.80	11.00
	170x32x32 (R)						
	210x32x32 (L)	10x 5.0x40	10x 5.0x40	24.79	24.79	13.50	15.00
	210x32x32 (R)						

Note: All capacities are for a pair of connectors (i.e. 2 connectors). Since not all the holes can be filled with fasteners at the same time, values are only valid for a number of fasteners equal to or higher than indicated

Table A 13-2 Detailed Load-carrying Capacities - Kruiskoppeling L/R – Rafter-Tie

Detailed Capacities		Timber [1]			Timber [2]
Model	Reference	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$
Kruiskoppeling L/R	170x32x32 (L)	17.46	6.75	7.50	12.40
	170x32x32 (R)	17.46	6.75	7.50	12.40
	210x32x32 (L)	12.60	5.40	5.50	9.92
	210x32x32 (R)	12.60	5.40	5.50	9.92

A13.5 Gripanker – Folded Angle Bracket - Timber to Timber Connection

Table A 13-3 Standard Load-carrying Capacities - Gripanker – Folded Angle Bracket

Folded Angle Bracket Connector	Fasteners			Characteristic Load-carrying Capacity [kN]				
Model / Reference	Member 1	Member 2	Side	$F_{x,k}$	$F_{y,pull,k}$	$F_{y,push,k}$	$F_{z,pull,k}$	$F_{z,push,k}$
Gripanker	3x 4.0x35	3x 4.0x35	6x 4.0x35	0.75	2.73	2.50	2.73	2.50

Note: The capacities are the worst case between the two main faces of the connector. The locations of the fasteners differ slightly between the faces, i.e. the faces are slightly non-symmetrical

Table A 13-4 Detailed Load-carrying Capacities - Gripanker – Folded Angle Bracket

Detailed Capacities		Timber [1]				Timber [2]				Timber [S]		
Model	Ref.	$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$	$V_{k,[S]}$	$T_{k,[S]}$	$C_{k,[S]}$
Gripanker	(L)	2.73	1.46	0.95	2.50	2.73	1.65	1.08	2.50	2.73	0.90	2.50
	(R)	2.73	1.20	0.78	2.50	2.73	1.74	1.24	2.50	2.73	0.75	2.50

A13.6 Ruitersteun – Ridge Board Connector -Timber to Timber Connection

Table A 13-5 Standard Load-carrying Capacities - Ruitersteun – Ridge Board Connector

Ridge Board Connector		Fasteners			Characteristic Load-carrying Capacity [kN]
Model	Reference	Member 1	Plate 2	Side plate	$F_{y,pull,k}$
Ruitersteun	28x30	4x 4.0x35	optional	12x 4.0x35	3.64
	32x30				
	38x30				

Note: Fasteners may be omitted from holes in Plate 2 (seat)

Table A 13-6 Detailed Load-carrying Capacities - Ruitersteun – Ridge Board Connector

Detailed Capacities		Timber [1]	Timber [2]	Timber [S]
Model	Reference	$V_{k,1}$	$T_{k,2}$	$V_{k,[S]}$
Ruitersteun	28x30	3.64	0.96	7.71
	32x30			
	38x30			

A13.7 Special Connectors – Method for Adjusting Load-carrying Capacities for Alternative Grades and/or Fasteners

This section describes the method for determining load-carrying capacities of Special Connectors for alternative grades and/or fasteners by determining appropriate modification factors for:

- the selected grade and/or fastener(s)
- each of the failure modes of the relevant connection configuration

and applying them by multiplication to the detailed load-carrying capacities in the relevant tables in Annex 13 above.

For each plate and each load direction the minimum value obtained for the corresponding failure modes after applying the adjustment factors provides the characteristic load-carrying capacity for this plate and load direction.

The modification factors for calculating alternative load-carrying capacities of Special Connectors are given in:

Table A 13-10 Alternative Fastener and/or Grade – Adjustment Factors for Special Connectors – Timber to Timber

A13.7.1 Definition of Adjustment Factors for Alternative Grades and Fasteners

Alternative Timber Grade (Either Member)

$k_{\mathrm{v,dens}} = \frac{\rho_{\mathrm{k}}}{350}$ factor for adjustment of fastener shear capacity for characteristic density of the timber grade

$k_{\mathrm{ax,dens}} = \left(\frac{\rho_{\mathrm{k}}}{350}\right)^2$ factor for adjustment of fastener withdrawal capacity for characteristic density of the timber grade

$k_{\mathrm{c}} = \frac{f_{\mathrm{c,90,k}}}{2.5}$ factor for adjustment of compression resistance for $f_{\mathrm{c,90,k}}$ resistance of the timber grade

Alternative Fastener (Either Member)

$k_{\mathrm{v}} = \frac{F_{\mathrm{v,Rk}}}{F_{\mathrm{v,Rk,ref}}}$ factors for adjustment of fastener shear capacity

where:

$F_{\mathrm{v,Rk}}$ characteristic shear capacity of the alternative fastener (nail or screw)

$F_{\mathrm{v,Rk,ref}}$ reference characteristic shear capacity per Table A 6-1 (nails) or Table A 6-2 (screws)

$k_{\mathrm{ax}} = \frac{F_{\mathrm{ax,Rk}}}{F_{\mathrm{ax,Rk,ref}}}$ factor for adjustment of fastener withdrawal or tension capacity

where:

$F_{\mathrm{ax,Rk}}$ characteristic withdrawal (nails, screws) capacity of the alternative fastener

$F_{\mathrm{ax,Rk,ref}}$ reference characteristic withdrawal capacity per Table A 6-1 (nails) or Table A 6-2 (screws)

Note that the adjustment factors are cumulative, e.g. for an alternative grade and an alternative fastener simultaneously, multiply $T_{\mathrm{k,1}}$ listed in the detailed capacity tables by $k_{\mathrm{v,dens}}$ x k_{ax}.

The standard capacities are determined as follows:

Table A 13-7 Critical Parameters for Load-carrying Capacities - Kruiskoppeling L/R - Rafter-Tie

Load	Timber to Timber
$F_{y,pull,k} = F_{y,push,k}$	$\min(V_{rot,k,1}; V_{k,2,y})$
$F_{z,pull,k}$	$\min(T_{k,1}; V_{k,2,z})$
$F_{z,push,k}$	$\min(C_{k,1}; V_{k,2,z})$

Note: These connectors only have Connector to Timber connections

Table A 13-8 Critical Parameters for Load-carrying Capacities - Gripanker - Folded Angle Bracket

Load	Timber to Timber
$F_{x,k}$	$\min(V_{rot,k,1}; V_{rot,k,2}; T_{k,[S]}; C_{k,[S]})$
$F_{y,pull,k}$	$\min(V_{k,1,y}; T_{k,2} + V_{k,[S],y})$
$F_{y,push,k}$	$\min(V_{k,1,y}; C_{k,2})$
$F_{z,pull,k}$	$\min(T_{k,1} + V_{k,[S],y}; V_{k,2,z})$
$F_{z,push,k}$	$\min(C_{k,1}; V_{k,2,z})$

Note: These connectors only have Connector to Timber connections

Table A 13-9 Critical Parameters for Load-carrying Capacities - Ruitersteun - Ridge Board Connector

Load	Timber to Timber
$F_{y,pull,k}$	$V_{k,1,y}$

Note: These connectors only have Connector to Timber connections

Table A 13-10 Alternative Fastener and/or Grade – Adjustment Factors for Special Connectors – Timber to Timber

Alternative fastener and/or Grade		Angle Brackets and Special Connectors – Timber to Timber Connection							
Load Applied to		Contact Area [1] : Timber				Contact Area [2] : Timber			
Adjustment for		$V_{k,1}$	$V_{rot,k,1}$	$T_{k,1}$	$C_{k,1}$	$V_{k,2}$	$V_{rot,k,2}$	$T_{k,2}$	$C_{k,2}$
Alternative timber grade	ρ_k ; $f_{c,90,k}$	$k_{v,dens}$		$k_{ax,dens}$	k_c	$k_{v,dens}$		$k_{ax,dens}$	k_c
Alternative fastener capacity	$F_{v,Rk}$; $F_{v,Rk}$	k_v		k_{ax}	-	k_v		k_{ax}	-

ANNEX 14 COLUMN BASES – LOAD-CARRYING CAPACITIES

The “Waelbers Column Base” products were included in the previous edition of this ETA; the “Paalhouder Verstelbaar 90x90” and “Paalhouder Verstelbaar 80x80/100x140” products have been introduced in this version.

The load-carrying capacities of the Column Base connectors have been obtained by testing, so they are only valid for the following build-up and component characteristics:

- Characteristic timber density $\rho_k \geq 350$ kg/m³ (C24 or better)
- Screw diameter ≥ 10 mm - screw holes shall be pre-drilled
- Effective anchorage length ≥ 40 mm

The column base connectors are subject to:

F_z centred vertical compression force parallel to axis of the connector (z-axis)
F_x non-centred shear force parallel to the length of the connector base plate (x-axis)
F_y non-centred shear force perpendicular to the length of the connector base plate (y-axis)

No adjustment factors are provided for column base products

Table A 14-1 Load-carrying Capacities – Waelbers Column Bases

Column Base Height [mm]	Characteristic Axial Compression [kN]	Characteristic Lateral Shear [kN]
110	147.03	2.54
120	140.59	2.54
130	134.15	2.54
140	127.71	2.54
150	121.26	2.54
160	114.82	2.54
170	108.38	2.54

Table A 14-2 Load-carrying Capacities – Model Paalhouder Verstelbaar 90x90

Reference	Fasteners	Column Base Height [mm]	$F_{z,k}$ [kN]	$F_{x,k}$ [kN]	$F_{y,k}$ [kN]
Paalhouder Verstelbaar 90x90	[T] 4x M10x45	115	93.5	0.40	0.40
		120	88.5		
		130	78.5		
		140	69.0		
		150	59.0		
		160	49.5		
		170	39.5		
		180	30.0		

[T] top plate of connector

Table A 14-3 Column base connector – Declared load-carrying capacities: Model Paalhouder verstelbaar 80x80/100x140

Reference	Fasteners	Column Base Height [mm]	$F_{z,k}$ [kN]	$F_{x,k}$ [kN]	$F_{y,k}$ [kN]
Paalhouder verstelbaar 80x80/100x140	[T] 4x M10x45	100	122.5	1.35	1.55
		110	118.5		
		120	114.5		
		130	110.5		
		140	106.5		
		150	102.5		
		160	98.5		
		170	94.5		
		180	90.5		

[T] top plate of connector