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Authorised and notified according to Article 10 of the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products

MEMBER OF EOTA

European Technical Approval ETA-08/0079

This ETA is a modification of the previous ETA with the same number and validity from 2008-04-24 to 2013-04-24

Trade name:	EuP Joist Hangers type A1, A2, B1and B2
Holder of approval:	Eisen- und Plastverarbeitung GmbH & Co. KG An der Tumpe 14-16 D - 58791 Werdohl-Dresel Tel. +49 2392 93 96-0 Fax +49 2392 93 96 44 Internet www.eup-holzverbinder.de
Generic type and use of construction product:	Three-dimensional nailing plate (Joist hanger for wood to wood connections and wood to concrete or steel connections)
Valid from: to:	2008-07-03 2013-07-03
Manufacturing plant:	Eisen- und Plastverarbeitung GmbH & Co. KG An der Tumpe 14-16 D - 58791 Werdohl-Dresel
This European Technical Approval contains:	46 pages including 3 annexes which form an integral part of the document

I LEGAL BASIS AND GENERAL CONDITIONS

1 This European Technical Approval is issued by ETA-Danmark A/S in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1)], as amended by Council Directive 93/68/EEC of 22 July 1993[2)].

- Bekendtgørelse 559 af 27-06-1994 (afløser bekendtgørelse 480 af 25-06-1991) om ikrafttræden af EF direktiv af 21. december 1988 om indbyrdes tilnærmelse af medlemsstaternes love og administrative bestemmelser om byggevarer.

- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC[3)].

- EOTA Guideline ETAG 015 *Three-dimensional nailing plates,* September 2002 edition.

2 ETA-Danmark A/S is authorized to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4 This European Technical Approval may be withdrawn by ETA-Danmark A/S pursuant to Article 5(1) of Council Directive89/106/EEC.

5 Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of ETA-Danmark A/S. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 This European Technical Approval is issued by ETA-Danmark A/S in English.
This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1) Official Journal of the European Communities N° L40, 11 Feb 1989, p 12.
2) Official Journal of the European Communities N° L220, 30 Aug 1993, p 1.
3) Official Journal of the European Communities N° L 17, 20 Jan 1994, p 34.

I SPECIAL CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

Definition of the product
EuP joist hangers type A1, A2, B1 and B2 are one-piece non-welded, face-fixed joist hangers to be used in timber to timber connections as well as connections between a timber joist and a concrete structure or a steel member.

The joist hangers are made from pre-galvanized steel Grade S250GD+Z (min Z275) according to EN 10326:2004 or alternatively joist hangers type A1, B1 and B2 can additionally be made from stainless steel Grade 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088:1997. Dimensions, hole positions, steel type and typical installations are shown in Annex A.

Intended use
The joist hangers are intended for use in making end-grain to side-grain connections in load bearing timber structures, as a connection between a wood based joist and a solid timber or wood based header, where requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled. They are also intended for use in making an end-grain connection between a timber joist and a concrete structure or a steel member.

The joist hangers can be installed as connections between wood based members such as:

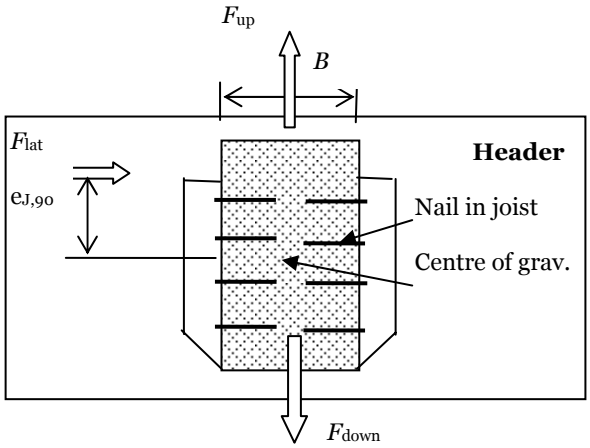
- Structural solid timber classified to C14-C40 according to EN 338 / EN 14081,
- Glulam classified to GL24-GL36 according to EN 1194 / EN 14080,
- LVL according to EN 14374,
- Parallam PSL,
- Intrallam LSL,
- Duo- and Triobalken,
- Layered wood plates,
- I-beams with backer blocks on both sides of the web in the header and web stiffeners in the joist
- Plywood according to EN 636

However, the calculation methods are only allowed for a characteristic wood density of up to 460 kg/m^3. Even though the wood based material may have a larger density, this must not be used when calculating the load-carrying capacities of the fasteners.

Annex B states the formulas for the characteristic load-carrying capacities of the joist hanger connections.

The design of the connections shall be in accordance with Eurocode 5 or a similar national Timber Code.

It is assumed that the forces acting on the joist hanger connection are F_{up}, F_{down} and F_{lat}, as shown in the figure below. The forces F_{up} and F_{down} shall act in the middle of the joist hanger. The force F_{lat} is assumed to act $e_{J,90}$ above the centre of gravity of the nails in the joist. It is assumed that the forces are acting right at the end of the joist.



It is assumed that the header is prevented from rotating. Similarly it is assumed that the concrete structure or the steel member, to which the joist hanger is bolted, does not rotate. If the header beam only has installed a joist hanger on one side, the eccentricity moment $M_v = F_d \cdot (B_H / 2 + 30\text{mm})$ shall be considered. The same applies when the header has joist hanger connections on both sides, but with vertical forces which differ more than 20%.

It is a condition for a force F_{lat} perpendicular to the vertical symmetry line that the joist hanger is connected to a wood-based header with nails in all holes (full nailing) or in all holes marked for partial nailing.

The joist hangers are intended for use for connections subject to static or quasi static loading.

The zinc-coated hangers are for use in timber structures subject to dry, internal conditions defined by the service classes 1 and 2 of EN 1995-1-1:2004, (Eurocode 5). The joist hangers made of stainless steel may also be used in conditions defined by service class 3 of EN 1995-1-1:2004, (Eurocode 5).

Assumed working life
The assumed intended working life of the joist hangers for the intended use is 50 years, provided that they are subject to appropriate use and maintenance. The information on the working life should not be regarded as a guarantee provided by the manufacturer or ETA Danmark. An "assumed intended working life" means that it is expected that, when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

2 Characteristics of product and assessment

ETAG paragraph	Characteristic		Assessment of characteristic
	2.1	**Mechanical resistance and stability*)**	
6.1.1		Characteristic load-carrying capacity	See Annex B
6.1.2		Stiffness	No performance determined
6.1.3		Ductility in cyclic testing	No performance determined
	2.2	**Safety in case of fire**	
6.2.1		Reaction to fire	The joist hangers are made from steel classified as **Euroclass A1** in accordance with EN 1350-1 and EC decision 96/603/EC, amended by EC Decision 2000/605/EC
	2.3	**Hygiene, health and the environment**	
6.3.1		Influence on air quality	No dangerous materials **)
	2.4	**Safety in use**	Not relevant
	2.5	**Protection against noise**	Not relevant
	2.6	**Energy economy and heat retention**	Not relevant
	2.7	**Related aspects of serviceability**	
6.7.1		Durability	The joist hangers have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1 and 2
6.7.2		Serviceability	
6.7.3		Identification	See Annex A

*) See page 5 of this ETA

**) In accordance with http://europa.eu.int-/comm/enterprise/construction/internal/dangsub/dangmain.htm In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

Safety principles and partial factors

2.1 Mechanical resistance and stability

See annex B for characteristic load-carrying capacities of the joist hangers.

The characteristic capacities of the joist hangers are determined by calculation assisted by testing as described in the EOTA Guideline 015 clause 5.1.2. They should be used for designs in accordance with Eurocode 5 or a similar national Timber Code.

The design models allow the use of fasteners described in the table on page 39 in Annex A:

Threaded nails (ringed shank nails) in accordance to prEN 14592
In the formulas in Annex B the capacities for threaded nails calculated from the formulas of Eurocode 5 are used assuming a thick steel plate when calculating the lateral nail load-carrying-capacity.

Further, the joist hangers type A1, B1 and B2 may be fastened to a concrete structure or steel member by bolts with a diameter of 12 mm in holes with a diameter of 13 mm. The joist hanger type A2 can be fastened to a concrete structure or steel member by bolts with a diameter of 10 mm in holes with a diameter up to 2 mm larger than the bolt.

The load bearing capacities of the brackets has been determined based on the use of connector nails 4,0 x 40 mm in accordance with the German national approval for the nails.

The characteristic withdrawal capacity of the nails has to be determined by calculation in accordance with EN 1995-1-1: 2004, paragraph 8.3.2 (head pull-through is not relevant):

$$F_{ax,Rk} = f_{ax,k} \times d \times t_{pen}$$

Where:

$f_{ax,k}$ Characteristic value of the withdrawal parameter in N/mm^2
d Nail diameter in mm
t_{pen} Penetration depth of the profiles shank in mm
$t_{pen} \geq 30$ mm

Based on tests by Versuchsanstalt für Stahl, Holz und Steine, University of Kalrsruhe, the characteristic value of the withdrawal resistance for the threaded nails used can be calculated as:

$$f_{ax,k} = 50 \times 10^{-6} \times \sigma_k^2$$

Where:

σ_k Characteristic density of the timber in kg/m^3

The shape of the nail directly under the head shall be in the form of a truncated cone with a diameter under the nail head which exceeds the hole diameter.

The joist hanger type A2 can also be fastened with connector screws according to prEN 14592.

No performance has been determined in relation to ductility of a joint under cyclic testing. The contribution to the performance of structures in seismic zones, therefore, has not been assessed.

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

2.2 Related aspects of serviceability

2.2.1 Corrosion protection in service class 1 and 2.
In accordance with ETAG 015 the joist hangers made of pre-galvanized steel have a zinc coating weight of min Z275. The steel employed is S250GD+Z (min Z275) according to EN 10326:2004.

3 Attestation of Conformity and CE marking

3.1 Attestation of Conformity system

The system of attestation of conformity is 2+ described in Council Directive 89/106/EEC (Construction Products Directive) Annex III.

a) Tasks for the manufacturer:

(1) Factory production control,
(2) Initial type testing of the product,

b) Tasks for the notified body:

(1) Initial inspection of the factory and the factory production control,
(2) Continuous surveillance

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer has a factory production control system in the plant 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 written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan[4]. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as sheet metal, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and zinc coating thickness.

The manufactured components are checked visually and for dimensions.

The control plan, which is part of the technical documentation of this European Technical Approval, includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control and has been agreed between the approval holder and ETA Danmark.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- Designation of the product, basic material and components;
- Type of control or 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 person responsible for factory production control.

The records shall be presented to ETA Danmark on request.

3.2.1.1 Initial type testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type testing has to be agreed between ETA Danmark and the notified body.

3.2.2. Tasks of notified bodies

3.2.2.1 Initial inspection of the factory and the factory production control

The approved body should ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the joist hangers with the specifications given in part 2.

3.2.2.2 Continuous surveillance

The approved body shall visit the factory at least twice a year for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the control plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body to ETA Danmark. Where the provisions of the European Technical Approval and the control plan are no longer fulfilled, the certificate

4 The control plan has been deposited at and is only made available to the approved bodies involved in the conformity attestation procedure.

of conformity shall be withdrawn by the approved body.

3.3 CE marking

The CE marking shall be affixed on each packaging of joist hangers. The initials "CE" shall be followed by the identification number of the notified body and shall be accompanied by the following information:

- Name or identifying mark of the manufacturer
- The last two digits of the year in which the marking was affixed
- Number of the European Technical Approval
- Name and size of product
- Number of the ETA Guideline (ETAG no. 015)
- Number of the EC Certificate of Conformity

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

EuP joist hangers are manufactured in accordance with the provisions of this European Technical Approval using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

4.2 Installation

Joist hanger connections

A joist hanger connection is deemed fit for its intended use provided:

Header – support conditions

- The header shall be restrained against rotation and be free from wane under the joist hanger.

  If the header carries joists only on one side, the eccentricity moment from the joists $M_{ec} = R_{joist}$ $(b_{header}/2+e_{nail})$ shall be considered at the strength verification of the header.

  R_{joist} Reaction force from the joists,
  b_{header} Width of header,
  e_{nail} Distance from nails in the joist to the surface of the header.
- For a header with joists from both sides but with different reaction forces a similar consideration applies.

Wood to wood connections

- Joist hangers may be fastened to wood-based members by nails or screws (type A2 only).
- There shall be nails or screws (type A2 only) in all holes or a partial nailing pattern as prescribed in Annex B may be used.
- The characteristic capacity of the joist hanger connection is calculated according to the manufacturer's technical documentation, dated 2008-02-15.
- The joist hanger connection is designed in accordance with Eurocode 5 or an appropriate national code.
- The gap between the end of the joist and the surface, where contact stresses can occur during loading shall be limited. This means that the gap between the surface of the end of the joist and that of the header shall not exceed 3 mm.
- For EuP joist hangers A1, B1 and B2 with overlapping nails in the joist (see figure 8.5 in EN 1995-1-1) the width of the joist shall be at least l+4d, where l is the length of the nails and d is the diameter of the nails in the joist. For joist hangers with staggered nails in the joist the width shall be at least the penetration length of the nails.
- For joist hangers type A2 the width of the joist shall be at least the penetration length of the fasteners.
- The cross section of the joist at the joist hanger connection shall have sharp edges at the lower side against the bottom plate, i.e. it shall be without wane.
- The cross section of the header shall have a plane surface against the whole joist hanger.
- The width B_J of the joist shall correspond to that of the joist hanger. B_J shall not be smaller than B-3 mm, where B is the inner width of the joist hanger.
- The depth of the joist shall be so large that the top of the joist is at least 20 mm above the upper fastener in the joist.
- Nails or screws (type A2 only) to be used shall have a diameter, which fit the holes of the joist hangers. Nails shall have a diameter which is not smaller than the diameter of the hole minus 1 mm.

Wood to concrete or steel

The above mentioned rules for wood to wood connections are applicable also for the connection between the joist and the joist hanger.

- The joist hanger shall be in close contact with the concrete or steel over the whole face. There shall be no intermediate layers in between.
- The gap between the end of the joist and the surface, where contact stresses can occur during loading shall be limited. This means that the gap between the surface of the end of the joist and that of the concrete or steel shall not exceed 3 mm.
- The bolt shall have a diameter not less than the hole diameter minus 2 mm.
- The bolts shall be placed symmetrically about the vertical symmetry line. There shall always be bolts in the 2 upper holes.
- The upper bolts shall have washers according to EN ISO 7094.

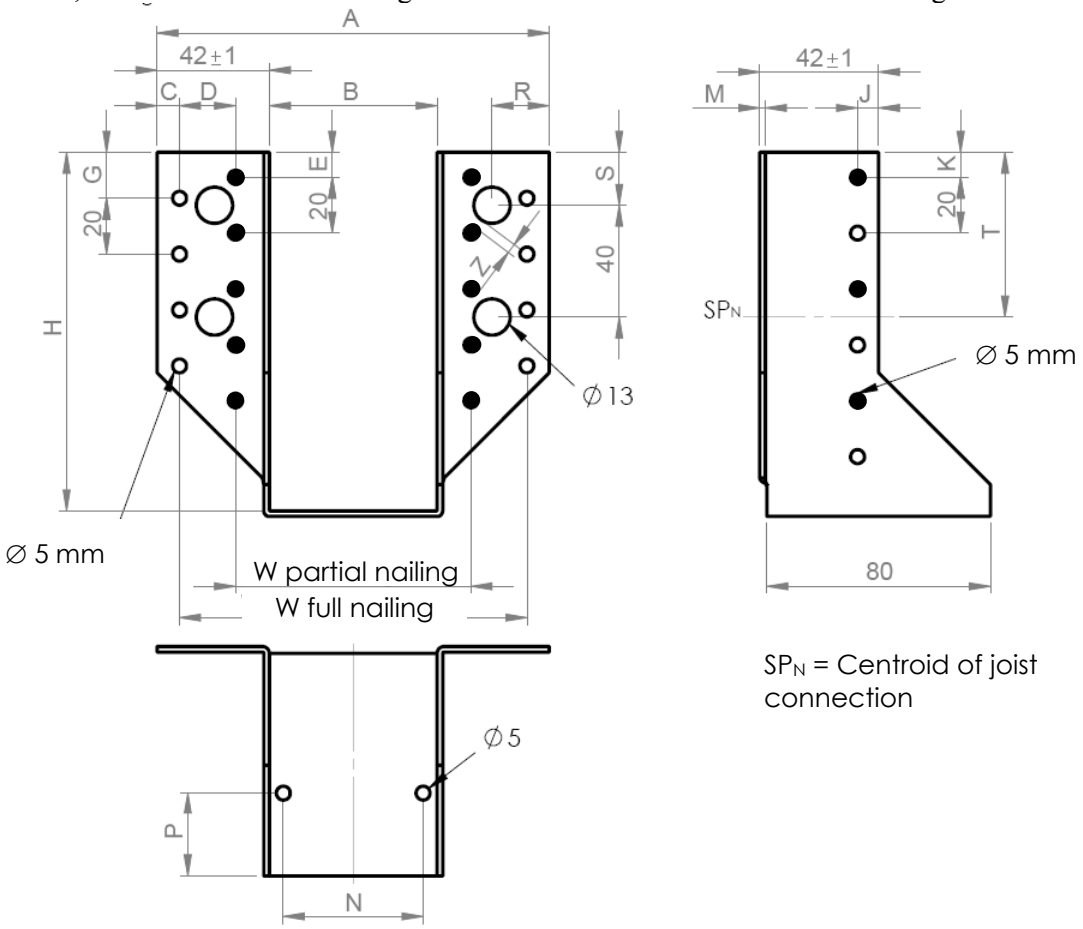
4.3 Maintenance and repair

Maintenance is not required during the assumed intended working life. Should repair prove necessary, it is normal to replace the joist hanger.

Thomas Bruun
Manager, ETA-Danmark

Annex A
Product details and definitions

Joist hanger type A1: Face mount hanger with external flanges
2,0 mm thick pre-galvanised steel S250GD+Z (min Z275) according to EN 10326:2004 or alternatively stainless steel Grade 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088:1997 with tolerances according to EN 10143:1993.

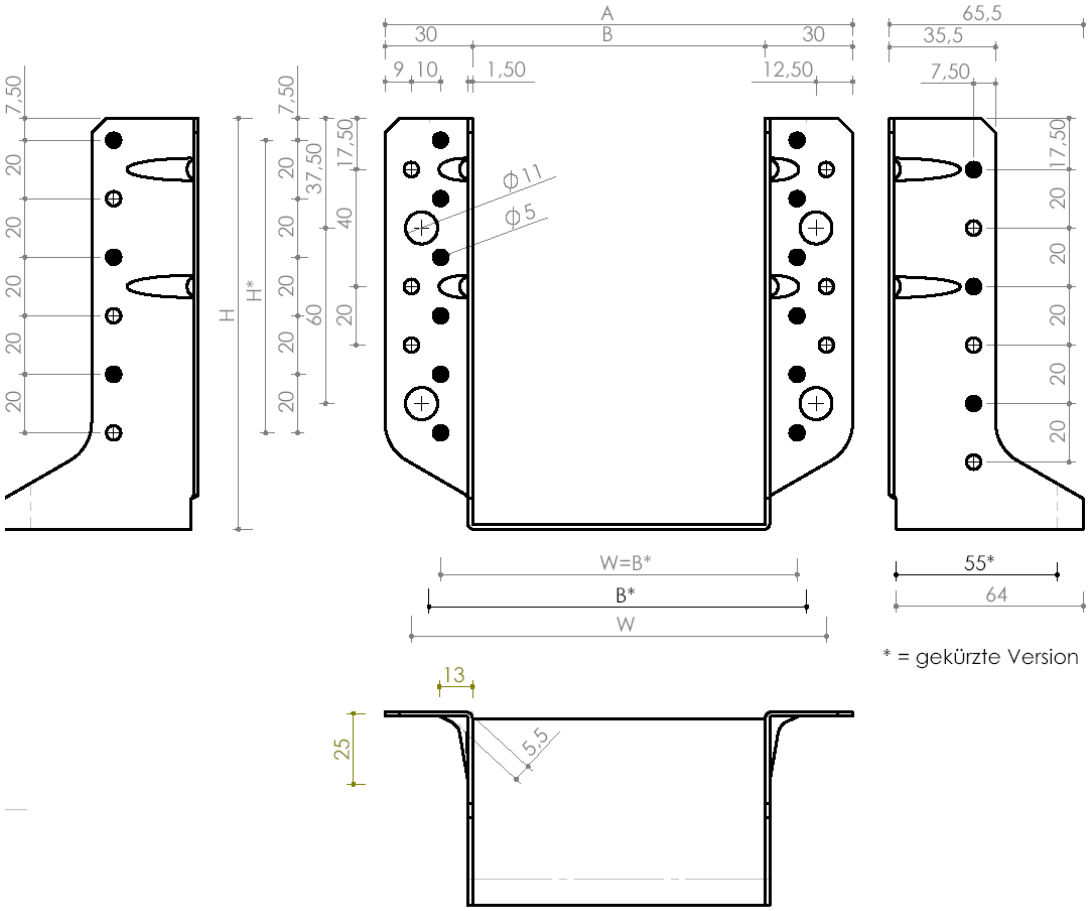


Blank	B min-max	C ±0,3	D ±0,2	E ±0,5	G ±0,5	J ±0,5	K ±0,5	M ±0,13	R ±0,3	S ±0,5	T	Z ±0,5	N ±0,3	P ±0,5
200	50-60	7,5	20	6	16	8,5	20	2	19,5	36	30	3,5	30	30
240/1	32-60	7,5	20	6	16	8,5	20	2	19,5	16	40	3,5	30	30
240/2	32-80	8	20	9	16,5	7,2	9	2	20,3	19	39	3,5	50	30
260	32-60	7,5	20	16	6	8,5	10	2	19,5	26	40	3,5	30	30
320	32-80	8	20	9	16,5	7,2	9	2	20,3	19	59	3,5	50	30
340	32-100	7,5	20	8	18	8,5	8	2	19,5	18	48	3,5	60	30
380	32-100	7,5	20	8	18	8,5	8	2	19,5	18	58	3,5	60	30
440	32-120	7,5	22	19	9	10	18,5	2	20,5	28	79	3,7	80	30
500	32-140	8,2	23	19,3	9,3	8	19	2	22	29	89	4,8	80	42,5
560	40-160	10,5	20	10	20	9,5	20	2,5	23	20	100	3,5	120	15
620	40-180	10,5	20	20	10	9,5	20	2,5	23	50	110	3,5	120	15
680	40-200	8,5	20	19,5	9,5	13,5	20	2,5	21	29,5	119	3,5	120	15

Blank	Full nailing		Partial nailing		Width interval		Height interval		A
	nH	nN	nH	nN	min	max	min	max	
200	10	4	-	-	50	60	70	84	=B+84
240/1	14	6	8	3	32	60	90	104	=B+84
240/2	10	8	6	4	32	80	80	104	=B+84
260	16	8	8	4	32	60	100	114	=B+84
320	18	12	10	6	32	80	120	144	=B+84
340	16	10	10	5	32	100	130	154	=B+84
380	20	12	12	6	32	100	140	174	=B+84
440	26	14	14	7	32	120	160	204	=B+84
500	30	16	16	8	32	140	180	234	=B+84
560	32	18	18	9	40	160	200	260	=B+84
620	38	22	20	11	40	180	220	290	=B+84
680	42	22	22	11	40	200	240	320	=B+84

- Partial nailing; Joist hanger's height = (blank – width)/2

Joist hanger type A2: Face mount hanger with external flanges
1,5 mm thick pre-galvanised steel S250GD+Z (min Z275) according to EN 10326:2004 with tolerances according to EN 10143:1993.



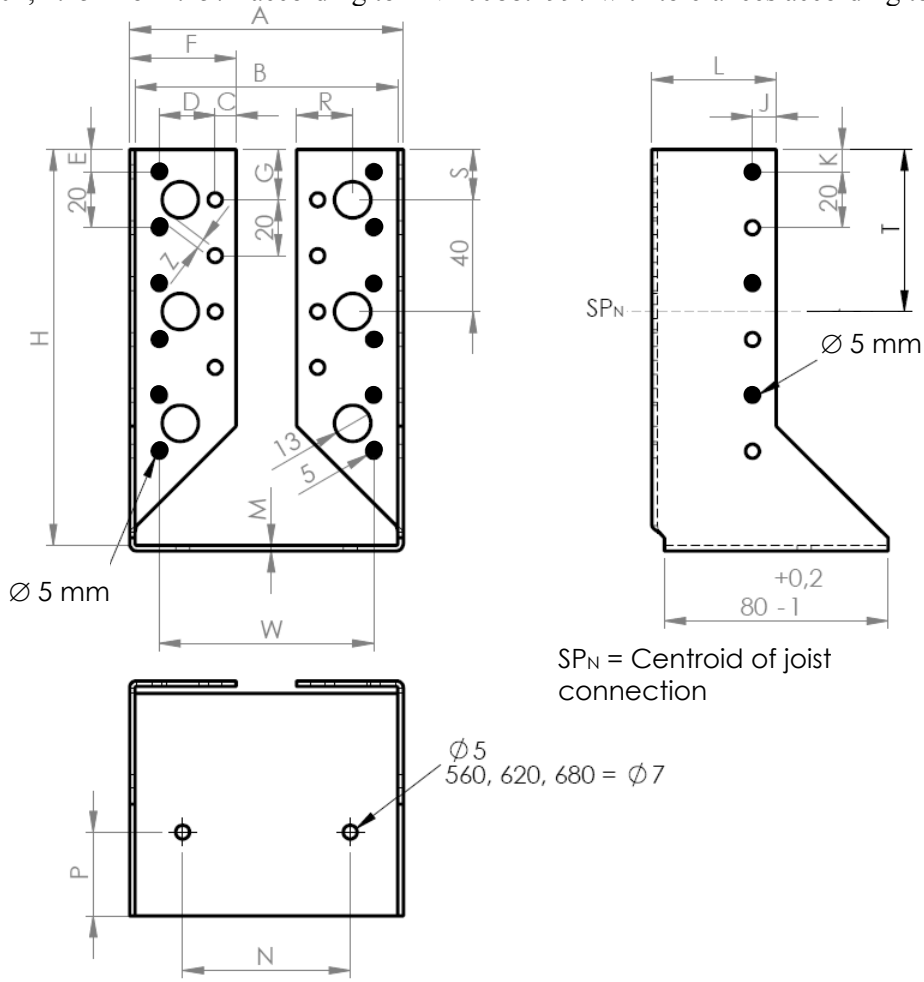
Blank	Total n° of holes		Width interval		Height interval		A
	n_H	n_J	min	max	min	max	
230	12	6	32	60	85	99	= B + 60
260	12	8	32	64	98	114	= B + 60
320	14	10	32	80	120	144	= B + 60
380	18	12	32	100	140	174	= B + 60
440	22	14	32	120	160	204	= B + 60
500	26	16	32	140	180	234	= B + 60

Joist hanger's height = (blank – width)/2

- Partial nailing; Drawing: blank 380;

The joist hanger type A2 is also supplied with a shorter bottom plate with a length of 55 mm. All other dimensions are unchanged. See annex B for the formulas for the joist hanger with the shorter bottom plate.

Joist hanger type B1: Face mount hanger with interior flanges
2,0 mm thick pre-galvanised steel S250GD+Z (min Z275) according to EN 10326:2004 or alternatively stainless steel Grade 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088:1997 with tolerances according to EN 10143:1993.

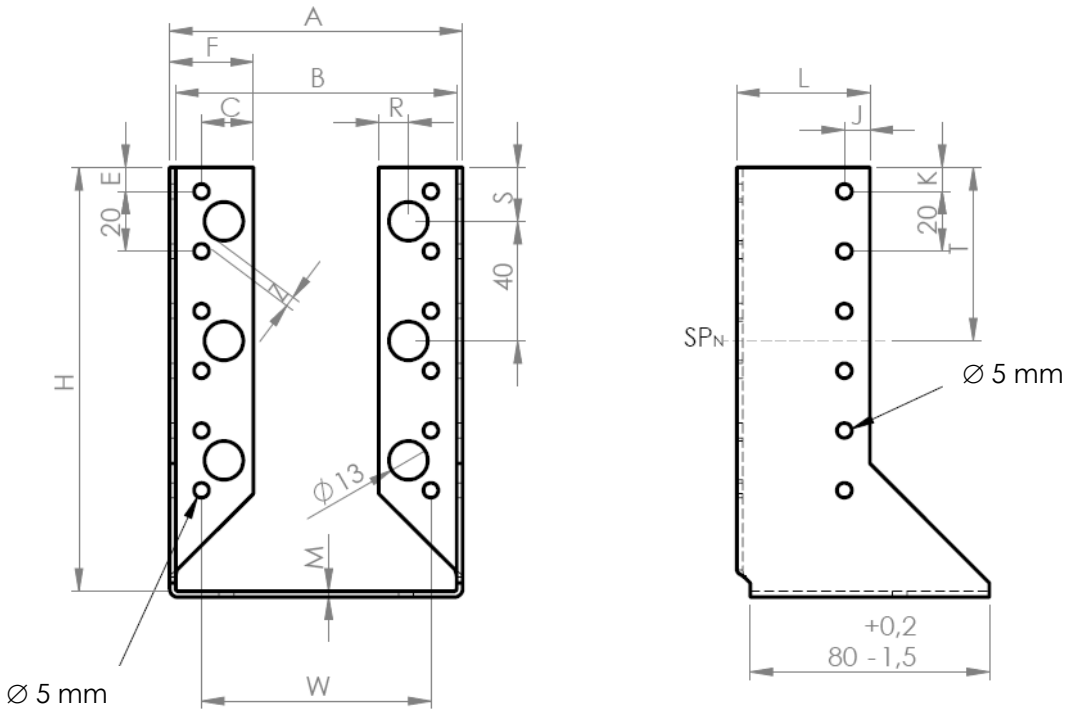


Blank	B min-max	C ±0,3	D ±0,2	E ±0,5	F ±2	G ±0,5	J ±0,5	K ±0,5	L ±44	M ±0,13	R ±0,3	S ±0,5	T	Z ±0,5	N ±0,3	P ±0,5
320	76-80	8	20	9	38	16,5	7,2	9	44	2	20,3	19	59	3,5	50	30
340	76-100	7,5	20	8	38	18	8,5	8	44	2	19,5	18	48	3,5	60	30
380	76-100	7,5	20	8	38	18	8,5	8	44	2	19,5	18	58	3,5	60	30
440	76-120	7,5	22	19	38	9	10	18,5	44	2	20,5	28	79	3,7	80	30
500	76-140	8,2	23	19,3	38	9,3	8	19	44	2	22	29	89	4,8	80	42,5
560	80-160	10,5	20	10	38	20	9,5	20	44	2,5	23	20	100	3,5	120	15
620	80-180	10,5	20	20	38	10	9,5	20	44	2,5	23	50	110	3,5	120	15
680	80-200	8,5	20	19,5	38	9,5	13,5	20	44	2,5	21	29,5	119	3,5	120	15

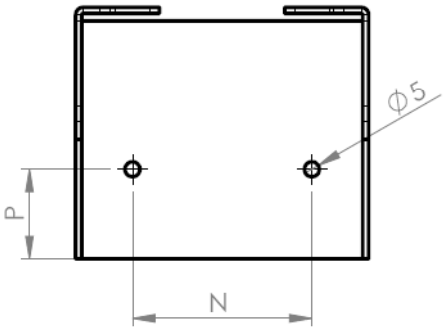
Blank	Full nailing		Partial nailing		Width interval		Height interval		A
	nH	nN	nH	nN	min	max	min	max	
320	18	12	10	6	76	80	120	122	=B+(2xM)
340	16	10	10	4	76	100	120	132	=B+(2xM)
380	20	12	12	6	76	100	140	152	=B+(2xM)
440	26	14	14	7	76	120	160	182	=B+(2xM)
500	30	16	16	8	76	140	180	212	=B+(2xM)
560	32	18	18	9	80	160	200	240	=B+(2xM)
620	38	22	20	11	80	180	220	270	=B+(2xM)
680	42	22	22	11	80	200	240	300	=B+(2xM)

- Partial nailing; Joist hanger's height = (blank – width)/2

Joist hanger type B2: Face mount hanger with interior flanges
2,0 mm thick pre-galvanised steel S250GD+Z (min Z275) according to EN 10326:2004 or alternatively stainless steel Grade 1.4301, 1.4401, 1.4541 or 1.4571 according to EN 10088:1997 with tolerances according to EN 10143:1993.



SP_N = Centroid of joist connection



Blank	B min-max	C ±0,3	E ±0,5	F +1/-3	J ±0,5	K ±0,5	L -1/+3	M ±0,13	R ±0,3	S ±0,5	T	Z ±0,5	N ±0,3	P ±0,5
200	52-60	17,5	6	28	8,5	20	44	2	9,5	36	26	3,5	30	30
240	52-60	17,5	6	28	8,5	20	44	2	9,5	16	36	3,5	30	30
260	52-60	17,5	16	28	8,5	10	44	2	9,5	26	46	3,5	30	30
320	52-80	18	9	28	7,2	9	44	2	10,3	19	59	3,5	50	30
340	52-100	17,5	8	28	8,5	8	44	2	9,5	18	48	3,5	60	30
380	52-100	17,5	8	28	8,5	8	44	2	9,5	18	58	3,5	60	30
440	52-120	17,5	19	28	10	18,5	44	2	20,5	28	79	3,7	80	30
500	52-140	18,2	19,3	28	8	19	44	2	22	29	59	4,8	80	42,5

Blank	Full nailing		Width interval		Height interval		A
	nH	nN	min	max	min	max	
200	6	4	52	60	70	75	=B+4
240	8	6	52	60	90	95	=B+4
260	8	8	52	60	100	105	=B+4
320	10	12	52	80	120	135	=B+4
340	10	10	52	100	120	145	=B+4
380	12	12	52	100	140	165	=B+4
440	14	14	52	120	160	195	=B+4
500	16	16	52	140	180	225	=B+4

- Partial nailing; Joist hanger's height = (blank – width)/2

Fastener types and sizes

NAIL diameter	Length Min – max	Nail type
4.0	35 - 100	Ringed shank nails according to prEN 14592

SCREW diameter	Length Min – max	Screw type (for type A2 joist hanger only)
5.0	25 - 70	Connector screws according to prEN 14592

BOLT diameter	Corresponding hole diameter	Bolt type
12.0	13.0	See specification of the manufacturer

Annex B
Characteristic load-carrying-capacities

Characteristic capacities of the joist hanger connections with nails

The downward and the upward directed forces are assumed to act in the middle of the joist. The lateral force is assumed to act at a distance $e_{J,90}$ above the centre of gravity of the nails in the joist.

Two nail patterns are specified. A full nailing pattern, where there are nails in all the holes, and a partial nailing pattern, where the number of nails in the joist and the header are at least half the numbers specified for full nailing. The nails in the joist may be staggered. For type A1, B1 and B2 there shall always be a nail in the upper and the lower holes and the other nails are distributed evenly over the height. The nails in the header shall be put in the holes closest to the bend line.

For joist hangers with overlapping nails in the joist (see figure 8.5 in EN 1995-1-1) the width of the joist shall be at least l+4d, where l is the length of the nails and d is the diameter of the nails in the joist. For joist hangers with staggered nails in the joist the width shall be at least the penetration length of the nails.

B.1 Joist hangers fastened with nails or screws

Force downward toward the bottom plate (type A1 with 64 mm bottom plate, A2, B1 and B2):

$$F_{Z,Rk} = \min \begin{cases} (n_J + 2) \cdot F_{v,J,Rk} \\ \dfrac{1}{\sqrt{\left(\dfrac{1}{n_H \cdot F_{v,H,Rk}}\right)^2 + \left(\dfrac{1}{k_{H,1} \cdot F_{ax,H,Rk}}\right)^2}} \end{cases} \quad \text{(B.1.1)}$$

Force downward toward the bottom plate for joist hanger type A2 with 55 mm bottom plate:

$$F_{Z,Rk} = \min \begin{cases} n_J \cdot F_{v,J,Rk} \\ \dfrac{1}{\sqrt{\left(\dfrac{1}{n_H \cdot F_{v,H,Rk}}\right)^2 + \left(\dfrac{1}{k_{H,2} \cdot F_{ax,H,Rk}}\right)^2}} \end{cases} \quad \text{(B.1.1.a)}$$

Force upward away from the bottom plate:

$$F_{Z,Rk} = \min \begin{cases} n_J \cdot F_{v,J,Rk} \\ \dfrac{1}{\sqrt{\left(\dfrac{1}{n_H \cdot F_{v,H,Rk}}\right)^2 + \left(\dfrac{1}{k_{H,2} \cdot F_{ax,H,Rk}}\right)^2}} \end{cases} \quad \text{(B.1.2)}$$

Lateral force for type A1, B1 and B2

$$F_{Y,Rk} = \min \begin{cases} \dfrac{n_J \cdot F_{v,J,Rk}}{\sqrt{\left(\dfrac{2 \cdot \sqrt{e_{J,0}^2 + e_{J,90}^2}}{B}\right)^2 + \left(\dfrac{F_{v,J,Rk}}{F_{ax,J,Rk}}\right)^2}} \\ \dfrac{F_{v,H,Rk}}{\sqrt{\left(\dfrac{1}{n_H} + \dfrac{e_H}{e_1}\right)^2 + \left(\dfrac{e_H}{e_2}\right)^2}} \end{cases} \quad \text{(B.1.3)}$$

Lateral force for type A2

$$F_{Y,Rd} = \min \begin{cases} \dfrac{\min\{1,0;\ 80/b_J\} \cdot n_J \cdot F_{v,J,Rd}}{\sqrt{\left(\dfrac{2 \cdot \sqrt{e_{J,0}^2 + e_{J,90}^2}}{b_J}\right)^2 + \left(\dfrac{F_{v,J,Rd}}{F_{ax,J,Rd}}\right)^2}} \\ \dfrac{\min\{1,0;\ 80/b_J\} \cdot F_{v,H,Rd}}{\sqrt{\left(\dfrac{1}{n_H} + \dfrac{e_H}{e_1}\right)^2 + \left(\dfrac{e_H}{e_2}\right)^2}} \end{cases} \qquad \text{(B.1.3a)}$$

n_J total number of nails in both sides of the joist

n_H total number of nails in the side of the header

$F_{v,Rk}$ characteristic lateral load-carrying capacity of a nail in the joist or in the header indicated by the indices J or H in N

$F_{ax,Rk}$ characteristic axial load-carrying capacity of a nail in the joist or in the header indicated by the indices J or H in N

B width of the joist hanger in mm, see figure B1

b_J width of the joist hanger in mm, see B in figure B1

$e_{J,90}$ distance of the lateral force above the centre of gravity of the nails in the joist in mm, see Tables B1 to B3. $e_{J,90}$ must not be taken less than 0,2 times the depth of the joist hanger

$e_{J,0}$ joist hanger dimension in mm, see Tables B1 to B3

e_1 joist hanger dimension in mm, see Tables B1 to B3

e_2 joist hanger dimension in mm, see Tables B1 to B3

$k_{H,1}$ form factor, see Tables B1 to B3

$k_{H,2}$ form factor, see Tables B1 to B3

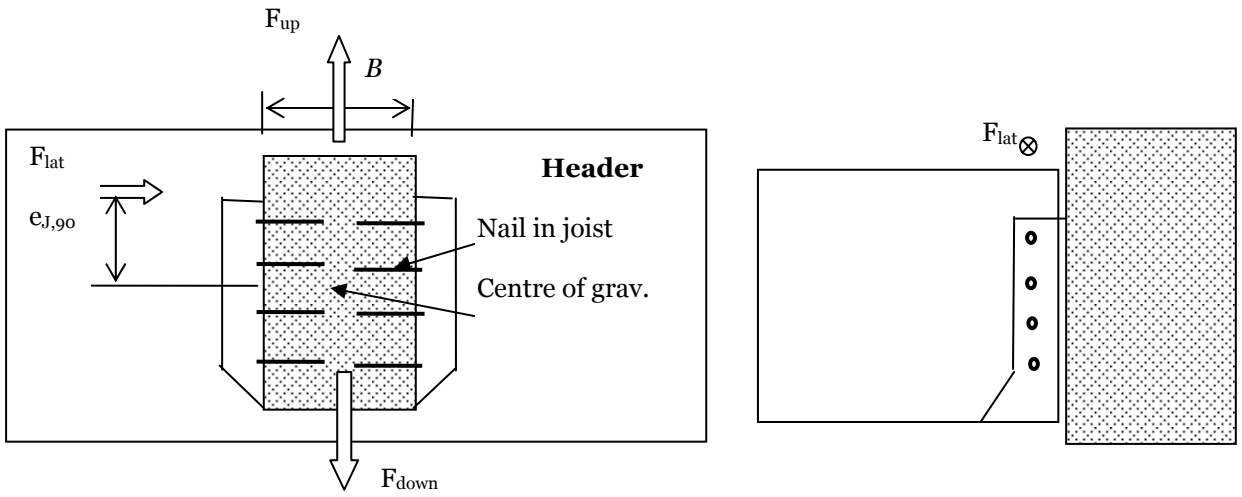


Figure B1: Definition of $e_{J,90}$

Combined forces

In case of combined forces the relevant of the following inequalities shall be fulfilled:

Downward force:
$$\left(\frac{F_{Down,Ed}}{F_{Down,Rk}}\right)^2 + \left(\frac{F_{lat,Ed}}{F_{lat,Rk}}\right)^2 \leq 1,0 \qquad \text{(B.1.4)}$$

Upward force:
$$\left(\frac{F_{Up,Ed}}{F_{Up,Rk}}\right)^2 + \left(\frac{F_{lat,Ed}}{F_{lat,Rk}}\right)^2 \leq 1,0 \qquad \text{(B.1.5)}$$

Table B1: Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	48	76	10	4	8,96	2,99	1229	420	33,5
V	52	74	10	4	8,46	3,09	1324	438	33,5
V	56	72	10	4	7,97	3,20	1423	455	33,5
V	60	70	10	4	7,50	3,32	1526	473	33,5
T	32	104	8	3	10,5	3,80	381	375	33,5
T	36	102	8	3	10,1	3,89	415	383	33,5
T	40	100	8	3	9,71	3,98	451	392	33,5
T	44	98	8	3	9,33	4,08	489	402	33,5
T	48	96	8	3	8,96	4,18	529	412	33,5
T	52	94	8	3	8,58	4,29	571	423	33,5
T	56	92	8	3	8,22	4,40	615	434	33,5
T	60	90	8	3	7,86	4,52	661	446	33,5
V	48	96	14	6	15,1	6,79	1266	649	33,5
V	52	94	14	6	14,5	6,97	1356	672	33,5
V	56	92	14	6	13,8	7,15	1450	696	33,5
V	60	90	14	6	13,2	7,34	1547	719	33,5
T	32	104	6	4	9,11	1,35	350	233	34,8
T	36	102	6	4	8,80	1,38	387	242	34,8
T	40	100	6	4	8,49	1,42	427	251	34,8
T	44	98	6	4	8,18	1,45	469	260	34,8
T	48	96	6	4	7,87	1,49	513	270	34,8
T	52	94	6	4	7,57	1,53	560	280	34,8
T	56	92	6	4	7,26	1,57	609	290	34,8
T	60	90	6	4	6,96	1,62	661	300	34,8
T	64	88	6	4	6,67	1,67	715	311	34,8
T	68	86	6	4	6,37	1,72	771	321	34,8
T	71	85	6	4	6,15	1,75	815	329	34,8
T	74	83	6	4	5,93	1,80	860	337	34,8
T	76	82	6	4	5,79	1,82	891	343	34,8
T	80	80	6	4	5,50	1,88	955	354	34,8
V	48	96	10	8	12,9	2,24	1206	416	34,8
V	52	94	10	8	12,4	2,30	1300	433	34,8
V	56	92	10	8	11,8	2,36	1398	451	34,8
V	60	90	10	8	11,3	2,43	1500	469	34,8
V	64	88	10	8	10,8	2,50	1606	487	34,8
V	68	86	10	8	10,3	2,57	1716	505	34,8
V	71	85	10	8	9,96	2,63	1801	518	34,8
V	74	83	10	8	9,59	2,69	1889	532	34,8
V	76	82	10	8	9,35	2,74	1948	541	34,8
V	80	80	10	8	8,86	2,83	2070	559	34,8
T	32	114	8	4	12,5	3,41	327	375	33,5
T	36	112	8	4	12,1	3,48	356	383	33,5
T	40	110	8	4	11,7	3,56	386	392	33,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	44	108	8	4	11,3	3,63	419	402	33,5
T	48	106	8	4	10,9	3,71	453	412	33,5
T	52	104	8	4	10,5	3,80	489	423	33,5
T	56	102	8	4	10,1	3,89	527	434	33,5
T	60	100	8	4	9,71	3,98	567	446	33,5
V	48	106	16	8	18,8	9,29	1361	814	33,5
V	52	104	16	8	18,1	9,50	1452	840	33,5
V	56	102	16	8	17,4	9,72	1546	866	33,5
V	60	100	16	8	16,6	9,95	1644	892	33,5
T	32	144	10	6	18,4	5,52	425	567	34,8
T	36	142	10	6	18,0	5,61	456	570	34,8
T	40	140	10	6	17,5	5,70	489	575	34,8
T	44	138	10	6	17,0	5,80	524	582	34,8
T	48	136	10	6	16,5	5,89	561	591	34,8
T	52	134	10	6	16,1	6,00	600	600	34,8
T	56	132	10	6	15,6	6,10	641	610	34,8
T	60	130	10	6	15,1	6,21	684	622	34,8
T	64	128	10	6	14,7	6,33	729	634	34,8
T	68	126	10	6	14,2	6,45	776	647	34,8
T	71	125	10	6	13,9	6,54	813	657	34,8
T	74	123	10	6	13,5	6,63	850	667	34,8
T	76	122	10	6	13,3	6,70	876	674	34,8
T	80	120	10	6	12,9	6,83	929	688	34,8
V	48	136	18	12	29,2	10,0	1334	920	34,8
V	52	134	18	12	28,3	10,2	1420	947	34,8
V	56	132	18	12	27,4	10,4	1510	974	34,8
V	60	130	18	12	26,6	10,6	1603	1002	34,8
V	64	128	18	12	25,8	10,8	1700	1030	34,8
V	68	126	18	12	24,9	11,0	1801	1059	34,8
V	71	125	18	12	24,3	11,1	1879	1081	34,8
V	74	123	18	12	23,7	11,3	1958	1103	34,8
V	76	122	18	12	23,3	11,4	2013	1118	34,8
V	80	120	18	12	22,5	11,6	2124	1148	34,8
T	32	154	10	5	22,0	5,27	433	567	33,5
T	36	152	10	5	21,5	5,35	464	571	33,5
T	40	150	10	5	20,9	5,43	498	577	33,5
T	44	148	10	5	20,4	5,51	533	584	33,5
T	48	146	10	5	19,9	5,60	571	593	33,5
T	52	144	10	5	19,4	5,69	610	603	33,5
T	56	142	10	5	18,9	5,78	652	613	33,5
T	60	140	10	5	18,4	5,87	695	625	33,5
T	64	138	10	5	17,9	5,97	741	637	33,5
T	68	136	10	5	17,4	6,07	788	650	33,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	71	135	10	5	17,0	6,15	825	660	33,5
T	74	133	10	5	16,7	6,23	863	670	33,5
T	76	132	10	5	16,4	6,28	889	677	33,5
T	80	130	10	5	15,9	6,40	943	692	33,5
V	48	146	16	10	33,7	7,23	1133	775	33,5
V	52	144	16	10	32,9	7,34	1208	799	33,5
V	56	142	16	10	32,1	7,46	1287	824	33,5
V	60	140	16	10	31,2	7,59	1368	849	33,5
V	64	138	16	10	30,4	7,71	1453	874	33,5
V	68	136	16	10	29,6	7,84	1541	900	33,5
V	71	135	16	10	29,0	7,94	1609	920	33,5
V	74	133	16	10	28,3	8,05	1679	939	33,5
V	76	132	16	10	27,9	8,12	1727	953	33,5
V	80	130	16	10	27,1	8,26	1824	980	33,5
T	40	170	12	6	27,3	8,64	566	820	33,5
T	44	168	12	6	26,7	8,76	600	822	33,5
T	48	166	12	6	26,1	8,87	636	826	33,5
T	52	164	12	6	25,5	9,00	674	832	33,5
T	56	162	12	6	24,9	9,12	714	839	33,5
T	60	160	12	6	24,3	9,25	755	849	33,5
T	64	158	12	6	23,7	9,38	799	859	33,5
T	68	156	12	6	23,1	9,52	845	871	33,5
T	71	155	12	6	22,7	9,62	880	880	33,5
T	74	153	12	6	22,3	9,73	917	890	33,5
T	76	152	12	6	22,0	9,80	942	897	33,5
T	80	150	12	6	21,4	10,0	993	911	33,5
T	81	150	12	6	21,3	10,0	1006	915	33,5
T	85	148	12	6	20,7	10,1	1060	930	33,5
T	89	146	12	6	20,2	10,30	1115	945	33,5
T	93	144	12	6	19,6	10,5	1173	962	33,5
T	97	142	12	6	19,1	10,6	1233	978	33,5
T	100	140	12	6	18,6	10,8	1278	991	33,5
V	48	166	20	12	45,7	12,3	1273	1088	33,5
V	52	164	20	12	44,7	12,4	1349	1115	33,5
V	56	162	20	12	43,6	12,6	1428	1142	33,5
V	60	160	20	12	42,6	12,8	1511	1171	33,5
V	64	158	20	12	41,6	13,0	1596	1200	33,5
V	68	156	20	12	40,6	13,2	1685	1230	33,5
V	71	155	20	12	39,9	13,3	1754	1253	33,5
V	74	153	20	12	39,1	13,4	1824	1276	33,5
V	76	152	20	12	38,6	13,5	1872	1291	33,5
V	80	150	20	12	37,6	13,7	1971	1322	33,5
V	81	150	20	12	37,4	13,8	1996	1330	33,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	85	148	20	12	36,4	14,0	2098	1362	33,5
V	89	146	20	12	35,4	14,2	2204	1395	33,5
V	93	144	20	12	34,5	14,5	2312	1427	33,5
V	97	142	20	12	33,5	14,7	2424	1460	33,5
V	100	140	20	12	32,8	14,9	2511	1486	33,5
T	32	204	14	7	40,7	12,30	545	1161	32,0
T	36	202	14	7	40,0	12,4	572	1144	32,0
T	40	200	14	7	39,3	12,6	601	1132	32,0
T	44	198	14	7	38,5	12,7	632	1125	32,0
T	48	196	14	7	37,8	12,9	664	1121	32,0
T	52	194	14	7	37,1	13,0	698	1120	32,0
T	56	192	14	7	36,3	13,2	734	1122	32,0
T	60	190	14	7	35,6	13,3	771	1126	32,0
T	64	188	14	7	34,9	13,5	810	1133	32,0
T	68	186	14	7	34,2	13,6	851	1141	32,0
T	71	185	14	7	33,7	13,7	883	1148	32,0
T	74	183	14	7	33,1	13,9	916	1156	32,0
T	76	182	14	7	32,8	14,0	938	1162	32,0
T	80	180	14	7	32,1	14,1	984	1174	32,0
T	81	180	14	7	31,9	14,2	996	1177	32,0
T	85	178	14	7	31,2	14,4	1044	1191	32,0
T	89	176	14	7	30,5	14,5	1094	1206	32,0
T	93	174	14	7	29,8	14,7	1146	1221	32,0
T	97	172	14	7	29,1	14,9	1199	1238	32,0
T	100	170	14	7	28,6	15,1	1241	1250	32,0
T	101	170	14	7	28,5	15,1	1255	1255	32,0
T	105	168	14	7	27,8	15,3	1311	1272	32,0
T	109	166	14	7	27,1	15,5	1370	1291	32,0
T	113	164	14	7	26,5	15,7	1430	1309	32,0
T	117	162	14	7	25,8	16,0	1492	1329	32,0
T	120	160	14	7	25,3	16,1	1540	1344	32,0
V	48	196	26	14	69,3	23,0	1511	1679	32,0
V	52	194	26	14	67,9	23,2	1589	1707	32,0
V	56	192	26	14	66,5	23,5	1670	1737	32,0
V	60	190	26	14	65,2	23,8	1755	1768	32,0
V	64	188	26	14	63,9	24,0	1842	1801	32,0
V	68	186	26	14	62,5	24,3	1933	1834	32,0
V	71	185	26	14	61,5	24,5	2003	1860	32,0
V	74	183	26	14	60,5	24,8	2075	1886	32,0
V	76	182	26	14	59,9	24,9	2124	1904	32,0
V	80	180	26	14	58,5	25,2	2224	1941	32,0
V	81	180	26	14	58,2	25,3	2250	1950	32,0
V	85	178	26	14	56,9	25,6	2354	1987	32,0
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	89	176	26	14	55,6	26,0	2462	2026	32,0
V	93	174	26	14	54,3	26,3	2573	2065	32,0
V	97	172	26	14	53,0	26,6	2687	2104	32,0
V	100	170	26	14	52,1	26,9	2774	2134	32,0
V	101	170	26	14	51,8	27,0	2804	2144	32,0
V	105	168	26	14	50,5	27,4	2924	2185	32,0
V	109	166	26	14	49,3	27,7	3048	2226	32,0
V	113	164	26	14	48,0	28,1	3175	2268	32,0
V	117	162	26	14	46,8	28,5	3305	2310	32,0
V	120	160	26	14	45,9	28,8	3404	2341	32,0
T	32	234	16	8	50,5	15,3	637	1604	34,0
T	36	232	16	8	49,7	15,5	664	1565	34,0
T	40	230	16	8	48,9	15,6	692	1535	34,0
T	44	228	16	8	48,1	15,8	721	1511	34,0
T	48	226	16	8	47,3	15,9	753	1494	34,0
T	52	224	16	8	46,5	16,1	786	1481	34,0
T	56	222	16	8	45,8	16,3	821	1473	34,0
T	60	220	16	8	45,0	16,4	857	1468	34,0
T	64	218	16	8	44,2	16,6	895	1466	34,0
T	68	216	16	8	43,4	16,7	935	1468	34,0
T	71	215	16	8	42,9	16,9	967	1470	34,0
T	74	213	16	8	42,3	17,0	999	1474	34,0
T	76	212	16	8	41,9	17,1	1020	1477	34,0
T	80	210	16	8	41,1	17,3	1065	1485	34,0
T	81	210	16	8	40,9	17,3	1077	1488	34,0
T	85	208	16	8	40,2	17,5	1124	1498	34,0
T	89	206	16	8	39,4	17,7	1173	1509	34,0
T	93	204	16	8	38,7	17,9	1224	1522	34,0
T	97	202	16	8	37,9	18,1	1276	1536	34,0
T	100	200	16	8	37,4	18,2	1316	1547	34,0
T	101	200	16	8	37,2	18,3	1330	1551	34,0
T	105	198	16	8	36,5	18,5	1386	1568	34,0
T	109	196	16	8	35,7	18,7	1443	1585	34,0
T	113	194	16	8	35,0	18,9	1502	1603	34,0
T	117	192	16	8	34,3	19,1	1563	1622	34,0
T	120	190	16	8	33,7	19,3	1610	1636	34,0
T	124	188	16	8	33,0	19,5	1674	1656	34,0
T	128	186	16	8	32,3	19,8	1739	1677	34,0
T	132	184	16	8	31,6	20,0	1807	1698	34,0
T	136	182	16	8	30,9	20,2	1875	1720	34,0
T	140	180	16	8	30,2	20,5	1946	1742	34,0
V	48	226	30	16	87,7	28,9	1675	2174	34,0
V	52	224	30	16	86,3	29,2	1752	2197	34,0
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	56	222	30	16	84,8	29,5	1832	2224	34,0
V	60	220	30	16	83,3	29,7	1916	2252	34,0
V	64	218	30	16	81,8	30,0	2002	2282	34,0
V	68	216	30	16	80,4	30,4	2092	2314	34,0
V	71	215	30	16	79,3	30,6	2162	2339	34,0
V	74	213	30	16	78,2	30,8	2233	2365	34,0
V	76	212	30	16	77,5	31,0	2281	2383	34,0
V	80	210	30	16	76,0	31,3	2381	2420	34,0
V	81	210	30	16	75,7	31,4	2406	2429	34,0
V	85	208	30	16	74,3	31,7	2510	2467	34,0
V	89	206	30	16	72,8	32,1	2616	2506	34,0
V	93	204	30	16	71,4	32,4	2726	2546	34,0
V	97	202	30	16	70,0	32,8	2839	2587	34,0
V	100	200	30	16	69,0	33,0	2926	2619	34,0
V	101	200	30	16	68,6	33,1	2955	2629	34,0
V	105	198	30	16	67,2	33,5	3075	2672	34,0
V	109	196	30	16	65,8	33,9	3197	2716	34,0
V	113	194	30	16	64,5	34,3	3323	2760	34,0
V	117	192	30	16	63,1	34,7	3452	2805	34,0
V	120	190	30	16	62,1	35,0	3551	2839	34,0
V	124	188	30	16	60,7	35,4	3686	2885	34,0
V	128	186	30	16	59,4	35,8	3823	2932	34,0
V	132	184	30	16	58,0	36,3	3964	2979	34,0
V	136	182	30	16	56,7	36,7	4109	3027	34,0
V	140	180	30	16	55,4	37,2	4256	3075	34,0
T	32	264	18	9	67,1	20,6	770	2240	32,5
T	36	262	18	9	66,2	20,8	796	2158	32,5
T	40	260	18	9	65,2	20,9	823	2091	32,5
T	44	258	18	9	64,3	21,1	853	2036	32,5
T	48	256	18	9	63,4	21,3	884	1991	32,5
T	52	254	18	9	62,4	21,5	916	1955	32,5
T	56	252	18	9	61,5	21,6	951	1926	32,5
T	60	250	18	9	60,6	21,8	988	1904	32,5
T	64	248	18	9	59,7	22,0	1026	1886	32,5
T	68	246	18	9	58,8	22,2	1066	1874	32,5
T	71	245	18	9	58,1	22,4	1097	1867	32,5
T	74	243	18	9	57,4	22,5	1129	1863	32,5
T	76	242	18	9	57,0	22,6	1151	1861	32,5
T	80	240	18	9	56,1	22,8	1197	1859	32,5
T	81	240	18	9	55,8	22,9	1208	1859	32,5
T	85	238	18	9	54,9	23,1	1256	1861	32,5
T	89	236	18	9	54,0	23,3	1306	1865	32,5
T	93	234	18	9	53,2	23,5	1357	1872	32,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	97	232	18	9	52,3	23,7	1410	1880	32,5
T	100	230	18	9	51,6	23,9	1451	1887	32,5
T	101	230	18	9	51,4	24,0	1465	1890	32,5
T	105	228	18	9	50,5	24,2	1522	1902	32,5
T	109	226	18	9	49,6	24,4	1580	1915	32,5
T	113	224	18	9	48,8	24,7	1640	1930	32,5
T	117	222	18	9	47,9	24,9	1703	1946	32,5
T	120	220	18	9	47,3	25,1	1750	1958	32,5
T	124	218	18	9	46,4	25,4	1816	1976	32,5
T	128	216	18	9	45,6	25,6	1883	1995	32,5
T	132	214	18	9	44,7	25,9	1951	2014	32,5
T	136	212	18	9	43,9	26,2	2022	2035	32,5
T	140	210	18	9	43,0	26,4	2095	2056	32,5
T	144	208	18	9	42,2	26,7	2169	2078	32,5
T	148	206	18	9	41,4	27,0	2245	2100	32,5
T	152	204	18	9	40,6	27,3	2323	2124	32,5
T	156	202	18	9	39,8	27,6	2402	2147	32,5
T	160	200	18	9	39,0	27,9	2484	2172	32,5
V	48	256	32	18	117	33,1	1712	2468	32,5
V	52	254	32	18	115	33,4	1785	2483	32,5
V	56	252	32	18	113	33,7	1860	2501	32,5
V	60	250	32	18	112	34,0	1939	2523	32,5
V	64	248	32	18	110	34,3	2021	2546	32,5
V	68	246	32	18	108	34,6	2106	2573	32,5
V	71	245	32	18	107	34,8	2172	2594	32,5
V	74	243	32	18	106	35,1	2240	2616	32,5
V	76	242	32	18	105	35,2	2286	2632	32,5
V	80	240	32	18	103	35,6	2381	2664	32,5
V	81	240	32	18	103	35,6	2405	2673	32,5
V	85	238	32	18	101	36,0	2504	2707	32,5
V	89	236	32	18	99,6	36,3	2606	2743	32,5
V	93	234	32	18	97,9	36,6	2711	2781	32,5
V	97	232	32	18	96,3	37,0	2820	2820	32,5
V	100	230	32	18	95,1	37,2	2903	2850	32,5
V	101	230	32	18	94,7	37,3	2931	2860	32,5
V	105	228	32	18	93,1	37,7	3046	2901	32,5
V	109	226	32	18	91,5	38,1	3164	2943	32,5
V	113	224	32	18	89,9	38,4	3285	2987	32,5
V	117	222	32	18	88,3	38,8	3410	3031	32,5
V	120	220	32	18	87,1	39,1	3505	3065	32,5
V	124	218	32	18	85,5	39,5	3635	3110	32,5
V	128	216	32	18	84,0	39,9	3768	3157	32,5
V	132	214	32	18	82,4	40,3	3905	3204	32,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	136	212	32	18	80,9	40,7	4044	3252	32,5
V	140	210	32	18	79,3	41,2	4187	3300	32,5
V	144	208	32	18	77,8	41,6	4333	3349	32,5
V	148	206	32	18	76,3	42,1	4482	3399	32,5
V	152	204	32	18	74,8	42,5	4635	3449	32,5
V	156	202	32	18	73,3	43,0	4790	3500	32,5
V	160	200	32	18	71,8	43,5	4949	3551	32,5
T	32	294	20	11	83,4	25,6	854	2950	32,5
T	36	292	20	11	82,4	25,8	878	2827	32,5
T	40	290	20	11	81,4	26,0	904	2725	32,5
T	44	288	20	11	80,3	26,2	931	2640	32,5
T	48	286	20	11	79,3	26,4	960	2569	32,5
T	52	284	20	11	78,3	26,6	991	2510	32,5
T	56	282	20	11	77,2	26,8	1023	2461	32,5
T	60	280	20	11	76,2	27,0	1057	2420	32,5
T	64	278	20	11	75,2	27,2	1093	2387	32,5
T	68	276	20	11	74,2	27,4	1131	2361	32,5
T	71	275	20	11	73,4	27,6	1160	2344	32,5
T	74	273	20	11	72,7	27,7	1190	2331	32,5
T	76	272	20	11	72,1	27,8	1211	2323	32,5
T	80	270	20	11	71,1	28,1	1253	2312	32,5
T	81	270	20	11	70,9	28,1	1264	2309	32,5
T	85	268	20	11	69,9	28,3	1309	2302	32,5
T	89	266	20	11	68,9	28,6	1355	2299	32,5
T	93	264	20	11	67,9	28,8	1403	2298	32,5
T	97	262	20	11	66,9	29,0	1453	2300	32,5
T	100	260	20	11	66,2	29,2	1491	2303	32,5
T	101	260	20	11	65,9	29,3	1504	2305	32,5
T	105	258	20	11	64,9	29,5	1557	2311	32,5
T	109	256	20	11	63,9	29,8	1612	2320	32,5
T	113	254	20	11	63,0	30,0	1668	2331	32,5
T	117	252	20	11	62,0	30,3	1726	2343	32,5
T	120	250	20	11	61,3	30,5	1771	2353	32,5
T	124	248	20	11	60,3	30,8	1832	2368	32,5
T	128	246	20	11	59,3	31,0	1895	2384	32,5
T	132	244	20	11	58,4	31,3	1959	2402	32,5
T	136	242	20	11	57,4	31,6	2025	2420	32,5
T	140	240	20	11	56,5	31,9	2093	2440	32,5
T	144	238	20	11	55,6	32,2	2163	2460	32,5
T	148	236	20	11	54,6	32,5	2234	2482	32,5
T	152	234	20	11	53,7	32,8	2307	2504	32,5
T	156	232	20	11	52,8	33,1	2381	2527	32,5
T	160	230	20	11	51,9	33,4	2457	2551	32,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	164	228	20	11	51,0	33,7	2535	2576	32,5
T	168	226	20	11	50,1	34,1	2615	2601	32,5
T	172	224	20	11	49,2	34,4	2696	2627	32,5
T	176	222	20	11	48,3	34,7	2779	2653	32,5
T	180	220	20	11	47,4	35,1	2864	2680	32,5
V	48	286	38	22	149	48,8	2049	3507	32,5
V	52	284	38	22	147	49,2	2123	3507	32,5
V	56	282	38	22	145	49,5	2199	3511	32,5
V	60	280	38	22	143	49,9	2279	3521	32,5
V	64	278	38	22	142	50,3	2362	3534	32,5
V	68	276	38	22	140	50,7	2449	3552	32,5
V	71	275	38	22	138	51,0	2516	3567	32,5
V	74	273	38	22	137	51,3	2584	3584	32,5
V	76	272	38	22	136	51,5	2631	3596	32,5
V	80	270	38	22	134	51,9	2727	3623	32,5
V	81	270	38	22	133	52,0	2751	3630	32,5
V	85	268	38	22	131	52,4	2851	3661	32,5
V	89	266	38	22	129	52,9	2955	3693	32,5
V	93	264	38	22	128	53,3	3061	3728	32,5
V	97	262	38	22	126	53,7	3171	3765	32,5
V	100	260	38	22	124	54,1	3255	3794	32,5
V	101	260	38	22	124	54,2	3283	3804	32,5
V	105	258	38	22	122	54,6	3399	3844	32,5
V	109	256	38	22	120	55,1	3518	3887	32,5
V	113	254	38	22	118	55,6	3641	3930	32,5
V	117	252	38	22	116	56,1	3766	3976	32,5
V	120	250	38	22	115	56,4	3863	4010	32,5
V	124	248	38	22	113	56,9	3994	4058	32,5
V	128	246	38	22	111	57,4	4128	4106	32,5
V	132	244	38	22	109	57,9	4266	4156	32,5
V	136	242	38	22	108	58,5	4406	4207	32,5
V	140	240	38	22	106	59,0	4550	4259	32,5
V	144	238	38	22	104	59,5	4698	4312	32,5
V	148	236	38	22	102	60,1	4848	4365	32,5
V	152	234	38	22	100	60,6	5001	4420	32,5
V	156	232	38	22	98,6	61,2	5158	4475	32,5
V	160	230	38	22	96,9	61,8	5318	4531	32,5
V	164	228	38	22	95,1	62,4	5481	4588	32,5
V	168	226	38	22	93,4	63,0	5648	4645	32,5
V	172	224	38	22	91,7	63,6	5817	4703	32,5
V	176	222	38	22	90,0	64,2	5990	4762	32,5
V	180	220	38	22	88,3	64,9	6166	4821	32,5
T	32	324	20	11	114	26,3	878	2827	28,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	36	322	20	11	112	26,4	904	2725	28,5
T	40	320	20	11	111	26,6	931	2640	28,5
T	44	318	20	11	110	26,8	960	2569	28,5
T	48	316	20	11	109	27,0	991	2510	28,5
T	52	314	20	11	108	27,2	1023	2461	28,5
T	56	312	20	11	106	27,4	1057	2420	28,5
T	60	310	20	11	105	27,5	1093	2387	28,5
T	64	308	20	11	104	27,7	1131	2361	28,5
T	68	306	20	11	103	27,9	1170	2339	28,5
T	71	305	20	11	102	28,1	1200	2327	28,5
T	74	303	20	11	101	28,2	1232	2317	28,5
T	76	302	20	11	100	28,3	1253	2312	28,5
T	80	300	20	11	99,0	28,5	1297	2304	28,5
T	81	300	20	11	98,7	28,6	1309	2302	28,5
T	85	298	20	11	97,5	28,8	1355	2299	28,5
T	89	296	20	11	96,4	29,0	1403	2298	28,5
T	93	294	20	11	95,2	29,2	1453	2300	28,5
T	97	292	20	11	94,0	29,4	1504	2305	28,5
T	100	290	20	11	93,1	29,6	1544	2309	28,5
T	101	290	20	11	92,8	29,6	1557	2311	28,5
T	105	288	20	11	91,6	29,9	1612	2320	28,5
T	109	286	20	11	90,4	30,1	1668	2331	28,5
T	113	284	20	11	89,3	30,3	1726	2343	28,5
T	117	282	22	11	89,1	41,2	1924	2806	28,5
T	120	280	22	11	88,2	41,5	1970	2814	28,5
T	124	278	22	11	87,0	41,8	2032	2827	28,5
T	128	276	22	11	85,7	42,1	2097	2840	28,5
T	132	274	22	11	84,5	42,5	2162	2856	28,5
T	136	272	22	11	83,3	42,8	2230	2873	28,5
T	140	270	22	11	82,1	43,1	2299	2891	28,5
T	144	268	22	11	80,9	43,5	2370	2910	28,5
T	148	266	22	11	79,7	43,8	2442	2931	28,5
T	152	264	22	11	78,6	44,2	2516	2952	28,5
T	156	262	22	11	77,4	44,6	2592	2975	28,5
T	160	260	22	11	76,2	44,9	2670	2998	28,5
T	164	258	22	11	75,0	45,3	2749	3022	28,5
T	168	256	22	11	73,9	45,7	2830	3048	28,5
T	172	254	22	11	72,7	46,1	2912	3073	28,5
T	176	252	22	11	71,6	46,5	2997	3100	28,5
T	180	250	22	11	70,4	46,9	3083	3127	28,5
T	184	248	22	11	69,3	47,3	3170	3155	28,5
T	188	246	22	11	68,2	47,7	3259	3184	28,5
T	192	244	22	11	67,1	48,1	3350	3213	28,5
T = partial nailing, V = full nailing									

Table B1 (continued): Joist hanger type A1 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	196	242	22	11	65,9	48,6	3443	3242	28,5
T	200	240	22	11	64,8	49,0	3537	3272	28,5
V	48	316	42	22	210	67,9	2391	4366	28,5
V	52	314	42	22	208	68,4	2468	4355	28,5
V	56	312	42	22	205	68,9	2548	4350	28,5
V	60	310	42	22	203	69,3	2631	4351	28,5
V	64	308	42	22	200	69,8	2718	4356	28,5
V	68	306	42	22	198	70,3	2807	4367	28,5
V	71	305	42	22	196	70,7	2877	4377	28,5
V	74	303	42	22	194	71,0	2948	4390	28,5
V	76	302	42	22	193	71,3	2996	4400	28,5
V	80	300	42	22	190	71,8	3095	4422	28,5
V	81	300	42	22	190	71,9	3121	4428	28,5
V	85	298	42	22	187	72,4	3224	4454	28,5
V	89	296	42	22	185	73,0	3330	4483	28,5
V	93	294	42	22	183	73,5	3440	4515	28,5
V	97	292	42	22	180	74,0	3553	4549	28,5
V	100	290	42	22	178	74,5	3640	4577	28,5
V	101	290	42	22	178	74,6	3669	4586	28,5
V	105	288	42	22	175	75,2	3788	4625	28,5
V	109	286	42	22	173	75,7	3911	4666	28,5
V	113	284	42	22	171	76,3	4036	4709	28,5
V	117	282	42	22	168	76,9	4165	4754	28,5
V	120	280	42	22	166	77,3	4264	4788	28,5
V	124	278	42	22	164	77,9	4398	4836	28,5
V	128	276	42	22	162	78,5	4536	4885	28,5
V	132	274	42	22	159	79,1	4677	4935	28,5
V	136	272	42	22	157	79,8	4821	4987	28,5
V	140	270	42	22	155	80,4	4968	5040	28,5
V	144	268	42	22	153	81,0	5118	5094	28,5
V	148	266	42	22	150	81,7	5272	5149	28,5
V	152	264	42	22	148	82,4	5429	5206	28,5
V	156	262	42	22	146	83,1	5589	5263	28,5
V	160	260	42	22	143	83,7	5752	5321	28,5
V	164	258	42	22	141	84,4	5919	5381	28,5
V	168	256	42	22	139	85,2	6088	5441	28,5
V	172	254	42	22	137	85,9	6261	5501	28,5
V	176	252	42	22	135	86,6	6437	5563	28,5
V	180	250	42	22	132	87,4	6616	5625	28,5
V	184	248	42	22	130	88,1	6799	5688	28,5
V	188	246	42	22	128	88,9	6984	5752	28,5
V	192	244	42	22	126	89,7	7173	5816	28,5
V	196	242	42	22	124	90,5	7365	5881	28,5
V	200	240	42	22	122	91,3	7561	5946	28,5

T = partial nailing, V = full nailing

Table B2: Joist hanger type A2 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2; $e_{J,0}$ = 28 mm

B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
		Full nailing						Partial nailing					
32	99	12	6	16,4	7,19	564	457	8	4	11,1	4,91	328	578
34	98	12	6	16,1	7,28	588	464	8	4	10,8	4,97	342	571
36	97	12	6	15,7	7,37	614	472	8	4	10,6	5,03	358	565
38	96	12	6	15,4	7,46	640	480	8	4	10,4	5,10	373	560
40	95	12	6	15,1	7,56	667	488	8	4	10,2	5,16	390	557
42	94	12	6	14,7	7,66	695	496	8	4	9,94	5,23	406	554
44	93	12	6	14,4	7,76	724	505	8	4	9,73	5,30	424	553
46	92	12	6	14,1	7,86	753	513	8	4	9,51	5,37	442	552
48	91	12	6	13,8	7,97	783	522	8	4	9,30	5,44	460	552
50	90	12	6	13,4	8,08	814	531	8	4	9,09	5,52	479	553
52	89	12	6	13,1	8,19	846	540	8	4	8,88	5,59	498	554
54	88	12	6	12,8	8,31	879	549	8	4	8,67	5,67	518	555
56	87	12	6	12,5	8,43	912	559	8	4	8,47	5,76	539	558
58	86	12	6	12,2	8,55	947	568	8	4	8,27	5,84	560	560
60	85	12	6	11,9	8,68	982	577	8	4	8,07	5,93	582	563
32	114	12	8	21,7	6,07	564	457	8	4	14,6	4,15	328	578
34	113	12	8	21,3	6,13	588	464	8	4	14,3	4,19	342	571
36	112	12	8	21,0	6,20	614	472	8	4	14,1	4,23	358	565
38	111	12	8	20,6	6,26	640	480	8	4	13,8	4,28	373	560
40	110	12	8	20,3	6,33	667	488	8	4	13,6	4,32	390	557
42	109	12	8	19,9	6,40	695	496	8	4	13,4	4,37	406	554
44	108	12	8	19,5	6,47	724	505	8	4	13,1	4,42	424	553
46	107	12	8	19,2	6,54	753	513	8	4	12,9	4,47	442	552
48	106	12	8	18,8	6,62	783	522	8	4	12,7	4,52	460	552
50	105	12	8	18,5	6,69	814	531	8	4	12,4	4,57	479	553
52	104	12	8	18,1	6,77	846	540	8	4	12,2	4,62	498	554
54	103	12	8	17,8	6,85	879	549	8	4	12,0	4,68	518	555
56	102	12	8	17,4	6,93	912	559	8	4	11,7	4,73	539	558
58	101	12	8	17,1	7,01	947	568	8	4	11,5	4,79	560	560
60	100	12	8	16,7	7,10	982	577	8	4	11,3	4,85	582	563
62	99	12	8	16,4	7,19	1018	587	8	4	11,1	4,91	604	566
64	98	12	8	16,1	7,28	1054	597	8	4	18,0	3,62	626	569
32	144	14	10	34,4	8,24	566	612	10	6	23,4	6,78	382	899
34	143	14	10	33,9	8,31	588	618	10	6	23,1	6,83	396	880
36	142	14	10	33,5	8,38	609	625	10	6	22,8	6,88	410	864
38	141	14	10	33,1	8,44	632	632	10	6	22,5	6,94	425	850
40	140	14	10	32,6	8,51	655	640	10	6	22,2	7,00	440	839
42	139	14	10	32,2	8,58	680	647	10	6	21,9	7,05	456	829
44	138	14	10	31,8	8,65	704	655	10	6	21,6	7,11	472	821
46	137	14	10	31,3	8,73	730	663	10	6	21,3	7,17	489	815
48	136	14	10	30,9	8,80	756	672	10	6	21,0	7,23	506	810
50	135	14	10	30,5	8,88	783	681	10	6	20,7	7,29	524	806
52	134	14	10	30,1	8,95	810	690	10	6	20,4	7,36	542	803

Table B2 (cont.): Joist hanger type A2 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2; $e_{J,0}$ = 28 mm

B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
		Full nailing						Partial nailing					
54	133	14	10	29,6	9,03	839	699	10	6	20,1	7,42	561	801
56	132	14	10	29,2	9,11	867	708	10	6	19,8	7,49	580	800
58	131	14	10	28,8	9,19	897	718	10	6	19,5	7,55	600	800
60	130	14	10	28,4	9,27	927	727	10	6	19,2	7,62	620	800
62	129	14	10	28,0	9,35	959	737	10	6	18,9	7,69	641	801
64	128	14	10	27,5	9,44	990	747	10	6	18,6	7,76	662	803
66	127	14	10	27,1	9,52	1023	758	10	6	18,4	7,83	684	805
68	126	14	10	26,7	9,61	1056	768	10	6	18,1	7,90	706	807
70	125	14	10	26,3	9,70	1090	778	10	6	17,8	7,97	729	810
72	124	14	10	25,9	9,79	1124	789	10	6	17,5	8,05	752	813
74	123	14	10	25,5	9,88	1160	800	10	6	17,2	8,12	776	817
76	122	14	10	25,1	10,0	1195	811	10	6	17,0	8,20	800	821
78	121	14	10	24,7	10,1	1232	821	10	6	16,7	8,28	825	825
80	120	14	10	24,3	10,2	1269	832	10	6	16,4	8,36	850	830
32	174	18	12	52,6	13,5	697	943	12	6	34,3	10,0	455	1338
34	173	18	12	52,1	13,6	720	947	12	6	33,9	10,1	468	1300
36	172	18	12	51,5	13,6	743	952	12	6	33,5	10,2	482	1268
38	171	18	12	51,0	13,7	766	958	12	6	33,2	10,2	496	1240
40	170	18	12	50,4	13,8	791	964	12	6	32,8	10,3	511	1216
42	169	18	12	49,9	13,9	816	971	12	6	32,4	10,4	526	1195
44	168	18	12	49,3	14,0	841	978	12	6	32,1	10,4	541	1177
46	167	18	12	48,8	14,1	868	986	12	6	31,7	10,5	557	1161
48	166	18	12	48,2	14,2	895	995	12	6	31,4	10,6	574	1148
50	165	18	12	47,7	14,3	923	1003	12	6	31,0	10,7	591	1137
52	164	18	12	47,1	14,4	952	1013	12	6	30,7	10,7	609	1127
54	163	18	12	46,6	14,5	981	1022	12	6	30,3	10,8	627	1119
56	162	18	12	46,0	14,6	1011	1032	12	6	29,9	10,9	645	1112
58	161	18	12	45,5	14,7	1042	1042	12	6	29,6	11,0	664	1107
60	160	18	12	45,0	14,8	1074	1053	12	6	29,2	11,0	683	1102
62	159	18	12	44,4	14,9	1106	1064	12	6	28,9	11,1	703	1099
64	158	18	12	43,9	15,0	1139	1075	12	6	28,5	11,2	724	1097
66	157	18	12	43,4	15,1	1173	1086	12	6	28,2	11,3	745	1095
68	156	18	12	42,8	15,2	1207	1097	12	6	27,8	11,3	766	1094
70	155	18	12	42,3	15,3	1242	1109	12	6	27,5	11,4	788	1094
72	154	18	12	41,8	15,4	1278	1121	12	6	27,2	11,5	810	1095
74	153	18	12	41,2	15,6	1315	1134	12	6	26,8	11,6	833	1096
76	152	18	12	40,7	15,7	1352	1146	12	6	26,5	11,7	856	1098
78	151	18	12	40,2	15,8	1390	1159	12	6	26,1	11,8	880	1100
80	150	18	12	39,7	15,9	1429	1171	12	6	25,8	11,9	904	1103
82	149	18	12	39,1	16,0	1468	1184	12	6	25,5	12,0	929	1106
84	148	18	12	38,6	16,1	1509	1197	12	6	25,1	12,0	954	1109
86	147	18	12	38,1	16,3	1550	1211	12	6	24,8	12,1	980	1113
88	146	18	12	37,6	16,4	1591	1224	12	6	24,4	12,2	1006	1118

Table B2 (cont.): Joist hanger type A2 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2; $e_{J,0}$ = 28 mm

B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
		Full nailing						Partial nailing					
90	145	18	12	37,1	16,5	1634	1238	12	6	24,1	12,3	1033	1122
92	144	18	12	36,6	16,7	1677	1251	12	6	23,8	12,4	1060	1127
94	143	18	12	36,0	16,8	1720	1265	12	6	23,4	12,5	1087	1133
96	142	18	12	35,5	16,9	1765	1279	12	6	23,1	12,6	1115	1138
98	141	18	12	35,0	17,1	1810	1293	12	6	22,8	12,7	1144	1144
100	140	18	12	34,5	17,2	1856	1307	12	6	22,5	12,8	1173	1150
32	204	22	14	73,7	21,4	899	1458	14	8	47,2	13,9	543	1918
34	203	22	14	73,0	21,6	922	1456	14	8	46,8	14,0	556	1854
36	202	22	14	72,4	21,7	946	1455	14	8	46,3	14,1	570	1799
38	201	22	14	71,7	21,8	970	1455	14	8	45,9	14,2	583	1750
40	200	22	14	71,0	21,9	995	1456	14	8	45,5	14,2	598	1707
42	199	22	14	70,4	22,0	1021	1458	14	8	45,1	14,3	612	1670
44	198	22	14	69,7	22,2	1047	1461	14	8	44,7	14,4	627	1637
46	197	22	14	69,0	22,3	1075	1465	14	8	44,2	14,5	643	1608
48	196	22	14	68,4	22,4	1103	1470	14	8	43,8	14,6	659	1582
50	195	22	14	67,7	22,5	1131	1475	14	8	43,4	14,6	676	1559
52	194	22	14	67,1	22,7	1161	1482	14	8	43,0	14,7	693	1539
54	193	22	14	66,4	22,8	1191	1489	14	8	42,6	14,8	710	1522
56	192	22	14	65,7	22,9	1222	1496	14	8	42,1	14,9	728	1507
58	191	22	14	65,1	23,1	1253	1504	14	8	41,7	15,0	747	1493
60	190	22	14	64,4	23,2	1286	1513	14	8	41,3	15,1	766	1482
62	189	22	14	63,8	23,3	1319	1522	14	8	40,9	15,2	785	1472
64	188	22	14	63,1	23,5	1353	1531	14	8	40,5	15,2	805	1463
66	187	22	14	62,5	23,6	1387	1541	14	8	40,1	15,3	825	1456
68	186	22	14	61,8	23,7	1423	1552	14	8	39,7	15,4	846	1450
70	185	22	14	61,2	23,9	1459	1563	14	8	39,3	15,5	867	1445
72	184	22	14	60,6	24,0	1495	1574	14	8	38,9	15,6	889	1441
74	183	22	14	59,9	24,2	1533	1586	14	8	38,5	15,7	911	1438
76	182	22	14	59,3	24,3	1571	1598	14	8	38,1	15,8	934	1436
78	181	22	14	58,6	24,5	1610	1610	14	8	37,7	15,9	957	1435
80	180	22	14	58,0	24,6	1650	1623	14	8	37,3	16,0	980	1434
82	179	22	14	57,4	24,8	1690	1636	14	8	36,8	16,1	1004	1435
84	178	22	14	56,7	24,9	1731	1649	14	8	36,4	16,2	1029	1435
86	177	22	14	56,1	25,1	1773	1662	14	8	36,1	16,3	1054	1437
88	176	22	14	55,5	25,2	1816	1676	14	8	35,7	16,4	1079	1439
90	175	22	14	54,9	25,4	1859	1690	14	8	35,3	16,5	1105	1441
92	174	22	14	54,2	25,6	1903	1704	14	8	34,9	16,6	1131	1444
94	173	22	14	53,6	25,7	1948	1719	14	8	34,5	16,7	1158	1448
96	172	22	14	53,0	25,9	1994	1734	14	8	34,1	16,8	1186	1452
98	171	22	14	52,4	26,1	2040	1749	14	8	33,7	16,9	1213	1456
100	170	22	14	51,8	26,2	2087	1764	14	8	33,3	17,0	1242	1461
102	169	22	14	51,2	26,4	2135	1779	14	8	32,9	17,2	1270	1466
104	168	22	14	50,5	26,6	2183	1794	14	8	32,5	17,3	1299	1471

Table B2 (cont.): Joist hanger type A2 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2; $e_{J,0}$ = 28 mm

B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
		Full nailing						Partial nailing					
106	167	22	14	49,9	26,8	2233	1810	14	8	32,1	17,4	1329	1477
108	166	22	14	49,3	26,9	2283	1826	14	8	31,8	17,5	1359	1483
110	165	22	14	48,7	27,1	2333	1842	14	8	31,4	17,6	1390	1489
112	164	22	14	48,1	27,3	2385	1858	14	8	31,0	17,7	1421	1496
114	163	22	14	47,5	27,5	2437	1874	14	8	30,6	17,9	1452	1502
116	162	22	14	46,9	27,7	2490	1891	14	8	30,2	18,0	1484	1509
118	161	22	14	46,3	27,9	2543	1908	14	8	29,9	18,1	1517	1517
120	160	22	14	45,7	28,1	2598	1924	14	8	29,5	18,2	1550	1524
32	234	26	16	98,7	30,5	1104	2089	16	8	62,2	18,5	647	2663
34	233	26	16	97,9	30,7	1127	2077	16	8	61,7	18,6	659	2564
36	232	26	16	97,1	30,8	1151	2067	16	8	61,2	18,6	672	2477
38	231	26	16	96,3	30,9	1176	2058	16	8	60,7	18,7	686	2400
40	230	26	16	95,6	31,1	1202	2052	16	8	60,3	18,8	700	2332
42	229	26	16	94,8	31,2	1228	2047	16	8	59,8	18,9	714	2272
44	228	26	16	94,0	31,4	1255	2043	16	8	59,3	19,0	729	2218
46	227	26	16	93,2	31,5	1283	2041	16	8	58,8	19,1	744	2171
48	226	26	16	92,4	31,7	1311	2040	16	8	58,3	19,2	760	2128
50	225	26	16	91,7	31,8	1340	2040	16	8	57,8	19,3	776	2090
52	224	26	16	90,9	32,0	1370	2041	16	8	57,4	19,4	793	2056
54	223	26	16	90,1	32,2	1401	2043	16	8	56,9	19,5	810	2025
56	222	26	16	89,3	32,3	1433	2047	16	8	56,4	19,6	828	1998
58	221	26	16	88,6	32,5	1465	2051	16	8	55,9	19,7	846	1973
60	220	26	16	87,8	32,6	1498	2056	16	8	55,5	19,8	864	1951
62	219	26	16	87,0	32,8	1531	2062	16	8	55,0	19,9	883	1932
64	218	26	16	86,3	33,0	1566	2068	16	8	54,5	20,0	903	1915
66	217	26	16	85,5	33,1	1601	2075	16	8	54,1	20,1	923	1899
68	216	26	16	84,7	33,3	1637	2083	16	8	53,6	20,2	943	1886
70	215	26	16	84,0	33,5	1674	2092	16	8	53,1	20,3	964	1874
72	214	26	16	83,2	33,6	1711	2101	16	8	52,6	20,4	985	1863
74	213	26	16	82,5	33,8	1749	2111	16	8	52,2	20,5	1007	1854
76	212	26	16	81,7	34,0	1788	2121	16	8	51,7	20,6	1029	1847
78	211	26	16	81,0	34,1	1828	2132	16	8	51,2	20,7	1051	1840
80	210	26	16	80,2	34,3	1868	2144	16	8	50,8	20,8	1075	1835
82	209	26	16	79,5	34,5	1909	2156	16	8	50,3	20,9	1098	1830
84	208	26	16	78,7	34,7	1951	2168	16	8	49,9	21,0	1122	1827
86	207	26	16	78,0	34,9	1994	2181	16	8	49,4	21,1	1147	1824
88	206	26	16	77,2	35,1	2037	2194	16	8	48,9	21,2	1171	1822
90	205	26	16	76,5	35,2	2081	2207	16	8	48,5	21,3	1197	1821
92	204	26	16	75,7	35,4	2126	2221	16	8	48,0	21,4	1223	1821
94	203	26	16	75,0	35,6	2171	2235	16	8	47,6	21,6	1249	1821
96	202	26	16	74,3	35,8	2218	2250	16	8	47,1	21,7	1276	1822
98	201	26	16	73,5	36,0	2265	2265	16	8	46,7	21,8	1303	1824
100	200	26	16	72,8	36,2	2313	2280	16	8	46,2	21,9	1331	1826

Table B2 (cont.): Joist hanger type A2 with external flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2; $e_{J,0}$ = 28 mm

B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]
		Full nailing						Partial nailing					
102	199	26	16	72,1	36,4	2361	2296	16	8	45,8	22,0	1359	1829
104	198	26	16	71,4	36,6	2410	2311	16	8	45,3	22,2	1387	1832
106	197	26	16	70,6	36,8	2460	2327	16	8	44,9	22,3	1416	1836
108	196	26	16	69,9	37,0	2511	2344	16	8	44,4	22,4	1446	1840
110	195	26	16	69,2	37,2	2563	2360	16	8	44,0	22,5	1476	1845
112	194	26	16	68,5	37,4	2615	2377	16	8	43,5	22,7	1506	1850
114	193	26	16	67,8	37,6	2668	2394	16	8	43,1	22,8	1537	1855
116	192	26	16	67,0	37,9	2722	2412	16	8	42,6	22,9	1568	1861
118	191	26	16	66,3	38,1	2776	2429	16	8	42,2	23,1	1600	1867
120	190	26	16	65,6	38,3	2831	2447	16	8	41,8	23,2	1632	1873
122	189	26	16	64,9	38,5	2887	2465	16	8	41,3	23,3	1665	1880
124	188	26	16	64,2	38,8	2944	2483	16	8	40,9	23,5	1698	1887
126	187	26	16	63,5	39,0	3002	2501	16	8	40,5	23,6	1732	1894
128	186	26	16	62,8	39,2	3060	2520	16	8	40,0	23,7	1766	1902
130	185	26	16	62,1	39,4	3119	2539	16	8	39,6	23,9	1800	1909
132	184	26	16	61,4	39,7	3178	2557	16	8	39,2	24,0	1835	1917
134	183	26	16	60,7	39,9	3239	2576	16	8	38,7	24,2	1871	1926
136	182	26	16	60,1	40,2	3300	2596	16	8	38,3	24,3	1907	1934
138	181	26	16	59,4	40,4	3362	2615	16	8	37,9	24,5	1943	1943
140	180	26	16	58,7	40,7	3425	2634	16	8	37,5	24,6	1980	1952

Table B3: Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	76	122,0	10	6	12,6	6,33	425	567	36,8
T	80	120,0	10	6	12,2	6,46	456	570	36,8
V	76	122,0	18	12	22,0	10,8	545	727	36,8
V	80	120,0	18	12	21,2	11,0	585	731	36,8
T	76	132,0	10	5	15,5	5,93	418	566	35,5
T	80	130,0	10	5	15,1	6,04	448	569	35,5
T	81	129,5	10	5	14,9	6,06	456	570	35,5
T	85	127,5	10	5	14,5	6,17	489	575	35,5
T	89	125,5	10	5	14,0	6,29	524	582	35,5
T	93	123,5	10	5	13,6	6,41	561	591	35,5
T	97	121,5	10	5	13,2	6,53	600	600	35,5
T	100	120,0	10	5	12,8	6,63	631	608	35,5
V	76	132,0	16	10	26,4	7,66	480	651	35,5
V	80	130,0	16	10	25,6	7,80	517	657	35,5
V	81	129,5	16	10	25,4	7,83	527	659	35,5
V	85	127,5	16	10	24,7	7,97	568	668	35,5
V	89	125,5	16	10	23,9	8,12	612	680	35,5
V	93	123,5	16	10	23,2	8,28	659	694	35,5
V	97	121,5	16	10	22,4	8,44	709	709	35,5
V	100	120,0	16	10	21,9	8,56	749	722	35,5
T	76	152,0	12	6	20,7	9,25	489	829	35,5
T	80	150,0	12	6	20,2	9,39	518	822	35,5
T	81	149,5	12	6	20,1	9,43	526	822	35,5
T	85	147,5	12	6	19,5	9,57	557	820	35,5
T	89	145,5	12	6	19,0	9,72	591	821	35,5
T	93	143,5	12	6	18,5	9,88	627	824	35,5
T	97	141,5	12	6	18,0	10,0	664	830	35,5
T	100	140,0	12	6	17,6	10,2	693	835	35,5
V	76	152,0	20	12	36,4	12,8	593	1005	35,5
V	80	150,0	20	12	35,5	13,0	629	998	35,5
V	81	149,5	20	12	35,3	13,0	638	998	35,5
V	85	147,5	20	12	34,4	13,2	678	998	35,5
V	89	145,5	20	12	33,4	13,4	722	1002	35,5
V	93	143,5	20	12	32,5	13,6	768	1011	35,5
V	97	141,5	20	12	31,6	13,9	818	1022	35,5
V	100	140,0	20	12	30,9	14,0	857	1032	35,5
T	76	182,0	14	7	30,8	13,1	532	1172	34,0
T	80	180,0	14	7	30,2	13,3	558	1152	34,0
T	81	179,5	14	7	30,0	13,3	565	1148	34,0
T	85	177,5	14	7	29,4	13,5	594	1135	34,0
T	89	175,5	14	7	28,7	13,7	624	1126	34,0
T	93	173,5	14	7	28,1	13,9	656	1121	34,0
T	97	171,5	14	7	27,4	14,0	689	1120	34,0
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	100	170,0	14	7	26,9	14,2	716	1121	34,0
T	101	169,5	14	7	26,8	14,2	725	1121	34,0
T	105	167,5	14	7	26,2	14,4	762	1125	34,0
T	109	165,5	14	7	25,5	14,6	800	1131	34,0
T	113	163,5	14	7	24,9	14,8	841	1139	34,0
T	117	161,5	14	7	24,3	15,0	883	1148	34,0
T	120	160,0	14	7	23,8	15,2	916	1156	34,0
V	76	182,0	26	14	56,3	23,5	764	1684	34,0
V	80	180,0	26	14	55,1	23,7	798	1647	34,0
V	81	179,5	26	14	54,8	23,8	807	1640	34,0
V	85	177,5	26	14	53,6	24,1	845	1616	34,0
V	89	175,5	26	14	52,3	24,4	886	1600	34,0
V	93	173,5	26	14	51,1	24,7	931	1592	34,0
V	97	171,5	26	14	49,9	25,1	978	1590	34,0
V	100	170,0	26	14	49,0	25,3	1016	1592	34,0
V	101	169,5	26	14	48,7	25,4	1029	1593	34,0
V	105	167,5	26	14	47,5	25,7	1083	1600	34,0
V	109	165,5	26	14	46,4	26,1	1141	1612	34,0
V	113	163,5	26	14	45,2	26,5	1201	1626	34,0
V	117	161,5	26	14	43,5	27,0	1265	1644	34,0
V	120	160,0	26	14	42,0	27,5	1314	1659	34,0
T	76	212,0	16	8	39,6	16,1	643	1596	36,0
T	80	210,0	16	8	38,8	16,3	669	1559	36,0
T	81	209,5	16	8	38,7	16,4	676	1551	36,0
T	85	207,5	16	8	38,0	16,5	705	1523	36,0
T	89	205,5	16	8	37,2	16,7	735	1503	36,0
T	93	203,5	16	8	36,5	16,9	768	1487	36,0
T	97	201,5	16	8	35,8	17,1	801	1477	36,0
T	100	200,0	16	8	35,3	17,2	828	1471	36,0
T	101	199,5	16	8	35,1	17,3	837	1470	36,0
T	105	197,5	16	8	34,4	17,5	874	1467	36,0
T	109	195,5	16	8	33,7	17,7	913	1467	36,0
T	113	193,5	16	8	33,1	17,9	954	1469	36,0
T	117	191,5	16	8	32,4	18,1	996	1474	36,0
T	120	190,0	16	8	31,9	18,2	1029	1479	36,0
T	124	188,0	16	8	31,2	18,4	1075	1487	36,0
T	128	186,0	16	8	30,5	18,7	1122	1497	36,0
T	132	184,0	16	8	29,9	18,9	1171	1509	36,0
T	136	182,0	16	8	29,2	19,1	1221	1521	36,0
T	140	180,0	16	8	28,6	19,4	1273	1535	36,0
V	76	212,0	30	16	73,2	29,3	961	2386	36,0
V	80	210,0	30	16	71,8	29,6	996	2319	36,0
V	81	209,5	30	16	71,5	29,6	1005	2305	36,0
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	85	207,5	30	16	70,1	30,0	1044	2256	36,0
V	89	205,5	30	16	68,8	30,3	1086	2219	36,0
V	93	203,5	30	16	67,4	30,6	1131	2193	36,0
V	97	201,5	30	16	66,1	30,9	1180	2175	36,0
V	100	200,0	30	16	65,1	31,2	1219	2166	36,0
V	101	199,5	30	16	64,8	31,3	1232	2164	36,0
V	105	197,5	30	16	63,5	31,6	1287	2159	36,0
V	109	195,5	30	16	62,2	32,0	1345	2160	36,0
V	113	193,5	30	16	60,9	32,4	1406	2166	36,0
V	117	191,5	30	16	59,6	32,7	1471	2176	36,0
V	120	190,0	30	16	58,6	33,0	1522	2186	36,0
V	124	188,0	30	16	57,3	33,4	1592	2203	36,0
V	128	186,0	30	16	56,1	33,8	1665	2222	36,0
V	132	184,0	30	16	54,8	34,2	1742	2244	36,0
V	136	182,0	30	16	53,6	34,7	1821	2269	36,0
V	140	180,0	30	16	52,3	35,1	1904	2296	36,0
T	80	240,0	18	9	52,8	21,5	868	2012	34,5
T	81	239,5	18	9	52,6	21,6	876	2001	34,5
T	85	237,5	18	9	51,7	21,7	908	1963	34,5
T	89	235,5	18	9	50,9	22,0	942	1933	34,5
T	93	233,5	18	9	50,1	22,2	978	1909	34,5
T	97	231,5	18	9	49,2	22,4	1016	1890	34,5
T	100	230,0	18	9	48,6	22,5	1046	1880	34,5
T	101	229,5	18	9	48,4	22,6	1056	1877	34,5
T	105	227,5	18	9	47,6	22,8	1097	1867	34,5
T	109	225,5	18	9	46,8	23,0	1140	1862	34,5
T	113	223,5	18	9	45,9	23,2	1185	1859	34,5
T	117	221,5	18	9	45,1	23,5	1232	1860	34,5
T	120	220,0	18	9	44,5	23,7	1268	1862	34,5
T	124	218,0	18	9	43,7	23,9	1318	1867	34,5
T	128	216,0	18	9	42,9	24,1	1370	1874	34,5
T	132	214,0	18	9	42,1	24,4	1424	1882	34,5
T	136	212,0	18	9	41,3	24,6	1479	1893	34,5
T	140	210,0	18	9	40,5	24,9	1536	1905	34,5
T	144	208,0	18	9	39,8	25,2	1595	1919	34,5
T	148	206,0	18	9	39,0	25,4	1656	1934	34,5
T	152	204,0	18	9	38,2	25,7	1718	1950	34,5
T	156	202,0	18	9	37,5	26,0	1783	1967	34,5
T	160	200,0	18	9	36,7	26,3	1849	1985	34,5
V	80	240,0	32	18	97,3	33,5	1194	2770	34,5
V	81	239,5	32	18	96,9	33,6	1205	2754	34,5
V	85	237,5	32	18	95,3	33,9	1248	2699	34,5
V	89	235,5	32	18	93,8	34,2	1295	2657	34,5
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	93	233,5	32	18	92,3	34,5	1345	2625	34,5
V	97	231,5	32	18	90,7	34,8	1398	2602	34,5
V	100	230,0	32	18	89,6	35,1	1440	2590	34,5
V	101	229,5	32	18	89,2	35,2	1455	2586	34,5
V	105	227,5	32	18	87,7	35,5	1514	2578	34,5
V	109	225,5	32	18	86,2	35,9	1577	2575	34,5
V	113	223,5	32	18	84,7	36,2	1643	2578	34,5
V	117	221,5	32	18	83,2	36,6	1712	2585	34,5
V	120	220,0	32	18	82,1	36,8	1766	2593	34,5
V	124	218,0	32	18	80,6	37,2	1841	2607	34,5
V	128	216,0	32	18	79,1	37,6	1919	2625	34,5
V	132	214,0	32	18	77,6	38,0	2000	2645	34,5
V	136	212,0	32	18	76,2	38,4	2085	2669	34,5
V	140	210,0	32	18	74,7	38,8	2172	2695	34,5
V	144	208,0	32	18	73,3	39,2	2263	2723	34,5
V	148	206,0	32	18	71,8	39,6	2357	2753	34,5
V	152	204,0	32	18	70,4	40,0	2454	2785	34,5
V	156	202,0	32	18	69,0	40,5	2555	2819	34,5
V	160	200,0	32	18	67,6	40,9	2658	2855	34,5
T	80	270,0	20	11	67,0	26,4	945	2603	34,5
T	81	269,5	20	11	66,8	26,5	953	2586	34,5
T	85	267,5	20	11	65,8	26,7	983	2524	34,5
T	89	265,5	20	11	64,9	26,9	1015	2472	34,5
T	93	263,5	20	11	64,0	27,1	1049	2430	34,5
T	97	261,5	20	11	63,0	27,4	1084	2395	34,5
T	100	260,0	20	11	62,3	27,5	1112	2373	34,5
T	101	259,5	20	11	62,1	27,6	1121	2367	34,5
T	105	257,5	20	11	61,2	27,8	1160	2344	34,5
T	109	255,5	20	11	60,2	28,1	1200	2327	34,5
T	113	253,5	20	11	59,3	28,3	1242	2314	34,5
T	117	251,5	20	11	58,4	28,5	1286	2305	34,5
T	120	250,0	20	11	57,7	28,7	1320	2301	34,5
T	124	248,0	20	11	56,8	29,0	1367	2298	34,5
T	128	246,0	20	11	55,9	29,2	1415	2298	34,5
T	132	244,0	20	11	55,0	29,5	1465	2301	34,5
T	136	242,0	20	11	54,1	29,8	1517	2306	34,5
T	140	240,0	20	11	53,2	30,0	1571	2313	34,5
T	144	238,0	20	11	52,3	30,3	1626	2322	34,5
T	148	236,0	20	11	51,5	30,6	1683	2334	34,5
T	152	234,0	20	11	50,6	30,9	1741	2346	34,5
T	156	232,0	20	11	49,7	31,2	1801	2360	34,5
T	160	230,0	20	11	48,9	31,5	1863	2376	34,5
T	164	228,0	20	11	48,0	31,8	1927	2393	34,5
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	168	226,0	20	11	47,2	32,1	1992	2411	34,5
T	172	224,0	20	11	46,3	32,4	2059	2430	34,5
T	176	222,0	20	11	45,5	32,7	2128	2450	34,5
T	180	220,0	20	11	44,6	33,0	2198	2471	34,5
V	80	270,0	38	22	126	48,9	1490	4104	34,5
V	81	269,5	38	22	126	49,0	1501	4073	34,5
V	85	267,5	38	22	124	49,4	1543	3962	34,5
V	89	265,5	38	22	122	49,8	1589	3870	34,5
V	93	263,5	38	22	120	50,2	1637	3794	34,5
V	97	261,5	38	22	118	50,6	1689	3733	34,5
V	100	260,0	38	22	117	50,9	1731	3695	34,5
V	101	259,5	38	22	117	51,0	1745	3683	34,5
V	105	257,5	38	22	115	51,5	1803	3645	34,5
V	109	255,5	38	22	113	51,9	1865	3615	34,5
V	113	253,5	38	22	111	52,4	1930	3594	34,5
V	117	251,5	38	22	110	52,8	1998	3581	34,5
V	120	250,0	38	22	108	53,2	2051	3575	34,5
V	124	248,0	38	22	106	53,6	2124	3572	34,5
V	128	246,0	38	22	105	54,1	2201	3575	34,5
V	132	244,0	38	22	103	54,6	2281	3582	34,5
V	136	242,0	38	22	101	55,1	2365	3594	34,5
V	140	240,0	38	22	100	55,6	2451	3610	34,5
V	144	238,0	38	22	97,9	56,1	2541	3630	34,5
V	148	236,0	38	22	96,3	56,6	2634	3652	34,5
V	152	234,0	38	22	94,6	57,1	2730	3678	34,5
V	156	232,0	38	22	92,9	57,7	2829	3707	34,5
V	160	230,0	38	22	91,3	58,2	2931	3738	34,5
V	164	228,0	38	22	89,6	58,8	3037	3771	34,5
V	168	226,0	38	22	88,0	59,3	3146	3807	34,5
V	172	224,0	38	22	86,4	59,9	3258	3845	34,5
V	176	222,0	38	22	84,8	60,5	3373	3884	34,5
V	180	220,0	38	22	83,2	61,1	3491	3925	34,5
T	80	300,0	20	11	92,6	26,7	917	2681	30,5
T	81	299,5	20	11	92,3	26,7	924	2660	30,5
T	85	297,5	20	11	91,2	26,9	953	2586	30,5
T	89	295,5	20	11	90,0	27,1	983	2524	30,5
T	93	293,5	20	11	88,9	27,3	1015	2472	30,5
T	97	291,5	20	11	87,8	27,5	1049	2430	30,5
T	100	290,0	20	11	87,0	27,6	1075	2403	30,5
T	101	289,5	20	11	86,7	27,7	1084	2395	30,5
T	105	287,5	20	11	85,6	27,9	1121	2367	30,5
T	109	285,5	20	11	84,5	28,1	1160	2344	30,5
T	113	283,5	20	11	83,4	28,3	1200	2327	30,5
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
T	117	281,5	22	11	83,3	38,5	1383	2847	30,5
T	120	280,0	22	11	82,4	38,8	1416	2831	30,5
T	124	278,0	22	11	81,3	39,1	1460	2814	30,5
T	128	276,0	22	11	80,1	39,4	1507	2801	30,5
T	132	274,0	22	11	79,0	39,7	1555	2791	30,5
T	136	272,0	22	11	77,9	40,0	1605	2786	30,5
T	140	270,0	22	11	76,7	40,3	1657	2783	30,5
T	144	268,0	22	11	75,6	40,6	1710	2783	30,5
T	148	266,0	22	11	74,5	41,0	1765	2786	30,5
T	152	264,0	22	11	73,4	41,3	1821	2792	30,5
T	156	262,0	22	11	72,3	41,6	1879	2799	30,5
T	160	260,0	22	11	71,2	42,0	1939	2809	30,5
T	164	258,0	22	11	70,1	42,3	2001	2820	30,5
T	168	256,0	22	11	69,0	42,7	2064	2833	30,5
T	172	254,0	22	11	67,9	43,1	2129	2848	30,5
T	176	252,0	22	11	66,9	43,4	2196	2864	30,5
T	180	250,0	22	11	65,8	43,8	2264	2882	30,5
T	184	248,0	22	11	64,8	44,2	2334	2900	30,5
T	188	246,0	22	11	63,7	44,6	2406	2920	30,5
T	192	244,0	22	11	62,7	45,0	2479	2941	30,5
T	196	242,0	22	11	61,6	45,4	2554	2963	30,5
T	200	240,0	22	11	60,6	45,8	2631	2986	30,5
V	80	300,0	42	22	178	67,1	1718	5550	30,5
V	81	299,5	42	22	177	67,2	1727	5495	30,5
V	85	297,5	42	22	175	67,7	1766	5299	30,5
V	89	295,5	42	22	173	68,2	1809	5132	30,5
V	93	293,5	42	22	171	68,7	1854	4992	30,5
V	97	291,5	42	22	168	69,2	1903	4873	30,5
V	100	290,0	42	22	167	69,6	1942	4797	30,5
V	101	289,5	42	22	166	69,7	1955	4773	30,5
V	105	287,5	42	22	164	70,2	2010	4690	30,5
V	109	285,5	42	22	162	70,8	2068	4621	30,5
V	113	283,5	42	22	159	71,3	2130	4564	30,5
V	117	281,5	42	22	157	71,8	2195	4518	30,5
V	120	280,0	42	22	156	72,2	2245	4491	30,5
V	124	278,0	42	22	153	72,8	2316	4461	30,5
V	128	276,0	42	22	151	73,4	2389	4440	30,5
V	132	274,0	42	22	149	73,9	2466	4426	30,5
V	136	272,0	42	22	147	74,5	2546	4419	30,5
V	140	270,0	42	22	145	75,1	2629	4417	30,5
V	144	268,0	42	22	143	75,7	2716	4421	30,5
V	148	266,0	42	22	140	76,3	2805	4429	30,5
V	152	264,0	42	22	138	77,0	2898	4442	30,5
T = partial nailing, V = full nailing									

Table B3 (continued): Joist hanger type B1 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	156	262,0	42	22	136	77,6	2994	4459	30,5
V	160	260,0	42	22	134	78,3	3093	4479	30,5
V	164	258,0	42	22	132	78,9	3195	4503	30,5
V	168	256,0	42	22	130	79,6	3301	4531	30,5
V	172	254,0	42	22	128	80,3	3410	4561	30,5
V	176	252,0	42	22	126	80,9	3522	4593	30,5
V	180	250,0	42	22	124	81,6	3637	4629	30,5
V	184	248,0	42	22	122	82,4	3755	4666	30,5
V	188	246,0	42	22	120	83,1	3877	4706	30,5
V	192	244,0	42	22	118	83,8	4001	4748	30,5
V	196	242,0	42	22	116	84,6	4129	4791	30,5
V	200	240,0	42	22	114	85,3	4261	4836	30,5
T = partial nailing, V = full nailing									

Table B4: Joist hanger type B2 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	52	74,0	6	4	4,98	1,94	172	196	35,5
V	56	72,0	6	4	4,72	2,01	194	199	35,5
V	60	70,0	6	4	4,45	2,09	219	203	35,5
V	52	94,0	8	6	8,10	4,04	215	369	35,5
V	56	92,0	8	6	7,76	4,15	235	361	35,5
V	60	90,0	8	6	7,42	4,26	257	358	35,5
V	52	104,0	8	8	8,10	4,04	215	369	35,5
V	56	102,0	8	8	7,76	4,15	235	361	35,5
V	60	100,0	8	8	7,42	4,26	257	358	35,5
V	52	134,0	10	12	15,2	5,67	281	624	36,8
V	56	132,0	10	12	14,7	5,77	300	600	36,8
V	60	130,0	10	12	14,3	5,88	321	584	36,8
V	64	128,0	10	12	13,9	5,98	344	573	36,8
V	68	126,0	10	12	13,4	6,10	369	568	36,8
V	71	124,5	10	12	13,1	6,18	389	566	36,8
V	74	123,0	10	12	12,8	6,27	410	566	36,8
V	76	122,0	10	12	12,6	6,33	425	567	36,8
V	80	120,0	10	12	12,2	6,46	456	570	36,8
V	52	144,0	10	10	18,3	5,37	277	632	35,5
V	56	142,0	10	10	17,8	5,45	295	605	35,5
V	60	140,0	10	10	17,4	5,54	316	587	35,5
V	64	138,0	10	10	16,9	5,63	338	575	35,5
V	68	136,0	10	10	16,4	5,73	363	569	35,5
V	71	134,5	10	10	16,1	5,80	382	566	35,5
V	74	133,0	10	10	15,7	5,88	403	566	35,5
V	76	132,0	10	10	15,5	5,93	418	566	35,5
V	80	130,0	10	10	15,1	6,04	448	569	35,5
V	81	129,5	10	10	14,9	6,06	456	570	35,5
V	85	127,5	10	10	14,5	6,17	489	575	35,5
V	89	125,5	10	10	14,0	6,29	524	582	35,5
V	93	123,5	10	10	13,6	6,41	561	591	35,5
V	97	121,5	10	10	13,2	6,53	600	600	35,5
V	100	120,0	10	10	12,8	6,63	631	608	35,5
V	52	164,0	12	12	24,0	8,49	354	1010	35,5
V	56	162,0	12	12	23,5	8,61	371	952	35,5
V	60	160,0	12	12	22,9	8,73	391	909	35,5
V	64	158,0	12	12	22,4	8,85	413	878	35,5
V	68	156,0	12	12	21,8	8,98	436	855	35,5
V	71	154,5	12	12	21,4	9,08	455	843	35,5
V	74	153,0	12	12	21,0	9,18	475	833	35,5
V	76	152,0	12	12	20,7	9,25	489	829	35,5
V	80	150,0	12	12	20,2	9,39	518	822	35,5
V	81	149,5	12	12	20,1	9,43	526	822	35,5

T = partial nailing, V = full nailing

Table B4 (continued): Joist hanger type B2 with interior flanges:
Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	85	147,5	12	12	19,5	9,57	557	820	35,5
V	89	145,5	12	12	19,0	9,72	591	821	35,5
V	93	143,5	12	12	18,5	9,88	627	824	35,5
V	97	141,5	12	12	18,0	10,0	664	830	35,5
V	100	140,0	12	12	17,6	10,2	693	835	35,5
V	52	194,0	14	14	31,5	13,0	445	1525	34,0
V	56	192,0	14	14	30,8	13,1	462	1422	34,0
V	60	190,0	14	14	30,2	13,3	481	1343	34,0
V	64	188,0	14	14	29,5	13,5	502	1282	34,0
V	68	186,0	14	14	28,9	13,6	525	1235	34,0
V	71	184,5	14	14	28,4	13,8	543	1208	34,0
V	74	183,0	14	14	27,9	13,9	563	1185	34,0
V	76	182,0	14	14	27,6	14,0	576	1172	34,0
V	80	180,0	14	14	26,9	14,2	605	1152	34,0
V	81	179,5	14	14	26,8	14,2	612	1148	34,0
V	85	177,5	14	14	26,2	14,4	643	1135	34,0
V	89	175,5	14	14	25,5	14,6	676	1126	34,0
V	93	173,5	14	14	24,9	14,8	710	1121	34,0
V	97	171,5	14	14	24,3	15,0	747	1120	34,0
V	100	170,0	14	14	23,5	15,3	775	1121	34,0
V	101	169,5	14	14	23,1	15,5	785	1121	34,0
V	105	167,5	14	14	23,1	15,5	825	1125	34,0
V	109	165,5	14	14	22,5	15,7	867	1131	34,0
V	113	163,5	14	14	21,9	15,9	911	1139	34,0
V	117	161,5	14	14	21,3	16,2	957	1148	34,0
V	120	160,0	14	14	20,9	16,3	992	1156	34,0
V	52	224,0	16	16	40,3	16,0	556	2137	36,0
V	56	222,0	16	16	39,6	16,1	573	1987	36,0
V	60	220,0	16	16	38,8	16,3	593	1869	36,0
V	64	218,0	16	16	38,1	16,5	614	1776	36,0
V	68	216,0	16	16	37,4	16,7	637	1702	36,0
V	71	214,5	16	16	36,9	16,8	655	1656	36,0
V	74	213,0	16	16	36,4	16,9	675	1618	36,0
V	76	212,0	16	16	36,0	17,0	688	1596	36,0
V	80	210,0	16	16	35,3	17,2	717	1559	36,0
V	81	209,5	16	16	35,1	17,3	724	1551	36,0
V	85	207,5	16	16	34,4	17,5	755	1523	36,0
V	89	205,5	16	16	33,7	17,7	788	1503	36,0
V	93	203,5	16	16	33,1	17,9	822	1487	36,0
V	97	201,5	16	16	32,4	18,1	859	1477	36,0
V	100	200,0	16	16	31,9	18,2	887	1471	36,0
V	101	199,5	16	16	31,7	18,3	897	1470	36,0
V	105	197,5	16	16	31,0	18,5	937	1467	36,0
T = partial nailing, V = full nailing									

Table B4 (continued): Joist hanger type B2 with interior flanges: Form factors $k_{H,1}$ and $k_{H,2}$ and dimensions e_1, e_2 and $e_{J,0}$

nailing pattern	B [mm]	H [mm]	n_H	n_J	$k_{H,1}$	$k_{H,2}$	e_1 [mm]	e_2 [mm]	$e_{J,0}$ [mm]
V	109	195,5	16	16	30,4	18,7	978	1467	36,0
V	113	193,5	16	16	29,7	18,9	1022	1469	36,0
V	117	191,5	16	16	29,0	19,2	1068	1474	36,0
V	120	190,0	16	16	28,6	19,4	1103	1479	36,0
V	124	188,0	16	16	27,9	19,6	1151	1487	36,0
V	128	186,0	16	16	27,3	19,9	1202	1497	36,0
V	132	184,0	16	16	26,6	20,1	1254	1509	36,0
V	136	182,0	16	16	26,0	20,4	1308	1521	36,0
V	140	180,0	16	16	25,4	20,6	1364	1535	36,0
T = partial nailing, V = full nailing									

B.2 Characteristic load-carrying-capacities of the joist hanger connections with bolts

For joist hangers connected to a wall of concrete, lightweight concrete or to a steel member the assumptions for the calculation of the load-carrying capacity of the connection are:

- The force transfer from the joist to the joist hanger is as for a wood-wood connection, see clause B.1.
- The bolts shall always be positioned symmetrically about the vertical axis of the joist hanger.
- Washers according to EN ISO 7094 shall be installed under the bolt heads or nuts.

Description of the static model

For a downward directed force toward the bottom plate the static behaviour is basically the same as for a wood-wood connection with nails.

The fasteners in the joist are subjected to a lateral force, which is equally distributed over the nails in the joist.

Since the concrete and steel have a larger compressive strength than timber subjected perpendicular to the grain the rotation point may be assumed positioned at the top of the bottom plate.

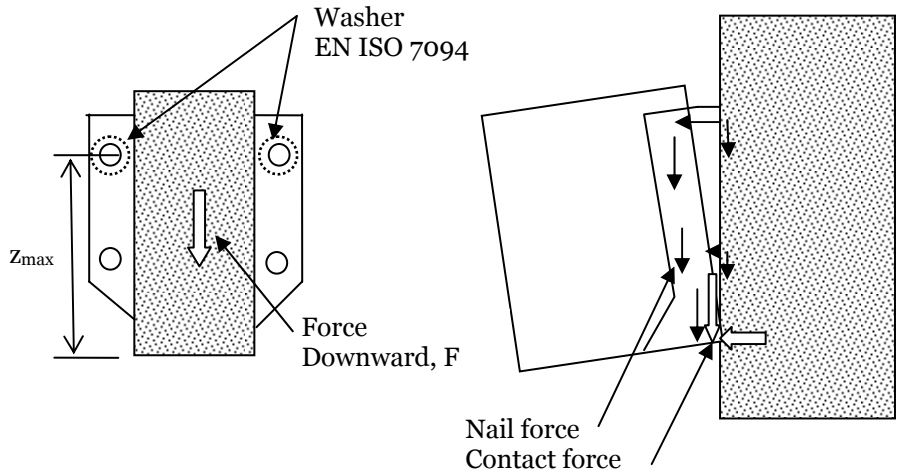


Figure B2 Left: Cross section in joist. Right: The joist will deflect and rotate, at the bottom a contact force will occur at the bottom plate, and the withdrawal forces in the bolts in the wall will vary linearly as assumed for a nailed connection in the header.

The forces in the bolts will be partly lateral forces, partly withdrawal forces. The lateral forces are distributed evenly over all bolts. The withdrawal forces are on the safe side assumed to be taken by the 2 upper bolts with washers. The maximum withdrawal force in a upper bolt can be calculated from

$$F_{ax,bolt} = \frac{F \cdot e}{2 \cdot z_{max}} \qquad (B.2.1)$$

Where

F downward directed force toward the bottom plate

e eccentricity = distance from the nail column in the joist to the surface of the header.

z_{max} max distance from upper bolt to the bottom plate (rotation point)

The upper 2 bolts are critical. They are subjected to a lateral force and a withdrawal force. The lateral force is determined assuming an even distribution of the downward force *F*.

$$F_{lat,bolt} = F_{Z,Ed} / n_{bolt} \quad \text{(B.2.2)}$$

Characteristic capacities of a bolted joist hanger connection

The characteristic capacity of the nail connection between the joist and the joist hanger can be calculated from the same assumptions and formulas as for joist hangers nailed to a wooden header.

$$F_{Z,J,Rk} = (n_J + 2) \cdot F_{v,J,Rk} \quad \text{(B.2.3)}$$

$$F_{Z,J,Rk} = (n_J) \cdot F_{v,J,Rk} \quad \text{(B.2.3.a)}$$

The upper 2 bolts are critical. They are subjected to a lateral force calculated from formula (B.2.2).

The withdrawal force in an upper bolt is calculated from (B.2.1).

Where

$F_{Z,Ed}$ downward directed force toward the bottom plate

n_{bolt} total number of bolts in the joist hanger

e eccentricity = distance from the nail column in the joist to the surface of the header

z_{max} max distance from the upper bolt to the bottom plate (rotation point)

It shall be verified by the design of the bolted connection that the upper bolts have sufficient load-carrying design capacity to carry the combined lateral and axial forces.

From the characteristic capacity of the bearing resistance between the bolt and the plate of the joist hanger the following maximum characteristic capacity of the joist hanger connection can be determined.

$$F_{bear,Rk} = n_{bolt} \cdot f_{u,k} \cdot d \cdot t \quad \text{(B.2.4)}$$

Where

n_{bolt} total number of bolts in the 2 flaps

$f_{u,k}$ characteristic ultimate tensile strength of the steel, 330 MPa

d diameter of the bolt

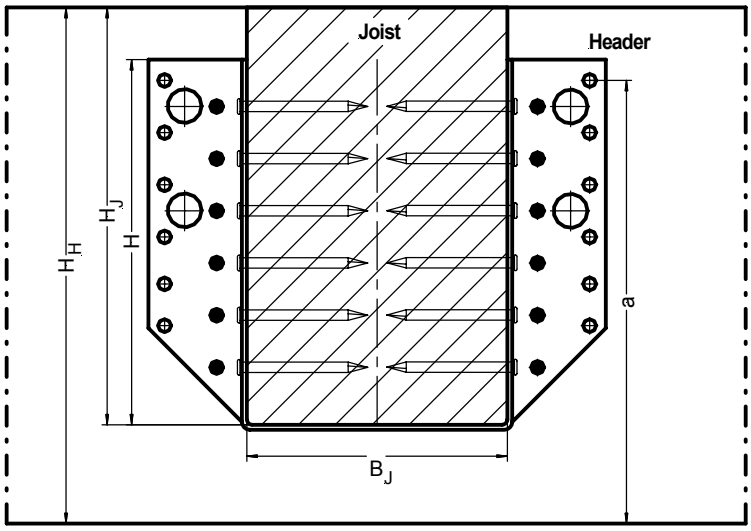
t thickness of the steel plate of the joist hanger

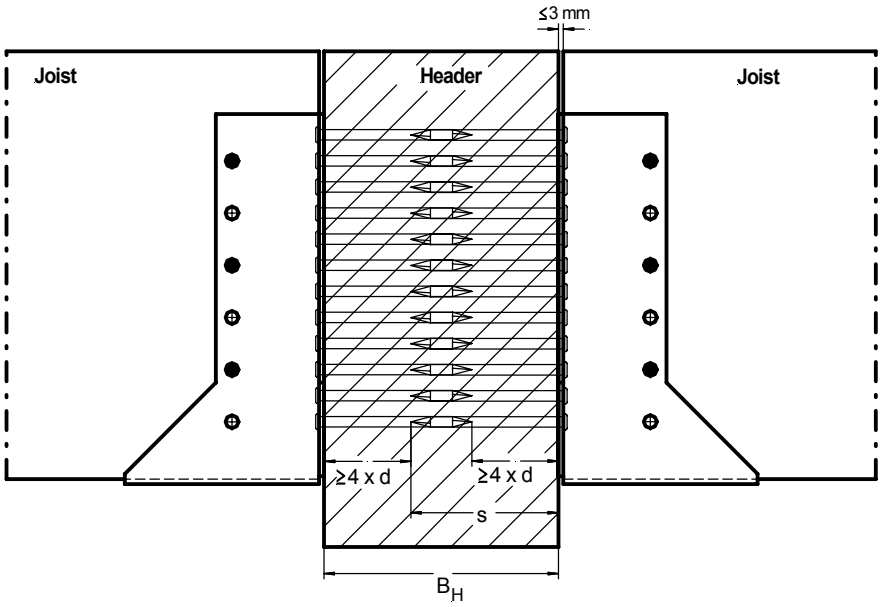
The characteristic load-carrying capacity of the joist hanger connection is the minimum of:

- The capacity determined from (B.2.3) from the nails in the joist generally and determined from (B.2.3.a) for joist hanger type A2 with 55 mm bottom plate
- The capacity determined from (B.2.4) from the embedding strength of the steel plate against the bolt
- The capacity controlled by the bolt forces given by (B.2.1) and (B.2.2).

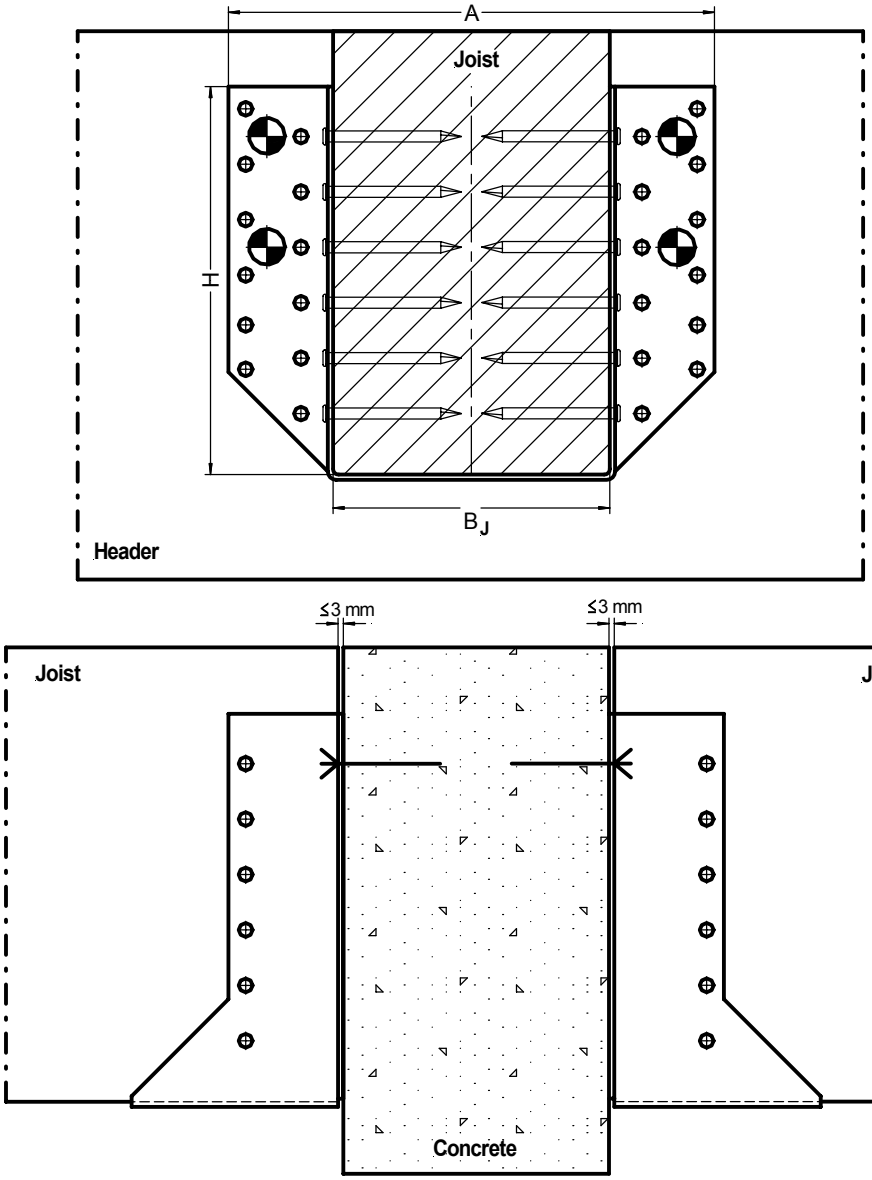
Annex C
Installation of joist hangers

Joist hanger in wood/wood connection





Joist hanger connected to concrete, lightweight concrete or a steel member by bolts



Bolts M12

Washer according to EN ISO 7094