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Authorised
And notified according
To article 10 of the council
Directive of 21 December
1988 on the approximation of
the laws regulations and
administrative provision of
the member States
relating to construction
products (89/106/EEC)

BM TRADA CERTIFICATION

Member of EOTA

European Technical Approval ETA-07/0043

Issue 2

[Original version in English language]

Trade name	**Simpson Strong-Tie joist Hangers type JHA, THA & THAI**
Holder of approval	**SIMPSON STRONG-TIE** Winchester Road Cardinal Point Tamworth Staffordshire B78 3HG Tel. +44 (0) 1827 255 600 Fax. +44 (0) 1827 255 616 Internet: www.strongtie.eu
Generic type and use of construction product	Three-dimensional nailing plates (Timber to timber joist hangers)
Validity: *from* *to*	30-11-2009 13-03-2012
Manufacturing plant(s)	Simpson Strong-Tie Winchester Road Cardinal Point Tamworth Staffordshire B78 3HG United Kingdom Simpson Strong-Tie ZAC des Quatre Chemins 85400 Sainte Gemme la Plaine France Simpson Strong-Tie 5151 South Airport Way Stockton CA95206 USA Simpson Strong-Tie North East USA Division 2600 International Street Columbus OH 43228 USA Simpson Strong-Tie A/S Boulstrup DK-8300 Odder Denmark
This Approval contains	*24 pages including 5 Annexes*
This Approval replaces	*ETA 07/0043 with validity from [14.03.2007] to [13.03.2012]*

Contents

1 LEGAL BASES AND GENERAL CONDITIONS

a) This European Technical Approval is issued by BM TRADA Certification in accordance with:
   - Council Directive 89/106/EEC of 21 December 1988 [Construction Products Directive (CPD)] on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2].
   - UK implementation of CPD Statutory Instruments 1991, No 1620 Building and Buildings The Construction Products Regulations 1991 – made 15 July 1991, laid before Parliament 22 July 1991, coming into force 27 December 1991, and amended by The Construction Products (Amendment) Regulations 1994 (Statutory Instruments 1994, No 3051).
   - 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.

b) BM TRADA Certification is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plants. 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.

c) 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.

d) This European Technical Approval may be withdrawn by BM TRADA Certification, in particular after information by the Commission on the basis of Article 5(1) of Council Directive 89/106/EEC.

e) 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 BM TRADA Certification. 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.

f) The European Technical Approval is issued by BM TRADA Certification 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 No L40, 11.2.1989, p12.
[2] Official Journal of the European Communities No L220, 30.8.1993, p1.
[3] Official Journal of the European Communities No L17, 20.1.1994, p34.

2 SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

2.1 Definition of product and intended use

Simpson Strong-Tie JHA, THA and THAI joist hangers (three-dimensional nailing plates) are one-piece, non-welded, face-fix or wrapped-over timber-to-timber joist hangers. They are connected to a header to support a timber joist with a range of nails.

The materials for headers and joists can be of solid timber, glued laminated timber or engineered timber products such as LVL or I-joist (fitted with backer blocks if used for the header).

The hangers are made from zinc-coated steel and are available in a range of sizes (see Annex 1). They are intended for use in making structural end grain to side-grain joints in timber structures, as a connection between a solid timber or wood-based joist and a solid timber or wood-based header, where Essential Requirement 1 Mechanical resistance and stability (CPD, Annex 1) applies.

The hangers are for use in timber structures subject to the dry, internal conditions defined by service classes 1 and 2 of EN 1995-1-1-2004+A1:2008 (Eurocode 5). Connectors manufactured from stainless steel can also be used in Service Class 3 as defined in EN 1995-1-1-2004+A1:2008.
The range of hangers within this ETA is detailed in Annex 1.

The hangers shall be installed to meet the following requirements:

- The hanger is connected to header using the specified nails in Annex 1, Table A1.2.1 The hanger side and back flanges may have a slight splay from nesting within the packing. It is essential to hold the hanger square to the header before nailing.
- Where it is necessary to wrap the straps over the header, a minimum wrap over of 45 mm is required for the JHA and THA and 65 mm for the THAI to achieve the minimum nailing specification.
- For I-joist headers backer blocks of softwood, OSB or plywood shall be installed (see Annex 2, A2.10).
- The size, material and installation details of the backer blocks shall be in accordance to the joist manufacturer's specifications.
- The joist is installed in the hanger ensuring it is free from wane and the gap between the end of joist and header does not exceed 3 mm.
- The specified joist nails are installed. For instances where double shear nailing is specified, ensure that the correct nail is installed into the joist at an angle of 45°. For the THAI, the specified nail is to be driven downwards at an angle of 45°, into the joist.
- When the supported member is an I-joist it will be necessary to install web stiffeners to the end of the joist if the top flange is not laterally restrained by the hanger side flanges. Refer to joist manufacturer's literature for details of web stiffener installation.
- Header is restrained against rotation before application of full loading.

The provisions made in this ETA are based on an assumed intended working life for the three-dimensional nailing plate of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2.2 Characteristics of product and methods of verification

The assessment of fitness for the intended use (see Section 2.1) has been made in accordance with EOTA ETAG 015: 2002.

- ***Essential requirement 1 – Mechanical resistance and stability***

The characteristic load-carrying capacities of the products shall be calculated in accordance with the manufacturer's design code, extracts of which are given in Annex 2. The design code has been derived in accordance with ETAG 015 and Eurocode 5 (2008).
The calculated values should be used for designs in accordance with Eurocode 5 only. These values are based on the assumption that there is a maximum gap of 3 mm between the timber members, the members are laterally restrained and wane is not present in the timber at the joint.

The hangers shall be used with the fasteners specified in Annex 1.
No performance has been determined in relation to the joint's stiffness properties — to be used for the analysis of the serviceability limit state.

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.

- ***Essential requirement 2 – Safety in case of fire***

– Reaction to fire

The joist hangers and associated nails 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.

– Resistance to fire

Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, therefore there is no performance determined to this Essential Requirement.

- ***Essential requirement 3 – Hygiene, health and the environment***

In relation to the release of dangerous substances, the manufacturer's declared that the three-dimensional nailing plates do not present any known risk of emission of dangerous substances to the immediate environment during normal use and that the product complies with all relevant European and national provisions applicable for the uses for which it is brought to the market.

- ***Essential requirement 4 – Safety in use***

Not relevant.

- ***Essential requirement 5 – Protection against noise***

Not relevant.

- ***Essential requirement 6 – Energy economy and heat retention***

Not relevant.

- ***Essential requirement 7 – Durability, serviceability and identification***

– Durability

The hangers have been assessed as having satisfactory durability and serviceability when used in timber structures with the timber species (including timbers preserved with organic solvent, boron diffusion and related preservatives) described in Eurocode 5 and subject to the dry, internal conditions defined by service classes 1 and 2. Connectors manufactured from stainless steel can also be used in Service Class 3 as defined in EN 1995-1-1: 2008.

– Serviceability

Not relevant.

– Identification

Each hanger bears the manufacturer's identification mark and the product type. The CE marking appears on the packaging.

2.3 Evaluation of Conformity and CE marking

2.3.1 Attestation of Conformity system

The system of Attestation of Conformity applied to this product shall be that laid down in the CPD, Annex III, 2(ii), first possibility (referred to as System 2+).

2.4 Responsibilities

2.4.1 Tasks for the manufacturer

- ***Factory production control***

The manufacturer shall continue to operate a factory production control system. All elements, requirements and provisions adopted by the manufacturer are to be documented to ensure that the product conforms to this ETA.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan. The raw materials shall be subject to agreed controls by the manufacturer before acceptance. Checks on incoming materials, such as sheet metal, shall include control of the certificates of conformity presented by suppliers (comparison with nominal values) by verifying dimensions and determining material properties, e.g. chemical composition, mechanical properties and zinc coating thickness.

The manufactured components are checked visually and dimensionally. The frequency of controls and tests conducted during production and on the finished hanger is laid down in the prescribed test plan agreed with BM TRADA Certification, taking account of the manufacturing process.

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

- 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 the person responsible for factory production control.

The records shall be presented to the inspection body involved in the continuous surveillance. Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan included in the technical documentation of this European Technical Approval.

- ***Initial type testing of the product***

For initial type testing the results of the assessments, calculations and tests performed as part of the verification for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between BM TRADA Certification and the approved body involved.

2.4.2 Tasks for the approved bodies

- ***Initial inspection of factory and of factory production control***

The approved body should ascertain that, in accordance with the prescribed test 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 hanger with the specifications given in part II, section 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 prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body to the BM TRADA Certification. Where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled, the certificate of conformity shall be withdrawn by the certification body.

2.4.3 CE marking

The CE marking shall be affixed to the packaging of the hangers. The CE symbol shall be accompanied by the following information:

- Identification number of the notified body
- Name/identification mark of the manufacturer
- Last two digits of the year in which the marking was affixed
- Identification of the product
- Number of the European Technical Approval
- Number of the EC certificate of conformity.

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

2.5.1 Manufacturing

Simpson Strong-Tie JHA, THA and THAI 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 BM TRADA Certification and laid down in the technical documentation.

2.5.2 Installation

2.5.2.1 Joints

A hanger (three-dimensional nailing plate) is deemed fit for its intended use provided:

- The hanger capacity is calculated in accordance with the manufacturer's design code (Annex 2).
- Joints are designed in accordance with Eurocode 5 or an appropriate national code, under the responsibility of an engineer experienced in timber structures
- Verifiable calculation, notes and drawings are prepared taking account of the loads to be resisted
- The requirements detailed in Section 2.1 of this ETA, relating to the timber members being joined are taken into account, e.g. lateral restraint, wane, etc
- Joints are designed for the specified fasteners and grade or type of joist and header
- The actual end bearing capacity of the joist to be used with the hanger is checked by the designer of the structure to ensure it is not less than the hanger capacity and, if necessary, a hanger with a larger end bearing capacity substituted to suit.
- The minimum edge distance to a loaded edge shall comply with the requirements of Eurocode 5, which is a minimum distance of seven times the diameter of the relevant nails.

2.5.3 Criteria

The fitness for use of the joint can be assumed if the hanger is installed correctly in accordance with the following requirements:

- Installation is carried out by personnel under the direction of supervisors, all of whom are appropriately qualified for this work
- Installation is in accordance with the manufacturer's specifications and drawings prepared for that purpose, and the appropriate tools are used
- The specified fasteners and grade or type of joist and header are used
- The requirements relating to the timber members being joined are taken into account e.g. lateral restraint, wane, etc.
- The maximum gap of 3 mm between the joist and the header assumed in the assessment is not exceeded.

2.5.4 Responsibility of the manufacturer

It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in part 2, of this ETA, is given to those concerned. This information may be made by replicating the respective parts of this European Technical Approval. In addition, all installation data shall be shown clearly on the package and/or on an instruction sheet, preferably using illustration(s).

The minimum information required is:

- Fastener specification
- Requirements for timber members
- Identification of the manufacturing batch.

2.6 Recommendations

2.6.1 Recommendations on packaging, transport and storage

The hangers are packed in boxes bearing the manufacturer's name, product type, dimensions, quantity, date of fabrication and batch reference details.
In relation to transportation and storage, the hangers should be treated as conventional metallic building products.

2.6.2 Recommendations on use, maintenance and repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life.
Should repair prove necessary, it is normal for the hanger to be replaced.

On behalf of BM TRADA Certification.	BM TRADA CERTIFICATION
Signature:	
Name:	David Payne
Title:	Product Certification Manager-Technical Approvals

Annex 1 Products Details and Specifications

A1.1 Hanger range

Figure A1.1.1 JHA270 Joist Hangers with Adjustable Height Strap

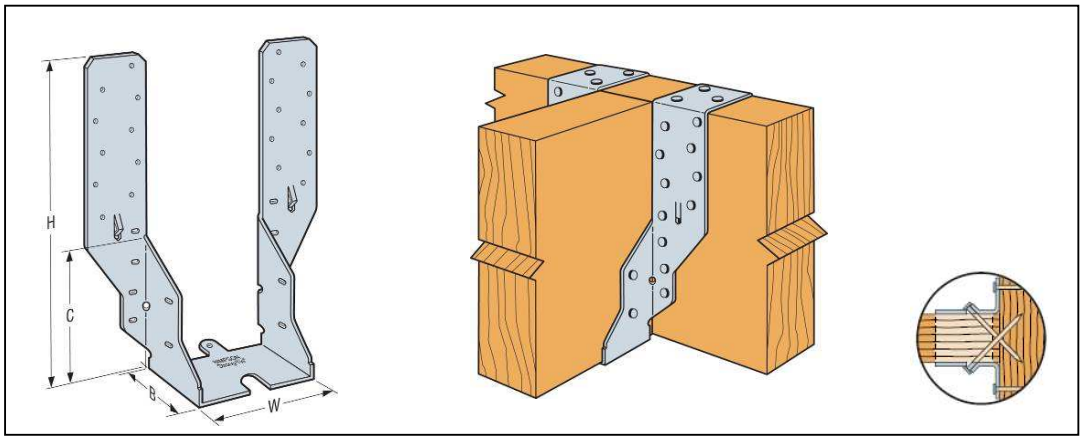


Table A1.1.1 Specifications for JHA270 Joist Hangers

Model Number	Steel Thickness (mm)	Steel Specification & Grade	Dimensions (mm)			
			W	H	B	C
JHA270/38	0.9	Pre-Galvanised S250GD+Z275 to EN 10436:2009	38	241.0	50	106.0
JHA270/44			44	238.0	50	103.0
JHA270/47			47	236.5	50	101.5
JHA270/50			50	235.0	50	100.0
JHA270/63			63	248.5	50	113.5
JHA270/75			75	242.5	50	107.5
JHA270/91			91	234.0	50	99.5
JHA270/100			100	230.0	50	95.0

Figure A1.1.2 JHA450 Joist Hangers with Adjustable Height Strap

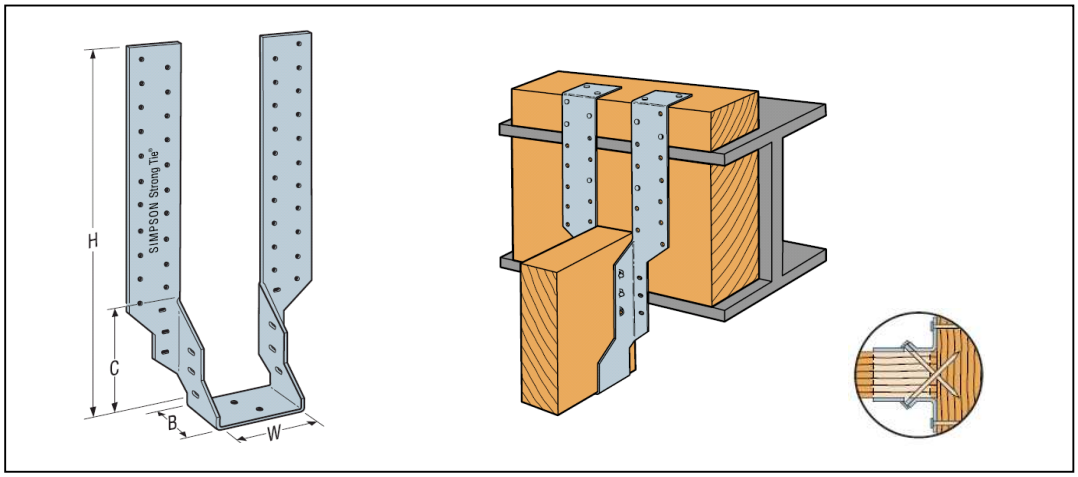


Table A1.1.2 Specifications for JHA450 Joist Hangers

Model Number	Steel Thickness (mm)	Steel Specification & Grade	Dimensions (mm)			
			W	H	B	C
JHA450/38	1.5	Pre-Galvanised S250GD+Z275 to EN 10436:2009	38	481.0	50	191.0
JHA450/44			44	478.0	50	188.0
JHA450/47			47	477.0	50	187.0
JHA450/50			50	475.0	50	185.0
JHA450/63			63	469.0	50	179.0
JHA450/75			75	463.0	50	173.0
JHA450/91			91	455.0	50	165.0
JHA450/100			100	450.0	50	160.0
JHA450/125			125	452.5	63	162.5
JHA450/137			137	446.5	63	156.5
JHA450/150			150	440.0	63	150.0

Figure A1.1.3 THA Adjustable Joist Hangers

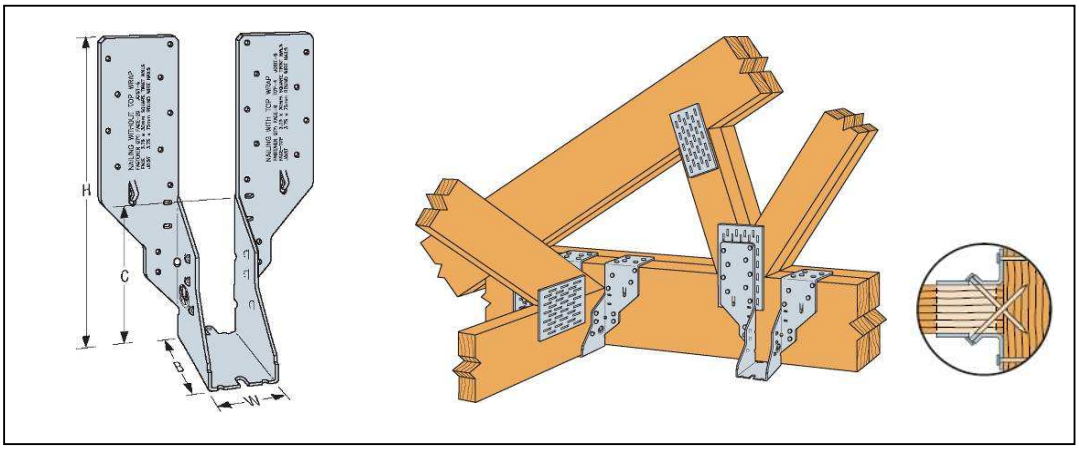


Table A1.1.3 Specifications for THA Joist Hangers

Model Number	Steel Thickness (mm)	Steel Specification & Grade	Dimensions (mm)			
			W	H	B	C
THA38	1.2	Pre-Galvanised S250GD+Z275 to EN 10436:2009	38	226.0	62.5	113.5
THA44			44	223.0	62.5	110.5
THA50			50	220.0	62.5	107.5
THA75			75	232.5	62.5	120.0
THA100			100	220.0	62.5	107.5

Figure A1.1.4 THAI Adjustable Strap Hangers

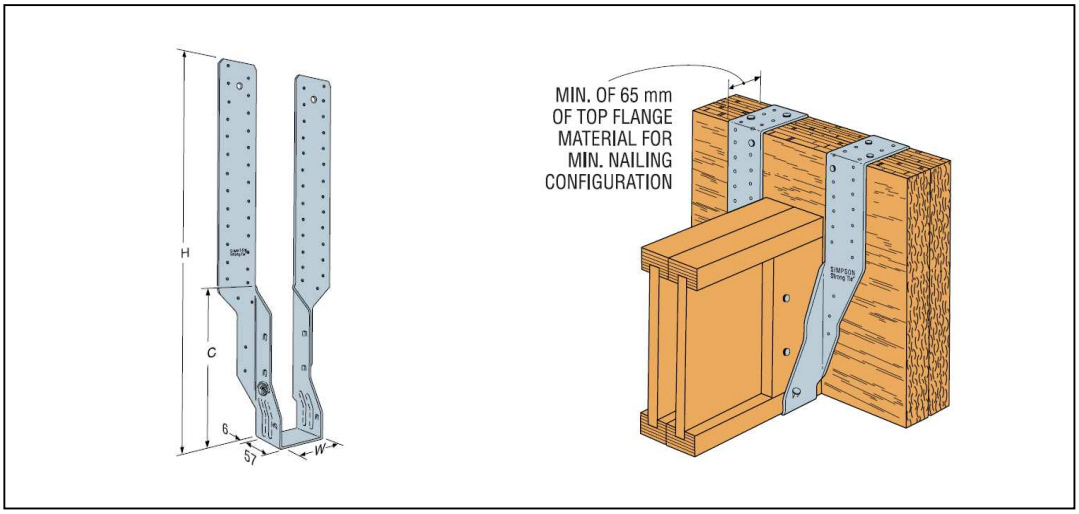


Table A1.1.4 Specifications for THAI Joist Hangers

Model Number	Steel Thickness (mm)	Steel Specification & Grade	Dimensions (mm)			
			W	H	B	C
THAI222	1.2	Pre-Galvanised S250GD+Z275 to EN 10436:2009 or G90, SS Grade 33 to ASTM A653	40	580.0	57	238.0
THAI1.81/22			46	577.0	57	235.0
THAI3522			59	570.0	57	228.0
THAI322			65	567.0	57	225.0
THAI422			90	555.0	57	220.0
THAI-2	2		45 - 150	550.0	63.5	224.0

Table A1.1.5 Fastener Specification

Nail Type	Nail Dimensions (mm)		Finish [1]	
	Diameter	Length		
Square Twist	3.75	30	Service Class 1	No protective finish
			Service Class 2	Galvanised Fe/Zn 12c or Z275
Round Wire	3.75	38	Service Class 1	No protective finish
			Service Class 2	Galvanised Fe/Zn 12c or Z275
Round Wire	3.75	75	Service Class 1	No protective finish
			Service Class 2	Galvanised Fe/Zn 12c or Z275
Ring Shank	4	50	Service Class 1	No protective finish
			Service Class 2	Galvanised Fe/Zn 12c or Z275

Note:

[1] The designer shall select the protective finish for the fastener dependant on the service class. See section 4 of EN1995-1-1 for further details.

A1.2 Typical Hanger and Nail Type Combinations

Table A1.2.1 Typical Hanger and Nail Type Combinations

Connector Type	Installation Configuration		Supporting Timber Fasteners						Supported Timber Fasteners		
			3.75 x 30 ST		3.75 x 75 SS		4.2 x 50 ARS		3.75 x 30 ST	3.75 x 38 SS	3.75 x 75 SS
			Top	Face	Top	Face	Top	Face			
JHA270	Std	FF	~	20					4		
		WO	4	8					4		
	Std	FF	~	20							4
		WO	4	8							4
JHA450	Std	FF	~	20					6		
		WO	4	8					6		
	Std	FF	~	20							6
		WO	4	8							6
	Und	FF	~	20					6		
		WO	4	4					6		
THA	Std	FF	~	20					6		
		WO	4	8					6		
		FF	~	20							6
		WO	4	8							6
THAI	Std	FF			~	20			2		
		WO			4	2			2		
		FF					~	20		2	
		WO					4	2		2	
THAI-2	Std	FF			~	20			2		
		WO			4	2			2		
		FF					~	20		2	
		WO					4	2		2	

Note:

- Std refers to a standard installation where the joist sits level with the header.
- Und refers to a under slung installation where the joist sits lower than the header.
- FF refers to a face fix installation.
- WO refers to a wrap over installation.
- 20 refers to the quantity of fasteners to be installed.

The hanger and nail type combinations in the table are typical, but other combinations may also be proven suitable, subject to following the design model given in Annex 2 of this document.

Annex 2 Design Method

A2.1 Basis of Design

The design method detailed below for the JHA, THA and THAI joist hangers has been validated by calculation assisted by testing method as defined in ETAG 015 and substantiated by BM TRADA Certification as part of the ETA approval process.

This method is applicable if the header beam is restrained from rotation.

The hanger characteristics needed to apply this method can be found in Annex A and D.

The designation of symbols is in section A2.11 of this Annex.

A2.2 Nail Capacities

The nail capacities are given in Annex C - C1 to C4 and have been validated against hanger test data.

They have had an efficiency factor applied as part of the design method validation and are only for use in conjunction with this ETA and the hangers listed in it.

A2.3 Hanger Characteristics

Hanger characteristics are given in Annex D, Table D1.

For hanger models not included in Table D1, but within the scope of the ETA, reference should be made to the ETA holder for further information regarding the hanger characteristics.

A2.4 Design – Vertical down load capacity

The load is transferred from the supported member (joist) to the supporting member (header) by:

1) Load transfer from the supported member to the hanger
2) Tension in the lower part of the hanger
3) Load transfer from the hanger to the supporting member.

Therefore, the capacity of the system is the minimum of the above three mechanisms:

$$F_{tot} = \text{Min}\begin{cases} F_{\text{Joist - Hanger}} \\ F_{\text{Hanger,Tension}} \\ F_{\text{Hanger}-\text{Header}} \end{cases} \quad (1)$$

A2.5 Load Transfer from Joist to Hanger ($F_{Joist\text{-}Hanger}$)

The force between joist and hanger per flange ($F_{Joist\text{-}Hanger}$) is:

$$F_{Joist-Hanger} = \frac{B_{eff} \times W \times f_{c,90,*}}{2} \quad (2)$$

Where from Eurocode 5

$$f_{c,90,*} = k_{c,90,joist} \times f_{c,90,joist} \qquad (k_{c,90,joist} = 1.5) \quad (3)$$

When joists are installed with 75mm long skewed nails, a contribution from these nails can be added to $F_{Joist\text{-}Hanger}$ to give:

$$F_{Joist-Hanger} = \frac{B_{eff} \times W \times f_{c,90,*}}{2} + \frac{n_{skewnail} \times F_{v,RK,joist}}{3} \quad (4)$$

A2.6 Characteristic tensile capacity of the lower part of the joist hanger ($F_{Hanger,Tension}$)

The tensile capacity per flange $F_{Hanger,\ Tension}$ is:

$$F_{Hanger,Tension} = \frac{S \times t_p \times f_u}{d} \quad (5)$$

When joists are installed with 75mm long skewed nails, a contribution from the skewed nails can be added to $F_{Hanger,\ Tension}$ to give:

$$F_{Hanger,Tension} = \frac{S \times t_p \times f_u}{d} + \frac{n_{skewnail} \times F_{v,RK,joist}}{3} \quad (6)$$

$F_{Hanger,\ Tension}$ shall be reduced by 25% if the joist hanger is installed in an under slung installation.

A2.7 Load transfer from the hanger to the header – Face Fix Installation

When face-fixed, the force between header and hanger per flange is:

$$F_{Hanger\text{-}Header} = \text{Min}\begin{Bmatrix} F_{Lat,\ nail} \\ F_{Ax,\ nail} \end{Bmatrix} \quad (7)$$

The vertical load is shared between the total numbers of nails per flange:

$$F_{Lat,nail} = n_{h,\ side\ nail} \times F_{v,Rk,header} \quad (8)$$

The axial force per flange in the nails is:

$$F_{Ax,nail} = \frac{F_{Ax,Rk,header} \times (a - 0.5a_c) \times n_{eff,ax}}{e} \quad (9)$$

When joists are installed with 75mm long skewed nails, a contribution from the skewed nails can be added, hence $F_{hanger\text{-}Header}$ becomes:

$$F_{Header-Hanger} = Min\begin{Bmatrix} F_{Lat,nail} \\ F_{Ax,nail} \end{Bmatrix} + \frac{n_{skewnail} \times F_{v,RK,joist}}{3} \quad (10)$$

Smooth nails (round or square) shall fulfil the following criterion:

$$\left(\frac{F_{Lat,nail}}{F_{v,Rk,header}}\right) \le 1 \quad \text{and} \quad \left(\frac{F_{Ax,nail}}{F_{ax,Rk,header}}\right) \le 1 \quad (11)$$

Ring shank nails shall fulfil the following criterion:

$$\left(\frac{F_{Lat,nail}}{F_{v,Rk,header}}\right)^2 + \left(\frac{F_{Ax,nail}}{F_{ax,Rk,header}}\right)^2 \le 1 \quad (12)$$

A2.8 Load transfer from the hanger to the header – Wrap over Installation

When wrapped-over, the force between header and hanger per flange is:

$$F_{Hanger\text{-}Header} = k_{ef}\left(F_c + F_r\right) + n_{h,side\,nail} \times F_{v,Rk,header} \quad (13)$$

Where

$$F_c = t_p\sqrt{\frac{f_u \times f_{c,90,k^*} \times l \times l_{eff}}{3}} \quad (14)$$

$$F_r = n_{h,top\ nail} \times F_{v,Rk,header} - \frac{f_u \times l \times t_p{}^2}{6 \times C_{hor}} \quad (15)$$

From Eurocode 5

$$f_{c,90,*} = k_{c,90,header} \times f_{c,90,header} \qquad (k_{c,90,header} = 1.0) \quad (16)$$

For instances where 75mm joist nails are used, a contribution from the skewed nails can be added, hence, $F_{hanger\text{-}Header}$ becomes:

$$F_{Hanger\text{-}Header} = k_{ef}\left(F_c + F_r\right) + n_{h,side\,nail} \times F_{v,Rk,header} + \frac{n_{skewnail} \times F_{v,RK,joist}}{3} \quad (17)$$

A2.9 Uplift Force

For uplift force, the load is transferred from the joist into the hanger by the nails in the side of the joist.

For skew nails with a length of 75 mm or greater, the load may also be transferred directly from the joist into the header.

For instances where nails with a length of 30 to 38 mm are inserted perpendicular to the joist the uplift capacity is:

$$F_{uplift} = 0{,}6 \times n_{joist} \times F_{Lat,RK,Joist} \quad (18)$$

When nails with a length of 75 mm are inserted skew to the joist the uplift capacity is:

$$F_{uplift} = \frac{n_{skewnail} \times F_{Lat,RK,Joist}}{3} \quad (19)$$

Where

n_{joist} is the total number of nails in the joist

$F_{Lat,RK,Joist}$ is the characteristic lateral capacity of the nails in the joist

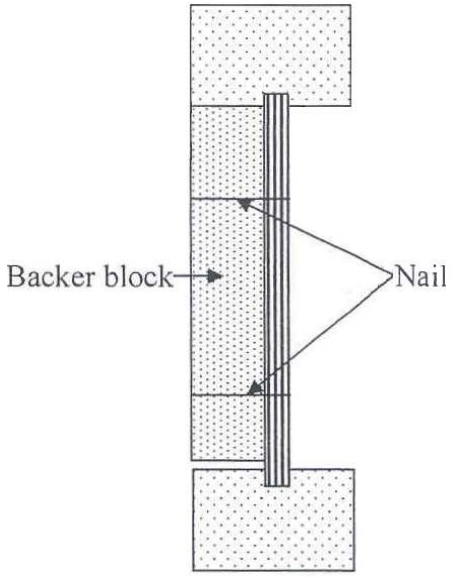
A2.10 I-beam as headers

If an I-beam is used as a header, a backer block must be installed between the joist hanger and the web. The backer shall fulfil the following criteria:

- The block shall fit tight to the underside of the top flange (Figure A2.10)
- The surface of the block shall be flush with the side of the flange
- The nails in the backer block shall be of sufficient length so that they go through the web and clinched.
- It is required that the number of nails in the backer block shall be determined from:

$$n_{nail,backer} = 2\left(n_{web} \times 2n_{top\,flange}\right) \quad (20)$$

Figure A2.10 Cross-section of an I-beam fitted with a backer block. The block is fitted tight to the underside of the top flange.



A2.11 Definition of Symbols

Table A2.11 Definition of Symbols

Symbol	Explanation
$a\text{-}0.5a_c$	Lever arm of the effective nails (face-fixed hangers)
B	Hanger seat depth (mm)
B_{eff}	Effective Compressed depth (mm)
C_{hor}	Horizontal lever arm
d	Divisor taking the inclination of the tilting force into account
e	Horizontal lever arm (face-fixed hangers)
$F_{Ax,nail}$	Axial force of the nails per flange (N)
$F_{Ax,Rk,header}$	Characteristic withdrawal capacity of each nail in the header beam (N)
$f_{c,90,k}$	Characteristic compression strength perpendicular to the grain of joist or header material (MPa)
$f_{c,90,k*}$	Local compressive strength perpendicular to the grain of joist or header material (MPa)
F_c	Load contributions from contact pressure at top corner of header beam
F_r	Load contributions from rope effect
$F_{Hanger\text{-}Header}$	Load transfer from the joist hanger to the header beam per flange (N)
$F_{Joist\text{-}Hanger}$	Load transfer from the joist to hanger per flange (N)
$F_{Lat,nail}$	Lateral force of the nails per flange (N)
$F_{hanger,Tension}$	Tensile capacity of the lower part of the joist hanger per flange (N)
f_u	Tensile strength of hanger steel (MPa)
$F_{v,RK,header}$	Characteristic lateral load carrying capacity of each of the nails in the header beam (N)
$F_{v,Rk,joist}$	Characteristic lateral load-carrying capacity of each of the nails in the joist member (N)
h	Depth of timber member (mm)
k_{ef}	Rope effect efficiency factor
l	Top flap width (mm)
l_{eff}	Effective compressive width of top flap (mm)
$n_{eff,ax}$	Number of effective nails per flange (face-fixed hangers)
$n_{h,\ side\ nail}$	Number of nails in the side of the header beam per flange
$n_{h,\ top\ nail}$	Number of nails in the top of the header beam per flange
$n_{j,side}$	Number of nails in the side of the joist per flange
$n_{nail,backer}$	Number of nails required for fixing backer blocks to the I-joist web
$n_{skew\ nail}$	Number of skew nails in double shear per flange
$n_{top\ flange}$	Number of nails in the header beam top into the top flange of an I-beam

Annex 3 Nail Capacity Tables

Table A3.1 Capacities of 3.75 x 30mm Square Twist Nails

Nail Reference	Nail Shape	Side Length or Diameter (mm)	Nail Length (mm)	Wire Tensile Strength (Mpa)	Plate Thickness (mm)	Timber Grade	Timber Char. Density (kg/m3)	$F_{ax,RK}$ (N)	$F_{v,RK}$ (N)
3.75 x 30 ST	S	3.4	30	600	0.9	C16	310	190	882
						C18	320	203	907
						C20	330	215	931
						C22	340	229	956
						C24	350	242	981
						C27	370	271	1031
						C30	380	286	1056
						SCL	420	349	1156
3.75 x 30 ST	S	3.4	30	600	1.2	C16	310	188	876
						C18	320	201	900
						C20	330	213	925
						C22	340	226	949
						C24	350	240	974
						C27	370	268	1023
						C30	380	283	1048
						SCL	420	345	1147
3.75 x 30 ST	S	3.4	30	600	1.5	C16	310	186	870
						C18	320	198	894
						C20	330	211	918
						C22	340	224	942
						C24	350	237	967
						C27	370	265	1015
						C30	380	280	1040
						SCL	420	342	1138
3.75 x 30 ST	S	3.4	30	600	2.0	C16	310	183	860
						C18	320	195	883
						C20	330	207	907
						C22	340	220	931
						C24	350	233	955
						C27	370	261	1003
						C30	380	275	1027
						SCL	420	336	1123

Table A3.2 Capacities of 3.75 x 38mm Round Wire Nails

Nail Reference	Nail Shape	Side Length or Diameter (mm)	Nail Length (mm)	Wire Tensile Strength (Mpa)	Plate Thickness (mm)	Timber Grade	Timber Char. Density (kg/m3)	$F_{ax,RK}$ (N)	$F_{v,RK}$ (N)
3.75 x 38 SS	R	3.75	38	600	0.9	C16	310	267	1105
						C18	320	285	1139
						C20	330	303	1172
						C22	340	322	1206
						C24	350	341	1240
						C27	370	381	1307
						C30	380	402	1341
						SCL	420	491	1461
3.75 x 38 SS	R	3.75	38	600	1.2	C16	310	265	1098
						C18	320	283	1131
						C20	330	301	1165
						C22	340	319	1198
						C24	350	338	1231
						C27	370	378	1299
						C30	380	399	1332
						SCL	420	487	1456
3.75 x 38 SS	R	3.75	38	600	1.5	C16	310	263	1091
						C18	320	280	1124
						C20	330	298	1157
						C22	340	316	1190
						C24	350	335	1223
						C27	370	375	1290
						C30	380	395	1323
						SCL	420	483	1450
3.75 x 38 SS	R	3.75	38	600	2.0	C16	310	259	1079
						C18	320	276	1111
						C20	330	294	1144
						C22	340	312	1176
						C24	350	331	1209
						C27	370	370	1275
						C30	380	390	1308
						SCL	420	476	1440

Table A3.3 Capacities of 3.75 x 75mm Round Wire Nails

Nail Reference	Nail Shape	Side Length or Diameter (mm)	Nail Length (mm)	Wire Tensile Strength (Mpa)	Plate Thickness (mm)	Timber Grade	Timber Char. Density (kg/m3)	$F_{ax,RK}$ (N)	$F_{v,RK}$ (N)
3.75 x 75 SS	R	3.75	75	600	0.9	C16	310	534	1309
						C18	320	569	1337
						C20	330	605	1364
						C22	340	642	1392
						C24	350	681	1420
						C27	370	761	1475
						C30	380	803	1502
						SCL	420	980	1614
3.75 x 75 SS	R	3.75	75	600	1.2	C16	310	532	1309
						C18	320	567	1336
						C20	330	603	1364
						C22	340	640	1391
						C24	350	678	1419
						C27	370	758	1474
						C30	380	799	1502
						SCL	420	976	1613
3.75 x 75 SS	R	3.75	75	600	1.5	C16	310	530	1308
						C18	320	564	1336
						C20	330	600	1363
						C22	340	637	1391
						C24	350	675	1418
						C27	370	755	1473
						C30	380	796	1501
						SCL	420	972	1612
3.75 x 75 SS	R	3.75	75	600	2.0	C16	310	526	1307
						C18	320	561	1335
						C20	330	596	1362
						C22	340	633	1390
						C24	350	671	1417
						C27	370	750	1472
						C30	380	791	1499
						SCL	420	966	1610

Table A3.4 Capacities of 4.00 x 50mm Annular Ring Shank Wire Nails

Nail Reference	Nail Shape	Side Length or Diameter (mm)	Nail Length (mm)	Wire Tensile Strength (Mpa)	Plate Thickness (mm)	Timber Grade	Timber Char. Density (kg/m3)	$F_{ax,RK}$ (N)	$F_{v,RK}$ (N)
4.00 x 50 ARS	ARS	4.00	50	600	0.9	C16	310	924	1315
						C18	320	985	1347
						C20	330	1048	1380
						C22	340	1112	1413
						C24	350	1178	1446
						C27	370	1247	1479
						C30	380	1389	1547
						SCL	420	1697	1685
4.00 x 50 ARS	ARS	4.00	50	600	1.2	C16	310	919	1309
						C18	320	979	1346
						C20	330	1041	1378
						C22	340	1105	1411
						C24	350	1171	1444
						C27	370	1239	1477
						C30	380	1381	1545
						SCL	420	1687	1683
4.00 x 50 ARS	ARS	4.00	50	600	1.5	C16	310	913	1301
						C18	320	973	1343
						C20	330	1035	1377
						C22	340	1098	1409
						C24	350	1164	1442
						C27	370	1231	1475
						C30	380	1372	1543
						SCL	420	1676	1680
4.00 x 50 ARS	ARS	4.00	50	600	2.0	C16	310	904	1288
						C18	320	963	1330
						C20	330	1024	1371
						C22	340	1087	1407
						C24	350	1152	1349
						C27	370	1219	1472
						C30	380	1358	1539
						SCL	420	1659	1676

Annex 4 Hanger Characteristics

Model No	W Width (mm)	H Height (mm)	B Seat Bearing (mm)	C (mm)	I (mm)	I_{eff} (mm)	t (mm)	S (mm)	B_{eff} (mm)	$a\text{-}0.5a_c$ (mm)	e (mm)	c_{hor} (mm)	K_{ef}	d	n_{eff} (per flange) Round Wire	n_{eff} (per flange) Ring Shank
JHA270/38	38	241.0	50.0	106.0	47.0	96	0.9	28.5	80	112	28.0	10	1.2	1.1	5	-
JHA270/44	44	238.0	50.0	103.0	47.0	99	0.9	28.5	80	112	28.0	10	1.2	1.1	5	-
JHA270/47	47	236.5	50.0	101.5	47.0	101	0.9	28.5	80	112	28.0	10	1.2	1.1	5	-
JHA270/50	50	235.0	50.0	100.0	47.0	102	0.9	28.5	80	112	28.0	10	1.2	1.1	5	-
JHA270/63	63	248.5	50.0	113.5	47.0	107	0.9	28.5	77	112	28.0	10	1.2	1.1	5	-
JHA270/75	75	242.5	50.0	107.5	47.0	107	0.9	28.5	74	112	28.0	10	1.2	1.1	5	-
JHA270/91	91	234.0	50.0	99.5	47.0	107	0.9	28.5	70	112	28.0	10	1.2	1.1	5	-
JHA270/100	100	230.0	50.0	95.0	47.0	107	0.9	28.5	68	112	28.0	10	1.2	1.1	5	-
JHA450/38	38	481.0	50.0	191.0	50.0	99	1.5	35.0	80	174	36.5	10	1.1	1.1	6	-
JHA450/44	44	478.0	50.0	188.0	50.0	102	1.5	35.0	80	174	36.5	10	1.1	1.1	6	-
JHA450/47	47	477.0	50.0	187.0	50.0	104	1.5	35.0	80	174	36.5	10	1.1	1.1	6	-
JHA450/50	50	475.0	50.0	185.0	50.0	105	1.5	35.0	80	174	36.5	10	1.1	1.1	6	-
JHA450/63	63	469.0	50.0	179.0	50.0	110	1.5	35.0	77	174	36.5	10	1.1	1.1	6	-
JHA450/75	75	463.0	50.0	173.0	50.0	110	1.5	35.0	74	174	36.5	10	1.1	1.1	6	-
JHA450/91	91	455.0	50.0	165.0	50.0	110	1.5	35.0	70	174	36.5	10	1.1	1.1	6	-
JHA450/100	100	450.0	50.0	160.0	50.0	110	1.5	35.0	68	174	36.5	10	1.1	1.1	6	-
JHA450/125	125	452.5	63.0	162.5	63.0	123	1.5	44.0	69	164	31.5	10	1.1	1.1	6	-
JHA450/137	137	446.5	63.0	156.5	63.0	123	1.5	44.0	66	164	31.5	10	1.1	1.1	6	-
JHA450/150	150	440.0	63.0	150.0	63.0	123	1.5	44.0	62	164	31.5	10	1.1	1.1	6	-
THA38	38	226.0	62.5	113.5	59.5	109	1.2	40.0	93	114	34.5	10	0.35	1.2	7	-
THA47	47	221.5	62.5	109.0	59.5	113	1.2	40.0	93	114	34.5	10	0.35	1.2	7	-
THA50	50	220.0	62.5	107.5	59.5	115	1.2	40.0	93	114	34.5	10	0.35	1.2	7	-
THA75	75	232.5	62.5	120.0	59.5	120	1.2	40.0	85	114	34.5	10	0.35	1.2	7	-
THA100	100	220.0	62.5	107.5	59.5	120	1.2	40.0	77	114	34.5	10	0.35	1.2	7	-
THAI222	40	580.0	57.0	238.0	57.0	107	1.2	39.0	87	200	37.0	15	1.0	1.1	5	2.5
THAI1.81/22	46	577.0	57.0	235.0	57.0	110	1.2	39.0	87	200	37.0	15	1.0	1.1	5	2.5
THAI3522	59	570.0	57.0	228.0	57.0	117	1.2	39.0	84	200	37.0	15	1.0	1.1	5	2.5
THAI322	65	568.0	57.0	225.0	57.0	117	1.2	39.0	83	200	37.0	15	1.0	1.1	5	2.5
THAI422	90	555.0	57.0	220.0	57.0	117	1.2	39.0	76	200	37.0	15	1.0	1.1	5	2.5
THAI-2	76	550.0	63.5	212.0	63.5	124	2.0	49.0	85	200	37.0	15	1.0	1.1	5	2.5

Annex 5 Revision History

Issue No.	Pages	Update / Description
1.0	~	First Release
2.0	1	Cover page updated to new EOTA requirements; Simpson Strong-Tie San Leandro, USA address changed
	4	EN 1195-1-1:2004 changed to EN 1995-1-1:2004 + A1:2008
	4	JHA & THA minimum wrap over changed from 55mm to 45mm
	10	Figure 1 and 2 have been updated and renamed: Table 1 has been split into two tables and renamed: Material reference's updated
	11	Table A1.1.3 was table 2. Table updated - model number changed & material reference updated.
	11	Figure A1.1.3 updated.
	12	Table A1.1.4 was table 3. THAI322 added to table: Material reference updated.
	12	Table A1.1.5 was table 4.
	13	Table A1.2.1 was table 5. Table updated - additional installation configurations added for JHA270, JHA450 & THA
	14 - 17	Equation reference numbers added
	14,15	Equation (2) updated; Equation (3) added; Equation (4) updated
	16	Equation (14) updated; Equation (16) added; Equation (18) updated
	17	Figure A2.10 was Figure A1.
	18	Definition of symbols table updated - B_{eff} and L_{eff} added
	19 - 22	Annex 3 Table A3.1 was table 8; Table A3.2 was table 7; Table A3.3 was table 6; Table A3.4 was table 9
	23	Annex 4 Table updated - L_{eff}, B_{eff}, C_{Hor} & K_{ef} added to table; B_{min*} removed from table.
	24	Annex 5 added.