



STATYBOS PRODUKCIJOS
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European Technical Assessment

ETA-15/0448
of 2015-08-06

General Part

Technical Assessment Body issuing the European Technical Assessment

Trade name of the construction product:

Product family to which the above construction product belongs:

Manufacturer:

Manufacturing plant:

This European Technical Assessment contains:

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

VĮ Statybos produkcijos sertifikavimo centras

Joist hangers:

- | | |
|---------------------|---------------------|
| - SA 45 × 96 × 2; | - SA 45 × 138 × 2; |
| - SA 45 × 168 × 2; | - SA 51 × 93 × 2; |
| - SA 51 × 135 × 2; | - SA 51 × 165 × 2; |
| - SA 51 × 195 × 2; | - SA 76 × 123 × 2; |
| - SA 76 × 153 × 2; | - SA 76 × 182 × 2; |
| - SA 63 × 158 × 2; | - SA 100 × 140 × 2; |
| - SA 100 × 170 × 2; | - SA 60 × 130 × 2; |
| - SA 80 × 120 × 2; | - SA 80 × 150 × 2 |

EC PAC 13: Three-dimensional nailing plate (Joist hangers for timber to timber connections)

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36 pages including 4 Annexes which form an integral part of this assessment.

Annex – Control plan Contain confidential information and is not included in the European Technical Assessment when that assessment is publicly disseminated

ETAG 015, edition November 2012, used as European Assessment Document (EAD).

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Specific Parts

1. Technical description of the product

Joist hangers SA 45 × 96 × 2, SA 45 × 138 × 2, SA 45 × 168 × 2, SA 51 × 93 × 2, SA 51 × 135 × 2, SA 51 × 165 × 2, SA 51 × 195 × 2, SA 76 × 123 × 2, SA 76 × 153 × 2, SA 76 × 182 × 2, SA 63 × 158 × 2, SA 100 × 140 × 2, SA 100 × 170 × 2, SA 60 × 130 × 2, SA 80 × 120 × 2 and SA 80 × 150 × 2, are one-piece non-welded face fixed joist hangers to be used in timber to timber connections. They are connected to the timber elements by ringed shank nails. Product details are shown in Annex A.

The joist hangers are made from pre-galvanized steel DX51D+Z275 according to standard EN 10346:2009¹ with minimum yield strength R_e of 250 MPa, minimum tensile strength R_m of 330 MPa and minimum elongation A_{80} of 22 %. Dimensions, hole positions are shown in the Annex C, typical installations are shown in Annex B. Joist hangers are made from steel with normal thickness tolerances according to EN 10143:2006².

2. Specifications of the intended use in accordance with the applicable EAD

Intended use of the joist hangers are the connections between beams of load bearing timber structures, where the requirements for mechanical resistance, stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 shall be fulfilled.

The static and kinematic behaviour of the timber members or the supports shall be as described in Annex B.

The wood members may be of solid timber or glued laminated timber with a characteristic density from 290 kg/m³ to 420 kg/m³. This requirement for material of the wood members may be fulfilled by using the following materials:

- structural solid timber classified to C14-C40 strength class according to EN 338:2010³ and EN 14081-1:2005+A1:2011⁴;
- glulam classified to GL24-GL36 according to EN 14080:2013⁵.

For joints shall be used threaded nails according to EN 14592:2008+A1:2012⁶ with diameter 4,0 mm. Another type of threaded nails may be used with values of axial characteristic load-carrying capacity per nail not less than stated in declaration of performance CE 300147-A3 of the nails producer GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, and with the tensile capacity of the wire for the nails equal to or greater than 650 N/mm².

Annex B states the load-carrying capacities of the joist hangers connections for a characteristic density of 350 kg/m³ of solid timber or glulam. For solid timber or glulam with a lower characteristic density than 350 kg/m³ the load-carrying capacities of the nailed connection shall be modified by the k_{dens} factor:

$$k_{dens} = \sqrt{\frac{\rho_k}{350}}$$

where:

ρ_k is the characteristic density of timber used in the connection.

¹ EN 10346:2009 Continuously hot-dip coated steel flat products - Technical delivery conditions.

² EN 10143:2006 Continuously hot-dip coated steel sheet and strip - Tolerances on dimensions and shape.

³ EN 338:2009 Structural timber - Strength classes.

⁴ EN 14081-1:2005+A1:2011 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.

⁵ EN 14080:2013 Timber structures - Glued laminated timber and glued solid timber - Requirements

⁶ EN 14592:2008+A1:2012 Timber structures - Dowel-type fasteners – Requirements

The design of the connections shall be in accordance with Eurocode 5⁷ or according to similar national regulations for design. The wood members shall have the thickness which is larger than the penetration depth of the nails into the members.

The joist hangers are primarily intended for use in timber structures subject to the dry, internal conditions defined by service class 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading. The joist hangers can also be used in outdoor structures, defined by service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield, ultimate strength and ductility is employed.

They are not intended for used in areas where they might support seismic actions.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the three-dimensional nailing plates of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

⁷ EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

2.1 Installation

2.1.1 Joints

A connector (three-dimensional nailing plate – joist hangers) is deemed fit for its intended use provided:

- joints are designed in accordance with Eurocode 5 or an appropriate national regulations for timber constructions design under the responsibility of an engineer experienced in timber structures;
- the structural members to which the joist hanger are fixed shall be restrained against rotation;
- the structural members of solid timber shall be of strength class C14 or better;
- the structural members of glulam shall be of strength class GL24 or better;
- the structural members shall be free from wane under the joist hanger;
- the tensile strength perpendicular to the grain capacity of the timber member to be used in conjunction with the joist hanger is to be checked by the designer of the structure to ensure that it is not less than the joist hangers capacity and, if necessary, the joist hanger capacity shall be reduced accordingly;
- the gap between the timber members does not exceed 3 mm;
- there are no specific requirements relating to preparation of the timber members.

2.1.2 Criteria

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

- installation is carried out by personnel under the direction of supervisors, which 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 are used.

2.1.3 Responsibility of the manufacturer

It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in sections 8, 9 and 10 of this European technical assessment, is given to those concerned. This information may be made by replicating the respective parts of this European Technical Assessment. 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.

All data shall be presented in a clear and explicit form.

2.2 Recommendations

2.2.1 Recommendations on packaging, transport and storage

The joist 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 connectors should be treated as conventional metallic building products.

2.2.2 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.

3. Performance of the product and references to the methods used for its assessment:

| ETAG paragraph | Characteristic | Assessment of characteristic |
|---|---|--|
| 3.1 Mechanical resistance and stability | | |
| 2.4.1 | Characteristic load-carrying capacity | see Annex B |
| 2.4.1 | Stiffness | No performance determined |
| 2.4.1 | Ductility in cyclic testing | No performance determined |
| 3.2 Safety in case of fire | | |
| 2.4.2.1 | Reaction to fire | The joist hangers are made from steel classified as Euroclass A1 in accordance with EN 13501-1:2007+A1:2009 ⁸ and EC decision 96/603/EC ⁹ , amended by EC Decision 2000/605/EC ¹⁰ |
| 2.4.2.2 | Resistance to fire | No performance determined |
| 3.3 Hygiene, health and the environment | | |
| 2.4.3 | Release of dangerous substances | No dangerous materials ¹⁾ |
| 3.4 General aspects relating to fitness for use (serviceability) | | |
| 2.4.7 | Durability | |
| 2.4.7.2 | Resistance to corrosion and deterioration | 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 |
| 2.4.8 | Dimensional stability | Tests are carried out during the assessment for mechanical resistance and stability |

¹⁾ Based on the declaration of the manufacturer and in accordance with TR 034¹¹ the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

In accordance with the Regulation (EC) No 1907/2006 of the European Parliament and the Council of 18 December 2006¹² and http://ec.europa.eu/growth/sectors/chemicals/reach/index_en.htm, the product does not contain/release dangerous substances.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, 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 Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply

3.1 Mechanical resistance and stability

The assessment of fitness for the intended use has been made in accordance with ETAG 015. The characteristic load-carrying capacities of the products are given in Annex B, which have been derived by calculation.

⁸ EN 13501-1:2007+A1:2009 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

⁹ OJ L 267, 19.10.1996, p. 23.

¹⁰ OJ L 258, 12.10.2000, p. 36

¹¹ General ER 3 Checklist for ETAGs/CUPAs/ETAs-Content and/or release of dangerous substances in products/kits, Edition March 2012

¹² OJ L 396, 30.12.2006, p. 1

The characteristic load-carrying capacities are based on the characteristic values of the nail connections, timber components and steel plates. The calculations were performed according to Eurocode 5.

According to EN 1990¹³ for structures or structural members that comprise more than one material acting in association, partial factors of all used materials shall be computed to obtain design values.

To obtain design values the capacities have to be divided by different partial factors of the material properties, the nail connection and the timber components in addition multiplied with the coefficient k_{mod} .

$$F_{1,d} = \frac{F_{1,k} \cdot k_{mod}}{\gamma_M}$$

where:

$F_{1,k}$ is the characteristic load-carrying capacity;

k_{mod} is the modification factor depending on service class and load-duration classes, see EN 1995-1-1¹⁴, § 3.1.3;

γ_M is the partial factor for a material property, according EN 1995-1-1, § 2.4.1.

The characteristic load-carrying capacity in the direction F is presented in the Annex B. These values are based on the assumption that there is a maximum gap of 3 mm between the timber members (see Annex B, Figure B.1), the members are laterally restrained and wane is not present in the timber at the joint. Minimum spacings and edge and end distances for nails shall be according to Eurocode 5. The number and position of nails are shown in Annex D.

The characteristic capacities of the joist hangers should be used for design in accordance with Eurocode 5 or a similar national regulations for timber structures design.

In the calculations are used threaded nails of 4,0 mm diameter, according EN 14592:2008+A1:2012. Nails manufacturer - GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, declaration of performance CE 300147-A3.

The characteristic axial load-carrying withdrawal capacity of a nails is taken according nails manufacturer declaration of performance CE 300147-A3. The characteristic lateral load-carrying capacity of nails calculated from the formulas of Eurocode 5 as for thin steel plate, see EN 1995-1-1, expression (8.9).

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.

13 EN 1990 Eurocode - Basis of structural design

14 EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

3.2 Safety in case of fire

Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, therefore there are no relevant aspects of performance to this Basic Requirement for the connectors.

3.3 Hygiene, health and the environment

Based on the declaration of the manufacturer and in accordance with TR 034, dated March 2012, the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

3.4 General aspects relating to fitness for use (durability and serviceability)

3.4.1 Durability

The joist 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 according Eurocode 5:

- service class 1 – is characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 65 % for a few weeks per year;
- service class 2 - characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 85 % for a few weeks per year.

In accordance with ETAG 015 the joist hangers are made from hot-dip zinc coating steel DX51D+Z275 according to EN 10346:2009 with a minimum yield strength R_e of 250 MPa, a minimum tensile strength R_m of 330 MPa and a minimum elongation A_{80} of 22 %.

3.4.2 Dimensional stability

Additional tests are not required for this property as it is covered during the assessment.

4. Assessment and verification of constancy of performance (AVPC) system applied, with reference to its legal base

According to the decision 97/638/EC¹⁵ of the European Commission, the system of assessment and verification of constancy of performance applied to this product shall be as laid down in the Commission delegated regulation (EU) No 568/2014¹⁶ amending Annex V to Regulation (EU) No 305/2011¹⁷ of the European Parliament and of the Council, referred to as System 2+.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the Control Plan deposited with the Statybos produkcijos sertifikavimo centras (SPSC), with which the factory production control shall be in accordance.

Issued in Vilnius on 2015-08-06

By State Enterprise Statybos produkcijos sertifikavimo centras (SPSC)

**Director
Robertas Encius**

¹⁵ Commission Decision 97/638/EC of 19 September 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards fasteners for structural timber (OJ L 268, 1.10.1997, p. 36).

¹⁶ Commission delegated regulation (EU) No 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products (OJ L 157, 27.05.2014, p. 76).

¹⁷ Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (OJ L 88, 4.04.2011, p. 5).

ANNEX A**Product details****Table A.1.** Steel for joist hanger specification

| Joist hanger type | | Steel thickness (mm) | Steel and coating specification ¹⁾ |
|-------------------|---------------|----------------------|---|
| SA | 45 × 96 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 138 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 168 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 93 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 135 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 165 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 195 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 123 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 153 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 182 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 63 × 158 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 140 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 170 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 60 × 130 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 120 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 150 × 2 | 2,0 | EN 10346 - DX51D + Z275 |

¹⁾ requirements according joist hangers manufacturer's UAB "Ardetas" documentation:
- minimum yield strength, $R_{p0,2}$ or R_{eL} – 250 MPa;
- minimum tensile strength, R_m – 330 MPa;
- minimum elongation, A_{80} – 22 % (according requirements of EN 10346:2009)

The joist hanger drawings with dimensions presented in the Annex C.

Table A.2. Nails specification

| Nail type according EN 14592 | Dimensions (mm) | Coating specification |
|-------------------------------|-----------------|------------------------------|
| GBO Fastening systems AB nail | 40 × 4,0 | 12 μm (ISO 2081 - Fe/Zn12/C) |

Characteristic capacities of nails for a characteristic density of the wood members 350 kg/m³:
- characteristic withdrawal capacity, $f_{ax,k}$ – 7,8 N/mm²;
- characteristic yield moment, $M_{y,Rk}$ – 7168 Nmm;
Tensile capacity of the wire for nails – 650 N/mm².

ANNEX B

Characteristic load-carrying capacities

B.1 Support conditions

The distance between the timber members in the area of the connection must not exceed 3 mm. The members shall be prevented from rotation.

B.2 Fastener specification

Number and position of nails presented in the Table B.1 and Annex D.

B.3 Wane

Wane is not allowed, the timber has to be sharp-edged in the area of the contact with the joist hanger and inside the joist hanger.

B.4 Characteristic load-carrying capacities

Timber beam to timber beam connections with an joist hanger

Table B.1. Characteristic load-carrying capacities $F_{1,k}$ of timber beam to timber beam connection for load direction according Figure B.1

| Joist hanger type | | Nails dimensions (mm) | Number of nails in | | Position of nails shown in Figure 2) | $F_{1,k}$ kN |
|-------------------|---------------|-----------------------|--------------------|------------------------------|--------------------------------------|--------------|
| | | | primary beam | secondary beam ¹⁾ | | |
| SA | 45 × 96 × 2 | 40 × 4,0 | 6 | 3 | D.1 | 3,45 |
| SA | 45 × 138 × 2 | 40 × 4,0 | 10 | 5 | D.2 | 5,76 |
| SA | 45 × 168 × 2 | 40 × 4,0 | 12 | 6 | D.3 | 6,91 |
| SA | 51 × 93 × 2 | 40 × 4,0 | 6 | 3 | D.4 | 3,45 |
| SA | 51 × 135 × 2 | 40 × 4,0 | 10 | 5 | D.5 | 5,76 |
| SA | 51 × 165 × 2 | 40 × 4,0 | 12 | 6 | D.6 | 6,91 |
| SA | 51 × 195 × 2 | 40 × 4,0 | 14 | 7 | D.7 | 8,06 |
| SA | 76 × 123 × 2 | 40 × 4,0 | 16 | 10 | D.8 | 11,5 |
| SA | 76 × 153 × 2 | 40 × 4,0 | 20 | 12 | D.9 | 13,8 |
| SA | 76 × 182 × 2 | 40 × 4,0 | 24 | 14 | D.10 | 16,1 |
| SA | 63 × 158 × 2 | 40 × 4,0 | 20 | 12 | D.11 | 13,8 |
| SA | 100 × 140 × 2 | 40 × 4,0 | 18 | 12 | D.12 | 13,8 |
| SA | 100 × 170 × 2 | 40 × 4,0 | 22 | 14 | D.13 | 16,1 |
| SA | 60 × 130 × 2 | 40 × 4,0 | 16 | 10 | D.14 | 11,5 |
| SA | 80 × 120 × 2 | 40 × 4,0 | 16 | 10 | D.15 | 11,5 |
| SA | 80 × 150 × 2 | 40 × 4,0 | 20 | 12 | D.16 | 13,8 |

¹⁾ with predrilled holes, Ø3,2 mm
²⁾ see Annex D

When load-carrying capacity is calculated the possibility of splinting caused by the tension perpendicular to the grain, shall be taken into account.

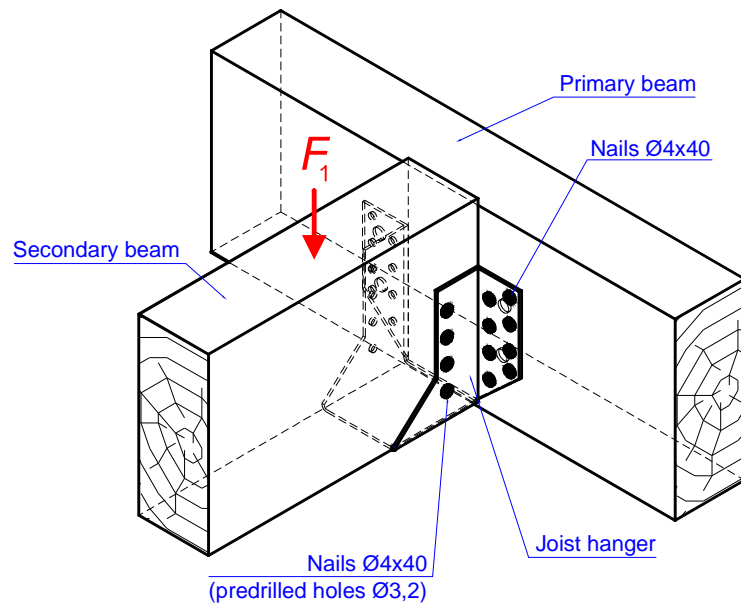


Figure B.1. Typical installation of the joist hanger in the timber beam to timber beam connections

ANNEX C

Joist hangers dimensions

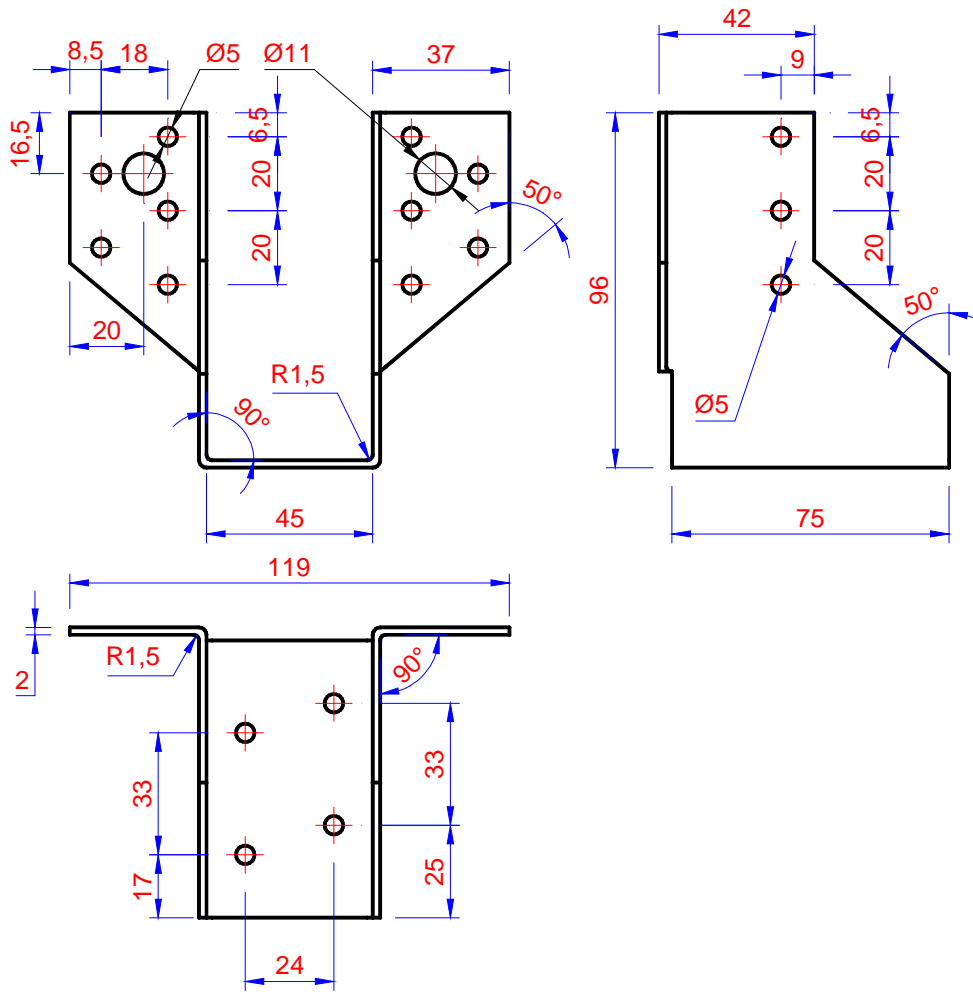


Figure C.1. Joist hanger SA 45 x 96 x 2

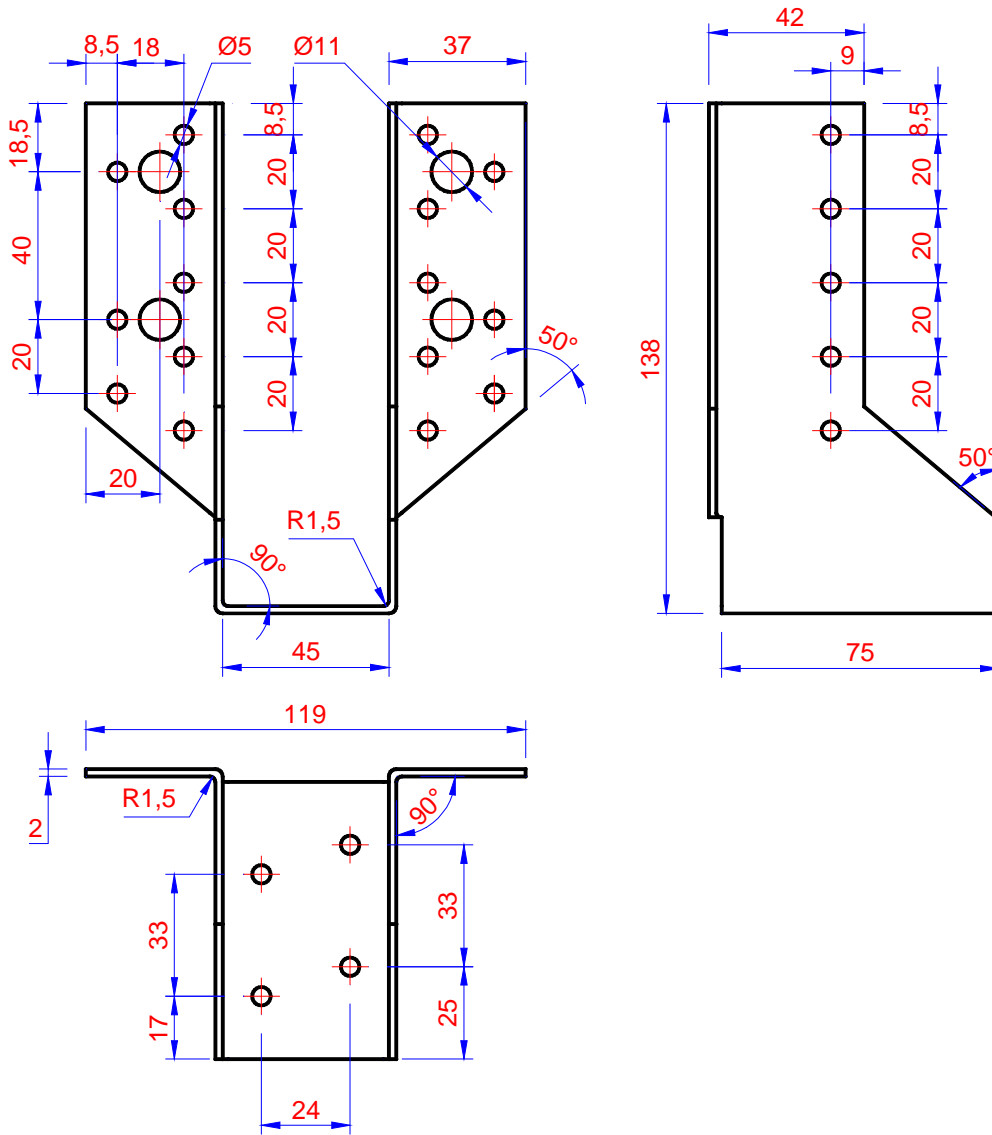


Figure C.2. Joist hanger SA 45 x 138 x 2

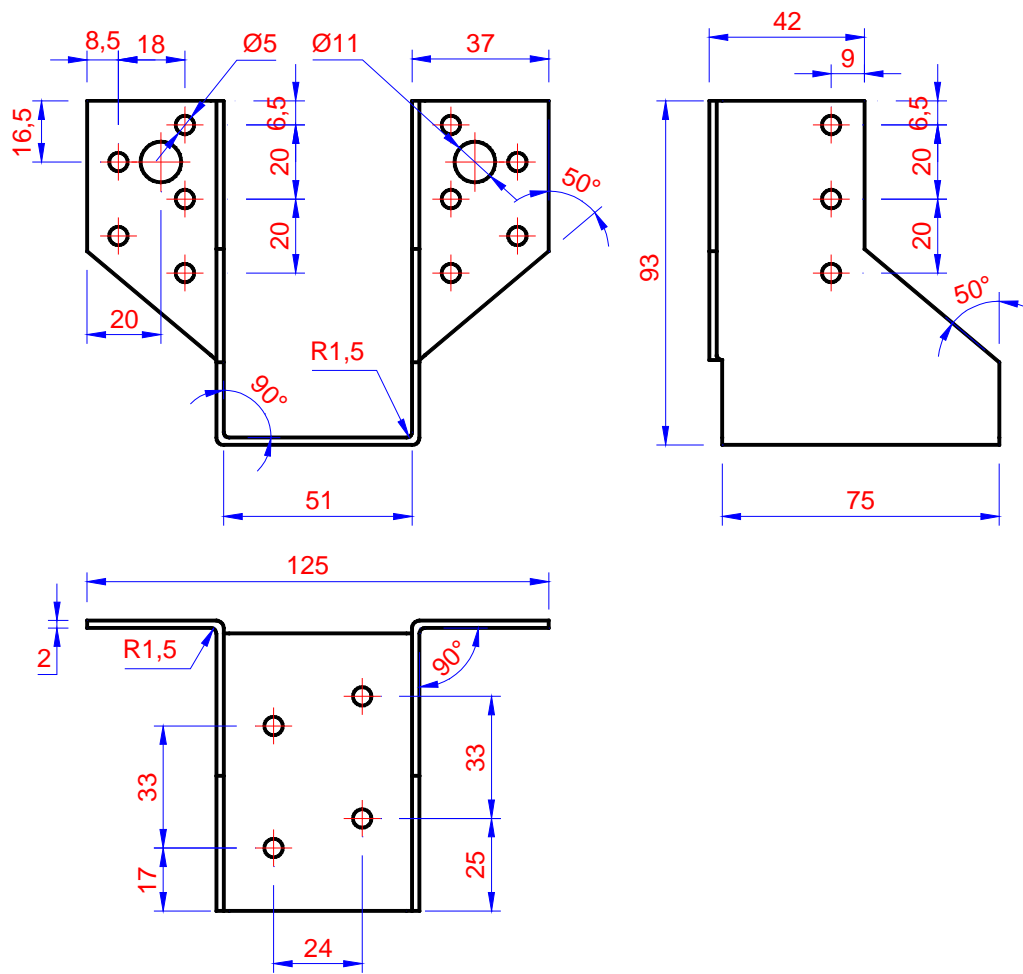


Figure C.4. Joist hanger SA 51 x 93 x 2

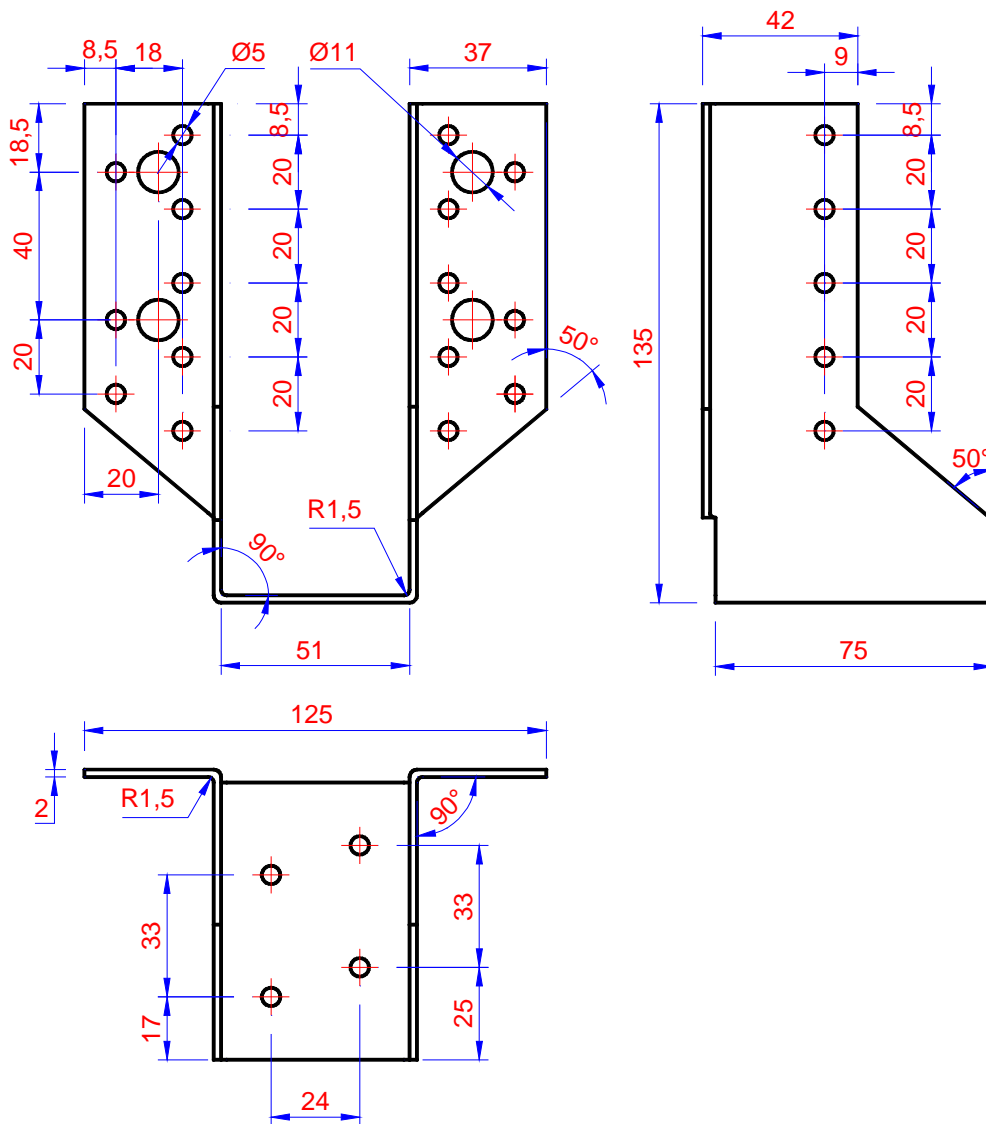


Figure C.5. Joist hanger SA 51 x 135 x 2

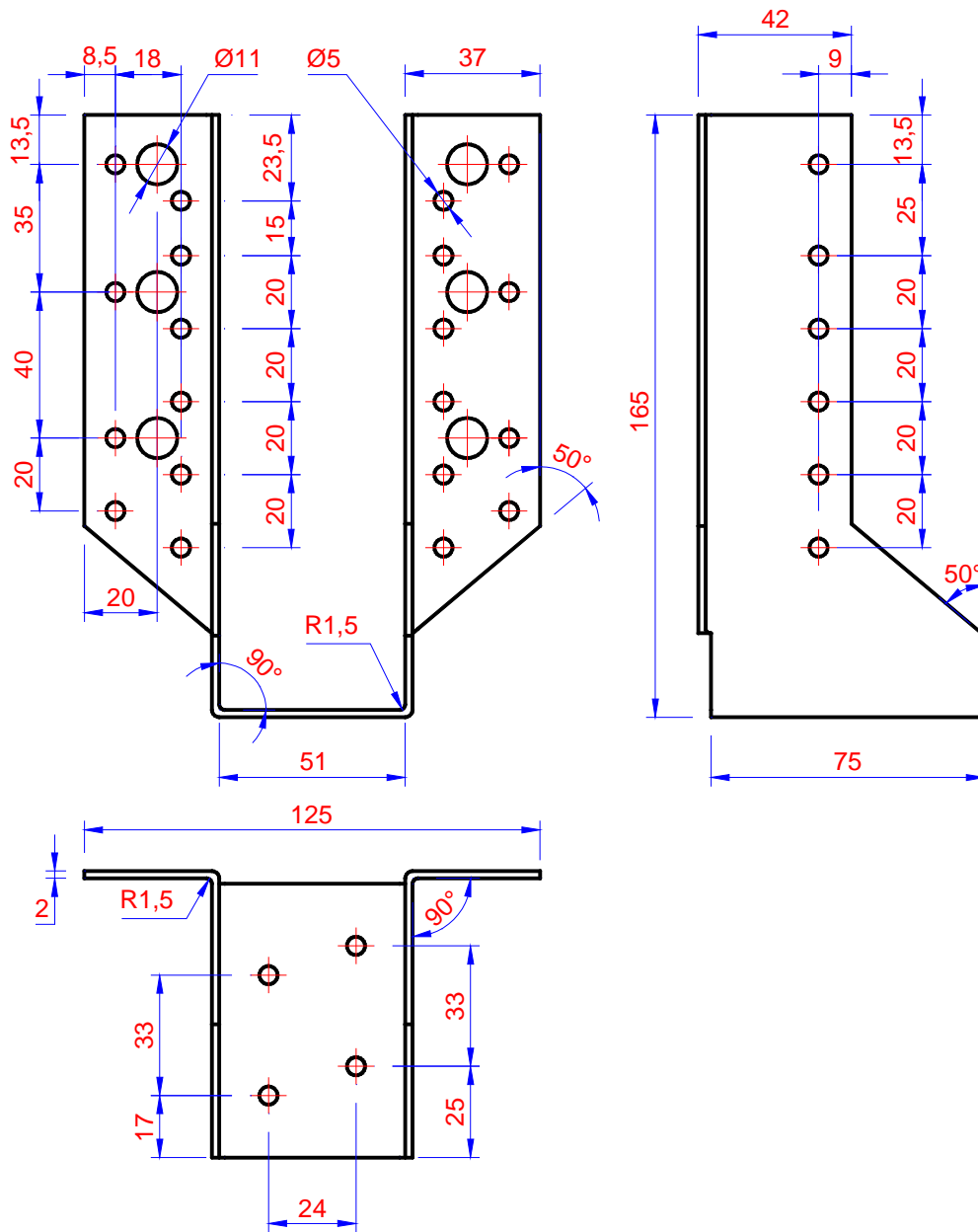


Figure C.6. Joist hanger SA 51 x 165 x 2

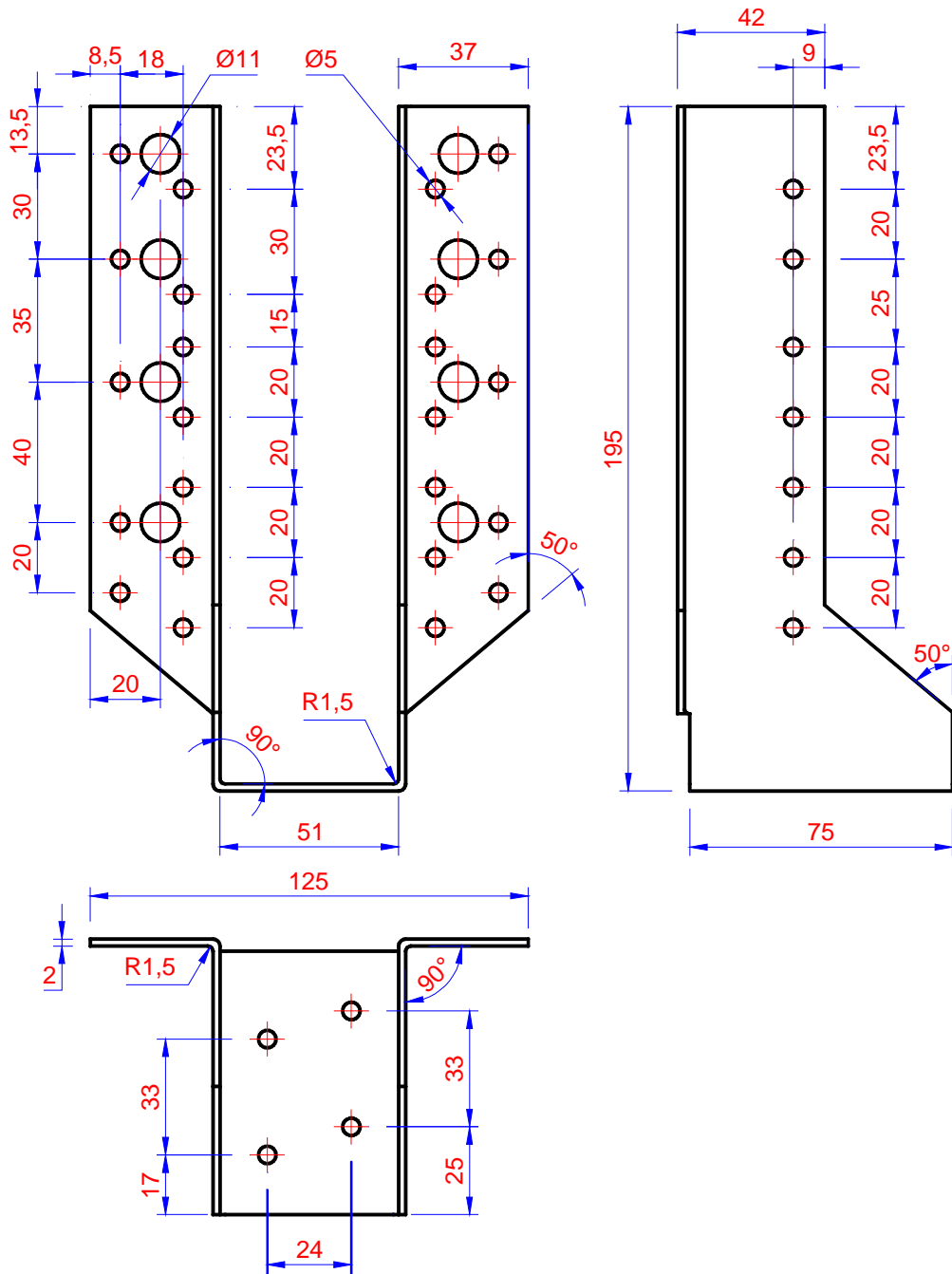


Figure C.7. Joist hanger SA 51 x 195 x 2

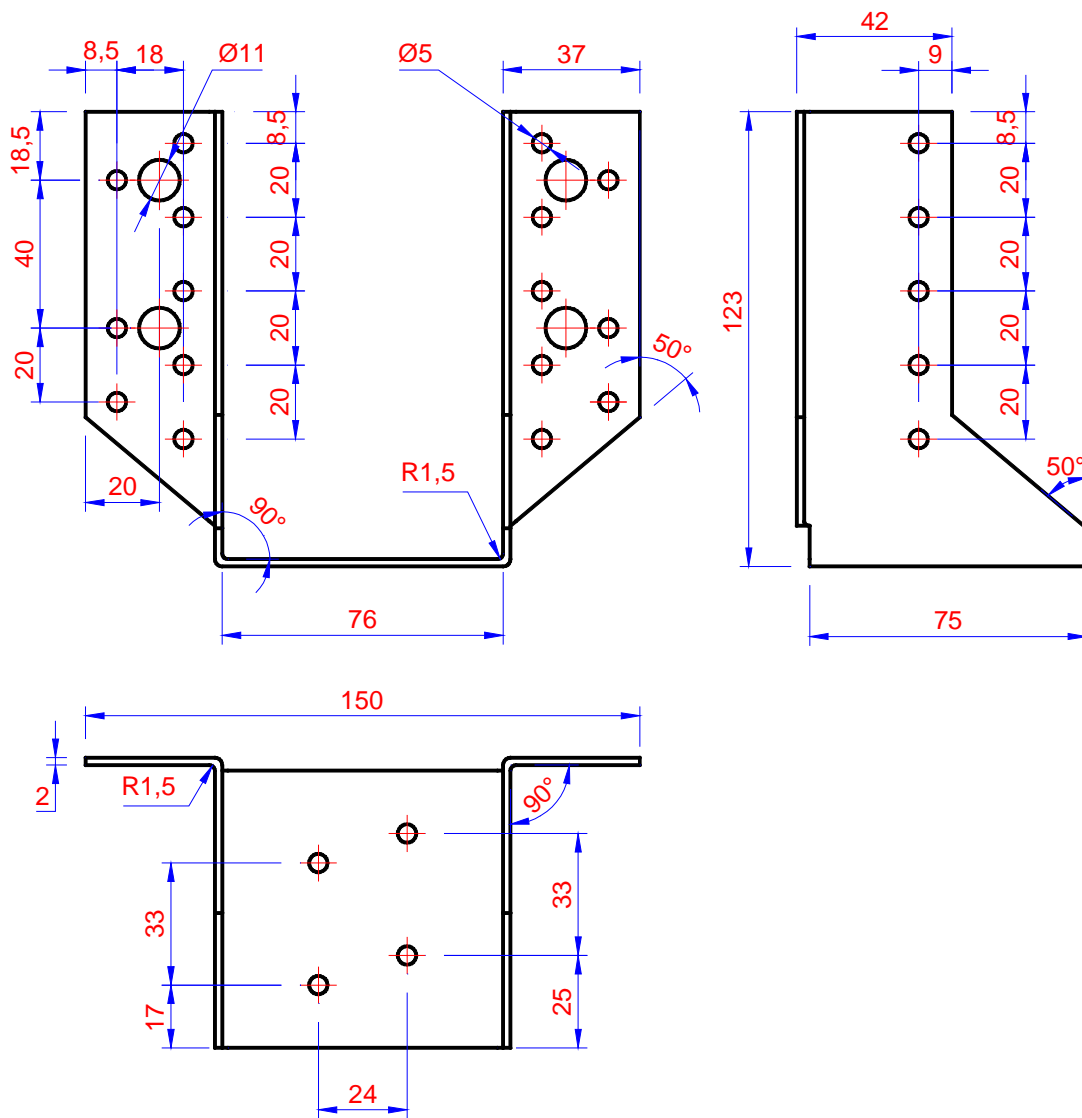


Figure C.8. Joist hanger SA 76 x 123 x 2

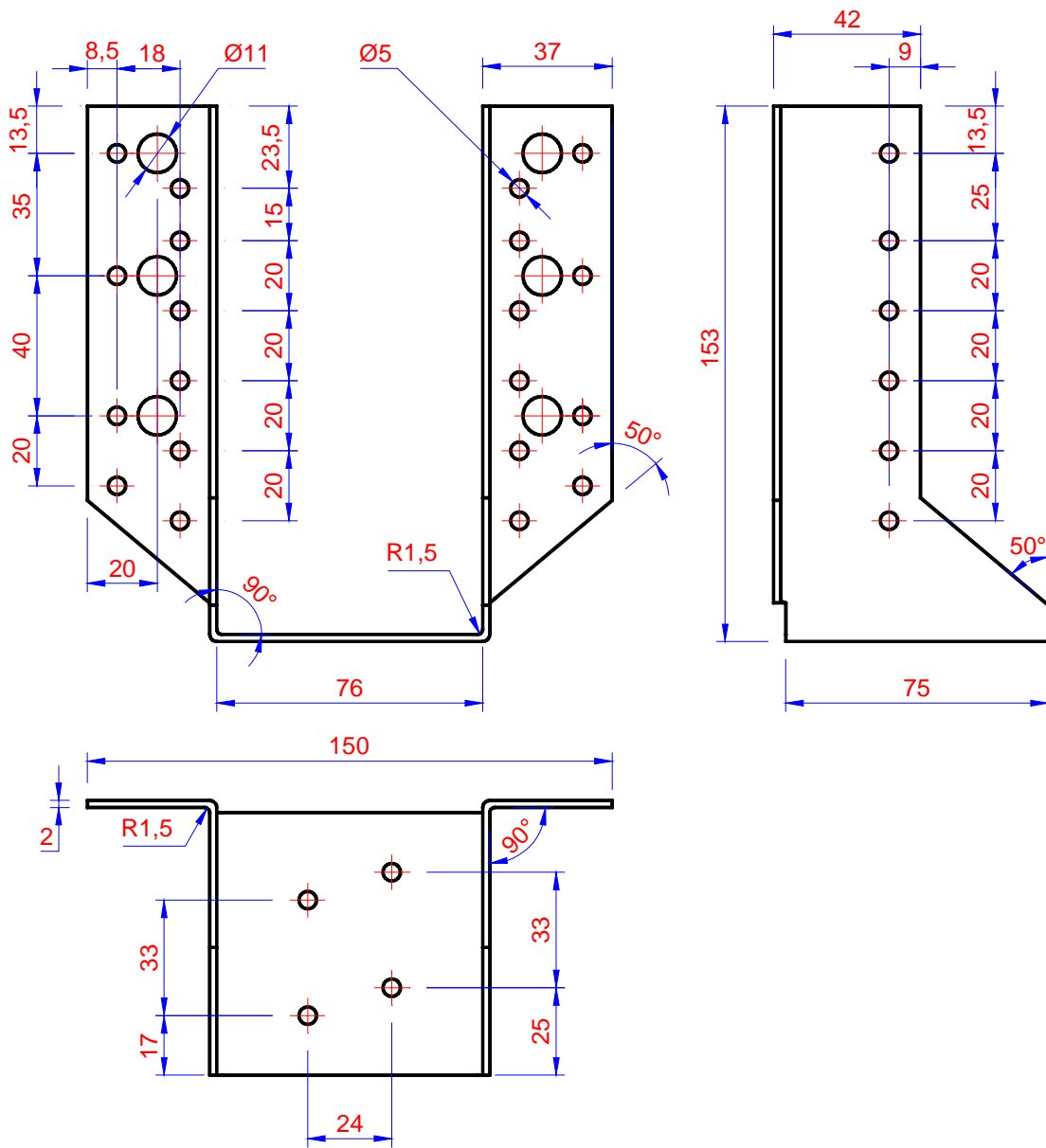


Figure C.9. Joist hanger SA 76 x 153 x 2

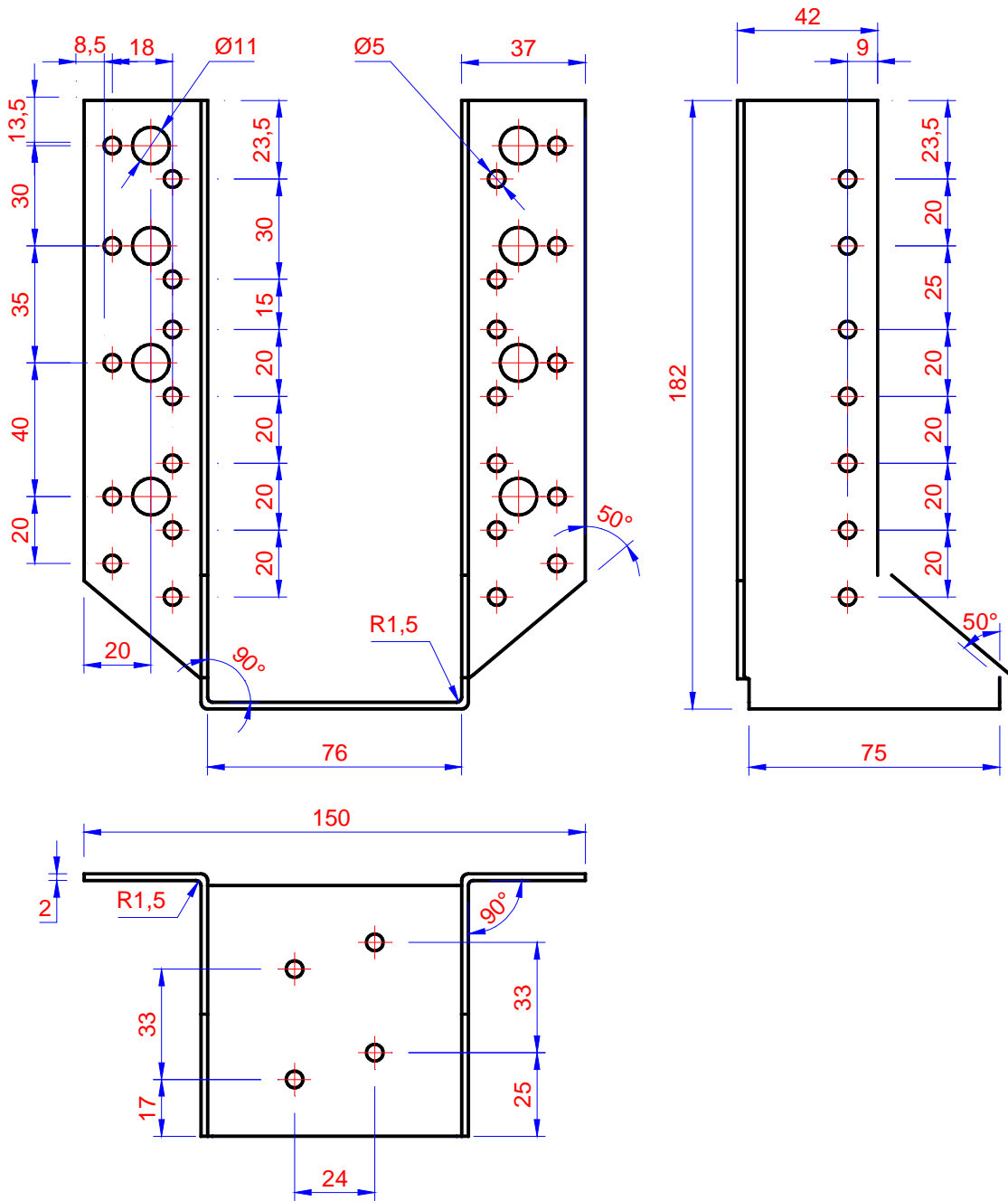


Figure C.10. Joist hanger SA 76 x 182 x 2

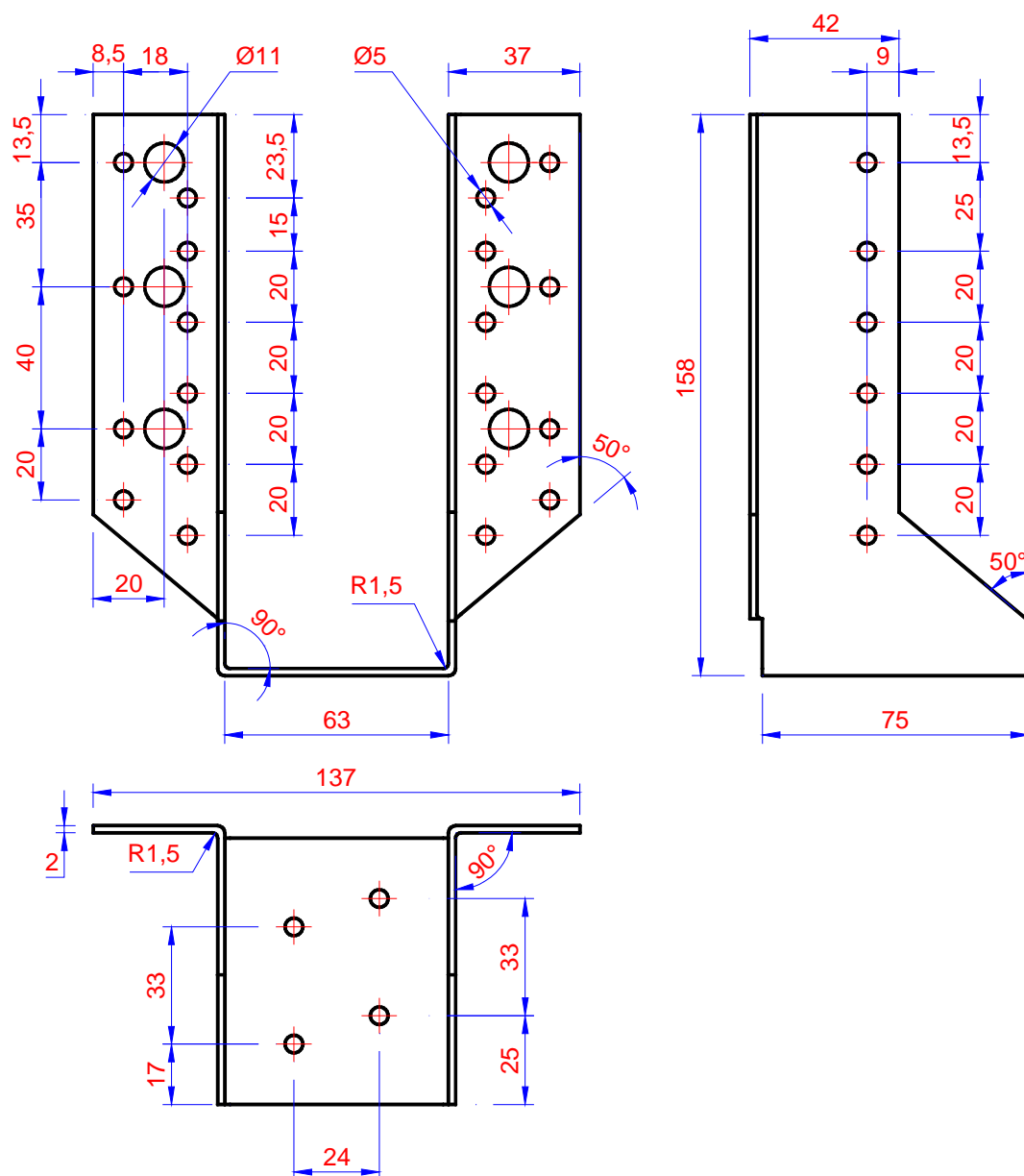


Figure C.11. Joist hanger SA 63 x 158 x 2

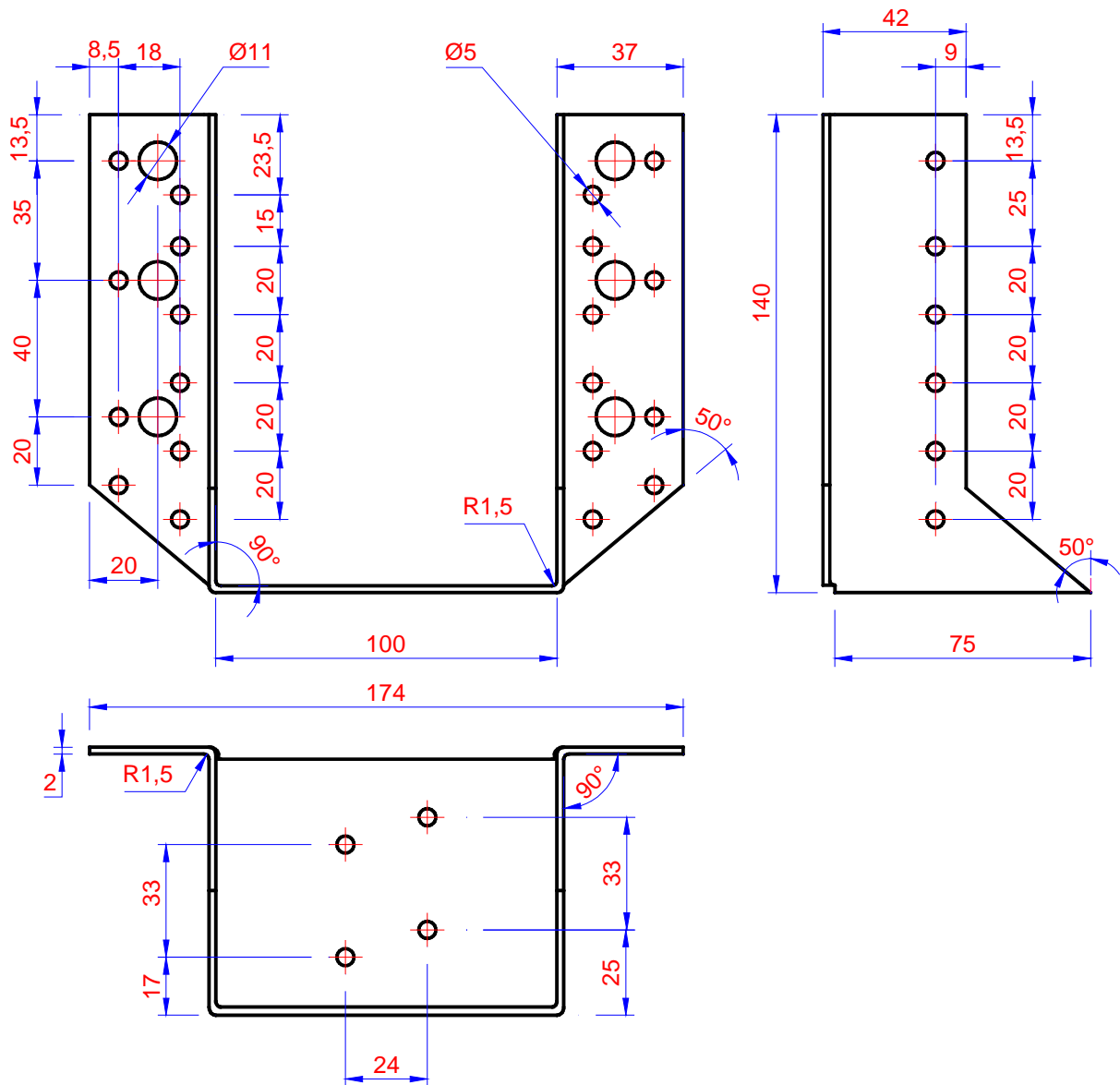


Figure C.12. Joist hanger SA 100 x 140 x 2

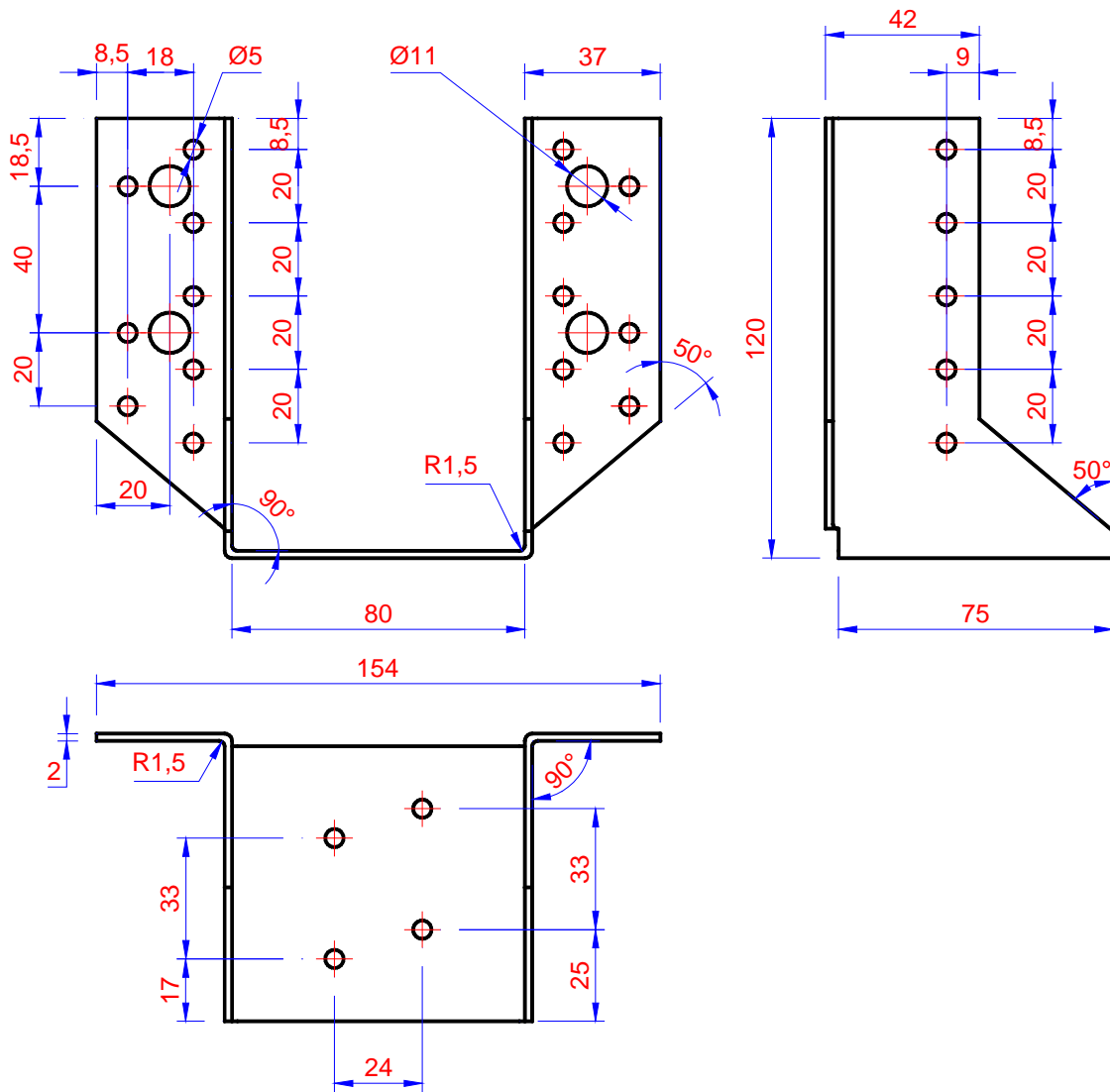


Figure C.15. Joist hanger SA 80 x 120 x 2

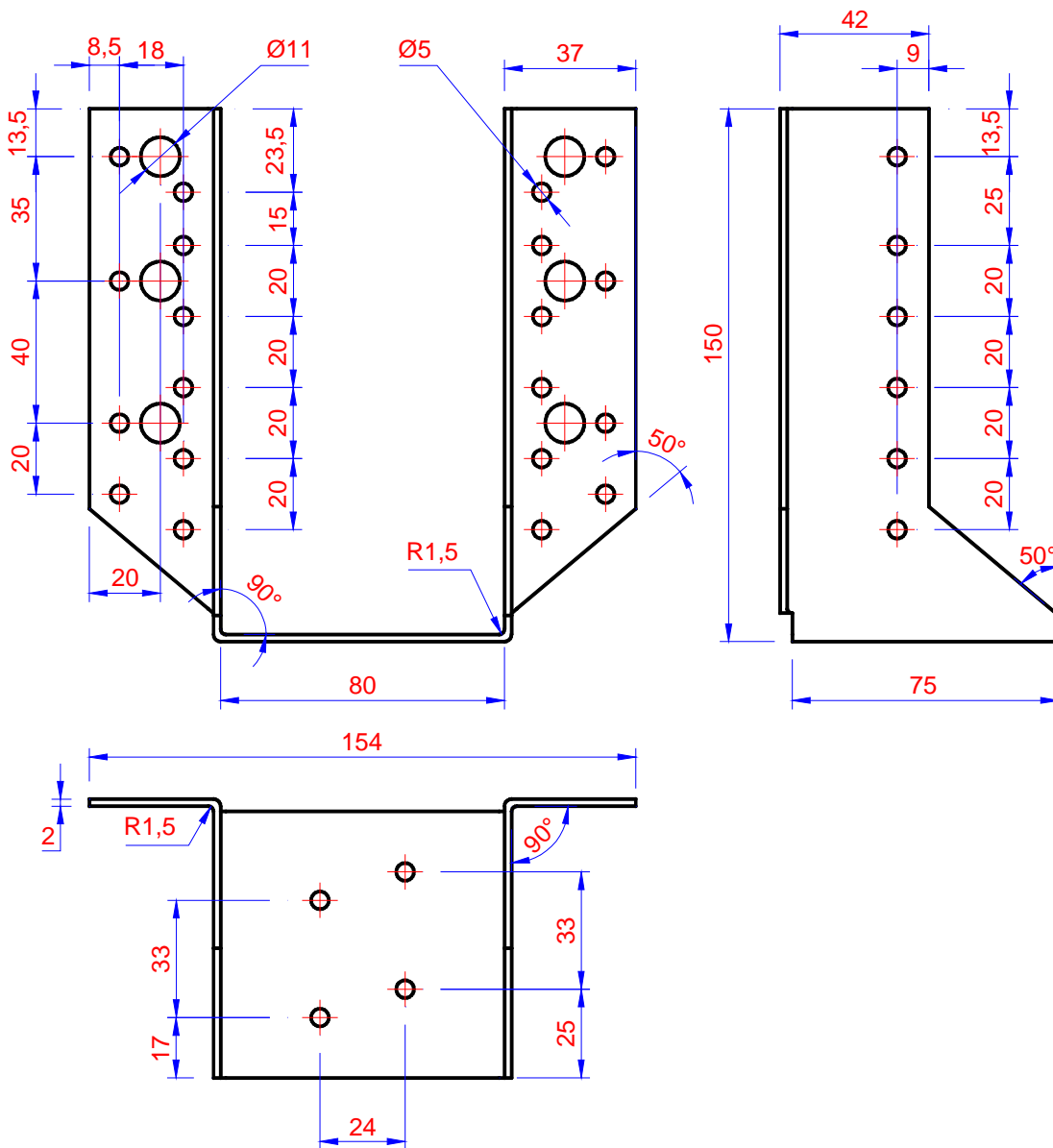


Figure C.16. Joist hanger SA 80 x 150 x 2

ANNEX D

Number and positions of nails in the joist hangers

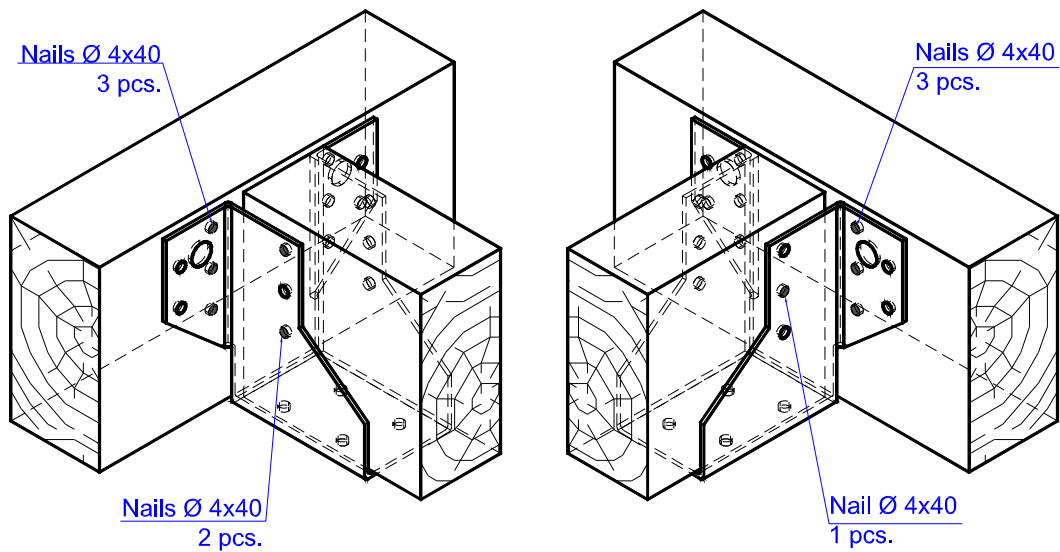


Figure D.1. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x96x2

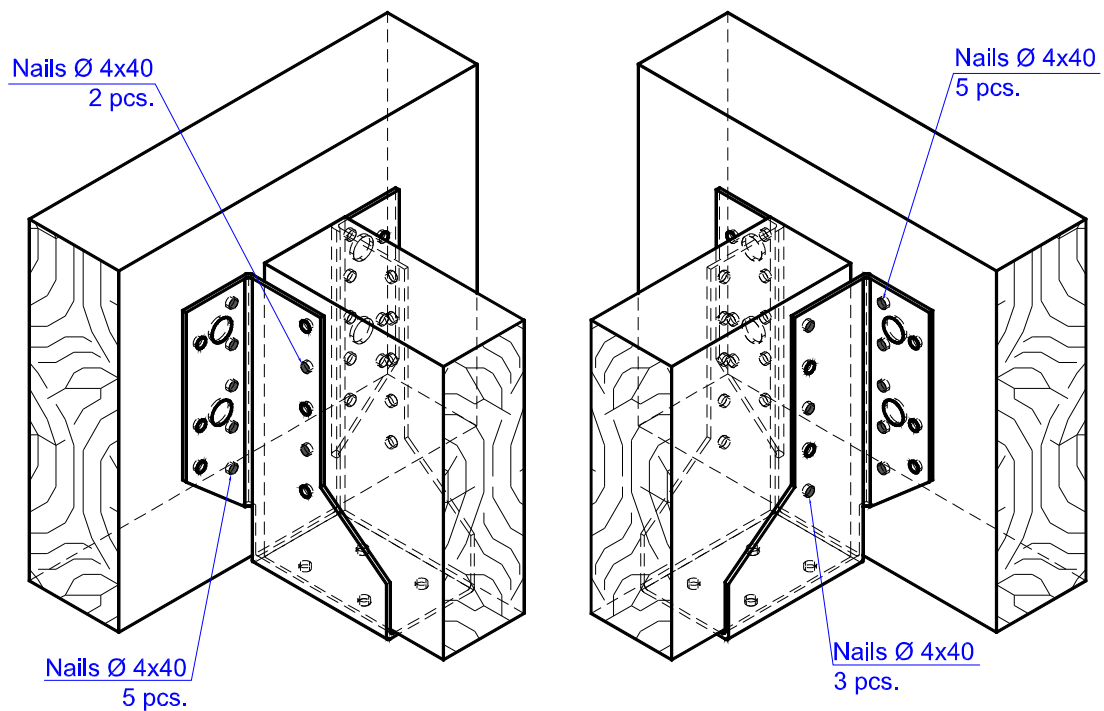


Figure D.2. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x138x2

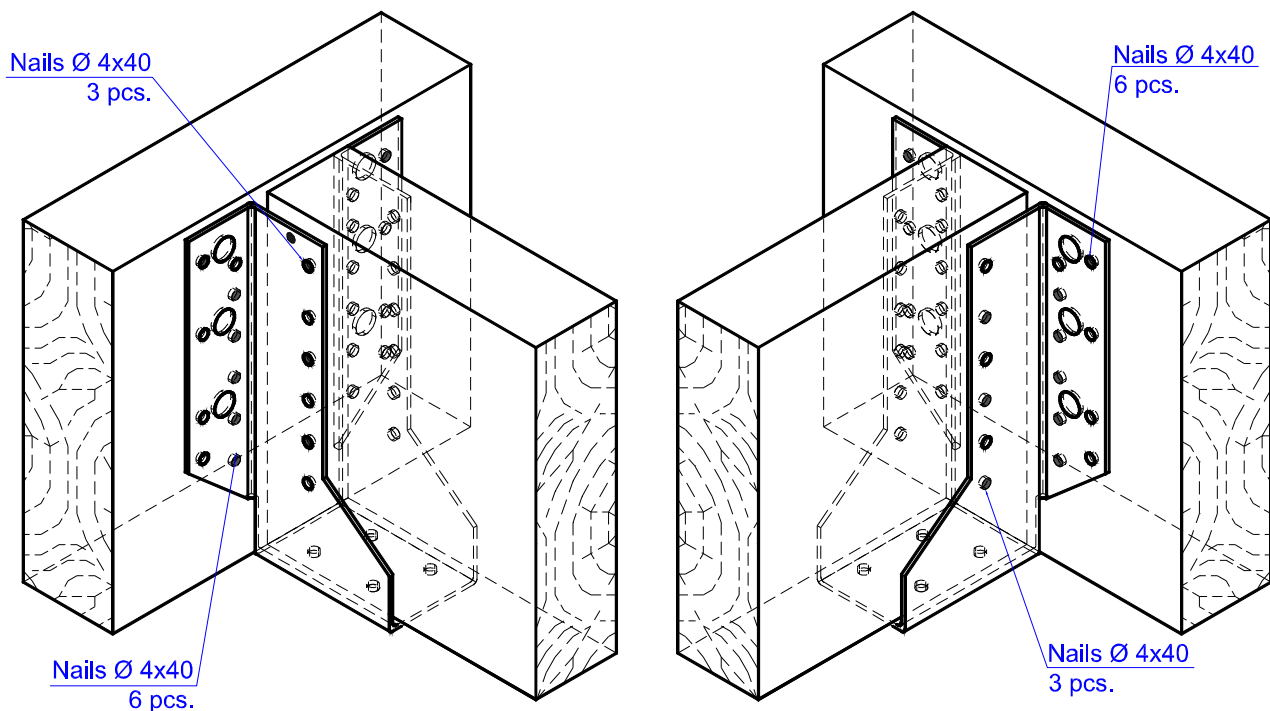


Figure D.3. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x168x2

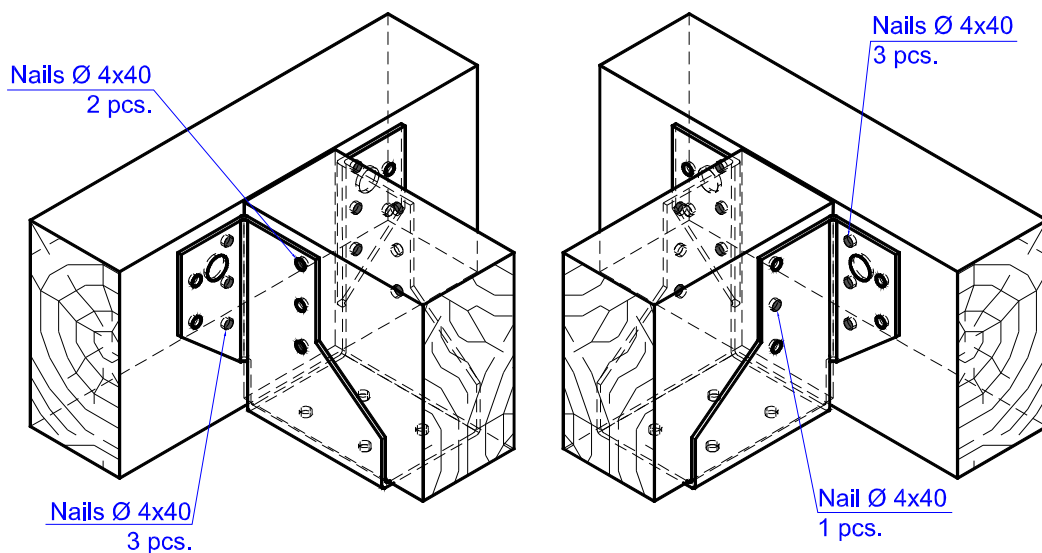


Figure D.4. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x93x2

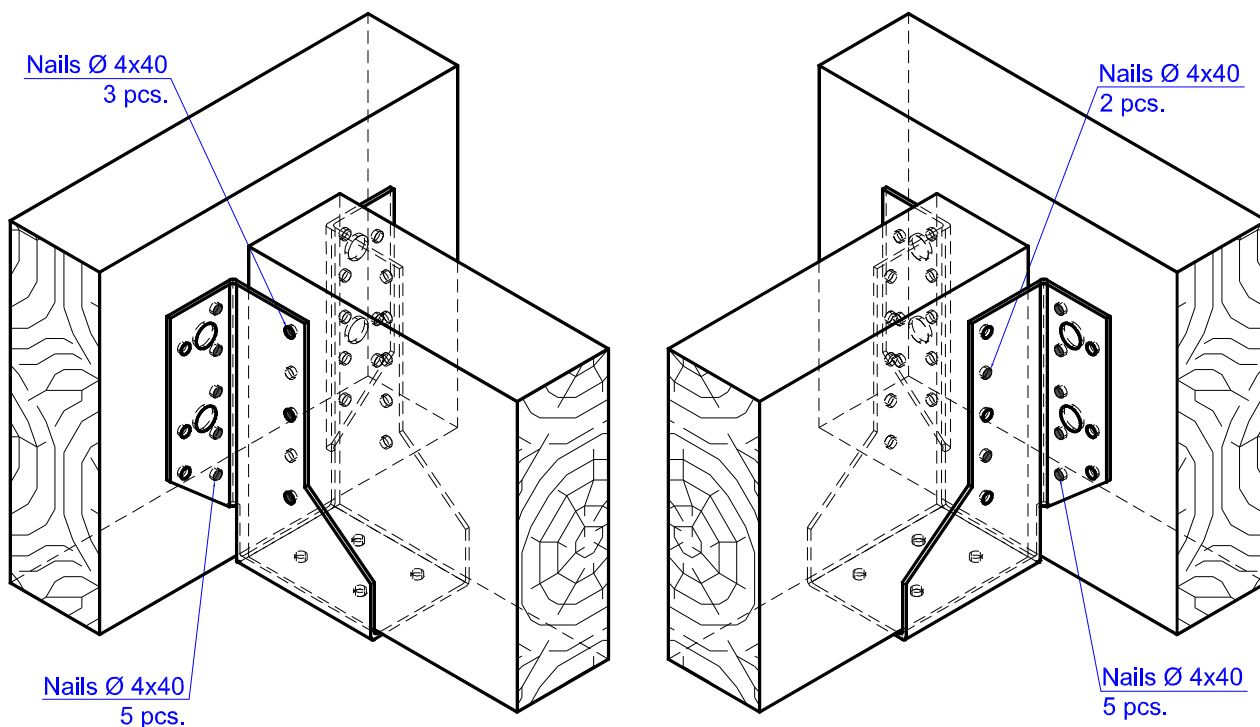


Figure D.5. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x135x2

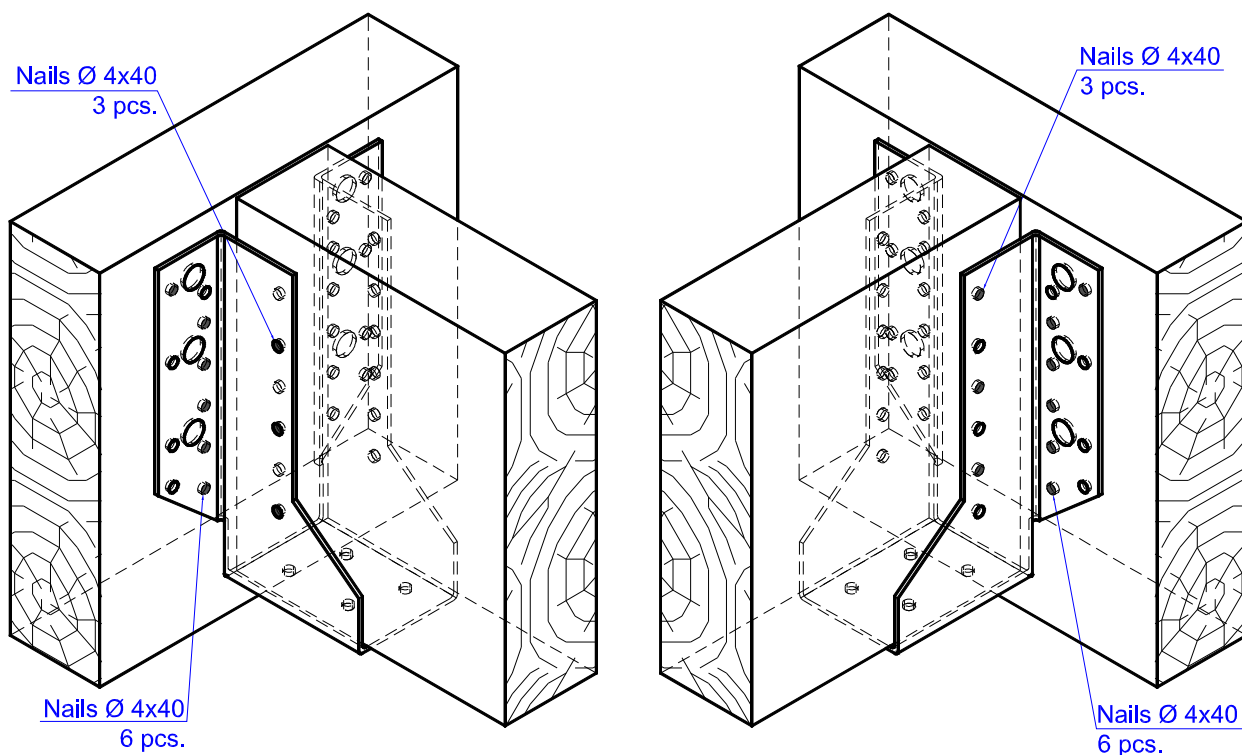


Figure D.6. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x165x2

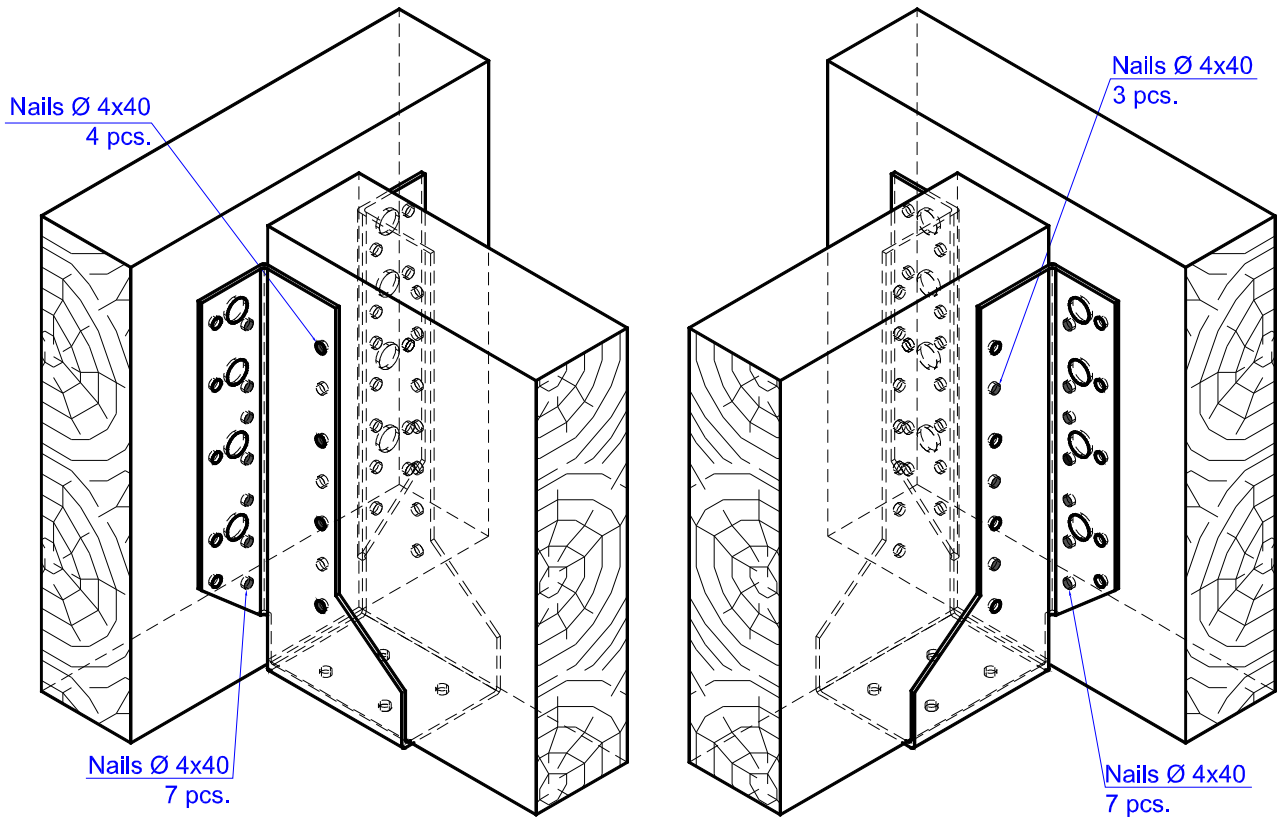


Figure D.7. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x195x2

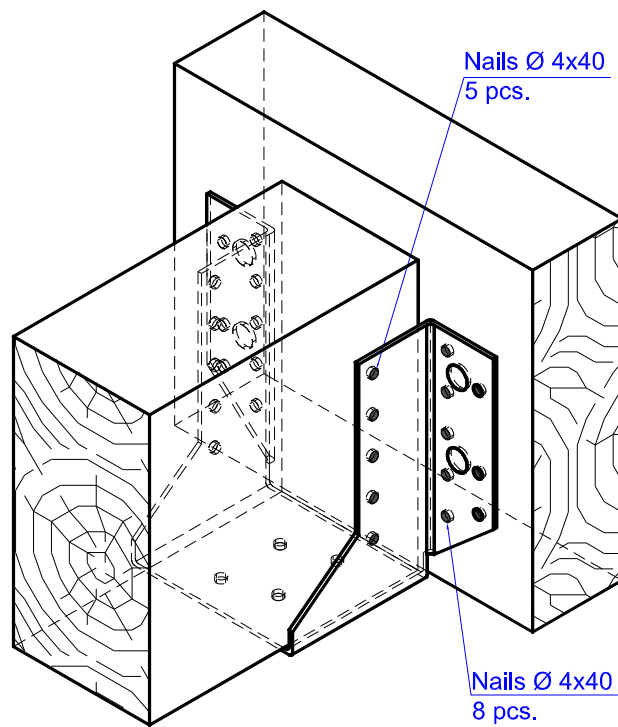


Figure D.8. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x123x2. Position of nails is symmetrical in both sides

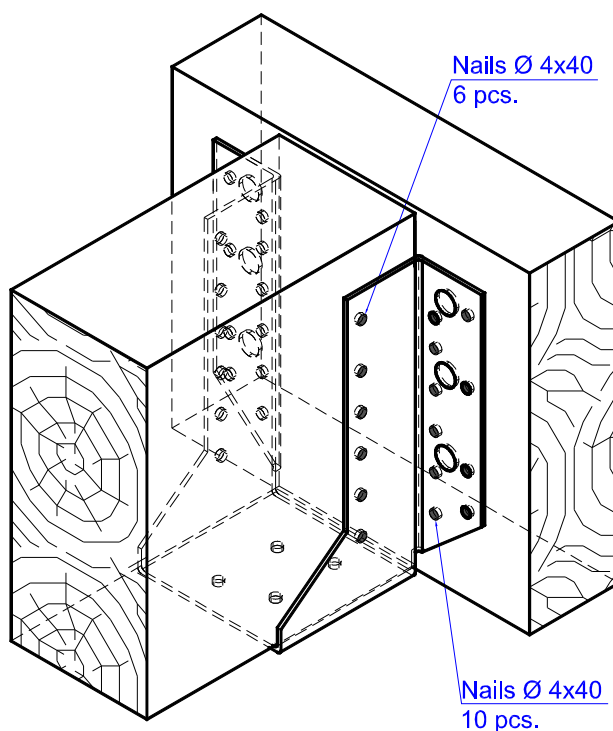


Figure D.9. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x153x2. Position of nails is symmetrical in both sides

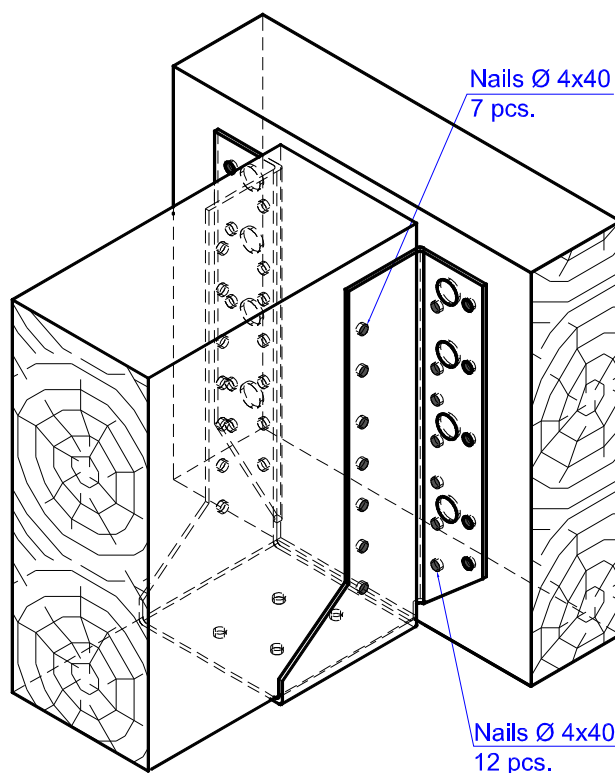


Figure D.10. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x182x2. Position of nails is symmetrical in both sides

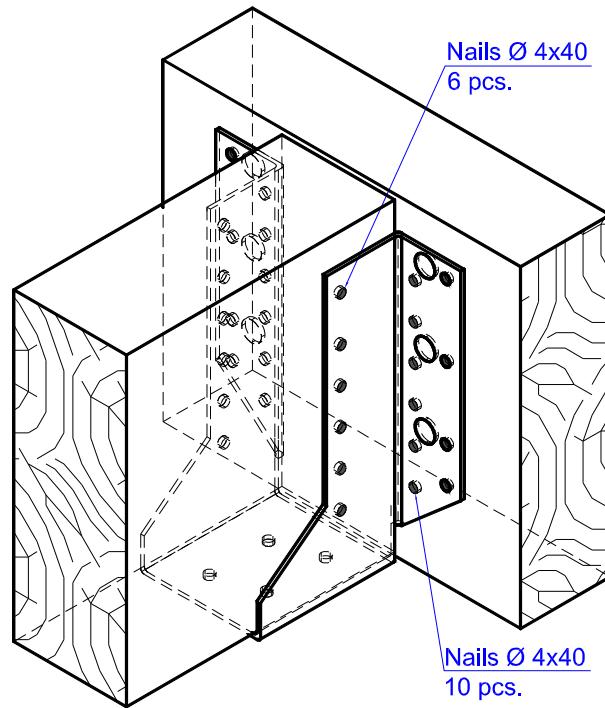


Figure D.11. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 63×158×2. Position of nails is symmetrical in both sides

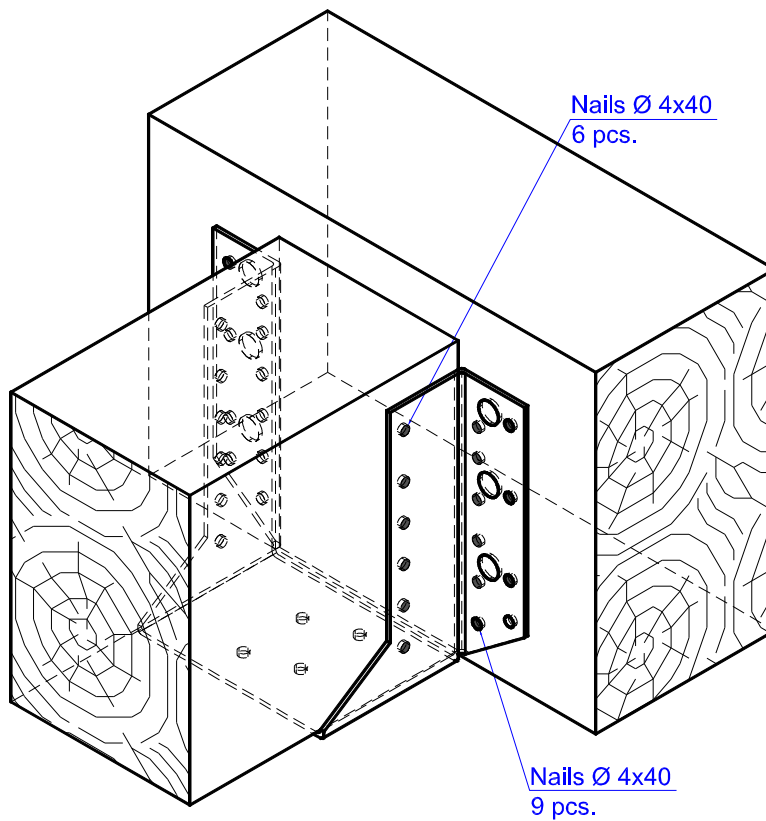


Figure D.12. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100×140×2. Position of nails is symmetrical in both sides

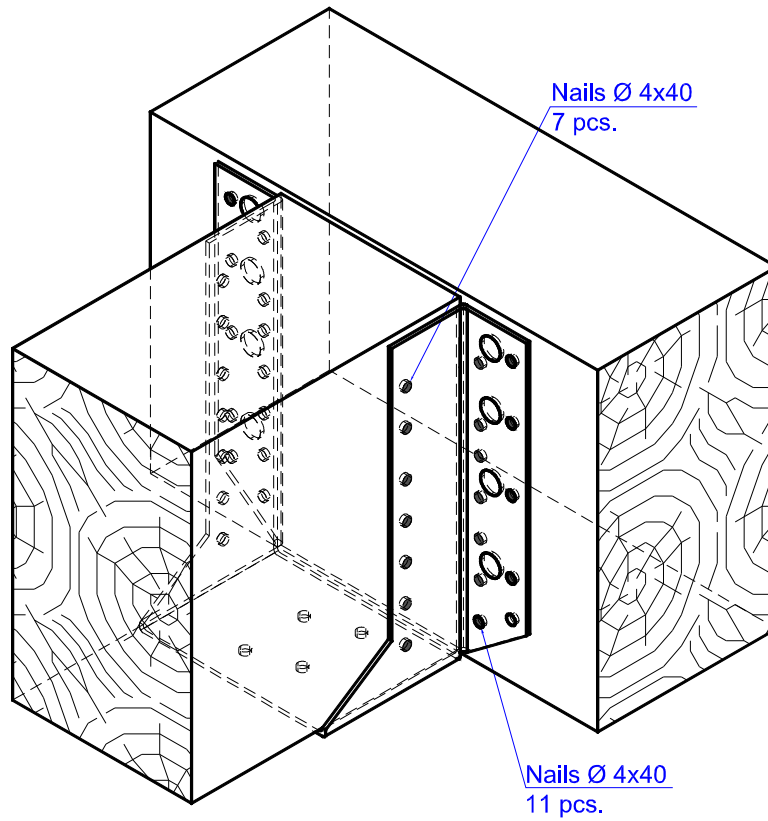


Figure D.13. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100x170x2. Position of nails is symmetrical in both sides

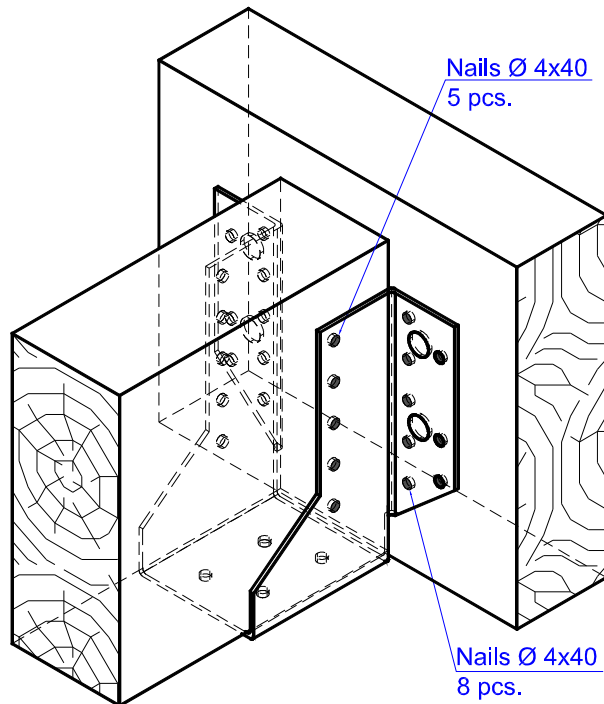


Figure D.14. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 60x130x2. Position of nails is symmetrical in both sides

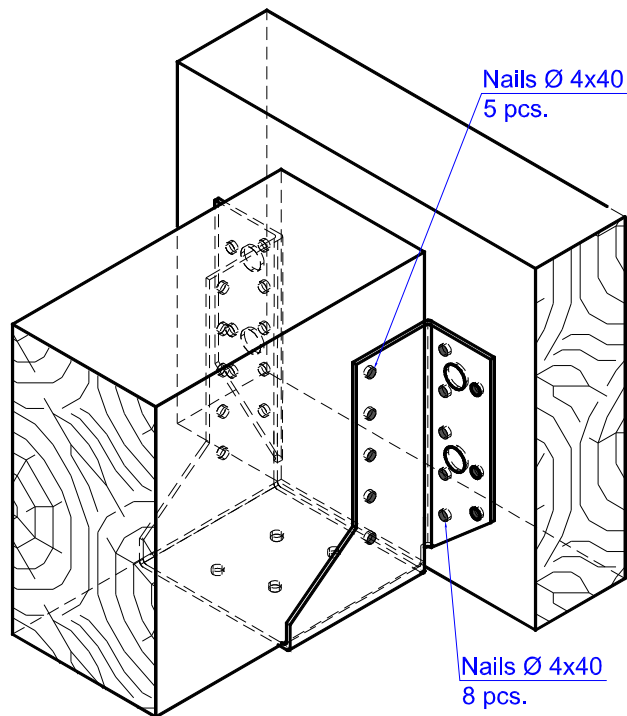


Figure D.15. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x120x2. Position of nails is symmetrical in both sides

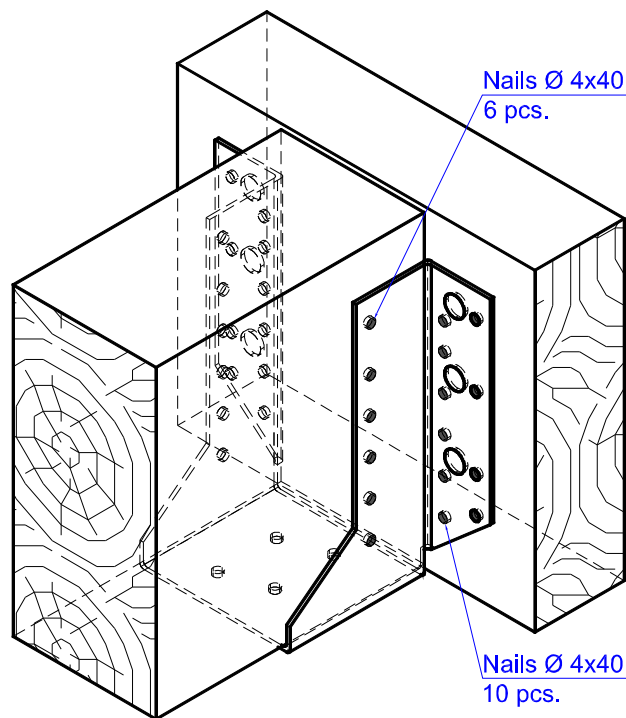


Figure D.16. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x150x2. Position of nails is symmetrical in both sides



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European Technical Assessment

ETA-15/0448
of 2015-08-06

General Part

Technical Assessment Body issuing the European Technical Assessment

VĮ Statybos produkcijos sertifikavimo centras

Trade name of the construction product:

Joist hangers:

- | | |
|---------------------|---------------------|
| - SA 45 × 96 × 2; | - SA 45 × 138 × 2; |
| - SA 45 × 168 × 2; | - SA 51 × 93 × 2; |
| - SA 51 × 135 × 2; | - SA 51 × 165 × 2; |
| - SA 51 × 195 × 2; | - SA 76 × 123 × 2; |
| - SA 76 × 153 × 2; | - SA 76 × 182 × 2; |
| - SA 63 × 158 × 2; | - SA 100 × 140 × 2; |
| - SA 100 × 170 × 2; | - SA 60 × 130 × 2; |
| - SA 80 × 120 × 2; | - SA 80 × 150 × 2 |

Product family to which the above construction product belongs:

EC PAC 13: Three-dimensional nailing plate (Joist hangers for timber to timber connections)

Manufacturer:

UAB "Ardetas"
Žirmūnų g. 46-40, LT-09227 Vilnius
Lithuania
www.ardetas.lt

Manufacturing plant:

UAB "Ardetas"
Arnionių g. 60, LT-18170 Pabradė,
Švenčionių district, Lithuania
www.ardetas.lt

This European Technical Assessment contains:

36 pages including 4 Annexes which form an integral part of this assessment.

Annex – Control plan Contain confidential information and is not included in the European Technical Assessment when that assessment is publicly disseminated

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ETAG 015, edition November 2012, used as European Assessment Document (EAD).

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Specific Parts

1. Technical description of the product

Joist hangers SA 45 × 96 × 2, SA 45 × 138 × 2, SA 45 × 168 × 2, SA 51 × 93 × 2, SA 51 × 135 × 2, SA 51 × 165 × 2, SA 51 × 195 × 2, SA 76 × 123 × 2, SA 76 × 153 × 2, SA 76 × 182 × 2, SA 63 × 158 × 2, SA 100 × 140 × 2, SA 100 × 170 × 2, SA 60 × 130 × 2, SA 80 × 120 × 2 and SA 80 × 150 × 2, are one-piece non-welded face fixed joist hangers to be used in timber to timber connections. They are connected to the timber elements by ringed shank nails. Product details are shown in Annex A.

The joist hangers are made from pre-galvanized steel DX51D+Z275 according to standard EN 10346:2009¹ with minimum yield strength R_e of 250 MPa, minimum tensile strength R_m of 330 MPa and minimum elongation A_{80} of 22 %. Dimensions, hole positions are shown in the Annex C, typical installations are shown in Annex B. Joist hangers are made from steel with normal thickness tolerances according to EN 10143:2006².

2. Specifications of the intended use in accordance with the applicable EAD

Intended use of the joist hangers are the connections between beams of load bearing timber structures, where the requirements for mechanical resistance, stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 shall be fulfilled.

The static and kinematic behaviour of the timber members or the supports shall be as described in Annex B.

The wood members may be of solid timber or glued laminated timber with a characteristic density from 290 kg/m³ to 420 kg/m³. This requirement for material of the wood members may be fulfilled by using the following materials:

- structural solid timber classified to C14-C40 strength class according to EN 338:2010³ and EN 14081-1:2005+A1:2011⁴;
- glulam classified to GL24-GL36 according to EN 14080:2013⁵.

For joints shall be used threaded nails according to EN 14592:2008+A1:2012⁶ with diameter 4,0 mm. Another type of threaded nails may be used with values of axial characteristic load-carrying capacity per nail not less than stated in declaration of performance CE 300147-A3 of the nails producer GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, and with the tensile capacity of the wire for the nails equal to or greater than 650 N/mm².

Annex B states the load-carrying capacities of the joist hangers connections for a characteristic density of 350 kg/m³ of solid timber or glulam. For solid timber or glulam with a lower characteristic density than 350 kg/m³ the load-carrying capacities of the nailed connection shall be modified by the k_{dens} factor:

$$k_{dens} = \sqrt{\frac{\rho_k}{350}}$$

where:

ρ_k is the characteristic density of timber used in the connection.

¹ EN 10346:2009 Continuously hot-dip coated steel flat products - Technical delivery conditions.

² EN 10143:2006 Continuously hot-dip coated steel sheet and strip - Tolerances on dimensions and shape.

³ EN 338:2009 Structural timber - Strength classes.

⁴ EN 14081-1:2005+A1:2011 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.

⁵ EN 14080:2013 Timber structures - Glued laminated timber and glued solid timber - Requirements

⁶ EN 14592:2008+A1:2012 Timber structures - Dowel-type fasteners – Requirements

The design of the connections shall be in accordance with Eurocode 5⁷ or according to similar national regulations for design. The wood members shall have the thickness which is larger than the penetration depth of the nails into the members.

The joist hangers are primarily intended for use in timber structures subject to the dry, internal conditions defined by service class 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading. The joist hangers can also be used in outdoor structures, defined by service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield, ultimate strength and ductility is employed.

They are not intended for used in areas where they might support seismic actions.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the three-dimensional nailing plates of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

⁷ EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

2.1 Installation

2.1.1 Joints

A connector (three-dimensional nailing plate – joist hangers) is deemed fit for its intended use provided:

- joints are designed in accordance with Eurocode 5 or an appropriate national regulations for timber constructions design under the responsibility of an engineer experienced in timber structures;
- the structural members to which the joist hanger are fixed shall be restrained against rotation;
- the structural members of solid timber shall be of strength class C14 or better;
- the structural members of glulam shall be of strength class GL24 or better;
- the structural members shall be free from wane under the joist hanger;
- the tensile strength perpendicular to the grain capacity of the timber member to be used in conjunction with the joist hanger is to be checked by the designer of the structure to ensure that it is not less than the joist hangers capacity and, if necessary, the joist hanger capacity shall be reduced accordingly;
- the gap between the timber members does not exceed 3 mm;
- there are no specific requirements relating to preparation of the timber members.

2.1.2 Criteria

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

- installation is carried out by personnel under the direction of supervisors, which 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 are used.

2.1.3 Responsibility of the manufacturer

It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in sections 8, 9 and 10 of this European technical assessment, is given to those concerned. This information may be made by replicating the respective parts of this European Technical Assessment. 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.

All data shall be presented in a clear and explicit form.

2.2 Recommendations

2.2.1 Recommendations on packaging, transport and storage

The joist 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 connectors should be treated as conventional metallic building products.

2.2.2 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.

3. Performance of the product and references to the methods used for its assessment:

| ETAG paragraph | Characteristic | Assessment of characteristic |
|---|---|--|
| 3.1 Mechanical resistance and stability | | |
| 2.4.1 | Characteristic load-carrying capacity | see Annex B |
| 2.4.1 | Stiffness | No performance determined |
| 2.4.1 | Ductility in cyclic testing | No performance determined |
| 3.2 Safety in case of fire | | |
| 2.4.2.1 | Reaction to fire | The joist hangers are made from steel classified as Euroclass A1 in accordance with EN 13501-1:2007+A1:2009 ⁸ and EC decision 96/603/EC ⁹ , amended by EC Decision 2000/605/EC ¹⁰ |
| 2.4.2.2 | Resistance to fire | No performance determined |
| 3.3 Hygiene, health and the environment | | |
| 2.4.3 | Release of dangerous substances | No dangerous materials ¹⁾ |
| 3.4 General aspects relating to fitness for use (serviceability) | | |
| 2.4.7 | Durability | |
| 2.4.7.2 | Resistance to corrosion and deterioration | 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 |
| 2.4.8 | Dimensional stability | Tests are carried out during the assessment for mechanical resistance and stability |

¹⁾ Based on the declaration of the manufacturer and in accordance with TR 034¹¹ the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

In accordance with the Regulation (EC) No 1907/2006 of the European Parliament and the Council of 18 December 2006¹² and http://ec.europa.eu/growth/sectors/chemicals/reach/index_en.htm, the product does not contain/release dangerous substances.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, 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 Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply

3.1 Mechanical resistance and stability

The assessment of fitness for the intended use has been made in accordance with ETAG 015. The characteristic load-carrying capacities of the products are given in Annex B, which have been derived by calculation.

⁸ EN 13501-1:2007+A1:2009 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

⁹ OJ L 267, 19.10.1996, p. 23.

¹⁰ OJ L 258, 12.10.2000, p. 36

¹¹ General ER 3 Checklist for ETAGs/CUPAs/ETAs-Content and/or release of dangerous substances in products/kits, Edition March 2012

¹² OJ L 396, 30.12.2006, p. 1

The characteristic load-carrying capacities are based on the characteristic values of the nail connections, timber components and steel plates. The calculations were performed according to Eurocode 5.

According to EN 1990¹³ for structures or structural members that comprise more than one material acting in association, partial factors of all used materials shall be computed to obtain design values.

To obtain design values the capacities have to be divided by different partial factors of the material properties, the nail connection and the timber components in addition multiplied with the coefficient k_{mod} .

$$F_{1,d} = \frac{F_{1,k} \cdot k_{mod}}{\gamma_M}$$

where:

$F_{1,k}$ is the characteristic load-carrying capacity;

k_{mod} is the modification factor depending on service class and load-duration classes, see EN 1995-1-1¹⁴, § 3.1.3;

γ_M is the partial factor for a material property, according EN 1995-1-1, § 2.4.1.

The characteristic load-carrying capacity in the direction F is presented in the Annex B. These values are based on the assumption that there is a maximum gap of 3 mm between the timber members (see Annex B, Figure B.1), the members are laterally restrained and wane is not present in the timber at the joint. Minimum spacings and edge and end distances for nails shall be according to Eurocode 5. The number and position of nails are shown in Annex D.

The characteristic capacities of the joist hangers should be used for design in accordance with Eurocode 5 or a similar national regulations for timber structures design.

In the calculations are used threaded nails of 4,0 mm diameter, according EN 14592:2008+A1:2012. Nails manufacturer - GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, declaration of performance CE 300147-A3.

The characteristic axial load-carrying withdrawal capacity of a nails is taken according nails manufacturer declaration of performance CE 300147-A3. The characteristic lateral load-carrying capacity of nails calculated from the formulas of Eurocode 5 as for thin steel plate, see EN 1995-1-1, expression (8.9).

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.

13 EN 1990 Eurocode - Basis of structural design

14 EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

3.2 Safety in case of fire

Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, therefore there are no relevant aspects of performance to this Basic Requirement for the connectors.

3.3 Hygiene, health and the environment

Based on the declaration of the manufacturer and in accordance with TR 034, dated March 2012, the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

3.4 General aspects relating to fitness for use (durability and serviceability)

3.4.1 Durability

The joist 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 according Eurocode 5:

- service class 1 – is characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 65 % for a few weeks per year;
- service class 2 - characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 85 % for a few weeks per year.

In accordance with ETAG 015 the joist hangers are made from hot-dip zinc coating steel DX51D+Z275 according to EN 10346:2009 with a minimum yield strength R_e of 250 MPa, a minimum tensile strength R_m of 330 MPa and a minimum elongation A_{80} of 22 %.

3.4.2 Dimensional stability

Additional tests are not required for this property as it is covered during the assessment.

4. Assessment and verification of constancy of performance (AVPC) system applied, with reference to its legal base

According to the decision 97/638/EC¹⁵ of the European Commission, the system of assessment and verification of constancy of performance applied to this product shall be as laid down in the Commission delegated regulation (EU) No 568/2014¹⁶ amending Annex V to Regulation (EU) No 305/2011¹⁷ of the European Parliament and of the Council, referred to as System 2+.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the Control Plan deposited with the Statybos produkcijos sertifikavimo centras (SPSC), with which the factory production control shall be in accordance.

Issued in Vilnius on 2015-08-06

By State Enterprise Statybos produkcijos sertifikavimo centras (SPSC)

**Director
Robertas Encius**

¹⁵ Commission Decision 97/638/EC of 19 September 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards fasteners for structural timber (OJ L 268, 1.10.1997, p. 36).

¹⁶ Commission delegated regulation (EU) No 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products (OJ L 157, 27.05.2014, p. 76).

¹⁷ Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (OJ L 88, 4.04.2011, p. 5).

ANNEX A**Product details****Table A.1.** Steel for joist hanger specification

| Joist hanger type | | Steel thickness (mm) | Steel and coating specification ¹⁾ |
|-------------------|---------------|----------------------|---|
| SA | 45 × 96 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 138 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 168 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 93 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 135 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 165 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 195 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 123 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 153 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 182 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 63 × 158 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 140 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 170 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 60 × 130 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 120 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 150 × 2 | 2,0 | EN 10346 - DX51D + Z275 |

¹⁾ requirements according joist hangers manufacturer's UAB "Ardetas" documentation:
- minimum yield strength, $R_{p0,2}$ or R_{eL} – 250 MPa;
- minimum tensile strength, R_m – 330 MPa;
- minimum elongation, A_{80} – 22 % (according requirements of EN 10346:2009)

The joist hanger drawings with dimensions presented in the Annex C.

Table A.2. Nails specification

| Nail type according EN 14592 | Dimensions (mm) | Coating specification |
|-------------------------------|-----------------|------------------------------|
| GBO Fastening systems AB nail | 40 × 4,0 | 12 μm (ISO 2081 - Fe/Zn12/C) |

Characteristic capacities of nails for a characteristic density of the wood members 350 kg/m³:
- characteristic withdrawal capacity, $f_{ax,k}$ – 7,8 N/mm²;
- characteristic yield moment, $M_{y,Rk}$ – 7168 Nmm;
Tensile capacity of the wire for nails – 650 N/mm².

ANNEX B

Characteristic load-carrying capacities

B.1 Support conditions

The distance between the timber members in the area of the connection must not exceed 3 mm. The members shall be prevented from rotation.

B.2 Fastener specification

Number and position of nails presented in the Table B.1 and Annex D.

B.3 Wane

Wane is not allowed, the timber has to be sharp-edged in the area of the contact with the joist hanger and inside the joist hanger.

B.4 Characteristic load-carrying capacities

Timber beam to timber beam connections with an joist hanger

Table B.1. Characteristic load-carrying capacities $F_{1,k}$ of timber beam to timber beam connection for load direction according Figure B.1

| Joist hanger type | | Nails dimensions (mm) | Number of nails in | | Position of nails shown in Figure 2) | $F_{1,k}$ kN |
|-------------------|---------------|-----------------------|--------------------|------------------------------|--------------------------------------|--------------|
| | | | primary beam | secondary beam ¹⁾ | | |
| SA | 45 × 96 × 2 | 40 × 4,0 | 6 | 3 | D.1 | 3,45 |
| SA | 45 × 138 × 2 | 40 × 4,0 | 10 | 5 | D.2 | 5,76 |
| SA | 45 × 168 × 2 | 40 × 4,0 | 12 | 6 | D.3 | 6,91 |
| SA | 51 × 93 × 2 | 40 × 4,0 | 6 | 3 | D.4 | 3,45 |
| SA | 51 × 135 × 2 | 40 × 4,0 | 10 | 5 | D.5 | 5,76 |
| SA | 51 × 165 × 2 | 40 × 4,0 | 12 | 6 | D.6 | 6,91 |
| SA | 51 × 195 × 2 | 40 × 4,0 | 14 | 7 | D.7 | 8,06 |
| SA | 76 × 123 × 2 | 40 × 4,0 | 16 | 10 | D.8 | 11,5 |
| SA | 76 × 153 × 2 | 40 × 4,0 | 20 | 12 | D.9 | 13,8 |
| SA | 76 × 182 × 2 | 40 × 4,0 | 24 | 14 | D.10 | 16,1 |
| SA | 63 × 158 × 2 | 40 × 4,0 | 20 | 12 | D.11 | 13,8 |
| SA | 100 × 140 × 2 | 40 × 4,0 | 18 | 12 | D.12 | 13,8 |
| SA | 100 × 170 × 2 | 40 × 4,0 | 22 | 14 | D.13 | 16,1 |
| SA | 60 × 130 × 2 | 40 × 4,0 | 16 | 10 | D.14 | 11,5 |
| SA | 80 × 120 × 2 | 40 × 4,0 | 16 | 10 | D.15 | 11,5 |
| SA | 80 × 150 × 2 | 40 × 4,0 | 20 | 12 | D.16 | 13,8 |

¹⁾ with predrilled holes, Ø3,2 mm
²⁾ see Annex D

When load-carrying capacity is calculated the possibility of splinting caused by the tension perpendicular to the grain, shall be taken into account.

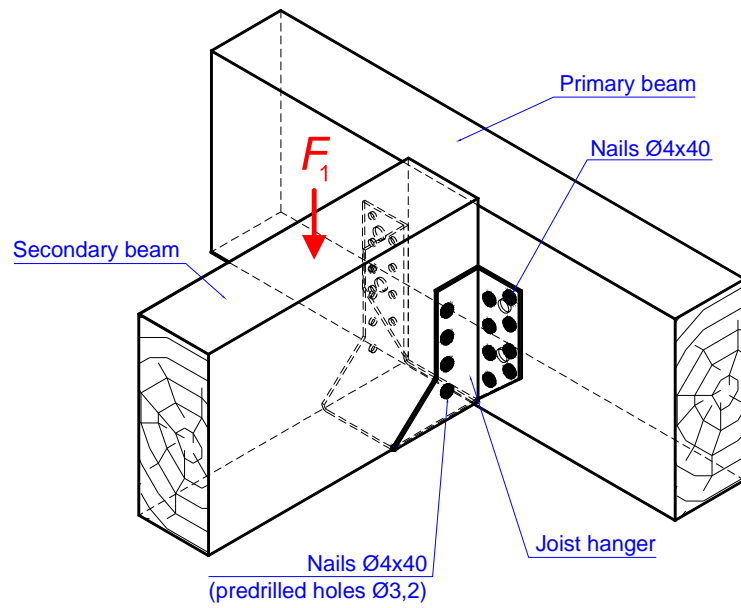


Figure B.1. Typical installation of the joist hanger in the timber beam to timber beam connections

ANNEX C

Joist hangers dimensions

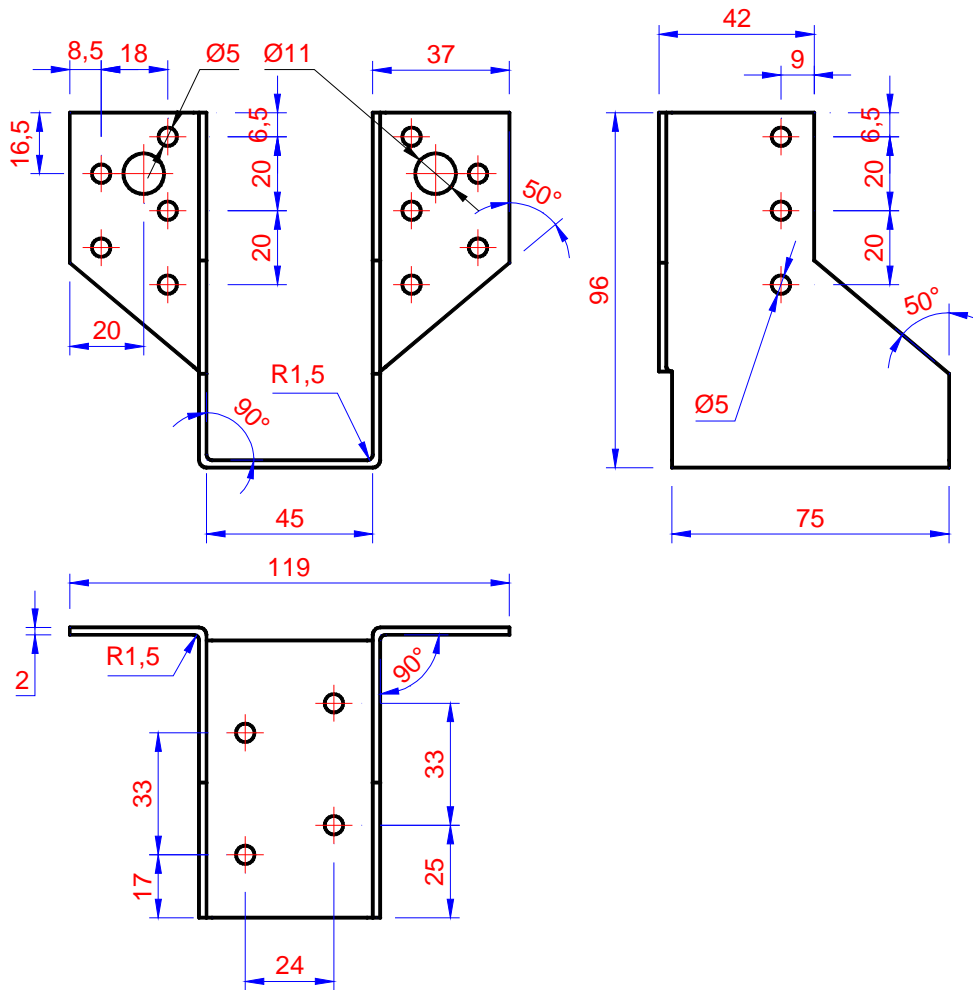


Figure C.1. Joist hanger SA 45 x 96 x 2

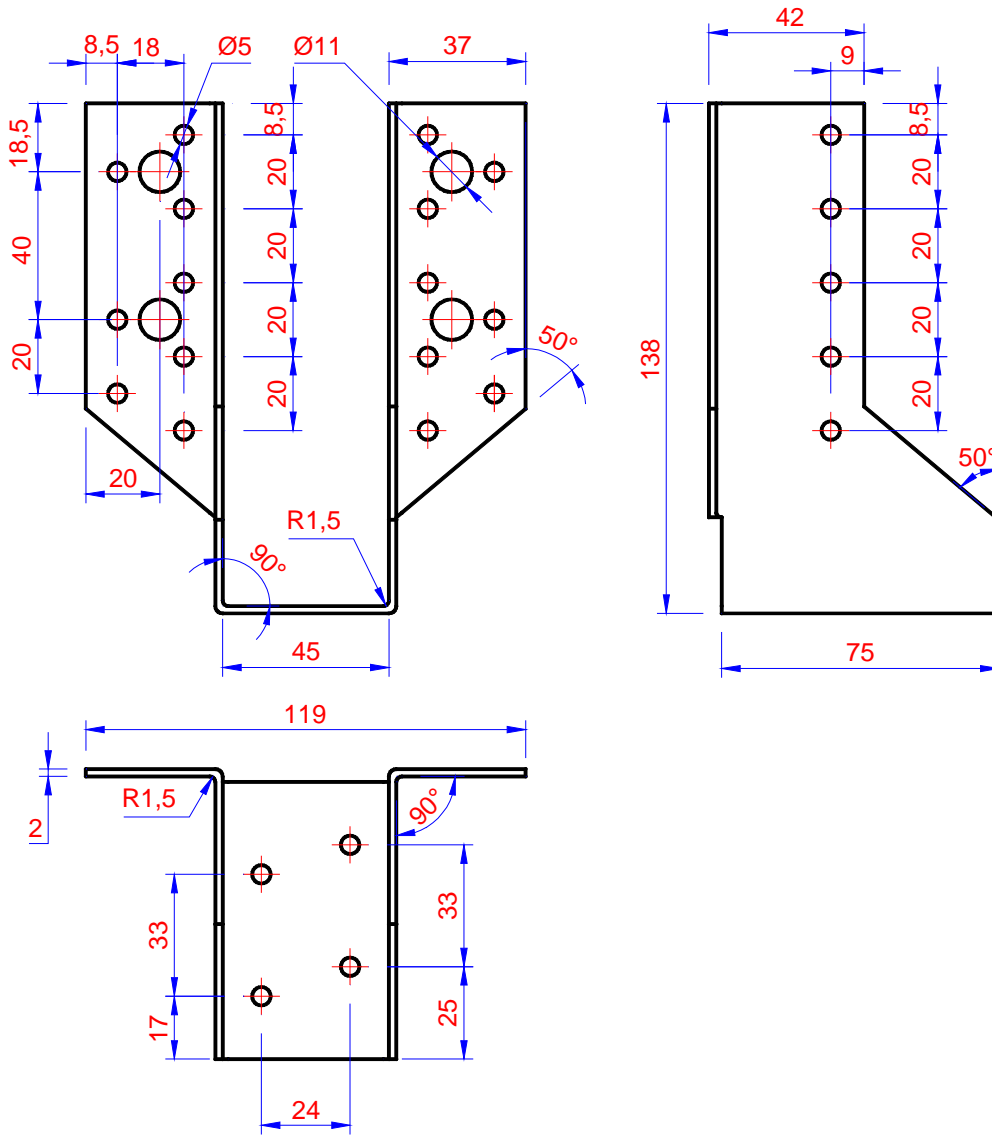


Figure C.2. Joist hanger SA 45 x 138 x 2

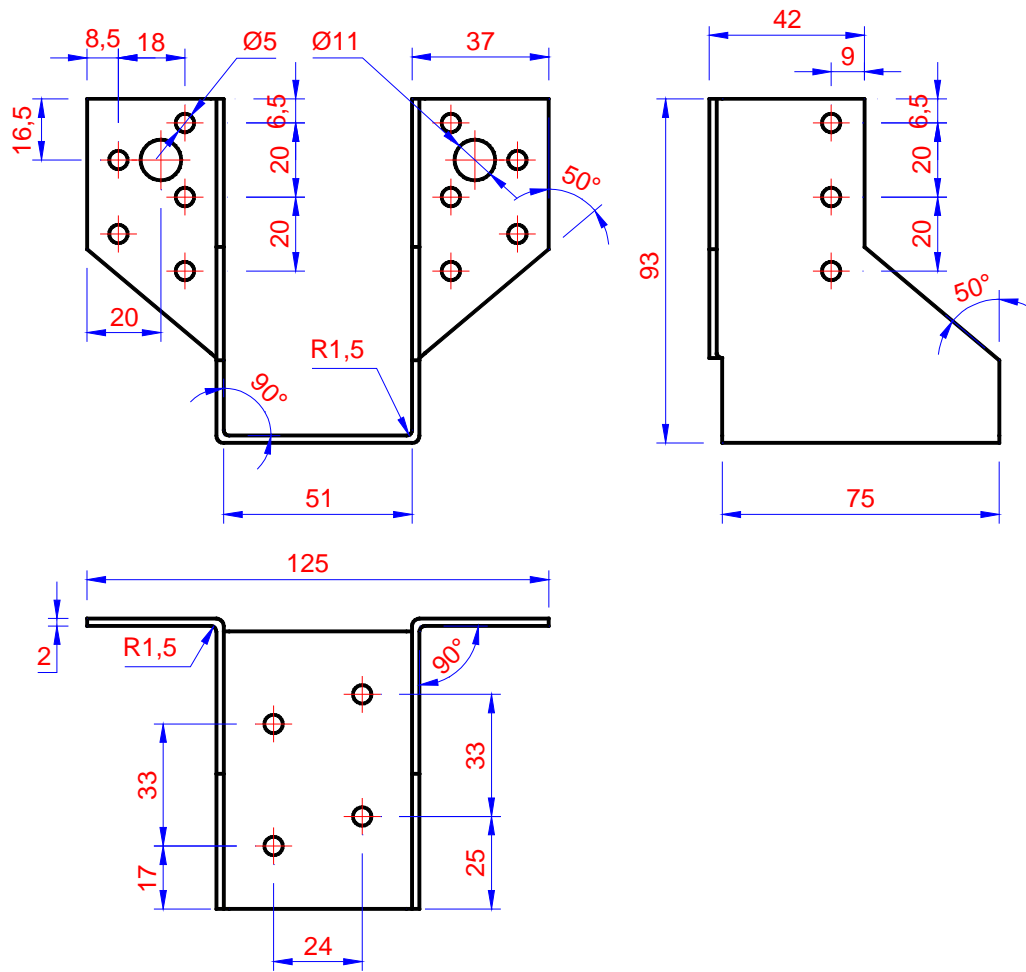


Figure C.4. Joist hanger SA 51 x 93 x 2

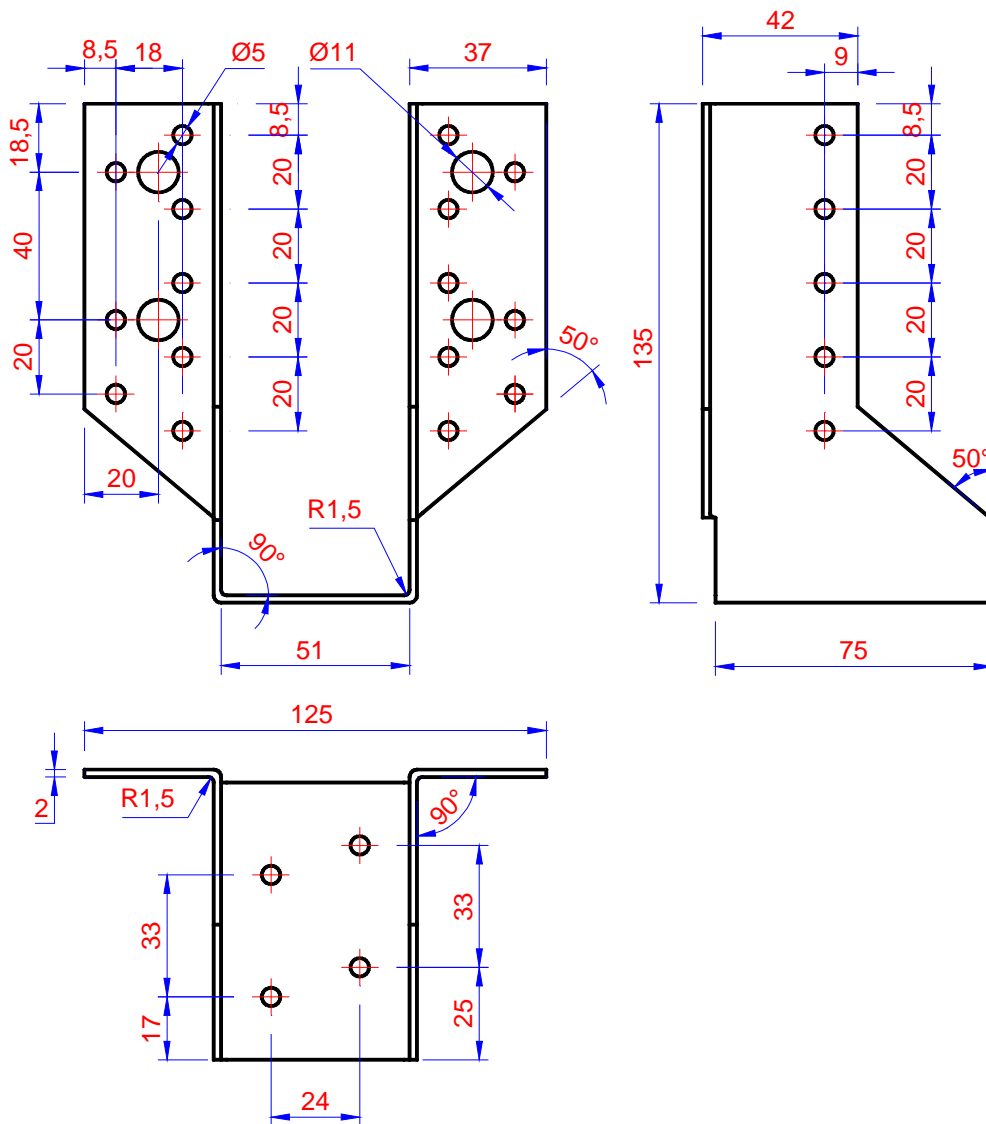


Figure C.5. Joist hanger SA 51 x 135 x 2

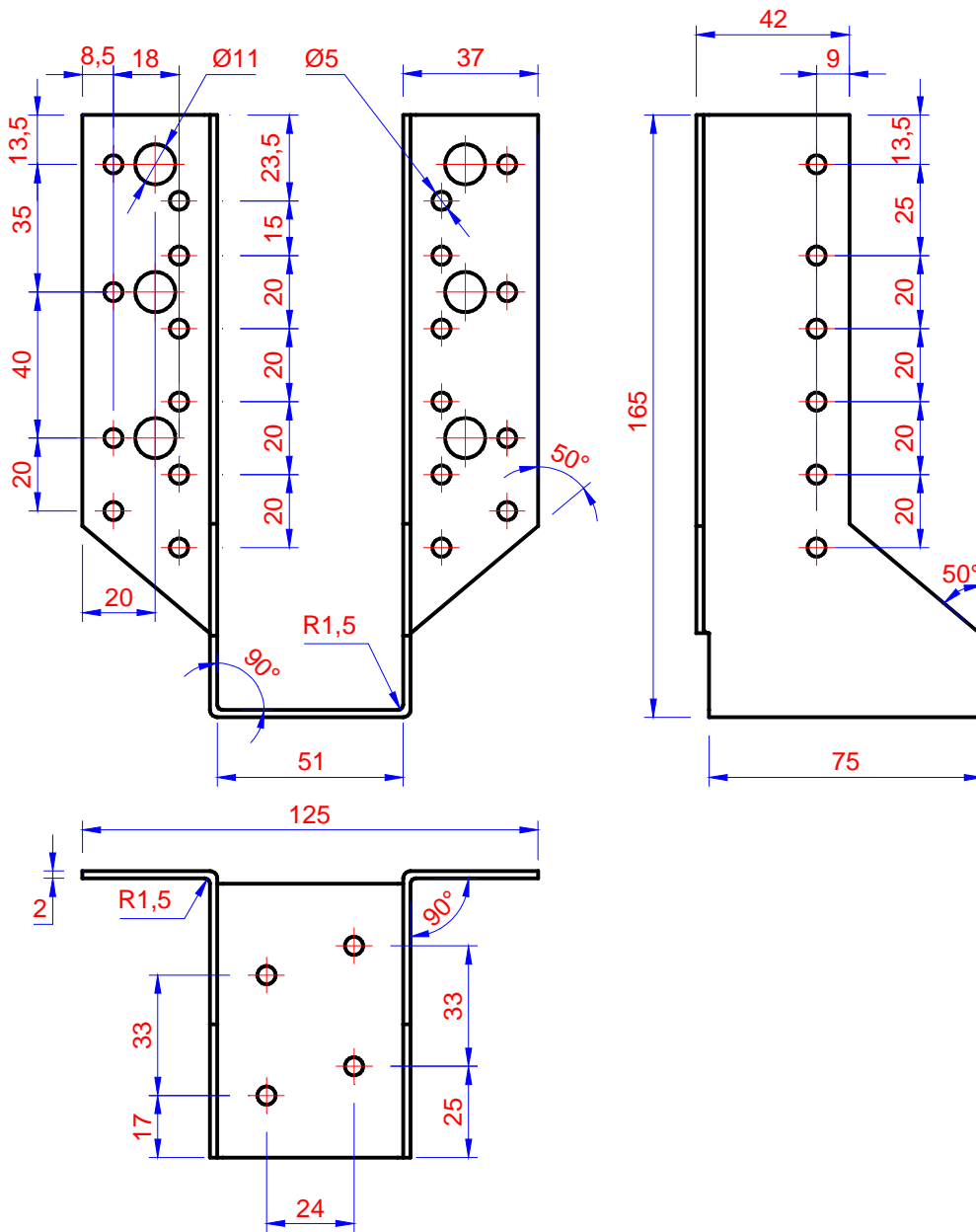


Figure C.6. Joist hanger SA 51 x 165 x 2

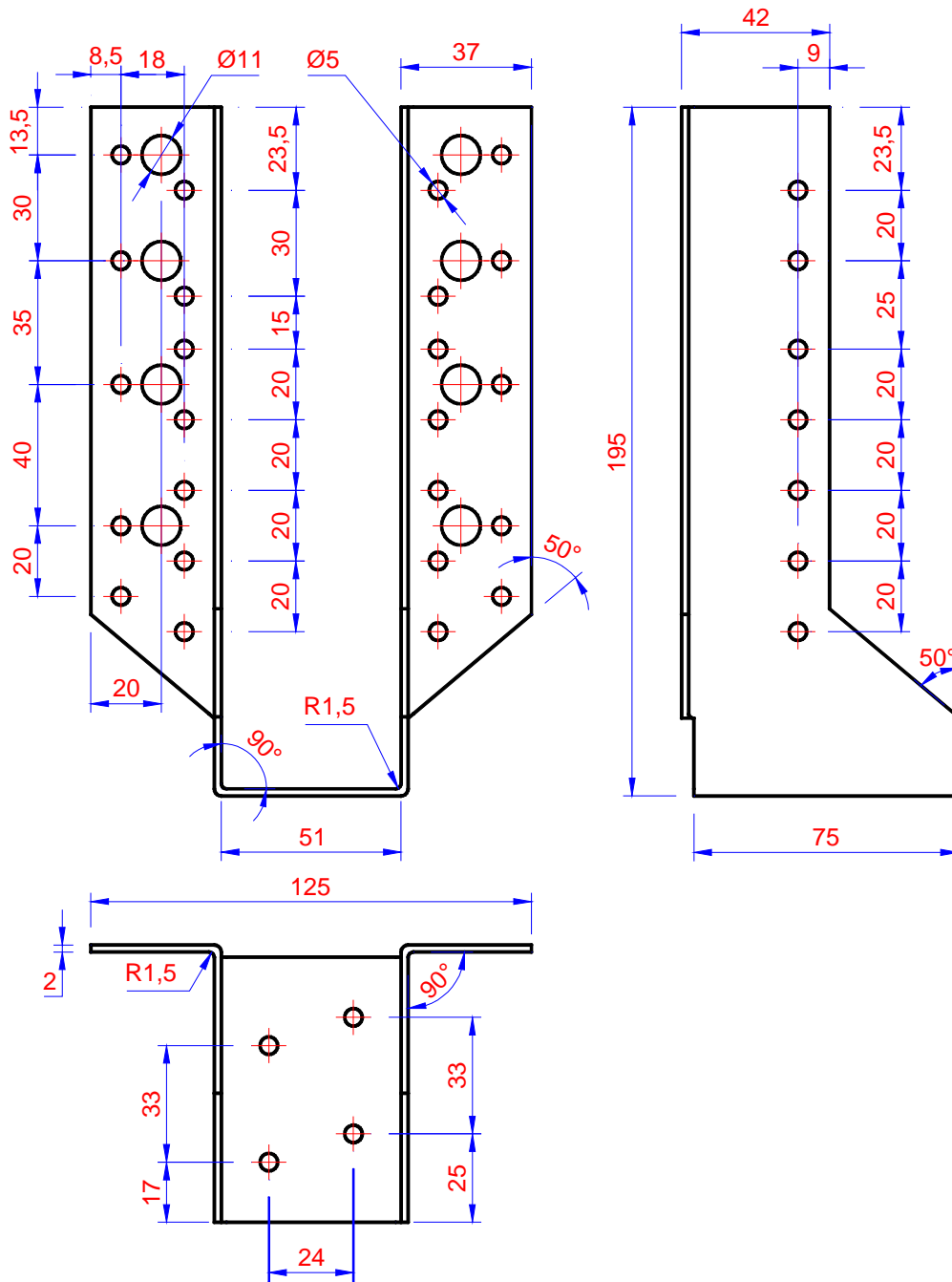


Figure C.7. Joist hanger SA 51 x 195 x 2

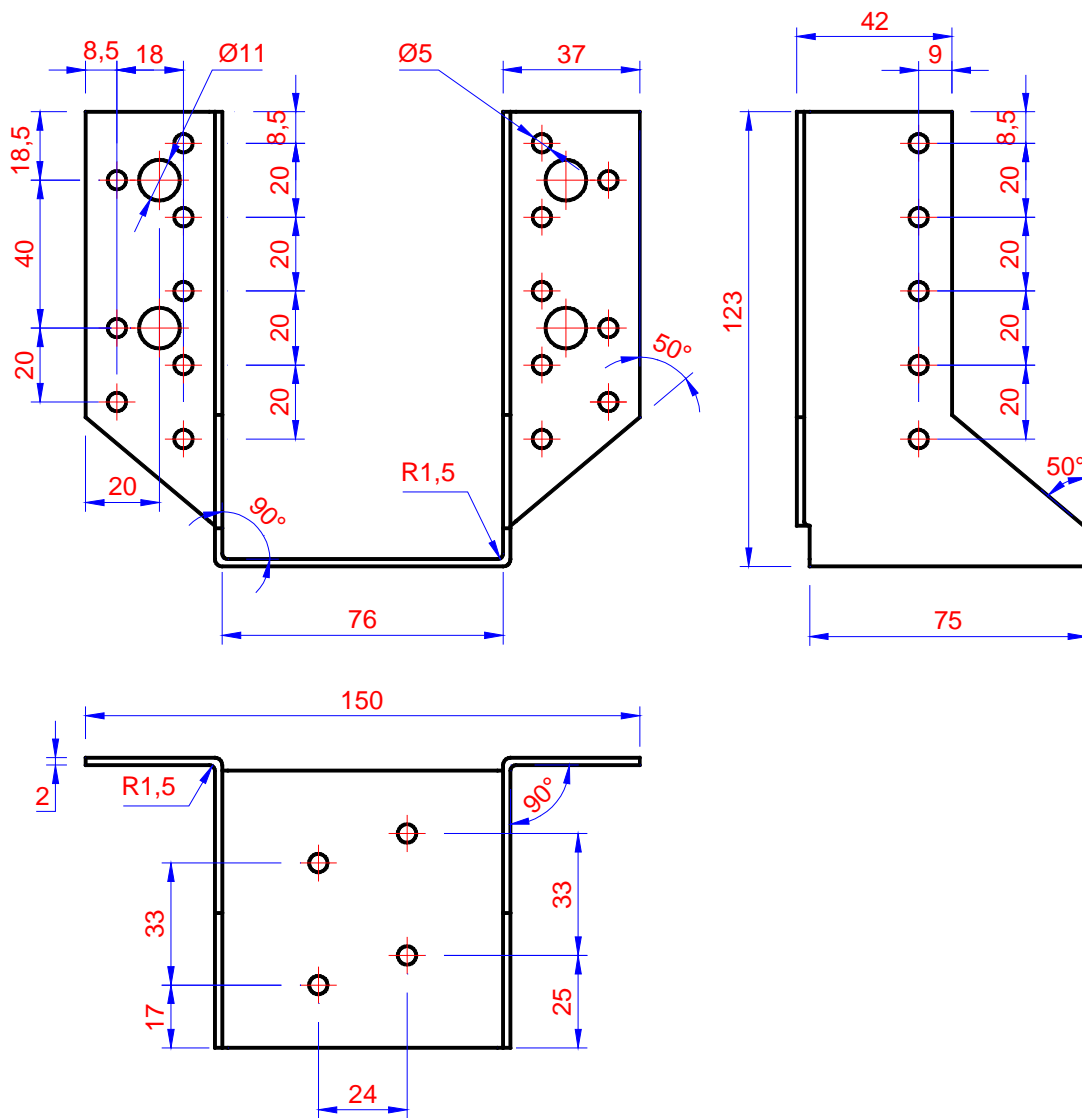


Figure C.8. Joist hanger SA 76 x 123 x 2

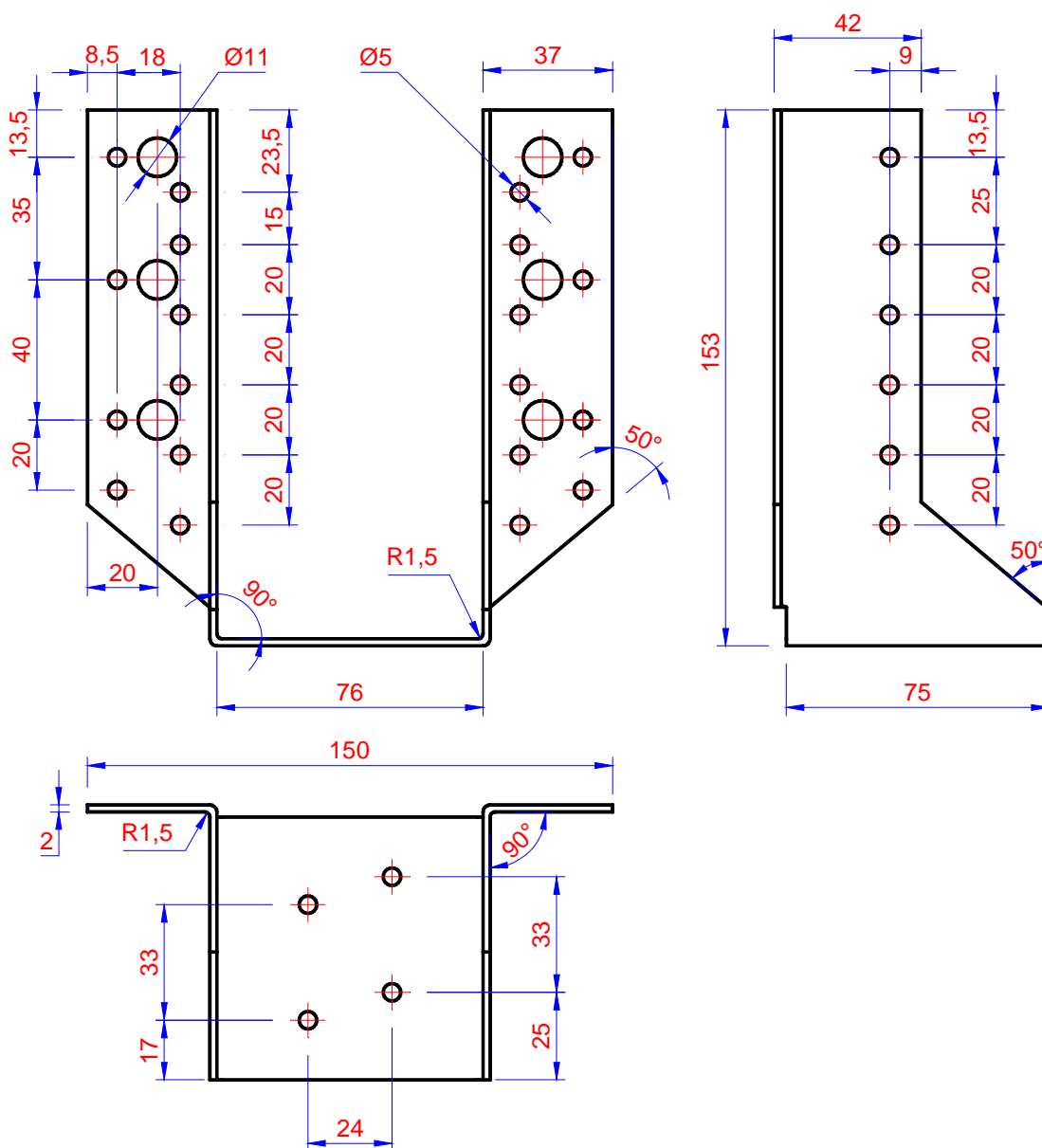


Figure C.9. Joist hanger SA 76 x 153 x 2

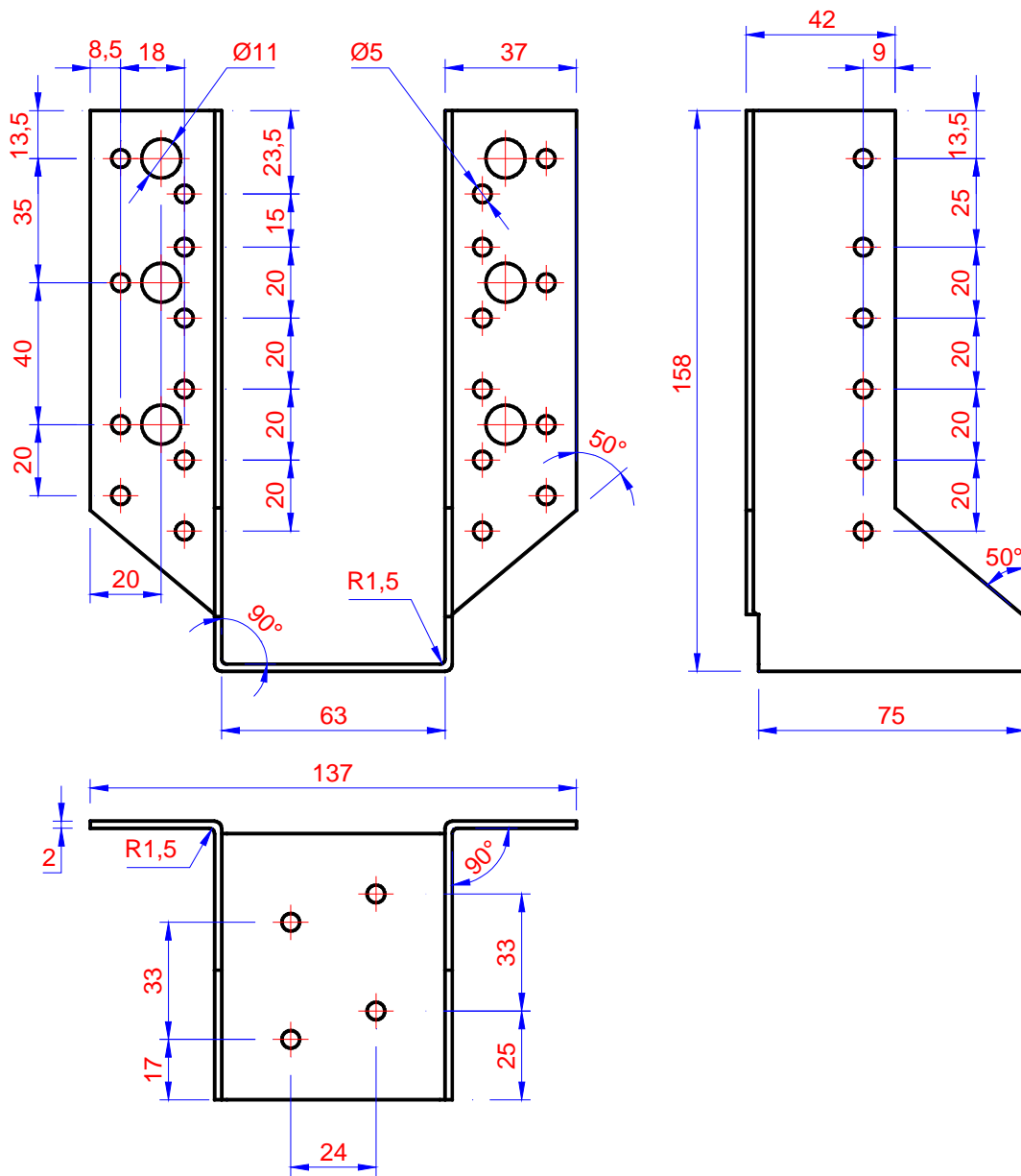


Figure C.11. Joist hanger SA 63 x 158 x 2

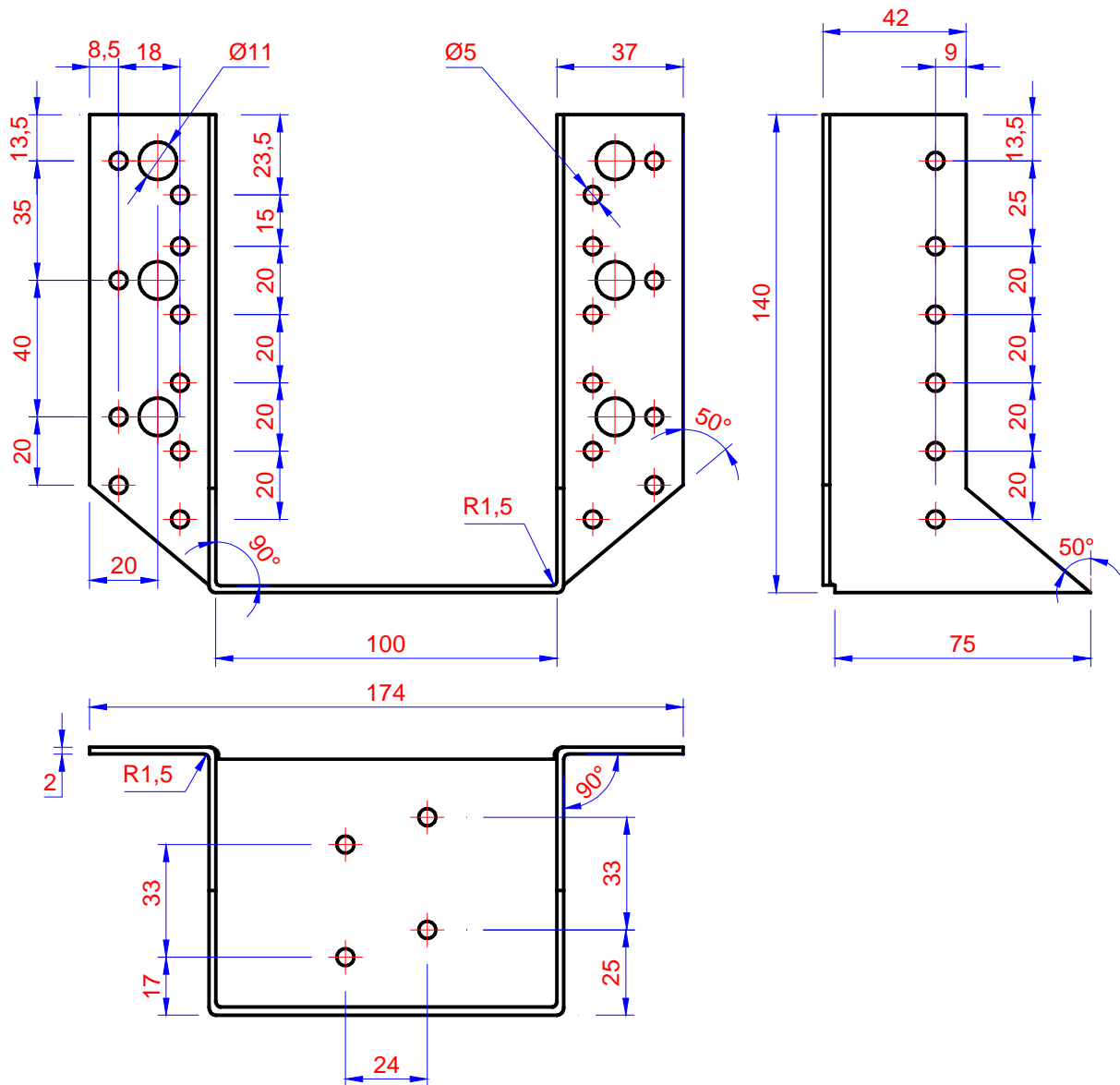


Figure C.12. Joist hanger SA 100 x 140 x 2

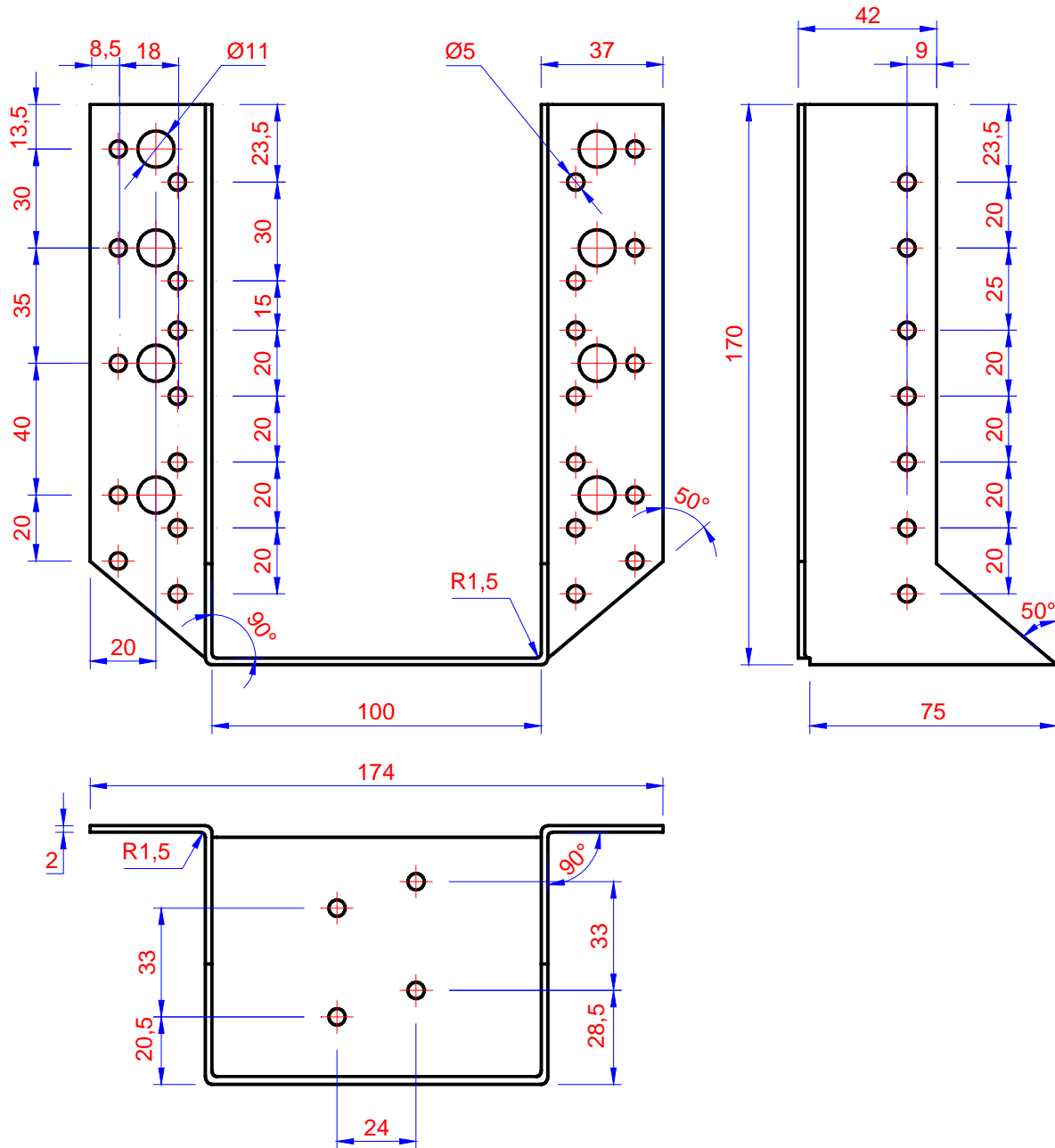


Figure C.13. Joist hanger SA 100 x 170 x 2

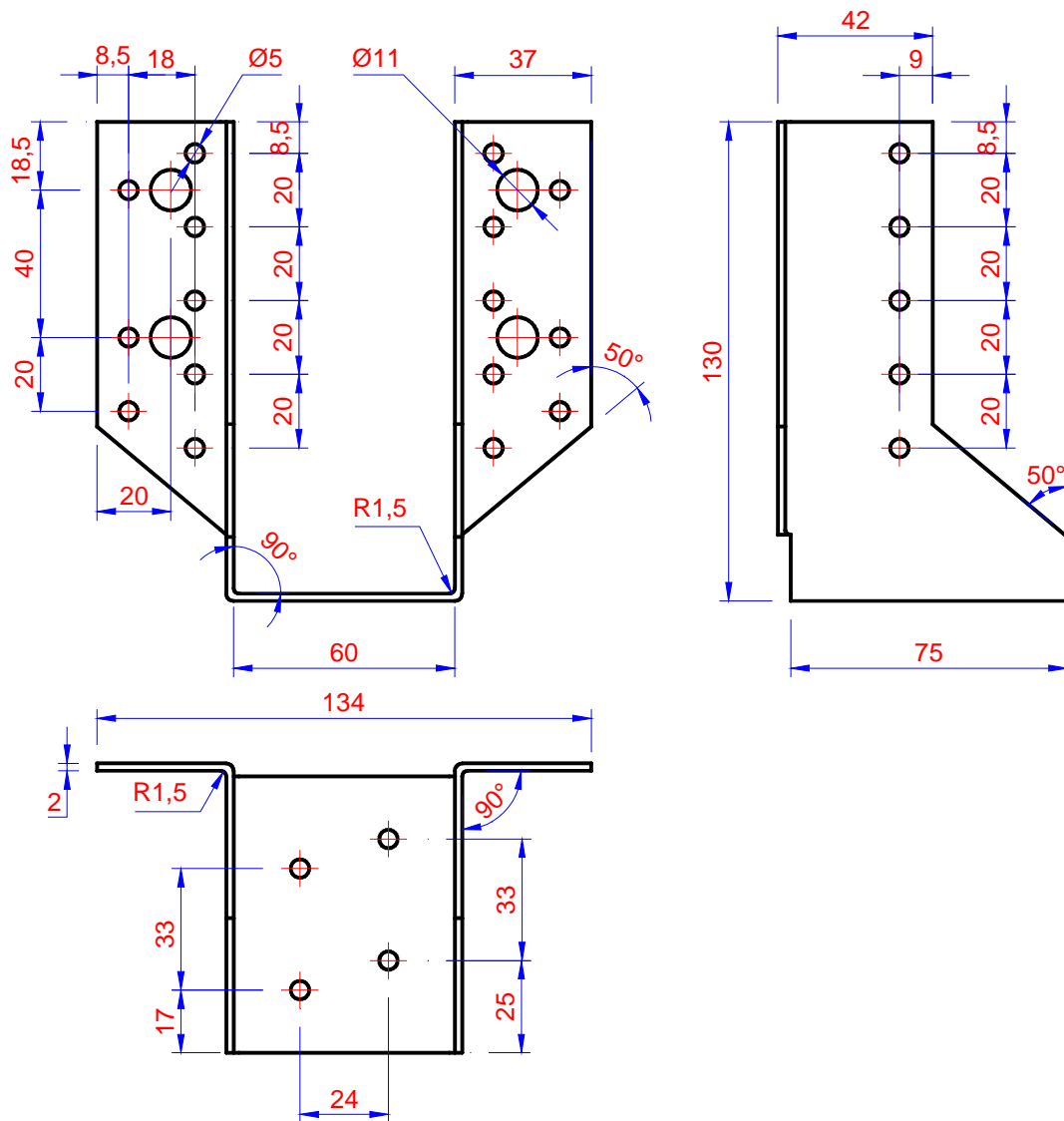


Figure C.14. Joist hanger SA 60 x 130 x 2

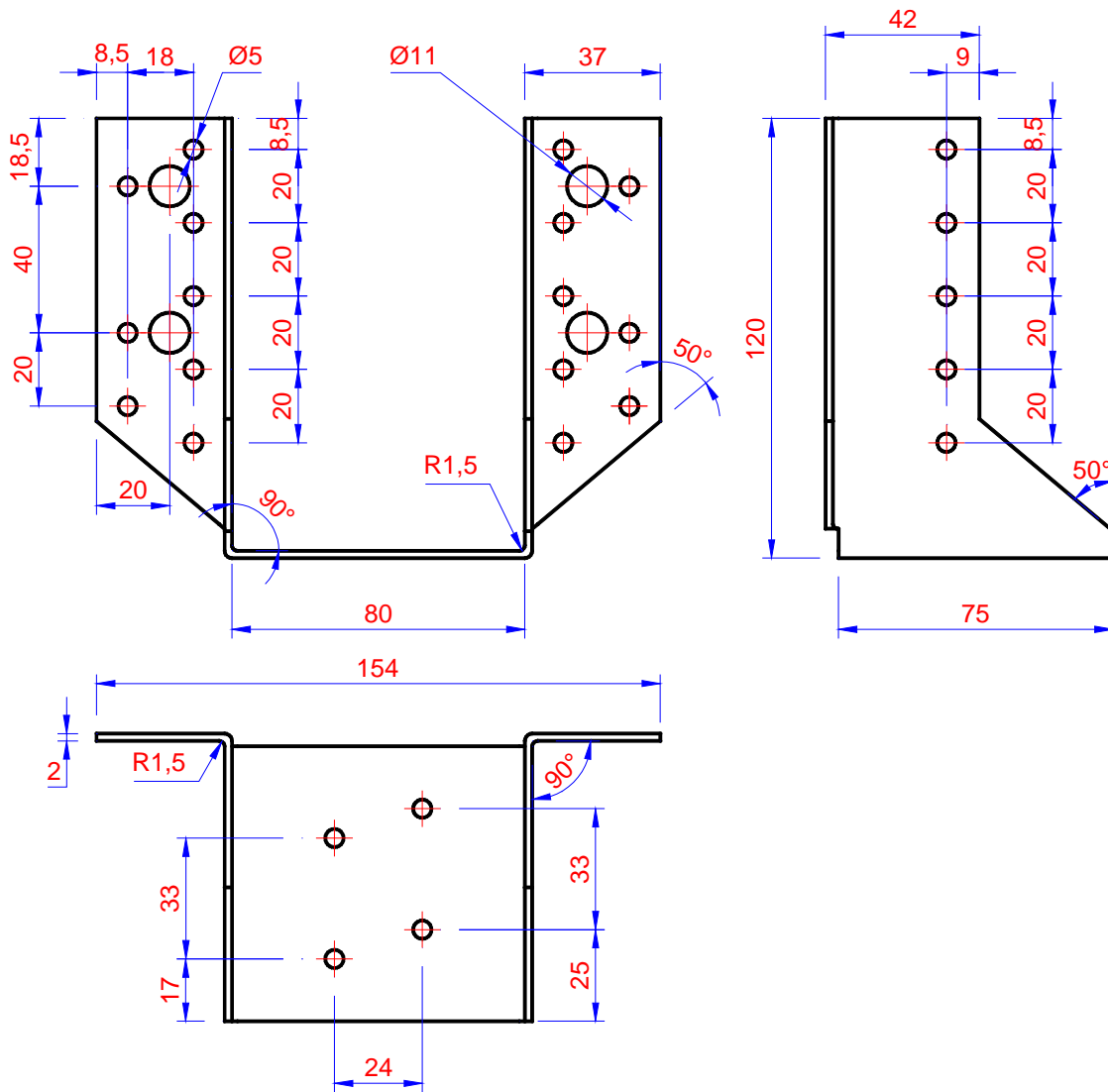


Figure C.15. Joist hanger SA 80 x 120 x 2

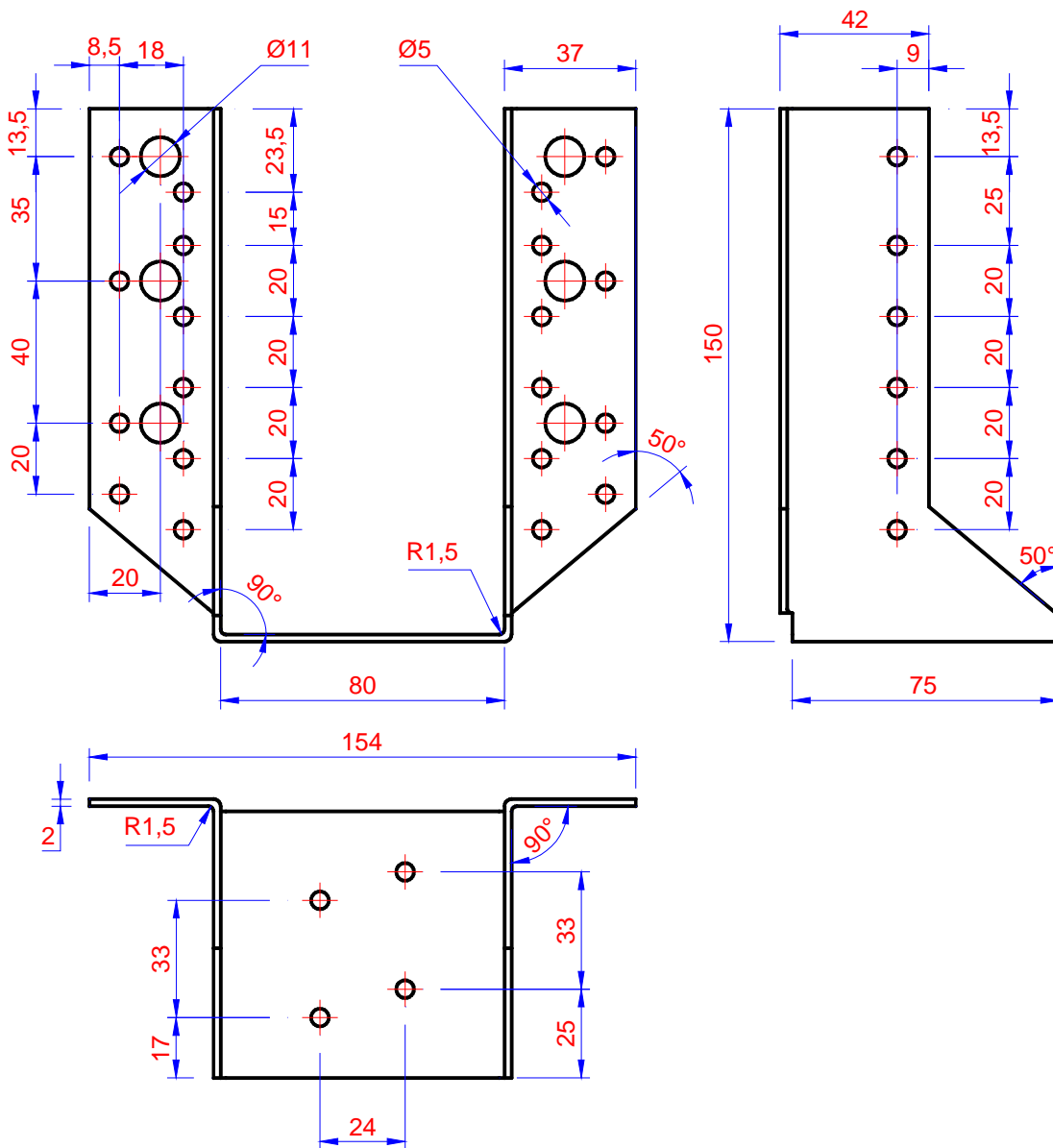


Figure C.16. Joist hanger SA 80 x 150 x 2

ANNEX D

Number and positions of nails in the joist hangers

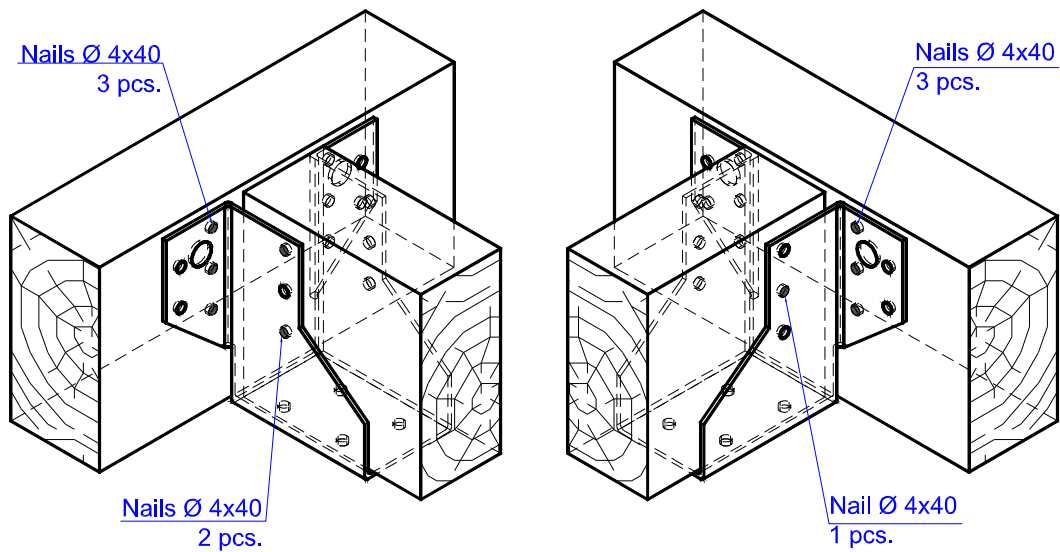


Figure D.1. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x96x2

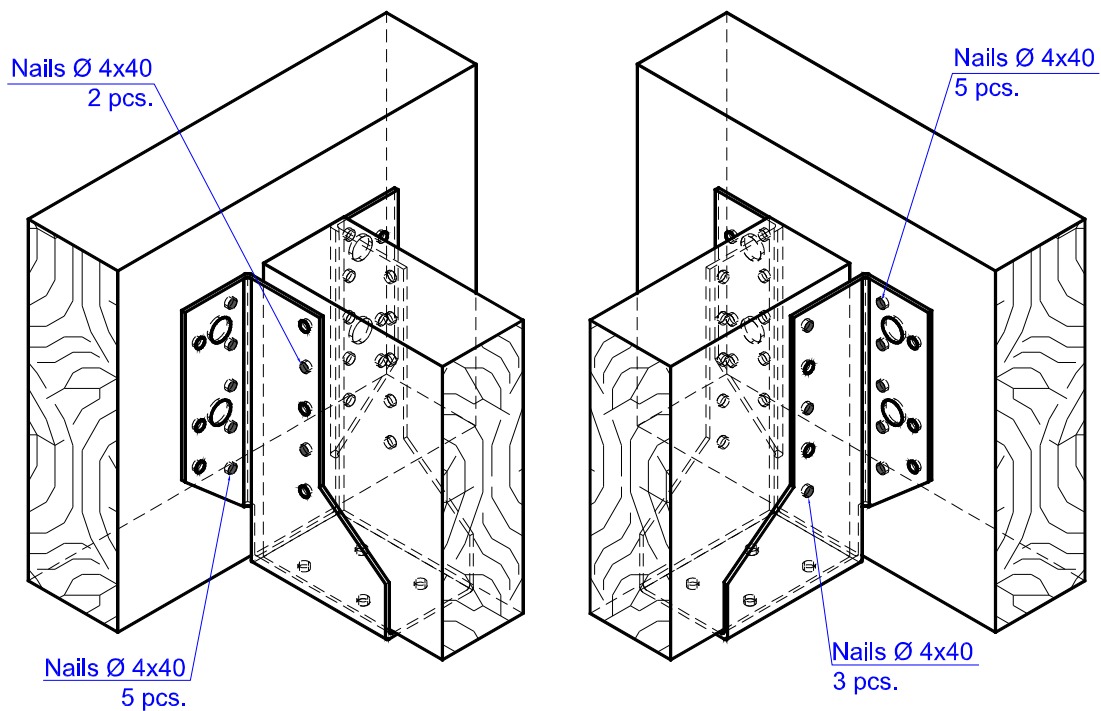


Figure D.2. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x138x2

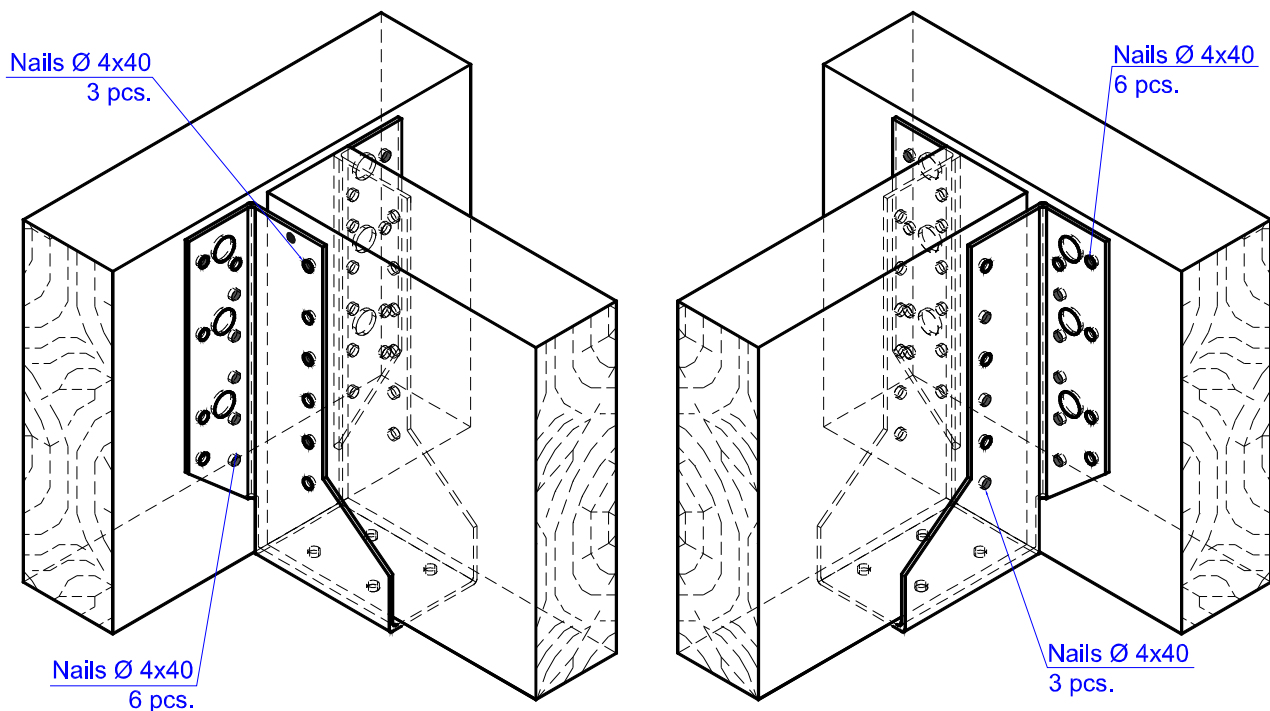


Figure D.3. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x168x2

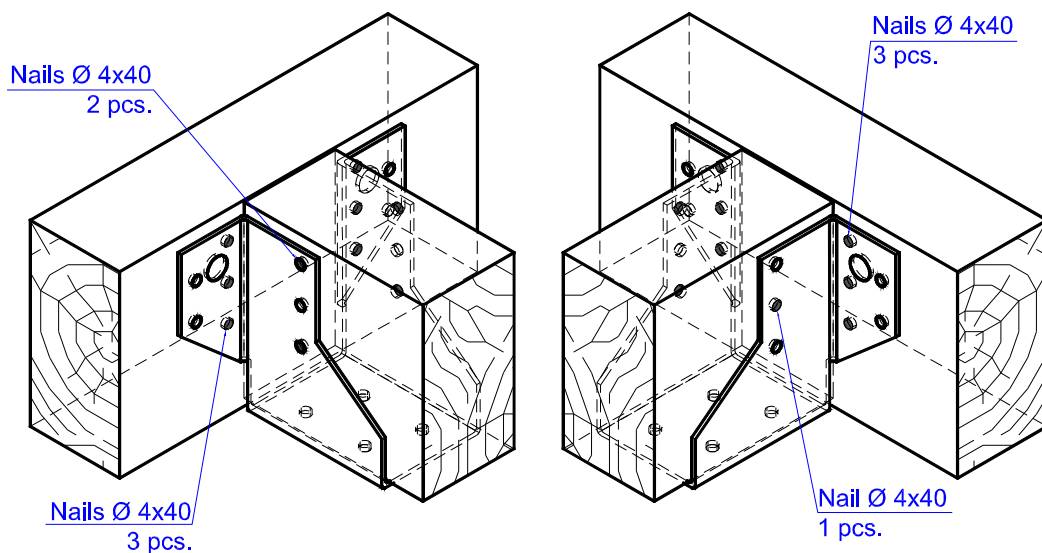


Figure D.4. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x93x2

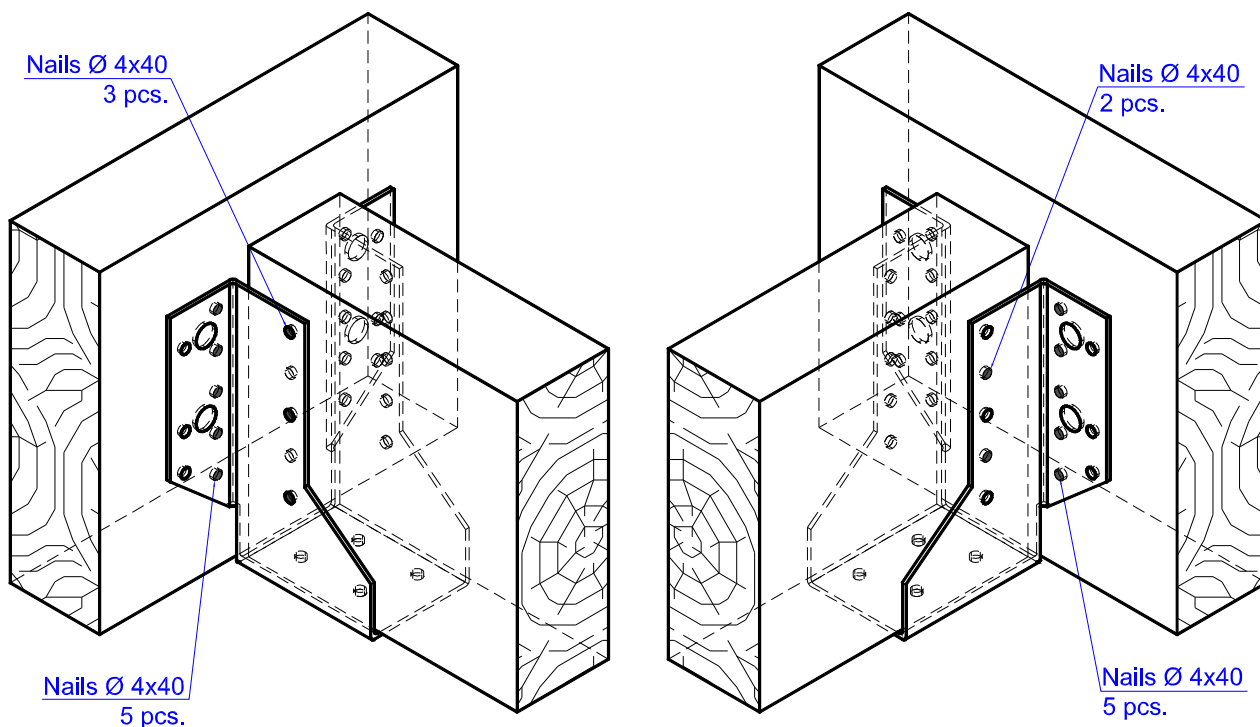


Figure D.5. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x135x2

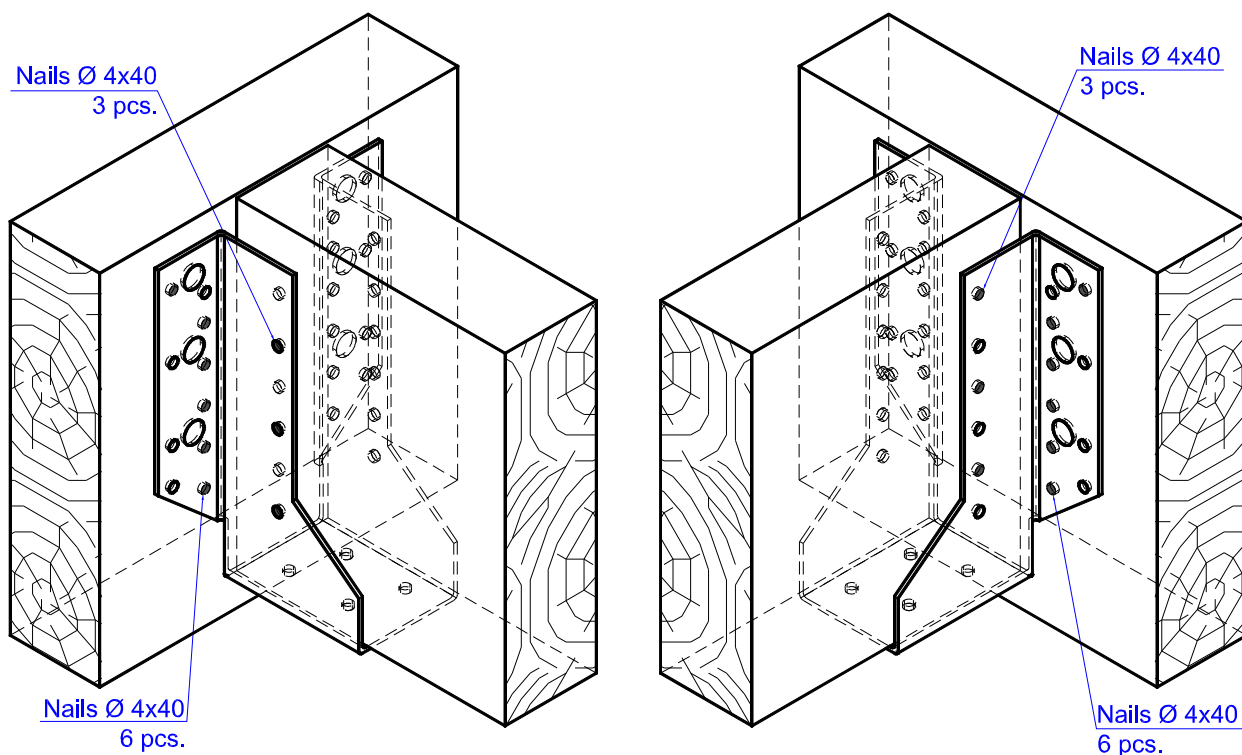


Figure D.6. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x165x2

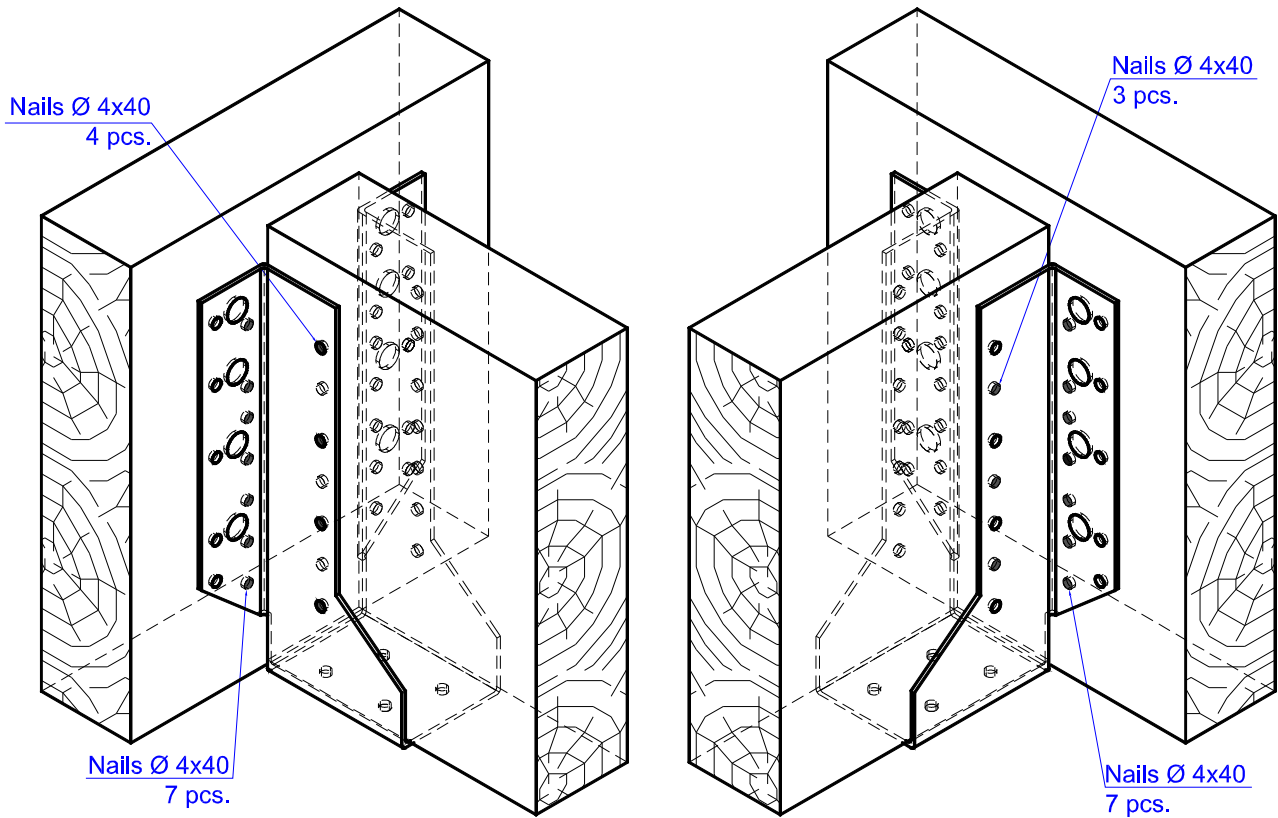


Figure D.7. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x195x2

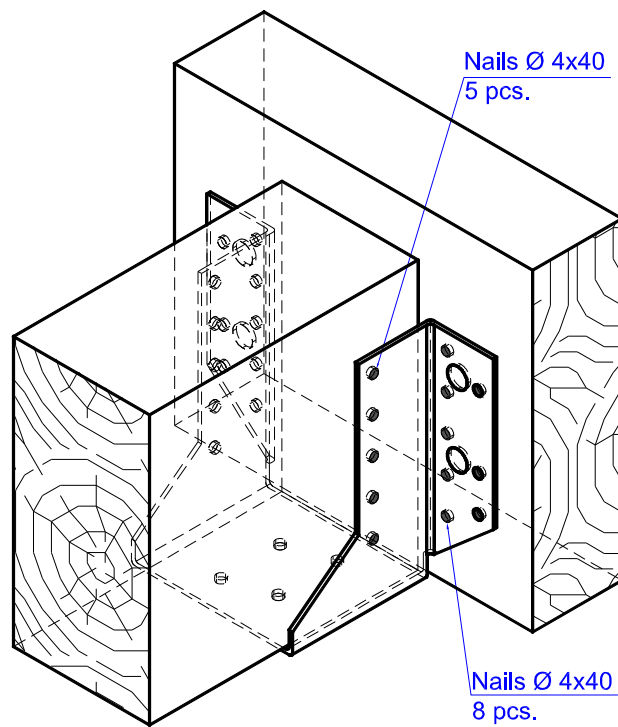


Figure D.8. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x123x2. Position of nails is symmetrical in both sides

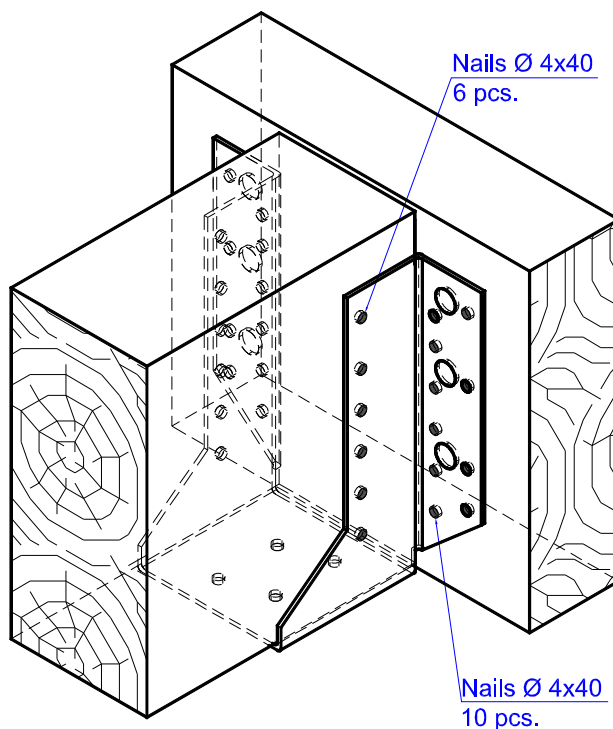


Figure D.9. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x153x2. Position of nails is symmetrical in both sides

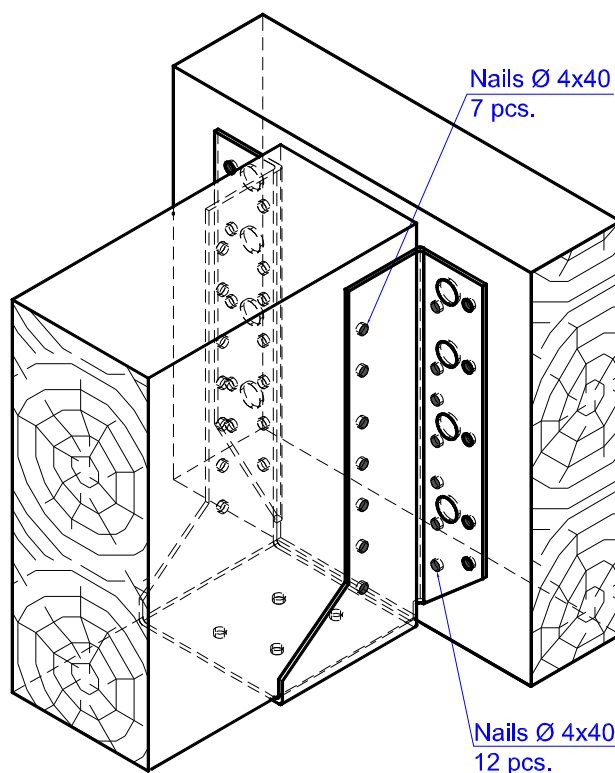


Figure D.10. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x182x2. Position of nails is symmetrical in both sides

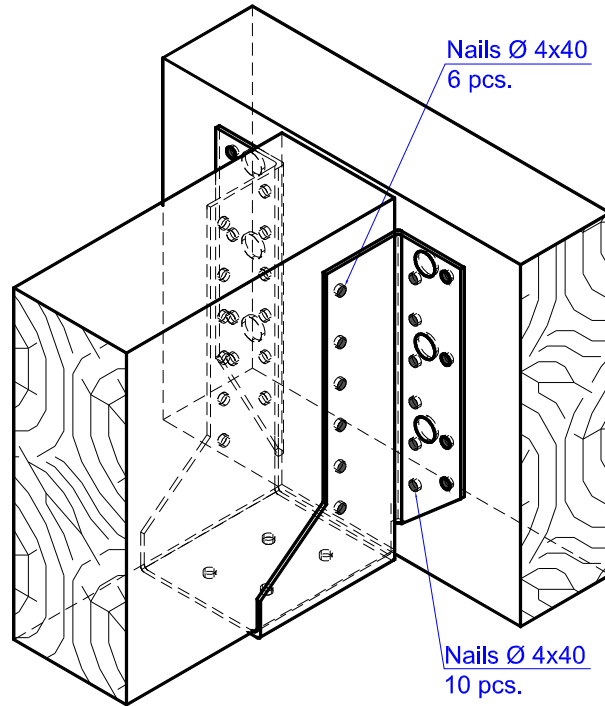


Figure D.11. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 63×158×2. Position of nails is symmetrical in both sides

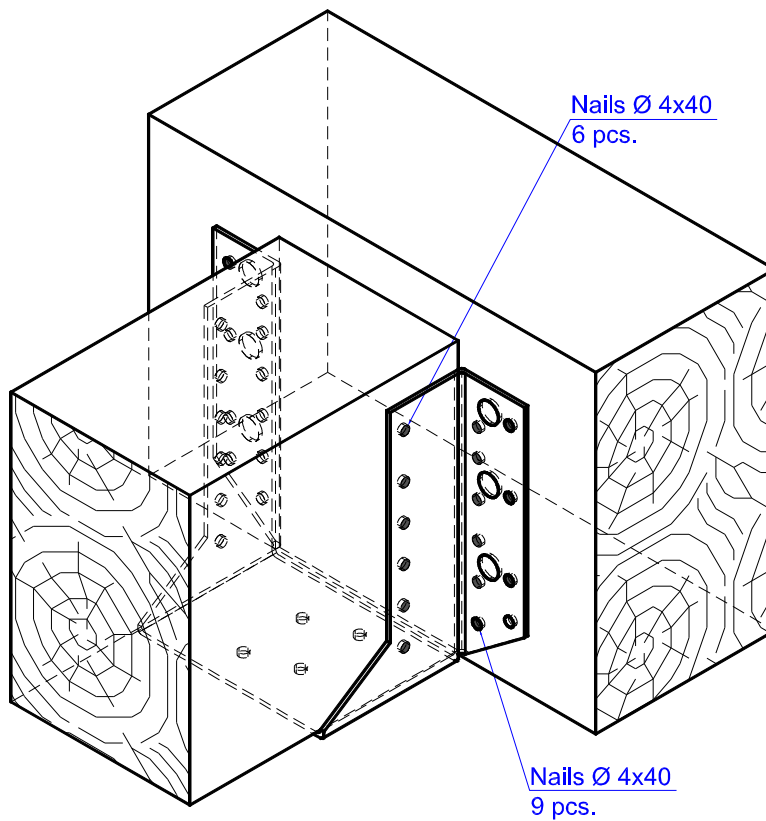


Figure D.12. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100×140×2. Position of nails is symmetrical in both sides

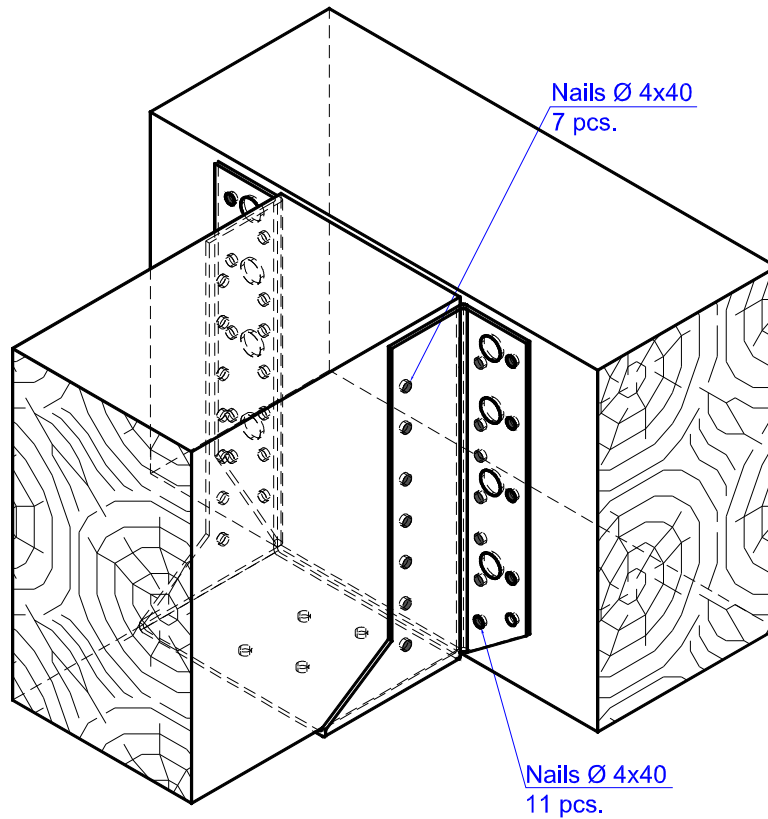


Figure D.13. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100x170x2. Position of nails is symmetrical in both sides

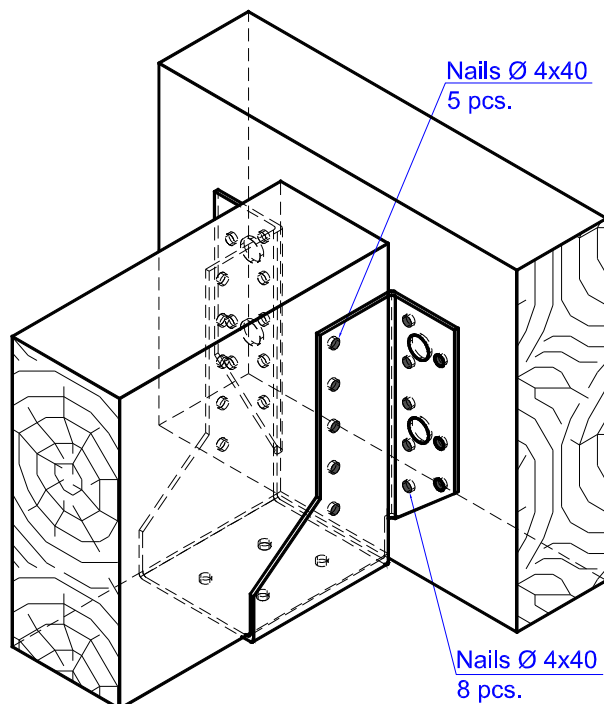


Figure D.14. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 60x130x2. Position of nails is symmetrical in both sides

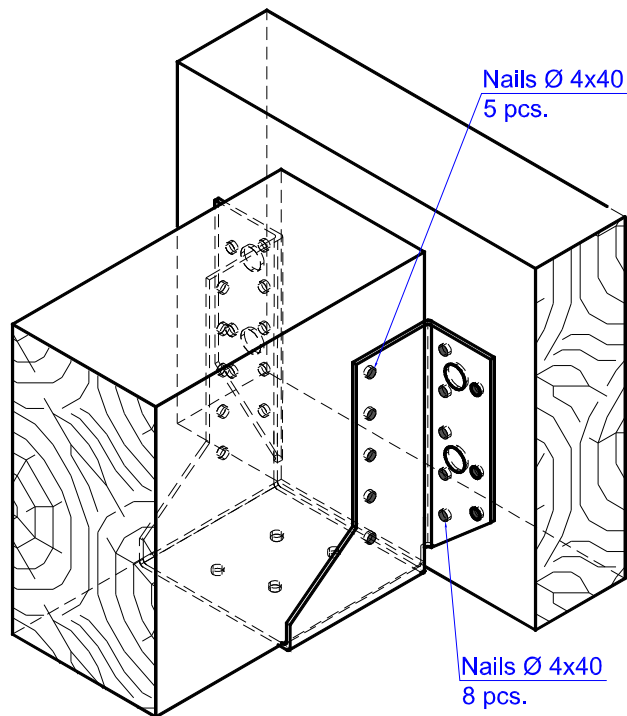


Figure D.15. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x120x2. Position of nails is symmetrical in both sides

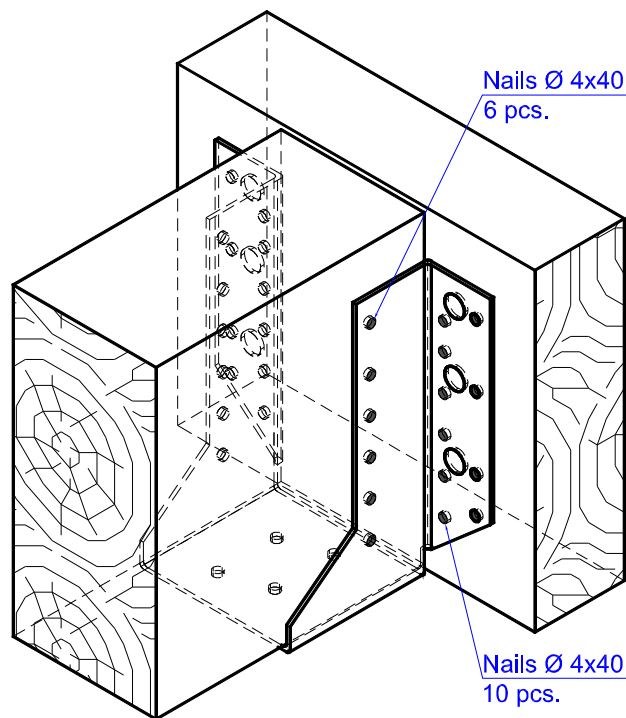


Figure D.16. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x150x2. Position of nails is symmetrical in both sides



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European Technical Assessment

ETA-15/0448
of 2015-08-06

General Part

Technical Assessment Body issuing the European Technical Assessment

Trade name of the construction product:

Product family to which the above construction product belongs:

Manufacturer:

Manufacturing plant:

This European Technical Assessment contains:

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

VĮ Statybos produkcijos sertifikavimo centras

Joist hangers:

- | | |
|---------------------|---------------------|
| - SA 45 × 96 × 2; | - SA 45 × 138 × 2; |
| - SA 45 × 168 × 2; | - SA 51 × 93 × 2; |
| - SA 51 × 135 × 2; | - SA 51 × 165 × 2; |
| - SA 51 × 195 × 2; | - SA 76 × 123 × 2; |
| - SA 76 × 153 × 2; | - SA 76 × 182 × 2; |
| - SA 63 × 158 × 2; | - SA 100 × 140 × 2; |
| - SA 100 × 170 × 2; | - SA 60 × 130 × 2; |
| - SA 80 × 120 × 2; | - SA 80 × 150 × 2 |

EC PAC 13: Three-dimensional nailing plate (Joist hangers for timber to timber connections)

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36 pages including 4 Annexes which form an integral part of this assessment.

Annex – Control plan Contain confidential information and is not included in the European Technical Assessment when that assessment is publicly disseminated

ETAG 015, edition November 2012, used as European Assessment Document (EAD).

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Specific Parts

1. Technical description of the product

Joist hangers SA 45 × 96 × 2, SA 45 × 138 × 2, SA 45 × 168 × 2, SA 51 × 93 × 2, SA 51 × 135 × 2, SA 51 × 165 × 2, SA 51 × 195 × 2, SA 76 × 123 × 2, SA 76 × 153 × 2, SA 76 × 182 × 2, SA 63 × 158 × 2, SA 100 × 140 × 2, SA 100 × 170 × 2, SA 60 × 130 × 2, SA 80 × 120 × 2 and SA 80 × 150 × 2, are one-piece non-welded face fixed joist hangers to be used in timber to timber connections. They are connected to the timber elements by ringed shank nails. Product details are shown in Annex A.

The joist hangers are made from pre-galvanized steel DX51D+Z275 according to standard EN 10346:2009¹ with minimum yield strength R_e of 250 MPa, minimum tensile strength R_m of 330 MPa and minimum elongation A_{80} of 22 %. Dimensions, hole positions are shown in the Annex C, typical installations are shown in Annex B. Joist hangers are made from steel with normal thickness tolerances according to EN 10143:2006².

2. Specifications of the intended use in accordance with the applicable EAD

Intended use of the joist hangers are the connections between beams of load bearing timber structures, where the requirements for mechanical resistance, stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 shall be fulfilled.

The static and kinematic behaviour of the timber members or the supports shall be as described in Annex B.

The wood members may be of solid timber or glued laminated timber with a characteristic density from 290 kg/m³ to 420 kg/m³. This requirement for material of the wood members may be fulfilled by using the following materials:

- structural solid timber classified to C14-C40 strength class according to EN 338:2010³ and EN 14081-1:2005+A1:2011⁴;
- glulam classified to GL24-GL36 according to EN 14080:2013⁵.

For joints shall be used threaded nails according to EN 14592:2008+A1:2012⁶ with diameter 4,0 mm. Another type of threaded nails may be used with values of axial characteristic load-carrying capacity per nail not less than stated in declaration of performance CE 300147-A3 of the nails producer GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, and with the tensile capacity of the wire for the nails equal to or greater than 650 N/mm².

Annex B states the load-carrying capacities of the joist hangers connections for a characteristic density of 350 kg/m³ of solid timber or glulam. For solid timber or glulam with a lower characteristic density than 350 kg/m³ the load-carrying capacities of the nailed connection shall be modified by the k_{dens} factor:

$$k_{dens} = \sqrt{\frac{\rho_k}{350}}$$

where:

ρ_k is the characteristic density of timber used in the connection.

¹ EN 10346:2009 Continuously hot-dip coated steel flat products - Technical delivery conditions.

² EN 10143:2006 Continuously hot-dip coated steel sheet and strip - Tolerances on dimensions and shape.

³ EN 338:2009 Structural timber - Strength classes.

⁴ EN 14081-1:2005+A1:2011 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.

⁵ EN 14080:2013 Timber structures - Glued laminated timber and glued solid timber - Requirements

⁶ EN 14592:2008+A1:2012 Timber structures - Dowel-type fasteners – Requirements

The design of the connections shall be in accordance with Eurocode 5⁷ or according to similar national regulations for design. The wood members shall have the thickness which is larger than the penetration depth of the nails into the members.

The joist hangers are primarily intended for use in timber structures subject to the dry, internal conditions defined by service class 1 and 2 of Eurocode 5 and for connections subject to static or quasi-static loading. The joist hangers can also be used in outdoor structures, defined by service class 3, when a corrosion protection in accordance with Eurocode 5 is applied, or when stainless steel with similar or better characteristic yield, ultimate strength and ductility is employed.

They are not intended for used in areas where they might support seismic actions.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the three-dimensional nailing plates of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

⁷ EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

2.1 Installation

2.1.1 Joints

A connector (three-dimensional nailing plate – joist hangers) is deemed fit for its intended use provided:

- joints are designed in accordance with Eurocode 5 or an appropriate national regulations for timber constructions design under the responsibility of an engineer experienced in timber structures;
- the structural members to which the joist hanger are fixed shall be restrained against rotation;
- the structural members of solid timber shall be of strength class C14 or better;
- the structural members of glulam shall be of strength class GL24 or better;
- the structural members shall be free from wane under the joist hanger;
- the tensile strength perpendicular to the grain capacity of the timber member to be used in conjunction with the joist hanger is to be checked by the designer of the structure to ensure that it is not less than the joist hangers capacity and, if necessary, the joist hanger capacity shall be reduced accordingly;
- the gap between the timber members does not exceed 3 mm;
- there are no specific requirements relating to preparation of the timber members.

2.1.2 Criteria

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

- installation is carried out by personnel under the direction of supervisors, which 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 are used.

2.1.3 Responsibility of the manufacturer

It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in sections 8, 9 and 10 of this European technical assessment, is given to those concerned. This information may be made by replicating the respective parts of this European Technical Assessment. 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.

All data shall be presented in a clear and explicit form.

2.2 Recommendations

2.2.1 Recommendations on packaging, transport and storage

The joist 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 connectors should be treated as conventional metallic building products.

2.2.2 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.

3. Performance of the product and references to the methods used for its assessment:

| ETAG paragraph | Characteristic | Assessment of characteristic |
|---|---|--|
| 3.1 Mechanical resistance and stability | | |
| 2.4.1 | Characteristic load-carrying capacity | see Annex B |
| 2.4.1 | Stiffness | No performance determined |
| 2.4.1 | Ductility in cyclic testing | No performance determined |
| 3.2 Safety in case of fire | | |
| 2.4.2.1 | Reaction to fire | The joist hangers are made from steel classified as Euroclass A1 in accordance with EN 13501-1:2007+A1:2009 ⁸ and EC decision 96/603/EC ⁹ , amended by EC Decision 2000/605/EC ¹⁰ |
| 2.4.2.2 | Resistance to fire | No performance determined |
| 3.3 Hygiene, health and the environment | | |
| 2.4.3 | Release of dangerous substances | No dangerous materials ¹⁾ |
| 3.4 General aspects relating to fitness for use (serviceability) | | |
| 2.4.7 | Durability | |
| 2.4.7.2 | Resistance to corrosion and deterioration | 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 |
| 2.4.8 | Dimensional stability | Tests are carried out during the assessment for mechanical resistance and stability |

¹⁾ Based on the declaration of the manufacturer and in accordance with TR 034¹¹ the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

In accordance with the Regulation (EC) No 1907/2006 of the European Parliament and the Council of 18 December 2006¹² and http://ec.europa.eu/growth/sectors/chemicals/reach/index_en.htm, the product does not contain/release dangerous substances.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, 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 Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply

3.1 Mechanical resistance and stability

The assessment of fitness for the intended use has been made in accordance with ETAG 015. The characteristic load-carrying capacities of the products are given in Annex B, which have been derived by calculation.

⁸ EN 13501-1:2007+A1:2009 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

⁹ OJ L 267, 19.10.1996, p. 23.

¹⁰ OJ L 258, 12.10.2000, p. 36

¹¹ General ER 3 Checklist for ETAGs/CUPAs/ETAs-Content and/or release of dangerous substances in products/kits, Edition March 2012

¹² OJ L 396, 30.12.2006, p. 1

The characteristic load-carrying capacities are based on the characteristic values of the nail connections, timber components and steel plates. The calculations were performed according to Eurocode 5.

According to EN 1990¹³ for structures or structural members that comprise more than one material acting in association, partial factors of all used materials shall be computed to obtain design values.

To obtain design values the capacities have to be divided by different partial factors of the material properties, the nail connection and the timber components in addition multiplied with the coefficient k_{mod} .

$$F_{1,d} = \frac{F_{1,k} \cdot k_{mod}}{\gamma_M}$$

where:

$F_{1,k}$ is the characteristic load-carrying capacity;

k_{mod} is the modification factor depending on service class and load-duration classes, see EN 1995-1-1¹⁴, § 3.1.3;

γ_M is the partial factor for a material property, according EN 1995-1-1, § 2.4.1.

The characteristic load-carrying capacity in the direction F is presented in the Annex B. These values are based on the assumption that there is a maximum gap of 3 mm between the timber members (see Annex B, Figure B.1), the members are laterally restrained and wane is not present in the timber at the joint. Minimum spacings and edge and end distances for nails shall be according to Eurocode 5. The number and position of nails are shown in Annex D.

The characteristic capacities of the joist hangers should be used for design in accordance with Eurocode 5 or a similar national regulations for timber structures design.

In the calculations are used threaded nails of 4,0 mm diameter, according EN 14592:2008+A1:2012. Nails manufacturer - GBO Fastening systems AB, Bruksvägen 2, SE 590 93 Gunnebo, Sweden, declaration of performance CE 300147-A3.

The characteristic axial load-carrying withdrawal capacity of a nails is taken according nails manufacturer declaration of performance CE 300147-A3. The characteristic lateral load-carrying capacity of nails calculated from the formulas of Eurocode 5 as for thin steel plate, see EN 1995-1-1, expression (8.9).

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.

13 EN 1990 Eurocode - Basis of structural design

14 EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings.

3.2 Safety in case of fire

Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, therefore there are no relevant aspects of performance to this Basic Requirement for the connectors.

3.3 Hygiene, health and the environment

Based on the declaration of the manufacturer and in accordance with TR 034, dated March 2012, the three dimensional nailing plates do not contain harmful or dangerous substances as defined in the EU database.

3.4 General aspects relating to fitness for use (durability and serviceability)

3.4.1 Durability

The joist 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 according Eurocode 5:

- service class 1 – is characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 65 % for a few weeks per year;
- service class 2 - characterised by a moisture content in the materials corresponding to a temperature of 20°C and the relative humidity of the surrounding air only exceeding 85 % for a few weeks per year.

In accordance with ETAG 015 the joist hangers are made from hot-dip zinc coating steel DX51D+Z275 according to EN 10346:2009 with a minimum yield strength R_e of 250 MPa, a minimum tensile strength R_m of 330 MPa and a minimum elongation A_{80} of 22 %.

3.4.2 Dimensional stability

Additional tests are not required for this property as it is covered during the assessment.

4. Assessment and verification of constancy of performance (AVPC) system applied, with reference to its legal base

According to the decision 97/638/EC¹⁵ of the European Commission, the system of assessment and verification of constancy of performance applied to this product shall be as laid down in the Commission delegated regulation (EU) No 568/2014¹⁶ amending Annex V to Regulation (EU) No 305/2011¹⁷ of the European Parliament and of the Council, referred to as System 2+.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the Control Plan deposited with the Statybos produkcijos sertifikavimo centras (SPSC), with which the factory production control shall be in accordance.

Issued in Vilnius on 2015-08-06

By State Enterprise Statybos produkcijos sertifikavimo centras (SPSC)

**Director
Robertas Encius**

¹⁵ Commission Decision 97/638/EC of 19 September 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards fasteners for structural timber (OJ L 268, 1.10.1997, p. 36).

¹⁶ Commission delegated regulation (EU) No 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products (OJ L 157, 27.05.2014, p. 76).

¹⁷ Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (OJ L 88, 4.04.2011, p. 5).

ANNEX A**Product details****Table A.1.** Steel for joist hanger specification

| Joist hanger type | | Steel thickness (mm) | Steel and coating specification ¹⁾ |
|-------------------|---------------|----------------------|---|
| SA | 45 × 96 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 138 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 45 × 168 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 93 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 135 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 165 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 51 × 195 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 123 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 153 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 76 × 182 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 63 × 158 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 140 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 100 × 170 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 60 × 130 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 120 × 2 | 2,0 | EN 10346 - DX51D + Z275 |
| SA | 80 × 150 × 2 | 2,0 | EN 10346 - DX51D + Z275 |

¹⁾ requirements according joist hangers manufacturer's UAB "Ardetas" documentation:
- minimum yield strength, $R_{p0,2}$ or R_{eL} – 250 MPa;
- minimum tensile strength, R_m – 330 MPa;
- minimum elongation, A_{80} – 22 % (according requirements of EN 10346:2009)

The joist hanger drawings with dimensions presented in the Annex C.

Table A.2. Nails specification

| Nail type according EN 14592 | Dimensions (mm) | Coating specification |
|-------------------------------|-----------------|------------------------------|
| GBO Fastening systems AB nail | 40 × 4,0 | 12 μm (ISO 2081 - Fe/Zn12/C) |

Characteristic capacities of nails for a characteristic density of the wood members 350 kg/m³:
- characteristic withdrawal capacity, $f_{ax,k}$ – 7,8 N/mm²;
- characteristic yield moment, $M_{y,Rk}$ – 7168 Nmm;
Tensile capacity of the wire for nails – 650 N/mm².

ANNEX B

Characteristic load-carrying capacities

B.1 Support conditions

The distance between the timber members in the area of the connection must not exceed 3 mm. The members shall be prevented from rotation.

B.2 Fastener specification

Number and position of nails presented in the Table B.1 and Annex D.

B.3 Wane

Wane is not allowed, the timber has to be sharp-edged in the area of the contact with the joist hanger and inside the joist hanger.

B.4 Characteristic load-carrying capacities

Timber beam to timber beam connections with an joist hanger

Table B.1. Characteristic load-carrying capacities $F_{1,k}$ of timber beam to timber beam connection for load direction according Figure B.1

| Joist hanger type | | Nails dimensions (mm) | Number of nails in | | Position of nails shown in Figure 2) | $F_{1,k}$ kN |
|-------------------|---------------|-----------------------|--------------------|------------------------------|--------------------------------------|--------------|
| | | | primary beam | secondary beam ¹⁾ | | |
| SA | 45 × 96 × 2 | 40 × 4,0 | 6 | 3 | D.1 | 3,45 |
| SA | 45 × 138 × 2 | 40 × 4,0 | 10 | 5 | D.2 | 5,76 |
| SA | 45 × 168 × 2 | 40 × 4,0 | 12 | 6 | D.3 | 6,91 |
| SA | 51 × 93 × 2 | 40 × 4,0 | 6 | 3 | D.4 | 3,45 |
| SA | 51 × 135 × 2 | 40 × 4,0 | 10 | 5 | D.5 | 5,76 |
| SA | 51 × 165 × 2 | 40 × 4,0 | 12 | 6 | D.6 | 6,91 |
| SA | 51 × 195 × 2 | 40 × 4,0 | 14 | 7 | D.7 | 8,06 |
| SA | 76 × 123 × 2 | 40 × 4,0 | 16 | 10 | D.8 | 11,5 |
| SA | 76 × 153 × 2 | 40 × 4,0 | 20 | 12 | D.9 | 13,8 |
| SA | 76 × 182 × 2 | 40 × 4,0 | 24 | 14 | D.10 | 16,1 |
| SA | 63 × 158 × 2 | 40 × 4,0 | 20 | 12 | D.11 | 13,8 |
| SA | 100 × 140 × 2 | 40 × 4,0 | 18 | 12 | D.12 | 13,8 |
| SA | 100 × 170 × 2 | 40 × 4,0 | 22 | 14 | D.13 | 16,1 |
| SA | 60 × 130 × 2 | 40 × 4,0 | 16 | 10 | D.14 | 11,5 |
| SA | 80 × 120 × 2 | 40 × 4,0 | 16 | 10 | D.15 | 11,5 |
| SA | 80 × 150 × 2 | 40 × 4,0 | 20 | 12 | D.16 | 13,8 |

¹⁾ with predrilled holes, Ø3,2 mm
²⁾ see Annex D

When load-carrying capacity is calculated the possibility of splinting caused by the tension perpendicular to the grain, shall be taken into account.

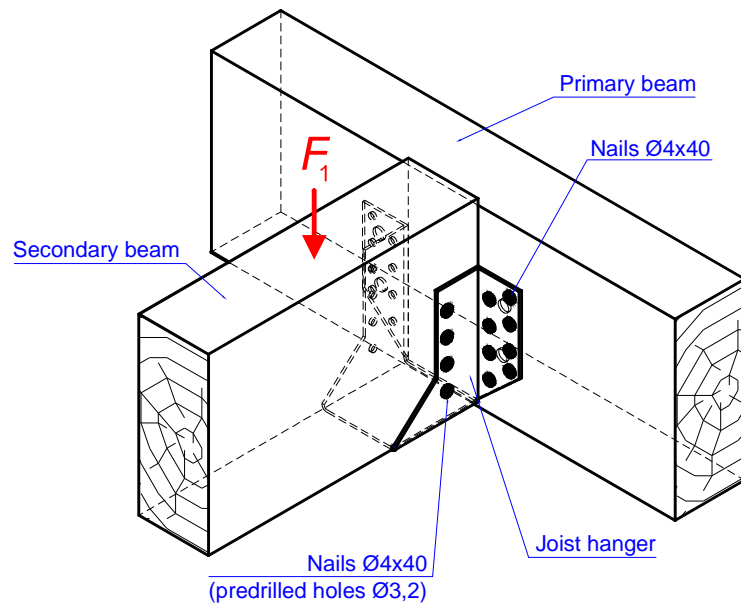


Figure B.1. Typical installation of the joist hanger in the timber beam to timber beam connections

ANNEX C

Joist hangers dimensions

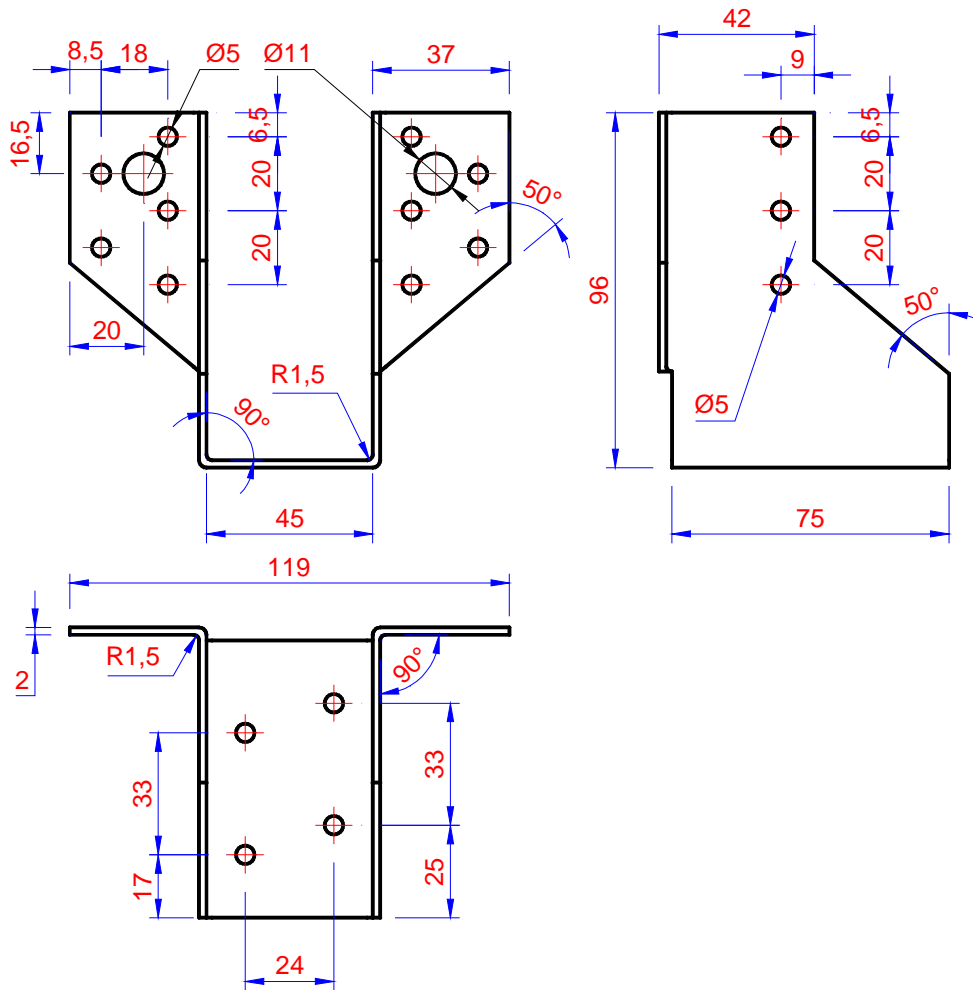


Figure C.1. Joist hanger SA 45 x 96 x 2

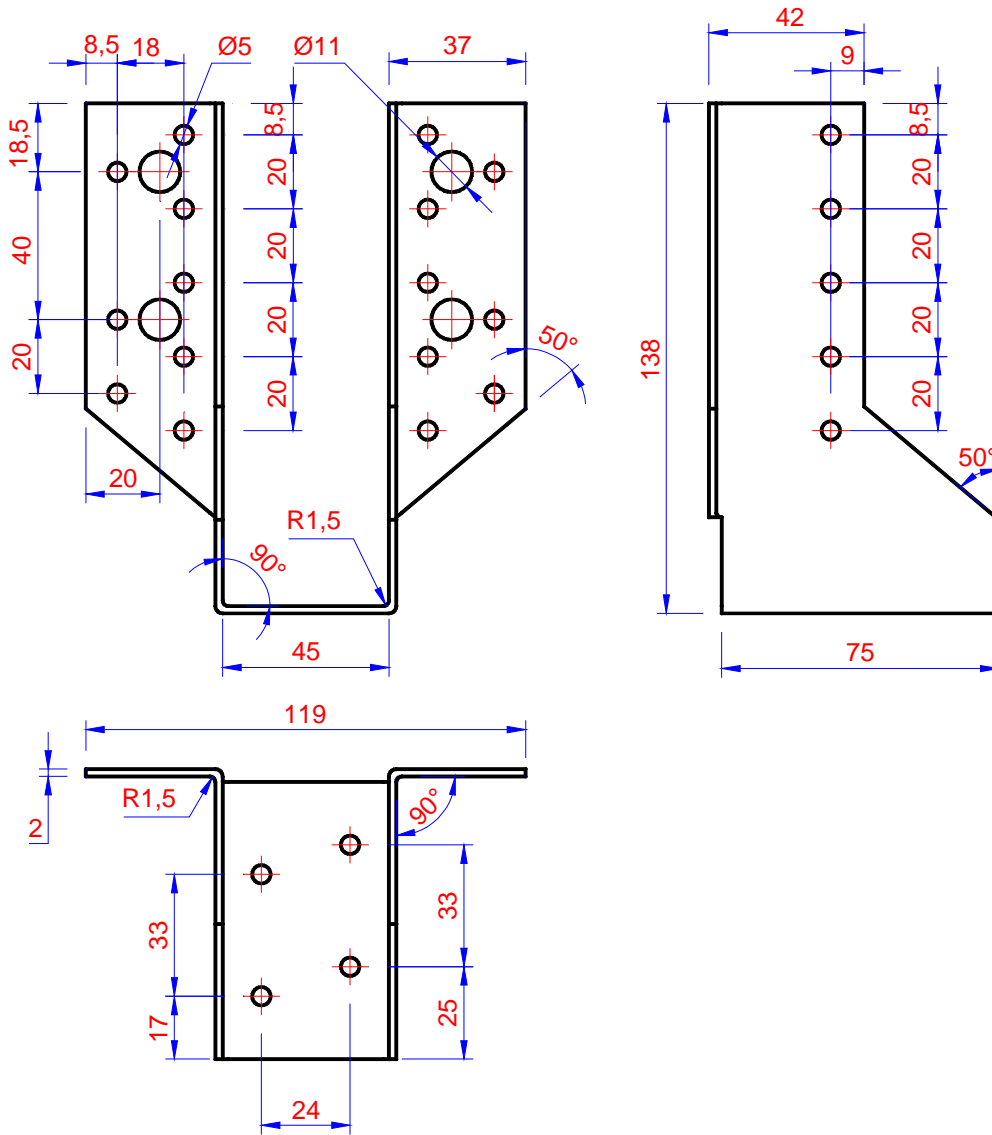


Figure C.2. Joist hanger SA 45 x 138 x 2

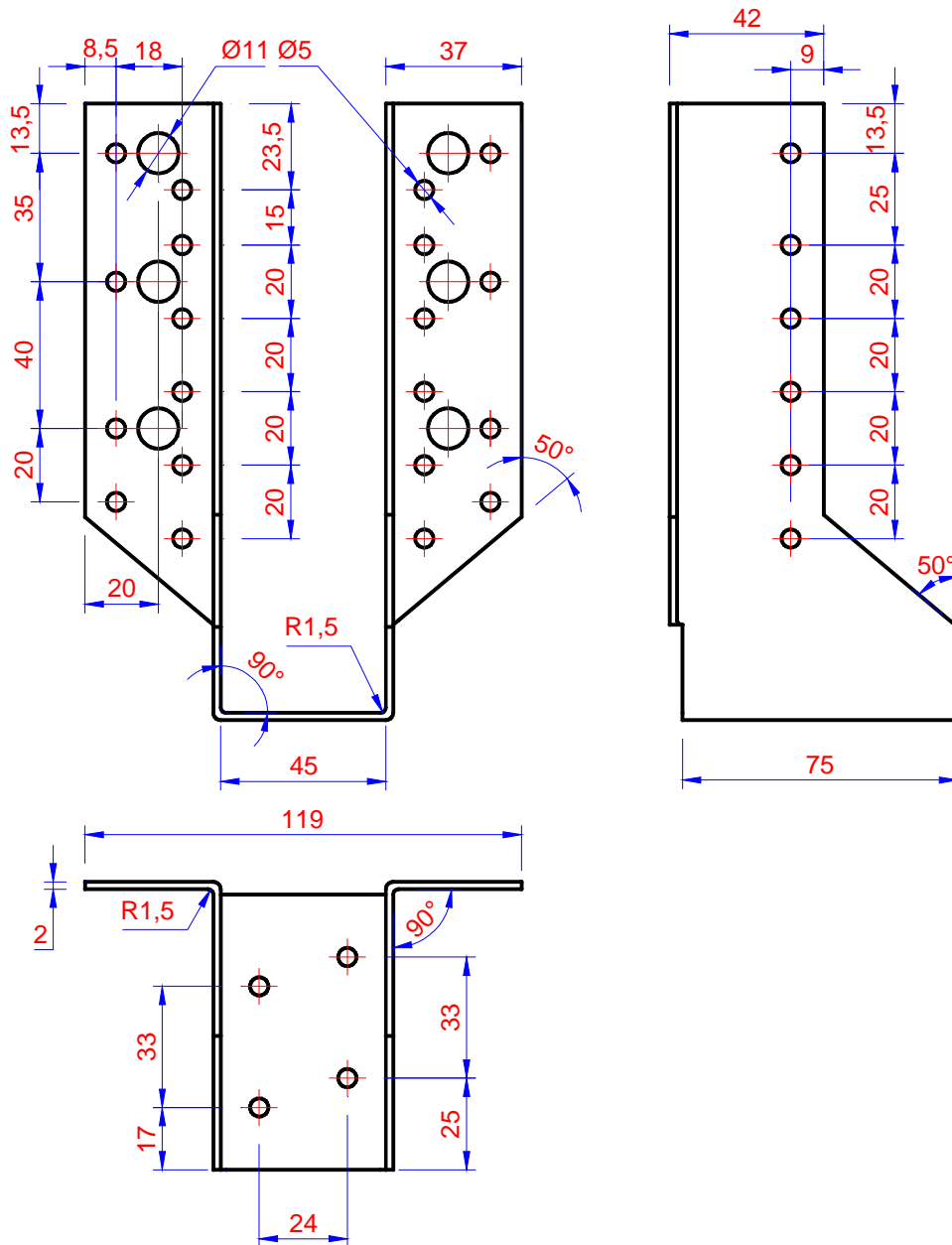


Figure C.3. Joist hanger SA 45 x 168 x 2

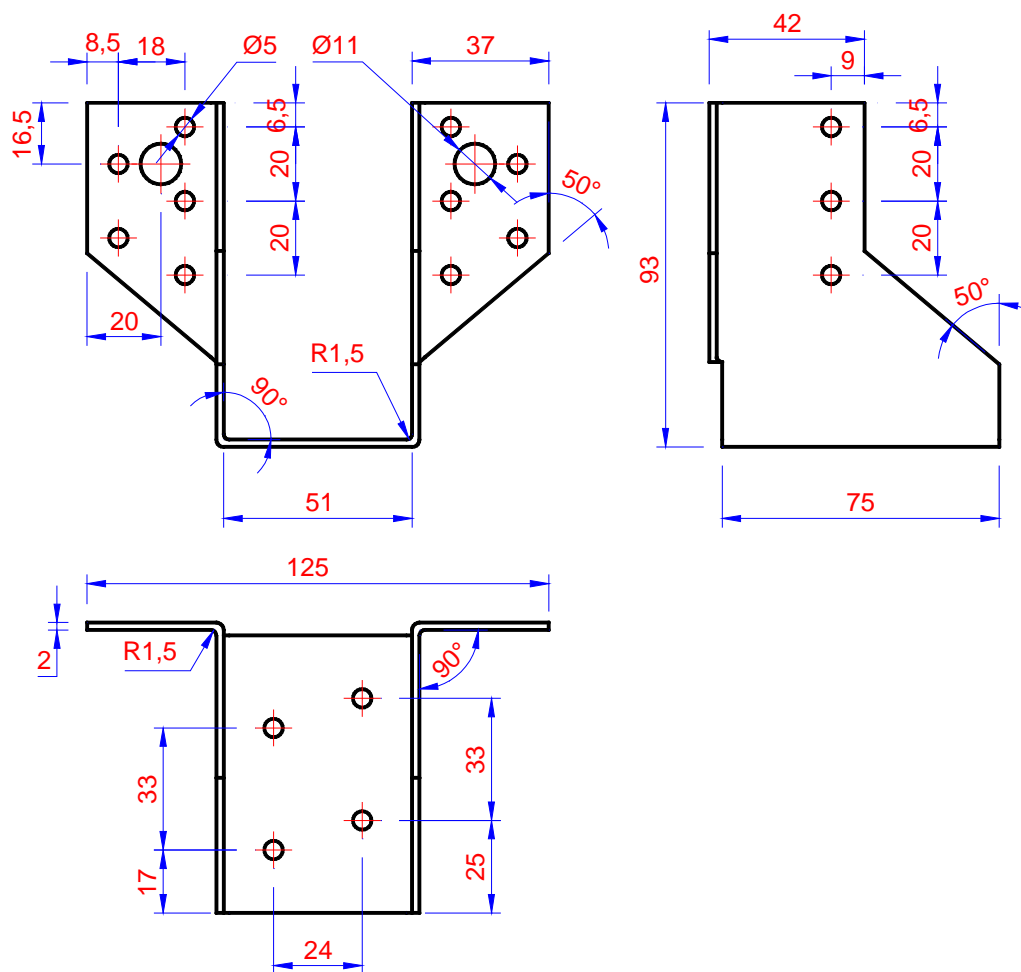


Figure C.4. Joist hanger SA 51 x 93 x 2

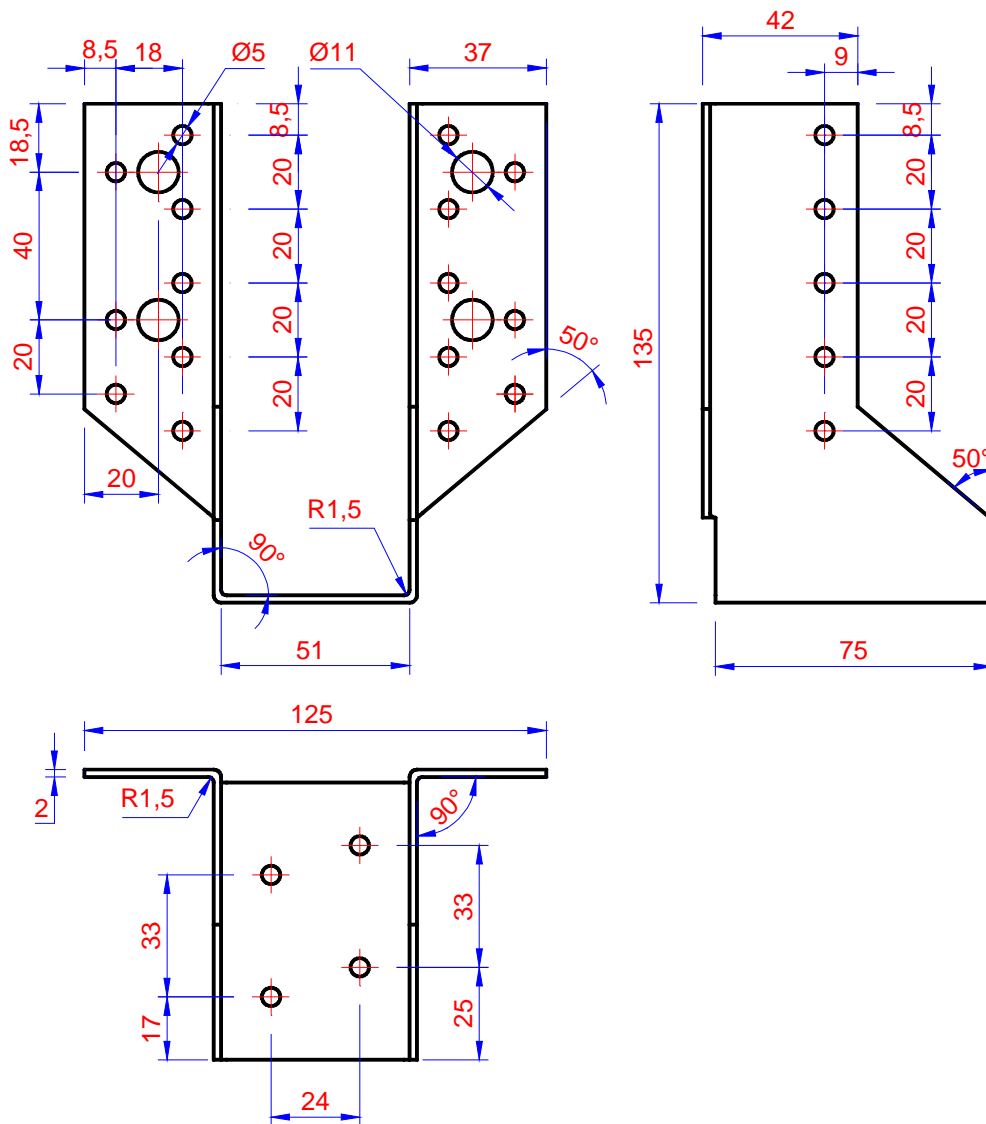


Figure C.5. Joist hanger SA 51 x 135 x 2

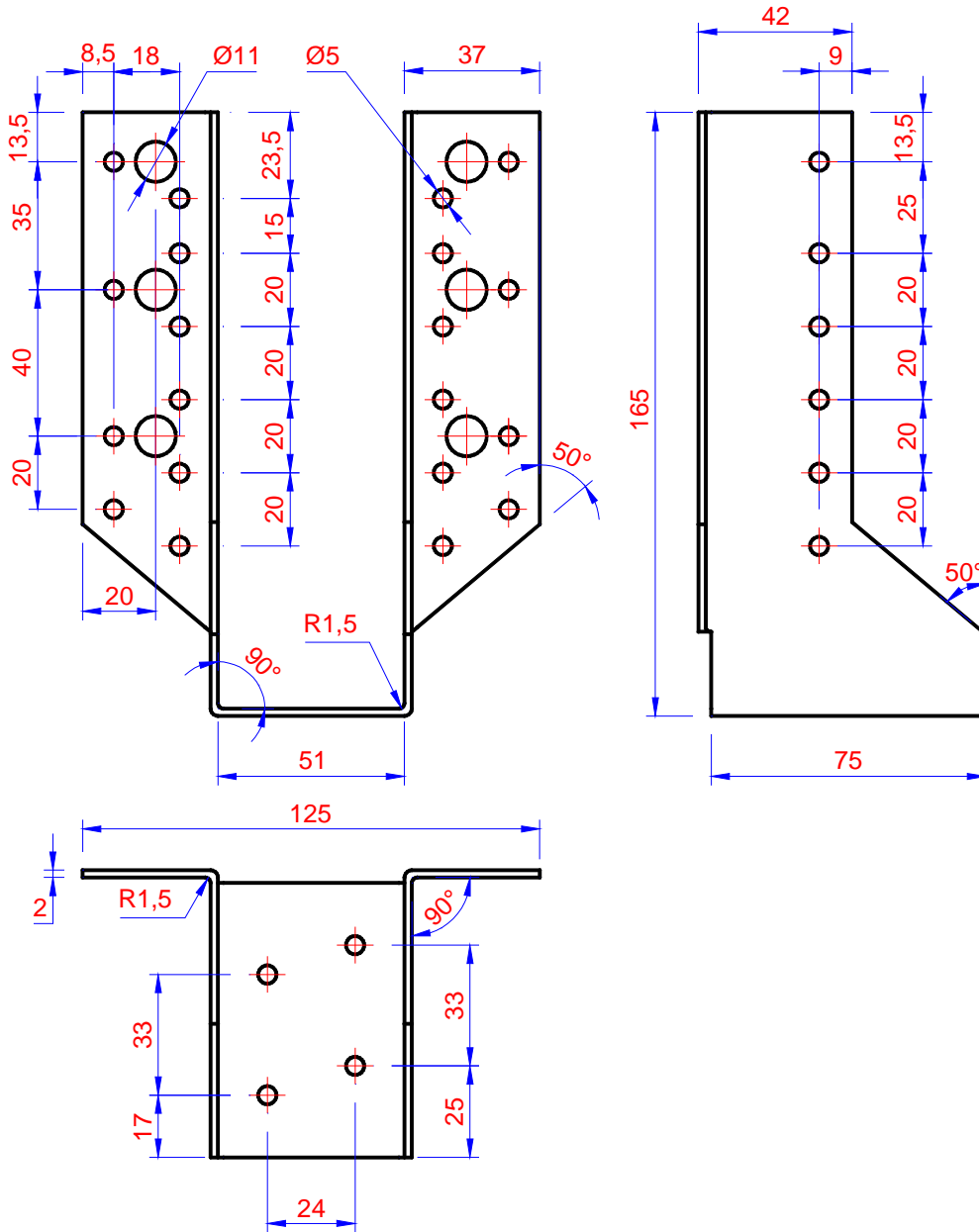


Figure C.6. Joist hanger SA 51 x 165 x 2

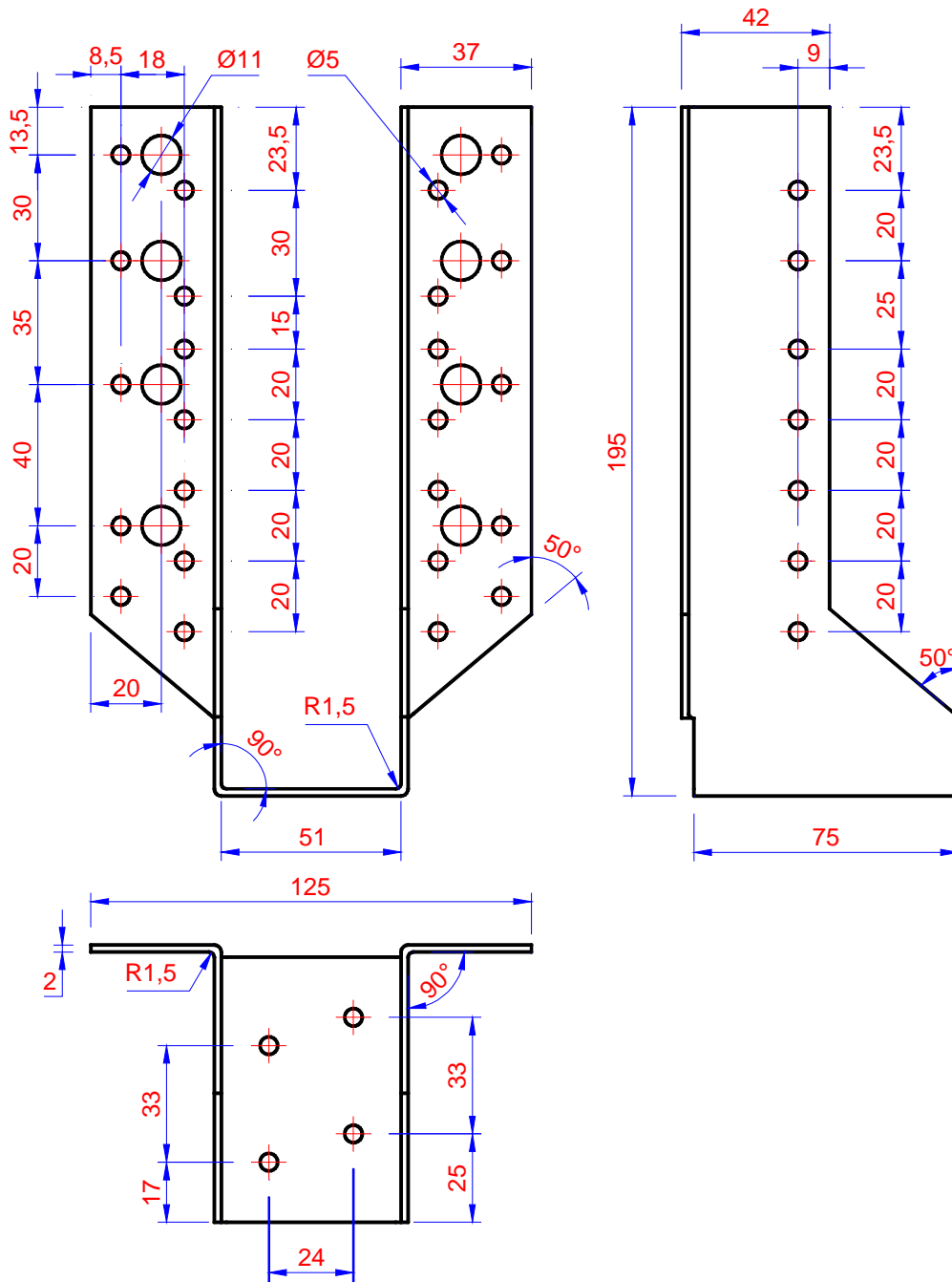


Figure C.7. Joist hanger SA 51 x 195 x 2

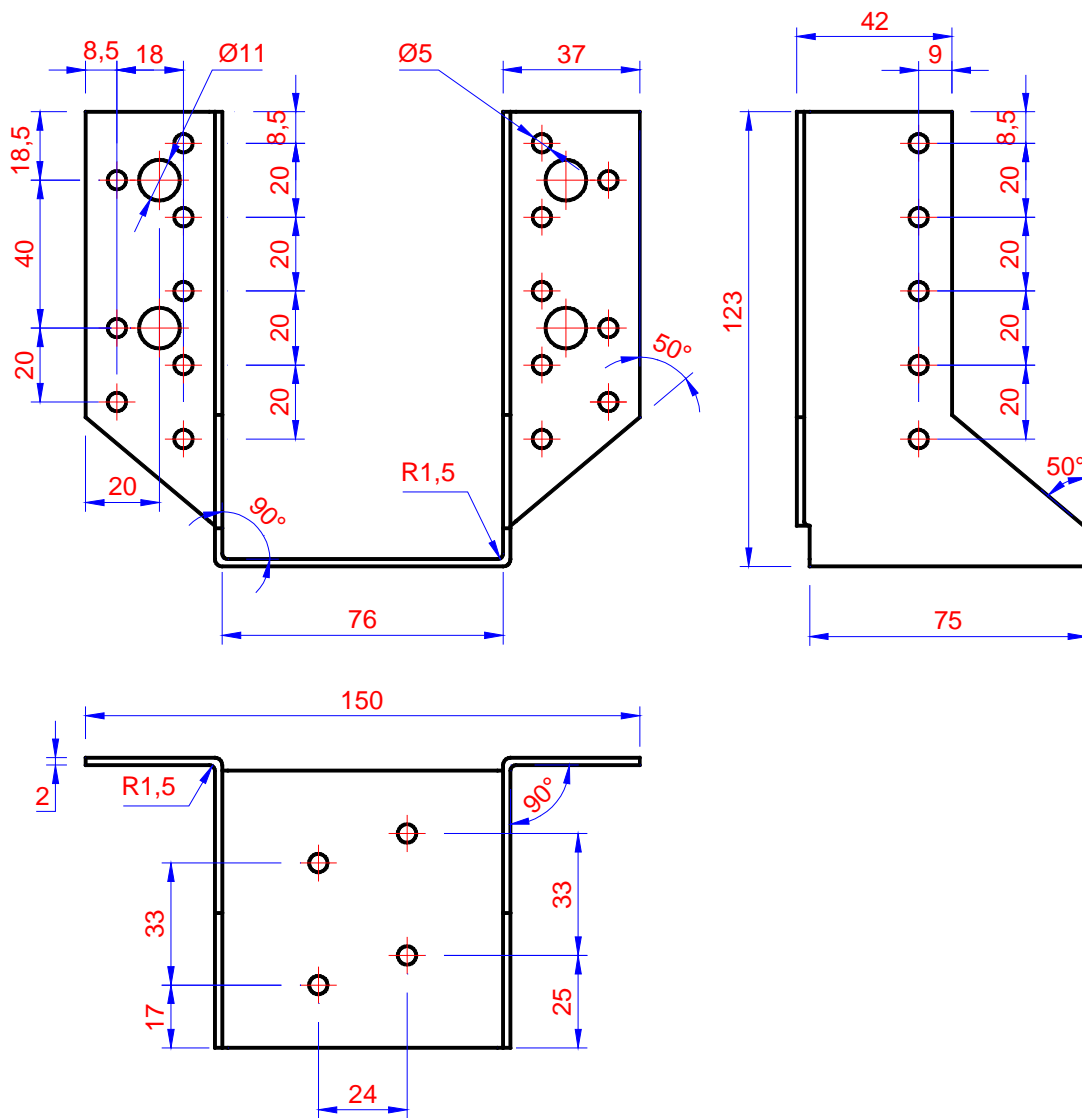


Figure C.8. Joist hanger SA 76 x 123 x 2

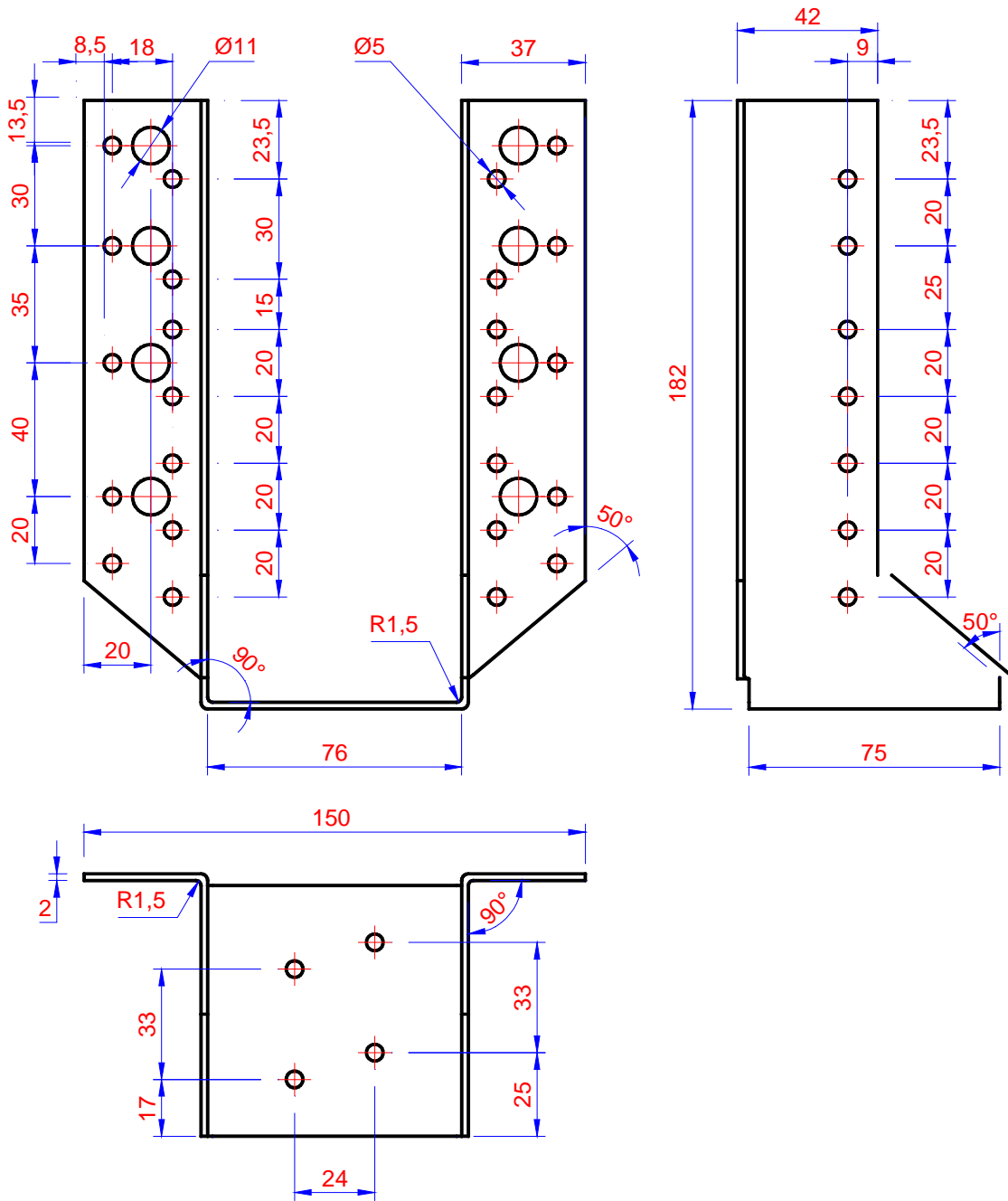


Figure C.10. Joist hanger SA 76 x 182 x 2

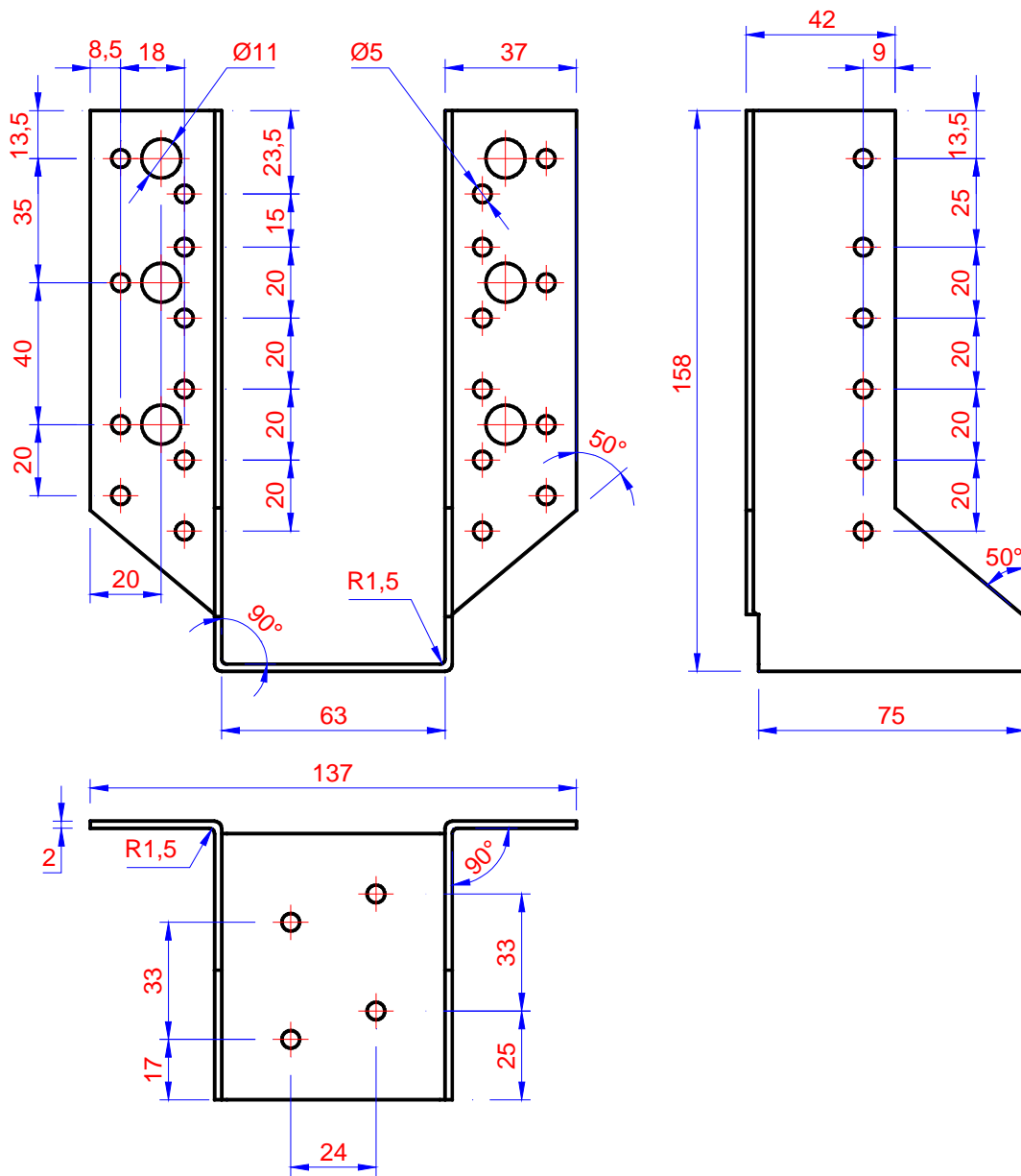


Figure C.11. Joist hanger SA 63 x 158 x 2

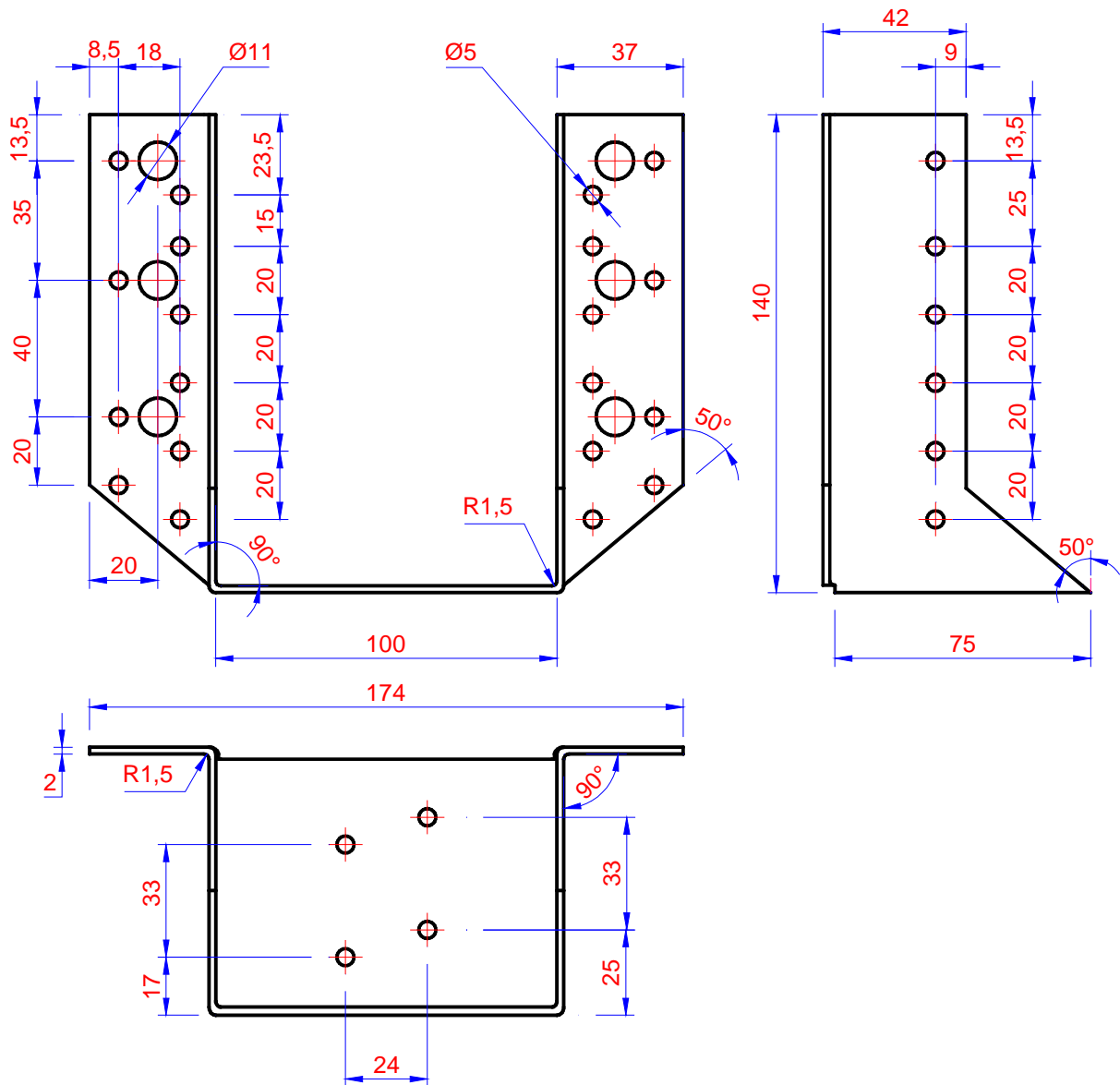


Figure C.12. Joist hanger SA 100 x 140 x 2

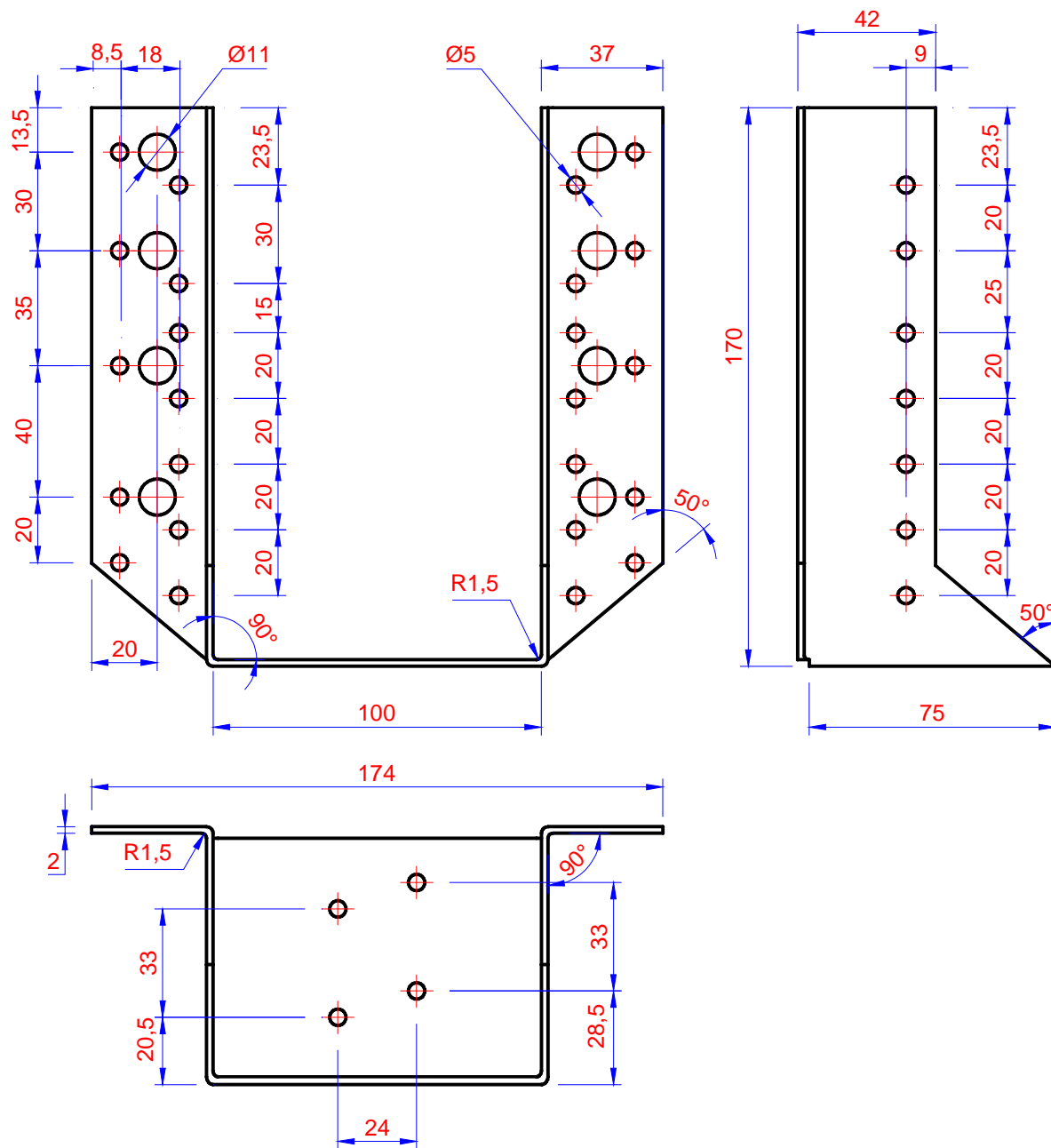


Figure C.13. Joist hanger SA 100 x 170 x 2

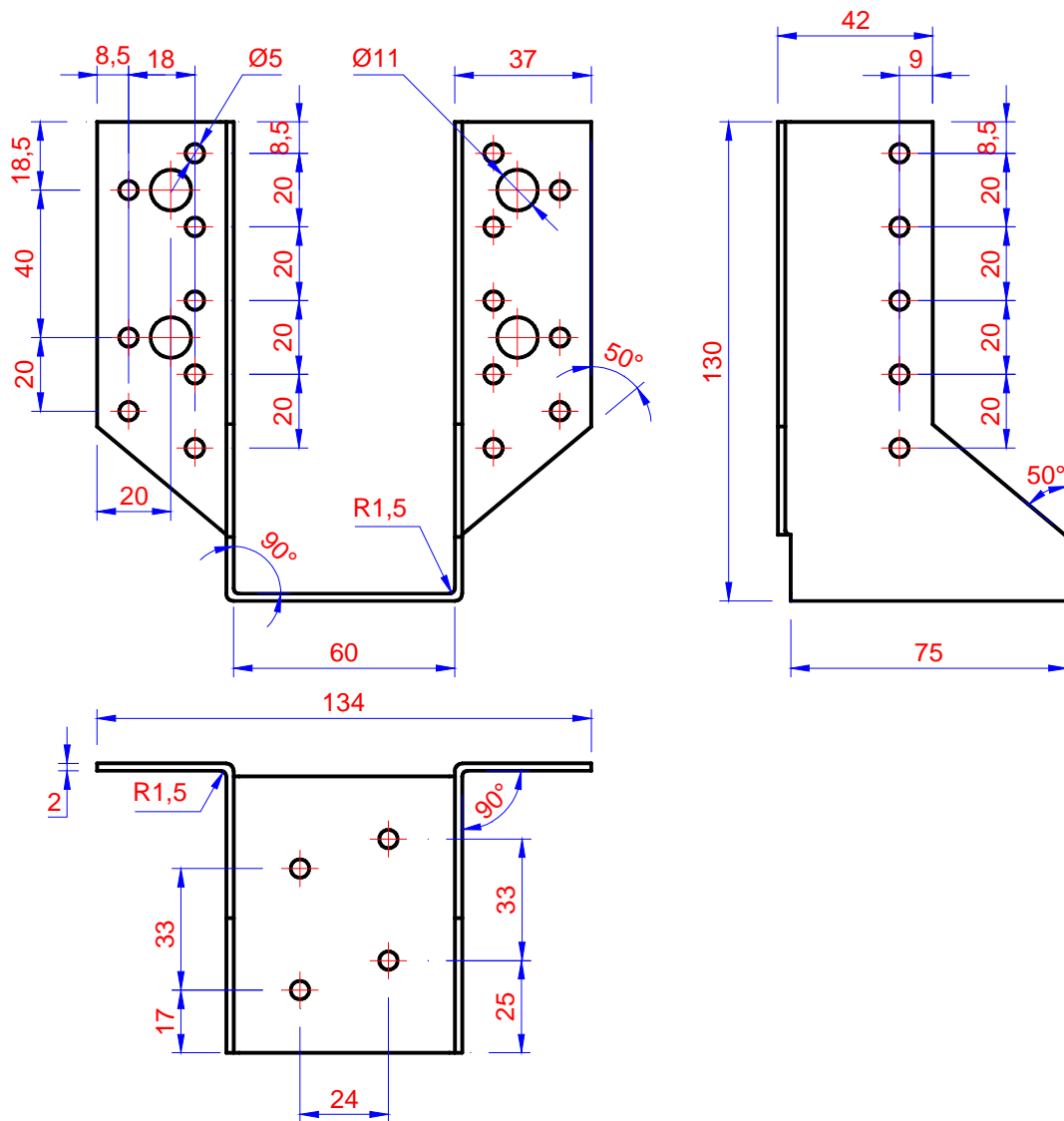


Figure C.14. Joist hanger SA 60 x 130 x 2

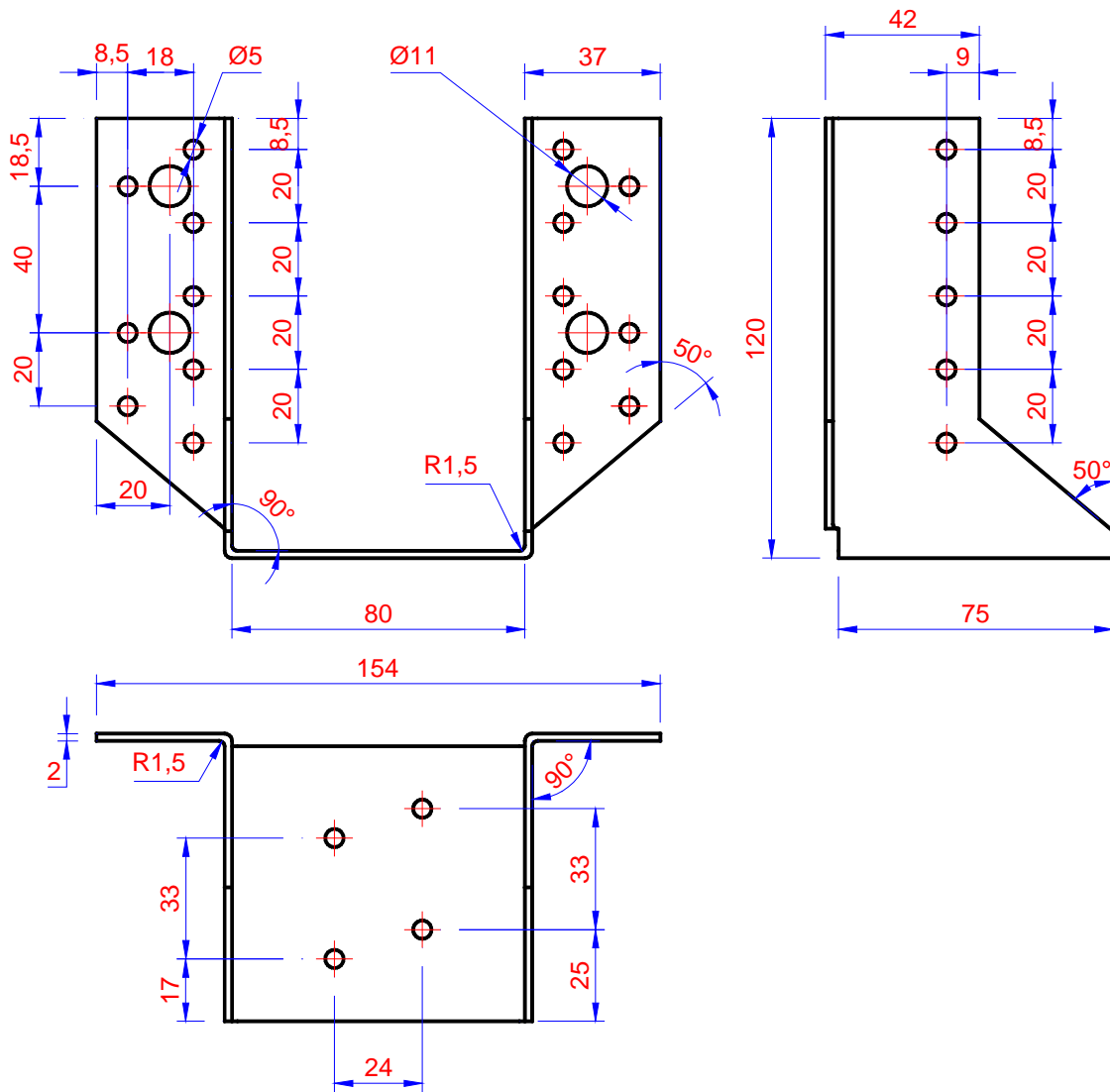


Figure C.15. Joist hanger SA 80 x 120 x 2

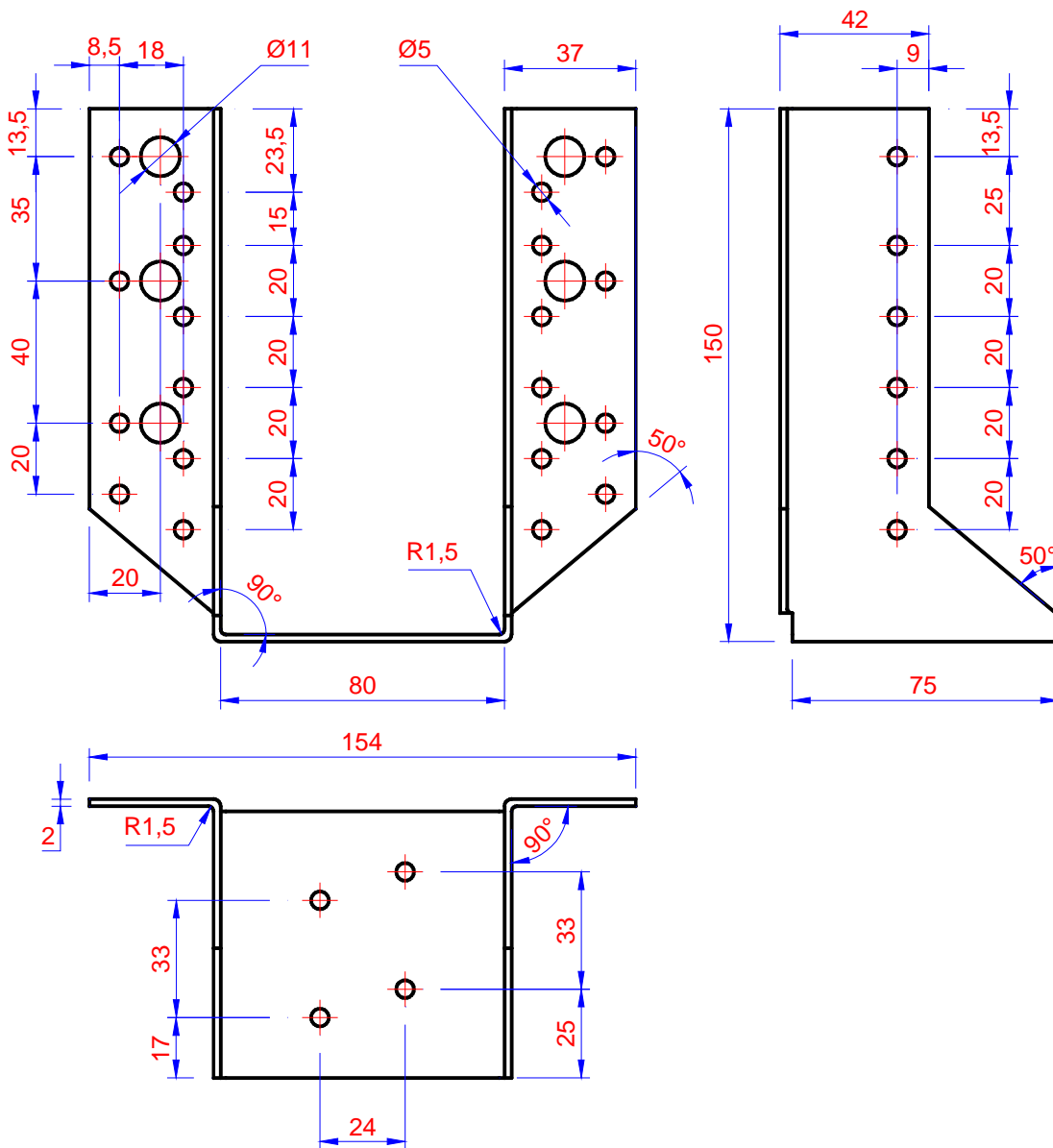


Figure C.16. Joist hanger SA 80 x 150 x 2

ANNEX D

Number and positions of nails in the joist hangers

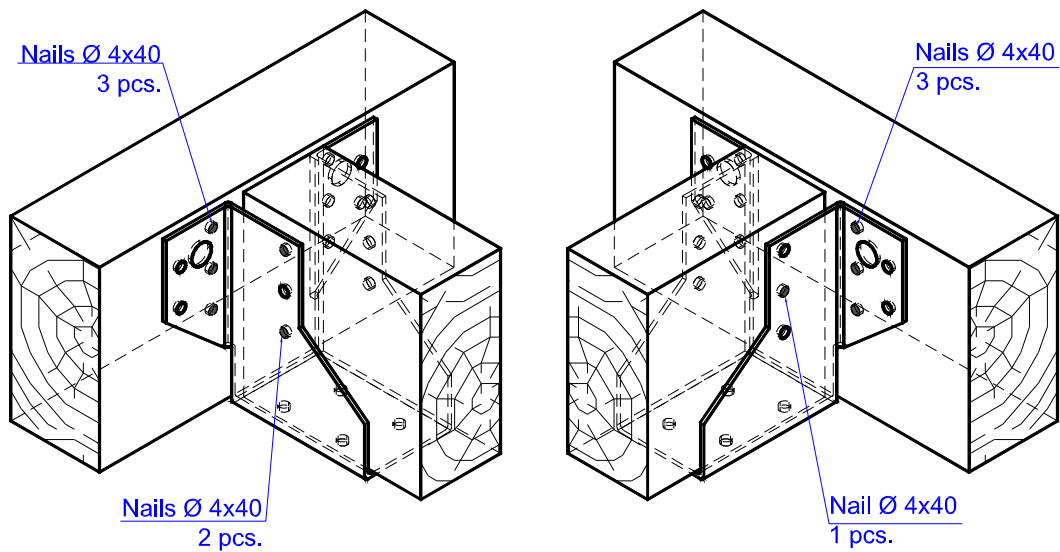


Figure D.1. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x96x2

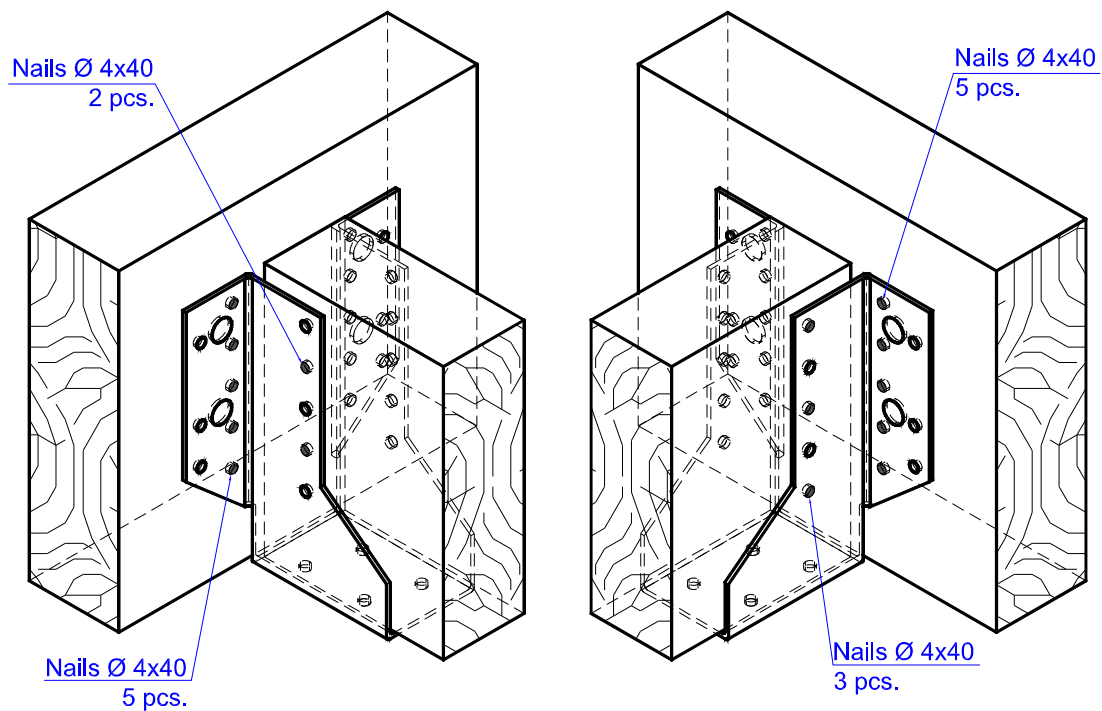


Figure D.2. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x138x2

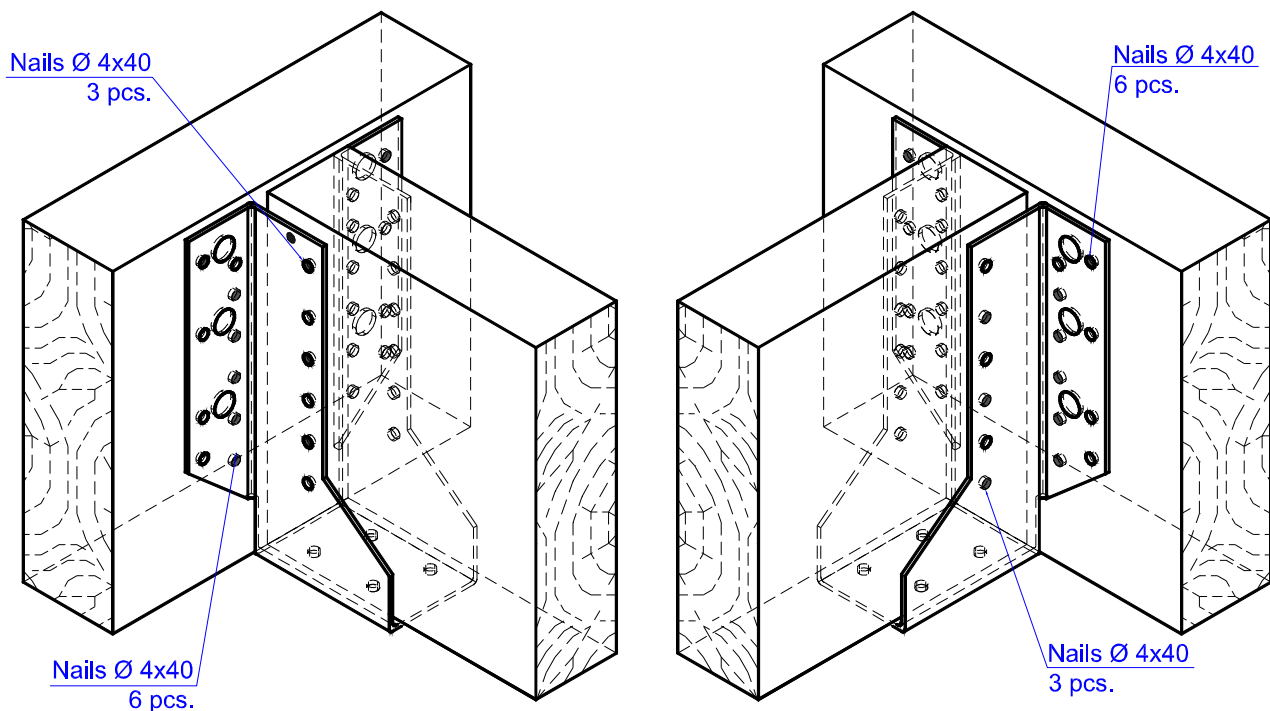


Figure D.3. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 45x168x2

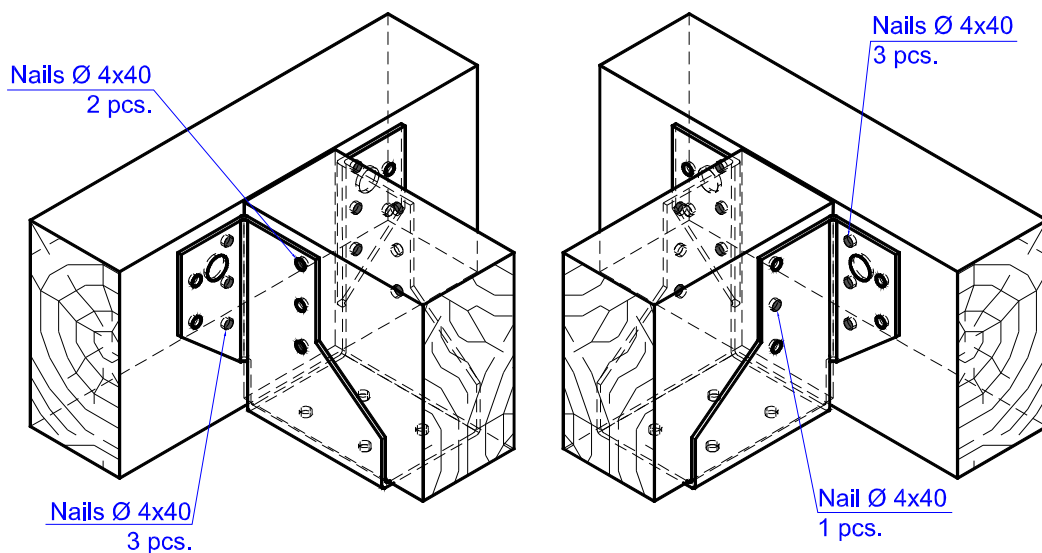


Figure D.4. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x93x2

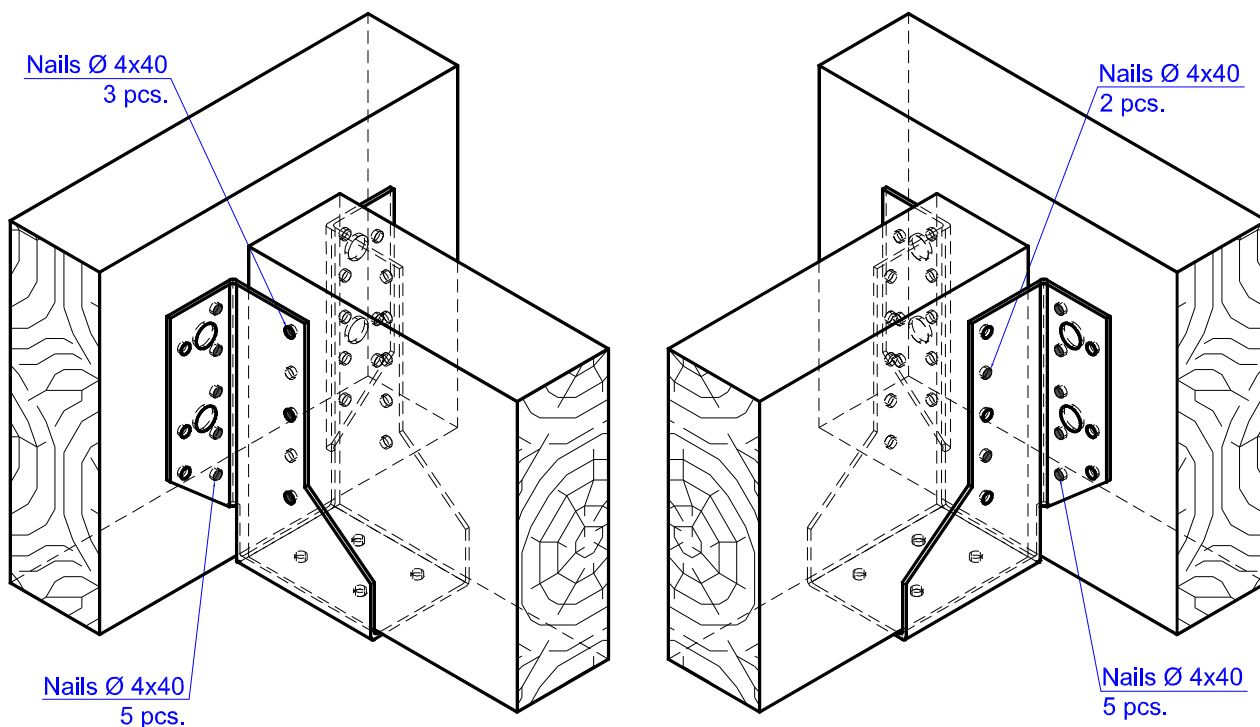


Figure D.5. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x135x2

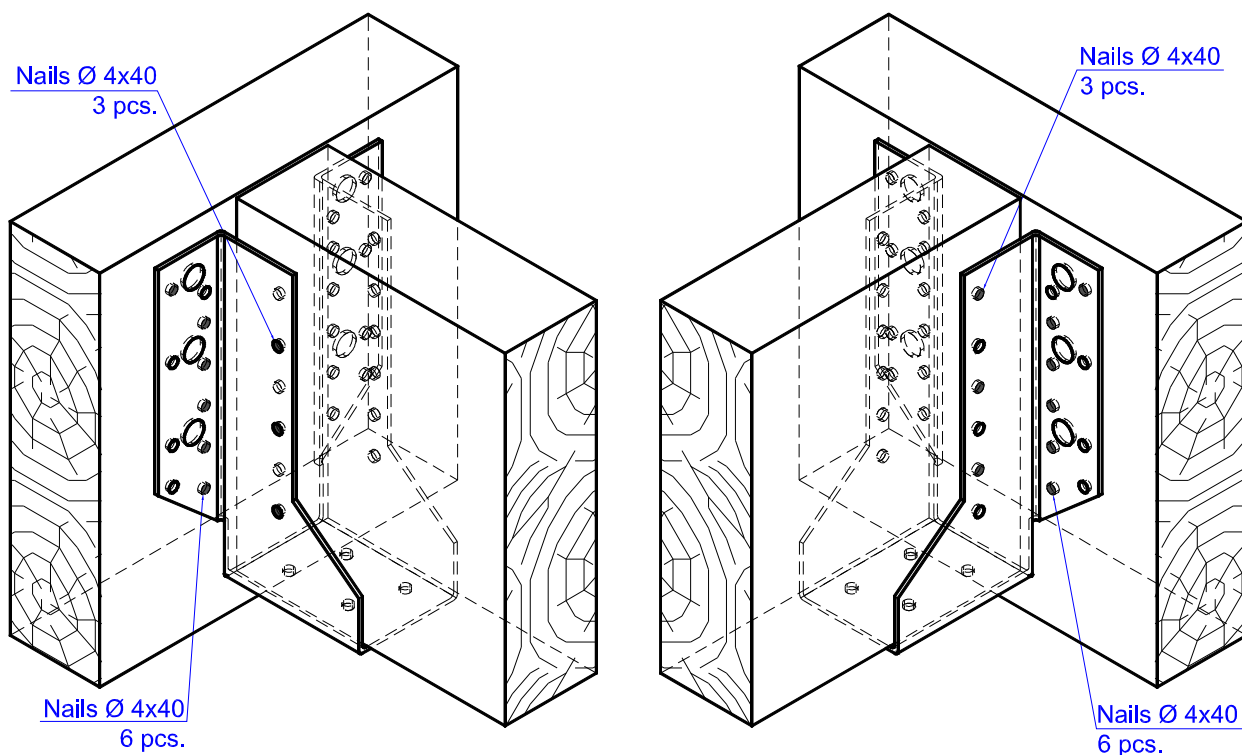


Figure D.6. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x165x2

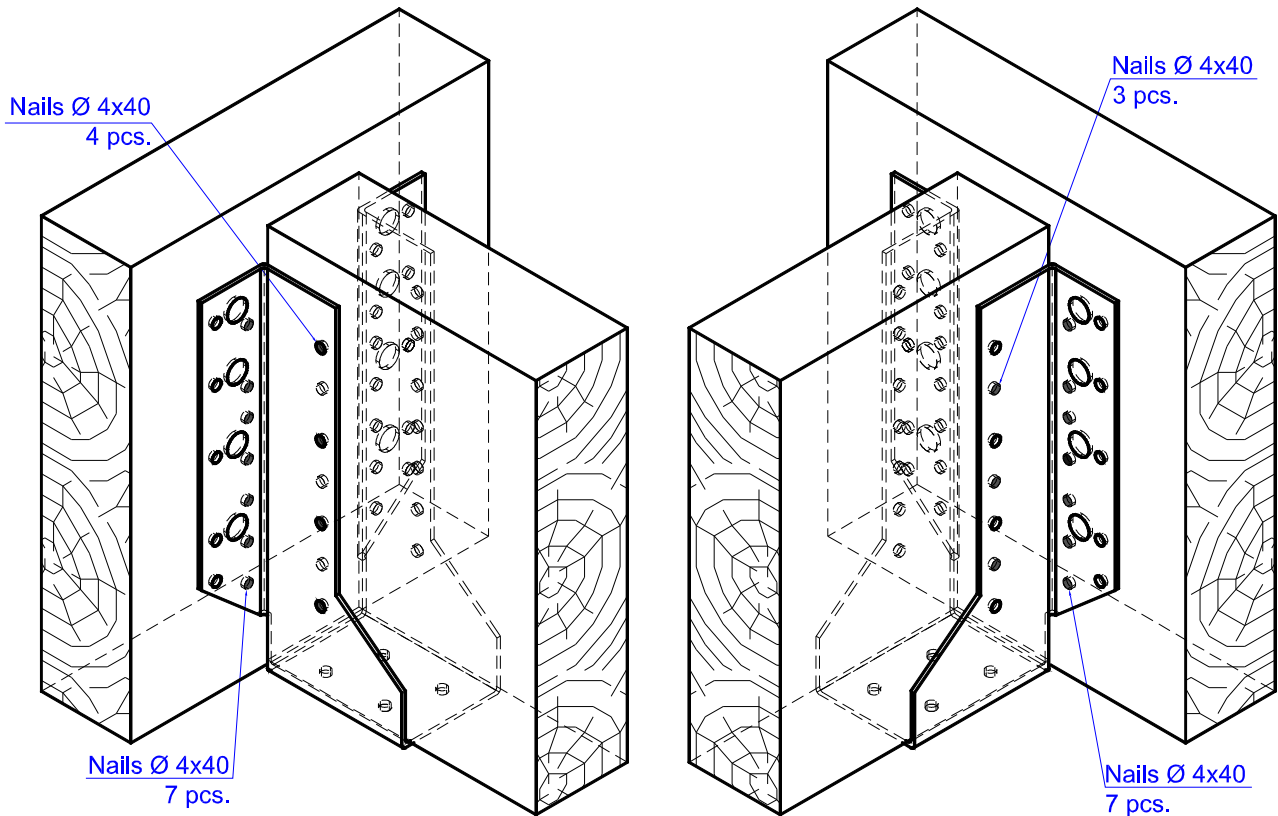


Figure D.7. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 51x195x2

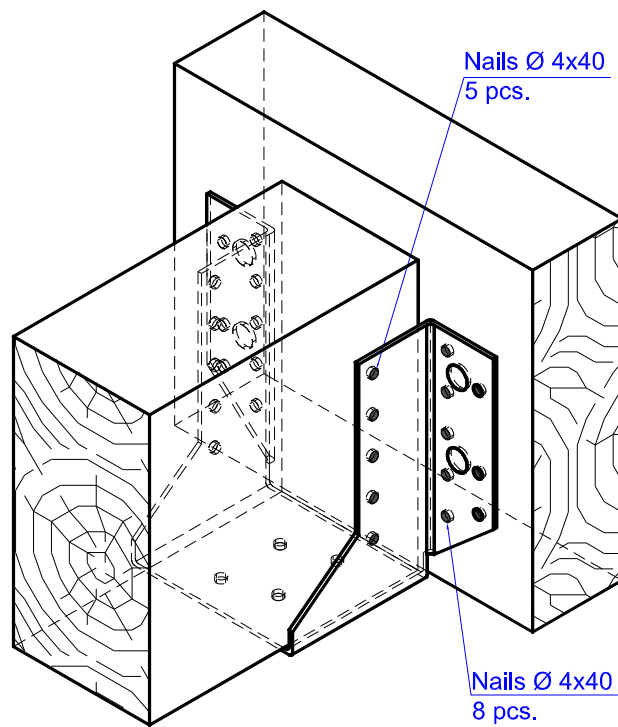


Figure D.8. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x123x2. Position of nails is symmetrical in both sides

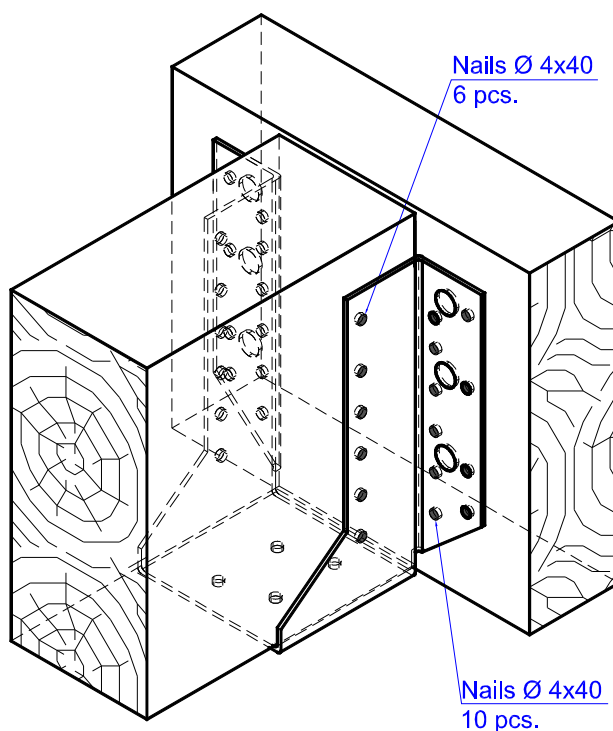


Figure D.9. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x153x2. Position of nails is symmetrical in both sides

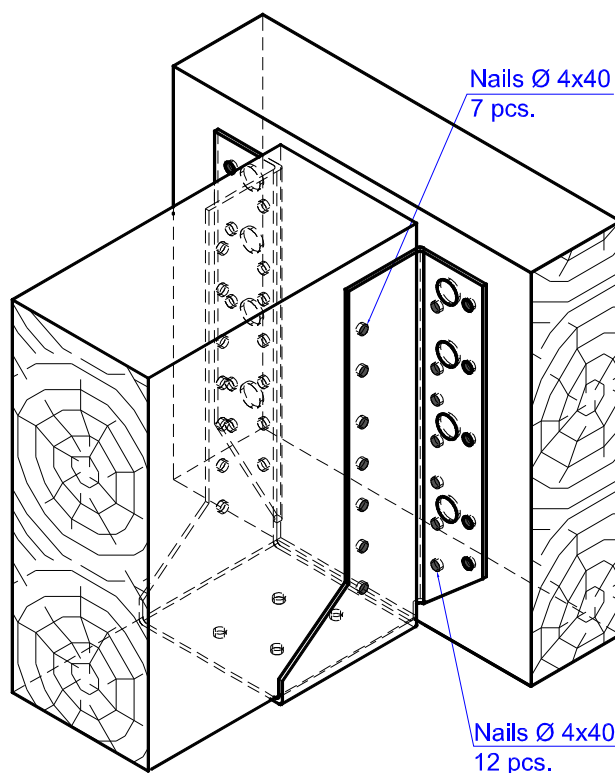


Figure D.10. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 76x182x2. Position of nails is symmetrical in both sides

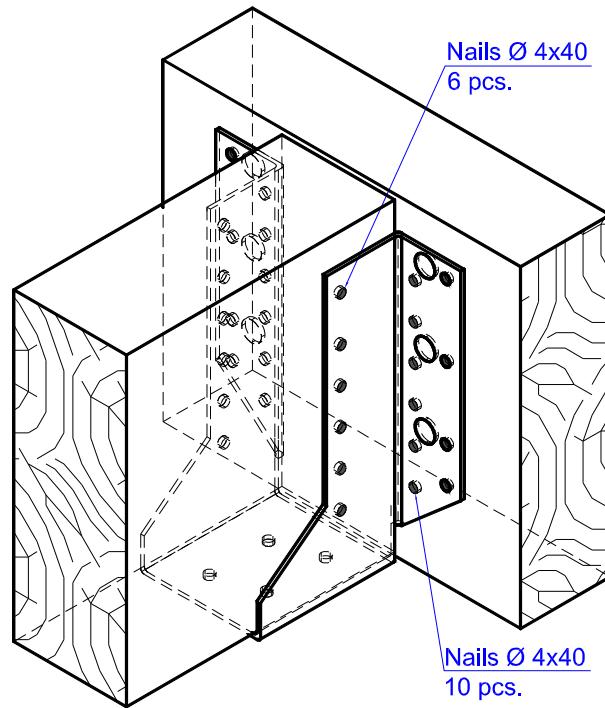


Figure D.11. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 63x158x2. Position of nails is symmetrical in both sides

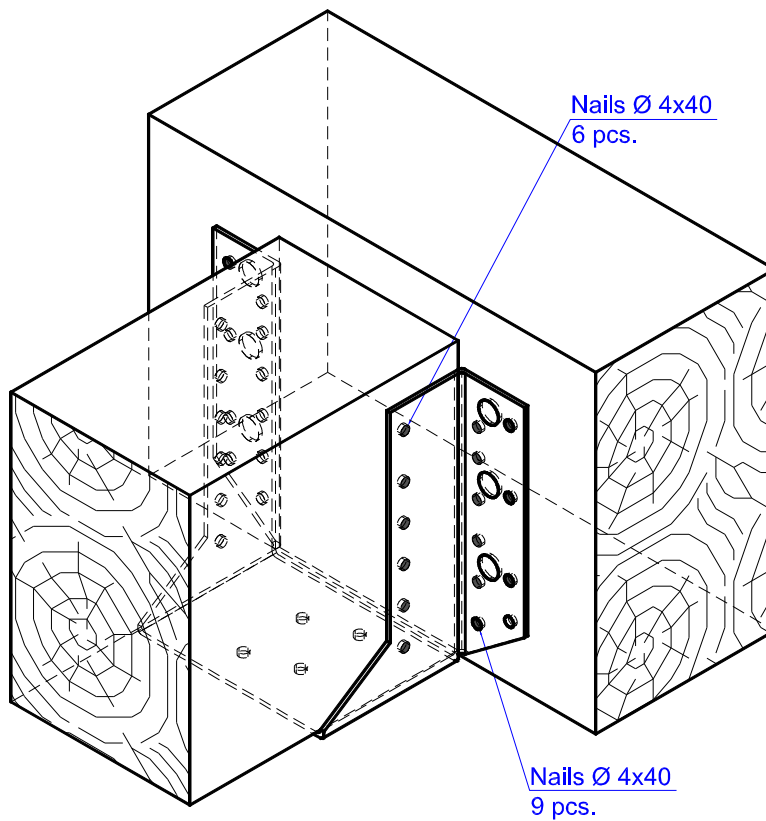


Figure D.12. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100x140x2. Position of nails is symmetrical in both sides

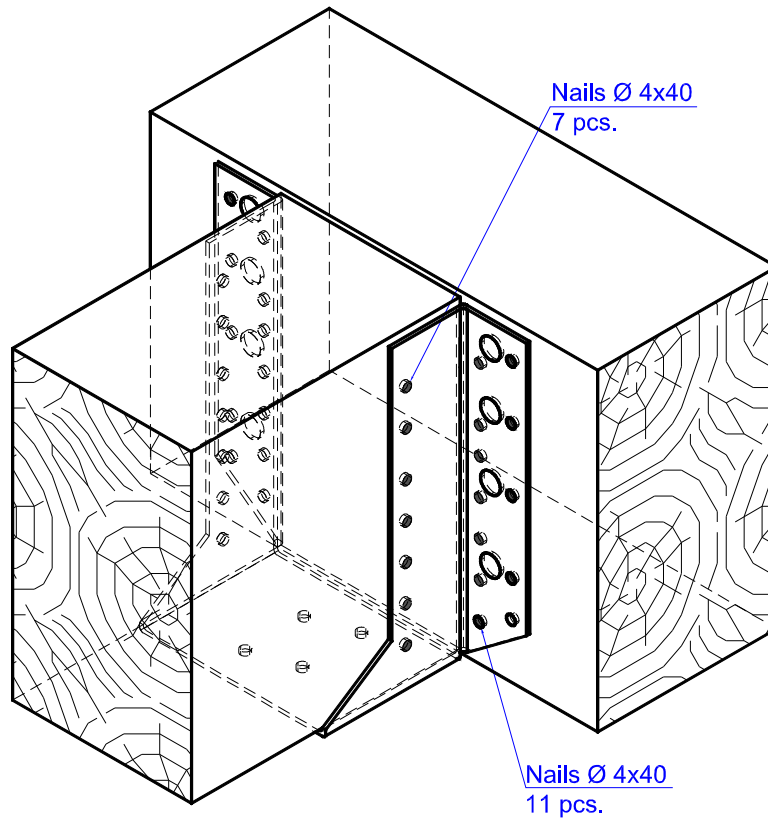


Figure D.13. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 100x170x2. Position of nails is symmetrical in both sides

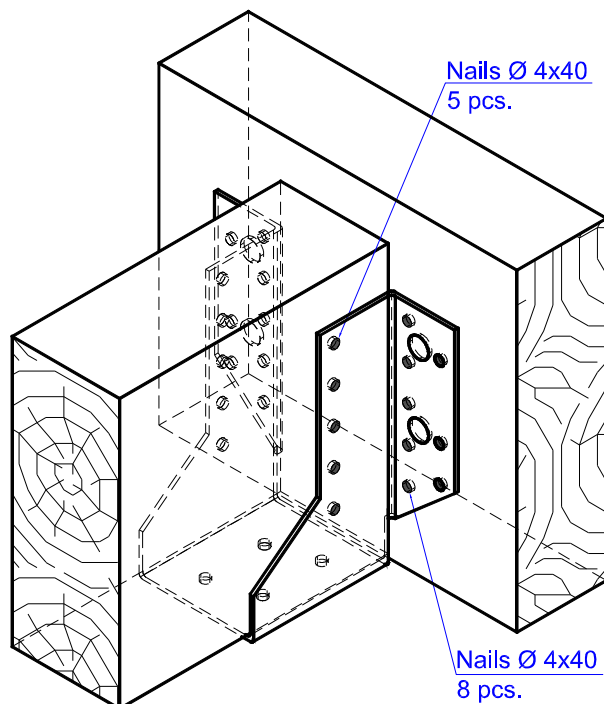


Figure D.14. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 60x130x2. Position of nails is symmetrical in both sides

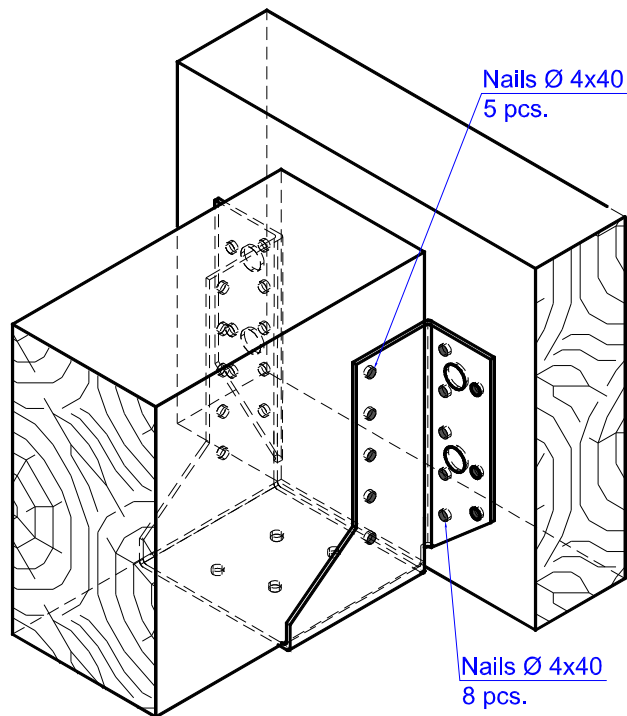


Figure D.15. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x120x2. Position of nails is symmetrical in both sides

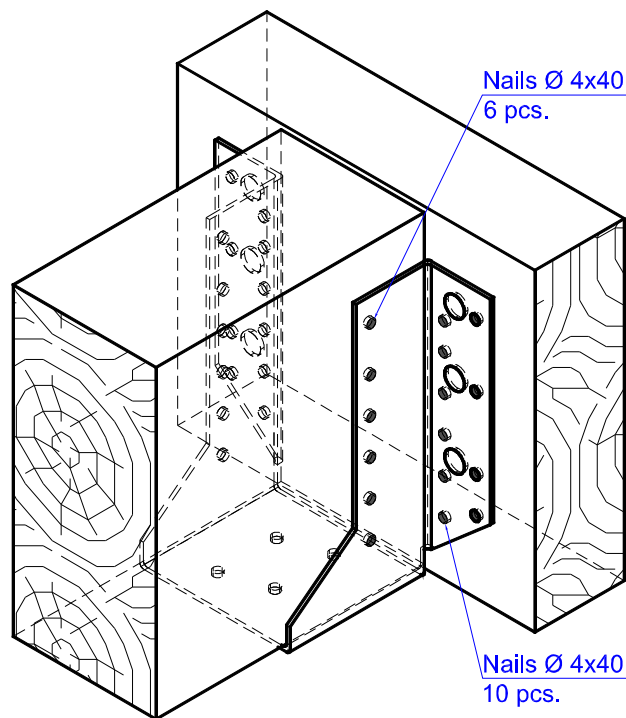


Figure D.16. Number and position of nails in the timber beam to timber beam connection with the joist hanger SA 80x150x2. Position of nails is symmetrical in both sides