

## European Technical Approval ETA-10/0186

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
*Trade name*

BiLO-Zuganker Typ 1 und Zuganker - vormontierbar - vorspannbar  
*BiLO hold-downs type 1 and hold-downs - possibly pre-assembled and pre-stressed*

Zulassungsinhaber  
*Holder of approval*

BiERBACH® GmbH & Co. KG  
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Industriegebiet West  
Rudolf-Diesel-Straße  
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DEUTSCHLAND

Zulassungsgegenstand  
und Verwendungszweck  
*Generic type and use  
of construction product*

Blechformteile (Zuganker für Verbindungen Holz an Beton oder Holz an Stahl)  
*Three-dimensional nailing plates (Hold-downs for timber to concrete or timber to steel connections)*

Geltungsdauer:  
*Validity:* vom  
*from*  
bis  
*to*

20 December 2011  
7 July 2015

Herstellwerke  
*Manufacturing plants*

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Diese Zulassung umfasst  
*This Approval contains*

21 Seiten einschließlich 2 Anhänge  
*21 pages including 2 annexes*

Diese Zulassung ersetzt  
*This Approval replaces*

ETA-10/0186 mit Geltungsdauer vom 08.07.2010 bis 07.07.2015  
*ETA-10/0186 with validity from 08.07.2010 to 07.07.2015*

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by law of 31 October 2006<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Three-dimensional nailing plates", ETAG 015.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12  
<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1  
<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25  
<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812  
<sup>5</sup> *Bundesgesetzblatt Teil I 2006*, p. 2407, 2416  
<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of the product and of the intended use

#### 1.1 Definition of the construction product

BiLO-Zuganker are one-piece or two-piece timber connectors which are fastened to timber members with nails and to concrete members or steel members with bolts or metal anchors. The hold-downs are made by cold forming of galvanized steel sheet S250GD+Z275 according to EN 10346.

The horizontal flange of the one-piece hold-down is provided with a base plate of steel S235 according to EN 10025-2. The base plate and the pressure piece of the two-piece hold-down consist of steel S235.

Dimensions, hole positions and typical installations are given in Annex B. Hold-downs are produced from steel sheets with dimensions according to the standard EN 10143.

#### 1.2 Intended use

The hold-downs are used for load-carrying timber to concrete resp. timber to steel connections in timber constructions, where the requirement "Mechanical resistance and stability" within the meaning of the Essential Requirement 1 of Council Directive 89/106/EEC has to be fulfilled.

The connection is manufactured with one hold-down (see Annex B). The joint with a one-piece hold-down can be performed also by a slidably interlayer of OSB with a thickness of 15.0 mm up to 25.0 mm. The horizontal flange of the one-piece hold-down is provided with a base plate according to Table A.2 in Annex A.

The connection with two-piece hold-downs is manufactured with a steel sheet and a base plate jointed with spring-type straight pins or parallel pins. The end of the base plate is underlaid with a 20 mm long and 60 mm broad pressure piece made of steel (see Annex B, Figures B.9 and B.10).

The structural behaviour of the construction elements and the support conditions shall correspond to the indications given in Annex B. The hold-downs may only be used in service classes 1 and 2 according to Eurocode 5 and for connections exposed to predominantly quasi static loads.

The timber members can be of solid timber, glued laminated timber or wood-based material. Requirements applicable to the timber construction elements are fulfilled by timber or wood-based material with a characteristic density between 290 kg/m<sup>3</sup> and 420 kg/m<sup>3</sup>. The following softwood materials are suitable for connections with BiLO-Zuganker.

- Solid timber of softwood according to EN 338:2009 / EN 14081-1:2005+A1:2011,
- Glued laminated timber according to EN 1194:1999 / EN 14080:2005,
- Glued laminated solid timber Duo- and Triobalken,
- Solid wood panels SWP according to EN 13353:2008 / EN 13986:2004,
- Laminated veneer lumber LVL according to EN 14374:2004, connection only perpendicular to the plane of the veneers,
- Plywood according to EN 636:2003 / EN 13986:2004,
- Parallel strand lumber Parallam PSL, connection only perpendicular to the plane of the veneers,
- Laminated strand lumber Intrallam LSL, connection only perpendicular to the plane of the veneers.

Annex B includes characteristic values of the load-carrying capacity for connections with hold-downs for a characteristic density of 350 kg/m<sup>3</sup>. For timber and wood-based materials with another density the characteristic values of the load-carrying capacity for nail failure shall be multiplied by the factor  $k_{\text{dens}}$ :

$$k_{\text{dens}} = \sqrt{\frac{\rho_k}{350}} \quad \text{where } \rho_k \text{ is the characteristic timber density in kg/m}^3$$

The design of the connections shall be carried out according to national provisions that apply at the installation site of the certified object in line with the partial safety factor format, e.g. in accordance with Eurocode 5.

The provisions made in this European technical approval are based on an assumed working life of the hold-downs of 50 years, provided that the hold-downs are subject to appropriate use and maintenance. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded as a means for choosing the right products in relation to the expected economically reasonable working life of the construction.

## 2 Characteristics of product and methods of verification

### 2.1 Characteristics

ETAG paragraph	Characteristic	Assessment of characteristic
<b>6.1</b>	<b>Mechanical resistance and stability <sup>*)</sup></b>	
6.1.1	Load-carrying capacities	see Annex B
6.1.2	Stiffness	see Annex B
6.1.3	Ductility in cyclic testing	no performance determined
<b>6.2</b>	<b>Safety in case of fire</b>	
	Reaction to fire	Hold-downs are made from steel classified as <b>Euroclass A1</b> in accordance with EC decision 96/603/EC, amended by EC Decision 2000/605/EC.
	Resistance to fire	Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, however not for a single connector. Therefore there is no performance determined to this Essential Requirement.
<b>6.3</b>	<b>Hygiene, health and the environment</b>	
6.3.1	Release of dangerous substances	no dangerous substances <sup>**)</sup>
<b>6.4</b>	<b>Safety in use</b>	not relevant
<b>6.5</b>	<b>Protection against noise</b>	not relevant
<b>6.6</b>	<b>Energy economy and heat retention</b>	not relevant
<b>6.7</b>	<b>Related aspects of serviceability <sup>***)</sup></b>	
6.7.1	Durability	Hold-downs have been assessed as having satisfactory durability and serviceability provided they are used in timber structures using the timber species described in Eurocode 5 and are subject to the conditions defined by service classes 1 and 2.
6.7.2	Serviceability	
6.7.3	Identification	See Annex A

<sup>\*)</sup> See section 2.2 of this ETA

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

<sup>\*\*\*)</sup> See section 2.3 of this ETA

## 2.2 Mechanical resistance and stability

The characteristic load-carrying capacities of a connection with a one-piece hold-down are based on the characteristic values of the nail connection and the steel sheet.

The characteristic load-carrying capacities of a connection with a two-piece hold-down are based on the characteristic values of the nail connection, the steel sheet, with spring-type straight pins or parallel pins and the base plate.

To calculate the design values, the characteristic load-carrying capacities given in Annex B have to be divided by partial safety factors for the material property and multiplied by the coefficient  $k_{mod}$  for the nail connection and the timber component with regard to the load duration and the service class defined in Eurocode 5.

According to the standard EN 1990:2002 + A1:2005 + A1/AC:2010 (Eurocode - Basis of design) paragraph 6.3.5 the design value of load-carrying capacity can be determined by reducing the characteristic values of the load-carrying capacity with different partial safety factors.

Thus, the characteristic values of the load-carrying capacity were determined for the failure of timber or wood-based material  $F_{Rk,H}$  (obtaining the embedment strength of nails subjected to shear) as well as for the steel sheet failure  $F_{Rk,S}$  (obtaining the tensile or bending strength of the tension sheet, the bending strength of the base plate or the load-bearing capacities of the spring-type straight pins or the parallel pins). The design value of the load-carrying capacity  $F_{Rd}$  is the smaller value of:

$$F_{Rd} = \min \left\{ \frac{k_{mod} \cdot F_{Rk,H}}{\gamma_{M,H}}, \frac{F_{Rk,S}}{\gamma_{M,S}} \right\}$$

Therefore, for timber or wood-based material failure the load duration class and the service class are taken into account. The various partial safety factors  $\gamma_M$  for steel and timber or wood-based material, respectively, are also taken into account.

Annex B states characteristic values of the load-carrying capacity for the direction of the load  $F_1$ . The characteristic values of the load-carrying capacity are determined by calculation assisted by testing according to the guideline ETAG 015. They are used for the design according to national provisions that apply at the installation site in line with the partial safety factor format, e.g. in accordance with Eurocode 5.

For ductility of a connection under cyclic load no performance was determined. Therefore, the contribution of the connections as to the structural behaviour under seismic load is not being assessed.

## 2.3 Aspects of durability

### 2.3.1 Corrosion protection in service classes 1 and 2

In line with ETAG 015, the hold-downs are made of zinc-coated steel grade S250GD+Z275 in accordance with EN 10346. The base plates of the two-piece hold-down consist of steel S235 with a thickness of 20 mm. The pressure piece is manufactured of steel S235.

### 2.3.2 In relation to the required corrosion protection national provisions that apply at the installation site of the certified object shall be considered e.g. Eurocode 5.

In accordance with Eurocode 5 - Table 4.1 the nails to be used may be of uncoated steel for service class 1 and require corrosion protection Fe/Zn 12c or Z275 for service class 2.

The parallel pins and the base plate to be used do not require corrosion protection for service classes 1 or 2.

The spring-type straight pine and the pressure piece to be used may be of uncoated steel for service class 1 and require corrosion protection FE/Zn 12c or Z275 for service class 2 in accordance with EC 5 - Table 4.1.

### 2.3.3 If preservative treatment of timber is used, national regulations apply.

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to the Decision 97/638/EC of the European Commission<sup>7</sup> system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- a) Tasks for the manufacturer:
  - (1) initial type-testing of the product;
  - (2) factory production control;
  - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- b) Tasks for the approved body:
  - (4) certification of factory production control on the basis of:
    - initial inspection of factory and of factory production control;
    - continuous surveillance, assessment and approval of factory production control.

Note: Approved body are also named "notified body".

#### 3.2 Responsibilities

##### 3.2.1 Tasks of the manufacturer

###### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the "Control plan relating to the European technical approval ETA-10/0186 issued on 20 December 2011" which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik<sup>8</sup>.

The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as steel sheet, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and zinc coating thickness.

The manufactured components shall be checked visually and for dimension accuracy. The control plan includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control.

<sup>7</sup> Official Journal of European Communities L 268/36 of 01.10.1997

<sup>8</sup> The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan. At least the following data shall be recorded:

- Designation of the product, basic materials and components,
- Type of control or testing,
- Date of manufacture of the product and date of testing of the product or basic materials and components,
- Result of control and testing and, if appropriate, comparison with the requirements,
- Signature of person responsible for factory production control.

The records shall be presented to the approved body involved in the continuous surveillance and shall be presented to Deutsches Institut für Bautechnik on request.

#### 3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of hold-downs in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing shall be agreed on between Deutsches Institut für Bautechnik and the notified body.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval ETA-10/0186 issued on 20 December 2011.

#### 3.2.2 Tasks for the approved body

The approved body shall perform the following tasks in accordance with the provisions of the control plan:

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

##### 3.2.2.1 Initial inspection of factory and factory production control

The approved body shall ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the hold-downs with this European technical approval.

##### 3.2.2.2 Continuous surveillance

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

##### 3.2.2.3 Other tasks of the approved body

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The results of the continuous surveillance shall be made available on demand by the certification body to Deutsches Institut für Bautechnik.

The approved certification body appointed by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

### 3.3 CE marking

The CE marking shall be affixed on each packaging of hold-downs. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- number of the EC certificate for the factory production control,
- number of the European technical approval,
- number of the guideline for European technical approval (ETAG 015),
- name and size of product.

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

### 4.1 Manufacturing

The hold-downs shall be manufactured in accordance with the provisions of the European technical approval using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

This European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

### 4.2 Installation

The connection of timber and concrete resp steel members with hold-downs is considered to be suitable for the intended use, provided:

#### - Nail arrangement

The holes of the one-piece hold-down have to be nailed beginning at the end of the hold-down. The holes of the straight two-piece hold-down have to be nailed symmetrically. The number of nails in the post constitutes at least 4 and follows from the static calculation. Nails to be used shall have a diameter which matches the holes of the hold-down. All holes of the bent two-piece hold-down have to be nailed. For the minimum distance between the nails values multiplied by the factor 0.7 given in Table 8.2 of Eurocode 5 shall apply.

#### - Interlayer

The joint of the one-piece hold-down to the timber element may also be done with a layer of OSB of the technical class OSB/2. The layer with a thickness of 15 mm up to 25 mm is slidable.



- *Wane*

A wane is not allowed, the hold-downs shall lay on the entire surface of the timber.

- *Support and restraint conditions*

The construction elements connected by hold-downs shall be secured against rotation.

- *Base plates*

A base plate shall be installed above the horizontal flange of the one-piece hold-down in accordance with Table A.2 in Annex A. See Figure B.8 in Annex B.

The base plate of the two-piece hold-down is connected to the sheet with spring-type straight pins or parallel pins according to Table A.5 in Annex A. It must be guaranteed that the base plate is shortly mounted to the steel sheet in the final state. (See Annex B Figures B.9 and B.10).

- *Installation of the two-piece connector (straight resp bent)*

The steel sheets were mounted to the timber members in the plant. The installation of the base plate with the compression plate and the connection to the sheet is carried out on the building site.

- *Others*

Installation is carried out by qualified personnel under the direction of a supervisor. The qualified personnel is appropriately qualified for this work. The installation is performed in accordance with the manufacturer's technical documentation.

The construction elements shall have a thickness exceeding the penetration depth of the nails in the construction element.

## 5 Recommendations

### 5.1 Packaging, transport and storage

BiLO-Zuganker are packed in boxes bearing the manufacturer's name, product type, dimensions, quantity, data of manufacture and details of the delivery batch.

In relation to transportation and storage BiLO-Zuganker should be treated as conventional metallic building products.

### 5.2 Use, maintenance, repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life. Should repair prove necessary, this is normally done by the replacement of the hold-down.

Georg Feistel  
Head of Department

*beglaubigt:*  
Niebur

Annex A

Product details and definitions  
Table A.1 Materials specification

Type of hold-down	Size of hold-down	Thickness (mm)	Steel specification	Coating specification
one-piece	<b>60x240</b>	2.5	S250GD	Z275
one-piece	<b>60x280</b>	2.5	S250GD	Z275
one-piece	<b>60x320</b>	2.5	S250GD	Z275
one-piece	<b>60x400</b>	2.5	S250GD	Z275
one-piece	<b>60x520</b>	2.5	S250GD	Z275
one-piece	<b>80x440</b>	2.5	S250GD	Z275
two-piece, straight	<b>60x300</b>	2.5	S250GD	Z275
two-piece, straight	<b>60x380</b>	2.5	S250GD	Z275
two-piece, bent	<b>60x380</b>	3.0	S250GD	Z275
Base plate	<b>60x140</b>	20.0 (45.0)	S235	/
Base plate	<b>60x260</b>	20.0 (45.0)	S235	/

Tabelle A.2 Ranges of size

Type of hold-down	Size of hold-down	Height (mm) vertical		Length (mm) horizontal		width (mm)		Thickness of base plate <sup>*)</sup> (mm)
		min	max	min	max	min	max	
one-piece	<b>60x240</b>	239	241	71	73	59	61	10.0
one-piece	<b>60x280</b>	279	281	71	73	59	61	15.0
one-piece	<b>60x320</b>	319	321	86	88	59	61	15.0
one-piece	<b>60x400</b>	399	401	101	103	59	61	15.0
one-piece	<b>60x520</b>	519	521	221	223	59	61	15.0
one-piece	<b>80x440</b>	439	441	221	223	79	81	20.0
two-piece, straight	<b>60x300</b>	299	301	/	/	59	61	/
two-piece, straight	<b>60x380</b>	379	381	/	/	59	61	/
two-piece, bent	<b>60x380</b>	379	381	/	/	59	61	/
Base plate	<b>60x140</b>	19	21 resp 46	139	141	59	61	/
Base plate	<b>60x260</b>	19	21 resp 46	259	261	59	61	/

<sup>\*)</sup> The length and the width of the base plate made of steel S235 meet the dimensions of the horizontal flange of the hold-down.

Table A.3 Interlayer for one-piece hold-downs

Material	Thickness (mm)	Type
Oriented strand board (OSB) according to EN 300 at least type OSB/2	15.0 to 25.0	see specification of the manufacturer

Table A.4 Fasteners nails

Nail type	Nail size (mm)		Finish
	Diameter	Length	
<b>for one-piece hold-down</b>  threaded nail with a truncated cone under the head	4.0	≥ 60 thread l ≥ 50 <b>if necessary</b> <b>fit length to</b> <b>interlayer</b>	Corrosion protection according to national provisions e.g. electroplated zinc
<b>for two-piece hold-down</b>  threaded nail with a truncated cone under the head	4.0	50 thread l ≥ 40	Corrosion protection according to national provisions e.g. electroplated zinc
<b>for two-piece hold-down</b>  threaded nail with a truncated cone under the head	4.0	40 thread l ≥ 30	Corrosion protection according to national provisions e.g. electroplated zinc
The characteristic value of the withdrawal parameter has to fulfil the requirement: $f_{ax,k} \geq 50 \times 10^{-6} \times \rho_k^2$ (N/mm <sup>2</sup> ) Where: $\rho_k$ Characteristic density of the timber in kg/m <sup>3</sup>			

Table A.5 Fasteners pins

Type of pin	Diameter (mm)	Length (mm)	acc. to standard
spring-type straight pin	6.0	20	EN ISO 8752:2009
parallel pin	6.0	20	EN ISO 8734:1998
parallel pin with internal thread	6.0	20	EN ISO 8735:1998

## Annex B

### Characteristic values of the load-carrying capacity

Table 1: Characteristic values of the load-carrying capacity of a one-piece hold-down

Size of hold-down	Thickness of the base plate (mm)	Nail failure ( $F_{v,Rk}$ ) per nail [kN] <sup>1)</sup>	Failure of concrete pressure	Steel failure ( $F_{S,Rk}$ )			Bolts
				Bending ( $F_{m,Rk}$ ) [kN]	Shearing ( $F_{c,Rk}$ ) [kN]	Tension ( $F_{t,Rk}$ ) [kN]	$k_t$
60x240	10.0	1.93	Design according to EN 1992	<b>10.1</b>	21.6	37.1	3.94
60x280	15.0	1.93		21.9	<b>21.6</b>	37.1	3.94
60x320	15.0	1.93		23.8	<b>21.6</b>	37.1	2.50
60x400	15.0	1.93		23.8	<b>21.6</b>	37.1	2.01
60x520	15.0	1.93		23.8	<b>21.6</b>	37.1	1.28
80x440	20.0	1.93		61.2	<b>28.9</b>	44.5	1.28

To consider an interlayer of 15 mm up to 25 mm thick OSB,  $R_{v,Rk}$  shall be reduced by the factor 0.7. For nail failure the coefficient  $k_{mod}$  for OSB shall be taken into account.

<sup>1)</sup> total loading capacity:  $n_{nail} \times$  tabular value

Table 2: Characteristic values of the load-carrying capacity of a two-piece hold-down

Zuganker Größe	Nail failure ( $F_{v,Rk}$ ) per nail		Steel failure			Base plate	Bolt	Failure of concrete pressure
	$\varnothing 4.0 \times 40 / \varnothing 4.0 \times 50$ [kN]		Tension ( $F_{t,Rk}$ ) [kN]	Bending ( $F_{m,Rk}$ ) [kN]	Shearing ( $F_{b,Rk}$ ) [kN]	Bending ( $F_{m,Rk}$ ) [kN]	$k_t$	
straight, 60x300 resp 60x380	1.60 <sup>1)</sup>	1.87 <sup>1)</sup>	31.2	-	<b>20.6</b>	-	-	Design according to EN 1992
bent 60x380	12.3 <sup>2)</sup>	14.5 <sup>2)</sup>	-	<b>10.2</b>	24.8	-	-	
Base plate (l = 140 mm)	-		-	-	-	20.6	1.86	
Base plate (l = 260 mm)	-		-	-	-	10.1	1.79	
<sup>1)</sup> Value per nail; total loading capacity: $n_{nail} \times$ tabular value; the hold-downs shall be nailed symmetrically. Information: $n_{nail} \geq 4$ <sup>2)</sup> Value for all nails, full nailing necessary (11 nails)								

### Definition of the load direction $F_1$

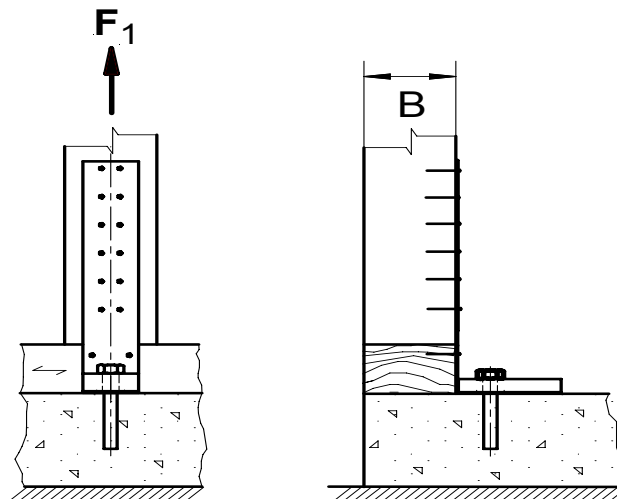


Figure B.1: Load by  $F_1$ , purlin and column

#### Nail arrangement

The number of nails in the post per one-piece or two-piece hold-down constitutes at least 4.

#### Wane

Wane is not allowed, in the area of hold-down the wood shall be sharp-edged.

#### Connection to concrete or steel

The connection of the hold-down to the concrete or steel member shall be verified. It is not subject of this European technical approval.

#### Cross tension

For the lifting force  $F_1$  a cross tension perpendicular to the grain has to be verified for the timber element, if necessary.

#### Stiffness

The values of stiffness have to be calculated according to EC 5, if necessary.

#### Bolts or metal anchors

The bolt or the metal anchor shall be designed for a tensile stress of

$$F_{B,Ed} = F_{1,Ed} \cdot k_t \text{ (N)}.$$

where:

$F_{1,Ed}$ : acting force (N)

$k_t$ : factor according to Table 1 (see previous page)

**BiLO hold-down (one-piece)**

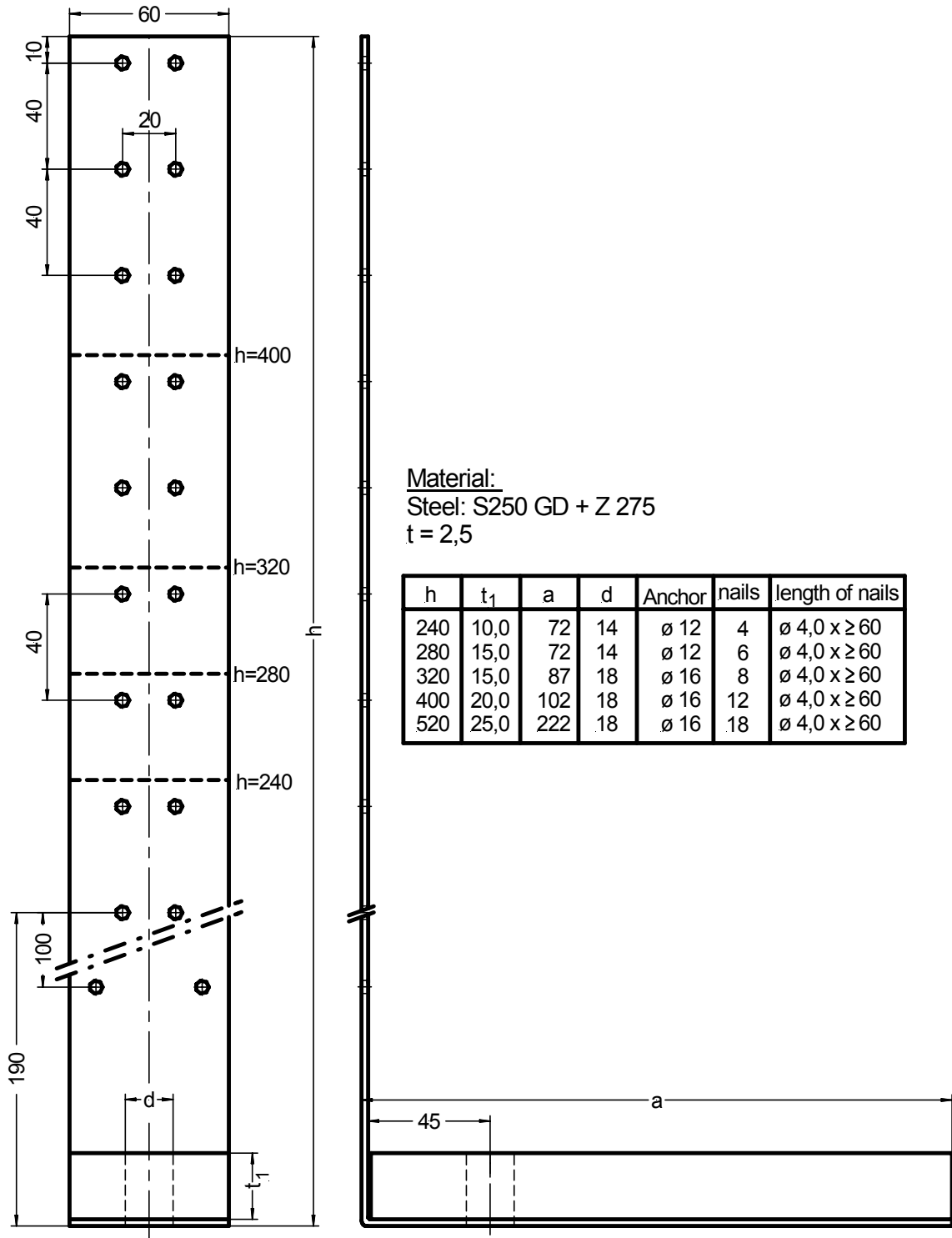


Figure B.2 Dimension of one-piece hold-down; width 60 mm

**BiLO hold-down (one-piece)**

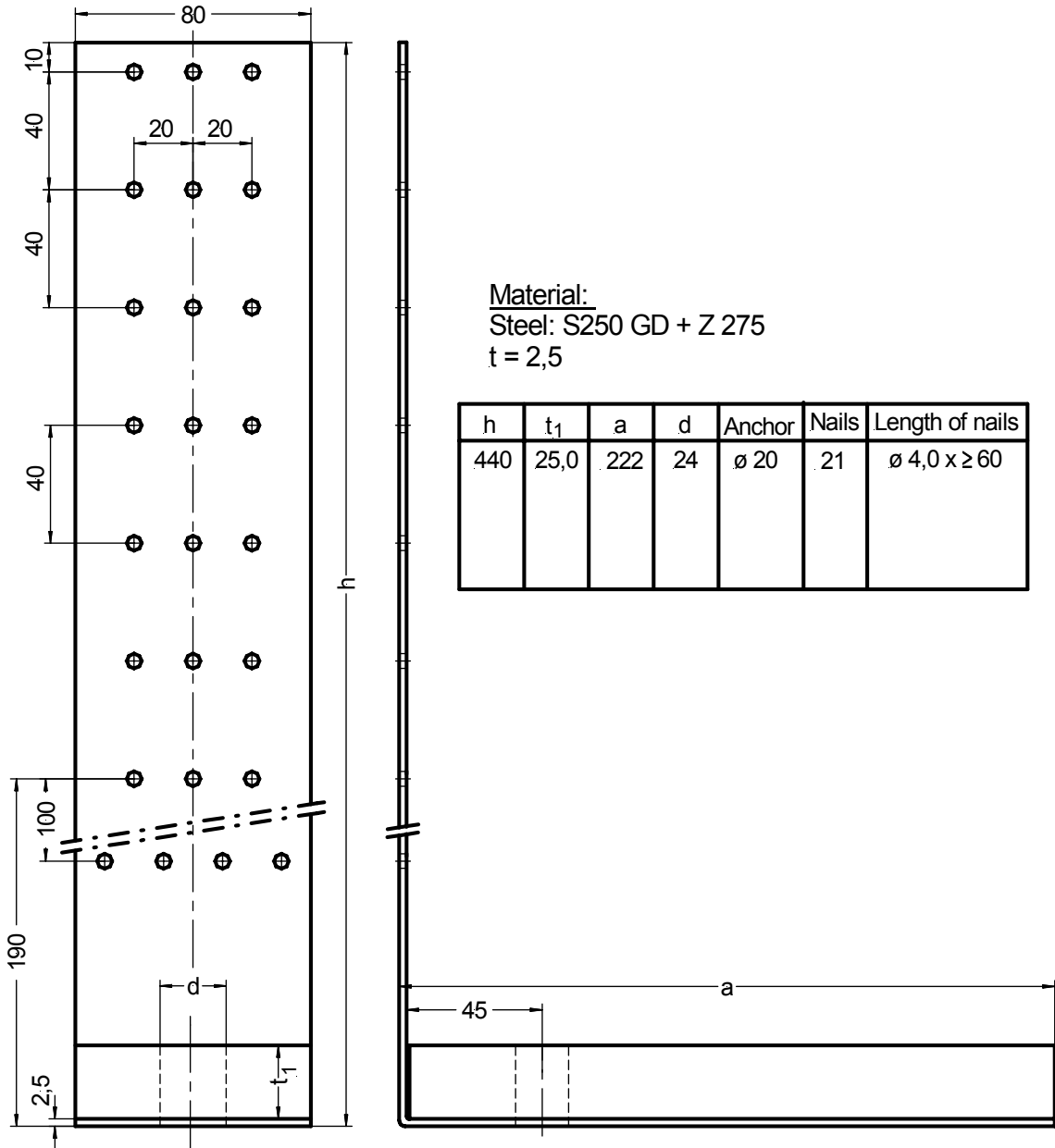


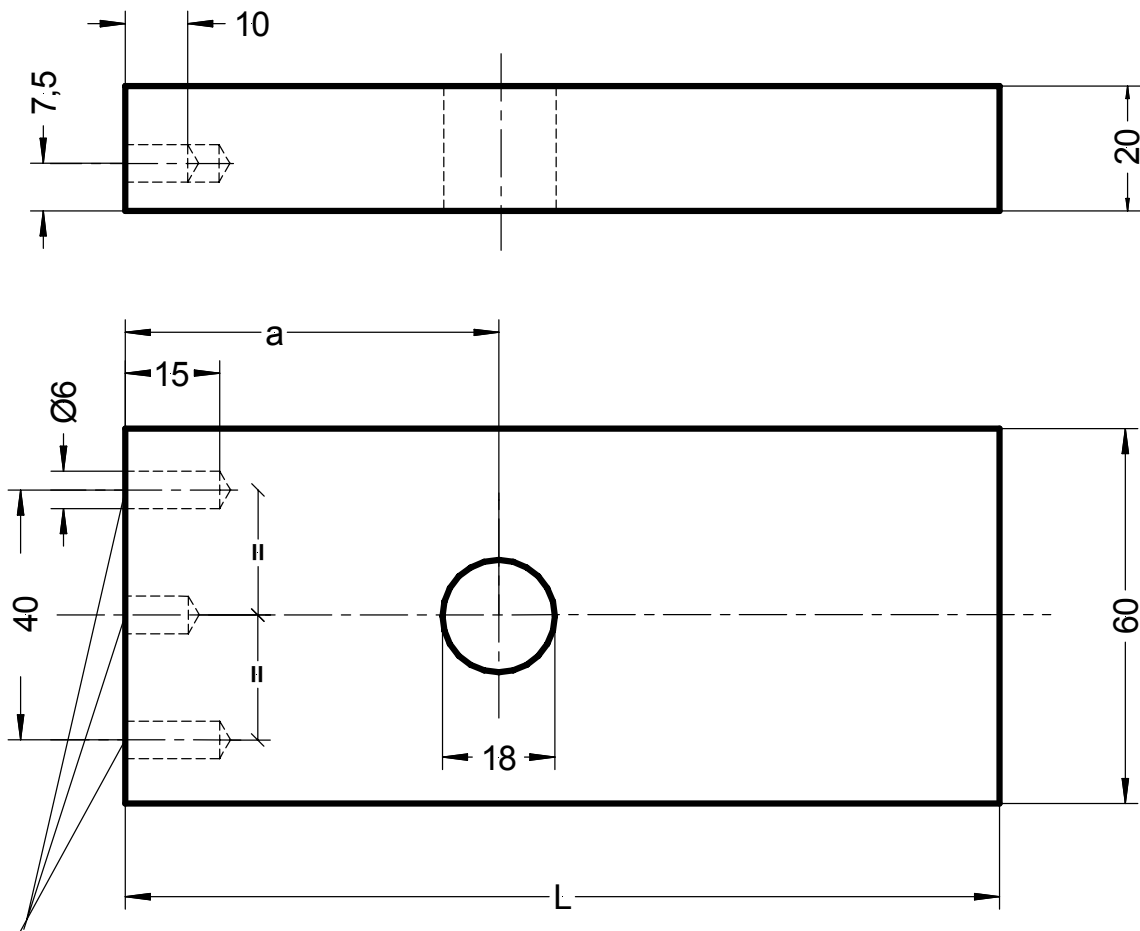
Figure B.3 Dimension of one-piece hold-down; width 80 mm







**BiLO base plate (straight) for two-piece hold-down**

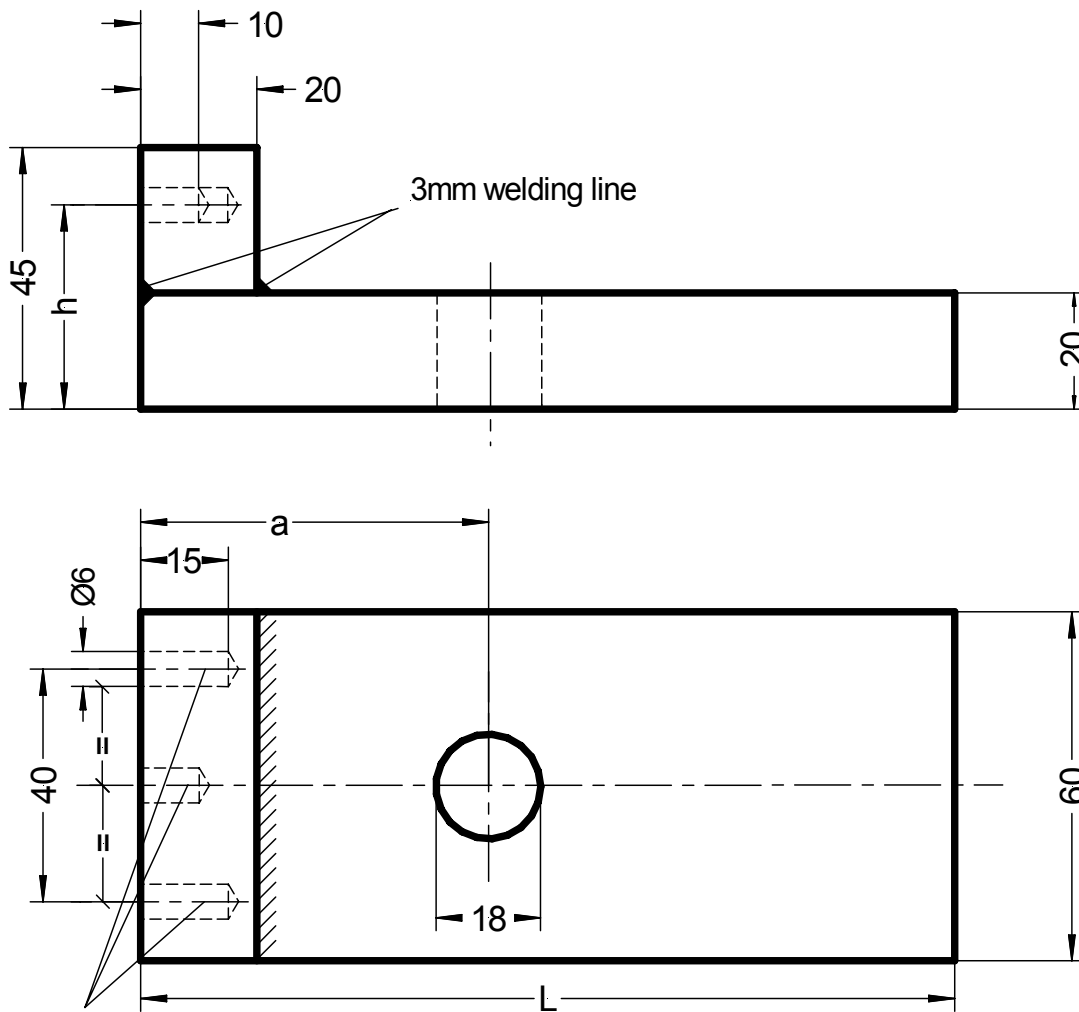


3 pieces drawpin  $\text{Ø}6 \times 20$  EN ISO 8752 assemble  
 or  
 dowels  $\text{Ø} 6 \times 20$  EN ISO 8735 oder  
 EN ISO 8734

a	L
60	140
110	260

Figure B.6 Dimensions of base plate (straight)

**BiLO base plate (angular) for two-piece hold-down**



3 pieces drawpin Ø6 x 20 EN ISO 8752 assemble  
 or  
 dowels Ø 6 x 20 EN ISO 8735 oder EN ISO 8734

a	L	$h_{\text{min.-max.}}$
60	140	25-35
110	260	25-35

Material:  
 Steel: S235

Figure B.7 Dimensions of welded base plate (angular)

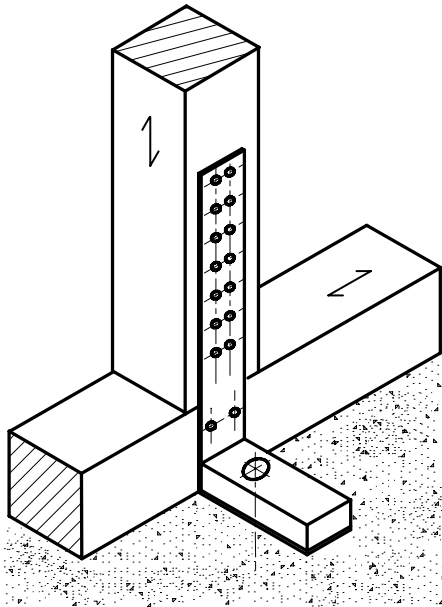


Figure B.8 Typical installation of a one-piece hold-down

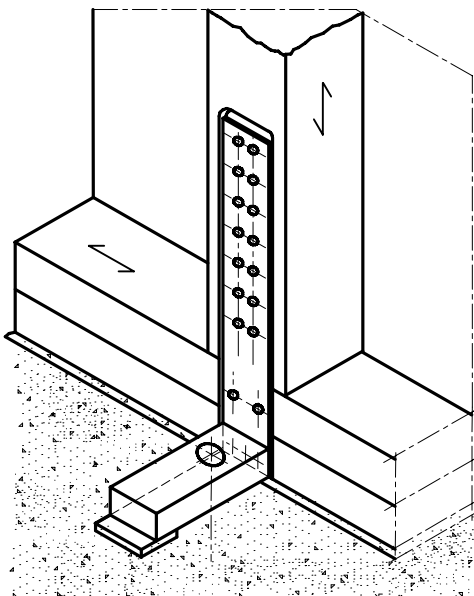


Figure B.9 Typical installation of a two-piece hold-down (straight) with a pressure piece under the base plate

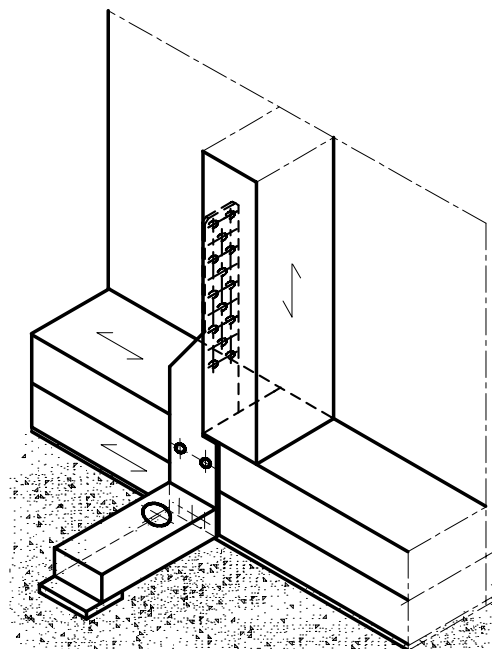


Figure B.10 Typical installation of a two-piece hold-down (bent) with a pressure piece under the base plate