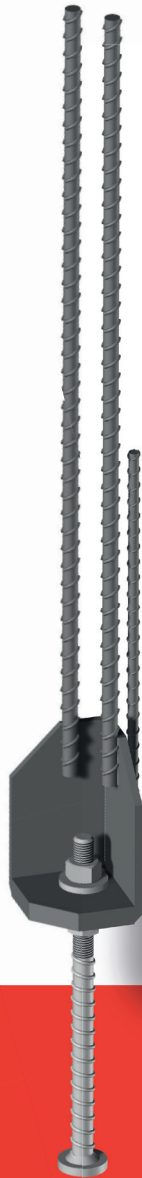


# PDP - COLUMN SHOES

Rigid bolted connection for precast  
concrete columns



EUROPEAN TECHNICAL ASSESSMENT 22/0668  
EUROPEAN TECHNICAL ASSESSMENT 21/0899

**iR** RECENSE





<b>1. PDP - COLUMN SHOES</b> .....	3
<b>Rigid bolted connection for precast concrete columns</b>	
1.1. Regulations.....	4
1.2. Intended use specifications .....	4
1.3. Stiffness.....	5
1.4. Examples of column shoe connections .....	5
<b>2. DIMENSIONS AND PROPERTIES</b> .....	6
Column sizes .....	7
<b>3. STRUCTURAL BEHAVIOUR</b> .....	8
3.1. Assembly stage .....	8
3.2. Final conditions.....	8
<b>4. RESISTANCES</b> .....	8
4.1. Axial strength .....	8
4.2. Shear strength .....	9
4.3. Shear and tensile strength .....	9
<b>5. RELATED PRODUCTS</b> .....	10
5.1. Anchor bolts.....	10
5.1.1. PAC short anchor bolts .....	10
5.1.2. PAL long anchor bolts.....	11
5.1.3. Strength .....	11
5.2. Recess formers .....	12
<b>6. ASSEMBLY INSTRUCTIONS</b> .....	13
6.1. PAC and PAL anchor bolts .....	13
6.2. Column shoes .....	13
6.2.1. Supplementary reinforcement for column shoes ...	14
6.3. On-site assembly .....	15
<b>CERTIFICATES AND TECHNICAL SHEETS</b> .....	17





## 1 PDP - COLUMN SHOES

### Rigid bolted connection for precast concrete columns

Column Shoes (PDP) are used in combination with Short Anchor Bolts (PAC) or Long Anchor Bolts (PAL) to form rigid connections between the column and foundation or between column and column. They are available in several sizes according to the strength required. The main advantages of this bolted system over traditional connections are the following:

- Quick and easy assembly
- No need for temporary bracing of column
- No curing times
- Tested and approved by European Technical Assessment
- Rigidity equivalent to a continuous column

The anchor bolts are cast into the foundation or column using a template for proper positioning. The column shoes are similarly embedded in the column during production at factory.

On site, the column is simply screwed to the anchor bolts, whose lower nuts must be levelled beforehand to provide the proper support. No bracing is needed so assembly time is greatly reduced. Finally, the joint is filled with non-shrink mortar.

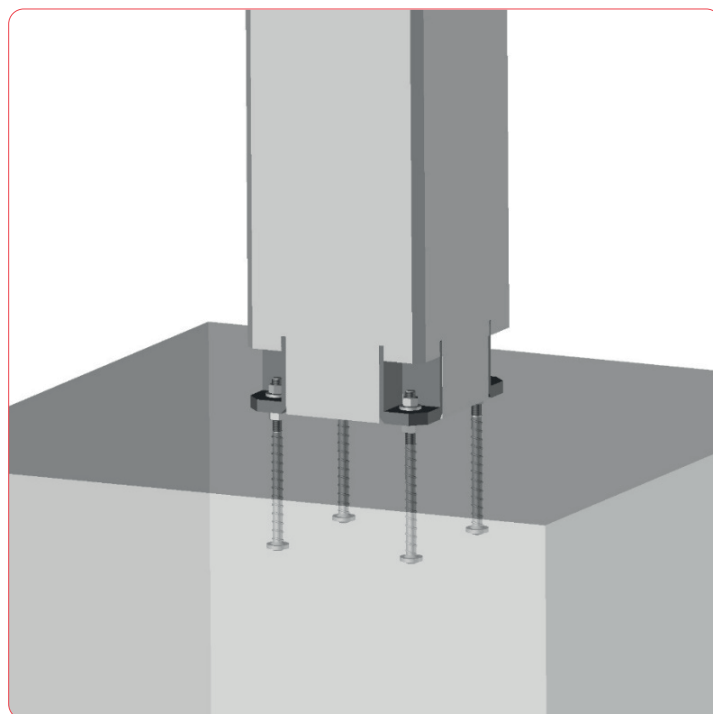


Image 1: Application example

## 1.1. Regulations

The CE marking for the column shoes can be done only via a European Technical Assessment since there is no harmonised standard that applies to them. The EN 1090 standard covers products for metallic structures such as beams, columns or substructures for façades; however, unlike these products, the performance of column shoes can be evaluated only in conjunction with the concrete they are embedded in.

Recense's PDP column shoes are approved by the European Technical Assessment 22/0668 issued by the IETcc, member of the European Organisation for Technical Assessment (EOTA). This ETA is based on the European Assessment Document EAD 200102-00-0302 which specifies the tests to be done on the system and the calculation method to ensure the tensile, shear, bending and stiffness strength.

Recense's PAC short anchor bolts are approved by the European Technical Assessment 21/0899 based on the EAD 330924-00-0601.

## 1.2. Intended use specifications

- Connection of reinforced concrete structural components of strength C30/37 to C70/85 according to EN 1992-1-1.
- Static or quasi-static loads.
- Tensile loads, compression loads, shear loads or any combination of these.
- In the area of the PDP column shoe, the concrete may either be cracked or uncracked.
- The standard EN 1992-1-1:2004 + AC:2010, section 4 applies for the PDP column shoes to be installed with a concrete cover.
- The lowest use temperature is -20°C.
- The column shoe connection will be dimensioned under the responsibility of an experienced engineer in the field of structural design and concrete constructions.
- The design will be based on the technical report TR 068: Structural Connections design with Column Shoes.
- The column shoe position, including the required reinforcement, must be specified in the construction drawings and execution specifications.
- The splice laps between the main column reinforcement bars and PDP anchor bars will be designed in accordance with the EN 1992-1-1:2004 + AC:2010 standard.
- The dimensioning and design of connected structural concrete members shall be done according to EN 1992-1-1:2004 + AC:2010.
- Expected working life: > 50 years

## 1.3. Stiffness

Connections with Recense Column shoes can be considered completely rigid. This parameter has been measured by specific tests following the EAD 200102-00-0302 guidelines on which the ETA is based.

Other systems without a European Technical Assessment should be considered semi-rigid.



Image 2: Stiffness test

## 1.4. Examples of column shoe connections

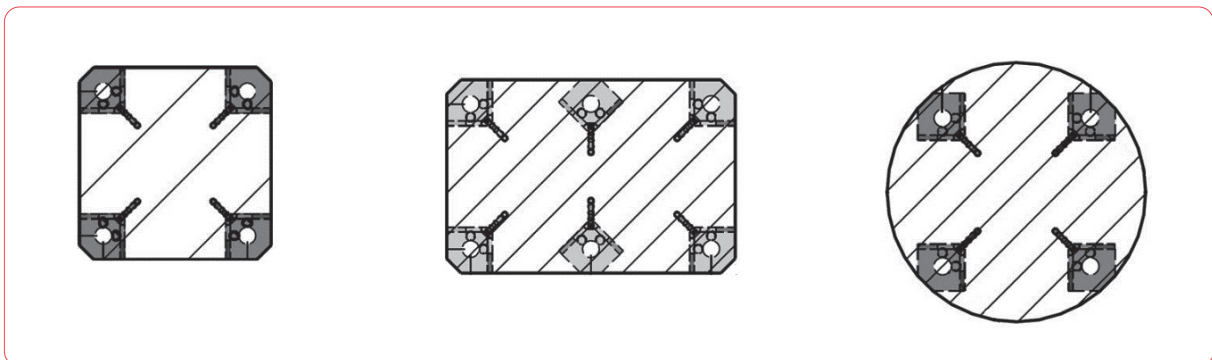


Image 3: Positioning on columns

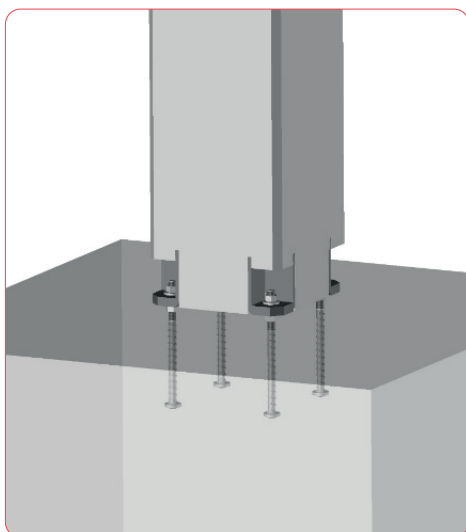


Image 4: Column-foundation connection

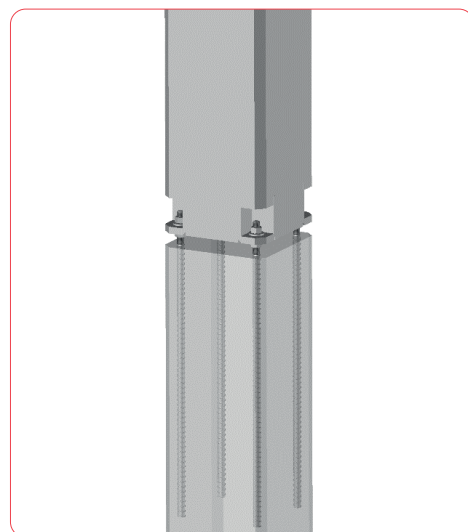


Image 5: Column-column connection

# PDP - COLUMN SHOES

Rigid bolted connection for precast concrete columns

## 2 DIMENSIONS AND PROPERTIES

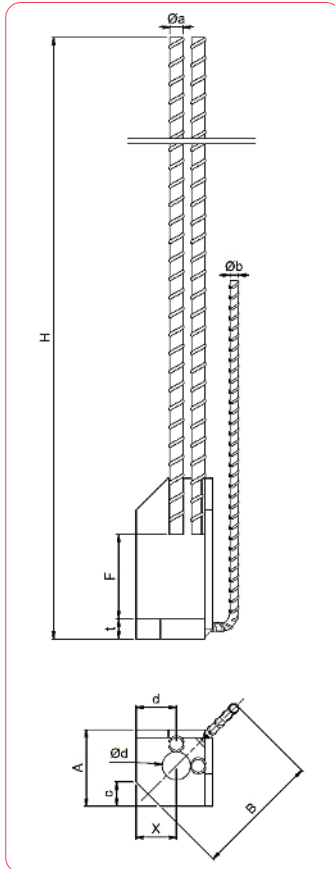


Image 6: PDP dimensions

Table 1: PDP Column Shoe dimensions

	PDP16	PDP20	PDP24	PDP30	PDP39
<b>H</b>	750	835	1080	1350	1920
<b>A</b>	81	88	95	105	130
<b>B</b>	135	142	155	181	235
<b>c</b>	30	30	30	30	37
<b>t</b>	15	20	25	35	45
<b>Øa</b>	12	16	16	20	25
<b>d</b>	45	50	50	50	53
<b>F</b>	85	95	105	120	150
<b>Ød</b>	27	30	35	40	55
<b>X</b>	50	50	50	50	60
<b>Øb</b>	8	8	10	12	20
<b>Color</b>	Yellow	Blue	Grey	Green	Orange

Under normal use conditions, PDP column shoes are installed in the concrete without additional measures or surface treatment. For use in aggressive conditions, such as one exposed to chemicals or a marine environment, specific treatments may be necessary.

Table 2: Materials

<b>Anchor bars</b>	B500SD reinforcement steel rebar, according to EN 1992-1-1:2004 + AC 2010 Annex C
<b>Rear bar</b>	B500SD reinforcement steel rebar, according to EN 1992-1-1:2004 + AC 2010 Annex C
<b>Base plate</b>	S355J2 structural steel, according to EN 10025:2019
<b>Side plates</b>	S355J2 structural steel, according to EN 10025:2019

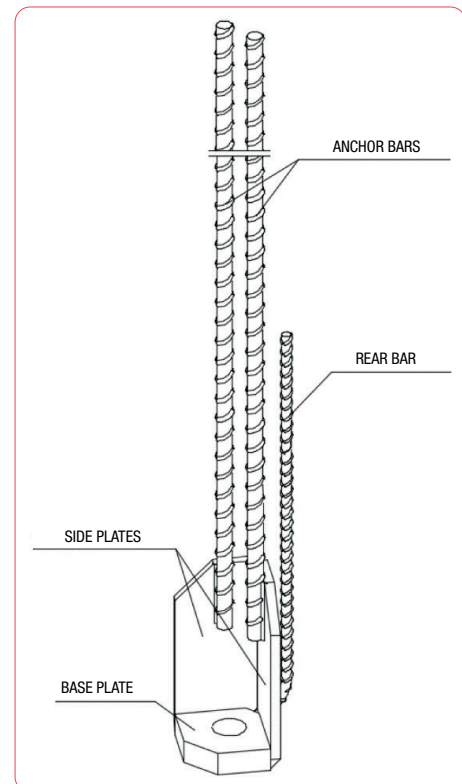


Image 7: PDP components

## Column sizes

Table 3: Column dimensions

	PDP16	PDP20	PDP24	PDP30	PDP39
$B_{1,min}$	235	245	270	300	400
$B_{2,min}$	275	290	315	370	475
$S_{1,min}$	135	145	170	200	280
$S_{2,min}$	175	190	215	270	360
$S_{3,min}$	120	130	155	180	250
$S_{4,min}$	135	145	170	200	280
$E$	50	50	50	50	60
$d_{c,min}$	295	310	345	385	515
$r$	50	50	50	50	60
$s$	105	115	130	150	180

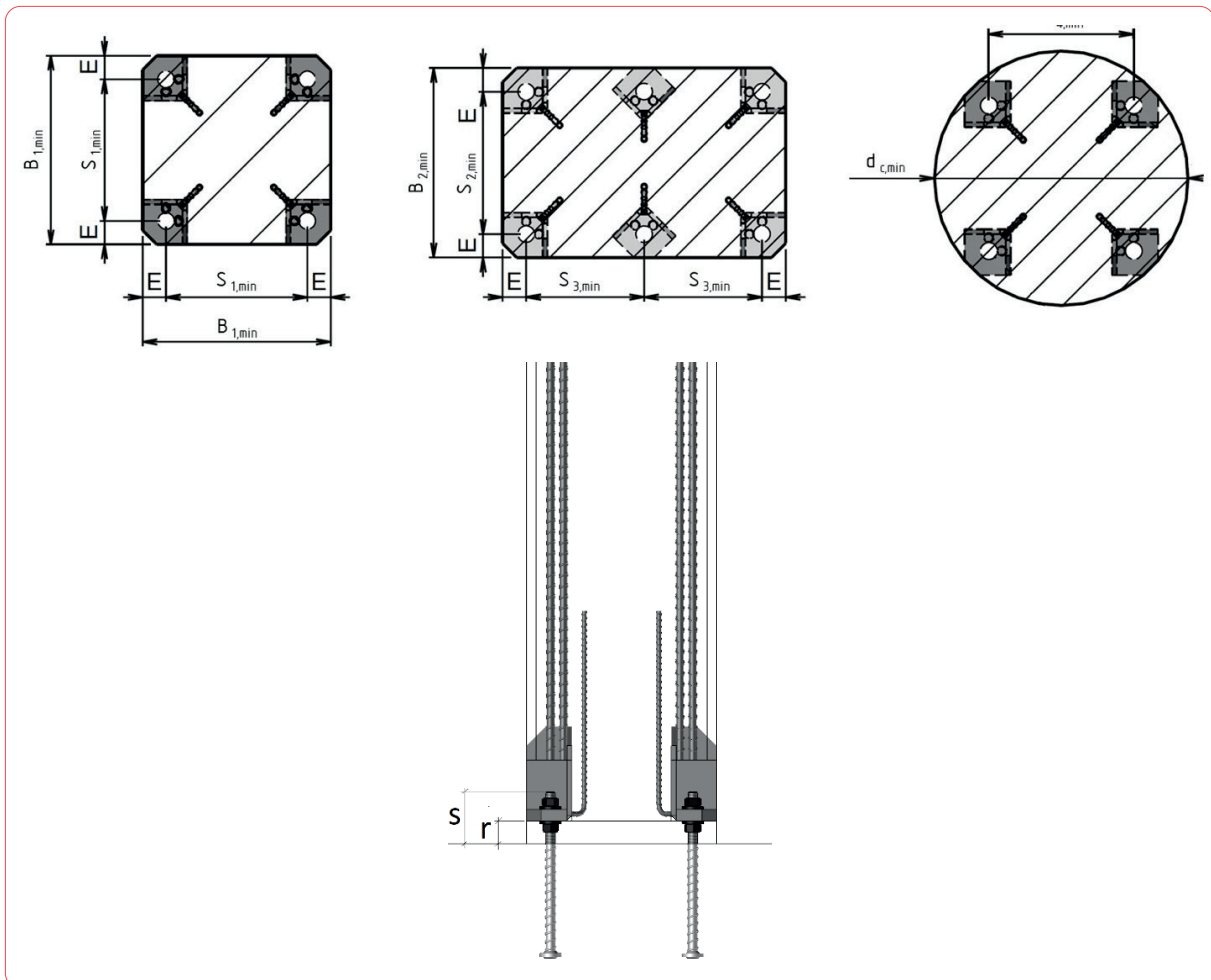


Image 8: Column dimensions

## 3 STRUCTURAL BEHAVIOUR

### 3.1. Assembly stage

During the assembly stage, the column is supported by the anchor bolts while the joint has not yet been filled with mortar. The loads acting on the column, such as its own weight and wind, are transmitted to the connection in the form of axial and shear forces. The anchor bolts must be able to withstand these forces on their own.

The axial load on a single column shoe is calculated from the total axial force and moment acting on the connection, assuming that the column shoes act as an infinitely rigid plate fixed to the column base.

### 3.2. Final conditions

Once the joint mortar has reached the expected resistance, the connection can transmit the final design loads. From this moment on, the system behaves like an in-situ concrete column with an equivalent rigidity verified through the ETA validation tests.

## 4 RESISTANCES

The connection must be verified according to the guidelines of the following standards and publications. It is recommended to request the calculation to the Recense technical department:

- European Technical Assessment 22/0668 for PDP column shoes
- European Technical Assessment 21/0899 for PAC short anchor bolts
- Technical Report EOTA TR068
- EN 1992-1-1
- EN 1992-4

The forces acting on the column base must be divided considering each column shoe individually. The axial load and the bending moment cause only tensile or compressive stresses in the column shoes when considered individually, so interaction is simplified just to the interaction between shear and axial stress.

### 4.1. Axial strength

Table 4: Design values of tensile and compressive strength,  $N_{Rd,S}$ , of a single PDP column shoe

	PDP16	PDP20	PDP24	PDP30	PDP39
$N_{Rd,S}$ (KN)	62,1	96,9	139,6	222	386,4

## 4.2. Shear strength

To calculate the shear load acting on an individual column shoe, the shear load absorbed by the friction between the column base and the grout of the joint is subtracted using the following equation:

$$V_{Ed}^1 = \frac{V_{Ed} - \mu N_{Ed}}{n}$$

where:

- $V_{Ed}$  Total shear load design value
- $\mu$  Coefficient of friction between the column base and grout = 0.2, according to EN 1993-1-8, 6.2.2, (6)
- $N_{Ed}$  Total compression load design value
- $n$  number of column shoes active under shear loads as stated below

The design shear force for a single column shoe is calculated by dividing the total shear force by only those shoes with transverse compression; see image 9.

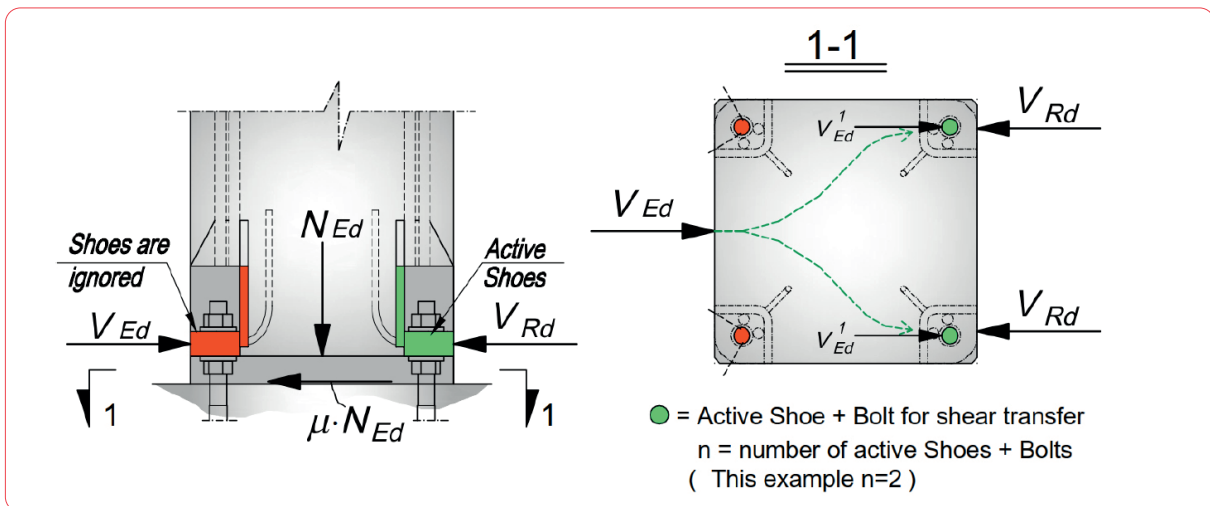


Image 9: Only the column shoes on the right side are considered active to shear forces.

The shear strength of a column shoe subjected to shear and compression must comply with the following:

$$V_{Ed}^1 \leq V_{Rd}$$

Where,  $V_{Rd}$  is indicated in the following table:

Table 5: Design value of shear strength  $V_{Rd}$  of a single PDP column shoe

	PDP16	PDP20	PDP24	PDP30	PDP39
$V_{Rd}$ (KN)	20,90	32,66	47,02	74,78	130,17

## 4.3. Shear and tensile strength

The tensile and shear forces in each individual column shoe must comply with the following:

$$\frac{N_{Ed}^1}{1,4N_{Rd}} + \frac{V_{Ed}^1}{V_{Rd}} \leq 1$$

## 5 RELATED PRODUCTS

### 5.1. Anchor bolts

#### 5.1.1. PAC short anchor bolts - European Technical Assessment 21/0899

PAC anchors consist of an anchor head which transmits the loads to the concrete where they are embedded in. Their short length makes them suitable for low-depth components such as foundations, beams or slabs.

They are approved by the European Technical Assessment 21/0899 which certifies that their performances have been evaluated through tests.

Table 6: PAC dimensions (mm)

	M	L	$\varnothing_p$	R	$h_{ef}$	$t_c$	$\varnothing_a$	$t_a$
<b>PAC16X285</b>	16	285	16	100	168	12	38	5
<b>PAC20X355</b>	20	355	20	110	227	13	45	6
<b>PAC24X436</b>	24	436	25	120	290	16	55	6
<b>PAC30X508</b>	30	508	32	140	340	18	65	8
<b>PAC39X710</b>	39	710	40	170	505	25	90	10

Table 7: PAC Materials

<b>Barra de anclaje</b>	Acero corrugado B500SD según EN 1992-1-1:2004 + AC 2010, Anexo C
<b>Arandelas</b>	Acero estructural S355J2 según EN 10025:2019
<b>Tuercas</b>	8.8 según EN ISO 4032:2012 y EN ISO 898-2:2012

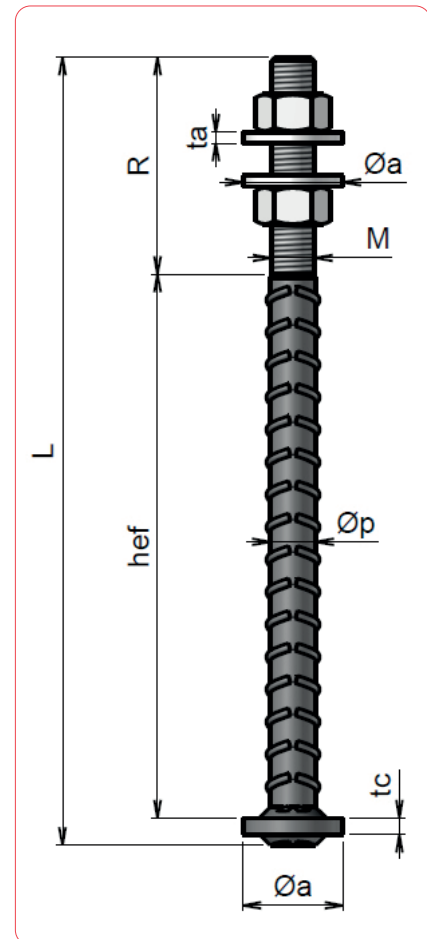


Image 10: PAC dimensions (mm)



## 5.1.2. PAL long anchor bolts

PAL bolts transmit loads by adhesion to the concrete surrounding them and by overlapping with other bars. They are used in deep foundations or column-column connections.

Table 8: PAL dimensions (mm)

	M	L	$\varnothing_p$	R
<b>PAL16X790</b>	16	790	16	100
<b>PAL20X970</b>	20	970	20	110
<b>PAL24X1110</b>	24	1110	25	120
<b>PAL30X1360</b>	30	1360	32	140
<b>PAL39X2000</b>	39	2000	40	170

Table 9: PAL Materials

<b>Anchor bar</b>	B500SD reinforcement steel rebar, according to EN 1992-1-1:2004 + AC 2010, Annex C
<b>Washers</b>	S355J2 structural steel, according to EN 10025:2019
<b>Nuts</b>	8.8 according to EN ISO 4032:2012 and EN ISO 898-2:2012

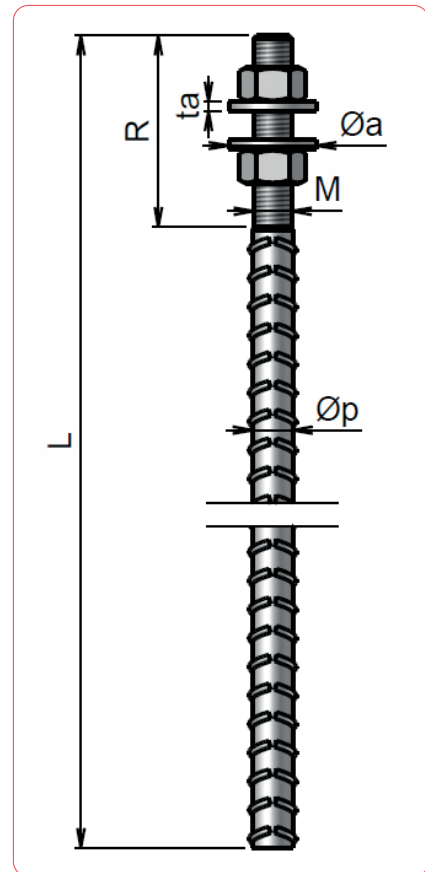


Image 11: PAL dimensions (mm)

## 5.1.3. Strength

The strength of a group of anchor bolts must be calculated according to CEN/TS 1992-4: 2009, EN 1992:1, EN 1992:4 and ETA 21-0899. If in doubt, contact the Recense technical department.

Table 10: Individual PAC and PAL bolt strength

	Tensile/compression strength $N_{Rd,s}$ (KN)	Shear strength in final stage $V_{Rd}$ (KN)	Shear strength during assembly $V_{Rd0}$ (KN)	R joint thickness (mm)
<b>M16</b>	60,4	20,9	4,6	50
<b>M20</b>	95,9	32,7	9,6	50
<b>M24</b>	138,3	47	17,3	50
<b>M30</b>	220,4	74,8	39,3	50
<b>M39</b>	360,7	130,2	77,8	60

# PDP - COLUMN SHOES

Rigid bolted connection for precast concrete columns

## 5.2. Recess formers

The next table shows the sizes of the recess formers necessary to form the pocket in the column shoes where the anchor bolt will be screwed. These formers can be supplied by Recense or be manufactured by the user in polystyrene, wood or other material.

Table 11: Dimensions of recess formers placed in the corner of the column (mm)

	a	c	h
<b>CEPDP16</b>	75	85	75
<b>CEPDP20</b>	80	92	85
<b>CEPDP24</b>	85	99	95
<b>CEPDP30</b>	90	106	110
<b>CEPDP39</b>	110	129	140

Table 12: Dimensions of recess formers placed in central position (mm)

	a	c	d	f	h
<b>CCPDP16</b>	120	85	32	125	75
<b>CCPDP20</b>	130	92	35	130	85
<b>CCPDP24</b>	140	99	39	135	95
<b>CCPDP30</b>	150	106	42	145	110
<b>CCPDP39</b>	183	129	51	175	140

## 6 ASSEMBLY INSTRUCTIONS

### 6.1. PAC and PAL anchor bolts

The anchor bolts must be positioned in the formwork and fixed with nuts and washers using a template in such a way they remains at same height. This template is then fixed to the formwork, making sure it stays in the proper position and cannot move while pouring the concrete. Once the concrete is hardened, the template is removed and can be reused.

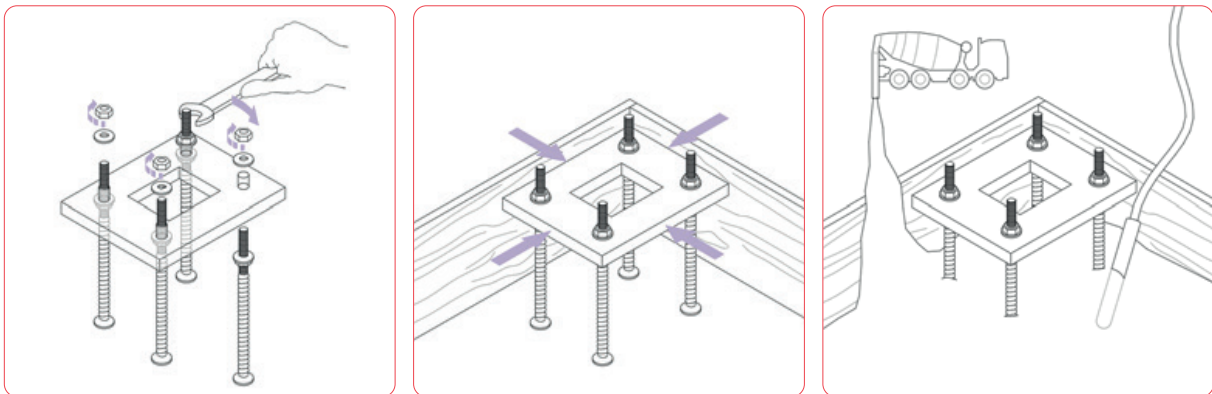


Image 12, Installation of anchor bolts on site

### 6.2. Column shoes

For fixing the column shoes to the formwork a template and centring bushings with fixing screws must be used as shown in the following image.

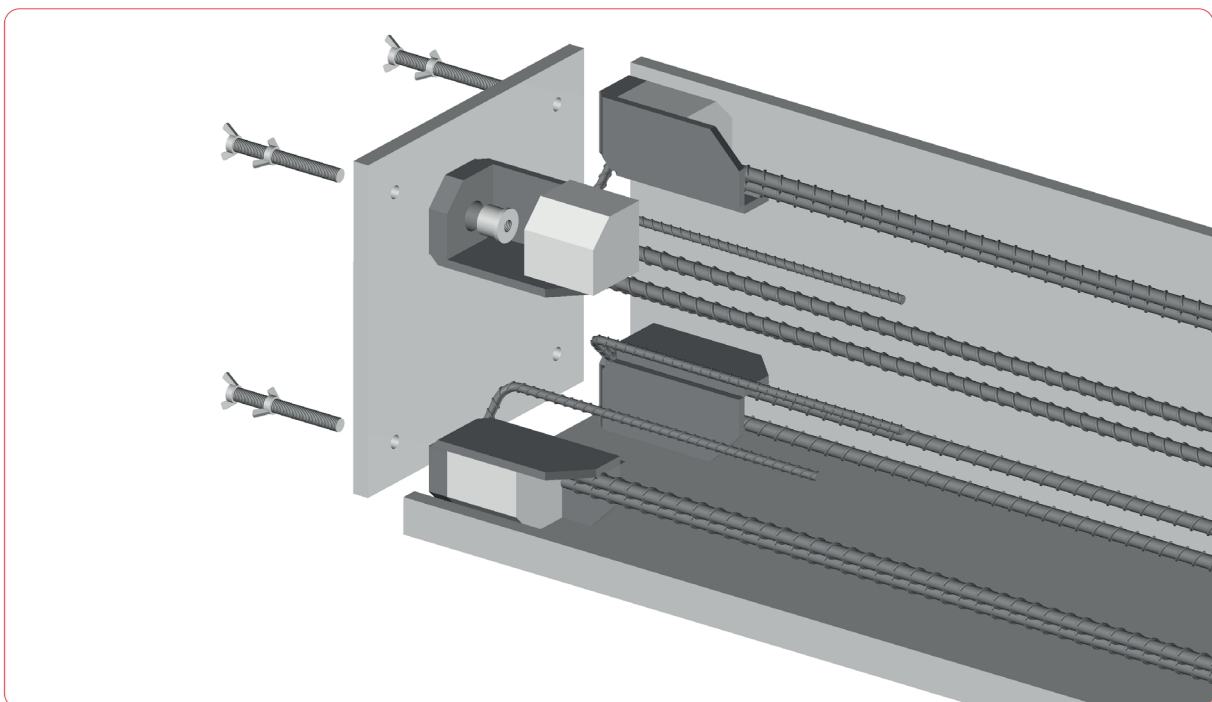


Image 13: Column shoes assembly in formwork

# PDP - COLUMN SHOES

Rigid bolted connection for precast concrete columns

## 6.2.1. Supplementary reinforcement for column shoes

Additional reinforcement required in the column shoes area is detailed below.

Table 13: Additional reinforcement, B500S rebars. (Sizes in mm).

		PDP16	PDP20	PDP24	PDP30	PDP39
1	Bottom stirrups	2Ø8	2Ø8	2+1Ø8	2+1Ø8	2+1Ø10
2	Central shoes stirrups	2Ø8	2Ø8	2+1Ø8	2+1Ø8	2+1Ø10
3	Overlap area stirrups	Ø8	Ø8	Ø8	Ø8	Ø10
4	Corner shoe U stirrups	4Ø6	4Ø6	4Ø6	4Ø6	4Ø8
5	Central shoe U stirrups	2Ø6	2Ø6	2Ø6	2Ø6	2Ø8
	a	140	165	200	250	315
	lb	300	300	300	300	300

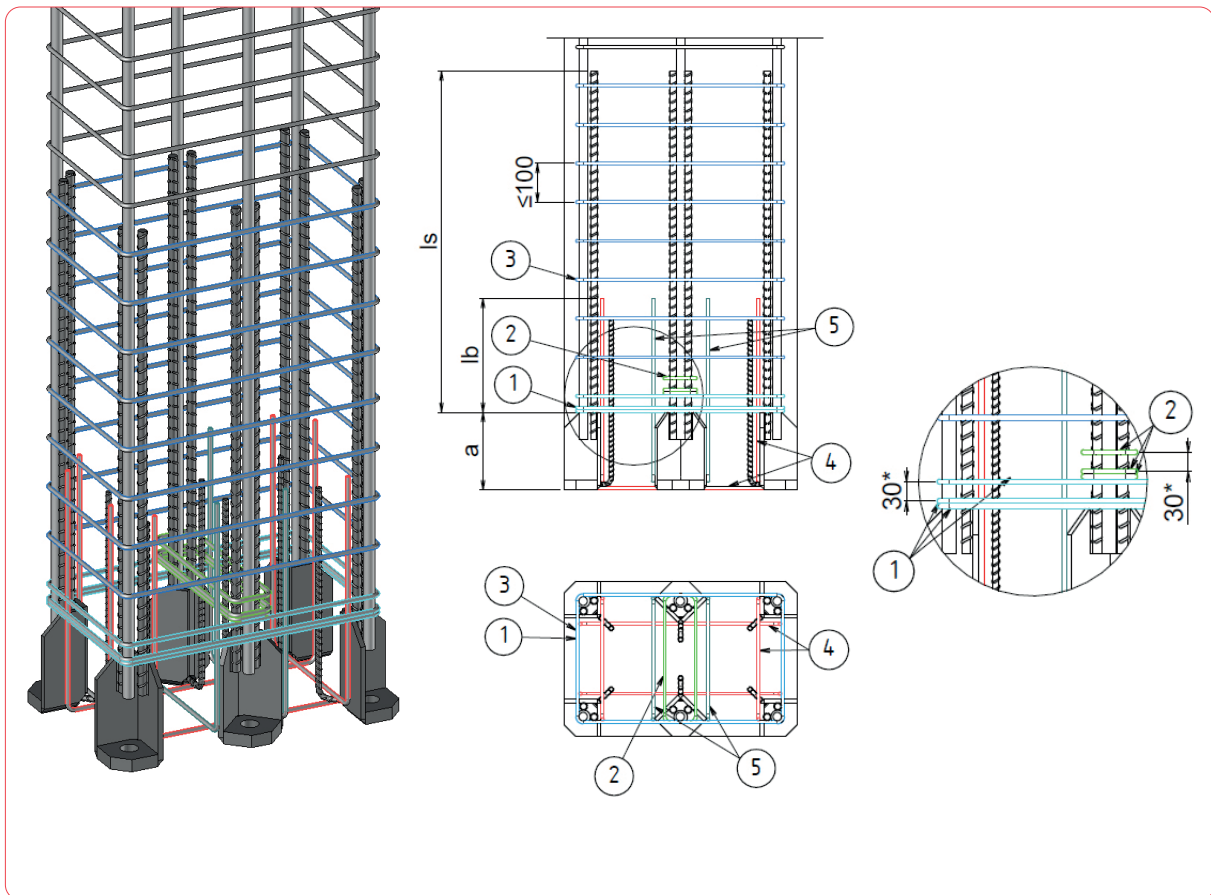
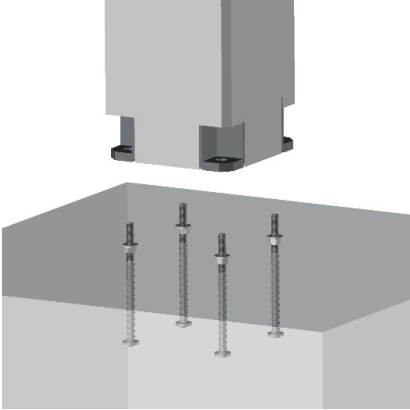
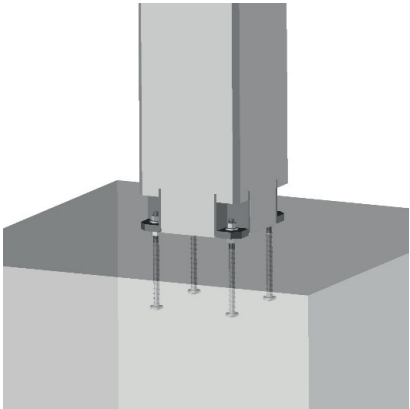
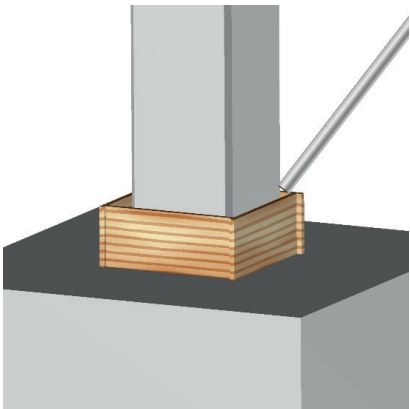
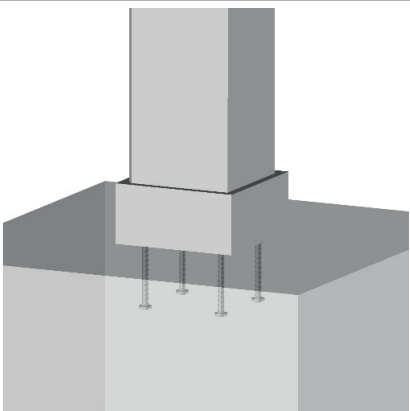


Image 14: Minimal reinforcement in connection shoes area

## 6.3. On-site assembly

	<p><b>1.</b> The lower nuts and washers are levelled so the column can rest on them. Check verticality and adjust with nuts if necessary.</p>
	<p><b>2.</b> Place upper washers and nuts on bolts and tighten firmly. No specific torque is required.</p>
	<p><b>3.</b> The joint must be filled before loading the column with other columns or beams. This is done by placing formwork around it and filling with non-shrink mortar. Filling must be done only from one side to avoid air pockets.</p>
	<p><b>4.</b> Once the grout reaches the required strength, the rest of the component can be assembled on the column.</p>





**INSTITUTO DE CIENCIAS  
DE LA CONSTRUCCIÓN  
EDUARDO TORROJA**

C/ Serrano Galvache n. 4 28033 Madrid (Spain)  
Tel.: (34) 91 302 04 40 www.ietcc.csic.es  
gestiondit@ietcc.csic.es dit.ietcc.csic.es

## European Technical Assessment

**ETA 21/0899  
of 04/05/2022**

English translation prepared by IETcc – original versión in Spanish lenguaje

### General Part

**Technical Assessment Body issuing the European Technical Assessment:**

Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

**Trade name of the construction product:**

**RECENSE short anchor bolt PAC/SZ**

**Product family to which the construction product belongs:**

Cast-in anchor bolts of ribbed reinforcing steel of sizes M16, M20, M24, M30, M39 for use in cracked and non-cracked concrete.

**Manufacturer:**

**Industrial Recense S.L.**  
Parque empresarial de A Pontenova.  
Parcelas 33 – 39. 27720  
A Pontenova (Lugo). Spain  
website: [www.recense.com](http://www.recense.com)

**Manufacturing plant :**

**Industrial Recense S.L.**  
Parque empresarial de A Pontenova.  
Parcelas 33 – 39. 27720  
A Pontenova (Lugo). Spain

**This European Technical Assessment contains:**

12 pages including 3 annexes which form an integral part of this assessment.

**This European Technical Assessment is issued in accordance with Regulation (EU) No. 305/2011, on the basis on:**

EAD 330924-00-0601 “Cast-in anchor bolts of ribbed reinforcing steel”, January 2018

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25, section 3, of Regulation (EU) No. 305/2011

## SPECIFIC PART

### 1. Technical description of the product

The RECENSE anchor bolt PAC/SZ consists of ribbed reinforcing steel of the diameters 16, 20, 25, 32 and 40 mm, two hexagon nuts and two washers. One of the ends of the bolt is provided with an anchor head and the other end with a thread of the sizes M16, M20, M24, M30, M39 and M39. The anchor bolt is imbedded in concrete up to the threaded length.

The product description is given in Annex A.

### 2. Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 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.

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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristics n. 1 to 12	Performances
Characteristics values for tension loading under static and quasi-static actions	See Annex C1
Characteristics values for shear loading under static and quasi-static actions	See Annex C2
Displacements under tension and shear load for static and quasi-static actions	No performance assessed

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristics n.13 to 14.	Performances
13. Reaction to fire	Meets the requirements for class A1
14. Resistance to fire	No performance assessed

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

The applicable European legal act for the system of assessment and verification of constancy of performance is (see Annex V of Regulation (UE) No. 305/2011): 96/582/CE.

The system to be applied is: 1.



**5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable European Assessment Document.**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Instituto de Ciencias de la Construcción Eduardo Torroja.



Instituto de Ciencias de la Construcción Eduardo Torroja  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

C/ Serrano Galvache n.º 4. 28033 Madrid.  
Tel: (+34) 91 302 04 40  
<https://dit.ietcc.csic.es>

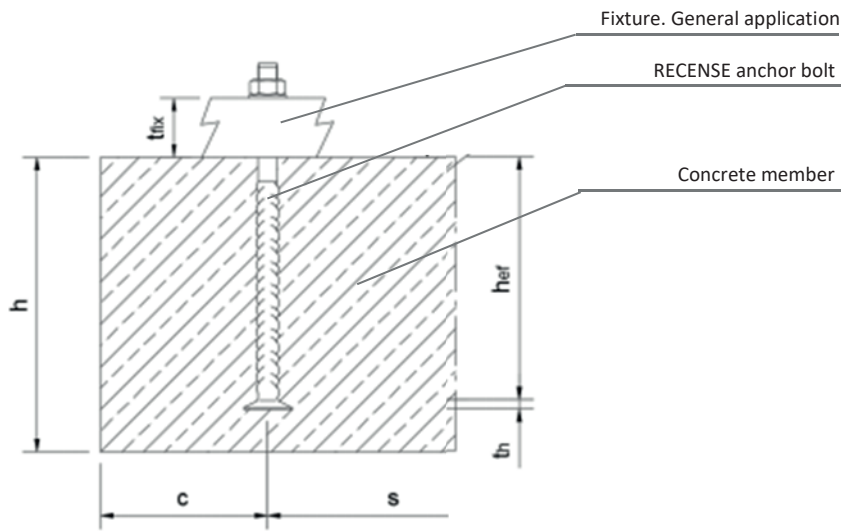


Madrid, on 4<sup>th</sup> May 2022

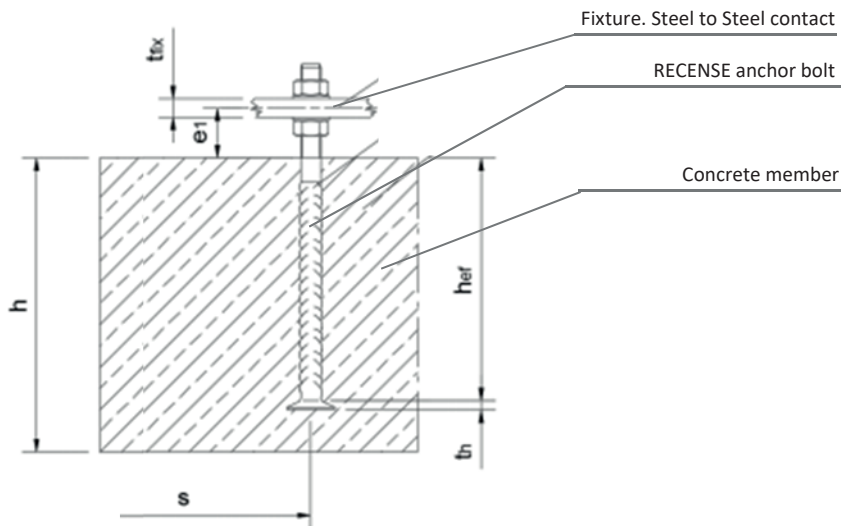
Firmado por CASTILLO TALAVERA  
ANGEL - DNI 52507605P  
Fecha: 19/05/2022 10:50:54 CEST

Director

**(A) General installation**



**(B) Steel to Steel contact**



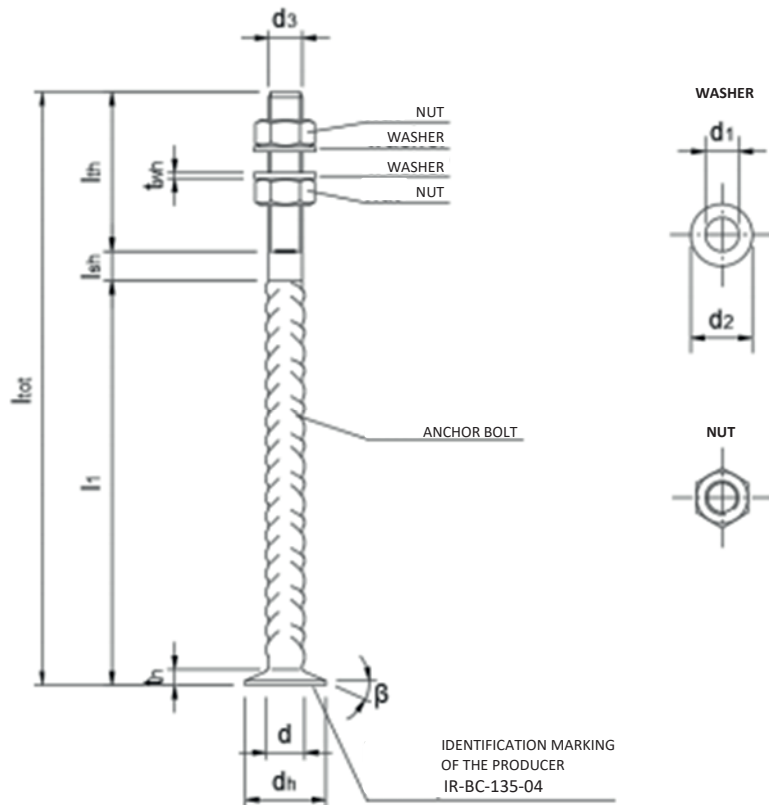
**RECENSE short anchor bolt PAC/SZ**

**Product description**

Installed condition

**Annex A1**

## Anchor bolt



**Table A1: Dimensions**

COMPONENT PAC/SZ	ANCHOR BOLT							WHASER			NUT
	d	d <sub>h</sub>	d <sub>3</sub>	l <sub>th</sub>	t <sub>h</sub>	l <sub>tot</sub>	l <sub>1</sub>	d <sub>2</sub>	d <sub>1</sub>	t <sub>wh</sub>	<sup>1)</sup>
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(-)
<b>16</b>	16	38	16	100	12	285	185	38	18	5	M-16
<b>20</b>	20	46	20	110	13	355	245	45	22	6	M-20
<b>24</b>	25	55	24	120	16	436	316	55	26	6	M-24
<b>30</b>	32	70	30	140	18	508	368	65	32	8	M-30
<b>39</b>	40	90	39	170	25	710	540	90	42	10	M-39

<sup>1)</sup> Dimensions according to EN ISO 4032:2012

**RECENSE short anchor bolt PAC/SZ**

**Product description**

Identification

**Annex A2**

**Table A2: Specifications, materials**

<b>ANCHOR BOLT</b>	Reinforcement Steel rebar B500SD according to EN 1992-1-1:2004 + AC:2010, Annex C
<b>WASHER</b>	S355J2
<b>HEX NUT</b>	Hexagonal nut, strength class 8.8, according to EN ISO 4032:2012 and EN ISO 898-2:2012

**RECENSE short anchor bolt PAC/SZ**

**Product description**

Materials

**Annex A3**

## **Specifications of intended use**

### **Anchorage subject to:**

- Static or quasi-static loads.
- Tension loads, shear loads or combination of tension and shear loads.

### **Anchoring base materials:**

- Reinforced concrete according to EN 206: 2000.
- Strength class: C20/25 to C50/60 according to EN 206: 2000.
- Cracked and uncracked concrete.

### **Use conditions (environmental conditions):**

- The anchor can only be used in dry internal conditions.
- For anchor, that are planned to be installed with a concrete cover, the EN 1992-1-1:2004 + AC:2010, section 4 applies.

### **Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorage and concrete structures.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be anchored. The position of the anchors is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.). The design drawings shall indicate the position of the anchorages, including the reinforcement required for anchoring.
- Anchorages under static and quasi static actions are designed in accordance with:
  - CEN/TS 1992-4:2009, Part 1 and 2 (Design of fastenings for use in concrete).

### **Minimum reinforcement:**

A reinforcement has to be present to resist the splitting forces.  
See CEN/TS 1992-4-2:2009, section 6.2.6.

## **RECENSE short anchor bolt PAC/SZ**

**Intended use**

Specifications

**Annex B1**

**Installation**

- Installation of anchors is carried out by appropriately qualified workers under supervision of the person responsible for technical matters on site.
- Use of anchor bolts as supplied by the manufacturer, without any manipulation or exchanging of components.
- Installation of anchor bolts in accordance with manufacturer's specifications given in Annex B3 and Annex B4.
- Anchors have to be fixed on the formwork so that no movement of the anchors will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- Concrete around anchors and especially under the heads of anchors has to be compacted properly.
- Area of the thread has to be protected against penetration of concrete, water and oil.
- Maximum setting torques given in Table B1 and Annex B4 must not be exceeded.

**Table B1: Installation parameters**

Short anchor bolt PAC/SZ			16	20	24	30	39
Embedment depth (EAD Table2.1/3)	$h_{ef}$	(mm)	168	227	290	340	505
Thread length	$l_{th}$	(mm)	100	110	120	140	170
Minimum thickness of concrete member (EAD Table2.1/5)	$h_{min}$	(mm)	$h_{min} = h_{ef} + k + C_{nom}^{(1)}$				
Maximum installation torque (EAD Table2.1/6)	$T_{inst}$	(Nm)	96	187,69	324,92	646,15	1464

<sup>(1)</sup> Concrete cover according to EN 1992-1-1:2004/AC:2010

**RECENSE short anchor bolt PAC/SZ**

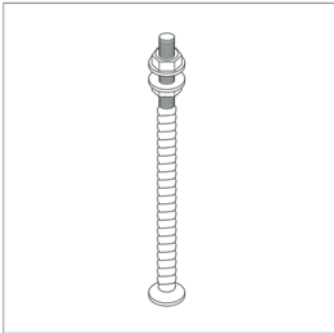
**Intended use**

Specifications, installation parameters

**Annex B2**

## Installation instructions

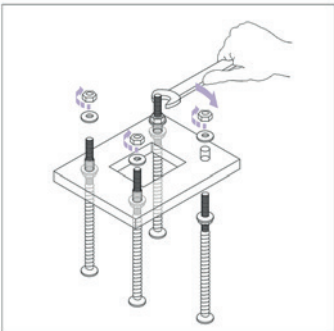
### Components



Anchor bolt PAC/SZ, consisting of:

1. Headed bolt (hot forged) with external thread, Surface untreated.
  2. For general installation: 1 x hexagon nut, Surface untreated.  
1 x washer, Surface untreated.
- For Steel to Steel contact: 2 x hexagon nut, Surface untreated.  
2 x washer, Surface untreated.

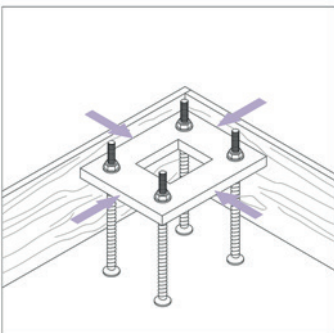
### Positioning



Depending on the further usage anchor bolts have to be fixed at the formwork precisely:

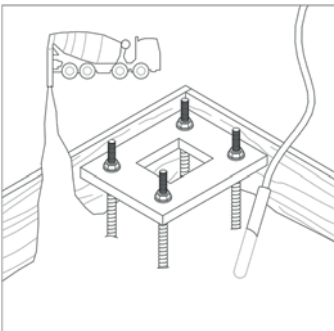
1. Prepare suitable template of Steel or Wood.  
→ Check the stability |
2. Fix anchor bolts at template by using nuts and washers.
3. Verify template with anchor bolts finally.

### Fixing at the formwork



1. Position template with anchor bolts at formwork.
2. Fix template with anchor bolts at formwork.  
→ Mind exact levelling |

### Pouring and compacting



1. Fill in concrete carefully, mind fixed anchors |
2. Compact concrete properly, avoid contact between vibrating device and anchor bolts.  
→ Don't move or damage anchor bolts |

**RECENSE short anchor bolt PAC/SZ**

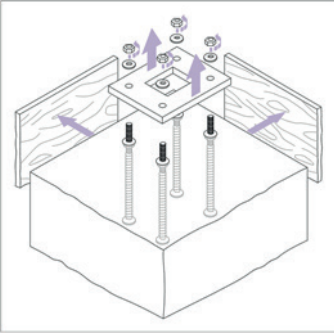
**Intended use**

Installation instructions

**Annex B3**

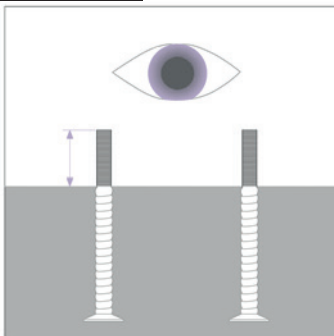
## Installation instructions

### Removal of formwork



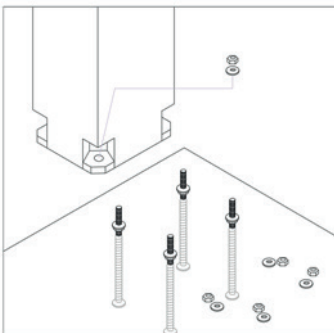
1. Remove formwork and accessories.
2. Remove upper nuts and washers.
3. Remove template.
4. Remove lower nuts and washers.

### Verification



1. Check threads of anchor bolts regarding dirt/contamination. Clean them if necessary |
2. Check overlapping of threaded area according to specifications.
3. Check positioning of anchor bolts according to specifications.

### Mounting of fixture

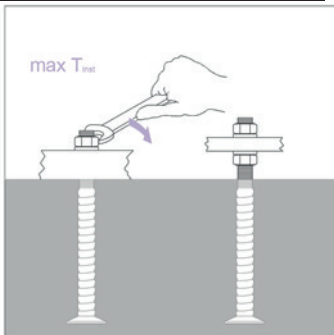


1. Ensure, that concrete has reached its design strength.
2. Check nuts and washers regarding dirt/contamination. Clean them if necessary |
3. Mount fixture.  
→ Consider maximum setting torques given below |  
→ Note additional information regarding the fixture |

**General installation:** Fixture with direct contact to the concrete.

**Steel to Steel contact:** Distance between fixture and Surface of concrete.

### Maximum setting torques



Maximum setting torques  $T_{inst}$   
for RECENSE anchor bolts PAC/SZ

16 (Nm)	20 (Nm)	24 (Nm)	30 (Nm)	39 (Nm)
96	187,69	324,92	646,15	1464

**RECENSE perno de anclaje corto PAC/SZ**

**Intended use**

Installation instructions

**Anexo B4**



**Table C1: Characteristic resistances values for tension load for static and quasi-static loads**

<b>Short anchor bolt PAC/SZ</b>		<b>16</b>	<b>20</b>	<b>24</b>	<b>30</b>	<b>39</b>
<b>Resistance to steel failure</b>						
Characteristic resistance (EAD Table2.1/1)	$N_{Rk,s}$ (kN)	84,52	134,20	193,60	308,55	505,02
Partial safety factor <sup>(1)</sup>	$\gamma_{Ms}$ (-)	1,4				
<b>Resistance to pull-out failure</b>						
Characteristic resistance In uncracked concrete C20/25 (EAD Table2.1/2)	$N_{Rk,p}$ (kN)	195,93	283,02	395,84	639,28	1072,07
Characteristic resistance In cracked concrete C20/25 (EAD Table2.1/2)	$N_{Rk,p}$ (kN)	139,95	202,16	282,74	456,63	765,76
Partial safety factor <sup>(1)</sup>	$\gamma_{Mp}$ (-)	1,5				
<b>Resistance to concrete cone failure</b>						
Effective embedment depth (EAD Table2.1/3)	$h_{ef}$ (mm)	168	227	290	340	505
Factor to take into account the influence of the load transfer mechanism (EAD Table2.1/3)	$K_{ucr}$ (-)	9.1				
	$K_{cr}$ (-)	6.5				
Characteristic spacing (EAD Table2.1/3)	$S_{cr,N}$ (mm)	504	681	870	1020	1515
Characteristic edge distance (EAD Table2.1/3)	$C_{cr,N}$ (mm)	252	340,5	435	510	757,5
Partial safety factor <sup>(1)</sup>	$\gamma_{Mc}$ (-)	1,5				
<b>Edge distance to prevent splitting failure</b>						
A reinforcement has to be present to resist the splitting forces and limits the crack width to $w_k \leq 0,3$ mm See CEN/TS 1992-4: 2009, section 6.2.6.2 (EAD Table2.1/4-5)						

<sup>(1)</sup> In absence of other national regulations

**RECEPSE short anchor bolt PAC/SZ**

**Performances**

Characteristics resistances under tension load for static and quasi-static loads

**Annex C1**

**Table C2: Characteristics resistances under shear load for static and quasi-static loads**

<b>Short anchor bolt PAC/SZ</b>			<b>16</b>	<b>20</b>	<b>24</b>	<b>30</b>	<b>39</b>
<b>Resistance to steel failure</b>							
Characteristic resistance (EAD Table2.1/8)	$V_{Rk,s}$	(kN)	42,9	67,1	96,8	154,3	268,4
Verification factor of group fastenings under shear load without lever arm according to CEN/TS 1992-4-2:2009, art. 6.3.3.1 (EAD Table2.1/8)	$K_2$	(-)	1,0				
Partial safety factor <sup>(1)</sup>	$\gamma_{Ms}$	(-)	1,4				
<b>Steel failure under shear load with lever arm</b>							
Characteristics bending resistance (EAD Table2.1/8)	$M_{Rk,s}^p$	(Nm)	181,6	353,3	617,4	1233,3	2850,2
Partial safety factor <sup>(1)</sup>	$\gamma_{Mp}$	(-)	1,5				
<b>Resistance to pry-out failure</b>							
Application factor according to CEN/TS 1992-4-2:2009, equation (32) (EAD Table2.1/10)	$K_3$	(-)	2,0				
Partial safety factor <sup>(1)</sup>	$\gamma_{Mc}$	(-)	1,5				
<b>Concrete edge failure</b>							
Effective embedment depth under shear load (EAD Table2.1/9)	$l_f$	(mm)	128	160	192	240	312
Effective outer diameter (EAD Table2.1/9)	$d_{nom}$	(mm)	16	20	24	30	39
Partial safety factor <sup>(1)</sup>	$\gamma_{Mc}$	(-)	1,5				

<sup>(1)</sup> In absence of other national regulations

<b>Combined tension and shear loads</b>							
Application factor according to CEN/TS 1992-4-2:2009, equation (49) (EAD Table2.1/12)	$K_7$	(-)	2/3				

**RECENSE short anchor bolt PAC/SZ**

**Performances**

Characteristic resistances under shear load for static or quasi-static loads  
Combined tensile and shear loads

**Annex C2**



**INSTITUTO DE CIENCIAS  
DE LA CONSTRUCCIÓN  
EDUARDO TORROJA**

C/ Serrano Galvache n. 4 28033 Madrid (Spain)  
Tel.: (34) 91 302 04 40  
[direccion.ietcc@csic.es](mailto:direccion.ietcc@csic.es) <https://dit.ietcc.csic.es>

## European Technical Assessment

**ETA 22/0668  
of 27/09/2022**

English translation prepared by IETcc – original version in Spanish language

### General Part

**Technical Assessment Body issuing the European Technical Assessment:**

Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

**Trade name of the construction product:**

**RECENSE PDP Column Shoe**

**Product family to which the construction product belongs:**

Column shoe for structural connections of reinforced concrete columns

**Manufacturer:**

**Industrial Recense S.L.**

Parque empresarial de A Pontenova  
Parcelas 33 – 39. 27720  
A Pontenova (Lugo). España  
website: [www.recense.com](http://www.recense.com)

**Manufacturing plant:**

**Industrial Recense S.L.**

Parque empresarial de A Pontenova  
Parcelas 33 – 39. 27720  
A Pontenova (Lugo). España

**This European Technical Assessment contains:**

10 pages including 4 annexes which form an integral part of this assessment. Annex D1 contains confidential information and is not included in the European Technical Assessment when that assessment is publicly available.

**This European Technical Assessment is issued in accordance with Regulation (EU) No. 305/2011, on the basis on:**

EAD 200102-00-0302. "Column shoes for structural connections of reinforced concrete columns", ed. September 2018.

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25, section 3, of Regulation (EU) No. 305/2011

## SPECIFIC PART

### 1. Technical description of the product

The Recense PDP Column Shoe consists of a horizontal part called base plate, vertical side plates, vertical anchor bars and a rear bar. The different components are connected to each other by welding.

The product description is given in Annex A.

### 2. Specification of the intended use in accordance with the applicable European Assessment Document

The column shoes serve as connectors between a concrete column and foundation or between two columns.

The performances given in Section 3 are only valid if the column shoe is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 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.

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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristics n. 1	Performances
Resistance to tension and shear loads	See Annex C

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristics n. 2 to 3.	Performances
Reaction to fire	Meets the requirements for class A1
Resistance to fire	No performance assessed

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

In accordance with the European Assessment Document EAD 200102-00-0302 the applicable European legal act is Commission Decision 2000/606/EC.

The system to be applied is: 2+.

**5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable European Assessment Document.**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Instituto de Ciencias de la Construcción Eduardo Torroja.



Instituto de Ciencias de la Construcción Eduardo Torroja  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

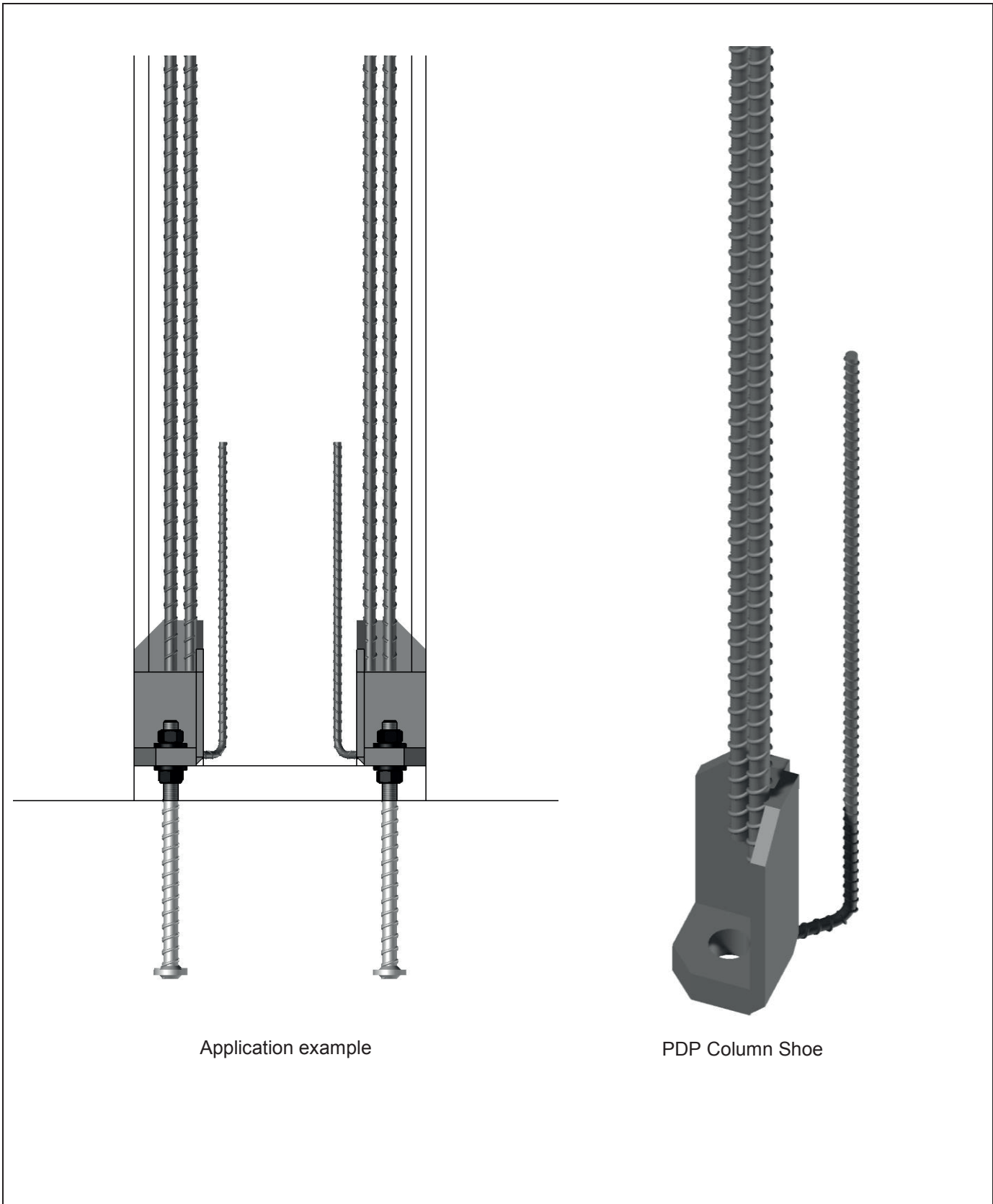
C/ Serrano Galvache n.º 4. 28033 Madrid.  
Tel: (+34) 91 302 04 40  
<https://dit.ietcc.csic.es>



Madrid on 27<sup>th</sup> September 2022

Firmado por CASTILLO TALAVERA  
ANGEL - DNI 52507605P  
Fecha: 03/10/2022 10:47:48 CEST

Director IETcc-CSIC

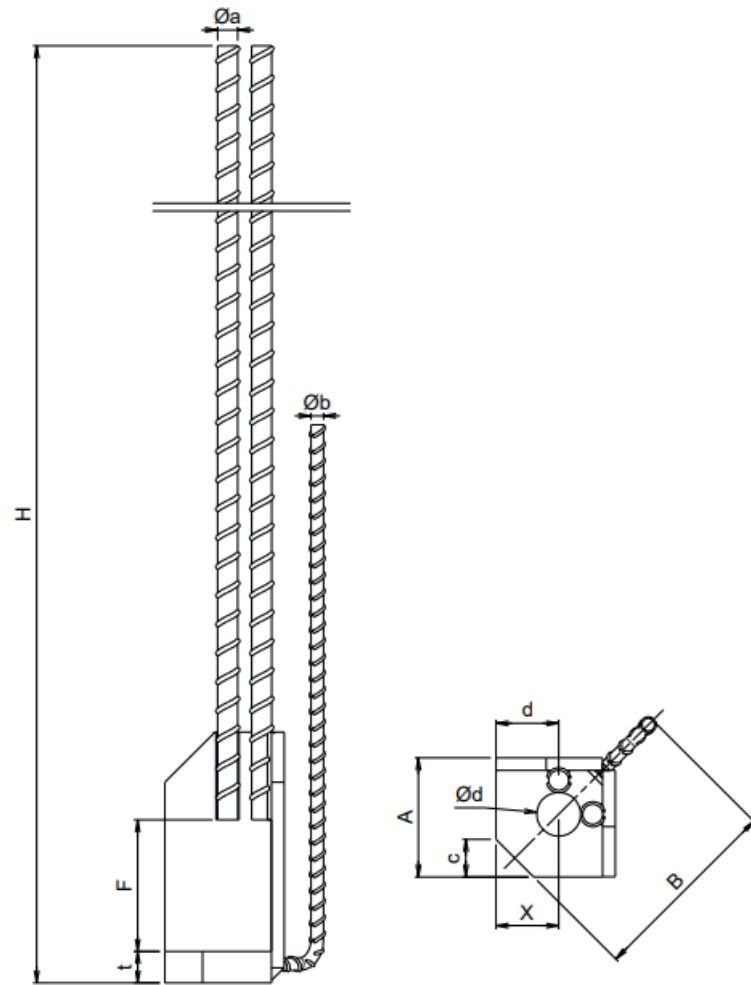


Application example

PDP Column Shoe

<b>RECENSE PDP Column Shoe</b>	<b>Annex A1</b>
<b>Product description</b>	
Installed condition	

English translation prepared by IETcc



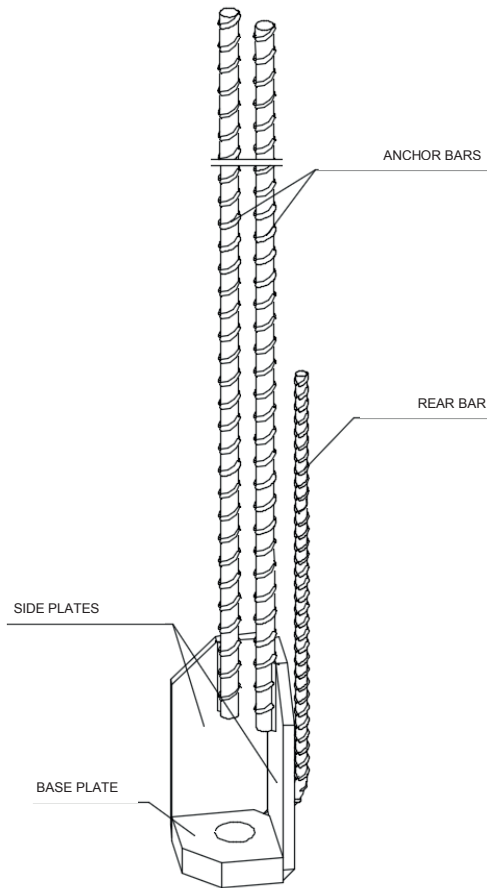
	PDP16	PDP20	PDP24	PDP30	PDP39
H	750	835	1080	1350	1920
A	81	88	95	105	130
B	135	142	155	181	235
c	30	30	30	30	37
t	15	20	25	35	45
$\varnothing_a$	12	16	16	20	25
d	45	50	50	50	53
F	85	95	105	120	150
$\varnothing_d$	27	30	35	40	55
X	50	50	50	50	60
$\varnothing_b$	8	8	10	12	20

**RECENSE PDP Column Shoe**

**Product description**

Dimensions

**Annex A2**



**Table A1: Specifications, materials**

<b>ANCHOR BARS</b>	Reinforcement steel rebar B500SD according to EN 1992-1-1:2004 + AC:2010, Annex C
<b>REAR BAR</b>	Reinforcement steel rebar B500SD according to EN 1992-1-1:2004 + AC:2010, Annex C
<b>SIDE PLATES</b>	Structural steel S355J2 according to EN 10025:2019
<b>BASE PLATE</b>	Structural steel S355J2 according to EN 10025:2019

**Table A2: Minimum requirements for reinforcing steel**

<b>General</b>	All requirements set in EN 10080:2005 and EN 1992-1-1:2004+AC10, Annex C for the reinforcing steel of Class B or Class C, strength class 500 MPa
<b>Additional</b>	The steel shall be weldable

**RECENSE PDP Column Shoe**

**Product description**

Materials

**Annex A3**



### **Specifications of intended use**

#### **Design value of loads:**

- Static and quasi-static load.
- Tension loads, compression loads and shear loads or any combination thereof.

#### **Anchoring base material:**

- The grade of the reinforced concrete used for the column shall be in the range C30/37 to C70/85 according to EN 1992-1-1:2004 + AC:2010.
- In the region of the PDP Column Shoes, the concrete may be cracked or uncracked.

#### **Use conditions (environmental conditions):**

- For PDP column shoe under normal conditions of use, they are installed in concrete without additional measures or surface treatments and when they fall within the scope of application of the EN 1992-1-1:2004 + AC:2010. Under conditions of use in aggressive environments, such as a marine environment or a chemical exposure environment, modifications can be necessary.
- The European standard EN 1992-1-1:2004 + AC:2010, section 4 applies to PDP Column Shoes, that are planned to be installed with concrete cover.
- The lowest temperature in use is  $-20^{\circ}\text{C}$ .

#### **Design:**

- The dimensioning of column shoes is carried out under the responsibility of an engineer experienced in the field of structural design and concrete constructions.
- The design is based on the Technical Report TR 068: Design of Structural Connections with Column Shoes.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be transferred.
- The position of the column shoes, including the reinforcement required, has to be specified on the construction drawings and execution specifications.
- The splice laps between the main column reinforcement bars and anchor bars of PDP Column Shoes are designed according to EN 1992-1-1:2004 + AC:2010.
- The dimensioning and design of connected structural concrete members shall be done according to EN 1992-1-1:2004 + AC:2010.

**RECENSE PDP Column Shoe**

**Intended use**

Specifications

**Annex B1**

### Installation

- Installation of the PDP Column Shoes is carried out by appropriately qualified workers under the supervision of the person responsible for technical matters on site.
- Use of PDP Column Shoes as supplied by the manufacturer, without any manipulation or exchanging of components.
- Installation of PDP Column Shoes in accordance with manufacturer's specifications.
- PDP Column Shoes have to be fixed on the formwork so that no movement of the column shoes will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- Concrete around PDP Column Shoes has to be compacted properly.
- Area of the PDP Column Shoes has to be protected against penetration of concrete, water and oil.
- The spacing and clear distance between PDP Column Shoes must be selected according to EN 1992-1-1:2004 + AC:2010 and shall be such that the concrete can be placed and compacted satisfactorily for the development of adequate bond.
- Examples of distances and arrangements of PDP Column Shoes are given in figure B1 and table B1.
- The PDP Column Shoes may be used in any cross section of concrete column.

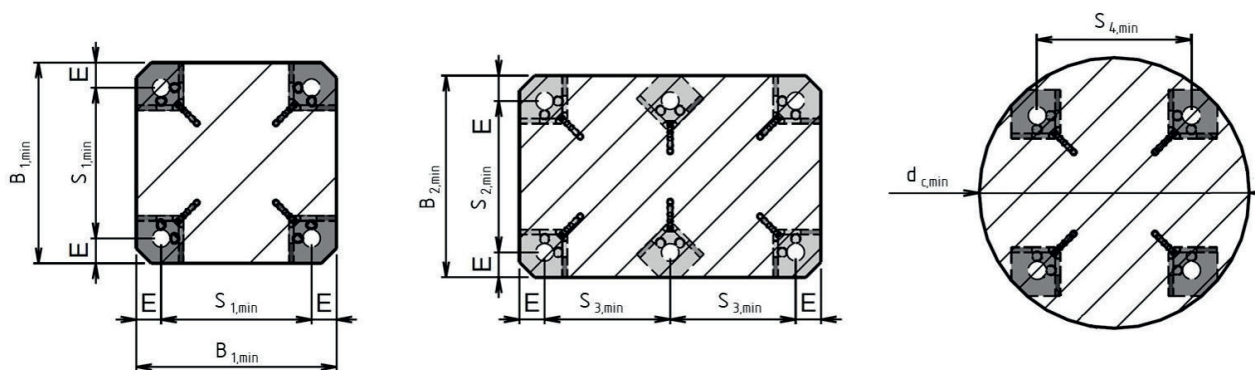


Figure B1: Examples of geometrical arrangements and distances of RECENSE PDP Column Shoe

**Table B1: Minimum distances (mm)**

PDP Column Shoe	16	20	24	30	39
B <sub>1,min</sub>	235	245	270	300	400
B <sub>2,min</sub>	275	290	315	370	475
S <sub>1,min</sub>	135	145	170	200	280
S <sub>2,min</sub>	175	190	215	270	360
S <sub>3,min</sub>	120	130	155	180	250
S <sub>4,min</sub>	135	145	170	200	280
E	50	50	50	50	60
d <sub>c,min</sub>	295	310	345	385	515

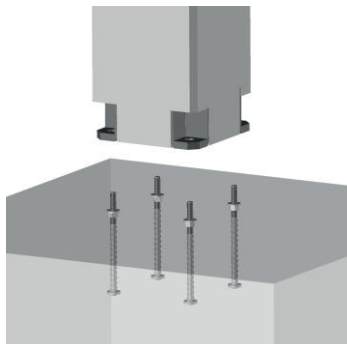
**RECENSE PDP Column Shoe**

**Intended use**

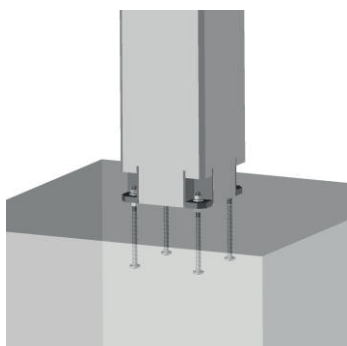
Installation and spacing parameters

**Annex B2**

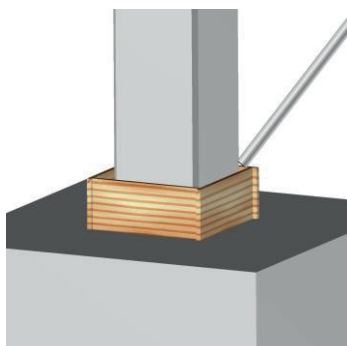
### Installation instructions - precast element



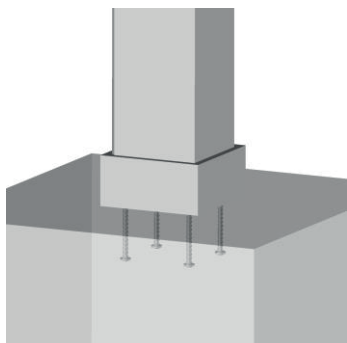
1. Column is installed directly on the pre-levelled washers and the lower nuts.



2. Upper washers are installed on the base plate and upper nuts are screwed on the bolts.



3. The formwork for the grouting joint and recesses is installed. The joint has to be grouted with non-shrink mortar.



4. The joint is finished when the formwork is removed and the grout has hardened.

**NOTE:**

Joint has to be grouted with non-shrink mortar and has to reach the design strength before the column is loaded by other structures.

**RECENSE PDP Column Shoe**

**Intended use**

Installation instructions

**Annex B3**

English translation prepared by IETcc

**Table C1: Resistances to tension, compression, and shear loads under static and quasi-static loading**

PDP Column Shoe			16	20	24	30	39
<b>Steel failure</b>							
Tension resistance <sup>(1)</sup>	$N_{Rd,S}$	(kN)	62,1	96,9	139,6	222	386,4
Bending resistance factor	$\eta_d$	(-)	0,79				
Bending stiffness factor	$K_L$	(-)	1,0				
Shear resistance factor	$K_S$	(-)	1,0				

<sup>(1)</sup> For dimensioning, the factor  $\eta_d$  applies to these values.

<b>RECEASE PDP Column Shoe</b>	<b>Annex C1</b>
<b>Performances</b>	
Resistances to tension and shear loads under static and quasi-static loading	

**Annex D1: Quality control**

This confidential information and is not included in the European Technical Assessment when that assessment is publicly available.





Parque Empresarial, parcelas 33-39, 27720 A PONTENOVA - LUGO - ESPAÑA

Tel.: (34) 982 355 710 / Fax: (34) 982 355 995

e-mail: [recense@recense.com](mailto:recense@recense.com)

[www.recense.com](http://www.recense.com)

