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## European Technical Assessment

**ETA 21/0476**  
of 04.11.2022



### General part

#### Technical Assessment Body issuing the ETA: ITeC

ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)

**Trade name of the construction product**

**Forma 97 system**

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

16 – Reinforcing and pre-stressing steel for concrete and ancillaries. Post tensioning kits.

**Manufacturer**

**FORMACIONES MICROPILOTES Y ANCLAJES97 S.L.**

Pol. Ind. Can Magre  
C/ De les Roquetes 20, 22, 24  
(08187) Santa Eulàlia de Ronçana, Barcelona  
Spain

**Manufacturing plant**

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**This European Technical Assessment contains**

21 pages including 1 annex which forms an integral part of this assessment.

**This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of**

European Assessment Document EAD 160071-00-0102  
*Kit for rock and soil anchors using prestressing steel strand.*  
Edition January 2019.

### **General comments**

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

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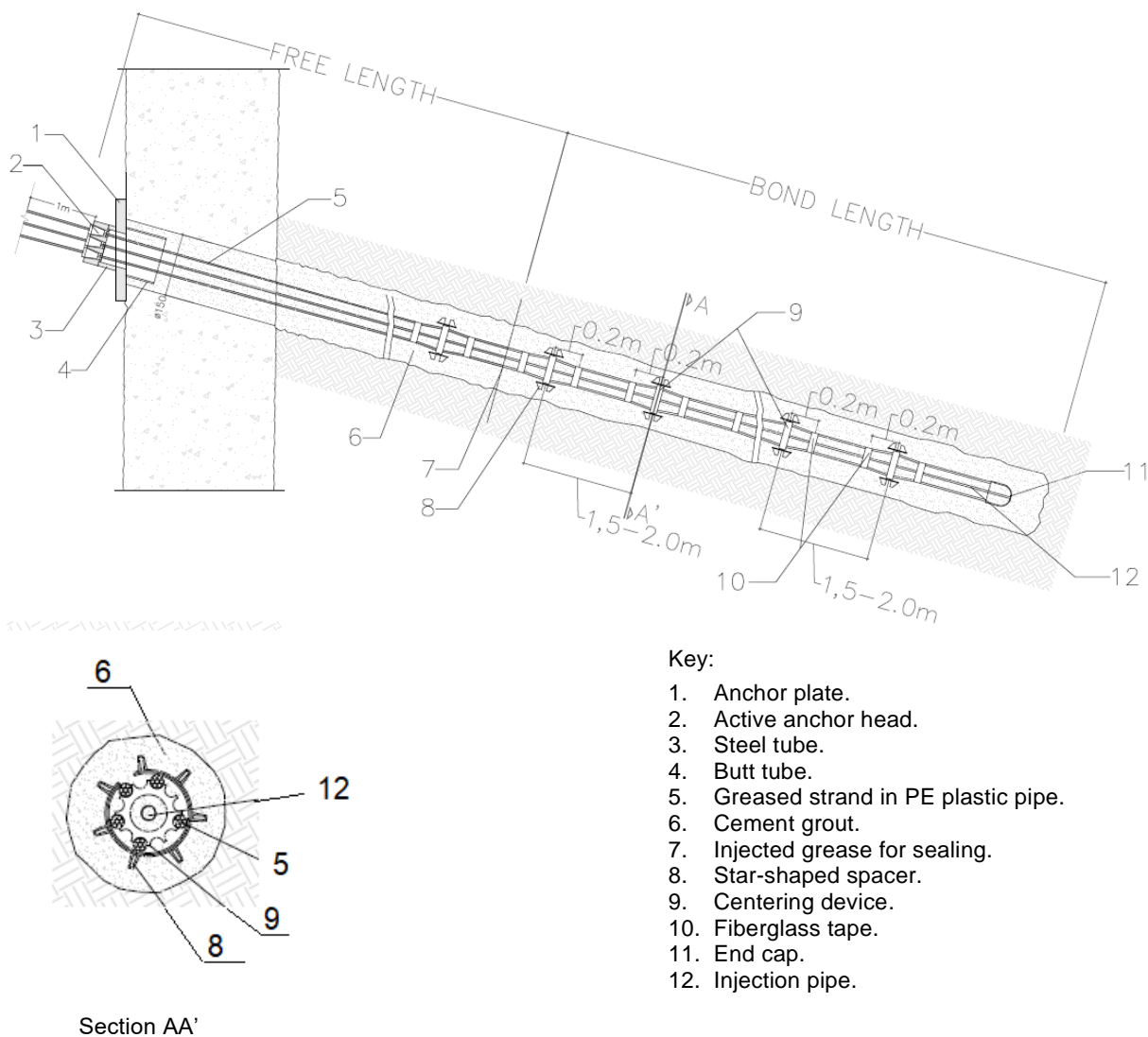
## Specific parts of the European Technical Assessment

### 1 Technical description of the product

#### 1.1 General

This ETA applies to Forma 97 system, kit for rock and soil anchor for geotechnical works grouted in accordance with EN 1537<sup>1</sup>, for temporary use (up to 2 years), comprising the following components (see Annex A):

**Figure 1.1:** General view of Forma 97 system.



- Tendon ranging from 2 to 7 tensile elements.
- 7-wire prestressing steel strand steel quality Y1860 S7 complying with the specifications of prEN 10138-3:2009, Table 4 as tensile element with nominal diameter, nominal cross-sectional area and characteristic tensile strength as given in Table 1.1.

<sup>1</sup> EN 1537: Execution of special geotechnical Works – Ground anchors.

**Table 1.1:** Tensile elements.

Nominal diameter		Nominal cross-sectional area	Characteristic tensile strength
[mm]	[inch]	[mm <sup>2</sup> ]	[MPa]
15,2	0,60"	140	1.860

The maximum admissible angular deviation of the tendon from the normal to the active anchor head is 3,0°.

- Structural anchorage components for load transfer from the tendon to the structure for 2, 3, 4, 5, 6 and 7 prestressing steel strands are:
  - Active anchor head of steel grade C45E according to EN ISO 683-1.
  - Anchor plate of steel grade S275JR (1.0044) according to EN 10025-2.
  - Steel tube of steel grade S355J2 (1.0577) according to EN 10025-2, in accordance with EN 10210-1, welded to the anchor plate and providing the inclination of the tendon.
  - Three-piece ring wedges of dimensions 30 mm x 45 mm (diameter x length), and steel grade C15 Pb + C.
  - Local anchorage zone reinforcement.
  - Butt tube of steel grade S235JR (1.0044) according to EN 10025-2, in accordance with EN 10210-1 and welded to the anchor plate.

Prestressing steel strands are anchored to the active anchor by means of wedges. Active anchor supports on a steel tube, and this supports on the anchor plate. Anchor plate supports on the concrete or steel structure.

Load transfer from the prestressing steel strand to rock or soil in the bond length is provided by the grout filling the void between tensile elements and borehole, thus no additional structural anchorage components (anchorage unit or corrugated compression pipe) are necessary in the bond length.

- Corrosion protection components for limited corrosion protection (PLL) option:
  - External cement grout in accordance with EN 1537 protects the tendon in the bond length and fills the void between individual PE sheaths and borehole in the free length.
  - Individual PE sheath and prestressing steel strand assembly filled with soft corrosion protection filling material -grease or wax- for free length of tendon.  
Individual PE sheath and prestressing steel strand assembly filled with soft corrosion protection filling material for free length of tendon is fabricated by applying grease coating and pushing the strand into the sheath.
  - Metallic coating in accordance with EN ISO 1461 is applied to the anchor cap satisfying requirements of EN ISO 12944 for the corrosivity category C4 for protection of steel components directly exposed to the atmosphere.
- Ancillary components for assembly, installation and sealing of the rock and soil anchor.
  - Star-shaped spacers made up of polymeric material used to separate tensile elements.
  - Centering devices made up of polymeric material arranged around the tendon. These elements provide the distance between the tensile elements of the tendon and the edges of the borehole.
  - Anchor caps for stressing end of anchor made of galvanised steel Z275.
  - Tubes for injection anchor: corrugated plastic tubes in accordance with EN 61386-1 and EN 61386-24 are used. Dimensions of the tubes depend on the injection procedure applied. Three injection procedures are possible:

- Unit global injection (IU or IGU): injection is carried out in a single step from the exterior of the anchorage using a PE tube running parallel to the tendon of dimensions 20 mm x 2,4 mm (diameter x thickness).
- Repetitive injection (IR): injection is carried out by using two injection tubes, the primary, which is running parallel to the tendon (as unit global injection), and the secondary, which is a U-shape tube rolled up to the strands with valves arranged to a distance between them of 0,5 m to 2,0 m. Dimensions of both tubes are the same (20 mm diameter).
  - Selective repetitive injection (IRS): injection is carried out by using two injection tubes, the primary tube of 20 mm of diameter, which is running parallel to the tendon (as unit global injection), and the secondary tube of 32 mm of diameter, which allows further selective injections (located or from a point onwards).

Vents are not necessary.

- Tape and fiberglass reinforced tape.

Forma 97 system is not provided with options for removability.

Forma 97 system may be provided with a monitoring system of anchor force. This monitoring system is based on load cells in the stressing end anchorage, between the anchor head and the anchor plate.

The stressing anchorage of Forma 97 system can be supported directly on concrete or on steel members. A steel tube is interposed between anchor head and anchor plate providing the necessary inclination of the stressing anchorage with respect to the support structure.

## **2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)**

### **2.1 Intended uses**

Forma 97 system is intended to be used for the anchoring of structures and to stabilise rock and soil by active introduction of prestressing forces. Forma 97 system may be used with limited corrosion protection (PLL) in non-aggressive ground conditions and without exposure to critical stray currents: for temporary use (up to 2 years).

### **2.2 Working life/Durability**

The provisions made in this ETA are based on an assumed working life of up to 2 years for temporary use for Forma 97 system when installed in the works provided that the Forma 97 system is subject to appropriate transport, storage and installation. These provisions are based upon the current state of the art and the available knowledge and experience.

The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer or the assessment body, 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 reference to the methods used for its assessment

The assessment of Forma 97 system for the intended use was performed following EAD 160071-00-0102 *Kit for rock and soil anchors using prestressing steel strand*.

**Table 3.1:** Performance of Forma 97 system.

Basic Works Requirement	Essential characteristic	Performance
BWR 1 Mechanical resistance and stability	Resistance to static load	See Clause 3.1
	Resistance to fatigue	See Clause 3.2
	Load transfer to structure	See Clause 3.3
	Friction in free length	See Clause 3.4
	Comprehensive corrosion protection (PLC only)	Not relevant for PLL option
	Enhanced corrosion protection (PLE only)	Not relevant for PLL option
	Limited corrosion protection (PLL only)	See Clause 3.5
	Effect of removability on resistance	Not assessed
	Effect of means for adjustment and monitoring of anchor force on resistance	See Clause 3.6
	Mass of soft filling material per metre (filling degree) (PLC and PLE only)	Not relevant for PLL option
	Maximum pull-out force for strand from sheath of manufactured assembly (PLC and PLE only)	Not relevant for PLL option
	Sealing of end of individual smooth PE or PP sheath (PLC and PLE only)	Not relevant for PLL option
	Resistance of corrugated PE pipe under internal pressure (PLC and PLE only)	Not relevant for PLL option
	Resistance of transition from smooth PE pipe to corrugated PE pipe and of end cap on corrugated PE pipe (PLC and PLE only)	Not relevant for PLL option
	Resistance of sealing of free length PE pipe to anchorage under external pressure (PLC and PLE only)	Not relevant for PLL option
Electrical resistance of isolating plate between anchor head and bearing plate (PLC only)	Not relevant for PLL option	
Filling of space outside of transition pipe from anchorage to free length for corrosion protection by cement grout (PLC and PLE only)	Not relevant for PLL option	

### 3.1 Resistance to static load

The kit for rock and soil anchor as described in the ETA meets the acceptance criteria of EAD 160071-00-0102, Clause 2.2.1. Assessment of mechanical anchorages at the stressing end of the anchor has been based on testing in accordance with EAD 160004-00-0301, Annex C.2.1, for external tendons. The number and size of the test specimens and the required performance have been in accordance with EAD 160004-00-0301, Clause 2.2.1. The determination of the relevant actual material characteristics has been in accordance with EAD 160004-00-0301, Annex C.1.

### 3.2 Resistance to fatigue

The kit for rock and soil anchor as described in the ETA meets the acceptance criteria of EAD 160071-00-0102, Clause 2.2.2. Assessment of mechanical anchorages at the stressing end of the anchor has been based on testing in accordance with EAD 160004-00-0301, Annex C.3.1. The number and size of the test specimens and the required performance have been in accordance with EAD 160004-00-0301, Clause 2.2.2. The determination of the relevant actual material characteristics has been in accordance with EAD 160004-00-0301, Annex C.1.

### 3.3 Load transfer to structure

The kit for rock and soil anchor as described in the ETA meets the acceptance criteria of EAD 160071-00-0102, Clause 2.2.3. Assessment of mechanical anchorages at the stressing end of the anchor supported on concrete members has been based on testing in accordance with EAD 160004-00-0301, Annex C.4.1.

Assessment of mechanical anchorages at the stressing end of the anchor supported on structural steel members has been based on design verification in accordance with the Eurocode 3 for a design anchor force of 110 % of the tensile element capacity and the design strength of the structural steel members. The type and dimensions of structural steel members is defined case-by-case in accordance with the load and resistance requirements.

When an additional component (steel tube) between anchor head and anchor plate is used to provide the inclination of the rock and soil anchor with respect to the anchored structure, this steel tube will be calculated on a case-by-case basis for a design anchoring force of 110 % of the tensile element capacity. However, it is verified that the compressive strength of the steel tube is higher than the design anchoring force of 110 % of the tensile element capacity in the range between 20° and 30° of inclination of the tendon.

The number and size of the test specimens and the required performance have been in accordance with EAD 160004-00-0301, Clause 2.2.3. The determination of the relevant actual material characteristics has been in accordance with EAD 160004-00-0301, Annex C.1.

See Clause A.5 of Annex A for the minimum anchorage centre spacing and edge distance.

### 3.4 Friction in free length

Assessment of the friction in tendon free length has been based on documented tests from sites provided by the manufacturer.

Friction loss in free length is 0,15% of prestressing force per meter when individual PE sheath and prestressing steel strand assembly filled with soft corrosion protection filling material -grease or wax- is used.

### 3.5 Limited corrosion protection (PLL)

Assessment of limited corrosion protection components has been carried out for the following aspects in accordance with EN 1537 Table C.1. Actual corrosion protection details of the kit are also given hereinafter.

- Tendon bond length: 7-wire prestressing steel strands protected with a minimum of 20 mm external grout cover (EN 1537, Table C.1, Item 1);

- Tendon free length: 7-wire prestressing steel strands encapsulated inside individual PE sheaths and all seven wires of the strands coated with soft corrosion protection filling material (EN 1537, Table C.1, Item 2b);
- Tendon transition from free length to anchorage: PE pipe and PE sheath end immediately next to anchor plate, exposed prestressing steel surfaces coated with a layer of soft corrosion protection filling material;
- Stressing end anchorage: 7-wire prestressing steel strand coated with a layer of soft corrosion protection filling material, anchor head and anchor plate coated with a layer of soft corrosion protection filling material (EN 1537, Table C.1, Item 4a);

### 3.6 Effect of means for adjustment and monitoring of anchor force on resistance

Assessment of additional components of kit for rock and soil anchor for monitoring of anchor force (load cells) for resistance to static load, has been based on design verification. A design anchor force of 110% of the capacity of the tensile elements and the design strength of the load cells have been considered.

The ring-shaped load cells are placed between the anchor head and the anchor plate. An additional anchor plate according to supplier instructions is placed between anchor head and ring-shaped load cell for load cell models 0L2M and 0L2E.

Load capacity and dimensions of available load cells are given in the table below.

**Table 3.2:** Load capacity and dimensions of available load cells.

Load cell model		Load capacity [kN]	Dimensions [mm]		
Manometer	Pressure transducer		Internal diameter	External diameter	Thickness
0L2M09075H0	0L2E0907500	750	92	196	30
0L2M11100H0	0L2E1110000	1.000	110	231	
0L2M16150H0	0L2E01615000	1.500	165	293	
ANC-1000	--	1.000	120	228	45
ANC-2500	--	2.500	225	316	

Load cells must be chosen according to the anchor force. See table below.

**Table 3.3:** Load cells according to prestressing force.

Anchor force			Load cell model				
Number of tensile elements	$(F_{pk})$ [kN]	$1,1 \cdot F_{pk}$ [kN]	0L2M09075 H0	0L2M11100 H0	0L2M16150 H0	ANC-1000	ANC-2500
			0L2E09075 00	0L2E11100 00	0L2E01615 000		
2	520,8	572,9	X	X	X	X	X
3	781,2	859,3	--	X	X	X	X
4	1.041,6	1.145,8	--	--	X	--	X
5	1.302,0	1.432,2	--	--	X	--	X
6	1.562,4	1.718,6	--	--	--	--	X
7	1.822,8	2.005,1	--	--	--	--	X



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

According to the decision 98/456/EC, as amended of the European Commission<sup>2</sup>, the system of AVCP (see EC delegated regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

**Table 4.1:** Applicable AVPC system.

Product	Intended use(s)	Level or class	System
Forma 97 system	Kit for rock and soil anchor	--	1+

#### 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 ITeC<sup>3</sup>, with which the factory production control shall be in accordance.

Products not manufactured by the kit manufacturer shall also be controlled according to the Control Plan.

Where materials/components are not manufactured and tested by the supplier in accordance with agreed methods, then they shall be subject to suitable checks/tests by the kit manufacturer before acceptance.

Any change in the manufacturing procedure which may affect the properties of the product shall be notified and the necessary type-testing revised according to the *Control Plan*.

Issued in Barcelona on 04 November 2022

by the Catalonia Institute of Construction Technology.



Ferran Bermejo Nualart  
Technical Director, ITeC

<sup>2</sup> Official Journal of the European Union (OJEU) L201/112 of 17/07/1998.

<sup>3</sup> The *Control Plan* is a confidential part of the ETA and is only handed over to the notified certification body involved in the assessment and verification of constancy of performance.

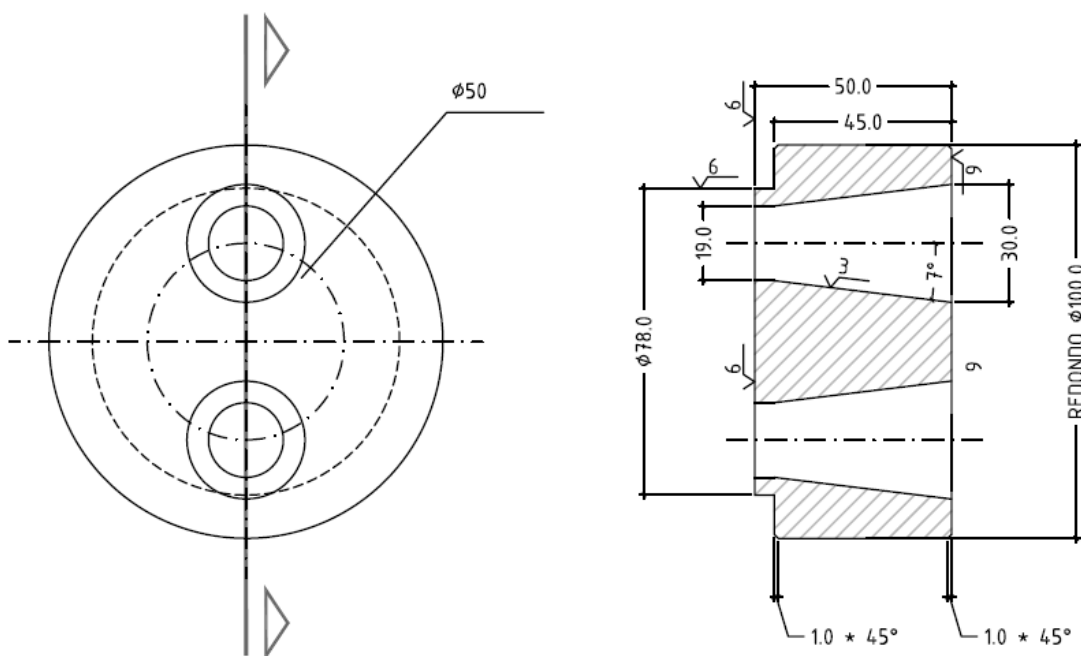
## ANNEX A – DESCRIPTION OF FORMA 97 SYSTEM

### A.1 Anchorage components of Forma 97 system

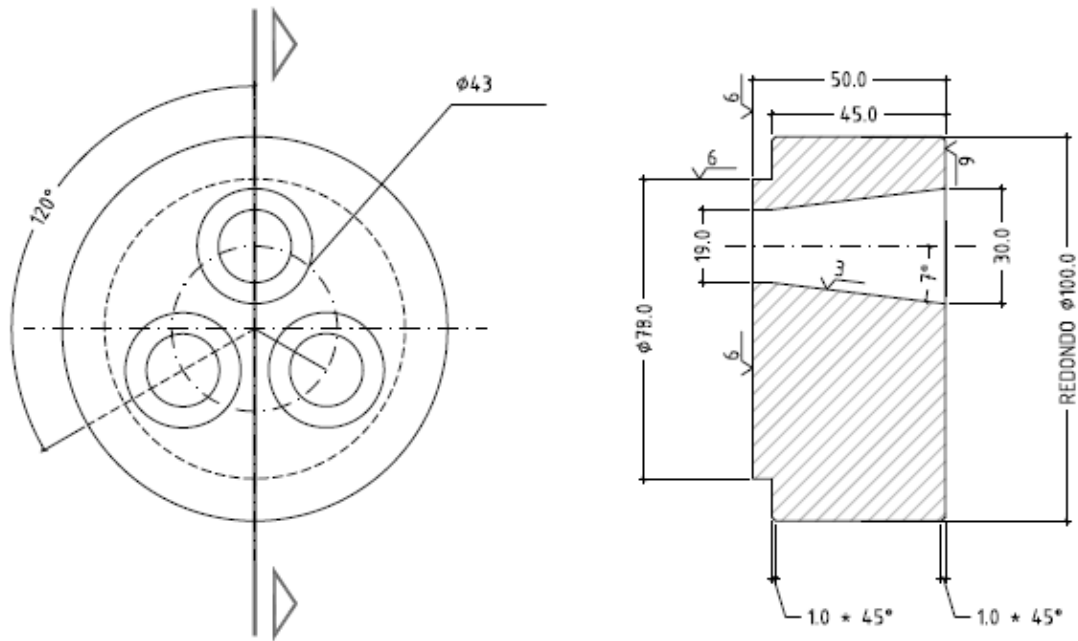
#### A.1.1. Active anchor heads

Active anchor heads are cylindrical steel elements of steel grade C45E according to EN ISO 683-1, for 2, 3, 4, 5, 6 and 7 tensile elements and with as many conical bores as prestressing steel strands are anchored. The geometry of the conical bores is shown in the figures below.

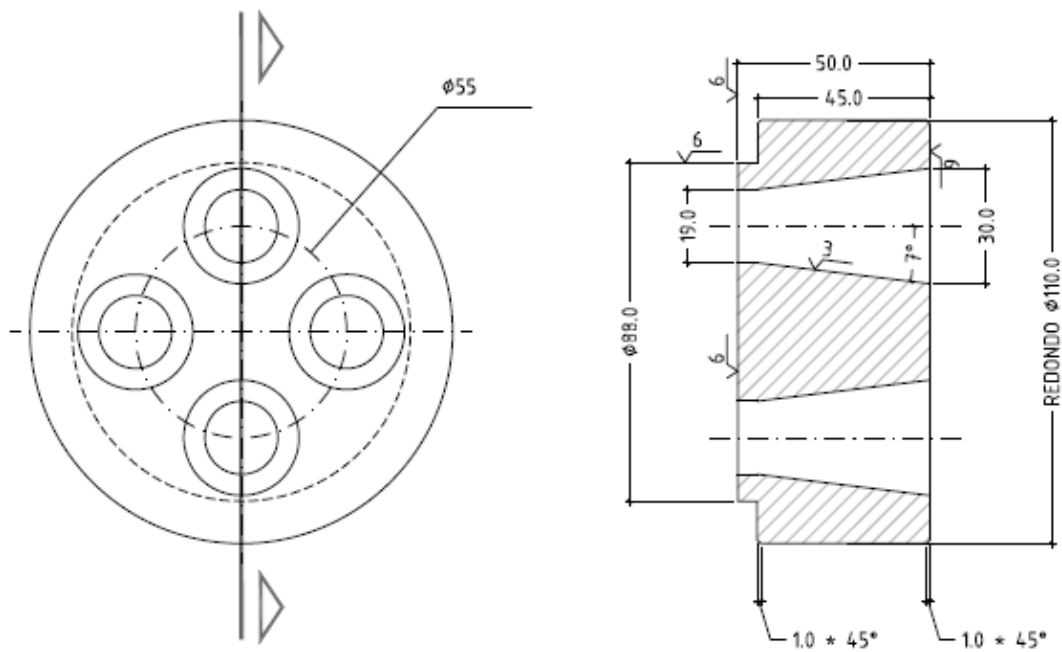
Figure A.1: Active anchor heads.



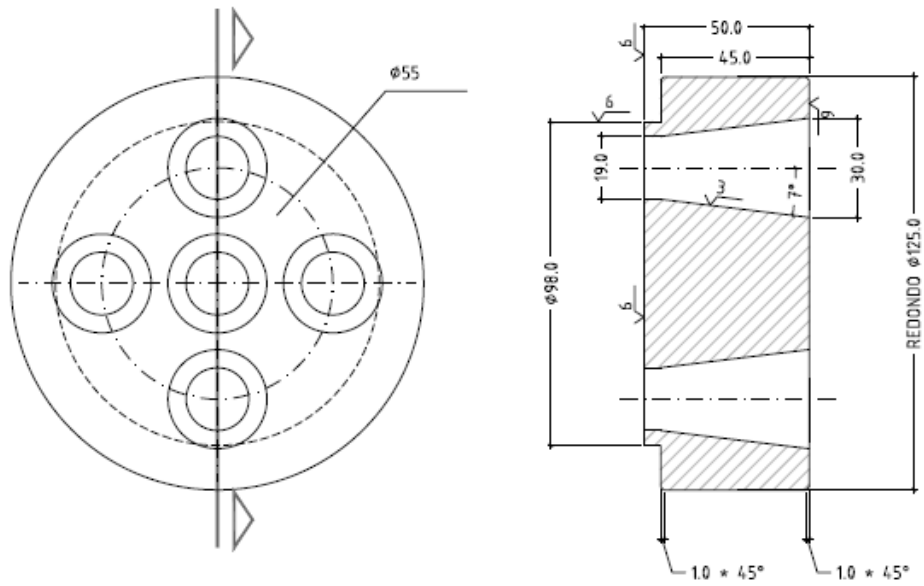
a) Anchor head for 2 strands.



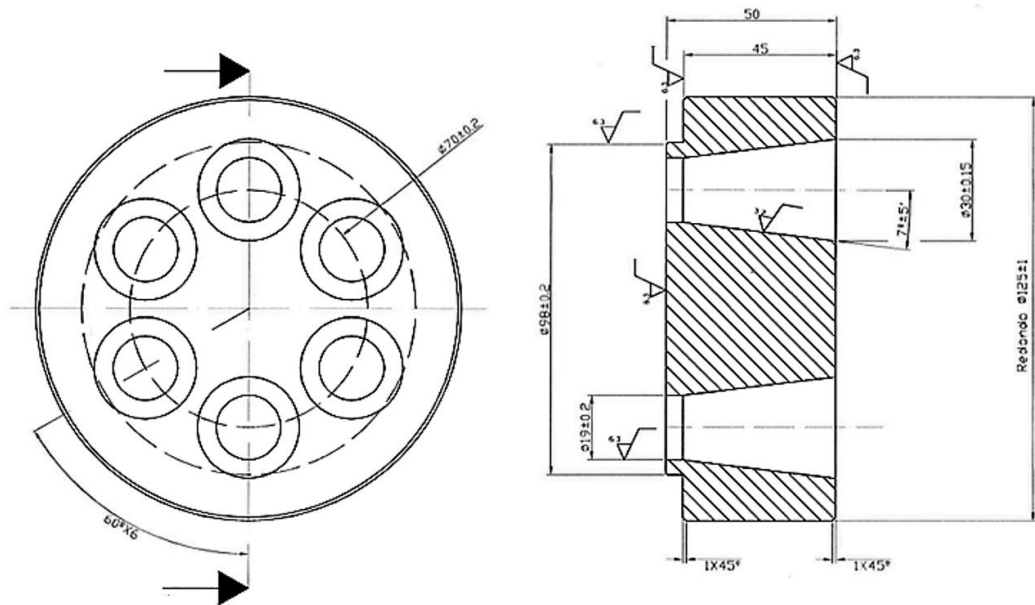
b) Anchor head for 3 strands.



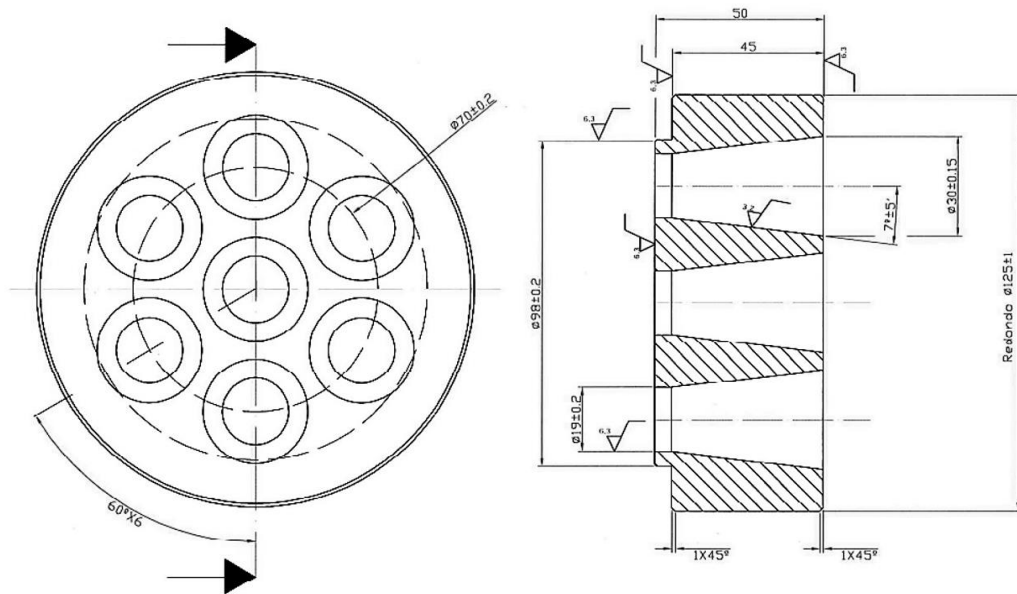
c) Anchor head for 4 strands.



d) Anchor head for 5 strands.



e) Anchor head for 6 strands.

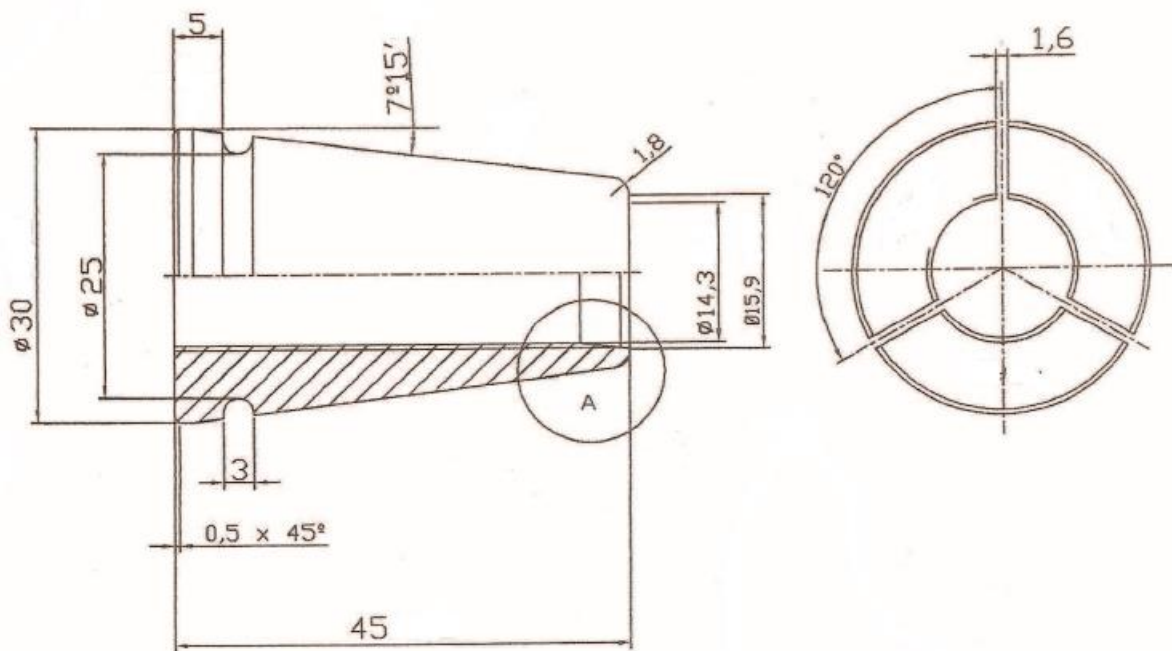


f) Anchor head for 7 strands.

### A.1.2. Wedges

Description of three-piece ring wedges of dimensions 30 mm x 45 mm (diameter x length), and steel grade C15 Pb + C is given below:

Figura A.2: Wedges.



### A.1.3. Anchor plates

Description of anchor plates of steel grade S275JR (1.0044) according to EN 10025-2 for 2, 3, 4, 5, 6 and 7 tensile elements is given in the figures below.

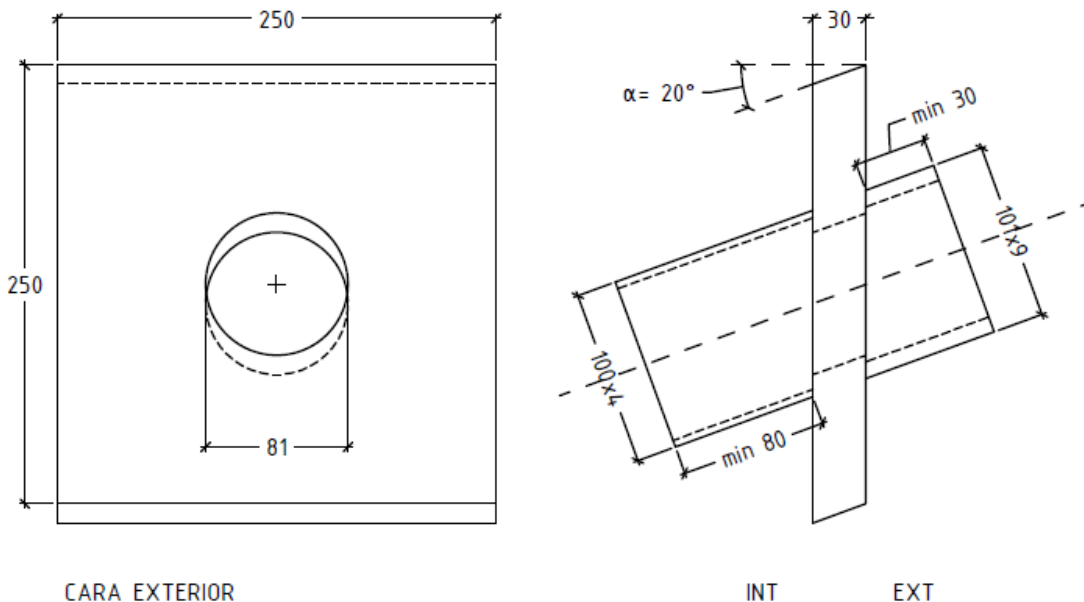
The anchor plates in the figures include the steel tube providing the inclination of the tendon and the butt tube behind the anchor plate. The steel tube is described in Clause A.1.4. Butt tube is a steel tube of grade S235JR in accordance with EN 10210-1 and is welded to the inner face of anchor plate to allow for the positioning of anchor plate in the hole of the supporting structure. Dimensions of butt tube are given in the table below:

**Table A.1:** Dimensions of butt tube.

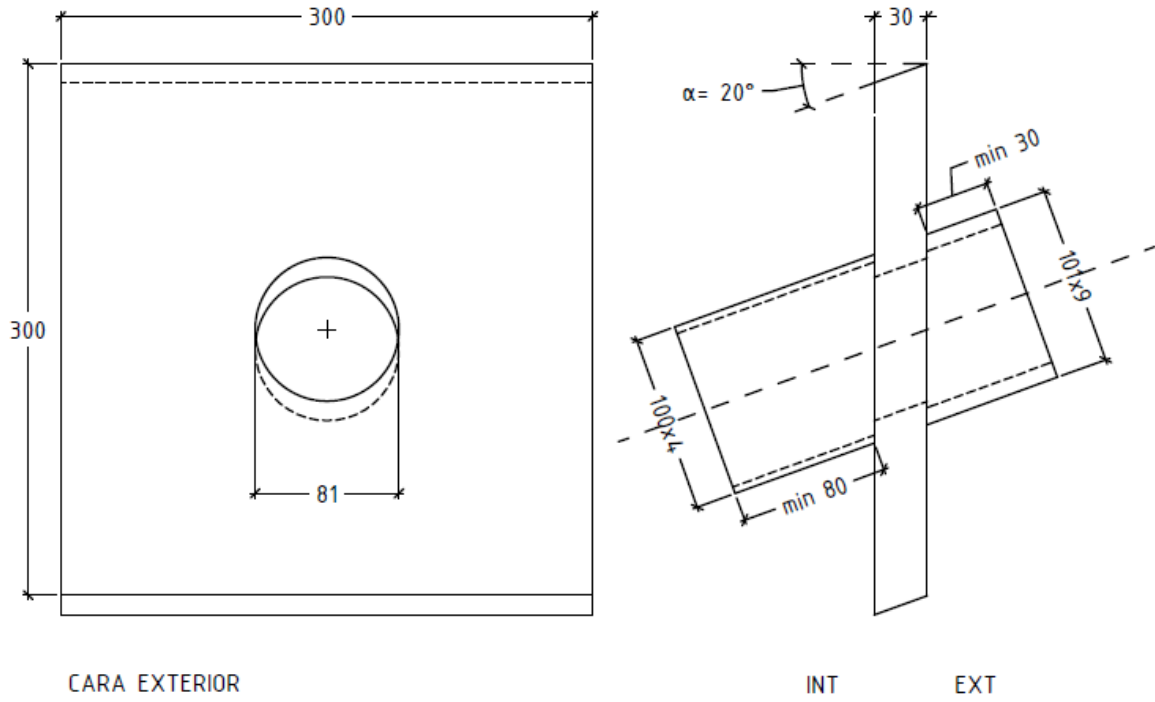
Number of strands	External diameter [mm]	Thickness [mm]	Minimum length [mm]
2	100	4,0	80
3	100		
4	110		
5	127	8,0	80
6	127		
7	127		

The inclination given in the figures (20°) is an example.

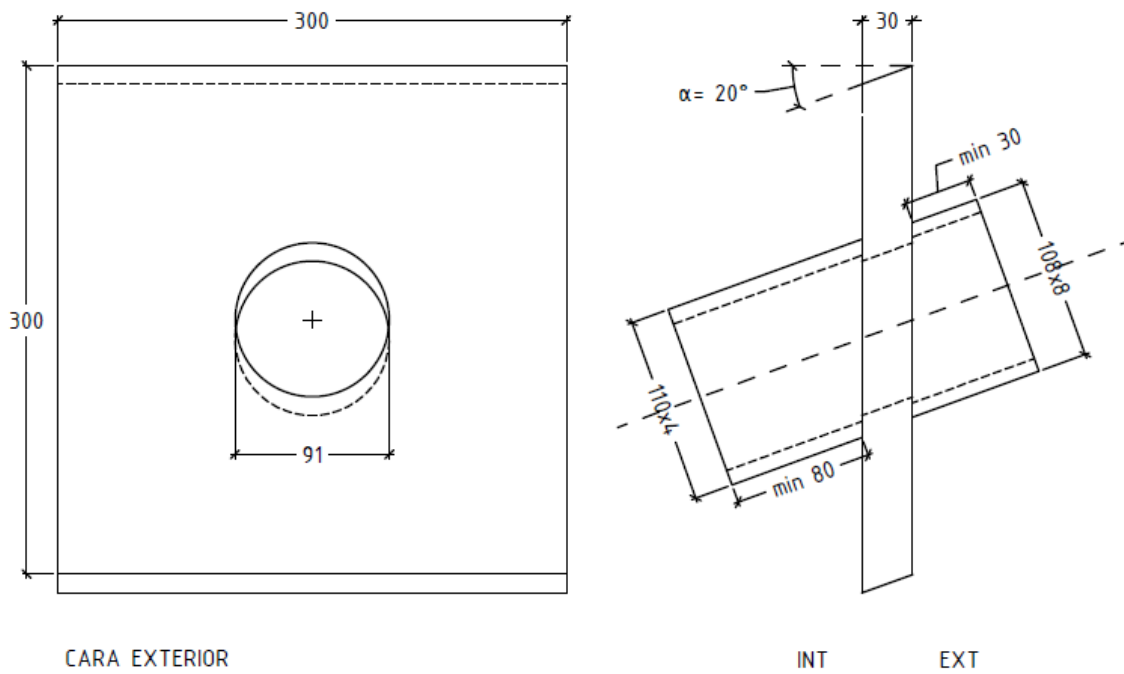
**Figure A.3:** Anchor plates.



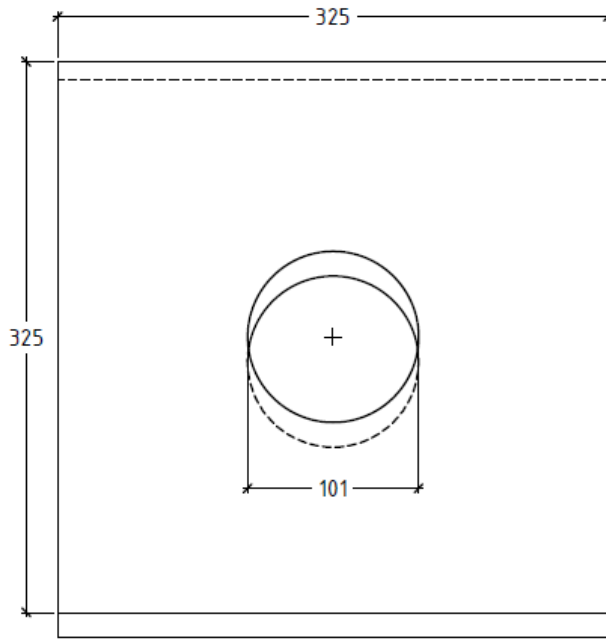
a) Anchor plate for 2 tensile elements.



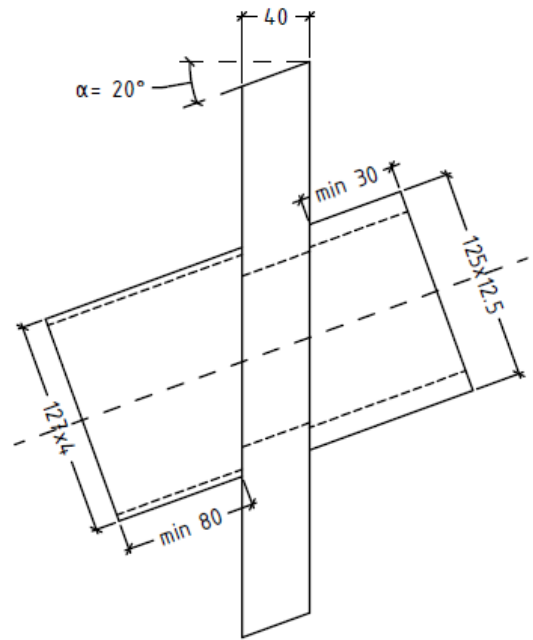
b) Anchor plate for 3 tensile elements.



c) Anchor plate for 4 tensile elements.

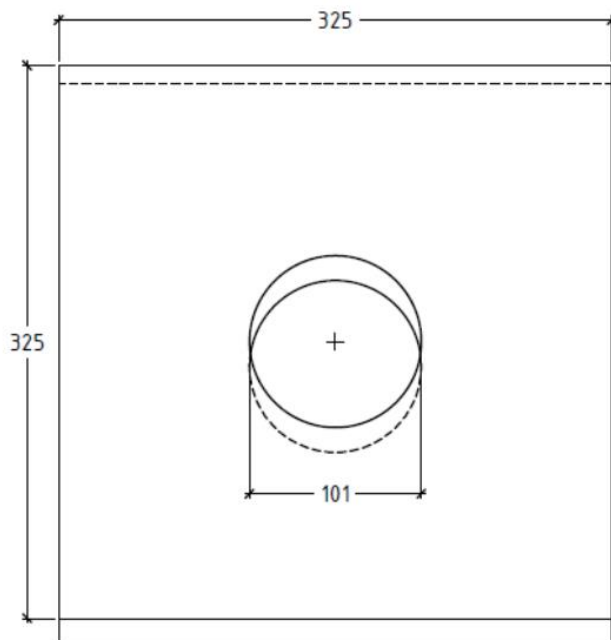


CARA EXTERIOR

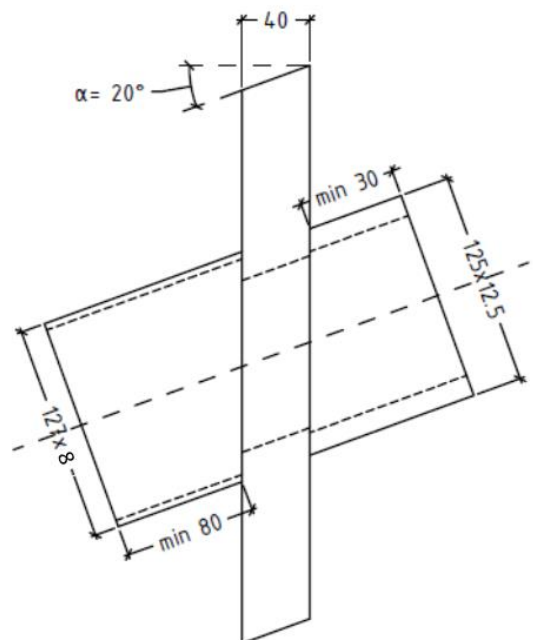


INT EXT

d) Anchor plate for 5 tensile elements.



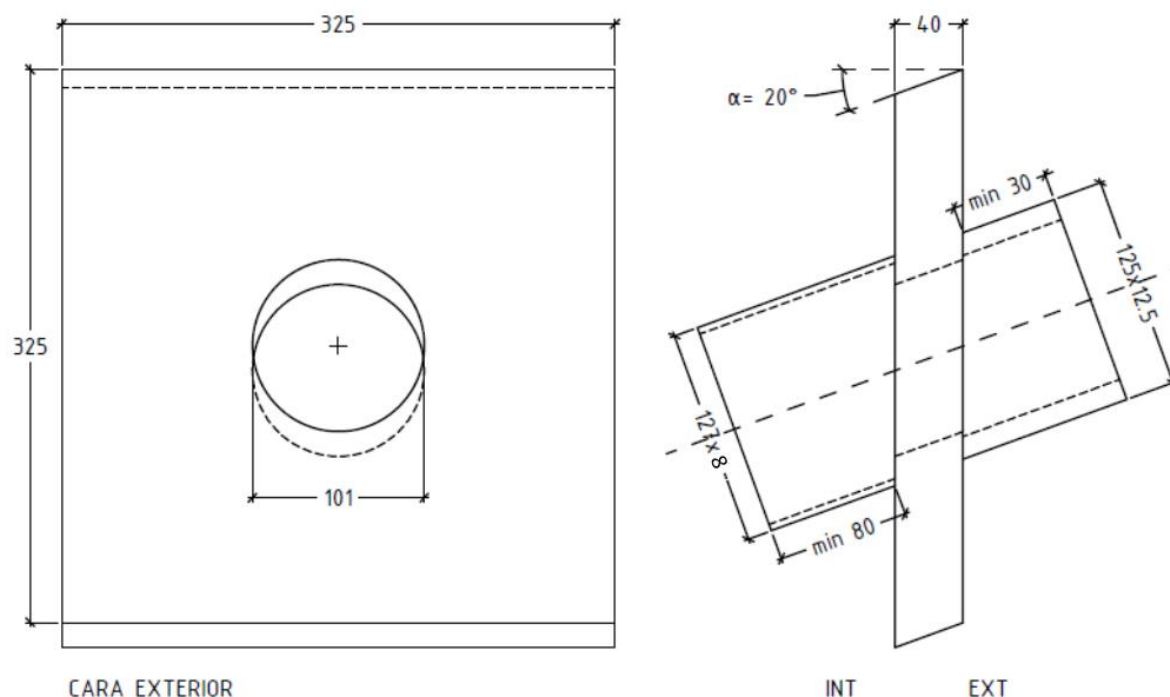
CARA EXTERIOR



INT EXT

e) Anchor plate for 6 tensile elements.





f) Anchor plate for 7 tensile elements.

#### A.1.4. Steel tubes providing the tendon inclination

Steel tubes between anchor head and anchor plate provide the necessary inclination of the tendon with respect to the supporting structure.

The tubes are made of steel grade S355J2 (1.0577) according to EN 10025-2, in accordance with EN 10210-1. Their dimensions are given in the table below.

**Table A.2:** Dimensions of steel tube providing inclination of the tendon.

Number of strands	External diameter [mm]	Thickness [mm]	Minimum length [mm]
2	101	9	30
3	101	9	
4	108	8	
5	125	12,5	
6			
7			

The support area of the anchor head on the steel tube is the same as the support area of the steel tube on the anchor plate, so that the compression loads are transferred from the anchor head to the anchor plate throughout the steel tube without being altered.

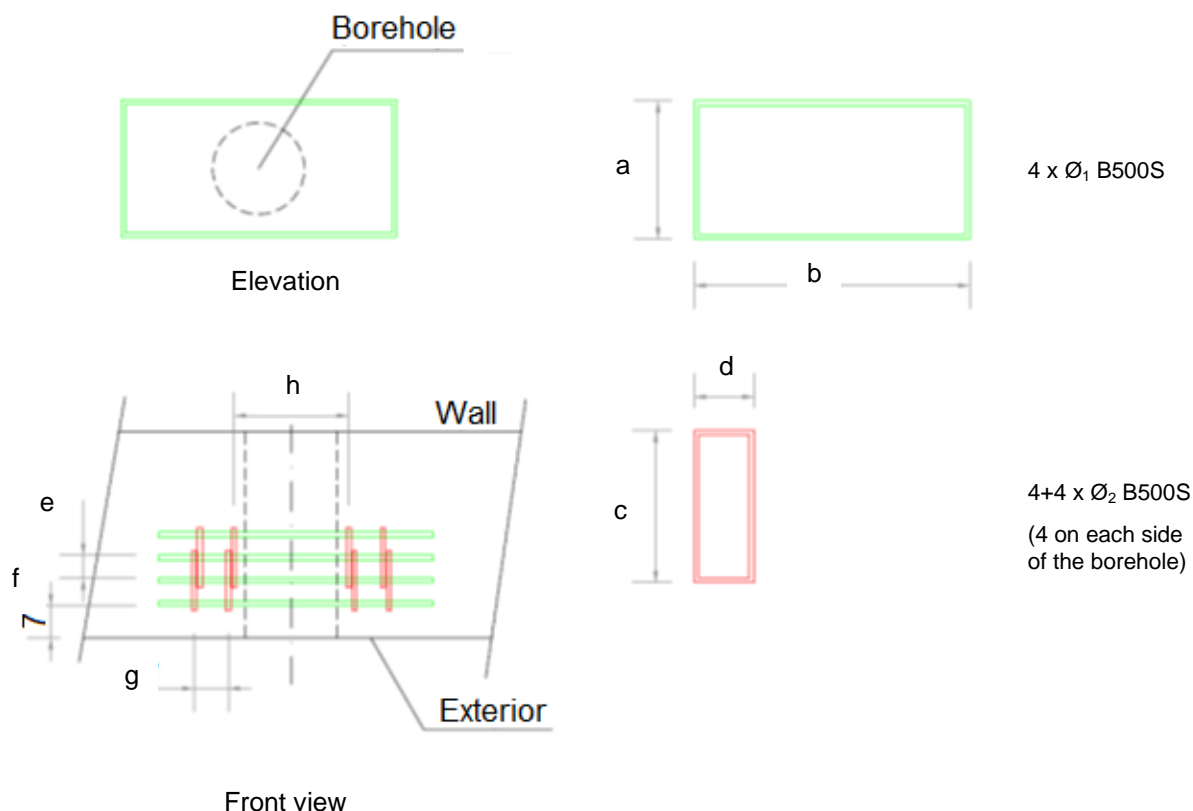
#### A.1.5. Local anchorage zone reinforcement

Local anchorage zone reinforcement of concrete structures is based on stirrups made of ribbed reinforcing steel  $R_e \geq 500$  MPa, arranged parallel and perpendicular to the borehole in accordance with the following table.

Verification of transfer of prestressing forces to the concrete structure is not required if grade and dimensions of local reinforcement, as well as centre spacing and edge distances of the anchorages (see Tables A.3 and A.7) are met.

If required for a specific project design, the reinforcement given in Table A.3 may be modified in accordance with the respective regulations in force at the place of use, as well as to the relevant approval of the local authorities and the ETA holder in order to provide equivalent performance.

**Figure A.4:** Layout of reinforcement parallel and perpendicular to the borehole.



**Note:**

- Dimensions indicated on the figure are given in the following table:

**Table A.3:** Characteristics of the longitudinal and transversal stirrups of the local anchorage zone reinforcement.

Number of strands	Dimensions [mm]									
	a	b	c	d	e	f	g	h	Ø <sub>1</sub>	Ø <sub>2</sub>
2	200	330	200	200	100	100	75	250	8	8
3, 4, 5	250	430	250	200	100	100	75	250	10	10
6, 7	250	430	250	200	120	120	75	250	12	10

Additionally, for anchorages with 6 and 7 tensile elements, a spiral bursting reinforcement is added to the anchorage. The dimensions of this reinforcement are indicated in the following table:

**Table A.4:** Characteristics of the spiral bursting reinforcement.

Spiral exterior diameter [mm]	Number of turns [-]	Distance between turns [mm]	Total length [mm]	Diameter [mm]
170	10	50	500	12

## A.2 Corrosion protection components for limited corrosion protection (PLL) option

### A.2.1. External cement grout

External cement grout in accordance with EN 447 protects the tendon in the bond length and fills the void between individual PE sheaths and borehole in the free length.

Recommended characteristics of cement grout are:

- Minimum cement content: 800 kg of cement per m<sup>3</sup> of grout.
- Water/cement ratio: smaller than 0,5 (more than 2 kg of cement per litre of water).
- Mechanically mixing conditions.
- Cement type: CEM I 42,5 SR in accordance with EN 197-1.
- Water in accordance with EN 1008.
- Additives, if used, must be in accordance with EN 934-4 or EN 934-2.
- Silica fume, if added, must be in accordance with EN 13263.

However, other characteristics of the cement grout can be used if required in place of use taking into consideration the exposure class as defined in EN 206-1.

### A.2.2. Individual PE sheath

Individual smooth PE sheath of dimensions  $20 \pm 0,2$  mm x  $1,2 \pm 0,2$  mm (diameter x thickness), and PN 20, in accordance with UNE 53367-1.

### A.2.3. Soft corrosion protection filling material

Individual PE sheaths with 7-wire prestressing steel strand inside are filled with lithium grease SIL Grease L-EP-2, in the free length only.

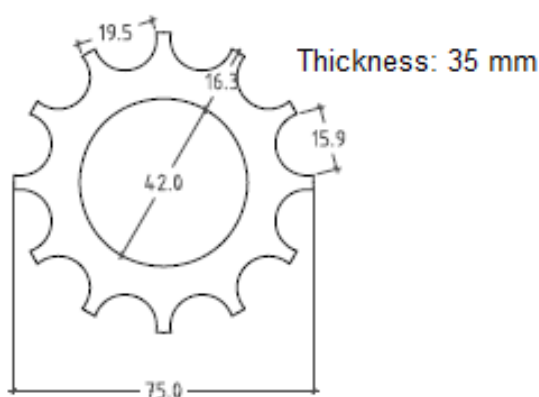
## A.3 Ancillary components

### A.3.1. Star-shaped spacers

Polymeric elements (PE) used to separate the strands in the tendon. The strands are arranged in the perimetral holes and the central hole is used by the grouting conduct.

Star-shaped spacer inner diameter is 42 mm. They are separated between 0,5 m and 2,0 m. A layer of tape or reinforced fiberglass tape is put at both sides of the spacer to avoid its displacement.

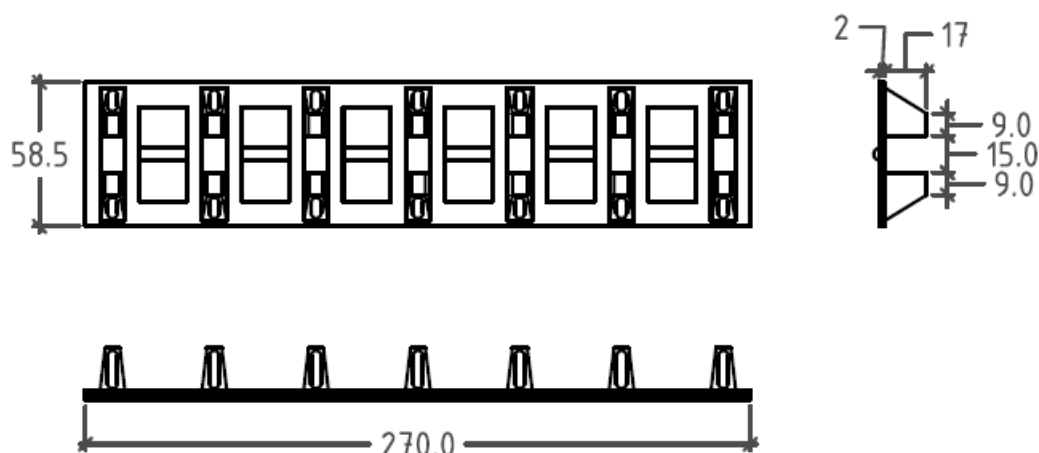
Figure A.5: Star-shaped spacers.



### A.3.2. Centering device

Polymeric elements (PE) used to guarantee the distance between the tensile elements of the tendon and the borehole.

Centering devices are complementary to star-shaped spacers. Their dimensions are: overall width =  $58,5$  mm  $\pm$  5 mm; overall height =  $19$  mm  $\pm$  2 mm, overall length =  $270$  mm  $\pm$  5 mm.

**Figura A.6:** Centering device.**A.3.3. Anchor caps**

Anchor caps for stressing end of anchor are steel tubes with closed end, of 130 mm or 150 mm of exterior diameter, 3 mm thick and between 300 mm and 1.000 mm long according to the length of the tendon outside the anchor head.

Anchor caps are fixed to the anchor head by means of a M8 rod.

Anchor caps are provided with a metallic coating in accordance with EN ISO 1461, of at least 275 g/m<sup>2</sup> (Z275). Additionally, it can be filled with grease if required.

**A.4 Dimensions of borehole**

Dimensions of the borehole in accordance with the tendon size are given in the table below.

**Table A.5:** Dimensions of the borehole.

Number of strands of the tendon	Dimensions of the borehole (diameter) [mm]
2	110
3	110
4	140
5	140
6	140
7	140

**A.5 Minimum anchorage centre spacing and edge distance**

Minimum anchorage centre spacing between adjacent tendons (CD) and distance from the tendon to the edges of structure (ED) are taken from the load transfer resistance tests and depend on the concrete strength class.

The reference cross-section dimensions, a and b, of the concrete prisms tested in axial compression, as well as the concrete strength class are given below:

**Table A.6:** Reference cross-section dimensions of the concrete prisms tested in axial compression.

Number of strands of the tendon	Cross-section dimensions [mm]		Concrete strength ( $f_{cm,0,cyl}$ ) [MPa]	
	a	b		
2	500	500	20	33
4	600	600	20	33
5	600	600	20	33
7	600	600	28	33

Minimum anchorage centre spacing in the structures in x- and y- directions, x and y, and minimum edge distances are derived from the following rule:  $A_c = x \cdot y \geq a \cdot b$ .

The actual spacing / centre distance and edge distance in the structure shall comply with:

$$x \geq 0,85 \cdot a$$

$$y \geq 0,85 \cdot b$$

Edge distances in the structure are calculated with centre spacing in x- and y- direction by:

$$e_x = \frac{x}{2} - 10 \text{ mm} + c$$

$$e_y = \frac{y}{2} - 10 \text{ mm} + c$$

Where:

$e_x$ ,  $e_y$ : edge distance in x- and y- direction respectively.

c: concrete cover of reinforcement in the structure as required at the place of use.

**Table A.7:** Minimum anchorage centre spacing in the structures in x- and y- directions, x and y, and minimum edge distances.

Number of strands of the tendon	Minimum anchorage centre spacing [mm]		Minimum edge distances (1) [mm]	
	x	y	$e_x$	$e_y$
2	425	425	232,5	232,5
3	425	425	232,5	232,5
4	510	510	275	275
5	510	510	275	275
6	510	510	275	275
7	510	510	275	275

**Note:**  
(1) Concrete cover of 30 mm is considered.

## A.6 Concrete strength at time of stressing

Concrete in conformity with EN 206 is used.

**Table A.8:** Concrete strength at time of stressing.

Number of strands	$f_{cm,0,cyl}$ [MPa]						$f_{cm,0,cube}$ [MPa]					
	2	3	4	5	6	7	2	3	4	5	6	7
Lowest concrete strength class	20			28			25			35		
Highest concrete strength class	33						41					