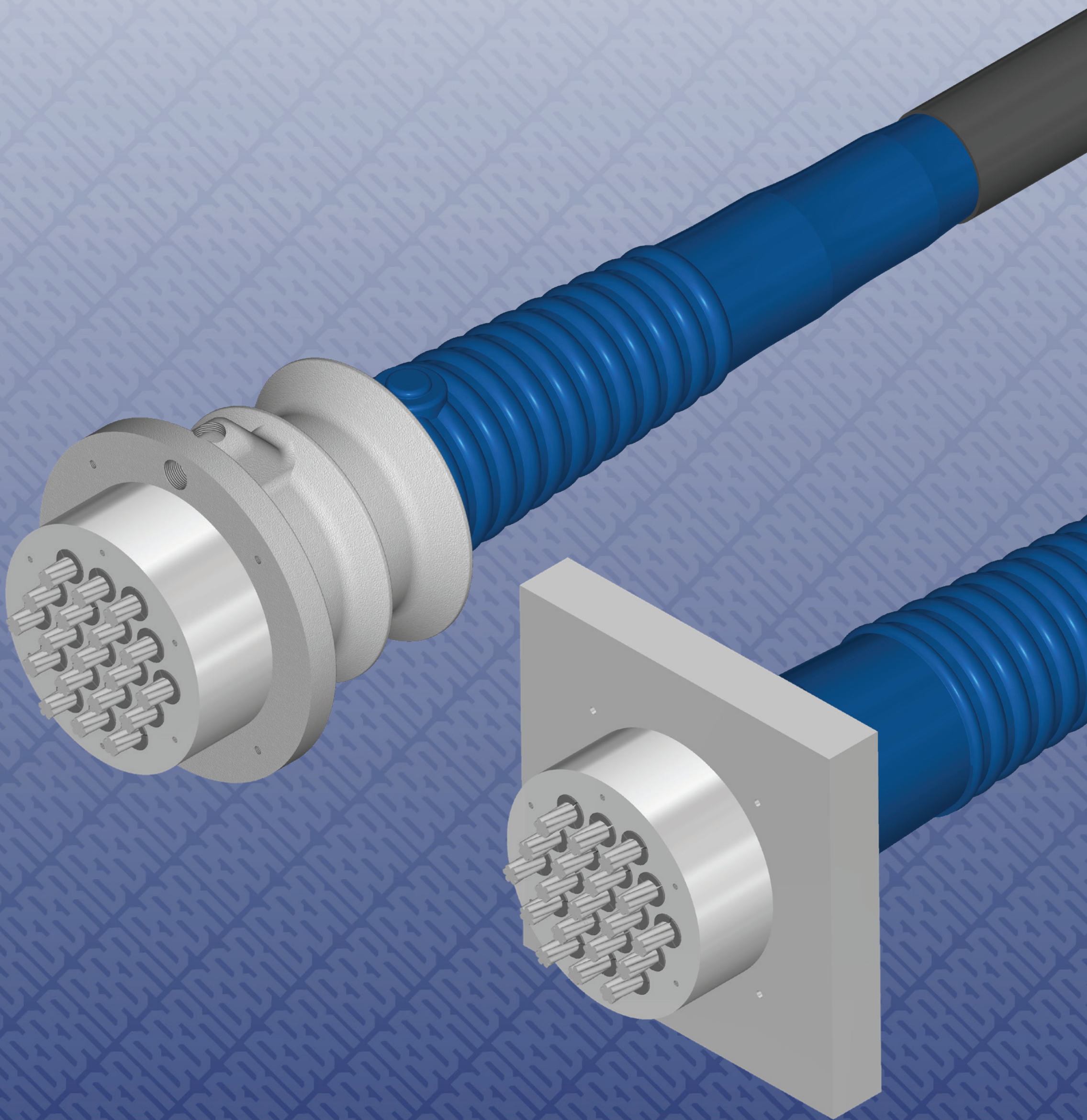
BBR VT CONA CME

External Post-tensioning System with 01 to 61 Strands

European Technical Assessment ETA – 07/ 0168

CE



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ETA-07/0168

BBR VT CONA CME

External Post-tensioning System

BBR VT International Ltd

Ringstrasse 2, 8603 Schwerzenbach (Switzerland)

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0432-CPR-00299-1.3/3

08

Responsible BBR PT Specialist Company

CE

The delivery note accompanying components of the BBR VT CONA CME Post-tensioning System will contain the CE marking.

Assembly and installation of BBR VT CONA CME tendons must only be carried out by qualified BBR PT Specialist Companies. Find the local BBR PT Specialist Company by visiting the BBR Network website www.bbrnetwork.com.

European Organisation for Technical Approvals
Europäische Organisation für Technische Zulassungen
Organisation Européenne pour l'Agrément technique

EAD 16004-00-0301

Post-tensioning Kits for Prestressing of Structures

CWA 14646

Requirements for the installation of post-tensioning kits for prestressing of structures and qualification of the specialist company and its personnel

BBR E-Trace www.bbrnetwork.com

BBR E-Trace is the trading and quality assurance platform of the BBR Network linking the Holder of Approval, BBR VT International Ltd, BBR PT Specialist Companies and the BBR Manufacturing Plant. Along with the established BBR Factory Production Control, BBR E-Trace provides effective supply chain management including installation, delivery notes and highest quality standards, as well as full traceability of components.

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Designated according to Article 29 of Regulation (EU) No 305/2011

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European Technical Assessment

ETA-07/0168 of 16.12.2024

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands
Product family to which the construction product belongs	Post-tensioning kit for external prestressing of structures
Manufacturer	BBR VT International Ltd Ringstrasse 2 8603 Schwerzenbach (ZH) SWITZERLAND
Manufacturing plant	BBR VT International Ltd Ringstrasse 2 8603 Schwerzenbach (ZH) SWITZERLAND
This European Technical Assessment contains	117 pages including Annexes 1 to 76, which form 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) 160004-00-0301 – Post-Tensioning Kits for Prestressing of Structures.
This European Technical Assessment replaces	European Technical Assessment ETA-07/0168 of 18.12.2017

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Specific parts

1 Technical description of the product

1.1 General

The European Technical Assessment[1] – ETA – applies to a kit, the PT system

BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands,

comprising the following components, see Annex 1, Annex 2, Annex 3, and Annex 4.

- Tendon

  External tendon with 01 to 61 tensile elements

- Tensile element

  7-wire prestressing steel strand with nominal diameters and maximum characteristic tensile strength as given in Table 1.

  7-wire prestressing steel strands with nominal diameters and maximum characteristic tensile strength as given in Table 1, factory-provided with a corrosion protection system, comprising corrosion protection filling material and HDPE-sheathing – Monostrand.

  Tendon with monostrands is installed in one common duct and grouted prior to stressing.

Table 1 Tensile elements

Nominal diameter	Nominal cross-sectional area	Maximum characteristic tensile strength
mm	mm^2	MPa
15.3	140	1 860
15.7	150	

NOTE 1 MPa = 1 N/mm^2

- Anchorage and coupler

  Anchorage of the prestressing steel strands with ring wedges

  - End anchorage

    Fixed (passive) anchor or stressing (active) anchor as end anchorage (FA, SA) for tendons with 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands

    Fixed (passive) anchor or stressing (active) anchor as end anchorage for replaceable tendons (FAR, SAR) with 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands

[1] ETA-07/0168 was firstly issued in 2007 as European technical approval with validity from 20.12.2007, extended in 2012 with validity from 20.12.2012, converted in 2017 to European Technical Assessment ETA-07/0168 of 18.12.2017, and amended in 2024 to European Technical Assessment ETA-07/0168 of 16.12.2024.

Fixed (passive) anchor or stressing (active) anchor for encapsulated tendons (FA, SA) with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, and 37 prestressing steel strands

Fixed (passive) anchor or stressing (active) anchor for electrically isolated tendons (FAE, SAE) with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

Fixed (passive) anchor or stressing (active) anchor for electrically isolated and replaceable tendons (FAER, SAER) with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

- Fixed or stressing coupler

  Single plane coupler (FK, SK) for tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

  Single plane coupler (FK, SK) for encapsulated tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

  Single plane coupler (FKE, SKE) for electrically isolated tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

  Sleeve coupler (FH, SH) for tendons with 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands

  Sleeve coupler (FH, SH) for encapsulated tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, and 37 prestressing steel strands

  Sleeve coupler (FHE, SHE) for electrically isolated tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, and 31 prestressing steel strands

- Bearing trumplate (BT) for tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands
- Square plate (SP) for tendons with 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands
- Helix and additional stirrup reinforcement in the region of the anchorage for tendons with 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, and 61 prestressing steel strands
- Only helix as additional reinforcement in the region of the anchorage for tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, and 37 prestressing steel strands
- Only stirrups as additional reinforcement in the region of the anchorage for tendons with 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, and 37 prestressing steel strands
- Ducts in steel or plastic
- Corrosion protection for tensile elements, couplers, and anchorages

PT system

1.2 Designation and range of anchorages and couplers

1.2.1 Designation

End anchorage, e.g. S A (E) CONA CME 1906-150 1860

- Stressing (S) or fixed (F) ← S
- Anchor head (A) ← A
- Optional tendon use ← (E)
  None ( ), Electrically isolated (E), Replaceable (R),
  Electrically isolated and replaceable (ER)
- Designation of the tendon ← CONA CME 1906-150 1860
  with information on number, cross-sectional area, and characteristic tensile strength of the prestressing steel strands, see Clause 1.5.1

Coupler, e.g. F K (E) CONA CME 1906-150 1860

- Fixed (F) or stressing (S) ← F
- Coupler anchor head (K or H) ← K
- Optional tendon use ← (E)
  None ( ), Electrically isolated (E)
- Designation of the tendon ← CONA CME 1906-150 1860
  with information on number, cross-sectional area, and characteristic tensile strength of the prestressing steel strands, see Clause 1.5.1

1.2.2 Anchorage

1.2.2.1 General

Anchorage of prestressing steel strands, FA, SA, is achieved by wedges and anchor heads A, see Annex 1, Annex 2, Annex 3, and Annex 4. The anchor heads A of stressing and fixed anchorages are identical. A differentiation is needed for the construction works.

The wedges of inaccessible fixed anchors are secured with either a wedge retaining plate or springs and a wedge retaining plate. An alternative is pre-locking each individual prestressing steel strand with ~ 0.5 · F_{pk} and applying a wedge retaining plate.

Where

F_{pk} .... N.............. Characteristic value of maximum force of one single prestressing steel strand

Anchor head A is supported on bearing trumplate A, steel ring E and bearing template E, or square plate. Bearing trumplate and square plate transmit the force to the structural concrete. In the region of the anchorage, the structural concrete is confined with

– Helix and additional stirrup reinforcement for tendon with 01 to 61 prestressing steel strands.
– Only helix as additional reinforcement for tendon with 02 to 37 prestressing steel strands.
– Only stirrups as additional reinforcement for tendon with 02 to 37 prestressing steel strands.

1.2.2.2 Restressable tendon

Anchorage of restressable tendon is in accordance with Clause 1.2.2.1. For tendons remaining restressable throughout the working life of the structure, grease, wax, or an equivalent soft corrosion protection filling material is used. This is applicable to

– Bare prestressing steel strands in a common duct for anchorages with bearing trumplate or square plate
– Monostrands, grouted in a common duct, see Clause 1.3, for anchorages with bearing trumplate or square plate
– Replaceable tendons according to Clause 1.2.2.3.

Bare prestressing steel strands, grouted in a common duct are not restressable. This also applies to replaceable tendons.

Significant to a restressable tendon is the excess length of the prestressing steel strands, see Clause 2.2.4.6, Annex 3 and Annex 4. The extent of the excess length depends on the prestressing jack used for restressing and where applicable, the elongation for a full release of the prestressing force of the tendon. The protrusions of the prestressing steel strands require a permanent corrosive protection and an adapted protection cap.

1.2.2.3 Replaceable tendon

Anchorage of replaceable tendon, FAR, SAR, is in accordance with Clause 1.2.2.1. Replacing tendons, see Clause 2.2.4.7, in general is available for

– Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct for anchorages with bearing trumplate or square plate
– Monostrands, grouted in a common duct, see Clause 1.3, for anchorages with bearing trumplate or square plate
– Bare prestressing steel strands, grouted in a common duct, can only be completely removed and subsequently replaced by a new tendon, see Annex 3, anchorages FAR and SAR. Inner trumpet A/E is placed in bearing trumplate A/E and trumpet A. Inner trumpet A/E extends up to anchor head A/Steel ring E and provides a separating layer between structure and tendon. Adjacent to trumpet A an outer duct around the common duct is arranged to separate from the structural concrete. After full release of the prestressing force, the complete tendon with inner trumpet A can be pulled out from the structure and replaced by a new tendon.
– Monostrands, grouted in a common duct with inner trumpet A/E is placed in bearing trumplate A/E and trumpet A. Inner trumpet A/E extends up to anchor head A/Steel ring E and provides a separating layer between structure and tendon. Adjacent to trumpet A an outer duct around the common duct is arranged to separate from the structural concrete. After full release of the prestressing force, the complete tendon with inner trumpet A can be pulled out from the structure and replaced by a new tendon.

1.2.2.4 Encapsulated tendon

Anchorage of encapsulated tendon, FA, SA, is in accordance with Clause 1.2.2.1. For encapsulated tendon, see Clause 2.2.4.3, trumpet A is threaded to bearing trumplate A which supports the anchor head A. Protection cap A and cap E 3106 for a tendon with 37 prestressing steel strands encase the anchorage. Trumpet A and duct are jointed with heat shrinking sleeve.

Thereby, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encapsulated.

1.2.2.5 Electrically isolated tendon

Anchorage for electrically isolated tendon, FAE, SAE, is in accordance with Clause 1.2.2.1. For electrically isolated tendon, see Clause 2.2.4.4, trumpet E continues through bearing trumplate E up to steel ring E and isolation ring E is placed between bearing trumplate E and steel ring E. Steel ring E supports the anchor head A. Protection cap E encases the anchorage and provides a port as inlet or vent that is sealed with a plug.

With electrically isolated tendon, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encased with isolation material. The integrity of the electrical isolation can be verified and monitored via electrical resistance measurements between tendon and reinforcement of the structure.

1.2.2.6 Electrically isolated and replaceable tendon

Anchorage for electrically isolated and replaceable tendon, FAER, SAER, is in accordance with Clause 1.2.2.1. For electrically isolated and replaceable tendon, see Clause 2.2.4.4 and Clause 2.2.4.7, trumpet E continues through bearing trumplate E up to steel ring E. Isolation ring E is placed between bearing trumplate E and steel ring E. Steel ring E supports the anchor head A. Protection cap E encases the anchorage and provides a port as inlet or vent that is sealed with a plug.

Alternatively, to completely removed and replace by a new tendon, inner trumpet E inside trumpet A and bearing trumplate E extends up to steel ring E. Isolation ring E is placed between bearing trumplate E and steel ring E. Steel ring E supports anchor head A. Protection cap E encases the anchorage and provides a port as inlet or vent that is sealed with a plug.

Inner trumpet E inside trumpet A provides a separating layer between structure and tendon. Adjacent to trumpet A an outer duct around the duct is arranged to separate from the structural concrete. After full release of the prestressing force, the complete tendon with inner trumpet E can be pulled out from the structure and replaced by a new tendon.

With electrically isolated and replaceable tendon, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encased with isolation material. The integrity of the electrical isolation can be verified and monitored via electrical resistance measurements between tendon and reinforcement of the structure.

1.2.3 Fixed and stressing coupler

1.2.3.1 General

The prestressing force at the second construction stage may not be greater than that at the first construction stage, neither during construction, nor in the final state, nor due to any load combination.

Coupler anchor head K and coupler anchor head H are supported by bearing trumplate A, or steel ring E and bearing trumplate E, or square plate, see Annex 2, Annex 3, and Annex 4.

1.2.3.2 Single plane coupler

With the single plane coupler, FK, SK, the coupling is achieved by means of a coupler anchor head K, see Annex 2 and Annex 4. The prestressing steel strands of the first construction stage are anchored by means of wedges in machined cones, drilled in parallel. The arrangement of the cones of the first construction stage is identical to that of anchor head A of the stressing anchorage. The prestressing steel strands of the second construction stage are anchored in a circle around the cones of the first construction stage by means of wedges in machined cones, drilled at an inclination of 7 °. The wedges for the second construction stage are secured by springs and a cover plate.

The transition trumpet to duct at the deviating point at the end of the trumpet is provided with a tension ring in steel equipped with a PE insert, see Annex 2 and Annex 4.

1.2.3.3 Sleeve coupler

With the sleeve coupler, FH, SH, coupler anchor head H, see Annex 2 and Annex 4, is of the same basic geometry as anchor head A of the fixed and stressing anchor. Compared to anchor head A of the fixed and stressing anchor, the coupler anchor head H is deeper and provide an external thread for the coupler sleeve H.

The connection between the coupler anchor heads H of first and second construction stage is achieved by means of a coupler sleeve H.

The transition trumpet to duct at the deviating point at the end of the trumpet is provided with a tension ring in steel equipped with a PE insert, see Annex 2 and Annex 4.

1.2.3.4 Encapsulated fixed and stressing coupler

The encapsulated fixed and stressing coupler, see Clause 2.2.4.3, is a single plane coupler, FK, SK, see Clause 1.2.3.2, or a sleeve coupler, FH, SH, see Clause 1.2.3.3. At the first construction stage with coupler anchor head K or coupler anchor head H an encapsulated stressing anchorage according to Clause 1.2.2.4 is placed. Connection of first and second construction stage by inserting the prestressing steel strands in the single plane coupler or with a sleeve coupler. Steel or plastic housing fully encases the fixed or stressing coupler with a leak tight envelope. The housing is bolted to a steel ring at the second construction stage and the steel ring is bolted to bearing trumplate A of the first construction stage. The housing is connected to the plastic duct with a heat shrink sleeve at the second construction stage. A deviator is installed for guiding the prestressing steel strands of the tendon into the duct.

Thereby, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encapsulated.

1.2.3.5 Electrically isolated fixed and stressing coupler

The electrically isolated fixed and stressing coupler, see Clause 2.2.4.4 and Annex 3, is a single plane coupler, FKE, SKE, see Clause 1.2.3.2, or a sleeve coupler, FHE, SHE, see Clause 1.2.3.3. At the first construction stage an electrically isolated stressing anchorage according to Clause 1.2.2.5 with coupler anchor head K supported by steel ring E on isolation ring E or coupler anchor head H supported by steel ring E on isolation ring E is placed. Connection of first and second construction stage by inserting the prestressing steel strands in the single plane coupler or with a sleeve coupler.

Plastic housing fully encases the fixed or stressing coupler with isolation material, see Annex 3. The housing is bolted to isolation ring E and steel cushion plate at the second construction stage. Isolation ring E is bolted to the steel cushion plate and steel cushion plate is bolted to bearing trumplate E of the first construction stage. The housing is connected to the plastic duct with a heat shrink sleeve at the second construction stage. A deviator is installed for guiding the prestressing steel strands of the tendon into the plastic duct.

With electrically isolated tendon, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encased with isolation material. The integrity of the electrical isolation can be verified and monitored via electrical resistance measurements between tendon and reinforcement of the structure.

1.3 Tendon with monostrands

The tendon comprises monostrands, see Clause 1.18, in one common duct that is grouted prior to stressing, see Clause 2.2.4.2.

Tendon with monostrands allows for the smallest deflection radius of the tendon.

Replacing of tendons with monostrands is in general performed according to the Clauses 1.2.2.3 and 2.2.4.7. Tendons with straight tendon paths – or tendon paths that exhibit slight deviations only – can be replaced in a strand-by-strand procedure, individually for each monostrand. However, in replacing the prestressing steel strands, the monostrands are sufficiently completed with soft corrosion protection filling material.

Monostrands, grouted in inner trumpet A/E and installed inside assembly of bearing trumplate A/E and trumpet A, can be completely removed and replaced with a new tendon.

1.4 Layout of the anchorage recesses

Bearing trumplate, square plate, anchor head, and coupler head are placed perpendicular to the axis of the tendon, see Annex 66, Annex 67, Annex 68, and Annex 69.

Clearance is required for handling of prestressing jacks and for stressing. The dimensions of the anchorage recesses are adapted to the prestressing jacks used. The ETA holder keeps available information on prestressing jacks, appropriate clearance behind the anchorage, and information on the minimum dimensions of the anchorage recesses.

The formwork for the anchorage recess should be slightly conical for ease of removal. In case of anchorage fully embedded in concrete, the recess is designed so as to permit a reinforced concrete cover with the required dimensions and in any case with a thickness of at least 20 mm. In case of exposed anchorage, concrete cover of anchorage and bearing trumplate is not required. However, the exposed surfaces of bearing trumplate and steel cap are provided with corrosion protection.

Where required, bursting out of prestressing steel in case of tendon failure is prevented. Sufficient protection is provided by, e.g. a cover of reinforced concrete.

1.5 Designation and range of the tendons

1.5.1 Designation

Tendon, e.g. CONA CME 19 06-150 1860

- External PT ← CONA CME
- Number of prestressing steel strands, 01 to 61 ← 19
- Prestressing steel strand ← 06
- Cross-sectional area of prestressing steel strand, 140 or 150 mm^2 ← 150
- Characteristic tensile strength of prestressing steel strand ← 1860

The tendons comprise 01 to 61 tensile elements, 7-wire prestressing steel strands according to Annex 22.

1.5.2 Range

1.5.2.1 General

Characteristic maximum force of tendon with 01 to 61 prestressing steel strands is listed in Annex 23 and Annex 24.

Prestressing and overstressing forces are applied according to the corresponding standards and regulations in force at the place of use. The maximum prestressing and overstressing forces according to Eurocode 2 are listed in Annex 25.

The tendons consist of 01, 02, 03, 04, 05, 06, 07, 08, 09, 12, 13, 15, 16, 19, 22, 24, 25, 27, 31, 37, 42, 43, 48, 55, or 61 prestressing steel strands. By omitting prestressing steel strands in the anchorages and couplers in a radially symmetrical way, also tendons with numbers of strands lying between the numbers given above can be installed. Any unnecessary hole either remains undrilled or is provided with a short piece of prestressing steel strand and a wedge is inserted. For coupler anchor head K the cones of the outer pitch circle, second construction stage, may be equally redistributed if prestressing steel strands are omitted. However, the overall dimensions of the coupler anchor head K remain unchanged.

Furthermore, each anchor and coupler can be installed with practically any suitable number of prestressing steel strands that is less than or up to equal to the full number of prestressing steel strands for the respective size. The resulting prestressing force remains axial with regard to anchor und coupler. This is applied, e.g., at the anchorages of tendons with monostrands.

With regard to dimensions and reinforcement, anchorages and couplers with omitted prestressing steel strands remains unchanged compared to anchorages and couplers with a full number of prestressing steel strands.

1.5.2.2 CONA CME n06-140

7-wire prestressing steel strand

Nominal diameter .... 15.3 mm

Nominal cross-sectional area .... 140 mm^2

Maximum characteristic tensile strength............... 1 860 MPa

Annex 23 lists the available tendon range for CONA CME n06-140.

1.5.2.3 CONA CME n06-150

7-wire prestressing steel strand

Nominal diameter .... 15.7 mm

Nominal cross-sectional area .... 150 mm^2

Maximum characteristic tensile strength............... 1 860 MPa

Annex 24 lists the available tendon range for CONA CME n06-150.

1.6 Duct

Ducts are either in plastic or in steel. The inner diameter of the duct meets the requirements of Table 2.

$$f = \frac{\text{cross-sectional area of prestressing steel}}{\text{cross-sectional area of inner diameter of duct}}$$

$$k_D = \frac{\text{Inner diameter of the duct}}{\sqrt{\text{cross-sectional area of prestressing steel}}}$$

Where

f...............—........... degree of filling

k_D ....—........... duct coefficient

Table 2 Degree of filling and duct coefficient

Duct	**f**	**k_D 1)**
Minimum 2)	0.45	1.68
Standard	0.40	1.79
Long tendons	0.30–0.35	2.05–1.90

1) Minimum value according to ENV 1992-1-5 [2], clause 1.6

2) Not for wax injection of PE-duct

Exemplary values of duct sizes are shown in Annex 19 and Annex 20.

Jointing and sealing of the ducts can be performed by welding or by non welding jointing techniques, e.g. sleeves and collars. If the joints are resistant to the injection pressure according to ENV 1992-1-5, an internal pressure of at least 1 MPa is observed.

1.7 Friction losses

For calculation of loss of prestressing force due to friction, Coulomb's law applies. Calculation of friction loss is by the equation

$$F_x = F_0 \cdot e^{-\mu \cdot \alpha}$$

Where

F_x .... kN .... Prestressing force at a distance x along the tendon

F_0 .... kN .... Prestressing force at x = 0 m

μ............ rad^{-1} .... Friction coefficient, see Table 3

α .... rad .... Sum of the angular displacements over the distance x, irrespective of direction or sign

x .... m .... Distance along the tendon from the point where the prestressing force is equal to F_0

NOTE 1 1 rad = 1 m/m = 1

NOTE 2 Wobble effects may be neglected for external tendons.

2 Standards and other documents referred to in the European Technical Assessment are listed in Annex 75 and Annex 76.

Table 3 Friction coefficient

Duct	Recommended values	Range of values
	μ	μ
	rad^{-1}	rad^{-1}
Bare prestressing steel strands in smooth steel duct	0.18	0.16–0.24
Bare prestressing steel strands in smooth plastic duct	0.12	0.10–0.14
Monostrands in duct and grouted	0.05	—

Friction loss in anchorage and coupler to be taken into consideration in design and execution are given in Table 4.

Table 4 Friction losses in anchorages

Tendon	ΔF_S
—	%
CONA CME 0106 [1)]	—
CONA CME 0206 to 0406	1.2
CONA CME 0506 to 0906	1.1
CONA CME 1206 to 3106	0.9
CONA CME 3706 to 6106	0.8

1) Friction loss is small and do not need to be considered in design and execution.

Where

ΔF_S .... % .... Friction loss in anchorage and first construction stage of stressing coupler. This is taken into account for determination of elongation and prestressing force along the tendon.

1.8 Slip at anchorages and couplers

Slip at stressing anchorages, at fixed anchorages, and at fixed couplers, first and second construction stages, is 6 mm. At stressing anchorage and at first construction stage of fixed couplers the slip is 4 mm, provided a prestressing jack with a wedge system and a wedging force of around 25 kN per prestressing steel strand is used.

1.9 Centre spacing and edge distance for anchorages

In general, spacing and distances are not less than given in Annex 26, Annex 27, Annex 28, Annex 29, Annex 30, Annex 31, Annex 32, and Annex 33. However, centre spacing of tendon anchorages may be reduced in one direction by up to 15 %, but not smaller than the outside diameter of the helix and, where additional stirrup reinforcement is required, placing of that additional stirrup reinforcement is still possible. In case of reduced centre spacing, centre spacing in the perpendicular direction is increased by the same percentage, see also Annex 52 and Annex 65. The corresponding edge distances are calculated by

$$a_e = \frac{a_c}{2} - 10\text{ mm} + c$$

$$b_e = \frac{b_c}{2} - 10\text{ mm} + c$$

Where

a_c............mm.......... Centre spacing

b_c............mm.......... Centre spacing in the direction perpendicular to a_c

a_e............mm.......... Edge distance

b_e............mm.......... Edge distance in the direction perpendicular to a_e

c.............mm.......... Concrete cover

The minimum values for a_c, b_c, a_e, and b_e are given in Annex 26, Annex 27, Annex 28, Annex 29, Annex 30, Annex 31, Annex 32, and Annex 33.

Standards and regulations on concrete cover in force at the place of use are observed.

1.10 Concrete strength at time of stressing

Concrete in conformity with EN 206 is used.

At the time of stressing, the mean concrete compressive strength, $f_{cm,\,0}$, is at least according to Table 5. The concrete test specimens are subjected to the same hardening conditions as the structure.

For partial stressing with 30 % of the full prestressing force, the actual mean value of concrete compressive strength is at least 0.5 · $f_{cm,\,0,\,cube}$ or 0.5 · $f_{cm,\,0,\,cylinder}$. Intermediate values may be interpolated linearly according to Eurocode 2.

Table 5 Compressive strength of concrete

Specimen for testing			**Mean concrete strength $f_{cm,\,0}$**								
Cube strength, 150 mm cube	$f_{cm,\,0,\,cube}$	MPa	23	26	28	34	38	43	46	53	60
Cylinder strength, 150 mm cylinder diameter	$f_{cm,\,0,\,cylinder}$	MPa	19	21	23	28	31	35	38	43	50

Helix, additional stirrup reinforcement, centre spacing, and edge distance corresponding to the concrete compressive strengths are taken from Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59, Annex 60, Annex 61, Annex 62, Annex 63, Annex 64, see also the Clauses 1.14.11 and Clause 2.2.3.4.

1.11 Minimum radii of curvature

In Annex 19 and Annex 20 the minimum radii of curvature of the tendon, R_{min}, are given versus the number of prestressing steel strands in the tendon.

The tendon with monostrands, grouted prior to stressing, provides the smallest radius of curvature.

For smaller radii, stresses in tensile elements and wear of the duct need to be verified.

1.12 Deviator

1.12.1 General

The deviator transfers the forces generated by the tendon, transversal (radial to the deviator) and longitudinal (tangential to the deviator), to the structure. Moreover, the deviator provides a smooth surface for the tendon. The deviator can be made of concrete, steel, or of other material, equivalent in terms of structural and surface requirements. Permanent inserts for deviators of concrete can be made of PE-HD, steel, or of equivalent material to meet the surface requirements.

To avoid any kinking of the tendon, it is recommended to provide an additional deviation, $\Delta\alpha$, of e.g. ≥ 3 °, see Annex 18.

For grouting or for filling the ducts with corrosion protection filling material, vents are provided, or vacuum grouting is applied.

1.12.2 Pre-installed single tube deviator

The deviator is a pre-bent tube that is part of the tendon conduit, see Annex 18. The duct of the tendon is jointed to both ends of the tube.

Jointing between duct and deviator can be by sleeves, collars, or by welding

1.12.3 Double tube deviator

The deviator is a pre-formed recess unit of the structure that is not part of the tendon conduit. The duct of the tendon is passed through the recess unit, see Annex 18.

Components

1.13 Prestressing steel strand

Only 7-wire prestressing steel strands with characteristics according to Table 6 are used, see also Annex 22. The corrosion protection system of the monostrands, comprising corrosion protection filling material and HDPE-sheathing, is as specified in Clause 1.18.

Table 6 Prestressing steel strands and monostrands

Maximum characteristic tensile strength [1)]	f_{pk}	MPa	1 860	
Nominal diameter	d	mm	15.3	15.7
Nominal cross-sectional area	A_p	mm²	140	150
Mass of prestressing steel	M	kg/m	1.093	1.172

Maximum characteristic tensile strength [1) f_{pk}]		MPa	1 860	
Monostrands				
Mass of monostrand		kg/m	1.23	1.31
External diameter of HDPE-sheathing		mm	≥ 19.5	≥ 20

[1)] Prestressing steel strands with a characteristic tensile strength below 1 860 MPa may also be used.

In a single tendon, only prestressing steel strands spun in the same direction are used.

In the course of preparing the European Technical Assessment, no characteristic has been assessed for the prestressing steel strands. In execution, a suitable prestressing steel strand that conforms to Annex 22 and is according to the standards and regulations in force at the place of use is taken.

1.14 Anchorage and coupler

1.14.1 General

The components of anchorages and couplers are in conformity with the specifications given in Annex 5, Annex 6, Annex 7, Annex 8, Annex 9, Annex 10, Annex 11, Annex 12, Annex 13, Annex 14, Annex 15, Annex 16, and Annex 17 and the technical file[3]. Therein the component dimensions, materials, and material identification data with tolerances are given.

1.14.2 Anchor head

The anchor head A is made of steel and provides regularly arranged conical holes, drilled in parallel to accommodate prestressing steel strands and wedges, see Annex 6. The back exits of the bore holes are provided with bell mouth openings or plastic ring cushions, see Annex 5. In addition, threaded bores may be provided to attach protection caps and wedge retaining plates. At the back of the anchor head A there may be a step for ease of centring the anchor head A on bearing trumplate A or E, on square plate, or on steel ring E.

1.14.3 Bearing trumplate

The bearing trumplate, made of cast iron, transmits the force via 3 anchorage planes to the concrete, see Annex 8. Air-vents are located at top of the bearing trumplate and at interface plane to the anchor head. A ventilation tube can be fitted to these air-vents. On the tendon sided end, there is an inner thread to take the trumpet.

There are two bearing trumplates.

- Bearing trumplate A with trumpet A, see Annex 8,
- Bearing trumplate E, see Annex 8, for electrically isolated tendons with trumpet E or trumpet A together with inner trumpet E.

1.14.4 Trumpet

The conical trumpets A, K, H, and A SP, see Annex 14 and Annex 17, are made either of steel, PE, or PP, and the conical trumpet E, inner trumpet A, and inner trumpet E, see Annex 16 and Annex 17, are made of PE or PP. Inner trumpet A and inner trumpet E are used together with trumpet A and trumpet E in PE or PP.

[3] The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

The trumpets manufactured in steel have a corrugated or plain surface. In case the transition from trumpet to duct is made in steel, a 100 mm long and at least 3.5 mm thick PE-HD insert is installed at the deviating point of the prestressing steel strands.

At the coupler, FK, SK, FH, SH, the transition trumpet to duct at the deviating point at the end of the trumpet is provided with a tension ring in steel equipped with a PE insert, see Annex 2 and Annex 4.

The conical trumpets made of PE or PP may have either a corrugated or a plain surface. At the duct-side end, there is a radius for the deviation of the prestressing steel strands and a smooth surface, to ensure a good transition to the duct. The opposite end is connected to the bearing trumplate. Trumpet and PE duct are usually jointed by mirror-welding.

For completely replaceable tendons with inner trumpet A/E, a circular steel tube with flange can be bolted to bearing trumplate A instead of inserting trumpet A.

1.14.5 Coupler anchor heads K and H

Coupler anchor head K, see Annex 7, for the single plane coupler is made of steel and provide in the inner part for anchorage the prestressing steel strands of the first construction stage the same arrangement of holes as the anchor head A for the stressing or fixed anchorages. In the outer pitch circle, there is an arrangement of holes with an inclination of 7 ° and springs K to accommodate the prestressing steel strands of the second construction stage. A cover plate is fastened by means of additional threaded bores.

Coupler anchor head H, see Annex 5 and Annex 7, for the sleeve coupler H is made of steel and has the same basic geometry as the anchor head A of the stressing or fixed anchorages. Ring cushions, see Annex 5, are inserted in coupler anchor head H2. Compared to the anchor head A of the fixed and stressing anchor, coupler anchor head H is deeper and provides an external thread for coupler sleeve H. Wedge retaining plate H is fastened by means of additional threaded bores.

The coupler sleeve H, see Annex 9, is a steel tube with an inner thread and provided with ventilation holes.

At the back of the coupler anchor heads K and H there is a step for ease of centring the coupler anchor head on bearing trumplates A, on steel ring E, or on square plate.

1.14.6 Components for replaceable anchorage

The anchorage of a replaceable tendon, see Clause 1.2.2.3, comprises the following components.

- Prestressing steel strand
  - Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct
  - Monostrands, grouted in a common duct, see Clause 1.3
- Fixed and stressing anchorage according to Clause 1.2.2.1
- Either
  - Bearing trumplate A, see Annex 8
  - Trumpet A, see Annex 14

  or
  - Square plate, see Annex 8
  - Trumpet A SP, see Annex 17
- Plastic duct or steel duct, see Annex 19 and Annex 20
- Protection cap A, see Annex 12

For complete replacement, the tendon comprises.

- Prestressing steel strand
  - Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct
  - Bare prestressing steel strands grouted in a common duct
  - Monostrands grouted in a common duct, see Clause 1.3
- Fixed and stressing anchorage according to Clause 1.2.2.1
- Bearing trumplate A/E, see Annex 8
- Steel ring E if required
- Inner trumpet A/E, see Annex 16
- Trumpet A/E, see Annex 14 and Annex 17
- Plastic duct, see Annex 19 and Annex 20 with outer duct
- Protection cap A/E, see Annex 12 and Annex 13

1.14.7 Components for encapsulated anchorage and coupler

Anchorage and coupler of an encapsulated tendon, see Clause 1.2.2.4 and Clause 1.2.3.4 comprises the following components.

- Fixed and stressing anchorage according to Clause 1.2.2.1
- Fixed and stressing coupler according to Clause 1.2.3.2 and Clause 1.2.3.3
- Bearing trumplate A, see Annex 8
- Trumpet A, see Annex 14
- Plastic duct, see Annex 19 and Annex 20
- Trumpet A and plastic duct are jointed with heat shrinking sleeve
- Protection cap A, see Annex 12, and for bearing trumplate A 3706 protection cap E 3106, see Annex 13, is applied.
- Housing in steel or plastic encasing the coupler with deviator for guiding the prestressing steel strands into the duct, similar to Annex 3.
- The housing is bolted to the steel cushion plate at the second construction stage and the steel cushion plate is bolted to bearing trumplate A.

Thereby, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encapsulated.

1.14.8 Components for electrically isolated anchorage and coupler

Anchorage and coupler of electrically isolated tendon, see Clause 1.2.2.5, Clause 1.2.3.5, Annex 1 and Annex 3, comprises the following components.

- Prestressing steel strand
  - Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct
  - Bare prestressing steel strands grouted in a common duct
  - Monostrands grouted in a common duct, see Clause 1.18
- Fixed and stressing anchorage according to Clause 1.2.2.1
- Fixed and stressing coupler according to Clause 1.2.3.2 and Clause 1.2.3.3

- Steel ring E, see Annex 9
- Isolation ring E, see Annex 11
- Bearing trumplate E, see Annex 8
- Trumpet E, see Annex 17
- Plastic duct, see Annex 19 and Annex 20
- Protection cap E, see Annex 13
- Housing in plastic encasing the coupler with deviator for guiding the prestressing steel strands into the duct, see Annex 3.
- The housing is bolted to steel cushion plate and isolation ring E at the second construction stage and the steel cushion plate is bolted to bearing trumplate E, see Annex 3.

Thereby, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encased with isolation material. The integrity of the electrical isolation can be verified and monitored via electrical resistance measurements between tendon and reinforcement of the structure.

1.14.9 Components for electrically isolated and replaceable anchorage

The anchorage of an electrically isolated and replaceable tendon, see Clause 1.2.2.6, comprises the following components.

- Prestressing steel strand
  - Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct
  - Monostrands, grouted in a common duct, see Clause 1.3
- Fixed and stressing anchorage according to Clause 1.2.2.1
- Steel ring E, see Annex 9
- Isolation ring E, see Annex 11
- Bearing trumplate E, see Annex 8
- Trumpet E, see Annex 17
- Plastic duct, see Annex 19 and Annex 20
- Protection cap E, see Annex 13

For completely replacing the electrically isolated tendon, the tendon comprises.

- Prestressing steel strand
  - Bare prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material in a common duct
  - Bare prestressing steel strands grouted in a common duct
  - Monostrands grouted in a common duct, see Clause 1.3
- Fixed and stressing anchorage according to Clause 1.2.2.1
- Steel ring E, see Annex 9
- Isolation ring E, see Annex 11
- Bearing trumplate E, see Annex 8
- Inner trumpet E, see Annex 16
- Trumpet E, see Annex 17. Trumpet E is cut at the thread for screwing in trumplate E to allow inner trumpet E to continue to the steel ring.

- Plastic duct, see Annex 19 and Annex 20 with outer duct
- Protection cap E, see Annex 13

Thereby, the complete tendon, i.e. including prestressing steel strands and anchorages is fully encased with isolation material. The integrity of the electrical isolation can be verified and monitored via electrical resistance measurements between tendon and reinforcement of the structure.

1.14.10 Ring wedges

The ring wedges, see Annex 5, are in either two pieces or three pieces. Four different ring wedges are used.

- Ring wedge H in three pieces, fitted with spring ring, is available in two different materials
- Ring wedge F in three pieces, without spring ring or fitted with spring ring, is made of one material.
- Ring wedge G in two pieces, without spring ring or fitted with spring ring, is made of one material.

Within one anchorage or coupler, only one of these ring wedges is used.

In the case of fixed anchors and couplers, the wedges are held in place by a wedge retaining plate, by springs with a wedge retaining plate, or by springs with a cover plate. An alternative is pre-locking each individual prestressing steel strand with ~ 0.5 · F_{pk} and applying a wedge retaining plate as per Clause 1.2.2.1.

Where

F_{pk} .... N .... Characteristic value of maximum force of one single prestressing steel strand

1.14.11 Additional reinforcement

For tendons with 02 to 37 prestressing steel strands in CONA CME BT system three options for additional reinforcement are available.

- Only helix
- Only additional stirrup reinforcement
- Both, helix and additional stirrup reinforcement

For tendons with more than 37 and up to 61 prestressing steel strands in the CONA CME BT system and for tendons with 01 to 61 prestressing steel strands in the CONA CME SP system, only the option of both helix and additional stirrup reinforcement is available.

Helix and additional stirrup reinforcement are made of ribbed reinforcing steel. The end of the helix on the anchorage side is welded to the next turn. The helix is placed exactly in the tendon axis. The helix dimensions conform to the values specified in Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59, Annex 60, Annex 61, Annex 62, Annex 63, Annex 64.

If required for a specific project design, the reinforcement given in Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59, Annex 60, Annex 61, Annex 62, Annex 63, Annex 64 may be modified in accordance with the respective regulations in force at the place of use as well as with the relevant approval of the local authority and of the ETA holder to provide equivalent performance.

1.14.12 Caps

1.14.12.1 General

Recessed and exposed anchorages without permanent protection caps with vents are not executed. All inaccessible or accessible fixed anchorages FA are equipped with protection caps to ensure a fully continuous corrosion protection of the tendon, from all wedges of the one end to all wedges of the other end.

1.14.12.2 Grouting cap

The grouting cap A, shown in Annex 1, Annex 2, Annex 3, Annex 4, and Annex 12 is for stressing anchorage SA, accessible fixed anchorage FA and fixed and stressing coupler FK and SK. It is provided with an air-vent and attached to anchor head A and coupler head K with screws. Grouting cap A is a permanent UV-protected plastic cap that resists grouting pressure up to maximum 1 500 kPa. The cap is for one-time use and left in place after grouting. The anchorage recess is completed with concrete to provide a concrete cover as required, at least with a thickness of 20 mm at the grouting cap A.

Alternatively, the anchorage recess is not completed with concrete. However, in this case exposed surfaces of steel or cast iron components are provided with corrosion protection.

1.14.12.3 Protection caps, long protection cap

The protection caps A and E, and the long protection cap, see Annex 1, Annex 3, Annex 4, Annex 12, and Annex 13, are provided with an air-vent and attached to the anchorage with screws or threaded rods. The protection caps are permanent. Protection cap A is made of steel or plastic, protection cap E is made of plastic, and the long protection cap is made of steel or plastic.

- Protection cap A in steel fully encases anchor head A with ring wedges and is left in place after filling. The permanent steel cap is used for inaccessible and accessible fixed anchorages FA and FAR, and for stressing anchorages SA and SAR.
- Protection cap A in plastic, see Annex 12, is a UV-protected plastic cap that fully encases anchor head A and ring wedges. The protection cap is permanent and for one-time use only. The protection cap is used for inaccessible and accessible fixed anchorages FA and FAR, and for stressing anchorages SA and SAR.
- Protection cap E in plastic, see Annex 13, is a permanent UV-protected plastic cap that fully encases anchor head A and ring wedges. The protection cap is permanent and for one-time use only. Protection cap E is used for electrically isolated tendons. In particular it is attached to electrically isolated inaccessible and accessible fixed anchorages FAE and stressing anchorages SAE and SAER. After filling, all inlet and outlet ports of the electrically isolated tendon are sealed with suitable plugs to provide fully electrically isolation.
- The long protection cap in steel, see Annex 13, fully encases anchor head A with ring wedges and is left in place after filling. The permanent steel cap is used for restressable and replaceable tendons at the stressing anchorages SA and SAR to protect the strand protrusions. The long protection cap is also available in plastic.

1.15 Ducts

1.15.1 Plastic duct

Plastic ducts conform to EN 12201-1 and EN 12201-2. If not installed in a closed hollow box girder, the plastic ducts are resistant to UV radiation. In general, for tendons with a maximum of 12 prestressing steel strands, ducts made of PE 80 or PE 100, class PN 10 may be used, while for larger tendons class PN 6 is sufficient. A frequently used method for jointing is mirror welding.

The minimum wall thicknesses given in Annex 19 and Annex 20 are appropriate for the minimal radius and grout or corrosion protection filling material. It is permitted to reduce these values by 15 % for a radius $R \geq 1.5 \cdot R_{min}$. In case of injection of wax as corrosion protection filling material, the values are increased by 15 %, see Annex 19.

1.15.2 Steel duct

Steel ducts conform to EN 10210-1, EN 10216-1, EN 10217-1, EN 10219-1, EN 10255, or EN 10305-3.

Minimum wall thicknesses of steel ducts are given in Annex 19 and Annex 20.

1.16 Material specifications

In Annex 21 the material specifications of the components are given.

1.17 Permanent corrosion protection

In the course of preparing the European Technical Assessment, no characteristic has been assessed for components and materials of the corrosion protection system. In execution, all components or materials are selected according to the standards and regulations in force at the place of use.

To protect the tendons from corrosion, ducts, couplers, and anchorages are completely filled with grout according to EN 447 or special grout according to EAD 160027-00-0301, or corrosion protection filling material according to EAD 160027-00-0301, as applicable at the place of use. However, applicable corrosion protection filling materials are grout as rigid material and grease, wax, or an equivalent soft corrosion protection filling material.

In case of anchorages fully embedded in concrete, the recesses are designed as to permit a reinforced concrete cover with the required dimensions and in any case with a thickness of at least 20 mm. With exposed anchorages or with anchorages with insufficiently thick concrete cover, the surfaces of bearing trumplates and steel caps are provided with corrosion protection.

1.18 Monostrand

Tendons with monostrands are installed in one common duct and grouted prior to stressing.

Monostrand is a prestressing steel strand that is factory-provided with a corrosion protection filling material and an extruded HDPE sheathing.

Corrosion protection filling material is grease or wax according to EAD 160027-00-0301, or an equivalent soft corrosion protection filling material as applicable at the place of use.

As an alternative, monostrands, including corrosion protection filling material and sheathing, according to the standards and regulations in force at the place of use may be applied.

2 Specification of the intended uses in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended uses

The PT system BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands is intended to be used for the prestressing of structures. The specific intended uses are listed in Table 7.

Table 7 Intended uses

Line №	Use category
Use category according to tendon configuration and material of structure	
1	External tendon for concrete and composite (steel-concrete) structures with a tendon path situated outside the cross section of the structure or member but inside its envelope. Included are ring tendons for, e.g. tanks, placed circumferentially onto the outer surface of the structure.
Optional use categories	
2	Encapsulated tendon
3	Electrically isolated tendon

2.2 Assumptions

2.2.1 General

Concerning product packaging, transport, storage, maintenance, replacement, and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on transport, storage, maintenance, replacement, and repair of the product as he considers necessary.

2.2.2 Packaging, transport, and storage

Advice on packaging, transport, and storage includes.

- During transport of prefabricated tendons, a minimum diameter of curvature as below is observed.
  - 1.65 m for tendons up to CONA CME 1206
  - 1.80 m for tendons up to CONA CME 3106
  - 2.00 m for tendons larger than CONA CME 3106
- Temporary protection of prestressing steel and components in order to prevent corrosion during transport from production site to job site
- Transportation, storage, and handling of prestressing steel and other components in a manner as to avoid damage by mechanical or chemical impact
- Protection of prestressing steel and other components from moisture
- Keeping tensile elements separate from areas where welding operations are performed

2.2.3 Design

2.2.3.1 General

It is the responsibility of the ETA holder to ensure that all necessary information on design and installation is submitted to those responsible for design and execution of the structures executed with "BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands".

Design of the structure permits correct installation and stressing of the tendons. The reinforcement in the anchorage zone permits correct placing and compacting of concrete.

At the anchorages and couplers, the tendon layout provides a straight section over a length as specified in Annex 18 beyond the end of the trumpet.

Design of the structure should consider protection of the external tendons against damage by, e.g. impact of vehicles, vibrations, etc..

2.2.3.2 Anchorage Recess

Clearance is required for handling of prestressing jacks and for stressing. The dimensions of the anchorage recess are adapted to the prestressing jack used. The ETA holder keeps available information on prestressing jacks and appropriate clearance behind the anchorage.

The anchorage recess is designed with such dimensions as to ensure the required concrete cover and at least 20 mm at the protection cap in the final state.

In case of exposed anchorages, concrete cover on anchorage, bearing trumplate and square plate is not required. However, the exposed surface of bearing trumplate, square plate and steel cap is provided with corrosion protection.

Where required, bursting out of prestressing steels in case of tendon failure is prevented. Sufficient protection is provided by e.g. a cover of reinforced concrete.

2.2.3.3 Maximum prestressing force

The prestressing and overstressing forces are specified in the respective standards and regulations in force at the place of use. Annex 25 lists the maximum prestressing and overstressing forces according to Eurocode 2.

2.2.3.4 Centre spacing, edge distance, and reinforcement in the anchorage zone

Centre spacing, edge distance, and additional reinforcement as helix, or as additional stirrup reinforcement, or as helix and additional stirrup reinforcement given in Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59 Annex 60, Annex 61, Annex 62, Annex 63, and Annex 64 are adopted.

Verification of transfer of prestressing forces to structural concrete is not required if centre spacing and edge distances of anchorages and couplers as well as grade and dimensions of additional reinforcement, see Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59 Annex 60, Annex 61, Annex 62, Annex 63, and Annex 64, are conformed to. In case of grouped anchorages, additional reinforcement of the individual anchorages can be combined, provided appropriate anchorage is ensured. However, number, cross-sectional area, and position with respect to the bearing trumplate or square plate remain unchanged.

NOTE Centre spacing and edge distances as well as concrete strength and reinforcement for larger tendons in terms of number, nominal diameter, and strength of prestressing steel strands are as well applicable to smaller tendons. For example, it is fully applicable to fit a tendon CONA CME 1906-140 1860 into an anchorage zone, detailed and executed for a CONA CME 2406-150 1860 tendon.

The reinforcement of the structure is not employed as additional reinforcement. Reinforcement exceeding the required reinforcement of the structure may be used as additional reinforcement, provided appropriate placing is possible.

The forces outside the area of the additional reinforcement are verified and, if necessary, dealt with by appropriate reinforcement.

If required for a specific project design, the reinforcement given in Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59 Annex 60, Annex 61, Annex 62, Annex 63, and Annex 64 may be modified in accordance with the respective regulations in force at the place of use as well as with the relevant approval of the local authority and of the ETA holder to provide equivalent performance.

2.2.3.5 Fixed and stressing coupler

The prestressing force at the second construction stage is at no time greater than at the first construction stage, neither during construction, nor in the final state, nor due to any load combination.

2.2.3.6 Tendons in masonry structures – Load transfer to the structure

Post-tensioning kits are primarily used in structures made of concrete. They can, however, be used with other structural materials, e.g., in masonry structures. However, there is no particular assessment in EAD 160004-00-0301 for these applications. Hence, load transfer of prestressing force to masonry structures is via concrete or steel members, designed according to the European Technical Assessment, in particular according to the Clauses 1.9, 1.10, 1.14.11, and 2.2.3.4 or according to Eurocode 3 respectively.

The concrete or steel members have such dimensions as to permit a force of 1.1 · F_{pk} being transferred into the masonry. The verification is performed according to Eurocode 6 as well as to the respective standards and regulations in force at the place of use.

Deviators are made of concrete or steel. The transfer of the forces from the deviator to the masonry is verified according to Eurocode 6 as well as to the respective standards and regulations in force at the place of use.

2.2.4 Installation

2.2.4.1 General

It is assumed that the product will be installed according to the manufacturer’s instructions or – in absence of such instructions – according to the usual practice of the building professionals.

Assembly and installation of tendons are only carried out by qualified PT specialist companies with the required resources and experience in the use of external multi strand post-tensioning systems, see CWA 14646. The respective standards and regulations in force at the place of use are considered. The company's PT site manager has a certificate, stating that she or he has been trained by the ETA holder and that she or he possesses the necessary qualifications and experience with the external PT system BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands.

The tendons may be manufactured on site or in the factory – prefabricated tendons.

Bearing trumplate, square plate, anchor head, and coupler anchor head are placed perpendicular to the tendon's axis.

The sequence of work steps for installation of anchorage, fixed and moveable coupler is described in Annex 66, Annex 67, Annex 68, Annex 69, Annex 70, and Annex 71.

In case of single plane coupler K, the prestressing steel strands are provided with markers to be able to check the depth of engagement.

At the anchorages the tendon layout provides a straight section according to Annex 18.

Before placing the concrete, a final check of the installed tendons or ducts is carried out.

2.2.4.2 Monostrand tendon

The monostrands are threaded in one common duct, see Annex 67 and Annex 69.

Prior to stressing, the monostrand tendon is grouted. During grouting a sealing plate together with an activation plate is installed at the anchorage to arrange the monostrands and resist the grouting pressure. After grouting, sealing plate and activation plate are removed and the protruding monostrands are de-sheathed. For stressing, anchor head A is placed on the grouted tendon.

Stressing can be commenced, once compressive strength of the grout is sufficiently developed. This is in general not before a compressive strength of $\geq$ 10 MPa is attained by the grout.

After stressing, protection cap A is fastened with screws on the anchorage. Protection cap A encases the anchorage and is filled with corrosion protection filling material to complete the corrosion protection. After filling, the inlet port of protection cap A is sealed with a plug.

Monostrand tendon is also available as replaceable and electrically isolated tendon.

2.2.4.3 Encapsulated tendon

For anchorage of an encapsulated tendon, trumpet A is threaded into bearing trumplate A that supports anchor head A, see Annex 1. For coupler of an encapsulated tendon, a steel cushion plate is placed between bearing trumplate A and anchor head A, similar to electrically isolated tendon in Annex 3.

Voids in bearing trumplate A are filled with polymeric material to enhance leak tightness.

After stressing, protection cap A is fastened with screws on the anchorage. Protection cap A encases the anchorage and provides a port as inlet or vent.

At second construction stage of the coupler, a housing in steel or plastic encloses the transition length of the tendon and is bolted the steel cushion plate, similar to electrically isolated tendon in Annex 3. The steel cushion plate is bolted to bearing trumplate A of the first construction stage. The housing is connected to the plastic duct with a heat shrink sleeve at the. A deviator is installed for guiding the prestressing steel strands of the tendon into the plastic duct.

After filling, all inlet and outlet ports of the encapsulated tendon are sealed with suitable plugs to provide full encapsulation.

With encapsulated tendon, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encapsulated.

2.2.4.4 Electrically isolated tendon

For electrically isolated anchorage, isolation ring E together with steel ring E are placed between bearing trumplate E and anchor head A, see Annex 1. For electrically isolated coupler steel cushion plate together with isolation ring E and steel ring E are placed between bearing trumplate E and steel ring E with anchor head A, see Annex 3. Trumpet E or inner trumpet E extend through bearing trumplate E. Steel ring E is screwed on trumpet E or inner trumpet E.

Voids in bearing trumplate E are filled with polymeric material to enhance electrical isolation.

After stressing, protection cap E is fastened with screws on the anchorage. Protection cap E encases the anchorage and provides a port as inlet or vent.

At second construction stage of the coupler, a plastic housing that encloses the transition length of the tendon is bolted to isolation ring E and steel cushion plate. Steel cushion plate is bolted to bearing trumplate E of the first construction stage, see Annex 3. The housing is connected to the plastic duct with a heat shrink sleeve at the. A deviator is installed for guiding the prestressing steel strands of the tendon into the plastic duct.

After filling, all inlet and outlet ports of the electrically isolated tendon are sealed with suitable plugs to provide fully electrical isolation.

With electrically isolated tendon, the complete tendon, i.e. including prestressing steel strands, anchorages, and couplers, is fully encased with isolation material. The integrity of the electrical isolation is verified via electrical resistance measurements between tendon and reinforcement of the structure.

2.2.4.5 Stressing operation

With a mean concrete compressive strength in the anchorage zone according to the values laid down in Annex 34, Annex 35, Annex 36, Annex 37, Annex 38, Annex 39, Annex 40, Annex 41, Annex 42, Annex 43, Annex 44, Annex 45, Annex 46, Annex 47, Annex 48, Annex 49, Annex 50, Annex 51, Annex 53, Annex 54, Annex 55, Annex 56, Annex 57, Annex 58, Annex 59 Annex 60, Annex 61, Annex 62, Annex 63, and Annex 64 full prestressing may be applied.

Stressing and, if applicable, wedging is carried out using a suitable prestressing jack. The wedging force corresponds to approximately 25 kN per wedge. Tendon with monostrands can be stressed as full tendon or strand by strand.

Elongation and prestressing forces are continuously checked during the stressing operation. The results of the stressing operation are recorded, and the measured elongations compared with the prior calculated values.

After releasing the prestressing force from the prestressing jack, the tendon pulls the prestressing steel strands by the amount of the slip into the anchor head.

Information on the prestressing equipment has been submitted to Österreichisches Institut für Bautechnik. The ETA holder keeps available information on prestressing jacks and appropriate clearance behind the anchorage.

The safety-at-work and health protection regulations shall be complied with.

2.2.4.6 Restressing

Specifications for a restressable tendon are defined during the design phase. A restressable tendon requires excess length of prestressing steel strands to an extent corresponding to the prestressing jack used for restressing and, where applicable, to an elongation to fully release the prestressing force of the tendon. The protrusions of the prestressing steel strands require a permanent corrosive protection and an adapted protection cap, see Annex 3 and Annex 4.

Restressing of tendon in combination with release and reuse of wedges is permitted, whereas the wedges bite into a least 15 mm of virgin strand surface and no wedge bite remains inside the final length of the tendon between anchorages.

For a tendon remaining restressable throughout the working life of the structure, grease, wax, or an equivalent soft corrosion protection filling material according to Clause 1.17 is used as corrosion protection. This applies to a monostrand tendon as well.

2.2.4.7 Replacing of tendons

Specifications for replaceable tendons are defined during the design phase. Tendon layout requires special attention to allow for full release of the prestressing force and pulling out of the prestressing steel strands, in particular in case of a grouted tendon. Subject of replacing is either

- The prestressing steel strands as complete tendon
- The prestressing steel strands as strand-by-strand
- The complete tendon including prestressing steel strands with grease, wax, or an equivalent soft corrosion protection filling material, duct, and inner trumpet
- The complete tendon including grouted prestressing steel strands, duct, and inner trumpet
- The complete tendon with grouted monostrands, duct, and inner trumpet

Unless special procedures are considered already in the design phase of the structure, strand protrusions remain at the stressing anchor with a length compatible with the prestressing jack and allowing for release of the complete prestressing force. Moreover, soft corrosion protection filling material according to Clause 1.17 is applied.

Stressing and fixed anchorages are accessible and adequate clearance is provided behind the anchorages.

Tendon with bare prestressing steel strands and grease, wax, or an equivalent soft corrosion protection filling material in inner trumpet A/E and installed inside assembly of bearing trumplate A and trumpet A, can be completely removed and replaced with a new tendon. After full release of the prestressing force, the complete tendon with inner trumpet A/E is pulled out from the structure and replaced by a new tendon.

Tendon with bare prestressing steel strands, grouted in inner trumpet A/E and installed inside assembly of bearing trumplate A and trumpet A, can only be completely removed and replaced with a new tendon. After full release of the prestressing force, the complete tendon with inner trumpet A/E is pulled out from the structure and replaced by a new tendon.

Tendon with grouted monostrands can be replaced strand-by-strand. The replacement prestressing steel strands are sufficiently completed with soft corrosion protection filling material. Tendon with grouted monostrands in inner trumpet A/E and installed inside assembly of bearing trumplate A and trumpet A, can be completely removed and replaced with a new tendon. After full release of the prestressing force, the complete tendon with inner trumpet A/E is pulled out from the structure and replaced by a new tendon.

To completely remove a tendon with grouted bare prestressing steel strands or grouted monostrands requires particular attention regarding

- Access to allow for cutting the tendon. By cutting the tendon full release of prestrssing force is attained.
- Straight tendon layout or tendon layout with curvature that nevertheless allow the grouted tendon to be pulled out
- Access to stressing and fixed anchorages
- Clearance behind stressing and fixed anchorage to pull out the existing tendon and to install a new tendon

2.2.4.8 Filling operations

2.2.4.8.1 Grouting

Grouting accessories such as inlets, outlets, caps, vents, etc. require compatibility with the PT system and provide sufficient tightness. Grouting caps or protection caps are always used to ensure proper grouting of tendon and to avoid voids around the wedges. Grout is injected through the inlet holes until it escapes from the outlet tubes with the same consistency. To avoid voids in the hardened grout special measures are applied for long tendons, tendon paths with distinct high points or inclined tendons. All vents and grouting inlets are sealed immediately after grouting. In case of K-couplers, the holes of the second construction stage, together with wedges and springs are checked for cleanness before and immediately after grouting the first construction stage.

The standards, observed for cement grouting in prestressing ducts, are EN 445, EN 446, and EN 447 or the standards and regulations in force at the place of use applies for ready mixed grout.

The results of the grouting operation are recorded in grouting records.

2.2.4.8.2 Filling with corrosion protection filling material

The recommendations of the supplier are relevant for the filling material applied. The filling process with grease, wax, and an equivalent soft corrosion protection filling material follows a similar procedure as the one specified for grouting. However, a different filling procedure might be possible if permitted at the place of use.

The results of the filling operation are recorded in the filling records.

2.2.4.9 Welding

Ducts may be welded.

The helix may be welded to bearing trumplate or square plate to secure its position.

After installation of the tendons, no further welding operations are carried out on the tendons. In case of welding operations near tendons, precautionary measures are required to avoid damage. However, plastic components may be welded even after installation of the tendons.

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands of 100 years, provided that the BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands is subject to appropriate installation, use, and maintenance, see Clause 2.2. These provisions are based upon the current state of the art and the available knowledge and experience.

In normal use conditions, the real working life may be considerably longer without major degradation affecting the basic requirements for construction works[4].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee, neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

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[4] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works are subject, as well as on the particular conditions of design, execution, use, and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the assumed working life.

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

3.1 Essential characteristics

The performances of the PT system for the essential characteristics are given in Table 8. In Annex 74 the combinations of essential characteristics and corresponding intended uses are listed.

Table 8 Essential characteristics and performances of the product

Essential characteristic	Method of assessment	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability		
Resistance to static load	See Clause 3.2.1.1.	See Clause 3.2.1.1.
Resistance to fatigue	See Clause 3.2.1.2.	See Clause 3.2.1.2.
Load transfer to the structure	See Clause 3.2.1.3.	See Clause 3.2.1.3.
Friction coefficient	EAD 160004-00-0301, Clause 2.2.4.	See Clause 3.2.1.4.
Deviation, deflection (limits)	EAD 160004-00-0301, Clause 2.2.6	See Clause 3.2.1.5.
Assessment of assembly	See Clause 3.2.1.6.	See Clause 3.2.1.6.
Material properties, component performance, system performance of plastic duct to provide an encapsulated tendon	See Clause 3.2.1.7.	See Clause 3.2.1.7.
Material properties, component performance, system performance of plastic duct to provide an electrically isolated tendon	See Clause 3.2.1.8.	See Clause 3.2.1.8.
Corrosion protection	See Clause 3.2.1.9.	See Clause 3.2.1.9.
Basic requirement for construction works 2: Safety in case of fire		
Reaction to fire	See Clause 3.2.2.1.	See Clause 3.2.2.1.
Basic requirement for construction works 3: Hygiene, health, and the environment		
Content, emission, and/or release, of dangerous substances	See Clause 3.2.3.1.	See Clause 3.2.3.1.
Basic requirement for construction works 4: Safety and accessibility in use		
Not relevant. No characteristic assessed.		—
Basic requirement for construction works 5: Protection against noise		
Not relevant. No characteristic assessed.		—

Essential characteristic	Method of assessment	Product performance
Basic requirement for construction works 6: Energy economy and heat retention		
Not relevant. No characteristic assessed.		—
Basic requirement for construction works 7: Sustainable use of natural resources		
No characteristic assessed.		—

3.2 Product performance

3.2.1 Mechanical resistance and stability

3.2.1.1 Resistance to static load

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.1. The characteristic values of maximum force, F_{pk}, of tendon with prestressing steel strands according to Annex 22 are listed in Annex 23 and Annex 24.

3.2.1.2 Resistance to fatigue

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.2. Fatigue resistance of anchors and couplers was tested and verified with an upper force of $0.65 \cdot F_{pk}$, a fatigue stress range of 80 MPa, and $2 \cdot 10^6$ load cycles. The characteristic values of maximum force, F_{pk}, of tendon with prestressing steel strands according to Annex 22 are listed in Annex 23 and Annex 24.

3.2.1.3 Load transfer to the structure

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.3. Conformity with the stabilisation and crack width criteria specified for the load transfer test was verified to a force level of $0.80 \cdot F_{pk}$. The characteristic values of maximum force, F_{pk}, of tendon with prestressing steel strands according to Annex 22 are listed in Annex 23 and Annex 24.

3.2.1.4 Friction coefficient

For friction losses including friction coefficient see Clause 1.7.

3.2.1.5 Deviation, deflection (limits)

For minimum radii of curvature see Clause 1.11.

3.2.1.6 Assessment of assembly

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.7.

3.2.1.7 Material properties, component performance, system performance of plastic duct to provide an encapsulated tendon

The external tendon does no comprise polymer material and duct components for PL2 and the respective assessments are not relevant. Performance of the duct system is given in Table 9.

Table 9 Duct system performances for PL2

Essential characteristic	**Product performance**
Leak tightness of anchorage-duct assembly	No leakage with positive and negative pressure for 30 minutes
Full scale duct assembly	Acceptance criteria according to EAD 160004-00-0301, Clause 2.2.11, are met.
Leak tightness of assembled duct system	Characteristic not assessed.

3.2.1.8 Material properties, component performance, system performance of plastic duct to provide an electrically isolated tendon

The external tendon does no comprise polymer material and duct components for PL3 and the respective assessments are not relevant. Performance of the duct system is given in Table 10.

Table 10 Duct system performances for PL3

Essential characteristic	**Product performance**
Leak tightness of anchorage-duct assembly	No leakage with positive and negative pressure for 30 minutes.
EIT performance of the duct system	Not relevant
EIT performance of anchorage-duct assembly	≥ 15 kΩ
Full scale duct assembly	Acceptance criteria according to EAD 160004-00-0301, Clause 2.2.12, are met.
Leak tightness of assembled duct system	Characteristic not assessed.

3.2.1.9 Corrosion protection

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.13.

3.2.2 Safety in case of fire

3.2.2.1 Reaction to fire

The performance of components made of steel or cast iron is Class A1 without testing.

The performance of components of other materials has not been assessed.

3.2.3 Hygiene, health, and the environment

3.2.3.1 Content, emission and/or release of dangerous substances

According to the manufacturer's declaration, the PT system does not contain dangerous substances.

SVOC and VOC

The performance of components made of steel or cast iron that are free of coating with organic material is no emission of SVOC and VOC.

The performance of components of other materials has not been assessed.

Leachable substances

The product is not intended to be in direct contact to soil, ground water, and surface water.

3.3 Assessment methods

The assessment of the essential characteristics in Clause 3.1 of the PT system, for the intended uses, and in relation to the requirements for mechanical resistance and stability, safety in case of fire, and for hygiene, health and the environment, in the sense of the basic requirements for construction works № 1, 2, and 3 of Regulation (EU) № 305/2011, has been made in accordance with Annex A of EAD 160004-00-0301, Post-tensioning kits for prestressing of structures, for

- Item 5, External tendon
- Item 6, External tendon – Individually greased and sheathed strands
- Item 13, Optional use category – Encapsulated tendon
- Item 14, Optional use category – Electrically isolated tendon

3.4 Identification

The European Technical Assessment for the PT system is issued on the basis of agreed data[5] that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are introduced, as an amendment of the European Technical Assessment is possibly necessary.

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

4.1 System of assessmennt and verification of constancy of performance

According to Commission Decision 98/456/EC, the system of assessment and verification of constancy of performance to be applied to the BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands is System 1+. System 1+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, point 1.1., and provides for the following items.

(a) The manufacturer shall carry out

  (i) factory production control;

  (ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan[6].

---

[5] The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

[6] The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

(b) The notified product certification body shall decide on the issuing, restriction, suspension, or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body

(i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values, or descriptive documentation of the product;

(ii) initial inspection of the manufacturing plant and of factory production control;

(iii) continuing surveillance, assessment, and evaluation of factory production control;

(iv) audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 1+ shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in Clause 4.1, point (b) (i).

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

5.1 Tasks for the manufacturer

5.1.1 Factory production control

The kit manufacturer exercises permanent internal control of the production. All the elements, procedures, and specifications adopted by the kit manufacturer are documented in a systematic manner in the form of written policies and procedures.

– Control of the incoming materials

  The manufacturer checks the incoming materials to establish conformity with their specifications.

– Inspection and testing

  Kind and frequency of inspections, tests, and checks, conducted during production and on the final product normally include.

  – Definition of the number of samples taken by the kit manufacturer
  – Material properties e.g., tensile strength, hardness, surface finish, chemical composition, etc.
  – Determination of the dimensions of components
  – Check correct assembly
  – Documentation of tests and test results

At least once a year the manufacturer audits the manufacturers of the components given in Annex 73. All tests are performed according to written procedures with suitable calibrated measuring devices. All results of inspections, tests, and checks are recorded in a consistent and systematic way. The basic elements of the prescribed test plan are given in Annex 72, conform to EAD 160004-00-0301, Table 3, and are specified in the quality management plan of the BBR VT CONA CME – External Post-tensioning System with 01 to 61 Strands.

The results of inspections, tests, and checks are evaluated for conformity. Shortcomings request the manufacturer to immediately implement measures to eliminate the defects.

– Control of non-conforming products

  Products, which are considered as not conforming to the prescribed test plan, are immediately marked and separated from such products that do conform. Factory production control addresses control of non-conforming products.

– Complaints

  Factory production control includes procedures to keep records of all complaints about the PT system.

The records are presented to the notified product certification body involved in continuous surveillance and are kept at least for ten years after the product has been placed on the market. On request, the records are presented to Österreichisches Institut für Bautechnik.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of constancy of performance issued by the notified product certification body, the manufacturer draws up the declaration of performance. Essential characteristics included in the declaration of performance for the corresponding intended use are given in Table 8. In Annex 74 the combinations of essential characteristics and corresponding intended uses are listed.

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body establishes that, in accordance with the prescribed test plan, the manufacturing plant, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous manufacturing of the PT system according to the given technical specifications. For the most important activities, EAD 160004-00-0301, Table 4, summarises the minimum procedure.

5.2.2 Continuing surveillance, assessment, and evaluation of factory production control

The activities are conducted by the notified product certification body and include surveillance inspections. The kit manufacturer is inspected at least once a year. Factory production control is inspected and samples are taken for independent single tensile element tests.

For the most important activities, the control plan according to EAD 160004-00-0301, Table 4, summarises the minimum procedure. It is verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the control plan.

Each manufacturer of the components given in Annex 73 is audited at least once in five years. It is verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan.

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the prescribed test plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

5.2.3 Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities

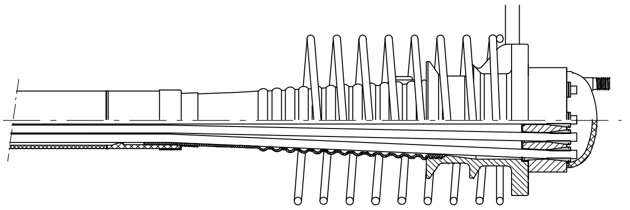
During surveillance inspection, the notified product certification body takes samples of components of the PT system for independent testing. Audit-testing is conducted at least once a year by the notified product certification body. For the most important components, Annex 73 summarises the minimum procedures. Annex 73 conforms to EAD 160004-00-0301, Table 4. In particular, at least once a year, the notified product certification body also carries out one single tensile element test series according to EAD 160004-00-0301, Annex C.7 and Clause 3.3.4 on specimens taken from the manufacturing plant or at the manufacturer's storage facility.

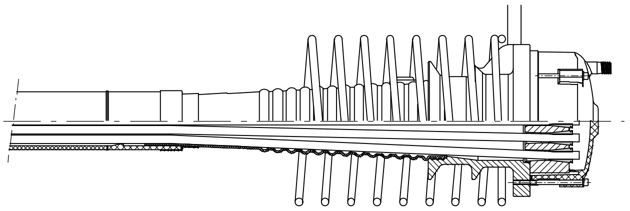
Issued in Vienna on 16 December 2024
by Österreichisches Institut für Bautechnik

The original document is signed by

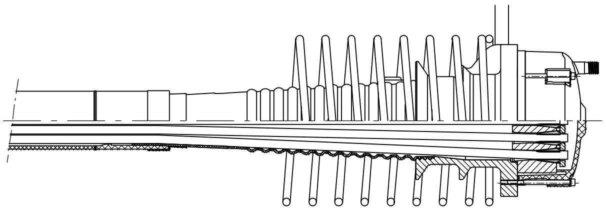
Thomas Rockenschaub
Deputy Managing Director

Stressing anchorage, accessible fixed anchorage SA, FA [1), 2)]

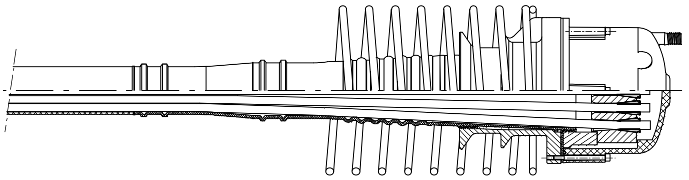




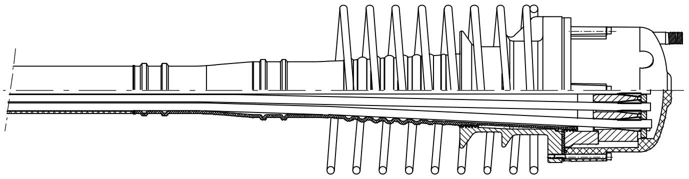
Inaccessible fixed anchorage FA [1), 2)]



Electrically isolated stressing, electrically isolated accessible fixed anchorage SAE, FAE [1)]



Electrically isolated inaccessible fixed anchorage FAE [1)]

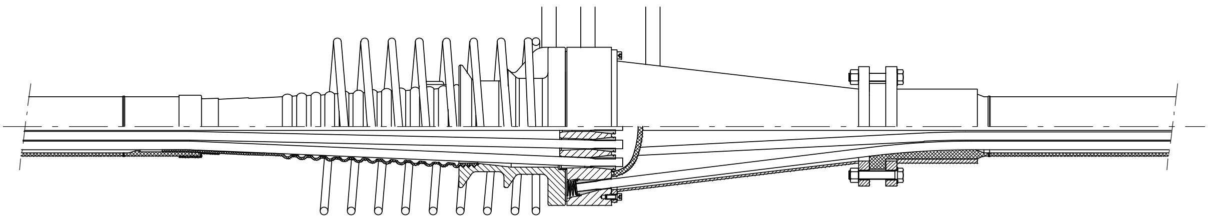


1) For anchorage sizes up to 3706, either helix or stirrups, or both helix and stirrups can be placed as additional reinforcement.
For anchorage sizes above 3706, 4206 and larger, both helix and stirrups shall be placed as additional reinforcement.

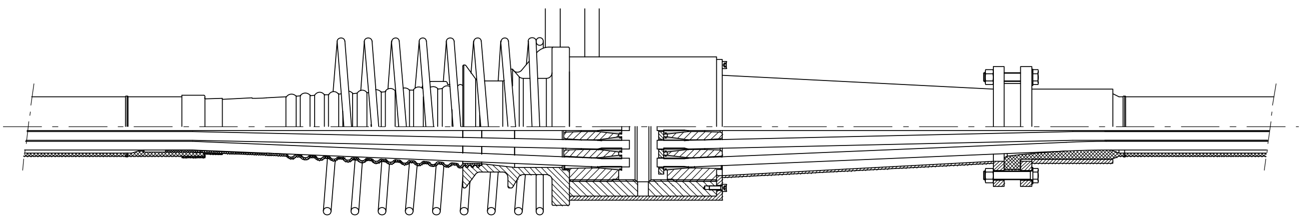
2) For anchorages of other than fully encapsulated or electrically isolated tendons, steel caps are available as well.

CONA CME	**External Post-tensioning System** Overview on anchorages of CONA CME BT	**Annex 1** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Fixed and stressing coupler FK, SK [1), 2)]



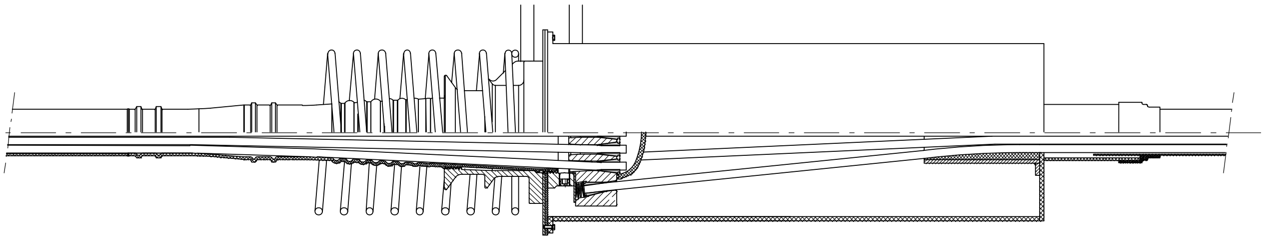
Fixed and stressing coupler FH, SH [1)]



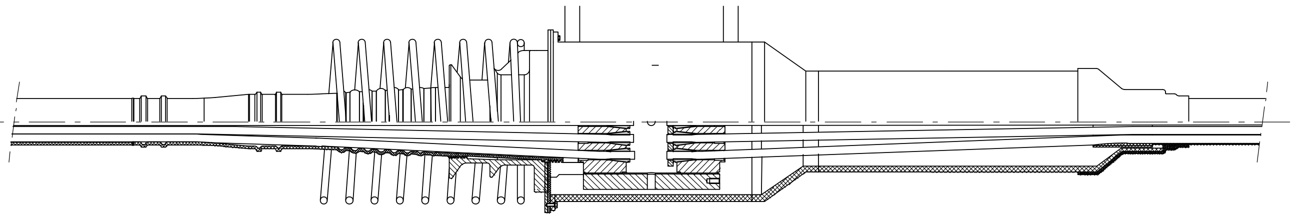
1) For anchorage sizes up to 3706, either helix or stirrups, or both helix and stirrups can be placed as additional reinforcement.
For anchorage sizes above 3706, 4206 and larger, both helix and stirrups shall be placed as additional reinforcement.

2) For anchorages of other than fully encapsulated or electrically isolated tendons, steel caps are available as well.

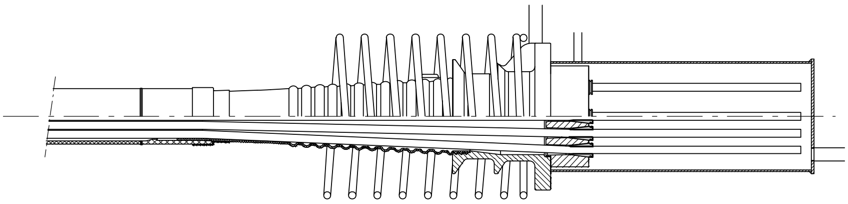
Electrically isolated fixed and stressing coupler FKE, SKE [1)]



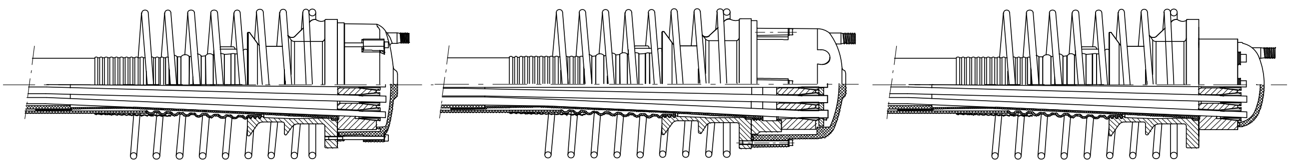
Electrically isolated fixed and stressing coupler FHE, SHE [1)]



Restressable / exchangeable anchorage with monostrands or grease / wax, SAR [1)]



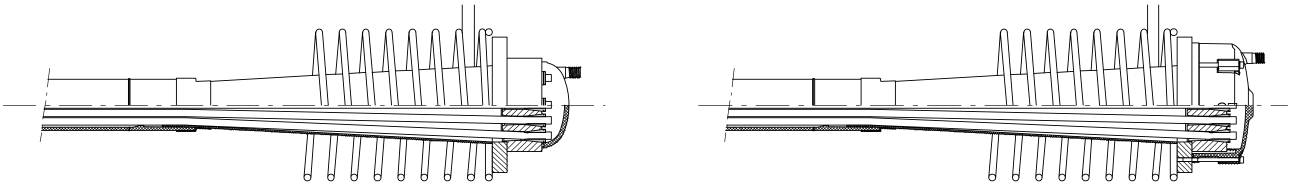
Stressing anchorage, accessible fixed anchorage, replaceable SAR, FAR [1), 2)]
With bare strands or monostrands



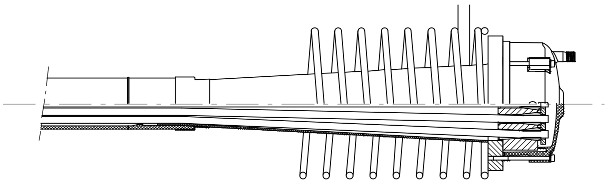
[1)] For anchorage sizes up to 3706, either helix or stirrups, or both helix and stirrups can be placed as additional reinforcement.
For anchorage sizes above 3706, 4206 and larger, both helix and stirrups shall be placed as additional reinforcement.

[2)] For anchorages other than fully encapsulated or electrically isolated tendons, steel caps are available as well.

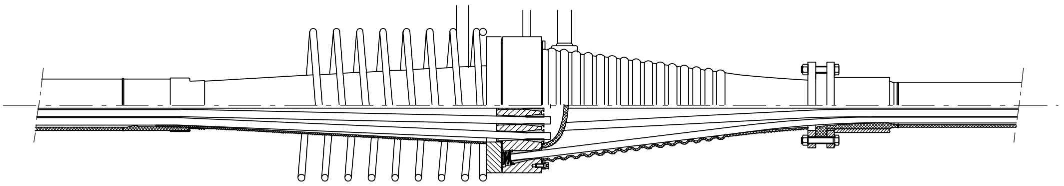
Stressing anchorage, accessible fixed anchorage FA [1), 2)]



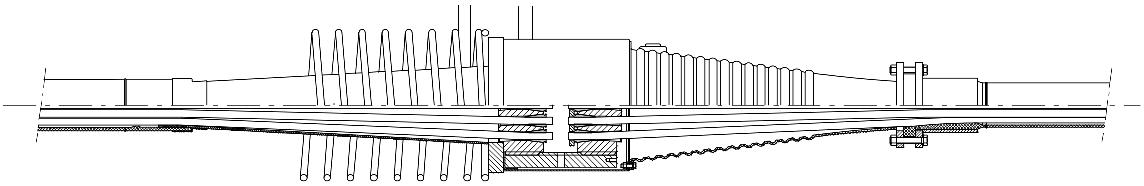
Inaccessible fixed anchorage FA [1), 2)]



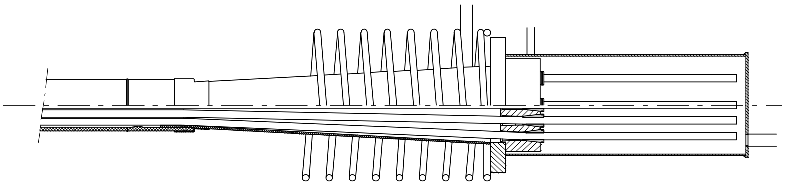
Fixed and stressing coupler FK, SK [1), 2)]



Fixed and stressing coupler FH, SH [1)]



Restressable / exchangeable anchorage [1)]

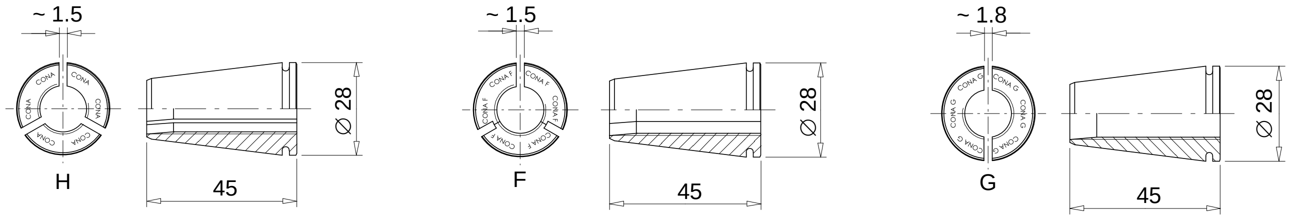


1) For anchorage sizes up to 3706, either helix or stirrups, or both helix and stirrups can be placed as additional reinforcement.
For anchorage sizes above 3706, 4206 and larger, both helix and stirrups shall be placed as additional reinforcement.

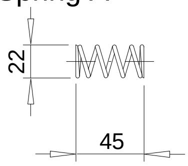
2) For anchorages other than fully encapsulated or electrically isolated tendons, steel caps are available as well.

BBR CONA CME	**External Post-tensioning System** Overview on anchorages and couplers of CONA CME SP	**Annex 4** of European Technical Assessment **ETA-07/0168** of 16.12.2024

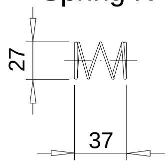
Wedges



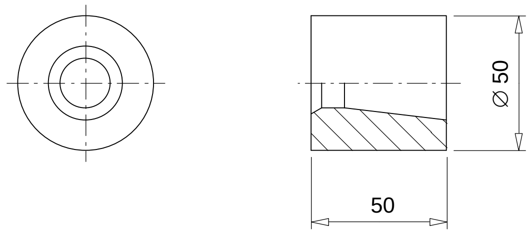
Spring A



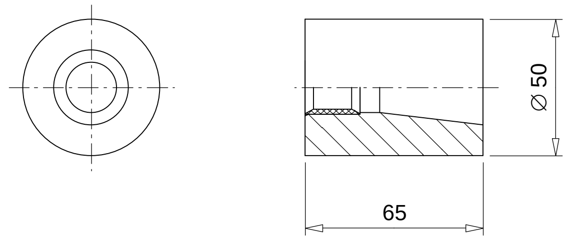
Spring K



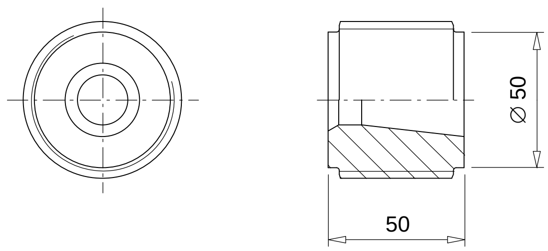
Anchor head A3 0106



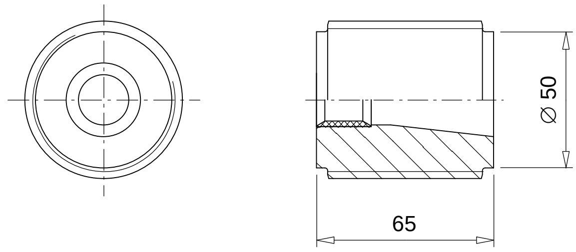
Anchor head A7 0106



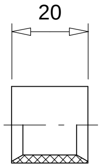
Coupler anchor head H1 0106



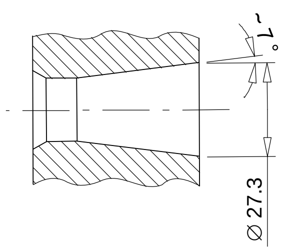
Coupler anchor head H2 0106



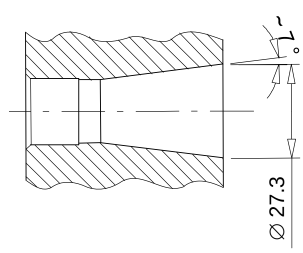
Ring cushion
Anchor head A5-A8
Coupler head H2



Cone
A1–A4



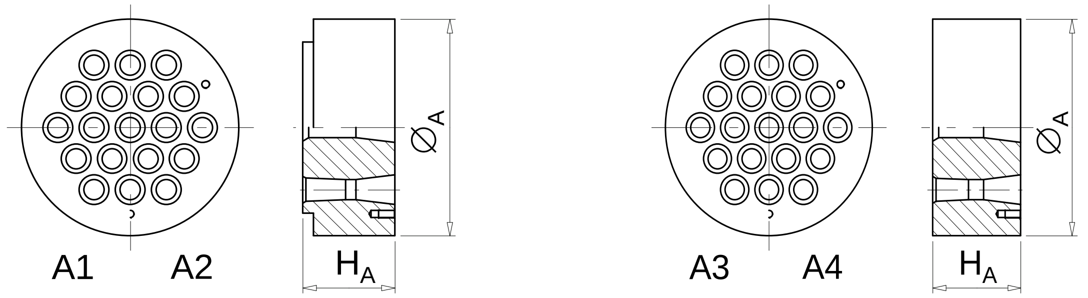
Cone
A5–A8



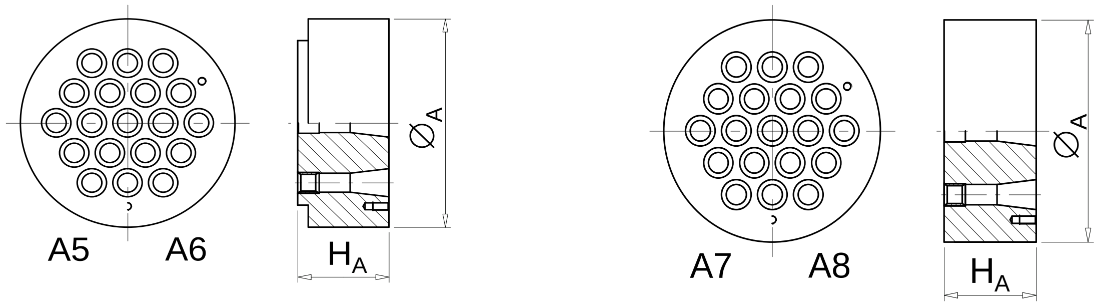
Dimensions in mm

BBR CONA CME	**External Post-tensioning System** Components – Anchorage and coupler	**Annex 5** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Anchor head A1-A4



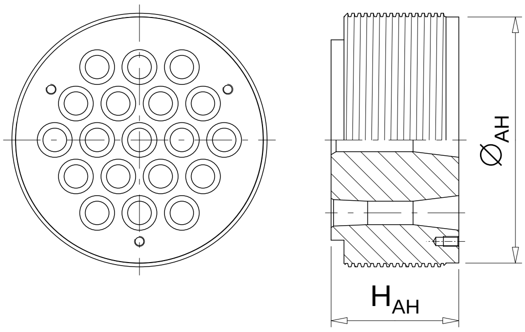
Anchor head A5-A8



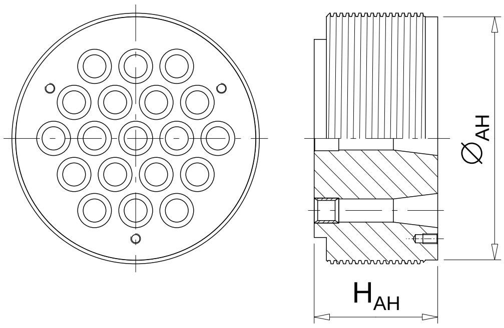
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Anchor head														
Nominal diameter	$\varnothing_A$	mm	90	100	100	130	130	130	150	160	160	180	200	200
Height head A1-A4	H_A	mm	50	50	50	50	55	55	60	60	65	72	75	80
Height head A5-A8		mm	65	65	65	65	65	65	65	65	70	72	75	80

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Anchor head														
Nominal diameter	$\varnothing_A$	mm	200	225	240	255	255	255	285	300	320	325	335	365
Height head A1-A4	H_A	mm	85	95	100	100	105	110	—	—	—	—	—	—
Height head A5-A8		mm	85	95	100	100	105	110	120	130	130	140	150	155

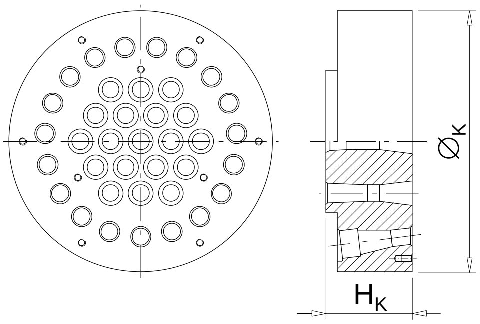
Coupler head H1



Coupler head H2



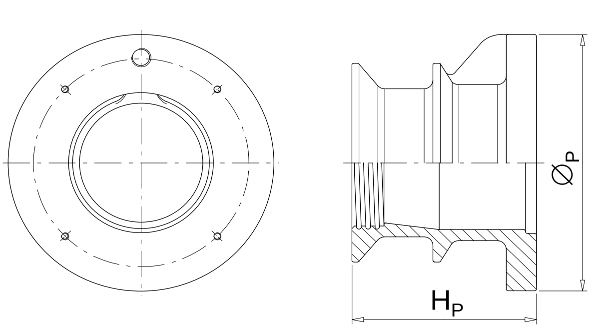
Coupler head K



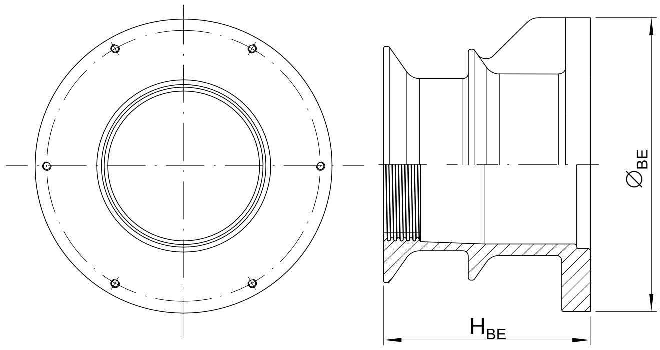
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Coupler anchor heads H1 and H2														
Nominal diameter $\varnothing_{AH}$		mm	90	95	100	130	130	130	150	160	160	180	200	200
Height head H1	H_{AH}	mm	50	50	55	55	60	65	65	70	80	80	80	85
Height head H2		mm	65	65	65	65	65	65	65	70	80	80	80	85
Coupler head K														
Diameter	$\varnothing_K$	mm	195	195	195	210	210	210	250	250	250	290	290	290
Height	H_K	mm	85	85	85	85	85	85	90	90	90	90	90	95

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Coupler anchor heads H1 and H2														
Nominal diameter $\varnothing_{AH}$		mm	200	225	240	255	255	255	285	300	320	325	335	365
Height head H1	H_{AH}	mm	95	100	100	100	105	115	—	—	—	—	—	—
Height head H2		mm	95	100	100	100	105	115	125	135	135	145	160	160
Coupler head K														
Diameter	$\varnothing_K$	mm	290	310	340	390	390	390	—	—	—	—	—	—
Height	H_K	mm	95	105	120	125	125	130	—	—	—	—	—	—

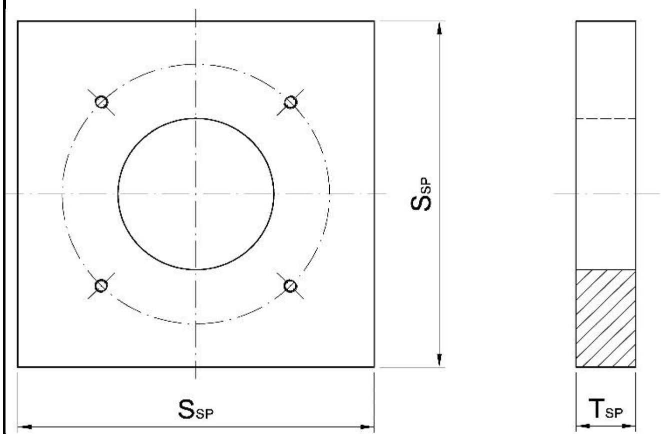
Bearing trumplate A



Bearing trumplate E



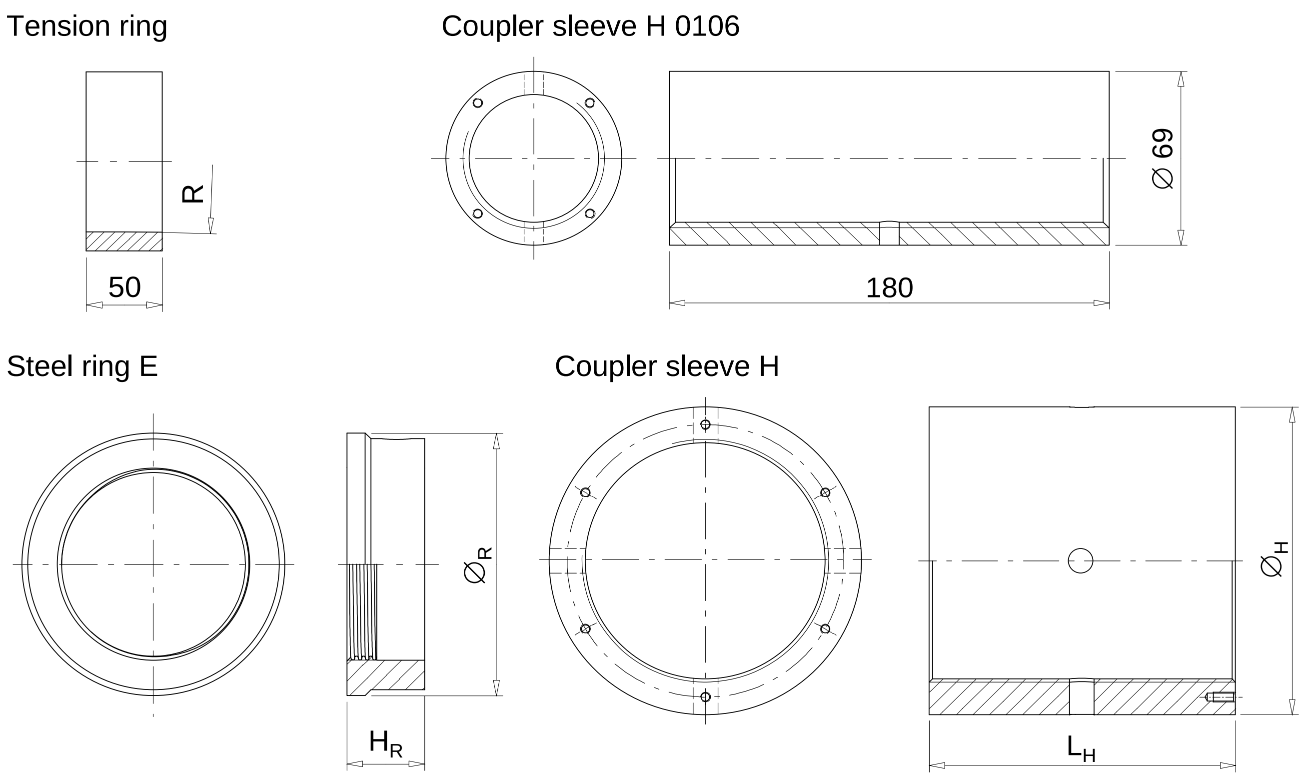
Square plate [1)]



1) Minimum dimensions see Annex 43 to Annex 51.

Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Bearing trumplate A														
Diameter	$\varnothing_P$	mm	130	130	130	170	170	170	195	225	225	240	280	280
Height	H_P	mm	120	120	120	128	128	128	133	150	150	160	195	195
Bearing trumplate E														
Diameter	$\varnothing_{BE}$	mm	145	145	145	170	170	170	—	225	225	—	280	280
Height	H_{BE}	mm	120	120	120	128	128	128	—	150	150	—	195	195

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Bearing trumplate A														
Diameter	$\varnothing_P$	mm	280	310	325	360	360	360	400	425	485	485	485	520
Height	H_P	mm	195	206	227	250	250	250	275	290	340	340	340	350
Bearing trumplate E														
Diameter	$\varnothing_{BE}$	mm	280	310	325	360	360	360	—	—	—	—	—	—
Height	H_{BE}	mm	195	206	227	250	250	250	—	—	—	—	—	—

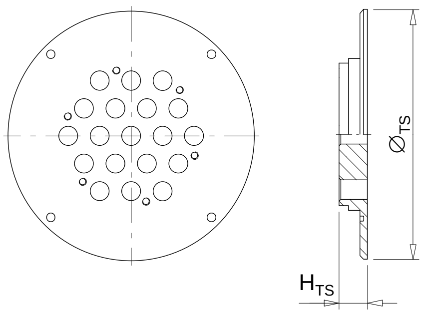


Dimensions in mm

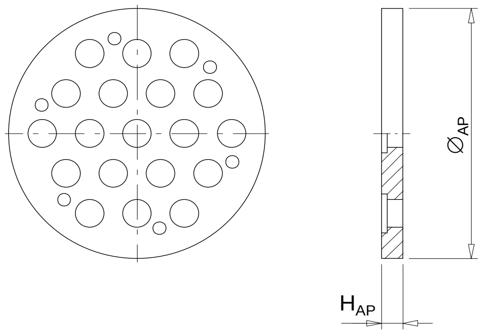
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Coupler sleeve H														
Diameter	$\varnothing_H$	mm	114	124	133	163	167	170	192	203	213	233	259	259
Length sleeve	L_H	mm	180	180	180	180	190	200	200	210	230	230	240	250
Steel ring E														
Diameter	$\varnothing_R$	mm	100	100	100	130	130	130	—	173	173	—	214	214
Length	H_R	mm	59	59	59	59	59	59	—	65	65	—	65	65

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Coupler sleeve H														
Diameter	$\varnothing_H$	mm	269	296	312	327	330	338	373	395	413	425	443	475
Length sleeve	L_H	mm	270	270	280	280	300	320	340	360	360	380	410	410
Steel ring E														
Diameter	$\varnothing_R$	mm	214	238	251	274	274	274	—	—	—	—	—	—
Length	H_R	mm	65	65	65	65	65	65	—	—	—	—	—	—

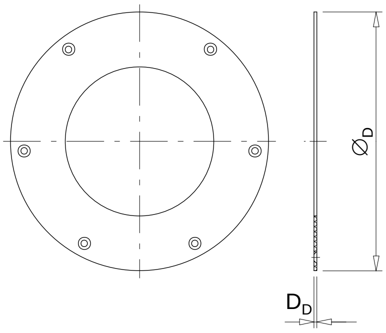
Temporary sealing plate



Activation plate



Cover Plate K

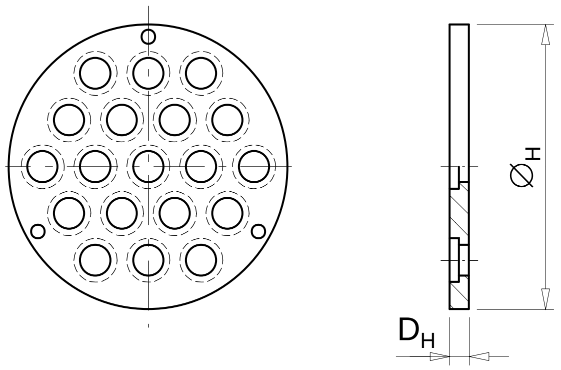


Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Temporary sealing plate														
Diameter	$\varnothing_{TS}$	mm	129	129	129	169	169	169	—	225	225	—	260	260
Height	H_{TS}	mm	29	29	29	29	29	29	—	29	29	—	30	30
Activation plate														
Diameter	$\varnothing_{AP}$	mm	90	90	90	120	120	120	—	150	150	—	180	180
Height	H_{AP}	mm	10	10	10	10	10	10	—	15	15	—	15	15
Cover plate K														
Diameter	$\varnothing_{D}$	mm	192	192	192	207	207	207	246	246	246	286	286	286
Thickness	D_{D}	mm	3	3	3	3	3	3	3	3	3	3	3	3

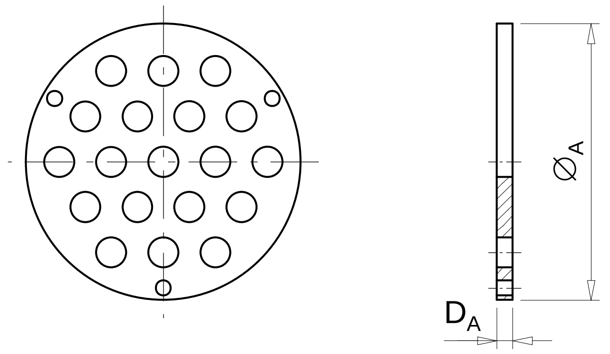
Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Temporary sealing plate														
Diameter	$\varnothing_{TS}$	mm	260	305	310	350	350	350	360	405	465	465	465	500
Height	H_{TS}	mm	30	30	30	30	30	30	30	35	40	40	40	40
Activation plate														
Diameter	$\varnothing_{AP}$	mm	180	200	220	220	220	220	250	280	300	300	315	345
Height	H_{AP}	mm	15	15	15	15	15	15	15	15	15	15	15	15
Cover plate K														
Diameter	$\varnothing_{D}$	mm	286	306	336	386	386	386	—	—	—	—	—	—
Thickness	D_{D}	mm	3	5	5	5	5	5	—	—	—	—	—	—

Member of EOTA

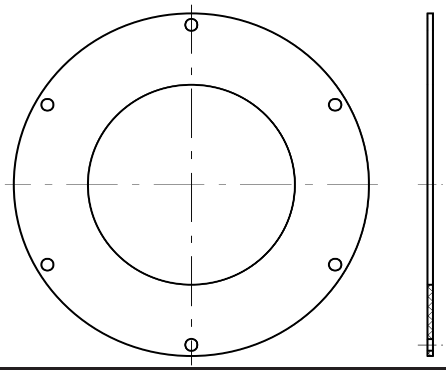
Wedge retaining plate H



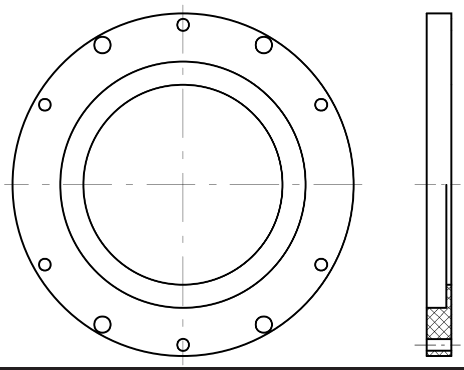
Wedge retaining plate A and E



Isolation ring E [1)]



Isolation ring E with steps



Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Wedge retaining plate H														
Diameter	$\varnothing_H$	mm	65	73	91	117	117	117	130	157	157	145	185	185
Thickness	D_H	mm	30	30	30	30	30	30	30	30	30	30	30	30
Wedge retaining plate A and E														
Diameter	$\varnothing_A$	mm	65	73	91	117	117	117	130	157	157	145	185	185
Thickness	D_A	mm	5	5	5	5	5	5	8	8	8	10	10	10

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Wedge retaining plate H														
Diameter	$\varnothing_H$	mm	185	205	232	234	234	234	240	275	275	275	310	310
Thickness	D_H	mm	30	30	30	30	30	30	30	30	30	30	30	30
Wedge retaining plate A and E														
Diameter	$\varnothing_A$	mm	185	205	232	234	234	234	240	275	275	275	310	310
Thickness	D_A	mm	10	10	10	10	10	10	12	12	12	12	12	12

[1)] Larger isolation ring for fixed and stressing coupler

CONA CME

External Post-tensioning System
Components – Accessory

Annex 11
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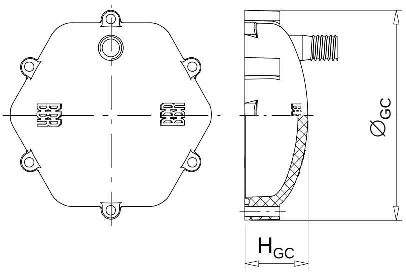
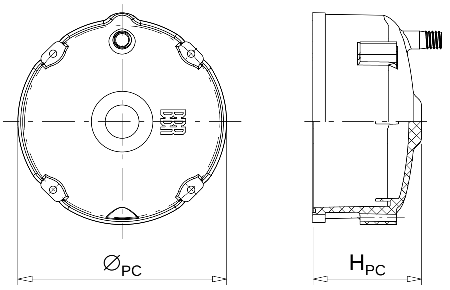
Grouting Cap A

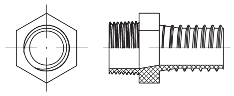


Protection Cap A

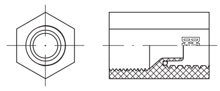


Grouting adaptor

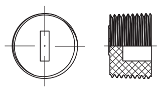
Male grouting adaptor 3/4 " to 23 mm



Female grouting adaptor 23 mm to 3/4 "



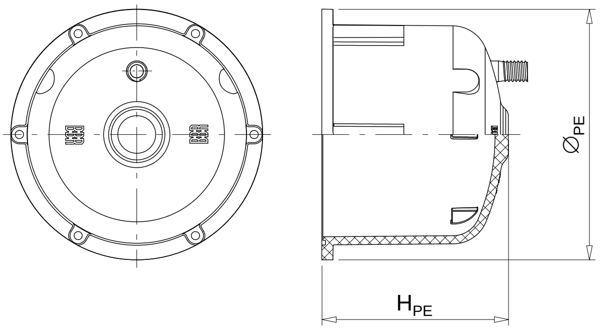
Plug 3/4 "



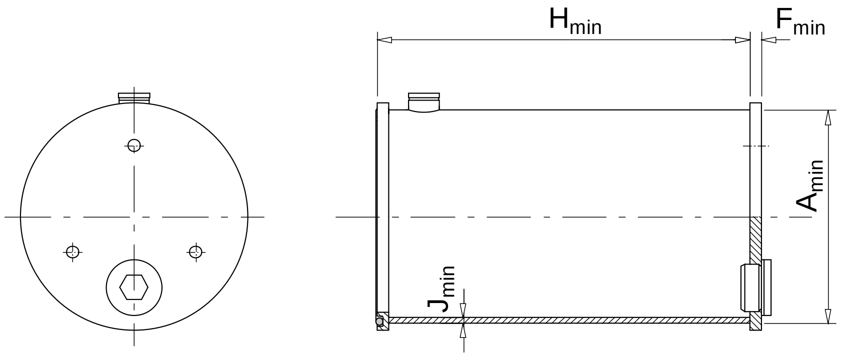
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Grouting Cap A														
Diameter	$\varnothing_{GC}$	mm	—	—	98	118	118	118	—	158	158	—	188	188
Height	H_{GC}	mm	—	—	52	53	53	53	—	58	58	—	58	58
Protection Cap A														
Diameter	$\varnothing_{PC}$	mm	—	—	116	170	170	170	—	218	218	—	257	257
Height	H_{PC}	mm	—	—	98	110	110	110	—	114	114	—	133	133

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Grouting Cap A														
Diameter	$\varnothing_{GC}$	mm	188	204	234	242	242	242	—	—	—	—	—	—
Height	H_{GC}	mm	58	60	68	68	68	68	—	—	—	—	—	—
Protection Cap A														
Diameter	$\varnothing_{PC}$	mm	257	277	277	320	320	320	360	380	400	400	400	440
Height	H_{PC}	mm	133	144	144	162	162	162	175	190	190	200	210	210

Protection cap E



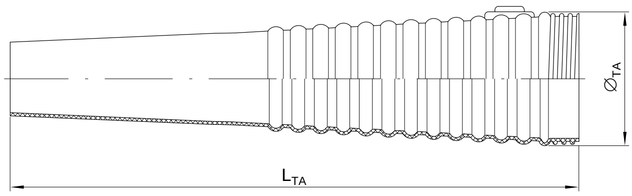
Long protection cap



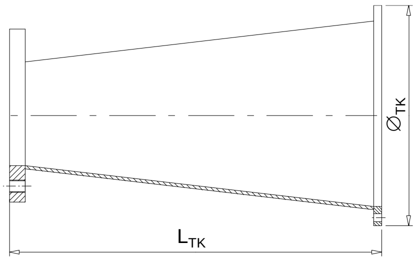
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Protection Cap E														
Diameter	$\varnothing_{PE}$	mm	143	143	143	168	168	168	—	229	229	—	276	276
Height	H_{PE}	mm	167	167	167	174	174	174	—	185	185	—	205	205
Long protection Cap														
Diameter	A_{min}	mm	110	110	110	140	140	140	—	170	170	—	210	210
Min. wall thickness	J_{min}	mm	3	3	3	3	3	3	—	3	3	—	3	3
Min. cover thickness	F_{min}	mm	5	5	5	5	5	5	—	5	5	—	5	5

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Protection Cap E														
Diameter	$\varnothing_{PE}$	mm	276	306	316	348	348	348	—	—	—	—	—	—
Height	H_{PE}	mm	205	217	223	233	233	233	—	—	—	—	—	—
Long protection Cap														
Diameter	A_{min}	mm	210	240	250	270	270	270	300	310	330	340	350	370
Min. wall thickness	J_{min}	mm	3	3	3	3	3	3	3	3	3	3	3	3
Min. cover thickness	F_{min}	mm	5	5	5	5	5	5	5	5	5	5	5	5

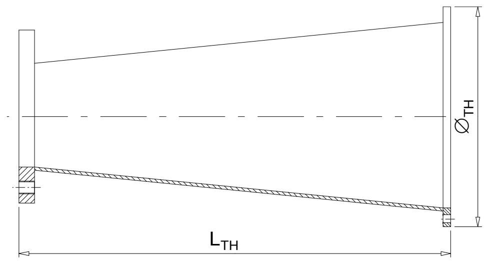
Trumpet A



Trumpet K



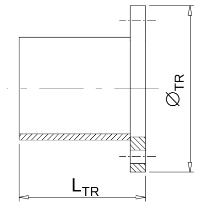
Trumpet H



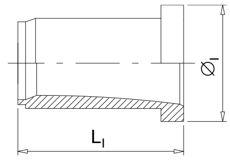
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Trumpet A														
Diameter	$Ø_{TA}$	mm	72	72	72	88	88	88	127	127	127	153	153	153
Length	L_{TA}	mm	197	197	197	325	325	325	618	618	503	689	689	689
Trumpet K														
Diameter	$Ø_{TK}$	mm	195	195	195	210	210	210	250	250	250	290	290	290
Length	L_{TK}	Mm	308	308	308	340	340	340	428	428	428	473	473	473
Trumpet H														
Diameter	$Ø_{TH}$	mm	—	—	—	170	170	170	203	203	213	259	259	269
Length	L_{TH}	mm	—	—	—	190	190	190	570	570	390	480	480	480

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Trumpet A														
Diameter	$Ø_{TA}$	mm	153	170	191	191	191	191	219	229	254	254	254	278
Length	L_{TA}	mm	574	710	866	866	866	751	1 060	1 060	1 244	1 244	1 244	1 290
Trumpet K														
Diameter	$Ø_{TK}$	mm	290	310	340	390	390	390	—	—	—	—	—	—
Length	L_{TK}	mm	473	498	597	734	734	734	—	—	—	—	—	—
Trumpet H														
Diameter	$Ø_{TH}$	mm	269	296	312	330	330	338	370	392	410	422	440	472
Length	L_{TH}	mm	480	550	820	820	820	660	930	890	1 080	910	980	1 070

Tension ring



PE insert



Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Tension ring														
Diameter	$\varnothing_{ITA}$	mm	130	130	130	150	150	150	150	150	165	200	200	200
Length	L_{ITA}	mm	95	95	95	95	95	95	135	135	135	168	168	168
PE insert														
Diameter	$\varnothing_{ITE}$	mm	105	105	105	105	105	105	105	105	120	150	150	150
Length	L_{ITE}	mm	110	110	110	110	110	110	150	150	150	220	220	220

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Tension ring														
Diameter	$\varnothing_{B}$	mm	200	215	215	215	215	230	250	250	250	270	270	290
Length	L_{B}	mm	168	168	168	168	168	168	168	168	168	168	168	168
PE insert														
Diameter	$\varnothing_{I}$	mm	150	165	165	165	165	180	200	200	200	220	220	240
Length	L_{I}	mm	220	220	220	220	220	220	220	220	220	220	220	220

CONA CME

External Post-tensioning System
Components – Tension ring, PE insert

Annex 15
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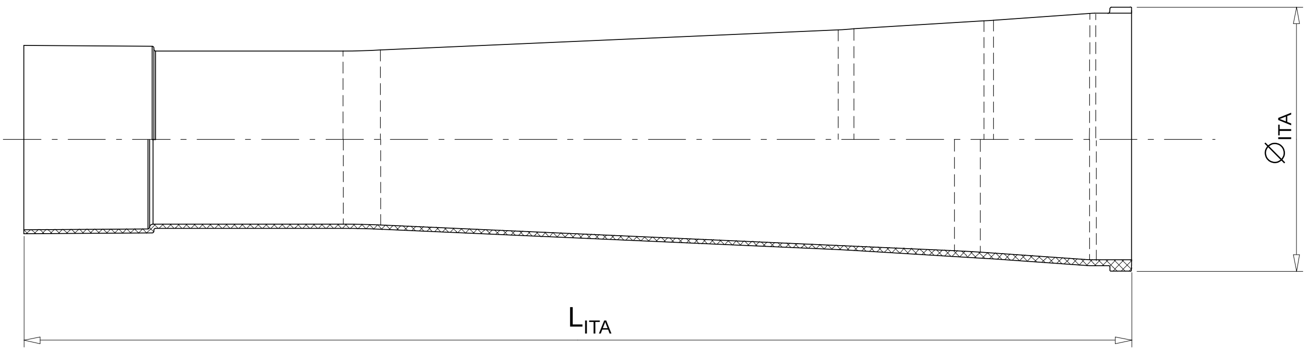
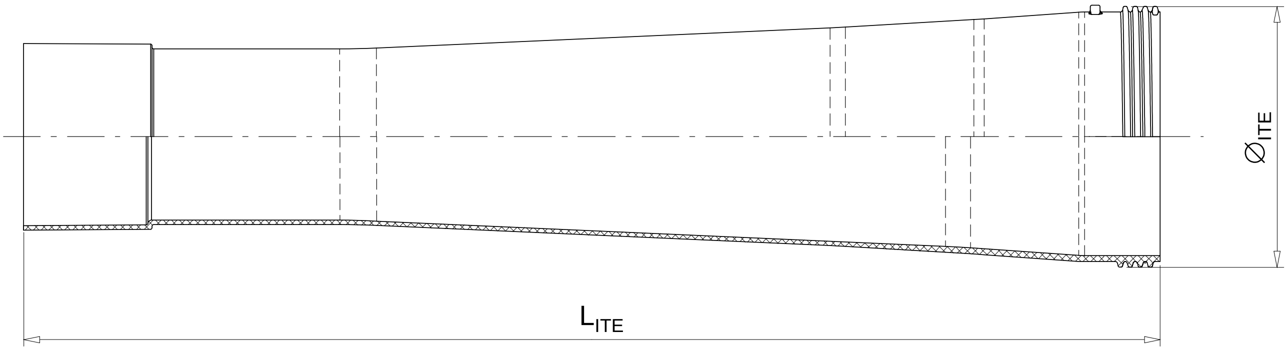
ETA-07/0168 of 16.12.2024

Inner trumpet A



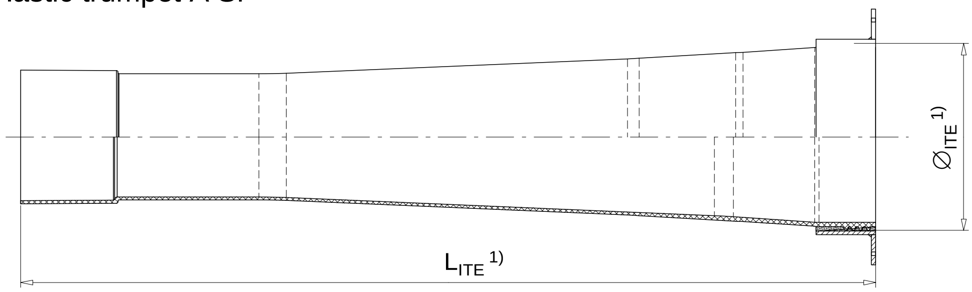
Inner trumpet E



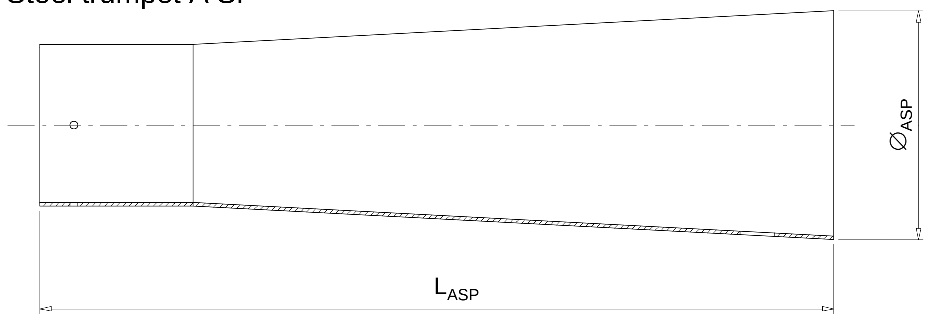
Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Inner trumpet A														
Diameter	$\varnothing_{ITA}$	mm	—	—	69	89	89	89	—	128	128	—	158	158
Length	L_{ITA}	mm	—	—	190	220	220	220	—	533	533	—	649	648
Inner trumpet E														
Diameter	$\varnothing_{ITE}$	mm	—	—	74	93	93	93	—	128	128	—	156	156
Length	L_{ITE}	mm	—	—	220	250	250	250	—	568	568	—	684	684

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Inner trumpet A														
Diameter	$\varnothing_{ITA}$	mm	158	178	194	202	202	202	224	238	264	264	264	296
Length	L_{ITA}	mm	648	600	630	630	630	630	1 020	980	1 170	995	1 070	1 160
Inner trumpet E														
Diameter	$\varnothing_{ITE}$	mm	156	178	191	201	201	201	—	—	—	—	—	—
Length	L_{ITE}	mm	684	635	665	665	665	665	—	—	—	—	—	—

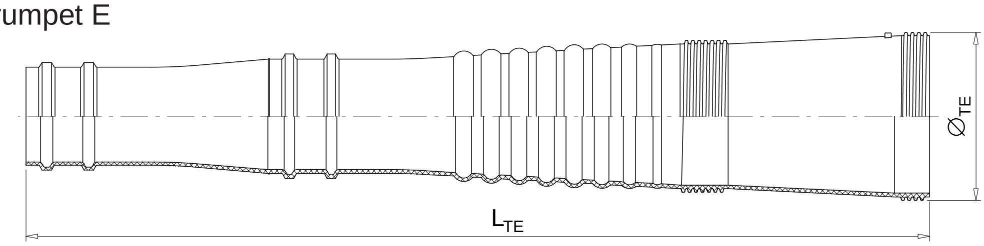
Plastic trumpet A SP



Steel trumpet A SP



Trumpet E



Number of strands			02	03	04	05	06	07	08	09	12	13	15	16
Trumpet A SP														
Diameter	$\varnothing_{ASP}$	mm	74	74	74	94	94	94	116	131	131	146	164	164
Length	L_{ASP}	mm	194	264	232	393	330	273	519	679	565	658	799	799
Trumpet E														
Diameter	$\varnothing_{TE}$	mm	74	74	74	93	93	93	—	128	128	—	157	157
Length	L_{TE}	mm	312	312	312	428	428	428	—	600	600	—	848	848

Number of strands			19	22	24	25	27	31	37	42	43	48	55	61
Trumpet A SP														
Diameter	$\varnothing_{ASP}$	mm	164	184	199	209	209	209	229	243	269	269	269	301
Length	L_{ASP}	mm	680	839	941	989	989	875	1 020	1 068	1 258	1 180	1 126	1 369
Trumpet E														
Diameter	$\varnothing_{TE}$	mm	157	178	191	201	201	201	—	—	—	—	—	—
Length	L_{TE}	mm	848	980	1 005	1 040	1 040	1 040	—	—	—	—	—	—

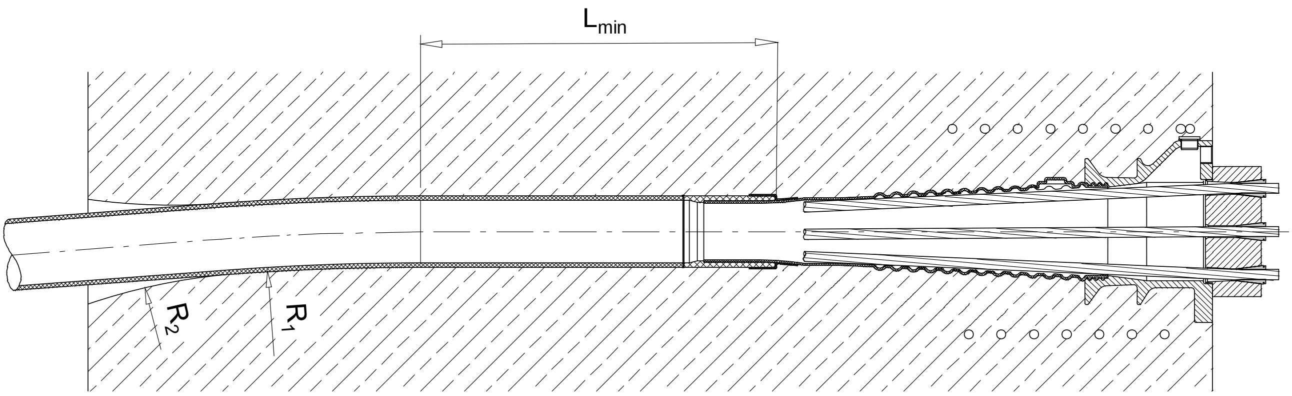
1) See Annex 16.

CONA CME

External Post-tensioning System
Components – Trumpet

Annex 17
of European Technical Assessment
ETA-07/0168 of 16.12.2024

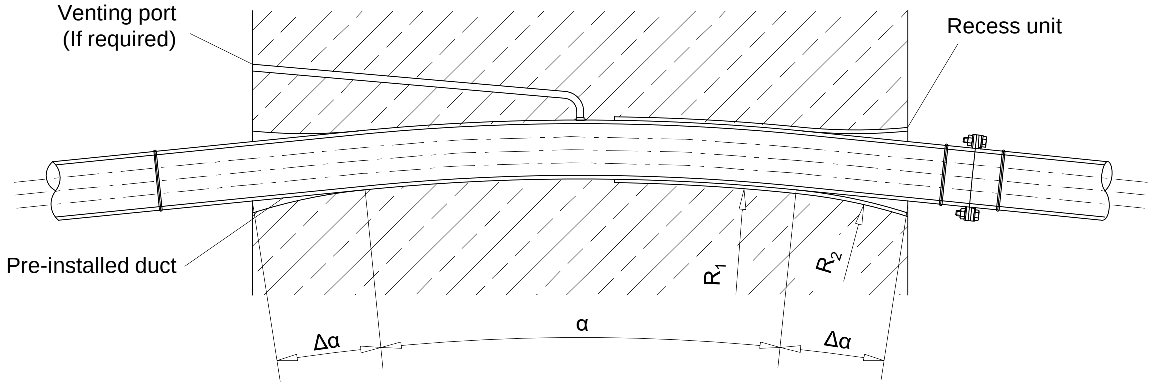
Straight length at fixed and stressing anchorage

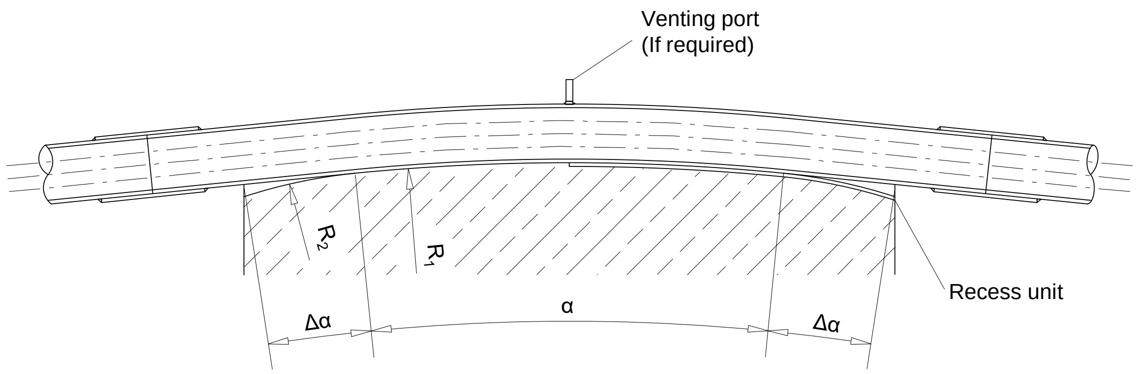


Degree of filling 0.35 $\leq f \leq 0.50$, minimum straight length $L_{min} = 5 \cdot d_i \geq 250$ mm
Degree of filling 0.25 $\leq f \leq 0.30$, minimum straight length $L_{min} = 8 \cdot d_i \geq 400$ mm

Where
f............—.............Degree of filling, see Clause 1.6
d_i.........mm............Nominal inner diameter of duct

Deviator



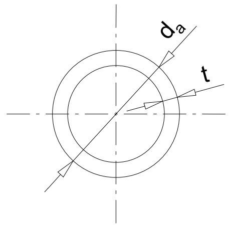


Key

$R_1 \geq R_2 \geq R_{min}$
Δα...... Additional deviation, e. g. 3 °
For R_{min} see Annex 19 and Annex 20.

CONA CME	**External Post-tensioning System** Deviator and straight length	**Annex 18** of European Technical Assessment **ETA-07/0168** of 16.12.2024

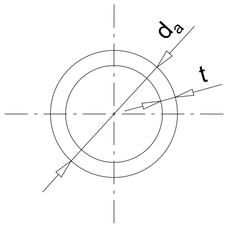
Duct



Bare strand

Number of strands	PE duct			PE duct			Steel duct		
	Minimum radii of curvature	Diameter	Thickness	Minimum radii of curvature	Diameter	Thickness	Minimum radii of curvature	Diameter	Thickness
	R_{min}	d_a	t	$1.5 \cdot R_{min}$	d_a	t	R_{min}	d_a	t
—	m	mm	mm	m	mm	mm	m	mm	mm
01	2.0	25	2.0	3.0	25	2.0	2.0	25	1.5
02	2.0	40	2.4	3.0	40	2.0	2.0	42	1.5
03	2.0	50	3.7	3.0	50	2.4	2.0	42	1.5
04	2.0	50	3.7	3.0	63	2.4	2.0	48	1.5
05	2.0	63	4.7	3.0	63	3.7	2.0	57	1.5
06	2.0	75	5.6	3.0	63	3.7	2.0	64	1.5
07	2.0	75	5.6	3.0	75	4.5	2.0	64	1.5
08	2.2	75	5.6	3.3	75	4.5	2.2	73	1.5
09	2.2	75	5.6	3.3	75	4.5	2.2	73	1.5
12	2.5	90	5.4	3.8	90	4.3	2.5	83	1.5
13	2.7	90	5.4	4.1	90	4.3	2.5	83	1.5
15	2.7	110	5.3	4.1	110	4.2	2.7	89	2.0
16	2.7	110	5.3	4.1	110	4.2	3.0	89	2.0
19	3.0	110	5.3	4.5	110	4.2	3.0	102	2.0
22	3.2	125	6.0	4.8	125	4.8	3.2	114	2.0
24	3.3	125	6.0	5.0	125	4.8	3.3	114	2.0
25	3.3	125	6.0	5.0	125	4.8	3.5	114	2.0
27	3.5	125	6.0	5.3	125	4.8	3.5	127	2.5
31	3.7	140	6.7	5.6	140	5.4	3.7	127	2.5
37	4.0	140	6.7	6.0	140	5.4	4.0	141	2.5
42	4.5	160	7.7	6.8	160	6.2	4.5	168	3.0
43	4.5	160	7.7	6.8	160	6.2	4.5	168	3.0
48	4.5	180	8.6	6.8	180	6.9	4.5	168	3.0
55	5.2	180	8.6	7.8	180	6.9	5.2	168	3.0
61	5.5	200	9.6	8.3	200	7.7	5.5	168	3.0

Duct



Monostrand with grouting prior to stressing

Number of strands	PE duct			Steel duct		
	Minimum radii of curvature	Diameter	Thickness	Minimum radii of curvature	Diameter	Thickness
	R_{min}	d_a	t	R_{min}	d_a	t
—	m	mm	mm	m	mm	mm
02	2.0	50	3.7	2.0	48	1.5
03	2.0	63	4.7	2.0	48	1.5
04	2.0	75	5.6	2.0	57	1.5
05	2.0	75	5.6	2.0	60	1.5
06	2.0	75	5.6	2.0	76	1.5
07	2.0	90	5.4	2.0	76	1.5
08	2.5	90	5.4	2.5	76	1.5
09	2.5	90	5.4	2.5	83	1.5
12	2.5	110	5.3	2.5	95	1.5
13	2.5	110	5.3	2.5	95	1.5
15	2.5	125	5.3	2.5	114	2.0
16	2.5	125	5.3	2.5	114	2.0
19	2.5	125	5.3	2.5	114	2.0
22	2.5	140	5.4	2.5	127	2.0
24	2.5	140	5.4	2.5	140	2.0
25	2.5	140	5.4	2.5	140	2.0
27	2.5	140	5.4	2.5	152	2.5
31	2.5	160	6.2	2.5	159	2.5
37	2.5	180	6.9	2.5	168	2.5
42	2.5	180	6.9	2.5	178	3.0
43	2.5	180	6.9	2.5	178	3.0
48	2.5	200	7.7	2.5	194	3.0
55	2.5	225	8.6	2.5	219	3.0
61	2.5	225	8.6	2.5	219	3.0

Material specifications

Component	Standard / Specification
Anchor head A A CONA CME 0106 to 6106	EN ISO 683-1 EN ISO 683-2
Coupler anchor head K K CONA CME 0206 to 3106	EN ISO 683-1 EN ISO 683-2
Coupler anchor head H H CONA CME 0106 to 6106	EN ISO 683-1 EN ISO 683-2
Bearing trumplate A CONA CME 0206 to 6106 Bearing trumplate E CONA CME 0206 to 3106	EN 1561 EN 1563
Square plate CONA CME SP 0106 to 6106	EN 10025-2
Coupler sleeve H H CONA CME 0106 to 6106	EN 10210-1
Ring wedge H, F, and G	EN 10277 EN ISO 683-3
Ring cushion	EN ISO 17855-1 EN ISO 19069-1
Wedge retaining plate A, E, and H CONA CME 0206 to 6106 Cover plate K CONA CME 0206 to 3106	EN 10025-2
Trumpet A, A SP, K, and E Inner trumpet A and E	EN ISO 17855-1 EN ISO 19069-1
Trumpet A, A SP, K, and H	EN 10025-2
Steel ring E	EN 10210-1
Temporary sealing plate Activation plate	EN 10025-2
Isolation ring E	Composite material
Grouting cap A Protection cap A Protection cap E Long protection cap PE insert Grouting adaptor Plug	EN ISO 17855-1
Protection cap A Long protection cap	EN 10025-2
Tension ring	EN 10210-1
Spring A and K	EN 10270-1
Helix	Ribbed reinforcing steel, $R_e \geq 500$ MPa
Additional stirrup reinforcement	Ribbed reinforcing steel, $R_e \geq 500$ MPa
Duct	EN 12201-1, EN 12201-3, EN 10210-1, EN 10216-1, EN 10217-1, EN 10219-1, EN 10255, EN 10305-3

7-wire prestressing steel strands according to prEN 10138-3 [1)]

Steel designation			Y1770S7	Y1860S7	Y1770S7	Y1860S7
Tensile strength	R_m	MPa	1 770	1 860	1 770	1 860
Diameter	d	mm	15.3	15.3	15.7	15.7
Nominal cross-sectional area	A_p	mm^2	140	140	150	150
Nominal mass per metre	m	kg/m	1.093		1.172	
Permitted deviation from nominal mass		%	± 2			
Characteristic value of maximum force	F_{pk}	kN	248	260	266	279
Maximum value of maximum force	$F_{m,\,max}$	kN	285	299	306	321
Characteristic value of 0.1 % proof force [2)]	$F_{p0.1}$	kN	218	229	234	246
Minimum elongation at maximum force, $L_0 \geq 500$ mm	A_{gt}	%	3.5			
Modulus of elasticity	E_p	MPa	195 000 [3)]			

1) Suitable prestressing steel strands according to standards and regulations in force at the place of use may also be used.
2) For prestressing steel strands according to prEN 10138-3, 09.2000, the value is multiplied by 0.98.
3) Standard value

CONA CME n06-140

Number of strands	Nominal cross-sectional area of prestressing steel	Nominal mass of prestressing steel	Characteristic value of maximum force of tendon	
			f_{pk} = 1 770 MPa	f_{pk} = 1 860 MPa
n	A_p	M	F_{pk}	F_{pk}
—	mm²	kg/m	kN	kN
01	140	1.1	248	260
02	280	2.2	496	520
03	420	3.3	744	780
04	560	4.4	992	1 040
05	700	5.5	1 240	1 300
06	840	6.6	1 488	1 560
07	980	7.7	1 736	1 820
08	1 120	8.7	1 984	2 080
09	1 260	9.8	2 232	2 340
12	1 680	13.1	2 976	3 120
13	1 820	14.2	3 224	3 380
15	2 100	16.4	3 720	3 900
16	2 240	17.5	3 968	4 160
19	2 660	20.8	4 712	4 940
22	3 080	24.0	5 456	5 720
24	3 360	26.2	5 952	6 240
25	3 500	27.3	6 200	6 500
27	3 780	29.5	6 696	7 020
31	4 340	33.9	7 688	8 060
37	5 180	40.4	9 176	9 620
42	5 880	45.9	10 416	10 920
43	6 020	47.0	10 664	11 180
48	6 720	52.5	11 904	12 480
55	7 700	60.1	13 640	14 300
61	8 540	66.7	15 128	15 860

CONA CME n06-150

Number of strands	Nominal cross-sectional area of prestressing steel	Nominal mass of prestressing steel	Characteristic value of maximum force of tendon	
			f_{pk} = 1 770 MPa	f_{pk} = 1 860 MPa
n	A_p	M	F_{pk}	F_{pk}
—	mm^2	kg/m	kN	kN
01	150	1.2	266	279
02	300	2.3	532	558
03	450	3.5	798	837
04	600	4.7	1 064	1 116
05	750	5.9	1 330	1 395
06	900	7.0	1 596	1 674
07	1 050	8.2	1 862	1 953
08	1 200	9.4	2 128	2 232
09	1 350	10.5	2 394	2 511
12	1 800	14.1	3 192	3 348
13	1 950	15.2	3 458	3 627
15	2 250	17.6	3 990	4 185
16	2 400	18.8	4 256	4 464
19	2 850	22.3	5 054	5 301
22	3 300	25.8	5 852	6 138
24	3 600	28.1	6 384	6 696
25	3 750	29.3	6 650	6 975
27	4 050	31.6	7 182	7 533
31	4 650	36.3	8 246	8 649
37	5 550	43.4	9 842	10 323
42	6 300	49.2	11 172	11 718
43	6 450	50.4	11 438	11 997
48	7 200	56.3	12 768	13 392
55	8 250	64.5	14 630	15 345
61	9 150	71.5	16 226	17 019

Maximum prestressing and overstressing forces

Designation		Maximum prestressing force [1)] $0.9 \cdot F_{p0.1}$				Maximum overstressing force [1), 2)] $0.95 \cdot F_{p0.1}$			
		CONA CME							
		n06-140		n06-150		n06-140		n06-150	
Characteristic tensile strength	MPa	1 770	1 860	1 770	1 860	1 770	1 860	1 770	1 860
—	—	kN	kN	kN	kN	kN	kN	kN	kN
n Number of strands	01	196	206	211	221	207	218	222	234
	02	392	412	421	443	414	435	445	467
	03	589	618	632	664	621	653	667	701
	04	785	824	842	886	828	870	889	935
	05	981	1 031	1 053	1 107	1 036	1 088	1 112	1 169
	06	1 177	1 237	1 264	1 328	1 243	1 305	1 334	1 402
	07	1 373	1 443	1 474	1 550	1 450	1 523	1 556	1 636
	08	1 570	1 649	1 685	1 771	1 657	1 740	1 778	1 870
	09	1 766	1 855	1 895	1 993	1 864	1 958	2 001	2 103
	12	2 354	2 473	2 527	2 657	2 485	2 611	2 668	2 804
	13	2 551	2 679	2 738	2 878	2 692	2 828	2 890	3 038
	15	2 943	3 092	3 159	3 321	3 107	3 263	3 335	3 506
	16	3 139	3 298	3 370	3 542	3 314	3 481	3 557	3 739
	19	3 728	3 916	4 001	4 207	3 935	4 133	4 224	4 440
	22	4 316	4 534	4 633	4 871	4 556	4 786	4 891	5 141
	24	4 709	4 946	5 054	5 314	4 970	5 221	5 335	5 609
	25	4 905	5 153	5 265	5 535	5 178	5 439	5 558	5 843
	27	5 297	5 565	5 686	5 978	5 592	5 874	6 002	6 310
	31	6 082	6 389	6 529	6 863	6 420	6 744	6 891	7 245
	37	7 259	7 626	7 792	8 192	7 663	8 049	8 225	8 647
	42	8 240	8 656	8 845	9 299	8 698	9 137	9 337	9 815
	43	8 437	8 862	9 056	9 520	8 905	9 355	9 559	10 049
	48	9 418	9 893	10 109	10 627	9 941	10 442	10 670	11 218
	55	10 791	11 336	11 583	12 177	11 391	11 965	12 227	12 854
	61	11 968	12 572	12 847	13 505	12 633	13 271	13 560	14 256

1) The given values are maximum values according to Eurocode 2. The actual values are taken from the standards and regulations in force at the place of use. Conformity with the stabilisation and crack width criteria in the load transfer test has been verified to a load level of $0.80 \cdot F_{pk}$.

2) Overstressing is permitted if the force in the prestressing jack is measured to an accuracy of ± 5 % of the final value of the prestressing force.

Where

F_{pk}....... Characteristic value of maximum force of tendon
$F_{p0.1}$..... Characteristic value of 0.1% proof force of the tendon

Minimum centre spacing of tendon anchorages BT with both, helix and stirrups as additional reinforcement

Tendon			Minimum centre spacing $a_c = b_c$				
$f_{cm, 0, cube, 150}$	MPa		23	28	34	38	43
$f_{cm, 0, cylinder, \varnothing 150}$	MPa		19	23	28	31	35
CONA CME BT 0206	A [1]	mm	210	210	210	210	205
	E [1]	mm	210	210	210	210	210
CONA CME BT 0306	A	mm	210	210	210	210	205
	E	mm	210	210	210	210	210
CONA CME BT 0406	A	mm	235	215	210	210	205
	E	mm	235	215	210	210	210
CONA CME BT 0506	A, E	mm	265	250	250	250	250
CONA CME BT 0606	A, E	mm	290	265	250	250	250
CONA CME BT 0706	A, E	mm	310	285	260	255	255
CONA CME BT 0806	A, E	mm	330	305	280	275	275
CONA CME BT 0906	A, E	mm	350	320	310	310	310
CONA CME BT 1206	A, E	mm	405	370	340	325	310
CONA CME BT 1306	A, E	mm	425	390	355	340	325
CONA CME BT 1506	A, E	mm	455	415	380	365	365
CONA CME BT 1606	A, E	mm	470	430	390	375	365
CONA CME BT 1906	A, E	mm	510	465	425	410	390
CONA CME BT 2206	A, E	mm	550	500	460	440	420
CONA CME BT 2406	A, E	mm	575	525	480	460	435
CONA CME BT 2506	A, E	mm	590	535	485	465	450
CONA CME BT 2706	A, E	mm	610	555	505	485	460
CONA CME BT 3106	A, E	mm	650	595	545	520	495
CONA CME BT 3706	A, E	mm	—	680	680	680	680
CONA CME BT 4206	A, E	mm	—	735	735	735	735
CONA CME BT 4306	A, E	mm	—	755	755	755	755
CONA CME BT 4806	A, E	mm	—	805	805	805	805
CONA CME BT 5506	A, E	mm	—	875	875	875	875
CONA CME BT 6106	A, E	mm	—	940	940	940	940

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

CONA CME	**External Post-tensioning System** Minimum centre spacing of CONA CME BT Helix and stirrups as additional reinforcement	**Annex 26** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Minimum centre spacing of tendon anchorages BT with only helix as additional reinforcement

Tendon			Minimum centre spacing $a_c = b_c$			
$f_{cm, 0, cube, 150}$	MPa		38	43	53	60
$f_{cm, 0, cylinder, \varnothing 150}$	MPa		31	35	43	50
CONA CME BT 0206	A [1]	mm	180	180	180	180
	E [1]	mm	195	195	195	195
CONA CME BT 0306	A	mm	180	180	180	180
	E	mm	195	195	195	195
CONA CME BT 0406	A	mm	200	190	190	180
	E	mm	200	200	200	200
CONA CME BT 0506	A, E	mm	235	230	225	225
CONA CME BT 0606	A, E	mm	245	235	225	225
CONA CME BT 0706	A, E	mm	270	240	230	240
CONA CME BT 0806	A, E	mm	280	270	270	260
CONA CME BT 0906	A, E	mm	305	305	305	305
CONA CME BT 1206	A, E	mm	325	310	310	310
CONA CME BT 1306	A, E	mm	345	340	330	330
CONA CME BT 1506	A, E	mm	355	350	350	350
CONA CME BT 1606	A, E	mm	375	365	350	350
CONA CME BT 1906	A, E	mm	435	390	375	360
CONA CME BT 2206	A, E	mm	435	420	405	380
CONA CME BT 2406	A, E	mm	460	445	435	425
CONA CME BT 2506	A, E	mm	465	445	435	430
CONA CME BT 2706	A, E	mm	480	465	450	430
CONA CME BT 3106	A, E	mm	515	485	460	445
CONA CME BT 3706	A, E	mm	565	520	500	490

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

CONA CME	**External Post-tensioning System** Minimum centre spacing of CONA CME BT Only helix as additional reinforcement	**Annex 27** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Minimum centre spacing of tendon anchorages BT with only stirrups as additional reinforcement

Tendon			Minimum centre spacing $a_c = b_c$			
$f_{cm,\,0,\,cube,\,150}$	MPa		38	43	53	60
$f_{cm,\,0,\,cylinder,\,\varnothing\,150}$	MPa		31	35	43	50
CONA CME BT 0206	A [1]	mm	180	180	180	180
	E [1]	mm	195	195	195	195
CONA CME BT 0306	A	mm	180	180	180	180
	E	mm	195	195	195	195
CONA CME BT 0406	A	mm	200	190	190	180
	E	mm	200	200	200	200
CONA CME BT 0506	A, E	mm	235	230	225	225
CONA CME BT 0606	A, E	mm	245	235	225	225
CONA CME BT 0706	A, E	mm	270	240	230	240
CONA CME BT 0806	A, E	mm	280	270	270	260
CONA CME BT 0906	A, E	mm	305	305	305	305
CONA CME BT 1206	A, E	mm	325	310	310	310
CONA CME BT 1306	A, E	mm	345	340	330	330
CONA CME BT 1506	A, E	mm	355	350	350	350
CONA CME BT 1606	A, E	mm	375	365	350	350
CONA CME BT 1906	A, E	mm	435	390	375	350
CONA CME BT 2206	A, E	mm	435	420	405	380
CONA CME BT 2406	A, E	mm	460	445	435	425
CONA CME BT 2506	A, E	mm	465	445	435	430
CONA CME BT 2706	A, E	mm	480	465	450	430
CONA CME BT 3106	A, E	mm	515	485	460	445
CONA CME BT 3706	A, E	mm	565	520	500	490

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

Minimum centre spacing of tendon anchorages SP with both helix and stirrups as additional reinforcement

Tendon		Minimum centre spacing $a_c = b_c$					
$f_{cm, 0, cube, 150}$	MPa	26	28	34	38	43	46
$f_{cm, 0, cylinder, \varnothing 150}$	MPa	21	23	28	31	35	38
CONA CME SP 0106	mm	120	115	105	100	95	95
CONA CME SP 0206	mm	170	165	150	145	135	135
CONA CME SP 0306	mm	205	200	185	175	170	165
CONA CME SP 0406	mm	235	230	210	200	190	185
CONA CME SP 0506	mm	265	255	240	225	215	210
CONA CME SP 0606	mm	290	280	260	245	230	225
CONA CME SP 0706	mm	315	300	280	270	255	245
CONA CME SP 0806	mm	335	320	300	285	270	260
CONA CME SP 0906	mm	355	340	315	300	285	275
CONA CME SP 1206	mm	410	395	365	345	330	320
CONA CME SP 1306	mm	425	410	380	360	340	330
CONA CME SP 1506	mm	455	440	410	390	370	360
CONA CME SP 1606	mm	470	455	420	400	380	370
CONA CME SP 1906	mm	510	490	455	435	415	405
CONA CME SP 2206	mm	550	530	490	465	445	435
CONA CME SP 2406	mm	575	550	515	485	465	455
CONA CME SP 2506	mm	585	565	520	495	470	460
CONA CME SP 2706	mm	605	585	540	515	490	480
CONA CME SP 3106	mm	650	625	580	555	535	520
CONA CME SP 3706	mm	715	715	715	715	715	715
CONA CME SP 4206	mm	765	765	765	765	765	765
CONA CME SP 4306	mm	775	775	775	775	775	775
CONA CME SP 4806	mm	830	830	830	830	830	830
CONA CME SP 5506	mm	905	905	905	905	905	905
CONA CME SP 6106	mm	960	960	960	960	960	960

Minimum edge distance of tendon anchorages BT with both helix and stirrups as additional reinforcement

Tendon			Minimum edge distance $a_e = b_e$				
$f_{cm, 0, cube, 150}$	MPa		23	28	34	38	43
$f_{cm, 0, cylinder, \varnothing 150}$	MPa		19	23	28	31	35
CONA CME BT 0206	A [1]	mm	95 + c	95 + c	95 + c	95 + c	95 + c
	E [1]	mm	100 + c	100 + c	100 + c	100 + c	100 + c
CONA CME BT 0306	A	mm	95 + c	95 + c	95 + c	95 + c	95 + c
	E	mm	100 + c	100 + c	100 + c	100 + c	100 + c
CONA CME BT 0406	A	mm	110 + c	100 + c	95 + c	95 + c	95 + c
	E	mm	110 + c	100 + c	100 + c	100 + c	100 + c
CONA CME BT 0506	A, E	mm	125 + c	115 + c	115 + c	115 + c	115 + c
CONA CME BT 0606	A, E	mm	135 + c	125 + c	115 + c	115 + c	115 + c
CONA CME BT 0706	A, E	mm	145 + c	135 + c	120 + c	120 + c	120 + c
CONA CME BT 0806	A, E	mm	155 + c	145 + c	130 + c	130 + c	130 + c
CONA CME BT 0906	A, E	mm	165 + c	150 + c	145 + c	145 + c	145 + c
CONA CME BT 1206	A, E	mm	195 + c	175 + c	160 + c	155 + c	145 + c
CONA CME BT 1306	A, E	mm	205 + c	185 + c	170 + c	160 + c	155 + c
CONA CME BT 1506	A, E	mm	220 + c	200 + c	180 + c	175 + c	175 + c
CONA CME BT 1606	A, E	mm	225 + c	205 + c	185 + c	180 + c	175 + c
CONA CME BT 1906	A, E	mm	245 + c	225 + c	205 + c	195 + c	185 + c
CONA CME BT 2206	A, E	mm	265 + c	240 + c	220 + c	210 + c	200 + c
CONA CME BT 2406	A, E	mm	280 + c	255 + c	230 + c	220 + c	210 + c
CONA CME BT 2506	A, E	mm	285 + c	260 + c	235 + c	225 + c	215 + c
CONA CME BT 2706	A, E	mm	295 + c	270 + c	245 + c	235 + c	220 + c
CONA CME BT 3106	A, E	mm	315 + c	290 + c	265 + c	250 + c	240 + c
CONA CME BT 3706	A, E	mm	—	330 + c	330 + c	330 + c	330 + c
CONA CME BT 4206	A, E	mm	—	360 + c	360 + c	360 + c	360 + c
CONA CME BT 4306	A, E	mm	—	370 + c	370 + c	370 + c	370 + c
CONA CME BT 4806	A, E	mm	—	395 + c	395 + c	395 + c	395 + c
CONA CME BT 5506	A, E	mm	—	430 + c	430 + c	430 + c	430 + c
CONA CME BT 6106	A, E	mm	—	460 + c	460 + c	460 + c	460 + c

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

c .....Concrete cover in mm. Standards and regulations on concrete cover in force at the place of use are observed.

Minimum edge distance of tendon anchorages BT with only helix as additional reinforcement

Tendon			Minimum edge distance $a_e = b_e$			
$f_{cm,\ 0,\ cube,\ 150}$	MPa		38	43	53	60
$f_{cm,\ 0,\ cylinder,\ \varnothing\ 150}$	MPa		31	35	43	50
CONA CME BT 0206	A [1]	mm	80 + c	80 + c	80 + c	80 + c
	E [1]	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0306	A	mm	80 + c	80 + c	80 + c	80 + c
	E	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0406	A	mm	90 + c	85 + c	85 + c	80 + c
	E	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0506	A, E	mm	110 + c	105 + c	105 + c	105 + c
CONA CME BT 0606	A, E	mm	115 + c	110 + c	105 + c	105 + c
CONA CME BT 0706	A, E	mm	125 + c	110 + c	105 + c	110 + c
CONA CME BT 0806	A, E	mm	130 + c	125 + c	125 + c	120 + c
CONA CME BT 0906	A, E	mm	145 + c	145 + c	145 + c	145 + c
CONA CME BT 1206	A, E	mm	155 + c	145 + c	145 + c	145 + c
CONA CME BT 1306	A, E	mm	165 + c	160 + c	155 + c	155 + c
CONA CME BT 1506	A, E	mm	170 + c	165 + c	165 + c	165 + c
CONA CME BT 1606	A, E	mm	180 + c	175 + c	165 + c	165 + c
CONA CME BT 1906	A, E	mm	210 + c	185 + c	180 + c	170 + c
CONA CME BT 2206	A, E	mm	210 + c	200 + c	195 + c	180 + c
CONA CME BT 2406	A, E	mm	220 + c	215 + c	210 + c	205 + c
CONA CME BT 2506	A, E	mm	225 + c	215 + c	210 + c	205 + c
CONA CME BT 2706	A, E	mm	230 + c	225 + c	215 + c	205 + c
CONA CME BT 3106	A, E	mm	250 + c	235 + c	220 + c	215 + c
CONA CME BT 3706	A, E	mm	275 + c	250 + c	240 + c	235 + c

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

c ..... Concrete cover in mm. Standards and regulations on concrete cover in force at the place of use are observed.

BBR CONA CME	External Post-tensioning System Minimum edge distance of CONA CME BT Only helix as additional reinforcement	**Annex 31** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Minimum edge distance of tendon anchorages BT with only stirrups as additional reinforcement

Tendon			Minimum edge distance $a_e = b_e$			
$f_{cm, 0, cube, 150}$	MPa		38	43	53	60
$f_{cm, 0, cylinder, \varnothing 150}$	MPa		31	35	43	50
CONA CME BT 0206	A [1]	mm	80 + c	80 + c	80 + c	80 + c
	E [1]	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0306	A	mm	80 + c	80 + c	80 + c	80 + c
	E	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0406	A	mm	90 + c	85 + c	85 + c	80 + c
	E	mm	90 + c	90 + c	90 + c	90 + c
CONA CME BT 0506	A, E	mm	110 + c	105 + c	105 + c	105 + c
CONA CME BT 0606	A, E	mm	115 + c	110 + c	105 + c	105 + c
CONA CME BT 0706	A, E	mm	125 + c	110 + c	105 + c	110 + c
CONA CME BT 0806	A, E	mm	130 + c	125 + c	125 + c	120 + c
CONA CME BT 0906	A, E	mm	145 + c	145 + c	145 + c	145 + c
CONA CME BT 1206	A, E	mm	155 + c	145 + c	145 + c	145 + c
CONA CME BT 1306	A, E	mm	165 + c	160 + c	155 + c	155 + c
CONA CME BT 1506	A, E	mm	170 + c	165 + c	165 + c	165 + c
CONA CME BT 1606	A, E	mm	180 + c	175 + c	165 + c	165 + c
CONA CME BT 1906	A, E	mm	210 + c	185 + c	180 + c	165 + c
CONA CME BT 2206	A, E	mm	210 + c	200 + c	195 + c	180 + c
CONA CME BT 2406	A, E	mm	220 + c	215 + c	210 + c	205 + c
CONA CME BT 2506	A, E	mm	225 + c	215 + c	210 + c	205 + c
CONA CME BT 2706	A, E	mm	230 + c	225 + c	215 + c	205 + c
CONA CME BT 3106	A, E	mm	250 + c	235 + c	220 + c	215 + c
CONA CME BT 3706	A, E	mm	275 + c	250 + c	240 + c	235 + c

[1] A ....Bearing trumplate A
E ....Bearing trumplate E

c .....Concrete cover in mm. Standards and regulations on concrete cover in force at the place of use are observed.

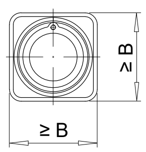
CONA CME	**External Post-tensioning System** Minimum edge distance of CONA CME BT Only stirrups as additional reinforcement	**Annex 32** of European Technical Assessment **ETA-07/0168** of 16.12.2024

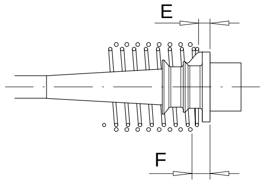
Minimum edge distance of tendon anchorages SP with both helix and stirrups as additional reinforcement

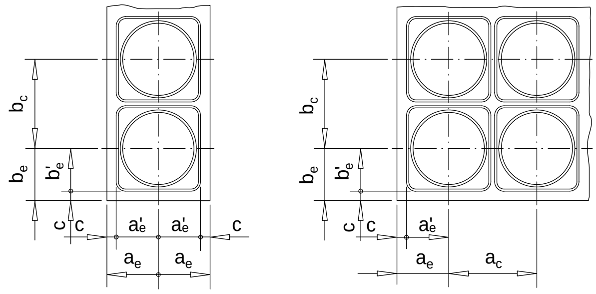
Tendon		Minimum edge distance $a_e = b_e$					
$f_{cm, 0, cube, 150}$	MPa	26	28	34	38	43	46
$f_{cm, 0, cylinder, \varnothing 150}$	MPa	21	23	28	31	35	38
CONA CME SP 0106	mm	50 + c	50 + c	45 + c	40 + c	40 + c	40 + c
CONA CME SP 0206	mm	75 + c	75 + c	65 + c	65 + c	60 + c	60 + c
CONA CME SP 0306	mm	95 + c	90 + c	85 + c	80 + c	75 + c	75 + c
CONA CME SP 0406	mm	110 + c	105 + c	95 + c	90 + c	85 + c	85 + c
CONA CME SP 0506	mm	125 + c	120 + c	110 + c	105 + c	100 + c	95 + c
CONA CME SP 0606	mm	135 + c	130 + c	120 + c	115 + c	105 + c	105 + c
CONA CME SP 0706	mm	150 + c	140 + c	130 + c	125 + c	120 + c	115 + c
CONA CME SP 0806	mm	160 + c	150 + c	140 + c	135 + c	125 + c	120 + c
CONA CME SP 0906	mm	170 + c	160 + c	150 + c	140 + c	135 + c	130 + c
CONA CME SP 1206	mm	195 + c	190 + c	175 + c	165 + c	155 + c	150 + c
CONA CME SP 1306	mm	205 + c	195 + c	180 + c	170 + c	160 + c	155 + c
CONA CME SP 1506	mm	220 + c	210 + c	195 + c	185 + c	175 + c	170 + c
CONA CME SP 1606	mm	225 + c	220 + c	200 + c	190 + c	180 + c	175 + c
CONA CME SP 1906	mm	245 + c	235 + c	220 + c	210 + c	200 + c	195 + c
CONA CME SP 2206	mm	265 + c	255 + c	235 + c	225 + c	215 + c	210 + c
CONA CME SP 2406	mm	280 + c	265 + c	250 + c	235 + c	225 + c	220 + c
CONA CME SP 2506	mm	285 + c	275 + c	250 + c	240 + c	225 + c	220 + c
CONA CME SP 2706	mm	295 + c	285 + c	260 + c	250 + c	235 + c	230 + c
CONA CME SP 3106	mm	315 + c	305 + c	280 + c	270 + c	260 + c	250 + c
CONA CME SP 3706	mm	350 + c	350 + c	350 + c	350 + c	350 + c	350 + c
CONA CME SP 4206	mm	375 + c	375 + c	375 + c	375 + c	375 + c	375 + c
CONA CME SP 4306	mm	380 + c	380 + c	380 + c	380 + c	380 + c	380 + c
CONA CME SP 4806	mm	405 + c	405 + c	405 + c	405 + c	405 + c	405 + c
CONA CME SP 5506	mm	445 + c	445 + c	445 + c	445 + c	445 + c	445 + c
CONA CME SP 6106	mm	470 + c	470 + c	470 + c	470 + c	470 + c	470 + c

c ..... Concrete cover in mm. Standards and regulations on concrete cover in force at the place of use are observed.

Stressing and fixed anchorage or coupler – Centre spacing and edge distance







Bearing trumplate A

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME BT			0206					0306					0406				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area	A_p	mm²	300					450					600				
Char. value of maximum force	F_{pk}	kN	558					837					1 116				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	492					738					984				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	443					664					886				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	467					701					935				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	160	160	160	160	155	160	160	160	160	155	180	160	160	160	155
Bar diameter		mm	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Length approximately		mm	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Pitch		mm	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Number of pitches		—	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Distance	E	mm	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Additional stirrup reinforcement																	
Number of stirrups		—	3	3	3	3	3	4	3	4	4	3	3	3	4	4	3
Bar diameter		mm	8	8	8	8	8	8	10	8	8	10	12	12	10	10	12
Spacing		mm	55	55	55	55	55	45	55	45	45	55	60	55	45	45	55
Distance from anchor plate	F	mm	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Minimum outer dimensions	B × B	mm	190	190	190	190	190	190	190	190	190	190	220	200	190	190	190
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	210	210	210	210	205	210	210	210	210	205	235	215	210	210	205
Min. edge distance + c	a'_e, b'_e	mm	95	95	95	95	95	95	95	95	95	95	110	100	95	95	95

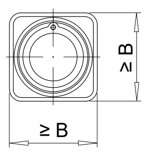
1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.

CONA CME

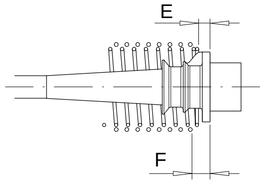
External Post-tensioning System
Anchorage zone of CONA CME BT
Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance

Annex 34
of European Technical Assessment
ETA-07/0168 of 16.12.2024

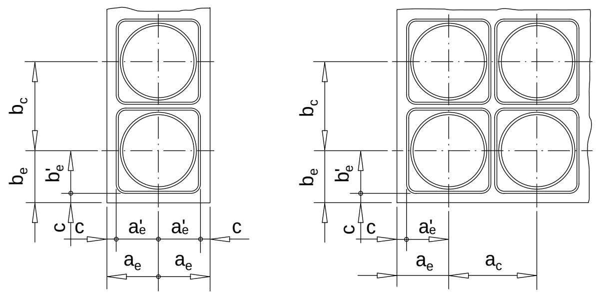
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



Bearing trumplate E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

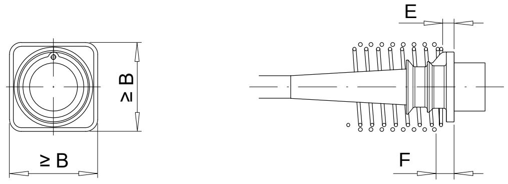


BBR VT CONA CME BT		0206					0306					0406				
Strand arrangement																
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																
Tendon																
Cross-sectional area A_p	mm²	300					450					600				
Char. value of maximum force F_{pk}	kN	558					837					1 116				
Char. value of 0.1% proof force $F_{p0.1}$	kN	492					738					984				
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	443					664					886				
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	467					701					935				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																
Minimum concrete strength																
Cube $f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder $f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																
Outer diameter	mm	175	175	175	175	175	175	175	175	175	175	180	175	175	175	175
Bar diameter	mm	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Length approximately	mm	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Pitch	mm	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Number of pitches	—	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Distance E	mm	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Additional stirrup reinforcement																
Number of stirrups	—	3	3	3	3	3	4	3	4	4	3	3	3	4	4	3
Bar diameter	mm	8	8	8	8	8	8	10	8	8	10	12	12	10	10	12
Spacing	mm	55	55	55	55	55	45	55	45	45	55	60	55	45	45	55
Distance from anchor plate F	mm	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Minimum outer dimensions B × B	mm	195	195	195	195	195	195	195	195	195	195	220	200	195	195	195
Centre spacing and edge distance																
Minimum centre spacing a_c, b_c	mm	210	210	210	210	210	210	210	210	210	210	235	215	210	210	210
Min. edge distance + c a'_e, b'_e	mm	100	100	100	100	100	100	100	100	100	100	110	100	100	100	100

[1)] Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.

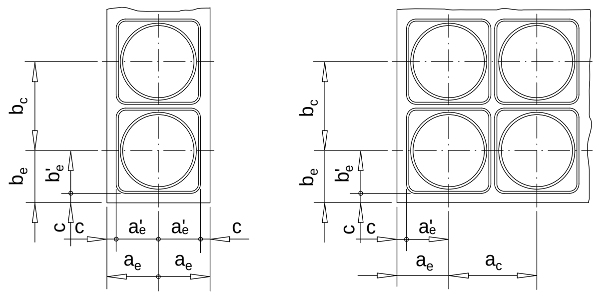
Member of EOTA

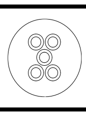
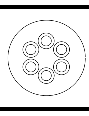
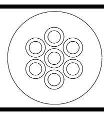
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

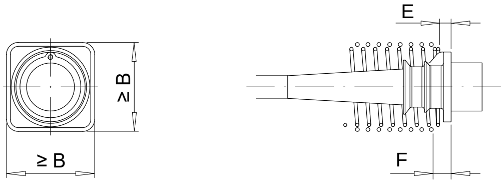


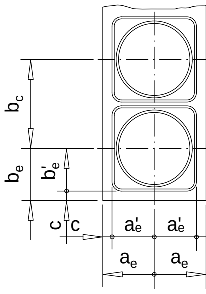
BBR VT CONA CME BT			**0506**					**0606**					**0706**				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area	A_p	mm²	750					900					1 050				
Char. value of maximum force	F_{pk}	kN	1 395					1 674					1 953				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	1 230					1 476					1 722				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	1 107					1 328					1 550				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	1 169					1 402					1 636				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	200	195	195	195	195	200	200	195	195	195	230	200	200	200	200
Bar diameter		mm	10	10	10	10	10	10	10	10	10	10	12	12	12	12	12
Length approximately		mm	230	205	205	245	230	253	230	205	245	230	254	256	231	231	231
Pitch		mm	45	50	50	60	50	45	50	50	60	50	45	50	50	50	50
Number of pitches		—	6	5	5	5	5	6	5	5	5	5	6	6	5	5	5
Distance	E	mm	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Additional stirrup reinforcement																	
Number of stirrups		—	4	4	4	3	4	5	4	5	3	4	5	4	4	4	4
Bar diameter [2)]		mm	12	12	12	12	12	12	12	12	12	12	14	14	12	14	14
Spacing		mm	55	50	50	65	50	50	55	45	65	50	55	60	55	55	55
Distance from anchor plate	F	mm	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Minimum outer dimensions	B × B	mm	250	230	230	230	230	270	250	230	230	230	290	270	240	240	240
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	265	250	250	250	250	290	265	250	250	250	310	285	260	255	255
Min. edge distance + c	a'_e, b'_e	mm	125	115	115	115	115	135	125	115	115	115	145	135	120	120	120

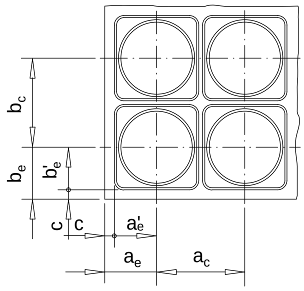
1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME BT Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance	**Annex 36** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

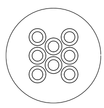
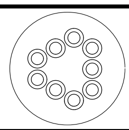
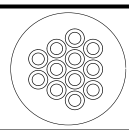






Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME BT			0806					0906					1206				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area	A_p	mm²	1 200					1 350					1 800				
Char. value of maximum force	F_{pk}	kN	2 232					2 511					3 348				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	1 968					2 214					2 952				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	1 771					1 993					2 657				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	1 870					2 103					2 804				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	270	230	225	220	220	280	260	255	250	250	330	280	275	260	250
Bar diameter [2)]		mm	14	12	12	12	12	14	12	12	12	12	14	14	14	14	14
Length approximately		mm	282	256	231	256	256	282	281	281	281	281	332	332	332	332	282
Pitch		mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches		—	6	6	5	6	6	6	6	6	6	6	7	7	7	7	6
Distance	E	mm	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Additional stirrup reinforcement																	
Number of stirrups		—	4	6	5	4	5	5	5	5	4	5	7	6	5	5	6
Bar diameter [2)]		mm	12	12	12	14	14	12	14	12	14	14	12	14	16	16	14
Spacing		mm	70	45	50	55	50	60	55	55	65	55	60	55	70	70	50
Distance from anchor plate	F	mm	33	33	33	33	33	35	35	35	35	35	35	35	35	35	35
Minimum outer dimensions	B × B	mm	310	290	260	260	260	330	300	290	290	290	390	350	320	310	290
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	330	305	280	275	275	350	320	310	310	310	405	370	340	325	310
Min. edge distance + c	a'_e, b'_e	mm	155	145	130	130	130	165	150	145	145	145	195	175	160	155	145

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.

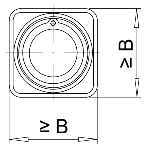
2) Bar diameter of 14 mm can be replaced by 16 mm.

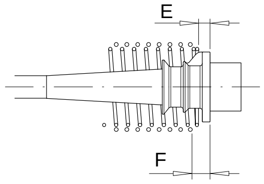
BBR CONA CME

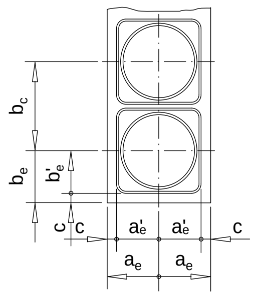
External Post-tensioning System
Anchorage zone of CONA CME BT
Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance

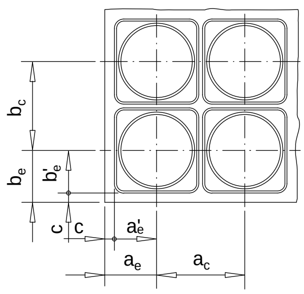
Annex 37
of European Technical Assessment
ETA-07/0168 of 16.12.2024

Stressing and fixed anchorage or coupler – Centre spacing and edge distance



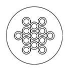
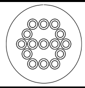
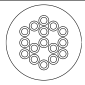






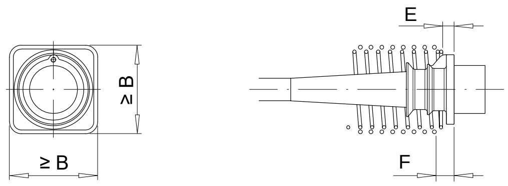
Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME BT			**1306**					**1506**					**1606**				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area	A_p	mm²	1 950					2 250					2 400				
Char. value of maximum force	F_{pk}	kN	3 627					4 185					4 464				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	3 198					3 690					3 936				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	2 878					3 321					3 542				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	3 038					3 506					3 739				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	375	330	300	280	270	375	330	315	305	305	375	330	320	310	305
Bar diameter [2)]		mm	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Length approximately		mm	382	357	382	332	282	432	432	382	332	332	432	432	432	382	332
Pitch		mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches		—	8	8	8	7	6	9	9	8	7	7	9	9	9	8	7
Distance	E	mm	23	23	23	23	23	27	27	27	27	27	27	27	27	27	27
Additional stirrup reinforcement																	
Number of stirrups		—	7	6	6	6	7	7	6	5	6	5	7	6	5	6	6
Bar diameter [2)]		mm	12	14	14	14	14	14	16	16	16	16	14	16	16	16	16
Spacing		mm	55	60	55	60	45	60	65	65	55	60	60	65	65	60	60
Distance from anchor plate	F	mm	40	40	40	40	40	42	42	42	42	42	42	42	42	42	42
Minimum outer dimensions	B × B	mm	410	370	340	320	310	440	400	360	350	350	450	410	370	360	350
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	425	390	355	340	325	455	415	380	365	365	470	430	390	375	365
Min. edge distance + c	a'_e, b'_e	mm	205	185	170	160	155	220	200	180	175	175	225	205	185	180	175

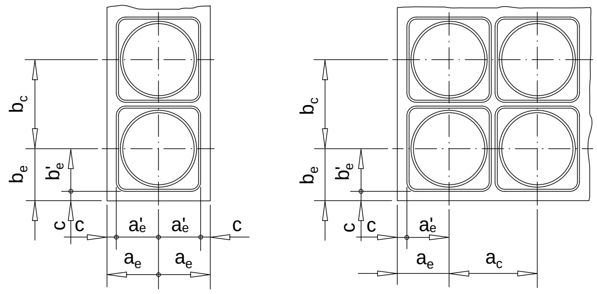
1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

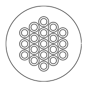
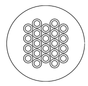
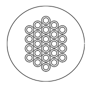
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



BBR VT CONA CME BT			1906					2206					2406				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** 1)																	
Tendon																	
Cross-sectional area	A_p	mm^2	2 850					3 300					3 600				
Char. value of maximum force	F_{pk}	kN	5 301					6 138					6 696				
Char. value of 0.1 % proof force	$F_{p0.1}$	kN	4 674					5 412					5 904				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	4 207					4 871					5 314				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	4 440					5 141					5 609				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	420	360	360	330	325	475	420	390	360	340	475	430	410	360	360
Bar diameter 2)		mm	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Length approximately		mm	457	457	432	432	382	482	482	432	432	382	532	532	482	482	432
Pitch		mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches		—	10	10	9	9	8	10	10	9	9	8	11	11	10	10	9
Distance	E	mm	27	27	27	27	27	31	31	31	31	31	32	32	32	32	32
Additional stirrup reinforcement																	
Number of stirrups		—	7	7	7	7	7	6	7	8	7	8	7	7	7	7	8
Bar diameter		mm	16	16	16	16	16	20	20	20	20	16	20	20	20	20	20
Spacing		mm	65	65	65	65	60	80	75	65	65	50	80	80	70	65	55
Distance from anchor plate	F	mm	42	42	42	42	42	46	46	46	46	46	47	47	47	47	47
Minimum outer dimensions	B × B	mm	490	450	410	390	370	530	480	440	420	400	560	510	460	440	420
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	510	465	425	410	390	550	500	460	440	420	575	525	480	460	435
Min. edge distance + c	a'_e, b'_e	mm	245	225	205	195	185	265	240	220	210	200	280	255	230	220	210

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

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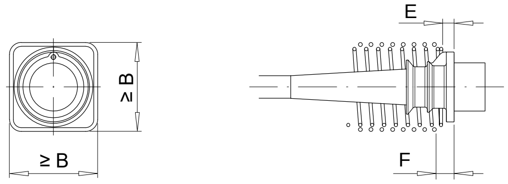
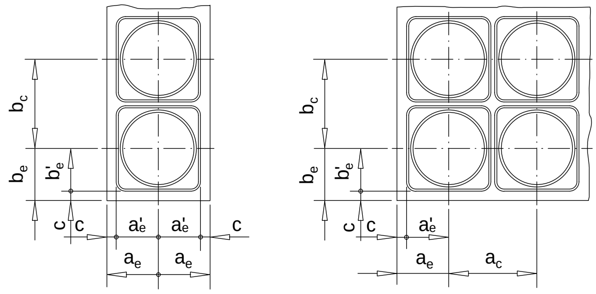
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



BBR VT CONA CME BT			2506					2706					3106				
Strand arrangement			(strand arrangement)					(strand arrangement)					(strand arrangement)				
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1]																	
Tendon																	
Cross-sectional area	A_p	mm²	3 750					4 050					4 650				
Char. value of maximum force	F_{pk}	kN	6 975					7 533					8 649				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	6 150					6 642					7 626				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	5 535					5 978					6 863				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	5 843					6 310					7 245				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	520	430	420	390	380	520	475	440	420	390	560	520	475	430	430
Bar diameter [2]		mm	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Length approximately		mm	532	532	482	482	432	532	532	482	482	432	532	532	582	482	432
Pitch		mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches		—	11	11	10	10	9	11	11	10	10	9	11	11	12	10	9
Distance	E	mm	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Additional stirrup reinforcement																	
Number of stirrups		—	7	6	7	7	7	8	7	7	8	8	9	8	8	8	8
Bar diameter		mm	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Spacing		mm	80	90	70	60	60	80	80	75	60	60	80	75	70	65	60
Distance from anchor plate	F	mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Minimum outer dimensions	B × B	mm	570	520	470	450	430	590	540	490	470	440	630	580	530	500	480
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	590	535	485	465	450	610	555	505	485	460	650	595	545	520	495
Min. edge distance + c	a'_e, b'_e	mm	285	260	235	225	215	295	270	245	235	220	315	290	265	250	240

[1] Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.

[2] Bar diameter of 14 mm can be replaced by 16 mm.

BBR CONA CME	External Post-tensioning System	Annex 40
	Anchorage zone of CONA CME BT Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance	of European Technical Assessment **ETA-07/0168** of 16.12.2024

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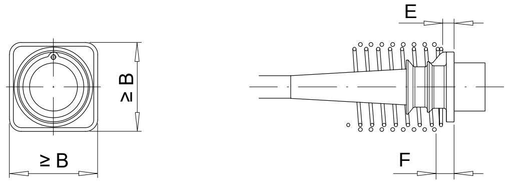
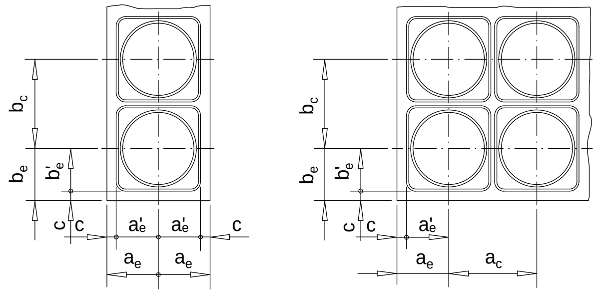
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



Bearing trumplate A and E

$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



BBR VT CONA CME BT			**3706**					**4206**					**4306**				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm^2** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area	A_p	mm^2	5 550					6 300					6 450				
Char. value of maximum force	F_{pk}	kN	10 323					11 718					11 997				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	9 102					10 332					10 578				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	8 192					9 299					9 520				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	8 647					9 815					10 049				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	**$f_{cm, 0, cube, 150}$**	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	**$f_{cm, 0, cylinder, \varnothing 150}$**	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	—	580	580	580	580	—	630	630	630	630	—	670	670	670	670
Bar diameter		mm	—	16	16	16	16	—	16	16	16	16	—	16	16	16	16
Length approximately		mm	—	533	533	533	533	—	583	583	583	583	—	583	583	583	583
Pitch		mm	—	50	50	50	50	—	50	50	50	50	—	50	50	50	50
Number of pitches		—	—	11	11	11	11	—	12	12	12	12	—	12	12	12	12
Distance	E	mm	—	40	40	40	40	—	45	45	45	45	—	45	45	45	45
Additional stirrup reinforcement																	
Number of stirrups		—	—	9	9	9	9	—	10	10	10	10	—	10	10	10	10
Bar diameter		mm	—	20	20	20	20	—	20	20	20	20	—	20	20	20	20
Spacing		mm	—	70	70	70	70	—	70	70	70	70	—	70	70	70	70
Distance from anchor plate	F	mm	—	50	50	50	50	—	55	55	55	55	—	55	55	55	55
Minimum outer dimensions	B × B	mm	—	660	660	660	660	—	720	720	720	720	—	740	740	740	740
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	—	680	680	680	680	—	735	735	735	735	—	755	755	755	755
Min. edge distance + c	a'_e, b'_e	mm	—	330	330	330	330	—	360	360	360	360	—	370	370	370	370

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm^2 or with characteristic tensile strength below 1 860 MPa may also be used.

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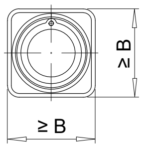
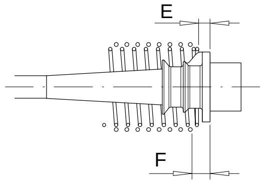
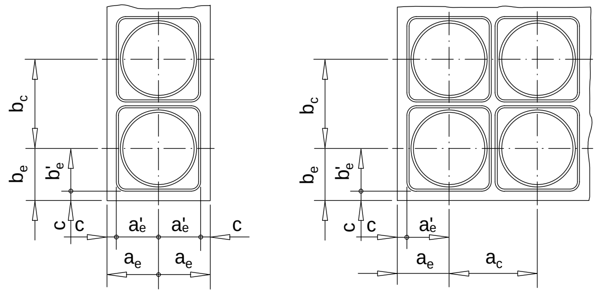
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

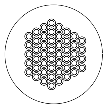
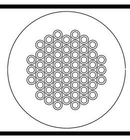
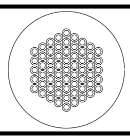






Bearing trumplate A and E

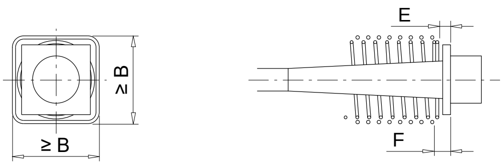
$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

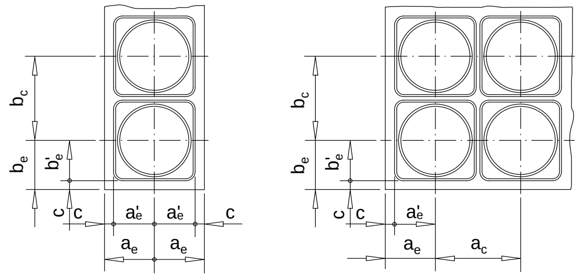
BBR VT CONA CME BT			**4806**					**5506**					**6106**				
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1]																	
Tendon																	
Cross-sectional area	A_p	mm²	7 200					8 250					9 150				
Char. value of maximum force	F_{pk}	kN	13 392					15 345					17 019				
Char. value of 0.1% proof force	$F_{p0.1}$	kN	11 808					13 530					15 006				
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	10 627					12 177					13 505				
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	11 218					12 854					14 256				
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**	**23**	**28**	**34**	**38**	**43**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**	**19**	**23**	**28**	**31**	**35**
Helix																	
Outer diameter		mm	—	710	710	710	710	—	780	780	780	780	—	850	850	850	850
Bar diameter		mm	—	16	16	16	16	—	20	20	20	20	—	20	20	20	20
Length approximately		mm	—	633	633	633	633	—	760	760	760	760	—	790	790	790	790
Pitch		mm	—	50	50	50	50	—	60	60	60	60	—	60	60	60	60
Number of pitches		—	—	13	13	13	13	—	13	13	13	13	—	14	14	14	14
Distance	E	mm	—	45	45	45	45	—	50	50	50	50	—	55	55	55	55
Additional stirrup reinforcement																	
Number of stirrups		—	—	11	11	11	11	—	11	11	11	11	—	12	12	12	12
Bar diameter		mm	—	20	20	20	20	—	20	20	20	20	—	20	20	20	20
Spacing		mm	—	70	70	70	70	—	75	75	75	75	—	75	75	75	75
Distance from anchor plate	F	mm	—	55	55	55	55	—	55	55	55	55	—	60	60	60	60
Minimum outer dimensions	B × B	mm	—	790	790	790	790	—	860	860	860	860	—	920	920	920	920
Centre spacing and edge distance																	
Minimum centre spacing	a_c, b_c	mm	—	805	805	805	805	—	875	875	875	875	—	940	940	940	940
Min. edge distance + c	a'_e, b'_e	mm	—	395	395	395	395	—	430	430	430	430	—	460	460	460	460

[1] Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.

OIB Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance





$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME SP			0106					
Strand arrangement			◎					
7-wire prestressing steel strand – Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1)]								
Tendon								
Cross-sectional area	A_p	mm^2	150					
Char. value of maximum force	F_{pk}	kN	279					
Char. value of 0.1 % proof force	$F_{p0.1}$	kN	246					
Maximum prestressing force	$0.90 \cdot F_{p0.1}$	kN	221					
Maximum overstressing force	$0.95 \cdot F_{p0.1}$	kN	234					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions								
Minimum concrete strength								
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa								
Outer diameter		mm	100	100	75	75	75	75
Bar diameter		mm	10	10	10	8	8	8
Length approximately		mm	100	100	78	76	76	76
Pitch		mm	45	45	45	45	45	45
Number of pitches		—	3	3	2.5	2.5	2.5	2.5
Distance	E	mm	20	20	20	20	20	20
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa								
Number of stirrups		—	2	2	2	2	2	2
Bar diameter		mm	6	6	6	6	6	6
Spacing		mm	80	75	70	65	60	60
Distance from anchor plate	F	mm	40	40	40	40	40	40
Minimum outer dimensions	B × B	mm	100	95	85	80	75	75
Centre spacing and edge distance								
Minimum centre spacing	a_c, b_c	mm	120	115	105	100	95	95
Min. edge distance + c	a'_e, b'_e	mm	50	50	45	40	40	40
Square plate dimensions [2)]								
Side length	S_{SP}	mm	80	80	80	80	80	80
Thickness	T_{SP}	mm	20	20	20	20	20	20

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

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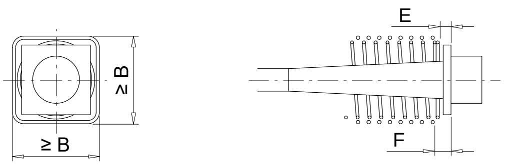
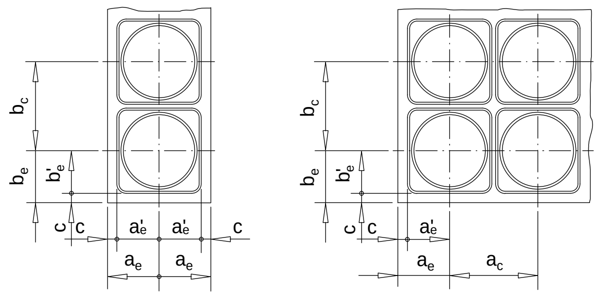
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



BBR VT CONA CME SP		0206						0306						0406					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1)]																			
Tendon																			
Cross-sectional area A_p	mm^2	300						450						600					
Char. value of maximum force F_{pk}	kN	558						837						1 116					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	492						738						984					
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	443						664						886					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	467						701						935					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	130	130	100	100	100	100	165	160	130	130	120	120	195	190	165	150	145	140
Bar diameter	mm	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Length approximately	mm	145	145	123	123	123	123	168	168	145	145	145	145	190	190	168	168	168	168
Pitch	mm	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Number of pitches	—	4	4	3.5	3.5	3.5	3.5	4.5	4.5	4	4	4	4	5	5	4.5	4.5	4.5	4.5
Distance E	mm	20	20	20	20	20	20	20	20	20	20	20	20	25	25	25	25	25	25
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	2	2	3	3	2	2	3	3	6	5	5	5	4	3	5	4	4	4
Bar diameter	mm	6	6	6	6	6	6	10	10	8	8	8	8	10	10	10	10	10	10
Spacing	mm	110	110	60	55	90	90	80	80	30	35	35	35	65	90	45	55	50	50
Distance from anchor plate F	mm	40	40	40	40	40	40	40	40	40	40	40	40	45	45	45	45	45	45
Minimum outer dimensions B × B	mm	150	145	130	125	115	115	185	180	165	155	150	145	215	210	190	180	170	165
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	170	165	150	145	135	135	205	200	185	175	170	165	235	230	210	200	190	185
Min. edge distance + c a'_e, b'_e	mm	75	75	65	65	60	60	95	90	85	80	75	75	110	105	95	90	85	85
Square plate dimensions [2)]																			
Side length S_{SP}	mm	140	140	140	140	135	135	145	145	145	140	140	140	155	155	155	155	150	150
Thickness T_{SP}	mm	20	20	20	20	20	20	20	20	20	20	20	20	25	25	25	25	25	25

[1)] Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
[2)] The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

CONA CME

External Post-tensioning System
Anchorage zone of CONA CME SP
Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance – Square plate dimensions

Annex 44
of European Technical Assessment
ETA-07/0168 of 16.12.2024

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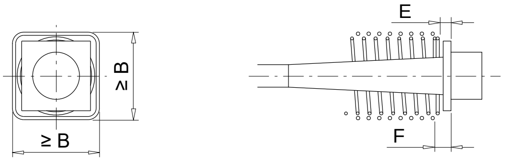
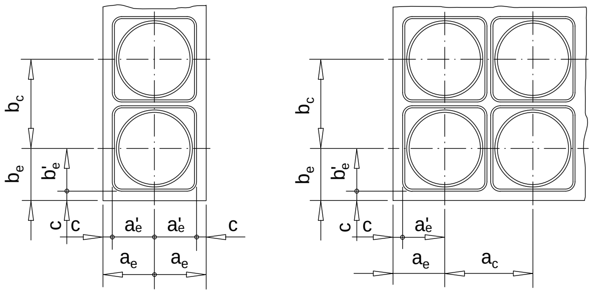
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

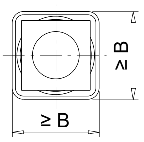


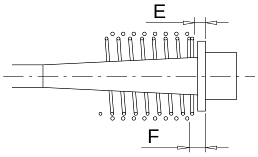
BBR VT CONA CME SP		0506						0606						0706					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1)]																			
Tendon																			
Cross-sectional area A_p	mm²	750						900						1 050					
Char. value of maximum force F_{pk}	kN	1 395						1 674						1 953					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	1 230						1 476						1 722					
Maxi. prestressing force $0.90 \cdot F_{p0.1}$	kN	1 107						1 328						1 550					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	1 169						1 402						1 636					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm,0,cube,150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm,0,cylinder,\varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	215	200	185	170	160	160	250	230	210	180	175	175	260	255	220	210	195	190
Bar diameter	mm	10	10	10	10	10	10	10	10	12	12	12	12	10	10	12	12	12	12
Length approximately	mm	235	213	210	185	185	185	235	235	212	212	187	187	258	258	237	237	212	212
Pitch	mm	45	45	50	50	50	50	45	45	50	50	50	50	45	45	50	50	50	50
Number of pitches	—	6	5.5	5	4.5	4.5	4.5	6	6	5	5	4.5	4.5	6.5	6.5	5.5	5.5	5	5
Distance E	mm	30	30	30	30	30	30	35	35	35	35	35	35	35	35	35	35	35	35
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	2	2	5	4	4	3	3	2	4	3	3	3	5	4	5	5	5	4
Bar diameter	mm	12	12	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12	12
Spacing	mm	175	170	50	60	60	80	115	185	70	95	90	90	70	85	60	60	55	70
Distance from anchor plate F	mm	50	50	50	50	50	50	55	55	55	55	55	55	55	55	55	55	55	55
Minimum outer dimensions B × B	mm	245	235	220	205	195	190	270	260	240	225	210	205	295	280	260	250	235	225
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	265	255	240	225	215	210	290	280	260	245	230	225	315	300	280	270	255	245
Min. edge distance + c a'_e, b'_e	mm	125	120	110	105	100	95	135	130	120	115	105	105	150	140	130	125	120	115
Square plate dimensions [2)]																			
Side length S_{SP}	mm	185	185	185	185	180	180	190	190	190	190	185	185	205	205	205	200	195	195
Thickness T_{SP}	mm	30	30	30	30	30	30	35	35	35	35	35	35	35	35	35	35	35	35

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

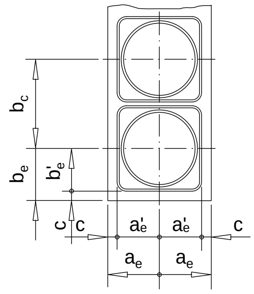
CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME SP Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance – Square plate dimensions	**Annex 45** of European Technical Assessment **ETA-07/0168** of 16.12.2024

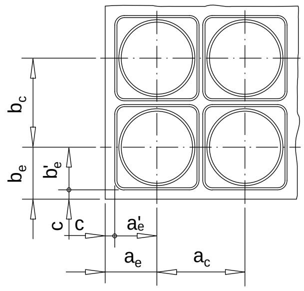
Stressing and fixed anchorage or coupler – Centre spacing and edge distance





$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover





BBR VT CONA CME SP			0806						0906						1206					
Strand arrangement			(strand arrangement)						(strand arrangement)						(strand arrangement)					
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1]																				
Tendon																				
Cross-sectional area	A_p	mm²	1 200						1 350						1 800					
Char. value of maximum force	F_{pk}	kN	2 232						2 511						3 348					
Char. value of 0.1 % proof force	$F_{p0.1}$	kN	1 968						2 214						2 952					
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	1 771						1 993						2 657					
Maximum overstressing force	$0.95 \cdot F_{p0.1}$	kN	1 870						2 103						2 804					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																				
Minimum concrete strength																				
Cube	$f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder	$f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																				
Outer diameter		mm	280	270	230	215	205	200	295	280	240	225	215	215	325	320	290	280	270	260
Bar diameter [2]		mm	10	10	12	12	12	12	10	10	10	10	12	12	12	12	12	14	14	14
Length approximately		mm	280	258	237	237	237	212	280	280	260	260	262	212	327	327	312	289	289	239
Pitch		mm	45	45	50	50	50	50	45	45	50	50	50	50	45	45	50	50	50	50
Number of pitches		—	7	6.5	5.5	5.5	5.5	5	7	7	6	6	6	5	8	8	7	6.5	6.5	5.5
Distance	E	mm	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																				
Number of stirrups		—	5	4	3	3	3	3	5	4	4	4	3	4	7	6	7	6	6	6
Bar diameter [2]		mm	12	12	16	16	16	16	12	12	16	16	16	16	14	14	16	16	16	16
Spacing		mm	70	90	120	110	105	100	75	75	90	85	110	75	55	55	55	60	60	55
Distance from anchor plate	F	mm	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Minimum outer dimensions	B × B	mm	315	300	280	265	250	240	330	320	295	280	265	255	385	375	345	325	310	300
Centre spacing and edge distance																				
Minimum centre spacing	a_c, b_c	mm	335	320	300	285	270	260	355	340	315	300	285	275	410	395	365	345	330	320
Min. edge distance + c	a'_e, b'_e	mm	160	150	140	135	125	120	170	160	150	140	135	130	195	190	175	165	155	150
Square plate dimensions [3]																				
Side length	S_{SP}	mm	225	225	225	220	215	215	255	255	250	245	240	240	265	265	265	260	255	250
Thickness	T_{SP}	mm	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

[1] Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
[2] Bar diameter of 14 mm can be replaced by 16 mm.
[3] The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

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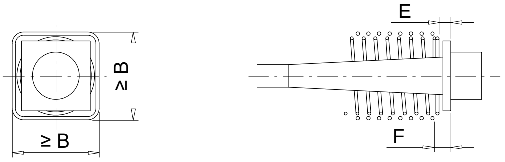
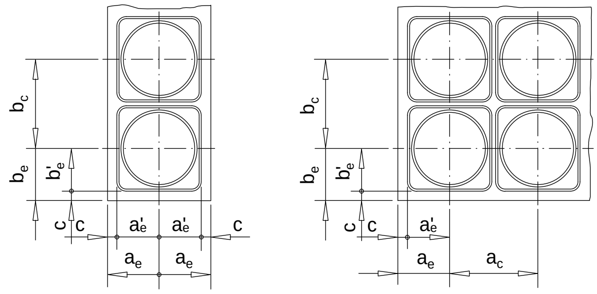
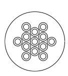
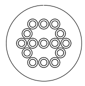
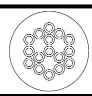
Stressing and fixed anchorage or coupler – Centre spacing and edge distance





$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME SP		1306						1506						1606					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** 1)																			
Tendon																			
Cross-sectional area A_p	mm^2	1 950						2 250						2 400					
Char. value of maximum force F_{pk}	kN	3 627						4 185						4 464					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	3 198						3 690						3 936					
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	2 878						3 321						3 542					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	3 038						3 506						3 739					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	340	330	305	290	280	270	370	350	325	300	290	280	390	370	340	330	310	310
Bar diameter 2)	mm	12	12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Length approximately	mm	350	327	312	314	289	264	389	364	339	339	314	289	389	389	364	339	339	289
Pitch	mm	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches	—	8.5	8	7	7	6.5	6	8.5	8	7.5	7.5	7	6.5	8.5	8.5	8	7.5	7.5	6.5
Distance E	mm	40	40	40	40	40	40	45	45	45	45	45	45	45	45	45	45	45	45
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	7	6	6	6	6	6	7	6	6	6	6	6	7	6	7	6	6	7
Bar diameter 2)	mm	14	14	16	16	16	16	14	14	16	16	16	16	14	14	16	16	16	16
Spacing	mm	65	65	65	65	60	60	70	70	70	70	65	65	70	70	60	70	65	55
Distance from anchor plate F	mm	60	60	60	60	60	60	65	65	65	65	65	65	65	65	65	65	65	65
Minimum outer dimensions B × B	mm	405	390	360	340	320	310	435	420	390	370	350	340	450	435	400	380	360	350
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	425	410	380	360	340	330	455	440	410	390	370	360	470	455	420	400	380	370
Min. edge distance + c a'_e, b'_e	mm	205	195	180	170	160	155	220	210	195	185	175	170	225	220	200	190	180	175
Square plate dimensions 3)																			
Side length S_{SP}	mm	285	285	280	275	270	270	320	320	315	310	305	300	330	330	325	320	315	305
Thickness T_{SP}	mm	40	40	40	40	40	40	45	45	45	45	45	45	45	45	45	45	45	45

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.
3) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME SP Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance – Square plate dimensions	**Annex 47** of European Technical Assessment **ETA-07/0168** of 16.12.2024

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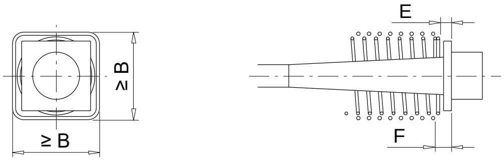
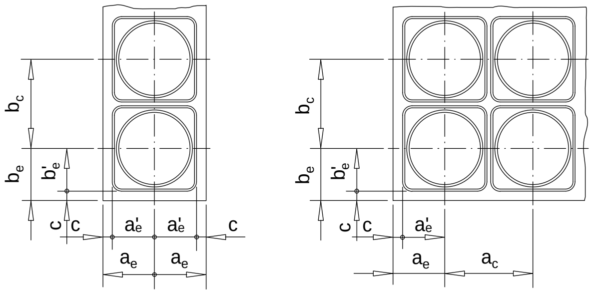
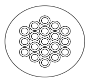
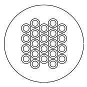
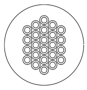
Stressing and fixed anchorage or coupler – Centre spacing and edge distance



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



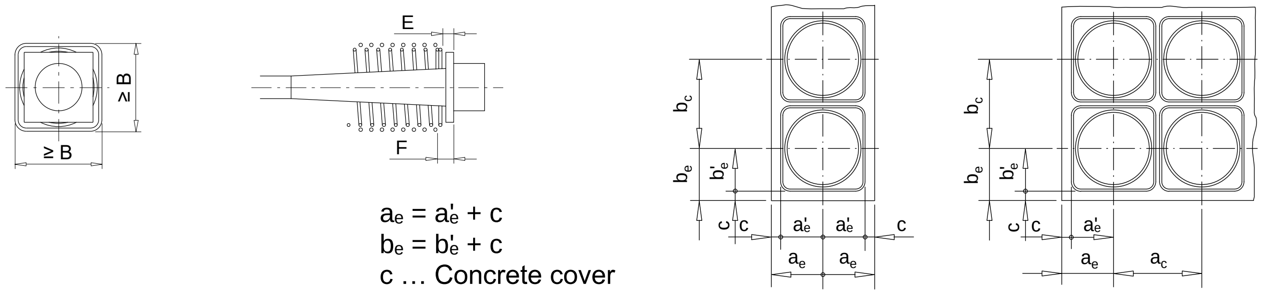
BBR VT CONA CME SP			1906						2206						2406					
Strand arrangement																				
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** 1)																				
Tendon																				
Cross-sectional area	A_p	mm²	2 850						3 300						3 600					
Char. value of maximum force	F_{pk}	kN	5 301						6 138						6 696					
Char. value of 0.1 % proof force	$F_{p0.1}$	kN	4 674						5 412						5 904					
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	4 207						4 871						5 314					
Maximum overstressing force	$0.95 \cdot F_{p0.1}$	kN	4 440						5 141						5 609					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																				
Minimum concrete strength																				
Cube	$f_{cm,\,0,\,cube,\,150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder	$f_{cm,\,0,\,cylinder,\,\varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																				
Outer diameter		mm	435	410	380	350	340	340	460	430	400	360	350	350	480	460	410	370	360	360
Bar diameter		mm	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Length approximately		mm	391	391	391	366	341	291	441	441	416	391	366	316	466	441	416	416	391	341
Pitch		mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches		—	8.5	8.5	8.5	8	7.5	6.5	9.5	9.5	9	8.5	8	7	10	9.5	9	9	8.5	7.5
Distance	E	mm	50	50	50	45	45	45	55	55	55	55	55	55	55	55	55	55	55	55
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																				
Number of stirrups		—	7	6	9	8	7	7	7	6	9	8	8	7	7	6	9	8	8	7
Bar diameter 3)		mm	14	16	16	16	16	16	16	16	16	16	16	16	20	20	20	20	20	20
Spacing		mm	70	85	50	55	60	55	80	80	55	60	55	55	90	100	70	70	70	80
Distance from anchor plate	F	mm	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Minimum outer dimensions	B × B	mm	490	470	435	415	395	385	530	510	470	445	425	415	550	530	495	465	445	435
Centre spacing and edge distance																				
Minimum centre spacing	a_c, b_c	mm	510	490	455	435	415	405	550	530	490	465	445	435	575	550	515	485	465	455
Min. edge distance + c	a'_e, b'_e	mm	245	235	220	210	200	195	265	255	235	225	215	210	280	265	250	235	225	220
Square plate dimensions 2)																				
Side length	S_{SP}	mm	340	340	335	325	320	310	370	370	365	355	345	345	390	390	385	375	370	370
Thickness	T_{SP}	mm	50	50	50	45	45	45	55	55	55	55	55	55	55	55	55	55	55	55

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.
3) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME SP Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance – Square plate dimensions	**Annex 48** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance



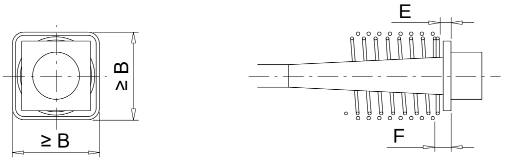
$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover

BBR VT CONA CME SP		2506						2706						3106					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1)]																			
Tendon																			
Cross-sectional area A_p	mm²	3 750						4 050						4 650					
Char. value of maximum force F_{pk}	kN	6 975						7 533						8 649					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	6 150						6 642						7 626					
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	5 535						5 978						6 863					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	5 843						6 310						7 245					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm,0,cube,150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm,0,cylinder,\varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	500	480	420	380	370	370	520	500	450	400	390	380	560	540	480	430	430	430
Bar diameter	mm	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Length approximately	mm	466	466	441	441	391	366	491	491	441	441	416	391	516	516	466	466	416	391
Pitch	mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches	—	10	10	9.5	9.5	8.5	8	10.5	10.5	9.5	9.5	9	8.5	11	11	10	10	9	8.5
Distance E	mm	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	7	6	9	8	8	6	6	5	7	6	6	6	8	7	10	9	8	8
Bar diameter	mm	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Spacing	mm	100	100	70	70	70	80	100	100	80	90	85	70	80	95	60	65	70	65
Distance from anchor plate F	mm	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Minimum outer dimensions B × B	mm	565	545	500	475	450	440	585	565	520	495	470	460	630	605	560	535	515	500
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	585	565	520	495	470	460	605	585	540	515	490	480	650	625	580	555	535	520
Min. edge distance + c a'_e, b'_e	mm	285	275	250	240	225	220	295	285	260	250	235	230	315	305	280	270	260	250
Square plate dimensions [2)]																			
Side length S_{SP}	mm	405	405	405	395	385	385	415	415	410	400	395	395	440	440	435	425	420	415
Thickness T_{SP}	mm	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

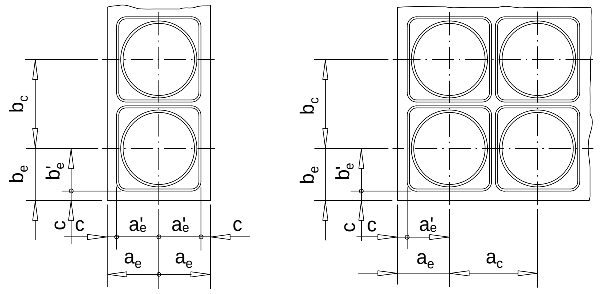
1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

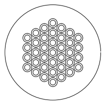
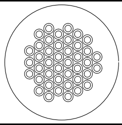
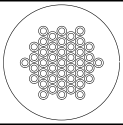
OIB Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover



BBR VT CONA CME SP		3706						4206						4306					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1)]																			
Tendon																			
Cross-sectional area A_p	mm²	5 550						6 300						6 450					
Char. value of maximum force F_{pk}	kN	10 323						11 718						11 997					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	9 102						10 332						10 578					
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	8 192						9 299						9 520					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	8 647						9 815						10 049					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	620	620	620	620	620	620	660	660	660	660	660	660	670	670	670	670	670	670
Bar diameter	mm	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Length approximately	mm	566	566	566	566	566	566	616	616	616	616	616	616	666	666	666	666	666	666
Pitch	mm	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Number of pitches	—	12	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14	14	14
Distance E	mm	70	70	70	70	70	70	75	75	75	75	75	75	75	75	75	75	75	75
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Bar diameter	mm	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Spacing	mm	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Distance from anchor plate F	mm	90	90	90	90	90	90	95	95	95	95	95	95	95	95	95	95	95	95
Minimum outer dimensions B × B	mm	695	695	695	695	695	695	745	745	745	745	745	745	755	755	755	755	755	755
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	715	715	715	715	715	715	765	765	765	765	765	765	775	775	775	775	775	775
Min. edge distance + c a'_e, b'_e	mm	350	350	350	350	350	350	375	375	375	375	375	375	380	380	380	380	380	380
Square plate dimensions [2)]																			
Side length S_{SP}	mm	480	480	480	480	480	480	510	510	510	510	510	510	520	520	520	520	520	520
Thickness T_{SP}	mm	70	70	70	70	70	70	75	75	75	75	75	75	75	75	75	75	75	75

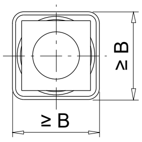
1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

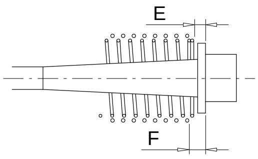
BBR CONA CME

External Post-tensioning System
Anchorage zone of CONA CME SP
Minimum concrete strength – Helix and stirrups as additional reinforcement – Centre spacing and edge distance – Square plate dimensions

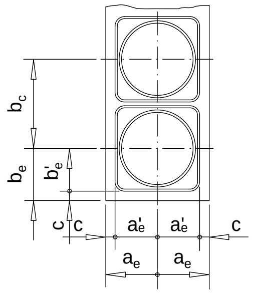
Annex 50
of European Technical Assessment
ETA-07/0168 of 16.12.2024

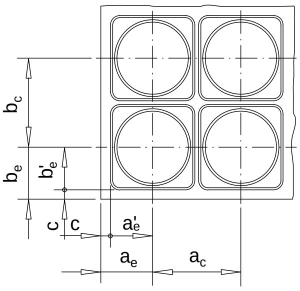
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

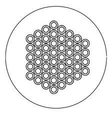
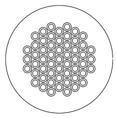
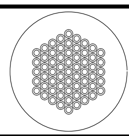




$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover





BBR VT CONA CME SP		4806						5506						6106					
Strand arrangement																			
7-wire prestressing steel strand Nominal diameter **15.7 mm** … Nominal cross-sectional area **150 mm²** … Maximum characteristic tensile strength **1 860 MPa** [1]																			
Tendon																			
Cross-sectional area A_p	mm²	7 200						8 250						9 150					
Char. value of maximum force F_{pk}	kN	13 392						15 345						17 019					
Char. value of 0.1 % proof force $F_{p0.1}$	kN	11 808						13 530						15 006					
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	10 627						12 177						13 505					
Maximum overstressing force $0.95 \cdot F_{p0.1}$	kN	11 218						12 854						14 256					
Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube $f_{cm, 0, cube, 150}$	**MPa**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**	**26**	**28**	**34**	**38**	**43**	**46**
Cylinder $f_{cm, 0, cylinder, \varnothing 150}$	**MPa**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**	**21**	**23**	**28**	**31**	**35**	**38**
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Outer diameter	mm	720	720	720	720	720	720	790	790	790	790	790	790	860	860	860	860	860	860
Bar diameter	mm	20	20	20	20	20	20	25	25	25	25	25	25	25	25	25	25	25	25
Length approximately	mm	860	860	860	860	860	860	940	940	940	940	940	940	985	985	985	985	985	985
Pitch	mm	60	60	60	60	60	60	70	70	70	70	70	70	60	60	60	60	60	60
Number of pitches	—	15	15	15	15	15	15	14	14	14	14	14	14	17	17	17	17	17	17
Distance E	mm	80	80	80	80	80	80	90	90	90	90	90	90	90	90	90	90	90	90
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																			
Number of stirrups	—	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
Bar diameter	mm	20	20	20	20	20	20	16	16	16	16	16	16	16	16	16	16	16	16
Spacing	mm	75	75	75	75	75	75	70	70	70	70	70	70	70	70	70	70	70	70
Distance from anchor plate F	mm	100	100	100	100	100	100	110	110	110	110	110	110	110	110	110	110	110	110
Minimum outer dimensions B × B	mm	810	810	810	810	810	810	885	885	885	885	885	885	940	940	940	940	940	940
Centre spacing and edge distance																			
Minimum centre spacing a_c, b_c	mm	830	830	830	830	830	830	905	905	905	905	905	905	960	960	960	960	960	960
Min. edge distance + c a'_e, b'_e	mm	405	405	405	405	405	405	445	445	445	445	445	445	470	470	470	470	470	470
Square plate dimensions [2]																			
Side length S_{SP}	mm	550	550	550	550	550	550	595	595	595	595	595	595	620	620	620	620	620	620
Thickness T_{SP}	mm	80	80	80	80	80	80	90	90	90	90	90	90	90	90	90	90	90	90

1) Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1 860 MPa may also be used.
2) The square plate dimensions are minimum values, therefore larger or thicker plates may be used.

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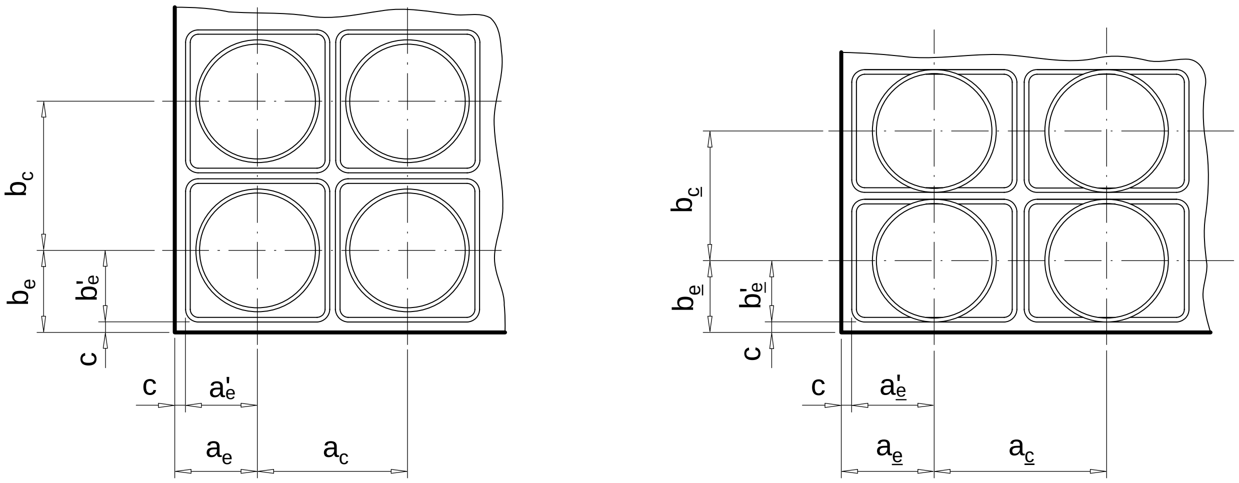
Modification of centre spacing and edge distance



a_c, b_c
a_e, b_e

$a_{\underline{c}} \geq b_{\underline{c}}$
$a_{\underline{e}} \geq b_{\underline{e}}$

Modification of centre spacing and edge distance are in accordance with Clause 1.9.

$$b_{\underline{c}} \geq \begin{cases} 0.85 \cdot b_c \\ \text{and} \\ \geq \text{Helix, outside diameter}^{1)} \end{cases}$$

$$a_{\underline{c}} \geq \frac{A_c}{b_{\underline{c}}}$$

$$A_c = a_c \cdot b_c \leq a_{\underline{c}} \cdot b_{\underline{c}}$$

Corresponding edge distances

$$a_{\underline{e}} = \frac{a_{\underline{c}}}{2} - 10\text{ mm} + c$$

and

$$b_{\underline{e}} = \frac{b_{\underline{c}}}{2} - 10\text{ mm} + c$$

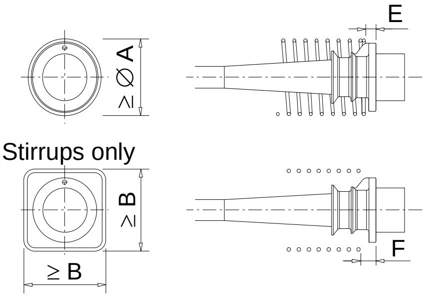
c..... Concrete cover

1) Except the dimensions of helix, the outer dimensions of the additional stirrup reinforcement are adjusted accordingly. Further modifications of reinforcement are in accordance with the Clauses 1.14.11 and 2.2.3.4.

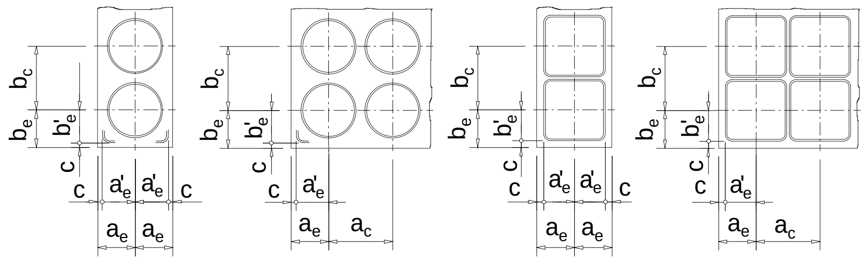
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement
Helix only

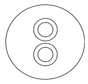
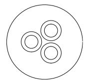
Stirrups only



Bearing trumplate A



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

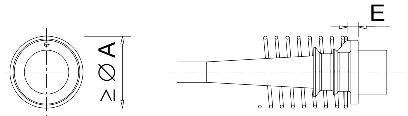
Technical data of anchorages																		
BBR VT CONA CME BT			**0206**								**0306**							
Strand arrangement																		
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																		
Tendon																		
Cross-sectional area	A_p	mm²	300								450							
Char. maximum force	F_{pk}	kN	558								837							
Char. 0.1 % proof force	$F_{p0.1}$	kN	492								738							
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	443								664							
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	467								701							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																		
Minimum concrete strength																		
Cube	$f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder	$f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Outer diameter	∅ A	mm	155	—	155	—	155	—	155	—	155	—	155	—	155	—	155	—
Bar diameter		mm	8	—	8	—	8	—	8	—	8	—	8	—	8	—	8	—
Length, approximately		mm	153	—	153	—	153	—	153	—	153	—	153	—	153	—	153	—
Pitch		mm	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—
Number of pitches		—	4	—	4	—	4	—	4	—	4	—	4	—	4	—	4	—
Distance	E	mm	15	—	15	—	15	—	15	—	15	—	15	—	15	—	15	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Number of stirrups		—	—	5	—	5	—	5	—	5	—	5	—	5	—	5	—	5
Bar diameter		mm	—	10	—	10	—	10	—	10	—	10	—	10	—	10	—	10
Spacing		mm	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45
Distance	F	mm	—	15	—	15	—	15	—	15	—	15	—	15	—	15	—	15
Minimum outer dimensions	B × B	mm	—	160	—	160	—	160	—	160	—	160	—	160	—	160	—	160
Centre spacing and edge distance																		
Minimum centre spacing	a_c, b_c	mm	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Min. edge distance + c	a'_e, b'_e	mm	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

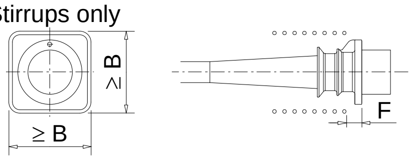
BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME BT Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance	**Annex 53** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

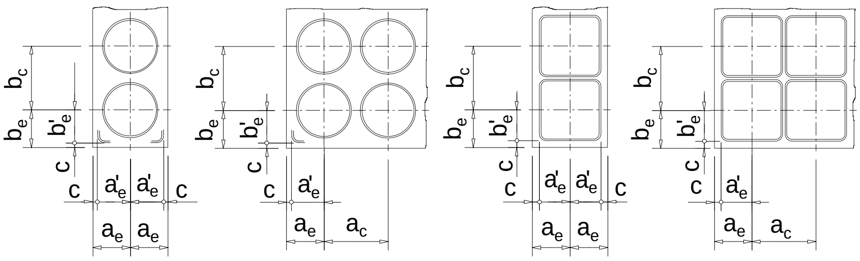
Additional reinforcement
Helix only



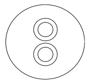
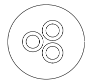
Stirrups only



Bearing trumplate E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

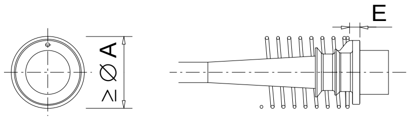
Technical data of anchorages																	
BBR VT CONA CME BT		**0206**								**0306**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	300								450							
Char. maximum force F_{pk}	kN	558								837							
Char. 0.1 % proof force $F_{p0.1}$	kN	492								738							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	443								664							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	467								701							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	170	—	170	—	170	—	170	—	170	—	170	—	170	—	170	—
Bar diameter	mm	8	—	8	—	8	—	8	—	8	—	8	—	8	—	8	—
Length, approximately	mm	153	—	153	—	153	—	153	—	153	—	153	—	153	—	153	—
Pitch	mm	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—
Number of pitches	—	4	—	4	—	4	—	4	—	4	—	4	—	4	—	4	—
Distance E	mm	15	—	15	—	15	—	15	—	15	—	15	—	15	—	15	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	5	—	5	—	5	—	5	—	5	—	5	—	5	—	5
Bar diameter	mm	—	10	—	10	—	10	—	10	—	10	—	10	—	10	—	10
Spacing	mm	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45
Distance F	mm	—	15	—	15	—	15	—	15	—	15	—	15	—	15	—	15
Minimum outer dimensions B × B	mm	—	175	—	175	—	175	—	175	—	175	—	175	—	175	—	175
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195
Min. edge distance + c a'_e, b'_e	mm	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

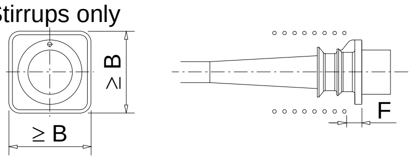
Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

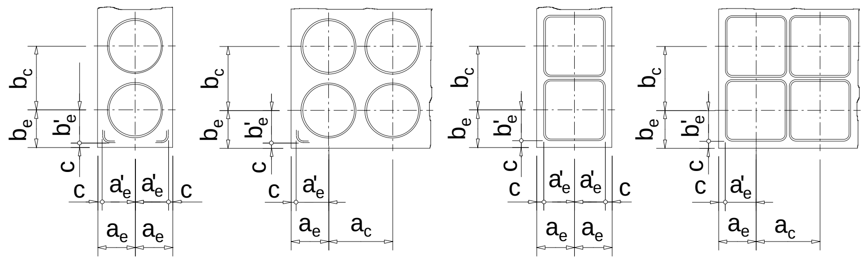
Additional reinforcement
Helix only



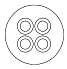
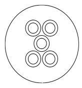
Stirrups only



Bearing trumplate A



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																	
BBR VT CONA CME BT		**0406**								**0506**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	600								750							
Char. maximum force F_{pk}	kN	1 116								1 395							
Char. 0.1 % proof force $F_{p0.1}$	kN	984								1 230							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	886								1 107							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	935								1 169							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	175	—	170	—	160	—	160	—	205	—	200	—	200	—	200	—
Bar diameter	mm	10	—	10	—	10	—	10	—	10	—	10	—	10	—	10	—
Length, approximately	mm	203	—	158	—	158	—	158	—	203	—	203	—	180	—	180	—
Pitch	mm	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—
Number of pitches	—	5	—	5	—	4	—	4	—	5	—	5	—	5	—	5	—
Distance E	mm	15	—	15	—	15	—	15	—	18	—	18	—	18	—	18	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	6	—	5	—	5	—	5	—	6	—	6	—	6	—	6
Bar diameter	mm	—	12	—	12	—	12	—	12	—	12	—	12	—	12	—	12
Spacing	mm	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45
Distance F	mm	—	15	—	15	—	15	—	15	—	18	—	18	—	18	—	18
Minimum outer dimensions B × B	mm	—	180	—	170	—	170	—	160	—	215	—	210	—	205	—	205
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	200	200	190	190	190	190	180	180	235	235	230	230	225	225	225	225
Min. edge distance + c a'_e, b'_e	mm	90	90	85	85	85	85	80	80	110	110	105	105	105	105	105	105

[1)] Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

BBR
CONA CME

External Post-tensioning System
Anchorage zone of CONA CME BT
Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance

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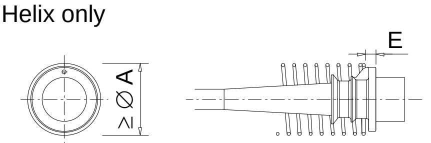
of European Technical Assessment
ETA-07/0168 of 16.12.2024

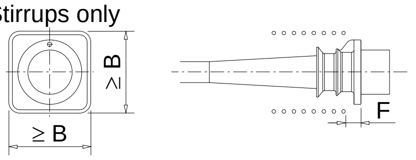
OiB Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

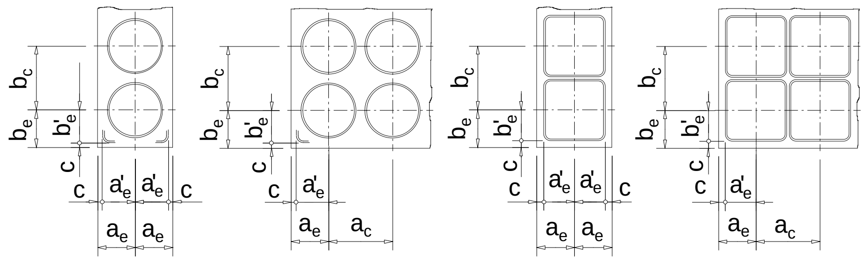
Additional reinforcement
Helix only



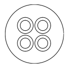
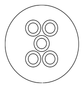
Stirrups only



Bearing trumplate E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																	
BBR VT CONA CME BT		**0406**								**0506**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	600								750							
Char. maximum force F_{pk}	kN	1 116								1 395							
Char. 0.1 % proof force $F_{p0.1}$	kN	984								1 230							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	886								1 107							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	935								1 169							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, R_e ≥ 500 MPa																	
Outer diameter ∅ A	mm	175	—	175	—	175	—	175	—	205	—	200	—	200	—	200	—
Bar diameter	mm	10	—	10	—	10	—	10	—	10	—	10	—	10	—	10	—
Length, approximately	mm	203	—	158	—	158	—	158	—	203	—	203	—	180	—	180	—
Pitch	mm	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—
Number of pitches	—	5	—	5	—	4	—	4	—	5	—	5	—	5	—	5	—
Distance E	mm	15	—	15	—	15	—	15	—	18	—	18	—	18	—	18	—
Additional stirrup reinforcement, ribbed reinforcing steel, R_e ≥ 500 MPa																	
Number of stirrups	—	—	6	—	5	—	5	—	5	—	6	—	6	—	6	—	6
Bar diameter	mm	—	12	—	12	—	12	—	12	—	12	—	12	—	12	—	12
Spacing	mm	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45
Distance F	mm	—	15	—	15	—	15	—	15	—	18	—	18	—	18	—	18
Minimum outer dimensions B × B	mm	—	180	—	180	—	180	—	180	—	215	—	210	—	205	—	205
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	200	200	200	200	200	200	200	200	235	235	230	230	225	225	225	225
Min. edge distance + c a'_e, b'_e	mm	90	90	90	90	90	90	90	90	110	110	105	105	105	105	105	105

[1)] Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

BBR CONA CME

External Post-tensioning System
Anchorage zone of CONA CME BT
Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance

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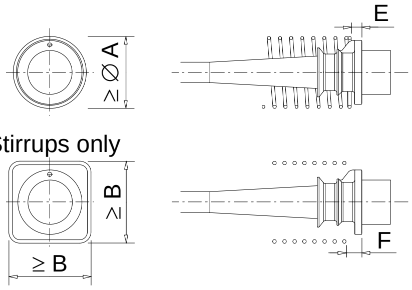
of European Technical Assessment
ETA-07/0168 of 16.12.2024

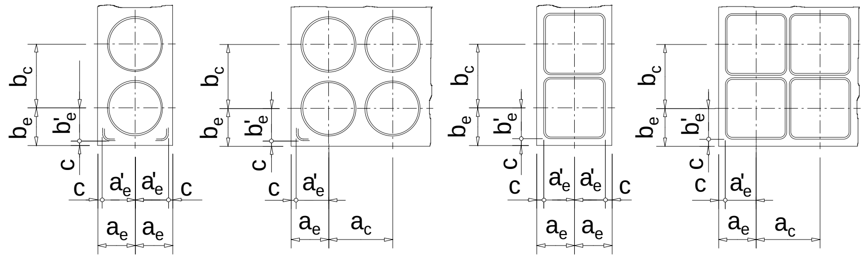
Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

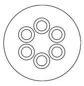
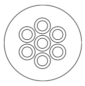
Additional reinforcement
Helix only



Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

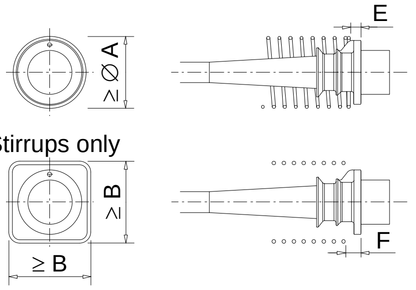
Technical data of anchorages																	
BBR VT CONA CME BT		**0606**								**0706**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	900								1 050							
Char. maximum force F_{pk}	kN	1 674								1 953							
Char. 0.1 % proof force $F_{p0.1}$	kN	1 476								1 722							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	1 328								1 550							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	1 402								1 636							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	200	—	200	—	200	—	200	—	205	—	205	—	205	—	210	—
Bar diameter	mm	10	—	10	—	10	—	10	—	12	—	12	—	12	—	10	—
Length, approximately	mm	203	—	203	—	180	—	180	—	230	—	207	—	207	—	248	—
Pitch	mm	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—
Number of pitches	—	5	—	5	—	4.5	—	4.5	—	5.5	—	5	—	5	—	6	—
Distance E	mm	18	—	18	—	18	—	18	—	18	—	18	—	18	—	20	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	6	—	6	—	6	—	6	—	7	—	6	—	6	—	7
Bar diameter [2)]	mm	—	12	—	12	—	12	—	12	—	14	—	14	—	14	—	14
Spacing	mm	—	45	—	45	—	45	—	45	—	45	—	45	—	45	—	45
Distance F	mm	—	18	—	18	—	18	—	18	—	18	—	18	—	18	—	18
Minimum outer dimensions B × B	mm	—	225	—	215	—	205	—	205	—	250	—	220	—	210	—	220
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	245	245	235	235	225	225	225	225	270	270	240	240	230	230	240	240
Min. edge distance + c a'_e, b'_e	mm	115	115	110	110	105	105	105	105	125	125	110	110	105	105	110	110

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

Member of EOTA

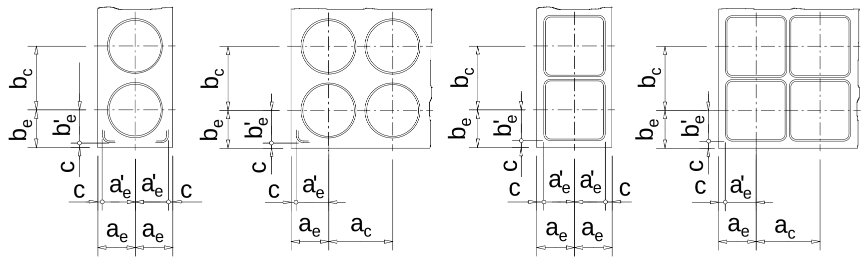
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement
Helix only

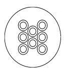
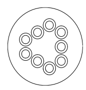


Stirrups only

Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																	
BBR VT CONA CME BT		**0806**								**0906**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	1 200								1 350							
Char. maximum force F_{pk}	kN	2 232								2 511							
Char. 0.1 % proof force $F_{p0.1}$	kN	1 968								2 214							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	1 771								1 993							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	1 870								2 103							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	245	—	235	—	235	—	230	—	275	—	275	—	275	—	275	—
Bar diameter	mm	12	—	12	—	12	—	12	—	12	—	12	—	12	—	12	—
Length, approximately	mm	252	—	230	—	227	—	227	—	270	—	248	—	223	—	233	—
Pitch	mm	45	—	45	—	50	—	50	—	45	—	45	—	50	—	55	—
Number of pitches	—	6	—	5.5	—	5	—	5	—	6.5	—	6	—	5	—	4.5	—
Distance E	mm	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	7	—	6	—	6	—	6	—	7	—	6	—	6	—	6
Bar diameter	mm	—	16	—	16	—	16	—	16	—	16	—	16	—	16	—	16
Spacing	mm	—	50	—	50	—	50	—	50	—	50	—	50	—	50	—	50
Distance F	mm	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20
Minimum outer dimensions B × B	mm	—	260	—	250	—	250	—	240	—	285	—	285	—	285	—	285
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	280	280	270	270	270	270	260	260	305	305	305	305	305	305	305	305
Min. edge distance + c a'_e, b'_e	mm	130	130	125	125	125	125	120	120	145	145	145	145	145	145	145	145

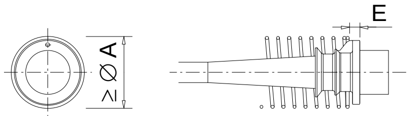
1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

OIB Member of EOTA

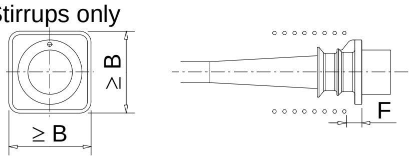
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement

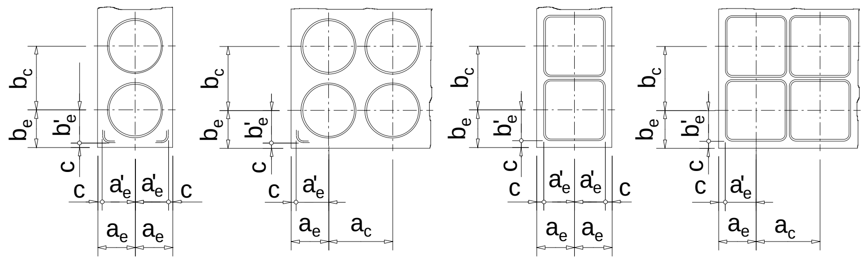
Helix only



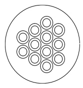
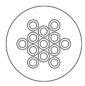
Stirrups only



Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																	
BBR VT CONA CME BT		**1206**								**1306**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	1 800								1 950							
Char. maximum force F_{pk}	kN	3 348								3 627							
Char. 0.1 % proof force $F_{p0.1}$	kN	2 952								3 198							
Max. prestressing force 0.90 · $F_{p0.1}$	kN	2 657								2 878							
Max. overstressing force 0.95 · $F_{p0.1}$	kN	2 804								3 038							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, R_e ≥ 500 MPa																	
Outer diameter ∅ A	mm	280	—	280	—	280	—	280	—	300	—	300	—	300	—	300	—
Bar diameter [2)]	mm	14	—	14	—	14	—	14	—	14	—	14	—	14	—	14	—
Length, approximately	mm	302	—	279	—	257	—	282	—	302	—	302	—	279	—	282	—
Pitch	mm	45	—	45	—	45	—	50	—	45	—	45	—	45	—	50	—
Number of pitches	—	7	—	6.5	—	6	—	6	—	7	—	7	—	6.5	—	6	—
Distance E	mm	20	—	20	—	20	—	20	—	23	—	23	—	23	—	23	—
Additional stirrup reinforcement, ribbed reinforcing steel, R_e ≥ 500 MPa																	
Number of stirrups	—	—	7	—	6	—	6	—	6	—	7	—	7	—	7	—	7
Bar diameter	mm	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20
Spacing	mm	—	55	—	55	—	55	—	55	—	55	—	55	—	55	—	55
Distance F	mm	—	20	—	20	—	20	—	20	—	23	—	23	—	23	—	23
Minimum outer dimensions B × B	mm	—	305	—	290	—	290	—	290	—	325	—	320	—	310	—	310
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	325	325	310	310	310	310	310	310	345	345	340	340	330	330	330	330
Min. edge distance + c a'_e, b'_e	mm	155	155	145	145	145	145	145	145	165	165	160	160	155	155	155	155

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

BBR CONA CME

External Post-tensioning System

Anchorage zone of CONA CME BT
Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance

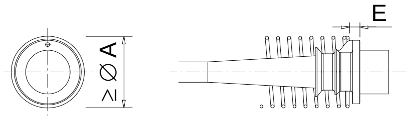
Annex 59
of European Technical Assessment
ETA-07/0168 of 16.12.2024

Member of EOTA

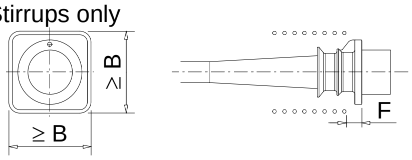
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement

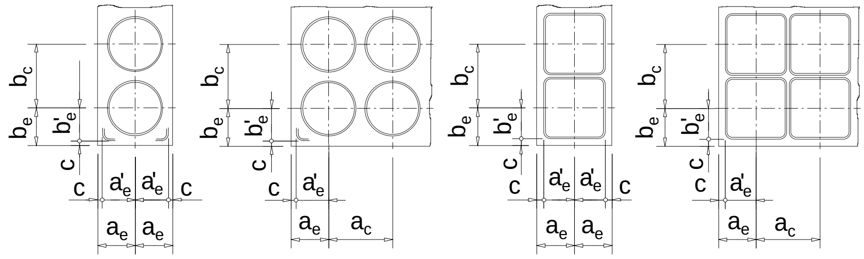
Helix only



Stirrups only

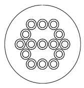
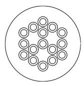


Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages

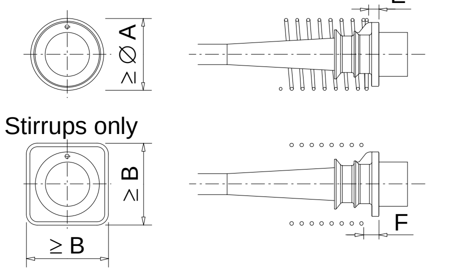
BBR VT CONA CME BT		1506								1606							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm^2	2 250								2 400							
Char. maximum force F_{pk}	kN	4 185								4 464							
Char. 0.1 % proof force $F_{p0.1}$	kN	3 690								3 936							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	3 321								3 542							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	3 506								3 739							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	320	—	320	—	320	—	320	—	320	—	320	—	320	—	320	—
Bar diameter [2)]	mm	14	—	14	—	14	—	14	—	14	—	14	—	14	—	14	—
Length, approximately	mm	324	—	302	—	297	—	277	—	347	—	347	—	302	—	297	—
Pitch	mm	45	—	45	—	45	—	50	—	45	—	45	—	45	—	45	—
Number of pitches	—	7.5	—	7	—	7	—	6	—	8	—	8	—	7	—	7	—
Distance E	mm	27	—	27	—	27	—	27	—	27	—	27	—	27	—	27	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	7	—	7	—	7	—	7	—	8	—	8	—	7	—	7
Bar diameter	mm	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20
Spacing	mm	—	55	—	55	—	55	—	55	—	55	—	55	—	55	—	55
Distance F	mm	—	27	—	27	—	27	—	27	—	27	—	27	—	27	—	27
Minimum outer dimensions B × B	mm	—	335	—	330	—	330	—	330	—	355	—	345	—	330	—	330
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	355	355	350	350	350	350	350	350	375	375	365	365	350	350	350	350
Min. edge distance + c a'_e, b'_e	mm	170	170	165	165	165	165	165	165	180	180	175	175	165	165	165	165

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 14 mm can be replaced by 16 mm.

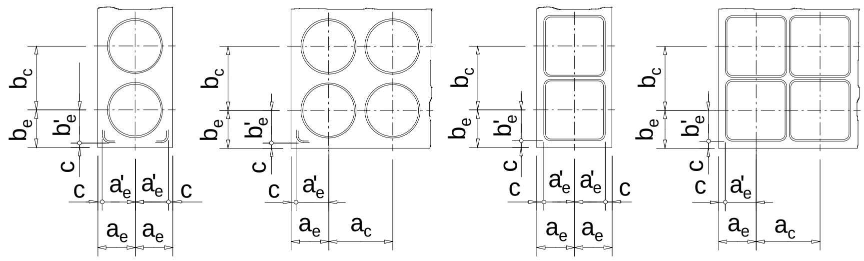
OiB Member of EOTA

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

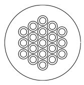
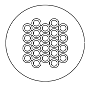
Additional reinforcement
Helix only



Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																	
BBR VT CONA CME BT		**1906**								**2206**							
Strand arrangement																	
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																	
Tendon																	
Cross-sectional area A_p	mm²	2 850								3 300							
Char. maximum force F_{pk}	kN	5 301								6 138							
Char. 0.1 % proof force $F_{p0.1}$	kN	4 674								5 412							
Max. prestressing force $0.90 \cdot F_{p0.1}$	kN	4 207								4 871							
Max. overstressing force $0.95 \cdot F_{p0.1}$	kN	4 440								5 141							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																	
Minimum concrete strength																	
Cube $f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder $f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Outer diameter ∅ A	mm	370	—	330	—	325	—	330	—	360	—	360	—	360	—	360	—
Bar diameter	mm	16	—	16	—	16	—	20	—	20	—	20	—	20	—	20	—
Length, approximately	mm	411	—	361	—	361	—	370	—	403	—	375	—	375	—	351	—
Pitch	mm	50	—	50	—	50	—	50	—	55	—	55	—	55	—	60	—
Number of pitches	—	9	—	7.5	—	7.5	—	7.5	—	7.5	—	7	—	7	—	7	—
Distance E	mm	27	—	27	—	27	—	27	—	31	—	31	—	31	—	31	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																	
Number of stirrups	—	—	8	—	8	—	8	—	8	—	9	—	9	—	9	—	9
Bar diameter	mm	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20
Spacing	mm	—	55	—	55	—	50	—	50	—	50	—	50	—	45	—	45
Distance F	mm	—	27	—	27	—	27	—	27	—	31	—	31	—	31	—	31
Minimum outer dimensions B × B	mm	—	415	—	370	—	355	—	330	—	415	—	400	—	385	—	360
Centre spacing and edge distance																	
Minimum centre spacing a_c, b_c	mm	435	435	390	390	375	375	360	350	435	435	420	420	405	405	380	380
Min. edge distance + c a'_e, b'_e	mm	210	210	185	185	180	180	170	165	210	210	200	200	195	195	180	180

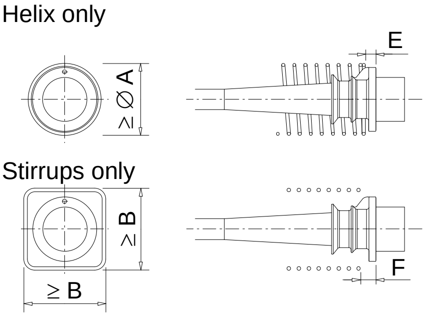
1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME BT Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance	**Annex 61** of European Technical Assessment **ETA-07/0168** of 16.12.2024

OiB Member of EOTA

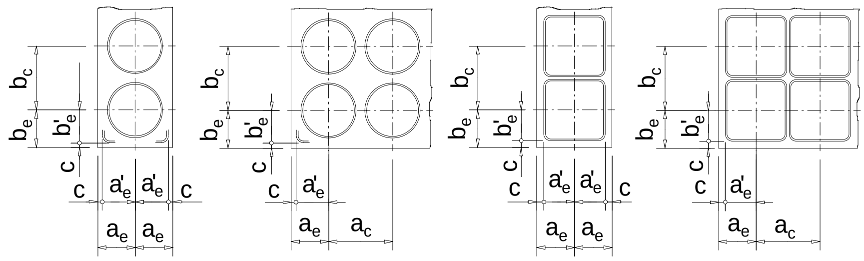
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement
Helix only



Stirrups only

Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																		
BBR VT CONA CME BT			**2406**								**2506**							
Strand arrangement																		
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** 1)																		
Tendon																		
Cross-sectional area	A_p	mm²	3 600								3 750							
Char. maximum force	F_{pk}	kN	6 696								6 975							
Char. 0.1 % proof force	$F_{p0.1}$	kN	5 904								6 150							
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	5 314								5 535							
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	5 609								5 843							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																		
Minimum concrete strength																		
Cube	$f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder	$f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Outer diameter	∅ A	mm	375	—	375	—	375	—	385	—	410	—	410	—	410	—	410	—
Bar diameter		mm	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—
Length, approximately		mm	430	—	430	—	405	—	386	—	465	—	465	—	366	—	366	—
Pitch		mm	55	—	55	—	60	—	55	—	60	—	60	—	60	—	60	—
Number of pitches		—	8	—	8	—	7	—	8	—	8	—	8	—	7	—	7	—
Distance	E	mm	32	—	32	—	32	—	32	—	35	—	35	—	35	—	35	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Number of stirrups		—	—	10	—	9	—	9	—	9	—	10	—	10	—	9	—	9
Bar diameter		mm	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20
Spacing		mm	—	50	—	50	—	50	—	50	—	50	—	50	—	50	—	50
Distance	F	mm	—	32	—	32	—	32	—	32	—	35	—	35	—	35	—	35
Minimum outer dimensions	B × B	mm	—	440	—	425	—	415	—	405	—	445	—	425	—	415	—	410
Centre spacing and edge distance																		
Minimum centre spacing	a_c, b_c	mm	460	460	445	445	435	435	425	425	465	465	445	445	435	435	430	430
Min. edge distance + c	a'_e, b'_e	mm	220	220	215	215	210	210	205	205	225	225	215	215	210	210	205	205

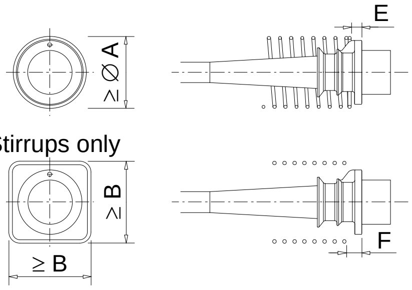
1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

BBR CONA CME	**External Post-tensioning System** Anchorage zone of CONA CME BT Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance	**Annex 62** of European Technical Assessment **ETA-07/0168** of 16.12.2024

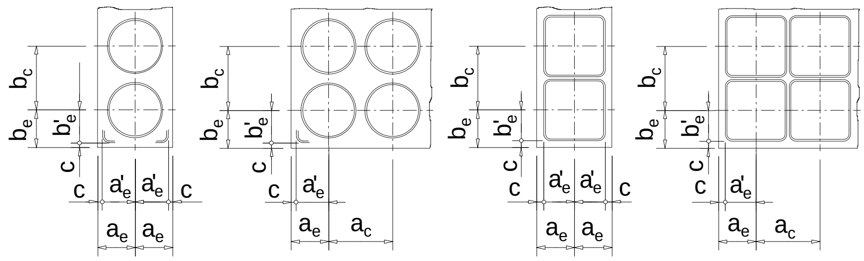
Stressing and fixed anchorage or coupler – Centre spacing and edge distance

Additional reinforcement
Helix only

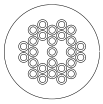
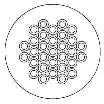
Stirrups only



Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages																		
BBR VT CONA CME BT			**2706**								**3106**							
Strand arrangement																		
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** Maximum characteristic tensile strength **1 860 MPa** [1)]																		
Tendon																		
Cross-sectional area	A_p	mm²	4 050								4 650							
Char. maximum force	F_{pk}	kN	7 533								8 649							
Char. 0.1 % proof force	$F_{p0.1}$	kN	6 642								7 626							
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	5 978								6 863							
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	6 310								7 245							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance																		
Minimum concrete strength																		
Cube	$f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**		**38**		**43**		**53**		**60**	
Cylinder	$f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**		**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Outer diameter	Ø A	mm	410	—	410	—	410	—	410	—	410	—	410	—	410	—	410	—
Bar diameter		mm	20	—	20	—	20	—	20	—	20	—	20	—	20	—	20	—
Length, approximately		mm	485	—	485	—	430	—	386	—	495	—	445	—	445	—	395	—
Pitch		mm	55	—	55	—	55	—	55	—	50	—	50	—	50	—	50	—
Number of pitches		—	9	—	9	—	8	—	8	—	10	—	9	—	9	—	8	—
Distance	E	mm	35	—	35	—	35	—	35	—	35	—	35	—	35	—	35	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa																		
Number of stirrups		—	—	10	—	10	—	9	—	9	—	9	—	9	—	9	—	9
Bar diameter [2)]		mm	—	20	—	20	—	20	—	20	—	24	—	24	—	24	—	24
Spacing		mm	—	50	—	50	—	50	—	50	—	60	—	60	—	55	—	55
Distance	F	mm	—	35	—	35	—	35	—	35	—	35	—	35	—	35	—	35
Minimum outer dimensions	B × B	mm	—	460	—	445	—	430	—	410	—	495	—	465	—	440	—	425
Centre spacing and edge distance																		
Minimum centre spacing	a_c, b_c	mm	480	480	465	465	450	450	430	430	515	515	485	485	460	460	445	445
Min. edge distance + c	a'_e, b'_e	mm	230	230	225	225	215	215	205	205	250	250	235	235	220	220	215	215

1) Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.
2) Bar diameter of 24 mm can be replaced by 25 mm.

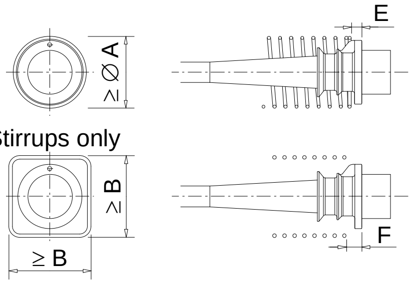
BBR CONA CME	External Post-tensioning System Anchorage zone of CONA CME BT Minimum concrete strength – Helix or additional stirrup reinforcement – Centre spacing and edge distance	**Annex 63** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Stressing and fixed anchorage or coupler – Centre spacing and edge distance

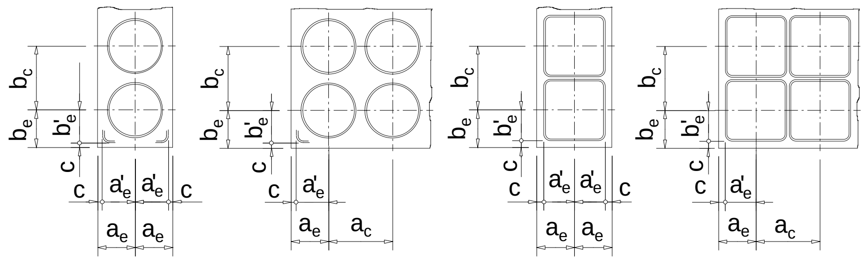
Additional reinforcement

Helix only

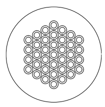
Stirrups only



Bearing trumplate A and E



$a_e = a'_e + c$
$b_e = b'_e + c$
c … Concrete cover of reinforcement in the same cross section

Technical data of anchorages										
BBR VT CONA CME BT			**3706**							
Strand arrangement										
7-wire prestressing steel strand – Nominal diameter **15.7 mm** – Nominal cross-sectional area **150 mm²** – Maximum characteristic tensile strength **1 860 MPa** [1)]										
Tendon										
Cross-sectional area	A_p	mm²	5 550							
Char. maximum force	F_{pk}	kN	10 323							
Char. 0.1 % proof force	$F_{p0.1}$	kN	9 102							
Max. prestressing force	$0.90 \cdot F_{p0.1}$	kN	8 192							
Max. overstressing force	$0.95 \cdot F_{p0.1}$	kN	8 647							
Minimum concrete strength / Additional reinforcement as helix or stirrups / Centre spacing and edge distance										
Minimum concrete strength										
Cube	$f_{cm,0}$	**MPa**	**38**		**43**		**53**		**60**	
Cylinder	$f_{cm,0}$	**MPa**	**31**		**35**		**43**		**50**	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa										
Outer diameter	Ø A	mm	450	—	450	—	450	—	450	—
Bar diameter		mm	20	—	20	—	20	—	20	—
Length, approximately		mm	520	—	495	—	458	—	458	—
Pitch		mm	50	—	50	—	55	—	55	—
Number of pitches		—	10.5	—	10	—	8.5	—	8.5	—
Distance	E	mm	30	—	30	—	30	—	30	—
Additional stirrup reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa										
Number of stirrups		—	—	10	—	10	—	10	—	11
Bar diameter [2)]		mm	—	24	—	24	—	24	—	20
Spacing		mm	—	55	—	55	—	55	—	50
Distance	F	mm	—	30	—	30	—	30	—	30
Minimum outer dimensions	B × B	mm	—	545	—	500	—	480	—	470
Centre spacing and edge distance										
Minimum centre spacing	a_c, b_c	mm	565	565	520	520	500	500	490	490
Min. edge distance + c	a'_e, b'_e	mm	275	275	250	250	240	240	235	235

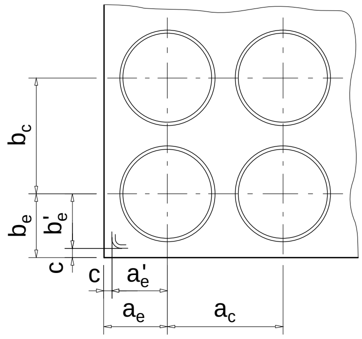
[1)] Prestressing steel strand with nominal diameter 15.3 mm, cross-sectional area 140 mm², or with characteristic tensile strength below 1 860 MPa may also be used.

[2)] Bar diameter of 24 mm can be replaced by 25 mm.

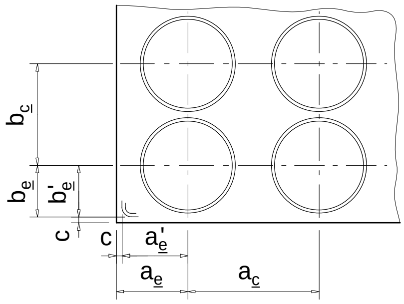
Member of EOTA

Modification of centre spacing and edge distance

Additional reinforcement as helix only

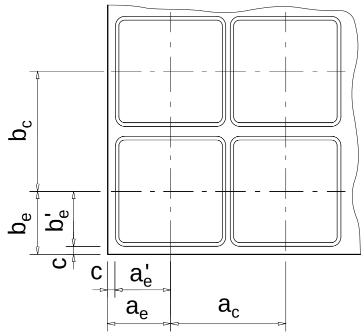


a_c, b_c
a_e, b_e

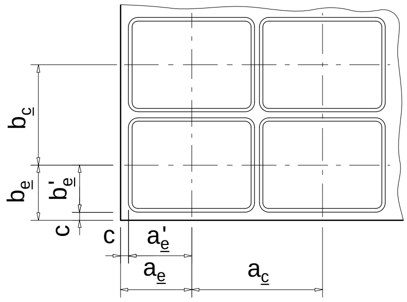


$a_{\underline{c}} \geq b_{\underline{c}}$
$a_{\underline{e}} \geq b_{\underline{e}}$

Additional reinforcement as stirrups only



a_c, b_c
a_e, b_e



$a_{\underline{c}} \geq b_{\underline{c}}$
$a_{\underline{e}} \geq b_{\underline{e}}$

Modification of centre spacing and edge distance are in accordance with Clause 1.9.

$$b_{\underline{c}} \geq \begin{cases} 0.85 \cdot b_c \\ \text{and} \\ \geq \text{Helix, outside diameter}^{1)} \end{cases}$$

$$a_{\underline{c}} \geq \frac{A_c}{b_{\underline{c}}}$$

$$A_c = a_c \cdot b_c \leq a_{\underline{c}} \cdot b_{\underline{c}}$$

Corresponding edge distances

$$a_{\underline{e}} = \frac{a_{\underline{c}}}{2} - 10\text{ mm} + c \qquad \text{and} \qquad b_{\underline{e}} = \frac{b_{\underline{c}}}{2} - 10\text{ mm} + c$$

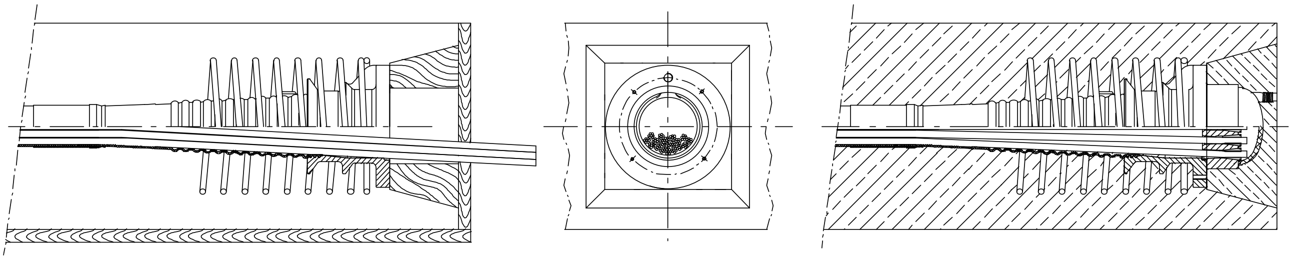
c ..... Concrete cover

1) Except the dimensions of helix, the outer dimensions of the additional stirrup reinforcement are adjusted accordingly. Further modifications of reinforcement are in accordance with the Clauses 1.14.11 and 2.2.3.4.

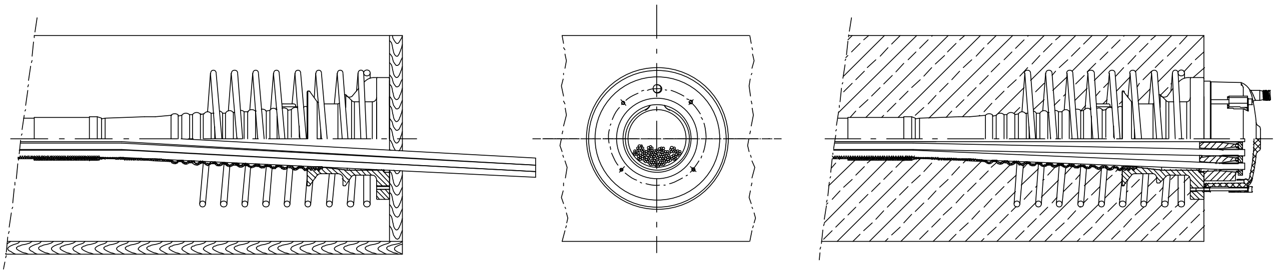
CONA CME	**External Post-tensioning System** Modification of centre spacing and edge distance of CONA CME BT with helix or additional stirrup reinforcement	**Annex 65** of European Technical Assessment **ETA-07/0168** of 16.12.2024

Member of EOTA

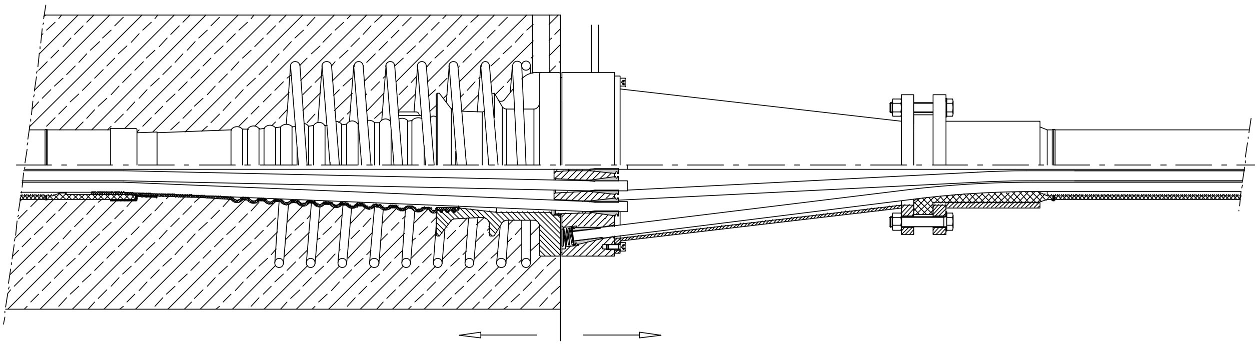
Stressing anchorage SA (SAE)



Fixed anchorage FA (FAE)



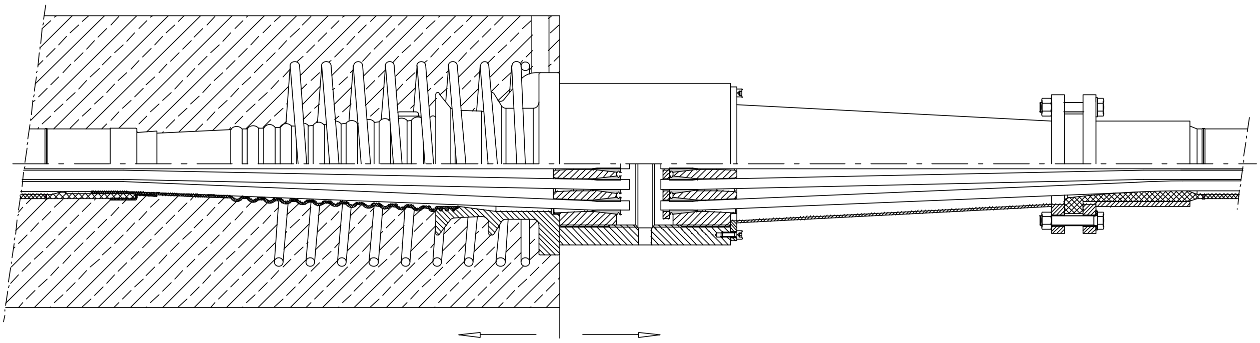
Fixed coupler FK



1. BA
1st construction stage

2. BA
2nd construction stage

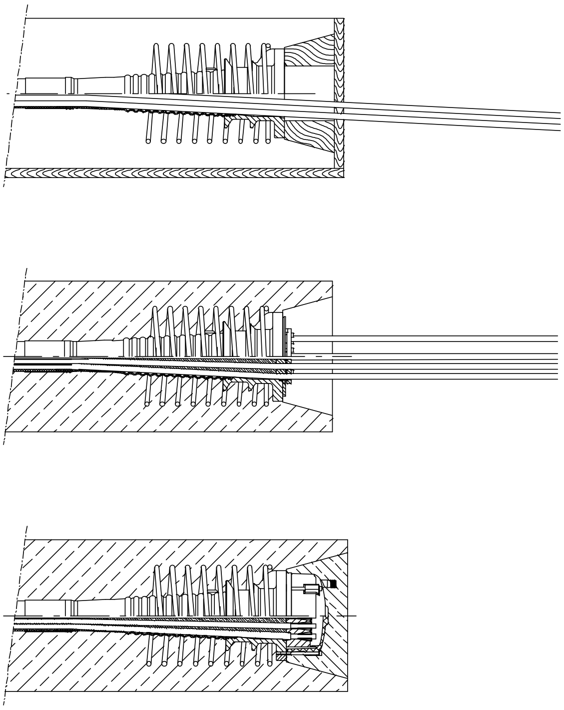
Fixed coupler FH



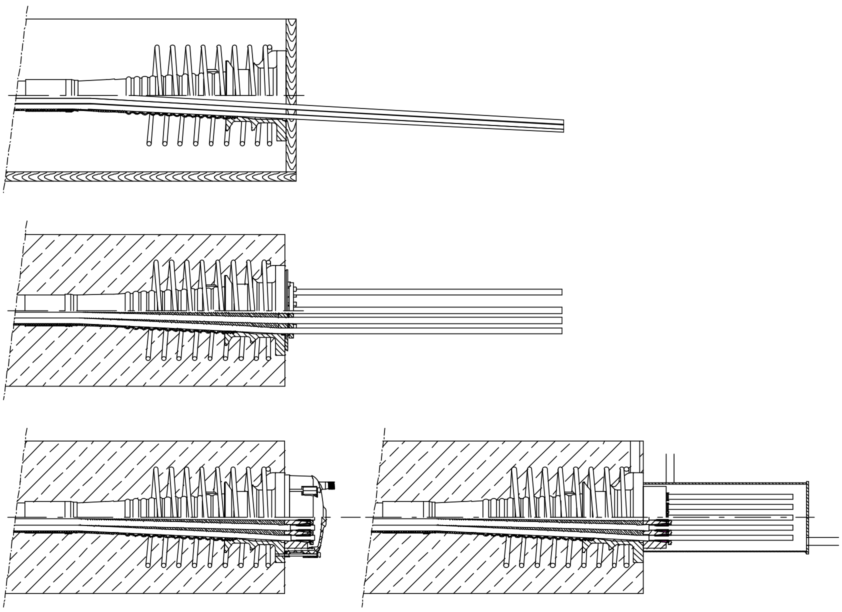
1. BA
1st construction stage

2. BA
2nd construction stage

Stressing anchorage with monostrand, recessed

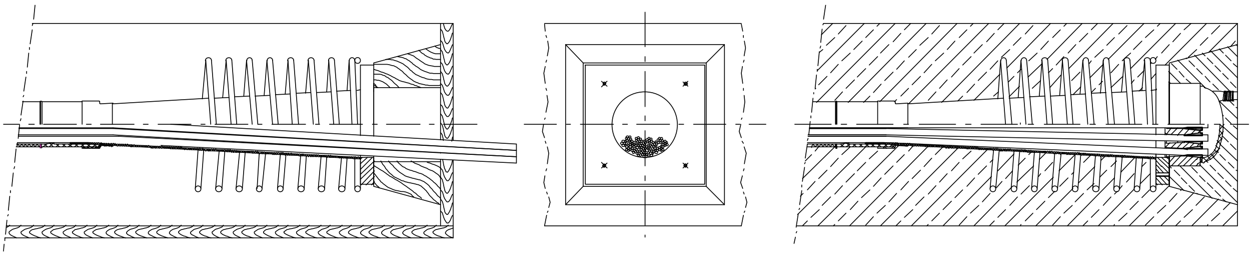


Stressing anchorage with monostrand, exposed

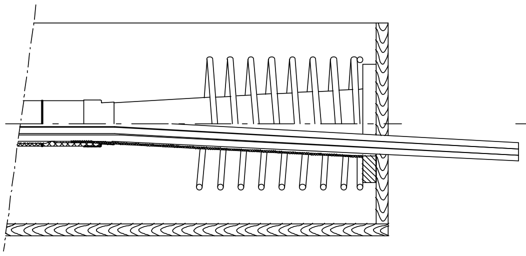


Member of EOTA

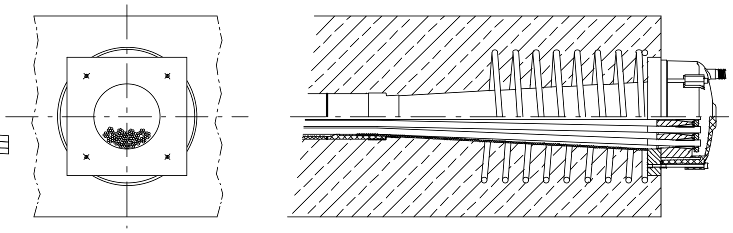
Recessed stressing anchorage SA



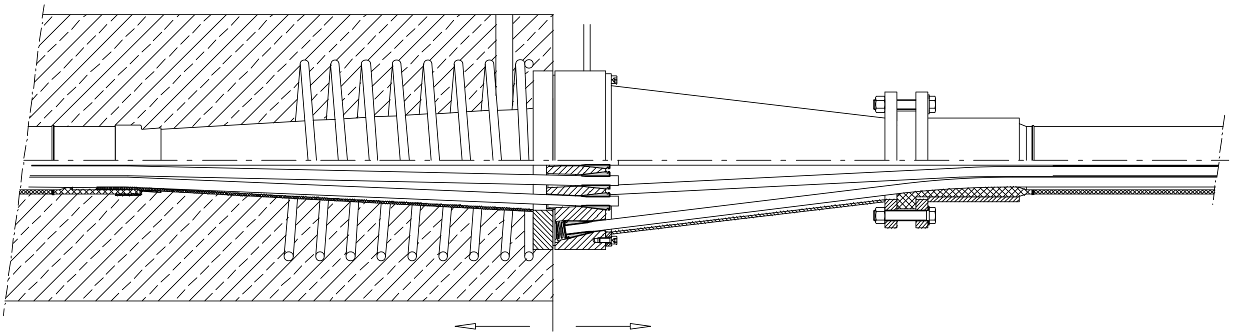
Fixed anchorage FA



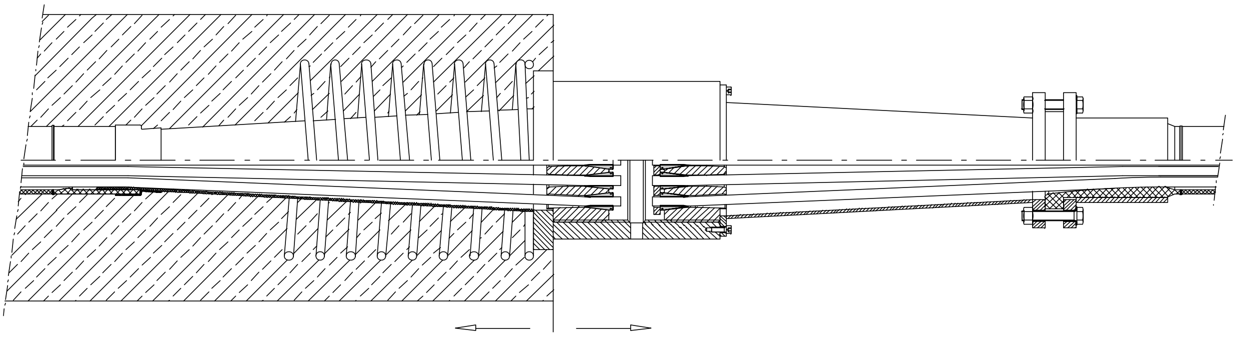
Exposed stressing anchorage SA



Fixed and stressing coupler FK, SK

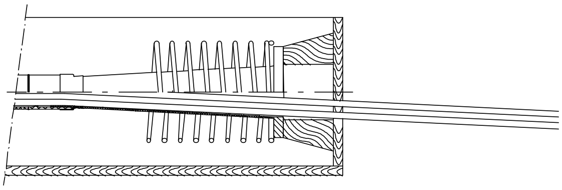


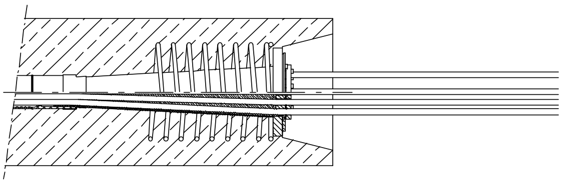
Fixed and stressing coupler FH, SH

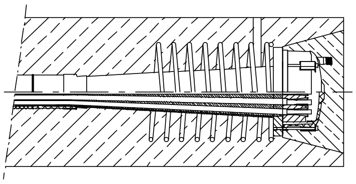


CONA CME	**External Post-tensioning System** Construction stages of CONA CME SP	**Annex 68** of European Technical Assessment **ETA-07/0168** of 16.12.2024

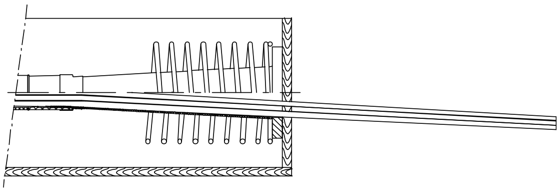
Stressing anchorage with monostrand, recessed

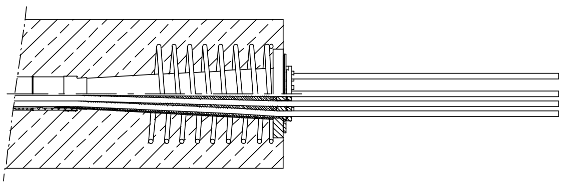


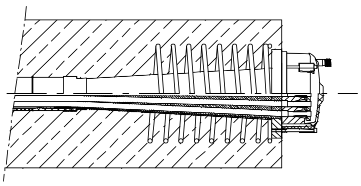


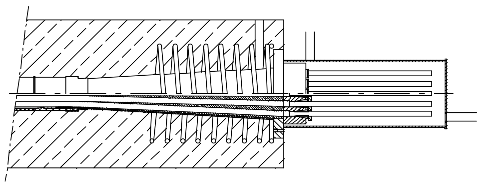


Stressing anchorage with monostrand, exposed









CONA CME

External Post-tensioning System
Construction stages of CONA CME SP

Annex 69
of European Technical Assessment
ETA-07/0168 of 16.12.2024

1 Preparatory work

The components of the post-tensioning kit are stored so as to avoid any damage or corrosion.

2 Anchorage recesses

Adequate space to accommodate and to use the prestressing jack is ensured, see also the Clauses 1.4 and 2.2.3.2.

3 Fastening the bearing trumplates or square plates

Four holes are provided to fasten the bearing trumplates or square plates to the formwork. The trumpet is screwed into the bearing trumplate if applicable. The helix is either welded to the bearing trumplate by means of radial bars or to the square plate, see also the Clauses 1.14.11, 2.2.3.4, and 2.2.4.9 or positioned by fastening it to the existing reinforcement.

4 Installation of deviators

For accurate installation, it is recommended to use a guide wire or equivalent between successive deviators for pre-adjustment. The deviator is properly connected to the formwork and the reinforcement mesh to avoid any movement during concreting. If required, recess units are inserted in the deviator to avoid deformations. The minimum radii of curvature conforms to Clause 1.11.

5 Placing of ducts

The ducts are placed on supports with a spacing of 2 m to 4 m by taking into account the increase of weight due to the tensile elements. The ducts are jointed in a leak-proof way, see also the Clauses 1.6 and 2.2.4.9. In the case of plastic ducts at least one telescopic joint is installed do adjust the length of the duct to the tendon. This opening will be jointed after stressing.

6 Installation of tensile elements, prestressing steel strands

The prestressing steel is pushed or pulled into the sheath before or after concreting of the structure.

7 Installation of the inaccessible fixed anchorages

After passing the strands through the anchor head, they are anchored individually in the cones by means of ring wedges, see also Clause 1.2.2.1. After assembling the wedges are secured with springs or a wedge retaining plate.

An alternative is pre-locking each individual strand with ~ $0.5 \cdot F_{pk}$ and applying a wedge retaining plate.

8 Installation of fixed coupler anchor head 2.BA

The function of the fixed coupler is to connect two tendons, whereas the first tendon is stressed before the second tendon is installed and stressed, see also Clause 1.2.3.1.

The coupling is achieved by pushing the strands into the already stressed coupler anchor head K, side 2. BA in the outer pitch circle, whereby the strands are marked to check the correct depth of engagement, see also Clause 1.2.3.2.

The coupler anchor head H, 2. BA is assembled with ring wedges and a wedge retaining plate. It is connected to the already stressed coupler anchor head H, 1. BA by means of a threaded coupler sleeve, see also Clause 1.2.3.3.

9 Checking the tendons before concreting

Before concreting the structure, position and fastening of the entire tendon are checked and corrected if necessary. The sheaths are checked for any damage.

10 Assembly of anchor head/coupler anchor head 1.BA

After passing the strands through the anchor head, they are anchored individually in the cones by means of ring wedges. The same applies for the coupler anchor head in case of stressing couplers in the first construction stage.

11 Stressing

At the time of stressing the mean concrete compressive strength is at least according to Table 5 and the data of Clause 1.10. Stressing and possible wedging are carried out with a suitable prestressing jack and in accordance with Clause 2.2.4.5.

Elongation of the tendon and prestressing forces are checked and recorded systematically during the stressing operation.

Restressing the tendons is permitted in accordance with Clause 2.2.4.6.

12 Grouting the tendons

The grout is injected through the inlet holes until it escapes from the outlet tubes with the same consistency. All vents and grouting inlets are sealed immediately after grouting, see also Clause 2.2.4.8.1.

Grease and way are injected in a similar way as for grouting and the recommendations of the supplier, see also Clause 2.2.4.8.2.

More detailed information on installation can be obtained from the ETA holder.

Contents of the prescribed test plan

Component	Item	Test / Check	Trace-ability	Minimum frequency	Documen-tation
Bearing trumplate A Bearing trumplate E	Material	Check	Full	100 %	"3.1" 1)
	Detailed dimensions	Test		3 % ≥ 2 specimens	Yes
	Visual inspection 2)	Check		100 %	No
Square plate	Material	Check	Full	100 %	"2.2" 3)
	Detailed dimensions	Test		3 % ≥ 2 specimens	Yes
	Visual inspection 2)	Check		100 %	No
Anchor head A Coupler anchor head H, K	Material	Check	Full	100 %	"3.1" 1)
	Detailed dimensions 4)	Test		5 % ≥ 2 specimens	Yes
	Visual inspection 2), 5)	Check		100 %	No
Ring wedge H, F, G	Material	Check	Full	100 %	"3.1" 1)
	Treatment, hardness 6), 7)	Test		0.5 % ≥ 2 specimens	Yes
	Detailed dimensions	Test		5 % ≥ 2 specimens	Yes
	Visual inspection 2), 8)	Check		100 %	No
Steel ring E	Material	Check	Bulk	100 %	"2.2" 3)
	Detailed dimensions	Test		0.5 % ≥ 2 specimens	Yes
	Visual inspection 2)	Check		100 %	No
Coupler sleeve H	Material	Check	Full	100 %	"3.1" 1)
	Detailed dimensions	Test		5 % ≥ 2 specimens	Yes
	Visual inspection 2)	Check		100 %	No
Prestressing steel strand 9)	Material	Check	Full	100 %	"CE" 9)
	Diameter	Test		Each coil	No
	Visual inspection 2)	Check		Each coil	No
Constituents of filling material as per EN 447	Cement	Check	Full	100 %	"CE"
	Admixtures, additions	Check	Bulk	100 %	"CE"
Components for electrically isolated tendon	Material	Check	Full	100 %	MC 10)
	Visual inspection 2)	Check		100 %	No

1) "3.1": Inspection certificate type "3.1" according to EN 10204
2) Visual inspections include e.g., main dimensions, gauge testing, correct marking or labelling, appropriate performance, surface, fins, kinks, smoothness, corrosion, coating, etc., as detailed in the prescribed test plan.
3) "2.2": Test report type "2.2" according to EN 10204
4) Other dimensions than 5)
5) Dimensions: All conical bores of the anchor heads and coupler anchor heads regarding angle, diameter and surface condition, thread dimensions of all anchor heads and coupler anchor heads
6) Geometrical properties
7) Surface hardness
8) Teeth, cone surface
9) As long as the basis for CE marking of prestressing steel is not available, an approval or certificate according to the respective standards and regulations in force at the place of use accompanies each delivery.
10) Certificate of the manufacturer of the material that allow for proof of conformity.

Full............ Full traceability of each component to its raw materials
Bulk........... Traceability of each delivery of components to a defined point

Audit testing

Component	Item	Test / Check	Sampling [2] Number of components per visit
Anchor head A Coupler anchor head H, K Coupler sleeve H Bearing trumplate A Bearing trumplate E Square plate Steel ring E	Material according to specification	Test / Check	1
	Detailed dimensions	Test	
	Visual inspection [1]	Check	
Ring wedge	Material according to specification	Test / Check	2
	Treatment	Test	2
	Detailed dimensions	Test	1
	Main dimensions, surface hardness and surface finish	Test	5
	Visual inspection [1]	Check	5
Single tensile element test	Single tensile element test according to EAD 160004-00-0301, Annex C.7	Test	1 series

[1] Visual inspections mean e.g., main dimensions, gauge testing, correct marking or labelling, appropriate performance, surface, fins, kinks, smoothness, corrosion protection, corrosion, coating, etc., as given in the prescribed test plan.

[2] If the kit comprises different types of anchor heads, e.g. with different materials, different shape, different wedges, etc., the number of samples is understood as per type.

All samples are randomly selected and clearly identified.

Essential characteristics for the intended uses

Essential Characteristic	Clause	Intended use Line № according to Clause 2.1, Table 7		
		1	2	3
Resistance to static load	3.2.1.1	+	+	+
Resistance to fatigue	3.2.1.2	+	+	+
Load transfer to the structure	3.2.1.3	+	+	+
Friction coefficient	3.2.1.4	+	+	+
Deviation, deflection (limits)	3.2.1.5	+	+	+
Assessment of assembly	3.2.1.6	+	+	+
Material properties, component performance, system performance of plastic duct to provide an encapsulated tendon	3.2.1.7	—	+	—
Material properties, component performance, system performance of plastic duct to provide an electrically isolated tendon	3.2.1.8	—	—	+
Corrosion protection	3.2.1.9	+	+	+
Reaction to fire	3.2.2.1	+	+	+
Content, emission, and/or release, of dangerous substances	3.2.3.1	+	+	+

Key
+.................Essential characteristic relevant for the intended use
—................Essential characteristic not relevant for the intended use
[1].................Essential characteristic relevant for cryogenic applications where plastic duct are used.

For combinations of intended uses, the essential characteristics of all intended uses composing the combination are relevant.

Reference documents

European Assessment Document

EAD 160004-00-0301	Post-Tensioning Kits for Prestressing of Structures
EAD 160027-00-0301	Special filling products for post-tensioning kits

Standards

EN 206, 12.2013 EN 206/A2, 03.2021	Concrete – Specification, performance, production and conformity
EN 445, 10.2007	Grout for prestressing tendons – Test methods
EN 446, 10.2007	Grout for prestressing tendons – Grouting procedures
EN 447, 10.2007	Grout for prestressing tendons – Basic requirements
EN 1561, 12.2023	Founding – Grey cast irons
EN 1563, 08.2018	Founding – Spheroidal graphite cast irons
Eurocode 2	Eurocode 2 – Design of concrete structures
Eurocode 3	Eurocode 3 – Design of steel structures
Eurocode 6	Eurocode 6 – Design of masonry structures
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EN 10210-1, 04.2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery conditions
EN 10216-1, 12.2013	Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 1: Non-alloy steel tubes with specified room temperature properties
EN 10217-1, 04.2019	Welded steel tubes for pressure purposes – Technical delivery conditions – Part 1: Electric welded and submerged arc welded non-alloy steel tubes with specified room temperature properties
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EN 10255+A1, 04.2007	Non-Alloy steel tubes suitable for welding and threading – Technical delivery conditions
EN 10270-1, 02.2024	Steel wire for mechanical springs – Part 1: Patented cold drawn unalloyed spring steel wire
EN 10277, 06.2018	Bright steel products – Technical delivery conditions
EN 10305-3, 12.2023	Steel tubes for precision applications – Technical delivery conditions – Part 3: Welded cold sized tubes
EN 12201-1, 01.2024	Plastics piping systems for water supply, and for drains and sewers under pressure – Polyethylene (PE) – Part 1: General
EN 12201-2, 01.2024	Plastics piping systems for water supply, and for drains and sewers under pressure – Polyethylene (PE) – Part 2: Pipes
EN ISO 683-1, 06.2018	Heat-treatable steels, alloy steels and free-cutting steels – Part 1: Non-alloy steels for quenching and tempering
EN ISO 683-2, 06.2018	Heat-treatable steels, alloy steels and free-cutting steels – Part 2: Alloy steels for quenching and tempering
EN ISO 683-3, 02.2022	Heat-treatable steels, alloy steels and free-cutting steels – Part 3: Case-hardening steels

EN ISO 17855-1, 10.2014	Plastics – Polyethylene (PE) moulding and extrusion materials – Part 1: Designation system and basis for specifications
EN ISO 19069-1, 03.2015	Plastics – Polypropylene (PP) moulding and extrusion materials – Part 1: Designation system and basis for specifications
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prEN 10138-3, 09.2000	Prestressing steels – Part 3: Strand
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Other documents

CWA 14646, 01.2003	Requirements for the installation of post-tensioning kits for prestressing of structures and qualification of the specialist company and its personnel
98/456/EC	Commission decision 98/456/EC of 3 July 1998 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards posttensioning kits for the prestressing of structures, Official Journal of the European Communities L 201 of 17 July 1998, p. 112
305/2011	Regulation (EU) № 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, OJ L 088 of 04.04.2011, p. 5, amended by Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, OJ L 157 of 27.05.2014, p. 76, Commission Delegated Regulation (EU) № 574/2014 of 21 February 2014, OJ L 159 of 28.05.2014, p. 41, and Regulation (EU) 2019/1020 of the European Parliament and of the Council of 20 June 2019, OJ L 169 of 25.06.2019, p. 1
568/2014	Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) № 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products, OJ L 157 of 27.05.2014, p. 76

Certificate of constancy of performance
0432-CPR-00299-1.3 (EN)

Version 03

In compliance with Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction products Regulation or CPR), this certificate applies to the construction product

BBR VT CONA CME -
External Post-tensioning System with 01 to 61 Strands

Post-tensioning kit for external prestressing of structures

placed on the market under the name or trade mark of

BBR VT International Ltd

Ringstr. 2
CH-8603 Schwerzenbach (ZH) / SWITZERLAND

and produced in the manufacturing plant(s)

BBR VT International Ltd

Ringstr. 2
CH-8603 Schwerzenbach (ZH) / SWITZERLAND

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in the

ETA-07/0168, issued on 16.12.2024

and

(EAD) 160004-00-0301 – Post-Tensioning Kits for Prestressing of Structures

under **system 1+** for the performance set out in the ETA are applied and that the factory production control conducted by the manufacturer is assessed to ensure the

constancy of performance of the construction product.

This certificate was first issued on 10.03.2008 and will remain valid until 09.01.2030 as long as neither the ETA, the EAD, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body.

Dortmund, 10.01.2025

by order

Dipl.-Ing. Becker
Head of Certification Body (Dep. 21.40)

Materialprüfungsamt Nordrhein-Westfalen MPA NRW 10

This Certificate consists of 1 page.

DAkkS Deutsche Akkreditierungsstelle D-ZE-11142-01-00

The original of this document was issued in German language.
In case of doubt only the German version is valid.

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