BBR PTE

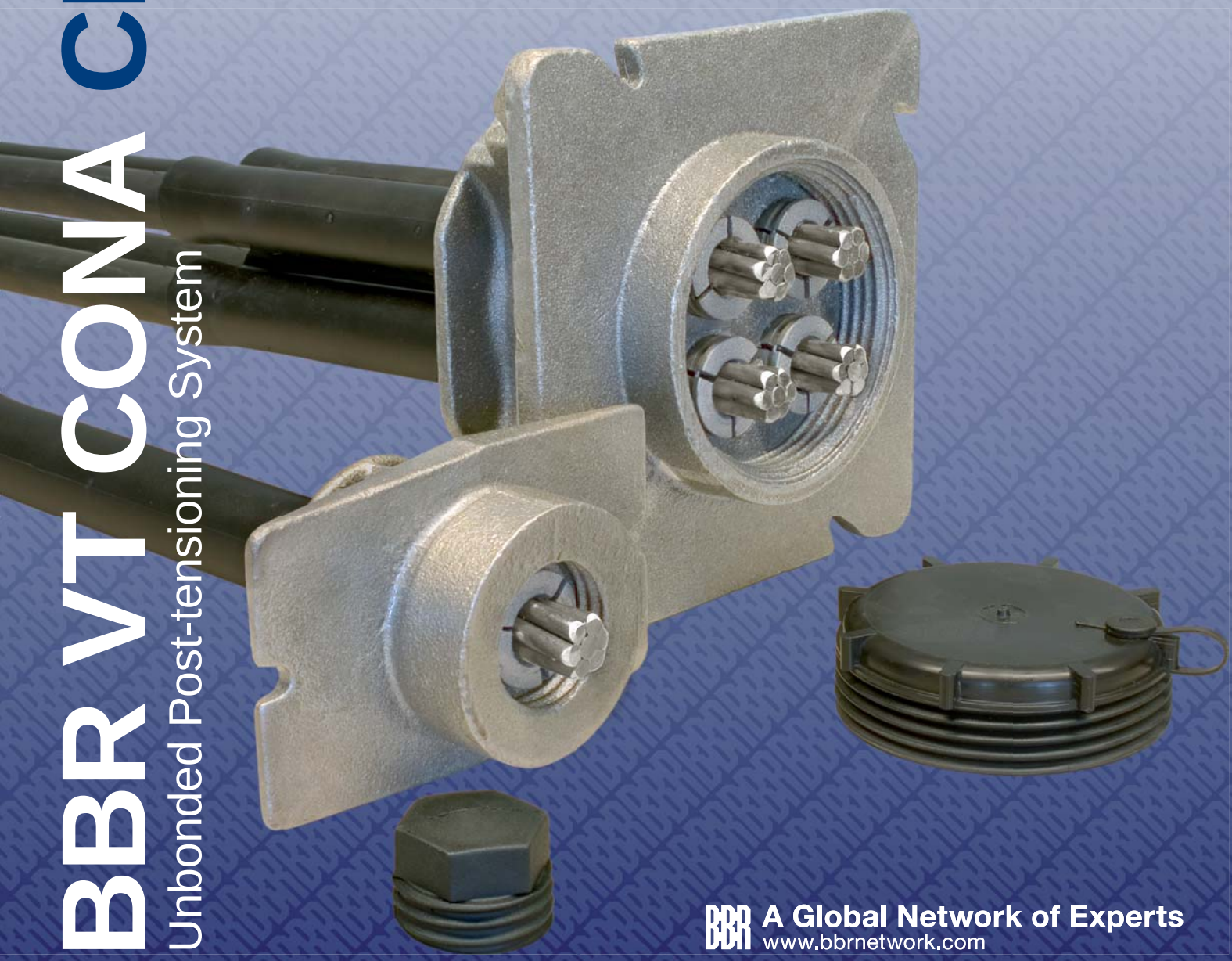
BBR Pretensados y Técnicas Especiales, S.L.

BBR VT CONA CMM

Unbonded Post-tensioning System

European Technical Approval
ETA – 06/0165

CE



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EN

prEN 13391 Mechanical Tests for Post-tensioning Systems

ETAG 013 Guideline for European Technical Approval of Post-tensioning Kits for Prestressing of Structures

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

With the European Technical Approval and an associated Certificate of Conformity, the BBR VT CONA CMM Post-tensioning Kit can be placed on the market with the CE marking.

PT Specialist Company

The installation of Post-tensioning Kits with CE marking has to be performed by certified Companies. For a complete list of all countries where BBR certified PT Specialist Companies can be found, please visit the BBR Website:

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ÖSTERREICHISCHES
INSTITUT FÜR
BAUTECHNIK
A-1010 Wien, Schenkenstraße 4
Tel.: +43(0)1-5336550
Fax: +43(0)1-5336423
E-Mail: mail@oib.or.at

Ermächtigt und notifiziert gemäß Artikel 10 der Richtlinie des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedsstaaten über Bauprodukte (89/106/EWG)

Mitglied der EOTA

European Technical Approval ETA-06/0165

English translation, the original version is in German

Handelsbezeichnung *Trade name*	**BBR VT CONA CMM – Spannverfahren ohne Verbund mit 01, 02 und 04 Litzen** *BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands*
Zulassungsinhaber *Holder of approval*	**BBR VT International Ltd Bahnstrasse 23 CH-8603 Schwerzenbach (ZH) Switzerland**
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	**Litzen-Spannverfahren, intern, ohne Verbund, für das Vorspannen von Tragwerken** *Post-tensioning kit for prestressing of structures with internal unbonded strands*
Geltungsdauer vom *Validity from* bis zum *to*	**15.11.2006** **14.11.2011**
Herstellwerk *Manufacturing plant*	**BBR VT International Ltd Bahnstrasse 23 CH-8603 Schwerzenbach (ZH) Switzerland**
Diese Europäische Technische Zulassung umfasst *This European Technical Approval contains*	**32 Seiten, einschließlich 13 Anhängen** *32 Pages, including 13 Annexes*

OIB-250-002/06-017

I LEGAL BASES AND GENERAL CONDITIONS

1 This European Technical Approval is issued by Österreichisches Institut für Bautechnik in accordance with:

1. Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1] – Construction Products Directive (CPD) –, amended by the Council Directive 93/68/EEC of 22 July 1993[2];
2. *dem Salzburger Bauproduktegesetz, LGBl. Nr. 11/1995, in der Fassung LGBl. Nr. 47/1995, LGBl. Nr. 63/1995, LGBl. Nr. 123/1995, LGBl. Nr. 46/2001, LGBl. Nr. 73/2001 und LGBl. Nr. 99/2001;* the Salzburg Construction Product Regulation LGBl. Nr. 11/1995, amended by LGBl. No. 47/1995, LGBl. No. 63/1995, LGBl. No. 123/1995, LGBl. No. 46/2001, LGBl. No. 73/2001 and LGBl. No. 99/2001;
3. Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[3];
4. Guideline for European Technical Approval of Post-Tensioning Kits for Prestressing of Structures, ETAG 013, Edition June 2002.

2 Österreichisches Institut für Bautechnik is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place at the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval shall not be transferred to manufacturers or agents of manufacturers other than those indicated on Page 1, or manufacturing plants other than those indicated on Page 1 of this European Technical Approval.

4 This European Technical Approval may be withdrawn by Österreichisches Institut für Bautechnik, in particular because of information by the Commission on the basis of Article 5 (1) of the Council Directive 89/106/EEC.

5 Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Österreichisches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 The European Technical Approval is issued by the Approval Body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities N° L 40, 11.2.1989, page 12
2 Official Journal of the European Communities N° L 220, 30.8.1993, page 1
3 Official Journal of the European Communities N° L 17, 20.1.1994, page 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of product

This European Technical Approval (ETA) applies to a kit, the PT system

BBR VT CONA CMM –
Unbonded Post-tensioning System
with 01, 02 and 04 Strands,

comprising the following components:

- Tendon

  Unbonded tendons with 01, 02 or 04 tensile elements.

- Tensile element

  7-wire prestressing steel strand with nominal diameters and nominal tensile strengths as given in Table 1, factory-provided with a corrosion protection system consisting of a corrosion protection filling material and an HDPE-sheathing.

Table 1: Tensile elements

Nominal diameter mm	Nominal cross section mm^2	Maximum characteristic tensile strength MPa
15.3	140	1,860
15.7	150	1,860
15.2 [1)]	165	1,820
Note [1)] Compacted strand		

Note
1 MPa = 1 N/mm^2

- Anchorage and coupler

  Anchorage of the strands with ring wedges;

  End anchorage

  Fixed (passive) or stressing (active) anchor as end anchorage for 01, 02 and 04 strands;

  Fixed coupler

  Sleeve coupler for 01 and 04 strands;

- Helix and additional reinforcement in the region of the anchorage;
- Corrosion protection system for tensile elements, anchorages and couplers.

1.2 Intended use

The PT system is intended to be used for the prestressing of structures.

Use categories according to type of tendon and material of structure:

- Internal unbonded tendon for normal weight concrete in concrete and composite structures;
- For special structures according to Eurocode 2, Eurocode 4 and Eurocode 6.

The provisions made in this European Technical Approval are based on an assumed intended working life of the PT system of 100 years. The indications given on the working life of the PT system cannot be interpreted as a guarantee given by the manufacturer or the Approval Body, but are to be regarded only as a means for selecting the appropriate product in relation to the expected, economically reasonable working life of the construction works.

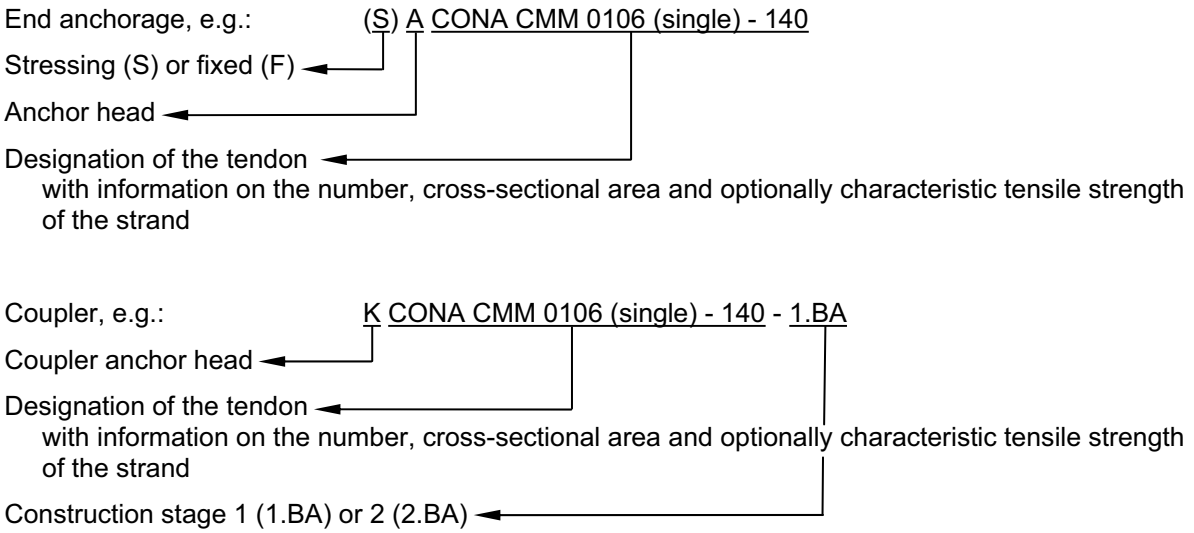
2 Characteristics of the product and methods of verification

PT system

2.1 Designation and range of anchorages and couplers

End anchorages are provided as stressing and fixed anchorages, while couplers are intended as fixed couplers only. Fixed couplers are foreseen for tendons with 01 or 04 strands, see Annex 1. The principal dimensions of anchorages and couplers are given in Annexes 2 and 3.

2.1.1 Designation



2.1.2 Anchorage

The anchor heads of the stressing and fixed anchorages are identical. A differentiation is needed for the construction works.

Fixed anchorages that are accessible may be prelocked; fixed anchorages that are not accessible shall be prelocked with a prelocking force as specified in Table 5. The ring wedges shall be secured with rings between the ring wedges and the covering cap.

2.1.3 Fixed coupler

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.

The tendon of construction stage 2 is coupled by screwing the coupler sleeve entirely on the threaded part of the coupler anchor head 1.BA (construction stage 1). The coupler anchor head 2.BA (construction stage 2) shall be prelocked with a prelocking force as specified in Table 5. At coupler anchor head K CONA CMM (single) – 2.BA (construction stage 2), the ring wedges are secured with wedge holding rings. At coupler anchor head K CONA CMM (four) – 2.BA (construction stage 2), the ring wedges are secured with a wedge holding plate.

2.1.4 Layout of the anchorage recesses

All anchor heads shall be placed perpendicular to the axis of the tendon, see Annex 5.

The minimum dimensions of the anchorage recesses are given in the Annexes 5 to 7. This clearance is required for positioning of the prestressing jacks. In order to allow for imperfections and to ease the cutting of the strand excess lengths, it is recommended to increase the dimensions of the recesses compared to their minimum dimensions.

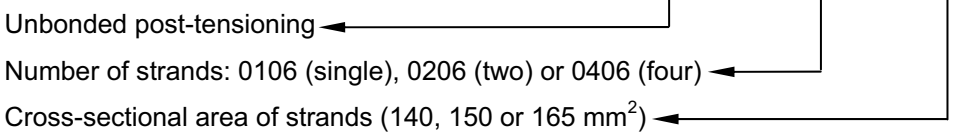
If other prestressing jacks than those shown in Annex 7 are used, the ETA holder shall keep information on the minimum dimensions of the anchorage recesses.

The formwork for the anchorage recesses should be slightly conical for ease of removal. The anchorage recesses shall be designed in such a way as to permit a reinforced cover concrete with the required dimensions, and in any case with a thickness of at least 20 mm.

2.2 Designation and range of the tendons

2.2.1 Designation

Tendon, e.g.: CONA CMM 0106 (single) - 140



The characteristic tensile strength of strands (e.g. 1,860 MPa) may be indicated optionally.

2.2.2 Range

Prestressing and overtensioning forces are given in the corresponding standards and regulations in force at the place of use. The maximum possible prestressing forces are listed in Table 11.

The tendons consist of 01, 02 or 04 strands, factory-provided with a corrosion protection system consisting of corrosion protection grease and an HDPE-sheathing.

2.2.2.1 CONA CMM 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

HDPE-sheathed and greased strand

Mass of sheathed and greased strand .....1.20 kg/m

External diameter of strand sheathing.....≥ 20 mm

Table 2: CONA CMM n06 - 140

Number of strands	n	---	01	02	04
Nominal cross-sectional area of prestressing steel	A_p	mm^2	140	280	560
Nominal mass of prestressing steel	m	kg/m	1.09	2.19	4.37
Nominal mass of tendon	m	kg/m	1.20	2.40	4.80
Characteristic tensile strength f_{pk} = 1,770 MPa					
Characteristic ultimate resistance of tendon	F_{pk}	kN	248	496	992
Characteristic tensile strength f_{pk} = 1,860 MPa					
Characteristic ultimate resistance of tendon	F_{pk}	kN	260	520	1,040

2.2.2.2 CONA CMM 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

HDPE-sheathed and greased strand

Mass of sheathed and greased strand .....1.30 kg/m

External diameter of strand sheathing.....≥ 20 mm

Table 3: CONA CMM n06 - 150

Number of strands	n	---	01	02	04
Nominal cross-sectional area of prestressing steel	A_p	mm^2	150	300	600
Nominal mass of prestressing steel	m	kg/m	1.17	2.34	4.69
Nominal mass of tendon	m	kg/m	1.30	2.60	5.20
Characteristic tensile strength f_{pk} = 1,770 MPa					
Characteristic ultimate resistance of tendon	F_{pk}	kN	266	532	1,064
Characteristic tensile strength f_{pk} = 1,860 MPa					
Characteristic ultimate resistance of tendon	F_{pk}	kN	279	558	1,116

2.2.2.3 CONA CMM n06 - 165

Compacted 7-wire prestressing steel strand

Nominal diameter.....15.2 mm

Nominal cross-sectional area .....165 mm^2

Maximum characteristic tensile strength .....1,820 MPa

HDPE-sheathed and greased strand

Mass of sheathed and greased strand .....1.42 kg/m

External diameter of strand sheathing.....≥ 20 mm

Table 4: CONA CMM n06 - 165

Number of strands	n	---	01	02	04
Nominal cross-sectional area of prestressing steel	A_p	mm^2	165	330	660
Nominal mass of prestressing steel	m	kg/m	1.29	2.58	5.16
Nominal mass of tendon	m	kg/m	1.42	2.84	5.68
Characteristic tensile strength f_{pk} = 1,820 MPa					
Characteristic ultimate resisting force of tendon	F_{pk}	kN	300	600	1,200

2.3 Friction losses

For the calculation of loss of prestressing force due to friction Coulomb's law applies. Due to the grease filling of the HDPE-sheathing of the individual monostrands or VT CMM bands, the friction coefficient μ is very low. The calculation of the friction losses is given by the equation

$$F_x = F_0 \cdot e^{-\mu \cdot (\alpha + k \cdot x)}$$

With

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; μ = 0.06 (CONA CMM n06 - 140/150) or 0.05 (CONA CMM n06 - 165)

k ..... rad/m .....wobble coefficient; $k = 8.73 \cdot 10^{-3}$ rad/m (= 0.5 °/m)

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 rad = 1 m/m = 1

If band-shaped tendons CONA CMM 150 or 165 with two or four strands are installed vertically with flat-wise curvature and connected at support distances of 1.15 to 1.30 m, the wobble coefficient is $k = 4.37 \cdot 10^{-3}$ rad/m (= 0.25 °/m).

Friction losses in anchorages are low and do not have to be taken into consideration in design and execution.

2.4 Support of tendons

The individual monostrands or VT CMM bands shall be fixed in their position. Spacing of supports is:

1 Normally

Individual monostrands (01 strand) and

VT CMM bands with 02 and 04 strands ..... 1.00 to 1.30 m

2 Free tendon layout in ≤ 45 cm thick slabs

In the transition region between

a) high tendon position and anchorage (e.g. cantilever) ..... 1.50 m

b) low and high tendon position or low tendon position and anchorage ..... 3.00 m

In regions of the high or low tendon position the tendons shall be connected in an appropriate way to the reinforcement mesh at two points at least, with a spacing of 0.3 to 1.3 m. The reinforcement mesh shall be fixed in its position. Special spacers for tendons are therefore not required. For details see Annex 8.

2.5 Slip at anchorages and couplers

Table 5 specifies the values of slip at anchorages and couplers which shall be taken into consideration in calculations of tendon elongation and forces in tendon.

Table 5: Slip values

Active anchorage	(S) A	6 mm
	K 1.BA	
Not accessible passive anchorage, prelocked [1)]	(F) A	3 mm
	K 2.BA	
Accessible passive anchorage	(F) A CONA CMM 0106 (single)	6 mm
	(F) A CONA CMM 0206 (two)	8 mm [2)]
	(F) A CONA CMM 0406 (four)	
Notes 1) Prelocked with $0,5 \cdot F_{pk}$ 2) If a more exact evaluation is required, slip Y1860S7 9 mm Y1820S7G 7 mm		

2.6 Centre spacing and edge distances for anchorages

In general, spacing and distances shall not be less than the values given in Table 6 and Annexes 5 and 6. However, a reduction of up to 15 % of the centre spacing of tendon anchorages in one direction is permitted, but shall not be less than the outside diameter of the helix and placing of additional reinforcement shall still be possible. In this case the spacing in perpendicular direction shall be increased by the same percentage.

Table 6: Minimum centre spacing and edge distance of anchorages

Tendon			CONA CMM 0106	CONA CMM 0206	CONA CMM 0406
Minimum centre spacing	a_c, b_c	mm	180, 140	200, 150	300, 220
Minimum edge distance	a_e, b_e	mm	70 + c, 50 + c	90 + c, 65 + c	130 + c, 90 + c

With

c ..... concrete cover in mm

Standards and regulations on concrete cover in force at the place of use shall be complied with.

2.7 Minimum radii of curvature of internal tendons

The minimum radius of curvature R_{min} of internal tendons with strands of nominal diameter of 15.2 to 15.7 mm is 2.5 m. If this radius is adhered to, the verification of prestressing steel outer fibre stresses in curved sections is not required. The minimum radius of curvature for deviation of a tendon with multistrand anchorages in the anchorage zone outside the transition tubes is 3.5 m.

2.8 Concrete strength at time of stressing

Concrete complying with EN 206-1[4] has to be used. At the time of stressing the mean concrete compressive strength, $f_{cm,\,0}$, shall be at least 24 MPa (cube strength, 150 m cube) or 20 MPa (cylinder strength, 150 mm cylinder diameter). The concrete test specimen shall be subjected to the same hardening conditions as the structure.

For partial prestressing with 30 % of the full prestressing force the actual mean value of the concrete compressive strength shall be at least $0.5 \cdot f_{cm,\,0,\,cube}$ or $0.5 \cdot f_{cm,\,0,\,cylinder}$. Intermediate values may be interpolated linearly according to EN 1992-1-1.

4 Reference documents are listed in Annex 13.

Components

2.9 Strands

Table 7: Prestressing steel strands

Max. characteristic tensile strength	f_{pk}	MPa	1,860	1,860	1,820
Nominal diameter	d	mm	15.3	15.7	15.2 [1)]
Nominal cross-sectional area	A_p	mm^2	140	150	165
Mass of prestressing steel	m	kg/m	1.093	1.172	1.289
Greased and sheathed strand – Individual monostrands or VT CMM bands					
Nominal mass per strand	---	kg/m	1.20	1.30	1.42
External diameter of HDPE-sheathing	---	mm	≥ 20		
Note [1)] Compacted strand					

The greased and sheathed strands may be either individual monostrands or VT CMM bands.

Only 7-wire prestressing steel strands as given in Table 7 and Annex 12 shall be used.

The corrosion protection system of the strand is as specified in ETAG 013, Annex C.1, see also Annex 10 and 11.

2.10 Anchorages and couplers

The components of anchorages and couplers shall comply with the specifications given in Annexes 2, 3, 5 and 6 and the technical documentation[5]. Therein the components' dimensions, materials and material identification data with tolerances and the materials used in the corrosion protection system are given.

2.10.1 Anchor heads

The anchor heads are made of cast iron with spheroidal graphite. They provide regularly arranged conical holes to accommodate 01, 02 or 04 strands and ring wedges. The load transfer to the concrete occurs in two planes. The anchor head has a cylindrical extension with an internal thread to screw-in a protection cap, which will be filled with corrosion protection grease to protect the ring wedges and the strands.

The outlet end of the holes is formed in such a way as to allow the transition pipes to be inserted tension-proof. The transition pipes act as the transition from the anchor head to the sheathing of the strands.

2.10.2 Couplers

Fixed couplers are provided with 01 and 04 strands. They consist of a coupler anchor head 1.BA (construction stage 1) and a coupler anchor head 2.BA (construction stage 2).

The coupler anchor head 1.BA (construction stage 1) has the same basic body as the anchor heads of active and passive anchorages for 01 and 04 strands and a cylindrical extension to accommodate the coupler thread.

The connection between coupler anchor heads 1.BA (construction stages 1) and 2.BA (construction stages 2) is by means of a coupler sleeve, a steel tube having an internal thread, a threaded bore to accommodate the filling device and a bore for ventilation.

[5] The technical documentation of this European Technical Approval is deposited at Österreichisches Institut für Bautechnik and, as far as relevant for the tasks for the approved body involved in the attestation of conformity procedure, is handed over to the approved body.

The coupler anchor head 2.BA (construction stage 2) for 01 strand is either a cast iron head with a conical hole or a steel body with a conical bore. The coupler anchor head 2.BA (construction stage 2) for 04 strands is a steel body with conical bores. All coupler anchor heads provide a machined external thread for the coupler sleeve.

The end surface of the fixed coupler K CONA CMM 0406 (four) is provided with a BDSD-plate to permit settlement of the coupler during stressing.

2.10.3 Ring wedges

The ring wedges are in three pieces, which are held together by spring rings. Two types of ring wedge are used, which have identical dimensions but are made of different steel material with equivalent strengths. Within one anchorage or coupler only one type of ring wedge may be used.

Wedge holding rings serve to secure the ring wedges after prelocking. The fastening of the ring wedges of the prelocked coupler anchor head CONA CMM 0406 (four) - 140/150/165 - 2.BA (construction stage 2) is made by means of a wedge holding plate.

2.10.4 Helix and additional reinforcement

The helixes, stirrups and the additional reinforcement are made of ribbed reinforcing steel. The end of the helix on the anchorage side is welded to the next ring. The helix shall be placed exactly in the tendon axis. The helix' dimensions shall comply with the values specified in Annexes 5 and 6.

2.10.5 Material properties

Table 8: Material properties

Component	Standard / Specification
Anchor head 0106/0206/0406	EN 1563
Coupler anchor head 0106/0406 – 1.BA	EN 1563
Coupler anchor head 0106 – 2.BA	EN 1563 EN 10083-1 EN 10083-2
Coupler anchor head 0406 – 2.BA	EN 10083-1 EN 10083-2
Coupler sleeve 0106/0406	EN 10210-1
Ring wedge BBR Ring wedge BBR F	EN 10277-2 EN 10084
Wedge holding plate	EN 10025-2
Helix	Ribbed reinforcing steel $R_e \geq 500$ MPa
Additional reinforcement, stirrups	Ribbed reinforcing steel $R_e \geq 500$ MPa
Corrosion protection grease	ETAG 013, Annex C
Strand sheathing	ETAG 013, Annex C
Greased bandage or greased felt rings	---
Transition pipes	EN ISO 1872-1 EN ISO 1874-1
Wedge holding ring, protection caps	EN ISO 1874-1

Component	Standard / Specification
BDSD-plate	---

2.11 Permanent corrosion protection

The corrosion protection materials used are specified according to ETAG 013, Annex C.1, see also Annexes 10 and 11.

2.11.1 Corrosion protection of the strand

The strands are sheathed in the factory with an extruded HDPE-sheathing with a thickness of at least 1.0 mm. The actual thickness of the sheathing shall be in accordance with the standards and regulations valid in place of use.

2.11.2 Corrosion protection in anchorage and coupler zones

The voids inside the HDPE-sheathing are filled with corrosion protection grease. When mounting the anchorage, the sheathing is removed along the required length. During construction the strand excess lengths are temporarily protected with cut-off HDPE-sheaths.

All voids of the anchorages are filled with corrosion protection grease according to the installation instructions given in Annex 9.

Anchorages which are prelocked receive their corrosion protection immediately after the prelocking operation by screwing-on of the protection cap and filling with corrosion protection grease.

2.12 Dangerous substances

The release of dangerous substances is determined according to ETAG 013, clause 5.3.1. The PT system complies with the provisions of Guidance Paper H[6] relating to dangerous substances.

A declaration of conformity in this respect was made by the manufacturer.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the product falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements also need to be complied with, when and where they apply.

2.13 Methods of verification

The assessment of the fitness of the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands" for the intended use in relation to the requirements for mechanical resistance and stability in the sense of Essential Requirement 1 of the Council Directive 89/106/EEC has been made in compliance with the Guideline for European Technical Approvals of "Post-Tensioning Kits for Prestressing of Structures", ETAG 013, Edition June 2002, based on the provisions for unbonded systems.

2.14 Identification

This European Technical Approval for the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands" is issued on the basis of agreed data, deposited with Österreichisches Institut für Bautechnik, which identifies the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands" that has been assessed and judged. Changes to the production process of the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands", which could result in this deposited data being incorrect, should be notified to Österreichisches Institut für Bautechnik before the changes are introduced. Österreichisches Institut für Bautechnik will decide whether or not such changes affect this European Technical Approval and consequently the validity of the CE marking on the basis of this European Technical Approval and, if so, whether further assessment or alterations to this European Technical Approval are considered necessary.

[6] Guidance Paper H: A harmonised approach relating to Dangerous substances under the Construction Products Directive, Rev. September 2003.

3 Evaluation of conformity and CE marking

3.1 Attestation of conformity system

The system of attestation of conformity assigned by the European Commission to this product in accordance with the Council Directive 89/106/EEC of 21 December 1988, Annex III, Section 2, Clause i), referred to as System 1+, provides for:

Certification of the conformity of the product by an approved certification body on the basis of

(a) Tasks for the manufacturer

(1) Factory production control;

(2) Further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan[7];

(b) Tasks for the approved body

(3) Initial type testing of the product;

(4) Initial inspection of factory and of factory production control;

(5) Continuous surveillance, assessment and approval of factory production control;

(6) Audit testing of samples taken at the factory.

3.2 Responsibilities

3.2.1 Tasks for the manufacturer – Factory production control

At the manufacturing plant, the manufacturer shall implement and continuously maintain a factory production control system. All the elements, requirements and provisions adopted by the manufacturer shall be documented systematically in the form of written operating and processing instructions. The factory production control system shall ensure that the product is in conformity with this European Technical Approval.

Within the framework of factory production control, the manufacturer shall carry out tests and controls in accordance with the prescribed test plan[7], which is fixed with this European Technical Approval. Details of the extent, nature and frequency of testing and controls to be performed within the framework of the factory production control shall correspond to this prescribed test plan[7], which forms part of the technical documentation[6] of this European Technical Approval.

The results of factory production control are recorded and evaluated. The records include at a minimum the following information:

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

On request the records shall be presented to Österreichisches Institut für Bautechnik.

If test results are unsatisfactory, the manufacturer shall immediately implement measures to eliminate the defects. Construction products or components which are not in compliance with the requirements shall be removed. After elimination of the defects the respective test – if verification is required for technical reasons – shall be repeated immediately.

The basic elements of the prescribed test plan[7] comply with ETAG 013, Annex E.1 and are specified in the quality management plan of the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands".

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[7] The prescribed test plan has been deposited at Österreichisches Institut für Bautechnik and is handed over only to the approved body involved in the conformity attestation procedure.

Table 9: Contents of the prescribed test plan[7]

Component	Item	Test / Check	Traceability	Minimum frequency	Documentation
Anchor head and coupler anchor head	Material	Check	full	100 %	"3.1" [1)]
	Detailed dimensions [2)]	Test		5 % ≥ 2 specimens	yes
	Visual inspection [3), 4)]	Check		100 %	no
Ring wedge	Material	Check	full	100 %	"3.1" [1)]
	Treatment, Hardness [5), 6)]	Test		0.5 % ≥ 2 specimens	yes
	Detailed dimensions [2)]	Test		5 % ≥ 2 specimens	yes
	Visual inspection [3)]	Check		100 %	no
Coupler sleeve	Material	Check	full	100 %	"3.1" [1)]
	Detailed dimensions	Test		5 % ≥ 2 specimens	yes
	Visual inspection [3)]	Check		100 %	no
VT CMM band	Material of strand	Check	full	100 %	"CE" [8)]
	Diameter of strand	Test		each coil	no
	Visual inspection of strand [3)]	Check		each coil	no
	HDPE-sheath [7)]	Check		100 % ETAG 013, Annex C.1	yes
	Corrosion protection grease [7)]	Check		100 % ETAG 013, Annex C.4.1	yes
	Material of VT CMM band [9)]	Test		ETAG 013, Annex C.1.4	yes
	Visual inspection of VT CMM band [3)]	Check		100 %	no
Individual monostrand	Material of strand	Check	full	100 %	"CE" [8)]
	Diameter of strand	Test		each coil	no
	Visual inspection of strand [3)]	Check		each coil	no
	Material of individual monostrand [7), 9)]	Check		100 % ETAG 013, Annex C.1	yes
	Visual inspection of individual monostrand [3)]	Check		100 %	no

1) "3.1": Inspection certificate type "3.1" according to EN 10204

[2] Other dimensions than [4]

[3] Visual inspections includes 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[7].

[4] 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.

[5] Geometrical properties

[6] Surface hardness

[7] Suppliers certificate

[8] As long as the basis for CE marking of prestressing steel is not available, an approval or certificate according to the respective rules in force at the place of use shall accompany each delivery.

[9] According to ETAG 013, Annex C.1.4

full: Full traceability of each component to its raw materials.

3.2.2 Tasks for the approved body

3.2.2.1 Initial type testing of the products

For initial type testing the results of the tests performed as part of the assessment for this European Technical Approval may be used unless there are changes in the production procedure or factory plant. In such cases, the necessary initial type testing shall be agreed between Österreichisches Institut für Bautechnik and the approved body involved.

3.2.2.2 Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan[7], the manufacturing plant, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous and orderly manufacturing of the PT system according to the specifications given in Section II as well as in the Annexes of this European Technical Approval.

3.2.2.3 Continuous surveillance

The kit manufacturer shall be inspected at least once a year. Each component manufacturer of the components listed in Table 10 shall be inspected at least once in five years. It shall be verified that the system of factory production control and the specified manufacturing process are maintained taking account of the prescribed test plan[7].

The results of product certification and continuous surveillance shall be made available on demand by the approved body to Österreichisches Institut für Bautechnik. If the provisions of this European Technical Approval and the prescribed test plan[7] are no longer fulfilled, the certificate of conformity shall be withdrawn and Österreichisches Institut für Bautechnik informed immediately.

3.2.2.4 Audit testing of samples taken at the factory

During surveillance inspection, the approved body shall take samples at the factory of components of the PT system or of individual components, for which this European Technical Approval has been granted, for independent testing. For the most important components Table 10 given below summarises the minimum procedures, which shall be implemented by the approved body.

Table 10: Audit testing

Component	Item	Test / Check	Sampling [2] – Number of components per visit
Anchor head and coupler anchor head	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	Test	5
	Visual inspection [1]	Check	5
Coupler sleeve	Material according to specification	Test / Check	1
	Detailed dimensions	Test	
	Visual inspection [1]	Check	
Individual monostrands or VT CMM bands	Material according to specification	Test / Check	1
	Diameter	Test	
	Visual inspection [1]	Check	
Strand	Material according to specification	Test / Check	1
Single tensile element test	Single tensile element test according to ETAG 013, Annex E.3	Test	1 Series

[1] Visual inspections means 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[7].

[2] All samples shall be randomly selected and clearly identified.

3.3 CE marking

The delivery note of the components of the PT system shall contain the CE marking. The symbol "CE" shall be followed by the identification number of the certification body and shall be accompanied by the following information:

- Name or identification mark and address of the manufacturer;
- The last two digits of the year in which the CE marking was affixed;
- Number of the European Technical Approval;
- Number of the certificate of conformity;
- Product identification (trade name).

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

4.1 Manufacturing

"BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands" is manufactured in accordance with the provisions of this European Technical Approval. Composition and manufacturing process are deposited at Österreichisches Institut für Bautechnik.

4.2 Design

4.2.1 Anchorage recess

The anchorage recess shall be designed so as to ensure a concrete cover of at least 20 mm at the protection caps or locking plates in the final state. Clearance is required for the handling of prestressing jacks. In order to allow for imperfections and to ease the cutting of the strand excess lengths it is recommended to increase the dimensions of the recesses. The forms for the recesses should be slightly conical for easy removal.

If other prestressing jacks than those shown in Annex 7 are used, the ETA holder shall keep information on the prestressing jacks and minimum dimensions of the anchorage recesses.

In case of failure the springing out of prestressing steels shall be prevented. Sufficient protection is provided by e.g. a cover of reinforced concrete.

4.2.2 Maximum prestressing force

The prestressing and overstressing forces are specified in the respective standards and regulations in force at the place of use. Table 11 lists the maximum prestressing and overstressing forces.

Table 11: Maximum prestressing and overstressing forces [1)]

CONA CMM 0106 (single)							
Strands	A_p	mm^2	140		150		165
Characteristic tensile strength	f_{pk}	MPa	1,770	1,860	1,770	1,860	1,820
Characteristic ultimate resisting force	F_{pk}	kN	248	260	265	279	300
Maximum prestressing force $0.9 \cdot F_{p0.1k}$		kN	192	202	206	216	232
Maximum overstressing force [2)] $0.95 \cdot F_{p0.1k}$		kN	202	213	218	228	245
CONA CMM 0206 (two)							
Strands	A_p	mm^2	140		150		165
Characteristic tensile strength	f_{pk}	MPa	1,770	1,860	1,770	1,860	1,820
Characteristic ultimate resisting force	F_{pk}	kN	496	520	532	558	600
Maximum prestressing force $0.9 \cdot F_{p0.1k}$		kN	383	403	412	432	464
Maximum overstressing force [2)] $0.95 \cdot F_{p0.1k}$		kN	405	426	435	456	490

CONA CMM 0406 (four)							
Strands	A_p	mm^2	140		150		165
Characteristic tensile strength	f_{pk}	MPa	1,770	1,860	1,770	1,860	1,820
Characteristic ultimate resisting force	F_{pk}	kN	992	1,040	1,064	1,116	1,200
Maximum prestressing force $0.9 \cdot F_{p0.1k}$		kN	767	806	824	864	929
Maximum overstressing force [2] $0.95 \cdot F_{p0.1k}$		kN	809	851	870	912	980

Notes

[1] The given values are maximum values according to EN 1992-1-1. The actual values are to be taken from the standards and regulations in force at the place of use. Compliance with the stabilisation and crack width criteria in the load transfer test was verified to a load level of $0.80 \cdot F_{pk}$.

[2] Overstressing is permitted if the force in the prestressing jack can be measured to an accuracy of $\pm$ 5 % of the final value of the prestressing force.

4.2.3 Reinforcement in the anchorage zone

The helix and the additional reinforcement as given in Annexes 5 and 6 shall be adopted.

Verification of the transfer of prestressing forces to the structural concrete is not required if the centre spacing and edge distances of the anchorages or couplers as well as grade and dimensions of additional reinforcement, see Annexes 5 and 6, are complied with. The forces outside the area of the helix and additional reinforcement shall be verified and, if necessary, resisted by appropriate (transversal) reinforcement.

If required for a specific project design, the reinforcement given in Annexes 5 and 6 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.

4.2.4 Fatigue resistance

Fatigue resistance of the tendons was tested with a maximum force of $0.65 \cdot F_{pk}$ and a stress variation of 80 MPa up to $2.0 \cdot 10^6$ load cycles.

4.2.5 Tendons in masonry structures – Load transfer to the structure

Load transfer of prestressing force to masonry structures shall be achieved by means of concrete members designed according to this European Technical Approval, especially according to clauses 2.6, 2.8, 2.10.5 and 4.2.3.

The concrete members shall have dimensions so as to permit a force of $1.1 \cdot F_{pk}$ being transferred into the masonry. The verification shall be performed according to Eurocode 6 as well as to the respective standards and regulations in force at the place of use.

4.3 Installation

Assembly and installation of tendons shall only be carried out by qualified PT specialist companies with the required resources and experience in the use of unbonded post-tensioning systems, see ETAG 013, Annex D.1 and CWA 14646. The respective standards and regulations in force at the place of use shall be complied with. The company's PT site manager shall have a certificate, stating that he has been trained by the ETA holder and that he possesses the necessary qualifications and experience with the "BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands".

The tendons shall be carefully handled during production, transport, storage and installation. The corrosion-protected HDPE-sheathed strands are usually delivered to site in coils with an internal diameter of 1.45 to 1.75 m.

In the anchorage zone, the webs of the VT CMM bands shall be longitudinally cut over a length of 1.3 m from the end. The layout of the transition zone is shown in Annex 8.

The sequence of work steps for installation of anchorage and fixed coupler is described in Annex 9.

Before placing the concrete a final check of the installed tendons shall be carried out by the person responsible for tendon placement. At that time, the passive anchorages mounted at the PT works shall be randomly checked for proper seating of the ring wedges and complete filling of the protection caps with corrosion protection grease. In the case of minor damage to the sheathing, the damaged area shall be cleaned and sealed with an adhesive tape.

4.4 Stressing

Prestressing requires free space directly behind the anchorages. The ETA holder shall keep information on prestressing jacks and appropriate clearance behind the anchorage.

With a mean concrete compressive strength in the anchorage zone, $f_{cm,\,0}$, complying with the values laid down in Annex 6 full prestressing may be applied.

Elongations and prestressing forces shall be checked continuously during the stressing operation. The results of the stressing operation shall be recorded for each tendon and the measured elongations shall be compared with the previously calculated values.

Information on the prestressing equipment shall have been submitted to Österreichisches Institut für Bautechnik.

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

4.5 Restressing

Restressing of tendons in combination with the release and reuse of wedges is permitted, whereby the wedges shall bite into at least 15 mm of virgin strand surface and no wedge bites shall remain inside the final length of the tendon between anchorages.

4.6 Welding

Welding is not intended and it is not permitted to weld on built-in components of PT systems.

In the case of welding operations near tendons precautionary measures are required to avoid damage to the corrosion protection system.

5 Recommendations for the manufacturer

5.1 Recommendations for packaging, transport and storage

During transport of prefabricated tendons a minimum diameter of curvature of 1.45 to 1.75 m or as specified by the manufacturer of the strand shall be observed.

The ETA holder shall have instructions related to

- Temporary protection of prestressing steels and components in order to prevent corrosion during transportation from the production site to the job site;
- Transportation, storage and handling of the tensile elements and of other components in order to avoid any mechanical, chemical or electrochemical changes;
- Protection of tensile elements and other components from moisture;
- Keeping tensile elements separate from areas where welding operations are performed.

5.2 Recommendations on installation

The manufacturer's installation instructions have to be complied with, see ETAG 013, Annex D.3. The respective standards and regulations in force at the place of use shall be observed.

5.3 Accompanying information

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 CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands".

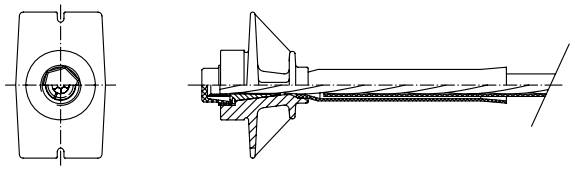
On behalf of Österreichisches Institut für Bautechnik

Dipl.-Ing. Dr. Rainer Mikulits

Managing Director

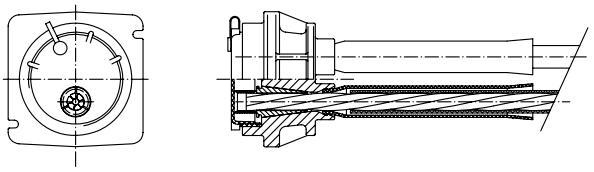
Active and passive anchorage

CONA CMM 0106
(single)



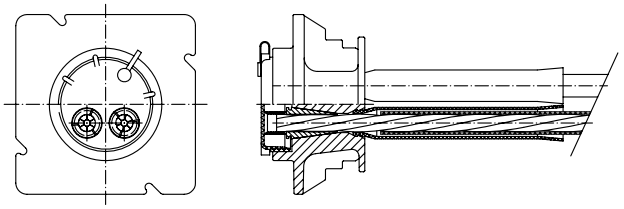
Monostrand
or VT CMM Band

CONA CMM 0206
(two)



Monostrands
or VT CMM Band

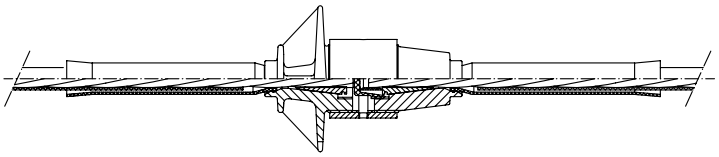
CONA CMM 0406
(four)



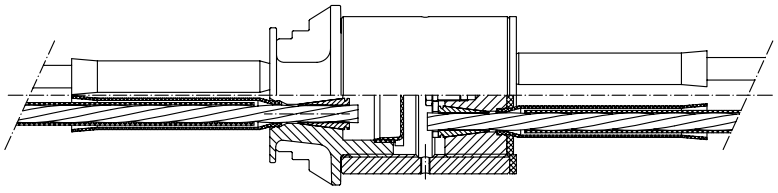
Monostrands
or VT CMM Band

Fixed couplers

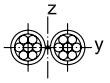
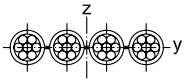
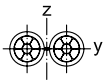
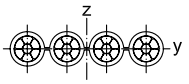
Fixed coupler CONA CMM 0106 (single)



Fixed coupler CONA CMM 0406 (four)



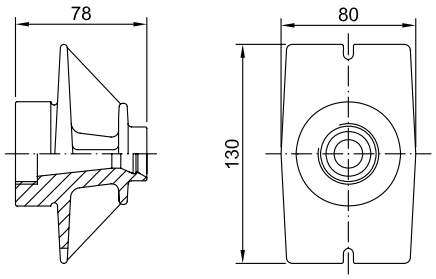
VT CMM Band

VT CMM Band 01-140 VT CMM Band 01-150		VT CMM Band 02-140 VT CMM Band 02-150		VT CMM Band 04-140 VT CMM Band 04-150	
VT CMM Band 01-165		VT CMM Band 02-165		VT CMM Band 04-165	

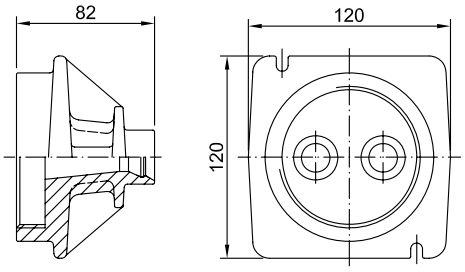
CONA CMM	Unbonded Post-tensioning System Overview	Annex 1 of European Technical Approval ETA-06/0165

Active and passive anchorage

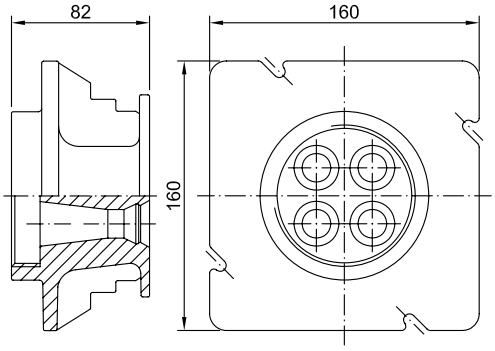
(S/F) A CONA CMM 0106 (single)



(S/F) A CONA CMM 0206 (two)



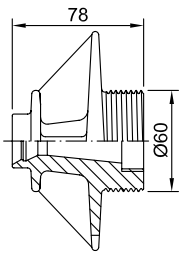
(S/F) A CONA CMM 0406 (four)



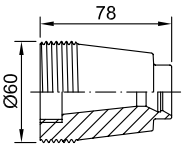
Fixed coupler

K CONA CMM 0106 (single)

1. BA:

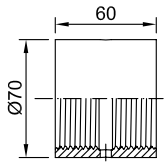


2. BA:

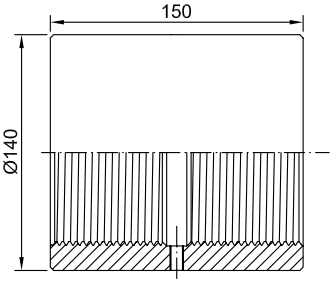


Threaded coupler sleeve:

K CONA CMM 0106 (single)

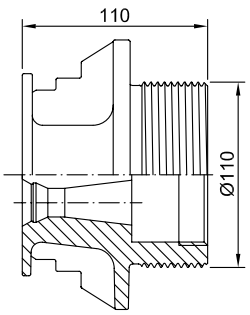


K CONA CMM 0406 (four)

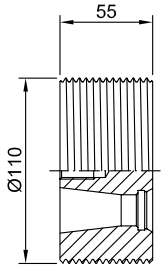


K CONA CMM 0406 (four)

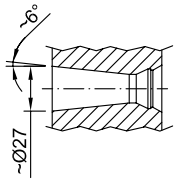
1. BA:



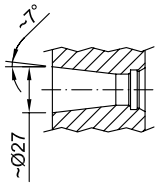
2. BA:



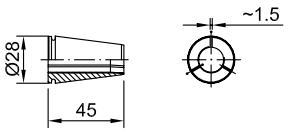
Cast iron cone



Machined cone



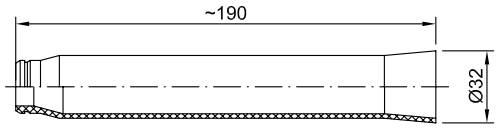
Ring wedge



Dimensions in mm

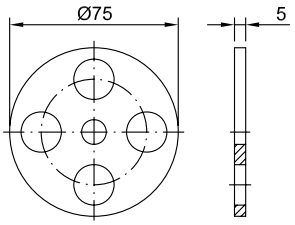
BBR CONA CMM	Unbonded Post-tensioning System Components of anchorages and fixed couplers	Annex 2 of European Technical Approval ETA-06/0165

Transition pipe

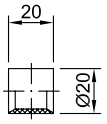


Wedge holding plate

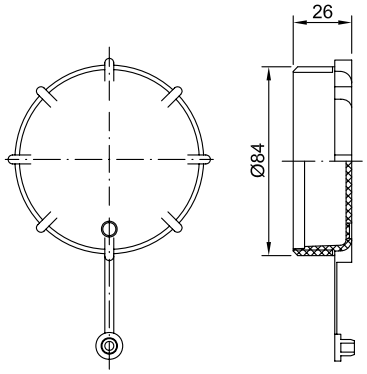
K CONA CMM 0406 (four), 2.BA



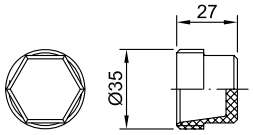
Wedge holding ring



Protection caps



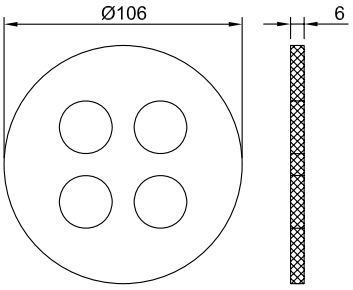
CONA CMM 0206 (two)
CONA CMM 0406 (four)



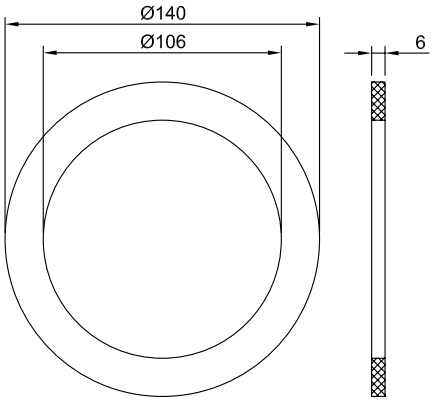
CONA CMM 0106 (single)

BDSD-plate

Version A



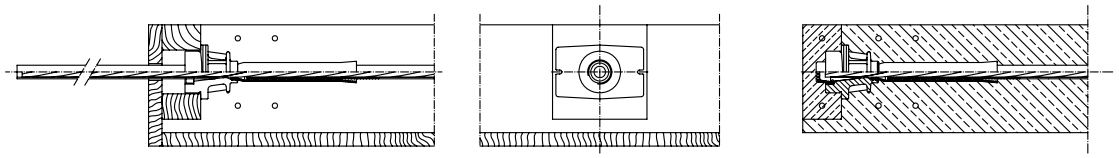
Version DF



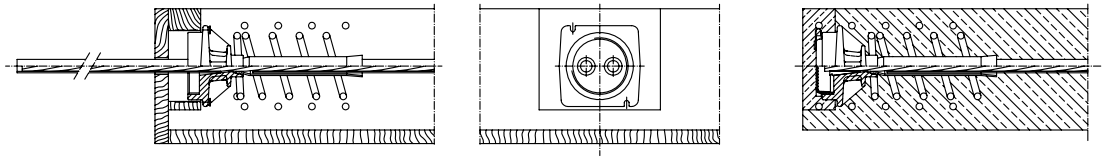
Dimensions in mm

BBR CONA CMM	Unbonded Post-tensioning System Accessories	Annex 3 of European Technical Approval ETA-06/0165

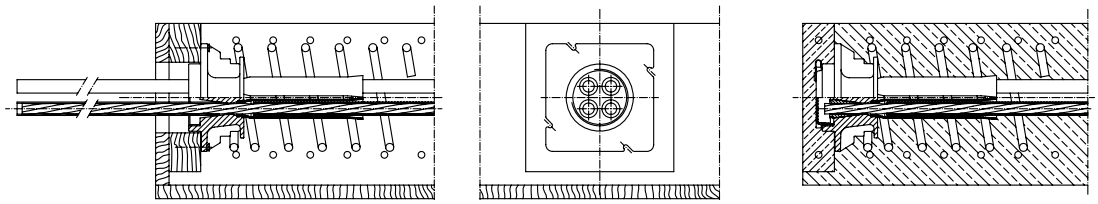
Tendon CONA CMM 0106 (single)



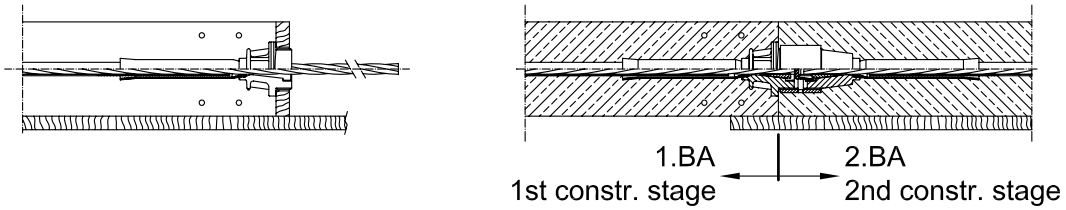
Tendon CONA CMM 0206 (two)



Tendon CONA CMM 0406 (four)



Fixed coupler CONA CMM 0106 (single)



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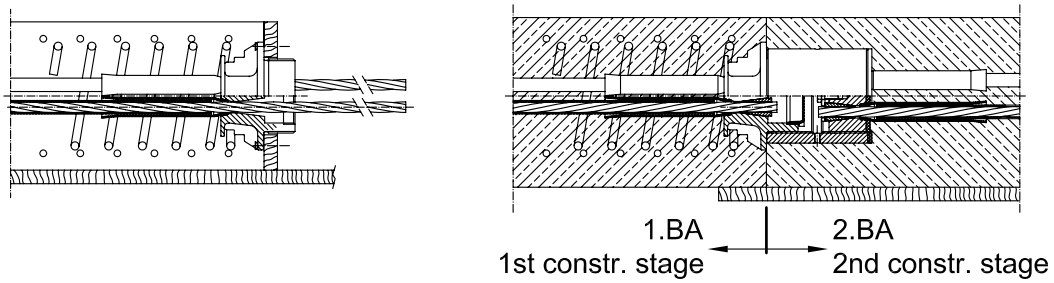
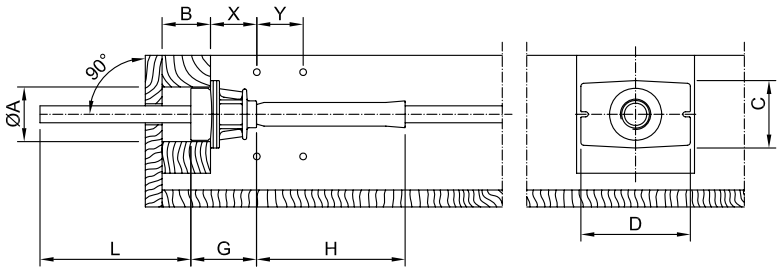
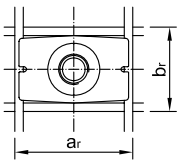


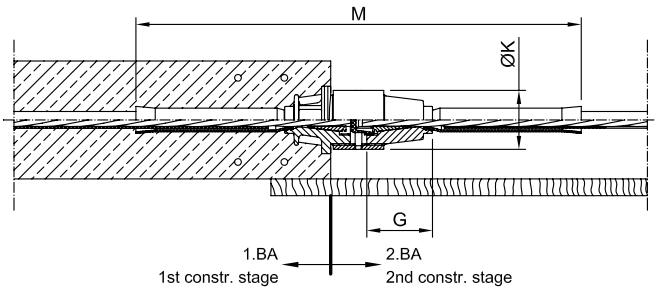
BBR CONA CMM	Unbonded Post-tensioning System Construction stages – anchorages and fixed couplers	Annex 4 of European Technical Approval ETA-06/0165

CONA CMM 0106 (single)

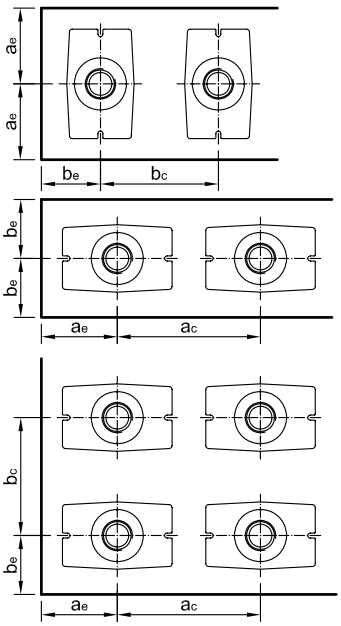
Additional reinforcement:
Stirrups or orthogonal reinforcement



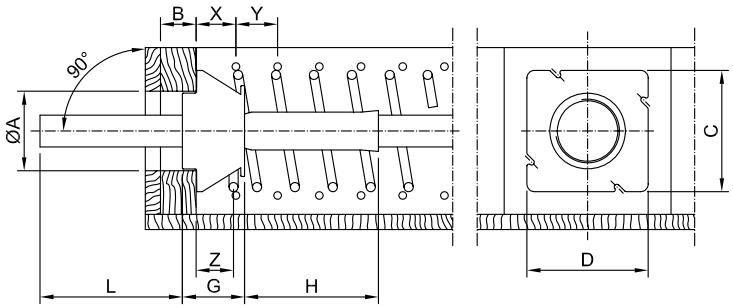


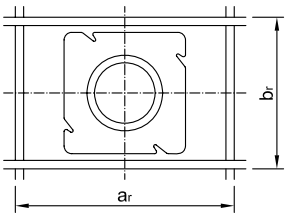


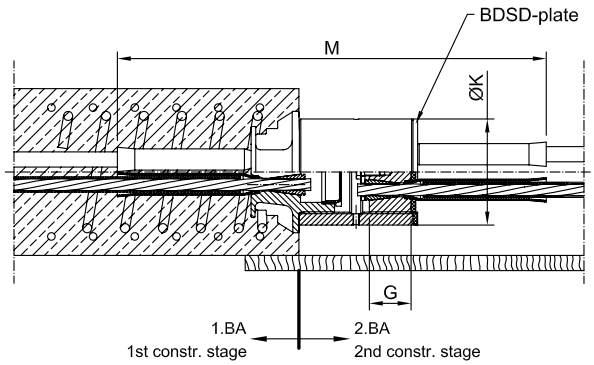
Fixed Coupler CONA CMM 0106 (single)

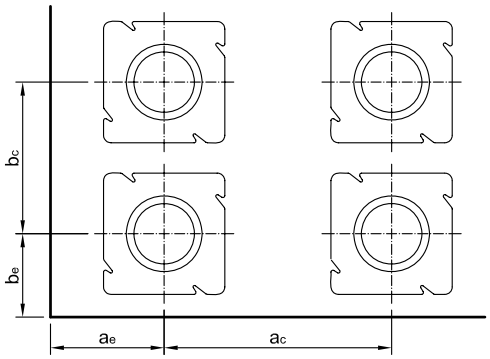


CONA CMM 0206 (two) / CONA CMM 0406 (four)









Fixed Coupler CONA CMM 0406 (four)

CONA CMM	Unbonded Post-tensioning System Dimensions of anchorage, helix and additional reinforcement and spacing	Annex 5 of European Technical Approval ETA-06/0165

Technical data of the BBR VT CONA CMM anchorage system

CONA CMM			**0106 (single)**					**0206 (two)**					**0406 (four)**				
Strands	A_P	mm^2	**140**		**150**		**165**	**140**		**150**		**165**	**140**		**150**		**165**
Charact. tensile strength	f_{pk}	MPa	1,770	1,860	1,770	1,860	1,820	1,770	1,860	1,770	1,860	1,820	1,770	1,860	1,770	1,860	1,820
Charact. value of max. force	F_{pk}	kN	248	260	266	279	300	496	520	532	558	600	992	1,040	1,064	1,116	1,200
0.90 $F_{p0,1k}$	-	kN	192	202	206	216	232	383	403	412	432	464	767	806	824	864	929
0.95 $F_{p0,1k}$	-	kN	202	213	218	228	245	405	426	435	456	490	809	851	870	912	980
Dimensions of monostrands / band	-	mm	Ø 20					2 x Ø 20 / 44x20					4 x Ø 20 / 90x20				
Concrete Strength																	
min. Strength (cub)	$f_{cm,0}$	MPa	≥ 24														
min. Strength (cyl.)	$f_{cm,0}$	MPa	≥ 20														
Helix	Ribbed reinforcing steel Re ≥ 500 MPa																
External diameter	-	mm						100					160				
Bar diameter	-	mm						10					12				
Length, approx.	-	mm						180					275				
Pitch	-	mm						40					50				
Number of pitches	-							4+1					5+1				
Distance	Z	mm						50					45				
								The anchorage sided helix end is welded									
Additional Reinforcement	Ribbed reinforcing steel Re ≥ 500 MPa																
Number of stirrups	-		2					4					6				
Bar diameter	-	mm	8					10					10				
Spacing	X	mm	55					25					53				
	Y	mm	50					50					55				
Outside dimensions	a_r	mm	140					180					260				
	b_r	mm	100					130					180				
Spacing of anchorages																	
Min. centre spacing	a_c	mm	180					200					300				
	b_c	mm	140					150					220				
Min. edge distance	a_e	mm	70+c					90+c					130+c				
	b_e	mm	50+c					65+c					90+c				
Anchorage recesses (open on top)																	
Bore in forms	ØA	mm	65					103					103				
- for coupler 1.BA	ØA	mm	62					---					113				
Depth	B	mm	60					50					50				
Dimensions of anchorages																	
Active/passive anchor block	CxDxG	mm	80x130x78					120x120x82					160x160x82				
Coupler 1. BA	CxDxG	mm	80x130x78					= 2 Couplers K CONA CMM 106					160x160x110				
Coupler 2. BA	ØxG	mm	Ø62x78										Ø110x55				
Coupler sleeve	ØK	mm	70					---					140				
Coupler	M	mm	~545					---					~565				
Transition pipe	H	mm	175														

c ..... Concrete cover

CONA CMM

Unbonded Post-tensioning System
Dimensions of anchorage, helix and additional reinforcement and spacing

Annex 6

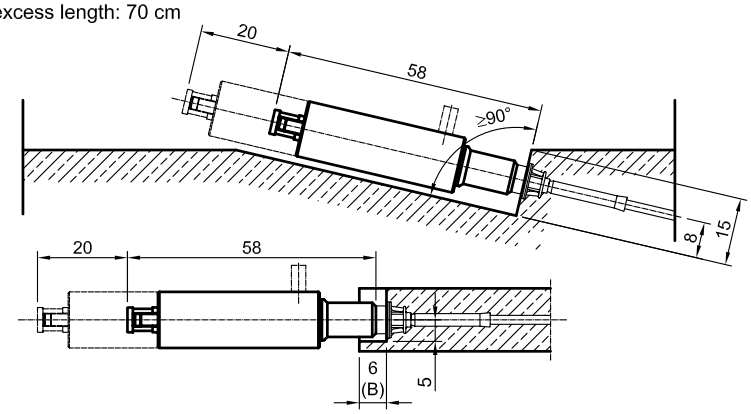
of European Technical Approval ETA-06/0165

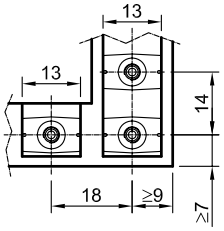
Construction examples, minimized anchorage recess dimensions

Tendon CONA CMM 0106 (single)

supposed 2 cm concrete cover

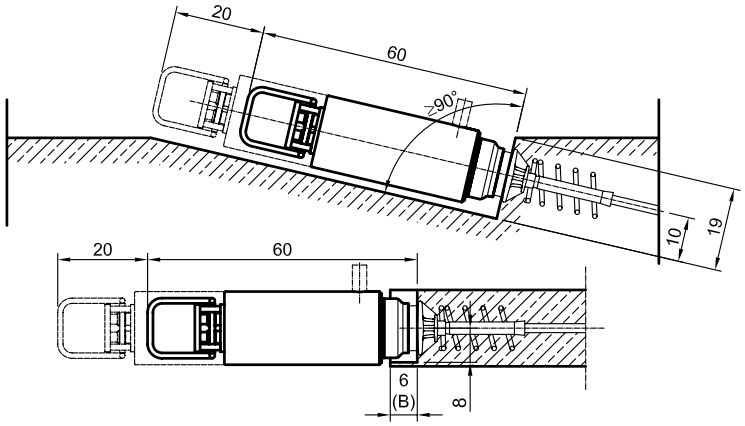
Strand excess length: 70 cm

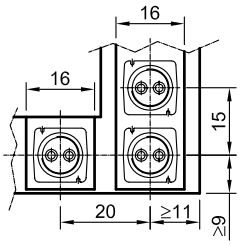




Tendon CONA CMM 0206 (two)

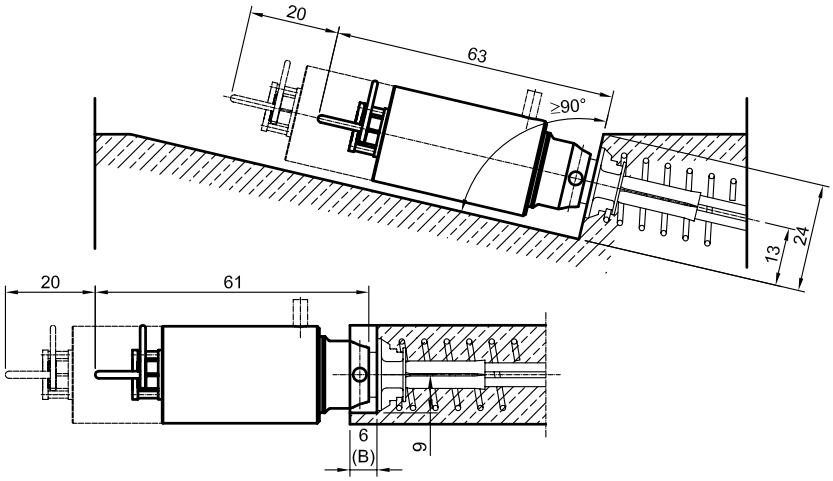
Strand excess length: 40 cm

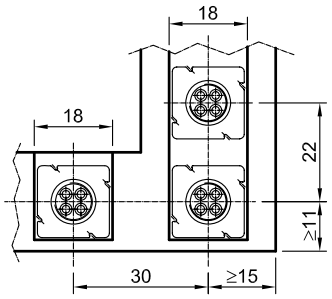




Tendon CONA CMM 0406 (four)

Strand excess length: 40 cm





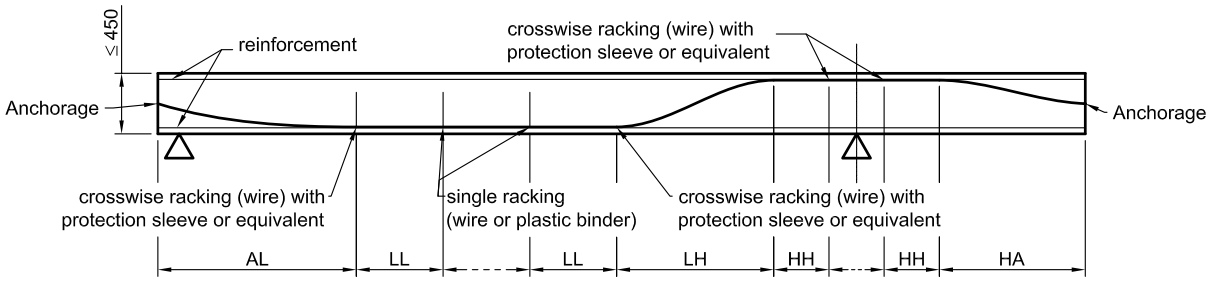
If other prestressing jacks will be used different minimum dimensions may apply. Ask ETA holder for advice.

Dimensions in cm

CONA CMM	Unbonded Post-tensioning System Dimensions of anchorage recesses	Annex 7 of European Technical Approval ETA-06/0165

Free tendon layout

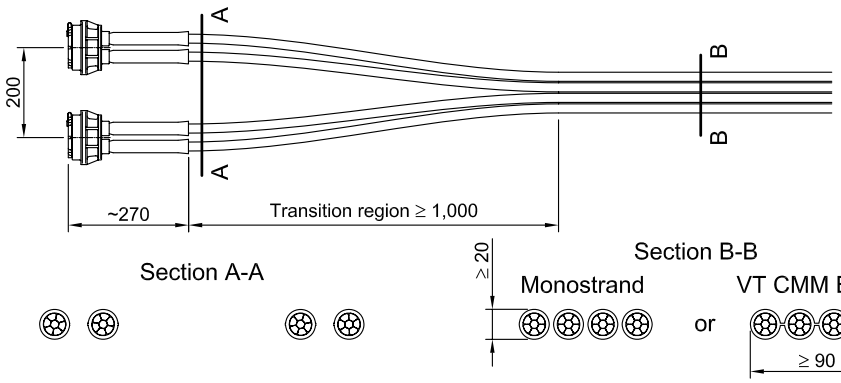
For slab thickness ≤ 45 cm



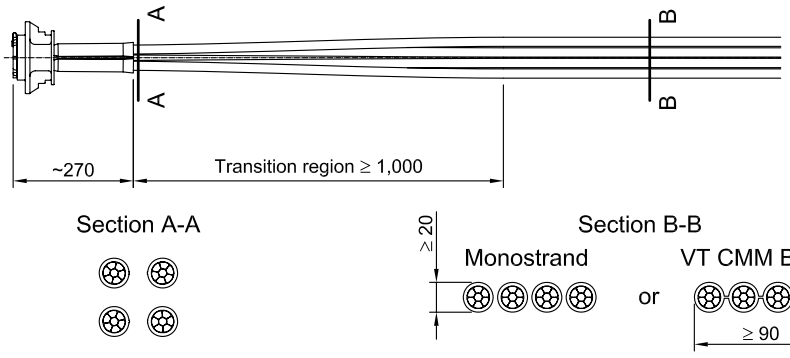
Sections		max. distances of fixing points
AL	Anchorage to Low point	3,0 m
LL	Low point to Low point	1,0 m - 1,3 m
LH	Low point to High point	3,0 m
HH	High point to High point	0,3 m - 1,0 m
HA	High point to Anchorage	1,5 m

Transition regions

Tendon CONA CMM 0206 (two)



Tendon CONA CMM 0406 (four)



Dimensions in mm

CONA CMM	Unbonded Post-tensioning System Free tendon layout Transition regions	Annex 8 of European Technical Approval ETA-06/0165

PT Works		Construction Works
	A) Manufacturing of the tendon	
1) Longitudinal cutting of the VT CMM Band[1)] 2) Removing the PE-sheathing at the end 3) Wrapping the single strands with greased bandage in the region of the transition pipe 4) Mounting the anchor block on the strands 5) Prelocking the anchor block 6) Securing wedges with wedge holding rings or holding plate[2)] 7) Filling protection cap with grease and screwing it onto the anchor block 8) Coiling according to the tendon list and fixing the tendon for transport/ Transport[3)]		
	B) Preliminary site works	
		1) Erection of the formwork
2) Fixing the active anchor block (SA, K 1.BA) on the formwork		
		3) Placing reinforcement bottom layer and supporting stirrups
	C) Tendon installation	
1) Placing the tendon 2) Fastening the tendon with wire or plastic binder at the bottom layer and supporting stirrups		
Coupling[4)]: The coupler anchor block 2.BA is mounted and prelocked on the prefabricated tendon 3) Placing the coupler anchor block (2nd construction stage) 4) Screwing-on the coupler sleeve on the coupler anchor 1.BA, meanwhile or afterwards filling of the space inside the coupler sleeve and both coupler anchor blocks with grease.		
Connecting tendon with the active anchor block (SA, K 1.BA) 5) Longitudinal cutting of the VT CMM Band[1)] 6) Removing the PE-sheathing at the end 7) Wrapping the single strands with greased bandage in the region of the transition pipe 8) Inserting the strands into the anchor block 9) Putting on removed PE-sheathing to protect excess strand length		
		10) Placing reinforcement top layer
11) Fastening tendon with wire or plastic binder on the reinforcement top layer		
	D) Concreting of the structure	
		1) Concreting the structure, recommended to make testing cubes 2) Determining concrete strength 3) Dismantling the formwork at the active anchorage side
	E) Stressing and finishing work	
1) Removal of protecting PE-sheaths and check whether cones are clean 2) Inserting ring wedges 3) Stressing the tendon according to stressing order 4) Cutting excess strand lengths 5) Filling protection cap with grease and screwing it onto the anchor block		
		6) Filling of the anchorage recess with concrete[5)]

1) not applicable when assembling a tendon CONA CMM 0106 or monostrand
2) applicable case of using an anchor body K CONA CMM 0406 - 2.BA
3) not applicable in case of manufacturing on the site
4) only applicable when using a coupler
5) not applicable when assembling a coupler 1st construction stage

BBR CONA CMM	Unbonded Post-tensioning System Description of worksteps – anchorage, fixed coupler 1st and 2nd construction stage	Annex 9 of European Technical Approval ETA-06/0165

Sheathing base material specification

Characteristics	Test method / Standard	Acceptance Criteria
Melt index	ISO 1133 (10 minutes at 2.16 kg)	≤ 0.25 g
Density	DIN 53479	≥ 0.95 g/cm³
Carbon black - Content - Dispersion - Distribution	 ISO 6964 ISO 4437 ISO 4437	 2.3 +/- 0.3 % Index max. C2 Index max. 3
Tensile strength (23 °C)	EN ISO 527-2	≥ 22 MPa [1)]
Elongation - at 23 °C - at -20 °C	EN ISO 527-2	 > 600 % [1)] > 350 % [1)]
Thermal stability	ISO/TR 10837	≥ 20 minutes at 210 °C in O_2 without degradation (oxygen induction time)

[1)] Standardised specimen according to ISO 1 BA, loading speed 100 mm/minute

Manufactured sheathing specification

Characteristics	Test method / Standard	Acceptance Criteria
Tensile strength at 23 °C	EN ISO 527-2	≥ 18 MPa [1)]
Elongation		
- at 23 °C - at -20 °C	EN ISO 527-2 EN ISO 527-2	≥ 450 % [1)] ≥ 250 % [1)]
Surface of sheathing		No visual damage No bubbles No traces of filling material visible
Environmental stress cracking	NF C 32-060	No cracking after 72 hours in a tensio-active liquid at 50 °C
Temperature resistance		
Variation of tensile strength at 23 °C after conditioning for 3 days at 100 °C	EN ISO 527-2	≤ 25 %
Variation of elongation at 23 °C after conditioning for 3 days at 100 °C	EN ISO 527-2	≤ 25 %
Resistance to externally applied agents		
Mineral oil Acids Bases Solvents Salt spray	EN ISO 175	 Var. of tensile strength ≤ 25 % Variation of elongation ≤ 25 % Variation of volume ≤ 5 %
Sheathing minimum thickness	EN 496	≥ 1.0 mm [2)]

[1)] Standardised specimen according to ISO 1 BA, loading speed 100 mm/minute
[2)] The actual value has to conform to standards and requirements valid at place of application.

Monostrand / VT-CMM Band specification

Characteristics	Test method / Standard	Acceptance Criteria
Impact resistance	Clause C.1.3.2.1 [1)]	No tear or penetration of sheathing
Friction between sheathing and strand	Clause C.1.3.2.2 [1)]	≤ 60 N/m
Squeezing - Transverse deformation under load - Residual transverse deformation after removal of load	Clause C.1.3.2.3 [1)]	 ≤ 3 % ≤ 2.5 %
Leak tightness	Clause C.1.3.2.3 [1)]	No water leaking through specimen

[1)] in ETAG 013, June 2002

Grease specification

Characteristics	Test method / Standard	Acceptance Criteria
Cone penetration, 60 strokes (1/10mm)	ISO 2137	250 - 300
Dropping point	ISO 2176	≥ 150 °C
Oil separation at 40 °C	DIN 51817	at 72 hours ≤ 2.5 % at 7 days ≤ 4.5 %
Oxidation stability	DIN 51808	100 hours at 100°C ≤ 0.06 MPa 1000 hours at 100°C ≤ 0.2 MPa
Corrosion protection 168 hours at 35 °C 168 hours at 35 °C	 NFX 41-002 (salt spray) [1)] NFX 41-002 (distilled water spray) [1)]	 Pass No corrosion
Corrosion test	DIN 51802	Grade 0
Content of aggressive elements Cl^-, S^{2-}, NO_3^- SO_4^{2-}	 NFM 07-023 [2)] NFM 07-023 [2)]	 ≤ 50 ppm (0.005 %) ≤100 ppm (0.010 %)

[1)] Test sample consists of a structural steel plate Fe 510 with a surface roughness comparable to the prestressing wire and strand. The plate is covered with a layer of grease of a maximum thickness corresponding to the declared mass of the filling material per linear meter of monostrand divided by the nominal strand surface per linear meter (based on nominal strand diameter).

[2)] Applied accordingly to grease.

Grease properties after monostrand / VT-CMM Band manufacturing

Characteristics	Test method / Standard	Acceptance Criteria
Dropping point - variation during monostrand manufacturing	ISO 2176	≤ 10 %
Oil separation - variation during monostrand manufacturing	DIN 51808	at 72 hours ≤ 3.0 % at 7 days ≤ 5.0 %

Strands according to prEN 10138-3 [d]

Steel name			Y 1770S7	Y1860S7	Y 1770S7	Y 1860S7	Y 1820S7G
Tensile strength	f_{pk}	MPa	1,770	1,860	1,770	1,860	1,820
Diameter	d	mm	15.3	15.3	15.7	15.7	15.2
Nom. cross-sectional area	A_p	mm^2	140	140	150	150	165
Mass per metre	m	kg/m	1.093		1.172		1.289
Allowable deviation from nominal mass		%	± 2				
Characteristic value of maximum force	F_{pk}	kN	248	260	266	279	300
Maximum value of maximum force	$F_{m,max}$	kN	285	299	306	321	345
Characteristic value of 0.1 % proof force	$F_{p0,1}$	kN	213	224	229	240	258
Minimum elongation at max. force; $L_0 \geq 500$ mm	A_{gt}	%	3.5				

Relaxation after 1,000 hours

at 0.7 • f_{pk}		%	2.5[a]
at 0.8 • f_{pk}		%	4.5[b]
Modulus of elasticity	E_p	MPa	195,000[c]

[a] For specific applications the relaxation requirement may be agreed between supplier and purchaser at time of enquiry and order.
[b] The requirement for 0.7 • f_{pk} is mandatory. Values for 0.8 • f_{pk} may be agreed at time of enquiry and order.
[c] Standard value
[d] Suitable strands according to standards and regulations valid at the place of use may also be used.

Reference documents

Guideline for European Technical Approval

ETAG 013 (06.2002)	Guideline for European Technical Approval of Post-Tensioning Kits for Prestressing of Structures

Standards

EN 206-1 (12.2000)	Concrete - Part 1: Specification, performance, production and conformity
EN 1563+A1+A2 (07.2005)	Founding – Spheroidal graphite cast irons
EN 1992-1-1 (12.2004)	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings
EN 10025-2+AC (06.2005)	Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels
EN 10083-1+A1 (08.1996)	Quenched and tempered steels – Part 1: Technical delivery conditions for special steels
EN 10083-2+A1 (08.1996)	Quenched and tempered steels – Part 2: Technical delivery conditions for unalloyed quality steels
EN 10084 (04.1998)	Case hardening steels – Technical delivery conditions
EN 10204 (10.2004)	Metallic products – Types of inspection documents
EN 10210-1 (03.1994)	Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 1: technical delivery requirements
EN 10277-2+AC (12.2003)	Bright steel products – Technical delivery conditions – Part 2: Steels for general engineering purposes
EN ISO 1872-1 (05.1999)	Plastics – Polyethylene (PE) moulding and extrusion materials – Part 1: Designation system and basis for specifications (ISO 1872-1:1993)
EN ISO 1874-1 (09.2000)	Plastics – Polyamide (PA) moulding and extrusion materials – Part 1: Designation (ISO 1874-1:1992)
prEN 10138-3 (04.2005)	Prestressing steels – Part 3: Strands
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

MPA NRW.

MATERIALPRÜFUNGSAMT NORDRHEIN-WESTFALEN

EC-CERTIFICATE OF CONFORMITY
0432-CPD-11 9181-2/1

In compliance the Directive 89/106/EEC of the Council of European Communities of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to the construction products (Construction Products Directive - CPD), amended by the Directive 93/68/EEC of the Council of European Communities of 22 July 1993, it has been stated that the construction product

BBR VT CONA CMM – Unbonded Post-tensioning System with 01, 02 and 04 Strands

placed on the market by

BBR VT International Ltd
Bahnstraße 23
CH-8603 Schwerzenbach (ZH)
SWITZERLAND

and produced in the factory

BBR VT International Ltd
Bahnstraße 23
CH-8603 Schwerzenbach (ZH)
SWITZERLAND

is submitted by the manufacturer

- to a factory production control and
- to the further testing of samples taken at the factory in accordance with a prescribed test plan

and that the approved body – MPA NRW -

- has performed the initial type-testing for the relevant characteristics of the product
- the initial inspection of the factory and of the factory production control
- and performs the continuous surveillance, assessment and approval of the factory production control and
- an audit-testing of samples taken at the factory, on the market or at the construction site.

This certificate attests that all provisions concerning the attestation of conformity and the performances described in the European Technical Approval

ETA-06/0165 from 15.11.2006

were applied and that the product fulfils all the prescribed requirements.

This certificate was first issued on 09.01.2007 and remains valid as long as the conditions laid down in the harmonized technical specification in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly, and latest on 14.11.2011.

Dortmund, 09.01.2007

Materialprüfungsamt MPA NRW 10 Nordrhein-Westfalen

Dipl.-Ing. Gödecker
Head of Certification Body

English translation, the original version is in German.

MPA NRW · Marsbruchstraße 186 · 44287 Dortmund · Telefon: +49 (0)231 4502-0 · Telefax: +49 (0)231 458549 · Internet: www.mpanrw.de

BBR Pretensados y Técnicas Especiales, S.L.
Antigua Carretera N-III, km. 31,150
28500 Arganda del Rey, Madrid
Spain

Tel +34 91 876 09 00
Fax +34 91 876 09 01

www.bbrpte.com
bbrpte@bbrpte.com

BBR A Global Network of Experts
www.bbrnetwork.com