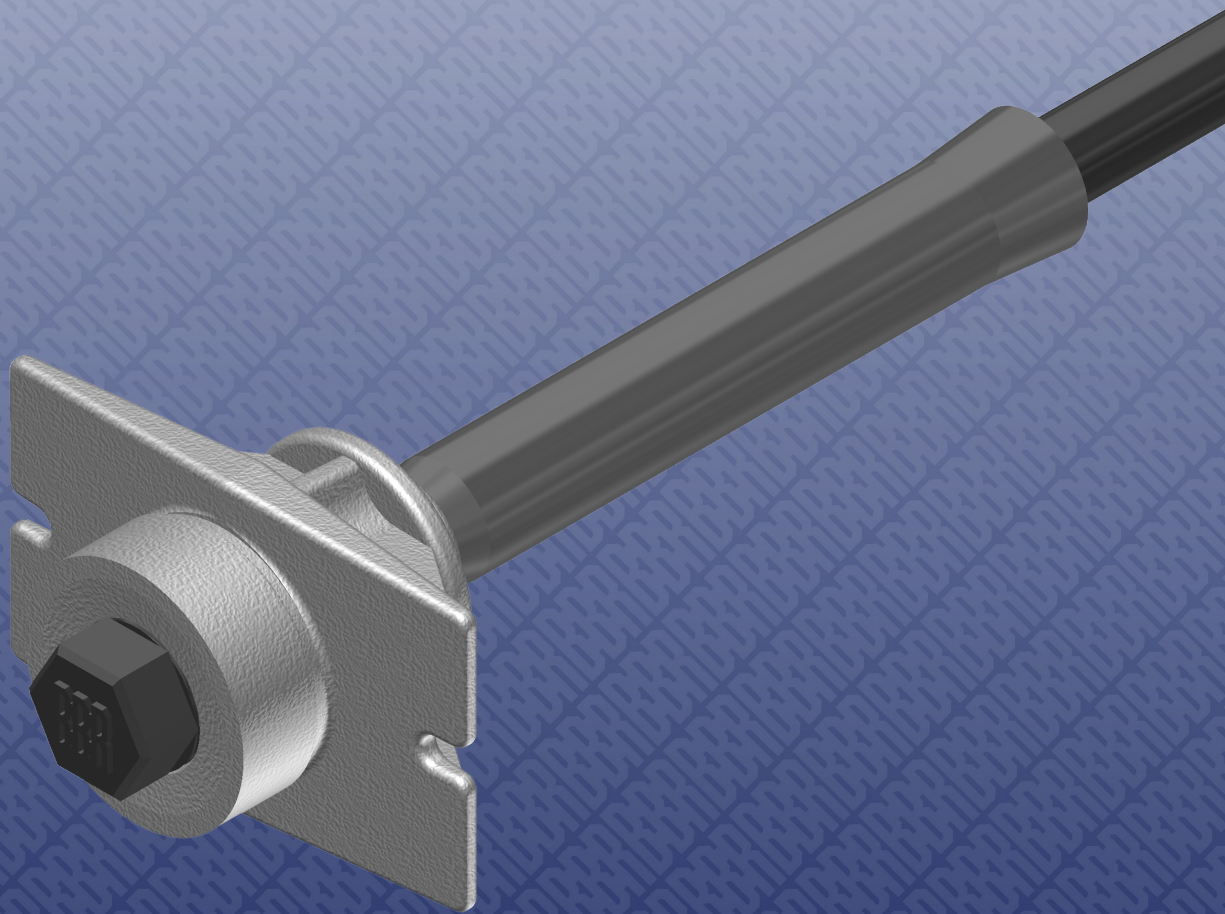


BBR VT CONA CMM Single

Internal Post-tensioning System with 01 Strand (bonded or unbonded)



European Technical Approval
ETA – 12/0282
CE



A Global Network of Experts
www.bbrnetwork.com



ETA-12/0282

BBR VT CONA CMM Single

Internal Post-tensioning System with 01 Strand

BBR VT International Ltd

Ringstrasse 2, 8603 Schwerzenbach (Switzerland)

www.bbrnetwork.com

0432-CPD-11 9181-1.8/1

13

Responsible BBR PT Specialist Company



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



Assembly and installation of BBR VT CONA CMM Single 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

ETAG 013

Guideline for European Technical Approval of 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 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.



Österreichisches Institut für Bautechnik
Schenkenstrasse 4 | 1010 Vienna | Austria
T +43 1 533 65 50 | F +43 1 533 64 23
mail@oib.or.at | www.oib.or.at



European technical approval

ETA-12/0282

English translation, the original version is in German

Handelsbezeichnung

Trade name

BBR VT CONA CMM Single – Internes Spannverfahren mit 01 Litze

BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand

Zulassungsinhaber

Holder of approval

**BBR VT International Ltd.
Bahnstrasse 23
8603 Schwerzenbach (ZH)
Switzerland**

Zulassungsgegenstand und Verwendungszweck

Generic type and use of construction product

Litzen-Spannverfahren, intern, im Verbund oder ohne Verbund, für das Vorspannen von Tragwerken

Post-tensioning kit for prestressing of structures with internal bonded or unbonded strands

Geltungsdauer vom

Validity from

bis zum

to

26.06.2013

25.06.2018

Herstellwerk

Manufacturing plant

**BBR VT International Ltd.
Bahnstrasse 23
8603 Schwerzenbach (ZH)
Switzerland**

Diese Europäische technische Zulassung umfasst

This European technical approval contains

44 Seiten einschließlich 22 Anhängen

44 Pages including 22 Annexes



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

Table of contents

EUROPEAN TECHNICAL APPROVAL	ETA-12/0282	1
TABLE OF CONTENTS		2
I	LEGAL BASES AND GENERAL CONDITIONS	5
II	SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL	6
1	DEFINITION OF PRODUCT AND INTENDED USE	6
1.1	Definition of product	6
1.2	Intended use	7
2	CHARACTERISTICS OF THE PRODUCT AND METHODS OF VERIFICATION	7
PT SYSTEM		7
2.1	Designation and range of the anchorages and couplers	7
2.1.1	Designation	7
2.1.2	Anchorage	7
2.1.2.1	General	7
2.1.2.2	Restressable and exchangeable tendon	8
2.1.3	Fixed coupler	8
2.1.4	Layout of anchorage recesses	8
2.2	Designation and range of the tendons	8
2.2.1	Designation	8
2.2.2	Range	8
2.2.2.1	Bonded tendon	8
2.2.2.2	Unbonded tendon	8
2.2.2.3	CONA CMM Single-140	9
2.2.2.4	CONA CMM Single-150	9
2.2.2.5	CONA CMM Single-165	9
2.3	Duct	9
2.3.1	Use of ducts	9
2.3.1.1	Internal bonded prestressing with 7-wire prestressing steel strands	9
2.3.1.2	Internal unbonded prestressing with 7-wire prestressing steel strands	10
2.3.2	Round steel strip sheath	10
2.3.3	Pre-bent smooth round steel duct	10
2.3.4	Corrugated plastic duct	10
2.3.5	Smooth plastic duct	10
2.4	Minimum radii of curvature	10
2.4.1	Minimum radii of curvature for tendons with 7-wire prestressing steel strands	10
2.4.2	Minimum radii of curvature for tendons with monostrands	11
2.5	Support of tendons	11
2.5.1	Support of 7-wire prestressing steel strand tendons	11
2.5.2	Support of monostrand tendons	11
2.6	Friction losses	11
2.7	Slip at anchorages	12
2.8	Concrete strength at time of stressing	13
2.9	Centre spacing and edge distances for anchorages	13
COMPONENTS		14
2.10	Strand	14
2.11	Anchorage and coupler	14

2.11.1	Anchor head.....	14
2.11.2	Coupler	14
2.11.3	Ring wedge	14
2.11.4	Additional reinforcement	14
2.11.5	Protection cap	15
2.11.6	Material properties	15
2.12	Permanent corrosion protection	15
2.12.1	Corrosion protection of tendons with 7-wire prestressing steel strands.....	15
2.12.2	Corrosion protection of tendons with monostrand.....	15
2.13	Dangerous substances.....	15
2.14	Methods of verification	16
2.15	Identification	16
3	EVALUATION OF CONFORMITY AND CE MARKING	16
3.1	Attestation of conformity system	16
3.2	Responsibilities	16
3.2.1	Tasks for the manufacturer – factory production control.....	16
3.2.2	Tasks of the approved body.....	17
3.2.2.1	Initial type-testing of the products	17
3.2.2.2	Initial inspection of factory and of factory production control	17
3.2.2.3	Continuous surveillance	17
3.2.2.4	Audit testing of samples taken at the factory	18
3.3	CE marking.....	18
4	ASSUMPTIONS UNDER WHICH THE FITNESS OF THE PRODUCTS FOR THE INTENDED USE WAS FAVOURABLY ASSESSED	18
4.1	Manufacturing.....	18
4.2	Design	18
4.2.1	General	18
4.2.2	Anchorage recess	18
4.2.3	Reinforcement in the anchorage zone	18
4.2.4	Fatigue resistance.....	19
4.2.5	Tendons in masonry structures – load transfer to the structure.....	19
4.2.6	Maximum prestressing force	19
4.3	Installation	19
4.4	Stressing operation	20
4.5	Restressing	20
4.6	Exchanging tendons.....	20
4.6.1	General	20
4.6.2	Exchanging unbonded 7-wire prestressing steel strand tendon	20
4.6.3	Exchanging unbonded monostrand tendon	20
4.7	Filling material	21
4.7.1	General	21
4.7.2	Grout	21
4.7.3	Grease and wax	21
4.7.4	Records.....	21
4.8	Welding	21
5	RECOMMENDATIONS FOR THE MANUFACTURER	21
5.1	Recommendations on packaging, transport and storage.....	21

5.2	Recommendations on installation	21
5.3	Accompanying information	22
	ANNEXES	23
ANNEX 1	OVERVIEW ON ANCHORAGES AND FIXED COUPLERS – BONDED TENDON AND UNBONDED TENDON WITH DUCT	23
ANNEX 2	OVERVIEW ON ANCHORAGES AND FIXED COUPLERS – MONOSTRANDS AND VT CMM BANDS.....	24
ANNEX 3	COMPONENTS OF ANCHORAGES AND FIXED COUPLERS	25
ANNEX 4	ACCESSORIES	26
ANNEX 5	MATERIAL PROPERTIES	27
ANNEX 6	CONTENTS OF PRESCRIBED TEST PLAN.....	28
ANNEX 7	AUDIT TESTING	29
ANNEX 8	TENDON RANGES AND MAXIMUM PRESTRESSING AND OVERSTRESSING FORCES.....	30
ANNEX 9	CONSTRUCTION STAGES	31
ANNEX 10	DIMENSIONS OF ANCHORAGE, ADDITIONAL REINFORCEMENT, AND CENTRE SPACING AND EDGE DISTANCE	32
ANNEX 11	MODIFICATION OF CENTRE SPACING AND EDGE DISTANCE	33
ANNEX 12	DIMENSIONS OF ANCHORAGE RECESSES – FREE TENDON LAYOUT WITH MONOSTRAND OR VT CMM BANDS.....	34
ANNEX 13	DESCRIPTION OF INSTALLATION.....	35
ANNEX 14	DESCRIPTION OF INSTALLATION.....	36
ANNEX 15	DESCRIPTION OF INSTALLATION OF MONOSTRANDS OR VT CMM BANDS.....	37
ANNEX 16	SPECIFICATIONS	38
ANNEX 17	SPECIFICATIONS	39
ANNEX 18	SPECIFICATIONS	40
ANNEX 19	TABLE OF STRANDS.....	41
ANNEX 20	REFERENCE DOCUMENTS.....	42
ANNEX 21	REFERENCE DOCUMENTS.....	43
ANNEX 22	REFERENCE DOCUMENTS.....	44

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 products¹ – Construction Products Directive (CPD) –, amended by the Council Directive 93/68/EEC of 22 July 1993², and Regulation (EC) 1882/2003 of the European Parliament and of the Council of 29 September 2003³;
 2. *dem Salzburger Bauproduktengesetz, 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, LGBl. Nr. 99/2001 und LGBl. Nr. 20/2010;*
the Salzburg Construction Product Regulation LGBl. № 11/1995, amended by LGBl. № 47/1995, LGBl. № 63/1995, LGBl. № 123/1995, LGBl. № 46/2001, LGBl. № 73/2001, LGBl. № 99/2001 and LGBl. № 20/2010;
 3. Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex of Commission Decision 94/23/EC⁴;
 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 pursuant to information by the Commission according to Article 5 (1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction may 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.

¹ Official Journal of the European Communities № L 40, 11.02.1989, page 12

² Official Journal of the European Communities № L 220, 30.08.1993, page 1

³ Official Journal of the European Union № L 284, 31.10.2003, page 1

⁴ Official Journal of the European Communities № L 17, 20.01.1994, page 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of product

The European technical approval (ETA) applies to a kit, the PT system

BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand,

comprising the following components:

- Tendon
Internal tendons with 01 tensile element
- Tensile element
 - 7-wire prestressing steel strand with nominal diameters and maximum characteristic tensile strengths as given in Table 1
 - Unbonded 7-wire prestressing steel monostrand or VT CMM Band 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	Nominal cross-sectional area	Maximum characteristic tensile strength
mm	mm ²	MPa
15.3	140	1 860
15.7	150	
15.2 ¹⁾	165	1 820

¹⁾ Compacted strand

NOTE 1 MPa = 1 N/mm²

- Anchorage and coupler
Anchorage of the strands with ring wedges
End anchorage
Fixed (passive) anchor or stressing (active) anchor as end anchorage for 01 strand
Fixed or stressing coupler
Sleeve coupler for 01 strand
- Additional reinforcement in the region of the anchorage
- Corrosion protection for tensile elements, anchorages and couplers

1.2 Intended use

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

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

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

Optional use categories:

- Restressable tendons
- Exchangeable tendons

The provisions made in the 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 the anchorages and couplers

End anchorages can be used as fixed or stressing anchors. Couplers are intended as fixed couplers only. The principal dimensions of the anchorages and couplers are given in Annex 3.

2.1.1 Designation

Anchorage, e.g. S A CONA CMM Single-140
 Fixed (F) or stressing (S) ←
 Anchor head ←
 Designation of the tendon ←
 with information on number, one single strand, and cross-sectional area of the strand

Fixed coupler, e.g. H CONA CMM Single-140-1.BA
 Coupler anchor head ←
 Designation of the tendon ←
 with information on number, one single strand, and cross-sectional area of the strand
 Construction stage 1 (1.BA) or 2 (2.BA) ←

2.1.2 Anchorage

2.1.2.1 General

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 and the ring wedges might be secured with rings between the ring wedges and the protection cap.

Non accessible fixed anchorages shall be prelocked with a prelocking force as specified in Table 3. The ring wedges shall be secured with rings between the ring wedges and the protection cap.

2.1.2.2 Restressable and exchangeable tendon

In the case of restressable and exchangeable tendons the ring wedges are secured with the inner groove of the long protection cap.

2.1.3 Fixed coupler

The prestressing force at the second construction stage shall 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 3. At coupler anchor head H CONA CMM Single-2.BA (construction stage 2) the ring wedges are secured with wedge holding rings.

2.1.4 Layout of anchorage recesses

All anchor heads have to be placed perpendicular to the axis of the tendon, see Annex 9.

In Annex 12 the minimum dimensions of the anchorage recesses are given. The dimensions of the anchorage recesses shall be adapted to the prestressing jacks used. The ETA holder shall save for reference 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.

Internal post-tensioning

Cross-sectional area of strands (140, 150 or 165 mm²)

CONA CMM Single-140

The characteristic tensile strength (1 770, 1 820 or 1 860 MPa) may be indicated optionally.

The tendon comprises 01 tensile element, a 7-wire prestressing steel strand according to Annex 19.

2.2.2 Range

Prestressing and overstressing forces are given in the corresponding standards and regulations in force at the place of use. The maximum prestressing and overstressing forces are listed in Annex 8.

2.2.2.1 Bonded tendon

A bonded tendon consists of one 7-wire prestressing steel strand within a duct, either in plastic or in steel, all injected with grout.

Compacted strand, as described in Table 1, shall not be used for bonded tendons.

2.2.2.2 Unbonded tendon

An unbonded tendon consists of one 7-wire prestressing steel strand, factory-provided with a corrosion protection system consisting of a corrosion protection filling material and an HDPE-sheathing.

Alternatively, an unbonded tendon might also consists of one 7-wire prestressing steel strand within a duct, either in plastic or in steel, all injected with grease or wax.

2.2.2.3 CONA CMM Single-140

7-wire prestressing steel strand

Nominal diameter..... 15.3 mm

Nominal cross-sectional area 140 mm²

Characteristic tensile strength 1 770 or 1 860 MPa

HDPE sheathed and greased strand

Mass of sheathed and greased strand 1.23 kg/m

External diameter of strand sheathing ≥ 19.5 mm

Annex 8 lists the characteristics of CONA CMM Single-140 tendons.

2.2.2.4 CONA CMM Single-150

7-wire prestressing steel strand

Nominal diameter..... 15.7 mm

Nominal cross-sectional area 150 mm²

Characteristic tensile strength 1 770 or 1 860 MPa

HDPE sheathed and greased strand

Mass of sheathed and greased strand 1.31 kg/m

External diameter of strand sheathing ≥ 20 mm

Annex 8 lists the characteristics of CONA CMM Single-150 tendons.

2.2.2.5 CONA CMM Single-165

7-wire prestressing steel strand

Nominal diameter..... 15.2 mm

Nominal cross-sectional area 165 mm²

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 ≥ 19.5 mm

Annex 8 lists the characteristics of CONA CMM Single-165 tendons.

2.3 Duct

2.3.1 Use of ducts

Ducts are used for prestressing tendons with 7-wire prestressing steel strands in either bonded or unbonded applications.

2.3.1.1 Internal bonded prestressing with 7-wire prestressing steel strands

For bonded tendons in general corrugated ducts either in steel or in plastic shall be used. Smooth steel ducts may be used if permitted at the place of use.

2.3.1.2 Internal unbonded prestressing with 7-wire prestressing steel strands

For unbonded tendons smooth steel or plastic ducts can be used.

2.3.2 Round steel strip sheath

Steel strip sheaths in conformity with EN 523⁵ shall be used. The minimum radii of curvature, R_{min} , shall be according to Clause 2.4.

2.3.3 Pre-bent smooth round steel duct

If permitted at the place of use, smooth steel ducts according to EN 10255, EN 10216-1, EN 10217-1, EN 10219-1 or EN 10305-5 can be used. The ducts shall be pre-bent and free of any kinks. The minimum radii of curvature, R_{min} , shall be according to Clause 2.4. The minimum wall thickness shall be according to the standards and regulations in force at the place of use.

2.3.4 Corrugated plastic duct

Corrugated plastic ducts made of HDPE or PP conforming to ETAG 013, Annex C.3 shall be used. The minimum radii of curvature, R_{min} , shall be according to Clause 2.4.

2.3.5 Smooth plastic duct

Smooth plastic ducts according to EN 12201-1 may be used if permitted at the place of use. The minimum radii of curvature, R_{min} , shall be according to Clause 2.4. The minimum wall thickness shall meet the requirements applicable at the place of use.

2.4 Minimum radii of curvature

2.4.1 Minimum radii of curvature for tendons with 7-wire prestressing steel strands

The minimum radius of curvature, R_{min} , of internal tendons is

$$R_{min} = \begin{cases} \geq \frac{F_{pm,0}}{p_R} \\ \text{and} \\ \geq \frac{400 \cdot d}{3\,000} \end{cases}$$

Where

R_{min} m Minimum radii of curvature

$F_{pm,0}$ kN Prestressing force of the tendon

d mm Nominal diameter of the strand

p_R kN/m Design pressure under the strands

The above given equations on the minimum radius of curvature result in a minimum radius of 2.0 m applying the following parameters:

- a prestressing force of the tendon of $F_{pm,0} = 0.85 \cdot F_{p0.1}$
- a nominal diameter of the strand of $d = 15.3$ mm, $d = 15.7$ mm and $d = 15.2$ mm
- a pressure under the prestressing strands of $p_R = 140$ kN/m or $p_R = 200$ kN/m and
- a concrete compressive strength of $f_{cm,0,cube} = 24$ MPa.

In case of different tendon parameters or a different pressure under the prestressing strands, p_R , the calculation of the minimum radius of curvature of the tendon can be carried out using the equation given above.

⁵ Reference documents are listed in the Annexes 20 and 21.

Depending on the concrete strength at the time of stressing, additional reinforcement for splitting forces may be required in the areas of reduced minimum radii of curvature.

Standards and regulations on minimum radii of curvature or on the pressure under the prestressing strands in force at the place of use shall be observed.

2.4.2 Minimum radii of curvature for tendons with monostrands

The minimum radius of curvature, R_{\min} , of internal tendons with monostrands is 2.5 m. If this radius is adhered to, the verification of prestressing steel outer fibre stresses in curved sections is not required.

For tendons with nearly straight tendon layout, an HDPE-sheathing with a thickness of 1 mm may be used if acceptable at the place of use.

2.5 Support of tendons

2.5.1 Support of 7-wire prestressing steel strand tendons

Spacing of supports is between 1.0 and 1.8 m. In the region of maximum tendon curvature a spacing of 0.8 m shall be applied and 0.6 m in case the minimum radius of curvature is smaller than 4.0 m. The tendons shall be systematically fixed in their position so that they are not displaced by placing and compacting the concrete.

2.5.2 Support of monostrand tendons

Individual monostrands shall be fixed in their position. Spacing of supports is:

- 1 Normally
Individual monostrand 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 least at two points 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 12.

2.6 Friction losses

For the calculation of loss of prestressing force due to friction Coulomb's law applies. Friction losses in anchorages are low and do not have to be taken into consideration in design and execution. The calculation of the friction losses is carried out using the equation

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

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 2

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

k rad/m..... Wobble coefficient, see Table 2

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

NOTE 1 rad = 1 m/m = 1

Table 2: Friction parameters

Type of duct	Recommended values		Range of values	
	μ	k	μ	k
	rad ⁻¹	rad/m	rad ⁻¹	rad/m
Steel strip sheath	0.18	0.005	0.17 – 0.19	0.004 – 0.007
Smooth steel duct	0.18		0.16 – 0.24	
Corrugated plastic duct	0.12		0.10 – 0.14	
Smooth plastic duct	0.12		0.10 – 0.14	
Monostrand CONA CMM Single 140/150	0.06	$8.73 \cdot 10^{-3}$	0.05 – 0.07	0.007 – 0.011
Monostrand CONA CMM Single 165	0.05		0.04 – 0.06	

NOTE As far as acceptable at the place of use, due to special measures like oiling or for a tendon layout with only few deviations the friction coefficient μ can be reduced by 10 to 20 %. Compared to e.g. the use of prestressing steel or sheaths with a film of rust this value increases by more than 100 %.

2.7 Slip at anchorages

Table 3 specifies the values of slip at anchorages that have to be taken into consideration in calculations of tendon elongation and forces in tendon.

Table 3: Slip values

Active anchorage	S A CONA CMM Single	6 mm
	H CONA CMM Single-1.BA	
Not accessible passive anchorage, prelocked ¹⁾	F A CONA CMM Single	3 mm
	H CONA CMM Single-2.BA	
Accessible passive anchorage	F A CONA CMM Single	6 mm

¹⁾ Prelocked with $\sim 0.5 \cdot F_{pk}$

Where

F_{pk} kN..... Characteristic value of maximum force of single strand

2.8 Concrete strength at time of stressing

Concrete in conformity with EN 206-1 shall be used. At the time of stressing the mean concrete compressive strength, $f_{cm, 0}$, shall be at least 24 MPa, cube strength, 150 mm cube, or 20 MPa, cylinder strength, 150 mm cylinder diameter. The concrete test specimen shall be subjected to the same curing 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 $0.5 \cdot f_{cm, 0, \text{cube}}$ or $0.5 \cdot f_{cm, 0, \text{cylinder}}$. Intermediate values may be interpolated linearly according to EN 1992-1-1.

The additional reinforcement, centre spacing and edge distance corresponding to the concrete compressive strength shall be taken from Annex 10, see also the Clauses 2.11.4 and 4.2.3.

2.9 Centre spacing and edge distances for anchorages

In general, spacing and distances shall not be less than the values given in Annex 10. However, a reduction of up to 15 % of the centre spacing of tendon anchorages in one direction is permitted, but the placing of additional reinforcement shall still be possible. In this case the spacing in the perpendicular direction shall be increased by the same percentage. The corresponding edge distance is calculated by

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

and

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

Where

$a_c, a_{\underline{c}}$ mm Centre spacing before and after modification

$b_c, b_{\underline{c}}$ mm Centre spacing in the direction perpendicular to a_c , before and after modification

$a_e, a_{\underline{e}}$ mm Edge distance before and after modification

$b_e, b_{\underline{e}}$ mm Edge distance in the direction perpendicular to a_e , before and after modification

c mm Concrete cover

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

The minimum values for a_c , b_c , a_e and b_e are given in Annex 10,

where

$f_{cm, 0, \text{cube } 150}$ Mean concrete compressive strength at time of stressing, determined at cubes, 150 mm

$f_{cm, 0, \text{cylinder } \varnothing 150}$ Mean concrete compressive strength at time of stressing, determined at cylinders, diameter 150 mm

NOTE The replacement of the additional stirrup reinforcement by a helix according to Annex 10 does not prevent the modification of centre spacing and edge distance. The external dimensions of the rectangular helix replacing stirrups have to be adapted to the modified spacing and distance.

Components

2.10 Strand

In general, 7-wire prestressing steel strands or monostrands with characteristics according to Annex 19 shall be used. Other prestressing steel strand or monostrand permitted at the place of use might be also used.

The corrosion protection system of the monostrand is as specified in ETAG 013, Annex C.1, see also the Annexes 16 to 18.

2.11 Anchorage and coupler

The components of anchorage and coupler shall conform to the specifications given in the Annexes 3 and 4 and the technical documentation⁶. Therein the component dimensions, materials and material identification data with tolerances are given.

2.11.1 Anchor head

The anchor head is made of cast iron with spheroidal graphite. It provides a conical hole to accommodate strand and ring wedge. 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, wax or grout to protect the ring wedges and the strands.

The outlet end of the holes is formed in such a way as to allow the grout and transition pipes to be inserted tension-proof, whereby

- the grout pipes act as single tendon trumpet where the duct shall be connected and
- the transition pipes act as the transition from the anchor head to the sheathing of the strands.

2.11.2 Coupler

The fixed coupler consists 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 and a cylindrical extension to accommodate the coupler thread.

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

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

2.11.3 Ring wedge

The ring wedge is in three pieces, which are held together by a spring ring. Two types of ring wedges are used.

Wedge holding rings serve to secure the ring wedges after prelocking. Alternatively, long protection caps are equipped with an inner groove to also secure the ring wedges.

2.11.4 Additional reinforcement

The additional reinforcement is made of ribbed reinforcing steel. Dimensions and grade of the additional reinforcement shall conform to the values specified in Annex 10, see also Clause 4.2.3.

⁶ The technical documentation of the European technical approval is deposited at Österreichisches Institut für Bautechnik and, in so far as is relevant to the tasks of the approved body involved in the attestation of conformity procedure, is handed over to the approved body.

If required for a specific project design, the reinforcement given in Annex 10 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 authorities and of the ETA holder to provide equivalent performance.

2.11.5 Protection cap

The protection cap is made of plastic. It is screwed in the internal thread of the cylindrical extension of the anchor head and is filled with corrosion protection grease, wax or grout to protect the ring wedges and the strands.

2.11.6 Material properties

Annex 5 lists the material properties and the standard or specification the components conform to.

2.12 Permanent corrosion protection

2.12.1 Corrosion protection of tendons with 7-wire prestressing steel strands

To protect the tendons from corrosion, the ducts, couplers and anchorages have to be completely filled with grout according to EN 447, special grout according to ETAG 013, Annex C.4.3, grease according ETAG 013, Annex C.4.1 or wax according ETAG 013, Annex C.4.2.

Alternatively grease or wax according to the standards and regulations in force at the place of use may be used.

With exposed anchorages, not fully embedded in concrete, an adequate corrosion protection for the exposed parts shall be applied.

2.12.2 Corrosion protection of tendons with monostrand

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 in force at the place of use.

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-sheathings.

All voids of the anchorages are filled with corrosion protection grease according to the installation instructions in Annex 15.

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

2.13 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 H⁷ relating to dangerous substances.

A declaration in this respect has been made by the manufacturer.

In addition to the specific clauses relating to dangerous substances in the European technical approval, there may be other requirements applicable to the product falling within their 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.

⁷ Guidance Paper H: A harmonised approach relating to dangerous substances under the Construction Products Directive, Rev. September 2002.

2.14 Methods of verification

The assessment of the fitness of "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand" for its 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 conformity to the Guideline for European technical approvals of "Post-Tensioning Kits for Prestressing of Structures", ETAG 013, Edition June 2002.

2.15 Identification

The European technical approval for the "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand" is issued on the basis of agreed data, deposited with Österreichisches Institut für Bautechnik, which identifies "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand" that has been assessed and judged. Changes to the manufacturing process of the "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand", 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 the European technical approval and consequently the validity of the CE marking on the basis of the European technical approval and, if so, whether further assessment or alterations to the European technical approval are considered necessary.

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 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 plan⁸;

(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

In 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 the European technical approval.

⁸ 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. The prescribed test plan is also referred to as control plan.

Within the framework of factory production control, the manufacturer shall carry out tests and controls in accordance with the prescribed test plan and in accordance with the 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 the prescribed test plan, which forms part of the technical documentation of the European technical approval.

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

- Designation of the products and of 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;
- Results of check and testing and, if appropriate, comparison with requirements;
- Name and signature of the person responsible for the factory production control.

The records of the factory production control shall be submitted to the approved body and shall be filed for at least 10 years. On request, the records shall be presented to Österreichisches Institut für Bautechnik.

If the test results are unsatisfactory, the manufacturer shall immediately implement measures to eliminate the defects. Construction products or components which are not in conformity 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 conform to ETAG 013, Annex E.1 and are specified in the quality management plan of the "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand".

Annex 6 lists the contents of the prescribed test plan.

3.2.2 Tasks of 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 the 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, the manufacturing plant, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous orderly manufacturing of the PT system according to the specifications given in Section II as well as in the Annexes of the 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 Annex 7 shall be inspected at least once every 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.

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 the European technical approval and the prescribed test plan 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 the European technical approval has been granted for independent testing. For the most important components Annex 7 summarises the minimum procedures that shall be implemented by the approved body.

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 approved 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 products for the intended use was favourably assessed

4.1 Manufacturing

"BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand" is manufactured in accordance with the provisions of the European technical approval. Composition and manufacturing process are deposited at Österreichisches Institut für Bautechnik.

4.2 Design

4.2.1 General

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

4.2.2 Anchorage recess

The anchorage recess shall be designed so as to ensure a concrete cover of at least 20 mm at the protection caps 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 12 are used, the ETA holder shall keep information on the prestressing jacks and minimum dimensions of the anchorage recesses.

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

In case of exposed anchorages concrete cover of the anchorage is not required. However, the exposed surface shall be provided with a corrosion protection.

4.2.3 Reinforcement in the anchorage zone

Verification of the transfer of the prestressing forces to the structural concrete is not required if the centre spacing and edge distance of the anchorages as well as grade and dimensions of additional reinforcement, see Annex 10, are conformed to. In the case of grouped anchorages the additional reinforcement of the individual anchorages can be combined, provided appropriate

anchorage is ensured. However, the number, cross section and position with respect to the anchor heads shall remain unchanged.

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

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

If required for a specific project design, the reinforcement given in Annex 10 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 has been tested with an upper force of $0.65 \cdot F_{pk}$ and a stress range of 80 MPa up to $2 \cdot 10^6$ load cycles.

4.2.5 Tendons in masonry structures – load transfer to the structure

Load transfer of prestressing force from the anchorage to masonry structures shall be via concrete or steel members designed according to the European technical approval, especially according to the Clauses 2.8, 2.9, 2.11.4 and 4.2.3, or according to Eurocode 3, respectively.

The concrete or steel members supporting the anchorages shall have dimensions that permit a force of $1.1 \cdot F_{pk}$ to be transferred to 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.

4.2.6 Maximum prestressing force

Annex 8 lists the maximum possible prestressing and overstressing forces.

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 multi-strand internal 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 considered. The company's PT site manager shall have 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 "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand".

The tendons might be manufactured on site or in the factory (prefabricated tendons).

To avoid confusion it is recommended to, in general, use on one site prestressing steel strands with one nominal diameter only.

Anchorage and coupler shall be placed perpendicular to the tendon's axis.

Couplers shall be situated in a straight tendon section.

The tendons shall be carefully handled during production, transport, storage and installation. The sequence of work steps for installation of anchorage and fixed coupler is described in the Annexes 13 to 15.

Before placing the concrete a final check of the installed tendons has to be carried out. For tendons with monostrands:

- 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 of the sheathing, the damaged area shall be cleaned and sealed with an adhesive tape.

4.4 Stressing operation

With a mean concrete compressive strength in the anchorage zone according to the values laid down in Annex 10 full prestressing may be applied.

Stressing and, if applicable, wedging shall be carried out using a suitable prestressing jack. The wedging force shall correspond to approximately 25 kN per wedge.

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

After releasing the prestressing force from the prestressing jack, the tendon length reduces by the amount of wedge draw-in at the anchor head.

The ETA holder shall save information on the prestressing jacks and the appropriate clearance behind the anchorage.

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

4.5 Restressing

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

Restressing of tendons with monostrand or VT CMM Bands is possible.

For tendons with 7-wire prestressing steel strands and remaining restressable throughout the working life of the structure, wax or grease shall be used as filling material for ducts. Moreover, a strand protrusion at the stressing anchor shall remain with a length compatible with the prestressing jack used.

4.6 Exchanging tendons

4.6.1 General

Exchange of tendons is permitted in unbonded tendons.

The specifications for the exchangeable tendons shall be defined during the design phase.

Stressing and fixed anchorages shall be accessible and adequate space shall be provided behind the anchorages. Moreover, a strand protrusion at the stressing anchor shall remain with a length compatible with the prestressing jack used. The radii of curvature should be reasonable larger than the minimum radii given in Clause 2.4 as to not impair the plastic duct or monostrand sheathing by wear due to stressing of the tendon.

4.6.2 Exchanging unbonded 7-wire prestressing steel strand tendon

For exchangeable tendons, wax or grease shall be used as filling material.

4.6.3 Exchanging unbonded monostrand tendon

Exchanging only the prestressing steel strand of the monostrand or VT CMM Band is also possible if permitted at the place of use.

4.7 Filling material

4.7.1 General

Filling operations shall be executed according to the standards and regulations in force at the place of use.

4.7.2 Grout

Grout shall be 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 shall be applied for long tendons, tendon paths with distinct high points or inclined tendons. All vents and grouting inlets shall be sealed immediately after grouting. The standards to be 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 shall be applied for ready mixed grout.

4.7.3 Grease and wax

The specifications in ETAG 013, Annex C.4 and the recommendations of the supplier are relevant for grease and wax.

The filling procedure with grease and wax shall follow a similar procedure as the one specified for filling with grout.

4.7.4 Records

The results of the filling operation shall be recorded. The respective standards and regulations in force at the place of use shall be observed.

4.8 Welding

Ducts may be welded.

It is not permitted to weld on built-in components of post-tensioning systems.

In 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 on 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 separated from zones where welding operations are performed.

5.2 Recommendations on installation

The manufacturer's installation instructions shall be followed, see ETAG 013, Annex D.3. The respective standards and regulations in force at the place of use shall be observed. For the installation see also the Annexes 13 to 15.

5.3 Accompanying information

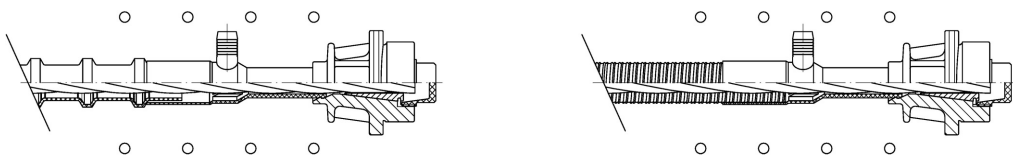
It is the responsibility of the ETA holder to ensure that all necessary information on design and installation is submitted to those responsible for design and execution of the structures executed with "BBR VT CONA CMM Single – Internal Post-tensioning System with 01 Strand".

On behalf of Österreichisches Institut für Bautechnik

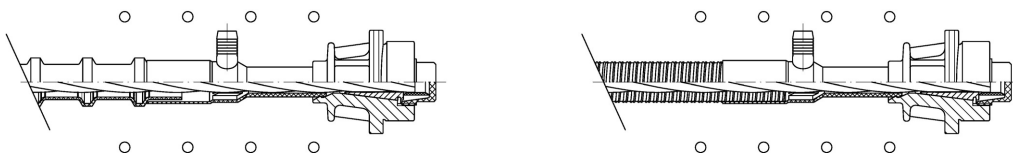
The original document is signed by:

Rainer Mikulits
Managing Director

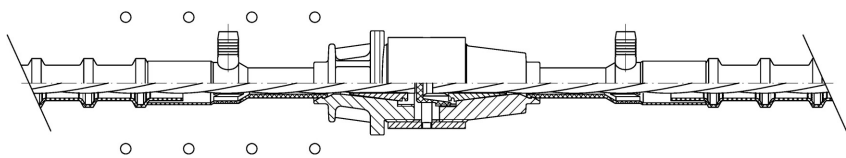
Stressing anchorage type SA, accessible fixed anchorage type FA



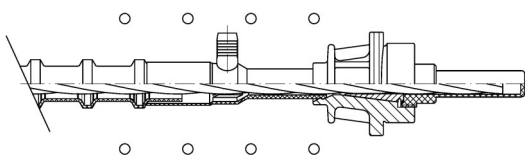
Inaccessible fixed anchorage type FA



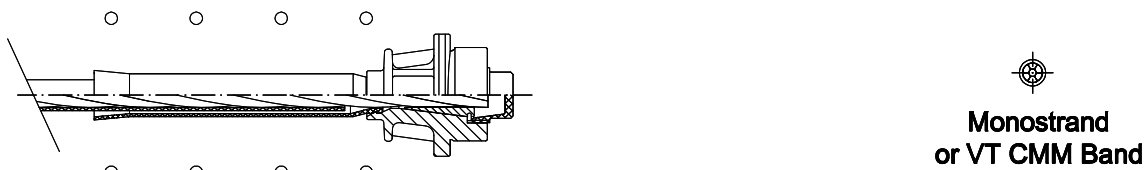
Fixed and stressing coupler type FH, SH



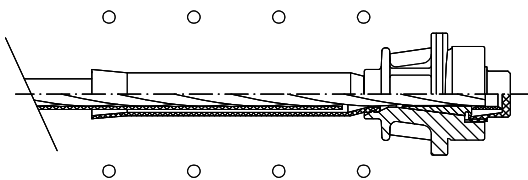
Restressable or exchangeable anchorage



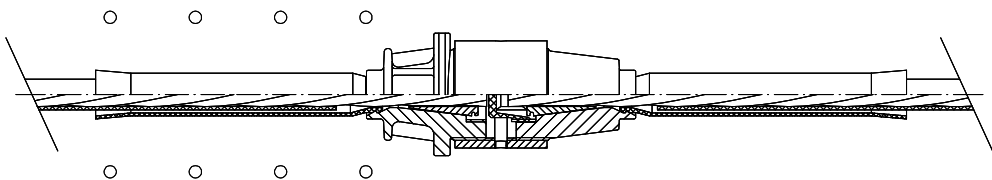
Stressing anchorage type SA, accessible fixed anchorage type FA



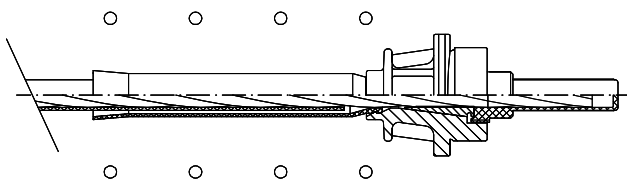
Inaccessible fixed anchorage type FA



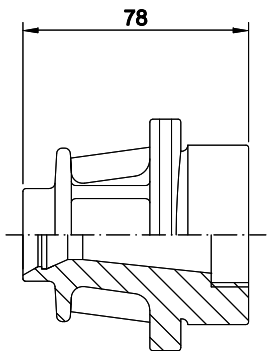
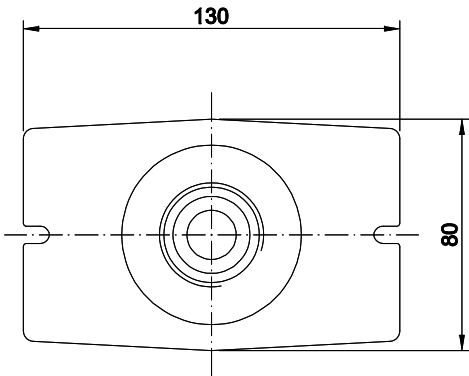
Fixed and stressing coupler type FH, SH



Restressable or exchangeable anchorage

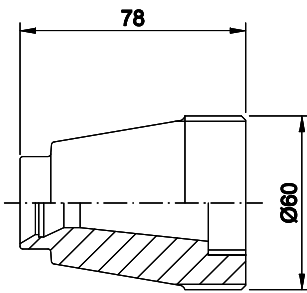
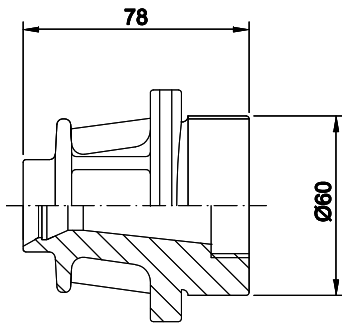


Stressing and fixed anchorage
 (S/F) A CONA CMM Single

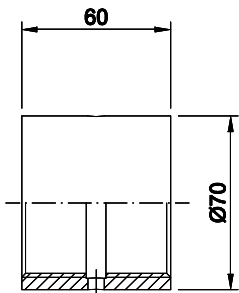


Stressing and fixed coupler
 H CONA CMM Single

Fixed coupler

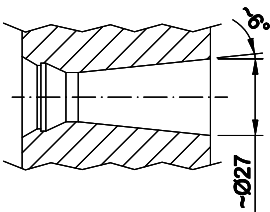


Threaded coupler sleeve

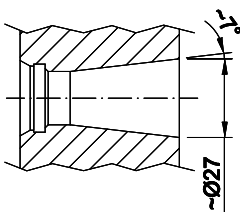


Cone details and wedge

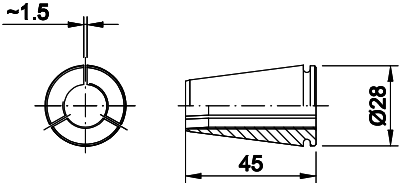
Cast-iron cone




Machined cone



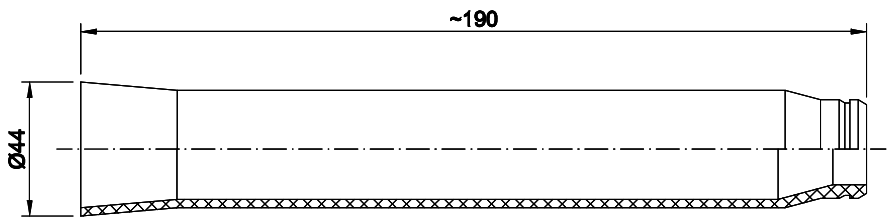
Ring wedge



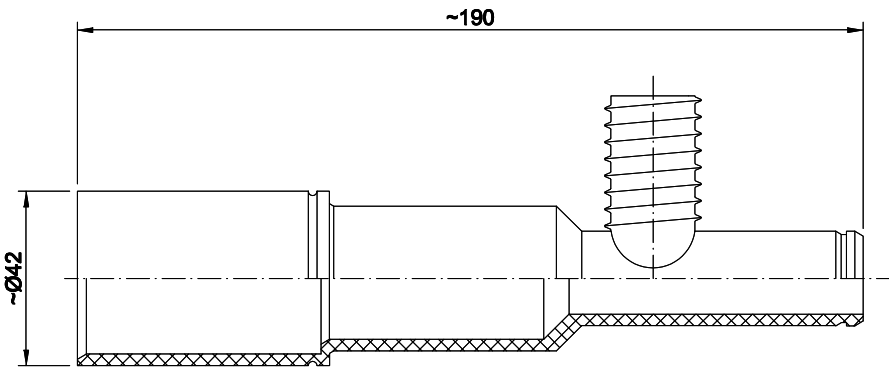
Dimensions in mm

	<p>Internal Post-tensioning System Components of anchorages and fixed couplers</p>	<p>Annex 3 of European technical approval ETA-12/0282</p>
---	--	--

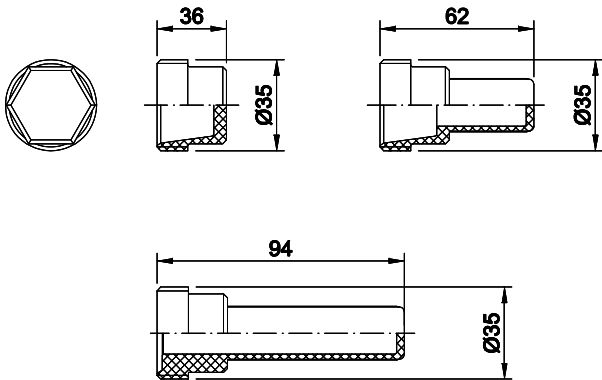
Transition pipe



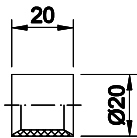
Grout pipe



Protection cap



Wedge holding ring



Dimensions in mm



CONA CMM Single

Internal Post-tensioning System
Accessories

Annex 4

of European technical approval
ETA-12/0282

Material properties

Component	Standard / Specification
Anchor head	EN 1563
Coupler anchor head 1.BA	EN 1563
Coupler anchor head 2.BA	EN 1563 EN 10083-1 EN 10083-2
Coupler sleeve	EN 10210-1
Ring wedge Type H	EN 10277-2
Ring wedge Type F	EN 10084
Additional reinforcement	Ribbed reinforcing steel, $R_e \geq 500 \text{ MPa}$ ¹⁾
Corrosion protection grease	ETAG 013, Annex C
Corrosion protection wax	ETAG 013, Annex C
Transition pipe	EN ISO 1872-1 EN ISO 1874-1
Grout pipe	EN ISO 1872-1 EN ISO 1874-1
Protection cap, Wedge holding ring	EN ISO 1874-1
Spring Type A	EN 10270-1
Steel strip sheath	EN 523
Corrugated plastic duct	ETAG 013, Annex C.3
Smooth steel duct	EN 10255, EN 10216-1, EN 10217-1, EN 10219-1, EN 10305-5
Smooth plastic duct	EN 12201-1

¹⁾ Ribbed reinforcing steel with $R_e \geq 460 \text{ MPa}$ may be placed according to Annex 10.



CONA CMM Single

Internal Post-tensioning System
Material properties

Annex 5

of European technical approval
ETA-12/0282

Contents of the prescribed test plan

Component	Item	Test / Check	Traceability	Minimum frequency	Documentation
Anchor head, Coupler anchor head	Material	Check	Full	100 %	"3.1" ¹⁾
	Detailed dimensions ²⁾	Test		5 %	Yes
	Visual inspection ^{3), 4)}	Check		≥ 2 specimens	
Ring wedge	Material	Check	Full	100 %	"3.1" ¹⁾
	Treatment, hardness ^{5), 6)}	Test		0.5 %	Yes
				≥ 2 specimens	
	Detailed dimensions ²⁾	Test		5 %	Yes
				≥ 2 specimens	
Coupler sleeve	Material	Check	Full	100 %	"3.1" ¹⁾
	Detailed dimensions	Test		5 %	Yes
	Visual inspection ³⁾	Check		≥ 2 specimens	
Steel strip sheath	Material	Check	"CE"	100%	"CE"
	Visual inspection ³⁾	Check		100%	No
Steel duct	Material	Check	Bulk	100 %	"2.2" ⁸⁾
	Visual inspection ³⁾	Check		100 %	No
Plastic duct, ETAG 013, Annex C.3	Material	Check	Full	100 %	"CE" ¹⁰⁾
VT CMM Band	Strand, material	Check	Full	100 %	"CE" ¹⁰⁾
	Diameter of strand	Test		Each coil	No
	Visual inspection of strand	Check		Each coil	No
	HDPE-sheathing	Check		100 %	Yes
	Corrosion protection grease	Check		100 %	Yes
	Material	Test		ETAG 013, Table C.1.4	Yes
	Visual inspection	Check		100 %	No
Individual monostrand	Strand, material	Check	Full	100 %	"CE" ¹⁰⁾
	Diameter of strand	Test		Each coil	No
	Visual inspection of strand	Check		Each coil	No
	Material	Check		100 %	Yes
	Visual inspection	Check		100 %	No
Strand ⁹⁾	Material	Check	Full	100 %	"CE" ⁹⁾
	Diameter	Test		Each coil	No
	Visual inspection ³⁾	Check		Each coil	No
Constituents of filling material as per EN 447	Cement	Check	Full	100 %	"CE" ¹⁰⁾
	Admixtures, additions	Check	Bulk	100 %	"CE" ¹⁰⁾

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

²⁾ Other dimensions than ⁴⁾

³⁾ 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.

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⁾ Teeth, cone surface

⁸⁾ "2.2": Test report "2.2" according to EN 10204

⁹⁾ If 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 shall accompany each delivery.

¹⁰⁾ If the basis for CE marking of constituents of filling materials and of plastic ducts is not available, an approval or certificate according to the respective standards and regulations in force at the place of use shall accompany each delivery.

Full: Full traceability of each component to its raw materials

Bulk: Traceability of each delivery of components to a defined point



CONA CMM Single

Internal Post-tensioning System
Contents of prescribed test plan

Annex 6

of European technical approval
ETA-12/0282

Audit testing

Component	Item	Test / Check	Sampling ²⁾ – Number of components per visit
Anchor head, 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 monostrand, VT CMM Band	Material according to specification	Test / Check	1
	Diameter	Test	
	Visual inspection	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 inspection 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.

²⁾ All samples shall be randomly selected and clearly identified.



CONA CMM Single

Internal Post-tensioning System
Audit testing

Annex 7

of European technical approval
ETA-12/0282

Tendon ranges

CONA CMM Single						
Nominal cross-sectional area	A_p	mm ²	140	150	165	
Nominal mass of prestressing steel	M	kg/m	1.09	1.17	1.29	
Nominal mass of tendon, monostrand or VT CMM Band	M	kg/m	1.23	1.31	1.42	
Characteristic tensile strength	f_{pk}	MPa	1 770	1 860	1 770	1 860
Characteristic value of maximum force	F_{pk}	kN	248	260	266	279
						300

Maximum prestressing and oversteering forces

CONA CMM Single						
Nominal cross-sectional area	A_p	mm ²	140	150	165	
Characteristic tensile strength	f_{pk}	MPa	1 770	1 860	1 770	1 860
Characteristic value of maximum force	F_{pk}	kN	248	260	266	279
Maximum prestressing force ^{1), 3)}	$0.90 \cdot F_{p0.1}$	kN	196	206	211	221
Maximum oversteering force ^{1), 2), 3)}	$0.95 \cdot F_{p0.1}$	kN	207	218	222	234
						251

¹⁾ The given values are maximum values according to EN 1992-1-1. The actual values shall be 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⁾ Oversteering 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.

Where

F_{pk} Characteristic value of maximum force of tendon

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

³⁾ For strands according to prEN 10138-3, 09.2000, the values shall be multiplied by 0.98.

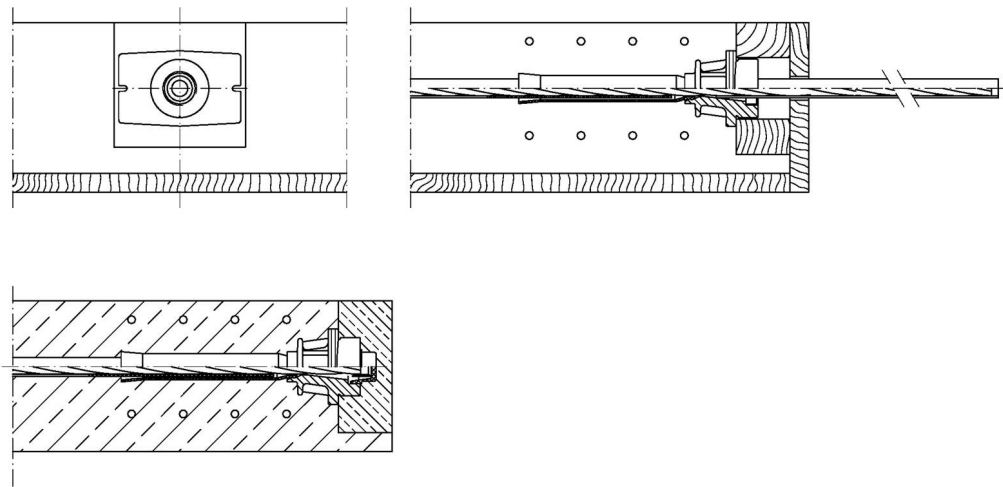


CONA CMM Single

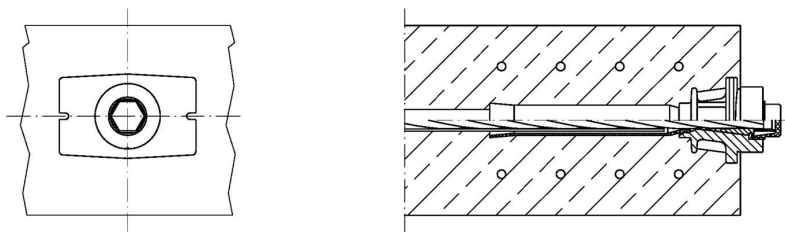
Internal Post-tensioning System
Tendon ranges and
maximum prestressing and oversteering forces

Annex 8
of European technical approval
ETA-12/0282

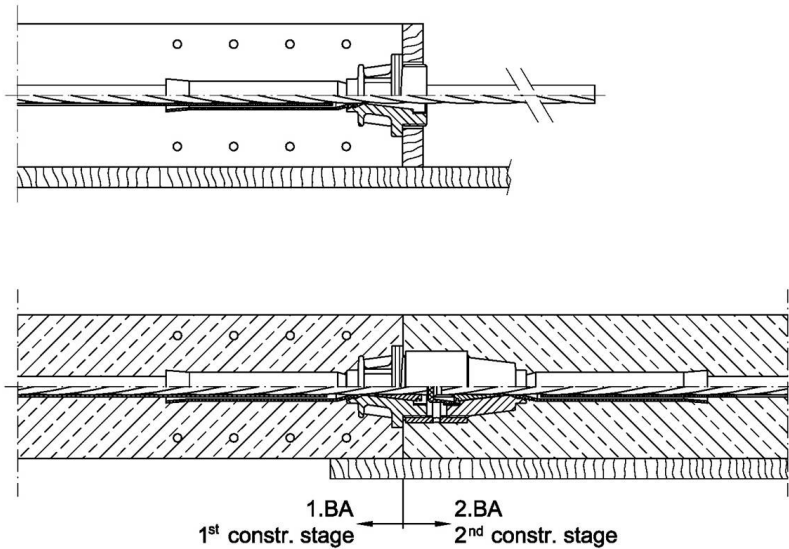
Recessed stressing anchorage type SA



Exposed stressing anchorage type SA



Fixed and stressing coupler type FH, SH

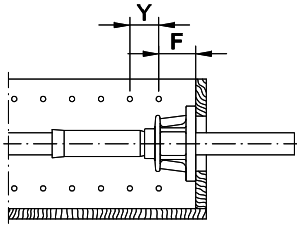


CONA CMM Single

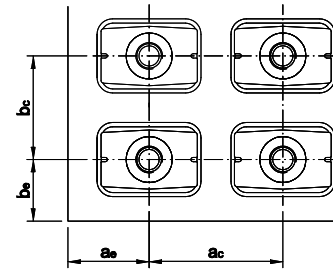
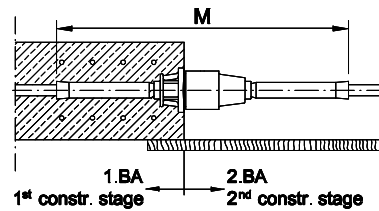
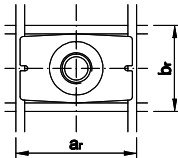
Internal Post-tensioning System
 Construction stages

Annex 9
 of European technical approval
 ETA-12/0282

Stressing and fixed anchorage and coupler



Centre spacing and edge distance



Technical data of BBR VT CONA CMM Single

Number of strands		—	01				
Nominal cross-sectional area	A _p	mm ²	140		150		165
Characteristic tensile strength	f _{pk}	MPa	1 770	1 860	1 770	1 860	1 820
Characteristic value of maximum force	F _{pk}	kN	248	260	266	279	300
Maximum prestressing force ¹⁾	0.90 · F _{p0.1}	kN	196	206	211	221	238
Maximum overstressing force ¹⁾	0.95 · F _{p0.1}	kN	207	218	222	234	251
Nominal diameter of monostrand or VT CMM Band	M	mm	20				
Minimum concrete strength – Additional reinforcement – Centre spacing and edge distance							
Minimum concrete strength							
Cube	f _{cm, 0}	MPa	≥ 24				
Cylinder			≥ 20				
Additional reinforcement ²⁾ – Ribbed reinforcing steel R _e ≥ 500 MPa ³⁾							
Number of stirrups		—	2				
Bar diameter		mm	8				
Spacing	Y	mm	50				
Distance	F	mm	55				
Minimum outer dimensions	a _r	mm	140				
	b _r		100				
Centre spacing and edge distance							
Minimum centre spacing	a _c	mm	180				
	b _c		140				
Minimum edge distance	a _e	mm	70 + c				
	b _e		50 + c				
Dimensions of recesses and couplers							
Bore in form	ØA	mm	65				
for coupler 1.BA	ØA	mm	62				
Coupler	M	mm	~ 545				

c..... Concrete cover

¹⁾ For strands according to prEN 10138-1, 09.2000, the values shall be multiplied by 0.98.

²⁾ Additional reinforcement may be replaced by a rectangular helix of identical characteristics and number of pitches equal to number of stirrups plus one.

³⁾ Reinforcing steel with $R_e \geq 460$ MPa requires a stirrup spacing of 40 mm and one additional stirrup.



CONA CMM Single

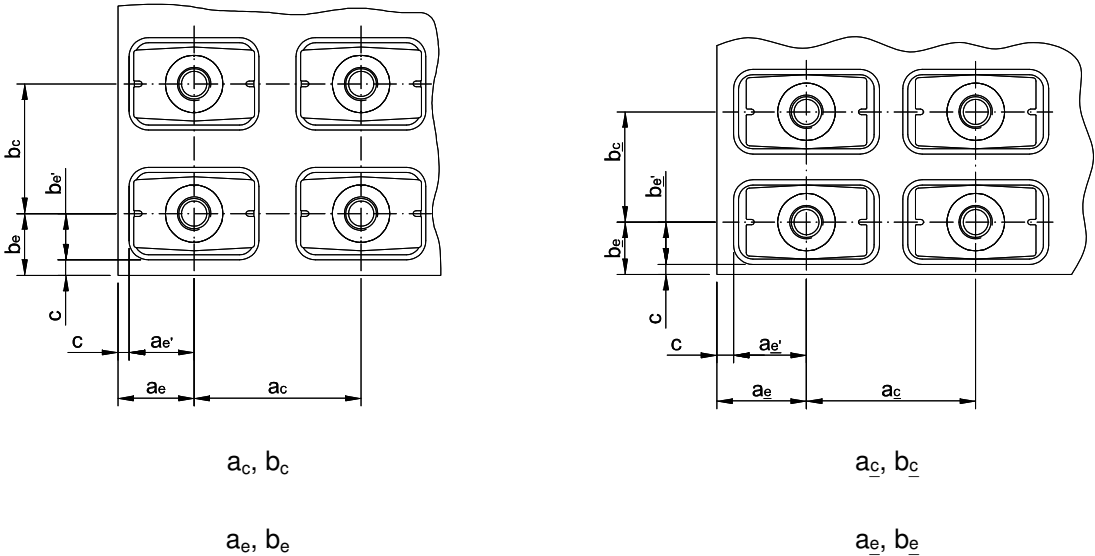
Internal Post-tensioning System

Dimensions of anchorage, additional reinforcement,
and centre spacing and edge distance

Annex 10

of European technical approval
ETA-12/0282

Centre spacing and edge distance



Modification of centre spacing and edge distance shall be in accordance with Clause 2.9:

$$b_c \geq 0.85 \cdot b_c$$

$$a_c \geq \frac{A_c}{b_c}$$

$$A_c = a_c \cdot b_c \leq a_c \cdot b_c$$

$$a_c \geq 0.85 \cdot a_c$$

$$b_c \geq \frac{A_c}{a_c}$$

Corresponding edge distances

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

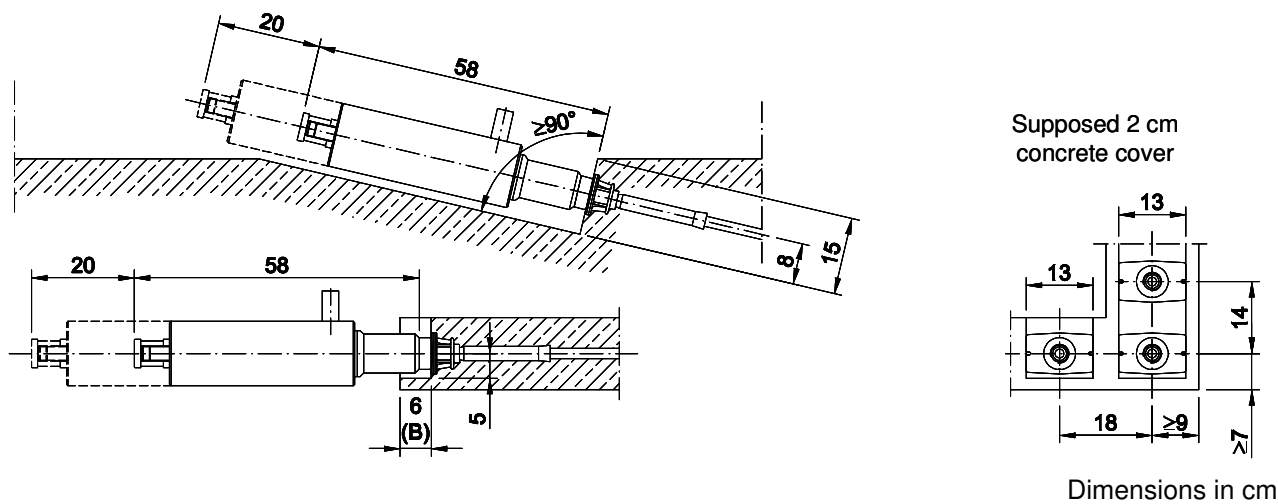
$$b_e = \frac{b_c}{2} - 10 \text{ mm} + c$$

cConcrete cover
The outer dimensions of the additional reinforcement shall be adjusted accordingly.
Further modifications of reinforcement have to be in accordance with Clause 4.2.3.

Dimensions in mm

Construction examples

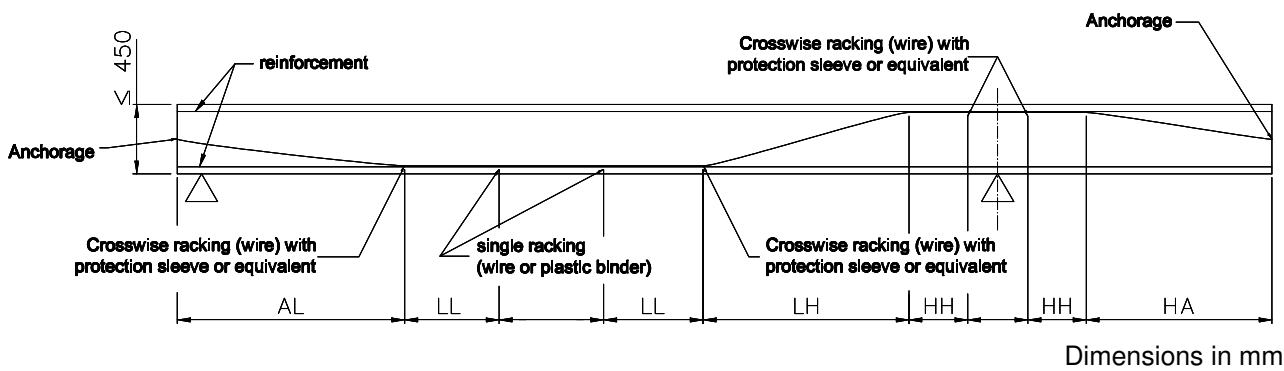
Minimum anchorage recess dimensions and a strand excess length of ≥ 70 cm



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

Free tendon layout

Free tendon layout with monostrands or VT CMM Bands for slabs with thickness ≤ 45 cm



Sections		Maximum distances of fixing points
AL	Anchorage to Low point	3.0 m
LL	Low point to Low point	1.0 – 1.3 m
LH	Low point to High point	3.0 m
HH	High point to High point	0.3 – 1.0 m
HA	High point to Anchorage	1.5 m

Installation of steel strand tendons

1) Preparatory work

The components of the prestressing kit shall be stored in such a way as to avoid any damage or corrosion.

2) Anchorage recesses

Adequate clearance to accommodate and to use the prestressing jack shall be ensured, see also Clauses 2.1.4 and 4.2.2.

3) Fixing the anchor heads

Two slots are provided to fix the anchor heads to the formwork. The grout pipe is inserted into the anchor head.

4) Placing of ducts

The ducts are placed on supports with spacing according to Clause 2.5 and minimum radii of curvature according to Clause 2.4. The ducts shall be connected in a water-proof way. The ducts shall be supported such that any movement is prevented.

The same applies for prefabricated tendons.

5) Installation of tensile elements (prestressing steel)

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

6) Installation of inaccessible fixed anchorages

After passing the strands through the anchor head, they are anchored individually in the cones by means of ring wedges. After the assembly the wedges are secured with rings. An alternative is pre-locking each individual strand with $\sim 0.5 \cdot F_{pk}$ and applying a wedge holding ring.

7) Checking the tendons before concreting

Before concreting the structure the fixation and position of the entire tendon shall be checked and corrected if necessary. The ducts shall be checked for any damage.

8) 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 the first construction stage.

9) Prestressing

At the time of stressing the mean concrete compressive strength shall be at least according to Clause 2.8. The stressing and possible wedging shall be carried out with a suitable prestressing jack and in accordance with Clause 4.4.

The elongations of the tendon and the prestressing forces shall be checked and recorded systematically during the stressing operation.

Restressing of the tendons is allowed in accordance with Clause 4.5.



CONA CMM Single

Internal Post-tensioning System
Description of installation

Annex 13

of European technical approval
ETA-12/0282

10) 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.

The coupler anchor head H, 2.BA is assembled with ring wedges and a wedge holding ring. It is connected to the already tensioned coupler anchor head H, 1.BA by means of a threaded coupler sleeve.

11) Filling of tendons

Grout shall be injected through the inlet holes until it escapes from the outlet tubes with the same consistency. All vents and grouting inlets shall be sealed immediately after grouting, see also Clause 4.7.

Grease or wax shall be injected in accordance with ETAG 013 and the recommendations of the supplier.

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

Installation of monostrand or VT CMM Band tendons

1) Preparatory work

The components of the prestressing kit shall be stored in such a way as to avoid any damage or corrosion.

2) Anchorage recesses

Adequate clearance to accommodate and to use the prestressing jack shall be ensured, see also Clauses 2.1.4 and 4.2.2.

3) Fixing the anchor heads

Two slots are provided to fix the anchor heads to the formwork. The transition pipes are pushed into the anchor heads.

4) Placing of monostrands or VT CMM Bands

The strands are placed on supports with spacing according to Clause 2.5 and minimum radii of curvature according to Clause 2.4. The strands shall be supported such that any movement is prevented.

The same applies for prefabricated tendons.

5) Installation of inaccessible fixed anchorages

Removal of the HDPE-sheathing at the end and inserting the felt sealing on each single strand in the region of the transition pipe. The same applies for accessible fixed anchorages and stressing anchorages, where after pushing the strands through the anchor head, the removed HDPE-sheathing is placed back to protect the excess strand length of the stressing anchorage.

After passing the strands through the anchor head of the inaccessible fixed anchorage, they are anchored individually in the cones by means of ring wedges. After the assembly, wedges are secured with rings. An alternative is pre-locking each individual strand with $\sim 0.5 \cdot F_{pk}$ and applying a wedge holding ring.

After filling the hollow space behind the anchor head with grease and closing the inlet, the protection cap is filled with grease and connected to the anchor head.

6) Similar procedures

In accordance with the installation of steel strand tendons, the following procedures are observed:

- Checking of the tendons before concreting
- Assembly of anchor head/coupler anchor head 1.BA
- Prestressing
- Installation of fixed coupler anchor head 2.BA

7) Filling of anchorages

Stressing anchorages, accessible fixed anchorages and coupler anchorages 1.BA shall be filled with grease in accordance with point 5) and protected with a cap (not for couplers).

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



CONA CMM Single

Internal Post-tensioning System
Description of installation of monostrands or
VT CMM Bands

Annex 15
of European technical approval
ETA-12/0282

Sheathing base material specification for monostrand / VT CMM Band

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/cm ³
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 EN ISO 527-2: 1BA, loading speed 100 mm/minute

Manufactured sheathing specification for monostrand / VT CMM Band

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 C32-060	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 Variation of elongation at 23 °C after conditioning for 3 days at 100 °C	EN ISO 527-2 EN ISO 527-2	≤ 25 % ≤ 25 %
Resistance to externally applied agents: Mineral oil Acids Bases Solvents Salt spray	EN ISO 175	Variation of tensile strength ≤ 25 % Variation of elongation ≤ 25 % Variation of volume ≤ 5 %
Sheathing minimum thickness	prEN 496	≥ 1.0 mm ²⁾

¹⁾ Standardised specimen according to EN ISO 527-2: 1BA, loading speed 100 mm/minute

²⁾ The actual value shall conform to the standards and regulations in force at place of use.



CONA CMM Single

Internal Post-tensioning System
Specifications

Annex 16

of European technical approval
ETA-12/0282

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 of the monostrand / of the VT CMM Band

Characteristics	Test method / Standard	Acceptance criteria
Cone penetration, 60 strokes (1/10 mm)	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 1 000 hours at 100 °C ≤ 0.2 MPa
Corrosion protection 168 hours at 35 °C 168 hours at 35 °C	NF X41-002 (salt spray) ¹⁾ NF X41-002 (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⁻	NF M07-023 ²⁾ NF M07-023 ²⁾	≤ 50 ppm (0.005 %) ≤ 100 ppm (0.010 %)

¹⁾ Test sample consists of a structural steel plate S355 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 (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 %



CONA CMM Single

Internal Post-tensioning System
Specifications

Annex 17
of European technical approval
ETA-12/0282

Wax specification

Characteristics	Test method / Standard	Acceptance criteria
Congealing point	NF T60-128	≥ 65 °C
Penetration (1/10 mm) at -20 °C	NF T60-119	No cracking
Bleeding at 40 °C	BS 2000: PT121 (1982) modified	≤ 0.5 %
Resistance to oxidation 100 hours at 100 °C	ASTM D942-70	≤ 0.03 MPa
Copper-strip corrosion 100 hours at 100 °C	ISO 2160	Class 1a
Corrosion protection 168 hours at 35 °C 168 hours at 35 °C	NF X41-002 (salt spray) ¹⁾ NF X41-002 (distilled water spray) ¹⁾	Pass No corrosion
Content of aggressive elements		
Cl ⁻ , S ²⁻ , NO ₃ ⁻	NF M07-023	≤ 50 ppm (0.005 %)
SO ₄ ²⁻	NF M07-023	≤ 100 ppm (0.010 %)

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



CONA CMM Single

Internal Post-tensioning System
Specifications

Annex 18

of European technical approval
ETA-12/0282

7-wire prestressing steel strands according to prEN 10138-3 ¹⁾							
Steel designation	—	Y1770S7	Y1860S7	Y1770S7	Y1860S7	Y1820S7G	
Nominal tensile strength	f _{pk}	MPa	1 770	1 860	1 770	1 860	1 820
Nominal diameter	d	mm	15.3	15.3	15.7	15.7	15.2
Nominal cross-sectional area	A _p	mm ²	140	140	150	150	165
Nominal mass per metre	M	kg/m	1.093		1.172		1.289
Permitted 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 ³⁾	F _{p0.1}	kN	218	229	234	246	264
Minimum elongation at maximum force, L ₀ = 100 mm	A _{gt}	%	≥ 3.5				
Modulus of elasticity	E _p	MPa	195 000 ²⁾				

¹⁾ Suitable strands according to standards and regulations in force at the place of use may also be used.

²⁾ Standard value

³⁾ For strands according to prEN 10138-3, 09.2000, the value shall be multiplied by 0.98.



CONA CMM Single

Internal Post-tensioning System
Table of strands

Annex 19
of European technical approval
ETA-12/0282

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+A1+A2 (06.2005) Concrete - Part 1: 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 523 (08.2003) Steel strip sheaths for prestressing tendons - Terminology, requirements, quality control

EN 1563 (12.2011) Founding - Spheroidal graphite cast irons

EN 1992-1-1+AC (11.2010) Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings

EN 1993-series Eurocode 3: Design of steel structures

EN 1996-series Eurocode 6: Design of masonry structures

EN 10083-1 (08.2006) Steels for quenching and tempering - Part 1: Technical delivery conditions for special steels

EN 10083-2 (08.2006) Steels for quenching and tempering - Part 2: Technical delivery conditions for unalloyed quality steels

EN 10084 (04.2008) Case hardening steels - Technical delivery conditions

EN 10204 (10.2004) Metallic products - Types of inspection documents

EN 10210-1 (04.2006) Hot finished structural hollow sections of non-alloy and fine grain structural steels - Part 1: Technical delivery conditions

EN 10216-1+A1 (03.2004) Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties

EN 10217-1+A1 (01.2005) Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties

EN 10219-1 (04.2006) Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions




CONA CMM Single

Internal Post-tensioning System
Reference documents

Annex 20
of European technical approval
ETA-12/0282

EN 10255+A1 (04.2007)	Non-alloy steel tubes suitable for welding and threading - Technical delivery conditions	
EN 10270-1 (10.2011)	Steel wire for mechanical springs - Part 1: Patented cold drawn unalloyed steel wire	
EN 10277-2 (03.2008)	Bright steel products - Technical delivery conditions - Part 2: Steels for general engineering purposes	
EN 10305-5 (01.2010)	Steel tubes for precision applications - Technical delivery conditions - Part 5: Welded and cold sized square and rectangular tubes	
EN 12201-1 (09.2011)	Plastic piping system for water supply - Polyethylene (PE) - Part 1: General	
prEN 496 (05.1991)	Plastics piping systems - Plastics pipes and fittings - Measurements of dimensions and visual inspection of surfaces	
prEN 10138-3 (08.2009)	Prestressing steels - Part 3: Strand	
prEN 10138-3 (09.2000)	Prestressing steels - Part 3: Strand	
EN ISO 175 (10.2010)	Plastics - Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175:1999)	
EN ISO 527-2 (02.2012)	Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics	
EN ISO 1872-1 (05.1999)	Plastics - Polyethylene (PE) moulding and extrusion materials - Part 1: Designation system and basis for specifications	
EN ISO 1874-1 (11.2010)	Plastics - Polyamide (PA) moulding and extrusion materials - Part 1: Designation system and basis for specification	
ISO 1133 (01.1997)	Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics	
ISO 2137 (11.1985)	Petroleum products - Lubricating grease and petrolatum - Determination of cone penetration	
ISO 2160 (09.1998)	Petroleum products - Corrosiveness to copper - Copper strip test	
ISO 2176 (03.1995)	Petroleum products - Lubricating grease - Determination of dropping point	
ISO 4437 (08.1997)	Buried polyethylene (PE) pipes for the supply of gaseous fuels - Metric series - Specifications	
ISO 6964 (12.1986)	Polyolefin pipes and fittings - Determination of carbon black content by calcination and pyrolysis - Test method and basic specification	
ISO/TR 10837 (07.1991)	Determination of the thermal stability of polyethylene (PE) for use in gas pipes and fittings	
	Internal Post-tensioning System Reference documents	Annex 21 of European technical approval ETA-12/0282

NF C32-060 (05.1996)	Polyethylen for insulation and sheath for telecommunication cables
NF M07-023 (02.1969)	Liquid fuels - Determination of chlorides in crude petroleum and petroleum products
NF T60-128 (12.1974)	Congelating point of petroleum waxes, including petrolatum
NF X41-002 (08.1975)	Protection against physical, chemical and biological agents - Salt spray test
DIN 51802 (04.1990)	Testing lubricating greases for their corrosion-inhibiting properties by the SKF Emcor method
DIN 51808 (01.1978)	Testing of lubricants - Determination of oxidation stability of greases, oxygen method
DIN 51817 (04.1998)	Testing of lubricants - Determination of oil separation from greases under static conditions
DIN 53479 (10.1991)	Testing of plastics and elastomers - Determination of density
BS 2000: PT121 (03.1982)	Methods of test for petroleum and its products - Oil separation on storage of grease
ASTM D942-70	Standard test method for oxidation stability of lubricating greases by the oxygen bomb method
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
<div>  BBR CONA CMM Single </div>	
Internal Post-tensioning System Reference documents	
Annex 22 of European technical approval ETA-12/0282	

**EC Certificate of Conformity
0432-CPD-11 9181-1.8/1**

In compliance with Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (the Construction Products Directive or CPD), as later amended, it has been stated that the construction product

**BBR VT CONA CMM Single – Internal Post-tensioning
System with 01 Strand**

Post-tensioning kit for prestressing of structures with internal bonded or unbonded 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 notified body No. 0432 – 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 ETA


ETA-12/0282 from 26-06-2013

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

This certificate was first issued on 30-06-2013 and remains valid as long as the conditions laid down in the harmonised technical specification in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly and latest on 25-06-2018.

Dortmund, 30-06-2013




Dipl.-Ing. Gödecker
Head of Certification Body

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

BBR VT International Ltd
Ringstrasse 2
8603 Schwerzenbach (ZH)
Switzerland

Tel +41 44 806 80 60
Fax +41 44 806 80 50

www.bbrnetwork.com
info@bbnetwork.com

BBR VT International Ltd
Technical Headquarters and Business Development Centre
Switzerland