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European Technical Assessment

ETA-10/0308 of 27.06.2018

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands
Product family to which the construction product belongs	Unbonded post-tensioning kits for prestressing of structures with strands
Manufacturer	Gleitbau Ges.m.b.H. Itzlinger Hauptstraße 105 5020 Salzburg Austria
Manufacturing plant	Gleitbau Ges.m.b.H. Itzlinger Hauptstraße 105 5020 Salzburg Austria
This European Technical Assessment contains	38 pages including Annexes 1 to 19, which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) № 305/2011, on the basis of	EAD 160004-00-0301, European Assessment Document for Post-Tensioning Kits for Prestressing of Structures.
This European Technical Assessment replaces	European technical approval ETA-10/0308 with validity from 30.06.2013 to 29.06.2018.

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Remarks

Specific parts

1 Technical description of the product

1.1 General

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

VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands,

comprising the following components, see Annex 1, Annex 2, Annex 3, Annex 4, and Annex 5.

– Tendon

Unbonded tendons with 1 to 16 tensile elements. Monostrand, single band or stacked bands

– Tensile element

Unbonded 7-wire prestressing steel strand with nominal diameter and maximum characteristic tensile strengths as given in Table 1, factory-provided with a corrosion protection system comprising corrosion protection filling material and HDPE-sheathing.

Table 1 Tensile elements

Nominal diameter	Nominal cross-sectional area	Maximum characteristic tensile strength 1)
mm	mm²	MPa
15.7	150	1 860

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

NOTE 1 MPa = 1 N/mm²

– Anchorage and coupler

Anchorage of the prestressing steel strands with ring wedges

End anchorage

Fixed (passive) anchor or stressing (active) anchor as end anchorage with anchor blocks for 1 to 4 prestressing steel strands

Coupler

Coupler for 1 to 4 prestressing steel strands

[1] ETA-10/0308 was firstly issued in 2010 as European technical approval with validity from 29.10.2010, extended in 2013 with validity from 30.06.2013 and converted 2018 to European Technical Assessment ETA-10/0308 of 27.06.2018.

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

PT system

1.2 Designation

End anchorages can be fixed or stressing anchors. The principal dimensions of anchorages and couplers are given in Annex 3, Annex 4, Annex 5, Annex 8, and Annex 9.

Designation e.g.

VBT-BI 4 150 1860

or

VBT-BI 2×4 M 150 1770

- The first number of the designation identifies the number of strands (e.g. 4) or the number of bands and the number of strand for each band (e.g. 2×4).
- In addition, an optional letter defines the anchorage (M – anchorage with multiple anchor blocks, bundle anchorage, B – coupler with coupler bolts).
- The nominal cross-sectional area of a single strand is identified by a number („150" for 150 mm²).
- Finally, the nominal tensile strength of the strands is given (e.g. „1860" for Y1860S7).

The components, including helix and additional reinforcement, are suitable for strands with a nominal tensile strength of up to 1 860 MPa.

1.3 Friction losses

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

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

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 $\mu = 0.06$

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

k .... rad/m .... Wobble coefficient k = 0.25 °/m (0.0044 rad/m) to account for unintentional tendon deviations

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

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

1.4 Support of tendons

The individual monostrands or VBT-BI bands are fixed in their position. Spacing of supports is.

1 Normally

Individual monostrands and VBT-BI bands with 1 to 16 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 high or low tendon position, the tendons are 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 is fixed in its position. Special spacers for tendons are therefore not required.

1.5 Slip at anchorages and couplers

Table 2 specifies the slip at anchorages couplers that is taken into consideration in calculations of tendon elongation and forces in tendon.

Table 2 Slip at anchorages and couplers

Pre-locking at anchorage and coupler	Slip mm
Pre-locking with 0.8 · F_{pk}	4
Pre-locking with ~ 50 kN	6
Without pre-locking, stressing anchor	9

1.6 Centre spacing and edge distances for anchorages

In general, spacing and distances are not less than the values given in Annex 8 and Annex 9.

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

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

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

Where

a_c .... mm .... Centre spacing before and after modification

b_c .... mm .... Centre spacing in the direction perpendicular to a_c before and after modification

a_e .... mm .... Edge distance before and after modification

b_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 are observed. Minimum concrete cover is taken as 20 mm.

The minimum values for a_c, b_c, a_e, and b_e are given in Annex 8 and Annex 9.

Centre spacing and edge distances are given for anchorages with singe anchor bock, i.e. VBT-BI 1 to VBT-BI 4 and for bundle anchorages, i.e. VBT-BI 4 to VBT-BI 16. The individual anchor blocks in bundle anchorages are arranged next to each other, i.e. without a clear distance between them. Centre spacing and edge distances of bundle anchorages are indicated from the virtual centre of the bundle anchorage, see Annex 7.

1.7 Minimum radii of curvature of the tendons

The minimum radii of curvature are given in Table 3. Verification of edge stresses in the prestressing steel strand is not required if these minimum radii of curvature are observed.

Table 3 Minimum radii of curvature

Number of bands NL	Minimum wall thickness of sheathing in mm							
	≥ 1.5			≥ 1.75			≥ 1.0 [1]	≥ 0.8 [2]
Minimum deviation radius $R_{horizontal}$ in m								
—	≥ 10.0	≥ 20.0	→ ∞	≥ 10.0	≥ 20.0	→ ∞	→ ∞ [3]	→ ∞ [3]
Minimum deviation radius $R_{vertical}$ in m								
4	10.0	7.20	6.80	6.40	5.60	5.40	→ ∞ [3]	→ ∞ [3]
3	7.50	5.40	5.10	4.80	4.20	3.90		
2	5.00	3.60	3.40	3.20	2.80	2.60		
1	2.50	1.90	1.90	1.90	1.90	1.90		

1) Restressable tendon
2) Non-restressable tendon
3) Straight tendon

Where

$R_{horizontal}$ ......m......... Radius of curvature for bending in plane of the width of the band

$R_{vertical}$ ....m......... Radius of curvature for bending in plane of the thickness of the band

1.8 Sliding travel

The total sliding travel of the tendon, i.e. sliding due to elongation by prestressing, restressing and possible release of prestressing force, is limited. The maximum sliding travel for the minimum radius of curvature and 4 bands top of each other $\Delta l(R_{v,\,min}) = 160$ cm.

The maximum sliding travel can be increased by applying a larger radius of curvature than the minimum radii given in Table 3. The equation to determine the maximum sliding travel is.

$$\Delta l(R_v) = \Delta l(R_{v,\,min}) \cdot \frac{4}{NL} \cdot \frac{R_v}{R_{v,\,min}}$$

Where

R_v, $R_{v,\,min}$ .... Radius of curvature for bending in plane of the thickness of the band, $R_{vertical}$

$\Delta l(R_{v,\,min})$........ Maximum sliding travel at minimum radius of curvature, $R_{v,\,min}$, and 4 layers of bands, $\Delta l(R_{v,\,min}) = 160$ cm

$R_{v,\,min}$ .... Minimum radii of curvature according to Table 3

$\Delta l(R_v)$............. Maximum sliding travel with actual radius of curvature R_v

NL .... actual number of band layers

1.9 Lengths of transitions tubes and overlapping

The required lengths of the transition tubes as well as the required length of engagement of the sheathing in the transition tubes is determined, taking account in particular of temperature differences during construction, displacements caused by stressing, and construction tolerances. In the final state, a length of engagement of about 100 mm is ensured.

The ETA holder is consulted in specifying the required dimensions. The minimum length of the transition tubes is 200 mm.

1.10 Concrete strength at time of stressing

Concrete in conformity with EN 206[2] is used. At the time of stressing the mean concrete compressive strength, $f_{cm,0}$, is at least

$f_{cm,0,cube\,150} \geq 25$ MPa cube strength, 150 mm cube, or

$f_{cm,0,cylinder} \geq 20$ MPa cylinder strength, 150 mm cylinder diameter

The concrete test specimens are 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 is 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 Eurocode 2.

Helix, additional reinforcement, centre spacing and edge distance are taken from Annex 8 and Annex 9, see also the Clauses 1.12.5 and 2.2.3.4.

Where

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

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

Components

1.11 Prestressing steel strands

Only 7-wire prestressing steel strands with characteristics according to Table 4 are used, see also Annex 11.

Table 4 Prestressing steel strands

Maximum characteristic tensile strength	f_{pk}	MPa	1 770	1 860
Nominal diameter	d	mm	15.7	15.7
Nominal cross-sectional area	A_p	mm²	150	150
Mass of prestressing steel	M	kg/m	1.172	1.172

The greased and sheathed strands may be either individual monostrands or VBT-BI bands made of monostrands.

In the course of preparing the European Technical Assessment, no characteristic has been assessed for prestressing steel strands. In execution, a suitable prestressing steel strand that conforms to Annex 11 and is according to the standards and regulations in force at the place of use is taken.

2 Standards and other documents referred to in the European Technical Assessment are listed in Annex 18 and Annex 19.

1.12 Anchorages and couplers

1.12.1 General

The components of anchorages and couplers conform to the specifications given in Annex 3, Annex 4, and Annex 5 and the technical file[3]. Therein the component dimensions, materials and material identification data with tolerances are given.

1.12.2 Anchorage

The anchor blocks of fixed and stressing anchors are identical, see Annex 1 and Annex 2. A differentiation is needed for the construction works. The principal dimensions of the anchorages are given in Annex 3, Annex 4, and Annex 5.

Anchorages with 1 to 4 strands are single anchor blocks. Anchorages with 4 to 16 strands are bundle anchorages with 2 to 4 single anchor blocks.

The conical holes of the anchor blocks are clean, free of corrosion and provided with grease.

1.12.3 Coupler

Couplers are fixed couplers and are in two parts, see Annex 1 and Annex 2.

- Part A for 1st construction stage is like a fixed or stressing anchor with threaded holes for the coupler bolts
- Part B is for the 2nd construction stage
- Part A and part B are jointed with coupler bolts

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.

1.12.4 Ring wedges

The ring wedges, see Annex 5, are in three pieces. The individual pieces are held together by a spring ring.

Within one anchorage or coupler, only ring wedges from one supplier are used.

1.12.5 Helix and additional reinforcement

Helixes and additional reinforcement as stirrups etc. are made of ribbed reinforcing steel. The end turns of both sides of the helixes are welded to the previous turns. The helix is placed in the tendon axis. Dimensions of helix and additional reinforcement conforms to the values specified in Annex 8 and Annex 9, see also Clause 2.2.3.4.

If required for a specific project design, the reinforcement given in Annex 8 and Annex 9 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 provided equivalent performance.

1.12.6 Material specifications

Annex 10 lists the material standards or specifications of the components.

1.13 Permanent corrosion protection

1.13.1 General

In the course of preparing the European Technical Assessment, no characteristic has been assessed for components and materials of the corrosion protection system referred to in the Clauses 1.13.2 and 1.13.3. In execution, all components or materials are selected according to the standards and regulations in force at the place of use.

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

1.13.2 Corrosion protection of prestressing steel strand

Monostrands or VBT-BI bands are sheathed in the factory with an extruded HDPE-sheathing with a thickness of at least 0.8 mm for non-restressable or 1.0 mm for restressable straight tendons. The actual thickness of the sheathing is in accordance with the deviation radii, see Table 3, and the standards and regulations in force at the place of use.

The voids inside the HDPE-sheathing are filled with corrosion protection filling material. During installation of the tendon, the sheathing is removed along the required length. Cut-off HDPE-sheaths are slipped on the dismantled strands excess length for temporary protection.

1.13.3 Corrosion protection in anchorage and coupler

All voids of anchorages and couplers are completely filled with corrosion protection filling material according to the installation instructions in Annex 15, Annex 16, and Annex 17.

Anchorages that are pre-locked receive their corrosion protection immediately after the pre-locking operation by filling with corrosion protection filling material and screwing-on of the protection cap.

All anchorages and couplers are fully embedded in concrete. The recesses are designed as to permit a reinforced concrete cover with the required dimensions and in any case with a thickness of at least 20 mm.

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

2.1 Intended use

The PT system is intended to be used for the prestressing of structures. The use category according to tendon configuration and material of structure is

- Internal unbonded tendon for concrete and composite structures

2.2 Assumptions

2.2.1 General

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

2.2.2 Packaging, transport and storage

Advice on packaging, transport, and storage includes.

- During transport of prefabricated tendons, a minimum diameter of curvature of 1.10 to 1.75 m or as specified by the manufacturer of the prestressing steel strand is observed.
- Temporary protection of prestressing steel and components in order to prevent corrosion during transport from production site to job site
- Transportation, storage and handling of the prestressing steel and other components in a manner as to avoid damage by mechanical or chemical impact
- Protection of prestressing steel and other components from moisture
- Keeping tensile elements separate from areas where welding operations are performed

2.2.3 Design

2.2.3.1 General

It is the responsibility of the ETA holder to ensure that all necessary information on design and installation is submitted to those responsible for the design and execution of the structures executed with "VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands".

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

2.2.3.2 Anchorage Recess

The anchorage recess is designed so as to permit 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 prestressing steel 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.

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

2.2.3.3 Maximum prestressing forces

Prestressing and overstressing forces are specified in the respective standards and regulations in force at place of use. Annex 12 lists the maximum possible prestressing and overstressing forces according to Eurocode 2.

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

Centre spacing, edge distance, helix, and additional reinforcement given in Annex 8 and Annex 9 are adopted, see Clause 1.6.

Verification of transfer of prestressing forces to structural concrete is not required if centre spacing and edge distance of anchorages and couplers as well as grade and dimensions of additional reinforcement, see Annex 8 and Annex 9, are conformed to. Existing reinforcement in excess to the required reinforcement may be taken into account for the additional reinforcement.

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

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

If required for a specific project design, the reinforcement given in Annex 8 and Annex 9 may be modified in accordance with the respective regulations in force at the place of use as well as with the relevant approval of the local authority and of the ETA holder to provide equivalent performance.

2.2.3.5 Tendons in masonry or timber structures – load transfer to the structure

Post-tensioning kits are primarily used in structures made of concrete. They can, however, be used with other structural materials, e.g. in masonry or timber structures. However, there is no particular assessment in EAD 160004-00-0301 for these applications. Hence, load transfer of stressing force from the anchorage to masonry structures is via concrete or steel members, designed according to the European Technical Assessment, especially according to the Clauses 1.6, 1.10, 1.12.5, and 2.2.3.4, or according to Eurocode 3, respectively. Load transfer from anchorage to timber structures is via steel members, designed according to Eurocode 3.

The concrete or steel members have dimensions as to permit a force of 1.1 · F_{pk} being transferred into the masonry or timber structure. The verification is according to Eurocode 6 or Eurocode 5 respectively as well as to the respective standards and regulations in force at the place of use.

2.2.4 Installation

2.2.4.1 General

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

Assembly and installation of tendons is only carried out by qualified PT specialist companies with the required resources and experience in the use of multi strand unbonded post-tensioning systems, see CWA 14646. The respective standards and regulations in force at the place of use are considered. The company's PT site manager has a certificate, stating that she or he has been trained by the ETA holder and that she or he possesses the necessary qualifications and experience with the "VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands".

The sequence of work steps for installation of anchorage and fixed coupler is described in Annex 6, Annex 15, Annex 16, and Annex 17.

The tendons may be manufactured on site or in the manufacturing plant, i.e. prefabricated tendons. The tendons are carefully handled during production, transport, storage, and installation. Corrosion protected HDPE sheathed prestressing steel strands are usually delivered to site in coils with an internal diameter of 1.10 to 1.75 m.

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

2.2.4.2 Stressing operation

Prestressing requires free space directly behind the anchorages.

With a mean concrete compressive strength in the anchorage zone according to the values laid down in Annex 8 and Annex 9, full prestressing may be applied.

Stressing and, if applicable, wedging is carried out using a suitable prestressing jack. The wedging force corresponds to approximately 50 kN per wedge.

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

After releasing the prestressing force from the prestressing jack, the tendon is pulled in and reduces the elongation by the amount of slip at the anchor head of the stressing anchor.

The records of the stressing operations are filed for future reference. In the case of restressing or exchange of strands the elongations for restressing or release and subsequent stressing are added to compare with the maximum sliding travel of Clause 1.8.

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

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

2.2.4.3 Restressing

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

For restressing, strand protrusions are required appropriate for the prestressing jacks.

2.2.4.4 Exchanging tendons

Exchange of unbonded tendons is permitted, subject of acceptance at the place of use. The specifications for exchangeable tendons are defined during the design phase.

Exchanging the prestressing steel strand of monostrand or VBT-BI band, with the sheathing remaining in the structure is also possible.

The radii of curvature should be reasonable larger than the minimum radii given in Clause 1.7 as to not impair the sheathings of monostrand or VBT-BI band by wear due to stressing of the tendons.

Stressing and fixed anchors are accessible and adequate space is provided behind the anchorages. Moreover, a strand protrusion at the stressing anchor remains with a length compatible with the prestressing jack used and allowing for a safe release of the complete prestressing force.

2.2.4.5 Welding

Welding is not intended and 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.

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands of 100 years, provided that the VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands is subject to appropriate installation, use, and maintenance, see Clause 2.2. These provisions are based upon the current state of the art and the available knowledge and experience.

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

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

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

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

3.1 Essential characteristics

The performances of the PT system for the essential characteristics are given in Table 5.

Table 5 Essential characteristics and performances of the product

№	Essential characteristic	Product performance
Product VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands Intended use The PT system is intended to be used for internal unbonded tendon for concrete and composite structures.		
Basic requirement for construction works 1: Mechanical resistance and stability		
1	Resistance to static load	See Clause 3.2.1.1.
2	Resistance to fatigue	See Clause 3.2.1.2.
3	Load transfer to the structure	See Clause 3.2.1.3.
4	Friction coefficient	See Clause 3.2.1.4.
5	Deviation, deflection (limits) for internal bonded and unbonded tendon	See Clause 3.2.1.5.
6	Assessment of assembly	See Clause 3.2.1.6.
7	Corrosion protection	See Clause 3.2.1.7.
Basic requirement for construction works 2: Safety in case of fire		
8	Reaction to fire	See Clause 3.2.2.1.
Basic requirement for construction works 3: Hygiene, health and the environment		
9	Content, emission and/or release of dangerous substances	See Clause 3.2.3.1.
Basic requirement for construction works 4: Safety and accessibility in use		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 5: Protection against noise		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 6: Energy economy and heat retention		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 7: Sustainable use of natural resources		
—	No characteristic assessed.	—

3.2 Product performance

3.2.1 Mechanical resistance and stability

3.2.1.1 Resistance to static load

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.1. The characteristic values of maximum force, F_{pk}, of the tendon for prestressing steel strands according to Annex 11 are listed in Annex 11.

3.2.1.2 Resistance to fatigue

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.2. The characteristic values of maximum force, F_{pk}, of the tendon for prestressing steel strands according to Annex 11 are listed in Annex 11.

3.2.1.3 Load transfer to the structure

The PT system as described in the ETA meets the acceptance criteria of EAD 160004-00-0301, Clause 2.2.3. The characteristic values of maximum force, F_{pk}, of the tendon for prestressing steel strands according Annex 11 are listed in Annex 11.

3.2.1.4 Friction coefficient

For friction losses including friction coefficient see Clause 1.3.

3.2.1.5 Deviation, deflection (limits) for internal bonded and unbonded tendon

For minimum radii of curvature see Clause 1.7.

3.2.1.6 Assessment of assembly

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

3.2.1.7 Corrosion protection

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

3.2.2 Safety in case of fire

3.2.2.1 Reaction to fire

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

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

3.2.3 Hygiene, health and the environment

3.2.3.1 Content, emission and/or release of dangerous substances

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

- SVOC and VOC

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

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

- Leachable substances

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

3.3 Assessment methods

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

3.4 Identification

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

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

4.1 System of assessment and verification of constancy of performance

According to the Commission Decision 98/456/EC the system of assessment and verification of constancy of performance to be applied to the PT system is System 1+. System 1+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, point 1.1., and provides for the following items.

(a) The manufacturer shall carry out

(i) factory production control;

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

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

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

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

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

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

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

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

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

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

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

5.1 Tasks for the manufacturer

5.1.1 Factory production control

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

- Control of the incoming materials

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

- Inspection and testing

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

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

  All tests are performed according to written procedures with suitable calibrated measuring devices. All results of inspections, tests, and checks are recorded in a consistent and systematic way. The basic elements of the prescribed test plan are given in Annex 13, conform to EAD 160004-00-0301, Table 3, and are specified in the quality management plan of the VBT-BI – Unbonded Post-tensioning System with 1 to 16 Strands.

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

- Control of non-conforming products

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

- Complaints

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

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

At least once a year the manufacturer audits the manufacturers of the components given in Annex 14.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of constancy of performance issued by the notified product certification body, the manufacturer draws up the declaration of performance. Essential characteristics to be included in the declaration of performance for the corresponding intended use are given in Table 5.

5.2 Tasks for the notified product certification body

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

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

5.2.2 Continuing surveillance, assessment and evaluation of factory production control

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

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

Each manufacturer of the components given in Annex 14 is audited at least once in five years. It is verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan.

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

5.2.3 Audit-testing of samples taken at the manufacturing plant or at the manufacturer's storage facilities

During surveillance inspection, the notified product certification body takes samples of components of the PT system for independent testing. Audit-testing is conducted at least once a year by the notified product certification body. For the most important components, Annex 14 summarises the minimum procedures. Annex 14 conforms to EAD 160004-00-0301, Table 4. In particular, at least once a year, the notified product certification body also carries out one single tensile element test series according to EAD 160004-00-0301, Annex C.7 and Clause 3.3.4 on specimens taken from the manufacturing plant or at the manufacturer's storage facility.

Issued in Vienna on 27 June 2018
by Österreichisches Institut für Bautechnik

Rainer Mikulits
Managing Director

Overview on stressing and fixed anchors

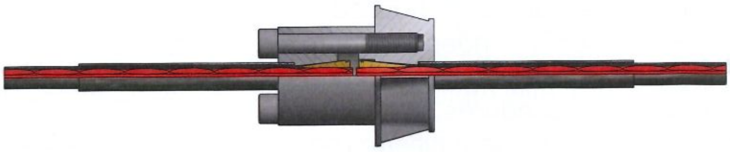
VBT-BI 1 – Stressing/Fixed

VBT-BI 2 – Stressing/Fixed

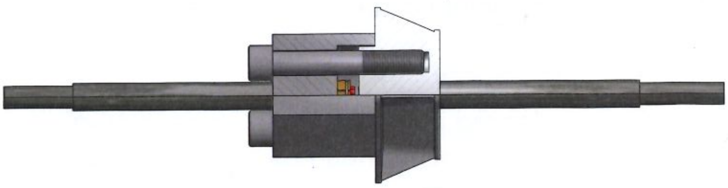
VBT-BI 4 – Stressing/Fixed

Overview on couplers

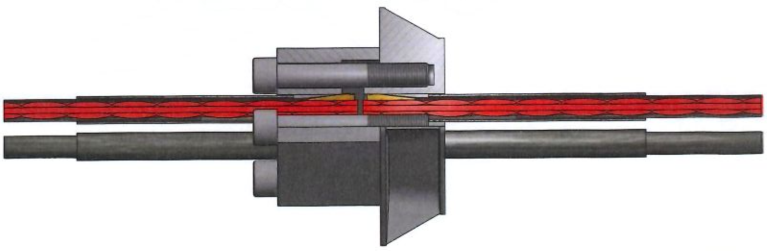
VBT-BI 1 – Coupler



VBT-BI 2 – Coupler



VBT-BI 4 – Coupler



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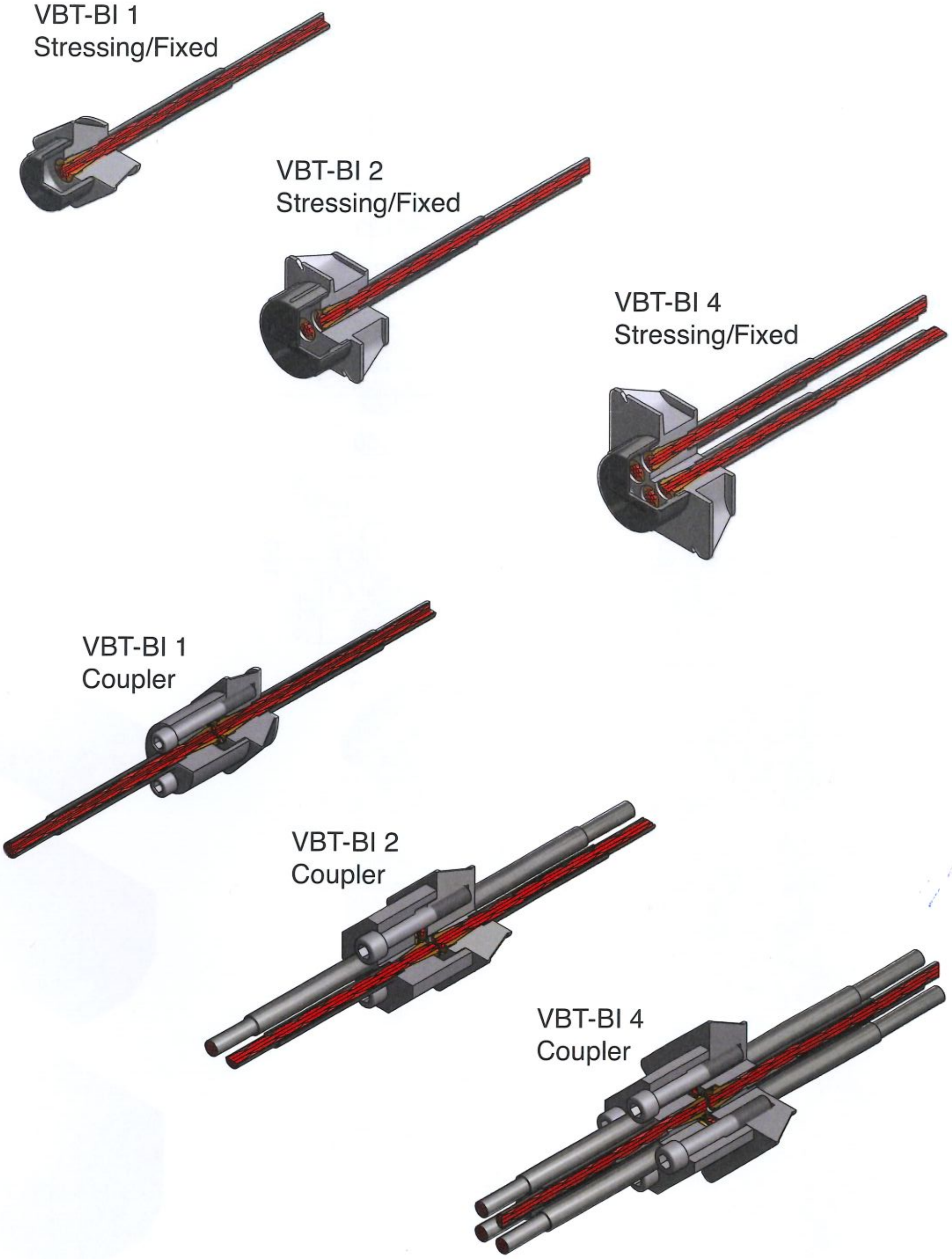
Overview on anchorages and couplers



OIB Member of EOTA

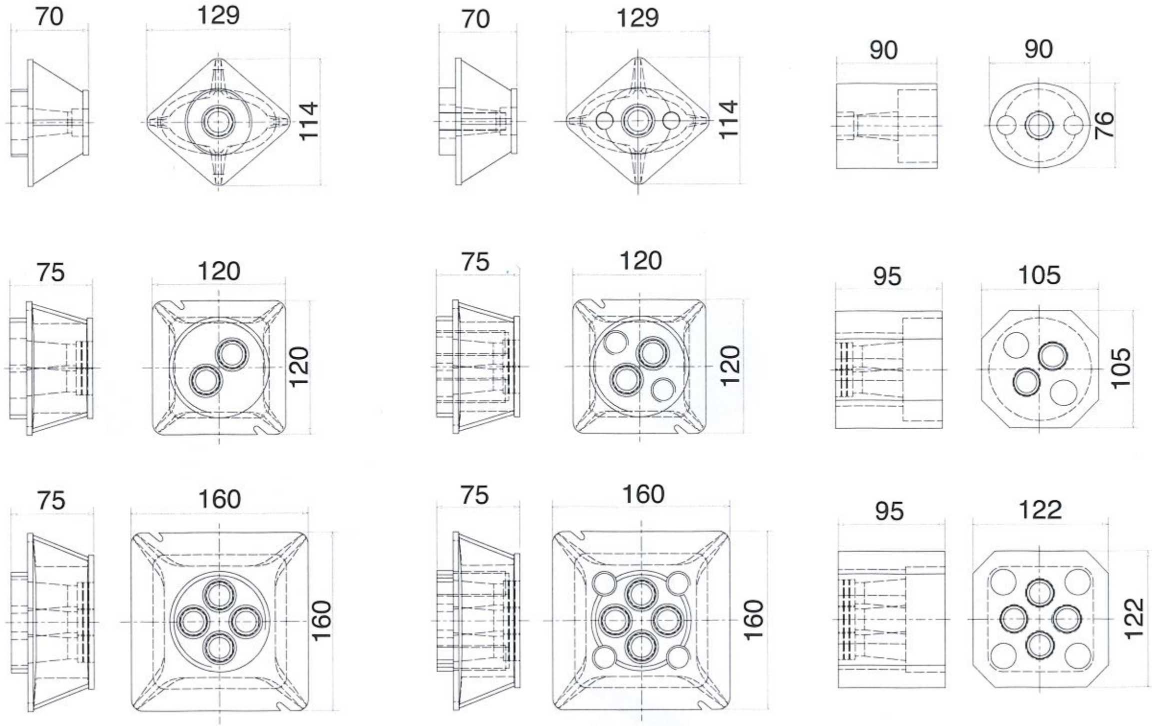
Anchorages and couplers

Stressing/Fixed anchor | Coupler Part A | Coupler Part A

VBT-BI 1

VBT-BI 2

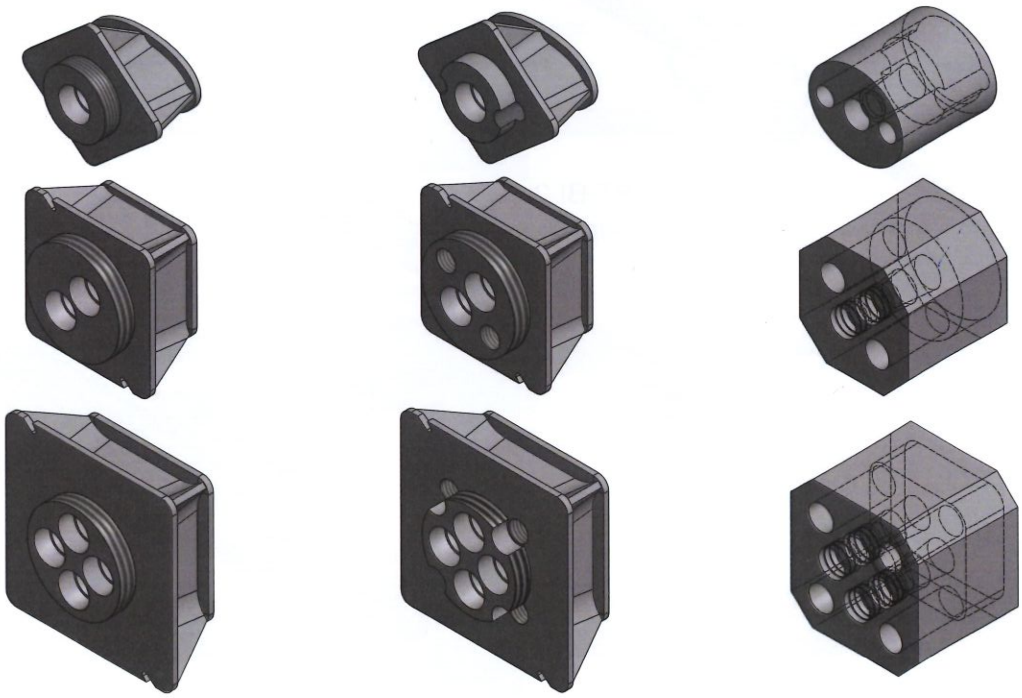
VBT-BI 4



VBT-BI 1

VBT-BI 2

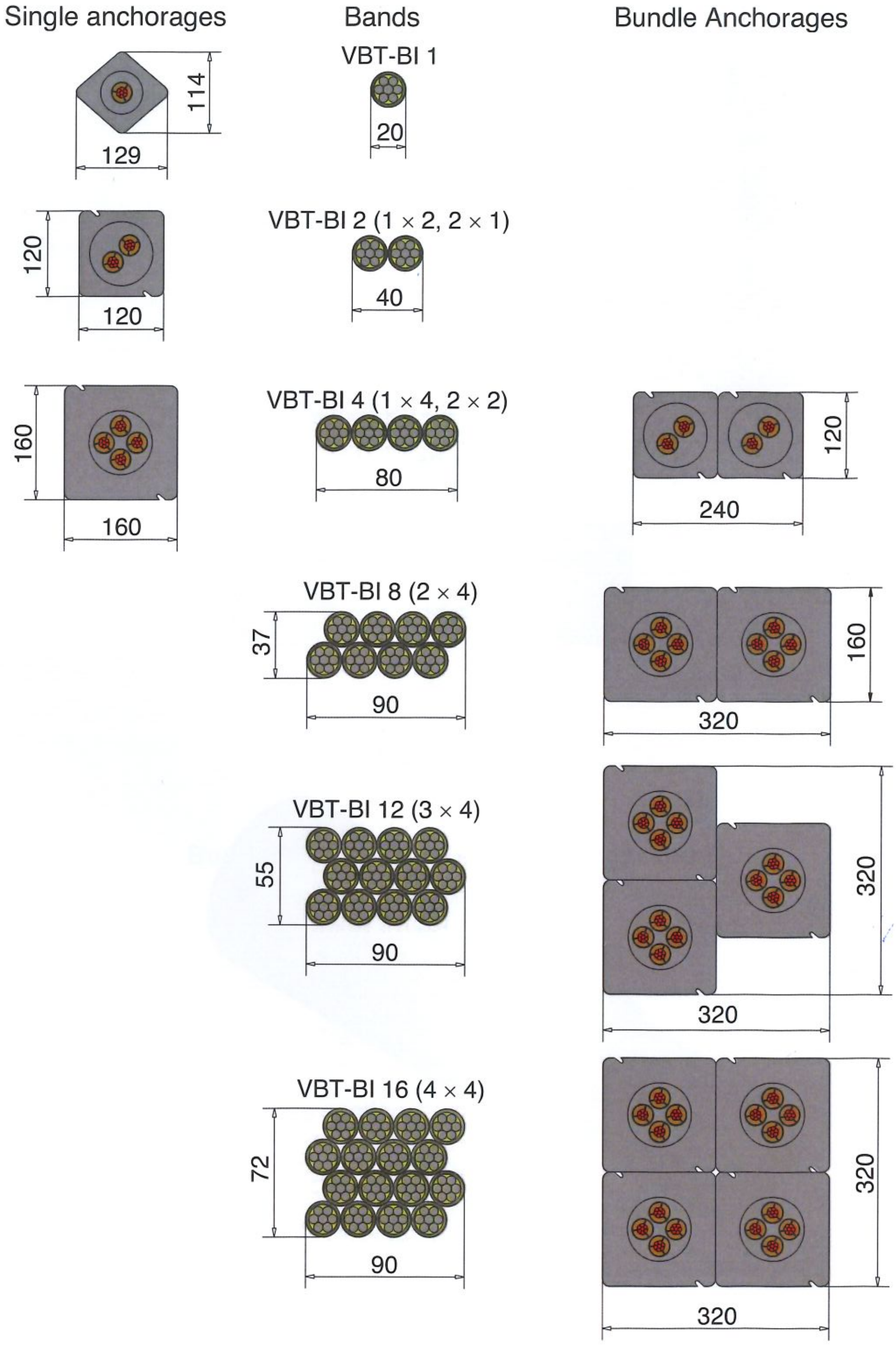
VBT-BI 4



Dimensions in mm

Unbonded Post-Tensioning-System VBT-BI	VBTSystems GleitbauSalzburg	**Annex 3** of European Technical Assessment **ETA-10/0308** of 27.06.2018
Anchorages and couplers – Components and dimensions		

Bands and single and bundle anchorages



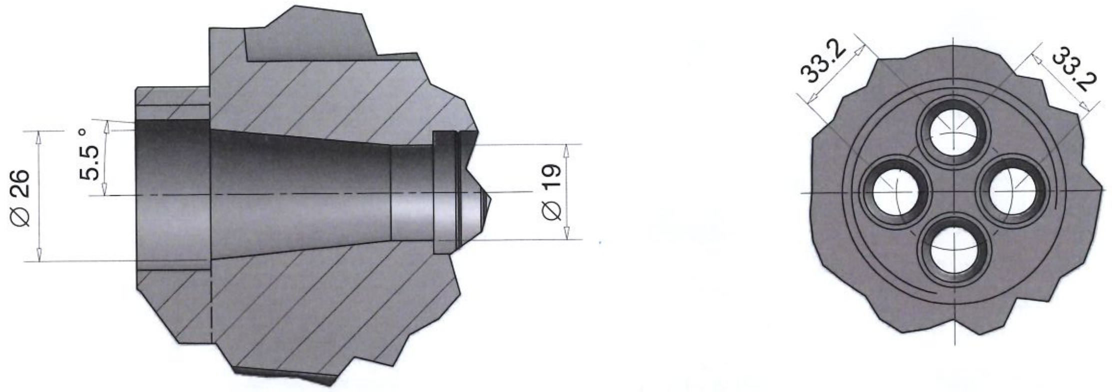
Dimensions in mm

Unbonded Post-Tensioning-System VBT-BI	VBT Systems Gleitbau Salzburg	**Annex 4** of European Technical Assessment **ETA-10/0308** of 27.06.2018
Bands and single and bundle anchorages		

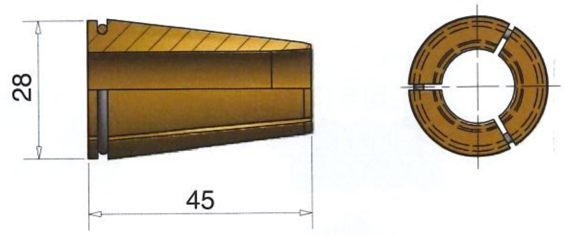
OiB Member of EOTA

Details

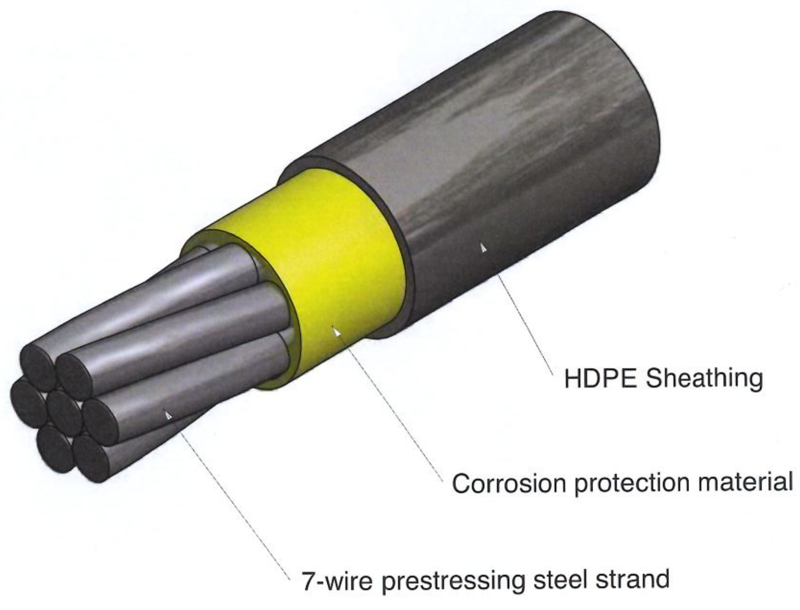
Cone specifications



Wedge



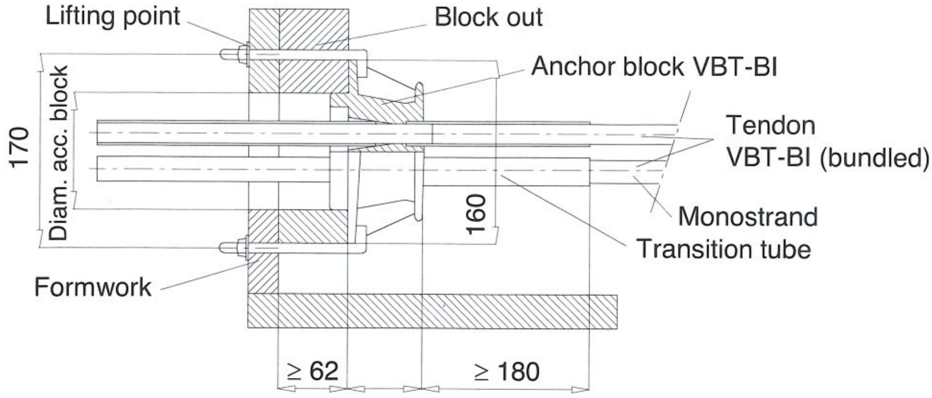
Monostrand



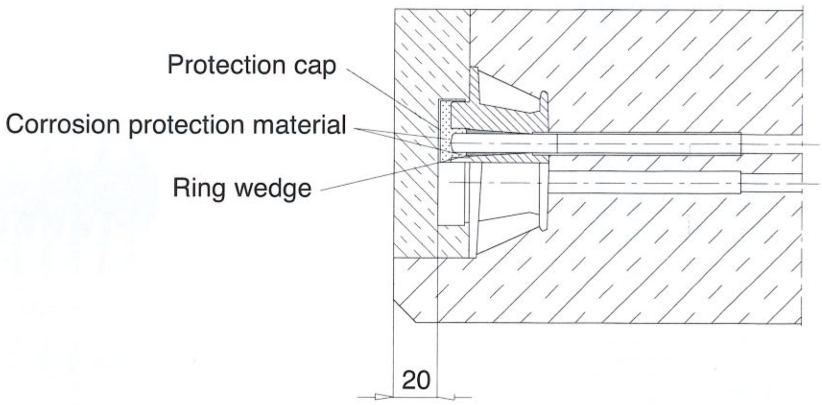
Dimensions in mm

Unbonded Post-Tensioning-System VBT-BI	VBTSystems GleitbauSalzburg	**Annex 5** of European Technical Assessment **ETA-10/0308** of 27.06.2018
Details		

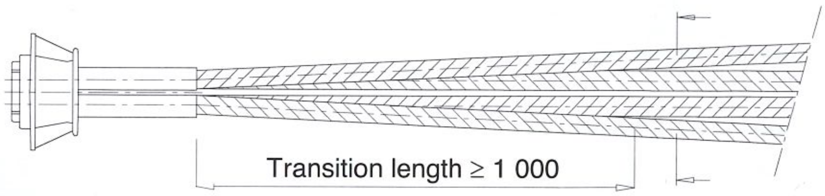
Stressing anchor – Installation stage



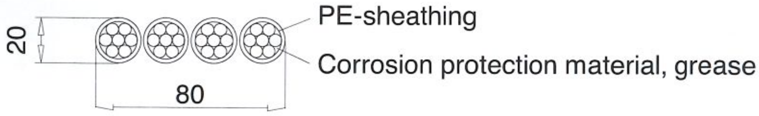
Stressing anchor – Final stage



Bundel – Transition tendon to anchorage



Coss section – Tendon VBT-BI 4



Dimensions in mm

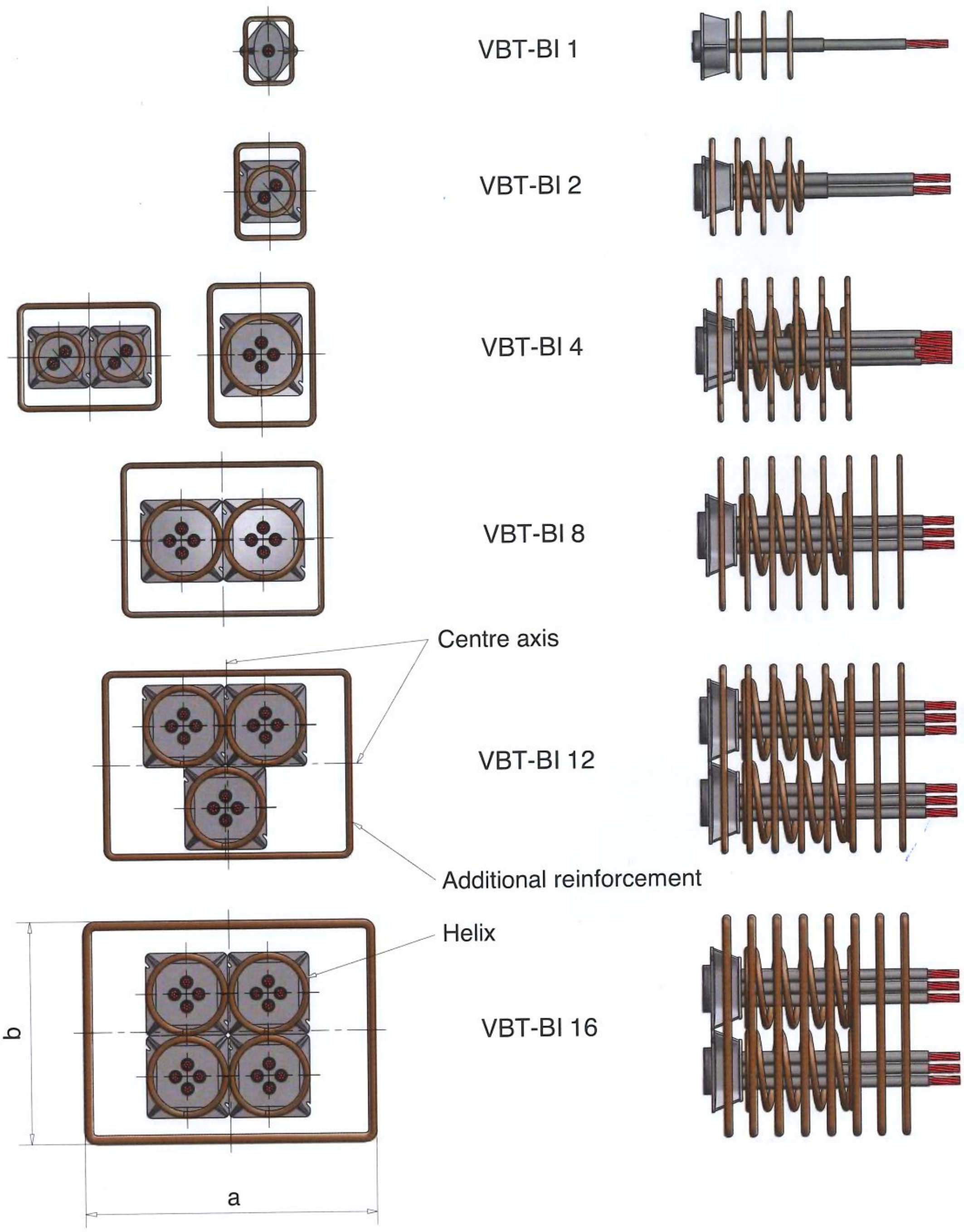
Unbonded
Post-Tensioning-System
VBT-BI

VBTSystems
GleitbauSalzburg

Installation details

Annex 6
of European Technical Assessment
ETA-10/0308 of 27.06.2018

Helixes and additional reinforcement



Unbonded Post-Tensioning-System VBT-BI	VBTSystems GleitbauSalzburg	**Annex 7** of European Technical Assessment **ETA-10/0308** of 27.06.2018
Helixes and additional reinforcement		

Dimensions and forces

System VBT-BI		—	1		2		4	
Number of strands	n	—	1		2		4	
Nominal mass per metre	A_p = 150 mm² per strand	kg/m	1.17		2.34		4.69	
Nominal cross-sectional area	A_p = 150 mm² per strand	mm²	150		300		600	
Tendon – Forces, A_p= 150 mm²								
Nominal tensile strength of strand Y1770S7 or Y1860S7		MPa	1 770	1 860	1 770	1 860	1 770	1 860
Characteristic value of maximum force	F_{pk}	kN	266	279	532	558	1 064	1 116
Maximum overstressing force	$0.95 \cdot F_{p0.1}$	kN	222	234	445	467	889	935
Maximum prestressing force	$0.9 \cdot F_{p0.1}$	kN	211	221	421	443	842	886
Anchorage – Anchor block								
Single, E, or bundle anchorage, M		—	E		E		E	M
Number of anchor blocks	NA	—	1		1		1	2
Width [1)]	B × B	mm	129 × 114		120		160	240 × 120
Height [1)]	D	mm	70		75		75	75
Coupler								
Width, "Part B" [1)]	BC × BC	mm	90 × 76		105		122	—
Number of bolts M22 × 140	NB	—	2 · (M18 × 130)		2		4	2 × 2
Band sizes								
Number of band layers	NL	—	1		1		1	1
External dimensions of band section	BB × BH	mm	20 × 20		40 × 20		80 × 20	
Minimum centre spacing and edge distance, $f_{cm, 0, cube, 150} \geq 25$ MPa [2)]								
Centre spacing [3)]	a_c / b_c	mm	145 / 110		200 / 150		290 / 220	
Edge distance [3), 4)]	a_e / b_e	mm	65 + c / 45 + c		90 + c / 65 + c		135 + c / 100 + c	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa, $f_{cm, 0, cube, 150} \geq 25$ MPa [2)]								
Number of helixes	NW	—	—		1		1	2
Diameter of reinforcing steel	ϕ_{min}	mm	—		10		12	10
Pitch	maximum	mm	—		40		50	40
Length	minimum	mm	—		120		200	120
External diameter	$\varnothing_{min}$	mm	—		100		160	100
Additional reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa, $f_{cm, 0, cube, 150} \geq 25$ MPa [2)]								
Number and diameter of reinforcing steel	ϕ_{min}	mm	3 × ∅ 8		4 × ∅ 10		6 × ∅ 10	
Distance	e	mm	50		50		50	
Dimensions a × b [5)]	minimum	mm	125 × 90		180 × 130		270 × 200	

1) See Annex 3 and Annex 4
2) Minimum concrete compressive strength at time of stressing in MPa
3) The minimum centre spacing, a_c, b_c, can be reduced by 15 % in one direction, when increased in the perpendicular direction by the same percentage. The edge distances, a_e, b_e, are calculated by $a_e = \frac{a_c}{2} - 10 + c$, $b_e = \frac{b_c}{2} - 10 + c$, see Clause 1.6. Further the dimensions of helix and additional reinforcement are considered.
4) c … Concrete cover – Concrete cover is according to the standards and regulations in force at the place of use.
5) See Annex 7

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Dimensions and forces

System VBT-BI		—	8		12		16	
Number of strands	n	—	8		12		16	
Nominal mass per metre	A_p = 150 mm² per strand	kg/m	9.38		14.06		18.75	
Nominal cross-sectional area	A_p = 150 mm² per strand	mm²	1 200		1 800		2 400	
Tendon – Forces, A_p= 150 mm²								
Nominal tensile strength of strand Y1770S7 or Y1860S7		MPa	1 770	1 860	1 770	1 860	1 770	1 860
Characteristic value of maximum force	F_{pk}	kN	2 128	2 232	3 192	3 348	4 256	4 464
Maximum overstressing force	$0.95 \cdot F_{p0.1k}$	kN	1 778	1 870	2 668	2 804	3 557	3 739
Maximum prestressing force	$0.9 \cdot F_{p0.1k}$	kN	1 685	1 771	2 527	2 657	3 370	3 542
Anchorage – Anchor block								
Single, E, or bundle anchorage, M		—	M		M		M	
Number of anchor blocks	NA	—	2		3		4	
Width [1]	B × B	mm	320 × 160		320 × 320		320 × 320	
Height [1]	D	mm	75		75		75	
Coupler								
Width, "Part B" [1]	BC × BC	mm	—		—		—	
Number of bolts M22 × 140	NB	—	2 × 4		3 × 4		4 × 4	
Band sizes								
Number of band layers	NL	—	2		3		4	
External dimensions of band section	BB × BH	Mm	90 × 37		90 × 55		90 × 72	
Minimum centre spacing and edge distance, $f_{cm, 0, cube, 150} \geq 25$ MPa [2]								
Centre spacing [3]	a_c / b_c	mm	405 / 310		495 / 375		575 / 435	
Edge distance [3), 4)]	a_e / b_e	mm	195 + c / 145 + c		240 + c / 180 + c		280 + c / 210 + c	
Helix, ribbed reinforcing steel, $R_e \geq 500$ MPa, $f_{cm, 0, cube, 150} \geq 25$ MPa [2]								
Number of helixes	NW	—	2		3		4	
Diameter of reinforcing steel	ϕ_{min}	mm	12		12		12	
Pitch	maximum	mm	50		50		50	
Length	minimum	mm	200		200		200	
External diameter	$\varnothing_{min}$	mm	160		160		160	
Additional reinforcement, ribbed reinforcing steel, $R_e \geq 500$ MPa, $f_{cm, 0, cube, 150} \geq 25$ MPa [2]								
Number and diameter of reinforcing steel	ϕ_{min}	mm	8 × ∅ 10		8 × ∅ 12		8 × ∅ 14	
Distance	e	mm	50		50		50	
Dimensions a × b [5]	minimum	mm	385 × 290		475 × 355		555 × 415	

1) See Annex 3 and Annex 4
2) Minimum concrete compressive strength at time of stressing in MPa
3) The minimum centre spacing, a_c, b_c, can be reduced by 15 % in one direction, when increased in the perpendicular direction by the same percentage. The edge distances, a_e, b_e, are calculated by $a_e = \frac{a_c}{2} - 10 + c$, $b_e = \frac{b_c}{2} - 10 + c$, see Clause 1.6. Further the dimensions of helix and additional reinforcement are considered.
4) c … Concrete cover – Concrete cover is according to the standards and regulations in force at the place of use.
5) See Annex 7

Material specifications

Component	Material [1]	Standard
Anchor block, Coupler	Cast Iron	EN 1563
Ring wedge	Steel	EN 10084
Coupler bolt	Steel	EN ISO 4762
Transition tubes	HDPE	EN ISO 17855-1
Protection cap	HDPE	EN ISO 17855-1
Helix and additional reinforcement	Ribbed reinforcing steel, $R_e \geq 500$ MPa	

[1] Detailed material specifications deposited at OIB

OIB Member of EOTA

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

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

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

2) For prestressing steel strands according to prEN 10138-3, 09.2000, the values are multiplied by 0.98.

3) Standard value

VBT-BI n 150 1770 and VBT-BI n 150 1860

Number of strands	Nominal cross-sectional area of prestressing steel	Nominal mass of prestressing steel	Nominal mass of tendon [1)]	Characteristic value of maximum force of tendon	
				f_{pk} = 1 770 MPa	f_{pk} = 1 860 MPa
n	A_p	M	M	F_{pk}	F_{pk}
—	mm^2	kg/m	kg/m	kN	kN
1	150	1.17	1.31	266	279
2	300	2.34	2.62	532	558
4	600	4.69	5.24	1 064	1 116
8	1 200	9.38	10.48	2 128	2 232
12	1 800	14.06	15.72	3 192	3 348
16	2 400	18.75	20.96	4 256	4 464

1) Varies with sheathing thickness.

Maximum prestressing and overstressing forces for tendons with nominal cross-sectional area of a single strand A_p = 150 mm²

Tendon Designation	Number of strands	Cross-sectional area	Y1770S7		Y1860S7	
			Maximum prestressing force [2]	Maximum overstressing force [2), 3)]	Maximum prestressing force [2]	Maximum overstressing force [2), 3)]
	n	A_p	$0.90 \cdot F_{p0.1}$	$0.95 \cdot F_{p0.1}$	$0.90 \cdot F_{p0.1}$	$0.95 \cdot F_{p0.1}$
	—	mm²	kN	kN	kN	kN
VBT-BI 1	1	150	211	222	221	234
VBT-BI 2	2	300	421	445	443	467
VBT-BI 4	4	600	842	889	886	935
VBT-BI 8	8	1 200	1 685	1 778	1 771	1 870
VBT-BI 12	12	1 800	2 527	2 668	2 657	2 804
VBT-BI 16	16	2 400	3 370	3 557	3 542	3 739

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

Where F_{pk} .... Characteristic value of maximum force of tendon

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

For prestressing steel strands according to prEN 10138-3, 09.2000, the values are multiplied by 0.98.

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

Contents of control plan

Subject / type of control		Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Anchor block, Coupler	Material	Checking 1)	2)	100 %	continuous
	Detailed dimensions	Testing	2)	5 %, ≥ 2 specimens	continuous
	Visual inspection 3)	Checking	2)	100 %	continuous
	Traceability	full			
Coupler bolts	Material	Checking 1)	2)	100 %	continuous
	Visual inspection 3)	Checking	2)	100 %	continuous
	Traceability	bulk			
Ring wedge	Material	Checking 1)	2)	100 %	continuous
	Treatment, hardness	Testing	2)	0.5 %, ≥ 2 specimens	continuous
	Detailed dimensions	Testing	2)	5 %, ≥ 2 specimens	continuous
	Visual inspection 3)	Checking	2)	100 %	continuous
	Traceability	full			
VBT-BI band, Individual monostrand	Material	Checking	2), 4)	100 %	continuous
	Diameter	Testing	2)	1 sample	each coil or every 7 tons 5)
	Visual inspection	Checking	2)	1 sample	

1) Checking by means of an inspection report 3.1 according to EN 10204.
2) Conformity with the specifications of the components
3) Successful visual inspection does not need to be documented.
4) Checking of relevant certificate, as long as the basis of "CE"-marking is not available.
5) Maximum between a coil and 7 tons is taken into account

Traceability	full	Full traceability of each component to its raw material.
	bulk	Traceability of each delivery of components to a defined point
Material		Defined according to technical specification deposited by the supplier
Detailed dimension		Measuring of all the dimensions and angles according to the specification given in the test plan
Visual inspection		Main dimensions, correct marking and labelling, surface, corrosion, coating, etc.

Treatment, hardnessSurface hardness, core hardness, and treatment depth

Audit testing

Subject / type of control		Test or control method	Criteria, if any	Minimum number of samples [1)]	Minimum frequency of control
Anchor block, Coupler	Material	Checking and testing, hardness and chemical [2)]	[3)]	1	1/year
	Detailed dimensions	Testing	[3)]	1	1/year
	Visual inspection	Checking	[3)]	1	1/year
Coupler bolts	Material	Checking [4)]	[3)]	2	1/year
	Visual inspection	Checking	[3)]	5	1/year
Ring wedge	Material	Checking and testing, hardness and chemical [2)]	[3)]	2	1/year
	Treatment, hardness	Checking and testing, hardness profile	[3)]	2	1/year
	Detailed dimensions	Testing	[3)]	1	1/year
	Main dimensions, surface hardness	Testing	[3)]	5	1/year
	Visual inspection	Checking	[3)]	5	1/year
Single tensile element test		According to EAD 160004-00-0301, Annex C.7		9	1/year

[1)] If the kits comprise different kinds of anchor heads e.g. with different materials, different shape, different wedges, etc., then the number of samples are understood as per kind.

[2)] Testing of hardness and checking of chemical composition by means of an inspection report 3.1 according to EN 10204.

[3)] Conformity with the specifications of the components

[4)] Checking by means of an inspection report 3.1 according to EN 10204.

Material	Defined according to technical specification deposited by the ETA holder at the Notified body
Detailed dimension	Measuring of all the dimensions and angles according to the specification given in the test plan
Visual inspection	Main dimensions, correct marking and labelling, surface, corrosion, coating, etc.
Treatment, hardness	Surface hardness, core hardness, and treatment depth

Installation method of single strand tendon
VBT-BI Fixed anchor – Stressing anchor

• Cutting to length of the tendons	Shop assembly Site assembly
• Removal of PE sheathing in the region of the fixed anchor on a length of about 100 mm	Shop assembly Site assembly
• Slide on the anchor block with pre-assembled transition tubes onto the strands	Shop assembly Site assembly
• Pre-wedging of the fixed anchor. • Filling of the anchor block around the ring wedges with corrosion protection filling material	Shop assembly Site assembly
• Installation of the protection caps onto the anchor block filled with corrosion protection filling material	Shop assembly Site assembly
• Coiling up and transport of the pre-fabricated tendon to the construction site	Transport (Shop assembly only)
• Installation of the anchor block of the stressing anchor with pre-assembled transition tubes into the formwork	Site assembly
• Placing and installation of the tendon into the formwork	Site assembly
• Removal of the PE sheathing in the region of the stressing anchor along a length of about 100 mm + strand excess length	Site assembly
• Mounting the strands into the stressing anchor installed in the formwork	Site assembly
• Protecting the strand excess length with PE sheathings	Site assembly
• Placing of concrete	Concreting
• Striking the formwork around the stressing anchor	Site assembly
• Removal of the PE sheathings from the strand excess length	Site assembly
• Stressing of tendon	Site assembly
• Cutting to length of the strand excess length, filling of the anchor block around the ring wedges with corrosion protection filling material	Site assembly
• Installation of the protection caps onto the anchor block filled with corrosion protection filling material	Site assembly
• Covering of the recess area with cement mortar or concreting of an adequate face concrete	Site assembly

Installation method of single strand tendon VBT-BI with coupler

• Cutting to length of the tendons	Shop assembly Site assembly
• Removal of PE sheathing in the region of the fixed anchor on a length of about 100 mm	Shop assembly Site assembly
• Slide on the anchor block with pre-assembled transition tubes onto the strands	Shop assembly Site assembly
• Pre-wedging of the fixed anchor • Filling of the anchor block around the ring wedges with corrosion protection filling material	Shop assembly Site assembly
• Installation of the protection caps onto the anchor block filled with corrosion protection filling material	Shop assembly Site assembly
• Coiling up and transport of the pre-fabricated tendon to the construction site	Transport (Shop assembly only)
• Installation of the coupler part A with pre-assembled transition tubes into the formwork (stressing anchor side)	Site assembly
• Placing and installation of the tendon into the formwork	Site assembly
• Removal of the PE sheathing in the region of the coupler part A along a length of about 100 mm + strand excess length	Site assembly
• Mounting the strands into coupler part A with pre-assembled transition tubes	Site assembly
• Protecting the strand excess length with PE sheathings	Site assembly
• Placing of concrete	Concreting
• Striking the formwork around the coupler	Site assembly
• Removal of the PE sheathings from the strand excess length	Site assembly
• Stressing of tendon (1st construction stage)	Site assembly
• Cutting to length of the strand excess length	Site assembly
• Placing of the pre-fabricated tendon and the pre-wedged coupler part B	Site assembly
• Jointing of both parts of the coupler, part A and B, with coupler bolts	Site assembly

• Filling the gap between both parts of the coupler with corrosion protection filling material	Site assembly
• Installation of the anchor block with pre-assembled transition tubes onto the formwork (stressing anchor side)	Site assembly
• Removal of PE sheathing on a length of about 100 mm + strand excess length	Site assembly
• Slide on the anchor block with pre-assembled transition tubes onto the strands	Site assembly
• Protecting the strand excess length with PE sheathings	Site assembly
• Placing of concrete	Concreting
• Striking of the formwork around the stressing anchor	Site assembly
• Removal of the PE sheathings from the strand excess length	Site assembly
• Stressing of tendon (2nd construction stage)	Site assembly
• Cutting to length of the strand excess length, filling of the anchor block around the ring wedges with corrosion protection filling material	Site assembly
• Installation of the protection caps onto the anchor block filled with corrosion protection filling material	Site assembly
• Covering of the recess area with cement mortar or concreting of an adequate face concrete	Site assembly

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References

European Assessment Document

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

Eurocodes

Eurocode 2	Eurocode 2 – Design of concrete structures
Eurocode 3	Eurocode 3 – Design of steel structures
Eurocode 4	Eurocode 4 – Design of composite steel and concrete structures
Eurocode 5	Eurocode 5 – Design of timber structures
Eurocode 6	Eurocode 6 – Design of masonry structures

Standards

EN 206+A1, 11.2016	Concrete – Specification, performance, production and conformity
EN 1563 (12.2011)	Founding – Spheroidal graphite cast irons
EN 10084 (04.2008)	Case hardening steels – Technical delivery conditions
EN 10204 (10.2004)	Metallic products – Types of inspection documents
EN ISO 4762 (03.2004)	Hexagon socket head cap screws
EN ISO 17855-1 (10.2014)	Plastics – Polyethylene (PE) moulding and extrusion materials – Part 1: Designation system and basis for specifications
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prEN 10138-3 (09.2000)	Prestressing steels – Part 3: Strand
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

References

Other documents

98/456/EC	Commission decision 98/456/EC of 3 July 1998 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards posttensioning kits for the prestressing of structures, Official Journal of the European Communities L 201 of 17 July 1998, p. 112
305/2011	Regulation (EU) № 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, OJ L 88 of 4 April 2011, p. 5, amended by Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, OJ L 157 of 27.05.2014, p. 76 and Commission Delegated Regulation (EU) № 574/2014 of 21 February 2014, OJ L 159 of 28.05.2014, p. 41
568/2014	Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) № 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products, OJ L 157 of 27.05.2014, p. 76