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APPROVAL

ANP - strand anchor

BMVIT-327.120/0018-IV/ST2/2014

ANP - Systems GmbH

Anchor | Nail | Pile | Tensioning systems | Formwork ties | Reinforcement systems | Stressing equipment

International reference projects and further information: **www.anp-systems.at**

BMVIT-327.120/0018-IV/ST2/2014

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Data sheet/specification sheet for approval

Object of approval:	**ANP strand anchor with 2 to 15 steel strands Y 1770 and Y 1860 S7 (140 and 150 mm²) as anchor for temporary use, as temporary anchor for extended short-term use, as controllable permanent anchor as well as anchor with staggered bond length optionally**
Approval holder:	ANP – SYSTEMS GmbH Christophorusstraße 12 5061 Elsbethen / Austria
Owner of ETA Post-tensioning system:	DEAL S.r.l. Via Buttrio, Fraz. Cargnacco 33050 Pozzuolo del Friuli Udine – Italy
Manufacturer of Post-tensioning system:	TENSACCIAI S.r.l. Via pordenone 8 20132 Milan Italy
Manufacturer of anchor - specific components - and corrosion protection:	ANP - SYSTEMS GmbH Christophorusstraße 12 5061 Elsbethen / Austria
External quality control	The Institute for Testing and Research (LTD) of the University of Technology in Vienna (TVFA-TU Wien)
Area of application:	Republic of Austria - Road Administration
Reference standard:	ÖNORM EN 1537: 2013 Execution of special geotechnical works - ground anchors ÖNORM B 1997-1-1: 2013 Eurocode 7: Geotechnical design-Part 1: General rules - National specifications concerning OENORM EN 1997-1 and national supplements ETA – 08/0012 Setra Validity: 07.06.2013 to 07.06.2018 TENSACCIAI (bonded and unbonded) strand post tensioning system Certificate of conformity number 161683-CPD-0006 ASQPE, date: 26 June 2013

The approval comprises 12 pages and 18 annexes.

I General regulations

1. The proof of the usability of the object of approval is established by the BMVIT (Federal Ministry of Transport, Innovation and Technology). The approval is granted on the basis of non-harmonized technical specifications and without prejudice to third-party rights.
2. The approval holder is responsible for the building product's conformity with the approval and guarantees all the assured properties.
3. The approval refers only to the building product of the named approval holder and manufacturer.
4. The BMVIT is authorized to check at the approval holder´s expense whether the regulations of this approval and the data sheet are complied with.
5. The approval is not granted irrevocably. It may be amended due to new technical findings and standards.
6. The approval and data sheet may only be copied in its entirety. Texts and drawings in advertising brochures must not contradict the approval certificate.

II Special regulations

Contents

1. General regulations

The planning, dimensioning, installation, testing and control of grouted anchors must be carried out by companies and skilled staff with adequate expert knowledge and experience without exception.

The responsibilities for the planning, dimensioning, execution, testing and control must be agreed by contract for the implementation of a building project. Appropriate records and minutes shall be kept about the anchor system, the anchor production and the installation.

The manufacturer of the anchor components and the corrosion protection is responsible for the products' conformity with the approval.

2. References

ÖNORM EN 1537: 2013	Execution of special geotechnical works – Ground anchors
ÖNORM EN ISO 22477-5: 2010	Geotechnical investigation and testing - Testing of geotechnical structures - Part 5: Testing of anchorages
ÖNORM EN 1990: 2013	Eurocode-Basis of structural design
ÖNORM EN 1997-1: 2009	Eurocode 7 – Geotechnical design-Part 1: General rules
ÖNORM B 1997-1-1: 2013	Eurocode 7 – Geotechnical desin-Part 1: General rules - National specifications concerning ÖNORM EN 1997-1 and national supplements
ÖNORM EN 1992-1-1:2011	Eurocode2 – design of concrete structures-Part 1-1: General rules and rules for building
ÖNORM B4707: 2010	Steel for the reinforcement of concrete - Requirements, classification and conformity assessment
ÖNORM B4758: 2011	Prestressing steel - Requirements, classification and conformity assessment
ETAG 013: 2002	Guideline for European technical approval of Post-tensioning kits for prestressing of structures
ÖNORM EN 445: 2008	Grout for prestressing tendons - Test methods
ÖNORM EN 446: 2008	Grout for prestressing tendons - Grouting procedures
ÖNORM EN 447: 2008	Grout for prestressing tendons - Basic requirements
ÖNORM EN 206-1: 2005	Concrete - Part 1: Specification performance, production and conformity (consolidated version)
ÖNORM EN ISO 9001: 2009	Quality management systems - Requirements
RVS 08.22.01: 2013	Grouted anchor, grouted anchors under tensile stress and nails

3. Description of the prestressed ground anchor

The ANP strand anchor is built out of 2 - 15 seven-wire prestressing steel strands:

- **Y 1770 S7** – cross section 140 mm² and 150 mm²(Ø 15,3 und 15,7mm)
- **Y 1860 S7** – cross section 140 mm² and 150 mm²(Ø 15,3 und 15,7mm)

The Usability of the prestressing steel strand has to be proved with a BMVIT approval.

Anchors are produced according the requirements of ÖNORM EN 1537:

- Temporary anchor with individual sheathing of strands in the unbonded length and PE - transition tubes in the area of the anchor head.
- Temporary anchors for extended short-term use or for aggressive soil conditions and higher demands on corrosion protection with single strands in the unbonded length and PE - transition tubes in the area of the anchor head.
- Controllable permanent anchor with single strands in the unbonded length and a PE -corrugated sheathing over the complete anchor length and sealing against the steel pipe that is welded on the base plate.

Following wedge plates of the TENSACCIAI - Systems MT (System MTAI) together with three-piece wedges are used for the anchor head according to ETA-08/0012:

Anchorage	Number of strands
MT 4	2 - 4
MT 7	5 - 7
MT 9	8, 9
MT 12	10 - 12
MT 15	13 - 15

According to ÖNORM EN 1992-1-1 the anchorage of the prestressed anchor must have a technical approval for tensioning systems according to ETAG 013.

The reference system at hand is a tensioning system with subsequent bond and it uses a cast-load transmission unit that is set in concrete. The static load test according to ETAG 013 considered the requirements on an external tendon.

To use the tensioning system as anchor with a anchor plate that is put on the concrete body, the anchor plate, concrete anchor body and the tensile stress reinforcement are dimensioned for the anchorage line and the preset cut-out pipes. For the use as anchor stirrups are used as additional reinforcement. The values were verified and optimized by means of a load transmission test with a medium-sized anchorage according to ETAG 013 (Post-tensioning kits for prestressing of structures).

The anchor head consists of a wedge plate which is put on in the middle of a square or round anchor plate. The wedge plate and the anchor plate are designed for the maximum load capacity

of a prestressing steel strand Y 1860 S7 – cross section 150 mm² and a concrete quality C 25/30 of the support. For the strand cross sections 140 mm² and 150 mm² the same anchor wedges are used.

For the special use in geotechnics there are wedge plates with a trapezoidal external thread and the system marking MTR for the controllable permanent anchor. These wedge plates are bigger than those of the MT system (referring to diameter and height) to comply with ETAG 013. The spigot is the same for both systems.

Anchorage	Number of strands
MTR 4	2 - 4
MTR 7	5 - 7
MTR 9	8, 9
MTR 12	10 - 12
MTR 15	13 - 15

The wedge plate can be lifted if a special lift-off device is used.

The strands of temporary anchor are cased individually in the unbonded length and blank in the bond length. Other anchor types use strands with a PE - sheathing and a complete filling with corrosion protection compound, the cavity is filled completely (monostrands).

The minimum thickness of the PE sheathing is set at ≥ 1,0 mm. The requirements for individual strands that are stated in ETAG 013 and ÖNORM EN 1537 are the basis. The PE - sheathing serves as mechanical protection of the strands during manipulation, installation and anchor tensioning.

The friction between PE - sheathing and the strand is ≤ 60 N/m. The requirements for individual strands that are stated in ETAG 013 are the basis. These requirements are fulfilled when the quantity of corrosion protection compound is ≥ 40 g/m.

The monostrands are produced in the factory in Elsbethen according to the ANP corrosion protection procedure. The corrosion protection compounds that are used comply with the requirements of ÖNORM EN 1537. Annexe 14 includes the specifications of the utilized corrosion protection compounds. Optionally the use of customary individual strands is possible if the conformity of the corrosion protection system is certified with ETAG 013.

Temporary anchor: The tensioning end of unbonded length of the individual sheathing of the prestressing steel strands / monostrands is sealed with PE transition tubes that are screwed into the wedge plate.

Permanent anchor: A steel pipe is welded closely on the permanent anchor plate. Using a sealing ring the steel pipe and the corrugated PE - sheathing of the free length that covers the individual strand are sealed.

In both cases the transition between anchor head and free steel length is executed according to ÖNORM EN 1537.

The permanent anchor is cased in a corrugated PE - sheathing on its entire length. The thickness of the corrugated PE - sheathing is dependent on its diameter and specified in ÖNORM EN 1537.

The strand anchor is inserted into a predrilled borehole. The bond length is centered in the borehole with spacers, grouting mortar is used to connect it with the ground. The unbonded length of a permanent anchor is filled with cement mortar inside and outside of the corrugated PE - sheathing.

The anchor with staggered bond length is used in soft soils and grounds with different layers. The anchorage lengths of the monostrands are staggered along the complete bond length. The load transmission is not limited to one point but is distributed with several individual anchors over the anchorage length. So the existing shear stress in the ground can be utilized more efficiently.

The ANP strand anchor's corrosion protection systems are designed according to ÖNORM EN 1537 and intended for the following fields of application:

- **Short-term** / **temporary anchor** with service life up to 2 years
- **Short-term** / **temporary anchor for extended use** and a planned service life of more than 2 years and up to 7 years
- **Permanent anchor** for a service life of more than 2 years and up to a planned service life of 100 years

Following annexes include detailed information about the anchor system:

Annex 1:	System drawing strand anchor for temporary use and for extended short-term use, anchor head design and details about corrosion protection
Annex 2:	System drawing strand anchor for permanent use, anchor head design and details about corrosion protection
Annex 3:	System drawing strand anchor with staggered bond length and details about corrosion protection
Annex 4:	Anchor head, center distance and edge distance
Annex 5 and 6:	Rated value for material resistance of anchor in damage categories according to ÖNORM B 1997-1-1
Annex 7 and 8:	Permitted test load of anchor according to ÖNORM B 1997-1-1
Annex 9 to 14:	Components of anchor head and corrosion protection system with dimensions and material information
Annex 15 to 18:	Production of strand anchors, composition of factory-provided corrosion protection, transport and storage and installation and tensioning of strand anchors

4. Application range

Strand anchors are ground support elements that transfer an applied force on a bearing layer in the ground in accordance with the principles for the execution of geotechnical works. Ground can be soil as well as rock.

The new anchor standard ÖNORM EN 1537 is an application standard and includes details about the execution of anchor works, geotechnical testings, building materials, building products, design, testing and control of anchors. In annexe B of ÖNORM EN 1537 informative details about material properties of corrosion protection compounds are provided, annexe C informs about anchor design and corrosion protection for temporary and permanent anchors.

The principles for the dimensioning concept of structures referring to the ultimate limit state of external load capacity are specified in ÖNORM EN 1990 (Basis of structural design). The soil conditions have to be determined according to ÖNORM EN 1997-1.

The anchor's dimensioning values for the ultimate limit state of the internal load capacity are defined in ÖNORM B 1997-1-1 and their load capacity is specified depending on damage categories. ÖNORM B 1997-1-1 determines national parameters for ÖNORM EN 1997-1, both standards have to be applied together.

5. Building materials and building products

5.1 Tendon

5.1.1 Features and classification of the steel tendon

As tendon 2 - 15 of the following types of 7-wire prestressing steel strands according to ÖNORM B4758 are used:

- **Y 1770 S7** – cross section 140 mm² and 150 mm²(Ø 15,3 and 15,7mm)
- **Y 1860 S7** – cross section140 mm² and 150 mm²(Ø 15,3 and 15,7mm)

The Usability of the prestressing steel strand has to be proved with a BMVIT approval. ***Annexes 1 to 4*** include system drawings that show the elements of the ANP strand anchor.

5.1.2 Load capacity requirements for the anchor

The strand anchor's tensile capacity shows an efficiency of 95% in relation to the characteristic tensile strength of the steel tension according to ETAG 013.

The strand anchor's fatigue limit, proven under the terms of ETAG 013, is 80 N/mm².

In ***annexes 5 and 6*** the rated values of the tendon's material resistance Rt,d for the anchor's internal load capacity with reference to damage categories CC 1, CC 2 and CC 3 are compiled in compliance with ÖNORM B 1997-1-1. The relatively low factor for the anchor's rated value is derived from the 100% test frequency within the scope of the acceptance test.

For the rated values of the anchor a wedge slip between 3,5 and 4,5mm can be specified.

Annexes 7 and 8 include the maximum permitted test loads of the anchor system in the terms of ÖNORM B 1997-1-1. The required test loads against a pulling out of the anchor have to be determined in reference to the external load capacity with a safety factor according to ÖNORM B 1997-1-1 for all dimensioning situations. The maximum test loads must not be exceeded.

5.2 Anchor head

5.2.1 Anchor head design

The anchor head is composed out of elements of the TENSACCIAI Post - tensioning systems in accordance with ETA 08/0012. The wedge plate and the wedges are ETA components. The square or round anchor plate has been dimensioned in accordance with load capacity of the system.

The anchor head is designed in accordance with ÖNORM EN 1537.

Temporary anchor: Prestressing steel strands with individual plastic tube, individual strands respectively are connected with PE - transition tubes to the anchor plate.

The force can be regulated by re - tensioning or releasing via the strand excess length or lift-off device at wedge plates with external thread (MTR system) using 2-piece washers between wedge plate and anchor plate. An application is provided with permanent anchors mainly.

Permanent anchor: A cylindrical steel pipe is closely welded on the anchor plate. A sealing ring is used to seal the corrugated sheathing that covers the monostrands in the unbonded steel length against the steel pipe.

The anchor plate has to be placed perpendicular to the anchor axis. Any angular misalignment has to be compensated with an angle construction.

Annexes 9 to 14 include details about anchor head components and the corrosion protection system as well as dimensions and building material.

5.2.2 Load transfer to structure

Load transfer from anchor head to bearing structure happens via a concrete body with joint fissure additional reinforcement (stirrups). The requirements for a system's maximum load capacity with prestressing steel strands Y 1860 S7 - cross section 150 mm² according to ETAG 013 are relevant for the dimensioning. With following parameters an efficiency of 110% is observed with respect to the characteristic breaking force of the steel tendon:

- Concrete compressive strength at time of stressing $f_{cm,0,\ cube\ 150} \geq 30$ N/mm²
- Minimum concrete class ≥ C 25/30 according to ÖNORM EN 206-1
- additional reinforcement (stirrups) with reinforcing steel B550B based on ÖNORM B4707
- Center distance and edge distance with additional reinforcement (stirrups) according to ***annex 4***.

If no additional reinforcement (stirrups) is used then the center distances and edge distances have to be increased by approximately factor 1,4 to 1,5 and the concrete class has to be upgraded to ≥ C 30/37. So a calculated efficiency of 130% is maintained according to ETAG requirements for a non-reinforced system. ***Annex 4*** defines center distances and edge distances with or without the use of additional reinforcement. A constructional reinforcement with 50kg/ m³ concrete is necessarily provided for.

5.3 Grouting mortar

All installed strand tendons with and without corrosion protection cover in the anchorage length have a minimum external cement mortar cover of 10mm towards the borehole wall. Spacers are used for centering. The cement mortar to form the grout body has to fulfil the requirements of ÖNORM EN 1537.

When choosing the cement for the grout body exposed to soil the impact of soil conditions, according to the ÖNORM EN 206-1 exposure classes, have to be taken into consideration.

The permanent anchor is built with a corrugated - sheathing over its entire length. The bonded length has an internal cement mortar cover between corrugated - sheathing and strand of minimum 5mm. The bundled strand tendon is centered with spacers. The cement mortar used, has to meet the standards of ÖNORM EN 445, ÖNORM EN 446 and ÖNORM EN 447.

5.4 Corrosion protection

ÖNORM EN 1537 gives examples for the execution of corrosion protection systems with temporary and permanent anchors. Furthermore the terms for a temporary anchor for extended short-term use or aggressive soil conditions are specified.

The anchor systems at hand conform to the specified standards. The application of the corrosion protection system, except for the production of the grout body, is carried out in the factory.

The assembling of the corrosion protection is explained subsequently. The components of the anchor head and the corrosion protection with dimensions and material details are compiled in ***annexes 9 to 14***.

5.4.1 Anchor for temporary use

Annex 1 includes a schematic drawing of the temporary anchor with details about corrosion protection. The corrosion protection is guaranteed in the different sectors of the anchor as follows:

Bond length: Cement mortar cover of strand bundle ≥ 10 mm towards the borehole wall. The strands are distanced with internal spacers, are bundled and centered in the borehole with external spacers.

Unbonded length: Individual casing of strands with a smooth PE - tube ≥ 1,0 mm and final sealing with tape or heat shrink sleeve against water ingress.

Anchor head: PE - transition tubes are screwed into the holes of the wedge plate, they overlap the strand's PE casing. The corrosion protection of the anchor head is executed according to ÖNORM EN 1537.

5.4.2 Temporary anchor with extended short-term use

Annex 1 includes a schematic drawing of the temporary anchor for extended short-term use and detailed information about corrosion protection. The corrosion protection is guaranteed in the different sectors of the anchor as follows:

Bond length: Cement mortar coverage of strand bundle ≥ 10 mm towards borehole wall. The strands are distanced with internal spacers, are bundled and centered in the borehole with external spacers.

Unbonded length: Monostrands with smooth PE-tube ≥ 1,0 mm, filled with corrosion protection compound and final sealing with tape or heat shrink sleeve against water ingress.

Anchor head: PE - transition tubes are screwed into the holes of the wedge plate, they overlap the strand's PE casing. The PE - transitions tubes are filled with corrosion protection compound. The corrosion protection of the anchor head is executed according to ÖNORM EN 1537.

5.4.3 Permanent anchor

Annex 2 includes a schematic drawing of the permanent anchor with details for corrosion protection. The corrosion protection is guaranteed in the different sectors of the anchor as follows:

Bond length: Corrugated PE - sheething ≥ 1,0 mm, respectively ≥ 1,0 mm depending on internal diameter. Internal cement mortar cover ≥ 5 mm towards strand bundle with distance elements. External cement mortar cover ≥ 10 mm towards borehole wall with spacers. The earth side anchor end is closed with an end cap.

Unbonded length: Monostrands with corrugated sheathing ≥ 1,0 mm, filled with corrosion protection compound and final sealing of transition to bond length with tape or heat shrink sleeve. The corrugated PE - sheething of the bond length is continued with internal cement mortar layer.

Anchor head: A steel pipe is welded on the wedge plate and the transition to the corrugated sheathing is sealed with a sealing ring. After tensioning the pipe is filled with corrosion protection compound (by adjustable anchors) or cement mortar (by controllable anchors). A steel ring is put on the corrugated sheathing in that area to absorb transverse tension.

The anchor plate with the welded on steel pipe is coated with corrosion protection system appropriate for structural steel works or hot-dip galvanized.

After the tensioning of the strand anchor a coated or hot-dip galvanized cast steel / steel cap or plastic cap is put closely on the anchor plate and filled with corrosion protection compound. When controllable anchors are used, the wedge plate, strand excess length and wedges have to be thickly coated with corrosion protection compound and wrapped with multiple layers of corrosion protection tape.

Neither a cover cap nor corrosion protection coating is needed when the head is set in concrete. Care must be taken that the wedges are not blocked.

5.4.4 Anchor with staggered bond length

Annex 3 includes a schematic drawing of a permanent anchor with staggered bond length length. Temporary anchors can be executed as staggered anchors as well.

The PE - sheathing of the Monostrands as described above, is continued partly into the staggered bond length of Monostrands or strand bundles are established.

6. Anchor production and installation

For the installation of the ANP strand anchor the guidelines of RVS 08.22.01 must be observed. RVS 08.22.01 points out that it is a prerequisite for the execution of anchorages to proof the anchorage system's aptitude in time. The executions of works, record keeping and testings have to be done according the respective embodiments and test standards.

With reference to ÖNORM EN 1997-1-1 the anchor system's aptitude is proven for federal roads by a BMVIT approval.

Annexes 15 to 18 include instructions for the factory-made corrosion protection of the strand anchor, the handling, installation and tensioning.

It has to be noted that after the installation of the strand anchor and a sufficient hardening of the grouting mortar a prestressing force of at least 35% of the strand breaking force has to be applied. So a strong wedge bite between wedge and strand shall be achieved to avoid strand slipping.

The assembly and installation of the ANP strand anchor has to comply with the manufacturer's installation guide and must be executed by skilled staff and technical supervision only.

According to ÖNORM B1997-1-1 the maintenance of grouted anchors includes:

- Visual inspection of all anchor heads every 2 to 3 years
- Annual reading of designated anchor head measuring devices
- Lift-off test every 5 to 10 years

7. Testings

7.1 Material testings and conformity

7.1.1 Anchor components

The production control of the „TENSACCIAI – strand tensioning procedure" happens with a defined inspection according to ETAG 013, the approval holder of ETA 08/0012 is responsible. The product has an accredited certification body's certificate of conformity.

The wedge plates of the system MTR are tested by TENSACCIAI with the same test plan like those of type MT. The test plan is specified in ETA – 08/0012.

A documentation of executed tests and control of the utilized anchor components has to be left at the manufacturer of the anchor.

7.1.2 Specific anchor components and corrosion protection

The manufacturer of the ANP strand anchor has to carry out an own company production control according to ÖNORM EN ISO 9001. This control refers to those components that are not covered in ETA - 08/0012 and the production of the corrosion production system.

The inspection which is based on a supervision contract has to be carried out by an accredited inspection and supervision authority. In this supervision contract also the scope of the company's production is defined.

A surveillance contract has to be closed between the approval holder and an external control body. The inspection has to be carried out at least once a year and comprises a check of the company's own production control and a sampling test. The results have to be documented in a report.

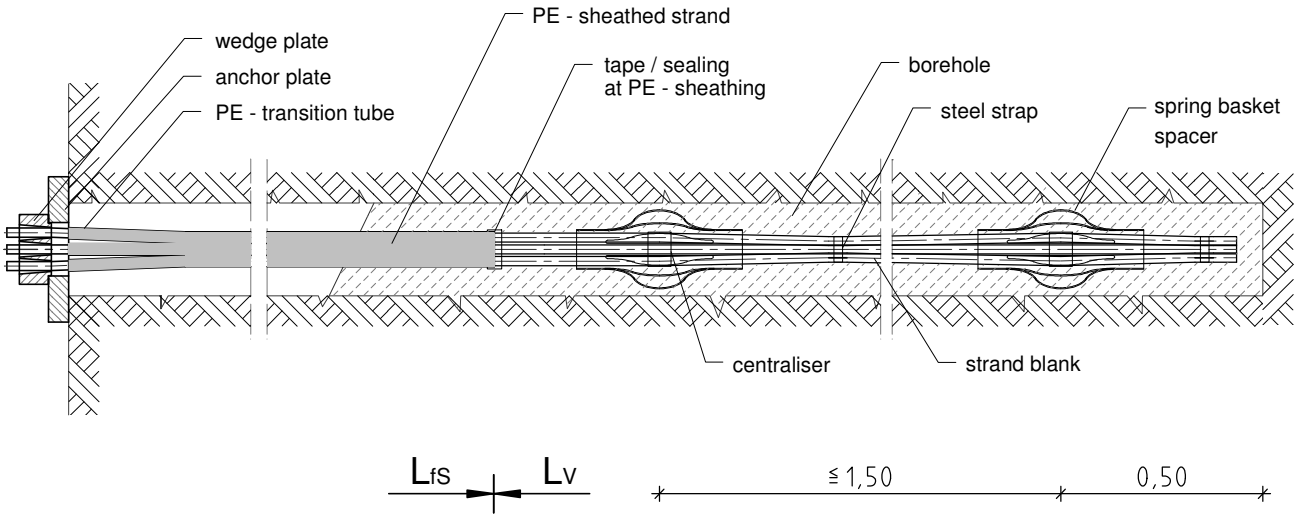
7.2 Anchor testings

At the building site static load tests have to be carried out and documented according to ÖNORM B 1997-1-1. The aptitude tests have to be carried out on at least 3 building anchors to confirm the design assumption and as confirmation of each dimensioning case.

The tests have to be executed according to ÖNORM EN ISO 22477-5 (draft). The applicable test procedures are specified in ÖNORM EN ISO 22477-5.

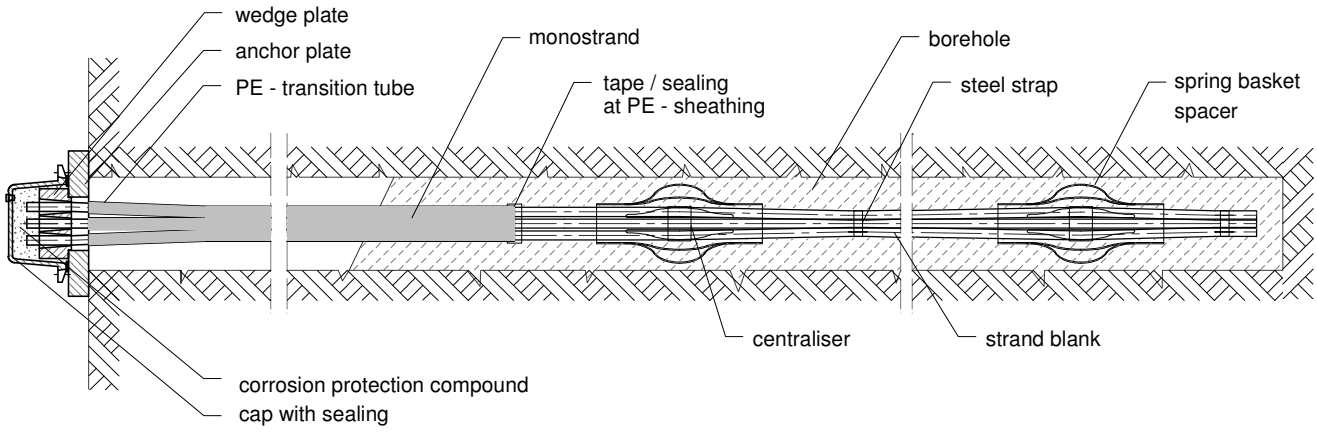
ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Temporary strand anchor and temporary strand anchor for extended use	Annex 1

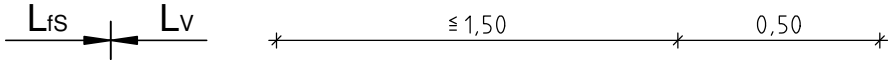
Temporary strand anchor



L_{fs} ... unbonded length
L_v ... bond length

Temporary strand anchor for extended use

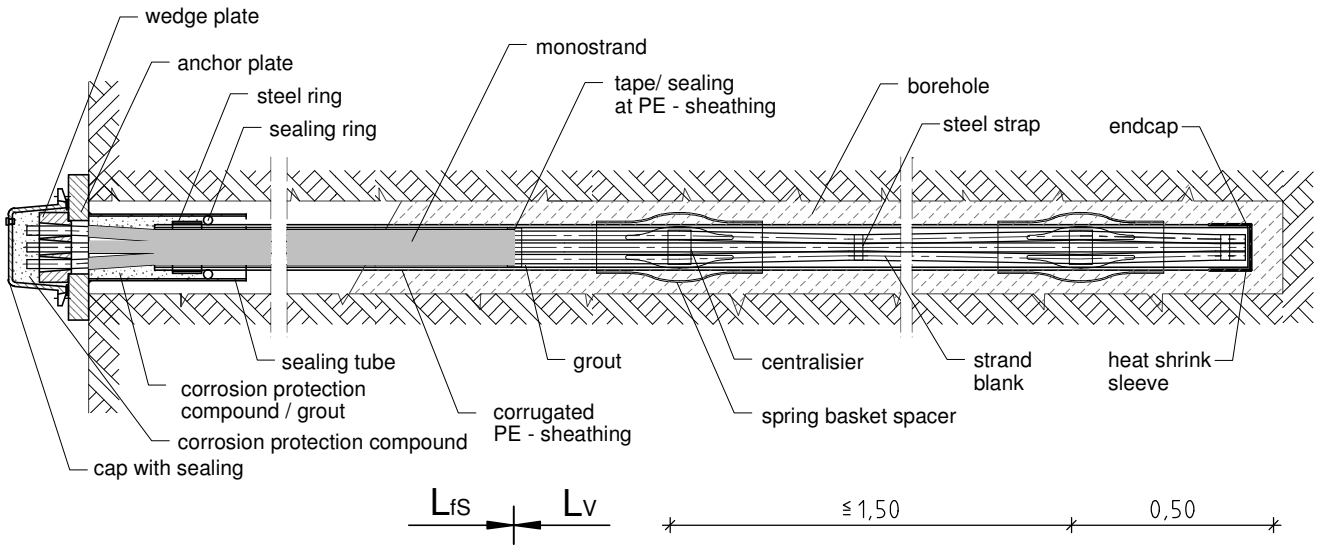




L_{fs} ... unbonded length
L_v ... bond length

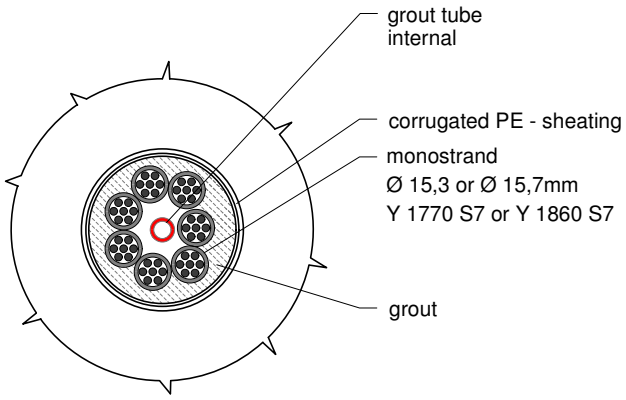
ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Permanent strand anchor	Annex 2

Permanent strand anchor

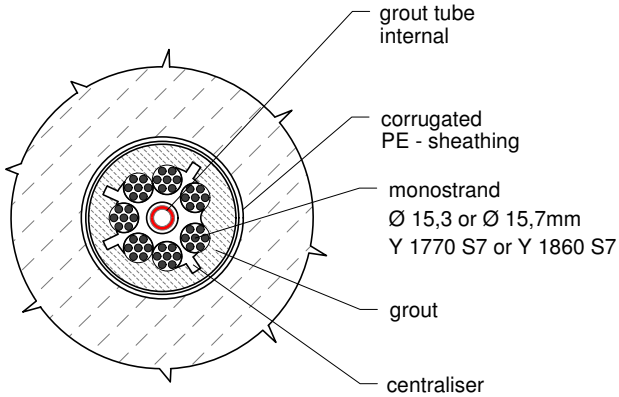


L_{fS} ... unbonded length
L_V ... bond length

section L_{fS}



section L_V

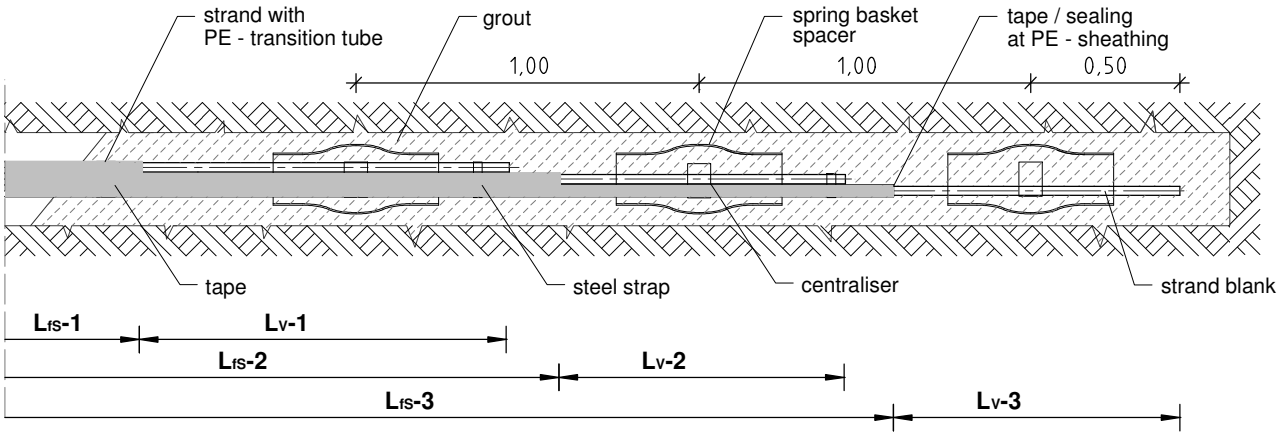


L_{fS} ... unbonded length
L_V ... bond length

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Anchor with staggered bond length	Annex 3

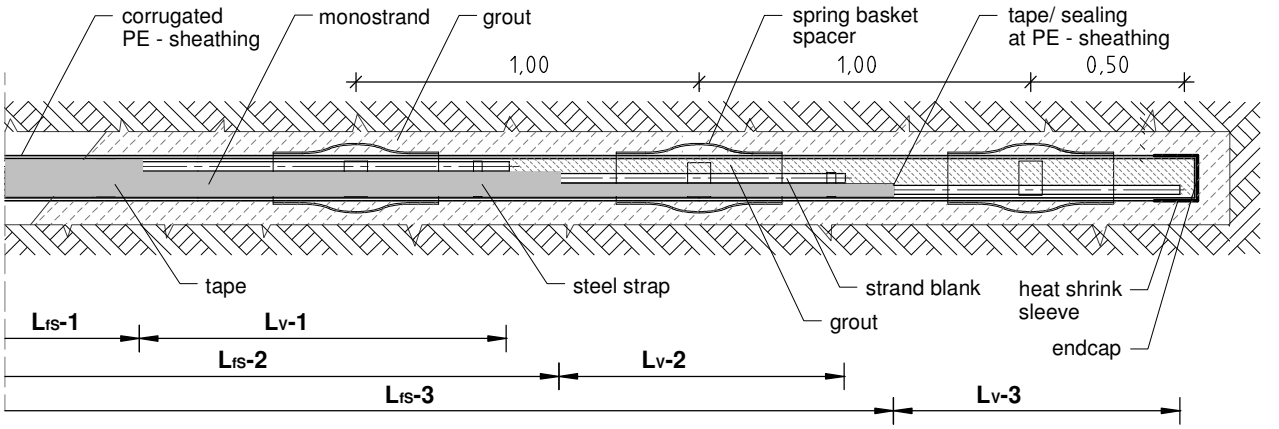
Temporary strand anchor with staggered bond length

(anchor head details like temporary strand anchor)



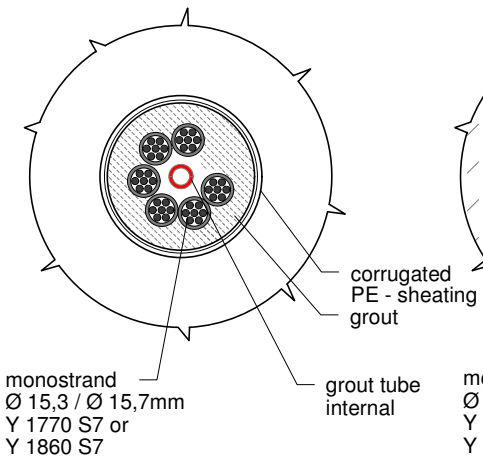
Permanent strand anchor with staggered bond length

(anchor head details like permanent strand anchor)

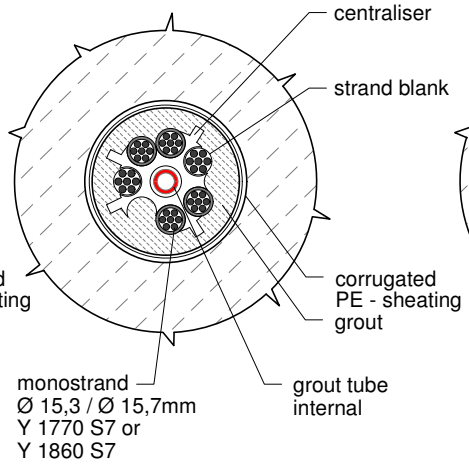


L_{fs} ... unbonded length L_v ... bond length

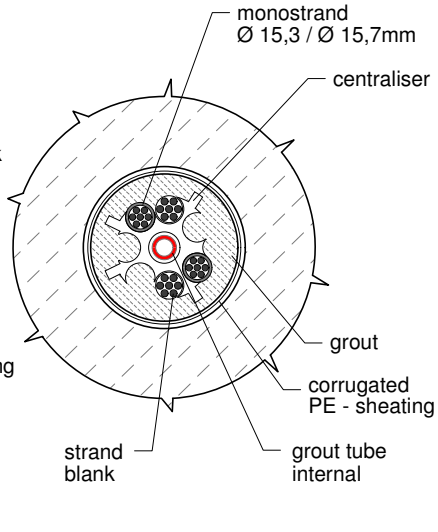
section L_{fs}-2



section L_v -1



section L_v -2



ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Anchor head, center- and edge distance	Annex 4

Anchor head

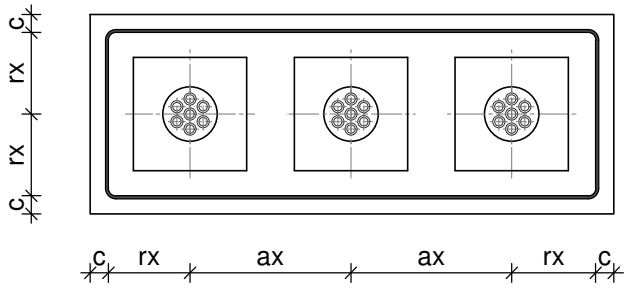
No. of strands				2 - 4	5 - 7	8 - 9	10 - 12	13 - 15
min. Borehole diameter				88	105	125	125	150
Sheathing	Typ	steel max Ø $_A$/d		118,6x4,5	159x4,5	200x4,5	200x4,5	200x4,5
		PE-HD max Ø $_A$/d		125,0x3,2	160x4,0	200x4,0	200x4,0	200x4,0
Bursting reinforcement (stirrup)	rod diameter			10	12	12	14	14
	lateral length			230	330	400	430	460
	distance of the stirrups			50	60	60	60	60
	number of the stirrups			7	8	10	10	12
Center- and edge distance [2]	with bursting reinforcement		ax	260	365	440	470	505
	concrete ≥ C 25/30		rx	130 + c	185 + c	210 + c	235 + c	255 + c
	without bursting reinforcement		ax	350	550	650	700	750
	concrete ≥ C 30/37		rx	175 + c	275 + c	325 + c	350 + c	375 + c

All values in mm

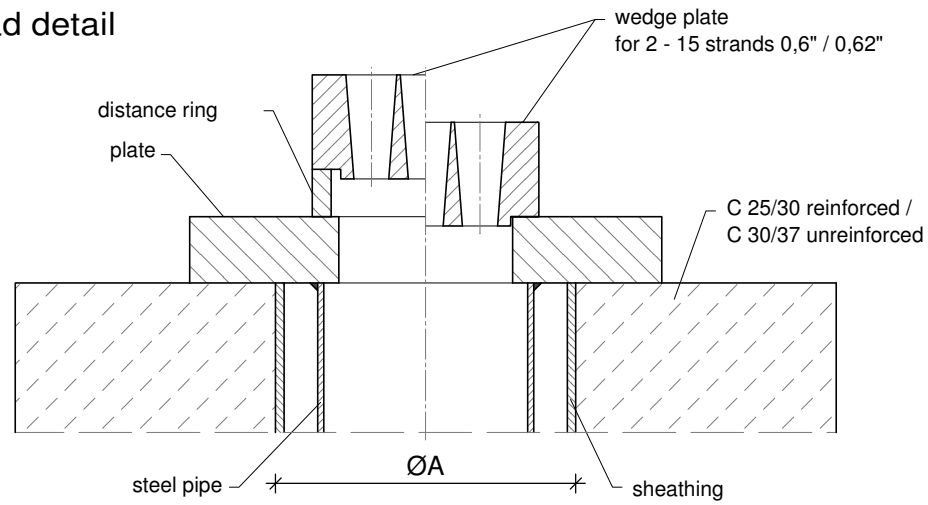
c - concrete cover of a constructive reinforcement acc. to national requirements and possibly of exposure class acc. to ÖNORM EN 206-1

1) with a constructive reinforcement of min. 50 kg/m³ concrete (acc. to ETAG 013)

2) Center- and edge distance and bursting reinforcement are designed for both Types of anchor plates (round / square)



Anchor head detail



ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Prestressing strand Y 1770 S7, section 140mm² and 150mm² rated value for material resistance in damage categories acc. to ÖNORM B 1997-1-1	Annex 5

No. of strands	**Y1770 S7 - 15,3mm** **F_{pk}=248kN, $F_{p0,1k}$=218kN, S_0=140mm²**			
	Force at permanent strain of 0,1%	Characteristic breaking force	Design resistance acc. to damage category $R_{t,d} = R_{p0,1k} / (1,15 * \eta)$ [1)]	
	$R_{p0,1k}$ [kN]	$R_{p,k}$ [kN]	CC 1 und CC 2, η=1,0 [kN]	CC3, η=1,15 [kN]
2	436	496	379	330
3	654	744	569	495
4	872	992	758	659
5	1090	1240	948	824
6	1308	1488	1137	989
7	1526	1736	1327	1154
8	1744	1984	1517	1319
9	1962	2232	1706	1484
10	2180	2480	1896	1648
11	2398	2728	2085	1813
12	2616	2976	2275	1978
13	2834	3224	2464	2143
14	3052	3472	2654	2308
15	3270	3720	2843	2473

No. of strands	**Y1770 S7 - 15,7mm** **F_{pk}=266kN, $F_{p0,1k}$=234kN, S_0=150mm²**			
	Force at permanent strain of 0,1%	Characteristic breaking force	Design resistance acc. to damage category $R_{t,d} = R_{p0,1k} / (1,15 * \eta)$ [1)]	
	$R_{p0,1k}$ [kN]	$R_{p,k}$ [kN]	CC 1 und CC 2, η=1,0 [kN]	CC3, η=1,15 [kN]
2	468	532	407	354
3	702	798	610	531
4	936	1064	814	708
5	1170	1330	1017	885
6	1404	1596	1221	1062
7	1638	1862	1424	1239
8	1872	2128	1628	1416
9	2106	2394	1831	1592
10	2340	2660	2035	1769
11	2574	2926	2238	1946
12	2808	3192	2442	2123
13	3042	3458	2645	2300
14	3276	3724	2849	2477
15	3510	3990	3052	2654

[1)] Factor η in dependence of the damage categories acc. to ÖNORM B 1997-1-1,
partial safety factor for prestressing steel acc. to ÖNORM EN 1992-1-1, table 2.1N: γ_S = 1,15

No. of strands	**Y1860 S7 - 15,3mm** F_{pk}=260kN, $F_{p0,1k}$=229kN, S_0=140mm²			
	Force at permanent strain of 0,1%	Characteristic breaking force	Design resistance acc. to damage category $R_{t,d} = R_{p0,1k} / (1,15 * \eta)$ [1]	
	$R_{p0,1k}$ [kN]	$R_{p,k}$ [kN]	CC 1 und CC 2, η=1,0 [kN]	CC3, η=1,15 [kN]
2	458	520	398	346
3	687	780	597	519
4	916	1040	797	693
5	1145	1300	996	866
6	1374	1560	1195	1039
7	1603	1820	1394	1212
8	1832	2080	1593	1385
9	2061	2340	1792	1558
10	2290	2600	1991	1732
11	2519	2860	2190	1905
12	2748	3120	2390	2078
13	2977	3380	2589	2251
14	3206	3640	2788	2424
15	3435	3900	2987	2597

No. of strands	**Y1860 S7 - 15,7mm** F_{pk}=279kN, $F_{p0,1k}$=246kN, S_0=150mm²			
	Force at permanent strain of 0,1%	Characteristic breaking force	Design resistance acc. to damage category $R_{t,d} = R_{p0,1k} / (1,15 * \eta)$ [1]	
	$R_{p0,1k}$ [kN]	$R_{p,k}$ [kN]	CC 1 und CC 2, η=1,0 [kN]	CC3, η=1,15 [kN]
2	492	558	428	372
3	738	837	642	558
4	984	1116	856	744
5	1230	1395	1070	930
6	1476	1674	1283	1116
7	1722	1953	1497	1302
8	1968	2232	1711	1488
9	2214	2511	1925	1674
10	2460	2790	2139	1860
11	2706	3069	2353	2046
12	2952	3348	2567	2232
13	3198	3627	2781	2418
14	3444	3906	2995	2604
15	3690	4185	3209	2790

[1] Factor η in dependence of the damage categories acc. to ÖNORM B 1997-1-1,
partial safety factor for prestressing steel acc. to ÖNORM EN 1992-1-1, table 2.1N: γ_S = 1,15

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Prestressing strand Y 1770 S7, section 140mm² and 150mm² Permitted test load of anchor acc. to ÖNORM EN 1997-1-1	Annex 7

No. of strands	**Y1770 S7 - 15,3mm** **F_{pk}=248kN, $F_{p0,1k}$=218kN, S_0=140mm²**				
	Force at permanent strain of 0,1% $R_{p0,1k}$ [kN]	Characteristic breaking force $R_{p,k}$ [kN]	Characteristic anchor design resistance $R_k = R_{p0,1k} / \gamma_S$ [1)] [kN]	Max. test force $P_{P,max}$ [2)] 0,8 R_{pk} [kN]	 0,9 $R_{p0,1k}$ [kN]
2	436	496	379	397	392
3	654	744	569	595	589
4	872	992	758	794	785
5	1090	1240	948	992	981
6	1308	1488	1137	1190	1177
7	1526	1736	1327	1389	1373
8	1744	1984	1517	1587	1570
9	1962	2232	1706	1786	1766
10	2180	2480	1896	1984	1962
11	2398	2728	2085	2182	2158
12	2616	2976	2275	2381	2354
13	2834	3224	2464	2579	2551
14	3052	3472	2654	2778	2747
15	3270	3720	2843	2976	2943

No. of strands	**Y1770 S7 - 15,7mm** **F_{pk}=266kN, $F_{p0,1k}$=234kN, S_0=150mm²**				
	Force at permanent strain of 0,1% $R_{p0,1k}$ [kN]	Characteristic breaking force $R_{p,k}$ [kN]	Characteristic anchor design resistance $R_k = R_{p0,1k} / \gamma_S$ [1)] [kN]	Max. test force $P_{P,max}$ [2)] 0,8 R_{pk} [kN]	 0,9 $R_{p0,1k}$ [kN]
2	468	532	407	426	421
3	702	798	610	638	632
4	936	1064	814	851	842
5	1170	1330	1017	1064	1053
6	1404	1596	1221	1277	1264
7	1638	1862	1424	1490	1474
8	1872	2128	1628	1702	1685
9	2106	2394	1831	1915	1895
10	2340	2660	2035	2128	2106
11	2574	2926	2238	2341	2317
12	2808	3192	2442	2554	2527
13	3042	3458	2645	2766	2738
14	3276	3724	2849	2979	2948
15	3510	3990	3052	3192	3159

1) Lock of load P_0 must not exceed $P_0 \leq P_k$
Partial safety factor γ_S = 1,15 of prestressing steel acc. to ÖNORM EN 1992-1-1, table 2.1N

2) The strand anchor must be designed, that the defined max. test force in case of investigations test, suitability test and acceptance test must not be exceeded. The less test force is definitive for designing.

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Prestressing strand Y 1860 S7, section 140mm² and 150mm² Permitted test load of anchor acc. to ÖNORM EN 1997-1-1	Annex 8

No. of strands	Y1860 S7 - 15,3mm F_{pk}=260kN, $F_{p0,1k}$=229kN, S_0=140mm²				
	Force at permanent strain of 0,1% $R_{p0,1k}$ [kN]	Characteristic breaking force $R_{p,k}$ [kN]	Characteristic anchor design resistance $R_k = R_{p0,1k} / \gamma_S$ [1)] [kN]	Max. test force $P_{P,max}$ [2)] 0,8 R_{pk} [kN]	 0,9 $R_{p0,1k}$ [kN]
2	458	520	398	416	412
3	687	780	597	624	618
4	916	1040	797	832	824
5	1145	1300	996	1040	1031
6	1374	1560	1195	1248	1237
7	1603	1820	1394	1456	1443
8	1832	2080	1593	1664	1649
9	2061	2340	1792	1872	1855
10	2290	2600	1991	2080	2061
11	2519	2860	2190	2288	2267
12	2748	3120	2390	2496	2473
13	2977	3380	2589	2704	2679
14	3206	3640	2788	2912	2885
15	3435	3900	2987	3120	3092

No. of strands	Y1860 S7 - 15,7mm F_{pk}=279kN, $F_{p0,1k}$=246kN, S_0=150mm²				
	Force at permanent strain of 0,1% $R_{p0,1k}$ [kN]	Characteristic breaking force $R_{p,k}$ [kN]	Characteristic anchor design resistance $R_k = R_{p0,1k} / \gamma_S$ [1)] [kN]	Max. test force $P_{P,max}$ [2)] 0,8 R_{pk} [kN]	 0,9 $R_{p0,1k}$ [kN]
2	492	558	428	446	443
3	738	837	642	670	664
4	984	1116	856	893	886
5	1230	1395	1070	1116	1107
6	1476	1674	1283	1339	1328
7	1722	1953	1497	1562	1550
8	1968	2232	1711	1786	1771
9	2214	2511	1925	2009	1993
10	2460	2790	2139	2232	2214
11	2706	3069	2353	2455	2435
12	2952	3348	2567	2678	2657
13	3198	3627	2781	2902	2878
14	3444	3906	2995	3125	3100
15	3690	4185	3209	3348	3321

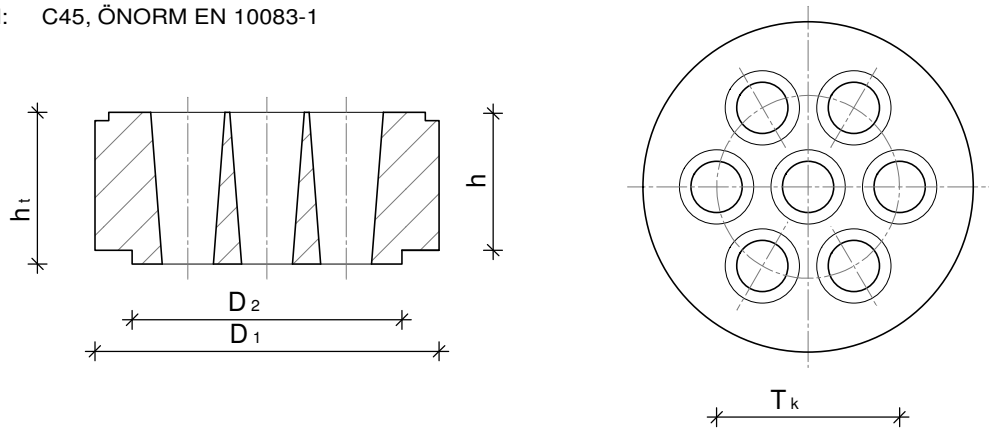
1) Lock of load P_0 must not exceed $P_0 \leq P_k$
Partial safety factor γ_S = 1,15 of prestressing steel acc. to ÖNORM EN 1992-1-1, table 2.1N

2) The strand anchor must be designed, that the defined max. test force in case of investigations test, suitability test and acceptance test must not be exceeded. The less test force is definitive for designing.

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Components: wedge plate	Annex 9

Wedge plate TYPE MT

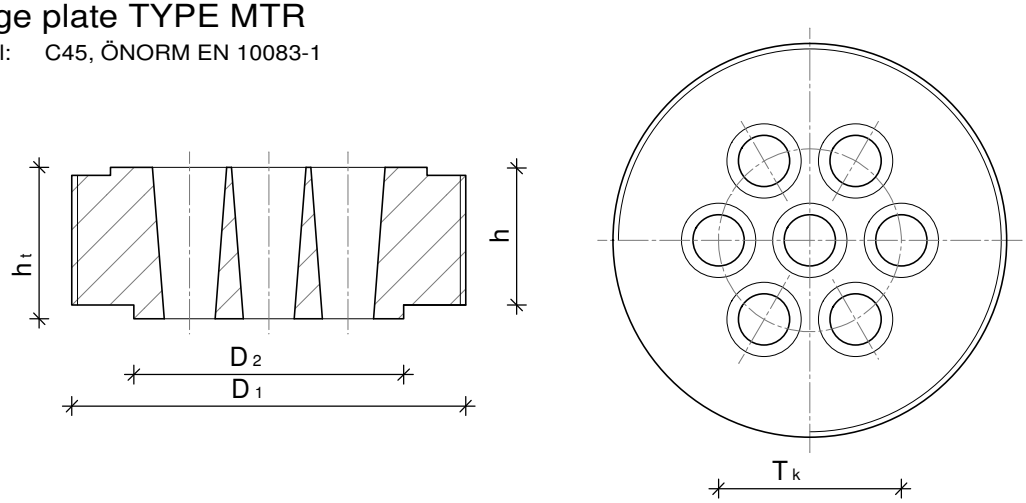
Material: C45, ÖNORM EN 10083-1



No. of strands	h_t [mm]	h [mm]	D_1 [mm]	D_2 [mm]	T_k [mm]
2 - 4	53	45	105	79	55
5 - 7	55	49	125	98	70
8 - 9	58	52	146	118	90
10 - 12	68	62	160	132	107 / 42,5
13 - 15	75	69	176	146	120 / 57

Wedge plate TYPE MTR

Material: C45, ÖNORM EN 10083-1

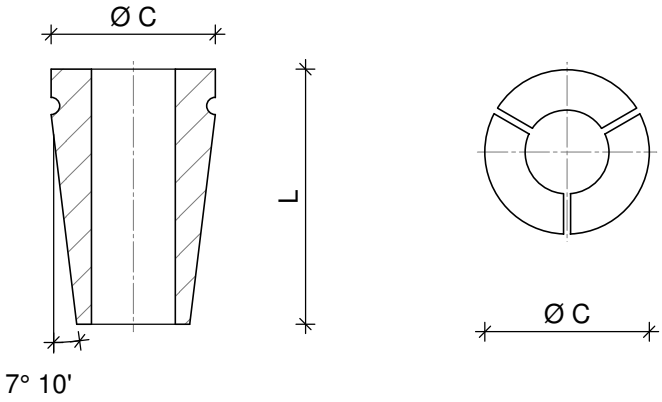


No. of strands	h_t [mm]	h [mm]	D_1 [mm]	D_2 [mm]	T_k [mm]	external thread T x Y
2 - 4	50	45	120	79	55	TR 120 × 6
5 - 7	60	55	143	98	70	TR 143 × 6
8 - 9	60	55	165	118	90	TR 165 × 6
10 - 12	67	62	175	132	107 / 42,5	TR 175 × 6
13 - 15	75	69	193	146	120 / 57	TR 193 × 6

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Components: wedge, transition tube distance ring, steel ring	Annex 10

Wedge

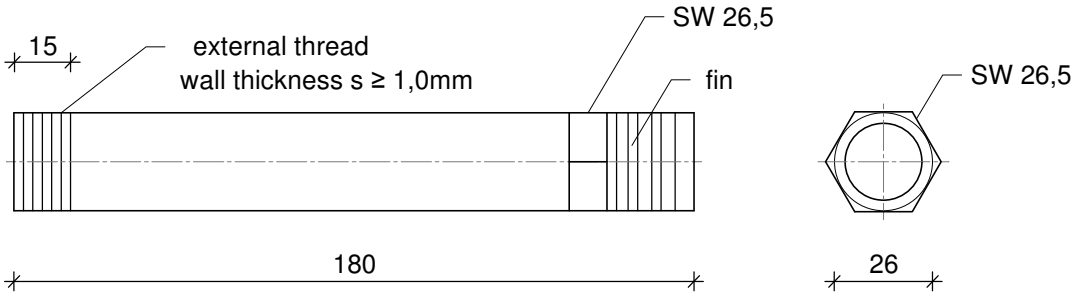
Material: 16NiCr, EN 10084 respectively C15 EN 10277-2



Ø C [mm]	L [mm]
28	43

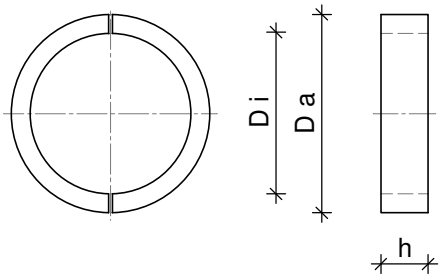
Transition tube

Material: HDPE 80, ÖNORM EN ISO 3126



Distance ring (splitted)

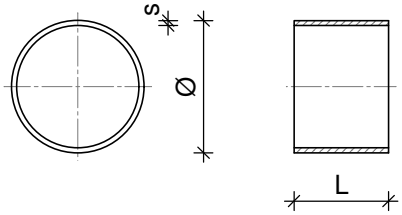
Material: S 355J2H, ÖNORM EN 10210



No. of strands	h [mm]	D_a [mm]	D_i [mm]
2 - 4	20 / 30 / 40	114,3	82,3
5 - 7		139,7	99,7
8 - 9		159,0	119,0
10 - 12		177,8	133,4
13 - 15		193,7	149,3

Steel ring (absorption of lateral tensile forces at anchor head area)

Material: P235TR1, ÖNORM EN 10217-1

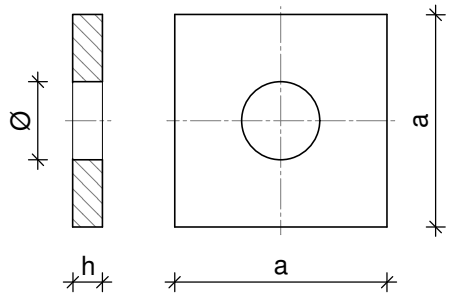


No. of strands	L [mm]	Ø [mm]	s [mm]
2 - 4	50	70,0	2,6
5 - 7		88,9	2,9
8 - 12		108,0	2,9
13 - 15		139,7	3,6

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Components: anchor plate, anchor plate with steel pipe	Annex 11

Anchor plate square

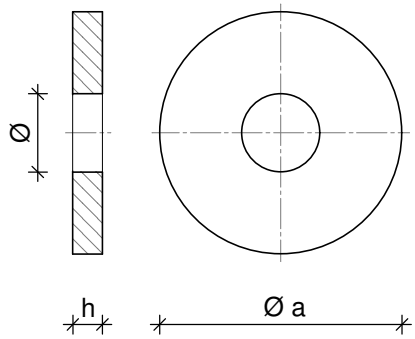
Material: S 355, ÖNORM EN 10025-2



No. of strands	a [mm]	h [mm]	Ø [mm]
2 - 4	225	35	81
5 - 7	260	40	100
8 - 9	310	45	120
10 - 12	340	50	134
13 - 15	400	50	148

Anchor plate round

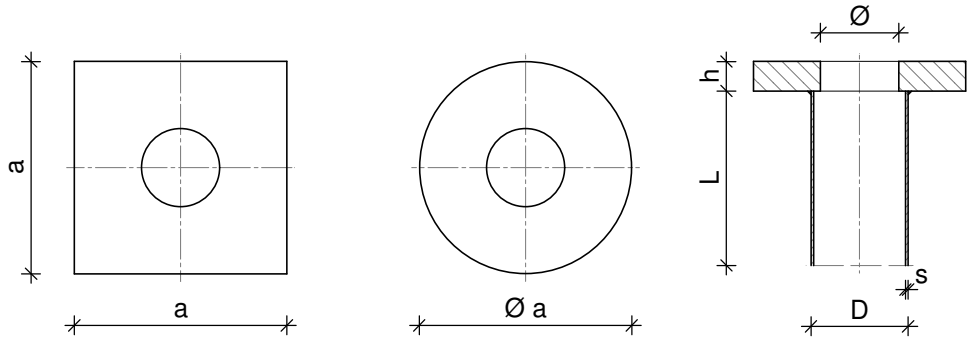
Material: S 355, ÖNORM EN 10025-2



No. of strands	Ø a [mm]	h [mm]	Ø [mm]
2 - 4	250	35	81
5 - 7	290	40	100
8 - 9	350	45	120
10 - 12	380	50	134
13 - 15	450	50	148

Anchor plate with steel pipe

Material steel pipe: P 235 TR1/2, ÖNORM EN 10217-1/ ÖNORM EN 10220



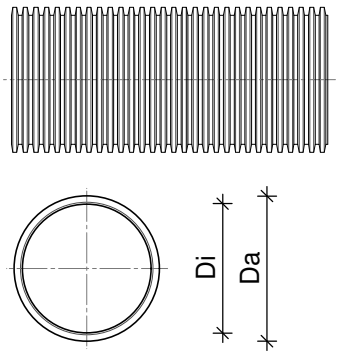
No. of strands	a [mm]	h [mm]	Ø a [mm]	Ø [mm]	L [mm]	s [mm]	D [mm]
2 - 4	225	35	250	81	400	2,9	88,9
5 - 7	260	40	290	100	400	3,2	114,3
8 - 9	310	45	350	120	500	3,2	127,0
10 - 12	340	50	380	134	500	3,6	139,7
13 - 15	400	50	450	148	500	4,0	152,4

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Components: corrugated PE - sheathing, spring basket spacer, sealing ring	Annex 12

Corrugated PE-sheathing

Material: PE - HD, DIN 16776

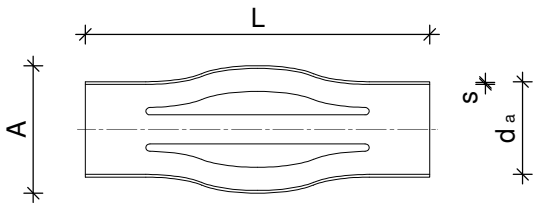
No. of strands	min Di [mm]	Da [mm]	min s [mm]
2 - 4	52	64	1,0
5 - 7	66	78	1,0
8 - 12	86	98	1,5
13 - 15	97	125	2,0



Spring basket spacer

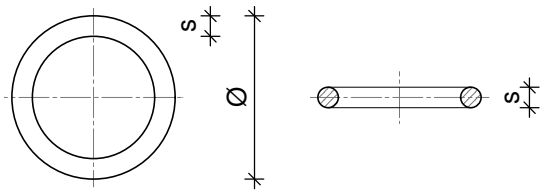
Material: PVC-U, DIN 8061 / 8062

No. of strands	L [mm]	Temporary strand anchor			Permanent strand anchor		
		A [mm]	d_a [mm]	s [mm]	A [mm]	d_a [mm]	s [mm]
2 - 4	270 - 300	100	50	3	125	63	3,6
5 - 7		125	63	3,6	125	90	2,7
8 - 12		135	90	2,7	140	110	3,2
13 - 15		190	110	3,2	190	125	3,7



Sealing ring

Material: Silicon - expanded / cellular rubber

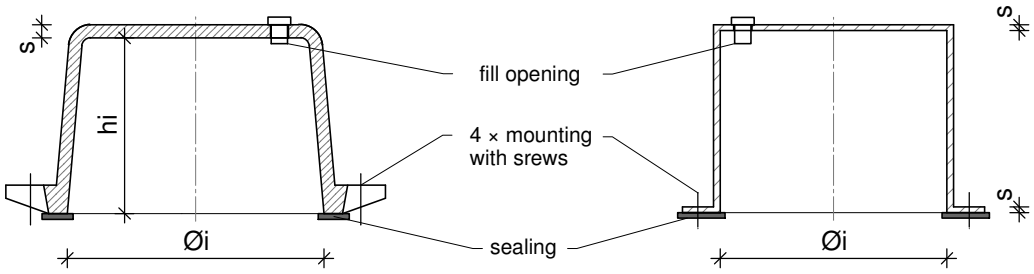


No. of strands	Ø [mm]	s [mm]
2 - 4	88	20
5 - 7	114	25
8 - 9	127	20
10 - 12	139	25
13 - 15	166	30

ANP - SYSTEMS GmbH	ANP - strand anchor 2 - 15 strands, Ø 15,3mm and 15,7mm Components: steelcap, cladding tube for single strand, centralisier	Annex 13

Cap

Material: PE - HD, DIN 16776 resp. EN-GJS-400-15, ÖNORM EN 1563 resp. S235, ÖNORM EN 10025-2

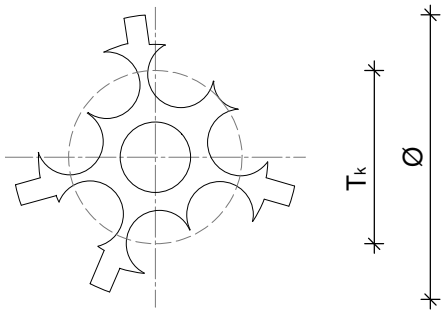


No. of strands	Wedge plate type MT		Wedge plate type MTR		minimum Wall thickness s	
	min hi [mm]	min Øi [mm]	min hi [mm]	min Øi [mm]	steel [mm]	plastic [mm]
2 - 4	80	115	80	130	3,0	5,0
5 - 7		135	95	155		
8 - 9	95	155		175		
10 - 12		170		185		
13 - 15		185	100	205		

Centraliser

Material: PE - HD, DIN 16776

No. of strands	T_k [mm]	Ø [mm]
2 - 4	26	52
5 - 7	41	67
8 - 12	60	86
13 - 15	71	99



PE-sheathing for Monostrands

Material: HDPE 80, ÖNORM EN ISO 3126

Strands - Ø [mm]	Outside diameter [mm]	Wall thickness [mm]
15,3	19,0 +0,3/-0	1,25 +0,2/-0
15,7	19,6 +0,3/-0	1,25 +0,2/-0

ANP - corrosion protection process

Material: corrosion protection wax Petroplast acc. to ÖNORM EN 1537, appendix B

Features	standard	criteria for acceptability
flash point	DIN 51 376	> 160° C
density (23° C)	ISO 2811	~ 0,90 g/cm³
dropping point	DIN 51 801	≥ 60° C
electical volume resistivity	DIN 53 482	$>10^9$ Ohm.cm
neutralization value	DIN 51 558	< 1 mgKOH/g
soapification value	DIN 53 401	< 10 mgKOH/g
testing of corrosive sulfur	DIN 51 759	not corrosive
permanent temperature stability		40° C
recommended Grouting temperature		90 - 120° C
colour		brown
cleaning supplies		Benzin, Petroleum, Xylol
amount / running meter single strand		> 40 g/m
friction: cladding and wax filled strand		< 60 N/m

Material: corrosion protection compound Unigel 128F-1 acc. to ÖNORM EN 1537, appendix B

Features	standard	criteria for acceptability
flash boint	ISO 2592	> 230° C
density	ASTM D1475	~ 0,84 - 0,88 g/ml
dropping point	ISO 2176	≥ 190° C
Cone penetration, 25°C	ISO 2137	410 - 450
oil seperation at 40° C	DIN 51 817	after 72 h: ≤ 2,5 % after 7 d: ≤ 4,5 %
oxidation resistance	DIN 51 808	100 h at 100° C: < 0,06 Mpa 1000 h at 100° C: < 0,02 Mpa
corrosions protection 168 h at 35° C - salt spray 168 h at 35° C - destillated water spray	 NFX 41-002 NFX 41-002	 passed, no corrosion passed, no corrosion
corrosions test (EMCOR)	DIN 51 802	Grad: 0
content of aggressive substance Cl^-, S^{2-}, $NO3^-$: $SO4^{2-}$:	 NFM 07-023 NFM 07-023	 ≤ 50 ppm (0,005%) ≤ 100 ppm (0,010%)

Corrosion protection compound for anchor head area

a filling material with petrolatum products acc. to ÖNORM EN 1537, appendix B is used

Material: corrosion protection wax Petroplast or Denso-Jet
corrosion protection compound Unigel 128F-1

Corrosion protection tape for wedge plate

tape with integrated corrosion protection compound acc. to ÖNORM EN 1537, appendix B

Material: Densoplast or KEBU

Assembly instruction for the ANP temporary strand anchor

- The strands of this anchor type are cased individually in the unbonded length and blank in the bond length.
- The pushing of the blank strand into the sheathing takes place in the production manufacturing plant of the company ANP-Systems Gmbh.
- At the transition from the unbonded length to bond length the sealing from PE - sheathing to strand is achieved with a tape or heat shrink sleeve.
- At bond length the strands are equipped with spacers and bundled according to annex 1 of the approval.
- Filling pipes and post grouting pipes can be fixed at the strand bundle.
- The produced anchors are marked, curled and delivered to the job site on wooden reels.

Assembly instruction for the ANP temporary strand anchor for extended short-term use

- The strands of this anchor type are cased individually in the unbonded length and provided with corrosion protection compound. They are blank in the bond length.
- The blank strand is fanned out over the area of the unbonded length in the production manufacturing plant of the company ANP-Systems GmbH, provided with corrosion protection compound, closed again and inserted into a smooth PE - sheathing.
- At the transition of the unbonded length to bond length the sealing from PE - sheathing and strand is achieved with a tape or heat shrink sleeve.
- At bond length the strands are equipped with centering spacers and bundled according to annex 1 of the approval.
- The produced anchors are marked, curled and delivered to the job site on wooden reels.

Assembly

- The complete anchor is cased in a corrugated PE - sheathing.
- The strands of this anchor type are cased individually in the unbonded length and equipped with corrosion protection compound. They are blank in the bond length.
- The blank strand is fanned out over the area of the unbonded length in the production manufacturing plant of the company ANP-Systems GmbH, provided with corrosion protection compound, closed again and inserted into a smooth PE - sheathing.
- At the transition from the unbonded length to bond length the sealing from PE - sheathing to strand is achieved with a tape or heat shrink sleeve.
- At bond length the strands are equipped with centering spacers and bundled it between in a way that cement cover >5mm is ensured in the PE corrugated PE - sheathing.

The filling pipe for the anchor interior space is fixed at the strand bundle.

- The prepared strand bundle with the filling pipes is inserted into the corrugated PE - sheathing.
- The end cap is assembled on the corrugated PE - sheathing and sealed.
- The filling pipes for the anchor exterior space and the optional post grouting pipes can be assembled outside on the corrugated PE - sheathing. The produced anchors are labeled, curled and delivered to the job site on wooden reels.

Assembly instruction for the ANP – strand anchor with staggered bond length

- All the anchor types that have been mentioned so far can also be produced as anchors with staggered bond length and different unbounded length.
- The manufacturing methods remain unchanged.
- The strands have to be labeled at the downstream end in a way so that the unbounded length can be clearly identified.

Installation instruction for ANP temporary strand anchor and ANP temporary strand anchor for extended short-term use

- After drilling the borehole has to be cleaned. Then the drill rods are removed and the anchor is installed.
- Anchors, depending on their size and length, can be installed in either manually, automatically (with a crane) or with an anchor drum. Before installation mud has to be removed if necessary along the bond length. Filling and post grouting pipes and the external spacers have to be assembled.
- The borehole is filled with cement mortar according the requirements of ÖNORM EN 1537 either before or after anchor installation on the borehole ground.
- When the casing is removed cement mortar is refilled to ensure a complete filling of the bond length.
- At least the top 50 cm of the borehole should not be filled. It may be necessary to flush this area.
- If necessary, a post grouting of the bond length can take place after some hours.
- The head is installed shortly before the tensioning of the anchor. First the individual strand sheathing is cut off and removed at the tendon. After the anchor plate has been positioned, the wedge plate with the screwed-in PE – transition tubes and the wedges are installed. The temporary anchor for extended short-term use PE - transition tubes that are filled with corrosion protection compound. After tensioning of the anchor the anchor head is coated with corrosion protection material and a cover cap is mounted.

Installation instruction for the
ANP permanent strand anchor

- After drilling the borehole has to be cleaned. Then the drill rods are removed and the anchor is installed.
- Anchors, depending on their size and length, can be installed in either manually, automatically (with a crane) or with an anchor drum. Before installation mud has to be removed if necessary along the bond length. Filling and post grouting pipes and the external spacers have to be assembled. The corrugated sheath has to be checked for damage. Any damage has to be sealed with appropriate heat shrink sleeve.
- After installation first the interior anchor space is filled with cement mortar according to the requirements of ÖNORM EN 445, ÖNORM EN 446 and ÖNORM EN 447 via the injection tube and then the anchor exterior space is filled with grout injection mortar according to the requirements of ÖNORM EN 1537.
- When the sheathing is removed, the annulus between corrugated PE - sheathing and borehole wall is constantly refilled to ensure a complete filling of the bond length.
- At least the top 50 cm of the borehole should not be filled. It may be necessary to flush this area. Furthermore the top 30 cm of the corrugated PE - sheathing have to be flush and cleaned before the cement mortar starts hardening.
- If necessary, a post grouting of the bond length can take place after some hours.
- The head is installed shortly before the anchor is tensioned. First the seal ring and a steel ring (it is needed for the absorption of transverse tension) are pushed about 25cm behind the tendon on the corrugated PE - sheathing and the corrugated PE - sheathing is cut off (use special tools) about 15cm behind the tendon.

After the anchor has been tensioned the steel pipe is filled with cement mortar (adjustable anchors) or with liquid corrosion protection compound (controllable anchors) via a directional borehole in the anchor plate, the cover cap is mounted and filled with liquid corrosion protection compound.

Tensioning of ANP strand anchors

- A precondition for tensioning is the sufficient strength of the grout body (bond length) and the concrete bearing.
- Hydraulic bundle prestressing jacks (one press stroke to tension all tendons -> identical press condition in all tendons) that have to comply with the test load requirements have to be used for anchor tensioning, the presses and have to be checked annually
- The test setup and the test method respectively comply with the requirements of ÖNORM EN ISO 22477-5.
- A wedge reset plate is placed in the area of the stressing chair so that an regular wedge slip is ensured when the anchor is locked.

Tensioning of ANP strand anchor with staggered bond length

- Unlike conventional strand anchors, the anchors with staggered bond length have different unbonded length and different elongation values.
- Either individual jacks with a single hydraulic aggregate unit and a distribution device or bundle jacks with staggered press wedges can be used to guarantee a regular force distribution. The press wedges' distribution has to be calculated depending on the respective unbounded length.

Anchor | **N**ail | **P**ile

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