



Austrian Institute of Construction Engineering
Schenkenstrasse 4 | T+43 1 533 65 50
1010 Vienna | Austria | F+43 1 533 64 23
www.oib.or.at | mail@oib.or.at



European Technical Assessment

ETA-12/0310
of 18.08.2017

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

MeKano4 PT System M, internal bonded post
tensioning system with 4 to 37 strands

Product family to which the construction product belongs

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

Manufacturer

MK4 World Wide S.L.
Pol. Ind. Can Nadal
C/ Can Nadal Nave 1A-2
08185 Lliça de Vall, Barcelona
Spain

Manufacturing plant

MK4 Innovative Solutions, S.L.U.
Pol. Ind. Can Nadal
C/ Can Nadal Nave 1A-2
08185 Lliça de Vall, Barcelona
Spain

This European Technical Assessment contains

74 pages including Annexes 1 to 26, which form
an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

ETAG 013, Guideline for European technical approval for Post-Tensioning Kits for Prestressing of Structures, edition June 2002, used according to Article 66 (3) of Regulation (EU) № 305/2011 as European Assessment Document.

This European Technical Assessment replaces

European technical approval ETA-12/0310 with
validity from 28.06.2013 to 02.09.2017.

Table of contents

EUROPEAN TECHNICAL ASSESSMENT ETA-12/0310 OF 18.08.2017 1

GENERAL PART..... 1

Table of contents.....2

Remarks.....6

Specific parts.....6

1 TECHNICAL DESCRIPTION OF THE PRODUCT 6

1.1 General 6

PT system 7

1.2 Designation and range of anchorages 7

1.2.1 General 7

1.2.2 MSA active anchorages 8

1.2.3 MPA passive anchorages..... 8

1.3 Designation and range of couplers 9

1.3.1 General.....9

1.3.2 MCR coupler..... 10

1.3.2.1 Fixed coupler.....10

1.3.2.2 Movable coupler 11

1.3.3 MCU coupler 11

1.4 Designation and range of the tendons 11

1.5 Sheathing, minimum radii of curvature of tendons 12

1.6 Friction losses 12

1.7 Support of tendons 13

1.8 Anchorage slippage..... 13

1.9 Minimum centre spacing and edge distance..... 13

1.10 Concrete strength at time of stressing 14

Components..... 14

1.11 Prestressing steel strands 14

1.12 Anchorage and coupler 15

1.12.1 General..... 15

1.12.2 Anchorage 15

1.12.2.1 MSA anchor head 15

1.12.2.2 MPA anchor head 15

1.12.3 Trumpets..... 15

1.12.4 Coupler 15

1.12.4.1 MCR Coupler..... 15

1.12.4.1.1 MCR coupler anchor head..... 15

1.12.4.1.2 Coupler sleeve 16

1.12.4.2 MCU coupler..... 16

1.12.4.2.1 Barrel 16

electronic copy

3.2.4	Mechanical resistance and stability	24
3.2.4.1	Resistance to static load under cryogenic conditions	24
3.3	Assessment methods	24
3.4	Identification	24
4	ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE (HEREINAFTER AVCP) SYSTEM APPLIED, WITH REFERENCE TO ITS LEGAL BASE.....	25
4.1	System of assessment and verification of constancy of performance	25
4.2	AVCP for construction products for which a European Technical Assessment has been issued.....	25
5	TECHNICAL DETAILS NECESSARY FOR THE IMPLEMENTATION OF THE AVCP SYSTEM, AS PROVIDED FOR IN THE APPLICABLE EAD	25
5.1	Tasks for the manufacturer.....	25
5.1.1	Factory production control.....	25
5.1.2	Declaration of performance	26
5.2	Tasks for the notified product certification body	26
5.2.1	Initial inspection of the manufacturing plant and of factory production control	26
5.2.2	Continuing surveillance, assessment, and evaluation of factory production control.....	26
5.2.3	Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities	27
	ANNEXES.....	28
Annex 1	Anchorage – Active anchorage – Overview	28
	Anchorage – Passive anchorage – Overview	29
Annex 2	Coupler – MCU movable coupler – Overview	30
	Coupler – MCR movable coupler – Overview	31
	Coupler – MCR fixed coupler – Overview	32
	Coupler – MCR fixed coupler for precast concrete elements	33
Annex 3	Anchorage and coupler – Overview.....	34
Annex 4	Anchorage – Components.....	35
Annex 5	MCR coupler – Components	38
Annex 6	MCU coupler – Components	42
Annex 7	Anchorage and coupler – Cone geometry, wedge	44
Annex 8	Anchorage and coupler – Centre spacing, edge distance – Additional reinforcement.....	45
	Anchorage – Minimum concrete strength, additional reinforcement, details on dimensions.....	46
	MCR coupler – Minimum concrete strength, additional reinforcement, details on dimensions.....	48
Annex 9	Anchorage and coupler – Details on dimensions.....	49
Annex 10	Duct – Dimensions, minimum radius of curvature.....	50
Annex 11	Tendon range – n/0.6” – 140.....	51
	Tendon range – n/0.6” – 150.....	52
Annex 12	Maximum prestressing and overstressing forces of a single prestressing steel strand	53

Tendon n/0.6" – 140 – 1770 – Maximum prestressing and overstressing forces	54
Tendon n/0.6" – 140 – 1860 – Maximum prestressing and overstressing forces	55
Tendon n/0.6" – 150 – 1770 – Maximum prestressing and overstressing forces	56
Tendon n/0.6" – 150 – 1860 – Maximum prestressing and overstressing forces	57
Annex 13 Material specifications	58
Annex 14 Prescribed test plan.....	59
Annex 15 Audit testing	61
Annex 16 Anchorage recess – Clearance for handling and stressing	62
Annex 17 Installation – Anchorage MSA and MPA.....	63
Annex 18 Installation – MCR coupler	64
Annex 19 Installation – MCU coupler	66
Annex 20 Installation – MSA active anchorage	67
Annex 21 Installation – MPA passive anchorage.....	68
Annex 22 Installation – MCR coupler	69
Annex 23 Installation – MCU coupler	71
Annex 24 Prestressing steel strand specifications.....	72
Annex 25 Essential characteristics for the intended uses	73
Annex 26 Reference documents	74

Remarks

Translations of the European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of the European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may be made with the written consent of Österreichisches Institut für Bautechnik. Any partial reproduction has to be identified as such.

Specific parts

1 Technical description of the product

1.1 General

The European Technical Assessment¹ – ETA – applies to a kit, the PT system

MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands,

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

– Tendon

Internal bonded tendon ranging from 4 to 37 tensile elements

– Tensile element

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

Table 1: Tensile elements

Nominal diameter	Nominal cross-sectional area	Characteristic tensile strength	
mm	mm ²	MPa	
15.3	140	1 770	1 860
15.7	150		

NOTE 1 MPa = 1 N/mm²

– Anchorage and coupler

Anchorage of the prestressing steel strands with ring wedges

End anchorage

Active anchor head MSA for 4, 5, 7, 9, 12, 15, 19, 24, 27, 31, and 37 prestressing steel strands, see Annex 1

Passive anchor head MPA for 4, 5, 7, 9, 12, 15, 19, 24, 27, 31, and 37 prestressing steel strands, see Annex 1

¹ ETA-12/0310 was firstly issued in 2012 as European technical approval with validity from 03.09.2012, amended in 2013 with validity from 28.06.2013, and converted in 2017 to European Technical Assessment ETA-12/0310 of 18.08.2017.

Fixed coupler

Sleeve coupler MCR for 4, 5, 7, 9, and 12 prestressing steel strands, see Annex 2

Movable coupler

Single strand coupler MCU, see Annex 2

Sleeve coupler MCR for 4, 5, 7, 9, and 12 prestressing steel strands, see Annex 2

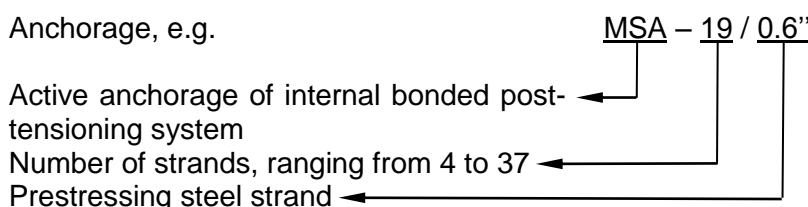
- Trumpet for 4, 5, 7, 9, 12, 15, 19, 24, 27, 31, and 37 prestressing steel strands
- Additional reinforcement in the anchorage region
- Corrosion protection for tensile elements, anchorages, and couplers

PT system

1.2 Designation and range of anchorages

1.2.1 General

The anchorage is designated by a three letter code followed by the number of prestressing steel strands and their nominal diameter expressed in inches.



Anchorage of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands are divided in

Small and medium sizes, from 4 to 19 prestressing steel strands, see Annex 3. These anchorages comprise, see

- Table 2 and Table 4,
 - an anchor head with wedges, and
 - a cast iron trumpet with two anchorage planes.
- Large sizes, from 24 to 37 prestressing steel strands, see Annex 3. These anchorages comprise, see Table 3 and Table 5,
 - an anchor head with wedges,
 - a PE-deviator,
 - a cast iron trumpet with three anchorage planes, and
 - a PE-transition sleeve, threaded into the trumpet as a transition to the duct.

Within active anchorages MSA active anchor heads are used. For passive anchorages, either MSA active anchor heads or MPA passive anchor heads can be used.

The main dimensions of the anchorages are given in Annex 8 and Annex 9. The anchorages are suitable for prestressing steel strands with nominal diameters 15.3 mm and 15.7 mm and with tensile strengths 1 770 MPa and 1 860 MPa.

1.2.2 MSA active anchorages

MSA anchorages are intended as active and passive anchorages, placed at both ends of a tendon. MSA anchorages, employed at passive anchorages, require access during stressing.

The MSA anchor head is a cylindrical part with as many conical bores as prestressing steel strands are anchored. The geometry of the conical bores is shown in Annex 7.

Table 2: Small and medium size anchorages – Components

MSA	Anchor head	Trumpet	Wedge	Duct inner diameter in mm
4/0.6"	102-04-602	T4	MH6	51
5/0.6"	102-05-602	T4		51
7/0.6"	102-07-602	T5		62
9/0.6"	102-09-602	T6		70
12/0.6"	102-12-602	T7		85
15/0.6"	102-15-602	T8		90
19/0.6"	102-19-602	T19		100

Table 3: Large size anchorages – Components

MSA	Anchor head	PE deviator	Trumpet	PE transition sleeve	Wedge	Duct inner diameter in mm
24/0.6"	102-24-602	102-24-603A	TR24	101-24-03	MH6	110
27/0.6"	102-27-602	102-31-603A	TR31	101-31-03		120
31/0.6"	102-31-602	102-31-603A	TR31	101-31-03		120
37/0.6"	102-37-602	102-37-603A	TR37	101-37-02		130

1.2.3 MPA passive anchorages

MPA anchorages are intended to be embedded in concrete at non accessible tendon ends, where there is no need to place the prestressing jack and there is no access to the anchor head. So there is no way to verify e.g. the entrance of concrete in the wedges and so a proper installation of the wedges.

At accessible anchorages MSA anchorages could be installed as passive anchorages.

MPA anchor head geometry is basically the same as for MSA anchor head but with its thickness being increased allowing installation of springs.

After threading and prior to concreting, the MPA anchor head is tightly secured to the trumpet by means of a fastening bar.

Table 4: Small and medium size anchorages – Components

MPA	Anchor head	Trumpet	Fastening bar	Wedge	Duct inner diameter in mm
4/0.6"	113-04-605	T4	113-04-603	MH6	51
5/0.6"	113-05-605	T4	113-05-603		51
7/0.6"	113-07-605	T5	113-07-603		62
9/0.6"	113-09-605	T6	113-09-603		70
12/0.6"	113-12-605	T7	113-12-603		85
15/0.6"	113-15-605	T8	113-15-603		90
19/0.6"	113-19-605	T19	113-19-603		100

Table 5: Large size anchorages – Components

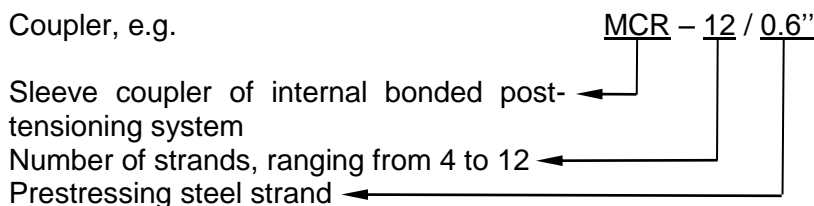
MPA	Anchor head	PE deviator	Trumpet	PE transition sleeve	Fastening bar	Wedge	Duct ¹⁾
24/0.6"	113-24-605	102-24-603A	TR24	101-24-03	113-24-603	MH6	110
27/0.6"	113-27-605	102-31-603A	TR31	101-31-03	113-27-603		120
31/0.6"	113-31-605	102-31-603A	TR31	101-31-03	113-31-603		120
37/0.6"	113-37-605	102-37-603A	TR37	101-37-02	113-37-603		130

¹⁾ Duct inner diameter in mm

1.3 Designation and range of couplers

1.3.1 General

The coupler is designated by a three letter code followed by the number of prestressing steel strands and their nominal diameter expressed in inches.



The couplers of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands are either

- Fixed or movable MCR sleeve couplers for 4 to 12 prestressing steel strands. The fixed coupler allows for jointing the tendon of the (N + 1)th construction stage with an already stressed tendon of the Nth construction stage. The movable coupler joints two, Nth and (N + 1)th, simultaneously stressed tendon sections. The MCR coupler comprises, see Table 6,
 - coupler anchor heads for Nth and (N + 1)th construction stage or tendon sections with wedges,
 - a coupler sleeve,

- ancillary components such as anchor lid, springs, washers, and caps, and
- a cast iron trumpet with two anchorage planes for fixed couplers only.
- Movable MCU single strand couplers, which allow for jointing two tendon sections prior to stressing. I.e. the (N + 1)th tendon section is jointed with the unstressed Nth tendon section. MCU coupler can be used for coupling of tendons with 4 to 37 prestressing steel strands. The MCU coupler comprises, see Table 7,
 - barrels with wedges for both tendon ends,
 - connector body,
 - ancillary components such as springs, washers, and
 - deviators, to keep in distance MCR couplers and prestressing steel strands of the tendons.

The main dimensions of the couplers are given in Annex 6, Annex 8, and Annex 9. The couplers are suitable for prestressing steel strands with nominal diameters 15.3 mm and 15.7 mm and with tensile strengths 1 770 MPa and 1 860 MPa.

Couplers are placed within straight sections of the tendons.

1.3.2 MCR coupler

The MCR coupler comprises two coupler anchor heads that are connected with a coupler sleeve. The coupler anchor heads are of the same geometry as the active anchor heads MSA and provide an external thread for the coupler sleeve. The pattern of the conical bores of the coupler anchor head is the same as of the active anchor head MSA.

Table 6: MCR coupler – Components

MCR	Coupler anchor head	Coupler sleeve	Trumpet ¹⁾	Wedge
4/0.6"	123-04-606	123-04-604	T4	MH6
5/0.6"	123-05-606	123-05-604	T4	
7/0.6"	123-07-606	123-07-604	T5	
9/0.6"	123-09-606	123-09-604	T6	
12/0.6"	123-12-606	123-12-604	T7	

¹⁾ For fixed couplers or partially stressed tendons only

1.3.2.1 Fixed coupler

The fixed coupler is used in jointing two tendons, whereas the first tendon, Nth construction stage, is already stressed and generally grouted before the second tendon, the (N + 1)th construction stage, is installed and stressed. The prestressing steel strands of the second tendon are threaded by hand and secured by means of springs and a screwed on anchor lid that keep in place the wedges.

At the fixed coupler, the prestressing force at the (N + 1)th construction stage is not greater than that at the Nth construction stage, neither during construction, nor in the final state, nor due to any load combination.

electronic copy

1.3.2.2 Movable coupler

The movable coupler is used to lengthen unstressed or partially stressed tendons. The axial movement during stressing is ensured by a housing with dimensions suitable to the expected elongation of the coupler.

The prestressing steel strands of the first tendon, the Nth construction stage, are either partially stressed or the wedges are pre-set with a force of $\sim 0.5 \cdot F_{pk}$. When required, a flat wedge retaining plate can be installed to secure the wedges. The prestressing steel strands of the second tendon, the (N + 1)th construction stage, are secured by means of springs and a screwed on anchor lid that keep in place the wedges.

Where

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

1.3.3 MCU coupler

The MCU coupler comprises two barrels for two single prestressing steel strands that are connected with a connector body. The barrels provide an internal thread to screw in the connector body.

MCU coupler is used in jointing only two single prestressing steel strands. To lengthen a complete tendon of 4 to 37 prestressing steel strands, the individually jointed prestressing steel strands are kept in distance by two deviators and the MCU couplers are staggered as to not get in contact with the prestressing steel strands and with each other.

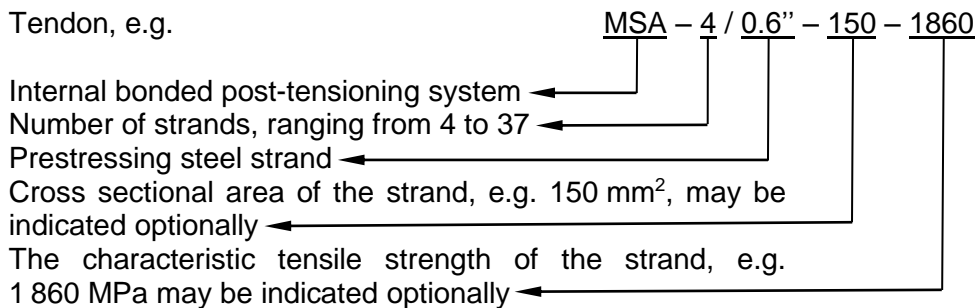
MCU couplers are used as movable couplers to only lengthen unstressed tendons. The axial movement during stressing is ensured by a housing with dimensions suitable to the expected elongation of the coupler.

Table 7: MCU coupler – Components

MCU	Connector body	Barrel	Wedge
1/0.6" left	103-1E-604	103-1E-601	MH6
1/0.6" right	103-1F-604	103-1F-601	

1.4 Designation and range of the tendons

The tendon designation is given by



The tendon number ranges from 4 to 37 prestressing steel strands. By omitting prestressing steel strands in the anchorages and couplers in a radial symmetrically way, any tendon within 4 and 37 prestressing steel strands can be installed. Any omitted hole either remains undrilled or is sealed with a short piece of prestressing steel strand and a wedge is pressed in.

Prestressing and overstressing forces are given in the corresponding standards and regulations in force at the place of use. The maximum prestressing and overstressing forces according to Eurocode 2 are listed in Annex 12, Table 20 to Table 24. Prestressing steel strands considered are

7-wire prestressing steel strand

- Nominal diameter.....15.3 mm
- Nominal cross-sectional area.....140 mm²
- Maximum characteristic tensile strength1 770 MPa or
1 860 MPa

7-wire prestressing steel strand

- Nominal diameter.....15.7 mm
- Nominal cross-sectional area.....150 mm²
- Maximum characteristic tensile strength1 770 MPa or
1 860 MPa

Nominal cross-sectional area and nominal mass of prestressing steel and characteristic maximum force of the tendons are given in Annex 11.

1.5 Sheathing, minimum radii of curvature of tendons

It is recommended not to exceed a degree of filling of $f = 0.5$.

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

Where

f —.....Degree of filling

For the tendons corrugated sheath, either of steel or of plastic are used. Sheaths of steel are circular steel strip sheaths according to EN 523 and sheath of plastic are circular plastic sheath in conformity with ETAG 013, Annex C.3. As an alternative other corrugated plastic ducts may be used if permitted at the place of use.

Inner diameter of sheaths and minimum radii of curvature for the tendons are given in Annex 10 for a pressure under the prestressing steel strands of 140 and 200 kN/m.

1.6 Friction losses

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

$$\Delta P_{i,1} = P_0 \cdot e^{-\mu \cdot (\alpha + k \cdot x)}$$

Where

$\Delta P_{i,1}$kN.....Loss of prestressing force, at a distance x along the tendon, away from the active anchorage

P_0kN.....Prestressing force at $x = 0$ m

μ rad⁻¹.....Friction coefficient. A value of $\mu = 0.20$ rad⁻¹ is normally applied for steel strip sheath and $\mu = 0.14$ rad⁻¹ for corrugated plastic ducts. Friction coefficients different to the given value are permitted, as long as sufficient technical justification is delivered.

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

electronic copy

k rad/m.....Wobble coefficient per unit length in rad/m of tendon. $k = 0.01$ rad/m is normally applied for steel strip sheath and plastic ducts.

x m.....Distance along the tendon from the point where the prestressing force is equal to P_0

NOTE 1 rad = 1 m/m = 1

Friction losses in active anchorages and fixed coupler anchor heads of the N^{th} construction stage are about 1.5 %.

1.7 Support of tendons

The tendons are installed according to their layouts for the respective structure.

Spacing of supports is between 1.0 m and 1.8 m. In the region of tendon curvatures, a spacing of 0.8 m applies.

The tendons are systematically fastened in their position to avoid displacement during placing and vibration of the concrete.

1.8 Anchorage slippage

Anchorage slippage is taken into consideration in calculation of tendon elongation and prestressing force in tendon.

Slippage is

- 6 mm at
 - active and passive anchorage
 - coupler N^{th} construction stage or tendon section
 - coupler $(N + 1)^{\text{th}}$ construction stage or tendon section
- 4 mm at
 - active anchorage, stressed with a prestressing jack with a wedge setting device
 - N^{th} construction stage of a fixed coupler, stressed with a prestressing jack with a wedge setting device
 - N^{th} construction stage or tendon section of a coupler with wedges pre-set with a force of $\sim 0.5 \cdot F_{pk}$

Reduced slippage can be obtained for anchorages and couplers, provided technical evidence can be delivered.

After releasing the prestressing force from the prestressing jack into the anchorage, the elongation is reduced by the slippage at the anchorage and thus causes loss in the applied prestressing force $\Delta P_{i,2}$. As given above, the slippage amounts to 4 to 6 mm for the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands. Due to friction, the reduction in elongation only affects a limited length of the tendon. Beyond that length the slippage has no influence on the applied prestressing force. For further details concerning loss in prestressing force due to slippage see Clause 2.2.3.4.1.

1.9 Minimum centre spacing and edge distance

Minimum centre spacing (CD) and edge distances (ED) depend on the concrete compressive strength at the time of stressing, $f_{cm,0}$, and are given in Annex 8.

However, the values specified in Annex 8 for centre spacing between anchorages may be modified, i.e. reduced in one direction by up to 15 % and placing of additional reinforcement still remains possible. Thereby, in the perpendicular direction the centre spacing is increased by the same percentage. The area of the rectangle defined by the modified centre spacing is at least the area of the square, defined by the centre spacing specified in Annex 8, i.e. $CD \cdot CD$. The corresponding edge distances are calculated by

$$ED = \frac{CD}{2} - 10 \text{ mm} + c$$

Where

CDmmCentre spacing

EDmmEdge distance

cmmConcrete cover

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

1.10 Concrete strength at time of stressing

Concrete in conformity with EN 206 is used.

The mean concrete compressive strength at the time of stressing, $f_{cm,0}$, is given in Annex 8. Therein centre spacing and additional reinforcement are specified for

$f_{cm,0, \text{cube}} \geq 30 \text{ MPa}$ and $\geq 53 \text{ MPa}$ cube strength, 150 mm cube

$f_{cm,0, \text{cylinder}} \geq 25 \text{ MPa}$ and $\geq 45 \text{ MPa}$ cylinder strength, 150 mm cylinder diameter

The concrete test specimen are subjected to the same hardening conditions as the structure.

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

Additional reinforcement and centre spacing and edge distance for the corresponding concrete compressive strengths are taken from Annex 8, see also the Clauses 1.12.6 and 2.2.3.5.

Where

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

$f_{cm,0, \text{cylinder}}$ MPaconcrete compressive strength at the time of stressing, determined on cylinders, 150 mm cylinder diameter

Components

1.11 Prestressing steel strands

Only 7-wire prestressing steel strands with characteristics according to Table 8 are used, see also Annex 24.

Table 8: Prestressing steel strands

Maximum characteristic tensile strength	f_{pk}	MPa	1 770	1 860	1 770	1 860
Nominal diameter	D	mm	15.3	15.3	15.7	15.7
Nominal cross-sectional area	A_p	mm ²	140	140	150	150
Mass of prestressing steel	M	kg/m	1.093	1.093	1.172	1.172

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

In the course of preparing the European Technical Assessment, no characteristic has been assessed for the prestressing steel strands. In execution, a suitable prestressing steel strand that conforms to Annex 24 and is according to the standards and regulations in force at the place of use is taken.

1.12 Anchorage and coupler

1.12.1 General

The components of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands are in conformity with the specifications given in Annex 4 to Annex 9 and Annex 13 and the technical file². Therein the component dimensions, materials, and material identification data with tolerances are given. The material specifications of the components are listed in Annex 13.

1.12.2 Anchorage

1.12.2.1 MSA anchor head

The MSA anchor head is a circular cylinder made of steel. It provides regularly arranged conical holes to accommodate 4 to 37 prestressing steel strands with wedges, see Annex 4. In Annex 7 the geometry of the conical hole is shown.

For tendon sizes above 19 prestressing steel strands a deviator made of PE is attached to the back side of the MSA anchor head, see Annex 3 and Annex 4.

1.12.2.2 MPA anchor head

The MPA anchor head is a circular cylinder made of steel. It provides regularly arranged conical holes to accommodate 4 to 37 prestressing steel strands with wedges, see Annex 4. In Annex 7 the geometry of the conical hole is shown. Compared to the MSA anchor head the MPA anchor head is of increased thickness. Pattern and geometry of the conical holes is identical to the MSA anchor head. However, the conical hole for the wedge seating is further down compared to the MSA anchor head to allow for a washer and a spring forcing the wedge. A step on the back side of the MPA anchor head ensures a centric placement on the trumpet.

For tendon sizes above 19 prestressing steel strands a deviator made of PE is attached to the back side of the MPA anchor head. The deviator is the same as the deviator of the MSA anchor head.

1.12.3 Trumpets

The trumpets are made of cast iron, see Annex 5. They transfer the applied force via two or three anchor planes to the concrete. A grouting inlet or vent is installed at the interface plane to the anchor head.

1.12.4 Coupler

1.12.4.1 MCR Coupler

1.12.4.1.1 MCR coupler anchor head

The MCR coupler anchor head is a circular cylinder made of steel, see Annex 5. It provides regularly arranged conical holes to accommodate 4 to 12 prestressing steel strands with wedges. Pattern of conical holes and cone geometry are identical to the MSA anchor head. A thread is machined on the coupler anchor head to screw on the coupler sleeve.

When required, a flat retaining plate can be installed to secure the wedges of the Nth construction stage. The wedges of the second tendon, the (N + 1)th construction stage, are secured by means of springs, kept in place by a screwed on anchor lid.

² The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

1.12.4.1.2 Coupler sleeve

The coupler sleeve is a circular steel tube, see Annex 5. It provides an internal thread to connect the coupler anchor heads.

1.12.4.2 MCU coupler

1.12.4.2.1 Barrel

The barrel is a circular cylinder made of steel, see Annex 6. It provides a concentric conical hole to accommodate one single prestressing steel strand with a wedge. An inner thread is machined on one end of the barrel to fit the connector body. Washer and spring, forcing the wedge, are arranged between wedge and connector body.

1.12.4.2.2 Connector body

The connector body is a short threaded steel rod to joint the two barrels of the MCU coupler, see Annex 6.

1.12.4.2.3 Deviator

The deviator is a circular disc with regularly arranged holes for 4 to 37 prestressing steel strands. The hole pattern is the same as to the MSA anchor head but with increased distances between the holes.

The deviator serves to keep in distance the individually jointed prestressing steel strands as to not get in contact prestressing steel strands and MCU couplers, see Annex 6.

1.12.5 Wedge

Three-piece wedges, kept together with spring rings, are used, see Annex 7. Two wedges are available, which have identical dimensions but are made of different steel material with equivalent strengths. Within one anchorage only one of these two wedges is used.

All anchor heads, MSA and MPA, and all couplers, MCR and MCU, are suitable for both wedges.

1.12.6 Additional reinforcement

Additional reinforcement is made of ribbed reinforcing steel. It conforms to the specifications given in Annex 8 and Annex 13.

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

1.12.7 Protection caps

Protection caps made of steel or plastics can be applied to the anchor heads.

1.12.8 Material specifications

In Annex 13 the material specifications of the components are given.

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. In execution, all components or materials have to be selected according to the standards and regulations in force at the place of use. In the absent of such standards or regulations, components and materials in accordance with ETAG 013 are deemed as acceptable.

1.13.2 Grout

Sheaths, anchorage zones, and couplers are completely filled with grout according to EN 447 or special grout according to the ETAG 013, Annex C.4.3, to protect the tendon from corrosion and to provide bond between tendon and structure.

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

2.1 Intended uses

The PT system is intended to be used for the prestressing of structures. The specific intended uses are listed in Table 9.

Table 9: Intended uses

Line №	Use category
Use category according to tendon configuration and material of structure	
1	Internal bonded tendon for concrete and composite structures
Optional use category	
2	Tendon for cryogenic applications

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 1.45 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 prestressing steel and other components in a manner as to avoid damage by mechanical or chemical impact
- Protection of prestressing steel and other components from moisture
- Keeping tensile elements separate from areas where welding operations are performed

2.2.3 Design

2.2.3.1 General

It is the responsibility of the ETA holder to ensure that all necessary information on design and installation is submitted to those responsible for design and execution of the structures executed with MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands.

Design and reinforcement of the anchorage zone permits correct placing and compacting of concrete.

Design of the structure permits correct installation and stressing of the tendons and correct application of the corrosion protection, in particular grouting.

2.2.3.2 Anchorage recess

Clearance is required for handling of prestressing jacks and for stressing operations. In order to allow for imperfections and to ease cutting of the prestressing steel strand excess length, it is recommended to increase the dimensions of the recesses. The forms for the recesses should be slightly conical for easy removal.

Details on anchorage recesses and clearance required are given in Annex 16. The ETA holder saves for reference information on minimum dimensions of the anchorage recess and appropriate clearance behind the anchorage.

2.2.3.3 Maximum prestressing force

Prestressing and overstressing forces are specified in the respective standards and regulations in force at the place of use. In Annex 12, Table 20 to Table 24, the respective maximum values according to Eurocode 2 are listed. The fulfilment of the stabilisation criteria and the requirements for crack widths in the load transfer tests were verified up to $0.8 \cdot F_{pk}$.

2.2.3.4 Losses of prestressing force

2.2.3.4.1 General

The initial post-tensioning force applied to the active anchorage (P_0) is transmitted along the tendon, but decreases as a consequence of instantaneous and long term losses. The effective post-tensioning force at each tendon point x (P_x) can be determined as follows.

$$P_x = P_0 - \Delta P_i - \Delta P_{lt}$$

Where

P_x kN Prestressing force at a point x away from the anchorage

P_0 kN Prestressing force or initial prestressing force at the anchorage, $x = 0$

ΔP_i kN Instantaneous losses, $\Delta P_i = \Delta P_{i,1} + \Delta P_{i,2} + \Delta P_{i,3}$

$\Delta P_{i,1}$ kN Loss in prestressing force in kN at a distance x away from the active anchorage along the tendon, see Clause 1.6

$\Delta P_{i,2}$ kN Loss in prestressing force due to anchorage slippage, see Clause 1.8

$\Delta P_{i,3}$ kN Loss in prestressing force due to instantaneous deformation of the concrete, see Clause 2.2.3.4.2

ΔP_{lt} kN Long term losses

2.2.3.4.2 Instantaneous deformation of the concrete

During stressing the tendons, the concrete is compressed by the prestressing force. If the tendons in the respective section are not stressed simultaneously, there is a progressive loss of prestressing force, $\Delta P_{i,3}$, due to the concrete being compressed by the subsequently stressing of the tendons.

The elastic deformation of concrete is not specific to the PT system. Further information can be found in the Eurocode 2.

2.2.3.4.3 Long term losses

Long term losses, ΔP_{lt} , are a result of concrete creep and shrinkage, as well as relaxation of the prestressing steel strand.

Long term losses are not specific to the PT system. Further information can be found in Eurocode 2.

2.2.3.5 Reinforcement in the anchorage zone

The anchorages transfer the prestressing force to the structure by means of the trumpets embedded in concrete. The concentrated force at the anchorage causes biaxial or triaxial compression right behind the trumpet and spreading of the force causes transverse tensile stresses further away.

The anchorage zone is reinforced with minimum reinforcement and additional reinforcement as given in Annex 8.

Verification of transfer of prestressing forces to the structural concrete is not required if centre spacing and edge distances of the anchorages as well as grade and dimensions of additional reinforcement, see Annex 8, are met. The forces outside the area of the additional reinforcement are verified and, if necessary, covered with appropriate, in general transversal reinforcement.

If required for a specific project design, the reinforcement given in Annex 8 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.

2.2.3.6 Fatigue resistance

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

2.2.4 Installation

2.2.4.1 General

It is assumed that the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands will be installed according to the manufacturer's instructions or – in absence of such instructions – according to the usual practice of the building professionals.

Assembly and installation of tendons are only carried out by qualified PT specialist companies with the required resources and experience in the use of bonded post-tensioning systems, see ETAG 013, Annex D.1, and 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 MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands.

The tendons are carefully handled during assembly, transport, storage, and installation.

To avoid confusion, it is recommended to use on each site prestressing steel strands with one nominal diameter and one nominal tensile strength only.

Trumpet, anchor head and coupler anchor head are placed perpendicular to the tendon's axis.

Couplers are situated in a straight tendon section only.

At the anchorages and couplers the tendon layout provides a straight section over a length of at least 750 mm beyond the end of the trumpet.

The sequence of work steps for installation of anchorages and couplers is described in Annex 17 to Annex 23.

Before placing the concrete a final check of the installed tendons or sheaths is carried out by the person responsible for tendon placement. In case of minor damage to the sheathing, when replacement does not seem necessary, the damaged area is cleaned and sealed with an adhesive tape.

The respective standards and regulations in force at the place of use are observed.

2.2.4.2 Installation of the trumpet

In general, for each anchorage a recess form is assembled and attached to the external formwork. The recess form provides the exact inclination for the trumpet according to the particular tendon layout. Marks are applied on the recess form for correctly placing the fastening bolts for the trumpet. Preferably a template is used or an equivalently precise method. The recess form also is the shuttering for the final recess, which, after stressing, is filled with concrete for corrosion protection of the anchorage.

Prior to concreting of the structure

- the correct position and the correct inclination of the trumpet is checked.
- the dimensions of the recess form are checked to verify the stressing jack can be placed at the intended position and an appropriate clearance for stressing is available, see Annex 16.
- the tightening of the fastening bolts is checked.
- the front surface of the trumpet is checked for full contact with the formwork. Any gap, which would allow concrete or fines of the concrete to penetrate inside the trumpet, is sealed water tight.
- the correct position of the injection inlet or vent of the trumpets is checked for the highest possible position.

2.2.4.3 Sheathing installation

The internal diameters for standard sheathings are detailed in Annex 10.

The sheathing usually is supplied in 6 m pieces and each piece has a coupler screwed on at one end. These couplers are about 200 mm long.

The sheathings are installed according to the intended tendon layout. For proper installation the following procedure is followed.

- Horizontal reinforcement is installed at the required elevation to place the sheathing on top of it. The radius of the sheathing has to be considered to obtain a correct position of the tendon axis. In general the supporting reinforcement is welded to the reinforcement of the structure. The distance between two consecutive supports is about 3 m.
- Subsequently a second row of horizontal reinforcement is installed between the first row of reinforcement described in the paragraph above. This row will be tied to the general reinforcement of the structure by means of tie wires. After the installation of the second row of reinforcement, the distance between the supports of the sheathing will be about 1 m. The second row of supports can be adjusted easily, if required.

It is important to ensure that the supporting reinforcement will not be displaced during placing and vibrating the structural concrete.

- The recommended diameter for the supporting reinforcement depends on the span and the size of tendon to be installed. However a minimum diameter of 12 mm is recommended for tendons up to 12/0.6" and 20 mm for larger one.

Once the supporting reinforcement is installed, the sheathing is placed and firmly fastened usually with wires. Fastening is sufficiently tight, but carefully observing not to deform the sheathing. After placement, the tendon is checked for a smooth tendon path without any kinks. The maximum local deviation is expected smaller than 1 cm within 1 m length.

Once the sheathing is placed correctly, the joint trumpet to sheathing is sealed with an adhesive tape.

2.2.4.4 Stressing operation

Prestressing requires free space directly behind the anchorages, see Annex 16. 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.

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

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

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

2.2.4.5 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.

2.2.4.6 Grouting

Grout is injected through the inlet holes until it escapes from the outlet tubes with the same consistency. To avoid voids in the hardened grout special measures are applied for long tendons, tendon paths with distinct high points or inclined tendons. All vents and grouting inlets are sealed immediately after grouting.

The standards to be observed for cement grouting of prestressing ducts are EN 445, EN 446, and EN 447. Special grout according to the ETAG 013, Annex C.4.3, may be used as well. Standards and regulations in force at the place of use apply for ready mixed grout.

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

2.2.4.7 Welding

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

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

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the PT system of 100 years, provided that the PT system is subject to appropriate installation, use, and maintenance, see Clause 2.2.

In normal use conditions the real working life may be considerably longer without major degradation affecting the basic requirements for construction works³.

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

³ 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.

Technical Assessment Body, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

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 10 and Table 11. In Annex 25 the combinations of essential characteristics and corresponding intended uses are listed.

Table 10: Essential characteristics and performances of the product

No	Essential characteristic	Product performance
Product MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands		
Intended use The PT system is intended to be used for the prestressing of structures, Clause 2.1, Table 9, line No 1.		
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)	See Clause 3.2.1.5.
6	Practicability, reliability of installation	See Clause 3.2.1.6.
Basic requirement for construction works 2: Safety in case of fire		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 3: Hygiene, health, and the environment		
7	Content, emission, and/or release of dangerous substances	See Clause 3.2.2.
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.	—

electronic copy

No	Essential characteristic	Product performance
Basic requirement for construction works 7: Sustainable use of natural resources		
—	No characteristic assessed.	—
Related aspects of serviceability		
8	Related aspects of serviceability	See Clause 3.2.3.

Table 11: Essential characteristics and performances of the product in addition to Table 10 for optional use category

No	Additional essential characteristic	Product performance
Product MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands Optional use category Clause 2.1, Table 9, line No 2, Tendon for cryogenic applications		
Basic requirement for construction works 1: Mechanical resistance and stability		
9	Resistance to static load under cryogenic conditions	See Clause 3.2.4.1.

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 ETAG 013, Clause 6.1.1-I. The characteristic values of maximum force, F_{pk} , of the tendon for prestressing steel strands according to Annex 24 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 ETAG 013, Clause 6.1.2-I. The characteristic values of maximum force, F_{pk} , of the tendon for prestressing steel strands according to Annex 24 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 ETAG 013, Clause 6.1.3-I. The characteristic values of maximum force, F_{pk} , of the tendon for prestressing steel strands according to Annex 24 are listed in Annex 11.

3.2.1.4 Friction coefficient

The PT system as described in the ETA meets the acceptance criteria of ETAG 013, Clause 6.1.4-I. For friction losses including friction coefficient see Clause 1.6.

3.2.1.5 Deviation, deflection (limits)

The PT system as described in the ETA meets the acceptance criteria of ETAG 013, Clause 6.1.5-I. For minimum radii of curvature see Clause 1.5.

3.2.1.6 Practicability, reliability of installation

The PT system as described in the ETA meets the acceptance criteria of ETAG 013, Clause 6.1.6-I.

3.2.2 Hygiene, health, and the environment

The release of dangerous substances is determined according to ETAG 013, Clause 5.3.1. No dangerous substances is the performance of the PT system in this respect. A manufacturer's declaration to this effect has been submitted.

NOTE In addition to specific clauses relating to dangerous substances in the European Technical Assessment, there may be other requirements applicable to the product falling within their scope, e.g. transposed European legislation and national laws, regulations and administrative provisions. These requirements also need to be complied with, when and where they apply.

3.2.3 Related aspects of serviceability

The PT system as described in the ETA meets the acceptance criteria of ETAG 013, Clause 6.7.

3.2.4 Mechanical resistance and stability

3.2.4.1 Resistance to static load under cryogenic conditions

Resistance to static load under cryogenic conditions has been verified on full tendon specimens including both PT end anchorages subjected to cryogenic conditions. The PT system as described in the ETA meets the acceptance criteria of ETAG 013, Clause 6.1.6-II(c) for cryogenic applications

- with anchorages and couplers outside the possible cryogenic zone and
- with anchorages and couplers inside the possible cryogenic zone.

The characteristic values of maximum force, F_{pk} , of the tendon for prestressing steel strands according to Annex 24 are listed in Annex 11.

3.3 Assessment methods

The assessment of the essential characteristics in Clause 3.1 of the PT system, for the intended uses and in relation to the requirements for mechanical resistance and stability, and for hygiene, health, and the environment in the sense of the basic requirements for construction works № 1 and 3 of Regulation (EU) № 305/2011 has been made in accordance with ETAG 013, Guideline for European technical approvals of "Post-Tensioning Kits for Prestressing of Structures", used according to Article 66 (3) of Regulation (EU) № 305/2011 as European Assessment Document, and is based on the assessment of internal bonded PT systems.

3.4 Identification

The European Technical Assessment for the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands is issued on the basis of agreed data that identify the assessed product⁴. Changes to materials, to composition, or to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches

⁴ The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

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 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 plan⁵.

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

- (i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values, or descriptive documentation of the product;
- (ii) initial inspection of the manufacturing plant and of factory production control;
- (iii) continuing surveillance, assessment, and evaluation of factory production control;
- (iv) audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities.

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

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

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

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer establishes and continuously maintains a factory production control. All procedures and specifications adopted by the manufacturer are documented in a systematic manner. Purpose of factory production control is to ensure the constancy of performances of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands with regard to the essential characteristics.

⁵ 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.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to controls by the manufacturer before acceptance. Check of incoming materials includes control of inspection documents presented by the manufacturer of the raw materials.

Testing within factory production control is in accordance with the prescribed test plan. The results of factory production control are recorded and evaluated. The records are kept at least for ten years after the product has been placed on the market and are presented to the notified product certification body involved in continuous surveillance. On request the records are presented to Österreichisches Institut für Bautechnik.

If test results are unsatisfactory, the manufacturer immediately implements measures to eliminate the defects. Products or components that are not in conformity with the requirements are removed. After elimination of the defects, the respective test – if verification is required for technical reasons – is repeated immediately.

At least once a year the manufacturer audits the manufacturers of the components given in Annex 15.

The basic elements of the prescribed test plan are given in Annex 14, conform to ETAG 013, Annex E.1, and are specified in the quality management plan of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands.

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 Clause 3.1, Table 10 and Table 11. In Annex 25 the combinations of essential characteristics and corresponding intended uses are listed.

5.2 Tasks for the notified product certification body

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

The notified product certification body verifies the ability of the manufacturer for a continuous and orderly manufacturing of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands according to the European Technical Assessment. In particular the following items are appropriately considered.

- Personnel and equipment
- Suitability of the factory production control established by the manufacturer
- Full implementation of the prescribed test plan

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

The notified product certification body visits the factory at least once a year for routine inspection. In particular the following items are appropriately considered.

- Manufacturing process including personnel and equipment
- Factory production control
- Implementation of the prescribed test plan

Each manufacturer of the components given in Annex 15 is audited at least once in five years. It is verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan.

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

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

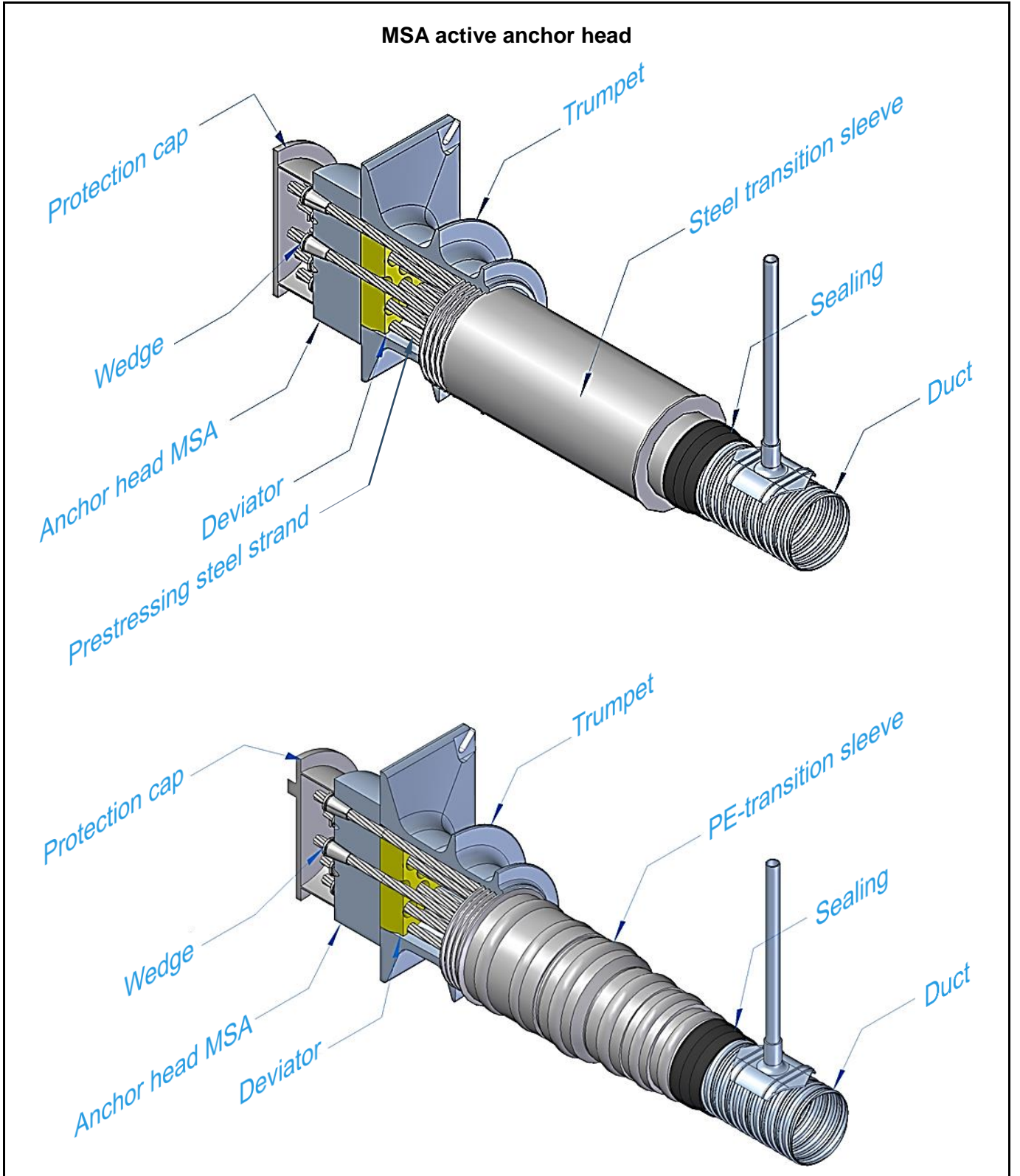
During surveillance inspections the notified product certification body takes samples of components of the MeKano4 PT System M, internal bonded post tensioning system with 4 to 37 strands for independent testing. For the most important components Annex 15 summarises the minimum procedures performed by the notified product certification body.

Issued in Vienna on 18 August 2017
by Österreichisches Institut für Bautechnik

The original document is signed by

Rainer Mikulits
Managing Director

electronic copy
electronic copy
electronic copy
electronic copy
electronic copy
electronic copy
electronic copy



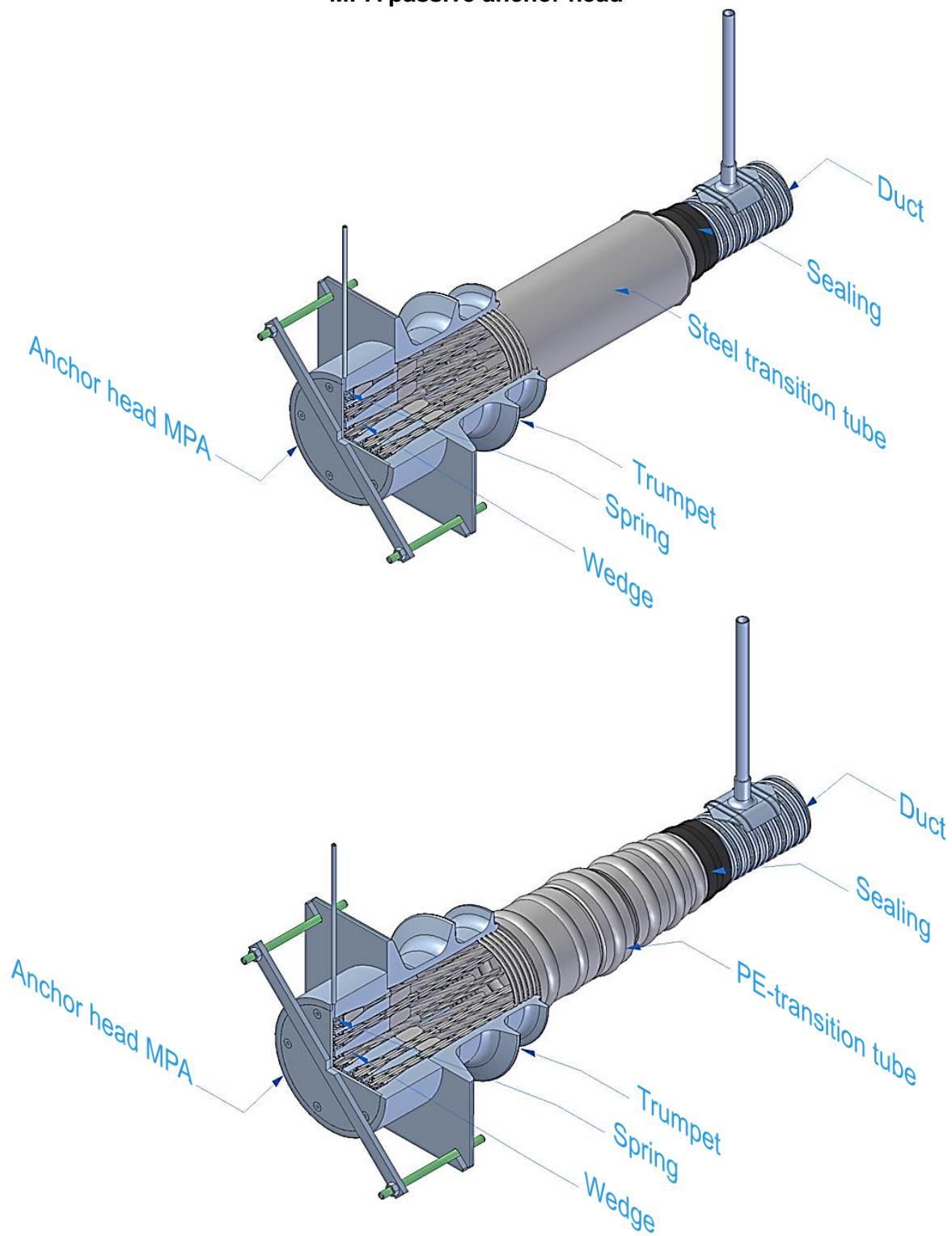
MK4

MeKano4 PT System M
Anchorage
Active anchorage – Overview

Annex 1
Page 1 of 2
of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy

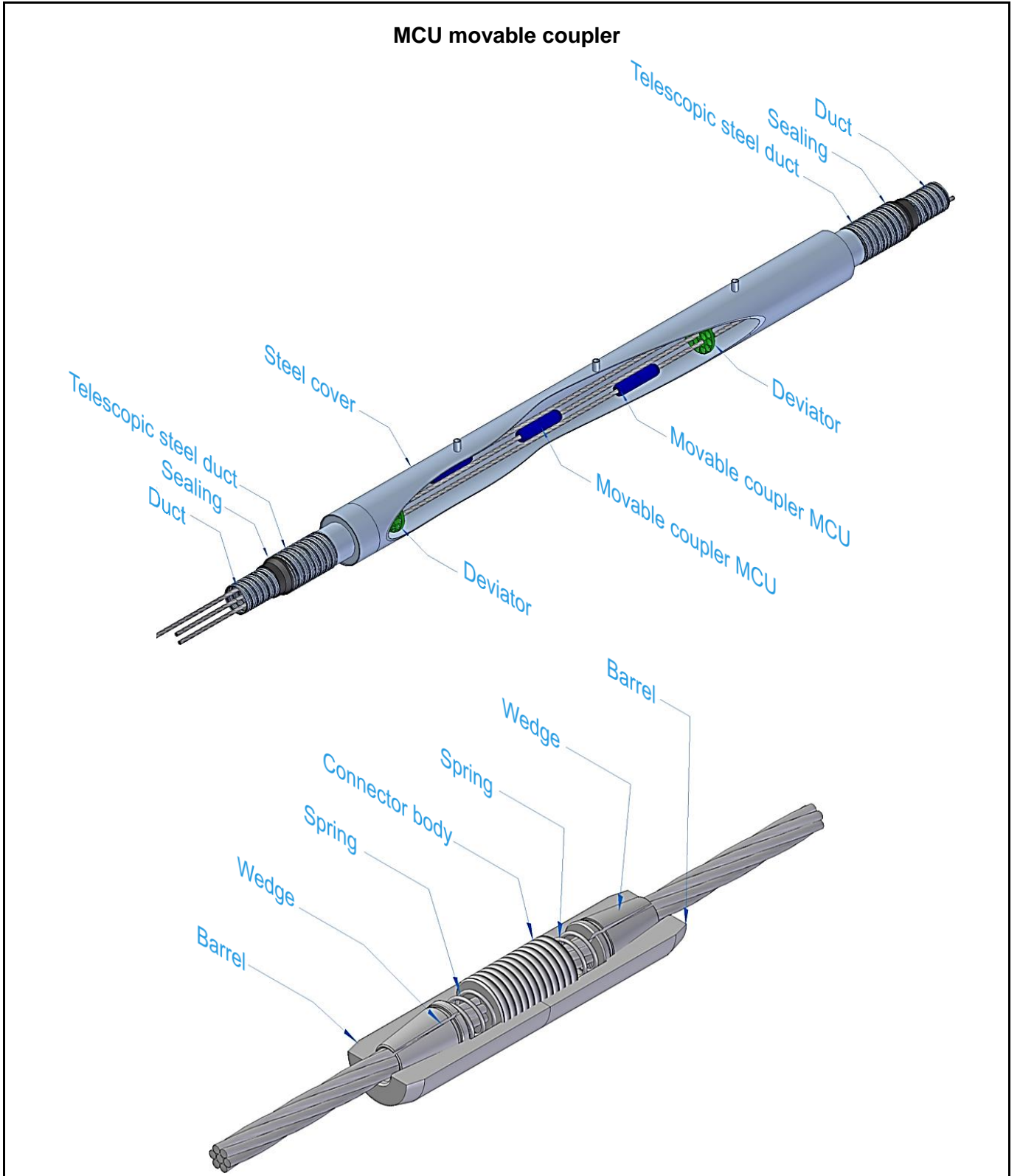
MPA passive anchor head



MK4

MeKano4 PT System M
Anchorage
Passive anchorage – Overview

Annex 1
Page 2 of 2
of European Technical Assessment
ETA-12/0310 of 18.08.2017

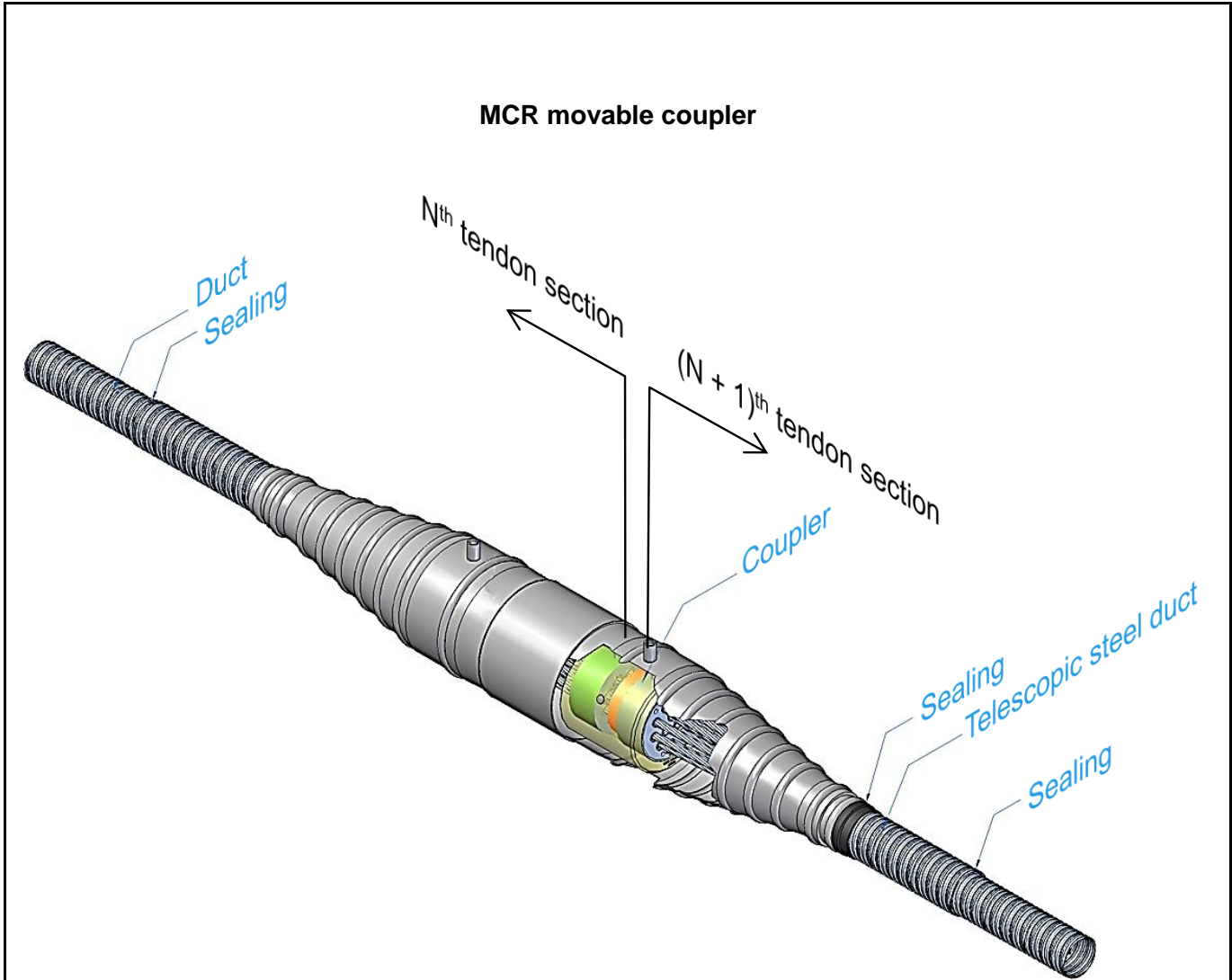


MK4


MeKano4 PT System M
Coupler
MCU movable coupler – Overview

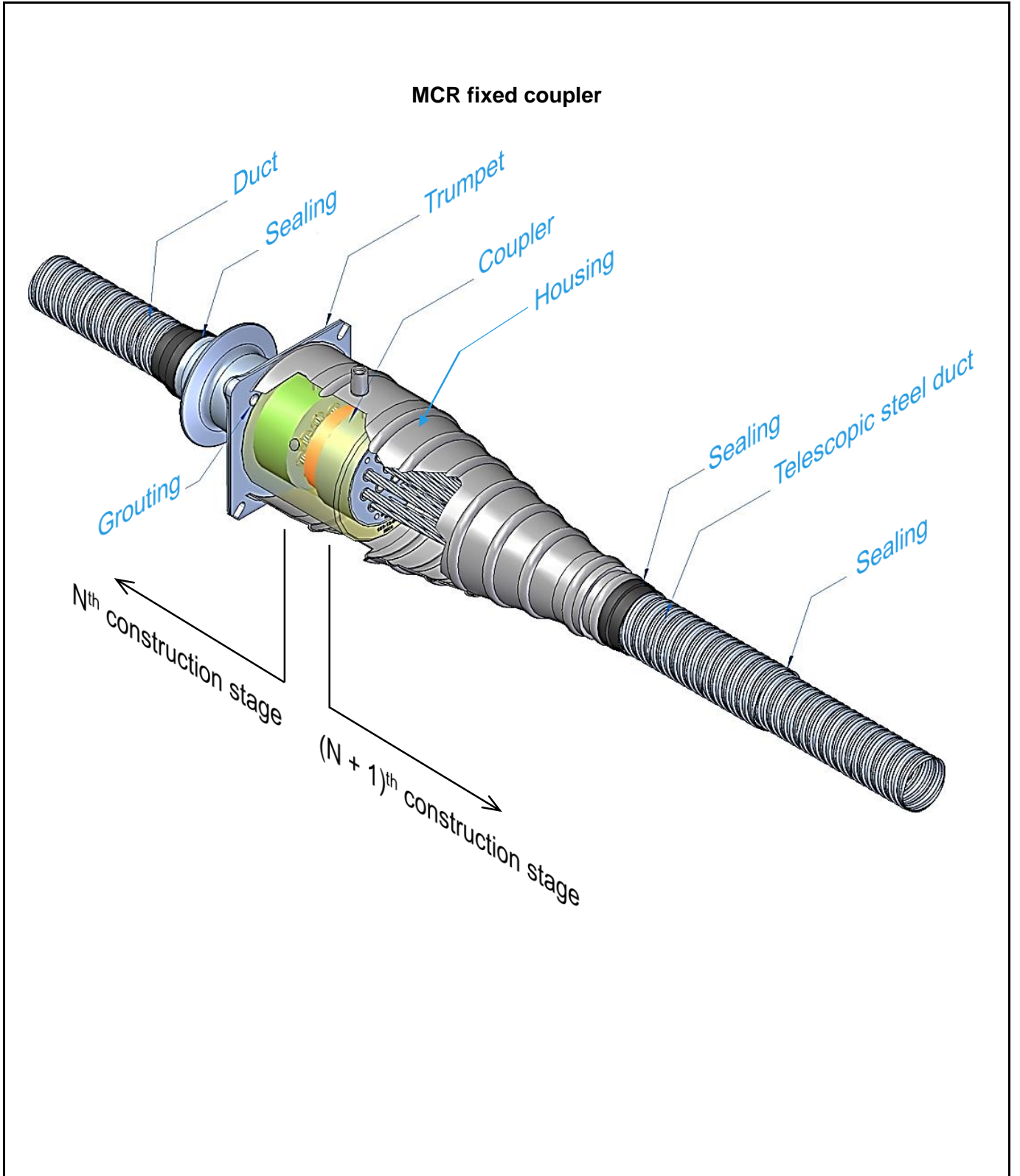
Annex 2
Page 1 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy



For coupler anchor head of the N^{th} construction stage pre-setting of wedges is required. Wedges may be secured by means of a flat retaining plate.

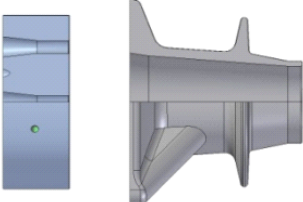
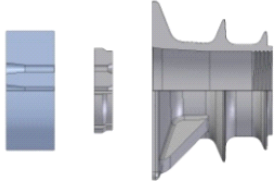
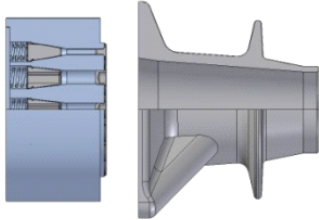
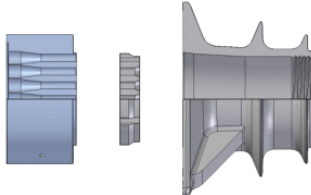
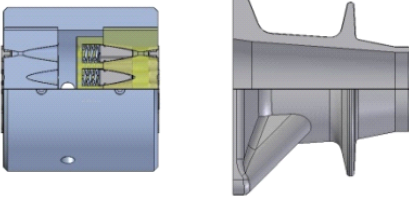

	<p align="center">MeKano4 PT System M</p> <p align="center">Coupler MCR movable coupler – Overview</p>	<p align="right">Annex 2 Page 2 of 4</p> <p align="right">of European Technical Assessment ETA-12/0310 of 18.08.2017</p>
---	--	--



MK4

MeKano4 PT System M
Coupler
MCR fixed coupler – Overview

Annex 2
Page 3 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Anchorage or coupler	Schematic representation	Tendon
Active MSA		4/0.6" 5/0.6" 7/0.6" 9/0.6" 12/0.6" 15/0.6" 19/0.6"
		24/0.6" 27/0.6" 31/0.6" 37/0.6"
Passive MPA		4/0.6" 5/0.6" 7/0.6" 9/0.6" 12/0.6" 15/0.6" 19/0.6"
		24/0.6" 27/0.6" 31/0.6" 37/0.6"
Coupler MCR		4/0.6" 5/0.6" 7/0.6" 9/0.6" 12/0.6"
Coupler MCU		$n \times 1/0.6''$



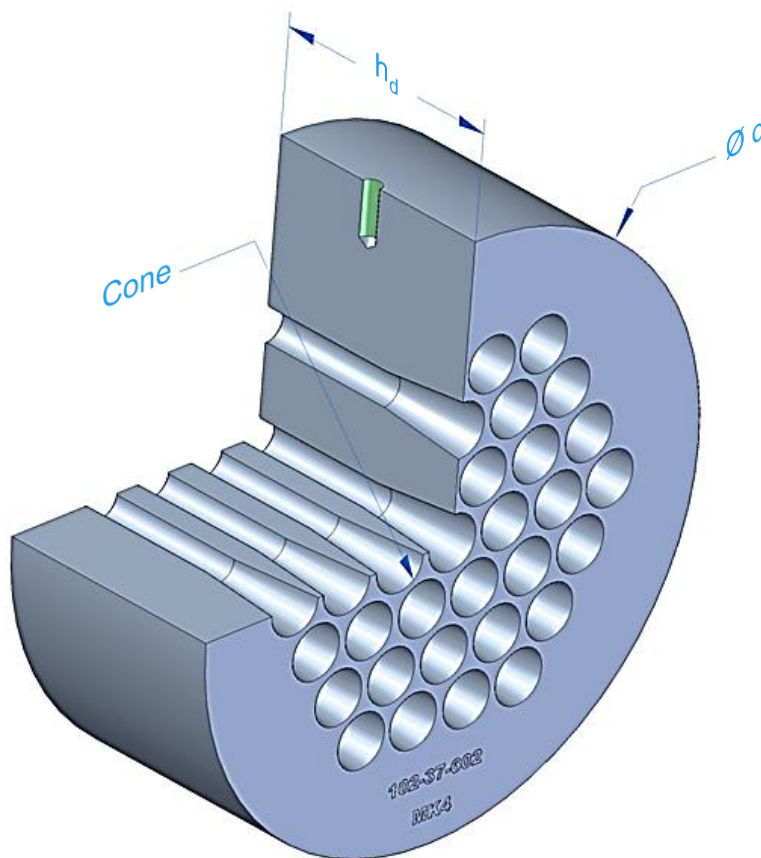
MeKano4 PT System M
 Anchorage and coupler – Overview

Annex 3
Page 1 of 1
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

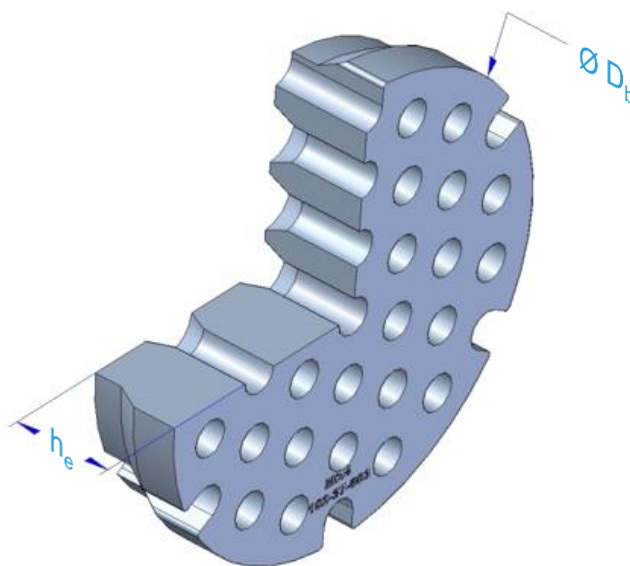
electronic copy

electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy

MSA active anchor head



PE deviator



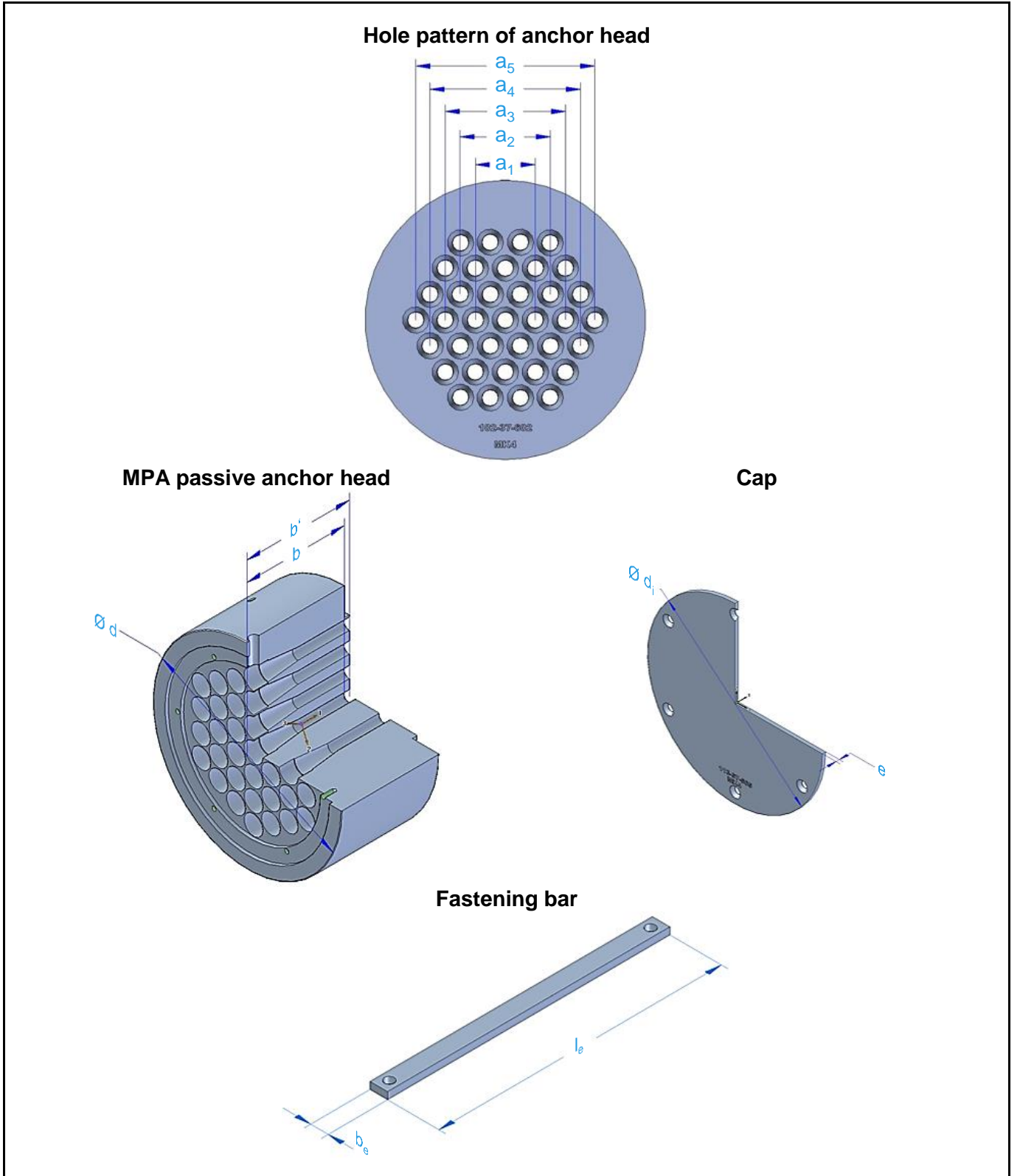
MK4

MeKano4 PT System M
 Anchorage – Components

Annex 4
Page 1 of 3

of European Technical Assessment
ETA-12/0310 of 18.08.2017

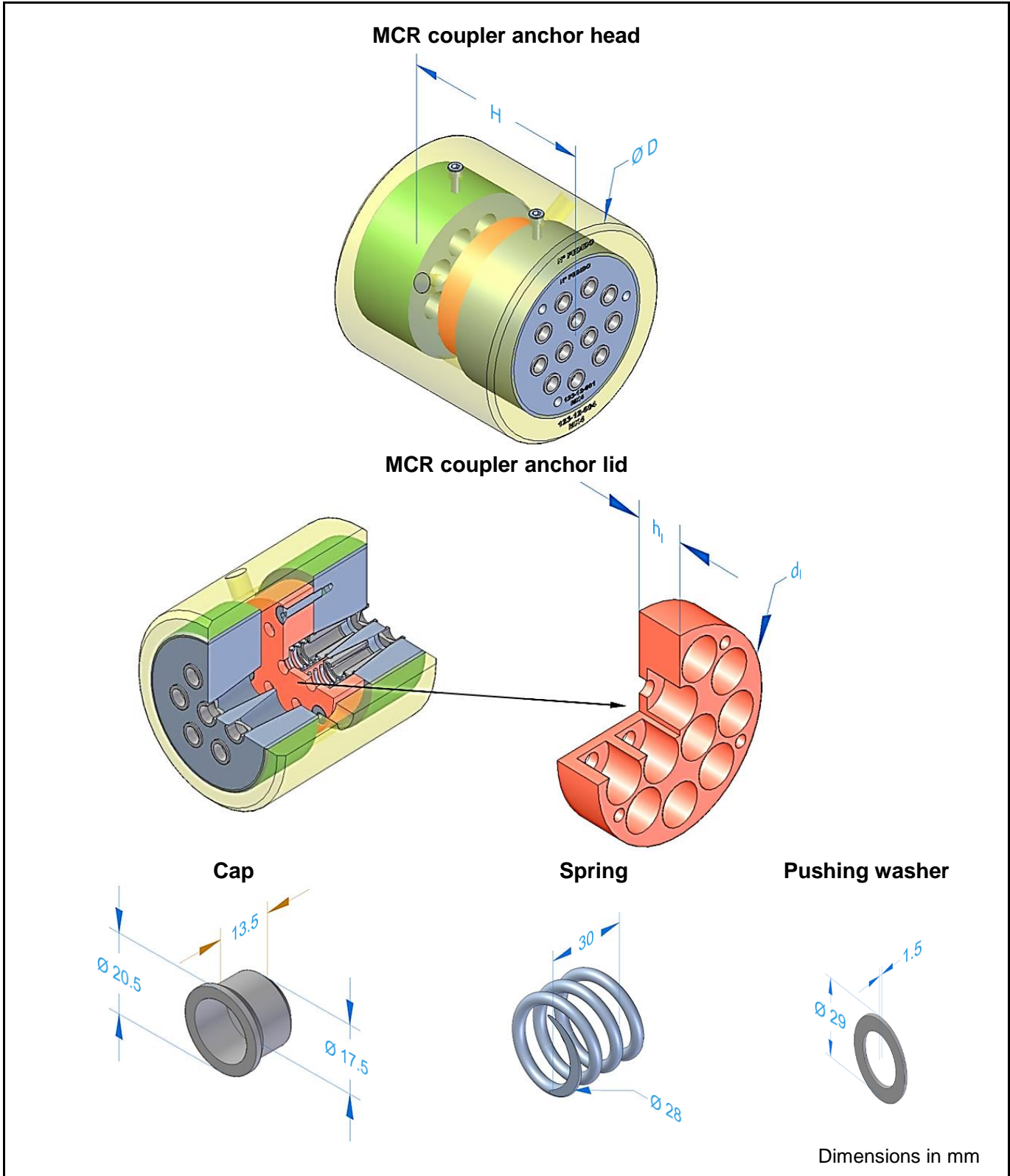
electronic copy



MeKano4 PT System M
 Anchorage – Components

Annex 4
 Page 2 of 3
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

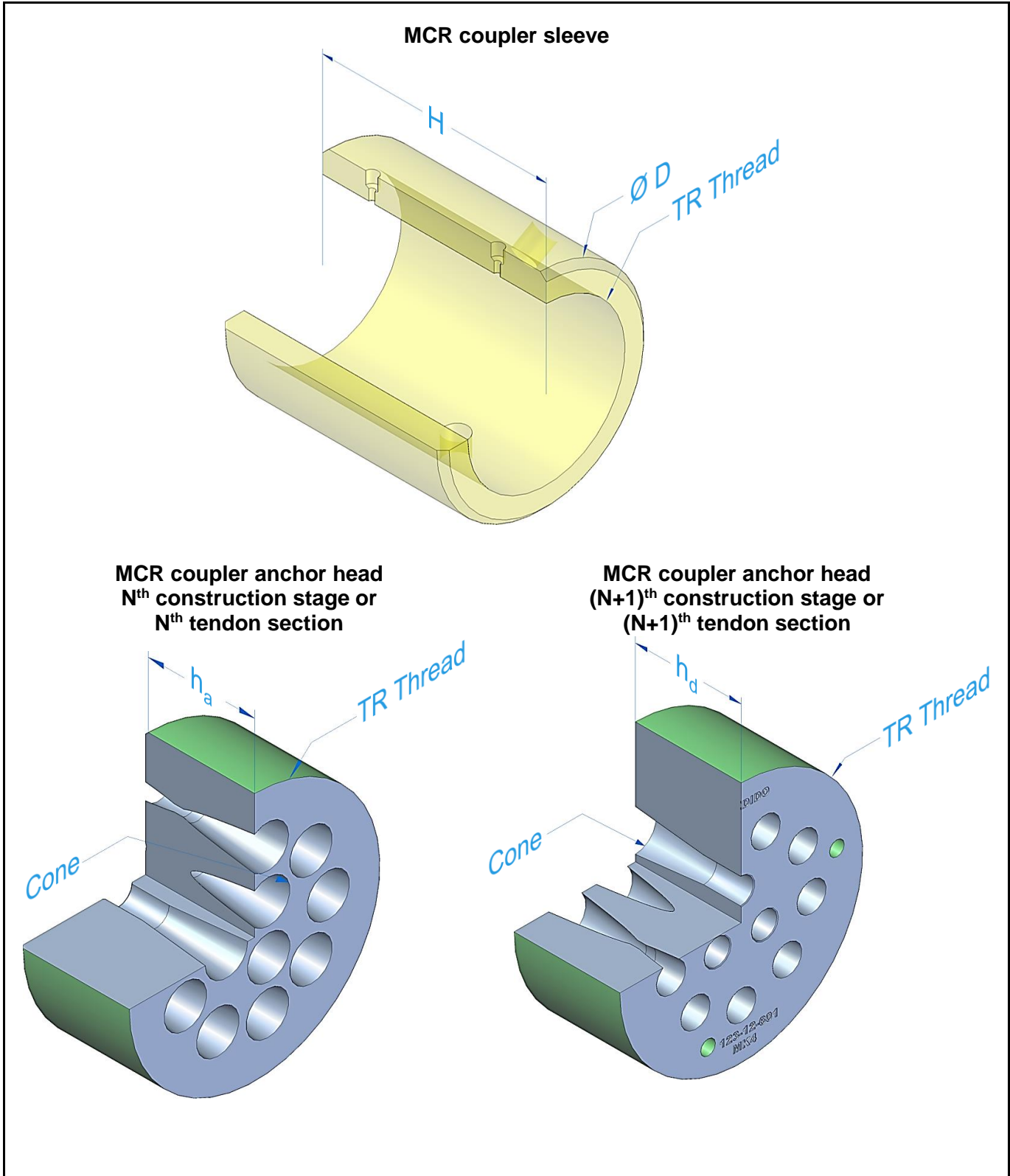
electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy




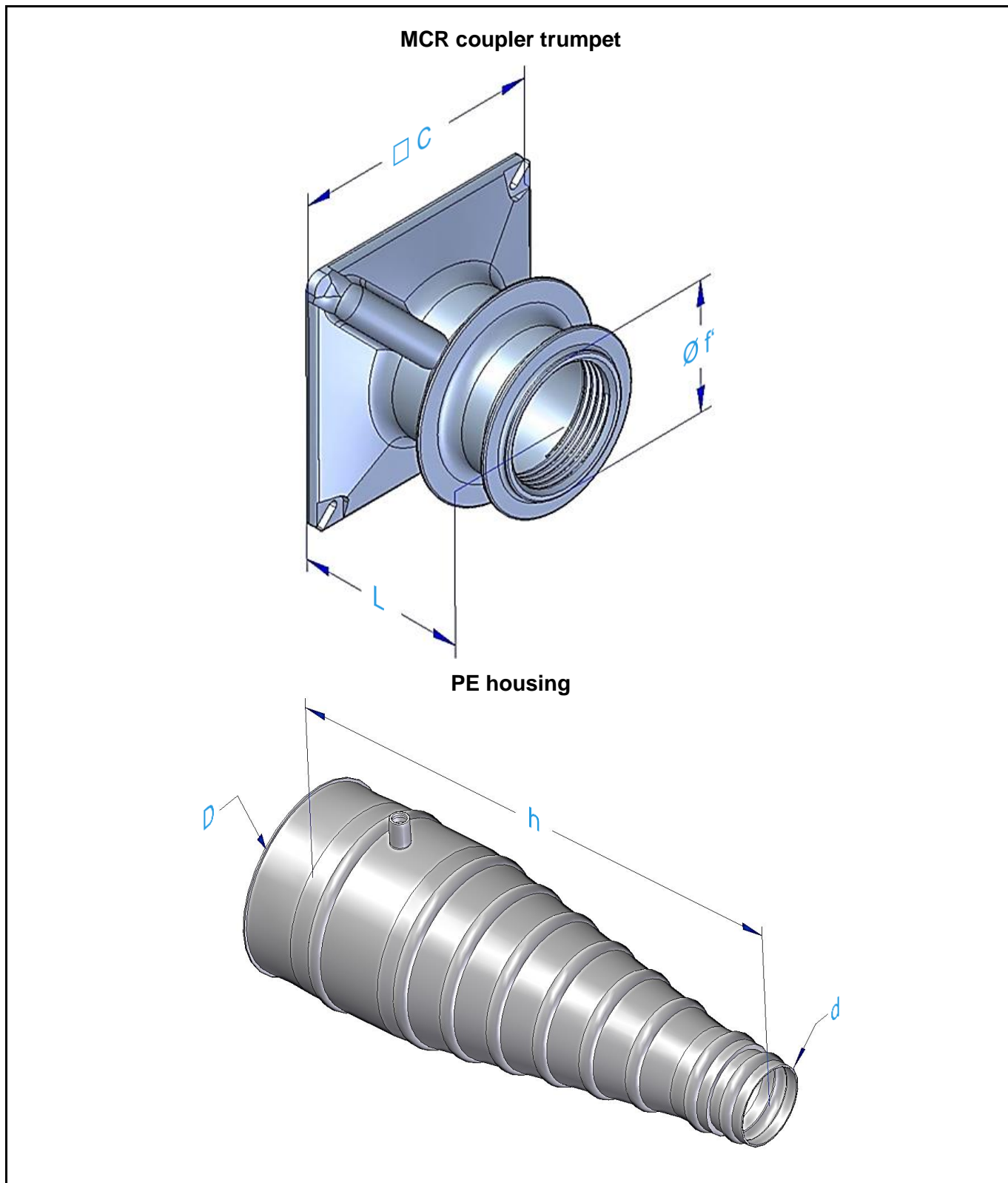
MeKano4 PT System M
 MCR coupler – Components

Annex 5
 Page 1 of 4
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy electronic copy



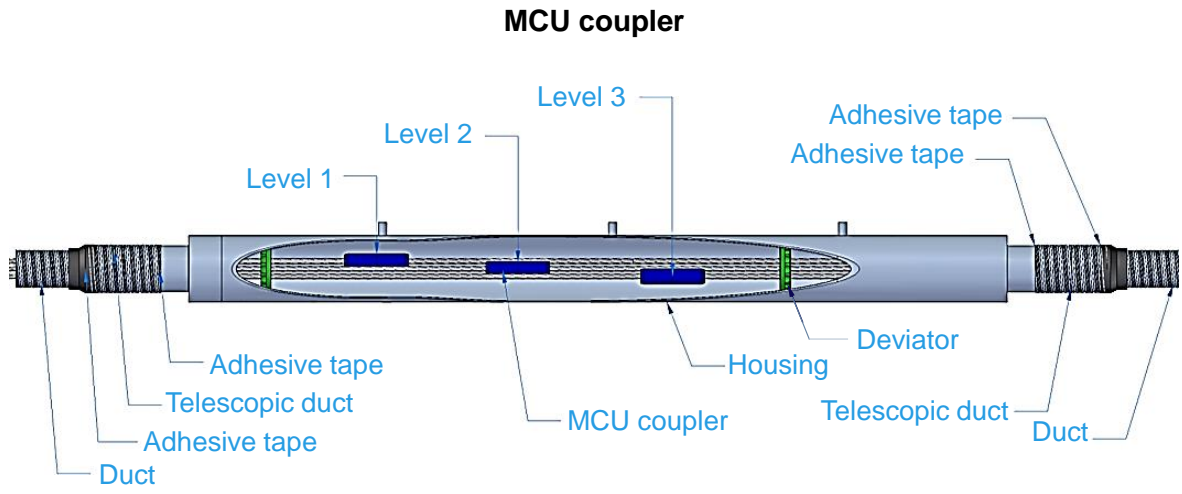
	<p align="center">MeKano4 PT System M MCR coupler – Components</p>	<p align="right">Annex 5 Page 2 of 4</p> <p align="right">of European Technical Assessment ETA-12/0310 of 18.08.2017</p>
---	--	--



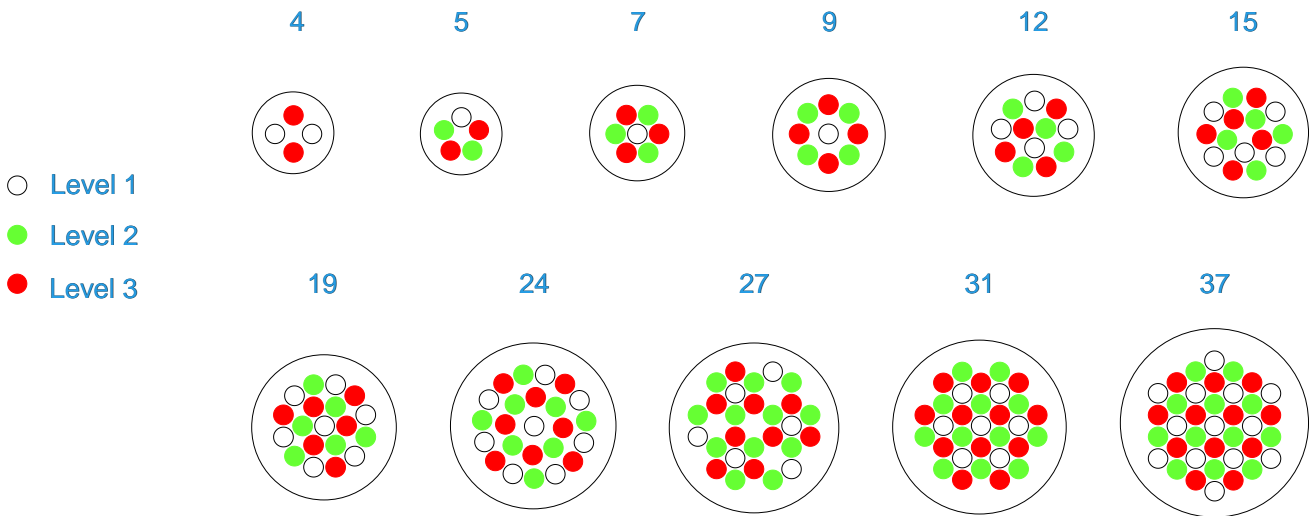
MK4

MeKano4 PT System M
MCR coupler – Components

Annex 5
Page 3 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017



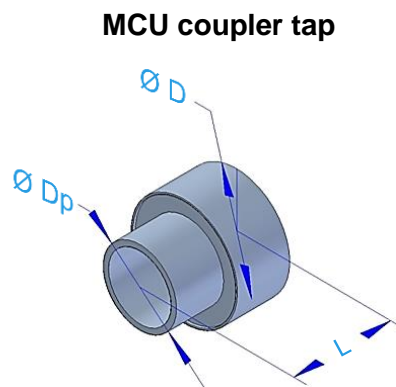
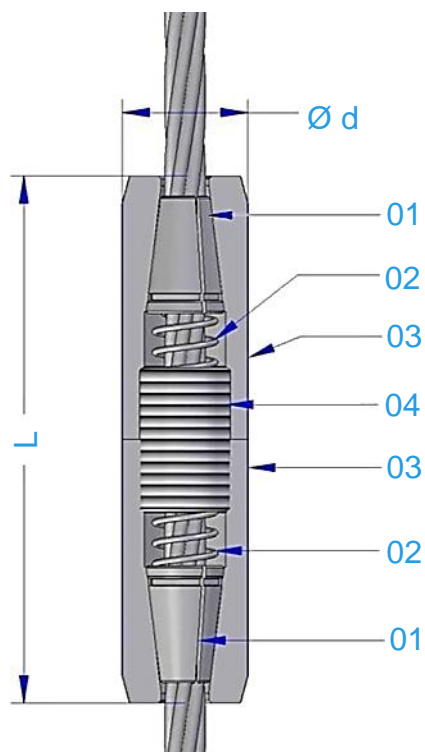
Arrangement of individual MCU couplers



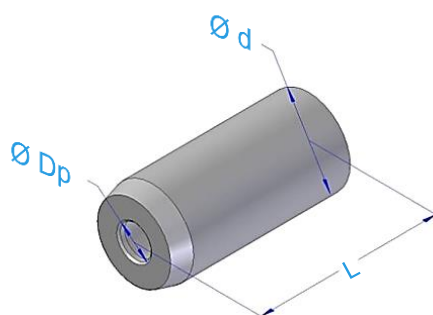
MK4

MeKano4 PT System M
 MCU coupler – Components

Annex 6
 Page 1 of 2
 of European Technical Assessment
ETA-12/0310 of 18.08.2017



Barrel



Connector body

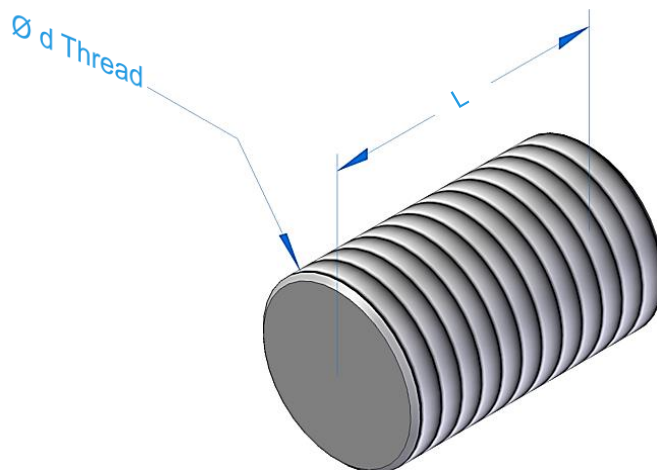


Table 12: MCU coupler – Dimensions

Key	Component	L	Ø d
04	Connector Body	53	M33 x 3
03	Barrel for Coupler	97	46
02	Spring	—	—
01	MK4 Wedge WH6	—	—
—	MCU Coupler, 2 Barrels	194	46

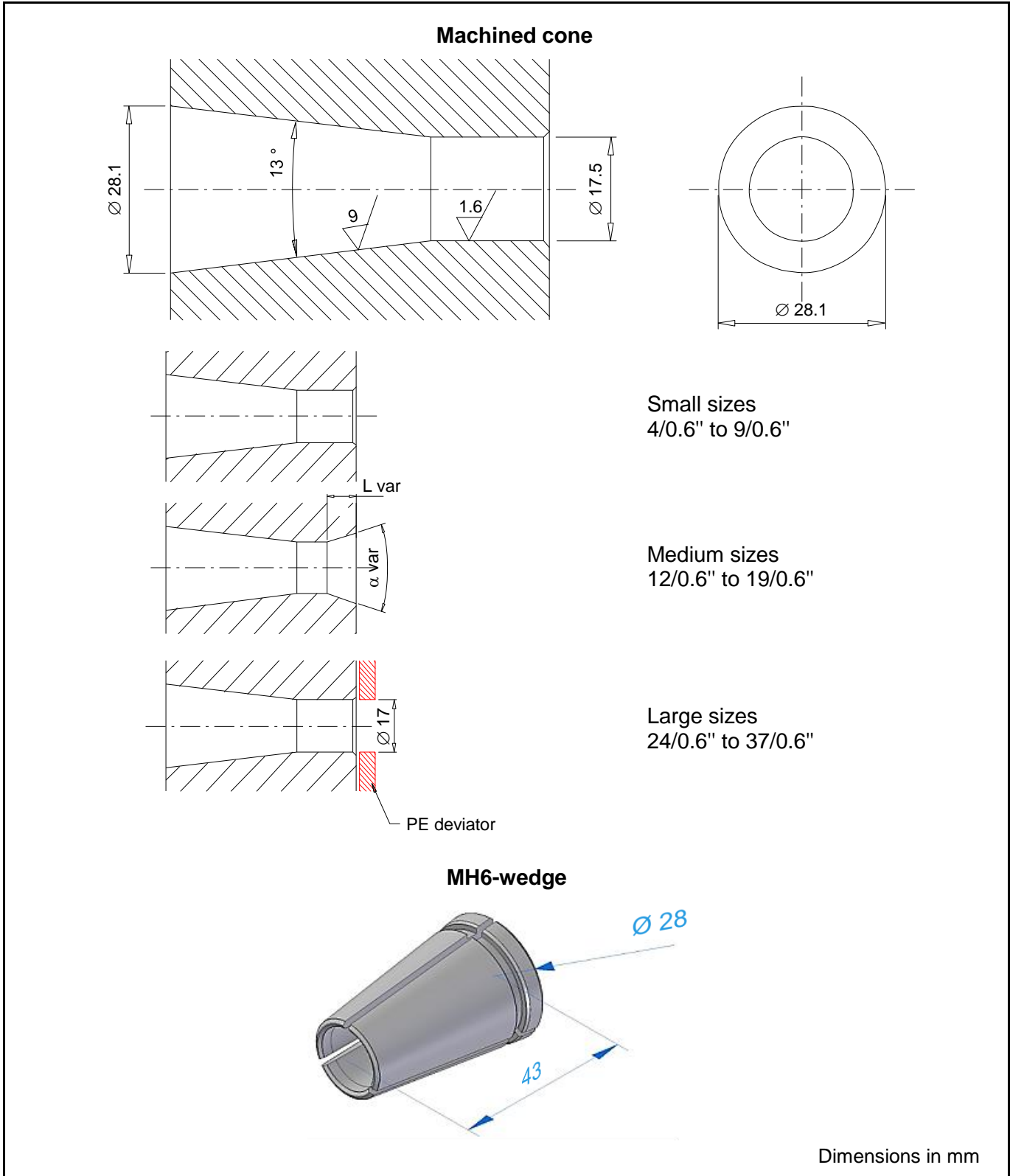
MK4

MeKano4 PT System M
 MCU coupler – Components

Annex 6
 Page 2 of 2

of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy



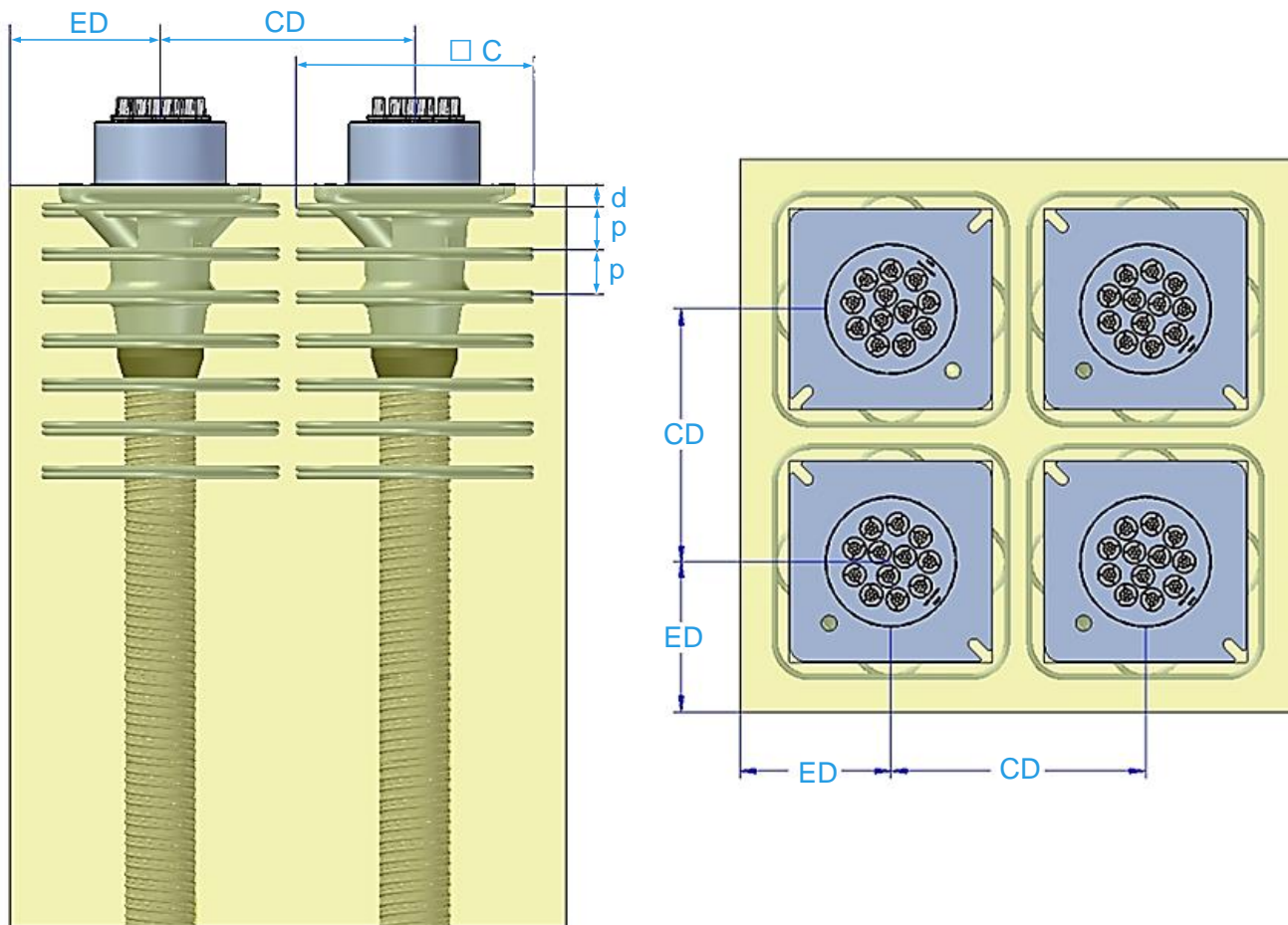
MeKano4 PT System M

Anchorage and coupler
Cone geometry, wedge

Annex 7
Page 1 of 1

of European Technical Assessment
ETA-12/0310 of 18.08.2017

Anchorage and coupler










MK4

MeKano4 PT System M
Anchorage and coupler
Centre spacing, edge distance
Additional reinforcement

Annex 8
Page 1 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 13: Anchorage – Minimum concrete strength, additional reinforcement, details on dimensions

Tendon		4/0.6"	5/0.6"	7/0.6"	9/0.6"	12/0.6"	15/0.6"	19/0.6"							
Number of strands	n	4	5	7	9	12	15	19							
Anchorage															
Strand arrangement															
Trumpet	□ C	170	170	194	220	254	282	320							
	∅ f	81	81	95	108	121	135	144							
	∅ f'	59	59	71	82	94	99	114							
	L	155	155	150	175	200	235	275							
MSA anchor head	∅ d	110	110	130	144	165	186	200							
	h _d	50	50	61	60	72	78	94							
MPA anchor head	b'	88	88	99	85	90	115	127							
	b	83	83	94	81	85	111	123							
Minimum concrete strength at time of stressing, cylinder															
Minimum concrete strength in MPa	f _{cm,0}	25	45	25	45	25	45	25	45	25	45	25	45	25	45
Centre spacing and edge distance															
Centre spacing	CD	245	185	270	205	320	245	365	275	420	320	470	355	530	400
Edge distance ¹⁾	ED	145	115	155	125	180	145	205	160	230	180	255	200	285	220
Additional reinforcement – Pairs of stirrups – Ribbed reinforcing steel, R _e ≥ 500 MPa															
Number of pairs		4	3	4	3	5	4	7	5	8	7	10	9	9	5
Diameter	∅	16	8	16	8	16	8	16	8	16	8	16	8	16	12
Outer dimensions	□ C	225	165	250	185	300	225	345	255	400	300	450	335	510	380
Distance from concrete edge	d	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Spacing	p	74	81	74	81	61	66	54	57	50	50	47	49	64	86

Dimensions in mm





¹⁾ Values of edge distance are based on a concrete cover of 30 mm. For different concrete covers the edge distance is calculated to
ED = CD / 2 + concrete cover – 10 mm

MK4

MeKano4 PT System M
Anchorage
Minimum concrete strength,
additional reinforcement,
details on dimensions

Annex 8
Page 2 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 14: Anchorage – Minimum concrete strength, additional reinforcement, details on dimensions

Tendon		24/0.6"	27/0.6"	31/0.6"	37/0.6"				
Number of strands	n	24	27	31	37				
Anchorage									
Strand arrangement									
Trumpet	□ C	356	395	395	444				
	∅ f	177	186	186	215				
	∅ T ¹⁾	119	134	134	141				
	L	240	275	275	300				
	L' ¹⁾	400	445	445	465				
MSA anchor head	∅ d	240	252	268	296				
	h _d	90	105	110	120				
MPA anchor head	b'	128	143	143	161				
	b	123	138	138	153				
PE deviator	∅ D _b	172	189	189	210				
	h _e	45	45	45	45				
Minimum concrete strength at time of stressing, cylinder									
Minimum concrete strength in MPa	f _{cm, 0}	25	45	25	45	25	45	25	45
Centre spacing and edge distance									
Centre spacing	CD	600	485	640	510	680	545	745	600
Edge distance ²⁾	ED	320	265	340	275	360	295	395	320
Additional reinforcement – Pairs of stirrups – Ribbed reinforcing steel, R _e ≥ 500 MPa									
Number of pairs	n	11	9	8	8	10	8	10	8
Diameter	∅	16	12	20	14	20	16	20	16
Outer dimensions	□ C	580	465	620	490	660	525	725	580
Distance from concrete edge	d	20	20	20	20	20	20	20	20
Spacing	p	55	75	75	85	70	100	80	100

1) Dimensions at transition sleeve

Dimensions in mm






2) Values of edge distance are based on a concrete cover of 30 mm. For different concrete covers the edge distance is calculated to ED = CD / 2 + concrete cover – 10 mm

MK4

MeKano4 PT System M
Anchorage
Minimum concrete strength,
additional reinforcement,
details on dimensions

Annex 8
Page 3 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 15: MCR Coupler – Minimum concrete strength, additional reinforcement, details on dimensions

Tendon		4/0.6"	5/0.6"	7/0.6"	9/0.6"	12/0.6"					
Number of strands	n	4	5	7	9	12					
Coupler sleeve and anchor head											
Strand arrangement											
Coupler sleeve	H	160	160	182	185	204					
	∅ D	127	139.7	168.3	193.7	219					
	TR	100 × 8	115 × 8	135 × 8	150 × 8	165 × 10					
Coupler anchor head N th	h _a	50	50	61	60	72					
	TR	100 × 8	115 × 8	135 × 8	150 × 8	165 × 10					
Coupler anchor head (N+1) th	h _d	50	50	61	60	72					
	TR	100 × 8	115 × 8	135 × 8	150 × 8	165 × 10					
Anchor lid	d _l	90	96	116	131	140					
	h _l	35	35	35	35	35					
Minimum concrete strength at time of stressing, cylinder											
Minimum concrete strength in MPa	f _{cm, 0}	25	45	25	45	25	45	25	45	25	45
Centre spacing and edge distance											
Minimum centre spacing	CD	245	185	270	205	320	245	365	275	420	320
Minimum edge distance	ED	ED = CD / 2 + concrete cover – 10									
Additional reinforcement – Pairs of stirrups – Ribbed reinforcing steel, R _e ≥ 500 MPa											
Number of pairs	n	4	3	4	3	5	4	7	5	8	7
Diameter	∅	16	8	16	8	16	8	16	8	16	8
Outer dimensions	□ C	225	165	250	185	300	225	345	255	400	300
Distance from concrete edge	d	20	20	20	20	20	20	20	20	20	20
Spacing	p	74	81	74	81	61	66	54	57	50	50












Dimensions in mm

MK4

MeKano4 PT System M
MCR coupler
Minimum concrete strength,
additional reinforcement,
details on dimensions

Annex 8
Page 4 of 4
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 16: Anchorage – Anchor head, details on dimensions

Tendon		4/0.6"	5/0.6"	7/0.6"	9/0.6"	12/0.6"	15/0.6"	19/0.6"	24/0.6"	27/0.6"	31/0.6"	37/0.6"
Number of strands		4	5	7	9	12	15	19	24	27	31	37
Strand arrangement												
PE deviator	h_e	—	—	—	—	—	—	—	45	45	45	45
Hole pattern	a_1	54	58	63	83	37	54	63	84	63	63	63
	a_2	—	—	—	—	97	112	122	152	110	110	110
	a_3	—	—	—	—	—	—	—	—	127	127	127
	a_4	—	—	—	—	—	—	—	—	168	168	168
	a_5	—	—	—	—	—	—	—	—	—	—	189

Dimensions in mm

MK4

MeKano4 PT System M

Anchorage and coupler
 Details on dimensions

Annex 9

Page 1 of 1

of European Technical Assessment
ETA-12/0310 of 18.08.2017

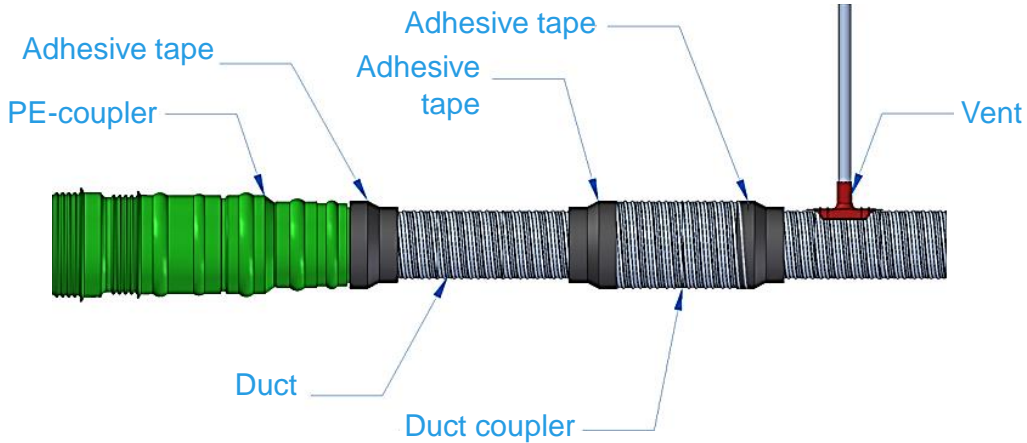


Table 17: Dimensions of ducts – Minimum radii of curvature

Tendon	4/0.6"	5/0.6"	7/0.6"	9/0.6"	12/0.6"	15/0.6"	19/0.6"	24/0.6"	27/0.6"	31/0.6"	37/0.6"
Number of strands	4	5	7	9	12	15	19	24	27	31	37
Duct $\varnothing_{\text{internal}}$ (in mm)	51	51	62	70	85	90	100	110	120	120	130
Duct $\varnothing_{\text{external}}$ (in mm)	56	56	67	79	94	99	109	119	129	129	139
Minimum radius of curvature (in m) for $p_{R, \text{max}}$	140 ¹⁾ 200 ¹⁾	3.6 3.1	4.5 3.6	5.2 4.1	5.9 4.5	6.5 5.3	7.6 6.1	8.7 7.0	10.0 7.2	10.3 8.3	11.8 9.1

- 1) The minimum radii of curvature, R_{min} , given in Table 17 correspond to
- a prestressing force of the tendon of $F_{\text{pm}, 0} = 0.85 \cdot n \cdot F_{\text{p}0.1}$
 - a nominal diameter of the prestressing steel strand Y1860S7 of $d = 15.7 \text{ mm}$
 - a pressure under the prestressing steel strands of $p_{R, \text{max}} = 140 \text{ kN/m}$ or 200 kN/m
 - a concrete compressive strength of $f_{\text{cm}, 0, \text{cyl}} = 25 \text{ MPa}$.

In case of different tendon parameters or a different pressure under the prestressing steel strands, the calculation of the minimum radius of curvature of the tendon can be carried out with the equation

$$R_{\text{min}} = \max \left\{ \begin{array}{l} \frac{2 \cdot F_{\text{pm}, 0} \cdot d}{d_i \cdot p_{R, \text{max}}} \\ \text{and} \\ \frac{400 \cdot d}{3000} \end{array} \right. \geq 2.0 \text{ m}$$

Where R_{min} m minimum radius of curvature
 $F_{\text{pm}, 0}$ kN prestressing force of the tendon
 $F_{\text{p}0.1}$ kN Characteristic force at 0.1 % proof force of prestressing steel strand, see Annex 24
 d m nominal diameter of the prestressing steel strand
 d_i m inner duct diameter
 $p_{R, \text{max}}$ kN/m pressure under the prestressing steel strands
 n — Number of prestressing steel strands



MeKano4 PT System M
 Duct – Dimensions,
 minimum radius of curvature

Annex 10
Page 1 of 1
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 18: Tendons n/0.6" – 140

Tendon				Characteristic tensile strength	
Designation	Number of strands	Nominal cross-sectional area	Nominal mass of prestressing steel	1 770 MPa	1 860 MPa
				Characteristic value of maximum tendon force	
—	n	A _p	M	F _{pk}	F _{pk}
—	—	mm ²	kg / m	kN	kN
small					
4/0.6" – 140	4	560	4.37	992	1 040
5/0.6" – 140	5	700	5.47	1 240	1 300
7/0.6" – 140	7	980	7.65	1 736	1 820
9/0.6" – 140	9	1 260	9.84	2 232	2 340
medium					
12/0.6" – 140	12	1 680	13.12	2 976	3 120
15/0.6" – 140	15	2 100	16.40	3 720	3 900
19/0.6" – 140	19	2 660	20.77	4 712	4 940
large					
24/0.6" – 140	24	3 360	26.23	5 952	6 240
27/0.6" – 140	27	3 780	29.51	6 696	7 020
31/0.6" – 140	31	4 340	33.88	7 688	8 060
37/0.6" – 140	37	5 180	40.44	9 176	9 620



MeKano4 PT System M
 Tendon range – n/0.6" – 140

Annex 11
Page 1 of 2
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 19: Tendons n/0.6" – 150

Tendon				Characteristic tensile strength	
Designation	Number of strands	Nominal cross-sectional area	Nominal mass of prestressing steel	1 770 MPa	1 860 MPa
				Characteristic value of maximum tendon force	
—	n	A _p	M	F _{pk}	F _{pk}
—	—	mm ²	kg / m	kN	kN
small					
4/0.6" – 150	4	600	4.69	1 064	1 116
5/0.6" – 150	5	750	5.86	1 330	1 395
7/0.6" – 150	7	1 050	8.20	1 862	1 953
9/0.6" – 150	9	1 350	10.55	2 394	2 511
medium					
12/0.6" – 150	12	1 800	14.06	3 192	3 348
15/0.6" – 150	15	2 250	17.58	3 990	4 185
19/0.6" – 150	19	2 850	22.27	5 054	5 301
large					
24/0.6" – 150	24	3 600	28.13	6 384	6 696
27/0.6" – 150	27	4 050	31.64	7 182	7 533
31/0.6" – 150	31	4 650	36.33	8 246	8 649
37/0.6" – 150	37	5 550	43.36	9 842	10 323



MeKano4 PT System M
 Tendon range – n/0.6" – 150

Annex 11
Page 2 of 2
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 20: Maximum prestressing and overstressing forces of a single prestressing steel strand

Nominal diameter	Nominal cross-sectional area	Characteristic value of maximum force	Force at 0.1 % proof stress	Maximum prestressing force ¹⁾	Maximum overstressing force ^{1), 2)}
d	A _p	F _{pk}	F _{p0.1}	0.9 · F _{p0.1}	0.95 · F _{p0.1}
mm	mm ²	kN	kN	kN	kN
Characteristic tensile strength f _{pk} = 1 770 MPa					
15.3	140	248	213	192	202
Characteristic tensile strength f _{pk} = 1 860 MPa					
15.3	140	260	224	202	213
Characteristic tensile strength f _{pk} = 1 770 MPa					
15.7	150	266	228	205	217
Characteristic tensile strength f _{pk} = 1 860 MPa					
15.7	150	279	240	216	228

1) The maximum prestressing and overstressing forces are maximum values according to Eurocode 2, i.e. $\min(k_1 \cdot f_{pk}, k_2 \cdot f_{p0.1})$ applies, and prEN 10138-3:2000. The fulfilment of the stabilisation criteria and the requirements for crack widths in the load transfer tests were verified at $0.8 \cdot F_{pk}$.

For prestressing steel strands according to prEN 10138-3:2009 the maximum prestressing and overstressing forces can be multiplied by the factor 1.025.

However, maximum prestressing and overstressing forces according to the standards and regulations in force at the place of use shall be observed.

2) Overstressing up to the maximum overstressing forces is permitted if the force in the prestressing jack can be measured to an accuracy of $\pm 5\%$ of the final value of the prestressing force.



MeKano4 PT System M
 Maximum prestressing and overstressing forces of a single prestressing steel strand

Annex 12
Page 1 of 5
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 21: Maximum prestressing and overstressing forces of a tendon with prestressing steel strands of 140 mm² nominal cross-sectional area and 1 770 MPa characteristic tensile strength

Designation of tendon	Number of strands	Nominal cross-sectional area of tendon	Characteristic value of maximum tendon force	Maximum prestressing force of tendon ¹⁾	Maximum overstressing force of tendon ^{1), 2)}
—	n	A _p	F _{pk}	0.9 · F _{p0.1}	0.95 · F _{p0.1}
	—	mm ²	kN	kN	kN
Nominal cross-sectional area of a single prestressing steel strand A _p = 140 mm² Characteristic tensile strength f _{pk} = 1 770 MPa					
4/0.6" – 140	4	560	992	767	809
5/0.6" – 140	5	700	1 240	959	1 012
7/0.6" – 140	7	980	1 736	1 342	1 416
9/0.6" – 140	9	1 260	2 232	1 725	1 821
12/0.6" – 140	12	1 680	2 976	2 300	2 428
15/0.6" – 140	15	2 100	3 720	2 876	3 035
19/0.6" – 140	19	2 660	4 712	3 642	3 845
24/0.6" – 140	24	3 360	5 952	4 601	4 856
27/0.6" – 140	27	3 780	6 696	5 176	5 463
31/0.6" – 140	31	4 340	7 688	5 943	6 273
37/0.6" – 140	37	5 180	9 176	7 093	7 487

NOTE For footnotes ¹⁾ and ²⁾ see Annex 12, Page 1



MeKano4 PT System M
 Tendon n/0.6" – 140 – 1770
 Maximum prestressing and overstressing forces

Annex 12
Page 2 of 5
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy

Table 22: Maximum prestressing and overstressing forces of a tendon with prestressing steel strands of 140 mm² nominal cross-sectional area and 1 860 MPa characteristic tensile strength

Designation of tendon	Number of strands	Nominal cross-sectional area of tendon	Characteristic value of maximum tendon force	Maximum prestressing force of tendon ¹⁾	Maximum overstressing force of tendon ^{1), 2)}
—	n	A _p	F _{pk}	0.9 · F _{p0.1}	0.95 · F _{p0.1}
	—	mm ²	kN	kN	kN
Nominal cross-sectional area of a single prestressing steel strand A _p = 140 mm² Characteristic tensile strength f _{pk} = 1 860 MPa					
4/0.6" – 140	4	560	1 040	806	851
5/0.6" – 140	5	700	1 300	1 008	1 064
7/0.6" – 140	7	980	1 820	1 411	1 490
9/0.6" – 140	9	1 260	2 340	1 814	1 915
12/0.6" – 140	12	1 680	3 120	2 419	2 554
15/0.6" – 140	15	2 100	3 900	3 024	3 192
19/0.6" – 140	19	2 660	4 940	3 830	4 043
24/0.6" – 140	24	3 360	6 240	4 838	5 107
27/0.6" – 140	27	3 780	7 020	5 443	5 746
31/0.6" – 140	31	4 340	8 060	6 250	6 597
37/0.6" – 140	37	5 180	9 620	7 459	7 874

NOTE For footnotes ¹⁾ and ²⁾ see Annex 12, Page 1

MK4

MeKano4 PT System M
Tendon n/0.6" – 140 – 1860
Maximum prestressing and
overstressing forces

Annex 12
Page 3 of 5
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 23: Maximum prestressing and overstressing forces of a tendon with prestressing steel strands of 150 mm² nominal cross-sectional area and 1 770 MPa characteristic tensile strength

Designation of tendon	Number of strands	Nominal cross-sectional area of tendon	Characteristic value of maximum tendon force	Maximum prestressing force of tendon ¹⁾	Maximum overstressing force of tendon ^{1), 2)}
—	n	A _p	F _{pk}	0.9 · F _{p0.1}	0.95 · F _{p0.1}
	—	mm ²	kN	kN	kN
Nominal cross-sectional area of a single prestressing steel strand A _p = 150 mm² Characteristic tensile strength f _{pk} = 1 770 MPa					
4/0.6" – 150	4	600	1 064	821	866
5/0.6" – 150	5	750	1 330	1 026	1 083
7/0.6" – 150	7	1 050	1 862	1 436	1 516
9/0.6" – 150	9	1 350	2 394	1 847	1 949
12/0.6" – 150	12	1 800	3 192	2 462	2 599
15/0.6" – 150	15	2 250	3 990	3 078	3 249
19/0.6" – 150	19	2 850	5 054	3 899	4 115
24/0.6" – 150	24	3 600	6 384	4 925	5 198
27/0.6" – 150	27	4 050	7 182	5 540	5 848
31/0.6" – 150	31	4 650	8 246	6 361	6 715
37/0.6" – 150	37	5 550	9 842	7 592	8 014

NOTE For footnotes ¹⁾ and ²⁾ see Annex 12, Page 1



MeKano4 PT System M
Tendon n/0.6" – 150 – 1770
Maximum prestressing and
overstressing forces

Annex 12
Page 4 of 5
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 24: Maximum prestressing and overstressing forces of a tendon with prestressing steel strands of 150 mm² nominal cross-sectional area and 1 860 MPa characteristic tensile strength

Designation of tendon	Number of strands	Nominal cross-sectional area of tendon	Characteristic value of maximum tendon force	Maximum prestressing force of tendon ¹⁾	Maximum overstressing force of tendon ^{1), 2)}
—	n	A _p	F _{pk}	0.9 · F _{p0.1}	0.95 · F _{p0.1}
	—	mm ²	kN	kN	kN
Nominal cross-sectional area of a single prestressing steel strand A _p = 150 mm ² Characteristic tensile strength f _{pk} = 1 860 MPa					
4/0.6" – 150	4	600	1 116	864	912
5/0.6" – 150	5	750	1 395	1 080	1 140
7/0.6" – 150	7	1 050	1 953	1 512	1 596
9/0.6" – 150	9	1 350	2 511	1 944	2 052
12/0.6" – 150	12	1 800	3 348	2 592	2 736
15/0.6" – 150	15	2 250	4 185	3 240	3 420
19/0.6" – 150	19	2 850	5 301	4 104	4 332
24/0.6" – 150	24	3 600	6 696	5 184	5 472
27/0.6" – 150	27	4 050	7 533	5 832	6 156
31/0.6" – 150	31	4 650	8 649	6 696	7 068
37/0.6" – 150	37	5 550	10 323	7 992	8 436

NOTE For footnotes ¹⁾ and ²⁾ see Annex 12, Page 1



MeKano4 PT System M
Tendon n/0.6" – 150 – 1860
Maximum prestressing and
overstressing forces

Annex 12
Page 5 of 5
of European Technical Assessment
ETA-12/0310 of 18.08.2017

Table 26: Contents of the prescribed test plan

Component	Item	Test / Check	Traceability	Minimum frequency	Documentation
Anchor head, MSA, MPA Barrel, Connector body Coupler anchor head, Coupler sleeve	Material	Check	full	100 %	"3.1" ¹⁾
	Detailed dimensions ²⁾	Test		5 % ≥ 2 specimens	Yes
	Visual inspection ^{3), 4)}	Check		100 %	No
Wedge	Material	Check	full	100 %	"3.1" ¹⁾
	Treatment, Hardness	Test		0.5 % ≥ 2 specimens	Yes
	Detailed dimensions ²⁾	Test		5 % ≥ 2 specimens	Yes
	Visual inspection ^{3), 5)}	Check		100 %	No
Trumpet	Material	Check	full	100 %	"3.1" ¹⁾
	Detailed dimensions ²⁾	Test		3 % ≥ 2 specimens	Yes
	Visual inspection ³⁾	Check		100 %	No
Anchor lid	Material	Check	full	100 %	"2.2" ¹⁾
	Detailed dimensions ²⁾	Test		1 % ≥ 2 specimens	Yes
	Visual inspection ³⁾	Check		100 %	No
Prestressing steel strand ⁶⁾	Material	Check	full	100 %	"CE" ⁶⁾
	Diameter	Test		each coil	No
	Visual inspection ³⁾	Check		each coil	No
Steel strip sheath	Material	Check	full	100 %	"CE"
	Visual inspection ³⁾	Check		100 %	No
PE deviator at anchorage	Material	Check	bulk	100 %	"2.2" ¹⁾
	Detailed dimensions	Test		1 % ≥ 2 specimens	Yes
	Visual inspection ³⁾	Check		100 %	No



MeKano4 PT System M
 Prescribed test plan

Annex 14
Page 1 of 2

of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy

Table 27: Contents of the prescribed test plan

Component	Item	Test / Check	Traceability	Minimum frequency	Documentation
HDPE components Transition sleeve Housing of MCR coupler	Material	Check	bulk	100 %	"2.2" ¹⁾
	Visual inspection ³⁾	Check		100 %	No
Steel transition sleeve Housing of MCU coupler	Material	Check	bulk	100 %	"2.2" ¹⁾
	Visual inspection ³⁾	Check		100 %	No
Constituents of filling material as per EN 447	Cement	Check	full	100 %	"CE" ⁷⁾
	Admixtures, additions	Check	full	100 %	"CE" ⁷⁾

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

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

2) Other dimensions than ⁴⁾

3) Visual inspections include e.g. main dimensions, gauge testing, correct marking or labelling, appropriate performance, surface, fins, kinks, smoothness, corrosion, coating etc., as detailed in the prescribed test plan

4) Dimensions: All conical bores of the anchor head regarding angle, diameter and surface condition.

5) Teeth, cone surface

6) If the basis for CE marking of prestressing steel is not available, an approval or certificate according to the respective standards and regulations in force at the place of use shall accompany each delivery.

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

full Full traceability of each component to its raw materials.

bulk Traceability of each delivery of components to a defined point.



MeKano4 PT System M

Prescribed test plan

Annex 14

Page 2 of 2

of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy

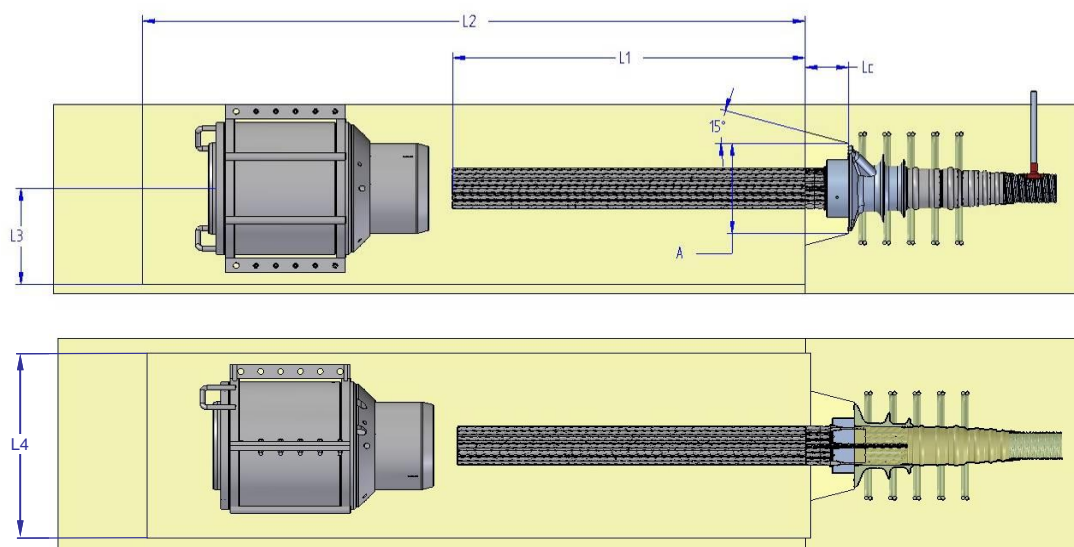


Table 29: Dimensions of anchorage recess, clearance for handling and stressing

Tendon	L1	L2	L3	L4	L _c	A
—	mm	mm	mm	mm	mm	mm
4/0.6"	800	1 750	170	410	120	220
5/0.6"	800	1 650	200	450	120	220
7/0.6"	800	1 650	200	450	131	250
9/0.6"	850	1 700	240	580	130	270
12/0.6"	850	1 700	240	580	150	310
15/0.6"	900	1 750	280	660	150	340
19/0.6"	900	1 750	280	660	170	370
24/0.6"	1 000	2 000	315	750	170	410
27/0.6"	1 000	2 000	340	800	180	450
31/0.6"	1 000	2 000	340	800	190	450
37/0.6"	1 000	2 050	370	850	200	500


Dimensions in mm

MK4


MeKano4 PT System M
 Anchorage recess
 Clearance for handling and stressing

Annex 16
Page 1 of 1
 of European Technical Assessment
ETA-12/0310 of 18.08.2017


electronic copy

Anchorage MSA and MPA		
PT Works	Construction Works	
Step 1 – Mounting		
Mounting of the formwork		
Fastening the trumpet of active anchorage to the formwork		
Placing reinforcement bottom layer and supporting stirrups		
Placing the sheaths Fastening of sheaths with wire to the support Connecting the sheaths with the trumpet of the active anchor Placing hoses for grouting and venting		
In case of passive anchorages MPA embedded in concrete, installation of the trumpet and preparation of the anchorages MPA.		
Placing reinforcement top layer and anchorage zone reinforcement		
Step 2 – Threading the strands		
Threading prestressing steel in all sheaths and leaving required excess length at the active anchorages		
In case of passive anchorages MPA embedded in concrete, threading of prestressing steel in the passive anchor head and fastening of the assembled anchorage.		
Step 3 – Concreting		
Concreting of the structure		
Determining the strength of the concrete Dismantling the formwork at the active anchor		
Step 4 – Stressing		
Installation of anchor heads and wedges in the active anchors		
Tensioning the tendons using a hydraulic jack Check the elongation of the prestressing steel Cut the excess length of the tendon at the active anchorages		
Step 5 – Grouting		
Sealing the boxes of active anchorages		
Grouting the tendon		
	MeKano4 PT System M Installation Anchorage MSA and MPA	Annex 17 Page 1 of 1 of European Technical Assessment ETA-12/0310 of 18.08.2017

electronic copy

Coupler MCR – 1st construction stage		
PT Works	Construction Works	
	Step 1 – Formwork	
	Mounting of the formwork	
	Fastening the active and passive anchorage to the formwork	
	Placing reinforcement bottom layer and supporting stirrups	
	Placing the sheathing and the hoses for grouting and venting Fastening the sheathing with wire or plastic binder at the bottom layer reinforcement and supporting stirrups Connecting sheathing with the active and passive anchorage	
	Placing reinforcement top layer and anchorage zone reinforcement	
	Concreting the structure	
	Step 2 – Striking of shuttering	
	Determining concrete strength Dismantling the formwork at the active anchorage side	
	Step 3 – Threading the strands	
	Threading the individual strands into the sheathing Cutting at the right length	
	Step 4 – Placing the anchorage	
	Inserting the strands into the anchor heads Putting wedges in both ends and locking them with hand tools	
	Step 5 – Stressing	
	Putting the stressing chair Stressing with a hydraulic jack Check the elongation of the first construction stage Cutting the protruding strands at both ends Complete MCR coupler installation, i.e. connect the coupling sleeve and the 2 nd construction stage anchor head to the 1 st construction stage anchorage head	
	Step 6 – Corrosion Protection	
	Installing the grouting cap or alternatively fill in with mortar the recess box	
	MeKano4 PT System M Installation – MCR coupler	Annex 18 Page 1 of 2 of European Technical Assessment ETA-12/0310 of 18.08.2017

electronic copy

Coupler MCR – 2nd construction stage		
PT Works	Construction Works	
Step 7 - Placing the anchorage and threading the strands		
Fastening the active anchorage to the formwork in the other side of the coupler		
Placing reinforcement bottom layer and supporting stirrups		
Placing the sheathing, plastic housing and the hoses for grouting and venting, leaving 2 m clearance ahead of the coupler Connecting sheathing with the active anchorage Fastening the sheathing with wire or plastic binder at the bottom layer and supporting stirrups Threading the individual strands into the sheathing Inserting the strands into the anchor head, verifying that the length is correct Cutting at the right length Move the plastic housing and the telescopic sheath to its final position over the coupler and ensure tightness		
Placing reinforcement top layer and anchorage zone reinforcement		
Concreting the structure		
Step 8 – Striking of shuttering		
Determining concrete strength Dismantling the formwork at the active anchorage side		
Step 9 – Stressing		
Putting wedges in the active anchor head and locking them with hand tools Putting the stressing chair Stressing with a hydraulic jack		
Step 10 – Grouting		
Grouting the tendon		
	MeKano4 PT System M Installation – MCR coupler	Annex 18 Page 2 of 2 of European Technical Assessment ETA-12/0310 of 18.08.2017

electronic copy


Coupler MCU	
PT Works	Construction Works
Step 1 – Mounting	
Mounting of the formwork	
Fastening the trumpet of the active anchorage to formwork	
Placing reinforcement bottom layer and supporting stirrups	
Placing the sheaths Fastening of sheaths with wire to the support. Connecting the sheaths with the trumpet of the active anchor. Placing the hoses for grouting and venting	
In case of movable coupler MCU, placing the metal housing and telescopic sleeve, leaving free space for connecting the tendon.	
Placing reinforcement top layer and anchorage zone reinforcement	
Step 2 – Threading the strands	
Threading the individual strands into the sheathing, leaving the required excess length in the active anchors.	
In case of movable coupler MCU, cut the strands to the length required Place deviators and couplers MCU on the tendon Threading of strands and connection to the coupler MCU Fastening the metal case and telescopic sheath in its final position and seal to the duct	
Step 3 - Concreting	
Concreting of the structure	
Determining the strength of the concrete Dismantling the formwork at the active anchor	
Step 4 - Stressing	
Installation of anchor head and wedges at the active anchorage	
Stressing the tendons using a hydraulic jack Check the elongation of the tendon Cut the excess length of the tendon at the active anchorage	
Step 5 – Grouting	
Sealing the boxes of active anchorages	
Grouting the tendon	
	MeKano4 PT System M Installation – MCU coupler
Annex 19 Page 1 of 1 of European Technical Assessment ETA-12/0310 of 18.08.2017	

Table 31: Essential characteristics for the intended uses of the PT system

№	Essential Characteristic	Clause	Intended use	
			Line № according to Clause 2.1, Table 9	
			1	2
1	Resistance to static load	3.2.1.1	+	+
2	Resistance to fatigue	3.2.1.2	+	+
3	Load transfer to the structure	3.2.1.3	+	+
4	Friction coefficient	3.2.1.4	+	+
5	Deviation, deflection (limits)	3.2.1.5	+	+
6	Practicability, reliability of installation	3.2.1.6	+	+
7	Content, emission, and/or release of dangerous substances	3.2.2	+	+
8	Related aspects of serviceability	3.2.3	+	+
9	Resistance to static load under cryogenic conditions	3.2.4.1	—	+

Key

- + Essential characteristic relevant for the intended use
- Essential characteristic not relevant for the intended use

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



MeKano4 PT System M
 Essential characteristics for the
 intended uses

Annex 25
 Page 1 of 1
 of European Technical Assessment
ETA-12/0310 of 18.08.2017

electronic copy

Reference documents

Guideline for European Technical Approval

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

Eurocodes

Eurocode 2 Eurocode 2: Design of concrete structures

Eurocode 4 Eurocode 4: Design of composite steel and concrete structures

Standards

EN 206-1 (12.2000),
 EN 206-1/A1 (07.2004),
 EN 206-1/A2 (06.2005) Concrete - Part 1: Specification, performance, production and conformity

EN 445 (10.2007) Grout for prestressing tendons - Test methods

EN 446(10.2007) Grout for prestressing tendons - Grouting procedures

EN 447 (10.2007) Grout for prestressing tendons - Basic requirements

EN 523 (08.2003) Steel strip sheaths for prestressing tendons - Terminology, requirements, quality control

EN 1561 (10.2011) Founding - Grey cast irons

EN 1563 (06.1997)
 EN 1563/A1 (05.2002)
 EN 1563/A2 (07.2005) Founding - Spheroidal graphite cast irons

EN 10025-2 (11.2004)
 EN 10025-2/AC (06.2005) Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels

EN 10083 (08.2006) Steels for quenching and tempering - Part 1: General technical delivery conditions

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

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

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

EN 10277-2 (03.2008) Bright steel products – Technical delivery conditions – Part 2: Steels for general engineering purposes

prEN 10138-3 (09.2000) Prestressing steels – Part 3: Strand

prEN 10138-3 (08.2009) Prestressing steels – Part 3: Strand

EN ISO 1872-1 (05.1999) Plastics – Polyethylene (PE) moulding and extrusion materials – Part 1: Designation system and basis for specifications



MeKano4 PT System M

Reference documents

Annex 26

Page 1 of 1

of European Technical Assessment
ETA-12/0310 of 18.08.2017