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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-23/0051 of 2023/02/14

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	TCM PRO+
Product family to which the above construction product belongs:	Bonded injection type anchor for use in concrete: sizes M8 to M24, rebar 8 to 25 mm
Manufacturer:	Trutek Fasteners Polska Sp z o.o. Al. Krakowska 38 Janki PL-05-090 Raszyn Tel. +48 22 701 93 24 Fax +48 22 100 58 82 Internet www.trutek.com.pl
Manufacturing plant:	Trutek Fasteners Polska Sp z o.o. Factory Plant 1
This European Technical Assessment contains:	20 pages including 14 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EOTA EAD 330499-01-0601, “Bonded fasteners for use in concrete”
This version replaces:	

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product
The TCM PRO+ is a bonded anchor (injection type) for concrete consisting of a cartridge with Trutek injection mortar and a steel element. The steel element consists of a commercial threaded rod with washer and hexagon nut in the range of M8 to M24 or a reinforcing bar in the range of diameter 8 to 25mm.

The product specification is given in annex A.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes shall correspond to the respective values laid down in the technical documentation[1] of this European Technical Assessment.

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

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the anchor of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

1 The technical documentation of this European Technical Assessment is deposited at ETA-Danmark and, as far as relevant for the tasks of the Notified bodies involved in the attestation of conformity procedure, is handed over to the notified bodies.

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

3.1 Characteristics of product

Mechanical resistance and stability (BWR 1):
The essential characteristics are detailed in the Annex C.

Safety in case of fire (BWR 2):
The essential characteristics are detailed in the Annex C.

Hygiene, health and the environment (BWR3):
No performance assessed

Safety in use (BWR4):
For basic requirement Safety in use the same criteria are valid for Basic Requirement Mechanical resistance and stability (BWR1).

Other Basic Requirements are not relevant.

3.2 Methods of assessment

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance with EOTA EAD 330499-01-0601, “Bonded fasteners for use in concrete” option 1 and 7.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 96/582/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 1.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

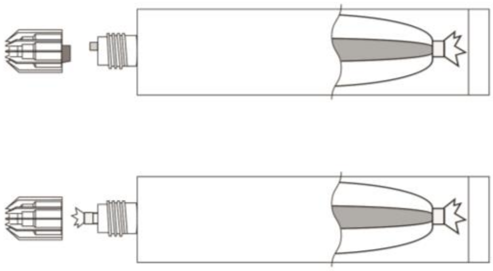
Issued in Copenhagen on 2023-02-14 by

Thomas Bruun
Managing Director, ETA-Danmark

Cartridge: TCM PRO+

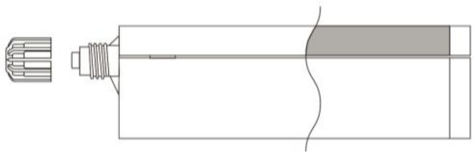
A) Foil Bag Cartridge 165ml, 300ml.
B) Coaxial Cartridge 380ml / 400 ml / 410 ml / 420ml
C) Side by Side Cartridge 345ml, 825ml

Cartridge Print:
TCM PRO+
Including - Installation procedure, Production Batch code, Expiry Date, Storage conditions, Health & Safety warning, Gel & Cure time according to temperatures.



A)

B)

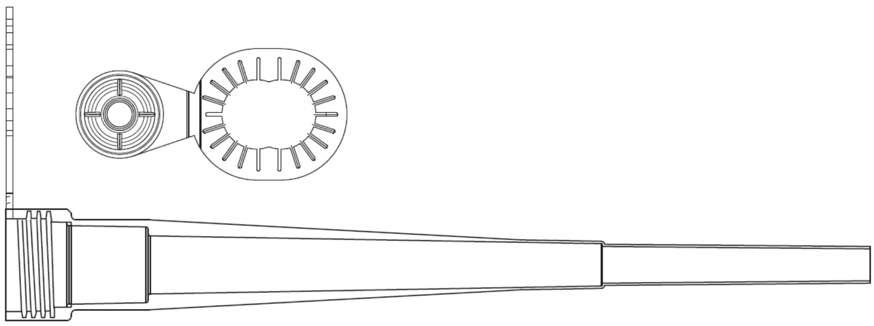


C)

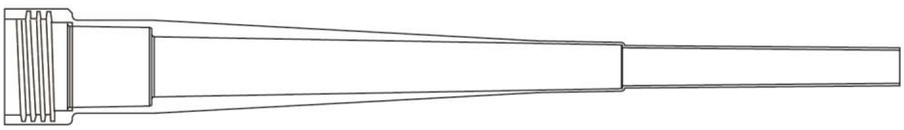
Marking:

TCM PRO+
Batch code, either expiry date or manufacturing date with shelf life

Mixer with hanger



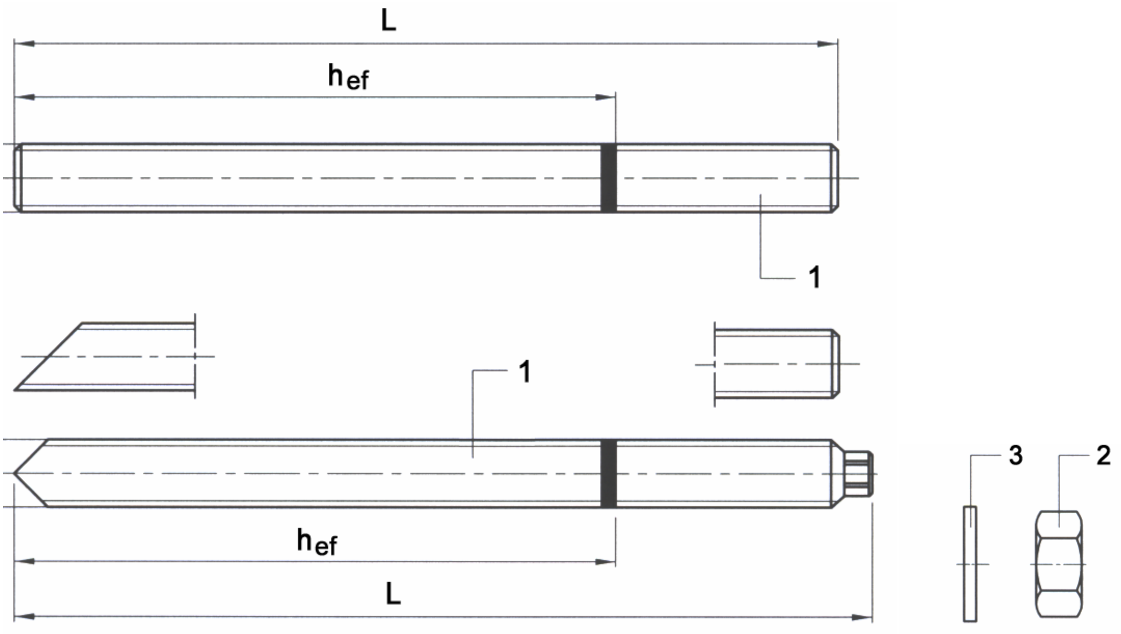
Mixer



SYSTEM TCM PRO+	**Annex A1** of European Technical Assessment ETA-23/0051
Product and intended use	

Anchor rod and rebar

Threaded Steel Stud, Nut and Washer
Sizes M8, M10, M12, M16, M20, M24



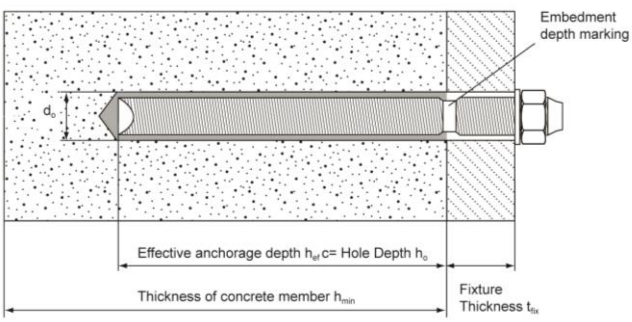
Rebar
Diameter Ø 8mm, Ø 10mm, Ø 12mm, Ø 14mm, Ø 16mm, Ø 20mm, Ø 24mm, Ø 25mm,

SYSTEM TCM PRO+	Annex A2 of European Technical Assessment ETA-23/0051
Threaded rod types and rebar's dimensions	

Installed Anchor and Intended Use

Table A1: Installation details for anchor rods

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Diameter of element	d	[mm]	8	10	12	16	20	24
Range of anchorage depth h_{ef}	min	[mm]	60	60	70	80	90	100
and bore hole depth h_o	max	[mm]	96	120	144	192	240	288
Nominal diameter of drill bit	d_o	[mm]	10	12	14	18	22	28
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Maximum torque moment	T_{max}	[Nm]	10	12	20	40	70	90
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100mm			$h_{ef} + 2d_o$		
Minimum spacing	S_{min}	[mm]	40	40	60	75	95	115
Minimum edge distance	C_{min}	[mm]	35	40	45	50	60	65



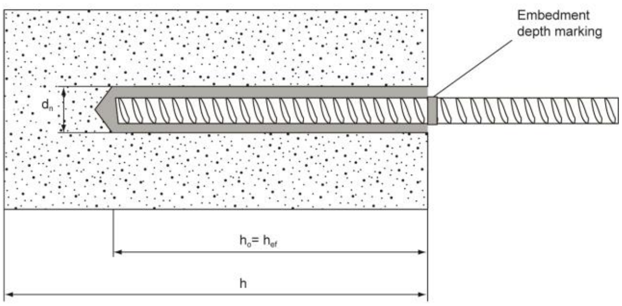


Table A2: Installation details for rebar

Rebar size (mm)			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 24**	**ϕ 25**
Diameter of element	d	[mm]	8	10	12	14	16	20	24	25
Range of anchorage depth h_{ef}	min	[mm]	60	60	70	75	80	90	100	100
and bore hole depth h_o	max	[mm]	96	120	144	168	192	240	288	300
Nominal diameter of drill bit	D_o	[mm]	10/12	12/14	14/16	16/18	20	25	28	30
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100mm			$h_{ef} + 2d_o$				
Minimum spacing	S_{min}	[mm]	40	50	60	70	80	100	120	120
Minimum edge distance	C_{min}	[mm]	40	50	60	70	80	100	120	120

Table A3: Threaded rod and rebar materials

Designation	Material
Threaded rods made of zinc coated steel	
Threaded rod M8 – M24	Strength class 4.6 to 12.9 EN ISO 898-1 Steel galvanized ≥ 5µm EN ISO 4042 Hot dipped galvanized ≥ 45µm EN ISO 10684
Washer ISO 7089	Steel galvanized EN ISO 4042; hot dipped galvanized EN ISO 10684
Nut EN ISO 4032	Strength class 8 EN ISO 898-2 Steel galvanized ≥ 5µm EN ISO 4042 Hot dipped galvanized ≥ 45µm EN ISO 10684
Threaded rods made of stainless steel	
Threaded rod M8 – M24	Strength class 50, 70 or 80 EN ISO 3506; Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Washer ISO 7089	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Nut EN ISO 4032	Strength class 70 and 80 EN ISO 3506-1; Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 end 10088
Threaded rods made of high corrosion resistant steel	
Threaded rod M8 – M24	Strength class 70 or 80 R_m = 800 N/mm^2; $R_{p0,2}$=640 N/mm^2 High corrosion resistant steel 1.4529, 1.4565 EN 10088
Washer ISO 7089	High corrosion resistant steel 1.4529, 1.4565 EN 10088
Nut EN ISO 4032	Strength class 70 EN ISO 3506-2; High corrosion resistant steel 1.4529, 1.4565 EN 10088
Rebars	
Rebars ϕ8 to ϕ25	class B and C of characteristic yield strength f_{yk} from 400 MPa to 600 MPa

Specifications of intended use

Anchorages subject to:
- Static and quasi-static loads: M8 to M24, Rebar Ø8 to Ø25

Base materials:
- Reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.
- Cracked and non-cracked concrete: M8 to M24, Rebar Ø8 to Ø25.

Temperature Range:
- I: - 40 °C to +40 °C (max long-term temperature +24 °C and max short -term temperature +40 °C)

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:
  - Stainless steel A2 according to Annex A4, Table A1: CRC II
  - Stainless steel A4 according to Annex A4, Table A1: CRC III
  - High corrosion resistance steel HCR according to Annex A4, Table A1: CRC V (for marine environment)

Design:
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- The Anchorages are designed in accordance with:
  - EN 1992-4:2018
  - Technical Report TR055, edition 2018

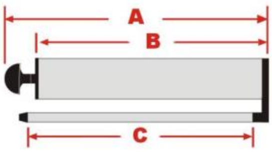
Installation:
- Dry and wet concrete.
- Flooded holes (not sea water).
- Hole drilling by hammer drilling (HD) or compressed air drilling (CD) used in Category 1 (dry and wet concrete) and Category 2 (flooded holes)
- Hole drilling by hollow drill bits for dust free drilling (HDB) (e.g. Bosch self-cleaning system including vacuum cleaner) used in Category 1 – dry and wet concrete
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Table B1: Installation data

Threaded rod and rebar	Size	Nominal drill bit diameter d_o (mm)	Steel Brush	Cleaning methods		
				Hollow drilling with vacuum cleaner (HDB)	Manual cleaning (MAC)	Compressed air cleaning (CAC)
Studs 	M8	10	10 mm	No cleaning needed	h_{ef} ≤ 80 mm	Yes
	M10	12	12 mm		h_{ef} ≤ 100 mm	
	M12	14	14 mm		h_{ef} ≤ 120 mm	
	M16	18	18 mm		h_{ef} ≤ 160 mm	
	M 20	22	22 mm		h_{ef} ≤ 200 mm	
	M 24	28	28 mm		h_{ef} ≤ 240 mm	
Rebar 	ϕ 8 mm	10 or 12	10 or 12 mm	No cleaning needed	h_{ef} ≤ 80 mm	Yes
	ϕ 10 mm	12 or 14	12 or 14 mm		h_{ef} ≤ 100 mm	
	ϕ 12 mm	14 or 16	14 or 16 mm		h_{ef} ≤ 120 mm	
	ϕ 14 mm	16 or 18	16 or 18 mm		h_{ef} ≤ 140 mm	
	ϕ 16 mm	20	20 mm		h_{ef} ≤ 160 mm	
	ϕ 20 mm	24	24 mm		h_{ef} ≤ 200 mm	
	ϕ 24 mm	28	28 mm		h_{ef} ≤ 240 mm	
	ϕ 25 mm	30	30 mm		h_{ef} ≤ 250 mm	

Manual Cleaning (MAC):
Hand pump recommended for
Blowing out bore holes with diameters
d_o≤ 24 mm and bore holes depth h_o≤10d

Compressed air cleaning (CAC):
Recommended air nozzle with an
Orifice opening of minimum 3,5mm in
diameter.



Hollow Drilling and Vacuum (HDB) (e.g. Bosch®)

Steel brush just for manual cleaning and CAC (not needed for HDB)

Table B2: Minimum curing time

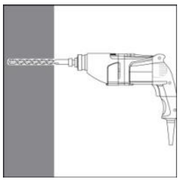
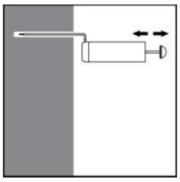
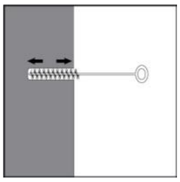
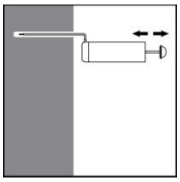
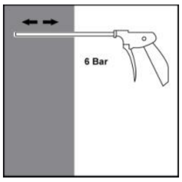
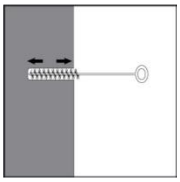
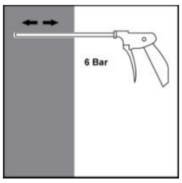
Minimum base material temperature C°	Gel time (working time) In dry/wet concrete	Curing time in dry concrete	Curing time in wet concrete or flooded holes
0°C ≤ $T_{base\ material}$ < 10°C	20 min	90 min	180 min
10°C ≤ $T_{base\ material}$ < 20°C	9 min	60 min	120 min
20°C ≤ $T_{base\ material}$ < 30°C	5 min	30 min	60 min
30°C ≤ $T_{base\ material}$ ≤ 40°C	3 min	20 min	40 min

The temperature of the bond material must be ≥ 20°C

Resin injection pump details		
Image	**Size Cartridge / Code**	**Type**
	**165 / 300ml**	**Manual**
	**345 / 380 / 400 / 410 / 420ml**	**Manual**
	**165 / 300 / 345 / 380 / 400 / 410 / 420ml** **7.4v Tool**	**Battery**
	**165 / 300 / 380 / 400 / 410 / 420ml**	**Drill Adaptor**
	**380 / 400 / 410 / 420 / 825ml**	**Pneumatic**

SYSTEM TCM PRO+	Annex B3 of European Technical Assessment ETA-23/0051
Intended use – data	

Table B3 - parameters: drilling, hole cleaning and installation

Instructions for use – Hammer drilling (HD) and Compressed air drilling (CD)		
Bore hole drilling		
		Drill hole in the substrate to the required embedment depth using the appropriately sized carbide drill bit.
Bore hole cleaning Just before setting an anchor, the bore hole must be free of dust and debris.		
a) Manual air cleaning (MAC) for all bore hole diameters $d_0 \leq$ 24mm and bore hole depth $h_0 \leq$ 10d		
	**X 4**	The manual pump shall be used for blowing out bore holes up to diameters $d_0 \leq$ 24mm and embedment depths up to $h_{ef} \leq$ 10d. Blow out at least 4 times from the back of the bore hole, using an extension if needed.
	**X 4**	Brush 4 times with the specified brush size (see Table B1) by inserting the steel brush to the back of the hole (if needed with an extension) in a twisting motion and removing it.
	**X 4**	Blow out again with manual pump at least 4 times.
b) Compressed air cleaning (CAC) for all bore hole diameters d_0 and all bore hole depths		
	**X 2**	Blow 2 times from the back of the hole (if needed with a nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h).
	**X 2**	Brush 2 times with the specified brush size (see Table B1) by inserting the steel brush to the back of the hole (if needed with an extension) in a twisting motion and removing it.
	**X 2**	Blow out again with compressed air at least 2 times.

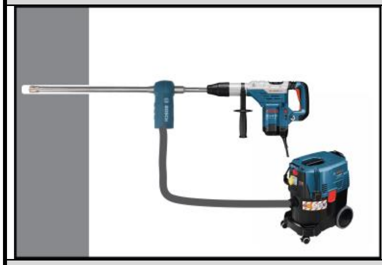
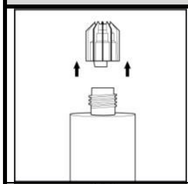
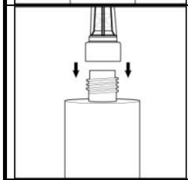
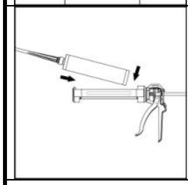
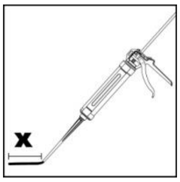
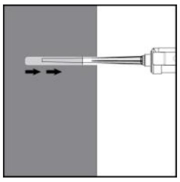
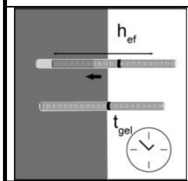
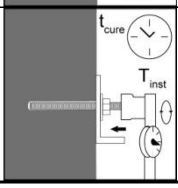
Instructions for use – Hollow drill bits for dust free drilling		
Bore hole drilling and cleaning		
		Select a suitable hollow drill bit (see table B1) and install it into the hammer drilling machine. Connect the dust extraction system to the aperture in the hollow drill bit. (e.g.: **Bosch®** system) Drill hole to the required embedment depth with the hammer drill set in rotation-hammer mode and with the dust extraction system working permanently at full power.
Bore hole cleaning: Manual cleaning is not necessary when using the self-cleaning drilling method.		

Table B4 - parameters: After cleaning injection and installation of the stud/rebar		
		Remove the threaded cap from the cartridge. Cut open the foil bag if necessary.
		Tightly attach the Tmixing nozzle. Do not modify the mixer in any way. Made sure the mixing element is inside the mixer. Use only the supplied mixer.
		Insert the cartridge into the dispenser gun.
		Discard the initial trigger pulls of adhesive. Depending on the size of the cartridge, an initial amount of adhesive mix must be discarded. Each time when the mixer is changed, new discard of waste is needed until the colour is homogeneous. Discard quantities are 10 cm for all cartridges
		Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull. Fill holes approximately 2/3 full, to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment depth.
		Before use, verify that the threaded rod is dry and free of contaminants. Install the threaded rod to the required embedment depth during the open gel time t_{gel} has elapsed. The working time t_{gel} is given in Table B2.
		The anchor can be loaded after the required curing time t_{cure} (see Table B2). The applied torque shall not exceed the values T_{max} given in Table A1.

SYSTEM TCM PRO+	**Annex B4** of European Technical Assessment ETA-23/0051
Procedure (2)	

Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Size				M8	M10	M12	M16	M20	M24
Cross section area		A_s	[mm²]	36.6	58	84.3	157	245	353
Characteristic tension resistance, Steel failure									
Steel, Property class 4.6 and 4.8		$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Steel, Property class 5.6 and 5.8		$N_{Rk,s}$	[kN]	18	29	42	78	122	176
Steel, Property class 8.8		$N_{Rk,s}$	[kN]	29	46	67	125	196	282
Steel, Property class 10.9		$N_{Rk,s}$	[kN]	37	58	84	157	245	353
Steel, Property class 12.9		$N_{Rk,s}$	[kN]	44	70	101	188	294	424
Stainless steel A2, A4 and HCR, Property class 50		$N_{Rk,s}$	[kN]	18	29	42	79	123	177
Stainless steel A2, A4 and HCR, Property class 70		$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Stainless steel A4 and HCR, Property class 80		$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Characteristic tension resistance, Partial factor									
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,N}$ [1)]	[-]	2,0					
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,N}$ [1)]	[-]	1,5					
Steel, Property class 10.9 and 12.9		$\gamma_{Ms,N}$ [1)]	[-]	1.4					
Stainless steel A2, A4 and HCR, Property class 50		$\gamma_{Ms,N}$ [1)]	[-]	2,86					
Stainless steel A2, A4 and HCR, Property class 70		$\gamma_{Ms,N}$ [1)]	[-]	1,87					
Stainless steel A4 and HCR, Property class 80		$\gamma_{Ms,N}$ [1)]	[-]	1,6					
Characteristic shear resistance, Steel failure									
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	7	12	17	31	49	71
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
	Steel, Property class 10.9	$V^0_{Rk,s}$	[kN]	18	29	42	79	123	177
	Steel, Property class 12.9	$V^0_{Rk,s}$	[kN]	22	35	51	94	147	212
	Stainless steel A2, A4 and HCR, Property class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88
	Stainless steel A2, A4 and HCR, Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124
	Stainless steel A4 and HCR, Property class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
With lever arm	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896
	Steel, Property class 10.9	$M^0_{Rk,s}$	[Nm]	37	75	131	333	649	1123
	Steel, Property class 12.9	$M^0_{Rk,s}$	[Nm]	45	90	157	400	778	1347
	Stainless steel A2, A4 and HCR, Property class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561
	Stainless steel A2, A4 and HCR, Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784
	Stainless steel A4 and HCR, Property class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896
Characteristic shear resistance, Partial factor									
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,V}$ [1)]	[-]	1,67					
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,V}$ [1)]	[-]	1,25					
Steel, Property class 10.9 and 12.9		$\gamma_{Ms,V}$ [1)]	[-]	1,50					
Stainless steel A2, A4 and HCR, Property class 50		$\gamma_{Ms,V}$ [1)]	[-]	2,38					
Stainless steel A2, A4 and HCR, Property class 70		$\gamma_{Ms,V}$ [1)]	[-]	1,56					
Stainless steel A4 and HCR, Property class 80		$\gamma_{Ms,V}$ [1)]	[-]	1,33					

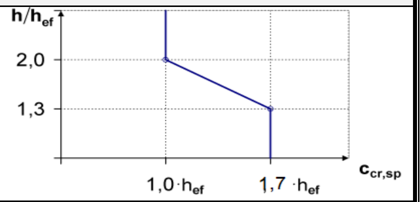
[1)] in absence of national regulation

Table C2: Characteristic values of tension loads under static and quasi-static for threaded rods

Anchor size threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure								
Characteristic tension resistance	$N_{Rk,s}$	[kN]	see Table C1					
Partial factor	$\gamma_{Ms,N}$	[-]	see Table C1					
Combined Pull-out and Concrete cone failure 2)								
Characteristic bond resistance in concrete C20/25 – **dry or wet** concrete for **hammer drilling (HD) and CD**								
Temperature range 40°C/24°C **non-cracked** concrete	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	9,5	9	8,5
Temperature range 40°C/24°C **cracked** concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3	3,5	3,5	3,5
Partial safety factor – dry or wet concrete	γ_{inst}	[-]	1,2			1,4		
Characteristic bond resistance in non-cracked concrete C20/25 – **flooded** holes for **hammer drilling (HD)**								
Temperature range 40°C/24°C **non-cracked** concrete	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	9	7,5	7
Temperature range 40°C/24°C **cracked** concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3	3,5	3	3
Partial safety factor – flooded holes	γ_{inst}	[-]	1,2		1,4			
Characteristic bond resistance in non-cracked concrete C20/25 – **dry or wet** concrete for **hollow drill bits (HDB) – dust free system**								
Temperature range 40°C/24°C **non-cracked** concrete	$\tau_{Rk,ucr}$	[N/mm²]	7	7	7.5	8	8	8.5
Temperature range 40°C/24°C **cracked** concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	4	3,5	3,5	3,5
Partial safety factor – dry or wet concrete	γ_{inst}	[-]	1,2					1,4
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked for hammer drilling	ψ_c	C30/37	1,08					1,00
		C40/50	1,15					1,00
		C50/60	1,20					1,00
Increasing factor for $\tau_{Rk,cr}$ in cracked concrete for hammer drilling	ψ_c	C30/37	1,08	1,00				
		C40/50	1,15	1,00				
		C50/60	1,20	1,00				
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete for hollow drilling	ψ_c	C30/37	1,00					
		C40/50	1,00					
		C50/60	1,00					
Increasing factor for $\tau_{Rk,cr}$ in cracked concrete for hollow drilling	ψ_c	C30/37	1,20	1,00				
		C40/50	1,36	1,00				
		C50/60	1,50	1,00				
Reduction factor in cracked or non-cracked concrete C20/25 for all drilling methods	ψ^0_{sus}	[-]	0,794					
Factor for determination of the concrete cone failure	$k_{ucr,N}$	[-]	11,0 (based on concrete cylinder strength f_{ck})					
Factor for determination of the concrete cone failure	$k_{cr,N}$	[-]	7,7					
Edge distance for concrete cone failure	$c_{cr,N}$	[mm]	1,5 h_{ef}					
Axial distance for concrete cone failure	$s_{cr,N}$	[mm]	2 $c_{cr,N}$					

SYSTEM TCM PRO+	Annex C2 of European Technical Assessment ETA-23/0051
Performance for static, quasi-static: Displacements	

Table C2 : continuation

Splitting failure[2)]				
Edge distance $c_{cr,sp}$ [mm] for	h / h_{ef} [4)] ≥ 2,0		$1{,}0\ h_{ef}$	
	$2{,}0 > h / h_{ef}$ [4)] > 1,3		$3\ h_{ef} - 1\ h$	
	h / h_{ef} [4)] ≤ 1,3		$1{,}7\ h_{ef}$	
Spacing	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$	

1) In absence of national regulations
2) Calculation of concrete and splitting, see annex B1
3) Explanations, see annex B1
4) h concrete member thickness, h_{ef} effective anchorage depth

Table C3: Displacements under tension load

TCM PRO+ with threaded rods With Hammer drilling (HD) or compressed air drilling (CD)			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Temperature range a [5)]**: 40°C / 24°C**								
Displacement	δ_{N0}	[mm/(N/mm²)]	0,11	0,11	0,10	0,11	0,12	0,10
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,28	0,18	0,82	0,76	0,22	0,30
TCM PRO+ with threaded rods for Hollow drilling HDB (dust-free system)			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Temperature range a [5)]**: 40°C / 24°C**								
Displacement	δ_{N0}	[mm/(N/mm²)]	0,10	0,12	0,15	0,14	0,14	0,13
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,49	0,19	0,38	0,52	0,14	0,19

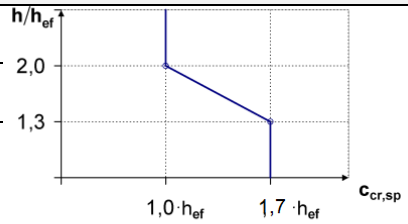
5) Explanation see annex B1

Table C4: Displacements under shear load for all types of drilling for threaded rods

TCM PRO+ with threaded rods			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Displacement	δ_{V0}	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05

Table C5: Characteristic values for steel tension resistance and tension load values for rebar

TCM PRO+ with rebar			ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 24	ϕ 25
Steel failure										
Characteristic tension resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ 1)							
Cross section area	A_s	[mm²]	50	79	113	154	201	314	452	491
Partial safety factor	$\gamma_{Ms,N}$ 2)	[-]	1,4							
Combined Pull-out and Concrete cone failure 3)										
Diameter of rebar	d	[mm]	8	10	12	14	16	20	24	25
Characteristic bond resistance in non-cracked concrete C20/25 – dry or wet concrete for **hammer drilling (HD) and CD**										
Temperature range a 4) : 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	5,5	5,5	5,5	5,5	5,5
Partial safety factor – dry or wet concrete	γ_{inst} 2)	[-]	1,2			1,4				
Characteristic bond resistance in non-cracked concrete C20/25 – flooded holes for **hammer drilling (HD) and CD**										
Temperature range a 4) : 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	5,5	5,5	4,5	4,5	4,5
Partial safety factor – flooded holes	γ_{inst}	[-]	1,2		1,4					
Characteristic bond resistance in non-cracked concrete C20/25 – dry or wet concrete for **hollow drill bits (HDB) – dust free system**										
Temperature range a 4) : 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	5	5	5,5	5,5	5,5	5,5	5,5	5,5
Partial safety factor – dry or wet concrete	γ_{inst}	[-]	1,2						1,4	
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,00	1,04	1,08				1,13	
		C40/50	1,00	1,07	1,15				1,23	
		C50/60	1,00	1,10	1,20				1,32	
Factor for determination of the concrete cone failure	$k_{ucr,N}$	[-]	11,0 (based on concrete cylinder strength f_{ck})							
Factor for determination of the concrete cone failure	$k_{cr,N}$	[-]	7,7							
Splitting failure 3)										
Edge distance $c_{cr,sp}$ [mm] for		h / h_{ef} 5) ≥ 2,0	$1,0\ h_{ef}$							
		2,0 > h / h_{ef} 5) > 1,3	$3\ h_{ef} - 1\ h$							
		h / h_{ef} 5) ≤ 1,3	$1,7\ h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$							



1) f_{uk} shall be taken from the specifications of reinforcing bars
2) in absence of national regulation
3) Calculation of concrete and splitting, see annex B1
4) Explanations, see annex B1
5) h concrete member thickness, h_{ef} effective anchorage depth

Table C6: Displacements under tension load for rebar

TCM PRO+ with rebar for hammer drilling (HD) and CD			ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 24/ ϕ 25
Temperature range a [4]: 40°C / 24°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,03	0,04	0,04	0,07	0,07	0,10
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,11	0,11	0,15	0,21	0,26	0,26	0,38
TCM PRO+ with rebar for hollow drilling dust free system (HDB)			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**
Temperature range a [4]: 40°C / 24°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,16	0,10	0,03	0,03	0,04	0,04	0,04
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,75	0,45	0,15	0,16	0,17	0,18	0,19

Table C7: Characteristic steel shear resistance for rebar

TCM PRO+ with rebar			ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 25
Steel failure without lever arm									
Characteristic shear resistance	$V_{Rk,s}$	[kN]	$0,50 \cdot A_s \cdot f_{uk}$ [1]						
Cross section area	A_s	[mm²]	50	79	113	154	201	314	491
Partial safety factor	$\gamma_{Ms,N}$ [2]	[-]	1,5						
Steel failure with lever arm									
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1.2 \cdot W_{el} \cdot f_{uk}$ [1]						
Elastic section modulus	W_{el}	[Nm]	50	98	170	269	402	785	1534
Partial safety factor	$\gamma_{Ms,N}$ [2]	[-]	1,5						
Concrete pryout failure									
Factor	k_8	[-]	1,0 for $h_{ef} < 60$mm 2,0 for $h_{ef} \geq 60$mm						
Partial safety factor	γ_{MC}	[-]	1,5						
Concrete edge failure									
Partial safety factor	γ_{Mc} [1]	[-]	1,5						

[1] f_{uk} shall be taken from the specifications of reinforcing bars
[2] In absence of national regulations

Table C8: Displacements under shear load for rebar

TCM PRO+ with rebar			ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 25
Displacement	δ_{V0}	[mm/kN]	0,05	0,05	0,05	0,04	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,08	0,08	0,07	0,06	0,06	0,05	0,05

Table C9: Resistance to fire

ESSENTIAL CHARACTERISTICS	PERFORMANCE
Resistance to fire	No performance assessed

Table C10: Reaction to fire

ESSENTIAL CHARACTERISTICS	PERFORMANCE
Reaction to fire	In the final application, the thickness of the mortar layer is about 1 to 2 mm and most of the mortar is material classified class A1 according to EC Decision 96/603/EC. Therefore, it may be assumed that the bonding material (synthetic mortar or a mixture of synthetic mortar and cementitious mortar) in connection with the metal anchor in the end use application do not contribute to fire growth or to the fully developed fire and they have no influence on the smoke hazard.