INSTYTUT TECHNIKI BUDOWLANEJ

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

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European Technical Assessment

ETA-21/0243 of 30/12/2024

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	RAWL R-KEM II / RAWL R-KEM II-S / RAWL R-KEM II-W and RAWL RM50 / RAWL RM50-S / RAWL RM50-W
Product family to which the construction product belongs	Bonded anchors of sizes M8 to M30 for use in uncracked concrete
Manufacturer	RAWLPLUG S.A. ul. Kwidzyńska 6 51-416 Wrocław Poland
Manufacturing plant	Manufacturing Plant no. 3
This European Technical Assessment contains	18 pages including 3 Annexes 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	European Assessment Document (EAD) 330499-02-0601 "Bonded fasteners and bonded expansion fasteners for use in concrete"
This version replaces	ETA-21/0243 issued on 11/03/2021

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Specific Part

1 Technical description of the product

The RAWL R-KEM II / RAWL R-KEM II-S / RAWL R-KEM II-W and RAWL RM50 / RAWL RM50-S / RAWL RM50-W are bonded anchors (injection type) consisting of an injection mortar cartridge using an applicator gun equipped with a special mixing nozzle and threaded anchor rod sizes M8 to M30 made of:

- galvanized carbon steel,
- stainless steel,
- high corrosion resistant stainless steel,

with hexagon nut and washer.

The threaded rod is placed into a drilled hole previously cleaned and injected (using an applicator gun) with a mortar with a slow and slight twisting motion. The rod is anchored by the bond between rod, mortar and concrete.

The product description is given in Annex A.

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

The performances given in clause 3 are only valid if the anchors are used in the compliance with the specifications and conditions given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical 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.

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

3.1 Performance of the product

3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load and shear load (static and quasi static loading), displacements	Annex C1 to C4

3.1.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.1.3 Hygiene, health and the environment (BWR 3)

No performance assessed.

3.2 Methods used for the assessment

The assessment has been made in accordance with EAD 330499-02-0601.

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

According to Decision 96/582/EC of the European Commission the system 1 of assessment and verification of constancy of performance applies (see Annex V to regulation (EU) No 305/2011).

5 Technical details necessary for the implementation of the AVCP system, as provided in the applicable European Assessment Document (EAD)

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited in Instytut Techniki Budowlanej.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

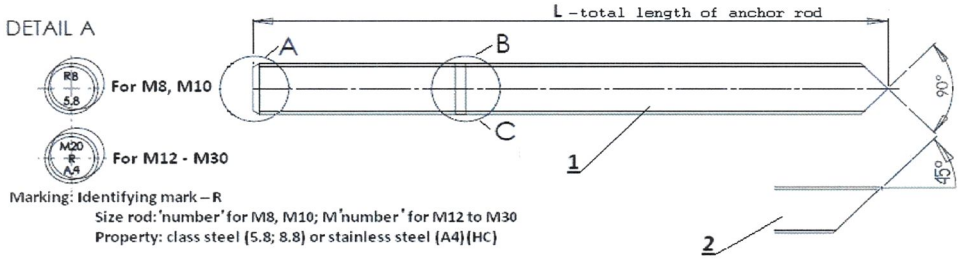
Issued in Warsaw on 30/12/2024 by Instytut Techniki Budowlanej



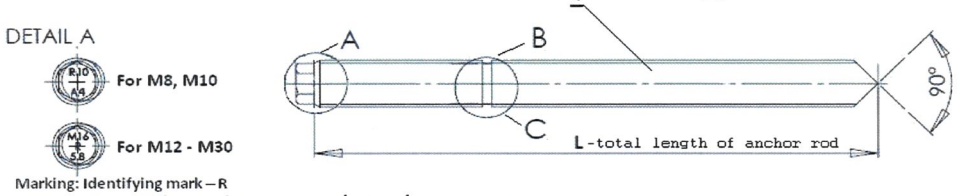
Anna Panek, MSc

Deputy Director of ITB

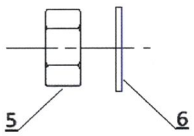
Threaded anchor rods



Marking: Identifying mark – R
Size rod: 'number' for M8, M10; M 'number' for M12 to M30
Property: class steel (5.8; 8.8) or stainless steel (A4) (HC)



Marking: Identifying mark – R
Size rod: 'number' for M8, M10; M 'number' for M12 to M30
Property: class steel (5.8; 8.8) or stainless steel (A4) (HC)





DETAIL B
Painted Mark Version
Depth h_{mid}



DETAIL C
Notched Mark Version
Depth h_{mid}

1. Anchor rod R-STUDS–(88),(A4),(HC)-FL
2. 45° shape with anchor rod
3. The flat end of anchor rod
4. Anchor rod R-STUDS–(88),(A4),(HC) with the hexagonal tip
5. Hexagonal nut
6. Washer

Table A1: Threaded rods

Designation		Material			
Steel, zinc electroplated ≥ 5 µm according to EN ISO 4042 **Steel, hot-dip galvanized ≥ 45 µm according to EN ISO 10684**					
Threaded rod	**Property class**	**Characteristic steel ultimate strength**	**Characteristic steel yield strength**	**Fracture elongation**	
	5.8	$f_{uk} \geq 500$ N/mm²	$f_{yk} \geq 400$ N/mm²	$A_5 > 8\%$	EN ISO 898-1
	8.8	$f_{uk} \geq 800$ N/mm²	$f_{yk} \geq 640$ N/mm²	$A_5 \geq 12\%$	
	10.9	$f_{uk} \geq 1000$ N/mm²	$f_{yk} \geq 900$ N/mm²	$A_5 > 9\%$	
	12.9	$f_{uk} \geq 1200$ N/mm²	$f_{yk} \geq 1080$ N/mm²	$A_5 > 8\%$	
Hexagon nut	5	for class 5.8 rods			EN ISO 898-2
	8	for class 8.8 rods			
	10	for class 10.9 rods			
	12	for class 12.9 rods			
Washer	Steel according to EN ISO 7089; corresponding to anchor rod material				
Stainless steel A4 **(Materials) 1.4401, 1.4404, 1.4571** **High corrosion resistance stainless steel (HCR)** **(Materials) 1.4529, 1.4565, 1.4547**					
Threaded rod	**Property class**	**Characteristic steel ultimate strength**	**Characteristic steel yield strength**	**Fracture elongation**	
	70	$f_{uk} \geq 700$ N/mm²	$f_{yk} \geq 450$ N/mm²	$A_5 \geq 12\%$	EN 10088 EN ISO 3506
	80	$f_{uk} \geq 800$ N/mm²	$f_{yk} \geq 600$ N/mm²	$A_5 \geq 12\%$	
Hexagon nut	70	for class 70 rods			EN 10088 EN ISO 3506
	80	for class 80 rods			
Washer	Steel according to EN 10088; corresponding to anchor rod material				

Commercial threaded rods (in the case of rods made of galvanized steel – standard rods with property class ≤ 8.8 only), with:

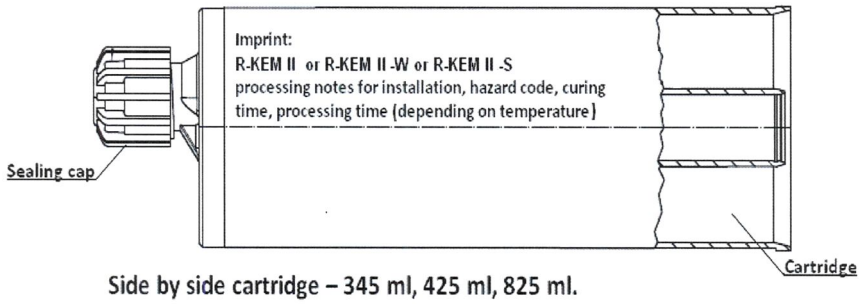
- material and mechanical properties according to Table A1,
- confirmation of material and mechanical properties by inspection certificate 3.1 according to EN-10204:2004; the documents shall be stored,
- marking of the threaded rod with the embedment depth.

Note: Commercial standard threaded rods made of galvanized steel with property class above 8.8 are not permitted in some Member States.

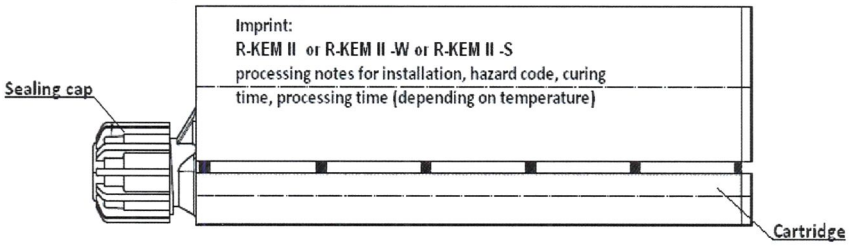
Table A2: Injection mortars

Product	Composition
RAWL R-KEM II / RAWL R-KEM II-S / RAWL R-KEM II-W RAWL RM50 / RAWL RM50-S / RAWL RM50-W	Bonding agent: polyester resin styrene free Hardener: dibenzoyl peroxide Additive: quartz sand Supplied in three colours: standard, grey (G) and stone (ST)

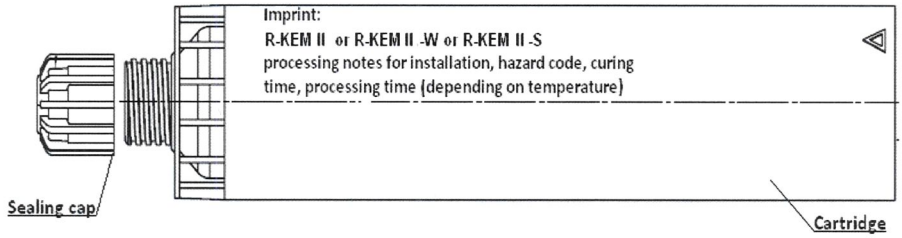
Coaxial cartridge –
150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 410 ml, 420 ml.



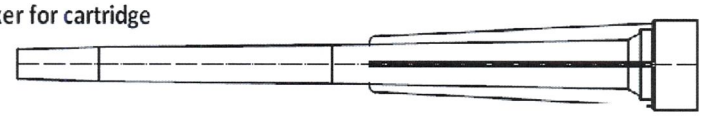
Side by side cartridge – 345 ml, 425 ml, 825 ml.



Cartridge a single component for two part foil capsules –
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.



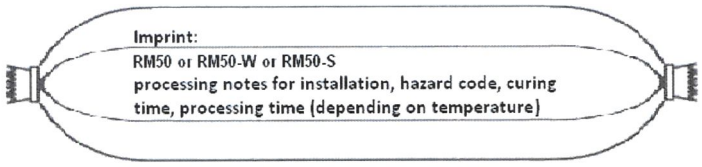
Mixer for cartridge



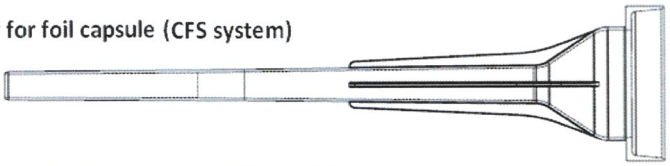
RAWL R-KEM II / RAWL R-KEM II-S / RAWL R-KEM II-W and RAWL RM50 / RAWL RM50-S / RAWL RM50-W	Annex A3 of European Technical Assessment ETA-21/0243
Product description Cartridge types and sizes (1)	

Foil capsule (CFS system) –

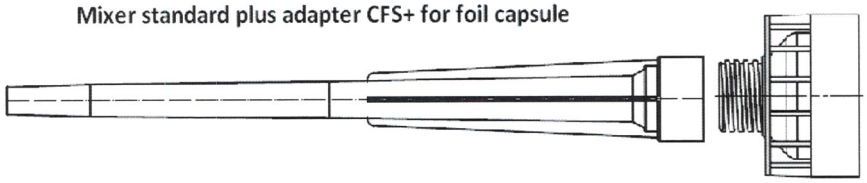
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.



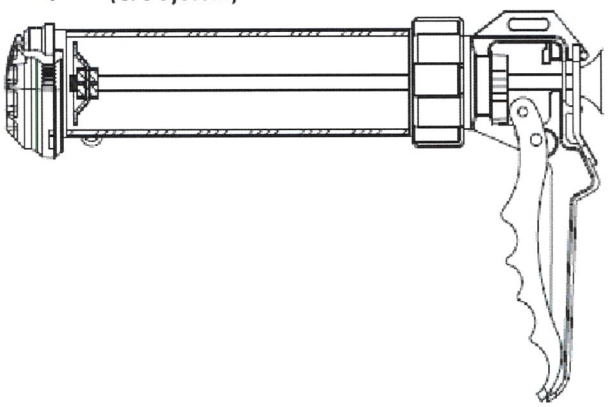
Mixer for foil capsule (CFS system)



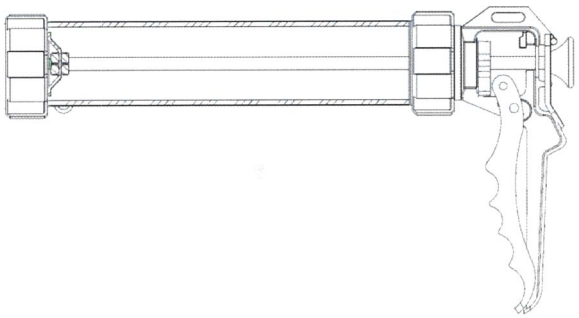
Mixer standard plus adapter CFS+ for foil capsule



Gun for foil capsule (CFS system)



Gun for capsule (RAWL CFS +)



Specification of intended use

Anchors subject to:

Static and quasi-static loads: sizes M8 to M30.

Base material:

- Reinforced or unreinforced normal weight concrete (without fibres) of strength class C20/25 to C50/60 to EN 206.
- Uncracked concrete.

Temperature ranges:

Installation temperature (temperature of substrate):

- -5°C to +30°C in case of R-KEM II / RM50 (standard version).
- -5°C to +40°C in case of R-KEM II-S / RM50-S (version for summer season).
- -20°C to +20°C in case of R-KEM II-W / RM50-W (version for winter season).

In-service temperature:

The anchorages may be used in the following temperature range:

- -40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C).
- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°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 (CRC):
  - stainless steel A4 according to Annex A, Table A3: CRC III,
  - high corrosion resistance steel (HCR) according to Annex A, Table A3: CRC V.

Installation:

- Dry or wet concrete (use category I1).
- Flooded holes (use category I2).
- Installation direction D2 (downward and horizontal installation).
- The anchorages are suitable for rotary hammer drilled holes.

Design:

- Anchorages are designed in accordance to EN 1992-4:2018 and EOTA Technical Report TR 055.
- Anchorages are designed under the responsibility of the engineer experienced in anchorages and concrete work.
- 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.).

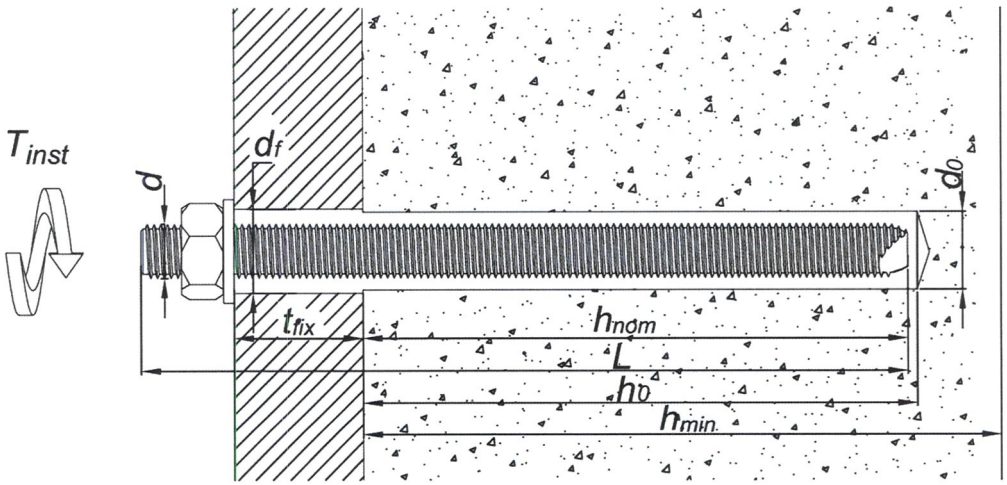


Table B1: Installation parameters

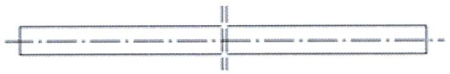
Size			M8	M10	M12	M16	M20	M24	M30
Diameter of anchor rod	d	[mm]	8	10	12	16	20	24	30
Nominal drilling diameter	d_0	[mm]	10	12	14	18	24	28	35
Maximum diameter hole in the fixture	d_f	[mm]	9	12	14	18	22	26	33
Effective embedment depth	$h_{ef,min}$	[mm]	60	70	80	100	120	140	165
	$h_{ef,max}$	[mm]	160	200	240	320	400	400	600
Depth of the drilling hole	h_0	[mm]	h_{ef} + 5 mm						
Minimum thickness of the concrete slab	h_{min}	[mm]	h_{ef} + 30 mm; ≥ 100 mm			h_{ef} + $2d_0$			
Maximum installation torque	$T_{inst,max}$	[Nm]	10	20	40	80	120	180	300
Minimum spacing	s_{min}	[mm]	40	40	40	50	60	70	85
Minimum edge distance	c_{min}	[mm]	40	40	40	50	60	70	85

Table B2: Maximum processing time and minimum curing time

Temperature of mortar [°C]	Temperature of substrate (concrete) [°C]	Maximum processing time [min.]			Minimum curing time [1] [min.]		
		R-KEM II / RM50	R-KEM II-S / RM50-S	R-KEM II-W / RM50-W	R-KEM II / RM50	R-KEM II-S / RM50-S	R-KEM II-W / RM50-W
+5	-20	-	-	45	-	-	1440
+5	-15	-	-	30	-	-	1080
+5	-10	-	-	20	-	-	480
+5	-5	70	180	11	480	1440	300
+5	0	45	120	7	240	1080	120
+5	+5	25	60	5	120	720	60
+10	+10	15	45	2	90	480	45
+15	+15	9	25	1,5	60	360	30
+20	+20	5	15	1	45	240	15
+25	+30	2	7	-	30	90	-
+25	+35	-	6	-	-	60	-
+25	+40	-	5	-	-	45	-

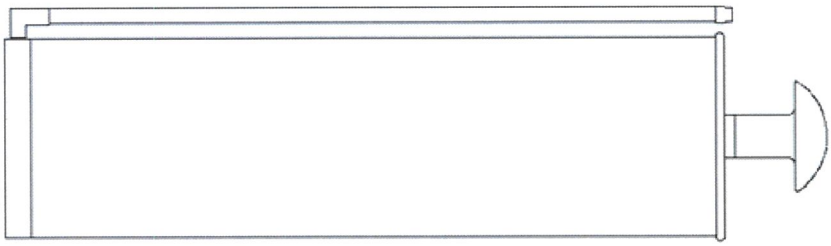
[1] Minimum mortar temperature for installation +5°C; maximum mortar temperature for installation +25°C. For wet condition and flooded holes the curing time must be doubled.

Additional mixer extension



*Variable length from 300 mm up 1000 mm

Manual blower pump



Steel brush

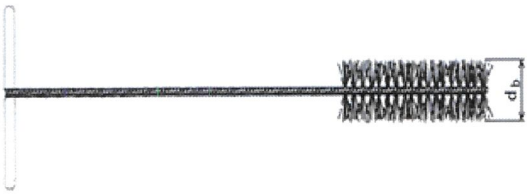


Table B3: Brush diameter

Size rod			M8	M10	M12	M16	M20	M24	M30
d_b	Brush diameter	[mm]	12	14	16	20	26	30	37

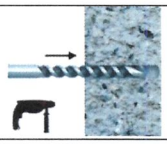
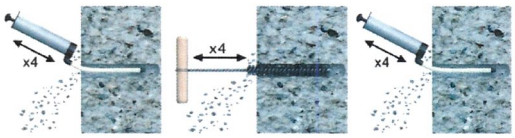
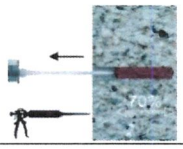
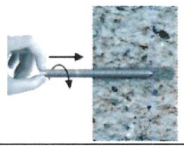
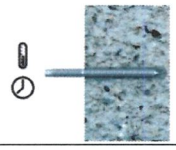
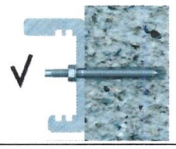
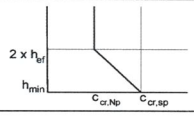
	1. Drill hole to the required diameter and depth using a rotary hammer.
a. 	2. Hole cleaning. Clean the hole with brush and hand pump: – starting from the drill hole bottom blow the hole at least 4 times using the hand pump, – using the specified brush, mechanically brush out the hole at least 4 times, – starting from the drill hole bottom, blow at least 4 times with the hand pump.
	3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained.
	4. Insert the mixing nozzle to the far end of the hole and inject mortar, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	5. Immediately insert the rod, slowly and with slight twisting motion. Remove any excess mortar around the hole before it sets.
	6. Leave the fixing undisturbed until the curing time elapses.
	7. Attach fixture and tighten the nut to the required torque. The installation torque cannot exceed $T_{inst,max}$.

Table C1: Characteristic resistance under tension load in uncracked concrete – static and quasi-static loads

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel failure with standard threaded rod grade 5.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	18	29	42	78	122	176	280
Partial safety factor	γ_{Ms} [1)]	[-]	1,50						
Steel failure with standard threaded rod grade 8.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,50						
Steel failure with standard threaded rod grade 10.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,40						
Steel failure with standard threaded rod grade 12.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	44	70	101	188	294	424	673
Partial safety factor	γ_{Ms} [1)]	[-]	1,40						
Steel failure with standard stainless steel threaded rod A4-70									
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87						
Steel failure with standard stainless steel threaded rod A4-80									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,60						
Steel failure with standard high corrosion threaded rod grade 70									
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,87						
Combined pull-out and concrete cone failure (working life 50 and/or 100 years)									
Characteristic bond resistance in uncracked concrete C20/25, working life 50 years									
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr,50}$	[N/mm²]	9,3	9,3	8,8	8,1	7,8	6,3	5,3
Temperature range II: 80°C/50°C	$\tau_{Rk,ucr,50}$	[N/mm²]	7,7	7,7	7,3	6,7	6,5	5,2	4,4
Sustained load factor for $\tau_{Rk,ucr,50}$ in uncracked concrete	$\psi^0_{sus,50}$	40°C/24°C	0,74						
		80°C/50°C	0,69						
Characteristic bond resistance in uncracked concrete C20/25, working life 100 years									
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr,100}$	[N/mm²]	9,3	9,3	8,8	8,1	7,8	6,3	5,3
Temperature range II: 80°C/50°C	$\tau_{Rk,ucr,100}$	[N/mm²]	7,7	7,7	7,3	6,7	6,5	5,2	4,4
Sustained load factor for $\tau_{Rk,ucr,100}$ in uncracked concrete	$\psi^0_{sus,100}$	40°C/24°C	0,83						
		80°C/50°C	0,78						
Increasing factors	ψ_c	C30/37	1,04				1,0		
		C40/50	1,07				1,0		
		C50/60	1,09				1,0		

1) In the absence of national regulations
2) h – concrete member thickness

Table C1: (continuation)

Concrete cone failure					
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0		
Edge distance	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$		
Spacing	$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$		
Splitting failure					
Edge distance	$c_{cr,sp}$ for h_{min}	[mm]	$2,5 \cdot h_{ef}$	$2,0 \cdot h_{ef}$	$1,5 \cdot h_{ef}$
	$c_{cr,sp}$ for $h_{min} < h^{1)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)	[mm]			
	$c_{cr,sp}$ for $h^{1)} \geq 2 \cdot h_{ef}$	[mm]	$c_{cr,Np}$		
Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$		
Installation safety factors for combined pull-out, concrete cone and splitting failure					
Installation safety factors for category I1 + I2	γ_{inst}	[-]	1,4	1,2	

1) h – concrete member thickness

Table C2: Characteristic resistance under shear loads in uncracked concrete – steel failure without lever arm

Size				M8	M10	M12	M16	M20	M24	M30
Characteristic resistance		$V^0_{Rk,s}$	[kN]	$k_6 \cdot A_s$ [2] $\cdot f_{uk}$ [3]						
Factor considering ductility	carbon steel with $f_{uk} \leq 500$ N/mm²	k_6	[-]	0,6						
	carbon steel with $500 < f_{uk} \leq 1000$ N/mm² or stainless steel			0,5						
Factor considering ductility		k_7		1,0						
Partial safety factor [1]										
Threaded rod grade 5.8		γ_{Ms}	[-]	1,25						
Threaded rod grade 8.8				1,25						
Threaded rod grade 10.9				1,50						
Threaded rod grade 12.9				1,50						
Stainless steel threaded rod A4-70				1,56						
Stainless steel threaded rod A4-80				1,33						
High corrosion stainless steel grade 70				1,56						

[1] In the absence of other national regulation
[2] Stressed cross section of the steel
[3] According to EN 1992-1-1

Table C3: Characteristic values for shear load in uncracked concrete – steel failure with lever arm

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure with standard threaded rod grade 5.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	561	1124
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard threaded rod grade 8.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1799
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard threaded rod grade 10.9									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	37	75	131	333	649	1123	2249
Partial safety factor	γ_{Ms}	[-]	1,50						
Steel failure with standard threaded rod grade 12.9									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	45	90	157	400	779	1347	2699
Partial safety factor	γ_{Ms}	[-]	1,50						
Steel failure with standard stainless steel threaded rod A4-70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	1574
Partial safety factor	γ_{Ms}	[-]	1,56						
Steel failure with standard stainless steel threaded rod A4-80									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1799
Partial safety factor	γ_{Ms}	[-]	1,33						
Steel failure with high corrosion stainless steel threaded rod grade 70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	1574
Partial safety factor	γ_{Ms}	[-]	1,56						

Table C4: Concrete pry out failure and concrete edge failure

Size			M8	M10	M12	M16	M20	M24	M30
Pry out failure									
Pry-out factor	k_8	[-]	2						
Concrete edge failure									
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	30
Effective length of anchor shear loading	l_f	[mm]	min (h_{ef}; $12d_{nom}$)						min (h_{ef}; 300)

Table C5: Displacement under tension loads

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement in uncracked C20/25 to C50/60 concrete									
Displacement [1)]	δ_{N0}	[mm/N/mm²]	0,046	0,057	0,073	0,094	0,108	0,128	0,169
	$\delta_{N\infty}$	[mm/N/mm²]	0,130	0,130	0,130	0,130	0,130	0,130	0,130

[1)] These values are suitable for each temperature range and categories specified in Annex B1
Calculation of the displacement: $\delta_{N0} = \delta_{N0}$-factor · N; $\delta_N = \delta_{N\infty}$-factor · N; (N – applied tension load)

Table C6: Displacement under shear loads

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement in uncracked C20/25 to C50/60 concrete									
Displacement [1)]	δ_{V0}	[mm/kN]	0,228	0,144	0,099	0,053	0,034	0,024	0,015
	$\delta_{V\infty}$	[mm/kN]	0,342	0,216	0,148	0,080	0,051	0,035	0,022

[1)] These values are suitable for each temperature range and categories specified in Annex B1
Calculation of the displacement: $\delta_{N0} = \delta_{N0}$-factor · V; $\delta_N = \delta_{N\infty}$-factor · V; (V – applied shear load)