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European Technical Assessment

ETA-10/0108 of 20/09/2016

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	R-CAS-V
Product family to which the construction product belongs	Bonded anchor with anchor rod of sizes M8 to M30 made of galvanized steel or stainless steel for use in non-cracked concrete
Manufacturer	RAWLPLUG S.A. ul. Kwidzyńska 6 51-416 Wrocław Poland
Manufacturing plant	Manufacturing Plant no. 3
This European Technical Assessment contains	14 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	Guideline for European Technical Approval ETAG 001, Edition April 2013 "Metal anchors for use in concrete – Part 1: Anchors in general and Part 5: Bonded anchors", used as European Assessment Document (EAD)
This version replaces	ETA-10/0108 issued on 23/06/2015

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Specific Part

1 Technical description of the product

The R-CAS-V is a bonded anchor (capsule type) consisting of chemical mortar glass capsules and threaded anchor rod of sizes M8 to M30 made of:

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

with hexagon nut and washer.

The glass capsule is placed into a drilled hole previously cleaned and the threaded rod is driven by machine with simultaneous hammering and turning. The threaded rod is anchored by the bond between threaded rod, chemical mortar and concrete.

The threaded rods are available for all diameters with two type of tip end: a one side 45° chamfer or a two sides 45° chamfer.

An illustration and description of the products are given in Annexes A.

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

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

The performances given in this European Technical Assessment are based on an assumed 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 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)

The essential characteristic is detailed in the Annexes C.

3.1.2 Safety in case of fire (BWR 2)

Essential characteristics	Performances
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.1.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of

the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.1.4 Safety and accessibility in use (BWR 4)

For Basic Requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability (BWR 1).

3.1.5 Sustainable use of natural resources (BWR 7)

No performance assessed.

3.2 Methods used for the assessment

The assessment of fitness of the anchors for declared 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 the ETAG 001 *"Metal anchors for use in concrete"*, Part 1: "*Anchors in general*" and Part 5: "*Bonded anchors*", on the basis of Option 7.

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 of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete structural elements (which contributes to the stability of the works) or heavy units	–	1

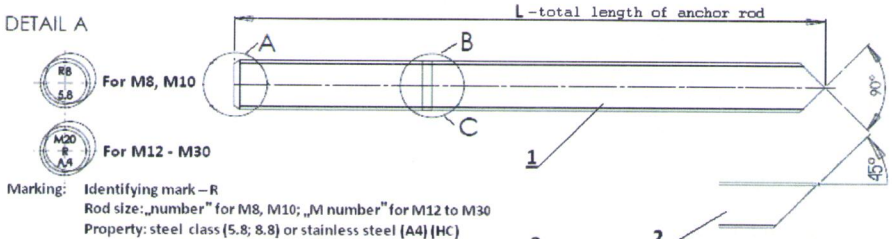
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document (EAD)

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

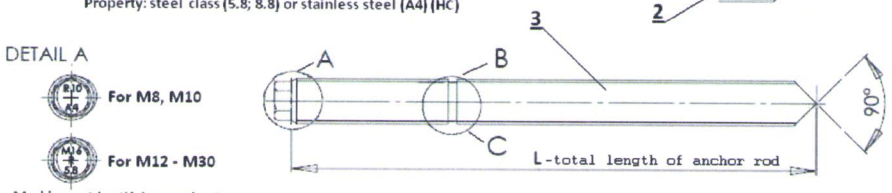
For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 20/09/2016 by Instytut Techniki Budowlanej

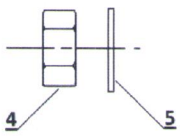
Anna Panek, MSc
Deputy Director of ITB



Marking: Identifying mark – R
Rod size: „number" for M8, M10; „M number" for M12 to M30
Property: steel class (5.8; 8.8) or stainless steel (A4) (HC)



Marking: Identifying mark – R
Rod size: „number" for M8, M10; „M number" for M12 to M30
Property: steel class (5.8; 8.8) or stainless steel (A4) (HC)

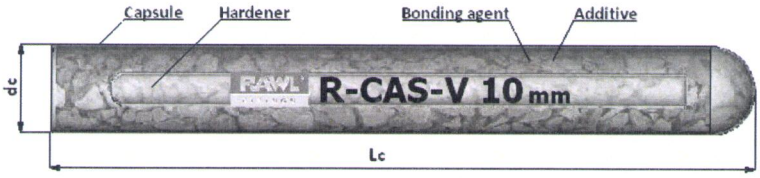


DETAIL B
Painted Mark Version
Depth h_{ef}

DETAIL C
Notched Mark Version
Depth h_{ef}

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

1. Anchor rod R-STUDS - (5.8, 8.8,..) (A4),(HC) – FL
2. 45°shape with anchor rod
3. Anchor rod R-Studs - (5.8, 8.8,..) (A4),(HC) – with Hex-drive
4. Hexagonal nut
5. Washer



Marking: Identifying mark –
Identifying capsule: **R-CAS-V**
Size rod: 8 to 30
Drilling diameter

R-CAS-V (glass capsules)	8 mm	10 mm	12 mm	16 mm	20 mm	24 mm	30 mm
L_c [mm]	85 ± 3%	85 ± 3%	95 ± 2%	95 ± 2%	180 ± 2%	215 ± 1%	270 ± 1%
d_c [mm]	9,25	10,75	12,65	16,75	21,55	23,75	33,20
R-STUDS (anchor rods)	M8	M10	M12	M16	M20	M24	M30
L [mm]	110; 160; 250	130, 170, 190, 220, 250	160, 190, 220, 260, 300	190, 220, 260, 300, 310, 380	260, 350	300, 400	380

R-CAS-V

Product description
Characteristic of the product

Annex A1

of European Technical Assessment ETA-10/0108

Table A1: Metal components

Part	Designation		
	Steel, zinc plated	**Stainless steel**	**High corrosion resistance stainless steel (HCR)**
Threaded rod	Steel, property class 5.8 to 12.9 acc. to EN ISO 898-1 electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Hexagon nut	Steel, property class 5 to 12, acc. to EN ISO 898-2; electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Washer	Steel, acc. to EN ISO 7089; electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088

Table A2: Chemical mortar

Product	Composition
R-CAS-V	Bonding agent: Vinylester styrene free resin Hardener: Dibenzoyl peroxide Additive: Quartz sand (filler)

SPECIFICATION OF INTENDED USE

Use:

The anchors are intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences.

Anchors subject to:

Static and quasi-static loads: M8 to M30.

Base material:

- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206.
- Non cracked concrete: M8 to M30.

Temperature range:

The anchors 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):

- Elements made of galvanized steel may be used in structures subject to dry internal conditions.
- Elements made of stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).
- Elements made of high corrosion resistant stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure or exposure in permanently damp internal conditions or in other particular aggressive conditions. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Installation:

- Installation temperature ≥ -5°C
- Dry or wet concrete (use category 1): M8 to M30.
- Flooded holes with the exception of seawater (use category 2): M8 to M30.
- All anchor sizes are suitable for rotary hammer drilled holes: M8 to M30.

Design methods:

EOTA Technical Report TR 029 (September 2010) or CEN/TS 1992-4:2009.

R-CAS-V	**Annex B1** of European Technical Assessment ETA-10/0108
Intended use Intended use	

Table B1: Installation data

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	32
Effective embedment depth	$h_{ef} = h_{nom}$ [mm]	80	90	110	125	170	210	270
Depth of the drilling hole	h_0 [mm]	h_{ef} + 5 mm						
Minimum thickness of concrete member	h_{min} [mm]	120	130	140	180	230	270	340
Torque moment	T_{inst} [Nm]	10	20	40	80	120	180	300
Minimum spacing	s_{min} [mm]	$0,5 \cdot h_{ef}$						
Minimum edge distance	c_{min} [mm]	$0,5 \cdot h_{ef}$						

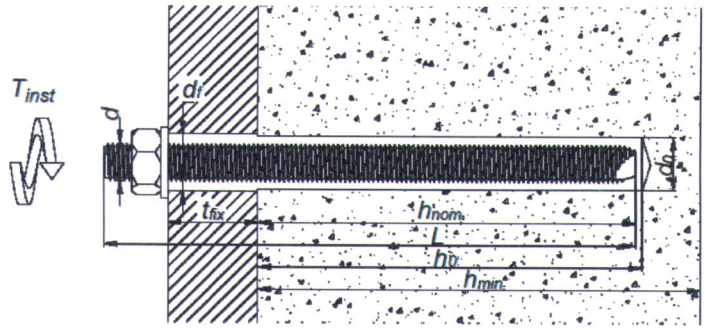


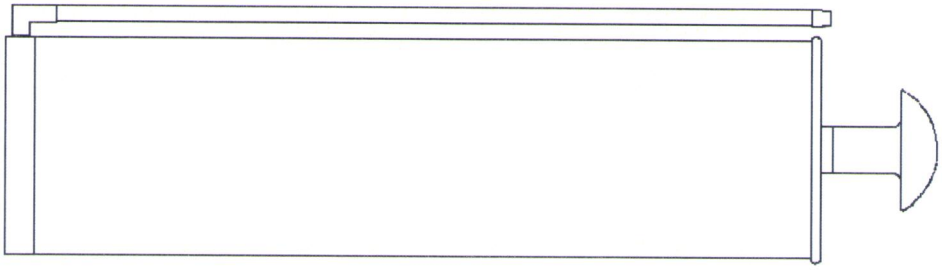
Table B2: Minimum curing time

Concrete temperature	Minimum curing time[1)]
-5°C	8 h
0°C	4 h
5°C	2,5 h
10°C	2 h
15°C	1,5 h
20°C	45 min
30°C	20 min
40°C	10 min

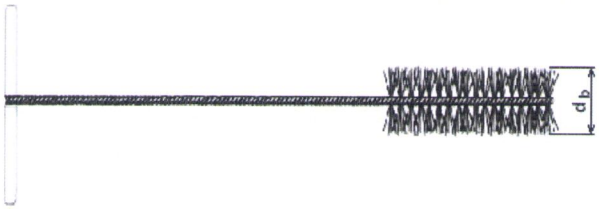
[1)] Curing time shall be doubled for wet concrete.

R-CAS-V	**Annex B2** of European Technical Assessment ETA-10/0108
Intended use Installation data	

Manual blower pump

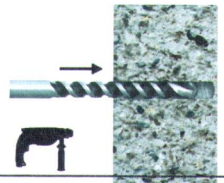
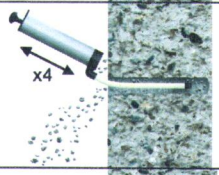
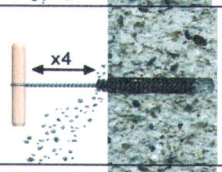
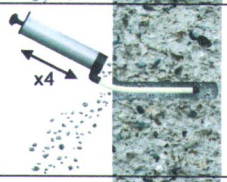
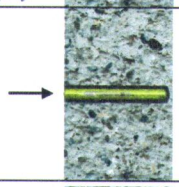
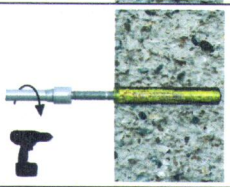
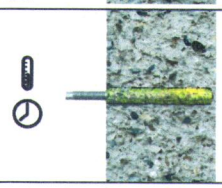
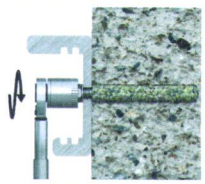


Steel brush



Brush diameter

Size rod	M8	M10	M12	M16	M20	M24	M30
Brushes diameter d_b (mm)	12	14	16	20	26	30	37

	Drill a hole to the required diameter and depth using a rotary hammer drilling machine.
	4x blowing starting from the bottom of the drilled hole using the hand pump.
	4x brushing (at least) using the specified steel brush.
	4x blowing starting from the bottom of the drilled hole using the hand pump.
	Insert the glass capsule into the cleaned hole.
	Positioning the stud into the drilled hole. Switch on the drilling machine (simultaneous hammering and turning) and drive the stud into the drilled hole until the embedment depth is reached. Setting control: Mortar excess flows out at the top of the drilled hole.
	Leave the fixing undisturbed until the cure time elapses.
	Attach the fixture and tighten the nut to the required torque.

R-CAS-V	**Annex B4** of European Technical Assessment ETA-10/0108
Intended use Installation instruction	

Table C1a: Characteristic values of resistance under tension loads

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel failure with 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 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 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 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 stainless steel threaded rod grade 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 stainless steel threaded rod grade 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 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									
Characteristic bond resistance in non-cracked concrete C20/25	$\tau_{Rk,ucr}$	[N/mm²]	13	12	12	11	10	9	8,5
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,04					1,0	
		C40/50	1,07					1,0	
		C50/60	1,09					1,0	
Installation safety factor for use category 1	γ_2 [2)] = γ_{inst} [3)]	[-]	1,2						
Installation safety factor for use category 2	γ_2 [2)] = γ_{inst} [3)]	[-]	1,4						
Factor acc. CEN/TS 1992-4-5:2009, § 6.2.2.3 and § 6.2.3.1	$k_8 = k_{ucr}$ [3)]	[-]	10,1						
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210	270
Edge distance and spacing	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$						
	$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$						

1) In the absence of other national regulations
2) Parameter for design according to EOTA Technical Report TR 029
3) Parameter for design according to CEN/TS 1992-4-5:2009

Table C1b: Characteristic values of resistance under tension loads

Size			M8	M10	M12	M16	M20	M24	M30
Splitting failure									
Effective anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210	270
Edge distance and spacing	$c_{cr,sp}$ [4)5)]	[mm]	$c_{cr,sp} = hef \cdot \left(\frac{\tau_{k,ucr}}{8}\right)^{0.4} \cdot \left(3{,}1 - 0{,}7\frac{h}{h_{ef}}\right)$						
	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$						
Installation safety factor for use category 1	γ_2 [2)] = γ_{inst} [3)]	[-]	1,2						
Installation safety factor for use category 2	γ_2 [2)] = γ_{inst} [3)]	[-]	1,4						

1) h = concrete member thickness
2) Parameter for design according to EOTA Technical Report TR 029
3) Parameter for design according to CEN/TS 1992-4-5:2009
4) For $h/h_{hef} \leq 2{,}4$; if $h/h_{hef} > 2{,}4$ $c_{cr,sp} = 1{,}5 \times hef$
5) $\tau_{k,ucr}$ from Table C1a

Table C2: Characteristic values of resistance under shear loads - steel failure without lever arm [1)]

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure with threaded rod grade 5.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	9	14	21	39	61	88	140
Partial safety factor	γ_{Ms} [2)]	[-]	1,25						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	224
Partial safety factor	γ_{Ms} [2)]	[-]	1,25						
Steel failure with threaded rod grade 10.9									
Characteristic resistance	$V_{Rk,s}$	[kN]	18	29	42	78	122	176	280
Partial safety factor	γ_{Ms} [2)]	[-]	1,50						
Steel failure with threaded rod grade 12.9									
Characteristic resistance	$V_{Rk,s}$	[kN]	22	35	51	94	147	212	337
Partial safety factor	γ_{Ms} [2)]	[-]	1,50						
Steel failure with stainless steel threaded rod grade A4-70									
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124	196
Partial safety factor	γ_{Ms} [2)]	[-]	1,56						
Steel failure with stainless steel threaded rod grade A4-80									
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	224
Partial safety factor	γ_{Ms} [2)]	[-]	1,33						
Steel failure with high corrosion stainless steel threaded rod grade 70									
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124	196
Partial safety factor	γ_{Ms} [2)]	[-]	1,56						

1) Ductility factor acc. CEN/TS 1992-4-5:2009, § 6.3.2.1: $k_2 = 1{,}0$
2) In the absence of national regulations

R-CAS-V	**Annex C2** of European Technical Assessment ETA-10/0108
Performances Characteristic resistance under shear loads. Design method: EOTA TR 029 or CEN/TS 1992-4:2009	

Table C3: Characteristic values of resistance under shear loads - steel failure with lever arm

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure with 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)]	[-]	1,25						
Steel failure with 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)]	[-]	1,25						
Steel failure with 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)]	[-]	1,50						
Steel failure with 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)]	[-]	1,50						
Steel failure with stainless steel threaded rod grade A4-70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56						
Steel failure with stainless steel threaded rod grade A4-80									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1799
Partial safety factor	γ_{Ms} [1)]	[-]	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)]	[-]	1,56						

[1)] In the absence of national regulations

Table C4: Characteristic values of resistance under shear loads – pry-out and concrete edge failure

Size			M8	M10	M12	M16	M20	M24	M30
Pry-out failure									
Factor acc. to equation (5.7) of TR 029 or acc. to equation (27) of CEN/TS 1992-4-5:2009	k [1] = k_3 [2]	[-]	2						
Concrete edge failure: see clause 5.2.3.4 of Technical Report TR 029									
Effective anchor length	l_f	[mm]	80	90	110	125	170	210	270
Diameter of the anchor	d [1] = d_{nom} [2]	[mm]	8	10	12	16	20	24	30

[1] Parameter for design according to EOTA Technical Report TR 029
[2] Parameter for design according to CEN/TS 1992-4-5:2009

Table C5: Displacements under tension loads

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement under tension loads in non-cracked concrete C20/25 to C50/60									
Admissible service load	N	[kN]	11,5	14,2	22,1	30,0	47,3	62,9	95,1
Displacement	δ_{N0}	[mm]	0,30	0,30	0,35	0,35	0,40	0,45	0,50
	$\delta_{N\infty}$	[mm]	0,65	0,65	0,65	0,65	0,65	0,65	0,65

These values are suitable for each temperature range and categories specified in Annex B1

Table C6: Displacements under shear loads

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement under shear loads in non-cracked concrete C20/25 to C50/60									
Admissible service load	V	[kN]	3,7	5,8	8,4	15,7	24,5	35,3	55,6
Displacement	δ_{V0}	[mm]	2,5	2,5	2,5	2,5	2,5	2,5	2,5
	$\delta_{V\infty}$	[mm]	3,7	3,7	3,7	3,7	3,7	3,7	3,7

These values are suitable for each temperature range and categories specified in Annex B1