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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-17/0594 of 29/03/2018

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	R-KER-II, R-KER-II-S and R-KER-II-W
Product family to which the construction product belongs	Bonded anchor with threaded rod, rod with inner thread and rebar for use in concrete
Manufacturer	RAWLPLUG S.A. ul. Kwidzyńska 6 51-416 Wrocław Poland
Manufacturing plant	Manufacturing Plant no. 3
This European Technical Assessment contains	45 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 330499-00-0601 "Bonded fasteners for use in concrete"

Specific Part

1 Technical description of the product

The R-KER-II, R-KER-II-S and R-KER-II-W are bonded anchors (injection type) consisting of a injection mortar cartridge using an applicator gun equipped with a special mixing nozzle and steel element.
The steel element consists of:

- threaded anchor rod sizes M8 to M30 made of:
  - galvanized carbon steel,
  - carbon steel with zinc flake coating,
  - stainless steel,
  - high corrosion resistant stainless steel,
  - ultra-high strength steel with zinc flake coating,

  with hexagon nut and washer,
- anchor rod with inner thread sizes M6/Ø10 to M16/Ø24 made of:
  - galvanized carbon steel,
  - stainless steel,
  - high corrosion resistant stainless steel,
- rebar sizes Ø8 to Ø32.

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

An illustration and the description of the products are given in Annex 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 Annex 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)

Essential characteristic	Performance
Characteristic resistance for static and quasi static loads, displacements	See Annex C1 to C15
Characteristic resistance for seismic performance category C1, displacements	See Annex C16 to C18

3.1.2 Hygiene, health and the environment (BWR 3)

No performance assessed.

3.2 Methods used for the assessment

The assessment of the product for the declared intended use has been made in accordance with the EAD 330499-00-0601 *"Bonded fasteners for use in concrete"*.

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 (see Annex V to Regulation (EU) No 305/2011) applies.

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

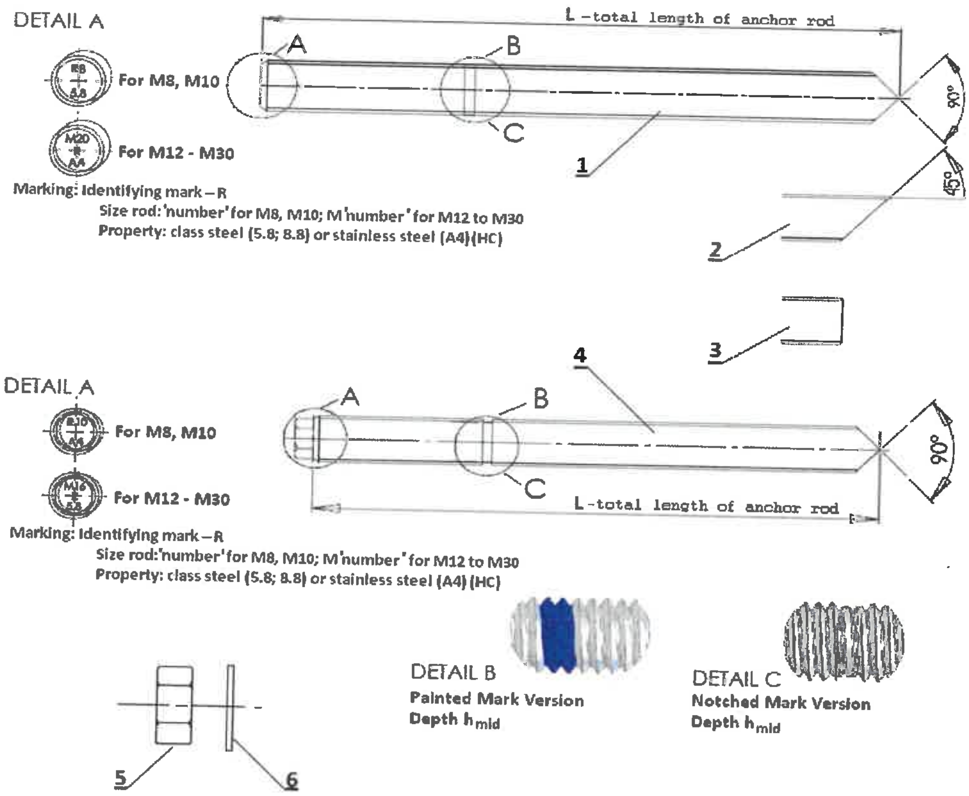
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Instytut Techniki Budowlanej.

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 29/03/2018 by Instytut Techniki Budowlanej

Anna Panek, MSc
Deputy Director of ITB

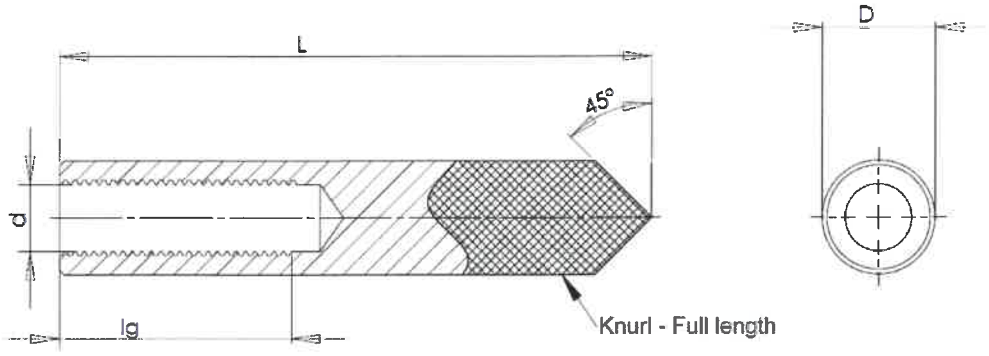
Threaded anchor rods

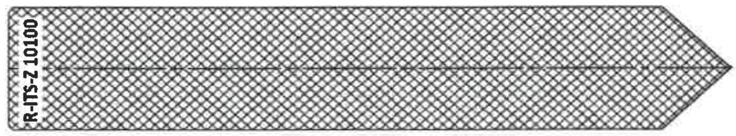


1. Anchor rod R-STUDS–
2. 45° shape with anchor rod
3. The flat end of anchor rod
4. Anchor rod R-STUDS–(88),(A4),(HC) with the hexagonal tip
5. Hexagonal nut
6. Washer

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex A1** of European Technical Assessment ETA-17/0594
Threaded anchor rods	

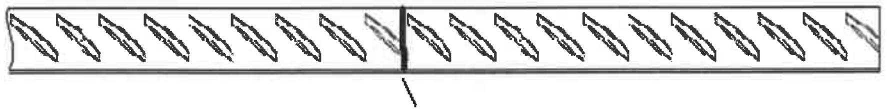
Anchor rods with inner thread





Marking: R - Identifying mark
ITS - product index
Z - carbon steel or A4 - stainless steel
XX - thread size
YYY - length of sleeve

Rebar



R-KER-II, R-KER-II-S and R-KER-II-W	**Annex A2** of European Technical Assessment ETA-17/0594
Anchor rods with inner thread and rebar	

Table A1: Threaded rods

Part	Designation: Steel, zinc plated	Stainless steel	High corrosion resistance stainless steel (HCR)	Ultra-high Strength Steel, coated
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 or non-electrolytically applied zinc flake coatings ≥ 8 µm acc. EN ISO 10683	Steel 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	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506	Steel, property class 14.8U to 16.8U acc. to USCAR- UHSFG-1416U non-electrolytically zinck flake coating ≥ 8 µm acc. EN ISO 10683
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 or non-electrolytically applied zinc flake coatings ≥ 8 µm acc. EN ISO 10683	Steel 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	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506	Steel, property class 12 to 16 acc. to USCAR- UHSFG-1416U non-electrolytically applied zinc flake coating ≥ 8 µm acc. EN ISO 10683
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 or non-electrolytically applied zinc flake coatings ≥ 8 µm acc. EN ISO 10683	Steel 1.4401, 1.4404, 1.4571 acc. to EN 10088	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088	Steel, or non-electrolytically applied zinc flake coating ≥ 8 µm acc. EN ISO 10683

Commercial standard 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- 0204:2004; 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: Rods with inner threaded

Part	Designation		
	Steel, zinc plated	Stainless steel	High corrosion resistance stainless steel (HCR)
Rod with inner threaded	Steel, property class 5.8 to 8.89 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

Table A3: Reinforcing bars according to EN 1992-1-1, Annex C

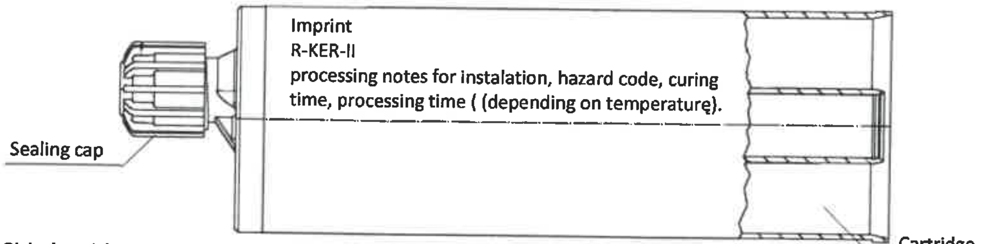
Product form		Bars and de-coiled rods	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ [N/mm²]		400 to 600	
Minimum value of $k = (f_t / f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force, ε_{uk} [%]		≥ 5,0	≥ 7,5
Bendability		Bend / Rebend test	
Maximum deviation from nominal mass (individual bar) [%]	Nominal bar size [mm] ≤ 8 > 8	± 6,0 ± 4,5	
Bond: minimum relative rib area, $f_{R,min}$	Nominal bar size [mm] 8 to 12 > 12	0,040 0,056	

Rib height h: The maximum rib height h_{rib} shall be: $h_{rib} \leq 0{,}07 \cdot Ø$

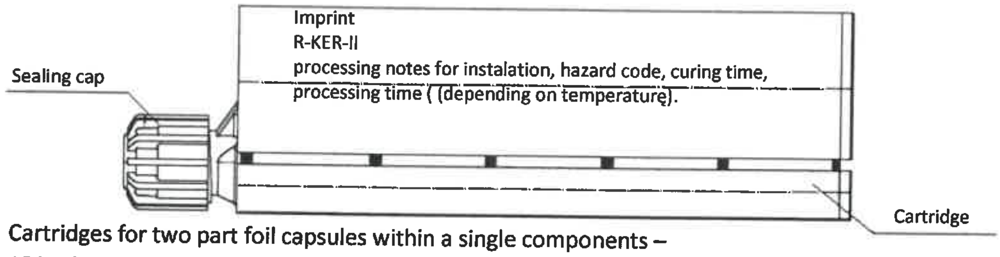
Table A4: Injection mortars

Product	Composition
R-KER-II (two component injection mortars)	Additive: quartz Bonding agent: vinyl ester resin styrene free Hardener: dibenzoyl peroxide

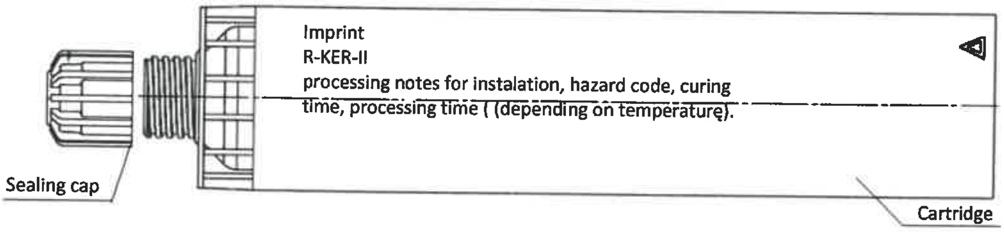
Coaxial cartridges – 150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 410 ml, 420 ml



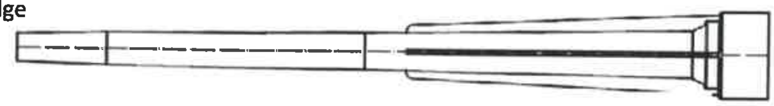
Side by side cartridges – 345 ml, 425 ml, 825 ml



Cartridges for two part foil capsules within a single components –
150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 550 ml, 600 ml

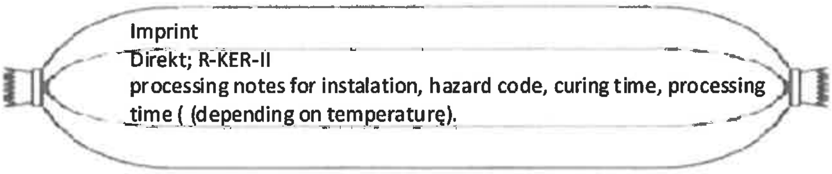


Mixer for Cartridge

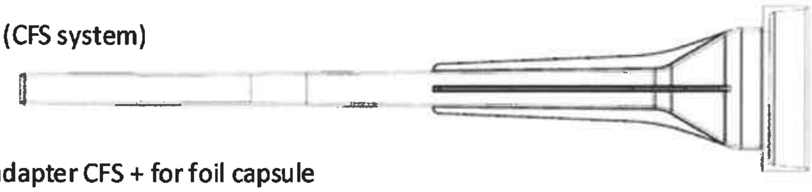


R-KER-II, R-KER-II-S and R-KER-II-W	Annex A5 of European Technical Assessment ETA-17/0594
Cartridge types and sizes	

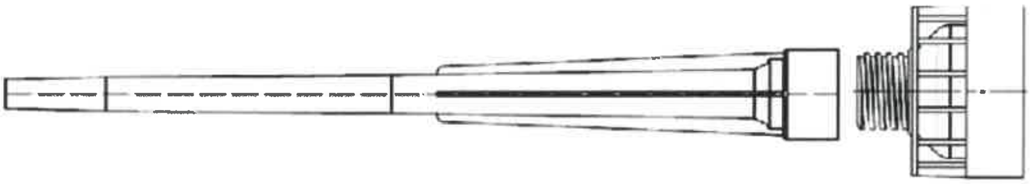
Foil capsule (CFS system) – 150 ml, 175 ml, 280 ml, 300 ml, 310 ml, 380 ml, 550 ml, 600 ml



Mixer for foil capsule (CFS system)



Mixer standard plus adapter CFS + for foil capsule



R-KER-II, R-KER-II-S and R-KER-II-W	Annex A6 of European Technical Assessment ETA-17/0594
Cartridge types and sizes	

SPECIFICATION OF INTENDED USE

Use:

The anchors are intended to be used for anchorages for which requirements for mechanical resistance and stability in the sense of the Basic Requirement 1 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: threaded rod size M8 to M30, rod with inner thread sizes M6/Ø10 to M16/Ø24 and rebar Ø8 to Ø32.

Seismic performance category C1: threaded rod size M8 to M30 and rebar Ø8 to Ø32

Base material:

- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206-1.
- Cracked and non-cracked concrete.

Temperature ranges:

Installation temperature (temperature of substrate):

- 0°C to +40°C in case of R-KER-II (standard version).
- +5°C to +40°C in case of R-KER-II-S (version for summer season).
- 0°C to +40°C in case of R-KER-II-W (version for winter season).

In-service temperature:

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).
- -40°C to +120°C (max. short term temperature +120°C and max. long term temperature +80°C).

Use conditions (environmental conditions):

- Elements made of galvanized steel or zinc flake coating 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 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:

- Dry or wet concrete (use category I1).
- Flooded holes (use category I2).
- Installation direction D3 (downward and horizontal and upwards installation)
- The anchors are suitable for hammer drilled holes or by special method with cleaning during drill a hole using hollow drill bit with vacuum cleaner.

Design methods:

- EOTA Technical Report TR 029 (September 2010) or CEN/TS 1992-4.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with EOTA Technical Report TR 045.

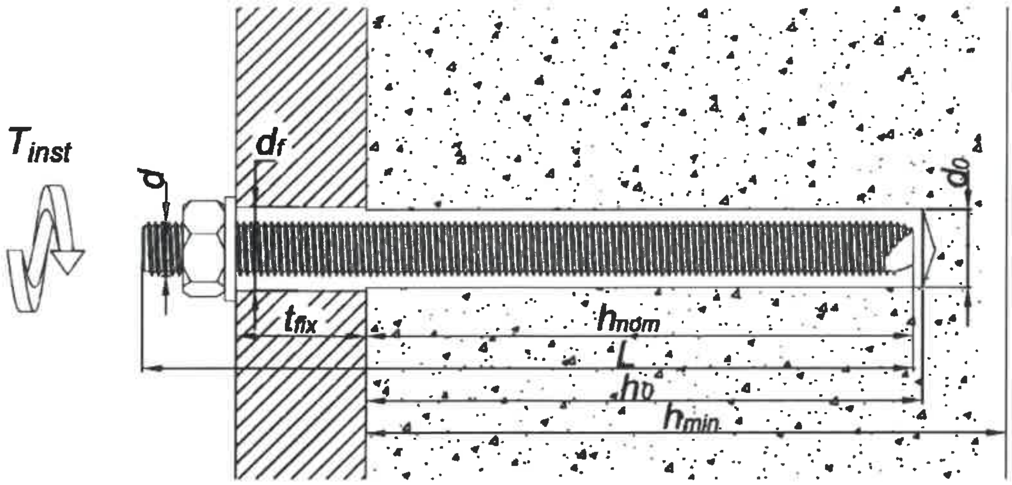


Table B1: Installation data – threaded anchor rod

Size		M8	M10	M12	M16	M20	M24	M30
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	$h_{ef,min}$ [mm]	60	60	60	60	80	96	120
	$h_{ef,max}$ [mm]	160	200	240	320	400	480	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			$h_{ef} + 2d_0$			
Torque moment	T_{inst} [N·m]	10	20	40	80	120	160	200
Minimum spacing	s_{min} [mm]	40	40	40	40	40	50	60
Minimum edge distance	c_{min} [mm]	40	40	40	40	40	50	60

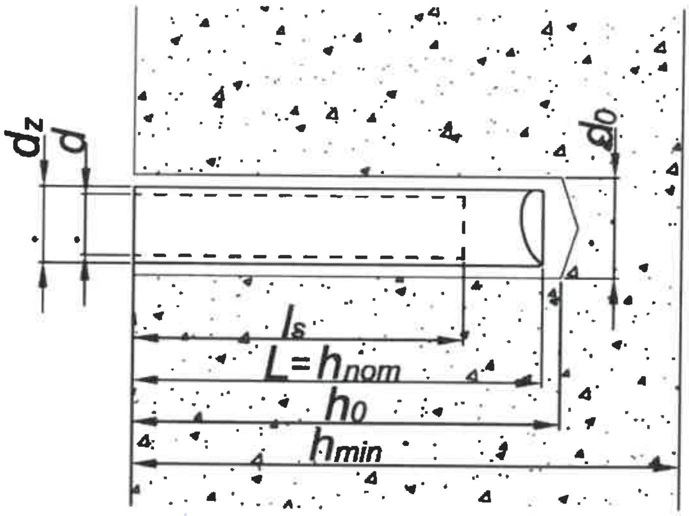


Table B2: Installation data – anchor rod with inner thread

Size		M6/ Ø10 /75	M8/ Ø12/ 75	M8/ Ø12/ 90	M10/ Ø16/ 75	M10/ Ø16/ 100	M12/ Ø16/ 100	M16/ Ø24/ 125
Nominal drilling diameter	d_0 [mm]	12	14	14	20	20	20	28
Maximum diameter hole in the fixture	d_f [mm]	7	9	9	12	12	14	18
Effective embedment depth	$h_{ef} = h_{nom}$ [mm]	75	75	90	75	100	100	125
Thread lenght, min	l_s [mm]	24	25	25	30	30	35	50
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			$h_{ef} + 2d_0$			
Torque moment	T_{inst} [N·m]	3	5	5	10	10	20	40
Minimum spacing	s_{min} [mm]	40	40	50	40	50	50	70
Minimum edge distance	c_{min} [mm]	40	40	50	40	50	50	70

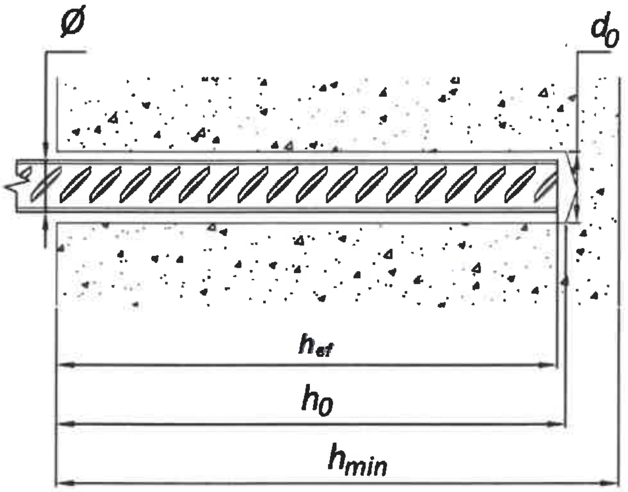


Table B3: Installation data – rebar

Size		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Nominal drilling diameter	d_0 [mm]	12	14	18	18	22	26	32	40
Effective embedment depth	$h_{ef,min}$ [mm]	60	60	60	60	64	80	100	128
	$h_{ef,max}$ [mm]	160	200	240	240	320	400	500	640
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				$h_{ef} + 2d_0$			
Minimum spacing	s_{min} [mm]	40	40	40	40	40	40	50	70
Minimum edge distance	c_{min} [mm]	40	40	40	40	40	40	50	70

Table B4: Processing time and minimum curing time

R-KER-II (standard version)			
Temperature of resin [°C]	Temperature of substrate [°C]	Processing time [min.]	Minimum curing time[1)] [min.]
+5	0	30	180
+5	+5	15	90
+10	+10	8	60
+15	+15	5	60
+20	+20	2,5	45
+25	+25	2	45
+25	+30	2	45
+25	+35	1,5	30
+25	+40	1,5	30

Table B5: Processing time and minimum curing time

R-KER-II-S (version for summer season)			
Temperature of resin [°C]	Temperature of substrate [°C]	Processing time [min.]	Minimum curing time[1)] [min.]
+5	+5	40	720
+10	+10	20	480
+15	+15	15	360
+20	+20	10	240
+25	+25	9,5	180
+25	+30	7	120
+25	+35	6,5	120
+25	+40	6,5	90

1) The minimum time from the end of the mixing to the time when the anchor may be torque or loaded (whichever is longer). Minimum resin temperature for installation +5°C; maximum resin temperature for installation +25°C. For wet condition and flooded holes the curing time must be doubled.

Table B6: Processing time and minimum curing time

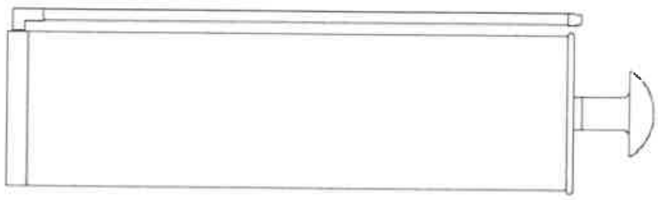
R-KER-II-W (version for winter season)			
Temperature of resin [°C]	**Temperature of substrate [°C]**	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
+5	0	14	120
+5	+5	9	60
+10	+10	5,5	45
+15	+15	3	30
+20	+20	2	15
+25	+25	1,5	10
+25	+30	1,5	10
+25	+35	1	5
+25	+40	1	5

1) The minimum time from the end of the mixing to the time when the anchor may be torque or loaded (whichever is longer). Minimum resin temperature for installation +5°C; maximum resin temperature for installation +25°C. For wet condition and flooded holes the curing time must be doubled.

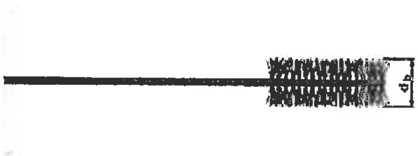
Additional mixer extension

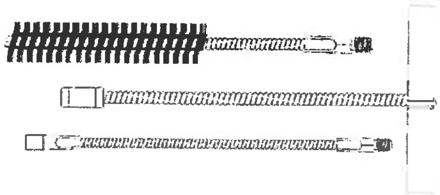
'Variable length from 300 mm up 1000 mm

Manual blower pump

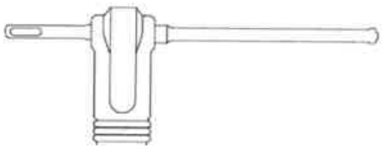


Steel brush

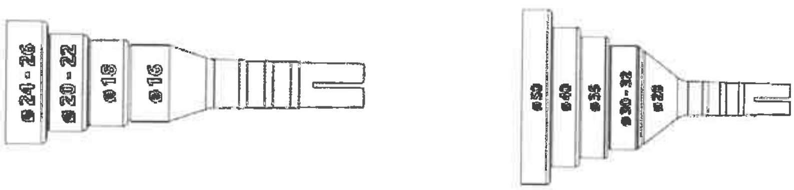




Brush with extension



Hollow drill bit with vacuum cleaner



Piston plugs

Temporary centring wedge

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex B7** of European Technical Assessment ETA-17/0594
Tools (1)	

Dispensers	Cartridge or foil capsule size
 Manual gun for coaxial cartridges	380, 400, 410 and 420 ml
 Manual gun for side by side cartridges	345 ml
 Manual gun for foil capsule in cartridge and coaxial cartridges	150, 175, 280, 300 and 310 ml
 Manual gun for foil capsules CFS+	300 to 600 ml
 Cordless dispenser gun for coaxial cartridges	380, 400, 410 and 420 ml
 Cordless dispenser gun for foil capsules	300 to 600 ml
 Pneumatic gun for coaxial cartridges	380, 400, 410 and 420 ml

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex B8** of European Technical Assessment ETA-17/0594
Tools (2)	

Table B7: Brush diameter for threaded rod

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

Table B8: Standard brush diameter for rod with inner thread

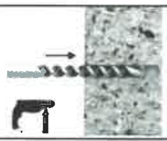
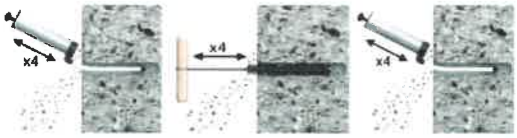
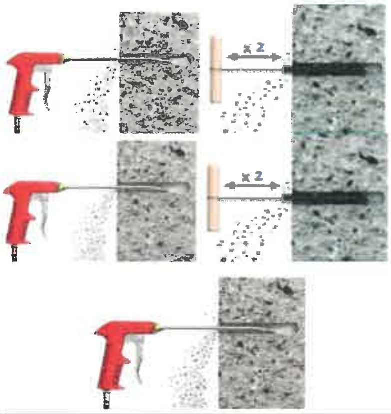
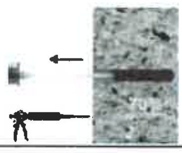
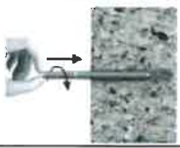
Threaded rod diameter			M6/Ø10	M8/Ø12	M10/Ø16	M12/ Ø16	M16/Ø24
d_b	Brush diameter	[mm]	16	16	22	22	30

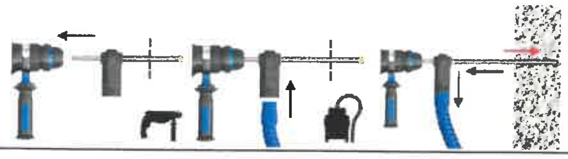
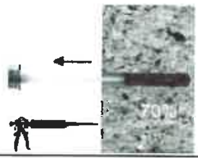
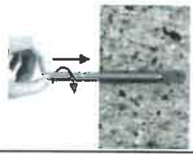
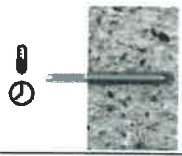
Table B9: Brush diameter for rebar

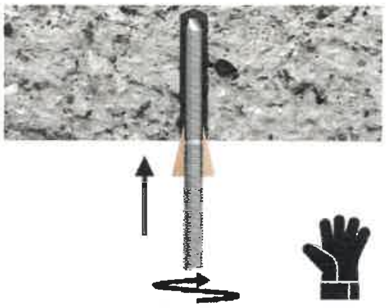
Rebar diameter			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
d_b	Brush diameter	[mm]	14	16	20	20	24	28	37	42

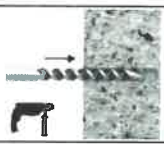
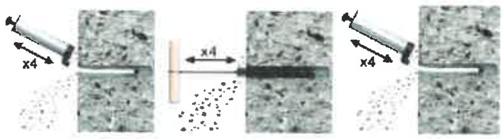
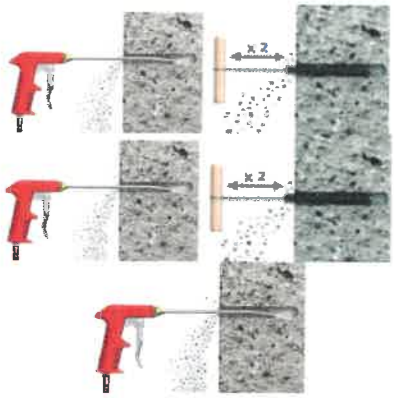
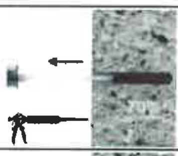
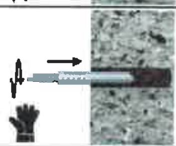
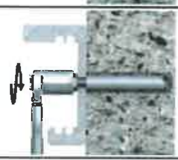
Table B10: Piston plug size

Hole diameter [mm]	16	18	20	22	24	25	26	28	30	32	35	40	50
Piston plug description	Ø16	Ø18	Ø20 to Ø22		Ø24 to Ø26			Ø28	Ø30 to 32		Ø35	Ø40	Ø50

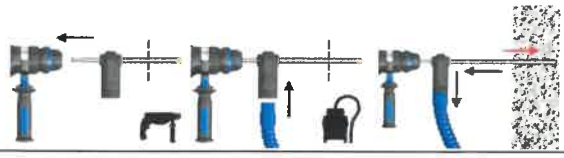
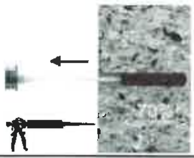
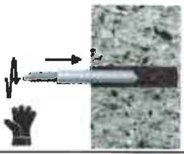
	1. Drill hole to the required diameter and depth using a rotary percussive machine
a.  b. 	2. Hole cleaning. a. Clean the hole with brush and hand pump: - starting from the drill hole bottom blow the hole at least 4 times using the hand pump - using the specified brush, mechanically brush out the hole at least 4 times - starting from the drill hole bottom, blow at least 4 times with the hand pump. b. Cleaning hole with compressed air: - starting from the drill hole bottom blow the hole at least twice by compressed air (6 atm) - using the specified brush, mechanically brush out the hole at least twice - blow the hole at least twice by compressed air (6atm) - brush out the hole at least twice - blow over the hole at least twice by compressed air (6atm).
	3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm).
	4. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	5. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin 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.

	1. Drill hole to the required diameter and depth using a hollow drill bit with vacuum cleaner.
	2. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained.
	3. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	4. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.
	5. Leave the fixing undisturbed until the curing time elapses.
	6. Attach fixture and tighten the nut to the required torque.

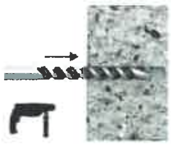
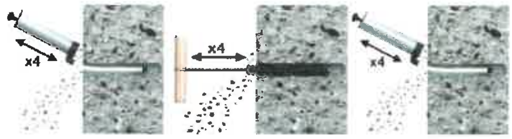
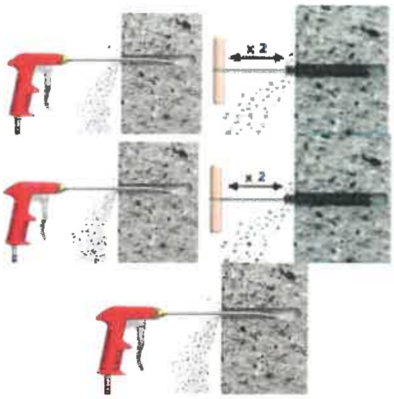
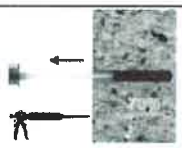
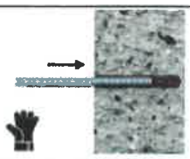
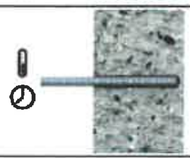
	1. Inject from the bottom of the hole. Inject the product about 2/3 of the hole depth. For best performance use extension and appropriately sized piston plug assembled on the mixer.
	2. Drive the stud immediately into the hole. Use temporary interlocking element.
	3. Leave the fixing undisturbed until the curing time elapses. To avoid the slipping of the stud during the open time of the product (due to the stud own weight) use a temporary interlocking element.

	1. Drill hole to the required diameter and depth using a rotary percussive machine.
a.  b. 	2. Hole cleaning. a. 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. b. Cleaning hole with compressed air: - starting from the drill hole bottom blow the hole at least twice by compressed air (6 atm) - using the specified brush, mechanically brush out the hole at least twice - blow the hole at least twice by compressed air (6 atm) - brush out the hole at least twice - blow over the hole at least twice by compressed air (6atm).
	3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm).
	4. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	5. Immediately insert the rod with inner thread, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.
	6. Leave the fixing undisturbed until the curing time elapses.
	7. Attach fixture and tighten the bolt to the required torque.

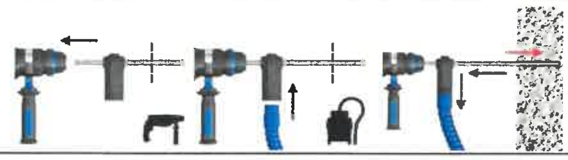
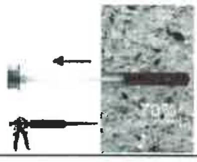
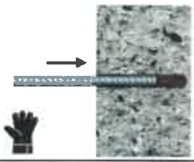
R-KER-II, R-KER-II-S and R-KER-II-W	**Annex B13** of European Technical Assessment ETA-17/0594
Installation instruction – anchor rod with inner thread – standard cleaning	

	1. Drill hole to the required diameter and depth using a hollow drill bit with vacuum cleaner.
	2. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained.
	3. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	4. Immediately insert the rod with inner thread, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.
	5. Leave the fixing undisturbed until the curing time elapses.
	6. Attach fixture and tighten the bolt to the required torque.

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex B14** of European Technical Assessment ETA-17/0594
Installation instruction–anchor rod with inner thread – cleaning with hollow drill bit (special cleaning method)	

	1. Drill hole to the required diameter and depth using a rotary percussive machine.
a.  b. 	2. Hole cleaning. a. Cleaning 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. b. Cleaning hole with compressed air: - starting from the drill hole bottom blow the hole at least twice by compressed air (6 atm) - using the specified brush, mechanically brush out the hole at least twice - blow the hole at least twice by compressed air (6 atm) - brush out the hole at least twice - blow over the hole at least twice by compressed air (6atm).
	3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm).
	4. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	5. Immediately insert the rebar, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.
	6. Leave the fixing undisturbed until the curing time elapses.

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex B15** of European Technical Assessment ETA-17/0594
Installation instruction – rebar – standard cleaning	

	1. Drill hole to the required diameter and depth using a hollow drill bit with vacuum cleaner.
	2. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even colour is obtained (min. 10 cm).
	3. Insert the mixing nozzle to the far end of the hole and inject resin, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.
	4. Immediately insert the rebar, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets.
	5. Leave the fixing undisturbed until the curing time elapses.

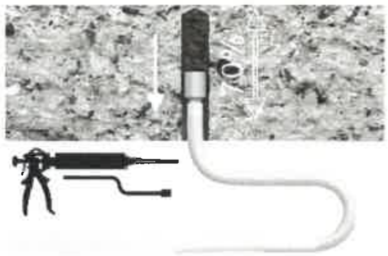
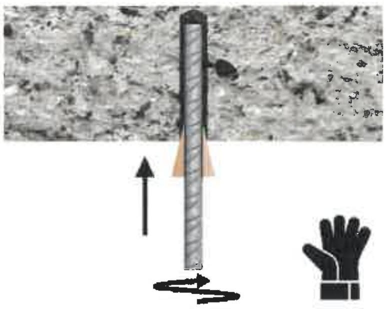
	1. Inject from the bottom of the hole. Inject the product about 2/3 of the hole depth. For best performance use extension and appropriately sized piston plug assembled on the mixer.
	2. Drive the rebar immediately into the hole. Use temporary interlocking element.
	3. Leave the fixing undisturbed until the curing time elapses. To avoid the slipping of the rebar during the open time of the product (due to the rebar own weight) use a temporary interlocking element.

Table C1-1: Characteristic values for tension load for threaded rod in non-cracked concrete

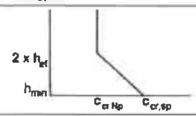
Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel failure with threaded rod grade 5.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	18	29	42	78	122	176	280
Partial safety factor[1]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 10.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	36	58	84	157	245	353	561
Partial safety factor[1]	γ_{Ms}	[-]	1,40						
Steel failure with threaded rod grade 12.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	43	69	101	188	294	423	673
Partial safety factor[1]	γ_{Ms}	[-]	1,40						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$N_{Rk,s}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	γ_{Ms}	[-]	1,87						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	γ_{Ms}	[-]	1,60						
Steel failure with high corrosion resistant steel grade 70									
Characteristic resistance	$N_{Rk,s}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	γ_{Ms}	[-]	1,87						
Steel failure with ultra-high strength steel threaded rod grade 14.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	51	81	118	219	343	494	785
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Steel failure with ultra-high strength steel threaded rod grade 15.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	54	87	126	235	367	529	841
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Steel failure with ultra-high strength steel threaded rod grade 16.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	58	92	134,9	251	392	564	897
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Combined pull-out and concrete cone failure in non-cracked concrete C20/25									
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	16,0	15,0	15,0	13,0	10,0	10,0	8,0
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	16,0	15,0	15,0	13,0	10,0	10,0	8,0
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	8,5	8,0	8,0	7,0	5,5	5,5	4,5
Increasing factor for C30/37	ψ_c	[-]	1,05	1,04					
Increasing factor for C40/50			1,07						
Increasing factor for C50/60			1,09						

Note: Design method according to TR 029.

[1] In the absence of other national regulation.

[2] See: Annex B1.

Table C1-2: Characteristic values for tension load for threaded rod in non-cracked concrete

Size				M8	M10	M12	M16	M20	M24	M30
Concrete cone failure in non-cracked concrete										
Factor for non-cracked concrete		k_{ucr} [1]	[-]	10,1						
		$k_{ucr,N}$	[-]	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]	$2{,}0 \cdot h_{ef}$					$1{,}5 \cdot h_{ef}$	
		$c_{cr,sp}$ for $h_{min} < h^{2)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)								
		$c_{cr,sp}$ for $h^{2)} \geq 2 \cdot h_{ef}$		$c_{cr,N}$						
Spacing		$s_{cr,sp}$	[mm]	$2{,}0 \cdot c_{cr,sp}$						
Partial safety factor for combined pull-out, concrete cone and splitting failure										
Partial safety factors for in use category I1[3]	standard cleaning	γ_{inst}	[-]	1,0						
	special cleaning			1,2	1,0					1,2
Partial safety factors for in use category I2[3]	standard cleaning			1,0						
	special cleaning			1,2	1,0					1,2

Note: Design method according to TR 029.

[1] Parameter for design acc. CEN/TS 1992-4-4:2009.
[2] h – concrete member thickness.
[3] In the absence of other national regulation.

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex C2** of European Technical Assessment ETA-17/0594
Characteristic resistance under tension loads for threaded rod in non-cracked concrete	

Table C2-1: Characteristic values for tension loads for threaded rod in cracked concrete

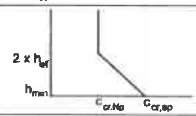
Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel failure with threaded rod grade 5.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	18	29	42	78	122	176	280
Partial safety factor[1]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 10.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	36	58	84	157	245	353	561
Partial safety factor[1]	γ_{Ms}	[-]	1,40						
Steel failure with threaded rod grade 12.9									
Characteristic resistance	$N_{Rk,s}$	[kN]	43	69	101	188	294	423	673
Partial safety factor[1]	γ_{Ms}	[-]	1,40						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$N_{Rk,s}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	γ_{Ms}	[-]	1,87						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	γ_{Ms}	[-]	1,60						
Steel failure with high corrosion resistant steel grade 70									
Characteristic resistance	$N_{Rk,s}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	γ_{Ms}	[-]	1,87						
Steel failure with ultra-high strength steel threaded rod grade 14.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	51	81	118	219	343	494	785
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Steel failure with ultra-high strength steel threaded rod grade 15.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	54	87	126	235	367	529	841
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Steel failure with ultra-high strength steel threaded rod grade 16.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	58	92	134,9	251	392	564	897
Partial safety factor[1]	γ_{Ms}	[-]	1,5						
Combined pull-out and concrete cone failure in cracked concrete C20/25									
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,cr}$	[N/mm²]	10,0	11,0	11,0	9,5	7,5	7,0	5,0
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,cr}$	[N/mm²]	10,0	11,0	11,0	9,5	7,5	7,0	5,0
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,cr}$	[N/mm²]	5,0	6,0	6,0	5,0	4,0	4,0	3,0
Increasing factor for C30/37	ψ_c	[-]	1,05	1,04					
Increasing factor for C40/50			1,07						
Increasing factor for C50/60			1,09						

Note: Design method according to TR 029.

[1] In the absence of other national regulation.
[2] See: Annex B1.

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex C3** of European Technical Assessment ETA-17/0594
Characteristic resistance under tension loads for threaded rod in cracked concrete	

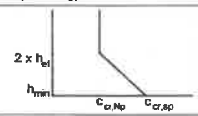
Table C2-2: Characteristic values for tension load for threaded rod in cracked concrete

Size				M8	M10	M12	M16	M20	M24	M30
Concrete cone failure in cracked concrete										
Factor for cracked concrete		k_{cr} [1]	[-]	7,2						
		$k_{cr,N}$	[-]	7,7						
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]	$2,0 \cdot h_{ef}$					$1,5 \cdot h_{ef}$	
		$c_{cr,sp}$ for $h_{min} < h^{2)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)								
		$c_{cr,sp}$ for $h^{2)} \geq 2 \cdot h_{ef}$		$c_{cr,N}$						
Spacing		$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$						
Partial safety factor for combined pull-out, concrete cone and splitting failure										
Partial safety factors for in use category I1[3]	standard cleaning	γ_{inst}	[-]	1,0						
	special cleaning			1,2	1,0					1,2
Partial safety factors for in use category I2[3]	standard cleaning			1,0						
	special cleaning			1,2	1,0					1,2

Note: Design method according to TR 029.

[1] Parameter for design acc. CEN/TS 1992-4-4:2009.
[2] h – concrete member thickness.
[3] In the absence of other national regulation.

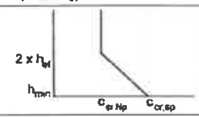
Table C3: Characteristic values for tension load for rod with inner thread in non-cracked concrete

Size			M6 /Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel failure							
Steel failure with rod with inner thread grade 5.8							
Characteristic resistance	$N_{Rk,s}$	[kN]	10	18	29	42	78
Partial safety factor[1]	γ_{Ms}	[-]	1,50				
Steel failure with rod with inner thread grade 8.8							
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	46	67	125
Partial safety factor[1]	γ_{Ms}	[-]	1,50				
Steel failure with stainless steel rod with inner thread threaded rod A4-70							
Characteristic resistance	$N_{Rk,s}$	[kN]	14	25	40	59	109
Partial safety factor[1]	γ_{Ms}	[-]	1,87				
Steel failure with stainless steel rod with inner thread A4-80							
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	46	67	125
Partial safety factor[1]	γ_{Ms}	[-]	1,60				
Steel failure with high corrosion resistant steel grade 70							
Characteristic resistance	$N_{Rk,s}$	[kN]	14	25	40	59	109
Partial safety factor[1]	γ_{Ms}	[-]	1,87				
Combined pull-out and concrete cone failure in non-cracked concrete C20/25							
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	11,0	14,0	11,0	11,0	8,0
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	11,0	14,0	11,0	11,0	8,0
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,ucr}$	[N/mm²]	6,0	7,0	6,0	6,0	4,0
Increasing factor for C30/37	ψ_c	[-]	1,04				1,00
Increasing factor for C40/50	ψ_c	[-]	1,07				1,00
Increasing factor for C50/60	ψ_c	[-]	1,09				1,00
Resistance to concrete cone failure in non-cracked concrete							
Factor for non-cracked concrete	k_{ucr}[3]	[-]	10,1				
	$k_{ucr,N}$	[-]	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]	$2,0 \cdot h_{ef}$				$1,5 \cdot h_{ef}$
	$c_{cr,sp}$ for $h_{min} < h^{4)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)	[mm]					
	$c_{cr,sp}$ for $h^{4)} \geq 2 \cdot h_{ef}$	[mm]	$c_{cr,N}$				
Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$				
Partial safety factor for combined pull-out, concrete cone and splitting failure							
Installation safety factors for use category I1[1] – standard cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I1[1] – special cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I2[1] – standard cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I2[1] – special cleaning	γ_{inst}	[-]	1,0				

Note: Design method according to TR 029.

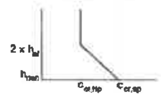
[1] In the absence of other national regulation. [2] See: Annex B1.
[3] Parameter for design acc. CEN/TS 1992-4-4:2009. [4] h – concrete member thickness.

Table C4: Characteristic values for tension loads for rod with inner thread in cracked concrete

Size			M6 /Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel failure							
Steel failure with rod with inner thread grade 5.8							
Characteristic resistance	$N_{Rk,s}$	[kN]	10	18	29	42	78
Partial safety factor[1]	γ_{Ms}	[-]	1,50				
Steel failure with rod with inner thread grade 8.8							
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	46	67	125
Partial safety factor[1]	γ_{Ms}	[-]	1,50				
Steel failure with stainless steel rod with inner thread A4-70							
Characteristic resistance	$N_{Rk,s}$	[kN]	14	25	40	59	109
Partial safety factor[1]	γ_{Ms}	[-]	1,87				
Steel failure with stainless steel rod with inner thread rod A4-80							
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	46	67	125
Partial safety factor[1]	γ_{Ms}	[-]	1,60				
Steel failure with high corrosion resistant steel grade 70							
Characteristic resistance	$N_{Rk,s}$	[kN]	14	25	40	59	109
Partial safety factor[1]	γ_{Ms}	[-]	1,87				
Combined pull-out and concrete cone failure in cracked concrete C20/25							
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,cr}$	[N/mm²]	10,0	10,0	9,5	9,0	4,0
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,cr}$	[N/mm²]	10,0	10,0	9,5	9,0	4,0
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,cr}$	[N/mm²]	5,0	6,0	5,0	5,0	2,0
Increasing factor for C30/37	ψ_c	[-]	1,04				1,00
Increasing factor for C40/50	ψ_c	[-]	1,07				1,00
Increasing factor for C50/60	ψ_c	[-]	1,09				1,00
Cone failure in cracked concrete							
Factor for cracked concrete	k_{cr}[3]	[-]	7,2				
	$k_{cr,N}$	[-]	7,7				
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]	$2{,}0 \cdot h_{ef}$				$1{,}5 \cdot h_{ef}$
	$c_{cr,sp}$ for $h_{min} < h^{4)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)	[mm]					
	$c_{cr,sp}$ for $h^{4)} \geq 2 \cdot h_{ef}$	[mm]	$c_{cr,N}$				
Spacing	$s_{cr,sp}$	[mm]	$2{,}0 \cdot c_{cr,sp}$				
Partial safety factor for combined pull-out, concrete cone and splitting failure							
Installation safety factors for use category I1[1] – standard cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I1[1] – special cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I2[1] – standard cleaning	γ_{inst}	[-]	1,0				
Installation safety factors for use category I2[1] – special cleaning	γ_{inst}	[-]	1,0				

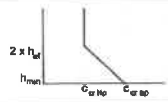
Note: Design method according to TR 029.
[1] In the absence of other national regulation. [2] See: Annex B1.
[3] Parameter for design acc. CEN/TS 1992-4-4:2009. [4] h – concrete member thickness

Table C5: Characteristic values for tension load for rebar in non-cracked concrete

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$N_{Rk,s}$	[kN]	A_s [5)] · f_{uk} [6)]							
Partial safety factor[1)]	γ_{Ms}	[-]	1,40							
Combined pull-out and concrete cone failure in non-cracked concrete C20/25										
Characteristic bond resistance temperature range -40°C / +40°C[2)]	$\tau_{Rk,ucr}$	[N/mm²]	13,0	14,0	14,0	13,0	13,0	10,0	9,0	7,5
Characteristic bond resistance temperature range -40°C / +80°C[2)]	$\tau_{Rk,ucr}$	[N/mm²]	13,0	14,0	14,0	13,0	13,0	10,0	9,0	7,5
Characteristic bond resistance temperature range -40°C / +120°C[2)]	$\tau_{Rk,ucr}$	[N/mm²]	7,0	7,0	7,0	7,0	7,0	5,5	5,0	4,0
Increasing factor for C30/37	ψ_c	[-]	1,04							
Increasing factor for C40/50			1,07							
Increasing factor for C50/60			1,09							
Concrete cone failure in non-cracked concrete										
Factor for non-cracked concrete	k_{ucr} [3)]	[-]	10,1							
	$k_{ucr,N}$	[-]	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]	$2,0 \cdot h_{ef}$						$1,5 \cdot h_{ef}$	
	$c_{cr,sp}$ for $h_{min} < h^{4)} < 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)									
	$c_{cr,sp}$ for $h^{4)} \geq 2 \cdot h_{ef}$		$c_{cr,N}$							
Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$							
Partial safety factor for combined pull-out, concrete cone and splitting failure										
Installation safety factors for use category I1[1)] – standard cleaning	γ_{inst}	[-]	1,0							
Installation safety factors for use category I1[1)] – special cleaning			1,2	1,0						1,2
Installation safety factors for use category I2[1)] – standard cleaning			1,2							
Installation safety factors for use category I2[1)] – special cleaning			1,2	1,0						1,2

Note: Design method according to TR 029.
1) In the absence of other national regulation. 2) See: Annex B1. 3) Parameter for design acc. CEN/TS 1992-4-4:2009.
4) h – concrete member thickness. 5) Stressed cross section of the steel. 6) Acc. to EN 1992-1-1.

Table C6: Characteristic values for tension loads for rebar in cracked concrete

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$N_{Rk,s}$	[kN]	A_s[5)] · f_{uk}[6)]							
Partial safety factor[1)]	γ_{Ms}	[-]	1,40							
Combined pull-out and concrete cone failure in cracked concrete C20/25										
Characteristic bond resistance temperature range -40°C / +40°C[2)]	$\tau_{Rk,cr}$	[N/mm²]	8	9	10	10	8,5	7,5	6	3,5
Characteristic bond resistance temperature range -40°C / +80°C[2)]	$\tau_{Rk,cr}$	[N/mm²]	8	9	10	10	8,5	7,5	6	3,5
Characteristic bond resistance temperature range -40°C / +120°C[2)]	$\tau_{Rk,cr}$	[N/mm²]	4,5	5	5	5	4,5	4	3	2
Increasing factor for C30/37	ψ_c	[-]	1,04							
Increasing factor for C40/50	ψ_c	[-]	1,07							
Increasing factor for C50/60	ψ_c	[-]	1,09							
Concrete cone failure in cracked concrete										
Factor for racked concrete	k_{cr}[3)]	[-]	7,2							
Factor for racked concrete	$k_{cr,N}$	[-]	7,7							
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]	$2,0 \cdot h_{ef}$						$1,5 \cdot h_{ef}$	
Edge distance	$c_{cr,sp}$ for $h_{min} < h$[4)] $< 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)	[mm]								
Edge distance	$c_{cr,sp}$ for h[4)] $\geq 2 \cdot h_{ef}$	[mm]	$c_{cr,N}$							
Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$							
Partial safety factor for combined pull-out, concrete cone and splitting failure										
Installation safety factors for use category I1[1)] – standard cleaning	γ_{inst}	[-]	1,0							
Installation safety factors for use category I1[1)] – special cleaning	γ_{inst}	[-]	1,2	1,0						1,2
Installation safety factors for use category I2[1)] – standard cleaning	γ_{inst}	[-]	1,2							
Installation safety factors for use category I2[1)] – special cleaning	γ_{inst}	[-]	1,2	1,0						1,2

Note: Design method according to TR 029.
[1)] In the absence of other national regulation. [2)] See: Annex B1. [3)] Parameter for design acc. CEN/TS 1992-4-4:2009.
[4)] h – concrete member thickness. [5)] Stressed cross section of the steel. [6)] Acc. to EN 1992-1-1.

Table C7: Characteristic values for shear loads for threaded rod – steel failure without lever arm

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
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,25						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	224
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,25						
Steel failure with threaded rod grade 10.9									
Characteristic resistance	$V_{Rk,s}$	[kN]	18	29	42	78	122	176	280
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 12.9									
Characteristic resistance	$V_{Rk,s}$	[kN]	22	35	51	94	147	212	336
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124	196
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,56						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	224
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,33						
Steel failure with high corrosion stainless steel grade 70									
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124	196
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,56						
Steel failure with ultra-high strength steel threaded rod grade 14.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	25	40	59	109	171	247	392
Factor considering ductility	k_7		0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with ultra-high strength steel threaded rod grade 15.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	27	43	63	117	183	264	420
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with ultra-high strength steel threaded rod grade 16.8									
Characteristic resistance	$V_{Rk,s}$	[kN]	29	46	67	125	196	282	448
Factor considering ductility	k_7	[-]	0,8						
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						

[1)] In the absence of other national regulation.

Table C8: Characteristic values for shear loads for threaded rod – 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[1)]	γ_{Ms}	[-]	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[1)]	γ_{Ms}	[-]	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[1)]	γ_{Ms}	[-]	1,50						
Steel failure with threaded rod grade 12.9									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	45	90	157	400	779	1347	2698
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	1574
Partial safety factor[1)]	γ_{Ms}	[-]	1,56						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1799
Partial safety factor[1)]	γ_{Ms}	[-]	1,33						
Steel failure with high corrosion resistant steel grade 70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	1574
Partial safety factor[1)]	γ_{Ms}	[-]	1,56						
Steel failure with ultra-high strength steel threaded rod grade 14.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	52	104	183	466	908	1571	3148
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with ultra-high strength steel threaded rod grade 15.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	56	112	196	499	973	1683	3373
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						
Steel failure with ultra-high strength steel threaded rod grade 16.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	59	119	209	532	1038	1796	3598
Partial safety factor[1)]	γ_{Ms}	[-]	1,50						

[1)] In the absence of other national regulation.

Table C9: Characteristic values for shear loads – pry out and concrete edge failure for threaded rod

Size			M8	M10	M12	M16	M20	M24	M30
Pry out failure									
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 under shear loading	l_f	[mm]	min $(h_{ef}; 8d_{nom})$						

Table C10: Characteristic values for shear loads for rod with inner thread – steel failure without lever arm

Size			M6 /Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel failure with for rod with inner thread grade 5.8							
Characteristic resistance	$V_{Rk,s}$	[kN]	5,0	9,2	14,5	21,1	39,3
Factor considering ductility	k_7	[-]			0,8		
Partial safety factor[1)]	γ_{Ms}	[-]			1,25		
Steel failure with for rod with inner thread grade 8.8							
Characteristic resistance	$V_{Rk,s}$	[kN]	8,0	14,6	23,2	33,7	62,8
Factor considering ductility	k_7	[-]	0,8				
Partial safety factor[1)]	γ_{Ms}	[-]			1,25		
Steel failure with stainless steel for rod with inner thread A4-70							
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	29,5	55,0
Factor considering ductility	k_7	[-]			0,8		
Partial safety factor[1)]	γ_{Ms}	[-]			1,56		
Steel failure with stainless steel for rod with inner thread A4-80							
Characteristic resistance	$V_{Rk,s}$	[kN]	8,0	14,6	23,2	33,7	62,8
Factor considering ductility	k_7	[-]			0,8		
Partial safety factor[1)]	γ_{Ms}	[-]			1,33		
Steel failure with high corrosion stainless steel grade 70							
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	29,5	55,0
Factor considering ductility	k_7	[-]			0,8		
Partial safety factor[1)]	γ_{Ms}	[-]			1,56		

[1)] In the absence of other national regulation.

Table C11: Characteristic values for shear loads for rod with inner thread - steel failure with lever arm

Size			M6 /Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel failure with for rod with inner thread grade 5.8							
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	7,6	18,7	37,4	65,5	166,5
Partial safety factor[1)]	γ_{Ms}	[-]			1,25		
Steel failure with for rod with inner thread grade 8.8							
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	104,8	266,4
Partial safety factor[1)]	γ_{Ms}	[-]			1,25		
Steel failure with stainless steel for rod with inner thread A4-70							
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	91,7	233,1
Partial safety factor[1)]	γ_{Ms}	[-]			1,56		
Steel failure with stainless steel for rod with inner thread A4-80							
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	104,8	266,4
Partial safety factor[1)]	γ_{Ms}	[-]			1,33		
Steel failure with high corrosion resistant steel grade 70							
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	91,7	233,1
Partial safety factor[1)]	γ_{Ms}	[-]			1,56		

[1)] In the absence of other national regulation.

Table C12: Characteristic values for shear loads – pry out and concrete edge failure for rod with inner thread

Size			M6 /Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Pry out failure							
Factor	k_8	[-]			2		
Concrete edge failure							
Outside diameter of anchor	d_{nom}	[mm]	10	12	16	16	24
Effective length of anchor under shear loading	ℓ_f	[mm]			min (h_{ef}; $8d_{nom}$)		

Table C13: Characteristic values for shear loads for rebar – steel failure without lever arm

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$V_{Rk,s}$	[kN]	$0{,}5 \cdot A_s^{2)} \cdot f_{uk}^{3)}$							
Factor considering ductility	k_7	[-]	0,8							
Partial safety factor[1)]	γ_{Ms}	[-]	1,5							

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

Table C14: Characteristic values for shear loads for rebar – steel failure with lever arm

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	$1{,}2 \cdot W_{el}^{2)} \cdot f_{uk}^{3)}$							
Partial safety factor[1)]	γ_{Ms}	[-]	1,5							

[1)] In the absence of other national regulation.
[2)] Elastic section modulus calculated from the stressed cross section of steel element.
[3)] Acc. to EN 1992-1-1.

Table C15: Characteristic values for shear loads – pry out and concrete edge failure for rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Pry out failure										
Factor	k_8	[-]	2							
Concrete edge failure										
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14	16	20	25	32
Effective length of anchor under shear loading	l_f	[mm]	$\min(h_{ef}; 8d_{nom})$							

Table C16: Displacement under tension loads – threaded rod

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement in non-cracked concrete C20/25 to C50/60 under tension loads									
Admissible service load*	N	[kN]	11,9	14,3	14,3	19,0	23,8	35,7	45,2
Displacement	δ_{N0}	[mm]	0,3	0,4	0,4	0,5	0,5	0,6	0,7
	$\delta_{N\infty}$	[mm]	0,6	0,6	0,6	0,6	0,6	0,6	0,6
Characteristic displacement in cracked concrete C20/25 to C50/60 under tension loads									
Admissible service load*	N	[kN]	7,6	9,5	11,9	14,3	19,0	23,8	28,6
Displacement	δ_{N0}	[mm]	0,3	0,4	0,4	0,5	0,5	0,6	0,6
	$\delta_{N\infty}$	[mm]	2	2	2	2	2	2	2

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

Table C17: Displacement under shear loads – threaded rod

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement in cracked and non-cracked concrete C20/25 to C50/60 under shear loads									
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.

Table C18: Displacement under tension loads – rod with inner thread

Size			M6/ Ø10	M8/ Ø12	M10/Ø 16	M12/Ø 16	M16/Ø 24
Characteristic displacement in non-cracked concrete C20/25 to C50/60 under tension loads							
Admissible service load*	N	[kN]	11,9	19,0	19,0	28,6	35,7
Displacement	δ_{N0}	[mm]	0,2	0,3	0,3	0,4	0,4
	$\delta_{N\infty}$	[mm]	0,6	0,6	0,6	0,6	0,6
Characteristic displacement in cracked concrete C20/25 to C50/60 under tension loads							
Admissible service load*	N	[kN]	11,9	14,2	16,6	23,8	19,0
Displacement	δ_{N0}	[mm]	0,3	0,4	0,4	0,5	0,3
	$\delta_{N\infty}$	[mm]	2	2	2	2	2

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

Table C19: Displacement under shear loads – rod with inner thread

Size			M6/ Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Characteristic displacement in cracked and non-cracked concrete C20/25 to C50/60 under shear loads							
Admissible service load*	V	[kN]	2,0	3,7	5,8	8,4	15,7
Displacement	δ_{V0}	[mm]	2,5	2,5	2,5	2,5	2,5
	$\delta_{V\infty}$	[mm]	3,7	3,7	3,7	3,7	3,7

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

Table C20: Displacement under tension loads – rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Characteristic displacement in non-cracked concrete C20/25 to C50/60 under tension loads										
Admissible service load*	N	[kN]	7,9	9,9	11,9	13,9	15,9	19,8	23,8	29,8
Displacement	δ_{N0}	[mm]	0,3	0,3	0,4	0,4	0,5	0,6	0,6	0,8
	$\delta_{N\infty}$	[mm]	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6
Characteristic displacement in cracked concrete C20/25 to C50/60 under tension loads										
Admissible service load*	N	[kN]	4,8	6,3	7,9	7,9	9,9	13,9	15,9	19,8
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,4	0,5	0,6	0,6	0,7
	$\delta_{N\infty}$	[mm]	2	2	2	2	2	2	2	2

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

Table C21: Displacement under shear loads – rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Characteristic displacement in cracked and non-cracked concrete C20/25 to C50/60 under shear loads										
Admissible service load*	V	[kN]	5,5	8,6	12,3	16,8	21,9	34,3	53,6	87,8
Displacement	δ_{V0}	[mm]	2,5	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	3,7

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

Table C22: Characteristic values for tension load for threaded rod for seismic performance category C1

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel failure with threaded rod grade 5.8									
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	18	29	42	78	122	176	280
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,50						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,50						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,87						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	29	46	67	125	196	282	448
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,60						
Steel failure with high corrosion resistant steel grade 70									
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	25	40	59	109	171	247	392
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,87						
Combined pull-out and concrete cone failure									
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,seis}$	[N/mm²]	8,0	10,0	10,0	9,5	7,5	7,0	4,0
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,seis}$	[N/mm²]	8,0	10,0	10,0	9,5	7,5	7,0	4,0
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,seis}$	[N/mm²]	4,5	5,0	6,0	5,0	4,0	4,0	2,0

Table C23: Characteristic values for tension load for rebar for seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	A_s[3] · f_{uk}[4]							
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,40							
Combined pull-out and concrete cone failure										
Characteristic bond resistance temperature range -40°C / +40°C[2]	$\tau_{Rk,seis}$	[N/mm²]	7,0	8,5	10,0	10,0	8,5	7,5	6,0	3,5
Characteristic bond resistance temperature range -40°C / +80°C[2]	$\tau_{Rk,seis}$	[N/mm²]	7,0	8,5	10,0	10,0	8,5	7,5	6,0	3,5
Characteristic bond resistance temperature range -40°C / +120°C[2]	$\tau_{Rk,seis}$	[N/mm²]	4,0	4,5	5,0	5,0	4,5	4,0	3,0	1,5

Note: Design method according to TR 045.
[1] In the absence of other national regulation. [2] See: Annex B1.
[3] Stressed cross section of the steel element. [4] Acc. to EN 1992-1-1.

R-KER-II, R-KER-II-S and R-KER-II-W	**Annex C16** of European Technical Assessment ETA-17/0594
Characteristic resistance under tension loads for threaded and rebar for seismic action category 1	

Table C24: Characteristic values for shear loads for threaded rod for seismic performance category C1 - steel failure without lever arm

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure with threaded rod grade 5.8									
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	6,3	10,1	14,7	27,3	42,7	61,6	98,0
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,25						
Steel failure with threaded rod grade 8.8									
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	10,2	16,1	23,5	44,1	68,6	98,7	156,8
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,25						
Steel failure with stainless steel threaded rod A4-70									
Characteristic resistance	$V_{Rk,seis}$	[kN]	9,1	14,4	20,7	38,5	59,9	86,5	137,4
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,56						
Steel failure with stainless steel threaded rod A4-80									
Characteristic resistance	$V_{Rk,seis}$	[kN]	10,2	16,1	23,5	44,1	68,6	98,7	157,2
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,33						
Steel failure with high corrosion stainless steel grade 70									
Characteristic resistance	$V_{Rk,seis}$	[kN]	9,1	14,4	20,7	38,5	59,9	86,5	137,4
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,56						

[1] In the absence of other national regulation.

Table C25: Characteristic values for shear loads for rebar for seismic performance category C1 - steel failure without lever arm

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar										
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	$0{,}35 \cdot A_s^{2)} \cdot f_{uk}^{3)}$							
Partial safety factor[1]	$\gamma_{Ms,seis}$	[-]	1,5							

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

Table C26: Displacement under tension loads – threaded rod for seismic performance category C1

Size			M8	M10	M12	M16	M20	M24	M30
Displacement	$\delta_{N,seis}$	[mm]	3,0	3,1	3,5	4,0	5,0	6,0	6,6

Table C27: Displacement under shear loads – threaded rod for seismic performance category C1

Size			M8	M10	M12	M16	M20	M24	M30
Displacement	$\delta_{V,seis}$	[mm]	3,5	4,0	4,6	5,0	5,8	6,5	7,0

Table C28: Displacement under tension loads – rebar for seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Displacement	$\delta_{N,seis}$	[mm]	3,0	3,1	3,5	4,0	4,0	5,0	6,0	6,4

Table C29: Displacement under shear loads – rebar for seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Displacement	$\delta_{V,seis}$	[mm]	3,5	4,0	4,6	5,0	5,0	5,8	6,5	7,2