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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-13/0805 of 29/06/2018

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S
Product family to which the construction product belongs	Bonded anchor with rod with internally threaded socket and rebar for use in concrete
Manufacturer	RAWLPLUG S.A. ul. Kwidzyńska 6 51-416 Wrocław Poland
Manufacturing plant(s)	Manufacturing Plant no. 3
This European Technical Assessment contains	23 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 / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S 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:

- anchor with rod with internally threaded socket 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, injection mortar 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 C12

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)

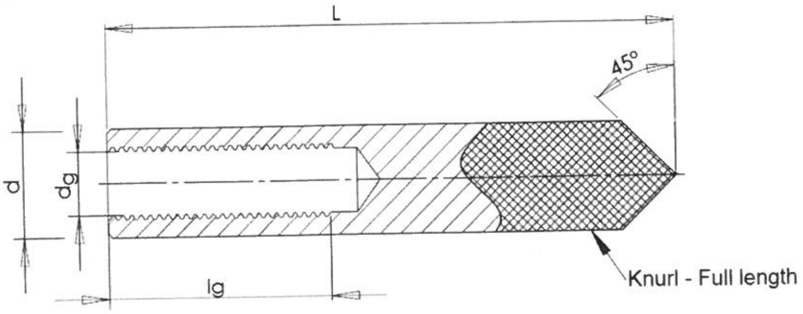
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Instytut Techniki Budowlanej.

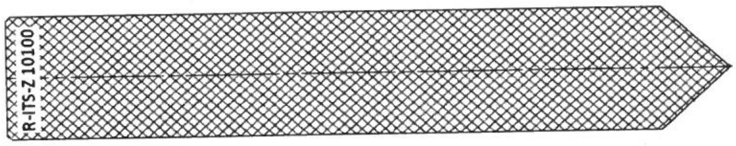
For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 29/06/2018 by Instytut Techniki Budowlanej

Anna Panek, MSc
Deputy Director of ITB

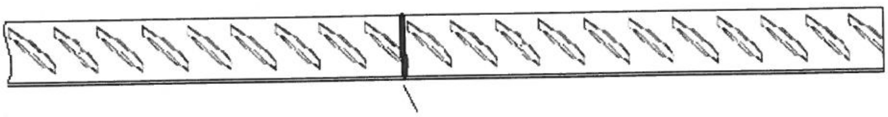
Rods with internally threaded socket: M6/10/75, M8/12/75, M8/12/90, M10/16/75, M10/16/100, M12/16/100, M16/24/125





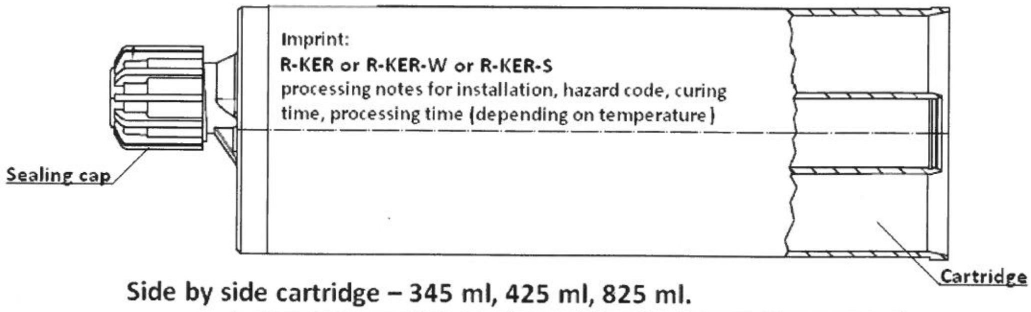
Marking: R - Identifying mark
ITS - product index
Z - carbon steel or A4 - stainless steel
XX - thread size
YYY - length of sleeve

Reinforcing bars (rebars): Ø8 to Ø32

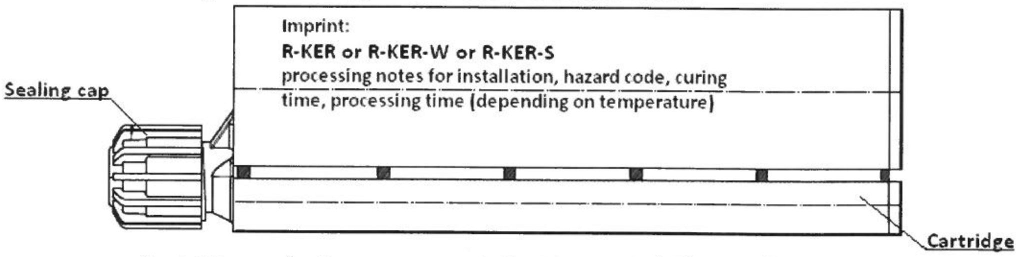


R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	**Annex A1** of European Technical Assessment ETA-13/0805
Product description Anchor rods – rod with internally threaded socket and rebar	

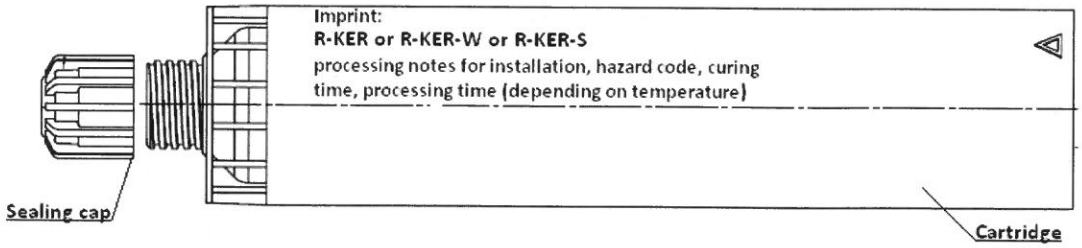
Coaxial cartridge –
150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 410 ml, 420 ml.



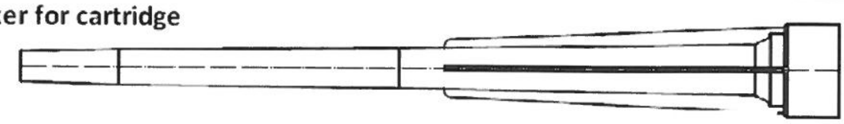
Side by side cartridge – 345 ml, 425 ml, 825 ml.



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



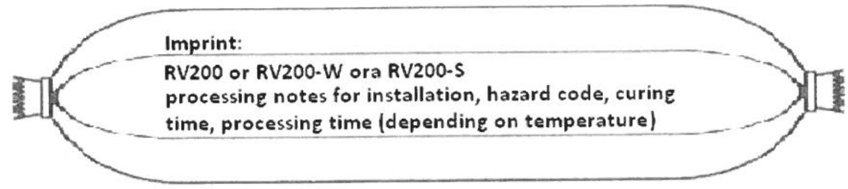
Mixer for cartridge



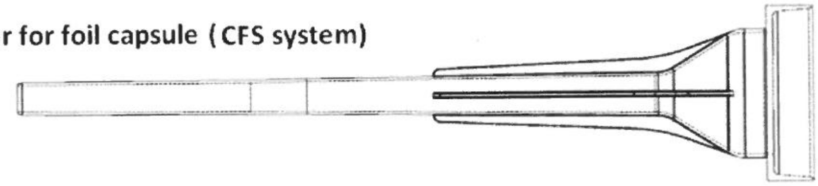
R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	Annex A2 of European Technical Assessment ETA-13/0805
Product description Cartridge types and sizes	

Foil capsule (CFS system) –

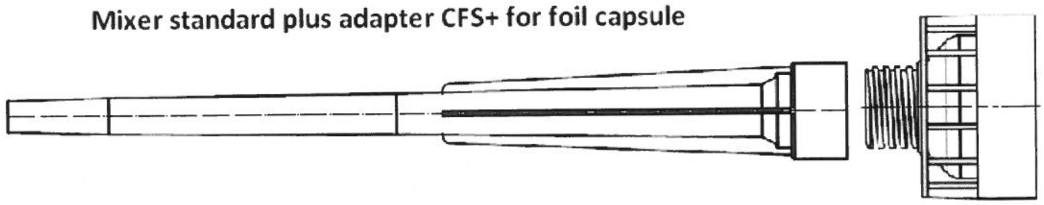
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.



Mixer for foil capsule (CFS system)



Mixer standard plus adapter CFS+ for foil capsule



R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	**Annex A3** of European Technical Assessment ETA-13/0805
Product description Cartridge types and sizes	

Table A1: Materials – rods with internally threaded socket

Designation	Materials
Rods with internally threaded socket made of zinc coated steel [1)]	Steel, property class 5.8 according to EN ISO 898-1; electroplated ≥ 5 μm according to EN ISO 4042 or hot-dip galvanized ≥ 45 μm according to EN ISO 10684
Rods with internally threaded socket made of stainless steel or high corrosion resistance stainless steel HCR [2)]	Material 1.4401, 1.4404, 1.4571 (stainless steel) and 1.44529, 1,4565 and 1.4547 (high corrosion resistance stainless steel HCR) according to EN 10088; property class 70 (A4-70) according to EN ISO 3506

1) related threaded rods or fastening screws: zinc coated steel strength class 5.8 or 8.8 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

2) related threaded rods or fastening screws: stainless steel 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 or 80 (A4-70 or A4-80) acc. to EN ISO 3506 or high corrosion resistance stainless steel 1.4529, 1.4565, 1.4547 acc. to EN 10088

Table A2: Materials – rebars (according to EN 1992-1-1, Annex C, Tables C.1 and C.2N)

Product form		Bars and de-coiled rods	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ [N/mm^2]		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 rib height h shall be: 0,05 · Ø ≤ h ≤ 0,07 · Ø

Table A3: Materials – injection mortar

Product	Composition
R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	Bonding agent: vinylester resin styrene free 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 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: rod with internally threaded socket sizes M6/Ø10 to M16/Ø24 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 concrete only.

Temperature ranges:

Installation temperature (temperature of substrate):

According to table B6.

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).

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:

- 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.

Design methods:

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

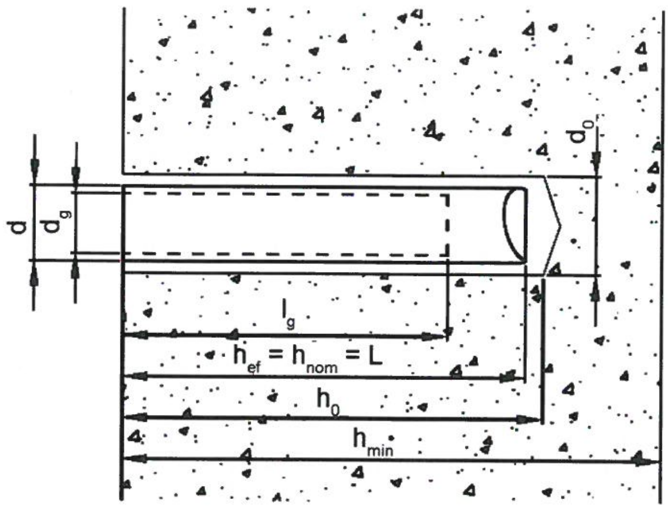


Table B1: Installation data – inner threaded rod

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Internally threaded diameter	d_g	[mm]	6	8	8	10	10	12	16
Diameter of sleeve	d	[mm]	10	12	12	16	16	16	24
Drilling diameter	d_0	[mm]	12	14	14	20	20	20	28
Diameter of the hole in the fixture	d_f	[mm]	7	9	9	12	12	14	18
Depth of the drilling hole	h_0	[mm]	h_{ef} + 5 mm						
Effective embedment depth = nominal embedment depth = anchor length	h_{ef} = h_{nom} = L	[mm]	75	75	90	75	100	100	125
Minimum thickness of the concrete member	h_{min}	[mm]	105	105	120	115	140	140	181
Max. torque moment	T_{inst}	[Nm]	3	5	5	10	10	20	40
Thread engagement length	l_g	[mm]	6-24	8-25	8-25	10-30	10-30	12-35	16-50
Minimum spacing and edge distance									
Minimum spacing	s_{min}	[mm]	$0{,}5 \cdot h_{ef} \geq 40$ mm						
Minimum edge distance	c_{min}	[mm]	$0{,}5 \cdot h_{ef} \geq 40$ mm						

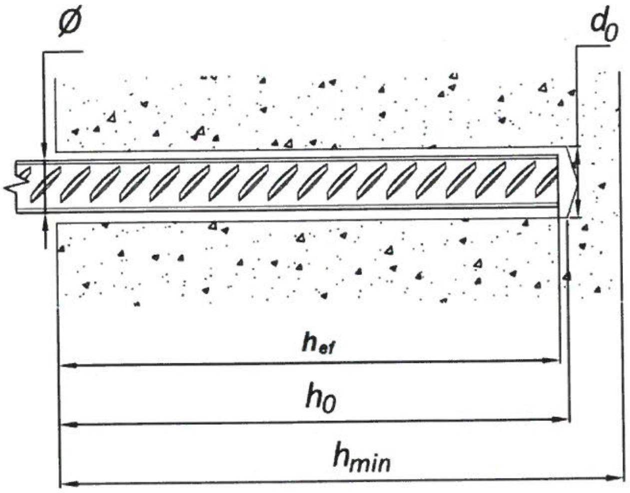
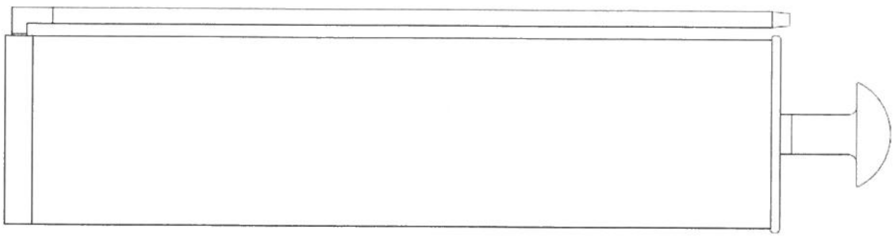


Table B2: Installation parameters of rebars

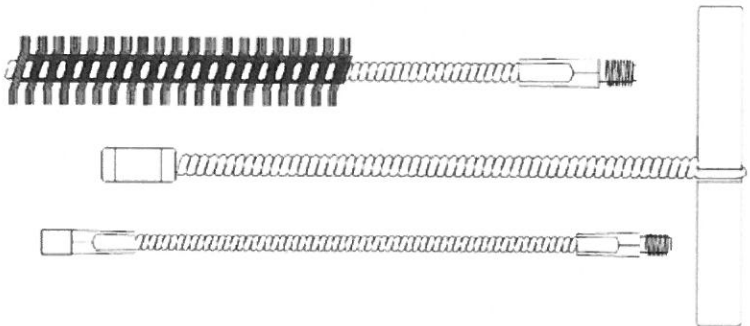
Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Nominal diameter of rebar	d	[mm]	8	10	12	14	16	20	25	32
Drilling diameter	d_0	[mm]	12	14	18	18	22	26	32	40
Depth of the drilling hole	h_0	[mm]	h_{ef} + 5							
Embedment depth	$h_{ef,\ min}$	[mm]	60	70	80	80	100	120	140	165
	$h_{ef,\ max}$	[mm]	100	120	145	145	190	240	290	360
Minimum thickness of the concrete member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2 \cdot d_0$					
Minimum spacing and edge distance										
Minimum spacing	s_{min}	[mm]	$0{,}5 \cdot h_{ef} \geq 40$ mm							
Minimum edge distance	c_{min}	[mm]	$0{,}5 \cdot h_{ef} \geq 40$ mm							

Manual blow pump R-BLOWPUMP



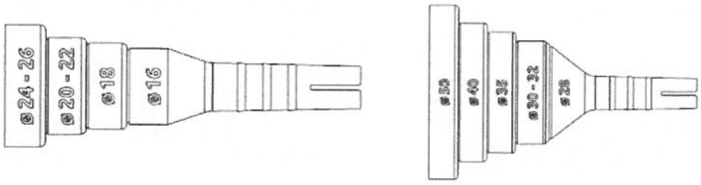
Steel brush R-BRUSH

Steel brush with extension R-BRUSH-T



Mixer nozzle extension R-NOZ-EXT

Dosing plug R-NOZ-P



Temporary positioning wedge

R-KER / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	**Annex B4** of European Technical Assessment ETA-13/0805
Installation Tools (1)	

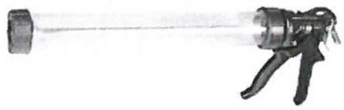
Dispensers	Cartridge or foil capsule size
 Manual gun for coaxial cartridges	380, 400, 410 and 420 ml
 Manual gun for side by side cartridges	345 ml
 Manual gun for foil capsule in cartridge and coaxial cartridges	150, 175, 280, 300 and 310 ml
 Manual gun for foil capsules CFS+	300 to 600 ml
 Cordless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

Table B3: Brush for rods with internally threaded socket

Size	M6/10	M8/12	M10/16	M12/16	M16/24
Brush diameter [mm]	14	16	22	22	30

Table B4: Brush for rebars

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

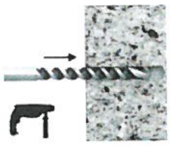
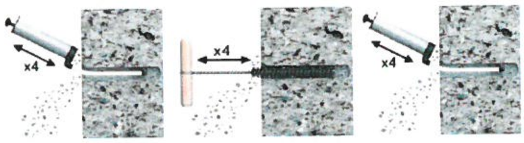
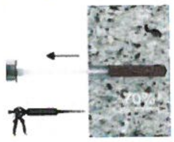
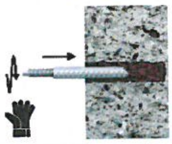
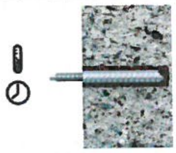
Table B5: Piston plug size

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

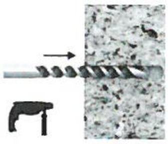
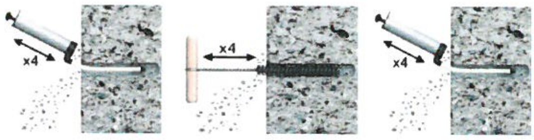
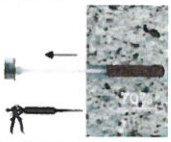
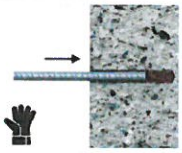
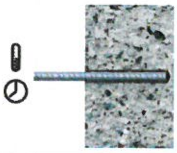
Table B6: Processing time and curing time

Mortar temperature	Temperature of substrate	Processing (open) time			Minimum curing time[1]		
		RAWL R-KER /..	RAWL R-KER-W / ..	RAWL R-KER-S / ..	RAWL R-KER /..	RAWL R-KER-W / ..	RAWL R-KER-S / ..
5°C	0°C	40 min.	12 min.	-	3 h	2 h	-
5°C	5°C	20 min.	8 min.	35 min.	2 h	1 h	12 h
10°C	10°C	12 min.	5 min.	20 min.	80 min.	45 min.	8 h
15°C	15°C	8 min.	3 min.	12 min.	60 min.	30 min.	6 h
20°C	20°C	5 min.	2 min.	9 min.	45 min.	10 min.	4 h
25°C	25°C	-	-	7 min.	-	-	3 h
25°C	30°C	2 min.	-	6 min.	20 min.	-	2 h
25°C	40°C	0,5 min.	-	5 min.	10 min.	-	45 min.

[1] curing time shall be doubled for the wet concrete

	1. Drill hole to the required diameter and depth using a rotary percussive machine
	2. Hole cleaning. 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.
	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 internally threaded socket, 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 / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	**Annex B7** of European Technical Assessment ETA-13/0805
Installation instruction Rods with internally threaded socket	

	1. Drill hole to the required diameter and depth using a rotary percussive machine
	2. Hole cleaning. 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.
	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 / RV200, R-KER-W / RV200-W and R-KER-S / RV200-S	**Annex B8** of European Technical Assessment ETA-13/0805
Installation instruction Rebars	

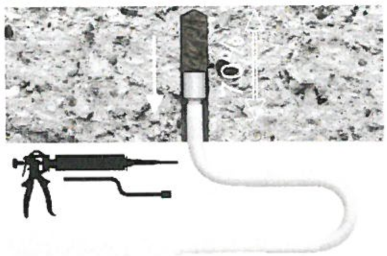
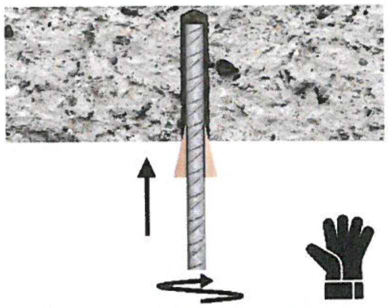
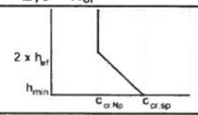
	1. Inject from the bottom of the hole. Inject the product about 2/3 of the hole depth. For best performance use extension and appropriately sized piston plug assembled on the mixer.
	2. Drive the rebar immediately into the hole. Use temporary interlocking element e.g wedges.
	3. Leave the fixing undisturbed 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: Characteristic values of resistance to tension loads – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Steel failure									
Steel failure with standard threaded rod grade 5.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	10	18	18	29	29	42	78
Partial safety factor	γ_{Ms} [1]	[-]	1,50						
Steel failure with standard threaded rod grade 8.8									
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	29	46	46	67	126
Partial safety factor	γ_{Ms} [1]	[-]	1,50						
Steel failure with standard stainless steel threaded rod A4-70									
Characteristic resistance	$N_{Rk,s}$	[kN]	14	26	26	41	41	59	110
Partial safety factor	γ_{Ms} [1]	[-]	1,87						
Steel failure with standard stainless steel threaded rod A4-80									
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	29	46	46	67	126
Partial safety factor	γ_{Ms} [1]	[-]	1,60						
Steel failure with high corrosion resistant stainless steel threaded rod grade 70									
Characteristic resistance	$N_{Rk,s}$	[kN]	14	26	26	41	41	59	110
Partial safety factor	γ_{Ms} [1]	[-]	1,87						
Resistance to combined pull-out and concrete cone failure in non-cracked concrete									
Characteristic resistance in non-cracked concrete C20/25									
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9,0	9,0	9,5	9,5	8,5	7,0
Temperature range II: 80°C/50°C	$\tau_{Rk,ucr}$	[N/mm²]	6,0	7,0	7,0	7,5	7,5	6,5	5,5
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,04						1,00
		C40/50	1,07						1,00
		C50/60	1,09						1,00
Resistance to concrete cone failure in non-cracked concrete									
Effective anchorage depth	h_{ef}	[mm]	75	75	90	75	100	100	125
Factor for non-cracked concrete	k_{ucr} [2]	[-]	10,1						
	$k_{ucr,N}$	[-]	11,0						
Edge distances and spacing for combined pull-out, concrete cone and splitting failure									
Edge distance	$c_{cr,N}$	[mm]	1,5 x h_{ef}						
	$c_{cr,sp}$ for h_{min}		2,0 · h_{ef}						1,5·h_{ef}
	$c_{cr,sp}$ for $h_{min} < h$ [3] $< 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)								
	$c_{cr,sp}$ for h [1] $\geq 2 \cdot h_{ef}$		$c_{cr,N}$						
Spacing	$s_{cr,N}$	[mm]	3 x h_{ef}						
	$s_{cr,sp}$		2,0 · $c_{cr,sp}$						
Partial safety factor for combined pull-out, concrete cone and splitting failure									
Partial safety factors for in use category 1	γ_{inst} [1]	[-]	1,2						
Partial safety factors for in use category 2			1,2						1,4

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

Table C2: Shear loads for steel failure without lever arm – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Steel failure with standard threaded rod grade 5.8									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	5	9	9	14	14	21	39
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard threaded rod grade 8.8									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	8	15	15	23	23	34	63
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard stainless steel threaded rod A4-70									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	7	13	13	20	20	29	55
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,56						
Steel failure with standard stainless steel threaded rod A4-80									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	8	15	15	23	23	34	63
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,33						
Steel failure with high corrosion resistant stainless steel threaded rod grade 70									
Characteristic resistance	$V^0_{Rk,s}$	[kN]	7	13	13	20	20	29	55
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,56						

Table C3: Shear loads for steel failure with lever arm – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Steel failure with standard threaded rod grade 5.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	8	19	19	37	37	65	166
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard threaded rod grade 8.8									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12	30	30	60	60	105	266
Partial safety factor	γ_{Ms}	[-]	1,25						
Steel failure with standard stainless steel threaded rod A4-70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	11	26	26	52	52	92	233
Partial safety factor	γ_{Ms}	[-]	1,56						
Steel failure with standard stainless steel threaded rod A4-80									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12	30	30	60	60	105	266
Partial safety factor	γ_{Ms}	[-]	1,33						
Steel failure with high corrosion resistant stainless steel threaded rod grade 70									
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	11	26	26	52	52	92	233
Partial safety factor	γ_{Ms}	[-]	1,56						

Table C4: Characteristic values for shear loads – pry out and concrete edge failure – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Effective anchorage depth	h_{ef}	[mm]	75	75	90	75	100	100	125
Pry out failure									
Factor	k_8	[-]	2	2	2	2	2	2	2
Partial safety factor	γ_{Mp}	[-]	1,5						
Concrete edge failure: see clause 5.2.3.4 of Technical Report TR 029									
Partial safety factor	γ_{Mc}	[-]	1,5						

Table C5: Displacement under tension loads – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Characteristic displacement in non-cracked C20/25 to C50/60 concrete under tension loads									
Admissible service load [1)]	F	[kN]	7,1	10,3	10,3	14,6	14,6	17,4	23,2
Displacement	δ_{N0}	[mm]	0,21	0,22	0,22	0,24	0,24	0,30	0,34
	$\delta_{N\infty}$	[mm]	0,60	0,60	0,60	0,60	0,60	0,60	0,60

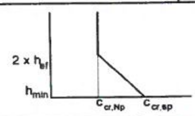
[1)] $F = F_{Rk} / \gamma_F \cdot \gamma_{Mc}$, with $\gamma_F = 1,4$

Table C6: Displacement under shear loads – rods with internally threaded socket

Size			M6/ 10/75	M8/ 12/75	M8/ 12/90	M10/ 16/75	M10/ 16/100	M12/ 16/100	M16/ 24/125
Characteristic displacement under shear loads									
Admissible service load [1)]	F	[kN]	6,4	11,6	11,6	18,4	18,4	26,7	49,8
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

[1)] $F = F_{Rk} / \gamma_F \cdot \gamma_{Mc}$, with $\gamma_F = 1,4$

Table C7: Characteristic values of resistance to tension loads – reinforcing bars

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure										
Steel failure with reinforcing bar B500B										
Characteristic resistance	$N_{Rk,s}$	[kN]	27,6	43,2	62,2	84,7	110,6	172,8	270,0	442,3
Partial safety factor	γ_{Ms} [1]	[-]	1,4							
Combined pull-out and concrete cone failure										
Characteristic resistance in non-cracked concrete C20/25										
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	11	10	10	9	9	7,5	7	6,5
Temperature range II: 80°C/50°C	$\tau_{Rk,ucr}$	[N/mm²]	9	8	8	7	7	6	6	5
Increasing factor for $\tau_{Rk,ucr}$ in non-cracked concrete	ψ_c	C30/37	1,04					1,00		
		C40/50	1,07							
		C50/60	1,09							
Partial safety factors for use category 1 and 2	$\gamma_{Mc} = \gamma_{Mp}$	[-]	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
Resistance to concrete cone failure in non-cracked concrete										
Effective anchorage depth h_{ef}	min	[mm]	60	70	80	80	100	120	140	165
	max	[mm]	100	120	145	145	190	240	290	360
Factor for non-cracked concrete	k_{ucr} [2]	[-]	10,1							
	$k_{ucr,N}$	[-]	11,0							
Edge distances and spacing for combined pull-out, concrete cone and splitting failure										
Edge distance	$c_{cr,N}$	[mm]	$1{,}5 \times h_{ef}$							
	$c_{cr,sp}$ for h_{min}		$2{,}5 \cdot h_{ef}$		$2{,}0 \cdot h_{ef}$			$1{,}5 \cdot h_{ef}$		
	$c_{cr,sp}$ for $h_{min} < h$ [3] $< 2 \cdot h_{ef}$ ($c_{cr,sp}$ from linear interpolation)									
	$c_{cr,sp}$ for h [1] $\geq 2 \cdot h_{ef}$		$c_{cr,Np}$							
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 1	γ_{inst} [1]	[-]	1,2							
Partial safety factors for in use category 2										

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

Table C8: Characteristic values of resistance to shear loads for steel failure without lever arm – reinforcing bars

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with reinforcing bars										
Characteristic resistance [1]	$V_{Rk,s}$	[kN]	13,8	21,6	31,1	42,3	55,3	86,4	135,0	221,2
Factor considering ductility	k_7	[-]	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8
Partial safety factor	γ_{Ms}	[-]	1,5							

[1] The characteristic resistance $V_{Rk,s}$ shall be determined acc. to Technical Report TR 029, equation (5.5)

Table C9: Characteristic values of resistance to shear loads for steel failure with lever arm – reinforcing bars

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with reinforcing bars										
Characteristic resistance [1]	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012	2123
Partial safety factor	γ_{Ms}	[-]	1,5							

[1] The characteristic resistance $M^0_{Rk,s}$ shall be determined acc. to Technical Report TR 029, equation (5.6b)

Table C10: Concrete pry out failure and concrete edge failure – reinforcing bars

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Pry out failure										
Factor	k_8	[-]	2							
Partial safety factor	γ_{Mp}	[-]	1,5							
Concrete edge failure: see clause 5.2.3.4 of Technical Report TR 029										
Partial safety factor	γ_{Mc}	[-]	1,5							

Table C11: Displacement under tension loads – reinforcing bars

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 [1)]	F	[kN]	6,9	9,1	13,4	12,8	19,2	24,4	33,5	44,6
Displacement	δ_{N0}	[mm]	0,20	0,30	0,35	0,35	0,35	0,41	0,45	0,47
	$\delta_{N\infty}$	[mm]	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60

1) $F = F_{Rk} / \gamma_F \cdot \gamma_{Mc}$, with $\gamma_F = 1{,}4$

Table C12: Displacement under shear loads – reinforcing bars

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Characteristic displacement in non-cracked concrete C20/25 to C50/60 under shear loads										
Admissible service load [1)]	F	[kN]	3,7	5,8	8,4	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	2,5
	$\delta_{V\infty}$	[mm]	3,7	3,7	3,7	3,7	3,7	3,7	3,7	3,7

1) $F = F_{Rk} / \gamma_F \cdot \gamma_{Mc}$, with $\gamma_F = 1{,}4$