





## European Technical Assessment

ETA-21/0244 of 30/12/2021

#### **General Part**

Technical Assessment Body issuing the European Technical Assessment

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of

This version replaces

Instytut Techniki Budowlanej

R-KEX-II

Bonded fasteners with threaded rod, rod with inner thread and rebar for use in concrete

RAWLPLUG S.A. ul. Kwidzyńska 6 51-416 Wrocław Poland

Manufacturing Plant no. 3

38 pages including 3 Annexes which form an integral part of this Assessment

European Assessment Document EAD 330499-01-0601 "Bonded fasteners for use in concrete"

ETA-21/0244 issued on 11/03/2021

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#### **Specific Part**

#### 1 Technical description of the product

The R-KEX-II 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,

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.

The product description is given in Annex A.

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

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

The provisions given in this European Technical Assessment are based on an assumed working life of the anchor of 50 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

#### 3.1 Performance of the product

#### 3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to static and quasi-static loading, displacements	See Annexes C1 to C13
Characteristic resistance to seismic performance category C1, displacements	See Annexes C14 to C16
Characteristic resistance to seismic performance category C2, displacements	See Annex C17

#### 3.1.2 Hygiene, health and the environment (BWR 3)

No performance assessed.

#### 3.2 Methods used for the assessment

The assessment has been made in accordance with the EAD 330499-01-0601.

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

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

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

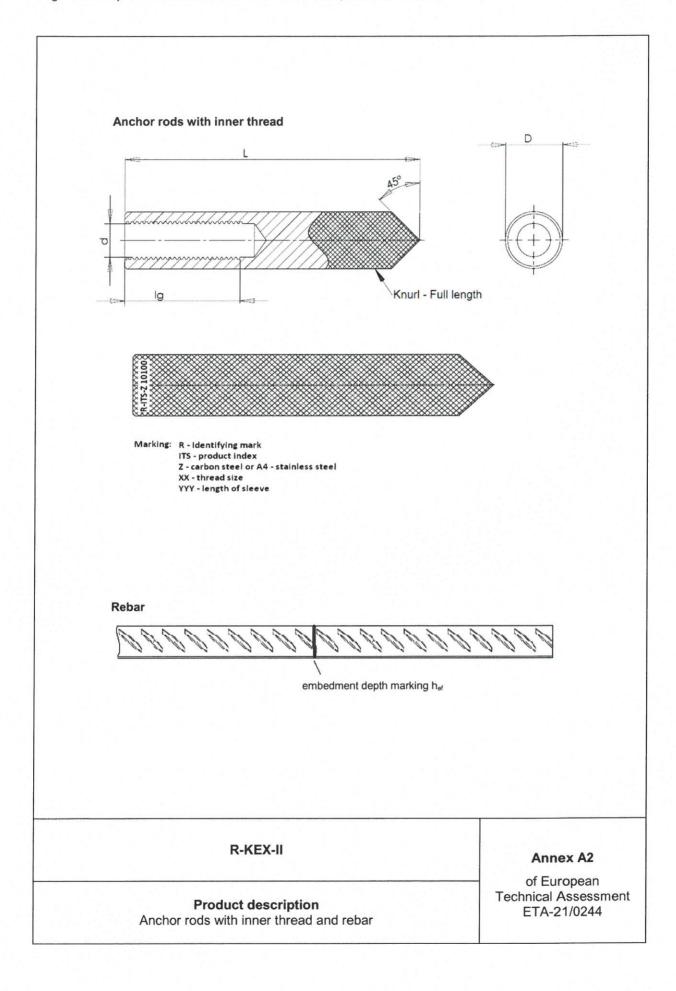
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Instytut Techniki Budowlanej.

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 30/12/2021 by Instytut Techniki Budowlanej

Anna Panek, MSc Deputy Director of ITB

# Threaded anchor rods L -total length of anchor rod DETAIL A B For M12 - M30 Marking: Identifying mark – R Size rod: 'number' for M8, M10; M'number' for M12 to M30 В DETAIL A L-total length of enchor rod For M12 - M30 Marking: Identifying mark – R Size rod: 'number' for M8, M10; M'number' for M12 to M30 DETAIL C DETAIL B Notched Mark Version Depth h<sub>mid</sub> Painted Mark Version Depth h<sub>mid</sub> 1. Anchor rod R-STUDS 1. Anchor rod R-STUDS 2. 45° shape with anchor rod 3. The flat end of anchor rod 4. Anchor rod R-STUDS 5. Hexagonal nut 6. Washer R-KEX-II Annex A1 of European **Technical Assessment Product description** ETA-21/0244 Threaded anchor rods



			3 5
Table	A1:	Threaded	l rods

		Designation	Designation			
Part	Steel, zinc plated	Stainless steel	High corrosion resistance stainless steel (HCR)			
Threaded rod	Steel, property class 5.8 to 12.9 acc. to EN ISO 898-1 electroplated ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684 or non-electrolytically applied zinc flake coating ≥ 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 Corrosion resistance class CRC III acc. to EN 1993-1- 4:2006+A1:2015	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506 Corrosion resistance class CRC V acc. to EN 1993-1-4:2006+A1:2015			
	elongation at fracture A <sub>5</sub> > 8%	elongation at fracture A <sub>5</sub> > 8%	elongation at tracture A5 > 076			
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 coating ≥ 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  Corrosion resistance class CRC III acc. to EN 1993-1- 4:2006+A1:2015	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506 Corrosion resistance class CRC V acc. to EN 1993-1- 4:2006+A1:2015			
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 coating ≥ 8 µm acc. EN ISO 10683	Steel 1.4401, 1.4404, 1.4571 acc. to EN 10088 Corrosion resistance class CRC III acc. to EN 1993-1- 4:2006+A1:2015	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088 Corrosion resistance class CRC V acc. to EN 1993-1- 4:2006+A1:2015			

 $Commercial\ threaded\ rods\ (in\ the\ case\ of\ rods\ made\ of\ galvanized\ steel-standard\ rods\ with\ property\ class \le 8.8\ only),\ with:$ 

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

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

R-KEX-II	Annex A3
	of European
Product description  Materials (1)	Technical Assessment ETA-21/0244

Table A2: Rods with inner thread

		Designation			
Part	Steel, zinc plated	Stainless steel	High corrosion resistance stainless steel		
Rod with inner thread	Steel, property class 5.8 to 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	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 Corrosion resistance class CRC III acc. to EN 1993-1- 4:2006+A1:2015	Steel 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506		
	elongation at fracture A <sub>5</sub> > 8%	elongation at fracture A <sub>5</sub> > 8%	elongation at fracture A <sub>5</sub> > 8%		

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

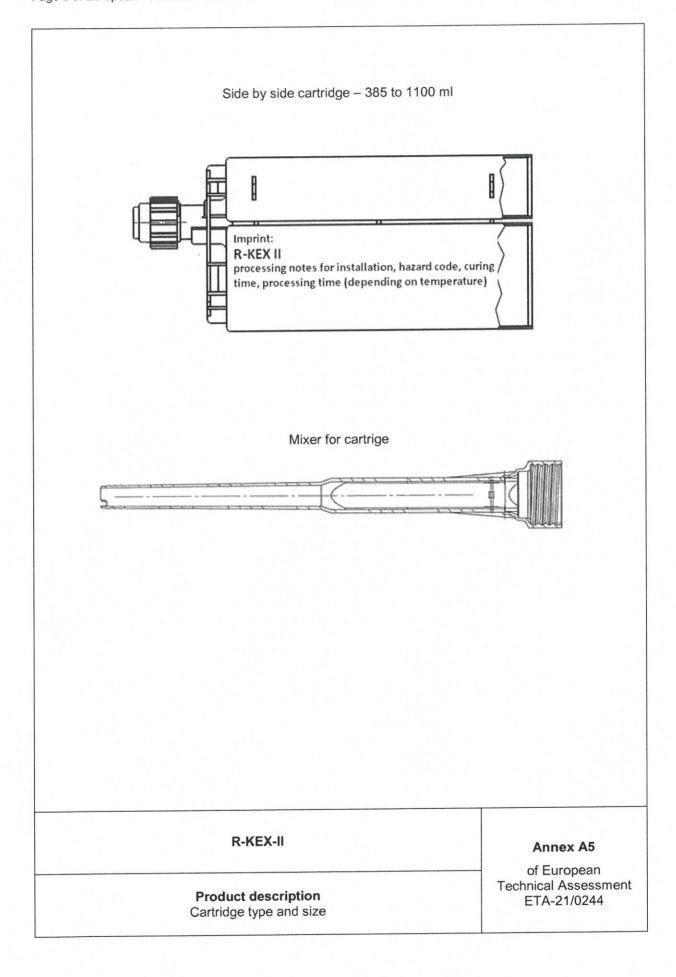
Product form		Bars and de-coiled rods		
Class	В	С		
Characteristic yield strength $f_{yk}$ or $f_{0,2k} \left[ N/mm^2 \right]$	400 to	400 to 600		
Minimum value of $k = (f_t / f_y)_k$	≥ 1,08	≥ 1,15 < 1,35		
Characteristic strain at maximum force, $\epsilon_{uk}  [\%]$	acteristic strain at maximum force, ε <sub>uk</sub> [%]		≥ 7,5	
Bendability	Bend / Rebend test			
		± 6,0 ± 4,5		
Bond: minimum relative rib area, f <sub>R,min</sub>	Nominal bar size [mm] 8 to 12 > 12	0,04		

**Rib height**: The maximum rib height is:  $h_{\text{rib}} \leq 0.07 \cdot \emptyset$ 

Table A4: Injection mortar

Product	Composition		
R-KEX-II (two component injection mortar)	Epoxy system with fillers		

R-KEX-II	Annex A4
Product description  Materials (2)	of European Technical Assessment ETA-21/0244



#### Specification of intended use

#### 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.

Seismic performance category C2: threaded rod size M12 to M24.

#### Base material:

- Reinforced or unreinforced normal weight concrete of strength class C20/25 to C50/60 according to EN 206:2013+A1:2016.
- Cracked and uncracked concrete threaded rod size M8 to M30 and rebar Ø8 to Ø32.
- Uncracked concrete only rod with inner thread sizes M6/Ø10 to M16/Ø24.

#### Temperature ranges:

#### Installation temperature (temperature of substrate):

+5°C to +30°C.

#### 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):

- Structures subject to dry internal conditions: all materials.
- For all other conditions according to EN 1993-1-4 corresponding to corrosion resistance class (CRC):
  - stainless steel A4 according to Annex A3, Table A1: CRC III,
  - high corrosion resistance steel (HCR) according to Annex A3, Table A1: CRC V.

#### Design methods:

- Anchorages are designed in accordance with EN 1992-4:2018 and Technical Report TR 055.
- Anchorages under seismic actions have to be designed in accordance with EOTA Technical Report TR 045.
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The
  position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to
  reinforcement or to supports, etc.).

#### Installation:

- Dry or wet concrete (use category I1).
- Flooded holes (use category I2).
- Installation direction D3 (downward, horizontal and upwards installation).
- The anchors are suitable for hammer drilled holes or diamond core drilled holes.

R-KEX-II	Annex B1
Intended use Specification	of European Technical Assessment ETA-21/0244

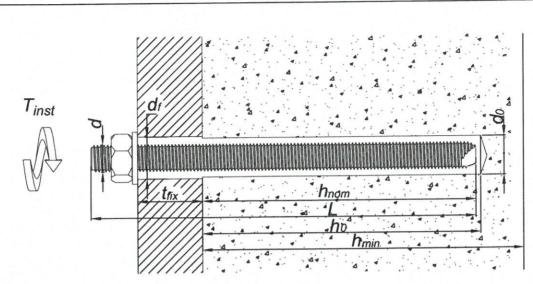


Table B1: Installation parameters – threaded anchor rod

Size		M8	M10	M12	M16	M20	M24	M30
Nominal drilling diameter	d <sub>0</sub> [mm]	10	12	14	18	22 or 24	28	35
Maximum diameter hole in the fixture	d <sub>f</sub> [mm]	9	12	14	18	22	26	33
Effective embedment depth	h <sub>ef,min</sub> [mm]	60	70	80	100	120	140	165
	h <sub>ef,max</sub> [mm]	160	200	240	320	400	480	600
Depth of the drilling hole	h <sub>0</sub> [mm]	h <sub>ef</sub> + 5 mm						
Minimum thickness of the concrete slab	h <sub>min</sub> [mm]	$h_{ef}$ + 30 mm; $\geq$ 100 mm $h_{ef}$ + 2d <sub>0</sub>						
Maximum installation torque	T <sub>inst,max</sub> [Nm]	10	20	40	80	120	180	200
Minimum spacing	s <sub>min</sub> [mm]	40	40	40	50	60	70	85
Minimum edge distance	c <sub>min</sub> [mm]	40	40	40	50	60	70	85

R-KEX-II	Annex B2
Intended use Installation parameters (1)	of European Technical Assessment ETA-21/0244

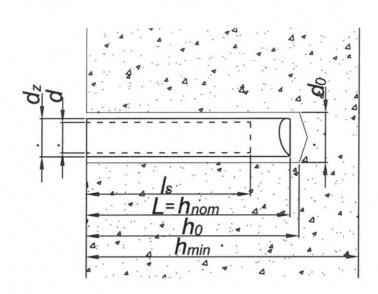


Table B2: Installation parameters – anchor rod with inner thread

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 <sub>0</sub> [mm]	12	14	14	20	20	20	28
Maximum diameter hole in the fixture	d <sub>f</sub> [mm]	7	9	9	12	12	14	18
Effective embedment depth	h <sub>ef</sub> = h <sub>nom</sub> [mm]	75	75	90	75	100	100	125
Thread length, min	I <sub>s</sub> [mm]	24	25	25	30	30	35	50
Depth of the drilling hole	h <sub>0</sub> [mm]	h <sub>ef</sub> + 5 mm						
Minimum thickness of the concrete slab	h <sub>min</sub> [mm]	h <sub>ef</sub> + 30 mm; ≥ 100 mm h <sub>ef</sub> + 2d <sub>0</sub>						
Maximum installation torque	T <sub>inst,max</sub> [Nm]	3	5	5	10	10	20	40
Minimum spacing	s <sub>min</sub> [mm]	40	40	50	40	50	50	70
Minimum edge distance	c <sub>min</sub> [mm]	40	40	50	40	50	50	70

R-KEX-II	Annex B3
Intended use Installation parameters (2)	of European Technical Assessment ETA-21/0244

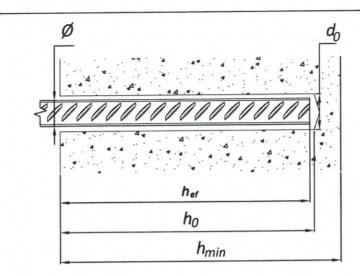


Table B3: Installation parameters – rebar

Size		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Nominal drilling diameter	d <sub>0</sub> [mm]	10 or 12	12 or 14	14 or 18	18	22	26	32	40
Effective embedment	h <sub>ef,min</sub> [mm]	60	70	80	80	100	120	140	165
depth	h <sub>ef,max</sub> [mm]	160	200	240	280	320	400	500	640
Depth of the drilling hole	h <sub>0</sub> [mm]	h <sub>ef</sub> + 5 mm							
Minimum thickness of the concrete slab	h <sub>min</sub> [mm]	h <sub>e</sub>	+ 30 mn	n; ≥ 100 r		h <sub>ef</sub> ⊀	- 2d <sub>0</sub>		
Minimum spacing s <sub>min</sub> [mm]		40	40	40	40	50	60	70	85
Minimum edge distance	c <sub>min</sub> [mm]	40	40	40	40	50	60	70	85

R-KEX-II	Annex B4
Intended use Installation parameters (3)	of European Technical Assessment ETA-21/0244

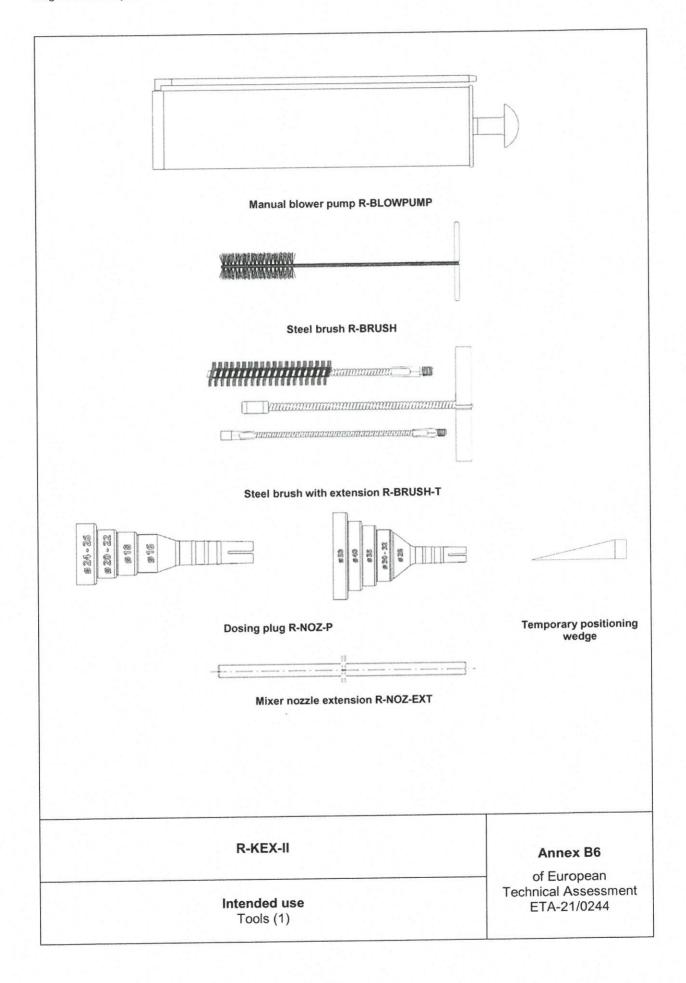
Table B4: Maximum processing time and minimum curing time

R-KEX-II									
Mortar temperature [°C]	Concrete (substrate) temperature [°C]	Maximum processing time [min.]	Minimum curing time <sup>1)</sup> [min.]						
+5	+5	150	2880						
+10	+10	120	1080						
+20	+20	35	480						
+25	+30	12	300						

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

Intended use
Maximum processing time and minimum curing time

Annex B5



Dispenser	Cartridge size
Manual gun for side by side cartridges R-GUN-385-P	385 ml
	385, 600 ml
Manual gun for side by side cartridges R-GUN-600-P	
Cordless dispenser gun	385, 600 ml
THE RESERVE OF THE PARTY OF THE	
Pneumatic dispenser gun	
Min the later later	385, 600 ml
Manual gun for side by side cartridges R-GUN-MULTI	

R-KEX-II	Annex B7
Intended use Tools (2)	of European Technical Assessment ETA-21/0244

#### Table B5: Brush diameter for threaded rod

	Threaded rod diame	eter	M8	M10	M12	M16	M20	M24	M30
d <sub>b</sub>	Brush diameter	[mm]	12	14	16	20	26	30	37

#### Table B6: Brush diameter for rod with inner thread

	Threaded rod diameter		M6/Ø10	M8/Ø12	M10/Ø16	M12/Ø16	M16/Ø24	
d <sub>b</sub>	Brush diameter	[mm]	16	16	22	22	30	

#### Table B7: Brush diameter for rebar

	Rebar diameter		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
d <sub>b</sub>	Brush diameter	[mm]	14	16	20	20	24	28	37	42

#### Table B8: Dosing plug diameter

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

R-KEX-II

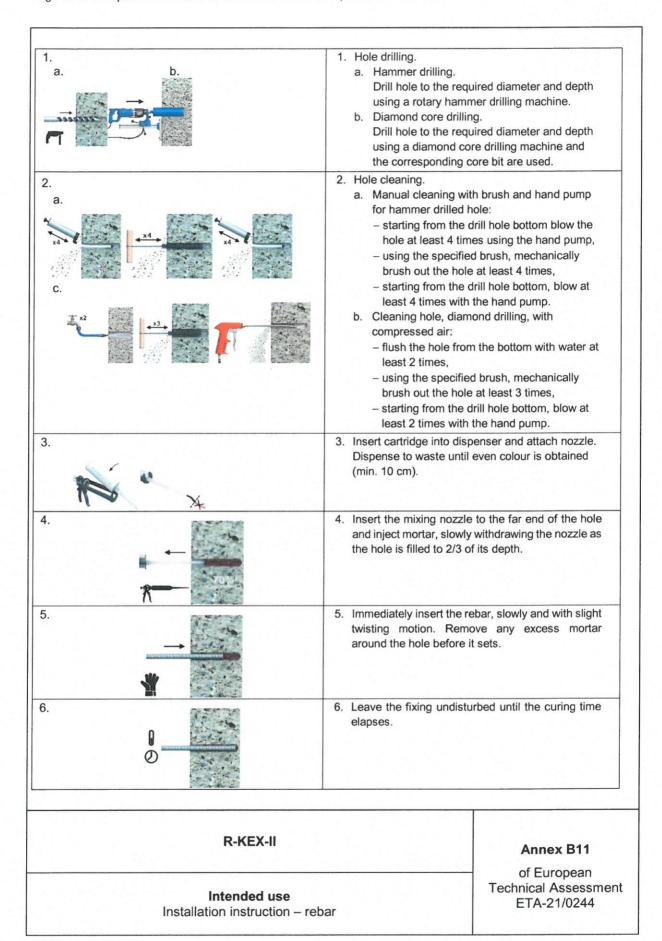
Annex B8

of European
Technical Assessment
ETA-21/0244

	1 d their delities
1.	Hole drilling.
a. b.	a. Hammer drilling.
a. D.	Drill hole to the required diameter and depth using a
	rotary hammer drilling machine.
$G \hookrightarrow G$	
	b. Diamond core drilling.
	Drill hole to the required diameter and depth using a
	diamond core drilling machine and the corresponding
Properties Properties	core bit are used.
2.	2. Hole cleaning.
۷.	a. Manual cleaning with brush and hand pump for
a.	hammer drilled hole:
DUNISTRA DUNISTRA DUNISTRA	
	<ul> <li>starting from the drill hole bottom blow the hole at</li> </ul>
	least 4 times using the hand pump,
X4 - X4 -	- using the specified brush, mechanically brush out
	the hole at least 4 times,
b.	<ul> <li>starting from the drill hole bottom, blow at least</li> </ul>
U.	4 times with the hand pump.
	b. Cleaning hole, diamond drilling, with compressed air:
I x2	
	<ul> <li>flush the hole from the bottom with water at least</li> </ul>
	2 times,
	- using the specified brush, mechanically brush out
Principal and Description 5	
	the hole at least 3 times,
ng Sare Gille Cagadian ta Hebragadha a lil	<ul> <li>starting from the drill hole bottom, blow at least</li> </ul>
	2 times with the hand pump.
	Insert cartridge into dispenser and attach nozzle.
3.	
	Dispense to waste until even colour is obtained (min.
	10 cm).
*	
	4. Insert the mixing nozzle to the far end of the hole and
1.	inject mortar, slowly withdrawing the nozzle as the hole
A STATE OF THE PARTY OF THE PAR	
	is filled to 2/3 of its depth.
<b>*</b>	
7	
	<ol><li>Immediately insert the threaded rod, slowly and with</li></ol>
5.	slight twisting motion. Remove any excess mortar
	around the hole before it sets.
	aloully the hole before it sets.
	<ol><li>Leave the fixing undisturbed until the curing time</li></ol>
	elapses.
Ø	
Contract to	
	7. Attach fixture and tighten the nut to the required torque.
	7. Attach fixture and tighten the nut to the required forque.  The installation torque cannot exceed T <sub>inst,max</sub> .
v. V =	
v. —	
<b>V</b> =	
V = 3	

R-KEX-II	Annex B9
Intended use Installation instruction – threaded rod	of European Technical Assessment ETA-21/0244

1. a. b.	Hole drilling.     a. Hammer drilling.     Drill hole to the required diameter and depth using a rotary hammer drilling machine.     b. Diamond core drilling.     Drill hole to the required diameter and depth using a diamond core drilling machine and the corresponding core bit are used.
2. a. b.	2. Hole cleaning.  a. Manual cleaning with brush and hand pump for hammer drilled hole:  - 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, diamond drilling, with compressed air:  - flush the hole from the bottom with water at least 2 times,  - using the specified brush, mechanically brush out the hole at least 3 times,  - starting from the drill hole bottom, blow at least 2 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.	<ol> <li>Insert the mixing nozzle to the far end of the hole and inject mortar, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.</li> </ol>
5.	5. Immediately insert the rod with inner thread, slowly and with slight twisting motion. Remove any excess mortar around the hole before it sets.
6.	Leave the fixing undisturbed until the curing time elapses.
7. A	7. Attach fixture and tighten the bolt to the required torque. The installation torque cannot exceed T <sub>inst,max</sub> .
R-KEX-II	Annex B10 of European
Intended use Installation instruction – anchor rod v	Technical Assessment



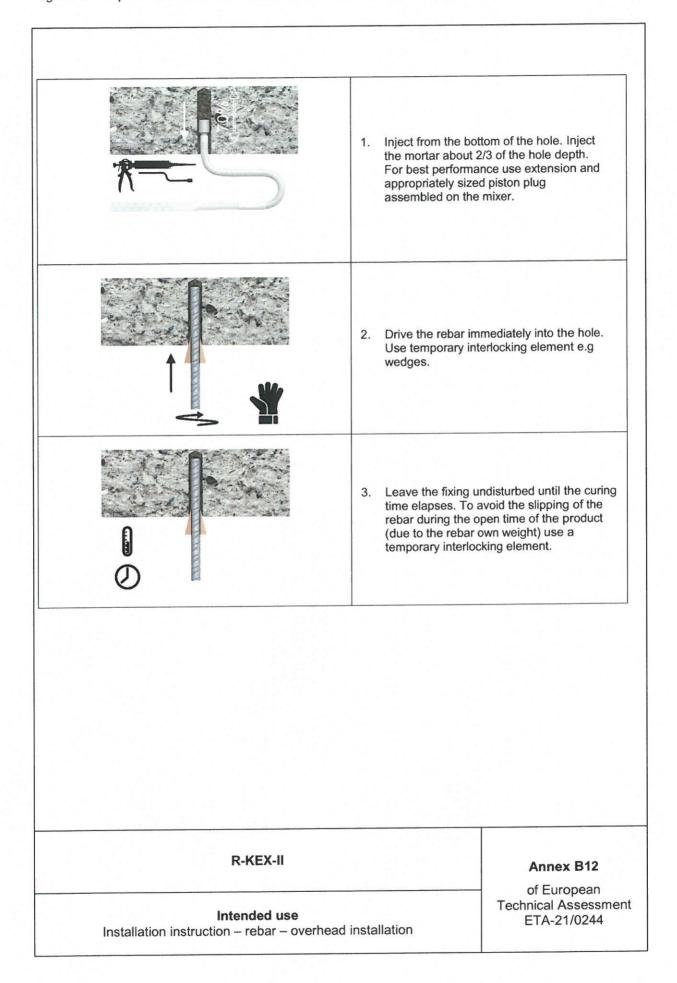


Table C1-1: Characteristic resistance to tension load for threaded rod in uncracked concrete – static and quasi-static loads

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure							ERESOLE		P. A.
Steel, property class 5.8		71.517	1.0	- 00	10	70	1.00	470	1 000
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	18	29	42	78	122	176	280
Partial safety factor 1)	γMs	[-]				1,50			
Steel, property class 8.8		7	,						
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	449
Partial safety factor 1)	γMs	[-]				1,50			
Steel, property class 10.9			,					,	
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	37	58	84	157	245	353	561
Partial safety factor 1)	γMs	[-]				1,40			
Steel, property class 12.9									
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	44	70	101	188	294	424	673
Partial safety factor 1)	γMs	[-]				1,40			
Stainless steel, property class A4-70									
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	393
Partial safety factor 1)	γMs	[-]				1,87			
Stainless steel, property class A4-80		-1							
Characteristic resistance	N <sub>Rks</sub>	[kN]	29	46	67	126	196	282	448
Partial safety factor 1)	ΥMs	[-]				1,60			
High corrosion resistant stainless steel.									
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	25	40	59	110	171	247	393
Partial safety factor 1)	Ϋ́Ms	[-]				1.87			
Combined pull-out and concrete con	e failure in uncra		C20/25 -	- hamme	r drilling		life 50 ye	ears	
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,50</sub>	[N/mm <sup>2</sup> ]	17,0	16,0	17,0	15,0	15,0	13,0	12,0
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,50</sub>	[N/mm²]	15,0	14,0	15,0	13,0	13,0	12,0	10,0
Combined pull-out and concrete con	e failure in uncra	cked concrete	C20/25 -	- diamon	d core di	illing, wo	orking life	50 years	S
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,50</sub>	[N/mm²]	14,0	15,0	16,0	14,0	14,0	12,0	11,0
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,50</sub>	[N/mm²]	12,0	14,0	14,0	13,0	13,0	11,0	10,0
Factors – working life 50 years				VIII CONTRACTOR					
		C30/37				1,04			
Increasing factor	Ψς	C40/50				1,07			
		C50/60				1,09			
Sustained load factor for τ <sub>Rk,ucr,50</sub>	0	40°C/24°C				0,75		34117/11-1-1-1-1	200000000000000000000000000000000000000
in uncracked concrete	Ψ <sup>0</sup> sus,50	80°C/50°C				0,72			
Combined pull-out and concrete con	e failure in uncra	cked concrete	C20/25 -	- hamme	r drilling,	working	life 100	years	
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,100</sub>	[N/mm²]	17,0	16,0	17,0	15,0	15,0	13,0	12,0
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,100</sub>	[N/mm²]	15,0	14,0	15,0	13,0	13,0	12,0	10,0
Combined pull-out and concrete con	e failure in uncra	cked concrete	C20/25 -	- diamon	d core dr	illing, wo	orking life	100 yea	rs
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,100</sub>	[N/mm²]	14,0	15,0	16,0	14,0	14,0	12,0	11,0
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,100</sub>	[N/mm²]	12,0	14,0	14,0	13,0	13,0	11,0	10,0
Factors – working life 100 years							170		
		C30/37				1,04	2 10 10 10 10 10		
Increasing factor	Ψο	C40/50				1,07		1000	
nicreasing factor		C50/60				1,09			

<sup>1)</sup> In the absence of other national regulation

#### **Performances**

Characteristic resistance to tension loads in uncracked concrete – threaded rod

#### Annex C1

Table C1-2: Characteristic resistance to tension load for threaded rod in uncracked concrete – static and quasi-static loads

Size			M8	M10	M12	M16	M20	M24	M3	
Concrete cone failure in uncrack	red concrete									
Factor for uncracked concrete	K <sub>ucr,N</sub>	[-]				11,0				
Edge distance	C <sub>cr,N</sub>	[mm]	1,5 · h <sub>ef</sub>							
Spacing	S <sub>cr,N</sub>	[mm]	3,0 · h <sub>ef</sub>							
Splitting failure										
	C <sub>cr,sp</sub> for h <sub>min</sub>		2,0 · h <sub>ef</sub>				1,5 · h			
Edge distance		[mm]	2 x h <sub>e</sub> , h <sub>min</sub> c <sub>orap</sub>							
	$c_{cr,sp}$ for $h^{(1)} \ge 2 \cdot h_{ef}$					C <sub>cr,N</sub>				
Spacing	S <sub>cr,sp</sub>	[mm]	2,0 · C <sub>cr,sp</sub>							
Installation safety factors for con	mbined pull-out, concrete	cone and	splitting	failure						
Installation safety factor for in use category  1		[-]	1,0							
Installation safety factor for in use category I2	Yinst	1,2								

<sup>1)</sup> h - concrete member thickness

**Performances** 

Characteristic resistance to tension loads in uncracked concrete – threaded rod

Annex C2

Table C2-1: Characteristic resistance to tension loads for threaded rod in cracked concrete – static and quasi-static loads

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel, property class 5.8									
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	18	29	42	78	122	176	280
Partial safety factor 1)	YMs	[-]				1,50			
Steel, property class 8.8	,								
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	29	46	67	125	196	282	448
Partial safety factor 1)	γMs	[-]				1,50			
Steel, property class 10.9	1110			***************************************					
Characteristic resistance	N <sub>Rk.s</sub>	[kN]	36	58	84	157	245	353	561
Partial safety factor 1)	γMs	[-]				1,40			
Steel, property class 12.9	1 100								
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	43	69	101	188	294	423	673
Partial safety factor 1)	YMs	[-]				1,40			
Stainless steel, property class A4-70	I								
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	25	40	59	109	171	247	392
Partial safety factor 1)	YMs	[-]				1,87			
Stainless steel, property class A4-80	I IMS	1 11 1				.,01			
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	29	46	67	125	196	282	448
Partial safety factor 1)		[-]	20	40	01	1,60	100	LOL	110
High corrosion resistant stainless stee	I property class 7					1,00			
Characteristic resistance	N <sub>Rk.s</sub>	[kN]	25	40	59	109	171	247	392
Partial safety factor 1)		[-]	20	40	39	1,87	1/1	241	552
Combined pull-out and concrete co	γ <sub>Ms</sub>		20/25	nammer (	trilling w		fo 50 yes	re	NV.18
Combined pull-out and concrete co	ne lanure in crac	keu concrete c	20125 - 1	iaiiiiiei (	mining, w	Orking ii	ie so yea	13	
Temperature range I: 40°C/24°C	T <sub>Rk,cr,50</sub>	[N/mm²]	8,0	8,0	7,0	7,0	7,0	6,0	5,0
Temperature range II: 80°C/50°C	T <sub>Rk,cr,50</sub>	[N/mm²]	7,0	7,0	6,0	6,0	6,0	5,0	4,0
Combined pull-out and concrete co	ne failure in crac	ked concrete C	20/25 - 0	diamond	core drill	ing, worl	king life !	50 years	2004
Temperature range I: 40°C/24°C	T <sub>Rk,cr,50</sub>	[N/mm²]	5,5	7,0	8,0	7,0	8,0	7,0	4,0
Temperature range II: 80°C/50°C	T <sub>Rk,cr,50</sub>	[N/mm <sup>2</sup> ]	5,0	6,5	7,5	6,5	7,0	6,5	3,5
Factors – working life 50 years	Cara Cara Cara					THE RES			
		C30/37				1,04			
Increasing factor	Ψο	C40/50	410-11			1,07			
		C50/60				1,09			
Sustained load factor for TRK,ucr,50	0	40°C/24°C				0,75			
n uncracked concrete	$\Psi^0$ sus,50	80°C/50°C				0,72			
Combined pull-out and concrete co	ne failure in crac	ked concrete C	20/25 - H	nammer o	Irilling, w	orking li	fe 100 ye	ars	
Temperature range I: 40°C/24°C	T <sub>Rk,cr,100</sub>	[N/mm²]	8,0	8,0	6,5	7,0	7,0	6,0	5,0
Temperature range II: 80°C/50°C	T <sub>Rk,cr,100</sub>	[N/mm²]	6,5	7,0	6,0	6,0	6,0	5,0	4,0
Combined pull-out and concrete co	ne failure in crac	ked concrete C	20/25 - 0	diamond (	core drilli	ng, work	ing life 1	00 years	
Temperature range I: 40°C/24°C	T <sub>Rk,cr,100</sub>	[N/mm²]	5,5	7,0	8,0	7,0	7,0	6,0	4,0
Temperature range II: 80°C/50°C	T <sub>Rk,cr,100</sub>	[N/mm²]	5,0	6,5	7,0	6,0	6,5	5,0	3,5
Factors – working life 100 years									
A		C30/37				1,00			
Increasing factor	Ψο	C40/50				1,00			
	C50/60				1,00				

<sup>1)</sup> In the absence of other national regulation

#### Performances

Characteristic resistance to tension loads in cracked concrete – threaded rod

#### Annex C3

Table C2-2: Characteristic resistance to tension load for threaded rod in cracked concrete – static and quasi-static loads

Size			M8	M10	M12	M16	M20	M24	M30		
Concrete cone failure in cracke	ed concrete										
Factor for cracked concrete	k <sub>cr,N</sub>	[-]				7,7					
Edge distance	C <sub>cr,N</sub>	[mm]	1,5 · h <sub>ef</sub>								
Spacing	S <sub>cr,N</sub>	[mm]				3,0 · h <sub>ef</sub>					
Splitting failure											
	C <sub>cr,sp</sub> for h <sub>min</sub>		2,0 · h <sub>ef</sub>				1,5	· h <sub>ef</sub>			
Edge distance	$\begin{array}{c} c_{\text{cr,sp}} \text{ for} \\ h_{\text{cr}} < h^{(1)} < 2 \cdot h_{\text{cf}} \end{array}$		2 x f <sub>lef</sub> h <sub>mo</sub> c <sub>α,sp</sub> c <sub>α,sp</sub>								
	$c_{cr,sp}$ for $h^{(1)} \ge 2 \cdot h_{ef}$					C <sub>cr,N</sub>					
Spacing	S <sub>cr,sp</sub>	[mm]	2,0 · C <sub>cr,sp</sub>								
Installation safety factors for co	ombined pull-out, concrete	cone and	plitting	failure							
Installation safety factors for in use category I1						1,0					
Installation safety factors for in use category I2	Yinst	1,2									

<sup>1)</sup> h – concrete member thickness

**Performances** 

Characteristic resistance to tension loads in cracked concrete – threaded rod

Annex C4

Table C3: Characteristic resistance to tension load for rod with inner thread in uncracked concrete - static and quasi-static loads

Size			M6/Ø10	M8/Ø12	M10/Ø16	M12/Ø16	M16 /Ø2	
Steel failure					CONFERENCE V			
Steel, property class 5.8								
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	10	18	29	42	78	
Partial safety factor 1)	Ϋ́Ms	[-]			1,50			
Steel, property class 8.8	I INO							
Characteristic resistance	N <sub>Rks</sub>	[kN]	16	29	46	67	125	
Partial safety factor 1)	YMs	[-]			1,50			
Stainless steel, property class A4-70								
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	14	25	40	59	109	
Partial safety factor 1)	ΥMs	[-]			1,87			
Stainless steel, property class A4-80					.,,			
Characteristic resistance	N <sub>Rk,s</sub>	[kN]	16	29	46	67	125	
Partial safety factor 1)		[-]	10	20	1,60	0,	120	
	γMs	[-]			1,00			
High corrosion resistant stainless sto Characteristic resistance		[kN]	14	25	40	59	109	
	N <sub>Rk,s</sub>	-	14	20	1.87	39	103	
Partial safety factor 1)  Combined pull-out and concrete of	γMs	[-]	20/25 has	omor drilling				
Combined pull-out and concrete to	one failure in uncracke	d concrete (	20/25 - Har	nmer arming				
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,50</sub>	[N/mm <sup>2</sup> ]	8,0	12,0	12,0	11,0	10,0	
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,50</sub>	[N/mm²]	7,5	11,0	11,0	10,0	9,0	
		C30/37			1,04			
Increasing factor	Ψο	C40/50			1,07			
		C50/60			1,09			
Sustained load factor for $\tau_{Rk,ucr,50}$	$\Psi^0$ sus,50	40°C/24°C			0,75			
in uncracked concrete	The second secon	80°C/50°C			0,72			
Combined pull-out and concrete of	one failure in uncracke	d concrete (	20/25 - han	nmer drilling	, working lif	e 100 years		
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,100</sub>	[N/mm²]	8,0	12,0	12,0	11,0	10,0	
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	7,5	11,0	10,0	10,0	9,0	
Factors – working life 100 years					MA STATE LA			
		C30/37			1,04			
Increasing factor	Ψο	C40/50			1,07			
		C50/60			1,09			
Resistance to concrete cone failu	re in uncracked concret	te - hammer	drilling					
Factor for uncracked concrete	k <sub>ucr,N</sub>	[-]			11.0			
Edge distance	C <sub>cr,N</sub>	[mm]			1,5 · h <sub>ef</sub>			
Spacing	S <sub>cr,N</sub>	[mm]			3,0 · h <sub>ef</sub>			
Splitting failure	Scr,N	1 []			O,O Tier			
Spitting landle	- fach	1		2.0	, h		1,5 · h	
	C <sub>cr,sp</sub> for h <sub>min</sub>	4 1		2,0	· h <sub>ef</sub>		1,5 11	
Edge distance	$c_{cr,sp}$ for $h_{min} < h^{2} < 2 \cdot h_{ef}$ ( $c_{cr,sp}$ from linear interpolation)	[mm]	2 x h <sub>et</sub> h <sub>min</sub> C <sub>GN0</sub> C <sub>Crap</sub>					
	$c_{cr,sp}$ for $h^{(2)} \ge 2 \cdot h_{ef}$		C <sub>cr,N</sub>					
Spacing	S <sub>cr,sp</sub>	[mm]			2,0 · C <sub>cr,sp</sub>			
Installation safety factors for com	bined pull-out, concrete	cone and s	plitting failu	re				
Installation safety factors for use category I1					1,2			
Installation safety factors for use category I2	Yinst	[-]	1,2					

 $<sup>^{1)}</sup>$  In the absence of other national regulation  $^{2)}$  h – concrete member thickness

#### **Performances**

Characteristic resistance to tension loads in uncracked concrete - rod with inner thread

#### **Annex C5**

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure						. 2)				
Characteristic resistance	N <sub>Rk,s</sub>	[kN]				A <sub>s</sub> <sup>3)</sup>				
Portial pataty factor 1)	Ϋ́мs	[-]					40			
Combined pull-out and concrete co	one failure in uncrack	ed concrete	C20/25	- hamn	ner drilli	ng, wor	king life	50 year	S	
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,50</sub>	[N/mm <sup>2</sup> ]	11,0	12,0	12,0	10,0	12,0	12,0	9,5	8,5
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,50</sub>	[N/mm²]	10,0	11,0	11,0	9,0	11,0	11,0	8,5	7,5
Combined pull-out and concrete co	one failure in uncrack	ed concrete	C20/25	- diame	ond core	drilling	, workii	ng life 5	years	1
Temperature range I: 40°C/24°C	τ <sub>Rk,ucr,50</sub>	[N/mm²]	9,5	11,0	10,0	10,0	10,5	11,0	9,0	8,0
Temperature range II: 80°C/50°C	τ <sub>Rk,ucr,50</sub>	[N/mm²]	8,5	10,0	9,0	9,0	9,0	10,0	8,0	7,0
Factors - working life 50 years			-		FOF A SE					
-		C30/37				,	04			
Increasing factor	Ψc	C40/50	1,07							
		C50/60					09			
Sustained load factor for TRK, ucr, 50	Ψ <sup>0</sup> sus,50	40°C/24°C								
in uncracked concrete		80°C/50°C					72	400		
Combined pull-out and concrete c	one failure in uncrack	ced concrete	C20/25	– hamr	ner drill	ing, wor	King life	100 yea	ars	_
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	11,0	12,0	12,0	10,0	12,0	12,0	9,5	8,5
Temperature range II: 80°C/50°C		[N/mm <sup>2</sup> ]	10,0	11,0	11,0	9,0	11,0	11,0	8,5	7,5
Combined pull-out and concrete c	one failure in uncracl	ced concrete	C20/25	- diam	ond cor	e drilling	g, worki	ng life 1	00 years	5
Temperature range I: 40°C/24°C	T <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	9,5	11,0	10,0	10,0	10,5	11,0	9,0	8,0
Temperature range II: 80°C/50°C	T <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	8,5	10,0	9,0	9,0	9,0	10,0	8,0	7,0
Factors – working life 100 years			The Real							
		C30/37					,04			
Increasing factor	Ψο	C40/50					,07			
		C50/60				1,	,09			
Concrete cone failure in uncracke	d concrete									
Factor for uncracked concrete	k <sub>ucr,N</sub>	[-]					1,0			
Edge distance	C <sub>cr,N</sub>	[mm]					· h <sub>ef</sub>			
Spacing	S <sub>cr,N</sub>	[mm]				3,0	· h <sub>ef</sub>			
Splitting failure				Aller &						11111111
opining rando	c <sub>cr,sp</sub> for h <sub>min</sub>				2,0	· h <sub>ef</sub>			1,5	5 · h <sub>ef</sub>
	C <sub>cr.sp</sub> for					1	1			
	$h_{min} < h^{(2)} < 2 \cdot h_{ef}$					2-5				
Edge distance (C <sub>cr,sp</sub> from li		[mm]				2 x h.	/			
	interpolation)					Trees	Co.No Co.sp	•		
		-					cr,N			
	30.									
Spacing	S <sub>cr,sp</sub>	[mm]	<u></u>			2,0	· C <sub>cr,sp</sub>			
Installation safety factors for com	bined pull-out, concre	ete cone and	ı splittir	ng failur	е		MARCH ASS			
Installation safety factors for use cate							1,2			

<sup>1)</sup> In the absence of other national regulation

# R-KEX-II Performances Characteristic resistance to tension loads in uncracked concrete – rebar Annex C6 of European Technical Assessment ETA-21/0244

<sup>2)</sup> h - concrete member thickness

<sup>3)</sup> Stressed cross section of the steel

Size				Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø3
Steel failure				20	1010	DIZ	1014	1010	DLU	DEC	, 20
Characteristic resistance		N <sub>Rk,s</sub>	[kN]				A.3	· f <sub>uk</sub>			
Partial safety factor 1)		γMs	[-]					40			
Combined pull-out and concrete of	cone failu	re in cracke		20/25 -	hamme	r drilling			0 years	A TEST S	
Temperature range I: 40°C/24°C		T <sub>Rk,cr,50</sub>	[N/mm <sup>2</sup> ]	5,5	5,0	5,5	5,5	5,0	5,0	5,4	4,
Temperature range II: 80°C/50°C		T <sub>Rk,cr,50</sub>	[N/mm <sup>2</sup> ]	5,0	4,5	5,0	5,0	4,5	4,5	5,0	3,
Combined pull-out and concrete of	cone failu	ire in cracke	d concrete C	20/25 -	diamon	d core c	rilling.	working	life 50 y	ears	
Temperature range I: 40°C/24°C		T <sub>Rk,cr,50</sub>	[N/mm <sup>2</sup> ]	5,5	5,5	6,0	6,0	5,0	5,5	4,5	4,
Temperature range II: 80°C/50°C		T <sub>Rk,cr,50</sub>	[N/mm <sup>2</sup> ]	5,0	5,0	5,5	5,5	4,5	5,0	4,0	4,
Factors - working life 50 years	139				<b>TESTS</b>				1000000	D Million	
			C30/37				1,	04			
Increasing factor		Ψο	C40/50					07			
			C50/60					09			
Sustained load factor for TRk,ucr,50		0	40°C/24°C				0,	75			
in uncracked concrete		$\Psi^0$ sus,50	80°C/50°C	10				72			
Combined pull-out and concrete of	cone failu	ire in cracked	concrete C	20/25 –	hamme	r drilling	, workii	ng life 1	00 years		
Temperature range I: 40°C/24°C		T <sub>Rk,cr,100</sub>	[N/mm <sup>2</sup> ]	5,5	5,0	5,5	5,5	5,0	5,0	5,4	4,
Temperature range II: 80°C/50°C		T <sub>Rk,cr,100</sub>	[N/mm <sup>2</sup> ]	5,0	4,5	5,0	5,0	4,5	4,5	5,0	3,
Combined pull-out and concrete of	cone failu	re in cracked	concrete C	20/25 –	diamon	d core d	rilling, v	working	life 100	years	
Temperature range I: 40°C/24°C		T <sub>Rk,or,100</sub>	[N/mm <sup>2</sup> ]	5,5	5,5	6,0	6,0	5,0	5,0	4,5	4,
Temperature range II: 80°C/50°C		T <sub>Rk,cr,100</sub>	[N/mm²]	5,0	5,0	5,5	5,5	4,5	4,5	4,0	4,
Factors – working life 100 years					1-5,100		100				
	The state of the s		C30/37		1 33			04			
Increasing factor		Ψο	C40/50					07			
			C50/60				1,	09			-
Concrete cone failure in cracked of	concrete		Charles and Charles								
Factor for cracked concrete		K <sub>cr,N</sub>	[-]					,7			
Edge distance		C <sub>cr,N</sub>	[mm]					· h <sub>ef</sub>			
Spacing		S <sub>cr,N</sub>	[mm]				3,0	· h <sub>ef</sub>			
Splitting failure											
		sp for h <sub>min</sub>				2,0	· h <sub>ef</sub>			1,5	· h <sub>ef</sub>
Edge distance	$c_{cr,sp}$ for $h_{min} < h^{2} < 2 \cdot h_{ef}$ ( $c_{cr,sp}$ from linear interpolation)		[mm]				2 x h <sub>e</sub>	Ga No Ga Sp			
	$c_{cr,sp}$ for $h^{(2)} \ge 2 \cdot h_{ef}$						Cc	r,N			
Spacing		S <sub>cr,sp</sub>	[mm]				2,0 ·	C <sub>cr,sp</sub>			
Partial safety factor for combined	pull-out,	concrete cor	ne and splitti	ing failu	ire			AND THE	NAME OF		
Installation safety factors for in use category I1		24	[-]				1,	.2			
Installation safety factors for in use category I2		Yinst					1,	2			

<sup>1)</sup> In the absence of other national regulation

# R-KEX-II Annex C7 of European Performances Characteristic resistance to tension loads in cracked concrete – rebar Annex C7 of European Technical Assessment ETA-21/0244

<sup>2)</sup> h - concrete member thickness

<sup>3)</sup> Stressed cross section of the steel element

Size			M8	M10	M12	M16	M20	M24	M30
Steel, property class 5.8							70	400	100
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	11	17	25	47	73	106	168
Factor considering ductility	k <sub>7</sub>	[-]				1,0			
Partial safety factor 1)	γMs	[-]				1,25			
Steel, property class 8.8			WAS THE				00	444	224
Characteristic resistance	V <sup>0</sup> Rk,s	[kN]	15	23	34	63	98	141	224
Factor considering ductility	k <sub>7</sub>	[-]				1,0			
Partial safety factor 1)	Ϋ́Ms	s [-] 1,25							die State
Steel, property class 10.9			3330		- 10		400	470	280
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	18	29	42	78	122	176	200
Factor considering ductility	k <sub>7</sub>	[-]	1,0						
Partial safety factor 1)	γMs	[-]	1,50						
Steel, property class 12.9	the by we make a property						147	212	336
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	22	35	51	94	147	212	330
Factor considering ductility	k <sub>7</sub>	[-]				1,0			
Partial safety factor 1)	γMs	[-]				1,50			20.00
Stainless steel, property class A4-70							1 00	124	196
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	13	20	29	55	86	124	190
Factor considering ductility	k <sub>7</sub>	[-]				1,0			
Partial safety factor 1)	ΥMs	[-]				1,56			
Stainless steel, property class A4-80			CONTRACT.		- 04	- 00	98	141	224
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	15	23	34	63	98	141	22.
Factor considering ductility	k <sub>7</sub>	[-]	1,0						
Partial safety factor 1)	γмs	[-]				1,33			
High corrosion resistant stainless steel	l, property class 70	A PARTY OF	10	1 00	1 00	FF	86	124	190
Characteristic resistance	V <sup>o</sup> <sub>Rk,s</sub>	[kN]	13	20	29	55	1 80	124	19
Factor considering ductility	k <sub>7</sub>	[-]				1,0			
Partial safety factor 1)	γмs	[-]				1,56			

<sup>1)</sup> In the absence of other national regulation

#### **Performances**

Characteristic resistance to shear loads in cracked and uncracked concrete – threaded rod

#### **Annex C8**

Size			M8	M10	M12	M16	M20	M24	M30
Steel, property class 5.8			CALLET AND			Ways.			
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	19	37	65	166	324	561	1124
Partial safety factor 1)	γMs	[-]	1,25						
Steel, property class 8.8									
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30	60	105	266	519	898	1799
Partial safety factor 1)	Ϋ́Ms	[-]				1,25			
Steel, property class 10.9								A PERSON	
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	37	75	131	333	649	1123	2249
Partial safety factor 1)	Ϋ́Ms	[-]	1,50						
Steel, property class 12.9								政學行	E TOTAL
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	45	90	157	400	779	1347	2698
Partial safety factor 1)	γMs	[-]				1,50			
Stainless steel, property class A4-70								125 F. J. S. S.	
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	26	52	92	233	454	786	1574
Partial safety factor 1)	γMs	[-]				1,56			
Stainless steel, property class A4-80				Mary San					
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30	60	105	266	519	898	1799
Partial safety factor 1)	Ϋ́Ms	[-]				1,33			
High corrosion resistant stainless stee	el, property class 70			- 7946	THE RESERVE	Mar 3 J			Die Control
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	26	52	92	233	454	786	1574
Partial safety factor 1)	Yan	γ <sub>Ms</sub> [-] 1,56							

<sup>1)</sup> In the absence of other national regulation

Table C8: Characteristic resistance to shear loads - pry out and concrete edge failure for threaded rod

Size		977440 74	M8	M10	M12	M16	M20	M24	M30
Pry out failure		7.64						7578574325	1102
Factor	k <sub>8</sub>	[-]				2			
Concrete edge failure						Programme Andrews			
Outside diameter of anchor	d <sub>nom</sub>	[mm]	8	10	12	16	20	24	30
Effective length of anchor under shear loading	I <sub>f</sub>	[mm]	min (h <sub>ef</sub> ; 12d <sub>nom</sub> )					min (h <sub>ef</sub> ; 8d <sub>nom</sub> )	

#### **Performances**

Characteristic resistance to shear loads in cracked and uncracked concrete – threaded rod

Annex C9

Table CO: Characteristic resistance to shear loa	ds for rod with inner thread	- steel failure without lever arm

Size			M6/ Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel, property class 5.8		and find the same					
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	6,0	11,0	17,0	25,0	47,0
Factor considering ductility	k <sub>7</sub>	[-]			1,0		
Partial safety factor 1)	γMs	[-]			1,25		
Steel, property class 8.8							
Characteristic resistance	V <sup>0</sup> Rk,s	[kN]	8,0	14,6	23,2	33,7	62,8
Factor considering ductility	k <sub>7</sub>	[-]			1,0		
Partial safety factor 1)	YMs	[-]			1,25		
Stainless steel, property class A4-70					THE WAY		
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	7,0	12,8	20,3	29,5	55,0
Factor considering ductility	k <sub>7</sub>	[-]			1,0		
Partial safety factor 1)	γMs	[-]			1,56		
Stainless steel, property class A4-80					A STATE OF THE		
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	8,0	14,6	23,2	33,7	62,8
Factor considering ductility	k <sub>7</sub>	[-]			1,0		
Partial safety factor 1)	γMs	[-]			1,33		
High corrosion resistant stainless stee	I, property class 70					te printed	
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	7,0	12,8	20,3	29,5	55,0
Factor considering ductility	k <sub>7</sub>	[-]			1,0		
Partial safety factor 1)	Ϋ́Ms	[-]			1,56		

<sup>1)</sup> In the absence of other national regulation

Table C10: Characteristic resistance to shear loads for rod with inner thread – steel failure with lever arm

Size			M6/ Ø10	M8/ Ø12	M10/ Ø16	M12/ Ø16	M16/ Ø24
Steel, property class 5.8			PER CONTRACTOR				alance (
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	7,6	18,7	37,4	65,5	166,5
Partial safety factor 1)	γMs	[-]			1,25		
Steel, property class 8.8			N. MIRROR	She dikin diki			
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	12,2	30,0	59,8	104,8	266,4
Partial safety factor 1)	γMs	[-]			1,25		
Stainless steel, property class A4-70	one contract the second of the second		THE RES	4 1			
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	10,7	26,2	52,3	91,7	233,1
Partial safety factor 1)	γMs	[-]			1,56		
Stainless steel, property class A4-80							
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	12,2	30,0	59,8	104,8	266,4
Partial safety factor 1)	γMs	[-]			1,33		
High corrosion resistant stainless ste	el, property class 70	MERCAN					
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	10,7	26,2	52,3	91,7	233,1
Partial safety factor 1)	γMs	[-]			1,56		

<sup>1)</sup> In the absence of other national regulation

Table C11: Characteristic resistance to 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 <sub>8</sub>	[-]			2		
Concrete edge failure							
Outside diameter of anchor	d <sub>nom</sub>	[mm]	10	12	16	16	24
Effective length of anchor under shear loading	l <sub>f</sub>	[mm]		n	nin (h <sub>ef</sub> ; 12d <sub>no</sub>	m)	

#### **Performances**

Characteristic resistance to shear loads in cracked and uncracked concrete – rod with inner thread

#### Annex C10

#### Table C12: Characteristic resistance to shear loads for rebar – steel failure without lever arm

Size				Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Rebar									EE E E	
Characteristic resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]				0,5 · A	(s <sup>2)</sup> · f <sub>uk</sub>			
Factor considering ductility	k <sub>7</sub>	[-]				1	,0			
Partial safety factor 1)	γ <sub>Ms</sub>	[-]		7/11		1	,5			

<sup>1)</sup> In the absence of other national regulation

#### Table C13: Characteristic resistance to shear loads for rebar - steel failure with lever arm

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Rebar			Time to		STEELE	TOPER	La grada	31333		
Characteristic resistance	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]				1,2 · W	el 2) · fuk			
Partial safety factor 1)	γMs	[-]				1	,5			

<sup>1)</sup> In the absence of other national regulation

#### Table C14: Characteristic resistance to shear loads - pry out and concrete edge failure for rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Pry out failure				19493		E STATE OF	-			
Factor	k <sub>8</sub>	[-]				2	2			
Concrete edge failure										
Outside diameter of anchor	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	25	32
Effective length of anchor under shear loading	l <sub>f</sub>	[mm]			min (h <sub>ef</sub>	; 12d <sub>nom</sub> )			min (h <sub>e</sub>	f; 8d <sub>nom</sub> )

#### R-KEX-II

#### Performances

Characteristic resistance to shear loads in cracked and uncracked concrete – rebar

#### Annex C11

<sup>2)</sup> Stressed cross section of the steel element

<sup>2)</sup> Elastic section modulus calculated from the stressed cross section of steel element

#### Table C15: Displacement under tension loads - threaded rod

Size			M10	M12	M16	M20	M24	M30
uncracked concrete C20	/25 to C50/6	0 under	tension	loads				THE S
δ <sub>N0</sub>	[mm]	0,33	0,40	0,41	0,47	0,52	0,56	0,70
δ <sub>N∞</sub>	[mm]	0,75	0,75	0,75	0,75	0,75	0,75	0,7
cracked concrete C20/25	to C50/60 u	ınder ter	sion loa	ids				
δ <sub>NO</sub>	[mm]	0,20	0,20	0,24	0,28	0,39	0,44	0,4
δ <sub>N∞</sub>	[mm]	3,0	3,0	2,5	2,6	2,5	2,4	3,0
	$\begin{array}{c c} & \delta_{\text{N0}} \\ & \delta_{\text{N} \infty} \end{array}$ cracked concrete C20/25	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	uncracked concrete C20/25 to C50/60 under tension $\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

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

#### Table C16: Displacement under shear loads - threaded rod

Size			M8	M10	M12	M16	M20	M24	M30
Characteristic displacement in cra	cked and uncracked cor	ncrete C2	0/25 to (	C50/60 u	nder she	ear loads			
	δνο	[mm]	2,5	2,5	2,5	2,5	2,5	2,5	2,5
Displacement 1)	δν∞	[mm]	3,7	3,7	3,7	3,7	3,7	3,7	3,7

#### Table C17: Displacement under tension loads - rod with inner thread

Size	M6/Ø10	M8/Ø12	M10/Ø16	M12/Ø16	M16/Ø24			
Characteristic displacement in	uncracked concrete	C20/25 to	C50/60 unde	r tension loa	ds	0,26 0,32		
	δ <sub>NO</sub>	[mm]	0,25	0,25	0,26	0,32	0,37	
Displacement 1)	δ <sub>N∞</sub>	[mm]	0,75	0,75	0,75	0,75	0,75	

### Table C18: Displacement under shear loads - rod with inner thread

Size			M6/Ø10	M8/Ø12	M10/Ø16	M12/Ø16	M16/Ø24							
Characteristic displacement in	uncracked concrete	C20/25 to	C50/60 unde	r shear load	S	2,5 2,5 2,5								
	δνο	[mm]	2,5	2,5	2,5	2,5	2,5							
Displacement 1)	δ <sub>V∞</sub>	[mm]	3,7	3,7	3,7	3,7	3,7							

#### R-KEX-II

#### **Performances**

Displacement under service loads: tension and shear loads – threaded rod and rod with inner thread

#### Annex C12

#### Table C19: Displacement under tension loads - rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Characteristic displacement i	n uncracked concrete	e C20/25 t	o C50/60	under te	ension lo	ads				
Displacement 1)	δηο	[mm]	0,25	0,25	0,32	0,37	0,43	0,45	0,48	0,53
Displacement 1)	δ <sub>N∞</sub>	[mm]	0,75	0,75	0,75	0,75	0,75	0,75	0,48	0,75
Characteristic displacement i	n cracked concrete C	20/25 to C	C50/60 ur	nder tens	sion load	ls				
Displacement	δηο	[mm]	0,2	0,2	0,24	0,30	0,31	0,34	0,38	0,40
Displacement	$\delta_{N\infty}$	[mm]	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0

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

#### Table C20: Displacement under shear loads - rebar

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Characteristic displacement in c	cracked and uncracked c	oncrete Ca	20/25 to	C50/60	under st	near load	ds			
	δνο	[mm]	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5
Displacement 1)	000	frinid	-,-							

These values are suitable for each temperature range and categories specified in Annex B1 Calculation of the displacement: δ<sub>N0</sub> = δ<sub>N0</sub>-factor · V; δ<sub>N</sub> = δ<sub>N∞</sub>-factor · V; (V – applied shear load)

#### R-KEX-II

#### **Performances**

Displacement under service loads: tension and shear loads - rebar

#### Annex C13

Size			M8	M10	M12	M16	M20	M24	M30
Steel failure									
Steel, property class 5.8								470	000
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	18	29	42	78	122	176	280
Partial safety factor 1)	YMs, C1	[-]				1,50			
Steel, property class 8.8							100	000	440
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	29	46	67	125	196	282	448
Partial safety factor 1)	YMs, C1	[-]				1,50			
Steel, property class 10.9							0.45	050	504
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	36	58	84	157	245	353	561
Partial safety factor 1)	YMs, C1	[-]				1,4			
Steel, property class 12.9							004	400	07/
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	43	69	101	188	294	423	673
Partial safety factor 1)	γMs, C1	[-]				1,4			
Stainless steel, property class A4-70								0.47	200
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	25	40	59	109	171	247	392
Partial safety factor 1)	YMs, C1	[-]				1,87			
Stainless steel, property class A4-80							400	000	4.44
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	29	46	67	125	196	282	448
Partial safety factor 1)	YMs, C1	[-]				1,60			
High corrosion resistant stainless steel,	property class 70			,				0.47	000
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]	25	40	59	109	171	247	39
Partial safety factor 1)	YMs, C1	[-]				1,87			
Combined pull-out and concrete cone	failure, working	life 50 years	BANK	LE MIN	244-1				
Temperature range I: 40°C/24°C	TRk,C1	[N/mm²]	6,0	7,0	6,5	7,0	6,0	5,5	4,0
Temperature range II: 80°C/50°C	T <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	5,0	6,5	5,5	6,0	5,5	5,0	3,5
Combined pull-out and concrete cone	failure, working	life 100 years					A SERVICE		
Temperature range I: 40°C/24°C	T <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	6,0	7,0	6,0	6,5	6,0	5,5	4,0
Temperature range II: 80°C/50°C	T <sub>Rk.C1</sub>	[N/mm²]	5,0	6,0	5,5	6,0	5,5	5,0	3,5

Note: Design method according to TR 045

1) In the absence of other national regulation

Table C22: Characteristic resistance to tension load – rebar under seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure										
Characteristic resistance	N <sub>Rk,s,C1</sub>	[kN]					· f <sub>uk</sub>			
Partial safety factor 1)	YMs, C1	[-]				1,	40			
Combined pull-out and concrete cone		life 50 years						112 34		
Temperature range I: 40°C/24°C	T <sub>Rk,C1</sub>	[N/mm <sup>2</sup> ]	4,0	4,5	5,0	5,0	5,0	5,0	5,0	3,0
Temperature range II: 80°C/50°C	T <sub>Rk,C1</sub>	[N/mm²]	3,5	4,0	4,5	4,5	4,5	4,5	4,5	2,5
Combined pull-out and concrete cone	failure, working	life 100 years		EL SE			ALCO DE			
Temperature range I: 40°C/24°C	T <sub>Rk,C1</sub>	[N/mm²]	3,5	4,5	5,0	5,0	5,0	3,5	5,0	3,0
Temperature range II: 80°C/50°C	T <sub>Rk,C1</sub>	[N/mm²]	3,5	4,0	4,5	4,5	4,5	4,0	4,5	2,5

Note: Design method according to TR 045

# R-KEX-II Performances Characteristic resistance to tension loads for threaded rod and rebar for seismic performance category C1 Annex C14 of European Technical Assessment ETA-21/0244

<sup>1)</sup> In the absence of other national regulation

<sup>2)</sup> Stressed cross section of the steel element

Table C23: Characteristic resistance to shear loads – threaded rod under 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						0=10/-2	19 8 60	-
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	7,7	11,9	17,5	32,9	51,1	74,2	117,6
Partial safety factor 1)	YMs, C1	[-]				1,25			
Steel failure with threaded rod grade 8	.8	A STATE OF		TENTAL S					FEET
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	10,2	16,1	23,5	44,1	68,6	98,7	156,8
Partial safety factor 1)	YMs, C1	[-]				1,25			
Steel failure with threaded rod grade 1	0.9				32020		ARTHR B		THE
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	12,6	20,3	29,4	54,6	85,4	123,2	196
Partial safety factor 1)	γMs, C1	[-]				1,5			
Steel failure with threaded rod grade 1								VALUE I	
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	15,4	24,5	35,7	65,8	102,9	148,4	235,2
Partial safety factor 1)	YMs, C1	[-]				1,5			Andrew Milani
Steel failure with stainless steel thread			a spine of						THE IS
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	9,1	14,4	20,7	38,5	59,9	86,5	137,4
Partial safety factor 1)	YMs, C1	[-]				1,56			
Steel failure with stainless steel thread		The state of the s	CAY THE	Maria Control					
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	10,2	16,1	23,5	44,1	68,6	98,7	157,2
Partial safety factor 1)	YMs, C1	[-]				1,33			
Steel failure with high corrosion stainle				Market					
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]	9,1	14,4	20,7	38,5	59,9	86,5	137,4
Partial safety factor 1)	YMs, C1	[-]				1,56			

<sup>1)</sup> In the absence of other national regulation

Table C24: Characteristic resistance to shear loads – rebar under seismic performance category C1 – steel failure without lever arm

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Steel failure with rebar		Secondary Secondary								
Characteristic resistance	V <sub>Rk,s,C1</sub>	[kN]				0,35 · /	A <sub>s</sub> <sup>2)</sup> · f <sub>uk</sub>			
Partial safety factor 1)	YMs, C1	[-]				1	,5			

<sup>1)</sup> In the absence of other national regulation

#### **Performances**

Characteristic resistance to shear loads under seismic performance category C1

Annex C15

<sup>2)</sup> Stressed cross section of the steel element

## Table C25: Displacement under tension loads – threaded rod under seismic performance category C1

Size			M8	M10	M12	M16	M20	M24	M30
Displacement	δ <sub>N,C1</sub>	[mm]	2,8	3,0	3,0	3,2	3,3	4,0	5,5

# Table C26: Displacement under shear loads – threaded rod under seismic performance category C1

Size			M8	M10	M12	M16	M20	M24	M30
Displacement	δ <sub>V,C1</sub>	[mm]	3,4	4,0	5,0	5,3	5,9	6,0	6,5

## Table C27: Displacement under tension loads – rebar under seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Displacement	δ <sub>N,C1</sub>	[mm]	3,0	3,3	3,5	3,9	4,1	4,5	5,6	6,0

## Table C28: Displacement under shear loads – rebar under seismic performance category C1

Size			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø32
Displacement	δ <sub>V,C1</sub>	[mm]	3,6	3,7	4,0	4,6	4,8	5,5	6,6	7,0

R-KEX-II

#### **Performances**

Displacement under service loads: tension and shear loads for seismic performance category C1 – threaded rod and rebar

Annex C16

#### Table C29: Characteristic resistance to tension load (threaded rod) – seismic performance category C2

Size			M12	M16	M20	M24
Steel failure				WHITE I		
Characteristic resistance	N <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	N <sub>Rk,s</sub>	N <sub>Rk,s</sub>	N <sub>Rk,s</sub>	N <sub>Rk,s</sub>
Combined pull-out and concrete cone failure (un	ncracked and cracked con	crete)				
Characteristic bond resistance temperature range -40°C / +40°C	T <sub>Rk,C2</sub>	[N/mm²]	5,65	3,93	5,18	3,65
Characteristic bond resistance temperature range -40°C / +80°C	T <sub>Rk,C2</sub>	[N/mm²]	5,03	3,50	4,61	3,25

#### Table C30: Characteristic resistance to shear load (threaded rod) – seismic performance category C2

Size		THE SUN	M12	M16	M20	M24
Steel failure with threaded rod grade 5.8						
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	11,6	13,7	26,3	47,0
Steel failure with threaded rod grade 8.8			E584_2(581)			
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	18,5	22,0	42,1	75,1
Steel failure with threaded rod grade 10.9						
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	23,2	27,4	52,6	93,9
Steel failure with threaded rod grade 12.9						
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	27,8	32,9	63,2	112,6
Stainless steel, property class A4-70		THE CONTRACT				
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	15,8	19,2	36,9	66,0
Stainless steel, property class A4-80		STATE OF THE STATE				
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	18,5	22,0	42,1	75,1
High corrosion resistant stainless steel, property			The Section			
Characteristic resistance	V <sub>Rk,s,C2</sub>	[N/mm <sup>2</sup> ]	15,8	19,2	36,9	66,0

#### Table C31: Displacements under tensile and shear load (threaded rod) - seismic performance category C2

Size		Ten Contract	M12	M16	M20	M24
Displacements for tensile and shear load for seismic pe	erformance category	C2				1 1/2
Displacement in tensile at damage limitation states 1)	δ <sub>N,eq,C2</sub> (DLS)	[mm]	0,85	1,14	0,77	0,94
Displacement in tensile at ultimate limit state 1)	δ <sub>N,eq,C2</sub> (ULS)	[mm]	1,70	2,01	2,07	1,91
Displacement in shear at damage limitation states 1)	δ <sub>V,eq,C2</sub> (DLS)	[mm]	3,01	2,28	3,60	3,15
Displacement in shear at ultimate limit state 1)	δ <sub>V,eq,C2</sub> (ULS)	[mm]	6,44	8,81	7,57	8,21

<sup>1)</sup> All temperature ranges

R-KEX-II

Performances
Characteristic resistance to tension and shear loads – threaded rod under seismic performance category C2

Annex C17
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