



INSTYTUT TECHNIKI BUDOWLANEJ



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## European Technical Assessment

**ETA-13/0585  
of 25/09/2023**



### General Part

**Technical Assessment Body issuing the European Technical Assessment**

Instytut Techniki Budowlanej

**Trade name of the construction product**

Injection System R-KEX II

**Product family to which the construction product belongs**

Post-installed rebar connections with mortar

**Manufacturer**

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

**Manufacturing plant**

Manufacturing Plant no. 3

**This European Technical Assessment contains**

25 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)  
330087-01-0601 "Systems for post-installed rebar connections with mortar"

**This version replaces**

ETA-13/0585 issued on 27/02/2019



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## Specific Part

### 1 Technical description of the product

The subject of this assessment are the post-installed rebar connections, by anchoring or overlap connection joint of steel reinforcing bars (rebars) in existing structures made of normal weight concrete, using injection mortar R-KEX II, in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with diameter from Ø8 to Ø40 mm and R-KEX II injection mortar are used for the post-installed rebar connections. The rebar is placed into a drilled hole previously filled with an injection mortar and is anchored by the bond between rebar, injection mortar and concrete.

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the post-installed rebar connections are used in the compliance with the specifications and conditions given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed working life of 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 under static and quasi-static loading	Annex C2 to C5
Characteristic resistance under seismic loading	Annex C6 and C7

##### 3.1.2 Safety in case of fire (BWR 2)

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

#### 3.2 Methods used for the assessment

The assessment has been made in accordance with the EAD 330087-01-0601.

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

According to the 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 in the applicable European Assessment Document (EAD)**

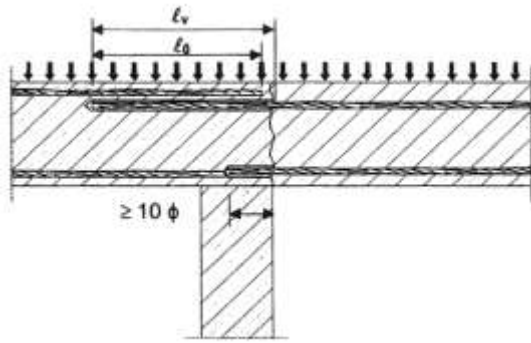
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited in Instytut Techniki Budowlanej.

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

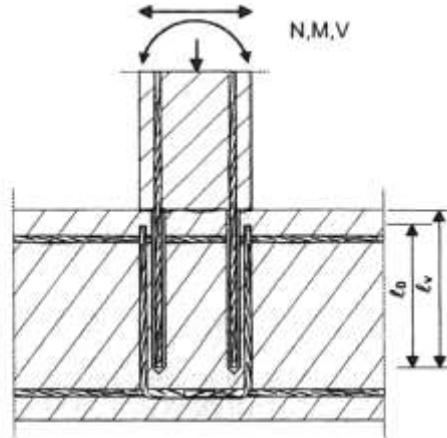
Issued in Warsaw on 25/09/2023 by Instytut Techniki Budowlanej



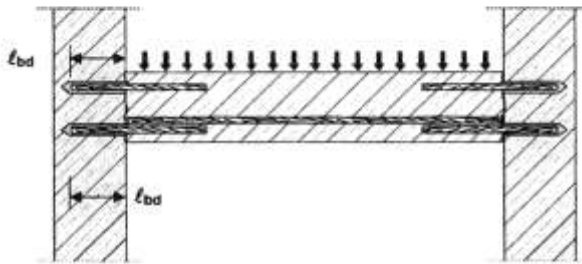
Anna Panek, MSc  
Deputy Director of ITB



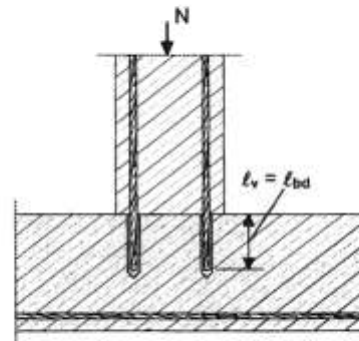
**Figure A1** Overlap joint for rebar connections of slabs and beams



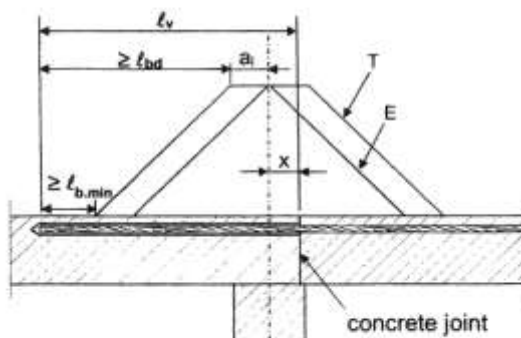
**Figure A2** Overlap joint at a foundation of a column or wall where the rebar is stressed in tension



**Figure A3** End anchoring of slabs or beams, designed as simply supported



**Figure A4** rebar connection for components stressed primarily in compression; rebar is stressed in compression



(only post-installed rebar is plotted)

**Figure A5** Anchoring of reinforcement to cover the line of acting tensile force

**Key to Figure A5:**

T – acting tensile force

E – envelope of  $M_{ed} / z + N_{ed}$

(see EN 1992-1-1:2004+AC:2010, Fig. 9.2)

x – distance between the theoretical point of support and concrete joint

**Note to Figure A1 to A5:**

In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1:2004+AC:2010 (EC 2) shall be present.

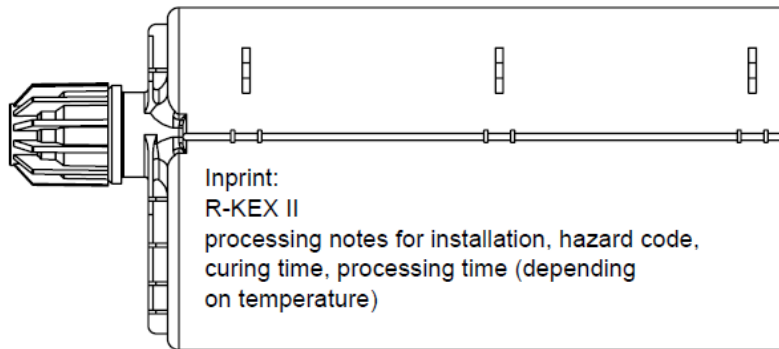
The shear transfer between old and new concrete shall be designed according to EN 1992-1-1:2004+AC:2010 (EC 2).

**Injection System R-KEX II  
for rebar connections**

**Product description**  
Use of the product – examples

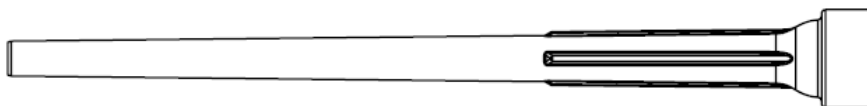
**Annex A1**  
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Side by side cartridge - 385 to 1100 ml

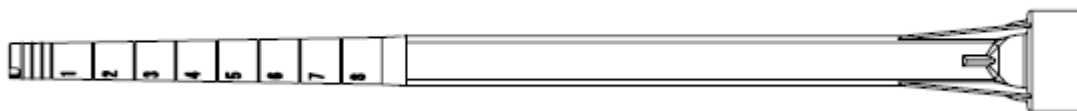


Mixer nozzles

a) STD

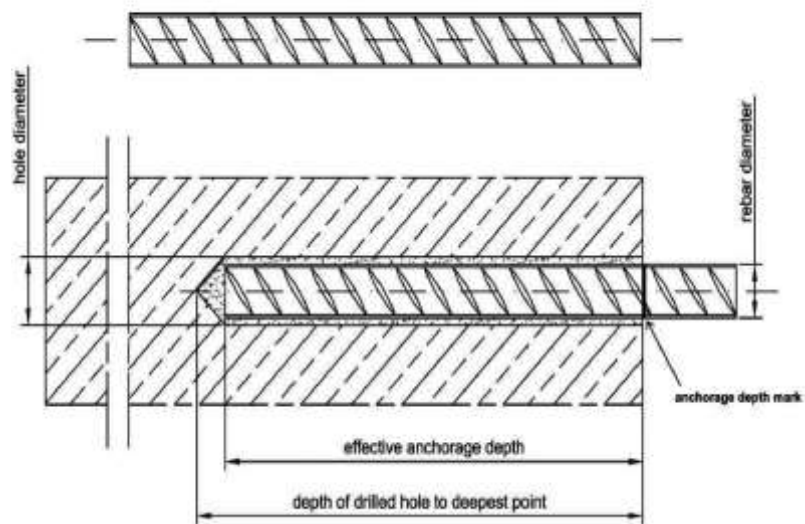


b) NEW



<p><b>Injection System R-KEX II for rebar connections</b></p>	<p><b>Annex A2</b> of European Technical Assessment ETA-13/0585</p>
<p><b>Product description</b> Cartridge and mixer nozzle</p>	

Reinforced bars (rebar):  
 Ø8, Ø10, Ø12, Ø13, Ø14, Ø16, Ø18, Ø20, Ø22, Ø25, Ø28, Ø30, Ø32, Ø34, Ø36, Ø40 mm



**Injection System R-KEX II  
 for rebar connections**

**Product description**  
 Reinforced bars (rebar)

**Annex A3**  
 of European  
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**Table A1: Rebars**

Designation	Rebars
Rebars according to EN 1992-1-1:2004 +AC:2010 (EC 2), Annex C	<p>Nominal diameter: Ø8 to Ø40</p> <p>Bars and de-coiled rods: Class B or C</p> <p>Minimum relative rib area, <math>f_{R,min}</math>, according to EN 1992-1-1:2004 +AC:2010 (EC 2)</p> <p>The rib height <math>h</math>: <math>0,05 \cdot \varnothing \leq h \leq 0,07 \cdot \varnothing</math></p> <p>Yield strength <math>f_{yk}</math> and <math>k</math> according to EN 1992-1-1:2004 +AC:2010 (EC 2)</p> <p>Ultimate tensile strength <math>f_{uk} = t_{tk} = k \cdot f_{yk}</math></p>

**Table A2: Injection mortar**

Designation	Composition
R-KEX II (two component injection mortar)	Injection mortar: epoxy system with fillers

**Injection System R-KEX II  
for rebar connections**

**Product description  
Materials**

**Annex A4**  
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**Specification of intended use****Anchorage subject to:**

- Static and quasi-static loading: hammer drilling with or without hollow drill bit or diamond drilling.
- Seismic loading: hammer drilling with or without hollow drill bit.

**Base material:**

- Reinforced or unreinforced normal weight concrete of strength class C12/15 to C50/60 according to EN 206.
- Maximum chloride content of 0,40% (Cl 0,40) related to the cement content according to EN 206.
- Non-carbonated concrete.

Note: In case of a carbonated surface of the existing concrete structure the carbonate layer shall be removed in the area of the post-installed rebar connection with a diameter of  $\varnothing + 60$  mm prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least the minimum concrete cover according to EN 1992-1-1:2004+AC:2010 (EC 2).

The above may be neglected if building components are new and not carbonated and if building components are in dry conditions.

**Temperature in the base material:****At installation:**

- +5°C to +30°C.

**In service:**

The products may be used in the following temperature range:

- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).

**Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking into account of the forces to be transmitted.
- Design under static and quasi-static loads and under seismic action according to EN 1992-1-1:2004 +AC:2010 (EC 2) and Annex B2.
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

**Installation:**

- Dry or wet concrete. It must not be installed in flooded holes.
- Installation direction: D3 (downwards, horizontal and overhead).
- Hole drilling by hammer drilling with or without hollow drill bit or diamond drilling.
- Installation of the post-installed rebar shall be done only by suitable trained installer and under supervision on the site.
- Check the position of the existing rebar (if the position of existing rebars is not known it shall be determined using a rebar detector suitable for this purpose as well as on the basis of the construction documentation and then marked on the building component for the overlap joint).

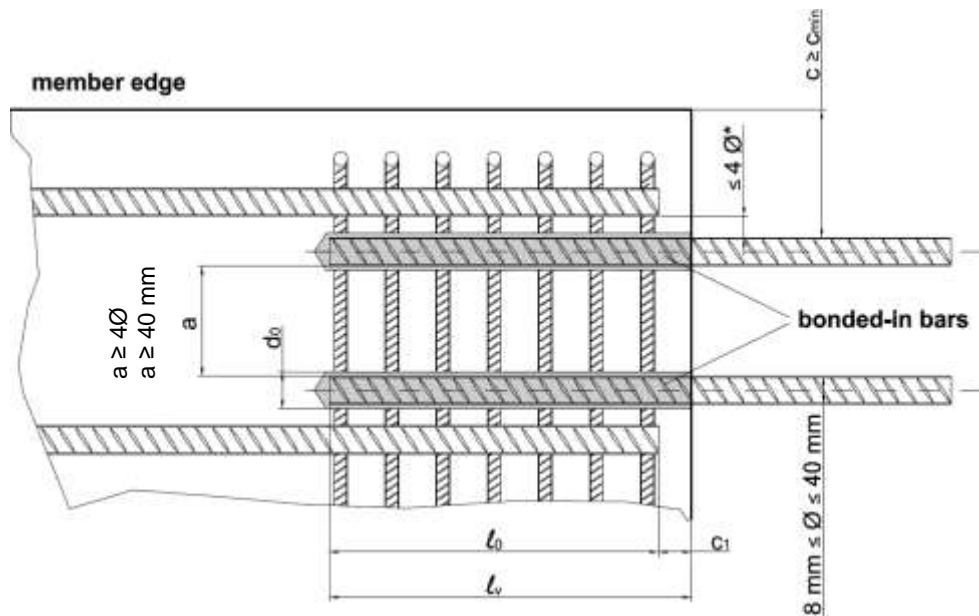
**Injection System R-KEX II  
for rebar connections**

**Intended use  
Specification**

**Annex B1**  
of European  
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### General construction rules for post-installed rebar

- Only tension forces in the axis of the rebar may be transmitted.
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1:2004+AC:2010 (EC 2).
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



\* If the clear distance between overlapping rebar is greater than  $4 \cdot \emptyset$  the overlap length shall be enlarged by the difference between the clear distance and  $4 \cdot \emptyset$ .

$l_0$  – lap length acc. to EN 1992-1-1:2004+AC:2010 (EC 2), clause 8.7.3

$l_v$  – effective embedment depth;  $l_v \geq l_0 + c_1$

$c$  – concrete cover of post-installed rebar

$c_{min}$  – minimum concrete cover acc. to Annexes B3 and B4 and EN 1992-1-1:2004+AC:2010 (EC 2), clause 4.4.1.2

$c_1$  – concrete cover at end-face of existing rebar

$d_0$  – nominal drill bit diameter acc. to Annexes B3 and B4

$\emptyset$  – rebar diameter ( $d_s$ )

#### Injection System R-KEX II for rebar connections

**Intended use**  
General construction rules for post-installed rebars

**Annex B2**  
of European  
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**Table B1: Installation parameters – hammer or diamond drilling – concrete class C12/15**

Rebar diameter [mm]	Ø8	Ø10	Ø12	Ø13	Ø14	Ø16	Ø18	Ø20
Drill bit diameter [mm]	10 or 12	12 or 14	14 or 18	16	18	20	22	25
Brush diameter [mm]	14	16	18	18	20	22	24	27
Maximum embedment depth $l_{v,max}$ [mm]	700	900	1000	1100	1200	1300	1500	1700

Rebar diameter [mm]	Ø22	Ø25	Ø28	Ø30	Ø32	Ø34	Ø36	Ø40
Drill bit diameter [mm]	26	30	35	35	40	45	45	50
Brush diameter [mm]	27	32	37	37	42	47	47	52
Maximum embedment depth $l_{v,max}$ [mm]	1800	2100	2300	2500	2000	2000	2000	2000

**Note:**

$$l_{v,max} = (\varnothing d_s / 4) \times (\sigma_{sd} / f_{bd,PIR}); \leq 2500 \text{ [mm]}$$

where:

 $\varnothing d_s$  – diameter (Ø8 to Ø40) [mm]

 $\sigma_{sd}$  – calculated stress in the rebar ( $f_{yk}/1,15$ ) [MPa]

 $f_{bd,PIR}$  – designed bond strength of post-installed rebar [N/mm<sup>2</sup>]

according to Table C4 (for hammer drilling) or Table C5 (for diamond drilling)

The minimum anchorage length  $l_{bd,PIR}$  and minimum anchorage length – overlap joint  $l_{o,PIR}$  should be determined according to EN 1992-1-1:2004+AC:2010 (EC 2).

**Minimum concrete cover (see Annex B2):**

 Rebar diameter < 25 mm:  $c_{min} = 30 \text{ mm} + 0,06 \cdot l_v \geq 2\varnothing$ 

 Rebar diameter  $\geq 25$  mm:  $c_{min} = 40 \text{ mm} + 0,06 \cdot l_v \geq 2\varnothing$ 
**Concrete cover under seismic loading  $c_{min,seis}$ :**

Design conditions	Distance of 1 <sup>st</sup> edge	Distance of 2 <sup>nd</sup> edge
Edge	$\geq 4\varnothing$	$\geq 8\varnothing$
Corner	$\geq 6\varnothing$	$\geq 6\varnothing$

The minimum concrete cover according to EN 1992-1-1:2004+AC:2010 (EC 2) shall be observed.

**Minimum clear spacing between two post-installed rebar:**
 $a \geq 40 \text{ mm}$ 
 $a \geq 4\varnothing$ 

**Injection System R-KEX II  
for rebar connections**

**Intended use**  
Installation data – hammer or diamond drilling

**Annex B3**  
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**Table B2: Installation parameters – hammer or diamond drilling – concrete class C20/25 ÷ C50/60**

Rebar diameter [mm]	Ø8	Ø10	Ø12	Ø13	Ø14	Ø16	Ø18	Ø20
Drill bit diameter [mm]	10 or 12	12 or 14	14 or 18	16	18	20	22	25
Brush diameter [mm]	14	16	18	18	20	22	24	27
Maximum embedment depth $l_{v,max}$ [mm]	400	500	600	700	700	800	900	1000

Rebar diameter [mm]	Ø22	Ø25	Ø28	Ø30	Ø32	Ø34	Ø36	Ø40
Drill bit diameter [mm]	26	30	35	35	40	45	45	50
Brush diameter [mm]	27	32	37	37	42	47	47	52
Maximum embedment depth $l_{v,max}$ [mm]	1100	1200	1400	1500	2500	2000	2000	2000

**Note:**

$$l_{v,max} = (\varnothing d_s / 4) \times (\sigma_{sd} / f_{bd,PIR}); \leq 2500 \text{ [mm]}$$

where:

$\varnothing d_s$  – diameter (Ø8 to Ø40) [mm]

$\sigma_{sd}$  – calculated stress in the rebar ( $f_{yk}/1,15$ ) [MPa]

$f_{bd,PIR}$  – designed bond strength of post-installed rebar [N/mm<sup>2</sup>]

according to Table C4 (for hammer drilling) or Table C5 (for diamond drilling)

The minimum anchorage length  $l_{bd,PIR}$  and minimum anchorage length – overlap joint  $l_{o,PIR}$  should be determined according to EN 1992-1-1:2004+AC:2010 (EC 2).

**Minimum concrete cover (see Annex B2):**

Rebar diameter < 25 mm:  $c_{min} = 30 \text{ mm} + 0,06 \cdot l_v \geq 2\varnothing$

Rebar diameter  $\geq 25$  mm:  $c_{min} = 40 \text{ mm} + 0,06 \cdot l_v \geq 2\varnothing$

**Concrete cover under seismic loading  $c_{min,seis}$ :**

Design conditions	Distance of 1 <sup>st</sup> edge	Distance of 2 <sup>nd</sup> edge
Edge	$\geq 4\varnothing$	$\geq 8\varnothing$
Corner	$\geq 6\varnothing$	$\geq 6\varnothing$

The minimum concrete cover according to EN 1992-1-1:2004+AC:2010 (EC 2) shall be observed.

**Minimum clear spacing between two post-installed rebar:**

$a \geq 40 \text{ mm}$

$a \geq 4\varnothing$

<b>Injection System R-KEX II for rebar connections</b>	<b>Annex B4</b> of European Technical Assessment ETA-13/0585
<b>Intended use</b> Installation data – hammer or diamond drilling	

**Table B3: Maximum processing time and minimum curing time**


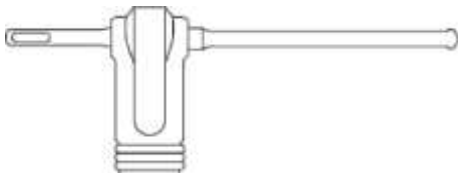

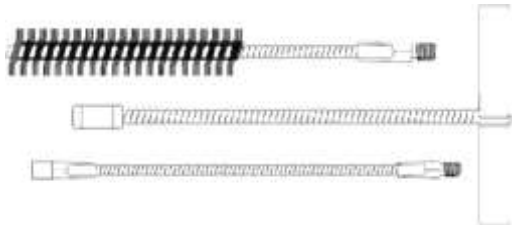
R-KEX II			
Temperature of mortar [C°]	Temperature of substrate [C°]	Maximum processing time [min.]	Minimum curing time <sup>1)</sup> [min.]
+5	+5	150	2880
+10	+10	120	1080
+20	+20	35	480
+25	+30	12	300

<sup>1)</sup> The minimum time from the end of the mixing to the time when the rebar may be loaded. For wet condition the curing time must be double.

**Injection System R-KEX II  
for rebar connections**

**Intended use**  
Maximum processing time and minimum curing time

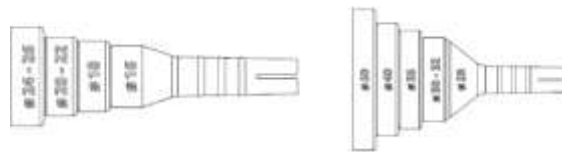
**Annex B5**  
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<p>Manual blow pump R-BLOWPUMP</p> 																	
<p>Hollow drill bit</p> 																	
<p>Steel brush R-BRUSH</p> 								<p>Steel brush with extension R-BRUSH-T</p> 									
<b>Table B4: Brushes for cleaning the drilled holes</b>																	
<b>Rebar diameter [mm]</b>		Ø8	Ø10	Ø12	Ø13	Ø14	Ø16	Ø18	Ø20	Ø22	Ø25	Ø28	Ø30	Ø32	Ø34	Ø36	Ø40
<b>Type of the brush</b>		with steel wires															
<b>Brush head diameter</b>	<b>[mm]</b>	14	16	18	18	20	22	24	27	27	32	37	37	42	47	47	52
<b>Brush head length</b>	<b>[mm]</b>	80							100								
<p><b>Injection System R-KEX II</b> for rebar connections</p>										<p><b>Annex B6</b> of European Technical Assessment ETA-13/0585</p>							
<p><b>Intended use</b> Tools for installation (1)</p>																	

Mixer nozzle extension R-NOZ-EXT



Dosing plug R-NOZ-P



**Table B5. Piston plug R-NOZ-P size**

Hole diameter [mm]	16	18	20	22	25	26	28	30	35	40	45	50
Piston plug R-NOZ-P description	Ø16	Ø18	Ø20-22		Ø24-26		Ø28	Ø30-32	Ø35	Ø40	Ø45	Ø50


Temporary positioning wedge



**Injection System R-KEX II  
for rebar connections**


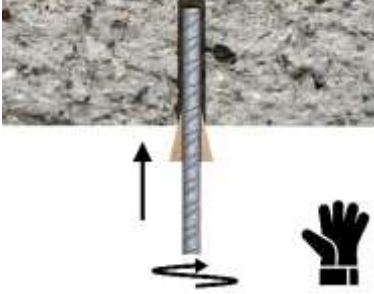

**Intended use**  
Tools for installation (2)

**Annex B6**  
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Dispenser	Cartridge size
 <p data-bbox="347 539 919 571">Manual gun for side by side cartridges R-GUN-385-P</p>	<p data-bbox="1075 421 1155 450">385 ml</p>
 <p data-bbox="347 840 919 871">Manual gun for side by side cartridges R-GUN-600-P</p>	<p data-bbox="1050 723 1182 752">385, 600 ml</p>
 <p data-bbox="507 1200 762 1229">Cordless dispenser gun</p>  <p data-bbox="496 1559 774 1588">Pneumatic dispenser gun</p>	<p data-bbox="1050 1234 1182 1263">385, 600 ml</p>
<p data-bbox="464 1823 794 1883"><b>Injection System R-KEX II for rebar connections</b></p>	<p data-bbox="1182 1852 1385 1991"><b>Annex B7</b> of European Technical Assessment ETA-13/0585</p>
<p data-bbox="491 1944 767 2004"><b>Intended use</b> Tools for installation (3)</p>	



	<ol style="list-style-type: none"> <li>1. Hole drilling:                             <ol style="list-style-type: none"> <li>a. Hammer drilling. Drill hole to the required diameter and depth using a rotary hammer drilling machine.</li> <li>b. Hammer drilling with hollow drill bit. Drill hole to the required diameter and depth using a hollow drill bit with vacuum cleaner. After drilling is completed, proceed to step no. 3. Hole cleaning is not necessary. Hollow drill bit cleans the drill hole during drilling.</li> <li>c. Diamond core drilling. Drill hole to the required diameter and depth using a diamond core drilling machine and the corresponding core bit are used.</li> </ol> </li> </ol>	
	<ol style="list-style-type: none"> <li>2. Hole cleaning:                             <ol style="list-style-type: none"> <li>a. Manual cleaning with brush and hand pump for hammer drilled hole:                                     <ul style="list-style-type: none"> <li>– starting from the drill hole bottom blow the hole at least 4 times using the hand pump,</li> <li>– using the specified brush, mechanically brush out the hole at least 4 times,</li> <li>– starting from the drill hole bottom, blow at least 4 times with the hand pump.</li> </ul> </li> <li>b. Cleaning hole, diamond drilling, with compressed air:                                     <ul style="list-style-type: none"> <li>– flush the hole from the bottom with water at least 2 times,</li> <li>– using the specified brush, mechanically brush out the hole at least 3 times,</li> <li>– starting from the drill hole bottom, blow at least 2 times with compressed air.</li> </ul> </li> </ol> </li> </ol>	
	<ol style="list-style-type: none"> <li>3. Insert cartridge into dispenser and attach nozzle. Dispense to waste until even color is obtained (min. 10 cm).</li> </ol>	
	<ol style="list-style-type: none"> <li>4. Insert the mixing nozzle to the far end of the hole and inject mortar, slowly withdrawing the nozzle as the hole is filled to 2/3 of its depth.</li> </ol>	
	<ol style="list-style-type: none"> <li>5. Immediately insert the rebar, slowly and with slight twisting motion. Remove any excess mortar around the hole before it sets.</li> </ol>	
	<ol style="list-style-type: none"> <li>6. Leave the fixing undisturbed until the curing time elapses.</li> </ol>	
<b>Injection System R-KEX II for rebar connections</b>		<b>Annex B8</b> of European Technical Assessment ETA-13/0585
<b>Intended use</b> Installation instruction (1)		

	<p>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.</p>
	<p>2. Drive the rebar immediately into the hole. Use temporary interlocking element e.g wedges.</p>
	<p>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.</p>

<p><b>Injection System R-KEX II for rebar connections</b></p>	<p><b>Annex B9</b> of European Technical Assessment ETA-13/0585</p>
<p><b>Intended use</b> Installation instruction (2) – overhead installation</p>	

### Minimum anchorage length and minimum lap length

The minimum anchorage length  $l_{b,min}$  and the minimum lap length  $l_{o,min}$  according to EN 1992-1-1:2004 +AC:2010 (EC 2) shall be multiplied by the relevant amplification factor  $\alpha_{lb,50y} = \alpha_{lb,100y}$  in Table C1.

**Table C1: Amplification factor  $\alpha_{lb,50y} = \alpha_{lb,100y}$**

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1	1	1	1	1	1	1	1	1
Ø10	1	1	1	1	1	1	1	1	1
Ø12	1	1	1	1	1	1	1	1	1
Ø13	1	1	1	1	1	1	1	1	1
Ø14	1	1	1	1	1	1	1	1	1
Ø16	1	1	1	1	1	1	1	1	1
Ø18	1	1	1	1	1	1	1	1	1
Ø20	1	1	1	1	1	1	1	1	1
Ø22	1	1	1	1	1	1	1	1	1
Ø25	1	1	1	1	1	1	1	1	1
Ø28	1	1	1	1	1	1	1	1	1
Ø30	1	1	1	1	1	1	1	1	1
Ø32	1	1	1	1	1	1	1	1	1
Ø34	1	1	1	1	1	1	1	1	1
Ø36	1	1	1	1	1	1	1	1	1
Ø40	1	1	1	1	1	1	1	1	1

**Injection System R-KEX II  
for rebar connections**

**Performances**  
Amplification factor  $\alpha_{lb}$

**Annex C1**  
of European  
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**Table C2: Bond efficiency factor under static and quasi-static loading  $k_{b,50y} = k_{b,100y}$  for hammer drilling with or without hollow drill bit**

Rear diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1	1	1	1	1	1	1	1	1
Ø10	1	1	1	1	1	1	1	1	1
Ø12	1	1	1	1	1	1	1	1	1
Ø13	1	1	1	1	1	1	1	1	1
Ø14	1	1	1	1	1	1	1	1	1
Ø16	1	1	1	1	1	1	1	1	0,93
Ø18	1	1	1	1	1	1	1	1	0,93
Ø20	1	1	1	1	1	1	1	0,92	0,86
Ø22	1	1	1	1	1	1	1	0,92	0,86
Ø25	1	1	1	1	1	1	0,91	0,84	0,79
Ø28	1	1	1	1	1	1	0,91	0,84	0,79
Ø30	1	1	1	1	1	0,90	0,82	0,76	0,71
Ø32	1	1	1	1	1	0,90	0,82	0,76	0,71
Ø34	1	1	1	1	0,89	0,80	0,73	0,67	0,63
Ø36	1	1	1	0,86	0,76	0,69	0,63	0,58	0,54
Ø40	1	1	1	0,86	0,76	0,69	0,63	0,58	0,54

**Injection System R-KEX II  
for rebar connections**

**Performances**  
Bond efficiency value under static and quasi-static loading  $k_b$   
for hammer drilling with or without hollow drill bit

**Annex C2**  
of European  
Technical Assessment  
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**Table C3: Bond efficiency factor under static and quasi-static loading  $k_{b,50y} = k_{b,100y}$  for diamond drilling**

Rear diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1	1	1	1	1	1	1	1	1
Ø10	1	1	1	1	1	1	1	1	1
Ø12	1	1	1	1	1	1	1	1	1
Ø13	1	1	1	1	1	1	1	1	1
Ø14	1	1	1	1	1	1	1	1	0,93
Ø16	1	1	1	1	1	1	1	1	0,93
Ø18	1	1	1	1	1	1	1	1	0,93
Ø20	1	1	1	1	1	1	1	0,92	0,86
Ø22	1	1	1	1	1	1	1	0,92	0,86
Ø25	1	1	1	1	1	1	0,91	0,84	0,79
Ø28	1	1	1	1	1	0,90	0,82	0,76	0,71
Ø30	1	1	1	1	0,89	0,80	0,73	0,67	0,63
Ø32	1	1	1	1	0,89	0,80	0,73	0,67	0,63
Ø34	1	1	1	1	0,89	0,80	0,73	0,67	0,63
Ø36	1	1	1	0,86	0,76	0,69	0,63	0,58	0,54
Ø40	1	1	0,86	0,74	0,66	0,59	0,54	0,50	0,47

**Injection System R-KEX II  
for rebar connections**

**Performances**  
Bond efficiency value under static and quasi-static loading  $k_b$   
for diamond drilling

**Annex C3**  
of European  
Technical Assessment  
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**Table C4: Design values of the ultimate bond resistance under static and quasi-static loading  $f_{bd,PIR,50y}^{1)} = f_{bd,PIR,100y}$  in N/mm<sup>2</sup> for hammer drilling with or without hollow drill bit**

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø10	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø12	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø13	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø14	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø16	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø18	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø20	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
Ø22	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
Ø25	1,60	2,00	2,30	2,70	3,00	3,40	3,40	3,40	3,40
Ø28	1,60	2,00	2,30	2,70	3,00	3,40	3,40	3,40	3,40
Ø30	1,60	2,00	2,30	2,70	3,00	3,00	3,00	3,00	3,00
Ø32	1,60	2,00	2,30	2,70	3,00	3,00	3,00	3,00	3,00
Ø34	1,60	2,00	2,30	2,70	2,70	2,70	2,70	2,70	2,70
Ø36	1,60	2,00	2,30	2,30	2,30	2,30	2,30	2,30	2,30
Ø40	1,60	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00

$$1) f_{bd,PIR} = k_b \cdot f_{bd}$$

- $f_{bd}$ : design value of the bond strength in N/mm<sup>2</sup> considering: the concrete strength class, the rebar diameter, the drilling method for good bond condition (for all other bond conditions multiply the values by  $\eta_1 = 0,7$ ), recommended partial factor  $\gamma_c = 1,5$  according to EN 1992-1-1:2004+AC:2010 (EC 2) and rebar diameter ( $\eta_2 = (132 - \varnothing) / 100$  for  $\varnothing > 32$  mm)
- $k_b$ : bond efficiency factor according to Table C2

**Injection System R-KEX II  
for rebar connections**

**Performances**

Design values of the ultimate bond resistance under static and quasi-static loading  $f_{bd}$  for hammer drilling with or without hollow drill bit

**Annex C4**

of European  
Technical Assessment  
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**Table C5: Design values of the ultimate bond resistance under static and quasi-static loading  $f_{bd,PIR}^{(1)} = f_{bd,PIR,100y}$  in N/mm<sup>2</sup> for diamond drilling**

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø10	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø12	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø13	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø14	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø16	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø18	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø20	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
Ø22	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
Ø25	1,60	2,00	2,30	2,70	3,00	3,40	3,40	3,40	3,40
Ø28	1,60	2,00	2,30	2,70	3,00	3,00	3,00	3,00	3,00
Ø30	1,60	2,00	2,30	2,70	3,00	2,70	2,70	2,70	2,70
Ø32	1,60	2,00	2,30	2,70	3,00	2,70	2,70	2,70	2,70
Ø34	1,60	2,00	2,30	2,70	2,70	2,70	2,70	2,70	2,70
Ø36	1,60	2,00	2,30	2,30	2,30	2,30	2,30	2,30	2,30
Ø40	1,60	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00

<sup>1)</sup>  $f_{bd,PIR} = k_b \cdot f_{bd}$ 

–  $f_{bd}$ : design value of the bond strength in N/mm<sup>2</sup> considering: the concrete strength class, the rebar diameter, the drilling method for good bond condition (for all other bond conditions multiply the values by  $\eta_1 = 0,7$ ), recommended partial factor  $\gamma_c = 1,5$  according to EN 1992-1-1:2004+AC:2010 (EC 2) and rebar diameter ( $\eta_2 = (132 - \varnothing) / 100$  for  $\varnothing > 32$  mm)

–  $k_b$ : bond efficiency factor according to Table C3

**Injection System R-KEX II  
for rebar connections**

**Performances**

Design values of the ultimate bond resistance under static and quasi-static loading  $f_{bd}$  for diamond drilling

**Annex C5**

of European  
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**Table C6: Bond efficiency factor under seismic loading  $k_{b,seis,50y} = k_{b,seis,100y}$  for hammer drilling with or without hollow drill bit**

Rear diameter [mm]	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	-	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Ø10	-	1,00	1,00	1,00	1,00	1,00	0,91	0,81	0,72
Ø12	-	1,00	1,00	1,00	1,00	0,99	0,87	0,77	0,68
Ø13	-	1,00	1,00	1,00	1,00	0,98	0,85	0,75	0,67
Ø14	-	1,00	1,00	1,00	1,00	0,96	0,84	0,74	0,66
Ø16	-	1,00	1,00	1,00	1,00	0,93	0,81	0,72	0,64
Ø18	-	1,00	1,00	1,00	1,00	0,90	0,79	0,70	0,62
Ø20	-	1,00	1,00	1,00	1,00	1,00	1,00	0,99	0,93
Ø22	-	1,00	1,00	1,00	1,00	1,00	1,00	0,96	0,90
Ø25	-	1,00	1,00	1,00	1,00	1,00	0,98	0,91	0,85
Ø28	-	1,00	1,00	1,00	1,00	1,00	0,92	0,85	0,80
Ø30	-	1,00	1,00	1,00	0,95	0,86	0,80	0,74	0,70
Ø32	-	1,00	1,00	1,00	0,95	0,86	0,80	0,74	0,70
Ø34	-	1,00	1,00	0,95	0,85	0,78	-	-	-
Ø36	-	1,00	0,98	-	-	-	-	-	-
Ø40	-	1,00	-	-	-	-	-	-	-

**Injection System R-KEX II  
for rebar connections**

**Performances**  
Bond efficiency value under seismic loading  $k_{b,seis}$  for hammer drilling  
with or without hollow drill bit

**Annex C6**  
of European  
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**Table C7: Design values of the ultimate bond resistance under seismic loading**  
 $f_{bd,PIR,seis,50y} = f_{bd,PIR,seis,100y}$  <sup>1)</sup> in N/mm<sup>2</sup> for hammer drilling with or without hollow drill bit

Rebar diameter [mm]	Concrete strength class								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	-	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø10	-	2,00	2,30	2,70	3,00	3,40	3,37	3,00	3,00
Ø12	-	2,00	2,30	2,70	3,00	3,38	3,21	3,00	2,70
Ø13	-	2,00	2,30	2,70	3,00	3,32	3,16	3,00	2,70
Ø14	-	2,00	2,30	2,70	3,00	3,27	3,11	2,70	2,70
Ø16	-	2,00	2,30	2,70	3,00	3,17	3,01	2,70	2,30
Ø18	-	2,00	2,30	2,70	3,00	3,06	2,91	2,70	2,30
Ø20	-	2,00	2,30	2,70	3,00	3,40	3,70	3,40	3,40
Ø22	-	2,00	2,30	2,70	3,00	3,40	3,70	3,40	3,00
Ø25	-	2,00	2,30	2,70	3,00	3,40	3,30	3,00	2,70
Ø28	-	2,00	2,30	2,70	3,00	3,40	3,00	2,70	2,70
Ø30	-	2,00	2,30	2,70	2,70	2,70	2,30	2,00	2,00
Ø32	-	2,00	2,30	2,70	2,70	2,30	2,30	2,00	2,00
Ø34	-	1,91	2,21	2,21	2,21	1,91	-	-	-
Ø36	-	1,87	2,12	-	-	-	-	-	-
Ø40	-	1,79	-	-	-	-	-	-	-

<sup>1)</sup>  $f_{bd,PIR} = k_b \cdot f_{bd}$

- $f_{bd}$ : design value of the bond strength in N/mm<sup>2</sup> considering: the concrete strength class, the rebar diameter, the drilling method for good bond condition (for all other bond conditions multiply the values by  $\eta_1 = 0,7$ ), recommended partial factor  $\gamma_c = 1,5$  according to EN 1992-1-1:2004+AC:2010 (EC 2) and rebar diameter ( $\eta_2 = (132 - \varnothing) / 100$  for  $\varnothing > 32$  mm)
- $k_b$ : bond efficiency factor according to Table C3

**Injection System R-KEX II  
for rebar connections**

**Performances**

Design values of the ultimate bond resistance under seismic loading  
 $f_{bd,PIR,seis}$  for hammer drilling with or without hollow drill bit

**Annex C7**

of European  
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