



INSTYTUT TECHNIKI BUDOWLANEJ
PL 00-611 WARSZAWA
ul. Filtrowa 1
tel.: (+48 22) 825-04-71
(+48 22) 825-76-55
fax: (+48 22) 825-52-86
www.itb.pl



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European Technical Assessment

**ETA-12/0528
of 30/09/2015**

General Part

Technical Assessment Body issuing the European Technical Assessment

Instytut Techniki Budowlanej

Trade name of the construction product

R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W

Product family to which the construction product belongs

Injection anchors for use in masonry

Manufacturer

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

Manufacturing plant

Manufacturing Plant No. 3

This European Technical Assessment contains

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

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

Guideline for European Technical Approval "Metal injection anchor for use in masonry", ETAG 029, Edition April 2013, used as European Assessment Document (EAD)

This version replaces

ETA-12/0528 issued on 27/06/2013

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Specific Part

1 Technical description of the product

The injection system R-KEM II / R-KEM II-S / R-KEM II-W i RM50 / RM50-S / RM50-W is a bonded anchors (injection type) consisting of a injection mortar cartridge, a perforated sleeve and an anchor rod with hexagon nut and washer. Anchor rods are made of galvanized carbon steel, stainless steel or high corrosion resistant stainless steel.

The anchor rod is placed into a drilled hole previously cleaned and filled with injection mortar and is anchored via the bond between steel element, injection mortar and masonry.

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

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

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

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

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

3.1 Performance of the product

3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance for tension and shear loads	Annexes C1 to C4
Characteristic resistance for bending moments	Annex C4
Displacements under shear and tension loads	Annexes C5 to C8
Reduction factor for job site tests (β -Factor)	Annex C9
Edge distance and spacing	Annex C9

3.1.2 Safety in case of fire (BWR 2)

No performance assessed.

3.1.3 Hygiene, health and the environment (BWR 3)

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

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

3.1.4 Safety in use (BWR 4)

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

3.1.5 Sustainable use of natural resources (BWR 7)

No performance assessed.

3.2 Methods used for the assessment

The assessment of fitness of the anchors for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of Basic Requirements 1 and 4 has been made in accordance with the ETAG 029 "Metal injection anchor for use in masonry".

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

According to Decision 97/177/EC of the European Commission the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal injection anchors for use in masonry	Fixing and/or support to masonry, structural elements (which contribute to the stability of the works) or heavy units such as cladding as well as installation	-	1

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

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

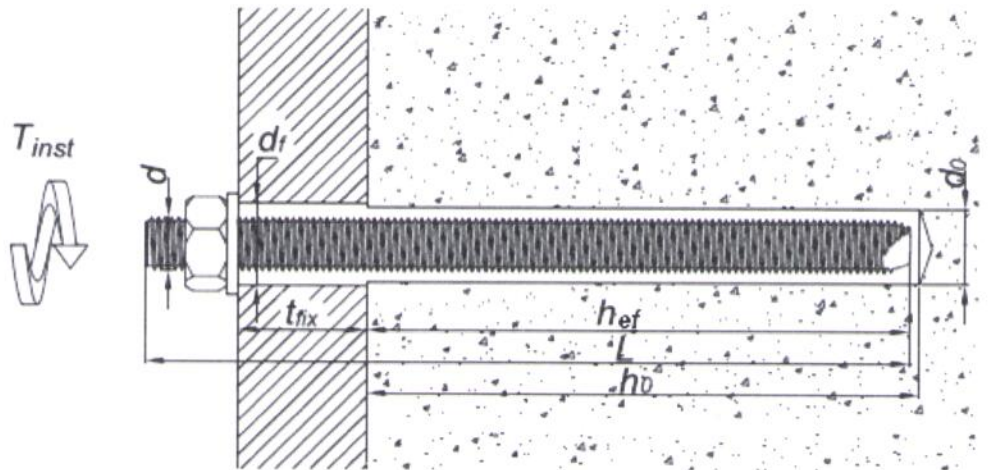
For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 30/09/2015 by Instytut Techniki Budowlanej

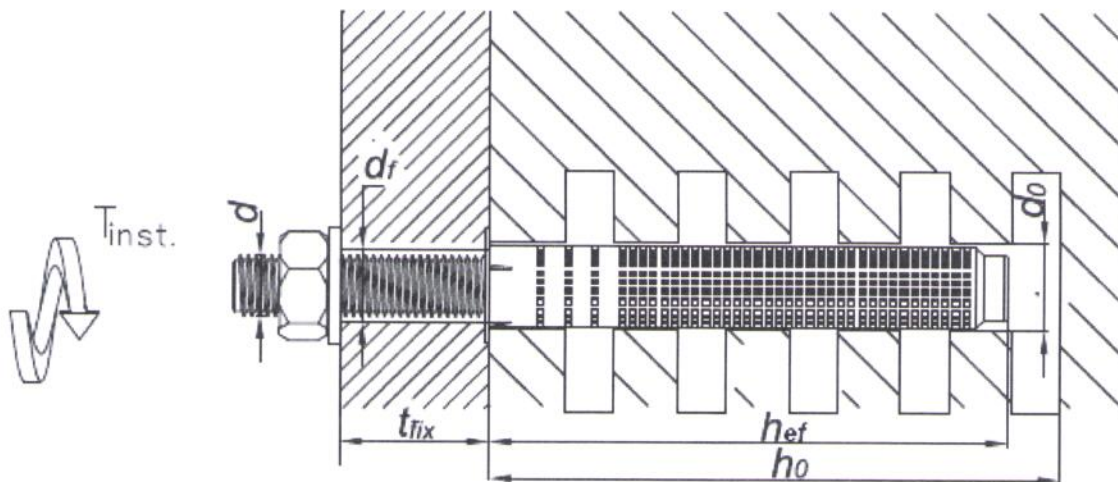


Marcin M. Kruk, PhD
Director of ITB

Anchor rod without perforated sleeve – installation in solid masonry



Anchor rod with perforated sleeve – installation in perforated masonry



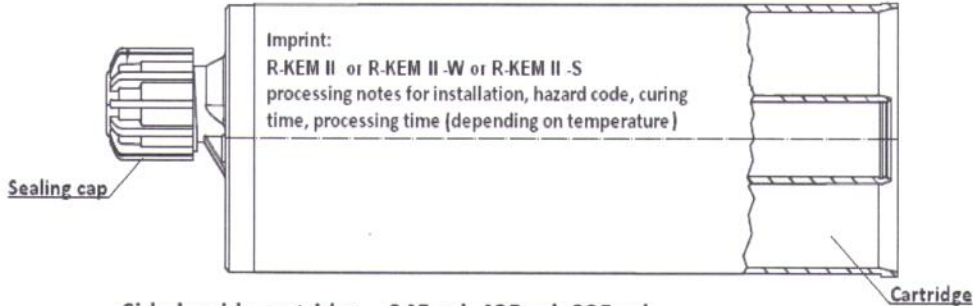
**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Product description
Installation conditions

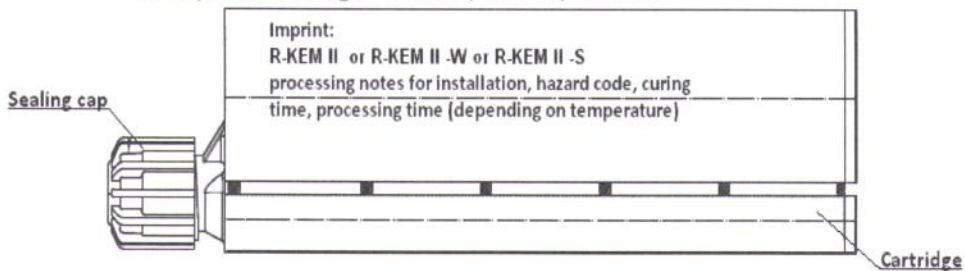
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Coaxial cartridge –

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

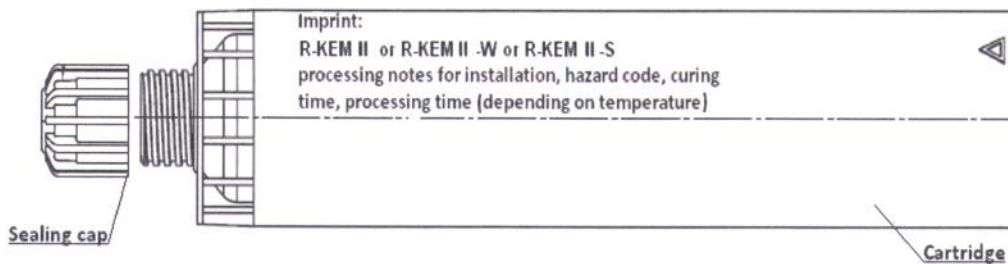


Side by side cartridge – 345 ml, 425 ml, 825 ml.

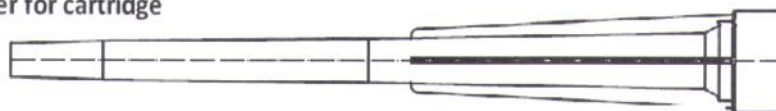


Cartridge a single component for two part foil capsules –

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



Mixer for cartridge



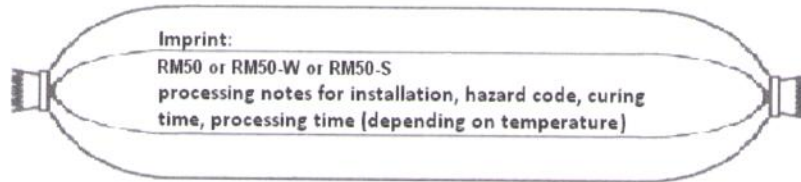
**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Product description
Injection system (R-KEM II / R-KEM II-S / R-KEM II-W)

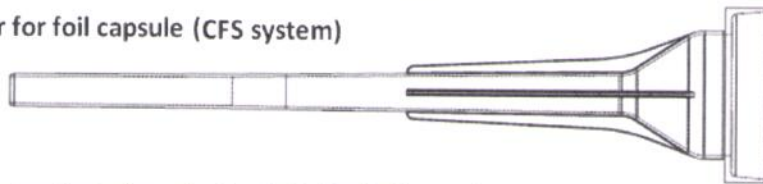
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Foil capsule (CFS system) –

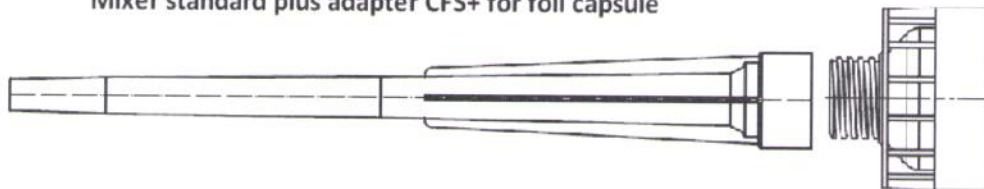
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.



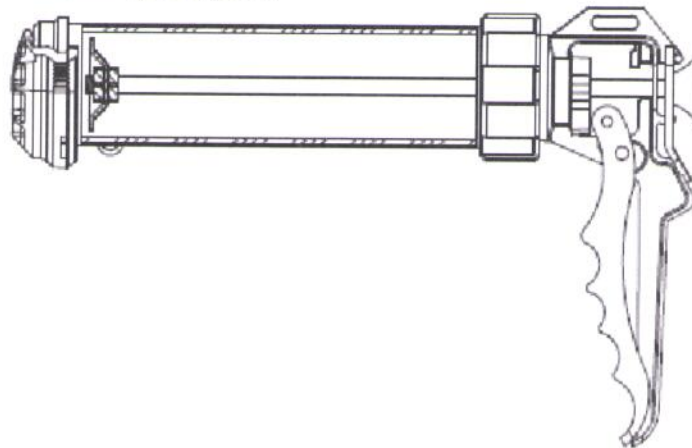
Mixer for foil capsule (CFS system)



Mixer standard plus adapter CFS+ for foil capsule



Gun for foil capsule (CFS system)

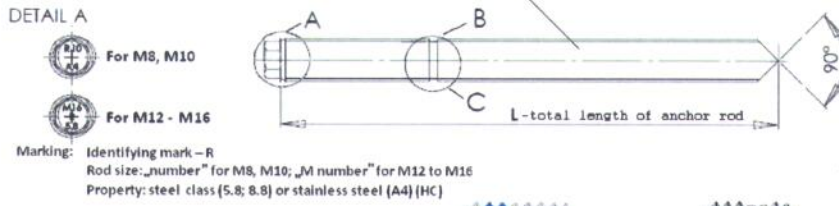
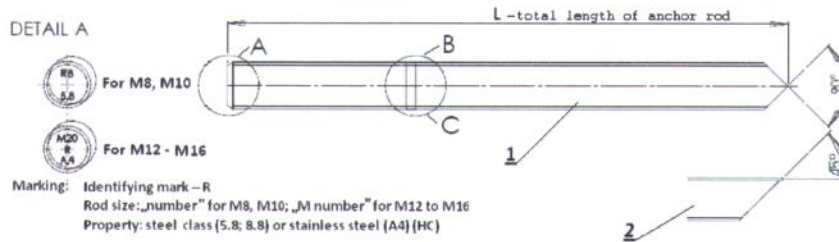


**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Product description
Injection system (RM50 / RM50-S / RM50-W)

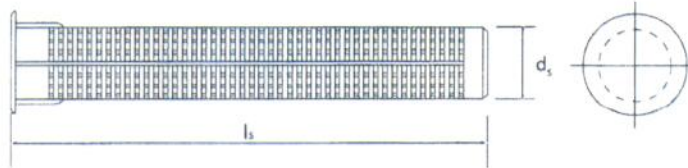
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Anchor rods



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

Perforated plastic or metal sleeve



Size of rod			M8	M8	M10	M10	M12	M12	M16
Size of sleeve	$d_s \times l_s$	[mm]	12x50	12x80	16x85	16x130	16x85	16x130	20x85

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Product description
Anchor rods and sleeves

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Table A1: Threaded rods

Part	Designation		
	Steel, zinc plated	Stainless steel	High corrosion resistance stainless steel (HCR)
Anchor rod	Steel, property class 5.8 to 12.9, acc. to EN ISO 898-1 electroplated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042 or hot-dip galvanized $\geq 45 \mu\text{m}$ acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Hexagon nut	Steel, property class 5 to 12, acc. to EN ISO 898-2; electroplated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042 or hot-dip galvanized $\geq 45 \mu\text{m}$ acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Washer	Steel, acc. to EN ISO 7089; electroplated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042 or hot-dip galvanized $\geq 45 \mu\text{m}$ acc. to EN ISO 10684	Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; corresponding to anchor rod material	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; corresponding to anchor rod material

Commercial standard threaded rods (in the case of rods made of galvanized steel – standard rods with property class ≤ 8.8 only), with:

- material and mechanical properties according to Table A1,
- confirmation of material and mechanical properties by inspection certificate 3.1 according to EN-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.

Table A2: Injection mortars

Product	Composition
R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W	Bonding agent: polyester styrene free resin Hardener: dibenzoyl peroxide Additive: quartz sand (filler) Supplied in three colors: standard, grey (G) and stone (ST)

R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W	Annex A5 of European Technical Assessment ETA-12/0528
Product description Materials	

Specification of intended use

Anchorage subject to:

Static and quasi-static loads: sizes from M8 to M16.

Base materials:

- Solid clay bricks (use category b), according to Annex B7.
- Autoclaved aerated concrete blocks AAC (use category d), according to Annex B7.
- Solid silicate bricks (use category b), according to Annex B7.
- Silicate hollow blocks (use category c), according to Annex B7.
- Perforated ceramic blocks (use category c), according to Annexes B7 and B8.
- Lightweight concrete hollow blocks (use category c), according to Annex B8.

Mortar strength class M2,5 at minimum according to EN 998-2.

For smaller brick size or smaller compressive strength in solid masonry or other bricks and blocks in hollow or perforated masonry the characteristic resistance of the anchor may be determined by job site tests according to ETAG 029, Annex B under consideration of the β -factor according to Annex C9.

Temperature range:

The anchors may be used in the following temperature range:

- -40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C).
- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).

Use conditions (environmental conditions):

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

Use categories:

- b, c, d base materials.
- w/w installation and use.

Installation:

- Dry or wet structures.
- Hole drilling by rotary drill mode (AAC, hollow and perforated masonry) and hammer drill mode (solid masonry).

Design:

- Verifiable calculation notes and drawings are prepared taking account the relevant masonry in the region of the anchorage, the loads to be transmitted and their transmission to the supports of the structure. The position of the anchor is indicated on the design drawings.
- The anchorages are designed in accordance with to ETAG 029, Annex C, design method A under the responsibility of an engineer experienced in anchorages and masonry work.

<p>R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W</p>	<p>Annex B1</p>
<p>Intended use Specification</p>	<p>of European Technical Assessment ETA-12/0528</p>

**Table B1: Installation parameters of anchor rods in solid masonry and AAC
(without perforated sleeves)**

Size of rod			M8	M10	M12	M16	
Diameter of rod	d	[mm]	8	10	12	16	
Drilling diameter	d ₀	[mm]	10	12	14	18	
Diameter of the hole in the fixture	d _{fix}	[mm]	9	12	14	18	
Depth of the drilling hole	h ₀	[mm]	85	90	100	110	
Embedment depth	h _{ef}	[mm]	80	85	95	105	
Torque moment	solid masonry	max. T _{inst}	[Nm]	5	8	10	15
	AAC			3	4	6	10
Minimum spacing and edge distance							
Minimum spacing	s _{min}	[mm]	50	50	50	54	
Minimum edge distance	c _{min}	[mm]	50	50	50	54	

Table B2: Installation parameters of anchor rods with perforated sleeves in hollow or perforated masonry

Size of rod			M8	M8	M10	M10	M12	M12	M16
Size of sleeve	d _s xl _s	[mm]	12x50	12x80	16x85	16x130	16x85	16x130	20x85
Diameter of rod	d	[mm]	8	8	10	10	12	12	16
Drilling diameter	d ₀	[mm]	12	12	16	16	16	16	20
Diameter of the hole in the fixture	d _{fix}	[mm]	9	9	12	12	14	14	18
Depth of the drilling hole	h ₀	[mm]	55	85	90	130	90	130	90
Embedment depth	h _{ef}	[mm]	50	80	85	125	85	125	85
Torque moment	max. T _{inst}	[Nm]	3	3	4	4	6	6	10
Minimum spacing and edge distance									
Minimum spacing	s _{min}	[mm]	100	100	100	100	100	100	120
Minimum edge distance	c _{min}	[mm]	100	100	100	100	100	100	120

R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W

Intended use
Installation data

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Table B3: Processing time and minimum curing time

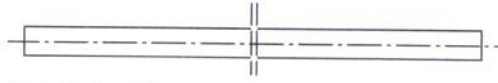
Mortar temperature	Base material temperature	Processing time [min.]			Minimum curing time [min.]		
		R-KEM II / RM50	R-KEM II-S / RM50-S	R-KEM II-W / RM50-W	R-KEM II / RM50	R-KEM II-S / RM50-S	R-KEM II-W / RM50-W
5°C	-20°C	-	-	45	-	-	1440
5°C	-15°C	-	-	30	-	-	1080
5°C	-10°C	-	-	20	-	-	480
5°C	-5°C	70	180	11	480	1440	300
5°C	0°C	45	120	7	240	1080	120
5°C	5°C	25	60	5	120	720	60
10°C	10°C	15	45	2	90	480	45
15°C	15°C	9	25	1,5	60	360	30
20°C	20°C	5	15	1	45	240	15
25°C	30°C	2	7	-	30	90	-
25°C	35°C	-	6	-	-	60	-
25°C	40°C	-	5	-	-	45	-

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Intended use
Processing time and curing time

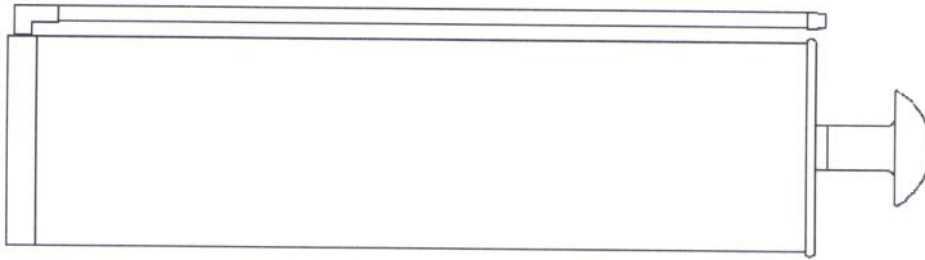
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Additional mixer extension



*Variable length from 300mm up to 1000mm.

Manual blower pump



Steel brush



Brush diameter for solid masonry

Size of rod			M8	M10	M12	M16
Brush diameter	d_b	[mm]	12	14	16	20

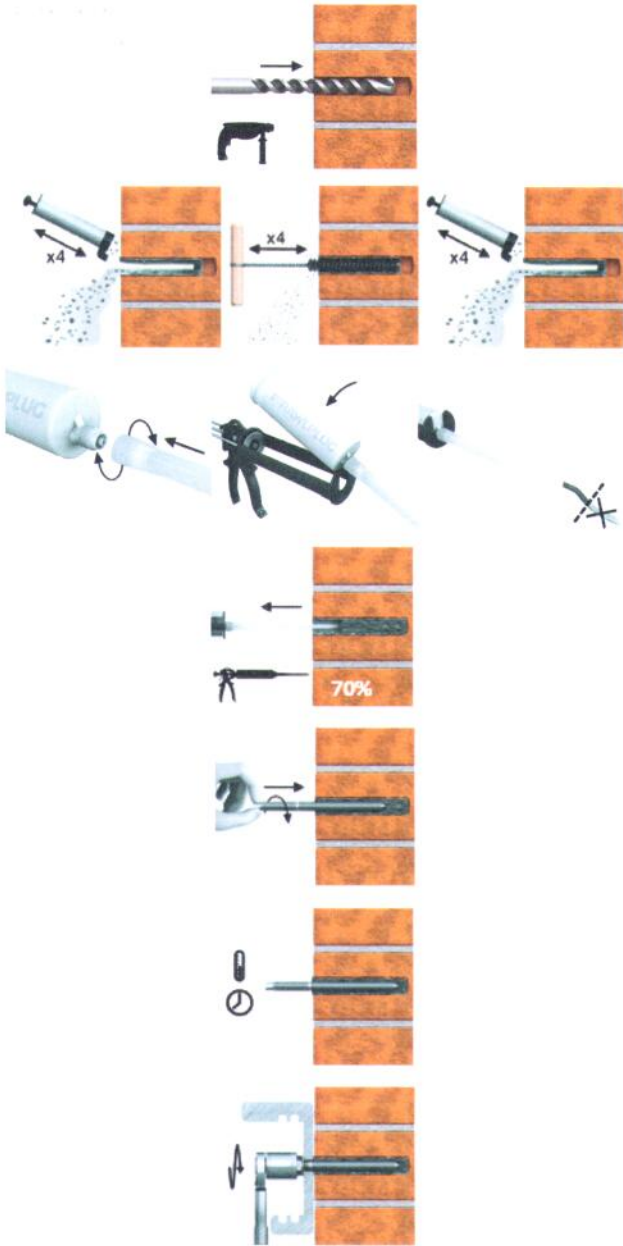
Brush diameter for hollow or perforated masonry

Size of rod			M8	M10	M12	M16
Brush diameter	d_b	[mm]	12	16	16	20

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Intended use
Tools

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	<ol style="list-style-type: none"> 1. Drill the hole to the required diameter and depth (hammer drilling for solid masonry and rotary drilling for AAC). 2. Clean the hole with brush and hand pump: at least four blowing operations then four brushing operations followed again by four blowing operations. 3. Insert cartridge into gun and attach nozzle. Dispense to waste until an even colour is obtained. 4. Insert the mixing nozzle to the far end of the hole and inject the resin, slowly withdrawing the nozzle as the hole is filled to 70% of its depth. 5. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets. 6. Leave the fixing undisturbed until the curing time elapses. 7. Attach the fixture and tighten the nut (max. torque acc. to Table B1).
<p>R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W</p>	<p>Annex B5 of European Technical Assessment ETA-12/0528</p>
<p>Intended use Installation instruction – solid masonry and AAC</p>	

	<ol style="list-style-type: none"> 1. Drill the hole to the required diameter and depth using a rotary machine. 2. Clean the hole with brush and hand pump: at least four blowing operations then two brushing operations followed again by four blowing operations. 3. Introduce the perforated sleeve of suitable dimension. 4. Insert cartridge into gun and attach nozzle. Dispense to waste until an even colour is obtained. 5. Insert the nozzle to the end of the sleeve and inject the resin so long till the sleeve will fill into 100% of depth. 6. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess resin around the hole before it sets. 7. Leave the fixing undisturbed until minimum curing time elapses. 8. Attach the fixture and tighten the nut (max. torque acc. to Table B2).
<p>R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W</p>	<p>Annex B6</p>
<p>Intended use Installation instruction – hollow and perforated masonry</p>	<p>of European Technical Assessment ETA-12/0528</p>

Table B4: Base materials

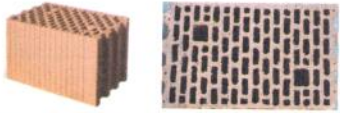
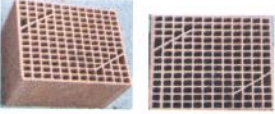





Type and dimensions	Standard
Brick No. 1. Solid clay bricks: 240 x 115 x 71 mm (e.g. Wienerberger Mz 20/2.0) $f_b \geq 20 \text{ N/mm}^2$; $\rho_m \geq 2,0 \text{ kg/dm}^3$ 	EN 771-1
Brick No. 2. Autoclaved aerated concrete blocks AAC 7: 599 x 199 x 240 mm $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,65 \text{ kg/dm}^3$ 	EN 771-4
Brick No. 3. Solid silicate bricks: 240 x 115 x 71 mm (e.g. KS NF 20/2.0) $f_b \geq 20 \text{ N/mm}^2$; $\rho_m \geq 2,0 \text{ kg/dm}^3$ 	EN 771-2
Brick No. 4. Silicate hollow blocks: 248 x 240 x 238 mm (e.g. KS Ratio Block 8 DF 12/1.4) $f_b \geq 12 \text{ N/mm}^2$; $\rho_m \geq 1,4 \text{ kg/dm}^3$ 	EN 771-2
Brick No. 5. Perforated ceramic blocks: 373 x 240 x 249 mm (e.g. Poroton Hlz 12/0.9 DF) $f_b \geq 12 \text{ N/mm}^2$; $\rho_m \geq 0,9 \text{ kg/dm}^3$ 	EN 771-1
Brick No. 6. Perforated ceramic blocks: 373 x 238 x 250 mm (e.g. Wienerberger Porotherm 25 P+W); $f_b \geq 15 \text{ N/mm}^2$; $\rho_m \geq 0,8 \text{ kg/dm}^3$ 	EN 771-1
Brick No. 7. Perforated ceramic blocks: 380 x 250 x 238 mm (e.g. Leier Thermopor 38 P+W) $f_b \geq 10 \text{ N/mm}^2$; $\rho_m \geq 0,7 \text{ kg/dm}^3$ 	EN 771-1

**R-KEM II / R-KEM II-S / R-KEM II-W
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Intended use
Base materials (1)

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Table B5: Base materials

Type and dimensions	Standard
<p>Brick No. 8. Perforated ceramic blocks: 375 x 250 x 238 mm (e.g. Kozłowice MEGA-MAX 250/238 P+W); $f_b \geq 15 \text{ N/mm}^2$; $\rho_m \geq 0,8 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 9. Perforated ceramic blocks: 300 x 375 x 212 mm (e.g. LS Tableau Mono Rect) $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,93 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 10. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. LS Tableau Rect) $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,75 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 11. Perforated ceramic blocks: 300 x 300 x 212 mm (e.g. LS Monomur 30) $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,865 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 12. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo) $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,659 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 13. Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo Plus) $f_b \geq 6 \text{ N/mm}^2$; $\rho_m \geq 0,755 \text{ kg/dm}^3$</p> 	EN 771-1
<p>Brick No. 14. Lightweight concrete hollow blocks Hbl: 245 x 245 x 300 mm $f_b \geq 2 \text{ N/mm}^2$; $\rho_m \geq 0,8 \text{ kg/dm}^3$</p> 	EN 771-3

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Intended use
Base materials (2)

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Table C1: Characteristic tension load and shear load values

Density / compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s \times l_s$	M	h_{ef}	N_{Rk}^1	V_{Rk}^2
[kg/dm ³] / [N/mm ²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 1					
$\rho_m \geq 2,0$ $f_b \geq 20$	without	M8	80	6,0	3,5
		M10	85	7,0	5,0
		M12	95	7,0	7,0
		M16	105	7,0	7,0
Brick No. 2					
$\rho_m \geq 0,65$ $f_b \geq 6$	without	M8	80	1,5	1,5
		M10	85	2,0	2,0
		M12	95	2,5	2,5
		M16	105	3,0	2,5
Brick No. 3					
$\rho_m \geq 2,0$ $f_b \geq 20$	without	M8	80	5,0	3,5
		M10	85	5,0	5,0
		M12	95	5,0	5,0
		M16	105	5,0	5,0
Brick No. 4					
$\rho_m \geq 1,4$ $f_b \geq 12$	$\phi 12 \times 50$	M8	50	2,5	2,5
	$\phi 12 \times 80$	M8	80	2,5	2,5
	$\phi 15 \times 85$	M10	85	2,5	2,5
	$\phi 15 \times 125$	M10	125	3,5	2,5
	$\phi 15 \times 85$	M12	85	3,0	2,5
	$\phi 15 \times 125$	M12	125	3,0	2,5
	$\phi 20 \times 85$	M16	85	3,0	2,5
Brick No. 5					
$\rho_m \geq 0,9$ $f_b \geq 12$	$\phi 12 \times 50$	M8	50	2,0	2,0
	$\phi 12 \times 80$	M8	80	2,5	2,5
	$\phi 15 \times 85$	M10	85	3,0	2,5
	$\phi 15 \times 125$	M10	125	3,5	2,5
	$\phi 15 \times 85$	M12	85	3,5	2,5
	$\phi 15 \times 125$	M12	125	4,0	2,5
	$\phi 20 \times 85$	M16	85	4,0	2,5

Partial safety factor $\gamma_M = 2,0$ for AAC (Brick No. 2) and $\gamma_M = 2,5$ for other base materials (in the absence of national regulation)

¹ For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,pb} = N_{Rk,s}$

² For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

For solid masonry (Brick No. 1, 2 and 3) $V_{Rk,c}$ shall be calculated acc. to ETAG 029, Annex C, equation C.5.7.

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Characteristic tension load and shear load values (1)

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Table C2: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s \times l_s$	M	h_{ef}	N_{Rk}^1	V_{Rk}^2
[kg/dm ³] / [N/mm ²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 6					
$\rho_m \geq 0,8$ $f_b \geq 15$	$\phi 12 \times 50$	M8	50	1,5	1,5
	$\phi 12 \times 80$	M8	80	2,0	2,0
	$\phi 15 \times 85$	M10	85	2,5	2,0
	$\phi 15 \times 125$	M10	125	2,5	2,5
	$\phi 15 \times 85$	M12	85	3,5	2,5
	$\phi 15 \times 125$	M12	125	3,5	2,5
	$\phi 20 \times 85$	M16	85	2,5	2,5
Brick No. 7					
$\rho_m \geq 0,7$ $f_b \geq 10$	$\phi 12 \times 50$	M8	50	1,5	1,5
	$\phi 12 \times 80$	M8	80	2,0	2,0
	$\phi 15 \times 85$	M10	85	2,0	2,0
	$\phi 15 \times 125$	M10	125	2,5	2,5
	$\phi 15 \times 85$	M12	85	2,5	2,5
	$\phi 15 \times 125$	M12	125	3,5	2,5
	$\phi 20 \times 85$	M16	85	3,0	2,5
Brick No. 8					
$\rho_m \geq 0,8$ $f_b \geq 15$	$\phi 12 \times 50$	M8	50	2,0	2,0
	$\phi 12 \times 80$	M8	80	2,5	2,5
	$\phi 15 \times 85$	M10	85	3,5	2,5
	$\phi 15 \times 125$	M10	125	3,5	2,5
	$\phi 15 \times 85$	M12	85	4,0	2,5
	$\phi 15 \times 125$	M12	125	4,0	2,5
	$\phi 20 \times 85$	M16	85	4,0	2,5
Brick No. 9					
$\rho_m \geq 0,93$ $f_b \geq 6$	$\phi 12 \times 50$	M8	50	0,9	0,9
	$\phi 12 \times 80$	M8	80	0,9	0,9
	$\phi 15 \times 85$	M10	85	2,0	1,5
	$\phi 15 \times 125$	M10	125	2,0	2,0
	$\phi 15 \times 85$	M12	85	2,0	2,0
	$\phi 15 \times 125$	M12	125	2,0	2,0
	$\phi 20 \times 85$	M16	85	1,5	1,2

Partial safety factor $\gamma_M = 2,5$ (in the absence of national regulation)

¹ For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,pb} = N_{Rk,s}$

² For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Characteristic tension load and shear load values (2)

Annex C2
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Table C3: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s \times l_s$	M	h_{ef}	N_{Rk}^1	V_{Rk}^2
[kg/dm ³] / [N/mm ²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 10					
$\rho_m \geq 0,75$ $f_b \geq 6$	$\phi 12 \times 50$	M8	50	1,2	0,9
	$\phi 12 \times 80$	M8	80	1,2	1,2
	$\phi 15 \times 85$	M10	85	1,5	1,5
	$\phi 15 \times 125$	M10	125	1,5	1,5
	$\phi 15 \times 85$	M12	85	2,0	1,5
	$\phi 15 \times 125$	M12	125	2,0	2,0
	$\phi 20 \times 85$	M16	85	1,5	1,5
Brick No. 11					
$\rho_m \geq 0,865$ $f_b \geq 6$	$\phi 12 \times 50$	M8	50	0,9	0,9
	$\phi 12 \times 80$	M8	80	0,9	0,9
	$\phi 15 \times 85$	M10	85	1,5	1,2
	$\phi 15 \times 125$	M10	125	1,5	1,5
	$\phi 15 \times 85$	M12	85	1,5	1,5
	$\phi 15 \times 125$	M12	125	1,5	1,5
	$\phi 20 \times 85$	M16	85	1,5	1,5
Brick No. 12					
$\rho_m \geq 0,659$ $f_b \geq 6$	$\phi 12 \times 50$	M8	50	0,9	0,9
	$\phi 12 \times 80$	M8	80	0,9	0,9
	$\phi 15 \times 85$	M10	85	1,5	1,5
	$\phi 15 \times 125$	M10	125	1,5	1,5
	$\phi 15 \times 85$	M12	85	1,5	1,5
	$\phi 15 \times 125$	M12	125	1,5	1,5
	$\phi 20 \times 85$	M16	85	1,5	1,5
Brick No. 13					
$\rho_m \geq 0,755$ $f_b \geq 6$	$\phi 12 \times 50$	M8	50	1,2	0,9
	$\phi 12 \times 80$	M8	80	1,2	1,2
	$\phi 15 \times 85$	M10	85	1,2	0,9
	$\phi 15 \times 125$	M10	125	1,2	0,9
	$\phi 15 \times 85$	M12	85	1,2	1,2
	$\phi 15 \times 125$	M12	125	1,5	1,5
	$\phi 20 \times 85$	M16	85	1,2	1,2

Partial safety factor $\gamma_M = 2,5$ (in the absence of national regulation)

¹ For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pt} = N_{Rk,s}$

² For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Characteristic tension load and shear load values (3)

Annex C3
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Table C4: Characteristic tension load and shear load values

Density / Compressive strength	Sleeve	Anchor size	Effective anchorage depth	Characteristic resistance	Characteristic resistance
ρ_m / f_b	$\phi d_s \times l_s$	M	h_{ef}	N_{Rk}^1	V_{Rk}^2
[kg/dm ³] / [N/mm ²]	[-]	[-]	[mm]	[kN]	[kN]
Brick No. 14					
$\rho_m \geq 0,8$ $f_b \geq 2$	$\phi 12 \times 50$	M8	50	1,2	1,2
	$\phi 12 \times 80$	M8	80	1,5	1,5
	$\phi 15 \times 85$	M10	85	2,5	2,5
	$\phi 15 \times 125$	M10	125	2,5	2,0
	$\phi 15 \times 85$	M12	85	2,5	2,5
	$\phi 15 \times 125$	M12	125	2,5	2,5
	$\phi 20 \times 85$	M16	85	2,5	2,5
Partial safety factor $\gamma_M = 2,5$ (in the absence of national regulation)					

¹ For design according to ETAG 029, Annex C: $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{R,pb} = N_{Rk,s}$

² For design according to ETAG 029, Annex C: $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

Table C5: Characteristic bending moments

Size of rod			M8	M10	M12	M16	
Characteristic bending moment	$M_{Rk,s}$	Nm	5.8	19	37	65	166
			6.8	22	45	79	200
			A4-70	26	52	92	232
Partial safety factor	γ_{Ms}	-	5.8	1,25			
			6.8	1,25			
			A4-70	1,56			

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Characteristic tension load and shear load values (4).
Characteristic bending moments

Annex C4
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Table C6: Displacement under tension load

Brick No. 1					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,11	0,12	0,15	0,16
δ_{Nz}	[mm]	0,36	0,36	0,36	0,36
Brick No. 2					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,05	0,07	0,10	0,11
δ_{Nz}	[mm]	0,19	0,19	0,20	0,22
Brick No. 3					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,13	0,15	0,15	0,18
δ_{Nz}	[mm]	0,36	0,36	0,36	0,36
Brick No. 4					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,10	0,13	0,15	0,18
δ_{Nz}	[mm]	0,36	0,36	0,36	0,36
Brick No. 5					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,14	0,13	0,24	0,18
δ_{Nz}	[mm]	0,36	0,36	0,48	0,36
Brick No. 6					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,09	0,27	0,14	0,16
δ_{Nz}	[mm]	0,36	0,54	0,36	0,36
Brick No. 7					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,05	0,16	0,30	0,28
δ_{Nz}	[mm]	0,36	0,36	0,60	0,56

Equation $N = N_{RK} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Displacements under tension load (1)

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Table C7: Displacement under tension load

Brick No. 8					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,08	0,10	0,10	0,27
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,54
Brick No. 9					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,06	0,04	0,07	0,10
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 10					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,05	0,08	0,12
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 11					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,05	0,08	0,12
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 12					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,06	0,08	0,08	0,15
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 13					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,04	0,04	0,10	0,07
$\delta_{N_{\infty}}$	[mm]	0,36	0,36	0,36	0,36
Brick No. 14					
Size of rod		M8	M10	M12	M16
δ_{N0}	[mm]	0,22	0,25	0,30	0,20
$\delta_{N_{\infty}}$	[mm]	0,44	0,50	0,60	0,40

Equation N = $N_{RK} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Displacements under tension load (2)

Annex C6
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Table C8: Displacement under shear load

Brick No. 1					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,29	0,33	0,34	0,42
$\delta_{V\infty}$	[mm]	0,44	0,50	0,51	0,63
Brick No. 2					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,15	0,16	0,22	0,23
$\delta_{V\infty}$	[mm]	0,23	0,24	0,33	0,35
Brick No. 3					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,21	0,22	0,25	0,25
$\delta_{V\infty}$	[mm]	0,32	0,33	0,38	0,38
Brick No. 4					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,10	0,13	0,16	0,20
$\delta_{V\infty}$	[mm]	0,15	0,20	0,24	0,30
Brick No. 5					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,18	0,22	0,25	0,25
$\delta_{V\infty}$	[mm]	0,27	0,33	0,38	0,38
Brick No. 6					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,18	0,21	0,23	0,19
$\delta_{V\infty}$	[mm]	0,27	0,32	0,35	0,29
Brick No. 7					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,24	0,2	0,34	0,26
$\delta_{V\infty}$	[mm]	0,36	0,30	0,51	0,39

Equation $V = V_{RK} / \gamma_F \times \gamma_{M1}$, with $\gamma_F = 1,4$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Przemieszczenia od obciążeń ścinających (1)

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Table C9: Displacement under shear load

Brick No. 8					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,11	0,13	0,36	0,27
$\delta_{V\infty}$	[mm]	0,17	0,20	0,54	0,41
Brick No. 9					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,12	0,15	0,22	0,21
$\delta_{V\infty}$	[mm]	0,18	0,23	0,33	0,32
Brick No. 10					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,11	0,14	0,15	0,25
$\delta_{V\infty}$	[mm]	0,17	0,21	0,23	0,38
Brick No. 11					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,14	0,15	0,25	0,20
$\delta_{V\infty}$	[mm]	0,21	0,23	0,38	0,30
Brick No. 12					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,09	0,11	0,24	0,26
$\delta_{V\infty}$	[mm]	0,14	0,17	0,36	0,39
Brick No. 13					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,1	0,14	0,17	0,21
$\delta_{V\infty}$	[mm]	0,15	0,21	0,26	0,32
Brick No. 14					
Size of rod		M8	M10	M12	M16
δ_{V0}	[mm]	0,24	0,35	0,32	0,34
$\delta_{V\infty}$	[mm]	0,36	0,53	0,48	0,51

Equation $V = V_{Rk} / \gamma_F \times \gamma_M$, with $\gamma_F = 1,4$

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
Displacements under shear load (2)

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Table C10: β -factor for job site tests according to ETAG 029, Annex B

Base material	Size of rod	β -factor
Brick No. 1	M8 to M16	0,71
Brick No. 2	M8 to M16	0,59
Brick No. 3 to 14	M8 to M16	0,71

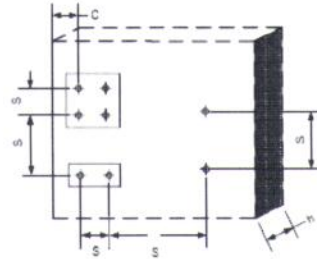


Table C11: Brick No. 1, 2 and 3 - edge distance and spacing for tension load

d_{nom} [mm]	$S_{cr,N}$ [mm]	$C_{cr,N}$ [mm]	$S_{cr,min}$ [mm]	$C_{cr,min}$ [mm]
8	$20 \times d_{nom}$	$10 \times d_{nom}$	50	50
10	$20 \times d_{nom}$	$10 \times d_{nom}$	50	50
12	$20 \times d_{nom}$	$10 \times d_{nom}$	50	50
16	$20 \times d_{nom}$	$10 \times d_{nom}$	54	54

Table C12: Brick No. 4 to 14 - edge distance and spacing for tension load

$d_{nom} + \phi d_s \times L_s$ [mm]	$S_{cr,N}$ [mm]	$C_{cr,N}$ [mm]	$S_{cr,min}$ [mm]	$C_{cr,min}$ [mm]
$8 + \phi 12 \times 50$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$8 + \phi 12 \times 80$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$10 + \phi 15 \times 85$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$10 + \phi 15 \times 125$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$12 + \phi 15 \times 85$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$12 + \phi 15 \times 125$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	100	100
$16 + \phi 20 \times 85$	$l_{unit,max}$	$0,5 \times l_{unit,max}$	120	120

Table C13: Brick No. 4 to 14 - edge distance and spacing for shear load

$d_{nom} + \phi d_s \times L_s$ [mm]	$S_{cr,cv}$ [mm]	$C_{cr,cv}$ [mm]
$8 + \phi 12 \times 50$	$l_{unit,max}$	$l_{unit,max}$
$8 + \phi 12 \times 80$	$l_{unit,max}$	$l_{unit,max}$
$10 + \phi 15 \times 85$	$l_{unit,max}$	$l_{unit,max}$
$10 + \phi 15 \times 125$	$l_{unit,max}$	$l_{unit,max}$
$12 + \phi 15 \times 85$	$l_{unit,max}$	$l_{unit,max}$
$12 + \phi 15 \times 125$	$l_{unit,max}$	$l_{unit,max}$
$16 + \phi 20 \times 85$	$l_{unit,max}$	$l_{unit,max}$

$l_{unit,max}$ – max. length of masonry unit

**R-KEM II / R-KEM II-S / R-KEM II-W
and RM50 / RM50-S / RM50-W**

Performances
 β - factor, edge distance and spacing

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