INSTYTUT TECHNIKI BUDOWLANEJ

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

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# European Technical Assessment

# ETA-20/0935 of 29/07/2025

## 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** | Metal injection anchors for use in masonry |
| **Manufacturer** | RAWLPLUG S.A.<br>ul. Kwidzyńska 6<br>51-416 Wrocław<br>Poland |
| **Manufacturing plant** | Manufacturing Plant No. 3 |
| **This European Technical Assessment contains** | 27 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) 330076-01-0604 "Metal injection anchors for use in masonry" |
| **This version replaces** | ETA-20/0935 issued on 31/03/2025 |

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## Specific Part

### 1 Technical description of the product

The R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W is a bonded anchor (injection type) consisting of a injection mortar cartridge, a perforated sleeve and an anchor rod with hexagon nut and washer. The steel elements 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.

The description of the products is given in Annex A.

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

The performances given in clause 3 are only valid if the anchor is used in 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 the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or Technical Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

### 3.1 Performance of the product

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

| Essential characteristic | Performance |
|---|---|
| Characteristic resistance for static and quasi-static loading | Annex C1 – C10 |
| Characteristic resistance and displacements for seismic loading | No performance assessed |

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

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | No performance assessed |
| Resistance to fire under tension and shear loading with and without lever arm, minimum edge distances and spacing | No performance assessed |

#### 3.1.3. Hygiene, health and the environment (BWR 3)

| Essential characteristic | Performance |
|---|---|
| Content, emission and/or release of dangerous substances | No performance assessed |

### 3.2 Methods used for the assessment

The assessment has been made in accordance with EAD 330076-01-0604.

## 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 1 of assessment and verification of constancy of performance (see Annex V to the 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.

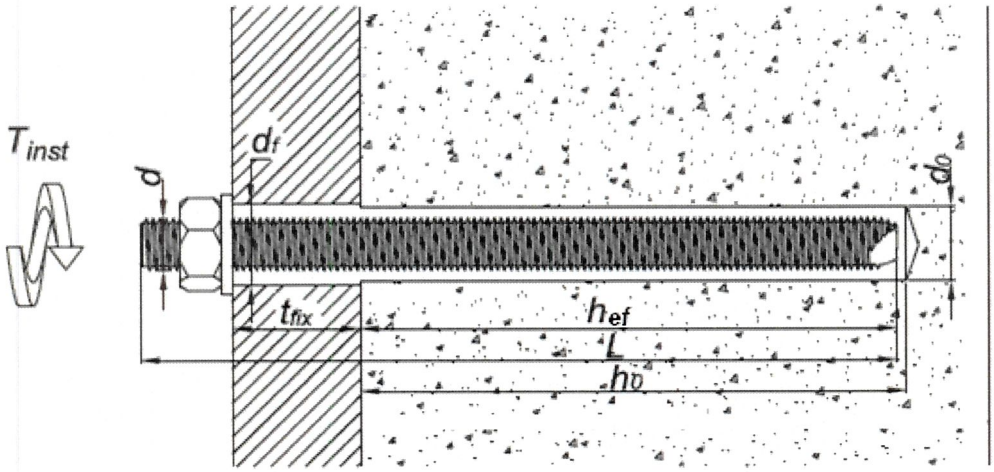
For the type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between Instytut Techniki Budowlanej and the notified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

Issued in Warsaw on 29/07/2025 by Instytut Techniki Budowlanej

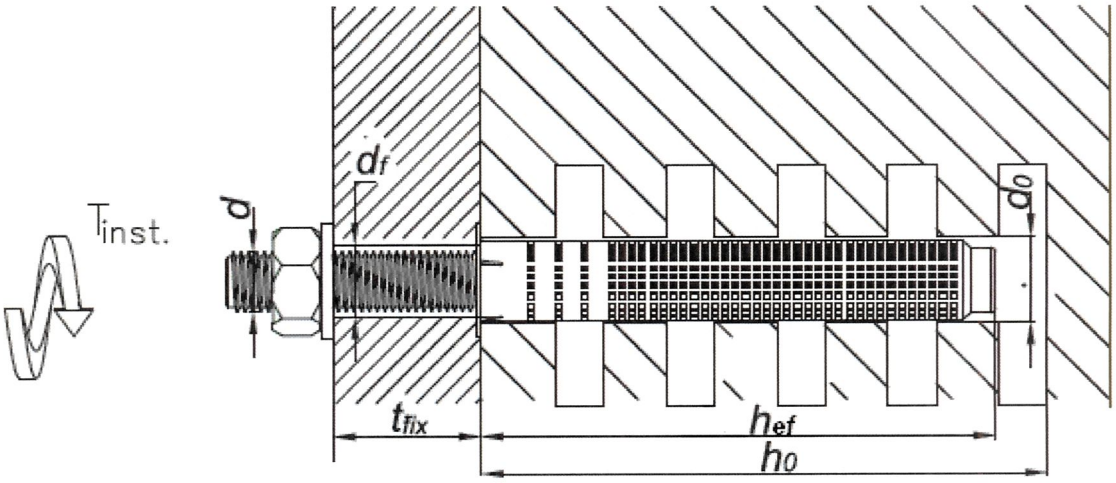
Anna Panek, MSc

Deputy Director of ITB

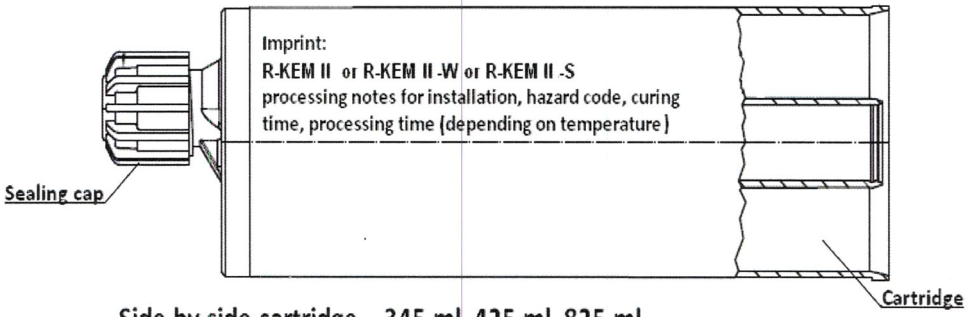
**Anchor rod without perforated sleeve – installation in solid masonry**



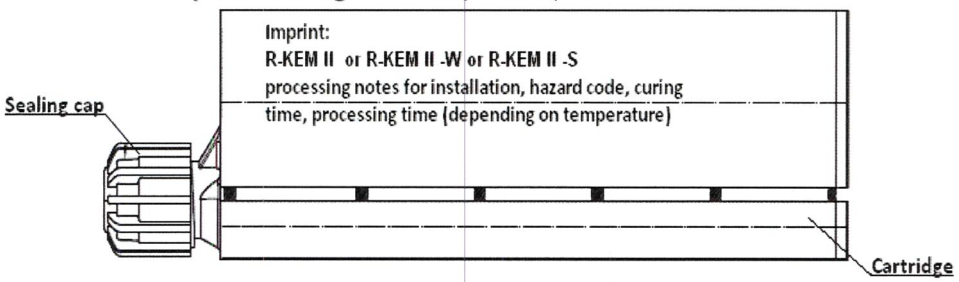

**Anchor rod with perforated sleeve – installation in perforated masonry**



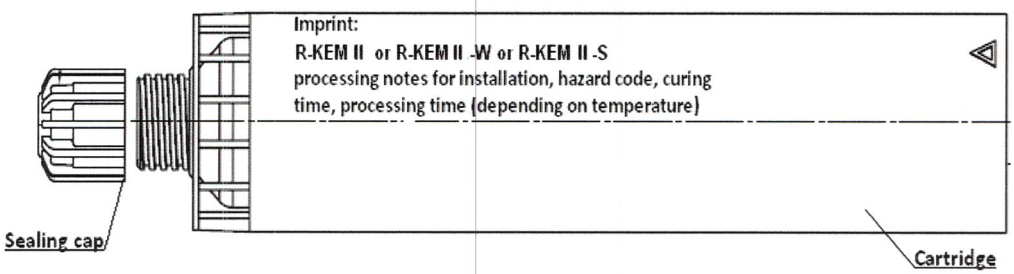
Coaxial cartridge –
150 ml, 280 ml, 300 ml, 310 ml, 330 ml, 380 ml, 400 ml, 410 ml, 420 ml.



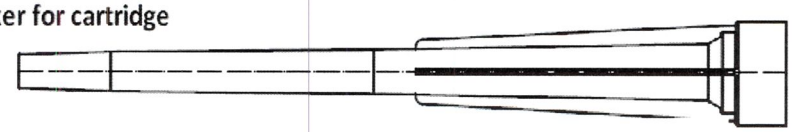

Side by side cartridge – 345 ml, 425 ml, 825 ml.




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.



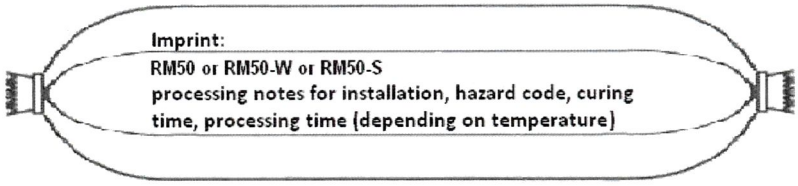

Mixer for cartridge



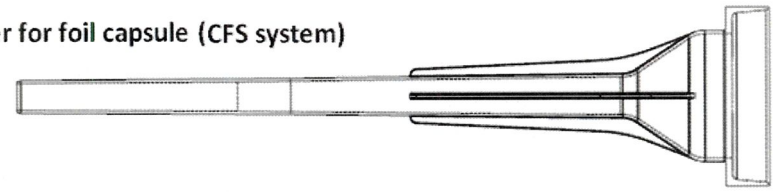
| R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W | Annex A2 of European Technical Assessment ETA-20/0935 |
|---|---|
| **Product description** Cartridge type and sizes (R-KEM II / R-KEM II-S / R-KEM II-W) | |

Foil capsule (CFS system) –

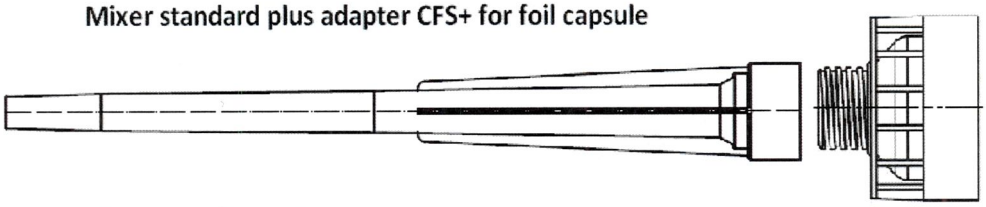
150 ml, 175 ml, 280ml, 300 ml, 310 ml, 380 ml, 400 ml, 550 ml, 600 ml.



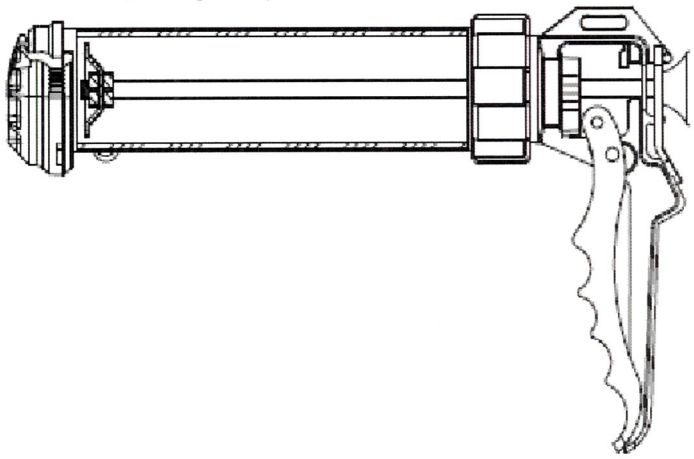

Mixer for foil capsule (CFS system)



Mixer standard plus adapter CFS+ for foil capsule

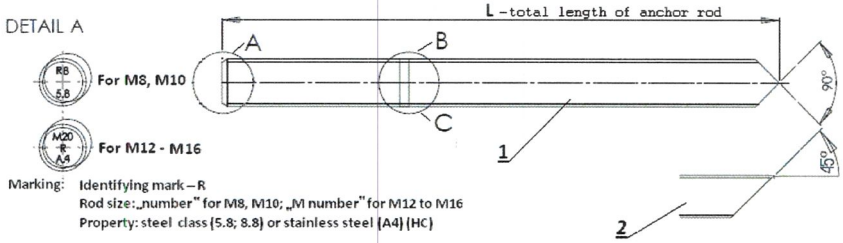


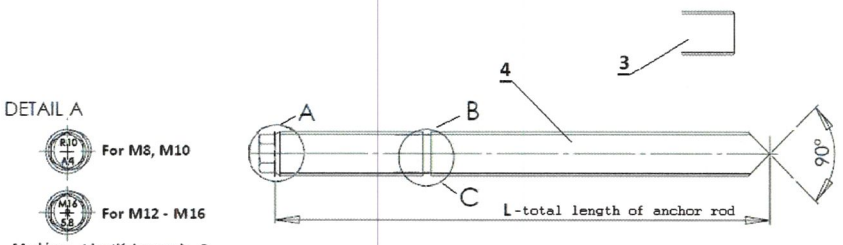
Gun for foil capsule (CFS system)

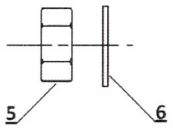


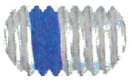
| | |
|---|---|
| **R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W** | **Annex A3** of European Technical Assessment ETA-20/0935 |
| **Product description** Cartridge type and sizes (RM50 / RM50-S / RM50-W) | |

## Threaded anchor rods



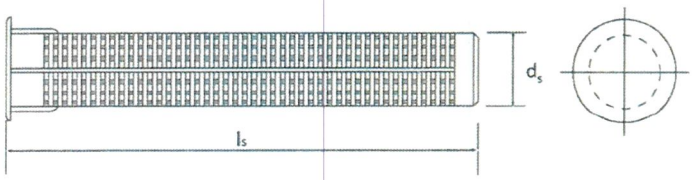
DETAIL B
**Painted Mark Version**
**Depth $h_{ef}$**



DETAIL C
**Notched Mark Version**
**Depth $h_{ef}$**

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 | $d_s$ x $l_s$ | [mm] | 12 x 50 | 12 x 80 | 16 x 85 | 16 x 130 | 16 x 85 | 16 x 130 | 20 x 85 |

**Table A1: Threaded rods**

| Part | Designation | | |
|---|---|---|---|
| | **Steel, zinc plated** | **Stainless steel (A4)** | **High corrosion resistance stainless steel (HCR)** |
| Anchor 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 | 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 ≥ 5 µm acc. to EN ISO 4042 or hot-dip galvanized ≥ 45 µm acc. to EN ISO 10684 | Material 1.4401, 1.4404, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506 | Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506 |
| 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 | 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<br>Hardener: dibenzoyl peroxide<br>Additive: quartz sand (filler)<br>Supplied in three colors: standard, grey (G) and stone (ST) |

**Specification of intended use**

**Anchorages subject to:**

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

**Base materials:**

- Solid clay bricks (base material group b), according to Annex B2.
- Autoclaved aerated concrete blocks AAC (base material group d), according to Annex B2.
- Solid silicate bricks (base material group b), according to Annex B2.
- Silicate hollow blocks (base material group c), according to Annex B2.
- Perforated ceramic blocks (base material group c), according to Annexes B2 and B3.
- Lightweight concrete hollow blocks (base material group c), according to Annex B3.
- 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 EOTA Technical Report TR 053 under consideration of the β-factor according to Table C10.

**Temperature range:**

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

**Use conditions (Environmental conditions):**

- Condition w/w: installation in dry or wet base material and use in structures subject to dry or wet environmental conditions.
- Structures subject to dry internal conditions: all materials.
- For all other conditions according to EN 1993-1-4, Annex A, Table A3 corresponding to corrosion resistance class (CRC):
  - stainless steel A4: CRC III,
  - high corrosion resistance steel (HCR): CRC V.

**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 the EOTA Technical Report TR 054 under the responsibility of an engineer experienced in anchorages and masonry work.

**Installation:**

- Hole drilling by rotary drill mode (AAC, hollow and perforated masonry) and hammer drill mode (solid masonry)
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

**Table B1: Base materials**

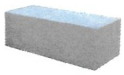
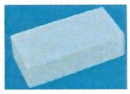
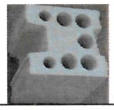
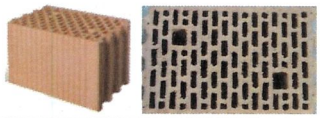
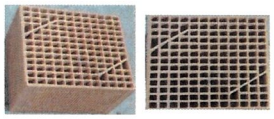
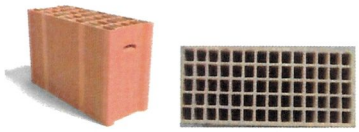
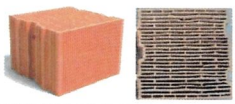
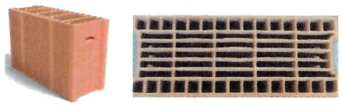
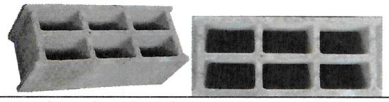
| Type and dimensions | Standard |
|---|---|
| **Brick No. 1.** Solid clay bricks: 240 x 115 x 71 mm (e.g. Wienerberger Mz 20/2.0)<br>$f_b \geq 20$ N/mm²; $\rho_m \geq 2{,}0$ kg/dm³  | EN 771-1 |
| **Brick No. 2.** Autoclaved aerated concrete blocks AAC 7: 599 x 199 x 240 mm<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}65$ kg/dm³  | EN 771-4 |
| **Brick No. 3.** Solid silicate bricks: 240 x 115 x 71 mm (e.g. KS NF 20/2.0)<br>$f_b \geq 20$ N/mm²; $\rho_m \geq 2{,}0$ kg/dm³  | 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)<br>$f_b \geq 12$ N/mm²; $\rho_m \geq 1{,}4$ kg/dm³; outer web thickness ≥ 17 mm   | EN 771-2 |
| **Brick No. 5.** Perforated ceramic blocks: 373 x 240 x 249 mm (e.g. Poroton Hlz 12/0.9 DF)<br>$f_b \geq 12$ N/mm²; $\rho_m \geq 0{,}9$ kg/dm³; outer web thickness ≥ 9 mm   | EN 771-1 |
| **Brick No. 6.** Perforated ceramic blocks: 373 x 238 x 250 mm (e.g. Wienerberger Porotherm 25 P+W)<br>$f_b \geq 15$ N/mm²; $\rho_m \geq 0{,}8$ kg/dm³;<br>outer web thickness ≥ 10 mm   | EN 771-1 |
| **Brick No. 7.** Perforated ceramic blocks: 380 x 250 x 238 mm (e.g. Leier Thermopor 38 P+W)<br>$f_b \geq 10$ N/mm²; $\rho_m \geq 0{,}7$ kg/dm³; outer web thickness ≥ 9 mm  | EN 771-1 |

**Table B2: Base materials**

| Type and dimensions | Standard |
|---|---|
| **Brick No. 8.** Perforated ceramic blocks: 375 x 250 x 238 mm (e.g. Kozłowice MEGA-MAX 250/238 P+W)<br>$f_b \geq 15$ N/mm²; $\rho_m \geq 0{,}8$ kg/dm³;<br>outer web thickness ≥ 17 mm  | EN 771-1 |
| **Brick No. 9.** Perforated ceramic blocks: 300 x 375 x 212 mm (e.g. LS Tableau Mono Rect[1])<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}93$ kg/dm³  | EN 771-1 |
| **Brick No. 10.** Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. LS Tableau Rect[1])<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}75$ kg/dm³  | EN 771-1 |
| **Brick No. 11.** Perforated ceramic blocks: 300 x 300 x 212 mm (e.g. LS Monomur 30[2])<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}865$ kg/dm³  | EN 771-1 |
| **Brick No. 12.** Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo[3])<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}659$ kg/dm³  | EN 771-1 |
| **Brick No. 13.** Perforated ceramic blocks: 500 x 200 x 314 mm (e.g. SM BGV Thermo Plus[3])<br>$f_b \geq 6$ N/mm²; $\rho_m \geq 0{,}755$ kg/dm³  | EN 771-1 |
| **Brick No. 14.** Lightweight concrete hollow blocks Hbl: 245 x 245 x 300 mm<br>$f_b \geq 2$ N/mm²; $\rho_m \geq 0{,}8$ kg/dm³; outer web thickness ≥ 25 mm  | EN 771-3 |

[1] The value of $N_{Rk}$ applies only for outer web thickness ≥ 9 mm; otherwise the characteristic resistance shall be determined by job site pull-out tests
[2] According to DTA 16/15-692
[3] According to DTA 16/14-697

**Table B3: Installation parameters of anchor rods in solid masonry and AAC (without perforated sleeves)**

| Size of rod | | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|---|
| Nominal diameter | | $d_{nom}$ | [mm] | 8 | 10 | 12 | 16 |
| Nominal drill hole diameter | | $d_0$ | [mm] | 10 | 12 | 14 | 18 |
| Diameter of clearance hole of the fixture | | $d_f \leq$ | [mm] | 9 | 12 | 14 | 18 |
| Drill hole depth | | $h_0$ | [mm] | 85 | 90 | 100 | 110 |
| Effective embedment depth | | $h_{ef}$ | [mm] | 80 | 85 | 95 | 105 |
| Maximum 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 |

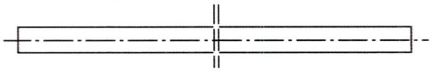
**Table B4: Installation parameters of anchor rods with perforated sleeves in hollow or perforated masonry**

| Size of rod | | | M8 | M8 | M10 | M10 | M12 | M12 | M16 |
|---|---|---|---|---|---|---|---|---|---|
| Size of sleeve | $d_s x l_s$ | [mm] | 12 x 50 | 12 x 80 | 16 x 85 | 16 x 130 | 16 x 85 | 16 x 130 | 20 x 85 |
| Nominal diameter | $d_{nom}$ | [mm] | 8 | 8 | 10 | 10 | 12 | 12 | 16 |
| Nominal drill hole diameter | $d_0$ | [mm] | 12 | 12 | 16 | 16 | 16 | 16 | 20 |
| Diameter of clearance hole of the fixture | $d_f \leq$ | [mm] | 9 | 9 | 12 | 12 | 14 | 14 | 18 |
| Drill hole depth | $h_0$ | [mm] | 55 | 85 | 90 | 130 | 90 | 130 | 90 |
| Effective embedment depth | $h_{ef}$ | [mm] | 50 | 80 | 85 | 125 | 85 | 125 | 85 |
| Maximum 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 |

**Table B5: Maximum processing time and minimum curing time**

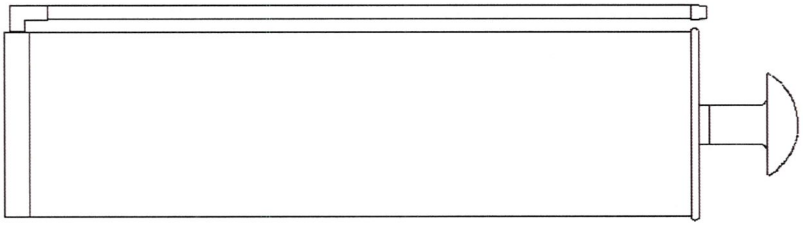
| Mortar temperature | Base material temperature | Maximum processing time [min.] | | | Minimum curing time [min.] | | |
|---|---|---|---|---|---|---|---|
| | | R-KEM II / RM50 | R-KEM II-S / RM50-S | R-KEM II-W / RM50-W | R-KEM II / RM50 | R-KEM II-S / RM50-S | R-KEM II-W / RM50-W |
| 5°C | -20°C | - | - | 45 | - | - | 1440 |
| 5°C | -10°C | - | - | 20 | - | - | 480 |
| 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 | - |

**Additional mixer extension**



*Variable length from 300mm up to 1000mm.

**Manual blower pump**



**Steel brush**

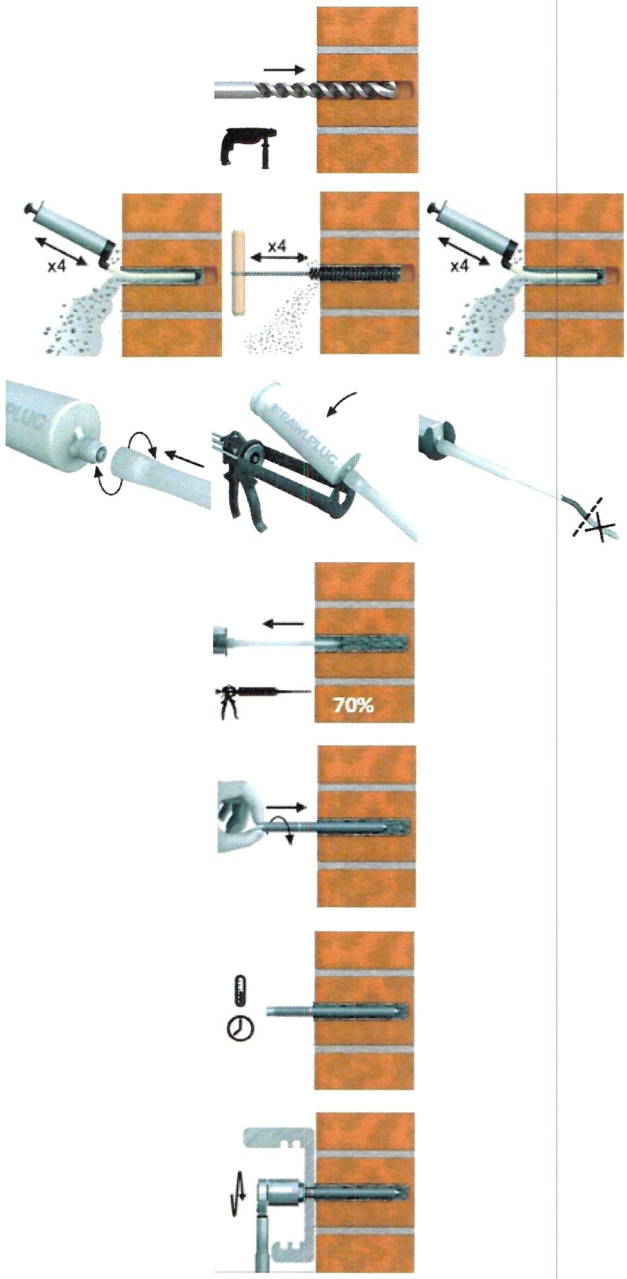



**Brush diameter for solid masonry**

| **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 |




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 color is obtained.
4. Insert the mixing nozzle to the far end the hole and inject the mortar, slowly withdrawing the nozzle as the hole is filled to 70% of it's depth.
5. Immediately insert the stud, slowly and with slight twisting motion. Remove any excess mortar around the hole before it sets.
6. Leave the fixing undisturbed until the minimum curing time elapses.
7. Attach the fixture and tighten the nut (max. torque moment acc. to Table B3).

| | |
|---|---|
| **R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W** | **Annex B7** of European Technical Assessment ETA-20/0935 |
| **Intended use** Installation instruction – solid masonry and AAC | |




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 color is obtained.
5. Insert the nozzle to the end of the sleeve and inject the mortar 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 mortar 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 moment acc. to Table B4).

| **R-KEM II / R-KEM II-S / R-KEM II-W and RM50 / RM50-S / RM50-W** | **Annex B8** of European Technical Assessment ETA-20/0935 |
|---|---|
| **Intended use** Installation instruction – hollow and perforated masonry | |

**Table C1: Characteristic resistance under tension and shear loading**

| Density / Compressive strength | Sleeve | Anchor size | Effective embedment depth | Characteristic resistance | Characteristic resistance |
|---|---|---|---|---|---|
| $\rho_m$ / $f_b$ | $d_s$ x $l_s$ | M | $h_{ef}$ | $N_{Rk}$ [1)] | $V_{Rk}$ [2)] |
| [kg/dm³] / [N/mm²] | [-] | [-] | [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 | 1,5 | 1,5 |
| | | M12 | 95 | 2,0 | 2,0 |
| | | M16 | 105 | 2,5 | 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** | | | | | |
| $\rho_m \geq 1,4$ / $f_b \geq 12$ | 12 x 50 | M8 | 50 | 2,0 | 2,0 |
| | 12 x 80 | M8 | 80 | 2,0 | 2,0 |
| | 16 x 85 | M10 | 85 | 2,5 | 2,5 |
| | 16 x 125 | M10 | 125 | 3,5 | 2,5 |
| | 16 x 85 | M12 | 85 | 2,5 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,0 | 2,5 |
| | 20 x 85 | M16 | 85 | 2,5 | 2,5 |
| **Brick No. 5** | | | | | |
| $\rho_m \geq 0,9$ / $f_b \geq 12$ | 12 x 50 | M8 | 50 | 2,0 | 2,0 |
| | 12 x 80 | M8 | 80 | 2,0 | 2,0 |
| | 16 x 85 | M10 | 85 | 3,0 | 2,5 |
| | 16 x 125 | M10 | 125 | 3,0 | 2,5 |
| | 16 x85 | M12 | 85 | 3,5 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,5 | 2,5 |
| | 20 x 85 | M16 | 85 | 4,0 | 2,5 |

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

[1)] $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$

[2)] $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

**Table C2: Characteristic resistance under tension and shear loading**

| Density / Compressive strength | Sleeve | Anchor size | Effective embedment depth | Characteristic resistance | Characteristic resistance |
|---|---|---|---|---|---|
| $\rho_m$ / $f_b$ | $d_s$ x $l_s$ | M | $h_{ef}$ | $N_{Rk}$ 1) | $V_{Rk}$ 2) |
| [kg/dm³] / [N/mm²] | [-] | [-] | [mm] | [kN] | [kN] |
| **Brick No. 6** | | | | | |
| $\rho_m \geq 0,8$ / $f_b \geq 15$ | 12 x 50 | M8 | 50 | 1,2 | 1,2 |
| | 12 x 80 | M8 | 80 | 1,5 | 1,5 |
| | 16 x 85 | M10 | 85 | 2,0 | 2,0 |
| | 16 x 125 | M10 | 125 | 2,5 | 2,5 |
| | 16 x 85 | M12 | 85 | 3,0 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,0 | 2,5 |
| | 20 x 85 | M16 | 85 | 2,0 | 2,0 |
| **Brick No. 7** | | | | | |
| $\rho_m \geq 0,7$ / $f_b \geq 10$ | 12 x 50 | M8 | 50 | 1,2 | 1,2 |
| | 12 x 80 | M8 | 80 | 1,5 | 1,5 |
| | 16 x 85 | M10 | 85 | 2,0 | 2,0 |
| | 16 x 125 | M10 | 125 | 2,5 | 2,5 |
| | 16 x 85 | M12 | 85 | 3,0 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,0 | 2,5 |
| | 20 x 85 | M16 | 85 | 2,0 | 2,0 |
| **Brick No. 8** | | | | | |
| $\rho_m \geq 0,8$ / $f_b \geq 15$ | 12 x 50 | M8 | 50 | 1,5 | 1,5 |
| | 12 x 80 | M8 | 80 | 2,0 | 2,0 |
| | 16 x 85 | M10 | 85 | 3,0 | 2,5 |
| | 16 x 125 | M10 | 125 | 3,0 | 2,5 |
| | 16 x 85 | M12 | 85 | 3,5 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,5 | 2,5 |
| | 20 x 85 | M16 | 85 | 3,5 | 2,5 |
| **Brick No. 9** | | | | | |
| $\rho_m \geq 0,93$ / $f_b \geq 6$ | 12 x 50 | M8 | 50 | 0,75 | 0,75 |
| | 12 x 80 | M8 | 80 | 0,75 | 0,75 |
| | 16 x 85 | M10 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M10 | 125 | 1,5 | 1,5 |
| | 16 x 85 | M12 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M12 | 125 | 1,5 | 1,5 |
| | 20 x 85 | M16 | 85 | 1,2 | 1,2 |

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

1) $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$

2) $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

**Table C3: Characteristic resistance under tension and shear loading**

| Density / Compressive strength | Sleeve | Anchor size | Effective embedment depth | Characteristic resistance | Characteristic resistance |
|---|---|---|---|---|---|
| $\rho_m$ / $f_b$ | $d_s$ x $l_s$ | M | $h_{ef}$ | $N_{Rk}$ [1] | $V_{Rk}$ [2] |
| [kg/dm³] / [N/mm²] | [-] | [-] | [mm] | [kN] | [kN] |
| **Brick No. 10** | | | | | |
| $\rho_m \geq 0,75$ / $f_b \geq 6$ | 12 x 50 | M8 | 50 | 1,0 | 0,9 |
| | 12 x 80 | M8 | 80 | 1,0 | 1,0 |
| | 16 x 85 | M10 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M10 | 125 | 1,5 | 1,5 |
| | 16 x 85 | M12 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M12 | 125 | 1,5 | 1,5 |
| | 20 x 85 | M16 | 85 | 1,2 | 1,2 |
| **Brick No. 11** | | | | | |
| $\rho_m \geq 0,865$ / $f_b \geq 6$ | 12 x 50 | M8 | 50 | 0,75 | 0,75 |
| | 12 x 80 | M8 | 80 | 0,9 | 0,9 |
| | 16 x 85 | M10 | 85 | 1,2 | 1,2 |
| | 16 x 125 | M10 | 125 | 1,2 | 1,2 |
| | 16 x 85 | M12 | 85 | 1,2 | 1,2 |
| | 16 x 125 | M12 | 125 | 1,2 | 1,2 |
| | 20 x 85 | M16 | 85 | 1,2 | 1,2 |
| **Brick No. 12** | | | | | |
| $\rho_m \geq 0,659$ / $f_b \geq 6$ | 12 x 50 | M8 | 50 | 0,9 | 0,9 |
| | 12 x 80 | M8 | 80 | 0,9 | 0,9 |
| | 16 x 85 | M10 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M10 | 125 | 1,2 | 1,2 |
| | 16 x 85 | M12 | 85 | 1,5 | 1,5 |
| | 16 x 125 | M12 | 125 | 1,5 | 1,5 |
| | 20 x 85 | M16 | 85 | 1,5 | 1,5 |
| **Brick No. 13** | | | | | |
| $\rho_m \geq 0,755$ / $f_b \geq 6$ | 12 x 50 | M8 | 50 | 1,0 | 0,9 |
| | 12 x 80 | M8 | 80 | 1,0 | 1,0 |
| | 16 x 85 | M10 | 85 | 1,0 | 0,9 |
| | 16 x 125 | M10 | 125 | 1,0 | 0,9 |
| | 16 x 85 | M12 | 85 | 1,2 | 1,2 |
| | 16 x 125 | M12 | 125 | 1,2 | 1,2 |
| | 20 x 85 | M16 | 85 | 1,2 | 1,2 |

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

[1] $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$

[2] $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

## Table C4: Characteristic resistance under tension and shear loading

| Density / Compressive strength | Sleeve | Anchor size | Effective embedment depth | Characteristic resistance | Characteristic resistance |
|---|---|---|---|---|---|
| $\rho_m$ / $f_b$ | $d_s$ x $l_s$ | M | $h_{ef}$ | $N_{Rk}$ [1] | $V_{Rk}$ [2] |
| [kg/dm³] / [N/mm²] | [-] | [-] | [mm] | [kN] | [kN] |
| **Brick No. 14** | | | | | |
| $\rho_m \geq 0,8$ / $f_b \geq 2$ | 12 x 50 | M8 | 50 | 1,0 | 1,0 |
| | 12 x 80 | M8 | 80 | 1,5 | 1,5 |
| | 16 x 85 | M10 | 85 | 2,0 | 2,0 |
| | 16 x 125 | M10 | 125 | 2,0 | 2,0 |
| | 16 x 85 | M12 | 85 | 2,5 | 2,5 |
| | 16 x 125 | M12 | 125 | 3,0 | 2,5 |
| | 20 x 85 | M16 | 85 | 3,5 | 2,5 |

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

[1] $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$

[2] $V_{Rk} = V_{Rk,b} = V_{Rk,c} = V_{Rk,s}$

**Table C5: Characteristic bending moment**

| Size of rod | | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|---|
| Characteristic bending moment | $M^0_{Rk,s}$ | Nm | 5.8 | 19 | 37 | 65 | 166 |
| | | | 6.8 | 22 | 45 | 79 | 200 |
| | | | 8.8 | 30 | 60 | 105 | 266 |
| | | | 10.9 | 37 | 75 | 131 | 333 |
| | | | 12.9 | 45 | 90 | 157 | 400 |
| | | | A4-70 | 26 | 52 | 92 | 232 |
| | | | A4-80 | 30 | 60 | 105 | 266 |
| | | | 70 | 26 | 52 | 92 | 233 |
| Partial safety factor | $\gamma_{Ms}$ | - | 5.8 | 1,25 | | | |
| | | | 6.8 | 1,25 | | | |
| | | | 8.8 | 1,25 | | | |
| | | | 10.9 | 1,50 | | | |
| | | | 12.9 | 1,50 | | | |
| | | | A4-70 | 1,56 | | | |
| | | | A4-80 | 1,33 | | | |
| | | | 70 | 1,56 | | | |

**Table C6: Displacements under tension loading**

| Brick No. 1 | | | | | |
|---|---|---|---|---|---|
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,11 | 0,12 | 0,15 | 0,16 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,36 | 0,36 |
| **Brick No. 2** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,05 | 0,07 | 0,10 | 0,11 |
| $\delta_{N\infty}$ | [mm] | 0,19 | 0,19 | 0,20 | 0,22 |
| **Brick No. 3** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,13 | 0,15 | 0,15 | 0,18 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,36 | 0,36 |
| **Brick No. 4** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,10 | 0,13 | 0,15 | 0,18 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,36 | 0,36 |
| **Brick No. 5** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,14 | 0,13 | 0,24 | 0,18 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,48 | 0,36 |
| **Brick No. 6** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,09 | 0,27 | 0,14 | 0,16 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,54 | 0,36 | 0,36 |
| **Brick No. 7** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,05 | 0,16 | 0,30 | 0,28 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,60 | 0,56 |
| **Brick No. 8** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [mm] | 0,08 | 0,10 | 0,10 | 0,27 |
| $\delta_{N\infty}$ | [mm] | 0,36 | 0,36 | 0,36 | 0,54 |

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

**Table C7: Displacements under tension loading**

| Brick No. 9 | | | | | |
|---|---|---|---|---|---|
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{N0}$ | [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 |
| $\delta_{N0}$ | [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 |
| $\delta_{N0}$ | [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 |
| $\delta_{N0}$ | [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 |
| $\delta_{N0}$ | [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 |
| $\delta_{N0}$ | [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 $\gamma_F = 1,4$

**Table C8: Displacements under shear loading**

| Brick No. 1 | | | | | |
|---|---|---|---|---|---|
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [mm] | 0,24 | 0,20 | 0,34 | 0,26 |
| $\delta_{V\infty}$ | [mm] | 0,36 | 0,30 | 0,51 | 0,39 |
| **Brick No. 8** | | | | | |
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{V0}$ | [mm] | 0,11 | 0,13 | 0,36 | 0,27 |
| $\delta_{V\infty}$ | [mm] | 0,17 | 0,20 | 0,54 | 0,41 |

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

**Table C9: Displacements under shear loading**

| **Brick No. 9** | | | | | |
|---|---|---|---|---|---|
| **Size of rod** | | M8 | M10 | M12 | M16 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [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 |
| $\delta_{V0}$ | [mm] | 0,10 | 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 |
| $\delta_{V0}$ | [mm] | 0,24 | 0,35 | 0,32 | 0,34 |
| $\delta_{V\infty}$ | [mm] | 0,36 | 0,53 | 0,48 | 0,51 |

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

**Table C10: β-factor for job site tests**

| 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 |

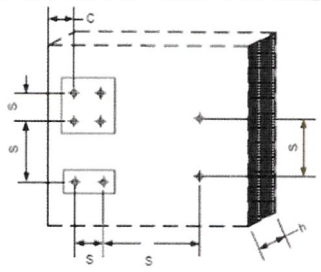



**Table C11: Brick No. 1 to 3 - edge distance and spacing for tension load**

| $d_{nom}$ | $s_{cr,N}$ | $c_{cr,N}$ | $s_{cr,min}$ | $c_{cr,min}$ |
|---|---|---|---|---|
| [mm] | [mm] | [mm] | [mm] | [mm] |
| 8 | 20 x $d_{nom}$ | 10 x $d_{nom}$ | 50 | 50 |
| 10 | 20 x $d_{nom}$ | 10 x $d_{nom}$ | 50 | 50 |
| 12 | 20 x $d_{nom}$ | 10 x $d_{nom}$ | 50 | 50 |
| 16 | 20 x $d_{nom}$ | 10 x $d_{nom}$ | 50 [1] / 54 [2] | 50 [1] / 54 [2] |

[1] for element 1 and 3
[2] for element 2

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

| $d_{nom} + d_s$ x $L_s$ | $s_{cr,N}$ | $c_{cr,N}$ | $s_{cr,min}$ | $c_{cr,min}$ |
|---|---|---|---|---|
| [mm] | [mm] | [mm] | [mm] | [mm] |
| 8 + 12 x 50 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 8 + 12 x 80 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 10 + 16 x 85 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 10 + 16 x 125 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 12 + 16 x 85 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 12 + 16 x 125 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 100 | 100 |
| 16 + 20 x 85 | $l_{unit,max}$ | 0,5 x $l_{unit,max}$ | 120 | 120 |

**Table C13: Brick No. 1 to 3 - edge distance and spacing for shear load**

| $d_{nom}$ | $s_{cr,cv}$ | $c_{cr,cv}$ |
|---|---|---|
| [mm] | [mm] | [mm] |
| 8 | 20 x $d_{nom}$ | 20 x $d_{nom}$ |
| 10 | 20 x $d_{nom}$ | 20 x $d_{nom}$ |
| 12 | 20 x $d_{nom}$ | 20 x $d_{nom}$ |
| 16 | 20 x $d_{nom}$ | 20 x $d_{nom}$ |

**Table C14: Brick No. 4 to 14 - edge distance and spacing for shear load**

| $d_{nom} + d_s$ x $L_s$ | $s_{cr,cv}$ | $c_{cr,cv}$ |
|---|---|---|
| [mm] | [mm] | [mm] |
| 8 + 12 x 50 | $l_{unit,max}$ | $l_{unit,max}$ |
| 8 + 12 x 80 | $l_{unit,max}$ | $l_{unit,max}$ |
| 10 + 16 x 85 | $l_{unit,max}$ | $l_{unit,max}$ |
| 10 + 16 x 125 | $l_{unit,max}$ | $l_{unit,max}$ |
| 12 + 16 x 85 | $l_{unit,max}$ | $l_{unit,max}$ |
| 12 + 16 x 125 | $l_{unit,max}$ | $l_{unit,max}$ |
| 16 + 20 x 85 | $l_{unit,max}$ | $l_{unit,max}$ |

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