# Declaration of Performance

## 1343-CPR-M 530-4/01.15

**1. Unique identification code of the product-type:** Mungo Injection system MIT-SE Plus for rebar connections

**2. Manufacturer:** Mungo Befestigungstechnik AG, Bornfeldstrasse 2, CH-4603 Olten/Switzerland

**3. System/s of AVCP:** System 1

**4. Intended use or use/es:**

| Product | Intended use |
|---|---|
| System for post installed rebar connection with mortar | Post-installed connection of reinforcing bars (rebar) by anchoring or overlap connection joint in normal weight concrete, see appendix, especially Annexes B1 to B8 |

**5. European Assessment Document:** ETAG 001 Part 5: "Bonded anchors", April 2013, used as EAD
**European Technical Assessment:** ETA-11/0168 of 13 December 2016
**Technical Assessment Body:** DIBt – Deutsches Institut für Bautechnik
**Notified body/ies:** 1343 – MPA Darmstadt

**6. Declared performance:**
**Mechanical resistance and stability (BWR 1)**

| Essential characteristic | Performance |
|---|---|
| Design values of the ultimate bond resistance | See appendix, especially Annex C1 |

**Safety in case of fire (BWR 2)**

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Rebar connections satisfy requirements for Class A1 |
| Resistance to fire | No performance determined (NPD) |

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Singed for and on behalf of the manufacturer by:

Dipl.-Ing. Massimo Pirozzi
Head of Engineering

p.p.a. Massimo Pirozzi

Olten, 2017-21-12

This DoP Has been prepared in different languages. In case there is a dispute on the interpretation the English version shall always prevail.
The Appendix includes voluntary and complementary information in English language exceeding the (language as neutrally specified) legal requirements.

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**Figure A1:** Overlapping joint for rebar connections of slabs and beams

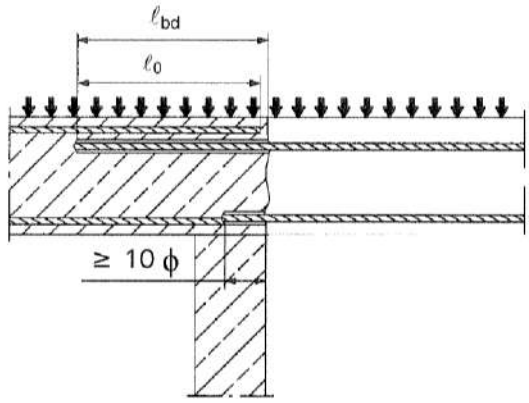



**Figure A2:** Overlapping joint at a foundation of a wall or column where the rebars are stressed in tension

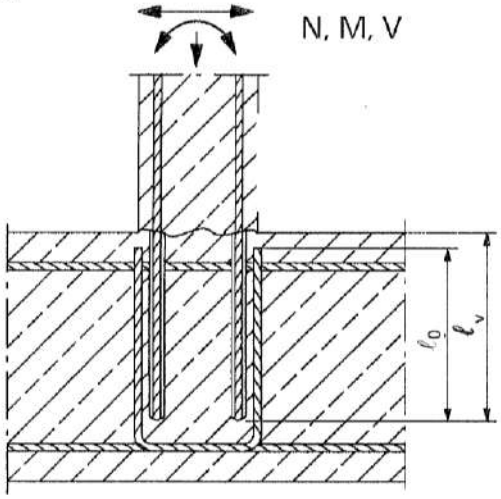



**Figure A3:** End anchoring of slabs or beams (e.g. designed as simply supported)

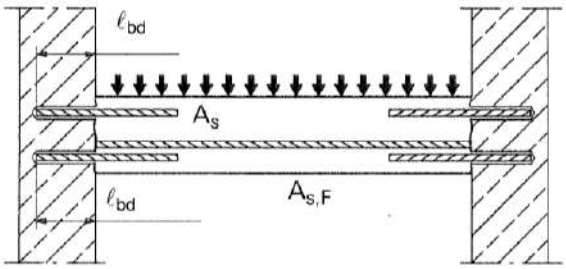



**Figure A4:** Rebar connection for components stressed primarily in compression. The rebars sre stressed in compression

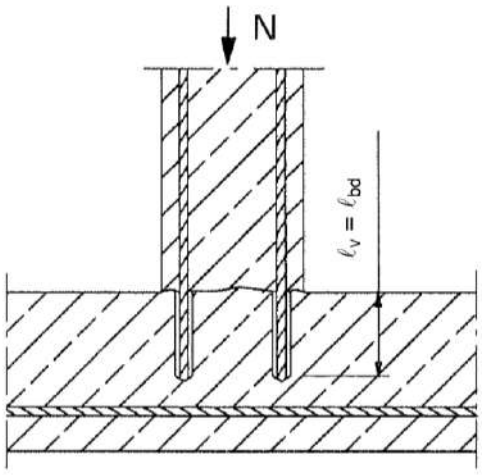
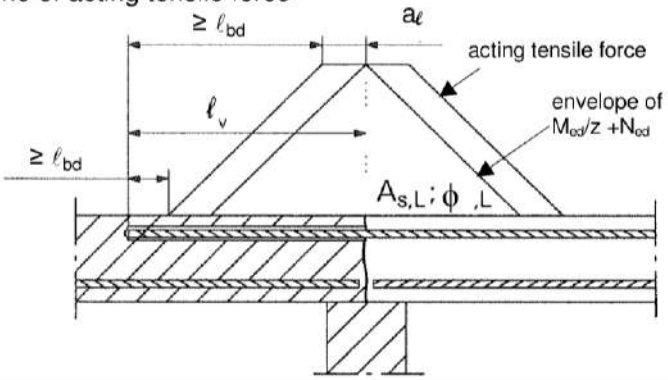



**Figure A5:** Anchoring of reinforcemend to cover the line of acting tensile force




**Note to Figure A1 to A5:**

In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2004+AC:2010.

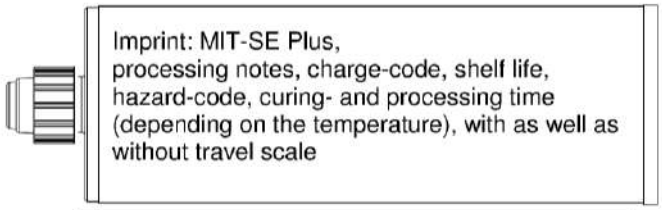
Preparing of joints according to Annex B 2

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex A 1** |
|---|---|
| **Product description**<br>Installed condition and examples of use for rebars | |

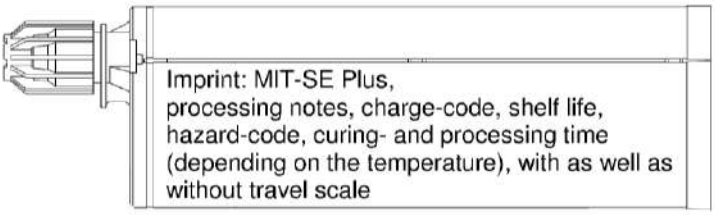
## Mungo Injection System MIT-SE Plus:

**Injection mortar: MIT-SE Plus**

**Typ "coaxial":** 150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml Kartusche



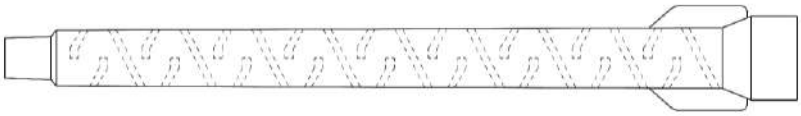

**Type "side-by-side":** 235 ml, 345 ml and 825 ml cartridge




**Static Mixer**

CRW 14W

TAH 18W



**Piston plug and mixer extension**

## Reinforcing bar (rebar): ø8, ø10, ø12, ø14, ø16, ø20, ø22, ø24, ø25, ø28, ø32

- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range $0{,}05\phi \le h \le 0{,}07\phi$ ($\phi$: Nominal diameter of the bar; h: Rip height of the bar)

### Table A1: Materials

| Designation | Material |
|---|---|
| Rebar EN 1992-1-1:2004+AC:2010, Annex C | Bars and de-coiled rods class B or C<br>$f_{yk}$ and k according to NDP or NCL of EN 1992-1-1/NA:2013<br>$f_{uk} = f_{tk} = k \cdot f_{yk}$ |

| Mungo Injection System MIT-SE Plus for rebar connection | Annex A 2 |
|---|---|
| **Product description**<br>Injection mortar / Static mixer / Rebar<br>Materials | |

# Specifications of intended use

**Anchorages subject to:**

- Static and quasi-static loads.

**Base materials:**

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C12/15 to C50/60 according to EN 206-1:2000.
- Maximum chloride concrete of 0,40% (CL 0.40) related to the cement content according to EN 206-1:2000.
- Non-carbonated concrete.

  Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of $\phi$ + 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 in accordance with EN 1992-1-1:2004+AC:2010.

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

**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 account of the forces to be transmitted.
- Design according to EN 1992-1-1:2004+AC:2010 and Annex B 2.
- 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.

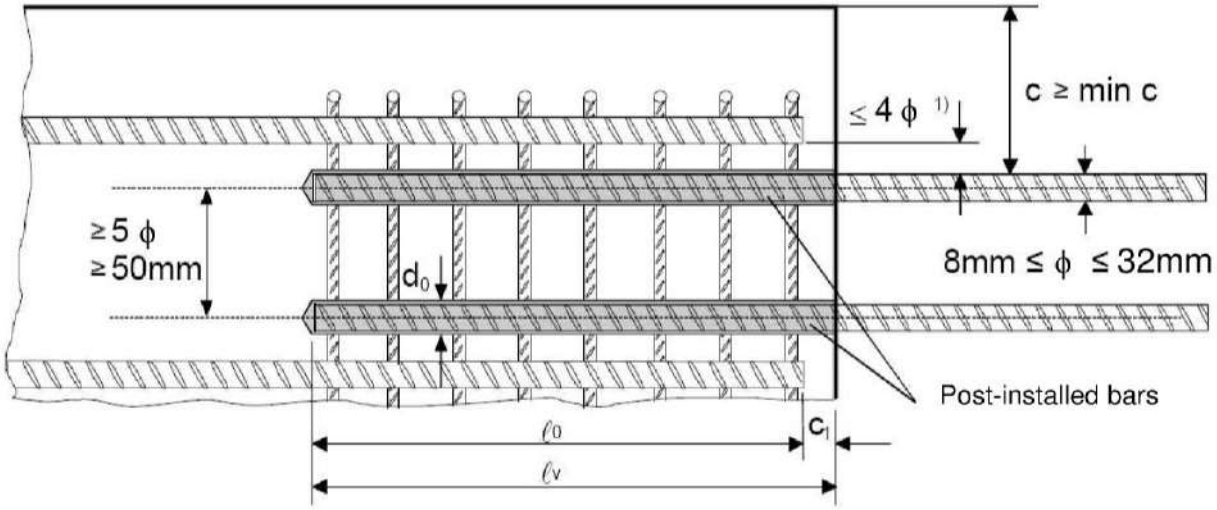
**Installation:**

- Dry or wet concrete.
- It must not be installed in flooded holes.
- Hole drilling by hammer drill or compressed air drill mode.
- The installation of post-installed rebar shall be done only by suitable trained installer and under supervision on site; the conditions under which an installer may be considered as suitable trained and the conditions for supervision on site are up to the Member States in which the installation is done.
- Check the position of the existing rebars (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).

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 1** |
|---|---|
| **Intended use**<br>Specifications | |

## Figure B1: General construction rules for post-installed rebars

- 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.
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



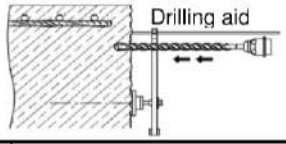

1) If the clear distance between lapped bars exceeds 4ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4ϕ.

The following applies to Figure B1:

| | |
|---|---|
| c | concrete cover of post-installed rebar |
| $c_1$ | concrete cover at end-face of existing rebar |
| min c | minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2 |
| ϕ | diameter of post-installed rebar |
| $\ell_0$ | lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3 |
| $\ell_v$ | effective embedment depth, ≥ $\ell_0 + c_1$ |
| $d_0$ | nominal drill bit diameter, see Annex B 6 |

| | |
|---|---|
| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 2** |
| **Intended use**<br>General construction rules for post-installed rebars | |

## Table B1: Minimum concrete cover min c[1] of post-installed rebar depending of drilling method




| Drilling method | Rebar diameter | Without drilling aid | With drilling aid |
|---|---|---|---|
| Hammer drilling (HD) | < 25 mm | 30 mm + 0,06 · $\ell_v$ ≥ 2 $\phi$ | 30 mm + 0,02 · $\ell_v$ ≥ 2 $\phi$ |
| | ≥ 25 mm | 40 mm + 0,06 · $\ell_v$ ≥ 2 $\phi$ | 40 mm + 0,02 · $\ell_v$ ≥ 2 $\phi$ |
| Compressed air drilling (CD) | < 25 mm | 50 mm + 0,08 · $\ell_v$ | 50 mm + 0,02 · $\ell_v$ |
| | ≥ 25 mm | 60 mm + 0,08 · $\ell_v$ | 60 mm + 0,02 · $\ell_v$ |

[1] see Annexes B2, Figures B1
Comments: The minimum concrete cover acc. EN 1992-1-1:2004+AC:2010 must be observed

## Table B2: maximum embedment depth $\ell_{v,max}$

| Rebar Ø $\phi$ | $\ell_{v,max}$ [mm] |
|---|---|
| 8 mm | 1000 |
| 10 mm | 1000 |
| 12 mm | 1200 |
| 14 mm | 1400 |
| 16 mm | 1600 |
| 20 mm | 2000 |
| 22 mm | 2000 |
| 24 mm | 2000 |
| 25 mm | 2000 |
| 28 mm | 1000 |
| 32 mm | 1000 |

## Table B3: Base material temperature, gelling time and curing time

| Concrete temperature | Gelling- / working time[1] | Minimum curing time in dry concrete[5] |
|---|---|---|
| | $t_{gel}$ | $t_{cure,dry}$ |
| -10°C bis -6°C | 90 min[2] | 24 h |
| -5°C bis -1°C | 90 min[3] | 14 h |
| 0°C bis +4°C | 45 min[3] | 7 h |
| +5°C bis +9°C | 25 min[3] | 2 h |
| +10°C bis +19°C | 15 min[3] | 80 min |
| +20°C bis +24°C | 6 min[3] | 45 min |
| +25°C bis +29°C | 4 min[3] | 25 min |
| +30°C bis +40°C | 2,5 min[4] | 15 min |

[1] $t_{gel}$: maximum time from starting of mortar injection to completing of rebar setting.
[2] Cartridge temperature **must** be at minimum +15°C
[3] Cartridge temperature **must** be between +5°C and +25°C
[4] Cartridge temperature **must** be below +20°C
[5] In wet concrete the curing time $t_{cure,dry}$ has to be doubled up

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 3** |
|---|---|
| **Intended use**<br>Minimum concrete cover<br>Maximum embedment depth / working time and curing times | |

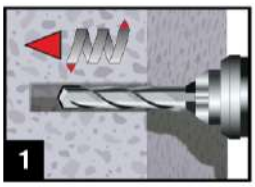
## Table B4: Dispensing tools

| Cartridge type/size | Hand tool | | Pneumatic tool |
|---|---|---|---|
| Coaxial cartridges 150, 280, 300 up to 333 ml |  e.g. Type H 297 or H244C | |  e.g. Type TS 492 X |
| Coaxial cartridges 380 up to 420 ml |  e.g. Type CCM 380/10 |  e.g. Type H 285 or H244C |  e.g. Type TS 485 LX |
| Side-by-side cartridges 235, 345 ml |  e.g. Type CBM 330A |  e.g. Type H 260 |  e.g. Type TS 477 LX |
| Side-by-side cartridge 825 ml | - | - |  e.g. Type TS 498X |

All cartridges could also be extruded by a battery tool.

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 4** |
|---|---|
| **Intended Use**<br>Dispensing tools | |

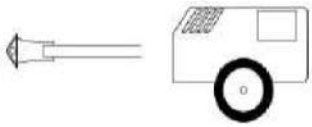
## A) Bore hole drilling




1. Drill a hole into the base material to the size and embedment depth required by the selected reinforcing bar with carbide hammer drill (HD) or a compressed air drill (CD). In case of aborted drill hole: the drill hole shall be filled with mortar.

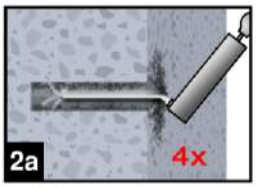
| Rebar - ∅ ϕ | Drill - ∅ [mm] |
|---|---|
| 8 mm | 12 |
| 10 mm | 14 |
| 12 mm | 16 |
| 14 mm | 18 |
| 16 mm | 20 |
| 20 mm | 25 |
| 22 mm | 28 |
| 24 mm | 32 |
| 25 mm | 32 |
| 28 mm | 35 |
| 32 mm | 40 |

Hammer drill (HD)

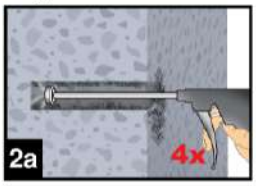


Compressed air drill (CD)

## B) Bore hole cleaning

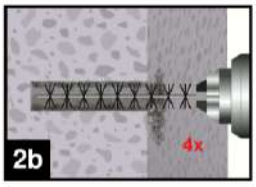



or

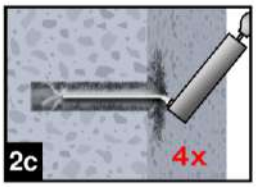



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump a minimum of four times. If the bore hole ground is not reached an extension shall be used.

For bore holes deeper then 240 mm, compressed air (min. 6 bar) **must** be used.




2b. Check brush diameter (Table B5) and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of four times.
If the bore hole ground is not reached with the brush, a brush extension shall be used.

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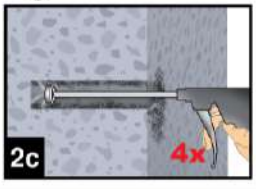


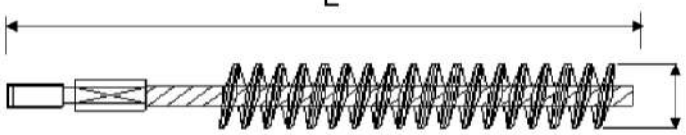

2c. Finally blow the hole clean again with compressed air (min. 6 bar) or a hand pump a minimum of four times. If the bore hole ground is not reached an extension shall be used.

For bore holes deeper than 240 mm, compressed air (min. 6 bar) **must** be used.

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 5** |
|---|---|
| **Intended Use**<br>Installation instruction: Bore hole drilling and Bore hole cleaning | |

## Table B5: Cleaning tools

**Brush:**

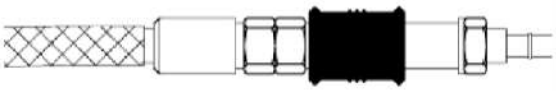



**SDS Plus Adapter:**

**Brush extension:**

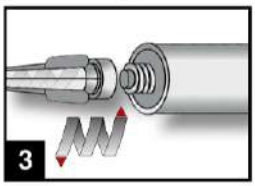
| ϕ Rebar - ∅ | $d_0$ Drill bit - ∅ | $d_b$ Brush - ∅ | $d_{b,min}$ min. Brush - ∅ |
|---|---|---|---|
| (mm) | (mm) | (mm) | (mm) |
| 8 | 12 | 14 | 12,5 |
| 10 | 14 | 16 | 14,5 |
| 12 | 16 | 18 | 16,5 |
| 14 | 18 | 20 | 18,5 |
| 16 | 20 | 22 | 20,5 |
| 20 | 25 | 27 | 25,5 |
| 22 | 28 | 30 | 28,5 |
| 24 | 32 | 34 | 32,5 |
| 25 | 32 | 34 | 32,5 |
| 28 | 35 | 37 | 35,5 |
| 32 | 40 | 41,5 | 40,5 |

**Hand pump (volume 750 ml)**

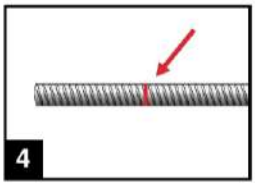


**Rec. compressed air tool hand slide valve (min 6 bar)**

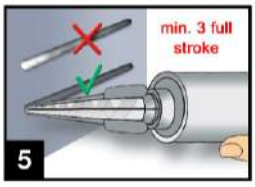
## C) Preparation of bar and cartridge




3. Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.
For every working interruption longer than the recommended working time (Table B3) as well as for every new cartridges, a new static-mixer shall be used.



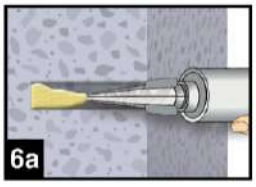

4. Prior to inserting the reinforcing bar into the filled bore hole, the position of the embedment depth shall be marked (e.g. with tape) on the reinforcing bar and insert bar in empty hole to verify hole and depth $\ell_v$.
The reinforcing bar should be free of dirt, grease, oil or other foreign material.



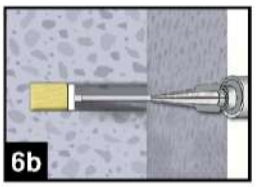

5. Prior to dispensing into the anchor hole, squeeze out separately the mortar until it shows a consistent grey colour, but a minimum of three full strokes, and discard non-uniformly mixed adhesive components.

| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 6** |
|---|---|
| **Intended Use**<br>Installation instruction: Cleaning tools and Preparation of bar and cartridge | |

## D) Filling the bore hole




6. Starting from the bottom or back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. For embedment larger than 190 mm an extension nozzle shall be used.

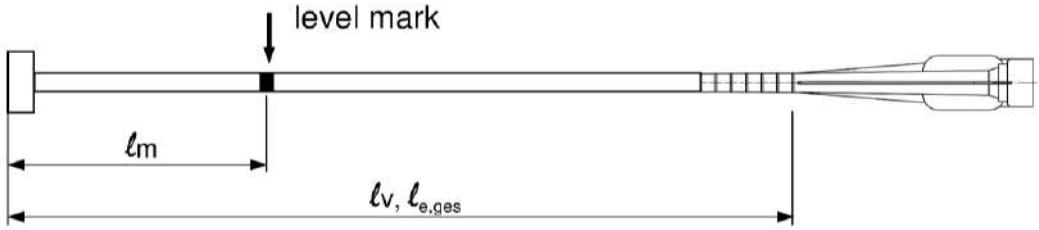



For overhead and horizontal installation and bore holes deeper than 240 mm a piston plug and the appropriate mixer extension must be used.

Observe the gel-/ working times given in Table B3.

### Table B6: Piston plugs, max anchorage depth and mixer extension

| Bar size | Drill bit - ∅ | | Piston plug | Cartridge: All sizes | | | | Cartridge: side-by-side (825 ml) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Hand or battery tool | | Pneumatic tool | | Pneumatic tool | |
| ϕ | HD | PD | | $l_{v,max}$ | Mixer extension | $l_{v,max}$ | Mixer extension | $l_{v,max}$ | Mixer extension |
| (mm) | (mm) | | No. | (cm) | | (cm) | | (cm) | |
| 8 | 12 | - | - | 70 | VL 10/0,75 | 80 | VL 10/0,75 | 80 | VL 10/0,75 |
| 10 | 14 | - | #14 | | | 100 | | 100 | |
| 12 | 16 | | #16 | | | 100 | | 120 | VL 16/1,8 |
| 14 | 18 | | #18 | | | | | 140 | |
| 16 | 20 | | #20 | | | | | 160 | |
| 20 | 25 | 26 | #25 | 50 | | 70 | | 200 | |
| 22 | 28 | | #28 | | | | | | |
| 24 | 32 | | #32 | | | 50 | | 100 | |
| 25 | 32 | | #32 | | | | | | |
| 28 | 35 | | #35 | | | | | | |
| 32 | 40 | | #40 | | | | | | |




Injection tool must be marked by mortar level mark $\ell_m$ and anchorage depth $\ell_v$ resp. $\ell_{e,ges}$ with tape or marker.

Quick estimation: $\ell_m = 1/3 \cdot \ell_v$

Continue injection until the mortar level mark $\ell_m$ becomes visible.

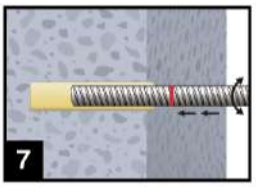
Optimum mortar volume: $\ell_m = \ell_v$ resp. $\ell_{e,ges} \cdot \left(1{,}2 \cdot \frac{\phi^2}{d_0^2} - 0{,}2\right)$ [mm]

**Mungo Injection System MIT-SE Plus for rebar connection**

**Intended Use**
Installation instruction: Filling the bore hole

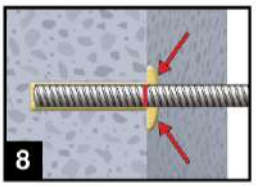
**Annex B 7**

## E) Inserting the rebar




7. Push the reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

   The bar should be free of dirt, grease, oil or other foreign material.




8. Be sure that the bar is inserted in the bore hole until the embedment mark is at the concrete surface and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead installation fix embedded part (e.g. wedges).


9. Observe gelling time $t_{gel}$. Attend that the gelling time can vary according to the base material temperature (see Table B3). It is not allowed to move the bar after geling time $t_{gel}$ has elapsed.
   Allow the adhesive to cure to the specified time prior to applying any load. Do not move or load the bar until it is fully cured (attend Table B3). After full curing time $t_{cure}$ has elapsed, the add-on part can be installed.

| | |
|---|---|
| **Mungo Injection System MIT-SE Plus for rebar connection** | **Annex B 8** |
| **Intended Use**<br>Installation instruction: Inserting rebar | |

## Minimum anchorage length and minimum lap length

The minimum anchorage length $\ell_{b,min}$ and the minimum lap length $\ell_{0,min}$ according to EN 1992-1-1:2004+AC:2010 ($\ell_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $\ell_{0,min}$ acc. to Eq. 8.11) shall be multiply by a factor according to Table C1.

**Table C1: Factor related to concrete class and drilling method**

| Concrete class | Drilling method | Factor |
|---|---|---|
| C12/15 to C50/60 | Hammer drilling and compressed air drilling | 1,0 |

**Table C2: Design values of the ultimate bond resistance $f_{bd}$ in N/mm² for all drilling methods for good conditions**
according to EN 1992-1-1:2004+AC:2010 for good bond conditions
(for all other bond conditions multiply the values by 0.7)

| Rebar - ∅ | Concrete class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ϕ | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 25 mm | 1,6 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 4,0 | 4,3 |
| 28 bis 32 mm | 1,6 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 3,7 | 3,7 |

| Mungo Injection System MIT-SE Plus for rebar connection | Annex C 1 |
|---|---|
| **Performances**<br>Minimum anchorage length and minimum lap length<br>Design values of ultimate bond resistance $f_{bd}$ | |