Declaration of Performance

2873-CPR-M 530-6

1. Unique identification code of the product-type: Mungo injection system MIT700RE for rebar connection

2. Manufacturer: Mungo Befestigungstechnik AG, Bornfeldstrasse 2, CH-4600 Olten - Switzerland

3. System/s of AVCP: System 1

4. Intended use or use/es:

Product	Intended use
Injection system for post installed rebar connection with mortar	Post-installed connection with mortar, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete acc. to regulations for reinforced concrete constructions

5. European Assessment Document: EAD 330087-00-0601, Edition 05/2018
European Technical Assessment: ETA-19/0204 of 02.12.2020
Technical Assessment Body: DIBt – Deutsches Institut für Bautechnik
Notified body/ies: 2873 (IFSW) acc. No. 305/2011 (Construction Product Regulation EU)

6. Declared performance:

Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static loading	See appendix, especially Annex C1

Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Satisfy requirements for Class A1
Resistance to fire	See appendix, especially Annex C2 and C3

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. Robert Klemencic
Head of Engineering
Olten, 29.03.2021

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.

Mungo
Befestigungstechnik AG
Bornfeldstrasse 2
CH-4600 Olten · Switzerland
Phone +41 62 206 75 75
Fax +41 62 206 75 85
mungo@mungo.swiss
www.mungo.swiss

Installation post installed rebar

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

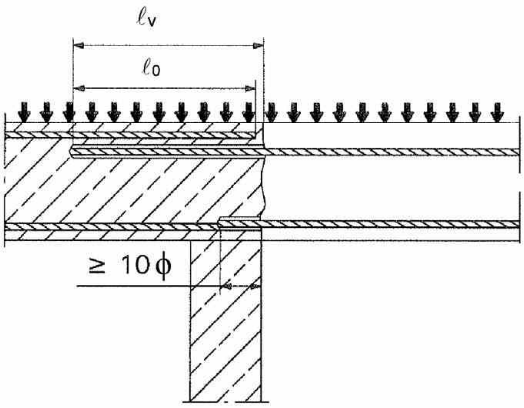


Figure A2: Overlapping joint at a foundation of a wall or column where the rebars are stressed in tension

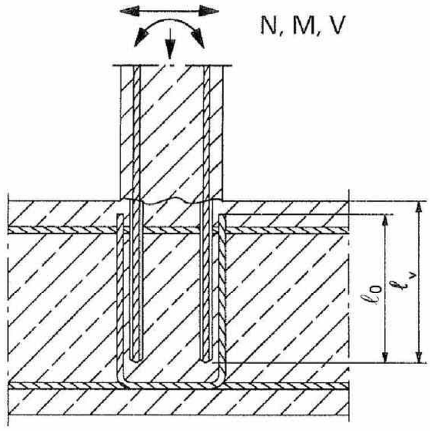


Figure A3: End anchoring of slabs or beams (e.g. designed as simply supported)

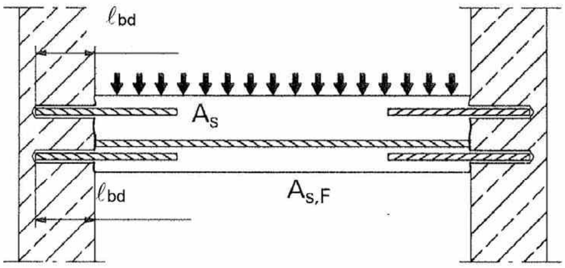


Figure A4: Rebar connection for components stressed primarily in compression. The rebars sre stressed in compression

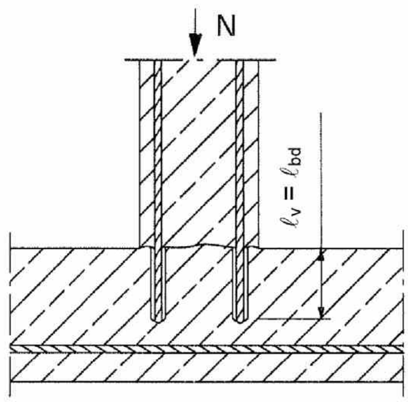
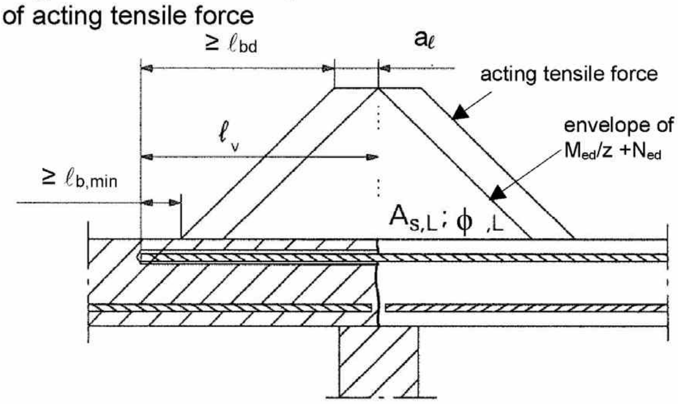


Figure A5: Anchoring of reinforcement to cover the line of acting tensile force



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 MIT700RE for rebar connection	**Annex A 1**
Product description Installed condition and examples of use for rebars	

Installation tension anchor ZA

Figure A6: Overlapping joint of a column stressed in bending to a foundation

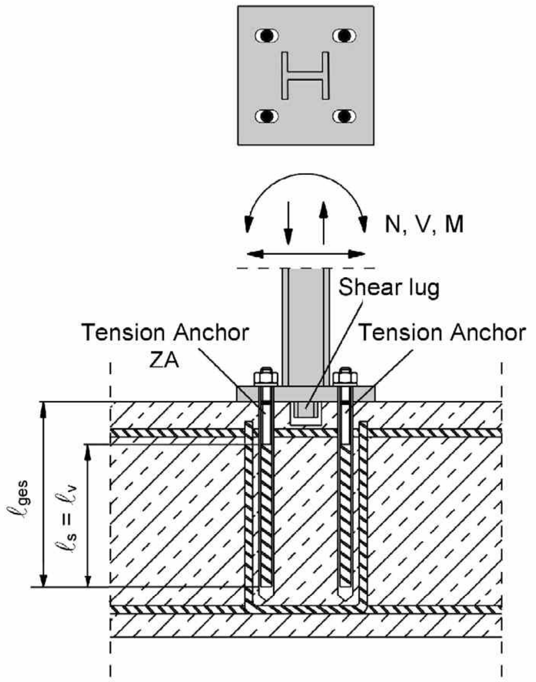


Figure A7: Overlap joint for the anchorage of barrier posts

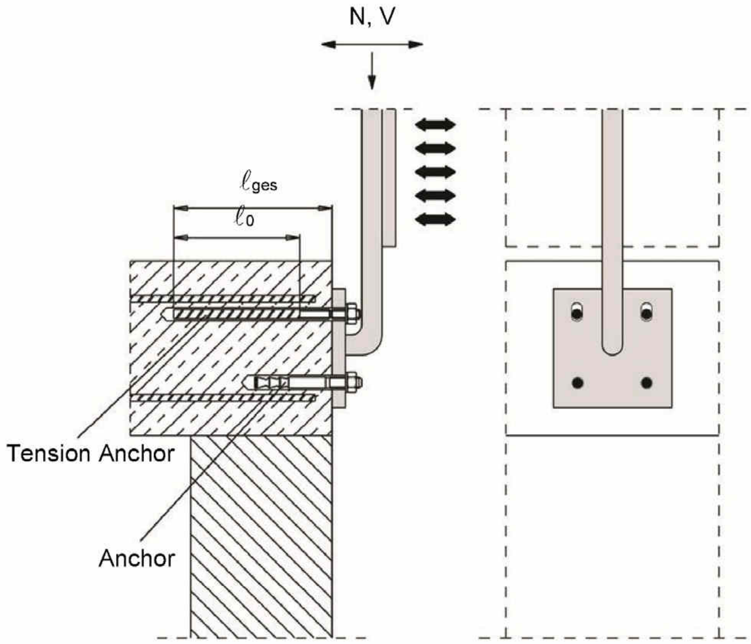
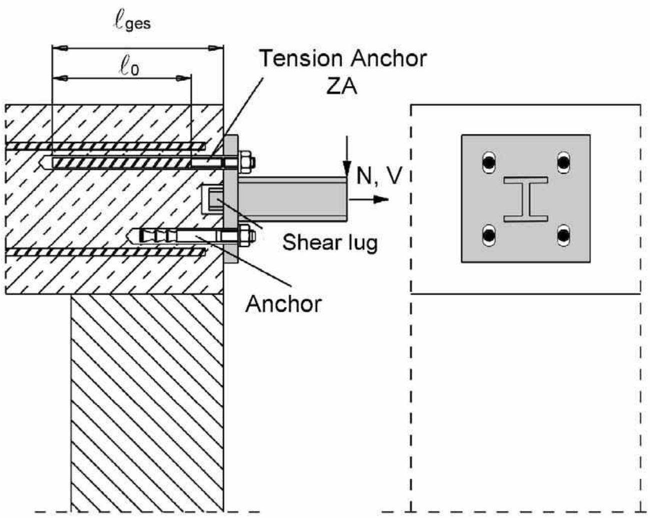


Figure A8: Overlap joint for the anchorage to centilever members



Note to Figure A6 to A8:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2002+AC:2010

Mungo Injection system MIT700RE for rebar connection	**Annex A 2**
Product description Installed condition and examples of use for tension anchors ZA	

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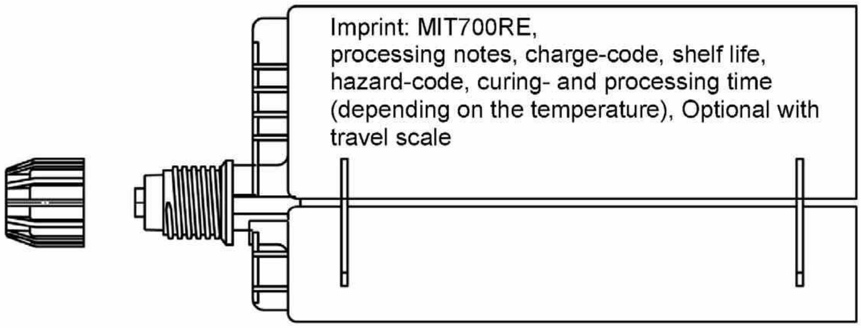
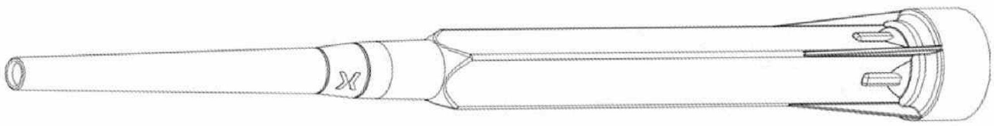
Mungo Injection system MIT700RE:

Injection mortar: MIT700RE

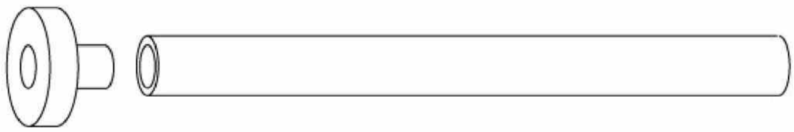
Type "side-by-side":
440ml, 585 ml and 1400 ml cartridge



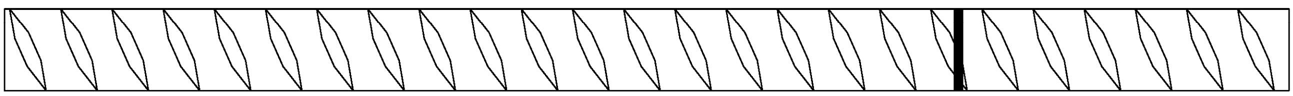
Static Mixer



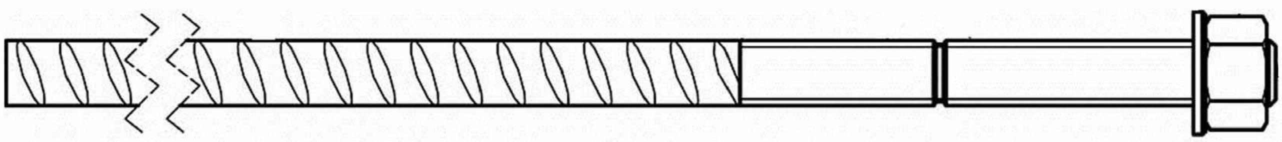
Piston plug and mixer extension



Reinforcing bar (rebar): ø8, ø10, ø12, ø14, ø16, ø20, ø22, ø24, ø25, ø28, ø32, ø34, ø36, ø40

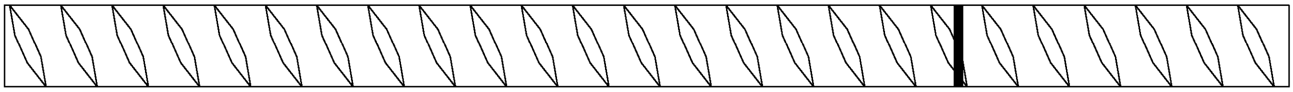


Tension Anchor ZA: M12 to M24



Mungo Injection system MIT700RE for rebar connection	**Annex A 3**
Product description Injection mortar / Static mixer / Rebar / Tension Anchor ZA	

Reinforcing bar (rebar): ø8, ø10, ø12, ø14, ø16, ø20, ø22, ø24, ø25, ø28, ø32, ø34, ø36, ø40



- 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 $0{,}05\phi \leq h_{rib} \leq 0{,}07\phi$
  (ϕ: Nominal diameter of the bar; h_{rib}: Rib 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 f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

Mungo Injection system MIT700RE for rebar connection

Product description
Materials Rebar

Annex A 4

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Tension Anchor ZA: M12, M16, M20, M24

Marking: e.g. ◇ZA◇12 A4

◇	Mark of the producer
ZA	Trade name
12	Rod diameter/thread
A4	for stainless steel A4
HCR	for high corrosion resistance steel

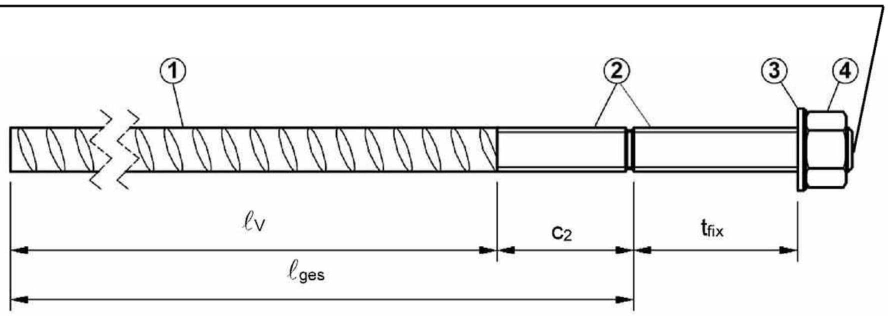

Table A2: Materials

Part	Designation		Material ZA vz M12	M16	M20	M24	ZA A4 M12	M16	M20	M24	ZA HCR M12	M16	M20	M24
1	Reinforcement bar		Class B according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$											
2	Threaded rod		Steel, zinc plated according to EN 10087:1998 or EN 10263:2001				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
		f_{yk} [N/mm²]	640				640			560	640			560
3	Washer		Steel, zinc plated according to EN 10087:1998 or EN 10263:2001				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
4	Nut													

Table A3: Dimensions and installation parameter

Size				ZA-M12	ZA-M16	ZA-M20	ZA-M24
Diameter of threaded rod		d_s	[mm]	12	16	20	24
Diameter of reinforcement bar		ϕ	[mm]	12	16	20	25
Drill hole diameter		d_0	[mm]	16	20	25	32
Diameter of clearance hole in fixture		d_f	[mm]	14	18	22	26
With across nut flats		SW	[mm]	19	24	30	36
Stress area		A_s	[mm²]	84	157	245	353
Effective embedment depth		ℓ_v	[mm]	according to static calculation			
Length of bonded thread	plated	c_2	[mm]	≥ 20	≥ 20	≥ 20	≥ 20
	A4/HCR			≥ 100	≥ 100	≥ 100	≥ 100
Minimum thickness of fixture		t_{fix}	[mm]	5	5	5	5
Maximum thickness of fixture		t_{fix}	[mm]	3000	3000	3000	3000
Maximum installation torque		T_{max}	[Nm]	50	100	150	150

Mungo Injection system MIT700RE for rebar connection

Product description
Specifications Tension Anchor ZA

Annex A 5

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.
- Fire exposure

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013 + A1:2016.
- Strength classes C12/15 to C50/60 according to EN 206:2013 + A1:2016.
- Maximum chloride content of 0,40% (CL 0.40) related to the cement content according to EN 206:2013 + A1:2016.
- 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 ϕ + 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).

Use conditions (Environmental conditions) with tension anchor ZA:

- Structures subject to dry internal conditions or subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion resistant steel).

Note: 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).

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, EN 1992-1-2:2004+AC:2008 and Annex B 2 and B 3.
- 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 (HD), hollow drill (HDB), diamond drill (DD) or compressed air drill (CD).
- The installation of post-installed rebar resp. tension anchors 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 MIT700RE for rebar connection	**Annex B 1**
Intended use Specifications	

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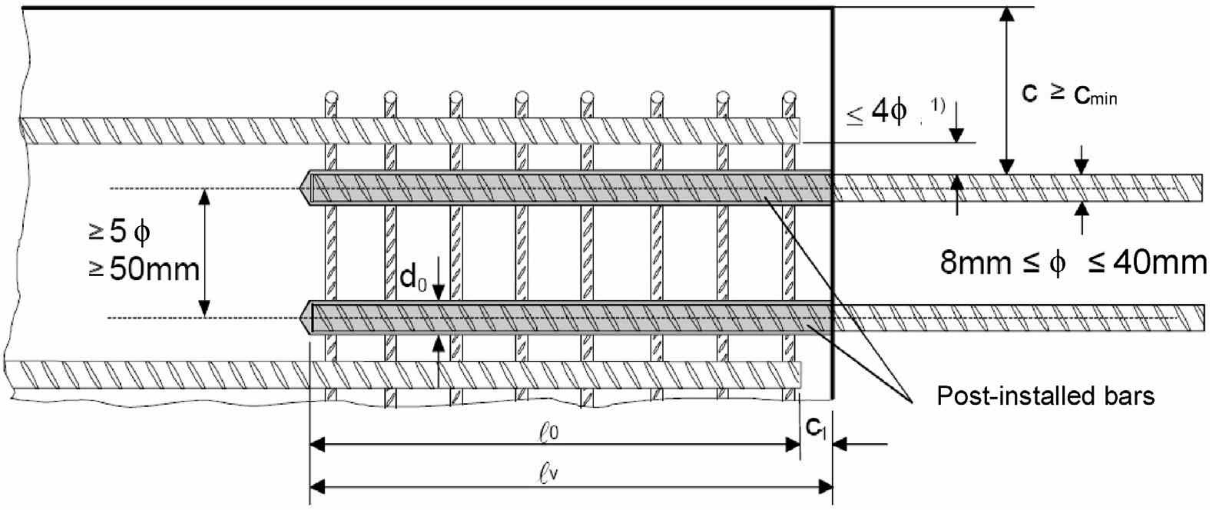
Figure B1: General construction rules for post-installed rebars

- 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
c_{min}	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
ℓ_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3
ℓ_v	effective embedment depth, $\geq \ell_0 + c_1$
d_0	nominal drill bit diameter, see Annex B 4

Mungo Injection system MIT700RE for rebar connection	**Annex B 2**
Intended use General construction rules for post-installed rebars	

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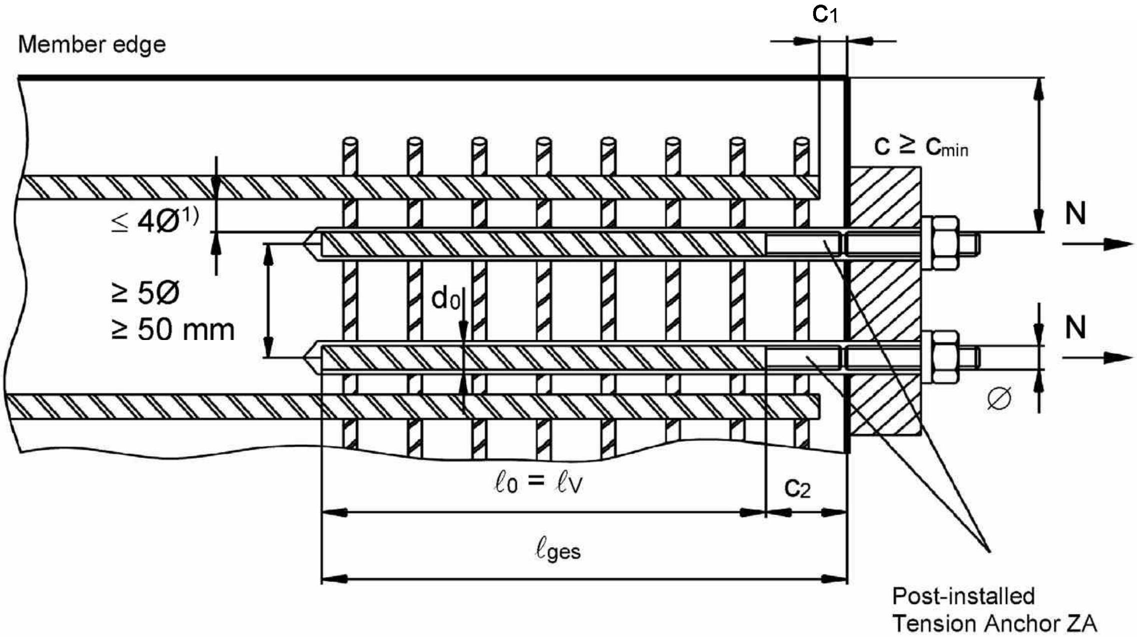
Figure B2: General construction rules for tension anchors ZA

- The length of the bonded-in thread may be not be accounted as anchorage
- Only tension forces in the direction of the bar axis may be transmitted by the tension anchor ZA
- The tension force must be transferred via an overlap joint to the reinforcement in the building part.
- The transfer of shear forces shall be ensured by appropriate additional measures, e.g shear lugs or by anchors with an European technical assessment.
- In the anchor plate, the holes for the tension anchors shall be executed as elongated holes with axis in the direction of the shear force.



[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 B2:

c	concrete cover of tension anchor ZA
c_1	concrete cover at end-face of existing rebar
c_2	Length of bonded thread
c_{min}	minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2
ϕ	diameter of tension anchor
ℓ_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3
ℓ_v	effective embedment depth, $\geq \ell_0 + c_1$
ℓ_{ges}	overall embedment depth, $\geq \ell_0 + c_2$
d_0	nominal drill bit diameter, see Annex B 4

Mungo Injection system MIT700RE for rebar connection

Intended use
General construction rules for tension anchors

Annex B 3

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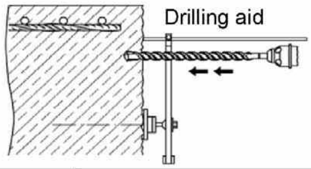
Table B1: Minimum concrete cover min c[1] of post-installed rebar and tension anchor ZA depending of drilling method



Drilling method	Rebar diameter	Without drilling aid	With drilling aid
Hammer drilling (HD) Hollow drilling (HDB)	< 25 mm	30 mm + 0,06 · ℓ_v ≥ 2 ϕ	30 mm + 0,02 · ℓ_v ≥ 2 ϕ
	≥ 25 mm	40 mm + 0,06 · ℓ_v ≥ 2 ϕ	40 mm + 0,02 · ℓ_v ≥ 2 ϕ
Diamond drilling (DD)	< 25 mm	Drill rig used as drilling aid	30 mm + 0,02 · ℓ_v ≥ 2 ϕ
	≥ 25 mm		40 mm + 0,02 · ℓ_v ≥ 2 ϕ
Compressed air drilling (CD)	< 25 mm	50 mm + 0,08 · ℓ_v	50 mm + 0,02 · ℓ_v
	≥ 25 mm	60 mm + 0,08 · ℓ_v	60 mm + 0,02 · ℓ_v

[1] see Annex B 2, Figure B1 and Annex B 3, Figure B2
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	Tension anchor	HD / CD / DD	HDB
ϕ	ϕ	$\ell_{v,max}$ [mm]	$\ell_{v,max}$ [mm]
8 mm		800	800
10 mm		1000	1000
12 mm	ZA-M12	1200	1000
14 mm		1400	1000
16 mm	ZA-M16	1600	1000
20 mm	ZA-M20	2000	1000
22 mm		2000	1000
24 mm		2000	1000
25 mm	ZA-M24	2000	1000
28 mm		2000	1000
32 mm		2000	1000
34 mm		2000	-
36 mm		2000	-
40 mm		2000	-

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

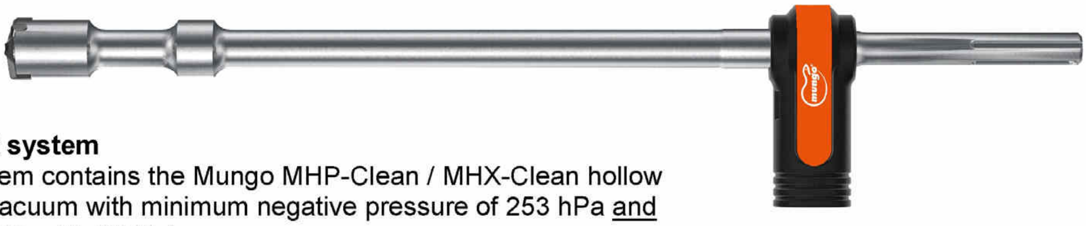
Concrete temperature	Gelling- / working time[1]	Minimum curing time in dry concrete	Minimum curing time in wet concrete
	t_{gel}	$t_{cure,dry}$	$t_{cure,wet}$
+ 5 °C to + 9°C	80 min	48 h	96 h
+ 10 °C to + 14°C	60 min	28 h	56 h
+ 15 °C to + 19°C	40 min	18 h	36 h
+ 20 °C to + 24°C	30 min	12 h	24 h
+ 25 °C to + 34°C	12 min	9 h	18 h
+ 35 °C to + 39°C	8 min	6 h	12 h
+40 °C	8 min	4 h	8 h
Cartridge temperature	+5°C to +40°C		

[1] t_{gel}: maximum time from starting of mortar injection to completing of rebar setting.

Mungo Injection system MIT700RE for rebar connection	**Annex B 4**
Intended use Minimum concrete cover Maximum embedment depth	

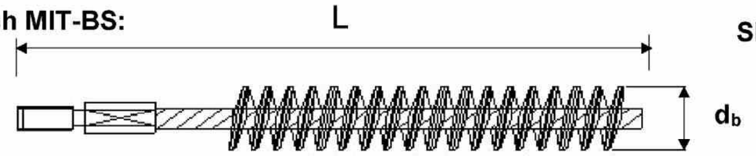
Table B4: Dispensing tools			
Cartridge type/size	**Hand tool**		**Pneumatic tool**
Side-by-side cartridges 440, 585 ml	 e.g. MIT-PP-H2 (440/585)	 e.g. MIT-PP-H0	 e.g. MIT-PP-P (440/585)
Side-by-side cartridges 1400 ml	-	-	 e.g. MIT-PP-P (1400)

Cleaning and installation tools



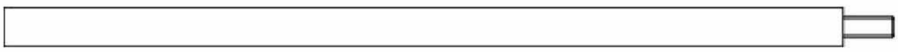
HDB – Hollow drill bit system
The hollow drill bit system contains the Mungo MHP-Clean / MHX-Clean hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa <u>and</u> flow rate of minimum 150 m³/h (42 l/s).

Brush MIT-BS:

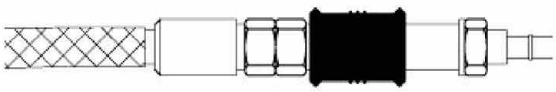


SDS Plus Adapter:

Brush extension:



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



Mungo Injection system MIT700RE for rebar connection	**Annex B 5**
Intended Use Dispensing, cleaning and installation tools	

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Table B5: Brushes, piston plugs, max anchorage depth and mixer extension, hammer (HD), diamond (DD) and compressed air (CD) drilling

Bar size	Tension anchor	Drill bit - ∅			d_b Brush - ∅		$d_{b,min}$ min. Brush - ∅	Piston plug	Cartridge: 440 ml or 585 ml				Cartridge: 1400 ml	
									Hand or battery tool		Pneumatic tool		Pneumatic tool	
φ	φ	HD	DD	CD					$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension
[mm]	[mm]		[mm]		MIT-	[mm]	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-
8	-	10	10	-	BS10	11,5	10,5	-	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
8	-	12	12	-	BS12	13,5	12,5	-	700	MI-V1/ MI-V2	800	MI-V1/ MI-V2	800	MI-V1/ MI-V2
10	-	12	12	-	BS12	13,5	12,5	-	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
10	-	14	14	-	BS14	15,5	14,5	VS14	700	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
12	ZA-M12	14	14	-	BS14	15,5	14,5	VS14	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
12	ZA-M12	16	16	16	BS16	17,5	16,5	VS16	700	MI-V1/ MI-V2	1300	MI-V1/ MI-V2	1200	MI-V1/ MI-V2
14	-	18	18	18	BS18	20,0	18,5	VS18	700	MI-V1/ MI-V2	1300	MI-V1/ MI-V2	1400	MI-V1/ MI-V2
16	ZA-M16	20	20	20	BS20	22,0	20,5	VS20	700	MI-V1/ MI-V2	1300	MI-V1/ MI-V2	1600	MI-V1/ MI-V2
20	ZA-M20	25	25	-	BS25	27,0	25,5	VS25	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
20	ZA-M20	-	-	26	BS26	28,0	26,5	VS25	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
22	-	28	28	28	BS28	30,0	28,5	VS28	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
24/25	ZA-M24	32	32	32	BS32	34,0	32,5	VS32	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
28	-	35	35	35	BS35	37,0	35,5	VS35	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
32/34	-	40	40	40	BS40	43,5	40,5	VS40	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
36	-	45	45	45	BS45	47,0	45,5	VS45	-	-	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
40	-	-	52	-	BS52	54,0	52,5	VS52	-	-	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2
40	-	55	-	55	BS55	58,0	55,5	VS55	-	-	1000	MI-V1/ MI-V2	2000	MI-V1/ MI-V2

Table B6: Brushes, piston plugs, max anchorage depth and mixer extension, hammer drilling with hollow drill bit system (HDB)

Bar size	Tension anchor	Drill bit - ∅	d_b Brush - ∅	$d_{b,min}$ min. Brush - ∅	Piston plug	Cartridge: 440 ml or 585 ml				Cartridge: 1400 ml	
						Hand or battery tool		Pneumatic tool		Pneumatic tool	
φ	φ	HDB				$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension
[mm]	[mm]	[mm]			MIT-	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-
8	-	10	No cleaning required		-	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
8	-	12	No cleaning required		-	700	MI-V1/ MI-V2	800	MI-V1/ MI-V2	800	MI-V1/ MI-V2
10	-	12	No cleaning required		-	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
10	-	14	No cleaning required		VS14	700	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
12	ZA-M12	14	No cleaning required		VS14	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2	250	MI-V1/ MI-V2
12	ZA-M12	16	No cleaning required		VS16	700	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
14	-	18	No cleaning required		VS18	700	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
16	ZA-M16	20	No cleaning required		VS20	700	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
20	ZA-M20	25	No cleaning required		VS25	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
22	-	28	No cleaning required		VS28	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
24/25	ZA-M24	32	No cleaning required		VS32	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
28	-	35	No cleaning required		VS35	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2
32/34	-	40	No cleaning required		VS40	500	MI-V1/ MI-V2	1000	MI-V1/ MI-V2	1000	MI-V1/ MI-V2

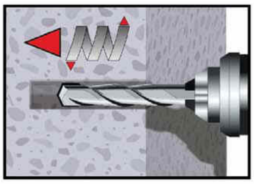
Mungo Injection system MIT700RE for rebar connection

Intended use
Installation tools

Annex B 6

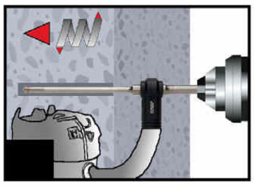
A) Bore hole drilling

Note: Before drilling, remove carbonated concrete and clean contact areas (see Annex B1)
In case of aborted drill hole: the drill hole shall be filled with mortar.

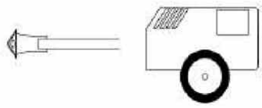


1a. **Hammer (HD) or compressed air drilling (CD)**
Drill a hole into the base material to the size and embedment depth required by the selected reinforcing bar
Proceed with Step B1.

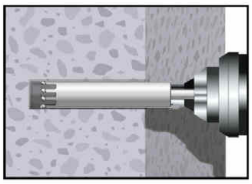
Hammer drill (HD + HDB)



1b. **Hollow drill bit system (HDB)** (see Annex B 5)
Drill a hole into the base material to the size and embedment depth required by the selected reinforcing bar.
This drilling system removes the dust and cleans the bore hole during drilling. Proceed with Step C.



Compressed air drill (CD)



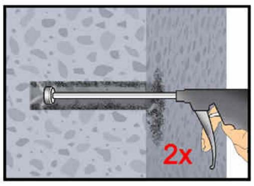
1c. **Diamond drilling (DD)**
Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor
Proceed with Step B2.

Diamond coring (DD)

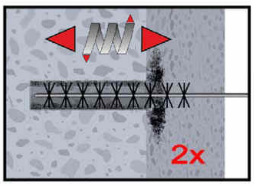
B1) Bore hole cleaning

CAC: Cleaning for all bore hole diameter and bore hole depth with drilling method HD and CD

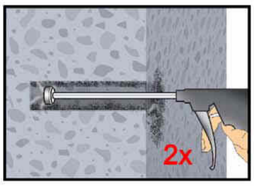
Attention! Standing water in the bore hole must be removed before cleaning.



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 7) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used



2b. Check brush diameter (Table B5). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of two times.
If the bore hole ground is not reached with the brush, a brush extension shall be used (Table B5).



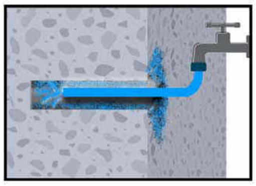
2c. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 7) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

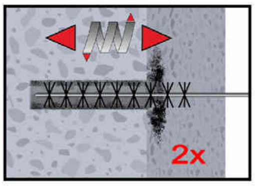
Mungo Injection system MIT700RE for rebar connection	**Annex B 7**
Intended use Installation instruction: Bore hole drilling and cleaning (HD, HDB and CD)	

B2) Bore hole cleaning

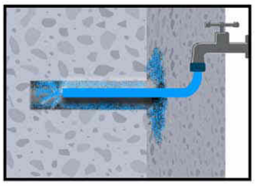
SPCAC: Cleaning for all bore hole diameter and bore hole depth with drilling method DD



2a. Rinsing with water until clear water comes out.

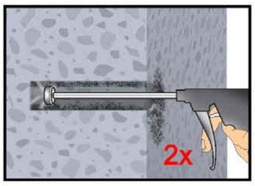


2b. Check brush diameter (Table B5). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of two times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension must be used.

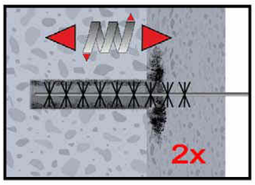


2c. Rinsing again with water until clear water comes out.

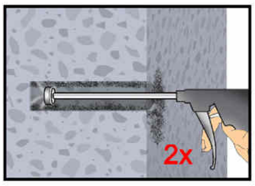
Attention! Standing water in the bore hole must be removed before proceed cleaning.



2d. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 7) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used



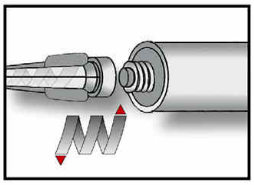
2e. Check brush diameter (Table B5). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B5) a minimum of two times.
If the bore hole ground is not reached with the brush, a brush extension shall be used (Table B5).



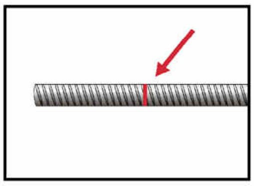
2f. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 7) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

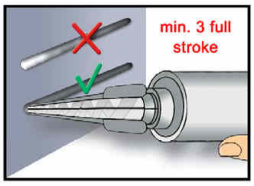
C) Preparation of bar and cartridge



3a. 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.

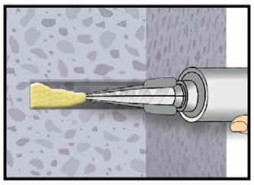


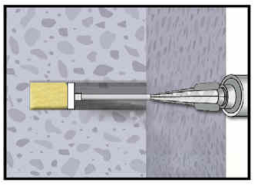
3b. Prior to inserting the reinforcing bar into the filled bore hole, the position of the embedment depth shall be marked (e.g. with tape) on the reinforcing bar and insert bar in empty hole to verify hole and depth ℓ_v.
The anchor should be free of dirt, grease, oil or other foreign material.



3c. Prior to dipensing into the bore hole, squeeze out separately the mortar until it shows a consistent grey or red colour, but a minimum of three full strokes, and discard non-uniformly mixed adhesive components.

D) Filling the bore hole

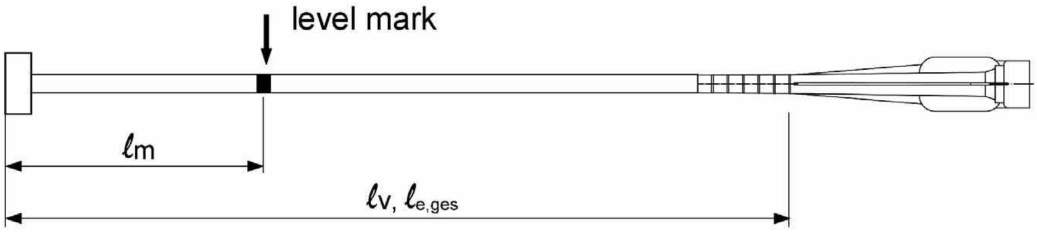




4. Starting from the bottom or back of the cleaned bore hole fill the hole with adhesive, until the level mark at the mixer extension (see below) is visible at the top of the hole. For embedment larger than 190 mm an extension nozzle shall be used.
Slowly withdraw the static mixing nozzle and using a piston plugs during injection of the mortar, helps to avoid creating air pockets.

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.



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

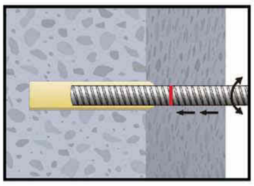
Quick estimation: $\ell_m = 1/3 \cdot \ell_v$

Continue injection until the mortar level mark ℓ_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]

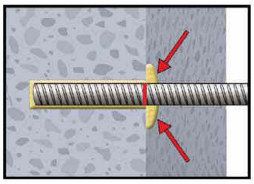
Mungo Injection system MIT700RE for rebar connection	**Annex B 9**
Intended Use Installation instruction: Preparation of bar and cartridge Filling the bore hole	

E) Setting the rebar

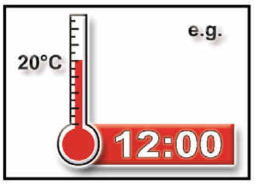


5a. Push the reinforcing bar into the bore hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

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



5b. 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 horizontal and overhead installation fix embedded part (e.g. with wedges).



5c. Observe gelling time t_{gel}. Attend that the gelling time can vary according to the base material temperature (see Table B3).
Do not move or load the bar until full curing time t_{cure} has elapsed (attend Table B3).

Mungo Injection system MIT700RE for rebar connection	**Annex B 10**
Intended Use Installation instruction: Inserting rebar	

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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 the amplification factor α_{lb} according to Table C1.

Table C1: Amplification factor α_{lb} related to concrete class and drilling method

Concrete class	Drilling method	Bar size	Amplification factor α_{lb}
C12/15 to C50/60	all drilling methods	8 mm to 40 mm ZA-M12 to ZA-M24	1,0

Table C2: Reduction factor k_b for all drilling methods

Rebar	Concrete class								
ϕ	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 40 mm ZA-M12 to ZA-M24	1,0								

Table C3: Design values of the ultimate bond stress $f_{bd,PIR}$ in N/mm² for all drilling methods and for good conditions

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

with

f_{bd}: Design value of the ultimate bond stress in N/mm² considering the concrete classes, the rebar diameter, the drilling method according to EN 1992-1-1:2004+AC:2010.
(for all other bond conditions multiply the values by 0.7)
k_b: Reduction factor according to Table C2

Rebar	Concrete class								
ϕ	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 32 mm ZA-M12 to ZA-M24	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
34 mm	1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
36 mm	1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,1
40 mm	1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	4,0

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Design value of the ultimate bond stress $f_{bd,fi}$ under fire exposure for concrete classes C12/15 to C50/60, (all drilling methods):

The design value of the bond strength $f_{bd,fi}$ under fire exposure has to be calculated by the following equation:

$$f_{bd,fi} = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \gamma_c / \gamma_{M,fi}$$

with: $\theta \leq 278°C$: $k_{fi}(\theta) = 4673{,}8 \cdot \theta^{-1{,}598} / (f_{bd,PIR} \cdot 4{,}3) \leq 1{,}0$

$\theta > 278°C$: $k_{fi}(\theta) = 0$

$f_{bd,fi}$ Design value of the ultimate bond stress in case of fire in N/mm²

θ Temperature in °C in the mortar layer.
$k_{fi}(\theta)$ Reduction factor under fire exposure.
$f_{bd,PIR}$ Design value of the ultimate bond stress in N/mm² in cold condition according to Table C3 considering the concrete classes, the rebar diameter, the drilling method and the bond conditions according to EN 1992-1-1:2004+AC:2010.
γ_c partially safety factor according to EN 1992-1-1:2004+AC:2010
$\gamma_{M,fi}$ partially safety factor according to EN 1992-1-2:2004+AC:2008

For evidence under fire exposure the anchorage length shall be calculated according to EN 1992-1-1:2004+AC:2010 Equation 8.3 using the temperature-dependent ultimate bond stress $f_{bd,fi}$.

Example graph of Reduction factor $k_{fi}(\theta)$ for concrete classes C20/25 for good bond conditions:

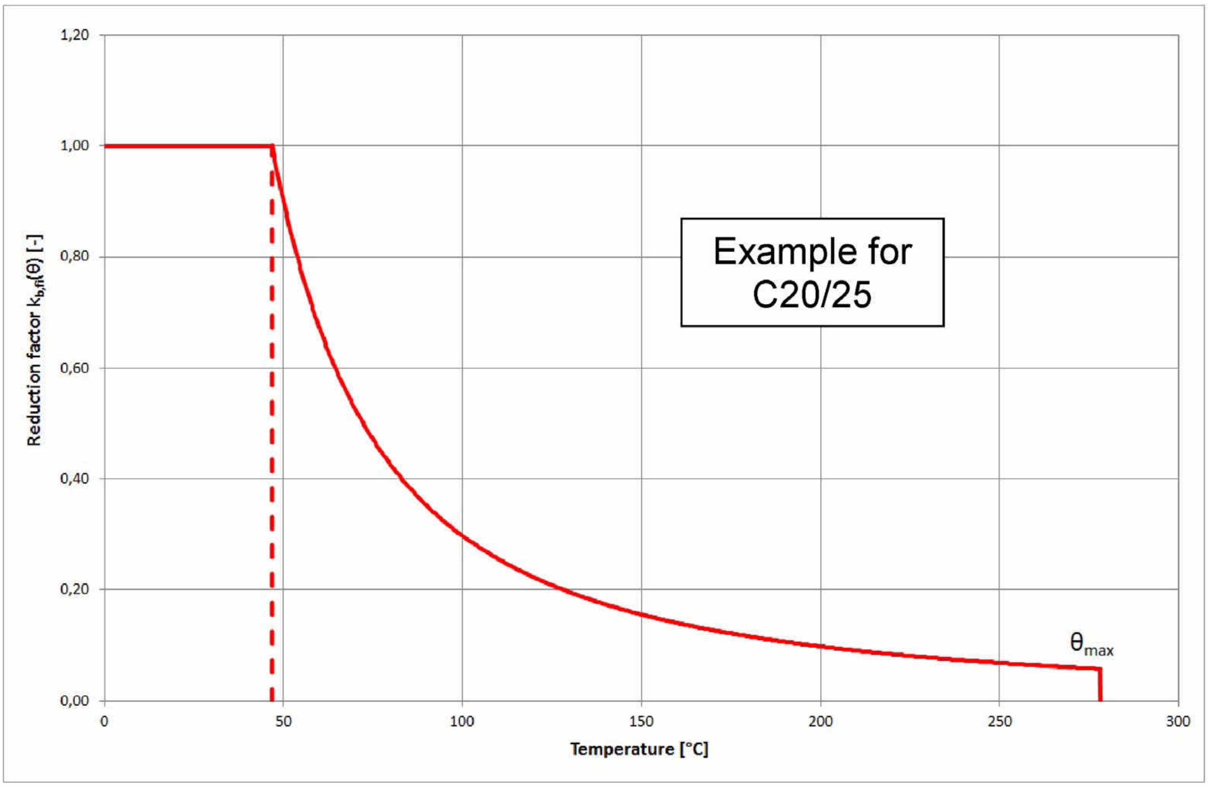

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Table C6: Characteristic tension strength for tension anchor ZA under fire exposure, concrete classes C12/15 to C50/60, according to Technical Report TR 020

Tension Anchor				**M12**	**M16**	**M20**	**M24**
Steel, zinc plated (ZA vz)							
Characteristic steel strength	R30	$\sigma_{Rk,s,fi}$	[N/mm²]	20			
	R60			15			
	R90			13			
	R120			10			
Stainless Steel (ZA A4 or ZA HCR)							
Characteristic steel strength	R30	$\sigma_{Rk,s,fi}$	[N/mm²]	30			
	R60			25			
	R90			20			
	R120			16			

Design value of the steel strength $\sigma_{Rd,s,fi}$ under fire exposure

The design value of the steel strength $\sigma_{Rd,s,fi}$ under fire exposure has to be calculated by the following equation:

$$\sigma_{Rd,s,fi} = \sigma_{Rk,s,fi} / \gamma_{M,fi}$$

with:

$\sigma_{Rk,s,fi}$ characteristic steel strength according to Table C4

$\gamma_{M,fi}$ partially safety factor according to EN 1992-1-2:2004+AC:2008

Mungo Injection system MIT700RE for rebar connection	**Annex C 3**
Performances Design value of the steel strength $\sigma_{Rd,s,fi}$ for tension anchor ZA under fire exposure	

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