Deutsches Institut für Bautechnik DIBt

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment

ETA-24/0233 of 1 November 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	MUNGO Injection system MIT900RE for rebar connection
Product family to which the construction product belongs	Post-installed reinforcing bar (rebar) connection with improved bond-splitting behaviour under static loading
Manufacturer	MUNGO Befestigungstechnik AG Webereiweg 6 4802 Strengelbach SCHWEIZ
Manufacturing plant	Plant 13
This European Technical Assessment contains	19 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	EAD 332402-00-0601, Edition 09/2023

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

The subject of this European Technical Assessment is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the "MUNGO Injection system MIT900RE for rebar connection" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars with a diameter ϕ from 8 to 40 mm according to Annex A and the injection mortar MIT700RE / MIT900RE are used for the post-installed rebar connection. The rebar is placed into a drilled hole filled with injection mortar and is anchored via the bond between embedded reinforcing bar, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European assessment Document

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the rebar connections of at least 50 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, 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 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 3
Characteristic resistance to tension load (seismic loading)	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

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

In accordance with European Assessment Document EAD No. 332402-00-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 1 November 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Referatsleiterin

beglaubigt:
Baderschneider

Installation condition and application example

Figure A1: Column / wall to foundation / slab

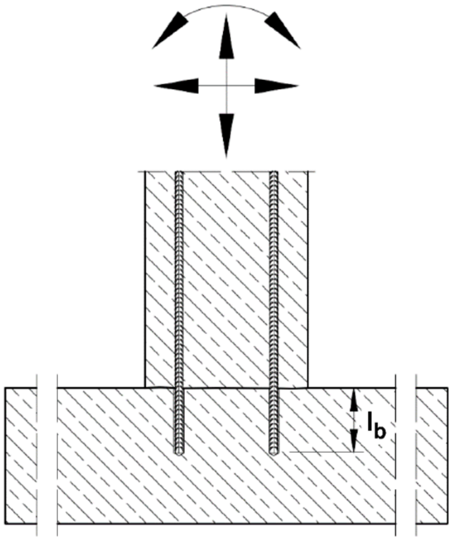
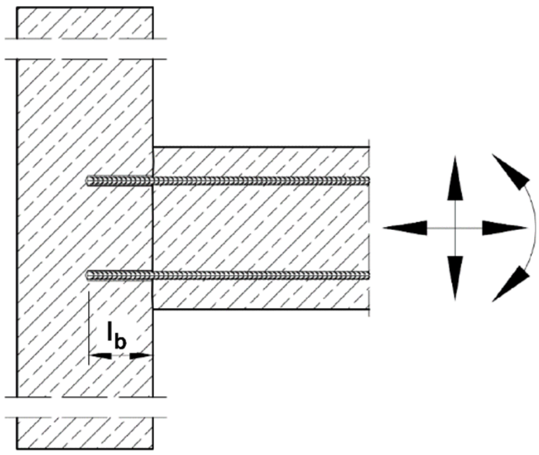


Figure A2: Slab / beam to wall or beam to column



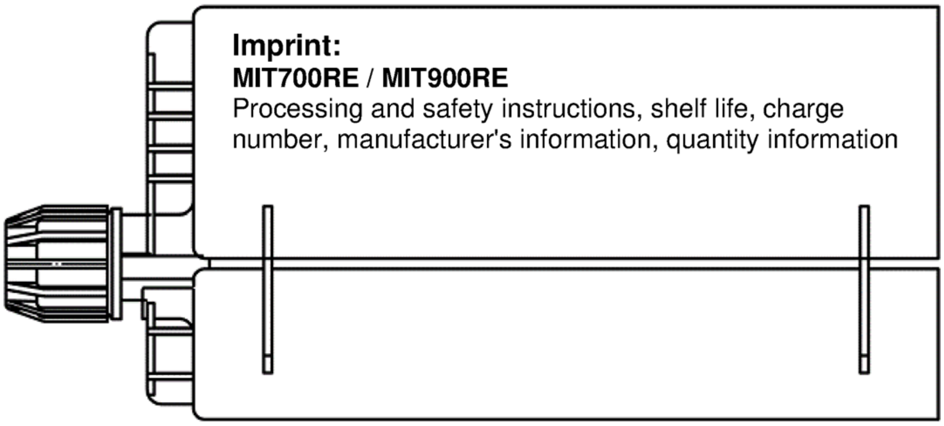
l_b = Embedment length

The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1:2004+AC:2010.

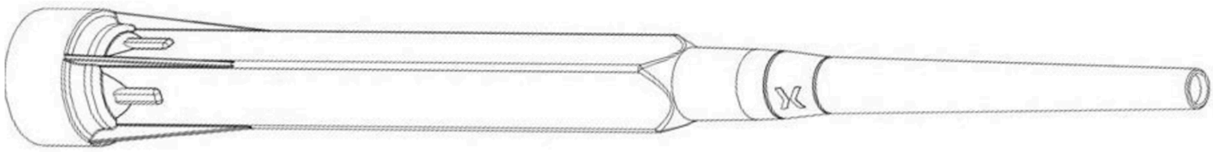
MUNGO Injection system MIT900RE for rebar connection	**Annex A 1**
Product description Installed condition and examples of use for rebars	

Cartridge system

Side-by-Side Cartridge:
440 ml, 585 ml and 1400 ml



Static mixer MIT-MI 4



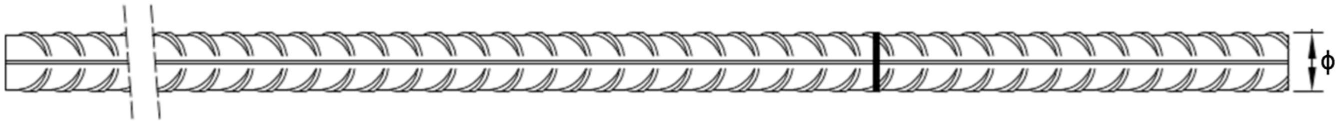
Piston plug MIT-VS and mixer extension MIT-VL

MUNGO Injection system MIT900RE for rebar connection

Product description
Injection system

Annex A 2

Reinforcing bar (rebar): ø8 up to 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 Rebar

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 NCI of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

MUNGO Injection system MIT900RE for rebar connection

Product description
Specifications Rebar

Annex A 3

Specification of the intended use

Anchorages subject to:		Working life 50 years	Working life 100 years
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling DD: Diamond drilling	static and quasi-static loads	Ø8 to Ø40	Ø8 to Ø40
Temperature Range:	I: - 40°C to +40°C (max long-term temperature +24 °C and max short-term temperature +40 °C) II: - 40°C to +72°C (max long-term temperature +50 °C and max short-term temperature +72 °C)		

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A2:2021.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A2:2021.
- Maximum chloride content of 0,40% (CL 0.40) related to the cement content according to EN 206:2013 + A2:2021.
- 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.

Design:

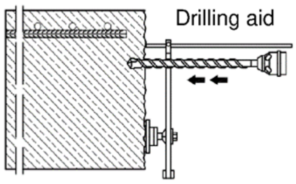
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design according to EOTA Technical Report TR 069, Edition June 2021.
- The actual position 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; for all drilling methods and all diameter.
- Water-filled drill holes; for rebar Ø8 to Ø32 only.
- Overhead installation allowed.
- Hole drilling by hammer drill (HD), hollow drill (HDB), diamond drill (DD) or compressed air drill mode (CD).
- Rebar installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- 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).

MUNGO Injection system MIT900RE for rebar connection	**Annex B 1**
Intended use Specifications	

Table B1: Minimum concrete cover c_{min} of post-installed rebar depending of drilling method

Drilling method	Rebar diameter	Without drilling aid	With drilling aid	
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit	< 25 mm	30 mm + 0,06 · l_b ≥ 2 ϕ	30 mm + 0,02 · l_b ≥ 2 ϕ	
	≥ 25 mm	40 mm + 0,06 · l_b ≥ 2 ϕ	40 mm + 0,02 · l_b ≥ 2 ϕ	
DD: Diamond drilling	< 25 mm	Drill rig used as drilling aid	30 mm + 0,02 · l_b ≥ 2 ϕ	
	≥ 25 mm		40 mm + 0,02 · l_b ≥ 2 ϕ	
CD: Compressed air drilling	< 25 mm	50 mm + 0,08 · l_b	50 mm + 0,02 · l_b	
	≥ 25 mm	60 mm + 0,08 · l_b ≥ 2 ϕ	60 mm + 0,02 · l_b ≥ 2 ϕ	

Comments: The minimum concrete cover acc. EN 1992-1-1:2004+AC:2010 must be observed.
The minimum clear spacing is a = max (40mm; 4 ϕ)

Table B2: Dispensing tools

Cartridge type/size	Hand tool		Pneumatic tool
Side-by-side cartridges 440, 585 ml	 e.g. SA 296C585	 e.g. Type H 244 C	 e.g. Type TS 444 KX
Side-by-side cartridges 1400 ml	-	-	 e.g. Type TS 471

All cartridges could also be extruded by a battery tool.

MUNGO Injection system MIT900RE for rebar connection	Annex B 2
Intended use Minimum concrete cover Dispensing tools	

Table B3: Brushes, piston plugs, max embedment length and mixer extension, hammer (HD), diamond (DD) and compressed air (CD) drilling

Bar size φ	Drill bit - Ø HD	Drill bit - Ø DD	Drill bit - Ø CD	d_b Brush - Ø	d_b Brush - Ø	$d_{b,min}$ min. Brush - Ø	Piston plug	Cartridge: 440 ml or 585 ml, Hand or battery tool $l_{b,max}$	Cartridge: 440 ml or 585 ml, Hand or battery tool Mixer extension	Cartridge: 440 ml or 585 ml, Pneumatic tool $l_{b,max}$	Cartridge: 440 ml or 585 ml, Pneumatic tool Mixer extension	Cartridge: 1400 ml, Pneumatic tool $l_{b,max}$	Cartridge: 1400 ml, Pneumatic tool Mixer extension
[mm]		[mm]		MIT-	[mm]	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-
8	10			BS10	11,5	10,5	-	250	VL10/0,75 or VL16/1,8	250	VL10/0,75 or VL16/1,8	250	VL10/0,75 or VL16/1,8
	12		-	BS12	13,5	12,5	-	700		800		800	
10								250		250		250	
	14		-	BS14	15,5	14,5	VS14	700		1000		1000	
12								250		250		250	
	16			BS16	17,5	16,5	VS16	700		1300		1200	VL16/1,8
14	18			BS18	20,0	18,5	VS18					1400	
16	20			BS20	22,0	20,5	VS20					1600	
20	25		-	BS25	27,0	25,5	VS25	500		1000		2000	
	-		26	BS26	28,0	26,5	VS25						
22	28			BS28	30,0	28,5	VS28						
24/25	30			BS30	32,0	30,5	VS30						
	32			BS32	34,0	32,5	VS32						
28	35			BS35	37,0	35,5	VS35						
32/34	40			BS40	43,5	40,5	VS40						
36	45			BS45	47,0	45,5	VS45	-	-				
40	-	52	-	BS52	54,0	52,5	VS52						
	55	-	55	BS55	58,0	55,5	VS55						

Table B4: Brushes, piston plugs, max embedment length and mixer extension, hammer drilling with hollow drill bit system (HDB)

Bar size φ	Drill bit - Ø HDB	d_b Brush - Ø	$d_{b,min}$ min. Brush - Ø	Piston plug	Cartridge: 440 ml or 585 ml, Hand or battery tool $l_{b,max}$	Cartridge: 440 ml or 585 ml, Hand or battery tool Mixer extension	Cartridge: 440 ml or 585 ml, Pneumatic tool $l_{b,max}$	Cartridge: 440 ml or 585 ml, Pneumatic tool Mixer extension	Cartridge: 1400 ml, Pneumatic tool $l_{b,max}$	Cartridge: 1400 ml, Pneumatic tool Mixer extension
[mm]	[mm]			MIT-	[mm]	MIT-	[mm]	MIT-	[mm]	MIT-
8	10	No cleaning Required		-	250	VL10/0,75 or VL16/1,8	250	VL10/0,75 or VL16/1,8	250	VL10/0,75 or VL16/1,8
	12			-	700		800		800	
10					250		250		250	
	14			VS14	700		1000		1000	
12					250		250		250	
	16			VS16	700		1000		1000	
14	18			VS18						
16	20			VS20						
20	25			VS25	500					
22	28			VS28						
24/25	30			VS30						
	32			VS32						
28	35			VS35						
32/34	40			VS40						

MUNGO Injection system MIT900RE for rebar connection

Intended use
Parameter brushes, piston plugs, max embedment length and mixer extension

Annex B 3

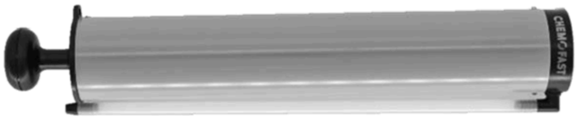
Cleaning and installation tools

HDB – Hollow drill bit system

The hollow drill system consists of MHP-Clean/ MHX-Clean and a class M vacuum cleaner with a minimum negative pressure of 253 hPa and a flow rate of minimum 150 m³/h (42 l/s).

Hand pump

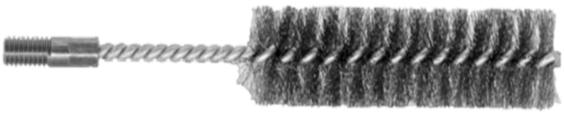
(Volume 750 ml, $h_0 \leq 10\ d_s$, $d_0 \leq 20$mm)



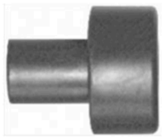
Compressed air tool

(min 6 bar)

Brush MIT-BS



Piston Plug MIT-VS



Brush extension MIT-BS

Table B5: Working time and curing time

Temperature in base material			Maximum working time	Initial curing time[1)]	Minimum curing time[2)]
T			t_{work}	$t_{cure,ini}$	t_{cure}
0 °C	up to	+ 4 °C	80 min	30 h	144 h
+ 5 °C	up to	+ 9 °C	80 min	20 h	48 h
+ 10 °C	up to	+ 14 °C	60 min	15 h	28 h
+ 15 °C	up to	+ 19 °C	40 min	9 h	18 h
+ 20 °C	up to	+ 24 °C	30 min	6 h	12 h
+ 25 °C	up to	+ 34 °C	12 min	4 h	9 h
+ 35 °C	up to	+ 39 °C	8 min	3 h	6 h
+40°C			8 min	1,5 h	4 h
Cartridge temperature			+5°C up to +40°C		

1) After Initial curing time has elapsed, the installation of the connecting reinforcement and the construction of the formwork can be continued

2) The minimum curing time is only valid for dry base material.
In wet base material the curing time must be doubled.

MUNGO Injection system MIT900RE for rebar connection

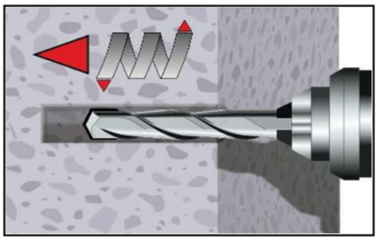
Intended use
Cleaning and installation tools
Working time and curing time

Annex B 4

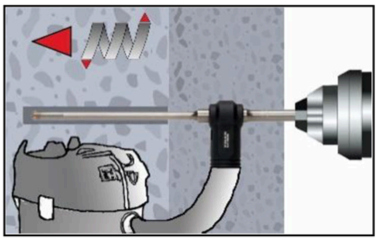
Installation instructions

Attention: Before drilling, remove carbonated concrete and clean contact areas (see Annex B 1)
In case of aborted drill hole: the drill hole shall be filled with mortar.

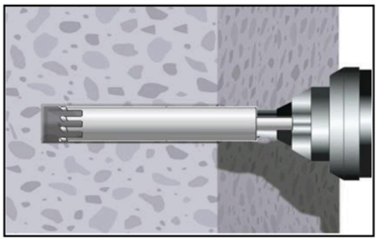
Drilling of the bore hole



1a. **Hammer drilling (HD) / Compressed air drilling (CD)**
Drill a hole to the required embedment length.
Drill bit diameter according to Table B3.
Proceed with Step 2 (MAC or CAC).



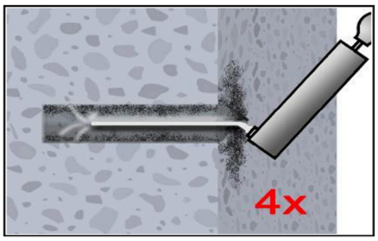
1b. **Hollow drill bit system (HDB) (see Annex B 4)**
Drill a hole to the required embedment length.
Drill bit diameter according to Table B4.
The hollow drilling system removes the dust and cleans the bore hole.
Proceed with Step 3.



1c. **Diamond drilling (DD)**
Drill a hole to the required embedment length required
Drill bit diameter according to Table B3.
Proceed with Step 2 (SPCAC).

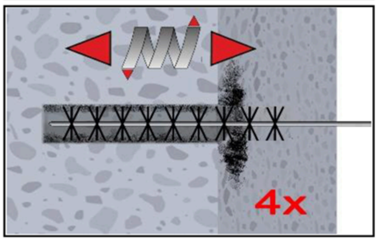
Installation instructions (continuation)

Manual Air Cleaning (MAC)
for drill hole diameter d_0 ≤ 20mm and drill hole depth h_0 ≤ 10ϕ with drilling method HD/CD

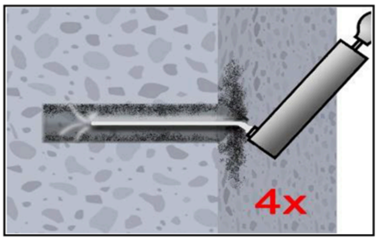


Attention! Standing water in the bore hole must be removed before cleaning.

2a. Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 4).

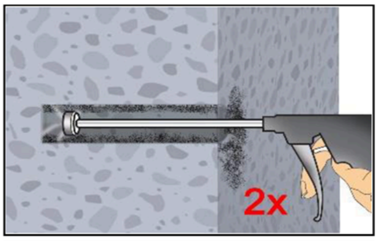


2b. Brush the bore hole minimum 4x with brush MIT-BS according to Table B3 over the entire embedment depth in a twisting motion (if necessary, use a brush extension MIT-BS).



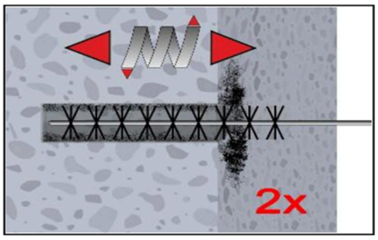
2c. Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 4).

Compressed Air Cleaning (CAC):
All diameter with drilling method HD/CD

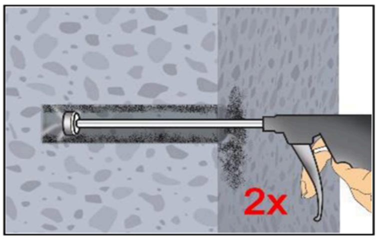


Attention! Standing water in the bore hole must be removed before cleaning.

2a. Blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



2b. Brush the bore hole minimum 2x with brush MIT-BS according to Table B3 over the entire embedment depth in a twisting motion. (If necessary, a brush extension MIT-BS shall be used.)



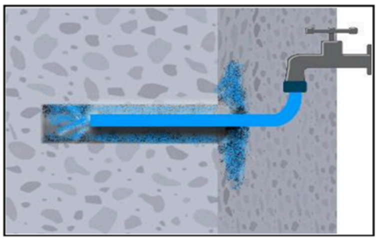
2c. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

Protect cleaned bore hole against re-contamination in an appropriate way. If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

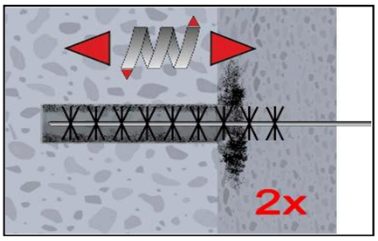
MUNGO Injection system MIT900RE for rebar connection	**Annex B 6**
Intended use Installation instructions (continuation)	

Installation instructions (continuation)

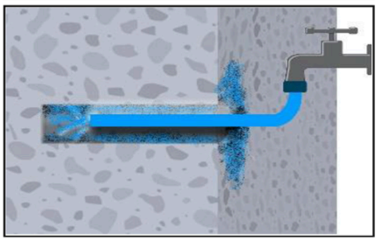
Flush & Compressed Air Cleaning (SPCAC):
All diameter with drilling method DD



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

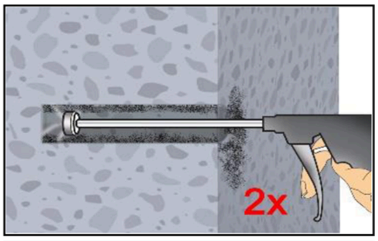


2b. Brush the bore hole minimum 2x with brush MIT-BS according to Table B3 over the entire embedment depth in a twisting motion. (If necessary, a brush extension MIT-BS shall be used.)

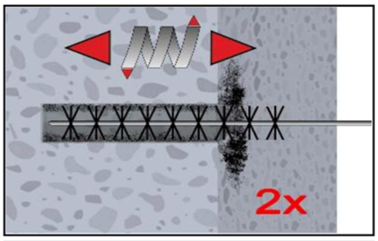


2c. Flushing again with water until clear water comes out.

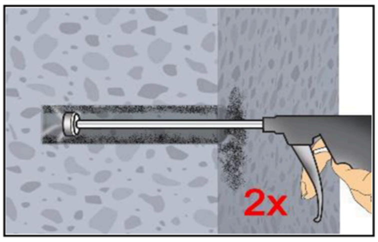
Attention! Standing water in the bore hole must be removed before proceeding.



2d. Blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



2e. Brush the bore hole minimum 2x with brush MIT-BS according to Table B3 over the entire embedment depth in a twisting motion. (If necessary, a brush extension MIT-BS shall be used.)

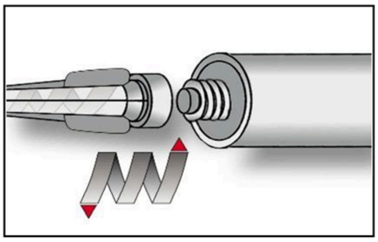


2f. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

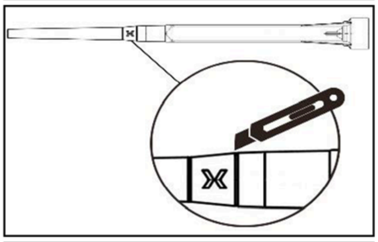
Protect cleaned bore hole against re-contamination in an appropriate way. If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

MUNGO Injection system MIT900RE for rebar connection	**Annex B 7**
Intended use Installation instructions (continuation)	

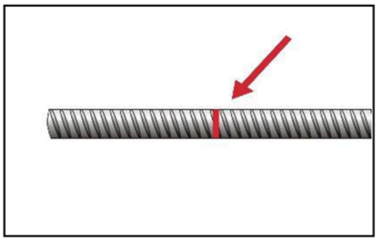
Installation instructions (continuation)



3. Screw on static-mixing nozzle MIT-MI 4, and load the cartridge into an appropriate dispensing tool.
For every working interruption longer than the maximum working time t_{work} (Annex B 4) as well as for new cartridges, a new static-mixer shall be used.



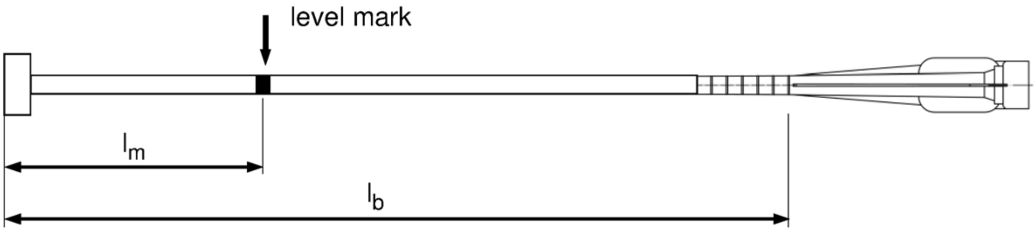
3a. In case of using the mixer extension MIT-VL16/1,8, cut off the tip of the mixer nozzle at position „X“.

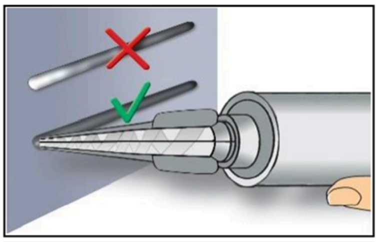


4. Mark embedment length l_b on the reinforcing bar .
The reinforcing bar shall be free of dirt, grease, oil or other foreign material.

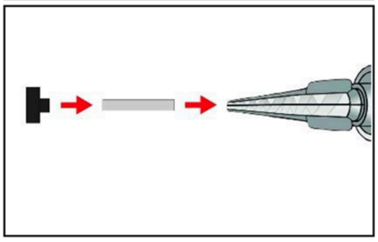
5. Mark mixer nozzle and extension with mortar level mark l_m and embedment length l_b
Quick estimation: $l_m = 1/3 \cdot l_b$
Optimum mortar volume:

$$l_m = l_b \cdot \left(1{,}2 \cdot \frac{\phi^2}{d_0^2} - 0{,}2\right)$$



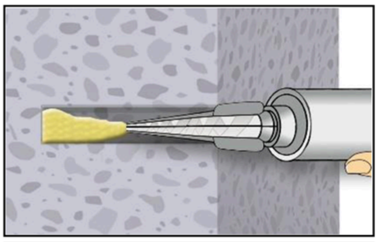


6. Not proper mixed mortar is not sufficient for fastening.
Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).

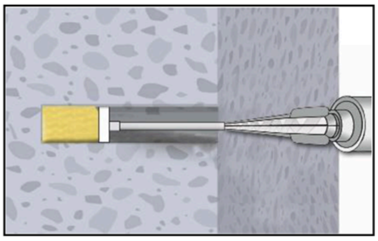


7. Piston plugs MIT-VS and mixer nozzle extensions MIT-VL shall be used according to
Table B3 or B4.
Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.

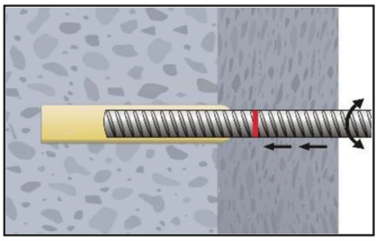
Installation instructions (continuation)



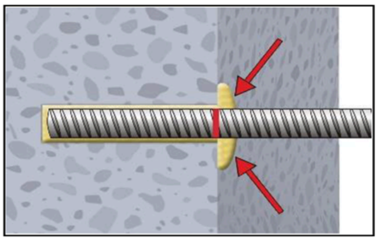
8a. **Injecting mortar without piston plug MIT-VS:**
Starting at bottom of the hole and fill the hole with adhesive until the mortar level mark is visible. (If necessary, a mixer nozzle extension shall be used.)
Slowly withdraw of the static mixing nozzle avoid creating air pockets
Observe the temperature related working time t_{work} (Annex B 4).



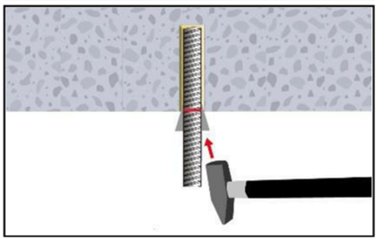
8b. **Injecting mortar with piston plug MIT-VS:**
Insert piston plug to bottom of the hole and fill the hole with mortar until mortar level mark l_m is visible. (If necessary, a mixer nozzle extension shall be used.)
During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.
Observe the temperature related working time t_{work} (Annex B 4).



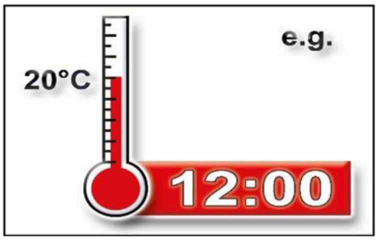
9. Insert the reinforcing bar while turning slightly up to the embedment mark.



10. Annular gap between reinforcing bar and base material must be completely filled with mortar. Otherwise, the installation must be repeated starting from step 8 before the maximum working time t_{work} has expired.



11. For application in vertical upwards direction the reinforcing bar shall be fixed (e.g. wedges).



12. Temperature related curing time t_{cure} (Annex B 4) must be observed.
After initial curing time $t_{cure,ini}$ has elapsed, the installation of the connecting reinforcement and the formwork can be continued. The full load to the reinforcing bar may be applied after the full curing time t_{cure} has elapsed.

MUNGO Injection system MIT900RE for rebar connection	**Annex B 9**
Intended use Installation instructions (continuation)	

Deutsches Institut für Bautechnik DIBt

Table C1: Characteristic resistance to tension load (static and quasi-static loading) for a working life of 50 and 100 years

Fastener			All sizes
Concrete cone failure			
Uncracked concrete	$k_{ucr,N}$	[-]	11,0
Cracked concrete	$k_{cr,N}$	[-]	7,7
Edge distance	$c_{cr,N}$	[mm]	1,5 l_b[1)]
Spacing	$s_{cr,N}$	[mm]	3,0 l_b[1)]

1) see Annex A 1

Table C2: Characteristic resistance to tension load under static and quasi-static loading in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB); working life 50 and 100 years

Reinforcing bar				**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 24**	**Ø 25**	**Ø 28**	**Ø 32**	**Ø 36**	**Ø 40**
Combined pull-out and concrete failure; working life 50 and 100 years															
Characteristic resistance in uncracked concrete C20/25 in hammer drilled holes (HD) and compressed air drilled holes (CD)															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,50} = \tau_{Rk,ucr,100}$	[N/mm²]	16	16	16	16	16	16	15	15	15	15	15	15
Temperature range II: 50°C/72°C				12	12	12	12	12	12	12	12	11	11	11	11
Characteristic resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)															
Temperature range I: 24°C/40°C	Dry, wet concrete	$\tau_{Rk,ucr,50} = \tau_{Rk,ucr,100}$	[N/mm²]	14	14	13	13	13	13	13	13	13	13	1)	
Temperature range II: 50°C/72°C				12	12	12	11	11	11	11	11	11	11		
Temperature range I: 24°C/40°C	flooded bore hole			13	13	13	13	13	13	13	13	13	13		
Temperature range II: 50°C/72°C				11	11	11	11	11	11	11	11	11	11		
Reduction factor $\psi^0_{sus,50}$, $\psi^0_{sus,100}$ in cracked and uncracked concrete C20/25; (HD, CD and HDB)															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,50} = \psi^0_{sus,100}$	[-]	0,80											
Temperature range II: 50°C/72°C				0,68											
Increasing factors for concrete		ψ_c	[-]	$(f_{ck} / 20)^{0,1}$											
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,ucr,50} =$		$\psi_c \cdot \tau_{Rk,ucr,50,(C20/25)}$											
		$\tau_{Rk,ucr,100} =$		$\psi_c \cdot \tau_{Rk,ucr,100,(C20/25)}$											
Influence of cracked concrete on combined pullout and concrete cone failure; working life of 50 and 100 years; (HD, CD and HDB)															
Factor for influence of cracked concrete	HD, CD	Ω_{cr}	[-]	0,84	0,84	0,85	0,86	0,87	0,89	0,91	0,91	0,92	0,94	0,94	0,95
	HDB			0,84	0,84	0,85	0,86	0,87	0,89	0,91	0,91	0,92	0,94	NDA 1)	
Bond-splitting failure; working life 50 and 100 years; (HD, CD and HDB)															
Product basic factor		A_k	[-]	6,0											
Exponent for influence of…															
- concrete compressive strength		sp1	[-]	0,32											
- rebar diameter ϕ		sp2	[-]	0,60											
- concrete cover c_d		sp3	[-]	0,30											
- side concrete cover (c_{max} / c_d)		sp4	[-]	0,28											
- embedment length l_b		lb1	[-]	0,66											
Concrete cone failure															
Relevant parameter				see Table C1											
Installation factor; (HD, CD and HDB)															
for dry and wet concrete		γ_{inst}	[-]	1,0										1,2	
for flooded bore hole				1,2										1)	

1) no performance assessed

MUNGO Injection system MIT900RE for rebar connection

Performances
Characteristic resistance to tension load under static and quasi-static loading; working life of 50 and 100 years; (HD, CD and HDB)

Annex C 2

Table C3: Characteristic resistance to tension load under static and quasi-static loading in diamond drilled holes (DD); working life 50 and 100 years

Reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Combined pull-out and concrete failure															
Characteristic resistance in uncracked concrete C20/25; working life 50 years															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,50}$	[N/mm²]	14	13	13	13	12	12	11	11	11	11	11	10
Temperature range II: 50°C/72°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,50}$	[N/mm²]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0	8,5	8,5
Reduction factor $\psi^0_{sus,50}$ in cracked and uncracked concrete C20/25; working life 50 years															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,50}$	[-]	0,77											
Temperature range II: 50°C/72°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,50}$	[-]	0,72											
Characteristic resistance in uncracked concrete C20/25; working life 100 years															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	14	13	13	13	12	12	11	11	11	11	11	10
Temperature range II: 50°C/72°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,100}$	[N/mm²]	11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5	8,0	8,0
Reduction factor $\psi^0_{sus,100}$ in cracked and uncracked concrete C20/25; working life 100 years															
Temperature range I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,100}$	[-]	0,73											
Temperature range II: 50°C/72°C	Dry, wet concrete and flooded bore hole	$\psi^0_{sus,100}$	[-]	0,70											
Increasing factors for concrete		ψ_c	[-]	$(f_{ck} / 20)^{0,2}$											
Characteristic bond resistance depending on the concrete strength class		$\tau_{Rk,ucr,50}$ =		$\psi_c \cdot \tau_{Rk,ucr,50,(C20/25)}$											
		$\tau_{Rk,ucr,100}$ =		$\psi_c \cdot \tau_{Rk,ucr,100,(C20/25)}$											
Influence of cracked concrete on combined pullout and concrete cone failure; working life 50 and 100 years															
Factor for influence of cracked concrete		Ω_{cr}	[-]	0,87	0,88	0,89	0,90	0,91	0,94	0,94	0,94	0,93	0,93	0,93	0,93
Bond-splitting failure; working life 50 and 100 years															
Product basic factor		A_k	[-]	5,9											
Exponent for influence of…															
- concrete compressive strength		sp1	[-]	0,28											
- rebar diameter ϕ		sp2	[-]	0,53											
- concrete cover c_d		sp3	[-]	0,36											
- side concrete cover (c_{max} / c_d)		sp4	[-]	0,29											
- embedment length l_b		lb1	[-]	0,65											
Concrete cone failure															
Relevant parameter				see Table C1											
Installation factor															
for dry and wet concrete		γ_{inst}	[-]	1,0											1,2
for flooded bore hole		γ_{inst}	[-]	1,2				1,4							1)

1) no performance assessed

MUNGO Injection system MIT900RE for rebar connection

Performances
Characteristic resistance to tension load under static and quasi-static loading;
working life 50 and 100 years (DD)

Annex C 3