

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-23/0860**  
**of 22 November 2023**

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

Mapei Injection system Mapefix UM Hybrid for rebar  
connection

Product family  
to which the construction product belongs

Post-installed reinforcing bar (rebar) Connections with  
improved bond-splitting behaviour

Manufacturer

Mapei S.p.A.  
Via Cafiero, 22  
20158 MILANO (Italy)  
ITALIEN

Manufacturing plant

Mapei s.p.a., plant1, Germany

This European Technical Assessment  
contains

16 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

332402-00-0601, Edition 09/2023

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## 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 Mapei Injection system Mapefix UM Hybrid in accordance with the regulations for reinforced concrete construction.

Reinforcing bars with a diameter  $\phi$  from 8 to 32 mm according to Annex A and the injection mortar Mapefix UM Hybrid 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)	
Resistance to combined pull-out and concrete failure in uncracked concrete	See Annex C 1
Resistance to concrete cone failure	See Annex C 1
Robustness	See Annex C 1
Resistance to bond-splitting failure	See Annex C 1
Influence of cracked concrete on resistance to combined pull-out and concrete failure	See Annex C 1
Characteristic resistance to tension load (seismic loading)	No performance assessed

**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 22 November 2023 by Deutsches Institut für Bautechnik

LBD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Baderschneider

Installation condition and application example

Figure A1: Column / wall to foundation / slab

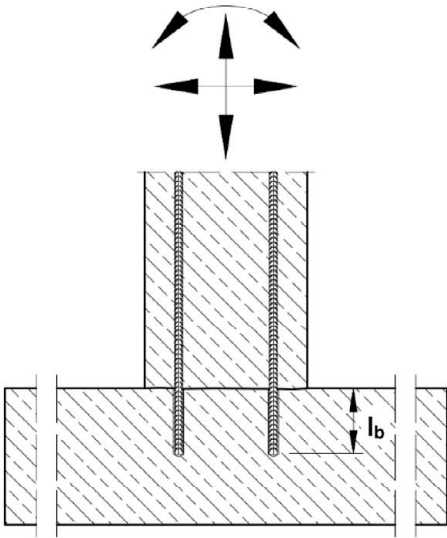
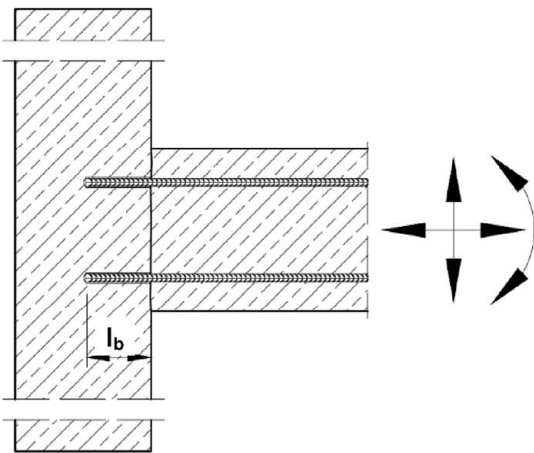


Figure A2: Slab / beam to wall or beam to column



$l_b$  = 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.

Mapei Injection system Mapefix UM Hybrid for rebar connection

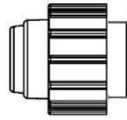
Product description  
Installed condition and examples of use for rebars

Annex A 1

## Cartridge system

### Coaxial Cartridge:

150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml



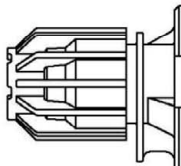
#### Imprint:

#### Mapefix UM Hybrid

Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

### Side-by-Side Cartridge:

235 ml, 345 ml up to 360 ml and 825 ml

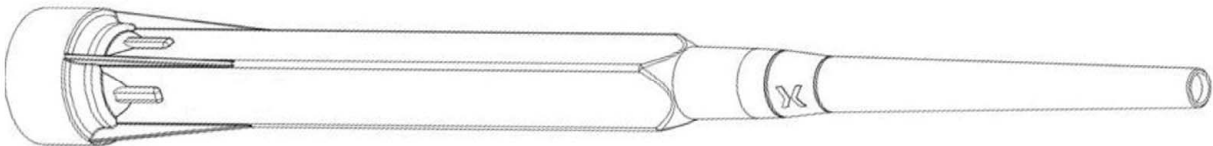


#### Imprint:

#### Mapefix UM Hybrid

Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

## Static mixer PM-19E



## Piston plug VS und mixer extension VL



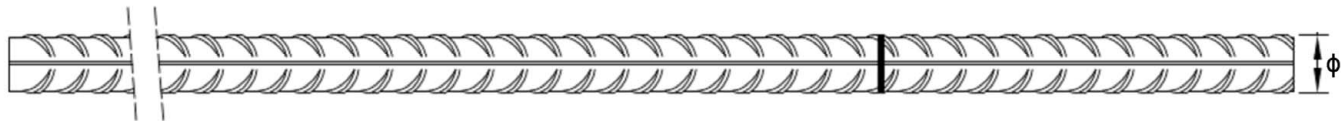
Mapai Injection system Mapefix UM Hybrid for rebar connection

### Product description

Injection system

Annex A 2

Reinforcing bar (rebar):  $\varnothing 8$  up to  $\varnothing 32$



- 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  $0,05\phi \leq h_{rib} \leq 0,07\phi$   
( $\phi$ : 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 $f_{uk} = f_{tk} = k \cdot f_{yk}$

Mapei Injection system Mapefix UM Hybrid for rebar connection

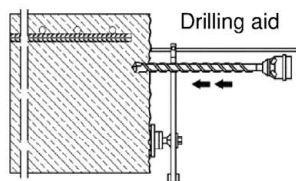
Product description  
Specifications Rebar

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	Static and quasi-static loads	Ø8 to Ø32	Ø8 to Ø32
Temperature Range:		I: - 40 °C to +40 °C <sup>1)</sup> II: - 40 °C to +80 °C <sup>2)</sup> III: - 40 °C to +120 °C <sup>3)</sup> IV: - 40 °C to +160 °C <sup>4)</sup>	I: - 40 °C to +40 °C <sup>1)</sup> II: - 40 °C to +80 °C <sup>2)</sup>
<div>1) (max. long-term temperature +24°C and max. short-term temperature +40°C)</div> <div>2) (max. long-term temperature +50°C and max. short-term temperature +80°C)</div> <div>3) (max. long-term temperature +72°C and max. short-term temperature +120°C)</div> <div>4) (max. long-term temperature +100°C and max. short-term temperature +160°C)</div>			
<b>Base materials:</b> <ul style="list-style-type: none"><li>- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.</li><li>- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.</li><li>- Maximum chloride content of 0,40% (CL 0.40) related to the cement content according to EN 206:2013 + A1:2016.</li><li>- Non-carbonated concrete.</li></ul> <div>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 <math>\phi + 60</math> 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.</div>			
<b>Design:</b> <ul style="list-style-type: none"><li>- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.</li><li>- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.</li><li>- Design according to EOTA Technical Report TR 069, Edition June 2021.</li><li>- 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.</li></ul>			
<b>Installation:</b> <ul style="list-style-type: none"><li>- Dry or wet concrete, as well as in flooded holes.</li><li>- Overhead installation allowed.</li><li>- Hole drilling by hammer drill (HD), hollow drill (HDB) or compressed air drill mode (CD).</li><li>- Rebar installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.</li><li>- 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).</li></ul>			
Mapei Injection system Mapefix UM Hybrid 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 + $0,06 \cdot l_b \geq 2 \phi$	30 mm + $0,02 \cdot l_b \geq 2 \phi$	
	$\geq 25$ mm	40 mm + $0,06 \cdot l_b \geq 2 \phi$	40 mm + $0,02 \cdot l_b \geq 2 \phi$	
CD: Compressed air drilling	< 25 mm	50 mm + $0,08 \cdot l_b$	50 mm + $0,02 \cdot l_b$	
	$\geq 25$ mm	60 mm + $0,08 \cdot l_b \geq 2 \phi$	60 mm + $0,02 \cdot l_b \geq 2 \phi$	

The minimum concrete cover acc. EN 1992-1-1:2004+AC:2010 must be observed.  
The minimum clear spacing is  $a = \max(40\text{mm}; 4 \phi)$

**Table B2: Dispensing tools**

Cartridge type/size	Hand tool		Pneumatic tool
Coaxial cartridges 150, 280, 300 up to 333 ml	 e.g. Type H297 / 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.

**Mapei Injection system Mapefix UM Hybrid for rebar connection**

**Intended use**  
Minimum concrete cover  
Dispensing tools

**Annex B 2**

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

Bar size  ϕ	Drill bit - Ø		d <sub>b</sub> Brush - Ø	d <sub>b,min</sub> min. Brush - Ø	Piston plug	Cartridge: All sizes				Cartridge: 825 ml		
	HD	CD				Hand or battery tool		Pneumatic tool		Pneumatic tool		
						l <sub>b,max</sub>	Mixer extension	l <sub>b,max</sub>	Mixer extension	l <sub>b,max</sub>	Mixer extension	
[mm]	[mm]		[mm]	[mm]		[mm]		[mm]		[mm]		
8	10	-	BR10	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	-	BR12	13,5	12,5	-	700		800		800	
10							14		-		BR14	
	700	1000	1000									
12	16		BR16	17,5	16,5	VS16	250		250		250	
							14		18		BR18	20,0
16	20	BR20	22,0	20,5	VS20	700						
							20		25		-	BR25
-	26	BR26	28,0	26,5	VS25	500						
22	28	BR28	30,0	28,5	VS28							
24/25	30	BR30	32,0	30,5	VS30							
	32	BR32	34,0	32,5	VS32							
28	35	BR35	37,0	35,5	VS35							
32	40	BR40	43,5	40,5	VS40							

**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	d <sub>b</sub> Brush - Ø	d <sub>b,min</sub> min. Brush - Ø	Piston plug	Cartridge: All sizes				Cartridge: 825 ml	
	HDB				Hand or battery tool		Pneumatic tool		Pneumatic tool	
					l <sub>b,max</sub>	Mixer extension	l <sub>b,max</sub>	Mixer extension	l <sub>b,max</sub>	Mixer extension
[mm]	[mm]	No cleaning required			[mm]		[mm]		[mm]	
8	10			-	250	VL10/0,75 or VL 16/1,8	250	VL10/0,75 or VL16/1,8	250	VL10/0,75 or VL16/1,8
	10				700		800		800	
12					250		250		250	
12				14	VS14		700		1000	
	16			250	250		250			
14	18			VS16	700		1000		1000	VL16/1,8
16	20			VS18						
20	25			VS20						
22	28			VS25	500		700			
24/25	30			VS28						
	32			VS30						
	28			35			VS32			
32	40			VS35						
		VS40								

**Mapei Injection system Mapefix UM Hybrid 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 Heller Duster Expert Hohlbohrer 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,  $h_0 \geq 10 d_s$ ,  $d_0 \leq 20\text{mm}$ )



### Compressed air tool

(min 6 bar)



### Brush BR



### Piston Plug VS



### Brush extension



**Table B5: Working time and curing time**

Temperature in base material			Maximum working time	Minimum curing time <sup>1)</sup>
T			$t_{\text{work}}$	$t_{\text{cure}}$
- 5 °C	up to	- 1 °C	50 min	5 h
0 °C	up to	+ 4 °C	25 min	3,5 h
+ 5 °C	up to	+ 9 °C	15 min	2 h
+ 10 °C	up to	+ 14 °C	10 min	1 h
+ 15 °C	up to	+ 19 °C	6 min	40 min
+ 20 °C	up to	+ 29 °C	3 min	30 min
+ 30 °C	up to	+ 40 °C	2 min	30 min
Cartridge temperature			+5 °C up to +40 °C	

<sup>1)</sup> The minimum curing time is only valid for dry base material.  
In wet base material the curing time must be doubled.

### Mapei Injection system Mapefix UM Hybrid for rebar connection

#### Intended use

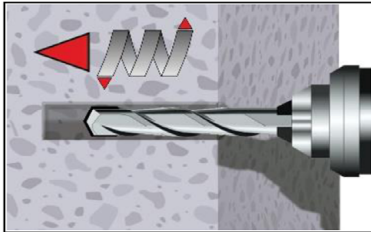
Cleaning and installation tools  
Working time and curing time

### Annex B 4

## Installation instructions

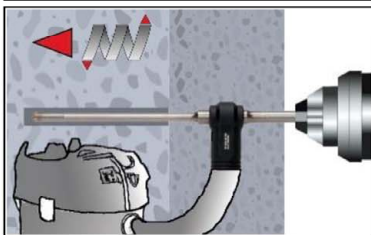
**Attention: Before drilling, remove carbonated concrete and clean contact areas (see Annex B 1)**  
**Aborted drill holes shall be filled with mortar.**

### 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).

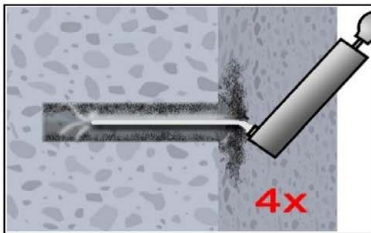


#### 1b. Hollow drill bit system (HDB) (see Annex B 4)

Drill a hole to the required embedment length.  
Drill bit diameter according to Table B4.  
Proceed with Step 3.

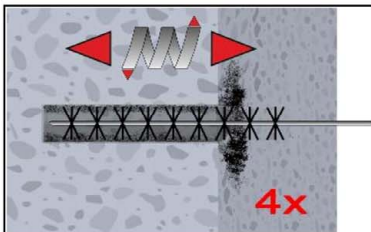
### Manual Air Cleaning (MAC)

for bore hole diameter  $d_0 \leq 20\text{mm}$  and bore hole depth  $h_0 \leq 10\phi$ , with drilling method HD and CD

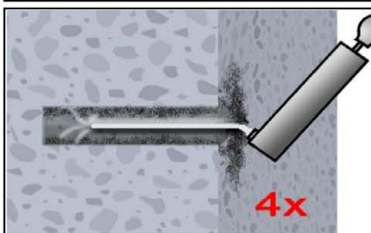


**Attention! Standing water in the bore hole must be removed before cleaning.**

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 BR according to Table B3 over the entire embedment depth in a twisting motion (if necessary, use a brush extension).



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

**Mapei Injection system Mapefix UM Hybrid for rebar connection**

**Intended use**  
Installation instruction

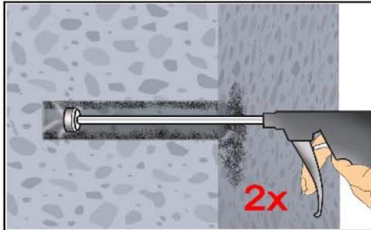
**Annex B 5**



## Installation instructions (continuation)

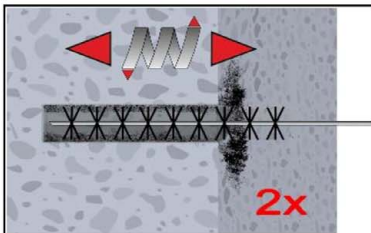
### Compressed Air Cleaning (CAC):

All diameter with drilling method HD and CD

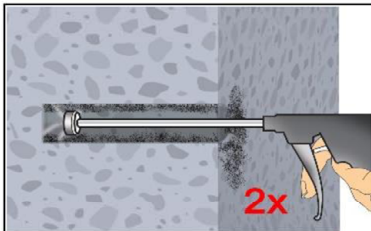


**Attention! Standing water in the bore hole must be removed before cleaning.**

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.)

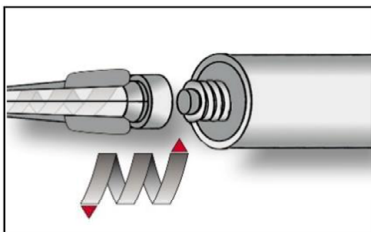


2b. Brush the bore hole minimum 2x with brush BR according to Table B3 over the entire embedment depth in a twisting motion. (If necessary, a brush extension shall be used.)

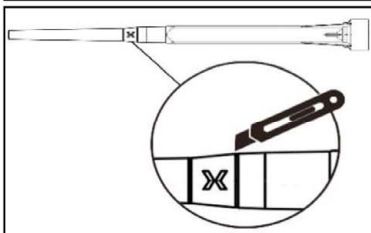


2c. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

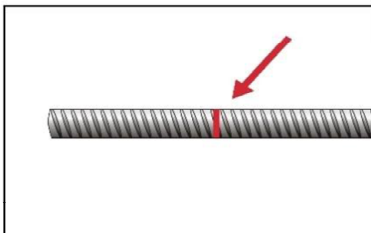
**Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar.**



3. Screw on static-mixing nozzle PM-19E and load the cartridge into an appropriate dispensing tool.  
For every working interruption longer than the maximum working time  $t_{\text{work}}$  (Annex B 4) as well as for new cartridges, a new static-mixer shall be used.



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



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

**Mapei Injection system Mapefix UM Hybrid for rebar connection**

**Intended use**

Installation instructions (continuation)

**Annex B 6**

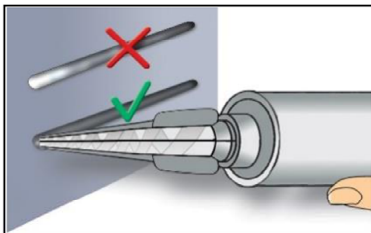
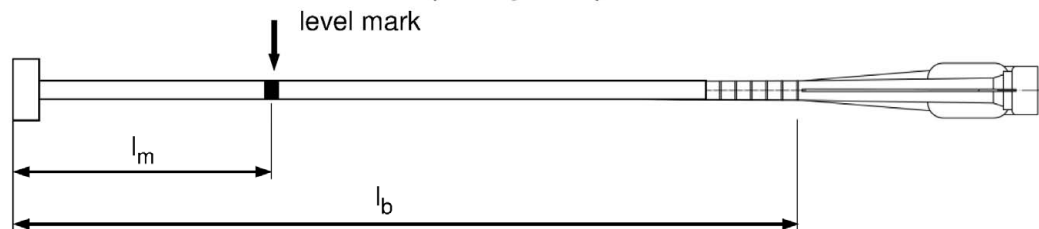
### Installation instructions (continuation)

5. Injection tool must be marked by mortar level mark  $l_m$  and embedment length  $l_b$  with tape or marker.

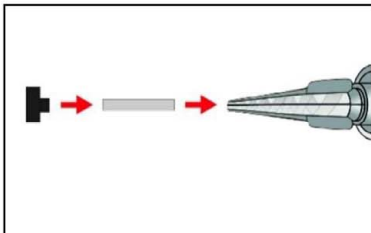
Quick estimation:  $l_m = 1/3 \cdot l_b$

Optimum mortar volume:

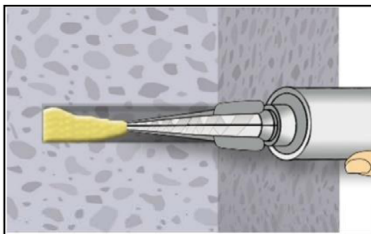
$$l_m = l_b \cdot \left( 1,2 \cdot \frac{\phi^2}{d_0^2} - 0,2 \right)$$



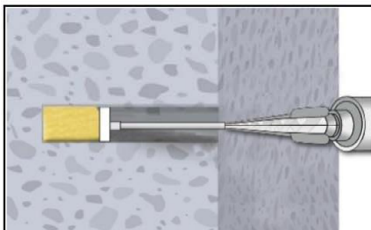
6. Not proper mixed mortar is not sufficient for fastening. Dispense and discard mortar until an uniform grey colour is shown (at least 3 full strokes).



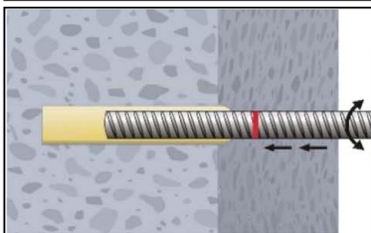
7. Piston plugs VS and mixer nozzle extensions VL shall be used according to Table B3 or B4  
Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.



- 8a. **Injecting mortar without piston plug VS**  
Starting at bottom of the hole and fill the hole up with mortar until the mortar level mark  $l_m$  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 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.

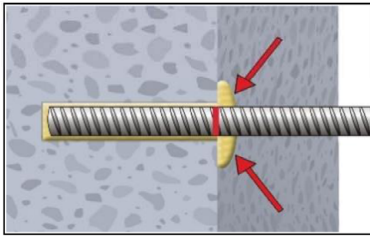
**Mapei Injection system Mapefix UM Hybrid for rebar connection**

**Intended use**

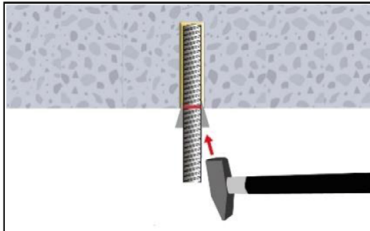
Installation instructions (continuation)

**Annex B 7**

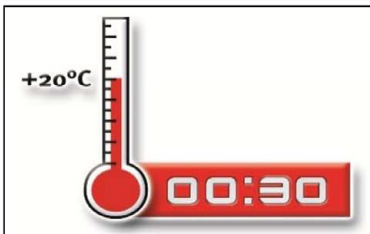
## Installation instructions (continuation)



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  $t_{\text{work}}$  has expired.



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



12. Temperature related curing time  $t_{\text{cure}}$  (Annex B 4) must be observed. Do not move or load the reinforcing bar during curing time.

**Mapei Injection system Mapefix UM Hybrid for rebar connection**

**Intended use**

Installation instructions (continuation)

**Annex B 8**

**Table C1: 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
Combined pull-out and concrete failure <sup>1)</sup>													
Characteristic bond resistance in uncracked concrete C20/25													
Temperature range <sup>1)</sup>	I: 24°C/40°C	Dry, wet concrete and flooded bore hole	τ <sub>Rk,ucr,50</sub> =	[N/mm²]	14	14	14	14	13	13	13	13	13
	II: 50°C/80°C		τ <sub>Rk,ucr,100</sub>		14	14	14	14	13	13	13	13	13
	III: 72°C/120°C		τ <sub>Rk,ucr,50</sub>		13	12	12	12	12	11	11	11	11
	IV: 100°C/160°C				9,5	9,5	9,5	9,0	9,0	9,0	9,0	8,5	8,5
Reduction factor ψ <sup>0</sup> <sub>sus,50</sub> or ψ <sup>0</sup> <sub>sus,100</sub> in cracked and uncracked concrete C20/25													
Temperature range <sup>1)</sup>	I: 24°C/40°C	Dry, wet concrete and flooded bore hole	ψ <sup>0</sup> <sub>sus,50</sub> =	[-]	0,90								
	II: 50°C/80°C		ψ <sup>0</sup> <sub>sus,100</sub>		0,87								
	III: 72°C/120°C		ψ <sup>0</sup> <sub>sus,50</sub>		0,75								
	IV: 100°C/160°C				0,66								
Increasing factors for concrete			ψ <sub>c</sub>	[-]	(f <sub>ck</sub> / 20) <sup>0,1</sup>								
Characteristic bond resistance depending on the concrete strength class			τ <sub>Rk,ucr,50</sub> =		ψ <sub>c</sub> • τ <sub>Rk,ucr,50</sub> ,(C20/25)								
			τ <sub>Rk,ucr,100</sub> =		ψ <sub>c</sub> • τ <sub>Rk,ucr,100</sub> ,(C20/25)								
Influence of cracked concrete on combined pullout and concrete cone failure													
Factor for influence of cracked concrete			Ω <sub>cr</sub>	[-]	0,77	0,78	0,79	0,81	0,81	0,82	0,83	0,83	0,83
Bond-splitting failure													
Product basic factor			A <sub>k</sub>	[-]	6,7								
Exponent for influence of...													
- concrete compressive strength			sp1	[-]	0,27								
- rebar diameter ϕ			sp2	[-]	0,36								
- concrete cover c <sub>d</sub>			sp3	[-]	0,37								
- side concrete cover (c <sub>max</sub> / c <sub>d</sub> )			sp4	[-]	0,16								
- embedment length l <sub>b</sub>			lb1	[-]	0,49								
Concrete cone failure													
Uncracked concrete			k <sub>ucr,N</sub>	[-]	11,0								
Cracked concrete			k <sub>cr,N</sub>	[-]	7,7								
Edge distance			c <sub>cr,N</sub>	[mm]	1,5 l <sub>b</sub> <sup>3)</sup>								
Axial distance			s <sub>cr,N</sub>	[mm]	3,0 l <sub>b</sub> <sup>3)</sup>								
Installation factor													
for dry and wet concrete	MAC	γ <sub>inst</sub>	[-]	1,2					2)				
	CAC			1,0									
	HDB			1,2									
for flooded bore hole	CAC			1,4									

<sup>1)</sup> Performance in Temperature Range III and IV assessed for working life 50 years only

<sup>2)</sup> no performance assessed

<sup>3)</sup> see Annex A 1

#### Mapei Injection system Mapefix UM Hybrid for rebar connection

##### Performances

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

#### Annex C 1