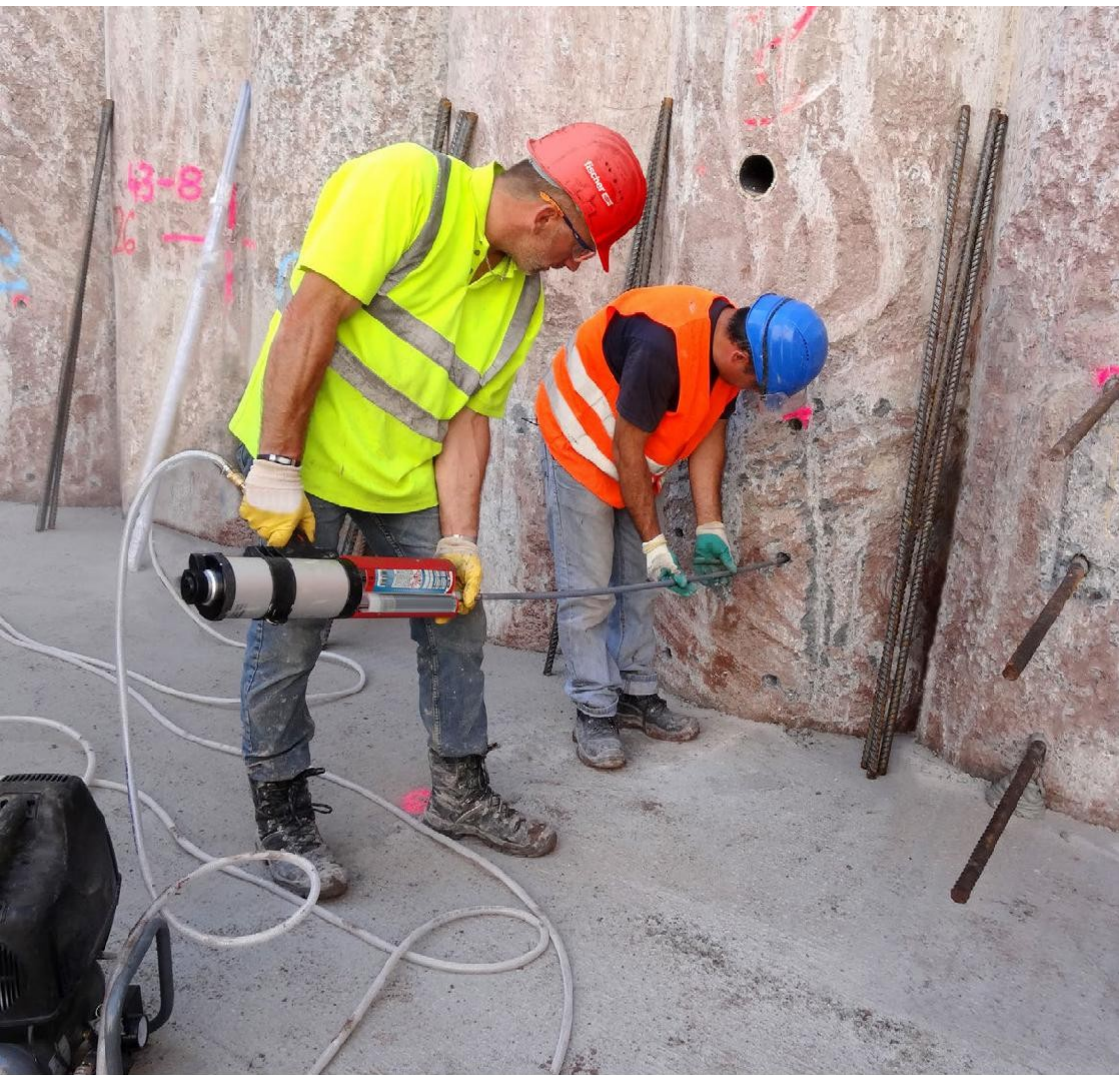


# Assembly instructions



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# 1 Description of the system

## 1.1 Ancoranti chimici ad iniezione FIS EM Plus, FIS EB, FIS SB, FIS V / VS, FIS VL

The connection of recovery irons by means of FIS **injection chemical anchors** allows **joints to be made on existing structures** with reinforced **concrete** steel bars for anchorages and overlapping joints in reinforced concrete structures or with FRA, the threaded adhesion anchor, for overlapping joints.- The connection of recovery irons on existing concrete structures can be made with the chemical injection anchors FIS EM Plus, FIS EB, FIS SB, FIS V/ VS, FIS VL (fig. 1).



Fig. 1:  
Ancoranti chimici ad  
iniezione FIS EB, FIS VL,  
FIS V, FIS SB, FIS EM Plus

## 1.2 Kit for shooting needle

The **kit for needles replaces**, in a single case, all the main accessories necessary for the execution, to rule of art, of the joints described above (fig. 2).



Fig. 2: Needle kit

# 1 Description of the system

---

## 1.3 Tools and accessories

In addition to the injection-moulded chemical anchor, the kit and the bars with improved adhesion to be anchored, the following **tools and accessories are necessary to perform a correct installation of the camera irons**:

Percussion drill, pneumatic drill or diamond crown. Cordless screwdriver or drill (to brush holes).

Drill with SDS plus or SDS max connection, depending on the required hole geometry. Oil-free air compressor with p 6 bar.

Shuttle gun (manual, rechargeable battery or pneumatic).

Extension for mixer, 9 mm or 15 mm.

Additional static mixers.

Stocker fischer tip for roughening the joint surfaces;

Suitable protective clothing, goggles and protective gloves (butyl rubber > 120 min. (EN 374) for FIS EM Plus and FIS EB).

## 1.4 Guide to drilling

In addition, according to the guidelines of the designer, the holes must be drilled with the drill guide (fig. 3) as an auxiliary tool, for example, when it is necessary to drill near the edge of the concrete structure or in a manner exactly parallel to the existing reinforcement.

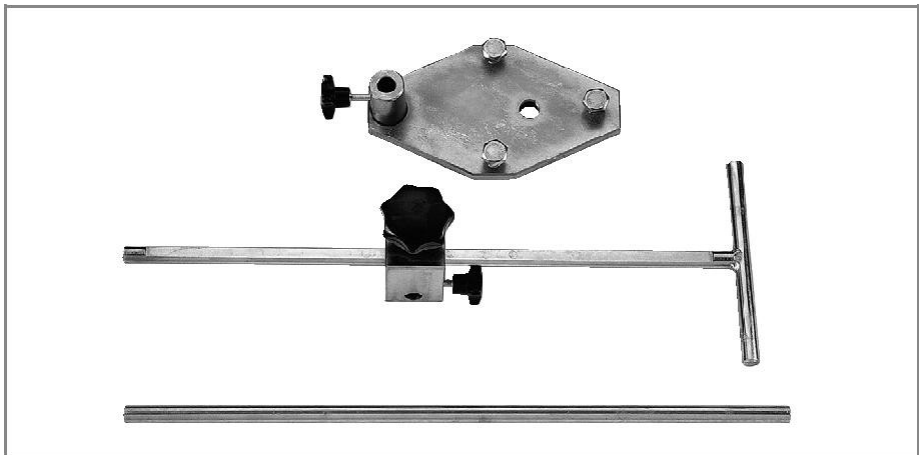


Fig. 3: Drill guide

## 2 Execution of recovery needles

The position and choice of diameter of the holes, the drilling depth and the decision on the use of the guide, are determined by the designer and must refer to the indications of the legislation. The individual steps of working to make recovery irons on an existing structure are described in detail in Chapters 2.1 to 2.10.

### 2.1 Hole marking

The executor must ensure that, in the case of anchorage close to the edge of the structure (Fig. 4), a minimum **iron cover**  $c_{min}$  ( Tab. 1) **is complied with and the minimum distance** between  $a_{s,min}$  (equation 1) between the catch bars inserted with the anchor. The minimum drilling distances  $s_{o,min}$ (equation 2) are derived from  $c_{min}$  **can** be calculated for the diameters of the individual bars **dse drilling depth** .

For the minimum distance between  $a_{s,Min}$  between the bars inserted with the anchor:  $a_{s,min} \geq 5 d_s$ (and  $a_{s,min} \geq 50$  mm) (equation 1)

For the minimum distance from the edge applies:  $s_{o,min} = c_{min} + d_s / 2$ (equation 2)

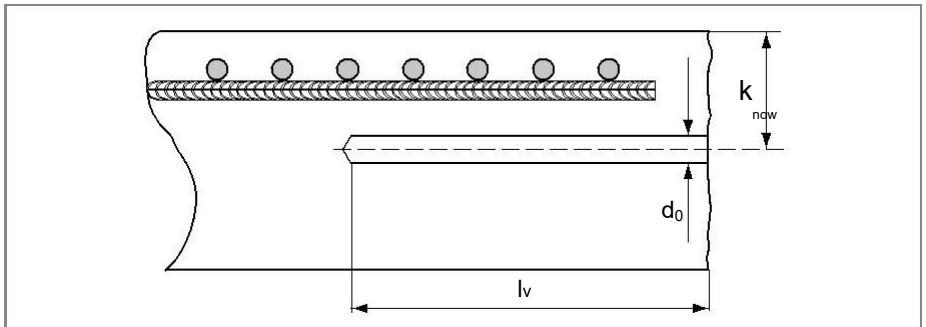


Fig. 4: Anchorage near the edge

Table 1: Minimum concrete iron cover  $c_{min}$  depending on the insertion depth  $l_v$

Type of drilling	Diameter of the bar $d_s$ (mm)	Minimum iron cover of concrete $c_{min}$ (mm)	
		without a drill guide	with guide for drilling
Percussion drill or diamond crown	$\leq 20$	$30 \text{ mm} + 0,06 l_v$	$30 \text{ mm} + 0.02 l_v \geq d_s$
	$\geq 25$	$40 \text{ mm} + 0,06 l_v$	$40 \text{ mm} + 0.02 l_v \geq d_s$

Air drill	$\leq 20$	50 mm + 0,08 l <sub>v</sub>	50 mm + 0,02 l <sub>v</sub>
	$\geq 25$	60 mm + 0,08 l <sub>v</sub>	60 mm + 0,02 l <sub>v</sub>

## 2 Execution of recovery needles

### 2.2 Guide to the fixing of drilling

In case of overlapping joints, care must be taken that the drilling is made parallel **to the existing reinforcement** and then parallel to a reference surface.

If the drill guide is used, it must first be fixed with a dowel.

The base of the plate must then be adjusted so that the reference rod is parallel to the concrete surface.

Finally, the rotating guide rod must be aligned in such a way that it is in the immediate vicinity of the hole marking to be carried out and can therefore serve as an optical guide for parallel drilling.

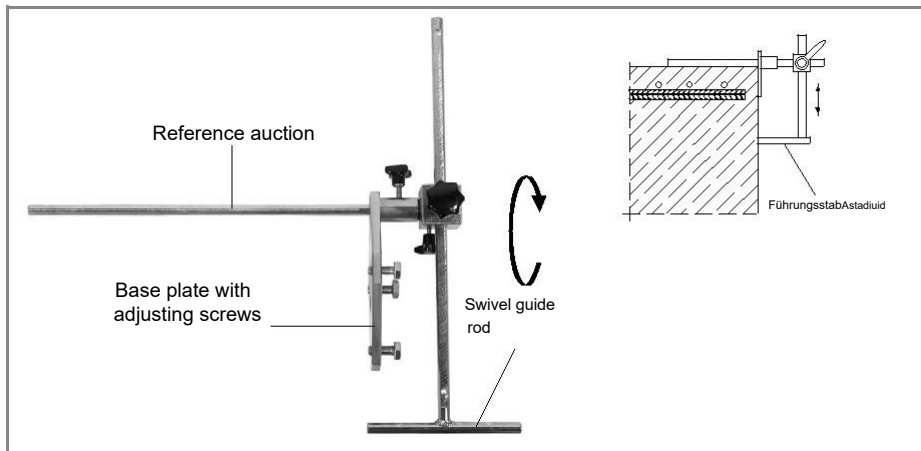


Fig. 5: Drill guide (base plate, reference rod, guide rod)

### 2.3 Punching

#### 2.3.1 Holes made with percussion drill

In the case of holes with a depth of insertion  $lv > 25 \text{ cm}$  it is **necessary to first perform a pre-drill with a short tip for at least 15 cm.**

After pre-drilling, it is recommended to roughen the concrete surface according to the designer's instructions (see chapter 2.4).

The **maximum insertion depth  $lv$**  (maximum hole depth) is shown in Table 2-4.

#### 2.3.2 Holes made with diamond crown

Drilling with diamond crown can only be carried out if it is used as an injection chemical anchor FIS EM Plus or FIS EB.

## 2 Execution of recovery needles

The **maximum insertion depth  $l_v$**  ( maximum hole depth) is shown in Table 2.

Holes with a diamond crown must always be cleaned by a special process (see paragraph. 2.5.1.2).

**Table 2: Maximum adjustment depth with cartridges and gun assignment for subsequent reinforcement connections with FIS EM Plus / FIS EB**

Cartridge			390 ml, 585 ml	390 ml, 585 ml	1500 ml
Gun			manual	battery/pneumatic	pneumatic
Bar diameter $d_s$ [mm]	Drilling $d_o$ [mm]	Diameter of the tip $d_{cut}$ [mm]	Maximum permissible insertion depth $l_v, max$ [mm]		
8	10/12	$\leq 10,5/\leq 12,5$	1000	1000	1800
10	12/14	$\leq 12,5/\leq 14,5$			
12/ FRA 12	14/16	$\leq 14,5/\leq 16,5$		1200	
14	18	$\leq 18,5$			
16/ FRA 16	20	$\leq 20,55$			
20/ FRA 20	25	$\leq 25,55$	700	1300	2000
22/25	30	$\leq 30,55$		1000	
26/28	35	$\leq 35,7$	500	700	
30/32/34	40	$\leq 40,7$	500	500	
36	45	$\leq 45,7$			
40	55	$\leq 55,7$			
Minimum temperature of concrete			+5 °C		
Maximum temperature of the concrete			+40 2009		



## 2 Execution of recovery needles

**Table 3: Maximum adjustment depth with cartridges and gun assembly for subsequent reinforcement connections with FIS SB**

Cartridge			390 ml	585 ml	390 ml	585 ml	1500 ml			
Gun			manual & battery		pneumatic					
Diameter bar	Drilling	Diameter of tip	Maximum permissible insertion depth $t_{v, max}$ [mm]							
$d_s$ [mm]	$d_o$ [mm]	$d_{cut}$ [mm]								
8	10/12	$\leq 10,5/\leq 12,5$	1000	1000	1400	2000	2000	2500	3000	
10	12/14	$\leq 12,5/\leq 14,5$								
12	14/16	$\leq 14,5/\leq 16,5$								
14	18	$\leq 18,5$								
16	20	$\leq 20,55$	600	600	1400	2000	2000	2500	3000	
20	25	$\leq 25,55$								
25	30	$\leq 30,55$								
28	35	$\leq 35,7$								
32	40	$\leq 40,7$								
Minimum temperature of concrete			-15 _BAR_ C					-5 _BAR_ C		
Maximum temperature of the concrete			+40 2009					+20 2009		

**Table 4: Maximum adjustment depth with cartridges and gun assignment for subsequent reinforcement connections with FIS V/VS, FIS VL**

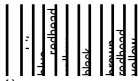
Cartridge			< 500 ml		> 500 ml	
Gun			manual	battery/pneumatica	pneumatic	
Bar diameter	foraturaØ	Diameter of tip	Maximum permissible insertion depth $t_{v, max}$ [mm]			
$d_s$ [mm]	$d_o$ [mm]	$d_{cut}$ [mm]				
8	10/12	$\leq 10,5/\leq 12,5$		1000		
10	12/14	$\leq 12,5/\leq 14,5$				

12/ FRA 12	14/16	$\leq 14,5/\leq 16,5$	1000		1800
14	18	$\leq 18,5$		1200	
16/ FRA 16	20	$\leq 20,55$		1500	
20/ FRA 20	25	$\leq 25,55$		1300	
25/ FRA 24	30	$\leq 30,55$	700	1000	
28	35	$\leq 35,7$	500	700	2000
Minimum temperature of concrete			0 C		
Maximum temperature of the concrete			+40 2009		

## 2 Execution of recovery needles

Table 5: Installation accessories

Bar diameter	$d_b$	8	10	12	14	16	18	22	26	30	36	40
Drilling diameter	[mm]							25		34		
Cleaning nozzle	$d_0$	10/12	12/14	14/16	18	20	25	30	35	40	45	55
Extension	AP PR											
cord	OP RI AT											
Color of the pipe cleaner	E	[mm]	11	15		19		28		38		
	AP PR OP RI AT											
	E	[mm]	9 <sup>n)</sup>					9 <sup>1)</sup> or 15				



1)

For 300 ml, 360 ml and 390 ml cartridges, use the 9 mm extension. The respective maximum insertion depths are given in Table 2.

## 2.4 Roughening of the joint

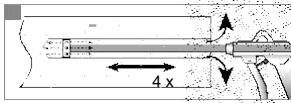
Before casting the new concrete of the structure to be connected, the connection joint (existing concrete surface) must be roughened, according to the designer's instructions, so that at least the inert materials protrude.

It is advisable to roughen the joints not after inserting the bar but already after the pre-drilling, **to allow** easy accessibility of the surface.

## 2.5 Hole cleaning

### 2.5.1 FIS EM Plus / FIS EB

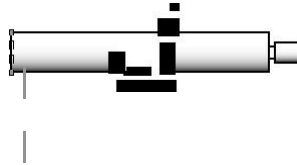
#### 2.5.1.1 Percussion or pneumatic drill



Completely clean the hole starting from the bottom blowing with a suitable nozzle

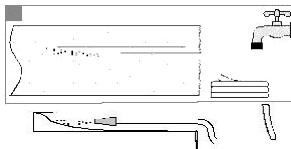
(Tab. 3) **for 4 times** (deprived compressed air oil 6 bar).

## 2 Execution of recovery needles

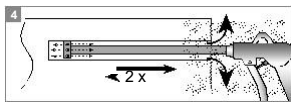


Extract the material  
core and eliminate it.

### 2.5.1.2 Diamond crown



Wash the hole until clean water comes out.



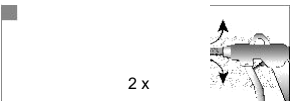
Clean the hole completely by blowing from the bottom with a suitable nozzle (Tab. 3) 2 times (oil-free compressed air 6 bar).

Clean the par-hole completely from blowing with a suitable nozzle (Tab. 3) for 2 times (oil-free compressed air 6 bar).

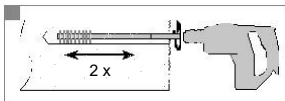
Mount on the electric drill a suitable extension and brush the hole completely 2 times.

### 2.5.2 FIS SB

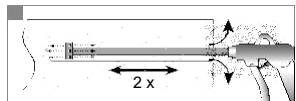
Drilling with percussion or pneumatic drill (diamond crown not allowed).



**Cleaning with compressed air:** clean the hole completely, starting from the bottom, using a suitable nozzle (Tab. 3) for 2 times (oil-free compressed air 6 bar).



**Brushing of the hole:** mount on electric drill one suitable steel pipe cleaner (Tab. 3) with extension and brush the hole completely for 2 times.



**Compressed air cleaning (check):** clean the hole completely from the bottom using a suitable nozzle (Tab. 3) for 2 times (oil-free compressed air 6 bar).

### 2.5.3 FIS V / FIS VS / FIS VL

Drilling with percussion or pneumatic drill (diamond crown not allowed).

3 x

3 x

**Cleaning with compressed air:**

clean hole completely, starting from the bottom, using a suitable nozzle (Tab. 3) for 3 times (air oil-free tablet 6 bar).

3 x

**Brushing of the hole:**

mount on electric drill one suitable steel pipe cleaner (Tab. 3) with extension and brush the 3x hole completely for 3 times.

3 x

**Cleaning with compressed air (con-**

**trollo):** completely clean the hole starting from the bottom using a suitable nozzle (Tab. 3) for 3 times (oil-free compressed air 6 bar).

## 2 Execution of recovery needles

### 2.6 Marking and control of the depth of insertion of shooting irons

The depth of insertion should be marked with **adhesive tape**.

The bar so marked is inserted for test in the clean hole until it **touches the bottom**, then it is rotated. In this way, you control the **sliding of the bar** and the **depth of the hole** (fig. 6). Any **burrs on the cutting edge** of the bars could prevent them from sliding and should be removed.

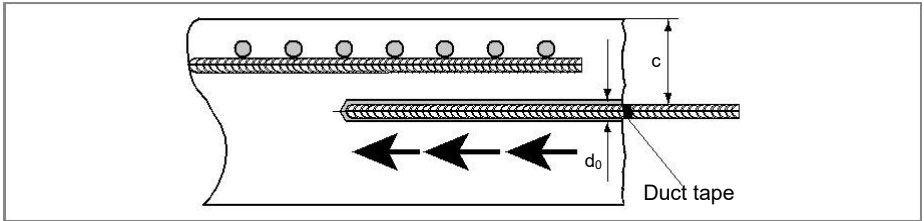


Fig. 6: Checking the slide of the shooting bar and the depth of the hole

### 2.7 Cutting, marking and assembly of the extension

The static mixers are equipped with relative **extensions (Ø 9 mm or 15 mm)**.

For small FIS MR Plus static mixers, the 9 mm extensions are suitable. For large FIS UMR static mixers, for 585 ml and 1,500 ml cartridges, the extensions from Ø 15 mm.

The extension should be chosen about 20 cm longer than the depth of the hole.

On the end of the extension, facing the hole, the prescribed **injection nozzle** is inserted, which allows regular filling and prevents the formation of bubbles. The compatibility of the injection nozzles is indicated in Table 5.

Finally, on the extension cord, the injection length must be marked with adhesive tape as shown in figure 7.

Tab. 6 indicates the values of  $l_m$ . To work safely, instead of the values in the table, the following empirical formula can also be applied:

**$l_m = 1/3 \times \text{hole depth (lv)}$  (equation 3)**

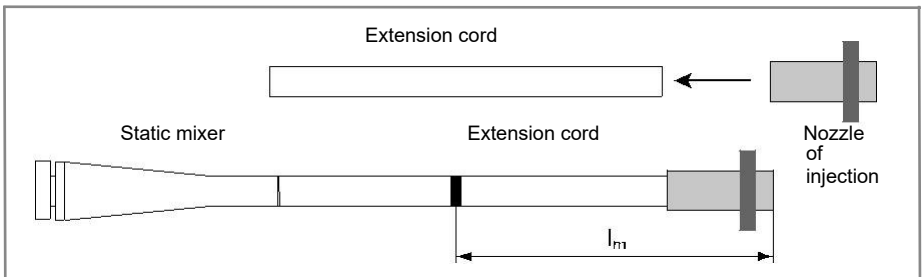


Fig. 7: Mounting the injection extension

## 2 Execution of recovery needles

Table 4: Marking length  $\ell_{ma}$  depending on insertion depth

$\ell$   
volet ges

Prof. foro = Prof. inseri chin $\ell_v$ [mm]	Marking length $\ell_m$ [mm]																
	Bar diameter $d_s$ [mm]																
	8	10	12/ FRA12	14	16/ FRA16	18	20/ FRA20	22	24	25	26	28	30	32	34	36	40
	Diametro punta $d_o$ [mm]																
	12	14	16	18	20	25	30			35		40		45	55		
80	25																
100	30	40															
120	40	50	55														
140	45	60	65	75													
160	50	65	75	85	90												
180	60	75	85	95	100	75											
200	65	80	95	105	115	80	120										
220	75	90	105	115	125	90	130	100									
240	80	100	115	125	135	100	140	105	135								
250	80	100	120	130	140	105	145	110	140	155							
260	85	105	125	135	150	110	150	115	145	165	120						
280	90	115	130	145	160	115	160	125	160	175	130	160					
300	100	125	140	160	170	125	170	135	170	190	140	170	140				
320	105	130	150	170	180	135	185	145	180	200	145	185	150	180			
340	110	140	160	180	190	145	195	150	190	215	155	195	160	190	225		
350	115	145	165	185	200	145	200	155	200	220	160	200	165	200	230		
360	120	150	170	190	205	150	205	160	205	225	165	205	170	205	240	205	
380	125	155	180	200	215	160	215	170	215	240	175	220	180	215	250	215	
400	130	165	190	210	225	170	230	175	225	250	185	230	190	225	265	225	
420	140	170	200	220	240	175	240	185	240	265	195	240	200	240	280	240	
450	150	185	215	235	255	190	255	200	255	285	205	260	215	255	300	255	
500	165	205	240	260	285	210	285	225	285	315	230	285	235	285	335	285	
550	180	225	260	290	310	230	310	245	310	345	255	315	260	310	365	310	
600	200	245	285	315	340	250	340	265	340	380	275	345	285	340	400	340	
650	215	270	310	340	370	275	370	290	370	410	300	370	310	370	434	370	
700	230	290	330	370	400	295	400	310	400	440	325	400	330	400	465	400	
750	250	310	355	395	425	315	425	335	435	475	345	425	355	425	500	425	
800	265	330	380	420	455	340	455	355	455	505	370	455	380	450	535	455	
850	280	350	405	445	480	360	480	380	480	535	390	480	405	480	565	480	
900	300	370	430	470	510	380	510	400	510	570	415	510	425	510	600	510	
950	315	390	450	500	540	400	540	420	540	600	440	540	450	540	635	540	
1000	330	410	475	525	570	420	570	445	570	635	460	570	475	570	665	565	
1100	360	450	520	580	625	465	625	490	625	695	505	625	525	625	735	625	
1200	400	490	570	630	680	505	680	535	680	760	555	680	570	680	800	680	
1300	430	530	620	680	740	550	740	580	740	820	600	740	615	740	865	740	
1400	460	570	670	730	790	590	795	620	795	885	645	795	665	795	935	795	
1500	500	610	720	790	850	630	850	670	850	950	690	850	710	850	1000	850	
1600	530	650	760	840	910	675	910	710	910	1010	740	910	760	910	1065	910	
1700	560	700	810	890	970	720	970	755	965	1075	785	960	810	965	1135	965	
1800	600	730	870	940	1030	760	1030	800	1020	1140	830	1020	855	1020	1200	1020	
1900								845	1080	1200	875	1080	900	1080	1265	1080	
2000								890	1135	1265	925	1135	950	1135	1335	1135	
2500										1585		1420		1420			
3000										1900		1705		1705			



## 2 Execution of recovery needles

### 2.8 Hole filling with chemical injection anchors FIS EM Plus, FIS EB, FIS SB, FIS V/VS, FIS VL

The effects of temperature must be taken into account for both storage and processing of the chemical injection anchorage.

Cartridge storage temperature between +5' C and +25' C

**Table 6: Opening times and hardening times of the FIS EM Plus injection chemical anchor**

Support temperature	Maximum working time 3)	Minimum hardening time 1)
	[minutes]	[hours]
[quell C]	FIS EM Plus	FIS EM Plus
+ 5 to +92)	120	40
+10 to +19	30	18
+20 to +29	14	10
+30 to +40	7	5

1) Hardening times are doubled in wet concrete.

2) In the case of processing at temperatures below +10 , C the epoxy anchor FIS EM Plus must be heated to +20 °C.

3) The time between the beginning of the filling with the anchor and the insertion/positioning of the needle.

**Table 7: Opening times and hardening times of the FIS EB injection chemical anchor**

Support temperature	Maximum working time 3)	Minimum hardening time 1)
	[minutes]	[hours]
[quell C]	FIS EB	FIS EB
+ 5 to +102)	120	45
+10 to +20	30	22

+20 to +30	14	12
+30 to +40	7	6

- 1) Hardening times are doubled in wet concrete.
- 2) In the case of processing at temperatures below +10 °C, the FIS EB epoxy anchor must be heated to +20 °C.
- 3) The time between the beginning of the filling with the anchor and the insertion/positioning of the needle.

## 2 Execution of recovery needles

**Table 8: Opening times and hardening times of the FIS SB injection chemical anchor**

Support temperature	Maximum working time	Minimum hardening time
	[minutes]	[minutes]
[quell C]	FIS SB	FIS SB
-15 to -10	60	36 h
-10 to -5	30	24 h
-5 to 0)	20	8 h
0 to +10	13	4 h
+ 5 to +10	9	120
+10 to +20	5	60
+20 to +30	4	45
+30 to +40	2	30

1) If the FIS SB cartridge is processed at temperatures below 0 °C, it must be heated to +15 °C.

**Table 9: Opening times and hardening times of the FIS V injection chemical anchor/ FIS VS/ FIS VL**

Support temperature	Maximum working time 3)	Minimum hardening time 1)
	[minutes]	[hours]
[quell C]	FIS V	FIS V
0 to + 5	13	180
> + 5 to +10	9	90
> +10 to +20	5	60
> +20 to +30	4	45
> +30 to +40 <sup>2)</sup>	2	35

1) Hardening times are doubled in wet concrete.

2) In the case of extrusion at temperatures above +30 °C, the cartridge must be cooled to approx. +15 °C/+20 °C.

3) The time between the beginning of the filling with the anchor and the insertion/positioning of the needle.

## 2 Execution of recovery needles

### Processing:

The following equation can be used to calculate the amount of the required VFIS anchor:

$$V_{FIS} = (d_0^2 - d_s^2) \times 0,95 \times l_v \quad [ml]$$

where:  $d_0$  = actual cutting diameter in [mm] (see Tab. 2)

$d_s$  = bar diameter in [mm]

$l_v$  = depth of insertion in [m]

Insert the cartridge with the static mixer into the injection gun.

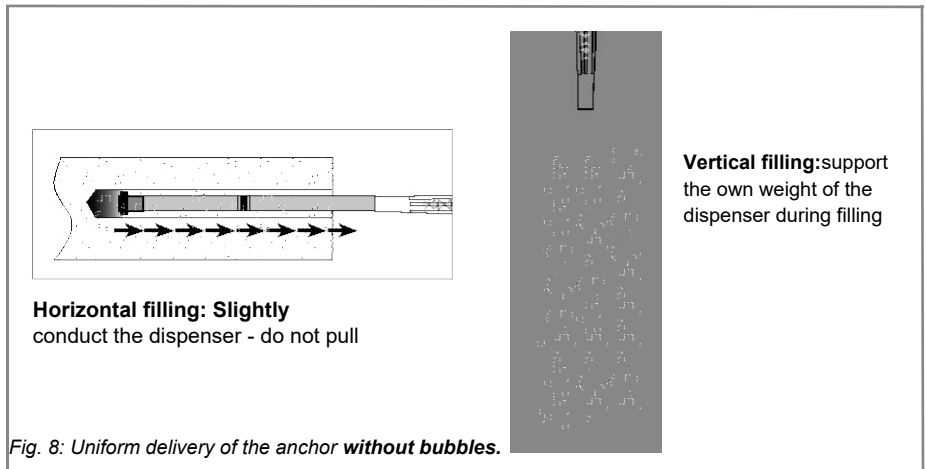
Operate the dispensing gun until the anchor that comes out will not be homogeneous gray.

Insert the extension cord and press until it is filled with the anchor of the extension cord.

Insert the extension and the injection nozzle to the bottom of the hole and dispense the anchor. In the holes filled with water it is not necessary to inject the anchor.

When filling, conduct the gun following the thrust of the injection nozzle - do not pull (Fig. 8).

Finish filling when the 1m marking of the injection extension appears above the concrete surface.



## 2 Execution of recovery needles

### 2.9 Insertion of the needles

After finishing the delivery of the anchor, remove the injection extension from the hole.

Arrange the bar that must be inserted into the hole filled with anchor **force** with rotary **movement** until the insertion depth marking (fig. 9).

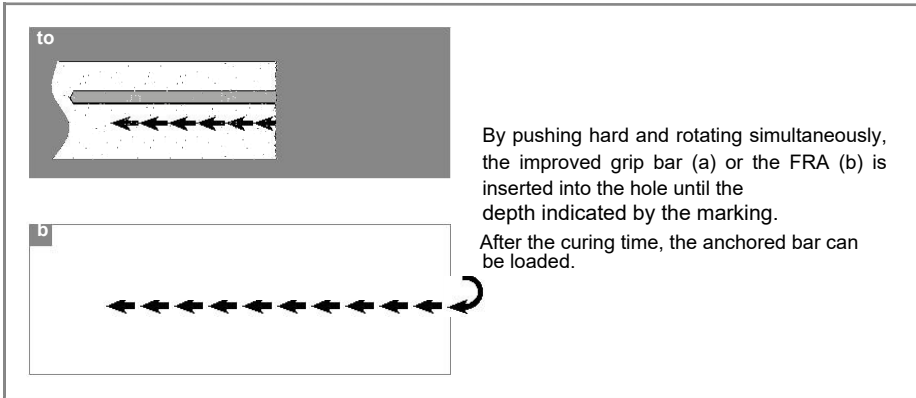


Fig. 9: Inserting the shooting bar

## 2 Execution of recovery needles

**The insertion of the bar is considered correctly performed when:**

no bar oscillations occur; there are no

bursts of air bubbles;

at the mouth of the hole appears an excess of anchor;

the insertion depth marking on the bar is flush with the concrete surface.

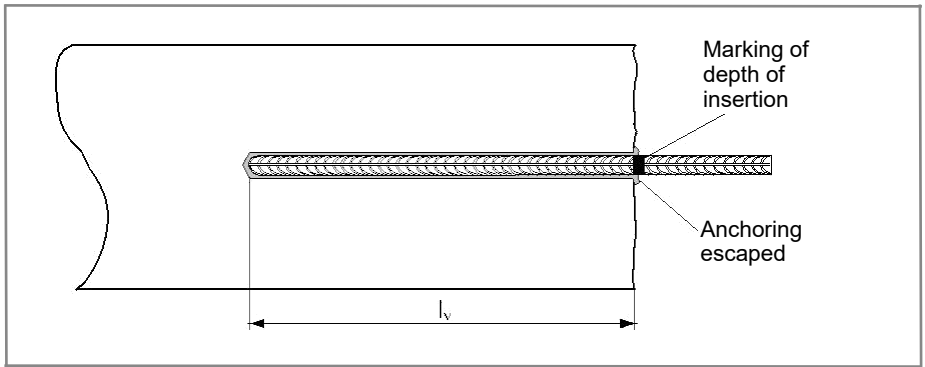


Fig. 10: Insertion control

### 2.10 Hardening of the chemical anchor

**See table Opening times and hardening times (Tab. 6 - 9).**

The bar should not be moved until the curing time is reached.

The hardening time depends on the temperature of the concrete structure and is calculated starting from the end of the processing time.


### 3 Additional accessories

Table 7: Additional accessories for FIS shooting reinforcement kit

No. code	Description
00001490	Pipe Brush for 12 mm drilling
00001491	Pipe Cleaner for drilling 14 mm
00001492	Pipe Pipe Cleaner for 16 mm drilling
00001493	Pipe Brush for drilling 18 mm
00001494	Pipe Cleaner for 20 mm drilling
00001495	Pipe Brush for drilling 25 mm
00090063	Pipe Cleaner for drilling 30 mm
00090071	Pipe Cleaner for drilling 35 mm
00505061	Pipe Brush for drilling 40 mm
00506254	Pipe Brush for drilling 45 mm
00505062	Pipe Brush for drilling 55 mm
00001497	Injection nozzle Ø 12 natural drilling (Ø 9)
00001498	Injection nozzle 14 blue (9)
00001499	Injection nozzle U drilling 16 red (SOMEONE 9)
00001483	Injection nozzle G drilling 18 yellow (INSTEAD 9)
00001506	Injection Nozzle 20 Green Drilling (9)
00001508	Injection nozzle G drilling 20 green (15)
00001507	Injection nozzle U drilling 25 black (9)
00001509	Injection nozzle U drilling 25 black (15)
00090689	Injection nozzle Ø drilling 30 grey (Ø 9)
00090700	Injection nozzle Ø drilling 30 grey (Ø 15)
00090699	Injection nozzle G drilling 35 brown (Ø 9)
00090701	Injection nozzle G drilling 35 brown (Ø 15)
00505077	Injection nozzle U drilling 40 red (9)
00505079	Injection nozzle U drilling 40 red (15)
00508909	Injection nozzle U drilling 45 yellow (INSTEAD 9)
00508910	Injection nozzle U drilling 45 yellow (INSTEAD 15)
00505078	Injection Nozzle 55 Natural Drilling Nozzle (9)
00505080	Injection Nozzle 55 Natural Drilling (15)
00511956	Compressed Air Nozzle 12-15
00511957	Compressed air nozzle 16-19
00511958	Compressed air nozzle 20-25
00511959	Compressed air nozzle 30-35
00511960	Compressed Air Nozzle 40-55
00508791	Extension for cleaning pipe cleaner
00511961	SDS support with internal thread M8
00019684	Control template for pipe cleaner
00019705	Cleaning hose with compressed air
00048983	FIS extension cable 9
00530800	Extension cable FIS 15
00001253	Stocker bush drill with SDS connection max
00090819	Drill guide
00512401	FIS DP S-XL Pneumatic extruder for 1500 ml cartridges
00058027	FIS AP Pneumatic extruder for 360 ml and 390 ml cartridges
00543629	FIS DC S Battery extruder for 360 ml and 390 ml cartridges
00511118	FIS DMS hand blowers for 360 ml and 390 ml cartridges
00510992	FIS DM S-L hand blowers for 585 ml cartridges
00511125	FIS DP S-L Pneumatic extruder for 585 ml cartridges






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