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European Technical Assessment Body for construction products



European Technical
Assessment

ETA-24/0647
of 17 October 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	Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid 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	EJOT SE & Co. KG Market Unit Construction In der Stockwiese 35 57334 Bad Laasphe GERMANY
Manufacturing plant	EJOT Plant 24
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	EAD 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 "Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars with a diameter ϕ from 8 to 32 mm according to Annex A and the injection mortar MULTIFIX HSF SEISMIC / Sormat ITH-HY Seismic 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
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 17 October 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

Installation condition and application example

Figure A1: Column / wall to foundation / slab

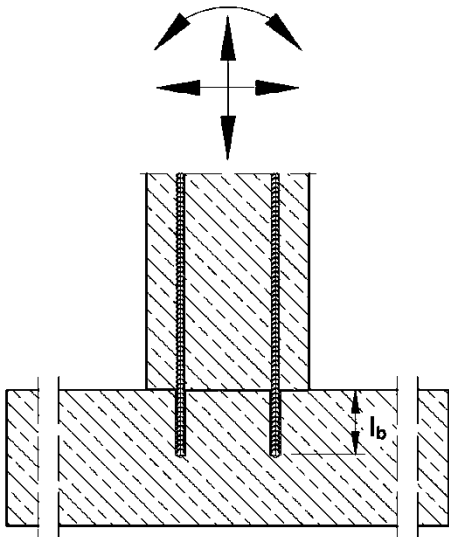
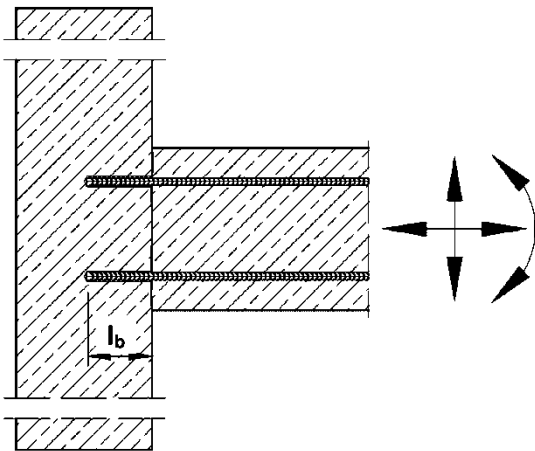


Figure A2: Slab / beam to wall or beam to column



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.

Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection

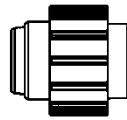
Product description
Installed condition and examples of use for rebars

Annex A 1

Cartridge system

Coaxial Cartridge:

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



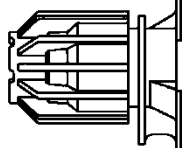
Imprint:

MULTIFIX HSF SEISMIC / Sormat ITH-HY Seismic

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

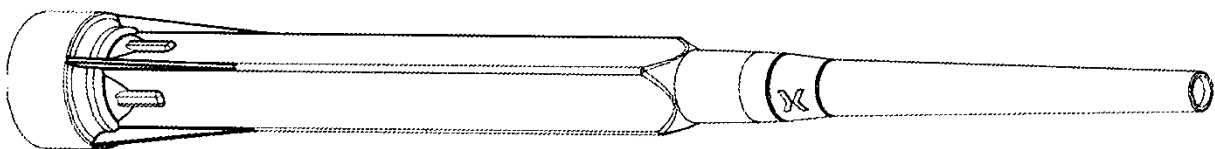


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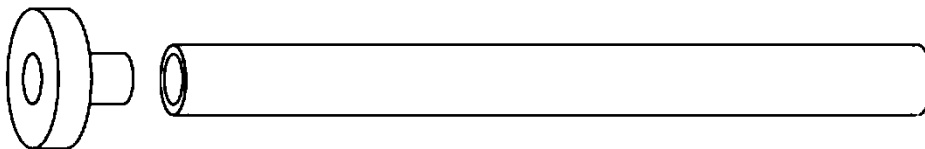
MULTIFIX HSF SEISMIC / Sormat ITH-HY Seismic

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

Static mixer PM-19E



Piston plug VS und mixer extension VL

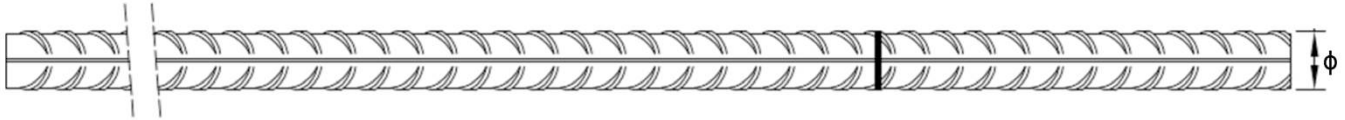


Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection

Product description
Injection system

Annex A 2

Reinforcing bar (rebar): ø8 up to ø32



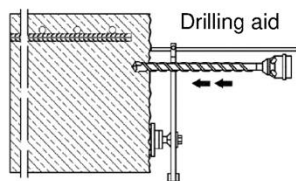
- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range $0,05\phi \leq h_{rib} \leq 0,07\phi$
(ϕ : Nominal diameter of the bar; h_{rib} : Rib height of the bar)

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 $f_{uk} = f_{tk} = k \cdot f_{yk}$
Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection	Annex A 3
Product description Specifications Rebar	










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 ¹⁾ II: - 40 °C to +80 °C ²⁾ III: - 40 °C to +120 °C ³⁾ IV: - 40 °C to +160 °C ⁴⁾	I: - 40 °C to +40 °C ¹⁾ II: - 40 °C to +80 °C ²⁾
<p>1) (max. long-term temperature +24°C and max. short-term temperature +40°C) 2) (max. long-term temperature +50°C and max. short-term temperature +80°C) 3) (max. long-term temperature +72°C and max. short-term temperature +120°C) 4) (max. long-term temperature +100°C and max. short-term temperature +160°C)</p> <p>Base materials:</p> <ul style="list-style-type: none">- 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. <p>Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of $\phi + 60$ mm prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least the minimum concrete cover in accordance with EN 1992-1-1:2004+AC:2010. The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.</p> <p>Design:</p> <ul style="list-style-type: none">- 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. <p>Installation:</p> <ul style="list-style-type: none">- Dry or wet concrete, as well as in flooded holes.- Overhead installation allowed.- Hole drilling by hammer drill (HD), hollow drill (HDB) 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).			
Injection System EJOT Multifix Hybrid / SORMAT ITH 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 + $0,02 \cdot l_b \geq 2 \phi$	
	≥ 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 + $0,02 \cdot l_b$	
	≥ 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.

Injection System EJOT Multifix Hybrid / SORMAT ITH 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 _b Brush - Ø	d _{b,min} min. Brush - Ø	Piston plug	Cartridge: All sizes				Cartridge: 825 ml				
	HD	CD				Hand or battery tool		Pneumatic tool		Pneumatic tool				
						l _{b,max}	Mixer extension	l _{b,max}	Mixer extension	l _{b,max}	Mixer extension			
[mm]	[mm]			[mm]		[mm]		[mm]		[mm]				
8	10	-	RB10	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	12	-	RB12	13,5	12,5	-		700		800		800	
10		14	-	RB14	15,5	14,5	VS14		250		250		250	250
	700								1000		1000		1000	
12	16		RB16	17,5	16,5	VS16	250		250		250	250		
							14		18		RB18	20,0	18,5	VS18
16	20	RB20	22,0	20,5	VS20	1400								
20	25	-	RB25	27,0	25,5	VS25	500		700		700	2000	VL16/1,8	
	-	26	RB26	28,0	26,5	VS25								
22	28		RB28	30,0	28,5	VS28			500		500			500
24/25	30		RB30	32,0	30,5	VS30								
	32		RB32	34,0	32,5	VS32								
28	35		RB35	37,0	35,5	VS35								
32	40		RB40	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 _b Brush - Ø	d _{b,min} min. Brush - Ø	Piston plug	Cartridge: All sizes				Cartridge: 825 ml			
	HDB				Hand or battery tool		Pneumatic tool		Pneumatic tool			
					l _{b,max}	Mixer extension	l _{b,max}	Mixer extension	l _{b,max}	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		
	12				700		800		800			
					250		250		250			
10				14	VS14		700		1000		1000	
	12			16	250		250		250			
				18	VS16		700		1000		VL10/0,75 or VL16/1,8	1000
20				VS18								
25	VS20											
22	VS25			500	700	500						
24/25	28						VS28					
	30						VS30					
	32						VS32					
28	35						VS35	500				
32	40						VS40					

Injection System EJOT Multifix Hybrid / SORMAT ITH 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 hollow drill bit 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, d₀ ≤ 20mm)



Compressed air tool
(min 6 bar)



Brush RB



Piston Plug VS



Brush extension RBL



Table B5: Working time and curing time

Temperature in base material			Maximum working time	Minimum curing time ¹⁾
T			t _{work}	t _{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	

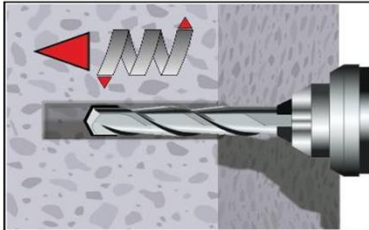
¹⁾ The minimum curing time is only valid for dry base material.
In wet base material the curing time must be doubled.

Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection	Annex B 4
Intended use Cleaning and installation tools Working time and curing time	

Installation instructions

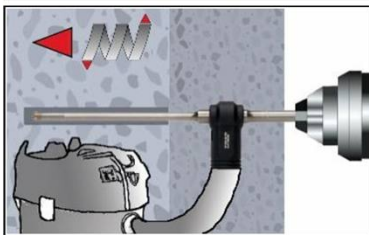
Attention: Before drilling, remove carbonated concrete and clean contact areas (see Annex B 1)
Aborted drill holes shall be filled with mortar.

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).

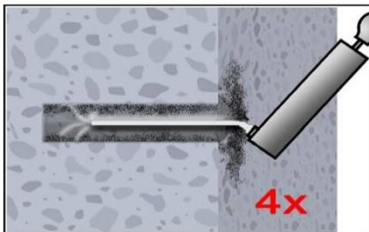


1b. Hollow drill bit system (HDB) (see Annex B 4)

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

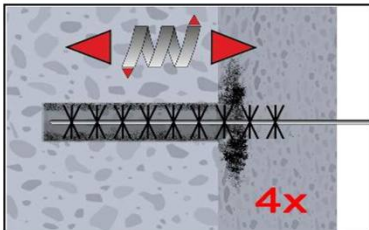
Manual Air Cleaning (MAC)

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

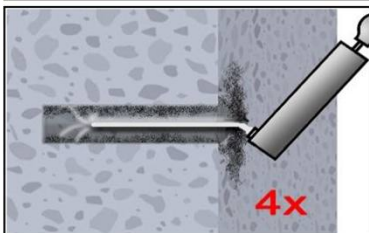


Attention! Standing water in the bore hole must be removed before cleaning.

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



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

Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection

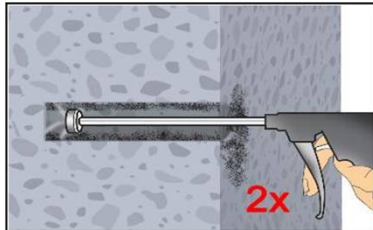
Intended use
Installation instruction

Annex B 5

Installation instructions (continuation)

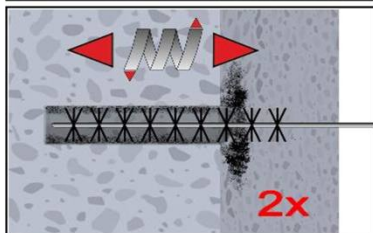
Compressed Air Cleaning (CAC):

All diameter with drilling method HD and CD

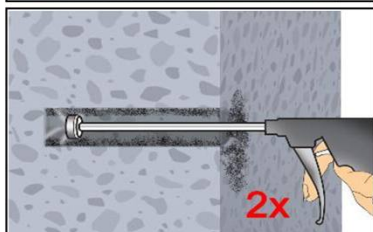


Attention! Standing water in the bore hole must be removed before cleaning.

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.)

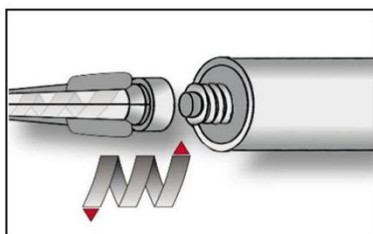


2b. Brush the bore hole minimum 2x with brush RB according to Table B3 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)

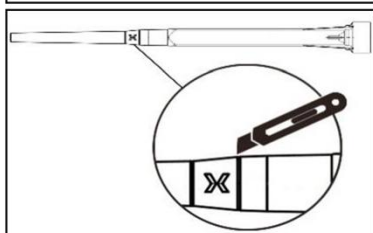


2c. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

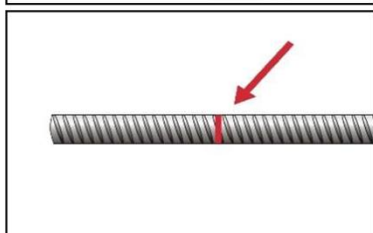
Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar.



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_{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.

Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection

Intended use

Installation instructions (continuation)

Annex B 6

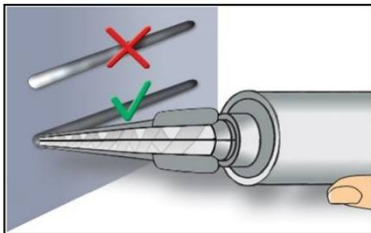
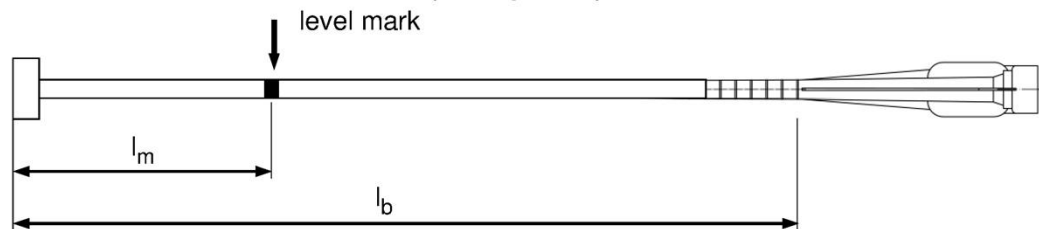
Installation instructions (continuation)

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

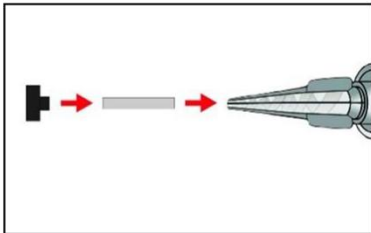
Quick estimation: $l_m = 1/3 \cdot l_b$

Optimum mortar volume:

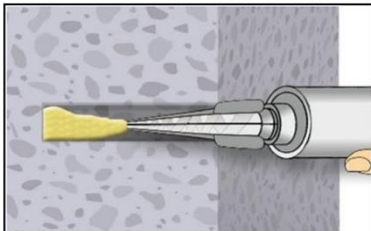
$$l_m = l_b \cdot \left(1,2 \cdot \frac{\phi^2}{d_0^2} - 0,2 \right)$$



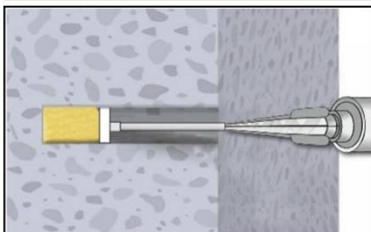
6. Not proper mixed mortar is not sufficient for fastening.
Dispense and discard mortar until a uniform grey colour is shown (at least 3 full strokes).



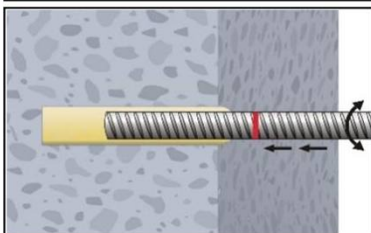
7. Piston plugs VS and mixer nozzle extensions VL shall be used according to Table B3 or B4
Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.



- 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.

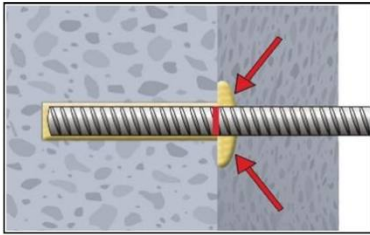
Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection

Intended use

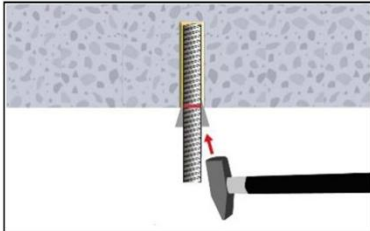
Installation instructions (continuation)

Annex B 7

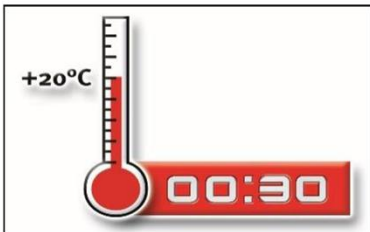
Installation instructions (continuation)



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_{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. Do not move or load the reinforcing bar during curing time.

Injection System EJOT Multifix Hybrid / SORMAT ITH 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 ¹⁾														
Characteristic bond resistance in uncracked concrete C20/25														
Temperature range ¹⁾	I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\tau_{Rk,ucr,50} =$	[N/mm²]	14	14	14	14	13	13	13	13	13	13
	II: 50°C/80°C		$\tau_{Rk,ucr,100}$		14	14	14	14	13	13	13	13	13	13
	III: 72°C/120°C		$\tau_{Rk,ucr,50}$		13	12	12	12	12	11	11	11	11	11
	IV: 100°C/160°C				9,5	9,5	9,5	9,0	9,0	9,0	9,0	9,0	8,5	8,5
Reduction factor $\psi_{sus,50}^0$ or $\psi_{sus,100}^0$ in cracked and uncracked concrete C20/25														
Temperature range ¹⁾	I: 24°C/40°C	Dry, wet concrete and flooded bore hole	$\psi_{sus,50}^0 =$	[-]	0,90									
	II: 50°C/80°C		$\psi_{sus,100}^0$		0,87									
	III: 72°C/120°C		$\psi_{sus,50}^0$		0,75									
	IV: 100°C/160°C				0,66									
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														
Factor for influence of cracked concrete			Ω_{cr}	[-]	0,77	0,78	0,79	0,81	0,81	0,82	0,83	0,83	0,83	0,83
Bond-splitting failure														
Product basic factor			A_k	[-]	6,7									
Exponent for influence of...														
- concrete compressive strength			sp1	[-]	0,27									
- rebar diameter ϕ			sp2	[-]	0,36									
- concrete cover c_d			sp3	[-]	0,37									
- side concrete cover (c_{max} / c_d)			sp4	[-]	0,16									
- embedment length l_b			lb1	[-]	0,49									
Concrete cone failure														
Uncracked concrete			$k_{ucr,N}$	[-]	11,0									
Cracked concrete			$k_{cr,N}$	[-]	7,7									
Edge distance			$c_{cr,N}$	[mm]	$1,5 l_b^{3)}$									
Axial distance			$s_{cr,N}$	[mm]	$3,0 l_b^{3)}$									
Installation factor														
for dry and wet concrete	MAC	γ_{inst}	[-]	1,2					2)					
	CAC			1,0										
	HDB			1,2										
for flooded bore hole	CAC			1,4										
¹⁾ Performance in Temperature Range III and IV assessed for working life 50 years only ²⁾ no performance assessed ³⁾ see Annex A 1														
Injection System EJOT Multifix Hybrid / SORMAT ITH Hybrid for rebar connection										Annex C 1				
Performances Characteristic resistance to tension load under static and quasi-static loading; working life 50 and 100 years (HD, CD and HDB)														