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European Technical Assessment

ETA-13/0436 of 19/06/2018

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial Trade name	**Injection System SPIT MULTI-MAX for rebar connection**
Famille de produit Product family	***Scellement d'armatures rapportées, diamètres 8 à 20mm, avec résine d'injection SPIT MULTI-MAX.*** **Post installed rebar connections diameter 8 to 20 mm made with *SPIT MULTI-MAX* injection adhesive.**
Titulaire Manufacturer	**Société SPIT** **Route de Lyon** **F-26501 BOURG-LES-VALENCE** **France**
Usine de fabrication Manufacturing plants	**Société SPIT** **Route de Lyon** **F-26501 BOURG-LES-VALENCE** **France**
Cette evaluation contient: This Assessment contains	*16 pages incluant 14 annexes qui font partie intégrante de cette évaluation* 16 pages including 14 annexes which form an integral part of this assessment
Base de l'ETE Basis of ETA	*DEE 330087-00-0601, juillet 2015* EAD 330087-00-0601, July 2015
Cette evaluation remplace: This Assessment replaces	*ETE- 13/0436 du 31/05/2013* ETA-13/0436 dated 31/05/2013

Specific Part

1 Technical description of the product

The SPIT MULTI-MAX is used for the connection, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of ordinary non-carbonated concrete C12/15 to C50/60. The design of the post-installed rebar connections is done in accordance with EN 1992-1-1 October 2005 (EN 1992-1-1).

Covered are rebar anchoring systems consisting of MULTI-MAX bonding material and an embedded straight deformed reinforcing bar with properties according to Annex C of EN 1992-1-1 and EN 10080; the classes B and C of the rebar are recommended. The ETA covers rebar connections with a diameter, ϕ, from 8 to 20 mm.

2 Specification of the intended use

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

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 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

3.1 Mechanical resistance and stability (BWR 1)

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

3.2 Safety in case of fire (BWR 2)

Not relevant.

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

For Basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources ((BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

3.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

4 Assessment and verification of constancy of performance (AVCP)

According to the EAD N°. 330087-00-0601, the applicable legal document is the Decision 96/582/EC:

The system apply is: 1

5 Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

The original French version is signed by

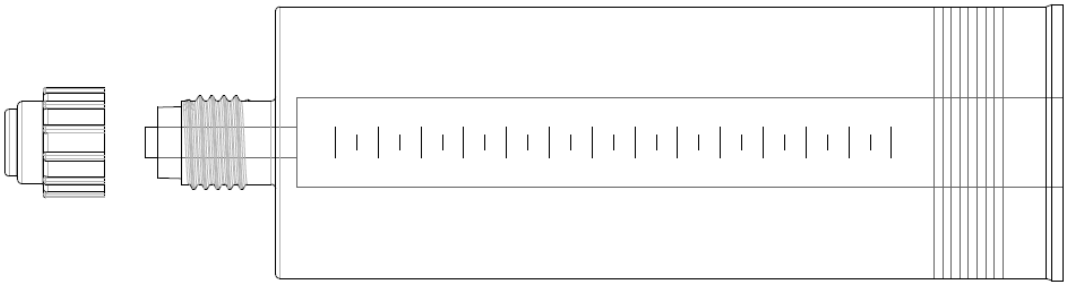
Charles Baloche
Technical Director

Product description and intended use

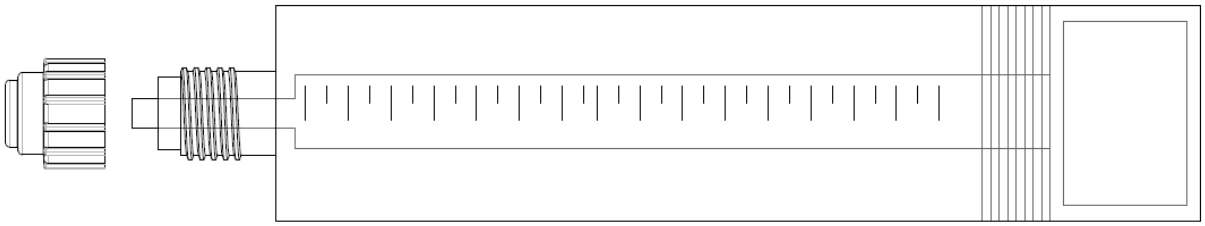
The post-installed rebar connection consists of injection mortar Spit MULTI-MAX and an embedded straight deformed reinforcing bar with properties of class B and C according to Annex C of Eurocode 2

Injection mortar MULTI-MAX

Cartridge 380 ml and 410 ml



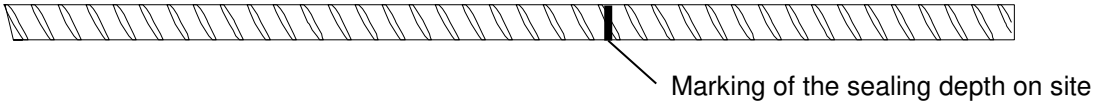
Cartridge 280 ml and 300 ml



Mixing nozzles

SPIT MULTI-MAX	
Product description	**Annex A1**

Figure A1: Reinforcing bar (rebar): ϕ 8 to ϕ 20



Proprety rebar

- Rebar according EN 1992-1-1:2004 Annex C;
- Bars and straightened wires class B or C;
- Diameter ϕ 8 à ϕ 20 mm;
- Ribs height of the bar h shall be in the range 0,05 ϕ ≤ h ≤ 0,07 ϕ;
- Nominal characteristic steel yiels strength fyk (MPa) acc. NDP or NCL to EN 1992-1-1/NA;
- Nominal characteristic steel ultimate tensile strength fuk = ftk = k · fyk.

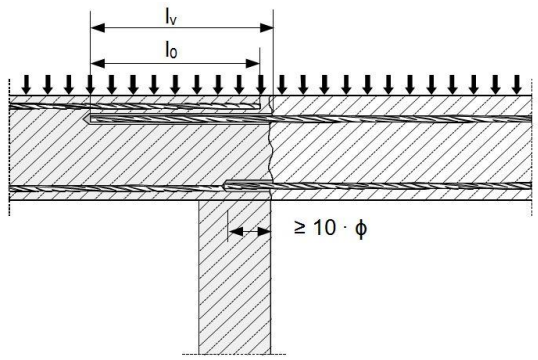


Figure A2:
Overlap joint with existing reinforcement for rebar connections of slabs and beams

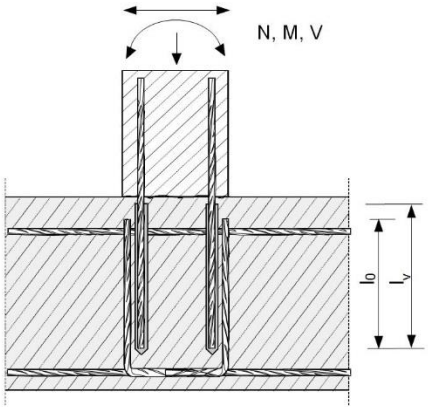


Figure A3:
Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed in tension

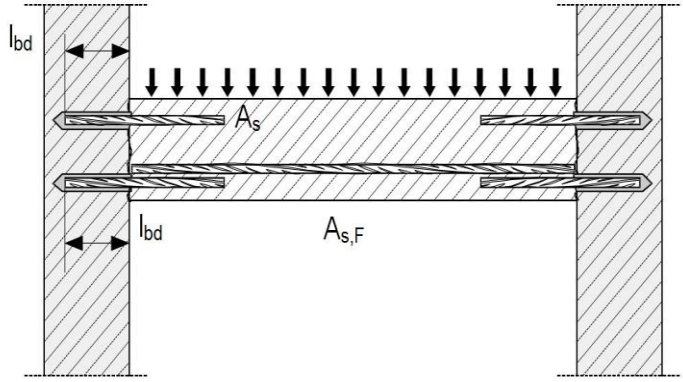


Figure A4:
End anchoring of slabs or beams

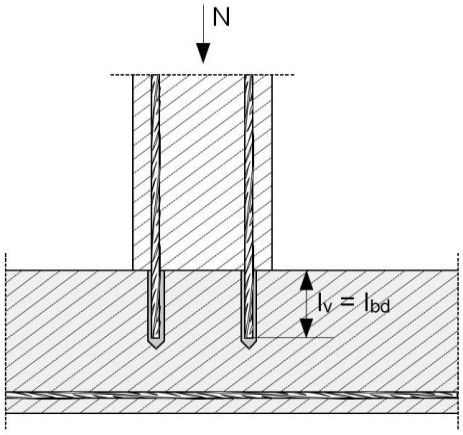


Figure A5:
Rebar connection for components stressed primarily in compression

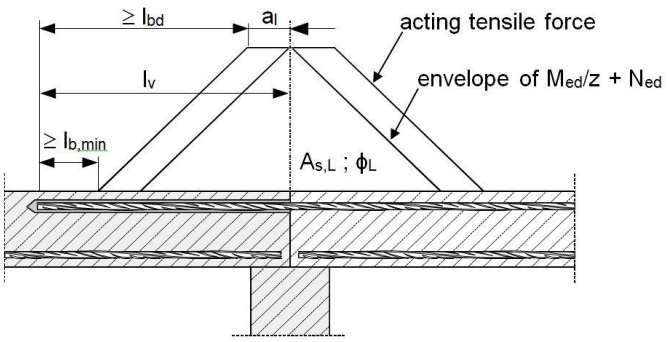


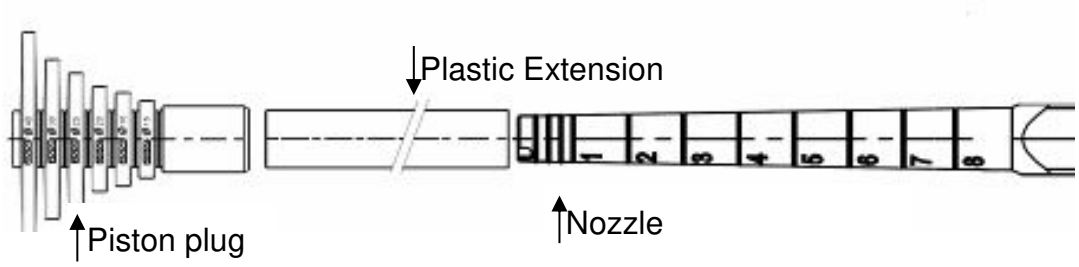
Figure A6:
Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member

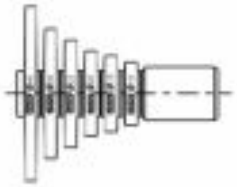
Note to Figure A2 to Figure A6:

- In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1.
- Preparing of joints according to Annex B2.

SPIT MULTI-MAX	
Product description Installation view and examples of use of reinforcement	**Annex A3**

Injection accessories for deep sealing



Ø Drilling	Plastic extension for mixing nozzle	Mixing nozzle		Piston plug
	ϕ_{ext} x l			
[mm]	[mm]	[-]	[-]	[-]
10 à 20	9x196 9x1000	Standard Mixing nozzle		

Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.

Base material:

- Reinforced or unreinforced normal weight concrete according to EN 206.
- Strength classes C12/15 to C50/60 according to EN 206.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206-1.
- 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.The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.

Temperature in the base material:

- **in-service**

  -40 °C to +40 °C (max. long term temperature +20 °C and max. short term temperature +40 °C)

Design:

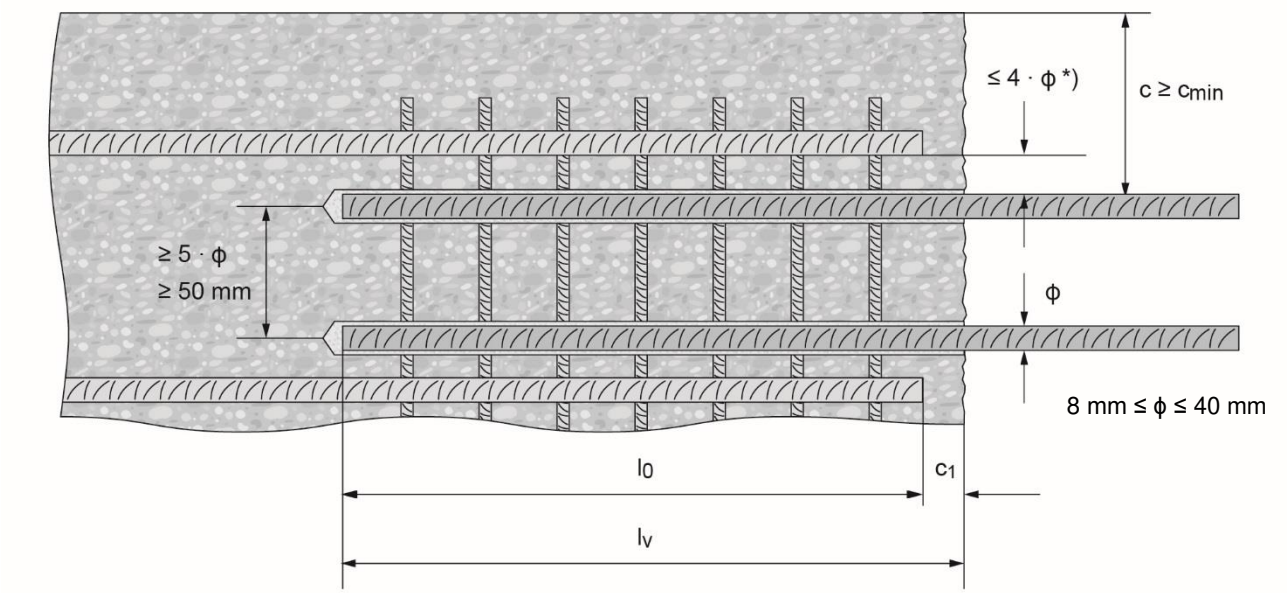
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design under static or quasi-static loading in accordance with EN 1992-1-1, Annex B2.
- 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:

- Use category: dry or wet concrete (not in flooded holes).
- Drilling technique:
  - hammer drilling,
  - diamond core drilling,
  - compressed air drilling
- 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 for the overlap joint).

Figure B1: General construction rules for post-installed rebars

- Post-installed rebar may be designed for tension forces only.
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1.
- The joints for concreting must be roughened to at least such an extent that aggregate protrudes.



*) If the clear distance between lapped bars exceeds 4 x ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4 x ϕ.

Minimum clear spacing between two post-installed bars a = 40 mm ≥ 4 x ϕ. When using a drilling aid the requirement of 4 x ϕ may be replaced by 2 x ϕ.

c concrete cover of post-installed rebar
c_1 concrete cover at end-face of existing rebar
c_{min} minimum concrete cover according to Table B1 and to EN 1992-1-1
ϕ diameter of reinforcement bar
l_0 lap length, according to EN 1992-1-1
l_v effective embedment depth ≥ $l_0 + c_1$
d_0 nominal drill bit diameter, see Table B2

SPIT MULTI-MAX	
Intended Use General design rules of construction spacing and edge distance for bonded in rebars	**Annex B2**

Table B1: Minimum concrete cover c_{min}[1)] of the post-installed rebar depending on drilling method and drilling tolerance

Drilling method	Bar diameter [mm]	Minimum concrete cover c_{min}[1)] [mm]	
		Without drilling aid	With drilling aid
Hammer drilling	$\phi \leq 20$	$30 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$
Compressed air drilling	$\phi \leq 20$	$50 + 0{,}08 \cdot l_v$	$50 + 0{,}02 \cdot l_v$

[1)] See Annex B2, Figure B1.
Comments: The minimum concrete cover acc. EN 1992-1-1.

Figure B2: Drilling aid System

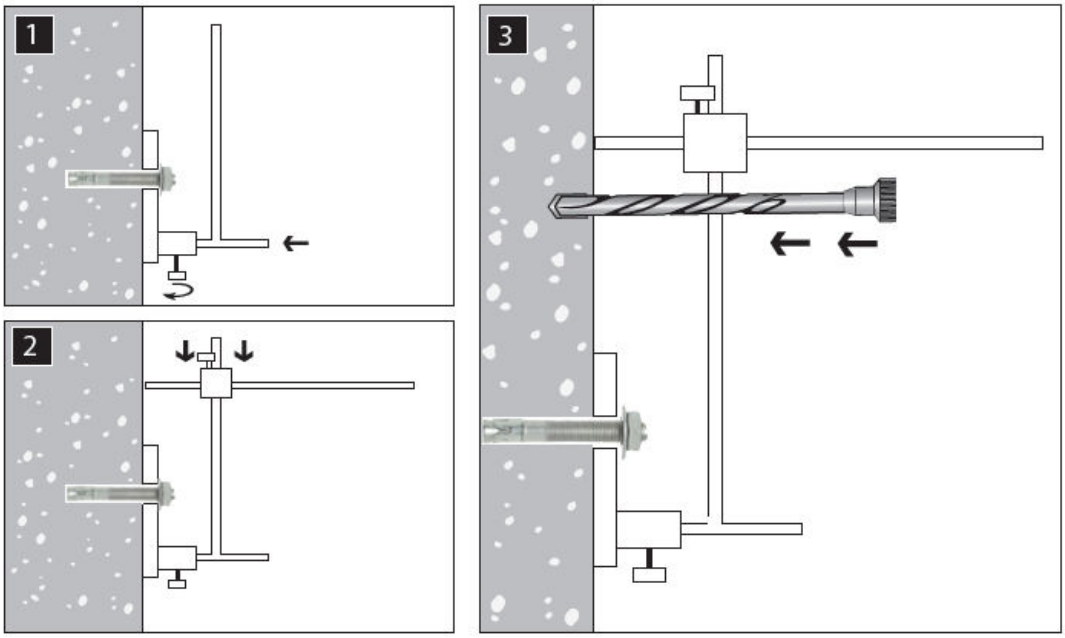


Table B2: Drilling diameter and maximum anchorage length

Rebar diameter d_s	Nominal drilling diameter d_0	Max Permissible anchorage depth l_v
[mm]	[mm]	[mm]
8	10	900 (1)
10	12	
12	15	
14	18	
16	20	
20	25	
(1) The temperature of the cartridge must be ≤ 40°		

Table B3: Dimensions of cleaning accessories

Rebar diameter [mm]	Brushes Diameter [mm]	Extension for brushes [-]	Plastic Extension for compressed air [-]
8	11	Lg 325 mm	9x196 9x1000
10	13		
12	16		
14	20		
16	22		
20	26		
25	32		
28	37		
32	42		
40	52		

The diameter of the round steel brush shall be checked before use. The minimum brush diameter has to be at least equal to the borehole diameter d_0. The round steel brush shall produce natural resistance as it enters the drill hole. If this is not the case, please use a new brush or a brush with a larger diameter

Table B4 : Processing and curing time

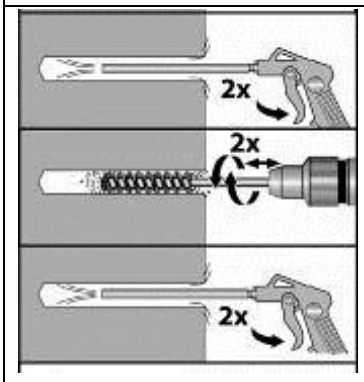
Temperature of base material	Gel time	Curing time in dry concrete
-5°C to 0°C	-	360 min
0°C to 5°C	18 min	180 min
5°C to 10°C	12 min	90 min
10°C to 20°C	6 min	60 min
20°C to 30°C	4 min	45 min
30°C to 40°C	2 min	35 min

Note: The temperature of the cartridge must be ≥ 0°C

Drilling the hole

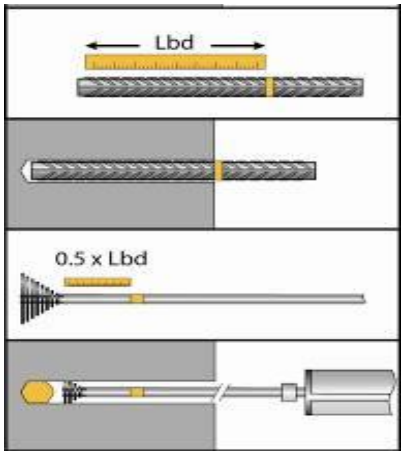
	Hammer drilling or compressed air drilling

Cleaning the hole:

Hammer drilling technique	
	1. Insert air nozzle fitted with the relevant plastic extension to bottom of the hole and blow out at least 2 times using oil free compressed air and until no dust is evacuated. 2. Using the relevant brush and extension fitted on a drilling machine, starting from the top of the hole, move downward to the bottom of the hole (duration 5s) then move upward to the top of the hole (duration 5s). Repeat this operation. 3. Insert air nozzle fitted with the relevant plastic extension to bottom of the hole and blow out at least 2 times using oil free compressed air and until no dust is evacuated.

Safety precaution

The safety data sheet must be red before using the product and the safety instructions must be followed.

	1. Put the anchorage depth mark on the rebar 2. Check the anchorage depth 3. Cut the piston plug at the relevant diameter. The volume of resin that need to be injected in the hole must be indicated on the mixing nozzle or its extension. The marking must be placed at 0.5 time the anchorage depth 4. Screw the mixing nozzle onto the cartridge and dispense the first part to waste until an even colour is achieved for each new cartridge or mixing nozzle. Insert the nozzle to the far end of the hole, and inject the resin, withdrawing the nozzle as the hole fills. Fill the hole until the mark appear.

Inserting the rebar:

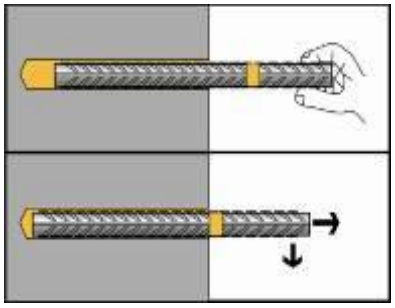
	1. Immediately insert the rebar, slowly and with a slight twisting motion. Remove excess resin from around the mouth of the hole before it sets. Control the embedment depth. 2. Leave the rebar undisturbed until the cure time has elapse.

Table C1: Amplification factor α_{lb} for the resine MULTI-MAX

The minimum anchorage length anchoring rebar $l_{b,min}$ and the minimum anchorage length overlap joint $l_{0,min}$ acc. to EN 1992-1-1 shall be multiplied by the factor α_{lb} given in the Table C1.

	Amplification factor α_{lb}								
Size	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 - ϕ 20	1,5								

Table C2: Design bond resistance f_{bd}[1)] en N/mm² for MULTI-MAX

	Design bond resistance f_{bd} according to EN 1992-1-1								
Size	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8	1.6	2.0	2.3	2.7	3.0	3.4	3.4	3.7	3.7
ϕ 10	1.6	2.0	2.3	2.7	3.0	3.4	3.4	3.4	3.4
ϕ 12	1.6	2.0	2.3	2.7	3.0	3.0	3.0	3.0	3.4
ϕ 14	1.6	2.0	2.3	2.7	3.0	3.0	3.0	3.0	3.0
ϕ 16	1.6	2.0	2.3	2.7	2.7	2.7	2.7	2.7	3.0
ϕ 20	1.6	2.0	2.3	2.3	2.3	2.3	2.3	2.3	2.7

[1)] Acc. En 1992-1-1 for good adhesion conditions. For all other conditions of adhesion multiply the values by 0.7.

Table C3: Anchoring of Rebar HA Fe E500 – C20/25 concrete (f_{bd}=2.3Mpa)

Rebar diameter	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1.0$			α_2 or α_5= 0.7 / $\alpha_1=\alpha_3=\alpha_4=1.0$		
	Anchorage depth l_{bd}	Max. design value N_{rd} in the rebar	Volume of resin	Anchorage depth	Max. design value N_{rd} in the rebar	Volume of resin
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	170 *	9.83	6	170 *	14.05	6
	220	12.72	7	190	15.69	6
	270	15.61	9	210	17.34	7
	320	18.50	11	240	19.82	8
	378	21.85	13	265	21.85	9
10	213 *	15.37	9	213 *	21.95	9
	270	19.51	11	240	24.77	10
	340	24.57	14	270	27.87	11
	400	28.90	17	300	30.97	12
	473	34.15	20	331	34.15	14
12	255 *	22.13	19	255 *	31.61	19
	330	28.61	25	290	35.92	22
	410	35.55	31	320	39.64	24
	480	41.62	37	360	44.59	27
	567	49.17	43	397	49.17	30
14	298 *	30.12	36	298 *	43.03	36
	380	38.44	46	330	47.69	40
	470	47.54	57	380	54.92	46
	570	57.66	69	420	60.70	51
	662	66.93	80	463	66.93	56
16	340 *	39.34	46	340 *	56.20	46
	440	50.87	60	380	62.76	52
	540	62.43	73	430	71.02	58
	650	75.15	88	480	79.28	65
	756	87.42	103	529	87.42	72
20	425 *	61.47	90	425 *	87.81	90
	540	78.04	115	480	99.09	102
	660	95.38	140	540	111.48	115
	780	112.72	165	600	123.87	127
	900	130.06	191	662	136.59	140

*** Values corresponding to the minimum anchorage length $l_{b,min}$**

Table C4: Overlap joint with Rebar HA Fe E500 – C20/25 concrete (f_{bd}=2.3Mpa)

Rebar diameter	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=\alpha_6=1.0$			α_2 or α_5= 0.7 / $\alpha_1=\alpha_3=\alpha_4=\alpha_6=1.0$		
	Anchorage depth l_{bd}	Max. design value N_{rd} in the rebar	Volume of resin	Anchorage depth	Max. design value N_{rd} in the rebar	Volume of resin
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	300 *	17.34	10	300 *	21.85	10
	310	17.92	11	300	21.85	10
	330	19.08	11	300	21.85	10
	350	20.23	12	300	21.85	10
	378	21.85	13	300	21.85	10
10	300 *	21.68	12	300 *	30.97	12
	340	24.57	14	300	30.97	12
	380	27.46	16	310	32.00	13
	420	30.35	17	320	33.03	13
	473	34.15	20	331	34.15	14
12	300 *	26.01	23	300 *	37.16	23
	360	31.21	27	320	39.64	24
	430	37.28	33	340	42.12	26
	500	43.35	38	370	45.83	28
	567	49.17	43	397	49.17	30
14	315 *	31.87	38	315 *	45.52	38
	400	40.46	48	350	50.58	42
	480	48.56	58	380	54.92	46
	570	57.66	69	420	60.70	51
	662	66.93	80	463	66.93	56
16	360 *	41.62	49	360 *	59.46	49
	450	52.02	61	400	66.06	54
	550	63.59	75	440	72.67	60
	650	75.15	88	480	79.28	65
	756	87.42	103	529	87.42	72
20	450 *	65.03	95	450 *	92.90	95
	560	80.93	119	500	103.22	106
	670	96.82	142	550	113.55	117
	780	112.72	165	600	123.87	127
	900	130.06	191	662	136.59	140

1) Tabulated maximum tension loads are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions the values for tension loads must be multiplied by 0.7.

2) The volume V of mortar can be estimated using the equation $V = 1,2 * (do^2 - d^2).\pi.l_{bd}/4$.

*** Values corresponding to the minimum anchorage length $l_{b,min}$**