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European Technical Assessment

ETA-08/0201 of 20/11/2023

English translation prepared by CSTB - Original version in French language

General Part

Technical Assessment Body issuing the European Technical Assessment: Centre Scientifique et Technique du Batiment (CSTB)	
Trade name:	**SPIT EPOBAR / EPOBAR^{+}**
Product family:	Post installed rebar connections diameter 8 to 32 mm made with SPIT EPOBAR / EPOBAR $^{+}$ injection mortar
Manufacturer:	Société SPIT Route de Lyon BP 104 F-26501 BOURG- LES -VALENCE France
Manufacturing plants:	Société SPIT Route de Lyon F-26501 BOURG-LES-VALENCE France
This European Technical Assessment contains:	21 pages including 18 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 330087-01-0601, Edition 12/2021
This Assessment replaces:	ETA-08/0201 issued on 23/02/2015

Specific part

1 Technical description of the product

The SPIT EPOBAR / EPOBAR^{+} 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 and EN 1992-1-2 under static loading

The European Technical Assessment covers rebar anchoring systems consisting of SPIT EPOBAR or EPOBAR^{+} bonding material and an embedded straight deformed reinforcing bar in the range of $\phi 8$ to $\phi 32$ with properties according to Annex C of EN 1992-1-1:2004 and EN 10080:2005..The classes B and C of the rebar are recommended.

The illustration and the description of the product are given in Annexes A.

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 for EPOBAR adhesive and 100 years for EPOBAR^{+} adhesive. 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 to C6
Characteristic resistance under seismic loading	No performance determined (NPD)

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance determined (NPD)

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 Decision 96/582/EC of the European Commission[1], as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	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

[1] Official Journal of the European Communities L 254 of 08.10.1996

Installed condition

Figure A1:

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

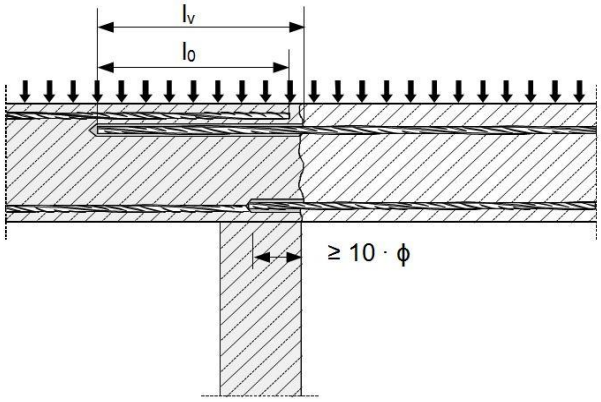


Figure A2:

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

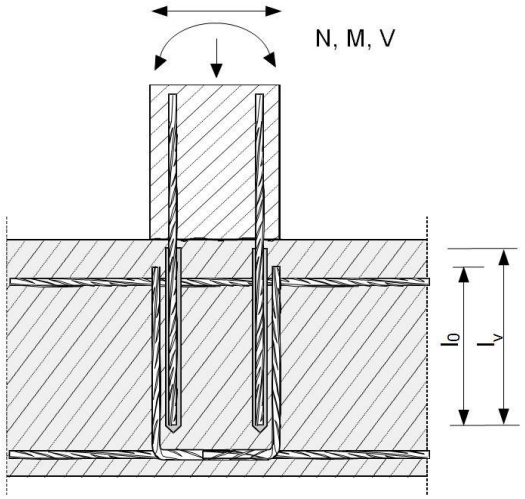
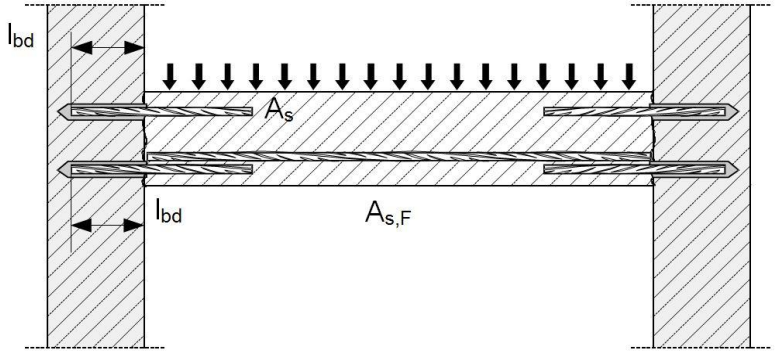


Figure A3:

End anchoring of slabs or beams



SPIT EPOBAR / EPOBAR$^+$ for rebar connection	
Product description Installed condition: application examples of post-installed rebars	**Annex A1**

Figure A4:

Rebar connection for components stressed primarily in compression

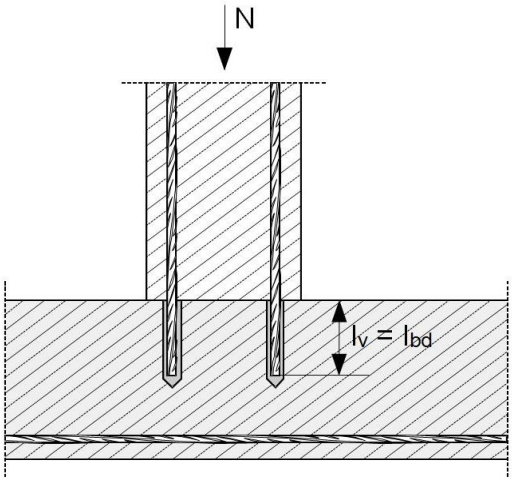
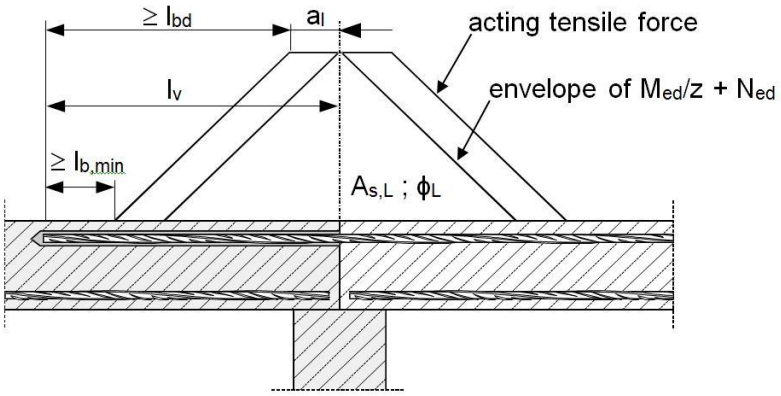


Figure A5:

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



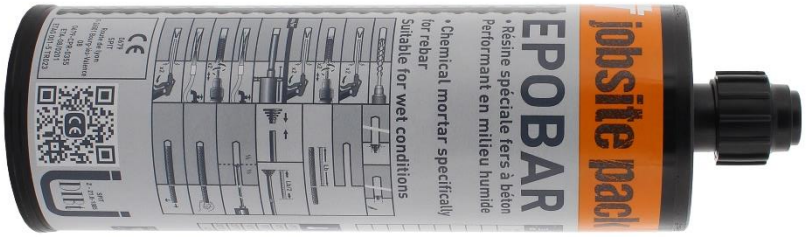
Note to Figure A1 to Figure A5:

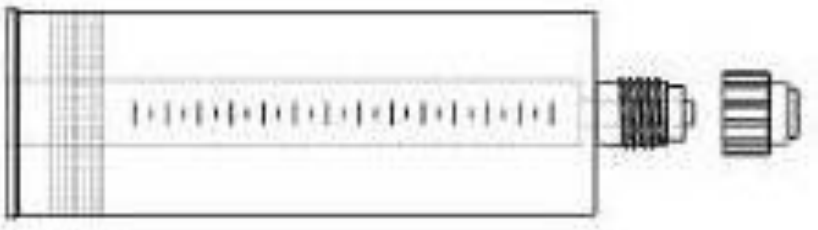
- In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1:2004+AC:2010 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1:2004+AC:2010.
- Preparing of joints according to Annex B2.

The reference to EN 1992-1-1:2004+AC:2010 is cited in the following as EN 1992-1-1 only.

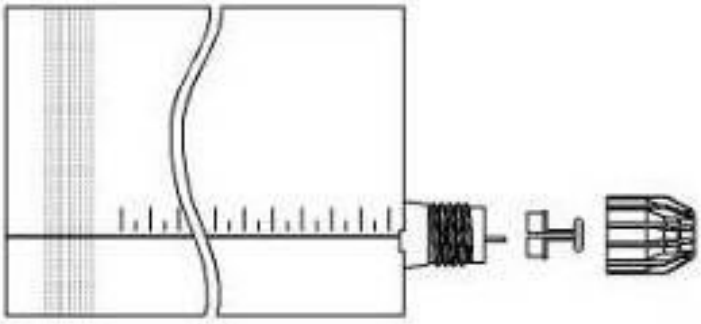
SPIT EPOBAR / EPOBAR$^+$ for rebar connection	**Annex A2**
Product description Installed condition: application examples of post-installed rebars	

EPOBAR / EPOBAR⁺ cartridge 410ml:





EPOBAR / EPOBAR⁺ cartridge 825ml :



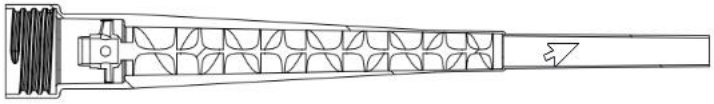
Marking of the mortar cartridges:

- Marking
- Trade name
- Charge code number
- Storage life
- Curing and processing time

SPIT EPOBAR / EPOBAR⁺ for rebar connection	**Annex A3**
Product description EPOBAR /EPOBAR⁺ Cartridges	

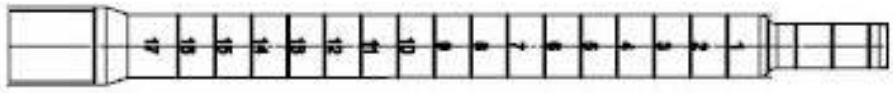
Mixing nozzles

- Mixing nozzle for cartridges 345ml - 410ml



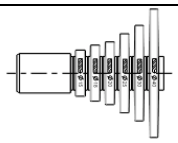
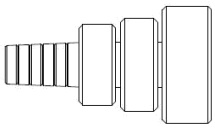
- High flow mixing nozzle for cartridges 825ml

- Reduction for mixing nozzle



Injection accessories for deep hole

Plastic extension must be use for drilled holes deeper than h_0 > 250 mm
Piston plug for hole deeper must be use for drilled holes deeper than h_0 > 350 mm

Cartridge volume	Mixing Nozzle	Extension for piston plug	Piston plug
All cartridges	Mixing nozzle for cartridges 345ml - 410ml	Ø13x1000	
Cartridge 825 ml	High flow	Ø20x1000	

Note: The piston plug can be used for all the hole diameters by cutting it to the relevant diameter.

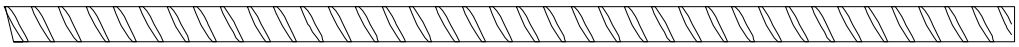
Dispensers

- Electric dispensers: EGI 380 / EGI 825
- Pneumatic dispensers: P380 / P825
- Manual dispensers: M345 / M380

SPIT EPOBAR / EPOBAR$^+$ for rebar connection	**Annex A4**
Product description Installation tools	

Figure A6: :

Reinforcing bar (rebar): ϕ 8 to ϕ 32 according to EN 1992-1-1



- Minimum value of related rib area f_R according to EN 1992-1-1.
- Rib height of the bar h_{rib} shall be in the range:
  $0{,}05 \cdot \phi \leq h_{rib} \leq 0{,}07 \cdot \phi$
- The maximum outer rebar diameter over the ribs shall be:
  $\phi + 2 \cdot 0{,}07 \cdot \phi = 1{,}14 \cdot \phi$
  (ϕ: nominal diameter of the bar; h_{rib}: rib height of the bar)

Properties of rebars (EN 1992-1-1)

Product form		**rebars and de-coiled rods**	
Class		B	C
Characteristic yield strength f_{yk} or $f_{0,2k}$ (MPa)		400 to 600	
Minimum value of $k = (f_t/f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force, ε_{uk} (%)		≥ 5,0	≥ 7,5
Bendability		Bend / Rebend test	
Maximum deviation from nominal mass (individual bar or wire) (%)	Nominal bar size (mm) ≤ 8 > 8	 ± 6,0 ± 4,5	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12 > 12	 0,040 0,056	

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016.
- Strength classes C12/15 to C50/60 according to EN 206:2013+A1:2016 for static and quasi static loading.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206:2013+A1:2016.
- 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 Range:

- - 40°C to +80°C (max. short term temperature +80°C and max long term temperature +50°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 of rebar under static or quasi static loading in accordance with EN 1992-1-1.
- 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:

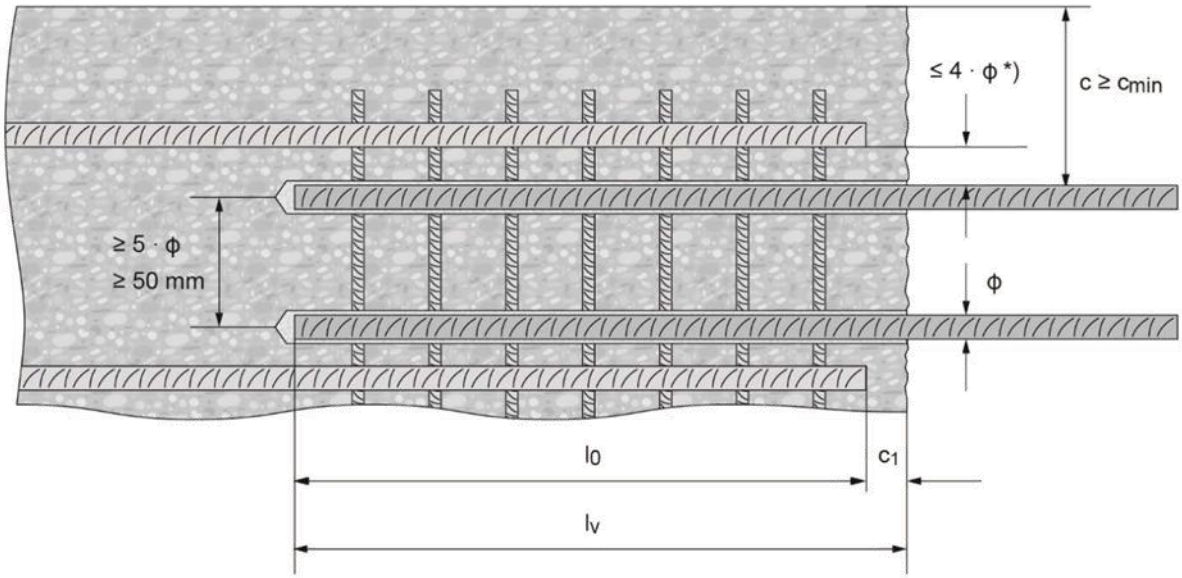
- Drilling technique:
  - Hammer drilling technique, compressed air drilling: all sizes
  - Hammer drilling with hollow drill bit XTD: sizes ϕ12 to ϕ25
  - Diamond coring, EPOBAR: sizes ϕ8 to ϕ32.
  - Diamond coring, EPOBAR$^+$: sizes ϕ12 to ϕ 32.
- Use category:
  Dry concrete for:
  - Hammer drilling technique, compressed air drilling
  - Hammer drilling with hollow drillt bit XTD
  - Diamond coring

  Wet concrete (not in flooded holes) for:
  - Hammer drilling technique, compressed air drilling
  - Diamond coring
- Overhead installation is admissible.
- Rebar installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

SPIT EPOBAR / EPOBAR$^+$ for rebar connection	**Annex B1**
Intended use Specifications	

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·ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4·ϕ.

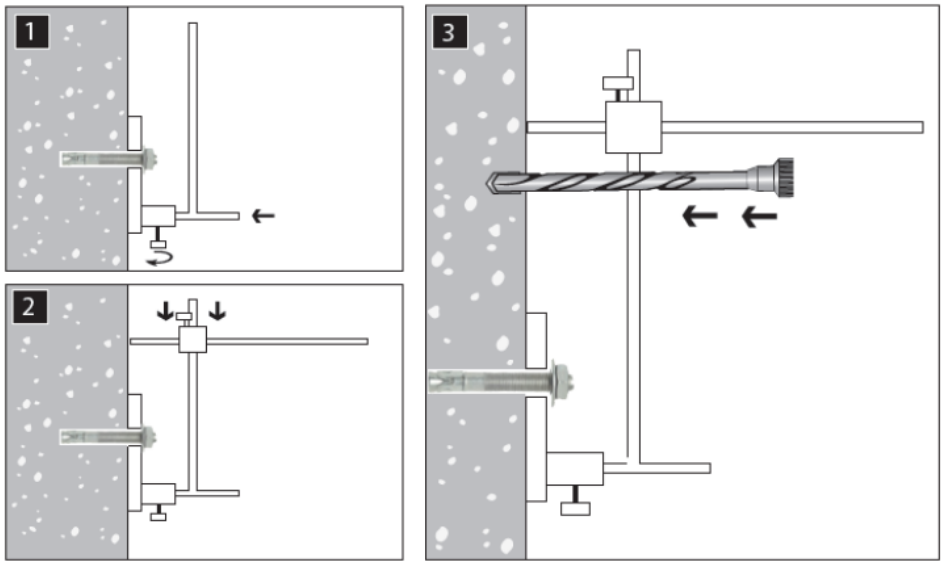
c concrete cover of post-installed rebar
c_1 concrete cover at end-face of existing rebar
c_{min} minimum concrete cover according to Table B3 and to EN 1992-1-1
ϕ diameter of reinforcement bar
l_0 lap length, according to EN 1992-1-1 for static loading
l_v embedment length ≥ $l_0 + c_1$
d_0 nominal drill bit diameter

Table B1: Minimum concrete cover c_{min}[1)] of post-installed rebar under static loading

Drilling method	Bar diameter ϕ	Without drilling aid	With drilling aid
Hammer drilling	< 25 mm	30 + 0,06 lv ≥ 2ϕ	30 + 0,02 lv ≥ 2ϕ
	≥ 25 mm	40 + 0,06 lv ≥ 2ϕ	40 + 0,02 lv ≥ 2ϕ
Hammer drilling with hollow drill bit XTD	< 25 mm	30 + 0,06 lv ≥ 2ϕ	30 + 0,02 lv ≥ 2ϕ
	≥ 25 mm	40 + 0,06 lv ≥ 2ϕ	40 + 0,02 lv ≥ 2ϕ
Compressed air drilling	< 25 mm	50 + 0,08 lv ≥ 2ϕ	50 + 0,02 lv ≥ 2ϕ
	≥ 25 mm	60 + 0,08 lv ≥ 2ϕ	60 + 0,02 lv ≥ 2ϕ
Diamond core drilling	< 25 mm	Drill stand is used as drilling aid	30 + 0,02 lv ≥ 2ϕ
	≥ 25 mm		40 + 0,02 lv ≥ 2ϕ

[1)] The minimum concrete cover as specified in EN 1992-1-1 must be observed.

Figure B2: Example of drilling aid system



SPIT EPOBAR / EPOBAR$^+$ for rebar connection	
Intended used Minimum concrete cover	**Annex B3**

Table B3 : Drilling diameter and maximum anchorage length

Rebar diameter d_{nom}	Nominal drilling diameter d_0			Max Permissible anchorage depth l_v		
	Drill bit	Hollow drill bit XTD (3)	Diamond core(4)	EPOBAR Dispensers: **M345 / M380, P380, EGI 380**	EPOBAR Dispensers : **P825**	EPOBAR+ Dispensers **M380, P380, EGI 380**
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
ϕ8	10	-	10	900 (1)	1500 (2)	600 (1)
ϕ10	12	-	12			
ϕ12	15	16	16			
ϕ14	18	18	18			
ϕ16	20	20	20			
ϕ20	25	25	25			
ϕ25	30	30	30			
ϕ28	35	-	35		1200 (2)	
ϕ32	40	-	40			

(1) The temperature of the cartridge must be ≤ 40°C
(2) The cartridge must be stored at ambient temperature (20°C)
(3) Maximum working length : 600 mm
(4) Diamond coring without roughening is allowed only for EPOBAR adhesive

Table B4: Parameters for use of roughening tool (only for EPOBAR+)

Rebar diameter d_{nom} [mm]	Nominal diamond core diameter d_0 [mm]	Roughtening tool 1) d_0 [mm]
ϕ12	16	16
ϕ14	18	18
ϕ16	20	20
ϕ20	25	25
ϕ25	30	30
ϕ28	35	35
ϕ32	40	40

1) For checking the wearing of roughening drill bit, a wear gauge is delivered with each roughtening tool

Table B5: Dimensions of the cleaning tools for reinforcing bars (rebars)

	Nominal diameter of the reinforcing bars (rebars)								
Rebar diameter d_{nom} [mm]	**ϕ8**	**ϕ10**	**ϕ12**	**ϕ14**	**ϕ16**	**ϕ20**	**ϕ25**	**ϕ28**	**ϕ32**
Ø Steel brush [mm] 1)	11	13	16	20	22	26	32	37	42
Ø Plastic extension for compress air cleaning	6	9	9	13	13	13	13/20	13/20	13/20

1) 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, use a new brush or a brush with a larger diameter.

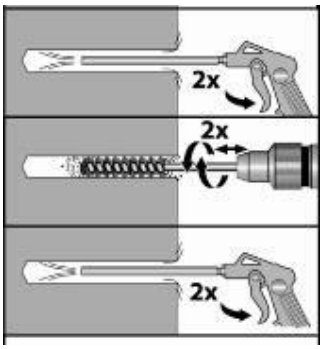
Table B6: Gel time and curing time for EPOBAR and EPOBAR +

Ambient temperature (°C)	Processing time (min)	Curing time in dry concrete (min)	Curing time in wet concrete (min)
5° to 9°C	22	250	500
10° to 19° C	11	190	380
20° to 29°C	6	110	220
30° to 39°C	3	65	130
40° C	3	50	100

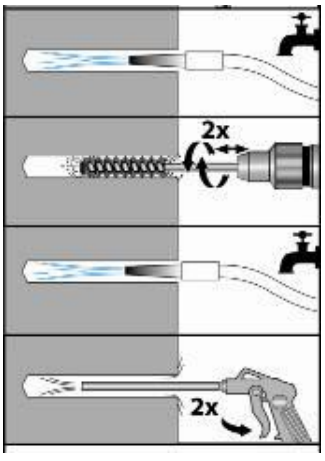
Drilling of the hole:

	Rotary hammer drilling or compressed air drilling
	Electrical hammer drilling with XTD hollow drill bit used in relation with the SPIT AC 1625 vacuum or the type. This drilling technique allows for cleaning the hole from the dust debris while operating drilling. No further cleaning is then required before injecting the adhesive.
	Diamond coring The roughening tool must be used for a coring diameter higher than 16 mm.(only for EPOBAR+, rebar diameter > ϕ12)

Cleaning the borehole:

Hammer drilling technique (with standard drill bit for concrete)	
	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 (6 bars min.) and until no more dust is evacuated. 2. Using the relevant brush and SPIT 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 (6 bars min.) and until no more dust is evacuated.

Hammer drilling technique with hollow drill bit XTD
Electrical hammer drilling with XTD hollow drill bit used in relation with the SPIT AC 1625 vacuum or the type. This drilling technique allows for cleaning the hole from the dust debris while operating drilling. No further cleaning is then required before injecting the adhesive.

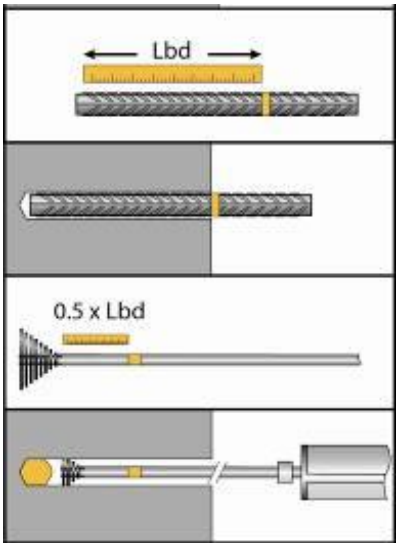
Diamond core drilling technique	
	1. Clean the hole with tap water 2. Using the relevant brush and extension fitted on a drilling machine, starting from the top of the hole, move downward to the bottom of the hole (duration 5s) then move upward to the top of the hole (duration 5s). Repeat this operation. 3. Clean the hole with tap water 4. 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 (min. 6 bars) and until no more dust is evacuated.

Safety precaution

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

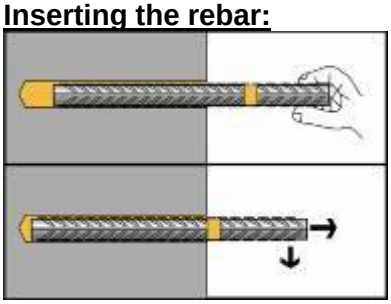
- Storage temperature of the cartridge +0°C to +35 °C
- Cartridge temperature at the time of installation must be ≥ +5°C
- Base material temperature at the time of installation must be between -5°C and +40°C
- Check the date of expiry of the cartridge

Dispensing into the borehole:



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 adhesive that is needed to be injected in the borehole must be reported on the mixing nozzle or its extension. The marking must be set to 0,5 times the anchorage depth.
4. When using a new cartitridge an initial amount of adhesive corresponding to the first the first trigs has to be discarded until an even color is achieved.
5. Insert the nozzle to the far end of the hole, and inject the adhesive, withdrawing the nozzle as the hole fills in order to avoid trapping air bubbles. Fill the hole until the mark appear.

Inserting the rebar:



6. Immediately after having injected the adhesive, insert the rebar, slowly and with a slight twisting motion. Remove excess adhesive from around the mouth of the hole before it sets. Control the embedment depth.
7. Leave the rebar undisturbed until the cure time has elapse.

Essential characteristics under static and quasi-static loading: EPOBAR

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 years for **Hammer drilling and Compressed air drilling**.

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C1.

The design bond strengths $f_{bd,PIR}$ are given in Table C3. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor $k_b = k_{b,100y}$ according to Table C2.

Table C1: Amplification factor factor α_{lb} and $\alpha_{lb,100y}$

Rebar diameter	Amplification factor α_{lb} [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,0								

Table C2: Bond efficiency factor k_b

Rebar diameter	Bond efficiency factor k_b [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Table C3: Design values of the bond strength $f_{bd,PIR}$[1)]

Rebar diameter	Bond strength $f_{bd,PIR}$ [N/mm²]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Essential characteristics under static and quasi-static loading: EPOBAR+

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 and 100 years for **Hammer drilling and Compressed air drilling**.

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ given in Table C4.

The design bond strengths $f_{bd,PIR}$ and $f_{bd,PIR,100y}$ are given in Table C6. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor $k_b = k_{b,100y}$ according to Table C5.

Table C4: Amplification factor α_{lb} and $\alpha_{lb,100y}$

Bar diameter	Amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8	1,0								
ϕ10	1,0								
ϕ12	1,0								
ϕ14	1,0							1,1	
ϕ16	1,0						1,1		
ϕ20	1,0						1,1	1,2	1,2
ϕ25	1,0				1,1		1,2	1,3	1,3
ϕ28	1,0				1,1		1,2	1,3	1,4
ϕ32	1,0				1,2		1,3	1,4	1,5

Table C5: Bond efficiency factor k_b and $k_{b,100y}$

Bar diameter	Bond efficiency factor $k_b = k_{b,100y}$ [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Table C6: Design values of the bond strength $f_{bd,PIR}$[1)] and $f_{bd,PIR,100y}$[1)]

Bar diameter	Bond resistance $f_{bd,PIR} = f_{bd,PIR,100y}$ [N/mm²]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Essential characteristics under static and quasi-static loading: EPOBAR

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 years for **Diamond coring**.

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C7.

The design bond strength $f_{bd,PIR}$ is given in Table C9. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor k_b according to Table C8.

Table C7: Amplification factor α_{lb}

Bar diameter	**Amplification factor α_{lb} [-]**								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,0								

Table C8: Bond efficiency factor k_b

Bar diameter	**Bond efficiency factor k_b [-]**								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,0	1,0	1,0	0,85	0,75	0,65	0,6	0,6	0,5

Table C9: Design values of the bond strength $f_{bd,PIR}$[1)]

Bar diameter	**Bond resistance $f_{bd,PIR}$ [N/mm²]**								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ8 to ϕ32	1,6	2,0	2,3	2,3	2,3	2,3	2,3	2,3	2,3

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Essential characteristics under static and quasi-static loading: EPOBAR+

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 years for **diamond coring with roughening tool.**

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C10.

The design bond strength $f_{bd,PIR}$ is given in Table C12. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor k_b according to Table C11.

Table C10: Amplification factor α_{lb}

Bar diameter	Amplification factor α_{lb} [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12	1,0							1,1	1,2
ϕ14									
ϕ16									
ϕ20									1,1
ϕ25								1,0	
ϕ28									1,0
ϕ32									

Table C11: Bond efficiency factor k_b

Bar diameter	Bond efficiency factor k_b [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ20	1,0								
ϕ25	1,0								0,9
ϕ28	1,0							0,9	0,9
ϕ32	1,0						0,9	0,8	0,9

Table C12: Design values of the bond strength $f_{bd,PIR}$ [1)]

Bar diameter	Bond resistance $f_{bd,PIR}$ [N/mm²]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12-ϕ20	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
ϕ25									4,0
ϕ28								3,7	4,0
ϕ32							3,4	3,4	3,7

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Essential characteristics under static and quasi-static loading: EPOBAR

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 years for **Hammer drilling with XTD hollow drill bit**.

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C13.

The design bond strength $f_{bd,PIR}$ is given in Table C15. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor k_b according to Table C14.

Table C13: Amplification factor α_{lb}

Bar diameter	**Amplification factor α_{lb} [-]**								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,5								

Table C14: Bond efficiency factor k_b

Bar diameter	**Bond efficiency factor k_b** [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,0								0,9

Table C15: Design values of the bond resistance $f_{bd,PIR}$[1)]

Bar diameter	**Bond resistance $f_{bd,PIR}$ [N/mm²]**								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,0

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Essential characteristics under static and quasi-static loading: EPOBAR+

Minimum anchorage length, minimum lap length and design values for bond strength for a working life of 50 years for **Hammer drilling with XTD hollow drill bit**.

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C16.

The design bond strength $f_{bd,PIR}$ is given in Table C18. It is obtained by multiplying the design bond strength f_{bd} according to EN 1992-1-1 (Eq. 8.3) by the bond efficiency factor k_b according to Table C17.

Table C16: Amplification factor α_{lb}

Bar diameter	Amplification factor α_{lb} [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,5								

Table C17: Bond efficiency factor k_b

Bar diameter	Bond efficiency factor k_b [-]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,0								

Table C18: Design values of the bond resistance $f_{bd,PIR}$ [1)]

Bar diameter	Bond resistance $f_{bd,PIR}$ [N/mm²]								
	Concrete strength class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ12 to ϕ25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.