



**INSTYTUT TECHNIKI BUDOWLANEJ**  
PL 00-611 WARSZAWA  
ul. Filtrowa 1  
tel.: (+48 22) 825-04-71  
(+48 22) 825-76-55  
fax: (+48 22) 825-52-86  
[www.itb.pl](http://www.itb.pl)



Member of



## European Technical Assessment

**ETA-19/0841  
of 20/12/2019**

### General Part

**Technical Assessment Body issuing the European Technical Assessment**

Instytut Techniki Budowlanej

**Trade name of the construction product**

Injection system XTREME GRIP VINYLESTER for rebar connections

**Product family to which the construction product belongs**

Post-installed rebar connections with injection mortar

**Manufacturer**

TORGGLER CHIMICA S.p.A.  
Via Verande 1/A  
I-39012 Merano (BZ)  
Italy

**Manufacturing plant**

TORGGLER CHIMICA S.p.A.  
Manufacturing Plant 1

**This European Technical Assessment contains**

23 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 331522-00-0601 „Post-installed rebar with mortar under seismic action”

*This European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.*

*Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.*

## Specific Part

### 1 Technical description of the product

The subject of this assessment are the post-installed connections, by anchoring or overlap connection joint of steel reinforcing bars (rebar) in existing structures made of normal weight concrete, using injection mortars XTREME GRIP VINYLESTER in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with diameter from 8 to 32 mm mortars XTREME GRIP VINYLESTER injection mortars are used for the post-installed rebar connections. The steel element is placed into a drilled hole previously filled with an injection mortar and is anchored by the bond between embedded element, injection mortar and concrete.

An illustration and the description of the products are given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document (EAD)

The performances given in clause 3 are only valid if the post-installed connections are used in the compliance with the specifications and conditions given in Annex B.

The performances given 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 or the Technical Assessment Body, 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 Performance of the product

##### 3.1.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi static loading	See Annex C1
Characteristic resistance under seismic loading	See Annex C2

##### 3.1.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Resistance to fire	See Annex C3

**3.2 Methods used for the assessment**

The assessment of the products has been made in accordance with EAD 331522-00-0601 „Post-installed rebar with mortar under seismic action”.

**4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base**

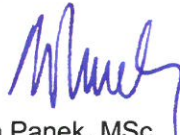
According to Decision 96/582/EC of the European Commission the system 1 of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) applies.

**5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document (EAD)**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Instytut Techniki Budowlanej.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary initial type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 20/12/2019 by Instytut Techniki Budowlanej



Anna Panek, MSc  
Deputy Director of ITB

Examples of post-installed rebar connections

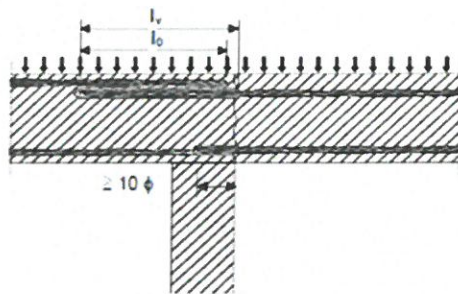


Figure 1.1 Overlap joint for rebar connections of slabs and beams

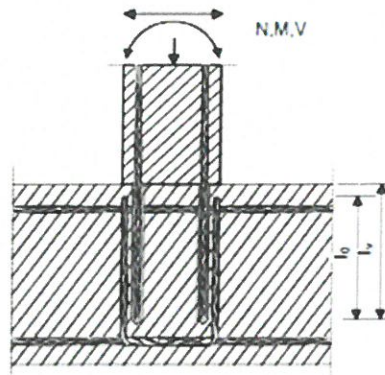


Figure 1.2 Overlap joint at a foundation of a column or wall where the rebar is stressed in tension

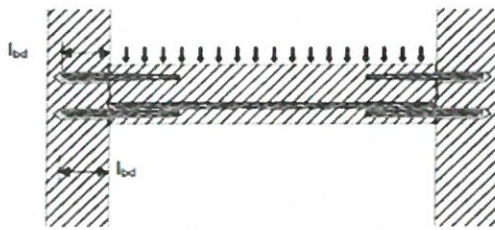


Figure 1.3 End anchoring of slabs or beams, designed as simply supported

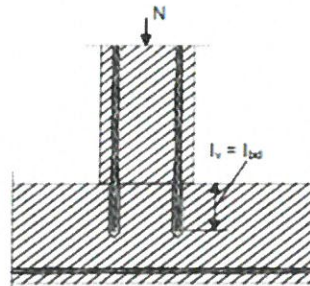
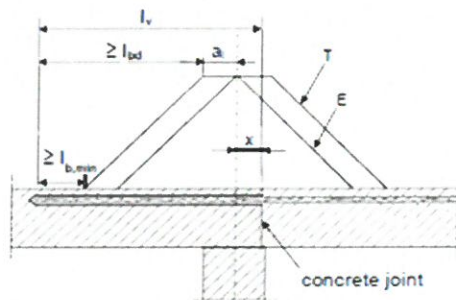


Figure 1.4 rebar connection for components stressed primarily in compression; rebar is stressed in compression



(only post-installed rebar is plotted)

Figure 1.5 Anchoring of reinforcement to cover the line of acting tensile force

Key to Figure 1.5

- T acting tensile force
- E envelope of  $M_{ed}/z + N_{ed}$  (see EN 1992-1-1, Figure 9.2)
- x distance between the theoretical point of support and concrete joint

Note to Figure 1.1 to 1.5:

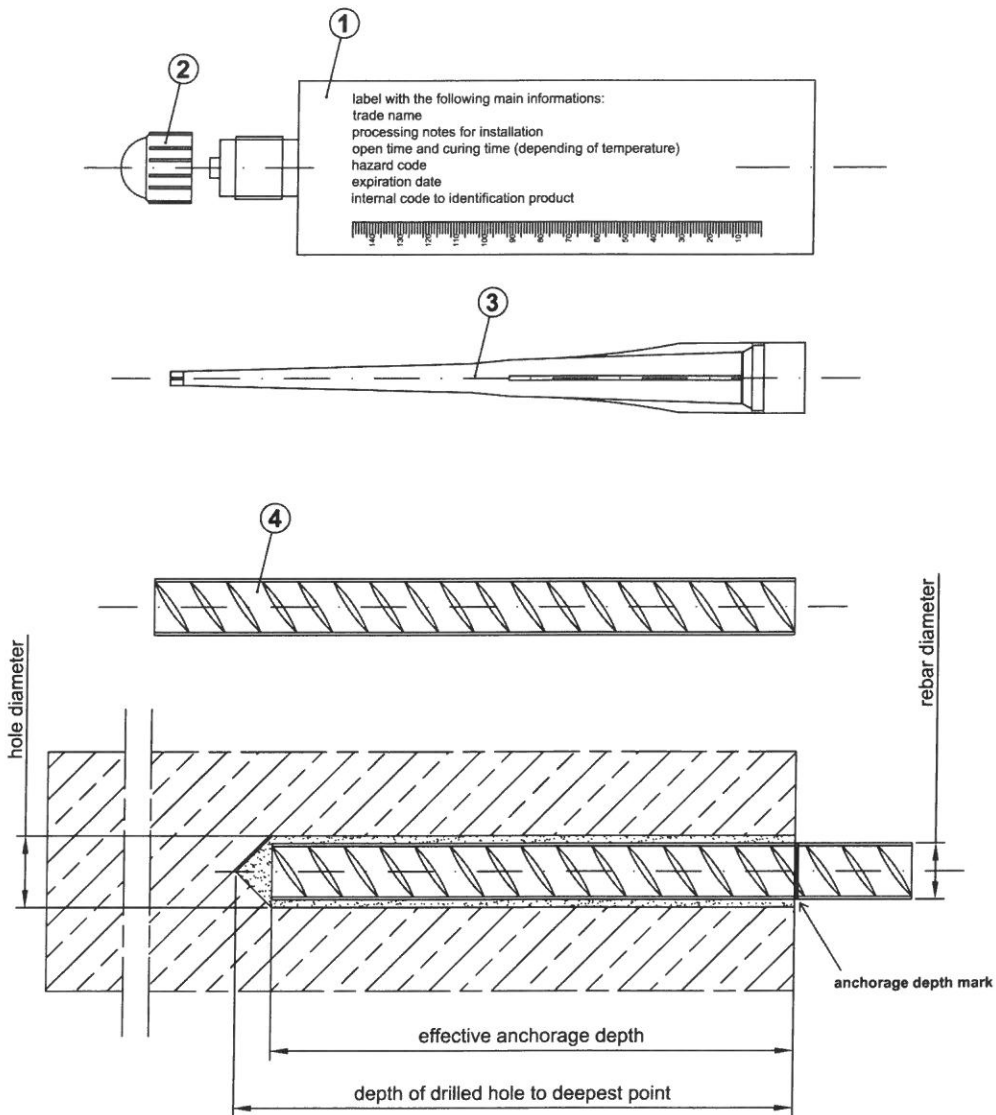
In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1 shall be present.

The shear transfer between old and new concrete shall be designed according to EN 1992-1-1.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Product description**  
Application examples of post-installed rebar

**Annex A1**  
of European  
Technical Assessment  
ETA-19/0841



- ① Cartridge
- ② Sealing cap
- ③ Mixer
- ④ Rebar - Reinforced bar

<p><b>Injection system XTREME GRIP VINYLESTER for rebar connections</b></p>	<p><b>Annex A2</b> of European Technical Assessment ETA-19/0841</p>
<p><b>Product description</b> Injection system</p>	

**Table A1: Reinforcing bars (Rebar)**

Designation	Material
Rebar according to EN 1992-1-1:2004+AC:2010	Bars and de-coiled rods Class B or C With $f_{yk}$ and $k$ according to EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \times f_{yk}$ The rib height $h$ : $h \leq 0,07 \varnothing$

**Table A2: Injection mortars**

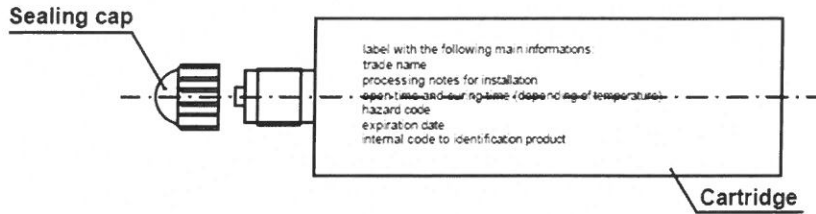
Product	Composition
XTREME GRIP VINYLESTER (two component injection mortars)	Additive: quartz Bonding agent: vinyl ester resin styrene free Hardener: dibenzoyl peroxide

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

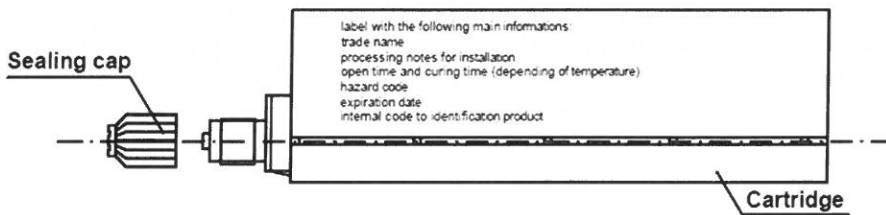
**Product description**  
Materials

**Annex A3**  
of European  
Technical Assessment  
ETA-19/0841

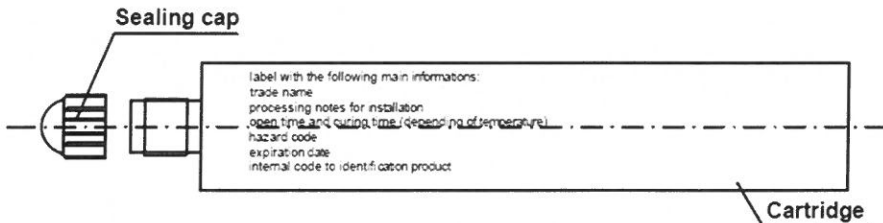
**coaxial cartridge - sizes from 75 ml to 420 ml**



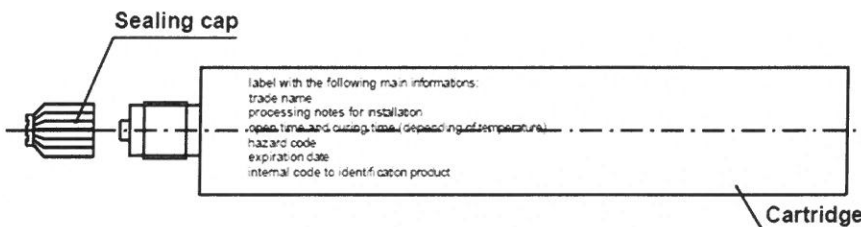
**side by side cartridge - sizes from 345 ml to 825 ml**



**CIC foil cartridge - sizes from 165 ml to 300 ml**



**coaxial peeler cartridge - size of 280 ml**



**MIXER - the mixer is suitable for each type of cartridge**



**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Product description**  
Cartridge types

**Annex A4**  
of European  
Technical Assessment  
ETA-19/0841



### SPECIFICATION OF INTENDED USE

**Anchorage subject to:**

Static and quasi-static load: from Ø8 to Ø32 mm

Seismic load: from Ø12 to Ø32 mm

Fire exposure: from Ø8 to Ø32 mm

**Base material:**

- Reinforced or unreinforced normal weight concrete of strength class C12/15 at minimum to C50/60 at maximum according to EN 206-1:2013+A1:2016 for static and quasi-static load and for fire exposure.
- Reinforced or unreinforced normal weight concrete of strength class C16/20 at minimum to C50/60 at maximum according to EN 206-1:2013+A1:2016 for seismic load.
- Maximum chloride content of 0,40% (Cl 0,40) related to the cement content according to EN 206-1:2013+A1:2016.
- Non-carbonated concrete.

Note: In case of a carbonated surface of the existing concrete structure the carbonate layer shall be removed in the area of the post-installed rebar connection with a diameter of  $d_s + 60$  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 according to EN 1992-1-1:2004+AC:2010.

The above may be neglected if building components are new and not carbonated and if building components are in dry conditions.

**Temperature range:**

The products may be used in the following temperature range:

- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).

Temperature of the base material according to Annex B4.

**Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking into account of the forces to be transmitted.
- Design according to EN 1992-1-1:2004+AC:2010 for static and quasi-static condition (see also Annex B2).
- Design according to EN 1998-1:2004+AC:2009 for seismic condition (see also 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:**

- Dry or wet concrete.
- It must not be installed in flooded holes.
- Overhead installation is permissible.
- Hole drilling by hammer drill (HD), hollow drill bit (HDB) or compressed air drill (CA).
- Installation of the post-installed rebar shall be done only by suitable trained installer and under supervision on the site.
- Check the position of the existing rebar (if the position of existing rebar in 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).

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use  
Specifications**

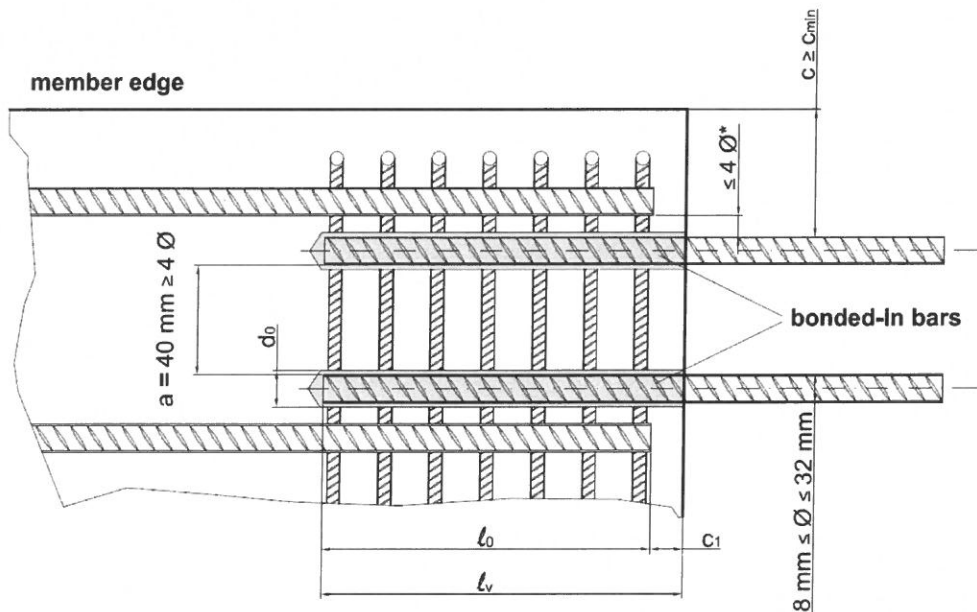
**Annex B1  
of European  
Technical Assessment  
ETA-19/0841**

### General design rules of construction for post-installed rebar

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 1992-1-1:2004+AC:2010.

The joints for concreting must be roughened to at least such an extent that aggregate protrude.



\* If the clear distance between overlapping rebar is greater than  $4 \cdot \emptyset$  the overlap length shall be enlarged by the difference between the clear distance and  $4 \cdot \emptyset$ .

- $l_0$  lap length according to EN 1992-1-1:2004+AC:2010 for static and quasi-static loading or EN 1998-1:2004+AC:2009 for seismic loading.
- $l_v$  effective embedment depth;  $l_v \geq l_0 + c_1$
- $c$  concrete cover of post-installed rebar
- $c_{min}$  minimum concrete cover acc. to Annex B3 and EN 1992-1-1:2004+AC:2010
- $c_1$  concrete cover at end-face of existing rebar
- $d_0$  nominal drill bit diameter acc. to Annex B3
- $\emptyset$  rebar diameter ( $d_s$ )

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
General construction rules for post-installed rebar

**Annex B2**  
of European  
Technical Assessment  
ETA-19/0841

**Table B1-1: Installation data for static and quasi static loading**

Rebar diameter [mm]	Ø8		Ø10		Ø12		Ø14	Ø16	Ø20	Ø22	Ø25	Ø28	Ø30	Ø32
Drill bit diameter [mm]	10 <sup>1)</sup>	12 <sup>1)</sup>	12 <sup>1)</sup>	14 <sup>1)</sup>	14 <sup>1)</sup>	16 <sup>1)</sup>	18	20	25	26	30	35	35	40
Brush diameter [mm]	12	14	14	16	16	18	20	22	27	27	32	37	37	42
Maximum embedment depth $l_{v, max}$ [mm]	250	400	250	500	250	600	700	800	1000	1000	1000	1000	1000	1000

<sup>1)</sup> Each of two given values can be used

**Table B1-2: Installation data for seismic loading**

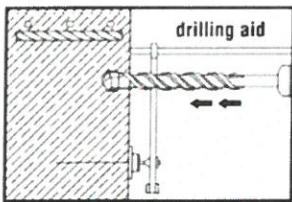
Rebar diameter [mm]	Ø12	Ø14	Ø16	Ø20	Ø22	Ø25	Ø28	Ø30	Ø32
Drill bit diameter [mm]	16	18	20	25	26	30	35	35	40
Brush diameter [mm]	18	20	22	27	27	32	37	37	42
Maximum embedment depth $l_{v, max}$ [mm]	600	700	800	1000	1000	1000	1000	1000	1000

**Table B2: Minimum concrete cover  $c_{min}$  without drilling aid**

Drilling method	Rebar diameter Ø	$c_{min}$
Hammer drilling (HD) Hollow drill bit (HDB)	< 25 mm	$30 \text{ mm} + 0,06 \times l_v \geq 2\phi$
	$\geq 25 \text{ mm}$	$40 \text{ mm} + 0,06 \times l_v \geq 2\phi$
Compressed air drilling (CA)	< 25 mm	$50 \text{ mm} + 0,08 \times l_v$
	$\geq 25 \text{ mm}$	$60 \text{ mm} + 0,08 \times l_v \geq 2\phi$

**Table B3: Minimum concrete cover  $c_{min}$  when using a drilling aid**

Drilling method	Rebar diameter Ø	$c_{min}$
Hammer drilling (HD) Hollow drill bit (HDB)	< 25 mm	$30 \text{ mm} + 0,02 \times l_v \geq 2\phi$
	$\geq 25 \text{ mm}$	$40 \text{ mm} + 0,02 \times l_v \geq 2\phi$
Compressed air drilling (CA)	< 25 mm	$50 \text{ mm} + 0,02 \times l_v$
	$\geq 25 \text{ mm}$	$60 \text{ mm} + 0,02 \times l_v \geq 2\phi$



Example of drilling aid

The minimum concrete cover according to 1992-1-1:2004+AC:2010 shall be observed.

**Minimum clear spacing between two post-installed rebar:**  
 $a = 40 \text{ mm} \geq 4 \times \phi$

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Installation parameters

**Annex B3**  
of European  
Technical Assessment  
ETA-19/0841

**Table B4: Maximum processing time and minimum curing time**

<b>XTREME GRIP VINYLESTER</b>		
<b>Concrete temperature [C°]</b>	<b>Processing time [min.]</b>	<b>Minimum curing time<sup>1)</sup> [min.]</b>
-5	65	780
0	45	420
+5	25	90
+10	16	60
+15	11,5	45
+20	7,5	40
+25	5	35
+30	3	30
+35	2	25
+40	1	20

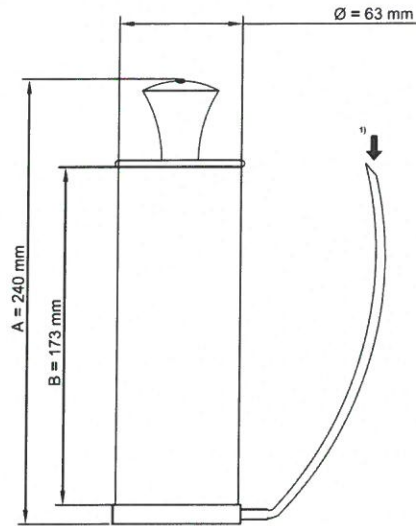
<sup>1)</sup> The minimum time from the end of the mixing to the time when the rebar may be loaded. Minimum resin temperature for installation +5°C. Maximum resin temperature for installation +30°C. For wet condition the curing time must be double.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Maximum processing time and minimum curing time

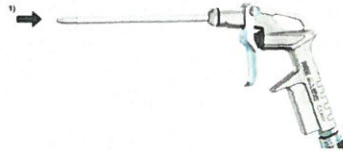
**Annex B4**  
of European  
Technical Assessment  
ETA-19/0841

**Manual Blower pump: nominal dimensions**



It is possible to use the mixer extensor with the manual blower pump.

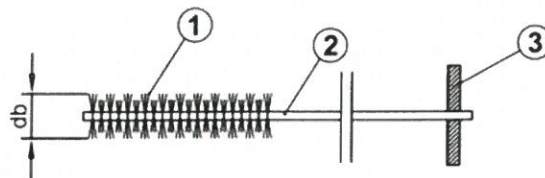
However it is possible to blow the hole using the mechanical air system (compressed air) also with the mixer extension



Suitable min pressure 6 bar at 6 m<sup>3</sup>/h  
Oil-free compressed air  
Recommended air gun with an orifice opening of minimum 3.5 mm in diameter

1) Position to insert the mixer extension

Mixer extension (from 380 mm to 1000 mm) with nominal diameter 8 or 10 mm



- ① Steel bristles
- ② Steel stem
- ③ Wood handle

**Table B5: Standard brush details (manual brush)**

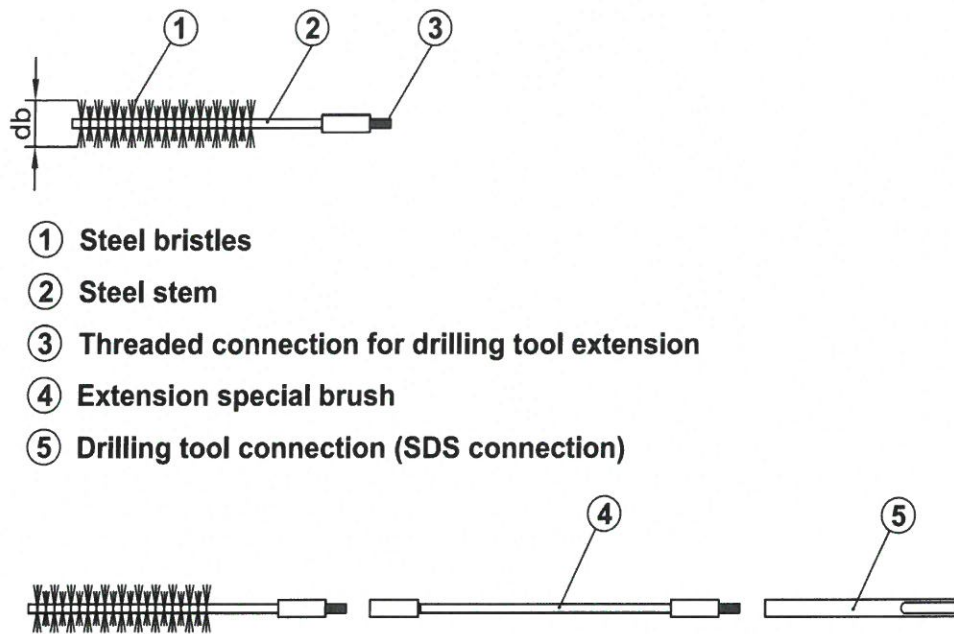
Rebar diameter [mm]		Ø8		Ø10		Ø12		Ø14	Ø16
<b>d<sub>0</sub></b>	Nominal drill hole [mm]	10 <sup>1)</sup>	12 <sup>1)</sup>	12 <sup>1)</sup>	14 <sup>1)</sup>	14 <sup>1)</sup>	16 <sup>1)</sup>	18	20
<b>d<sub>b</sub></b>	Brush diameter [mm]	12	14	14	16	16	18	20	22

<sup>1)</sup> Each of two given values can be used.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Cleaning tools (1)

**Annex B5**  
of European  
Technical Assessment  
ETA-19/0841



- ① Steel bristles
- ② Steel stem
- ③ Threaded connection for drilling tool extension
- ④ Extension special brush
- ⑤ Drilling tool connection (SDS connection)

**Table B6: Special brush details (mechanical brush)**

Rebar diameter [mm]		Ø8		Ø10		Ø12		Ø14	Ø16	Ø20	Ø22	Ø25	Ø28	Ø30	Ø32
$d_0$	Nominal drill hole [mm]	10 <sup>1)</sup>	12 <sup>1)</sup>	12 <sup>1)</sup>	14 <sup>1)</sup>	14 <sup>1)</sup>	16 <sup>1)</sup>	18	20	25	26	30	35	35	40
$d_b$	Brush diameter [mm]	12	14	14	16	16	18	20	22	27	27	32	37	37	42

<sup>1)</sup> Each of two given values can be used.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Cleaning tools (2)

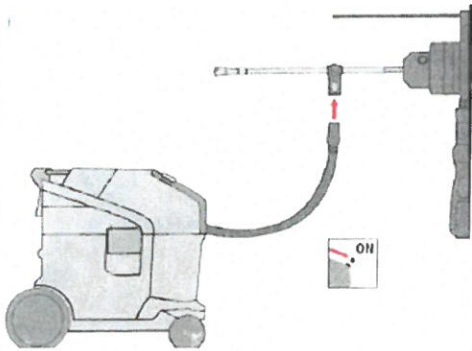
**Annex B6**  
of European  
Technical Assessment  
ETA-19/0841

### Installation with hollow drill bit (HDB)

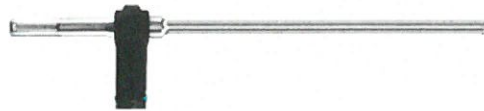
This drilling method is a hammer drilling method.

This drilling system removes the dust and cleans the bore hole during the drilling operation when used in accordance with the user's manual.

This drilling system include a vacuum cleaner. A suitable dust extraction system must be used. e.g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data.



**Switch-on the vacuum cleaner before to drill**



**Table B7: HDB installation – diameters**

Rebar diameter [mm]		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø30
<b>d<sub>0</sub></b>	Nominal drill hole [mm]	10 <sup>1)</sup> 12 <sup>1)</sup>	12 <sup>1)</sup> 14 <sup>1)</sup>	14 <sup>1)</sup> 16 <sup>1)</sup>	18	20	25	30	35	35

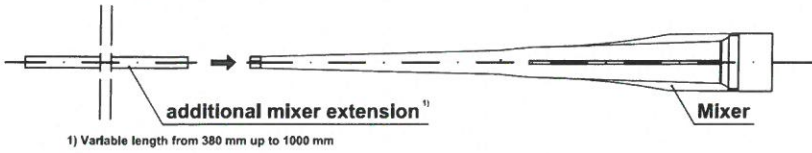
<sup>1)</sup> Each of two given values can be used.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

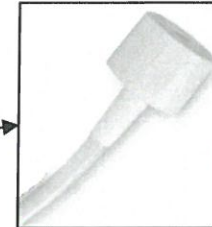
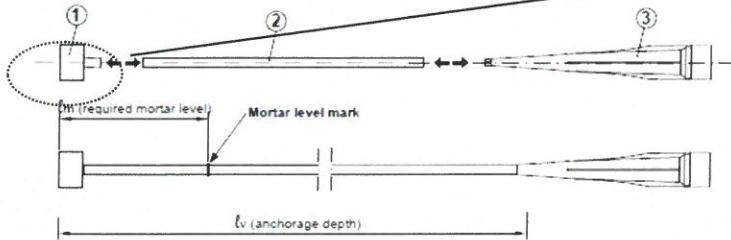
**Intended use**  
Hollow drill bit (HDB) specification

**Annex B7**  
of European  
Technical Assessment  
ETA-19/0841

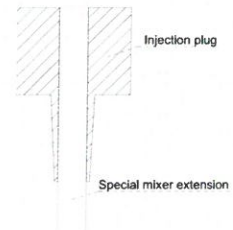
Use the mixer extension (assembled on the standard mixer) for the injection up to 300 mm if necessary.



Use this system for special conditions.



Insert the special mixer extension in the inner diameter of the injection plug up to reach the top of the plug

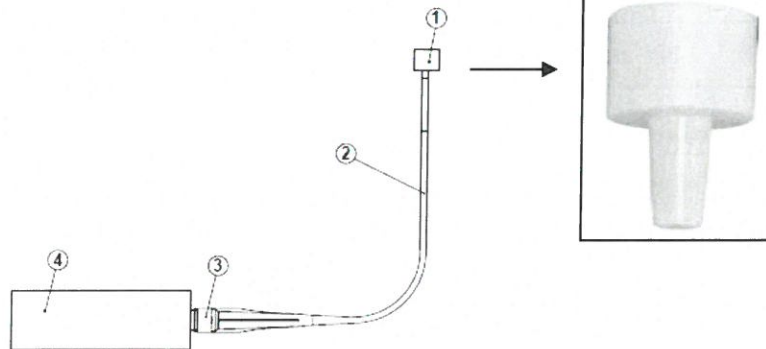


- ① Injection plug (nominal diameter according to the nominal diameter of drilled hole)
- ② Special mixer extension (variable length with external diameter 10 mm)  
Mark the required mortar level  $\ell_m$  and embedment depth  $\ell_v$  with tape or marker on the injection extension. Quick estimation:  $\ell_m = 1/3 \cdot \ell_v$   
Continue injection until the mortar level mark  $\ell_m$  becomes visible.
- ③ Mixer (suitable for all size of cartridge)

These tools allow the application in special conditions:  
 - installation with anchorage depth greater than 300 mm;  
 - overhead installation.  
 For these applications it is recommended the use of pneumatic or battery dispenser.

**System assembled**

- ① Injection plug
- ② Special mixer extension
- ③ Mixer
- ④ Cartridge
- ⑤ Sample of dispenser









**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Tools for installation (1)

**Annex B8**  
of European  
Technical Assessment  
ETA-19/0841



**Table B8: Mortar injection pumps**


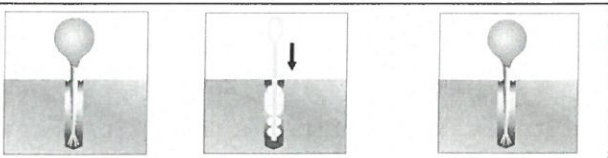
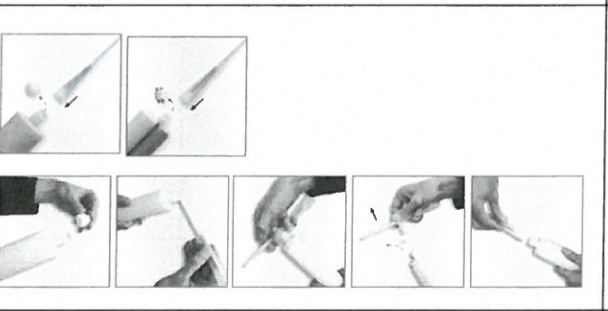
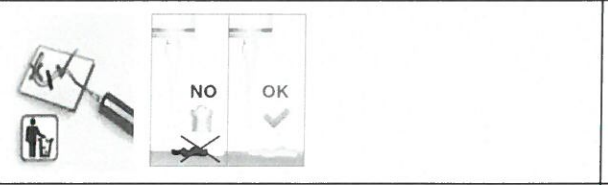
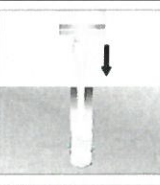
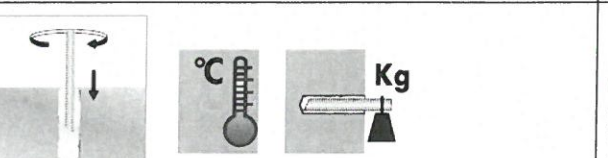
<b>Pumps (injection dispensers)</b>	<b>Cartridges</b>	<b>Clean hole tools</b>	<b>Depth of the drill hole</b>
 <i>Manual</i>	420 ml 400 ml 380 ml	Blower pump or compressed air and standard brush or special brush or HDB	to 300 mm
 <i>Manual</i>	345 ml 300 ml 280 ml 165 ml	Blower pump or compressed air and standard brush or special brush or HDB	to 300 mm
 <i>Manual</i>	300 ml 280 ml 165 ml	Blower pump or compressed air and standard brush or special brush or HDB	to 300 mm
 <i>Pneumatic</i>	825 ml	Compressed air and special brush or HDB	300 mm to 1000 mm*
 <i>Pneumatic</i>	420 ml 400 ml 380 ml	Compressed air and special brush or HDB	300 mm to 1000 mm*
 <i>Battery</i>	420 ml 400 ml 380 ml 345 ml	Compressed air and special brush or HDB	300 mm to 1000 mm*

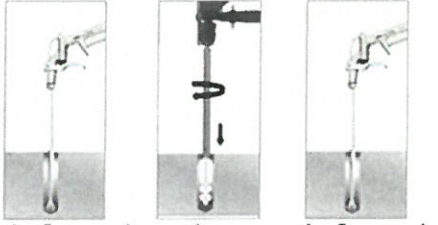
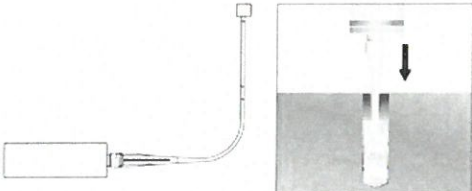
\* Note: use the mixer extension described in Annex B8 for the injection of the mortar

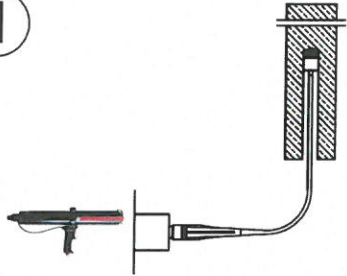
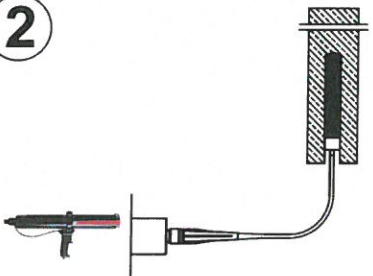
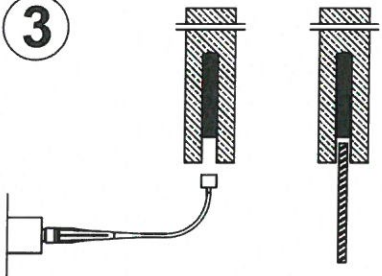

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Tools for installation (2)

**Annex B9**  
of European  
Technical Assessment  
ETA-19/0841

<p>1</p>		<p>Drill the hole with the correct diameter and depth using a rotary percussive machine. Check the perpendicularity of the hole during the drilling operation. <b>In case of use of hollow drill bit (Annex B7) proceed directly to the point 3</b></p>
<p>2</p>	 <p>4x blower manual pump      4x standard brush      4x blower manual pump</p> <p>if necessary use a mixer extension for the blower operation (see Annex B8)</p>	<p>Clean the hole from drilling dust: the hole shall be cleaned by at least 4 blowing operations, by at least 4 brushing operations followed again by at least 4 blowing operations; before brushing clean the brush and check (see Annex B5, standard brush) if the brush diameter is sufficient. For the blower tools see Annex B5.</p>
<p>3</p>		<p>For coaxial, peeler and side by side cartridges unscrew the front cup, screw on the mixer and insert the cartridge into the gun. For CIC sizes, unscrew the front cup, pull-out the steel closing clip according to the following operation:</p> <ol style="list-style-type: none"> <li>1) Insert the mixer in the eye of the plastic extractor;</li> <li>2) Pull the extractor to unhook the steel closing clip of the foil. In the version without the extractor cut the foil pack.</li> </ol> <p>After that screw on the mixer and insert the cartridge in the gun.</p>
<p>4</p>		<p>Before starting to use the cartridge, eject a first part of the product, being sure that the two components are completely mixed. The complete mixing is reached only after that the product, obtained by mixing the two components, comes out from the mixer with a uniform colour.</p>
<p>5</p>	 <p>if necessary, use a mixer extension for the injection (see Annex B8)</p>	<p>Fill the drilled hole uniformly starting from the drilled hole bottom, in order to avoid entrapment of the air; remove the mixer slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 2/3 of the drill hole depth.</p>
<p>6</p>	 <p><b>ATTENTION</b> Use rebar dry and free oil and other contaminants</p>	<p>Insert immediately the rebar, marked according to the proper anchorage depth, slowly and with a slight twisting motion, removing excess of injection mortar around the rebar. Observe the processing time according Annex B4. Wait the curing time according Annex B4.</p>
<p><b>Injection system XTREME GRIP VINYLESTER for rebar connections</b></p>		<p><b>Annex B10</b></p>
<p><b>Intended use</b> Installation instruction up to 300 mm depth</p>		<p>of European Technical Assessment ETA-19/0841</p>

1	See clause 1, Annex B10. In case of use of hollow drill bit (HDB) proceed directly to the clause 3.	
2	 <p>4 x 5 seconds    4x    4 x 5 seconds</p> <p>ATTENTION: compressed air free oil</p>	<p>Clean the hole from drilling dust:  the hole shall be cleaned by at least 4 blowing operations (5 seconds for single operation) with compressed air, by at least 4 brushing operations with special brush followed again by at least 4 blowing operations (5 seconds for single operation) with compressed air. Before brushing clean the brush and check if the brush diameter is sufficient (see Annex B6).</p>
3	See clause 3, Annex B10	
4	See clause 4, Annex B10	
5		<p>Before starting the injection, assemble the system according to Annex B8. After that, fill the drilled hole uniformly from the drilled hole bottom, in order to avoid entrapment of the air; remove the special mixer extension with injection plug slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 2/3 of the drill hole depth.</p>
6	See clause 6, Annex B10	
<p><b>Injection system XTREME GRIP VINYLESTER for rebar connections</b></p>		<p><b>Annex B11</b> of European Technical Assessment ETA-19/0841</p>
<p><b>Intended use</b> Installation instruction up to 1000 mm depth</p>		

<p>①</p> 	<p><b>1 - Start injection</b></p> <p>Inject from the bottom of the hole. Maintain this position during the injection phase.</p>
<p>②</p> 	<p><b>2 - Injection phase</b></p> <p>Inject the product about 2/3 of the hole depth. During the injection maintain this position to assure the correct installation</p>
<p>③</p> 	<p><b>3 - End injection</b></p> <p>Remove the Injection plug. Insert immediately the rebar (turn the rebar during the insertion).</p>
<p>④</p> 	<p><b>4 - End installation</b></p> <p>To avoid the slipping of the rebar during the open time of the product (due to the rebar own weight) use a temporary interlocking element (for ex. wedge of wood)</p>

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Intended use**  
Overhead installation instruction

**Annex B12**  
of European  
Technical Assessment  
ETA-19/0841

**Minimum anchorage length and minimum lap length under static loading**

The minimum anchorage length  $l_{b,min}$  and the minimum lap length  $l_{0,min}$  according to EN 1992-1-1:2004+AC:2010 shall be multiplied by the relevant amplification factor  $\alpha_{lb}$  given in Table C1.

The design bond strength  $f_{bd,PIR}$  is given in Table C3. It is obtained by multiplying the bond strength  $f_{bd}$  according to EN1992-1-1:2004+AC:2010 with the factor  $k_b$  according to Table C2.

**Table C1: Amplification factor  $\alpha_{lb}$  related to the concrete class and drilling method**

Concrete class	Drilling method	Bar size	Amplification factor $\alpha_{lb}$
C12/15 to C50/60	Hammer drilling (HD), hollow drill bit (HDB) and compressed air drill (CA)	8 to 32 mm	1,0

**Table C2: Bond efficiency factor  $k_b$  related to concrete class and drilling method**

$k_b$ for perforation with hammer drill (HD), hollow drill bit (HDB) and compressed air drill (CA)	Concrete class								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8 to Ø14	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Ø16 to Ø20	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,93
Ø22	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,92	0,93
Ø24 to Ø25	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,92	0,86
Ø28	1,00	1,00	1,00	1,00	1,00	1,00	0,91	0,84	0,79
Ø30 to Ø32	1,00	1,00	1,00	1,00	0,89	0,80	0,73	0,67	0,63

**Table C3. Design values of the ultimate bond resistance  $f_{bd,PIR}$ <sup>1)</sup> according to EN 1992-1-1:2004+AC:2010 for hammer drilling (HD), hollow drill bit (HDB) and compressed air drill (CA)**

Rebar diameter [mm]	Design values of the ultimate bond resistance $f_{bd,PIR}$ [N/mm <sup>2</sup> ]								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8 to Ø14	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø16 to Ø20	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø22	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	4,00
Ø24 to Ø25	1,60	2,00	2,30	2,70	3,00	3,40	3,70	3,70	3,70
Ø28	1,60	2,00	2,30	2,70	3,00	3,40	3,40	3,40	3,40
Ø30 to Ø32	1,60	2,00	2,30	2,70	2,70	2,70	2,70	2,70	2,70

<sup>1)</sup> The values given are valid for good bond condition according to EN 1992-1-1:2004+AC:2010.

For all other bond conditions multiply the value by 0,7.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Performances**  
Design values of the ultimate bond resistance  $f_{bd,PIR}$

**Annex C1**  
of European  
Technical Assessment  
ETA-19/0841

**Minimum anchor length and minimum lap length under seismic loading**

The minimum anchorage length  $l_{b,min}$  and the minimum lap length  $l_{0,min}$  according to EN 1992-1-1:2004+AC:2010 shall be multiplied by the relevant amplification factor  $\alpha_{lb}$  given in Table C1.

The design bond strength  $f_{bd,seis}$  is given in Table C5. It is obtained by multiplying the bond strength  $f_{bd}$  according to EN 1992-1-1:2004+AC:2010 with the factor  $k_{b,seis}$  according to Table C4.

The minimum concrete cover according to Annex B3 and  $c_{min,seis} = 2 \varnothing$  applies.

**Table C4: Bond efficiency factor  $k_{b,seis}$  related to concrete class and drilling method**

$k_{b,seis}$ for perforation with hammer drill (HD), hollow drill bit (HDB) and compressed air drill (CA)	Concrete class							
	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø12 to Ø25	1,00	1,00	0,85	0,77	0,68	0,62	0,58	0,53
Ø28 to Ø32	1,00	0,87	0,74	0,67	0,59	0,54	0,50	0,47

**Table C5: Design values of the ultimate bond resistance  $f_{bd,seis}$ <sup>1)</sup> for hammer drilling (HD), hollow drill bit (HDB) and compressed air drill (CA)**

Rebar diameter [mm]	Design values of the ultimate bond resistance $f_{bd,seis}$ [N/mm <sup>2</sup> ]							
	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø12 to Ø25	2,00	2,30	2,30	2,30	2,30	2,30	2,30	2,30
Ø28 to Ø32	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00

<sup>1)</sup>The values given are valid for good bond condition according to EN 1992-1-1:2004.

For all other bond conditions multiply the value by 0,7.

**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Performances**  
Design values of the ultimate bond resistance  $f_{bd,seis}$

**Annex C2**  
of European  
Technical Assessment  
ETA-19/0841

**Design value of the ultimate bond stress  $f_{bd,fi}$  under fire exposure for concrete classes C12/15 to C50/60 (all drilling methods).**

The design value of the bond strength  $f_{bd,fi}$  under fire exposure has to be calculated by the following equation:

$$f_{bd,fi}(\theta) = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \frac{\gamma_c}{\gamma_{M,fi}}$$

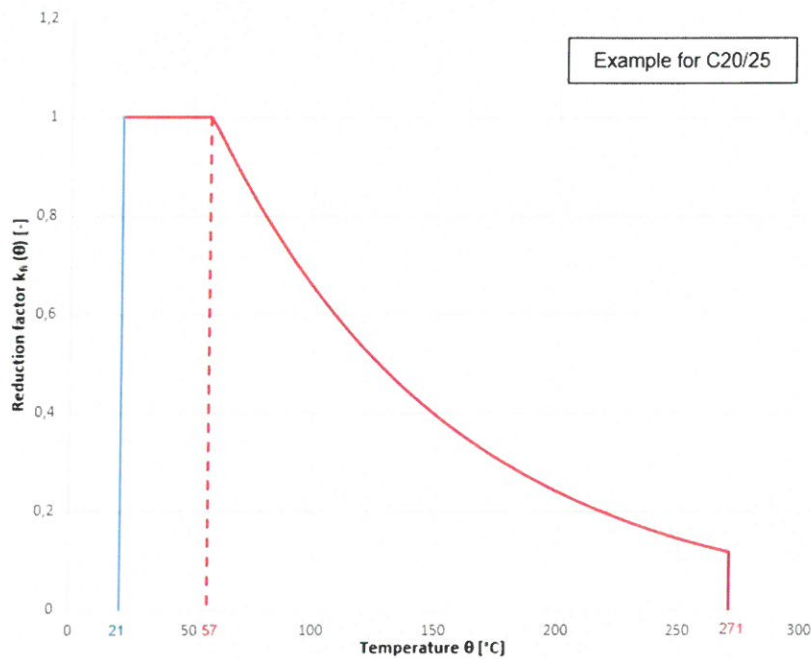
if  $21^\circ\text{C} \leq \theta \leq 271^\circ\text{C}$ :  $k_{fi}(\theta) = \frac{17,563 \cdot e^{-0.01\theta}}{f_{bd,PIR} \cdot 4,3} \leq 1,0$

if  $\theta > 271^\circ\text{C}$ :  $k_{fi}(\theta) = 0$

- $f_{bd,fi}(\theta)$  = Design value of the ultimate bond stress in case of fire exposure in N/mm<sup>2</sup>
- $(\theta)$  = Temperature in °C in the mortar layer
- $k_{fi}(\theta)$  = Reduction factor under fire exposure
- $f_{bd,PIR}$  = Design value of the ultimate bond stress in N/mm<sup>2</sup>, according to Table C3 considering the concrete class, the rebar diameter, the drilling method and the bond conditions according to EN 1992-1-1
- $\gamma_c$  = Partial safety factor according to EN 1992-1-1:2004+AC:2010
- $\gamma_{M,fi}$  = Partial safety factor according to EN 1992-1-2:2004+AC:2008

For evidence under fire exposure the anchorage length shall be calculated according to EN 1992-1-1:2004+AC:2010, Equation 8.3 using the temperature-dependent ultimate bond stress  $f_{bd,fi}$ .

**Figure C1: Example graph of reduction factor  $k_{fi}(\theta)$  for concrete classes C20/25 for good bond conditions:**



**Injection system XTREME GRIP VINYLESTER  
for rebar connections**

**Performances**

Design values of bond strength  $f_{bd,fi}(\theta)$  under fire exposure with temperature reduction factor  $k_{fi}(\theta)$

**Annex C3**  
of European  
Technical Assessment  
ETA-19/0841

