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European Technical Assessment

ETA-19/0751 of 02/01/2019

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**High Strength Epoxy PT450**
Famille de produit *Product family*	Scellement d'armatures rapportées, diamètres 12mm à 40mm, avec Système d'injection High Strength Epoxy PT450. *Post installed rebar connections diameter 12mm to 40 mm made with High Strength Epoxy* PT450 *mortar.*
Titulaire *Manufacturer*	UK PRUDENTIAL INDUSTRY CO.,LIMITED, Room 502,No.799 Yinxiang Road, Jiading District, Shanghai City, China
Usine de fabrication *Manufacturing plants*	UK PRUDENTIAL plant
Cette évaluation contient: *This assessment contains*	14 pages incluant 11 pages d'annexes qui font partie intégrante de cette évaluation *14 pages including 11 pages of annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	DEE 330087-00-0601, Edition juillet 2015 *EAD 330087-00-0601, Version July 2015*
Cette évaluation remplace: *This assessment replaces*	- -

Specific Part

1 Technical description of the product

The High Strength Epoxy PT450 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.

Covered are rebar anchoring systems consisting of High Strength Epoxy PT450 bonding material and an embedded straight deformed reinforcing bar diameter, from 12 mm to 40 mm 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 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. 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 tension resistance in case of static and quasi-static loading	See Annex

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	See Annex C2

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical approval, 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.

Issued in Marne La Vallée on 02/01/2019 by

The original French version is signed
La cheffe de division
Anca CRONOPOL

[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

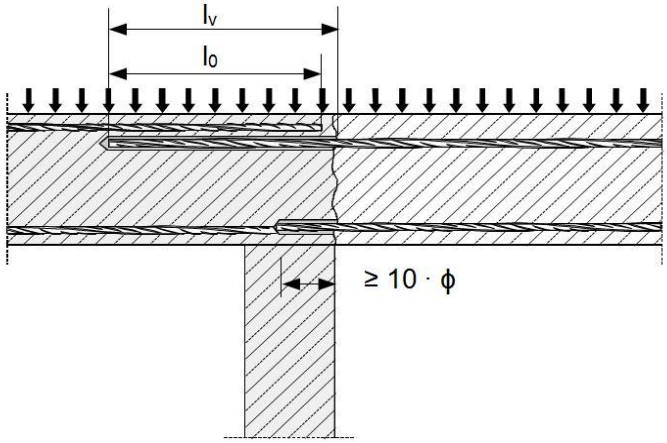


Figure A2:

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

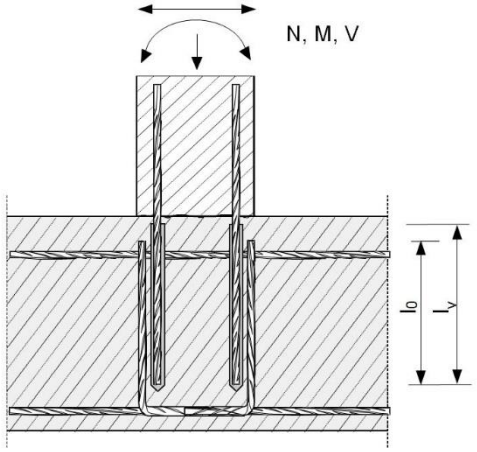


Figure A3:

End anchoring of slabs or beams

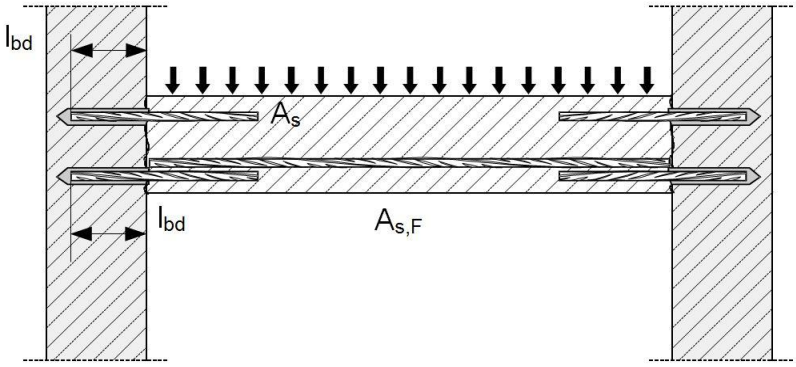


Figure A4:

Rebar connection for components stressed primarily in compression

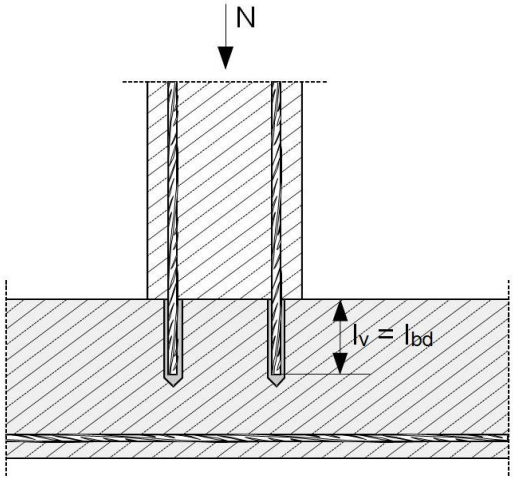
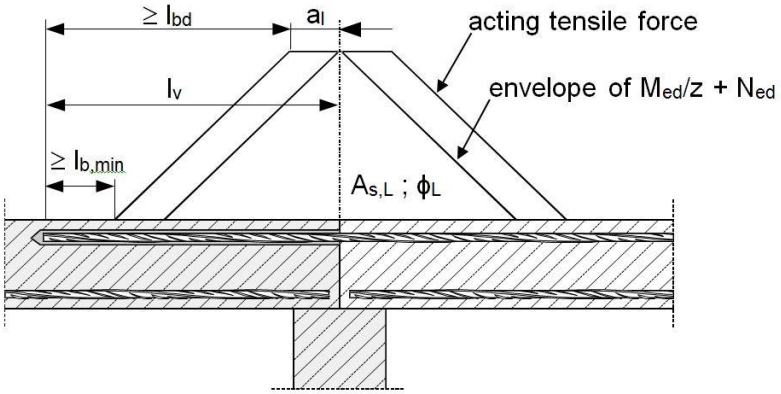


Figure A5:

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



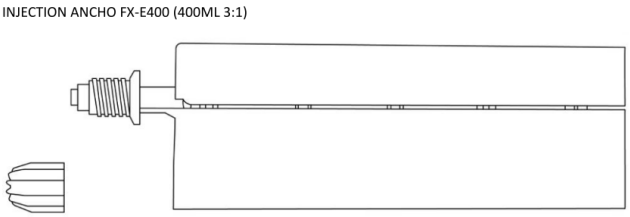
Note to Figure A1 to Figure A5:

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

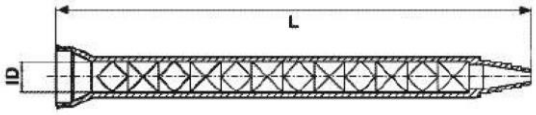
Product description: Injection mortar and steel elements

Injection mortar High Strength Epoxy PT450: epoxy resin system 400 ml

Marking:
High Strength Epoxy PT450
Instruction note;
hazard-code;
website;
processing time table;
regulatory information;
manufacturing date (MFG yyyy/dd);
Place of origin.



Static mixer MGQ 10-19A



Steel elements

Reinforcing bar (rebar): ϕ 12 to ϕ 40

- Materials and mechanical properties according to Table A1.
- 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)

Table A1: Materials

Designation	**Material**
Reinforcing bars (rebars)	
Rebar EN 1992-1-1	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1 $f_{uk} = f_{tk} = k \cdot f_{yk}$

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading.
- Fire exposure.

Base materials:

- 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:

- **at installation**
  +10 °C to +45 °C
- **in-service**
  +10 °C to +40 °C (max. long term temperature +20 °C and max. short term temperature +40 °C)

Design:

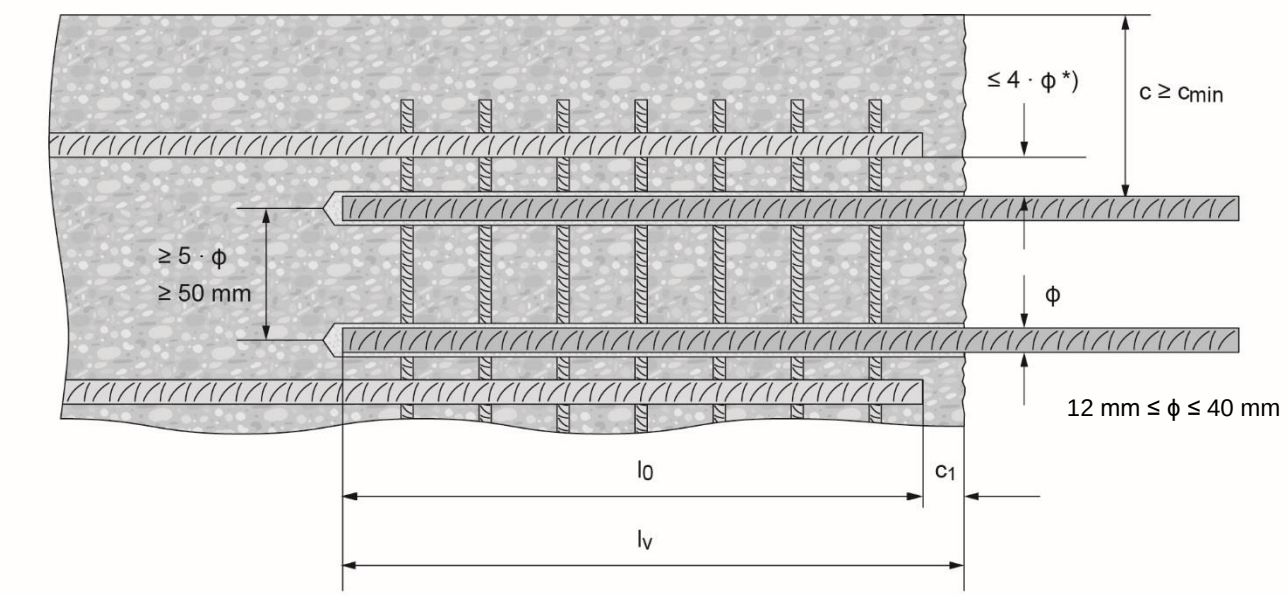
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design under static or quasi-static loading in accordance with EN 1992-1-1, Annex B2 and Annex B4.
- 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
- Overhead installation is not allowed.
- 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).
- In case of aborted hole the drill holeis filled with low shrinkage mortar of higher strength than the nominal concrete strength.

Figure B1: General construction rules for post-installed rebars

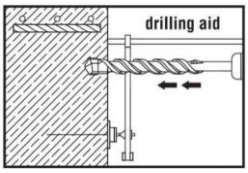
- Post-installed rebar may be designed for tension forces only.
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1.
- The joints for concreting must be roughened to at least such an extent that aggregate protrudes.



*) 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 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 Annex B4

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

Drilling method	Rebar diameter [mm]	Minimum concrete cover c_{min}[1)] [mm]		
		Without drilling aid	With drilling aid	
Hammer drilling	$\phi < 25$	$30 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$	$40 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	

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

Table B2: Maximum embedment depth $l_{v,max}$ depending on bar diameter

Elements	Dispensing tool
rebar	FX-GUN400
size	$l_{v,max}$ [mm]
ϕ 16	1000
ϕ 20	1000
ϕ 32	1000
ϕ 40	1000

Table B3: Gel time and loading time[1)]

Application temperature	Gel time		Loading time	
40	4	min.	3	hours
30	7	min.	5	hours
20	15	min.	7	hours
10	60	min.	12	hours

[1)] The curing time data are valid for dry base material only.
In wet base material the curing times must be doubled.

Table B4: Parameters of drilling, cleaning and setting tools, Hammer drilling and compressed air drilling

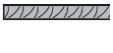
Elements	**Drill and clean**				**Installation**
Rebar	Hammer drilling	Brush Steel wire	Brush extension SDS Plus Adapter	Extension for air nozzle	Maximum embedment depth
			-		-
size	d_0 [mm]	[inch]	[mm]	[mm]	$l_{v,max}$ [mm]
ϕ 12	16	5/8”	1000	PP tubes: 7,5*1,5*10,5*1000	1000
ϕ 20	25	1”	1000		1000
ϕ 32	40	1 5/8”	1000		1000
ϕ 40	55	2 ¼”	1000		1000

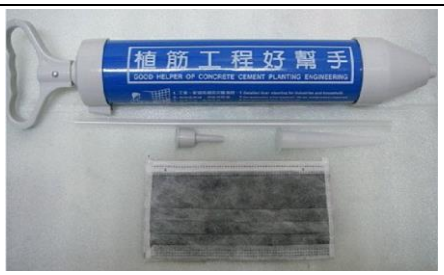
Table B5: Cleaning alternatives for hammer drilling

Compressed Air Cleaning (CAC):

air nozzle with an orifice opening of minimum 3,5 mm in diameter + brushing

Manual Cleaning (MC):

Hand pump (volume 750mL) + brushing



for cleaning of drilled holes with diameters $d_0 \leq 35$ mm and drill hole depths $h_0 \leq 200$ mm.

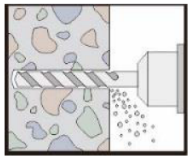
High Strength Epoxy PT450

Product description
Setting tools for hammer drilling
Cleaning alternatives.

Annex B5
of European
Technical Assessment
ETA- 19/0751

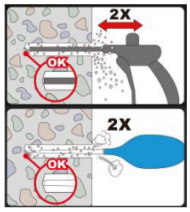
Installation instruction

1. Bore hole drilling

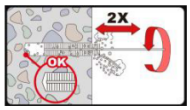


Drilling of hole with an electric drill to the diameter and depth required by the selected reinforcing bar. Drill hole diameter must be in accordance with anchor size.

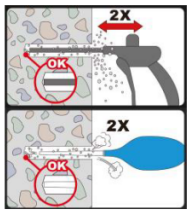
2. Bore hole cleaning



Start from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 30 seconds) or a hand pump a minimum of two times. If the bore hole ground is not reached an extension shall be used.
For bore holes deeper than 200 mm, or bore hole diameter bigger (≧) than 35 mm, compressed air (min. 30 seconds) must be used.

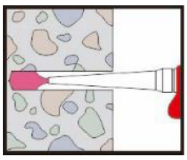


Brush the hole with an appropreate sized wire brush a minimum of two times.
If the bore hole ground is not reached with the brush, a brush extension shall be used.
The diameter of wire brush is equal to the hole diameter.



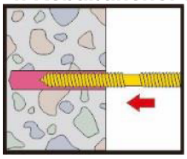
Finally blow the hole clean again with compressed air (min. 30 seconds) or a hand pump a minimum of two times. If the bore hole ground is not reached an extension shall be used.
For bore holes deeper than 200 mm, or bore hole diameter bigger (≧) than 35 mm, compressed air (min. 30 seconds) must be used.

3. Bore hole filling

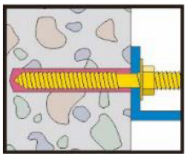


Prior to dispensing into the anchor hole, squeeze out separately the mortar until it shows a consistent grey colour, and discard non-uniformly mixed adhesive components.
Start from the bottom or back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets.

4. Rebar/anchor inserting



Insert the anchor with a rotary motion into the filled drill hole. Some adhesive must come out of the hole.
**Important: the anchor must be placed within the open time.



During the resin hardening time the anchor must not be moved or loaded.

Minimum anchorage length and minimum lap length

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 relevant amplification factor α_{lb} given in Table C1.

Table C1: Amplification factor α_{lb}

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 12	[-]	1,5								
ϕ 20	[-]	1,5								
ϕ 32	[-]	1,5								
ϕ 40	[-]	1,5								

Table C2: Bond efficiency value k_b

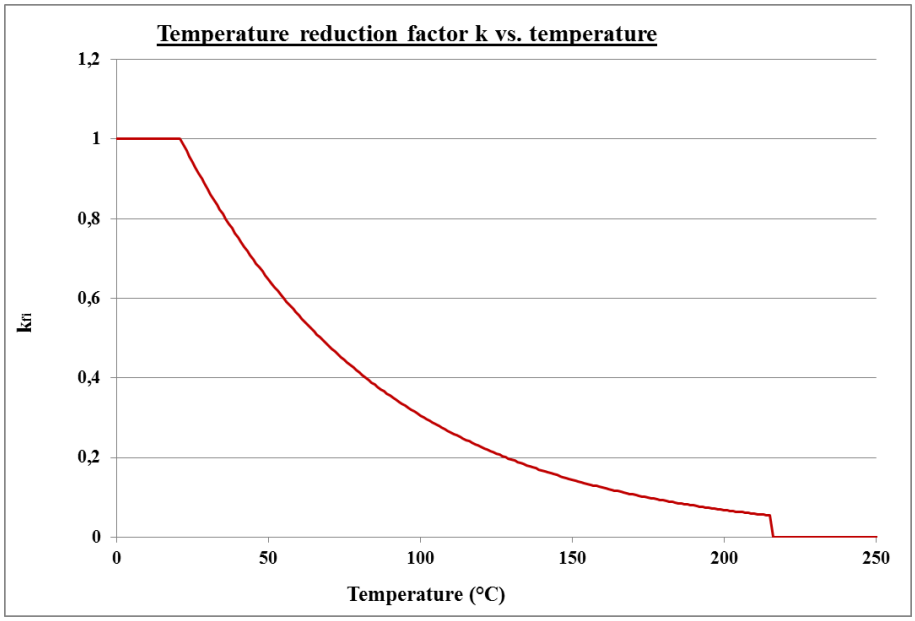
Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 12	[-]	1,6	1,6	1,6	2,0	2,0	2,0	2,3	2,3	2,3
ϕ 20	[-]	1,6	1,6	2,0	2,0	2,0	2,3	2,3	2,3	2,3
ϕ 32	[-]	1,6	2,0	2,0	2,0	2,3	2,3	2,3	2,7	2,7
ϕ 40	[-]	1,6	2,0	2,0	2,3	2,3	2,3	2,7	2,7	2,7

Table C3: Design values of the ultimate bond resistance f_{bd}[1)]

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 12	[N/mm²]	1,0	0,9	0,8	0,8	0,7	0,7	0,6	0,6	0,6
ϕ 20	[N/mm²]	1,0	1,0	0,9	0,8	0,7	0,7	0,7	0,6	0,6
ϕ 32	[N/mm²]	1,0	1,0	0,9	0,9	0,8	0,8	0,7	0,7	0,7
ϕ 40	[N/mm²]	1,0	1,0	1,0	0,9	0,8	0,8	0,8	0,7	0,7

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

Figure C1: Temperature reduction factor $k_{fi}(\theta)$



The analytic equation that describe the variation of $k_{fi}(\theta)$ with temperature is given by the following function :

If $22°C \leq \theta \leq 215°C$: $k_{fi}(\theta) = \frac{f_{bm(\theta)}}{f_{bm,rqd,d}} \leq 1{,}0$

If $\theta < 22°C$: $k_{fi}(\theta) = 1{,}0$

If $\theta > 215°C$: $k_{fi}(\theta) = 0{,}0$

With:

$$f_{bm}(\theta) = 13{,}713.\theta^{-0{,}015} \quad \theta \ in \ °C$$

High Strength Epoxy PT450	**Annex C2 of European Technical Assessment ETA- 19/0751**
Performance Temperature reduction factor $k_{fi}(\theta)$.	