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European Technical Assessment

ETA-14/0119 of 25/06/2014

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	VI100-PRO, VI100-PRO-W and VI100-PRO-T
Product family to which the construction product belongs	Bonded anchor with anchor rod made of galvanized steel or stainless steel for use in concrete
Manufacturer	ALSAFIX S.A.S 114a rue Principale, 67240 Gries France
Manufacturing plant(s)	ALSAFIX Manufacturing Plant 1
This European Technical Assessment contains	22 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	Guideline for European Technical Approval ETAG 001, Edition April 2013 "Metal anchors for use in concrete – Part 1: Anchors in general and Part 5: Bonded anchors", used as European Assessment Document (EAD)

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.

Specific Part

1 Technical description of the product

The VI100-PRO, VI100-PRO-W and VI100-PRO-T are a bonded anchors (injection type) consisting of a injection mortar cartridge using an applicator gun equipped with a special mixing nozzle and threaded anchor rod of the sizes M8 to M24 made of:

- galvanized carbon steel,
- stainless steel,
- high corrosion resistant stainless steel,

with hexagon nut and washer.

The threaded rod is placed into a drilled hole previously injected (using an applicator gun) with a mortar with a slow and slight twisting motion. The threaded rod is anchored by the bond between rod, mortar and concrete.

The threaded rods are available for all diameters with three type of tip end: a one side 45° chamfer, a two sides 45° chamfer or a flat. The threaded rods are either delivered with the mortar cartridges or commercial standard threaded rods purchased separately. The mortar cartridges are available in different sizes and types.

An illustration and the description of the products are given in Annex A1 to A4.

2 Specification of the intended use in accordance with the applicable EAD

The performances given in Section 3 are only valid if the anchors are used in compliance with the specifications and conditions given in Annex B1 to B10.

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)

The essential characteristic is detailed in the Annex C1 to C4.

3.1.2 Safety in case of fire (BWR 2)

No performance determined.

3.1.3 Hygiene, health and the environment (BWR 3)

Regarding the dangerous substances clauses 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 Regulation, these requirements need also to be complied with, when and where they apply.

3.1.4 Safety in use (BWR 4)

For Basic Requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability (BWR 1).

3.1.5 Sustainable use of natural resources (BWR 7)

No performance determined.

3.2 Methods used for the assessment

The assessment of fitness of the anchors for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance with the ETAG 001 *"Metal anchors for use in concrete"*, Part 1: "*Anchors in general*" and Part 5: "*Bonded anchors*", on the basis of Option 1 and 7.

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

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

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

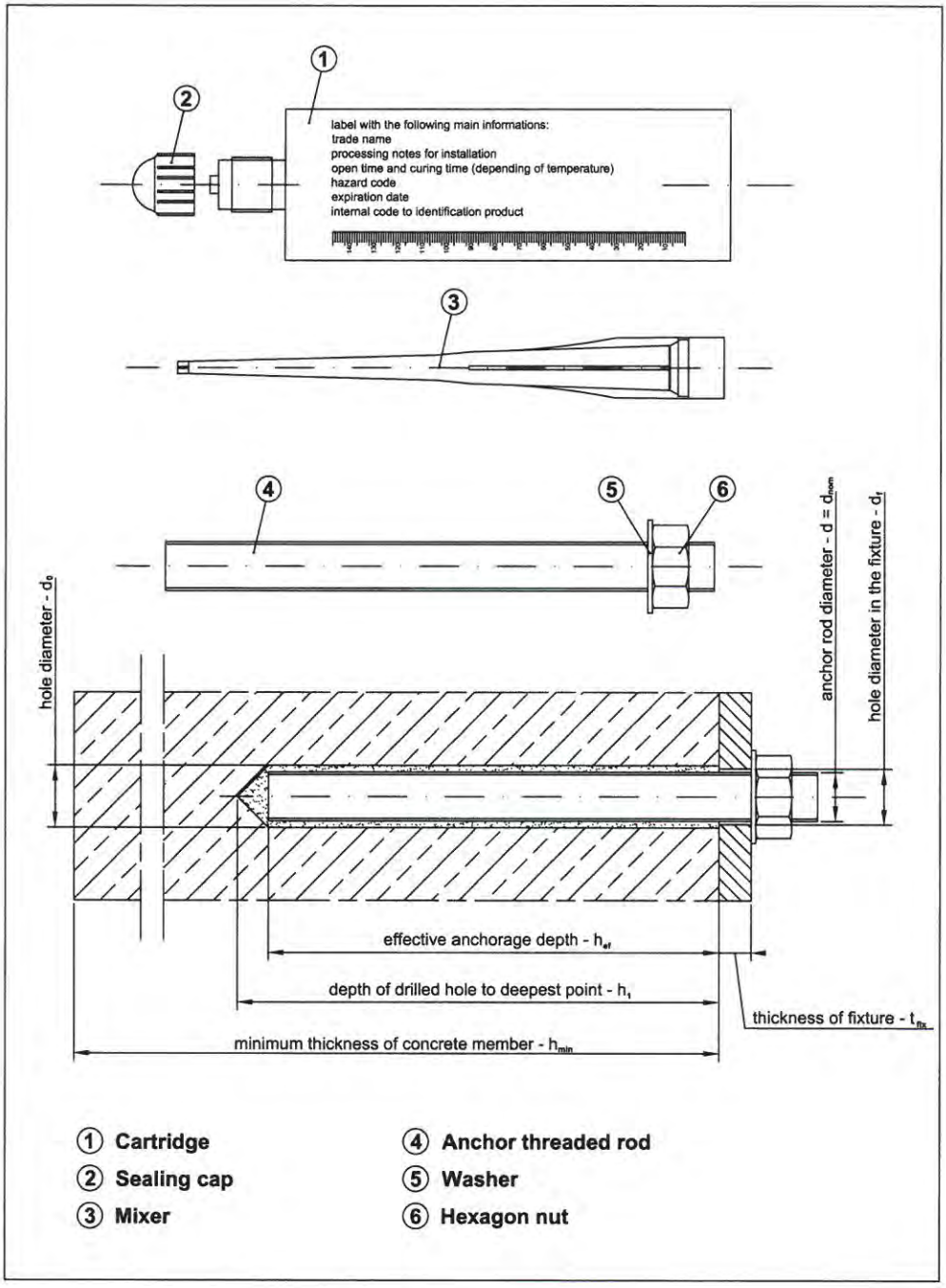
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

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 type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

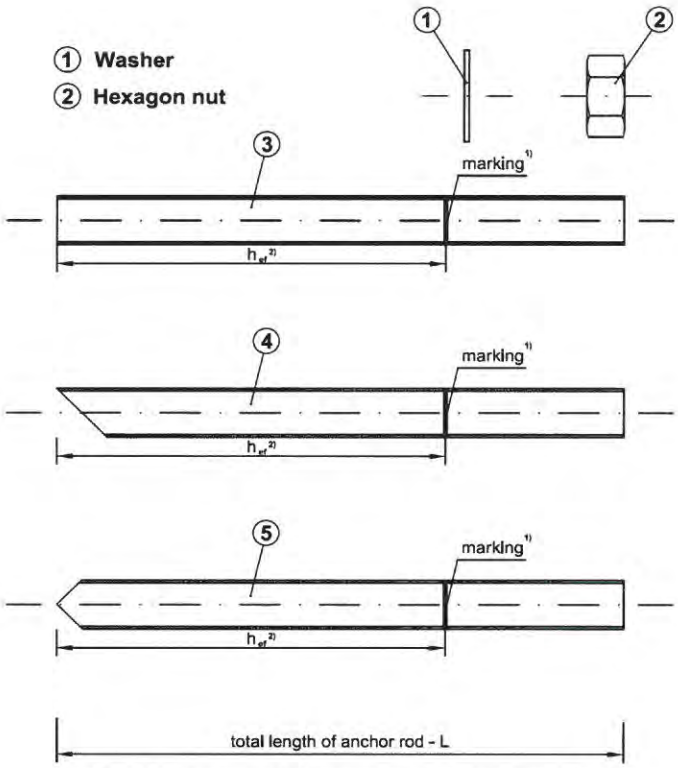
Issued in Warsaw on 25/06/2014 by Instytut Techniki Budowlanej

Marek Kaproń
Deputy Director of ITB



① **Cartridge**
② **Sealing cap**
③ **Mixer**
④ **Anchor threaded rod**
⑤ **Washer**
⑥ **Hexagon nut**

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex A1** of European Technical Assessment ETA-14/0119
Characteristic of the product	



③ **Version 1 - rod with flat end with marking on h_{ef}**
④ **Version 2 - rod with 45° cutted end with marking on h_{ef}**
⑤ **Version 3 - rod with V shape end with marking on h_{ef}**

1) Marking according to clause 2.1.2 of ETAG 001 – Part 5
2) Effective anchorage depth according to Table A1

Table A1: Anchor threaded rod dimensions

Size	d [mm]	$h_{ef,min}$ [mm]	$h_{ef,max}$ [mm]
M8	8	60	160
M10	10	70	200
M12	12	80	240
M16	16	100	320
M20	20	120	400
M24	24	145	480

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex A2** of European Technical Assessment ETA-14/0119
Anchor rod types and dimensions	

Table A2: Threaded rods

Part	Designation		
	Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042	**Stainless steel**	**High corrosion resistance stainless steel (HCR)**
Threaded rod	Steel, property class 4.8 to 12.9, acc. to EN ISO 898-1	Material 1.4401, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Hexagon nut	Steel, property class 4 to 12, acc. to EN 20898-2; corresponding to anchor rod material	Material 1.4401, 1.4571 acc. to EN 10088; property class 70 and 80 (A4-70 and A4-80) acc. to EN ISO 3506	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; property class 70 acc. to EN ISO 3506
Washer	Steel, acc. to EN ISO 7089; corresponding to anchor rod material	Material 1.4401, 1.4571 acc. to EN 10088; corresponding to anchor rod material	Material 1.4529, 1.4565, 1.4547 acc. to EN 10088; corresponding to anchor rod material

Commercial standard threaded rods (in the case of rods made of galvanized steel – standard rods with property class ≤ 8.8 only), with:

- material and mechanical properties according to Table A2,
- confirmation of material and mechanical properties by inspection certificate 3.1 according to EN-10204:2004; the documents shall be stored,
- marking of the threaded rod with the embedment depth.

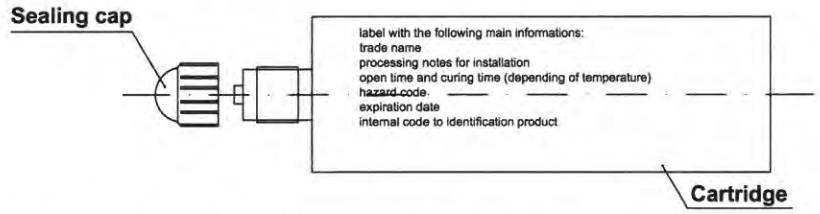
Note: Commercial standard threaded rods made of galvanized steel with property class above 8.8 are not permitted in some Member States.

Table A3: Injection mortars

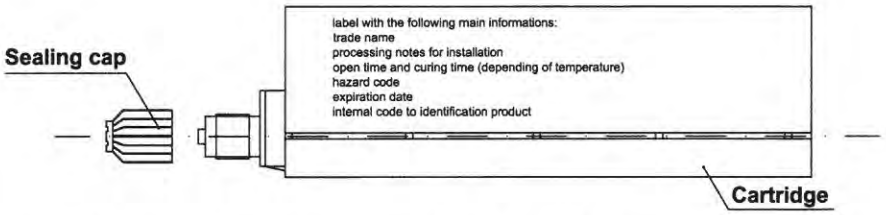
Product	**Composition**
VI100-PRO VI100-PRO-W VI100-PRO-T (two component injection mortars)	Additive: quartz Bonding agent: vinyl ester resin styrene free Hardener: dibenzoyl peroxide

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex A3** of European Technical Assessment ETA-14/0119
Materials	

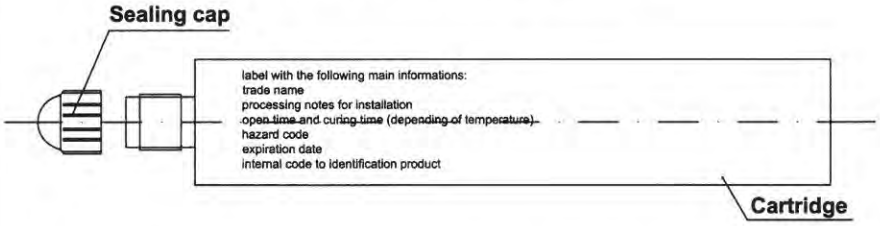
coaxial cartridge - sizes from 75 ml to 420 ml



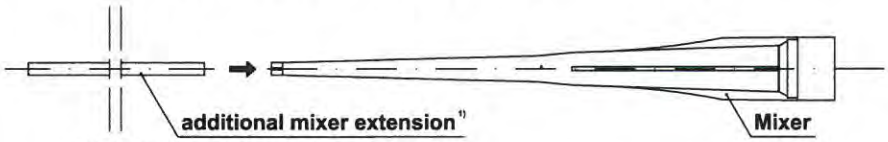
side by side cartridge - sizes from 345 ml to 825 ml



CIC foil cartridge - sizes from 165 ml to 300 ml



MIXER - the mixer is suitable for each type of cartridge



1) Variable length from 380 mm up to 1000 mm

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex A4** of European Technical Assessment ETA-14/0119
Cartridge types and sizes	

SPECIFICATION OF INTENDED USE

Use:

The anchors are intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences.

Anchors subject to:

Static and quasi-static loads: sizes from M8 to M24.

Base material:

- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206-1.
- Non cracked concrete: sizes from M8 to M24.
- Cracked concrete: sizes from M10 to M20.

Temperature range:

The anchors may be used in the following temperature range:

- -40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C).
- -40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C).
- -40°C to +120°C (max. short term temperature +120°C and max. long term temperature +72°C).

Use conditions (environmental conditions):

- Elements made of galvanized steel may be used in structures subject to dry internal conditions.
- Elements made of stainless steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).
- Elements made of high corrosion resistant steel may be used in structures subject to dry internal conditions and also in concrete subject to external atmospheric exposure or exposure in permanently damp internal conditions or in other particular aggressive conditions. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Installation:

- Dry or wet concrete (use category 1): sizes from M8 to M24.
- Flooded holes with the exception of seawater (use category 2): sizes from M8 to M24.
- All the diameters may be used overhead: sizes from M8 to M24.
- The anchors are suitable for hammer drilled holes: sizes from M8 to M24.

Design methods:

EOTA Technical Report TR029 (September 2010) or CEN/TS 1992-4.

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B1** of European Technical Assessment ETA-14/0119
Intended use	

Table B1: Installation data

Size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Nominal drilling diameter	d_0 [mm]	10	12	14	18	24	28
Maximum diameter hole in the fixture	d_{fix} [mm]	9	12	14	18	22	26
Effective embedment depth	$h_{ef,min}$ [mm]	60	70	80	100	120	145
	$h_{ef,max}$ [mm]	160	200	240	320	400	480
Depth of the drilling hole	h_1 [mm]	h_{ef} + 5 mm					
Minimum thickness of the concrete slab	h_{min} [mm]	h_{ef} + 30 mm; ≥ 100 mm			h_{ef} + $2d_0$		
Torque moment	T_{inst} [N·m]	10	20	40	80	130	200
Thickness to be fixed	$t_{fix,min}$ [mm]	> 0					
	$t_{fix,max}$ [mm]	< 1500					
Minimum spacing	s_{min} [mm]	40	40	40	50	60	80
Minimum edge distance	c_{min} [mm]	40	40	40	50	60	80

Table B2: Processing time and minimum curing time

VI100-PRO (standard version)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
-10	105	1320
-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

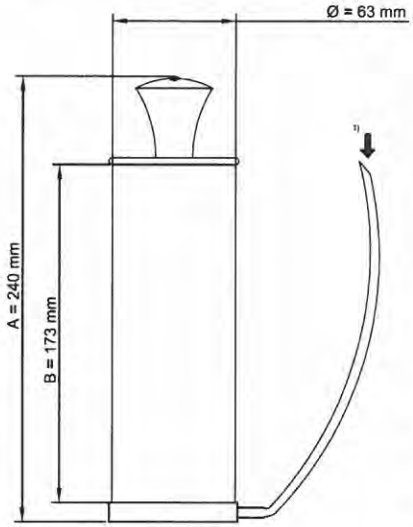
VI100-PRO-W (version for winter season)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
-20	120	1440
-15	90	1000
-10	60	600
-5	40	210
0	25	100
+5	15	70
+10	10	50
+15	7	35
+20	5	30

VI100-PRO-T (version for summer season)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
+20	14	60
+25	11	50
+30	8	40
+35	6	30
+40	4	20
+45	3	20
+50	2	20

[1)] The minimum time from the end of the mixing to the time when the anchor may be torque or loaded (whichever is longer). Minimum resin temperature for installation +5°C; maximum resin temperature for installation +30°C. For wet condition and flooded holes the curing time must be double.

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B3** of European Technical Assessment ETA-14/0119
Processing time and curing time	

Manual Blower pump: nominal dimensions



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

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

Suitable min pressure 6 bar at 6 m³/h
Oil-free compressed air
Recommended air gun with an orifice opening of minimum 3.5 mm in diameter

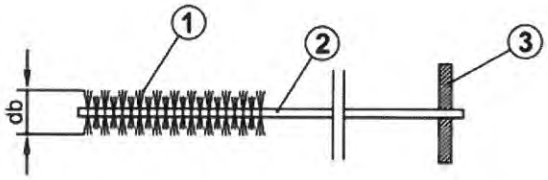
1) Position to insert the mixer extension

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

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B4** of European Technical Assessment ETA-14/0119
Cleaning tools (1)	

Table B3: Standard brush diameter

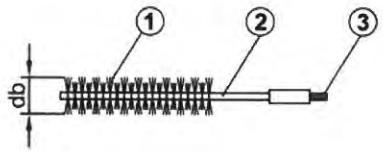
Threaded rod diameter			M8	M10	M12	M16	M20	M24
d_0	Nominal drill hole	[mm]	10	12	14	18	24	28
d_b	Brush diameter	[mm]	12	14	16	20	26	30



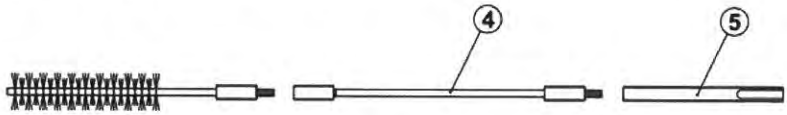
① **Steel bristles**
② **Steel stem**
③ **Wood handle**

Table B4: Special brush diameter (mechanical brush)

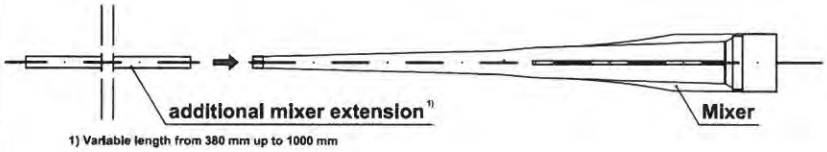
Threaded rod diameter			M16	M20	M24
d_0	Nominal drill hole	[mm]	18	24	28
d_b	Brush diameter	[mm]	20	26	30



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

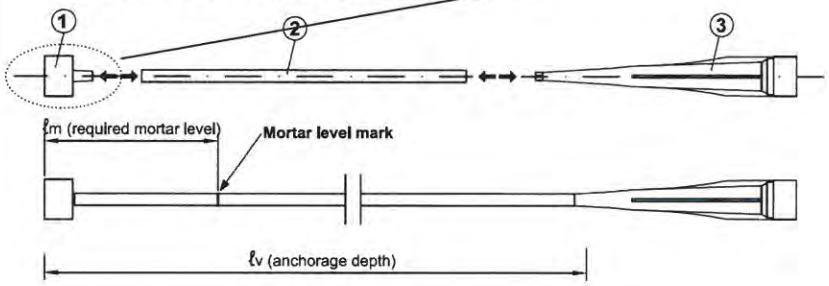


Use the mixer extension (assembled on the standard mixer) for the injection up to 300 mm if necessary.

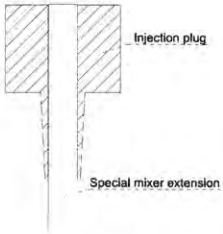


Use this system for special conditions.

Tools for installation in special condition



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

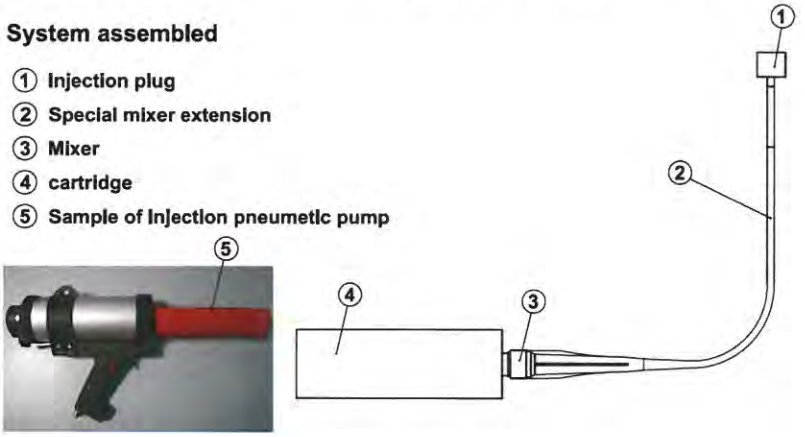


① **Injection plug (nominal diameter according to the nominal diameter of drilled hole)**
② **Special mixer extension (variable length with external diameter 10 mm)**
Mark the required mortar level ℓ_m and embedment depth ℓ_v with tape or marker on the injection extension. Quick estimation: $\ell_m =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

These tools allow the application in special conditions:
- installation with anchorage depth greater than 300 mm;
- overhead installation.
For these applications is recommanded the use of the injection pneumatic pump.

System assembled

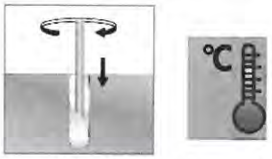
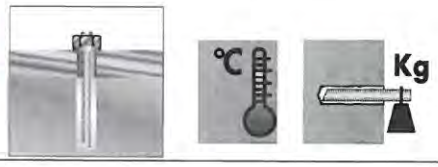
① **Injection plug**
② **Special mixer extension**
③ **Mixer**
④ **cartridge**
⑤ **Sample of injection pneumetic pump**



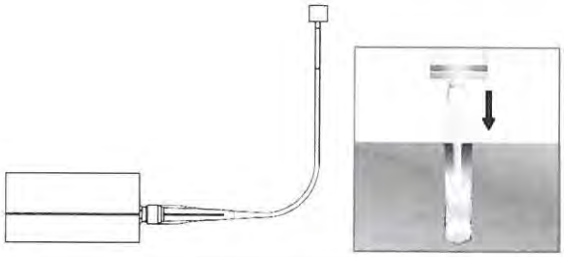
VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B6** of European Technical Assessment ETA-14/0119
Tools for injection (1)	

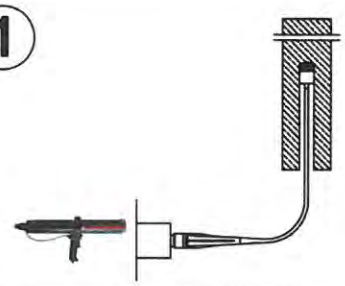
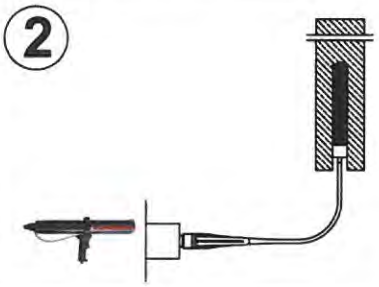
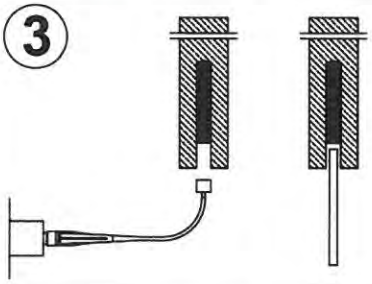
Table B5: Mortar injection pumps

Pumps (injection guns)	Cartridges	Types
	300 ml 165 ml	Manual (up to 300 mm anchorage depth)
	345 ml 300 ml 165 ml	Manual (up to 300 mm anchorage depth)
	from 380 ml to 420 ml	Manual (up to 300 mm anchorage depth)
	from 380 ml to 420 ml	Pneumatic
	825 ml	Manual (up to 300 mm anchorage depth)
	825 ml	Pneumatic

1		Drill the hole with the correct diameter and depth using a rotary percussive machine (hammer drill). Check the perpendicularity of the hole during the drilling operation.
2	 4x 4x 4x	Clean the hole from the drilling dust: the hole shall be cleaned by at least four blowing operations, by at least four brushing operations followed again by at least four blowing operations; before brushing clean the brush and check (according to Annex B5) if the brush diameter is sufficient. For the blower tools see Annex B4.
3		For coaxial and side by side cartridge unscrew the front cup, screw on the mixer and insert the cartridge in the injection gun. For the CIC cartridges, unscrew the front cup, pull-out the steel closing clip according to the following operations: - insert the mixer in the eye of the plastic extractor, - pull the extractor to unhook the steel closing clip of the foil. After that, screw on the mixer and insert the cartridge in the gun. Proper extrusion system according to Annex B7.
4		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 component, comes out from the mixer with an uniform color. Proper extrusion system according to Annex B7.
5	 **if necessary use a mixer extension for the injection (see Annex B6)**	Fill the drilled hole uniformly starting from the drilled hole bottom, in order to avoid entrapped 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.
6	 **ATTENTION: Use the rods dry and free oil and other contaminants**	Insert immediately the threaded rod, marked according to Annex A2, slowly and with a slight twisting motion, removing excess of injection mortar around the rod. Observe the processing time according to Annex B3.
7		Wait the curing time according to Annex B3. After that attach the fixture and tighten the nut to the required torque moment according to Annex B2.

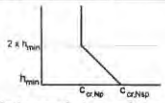
VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B8** of European Technical Assessment ETA-14/0119
Installation instruction up to 300 mm depth	

1	**See point 1 Annex B8**	
2	   **4 x 5 seconds** **4x** **4 x 5 seconds** **ATTENTION: compressed air free oil**	Clean the hole from the drilling dust: the hole shall be cleaned by at least four blowing operations, by at least four brushing operations followed again by at least four blowing operations; before brushing clean the brush and check (according to Annex B5) if the brush diameter is sufficient. For the blower tools see Annex B4.
3	**See point 3 Annex B8**	
4	**See point 4 Annex B8**	
5		Before starting the injection, assemble the system according to Annex B6. 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. Procedure for overhead installation are detailed in Annex B10.
6	**See point 6 Annex B8**	
7	**See point 7 Annex B8**	

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

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex B10** of European Technical Assessment ETA-14/0119
Overhead installation instruction	

Table C1: Characteristic values for tension load in non cracked concrete

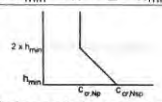
Size			M8	M10	M12	M16	M20	M24
Steel failure								
Steel failure with threaded rod grade 4.8								
Characteristic resistance	$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel failure with threaded rod grade 5.8								
Characteristic resistance	$N_{Rk,s}$	[kN]	18	29	42	78	122	176
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel failure with threaded rod grade 8.8								
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Partial safety factor	γ_{Ms}	[-]	1,50					
Steel failure with threaded rod grade 10.9								
Characteristic resistance	$N_{Rk,s}$	[kN]	37	58	84	157	245	353
Partial safety factor	γ_{Ms}	[-]	1,40					
Steel failure with threaded rod grade 12.9								
Characteristic resistance	$N_{Rk,s}$	[kN]	44	70	101	188	294	424
Partial safety factor	γ_{Ms}	[-]	1,40					
Steel failure with stainless steel threaded rod A4-70								
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Partial safety factor	γ_{Ms}	[-]	1,87					
Steel failure with stainless steel threaded rod A4-80								
Characteristic resistance	$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Partial safety factor	γ_{Ms}	[-]	1,60					
Steel failure with high corrosion resistant steel grade 70								
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Partial safety factor	γ_{Ms}	[-]	1,87					
Combined pull-out and concrete cone failure in non cracked concrete C20/25								
Characteristic bond resistance temperature range -40°C / +40°C [1]	$\tau_{Rk,ucr}$	[N/mm²]	16,0	12,0	12,0	12,0	9,5	9,5
Characteristic bond resistance temperature range -40°C / +80°C [1]	$\tau_{Rk,ucr}$	[N/mm²]	11,0	8,5	8,5	8,5	7,0	7,0
Characteristic bond resistance temperature range -40°C / +120°C [1]	$\tau_{Rk,ucr}$	[N/mm²]	6,0	4,5	4,5	4,5	4,0	4,0
Increasing factor for C30/37	ψ_c	[-]	1,12					
Increasing factor for C40/50			1,23					
Increasing factor for C50/60			1,30					
Splitting failure								
Edge distance	$C_{cr,Nsp}$	[mm]	If $h = h_{min}$					
			$2,5 \cdot h_{ef}$		$2,0 \cdot h_{ef}$		$1,5 \cdot h_{ef}$	
			If $h_{min} < h < 2 \cdot h_{min}$					
			 interpolate values					
			if $h \geq 2 \cdot h_{min}$					
			$C_{cr,Np}$					
Spacing	$S_{cr,Nsp}$	[mm]	$2 \cdot C_{cr,sp}$					
Partial safety factor for combined pull-out, concrete cone and splitting failure								
Partial safety factors for in use category 1 (γ_2 = 1,0 included)	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [2]	[-]	1,50					
Partial safety factors for in use category 2 (γ_2 = 1,2 included)			1,80					

Note: Design method according to TR 029

[1] See: Annex B1 [2] In the absence of other national regulation

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex C1** of European Technical Assessment ETA-14/0119
Characteristic resistance under tension loads in non cracked concrete	

Table C2: Characteristic values for tension loads in cracked concrete

Size			M10	M12	M16	M20
Steel failure						
Steel failure with threaded rod grade 4.8						
Characteristic resistance	$N_{Rk,s}$	[kN]	23	34	63	98
Partial safety factor	γ_{Ms}	[-]	1,50			
Steel failure with threaded rod grade 5.8						
Characteristic resistance	$N_{Rk,s}$	[kN]	29	42	78	122
Partial safety factor	γ_{Ms}	[-]	1,50			
Steel failure with threaded rod grade 8.8						
Characteristic resistance	$N_{Rk,s}$	[kN]	46	67	126	196
Partial safety factor	γ_{Ms}	[-]	1,50			
Steel failure with threaded rod grade 10.9						
Characteristic resistance	$N_{Rk,s}$	[kN]	58	84	157	245
Partial safety factor	γ_{Ms}	[-]	1,40			
Steel failure with threaded rod grade 12.9						
Characteristic resistance	$N_{Rk,s}$	[kN]	70	101	188	294
Partial safety factor	γ_{Ms}	[-]	1,40			
Steel failure with stainless steel threaded rod A4-70						
Characteristic resistance	$N_{Rk,s}$	[kN]	41	59	110	171
Partial safety factor	γ_{Ms}	[-]	1,87			
Steel failure with stainless steel threaded rod A4-80						
Characteristic resistance	$N_{Rk,s}$	[kN]	46	67	126	196
Partial safety factor	γ_{Ms}	[-]	1,60			
Steel failure with high corrosion resistant steel grade 70						
Characteristic resistance	$N_{Rk,s}$	[kN]	41	59	110	171
Partial safety factor	γ_{Ms}	[-]	1,87			
Combined pull-out and concrete cone failure in cracked concrete C20/25						
Characteristic bond resistance temperature range -40°C / +40°C [1)]	$\tau_{Rk,cr}$	[N/mm²]	9,0	9,0	9,0	6,5
Characteristic bond resistance temperature range -40°C / +80°C [1)]	$\tau_{Rk,cr}$	[N/mm²]	6,5	6,5	6,5	4,5
Characteristic bond resistance temperature range -40°C / +120°C [1)]	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3,5	2,5
Increasing factor for C30/37	ψ_c	[-]	1,12			
Increasing factor for C40/50			1,23			
Increasing factor for C50/60			1,30			
Splitting failure						
Edge distance	$C_{cr,Nsp}$	[mm]	If $h = h_{min}$			
			$2,5 \cdot h_{ef}$	$2,0 \cdot h_{ef}$		$1,5 \cdot h_{ef}$
			If $h_{min} < h < 2 \cdot h_{min}$			
			 interpolate values			
			if $h \geq 2 \cdot h_{min}$			
			$C_{cr,Np}$			
Spacing	$S_{cr,Nsp}$	[mm]	$2 \cdot C_{cr,sp}$			
Partial safety factor for combined pull-out, concrete cone and splitting failure						
Partial safety factors for in use category 1 (γ_2 = 1,0 included)	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [2)]	[-]	1,50			
Partial safety factors for in use category 2 (γ_2 = 1,2 included)			1,80			

Note: Design method according to TR 029

[1)] See: Annex B1 [2)] In the absence of other national regulation

VI100-PRO, VI100-PRO-W and VI100-PRO-T	**Annex C2** of European Technical Assessment ETA-14/0119
Characteristic resistance under tension loads in cracked concrete	

Table C3: Characteristic values for shear loads - steel failure without lever arm

Size			M8	M10	M12	M16	M20	M24
Steel failure with threaded rod grade 4.8								
Characteristic resistance	$V_{Rk,s}$	[kN]	7	12	17	31	49	71
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 5.8								
Characteristic resistance	$V_{Rk,s}$	[kN]	9	14	21	39	61	88
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 8.8								
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 10.9								
Characteristic resistance	$V_{Rk,s}$	[kN]	18	29	42	78	122	176
Partial safety factor [1]	γ_{Ms}	[-]	1,50					
Steel failure with threaded rod grade 12.9								
Characteristic resistance	$V_{Rk,s}$	[kN]	22	35	51	94	147	212
Partial safety factor [1]	γ_{Ms}	[-]	1,50					
Steel failure with stainless steel threaded rod A4-70								
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124
Partial safety factor [1]	γ_{Ms}	[-]	1,56					
Steel failure with stainless steel threaded rod A4-80								
Characteristic resistance	$V_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor [1]	γ_{Ms}	[-]	1,33					
Steel failure with high corrosion stainless steel grade 70								
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	29	55	86	124
Partial safety factor [1]	γ_{Ms}	[-]	1,56					

Table C4: Characteristic values for shear loads - steel failure with lever arm

Size			M8	M10	M12	M16	M20	M24
Steel failure with threaded rod grade 4.8								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 5.8								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	561
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 8.8								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898
Partial safety factor [1]	γ_{Ms}	[-]	1,25					
Steel failure with threaded rod grade 10.9								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	37	75	131	333	649	1123
Partial safety factor [1]	γ_{Ms}	[-]	1,50					
Steel failure with threaded rod grade 12.9								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	45	90	157	400	779	1347
Partial safety factor [1]	γ_{Ms}	[-]	1,50					
Steel failure with stainless steel threaded rod A4-70								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786
Partial safety factor [1]	γ_{Ms}	[-]	1,56					
Steel failure with stainless steel threaded rod A4-80								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898
Partial safety factor [1]	γ_{Ms}	[-]	1,33					
Steel failure with high corrosion resistant steel grade 70								
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786
Partial safety factor [1]	γ_{Ms}	[-]	1,56					

[1] In the absence of other national regulation

Table C5: Characteristic values for shear loads - pry out and concrete edge failure

Size			M8	M10	M12	M16	M20	M24
Effective anchorage depth h_{ef}	min	[mm]	60	70	80	100	120	145
	max	[mm]	160	200	240	320	400	480
Pry out failure								
Factor	k	[-]	2	2	2	2	2	2
Partial safety factor [1)]	γ_{Mp}	[-]	1,5					
Concrete edge failure								
Partial safety factor [1)]	γ_{Mc}	[-]	1,5					

[1)] In the absence of other national regulation

Table C6: Displacement under tension loads

Size			M8	M10	M12	M16	M20	M24
Characteristic displacement in non-cracked concrete C20/25 to C50/60 under tension loads								
Admissible service load*	F	[kN]	9,6	10,8	14,3	23,8	29,6	42,4
Displacement	δ_{N0}	[mm]	0,30	0,30	0,35	0,35	0,35	0,40
	$\delta_{N\infty}$	[mm]	0,85	0,85	0,85	0,85	0,85	0,85

Size			M10	M12	M16	M20
Characteristic displacement in cracked concrete C20/25 to C50/60 under tension loads						
Admissible service load*	F	[kN]	9,5	14,3	21,4	23,8
Displacement	δ_{N0}	[mm]	0,50	0,50	0,70	0,60
	$\delta_{N\infty}$	[mm]	0,85	0,85	0,85	0,85

* These values are suitable for each temperature range and categories specified in Annex B1

Table C7: Displacement under shear loads

Size			M8	M10	M12	M16	M20	M24
Characteristic displacement in cracked and non-cracked concrete C20/25 to C50/60 under shear loads								
Admissible service load*	F	[kN]	3,7	5,8	8,4	15,7	24,5	35,3
Displacement	δ_{V0}	[mm]	2,0	2,0	2,0	2,0	2,0	2,0
	$\delta_{V\infty}$	[mm]	3,0	3,0	3,0	3,0	3,0	3,0

* These values are suitable for each temperature range and categories specified in Annex B1

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European Technical Assessment

ETA-14/0120 of 16/06/2014

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections
Product family to which the construction product belongs	Post-installed rebar connections with VI100-PRO, VI100-PRO-W and VI100-PRO-T injection mortar
Manufacturer	ALSAFIX S.A.S 114a rue principale 67240 Gries France
Manufacturing plant(s)	ALSAFIX Manufacturing Plant 1
This European Technical Assessment contains	22 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	Guideline for European Technical Approval ETAG 001, Edition April 2013 "Metal anchors for use in concrete – Part 1: Anchors in general and Part 5: Bonded anchors", used as European Assessment Document (EAD)

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.

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 (rebars) in existing structures made of normal weight concrete, using injection mortars VI100-PRO, VI100-PRO-W and VI100-PRO-T in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with diameter from 8 to 32 mm and VI100-PRO, VI100-PRO-W and VI100-PRO-T injection mortars are used for the post-installed rebar connections. The steel element is placed into a drilled hole previously filled with a 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 A1 to A4.

2 Specification of the intended use in accordance with the applicable EAD

The performances given in Section 3 are only valid if the post-installed connections are used in compliance with the specifications and conditions given in Annex B1 to B11.

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)

The essential characteristic are detailed in the Annex C1 to C3.

3.1.2 Safety in case of fire (BWR 2)

No performance determined.

3.1.3 Hygiene, health and the environment (BWR 3)

Regarding the 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 Regulation, these requirements need also to be complied with, when and where they apply.

3.1.4 Safety in use (BWR 4)

For basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability (BR 1).

3.1.5 Sustainable use of natural resources (BWR 7)

No performance determined.

3.2 Methods used for the assessment

The assessment of fitness of the post-installed connections for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 1 and 4 has been made in accordance with the ETAG 001 *"Metal anchors for use in concrete"*, Part 1: "*Anchors in general*" and Part 5: "*Bonded anchors*" and EOTA Technical Report TR 023 "*Assessment of post-installed rebar connections*".

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

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

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, as provided for in the applicable 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 type testing has to be agreed between Instytut Techniki Budowlanej and the notified body.

Issued in Warsaw on 16/06/2014 by Instytut Techniki Budowlanej

Marek Kaproń
Deputy Director of ITB

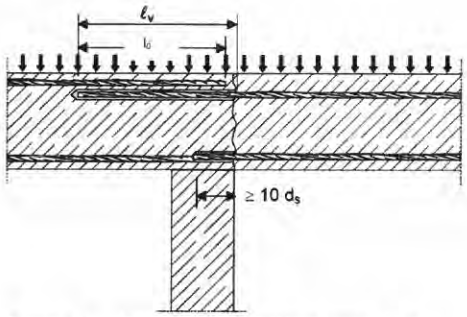


Figure 1: Overlap joint for rebar connections of slabs and beams

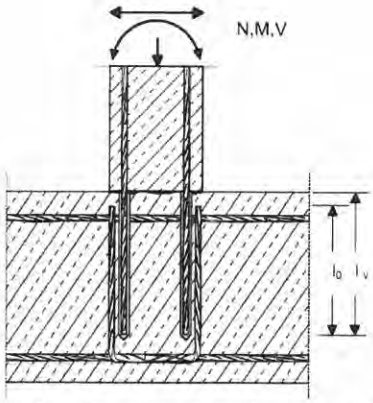


Figure 2: Overlap joint at a foundation of a column or wall where the rebars are stressed in tension

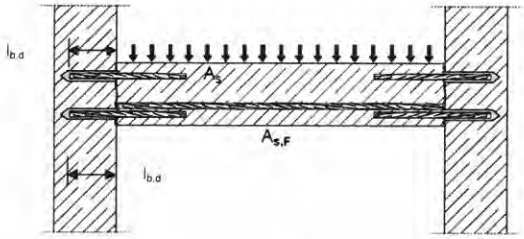


Figure 3: End anchoring of slabs or beams, designed as simply supported

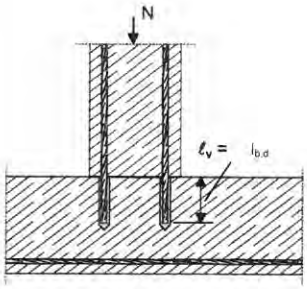


Figure 4: Rebar connection for components stressed primarily in compression. The rebars are stressed in compression

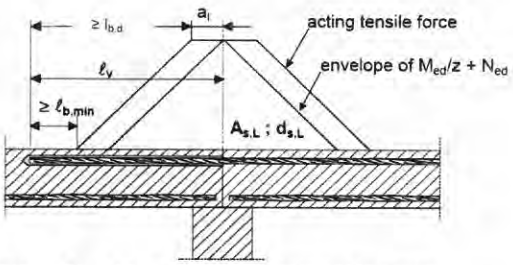


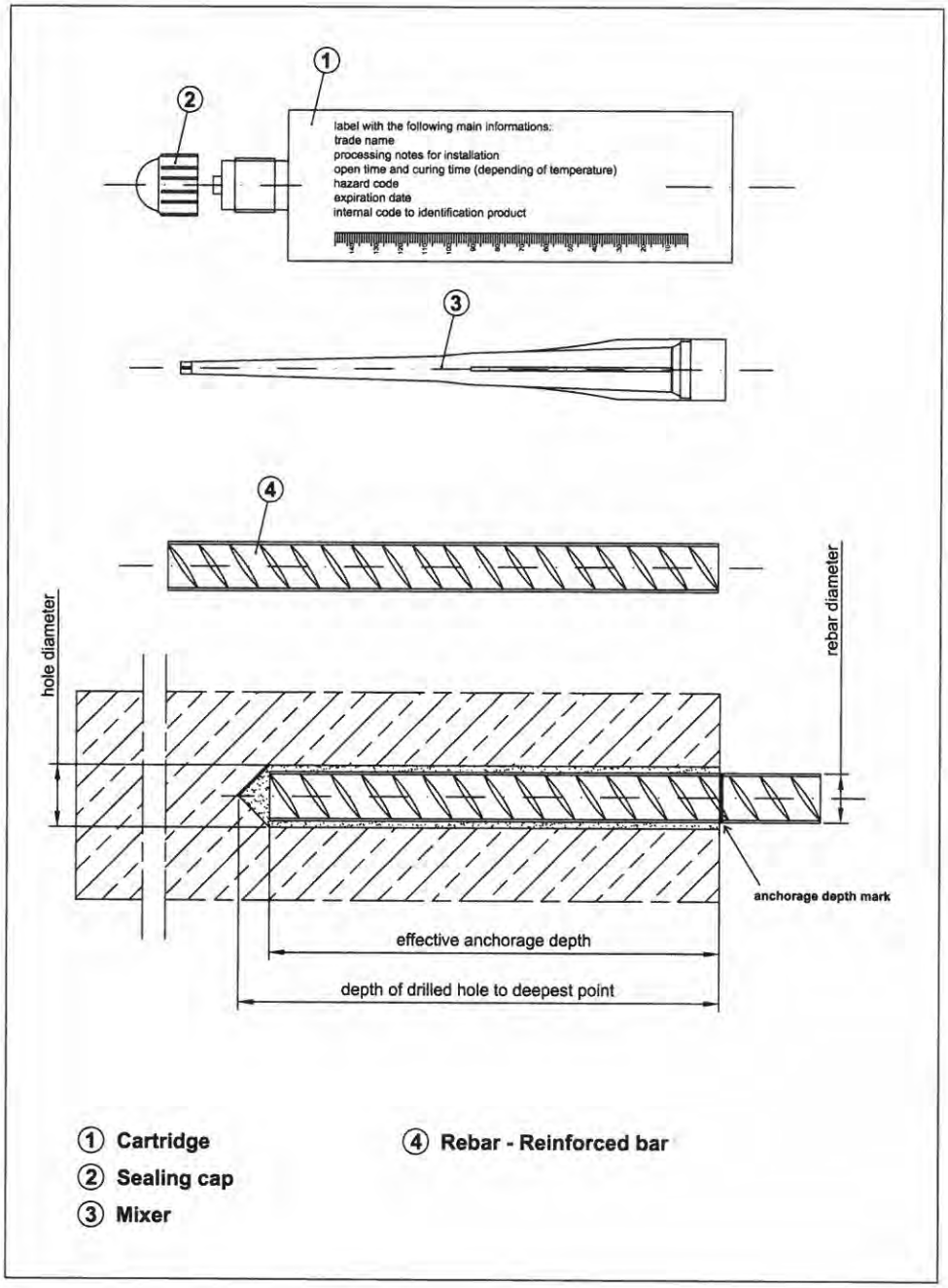
Figure 5: Anchoring of reinforcement to cover the line of acting tensile force

Note to Figure 1 to 5:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EC 2 shall be present.

The shear transfer between old and new concrete shall be designed according to EC 2.

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex A1** of European Technical Assessment ETA-14/0120
Use of the product	



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

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex A2** of European Technical Assessment ETA-14/0120
Product description	

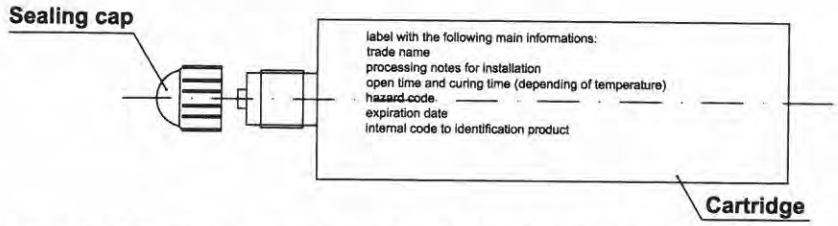
Table A1: Rebars

Designation	Rebars
Rebars according to EN 1992-1-1, Annex C, Table C.1 and C.2N	Bars and de-coiled rods Class B or C Minimum relative rib area, $f_{R,min}$, according to EN 1992-1-1 The rib height h: $h \leq 0{,}07 \cdot Ø$

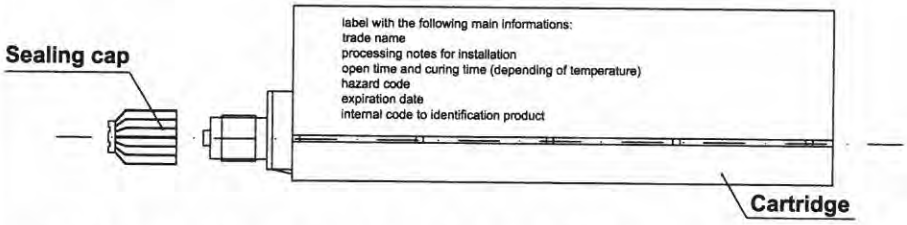
Table A2: Injection mortars

Designation	Composition
VI100-PRO VI100-PRO-W VI100-PRO-T (two component injection mortars)	Additive: quartz Bonding agent: vinyl ester resin styrene free Hardener: dibenzoyl peroxide

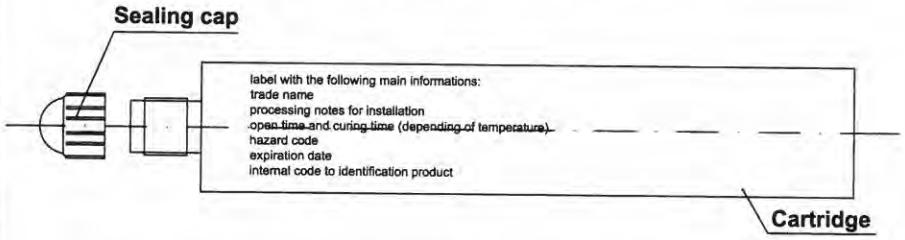
coaxial cartridge - sizes from 380 ml to 420 ml



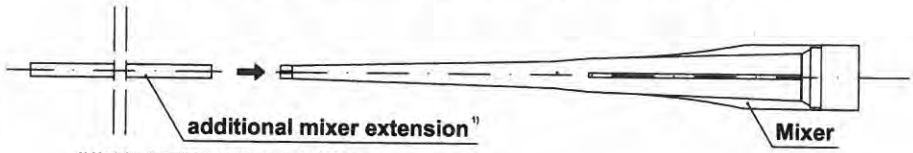
side by side cartridge - sizes from 345 ml to 825 ml



CIC foil cartridge - sizes from 165 ml to 300 ml



MIXER - the mixer is suitable for each type of cartridge



1) Variable length from 380 mm up to 1000 mm

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex A4** of European Technical Assessment ETA-14/0120
Cartridge types and sizes	

SPECIFICATION OF INTENDED USE

Anchorages subject to:

Static and quasi-static loads.

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.
- Maximum chloride content of 0,20% (Cl 0,20) 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 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.

  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).

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.
- Structures subject to external atmospheric exposure including industrial and marine environment.
- Structures subject to permanently damp internal conditions if no particular aggressive conditions exist.

  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

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 and 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.

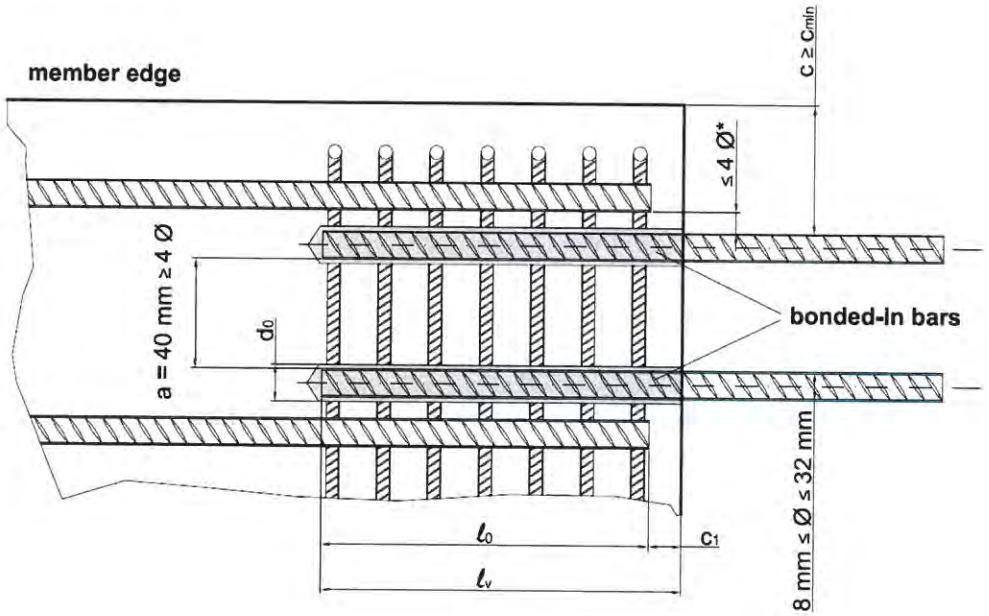
Installation:

- Dry or wet concrete (use category 1).
- It must not be installed in flooded holes.
- Overhead installation is permissible.
- Hole drilling by hammer drill.
- Installation of the post-installed rebars shall be done only by suitable trained installer and under supervision on the site.
- Check the position of the existing rebars (if the position of existing rebars 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 VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B1** of European Technical Assessment ETA-14/0120
Intended use. Specification	

General design rules of construction for post-installed rebars

- Only tension forces in the axis of the rebar may be transmitted.
- 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 extended that aggregate protrude.



* If the clear distance between overlapping rebars is greater than 4·Ø the overlap length shall be enlarged by the difference between the clear distance and 4·Ø.

l_0 – lap length acc. to EN 1992-1-1, clause 8.7.3
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, clause 4.4.1.2.
c_1 – concrete cover at end-face of existing rebar
d_0 – nominal drill bit diameter acc. to Annex B3
Ø – rebar diameter (d_s)

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B2** of European Technical Assessment ETA-14/0120
Intended use. General construction rules for post-installed rebars	

Table B1: Installation data – hammer drilling

Rebar diameter [mm]	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Drill bit diameter [mm]	12	14	16	18	20	25	30	35	40
Brush diameter [mm]	14	16	18	20	22	27	32	37	42
Minimum anchorage length $l_{b,min}$ [mm]	115	145	170	200	230	285	355	400	455
Minimum anchorage length $l_{o,min}$ - overlap joint [mm]	200	200	200	210	240	300	375	420	480
Maximum embedment depth $l_{v,max}$ [mm]	400	500	600	700	800	1000	1000	1000	1000

Note: $l_{b,min}$ and $l_{0,min}$ according to EN 1992-1-1 (8.6) and (8.11) with: yield stress for rebar 500 N/mm^2; γ_M = 1,15; α_6 = 1,0; concrete C20/25 and f_{bd} = 2,30 N/mm^2 (good bond conditions)

Minimum concrete cover (see Annex B2):

c_{min} = 30 mm + 0,06 · l_v ≥ 2 · Ø for Ø < 25 mm

c_{min} = 40 mm + 0,06 · l_v ≥ 2 · Ø for Ø ≥ 25 mm

The minimum concrete cover according to EN 1992-1-1 shall be observed.

Minimum clear spacing between two post-installed rebars:

a = 40 mm ≥ 4 · Ø

Table B2: Processing time and minimum curing time

VI100-PRO (standard version)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
-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

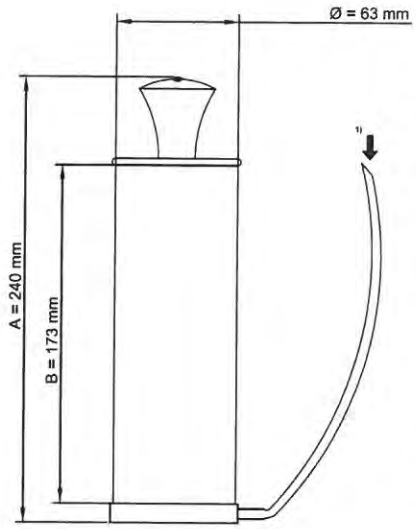
VI100-PRO-W (version for winter season)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
-5	40	210
0	25	100
+5	15	70
+10	10	50
+15	7	35
+20	5	30

VI100-PRO-T (version for summer season)		
Concrete temperature [C°]	**Processing time [min.]**	**Minimum curing time[1)] [min.]**
+20	14	60
+25	11	50
+30	8	40
+35	6	30
+40	4	20
+45	3	20
+50	2	20

[1)] 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 VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B4** of European Technical Assessment ETA-14/0120
Processing time and curing time	

Manual Blower pump: nominal dimensions



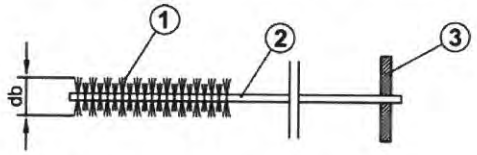
It is possible to use the mixer extension with the manual blower pump.

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

Suitable min pressure 6 bar at 6 m³/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 mm

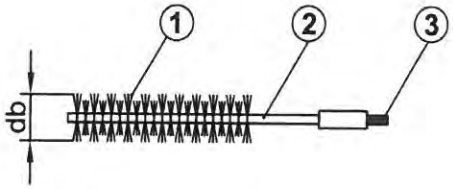


① Steel bristles
② Steel stem
③ Wood handle

Table B3: Standard brush details (manual brush)

Rebar diameter [mm]			Ø8	Ø10	Ø12	Ø14	Ø16
d_0	Nominal drill hole	[mm]	12	14	16	18	20
d_b	Brush diameter	[mm]	14	16	18	20	22

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	Annex B5 of European Technical Assessment ETA-14/0120
Cleaning tools (1)	



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

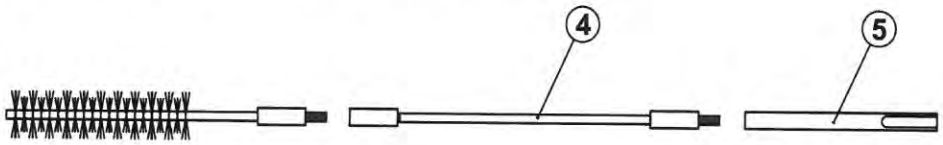
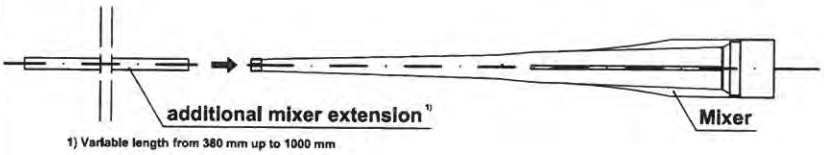


Table B4: Special brush details (mechanical brush)

Rebar diameter [mm]			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
d_0	Nominal drill hole	[mm]	12	14	16	18	20	25	30	35	40
d_b	Brush diameter	[mm]	14	16	18	20	22	27	32	37	42

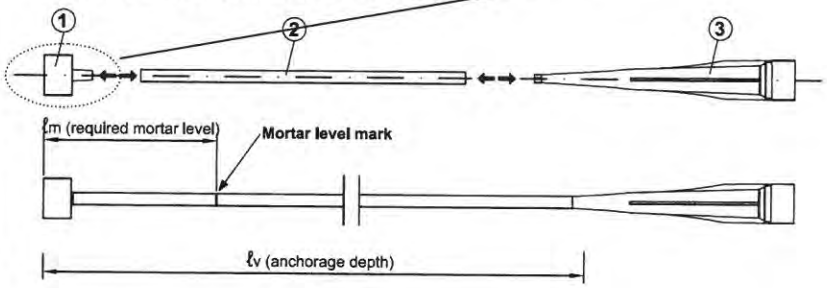
Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B6** of European Technical Assessment ETA-14/0120
Cleaning tools (2)	

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

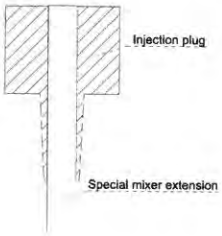


Use this system for special conditions.

Tools for installation in special condition



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)**

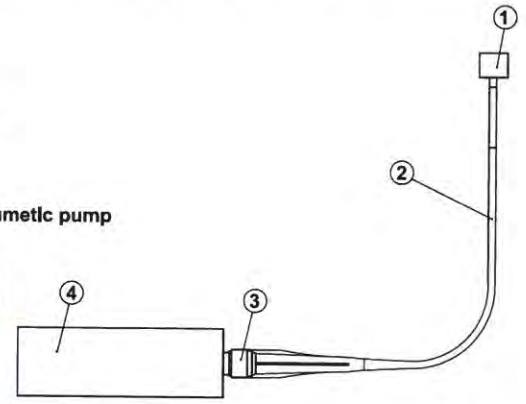
Mark the required mortar level ℓ_m and embedment depth ℓ_v with tape or marker on the injection extension. Quick estimation: $\ell_m = 1/3 \cdot \ell_v$
Continue injection until the mortar level mark ℓ_m becomes visible.

③ **Mixer (suitable for all size of cartirge)**

These tools allow the application in special conditions:
- installation with anchorage depth greater than 300 mm;
- overhead installation.
For these applications is recommanded the use of the injection pneumatic pump.

System assembled

① **Injection plug**
② **Special mixer extension**
③ **Mixer**
④ **cartridge**
⑤ **Sample of injection pneumetic pump**

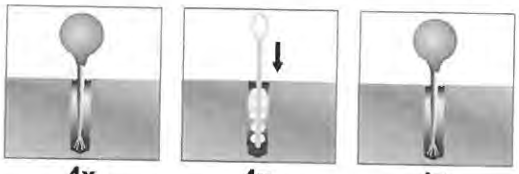
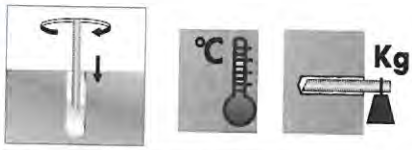


Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B7** of European Technical Assessment ETA-14/0120
Tools for installation (1)	

Table B5: Mortar injection pumps

Pumps (injection guns)	Cartridges	Clean hole tools	Maximum depth of the drill hole
 *Manual*	825 ml	Blower pump or compressed air and standard brush or special brush	300 mm
 *Manual*	400 ml 380 ml	Blower pump or compressed air and standard brush or special brush	300 mm
 *Manual*	345 ml 300 ml 165 ml	Blower pump or compressed air and standard brush or special brush	300 mm
 *Manual*	300 ml 165 ml	Blower pump or compressed air and standard brush or special brush	300 mm
 *Pneumatic*	825 ml	Compressed air and special brush	300 mm to 1000 mm*
 *Pneumatic*	400 ml 380 ml	Compressed air and special brush	300 mm to 1000 mm*

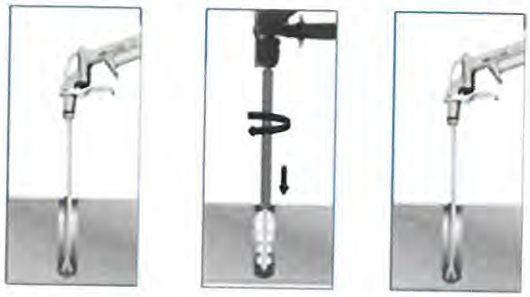
* Note: use the mixer extension described in Annex B7 for the injection of the mortar

1		Drill the hole with the correct diameter and depth using a rotary percussive machine (hammer drill). Check the perpendicularity of the hole during the drilling operation.
2		Clean the hole from the drilling dust: the hole shall be cleaned by at least four blowing operations, by at least four brushing operations followed again by at least four blowing operations; before brushing clean the brush and check (according to Annex B5 and B6) if the brush diameter is sufficient. For the blower tools see Annex B5.
3		For coaxial and side by side cartridge unscrew the front cup, screw on the mixer and insert the cartridge in the injection gun. For the CIC cartridges, unscrew the front cup, pull-out the steel closing clip according to the following operations: - insert the mixer in the eye of the plastic extractor, - pull the extractor to unhook the steel closing clip of the foil. After that, screw on the mixer and insert the cartridge in the injection gun. Proper extrusion system according to Annex B8.
4		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 component, comes out from the mixer with an uniform color.
5	 **if necessary use a mixer extension for the injection (see Annex B5)**	Fill the drilled hole uniformly starting from the drilled hole bottom, in order to avoid entrapped 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.
6		Insert immediately the rebar, marked according to Annex A2, slowly and with a slight twisting motion, removing excess of injection mortar around the rebar. Observe the curing time according to Annex B4.

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B9** of European Technical Assessment ETA-14/0120
Installation instruction up to 300 mm depth	

1 See point 1 Annex B9

2



4 x 5 seconds | 4x | 4 x 5 seconds

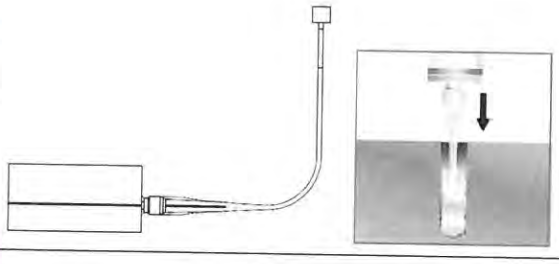
ATTENTION: compressed air free oil

Clean the hole from the drilling dust: the hole shall be cleaned by at least four blowing operations, by at least four brushing operations followed again by at least four blowing operations; before brushing clean the brush and check (according to Annex B5 and B6) if the brush diameter is sufficient. For the blower tools see Annex B5.

3 See point 3 Annex B9

4 See point 4 Annex B9

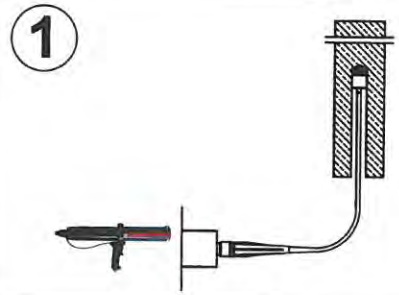
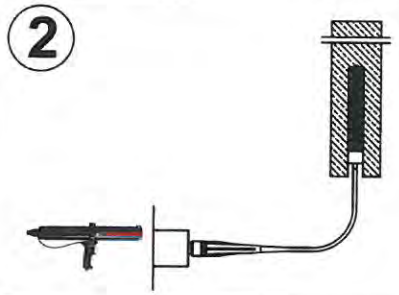
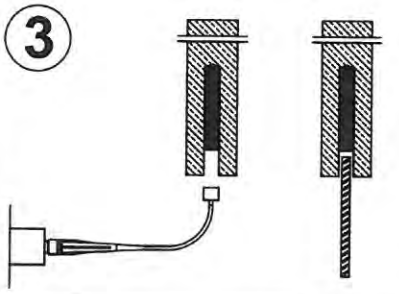
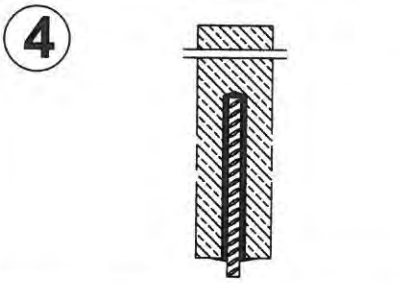
5



Before starting the injection, assemble the system according to Annex B7. 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.
Procedure for overhead installation are detailed in Annex B11.

6 See point 6 Annex B9

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B10** of European Technical Assessment ETA-14/0120
Installation instruction up to 1000 mm depth	

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

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex B11** of European Technical Assessment ETA-14/0120
Overhead installation instruction	

Table C1. Design values of the ultimate bond resistance f_{bd} according to EN 1992-1-1 for hammer drilling

Rebar diameter [mm]	Ultimate bond resistance f_{bd}[1] [N/mm²]								
	C12/15	C16/20	20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø10	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø12	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø14	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,30
Ø16	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
Ø20	1,60	2,00	2,30	2,70	3,00	3,40	3,70	4,00	4,00
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
Ø32	1,60	2,00	2,30	2,70	2,70	2,70	2,70	2,70	2,70

[1] The values given are valid for good bond condition according to EN 1992-1-1.
For all other bond conditions multiply the value by 0,7.

Values for pre-calculation of anchoring rebars connections
Examples for anchorage length[1] ($f_{y,k}$ = 500 N/mm^2; concrete C20/25; f_{bd} = 2,3 N/mm^2)

Rebar Ø	Tensile load B500	$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 1{,}0$			$\alpha_1 = \alpha_3 = \alpha_4 = 1{,}0$ and α_2 or $\alpha_5 = 0{,}7$		
		Anchorage length l_{bd}[1]	Tension load	Mortar volume V	Anchorage length l_{bd}[1]	Tension load	Mortar volume V
[mm]	[kN]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	21,85	115	6,65	8,50	115	9,50	8,50
		180	10,40	13,31	180	14,86	13,31
		250	14,45	18,48	200	16,52	14,78
		320	18,50	23,65	220	18,17	16,26
		378	21,85	27,95	265	21,85	19,56
10	34,15	145	10,48	12,86	145	14,97	12,86
		230	16,62	20,40	230	23,74	20,40
		310	22,40	27,50	260	26,84	23,06
		390	28,18	34,59	290	29,93	25,72
		473	34,15	41,92	331	34,15	29,34
12	49,17	170	14,74	17,59	170	21,06	17,59
		270	23,41	27,94	270	33,44	27,94
		370	32,08	38,29	300	37,16	31,05
		470	40,75	48,64	330	40,88	34,15
		567	49,17	58,69	397	49,17	41,08
14	66,93	200	20,23	23,65	200	28,90	23,65
		320	32,37	37,85	320	46,24	37,85
		440	44,51	52,04	360	52,02	42,58
		560	56,65	66,23	400	57,81	47,31
		662	66,93	78,25	463	66,93	54,78
16	87,42	230	26,59	30,60	230	37,99	30,60
		360	41,62	47,90	360	59,46	47,90
		490	56,65	65,20	400	66,06	53,22
		620	71,68	82,49	440	72,67	58,54
		756	87,42	100,61	529	87,42	70,43
20	136,59	285	41,19	59,25	285	58,84	59,25
		450	65,03	93,55	450	92,90	93,55
		620	89,60	128,90	500	103,22	103,95
		790	114,17	164,24	550	113,55	114,34
		945	136,59	196,50	662	136,59	137,55
25	213,42	355	64,13	90,21	355	91,61	90,21
		520	93,93	132,13	520	134,19	132,13
		680	122,84	172,79	600	154,84	152,46
		840	151,74	213,44	650	167,74	165,16
		1000	180,64	254,10	700	180,64	177,87
28	267,72	400	80,93	162,99	400	115,61	162,99
		550	111,28	224,12	550	158,96	224,12
		700	141,62	285,24	700	202,32	285,24
		850	171,97	346,36	850	245,67	346,36
		1000	202,32	407,48	926	267,72	377,44
32	349,67	455	105,21	242,16	455	150,29	242,16
		590	136,42	314,01	500	165,16	266,11
		730	168,79	388,52	550	181,67	292,72
		870	201,16	463,03	600	198,19	319,33
		1000	231,22	532,22	700	231,22	372,56

The given values are valid for good bond condition according to EN 1992-1-1. For all other bond condition the values for tension load shall be multiplied by 0,7. The mortar volume V can be calculated using the equation: $V = l_{bd} \cdot \pi \cdot (d_0^2 - d^2) / (4 \cdot 0{,}85)$ with the nominal hole diameter.

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex C2**
Design values for anchoring connections	of European Technical Assessment ETA-14/0120

Values for pre-calculation of overlap joint connections
Examples for the lap splice length[1] ($f_{y,k}$ = 500 N/mm²; concrete C20/25; f_{bd} = 2,3 N/mm²)

Rebar Ø	Tensile load B500	$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_5 = \alpha_6 = 1{,}0$			$\alpha_1 = \alpha_3 = \alpha_6 = 1{,}0$ and α_2 or $\alpha_5 = 0{,}7$		
		Lap splice length l_0[1]	Tension load	Mortar volume V	Lap splice length l_0[1]	Tension load	Mortar volume V
[mm]	[kN]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	21,85	200	11,56	14,78	200	16,52	14,78
		240	13,87	17,74	-	-	-
		280	16,19	20,70	-	-	-
		320	18,50	23,65	-	-	-
		378	21,85	27,95	-	-	-
10	34,15	200	14,45	17,74	200	20,64	17,74
		270	19,51	23,95	235	24,26	20,85
		340	24,57	30,16	270	27,87	23,95
		410	29,63	36,37	305	31,48	27,05
		473	34,15	41,92	331	34,15	29,34
12	49,17	200	17,34	20,70	200	24,77	20,70
		290	25,15	30,01	250	30,97	25,87
		380	32,95	39,33	300	37,16	31,05
		470	40,75	48,64	350	43,35	36,22
		567	49,17	58,69	397	49,17	41,08
14	66,93	210	21,24	24,84	210	30,35	24,84
		320	32,37	37,85	270	39,02	31,93
		430	43,50	50,86	330	47,69	39,03
		540	54,63	63,87	390	56,36	46,13
		662	66,93	78,25	463	66,93	54,78
16	87,42	240	27,75	31,93	240	39,64	31,93
		370	42,78	49,23	310	51,20	41,25
		500	57,81	66,53	380	62,76	50,56
		630	72,83	83,83	450	74,32	59,88
		756	87,42	100,61	529	87,42	70,43
20	136,59	300	43,35	62,37	300	61,93	62,37
		460	66,48	95,63	390	80,51	81,08
		620	89,60	128,90	480	99,09	99,79
		780	112,72	162,16	570	117,68	118,50
		945	136,59	196,50	662	136,59	137,55
25	213,42	375	67,74	95,29	375	96,77	95,29
		530	95,74	134,67	670	172,90	170,25
		690	124,64	175,33	780	201,29	198,20
		850	153,55	215,98	800	206,45	203,28
		1000	180,64	254,10	827	213,42	210,14
28	267,72	420	84,97	171,14	420	121,39	171,14
		570	115,32	232,27	720	208,10	293,39
		720	145,67	293,39	810	234,11	330,06
		870	176,02	354,51	900	260,12	366,73
		1000	202,32	407,48	926	267,72	377,44
32	349,67	480	110,99	255,47	480	158,55	255,47
		610	141,04	324,66	610	201,49	324,66
		740	171,10	393,84	740	244,43	393,84
		870	201,16	463,03	870	287,37	463,03
		1000	231,22	532,22	1000	330,32	532,22

The given values are valid for good bond condition according to EN 1992-1-1. For all other bond condition the values for tension load shall be multiplied by 0,7. The mortar volume V can be calculated using the equation: $V = l_{bd} \cdot \pi \cdot (d_0^2 - d^2) / (4 \cdot 0{,}85)$ with the nominal hole diameter.

Injection system VI100-PRO, VI100-PRO-W and VI100-PRO-T for rebar connections	**Annex C3** of European Technical Assessment ETA-14/0120
Design values for overlap joint connections	