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European Technical Assessment Body
for construction products



European Technical Assessment

ETA-23/0862
of 21 April 2026

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

Tecfi Injection system XWE for rebar connection

Product family
to which the construction product belongs

Systems for post-installed rebar
connections with mortar

Manufacturer

Tecfi S.p.A
Strada Statale Appia, Km. 193
81050 PASTORANO (CE)
ITALIEN

Manufacturing plant

Tecfi Plant 4

This European Technical Assessment
contains

24 pages including 3 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Article 95(4) of
Regulation (EU) 2024/3110, on the basis of

EAD 330087-01-0601

This version replaces

ETA-23/0862 issued on 28 November 2023

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Specific Part

1 Technical description of the product

The subject of this European Technical Assessment is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the "Tecfi injection system XWE for rebar connection" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter ϕ from 8 to 40 mm or the tension anchor ZA of sizes M12 to M24 according to Annex A and injection mortar XWE are used for rebar connections. The rebar is placed into a drilled hole filled with injection mortar and is anchored via the bond between rebar, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European assessment Document

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the rebar connections of at least 50 and/or 100 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 and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static loading	See Annex C 1
Characteristic resistance under seismic loading	See Annex B 4 and C 2

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 3 to C 4

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

In accordance with European Assessment Document EAD No. 330087-01-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 21 April 2026 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

Installation post installed rebar

Figure A1: Overlapping joint for rebar connections of slabs and beams

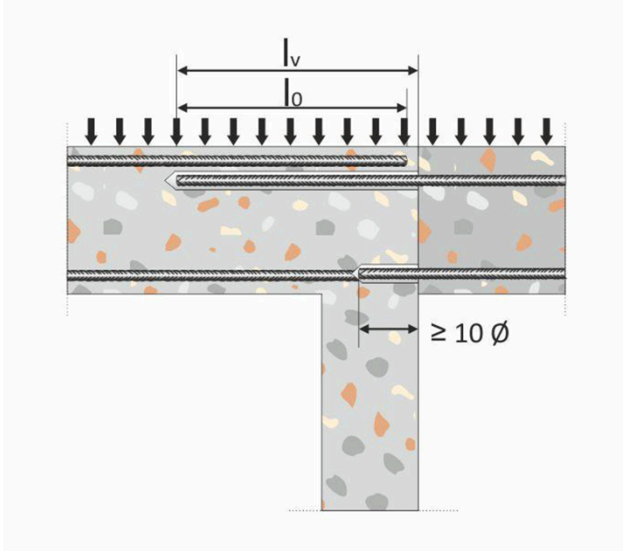


Figure A3: End anchoring of slabs or beams (e.g. designed as simply supported)

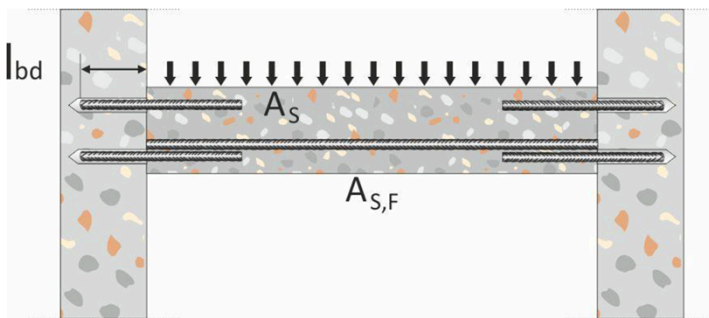


Figure A5: Anchoring of reinforcement to cover the line of acting tensile force

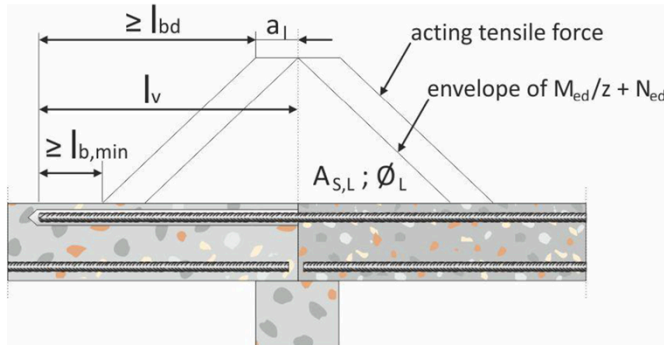


Figure A2: Overlapping joint at a foundation of a wall or column where the rebars are stressed in tension

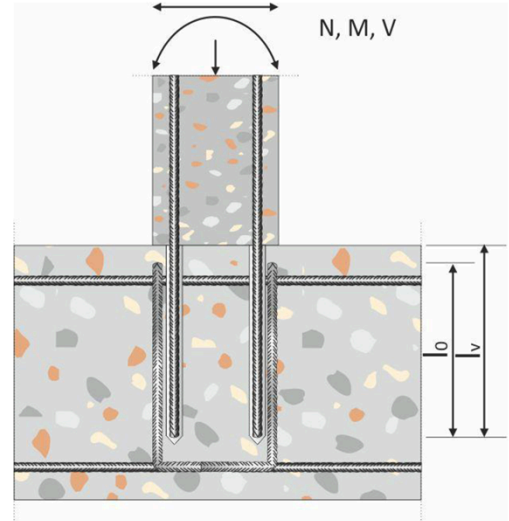
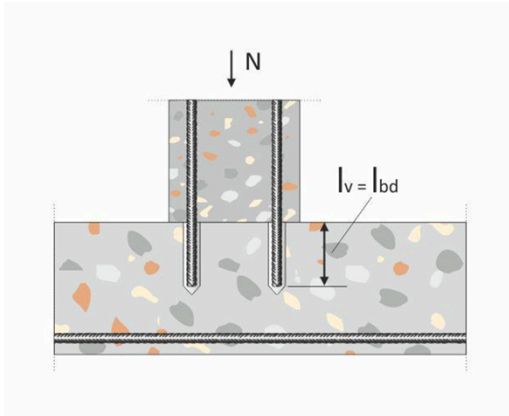


Figure A4: Rebar connection for components stressed primarily in compression. The rebars are stressed in compression



Note to Figure A1 to A5:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2004+AC:2010.

Preparing of joints according to Annex B 2

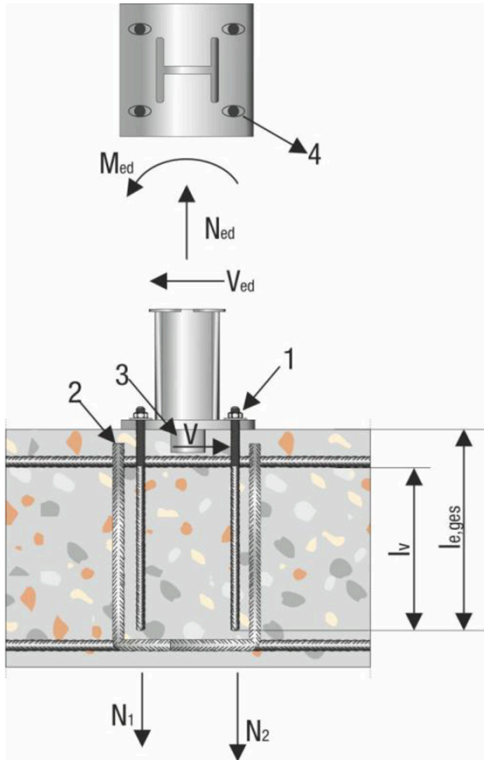
Tecfi Injection system XWE for rebar connection

Product description
Installed condition and examples of use for rebars

Annex A 1

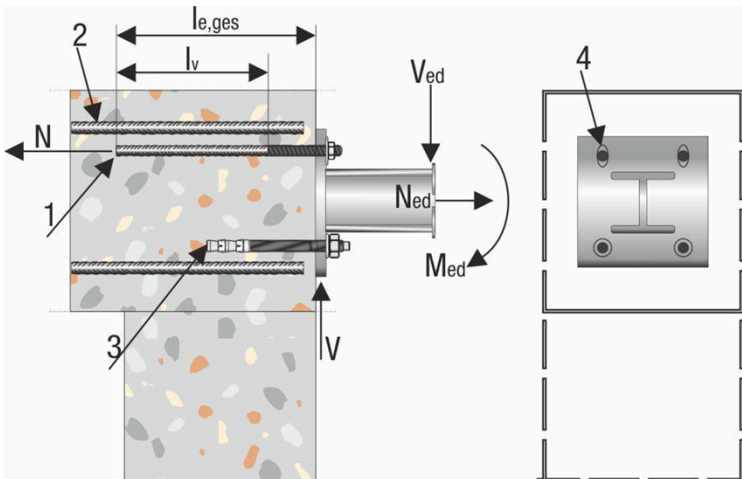
Installation tension anchor ZA

Figure A6: Anchorage of column to foundation with tension anchor ZA.



- 1 Tension anchor ZA (tension only)
- 2 Existing stirrup / reinforcement for overlap (lap splice)
- 3 Shear lug (or fastener loaded in shear)
- 4 Slotted hole with axial direction to the shear force

Figure A7: Anchorage of guardrail posts or cantilevered building components with tension anchor ZA and fastener.



- 1 Tension anchor ZA (tension only)
- 2 Existing stirrup / reinforcement for overlap (lap splice)
- 3 Fastener (or shear lug loaded in shear)
- 4 Slotted hole with axial direction to the shear force

Note to Figure A6 and A7: In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2004+AC:2010. The tension anchor may be only used for axial tensile force. The tensile force must be transferred by lap to the existing reinforcement of the building. The transfer of the shear force has to be ensured by suitable measures, e.g. by means of shear lugs or anchors with European Technical Assessment (ETA). General construction rules see Annex B 3

Tecfi Injection system XWE for rebar connection

Product description

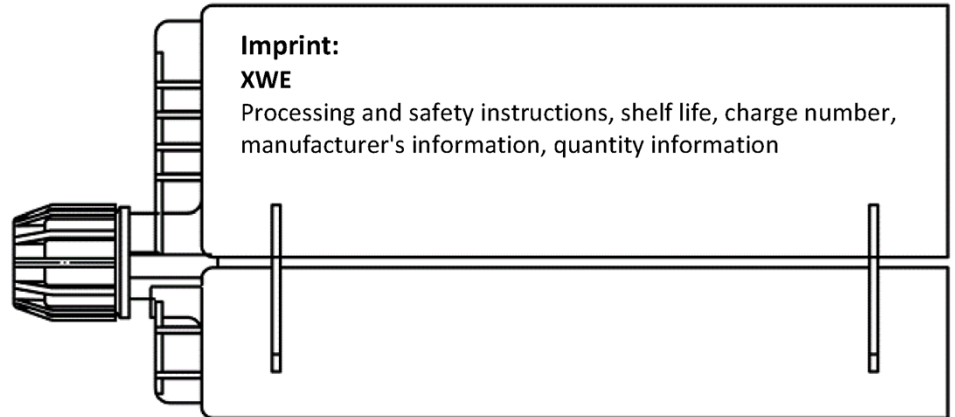
Installed condition and examples of use for tension anchors

Annex A 2

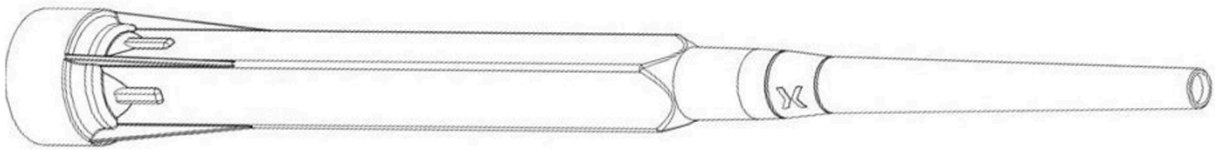
Cartridge system

Side-by-Side Cartridge:

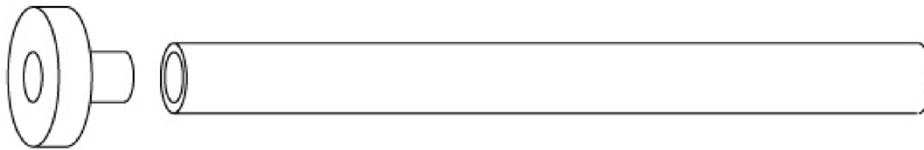
440 ml, 500 ml up to 540 ml, 585 ml
and 1400 ml



Static mixer DI03



Piston plug ACE and mixer extension ACF



Tecfi Injection system XWE for rebar connection

Product description
Injection system

Annex A 3

Reinforcing bar (rebar): $\phi 8$ up to $\phi 40$



- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range $0,05\phi \leq h_{rib} \leq 0,07\phi$
(ϕ : Nominal diameter of the bar; h_{rib} : Rib height of the bar)

Table A1: Materials Rebar


Designation	Material
Rebar EN 1992-1-1:2004+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$


Tecfi Injection system XWE for rebar connection

Product description
Specifications Rebar

Annex A 4

Tension Anchor ZA: -M12 up to ZA-M24

Marking: e.g.  12 A4

-  Mark of the producer
- ZA Trade name
- 12 Rod diameter/thread
- A4 for stainless steel A4
- HCR for high corrosion resistance steel

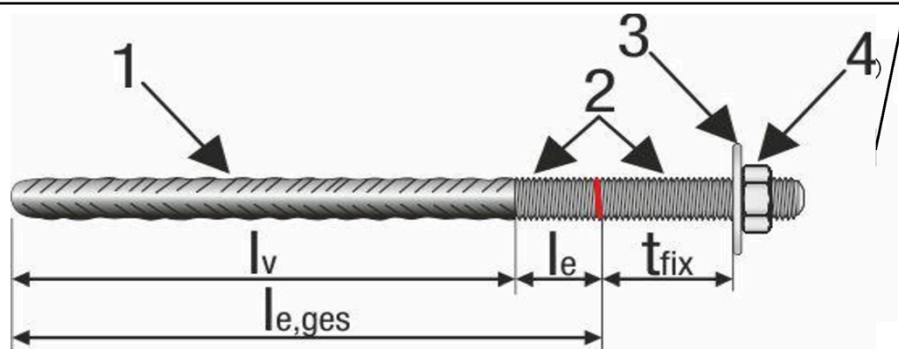


Table A2: Materials Tension Anchor ZA

Part	Designation	Material											
		ZA vz				ZA A4				ZA HCR			
		M12	M16	M20	M24	M12	M16	M20	M24	M12	M16	M20	M24
1	Reinforcement bar	Class B according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$											
	f_{yk} [N/mm ²]	500				500				500			
2	Threaded rod	Steel, zinc plated according to EN ISO 683-4:2018 or EN 10263:2021				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
3	Washer	Steel, zinc plated according to EN ISO 683-4:2018 or EN 10263:2021				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			
4	Nut	Steel, zinc plated according to EN ISO 683-4:2018 or EN 10263:2021				Stainless steel, 1.4362, 1.4401, 1.4404, 1.4571, EN 10088-1:2014				High corrosion resistant steel, 1.4529, 1.4565, EN 10088-1:2014			

Table A3: Dimensions and installation parameters – Tension anchor ZA

Size			ZA-M12	ZA-M16	ZA-M20	ZA-M24	
Diameter of threaded rod	d_s	[mm]	12	16	20	24	
Diameter of reinforcement bar	ϕ	[mm]	12	16	20	25	
Drill hole diameter	d_o	[mm]	16	20	25	32	
Diameter of clearance hole in fixture	d_f	[mm]	14	18	22	26	
With across nut flats	SW	[mm]	19	24	30	36	
Stress area	A_s	[mm ²]	84	157	245	353	
Effective embedment depth	l_v	[mm]	according to static calculation				
Length of bonded thread	Zinc plated	l_e	[mm]	≥ 20	≥ 20	≥ 20	≥ 20
	A4/HCR			≥ 100	≥ 100	≥ 100	≥ 100
Minimum thickness of fixture	min t_{fix}	[mm]	5	5	5	5	
Maximum thickness of fixture	max t_{fix}	[mm]	3000	3000	3000	3000	
Maximum installation torque	max T_{inst}	[Nm]	50	100	150	150	

Tecfi Injection system XWE for rebar connection

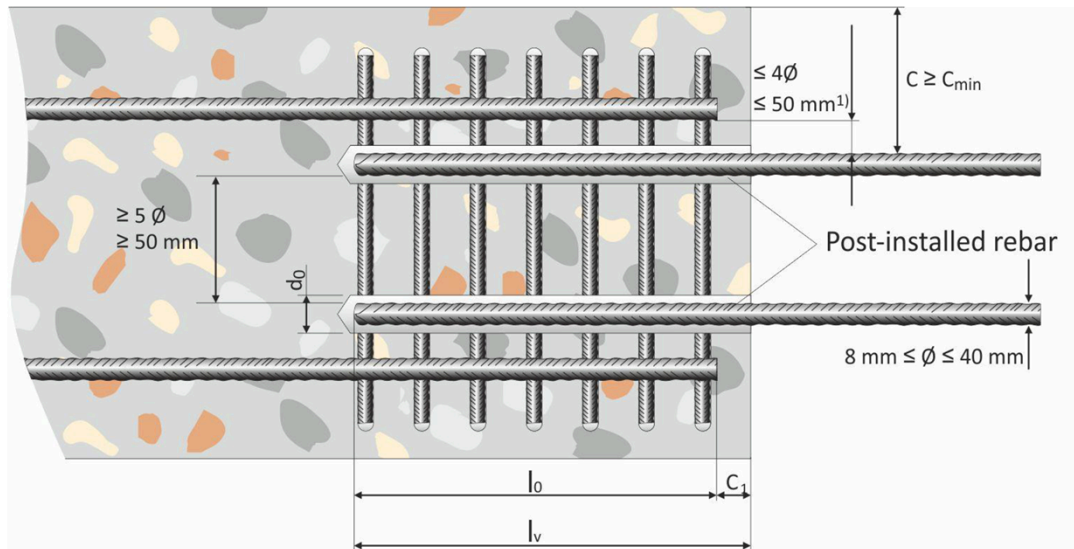
Product description
Specifications Tension Anchor ZA

Annex A 5

Specification of the intended use			
Anchorages subject to:		Working life 50 years	Working life 100 years
HD: Hammer drilling	static and quasi-static loads	Ø8 to Ø40 ZA-M12 to ZA-M24	Ø8 to Ø40 ZA-M12 to ZA-M24
HDB: Hammer drilling with hollow drill bit			
CD: Compressed air drilling			
DD: Diamond drilling	seismic action	Ø10 to Ø40	Ø10 to Ø40
	fire exposure	Ø8 to Ø40 ZA-M12 to ZA-M24	Ø8 to Ø40 ZA-M12 to ZA-M24
Temperature Range:	- 40°C to +80°C (max long-term temperature +50 °C and max short-term temperature +80 °C)		
Base materials:			
<ul style="list-style-type: none"> - Reinforced or unreinforced normal weight concrete according to EN 206:2013 + A1:2016. - Strength classes C12/15 to C50/60 according to EN 206:2013 + A1:2016. - Maximum chloride content of 0,40% (CL 0.40) related to the cement content according to EN 206:2013 + A1:2016. - Non-carbonated concrete. <p>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 $\phi + 60$ mm prior to the installation of the new rebar.</p> <p>The depth of concrete to be removed shall correspond to at least the minimum concrete cover in accordance with EN 1992-1-1:2004+AC:2010. The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.</p>			
Use conditions (Environmental conditions) with tension anchor ZA:			
<ul style="list-style-type: none"> - Structures subject to dry internal conditions (all materials). - For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class: <ul style="list-style-type: none"> • Stainless steel class A4 according to Annex A 5, Table A2: CRC III • High corrosion resistance steel HCR according to Annex A 5, Table A2: CRC V 			
Design:			
<ul style="list-style-type: none"> - 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 according to EN 1992-1-1:2004+AC:2010, EN 1992-1-2:2004+AC:2008 and Annex B 2 and B 3. - 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:			
<ul style="list-style-type: none"> - Dry or wet concrete. It must not be installed in flooded holes. - Overhead installation allowed. - Hole drilling by hammer drill (HD), hollow drill (HDB), diamond drill (DD) or compressed air drill mode (CD). - The installation of post-installed rebar resp. tension anchors shall be done only by suitable trained installer and under supervision on site; the conditions under which an installer may be considered as suitable trained and the conditions for supervision on site are up to the Member States in which the installation is done. - 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). 			
Tecfi Injection system XWE for rebar connection			Annex B 1
Intended use Specifications			

Figure B1: General construction rules 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 1992-1-1:2004+AC:2010.
- The joints for concreting must be roughened to at least such an extent that aggregate protrude.



- 1) If the clear distance between lapped bars exceeds 4ϕ or 50 mm, then the lap length shall be increased by the difference between the clear bar distance and the smaller of 4ϕ or 50 mm.

The following applies to Figure B1:

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 1992-1-1:2004+AC:2010, Section 4.4.1.2
ϕ	diameter of post-installed rebar
l_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3 for static loading and according to EN 1998-1:2004+AC:2009, section 5.6.3 for seismic action
l_v	effective embedment depth, $\geq l_0 + c_1$
d_0	nominal drill bit diameter, see Annex B 5

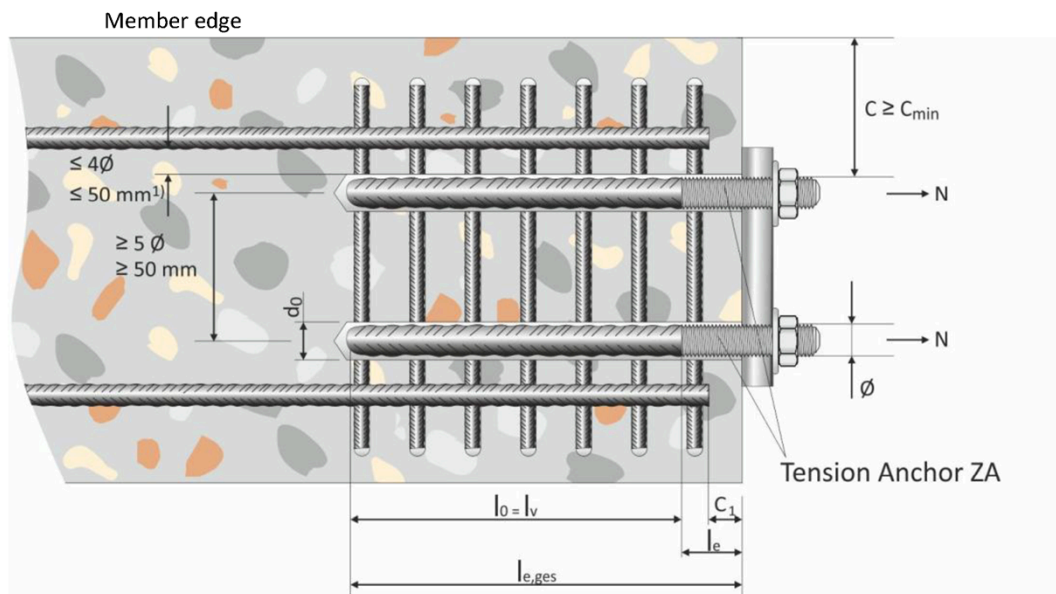
Tecfi Injection system XWE for rebar connection

Intended use
General construction rules for post-installed rebars

Annex B 2

Figure B2: General construction rules for tension anchors ZA

- The length of the bonded-in thread may not be accounted as anchorage.
- Only tension forces in the direction of the bar axis may be transmitted by the tension anchor ZA.
- The tension force must be transferred via an overlap joint to the reinforcement in the building part.
- The transfer of shear forces shall be ensured by appropriate additional measures, e.g. shear lugs or by anchors with an European technical assessment.
- In the anchor plate, the holes for the tension anchors shall be executed as elongated holes with axis in the direction of the shear force.



- 1) If the clear distance between lapped bars exceeds 4ϕ or 50 mm, then the lap length shall be increased by the difference between the clear bar distance and the smaller of 4ϕ or 50 mm.

The following applies to Figure B2:

c	concrete cover of tension anchor ZA
c_1	concrete cover at end-face of existing rebar
c_{min}	minimum concrete cover according to Table B1 and to EN 1992-1-1:2004+AC:2010, Section 4.4.1.2
ϕ	diameter of tension anchor
l_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section 8.7.3
l_v	effective embedment depth
l_e	length of bonded thread
$l_{e,ges}$	overall embedment depth, $\geq l_0 + c_2$
d_0	nominal drill bit diameter, see Annex B 5

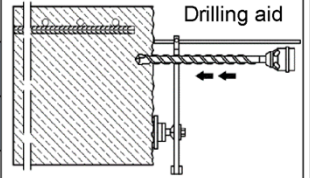
Tecfi Injection system XWE for rebar connection

Intended use
General construction rules for tension anchors ZA

Annex B 3

Table B1: Minimum concrete cover $c_{\min}^{1)}$ of post-installed rebar and tie rod ZA depending of drilling method

Drilling method	Rebar diameter	Without drilling aid	With drilling aid
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit	< 25 mm	30 mm + 0,06 · $l_v \geq 2 \varnothing$	30 mm + 0,02 · $l_v \geq 2 \varnothing$
	≥ 25 mm	40 mm + 0,06 · $l_v \geq 2 \varnothing$	40 mm + 0,02 · $l_v \geq 2 \varnothing$
DD: Diamond drilling	< 25 mm	Drill rig used as drilling aid	30 mm + 0,02 · $l_v \geq 2 \varnothing$
	≥ 25 mm		40 mm + 0,02 · $l_v \geq 2 \varnothing$
CD: Compressed air drilling	< 25 mm	50 mm + 0,08 · l_v	50 mm + 0,02 · l_v
	≥ 25 mm	60 mm + 0,08 · $l_v \geq 2 \varnothing$	60 mm + 0,02 · $l_v \geq 2 \varnothing$





1) see Annex B 2, Figure B1 and Annex B 3, Figure B2

Comments: The minimum concrete cover acc. EN 1992-1-1:2004+AC:2010 must be observed.
For the minimum concrete cover $c_{\min,seis}$ in case of a seismic action, see Table B2.

Table B2: Minimum concrete cover $\min c_{\min,seis}$

Drilling method	Design conditions	Distance to 1st edge	Distance to 2nd edge
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	Edge	≥ 2 \varnothing	≥ 2 \varnothing
	Corner	≥ 2 \varnothing	≥ 2 \varnothing
DD: Diamond drilling	Edge	≥ 4 \varnothing	≥ 8 \varnothing
	Corner	≥ 6 \varnothing	≥ 6 \varnothing

Table B3: Dispensing tools

Cartridge type/size	Hand tool		Pneumatic tool
Side-by-side cartridges 440 ml, 540 ml, 585 ml			
Side-by-side cartridges 1400 ml	-	-	

All cartridges could also be extruded by a battery tool.

Tecfi Injection system XWE for rebar connection

Intended use
Minimum concrete cover
Dispensing tools

Annex B 4

Bar size \varnothing	Tension anchor \varnothing	Drill bit - \varnothing			d_b Brush \varnothing	$d_{b,min}$ min. Brush \varnothing	Piston plug	Cartridge: 440, 540 or 585 ml				Cartridge: 1400 ml										
		HD	DD	CD				Hand or battery tool		Pneumatic tool		Pneumatic tool										
								$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension									
[mm]	[mm]	[mm]			[mm]	[mm]		[mm]		[mm]		[mm]										
8	-	10			ACD10	11,5	10,5	-	250	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	250	800	250	800	ACF10/0,75 or ACF16/1,8					
	-																	ACD12	13,5	12,5	-	700
10	-	12			ACD14	15,5	14,5	ACE14	250													
	-																	ACD16	17,5	16,5	ACE16	700
12	ZA-M12	14			ACD18	20,0	18,5	ACE18	700													
																		-	ACD20	22,0	20,5	ACE20
14	-	18			ACD25	27,0	25,5	ACE25	500									ACF10/0,75 or ACF16/1,8				
	-																		ACD26	28,0	26,5	ACE25
16	ZA-M16	20			ACD28	30,0	28,5	ACE28	500									ACF10/0,75 or ACF16/1,8				
																			-	ACD30	32,0	30,5
20	ZA-M20	25			ACD32	34,0	32,5	ACE32	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
															-	ACD35	37,0	35,5	ACE35	500	1000	2000
22	-	28			ACD40	43,5	40,5	ACE40	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
	-														ACD45	47,0	45,5	ACE45	500	1000	2000	
24/25	ZA-M24	30			ACD52	54,0	52,5	ACE52	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
															-	ACD28	30,0	28,5	ACE28	500	1000	2000
28	-	35			ACD32	34,0	32,5	ACE32	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
	-														ACD35	37,0	35,5	ACE35	500	1000	2000	
32/34	-	40			ACD45	47,0	45,5	ACE45	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
	-														ACD52	54,0	52,5	ACE52	500	1000	2000	
36	-	45			ACD55	58,0	55,5	ACE55	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
	-														ACD55	58,0	55,5	ACE55	500	1000	2000	
40	-	52			ACD55	58,0	55,5	ACE55	500	ACF10/0,75 or ACF16/1,8	1300	ACF10/0,75 or ACF16/1,8	2000	ACF16/1,8								
	-														ACD55	58,0	55,5	ACE55	500	1000	2000	
-	-	55			ACD55	58,0	55,5	ACE55	-	-	-	-	-	-								-

Table B5: Brushes, piston plugs, max anchorage depth and mixer extension, hammer drilling with hollow drill bit system (HDB)

Bar size \varnothing	Tension anchor \varnothing	Drill bit - \varnothing	d_b Brush - \varnothing	$d_{b,min}$ min. Brush \varnothing	Piston plug	Cartridge: 440, 540 or 585 ml				Cartridge: 1400 ml									
						Hand or battery tool		Pneumatic tool		Pneumatic tool									
						$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension								
[mm]	[mm]	[mm]				[mm]		[mm]		[mm]									
8	-	10			-	250	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	250	800	250	800	ACF10/0,75 or ACF16/1,8					
	-														700	250	700	250	1000
10	-	12			ACE14	700													
	-														250	700	250	1000	250
12	ZA-M12	14			ACE16	700													
															-	ACE18	250	700	250
14	-	18			ACE20	500									ACF10/0,75 or ACF16/1,8				
	-															ACE25	250	500	1000
16	ZA-M16	20			ACE28	500									ACF10/0,75 or ACF16/1,8				
																-	ACE30	250	500
20	ZA-M20	25			ACE32	500	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8								
												-	ACE35	250	500	1000	250	1000	
22	-	28			ACE40	500	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8								
	-											ACE32	250	500	1000	250	1000		
24/25	ZA-M24	30			ACE35	500	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8								
												-	ACE40	250	500	1000	250	1000	
28	-	35			ACE40	500	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8								
	-											ACE40	250	500	1000	250	1000		
32/34	-	40			ACE40	500	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8	1000	ACF10/0,75 or ACF16/1,8								
	-											ACE40	250	500	1000	250	1000		

Tecfi Injection system XWE for rebar connection	Annex B 5
Intended Use Parameter brushes, piston plugs, max anchorage depth and mixer extension	

Cleaning and installation tools

HDB – Hollow drill bit system



The hollow drill system consists of Heller Duster Expert hollow drill bit or a hollow drill bit with equivalent performance and a class M vacuum cleaner with a minimum negative pressure of 253 hPa and a flow rate of minimum 150 m³/h (42 l/s).

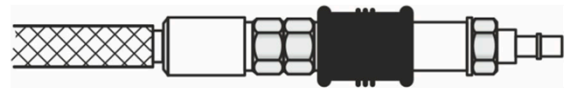
Hand pump DW01

(Volume 750 ml, $h_0 \geq 10$ d_s, d₀ ≤ 20mm)



Manual slide valve

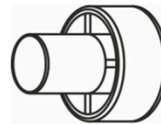
(min 6 bar)



Brush ACD



Piston Plug ACE



Brush extension ACH



Table B6: Working time and curing time

Temperature in base material			Maximum working time	Initial curing time ¹⁾	Minimum curing time ²⁾
T			t _{work}	t _{cure,ini}	t _{cure}
0 °C	up to	+ 4 °C	80 min	30 h	144 h
+ 5 °C	up to	+ 9 °C	80 min	20 h	48 h
+ 10 °C	up to	+ 14 °C	60 min	15 h	28 h
+ 15 °C	up to	+ 19 °C	40 min	9 h	18 h
+ 20 °C	up to	+ 24 °C	30 min	6 h	12 h
+ 25 °C	up to	+ 34 °C	12 min	4 h	9 h
+ 35 °C	up to	+ 39 °C	8 min	3 h	6 h
+40 °C			8 min	1,5 h	4 h
Cartridge temperature			+5 °C up to +40 °C		

1) After Initial curing time has elapsed, the installation of the connecting reinforcement and the construction of the formwork can be continued

2) The minimum curing time is only valid for dry base material.
In wet base material the curing time must be doubled.

Tecfi Injection system XWE for rebar connection

Intended Use

Cleaning and installation tools
Working time and curing time

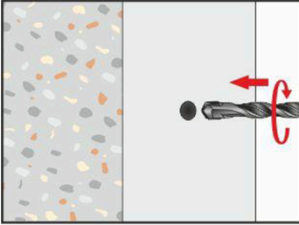
Annex B 6

Installation instructions

Attention: Before drilling, remove carbonated concrete and clean contact areas (see Annex B1)

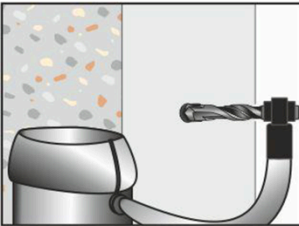
In case of aborted drill hole: the drill hole shall be filled with mortar.

Drilling of the bore hole



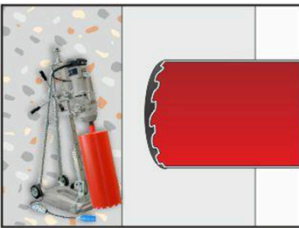
1a. Hammer drilling (HD) / Compressed air drilling (CD)

Drill a hole to the required embedment depth.
Drill bit diameter according to Table B4.
Proceed with Step 2 (MAC or CAC).



1b. Hollow drill bit system (HDB) (see Annex B 6)

Drill a hole to the required embedment depth.
Drill bit diameter according to B5.
The hollow drilling system removes the dust and cleans the bore hole.
Proceed with Step 3.



1c. Diamond drilling (DD)

Drill a hole to the required embedment depth required
Drill bit diameter according to Table B4.
Proceed with Step 2 (SPCAC).

Tecfi Injection system XWE for rebar connection

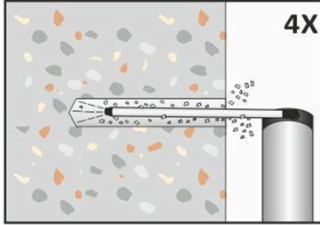
Intended use
Installation instruction

Annex B 7

Installation instructions (continuation)

Manual Air Cleaning (MAC)

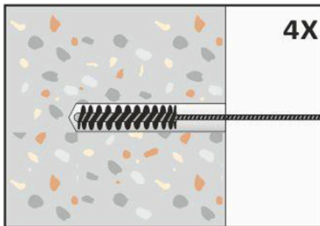
for drill hole diameter $d_0 \leq 20\text{mm}$ and drill hole depth $h_0 \leq 10\phi$ with drilling method HD/CD



4X

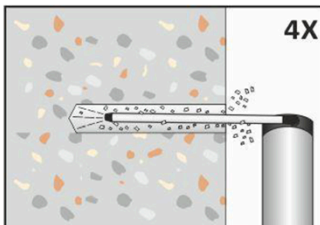
Attention! Standing water in the bore hole must be removed before cleaning.

2a. Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 6).



4X

2b. Brush the bore hole minimum 4x with brush ACD according to Table B4 over the entire embedment depth in a twisting motion (if necessary, a brush extension ACH shall be used.)

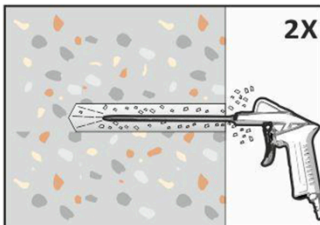


4X

2c. Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 6).

Compressed Air Cleaning (CAC):

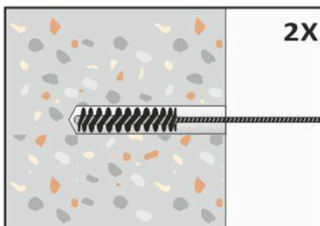
All diameter with drilling method HD/CD



2X

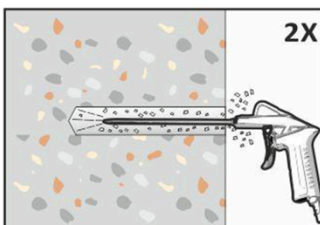
Attention! Standing water in the bore hole must be removed before cleaning.

2a. Blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 6) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



2X

2b. Brush the bore hole minimum 2x with brush ACD according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension ACH shall be used.)



2X

2c. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 6) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

Protect cleaned bore hole against re-contamination in an appropriate way. If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Tecfi Injection system XWE for rebar connection

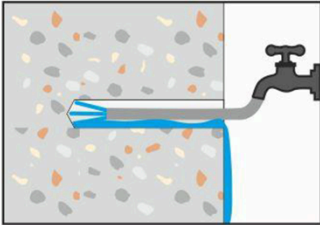
Intended use
Installation instructions (continuation)

Annex B 8

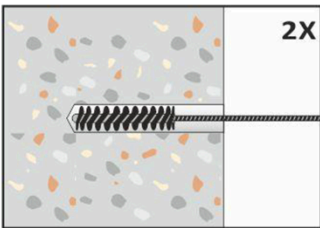
Installation instructions (continuation)

Flush & Compressed Air Cleaning (SPCAC):

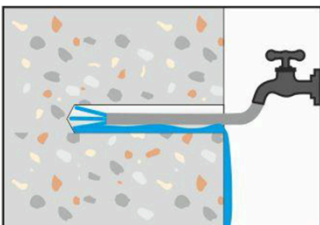
All diameter with drilling method DD



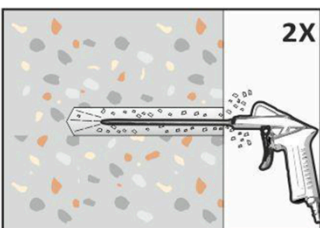
2a. Flushing with water until clear water comes out.



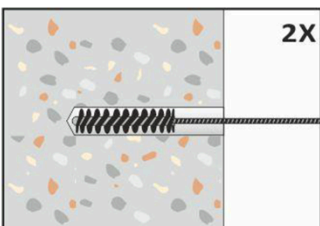
2b. Brush the bore hole minimum 2x with brush ACD according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension ACH shall be used.)



2c. Flushing again with water until clear water comes out.



2d. Blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 6) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



2e. Brush the bore hole minimum 2x with brush ACD according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension ACH shall be used.)



2f. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 6) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

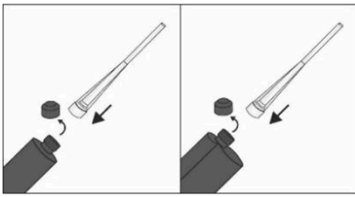
Protect cleaned bore hole against re-contamination in an appropriate way. If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Tecfi Injection system XWE for rebar connection

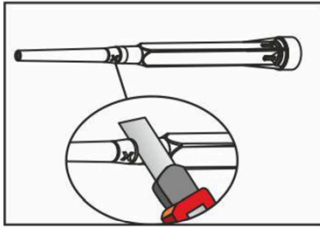
Intended use
Installation instructions (continuation)

Annex B 9

Installation instructions (continuation)



3. Screw on static-mixing nozzle DI03, and load the cartridge into an appropriate dispensing tool.
For every working interruption longer than the maximum working time t_{work} (Annex B 6) as well as for new cartridges, a new static-mixer shall be used.



- 3a. In case of using the mixer extension ACF16/1,8, cut off the tip of the mixer nozzle at position „X“.



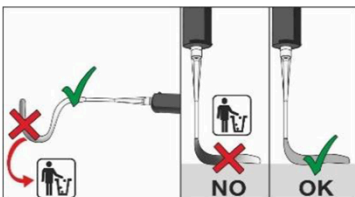
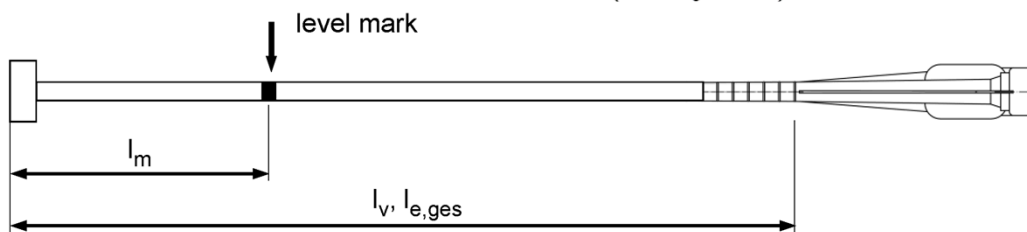
4. Mark embedment depth on the reinforcing bar.
The reinforcing bar shall be free of dirt, grease, oil or other foreign material.

5. Mark mixer nozzle and extension with mortar level mark l_m and anchorage depth l_v resp. $l_{e,ges}$

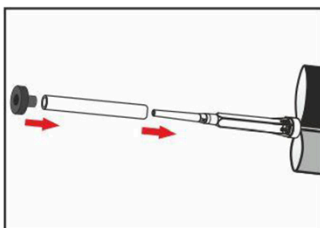
Quick estimation: $l_m = 1/3 \cdot l_v$

Optimum mortar volume:

$$l_m = l_v \text{ resp. } l_{e,ges} \cdot \left(1,2 \cdot \frac{\phi^2}{d_0^2} - 0,2 \right)$$



6. Not proper mixed mortar is not sufficient for fastening.
Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).



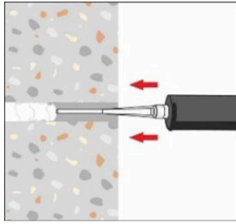
7. Piston plugs ACE and mixer nozzle extensions ACF shall be used according to Table B4 or B5.
Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.

Tecfi Injection system XWE for rebar connection

Intended Use
Installation instructions (continuation)

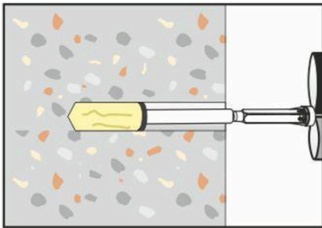
Annex B 10

Installation instructions (continuation)



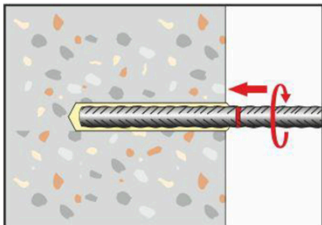
8a. **Injecting mortar without piston plug ACE:**

Starting at bottom of the hole and fill the hole with adhesive until the mortar level mark is visible. (If necessary, a mixer nozzle extension shall be used.)
Slowly withdraw of the static mixing nozzle avoid creating air pockets
Observe the temperature related working time t_{work} (Annex B 6).

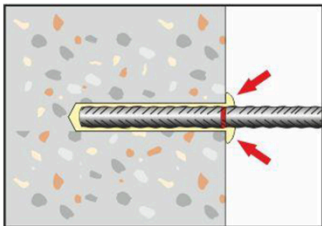


8b. **Injecting mortar with piston plug ACE:**

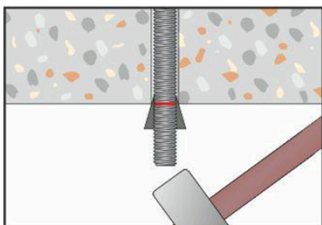
Insert piston plug to bottom of the hole and fill the hole with mortar until mortar level mark l_m is visible. (If necessary, a mixer nozzle extension shall be used.)
During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.
Observe the temperature related working time t_{work} (Annex B 6).



9. Insert the reinforcing bar while turning slightly up to the embedment mark.



10. Annular gap between reinforcing bar and base material must be completely filled with mortar. Otherwise, the installation must be repeated starting from step 8 before the maximum working time t_{work} has expired.



11. For application in vertical upwards direction the reinforcing bar shall be fixed (e.g. wedges).



12. Temperature related curing time t_{cure} (Annex B 6) must be observed.

After initial curing time $t_{cure,ini}$ has elapsed, the installation of the connecting reinforcement and the formwork can be continued. The full load to the reinforcing bar may be applied after the full curing time t_{cure} has elapsed.

Tecfi Injection system XWE for rebar connection

Intended Use
Installation instructions (continuation)

Annex B 11

Table C1: Characteristic tension resistance for tension anchor ZA

Tension Anchor			M12	M16	M20	M24
Steel, zinc plated (ZA vz)						
Characteristic tension resistance	$N_{Rk,s}$	[kN]	67	125	196	282
Partial factor	$\gamma_{Ms,N}$	[-]	1,4			
Stainless Steel (ZA A4 or ZA HCR)						
Characteristic tension resistance	$N_{Rk,s}$	[kN]	67	125	171	247
Partial factor	$\gamma_{Ms,N}$	[-]	1,4		1,3	1,4

Minimum anchorage length and minimum lap length under static or quasi-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 ($l_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $l_{0,min}$ acc. to Eq. 8.11) shall be multiply by the amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ according to Table C2.

Table C2: Amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ related to concrete class and drilling method; working life 50 and 100 years

Concrete class	Drilling method	Bar size	Amplification factor $\alpha_{lb} = \alpha_{lb,100y}$
C12/15 to C50/60	all drilling methods	8 mm to 40 mm ZA-M12 to ZA-M24	1,0

Table C3: Reduction factor $k_b = k_{b,100y}$ for all drilling methods; working life 50 and 100 years

Rebar	Concrete class									
	\emptyset	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 40 mm ZA-M12 to ZA-M24		1,0								

Table C4: Design values of the ultimate bond stress $f_{bd,PIR}$ and $f_{bd,PIR,100y}$ in N/mm² for all drilling methods and for good conditions; working life 50 and 100 years

$$f_{bd,PIR} = k_b \cdot f_{bd}$$

$$f_{bd,PIR,100y} = k_{b,100y} \cdot f_{bd}$$

with

f_{bd} : Design value of the ultimate bond stress in N/mm² considering the concrete classes, the rebar diameter, the drilling method for good bond condition (for all other bond conditions multiply the values by $\eta_1 = 0.7$) and recommended partial factor $\gamma_c = 1,5$ according to EN 1992-1-1:2004+AC:2010.

$k_b, k_{b,100y}$: Reduction factor according to Table C3

Rebar	Concrete class									
	\emptyset	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 32 mm ZA-M12 to ZA-M24		1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
34 mm		1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
36 mm		1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,1
40 mm		1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	4,0

Tecfi Injection system XWE for rebar connection

Performances

Characteristic tension resistance for tension anchor, Minimum anchorage length and minimum lap length, Amplification factor, Reduction factor and Design values of ultimate bond resistance

Annex C 1

Minimum anchorage length and minimum lap length under seismic action

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1:2004+AC:2010 ($l_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $l_{0,min}$ acc. to Eq. 8.11) shall be multiply by the amplification factor

$\alpha_{l_{b,seis}} = \alpha_{l_{b,seis,100y}}$ according to Table C5.

Table C5: Amplification factor $\alpha_{l_{b,seis}} = \alpha_{l_{b,seis,100y}}$ related to concrete class and drilling method; working life 50 and 100 years

Concrete class	Drilling method	Bar size	Amplification factor $\alpha_{l_{b,seis}} = \alpha_{l_{b,seis,100y}}$
C16/20 to C50/60	all drilling methods	10 mm to 40 mm	1,0

Table C6: Reduction factor $k_{b,seis} = k_{b,seis,100y}$ for all drilling methods; working life 50 and 100 years

Rebar \varnothing	Concrete classes								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
10 to 40 mm	No performance assessed	1,0							

Table C7: Design values of the ultimate bond stress $f_{bd,PIR,seis}$ and $f_{bd,PIR,seis,100y}$ in N/mm² for all drilling methods and for good conditions; working life 50 and 100 years

$$f_{bd,PIR,seis} = k_{b,seis} \cdot f_{bd}$$

$$f_{bd,PIR,seis,100y} = k_{b,seis,100y} \cdot f_{bd}$$

with

f_{bd} : Design value of the ultimate bond stress in N/mm² considering the concrete classes, the rebar diameter, the drilling method for good bond condition (for all other bond conditions multiply the value by $\eta_1 = 0.7$) and recommended partial factor $\gamma_c = 1.5$ according to EN 1992-1-1:2004+AC:2010.

$k_{b,seis}, k_{b,seis,100y}$: Reduction factor according to Table C6

Rebar \varnothing	Concrete classes								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
10 to 32 mm	No performance assessed	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
34 mm		2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
36 mm		1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,1
40 mm		1,8	2,1	2,5	2,8	3,1	3,4	3,7	4,0

Tecfi Injection system XWE for rebar connection

Performances

Minimum anchorage length and minimum lap length, Amplification factor, Reduction factor and Design values of ultimate bond stress under seismic action

Annex C 2

Design value of the ultimate bond stress $f_{bd,fi}$, $f_{bd,fi,100y}$ at increased temperature for concrete classes C12/15 to C50/60, (all drilling methods); working life 50 and 100 years:

The design value of the bond stress $f_{bd,fi}$ at increased temperature has to be calculated by the following equation:

For working life 50 years: $f_{bd,fi} = k_{fi}(\theta) \cdot f_{bd,PIR} \cdot \gamma_c / \gamma_{M,fi}$

with: $\theta \leq 278^\circ\text{C}$: $k_{fi}(\theta) = 4673,8 \cdot \theta^{-1,598} / (f_{bd,PIR} \cdot 4,3) \leq 1,0$
 $\theta > 278^\circ\text{C}$: $k_{fi}(\theta) = 0$

For working life 100 years: $f_{bd,fi,100y} = k_{fi,100y}(\theta) \cdot f_{bd,PIR,100y} \cdot \gamma_c / \gamma_{M,fi}$

with: $\theta \leq 278^\circ\text{C}$: $k_{fi,100y}(\theta) = 4673,8 \cdot \theta^{-1,598} / (f_{bd,PIR,100y} \cdot 4,3) \leq 1,0$
 $\theta > 278^\circ\text{C}$: $k_{fi,100y}(\theta) = 0$

$f_{bd,fi}$, $f_{bd,fi,100y}$ Design value of the ultimate bond stress at increased temperature in N/mm²

θ Temperature in °C in the mortar layer.

$k_{fi}(\theta)$, $k_{fi,100y}(\theta)$ Reduction factor at increased temperature.

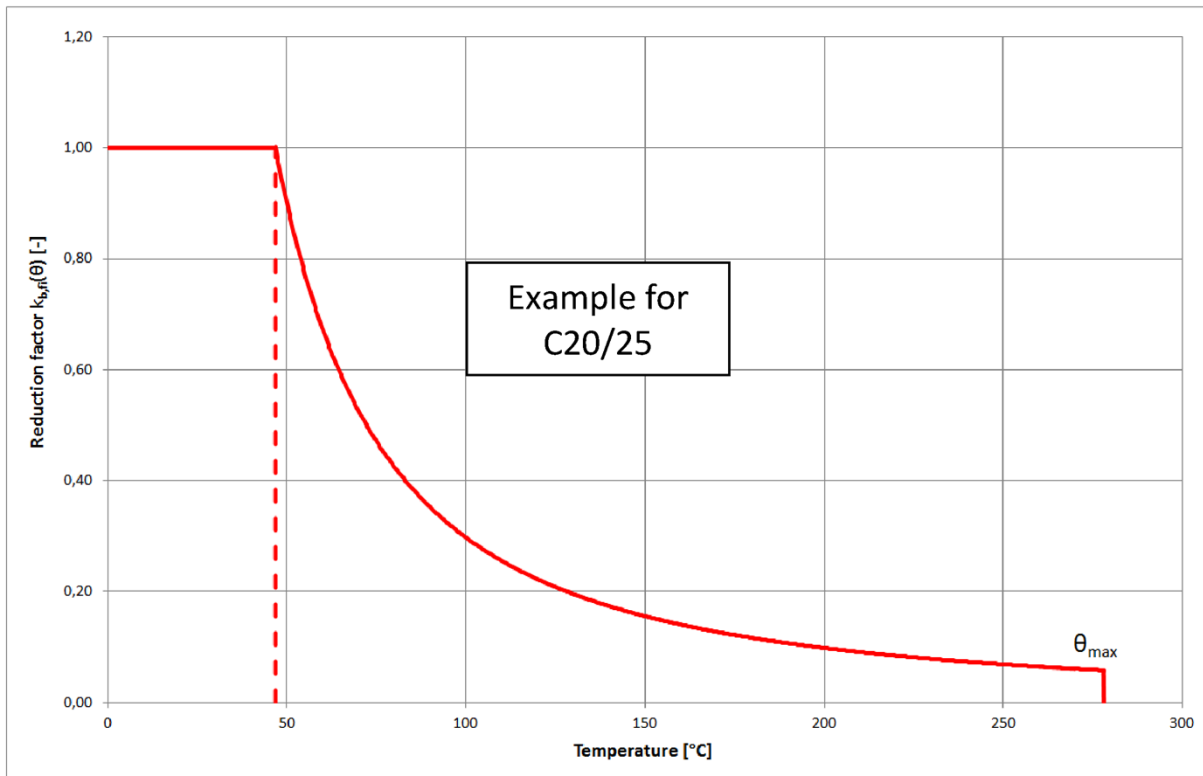
$f_{bd,PIR}$, $f_{bd,PIR,100y}$ Design value of the bond stress $f_{bd,PIR} = f_{bd,PIR,100y}$ in N/mm² in cold condition according to Table C4 considering the concrete classes, the rebar diameter, the drilling method and the bond conditions according to EN 1992-1-1:2004+AC:2010.

γ_c = 1,5, recommended partial factor according to EN 1992-1-1:2004+AC:2010

$\gamma_{M,fi}$ = 1,0, recommended partial factor according to EN 1992-1-2:2004+AC:2008

For evidence at increased temperature the anchorage length shall be calculated according to EN 1992-1-1: :2004+AC:2010 Equation 8.3 using the temperature-dependent design value of ultimate bond stress $f_{bd,fi}$, $f_{bd,fi,100y}$.

Example graph of Reduction factor $k_{fi}(\theta)$, $k_{fi,100y}(\theta)$ for concrete classes C20/25 for good bond conditions:



Tecfi Injection system XWE for rebar connection

Performances
Design value of ultimate bond stress at increased temperature

Annex C 3

Table C8: Characteristic tension resistance for tension anchor ZA under fire exposure

Tension Anchor				M12	M16	M20	M24
Steel, zinc plated (ZA vz)							
Characteristic tension resistance	R30	$N_{Rk,s,fi}$	[kN]	2,3	4,0	6,3	9,0
	R60			1,7	3,0	4,7	6,8
	R90			1,5	2,6	4,1	5,9
	R120			1,1	2,0	3,1	4,5
Stainless Steel (ZA A4 or ZA HCR)							
Characteristic tension resistance	R30	$N_{Rk,s,fi}$	[kN]	3,4	6,0	9,4	13,6
	R60			2,8	5,0	7,9	11,3
	R90			2,3	4,0	6,3	9,0
	R120			1,8	3,2	5,0	7,2

Tecfi Injection system XWE for rebar connection

Performances
Characteristic tension resistance for tension anchor ZA under fire exposure

Annex C 4