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European Technical Assessment

ETA-13/0861 of 05/05/2015

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**ELEMATIC ULTRA BLOK**
Famille de produit *Product family*	**Scellement d'armatures rapportées, diamètres 8 à 32 mm, avec Système d'injection ELEMATIC ULTRA BLOK** ***Post installed rebar connections diameter 8 to 32 mm made with ELEMATIC ULTRA BLOK injection mortar***
Titulaire *Manufacturer*	ITW CONSTRUCTION PRODUCTS ITALY SRL Viale Regione Veneto, 5 35127 Z. I. CAMIN- PADOVA ITALY
Usine de fabrication *Manufacturing plants*	Plant M2
Cette evaluation contient: *This Assessment contains*	16 pages incluant 11 annexes qui font partie intégrante de cette évaluation 16 *pages including 11 annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	ETAG 001 Partie 5, Version April 2013, utilisée en tant que EAD *ETAG 001 Part 5, Edition April 2013 used as EAD*
Cette evaluation remplace: *This Assessment replaces*	ATE-13/0861 valide du 17/06/2013 au 17/06/2018 *ETA-13/0861 with validity from 17/06/2013 to 17/06/2018*

Specific part

1 Technical description of the product

The ELEMATIC ULTRA BLOK is used for the connection, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of ordinary non-carbonated concrete C12/15 to C50/60. The design of the post-installed rebar connections is done in accordance with EN 1992-1-1 October 2005 (Eurocode 2).

Covered are rebar anchoring systems consisting of ELEMATIC ULTRA BLOK bonding material and an embedded straight deformed reinforcing bar diameter, d, from 8 to 32 mm with properties according to Annex C of EN 1992-1-1 and EN 10080. The classes B and C of the rebar are recommended.

An illustration of the product is provided in Annex A.

2 Specification of the intended use

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

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Ultimate bond resistance f_{bd}	See Annex C1

3.2 Safety in case of fire (BWR 2)

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

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

For Basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

3.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

4 Assessment and verification of constancy of performance (AVCP)

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

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	1

5 Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

The original French version is signed by

Charles Baloche
Technical Director

1 Official Journal of the European Communities L 254 of 08.10.1996

Installation anchor

Figure A1: Overlap joint with existing reinforcement for rebar connections of slabs and beams

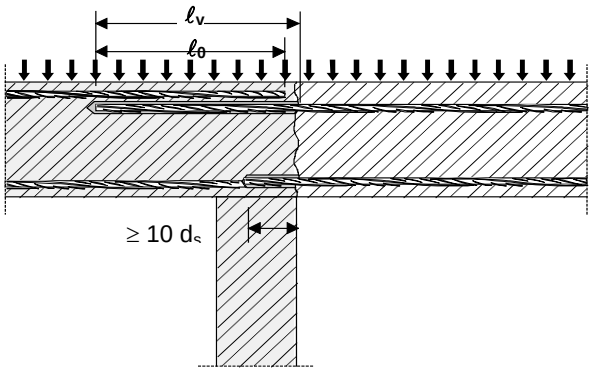


Figure A2: Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed in tension

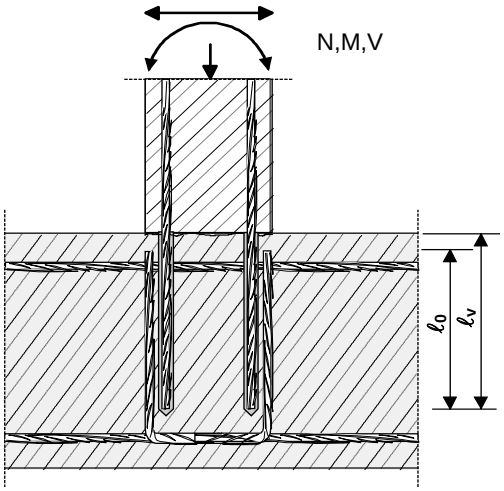


Figure A3: End anchoring of slabs or beams (e.g. designed as simply supported)

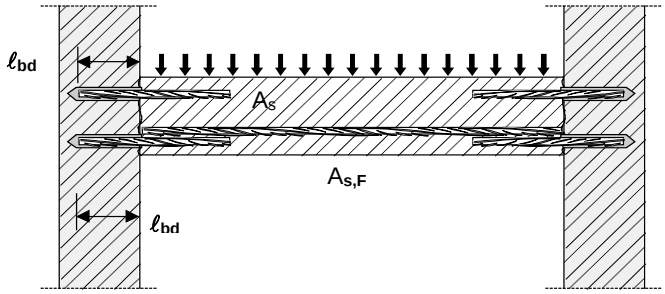


Figure A4: Rebar connection for components stressed primarily in compression.

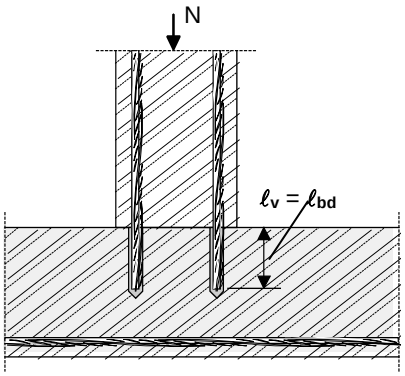
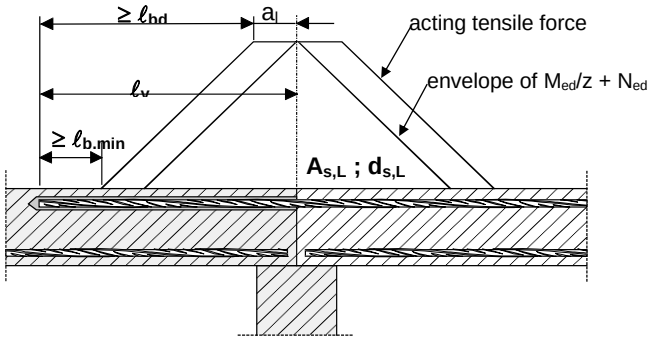


Figure A5: Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member



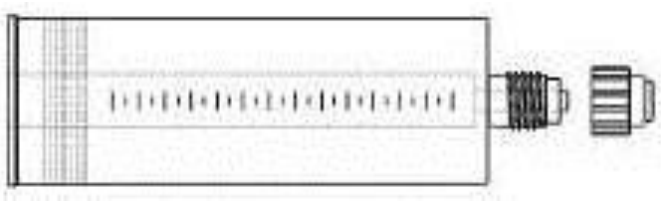
In the Figures no transverse reinforcement is plotted, the transverse reinforcement shall comply with EN 1992-1-1:2004/AC:2010.

Preparing of joints according to Annex B2

ELEMATIC ULTRA BLOK for rebar connection	**Annex A1**
Product description Installed condition and examples of use for rebars	

Marking of the mortar cartridges:

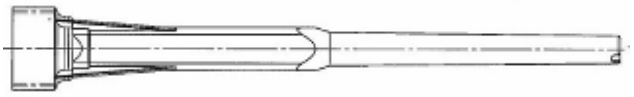
- Identifying mark of the producer
- Trade name
- Charge code number
- Storage life
- Curing and processing time



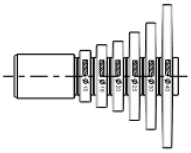
ULTRA BLOK cartridge 410 ml

- Metallic brush + Extension

- Mixing nozzle for cartridges 410ml



- Piston plug



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

Plastic extension for mixing nozzle (ϕ_{ext} x l) :

- 9x196
- 9x1000
- 13x1000
- 20 x 1000

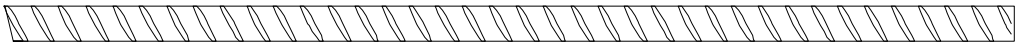
Dispensers

- Electric dispensers EGI 380/410
- Pneumatic dispensers P380/410
- Manual dispensers M380/410

ELEMATIC ULTRA BLOK for rebar connection	**Annex A2**
Product description ULTRA BLOK Cartridges and installation tools	

Figure 6: Reinforcing bar "rebar" according to EC2

5.1



Refer to EOTA TR 023:

This Technical Report covers post-installed rebar connections in non-carbonated concrete under the assumption only that the design of post-installed rebar connections is done in accordance with EN 1992-1-1.

Covered are rebar anchoring systems consisting of bonding material and an embedded straight deformed reinforcing bar with properties according to Annex C of EN 1992-1-1; the classes B and C of the rebar are recommended.

Refer to EN 1992-1-1 Annex C Table C.1 and C.2N Properties of reinforcement:

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

Rib height h:

The maximum outer rebar diameter over the rips shall be nominal diameter of the bar $d_{nom}+0,20 \cdot d_{nom}$

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000-12.
- Strength classes C12/15 to C50/60 according to EN 206-1:2000-12.
- Maximum chloride concrete of 0,40% (CL 0.40) related to the cement content according to EN 206-1:2000-12.
- Non-carbonated concrete.
  Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of 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 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.

Temperature Range:

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

Design:

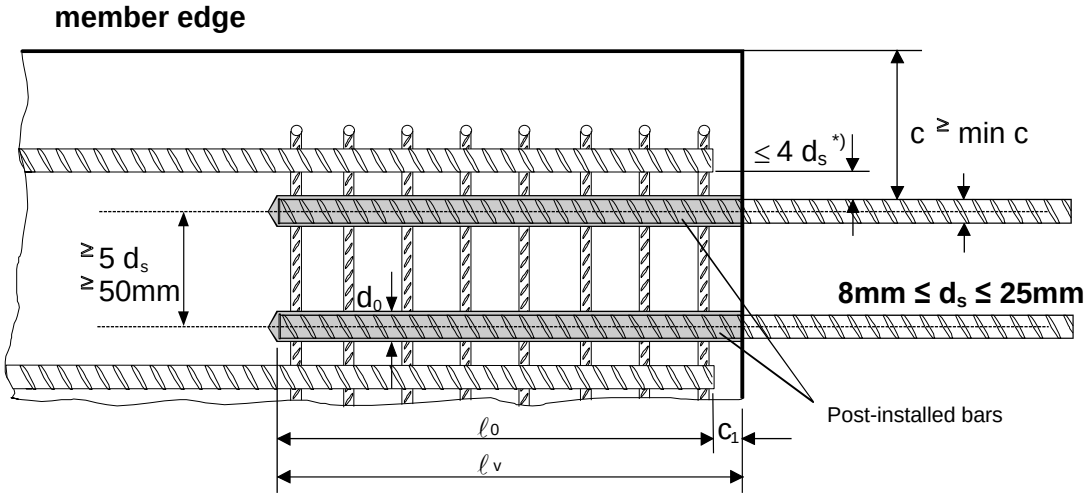
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design according to EN 1992-1-1:2004/AC:2010 and Annex B 2.
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

Installation:

- Dry or wet concrete.
- It must not be installed in flooded holes.
- Overhead installation is permitted.
- Hole drilling by hammer drill, hammer drill with hollow drill bit or diamond drill techniques.
- The installation of post-installed rebar 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).

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.



*) If the clear distance between lapped bars exceeds $4d_s$, then the lap length shall be increased by the difference between the clear bar distance and $4d_s$.

c	concrete cover of post-installed rebar
c_1	concrete cover at end-face of existing rebar
min c	minimum concrete cover according to Table B1 and to EN 1992-1-1:2004 AC:2010, Section 4.4.1.2
d_s	diameter of post-installed rebar
ℓ_0	lap length, according to EN 1992-1-1:2004/AC:2010, Section 8.7.3
ℓ_v	effective embedment depth, $\geq \ell_0 + c_1$
d_0	nominal drill bit diameter, see Annex B3

Perçage du trou:

Percer le trou à la profondeur requise en utilisant :

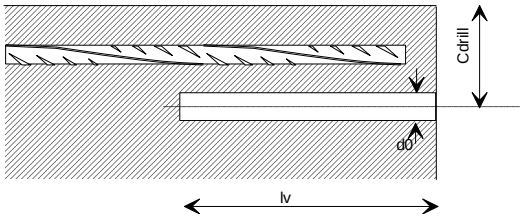
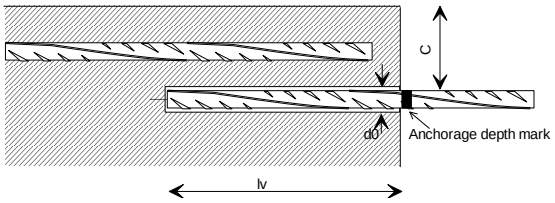
	Rotary hammer drilling or compressed air drilling.
	Electrical hammer drilling with XTD hollow drill bit used in relation with a 1600watt vacuum at least. This drilling technique allows for cleaning the hole from the dust debris while operating drilling. No further cleaning is then required before injecting resin.
	Diamond core drilling (Water in the hole is not permitted)

Rebar diameter *) d_{nom}	Nominal drilling diameter d_{cut}			Max Permissible anchorage depth l_v
	Drill bit	Hollow drill bit XTD (2)	Diamond core	ULTRA BLOK Dispensers **M380/410, P380/410, EGI 380/410**
[mm]	[mm]	[mm]	[mm]	[mm]
8	10	-	10	900 (1)
10	12	14	12	
12	15	16	15	
14	18	18	18	
16	20	20	20	
20	25	25	25	
25	30	30-32	30	
28	35	-	-	
32	40	-	-	

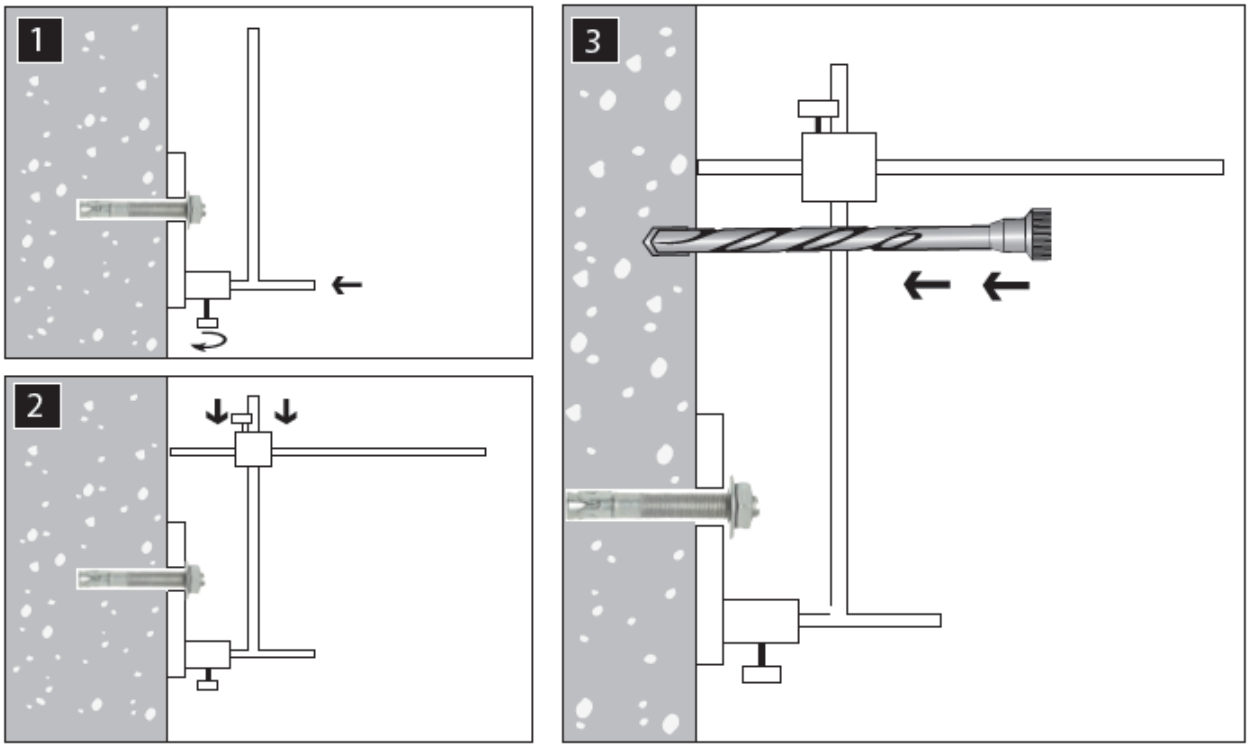
(1) The cartridge must be stored at ambient temperature (20°C)
(2) Maximum working length : 600 mm

Tableau 1 : Drilling diameter and maximum anchorage length.

Nota : The maximum outer rebar diameter over the rips shall be nominal diameter of the bar $d_{nom} + 0{,}20 \cdot d_{nom}$

	• Observe concrete coverage, c, as per setting plan. • Drill parallel to the edge
	• Put the anchorage depth mark on the rebar

Drilling the hole:



Minimum concrete cover:

$c_{min} = 30 + 0{,}06\ l_v \geq 2d_s$ (mm) for hammer drilled holes without drilling aid

$c_{min} = 30 + 0{,}03\ l_v \geq 2d_s$ (mm) for hammer drilled holes with drilling aid

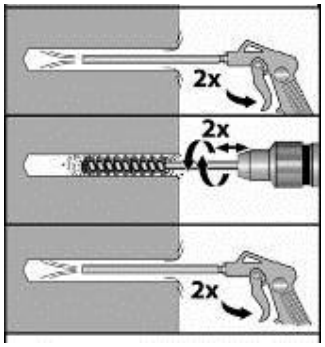
$c_{min} = 50 + 0{,}08\ l_v \geq 2d_s$ (mm) for compressed air drilled holes

Minimum clear spacing between two post-installed bars $a = 40\ mm \geq 4d_s$

ELEMATIC ULTRA BLOK for rebar connection	**Annex B3**
Intended Use Installation instructions : drilling hole, minimum concrete cover	

Cleaning the hole:

Hammer drilling technique (with standard drill bit for concrete)

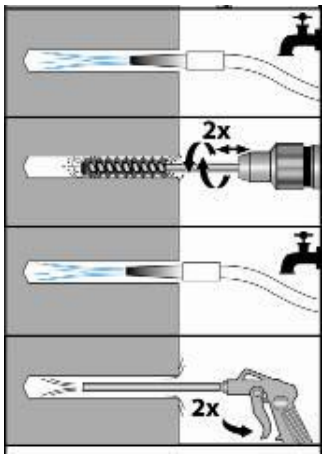


1. Insert air nozzle fitted with the relevant plastic extension to bottom of the hole and blow out at least 2 times using oil free compressed air (6 bars min.) and until no more dust is evacuated.
2. Using the relevant brush and ELEMATIC extension fitted on a drilling machine, starting from the top of the hole, move downward to the bottom of the hole (duration 5s) then move upward to the top of the hole (duration 5s). Repeat this operation.
3. Insert air nozzle fitted with the relevant plastic extension to bottom of the hole and blow out at least 2 times using oil free compressed air (6 bars min.) and until no more dust is evacuated.

Hammer drilling technique with hollow drill bit XTD

Electrical hammer drilling with XTD hollow drill bit used in relation with a 1600 watt vacuum at least. This drilling technique allows for cleaning the hole from the dust debris while operating drilling. No further cleaning is then required before injecting resin.

Diamond core drilling technique



1. Clean the hole with tap water
2. Using the relevant brush and extension fitted on a drilling machine, starting from the top of the hole, move downward to the bottom of the hole (duration 5s) then move upward to the top of the hole (duration 5s). Repeat this operation.
3. Clean the hole with tap water
4. Insert air nozzle fitted with the relevant plastic extension to bottom of the hole and blow out at least 2 times using oil free compressed air (min. 6 bars) and until no more dust is evacuated.

Rebar diameter	Brushes diameter	Extension for brushes	Plastic extension for compressed air
[mm]	[mm]	[-]	[-]
8	11	Lg 325 mm	9x196 9x1000
10	13		
12	16		
14	20		
16	22		
20	26		
25	32		
32	42		

The diameter of the round steel brush shall be checked before use. The minimum brush diameter has to be at least equal to the borehole diameter d_0. The round steel brush shall produce natural resistance as it enters the drill hole. If this is not the case, please use a new brush or a brush with a larger diameter.

ELEMATIC ULTRA BLOK for rebar connection

Annex B4

Intended Use

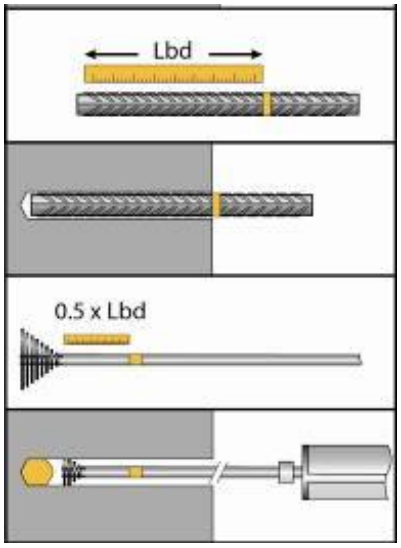
Installation instructions : cleaning

Safety precaution

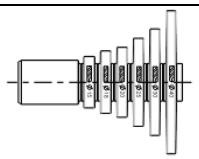
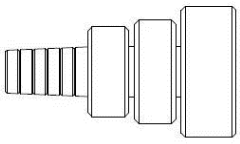
The safety data sheet must be read before using the product and the safety instructions followed.

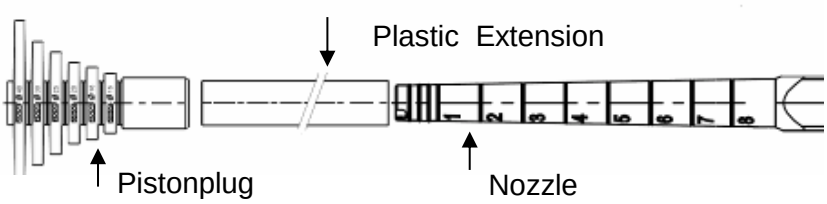
- Storage temperature of cartridge +0°C à +35 °C
- Cartridge temperature at time of installation: Must be ≥ +5°C
- Base material temperature at time of installation: Must be between -5°C and +40°C
- Check the date of expiry of the cartridge

Dispensing into the hole:



1. Put the anchorage depth mark on the rebar.
2. Check the anchorage depth.
3. Cut the piston plug at the relevant diameter. The volume of resin that need to be injected in the hole must be indicated on the mixing nozzle or its extension. The marking must be placed at 0.5 times the anchorage depth.
4. Dispense to waste the first trigs of every new cartridge until an even color is achieved.
5. Insert the nozzle to the far end of the hole, and inject the resin, withdrawing the nozzle as the hole fills in order to avoid trapping air bubbles. Fill the hole until the mark appear.

Drilled Hole diameter	Plastic extension for mixing nozzle	Mixing nozzle		Piston plug
	ϕ_{ext} x l			
[mm]	[mm]	[–]	[–]	[–]
10 à 40	9x196 9x1000	Mixing nozzle 380 - 410		
15 à 40	13x1000	Mixing nozzle 380 - 410	+ Réducteur de buse	
35 à 40	20 x 100	High flow mixing nozzle 825		



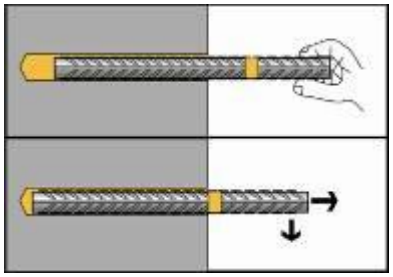
ELEMATIC ULTRA BLOK for rebar connection

Annex B5

Intended Use

Installation instructions : resin injection

Inserting the rebar:



1. Immediately insert the rebar, slowly and with a slight twisting motion. Remove excess resin from around the mouth of the hole before it sets. Control the embedment depth.
2. Leave the rebar undisturbed until the cure time has elapse.

Ambient temperature (°C)	Processing time (min)	Curing time in dry concrete (min)	Curing time in wet concrete (min)
5° à 9°C	11	210	420
10° à 19° C	6	60	120
20° à 29°C	3	40	80
30° à 39°C	1	35	70
40° C	1	30	60

Table 3: Processing and curing time for ULTRA BLOK resin

Rebar diameter	Minimum anchorage depth	
	Anchoring rebar $l_{b,min}$	Overlap joint $l_{0,min}$
[mm]	[mm]	[mm]
8	113	200
10	142	200
12	170	200
14	198	210
16	227	240
20	284	300
25	354	375
28	397	420
32	454	480

Minimum anchorage length for anchoring rebar in tension:
$l_{b,mi,n}$ = Max (0,3 $l_{b,rqd}$; 10 ϕ; 100mm)

(EN 1992-1-1 Equation 8.6)

minimum anchorage length for overlap joint:
$l_{0,mi,n}$ = Max (0,3.α_6.$l_{b,rqd}$; 15 ϕ; 200mm)

(EN 1992-1-1 Equation 8.11)

Nota: The minimum anchorage depth are valid for “good bond conditions” as described in EN 1992-1-1.

Table 4: Setting data

	Ultimate bond resistance f_{bd} acc. EN 1992-1-1 for hammer drilling and air compressed drilling								
Size	C12/15	C16/20	**C20/25**	C25/30	C30/37	C35/45	C40/50	C45/55	**C50/60**
ϕ 8	1.6	2.0	2.3	2.7	3.0	3.4	3.7	4.0	4.3
ϕ 10									
ϕ 12									
ϕ 14									
ϕ 16									
ϕ 20									
ϕ 25									
ϕ 28									
ϕ 30									
ϕ 32									

Table 5: Ultimate bond resistance f_{bd} of ULTRA BLOK resin acc. EN 1992-1-1 for hammer drilling and air compressed drilling

	Ultimate bond resistance f_{bd} acc.EN 1992-1-1 for hammer drilling with XTD hollow drill bit								
Size	C12/15	C16/20	**C20/25**	C25/30	C30/37	C35/45	C40/50	C45/55	**C50/60**
ϕ 10	1.6	2.0	2.3	2.7	3.0	3.4	3.7	4.0	4.0
ϕ 12									
ϕ 14									
ϕ 16									
ϕ 20									
ϕ 25									

Table 6: Ultimate bond resistance f_{bd} of ULTRA BLOK resin acc. EN 1992-1-1 for hammer drilling with XTD hollow drill bit

	Ultimate bond resistance f_{bd} acc. EN 1992-1-1 for diamond core drilling technique								
Size	C12/15	C16/20	**C20/25**	C25/30	C30/37	C35/45	C40/50	C45/55	**C50/60**
ϕ 8	1.6	2.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3
ϕ 10									
ϕ 12									
ϕ 14									
ϕ 16									
ϕ 20									
ϕ 25									

Table 7: Ultimate bond resistance f_{bd} of ULTRA BLOK resin acc. EN 1992-1-1 for diamond core drilling technique

Nota : The values given in tables 5, 6 and 7 are valid for “good bond conditions” as described in EN 1992-1-1. For all other conditions multiply the values by 0.7.

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ELEMATIC ULTRA BLOK for rebar connection

Annex C1

Performances

Design values for ultimate bond resistance f_{bd}

ELEMATIC ULTRA BLOK – Anchoring of Rebar HA Fe E500 – C20/25 concrete (f_{bd}=2.3Mpa)

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			α_2 **or** α_5= 0,7 $\alpha_1 = \alpha_3 = \alpha_4 = 1,0$		
	Anchorage length l_{bd}	Tension load	Mortar volume V	Anchorage length l_{bd}	Tension load	Mortar volume V
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	113 *	6.56	4	113 *	9.37	4
	170	9.83	6	150	12.39	5
	240	13.87	8	180	14.86	6
	310	17.92	11	220	18.17	7
	378	21.85	13	265	21.85	9
10	142 *	10.24	6	142 *	14.63	6
	220	15.90	9	180	18.58	7
	300	21.68	12	230	23.74	10
	380	27.46	16	280	28.90	12
	473	34.15	20	331	34.15	14
12	170 *	14.75	13	170 *	21.07	13
	260	22.54	20	220	27.25	17
	360	31.21	27	280	34.68	21
	460	39.89	35	340	42.12	26
	567	49.17	43	397	49.17	30
14	198 *	20.08	24	198 *	28.68	24
	310	31.36	37	260	37.57	31
	430	43.50	52	330	47.69	40
	540	54.63	65	390	56.36	47
	662	66.93	80	463	66.93	56
16	227 *	26.23	31	227 *	37.46	31
	350	40.46	48	300	49.55	41
	490	56.65	67	370	61.11	50
	620	71.68	84	450	74.32	61
	756	87.42	103	529	87.42	72
20	284 *	40.98	60	284 *	58.54	60
	430	62.14	91	370	76.39	78
	590	85.26	125	470	97.03	100
	740	106.94	157	560	115.61	119
	900	130.06	191	662	136.59	140
25	354 *	64.03	92	354 *	91.47	92
	490	88.51	127	470	121.29	122
	620	112.00	161	590	152.26	153
	760	137.29	197	700	180.64	181
	900	162.58	233	827	213.42	214
28	397 *	80.32	165	397 *	114.74	165
	520	105.21	216	520	150.29	216
	640	129.48	266	640	184.98	266
	770	155.79	320	770	222.55	320
	900	182.09	374	900	260.12	374
32	454 *	104.90	246	454 *	149.86	246
	560	129.48	304	560	184.98	304
	670	154.92	364	670	221.31	364
	780	180.35	423	780	257.65	423
	900	208.10	489	900	297.28	489

1) Tabulated maximum tension loads are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions the values for tension loads must be multiplied by 0.7.

2) The volume V of mortar can be estimated using the equation $V = 1.2.(do^2-d^2).\pi.l_{bd}/4$

* Values corresponding to the minimum anchorage length $l_{b,min}$

ELEMATIC ULTRA BLOK for rebar connection

Annex C2

Performances

Design values : example

ELEMATIC ULTRA BLOK – Overlap joint of Rebar HA Fe E500 – C20/25 concrete (f_{bd}=2.3Mpa)

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=\alpha_6=1,0$			α_2 **or** α_5= 0,7 $\alpha_1=\alpha_3=\alpha_4=\alpha_6=1,0$		
	Lap splice length l_0	Tension load	Mortar volume V	Lap splice length l_0	Tension load	Mortar volume V
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	200 *	11.56	7	200 *	16.52	7
	240	13.87	8	210	17.34	7
	280	16.19	10	230	18.99	8
	330	19.08	11	240	19.82	8
	378	21.85	13	265	21.85	9
10	200 *	14.45	8	200 *	20.64	8
	260	18.79	11	230	23.74	10
	330	23.84	14	260	26.84	11
	400	28.90	17	290	29.93	12
	473	34.15	20	331	34.15	14
12	200 *	17.34	15	200 *	24.77	15
	290	25.15	22	240	29.73	18
	380	32.95	29	290	35.92	22
	470	40.75	36	340	42.12	26
	567	49.17	43	397	49.17	30
14	210 *	21.24	25	210 *	30.35	25
	320	32.37	39	270	39.02	33
	430	43.50	52	330	47.69	40
	540	54.63	65	390	56.36	47
	662	66.93	80	463	66.93	56
16	240 *	27.75	33	240 *	39.64	33
	360	41.62	49	310	51.20	42
	490	56.65	67	380	62.76	52
	620	71.68	84	450	74.32	61
	756	87.42	103	529	87.42	72
20	300 *	43.35	64	300 *	61.93	64
	450	65.03	95	390	80.51	83
	600	86.71	127	480	99.09	102
	750	108.38	159	570	117.68	121
	900	130.06	191	662	136.59	140
25	375 *	67.74	97	375 *	96.77	97
	500	90.32	130	480	123.87	124
	630	113.80	163	600	154.84	156
	760	137.29	197	710	183.22	184
	900	162.58	233	827	213.42	214
28	420 *	84.97	175	420 *	121.39	175
	540	109.25	224	540	156.07	224
	660	133.53	274	660	190.76	274
	780	157.81	324	780	225.44	324
	900	182.09	374	900	260.12	374
32	480 *	110.99	261	480 *	158.55	261
	580	134.11	315	580	191.58	315
	690	159.54	375	690	227.92	375
	790	182.66	429	790	260.95	429
	900	208.10	489	900	297.28	489

1) Tabulated maximum tension loads are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions the values for tension loads must be multiplied by 0.7.

2) The volume V of mortar can be estimated using the equation $V = 1.2.(do^2-d^2).\pi.l_{bd}/4$

* Values corresponding to the minimum anchorage length $l_{b,min}$

ELEMATIC ULTRA BLOK for rebar connection

Annex C3

Performances

Design values : example