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European Technical Assessment

**ETA 17/0188
of 24/02/2017**

Technical Assessment Body issuing the ETA: Technical and Test Institute
for Construction Prague

Trade name of the construction product

SMART S-IRE for rebar connection

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

Product area code: 33
Post installed rebar connections
with SMART S-IRE injection mortar

Manufacturer

pgb-Polska Sp. z o.o.
ul. Fryderyka Wilhelma Redena 3
41-807 Zabrze
Polska

Manufacturing plant

pgb-Polska Sp. z o.o. Plant 1

**This European Technical Assessment
contains**

17 pages including 13 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**

ETAG 001-Part 1 and Part 5, edition 2013,
used as European Assessment Document
(EAD)

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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1. Technical description of the product

The SMART S-IRE injection system is a 3:1 pure epoxy bonded anchor used for the connection, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete. The design of the post-installed rebar connections is done in accordance with the regulations for reinforced concrete constructions.

Reinforcing bars made of steel with a diameter d from 8 to 32 mm and SMART S-IRE chemical mortar are used for rebar connections. The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between embedded element, injection mortar and concrete.

The illustration and the description of the product are given in Annex A.

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

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex 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 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
Design values of the ultimate bond resistance	See Annex C 1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfies requirements for Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and 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 Regulation (EU) No 305/2011, 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 Sustainable use of natural resources (BWR 7)

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

3.6 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.

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

According to the Decision 96/582/EC of the European Commission¹ the system of assessment 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 or heavy units such as cladding and suspended ceilings.	-	1

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

5.1 Tasks of the manufacturer

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European Technical Assessment.

The manufacturer may only use raw materials stated in the technical documentation of this European Technical Assessment.

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technical and Test Institute for Construction Prague.² The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

The manufacturer shall, on the basis of a contract, involve a body which is notified for the tasks referred to in section 4 in the field of anchors in order to undertake the actions laid down in section 5.2. For this purpose, the control plan referred to in this section and section 5.2 shall be handed over by the manufacturer to the notified body involved.

The manufacturer shall make a declaration of performance, stating that the construction product is in conformity with the provisions of this European Technical Assessment.

¹ Official Journal of the European Communities L 254 of 08.10.1996

² The control plan is a confidential part of the documentation of the European Technical Assessment, but not published together with the ETA and only handed over to the approved body involved in the procedure of AVCP.

5.2 Tasks of the notified bodies

The notified body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The notified certification body involved by the manufacturer shall issue a certificate of constancy of performance of the product stating the conformity with the provisions of this European Technical Assessment.

In cases where the provisions of the European Technical Assessment and its control plan are no longer fulfilled the notified body shall withdraw the certificate of constancy of performance and inform Technical and Test Institute for Construction Prague without delay.

Issued in Prague on 24.02.2017

By

Ing. Mária Schaan

Head of the Technical Assessment Body

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

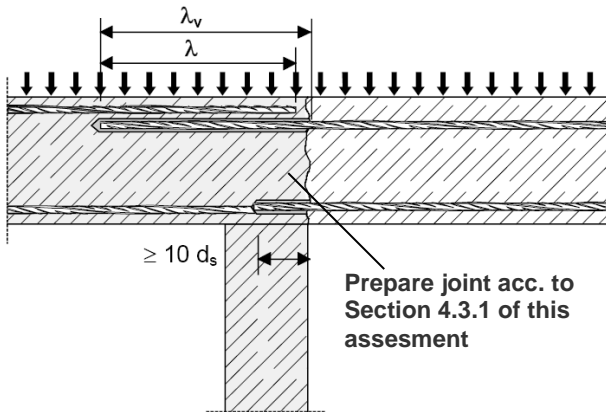


Figure A2: Overlap joint at a foundation of a column or wall where the rebars are stressed in tension

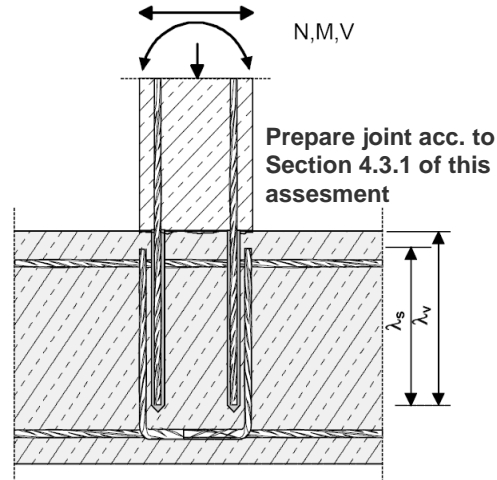


Figure A3: End anchoring of slabs or beams, designed as simply supported

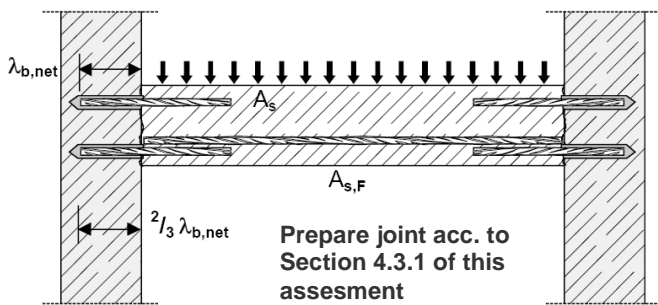


Figure A4: Rebar connection for components stressed primarily in compression. The rebars are stressed in compression.

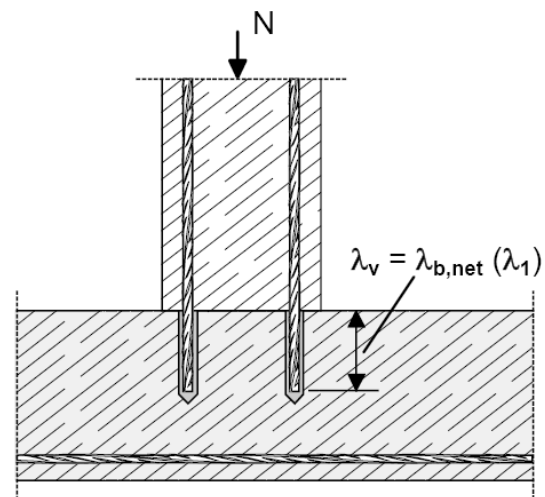
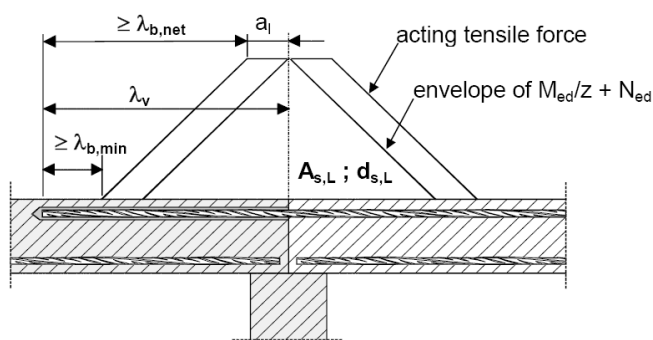


Figure A5: Anchoring of reinforcement to cover the line of acting tensile force



Note to Figure A1 to A5:

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 EC2.

SMART S-IRE

Product description

Installed condition and examples of use for rebars

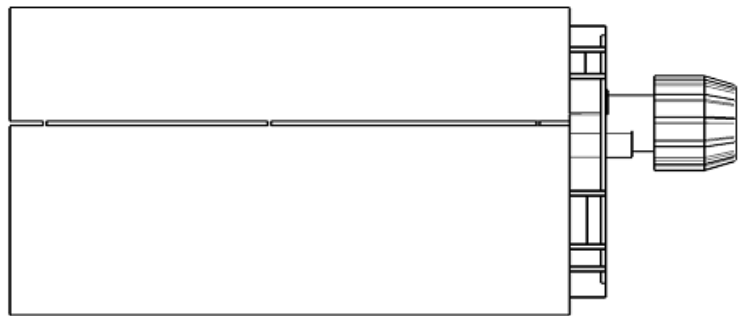
Annex A 1

Mortar cartridges

Side by side cartridge

SMART S-IRE

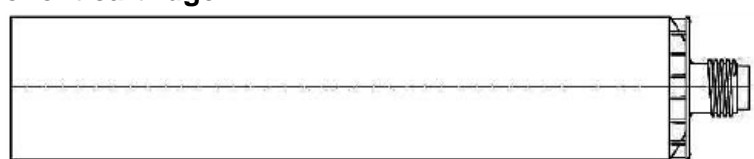
385 ml
585 ml



Two part foil in a single piston component cartridge

SMART S-IRE

300 ml

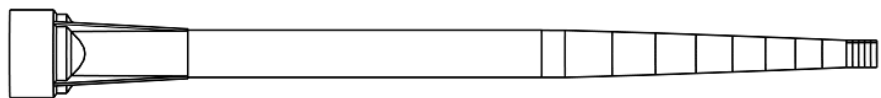


Marking of the mortar cartridges

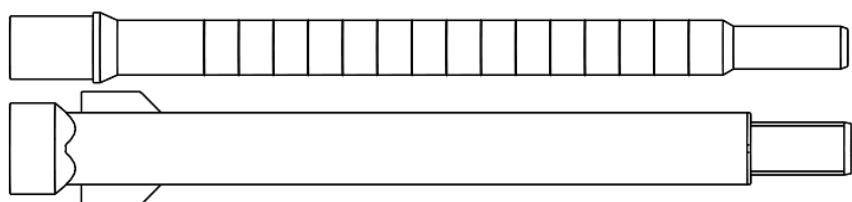
Identifying mark of the producer, Trade name, Charge code number, Storage life, Curing and processing time

Mixing nozzle

SMCH4-05



SMCH4-07



SMART S-IRE

Product description
Injection system

Annex A 2

Rebar Ø8, Ø10, Ø12, Ø14, Ø16, Ø20, Ø25, Ø28, Ø32

Figure A6: Reinforcing bar



Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004.

- The maximum outer rebar diameter over the ribs shall be:
 Nominal diameter of the rib $d + 2 \cdot h$ ($h \leq 0,07 \cdot d$)
 (d: nominal diameter of the bar; h: rib height of the bar)

Table A1: Materials

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 $k = (f_t / f_y)_k$		$\geq 1,08$	$\geq 1,15$ < 1,35
Characteristic strain at maximum force ϵ_{uk} (%)		$\geq 5,0$	$\geq 7,5$
Bendability		Bend / Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) ≤ 8	$\pm 6,0$	
	Nominal bar size (mm) > 8	$\pm 4,5$	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12	0,040	
	Nominal bar size (mm) > 12	0,056	

SMART S-IRE

Product description
Rebar and materials

Annex A 3

Specifications of intended use

Anchorage subject to:

- Static and quasi-static load.

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 $d_s + 60$ mm) prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least minimum concrete cover in accordance with EN 1992-1-1:2004.

The foregoing may be neglected if building components are new and not carbonated.

Temperature range:

- -40°C to $+80^{\circ}\text{C}$ (max. short. term temperature $+80^{\circ}\text{C}$ and max. long term temperature $+40^{\circ}\text{C}$)

Use conditions (Environmental conditions)

- The rebars may be installed in dry or wet concrete.

Design:

- The 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
- The 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.
- Hole drilling by hammer drill, compressed air drill mode or diamond core drilling.
- The installation of post-installed rebars 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

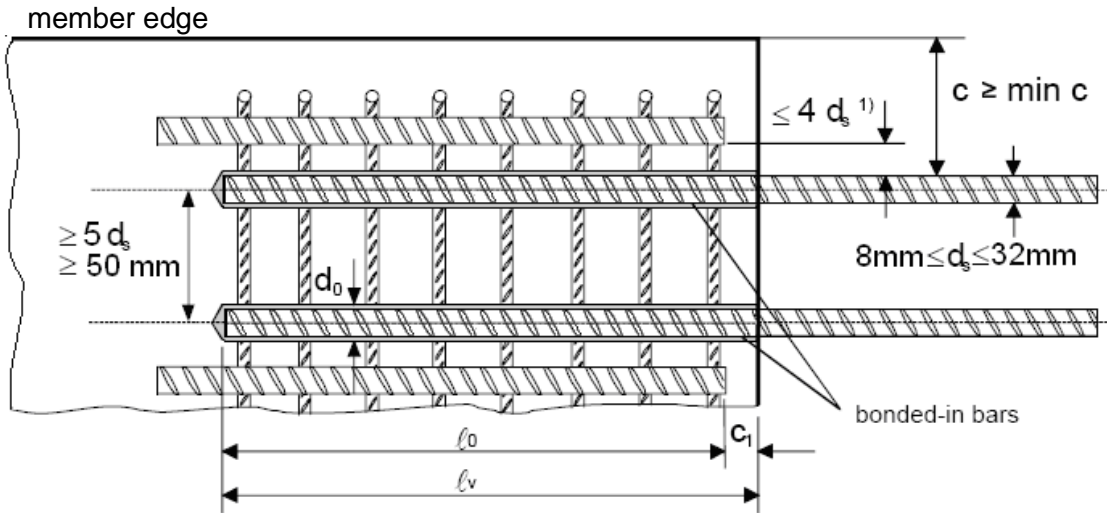
SMART S-IRE

Intended use
Specifications

Annex B 1

Figure B1: General design rules of construction for bonded-in 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 extent that aggregate protrude.



1) 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 bonded-in bar
 c_1 concrete cover at end-face of bonded-in bar
min c minimum concrete cover acc. Table B1 of this assessment
 d_s diameter of bonded-in bar
 ℓ_0 lap length acc. to EN 1992-1-1:2004
 ℓ_v effective embedment depth $\geq \ell_0 + c_1$
 d_0 nominal drill bit diameter, see Table B3

SMART S-IRE

Intended use
General design rules of construction

Annex B 2

Table B1: Minimum concrete cover min c of the bonded-in rebar depending on drilling method

Drilling method	
Hammer drilling	30mm + 0,06 $l_v \geq 2 d_s$
Compressed air drilling	50 mm + 0,08 l_v
Diamond core drilling	50 mm + 0,08 l_v

Table B2: Minimum anchorage length¹⁾ and lap lengths for C20/25 and maximum installation length l_{max} for good bond conditions.

Rebar		$l_{b,min}$ [mm]	$l_{o,min}$ [mm]	l_{max} [mm]
$\varnothing d_s$ [mm]	$f_{y,k}$ [N/mm ²]			
8	500	113	200	400
10	500	142	200	500
12	500	170	200	600
14	500	198	210	700
16	500	227	240	800
20	500	284	300	1000
25	500	354	375	1000
28	500	397	420	1000
32	500	454	480	1000

¹⁾ According to EN 1992-1-1: $l_{b,min}$ (8.6) and $l_{o,min}$ (8.11) for good bond conditions and $\alpha_6 = 1,0$ with maximum yield stress $\sigma_{sd} = 435$ N/mm² for rebar B500-B and $\gamma_M = 1,15$ and maximum installation length.

SMART S-IRE**Intended use**

Minimum concrete cover
 Minimum anchorage length
 Maximum installation length

Annex B 3

Table B3: Drilling diameter and maximum anchorage depth

Rebar diameter $d_{nom}^{1)}$ [mm]	Nominal drilling diameter d_{cut} [mm]	Max permissible embedment depth l_v [mm]
8	12	400
10	14	500
12	16	600
14	18	700
16	20	800
20	25	1000
25	32	1000
28	35	1000
32	40	1000

¹⁾ The maximum outer rebar diameter over the ribs shall be:
nominal diameter of the bar $d_{nom} + 0,20 d_{nom}$

Table B4: Processing and Cure time

Base Material Temperature °C	Cartridge Temperature °C	T Gel (mins)	T load (hrs)
+5°C	Minimum +10°C	300	24
+5°C to +10°C		150	
+10°C to +15°C	+10°C to +15°C	40	18
+15°C to +20°C	+15°C to +20°C	25	12
+20°C to +25°C	+20°C to +25°C	18	8
+25°C to +30°C	+25°C to +30°C	12	6
+30°C to +35°C	+30°C to +35°C	8	4
+35°C to +40°C	+35°C to +40°C	6	2
Ensure cartridge is > 10°C			

SMART S-IRE**Intended use**

Maximum anchorage depth
Processing and Load time

Annex B 4

Table B5: Applicator gun

A



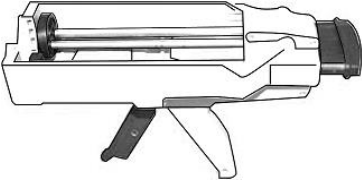
B



C



D



E



Applicator gun	A	B	C	D	E
Cartridge	Side by side 385 ml	Side by side 385 ml	Side by side 385 ml	Side by side 585 ml	Foil capsule 300 ml

SMART S-IRE

Intended use
Applicator gun

Annex B 5

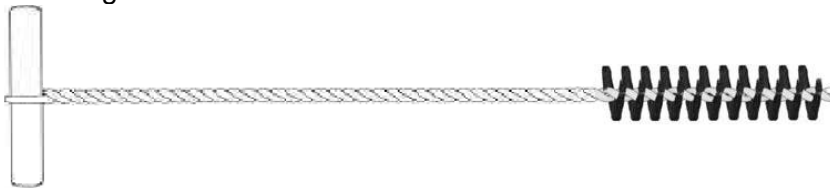
Table B6: Brush

Sizes		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Drill hole diameter d ₀	[mm]	12	14	16	18	20	25	32	35	40
Steel brush diameter	[mm]	S12HF S13HF	S14HF S15HF	S18HF	S22HF		S27HF	S35HF	S38HF	S43HF
Brushes head length	[mm]	75								

If required use additional accessories and extension for air nozzle and brush to reach back of hole.

Max. hole depth	Brush / extension configuration	Part
250 mm	Cleaning brush SMCH3	
375 mm	Brush head unit + handle unit	SDS + EXTSDS-150
675 mm	Brush head unit + extension piece + handle unit	SDS + EXTSDS-250 + EXTSDS-150
975 mm	Brush head unit + 2x extension piece + handle unit	SDS + EXTSDS-250 + EXTSDS-250 + EXTSDS-150

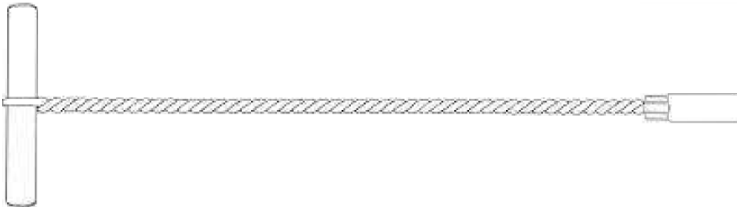
Cleaning brush SMCH3



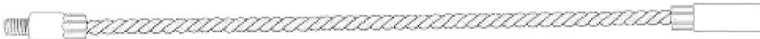
SMCH3 SDS



SMCH3 EXTSDS-150



SMCH3 EXTSDS-250

**Table B7: Extension hose for deep holes**

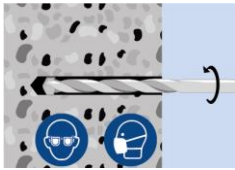
Sizes		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32	
Hole diameter	[mm]	12	14	16	18	20	25	32	35	40	
Extension hose	[mm]	6			9						
Resin stopper	[mm]	-	-	-	-	18	22	30		36	

SMART S-IRE**Intended use**

Brush
Extension hose for deep holes

Annex B 6

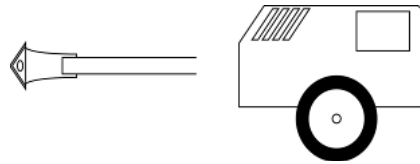
Drilling the hole



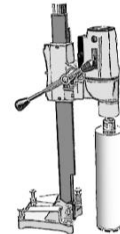
Drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode, or a compressed air drill or diamond core drill.



Rotary hammer drilling



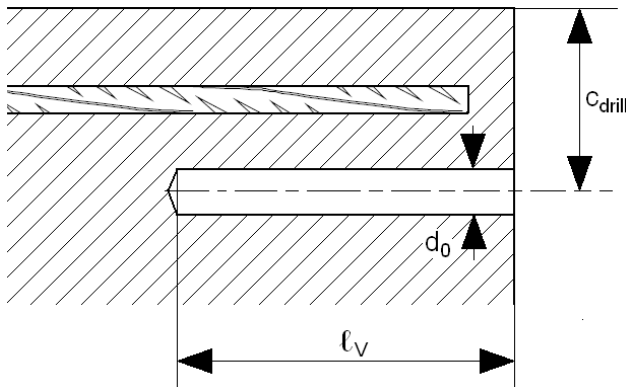
Compressed air drill



Diamond core drill

Before drilling remove carbonized concrete.

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



- Observe concrete coverage c , as per setting plan and Table B1
- Drill parallel to the edge and to existing rebar

Cleaning the hole

The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection.



- Blowing 2 time from the back of the hole with oil-free compressed air (min. 6 bar) until return air stream is free of noticed dust.
- Brushing 2 time with the special brush size (brush $\varnothing \geq$ borehole \varnothing) by inserting the brush to the back of the hole in a twisting motion. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case, please use a new brush or a brush with a larger diameter.
- Repeat operation 1 and 2.
- Blowing 1 time again with compressed air until return air stream is free of noticeable dust.

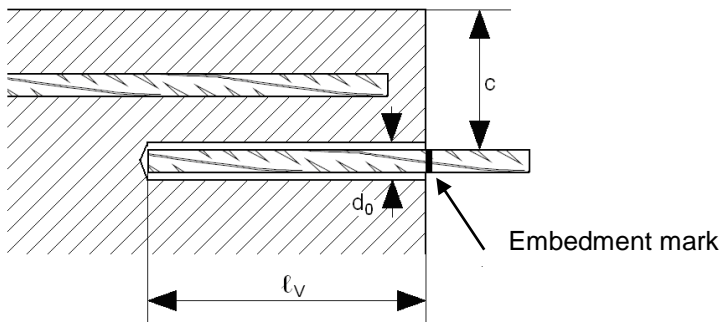
SMART S-IRE

Intended use
Installation instructions I

Annex B 7

Mortar injection

If the hole collects water after initial cleaning, this water must be removed before injecting the resin.



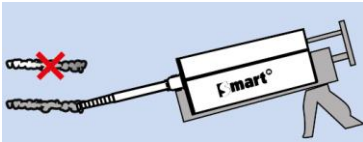
Before use, make sure the rebar is dry and free of oil or other residue.

Mark embedment depth on the rebar (e.g. with tape) ℓ_v

Insert rebar in borehole, to verify hole and setting depth ℓ_v

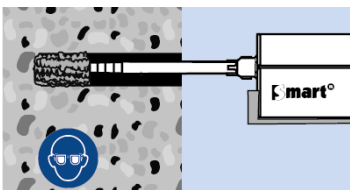
- Check expiration date: See imprint on cartridge. Do not use an expired product
- Foil pack temperature:
Must be between +10°C and +40°C when in use
- Base material temperature at time of installation:
Must be between +5°C and +40°C
- Instructions for transport and storage:
Keep in a cool, dry and dark place at +5°C to +20°C achieve maximum shelf life

Select the appropriate static mixer nozzle for the installation, open the cartridge/foil and screw onto the mouth of the cartridge. Insert the cartridge into the correct applicator gun.



Extrude the first part of the cartridge to waste until an even colour has been achieved without streaking in the resin

If necessary, cut the extension tube to the depth of the hole and push onto the end of the mixer nozzle, and (for rebars 16 mm dia. or more) fit the correct resin stopper to the other end. Attach extension tubing and resin stopper.



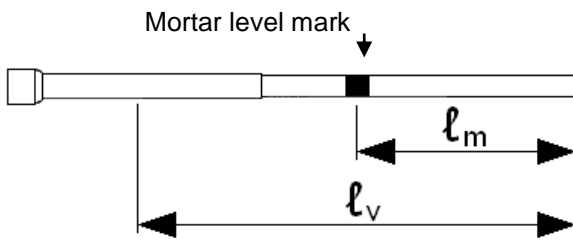
Insert the mixer nozzle (resin stopper / extension tube if applicable) to the bottom of the hole. Begin to extrude the resin and slowly withdraw the mixer nozzle from the hole ensuring that there are no air voids as the mixer nozzle is withdrawn. Fill the hole to approximately $\frac{1}{2}$ to $\frac{3}{4}$ full and remove the mixer nozzle completely.

SMART S-IRE

Intended use
Installation instructions II

Annex B 8

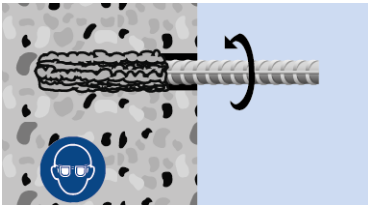
Inserting the rebar



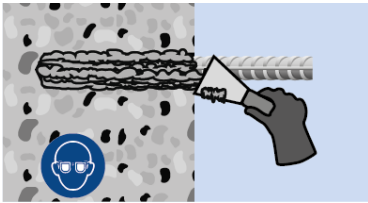
Mark the required mortar level l_m and embedment depth l_v with tape or marker on the injection extension.

Quick estimation: $l_m = 1/2 \cdot l_v$

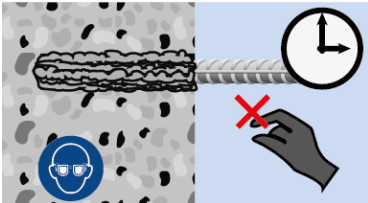
Continue injection until the mortar level mark l_m becomes visible.



Insert the rebar, free from oil or other release agents, to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time.



Any excess resin should be expelled from the hole evenly around the steel element showing that the hole is full. This excess resin should be removed from around the mouth of the hole before it sets.



Leave the anchor to cure.

Do not disturb the anchor until the appropriate loading/curing time has elapsed depending on the substrate conditions and ambient temperature.

SMART S-IRE

Intended use
Installation instructions III

Annex B 9

Table C1: Design values of the ultimate bond resistance $f_{bd}^{1)}$ in N/mm² for hammer drilling methods for good bond conditions

Size d_s [mm]	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
10									
12									
14									
16									
20									
25									
28									
32									

¹⁾ Tabulated values f_{bd} are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values for f_{bd} by 0,7.

Table C2: Design values of the ultimate bond resistance $f_{bd}^{1)}$ in N/mm² for diamond core drilling methods for good bond conditions

Size d_s [mm]	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
10									
12									
14									
16									
20									
25									
28									
32									

¹⁾ Tabulated values f_{bd} are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values for f_{bd} by 0,7.

SMART S-IRE

Performances
Design values of the ultimate bond resistance

Annex C 1