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European Technical Assessment

ETA-14/0001 of 12/02/2014

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**Hilti HIT-HY100**
Famille de produit *Product family*	**Scellement d'armatures rapportées, diamètres 8 à 25mm, avec Système d'injection Hilti HIT-HY 100** ***Post installed rebar connections diameter 8 to 25 mm made with Hilti HIT-HY 100 injection mortar***
Titulaire *Manufacturer*	Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein
Usine de fabrication *Manufacturing plants*	Plant 6
Cette evaluation contient: *This Assessment contains*	17 pages incluant 14 annexes qui font partie intégrante de cette évaluation 17 *pages including 14 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*	-

Specific part

1 Technical description of the product

The Hilti HIT-HY 100 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 Hilti HIT-HY 100 bonding material and an embedded straight deformed reinforcing bar diameter, d, from 8 to 25 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 C 1

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 B 1 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

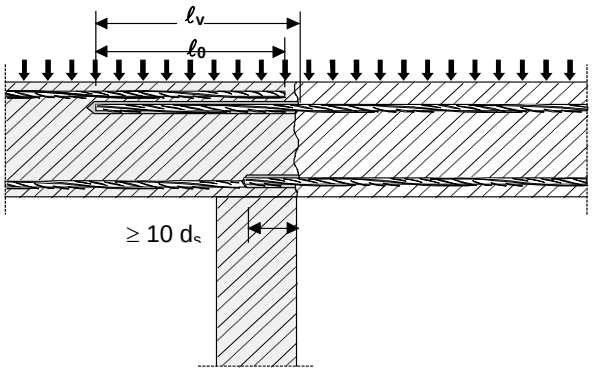


Figure A2: Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed in tension

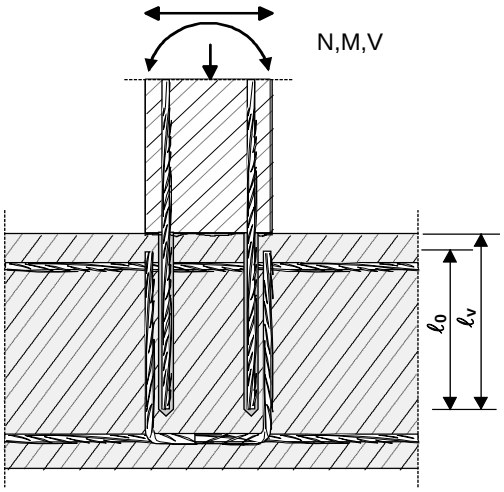


Figure A3: End anchoring of slabs or beams (e.g. designed as simply supported)

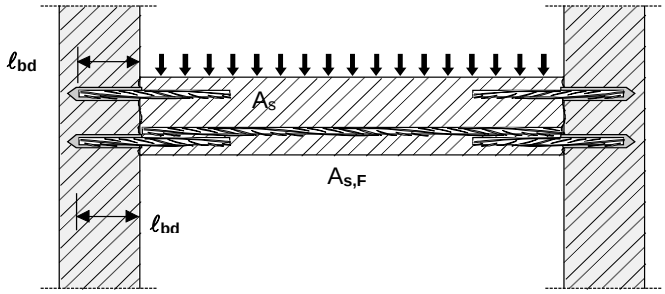


Figure A4: Rebar connection for components stressed primarily in compression.

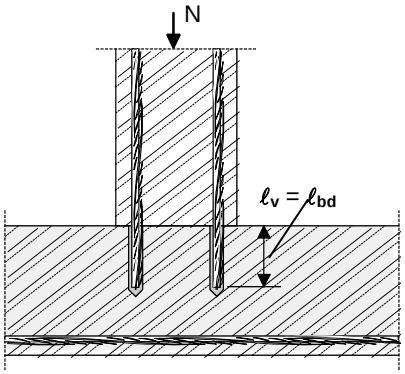
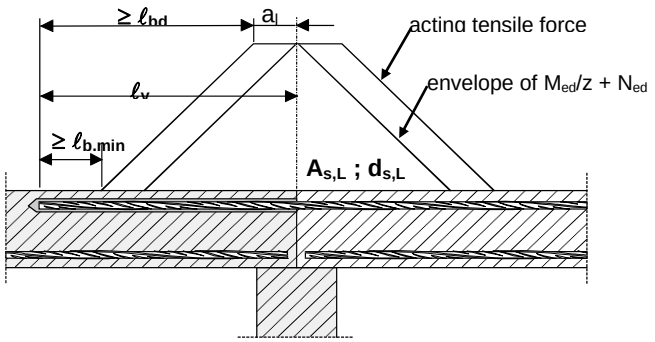


Figure A5: Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member



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

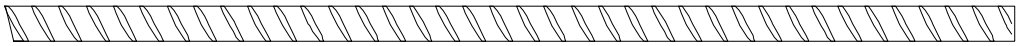
Preparing of joints according to Annex B 2

Injection system Hilti HIT-HY 100 for rebar connection	
Product description Installed condition and examples of use for rebars	**Annex A1**

Injection mortar Hilti HIT-HY 100: hybrid system with aggregate
330 ml, 500 ml

Static mixer Hilti HIT-RE-M

Reinforcing bar (rebar): ø8, ø10, ø12, ø14, ø16, ø18, ø20, ø22, ø24, ø25



- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004/AC:2010
- The maximum outer rebar diameter over the rips shall be:
  Nominal diameter of the bar d + 2 x h (h ≤ 0,07 x d)
  (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A1 Materials

Part	Designation	Rebar
1	Rebar EN 1992-1-1:2004/AC:2010, Annex C	Bars and de-coiled rods Class B or C with f_{yk} acc. EN 1992-1-1/NA:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$

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 ds + 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.
- Hole drilling by hammer drill or compressed air drill mode.
- 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).

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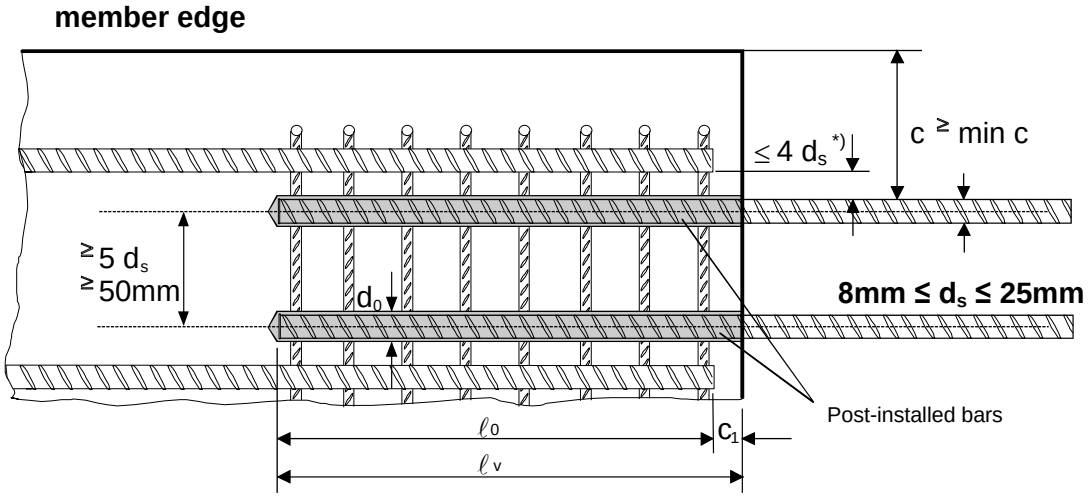
Figure B1: General construction rules for post-installed rebars

- 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 B 6

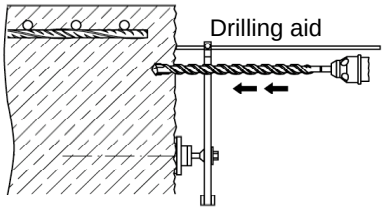


Table B1: Minimum concrete cover min c [1)] of the bonded-in rebar depending on drilling method and drilling tolerance

Drilling method	Bar diameter d_s	Without drilling aid	With drilling aid
Hammer drilling **(HD)**	< 25 mm	30mm + 0,06 $\ell_v \geq$ 2 d_s	30mm + 0,02 $\ell_v \geq$ 2 d_s
	25 mm	40mm + 0,06 $\ell_v \geq$ 2 d_s	40mm + 0,02 $\ell_v \geq$ 2 d_s
Compressed air drilling **(CA)**	< 25 mm	50mm + 0,08 ℓ_v	50mm + 0,02 ℓ_v
	25 mm	60mm + 0,08 ℓ_v	60mm + 0,02 ℓ_v

[1)] see Annexes B2, Figures B1

Comments: The minimum concrete cover acc. EN 1992-1-1:2004/AC:2010 must be observed

Table B2: Maximum permissible embedment depth l_{max} [mm] corresponding to dispenser

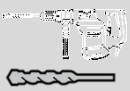
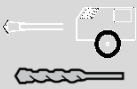
Rebar	Dispenser
Ø d_s [mm]	HDM 330, HDM 500, HIT-MD 2000, HIT-MD 2500 HDE 500 HIT-ED 3500, HIT-P300F, HIT-P3500F
8	700
10	
12	
14	
16	
18	500
20	
22	
24	
25	

Remark: Injection of mortar at low temperatures is easier and faster when the mortar is heated up slowly to 20°C

Table B3: Working time t_{work} and minimum curing time t_{cure}

Temperature in the anchorage base [°C]	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 to -6	180 min	12 h
-5 to -1	40 min	4 h
+0 to +4	20 min	2 h
+5 to +9	8 min	1 h
+10 to +14	7 min	50 min
+15 to +19	6 min	40 min
+20 to +24	5 min	30 min
+25 to +29	3 min	30 min
+30 to +40	2 min	30 min

Table B4: Installation tools for drilling with hammer drill (HD) or compressed air drill (CA)

Elements	**Drill and clean**					**Installation**		
Rebar -Ø  d_{nom} [mm]	Hammer drilling **(HD)**  d_0 [mm]	Compressed air drill **(CA)**  d_0 [mm]	Steel brush  HIT-RB	Air Nozzle  HIT-DL	Extension for air nozzle 	Piston plug  HIT-SZ	Extension for piston plug 	Maximum embedment depth l_v or $l_{e,ges}$ [mm]
8	10	-	10	10	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	250
	12	-	12	12		12		700
10	12	-	12	12		12		250
	14	-	14	14		14	HIT-VL 11/1,0	700
12	14	-	14	14		14		250
	16	-	16	16		16		700
	-	17	18	16		18		
14	18	17	18	18		18		
16	20	-	20	20	HIT-DL 16/0,8 or HIT-DL B and/or HIT-VL 16/0,7 and/or HIT-VL 16	20	HIT-VL 16/0,7 and/or HIT-VL 16	
	-	20	22	20		22		
18	22	22	22	22		22		500
20	25	-	25	25		25		
	-	26	28	25		28		
22	28	28	28	28		28		
24	32	32	32	32		32		
25	32	32	32			32		

Assemble extension HIT-VL 16/0.7 with coupler HIT-DL K for deeper anchor holes.

Injection system Hilti HIT-HY 100 for rebar connection

Intended Use

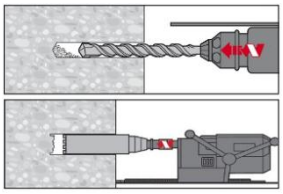
Installation tools for drilling with hammer drill (HD) or compressed air drill (CA)

Annex B5

Safety Regulations: 	Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 100. Important: Observe the Instructions for Use provided with each foil pack

1. Drill hole

Note: Before drilling, remove carbonized concrete; clean contact areas (see Annex B 1)
In case of aborted drill hole the drill hole shall be filled with mortar.



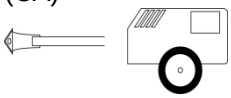
Drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode or a compressed air drill

Drill bit size for:

Hammer drill (HD)

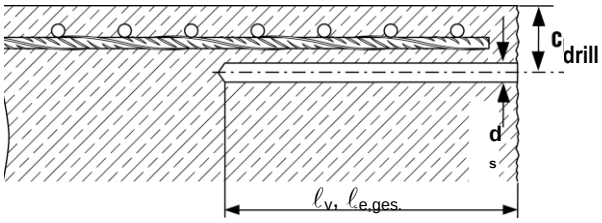
see Table B4

Compressed air drill (CA)



see Table B4

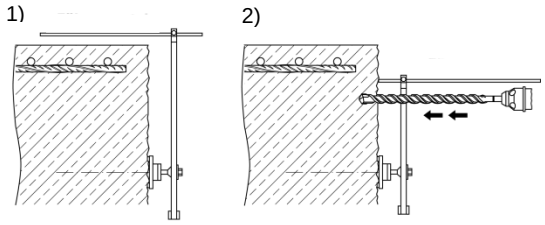
Splicing applications:



- Measure and control concrete cover c
- $c_{drill} = c + d_s/2$
- Drill parallel to surface edge and to existing rebar
- Where applicable use Hilti drilling aid HIT-BH.

Drilling aid

Example: HIT-BH



For holes ℓ_b > 20 cm use drilling aid.
Three different options can be considered:

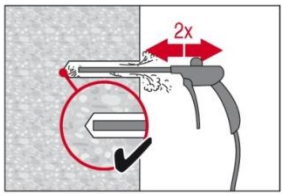
A) Hilti drilling aid HIT-BH
B) Slat or spirit level
C) Visual check

2. Clean hole

The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection. Inedequate borehole cleaning= poor load values.

Just before setting an rebar the hole must be cleaned of dust and debris by one of the two cleaning methods described below:

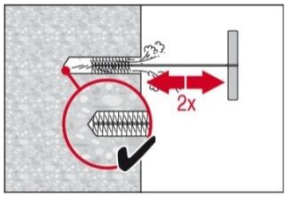
2.1. Compressed air cleaning:



Blowing

2 times from the back of the hole with oil-free compressed air (min. 6 bar at 100 litres per minute (LPM)) until return air stream is free of noticeable dust.

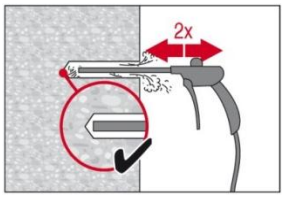
Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m³/hour.



Brushing

2 times with the specified brush size (brush Ø ≥ borehole Ø) by inserting the round steel 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.

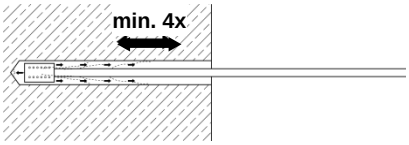
For appropriate brushes HIT-RB see Table B4.



Blowing

2 times again with compressed air until return air stream is free of noticeable dust.

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



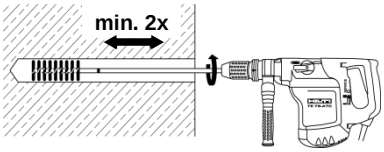
Deep Boreholes – Blowing:

For boreholes deeper than 250mm (for d_s = 8mm - 12mm) resp. deeper than 20xd_s (for d_s>12mm) use the appropriate air nozzle Hilti HIT-DL (see Table B4)

Safety tip: Do not inhale concrete dust. The application of the Hilti HIT-DRS dust collector is recommended.

Deep boreholes – brushing

For boreholes deeper than 250mm (for d_s = 8mm - 12mm) resp. deeper than 20xd_s (for d_s>12mm) use machine brushing and brush extensions HIT-RBS.



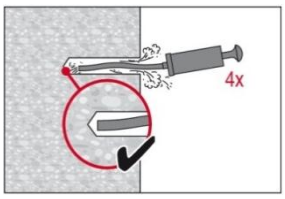
Screw the round steel brush HIT-RB in one end of the brush extension(s) HIT-RBS, so that the overall length of the brush is sufficient to reach the base of the borehole. Attach the other end of the extension to the TE-C/TE-Y chuck.

Safety tip:

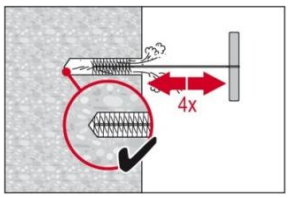
- Start machine brushing operation slowly.
- Start brushing operation once brush is inserted in borehole.

2.2. Manual cleaning:

Manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 \leq 18$mm and depths ℓ_v resp. $\ell_{e,ges.} \leq 160$ mm.

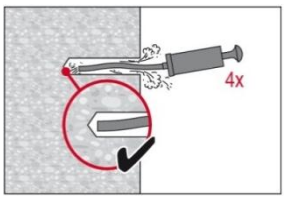


Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.



Brushing
4 times with the specified brush size (brush diameter ≥ borehole diameter d_0) by inserting the round steel wire brush to the back of the hole with 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.

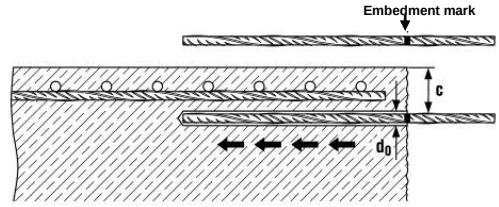
For appropriate Brushes HIT-RB see Table B4.



Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust

Manual Cleaning (MC):
Hilti hand pump recommended for blowing out bore holes with diameters $d_0 \leq 18$ mm and bore hole depth $h_0 \leq 160$ mm.

3. Rebar preparation and foil pack preparation

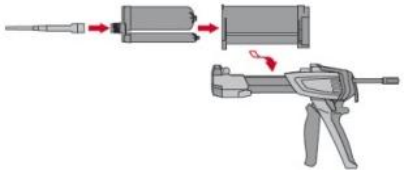


Before use, make sure the rebar is dry and free of oil or other residue.

Mark the embedment depth on the rebar

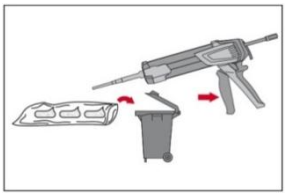
(e.g. with tape) → ℓ_v

Insert Rebar in borehole, to verify hole and setting depth ℓ_v resp. $\ell_{e,ges}$



Injection system preparation.

- Observe the Instruction for Use of the dispenser.
- Observe the Instruction for Use of the mortar.
- Tightly attach Hilti HIT- RE-M mixing nozzle to foil pack manifold.
- Insert foil pack into foil pack holder and swing holder into the dispenser.



Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.

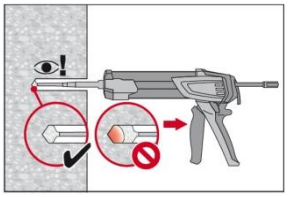
Discard quantities are:

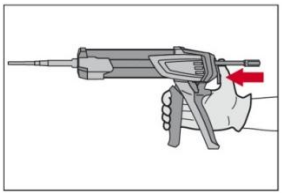
2 strokes	for 330 ml foil pack,
3 strokes	for 500 ml foil pack,
4 strokes	<5°C for 330/500 ml foil pack,

4. Inject mortar into borehole

Forming air pockets shall be avoided.

Injection method for borehole depth ≤ 250 mm:





Inject the mortar from the back of the hole towards the front and slowly withdraw the mixing nozzle step by step after each trigger pull.

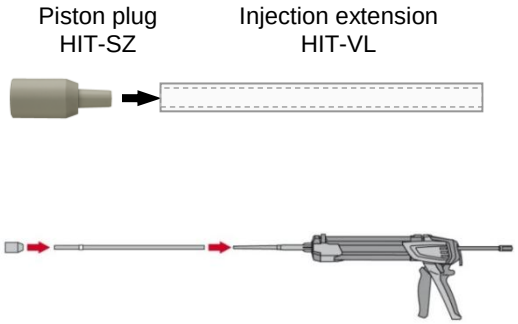
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.

After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

4. Inject mortar into borehole

Forming air pockets shall be avoided.

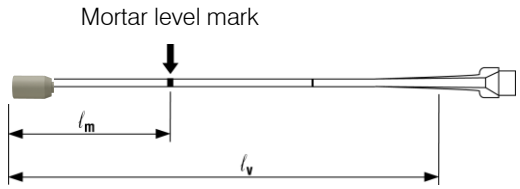
Injection method for borehole depth > 250 mm or overhead applications:



Assemble mixing nozzle, extension(s) and piston plug HIT-SZ (see Table B4)

For combinations of several injection extensions use coupler HIT-VL K. A substitution of the injection extension for a plastic hose or a combination of both is permitted.

The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.



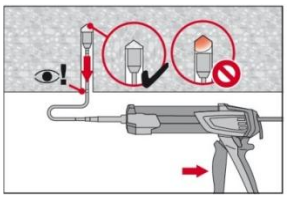
Mark the required mortar level ℓm and embedment depth ℓ_b resp. $\ell_{e,ges}$ with tape or marker on the injection extension.

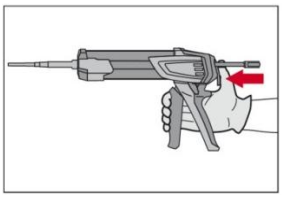
A) Estimation: $\ell_m = 1/3 \cdot \ell_v$ resp. $\ell_m = 1/3 \cdot \ell_{e,ges}$

B) Precise formula for optimum mortar volume:

$$\ell_m = \ell_v \; resp. \; \ell_{e,ges} \times \left((1{,}2 \times \frac{d_s^2}{d_0^2} - 0{,}2) \right) \; [mm]$$

When using a piston plug HIT-SZ continue injection until the mortar level mark ℓ_m becomes visible.





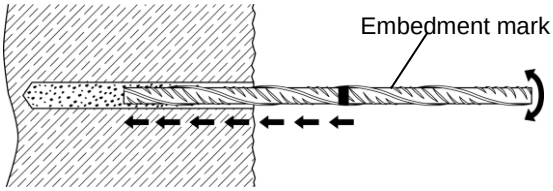
Insert piston plug to back of the hole. Begin injection allowing the pressure of the injected adhesive mortar to push the piston plug towards the front of the hole.

Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.

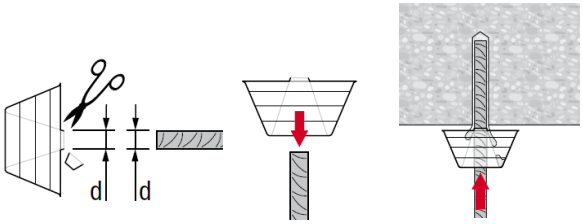
After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

Maximum embedment depth see B4.

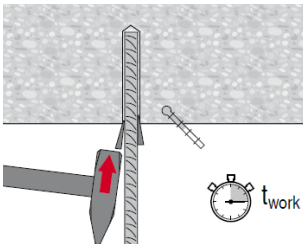
5. Insert rebar



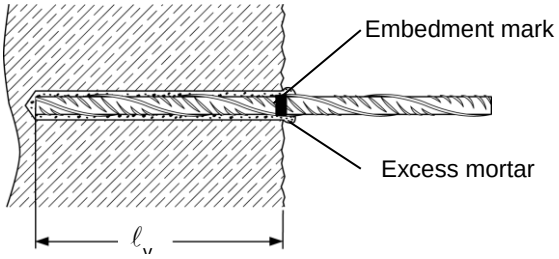
For ease installation insert the rebar slowly twisted into the borehole until the embedment mark is at the concrete surface.



Overhead application:
During insertion of the rebar mortar might flow out of the bore hole. For collection of the flowing mortar HIT-OHC may be used.

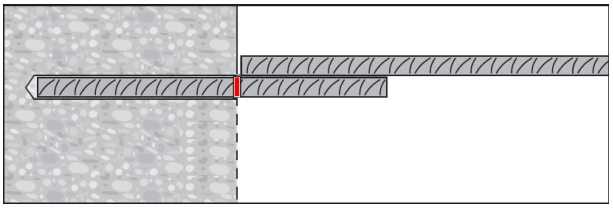


Support the rebar and secure it from falling till mortar started to harden, e.g. using HIT-OHW



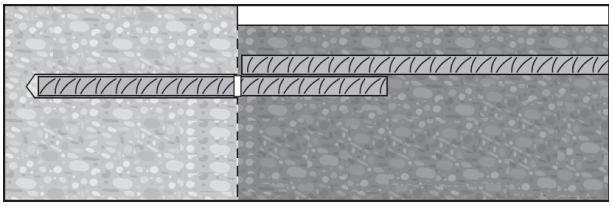
After installing the rebar the annular gap must be completely filled with mortar.
Proper installation

- Desired anchoring embedment is reached ℓ_v: Embedment mark at concrete surface.
- Excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark.
- Overhead application: Support the rebar and secure it from falling till mortar started to harden.



Observe the working time "t_{work}", which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the working time

"t_{work}" see Table B3.



Full load may be applied only after the curing time "t_{cure}" has elapsed (see Table B3)

Injection system Hilti HIT-HY 100 for rebar connection	
Intended Use Installation instruction VI	**Annex B11**

Minimum anchorage length and minimum lap length

The minimum anchorage length $\ell_{b,min}$ and the minimum lap length $\ell_{0,min}$ according to EN 1992-1-1:2004+AC:2010 ($\ell_{b,min}$ acc. to Eq. 8.6 and Eq. 8.7 and $\ell_{0,min}$ acc. to Eq. 8.11) shall be multiply by a factor according to Table C1.

Table C1: Factor related to concrete class and drilling method

Concrete class	Drilling method	Factor
C12/15 to C50/60	Hammer drilling and compressed air drilling	1,5

Table C1: Design values of the ultimate bond resistance f_{bd} in N/mm² for Hammer drilling (HD) and Compressed air drilling (CA)

according to EN 1992-1-1:2004+AC:2010 for good bond conditions
(for all other bond conditions multiply the values by 0.7)

Rebar	Concrete class								
Ø d_s [mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 24	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,7
25	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7