Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

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European Technical Assessment

ETA-13/1037 of 26 May 2014

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection system Hilti HIT-HY 110
Product family to which the construction product belongs	Post-installed rebar connection with Hilti injection mortar HIT-HY 110
Manufacturer	Hilti Aktiengesellschaft 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	18 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 5: "Bonded anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.
This version replaces	ETA-13/1037 issued on 17 January 2014

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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 injection mortar Hilti HIT-HY 110 in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter ϕ from 8 to 25 mm and injection mortar Hilti HIT-HY 110 are used for rebar connections. The reinforcing bar is placed into a drilled hole filled with injection mortar and is anchored via the bond between embedded element, 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 anchor 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 anchor of at least 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 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	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 there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of 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)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not applicable.

3.6 Energy economy and heat retention (BWR 6)

Not applicable.

3.7 Sustainable use of natural resources (BWR 7)

The sustainable use of natural resources was not investigated.

3.8 General aspects

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

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

According to Decision of the Commission of 24 June 1996 (96/582/EC) (OJ L 254 of 08.10.96 p. 62-65), the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal anchors for use in concrete (heavy-duty type)	For fixing and/or supporting 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 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 at Deutsches Institut für Bautechnik.

Issued in Berlin on 26 May 2014 by Deutsches Institut für Bautechnik

Dr.-Ing- Karsten Kathage
Vice President

Beglaubigt:
Baderschneider

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Installation post-installed rebar

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

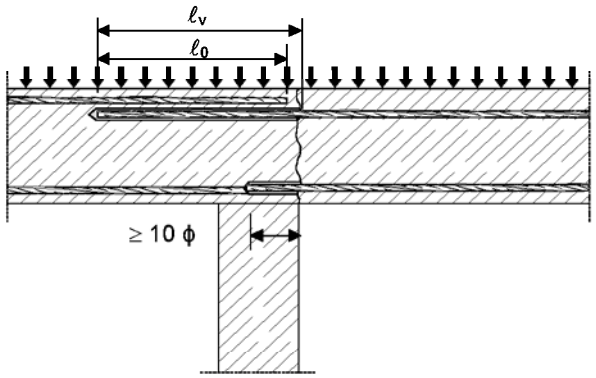


Figure A2: Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed in tension

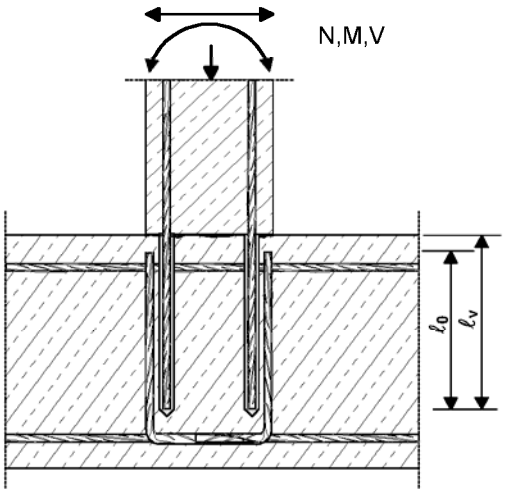


Figure A3: End anchoring of slabs or beams

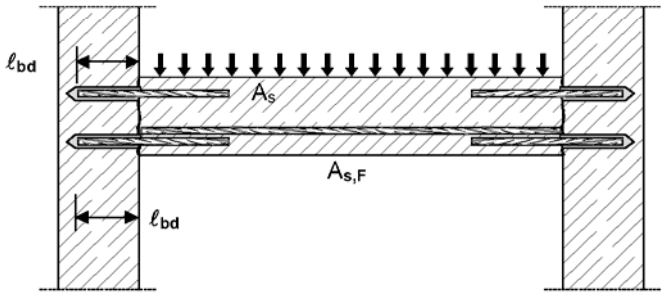


Figure A4: Rebar connection for components stressed primarily in compression.

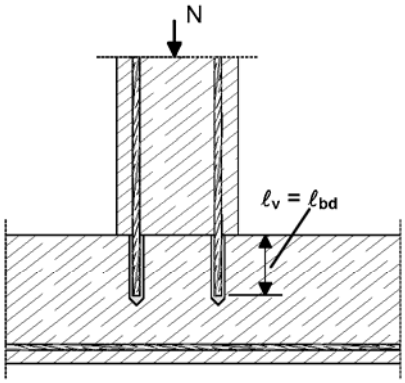
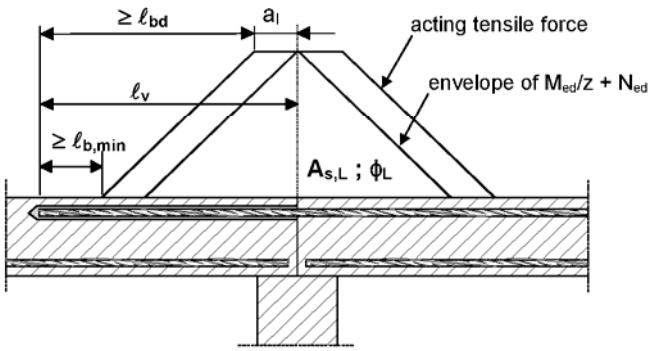


Figure A5: Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member



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

Injection system Hilti HIT-HY 110 for rebar connection	Annex A 1
Product description Installed condition and examples of use for rebars	

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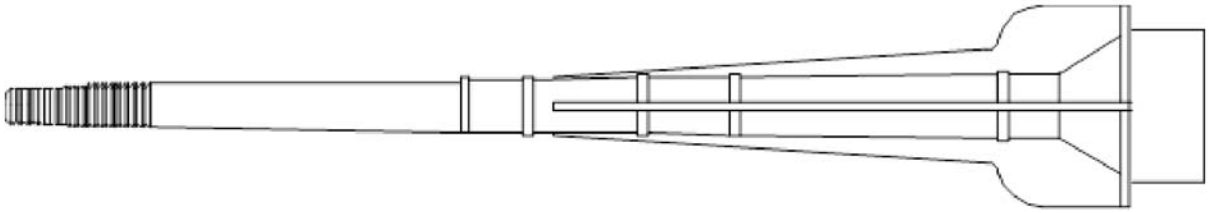
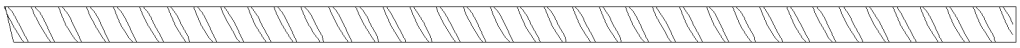
Injection mortar Hilti HIT-HY 110: hybrid system with aggregate
330 ml and 500 ml

Static mixer Hilti HIT-M1



Reinforcing bar (rebar): ϕ 8 mm to 25 mm



Injection system Hilti HIT-HY 110 for rebar connection	**Annex A 2**
Product description Injection mortar / Static mixer / Rebar	

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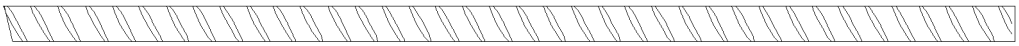
Figure A6: Reinforcing bar



- 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 rib $\phi + 2 * h$ ($h \leq 0{,}07 * \phi$)
  (ϕ: Nominal diameter of the bar; h: Rip height of the bar)

Table A1: Materials

Designation	Rebar
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:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$

Injection system Hilti HIT-HY 110 for rebar connection

Product description
Specifications reinforcing bar

Annex A 3

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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,
- Strength classes C12/15 to C50/60 according to EN 206-1:2000,
- Maximum chloride concrete of 0,40 % (CL 0.40) related to the cement content according to EN 206-1:2000,
- 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 ϕ + 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 (HD) or compressed air drill (CA) 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).

Injection system Hilti HIT-HY 110 for rebar connection	Annex B 1
Intended use Specifications	

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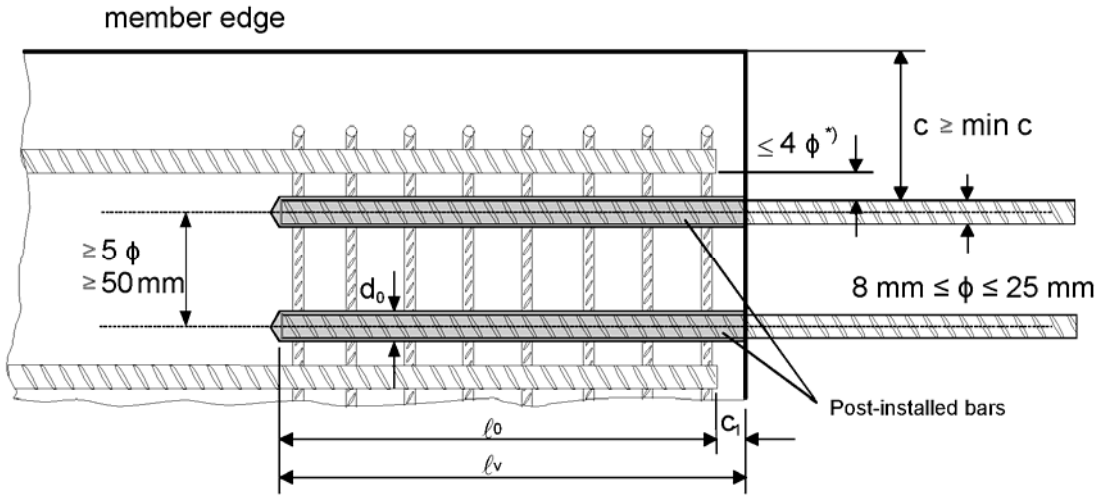
Figure B1: General construction rules for post-installed rebars

- 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 4 ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4 ϕ.

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
ϕ	diameter of reinforcement bar
ℓ_0	lap length, according to EN 1992-1-1:2004+AC:2010, Section
ℓ_v	8.7.3 effective embedment depth, ≥ ℓ_0 + c_1
d_0	nominal drill bit diameter, see Annex B 6

Injection system Hilti HIT-HY 110 for rebar connection	**Annex B 2**
Intended use General construction rules for post-installed rebars	

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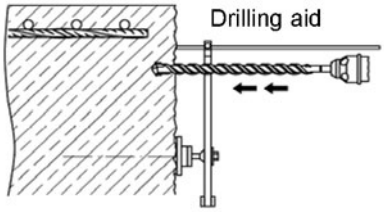
Table B1: Minimum concrete cover min c[1] of the bonded-in rebar depending on drilling method and drilling tolerance



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

1) see Annex B 2, Figure B1

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

Table B2: Dispensers and corresponding maximum embedment depth $\ell_{v,max}$

Rebar	Dispenser	
	HDM 330, HDM 500, HIT-MD 2000, HIT-MD 2500	HDE 500 HIT-ED 3500, HIT-P300F, HIT-P3500F
ϕ [mm]	$\ell_{v,max}$ [mm]	$\ell_{v,max}$ [mm]
8	700	1000
10		
12		1150
14		1300
16		1500
18	500	500
20		
22		
24		
25		

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

Temperature in the anchorage base [°C]	Maximum working time t_{work} [1]	Minimum curing time t_{cure}
-5 to -1	90 min	9 h
+0 to +4	45 min	4,5 h
+5 to +9	25 min	2 h
+10 to +19	6 min	90 min
+20 to +29	4 min	50 min
+30 to +40 [2]	2 min	40 min

1) The temperature of the foil pack must be between +5 °C and +25 °C during injection.

2) Foil pack temperature must be cooled to +15 °C to +20 °C

Injection system Hilti HIT-HY 110 for rebar connection	**Annex B 3**
Intended use Minimum concrete cover / Maximum embedment depth Working time and curing times	

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

Elements	Drill and clean					Installation		
Rebar	Hammer drilling (HD)	Compressed air drill (CA)	Steel brush	Air Nozzle	Extension for air nozzle	Piston plug	Extension for piston plug	Maximum embedment depth
								
ϕ [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-DL		HIT-SZ		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		1000
10	12	-	12	12		12		250
	14	-	14	14		14	HIT-VL 11/1,0	1000
12	14	-	14	14		14		250
	16	-	16	16		16		1150
	-	17	18	16		18		
14	18	17	18	18		18		1300
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	1500
	-	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		32		

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

Injection system Hilti HIT-HY 110 for rebar connection

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

Annex B 4

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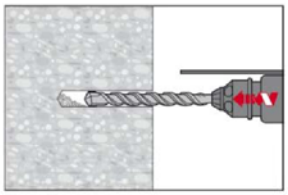
Safety Regulations: 	Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 110. Important: Observe the Instructions for Use provided with each foil pack

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.

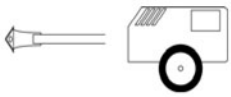


Drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode or a compressed air drill
Drill bit size for:

Hammer drill (HD)

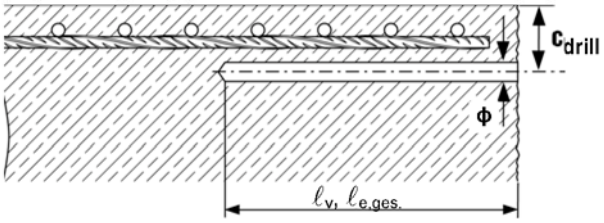
see Table B4

Compressed air drill (CA)



see Table B4

Splicing applications:

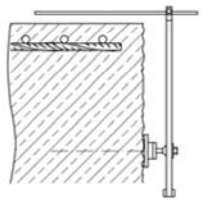


- Measure and control concrete cover c
- $c_{drill} = c + \phi/2$
- Drill parallel to surface edge and to existing rebar
- Where applicable use Hilti drilling aid HIT-BH.

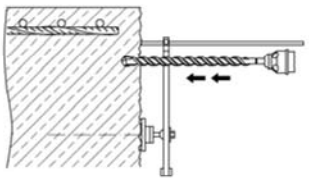
Drilling aid

Example: HIT-BH

1)



2)



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

Injection system Hilti HIT-HY 110 for rebar connection	**Annex B 5**
Intended use Installation instruction I	

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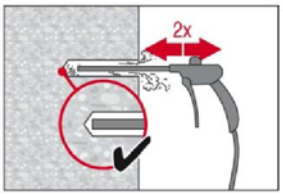
2. Clean hole

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

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

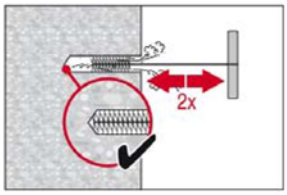
2.1. Compressed air cleaning:



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.

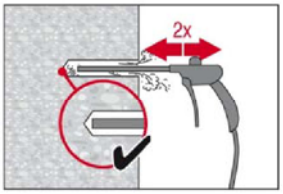
Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m³/hour.



Brushing

2 times with the specified brush size (brush diameter ≥ borehole diameter) 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.

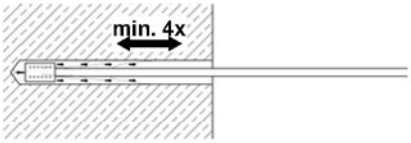
For appropriate brushes HIT-RB see Table B4.



Blowing

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

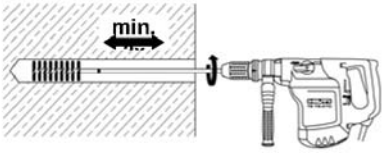
If required use additional accessories and extensions for air nozzle and brush to reach back of hole.



Deep Boreholes – Blowing:

For boreholes deeper than 250 mm (for ϕ = 8 mm – 12 mm) or deeper than 20·ϕ (for ϕ > 12 mm) 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 250 mm (for ϕ = 8 mm – 12 mm) or deeper than 20·ϕ (for ϕ >12 mm) 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.

Injection system Hilti HIT-HY 110 for rebar connection	Annex B 6
Intended use Installation instruction II	

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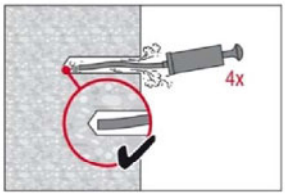
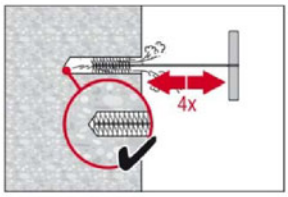
2.2. Manual cleaning:

Manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 \leq 20$ mm and depths ℓ_v or $\ell_{e,ges.} \leq 160$ mm.

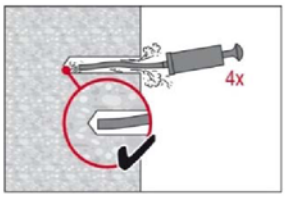


Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.



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.



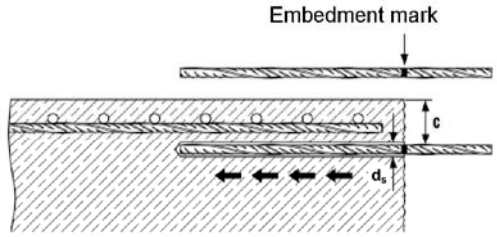
Blowing
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust

Manual Cleaning (MC):
Hilti hand pump recommended for blowing out bore holes with diameters $d_0 \leq 20$ mm and bore hole depth $h_0 \leq 160$ mm.

Injection system Hilti HIT-HY 110 for rebar connection	Annex B 7
Intended use Installation instruction III	

Deutsches Institut für Bautechnik DIBt

3. Rebar preparation and foil pack preparation

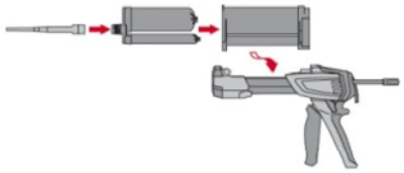


Before use, make sure the rebar is dry and free of oil or other residue.

Mark the embedment depth on the rebar

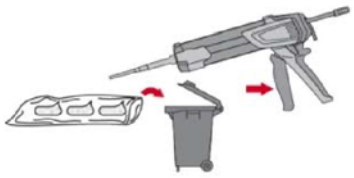
(e.g. with tape) → ℓ_v

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 and of the mortar
- Tightly attach mixing nozzle to foil pack manifold.
  Hilti HIT- M1 mixing nozzle for 330 ml or 500 ml foil pack
- 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.

After changing a mixing nozzle, the first few trigger pulls must be discarded as described above. For each new foil pack a new mixing nozzle must be used.

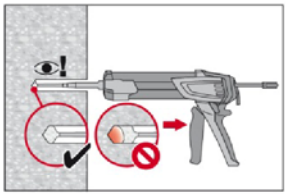
Discard quantities are:

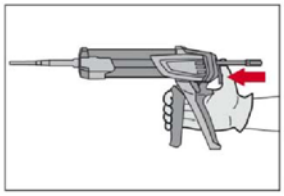
2 strokes for 330 ml foil pack,
3 strokes for 500 ml foil pack,

4. Inject mortar into borehole

Forming air pockets shall be avoided.

4.1. 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.

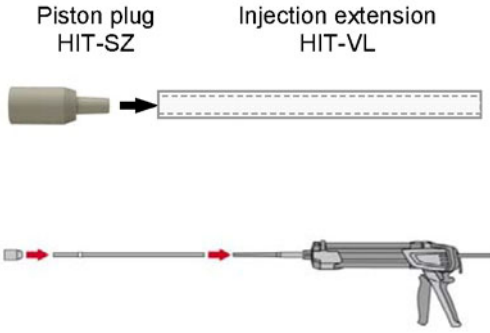
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length.

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

Injection system Hilti HIT-HY 110 for rebar connection	Annex B 8
Intended use Installation instruction IV	

Deutsches Institut für Bautechnik DIBt

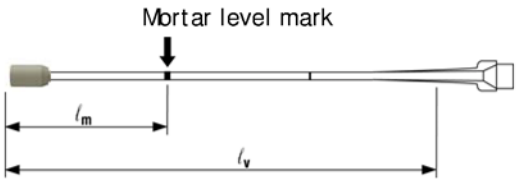
4.2. Injection method for borehole depth > 250 mm or overhead applications:



Assemble mixing nozzle HIT-M1, 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.

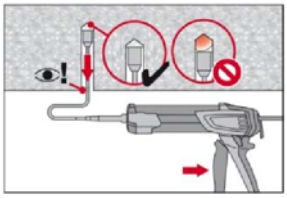


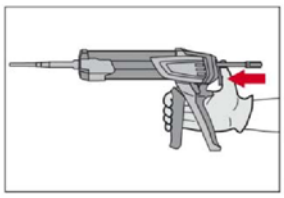
Mark the required mortar level ℓ_m and embedment depth ℓ_b resp. $\ell_{e,ges}$ with tape or marker on the injection extension.

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

B) Precise formula for optimum mortar volume:

$$\ell_m = \ell_v \text{ or } \ell_{e,ges} \times \left((1{,}2 \times \frac{\phi^2}{d_0^2} - 0{,}2) \right) \text{ [mm]}$$





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.

Injection until the mortar level mark ℓ_m becomes visible.

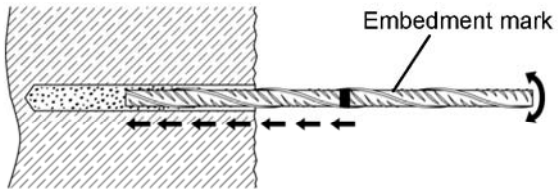
After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

Maximum embedment depth see Tables B2 and B4

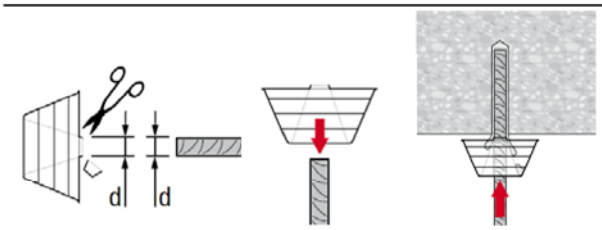
Injection system Hilti HIT-HY 110 for rebar connection	Annex B 9
Intended use Installation instruction V	

Deutsches Institut für Bautechnik DIBt

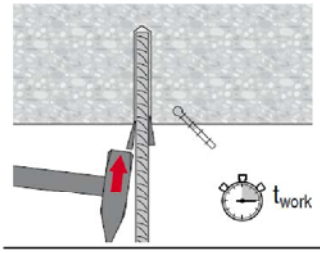
5. Insert rebar



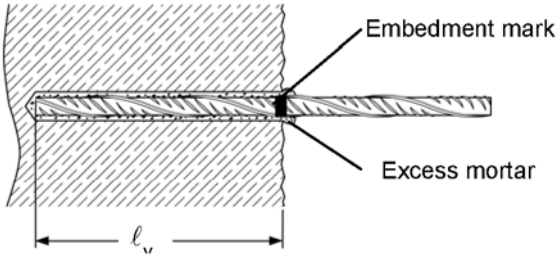
For ease installation insert the rebar slowly twisted into the borehole until the embedment mark is at the concrete surface level.



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.

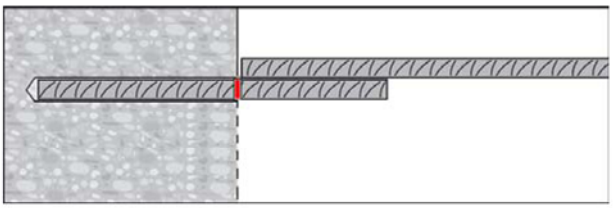


Support the rebar and secure it from falling till mortar started to harden, e.g. using wedges HIT-OHW

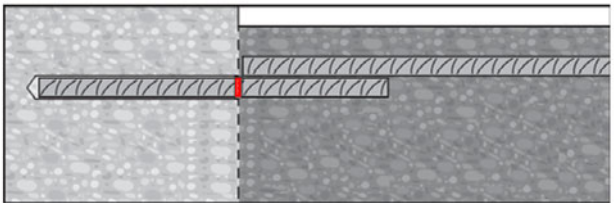


After installing the rebar the annular gap must be completely filled with mortar.
Proper installation

- 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.



Observe the working time "t_{work}" (see Table B3), which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the working time



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

Injection system Hilti HIT-HY 110 for rebar connection	Annex B 10
Intended use Installation instruction VI	

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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 C25/30	Hammer drilling (HD) and compressed air drilling (CA)	1,0
C30/37		1,1
C35/45 to C40/50		1,2
C45/55 to C50/60		1,3

Table C2: 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	bond resistance f_{bd} [N/mm²]								
	Concrete class								
ϕ [mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 25	1,6	2,0	2,3	2,7	3,0	3,0	3,0	3,4	3,7