Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-19/0149 of 10 December 2019

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection system Hilti HIT-RE 100-HC for post-installed rebar
Product family to which the construction product belongs	Systems for post-installed rebar connections with mortar
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	
This European Technical Assessment contains	22 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	EAD 330087-00-0601

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Specific Part

1 Technical description of the product

The subject of this approval is the post-installed rebar connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the "Injection system Hilti HIT-RE 100-HC for rebar connection" in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter ϕ from 8 to 40 mm according to Annex A and injection adhesive Hilti HIT-RE 100-HC are used for rebar connections. The rebar is placed into a drilled hole filled with injection mortar and is anchored via the bond between rebar, injection mortar and concrete.

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the 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 rebar connections 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
Amplification factor α_{lb}, Bond resistance f_{bd}, Bond efficiency factor k_b	See Annex C1 and C2

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

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

In accordance with European Assessment Document EAD No. 330087-00-0601, the applicable European legal act is: [96/582/EC].

The system(s) to be applied is (are): 1

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

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

Issued in Berlin on 10 December 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Aksünger

Deutsches Institut für Bautechnik DIBt

Installed condition

Figure A1:

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

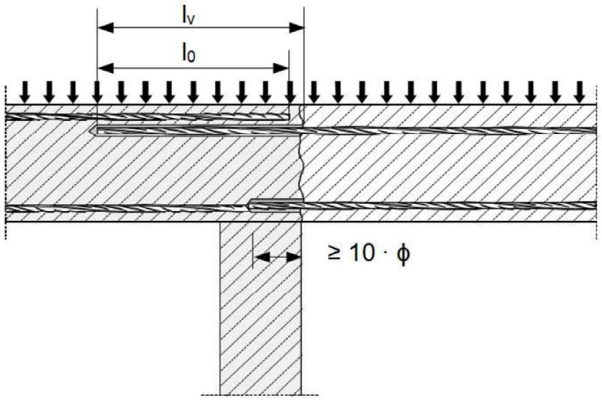


Figure A2:

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

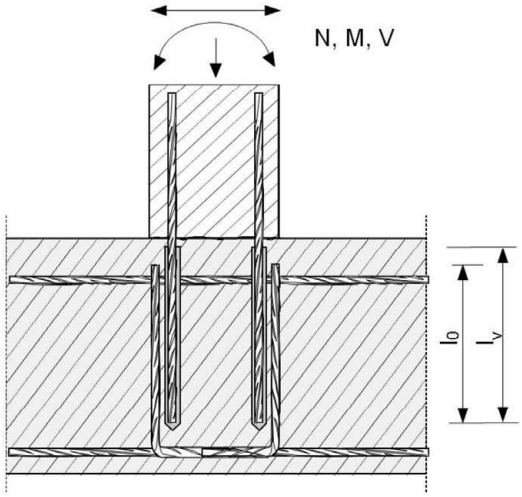
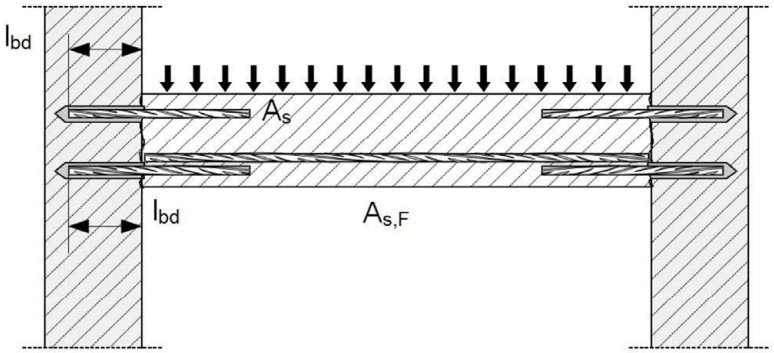


Figure A3:

End anchoring of slabs or beams



Injection system Hilti HIT-RE 100-HC for rebar connection	
Product description Installed condition: application examples of post-installed rebars	**Annex A1**

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Figure A4:

Rebar connection for components stressed primarily in compression

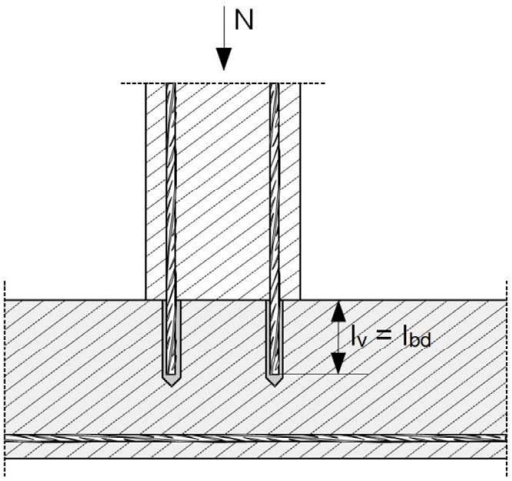
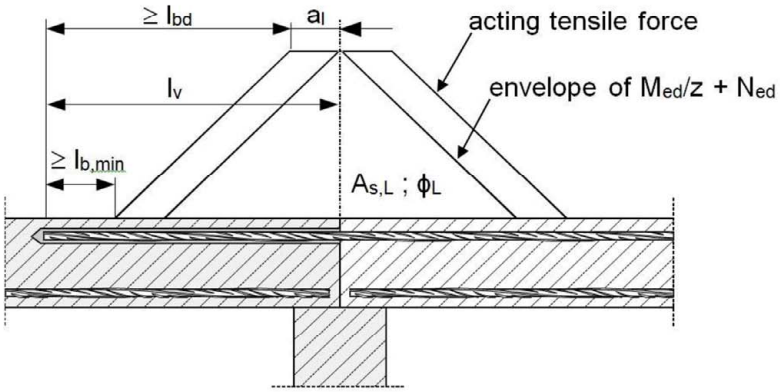


Figure A5:

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



Note to Figure A1 to Figure A5:

- In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1:2004 + AC:2010 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1:2004 + AC:2010.
- Preparing of joints according to Annex B2.

The reference to EN 1992-1-1:2004 + AC:2010 is cited in the following document as EN 1992-1-1 only.

Injection system Hilti HIT-RE 100-HC for rebar connection	Annex A2
Product description Installed condition: application examples of post-installed rebars	

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Product description: Injection mortar and steel elements

Injection mortar Hilti HIT-RE 100-HC: epoxy resin system with aggregate
580 ml

Static mixer Hilti HIT-RE-M

Steel elements

Reinforcing bar (rebar): ϕ 8 to ϕ 40

- Materials and mechanical properties according to Table A1.
- Minimum value of related rib area f_R according to EN 1992-1-1
- Rib height of the bar h_{rib} shall be in the range:
  $0{,}05 \cdot \phi \le h_{rib} \le 0{,}07 \cdot \phi$
- The maximum outer rebar diameter over the ribs shall be:
  $\phi + 2 \cdot 0{,}07 \cdot \phi = 1{,}14 \cdot \phi$
  (ϕ: Nominal diameter of the bar; h_{rib}: Rib height of the bar)

Table A1: Materials

Designation	Material
Reinforcing bars (rebars)	
Rebar EN 1992-1-1	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1 $f_{uk} = f_{tk} = k \cdot f_{yk}$

Injection system Hilti HIT-RE 100-HC for rebar connection	Annex A3
Product description Injection mortar / Static mixer / Steel elements Materials	

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Specifications of intended use

Anchorages subject to:

- Static and quasi static loading: rebar size ϕ8 to ϕ40mm.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibers according to EN 206:2013+A1:2016.
- Strength classes C12/15 to C50/60 according to EN 206:2013+A1:2016.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206:2013+A1:2016.
- Non-carbonated concrete.
  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 at least to the minimum concrete cover in accordance with EN 1992-1-1. The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.

Temperature in the base material:

- **at installation**
  +5 °C to +40 °C
- **in-service**
  -40 °C to +80 °C (max. long term temperature +50 °C and max. short term temperature +80 °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 under static or quasi-static loading in accordance with EN 1992-1-1.
- 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:

- Use category: dry or wet concrete (not in flooded holes).
- Hole drilling by hammer drill (HD), hollow drill bit (HDB), compressed air drill mode (CA), diamond coring dry (DD) or diamond coring wet (PCC).
- Overhead installation is admissible.
- Rebar installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
  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-RE 100-HC for rebar connection	Annex B1
Intended Use Specifications	

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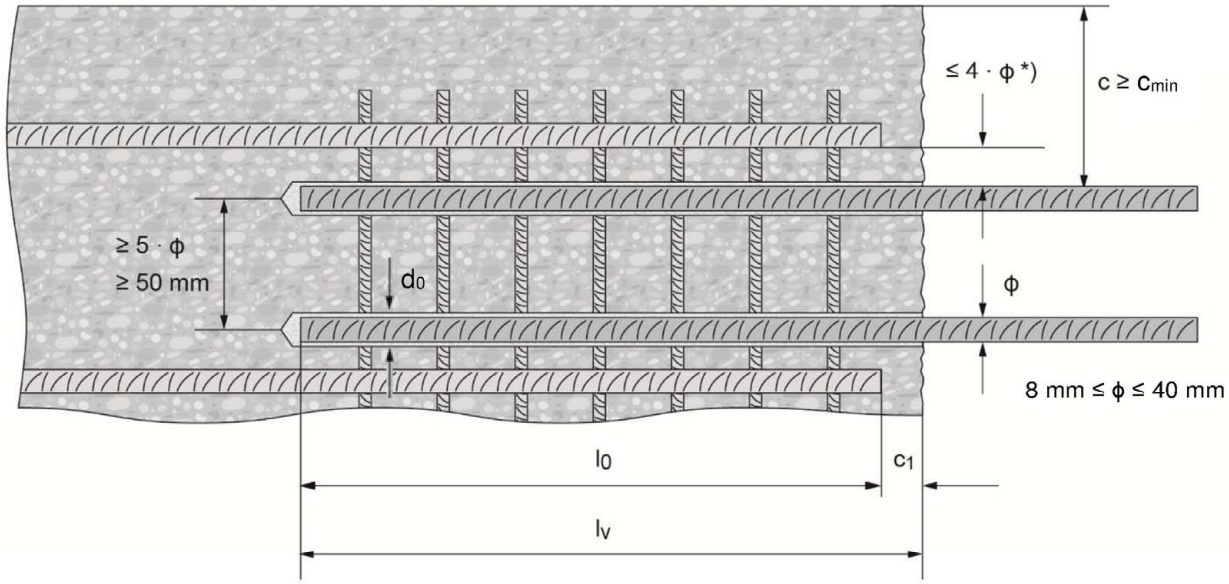
Figure B1: General construction rules for post-installed rebars

- Post-installed rebar may be designed for tension forces only.
- 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 protrudes.



*) 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
c_{min}	minimum concrete cover according to Table B1 and to EN 1992-1-1
ϕ	diameter of reinforcement bar
l_0	lap length, according to EN 1992-1-1
l_v	effective embedment depth ≥ $l_0 + c_1$
d_0	nominal drill bit diameter, see Annex B5 and B6

Injection system Hilti HIT-RE 100-HC for rebar connection	**Annex B2**
Intended Use General construction rules for post-installed rebars	

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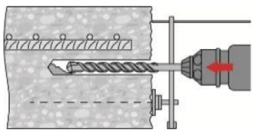
Table B1: Minimum concrete cover min c[1] of the post-installed rebar depending on drilling method and drilling tolerance

Drilling method	Bar diameter [mm]	Minimum concrete cover min c[1] [mm]		
		Without drilling aid	With drilling aid	
Hammer drilling **(HD)** and **(HDB)**[2]	$\phi < 25$	$30 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$	$40 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
Compressed air drilling **(CA)**	$\phi < 25$	$50 + 0{,}08 \cdot l_v$	$50 + 0{,}02 \cdot l_v$	
	$\phi \geq 25$	$60 + 0{,}08 \cdot l_v \geq 2 \cdot \phi$	$60 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
Diamont coring dry **(PCC)** or wet **(DD)**	$\phi < 25$	Drill stand is used as drilling aid	$30 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$		$40 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	

[1] See Annex B2, Figure B1.
[2] HDB = hollow drill bit Hilti TE-CD and TE-YD
Comments: The minimum concrete cover acc. EN 1992-1-1 must be observed.

Table B2: Maximum embedment depth $l_{v,max}$ depending on bar diameter and dispenser

Dispenser	HDM 500			HDE 500		
Mortar temperature	10-19°C	20-25°C		10-19°C	20-25°C	
Base material temperature	5-20°C	5-20°C	>20°C	5-20°C	5-20°C	>20°C
ϕ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]
8	500	1000	1000	500	1000	1000
10						
12						
14					1200	1200
16					1500	1500
18		700			1300	
20						
22					1000	
24						
25						
26		500	700		700	1000
28						
30						
32						
34					500	
36						
40						

Injection system Hilti HIT-RE 100-HC for rebar connection	Annex B3
Intended Use Minimum concrete cover / Maximum embedment depth	

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Table B3: Maximum working time, initial curing time and minimum curing time

Temperature in the base material T	Maximum working time t_{work}	Initial curing time $t_{cure,ini}$	Minimum curing time t_{cure}
5°C to 9°C	2,5 hours	18 hours	72 hours
10°C to 14°C	2 hours	12 hours	48 hours
15°C to 19°C	1 hours	8 hours	24 hours
20°C to 29°C	40 min	6 hours	18 hours
30°C to 40°C	20 min	2 hours	6 hours

Injection system Hilti HIT-RE 100-HC for rebar connection

Intended use
Maximum working time, initial curing time and minimum curing time

Annex B4

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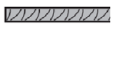
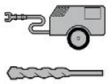
Table B4: Parameters of drilling, cleaning and setting tools

Elements		Drill and clean					Installation		
Rebar	Hammer drilling (HD)	Compressed air drilling (CA)	Diamond core wet (DD)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment depth
									-
size	d_0 [mm]	d_0 [mm]	d_0 [mm]	size	size	[-]	size	[-]	$l_{v,max}$ [mm]
ϕ 8	10	-	10	10	10	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	250
	12	-	12	12	12		12		1000
ϕ 10	12	-	12	12	12		12		250
	14	-	14	14	14		14	HIT-VL 11/1,0	1000
ϕ 12	14	-	14	14	14		14		250
	16	-	16	16	16		16		1000
	-	17	-	18	16		18		
ϕ 14	18	17	18	18	18		18 / 16[1)]		1200
ϕ 16	20	-	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 / 18[1)]	HIT-VL 16/0,7 and/or HIT-VL 16	1500
	-	20	-	22	20		22		
ϕ 18	22	22	22	22	22		22		
ϕ 20	25 / 24[1)]	-	25	25 / 24[1)]	25 / 24[1)]		25 / 24[1)]		1500 / 400[1)]
	-	26	-	28	25		28		
ϕ 22	28	28	28	28	28		28		1500
ϕ 24	32	32	32	32	32		32		
ϕ 25	32 / 30[1)]	32 / 30[1)]	32	32 / 30[1)]			32 / 30[1)]		1500 / 500[1)]
ϕ 26	35	35	35	35			35		1000
ϕ 28	35	35	35	35			35		
ϕ 30	-	35	35	35			35		
	37	-	-	37			37		
ϕ 32	40	40	40	40	32		40		
ϕ 34	-	42	42	42			42		
	45	-	-	45			45		
ϕ 36	45	45	-	45			45		
	-	-	47	47			47		
ϕ 40	-	-	52	52			52		
	55	57	-	55			55		

[1)] Each of the two given values can be used.
Assemble extension HIT-VL 16/0.7 with coupler HIT-DL K for deeper anchor holes.

Injection system Hilti HIT-RE 100-HC for rebar connection

Intended Use
Parameters of cleaning and setting tools for hammer drilling, compressed air drilling and diamond coring wet

Annex B5

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Table B5: Parameters of drilling and setting tools with hollow drill bit or dry diamond coring

Elements	Drill					Installation		
Rebar	Hammer drilling, hollow drill bit (HDB)	Diamond core dry (PCC)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment depth
							 1)	-
size	d_0 [mm]	d_0 [mm]	size	size	[-]	size	[-]	$l_{v,max}$ [mm]
ϕ 8	12	-	No cleaning required			12	HIT-VL 9/1,0	200
ϕ 10	12	-				12		
	14	-				14	HIT-VL 11/1,0	240
ϕ 12	14	-				14		
	16	-				16		1000
ϕ 14	18	-				18		
ϕ 16	20	-				20	HIT-VL 16/0,7 and/or HIT-VL 16	
ϕ 18	22	-				22		
ϕ 20	25	-				25		
ϕ 22	28	-				28		
ϕ 24	32	-				32		
	-	35				35		1500
ϕ 25	32	-				32		1000
	-	35				35		1500
ϕ 26	-	35				35		1000
ϕ 28	-	35				35		
ϕ 30	-	35				35		
ϕ 32	-	47				45		
ϕ 34	-	47				45		
ϕ 36	-	47				45		
ϕ 40	-	52				52		

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

Injection system Hilti HIT-RE 100-HC for rebar connection

Intended Use
Parameters of cleaning and setting tools for hammer drilling with hollow drill bit and diamond coring dry

Annex B6

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Cleaning alternatives

Manual Cleaning (MC):
Hilti hand pump for blowing out drill holes with diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$.

Compressed Air Cleaning (CAC):
air nozzle with an orifice opening of minimum 3,5 mm in diameter.

Automatic Cleaning (AC):
Cleaning is performed during drilling with Hilti TE-CD and TE-YD drilling system including vacuum cleaner.

Installation instruction

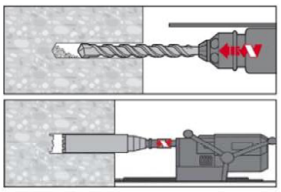
Safety Regulations:

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-RE 100-HC.
Important: Observe the installation instruction provided with each foil pack.

Hole drilling

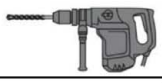
Before drilling remove carbonized concrete and clean contact areas (see Annex B1).
In case of aborted drill hole the drill hole shall be filled with mortar.

a) Hammer drilling

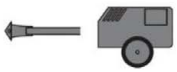


Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode, a compressed air drill using an appropriately sized carbide drill bit or a diamond coring machine.

Hammer drill (HD)

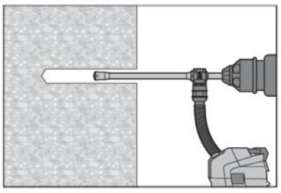


Compressed air drill (CA)



Diamond core wet (DD) and dry (PCC)

b) Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD



Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit attached to Hilti vacuum cleaner VC 20/40 (-Y) (suction volume ≥ 57 l/s) with automatic cleaning of the filter activated. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual.
After drilling is completed, proceed to the "injection preparation" step in the installation instruction

Injection system Hilti HIT-RE 100-HC for rebar connection	
Intended Use Cleaning alternatives Installation instructions	**Annex B7**

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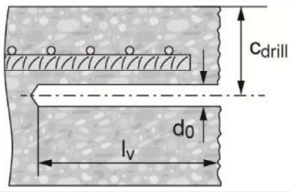
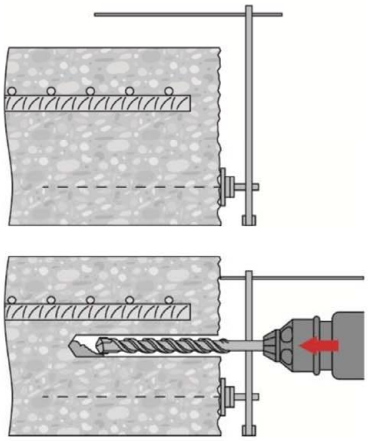
Splicing applications



- Measure and control concrete cover c.
- $c_{drill} = c + d_0/2$.
- Drill parallel to edge and to existing rebar.
- Where applicable use Hilti drilling aid HIT-BH.

Drilling aid — For holes l_v > 20 cm use drilling aid.

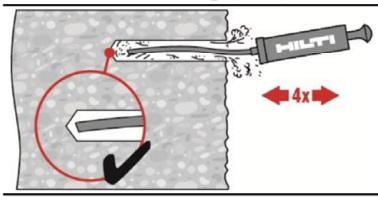


Ensure that the drill hole is parallel to the existing rebar.
Three different options can be considered:

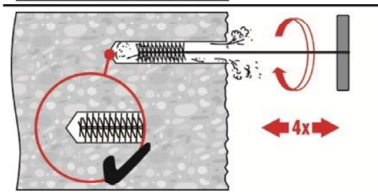
- Hilti drilling aid HIT-BH
- Lath or spirit level
- Visual check

Drill hole cleaning — Just before setting the bar the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.

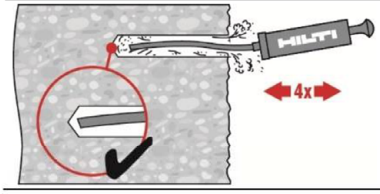
Manual Cleaning (MC) — For drill hole diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot \phi$.



The Hilti hand pump may be used for blowing out drill holes up to diameters $d_0 \leq 20$ mm and embedment depths up to $h_{ef} \leq 10 \cdot \phi$.
Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust.



Brush 4 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



Blow out again with the Hilti hand pump at least 4 times until return air stream is free of noticeable dust.

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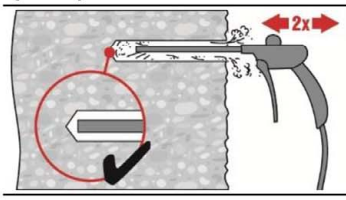
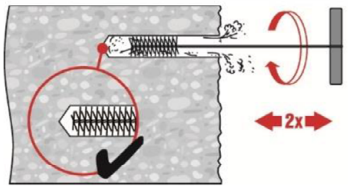
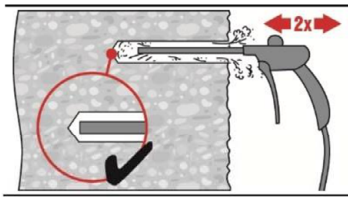
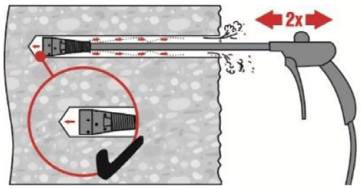
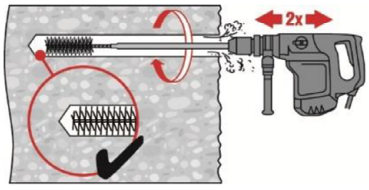
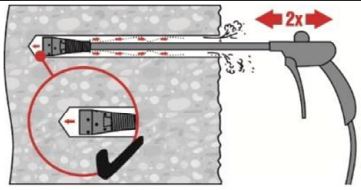
Compressed Air Cleaning (CAC)	For all drill hole diameters d_0 and all drill hole depths $h_0 \leq 20 \cdot \phi$.
	Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust. Safety tip: Do not inhale concrete dust.
	Brush 2 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Compressed Air Cleaning (CAC)	For drill holes deeper than 250 mm (for ϕ 8 to ϕ 12) or deeper than $20 \cdot \phi$ (for $\phi > 12$ mm)
	Use the appropriate air nozzle Hilti HIT-DL (see Table B4). Blow 2 times from the back of the hole over the whole length with oil-free compressed air until return air stream is free of noticeable dust. For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h. Safety tip: Do not inhale concrete dust. Use of the dust collector Hilti HIT-DRS is recommended.
	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 drill hole. Attach the other end of the extension to the TE-C/TE-Y chuck. Brush 2 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) and removing it. Safety tip: Start machine brushing operation slowly. Start brushing operation once the brush is inserted in the drill hole.
	Use the appropriate air nozzle Hilti HIT-DL (see Table B4). Blow 2 times from the back of the hole over the whole length with oil-free compressed air until return air stream is free of noticeable dust.

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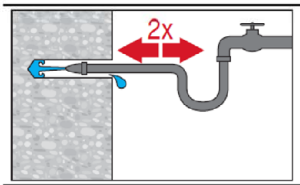
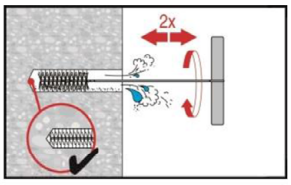
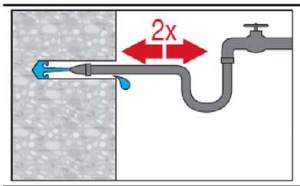
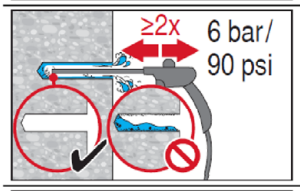
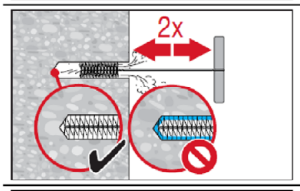
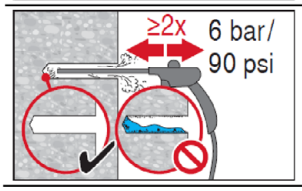
Cleaning of diamond cored holes:

For all drill hole diameters d_0 and all drill hole depths h_0.

	Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.
	Brush 2 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.
	Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water. For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.
	Brush 2 times with the specified brush size (brush Ø ≥ drill hole Ø, see Table B4 by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole – if not the brush is too small and must be replaced with the proper brush diameter.
	Blow again with compressed air 2 times until return air stream is free of noticeable dust and water.

Injection system Hilti HIT-RE 100-HC for rebar connection	
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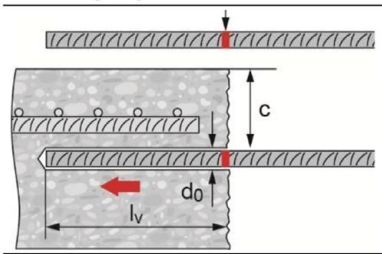
Rebar preparation

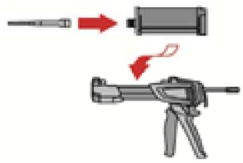


Before use, make sure the rebar is dry and free of oil or other residue.

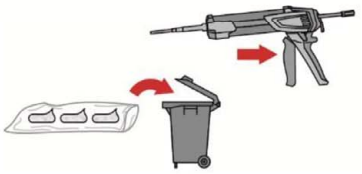
Mark the embedment depth on the rebar (e.g. with tape) → l_v.

Insert Rebar in borehole to verify hole and setting depth l_v.

Injection preparation



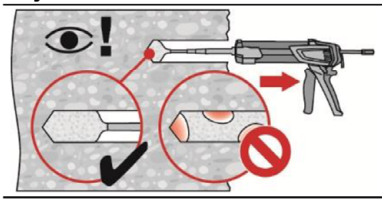
Tightly attach Hilti mixing nozzle HIT-RE-M to hard cartridge manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser. Insert hard cartridge into dispenser.



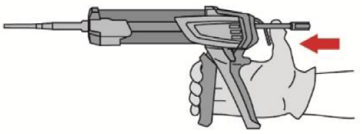
The hard cartridge opens automatically as dispensing is initiated. Prior to dispensing into the drill hole, squeeze out separately 3 full strokes.

Inject adhesive from the back of the drill hole without forming air voids.

Injection method for drill hole depth ≤ 250 mm (without overhead applications)



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
Fill approximately 2/3 of the drill hole to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.



After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

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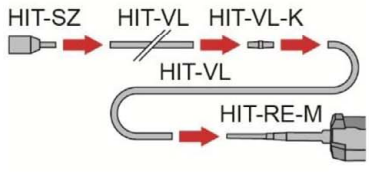
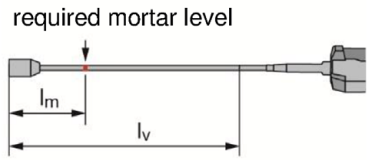
Injection method for drill hole depth > 250 mm or overhead applications

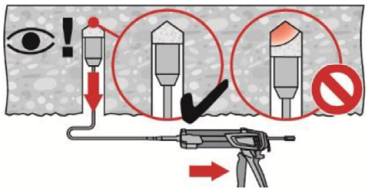


Assemble mixing nozzle HIT-RE-M, extension(s) and piston plug HIT-SZ (see Table B4).
For combinations of several injection extensions use coupler HIT-VL-K.
A substitution of the injection extension for a plastic hose or a combination of both is permitted.
The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube supports proper injection.

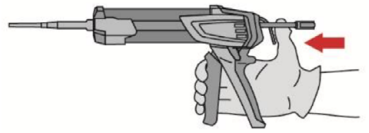


Mark the required mortar level l_m and embedment depth l_v with tape or marker on the injection extension.

- estimation:
  $l_m = 1/3 \cdot l_v$
- precise formula for optimum mortar volume:
  $l_m = l_v \cdot (1{,}2 \cdot (\phi^2 / d_0^2) - 0{,}2)$



For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B4). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.



After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

Injection system Hilti HIT-RE 100-HC for rebar connection

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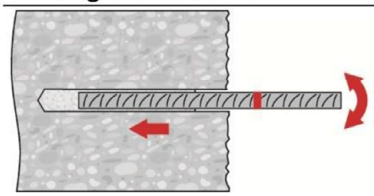
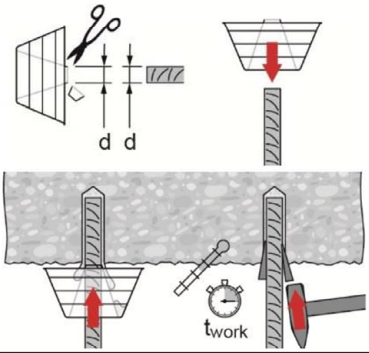
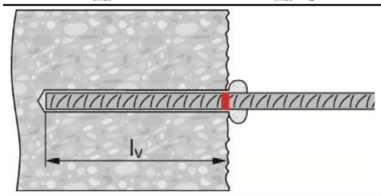
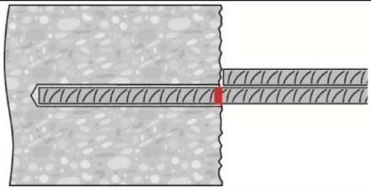
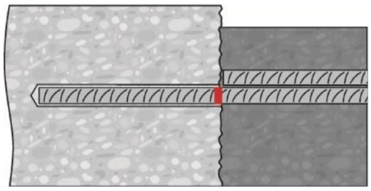
Setting the element	Before use, verify that the element is dry and free of oil and other contaminants.
	For easy installation insert the rebar into the drill hole while slowly twisting until the embedment mark is at the concrete surface level.
	For overhead application: During insertion of the rebar mortar might flow out of the drill hole. For collection of the flowing mortar HIT-OHC may be used. Support the rebar and secure it from falling until mortar has started to harden, e.g. using wedges HIT-OHW. For overhead installation use piston plugs and fix embedded parts with e.g. wedges.
	After installing the rebar the annular gap must be completely filled with mortar. Proper installation: • desired anchoring embedment l_v is reached: 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. After $t_{cure,ini}$ (see Table B3) preparation work may continue.
	Full load may be applied only after the curing time t_{cure} has elapsed (see Table B3).

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Minimum anchorage length and minimum lap length

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1 shall be multiplied by the amplification factor α_{lb} given in Table C1.
The design bond strength $f_{bd,PIR}$ is given in Table C3 and Table C5. It is obtained by multiplying the bond strength f_{bd} according to EN 1992-1-1 with the factor according to Table C2 and Table C4.

Table C1: Amplification factor α_{lb}

Concrete class	Bar diameter	Drilling method	Amplification factor α_{lb}
C12/15 to C50/60	ϕ 8 to ϕ 40	Hammer drilling (HD), hollow drill bit (HDB) and compressed air drilling (CA)	1,0
C12/15 to C50/60	ϕ 8 to ϕ 40	Diamond coring dry (PCC) and wet (DD)	1,5

Table C2: Bond efficiency factor k_b for hammer drilling (HD) and (HDB) and compressed air drilling (CA) and diamond coring dry (PCC)

	Bond efficiency factor k_b [-]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 40	1,0								

Table C3: Design values of the ultimate bond resistance $f_{bd,PIR}$ [1] for hammer drilling (HD) and (HDB), compressed air drilling (CA) and diamond coring dry (PCC)

	Bond strength $f_{bd,PIR}$ [N/mm²]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
ϕ 34	1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
ϕ 36	1,5	1,9	2,2	2,6	2,9	3,3	3,6	3,8	4,1
ϕ 40	1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	4,0

[1] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

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Table C4: Bond efficiency factor k_b for diamond coring wet (DD)

	Bond efficiency factor k_b [-]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32	1,00				0,90	0,79	0,73	0,68	0,63
ϕ 34	1,00				0,90	0,79	0,73	0,68	0,63
ϕ 36	1,00				0,90	0,79	0,73	0,68	0,63
ϕ 40	1,00				0,89	0,81	0,74	0,68	0,63

Table C5: Design values of the ultimate bond resistance $f_{bd,PIR}$[1)] for diamond coring wet (DD)

	Bond strength $f_{bd,PIR}$ [N/mm²]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32	1,6	2,0	2,3	2,7					
ϕ 34	1,6	2,0	2,3	2,6					
ϕ 36	1,5	1,9	2,2	2,6					
ϕ 40	1,5	1,8	2,1	2,5					

[1)] According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.