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-20/0475 of 15 June 2021

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	Connector Hilti HCC-K with Injectionmortar Hilti HIT-HY 200-R V3, Hilti HIT-RE 500 V3 and Hilti HIT-RE 500 V4
Product family to which the construction product belongs	Connector for Strengthening of existing concrete structures by concrete overlay
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	24 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 332347-00-0601, Edition 12/2019
This version replaces	ETA-20/0475 issued on 24 July 2020

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Specific Part

1 Technical description of the product

The Connector Hilti HCC-K is a headed fastener made of steel anchored with Injectionmortar Hilti HIT-HY 200-R V3, Hilti HIT-RE 500 V3 or Hilti HIT-RE 500 V4 into a predrilled cylindrical drill hole in existing concrete. The Hilti HCC-K is connecting two layers of concrete cast at different times (existing concrete and concrete overlay). The side with the anchor head of Hilti HCC-K is finally embedded in the concrete overlay.

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
Existing concrete: - resistances - edge distance and spacing	 See Annex C 1 to C 5 See Annex B 3
Concrete overlay: - resistances - edge distance and spacing	 See Annex C 6 See Annex B 3
Shear interface parameter under static and quasi-static and fatigue cyclic loading - material and geometric parameters - factor for fatigue cyclic loading	 See Annex C 6 No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

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. 332347-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 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 15 June 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Tempel

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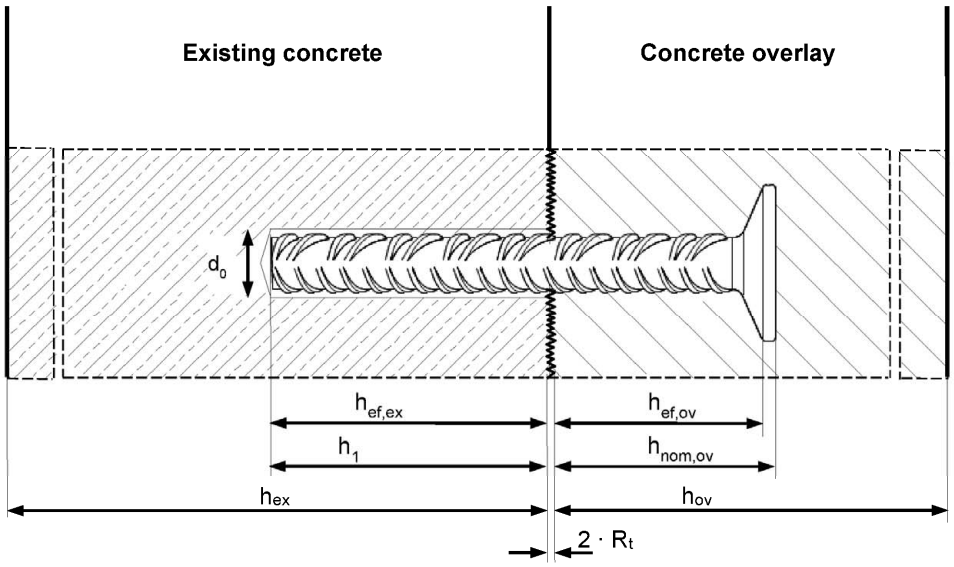
Installed condition

Figure A1:
Connector Hilti HCC-K



$h_{ef,ex}$	Effective embedment depth in existing concrete	$h_{ef,ov}$	Effective embedment depth in concrete overlay
h_1	Drill hole depth	$h_{nom,ov}$	Overall embedment depth in the concrete overlay
h_{ex}	Thickness of existing concrete	h_{ov}	Thickness of concrete overlay
R_t	Roughness according to EOTA Technical Report TR 066:2019-10		

Connector Hilti HCC-K	**Annex A1**
Product description Installed condition	

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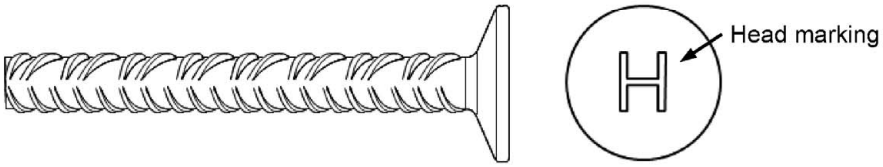
Product description: Connector and injection mortar

Steel element Hilti HCC-K, size 10, 12, 14, 16



Injection mortar Hilti HIT-HY 200-R V3: epoxy resin system with aggregate (330 ml and 500 ml)

Marking:
HILTI HIT
Product number
Production line
Expiry date mm/yyyy

Product name: "Hilti HIT-HY 200-R V3"

Injection mortar Hilti HIT-RE 500 V3: epoxy resin system with aggregate (330 ml, 500 ml and 1400 ml)

Marking:
HILTI HIT
Product name
Production time and line
Expiry date mm/yyyy

Product name: "Hilti HIT-RE 500 V3"

Injection mortar Hilti HIT-RE 500 V4: epoxy resin system with aggregate (330 ml, 500 ml and 1400 ml)

Marking:
HILTI HIT
Product name
Production time and line
Expiry date mm/yyyy

Product name: "Hilti HIT-RE 500 V4"

Static mixer Hilti HIT-E-M

Connector Hilti HCC-K	**Annex A2**
Product description Steel element / Injection mortar / Static mixer	

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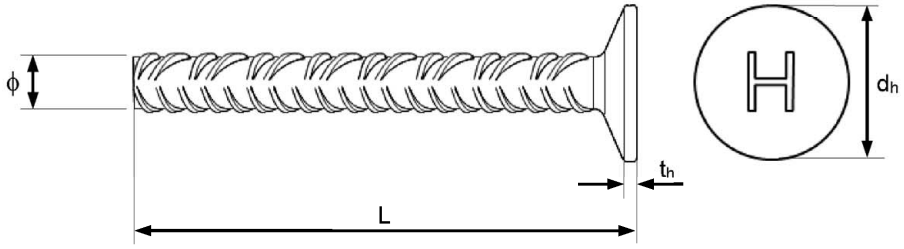
Table A1: Materials

Designation	Material
HCC-K	Reinforcing bar B500B according EN 1992-1-1:2004 and AC:2010, Annex C Strength: $f_{uk} \geq 550$ N/mm², $f_{yk} \geq 500$ N/mm² Strain at maximum force $\varepsilon_{uk} \geq 5\%$

Table A2: Specification

Connector Hilti HCC-K			10	12	14	16
Rebar diameter	ϕ	[mm]	10	12	14	16
Overall length	L	[mm]	100 to 650	140 to 650	200 to 650	230 to 650
Diameter of the head	d_h	[mm]	30	36	42	48
Thickness of the head	t_h	[mm]	2	2	2	2



Connector Hilti HCC-K	Annex A3
Product description Materials / Specification	

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Specifications of intended use

Anchorages subject to:

- static and quasi static actions
  - surface roughness “very smooth” to “very rough” of the shear interface according to EOTA Technical Report TR 066:2019-10.

Base material (existing concrete and concrete overlay):

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016.
- Cracked and uncracked concrete.

Temperature in the base material (existing concrete):

For use with **HIT-HY 200-R V3**

- **at installation:**
  -10 °C to +40 °C for the standard variation of temperatures after installation
- **in-service:**
  Temperature range I: -40 °C to +40 °C
  (max. long term temperature +24 °C and max. short term temperature +40 °C)
  Temperature range II: -40 °C to +80 °C
  (max. long term temperature +50 °C and max. short term temperature +80 °C)
  Temperature range III: -40 °C to +120 °C
  (max. long term temperature +72 °C and max. short term temperature +120 °C)

For use with **HIT-RE 500 V3**

- **at installation:**
  -5 °C to +40 °C for the standard variation of temperatures after installation
- **in-service:**
  Temperature range I: -40 °C to +40 °C
  (max. long term temperature +24 °C and max. short term temperature +40 °C)
  Temperature range II: -40 °C to +70 °C
  (max. long term temperature +43 °C and max. short term temperature +70 °C)

For use with **HIT-RE 500 V4**

- **at installation:**
  -5 °C to +40 °C for the standard variation of temperatures after installation
- **in-service:**
  Temperature range I: -40 °C to +40 °C
  (max. long term temperature +24 °C and max. short term temperature +40 °C)
  Temperature range II: -40 °C to +55 °C
  (max. long term temperature +43 °C and max. short term temperature +55 °C)
  Temperature range III: -40 °C to +75 °C
  (max. long term temperature +55 °C and max. short term temperature +75 °C)

Connector Hilti HCC-K	Annex B1
Intended use Specifications	

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Design:

- The design of an anchorage and the specification of the fastener is under the control of an engineer experienced in anchorages and concrete work.
- Post-installed shear connections are designed in accordance with EOTA Technical Report TR 066:2019-10.
- For the concrete overlay following requirements on the mixture apply:
  - Concrete compressive strength of the new concrete shall be higher than the concrete compressive strength of the existing concrete.
  - Use of concrete with low shrinkage is recommended.
  - Slump of fresh concrete f ≥ 380 mm, a slump value f ≥ 450 mm is recommended, if applicable.

Installation:

- Use category (existing concrete):
  - dry or wet concrete condition: all injection mortars.
  - water-filled drill holes: HIT-RE 500 V3 and HIT-RE 500 V4 only, for hammer drilling only, for uncracked concrete only.
- Installation direction in existing concrete is downward and horizontal and upwards (e.g. overhead) installation (D3).
- The fastener installation is executed by trained personnel, ensuring that the Installation instruction and the specifications by the engineer are observed.
- The requirements for construction works given in EOTA Technical Report TR 066:2019-10 have to be considered.

Connector Hilti HCC-K	**Annex B2**
Intended use Specifications	

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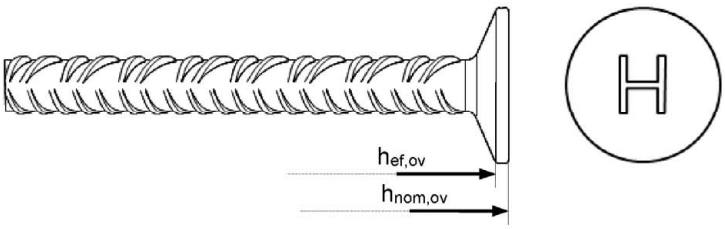
Table B1: Installation parameters of connector Hilti HCC-K in existing concrete

Connector Hilti HCC-K			**10**	**12**	**14**	**16**
Effective embedment depth and drill hole depth	$h_{ef,ex}$ = h_1	[mm]	60	70	75	80
			200	240	280	320
Nominal diameter of drill bit	d_0	[mm]	12[1)] 14[1)]	14[1)] 16[1)]	18	20
Minimum thickness of existing concrete	$h_{min,ex}$	[mm]	max (100; h_{ef} + 30, h_{ef} + 2 · d_0)			
Minimum spacing	$s_{min,ex}$	[mm]	50	60	70	80
Minimum edge distance	$c_{min,ex}$	[mm]	45	45	50	50

1) Each of the two given values can be used.

Table B2: Installation parameters of connector Hilti HCC-K in concrete overlay

Connector Hilti HCC-K			**10**	**12**	**14**	**16**
Effective embedment depth	min. $h_{ef,ov}$	[mm]	40			
	max. $h_{ef,ov}$		L - $h_{nom,ex}$ - t_h - 2 · R_t [1)]			
Overall embedment depth	$h_{nom,ov}$	[mm]	$h_{ef,ov}$ + t_h			
Minimum thickness of concrete overlay	$h_{min,ov}$	[mm]	$h_{nom,ov}$ + c_{nom}[2)]			
Minimum spacing	$s_{min,ov}$	[mm]	60	75	85	100
Minimum edge distance	$c_{min,ov}$	[mm]	15 + c_{nom}[2)]	20 + c_{nom}[2)]	25 + c_{nom}[2)]	25 + c_{nom}[2)]



1) R_t: Roughness according to EOTA Technical Report TR 066:2019-10.
2) c_{nom}: Minimum concrete cover according EN 1992-1-1:2004+AC:2010.

Connector Hilti HCC-K	**Annex B3**
Intended use Installation parameters	

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Table B3: Working time and curing time for Hilti HIT-HY 200-R V3 [1)]

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 °C to -5 °C	3 hours	20 hours
> -5 °C to 0 °C	1,5 hours	8 hours
> 0 °C to 5 °C	45 min	4 hours
> 5 °C to 10 °C	30 min	2,5 hours
> 10 °C to 20 °C	15 min	1,5 hours
> 20 °C to 30 °C	9 min	1 hour
> 30 °C to 40 °C	6 min	1 hour

1) The minimum temperature of the foil pack is 0° C.

Table B4: Working time and curing time for Hilti HIT-RE 500 V3 and Hilti HIT-RE 500 V4 [1)2)]

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
-5 °C to -1 °C	2 hours	168 hours
0 °C to 4 °C	2 hours	48 hours
5 °C to 9 °C	2 hours	24 hours
10 °C to 14 °C	1,5 hours	16 hours
15 °C to 19 °C	1 hour	16 hours
20 °C to 24 °C	30 min	7 hours
25 °C to 29 °C	20 min	6 hours
30 °C to 34 °C	15 min	5 hours
35 °C to 39 °C	12 min	4,5 hours
40 °C	10 min	4 hours

1) The curing time data are valid for dry base material only. In wet base material the curing times must be doubled.

2) The minimum temperature of the foil pack is +5° C.

Connector Hilti HCC-K	Annex B4
Intended use Working time and curing time	

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Table B5: Overview of installation options

Concrete condition	Drilling	Cleaning	HCC-K with … HIT-HY 200-R V3	HIT-RE 500 V3	HIT-RE 500 V4
Dry / wet	Hammer drilling with hollow drill bit TE-CD or TE-YD 	Automatic	✓	✓	✓
	Hammer drilling	Manual cleaning	✓	-	-
		Compressed air cleaning	✓	✓	✓
	Diamond coring with roughening tool TE-YRT 	Cleaning of diamond cored holes with roughening	✓	✓	✓
	Diamond coring 	Cleaning of diamond cored holes	-	✓	✓
Water-filled drill hole	Hammer drilling	Cleaning for water-filled drill holes	-	✓	✓

Table B6: Parameters of cleaning and setting tools

Elements	Drill and clean					Installation
HCC-K	Hammer drilling		Diamond coring		Brush	Piston plug
		Hollow drill bit TE-CD, TE-YD[1)]		Roughening tool TE-YRT		
						
size	d_0 [mm]	d_0 [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
10	12	12	12	-	12	12
	14	14	14	-	14	14
12	14	14	14	-	14	14
	16	16	16	-	16	16
14	18	18	18	18	18	18
16	20	20	20	20	20	20

[1)] With vacuum cleaner Hilti VC 20/40/60 (automatic filter cleaning activated) or vacuum cleaner with activated automatic filter cleaning as well as volumetric flow rate at turbine ≥ 57 l/s, volumetric flow rate at end of hose ≥ 106 m³/h and partial vacuum ≥ 16 kPa.

Connector Hilti HCC-K

Intended use
Overview of installation options / Parameters of cleaning and setting tools

Annex B5

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Table B7: Cleaning alternatives

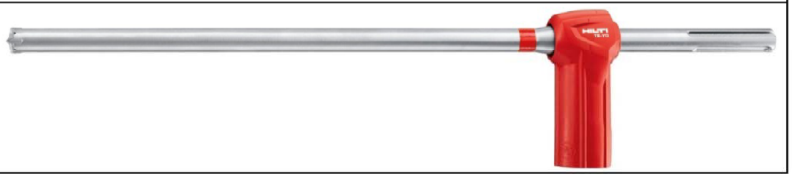
Manual Cleaning (MC) for use with **HIT-HY 200-R V3 only:** Hilti hand pump for blowing out drill holes with diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$.	
Compressed air cleaning (CAC): Air nozzle with an orifice opening of minimum 3,5 mm in diameter.	
Automatic Cleaning (AC): Cleaning is performed during drilling with Hilti TE-CD and TE-YD drilling system including vacuum cleaner.	

Table B8: Parameters for use of the Hilti Roughening tool TE-YRT

Associated components			
Diamond coring		Roughening tool TE-YRT	Wear gauge RTG…
			
d_0 [mm]		d_0 [mm]	size
nominal	measured		
18	17,9 to 18,2	18	18
20	19,9 to 20,2	20	20

Table B9: Installation parameters for use of the Hilti Roughening tool TE-YRT

	Roughening time $t_{roughen}$	**Minimum blowing time** $t_{blowing}$
$h_{ef,ex}$ [mm]	$t_{roughen}$ [sec] = $h_{ef,ex}$ [mm] / 10	$t_{blowing}$ [sec] = $t_{roughen}$ [sec] + 20
0 to 100	10	30
101 to 200	20	40
201 to 300	30	50
301 to 400	40	60

Table B10: Hilti Roughening tool TE-YRT and wear gauge RTG

TE-YRT	
RTG	

Connector Hilti HCC-K

Intended use
Cleaning alternatives / Parameters for use of roughening tool

Annex B6

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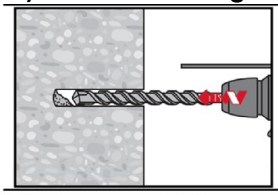
Installation instruction

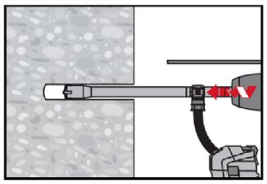
Hole drilling

a) Hammer drilling



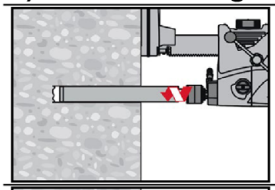
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

b) Hammer drilling with Hilti hollow drill bit

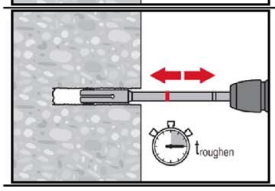


Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit attached to Hilti vacuum cleaner VC 20/40/60 or a vacuum cleaner acc. to Table B6 with automatic filter cleaning activated. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed to the "injection preparation" step in the installation instruction.

c) Diamond coring with roughening with Hilti roughening tool TE-YRT:

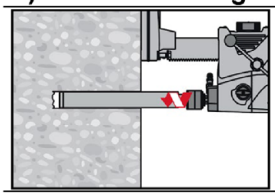


Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.
For the use in combination with Hilti roughening tool TE-YRT see parameters in Table B8 and Table B9.



Before roughening water needs to be removed from the drill hole.
Check usability of the roughening tool with the wear gauge RTG.
Roughen the drill hole over the whole length to the required $h_{ef,ex}$.

d) Diamond coring: For dry and wet concrete only, for use with **HIT-RE 500 V3** and **HIT-RE 500 V4**

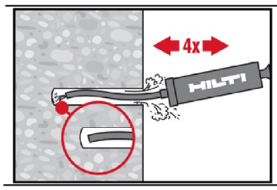


Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

Drill hole cleaning

Just before setting an anchor, the drill hole must be free of dust and debris.
Inadequate hole cleaning = poor load values.

Manual Cleaning (MC), for use with **HIT-HY 200-R V3 only**
Uncracked concrete only. For drill hole diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$.



The Hilti hand pump may be used for blowing out drill holes up to diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$.
Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust.

Connector Hilti HCC-K	Annex B7
Intended use Installation instructions	

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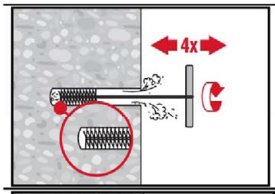
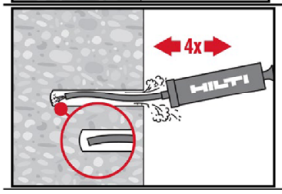
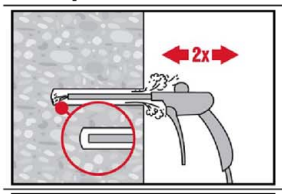
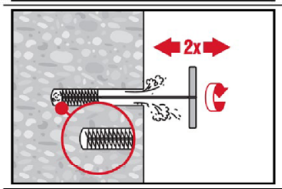
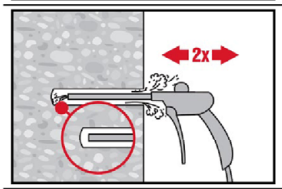
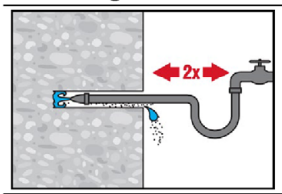
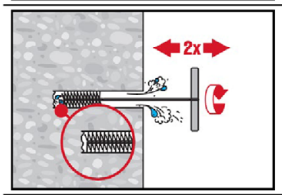
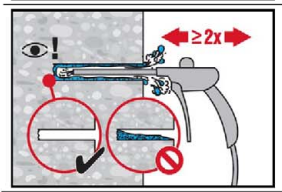
	Brush 4 times with the specified brush (see Table B6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is 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.
Compressed air cleaning (CAC) for all drill hole diameters d_0 and all drill hole depths h_0	
	Blow 2 times from the back of the hole (if needed with nozzle extension) over the hole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.
	Brush 2 times with the specified brush (see Table B6) 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.
Cleaning of diamond cored holes with roughening with Hilti roughening tool TE-YRT.	
	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 B6) 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 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. Remove all water from the drill hole until drill hole is completely dried before mortar injection.

Connector Hilti HCC-K	**Annex B8**
Intended use Installation instructions	

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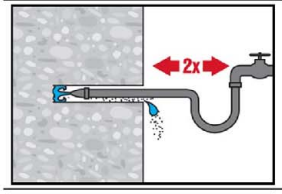
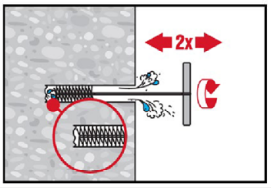
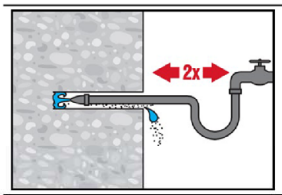
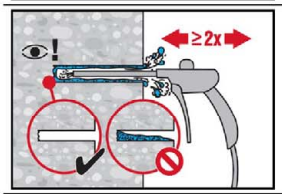
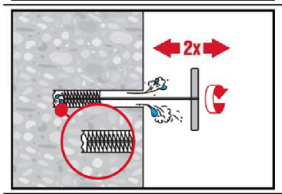
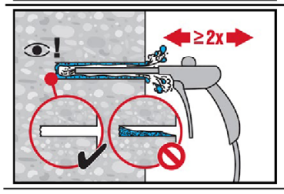
Cleaning of hammer drilled water-filled drill holes and diamond cored holes,
for use with **HIT-RE 500 V3** and **HIT-RE 500 V4**. For all drill hole diameters d_0 and all drill hole depths h_0.

	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 B6) 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.
	Brush 2 times with the specified brush size (brush Ø ≥ drill hole Ø, see Table B7 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.

Connector Hilti HCC-K	
Intended use Installation instructions	**Annex B9**

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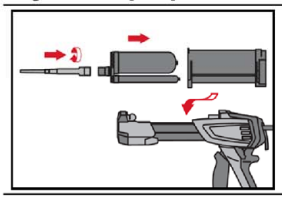
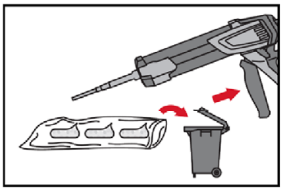
Injection preparation



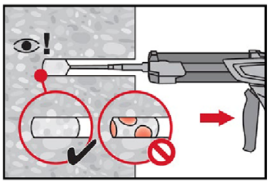
Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into dispenser.



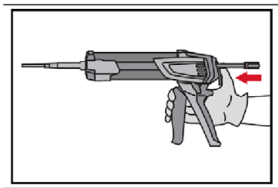
The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack, an initial amount of adhesive has to be discarded. Discarded quantities are:

- for use with **HIT-HY 200-R V3**:
  - 2 strokes for 330 ml foil pack,
  - 3 strokes for 500 ml foil pack,
  - 4 strokes for 500 ml foil pack ≤ 5 °C.
  - The minimum foil pack temperature is 0° C.
- for use with **HIT-RE 500 V3** and **HIT-RE 500 V4**:
  - 3 strokes for 330 ml foil pack,
  - 4 strokes for 500 ml foil pack,
  - 65 ml for 1400 ml foil pack
  - The minimum foil pack temperature is +5° C.

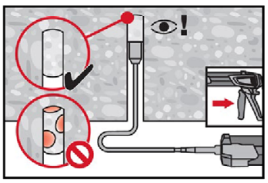
Inject adhesive from the back of the drill hole without forming air voids.



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.
In water saturated concrete it is required to set the fastener immediately after cleaning the drill hole.



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



Overhead installation and/or installation with embedment depth $h_{ef,ex}$ > 250mm.
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 B6). 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.

Connector Hilti HCC-K	**Annex B10**
Intended use Installation instructions	

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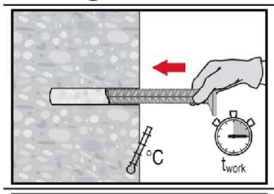
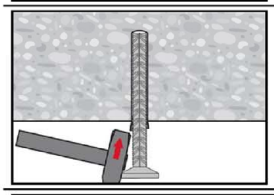
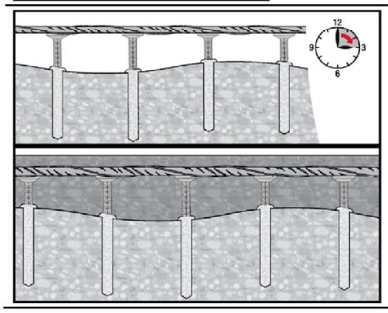
Setting the element



Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth before working time t_{work} has elapsed. The working time t_{work} is given in Table B3 and Table B4.



For overhead installation use piston plugs and fix embedded parts with e.g. wedges (Hilti HIT-OHW).



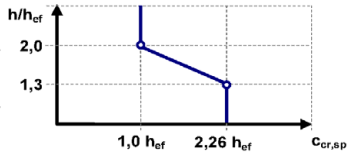
Observe the curing time t_{cure}, which varies according to temperature of base material (see Table 3 and Table B4). After t_{cure} has elapsed the concrete overlay can be concreted.
Observe the required condition of the surface before concreting and the use of the correct concrete composition.
For requirements on concrete composition see EOTA TR 066:2019-10.

Connector Hilti HCC-K	**Annex B11**
Intended use Installation instructions	

Deutsches Institut für Bautechnik DIBt

Table C1: Essential characteristics of connector Hilti HCC-K in existing concrete

Connector Hilti HCC-K			**10**	**12**	**14**	**16**
Steel failure						
Characteristic resistance	$N_{Rk,s,ex}$	[kN]	43	62	85	111
Partial safety factor	$\gamma_{Ms,N,ex}$	[-]	1,4			
Concrete cone failure						
Factor for cracked concrete	$k_{cr,N,ex}$	[-]	7,7			
Factor for uncracked concrete	$k_{ucr,N,ex}$	[-]	11,0			
Edge distance	$c_{cr,N,ex}$	[mm]	$1,5 \cdot h_{ef,ex}$			
Spacing	$s_{cr,N,ex}$	[mm]	$3,0 \cdot h_{ef,ex}$			
Splitting failure						
Edge distance $c_{cr,sp,ex}$ [mm] for	$h / h_{ef,ex} \geq 2,0$		$1,0 \cdot h_{ef,ex}$			
	$2,0 > h / h_{ef,ex} > 1,3$		$4,6 \cdot h_{ef,ex} - 1,8 \cdot h$			
	$h / h_{ef,ex} \leq 1,3$		$2,26 \cdot h_{ef,ex}$			
Spacing	$s_{cr,sp,ex}$	[mm]	$2,0 \cdot c_{cr,sp,ex}$			



Connector Hilti HCC-K	**Annex C1**
Performance Essential characteristics under tension load in existing concrete	

Deutsches Institut für Bautechnik DIBt

Table C1 continued (1)

Connector Hilti HCC-K				**10**	**12**	**14**	**16**
Installation factor for HCC-K with HIT-HY 200-R V3							
Hammer drilling		γ_{inst}	[-]	1,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD		γ_{inst}	[-]	1,0			
Diamond coring with roughening with Hilti roughening tool TE-YRT		γ_{inst}	[-]	[1)]		1,0	
Combined pullout and concrete cone failure for HCC-K with HIT-HY 200-R V3							
Characteristic bond resistance in cracked concrete C20/25							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	5,0	7,0		
Temperature range II:	80 °C / 50 °C	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,5		
Temperature range III:	120 °C / 72 °C	$\tau_{Rk,cr}$	[N/mm²]	3,5	5,0		
Characteristic bond resistance in uncracked concrete C20/25							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	12			
Temperature range II:	80 °C / 50 °C	$\tau_{Rk,ucr}$	[N/mm²]	10			
Temperature range III:	120 °C / 72 °C	$\tau_{Rk,ucr}$	[N/mm²]	8,5			
Influence factors ψ on bond resistance τ_{Rk}							
Factor for concrete strength							
Cracked and uncracked concrete		$\psi_{c,ex}$	C30/37	1,04			
			C40/50	1,07			
			C50/60	1,10			
Sustained load factor							
Cracked and uncracked concrete		ψ^0_{sus}	40 °C / 24 °C	0,74			
			80 °C / 50 °C	0,89			
			120 °C / 72 °C	0,72			

Connector Hilti HCC-K

Performance
Essential characteristics under tension load in existing concrete

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C1 continued (2)

Connector Hilti HCC-K				**10**	**12**	**14**	**16**
Installation factor for HCC-K with HIT-RE 500 V3							
Hammer drilling		γ_{inst}	[-]	1,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD		γ_{inst}	[-]	[1)]	1,0		
Diamond coring		γ_{inst}	[-]	1,2			1,4
Diamond coring with roughening with Hilti roughening tool TE-YRT		γ_{inst}	[-]	[1)]		1,0	
Hammer drilling in water-filled drill holes		γ_{inst}	[-]	1,4			
Combined pullout and concrete cone failure for HCC-K with HIT-RE 500 V3							
Characteristic bond resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti roughening tool TE-YRT**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	8,5	9,5	9,5	10
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm²]	7,0	7,5	7,5	7,5
Characteristic bond resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti roughening tool TE-YRT**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	15			
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	11			
Characteristic bond resistance in uncracked concrete C20/25 in **diamond cored holes**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,0			
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5			
Characteristic bond resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	12			
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,5			
Influence factors ψ on bond resistance τ_{Rk}							
Influence of concrete strength							
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	$\psi_{c,ex}$	C30/37	1,04			
			C40/50	1,07			
			C50/60	1,10			
	in diamond cored holes with roughening with Hilti roughening tool TE-YRT	$\psi_{c,ex}$	C30/37	1,0			
			C40/50				
			C50/60				
Influence of sustained load							
Cracked and uncracked concrete	in hammer drilled holes, hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ^0_{sus}	40°C / 24°C	0,88			
			70°C / 43°C	0,70			

Connector Hilti HCC-K

Performance
Essential characteristics under tension load in existing concrete

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C1 continued (3)

Connector Hilti HCC-K				**10**	**12**	**14**	**16**
Installation factor for HCC-K with HIT-RE 500 V4							
Hammer drilling		γ_{inst}	[-]	1,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD		γ_{inst}	[-]	[1)]	1,0		
Diamond coring		γ_{inst}	[-]	1,2			1,4
Diamond coring with roughening with Hilti roughening tool TE-YRT		γ_{inst}	[-]	[1)]		1,0	
Hammer drilling in water-filled drill holes		γ_{inst}	[-]	1,4			
Combined pullout and concrete cone failure HCC-K with HIT-RE 500 V4							
Characteristic bond resistance in cracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti roughening tool TE-YRT**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	10	12	12	12
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm²]	8,5	10	10	10
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	5,0	5,0
Characteristic bond resistance in uncracked concrete C20/25 in **hammer drilled holes** and **hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD** and **diamond cored holes with roughening with Hilti roughening tool TE-YRT**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	15	15	15	15
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	13	12	12	12
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,ucr}$	[N/mm²]	5,0	5,0	5,0	4,5
Characteristic bond resistance in uncracked concrete C20/25 in **diamond cored holes**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,5	9,5	9,5	9,5
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	7,5	7,5	8,0	8,0
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,ucr}$	[N/mm²]	4,5	4,5	4,5	5,0
Characteristic bond resistance in uncracked concrete C20/25 in **hammer drilled holes and installation in water-filled drill holes**							
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	13	13	13	12
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	10	10
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,ucr}$	[N/mm²]	4,0	4,0	4,0	4,0

Connector Hilti HCC-K

Performance
Essential characteristics under tension load in existing concrete

Annex C4

Deutsches Institut für Bautechnik DIBt

Table C1 continued (4)

Connector Hilti HCC-K				**10**	**12**	**14**	**16**
Influence factors ψ on bond resistance τ_{Rk}							
Influence of concrete strength							
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	$\psi_{c,ex}$	C30/37	1,04			
			C40/50	1,07			
			C50/60	1,10			
	in diamond cored holes with roughening with Hilti roughening tool TE-YRT	$\psi_{c,ex}$	C30/37	1,0			
			C40/50				
			C50/60				
Influence of sustained load							
Cracked and uncracked concrete	in hammer drilled holes, hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and in diamond cored holes with roughening with Hilti Roughening tool TE-YRT	ψ^0_{sus}	40°C / 24°C	0,88			
			55°C / 43°C	0,72			
			75°C / 55°C	0,69			
	in diamond cored holes	ψ^0_{sus}	40°C / 24°C	0,89			
			55°C / 43°C	0,70			
			75°C / 55°C	0,62			

Connector Hilti HCC-K	**Annex C5**
Performance Essential characteristics under tension load in existing concrete	

Deutsches Institut für Bautechnik DIBt

Table C2: Essential characteristics of connector Hilti HCC-K under tension load in concrete overlay

Connector Hilti HCC-K			**10**	**12**	**14**	**16**
Steel failure						
Characteristic resistance	$N_{Rk,s,ov}$	[kN]	43	62	85	111
Partial safety factor	$\gamma_{Ms,N,ov}$	[-]	1,4			
Pullout failure for anchor heads						
Projected area of the head	A_h	[mm²]	628	905	1232	1608
Thickness of the head	t_h	[mm]	2			
Concrete cone failure						
Effective embedment depth	min. $h_{ef,ov}$	[mm]	40			
	max. $h_{ef,ov}$		$L - h_{nom,ex} - t_h - 2 \cdot R_t$ [1)]			
Factor for cracked concrete	$k_{cr,N,ov}$	[-]	8,9			
Factor for uncracked concrete	$k_{ucr,N,ov}$	[-]	12,7			
Edge distance	$c_{cr,N,ov}$	[mm]	$1,5 \cdot h_{ef,ov}$			
Spacing	$s_{cr,N,ov}$	[mm]	$3,0 \cdot h_{ef,ov}$			
Splitting failure						
Edge distance	$c_{cr,sp,ov}$	[mm]	$3,0 \cdot h_{ef,ov}$			
Spacing	$s_{cr,sp,ov}$	[mm]	$6,0 \cdot h_{ef,ov}$			
Blow-out failure						
Projected area of the head	A_h	[mm²]	628	905	1232	1608
Factor for cracked concrete	$k_{5,cr}$	[-]	8,7			
Factor for uncracked concrete	$k_{5,ucr}$	[-]	12,2			

1) R_t: Roughness according to EOTA Technical Report TR 066:2019-10.

Table C3: Essential characteristics of connector Hilti HCC-K for the shear interface

Connector Hilti HCC-K			**10**	**12**	**14**	**16**
Characteristic yield strength	f_{yk}	[N/mm²]	500			
Product specific factor for ductility	α_{k1}	[-]	1,0			
Relevant cross section in area of the interface	A_s	[mm²]	78,5	113	154	201
Product specific factor for geometry	α_{k2}	[-]	1,0			

Connector Hilti HCC-K	**Annex C6**
Performance Essential characteristics under tension load in concrete overlay Essential characteristics for the shear interface	