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-18/1022 of 5 May 2023

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-B with Injectionmortar 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	17 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 09/2022
This version replaces	ETA-18/1022 issued on 15 June 2021

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Specific Part

1 Technical description of the product

The Connector Hilti HCC-B is an anchor made of malleable cast iron anchored with Injectionmortar Hilti HIT-RE 500 V3 or Hilti HIT-RE 500 V4 into a predrilled cylindrical drill hole in existing concrete. The Hilti HCC-B is connecting two layers of concrete cast at different times (existing concrete and concrete overlay). The side with shaped head of Hilti HCC-B 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, C 2 and C 3 See Annex B 3
Concrete overlay: - resistances - edge distance and spacing	 See Annex C 4 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 4 See Annex C 4

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 5 May 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Tempel

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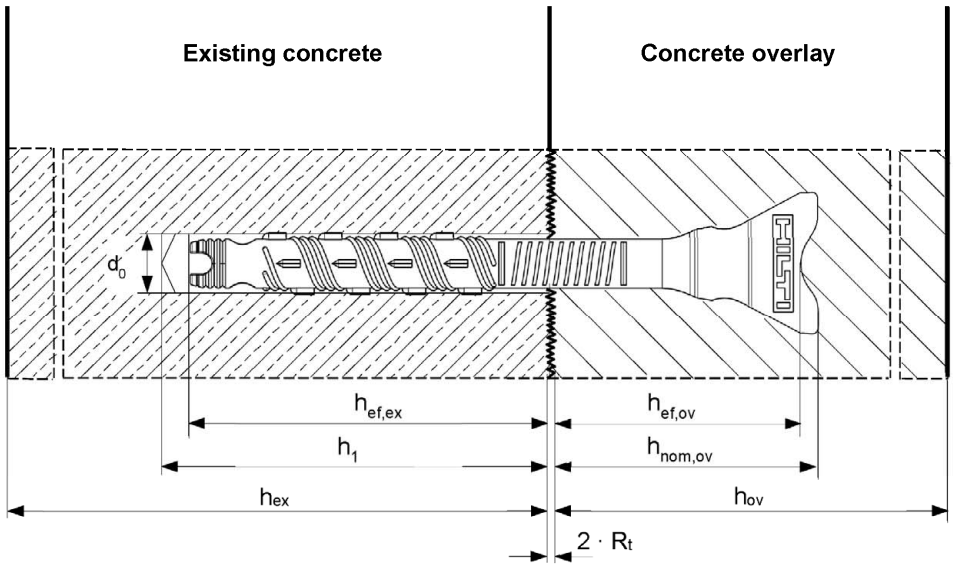
Installed condition

Figure A1:
Connector Hilti HCC-B

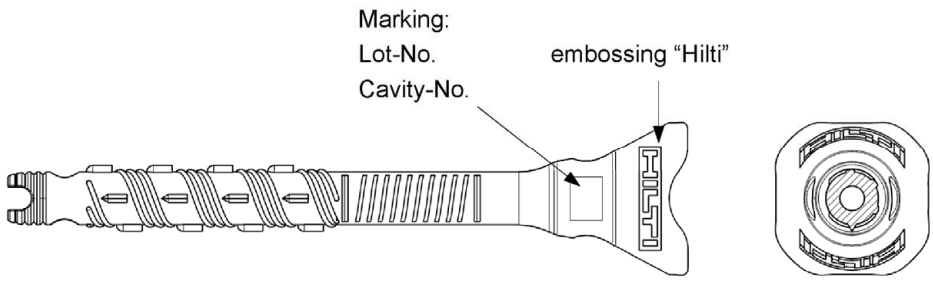


$h_{ef,ex}$	Effective embedment depth in existing concrete	$h_{ef,ov}$	Effective embedment depth in concrete overlay
h_1	Drill hole depth	$h_{nom,ov}$	Overall embedment depth in the concrete overlay
h_{ex}	Thickness of existing concrete	h_{ov}	Thickness of concrete overlay
R_t	Roughness according to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

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

Product description: Connector and injection mortar

Steel element Hilti HCC-B



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

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

Static mixer Hilti HIT-RE-M

Table A1: Materials

Designation	Material
HCC-B	Malleable cast iron, Material EN-GJMB-550-4 acc. EN 1562:2006 Strength: $f_{uk} \geq 500$ N/mm², $f_{yk} \geq 400$ N/mm² Rupture Elongation $A_{3,4} \geq 6\%$ Brinell hardness ≤ 250 HBW

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

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Specifications of intended use

Anchorages subject to:

- static and quasi static loading
  - surface roughness "very smooth" to "very rough" of the shear interface according to EOTA Technical Report TR 066:2019-10.
- fatigue cyclic loading
  - surface roughness "very rough" ($R_t \geq 3$ mm) of the shear interface according to EOTA Technical Report TR 066:2019-10.
  - concrete strength class of existing concrete ≥ C20/25 and concrete overlay ≥ C20/25 according to EN 206:2013+A1:2016.

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-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-B	Annex B1
Intended use Specifications	

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.

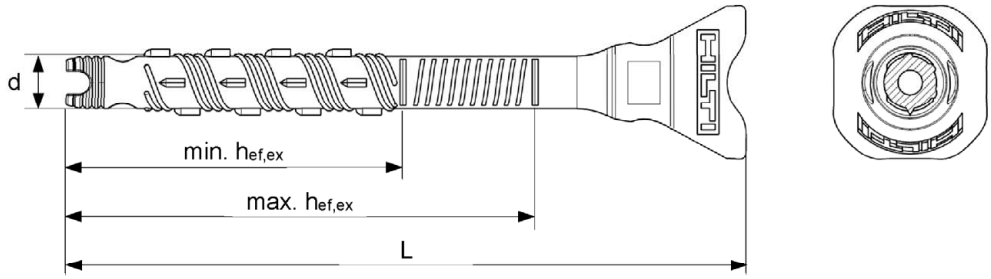
Installation:

- Use category (existing concrete): dry or wet concrete condition.
- 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-B	**Annex B2**
Intended use Specifications	

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

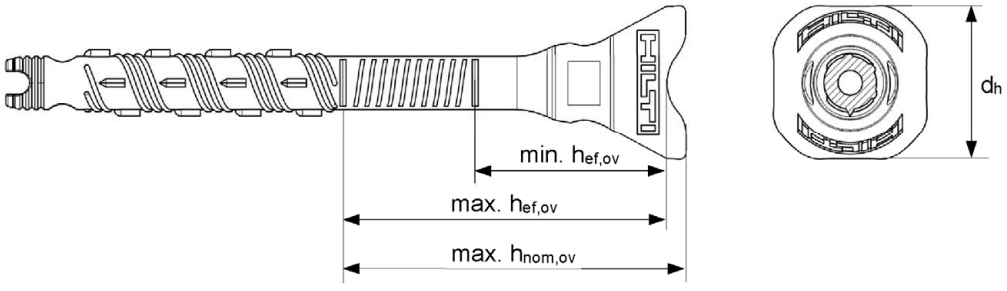
Connector Hilti HCC-B			
Outer diameter of shaft	d	[mm]	14
Overall length	L	[mm]	180
Effective embedment depth	min. $h_{ef,ex}$	[mm]	90
	max. $h_{ef,ex}$		125 - 2 · R_t [1]
Drill hole depth	h_1	[mm]	$h_{ef,ex}$ + 5 mm
Nominal diameter of drill bit	d_0	[mm]	16
Minimum thickness of existing concrete	$h_{min,ex}$	[mm]	h_1 + 2 · d_0
Minimum spacing	$s_{min,ex}$	[mm]	75
Minimum edge distance	$c_{min,ex}$	[mm]	50



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

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

Connector Hilti HCC-B			
Diameter of the head	d_h	[mm]	40,6
Effective embedment depth	min. $h_{ef,ov}$	[mm]	50
	max. $h_{ef,ov}$		85 - 2 · R_t [1]
Overall embedment depth	$h_{nom,ov}$	[mm]	$h_{ef,ov}$ + 5 mm
Minimum thickness of concrete overlay	$h_{min,ov}$	[mm]	$h_{nom,ov}$ + c_{nom} [2]
Minimum spacing	$s_{min,ov}$	[mm]	85
Minimum edge distance	$c_{min,ov}$	[mm]	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.

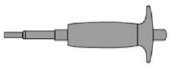
Connector Hilti HCC-B	**Annex B3**
Intended use Installation parameters	

Table B3: 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}
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.

Table B4: Parameters of drilling, cleaning and setting tools

Element	Drill and clean				Setting	
HCC-B	Hammer drilling		Diamond coring	Brush	machine setting	Hand setting
	all	Hollow drill bit TE-CD, TE-YD[1)]				
						
size	d_0 [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	item	item
16 x 180	16	16	16	16	HCC-M DM14 - HSD-M M12x25	HSD-G M12x25

1) With vacuum cleaner Hilti VC 10/20/40 (automatic filter cleaning activated, eco-mode off) or a vacuum cleaner providing equivalent cleaning performance in combination with the specified Hilti hollow drill bit TE-CD or TE-YD

Table B5: Cleaning alternatives

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.

Connector Hilti HCC-B	Annex B4
Intended use Working time and curing time / Parameters of drilling, cleaning and setting tools / Cleaning alternatives	

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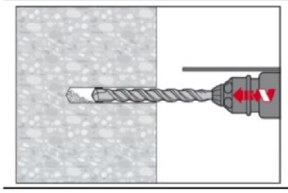
Installation instruction

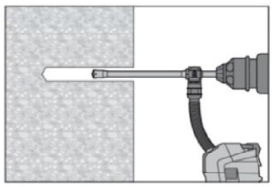
Hole drilling

a) Hammer drilling:



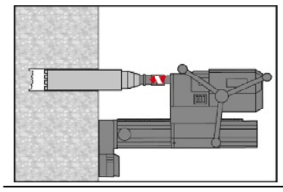
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

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 with vacuum attachment following the requirements given in Table B4. 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 "setting the element" step in the installation instruction.

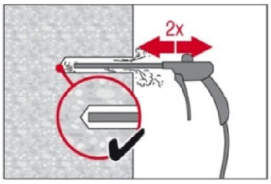
c) Diamond coring:



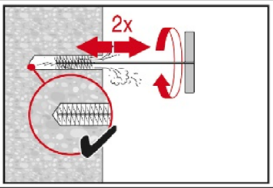
Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

Drill hole cleaning: Just before setting a connector, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.

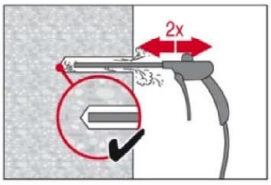
Compressed Air Cleaning (CAC)



Blow 2 times from the back of the hole 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.



Brush 2 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole 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.

Connector Hilti HCC-B	Annex B5
Intended use Installation instructions	

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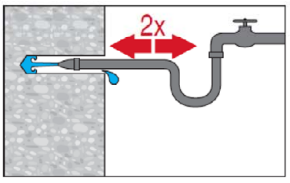
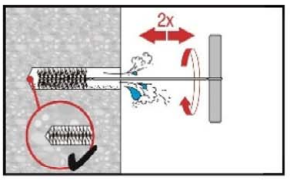
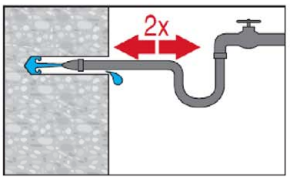
Cleaning of diamond cored holes:
For all drill hole diameters d_0 and all drill hole depths h_0.



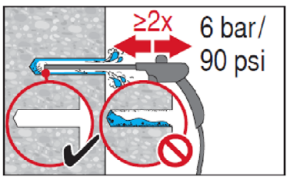
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



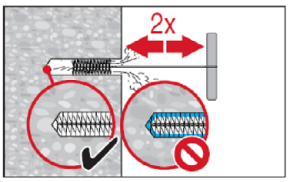
Brush 2 times with the specified brush (see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



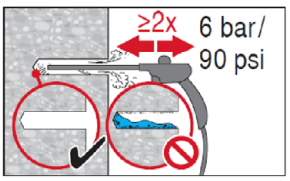
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



Blow 2 times from the back of the hole 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.

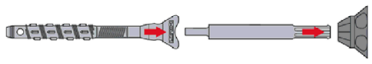


Brush 2 times with the specified brush size (brush Ø ≥ drill hole Ø, see Table B4) by inserting the steel brush Hilti HIT-RB to the back of the hole in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole – if not the brush is too small and must be replaced with the proper brush diameter.

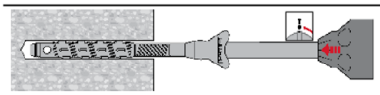


Blow again with compressed air 2 times until return air stream is free of noticeable dust and water.

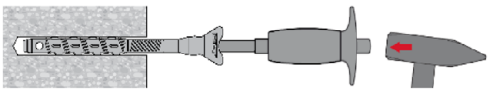
Setting the element



Assemble the setting tool HCC-M DM14 or HSD-M M12x25 to the connector HCC-B and to a drilling machine.



Set the drilling machine to hammering mode and hammer the connector to the desired anchoring embedment depth h_{ef}.



Alternatively, a hammer may also be used to hammer the connector to the desired anchoring embedment depth h_{ef}. Use of setting tool HSD-G M12x25 is recommended.

Connector Hilti HCC-B	**Annex B6**
Intended use Installation instructions	

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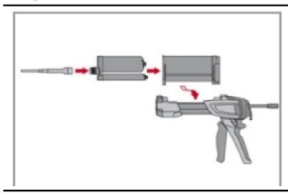
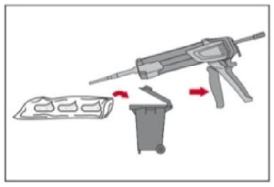
Right after setting the element the clamping noses of the connector create a robust resistance against typical jobsite conditions like hitting by foot or contact with mediumweight goods. Rebar connections may be done to the connectors as well.

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.

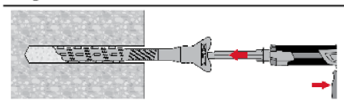


The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discarded quantities are:
for **HIT-RE 500 V3** and **HIT-RE 500 V4**:

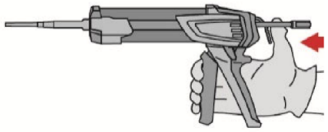
3 strokes	for 330 ml foil pack,
4 strokes	for 500 ml foil pack,
65 ml	for 1400 ml foil pack.

The minimum foil pack temperature is +5° C.

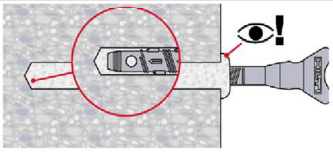
Inject adhesive



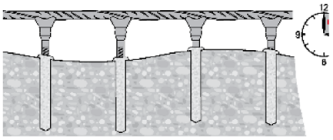
Put the front end of the mixer into the head of the connector. Dispense mortar until the mortar flows back to the concrete surface in the annular gap.



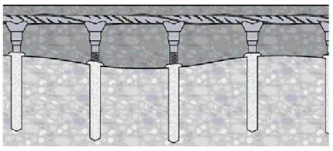
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.



After injection is completed the annular gap must be completely filled with mortar. Excess mortar flows out of the borehole.



Observe the curing time t_{cure}, which varies according to temperature of base material (see Table B5). 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 Technical Report TR 066:2019-10.

Connector Hilti HCC-B	
Intended use Installation instructions	**Annex B7**

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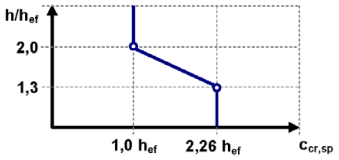
Table C1: Essential characteristics of connector Hilti HCC-B under tension load in existing concrete

Connector Hilti HCC-B			
Steel failure			
Characteristic resistance	$N_{Rk,s,ex}$	[kN]	54,8
Partial safety factor	$\gamma_{Ms,N,ex}$	[-]	1,5
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-B	**Annex C1**
Performance Essential characteristics under tension load in existing concrete	

Table C1 continued (1)

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

Table C1 continued (2)

Connector Hilti HCC-B				
Installation factor for HCC-B 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}	[-]	1,0
Diamond coring		γ_{inst}	[-]	1,4
Combined pullout and concrete cone failure for HCC-B 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**				
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	8,5
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm²]	7,5
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,cr}$	[N/mm²]	3,0
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**				
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	13
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	11
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,ucr}$	[N/mm²]	4,0
Characteristic bond resistance in uncracked concrete C20/25 in **diamond cored holes**				
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	11
Temperature range II:	55 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,0
Temperature range III:	75 °C / 55 °C	$\tau_{Rk,ucr}$	[N/mm²]	5,0
Influence factors ψ on bond resistance τ_{Rk}				
Influence of concrete strength				
Cracked and uncracked concrete		$\psi_{c,ex}$	C30/37	1,04
			C40/50	1,07
			C50/60	1,10
Influence of sustained load				
Cracked and uncracked concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD	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-B	**Annex C3**
Performance Essential characteristics under tension load in existing concrete	

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

Connector Hilti HCC-B			
Steel failure			
Characteristic resistance	$N_{Rk,s,ov}$	[kN]	54,8
Partial safety factor	$\gamma_{Ms,N,ov}$	[-]	1,5
Pullout failure			
for cracked concrete	$N_{Rk,p,cr,ov}$	[kN]	$\geq N^0_{Rk,c}$ [1]
for uncracked concrete	$N_{Rk,p,ucr,ov}$	[kN]	$\geq N^0_{Rk,c}$ [1]
Concrete cone failure			
Effective embedment depth	min. $h_{ef,ov}$	[mm]	50
	max. $h_{ef,ov}$		85 - 2 · R_t [2]
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 · $h_{ef,ov}$
Spacing	$s_{cr,N,ov}$	[mm]	3,0 · $h_{ef,ov}$
Splitting failure			
Edge distance	$c_{cr,sp,ov}$	[mm]	3,0 · $h_{ef,ov}$
Spacing	$s_{cr,sp,ov}$	[mm]	6,0 · $h_{ef,ov}$
Blow-out failure			
Projected area of the head	A_h	[mm²]	1140
Factor for cracked concrete	$k_{5,cr}$	[-]	8,7
Factor for uncracked concrete	$k_{5,ucr}$	[-]	12,2

1) $N^0_{Rk,c}$ according to EN 1992-4:2018, Equation (7.2).
2) R_t: Roughness according to EOTA Technical Report TR 066:2019-10.

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

Connector Hilti HCC-B			
Characteristic yield strength	f_{yk}	[N/mm²]	400
Product specific factor for ductility	α_{k1}	[-]	0,8
Relevant cross section in the area of the interface	A_s	[mm²]	109,5
Product specific factor for geometry	α_{k2}	[-]	1,30
Reduction factor for system performance under fatigue cyclic loading	η_{sc}	[-]	0,4

Connector Hilti HCC-B	**Annex C4**
Performance Essential characteristics under tension load in concrete overlay Essential characteristics for the shear interface	