Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment

ETA-19/0148 of 13 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
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Corporation
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 330499-01-0601

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Specific Part

1 Technical description of the product

The Injection system Hilti HIT-RE 100-HC is a bonded anchor consisting of a foil pack with injection mortar Hilti HIT- RE 100-HC and a steel element according to Annex A.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The product description is given in Annex A.

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

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to static and quasi-static loading tension load	See Annex C1 and C3
Characteristic resistance to static and quasi-static loading shear load	See Annex C2 and C4
Displacements for static and quasi-static loading	See Annex C5 to C6
Characteristic resistance for seismic performance category C1	No performance assessed
Characteristic resistance and displacements for seismic performance category C2	No performance assessed
Durability	See Annex B2

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330499-01-0601 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 at Deutsches Institut für Bautechnik.

Issued in Berlin on 13 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:

Threaded rod, HAS-U-…, HIT-V-… and AM 8.8

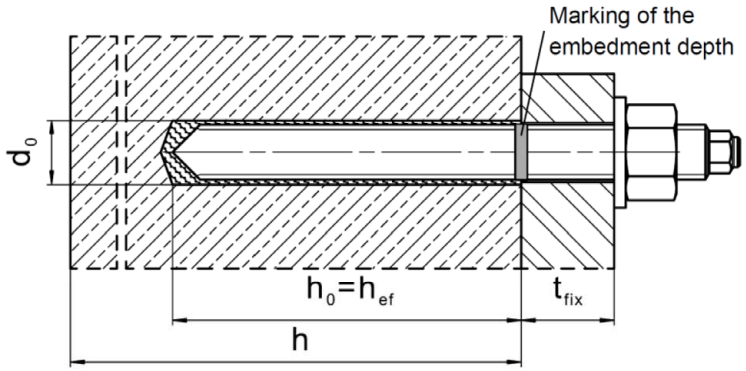
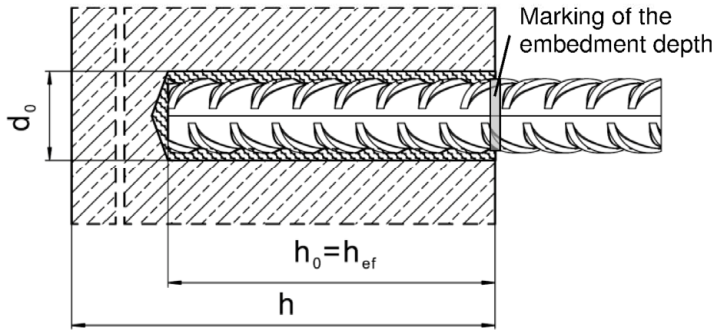


Figure A2:

Reinforcing bar



Injection System Hilti HIT-RE 100-HC	Annex A1
Product description Installed condition	

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Product description: Injection mortar and steel elements

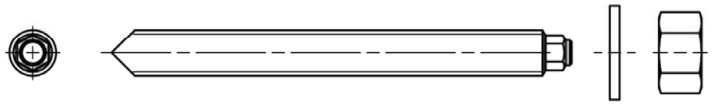
Injection mortar Hilti HIT-RE 100-HC: epoxy resin system with aggregate
580 ml

Marking:
HILTI-HIT
Production number and production line
Expiry date mm/yyyy

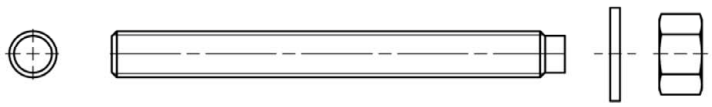
Product name: "Hilti HIT-RE 100-HC"

Static mixer Hilti HIT-RE-M

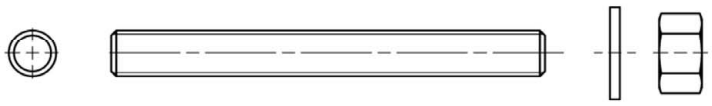
Steel elements



HAS-U-…: M8 to M30 washer nut



HIT-V-…: M8 to M30 washer nut



Threaded rod: M8 to M30 washer nut
Hilti AM 8.8 meter rod electroplated zinc coated: M8 to M30, 1m to 3m
Hilti AM HDG 8.8 meter rod hot dip galvanized: M8 to M30, 1m to 3m

Commercial standard threaded rod:
- Materials and mechanical properties according to Table A1.
- Inspection certificate 3.1 according to EN 10204:2004. The document shall be stored.
- Marking of embedment depth.

Reinforcing bar (rebar): ϕ 8 to ϕ 32
- Materials and mechanical properties according to Table A1
- Dimensions according to Annex B3

Injection System Hilti HIT-RE 100-HC	**Annex A2**
Product description Injection mortar / Static mixer / Steel elements	

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Table A1: Materials

Designation	Material
Reinforcing bars (rebars)	
Rebar: EN 1992-1-1: 2004 and AC:2010, Annex C	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$
Metal parts made of zinc coated steel	
HAS-U-5.8 (HDG), HIT-V-5.8(F), Threaded rod	Strength class 5.8, f_{uk} = 500 N/mm², f_{yk} = 400 N/mm², Elongation at fracture (l_0=5d) > 8% ductile Electroplated zinc coated ≥ 5 µm, (F) or (HDG) hot dip galvanized ≥ 45 µm
HAS-U-8.8 (HDG), HIT-V-8.8(F), Threaded rod	Strength class 8.8, f_{uk} = 800 N/mm², f_{yk} = 640 N/mm², Elongation at fracture (l_0=5d) > 12% ductile Electroplated zinc coated ≥ 5 µm, (F) or (HDG) hot dip galvanized ≥ 45 µm
Hilti Meter rod AM 8.8 (HDG)	Strength class 8.8, f_{uk} = 800 N/mm², f_{yk} = 640 N/mm² Elongation at fracture (l0 = 5d) > 12% ductile, Electroplated zinc coated ≥ 5 µm, (HDG) hot dip galvanized ≥ 45 µm
Washer	Electroplated zinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod Electroplated zinc coated ≥ 5 µm, (F) hot dip galvanized ≥ 45 µm
Metal parts made of stainless steel corrosion resistance class III according to EN 1993-1-4:2006+A1:2015	
HAS-U A4, HIT-V-R	For ≤ M24: strength class 70, f_{uk} = 700 N/mm², f_{yk} = 450 N/mm²; For > M24: strength class 50, f_{uk} = 500 N/mm², f_{yk} = 210 N/mm²; Elongation at fracture (l_0=5d) > 8% ductile
Threaded rod	For ≤ M24: strength class 70, f_{uk} = 700 N/mm², f_{yk} = 450 N/mm²; For > M24: strength class 50, f_{uk} = 500 N/mm², f_{yk} = 210 N/mm²; Elongation at fracture (l_0=5d) > 8% ductile Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	For ≤ M24: strength class 70, f_{uk} = 700 N/mm², f_{yk} = 450 N/mm²; For > M24: strength class 50, f_{uk} = 500 N/mm², f_{yk} = 210 N/mm²; Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Metal parts made of high corrosion resistant steel corrosion resistance class V according to EN 1993-1-4:2006+A1:2015	
HAS-U HCR, HIT-V-HCR	For ≤ M20: f_{uk} = 800 N/mm², f_{yk} = 640 N/mm², For > M20: f_{uk} = 700 N/mm², f_{yk} = 400 N/mm², Elongation at fracture (l0=5d) > 8% ductile
Threaded rod	For ≤ M20: f_{uk} = 800 N/mm², f_{yk} = 640 N/mm², For > M20: f_{uk} = 700 N/mm², f_{yk} = 400 N/mm², Elongation at fracture (l0=5d) > 8% ductile High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	For ≤ M20: f_{uk} = 800 N/mm², f_{yk} = 640 N/mm², For > M20: f_{uk} = 700 N/mm², f_{yk} = 400 N/mm², High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Injection System Hilti HIT-RE 100-HC

Product description
Materials

Annex A3

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Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206-1:2013+A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206-1:2013+A1:2016.
- Cracked and uncracked concrete.

Temperature in the base material:

- **at installation**

  +5 °C to +40 °C for the standard variation of temperature 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)

Table B1: Specifications of intended use

	HIT-RE 100-HC with …	
Elements	HAS-U-…, HIT-V-…, AM 8.8 	Rebar
Hammer drilling with hollow drill bit TE-CD or TE-YD 	✓	✓
Hammer drilling	✓	✓
Static and quasi static loading in uncracked concrete	M8 to M30	ϕ 8 to ϕ 32
Static and quasi static loading in cracked concrete	M10 to M30	ϕ 10 to ϕ 32

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Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according EN 1993-1-4:2006+A1:2015 correspoding to corrosion resistance classes Table A6 Annex A1. (stainless steels)

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 loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- The anchorages are designed in accordance with:
  EN 1992-4:2018 and EOTA Technical Report TR 055.

Installation:

- Use category: dry or wet concrete or in water-filled holes
- Drilling technique:
  - Hammer drilling
  - Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD
- Installation direction D3: downward, horizontal and upward (e.g. overhead) installation admissible for all elements.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Injection System Hilti HIT-RE 100-HC	**Annex B2**
Intended Use Specifications	

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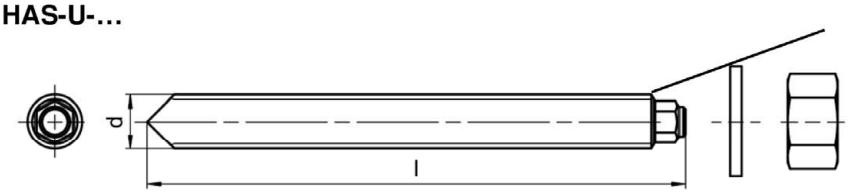
Table B2: Installation parameters of threaded rod, HAS-U-…, HIT-V-… and AM 8.8

Threaded rod, HAS-U- …, HIT-V-…, AM 8.8			M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	60 to 160	60 to 200	70 to 240	80 to 320	90 to 400	96 to 480	108 to 540	120 to 600
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			h_{ef} + 2·d_0				
Maximum torque moment	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80

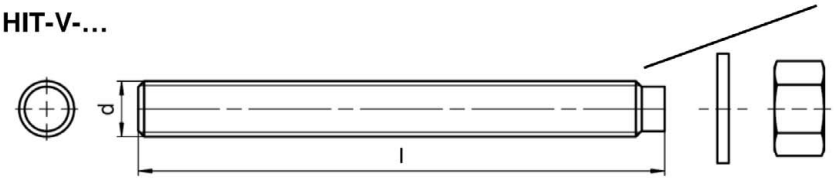
HAS-U-…



Marking:

Steel grade number and length identification letter: e.g. 8L

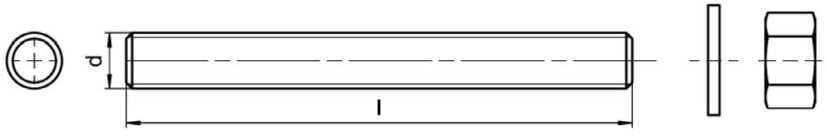
HIT-V-…



Marking:

5.8 - l = HIT-V-5.8 M…x l
5.8F - l = HIT-V-5.8F M…x l
8.8 - l = HIT-V-8.8 M…x l
8.8F - l = HIT-V-8.8F M…x l
R - l = HIT-V-R M …x l
HCR - l = HIT-V-HCR M …x l

Hilti meter rod AM (HDG) 8.8



Injection System Hilti HIT-RE 100-HC

Intended Use
Installation parameters of threaded rod, HAS-U-…, HIT-V-… and AM 8.8

Annex B3

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Table B3: Installation parameters of reinforcing bar

Reinforcing bar (rebar)			**ϕ 8**	**ϕ 10**	**ϕ 12**		**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 26**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Diameter	ϕ	[mm]	8	10	12		14	16	20	25	26	28	30	32
Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	60 to 160	60 to 200	70 to 240		75 to 280	80 to 320	90 to 400	100 to 500	104 to 520	112 to 560	120 to 600	128 to 640
Nominal diameter of drill bit	d_0	[mm]	10 / 12[1)]	12 / 14[1)]	14[1)]	16[1)]	18	20	25 / 24[1)]	32 / 30[1)]	32	35	37	40
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			$h_{ef} + 2 \cdot d_0$								
Minimum spacing	s_{min}	[mm]	40	50	60		70	80	100	125	130	140	150	160
Minimum edge distance	c_{min}	[mm]	40	45	45		50	50	65	70	75	75	80	80

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

Reinforcing bar

For rebar bolt

- Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar h_{rib} shall be in the range $0{,}05 \cdot \phi \le h_{rib} \le 0{,}07 \cdot \phi$
  (ϕ: Nominal diameter of the bar; h_{rib}: Rib height of the bar)

Injection System Hilti HIT-RE 100-HC

Intended Use
Installation parameters of reinforcing bar (rebar)

Annex B4

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Table B4: Maximum working time and minimum curing time Hilti-RE 100-HC

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

Table B5: Parameters of cleaning and setting tools

Elements		Drill and clean			Installation
Threaded rod, HAS-U-…, HIT-V-…, AM 8.8	Rebar	Hammer drilling		Brush	Piston plug
			Hollow drill bit		
					
size	size	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
M8	ϕ8	10	-	10	-
M10	ϕ8 / ϕ10	12	12	12	12
M12	ϕ10 / ϕ12	14	14	14	14
-	ϕ12	16	16	16	16
M16	ϕ14	18	18	18	18
-	ϕ16	20	20	20	20
M20	-	22	22	22	22
-	ϕ20	24	24	24	24
-	ϕ20	25	25	25	25
M24	-	28	28	28	28
M27	ϕ25	30	-	30	30
-	ϕ25 / ϕ26	32	32	32	32
M30	ϕ28	35	35	35	35
-	ϕ30	37	-	37	37
-	ϕ32	40	-	40	40

Injection System Hilti HIT-RE 100-HC

Intended Use
Maximum working time and minimum curing time
Parameters of cleaning and setting tools

Annex B5

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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 $h_0 \leq 10 \cdot d$.

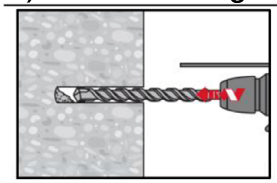
Compressed air cleaning (CAC):
Air nozzle with an orifice opening of minimum 3,5 mm in diameter.

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

Installation instruction

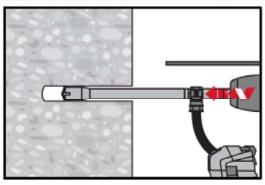
Hole drilling

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 (-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	Annex B6
Intended Use Cleaning alternatives Installation instructions	

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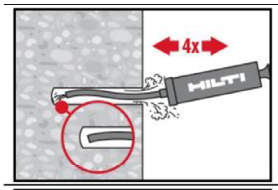
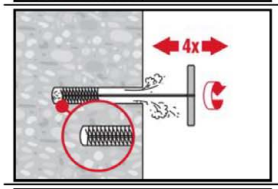
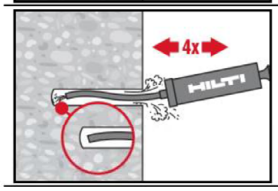
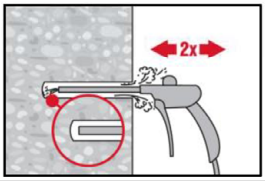
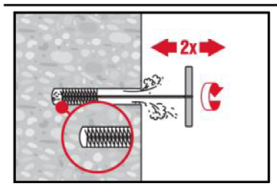
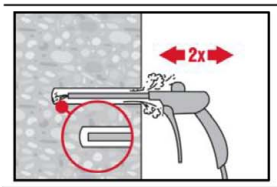
Drill hole cleaning	Just before setting an anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.
Manual Cleaning (MC)	Uncracked concrete only. For drill hole diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$.
	The Hilti hand pump may be used for blowing out drill holes up to diameters $d_0 \leq 20$ mm and embedment depths up to $h_{ef} \leq 10 \cdot d$. Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust.
	Brush 4 times with the specified brush (see Table B5) 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. 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 (see Table B5) 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.

Injection System Hilti HIT-RE 100-HC	**Annex B7**
Intended Use Installation instructions	

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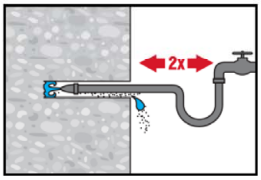
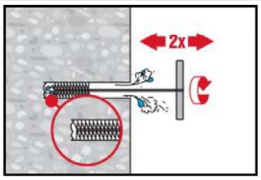
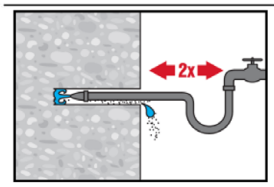
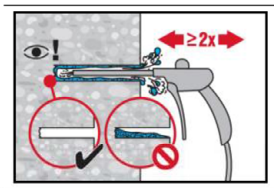
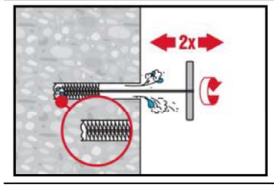
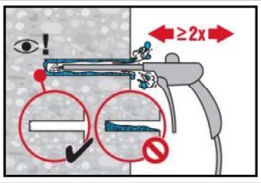
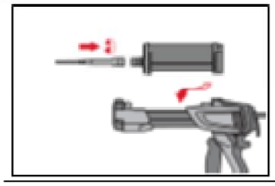
Cleaning of hammer drilled water-filled drill holes:
For all drill hole diameters d_0 and all drill hole depths h_0.

	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 B5) 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 B5 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.

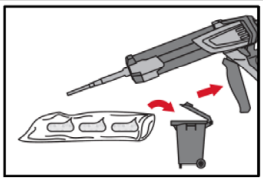
Injection System Hilti HIT-RE 100-HC	**Annex B8**
Intended Use Installation instructions	

Deutsches Institut für Bautechnik DIBt

Injection preparation

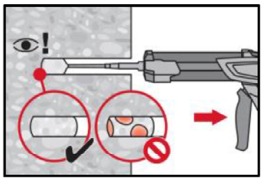


Tightly attach Hilti mixing nozzle HIT-RE-M to hard cartridge manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser. Insert hard cartridge into dispenser.

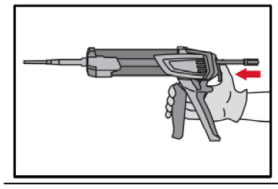


The hard cartridge opens automatically as dispensing is initiated. Prior to dispensing into the drill hole, squeeze out separately 3 full strokes.

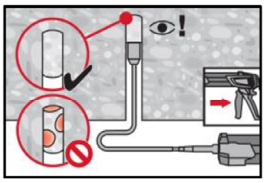
Inject adhesive from the back of the drill hole without forming air voids.



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 drillhole.

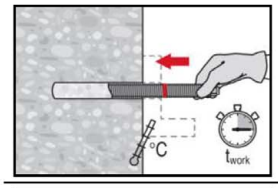


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

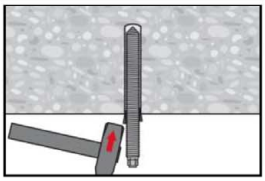


Overhead installation and/or installation with embedment depth h_{ef} > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B5). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

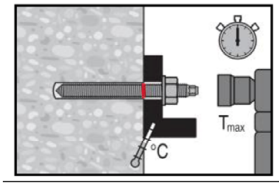
Setting the element



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} (see Table B4) has elapsed.



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



Loading the anchor: After required curing time t_{cure} (see Table B4) the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max} given in Table B2 to Table B3.

Injection System Hilti HIT-RE 100-HC

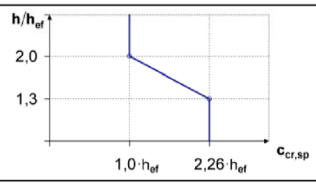
Intended Use
Installation instructions

Annex B9

Deutsches Institut für Bautechnik DIBt

Table C1: Essential characteristics for threaded rod, HAS-U-..., HIT-V-... and AM 8.8 under tension load in concrete

Threaded rod, HAS-U-..., HIT-V-... and AM 8.8				M8	M10	M12	M16	M20	M24	M27	M30
Installation safety factor											
Hammer drilling		γ_{inst}	[-]	1,4							
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD		γ_{inst}	[-]	2)	1,4						
Steel failure											
Characteristic resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$							
Partial factor grade 5.8		$\gamma_{Ms,N}$ 1)	[-]	1,5							
Partial factor grade 8.8		$\gamma_{Ms,N}$ 1)	[-]	1,5							
Partial factor HAS-U A4, HIT-V-R		$\gamma_{Ms,N}$ 1)	[-]	1,86						2,86	
Partial factor HAS-U HCR, HIT-V-HCR		$\gamma_{Ms,N}$ 1)	[-]	1,5					2,1		
Combined pullout and concrete cone failure											
Characteristic bond resistance in uncracked concrete C20/25											
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	15			14		12		
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	6			5,5		5		
Characteristic bond resistance in cracked concrete C20/25											
Temperature range I:	40 °C / 24 °C	$\tau_{Rk,cr}$	[N/mm²]	2)	7		6,5	6		5,5	
Temperature range II:	70 °C / 43 °C	$\tau_{Rk,cr}$	[N/mm²]	2)	2,5			2			
Sustained load factor		ψ^0_{sus}	[-]	Performance not assessed							
Influence factors ψ on bond resistance τ_{Rk}											
Cracked and uncracked concrete: Factor for concrete strength		ψ_c	C30/37	1,04							
			C40/45	1,07							
			C50/60	1,1							
Concrete cone failure											
Factor for uncracked concrete		$k_{ucr,N}$	[-]	11,0							
Factor for cracked concrete		$k_{cr,N}$	[-]	7,7							
Edge distance		$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$							
Spacing		$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$							
Splitting failure											
Edge distance $c_{cr,sp}$ [mm] for		$h / h_{ef} \geq 2,0$		$1,0 \cdot h_{ef}$							
		$2,0 > h / h_{ef} > 1,3$		$4,6 \cdot h_{ef} - 1,8 \cdot h$							
		$h / h_{ef} \leq 1,3$		$2,26 \cdot h_{ef}$							
Spacing		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$							



1) In absence of national regulations.
2) Performance not assessed.

Injection System Hilti HIT-RE 100-HC

Performances
Essential characteristics under tension load in concrete

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2: Essential characteristics for threaded rod, HAS-U-…, HIT-V-… and AM 8.8 under shear load in concrete

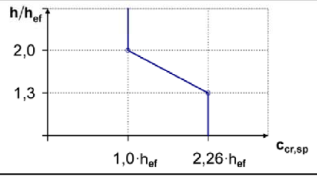
Threaded rod, HAS-U-…, HIT-V-…, AM 8.8			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure without lever arm										
Characteristic resistance	$V_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$							
Partial factor grade 5.8	$\gamma_{Ms,V}$ [1)]	[-]	1,25							
Partial factor grade 8.8	$\gamma_{Ms,V}$ [1)]	[-]	1,25							
Partial factor HAS-U A4, HIT-V-R	$\gamma_{Ms,V}$ [1)]	[-]	1,56						2,38	
Partial factor HAS-U HCR, HIT-V-HCR	$\gamma_{Ms,V}$ [1)]	[-]	1,25					1,75		
Ductility factor	k_7	[-]	1,0							
Steel failure with lever arm										
Bending moment	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$							
Ductility factor	k_7	[-]	1,0							
Concrete pry-out failure										
Pry-out factor	k_8	[-]	2,0							
Concrete edge failure										
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$						$\min(h_{ef}; 300)$	
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24	27	30

1) In absence of national regulations.

Deutsches Institut für Bautechnik DIBt

Table C3: Essential characteristics for rebar under tension load in concrete

Rebar				**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 26**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Installation safety factor														
Hammer drilling	γ_{inst}	[-]		1,4										
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]		1,4										
Steel failure														
Characteristic resistance Rebar B500B acc. to DIN 488:2009-08	$N_{Rk,s}$	[kN]		28	43	62	85	111	173	270	292	339	388	442
Partial factor	$\gamma_{Ms,N}$ [1)]	[-]		1,4										
Combined pull-out and concrete cone failure														
Diameter of rebar	d	[mm]		8	10	12	14	16	20	25	26	28	30	32
Characteristic bond resistance in uncracked concrete C20/25														
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]		12					11					
Temperature range II: 70°C/43°C	$\tau_{Rk,ucr}$	[N/mm²]		5,5					5			4,5		
Characteristic bond resistance in cracked concrete C20/25														
Temperature range I: 40°C/24°C	$\tau_{Rk,cr}$	[N/mm²]	2)	6,5					5,5			5		
Temperature range II: 70°C/43°C	$\tau_{Rk,cr}$	[N/mm²]	2)	2,5					2					
Sustained load factor	ψ^0_{sus}	[-]		Performance not assessed										
Influence factors ψ on bond resistance τ_{Rk}														
Cracked and uncracked concrete: Factor for concrete strength	ψ_c	C30/37		1,04										
		C40/45		1,07										
		C50/60		1,1										
Concrete cone failure														
Factor for uncracked concrete	$k_{ucr,N}$	[-]		11,0										
Factor for cracked concrete	$k_{cr,N}$	[-]		7,7										
Edge distance	$c_{cr,N}$	[mm]		$1,5 \cdot h_{ef}$										
Spacing	$s_{cr,N}$	[mm]		$3,0 \cdot h_{ef}$										
Splitting failure relevant for uncracked concrete														
Edge distance $c_{cr,sp}$ [mm] for		$h / h_{ef} \geq 2,0$		$1,0 \cdot h_{ef}$										
		$2,0 > h / h_{ef} > 1,3$		$4,6 \cdot h_{ef} - 1,8 \cdot h$										
		$h / h_{ef} \leq 1,3$		$2,26 \cdot h_{ef}$										
Spacing	$s_{cr,sp}$	[mm]		$2\ c_{cr,sp}$										



1) In absence of national regulations.
2) Performance not assessed.

Injection System Hilti HIT-RE 100-HC

Performances
Essential characteristics under tension load in concrete

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C4: Essential characteristics for rebar under shear load in concrete

Rebar			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 26**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Steel failure without lever arm													
Characteristic resistance Rebar B500B acc. to DIN 488:2009-08	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135	146	169	194	221
Partial factor	$\gamma_{Ms,V}$ [1)]	[-]	1,5										
Ductility factor	k_7	[-]	1,0										
Steel failure with lever arm													
Rebar B500B acc. to DIN 488:2009-08	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012	1139	1422	1749	2123
Ductility factor	k_7	[-]	1,0										
Concrete pry-out failure													
Pry-out factor	k_8	[-]	2,0										
Concrete edge failure													
Effective length of fastener	l_f	[mm]	min (h_{ef}; 12 · d_{nom})						min (h_{nom}; 300)				
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	20	25	26	28	30	32

1) In absence of national regulations.

Deutsches Institut für Bautechnik DIBt

Table C5: Displacements under tension load

Threaded rod, HAS-U-…, HIT-V-…, AM 8.8			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete temperature range I : 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03			0,04		0,05	0,06	
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04		0,05		0,06	0,07	0,08	0,09
Uncracked concrete temperature range II : 70°C / 43°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03			0,04		0,05	0,06	
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04	0,05		0,06	0,07	0,08	0,09	0,10
Cracked concrete temperature range I : 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	[1)]	0,07	0,08					
	$\delta_{N\infty}$	[mm/(N/mm²)]	[1)]	0,17	0,18	0,21	0,23	0,26	0,28	0,29
Cracked concrete temperature range II : 70°C / 43°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	[1)]	0,07	0,08					
	$\delta_{N\infty}$	[mm/(N/mm²)]	[1)]	0,17	0,18	0,21	0,23	0,26	0,28	0,29

1) Performance not assessed.

Table C6: Displacements under shear load

Threaded rod, HAS-U-…, HIT-V-…, AM 8.8			M8	M10	M12	M16	M20	M24	M27	M30
Displacement	δ_{V0}	[mm/kN]	0,06		0,05	0,04		0,03		
	$\delta_{V\infty}$	[mm/kN]	0,09	0,08		0,06		0,05		

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Table C7: Displacements under tension load

Rebar			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 26**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Uncracked concrete temperature range I : 40°C / 24°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03				0,04					0,05	
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04			0,05			0,06				
Uncracked concrete temperature range II : 70°C / 43°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03				0,04					0,05	
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04	0,05				0,06			0,07		
Cracked concrete temperature range I : 40°C / 24°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	1)	0,05				0,06				0,07	
	$\delta_{N\infty}$	[mm/(N/mm²)]	1)	0,06	0,08	0,10	0,12	0,16	0,21	0,22	0,24	0,26	0,28
Cracked concrete temperature range II : 70°C / 43°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	1)	0,05				0,06				0,07	
	$\delta_{N\infty}$	[mm/(N/mm²)]	1)	0,06	0,08	0,10	0,12	0,16	0,21	0,22	0,24	0,26	0,28

1) Performance not assessed.

Table C8: Displacements under shear load

Rebar			**ϕ 8**	**ϕ 10**	**ϕ 12**	**ϕ 14**	**ϕ 16**	**ϕ 20**	**ϕ 25**	**ϕ 26**	**ϕ 28**	**ϕ 30**	**ϕ 32**
Displacement	δ_{V0}	[mm/kN]	0,06	0,05		0,04			0,03				
	$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,07	0,06		0,05			0,04		

Injection System Hilti HIT-RE 100-HC

Performances
Displacements with rebar

Annex C6