Deutsches Institut für Bautechnik DIBt

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European Technical Assessment ETA-04/0027 of 17 May 2018

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 500
Product family to which the construction product belongs	Bonded anchor in the sizes of Ø 8 mm to Ø 32 mm for use in non-cracked concrete
Manufacturer	Hilti Aktiengesellschaft 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	37 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 330499-00-0601

Deutsches Institut für Bautechnik
Kolonnenstraße 30 B | 10829 Berlin | GERMANY | Phone: +49 30 78730-0 | Fax: +49 30 78730-320 | Email: dibt@dibt.de | www.dibt.de

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Specific Part

1 Technical description of the product

The Injection System Hilti HIT-RE 500is a bonded anchor consisting of a foil pack with injection mortar Hilti HIT-RE 500 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 tension load (static and quasi-static loading)	See Annex C 1 to C 8
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 9 to C 14
Displacements (static and quasi-static loading)	See Annex C 15 to C 17
Characteristic resistance and displacements for seismic performance category C1 and C2	No performance assessed

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 330499-00-0601 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 at Deutsches Institut für Bautechnik.

Issued in Berlin on 2 July 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Lange

Installed condition

Figure A1:
Threaded rod, HIT-V-…and HAS-(E)…

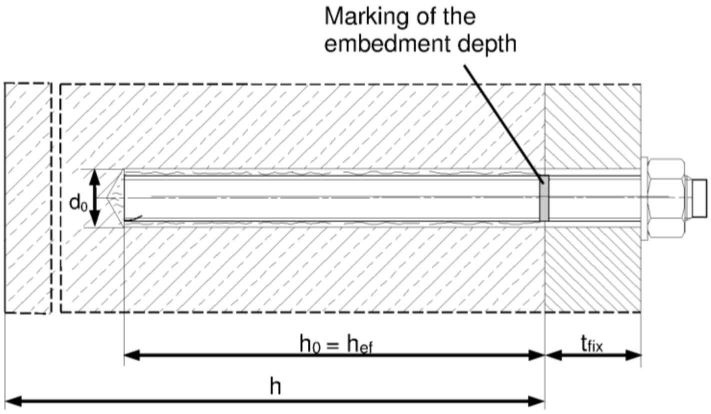


Figure A2:
Internally threaded sleeve HIS-(R)N

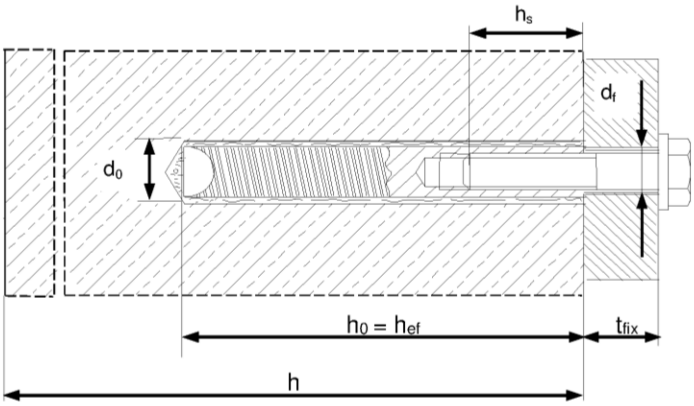
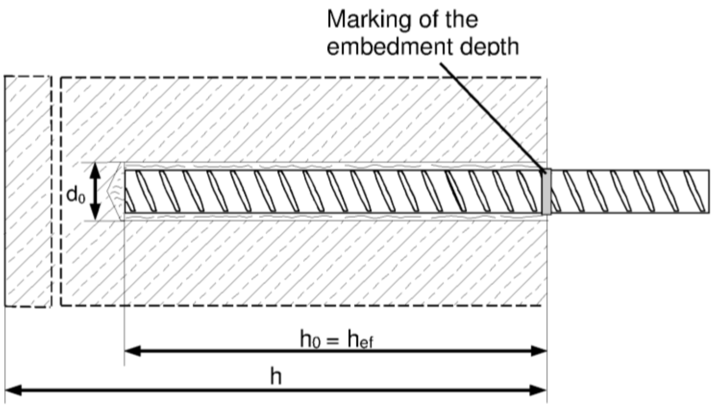


Figure A3:
Reinforcing bar (rebar)



Injection system Hilti HIT-RE 500	
Product description Installed condition	**Annex A1**

Product description: Injection mortar and steel elements

Injection mortar Hilti HIT- RE 500: hybrid system with aggregate

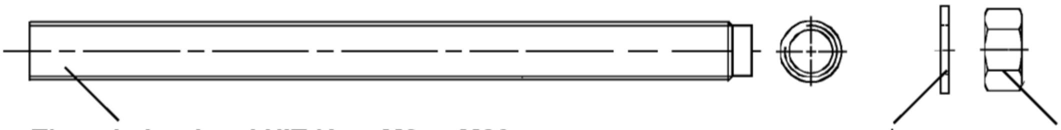
330 ml, 500 ml and 1400 ml

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

Product name: "Hilti HIT-RE 500"

Static mixer Hilti HIT-RE-M

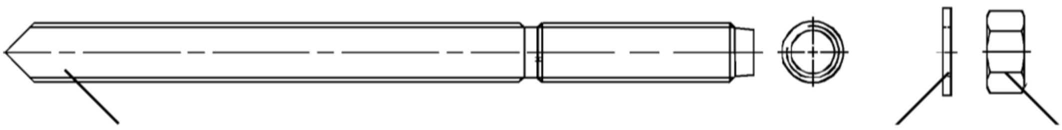
Steel elements



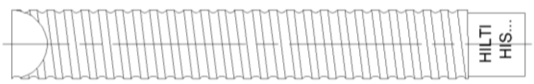
Threaded rod and HIT-V-...: M8 to M30 washer nut

Commercial standard threaded rod with:

- 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.

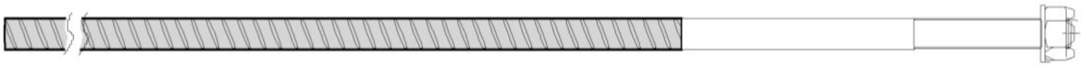


HAS-(E)...: M8 to M30 washer nut



Internally threaded sleeve HIS-(R)N: M8 to M20

Injection system Hilti HIT-RE 500	**Annex A2**
Product description Injection mortar / Static mixer / Steel elements	



Hilti Tension Anchor HZA-R: M12 to M24

Reinforcing bar (rebar): ϕ 8 to ϕ 32

- Materials and mechanical properties according to Table A1.
- Dimensions according to Annex B6.

Injection system Hilti HIT-RE 500	**Annex A3**
Product description Steel elements	

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:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$
Metal parts made of zinc coated steel	
Threaded rod, HIT-V-5.8(F), HAS-(E)	Strength class 5.8, f_{uk} = 500 N/mm², f_{yk} = 400 N/mm² Rupture elongation (l_0 = 5d) > 8% ductile Electroplated zinc coated ≥ 5 µm, (F) hot dip galvanized ≥ 45 µm
Threaded rod, HIT-V-8.8(F)	Strength class 8.8, f_{uk} = 800 N/mm², f_{yk} = 640 N/mm² Rupture elongation (l_0 = 5d) > 12% ductile Electroplated zinc coated ≥ 5 µm, (F) hot dip galvanized ≥ 45 µm
Internally threaded sleeve HIS-N	Electroplated zinc coated ≥ 5 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, hot dip galvanized ≥ 45 µm
Metal parts made of stainless steel	
Threaded rod, HIT-V-R, HAS-(E)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 Rupture elongation (l_0 = 5d) > 8% ductile Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Hilti tension anchor HZA-R	Round steel with threaded part: Stainless steel 1.4404, 1.4362, 1.4571 EN 10088-1:2014 Rebar: Bars class B according to NDP or NCL of EN 1992-1-1/NA:2013
Internally threaded sleeve HIS-RN	Stainless steel 1.4401, 1.4571 EN 10088-1:2014
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of threaded rod. 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	
Threaded rod, HIT-V-HCR, HAS-(E)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 Rupture elongation (l_0 = 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	Strength class of nut adapted to strength class of threaded rod. High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Injection system Hilti HIT-RE 500

Product description
Materials

Annex A4

Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.

Base material:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- Uncracked concrete.

Temperature in the base material:

- **At installation**
  +5 °C to +40 °C
- **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 +58 °C
  (max. long term temperature +35 °C and max. short term temperature +58 °C)
  Temperature range III: -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 500 with …			
Elements		Threaded rod, HIT-V-…, HAS-(E)…	HIS-(R)N	HZA-R	Rebar
Hammer drilling with hollow drill bit TE-CD or TE-YD		✓	✓	✓	✓
Hammer drilling		✓	✓	✓	✓
Diamond coring		✓	✓	✓	✓
Static and quasi static loading in uncracked concrete		M8 to M30	M8 to M20	M12 to M24	ϕ 8 to ϕ 32
Concrete condition:	dry or wet concrete (not in flooded holes)	✓	✓	✓	✓
	flooded holes	Hammer drilling only	Hammer drilling only	Hammer drilling only	Hammer drilling only

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal conditions, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal conditions, if other particular aggressive conditions exist
  (high corrosion resistant steel).
  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution
  (e.g. in desulphurization plants or road tunnels where de-icing products are used).

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.).
- Anchorages under static or quasi-static loading are designed in accordance with:
  FprEN 1992-4:2017 and EOTA Technical Report TR 055.

Installation:

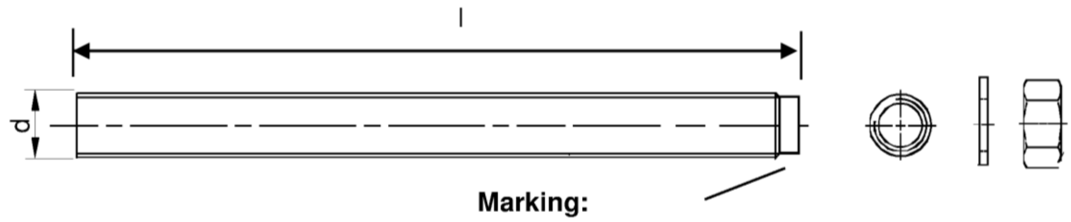
- Concrete condition I1: Installation and use in service in dry or wet concrete (not in flooded holes) for all drilling techniques.
  Concrete condition I2: Installation in dry or wet concrete and in flooded holes and use in service in dry or wet concrete for hammer drilling only.
- Drilling technique: hammer drilling, diamond coring, hammer drilling with hollow drill bit TE-CD, TE-YD.
- Installation direction D3: downward, horizontal and upward (e.g. overhead) installation.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- The anchor may only be set once.

Injection system Hilti HIT-RE 500	**Annex B2**
Intended Use Specifications	

Table B2: Installation parameters of threaded rod, HIT-V-… and HAS-(E)…

Threaded rod, HIT-V-…and HAS-(E)…			M8	M10	M12	M16	M20	M24	M27	M30
Diameter of fastener bolt or thread diameter	$d = d_{nom}$	[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
Threaded rod, HIT-V-...: Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	40 to 160	40 to 200	48 to 240	64 to 320	80 to 400	96 to 480	108 to 540	120 to 600
HAS-(E)...: Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	80	90	110	125	170	210	240	270
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Minimum allowed thickness of concrete member	h_{min}	[mm]	$h_{ef} + 30$ ≥ 100 mm			$h_{ef} + 2 \cdot d_0$				
Maximum torque moment	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Minimum allowable spacing	s_{min}	[mm]	40	50	60	80	100	120	135	150
Minimum allowable edge distance	c_{min}	[mm]	40	50	60	80	100	120	135	150

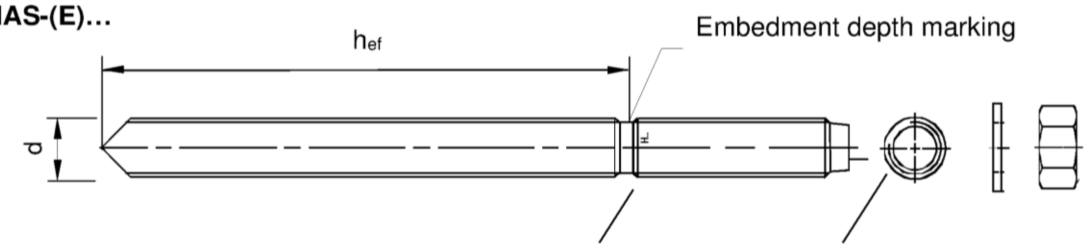
HIT-V-…



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

HAS-(E)…



Marking:

identifying mark - H, embossing “1” HAS-(E)
identifying mark - H, embossing “=” HAS-(E)R
identifying mark - H, embossing “CR” HAS-(E)HCR

Injection system Hilti HIT-RE 500

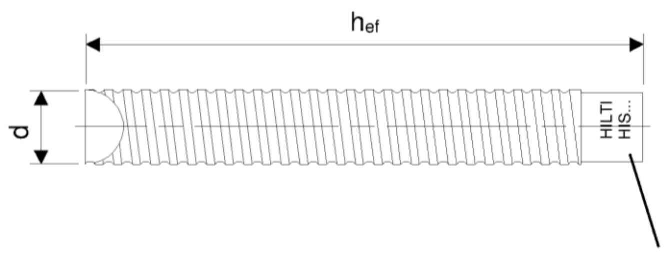
Intended Use
Installation parameters threaded rod, HIT-V-… and HAS-(E)…

Annex B3

Table B3: Installation parameters of internally threaded sleeve HIS-(R)N

Internally threaded sleeve HIS-(R)N			**M8**	**M10**	**M12**	**M16**	**M20**
Outer diameter of sleeve	$d = d_{nom}$	[mm]	12,5	16,5	20,5	25,4	27,6
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	90	110	125	170	205
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Minimum thickness of concrete member	h_{min}	[mm]	120	150	170	230	270
Maximum torque moment	T_{max}	[Nm]	10	20	40	80	150
Thread engagement length	h_s	[mm]	8 to 20	10 to 25	12 to 30	16 to 40	20 to 50
Minimum allowable spacing	s_{min}	[mm]	40	45	55	65	90
Minimum allowable edge distance	c_{min}	[mm]	40	45	55	65	90

Internally threaded sleeve HIS-(R)N…



Marking:
Identifying mark - HILTI and
embossing “HIS-N” (for zinc coated steel)
embossing “HIS-RN” (for stainless steel)

Injection system Hilti HIT-RE 500

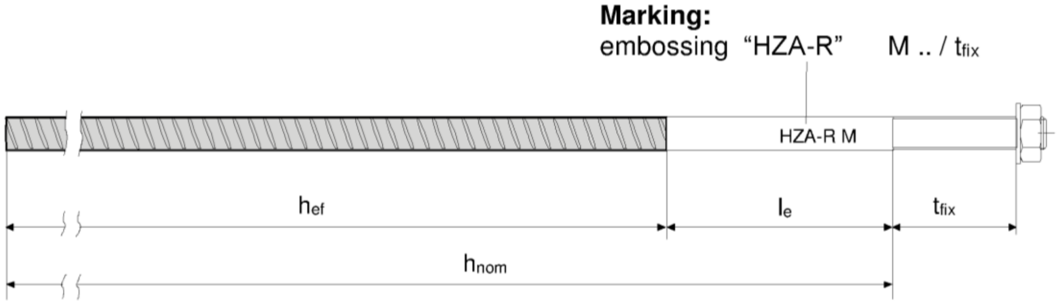
Intended Use
Installation parameters HIS-(R)N

Annex B4

Table B4: Installation parameters of Hilti tension anchor HZA-R

Hilti tension anchor HZA-R			**M12**	**M16**	**M20**	**M24**
Rebar diameter	ϕ	[mm]	12	16	20	25
Nominal embedment depth and drill hole depth	$h_{nom} = h_0$	[mm]	170 to 240	180 to 320	190 to 400	200 to 500
Effective embedment depth ($h_{ef} = h_{nom} - l_e$)	h_{ef}	[mm]	$h_{nom} - 100$			
Length of smooth shaft	l_e	[mm]	100			
Nominal diameter of drill bit	d_0	[mm]	16	20	25	32
Maximum diameter of clearance hole in the fixture	d_f	[mm]	14	18	22	26
Maximum torque moment	T_{max}	[Nm]	40	80	150	200
Minimum thickness of concrete member	h_{min}	[mm]	$h_{nom} + 2 \cdot d_0$			
Minimum allowable spacing	s_{min}	[mm]	60	80	100	120
Minimum allowable edge distance	c_{min}	[mm]	60	80	100	120

Hilti Tension Anchor HZA-R



Injection system Hilti HIT-RE 500

Intended Use
Installation parameters HZA-R

Annex B5

Table B5: Installation parameters of reinforcing bar (rebar)

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 540	120 to 600	130 to 640
Nominal diameter of drill bit	d_0	[mm]	10 / 12[1]	12 / 14[1]	14[1]	16[1]	18	20	25	32	35	35	37	40
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			$h_{ef} + 2 \cdot d_0$								
Minimum allowable spacing	s_{min}	[mm]	40	50	60		70	80	100	125	130	140	150	160
Minimum allowable edge distance	c_{min}	[mm]	40	50	60		70	80	100	125	130	140	150	160

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

Reinforcing bar (rebar)

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 $0{,}05 \cdot \phi \leq h_{rib} \leq 0{,}07 \cdot \phi$
  (φ: Nominal diameter of the bar; h_{rib}: Rib height of the bar).

Table B6: Maximum working time and minimum curing time

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
5 °C to 9 °C	120 min	72 hours
10 °C to 14 °C	90 min	48 hours
15 °C to 19 °C	30 min	24 hours
20 °C to 29 °C	20 min	12 hours
30 °C to 39 °C	12 min	8 hours
40 °C	12 min	4 hours

Table B7: Parameters of cleaning and setting tools

Elements				Drill and clean			Installation
Threaded rod, HIT-V-…and HAS-(E)…	HIS-(R)N	Rebar	HZA-R	Hammer drilling	Hollow drill bit TE-CD, TE-YD[1)]	Brush	Piston plug
							
Size	Name	Size	Size	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
M8	-	ϕ 8	-	10	-	10	-
M10	-	ϕ 8, ϕ 10	-	12	12	12	12
M12	M8	ϕ 10, ϕ 12	-	14	14	14	14
-	-	ϕ 12	M12	16	16	16	16
M16	M10	ϕ 14	-	18	18	18	18
-	-	ϕ 16	M16	20	20	20	20
M20	M12	-	-	22	22	22	22
-	-	ϕ 20	M20	25	25	25	25
M24	M16	-	-	28	28	28	28
M27	-	-	-	30	-	30	30
-	M20	ϕ 25	M24	32	32	32	32
M30	-	ϕ 26, ϕ 28	M27	35	35	35	35
-	-	ϕ 30	-	37	-	37	37
-	-	ϕ 32	-	40	-	40	40

1) To be used in combination with Hilti vacuum cleaner with suction volume ≥ 57 l/s.

Cleaning alternatives

Manual Cleaning (MC):
Hilti hand pump for blowing out drill holes with diameters $d_0 \leq 18$ 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.

Injection system Hilti HIT-RE 500

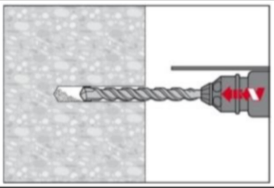
Intended Use
Cleaning and setting tools

Annex B8

Installation instruction

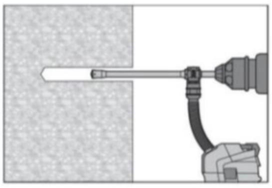
Hole drilling

a) Hammer drilling: For dry or wet concrete and installation in flooded holes (no sea water).



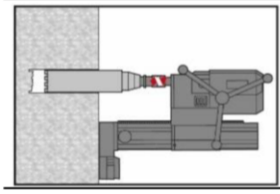
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

b) Hammer drilling with Hilti hollow drill bit: For dry and wet concrete only.



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.

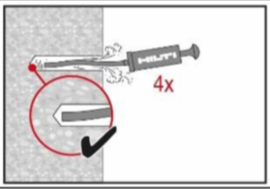
c) Diamond coring: For dry and wet concrete only.



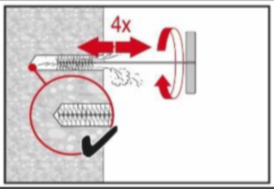
Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

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

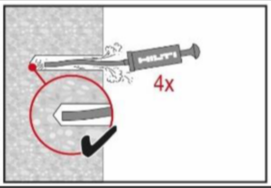
Manual Cleaning (MC): For drill hole diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$.



The Hilti hand pump may be used for blowing out drill holes up to diameters $d_0 \leq 18$ 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 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 (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

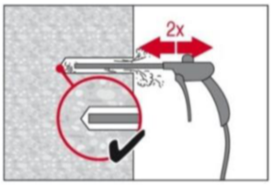


Blow out again with the Hilti hand pump at least 4 times until return air stream is free of noticeable dust.

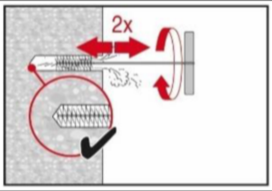
Injection system Hilti HIT-RE 500	**Annex B9**
Intended Use Installation instructions	

Deutsches Institut für Bautechnik

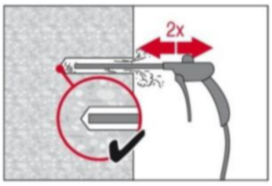
Compressed Air Cleaning (CAC): For all drill hole diameters d_0 and all drill hole depths h_0.



Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole 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.

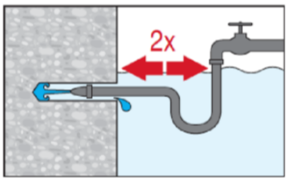


Brush 2 times with the specified brush (see Table B7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

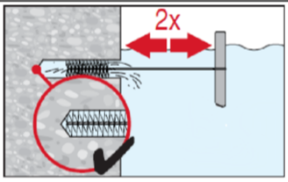


Blow again with compressed air 2 times until return air stream is free of noticeable dust.

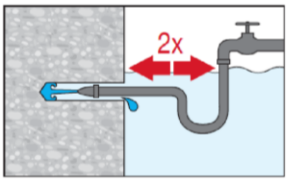
Submerged cleaning: For all drill hole diameters d_0 and all drill hole depths h_0.



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



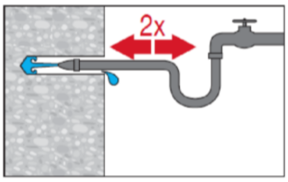
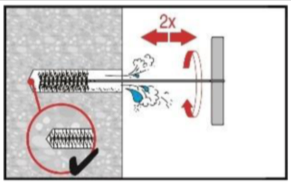
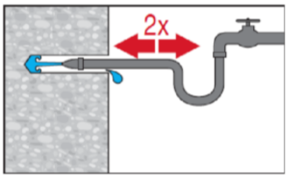
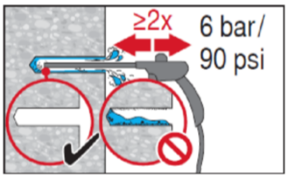
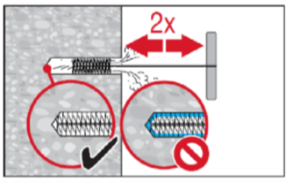
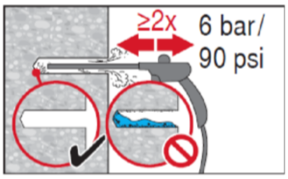
Brush 2 times with the specified brush (see Table B7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



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

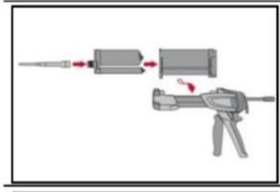
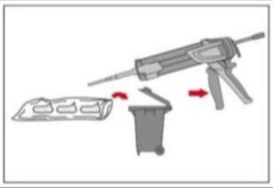
Injection system Hilti HIT-RE 500	**Annex B10**
Intended Use Installation instructions	

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

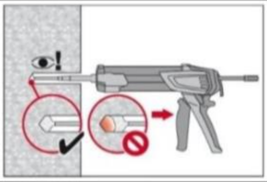
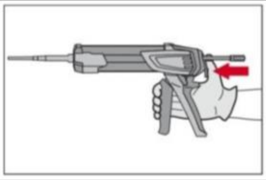
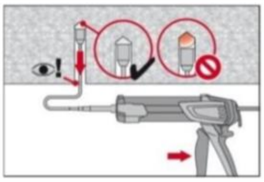
	Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.
	Brush 2 times with the specified brush (see Table B7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (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 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.

Injection system Hilti HIT-RE 500	**Annex B11**
Intended Use Installation instructions	

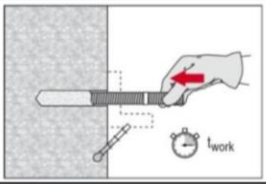
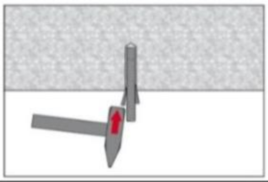
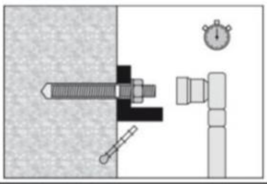
Injection preparation

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

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.
	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} > 250 mm. 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 **B7**). 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. **Under water application**: fill drill hole completely with mortar.

Setting the element Just before setting an anchor, the drill hole must be free of dust and debris.

	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 B6.
	For overhead installation use piston plugs and fix embedded parts with e.g. wedges.
	Loading the anchor: After required curing time t_{cure} (see Table B6) the anchor can be loaded. The applied installation torque shall not exceed the values T_{max} given in Table B2 to Table B4.

Injection system Hilti HIT-RE 500

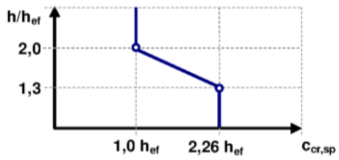
Intended Use
Installation instructions

Annex B12

Table C1: Essential characteristics for threaded rods under tension load

Threaded rod, HIT-V-… and HAS-...			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Installation sensitivity factor										
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,2			1,4				
Hammer drilling	γ_{inst}	[-]	1,4							
Diamond coring	γ_{inst}	[-]	1,2			1,4				
Steel failure										
Threaded rod, HIT-V 5.8(F)	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Threaded rod, HIT-V 8.8(F)	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,5							
Threaded rod, HIT-V R	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	230	281
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,87						2,86	
Threaded rod, HIT-V HCR	$N_{Rk,s}$	[kN]	29	46	67	126	196	247	321	393
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,5					2,1		
HAS-(E)	$N_{Rk,s}$	[kN]	17	26	38	72	112	160	347	422
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,5							
HAS-(E)-R	$N_{Rk,s}$	[kN]	23	37	53	101	157	224	217	263
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,87						2,86	
HAS-(E)-HCR	$N_{Rk,s}$	[kN]	27	42	61	115	180	224	304	369
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,5					2,1		
Combined pullout and concrete cone failure										
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Characteristic bond resistance in uncracked concrete C20/25 **with Hilti hollow drill bit or hammer drilling**										
Temperature range I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	16	16	16	15	15	14	14	13
Temperature range II: 58 °C / 35 °C	$\tau_{Rk,ucr}$	[N/mm²]	13	13	13	12	12	11	11	11
Temperature range III: 70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	8	8	8	7,5	7	7	6,5	6,5
Characteristic bond resistance in uncracked concrete C20/25 **with diamond coring**										
Temperature range I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	13	13	13	12	11	10	9	8,5
Temperature range II: 58 °C / 35 °C	$\tau_{Rk,ucr}$	[N/mm²]	11	11	11	9,5	9	8	7	6,5
Temperature range III: 70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	5,5	5	4,5	4,5	4

Table C1 continued

Increasing factors for τ_{Rk} in concrete	ψ_c	C30/37	1,04	
		C40/50	1,07	
		C50/60	1,09	
Concrete cone failure				
Factor for uncracked concrete	k_{ucr}	[-]	11,0	
Factor for cracked concrete	k_{cr}	[-]	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]	$2 \cdot c_{cr,sp}$	

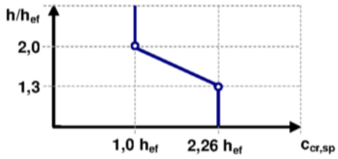
[1] In absence of national regulations.

Injection system Hilti HIT-RE 500	**Annex C2**
Performances Essential characteristics for threaded rods under tension load	

Table C2: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load

HIS-(R)N			M8	M10	M12	M16	M20
Installation sensitivity factor							
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,2	1,4			
Hammer drilling	γ_{inst}	[-]	1,4				
Diamond coring	γ_{inst}	[-]	1,2	1,4			
Steel failure							
Characteristic resistance HIS-N with with screw grade 8.8	$N_{Rk,s}$	[kN]	25	46	67	118	109
Partial factor	$\gamma_{Ms,N}$	[-]	1,43	1,5		1,47	
Characteristic resistance HIS-RN with screw grade 70	$N_{Rk,s}$	[kN]	26	41	59	110	166
Partial factor	$\gamma_{Ms,N}$	[-]	1,87				2,4
Combined pullout and concrete cone failure							
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4	27,6
Characteristic bond resistance in uncracked concrete C20/25 **with Hilti hollow drill bit or hammer drilling**							
Temp. range I: 40°C/24°C	N_{Rk}	[kN]	40	60	95	170	200
Temp. range II: 58°C/35°C	N_{Rk}	[kN]	35	50	75	140	170
Temp. range III: 70°C/43°C	N_{Rk}	[kN]	20	30	40	75	95
Characteristic bond resistance in uncracked concrete C20/25 **with diamond coring**							
Temp. range I: 40°C/24°C	N_{Rk}	[kN]	40	60	75	115	140
Temp. range II: 58°C/35°C	N_{Rk}	[kN]	35	50	60	95	115
Temp. range III: 70°C/43°C	N_{Rk}	[kN]	20	30	40	60	75
Increasing factors for $N_{Rk,p}$ in concrete	ψ_c	C30/37	1,04				
		C40/50	1,07				
		C50/60	1,09				
Concrete cone failure							
Factor for uncracked concrete	k_{ucr}	[-]	11,0				
Factor for cracked concrete	k_{cr}	[-]	7,7				
Edge distance	$c_{cr,N}$	[mm]	$1{,}5 \cdot h_{ef}$				
Spacing	$s_{cr,N}$	[mm]	$3{,}0 \cdot h_{ef}$				

Table C2 continued

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.

Injection system Hilti HIT-RE 500

Performances
Essential characteristics for internally threaded sleeve HIS-(R)N under tension load

Annex C4

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Table C3: Essential characteristics for Hilti tension anchor HZA-R under tension load

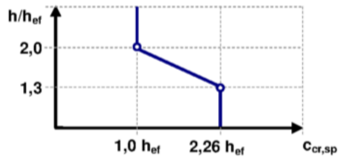
HZA-(R)…			**M12**	**M16**	**M20**	**M24**
Installation sensitivity factor						
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,2	1,4		
Hammer drilling	γ_{inst}	[-]	1,4			
Diamond coring	γ_{inst}	[-]	1,2	1,4		
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	62	111	173	248
Partial factor	$\gamma_{Ms,N}$	[-]	1,4			
Combined pullout and concrete cone failure						
Diameter of element	d	[mm]	12	16	20	25
Characteristic bond resistance in uncracked concrete C20/25 **with Hilti hollow drill bit or hammer drilling**						
Temp. range I: 40°C/24°C	$\tau_{Rd,ucr}$	[kN]	15	14	14	13
Temp. range II: 58°C/35°C	$\tau_{Rk,ucr}$	[kN]	12	11	11	11
Temp. range III: 70°C/43°C	$\tau_{Rk,ucr}$	[kN]	7	7	6,5	6,5
Characteristic bond resistance in uncracked concrete C20/25 **with diamond coring**						
Temp. range I: 40°C/24°C	$\tau_{Rd,ucr}$	[kN]	12	11	10	8,5
Temp. range II: 58°C/35°C	$\tau_{Rk,ucr}$	[kN]	9,5	8,5	8	7
Temp. range III: 70°C/43°C	$\tau_{Rk,ucr}$	[kN]	6	5	4,5	4
Increasing factors for τ_{Rk} in concrete	ψ_c	C30/37	1,04			
		C40/50	1,07			
		C50/60	1,09			
Effective anchorage depth for $N^0_{Rk,p}$	h_{ef}	[mm]	70 – 140	80 – 220	90 – 300	100 - 400
Concrete cone failure						
Effective anchorage depth for $N^0_{Rk,c}$	h_{ef}	[mm]	170 – 240	180 – 320	190 – 400	200 - 500
Factor for uncracked concrete	k_{ucr}	[-]	11,0			
Factor for cracked concrete	k_{cr}	[-]	7,7			
Edge distance	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$			
Spacing	$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$			

Injection system Hilti HIT-RE 500

Performances
Essential characteristics for Hilti tension anchor HZA-(R) under tension load

Annex C5

Table C3 continued

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.

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Table C4: Essential characteristics for rebars under tension load

Rebars			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø26	Ø28	Ø30	Ø32
Installation sensitivity factor													
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,2				1,4						
Hammer drilling	γ_{inst}	[-]	1,4										
Diamond coring	γ_{inst}	[-]	1,2				1,4						
Steel failure													
B500B acc. to DIN488:2009-08[1]	$N_{Rk,s}$	[kN]	28	43	62	85	111	173	270	-	339	-	442
Partial factor B500B acc. to DIN488:2009-08[2]	$\gamma_{Ms,N}$	[-]	1,4							-	1,4	-	1,4
Combined pullout and concrete cone failure													
Diameter of element	d	[mm]	8	10	12	14	16	20	25	26	28	30	32
Characteristic bond resistance in uncracked concrete C20/25 **with Hilti hollow drill bit or hammer drilling**													
Temperature range I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	15	15	15	14	14	14	13	13	13	13	13
Temperature range II: 58 °C / 35 °C	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	11	11	11	11	10	10	10
Temperature range III: 70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	7	7	7	7	7	6,5	6,5	6,5	6	6	6
Characteristic bond resistance in uncracked concrete C20/25 **with diamond coring**													
Temperature range I: 40 °C / 24 °C	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	11	11	10	8,5	8,5	8	7,5	7
Temperature range II: 58 °C / 35 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,5	9,5	9,5	9	8,5	8	7	6,5	6,5	6	5,5
Temperature range III: 70 °C / 43 °C	$\tau_{Rk,ucr}$	[N/mm²]	6	6	6	5,5	5	4,5	4	4	3,5	3,5	3,5
Increasing factors for τ_{Rk} in concrete	ψ_c	C30/37	1,04										
		C40/50	1,07										
		C50/60	1,09										

Injection system Hilti HIT-RE 500

Performances
Essential characteristics for rebars under tension load

Annex C7

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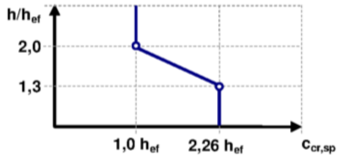
Table C4 continued

Concrete cone failure			
Factor for uncracked concrete	k_{ucr}	[-]	11,0
Factor for cracked concrete	k_{cr}	[-]	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) If the rebars do not fulfill the requirements acc. to DIN 488 values need to be calculated acc. to EAD 330499-00-0601 section 2.2.1.
2) In absence of national regulations. If the rebars do not fulfill the requirements acc. to DIN 488 values need to be calculated acc. to FprEN 1992-4:2017 Table 4.1.

Injection system Hilti HIT-RE 500	**Annex C8**
Performances Essential characteristics for rebars under tension load	

Table C5: Essential characteristics for threaded rods under shear load

Threaded rod, HIT-V… and HAS-(E)…			M8	M10	M12	M16	M20	M24	M27	M30
Installation sensitivity factor										
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,0							
Hammer drilling	γ_{inst}	[-]	1,0							
Diamond coring	γ_{inst}	[-]	1,0							
Steel failure without lever arm										
Threaded rod, HIT-V 5.8(F)	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Threaded rod, HIT-V 8.8(F)	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25							
Threaded rod, HIT-V R	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,56						2,38	
Threaded rod, HIT-V HCR	$V_{Rk,s}$	[kN]	15	23	34	63	98	124	161	196
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25					1,75		
HAS	$V_{Rk,s}$	[kN]	8,5	13	19	36	56	80	174	211
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25							
HAS- R	$V_{Rk,s}$	[kN]	12	19	27	51	79	112	108	132
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,56						2,38	
HCR	$V_{Rk,s}$	[kN]	13	21	31	58	90	112	152	184
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25					1,75		
Ductility factor	k_2	[-]	1,0							
Steel failure with lever arm										
Threaded rod, HIT-V 5.8(F)	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
Threaded rod, HIT-V 8.8(F)	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	898	1332	1799
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25							
Threaded rod, HIT-V R	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	786	832	1124
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,56						2,38	
Threaded rod, HIT-V HCR	$M^0_{Rk,s}$	[Nm]	30	60	105	266	520	786	1165	1574
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25					1,75		
HAS	$M^0_{Rk,s}$	[Nm]	16	33	56	147	284	486	1223	1637
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25							
HAS- R	$M^0_{Rk,s}$	[Nm]	23	45	79	205	398	680	764	1023
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,56						2,38	
HAS- HCR	$M^0_{Rk,s}$	[Nm]	26	52	90	234	455	680	1070	1433
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25					1,75		

Table C5 continued

Concrete pry-out failure			
Pry-out factor	k_8	[-]	1,0 (h_{ef} < 60mm) 2,0 ($h_{ef} \geq$ 60mm)
Partial factor	$\gamma_{Mcp,V}$ [1)]	[-]	1,5
Concrete edge failure			
Partial factor	γ_{Mc} [1)]	[-]	1,5

1) In absence of national regulations.

Table C6: Essential characteristics for internally threaded sleeve HIS-(R)N under shear load

HIS-(R)N …			**M8**	**M10**	**M12**	**M16**	**M20**
Installation sensitivity factor							
Hammer drilling with hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	1,0				
Hammer drilling	γ_{inst}	[-]	1,0				
Diamond coring	γ_{inst}	[-]	1,0				
Steel failure without lever arm							
HIS-N with screw grade 8.8	$V_{Rk,s}$	[kN]	13	23	39	59	55
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,25		1,5		
HIS-RN with screw grade 70	$V_{Rk,s}$	[kN]	13	20	30	55	83
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,56				2,0
Steel failure with lever arm							
HIS-N with screw grade 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,25				
HIS-RN with screw grade 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,56				
Ductility factor	k_2	[-]	1,0				
Concrete pry-out failure							
Pry-out factor	k_8	[-]	2,0				
Partial factor	γ_{Mcp} 1)	[-]	1,5				
Concrete edge failure							
Partial factor	γ_{Mc} 1)	[-]	1,5				

1) In absence of national regulations.

Injection system Hilti HIT-RE 500	**Annex C11**
Performances Essential characteristics for internally threaded sleeve HIS-(R)N under shear load	

Table C7: Essential characteristics for Hilti tension anchor HZA-R under shear load

HZA-R …			**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	[kN]	31	55	86	124
Partial factor	γ_{Ms} 1)	[-]	1,25			
Steel failure with lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	97	235	457	790
Partial factor	γ_{Ms} 1)	[-]	1,25			
Ductility factor	k_2	[-]	1,0			
Concrete pry-out failure						
Pry-out factor	k_8	[-]	2,0			
Partial factor	γ_{Mcp} 1)	[-]	1,5			
Concrete edge failure						
Partial factor	γ_{Mc} 1)	[-]	1,5			

1) In absence of national regulations.

Injection system Hilti HIT-RE 500

Performances
Essential characteristics for Hilti tension anchor HZA-R under shear load

Annex C12

Table C8: Essential characteristics for rebars under shear load

Rebars			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø26	Ø28	Ø30	Ø32
Steel failure without lever arm													
B500B acc. to DIN488:2009-08[1)]	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135	-	169	-	221
Partial factor B500B acc. to DIN488:2009-08[2)]	$\gamma_{Ms,V}$	[-]	1,5							-	1,5	-	1,5
Steel failure with lever arm													
B500B acc. to DIN488:2009-08[1)]	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012	-	1422	-	2123
Partial factor B500B acc. to DIN488:2009-08[2)]	$\gamma_{Ms,V}$	[-]	1,5							-	1,5	-	1,5
Ductility factor	k_2	[-]	1,0										
Concrete pry-out failure													
Pry-out factor	k	[-]	2,0										
Partial factor	γ_{Mcp} [1)]	[-]	1,5										
Concrete edge failure													
Partial factor	γ_{Mc} [1)]	[-]	1,5										

3) If the rebars do not fulfill the requirements acc. to DIN 488 values need to be calculated acc. to EAD 330499-00-0601 section 2.2.7.

4) In absence of national regulations. If the rebars do not fulfill the requirements acc. to DIN 488 values need to be calculated acc. to FprEN 1992-4:2017, Table 4.1.

Injection system Hilti HIT-RE 500

Performances
Essential characteristics for rebars under shear load

Annex C13

Table C9: Displacements for threaded rods under tension load[1)]

Threaded rod, HIT-V-… or HAS-(E)-…			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete										
Temperature range I: 40 °C / 24 °C										
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,02	0,02	0,03	0,04	0,05	0,06	0,06	0,07
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,04	0,05	0,06	0,08	0,11	0,13	0,15	0,17
Temperature range II: 58 °C / 35 °C										
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,03	0,04	0,05	0,07	0,09	0,11	0,13	0,14
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,07	0,09	0,10	0,14	0,18	0,22	0,25	0,28
Temperature range II: 70 °C / 43 °C										
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,07	0,09	0,10	0,14	0,18	0,22	0,25	0,28
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,09	0,12	0,15	0,20	0,26	0,31	0,35	0,40

1) Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ (τ: bond stress due to applied tension force).

Table C10: Displacements for threaded rods under shear load[1)]

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

1) Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ (V: applied shear force).

Table C11: Displacements for internally threaded sleeves HIS-(R)N under tension load[1)]

HIS-(R)N			**M8**	**M10**	**M12**	**M16**	**M20**
Temperature range I: 40 °C / 24 °C							
Displacement	δ_{N0}-factor	[mm/10kN]	0,08	0,06	0,06	0,04	0,04
Displacement	$\delta_{N\infty}$-factor	[mm/10kN]	0,18	0,15	0,14	0,10	0,09
Temperature range II: 58 °C / 35 °C							
Displacement	δ_{N0}-factor	[mm/10kN]	0,15	0,13	0,12	0,09	0,07
Displacement	$\delta_{N\infty}$-factor	[mm/10kN]	0,31	0,26	0,23	0,17	0,15
Temperature range III: 70 °C / 43 °C							
Displacement	δ_{N0}-factor	[mm/10kN]	0,31	0,26	0,23	0,17	0,14
Displacement	$\delta_{N\infty}$-factor	[mm/10kN]	0,43	0,36	0,33	0,24	0,20

[1)] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot N$; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot N$ (N: applied tension force).

Table C12: Displacements for internally threaded sleeves HIS-(R)N under shear load[1)]

HIS-(R)N			**M8**	**M10**	**M12**	**M16**	**M20**
Displacement	δ_{V0}-factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04
Displacement	$\delta_{V\infty}$-factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06

[1)] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ (V: applied shear force).

Table C13: Displacements for Hilti tension anchor HZA-R under tension load[1)]

Hilti tension anchor HZA-(R)			**M12**	**M16**	**M20**	**M24**
Temperature range I: 40 °C / 24 °C						
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,03	0,4	0,05	0,06
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,06	0,08	0,11	0,14
Temperature range II: 58 °C / 35 °C						
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,05	0,07	0,09	0,12
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,10	0,14	0,18	0,23
Temperature range III: 70 °C / 43 °C						
Displacement	δ_{N0}-factor	[mm/(N/mm²)]	0,10	0,14	0,18	0,23
Displacement	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,15	0,20	0,26	0,33

[1)] Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ (τ: bond stress due to applied tension force).

Table C14: Displacements for Hilti tension anchor HZA-R under shear load[1)]

Hilti tension anchor HZA-(R)			**M8**	**M10**	**M12**	**M16**
Displacement	δ_{V0}-factor	[mm/kN]	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$-factor	[mm/kN]	0,08	0,06	0,06	0,05

[1)] Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ (V: applied shear force).

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Table C15: Displacements for rebars under tension load[1)]

Rebars			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø26	Ø28	Ø30	Ø32
Temperature range I: 40°C/24°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	0,02	0,02	0,03	0,03	0,04	0,05	0,06	0,07	0,07	0,08	0,08
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04	0,05	0,06	0,07	0,08	0,11	0,14	0,14	0,15	0,17	0,18
Temperature range II: 58°C/35°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,04	0,05	0,06	0,07	0,09	0,12	0,12	0,13	0,14	0,15
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,07	0,09	0,10	0,12	0,14	0,18	0,23	0,24	0,26	0,28	0,30
Temperature range III: 70°C/43°C													
Displacement	δ_{N0}	[mm/(N/mm²)]	0,07	0,09	0,10	0,12	0,14	0,18	0,23	0,24	0,26	0,28	0,30
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,12	0,15	0,17	0,20	0,26	0,33	0,34	0,37	0,40	0,43

1) Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ (τ: action bond strength).

Table C16: Displacements for rebars under shear load[1)]

Rebars			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø26	Ø28	Ø30	Ø32
Displacement	δ_{V0}	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03	0,03
	$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,07	0,06	0,05	0,05	0,05	0,05	0,04	0,04	0,04

1) Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ (V: action shear load).